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PERMIT AMENDMENT APPLICATION

MESQUITE CREEK LANDFILL
COMAL AND GUADALUPE COUNTIES, TEXAS

MSW PERMIT NO. 66C

VOLUME IV OF IV

Physical Site Address:
1700 Kohlenberg Rd
New Braunfels, TX 78130
(830) 625-7894

Prepared for:
Waste Management of Texas, Inc.

Prepared by:

Geosyntec
consultants

8627 N Mopac Expy, Suite 300
Austin, Texas 78759
(512) 451-4003

Submitted October 2023
Revised November 2023; February 2024; April 2024
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Physical Site Address:
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10/11/2023

SCOTT M. GRAVES
86557

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EACH INDIVIDUAL ENGINEERING REPORT OR PLAN AND EACH ENGINEERING DRAWING WITHIN THE APPLICATION IS SIGNED, SEALED, AND DATED BY THE RESPONSIBLE ENGINEER AS REQUIRED BY THE TEXAS ENGINEERING PRACTICE ACT.

Prepared by:
Geosyntec Consultants, Inc.
Texas Board of Professional Engineers Firm Registration No. F-1182
8217 Shoal Creek Blvd, Suite 200
Austin, TX 78757
(512) 451-4003

October 2023

OVERALL TABLE OF CONTENTS

VOLUME I of IV

PART I and PART II – SITE AND APPLICANT INFORMATION, EXISTING CONDITIONS SUMMARY, AND CHARACTER OF THE FACILITY AND SURROUNDING LAND

SCOTT M. GRAVES
86557

10/11/2023

FOR PERMIT PURPOSES ONLY

GEOSYNTEC CONSULTANTS, INC.
TEXAS ENG. FIRM REGISTRATION NO. F-1182

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THE RESPONSIBLE GEOSCIENTIST HAS SIGNED, SEALED, AND DATED APPLICABLE ITEMS AS REQUIRED BY THE TEXAS GEOSCIENCE PRACTICE ACT.

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PART III – SITE DEVELOPMENT PLAN

STATE OF TEXAS
SCOTT M. GRAVES
86557
LICENSED PROFESSIONAL ENGINEER

10/11/2023

FOR PERMIT PURPOSES ONLY

GEOSYNTEC CONSULTANTS, INC.
TEXAS ENG. FIRM REGISTRATION NO. F-1182

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SCOTT M. GRAVES
86557

10/11/2023

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10/11/2023

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PART IV – SITE OPERATING PLAN

SCOTT M. GRAVES
86557

10/11/2023

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ATTACHMENT 4D

PIEZOMETER AND WELL LOGS

PIEZOMETER LOGS FROM GEOSYNTEC [2023]

MATTHEW WISSLER
13242

10/10/2023

Geosyntec Consultants, Inc.
Texas Board of Professional Geoscientists
Firm Registration No. 50256

Monitor Well Data Sheet

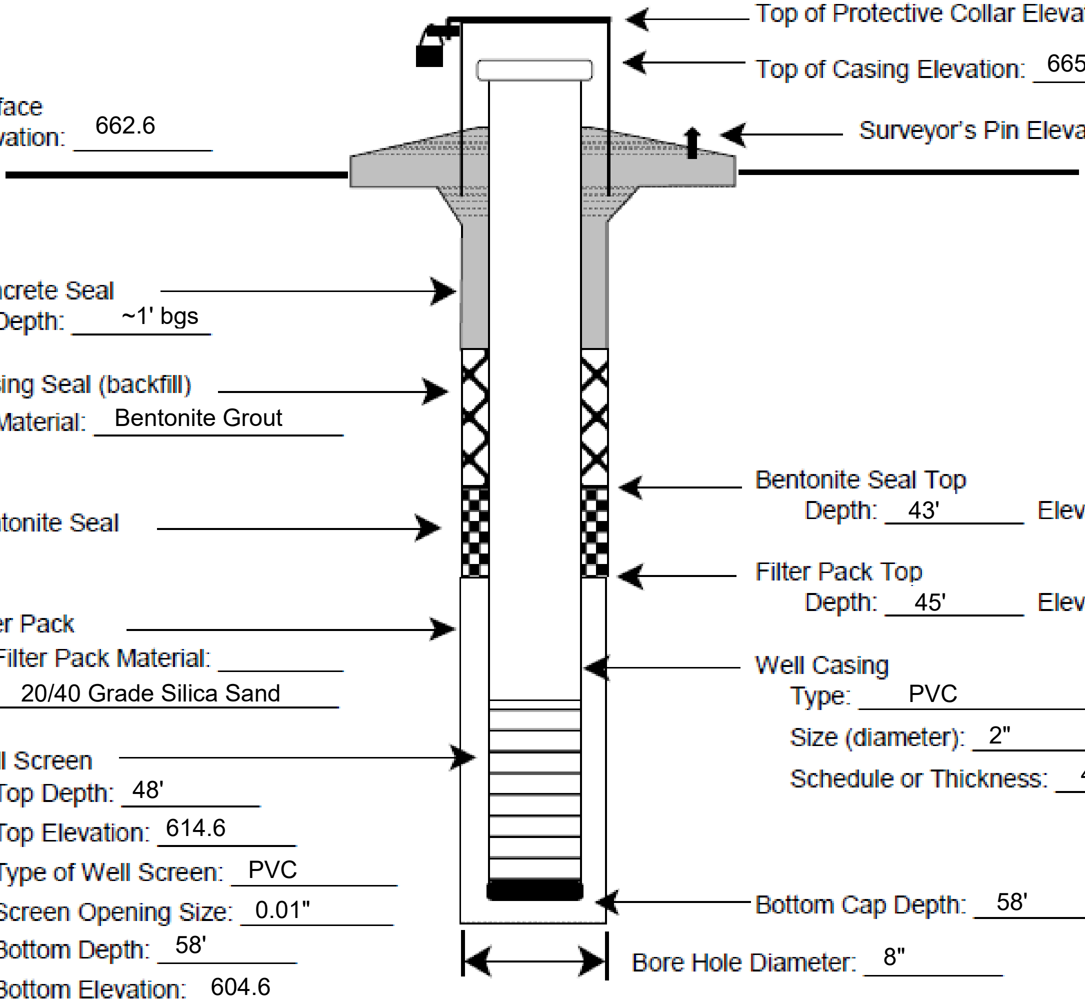
Texas Commission on Environmental Quality
Waste Permits Division

Permittee or Site Name: MESQUITE CREEK LANDFILL
MSW Permit No.: 66C
County: Guadalupe
Monitor Well I.D. No.: GB- 25(P)
Date of Monitor Well Installation: 2/6/2023
Date of Well Development: 2/17/2023
Monitor Well Latitude: 29°43'42.73" Longitude: -98°0'58.11"
Monitor Well Driller
Name: Scott James Campbell
License No.: 53439M
Monitor Well Hydraulic Position:
Upgradient X Downgradient

Geologist, Hydrologist, or Engineer Supervising Well Installation: B. Abbott
Static Water Level Elevation (with respect to MSL) after Well Development: 609.4
Name of Geologic Formation(s) in which Well is completed: Lower Taylor Group
Type of Locking Device: Padlock Type of Casing Protection: Steel Monument
Concrete Surface Pad (with steel reinforcement) Dimensions: 4' x 4' x 6"

Notes:

- Report all depths from Surface Elevation and all Elevations relative to Mean Sea Level (MSL), to nearest hundredth of a foot.
- Diameter of boring should be at least 4 inches larger than diameter of well casing.
- Use flush screw joint casing only, 2-inch diameter or larger, with o-rings or PTFE tape in joints (4-inch diameter recommend).
- Well development should continue until water is clear, and pH and conductivity are stable.



Top of Protective Collar Elevation: 665.9
Top of Casing Elevation: 665.8
Surface Elevation: 662.6
Surveyor's Pin Elevation: 663.1
Concrete Seal
Depth: ~1' bgs
Casing Seal (backfill)
Material: Bentonite Grout
Bentonite Seal Top
Depth: 43' Elevation: 619.6
Bentonite Seal
Filter Pack Top
Depth: 45' Elevation: 617.6
Filter Pack
Filter Pack Material: 20/40 Grade Silica Sand
Well Casing
Type: PVC
Size (diameter): 2"
Schedule or Thickness: 40
Well Screen
Top Depth: 48'
Top Elevation: 614.6
Type of Well Screen: PVC
Screen Opening Size: 0.01"
Bottom Depth: 58'
Bottom Elevation: 604.6
Bottom Cap Depth: 58'
Bore Hole Diameter: 8"

Monitor Well Data Sheet

Texas Commission on Environmental Quality
Waste Permits Division

Permittee or Site Name: MESQUITE CREEK LANDFILL

County: Guadalupe

Date of Monitor Well Installation: 2/7/2023

Monitor Well Latitude: 29°43'37.51" Longitude: -98°1'6.67"

Monitor Well Hydraulic Position:
Upgradient X Downgradient ________

MSW Permit No.: 66C

Monitor Well I.D. No.: GB- 30(P)

Date of Well Development: 2/18/2023

Monitor Well Driller
Name: Scott James Campbell
License No.: 53439M

Geologist, Hydrologist, or Engineer Supervising Well Installation: B. Abbott

Static Water Level Elevation (with respect to MSL) after Well Development: 653.1

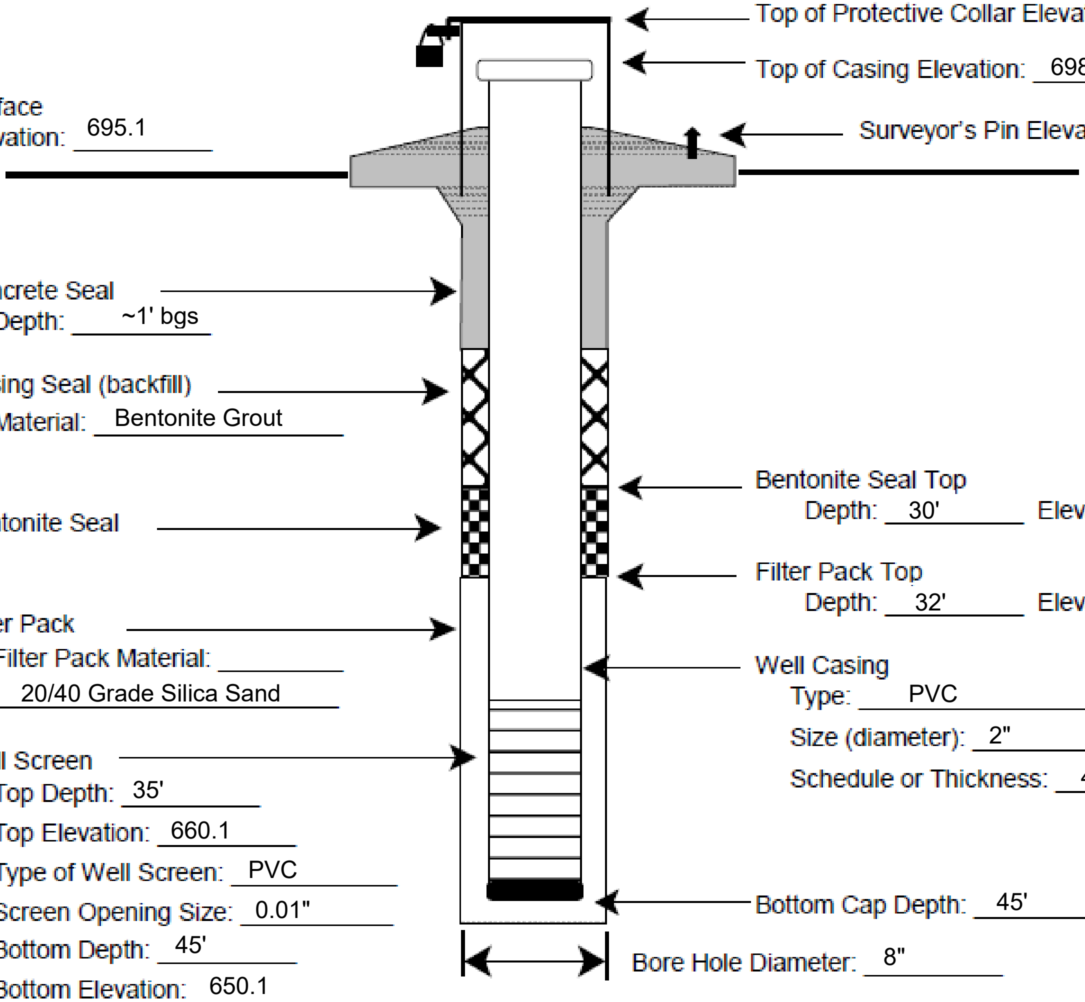
Name of Geologic Formation(s) in which Well is completed: Lower Taylor Group

Type of Locking Device: Padlock Type of Casing Protection: Steel Monument

Concrete Surface Pad (with steel reinforcement) Dimensions: 4' x 4' x 6"

Notes:

- Report all depths from Surface Elevation and all Elevations relative to Mean Sea Level (MSL), to nearest hundredth of a foot.
- Diameter of boring should be at least 4 inches larger than diameter of well casing.
- Use flush screw joint casing only, 2-inch diameter or larger, with o-rings or PTFE tape in joints (4-inch diameter recommend).
- Well development should continue until water is clear, and pH and conductivity are stable.



Top of Protective Collar Elevation: 698.6

Top of Casing Elevation: 698.4

Surface Elevation: 695.1

Surveyor's Pin Elevation: 695.3

Concrete Seal
Depth: ~1' bgs

Casing Seal (backfill)
Material: Bentonite Grout

Bentonite Seal

Bentonite Seal Top
Depth: 30' Elevation: 665.1

Filter Pack Top
Depth: 32' Elevation: 663.1

Filter Pack
Filter Pack Material:
20/40 Grade Silica Sand

Well Casing
Type: PVC
Size (diameter): 2"
Schedule or Thickness: 40

Well Screen
Top Depth: 35'
Top Elevation: 660.1
Type of Well Screen: PVC
Screen Opening Size: 0.01"
Bottom Depth: 45'
Bottom Elevation: 650.1

Bottom Cap Depth: 45'

Bore Hole Diameter: 8"

Monitor Well Data Sheet

Texas Commission on Environmental Quality
Waste Permits Division

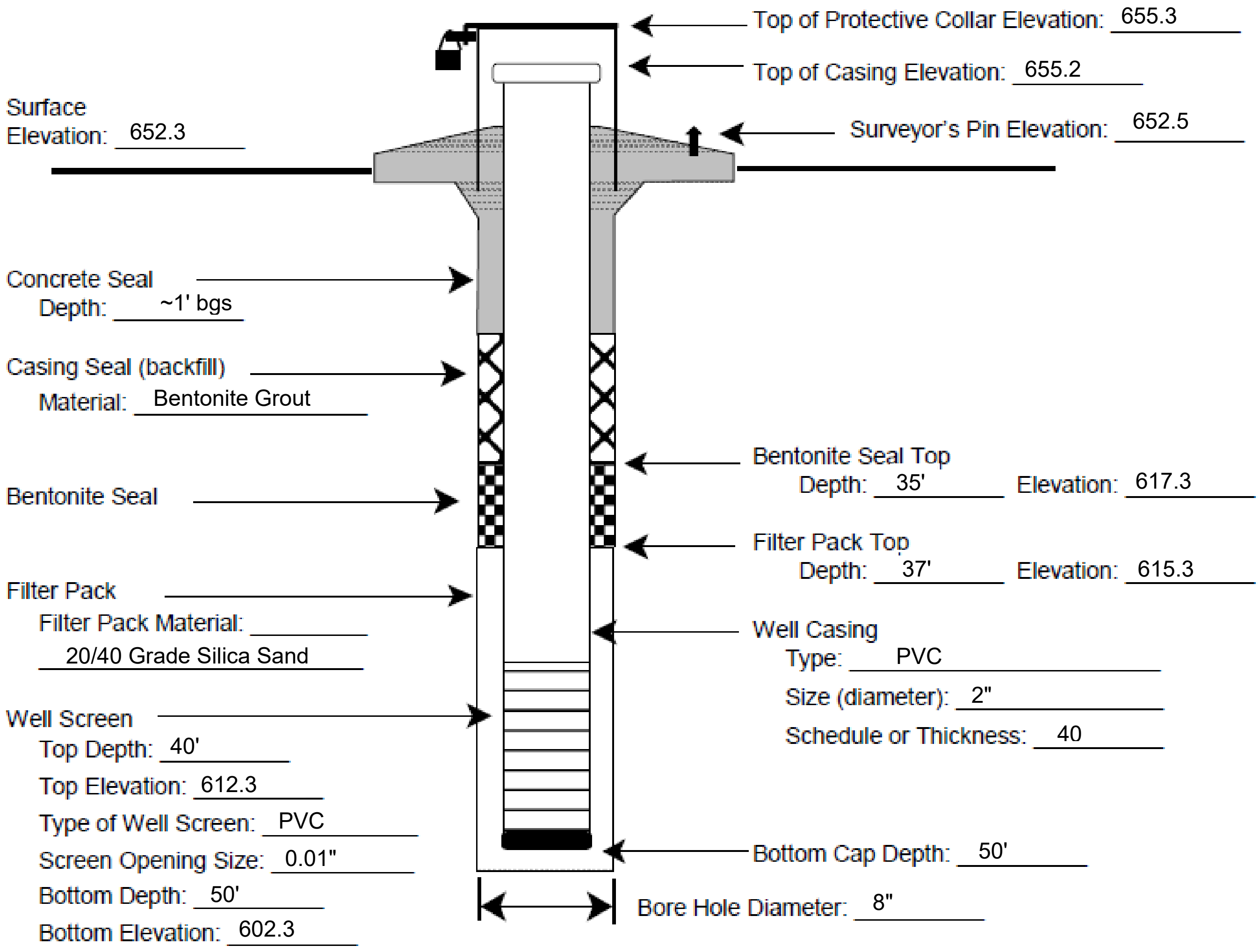
Permittee or Site Name: MESQUITE CREEK LANDFILL
County: Guadalupe
Date of Monitor Well Installation: 1/27/2023
Monitor Well Latitude: 29°43'30.71" Longitude: -98°0'56.63"
Monitor Well Hydraulic Position:
Upgradient X Downgradient ________

MSW Permit No.: 66C
Monitor Well I.D. No.: GB-32 (P)
Date of Well Development: 2/17/2023
Monitor Well Driller
Name: Scott James Campbell
License No.: 53439M

Geologist, Hydrologist, or Engineer Supervising Well Installation: P. Pandey
Static Water Level Elevation (with respect to MSL) after Well Development: 605.9
Name of Geologic Formation(s) in which Well is completed: Lower Taylor Group
Type of Locking Device: Padlock Type of Casing Protection: Steel Monument
Concrete Surface Pad (with steel reinforcement) Dimensions: 4' x 4' x 6"

Notes:

- Report all depths from Surface Elevation and all Elevations relative to Mean Sea Level (MSL), to nearest hundredth of a foot.
- Diameter of boring should be at least 4 inches larger than diameter of well casing.
- Use flush screw joint casing only, 2-inch diameter or larger, with o-rings or PTFE tape in joints (4-inch diameter recommend).
- Well development should continue until water is clear, and pH and conductivity are stable.



Top of Protective Collar Elevation: 655.3
Top of Casing Elevation: 655.2
Surface Elevation: 652.3
Surveyor's Pin Elevation: 652.5
Concrete Seal Depth: ~1' bgs
Casing Seal (backfill) Material: Bentonite Grout
Bentonite Seal
Bentonite Seal Top Depth: 35' Elevation: 617.3
Filter Pack Top Depth: 37' Elevation: 615.3
Filter Pack
Filter Pack Material: 20/40 Grade Silica Sand
Well Casing Type: PVC
Size (diameter): 2"
Schedule or Thickness: 40
Well Screen
Top Depth: 40'
Top Elevation: 612.3
Type of Well Screen: PVC
Screen Opening Size: 0.01"
Bottom Depth: 50'
Bottom Elevation: 602.3
Bottom Cap Depth: 50'
Bore Hole Diameter: 8"

Monitor Well Data Sheet

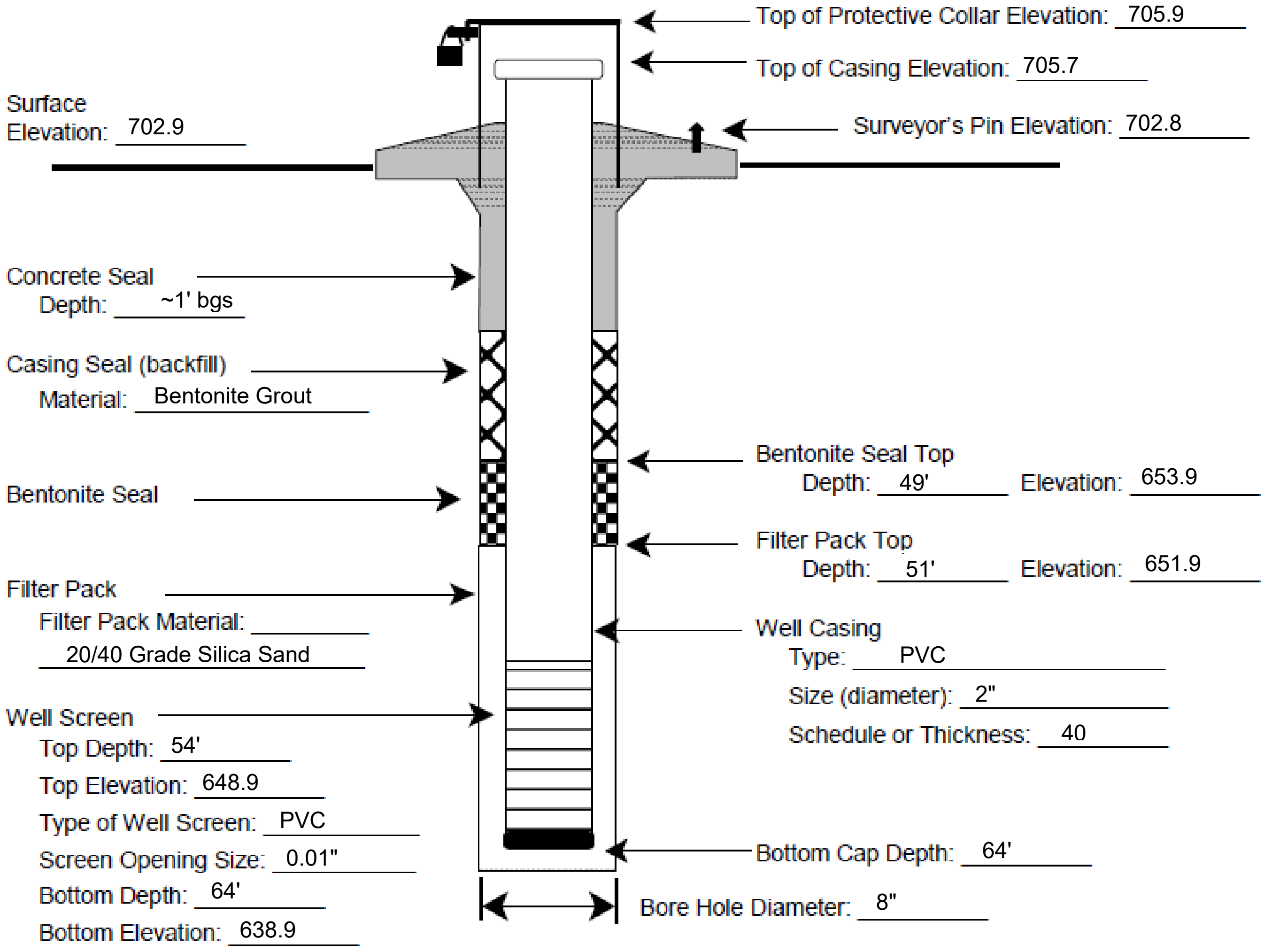
Texas Commission on Environmental Quality
Waste Permits Division

Permittee or Site Name: MESQUITE CREEK LANDFILL
MSW Permit No.: 66C
County: Guadalupe
Monitor Well I.D. No.: GB- 33(P)
Date of Monitor Well Installation: 2/8/2023
Date of Well Development: 2/17/2023
Monitor Well Latitude: 29°43'40.57" Longitude: -98°1'21.33"
Monitor Well Driller
Name: Scott James Campbell
License No.: 53439M
Monitor Well Hydraulic Position:
Upgradient X Downgradient ____

Geologist, Hydrologist, or Engineer Supervising Well Installation: B. Abbott
Static Water Level Elevation (with respect to MSL) after Well Development: 647.9
Name of Geologic Formation(s) in which Well is completed: Lower Taylor Group
Type of Locking Device: Padlock
Type of Casing Protection: Steel Monument
Concrete Surface Pad (with steel reinforcement) Dimensions: 4' x 4' x 6"

Notes:

- Report all depths from Surface Elevation and all Elevations relative to Mean Sea Level (MSL), to nearest hundredth of a foot.
- Diameter of boring should be at least 4 inches larger than diameter of well casing.
- Use flush screw joint casing only, 2-inch diameter or larger, with o-rings or PTFE tape in joints (4-inch diameter recommend).
- Well development should continue until water is clear, and pH and conductivity are stable.



Top of Protective Collar Elevation: 705.9
Top of Casing Elevation: 705.7
Surface Elevation: 702.9
Surveyor's Pin Elevation: 702.8
Concrete Seal Depth: ~1' bgs
Casing Seal (backfill) Material: Bentonite Grout
Bentonite Seal
Bentonite Seal Top Depth: 49' Elevation: 653.9
Filter Pack Top Depth: 51' Elevation: 651.9
Filter Pack
Filter Pack Material: 20/40 Grade Silica Sand
Well Casing Type: PVC
Size (diameter): 2"
Schedule or Thickness: 40
Well Screen
Top Depth: 54'
Top Elevation: 648.9
Type of Well Screen: PVC
Screen Opening Size: 0.01"
Bottom Depth: 64'
Bottom Elevation: 638.9
Bottom Cap Depth: 64'
Bore Hole Diameter: 8"

Monitor Well Data Sheet

Texas Commission on Environmental Quality
Waste Permits Division

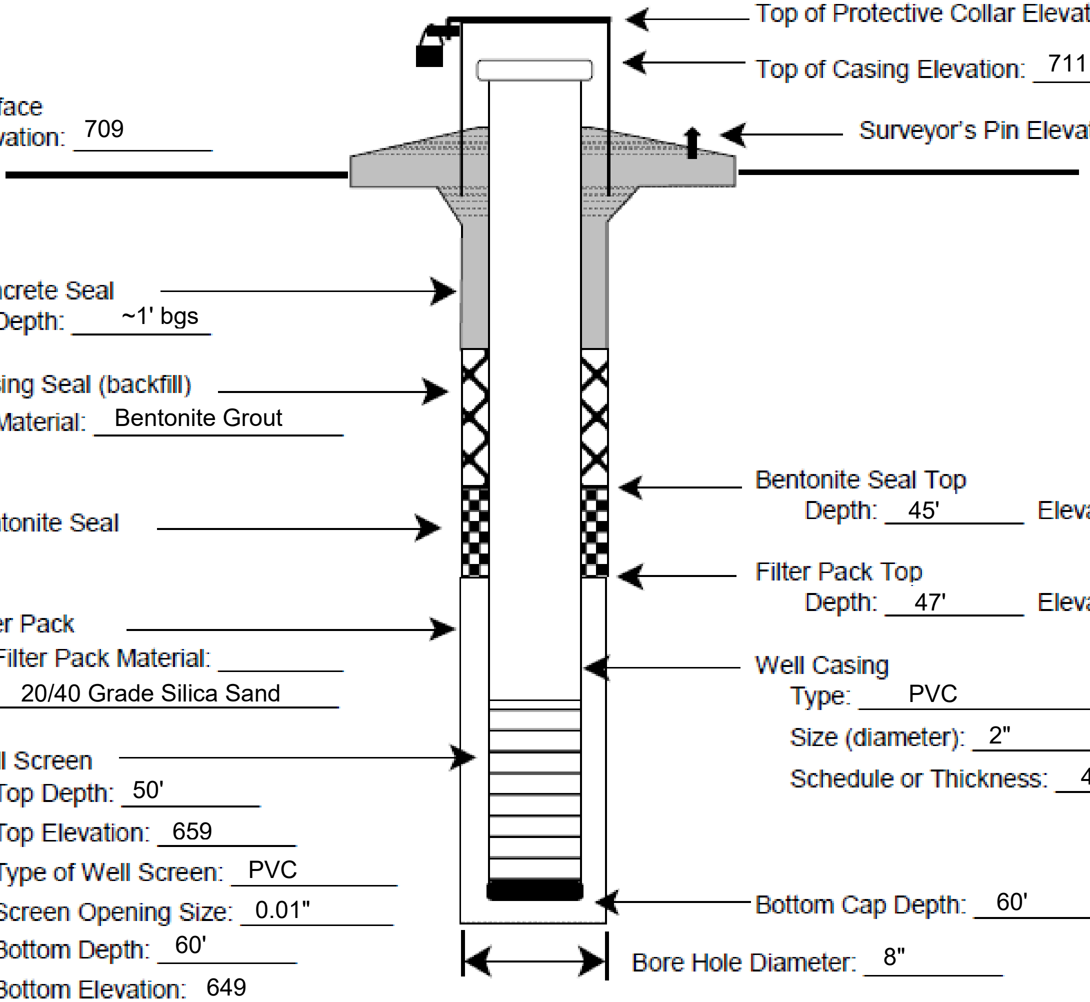
Permittee or Site Name: MESQUITE CREEK LANDFILL
County: Guadalupe
Date of Monitor Well Installation: 2/8/2023
Monitor Well Latitude: 29°43'32.3" Longitude: -98°1'13.22"
Monitor Well Hydraulic Position:
Upgradient X Downgradient ________

MSW Permit No.: 66C
Monitor Well I.D. No.: GB- 35(P)
Date of Well Development: 2/18/2023
Monitor Well Driller
Name: Scott James Campbell
License No.: 53439M

Geologist, Hydrologist, or Engineer Supervising Well Installation: B. Abbott
Static Water Level Elevation (with respect to MSL) after Well Development: 651.6
Name of Geologic Formation(s) in which Well is completed: Lower Taylor Group
Type of Locking Device: Padlock
Type of Casing Protection: Steel Monument
Concrete Surface Pad (with steel reinforcement) Dimensions: 4' x 4' x 6"

Notes:

- Report all depths from Surface Elevation and all Elevations relative to Mean Sea Level (MSL), to nearest hundredth of a foot.
- Diameter of boring should be at least 4 inches larger than diameter of well casing.
- Use flush screw joint casing only, 2-inch diameter or larger, with o-rings or PTFE tape in joints (4-inch diameter recommend).
- Well development should continue until water is clear, and pH and conductivity are stable.



Top of Protective Collar Elevation: 711.9
Top of Casing Elevation: 711.7
Surface Elevation: 709
Surveyor's Pin Elevation: 709.1
Concrete Seal Depth: ~1' bgs
Casing Seal (backfill) Material: Bentonite Grout
Bentonite Seal
Bentonite Seal Top Depth: 45' Elevation: 664
Filter Pack Top Depth: 47' Elevation: 662
Filter Pack
Filter Pack Material: 20/40 Grade Silica Sand
Well Casing
Type: PVC
Size (diameter): 2"
Schedule or Thickness: 40
Well Screen
Top Depth: 50'
Top Elevation: 659
Type of Well Screen: PVC
Screen Opening Size: 0.01"
Bottom Depth: 60'
Bottom Elevation: 649
Bottom Cap Depth: 60'
Bore Hole Diameter: 8"

Monitor Well Data Sheet

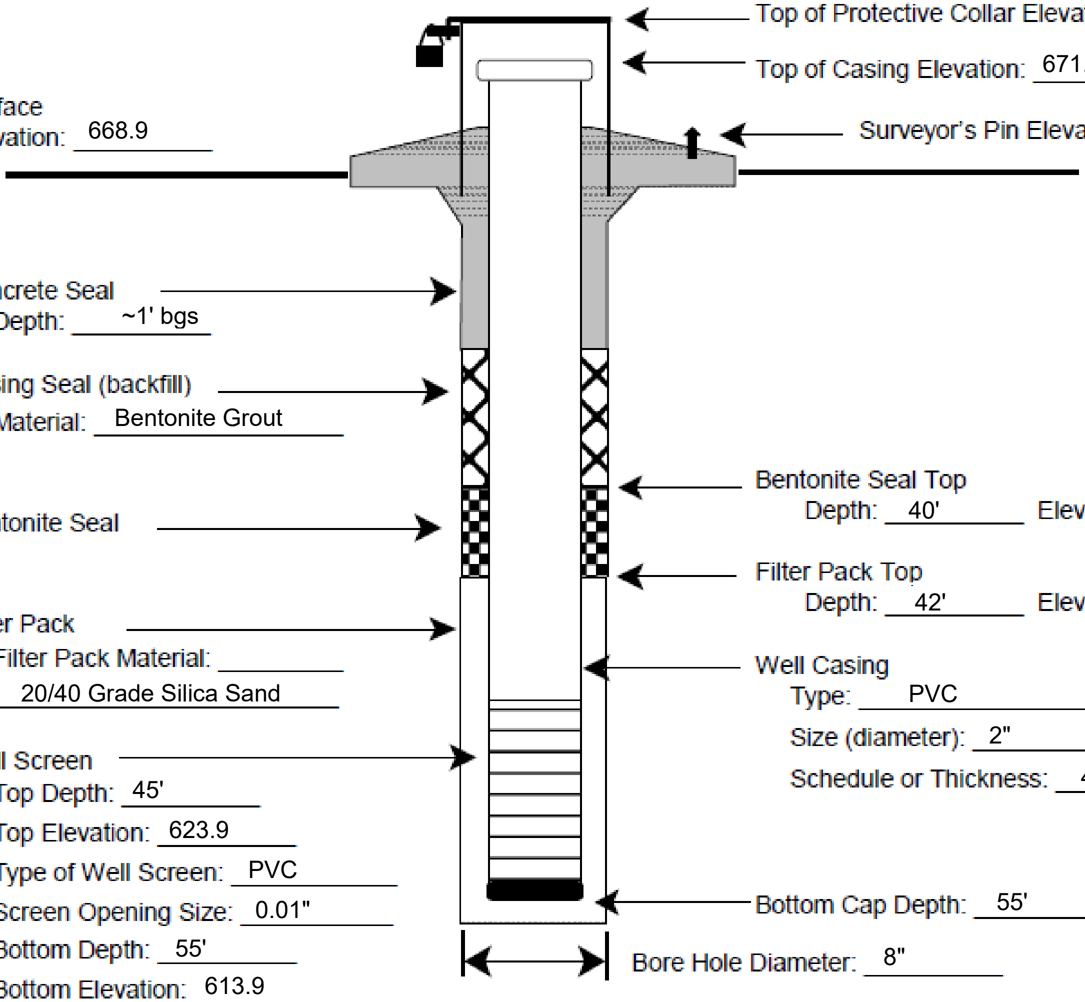
Texas Commission on Environmental Quality
Waste Permits Division

Permittee or Site Name: MESQUITE CREEK LANDFILL
MSW Permit No.: 66C
County: Guadalupe
Monitor Well I.D. No.: GB-37 (P)
Date of Monitor Well Installation: 1/26/2023
Date of Well Development: 2/17/2023
Monitor Well Latitude: 29°43'24.92" Longitude: -98°1'4.04"
Monitor Well Driller
Name: Scott James Campbell
License No.: 53439M
Monitor Well Hydraulic Position:
Upgradient X Downgradient ____

Geologist, Hydrologist, or Engineer Supervising Well Installation: Y. Bholat/ P. Pandey
Static Water Level Elevation (with respect to MSL) after Well Development: 615.2
Name of Geologic Formation(s) in which Well is completed: Lower Taylor Group
Type of Locking Device: Padlock Type of Casing Protection: Steel Monument
Concrete Surface Pad (with steel reinforcement) Dimensions: 4' x 4' x 6"

Notes:

- Report all depths from Surface Elevation and all Elevations relative to Mean Sea Level (MSL), to nearest hundredth of a foot.
- Diameter of boring should be at least 4 inches larger than diameter of well casing.
- Use flush screw joint casing only, 2-inch diameter or larger, with o-rings or PTFE tape in joints (4-inch diameter recommend).
- Well development should continue until water is clear, and pH and conductivity are stable.



Top of Protective Collar Elevation: 671.2
Top of Casing Elevation: 671.1
Surface Elevation: 668.9
Surveyor's Pin Elevation: 668.6
Concrete Seal
Depth: ~1' bgs
Casing Seal (backfill)
Material: Bentonite Grout
Bentonite Seal
Bentonite Seal Top
Depth: 40' Elevation: 628.9
Filter Pack Top
Depth: 42' Elevation: 626.9
Filter Pack
Filter Pack Material:
20/40 Grade Silica Sand
Well Casing
Type: PVC
Size (diameter): 2"
Schedule or Thickness: 40
Well Screen
Top Depth: 45'
Top Elevation: 623.9
Type of Well Screen: PVC
Screen Opening Size: 0.01"
Bottom Depth: 55'
Bottom Elevation: 613.9
Bottom Cap Depth: 55'
Bore Hole Diameter: 8"

Monitor Well Data Sheet

Texas Commission on Environmental Quality
Waste Permits Division

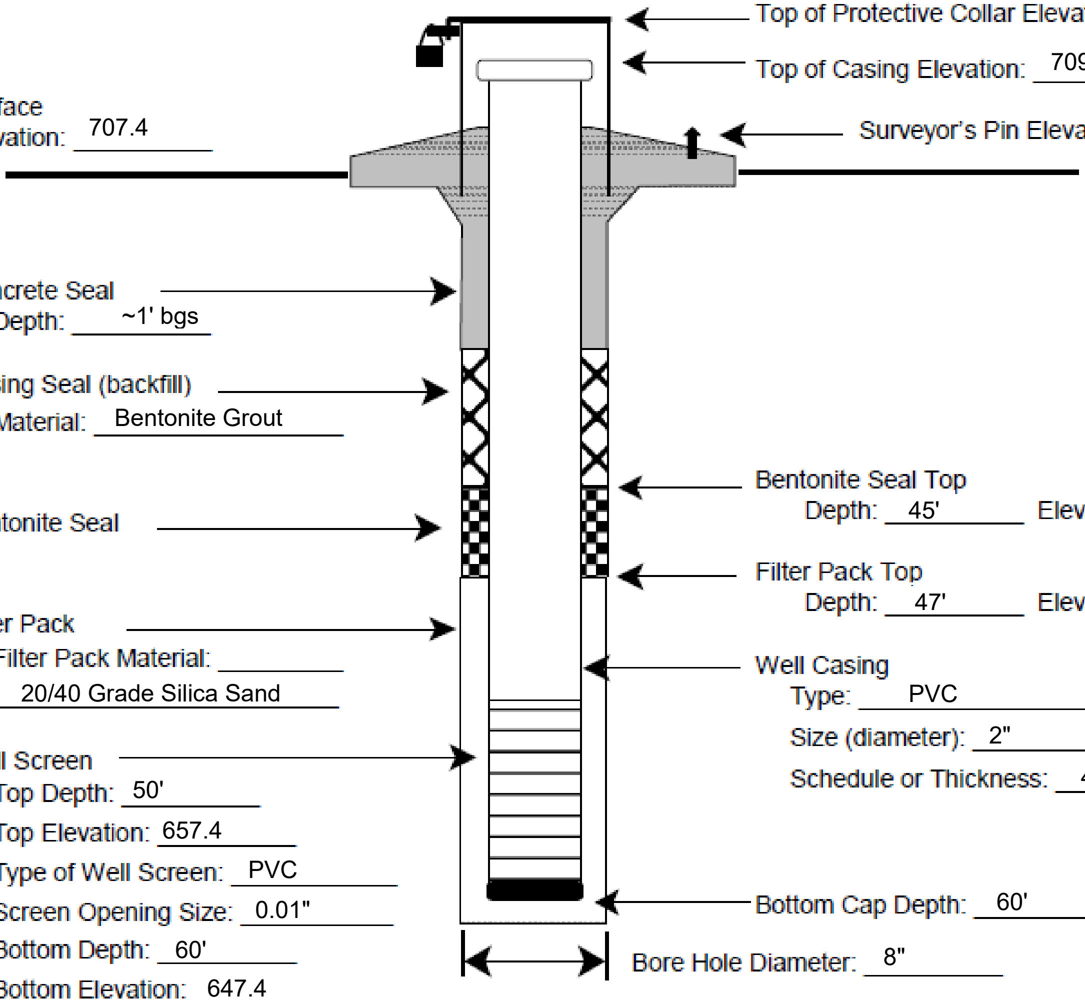
Permittee or Site Name: MESQUITE CREEK LANDFILL
County: Guadalupe
Date of Monitor Well Installation: 1/30/2023
Monitor Well Latitude: 29°43'30.75" Longitude: -98°1'22.65"
Monitor Well Hydraulic Position:
Upgradient X Downgradient ______

MSW Permit No.: 66C
Monitor Well I.D. No.: GB-39 (P)
Date of Well Development: 2/18/2023
Monitor Well Driller
Name: Scott James Campbell
License No.: 53439M

Geologist, Hydrologist, or Engineer Supervising Well Installation: P. Pandey/ B. Abbott
Static Water Level Elevation (with respect to MSL) after Well Development: 652.3
Name of Geologic Formation(s) in which Well is completed: Lower Taylor Group
Type of Locking Device: Padlock Type of Casing Protection: Steel Monument
Concrete Surface Pad (with steel reinforcement) Dimensions: 4' x 4' x 6"

Notes:

- Report all depths from Surface Elevation and all Elevations relative to Mean Sea Level (MSL), to nearest hundredth of a foot.
- Diameter of boring should be at least 4 inches larger than diameter of well casing.
- Use flush screw joint casing only, 2-inch diameter or larger, with o-rings or PTFE tape in joints (4-inch diameter recommend).
- Well development should continue until water is clear, and pH and conductivity are stable.



Top of Protective Collar Elevation: 710
Top of Casing Elevation: 709.9
Surface Elevation: 707.4
Surveyor's Pin Elevation: 707.2
Concrete Seal Depth: ~1' bgs
Casing Seal (backfill) Material: Bentonite Grout
Bentonite Seal
Bentonite Seal Top Depth: 45' Elevation: 662.4
Filter Pack Top Depth: 47' Elevation: 660.4
Filter Pack
Filter Pack Material: 20/40 Grade Silica Sand
Well Casing
Type: PVC
Size (diameter): 2"
Schedule or Thickness: 40
Well Screen
Top Depth: 50'
Top Elevation: 657.4
Type of Well Screen: PVC
Screen Opening Size: 0.01"
Bottom Depth: 60'
Bottom Elevation: 647.4
Bottom Cap Depth: 60'
Bore Hole Diameter: 8"

Monitor Well Data Sheet

Texas Commission on Environmental Quality
Waste Permits Division

Permittee or Site Name: MESQUITE CREEK LANDFILL

MSW Permit No.: 66C

County: Guadalupe

Monitor Well I.D. No.: GB-41 (P)

Date of Monitor Well Installation: 1/26/2023

Date of Well Development: 2/15/2023

Monitor Well Latitude: 29°43'23.04" Longitude: -98°1'14.33"

Monitor Well Driller
Name: Scott James Campbell
License No.: 53439M

Monitor Well Hydraulic Position:
Upgradient X Downgradient ________

Geologist, Hydrologist, or Engineer Supervising Well Installation: Y. Bholat/ P. Pandey

Static Water Level Elevation (with respect to MSL) after Well Development: 628.6

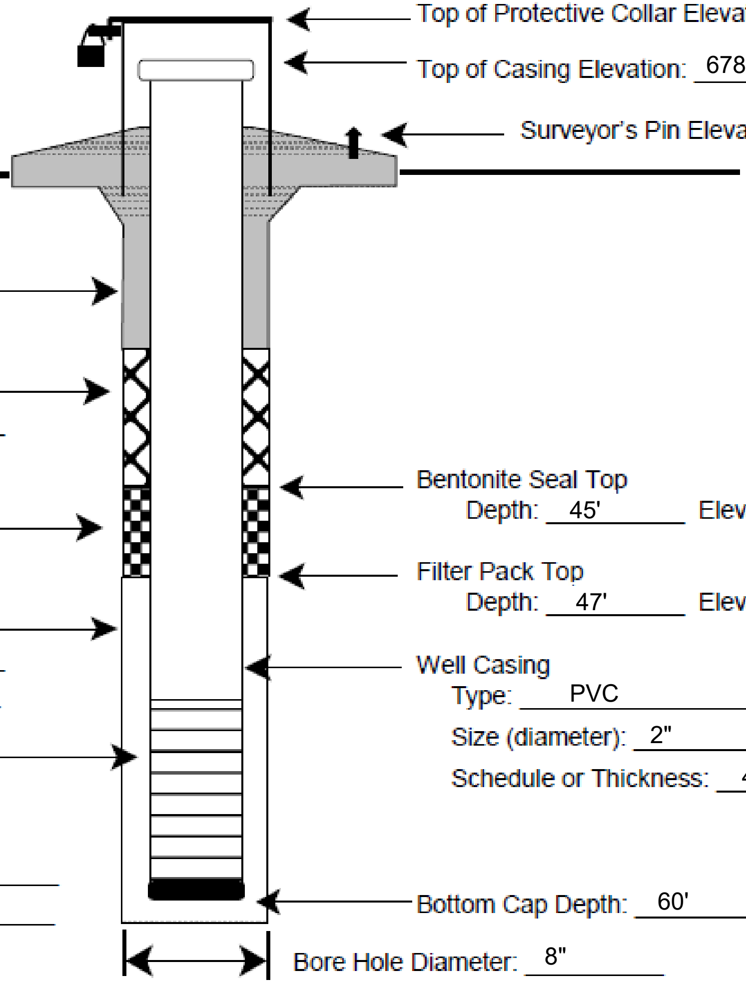
Name of Geologic Formation(s) in which Well is completed: Lower Taylor Group

Type of Locking Device: Padlock Type of Casing Protection: Steel Monument

Concrete Surface Pad (with steel reinforcement) Dimensions: 4' x 4' x 6"

Notes:

- Report all depths from Surface Elevation and all Elevations relative to Mean Sea Level (MSL), to nearest hundredth of a foot.
- Diameter of boring should be at least 4 inches larger than diameter of well casing.
- Use flush screw joint casing only, 2-inch diameter or larger, with o-rings or PTFE tape in joints (4-inch diameter recommend).
- Well development should continue until water is clear, and pH and conductivity are stable.



Top of Protective Collar Elevation: 678.5

Top of Casing Elevation: 678.4

Surface Elevation: 676.2

Surveyor's Pin Elevation: 675.8

Concrete Seal Depth: ~1' bgs

Casing Seal (backfill) Material: Bentonite Grout

Bentonite Seal

Bentonite Seal Top Depth: 45' Elevation: 631.2

Filter Pack Top Depth: 47' Elevation: 629.2

Filter Pack
Filter Pack Material: 20/40 Grade Silica Sand

Well Casing
Type: PVC
Size (diameter): 2"
Schedule or Thickness: 40

Well Screen
Top Depth: 50'
Top Elevation: 626.2
Type of Well Screen: PVC
Screen Opening Size: 0.01"
Bottom Depth: 60'
Bottom Elevation: 616.2

Bottom Cap Depth: 60'

Bore Hole Diameter: 8"

Monitor Well Data Sheet

Texas Commission on Environmental Quality
Waste Permits Division

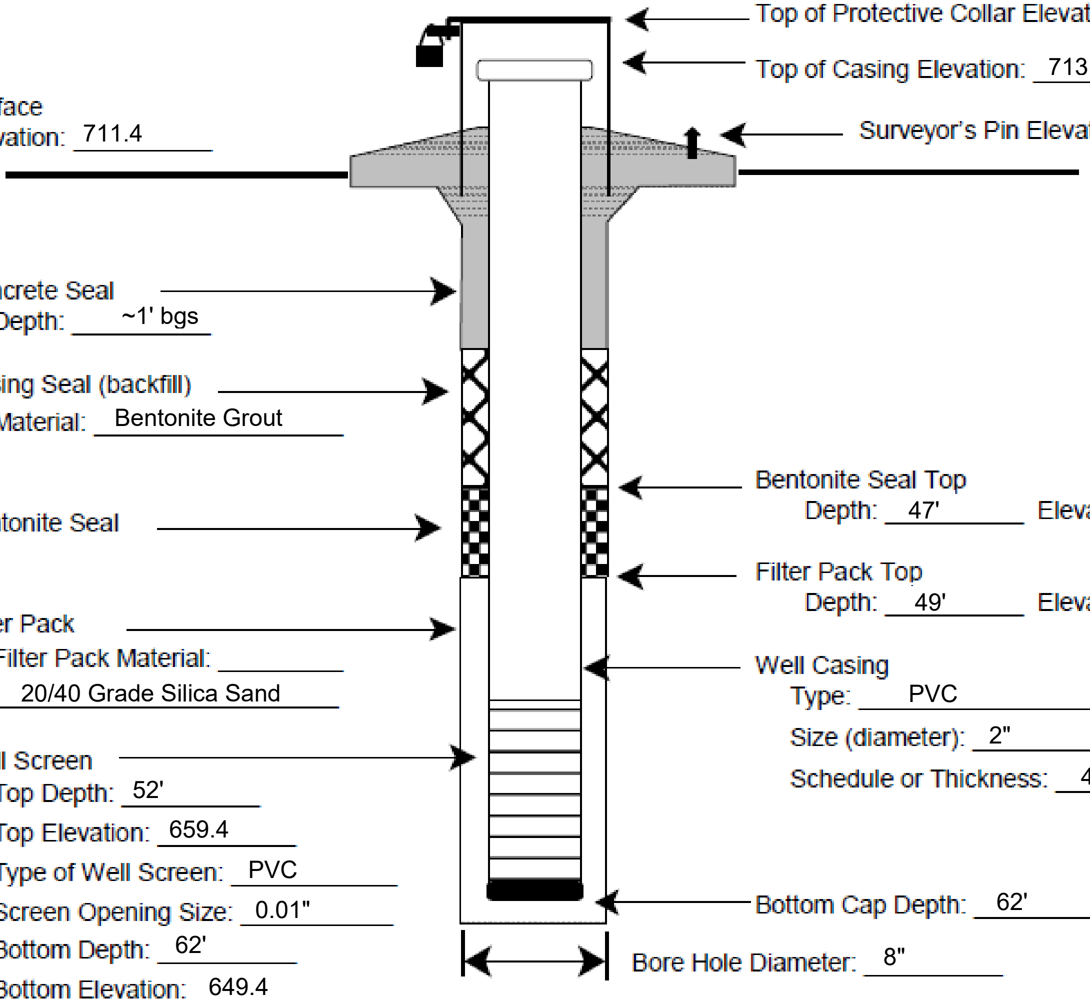
Permittee or Site Name: MESQUITE CREEK LANDFILL
County: Guadalupe
Date of Monitor Well Installation: 2/9/2023
Monitor Well Latitude: 29°43'22.94" Longitude: -98°1'24.81"
Monitor Well Hydraulic Position:
Upgradient X Downgradient

MSW Permit No.: 66C
Monitor Well I.D. No.: GB- 45(P)
Date of Well Development: 2/17/2023
Monitor Well Driller
Name: Scott James Campbell
License No.: 53439M

Geologist, Hydrologist, or Engineer Supervising Well Installation: B. Abbott
Static Water Level Elevation (with respect to MSL) after Well Development: 650.6
Name of Geologic Formation(s) in which Well is completed: Lower Taylor Group
Type of Locking Device: Padlock Type of Casing Protection: Steel Monument
Concrete Surface Pad (with steel reinforcement) Dimensions: 4' x 4' x 6"

Notes:

- Report all depths from Surface Elevation and all Elevations relative to Mean Sea Level (MSL), to nearest hundredth of a foot.
- Diameter of boring should be at least 4 inches larger than diameter of well casing.
- Use flush screw joint casing only, 2-inch diameter or larger, with o-rings or PTFE tape in joints (4-inch diameter recommend).
- Well development should continue until water is clear, and pH and conductivity are stable.



Top of Protective Collar Elevation: 713.82
Top of Casing Elevation: 713.66
Surface Elevation: 711.4
Surveyor's Pin Elevation: 711.07

Concrete Seal
Depth: ~1' bgs

Casing Seal (backfill)
Material: Bentonite Grout

Bentonite Seal

Bentonite Seal Top
Depth: 47' Elevation: 664.4

Filter Pack Top
Depth: 49' Elevation: 662.4

Filter Pack
Filter Pack Material:
20/40 Grade Silica Sand

Well Casing
Type: PVC
Size (diameter): 2"
Schedule or Thickness: 40

Well Screen
Top Depth: 52'
Top Elevation: 659.4
Type of Well Screen: PVC
Screen Opening Size: 0.01"
Bottom Depth: 62'
Bottom Elevation: 649.4

Bottom Cap Depth: 62'
Bore Hole Diameter: 8"

Monitor Well Data Sheet

Texas Commission on Environmental Quality
Waste Permits Division

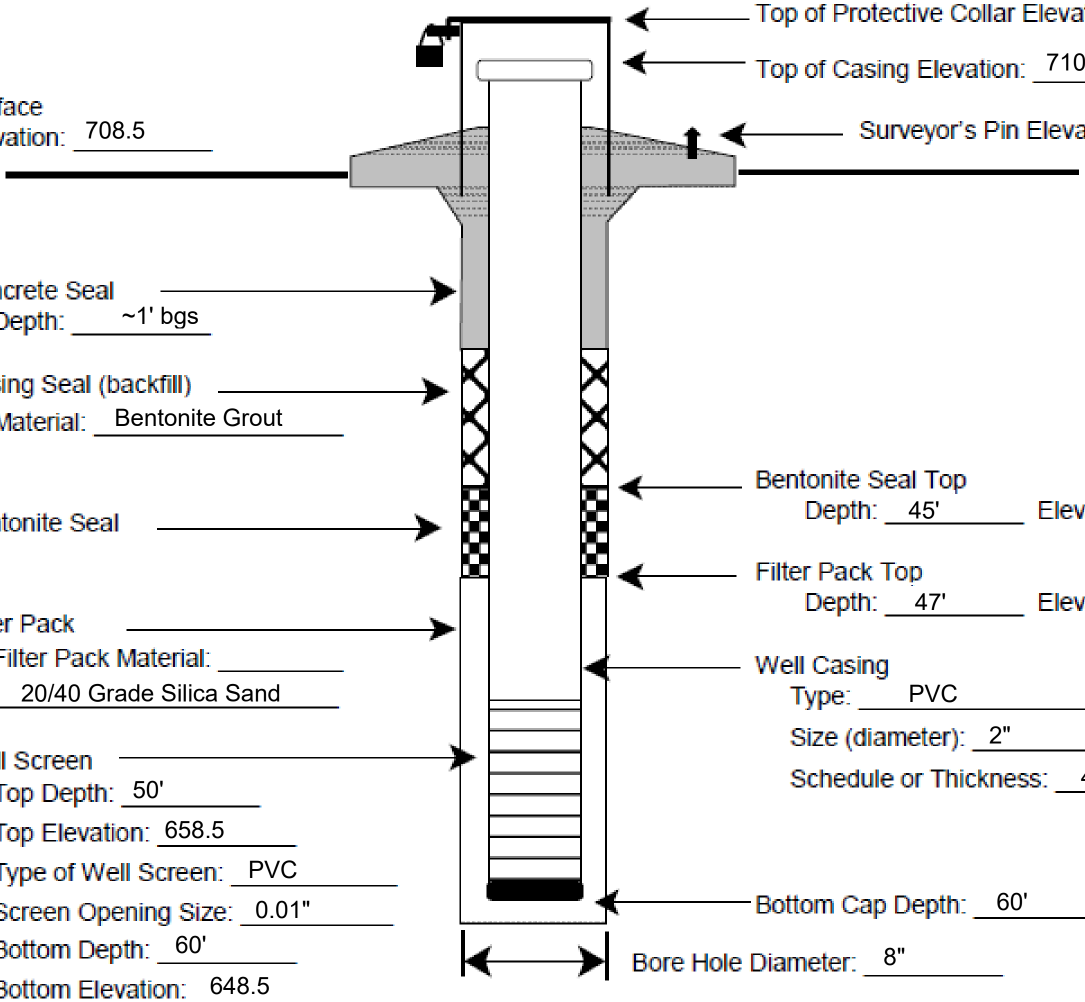
Permittee or Site Name: MESQUITE CREEK LANDFILL
County: Guadalupe
Date of Monitor Well Installation: 2/10/2023
Monitor Well Latitude: 29°43'25.22" Longitude: -98°1'39.35"
Monitor Well Hydraulic Position:
Upgradient X Downgradient ______

MSW Permit No.: 66C
Monitor Well I.D. No.: GB- 48(P)
Date of Well Development: 2/18/2023
Monitor Well Driller
Name: Scott James Campbell
License No.: 53439M

Geologist, Hydrologist, or Engineer Supervising Well Installation: B. Abbott
Static Water Level Elevation (with respect to MSL) after Well Development: 664.8
Name of Geologic Formation(s) in which Well is completed: Lower Taylor Group
Type of Locking Device: Padlock Type of Casing Protection: Steel Monument
Concrete Surface Pad (with steel reinforcement) Dimensions: 4' x 4' x 6"

Notes:

- Report all depths from Surface Elevation and all Elevations relative to Mean Sea Level (MSL), to nearest hundredth of a foot.
- Diameter of boring should be at least 4 inches larger than diameter of well casing.
- Use flush screw joint casing only, 2-inch diameter or larger, with o-rings or PTFE tape in joints (4-inch diameter recommend).
- Well development should continue until water is clear, and pH and conductivity are stable.



Top of Protective Collar Elevation: 710.9
Top of Casing Elevation: 710.8
Surface Elevation: 708.5
Surveyor's Pin Elevation: 708.1
Concrete Seal
Depth: ~1' bgs
Casing Seal (backfill)
Material: Bentonite Grout
Bentonite Seal
Bentonite Seal Top
Depth: 45' Elevation: 663.5
Filter Pack Top
Depth: 47' Elevation: 661.5
Filter Pack
Filter Pack Material: 20/40 Grade Silica Sand
Well Casing
Type: PVC
Size (diameter): 2"
Schedule or Thickness: 40
Well Screen
Top Depth: 50'
Top Elevation: 658.5
Type of Well Screen: PVC
Screen Opening Size: 0.01"
Bottom Depth: 60'
Bottom Elevation: 648.5
Bottom Cap Depth: 60'
Bore Hole Diameter: 8"

Monitor Well Data Sheet

Texas Commission on Environmental Quality
Waste Permits Division

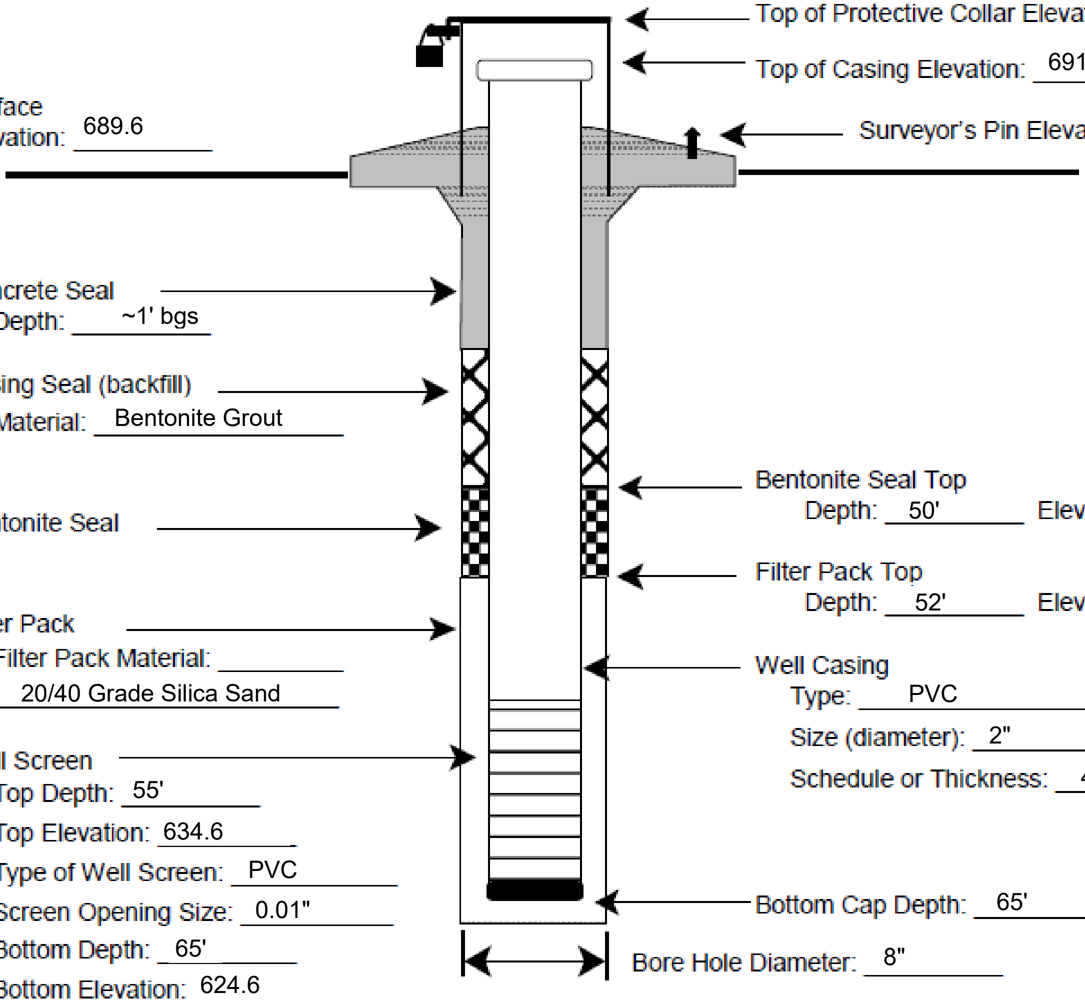
Permittee or Site Name: MESQUITE CREEK LANDFILL
County: Guadalupe
Date of Monitor Well Installation: 2/1/2023
Monitor Well Latitude: 29°43'17.4" Longitude: -98°1'30.77"
Monitor Well Hydraulic Position:
Upgradient X Downgradient ____

MSW Permit No.: 66C
Monitor Well I.D. No.: GB- 50(P)
Date of Well Development: 2/15/2023
Monitor Well Driller
Name: Scott James Campbell
License No.: 53439M

Geologist, Hydrologist, or Engineer Supervising Well Installation: B. Abbott
Static Water Level Elevation (with respect to MSL) after Well Development: 665.0
Name of Geologic Formation(s) in which Well is completed: Lower Taylor Group
Type of Locking Device: Padlock Type of Casing Protection: Steel Monument
Concrete Surface Pad (with steel reinforcement) Dimensions: 4' x 4' x 6"

Notes:

- Report all depths from Surface Elevation and all Elevations relative to Mean Sea Level (MSL), to nearest hundredth of a foot.
- Diameter of boring should be at least 4 inches larger than diameter of well casing.
- Use flush screw joint casing only, 2-inch diameter or larger, with o-rings or PTFE tape in joints (4-inch diameter recommend).
- Well development should continue until water is clear, and pH and conductivity are stable.



Top of Protective Collar Elevation: 691.6
Top of Casing Elevation: 691.4
Surface Elevation: 689.6
Surveyor's Pin Elevation: 688.7

Concrete Seal
Depth: ~1' bgs

Casing Seal (backfill)
Material: Bentonite Grout

Bentonite Seal

Bentonite Seal Top
Depth: 50' Elevation: 639.6

Filter Pack Top
Depth: 52' Elevation: 637.6

Filter Pack
Filter Pack Material: ____
20/40 Grade Silica Sand

Well Casing
Type: PVC
Size (diameter): 2"
Schedule or Thickness: 40

Well Screen
Top Depth: 55'
Top Elevation: 634.6
Type of Well Screen: PVC
Screen Opening Size: 0.01"
Bottom Depth: 65'
Bottom Elevation: 624.6

Bottom Cap Depth: 65'
Bore Hole Diameter: 8"

Monitor Well Data Sheet

Texas Commission on Environmental Quality
Waste Permits Division

Permittee or Site Name: MESQUITE CREEK LANDFILL

MSW Permit No.: 66C

County: Guadalupe

Monitor Well I.D. No.: GB- 52(P)

Date of Monitor Well Installation: 1/31/2023

Date of Well Development: 2/18/2023

Monitor Well Latitude: 29°43'9.35" Longitude: -98°1'22.13"

Monitor Well Driller
Name: Scott James Campbell
License No.: 53439M

Monitor Well Hydraulic Position:
Upgradient X Downgradient

Geologist, Hydrologist, or Engineer Supervising Well Installation: P. Pandey/ B. Abbott

Static Water Level Elevation (with respect to MSL) after Well Development: 635.7

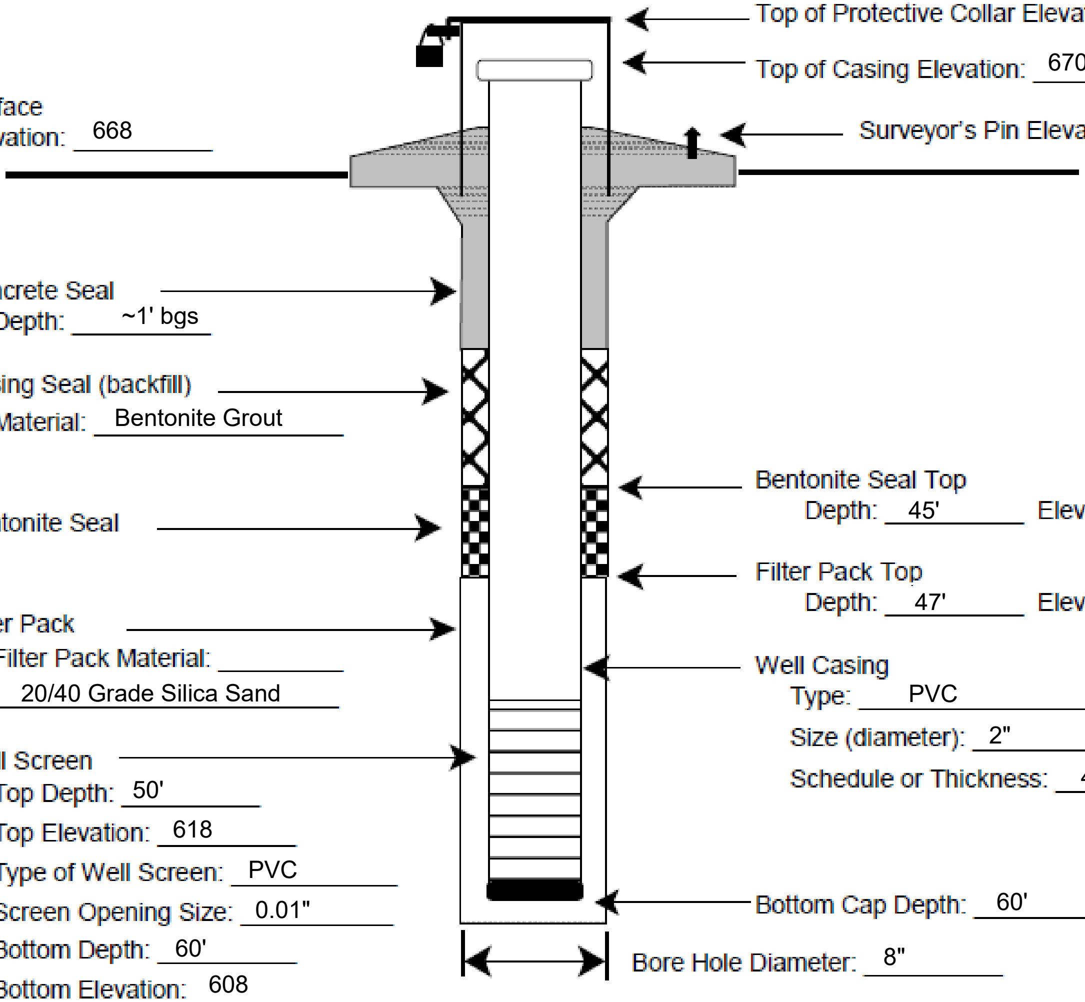
Name of Geologic Formation(s) in which Well is completed: Lower Taylor Group

Type of Locking Device: Padlock Type of Casing Protection: Steel Monument

Concrete Surface Pad (with steel reinforcement) Dimensions: 4' x 4' x 6"

Notes:

- Report all depths from Surface Elevation and all Elevations relative to Mean Sea Level (MSL), to nearest hundredth of a foot.
- Diameter of boring should be at least 4 inches larger than diameter of well casing.
- Use flush screw joint casing only, 2-inch diameter or larger, with o-rings or PTFE tape in joints (4-inch diameter recommend).
- Well development should continue until water is clear, and pH and conductivity are stable.



Top of Protective Collar Elevation: 670.4

Top of Casing Elevation: 670.2

Surface Elevation: 668

Surveyor's Pin Elevation: 667.4

Concrete Seal
Depth: ~1' bgs

Casing Seal (backfill)
Material: Bentonite Grout

Bentonite Seal

Bentonite Seal Top
Depth: 45' Elevation: 623

Filter Pack Top
Depth: 47' Elevation: 621

Filter Pack
Filter Pack Material:
20/40 Grade Silica Sand

Well Casing
Type: PVC
Size (diameter): 2"
Schedule or Thickness: 40

Well Screen
Top Depth: 50'
Top Elevation: 618
Type of Well Screen: PVC
Screen Opening Size: 0.01"
Bottom Depth: 60'
Bottom Elevation: 608

Bottom Cap Depth: 60'

Bore Hole Diameter: 8"

HISTORICAL PIEZOMETER AND WELL LOGS UNDER PERMIT 66B

PIEZOMETER INSTALLATION REPORT

PROJECT: Comal County Landfill

WELL NO: P-6

CLIENT: Waste Management, Inc.

PROJECT NO: 87-446

LOCATION: New Braunfels, Texas

PIEZOMETER COMPLETION

DATE: 12-5-87

DRY AUGURED 0 TO 80 FT

WASH BORED ______ TO ______ FT

DRILLING FLUID ______

PIEZOMETER DEVELOPMENT

DATE: 12-6-87

METHOD: Air

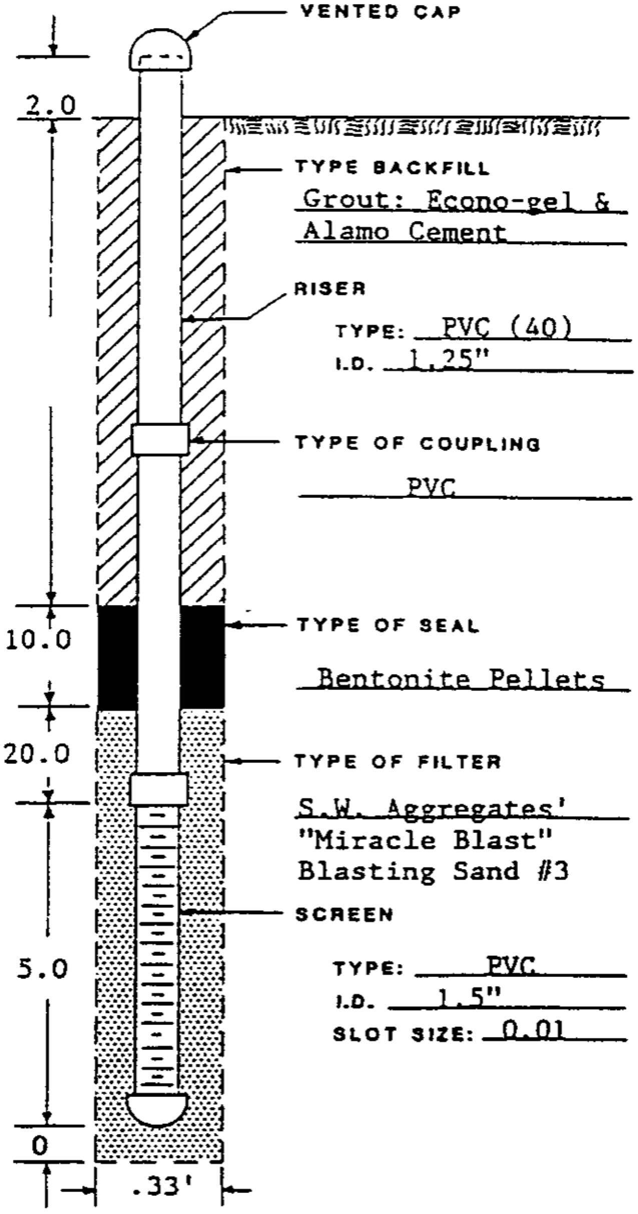
WATER LEVEL READINGS

FREE WATER AT ______ FT

DATE	DEPTH *	ELEVATION
12-7-87	21.5'	618.5
12-13-87	15.0'	625.0
1-12-88	10.4'	629.6
2-10-88	10.1'	629.9
5-10-88	10.5'	629.5

*Below top of casing.

DEPTH (FT)	ELEV. (FT)
	640
0	638
10	628
20	618
40	598
45	593
45	593



VENTED CAP

TYPE BACKFILL
Grout: Econo-gel &
Alamo Cement

RISER
TYPE: PVC (40)
I.D. 1.25"

TYPE OF COUPLING
PVC

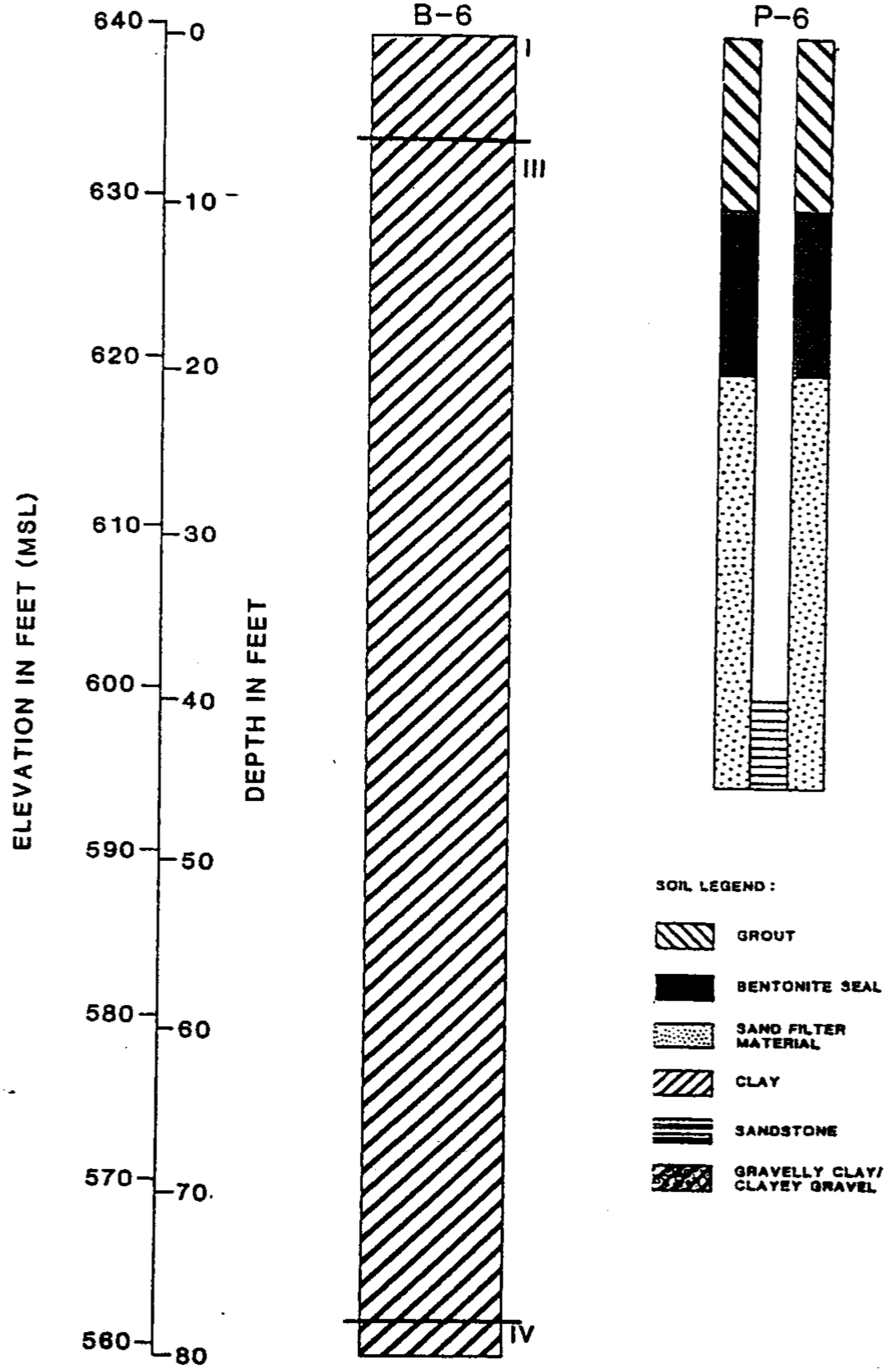
TYPE OF SEAL
Bentonite Pellets

TYPE OF FILTER
S.W. Aggregates'
"Miracle Blast"
Blasting Sand #3

SCREEN
TYPE: PVC
I.D. 1.5"
SLOT SIZE: 0.01

REMARKS:

Geo – disposal consultants, inc.



SCHEMATIC OF PIEZOMETER INSTALLATION
P-6

PIEZOMETER INSTALLATION REPORT

PROJECT: Comal County Landfill

WELL NO: P-7

CLIENT: Waste Management, Inc.

PROJECT NO: 87-446

LOCATION: New Braunfels, Texas

PIEZOMETER COMPLETION

DATE: 12-5-87

DRY AUGURED 0 **TO** 80 **FT**

WASH BORED ______ **TO** ______ **FT**

DRILLING FLUID ______

PIEZOMETER DEVELOPMENT

DATE: 12-6-87

METHOD: Air

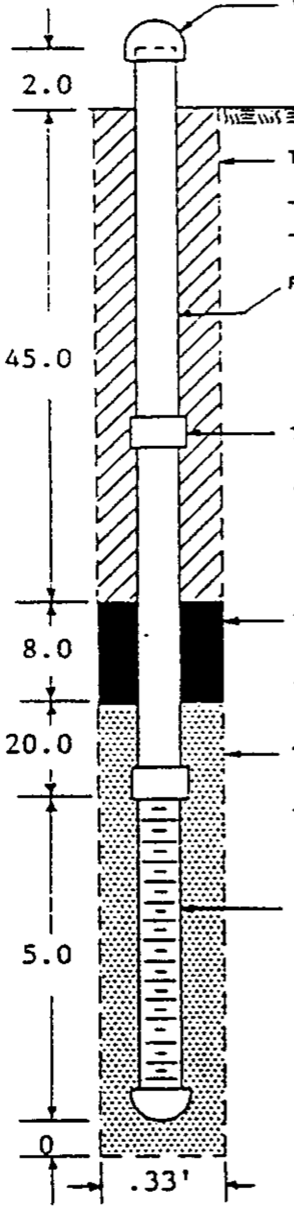
WATER LEVEL READINGS

FREE WATER AT ______ **FT**

DATE	DEPTH *	ELEVATION
12-7-87	dry	
12-13-87	73.0'	593.0
1-12-88	73.8'	592.2
2-10-88	72.0'	594.0
5-10-88	64.5'	601.5

*Below top of casing.

DEPTH (FT)	ELEV. (FT)
	666
0	664
45.0	619
53.0	611
73.0	591
78.0	586
78.0	586



VENTED CAP

TYPE BACKFILL
Grout: Econo-gel & Alamo Cement

RISER
TYPE: PVC (40)
I.D. 1.25"

TYPE OF COUPLING
PVC

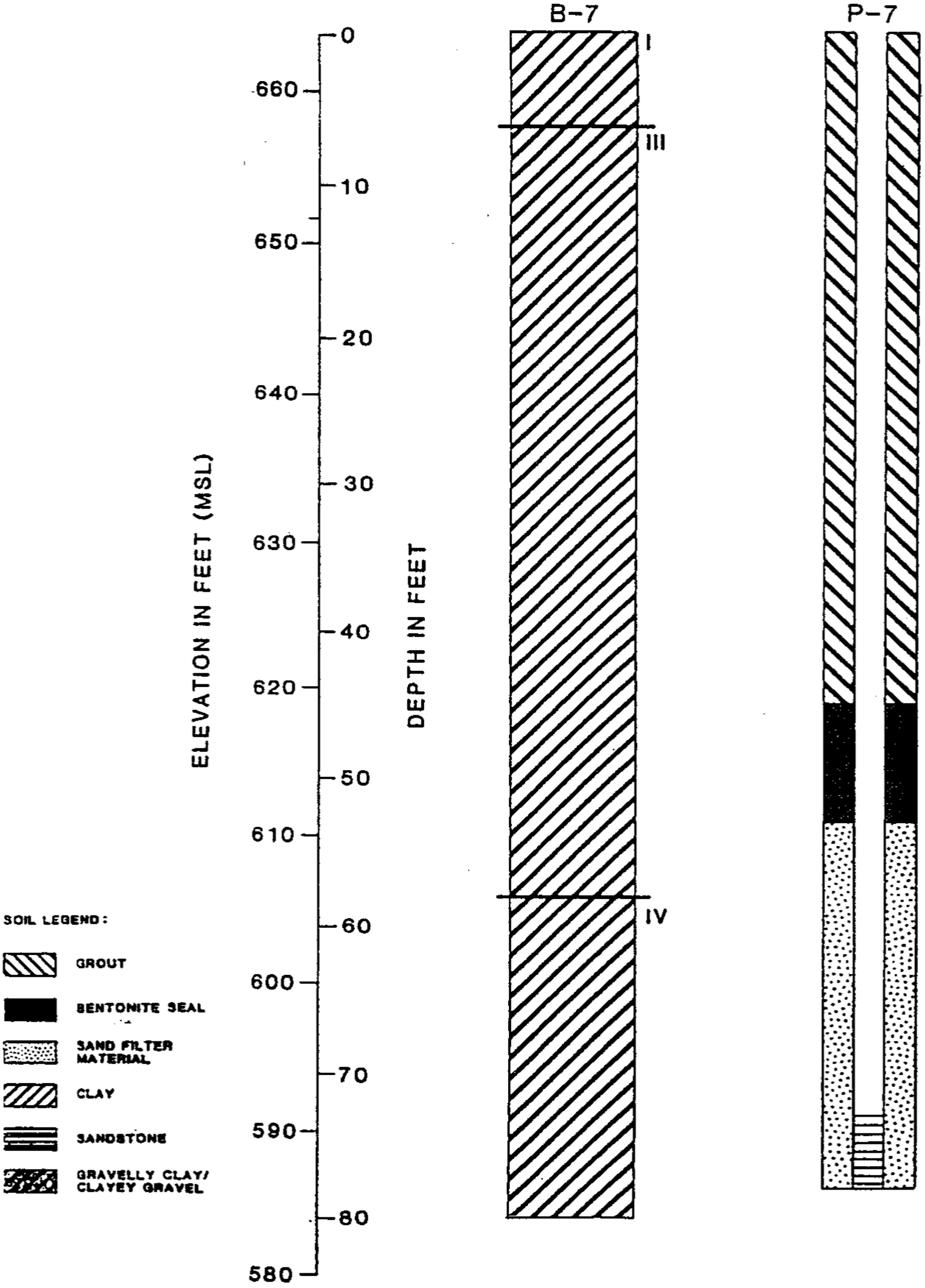
TYPE OF SEAL
Bentonite Pellets

TYPE OF FILTER
S.W. Aggregates' "Miracle Blast" Blasting Sand #3

SCREEN
TYPE: PVC
I.D. 1.5"
SLOT SIZE: 0.01

REMARKS:

Geo - disposal consultants, inc.



SCHEMATIC OF PIEZOMETER INSTALLATION
P-7

FILE NO. 87-446

McBride-Ratcliff and Associates, Inc.

PIEZOMETER INSTALLATION REPORT

PROJECT: Comal County Landfill

WELL NO: P-10

CLIENT: Waste Management, Inc.

PROJECT NO: 87-446

LOCATION: New Braunfels, Texas

PIEZOMETER COMPLETION

DATE: 12-7-87

DRY AUGURED 0 **TO** 68 **FT**

WASH BORED 68 **TO** 80 **FT**
(NX Cored)

DRILLING FLUID Water

PIEZOMETER DEVELOPMENT

DATE: 12-8-87

METHOD: Air

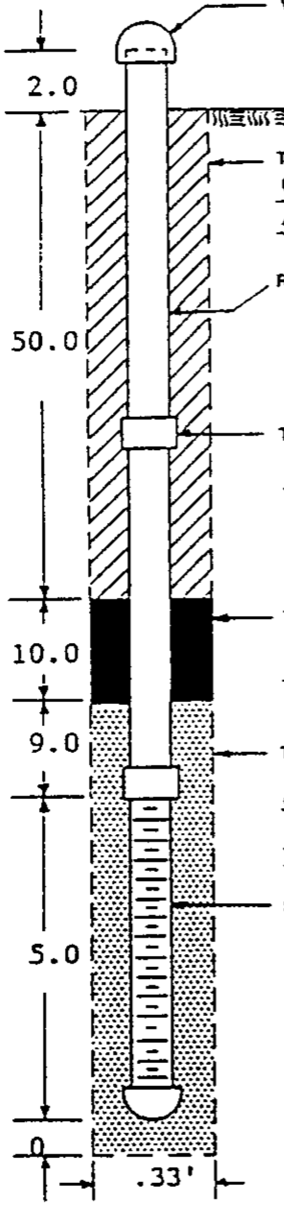
WATER LEVEL READINGS

FREE WATER AT _____ **FT**

DATE	DEPTH *	ELEVATION
12-7-87	72.0'	572.0
12-13-87	69.5'	574.5
1-12-88	DRY	
2-10-88	73.0'	571.0
5-10-88	72.2'	571.8

*Below top of casing.

DEPTH (FT)	ELEV. (FT)
	644
0.0	642
50.0	592
60.0	582
69.0	573
74.0	568
74.0	568



VENTED CAP

TYPE BACKFILL
Grout: Econo-gel & Alamo Cement

RISER
TYPE: PVC (40)
I.D. 1.25"

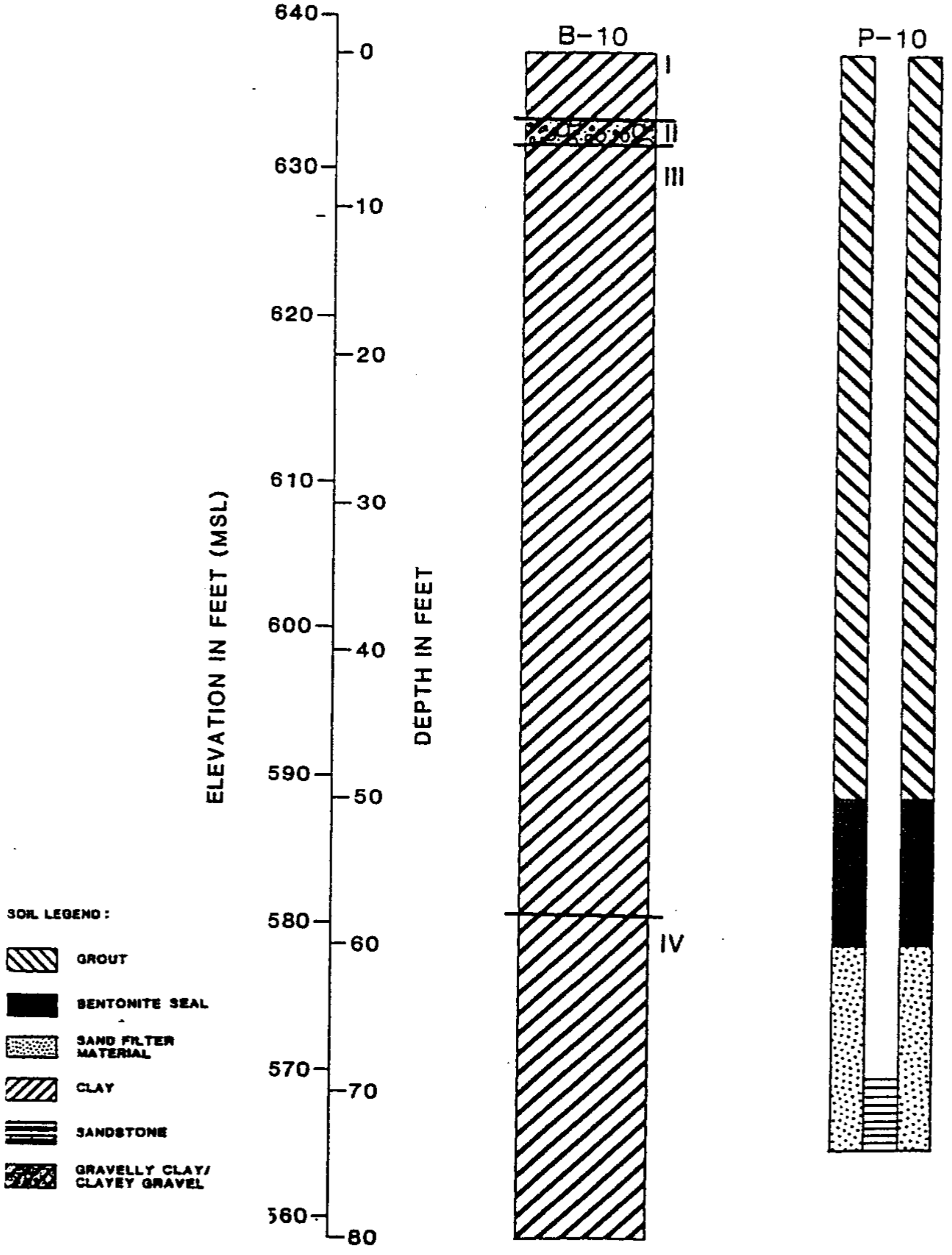
TYPE OF COUPLING
PVC

TYPE OF SEAL
Bentonite Pellets

TYPE OF FILTER
S.W. Aggregates' "Miracle Blast" Blasting Sand #3

SCREEN
TYPE: PVC
I.D. 1.5"
SLOT SIZE: 0.01

REMARKS: Could not extract remaining 2' of H_2O from borehole.
H_2O level at time of installation: 72.0'



SCHEMATIC OF PIEZOMETER INSTALLATION
P-10

FILE NO. 87-446

—McBride-Ratcliff and Associates, Inc.—

PIEZOMETER INSTALLATION REPORT

PROJECT: Comal County Landfill **WELL NO:** P-14

CLIENT: Waste Management, Inc. **PROJECT NO:** 87-446

LOCATION: New Braunfels, Texas

PIEZOMETER COMPLETION

DATE: 12-7-87

DRY AUGURED 0 **TO** 28 **FT**

WASH BORED 28 **TO** 50 **FT**
(NX Cored)

DRILLING FLUID Water

PIEZOMETER DEVELOPMENT

DATE: 12-8-87

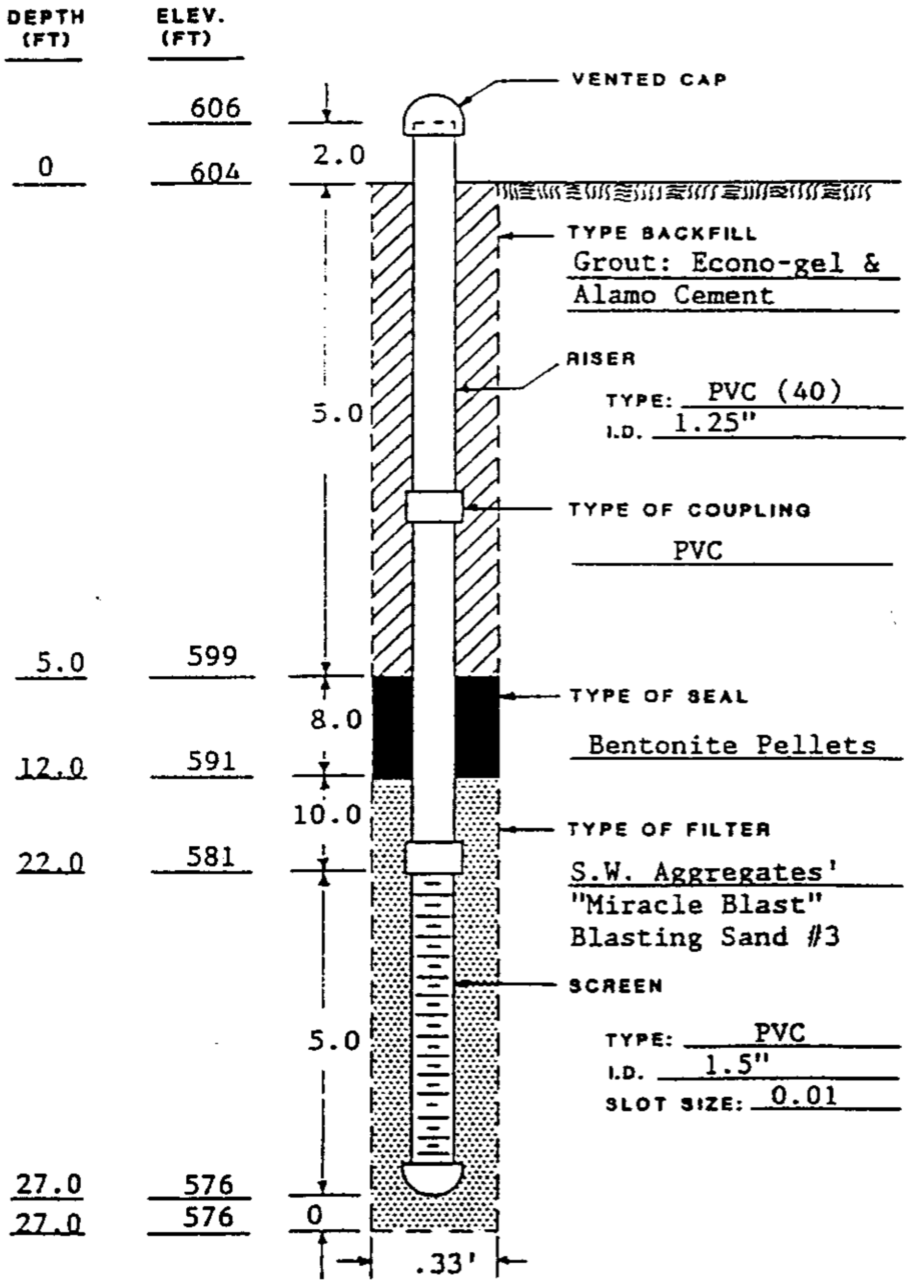
METHOD: Air

WATER LEVEL READINGS

FREE WATER AT _______ **FT**

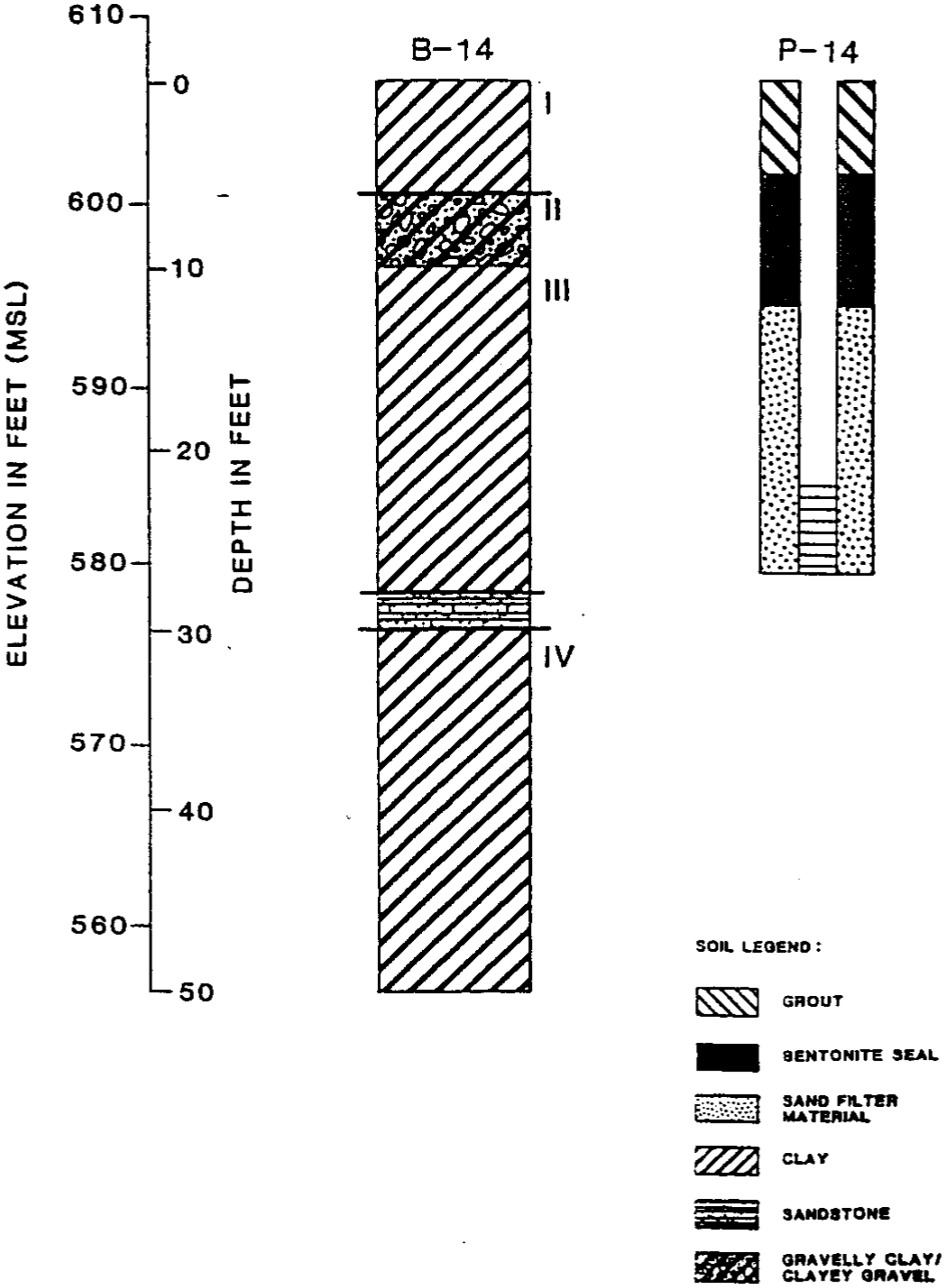
DATE	DEPTH *	ELEVATION
12-7-87	DRY	
12-13-87	DRY	
1-12-88	DRY	
5-10-88	23.3'	582.7

*Below top of casing.



REMARKS:

Geo – disposal consultants, inc.



SCHEMATIC OF PIEZOMETER INSTALLATION
P-14

FILE NO. 87-446

WELL PZ-2

WELL CONSTRUCTION SUMMARY

LOCATION or COORDS: N: 733,800 E: 1,823,200

ELEVATION: GROUND LEVEL 633.55 ft NG

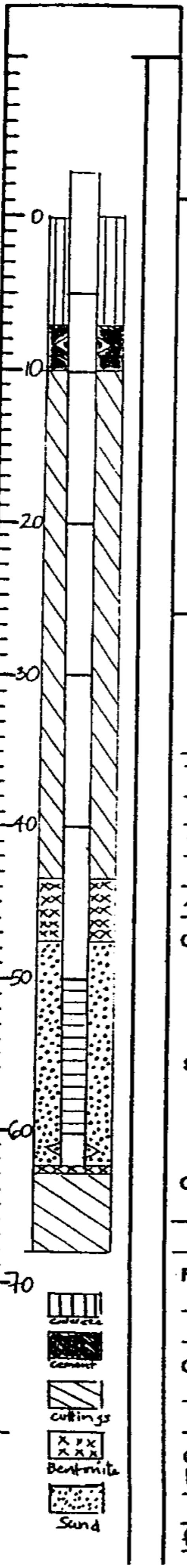
TOP OF CASING 635.62 ft N

CATION Nohlenberg Rd #2 & Hwy 1101

SUPERVISOR Eric F. Pastor

[illegible] Smyth

STAFF Rebecca C. Smyth



DRILLING SUMMARY:

TOTAL DEPTH Hole = 68 ft; Well = 62.5

BOREHOLE DIAMETER 9 inches

DRILLER Ric Jones
TWC Licence # 2799-M

RIG Mobil Drill B-62 HD

BIT(S) 9 inch cutter head w/ hollow-stem augers (8" O.D. & 3 3/8" I.D.)

DRILLING FLUID none

CONSTRUCTION TIME LOG:

TASK	START DATE	START TIME	FINISH DATE	FINISH TIME
DRILLING:	4/24/90	1420	4/25/90	0850
GEOPH. LOGGING:				
CASING:	4/25/90	0930	4/25/90	100C
FILTER PLACEMENT:	4/25/90	1000	4/25/90	1045
CEMENTING:	4/25/90	1045	4/25/90	1120
DEVELOPMENT:				
OTHER: Concrete pad	4/30/90		4/30/90	

WELL DESIGN:

BASIS: GEOLOGIC LOG ✓ GEOPHYSICAL LOG ___

CASING STRING(S): C-CASING S-SCREEN

+3 - 5	C1		50 - 60	S1	
5 - 10	C2		60 - 62.5	C7	
10 - 20	C3				
20 - 30	C4				
30 - 40	C5				
40 - 50	C6				

CASING: C1 1¼" x 10' Triloc PVC (sch 40)
C2 1¼" x 5' Triloc PVC "
C3, C4, C5, C6: 1¼" x 10' Triloc PVC (sch 40)
C7: 1¼" x 2.5' Triloc PVC (sch 40)

SCREEN: S1 1¼" x 10' Triloc Screen (0.01)
S2
S3
S4

CENTRALIZERS 8, 62 ft BGL (stainless steel)

FILTER MATERIAL 16-30 Silica Sand (100 # bags) 7 bags from 47.8 - 62.5 ft BGL.

CEMENT Portland Type I w/ 5% bentonite powder. 2-94 # bags from ≈7-10 ft BGL; 8-10 gal H_2O/ bag cement.

OTHER Bentonite ½" pellets (5 gal buckets): 1 bucket: 46.5-47.8; 1 gal H_2O/ bucket.
Bentonite Hole Plug (50 # bags): ⅓ bag from 62.5-63.0 ft; 1⅔ bags from 43.5-46.5'; 1 gal H_2O/ bag chips.

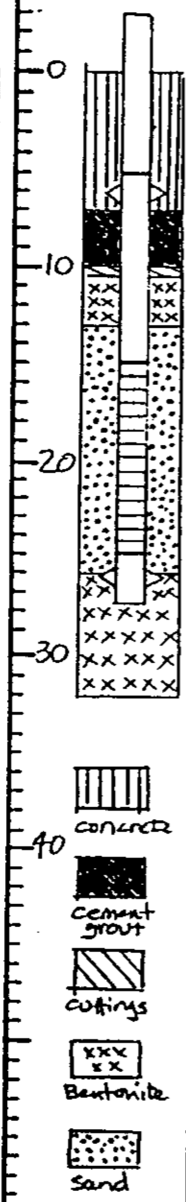
DECONTAMINATION:

COMMENTS:

* steel protective casing w/ lockable top & 6x6 ft × 6 inch concrete pad were installed at surface.

* T.D. of borehole was measured after auger flights were removed.

LOCATION Kanenberg Rd # 2 & Hwy 1101
UPERVISOR Eric F. Pastor
TAFF Rebecca C. Smyth



WELL PZ-3

WELL CONSTRUCTION SUMMARY

LOCATION or COORDS N: 764,000
E: 1,877,000

ELEVATION: GROUND LEVEL 643.86 ft ,N
TOP OF CASING 646.32 ft NSV

DRILLING SUMMARY:

TOTAL DEPTH Hole: 32.0 ft; Well = 27.5 ft
BOREHOLE DIAMETER 9 inches
DRILLER Ric Jones
TWC Licence # 2799-M
RIG Mobil Drill B-62HD
BIT(S) 9 inch cutter head w/ hollow-stem augers (8" O.D. & 3⅞" I.D.)
DRILLING FLUID none.

WELL DESIGN:

BASIS: GEOLOGIC LOG ✓ GEOPHYSICAL LOG ___

CASING STRING(S): C-CASING S-SCREEN

+3 – 5.0		C1
5.0 – 15.0		C2
15.0 – 25.0		S1
25.0 – 27.5		C3

CASING: C1 1¼" x 10' Triloc PVC (Sch 40)
C2 " "
C3 1¼" x 2.5' Triloc PVC (Sch 40)
C4

SCREEN: S1 1¼" x 10' Triloc Screen (0.01)
S2
S3
S4

CENTRALIZERS 6, 26 ft BGL (stainless steel)

FILTER MATERIAL 16-30 Silica Sand (100 # bags): 6 bags from 13.0 - 26.0 ft BGL.

CEMENT Portland Type I w/ 5% bentonite powder. 2-94 # bags w/ 8-10 gal H_2O per bag

OTHER Bentonite ½" d pellets (5 gal bucket): 2 buckets from 10.5 to 13 ft BGL.
Bentonite Hole Plug (50 # bags): 4 bags from 26 - 30.5'

CONSTRUCTION TIME LOG:

TASK	START DATE	START TIME	FINISH DATE	FINISH TIME
DRILLING:	4/24/90	0830	4/24/90	1200
GEOPH. LOGGING:				
CASING:	4/24/90	1245	4/24/90	1300
FILTER PLACEMENT:	4/24/90	1300	4/24/90	1325
CEMENTING:	4/24/90	1325	4/24/90	1400
DEVELOPMENT:				
OTHER: Concrete pad	4/30/90		4/30/90	

DECONTAMINATION:

Not required

COMMENTS:

* steel protective casing w/ lockable top & 4x4 ft x 6 inch concrete pad installed at surface
* T.D. of borehole was measured after auger flights were removed.

WELL PZ-4

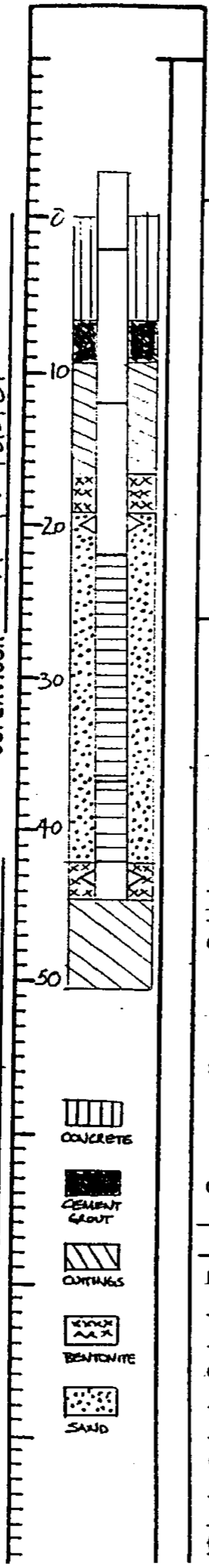
WELL CONSTRUCTION SUMMARY

PROJECT WMNI - Comal County Landfill, " **LOCATION** Kohlenberg Rd #2 & Hwy 1101

STAFF Rebecca C. Smyth **SUPERVISOR** Eric F. Pastor

LOCATION or COORDS: N: 645,800
E: 2,044,500

ELEVATION: GROUND LEVEL 627.45 G
TOP OF CASING 629.56 ft NG



DRILLING SUMMARY:

TOTAL DEPTH Hole = 50.5'; Well = 44.5 ft

BOREHOLE DIAMETER 9 inches

DRILLER Ric Jones
TWC Licence # 2799-M

RIG Mobil Drill B-62HD

BIT(S) 9 inch cutter head w/ hollow-stem augers (8" O.D. & 3⅜" I.D.)

DRILLING FLUID none

CONSTRUCTION TIME LOG:

TASK	START DATE	START TIME	FINISH DATE	FINISH TIM
DRILLING:	4/27/90	0820	4/27/90	113
GEOPH. LOGGING:				
CASING:	4/27/90	1455	4/27/90	151
FILTER PLACEMENT:	4/27/90	1510	4/27/90	153
CEMENTING:	4/27/90	1530	4/27/90	155
DEVELOPMENT:				
OTHER: concrete pad	4/30/90		4/30/90	

WELL DESIGN:

BASIS: GEOLOGIC LOG ✓ GEOPHYSICAL LOG ___

CASING STRING(S): C- CASING S- SCREEN

+3 - 2	C1	
2 - 12	C2	
12 - 22	C3	
22 - 32	S1	
32 - 37	S2	
37 - 42	S3	
42 - 44.5	C4	

CASING:
C1 1¼" x 10' PVC Triloc (Sch 40)
C2 " "
C3 " "
C4 1¼" x 2.5' Triloc PVC (sch 40)

SCREEN:
S1 1¼" x 10' Triloc Screen (0.01)
S2 " " "
S3
S4

CENTRALIZERS 20, 43 ft BGL (stainless steel)

FILTER MATERIAL 16-30 Silica Sand (100 # bags): 10 bags from 19.7 - 42.0 ft BGL.

CEMENT Portland Type I w/ 5% bent. powder: 2-94 # bags from ≈ 7-10 ft BGL; 8-10 gal H_2O/ bag cement.

OTHER Bentonite ½" pellets (5 gal bucket): 1 bucket from 18-19.7 ft BGL; 1 gal H_2O/ bucket.
Bentonite Hole Plug (50 # bags): 2⅓ bags from 42-44.5 ft; ⅓ bag from 16.9-18 ft BGL;

DECONTAMINATION:

none required

COMMENTS:

* steel protective casing w/ lockable top & 4x4 ft x 6 in concrete pad were installed at surface.

* T.D. of borehole was mea re after auger flights were rem

WELL PZ-5

WELL CONSTRUCTION SUMMARY

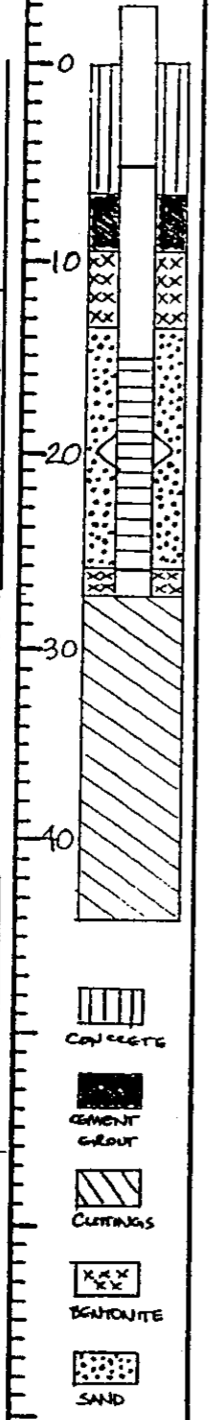
LOCATION or COORDS: N: 587,800
E: 2,032,000

ELEVATION: GROUND LEVEL 614.00 ft NGVI
TOP OF CASING 616.07 ft NGI

CATION Nohlenberg Rd # 2 & Hwy 1101

UPERVISOR Eric F. Pastor

TAFF Rebecca C. Smyth



DRILLING SUMMARY:

TOTAL DEPTH Hole = 44 ; Well = 27.5 ft BGL

BOREHOLE DIAMETER 9 inches

DRILLER Ric Jones
TWC Licence # 2799-M

RIG Mobil Drill B-62HD

BIT(S) 9 inch cutter head w/hollow-stem augers (8" O.D. & 3⅜" I.D.)

DRILLING FLUID none

CONSTRUCTION TIME LOG:

TASK	START DATE	START TIME	FINISH DATE	FINISH TIME
DRILLING:	4/25/90	1230	4/25/9	1630
GEOPH. LOGGING:				
CASING:	4/27/90	1700	4/27/90	1730
FILTER PLACEMENT:	4/27/90	1730	4/27/90	1745
CEMENTING:	4/27/90	1745	4/27/90	1815
DEVELOPMENT:				
OTHER:				

WELL DESIGN:

BASIS: GEOLOGIC LOG ✓ GEOPHYSICAL LOG ___

CASING STRING(S): C-CASING S-SCREEN

+3 – 5	C1	
5 – 15	C2	
15 – 25	S1	
25 – 27.5	C3	

CASING: C1 1¼" x 10' Triloc PVC (Sch 40)
C2 " " "
C3 1¼" x 2.5' Triloc PVC (Sch 40)
C4

SCREEN: S1 1¼" x 10' Triloc Screen (0.01)
S2
S3
S4

CENTRALIZERS 20 ft BGL (stainless steel)

FILTER MATERIAL 16-30 Silica Sand (100# bags)
6 bags from 13.4 – 26 ft

CEMENT Portland Type I w/5% bent. powder: 2-94# bags from ≈ 7-10 ft BGL; 8 gal H2O / bag cement.

OTHER Bentonite ½" pellets (5 gal bucket): 1 bucket from 26 - 27.5 ft BGL.
Bentonite Hole Plug (50# bags): 2 bags from 9.5 – 13.4 ft BGL.

DECONTAMINATION:

none required

COMMENTS:

* steel protective casing w/ lockable cap & 4X4ft X 6 in concret pad installed at surface.

* T.D. of borehole was measured after heavy rainstorm.

* Hole was filled w/ rain water during installation. Needs to be bailed dry prior to water level measurements.

WASTE MANAGEMENT OF NORTH AMERICA

LOG OF BORING PZ-6

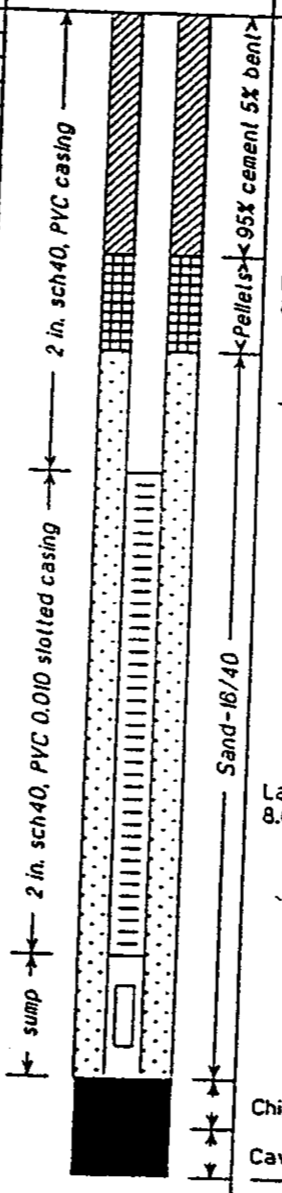
BORING LOCATION: *Comal County Landfill*
DRILLING COMPANY: *Jones Environmental Drilling Inc.*
DRILLER: *K. Seevers, L. Taylor*
DRILLING METHOD: *Mobile B-81 Hollow Stem Auger*
SIZE AND TYPE OF CASING: *2 in. sch.40, PVC, flush-threaded*
SAMPLING METHOD: *2' Split Barrel (SB)*

COORDINATES, N-E : *I + 49 - 2 + 7*
ELEVATION, GL (ft.NGVD): *602.66*
ELEVATION, TOC (ft.NGVD): *605.57*
DATE STARTED: *9-26-91*
DATE COMPLETED: *9-26-91*
DRILL BIT: *9 in. OD, 3 3/8 in. ID*
TOTAL DEPTH (ft.BGL): *24*
DRILL FLUID: *none*
GEOPHYS. LOG: *no*
GEOLOGIST: *B. Beveridge*
LOGGER: *none*

DESCRIPTION	USCS CLASS
CL CLAY, black (7.5YR,N2); silty; organic; roots; soft; no reaction to 10% HCL; dry; sparse chert cobbles	CL
CH CLAY, dark olive gray (5Y,3/2); reactive to HCL 10%	CH
GW GRAVEL, white (10YR,8/1), light gray (10YR,6/1), and olive brown (2.5Y,5/4); coarse limestone and chert gravel, angular to subangular, 2-60mm; 75-80% pebbles in clay/chalk matrix; strong reaction to 10% HCL	GW
CH CLAY, pale yellow (2.5Y,7/4); sparse FeO2 stain; chert pebbles, <1cm, v. sparse	CH
CH CLAY, pale yellow (2.5Y,7/4); light gray (10YR,7/1) on inside & limonite stained yellow (2.5Y,7/6) on outside of fracture planes; v. strong reaction to 10% HCL; soft; some FeO2 nodules,<2cm; gypsum in fracture planes; some black organic or manganese oxide staining in fractures; some chalky calc nodules; v. sparse mollusk shells, <1cm	
CH CLAY, light yellowish brown (2.5Y,6/4) blocked w/ gray (5Y,6/1); reacts to 10% HCL; soft but harder than clays above	
Total Depth = 24ft BGL	

SAMPLING METHOD	% REC
SB	55
SB	100
SB	100
SB	80
SB	50
SB	100
SB	100
SB	100
SB	100
SB	100
SB	100
SB	40

PIEZOMETER/WELL CONSTRUCTION



REMARKS

Layer I, 0.0ft - 3.2ft
Layer II, 3.2ft - 8.0ft
Layer III/IV, 8.0ft - 24.0ft
Chips 22-23ft
Cave-in 23-24ft

WASTE MANAGEMENT OF NORTH AMERICA

LOG OF BORING PZ-7

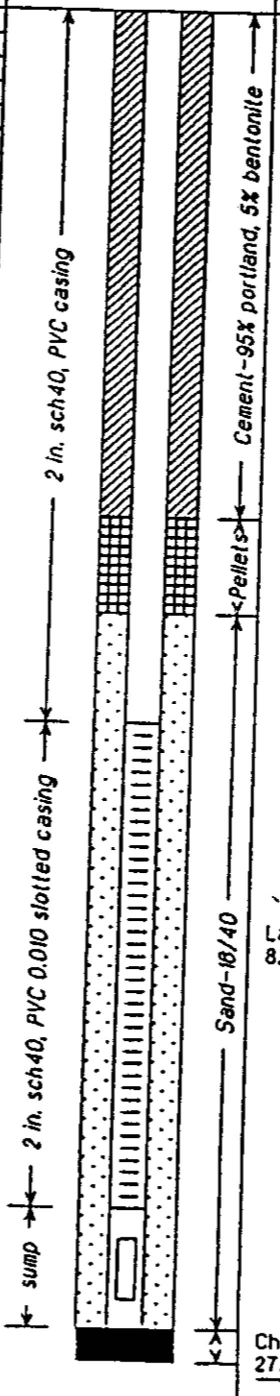
BORING LOCATION: *Comal County Landfill*
DRILLING COMPANY: *Jones Environmental Drilling Inc.*
ILLER: *K. Seevers, L. Taylor*
DRILLING METHOD: *Mobile B-61 Hollow Stem Auger*
SIZE AND TYPE OF CASING: *2 in. sch.40, PVC, flush threaded*
SAMPLING METHOD: *Split Barrel (SB), Split Spoon (SS)*
COORDINATES, N-E: *0 + 40 – 0 + 63*
ELEVATION, GL (ft.NGVD): *601.72*
ELEVATION, TOC (ft.NGVD): 39
DATE STARTED: *9-25-91*
DATE COMPLETED: *9-25-91*
DRILL BIT: *9 in. OD, 3 3/8 in. ID*
TOTAL DEPTH (ft.BGL): *28*
DRILL FLUID: *none*
GEOPHYS. LOG: *no*
GEOLOGIST: *B. Beveridge*
LOGGER: *none*

DESCRIPTION	USCS CLASS
CL CLAY, pale yellow (2.5Y,7/4); roots; strong reaction to 10% HCL; soft; moist	CL
CL CLAY, black (7.5YR,N2); silty; organic; roots; rich; no reaction to 10% HCL; soft; dry; sparse chert cobbles, < 4cm	CL
CH CLAY, dark olive gray (5Y,3/2); calc & chert fragments & nodules; strongly reactive to 10% HCL; plastic; moist; soft; roots	CH
GW GRAVEL, white (10YR,8/1), light gray (10YR,6/1), and olive brown (2.5Y,5/4); coarse limestone and chert gravel; dry; poorly sorted; 2-60mm; 75-85% pebbles in caliche/clay matrix; strong reaction to 10% HCL	GW
CH CLAY, pale yellow (2.5Y,7/4); 2-50mm mollusk fragments; some organic laminations; tr. FeO2 staining; tr. limonite; reacts to 10% HCL	CH
CH CLAY, pale yellow (2.5Y,7/4); fractures filled w/ lt.gray (10YR,7/1) on inside and limonite yellow (2.5y,7/6) on outside of fracture planes ; tr. FeO2 staining; strong reaction to 10% HCL	
CH CLAY, light yellowish brown (2.5Y,6/4), blocked w/ gray (5Y,5/1), 70/30; clay reacts to 10% HCL; SS sample = 100 blows	

Total Depth = 28ft BGL

SAMPLING METHOD	% REC
SB	100
SB	70
SB	100
SB	100
SB	90
SB	100
SB	100
SB	100
SB	100
SB	100
SB	100
SB	90
SB	50
SS	100

PIEZOMETER/WELL CONSTRUCTION



REMARKS

Layer I, 0.0ft – 4.8ft

Layer II, 4.8ft – 8.5ft

Layer III/IV, 8.5ft – 28.0ft

Chips/Cave-in, 27.3-28.0ft

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McCulley, Frick & Gilman, Inc.

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WASTE MANAGEMENT OF NORTH AMERICA

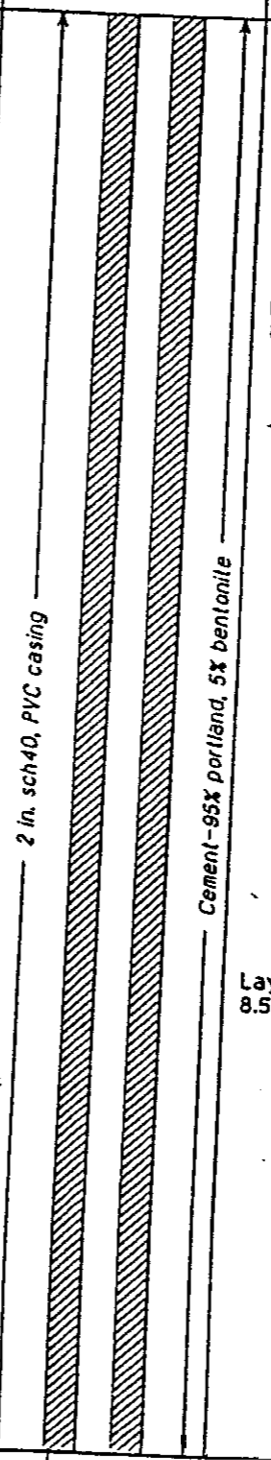
LOG OF BORING PZ-8

BORING LOCATION: *Comal County Landfill*
DRILLING COMPANY: *Jones Environmental Drilling Inc.*
DRILLER: *K. Seevers, L. Taylor*
DRILLING METHOD: *Mobile B-61 Hollow Stem Auger*
SIZE AND TYPE OF CASING: *2 in. sch.40, PVC, flush threaded*
SAMPLING METHOD: *Split Barrel (SB), Split Spoon (SS)*
COORDINATES, N-E : *0 + 30 - 0 + 61*
ELEVATION, GL (ft.NGVD): *600.65*
ELEVATION, TOC (ft.NGVD): 604.8
DATE STARTED: *9-23-91*
DATE COMPLETED: *9-25-91*
DRILL BIT: *9 in. OD, 3 3/8 in. ID*
TOTAL DEPTH (ft.BGL): *83.5*
DRILL FLUID: *none*
GEOPHYS. LOG: *no*
GEOLOGIST: *B. Beveridge*
LOGGER: *none*

DEPTH (feet)	DESCRIPTION	USCS CLASS
0	CL CLAY, pale yellow (2.5Y,7/4); roots; strong reaction to 10% HCL; soft; chert cobbles CL CLAY, black (7.5YR,N2); silty; organic; roots; soft; no reaction to 10% HCL	CL
2–4	CH CLAY, dark olive gray (5Y,3/2); 5% calc fragments; slight response to 10% HCL; soft	CH
4–8.5	GW GRAVEL, white (10YR,8/1), light gray (10YR,6/1), and olive brown (2.5Y,5/4); coarse limestone and chert gravel, angular to subangular, 2-60mm; 75-85% pebbles in caliche/clay matrix; strong reaction to 10% HCL	GW
8.5–28	CH CLAY, pale yellow (2.5Y,7/4), mottled with light gray (10YR,7/1); limonite stain, yellow (2.5Y,7/6); light gray in fractures; v. sparse FeO2 nodules; v. sparse calc nodules; v. strong reaction to 10% HCL; trace mollusk fragments; soft	CH
28–30	CH CLAY, light yellowish brown (2.5Y,6/4), blocked w/ gray (5Y,5/1), 60/40%; vertical fractures filled w/ gypsum; clay reacts to 10% HCL; sparse FeO2 nodules; soft	

DEPTH (feet)	SAMPLING METHOD	% REC
0–2	SB	100
2–4	SB	100
4–6	SB	100
6–8	SB	100
8–10	SB	100
10–12	SB	100
12–14	SB	100
14–16	SB	100
16–18	SB	100
18–20	SB	100
20–22	SB	100
22–24	SB	100
24–26	SB	100
26–28	SB	100
28–30	SB	50

PIEZOMETER/WELL CONSTRUCTION



REMARKS

Layer I, 0.0ft - 4.0ft

Layer II, 4.0ft - 8.5ft

Layer III/IV, 8.5ft - 40.1ft

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McCulley, Frick & Gilman, Inc.

WASTE MANAGEMENT OF NORTH AMERICA

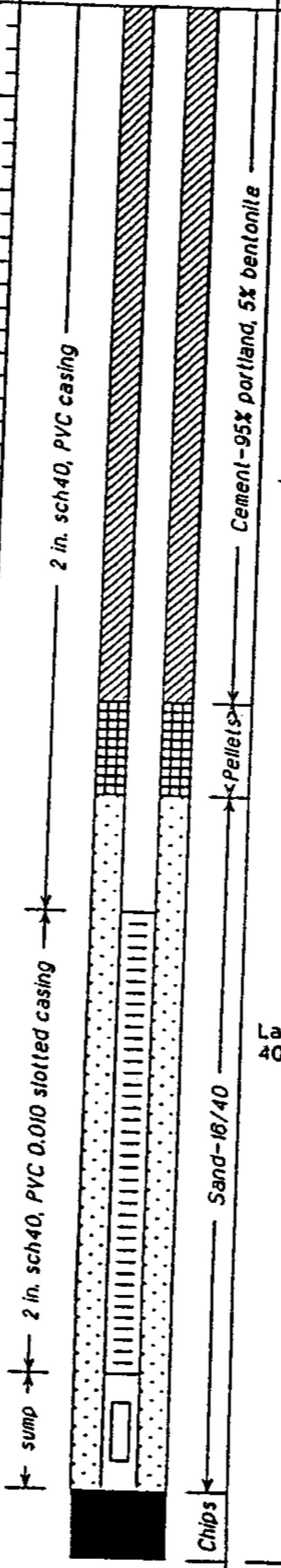
LOG OF BORING PZ-8

Depth (feet)	DESCRIPTION	USCS CLASS
32	see above description	
40	CH CALCAREOUS CLAYSTONE, gray (5Y,5/1); strong reaction to 10% HCL; trace mollusk fragments; friable but harder than clays above; each SS sample = 100 blows w/ hammer	CH

Total Depth = 63.5ft BGL

SAMPLING	
METHOD	% REC
SB	0
SB	100
SB	100
SB	10
SB	0
SS	100
SS	100
SS	100
SS	100
SS	100

PIEZOMETER/WELL CONSTRUCTION



REMARKS
Layer III/IV, 8.5ft - 40.1ft
Layer V/VI, 40.1ft - 63.5ft

Project No. 91-2221

McCulley, Frick & Gilman, Inc.

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WASTE MANAGEMENT OF NORTH AMERICA

LOG OF BORING PZ-9

BORING LOCATION: *Comal County Landfill*
DRILLING COMPANY: *Jones Environmental Drilling Inc.*
DRILLER: *K. Seevers, L. Taylor*
DRILLING METHOD: *Mobile B-61 Hollow Stem Auger*
SIZE AND TYPE OF CASING: *2 in. sch.40, PVC, flush threaded*
SAMPLING METHOD: *Split Barrel (SB)*

COORDINATES, N-E : *N + 33 - 17 + 67*
ELEVATION, GL (ft.NGVD): *621.93*
ELEVATION, TOC (ft.NGVD): *625.30*
DATE STARTED: *9-27-91*
DATE COMPLETED: *9-27-91*
DRILL BIT: *9 in. OD, 3 3/8 in. ID*
TOTAL DEPTH (ft.BGL): *58*
DRILL FLUID: *none*
GEOPHYS. LOG: *no*
GEOLOGIST: *B. Beveridge*
LOGGER: *none*

DEPTH (feet)	DESCRIPTION	USCS CLASS	SAMPLING METHOD	SAMPLING % REC	DEPTH (feet)	PIEZOMETER/WELL CONSTRUCTION	REMARKS
0–2	CH CLAY, black (7.5YR,N2); silty; organic; roots; soft; some chert pebbles <4cm, angular subangular; moist; elastic	CH	SB	100	0–2	2 in. sch40, PVC casing Cement-93% portland, 7% bentonite	Layer I, 0.0ft - 2.7ft
2–4	CH CLAY, v. dark gray (5Y,3/1); silty; chert pebbles, angular to subangular, more chert towards bottom		SB	100	2–4		
4–6	GW GRAVEL, white (10YR,8/1), light gray (10YR,8/1), and olive brown (2.5Y,5/4); coarse limestone and chert gravel, angular to subangular, 0.2-6cm; 80% pebbles in clay & chalk matrix; strong reaction to 10% HCL	GW	SB	100	4–6		Layer II, 2.7ft - 8.0ft
6–8			SB	70	6–8		
8–10	CH CLAY W/ CHALK, pale olive (5Y,6/3) w/ 20% calc chalk CH CLAY, pale olive (5Y,6/3) w/ 5-10% oxidation, brownish yellow (10YR,6/6); tr. black organic staining; friable; soft; mod. reaction to 10% HCL; v. sparse calc chalk nodules; vertical & high angle fractures filled w/ lt. gray clay (10YR,6/1) and gypsum in fracture planes; more oxidation towards bottom of layer	CH	SB	100	8–10		Layer III/IV, 8.0ft - 51.8ft
10–12			SB	25	10–12		
12–14			SB	0	12–14		
14–16			SB	100	14–16		
16–18			SB	100	16–18		
18–20			SB	100	18–20		
20–22			SB	100	20–22		
22–24			SB	100	22–24		
24–26			SB	100	24–26		
26–28			SB	100	26–28		
28–30			SB	100	28–30		

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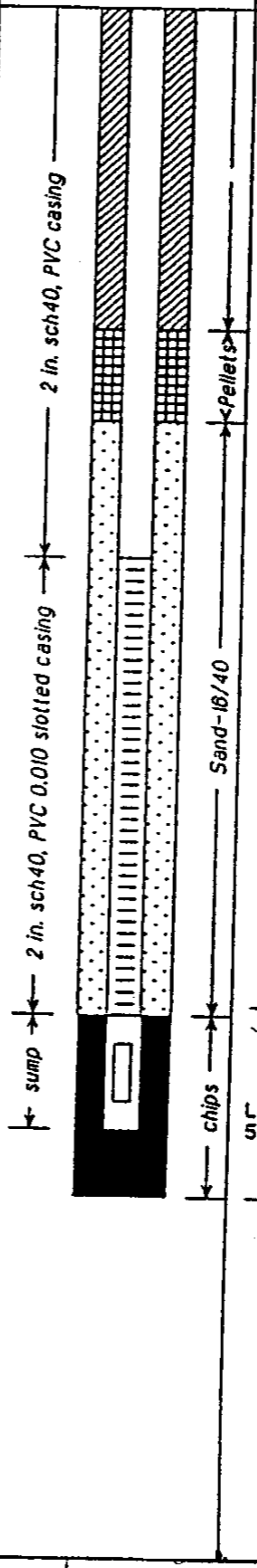
Sheet 1 of 2

WASTE MANAGEMENT OF NORTH AMERICA | LOG OF BORING PZ-9

DESCRIPTION	USCS CLASS	SAMPLING METHOD	SAMPLING % REC	REMARKS
	CH	SB	100	Layer III/IV, 8.0ft - 51.8ft
CH CLAY, olive gray (5Y,5/2), gray (5Y,5/1); friable; lt. gray (2.5Y,N6) and yellowish brown (10YR,5/8) oxidation w/ gypsum in high angle fractures; reacts to 10% HCL		SB	100	
		SB	100	
		SB	100	
		SB	100	
		SB	100	
		SB	100	
		SB	100	
		SB	0	
		SB	100	
		SB	100	
CH CLAYSTONE, dark gray (5Y,4/1); reacts to 10% HCL; soft but harder than clays above; massive		SB	100	Layer V/VI, 51.8ft - 58.0ft
		SB	100	
Total Depth = 56ft BGL				

PIEZOMETER/WELL CONSTRUCTION



WASTE MANAGEMENT OF NORTH AMERICA

LOG OF BORING PZ-10

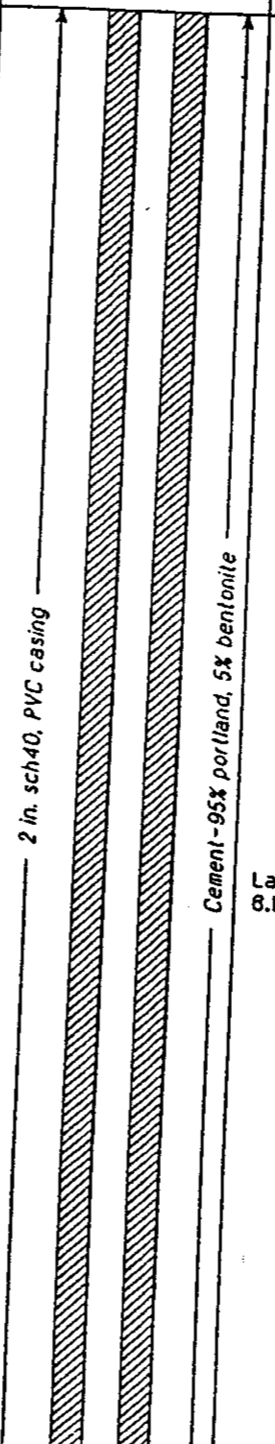
BORING LOCATION: *Comal County Landfill*
DRILLING COMPANY: *Jones Environmental Drilling Inc.*
RILLER: *K. Seevers, L. Taylor*
DRILLING METHOD: *Mobile B-61 Hollow Stem Auger*
SIZE AND TYPE OF CASING: *2 in. sch.40, PVC, flush threaded*
SAMPLING METHOD: *Split Barrel (SB)*

COORDINATES, N-E : *M+31 - 17+77*
ELEVATION, GL (ft.NGVD): *622.00*
ELEVATION, TOC (ft.NGVD): *624.94*
DATE STARTED: *9-28-91*
DATE COMPLETED: *9-27-91*
DRILL BIT: *9 in. OD, 3 3/8 in. ID*
TOTAL DEPTH (ft.BGL): *80*
DRILL FLUID: *none*
GEOPHYS. LOG: *no*
GEOLOGIST: *B. Beveridge*
LOGGER: *none*

DEPTH (feet)	DESCRIPTION
0	CH CLAY, black (7.5YR,N2); silty; organic; roots; soft; some chert pebbles <4cm, angular subangular; moist; elastic
2.5	CH CLAY, v. dark gray (5Y,3/1); silty; chert pebbles, angular to subangular; more chert towards bottom of layer
3.5	GW GRAVEL, white (10YR,8/1), light gray (10YR,6/1), and olive brown (2.5Y,5/4); coarse limestone and chert gravel, angular to subangular, 2-60mm; 75-85% pebbles in clay & chalk matrix; strong reaction to 10% HCL
6	CH CLAY W/ CHALK, pale olive (5Y,6/3), w/ 20% calc chalk
7	CH CLAY, pale olive (5Y,6/3) w/ 5-10% oxidation, brownish yellow (10YR,6/6); tr. black organic staining; friable; soft; mod. reaction to 10% HCL; v. sparse calc chalk nodules
22	fracturing begins at 22' filled w/ lt. gray clay (10YR,6/1) and gypsum in fracture planes, more oxidation towards bottom

USCS CLASS	SAMPLING METHOD	SAMPLING % REC	DEPTH (feet)
CH	SB	100	0-2
	SB	100	2-4
GW	SB	100	4-6
CH	SB	100	6-8
	SB	100	8-10
	SB	100	10-12
	SB	100	12-14
	SB	100	14-16
	SB	100	16-18
	SB	100	18-20
	SB	100	20-22
	SB	100	22-24
	SB	100	24-26
	SB	100	26-28
	SB	100	28-30

PIEZOMETER/WELL CONSTRUCTION



REMARKS

Layer I, 0.0ft - 2.5ft

Layer II, 2.5ft - 8.1ft

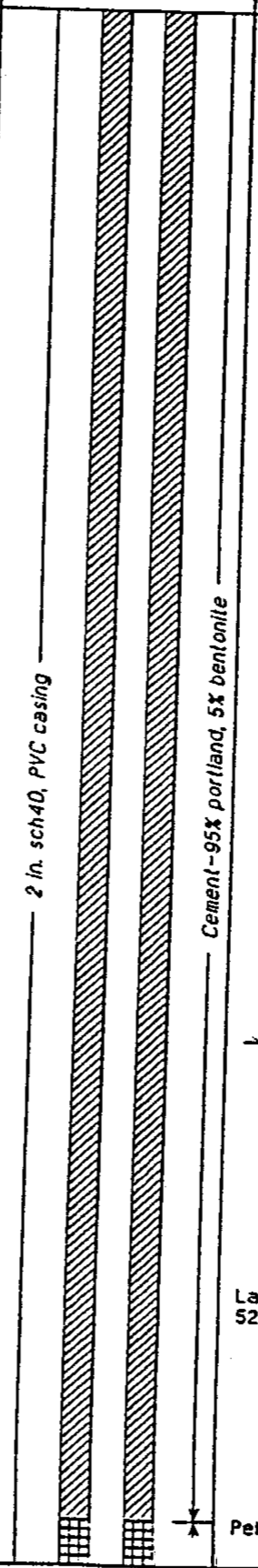
Layer III/IV, 8.1ft - 52.5ft

WASTE MANAGEMENT OF NORTH AMERICA | **LOG OF BORING** **PZ-10**

Depth (feet)	DESCRIPTION	USCS CLASS
30–52.5	CH CLAY, olive gray (5Y,5/2), gray (5Y,5/1); friable; lt. gray (2.5Y,N6) and yellowish brown (10YR,5/8) oxidation w/ gypsum in high angle fractures; reacts to 10% HCL	CH
52.5–64	CH CLAYSTONE, dark gray (5Y,4/1); reacts to 10% HCL; soft but harder than clays above; massive	

SAMPLING METHOD	% REC
SB	100
SB	85
SB	60
SB	100
SB	100
SB	65
SB	100
SB	0
SB	100
SB	100
SB	100
SB	100
SB	100
SB	100
SB	100
SB	100
SB	100

PIEZOMETER/WELL CONSTRUCTION



REMARKS

Layer III/IV, 8.1ft – 52.5ft

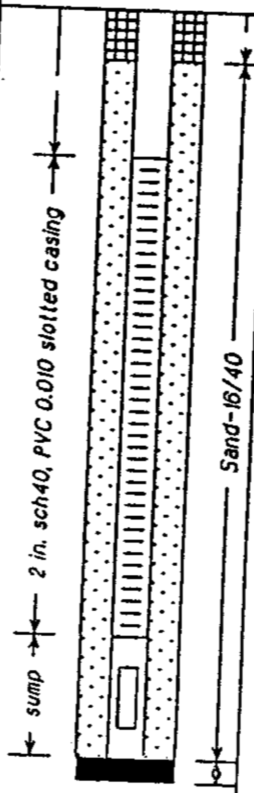
Layer V/VI, 52.5ft – 80.0ft

Pellets, 63-65ft

WASTE MANAGEMENT OF NORTH AMERICA | LOG OF BORING PZ-10

DEPTH (feet)	DESCRIPTION	USCS CLASS	SAMPLING METHOD	SAMPLING % REC	REMARKS
66	see above description	CH	SB	100	Pellets, 83-65ft
			SB	100	
			SB	100	
			SB	100	Layer V/VI, 52.5ft - 80.0ft
			SB	100	
			SB	100	
			SB	100	
			SB	100	Chips, 79.5-80ft
80	Total Depth = 80ft BGL				

PIEZOMETER/WELL CONSTRUCTION



Project No. 91-2221

McCulley, Frick & Gilman, Inc.

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WASTE MANAGEMENT OF NORTH AMERICA

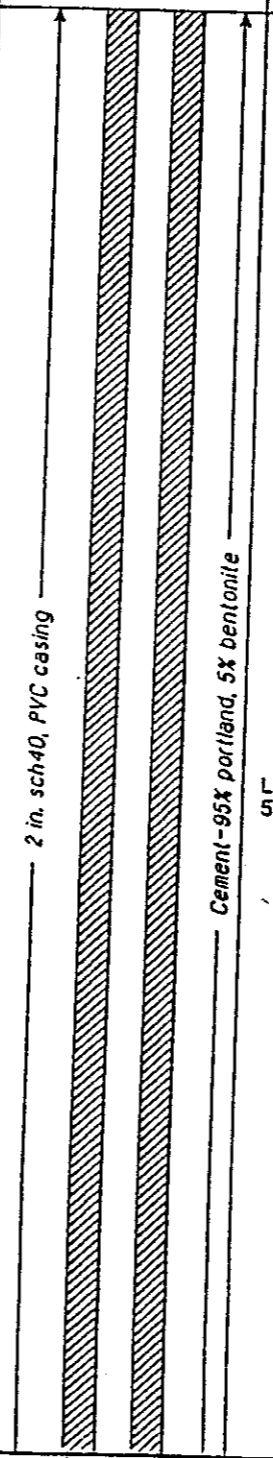
LOG OF BORING PZ-11

BORING LOCATION: *Comal County Landfill*
DRILLING COMPANY: *Jones Environmental Drilling Inc.*
DRILLER: *K. Seevers, L. Taylor*
DRILLING METHOD: *Mobile B-61 Hollow Stem Auger*
SIZE AND TYPE OF CASING: *2 in. sch.40, PVC, flush threaded*
SAMPLING METHOD: *Split Barrel (SB)*

COORDINATES, N-E : *ZERO + 7 - 16 + 77*
ELEVATION, GL (ft.NGVD): *659.74*
ELEVATION, TOC (ft.NGVD):
DATE STARTED: *9-30-91*
DATE COMPLETED: *10-1-91*
DRILL BIT: *9 in. OD, 3 3/8 in. ID*
TOTAL DEPTH (ft.BGL): *50*
DRILL FLUID: *none*
GEOPHYS. LOG: *no*
GEOLOGIST: *B. Beveridge*
LOGGER: *none*

DEPTH (feet)	DESCRIPTION	USCS CLASS	SAMPLING METHOD	SAMPLING % REC	DEPTH (feet)	REMARKS
0–2	CL CLAY, organic, dark gray (5Y,4/1); roots; limestone & chert pebbles .2-2cm; reacts to 10% HCL	CL	SB	40	0–2	
2–4	CH CLAY, dark gray (10YR,4/1); limestone cobbles & pebbles, subangular (5cm) at 2ft; slight reaction to 10% HCL		SB	10	2–4	Layer I/II, 0.0ft - 5.5ft
4–6	CH CLAY, light yellowish brown (2.5Y,6/3,4), olive yellow (2.5Y,6/6); intermittent limonite esp. at hi angle fractures; brownish yellow (10YR,6/8) outside fractures; lt. gray (2.5Y,N7/) in fracture planes; v. sparse black organic staining; v. soft; friable; slight reaction to 10% HCL		SB	100	4–6	
6–8			SB	100	6–8	
8–10			SB	100	8–10	
10–12			SB	100	10–12	
12–14			SB	100	12–14	
14–16			SB	100	14–16	
16–18		CH	SB	100	16–18	Layer III/IV, 5.5ft - 46.0ft
18–20			SB	100	18–20	
20–22			SB	100	20–22	
22–24			SB	100	22–24	
24–26			SB	100	24–26	
26–28			SB	80	26–28	
28–30			SB	95	28–30	

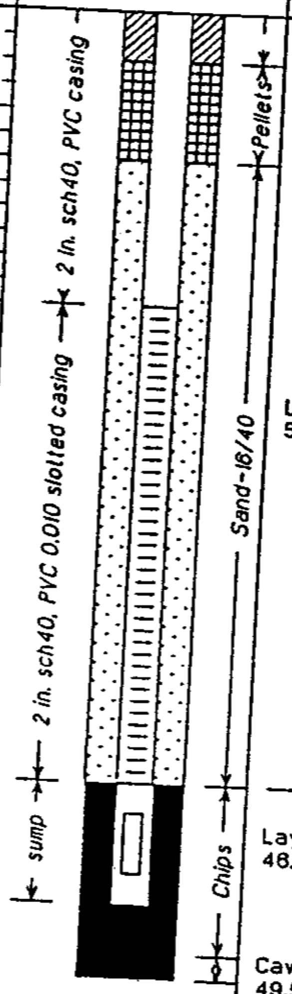
PIEZOMETER/WELL CONSTRUCTION



WASTE MANAGEMENT OF NORTH AMERICA | **LOG OF BORING** **PZ-11**

DEPTH (feet)	DESCRIPTION	USCS CLASS	SAMPLING METHOD	SAMPLING % REC
			SB	100
			SB	100
			SB	100
			SB	100
			SB	100
	CH CLAYSTONE, dark gray (5Y,4/1): soft but harder than clays above; wet from 41.9 to 42.0ft	CH	SB	100
42	CH CLAY, limonite oxidized brownish yellow (10YR,6/6): gypsum in fractures: soft		SB	100
			SB	100
	CH CLAYSTONE, dark gray (5Y,4/1): soft but harder than other clays above; massive		SB	100
			SB	100
50	Total Depth = 50ft BGL			

PIEZOMETER/WELL CONSTRUCTION



REMARKS

Layer III/IV, 5.5ft - 46.0ft

Layer V/VI, 46.0ft - 50.0ft

Cave-in 49.5-50ft

Project No. 91-2221 | McCulley, Frick & Gilman, Inc. | Sheet 2 of 2

WASTE MANAGEMENT OF NORTH AMERICA

LOG OF BORING PZ-12

BORING LOCATION: *Comal County Landfill*
RILLING COMPANY: *Jones Environmental Drilling Inc.*
RILLER: *K. Seevers, L. Taylor*
RILLING METHOD: *Mobile B-61 Hollow Stem Auger*
SIZE AND TYPE OF CASING: *2 in. sch.40, PVC, flush threaded*
SAMPLING METHOD: *Split Barrel (SB)*

COORDINATES, N-E : *ZERO + 7 - 16 + 65*
ELEVATION, GL (ft.NGVD): *660.12*
ELEVATION, TOC (ft.NGVD):
DATE STARTED: *9-30-91*
DATE COMPLETED: *9-30-91*
DRILL BIT: *9 in. OD, 3 3/8 in. ID*
TOTAL DEPTH (ft.BGL): *68*
DRILL FLUID: *none*
GEOPHYS. LOG: *no*
GEOLOGIST: *B. Beveridge*
LOGGER: *none*

DESCRIPTION

CL CLAY, organic, dark gray (5Y,4/1); roots; limestone & chert pebbles (.2-2cm); reacts to 10% HCL

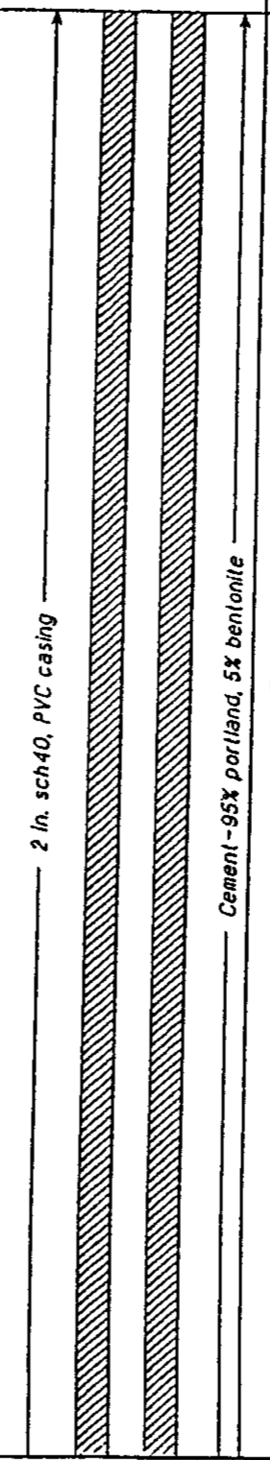
CL CLAY, pale yellow (2.5Y,5/3) & oxidized brownish yellow (10YR,6/8); calc chalk nodules; reacts to 10% HCL

CH CLAY, dark gray (10YR,4/1); sparse limestone pebbles, subangular, <1cm; slight reaction to 10% HCL

CH CLAY, light yellowish brown (2.5Y,6/3,4), olive yellow (2.5Y,6/6); intermittent limonite esp. at hi angle fractures; brownish yellow (10YR,6/8) outside fractures, lt. gray (2.5Y,N7/) in fracture planes; v. sparse black organic staining; v. soft; friable; slight reaction to 10% HCL

DEPTH (feet)	USCS CLASS	SAMPLING METHOD	SAMPLING % REC	REMARKS
0-2	CL	SB	100	
2-4	CH	SB	100	Layer I/II, 0.0ft - 4.2ft
4-6		SB	100	Layer III/IV, 4.2ft - 46.2ft
6-8		SB	100	
8-10		SB	100	
10-12		SB	100	
12-14		SB	100	
14-16		SB	100	
16-18		SB	100	
18-20		SB	100	
20-22		SB	80	
22-24		SB	100	
24-26		SB	100	
26-28		SB	100	
28-30		SB	100	

PIEZOMETER/WELL CONSTRUCTION

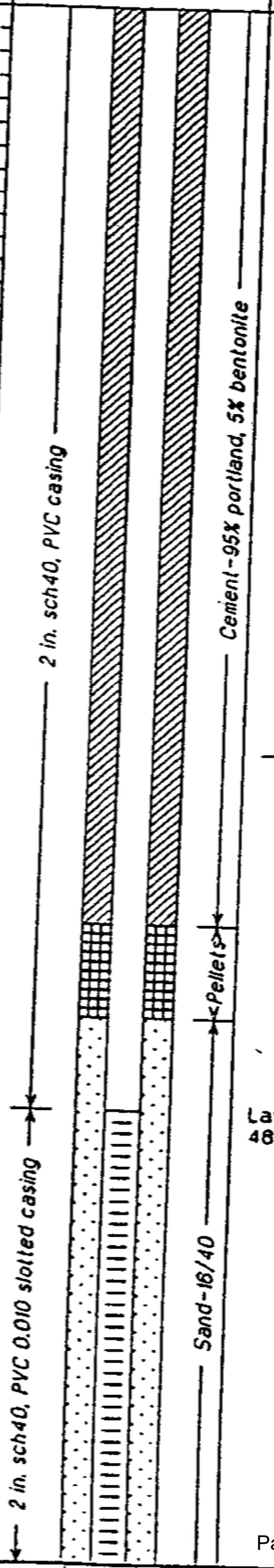


WASTE MANAGEMENT OF NORTH AMERICA

LOG OF BORING PZ-12

DESCRIPTION	USCS CLASS	SAMPLING METHOD	SAMPLING % REC
see above description		SB	100
		SB	100
		SB	100
		SB	100
		SB	100
		SB	100
		SB	100
		SB	100
CH CLAYSTONE, dark gray (5Y,4/1); tr. gypsum in fracture; soft but harder than clays above; reacts to 10% HCL	CH	SB	100
CH CLAY, limonite oxidized brownish yellow (10YR,6/6);some pale yellow (2.5Y,8/3) caliche; soft; reacts to 10% HCL		SB	20
CH CLAYSTONE, dark gray (5Y,4/1); reacts to 10% HCL, massive		SB	100
		SB	100
		SB	95
		SB	85
		SB	50
		SB	95
		SB	85

PIEZOMETER/WELL CONSTRUCTION



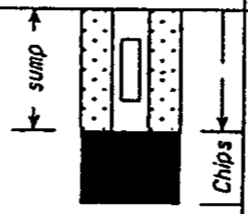
REMARKS

Layer V/VI,
48.2ft – 68.0ft

Project No. 91-2221

McCulley, Frick & Gilman, Inc.

WASTE MANAGEMENT OF NORTH AMERICA | LOG OF BORING | PZ-12

(feet)	DESCRIPTION	USCS CLASS	SAMPLING METHOD	SAMPLING % REC	DEPTH (feet)	PIEZOMETER/WELL CONSTRUCTION	REMA
			SB	85			
66	see above description	CH			66		Layer V/VI, 46.2ft – 68.0ft
			SB	50			
68	Total Depth = 68ft BGL				68		
70					70		
72					72		
74					74		
76					76		
78					78		
					80		
82					82		
84					84		
86					86		
88					88		
90					90		
92					92		
94					94		
					96		
98					98		

COMAL COUNTY LANDFILL
PIEZOMETER LOCATIONS
04-Dec-91

MONITOR WELL DESIGNATION	SITE GRID		TOP OF CASING ELEVATION	GROUND ELEVATION	LIP OF WELL COVER ELEVATION
	NORTHING	EASTING			
PZ - 6	I+49	2+71	605.57	602.66	605.76
PZ - 7	D+40	0+63	604.39	601.72	604.39
PZ - 8	D+30	0+61	604.81	600.65	604.97
PZ - 9	M+33	17+67	625.30	621.93	625.29
PZ - 10	M+31	17+77	624.94	622.00	624.91
PZ - 11	ZERO + 7	16+77	662.76	659.74	662.73
PZ - 12	ZERO + 7	16+65	662.98	660.12	662.88
P - 6	ZERO + 36	10+73	641.82	638.50	641.73
P - 7	ZERO + 9	21+43	665.16	661.89	665.24
P - 10	M+13	27+59	639.10	636.10	639.20
P - 14	M+25	8+18	606.95	604.96	NO COVER

SURVEYED BY:

DWIGHT LEE PITTMAN
REGISTERED PROFESSIONAL LAND SURVEYOR
TEXAS RPLS # 2442

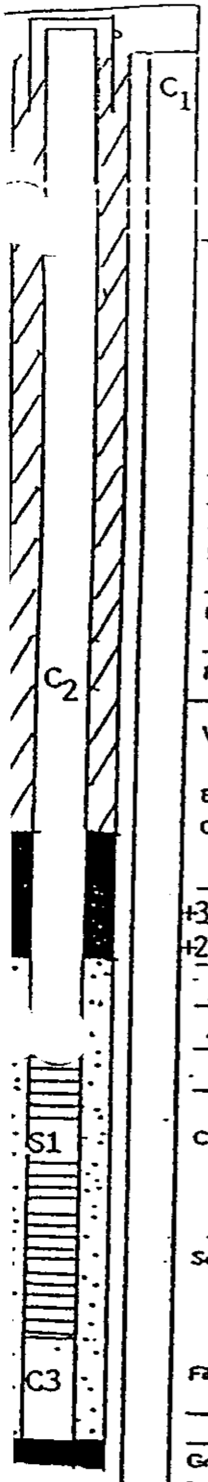
DWIGHT LEE PITTMAN
2442

Dwight Lee Pittman
12-9-91

Well No. PZ -1M

Boring No. X-Ref: PZ - 1M

MONITOR WELL CONSTRUCTION SUMMARY



Survey Coords: B+51 N, 11+19 E (Site Grid)

Elevation Ground Level 644.24 ft. MSL

Top of Casing 647 03 ft. MSL

Drilling Summary:

Total Depth 45'

Borehole Diameter

Casing Stick-up Height: 2.79'

Driller Roland Rodriguez/ Enviro-Drill

Rig Failing F-6-STD

Bit(s) 6-in finger bit 8.25-in O.D. Auger

Drilling Fluid None, hollow-stem auger

Protective Casing 5 ft x 4 in

Construction Time Log:

Task	Start Date	Start Time	Finish Date	Finish Time
Drilling 0 - 45'	3/18	2:30	3/18	5:00
Geophys. Logging:				
Casing: C_2, S_1, C_3	3/18	5:05	3/18	5:20
C_1	3/19	8:45	3/19	8:50
Filter Placement:	3/18	5:30	3/18	5:50
Cementing:	3/19	7:45	3/19	9:05
Development:	2/26	7:58	2/26	8:45

Well Design & Specifications

Basis: Geologic Log X Geophysical Log ____

Casing String (s): C = Casing S = Screen.

Depth	String(s)	Elevation
+3.16 - 1.84'	C_1	647.36 642.38'
+2.79 - 32'	C_2	647.03 612.24'
32 - 42'	S_1	612.24 602.24'
42 - 44.5'	C_3	602.24 599.74'

Casing: C1 4-in gold anodized

C2 & C_3 2-in dia Sch 40, flush-threaded PVC

Screen: S1 2-in dia Sch 40, flush-threaded PVC, 0.010

Filter Pack: 20-40 Colorado Silica sand, 28' - 44'

Grout Seal: Type I Portland with bentonite, 0 - 25'

Bentonite Seal: 3/8-in bentonite pellets, 25' - 28' and 44' - 45'

Well Development:

Mechanical Surging (w/surge block and air lift pumping

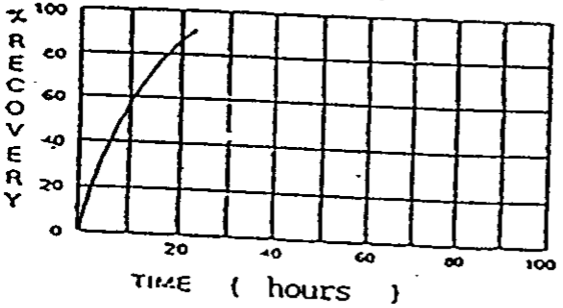
Total purge approx. 8 gallons (bailed dry)

Stabilization Test Data:

Time	pH	Spec. Cond.	Temp (C)
8:35	7.30	2440	15
8:45	6.90	2470	19
8:50	6.78	2460	20
9:00	6.56	2500	15
9:05	6.89	2500	19

Recovery Data:

Q= 8 gal. S_o= 12.2 ft.



Comments:

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SITE NAME WMI - Comal County Landfill

LOCATION New Braunfels, Texas

6979

SUPERVISED BY E. Hudson

DATE 2/18/92

A. Monitor Well Data Sheet

Texas Department of Health
Division of Solid Waste Management
SE. 67 (3/29/88)

Permittee or Site Name: WMI - Comal County Landfill

County: Comal

TDH Permit No.: 66

e of Monitor Well Installation: 2/18/92

Monitor Well I.D. No.: PZ - 1M

nitor Well: Latitude: ______ Longitude: ______

Date of Monitor Well Development: 2/26/92

Monitor Well Groundwater Gradient: Upgradient ___ Downgradient X

Monitor Well Driller Name: Henry Gompert

License No.: 2881 M

NOTE:

A)The information shown in the sketch below should be considered the minimum required for an installed ground-water monitor well.
B) Report All Depths from Surface Elevation and all Elevations relative to Mean Sea Level.
C) The minimum distance between the inside wall of the Bore Hole and the outside of the Well Casing shall be ~~4"~~ 3".
D) Use Flush Screw Joint Casing only, 2" diameter or larger. Recommend 4" diameter minimum & Teflon Taping Casing Joints.

eologist, Hydrologist or Engineer Supervising Well Installation: Emmett Hudson

tatic Water Level Elevation (with respect to MSL) after Well Developement: 633.79 ft.

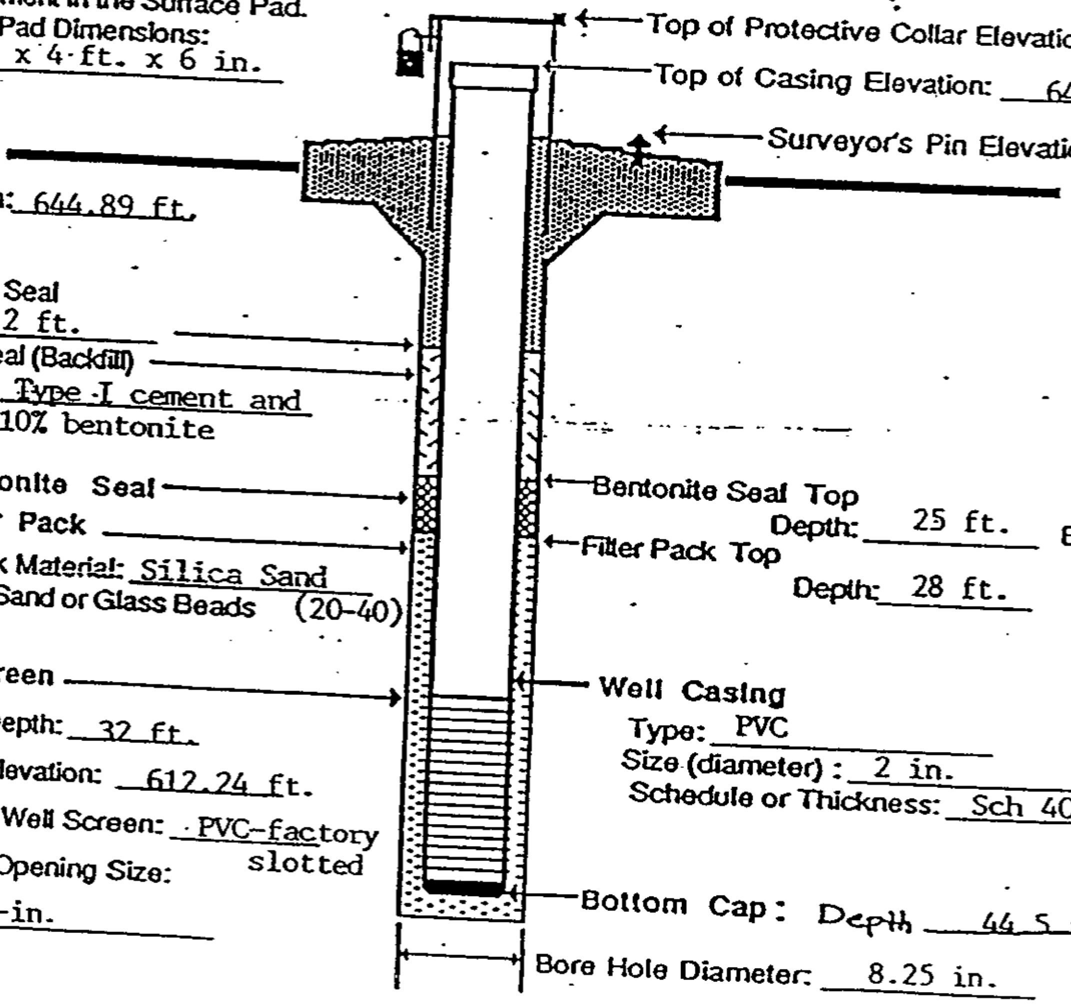
ame of Geologic Formation(s) in which Well is completed: Navarro

pe of Locking Device: Padlock

Type of Casing Protection: 5'x 4" Locking Aluminum

oncrete Surface Pad - Recommend steel inforcement in the Surface Pad.

urface Pad Dimensions: 4 ft. x 4 ft. x 6 in.



Top of Protective Collar Elevation: 647.36 ft.

Top of Casing Elevation: 647.03 ft.

Surveyor's Pin Elevation: 644.89 ft.

ace

n: 644.89 ft.

ncrete Seal

pth: 2 ft.

sing Seal (Backfill)

terial: Type I cement and 10% bentonite

Bentonite Seal

Filter Pack

r Pack Material: Silica Sand

ilized Sand or Glass Beads (20-40)

Bentonite Seal Top Depth: 25 ft. Elevation: 618.89 ft.

Filter Pack Top Depth: 28 ft. Elevation: 616.89 ft.

ll Screen

op Depth: 32 ft.

op Elevation: 612.24 ft.

pe of Well Screen: PVC-factory slotted

reen Opening Size: .010-in.

Well Casing

Type: PVC

Size (diameter): 2 in.

Schedule or Thickness: Sch 40

Bottom Cap: Depth 44.5 ft.

Bore Hole Diameter: 8.25 in.

Well No. MW-1

Boring No. X-Ref: SB - 1

MONITOR WELL CONSTRUCTION SUMMARY

Survey Coords: 0 + 28 N, 24 + 75 E (Site Grid)

Elevation Ground Level 662.36 ft. MSL

Top of Casing 664.92 ft. MSL

SITE NAME WMI - Comal County Landfill

LOCATION New Braunfels, Texas

'6979

Drilling Summary:

Total Depth 45-feet

Borehole Diameter 8.25 in

Casing Stick-up Height: 2.56

Driller Roland Rodriguez/ Enviro-Drill

Rig Failing F-6-STD

Bit(s) 6-in finger bit
8.25-in O.D. Auger

Drilling Fluid None, hollow-stem auger

Protective Casing 5 ft x 4 in, aluminum

Construction Time Log:

Task	Start Date	Start Time	Finish Date	Finish Time
Drilling				
0 - 45'	2/20	10:47	2/20	11:00
Geophys.Logging:				
Casing:				
C_2, S_1, C_3	2/20	12:00	2/20	12:30
C_1	2/20	15:15	2/20	15:30
Filter Placement:	2/20	12:45	2/20	13:30
Cementing:	2/20	15:00	2/20	15:45
Development:				

Well Design & Specifications

Basis: Geologic Log X Geophysical Log ____

Casing String (s): C = Casing S = Screen.

Depth	String(s)	Elevation
+ 2.91 - 2.09'	C_1	665.23 - 660.2
2.56 - 30.5'	C_2	664.92 - 631.8
30.5 - 40.5'	S_1	631.86 - 621.8
40.5 - 43'	C_3	621.86 - 619.3

Casing: C1 4-in gold anodized aluminum

C2 & C_3 2-in dia Sch 40, flush-threaded PVC

Screen: S1 2-in dia Sch 40, flush-threaded PVC, 0.010 slot

Filter Pack: 20-40 Colorado silica sand, 26.5' - 43'

Grout Seal: Type I Portland with Bentonite, 0 - 23.5'

Bentonite Seal: 3/8-in bentonite pellets 23.5 - 26.5' and 43 - 45'

Well Development:

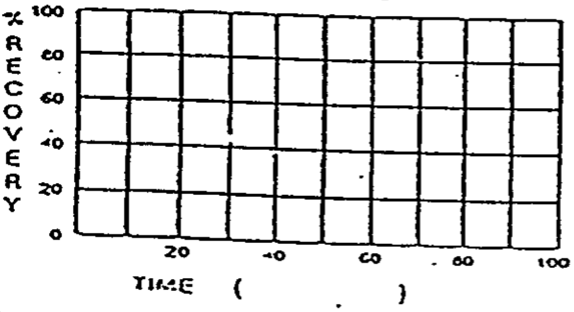
Well Dry

Stabilization Test Data:

Time	pH	Spec. Cond.	Temp (C)

Recovery Data:

Q= 0 gal S_o= 0 feet



Comments: No saturation or moisture encountered during drilling

SUPERVISED BY E. Hudson

DATE 2/20/92

Printed on recycled paper.

A. Monitor Well Data Sheet

Texas Department of Health
Division of Solid Waste Management
SE. 67 (3/29/88)

Permittee or Site Name: WMI - Comal County Landfill

unty: Comal

TDH Permit No.: 66

of Monitor Well Installation: 2/20/92

Monitor Well I.D. No.: MW-1

Monitor Well: Latitude: ____ Longitude: ____

Date of Monitor Well Development: 2/26/92 (Well Dry)

Monitor Well Groundwater Gradient: Upgradient X Downgradient ____

Monitor Well Driller Name: Wes Kowser

License No.: 3226 M

NOTE:

(A) The information shown in the sketch below should be considered the minimum required for an installed ground-water monitor well.
(B) Report All Depths from Surface Elevation and all Elevations relative to Mean Sea Level.
(C) The minimum distance between the inside wall of the Bore Hole and the outside of the Well Casing shall be $\frac{3}{4}$".
(D) Use Flush Screw Joint Casing only, 2" diameter or larger. Recommend 4" diameter minimum & Teflon Taping Casing Joints.

Geologist, Hydrologist or Engineer Supervising Well Installation: Emmett Hudson

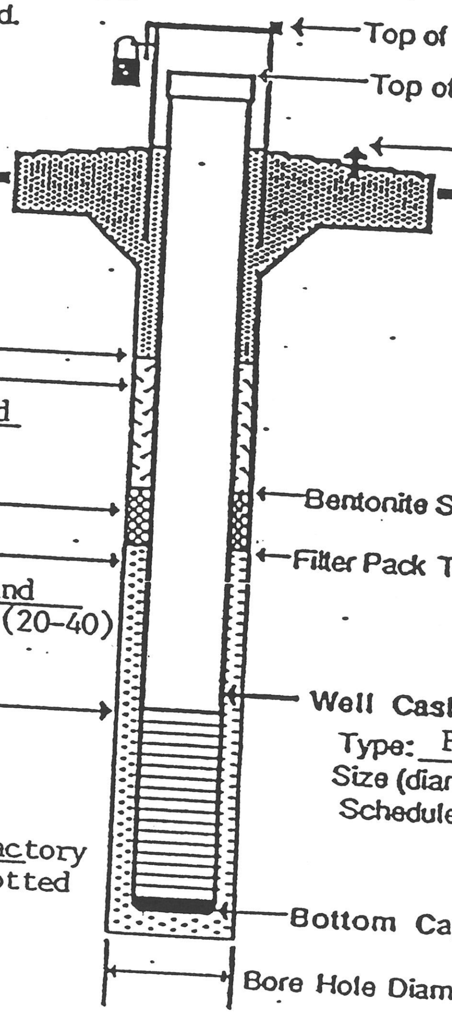
Static Water Level Elevation (with respect to MSL) after Well Developement: Dry

lame of Geologic Formation(s) in which Well is completed: Navarro

ype of Locking Device: Padlock

Type of Casing Protection: 5'x 4" Locking Aluminum

oncrete Surface Pad - Recommend steel einforcement in the Surface Pad.
urface Pad Dimensions: 4 ft. x 4 ft. x 6 in.



Top of Protective Collar Elevation: 665.23 ft.

Top of Casing Elevation: 664.92 ft.

Surveyor's Pin Elevation: 662.86 ft.

n: 662.36 ft.

ncrete Seal
pth: 2 ft.

sing Seal (Backfill)
terial: Type I cement and 10% bentonite

Bentonite Seal

Bentonite Seal Top
Depth: 23.5 ft. Elevation: 638.86 ft.

Filter Pack

Filter Pack Top
Depth: 26.5 ft. Elevation: 635.86 ft.

er Pack Material: Silica Sand
ilized Sand or Glass Beads (20-40)

ll Screen
op Depth: 30.5 ft.
op Elevation: 631.86 ft.

Well Casing
Type: PVC
Size (diameter): 2 in.
Schedule or Thickness: Sch 40

ype of Well Screen: PVC-factory slotted

creen Opening Size: .010-in.

Bottom Cap: Depth 43 ft.

Bore Hole Diameter: 8.25-in.

Well No. MW-2

Boring No. X-Ref: SB-2

MONITOR WELL CONSTRUCTION SUMMARY

Survey Coords: 0 + 5 N, 5 + 19 E
(Site Grid)

Elevation Ground Level 615.63 ft. MSL

Top of Casing 618.65 ft. MSL

Drilling Summary:

Total Depth 35-feet

Borehole Diameter 8.25 in

Casing Stick-up Height: 3.02 ft

Driller Roland Rodriguez/ Enviro-Drill

Rig Failing F-6-STD

Bit(s) 6-in finger bit
8.25-in O.D. Auger

Drilling Fluid None, hollow-stem auger

Protective Casing 5 ft x 4 in Aluminum

Construction Time Log:

Task	Start Date	Start Time	Finish Date	Finish Time
Drilling 0 - 35 ft	2/19	11:12	2/19	12:45
Geophys.Logging:				
Casing: C_2, S_1, C_3	2/19	12:45	2/19	1:00
C_1	2/20	16:10	2/20	16:20
Filter Placement:	2/19	1:10	2/19	1:45
Cementing:	2/20	16:00	2/20	16:30
Development:	2/26	14:45	2/26	15:20

Well Design & Specifications

Basis: Geologic Log X Geophysical Log ____

Casing String (s): C = Casing S = Screen.

Depth	String(s)	Elevation
+3.39 - 1.61	C_1	618.98 - 613.98'
+3.02 - 20.5'	C_2	618.65 - 595.13'
20.5 - 30.5'	S_1	595.13 - 585.13'
30.5 - 33'	C_3	585.13 - 582.63'

Casing: C1 4-in gold anodized aluminum

C2 & C_3 2-in dia Sch 40, flush-threaded PVC

Screen: S1 2-in dia Sch 40, flush-threaded PVC, 0.010

Filter Pack: 20-40 Colorado silica sand, 16.5 ft - 33 ft

Grout Seal: Type I Portland with Bentonite, 0 - 13.5 ft

Bentonite Seal: 3/8-in bentonite pellets 13.5 ft - 16.5 ft and 33-38 ft.

Well Development:

Mechanical Surging (w/surge block) and airlift pumping.

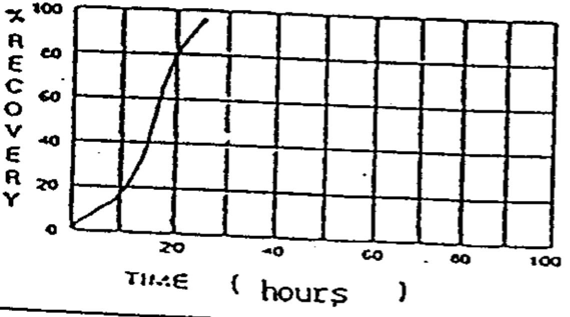
Total Purge: Apprx 7.8 gal (pumped dry)

Stabilization Test Data:

Time	pH	Spec. Cond.	Temp (C)
2:45	6.52	16,370	20°
2:50	7.42	24,100	21°
2:55	7.43	24,600	21°
3:00	7.46	24,700	21°
3:05	7.47	24,700	22°

Recovery Data:

Q= 7.8 gal S_o= 23.2 ft



Comments: Hissing sound in well, no water in well during or immediately after drilling

SITE NAME WMI - Comal County Landfill

LOCATION New Braunfels, Texas

WC 6979

SUPERVISED BY E. Hudson

DATE 2/19/92

A. Monitor Well Data Sheet

Texas Department of Health
Division of Solid Waste Management
SE. 67 (3/29/88)

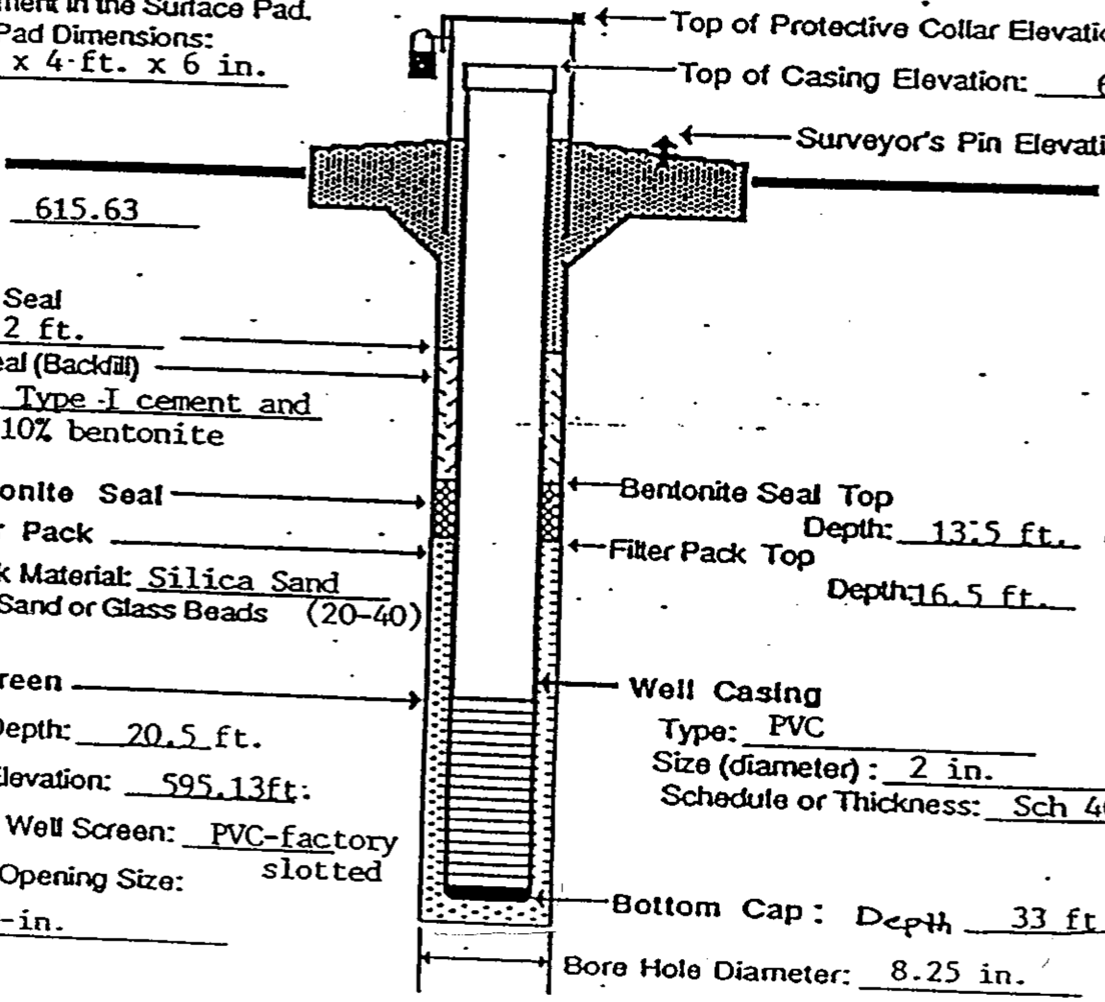
'ermittee or Site Name: WMI - Comal County Landfill
.unty: Comal
' Monitor Well Installation: 2/19/92
lonitor Well: Latitude: ______ Longitude: ______
onitor Well Groundwater
Gradient: Upgradient ___ Downgradient X

TDH Permit No.: 66
Monitor Well I.D. No.: MW - 2
Date of Monitor Well
Development: 2/26/92
Monitor Well Driller
Name: Henry Gompert
License No.: 2881 M

ITE:

The information shown in the sketch below should be considered the minimum required for an installed ground-water monitor well.
Report All Depths from Surface Elevation and all Elevations relative to Mean Sea Level.
The minimum distance between the inside wall of the Bore Hole and the outside of the Well Casing shall be ~~4"~~ 3".
Use Flush Screw Joint Casing only, 2" diameter or larger. Recommend 4" diameter minimum & Teflon Taping Casing Joints.

logist, Hydrologist or Engineer Supervising Well Installation: Emmett Hudson
c Water Level Elevation (with respect to MSL) after Well Developement: 594.06 ft
e of Geologic Formation(s) in which Well is completed: Navarro
e of Locking Device: Padlock
Type of Casing Protection: 5'x 4" Locking Aluminum
crete Surface Pad - Recommend steel
orcement in the Surface Pad.
ace Pad Dimensions:
ft. x 4-ft. x 6 in.



Top of Protective Collar Elevation: 618.98 ft.
Top of Casing Elevation: 618.65 ft.
Surveyor's Pin Elevation: 616.19 ft.

615.63

crete Seal
h: 2 ft.
g Seal (Backfill)
rial: Type-I cement and 10% bentonite

Bentonite Seal
Filter Pack
Pack Material: Silica Sand
zed Sand or Glass Beads (20-40)

Bentonite Seal Top
Depth: 13.5 ft. Elevation: 602.13 ft.
Filter Pack Top
Depth: 16.5 ft. Elevation: 599.13 ft.

Screen
Depth: 20.5 ft.
Elevation: 595.13ft.
e of Well Screen: PVC-factory slotted
een Opening Size:
010-in.

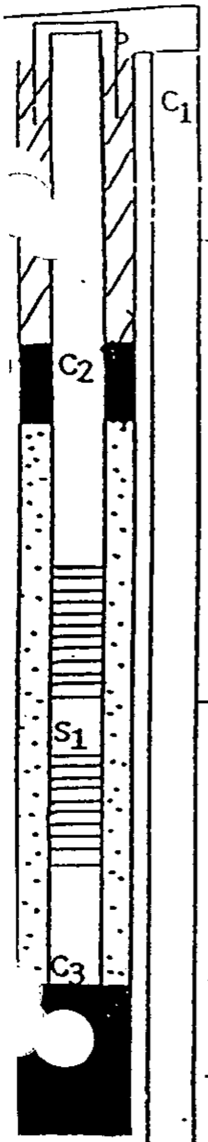
Well Casing
Type: PVC
Size (diameter): 2 in.
Schedule or Thickness: Sch 40

Bottom Cap: Depth 33 ft.
Bore Hole Diameter: 8.25 in.

Well No. MW - 3

Boring No. X-Ref: SB - 3

MONITOR WELL CONSTRUCTION SUMMARY



Survey Coords: F + 64 N, 0 + 76 E (Site Grid)

Elevation Ground Level 603.48 Ft. MSL

Top of Casing 506.02 Ft. MSL

Drilling Summary:

Total Depth 34'

Borehole Diameter 8"

Casing Stick-up Height: 2.54'

Driller Roland Rodriguez/ Enviro-Drill

Rig Failing F-6-STD

Bit(s) 6-in finger bit
8.25-in O.D. Auger

Drilling Fluid None, hollow-stem auger

Protective Casing 5 ft x 4 in

Construction Time Log:

Task	Start Date	Start Time	Finish Date	Finish Time
Drilling 0 - 30'	2/18	8:30	2/18	11:00
Geophys.Logging:				
Casing: C_2, S_1, C_3	2/18	11:15	2/18	11:30
	2/19	9:45	2/19	10:20
C_1	2/18	11:35	2/18	12:18
Filter Placement:	2/19	9:30	2/19	10:18
Cementing:	2/26	10:55	2/26	12:00
Development:	2/26	11:00	2/26	1:45

Well Design & Specifications

Basis: Geologic Log X Geophysical Log ____

Casing String (s): C = Casing S = Screen.

Depth	String(s)	Elevation
+2.89 - 2.11'	C_1	606.33 - 601.33
+2.54 - 16.5'	C_2	606.02 - 586.98
16.5 - 26.5'	S_1	586.98 - 576.98
26.5 - 29'	C_3	576.98 - 574.48

Casing: C1 4-in aluminum anodized

C2 & C_3 2-in dia Sch 40, flush-threaded PVC

Screen: S1 2-in dia Sch 40, flush-threaded PVC, 0.010" slot

Filter Pack: 20-40 Colorado silica sand, 12.5 - 29.5'

Grout Seal: Type I Portland Bentonite, 0 - 9.5'

Bentonite Seal: 3/8-in bentonite pellets 9.5' - 12.5'; and 29 - 34'

Well Development:

Mechanical Surging (w/surge block) and air lift pumping

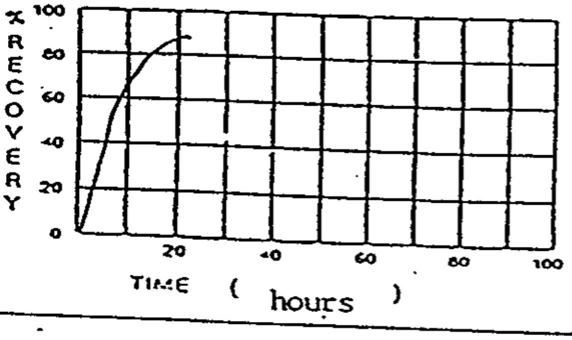
Total purge - approx. 14 gallons pumped dry

Stabilization Test Data:

Time	pH	Spec. Cond.	Temp (.C)
11:52	7.55	570	15
12:01	7.46	547	15
1:35	7.18	1782	20
1:40	7.24	1890	20
1:45	7.19	1820	20

Recovery Data:

Q= 14 gal. S_o= 6.29 ft.



Comments:

SITE NAME WMI - Comal County Landfill

LOCATION New Braunfels, Texas

6979

SUPERVISED BY E. Hudson

DATE 2/19/92

Printed on recycled paper.

A. Monitor Well Data Sheet

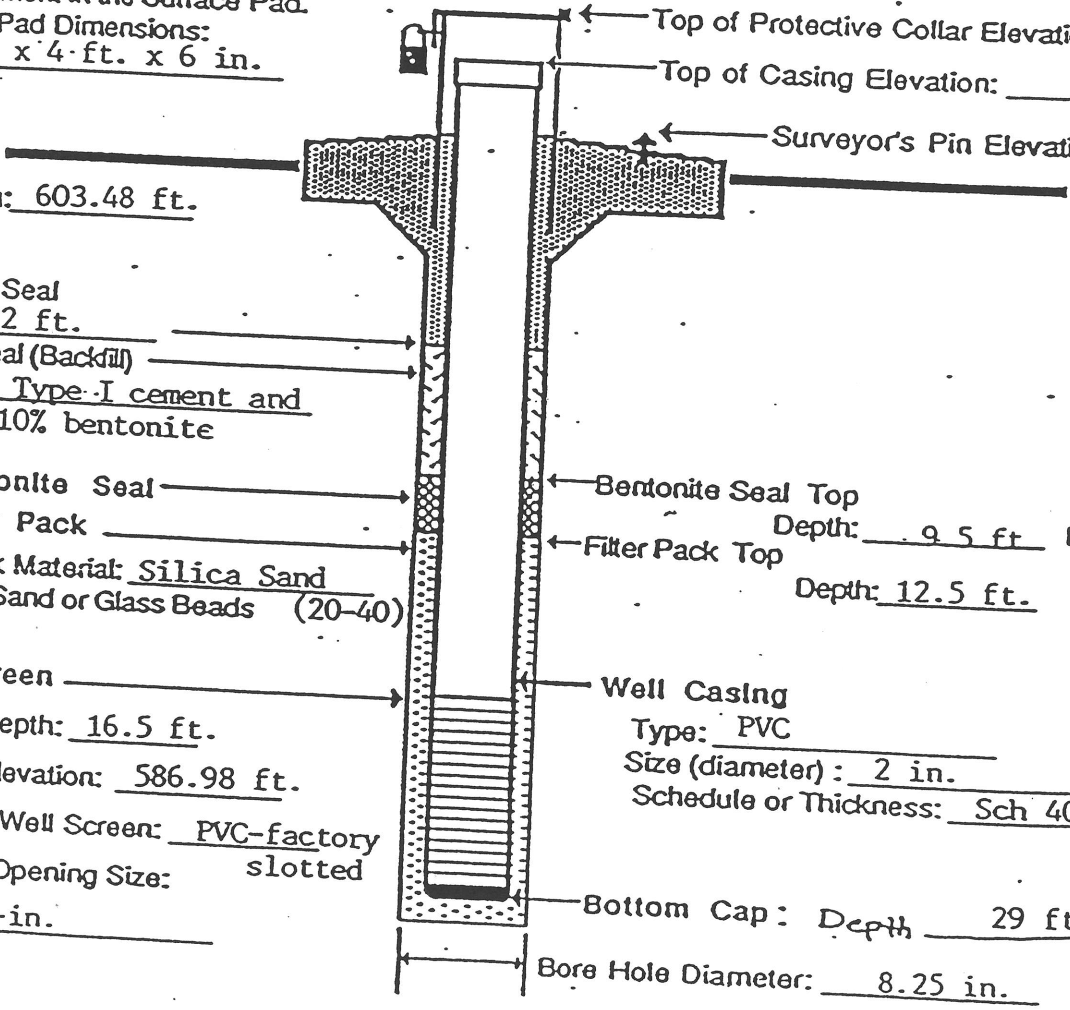
Texas Department of Health
Division of Solid Waste Management
SE. 67 (3/29/85)

Permittee or Site Name: WMI - Comal County Landfill
unty: Comal
of Monitor Well Installation: 2/18/92
Monitor Well: Latitude: ______ Longitude: ______
Monitor Well Groundwater
Gradient: Upgradient ____ Downgradient X

TDH Permit No.: 66
Monitor Well I.D. No.: Mw - 3
Date of Monitor Well
Development: 2/26/92
Monitor Well Driller
Name: Henry Gompert
License No.: 2881 M

IOTE:
A) The information shown in the sketch below should be considered the minimum required for an installed ground-water monitor well.
B) Report All Depths from Surface Elevation and all Elevations relative to Mean Sea Level.
C) The minimum distance between the inside wall of the Bore Hole and the outside of the Well Casing shall be 3/4".
D) Use Flush Screw Joint Casing only, 2" diameter or larger. Recommend 4" diameter minimum & Teflon Taping Casing Joints.

eologist, Hydrologist or Engineer Supervising Well Installation: Emmett Hudson
atic Water Level Elevation (with respect to MSL) after Well Developement: 597.26 ft.
ame of Geologic Formation(s) in which Well is completed: Navarro
pe of Locking Device: Padlock
Type of Casing Protection: 5'x 4" Locking Aluminum
oncrete Surface Pad - Recommend steel inforcement in the Surface Pad.
urface Pad Dimensions:
4 ft. x 4 ft. x 6 in.



Top of Protective Collar Elevation: 606.33 ft.
Top of Casing Elevation: 606.02 ft.
Surveyor's Pin Elevation: 603.96 ft.
n: 603.48 ft.

ncrete Seal
pth: 2 ft.
ing Seal (Backfill)
erial: Type I cement and 10% bentonite

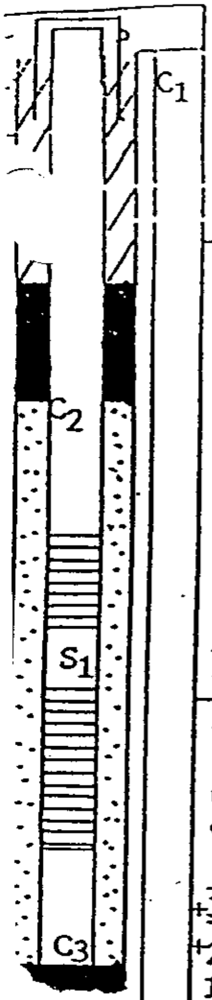
Bentonite Seal
Filter Pack
r Pack Material: Silica Sand
lized Sand or Glass Beads (20-40)

Bentonite Seal Top
Depth: 9.5 ft Elevation: 12.5 ft
Filter Pack Top
Depth: 12.5 ft. Elevation: 590.98 ft.

l Screen
p Depth: 16.5 ft.
p Elevation: 586.98 ft.
pe of Well Screen: PVC-factory slotted
reen Opening Size:
.010-in.

Well Casing
Type: PVC
Size (diameter): 2 in.
Schedule or Thickness: Sch 40

Bottom Cap: Depth 29 ft.
Bore Hole Diameter: 8.25 in.



Well No. MW - 4

Boring No. X-Ref: SB - 4

MONITOR WELL CONSTRUCTION SUMMARY

Survey Coords: M+33 N, B+36 E (Site Grid)

Elevation Ground Level 605.32 ft. MSL

Top of Casing 608.27 ft. MSL

Drilling Summary:

Total Depth 30'

Borehole Diameter

Casing Stick-up Height: 2.95'

Driller Roland Rodriguez/ Enviro-Drill

Rig Failing F-6-STD

Bit(s) 6-in finger bit
8.25-in O.D. Auger

Drilling Fluid None, hollow-stem auger

Protective Casing 5 ft x 4 in

Construction Time Log:

Task	Start Date	Start Time	Finish Date	Finish Time
Drilling 0 - 30'	2/19	4:00	2/19	5:30
Geophys. Logging:				
Casing: C_2, S_1, C_3	2/19	5:40	2/19	5:55
C_1	2/20	10:20	2/20	10:25
Filter Placement:	2/19	5:55	2/19	6:20
Cementing:	2/20	10:00	2/20	10:40
Development:	2/26	10:18	2/26	10:45

Well Design & Specifications

Basis: Geologic Log X Geophysical Log ___

Casing String (s): C = Casing S = Screen

Depth	String(s)	Elevation
+3.30 - 1.70'	C_1	608.58 - 603.58'
+2.95 - 15.5'	C_2	608.27 - 589.82'
15.5 - 25.5'	S_1	589.82 - 579.82'
25.5 - 28'	C_3	579.82 - 577.32'

Casing: C1 4-in aluminum anodized
C_2 and C_3 2-in dia sch. 40 flush - threaded PVC.

Screen: S1 2-in dia sch. 40, flush - threaded PVC, 0.010" slot

Filter Pack: 20-40 Colorado silica sand, 11.5 - 28'

Grout Seal: Type I Portland with Bentonite, 0 - 11.5'

Bentonite Seal: 3/8-in bentonite pellets, 8.5'- 11.5' and 28' - 30'

Well Development:

Mehcanical Surging (w/surge block) and air lift pumping

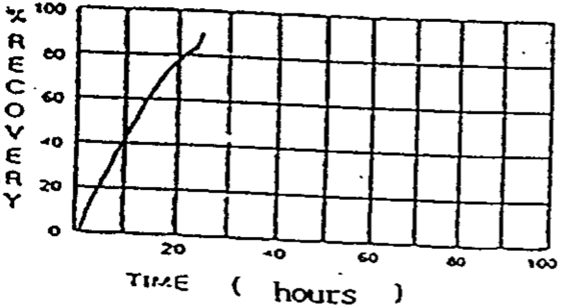
Total purge approx. 5 gallons (pumped dry)

Stabilization Test Data:

Time	pH	Spec. Cond.	Temp (C)
9:45	6.67	1830	21
9:55	6.96	1860	21
10:00	7.04	1860	20
10:05	7.10	1880	20
10:10	7.12	1870	20

Recovery Data:

Q= 5 gal. S_o= 28.75 ft.



Comments:

SITE NAME WMI - Comal County Landfill

LOCATION New Braunfels, Texas

WC '6979

SUPERVISED BY E. Hudson

DATE 2/19/92

Printed on recycled paper.

A. Monitor Well Data Sheet

Texas Department of Health
Division of Solid Waste Manageme
SE. 67 (3/29/88)

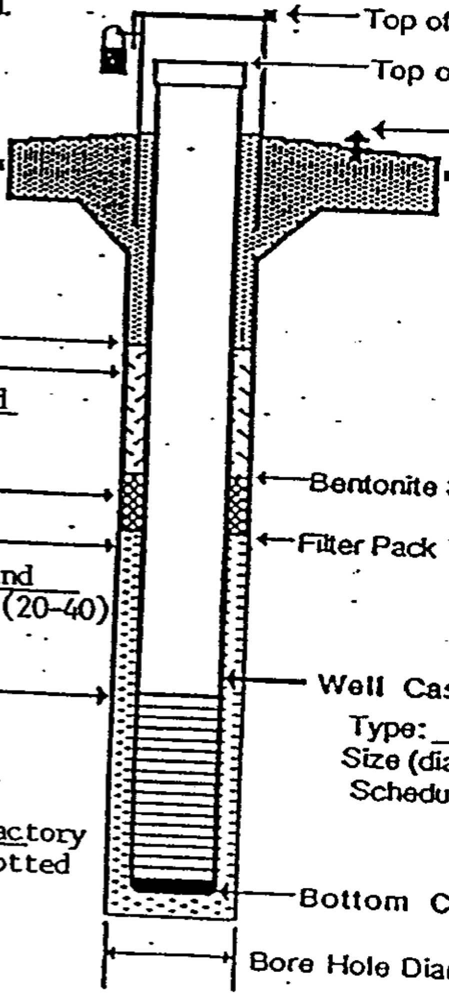
Permittee or Site Name: WMI - Comal County Landfill
County: Comal
of Monitor Well Installation: 2/19/92
Monitor Well: Latitude: ______ Longitude: ______
Monitor Well Groundwater
Gradient: Upgradient ___ Downgradient X

TDH Permit No.: 66
Monitor Well I.D. No.: MW - 4
Date of Monitor Well
Development: 2/26/92
Monitor Well Driller
Name: Henry Gompert
License No.: 2881 M

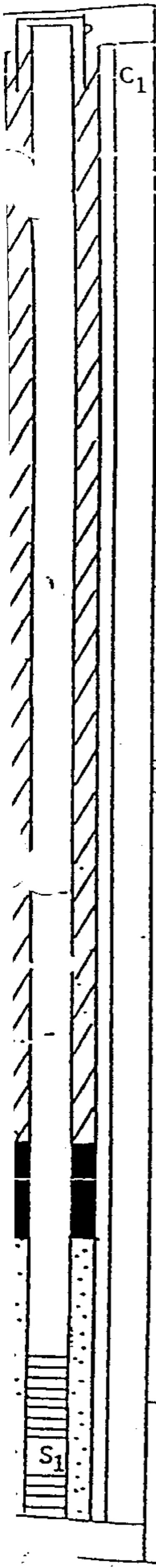
IOTE:

A)The information shown in the sketch below should be considered the minimum required for an installed ground-water monitor well.
3) Report All Depths from Surface Elevation and all Elevations relative to Mean Sea Level.
C) The minimum distance between the inside wall of the Bore Hole and the outside of the Well Casing shall be $\frac{3}{4}$".
D) Use Flush Screw Joint Casing only, 2" diameter or larger. Recommend 4" diameter minimum & Teflon Taping Casing Joints.

eologist, Hydrologist or Engineer Supervising Well Installation: Emmett Hudson
atic Water Level Elevation (with respect to MSL) after Well Developement: 578.92 ft.
ume of Geologic Formation(s) in which Well is completed: Navarro
pe of Locking Device: Padlock
Type of Casing Protection: 5'x 4" Locking Aluminum
oncrete Surface Pad - Recommend steel reinforcement in the Surface Pad.
rface Pad Dimensions:
4 ft. x 4 ft. x 6 in.



Top of Protective Collar Elevation: 608.58 ft.
Top of Casing Elevation: 608.27 ft.
Surveyor's Pin Elevation: 605.99 ft.
ace
: 605.32 ft.
ncrete Seal
oth: 2 ft.
ing Seal (Backfill)
erial: Type I cement and 10% bentonite
Bentonite Seal
Filter Pack
r Pack Material: Silica Sand
ilized Sand or Glass Beads (20-40)
Bentonite Seal Top
Depth: 8.5 ft. Elevation: 596.82 ft.
Filter Pack Top
Depth: 11.5 ft. Elevation: 593.82 ft.
l Screen
op Depth: 15.5 ft.
op Elevation: 589.82 ft
pe of Well Screen: PVC-factory slotted
reen Opening Size:
.010-in.
Well Casing
Type: PVC
Size (diameter): 2 in.
Schedule or Thickness: Sch 40
Bottom Cap: Depth 28 ft.
Bore Hole Diameter: 8.25 in.



Well No. Mw - 5

Boring No. X-Ref: SB - 5

MONITOR WELL CONSTRUCTION SUMMARY

Survey Coords: M+00 N, 36+90 E
(Site Grid)

Elevation Ground Level 668.16 ft. MSL

Top of Casing 671.43 ft. MSL

Drilling Summary:

Total Depth 60'
Borehole Diameter 8.25 in
Casing Stick-up Height: 3.27
Driller Roland Rodriguez/
Enviro-Drill
Rig Failing F-6-STD
Bit(s) 6-in finger bit
8.25-in O.D. Auger
Drilling Fluid None, hollow-stem auger
Protective Casing 5 ft x 4 in

Construction Time Log:

Task	Start Date	Start Time	Finish Date	Finish Time
Drilling				
0 - 44.5'	2/21	7:30	2/21	10:05
44.5 - 60'	2/21	10:05	2/21	11:45
Geophys.Logging:				
Casing:	2/21	11:50	2/21	12:05
C_2, S_1, C_3				
C_1	2/21	4:30	2/21	4:40
Filter Placement:	2/21	12:10	2/21	12:45
Cementing:	2/21	3:50	2/21	4:45
Development:	2/26	4:15	2/26	4:17

Well Design & Specifications

Basis: Geologic Log X Geophysical Log ____
Casing String (s): C = Casing S = Screen.

Depth	String(s)	Elevation
+3.47 - 2'	C_1	671.59 666.57'
+3.27 - 50'	C_2	671.43 618.16'
50 - 60'	S_1	618.16 608.16'
-	C_3	-
-		-

Casing: C1 4-in gold anodized aluminum
C_2 & C_3 2-in dia sch 40, flush - threaded PVC.
Screen: S1 2-in dia Sch 40, flush - threaded PVC, 0.010" slot
Filter Pack: 20-40 Colorado Silica sand, 46' - 60'
Grout Seal: Type I Portland with bentonite, 0 - 43'
Bentonite Seal: 3/8-in bentonite pellets, 43' - 46'

Well Development:

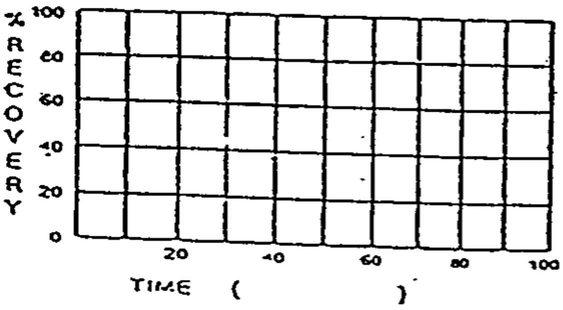
Well Dry

Stabilization Test Data:

Time	pH	Spec. Cond.	Temp (C)

Recovery Data:

Q= S_o=



Comments: Borehole had no saturation or moisture during drilling. Drillers added approximately 20 gal. H_2O to facilitate cutting and auger removal. Residual depth to H_2O = 55.5

SITE NAME WMI - Comal County Landfill

LOCATION New Braunfels, Texas

6979

SUPERVISED BY E. Hudson

DATE 2/21/92

Well No. M-5

Boring No. X-Ref:

MONITOR WELL CONSTRUCTION SUMMARY

Survey Coords:

Elevation Ground Level

Top of Casing

Drilling Summary:

Total Depth

Borehole Diameter 8.25 in

Casing Stick-up Height:

Driller Roland Rodriguez/ Enviro-Drill

Rig Failing F-6-STD

Bit(s) 6-in finger bit
8.25-in O.D. Auger

Drilling Fluid None, hollow-stem auger

Protective Casing 5 ft x 4 in

Well Design & Specifications

Basis: Geologic Log X Geophysical Log

Casing String (s): C = Casing S = Screen.

Depth	String(s)	Elevation
-	C_1	-
-	C_2	-
-	S_1	-
-	C_3	-
-		-

Casing: C1 4-in

C2 & C_3 2-in dia Sch 40, flush-threaded PVC

Screen: S1 2-in dia Sch 40, flush-threaded PVC, 0.010" SLOTS

S2

Filter Pack: 20-40 Colorado silica sand

Grout Seal: Type I Portland with Bentonite

Bentonite Seal: 3/8-in bentonite pellets

Construction Time Log:

	Start		Finish	
Task	Date	Time	Date	Time
Drilling				
Geophys.Logging:				
Casing:				
C_2, S_1, C_3				
C_2				
Filter Placement:				
Cementing:				
Development:				

Well Development:

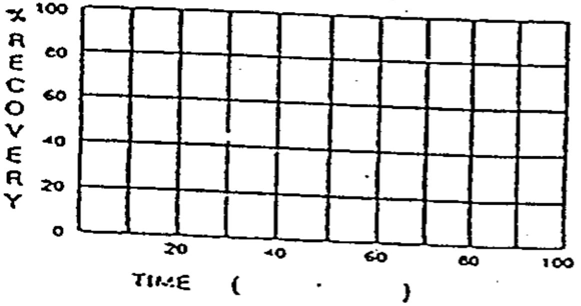
Stabilization Test Data:

Time	pH	Spec. Cond.	Temp (C)

Recovery Data:

Q=

S_o=



Comments:

Printed on recycled paper.

SITE NAME WMI - Comal County Landfill

LOCATION New Braunfels, Texas

WC '6979

SUPERVISED BY E. Hudson

DATE 2/21/92

A. Monitor Well Data Sheet

Texas Department of Health
Division of Solid Waste Managemen
SE. 67 (3/29/88)

Permittee or Site Name: WMI - Comal County Landfill

ounty: Comal

TDH Permit No. : 66

of Monitor Well Installation: 2/21/92

Monitor Well I.D. No.: MW - 5

Monitor Well: Latitude: ______ Longitude: ______

Date of Monitor Well Development: 2/26/92

Monitor Well Groundwater Gradient: Upgradient ___ Downgradient ___

Monitor Well Driller Name: WEs Kowser

License No.: 3226 M

OTE:

)The information shown in the sketch below should be considered the minimum required for an installed ground-water monitor well.
) Report All Depths from Surface Elevation and all Elevations relative to Mean Sea Level.
) The minimum distance between the inside wall of the Bore Hole and the outside of the Well Casing shall be 3" 4".
) Use Flush Screw Joint Casing only, 2" diameter or larger. Recommend 4" diameter minimum & Teflon Taping Casing Joints.

ologist, Hydrologist or Engineer Supervising Well Installation: Emmett Hudson

tic Water Level Elevation (with respect to MSL) after Well Developement : Dry

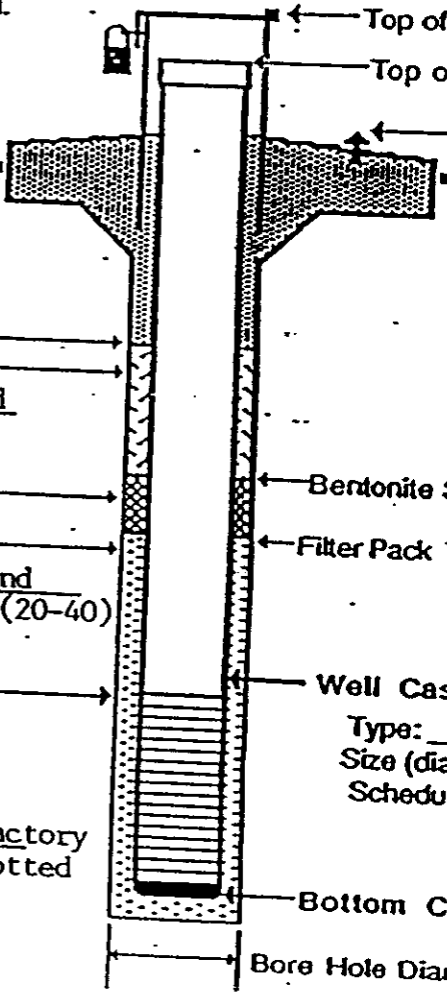
me of Geologic Formation(s) in which Well is completed: Taylor

pe of Locking Device: Padlock

Type of Casing Protection: 5'x 4" Locking Aluminum

ncrete Surface Pad - Recommend steel reinforcement in the Surface Pad.

rface Pad Dimensions: ft. x 4 ft. x 6 in.



Top of Protective Collar Elevation: 671.59 ft.

Top of Casing Elevation: 671.43 ft.

Surveyor's Pin Elevation: 668.74 ft.

ce : 668.16 ft.

crete Seal th: 2 ft.

ing Seal (Backfill) erial: Type I cement and 10% bentonite

Bentonite Seal

Filter Pack

Pack Material: Silica Sand ized Sand or Glass Beads (20-40)

Bentonite Seal Top Depth: 43 ft. Elevation: 625.16 ft.

Filter Pack Top Depth: 46 ft. Elevation: 622.16 ft.

Screen

p Depth: 50 ft.

p Elevation: 618.16 ft.

pe of Well Screen: PVC-factory slotted

reen Opening Size: .010-in.

Well Casing

Type: PVC

Size (diameter) : 2 in.

Schedule or Thickness: Sch 40

Bottom Cap: Depth 60 ft.

Bore Hole Diameter: 8.25 in.

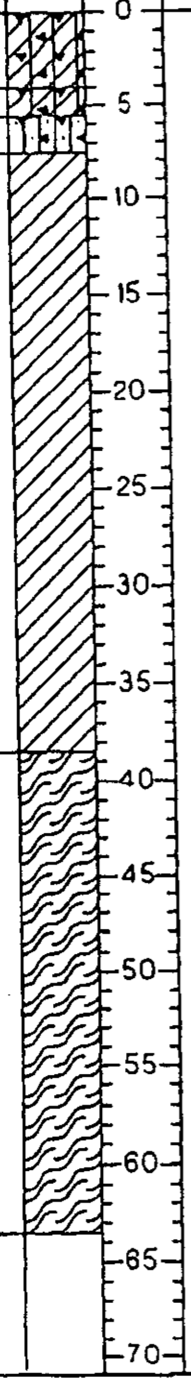
Monitoring Well No. W-6 (MW-6)

PROJECT: COMAL LANDFILL
L RIG: CME 55, 3 1/4" Hollow Stem Auger
INITIAL GW DEPTH: Dry ft.

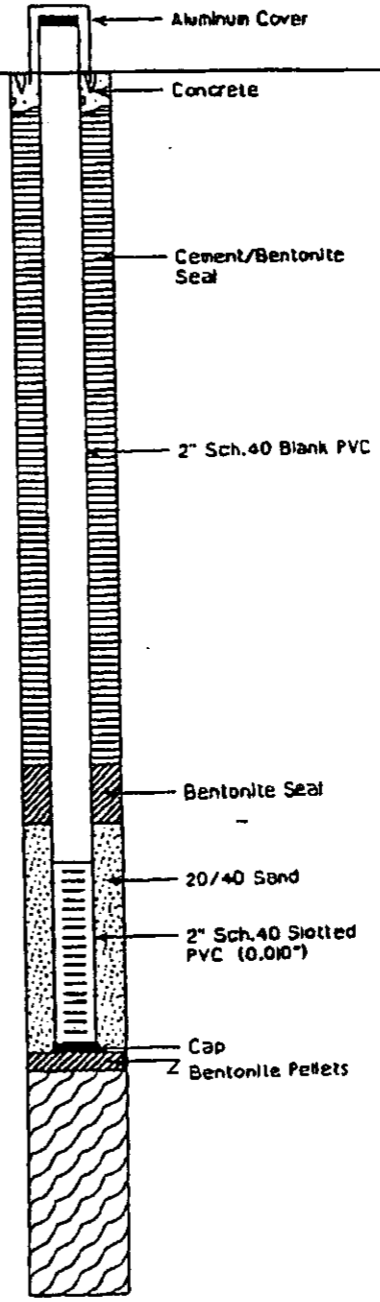
DATE: 11-07-95
HOLE DIA.: 8 5/8" In.
FINAL GW: ft.

LOGGED BY: John Webb
SAMPLER: None
HOLE ELEV.: N/A

DESCRIPTION	USCS CLASS	GRAPHIC LOG	DEPTH	SAMPLE	BLOWS/FT.
Fill - Brown & tan silty clay w/gravel					
Brown silty clay w/gravel					
Tan sandy silt w/gravel					
Tan & gray clay					
Gray shale w/calcite crystals (still)					
Terminated @ 63.5 feet					



WELL CONSTRUCTION DETAIL



JACK H. HOLT & ASSOCIATES, INC.

2220 Barton Skyway
Austin, Texas

N

Project
11-42495

Page 1 of 1

A Monitor Well Data Sheet

TEXAS NATURAL RESOURCE
CONSERVATION COMMISSION
MSWD-SE67

mittee or Site Name: **Comal County RDF**
County: **Comal County**
Date of Monitor Well Installation: **November 8, 1995**
Monitor Well: Latitude: **29° 44' 24.98"**
Longitude: **98° 01' 57.82"**
Monitor Well Groundwater: Upgradient: **X**
Downgradient:

MSW Permit No.: **66**
Monitor Well I.D. No.: **MW-6** 6
Date of Monitor Well Development: **Pending**
Monitor Well Driller Name: **Mr. John Webb**
License No.: **3023M**

NOTE:
(A) The information shown in the sketch below should be considered the minimum required for an installed ground-water monitor well.
(B) Report All Depths from Surface Elevation and all Elevations relative to Mean Sea Level.
(C) The minimum distance between the inside wall of the Bore Hole and the outside of the Well Casing shall be 3".
(D) Use Flush Screw Joint Casing only. 2" diameter or larger. Recommend 4" diameter minimum & Teflon Taping Casing Joints.
(E) Well development should continue until water is clear, and pH and conductivity are stable.

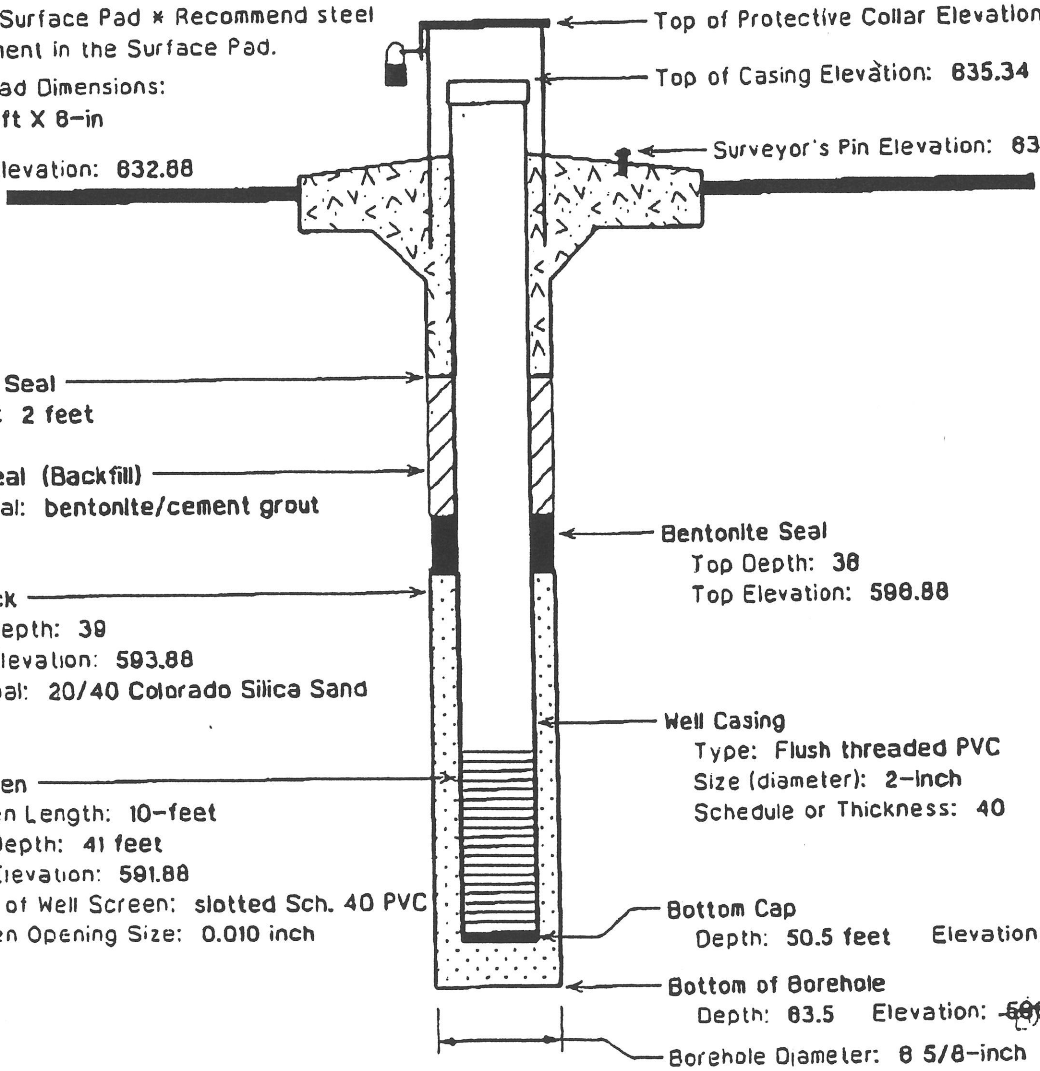
Geologist, Hydrologist or Engineer Supervising Well Installation: **David Smith**

Static Water Level Elevation (with respect to MSL) after Well Development: **dry**

Name of Geologic Formation (s) in which Well is completed: **Navarro Formation**

Type of Locking Device: **Key-lock**

Type of Casing Protection: **4-inch metal protective casing**



Concrete Surface Pad * Recommend steel reinforcement in the Surface Pad.
face Pad Dimensions:
X 8-ft X 6-in

Surface Elevation: **632.88**

Top of Protective Collar Elevation: **635.96**

Top of Casing Elevation: **635.34**

Surveyor's Pin Elevation: **633.28**

Concrete Seal
Depth: **2 feet**

Casing Seal (Backfill)
Material: **bentonite/cement grout**

Bentonite Seal
Top Depth: **36**
Top Elevation: **596.88**

Filter Pack
Top Depth: **39**
Top Elevation: **593.88**
Material: **20/40 Colorado Silica Sand**

Well Casing
Type: **Flush threaded PVC**
Size (diameter): **2-inch**
Schedule or Thickness: **40**

Well Screen
Screen Length: **10-feet**
Top Depth: **41 feet**
Top Elevation: **591.88**
Type of Well Screen: **slotted Sch. 40 PVC**
Screen Opening Size: **0.010 inch**

Bottom Cap
Depth: **50.5 feet** Elevation: **581.38**

Bottom of Borehole
Depth: **63.5** Elevation: ~~596.38~~ 569.38

Borehole Diameter: **8 5/8-inch**

Piezometer Data Sheet

Permittee or Site Name: WMTX – Mesquite Creek Landfill

County: Comal

Date of Monitor Well Installation: 12/20/04

Monitor Well Latitude: 29 44’ 13.85" Longitude: 98 01’ 24.55"

Northing: 13816876.45 Easting: 2278393.23

Monitor Well Groundwater Gradient Position:

Upgradient _______ Downgradient X

MSW Permit No. 66B

Monitor Well I.D. No.: GB-01

Date of Monitor Well Development: 02/14/05

Monitor Well Driller Name: GeoProjects/Jose Landeros

License No.: 2551W

NOTES:

Report all depths from Surface Elevation and all Elevations relative to Mean Sea Level (MSL), to nearest hundredth of a foot.
Diameter of boring should be at least 4 inches larger than diameter of well casing.
Use flush screw joint casing only, 2-inch diameter or larger, with o-rings or PTFE tape in joints (4-inch diameter recommend).
Well development should continue until water is clear, and pH and conductivity are stable.

Geologist, Hydrologist, or Engineer Supervising Well Installation: Taylor Johnston

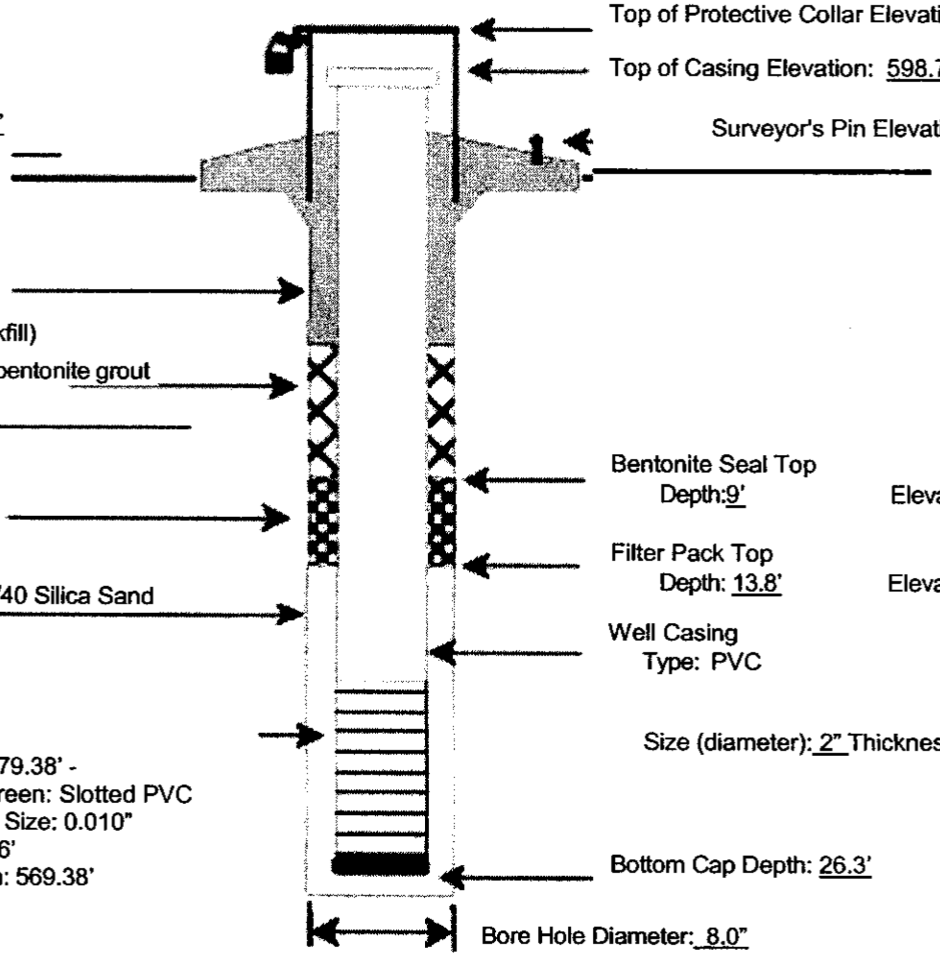
Static Water Level Elevation (with respect to MSL) after Well Development: 578.20’

Name of Geologic Formation(s) in which Well is completed: Lower Taylor Group (Stratum III of site-specific characterization)

Type of Locking Device: Padlock

Type of Casing Protection: Metal Stick-Up

Concrete Surface Pad (with steel reinforcement) Dimensions: 4’x4’



Top of Protective Collar Elevation: 598.98’

Top of Casing Elevation: 598.76’

Surface Elevation: 595.38’

Surveyor's Pin Elevation: N/A

Concrete Seal Depth: 2’

Casing Seal (backfill) Material: cement/bentonite grout

Bentonite Seal Top Depth: 9’ Elevation: 586.38’

Bentonite Seal

Filter Pack Top Depth: 13.8’ Elevation: 581.58’

Filter Pack: 20/40 Silica Sand

Well Casing Type: PVC

Size (diameter): 2" Thickness: Schedule 40

Well Screen
Top Depth: 16’
Top Elevation: 579.38’ -
Type of Well Screen: Slotted PVC
Screen Opening Size: 0.010"
Bottom Depth: 26’
Bottom Elevation: 569.38’

Bottom Cap Depth: 26.3’

Bore Hole Diameter: 8.0"

Piezometer Data Sheet

Permittee or Site Name: WMTX – Mesquite Creek Landfill

County: Comal

Date of Monitor Well Installation: 12/17/04

Monitor Well Latitude: 29 44' 10.41" Longitude: 98 01' 29.48"

Northing: 13816525.58 Easting: 2277962.38

Monitor Well Groundwater Gradient Position:

Upgradient ______ Downgradient X

Piezometer – Not applicable

MSW Permit No. 66B

Monitor Well I.D. No.: GB-02

Date of Monitor Well Development: 02/14/05

Monitor Well Driller Name: GeoProjects / Jose Landeros

License No.: 2551W

NOTES:

Report all depths from Surface Elevation and all Elevations relative to Mean Sea Level (MSL), to nearest hundredth of a foot.
Diameter of boring should be at least 4 inches larger than diameter of well casing.
Use flush screw joint casing only, 2-inch diameter or larger, with o-rings or PTFE tape in joints (4-inch diameter recommend).
Well development should continue until water is clear, and pH and conductivity are stable.

Geologist, Hydrologist, or Engineer Supervising Well Installation: Taylor Johnston

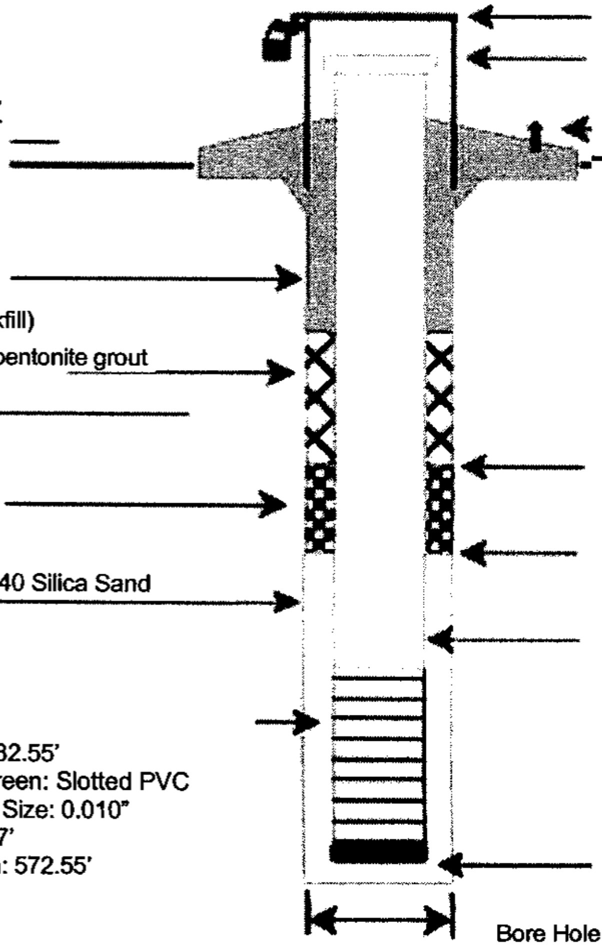
Static Water Level Elevation (with respect to MSL) after Well Development: 595.49'

Name of Geologic Formation(s) in which Well is completed: Lower Taylor Group

Type of Locking Device: Padlock

Type of Casing Protection: Metal Stick-Up

Concrete Surface Pad (with steel reinforcement) Dimensions: 4'x4'



Top of Protective Collar Elevation: 602.93'

Top of Casing Elevation: 602.67'

Surface Elevation: 599.55'

Surveyor's Pin Elevation: N/A

Concrete Seal Depth: 2'

Casing Seal (backfill) Material: cement/bentonite grout

Bentonite Seal Top Depth: 10' Elevation: 589.55'

Bentonite Seal

Filter Pack Top Depth: 15' Elevation: 584.55'

Filter Pack: 20/40 Silica Sand

Well Casing Type: PVC

Well Screen
Top Depth: 17'
Top Elevation: 582.55'
Type of Well Screen: Slotted PVC
Screen Opening Size: 0.010"
Bottom Depth: 27'
Bottom Elevation: 572.55'

Size (diameter): 2" Thickness: Schedule 40

Bottom Cap Depth: 27.3'

Bore Hole Diameter: 8.0"

Piezometer Data Sheet

Permittee or Site Name: WMTX – Mesquite Creek Landfill

County: Comal

Date of Monitor Well Installation: 12/15/04

Monitor Well Latitude: 29 44' 04.95" Longitude: 98 01' 34.70"

Northing: 13815970.63 Easting: 2277506.65

Monitor Well Groundwater Gradient Position:

Upgradient ______ ______Downgradient X

Piezometer – Not applicable

MSW Permit No. 66B

Monitor Well I.D. No.: GB-03

Date of Monitor Well Development: 02/11/05-02/14/05

Monitor Well Driller Name: GeoProjects/ Jose Landeros

License No.: 2551W

NOTES:

Report all depths from Surface Elevation and all Elevations relative to Mean Sea Level (MSL), to nearest hundredth of a foot.

Diameter of boring should be at least 4 inches larger than diameter of well casing.

Use flush screw joint casing only, 2-inch diameter or larger, with o-rings or PTFE tape in joints (4-inch diameter recommend).

Well development should continue until water is clear, and pH and conductivity are stable.

Geologist, Hydrologist, or Engineer Supervising Well Installation: Taylor Johnston

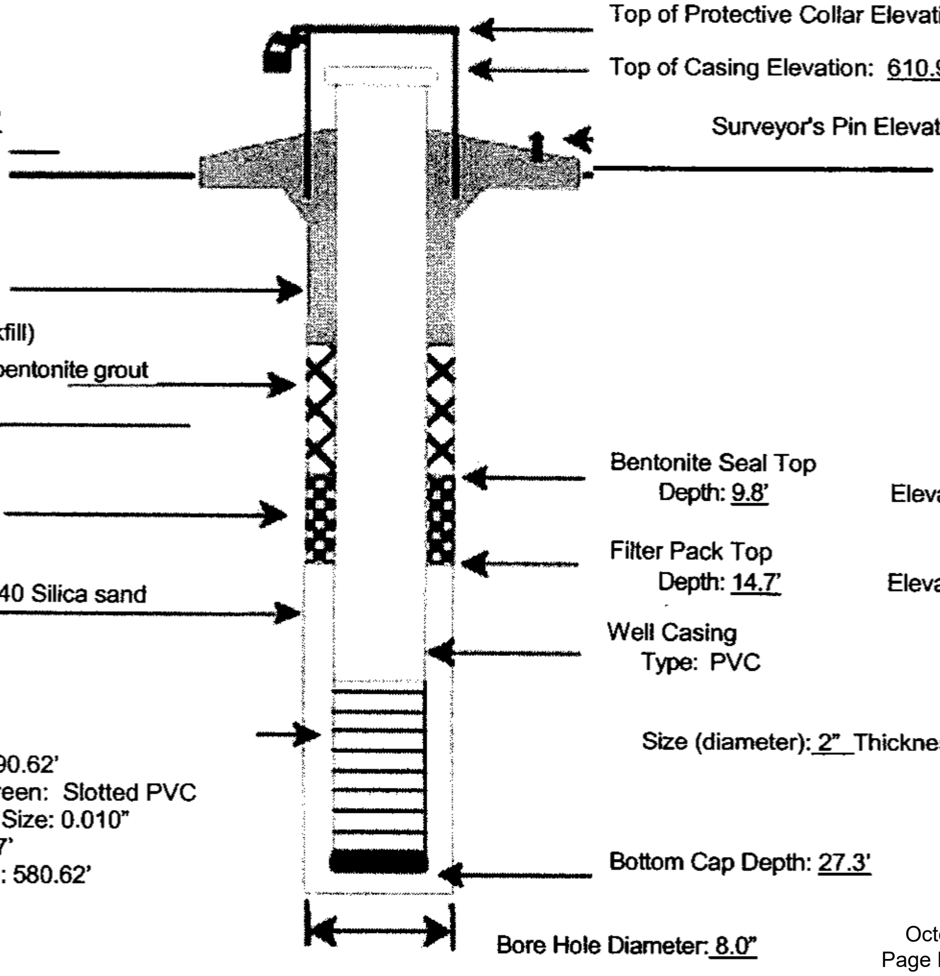
Static Water Level Elevation (with respect to MSL) after Well Development: 590.63'

Name of Geologic Formation(s) in which Well is completed: Lower Taylor Group

Type of Locking Device: Padlock

Type of Casing Protection: Metal Stick-Up

Concrete Surface Pad (with steel reinforcement) Dimensions: 4'x4'



Top of Protective Collar Elevation: 611.19'

Top of Casing Elevation: 610.91'

Surveyor's Pin Elevation: N/A

Surface Elevation: 607.62'

Concrete Seal Depth: 2'

Casing Seal (backfill) Material: cement/bentonite grout

Bentonite Seal

Bentonite Seal Top Depth: 9.8' Elevation: 597.82'

Filter Pack: 20/40 Silica sand

Filter Pack Top Depth: 14.7' Elevation: 592.92'

Well Casing Type: PVC

Size (diameter): 2" Thickness: Schedule 40

Well Screen
Top Depth: 17'
Top Elevation: 590.62'
Type of Well Screen: Slotted PVC
Screen Opening Size: 0.010"
Bottom Depth: 27'
Bottom Elevation: 580.62'

Bottom Cap Depth: 27.3'

Bore Hole Diameter: 8.0"

Piezometer Data Sheet

Permittee or Site Name: WMTX – Mesquite Creek Landfill
County: Guadalupe
Date of Monitor Well Installation: 12/17/04
Monitor Well Latitude: 29 43' 51.49" Longitude: 98 01' 20.31"
Northing: 13814621.77 Easting: 2278786.32
Monitor Well Groundwater Gradient Position:
Upgradient X____ ____Downgradient__
Piezometer – Not applicable

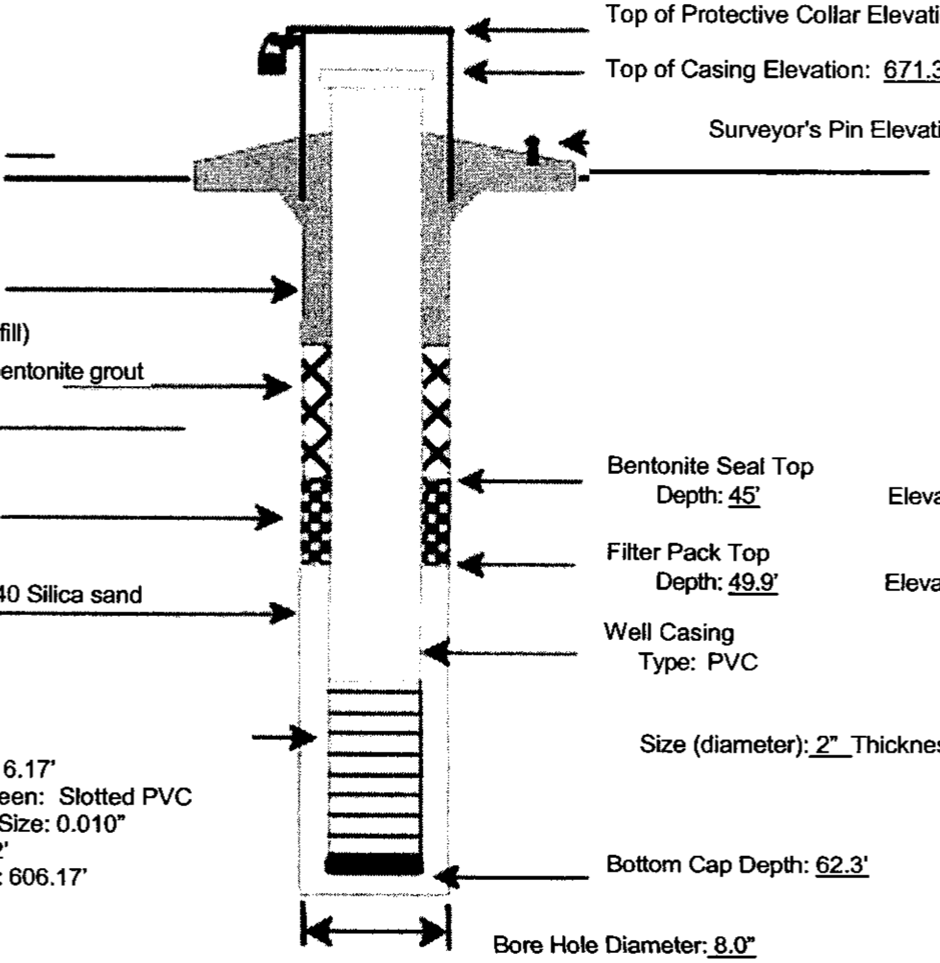
MSW Permit No. 66B
Monitor Well I.D. No.: GB-04
Date of Monitor Well Development: 02/10/05
Monitor Well Driller Name: GeoProjects/ Jose Landeros
License No.: 2551W

NOTES:

Report all depths from Surface Elevation and all Elevations relative to Mean Sea Level (MSL), to nearest hundredth of a foot.
Diameter of boring should be at least 4 inches larger than diameter of well casing.
Use flush screw joint casing only, 2-inch diameter or larger, with o-rings or PTFE tape in joints (4-inch diameter recommend).
Well development should continue until water is clear, and pH and conductivity are stable.

Geologist, Hydrologist, or Engineer Supervising Well Installation: Taylor Johnston
Static Water Level Elevation (with respect to MSL) after Well Development: 655.88'
Name of Geologic Formation(s) in which Well is completed: Lower Taylor Group

Type of Locking Device: Padlock
Type of Casing Protection: Metal Stick-Up
Concrete Surface Pad (with steel reinforcement) Dimensions: 4'x4'



Top of Protective Collar Elevation: 671.66'
Top of Casing Elevation: 671.34'
Surface Elevation: 668.17'
Surveyor's Pin Elevation: N/A
Concrete Seal Depth: 2'
Casing Seal (backfill) Material: cement/bentonite grout
Bentonite Seal
Bentonite Seal Top Depth: 45' Elevation: 623.17'
Filter Pack: 20/40 Silica sand
Filter Pack Top Depth: 49.9' Elevation: 618.17'
Well Casing Type: PVC
Size (diameter): 2" Thickness: Schedule 40

Well Screen
Top Depth: 52'
Top Elevation: 616.17'
Type of Well Screen: Slotted PVC
Screen Opening Size: 0.010"
Bottom Depth: 62'
Bottom Elevation: 606.17'

Bottom Cap Depth: 62.3'
Bore Hole Diameter: 8.0"

Piezometer Data Sheet

Permittee or Site Name: WMTX – Mesquite Creek Landfill

MSW Permit No. 66B

County: Guadalupe

Monitor Well I.D. No.: GB-05

Date of Monitor Well Installation: 01/05/05

Monitor Well Latitude: 29 43' 57.47" Longitude: 98 01' 15.76"

Northing: 13815229.06 Easting: 2279182.71

Date of Monitor Well Development: 02/10/05

Monitor Well Groundwater Gradient Position:

Upgradient ____ Downgradient X

Piezometer – Not applicable

Monitor Well Driller Name: GeoProjects/ Jose Landeros

License No.: 2551W

NOTES:

Report all depths from Surface Elevation and all Elevations relative to Mean Sea Level (MSL), to nearest hundredth of a foot.

Diameter of boring should be at least 4 inches larger than diameter of well casing.

Use flush screw joint casing only, 2-inch diameter or larger, with o-rings or PTFE tape in joints (4-inch diameter recommend).

Well development should continue until water is clear, and pH and conductivity are stable.

Geologist, Hydrologist, or Engineer Supervising Well Installation: Taylor Johnston

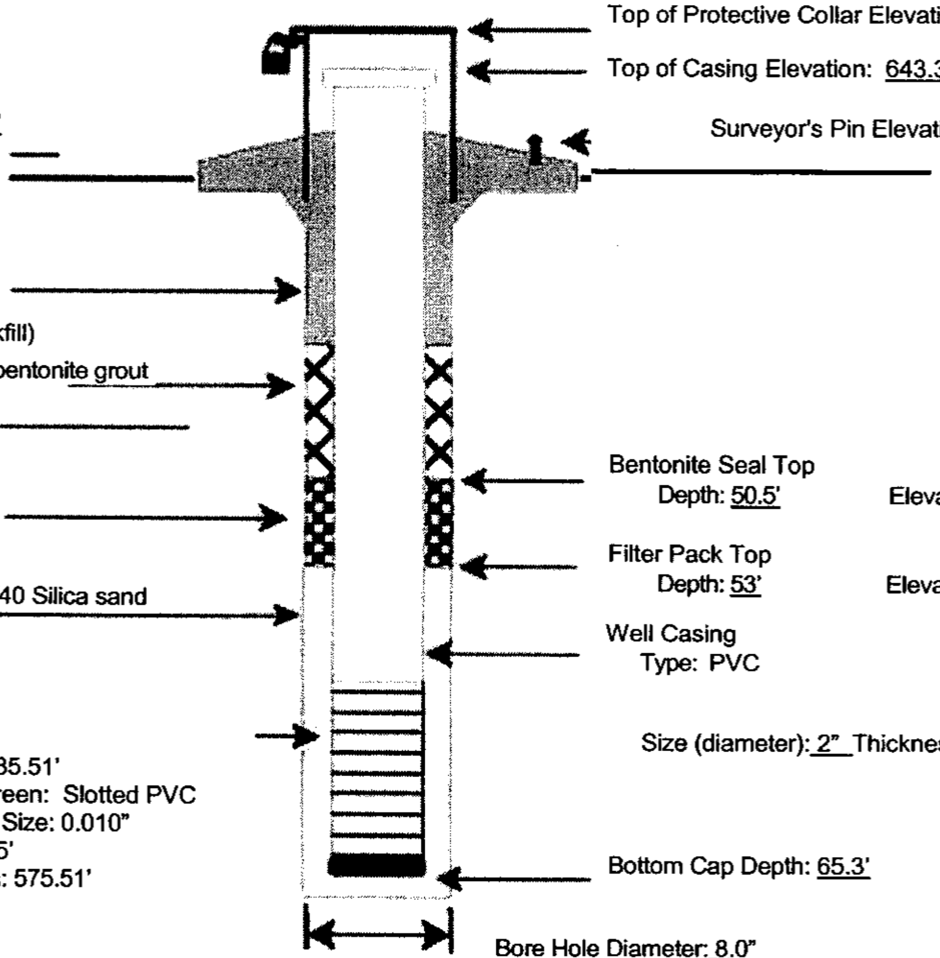
Static Water Level Elevation (with respect to MSL) after Well Development: 588.59'- 3/31/05

Name of Geologic Formation(s) in which Well is completed: Lower Taylor Group

Type of Locking Device: Padlock

Type of Casing Protection: Metal Stick-Up

Concrete Surface Pad (with steel reinforcement) Dimensions: 4'x4'



Top of Protective Collar Elevation: 643.56'

Top of Casing Elevation: 643.33'

Surface Elevation: 640.51'

Surveyor's Pin Elevation: N/A

Concrete Seal Depth: 2'

Casing Seal (backfill) Material: cement/bentonite grout

Bentonite Seal Top Depth: 50.5' Elevation: 590.01'

Bentonite Seal

Filter Pack Top Depth: 53' Elevation: 587.51

Filter Pack: 20/40 Silica sand

Well Casing Type: PVC

Size (diameter): 2" Thickness: Schedule 40

Well Screen

Top Depth: 55'

Top Elevation: 585.51'

Type of Well Screen: Slotted PVC

Screen Opening Size: 0.010"

Bottom Depth: 65'

Bottom Elevation: 575.51'

Bottom Cap Depth: 65.3'

Bore Hole Diameter: 8.0"

TCEQ-10308

October 2023

Piezometer Data Sheet

Permittee or Site Name: WMTX – Mesquite Creek Landfill

County: Guadalupe

Date of Monitor Well Installation: 1/28/05

Monitor Well Latitude: 29 44' 03.89" Longitude: 98 01' 07.88"

Northing: 13815883.30 Easting: 2279871.78

Monitor Well Groundwater Gradient Position:

Upgradient ______ Downgradient X

Piezometer – Not applicable

MSW Permit No. 66B

Monitor Well I.D. No.: GB-06

Date of Monitor Well Development: 02/08/05

Monitor Well Driller Name: GeoProjects/ Jose Landeros

License No.: 2551W

NOTES:

Report all depths from Surface Elevation and all Elevations relative to Mean Sea Level (MSL), to nearest hundredth of a foot.
Diameter of boring should be at least 4 inches larger than diameter of well casing.
Use flush screw joint casing only, 2-inch diameter or larger, with o-rings or PTFE tape in joints (4-inch diameter recommend).
Well development should continue until water is clear, and pH and conductivity are stable.

Geologist, Hydrologist, or Engineer Supervising Well Installation: Taylor Johnston

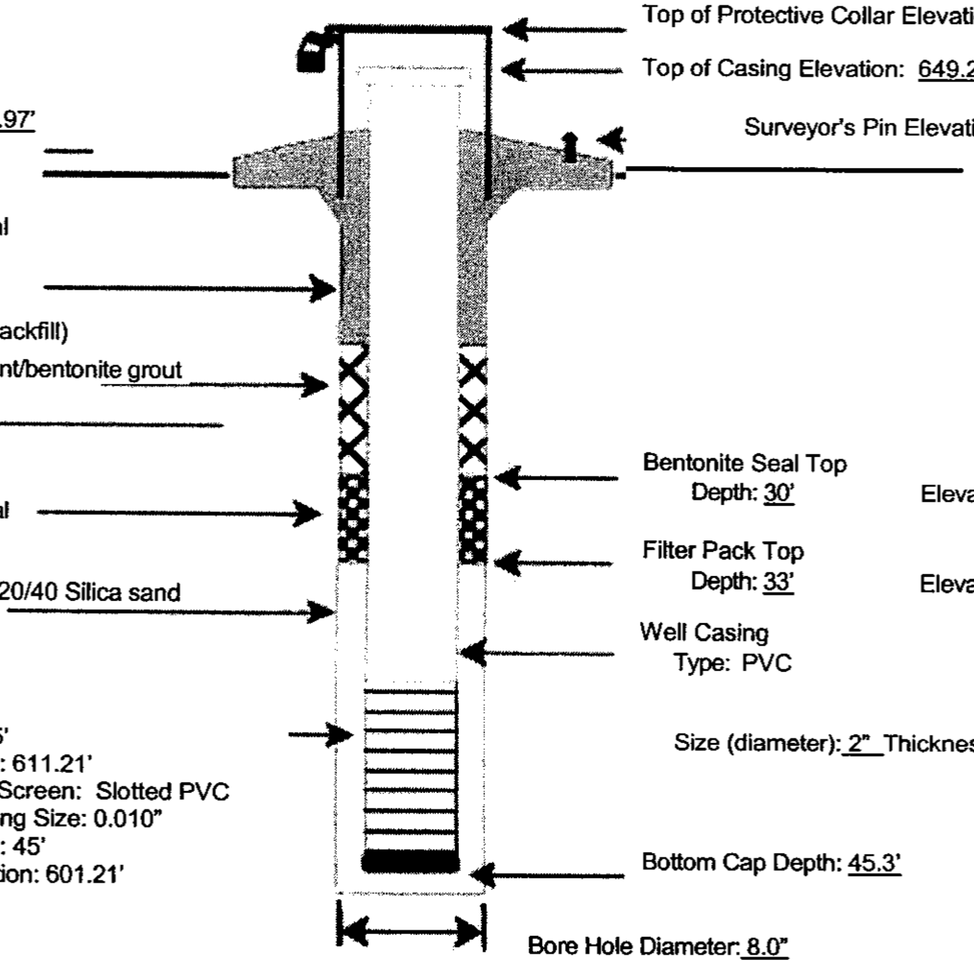
Static Water Level Elevation (with respect to MSL) after Well Development: 610.00'

Name of Geologic Formation(s) in which Well is completed: Lower Taylor Group

Type of Locking Device: Padlock

Type of Casing Protection: Metal Stick-Up

Concrete Surface Pad (with steel reinforcement) Dimensions: 4'x4'



Top of Protective Collar Elevation: 649.50'

Top of Casing Elevation: 649.29'

Surface Elevation: 645.97'

Surveyor's Pin Elevation: N/A

Concrete Seal Depth: 2'

Casing Seal (backfill) Material: cement/bentonite grout

Bentonite Seal Top Depth: 30' Elevation: 615.97'

Bentonite Seal

Filter Pack Top Depth: 33' Elevation: 612.97'

Filter Pack: 20/40 Silica sand

Well Casing Type: PVC

Size (diameter): 2" Thickness: Schedule 40

Well Screen
Top Depth: 35'
Top Elevation: 611.21'
Type of Well Screen: Slotted PVC
Screen Opening Size: 0.010"
Bottom Depth: 45'
Bottom Elevation: 601.21'

Bottom Cap Depth: 45.3'

Bore Hole Diameter: 8.0"

Piezometer Data Sheet

Permittee or Site Name: WMTX – Mesquite Creek Landfill

MSW Permit No. 66B

County: Guadalupe

Monitor Well I.D. No.: GB-09

Date of Monitor Well Installation: 12/22/04

Monitor Well Latitude: 29 44' 02.13" Longitude: 98 01'14.88"

Northing: 13815699.84 Easting: 2279256.03

Date of Monitor Well Development: 01/25/05

Monitor Well Groundwater Gradient Position:

Upgradient ______ Downgradient X

Piezometer – Not applicable

Monitor Well Driller Name: GeoProjects/ Jose Landeros

License No.: 2551W

NOTES:

Report all depths from Surface Elevation and all Elevations relative to Mean Sea Level (MSL), to nearest hundredth of a foot.
Diameter of boring should be at least 4 inches larger than diameter of well casing.
Use flush screw joint casing only, 2-inch diameter or larger, with o-rings or PTFE tape in joints (4-inch diameter recommend).
Well development should continue until water is clear, and pH and conductivity are stable.

Geologist, Hydrologist, or Engineer Supervising Well Installation: Ed Dolan

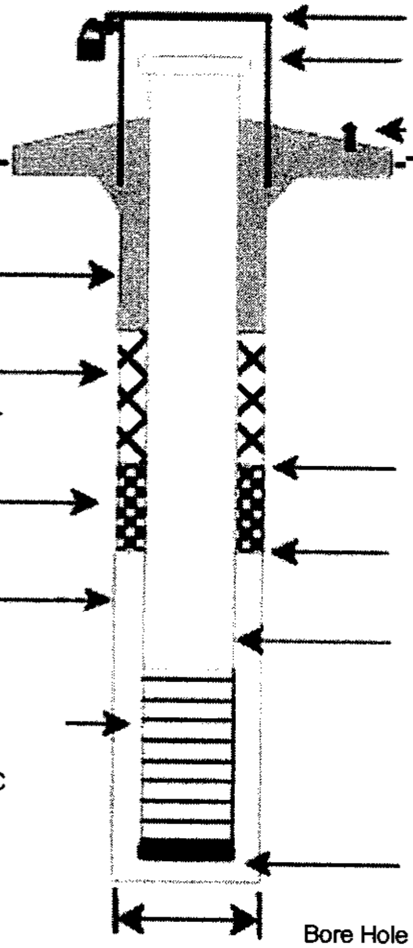
Static Water Level Elevation (with respect to MSL) after Well Development: 634.38'

Name of Geologic Formation(s) in which Well is completed: Lower Taylor Group (Stratum III of site-specific characterization)

Type of Locking Device: Padlock

Type of Casing Protection: Metal Stick-Up

Concrete Surface Pad (with steel reinforcement) Dimensions: 4'x4'



Top of Protective Collar Elevation: 642.05'

Top of Casing Elevation: 641.71'

Surface Elevation: 638.66'

Surveyor's Pin Elevation: N/A

Concrete Seal Depth: 2'

Casing Seal (backfill) Material: cement/bentonite grout

Bentonite Seal Top Depth: 36.5' Elevation: 602.16'

Bentonite Seal

Filter Pack Top Depth: 42' Elevation: 596.66'

Filter Pack: 20/40 Silica sand

Well Casing Type: PVC

Size (diameter): 2" Thickness: Schedule 40

Well Screen
Top Depth: 44'
Top Elevation: 595.5'
Type of Well Screen: Slotted PVC
Screen Opening Size: 0.010"
Bottom Depth: 54.0'
Bottom Elevation: 585.50'

Bottom Cap Depth: 54.3'

Bore Hole Diameter: 8.0"(0-64'), 4.0"(64-89')

Piezometer Data Sheet

Permittee or Site Name: WMTX – Mesquite Creek Landfill

MSW Permit No. 66B

County: Guadalupe

Monitor Well I.D. No.: GB-11

Date of Monitor Well Installation: 12/20/04

Monitor Well Latitude: 29 44' 03.81" Longitude: 98 01' 21.56"

Northing: 13815865.03 Easting: 2278665.34

Date of Monitor Well Development: 02/11/05-02/14/05

Monitor Well Groundwater Gradient Position:

Upgradient ______ ____Downgradient X__

Piezometer – Not applicable

Monitor Well Driller Name: GeoProjects/ Jose Landeros

License No.: 2551W

NOTES:

Report all depths from Surface Elevation and all Elevations relative to Mean Sea Level (MSL), to nearest hundredth of a foot.
Diameter of boring should be at least 4 inches larger than diameter of well casing.
Use flush screw joint casing only, 2-inch diameter or larger, with o-rings or PTFE tape in joints (4-inch diameter recommend).
Well development should continue until water is clear, and pH and conductivity are stable.

Geologist, Hydrologist, or Engineer Supervising Well Installation: Taylor Johnston

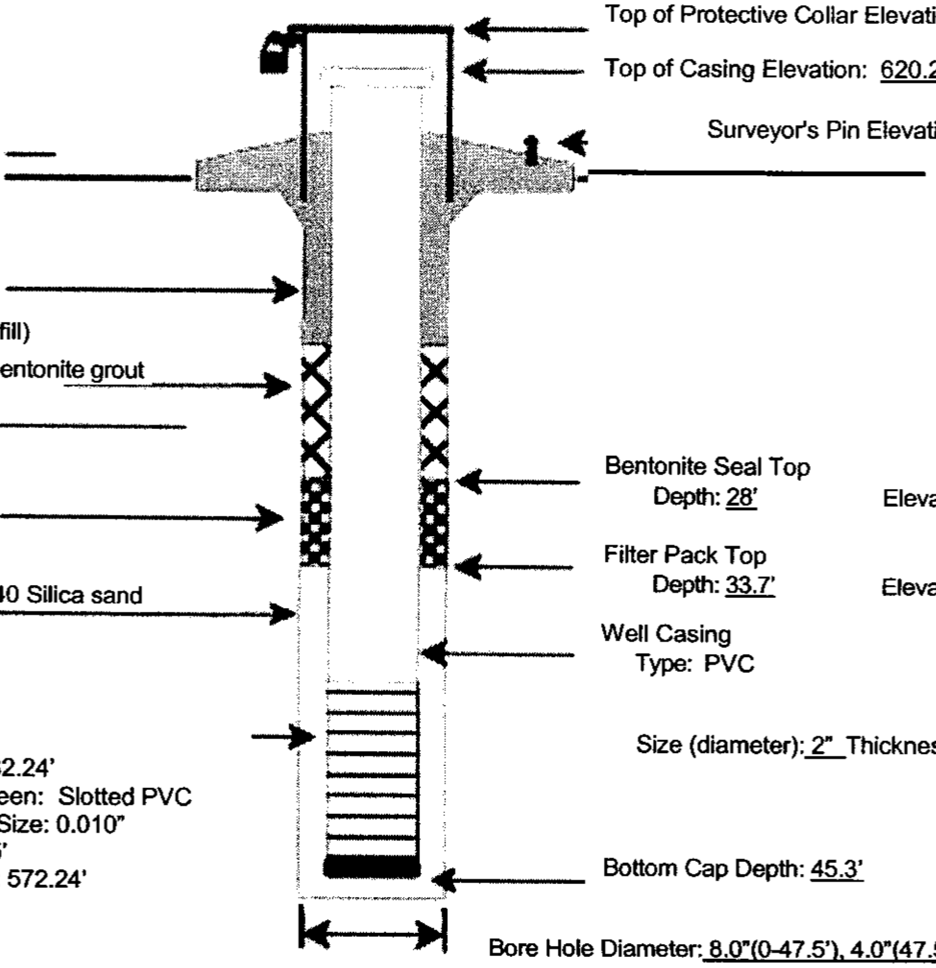
Static Water Level Elevation (with respect to MSL) after Well Development: 602.52'

Name of Geologic Formation(s) in which Well is completed: Lower Taylor Group (Stratum III of site-specific characterization)

Type of Locking Device: Padlock

Type of Casing Protection: Metal Stick-Up

Concrete Surface Pad (with steel reinforcement) Dimensions: 4'x4'



Top of Protective Collar Elevation: 620.59'

Top of Casing Elevation: 620.22'

Surveyor's Pin Elevation: N/A

Surface Elevation: 617.20'

Concrete Seal Depth: 2'

Casing Seal (backfill) Material: cement/bentonite grout

Bentonite Seal

Bentonite Seal Top Depth: 28' Elevation: 589.20'

Filter Pack: 20/40 Silica sand

Filter Pack Top Depth: 33.7' Elevation: 583.50"

Well Casing Type: PVC

Size (diameter): 2" Thickness: Schedule 40

Well Screen
Top Depth: 35'
Top Elevation: 582.24'
Type of Well Screen: Slotted PVC
Screen Opening Size: 0.010"
Bottom Depth: 45'
Bottom Elevation: 572.24'

Bottom Cap Depth: 45.3'

Bore Hole Diameter: 8.0"(0-47.5'), 4.0"(47.5-90')

Piezometer Data Sheet

Permittee or Site Name: WMTX – Mesquite Creek Landfill

County: Guadalupe

Date of Monitor Well Installation: 12/16/04

Monitor Well Latitude: 29 43' 58.78" Longitude: 98 01' 28.53"

Northing: 13815351.49 Easting: 2278055.83

Monitor Well Groundwater Gradient Position:

Upgradient X ______ ____Downgradient___

Piezometer – Not applicable

MSW Permit No. 66B

Monitor Well I.D. No.: GB-12

Date of Monitor Well Development: 02/10/05-02/11/05

Monitor Well Driller Name: GeoProjects/ Jose Landeros

License No.: 2551W

NOTES:

Report all depths from Surface Elevation and all Elevations relative to Mean Sea Level (MSL), to nearest hundredth of a foot.

Diameter of boring should be at least 4 inches larger than diameter of well casing.

Use flush screw joint casing only, 2-inch diameter or larger, with o-rings or PTFE tape in joints (4-inch diameter recommend).

Well development should continue until water is clear, and pH and conductivity are stable.

Geologist, Hydrologist, or Engineer Supervising Well Installation: Taylor Johnston

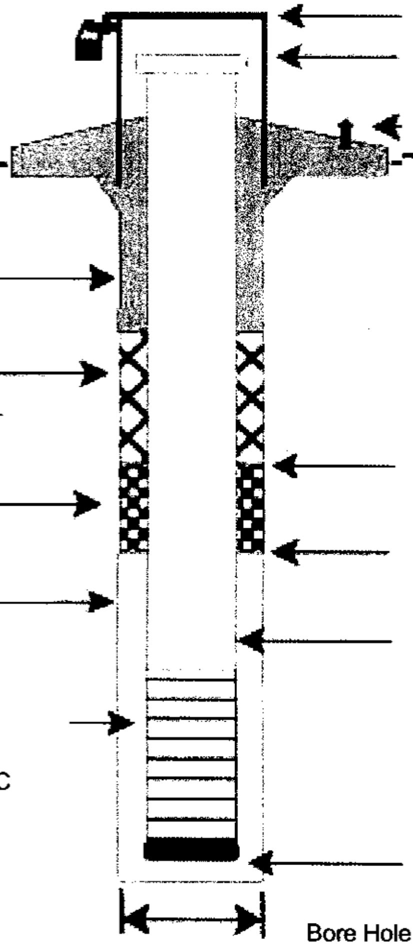
Static Water Level Elevation (with respect to MSL) after Well Development: 602.68'

Name of Geologic Formation(s) in which Well is completed: Lower Taylor Group (Stratum III of site-specific characterization)

Type of Locking Device: Padlock

Type of Casing Protection: Metal Stick-Up

Concrete Surface Pad (with steel reinforcement) Dimensions: 4'x4'



Top of Protective Collar Elevation: 643.20'

Top of Casing Elevation: 642.80'

Surface Elevation: 639.61'

Surveyor's Pin Elevation: N/A

Concrete Seal Depth: 2'

Casing Seal (backfill) Material: cement/bentonite grout

Bentonite Seal

Bentonite Seal Top Depth: 45' Elevation: 594.61'

Filter Pack: 20/40 Silica sand

Filter Pack Top Depth: 47.8 Elevation: 591.81'

Well Casing Type: PVC

Size (diameter): 2" Thickness: Schedule 40

Well Screen
Top Depth: 50'
Top Elevation: 589.72'
Type of Well Screen: Slotted PVC
Screen Opening Size: 0.010"
Bottom Depth: 60'
Bottom Elevation: 579.72'

Bottom Cap Depth: 60.3'

Bore Hole Diameter: 8.0"

Piezometer Data Sheet

Permittee or Site Name: WMTX – Mesquite Creek Landfill

MSW Permit No. 66B

County: Guadalupe

Monitor Well I.D. No.: GB-13

Date of Monitor Well Installation: 01/21/05

Monitor Well Latitude: 29 44' 07.81" Longitude: 98 01' 17.32"

Northing: 13816271.85 Easting: 2279036.29

Date of Monitor Well Development: 02/07/05-02/08/05

Monitor Well Groundwater Gradient Position:

Upgradient ______ ____Downgradient X

Piezometer – Not applicable

Monitor Well Driller Name: GeoProjects/ Jose Landeros

License No.: 2551W

NOTES:

Report all depths from Surface Elevation and all Elevations relative to Mean Sea Level (MSL), to nearest hundredth of a foot.
Diameter of boring should be at least 4 inches larger than diameter of well casing.
Use flush screw joint casing only, 2-inch diameter or larger, with o-rings or PTFE tape in joints (4-inch diameter recommend).
Well development should continue until water is clear, and pH and conductivity are stable.

Geologist, Hydrologist, or Engineer Supervising Well Installation: Ed Dolan

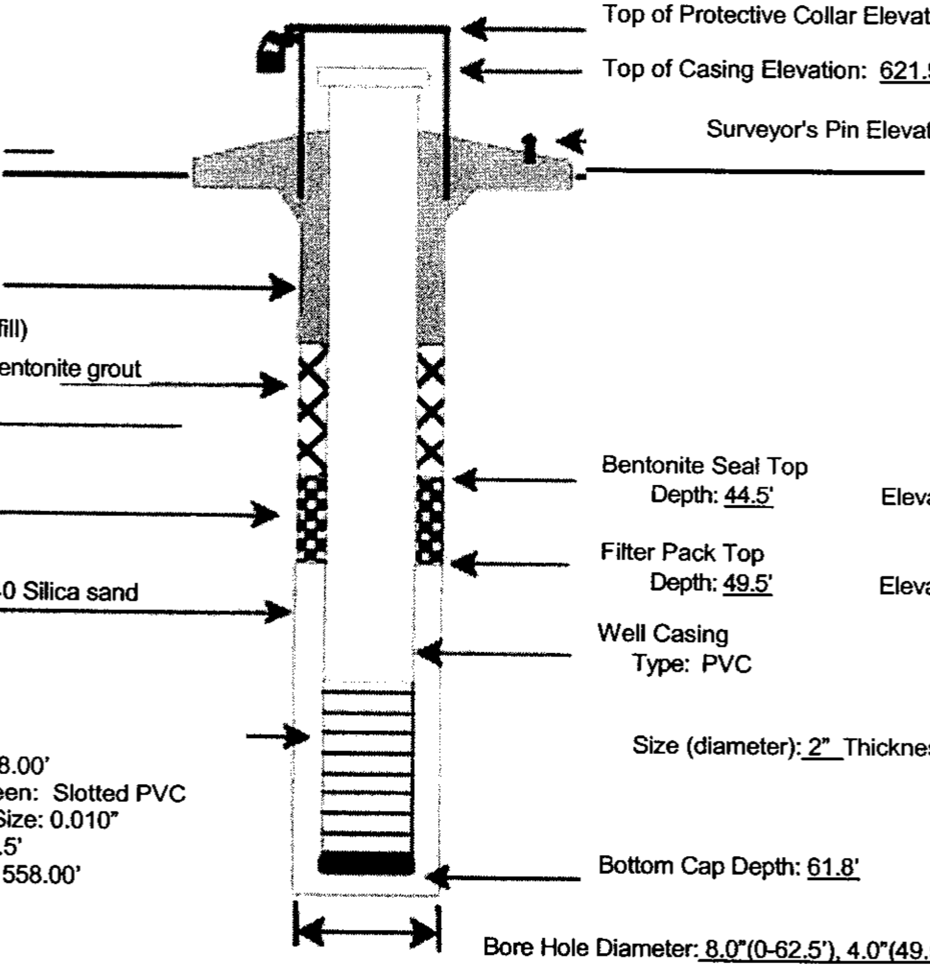
Static Water Level Elevation (with respect to MSL) after Well Development: 593.40'

Name of Geologic Formation(s) in which Well is completed: Lower Taylor Group (Stratum III of site-specific characterization)

Type of Locking Device: Padlock

Type of Casing Protection: Metal Stick-Up

Concrete Surface Pad (with steel reinforcement) Dimensions: 4'x4'



Top of Protective Collar Elevation: 622.14'

Top of Casing Elevation: 621.94'

Surface Elevation: 619.50'

Surveyor's Pin Elevation: N/A

Concrete Seal Depth: 2'

Casing Seal (backfill) Material: cement/bentonite grout

Bentonite Seal

Bentonite Seal Top Depth: 44.5' Elevation: 575.00'

Filter Pack: 20/40 Silica sand

Filter Pack Top Depth: 49.5' Elevation: 570.00'

Well Casing Type: PVC

Size (diameter): 2" Thickness: Schedule 40

Well Screen
Top Depth: 51.5'
Top Elevation: 568.00'
Type of Well Screen: Slotted PVC
Screen Opening Size: 0.010"
Bottom Depth: 61.5'
Bottom Elevation: 558.00'

Bottom Cap Depth: 61.8'

Bore Hole Diameter: 8.0"(0-62.5'), 4.0"(49.5-95')

Piezometer Data Sheet

Permittee or Site Name: WMTX – Mesquite Creek Landfill
County: Guadalupe
Date of Monitor Well Installation: 01/21/05
Monitor Well Latitude: 29 44' 01.27" Longitude: 98 00' 56.65"
Northing: 13815626.49 Easting: 2280863.47
Monitor Well Groundwater Gradient Position:
Upgradient ______ Downgradient X
Piezometer – Not applicable

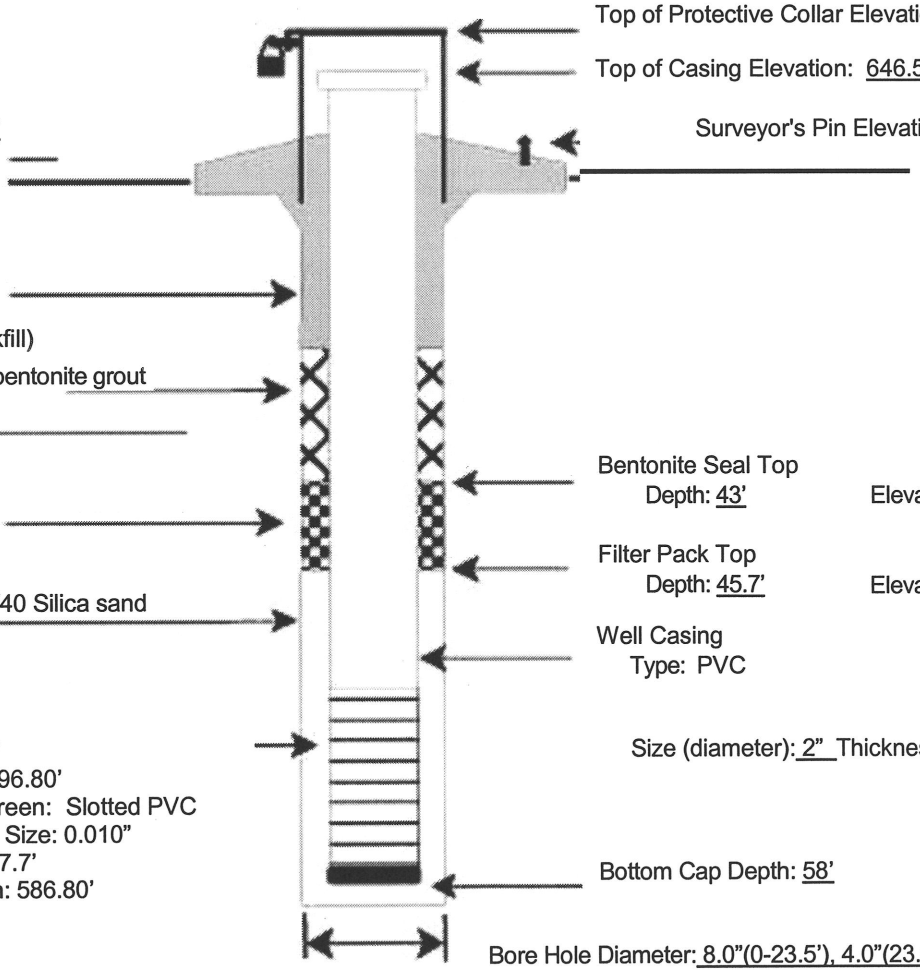
MSW Permit No. 66B
Monitor Well I.D. No.: GB-15 / MW-16
Date of Monitor Well Development: 02/08/05-02/09/05
Monitor Well Driller Name: GeoProjects/ Jose Landeros
License No.: 2551W

NOTES:

Report all depths from Surface Elevation and all Elevations relative to Mean Sea Level (MSL), to nearest hundredth of a foot.
Diameter of boring should be at least 4 inches larger than diameter of well casing.
Use flush screw joint casing only, 2-inch diameter or larger, with o-rings or PTFE tape in joints (4-inch diameter recommend).
Well development should continue until water is clear, and pH and conductivity are stable.

Geologist, Hydrologist, or Engineer Supervising Well Installation: Ed Dolan
Static Water Level Elevation (with respect to MSL) after Well Development: 638.49'
Name of Geologic Formation(s) in which Well is completed: Lower Taylor Group (Stratum III of site-specific characterization)

Type of Locking Device: Padlock
Type of Casing Protection: Metal Stick-Up
Concrete Surface Pad (with steel reinforcement) Dimensions: 4'x4'



Top of Protective Collar Elevation: 646.86'
Top of Casing Elevation: 646.53'
Surface Elevation: 643.39'
Surveyor's Pin Elevation: N/A
Concrete Seal Depth: 2'
Casing Seal (backfill) Material: cement/bentonite grout
Bentonite Seal
Bentonite Seal Top Depth: 43' Elevation: 600.39'
Filter Pack Top Depth: 45.7' Elevation: 597.69'
Filter Pack: 20/40 Silica sand
Well Casing Type: PVC
Size (diameter): 2" Thickness: Schedule 40

Well Screen
Top Depth: 47.7'
Top Elevation: 596.80'
Type of Well Screen: Slotted PVC
Screen Opening Size: 0.010"
Bottom Depth: 57.7'
Bottom Elevation: 586.80'

Bottom Cap Depth: 58'
Bore Hole Diameter: 8.0"(0-23.5'), 4.0"(23.5-144')

Piezometer Data Sheet

Permittee or Site Name: WMTX – Mesquite Creek Landfill

County: Guadalupe

Date of Monitor Well Installation: 01/24/05

Monitor Well Latitude: 29 43' 51.41" Longitude: 98 00' 56.50"

Northing: 13814630.98 Easting: 2280885.41

Monitor Well Groundwater Gradient Position:

Upgradient ______ Downgradient X

Piezometer – Not applicable

MSW Permit No. 66B

Monitor Well I.D. No.: GB-17

Date of Monitor Well Development: 02/10/05

Monitor Well Driller Name: GeoProjects/ Jose Landeros

License No.: 2551W

NOTES:

Report all depths from Surface Elevation and all Elevations relative to Mean Sea Level (MSL), to nearest hundredth of a foot.

Diameter of boring should be at least 4 inches larger than diameter of well casing.

Use flush screw joint casing only, 2-inch diameter or larger, with o-rings or PTFE tape in joints (4-inch diameter recommend).

Well development should continue until water is clear, and pH and conductivity are stable.

Geologist, Hydrologist, or Engineer Supervising Well Installation: Taylor Johnston

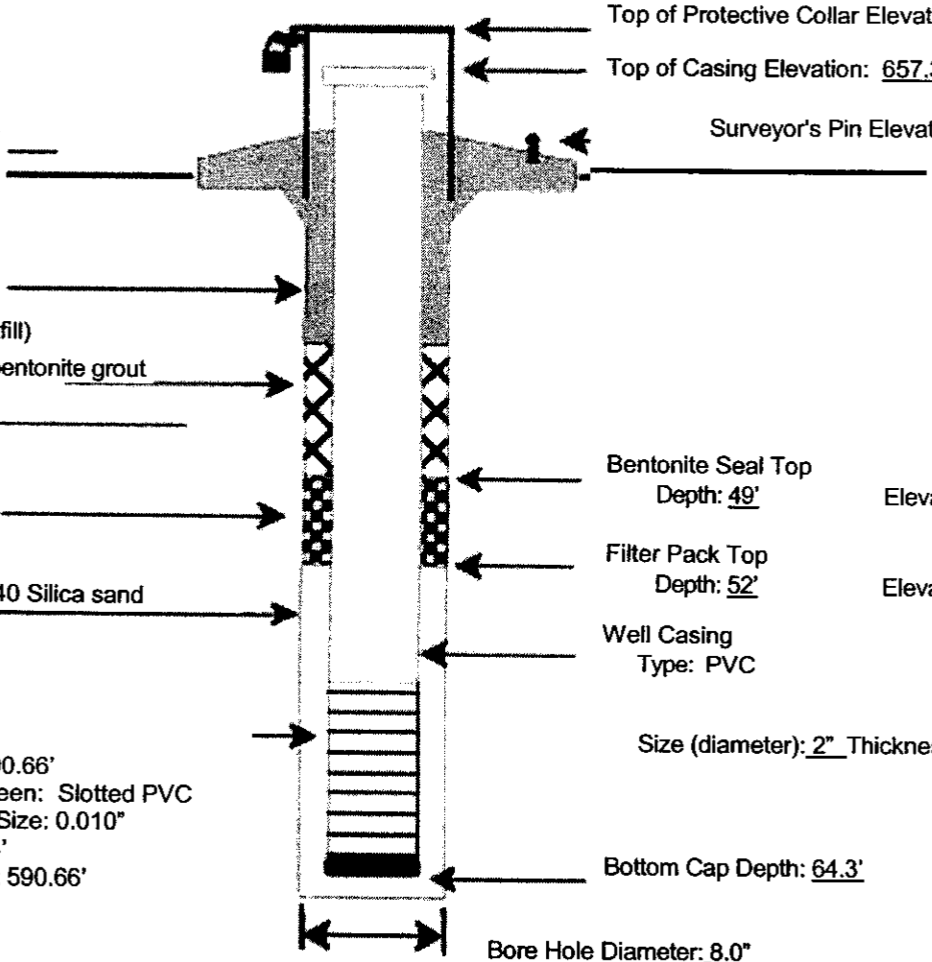
Static Water Level Elevation (with respect to MSL) after Well Development: 598.14'

Name of Geologic Formation(s) in which Well is completed: Lower Taylor Group (Stratum III of site-specific characterization)

Type of Locking Device: Padlock

Type of Casing Protection: Metal Stick-Up

Concrete Surface Pad (with steel reinforcement) Dimensions: 4'x4'



Top of Protective Collar Elevation: 658.16'

Top of Casing Elevation: 657.30'

Surface Elevation: 654.41'

Surveyor's Pin Elevation: N/A

Concrete Seal Depth: 2'

Casing Seal (backfill) Material: cement/bentonite grout

Bentonite Seal Top Depth: 49' Elevation: 605.41'

Bentonite Seal

Filter Pack Top Depth: 52' Elevation: 602.41'

Filter Pack: 20/40 Silica sand

Well Casing Type: PVC

Well Screen
Top Depth: 54'
Top Elevation: 600.66'
Type of Well Screen: Slotted PVC
Screen Opening Size: 0.010"
Bottom Depth: 64'
Bottom Elevation: 590.66'

Size (diameter): 2" Thickness: Schedule 40

Bottom Cap Depth: 64.3'

Bore Hole Diameter: 8.0"

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Piezometer Data Sheet

Permittee or Site Name: WMTX – Mesquite Creek Landfill

MSW Permit No. 66B

County: Guadalupe

Monitor Well I.D. No.: GB-20

Date of Monitor Well Installation: 12/13/04

Monitor Well Latitude: 29 43' 46.62" Longitude: 98 01' 14.02"

Northing: 13814134.94 Easting: 2279345.16

Date of Monitor Well Development: 02/09/05-2/10/05

Monitor Well Groundwater Gradient Position:

Upgradient X _____ ____Downgradient___

Piezometer – Not applicable

Monitor Well Driller Name: GeoProjects/ Jose Landeros

License No.: 2551W

NOTES:

Report all depths from Surface Elevation and all Elevations relative to Mean Sea Level (MSL), to nearest hundredth of a foot.

Diameter of boring should be at least 4 inches larger than diameter of well casing.

Use flush screw joint casing only, 2-inch diameter or larger, with o-rings or PTFE tape in joints (4-inch diameter recommend).

Well development should continue until water is clear, and pH and conductivity are stable.

Geologist, Hydrologist, or Engineer Supervising Well Installation: Taylor Johnston

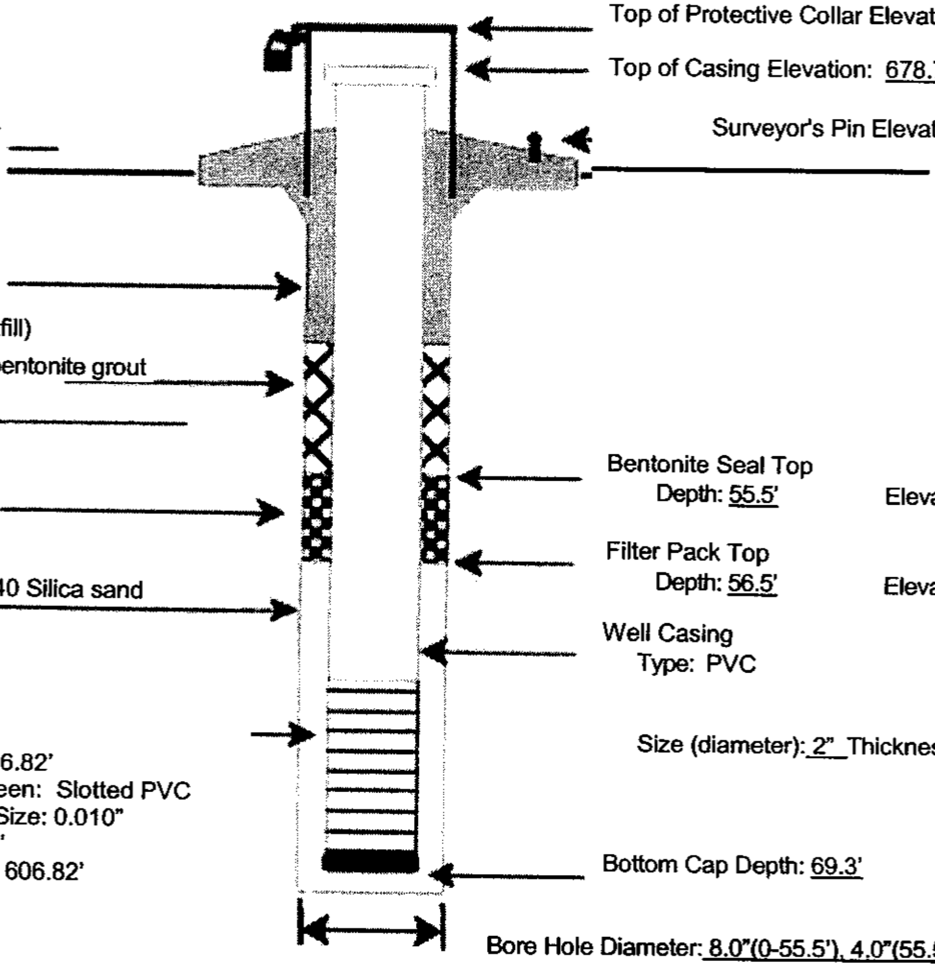
Static Water Level Elevation (with respect to MSL) after Well Development: 646.23'

Name of Geologic Formation(s) in which Well is completed: Lower Taylor Group (Stratum III of site-specific characterization)

Type of Locking Device: Padlock

Type of Casing Protection: Metal Stick-Up

Concrete Surface Pad (with steel reinforcement) Dimensions: 4'x4'



Top of Protective Collar Elevation: 679.11'

Top of Casing Elevation: 678.74'

Surface Elevation: 675.82'

Surveyor's Pin Elevation: N/A

Concrete Seal Depth: 2'

Casing Seal (backfill) Material: cement/bentonite grout

Bentonite Seal Top Depth: 55.5' Elevation: 620.32'

Bentonite Seal

Filter Pack Top Depth: 56.5' Elevation: 619.32'

Filter Pack: 20/40 Silica sand

Well Casing Type: PVC

Size (diameter): 2" Thickness: Schedule 40

Well Screen
Top Depth: 59'
Top Elevation: 616.82'
Type of Well Screen: Slotted PVC
Screen Opening Size: 0.010"
Bottom Depth: 69'
Bottom Elevation: 606.82'

Bottom Cap Depth: 69.3'

Bore Hole Diameter: 8.0"(0-55.5'), 4.0"(55.5-169')

Piezometer Data Sheet

Permittee or Site Name: WMTX – Mesquite Creek Landfill

MSW Permit No. 66B

County: Guadalupe

Monitor Well I.D. No.: GB-21

Date of Monitor Well Installation: 01/10/04

Monitor Well Latitude: 29 43' 41.98" Longitude: 98 01' 05.79"

Northing: 13813671.19 Easting: 2280075.19

Date of Monitor Well Development: 02/10/05

Monitor Well Groundwater Gradient Position:

Upgradient ________ Downgradient

Piezometer – Not applicable

Monitor Well Driller Name: GeoProjects/Jose Landeros

License No.: 2551W

NOTES:

Report all depths from Surface Elevation and all Elevations relative to Mean Sea Level (MSL), to nearest hundredth of a foot.
Diameter of boring should be at least 4 inches larger than diameter of well casing.
Use flush screw joint casing only, 2-inch diameter or larger, with o-rings or PTFE tape in joints (4-inch diameter recommend).
Well development should continue until water is clear, and pH and conductivity are stable.

Geologist, Hydrologist, or Engineer Supervising Well Installation: Taylor Johnston

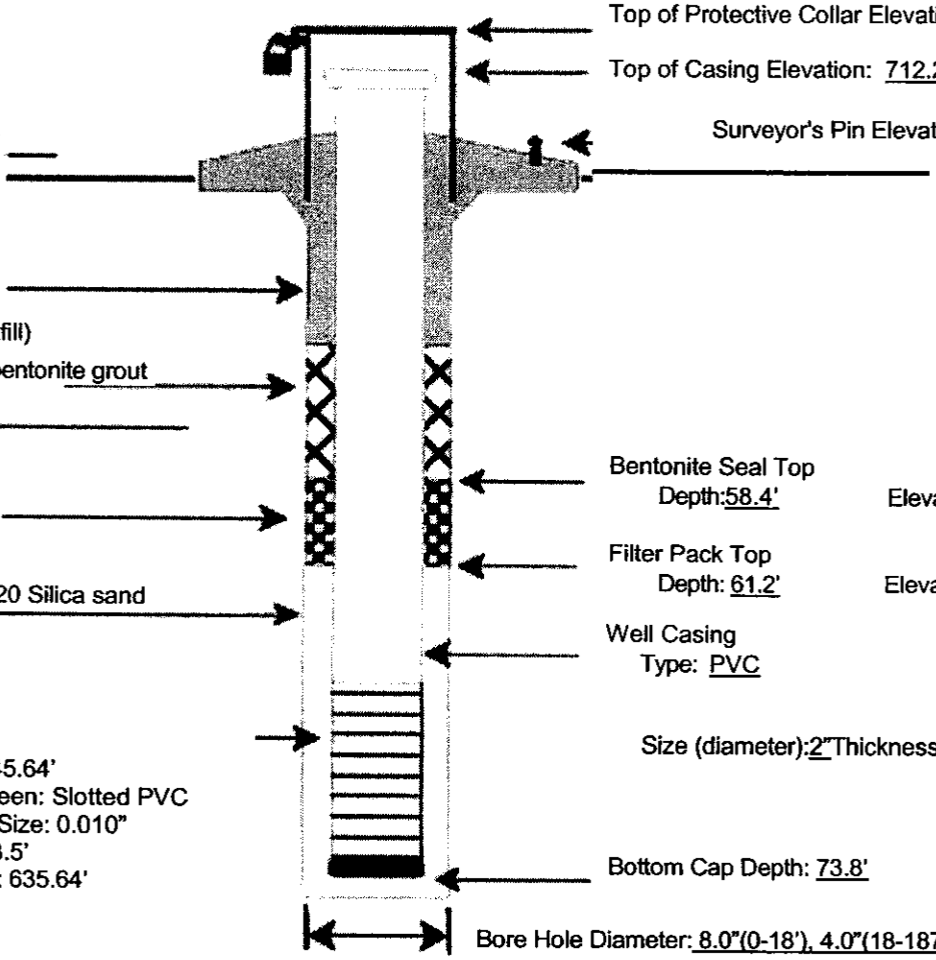
Static Water Level Elevation (with respect to MSL) after Well Development: 643.54'

Name of Geologic Formation(s) in which Well is completed: Lower Taylor Group (Stratum III of site-specific characterization)

Type of Locking Device: Padlock

Type of Casing Protection: Metal Stick-Up

Concrete Surface Pad (with steel reinforcement) Dimensions: 4'x4'



Top of Protective Collar Elevation: 712.52'

Top of Casing Elevation: 712.23'

Surface Elevation: 709.14'

Surveyor's Pin Elevation: N/A

Concrete Seal Depth: 2'

Casing Seal (backfill) Material: cement/bentonite grout

Bentonite Seal Top Depth: 58.4' Elevation: 650.74'

Bentonite Seal

Filter Pack Top Depth: 61.2' Elevation: 647.94'

Filter Pack: 12/20 Silica sand

Well Casing Type: PVC

Size (diameter): 2" Thickness: Schedule 40

Well Screen
Top Depth: 63.5'
Top Elevation: 645.64'
Type of Well Screen: Slotted PVC
Screen Opening Size: 0.010"
Bottom Depth: 73.5'
Bottom Elevation: 635.64'

Bottom Cap Depth: 73.8'

Bore Hole Diameter: 8.0"(0-18'), 4.0"(18-187')

Piezometer Data Sheet

Permittee or Site Name: WMTX – Mesquite Creek Landfill

MSW Permit No. 66B

County: Guadalupe

Monitor Well I.D. No.: GB-22

Date of Monitor Well Installation: 01/10/04

Monitor Well Latitude: 29 43' 53.31" Longitude: 98 01' 12.18"

Northing: 13814811.40 Easting: 2279501.03

Date of Monitor Well Development: 02/09/05

Monitor Well Groundwater Gradient Position:

Upgradient ______ Downgradient X

Piezometer – Not applicable

Monitor Well Driller Name: GeoProjects/Jose Landeros

License No.: 2551W

NOTES:

Report all depths from Surface Elevation and all Elevations relative to Mean Sea Level (MSL), to nearest hundredth of a foot.
Diameter of boring should be at least 4 inches larger than diameter of well casing.
Use flush screw joint casing only, 2-inch diameter or larger, with o-rings or PTFE tape in joints (4-inch diameter recommend).
Well development should continue until water is clear, and pH and conductivity are stable.

Geologist, Hydrologist, or Engineer Supervising Well Installation: Taylor Johnston

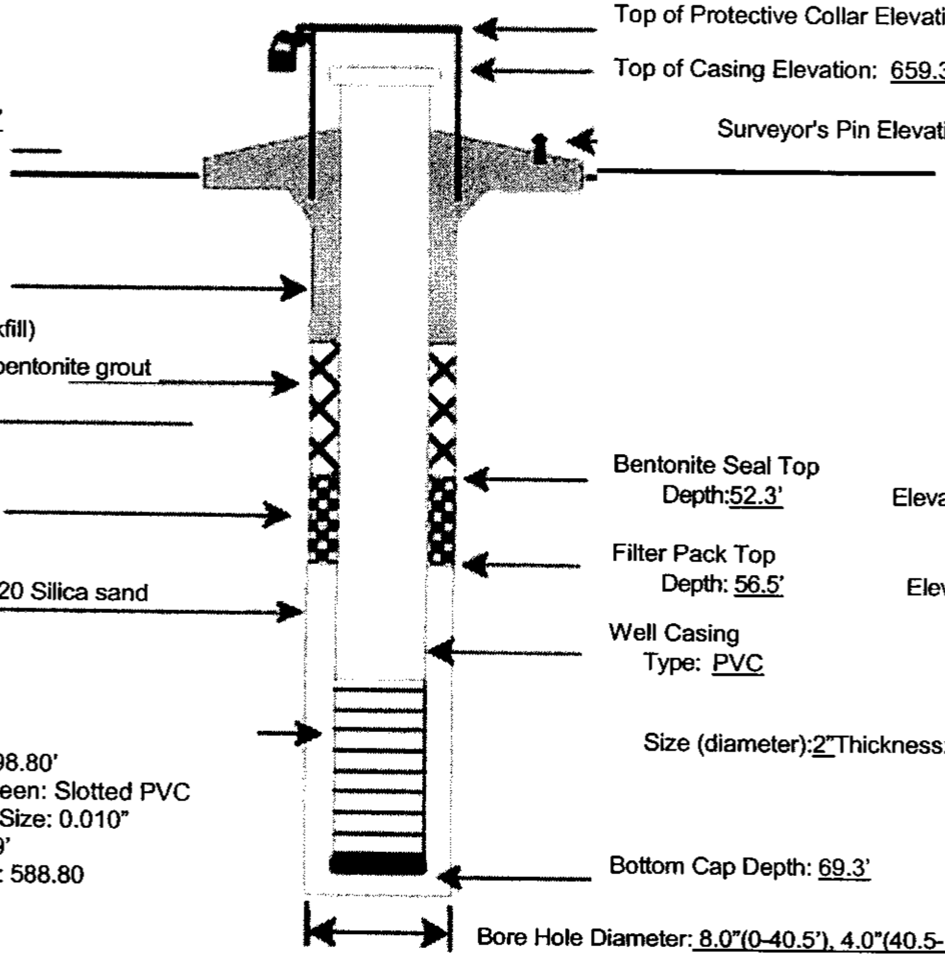
Static Water Level Elevation (with respect to MSL) after Well Development: 598.77'

Name of Geologic Formation(s) in which Well is completed: Lower Taylor Group (Stratum III of site-specific characterization)

Type of Locking Device: Padlock

Type of Casing Protection: Metal Stick-Up

Concrete Surface Pad (with steel reinforcement) Dimensions: 4'x4'



Top of Protective Collar Elevation: 659.67'

Top of Casing Elevation: 659.36'

Surface Elevation: 657.80'

Surveyor's Pin Elevation: N/A

Concrete Seal Depth: 2'

Casing Seal (backfill) Material: cement/bentonite grout

Bentonite Seal Top Depth: 52.3' Elevation: 605.50'

Bentonite Seal

Filter Pack Top Depth: 56.5' Elevation: 601.30"

Filter Pack: 12/20 Silica sand

Well Casing Type: PVC

Size (diameter): 2" Thickness: Schedule 40

Well Screen
Top Depth: 59'
Top Elevation: 598.80'
Type of Well Screen: Slotted PVC
Screen Opening Size: 0.010"
Bottom Depth: 69'
Bottom Elevation: 588.80

Bottom Cap Depth: 69.3'

Bore Hole Diameter: 8.0"(0-40.5'), 4.0"(40.5-140')

Monitor Well Data Sheet

Permittee or Site Name: Comal County Landfill

County: Comal

Date of Monitor Well Installation: 4/05/06

Monitor Well Latitude: 29.737172408 Longitude: -98.024908381

Monitor Well Groundwater Gradient Position:

Upgradient ____ Downgradient X

MSW Permit No.: 66-A

Monitor Well I.D. No.: MW-7

Date of Monitor Well Development: Dry

Monitor Well Driller

Name: John Egan Talbot

License No.: 3180-M

NOTES:

- Report all depths from Surface Elevation and all Elevations relative to Mean Sea Level (MSL), to nearest hundredth of a foot.
- Diameter of boring should be at least 4 inches larger than diameter of well casing.
- Use flush screw joint casing only, 2-inch diameter or larger, with o-rings or PTFE tape in joints (4-inch diameter recommend).
- Well development should continue until water is clear, and pH and conductivity are stable.

Geologist, Hydrologist, or Engineer Supervising Well Installation: Roger Gomez

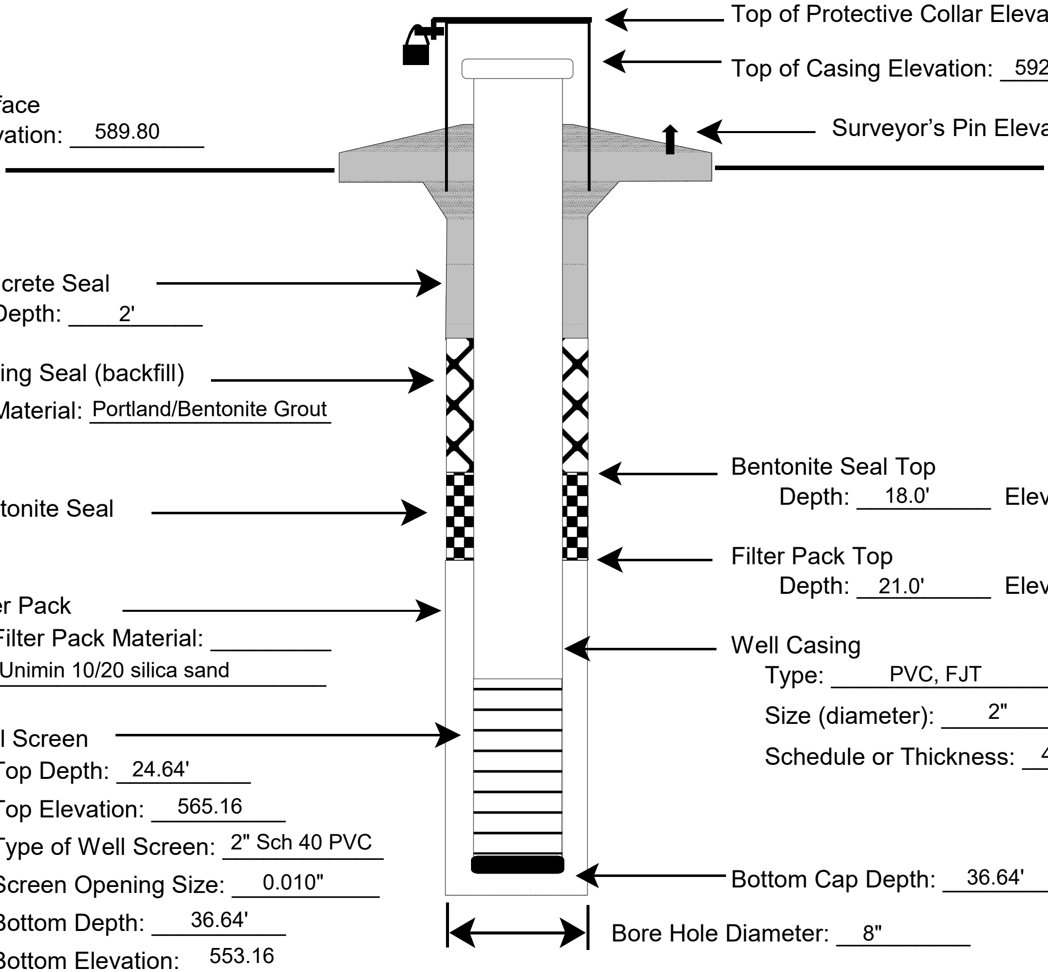
Static Water Level Elevation (with respect to MSL) after Well Development: Dry

Name of Geologic Formation(s) in which Well is completed: Weathered and Unweathered Claystone (Pecan Gap Chalk FM)

Type of Locking Device: Pad Lock

Type of Casing Protection: Aluminum

Concrete Surface Pad (with steel reinforcement) Dimensions: 4' x 4' x 6"



Top of Protective Collar Elevation: 592.63

Top of Casing Elevation: 592.23

Surface Elevation: 589.80

Surveyor's Pin Elevation: 590.03

Concrete Seal Depth: 2'

Casing Seal (backfill) Material: Portland/Bentonite Grout

Bentonite Seal

Bentonite Seal Top Depth: 18.0' Elevation: 571.80

Filter Pack Top Depth: 21.0' Elevation: 568.80

Filter Pack

Filter Pack Material: Unimin 10/20 silica sand

Well Casing

Type: PVC, FJT

Size (diameter): 2"

Schedule or Thickness: 40

Well Screen

Top Depth: 24.64'

Top Elevation: 565.16

Type of Well Screen: 2" Sch 40 PVC

Screen Opening Size: 0.010"

Bottom Depth: 36.64'

Bottom Elevation: 553.16

Bottom Cap Depth: 36.64'

Bore Hole Diameter: 8"

Monitor Well Data Sheet

Permittee or Site Name: Comal County Landfill
County: Comal
Date of Monitor Well Installation: 4/05/06
Monitor Well Latitude: 29.736065025 Longitude: -98.026358103
Monitor Well Groundwater Gradient Position:
Upgradient ______ Downgradient X

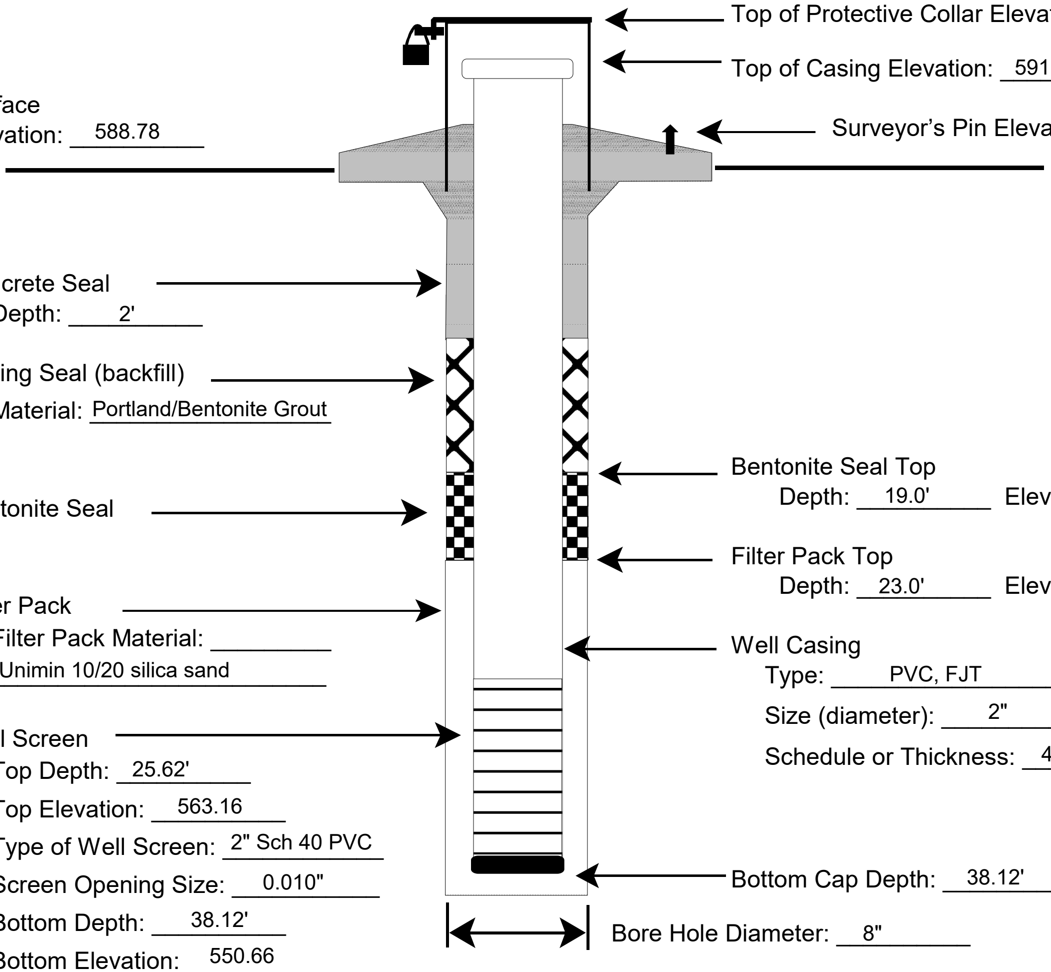
MSW Permit No.: 66-A
Monitor Well I.D. No.: MW-8
Date of Monitor Well Development: Dry
Monitor Well Driller
Name: John Egan Talbot
License No.: 3180-M

NOTES:

- Report all depths from Surface Elevation and all Elevations relative to Mean Sea Level (MSL), to nearest hundredth of a foot.
- Diameter of boring should be at least 4 inches larger than diameter of well casing.
- Use flush screw joint casing only, 2-inch diameter or larger, with o-rings or PTFE tape in joints (4-inch diameter recommend).
- Well development should continue until water is clear, and pH and conductivity are stable.

Geologist, Hydrologist, or Engineer Supervising Well Installation: Roger Gomez
Static Water Level Elevation (with respect to MSL) after Well Development: Dry
Name of Geologic Formation(s) in which Well is completed: Weathered and Unweathered Claystone (Pecan Gap Chalk FM)

Type of Locking Device: Pad Lock
Type of Casing Protection: Aluminum
Concrete Surface Pad (with steel reinforcement) Dimensions: 4' x 4' x 6"



Top of Protective Collar Elevation: 591.80
Top of Casing Elevation: 591.48
Surface Elevation: 588.78
Surveyor's Pin Elevation: 589.08

Concrete Seal
Depth: 2'

Casing Seal (backfill)
Material: Portland/Bentonite Grout

Bentonite Seal

Bentonite Seal Top
Depth: 19.0' Elevation: 569.78

Filter Pack Top
Depth: 23.0' Elevation: 565.78

Filter Pack
Filter Pack Material: Unimin 10/20 silica sand

Well Casing
Type: PVC, FJT
Size (diameter): 2"
Schedule or Thickness: 40

Well Screen
Top Depth: 25.62'
Top Elevation: 563.16
Type of Well Screen: 2" Sch 40 PVC
Screen Opening Size: 0.010"
Bottom Depth: 38.12'
Bottom Elevation: 550.66

Bottom Cap Depth: 38.12'
Bore Hole Diameter: 8"

Monitor Well Data Sheet

Permittee or Site Name: WMTX – Mesquite Creek Landfill
County: Comal and Guadalupe
Date of Monitor Well Installation: 03/17/09
Monitor Well Latitude: 29º 44’ 15.77” Longitude: 98º 01’ 27.16”
Monitor Well Groundwater Gradient Position:
Upgradient ________ Downgradient X

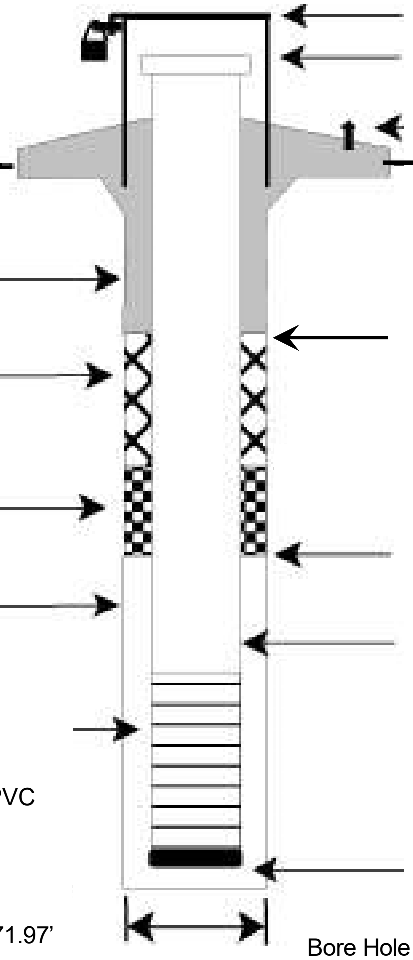
MSW Permit No. MSW-66B
Monitor Well I.D. No.: MW-2A
Date of Monitor Well Development: 04/24/09
Monitor Well Driller
Name: Brian Kern
License No.: 54611M

NOTES:

Report all depths from Surface Elevation and all Elevations relative to Mean Sea Level (MSL), to nearest hundredth of a foot.
Diameter of boring should be at least 4 inches larger than diameter of well casing.
Use flush screw joint casing only, 2-inch diameter or larger, with o-rings or PTFE tape in joints (4-inch diameter recommend).
Well development should continue until water is clear, and pH and conductivity are stable.

Geologist, Hydrologist, or Engineer Supervising Gas Probe Installation: Mohammad Z. Islam, under supervision of Edward B. Dolan, P.G.
Static Water Level Elevation (with respect to MSL) after Well Development: 572.71’
Name of Geologic Formation(s) in which probe is completed: Stratum III of site-specific characterization, which is predominantly Lower Taylor Group oxidized clay or claystone with fractures.

Type of Locking Device: Padlock
Type of Casing Protection: Metal Stick-Up
Concrete Surface Pad Dimensions: 4’x4’x6”



Top of Protective Collar Elevation: 612.34’
Top of Casing Elevation: 611.78’
Ground Surface Elevation: 608.97’
Surveyor's Pin Elevation: N/A

Concrete Seal Depth: 1.5’

Casing Seal (backfill)
Material: 3/8” bentonite pellets
Note: Material for Casing Seal and Bentonite Seal is the Same.

Bentonite Seal Top
Depth: 1.5’ Elevation: 586.97’

Bentonite Seal

Filter Pack Top
Depth: 24.0’ Elevation: 584.97’

Filter Pack: 20/40 silica sand

Well Casing
Type: PVC
Size (diameter): 2” Thickness: Schedule 40

Well Screen
Top Depth: 26.0’
Top Elevation: 582.97’
Type of Well Screen: Slotted PVC
Screen Opening Size: 0.010”
Bottom Depth: 36.1’
Bottom Elevation: 572.87’
Total depth of borehole: 37.0’
Bottom Elevation of borehole: 571.97’

Bottom Cap Depth: 36.35’

Bore Hole Diameter: 8.0”

Monitor Well Data Sheet

Permittee or Site Name: WMTX – Mesquite Creek Landfill
County: Comal and Guadalupe
Date of Monitor Well Installation: 03/11/09
Monitor Well Latitude: 29° 44' 10.19" Longitude: 98° 01' 37.49"
Monitor Well Groundwater Gradient Position:
Upgradient ________ Downgradient X

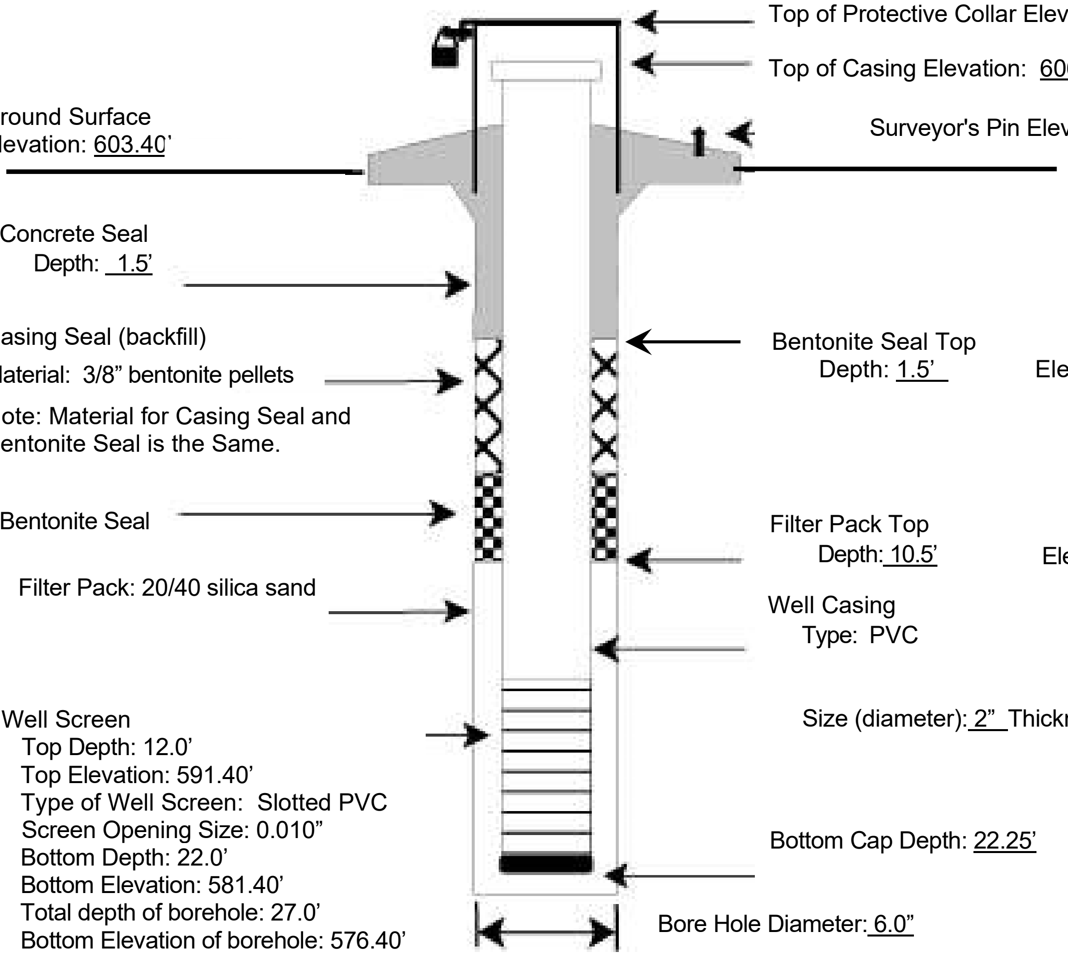
MSW Permit No. MSW-66B
Monitor Well I.D. No.: MW-7A
Date of Monitor Well Development: 04/24/09
Monitor Well Driller
Name: Brian Kern
License No.: 54611M

NOTES:

Report all depths from Surface Elevation and all Elevations relative to Mean Sea Level (MSL), to nearest hundredth of a foot.
Diameter of boring should be at least 4 inches larger than diameter of well casing.
Use flush screw joint casing only, 2-inch diameter or larger, with o-rings or PTFE tape in joints (4-inch diameter recommend).
Well development should continue until water is clear, and pH and conductivity are stable.

Geologist, Hydrologist, or Engineer Supervising Gas Probe Installation: Mohammad Z. Islam, under supervision of Edward B. Dolan, P.G.
Static Water Level Elevation (with respect to MSL) after Well Development: 582.17'
Name of Geologic Formation(s) in which probe is completed: Stratum III of site-specific characterization, which is predominantly Lower Taylor Group oxidized clay or claystone with fractures.

Type of Locking Device: Padlock
Type of Casing Protection: Metal Stick-Up
Concrete Surface Pad Dimensions: 4'x4'x6"



Top of Protective Collar Elevation: 606.73'
Top of Casing Elevation: 606.27'
Ground Surface Elevation: 603.40'
Surveyor's Pin Elevation: N/A
Concrete Seal Depth: 1.5'
Casing Seal (backfill)
Material: 3/8" bentonite pellets
Note: Material for Casing Seal and Bentonite Seal is the Same.
Bentonite Seal Top Depth: 1.5' Elevation: 594.90'
Bentonite Seal
Filter Pack Top Depth: 10.5' Elevation: 592.90'
Filter Pack: 20/40 silica sand
Well Casing Type: PVC
Size (diameter): 2" Thickness: Schedule 40

Well Screen
Top Depth: 12.0'
Top Elevation: 591.40'
Type of Well Screen: Slotted PVC
Screen Opening Size: 0.010"
Bottom Depth: 22.0'
Bottom Elevation: 581.40'
Total depth of borehole: 27.0'
Bottom Elevation of borehole: 576.40'

Bottom Cap Depth: 22.25'
Bore Hole Diameter: 6.0"

Modified from TCEQ-10308

Monitor Well Data Sheet

Permittee or Site Name: WMTX – Mesquite Creek Landfill
County: Comal and Guadalupe
Date of Monitor Well Installation: 03/19/09
Monitor Well Latitude: 29° 44' 16.66" Longitude: 98° 01' 48.25"
Monitor Well Groundwater Gradient Position:
Upgradient ________ Downgradient X

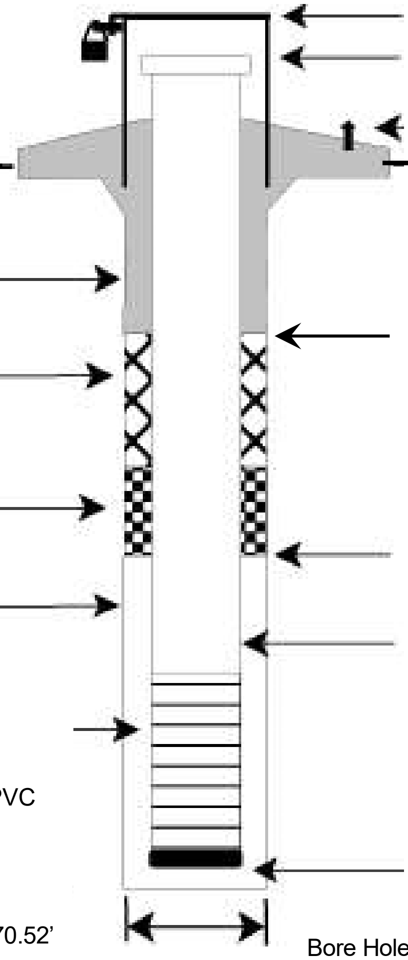
MSW Permit No. MSW-66B
Monitor Well I.D. No.: MW-8A
Date of Monitor Well Development: 04/24/09
Monitor Well Driller
Name: Brian Kern
License No.: 54611M

NOTES:

Report all depths from Surface Elevation and all Elevations relative to Mean Sea Level (MSL), to nearest hundredth of a foot.
Diameter of boring should be at least 4 inches larger than diameter of well casing.
Use flush screw joint casing only, 2-inch diameter or larger, with o-rings or PTFE tape in joints (4-inch diameter recommend).
Well development should continue until water is clear, and pH and conductivity are stable.

Geologist, Hydrologist, or Engineer Supervising Gas Probe Installation: Mohammad Z. Islam, under supervision of Edward B. Dolan, P.G.
Static Water Level Elevation (with respect to MSL) after Well Development: 573.47'
Name of Geologic Formation(s) in which probe is completed: Stratum III of site-specific characterization, which is predominantly Lower Taylor Group oxidized clay or claystone with fractures.

Type of Locking Device: Padlock
Type of Casing Protection: Metal Stick-Up
Concrete Surface Pad Dimensions: 4'x4'x6"



Top of Protective Collar Elevation: 629.01'
Top of Casing Elevation: 628.52'
Ground Surface Elevation: 625.52'
Surveyor's Pin Elevation: N/A
Concrete Seal Depth: 1.5'
Casing Seal (backfill)
Material: 3/8" bentonite pellets
Note: Material for Casing Seal and Bentonite Seal is the Same.
Bentonite Seal Top Depth: 1.5' Elevation: 587.52'
Bentonite Seal
Filter Pack Top Depth: 40.0' Elevation: 585.52'
Filter Pack: 20/40 silica sand
Well Casing Type: PVC
Size (diameter): 2" Thickness: Schedule 40
Well Screen
Top Depth: 42.0'
Top Elevation: 583.52'
Type of Well Screen: Slotted PVC
Screen Opening Size: 0.010"
Bottom Depth: 52.0'
Bottom Elevation: 573.52'
Total depth of borehole: 55.0'
Bottom Elevation of borehole: 570.52'
Bottom Cap Depth: 52.25'
Bore Hole Diameter: 8.0"

Modified from TCEQ-10308

Monitor Well Data Sheet

Permittee or Site Name: WMTX – Mesquite Creek Landfill
County: Comal and Guadalupe
Date of Monitor Well Installation: 03/24/09
Monitor Well Latitude: 29º 44’ 20.87” Longitude: 98º 01’ 52.70”
Monitor Well Groundwater Gradient Position:
Upgradient ________ Downgradient X

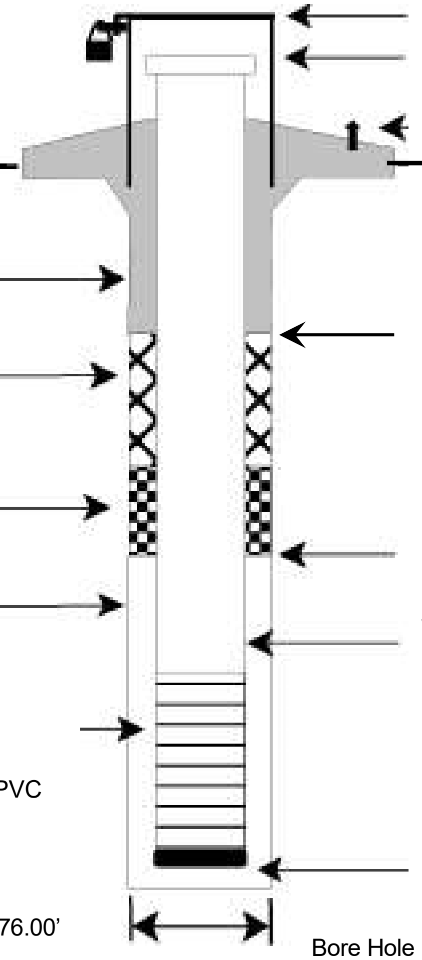
MSW Permit No. MSW-66B
Monitor Well I.D. No.: MW-9
Date of Monitor Well Development: 04/24/09
Monitor Well Driller
Name: Brian Kern
License No.: 54611M

NOTES:

Report all depths from Surface Elevation and all Elevations relative to Mean Sea Level (MSL), to nearest hundredth of a foot.
Diameter of boring should be at least 4 inches larger than diameter of well casing.
Use flush screw joint casing only, 2-inch diameter or larger, with o-rings or PTFE tape in joints (4-inch diameter recommend).
Well development should continue until water is clear, and pH and conductivity are stable.

Geologist, Hydrologist, or Engineer Supervising Gas Probe Installation: Mohammad Z. Islam, under supervision of Edward B. Dolan, P.G.
Static Water Level Elevation (with respect to MSL) after Well Development: 580.06’
Name of Geologic Formation(s) in which probe is completed: Stratum III of site-specific characterization, which is predominantly Lower Taylor Group oxidized clay or claystone with fractures.

Type of Locking Device: Padlock
Type of Casing Protection: Metal Stick-Up
Concrete Surface Pad Dimensions: 4’x4’x6”



Top of Protective Collar Elevation: 629.48’
Top of Casing Elevation: 629.06’
Ground Surface Elevation: 626.00’
Surveyor's Pin Elevation: N/A
Concrete Seal Depth: 1.5’
Casing Seal (backfill) Material: 3/8” bentonite pellets
Note: Material for Casing Seal and Bentonite Seal is the Same.
Bentonite Seal Top Depth: 1.5’ Elevation: 594.00’
Bentonite Seal
Filter Pack Top Depth: 34.0’ Elevation: 592.00’
Filter Pack: 20/40 silica sand
Well Casing Type: PVC
Size (diameter): 2” Thickness: Schedule 40

Well Screen
Top Depth: 36.5’
Top Elevation: 589.50’
Type of Well Screen: Slotted PVC
Screen Opening Size: 0.010”
Bottom Depth: 46.5’
Bottom Elevation: 579.50’
Total depth of borehole: 50.0’
Bottom Elevation of borehole: 576.00’

Bottom Cap Depth: 46.75’
Bore Hole Diameter: 8.0”

Monitor Well Data Sheet

Permittee or Site Name: WMTX – Mesquite Creek Landfill

County: Comal and Guadalupe

Date of Monitor Well Installation: 03/05/09

Monitor Well Latitude: 29º 43' 45.93" Longitude: 98º 01' 14.55"

Monitor Well Groundwater Gradient Position:

Upgradient X Downgradient ________

MSW Permit No. MSW-66B

Monitor Well I.D. No.: MW-11

Date of Monitor Well Development: 04/23/09-04/24/09

Monitor Well Driller

Name: Brian Kern

License No.: 54611M

NOTES:

Report all depths from Surface Elevation and all Elevations relative to Mean Sea Level (MSL), to nearest hundredth of a foot.

Diameter of boring should be at least 4 inches larger than diameter of well casing.

Use flush screw joint casing only, 2-inch diameter or larger, with o-rings or PTFE tape in joints (4-inch diameter recommend).

Well development should continue until water is clear, and pH and conductivity are stable.

Geologist, Hydrologist, or Engineer Supervising Gas Probe Installation: Mohammad Z. Islam, under supervision of Edward B. Dolan, P.G.

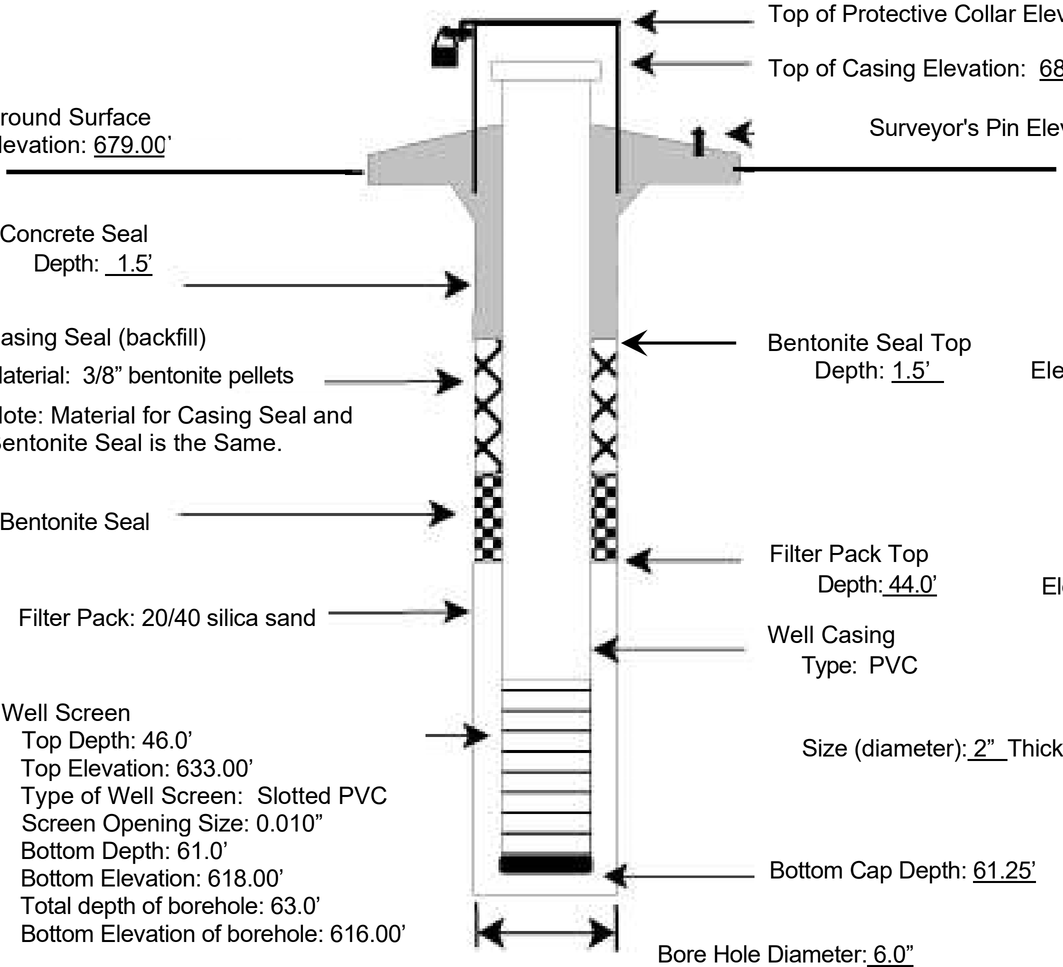
Static Water Level Elevation (with respect to MSL) after Well Development: 617.79'

Name of Geologic Formation(s) in which probe is completed: Stratum III of site-specific characterization, which is predominantly Lower Taylor Group oxidized clay or claystone with fractures.

Type of Locking Device: Padlock

Type of Casing Protection: Metal Stick-Up

Concrete Surface Pad Dimensions: 4'x4'x6"



Top of Protective Collar Elevation: 682.62'

Top of Casing Elevation: 682.05'

Ground Surface Elevation: 679.00'

Surveyor's Pin Elevation: N/A

Concrete Seal Depth: 1.5'

Casing Seal (backfill)

Material: 3/8" bentonite pellets

Note: Material for Casing Seal and Bentonite Seal is the Same.

Bentonite Seal Top Depth: 1.5' Elevation: 637.00'

Bentonite Seal

Filter Pack Top Depth: 44.0' Elevation: 635.00'

Filter Pack: 20/40 silica sand

Well Casing Type: PVC

Size (diameter): 2" Thickness: Schedule 40

Well Screen

Top Depth: 46.0'

Top Elevation: 633.00'

Type of Well Screen: Slotted PVC

Screen Opening Size: 0.010"

Bottom Depth: 61.0'

Bottom Elevation: 618.00'

Total depth of borehole: 63.0'

Bottom Elevation of borehole: 616.00'

Bottom Cap Depth: 61.25'

Bore Hole Diameter: 6.0"

Modified from TCEQ-10308

Monitor Well Data Sheet

Permittee or Site Name: WMTX – Mesquite Creek Landfill
County: Comal and Guadalupe
Date of Monitor Well Installation: 03/18/09
Monitor Well Latitude: 29º 44’ 04.92” Longitude: 98º 01’ 09.29”
Monitor Well Groundwater Gradient Position:
Upgradient ____ Downgradient X

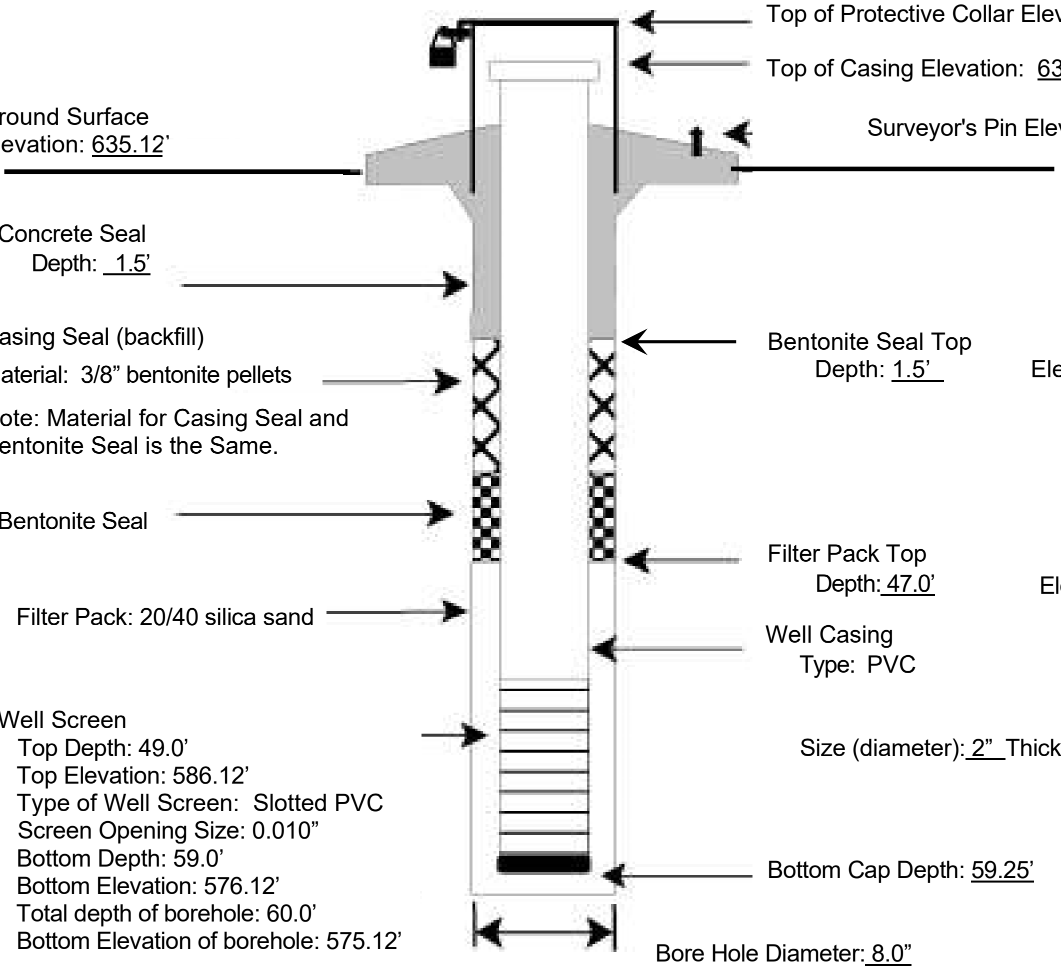
MSW Permit No. MSW-66B
Monitor Well I.D. No.: MW-18
Date of Monitor Well Development: 04/23/09
Monitor Well Driller Name: Brian Kern
License No.: 54611M

NOTES:

Report all depths from Surface Elevation and all Elevations relative to Mean Sea Level (MSL), to nearest hundredth of a foot.
Diameter of boring should be at least 4 inches larger than diameter of well casing.
Use flush screw joint casing only, 2-inch diameter or larger, with o-rings or PTFE tape in joints (4-inch diameter recommend).
Well development should continue until water is clear, and pH and conductivity are stable.

Geologist, Hydrologist, or Engineer Supervising Gas Probe Installation: Mohammad Z. Islam, under supervision of Edward B. Dolan, P.G.
Static Water Level Elevation (with respect to MSL) after Well Development: 576.75’
Name of Geologic Formation(s) in which probe is completed: Stratum III of site-specific characterization, which is predominantly Lower Taylor Group oxidized clay or claystone with fractures.

Type of Locking Device: Padlock
Type of Casing Protection: Metal Stick-Up
Concrete Surface Pad Dimensions: 4’x4’x6”



Top of Protective Collar Elevation: 638.68’
Top of Casing Elevation: 638.16’
Ground Surface Elevation: 635.12’
Surveyor's Pin Elevation: N/A
Concrete Seal Depth: 1.5’
Casing Seal (backfill) Material: 3/8” bentonite pellets
Note: Material for Casing Seal and Bentonite Seal is the Same.
Bentonite Seal Top Depth: 1.5’ Elevation: 590.12’
Bentonite Seal
Filter Pack Top Depth: 47.0’ Elevation: 588.12’
Filter Pack: 20/40 silica sand
Well Casing Type: PVC
Size (diameter): 2” Thickness: Schedule 40

Well Screen
Top Depth: 49.0’
Top Elevation: 586.12’
Type of Well Screen: Slotted PVC
Screen Opening Size: 0.010”
Bottom Depth: 59.0’
Bottom Elevation: 576.12’
Total depth of borehole: 60.0’
Bottom Elevation of borehole: 575.12’

Bottom Cap Depth: 59.25’
Bore Hole Diameter: 8.0”

Monitor Well Data Sheet

Permittee or Site Name: WMTX – Mesquite Creek Landfill

County: Comal and Guadalupe

Date of Monitor Well Installation: 03/02/09

Monitor Well Latitude: 29° 44’ 06.75” Longitude: 98° 01’ 15.26”

Monitor Well Groundwater Gradient Position:

Upgradient ______ Downgradient X

MSW Permit No. MSW-66B

Monitor Well I.D. No.: MW-19

Date of Monitor Well Development: 04/23/09

Monitor Well Driller

Name: Brian Kern

License No.: 54611M

NOTES:

Report all depths from Surface Elevation and all Elevations relative to Mean Sea Level (MSL), to nearest hundredth of a foot.

Diameter of boring should be at least 4 inches larger than diameter of well casing.

Use flush screw joint casing only, 2-inch diameter or larger, with o-rings or PTFE tape in joints (4-inch diameter recommend).

Well development should continue until water is clear, and pH and conductivity are stable.

Geologist, Hydrologist, or Engineer Supervising Gas Probe Installation: Mohammad Z. Islam, under supervision of Edward B. Dolan, P.G.

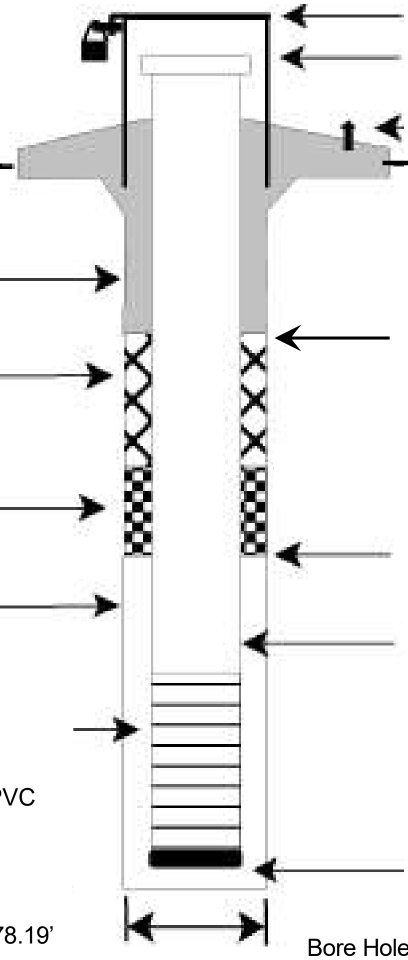
Static Water Level Elevation (with respect to MSL) after Well Development: 579.63’

Name of Geologic Formation(s) in which probe is completed: Stratum III of site-specific characterization, which is predominantly Lower Taylor Group oxidized clay or claystone with fractures.

Type of Locking Device: Padlock

Type of Casing Protection: Metal Stick-Up

Concrete Surface Pad Dimensions: 4’x4’x6”



Top of Protective Collar Elevation: 636.58’

Top of Casing Elevation: 636.29’

Ground Surface Elevation: 633.19’

Surveyor's Pin Elevation: N/A

Concrete Seal Depth: 1.5’

Casing Seal (backfill)

Material: 3/8” bentonite pellets

Note: Material for Casing Seal and Bentonite Seal is the Same.

Bentonite Seal Top Depth: 1.5’ Elevation: 602.19’

Bentonite Seal

Filter Pack Top Depth: 33.0’ Elevation: 600.19’

Filter Pack: 20/40 silica sand

Well Casing Type: PVC

Well Screen

Top Depth: 34.5’

Top Elevation: 598.69’

Type of Well Screen: Slotted PVC

Screen Opening Size: 0.010”

Bottom Depth: 54.5’

Bottom Elevation: 578.69’

Total depth of borehole: 55.0’

Bottom Elevation of borehole: 578.19’

Size (diameter): 2” Thickness: Schedule 40

Bottom Cap Depth: 54.75’

Bore Hole Diameter: 8.0”

Monitor Well Data Sheet

Permittee or Site Name: WMTX – Mesquite Creek Landfill

County: Comal and Guadalupe

Date of Monitor Well Installation: 03/03/09

Monitor Well Latitude: 29° 44' 10.92" Longitude: 98° 01' 20.15"

Monitor Well Groundwater Gradient Position:

Upgradient _____ Downgradient X

MSW Permit No. MSW-66B

Monitor Well I.D. No.: MW-20

Date of Monitor Well Development: 04/23/09

Monitor Well Driller

Name: Brian Kern

License No.: 54611M

NOTES:

Report all depths from Surface Elevation and all Elevations relative to Mean Sea Level (MSL), to nearest hundredth of a foot.

Diameter of boring should be at least 4 inches larger than diameter of well casing.

Use flush screw joint casing only, 2-inch diameter or larger, with o-rings or PTFE tape in joints (4-inch diameter recommend).

Well development should continue until water is clear, and pH and conductivity are stable.

Geologist, Hydrologist, or Engineer Supervising Gas Probe Installation: Mohammad Z. Islam, under supervision of Edward B. Dolan, P.G.

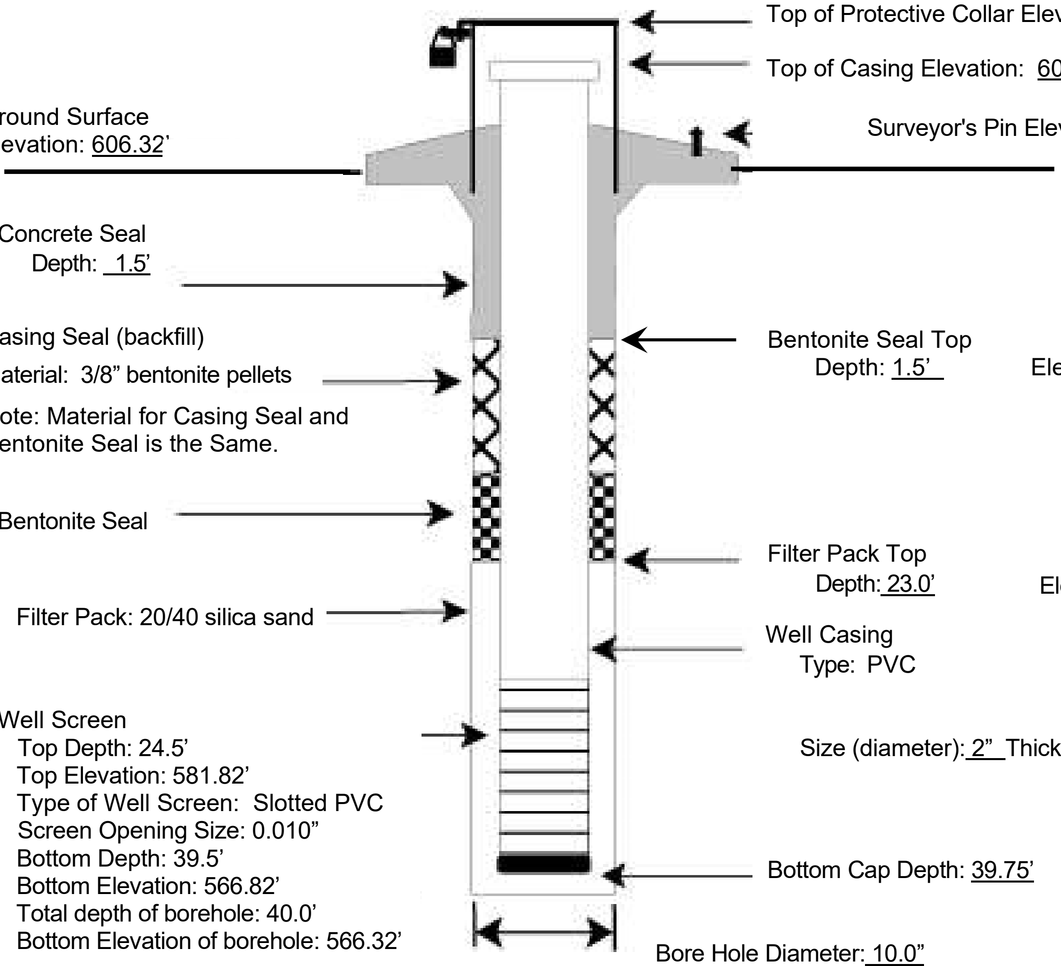
Static Water Level Elevation (with respect to MSL) after Well Development: 575.33'

Name of Geologic Formation(s) in which probe is completed: Stratum III of site-specific characterization, which is predominantly Lower Taylor Group oxidized clay or claystone with fractures.

Type of Locking Device: Padlock

Type of Casing Protection: Metal Stick-Up

Concrete Surface Pad Dimensions: 4'x4'x6"



Top of Protective Collar Elevation: 609.89'

Top of Casing Elevation: 609.47'

Ground Surface Elevation: 606.32'

Surveyor's Pin Elevation: N/A

Concrete Seal Depth: 1.5'

Casing Seal (backfill)
Material: 3/8" bentonite pellets

Note: Material for Casing Seal and Bentonite Seal is the Same.

Bentonite Seal Top Depth: 1.5' Elevation: 585.32'

Bentonite Seal

Filter Pack Top Depth: 23.0' Elevation: 583.32'

Filter Pack: 20/40 silica sand

Well Casing Type: PVC

Well Screen
Top Depth: 24.5'
Top Elevation: 581.82'
Type of Well Screen: Slotted PVC
Screen Opening Size: 0.010"
Bottom Depth: 39.5'
Bottom Elevation: 566.82'
Total depth of borehole: 40.0'
Bottom Elevation of borehole: 566.32'

Size (diameter): 2" Thickness: Schedule 40

Bottom Cap Depth: 39.75'

Bore Hole Diameter: 10.0"

Monitor Well Data Sheet

Permittee or Site Name: WMTX – Mesquite Creek Landfill

County: Comal and Guadalupe

Date of Monitor Well Installation: 03/10/09

Monitor Well Latitude: 29° 44’ 09.93” Longitude: 98° 01’ 24.99”

Monitor Well Groundwater Gradient Position:

Upgradient ______ Downgradient X

MSW Permit No. MSW-66B

Monitor Well I.D. No.: MW-21

Date of Monitor Well Development: 04/24/09

Monitor Well Driller

Name: Brian Kern

License No.: 54611M

NOTES:

Report all depths from Surface Elevation and all Elevations relative to Mean Sea Level (MSL), to nearest hundredth of a foot.

Diameter of boring should be at least 4 inches larger than diameter of well casing.

Use flush screw joint casing only, 2-inch diameter or larger, with o-rings or PTFE tape in joints (4-inch diameter recommend).

Well development should continue until water is clear, and pH and conductivity are stable.

Geologist, Hydrologist, or Engineer Supervising Gas Probe Installation: Mohammad Z. Islam, under supervision of Edward B. Dolan, P.G.

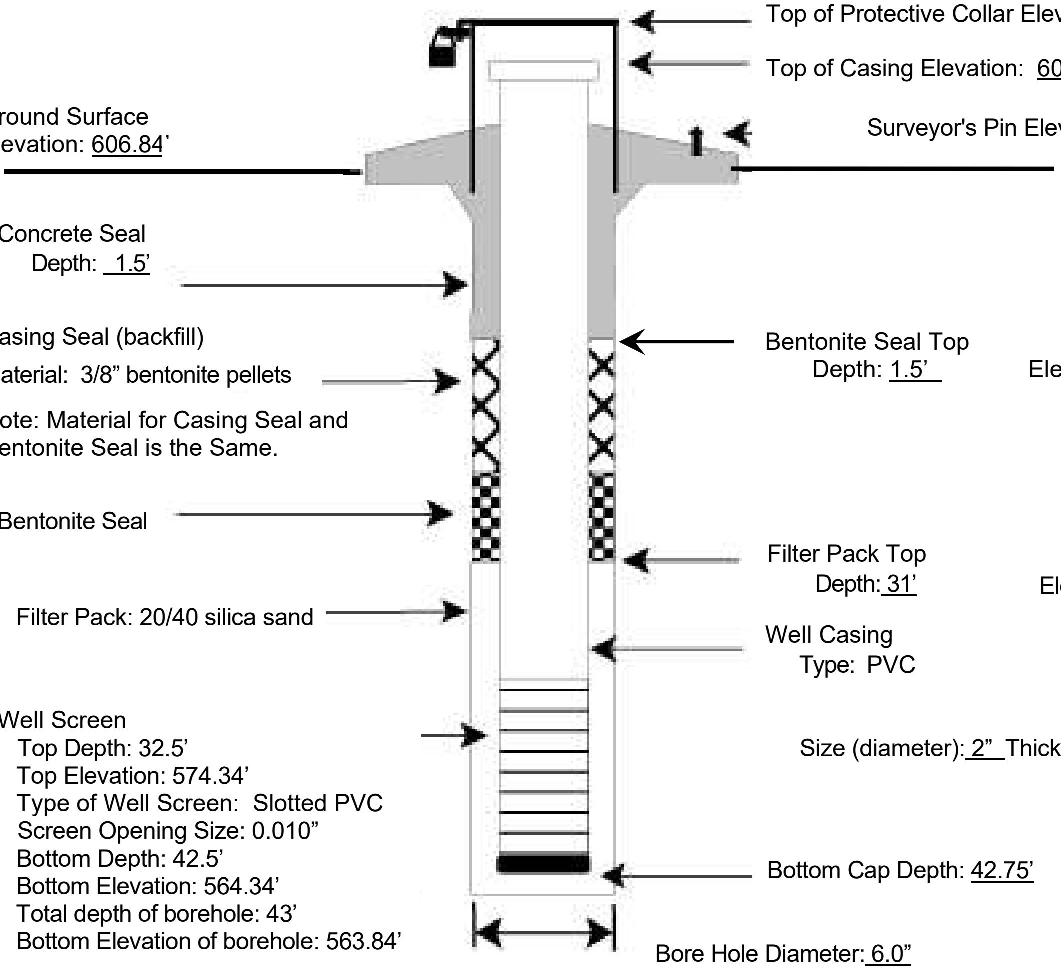
Static Water Level Elevation (with respect to MSL) after Well Development: 564.73’

Name of Geologic Formation(s) in which probe is completed: Stratum III of site-specific characterization, which is predominantly Lower Taylor Group oxidized clay or claystone with fractures.

Type of Locking Device: Padlock

Type of Casing Protection: Metal Stick-Up

Concrete Surface Pad Dimensions: 4’x4’x6”



Top of Protective Collar Elevation: 610.15’

Top of Casing Elevation: 609.58’

Ground Surface Elevation: 606.84’

Surveyor's Pin Elevation: N/A

Concrete Seal Depth: 1.5’

Casing Seal (backfill)

Material: 3/8” bentonite pellets

Note: Material for Casing Seal and Bentonite Seal is the Same.

Bentonite Seal Top Depth: 1.5’ Elevation: 577.84’

Bentonite Seal

Filter Pack Top Depth: 31’ Elevation: 575.84’

Filter Pack: 20/40 silica sand

Well Casing Type: PVC

Well Screen

Top Depth: 32.5’

Top Elevation: 574.34’

Type of Well Screen: Slotted PVC

Screen Opening Size: 0.010”

Bottom Depth: 42.5’

Bottom Elevation: 564.34’

Total depth of borehole: 43’

Bottom Elevation of borehole: 563.84’

Size (diameter): 2” Thickness: Schedule 40

Bottom Cap Depth: 42.75’

Bore Hole Diameter: 6.0”

Monitor Well Data Sheet

Permittee or Site Name: WMTX – Mesquite Creek Landfill

County: Comal and Guadalupe

Date of Monitor Well Installation: 03/10/09

Monitor Well Latitude: 29º 44’ 06.31” Longitude: 98º 01’ 28.15”

Monitor Well Groundwater Gradient Position:

Upgradient ___ Downgradient X

MSW Permit No. MSW-66B

Monitor Well I.D. No.: MW-22

Date of Monitor Well Development: 04/24/09

Monitor Well Driller Name: Brian Kern

License No.: 54611M

NOTES:

Report all depths from Surface Elevation and all Elevations relative to Mean Sea Level (MSL), to nearest hundredth of a foot.

Diameter of boring should be at least 4 inches larger than diameter of well casing.

Use flush screw joint casing only, 2-inch diameter or larger, with o-rings or PTFE tape in joints (4-inch diameter recommend).

Well development should continue until water is clear, and pH and conductivity are stable.

Geologist, Hydrologist, or Engineer Supervising Gas Probe Installation: Mohammad Z. Islam, under supervision of Edward B. Dolan, P.G.

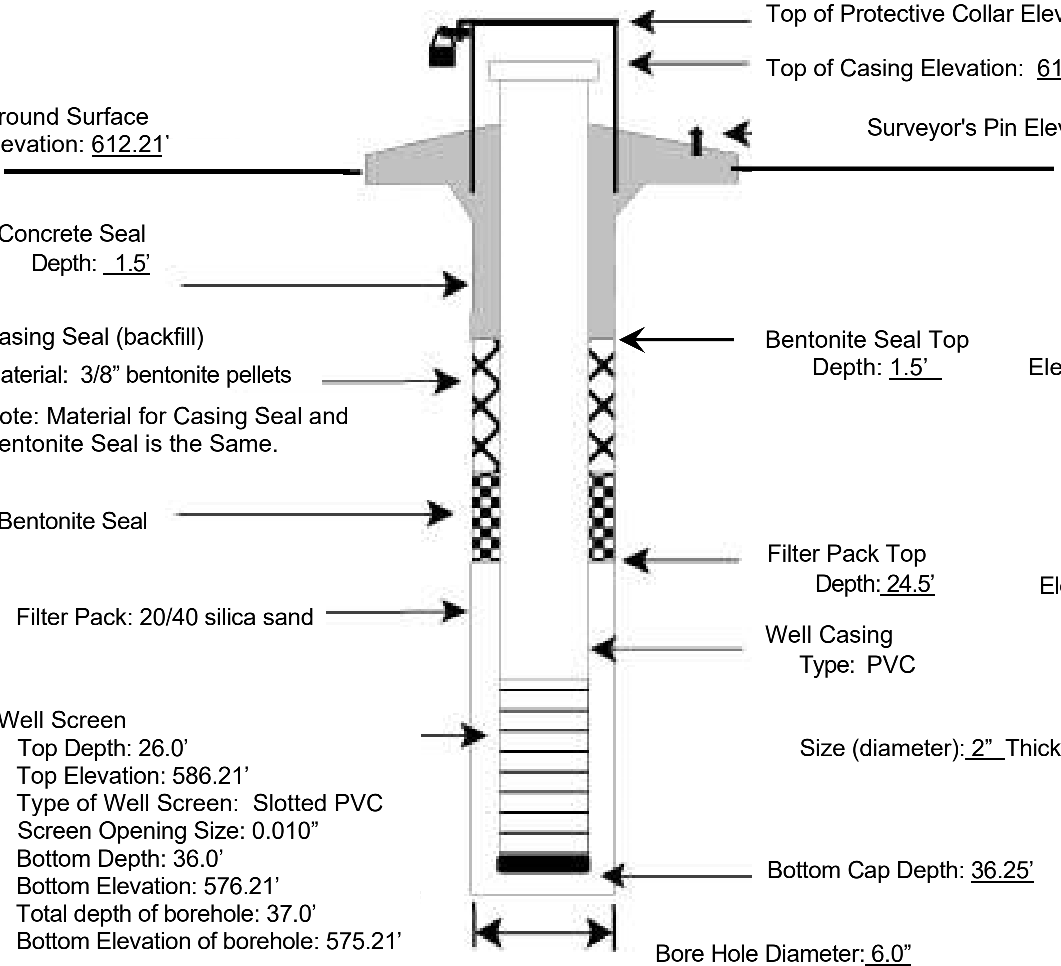
Static Water Level Elevation (with respect to MSL) after Well Development: 577.81’

Name of Geologic Formation(s) in which probe is completed: Stratum III of site-specific characterization, which is predominantly Lower Taylor Group oxidized clay or claystone with fractures.

Type of Locking Device: Padlock

Type of Casing Protection: Metal Stick-Up

Concrete Surface Pad Dimensions: 4’x4’x6”



Top of Protective Collar Elevation: 616.24’

Top of Casing Elevation: 615.81’

Ground Surface Elevation: 612.21’

Surveyor's Pin Elevation: N/A

Concrete Seal Depth: 1.5’

Casing Seal (backfill) Material: 3/8” bentonite pellets

Note: Material for Casing Seal and Bentonite Seal is the Same.

Bentonite Seal Top Depth: 1.5’ Elevation: 589.71’

Bentonite Seal

Filter Pack Top Depth: 24.5’ Elevation: 587.71’

Filter Pack: 20/40 silica sand

Well Casing Type: PVC

Size (diameter): 2” Thickness: Schedule 40

Well Screen
- Top Depth: 26.0’
- Top Elevation: 586.21’
- Type of Well Screen: Slotted PVC
- Screen Opening Size: 0.010”
- Bottom Depth: 36.0’
- Bottom Elevation: 576.21’
- Total depth of borehole: 37.0’
- Bottom Elevation of borehole: 575.21’

Bottom Cap Depth: 36.25’

Bore Hole Diameter: 6.0”

Modified from TCEQ-10308

Monitor Well Data Sheet

Permittee or Site Name: WMTX – Mesquite Creek Landfill
County: Comal and Guadalupe
Date of Monitor Well Installation: 03/06/09
Monitor Well Latitude: 29° 44’ 05.27” Longitude: 98° 01’ 30.90”
Monitor Well Groundwater Gradient Position:
Upgradient ___ Downgradient X

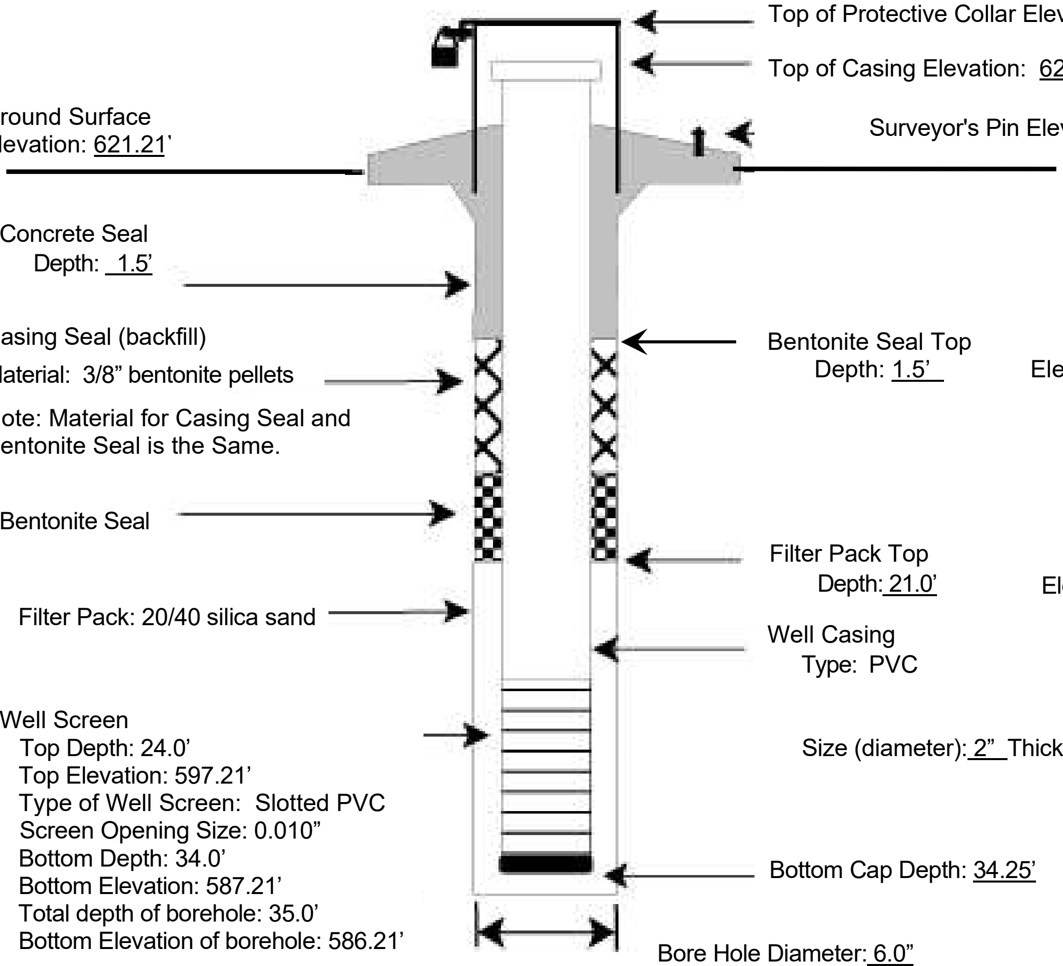
MSW Permit No. MSW-66B
Monitor Well I.D. No.: MW-23
Date of Monitor Well Development: 04/23/09
Monitor Well Driller
Name: Brian Kern
License No.: 54611M

NOTES:

Report all depths from Surface Elevation and all Elevations relative to Mean Sea Level (MSL), to nearest hundredth of a foot.
Diameter of boring should be at least 4 inches larger than diameter of well casing.
Use flush screw joint casing only, 2-inch diameter or larger, with o-rings or PTFE tape in joints (4-inch diameter recommend).
Well development should continue until water is clear, and pH and conductivity are stable.

Geologist, Hydrologist, or Engineer Supervising Gas Probe Installation: Mohammad Z. Islam, under supervision of Edward B. Dolan, P.G.
Static Water Level Elevation (with respect to MSL) after Well Development: 587.82’
Name of Geologic Formation(s) in which probe is completed: Stratum III of site-specific characterization, which is predominantly Lower Taylor Group oxidized clay or claystone with fractures.

Type of Locking Device: Padlock
Type of Casing Protection: Metal Stick-Up
Concrete Surface Pad Dimensions: 4’x4’x6”



Top of Protective Collar Elevation: 624.80’
Top of Casing Elevation: 624.24’
Ground Surface Elevation: 621.21’
Surveyor's Pin Elevation: N/A
Concrete Seal Depth: 1.5’
Casing Seal (backfill)
Material: 3/8” bentonite pellets
Note: Material for Casing Seal and Bentonite Seal is the Same.
Bentonite Seal Top Depth: 1.5’ Elevation: 602.21’
Bentonite Seal
Filter Pack Top Depth: 21.0’ Elevation: 600.21’
Filter Pack: 20/40 silica sand
Well Casing Type: PVC
Size (diameter): 2” Thickness: Schedule 40

Well Screen
Top Depth: 24.0’
Top Elevation: 597.21’
Type of Well Screen: Slotted PVC
Screen Opening Size: 0.010”
Bottom Depth: 34.0’
Bottom Elevation: 587.21’
Total depth of borehole: 35.0’
Bottom Elevation of borehole: 586.21’

Bottom Cap Depth: 34.25’
Bore Hole Diameter: 6.0”

Monitor Well Data Sheet

Permittee or Site Name: WMTX – Mesquite Creek Landfill
County: Comal and Guadalupe
Date of Monitor Well Installation: 11/04/2009
Monitor Well Latitude: 29° 43' 51" Longitude: 98° 01' 21"
Northing: 13814602.17 Easting: 2278766.64
Monitor Well Groundwater Gradient Position:
Upgradient ____X_____ Downgradient________
Piezometer – Not applicable

MSW Permit No. MSW-66B
Monitor Well I.D. No.: MW-10
Date of Monitor Well Development: 11/06/2009
Monitor Well Driller Name: Brian Kern

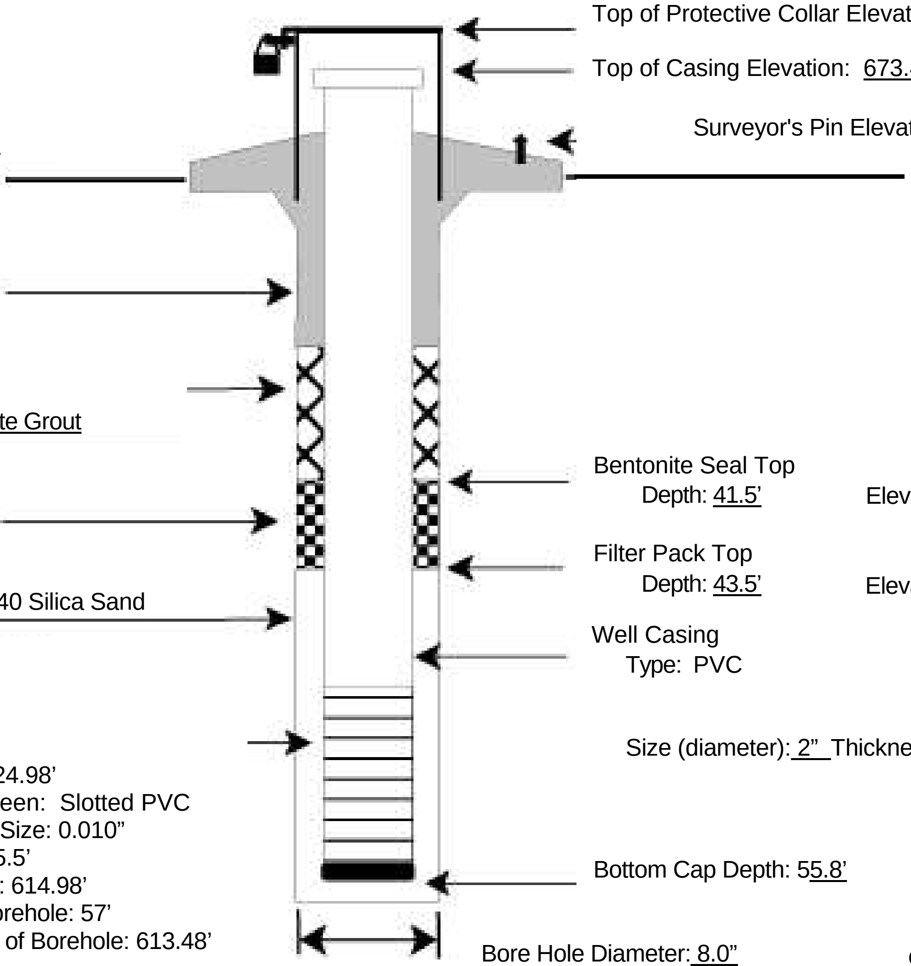
License No.: 54611M

NOTES:

Report all depths from Surface Elevation and all Elevations relative to Mean Sea Level (MSL), to nearest hundredth of a foot.
Diameter of boring should be at least 4 inches larger than diameter of well casing.
Use flush screw joint casing only, 2-inch diameter or larger, with o-rings or PTFE tape in joints (4-inch diameter recommend).
Well development should continue until water is clear, and pH and conductivity are stable.

Geologist, Hydrologist, or Engineer Supervising Well Installation: Mohammad Z. Islam, under supervision of Scott M. Graves, P.E.
Static Water Level Elevation (with respect to MSL) after Well Development: 615.98'
Name of Geologic Formation(s) in which Well is completed: Stratum III of site-specific characterization, which is predominantly Lower Taylor Group oxidized clay or claystone with fractures.

Type of Locking Device: Padlock
Type of Casing Protection: Metal Stick-Up
Concrete Surface Pad (with steel reinforcement) Dimensions: 4'x4'x6"



Top of Protective Collar Elevation: 673.94'
Top of Casing Elevation: 673.49'
Ground Surface Elevation: 670.48'
Surveyor's Pin Elevation: N/A
Concrete Seal Depth: 1.5'
Casing Seal (backfill) Material: Cement/Bentonite Grout
Bentonite Seal Top Depth: 41.5' Elevation: 628.98'
Bentonite Seal
Filter Pack Top Depth: 43.5' Elevation: 626.98'
Filter Pack: 20/40 Silica Sand
Well Casing Type: PVC
Size (diameter): 2" Thickness: Schedule 40

Well Screen
Top Depth: 45.5'
Top Elevation: 624.98'
Type of Well Screen: Slotted PVC
Screen Opening Size: 0.010"
Bottom Depth: 55.5'
Bottom Elevation: 614.98'
Total Depth of Borehole: 57'
Bottom Elevation of Borehole: 613.48'

Bottom Cap Depth: 55.8'
Bore Hole Diameter: 8.0"

Monitor Well Data Sheet

Permittee or Site Name: Mesquite Creek Landfill
County: Comal and Guadalupe
Date of Monitor Well Installation: 1/25/16
Monitor Well Latitude: 29.734310 Longitude: -98.017410
Monitor Well Groundwater Gradient Position:
Upgradient ______ Downgradient X

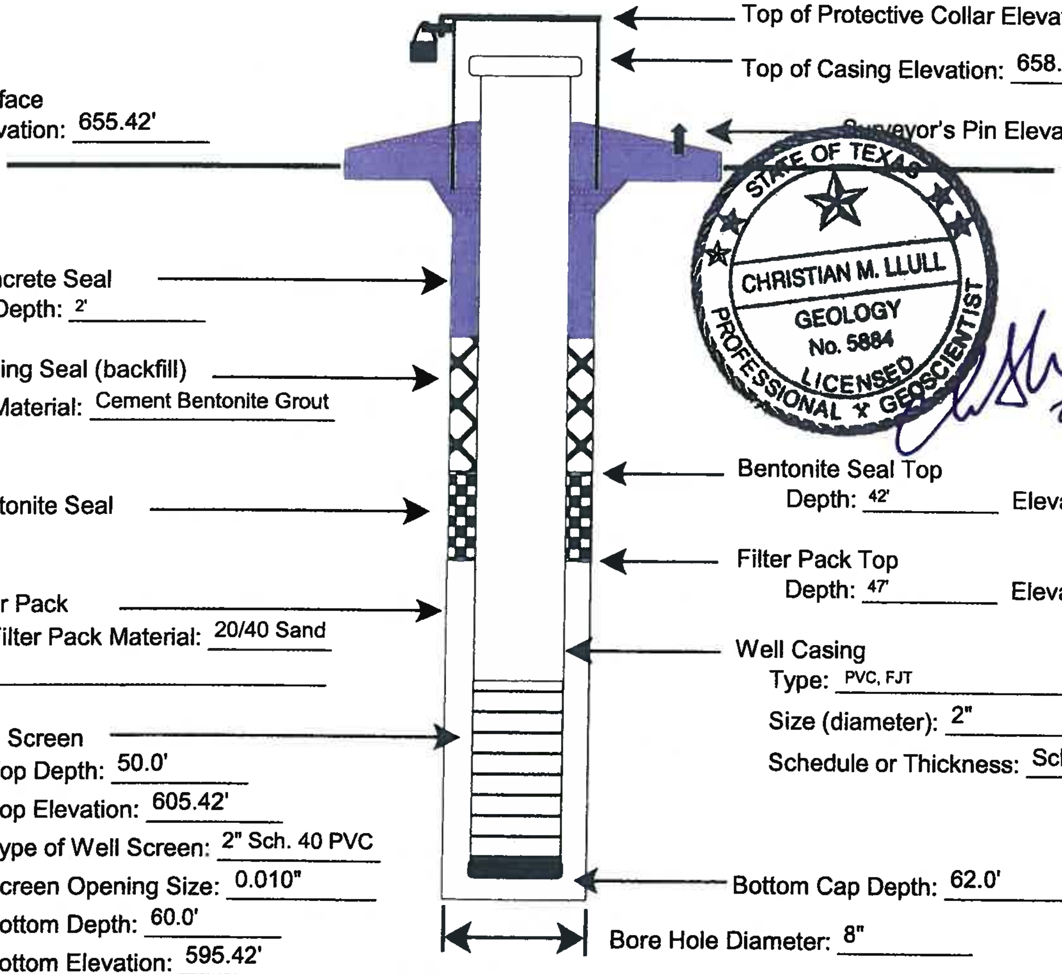
MSW Permit No.: 66B
Monitor Well I.D. No.: MW-17
Date of Monitor Well Development: Dry @ Completion
Monitor Well Driller Name: Jim Neal
License No.: 4868 WKPT

NOTES:

- Report all depths from Surface Elevation and all Elevations relative to Mean Sea Level (MSL), to nearest hundredth of a foot.
- Diameter of boring should be at least 4 inches larger than diameter of well casing.
- Use flush screw joint casing only, 2-inch diameter or larger, with o-rings or PTFE tape in joints (4-inch diameter recommend).
- Well development should continue until water is clear, and pH and conductivity are stable.

Geologist, Hydrologist, or Engineer Supervising Well Installation: Christian M. Llull, P.G. # 5884
Static Water Level Elevation (with respect to MSL) after Well Development: Dry @ Completion
Name of Geologic Formation(s) in which Well is completed: Lower Taylor Group

Type of Locking Device: Padlock
Type of Casing Protection: Anodized Aluminum
Concrete Surface Pad (with steel reinforcement) Dimensions: 4' x 4' x 6"



Top of Protective Collar Elevation: 659.05'
Top of Casing Elevation: 658.69'
Surface Elevation: 655.42'
Surveyor's Pin Elevation: 655.95

STATE OF TEXAS
CHRISTIAN M. LLULL
GEOLOGY
No. 5884
LICENSED PROFESSIONAL GEOSCIENTIST

2-26-16

Concrete Seal Depth: 2'
Casing Seal (backfill) Material: Cement Bentonite Grout
Bentonite Seal
Bentonite Seal Top Depth: 42' Elevation: 613.42'
Filter Pack
Filter Pack Material: 20/40 Sand
Filter Pack Top Depth: 47' Elevation: 608.42'
Well Casing
Type: PVC, FJT
Size (diameter): 2"
Schedule or Thickness: Sch. 40
Well Screen
Top Depth: 50.0'
Top Elevation: 605.42'
Type of Well Screen: 2" Sch. 40 PVC
Screen Opening Size: 0.010"
Bottom Depth: 60.0'
Bottom Elevation: 595.42'
Bottom Cap Depth: 62.0'
Bore Hole Diameter: 8"

Monitor Well Data Sheet

Permittee or Site Name: Mesquite Creek Landfill
County: Comal and Guadalupe
Date of Monitor Well Installation: 5/23/2018
Monitor Well Latitude: -98.018257 Longitude: 29.728313
Monitor Well Groundwater Gradient Position:
Upgradient ____ Downgradient X

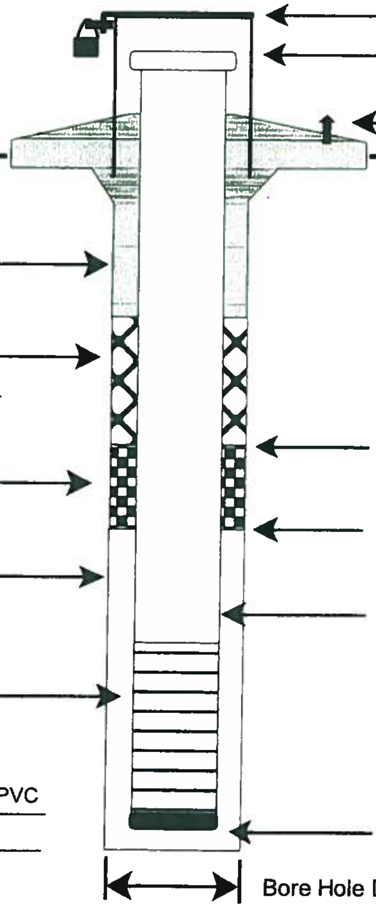
MSW Permit No.: 66B
Monitor Well I.D. No.: MW-12
Date of Monitor Well Development: On-going
Monitor Well Driller Name: Jim Neal
License No.: 4868 MPKT

NOTES:

- Report all depths from Surface Elevation and all Elevations relative to Mean Sea Level (MSL), to nearest hundredth of a foot.
- Diameter of boring should be at least 4 inches larger than diameter of well casing.
- Use flush screw joint casing only, 2-inch diameter or larger, with o-rings or PTFE tape in joints (4-inch diameter recommend).
- Well development should continue until water is clear, and pH and conductivity are stable.

Geologist, Hydrologist, or Engineer Supervising Well Installation: Christian M. Llull, P.G. # 5884
Static Water Level Elevation (with respect to MSL) after Well Development: Dry @ completion
Name of Geologic Formation(s) in which Well is completed: Lower Taylor Group (Predominantly Site-Specific Stratum III)

Type of Locking Device: Padlock
Type of Casing Protection: Anodized Aluminum
Concrete Surface Pad (with steel reinforcement) Dimensions: 4' x 4' x 6"



Top of Protective Collar Elevation: 712.27'
Top of Casing Elevation: 712.22'
Surface Elevation: 709.31'
Surveyor's Pin Elevation: 709.54'

STATE OF TEXAS
CHRISTIAN M. LLULL
GEOLOGY
No. 5884
LICENSED PROFESSIONAL GEOSCIENTIST

7-13-18

Concrete Seal Depth: 2'
Casing Seal (backfill) Material: Cement Bentonite Grout
Bentonite Seal
Bentonite Seal Top Depth: 59.5' Elevation: 649.81'
Filter Pack Top Depth: 61.5' Elevation: 647.81'
Filter Pack
Filter Pack Material: 20/40 Sand
Well Casing
Type: PVC, FJT
Size (diameter): 2"
Schedule or Thickness: Sch. 40
Well Screen
Top Depth: 63.5'
Top Elevation: 645.81'
Type of Well Screen: 2" Sch. 40 PVC
Screen Opening Size: 0.010"
Bottom Depth: 73.5'
Bottom Elevation: 635.81'
Bottom Cap Depth: 73.8'
Bore Hole Diameter: 8"

Monitor Well Data Sheet

Permittee or Site Name: Mesquite Creek Landfill
County: Comal and Guadalupe
Date of Monitor Well Installation: 4/10/2018
Monitor Well Latitude: -98.01007379 Longitude: 29.43457739
Monitor Well Groundwater Gradient Position:
Upgradient ______ Downgradient X

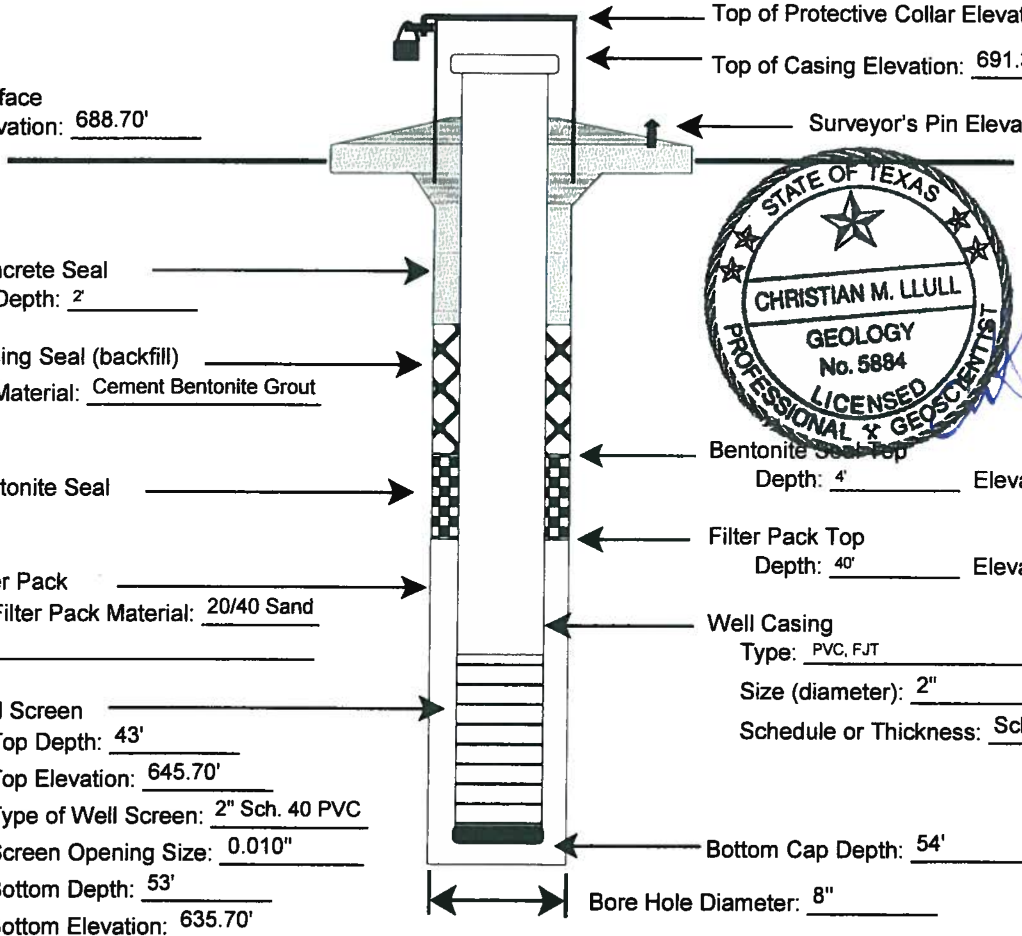
MSW Permit No.: 66B
Monitor Well I.D. No.: MW-13
Date of Monitor Well Development: Dry @ completion
Monitor Well Driller Name: Jim Neal
License No.: 4868 MPKT

NOTES:

- Report all depths from Surface Elevation and all Elevations relative to Mean Sea Level (MSL), to nearest hundredth of a foot.
- Diameter of boring should be at least 4 inches larger than diameter of well casing.
- Use flush screw joint casing only, 2-inch diameter or larger, with o-rings or PTFE tape in joints (4-inch diameter recommend).
- Well development should continue until water is clear, and pH and conductivity are stable.

Geologist, Hydrologist, or Engineer Supervising Well Installation: Christian M. Llull, P.G. # 5884
Static Water Level Elevation (with respect to MSL) after Well Development: Dry @ 24 Hours
Name of Geologic Formation(s) in which Well is completed: Lower Taylor Group (Predominantly Site-Specific Stratum III)

Type of Locking Device: Padlock
Type of Casing Protection: Anodized Aluminum
Concrete Surface Pad (with steel reinforcement) Dimensions: 4' x 4' x 6"



Top of Protective Collar Elevation: 691.58'
Top of Casing Elevation: 691.38'
Surface Elevation: 688.70'
Surveyor's Pin Elevation: 688.80'
Concrete Seal Depth: 2'
Casing Seal (backfill) Material: Cement Bentonite Grout
Bentonite Seal
Bentonite Seal Top Depth: 4' Elevation: 684.70'
Filter Pack Top Depth: 40' Elevation: 648.70'
Filter Pack
Filter Pack Material: 20/40 Sand
Well Casing
Type: PVC, FJT
Size (diameter): 2"
Schedule or Thickness: Sch. 40
Well Screen
Top Depth: 43'
Top Elevation: 645.70'
Type of Well Screen: 2" Sch. 40 PVC
Screen Opening Size: 0.010"
Bottom Depth: 53'
Bottom Elevation: 635.70'
Bottom Cap Depth: 54'
Bore Hole Diameter: 8"

CHRISTIAN M. LLULL
GEOLOGY
No. 5884

6/6/18

Monitor Well Data Sheet

Permittee or Site Name: Mesquite Creek Landfill
County: Comal and Guadalupe
Date of Monitor Well Installation: 4/10/2018
Monitor Well Latitude: -98.0056449 Longitude: 29.43502577
Monitor Well Groundwater Gradient Position:
Upgradient ____ Downgradient X

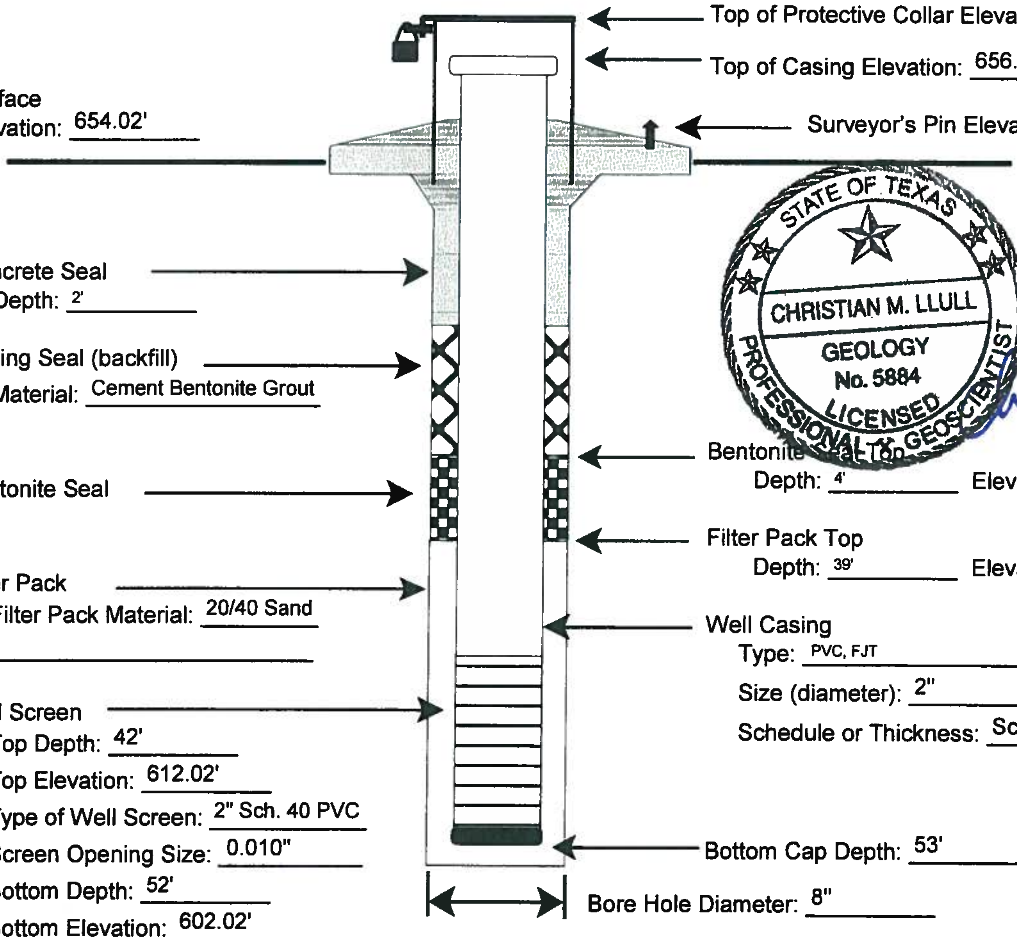
MSW Permit No.: 66B
Monitor Well I.D. No.: MW-14
Date of Monitor Well Development: Dry @ completion
Monitor Well Driller Name: Jim Neal
License No.: 4868 MPKT

NOTES:

- Report all depths from Surface Elevation and all Elevations relative to Mean Sea Level (MSL), to nearest hundredth of a foot.
- Diameter of boring should be at least 4 inches larger than diameter of well casing.
- Use flush screw joint casing only, 2-inch diameter or larger, with o-rings or PTFE tape in joints (4-inch diameter recommend).
- Well development should continue until water is clear, and pH and conductivity are stable.

Geologist, Hydrologist, or Engineer Supervising Well Installation: Christian M. Llull, P.G. # 5884
Static Water Level Elevation (with respect to MSL) after Well Development: Dry @ 24 hours
Name of Geologic Formation(s) in which Well is completed: Lower Taylor Group (Predominantly Site-Specific Stratum III)

Type of Locking Device: Padlock Type of Casing Protection: Anodized Aluminum
Concrete Surface Pad (with steel reinforcement) Dimensions: 4' x 4' x 6"



Top of Protective Collar Elevation: 656.89'
Top of Casing Elevation: 656.69'
Surface Elevation: 654.02'
Surveyor's Pin Elevation: 654.02'
Concrete Seal Depth: 2'
Casing Seal (backfill) Material: Cement Bentonite Grout
Bentonite Seal
Bentonite Seal Top Depth: 4' Elevation: 650.02'
Filter Pack Top Depth: 39' Elevation: 615.02'
Filter Pack
Filter Pack Material: 20/40 Sand
Well Casing Type: PVC, FJT
Size (diameter): 2"
Schedule or Thickness: Sch. 40
Well Screen
Top Depth: 42'
Top Elevation: 612.02'
Type of Well Screen: 2" Sch. 40 PVC
Screen Opening Size: 0.010"
Bottom Depth: 52'
Bottom Elevation: 602.02'
Bottom Cap Depth: 53'
Bore Hole Diameter: 8"

STATE OF TEXAS
CHRISTIAN M. LLULL
GEOLOGY
No. 5884
LICENSED
PROFESSIONAL GEOSCIENTIST

6/6/18

Monitor Well Data Sheet

Permittee or Site Name: Mesquite Creek Landfill

County: Comal and Guadalupe

Date of Monitor Well Installation: 4/11/2018

Monitor Well Latitude: -98.00564535 Longitude: 29.43557832

Monitor Well Groundwater Gradient Position:

Upgradient ______ Downgradient X

MSW Permit No.: 66B

Monitor Well I.D. No.: MW-15

Date of Monitor Well Development: On-going

Monitor Well Driller Name: Jim Neal

License No.: 4868 MPKT

NOTES:

- Report all depths from Surface Elevation and all Elevations relative to Mean Sea Level (MSL), to nearest hundredth of a foot.
- Diameter of boring should be at least 4 inches larger than diameter of well casing.
- Use flush screw joint casing only, 2-inch diameter or larger, with o-rings or PTFE tape in joints (4-inch diameter recommend).
- Well development should continue until water is clear, and pH and conductivity are stable.

Geologist, Hydrologist, or Engineer Supervising Well Installation: Christian M. Llull, P.G. # 5884

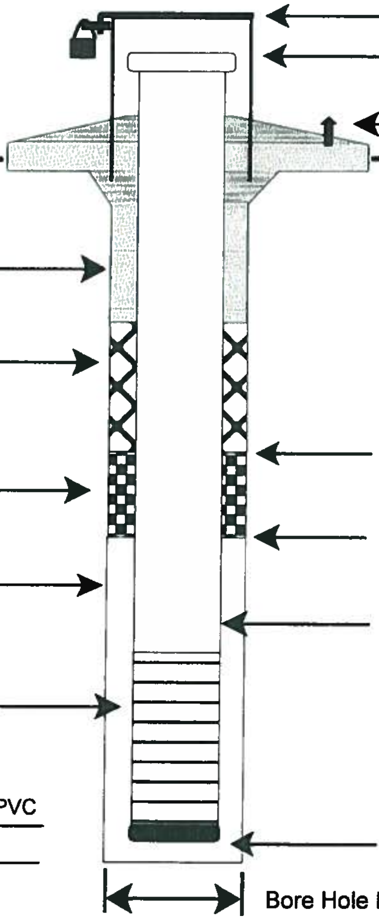
Static Water Level Elevation (with respect to MSL) after Well Development: 599.64' MSL @ 24 Hours

Name of Geologic Formation(s) in which Well is completed: Lower Taylor Group (Predominantly Site-Specific Stratum III)

Type of Locking Device: Padlock

Type of Casing Protection: Anodized Aluminum

Concrete Surface Pad (with steel reinforcement) Dimensions: 4' x 4' x 6"



Top of Protective Collar Elevation: 650.47'

Top of Casing Elevation: 650.24'

Surface Elevation: 647.19'

Surveyor's Pin Elevation: 647.47'

Concrete Seal Depth: 2'

Casing Seal (backfill) Material: Cement Bentonite Grout

CHRISTIAN M. LLULL
No. 5884
6/6/18

Bentonite Seal

Bentonite Seal Top Depth: 4' Elevation: 643.19'

Filter Pack Top Depth: 39' Elevation: 608.19'

Filter Pack
Filter Pack Material: 20/40 Sand

Well Casing
Type: PVC, FJT
Size (diameter): 2"
Schedule or Thickness: Sch. 40

Well Screen
Top Depth: 42.5'
Top Elevation: 604.69'
Type of Well Screen: 2" Sch. 40 PVC
Screen Opening Size: 0.010"
Bottom Depth: 52.5'
Bottom Elevation: 594.69'

Bottom Cap Depth: 53.5'

Bore Hole Diameter: 8"

Monitor Well Data Sheet

Texas Commission on Environmental Quality
Waste Permits Division

Permittee or Site Name: Mesquite Creek Landfill

County: New Braunfels, Comal & Guadalupe Counties

Date of Monitor Well Installation: 5/11/2020

Monitor Well Latitude: 29.7369129133 Longitude: -98.0286980642

Monitor Well Hydraulic Position:
Upgradient ____ Downgradient X

MSW Permit No.: 66B

Monitor Well I.D. No.: MW-4A

Date of Well Development: 5/14/2020

Monitor Well Driller
Name: James E. Neal
License No.: 4868

Geologist, Hydrologist, or Engineer Supervising Well Installation: Craig E. Bennett, PG

Static Water Level Elevation (with respect to MSL) after Well Development: 26.95

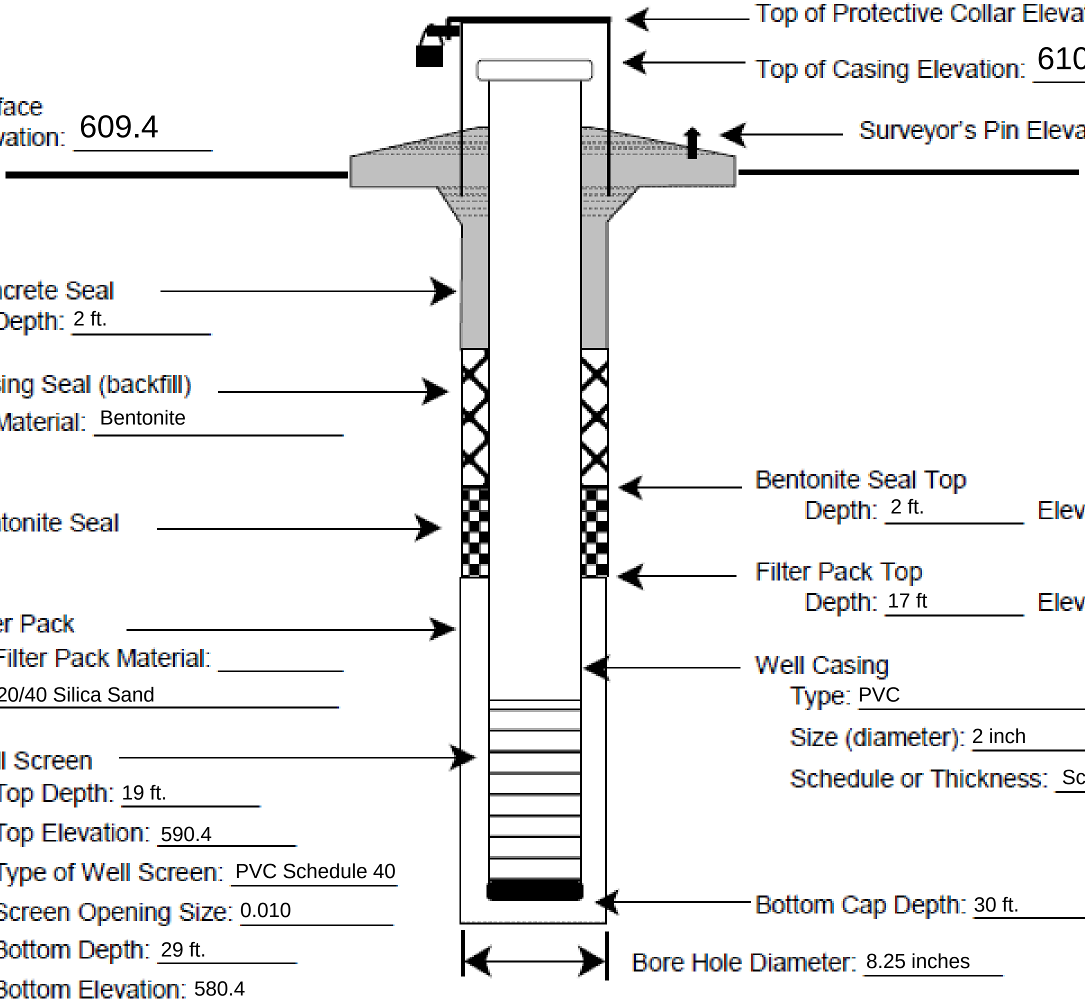
Name of Geologic Formation(s) in which Well is completed: Lower Taylor Group

Type of Locking Device: Keyed Alike Pad Lock Type of Casing Protection: Anodized Aluminum Stand Pipe

Concrete Surface Pad (with steel reinforcement) Dimensions: 6 ft x 6 ft

Notes:

- Report all depths from Surface Elevation and all Elevations relative to Mean Sea Level (MSL), to nearest hundredth of a foot.
- Diameter of boring should be at least 4 inches larger than diameter of well casing.
- Use flush screw joint casing only, 2-inch diameter or larger, with o-rings or PTFE tape in joints (4-inch diameter recommend).
- Well development should continue until water is clear, and pH and conductivity are stable.



Top of Protective Collar Elevation: 611.32

Top of Casing Elevation: 610.87

Surface Elevation: 609.4

Surveyor's Pin Elevation: 608.35

Concrete Seal
Depth: 2 ft.

Casing Seal (backfill)
Material: Bentonite

Bentonite Seal

Bentonite Seal Top
Depth: 2 ft. Elevation: 607.4

Filter Pack Top
Depth: 17 ft Elevation: 592.4

Filter Pack
Filter Pack Material: 20/40 Silica Sand

Well Casing
Type: PVC
Size (diameter): 2 inch
Schedule or Thickness: Schedule 40

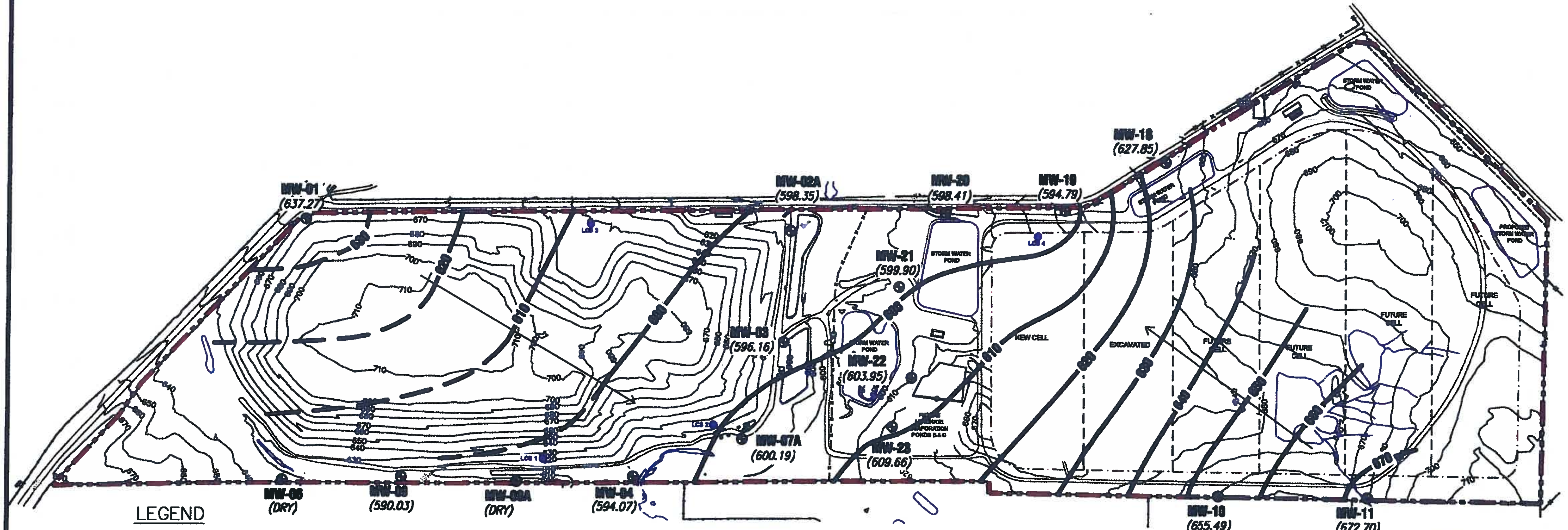
Well Screen
Top Depth: 19 ft.
Top Elevation: 590.4
Type of Well Screen: PVC Schedule 40
Screen Opening Size: 0.010
Bottom Depth: 29 ft.
Bottom Elevation: 580.4

Bottom Cap Depth: 30 ft.

Bore Hole Diameter: 8.25 inches

ATTACHMENT 4E

GROUNDWATER MAPS



LEGEND

10' CONTOUR
PROPERTY LINE
FENCE
DITCH (WATER) LINE
APPROXIMATE UNIT 2 FOOTPRINT
APPROXIMATE UNIT 2 CELLS
● LEACHATE COLLECTION SUMP
EXISTING ROAD
PROPOSED ROAD
MW-03 MONITORING WELL GAUGED MAY 7, 2015
(596.16) GROUNDWATER WATER ELEVATION (FT, NGVD)
640 POTENTIOMETRIC SURFACE CONTOUR (FT, NGVD)

SOURCE:
Base map from Geosyntec.

N
Scale in Feet
0 300 600

CHRISTIAN M. LULL
GEOLOGY
No. 5894

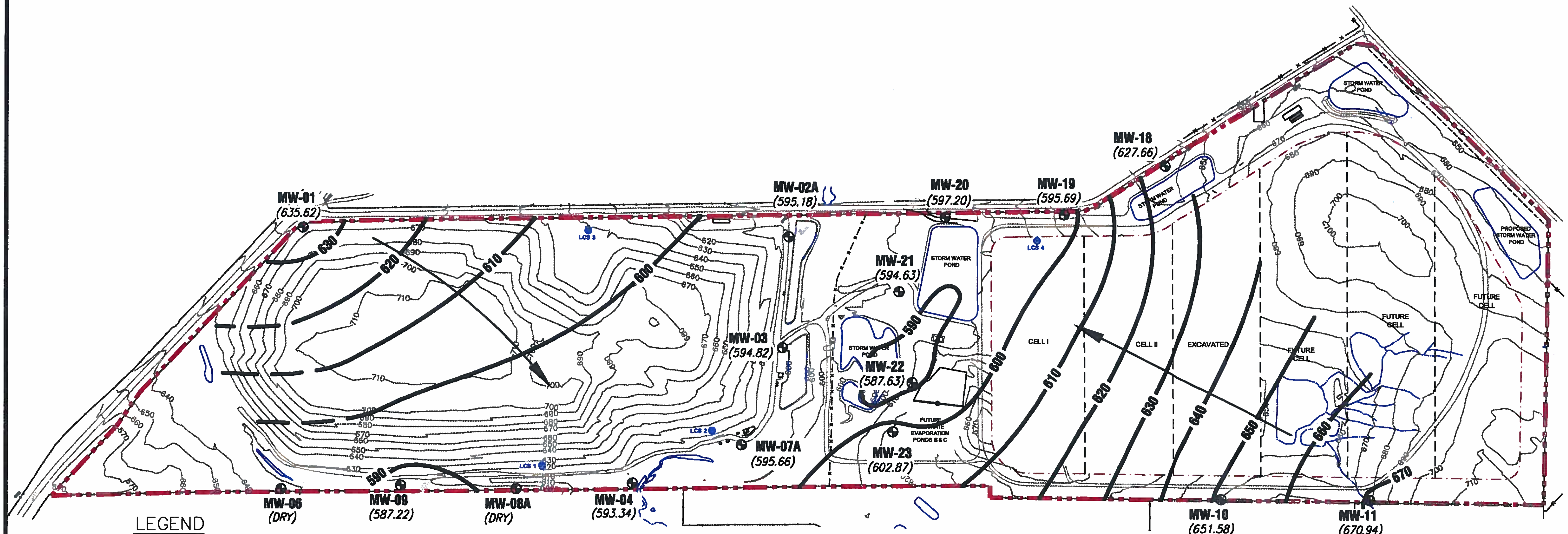
7-20-15

MESQUITE CREEK LANDFILL
NEW BRAUNFELS, TEXAS

FIGURE 1
POTENTIOMETRIC SURFACE MAP
MAY 2015

PROJECT: 024444	BY: ARM	REVISIONS
DATE: MAY 2015	CHECKED: CML	

TETRA TECH
COMPLEX WORLD, CLEAR SOLUTIONS

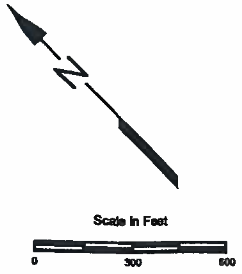


LEGEND

―――	10' CONTOUR
▬ ▪ ▪ ▬	PROPERTY LINE
—x—x—	FENCE
―――	DITCH (WATER) LINE
— · — · —	APPROXIMATE UNIT 2 FOOTPRINT
— — — —	APPROXIMATE UNIT 2 CELLS
●	LEACHATE COLLECTION SUMP
═══	EXISTING ROAD
═══	PROPOSED ROAD
MW-03 ⊕	MONITORING WELL GAUGED NOV 24, 2015
(594.82)	GROUNDWATER WATER ELEVATION (FT, NGVD)
640 ▬▬	POTENTIOMETRIC SURFACE CONTOUR (FT, NGVD)
⟶	GROUNDWATER FLOW DIRECTION

CHRISTIAN M. LLULL
GEOLOGY
No. 5884

2-15-16



SOURCE:
Base map from Geosyntec.

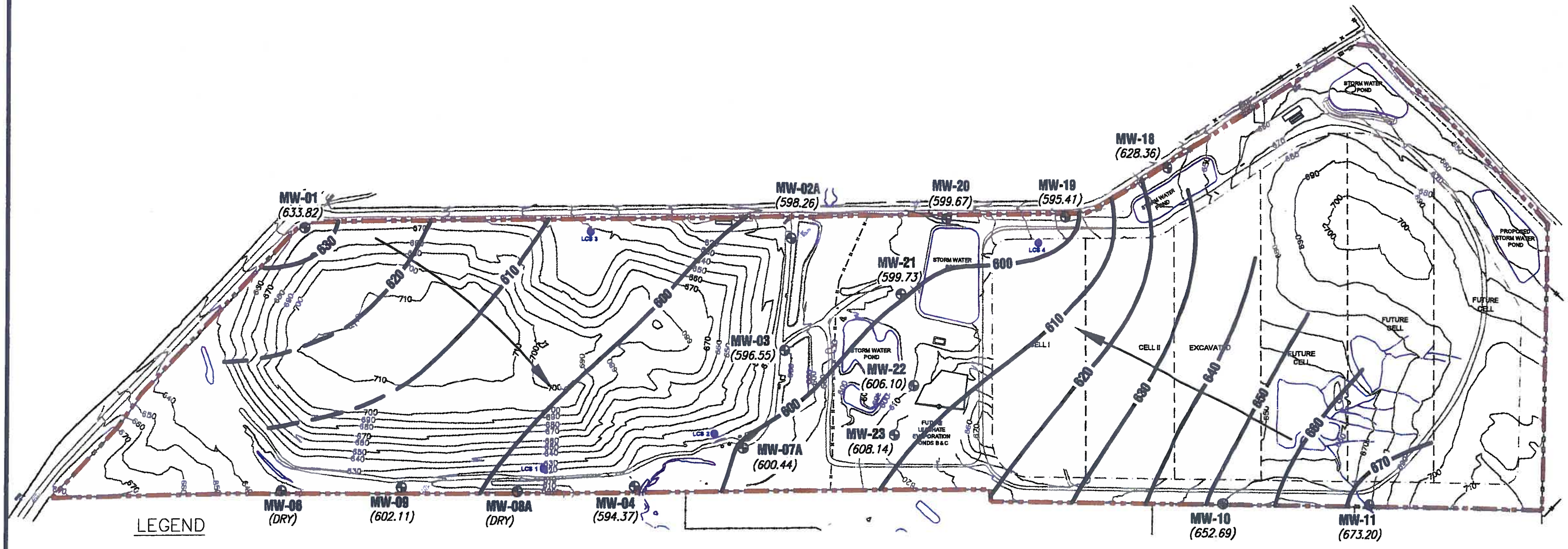
MESQUITE CREEK LANDFILL
NEW BRAUNFELS, TEXAS

FIGURE 1

POTENTIOMETRIC SURFACE MAP
NOVEMBER 2015

PROJECT: 024444	BY: ARM	REVISIONS
DATE: NOV 2015	CHECKED: CML	

TETRA TECH
COMPLEX WORLD. CLEAR SOLUTIONS



LEGEND

———	10' CONTOUR
▬ · · ▬	PROPERTY LINE
—x——x—	FENCE
············	DITCH (WATER) LINE
— · — · —	APPROXIMATE UNIT 2 FOOTPRINT
— — — —	APPROXIMATE UNIT 2 CELLS
●	LEACHATE COLLECTION SUMP
═══	EXISTING ROAD
═══	PROPOSED ROAD
MW-03 ⊕	MONITORING WELL GAUGED MAY 24–25, 2016
(596.55)	GROUNDWATER WATER ELEVATION (FT, NGVD)
640 ▬▬	POTENTIOMETRIC SURFACE CONTOUR (FT, NGVD)
——→	GROUNDWATER FLOW DIRECTION

N

Scale in Feet
0 300 600

STATE OF TEXAS
CHRISTIAN M. LLULL
GEOLOGY
No. 5884
LICENSED
PROFESSIONAL GEOSCIENTIST

7-29-16

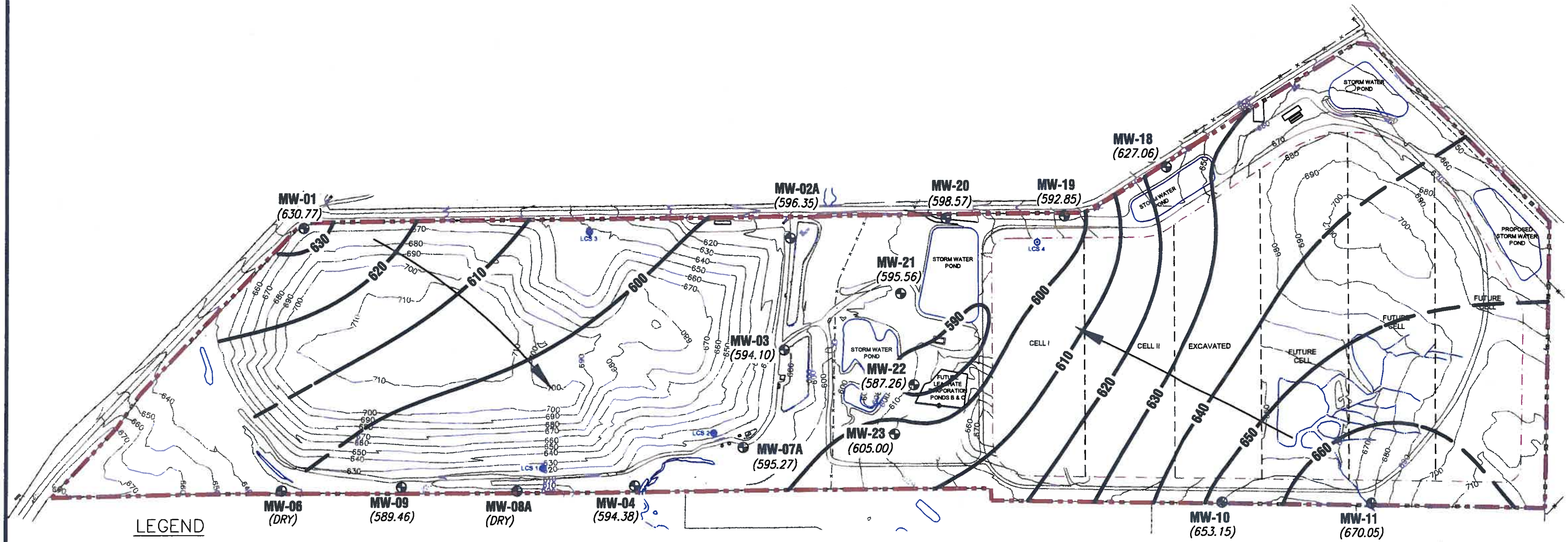
SOURCE:
Base map from Geosyntec.

MESQUITE CREEK LANDFILL
NEW BRAUNFELS, TEXAS

FIGURE 1
POTENTIOMETRIC SURFACE MAP
MAY 2016

PROJECT: 024444	BY: ARM	REVISIONS
DATE: JUNE 2016	CHECKED: CML	

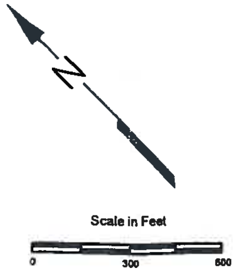
TETRA TECH
COMPLEX WORLD. CLEAR SOLUTIONS



LEGEND

	10' CONTOUR
	PROPERTY LINE
—x—x—	FENCE
	DITCH (WATER) LINE
	APPROXIMATE UNIT 2 FOOTPRINT
— — — —	APPROXIMATE UNIT 2 CELLS
●	LEACHATE COLLECTION SUMP
	EXISTING ROAD
	PROPOSED ROAD
MW-03 ●	MONITORING WELL GAUGED SEPTEMBER 20, 2016
(594.10)	GROUNDWATER WATER ELEVATION (FT, NGVD)
640	POTENTIOMETRIC SURFACE CONTOUR (FT, NGVD)
→	GROUNDWATER FLOW DIRECTION

SOURCE:
Base map from Geosyntec.



CHRISTIAN M. LLULL
GEOLOGY
No. 5884

12-5-16

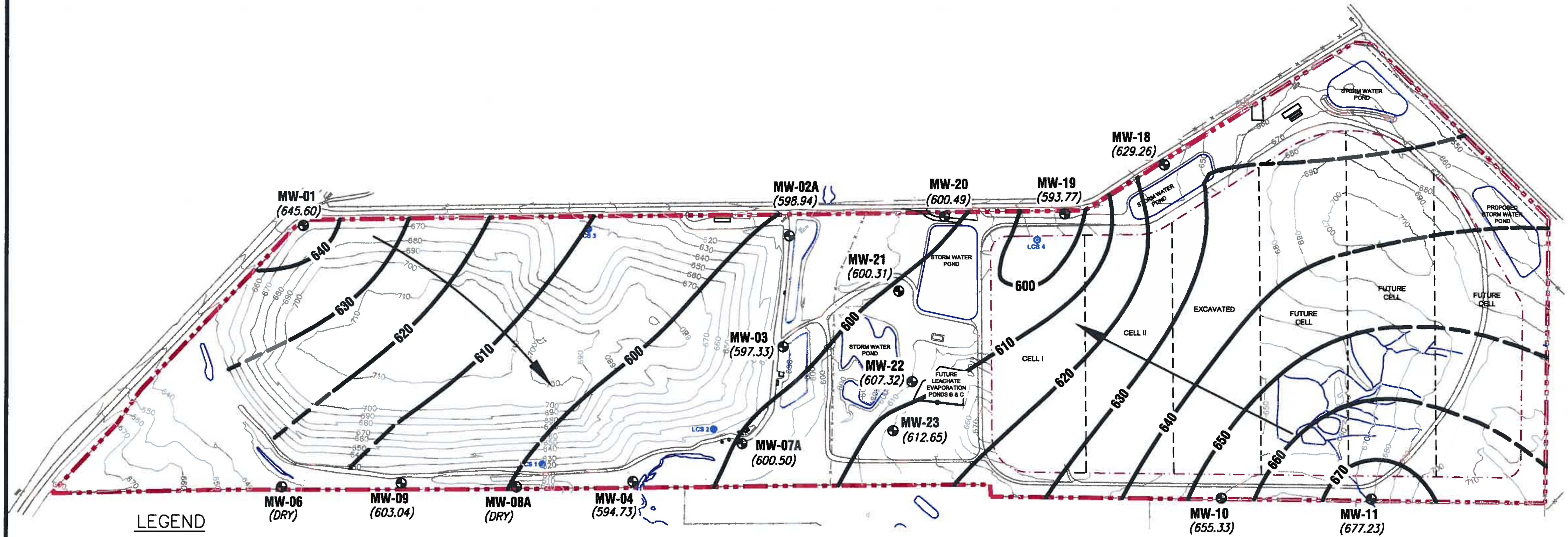
MESQUITE CREEK LANDFILL
NEW BRAUNFELS, TEXAS

FIGURE 1

POTENTIOMETRIC SURFACE MAP
SEPTEMBER 2016

PROJECT: 024444	BY: ARM	REVISIONS
DATE: OCT 2016	CHECKED: CML	

TETRA TECH
COMPLEX WORLD, CLEAR SOLUTIONS



LEGEND

10' CONTOUR

PROPERTY LINE

FENCE

DITCH (WATER) LINE

APPROXIMATE UNIT 2 FOOTPRINT

APPROXIMATE UNIT 2 CELLS

● LEACHATE COLLECTION SUMP

EXISTING ROAD

PROPOSED ROAD

MW-03 ● MONITORING WELL GAUGED MARCH 23, 2017

(597.33) GROUNDWATER WATER ELEVATION (FT, NGVD)

640 POTENTIOMETRIC SURFACE CONTOUR (FT, NGVD)

→ GROUNDWATER FLOW DIRECTION

N

Scale in Feet

0 300 600

SOURCE:
Base map from Geosyntec.

CHRISTIAN M. LLULL
GEOLOGY
No. 5884

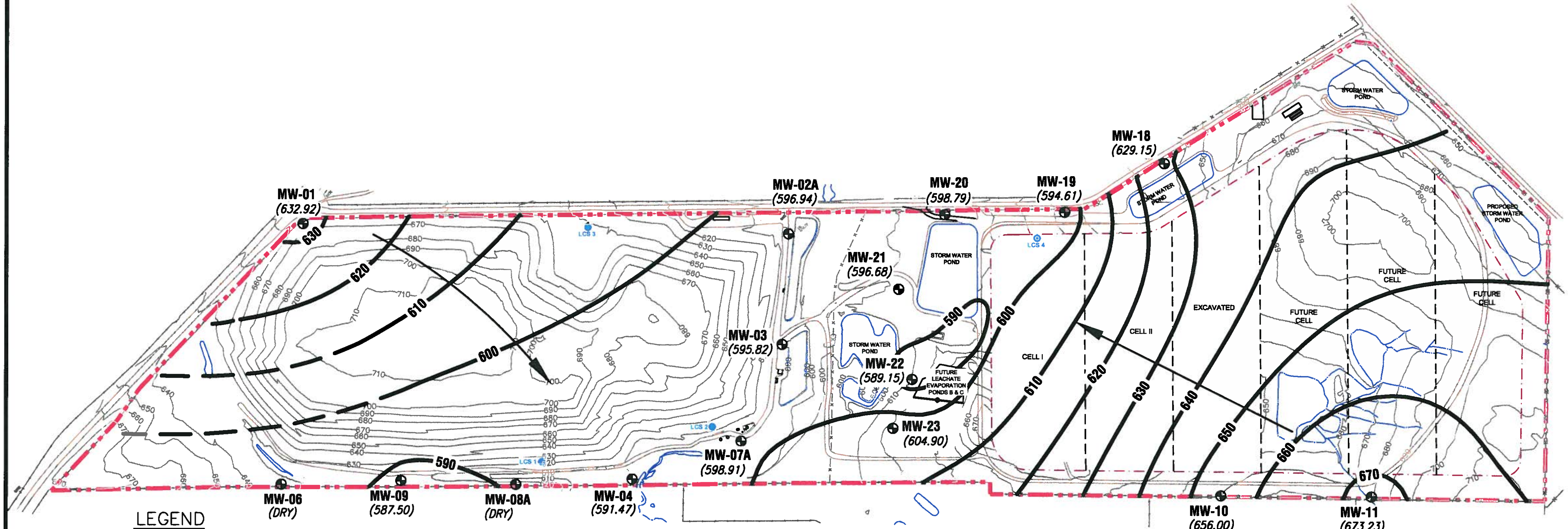
5-31-17

MESQUITE CREEK LANDFILL
NEW BRAUNFELS, TEXAS

FIGURE 1
POTENTIOMETRIC SURFACE MAP
MARCH 2017

PROJECT: 024444	BY: ARM	REVISIONS
DATE: MARCH 2017	CHECKED: CML	

TETRA TECH
COMPLEX WORLD, CLEAR SOLUTIONS



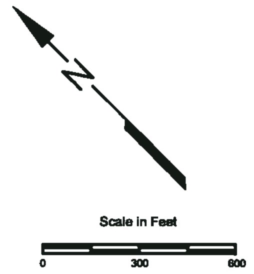
LEGEND

───	10' CONTOUR
━ · ━	PROPERTY LINE
─x─x─	FENCE
·─·─·	DITCH (WATER) LINE
─ · ─ ·	APPROXIMATE UNIT 2 FOOTPRINT
─ ─ ─	APPROXIMATE UNIT 2 CELLS
●	LEACHATE COLLECTION SUMP
═══	EXISTING ROAD
═══	PROPOSED ROAD
MW-03 ⊕	MONITORING WELL GAUGED OCTOBER 9, 2017
(595.82)	GROUNDWATER WATER ELEVATION (FT, NGVD)
640 ━━	POTENTIOMETRIC SURFACE CONTOUR (FT, NGVD)
──▶	GROUNDWATER FLOW DIRECTION

SOURCE:
Base map from Geosyntec.

CHRISTIAN M. LLULL
No. 5884

1-5-18

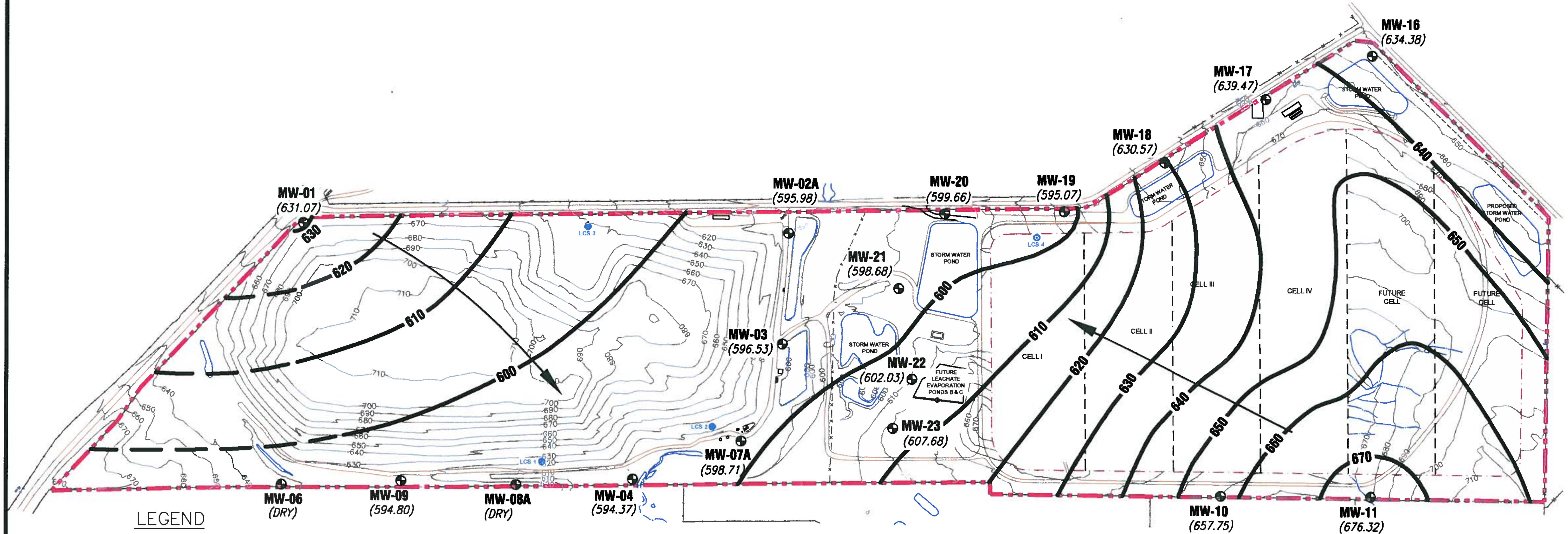


MESQUITE CREEK LANDFILL
NEW BRAUNFELS, TEXAS

FIGURE 1
POTENTIOMETRIC SURFACE MAP
OCTOBER 2017

PROJECT: 024444	BY: ARM	REVISIONS
DATE: OCTOBER 2017	CHECKED: CML	

TETRA TECH
COMPLEX WORLD, CLEAR SOLUTIONS



LEGEND

—	10' CONTOUR
▬ · ▬	PROPERTY LINE
—x—x—	FENCE
---·---	DITCH (WATER) LINE
-·-·-	APPROXIMATE UNIT 2 FOOTPRINT
— — —	APPROXIMATE UNIT 2 CELLS
●	LEACHATE COLLECTION SUMP
═	EXISTING ROAD
═	PROPOSED ROAD
MW-03 ⊕	MONITORING WELL GAUGED APRIL 18, 2018
(596.53)	GROUNDWATER WATER ELEVATION (FT, NGVD)
640 ▬	POTENTIOMETRIC SURFACE CONTOUR (FT, NGVD)
⟶	GROUNDWATER FLOW DIRECTION

CHRISTIAN M. LLULL
GEOLOGY
No. 5884

6-22-18

N

Scale in Feet
0 300 600

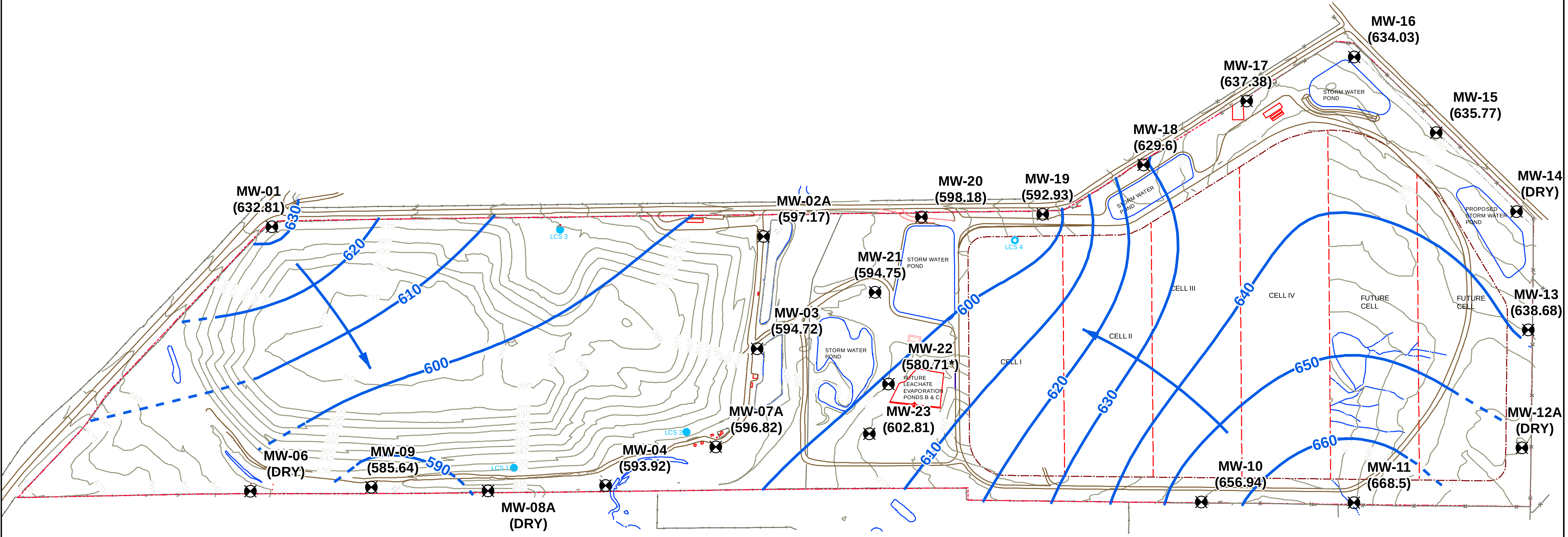
SOURCE:
Base map from Geosyntec.

MESQUITE CREEK LANDFILL
NEW BRAUNFELS, TEXAS

FIGURE 1
POTENTIOMETRIC SURFACE MAP APRIL 2018

PROJECT: 117-2402444	BY: ARM	REVISIONS
DATE: APRIL 2018	CHECKED: CML	

TETRA TECH
COMPLEX WORLD, CLEAR SOLUTIONS



Plot Date: 12/28/2018 - 6:08:18 PM , Plotted by E. Ficker
Drawing Path: C:\Users\user\Dropbox (BBA Engineering)\Jobs\WMTX\Mesquite Creek\GROUNDWATER POT MAPS\2018-2nd Semi\MXDs\Figure 1.mxd

Explanation

⊗	Monitoring Well
—600—	Potentiometric Surface Elevation Contour (In ft MSLl) C.I.= 10 Ft (Dashed Where Inferred)
→	General Groundwater Flow Direction
(592.82)	Water Level Elevation (In ft MSL)
-·-·-	Property Line

NOTE:
1. Base map from Geosyntec.
2. * - Water level from MW-22 is anomalous relative to historic data and was not used to develop potentiometric surface elevation contours.

CRAIG E. BENNETT
LIC #1205

Craig E Bennett
January, 11 2019

0 250 500 1,000
SCALE IN FEET
1:6,000

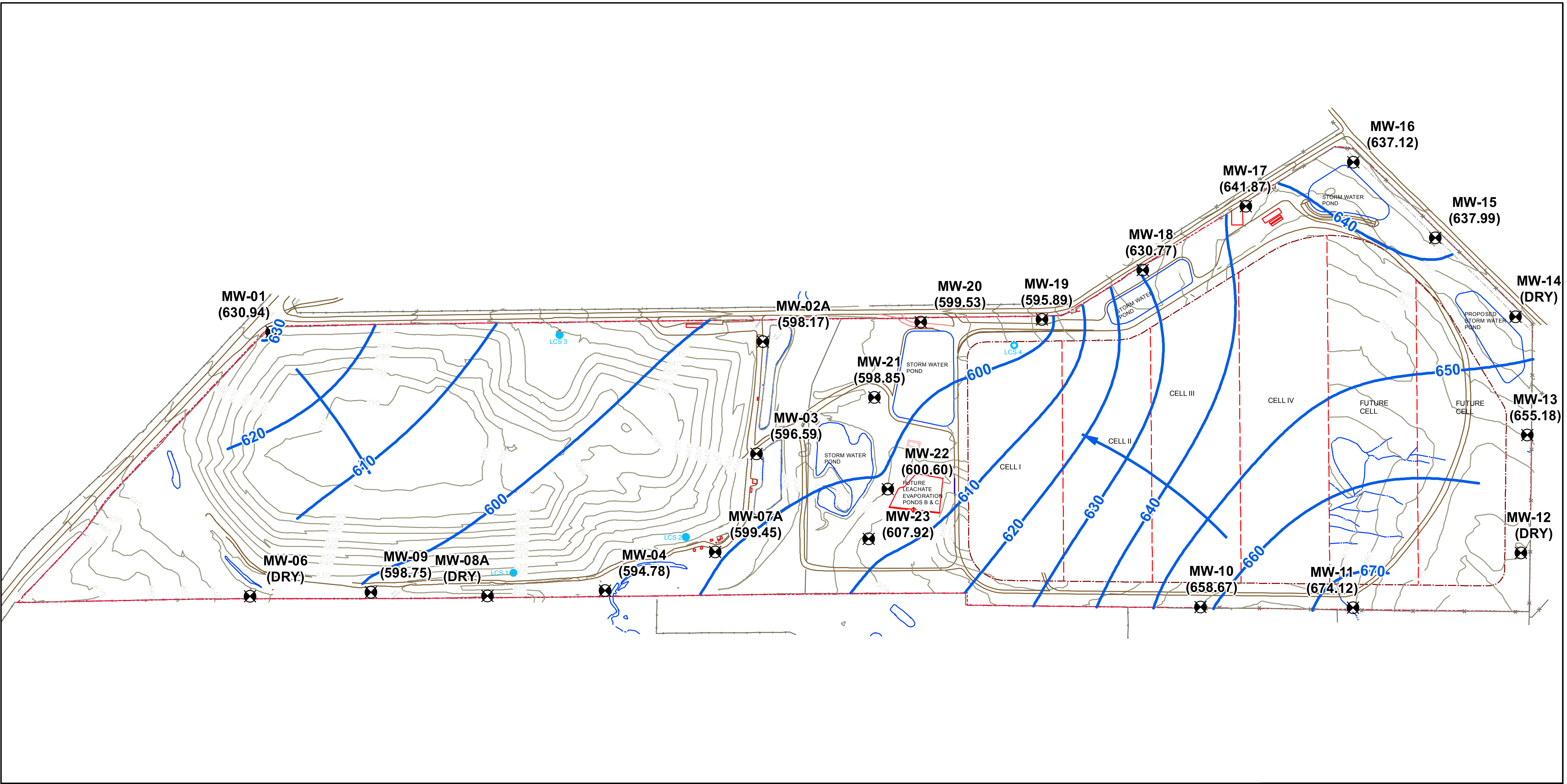
MESQUITE CREEK LANDFILL
NEW BRAUNFELS, TEXAS

FIGURE 1

POTENTIOMETRIC SURFACE MAP OCTOBER 2018

PROJECT: 18284	BY: EEF	REVISIONS
DATE: Dec 2018	CHECKED: CEB	

Bullock, Bennett & Associates, LLC
Engineering and Geoscience
Texas Registrations: Engineering F-8542, Geoscience 50127



Plot Date: 7/23/2019 - 2:18:47 PM , Plotted by E. Ficker
Drawing Path: C:\Users\user\Dropbox (BBA Engineering)\Jobs\WMTX\Mesquite Creek\GROUNDWATER POT MAPS\2019-1st Semi\MXDs\Figure 1

Explanation

⊕	Monitoring Well
—600—	Potentiometric Surface Elevation Contour (In ft MSLI) C.I.= 10 Ft (Dashed Where Inferred)
——►	General Groundwater Flow Direction
(596.59)	Water Level Elevation (In ft MSL)
-·-·-·-	Property Line

NOTE:
1. Base map from Geosyntec.

CRAIG E. BENNETT
GEOLOGY
LIC #1205

Craig E. Bennett
07/26/2019

0 250 500 1,000
SCALE IN FEET
1:6,000

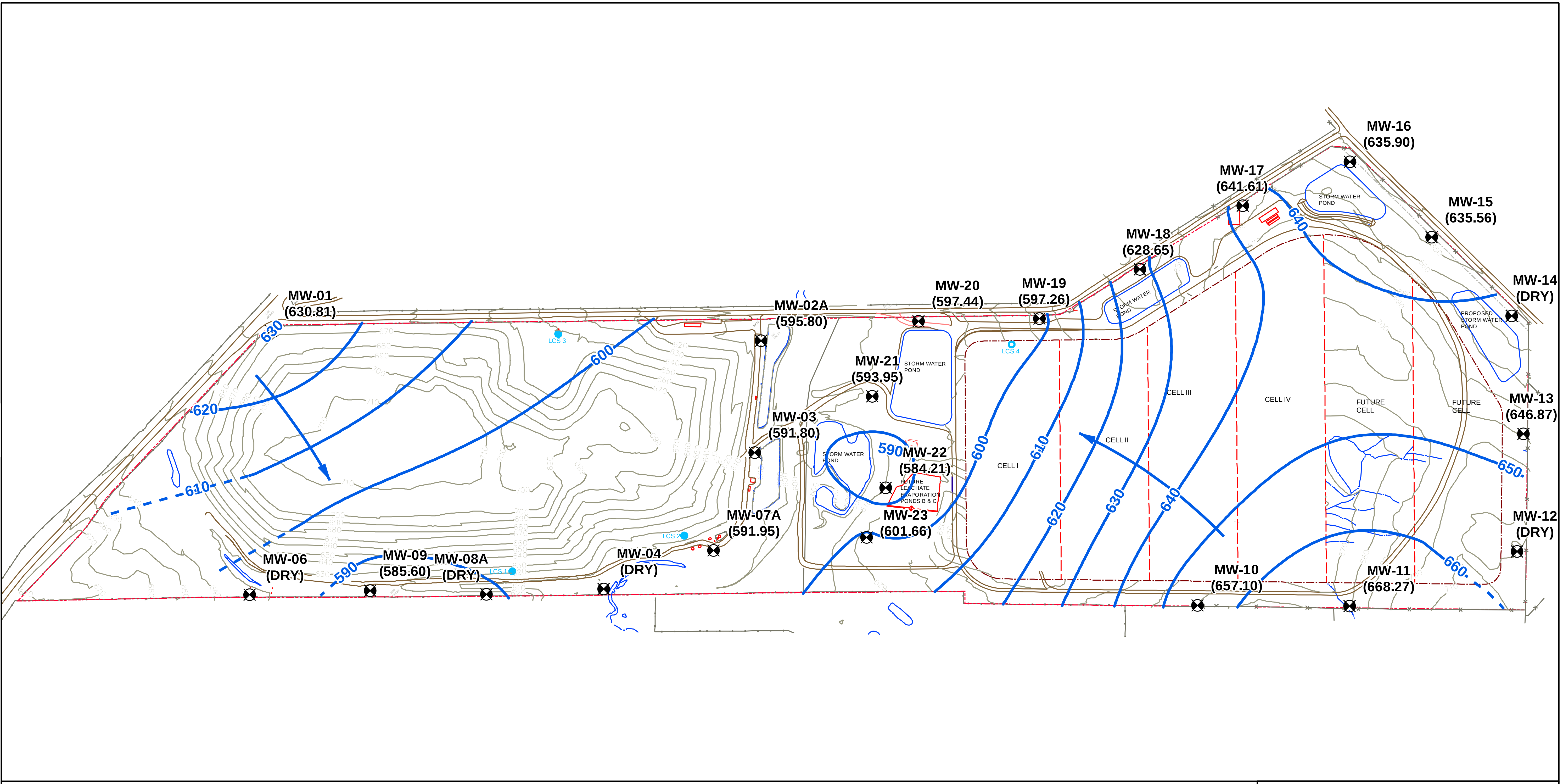
MESQUITE CREEK LANDFILL
NEW BRAUNFELS, TEXAS

FIGURE 1

POTENTIOMETRIC SURFACE MAP
MAY 2019

PROJECT: 18284	BY: EEF	REVISIONS
DATE: July 2019	CHECKED: CEB	

Bullock, Bennett & Associates, LLC
Engineering and Geoscience
Texas Registrations: Engineering F-8542, Geoscience 50127



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Drawing Path: C:\Users\user\Dropbox (BBA Engineering)\Jobs\WMTX\Mesquite Creek\GROUNDWATER POT MAPS\2019-2nd Semi\MXDs\Figure 1

Explanation

⊕	Monitoring Well
—600—	Potentiometric Surface Elevation Contour (In ft MSLl) C.I.= 10 Ft (Dashed Where Inferred)
→	General Groundwater Flow Direction
(593.95)	Water Level Elevation (In ft MSL)
-·-·-·	Property Line

NOTE:
1. Base map from Geosyntec.

CRAIG E. BENNETT
GEOLOGY
LIC #1205

Craig E Bennett
02/21/2020

N

0 250 500 1,000
SCALE IN FEET
1:6,000

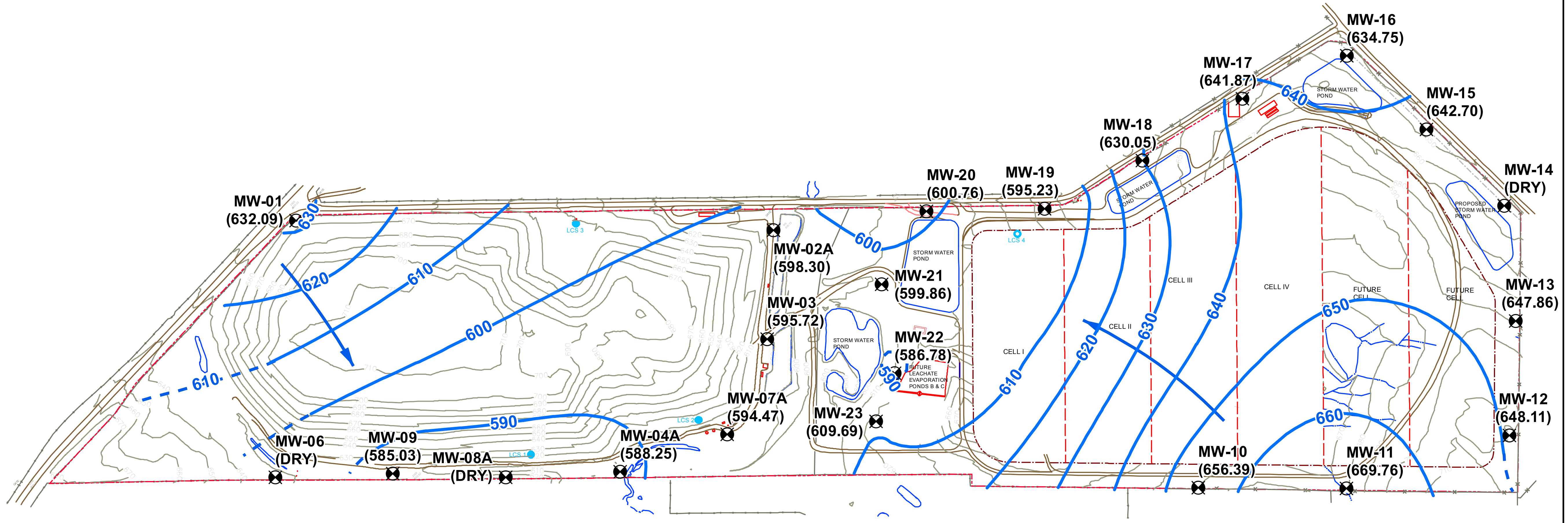
MESQUITE CREEK LANDFILL
NEW BRAUNFELS, TEXAS

FIGURE 1

POTENTIOMETRIC SURFACE MAP
NOVEMBER 2019

PROJECT: 18284	BY: EEF	REVISIONS
DATE: Feb 2020	CHECKED: CEB	

Bullock, Bennett & Associates, LLC
Engineering and Geoscience
Texas Registrations: Engineering F-8542, Geoscience 50127



Explanation

⊕	Monitoring Well
—600—	Potentiometric Surface Elevation Contour (In ft MSLI) C.I.= 10 Ft (Dashed Where Inferred)
→	General Groundwater Flow Direction
(585.03)	Water Level Elevation (In ft MSL)
-·-·-·-	Property Line

NOTE:
1. Base map from Geosyntec.

CRAIG E. BENNETT
GEOLOGY
LIC #1205

Craig E Bennett
8/12/2020

0 285 570 1,140
SCALE IN FEET
1:6,809

MESQUITE CREEK LANDFILL
NEW BRAUNFELS, TEXAS

FIGURE 1

POTENTIOMETRIC SURFACE MAP
MAY 2020

PROJECT: 18284	BY: EEF	REVISIONS
DATE: July 2020	CHECKED: CEB	

Bullock, Bennett & Associates, LLC
Engineering and Geoscience
Texas Registrations: Engineering F-8542, Geoscience 50127

Plot Date: 8/12/2020 - 1:51:17 PM , Plotted by E. Ficker
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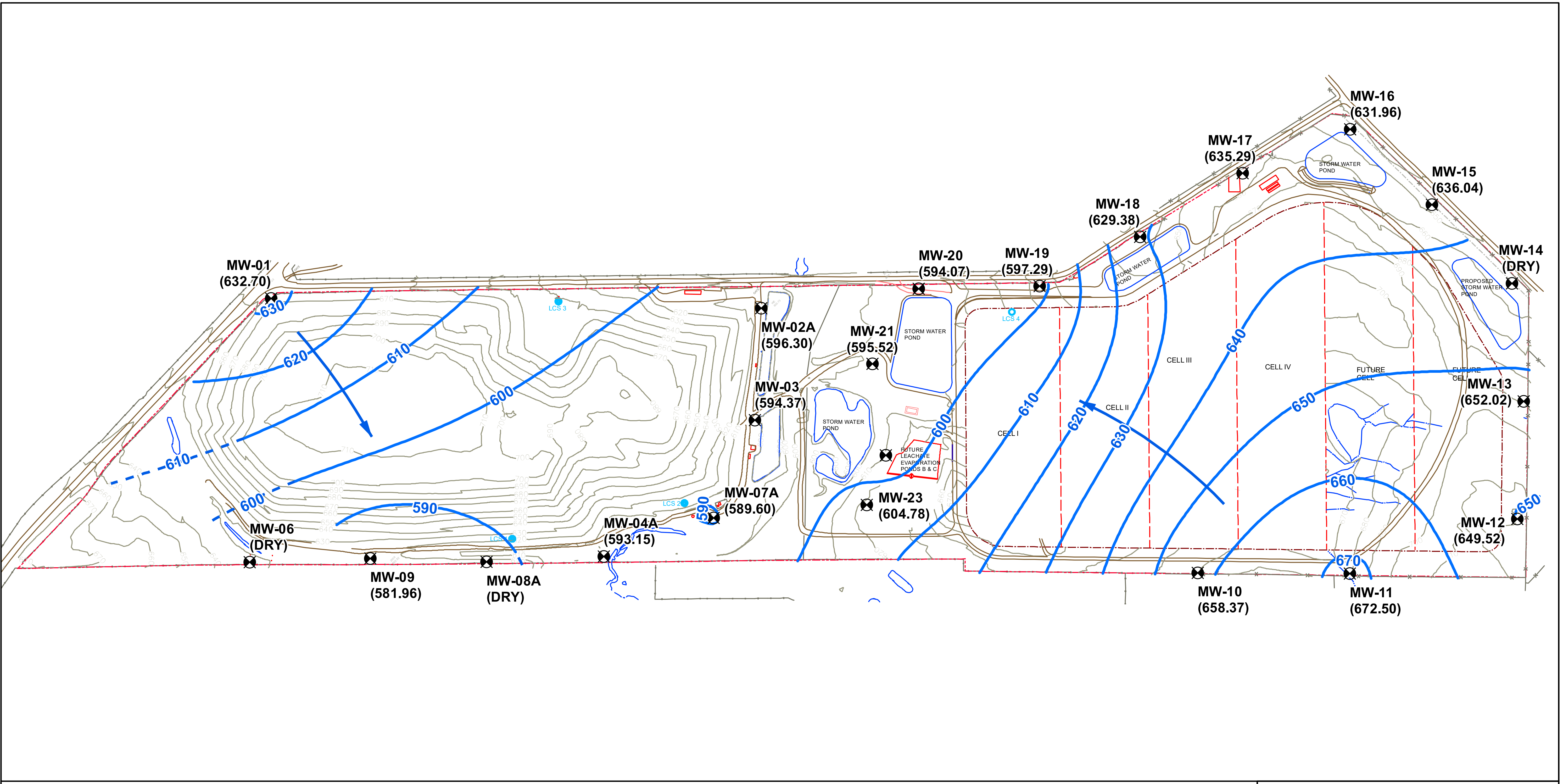

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Drawing Path: C:\Users\eficker\Dropbox (BBA Engineering)\Jobs\WMTX\Mesquite Creek\GROUNDWATER POT MAPS\2020-2nd Semi\MXDs\Figure 1.mxd

Explanation

⌖	Monitoring Well
—600—	Potentiometric Surface Elevation Contour (In ft MSLI) C.I.= 10 Ft (Dashed Where Inferred)
→	General Groundwater Flow Direction
(581.96)	Water Level Elevation (In ft MSL)
-·-·-·-	Property Line

NOTE:
1. Base map from Geosyntec.

STATE OF TEXAS
CRAIG E. BENNETT
GEOLOGY
LIC #1205
LICENSED
PROFESSIONAL GEOSCIENTIST

Craig E Bennett
3/8/2021

0 250 500 1,000
SCALE IN FEET
1:6,000

N

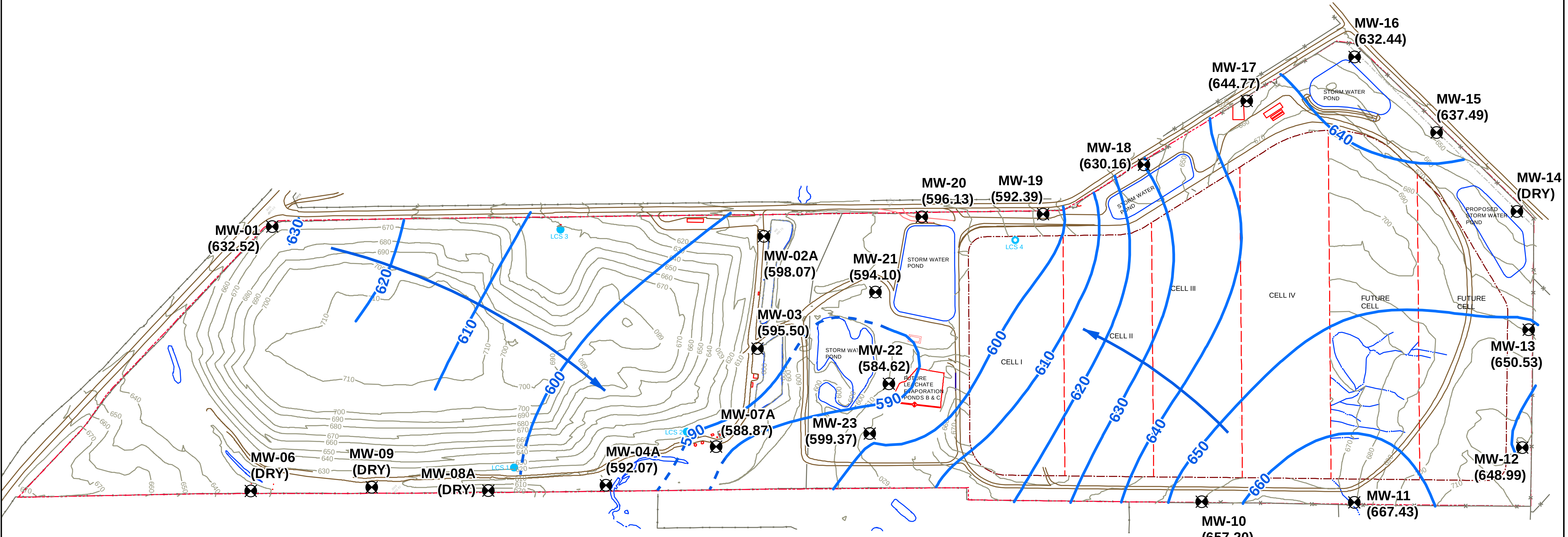
MESQUITE CREEK LANDFILL
NEW BRAUNFELS, TEXAS

FIGURE 1

POTENTIOMETRIC SURFACE MAP
DECEMBER 2020

PROJECT: 18284	BY: EEF	REVISIONS
DATE: Feb 2021	CHECKED: CEB	

Bullock, Bennett & Associates, LLC
Engineering and Geoscience
Texas Registrations: Engineering F-8542, Geoscience 50127



Plot Date: 7/6/2021 - 4:57:26 PM , Plotted by E. Ficker
Drawing Path: C:\Users\CJBennett\Dropbox (BBA Engineering)\Jobs\WMTX\Mesquite Creek\GROUNDWATER POT MAPS\2021-1st Semi\MXDs\Figure 1.mxd

Explanation

⊕	Monitoring Well
—600—	Potentiometric Surface Elevation Contour (In ft MSLI) C.I.= 10 Ft (Dashed Where Inferred)
→	General Groundwater Flow Direction
(599.37)	Water Level Elevation (In ft MSL)
-·-·-	Property Line

NOTE:
1. Base map from Geosyntec.

CRAIG E. BENNETT
GEOLOGY
LIC #1205

Craig E Bennett
7/2/2021

0 250 500 1,000
SCALE IN FEET
1:6,000

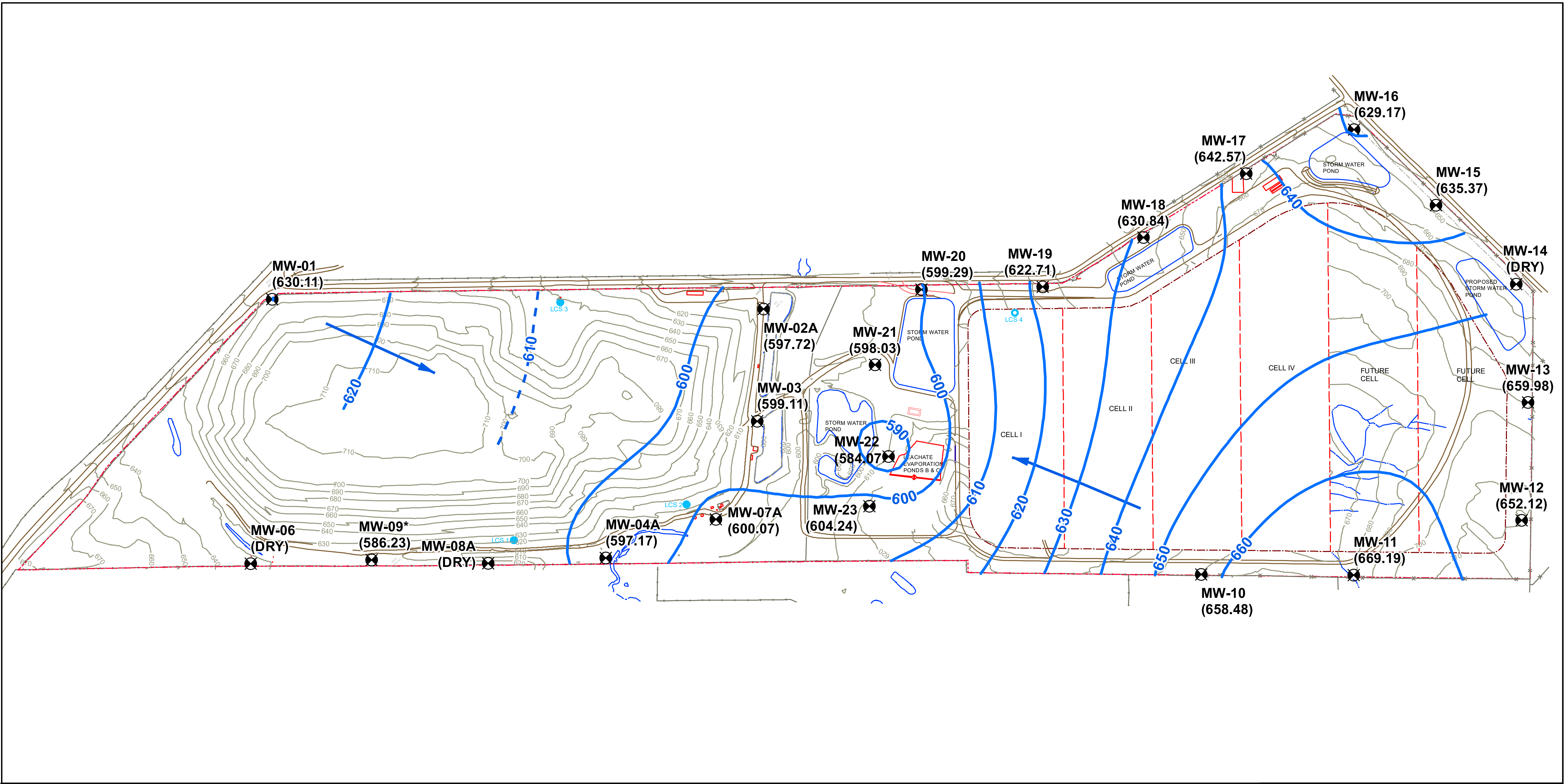
MESQUITE CREEK LANDFILL
NEW BRAUNFELS, TEXAS

FIGURE 1

POTENTIOMETRIC SURFACE MAP
APRIL 2021

PROJECT: 18284-21	BY: EEF	REVISIONS
DATE: June 2021	CHECKED: CEB	

Bullock, Bennett & Associates, LLC
Engineering and Geoscience
Texas Registrations: Engineering F-8542, Geoscience 50127



Plot Date: 2/18/2022 - 5:00:11 PM , Plotted by J. Aitken
Drawing Path: C:\Users\jaitken\Dropbox (BBA Engineering)\Jobs\WMTX\Mesquite Creek\GROUNDWATER POT MAPS\2021-2nd Semi\MXDs\2021 2nd Semi Figure 1.mxd

Explanation

⊕	Monitoring Well
—595—	Potentiometric Surface Elevation Contour (In ft MSLI) C.I.= 10 Ft (Dashed Where Inferred)
→	General Groundwater Flow Direction
(593.15)	Water Level Elevation (In ft MSL)
-·-·-·	Property Line

NOTE:
1. Base map from Geosyntec.
2. * - Water level from MW-09 is anomalous relative to historic data and was not used to develop potentiometric surface elevation contours.

CRAIG E. BENNETT
LIC #1205

Craig E Bennett
2/25/2022

0 250 500 1,000
SCALE IN FEET
1:6,000

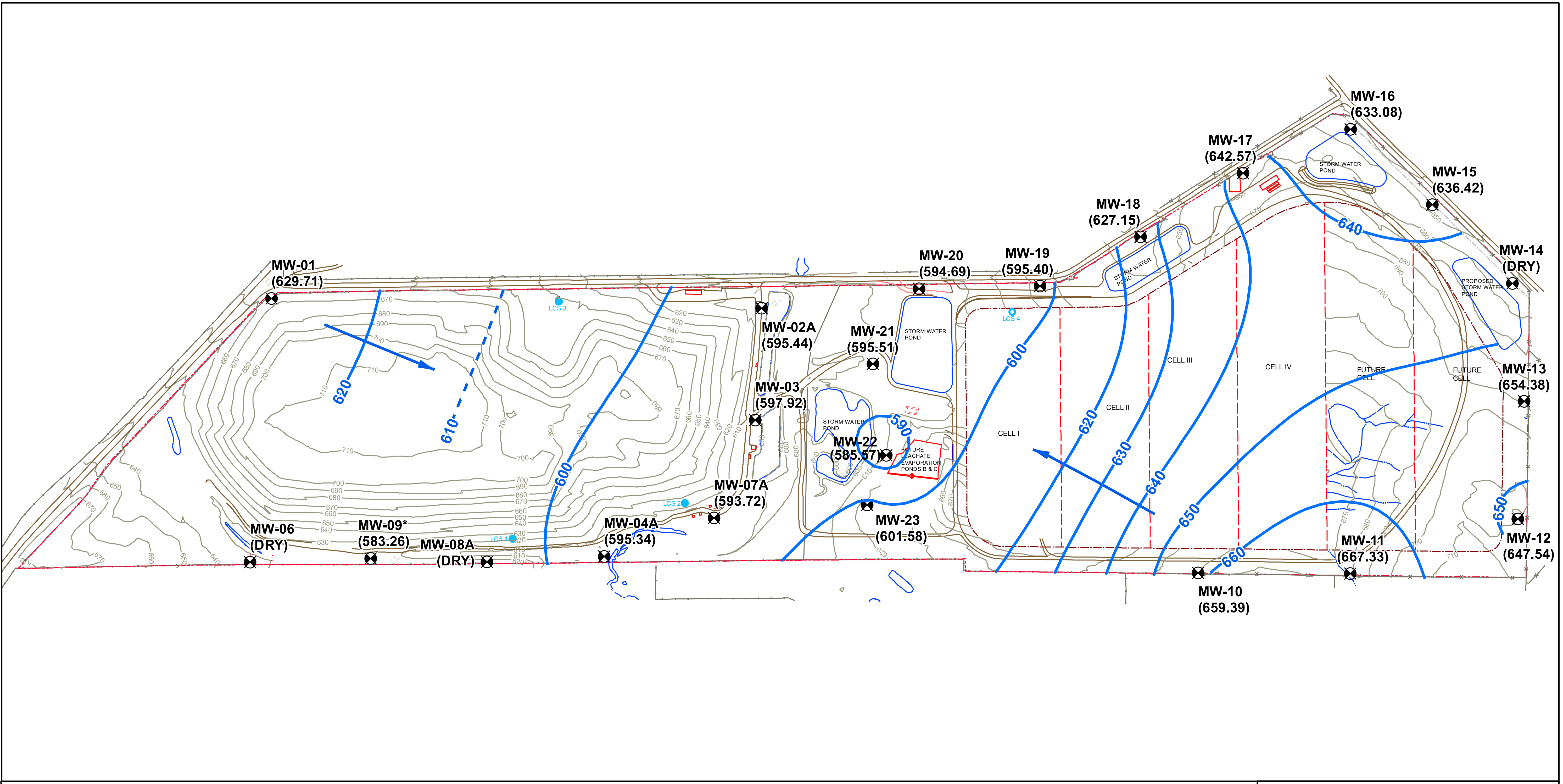
MESQUITE CREEK LANDFILL
NEW BRAUNFELS, TEXAS

FIGURE 1

POTENTIOMETRIC SURFACE MAP
NOVEMBER 2021

PROJECT: 18284-21	BY: JMA	REVISIONS
DATE: February 2022	CHECKED: CEB	

Bullock, Bennett & Associates, LLC
Engineering and Geoscience
Texas Registrations: Engineering F-8542, Geoscience 50127



Explanation

⊕ Monitoring Well

—595— Potentiometric Surface Elevation Contour (In ft MSLI) C.I.= 10 Ft (Dashed Where Inferred)

→ General Groundwater Flow Direction

(583.26) Water Level Elevation (In ft MSL)

-·-·- Property Line

NOTE:
1. Base map from Geosyntec.
2. * - Water level from MW-09 is anomalous relative to historic data and was not used to develop potentiometric surface elevation contours.

CRAIG E. BENNETT
LIC #1205

Craig E Bennett
9/16/2022

0 250 500 1,000
SCALE IN FEET
1:6,000

MESQUITE CREEK LANDFILL
NEW BRAUNFELS, TEXAS

FIGURE 1

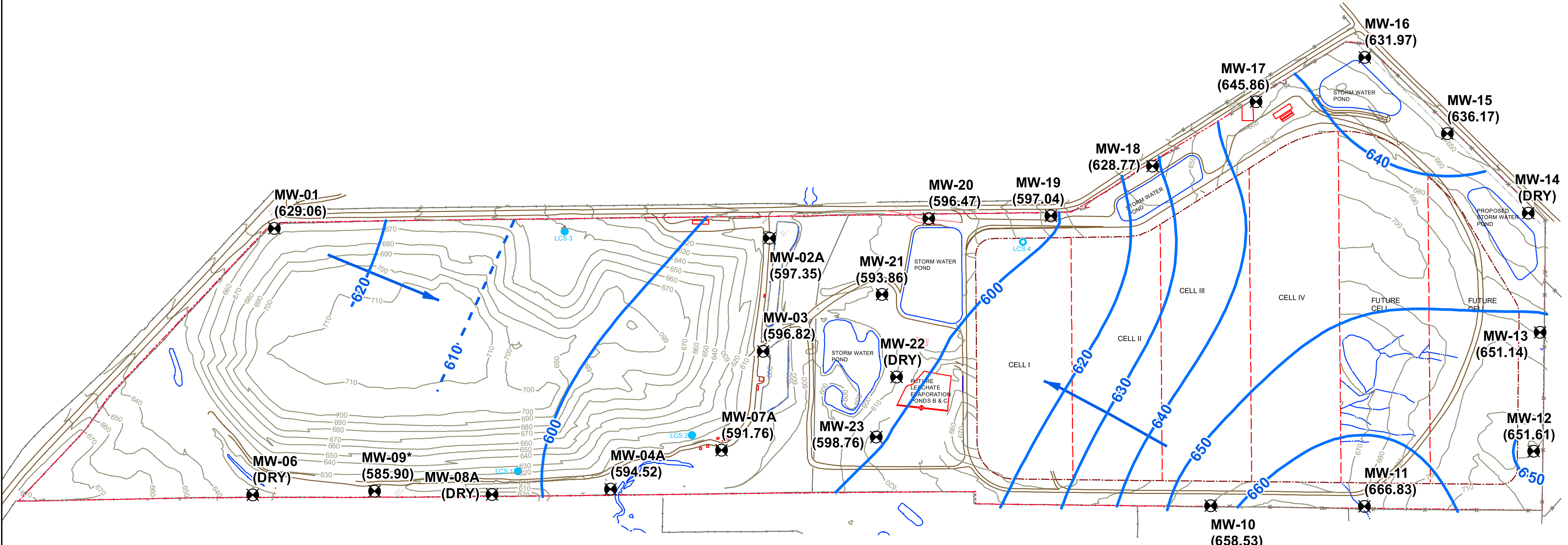
POTENTIOMETRIC SURFACE MAP
JULY 2022

PROJECT: 18284-22	BY: JMA	REVISIONS
DATE: August 2022	CHECKED: CEB	

Bullock, Bennett & Associates, LLC
Engineering and Geoscience
Texas Registrations: Engineering F-8542, Geoscience 50127

Plot Date: 8/11/2022 - 8:33:02 PM , Plotted by J. Aitken
Drawing Path: C:\Users\Jacob Aitken\BBA Engineering Dropbox\Jobs\WMTX\Mesquite Creek\GROUNDWATER POT MAPS\2022-1st Semi\MXDs\2022 1st Semi Figure 1.mxd

Plot Date: 3/8/2023 - 1:02:25 PM , Plotted by J. Aitken
Drawing Path: C:\Users\Jacob Aitken\BBA Engineering Dropbox\Jobs\WMTX\Mesquite Creek\GROUNDWATER POT MAPS\2022-2nd Semi\MXDs\2022 2nd Semi Figure 1.mxd



Explanation

⊕ Monitoring Well

—595— Potentiometric Surface Elevation Contour (In ft MSLl) C.I.= 10 Ft (Dashed Where Inferred)

→ General Groundwater Flow Direction

(583.26) Water Level Elevation (In ft MSL)

-·-·- Property Line

NOTE:
1. Base map from Geosyntec.
2. * - Water level from MW-09 is anomalous relative to historic data and was not used to develop potentiometric surface elevation contours.

CRAIG E. BENNETT
GEOLOGY
LIC #1205

Craig E Bennett
3/21/23

0 250 500 1,000
SCALE IN FEET
1:6,000

MESQUITE CREEK LANDFILL
NEW BRAUNFELS, TEXAS

FIGURE 1

POTENTIOMETRIC SURFACE MAP
DECEMBER 2022

PROJECT: 18284-22	BY: JMA	REVISIONS
DATE: March 2023	CHECKED: CEB	

Bullock, Bennett & Associates, LLC
Engineering and Geoscience
Texas Registrations: Engineering F-8542, Geoscience 50127

ATTACHMENT 4F

GROUNDWATER QUALITY DATA

Table 1

Analytical Data Summary for 12/22/2022 to 12/23/2022

Constituents	Units	MW01	MW02A	MW03	MW04A	MW07A	MW09	MW10	MW11	MW12	MW13
1,1,1,2-TETRACHLOROETHANE	ug/L	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
1,1,1-TRICHLOROETHANE	ug/L	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
1,1,2,2-TETRACHLOROETHANE	ug/L	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
1,1,2-TRICHLOROETHANE	ug/L	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
1,1-DICHLOROETHANE	ug/L	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
1,1-DICHLOROETHENE	ug/L	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
1,2,3-TRICHLOROPROPANE	ug/L	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
1,2-DIBROMO-3-CHLOROPROPANE	ug/L	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
1,2-DIBROMOETHANE	ug/L	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
1,2-DICHLOROBENZENE	ug/L	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
1,2-DICHLOROETHANE	ug/L	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
1,2-DICHLOROPROPANE	ug/L	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
1,4-DICHLOROBENZENE	ug/L	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
2-BUTANONE	ug/L	<5.9	<5.9	<5.9	<5.9	<5.9	<5.9	<5.9	<5.9	<5.9	<5.9
2-HEXANONE	ug/L	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
4-METHYL-2-PENTANONE	ug/L	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
ACETONE	ug/L	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
ACRYLONITRILE	ug/L	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
Alkalinity, total (as caco3), dissolved	mg/L	280	580	410	290	420	770	360	340	360	520
Ammonia, dissolved	mg/L	<.10	.22	<.10	.12	.15	.38	.38	<.10	.72	<.10
ANTIMONY-TOTAL	ug/L	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
ARSENIC-TOTAL	ug/L	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
BARIUM-TOTAL	ug/L	10	13	19	22	25	14	12	<10	<10	23
BENZENE	ug/L	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
BERYLLIUM-TOTAL	ug/L	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4
BROMOCHLOROMETHANE	ug/L	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
BROMODICHLOROMETHANE	ug/L	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
BROMOFORM	ug/L	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
BROMOMETHANE	ug/L	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
CADMIUM-TOTAL	ug/L	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
CALCIUM-DISSOLVED	mg/L	1200	540	160	670	180	270	590	560	560	210
CARBON DISULFIDE	ug/L	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
CARBON TETRACHLORIDE	ug/L	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Chloride, dissolved	mg/L	5100	1100	320	4400	700	820	570	380	190	85
CHLOROBENZENE	ug/L	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
CHLOROETHANE	ug/L	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
CHLOROFORM	ug/L	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
CHLOROMETHANE	ug/L	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
CHROMIUM-TOTAL	ug/L	180	<20	<20	<20	<20	<20	<20	<20	<20	<20
CIS-1,2-DICHLOROETHENE	ug/L	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
CIS-1,3-DICHLOROPROPENE	ug/L	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
COBALT-TOTAL	ug/L	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
COPPER-TOTAL	ug/L	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
DIBROMOCHLOROMETHANE	ug/L	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
DIBROMOMETHANE	ug/L	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
ETHYLBENZENE	ug/L	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
GROUNDWATER ELEV.	FT MSL	629.06	597.35	596.82	594.52	591.89	585.90	658.53	666.83	651.60	651.14
IODOMETHANE	ug/L	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
LEAD-TOTAL	ug/L	<15	<15	<15	<15	<15	<15	<15	<15	<15	<15
MAGNESIUM-DISSOLVED	mg/L	400	250	54	210	67	95	310	260	130	18
METHYLENE CHLORIDE	ug/L	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
NICKEL-TOTAL	ug/L	35	<20	<20	<20	<20	<20	<20	<20	<20	<20
Oxygen-dissolved	mg/L	2.5	2.5	1.8	2.5	2.3	2.5	2.4	2.8	1.9	2.2
pH FIELD	PH UNITS	6.60	6.66	6.64	7.02	6.84	6.83	7.17	6.93	6.91	7.13
POTASSIUM-DISSOLVED	mg/L	19.0	8.6	<3.0	9.8	<3.0	10.0	25.0	22.0	29.0	6.5
SELENIUM-TOTAL	ug/L	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
SILVER-TOTAL	ug/L	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
SODIUM-DISSOLVED	mg/L	2200	930	160	1400	350	630	600	480	690	270
SPECIFIC CONDUCTANCE FIELD	UMHOS/CM	15800	6420	3430	14300	3990	5840	5040	4810	6550	2300
STYRENE	ug/L	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Sulfate, dissolved	mg/L	2400	2400	590	2700	1200	1900	2900	2700	2800	460
TETRACHLOROETHENE	ug/L	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
THALLIUM-TOTAL	ug/L	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
TOLUENE	ug/L	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
TRANS-1,2-DICHLOROETHENE	ug/L	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
TRANS-1,3-DICHLOROPROPENE	ug/L	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
TRANS-1,4-DICHLORO-2-BUTENE	ug/L	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100
TRICHLOROETHENE	ug/L	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
TRICHLOROFLUOROMETHANE	ug/L	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
TURBIDITY (FIELD)	NTU	2.4	.0	.0	.0	7.6	15.5	.0	.0	.7	.0
VANADIUM-TOTAL	ug/L	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
VINYL ACETATE	ug/L	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100
VINYL CHLORIDE	ug/L	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
WATER TEMPERATURE IN DEG. CELSIUS	DEGREES C	22.8	23.1	24.6	23.5	23.9	23.7	23.0	22.4	22.1	23.7
XYLENE(TOTAL)	ug/L	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
ZINC-TOTAL	ug/L	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100

* - The displayed value is the arithmetic mean of multiple database matches.

Table 1

Analytical Data Summary for 12/22/2022 to 12/23/2022

Constituents	MW15	MW16	MW17	MW18	MW19	MW20	MW21	MW23
1,1,1,2-TETRACHLOROETHANE	<2	<2	<2	<2	<2	<2	<2	<2
1,1,1-TRICHLOROETHANE	<1	<1	<1	<1	<1	<1	<1	<1
1,1,2,2-TETRACHLOROETHANE	<1	<1	<1	<1	<1	<1	<1	<1
1,1,2-TRICHLOROETHANE	<1	<1	<1	<1	<1	<1	<1	<1
1,1-DICHLOROETHANE	<1	<1	<1	<1	<1	<1	<1	<1
1,1-DICHLOROETHENE	<1	<1	<1	<1	<1	<1	<1	<1
1,2,3-TRICHLOROPROPANE	<1	<1	<1	<1	<1	<1	<1	<1
1,2-DIBROMO-3-CHLOROPROPANE	<5	<5	<5	<5	<5	<5	<5	<5
1,2-DIBROMOETHANE	<1	<1	<1	<1	<1	<1	<1	<1
1,2-DICHLOROBENZENE	<2	<2	<2	<2	<2	<2	<2	<2
1,2-DICHLOROETHANE	<1	<1	<1	<1	<1	<1	<1	<1
1,2-DICHLOROPROPANE	<1	<1	<1	<1	<1	<1	<1	<1
1,4-DICHLOROBENZENE	<2	<2	<2	<2	<2	<2	<2	<2
2-BUTANONE	<5.9	<5.9	<5.9	<5.9	<5.9	<5.9	<5.9	<5.9
2-HEXANONE	<5	<5	<5	<5	<5	<5	<5	<5
4-METHYL-2-PENTANONE	<5	<5	<5	<5	<5	<5	<5	<5
ACETONE	<20	<20	<20	<20	<20	<20	<20	<20
ACRYLONITRILE	<50	<50	<50	<50	<50	<50	<50	<50
Alkalinity, total (as caco3), dissolved	320	260	300	360	430	430	490	390
Ammonia, dissolved	<.10	<.10	<.10	.72	.22	.47	<.10	<.10
ANTIMONY-TOTAL	<5	<5	<5	<5	<5	<5	<5	<5
ARSENIC-TOTAL	<5.0	<5.0	<5.0	7.0	<5.0	8.2	<5.0	<5.0
BARIUM-TOTAL	<10	12	11	<10	12	24	<10	<10
BENZENE	<1	<1	<1	<1	<1	<1	<1	<1
BERYLLIUM-TOTAL	<4	<4	<4	<4	<4	<4	<4	<4
BROMOCHLOROMETHANE	<1	<1	<1	<1	<1	<1	<1	<1
BROMODICHLOROMETHANE	<1	<1	<1	<1	<1	<1	<1	<1
BROMOFORM	<5	<5	<5	<5	<5	<5	<5	<5
BROMOMETHANE	<10	<10	<10	<10	<10	<10	<10	<10
CADMIUM-TOTAL	<2	<2	<2	<2	<2	<2	<2	<2
CALCIUM-DISSOLVED	590	520	580	600	590	210	320	150
CARBON DISULFIDE	<5	<5	<5	<5	<5	<5	<5	<5
CARBON TETRACHLORIDE	<5	<5	<5	<5	<5	<5	<5	<5
Chloride, dissolved	1300	340	890	1200	360	270	340	200
CHLOROBENZENE	<1	<1	<1	<1	<1	<1	<1	<1
CHLOROETHANE	<5	<5	<5	<5	<5	<5	<5	<5
CHLOROFORM	<1	<1	<1	<1	<1	<1	<1	<1
CHLOROMETHANE	<5	<5	<5	<5	<5	<5	<5	<5
CHROMIUM-TOTAL	<20	<20	<20	<20	<20	<20	<20	<20
CIS-1,2-DICHLOROETHENE	<1	<1	<1	<1	<1	<1	<1	<1
CIS-1,3-DICHLOROPROPENE	<2	<2	<2	<2	<2	<2	<2	<2
COBALT-TOTAL	<5.0	<5.0	<5.0	<5.0	<5.0	6.7	<5.0	<5.0
COPPER-TOTAL	<10	<10	<10	<10	<10	<10	<10	<10
DIBROMOCHLOROMETHANE	<2	<2	<2	<2	<2	<2	<2	<2
DIBROMOMETHANE	<1	<1	<1	<1	<1	<1	<1	<1
ETHYLBENZENE	<2	<2	<2	<2	<2	<2	<2	<2
GROUNDWATER ELEV.	636.17	631.97	645.86	628.77	597.04	596.47	593.86	598.76
IODOMETHANE	<5	<5	<5	<5	<5	<5	<5	<5
LEAD-TOTAL	<15	<15	<15	<15	<15	<15	<15	<15
MAGNESIUM-DISSOLVED	220	290	360	330	260	81	140	55
METHYLENE CHLORIDE	<5	<5	<5	<5	<5	<5	<5	<5
NICKEL-TOTAL	<20	<20	<20	<20	<20	<20	<20	<20
Oxygen-dissolved	2.5	3.0	3.2	2.1	2.0	2.6	2.3	2.9
pH FIELD	6.86	7.18	6.94	7.19	6.80	6.87	6.60	6.97
POTASSIUM-DISSOLVED	28.0	29.0	26.0	24.0	16.0	6.4	7.4	4.4
SELENIUM-TOTAL	<50	<50	<50	<50	<50	<50	<50	<50
SILVER-TOTAL	<10	<10	<10	<10	<10	<10	<10	<10
SODIUM-DISSOLVED	1100	500	820	1100	420	380	330	150
SPECIFIC CONDUCTANCE FIELD	2010	3750	6220	6070	4620	3360	5360	2460
STYRENE	<2	<2	<2	<2	<2	<2	<2	<2
Sulfate, dissolved	2900	2700	3100	3100	2400	930	2900	910
TETRACHLOROETHENE	<5	<5	<5	<5	<5	<5	<5	<5
THALLIUM-TOTAL	<1	<1	<1	<1	<1	<1	<1	<1
TOLUENE	<1	<1	<1	<1	<1	<1	<1	<1
TRANS-1,2-DICHLOROETHENE	<1	<1	<1	<1	<1	<1	<1	<1
TRANS-1,3-DICHLOROPROPENE	<5	<5	<5	<5	<5	<5	<5	<5
TRANS-1,4-DICHLORO-2-BUTENE	<100	<100	<100	<100	<100	<100	<100	<100
TRICHLOROETHENE	<5	<5	<5	<5	<5	<5	<5	<5
TRICHLOROFLUOROMETHANE	<10	<10	<10	<10	<10	<10	<10	<10
TURBIDITY (FIELD)	32.0	9.0	19.8	.0	.0	16.5	.0	.0
VANADIUM-TOTAL	<10	<10	<10	<10	<10	<10	<10	<10
VINYL ACETATE	<100	<100	<100	<100	<100	<100	<100	<100
VINYL CHLORIDE	<2	<2	<2	<2	<2	<2	<2	<2
WATER TEMPERATURE IN DEG. CELSIUS FIELD	23.7	23.2	22.8	22.7	23.4	22.4	22.8	22.8
XYLENE(TOTAL)	<10	<10	<10	<10	<10	<10	<10	<10
ZINC-TOTAL	<100	<100	<100	<100	<100	<100	<100	<100

* - The displayed value is the arithmetic mean of multiple database matches.

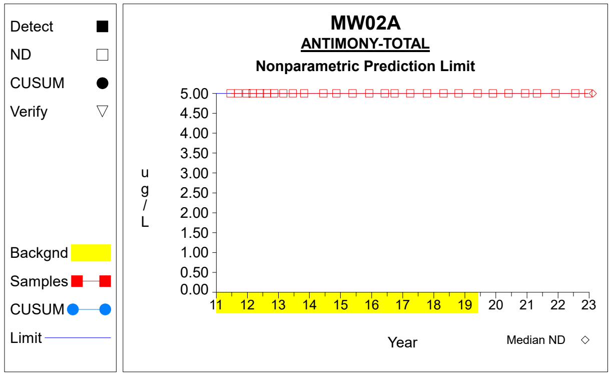
Table 1

Historical Volatile Organic Compound Detections

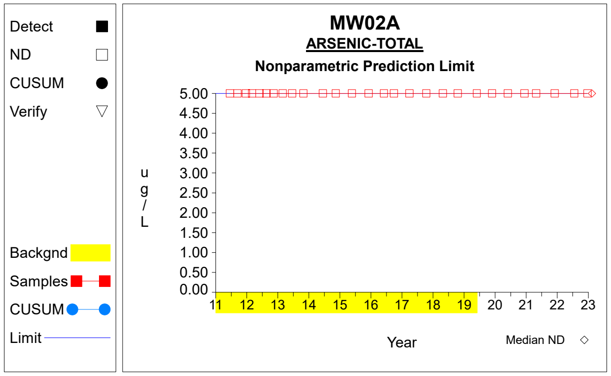
Constituent	Well	Date	Identifier	Result	Limit	Units
2-BUTANONE	MW01	6/16/2000		26	10	ug/L
ACETONE	MW01	6/16/2000		39	34	ug/L
1,1-DICHLOROETHANE	MW02A	6/16/2011		2.0	1.0	ug/L
1,1-DICHLOROETHANE	MW02A	7/27/2011		1.4	1.0	ug/L
1,1-DICHLOROETHANE	MW02A	8/03/2011		1.4	1.0	ug/L
1,1-DICHLOROETHANE	MW02A	9/14/2011		1.4	1.0	ug/L
1,1-DICHLOROETHANE	MW02A	12/21/2011		1.7	1.0	ug/L
1,1-DICHLOROETHANE	MW02A	3/01/2012		1.8	1.0	ug/L
1,1-DICHLOROETHANE	MW02A	5/29/2012		2.3	1.0	ug/L
1,1-DICHLOROETHANE	MW02A	8/17/2012		2.2	1.0	ug/L
1,1-DICHLOROETHANE	MW02A	11/13/2012		2.4	1.0	ug/L
1,1-DICHLOROETHANE	MW02A	2/28/2013		1.8	1.0	ug/L
1,1-DICHLOROETHANE	MW02A	6/18/2013		1.9	1.0	ug/L
1,1-DICHLOROETHANE	MW02A	10/29/2013		2.1	1.0	ug/L
1,1-DICHLOROETHANE	MW02A	6/13/2014		1.4	1.0	ug/L
1,1-DICHLOROETHANE	MW02A	11/12/2014		1.8	1.0	ug/L
1,1-DICHLOROETHANE	MW02A	5/20/2015		1.1	1.0	ug/L
1,1-DICHLOROETHANE	MW02A	12/02/2015		1.2	1.0	ug/L
1,1-DICHLOROETHANE	MW02A	6/01/2016		1.1	1.0	ug/L
1,1-DICHLOROETHANE	MW02A	9/28/2016		1.1	1.0	ug/L
1,1-DICHLOROETHANE	MW02A	3/28/2017		1.0	1.0	ug/L
1,1-DICHLOROETHANE	MW02A	10/12/2017		1.1	1.0	ug/L
1,1-DICHLOROETHANE	MW02A	10/18/2018		1.0	1.0	ug/L
1,1-DICHLOROETHENE	MW02A	12/21/2011		1.6	1.0	ug/L
1,1-DICHLOROETHENE	MW02A	5/29/2012		2.5	1.0	ug/L
1,1-DICHLOROETHENE	MW02A	8/17/2012		1.5	1.0	ug/L
1,1-DICHLOROETHENE	MW02A	11/13/2012		3.9	1.0	ug/L
1,1-DICHLOROETHENE	MW02A	2/28/2013		4.4	1.0	ug/L
1,1-DICHLOROETHENE	MW02A	6/18/2013		1.3	1.0	ug/L
1,1-DICHLOROETHENE	MW02A	10/29/2013		3.2	1.0	ug/L
1,1-DICHLOROETHENE	MW02A	11/12/2014		3.8	1.0	ug/L
1,1-DICHLOROETHENE	MW02A	5/29/2019		2.2	1.0	ug/L
ACETONE	MW02A	5/29/2019		110	20	ug/L
CIS-1,2-DICHLOROETHENE	MW02A	6/16/2011		1.5	1.0	ug/L
CIS-1,2-DICHLOROETHENE	MW02A	7/27/2011		1.1	1.0	ug/L
CIS-1,2-DICHLOROETHENE	MW02A	8/03/2011		1.0	1.0	ug/L
CIS-1,2-DICHLOROETHENE	MW02A	9/14/2011		1.2	1.0	ug/L
CIS-1,2-DICHLOROETHENE	MW02A	12/21/2011		1.4	1.0	ug/L
CIS-1,2-DICHLOROETHENE	MW02A	3/01/2012		1.5	1.0	ug/L
CIS-1,2-DICHLOROETHENE	MW02A	5/29/2012		1.8	1.0	ug/L
CIS-1,2-DICHLOROETHENE	MW02A	8/17/2012		1.8	1.0	ug/L
CIS-1,2-DICHLOROETHENE	MW02A	11/13/2012		1.9	1.0	ug/L
CIS-1,2-DICHLOROETHENE	MW02A	2/28/2013		1.8	1.0	ug/L
CIS-1,2-DICHLOROETHENE	MW02A	6/18/2013		2.0	1.0	ug/L
CIS-1,2-DICHLOROETHENE	MW02A	10/29/2013		2.0	1.0	ug/L
CIS-1,2-DICHLOROETHENE	MW02A	6/13/2014		1.1	1.0	ug/L
CIS-1,2-DICHLOROETHENE	MW02A	11/12/2014		1.7	1.0	ug/L
CIS-1,2-DICHLOROETHENE	MW02A	5/20/2015		1.2	1.0	ug/L
CIS-1,2-DICHLOROETHENE	MW02A	12/02/2015		1.6	1.0	ug/L
CIS-1,2-DICHLOROETHENE	MW02A	6/01/2016		1.7	1.0	ug/L
CIS-1,2-DICHLOROETHENE	MW02A	9/28/2016		1.9	1.0	ug/L
CIS-1,2-DICHLOROETHENE	MW02A	3/28/2017		1.8	1.0	ug/L
CIS-1,2-DICHLOROETHENE	MW02A	10/12/2017		1.6	1.0	ug/L
CIS-1,2-DICHLOROETHENE	MW02A	4/25/2018		1.3	1.0	ug/L
CIS-1,2-DICHLOROETHENE	MW02A	10/18/2018		1.4	1.0	ug/L
CIS-1,2-DICHLOROETHENE	MW02A	5/29/2019		1.3	1.0	ug/L
CIS-1,2-DICHLOROETHENE	MW02A	11/26/2019		1.5	1.0	ug/L
CIS-1,2-DICHLOROETHENE	MW02A	5/28/2020		1.1	1.0	ug/L
CIS-1,2-DICHLOROETHENE	MW02A	12/10/2020		1.1	1.0	ug/L
CIS-1,2-DICHLOROETHENE	MW02A	12/01/2021		1.0	1.0	ug/L
TOLUENE	MW02A	6/16/2011		1	1	ug/L
VINYL CHLORIDE	MW02A	10/29/2013		2.7	2.0	ug/L
VINYL CHLORIDE	MW02A	5/29/2019		4.8	2.0	ug/L
1,1-DICHLOROETHENE	MW03	6/15/2001		8.9	5.0	ug/L
1,1-DICHLOROETHENE	MW03	12/18/2001		6.9	5.0	ug/L
1,1-DICHLOROETHENE	MW03	5/22/2002		9.0	5.0	ug/L
1,1-DICHLOROETHENE	MW03	12/03/2002		7.0	5.0	ug/L
2-BUTANONE	MW06	11/17/2004		23	10	ug/L
2-BUTANONE	MW09	5/20/2015		130	5	ug/L
ACETONE	MW09	5/28/2020		42	20	ug/L
ACETONE	MW09	6/30/2020		44	20	ug/L
ACETONE	MW09	7/14/2020		44	20	ug/L
ACETONE	MW15	12/10/2020		34	20	ug/L
ACETONE	MW17	4/24/2018		26	20	ug/L

Detections are shown for the constituents and sample points selected for the analysis
The Limit column refers to the laboratory reporting limit

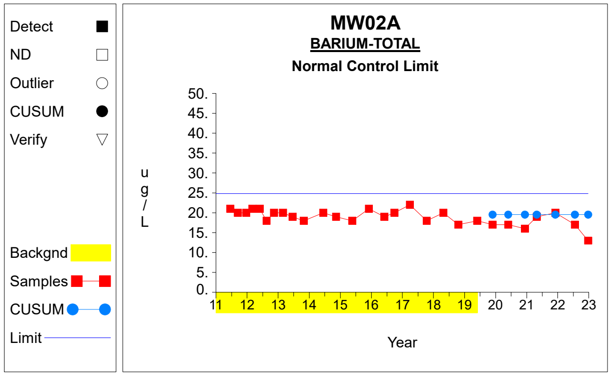
Intra-Well Control Charts / Prediction Limits



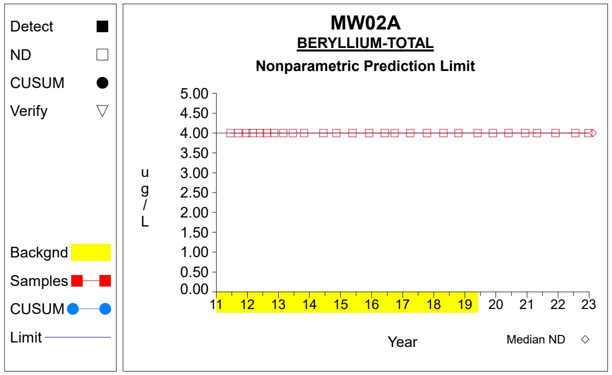
Graph 1



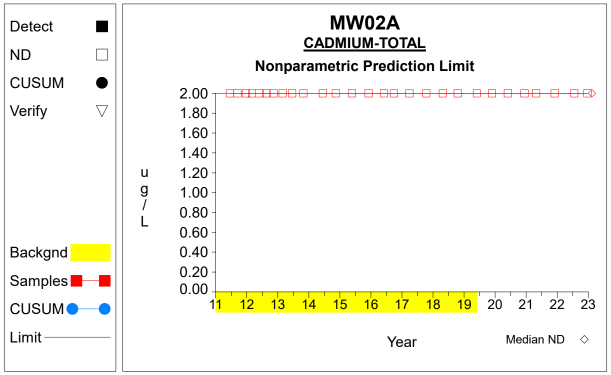
Graph 2



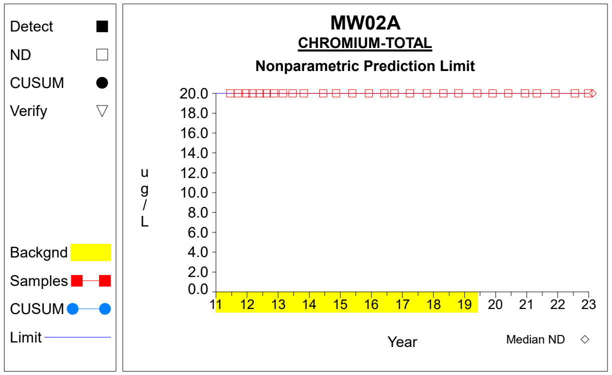
Graph 3



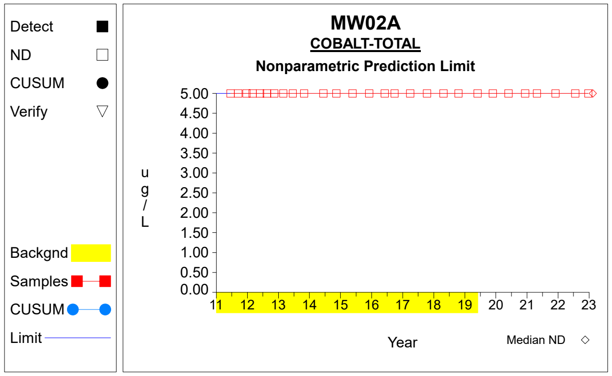
Graph 4



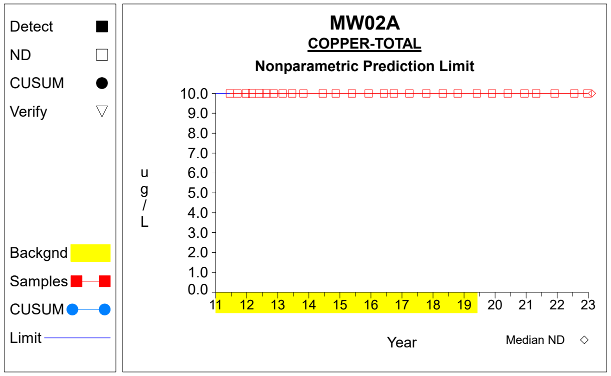
Graph 5



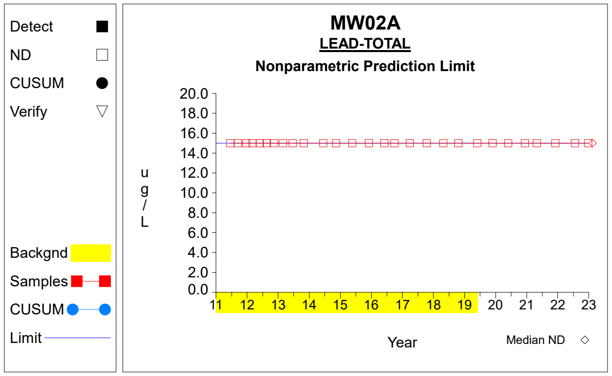
Graph 6



Graph 7

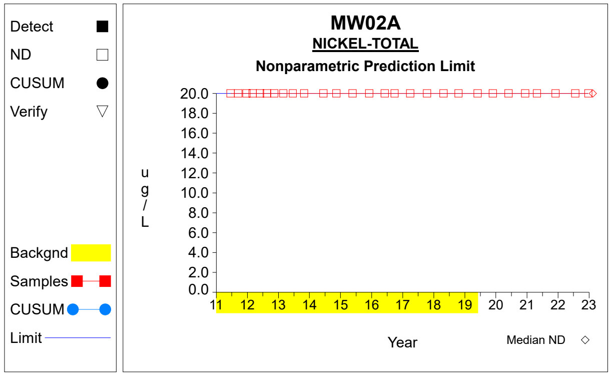


Graph 8

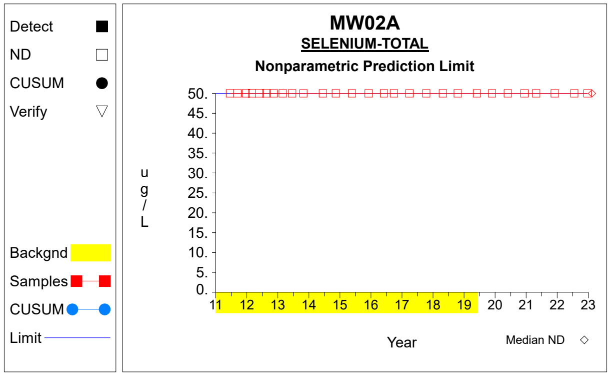


Graph 9

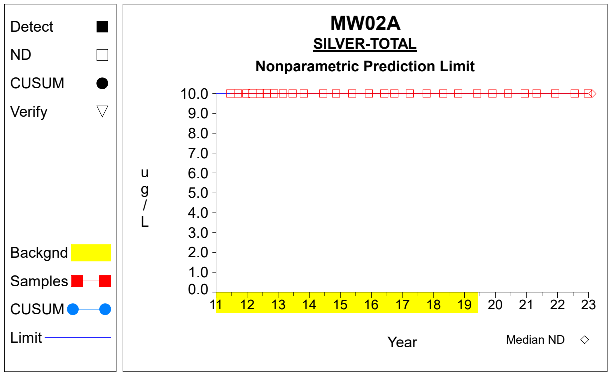
Intra-Well Control Charts / Prediction Limits



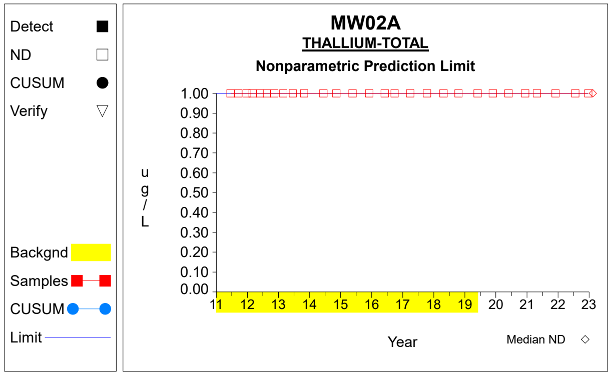
Graph 10



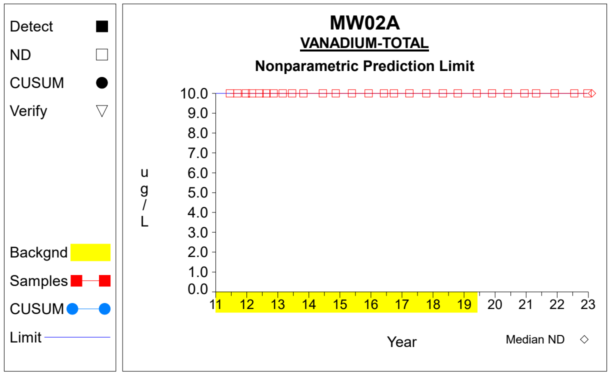
Graph 11



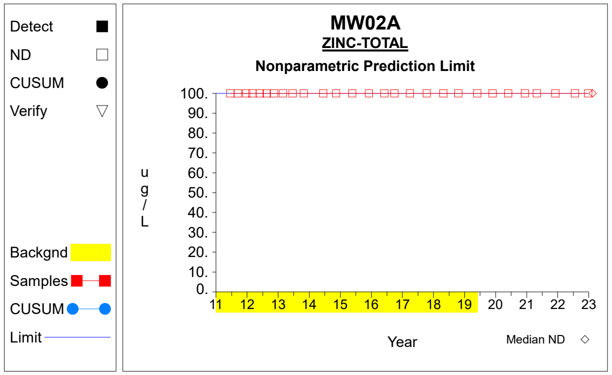
Graph 12



Graph 13

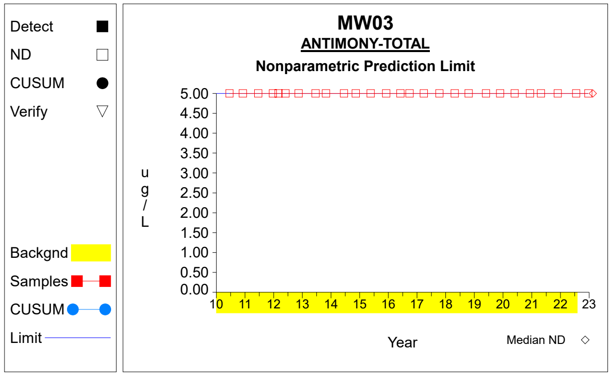


Graph 14

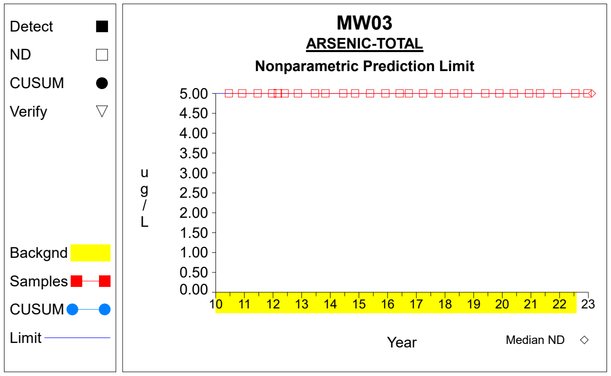


Graph 15

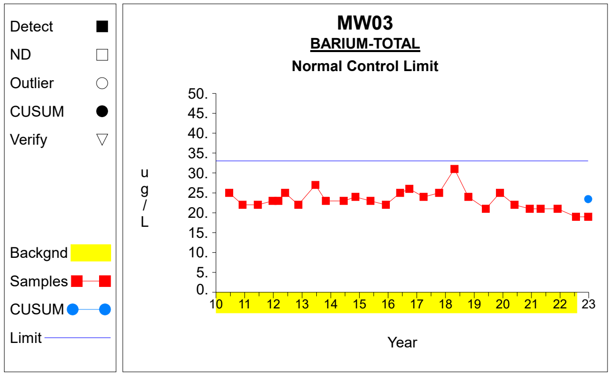
Intra-Well Control Charts / Prediction Limits



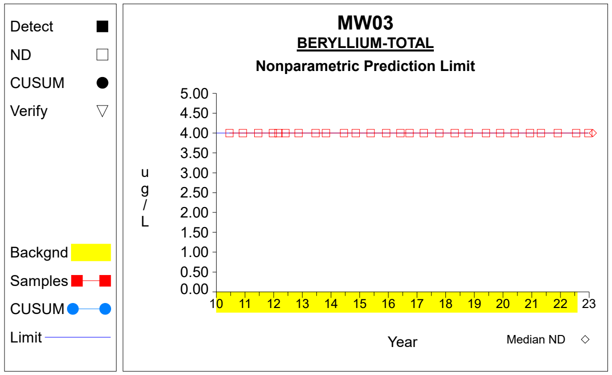
Graph 16



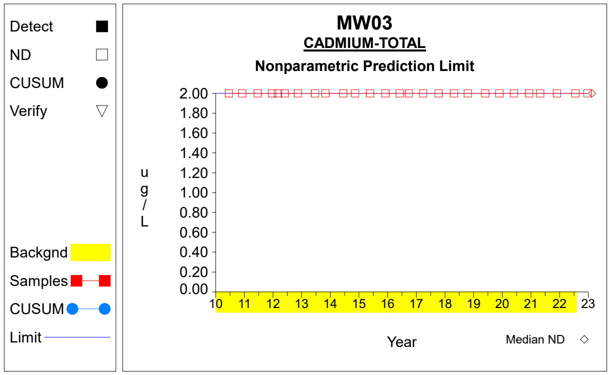
Graph 17



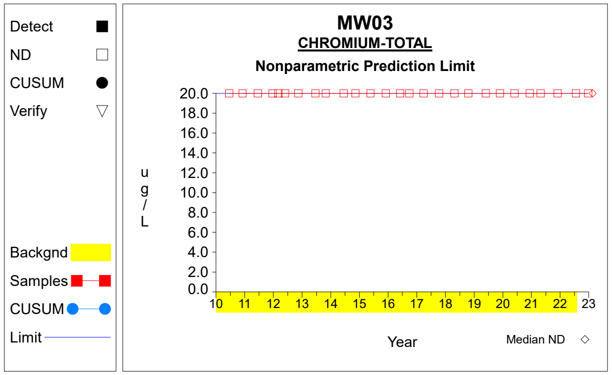
Graph 18



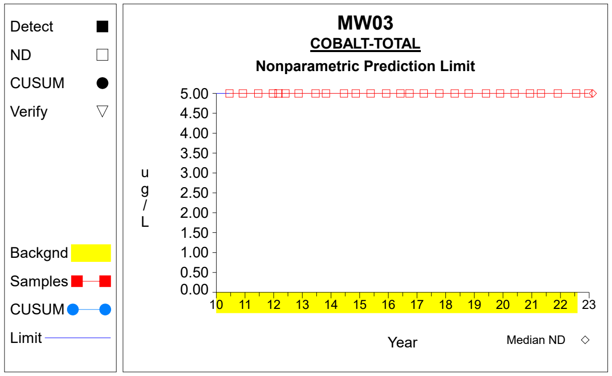
Graph 19



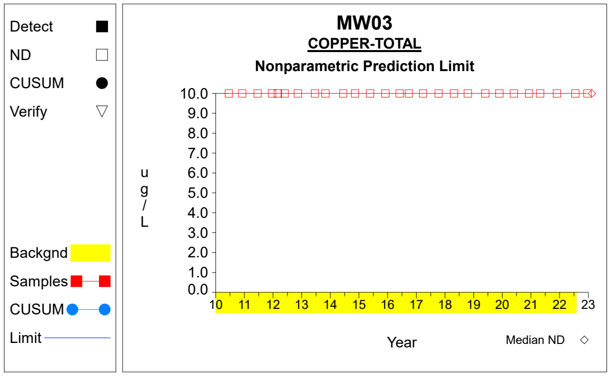
Graph 20



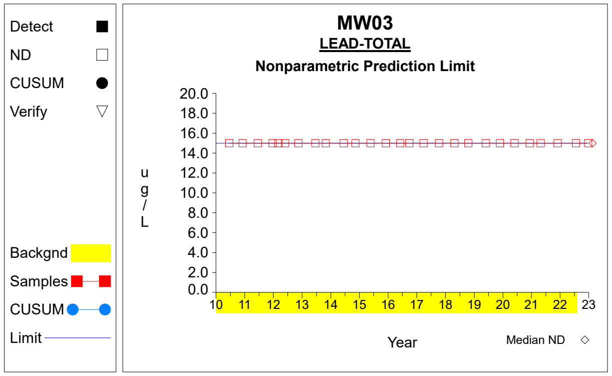
Graph 21



Graph 22

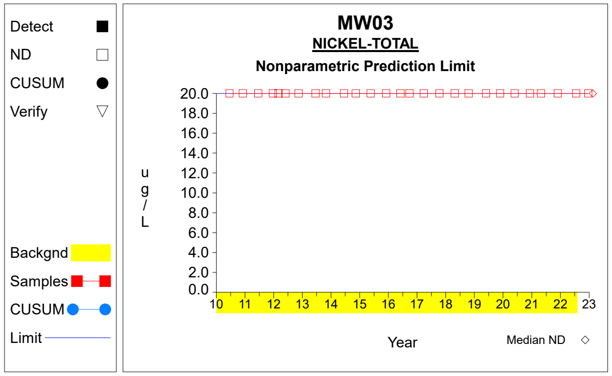


Graph 23

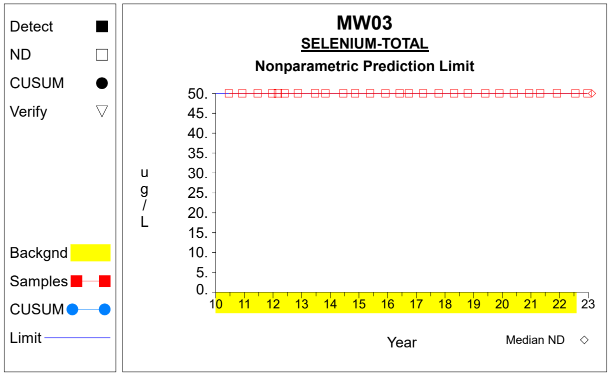


Graph 24

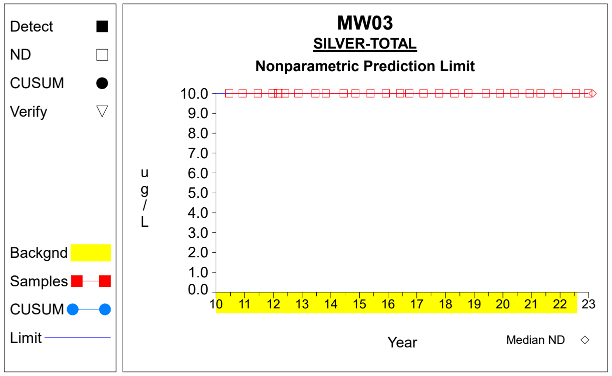
Intra-Well Control Charts / Prediction Limits



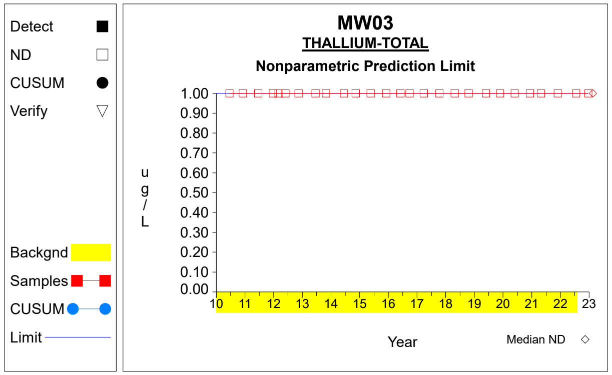
Graph 25



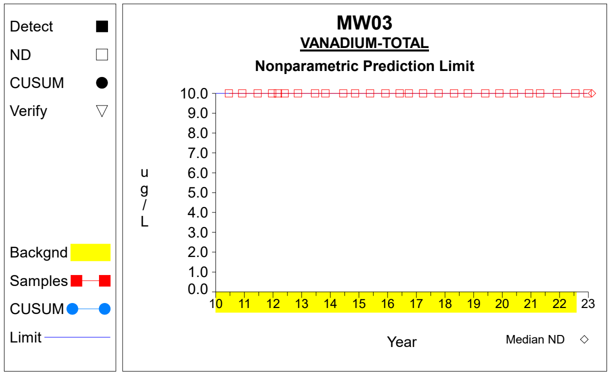
Graph 26



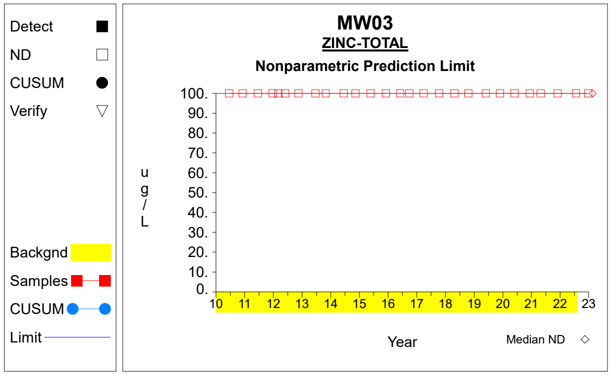
Graph 27



Graph 28

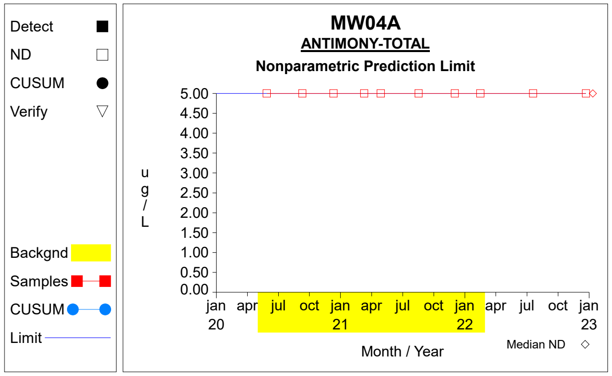


Graph 29

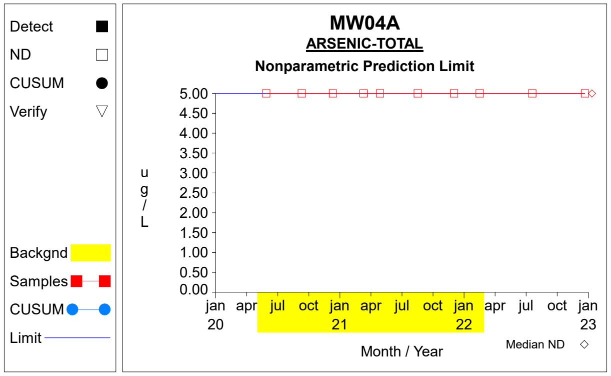


Graph 30

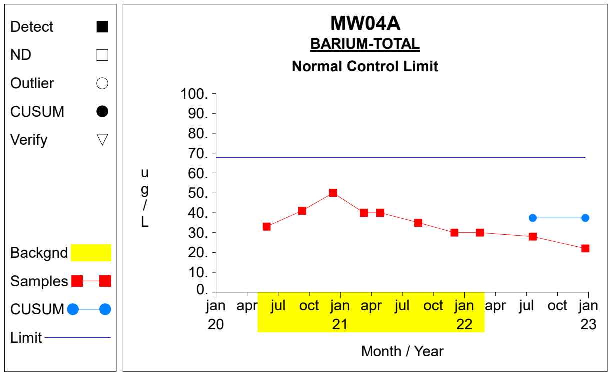
Intra-Well Control Charts / Prediction Limits



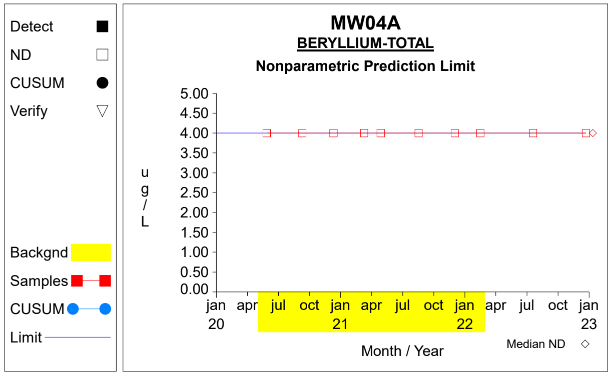
Graph 31



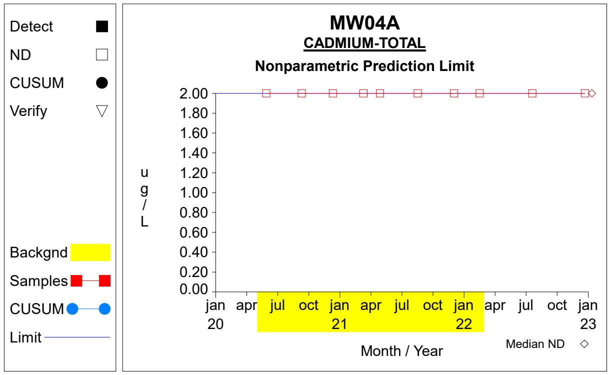
Graph 32



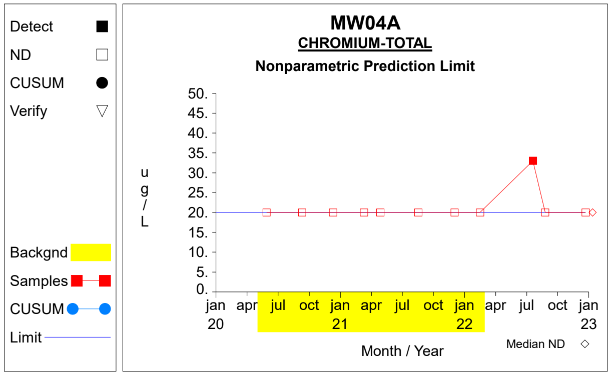
Graph 33



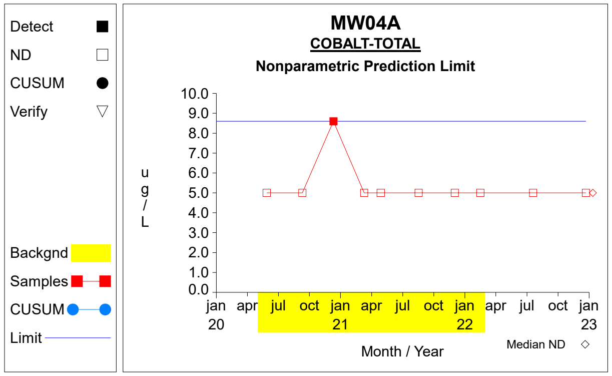
Graph 34



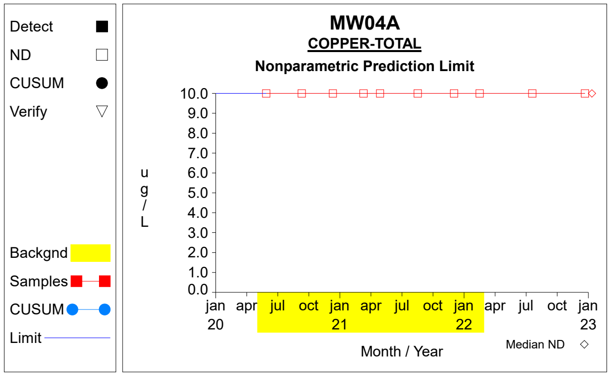
Graph 35



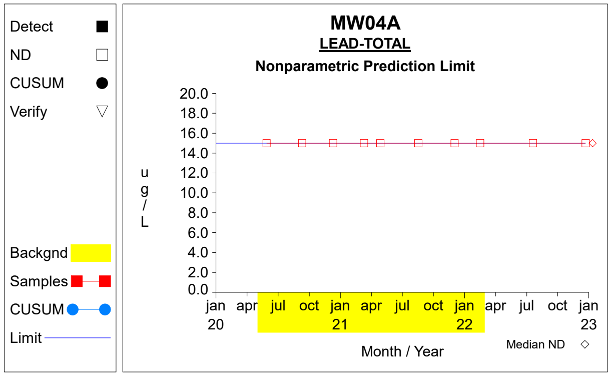
Graph 36



Graph 37

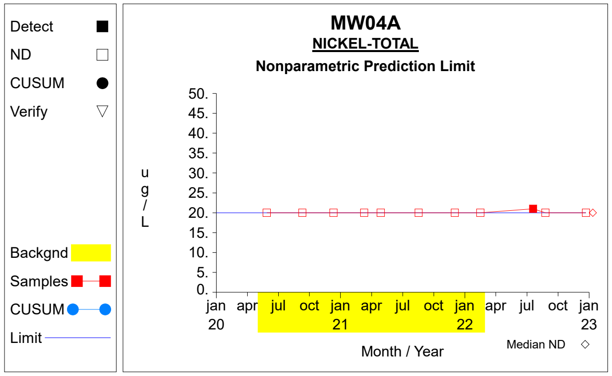


Graph 38

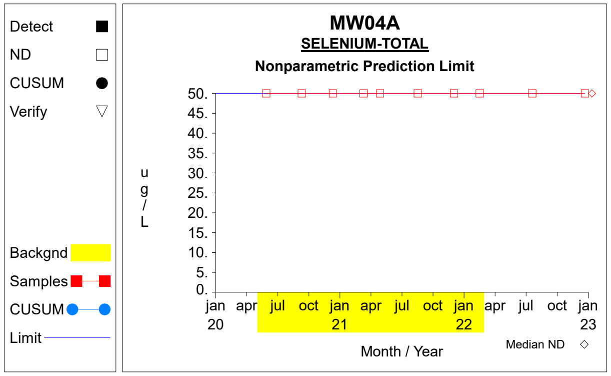


Graph 39

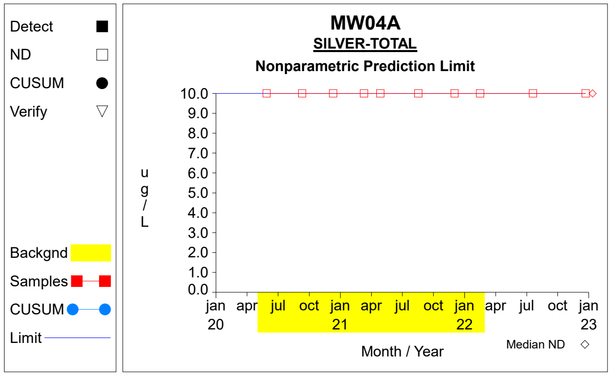
Intra-Well Control Charts / Prediction Limits



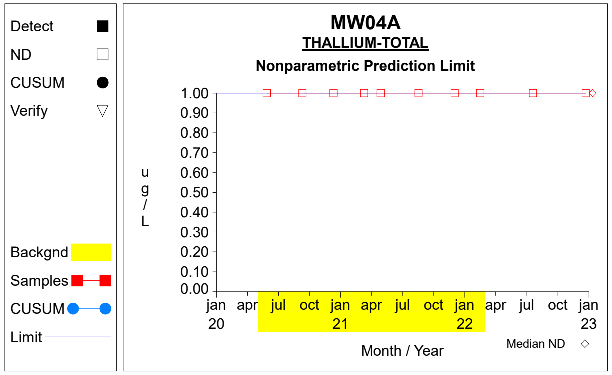
Graph 40



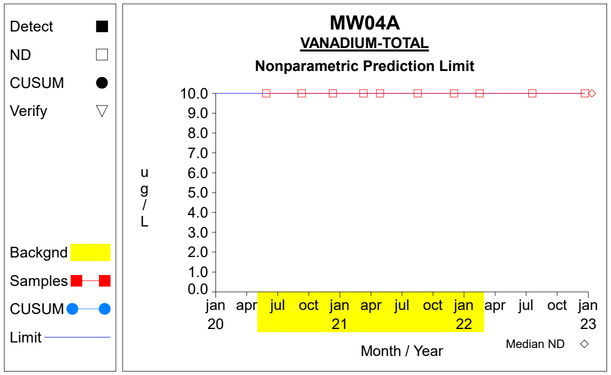
Graph 41



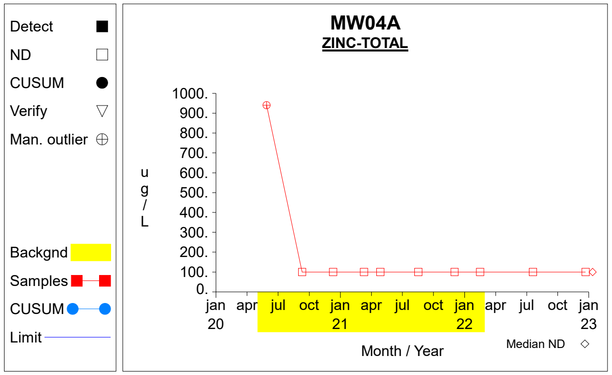
Graph 42



Graph 43

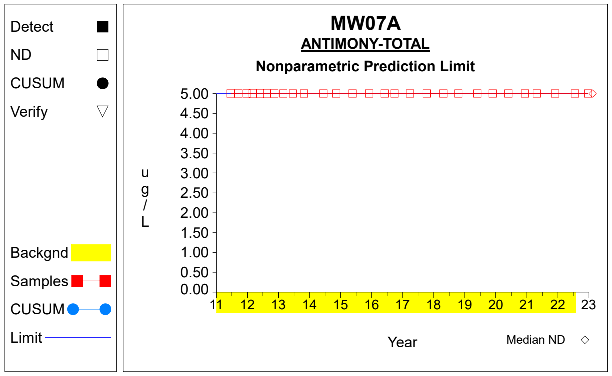


Graph 44

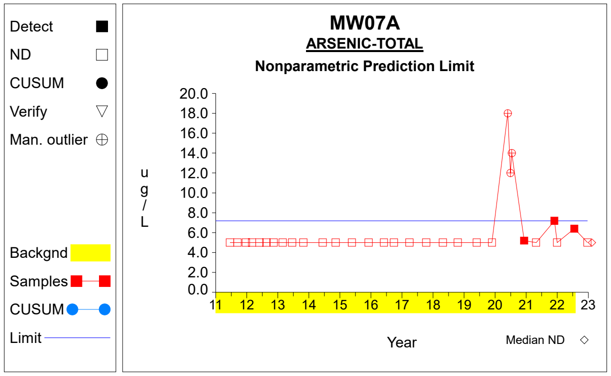


Graph 45

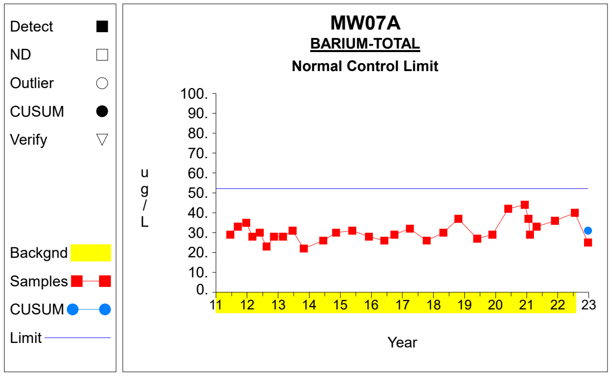
Intra-Well Control Charts / Prediction Limits



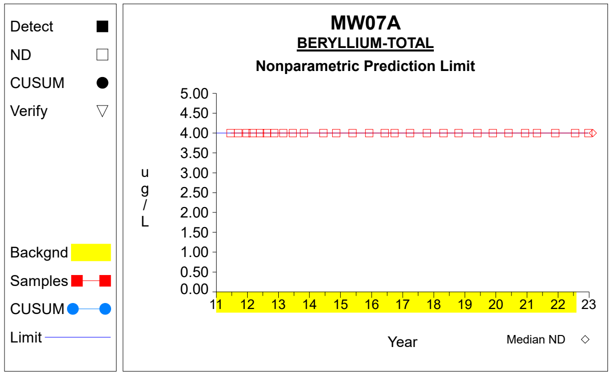
Graph 46



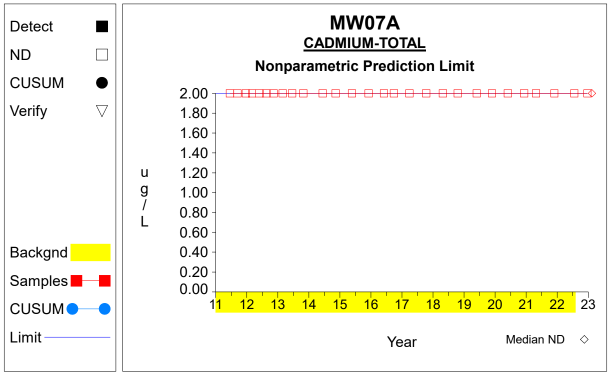
Graph 47



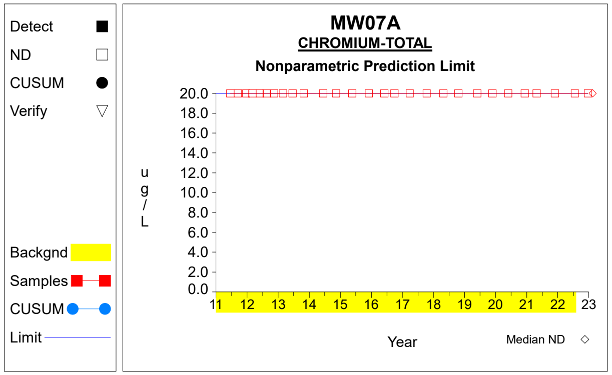
Graph 48



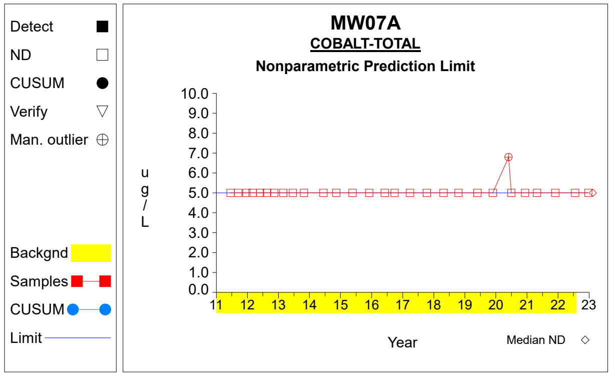
Graph 49



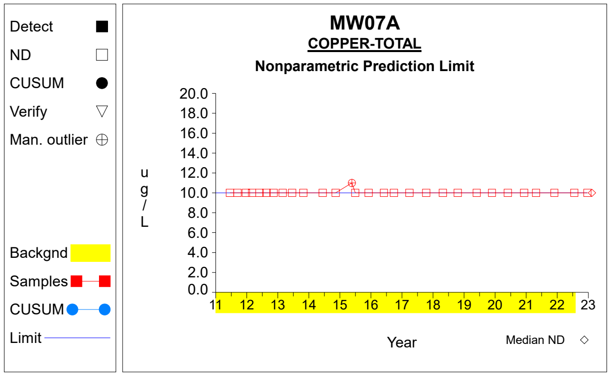
Graph 50



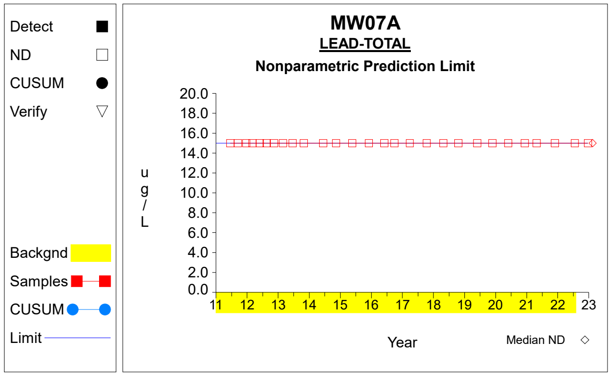
Graph 51



Graph 52

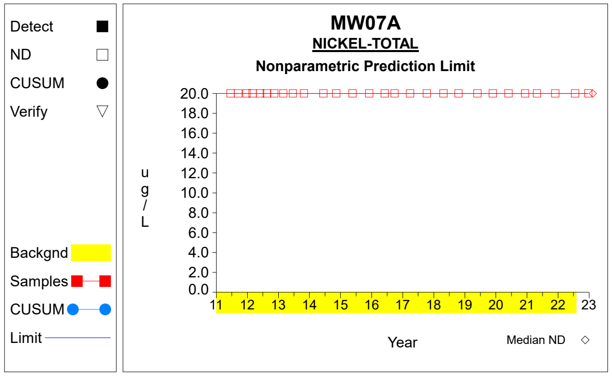


Graph 53

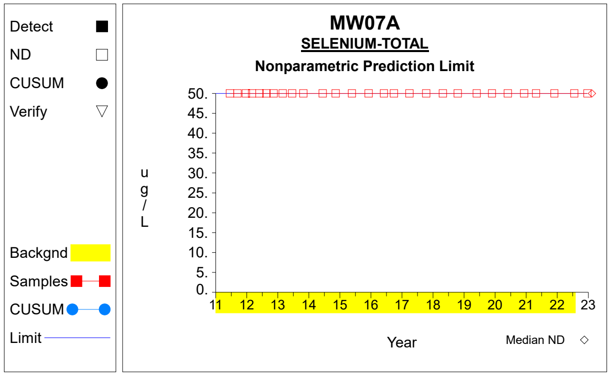


Graph 54

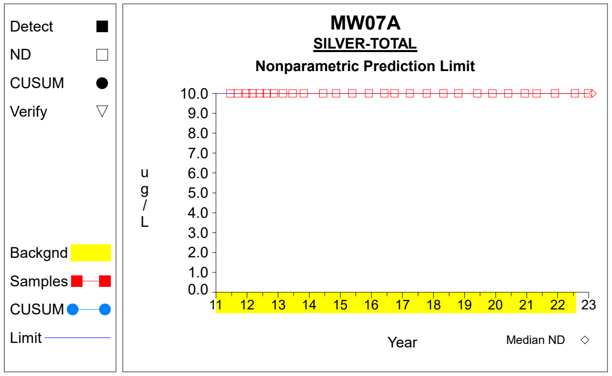
Intra-Well Control Charts / Prediction Limits



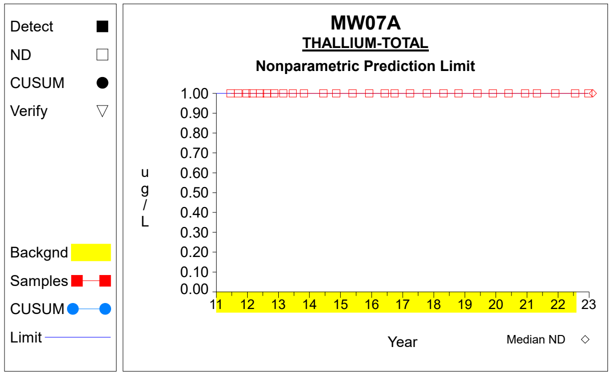
Graph 55



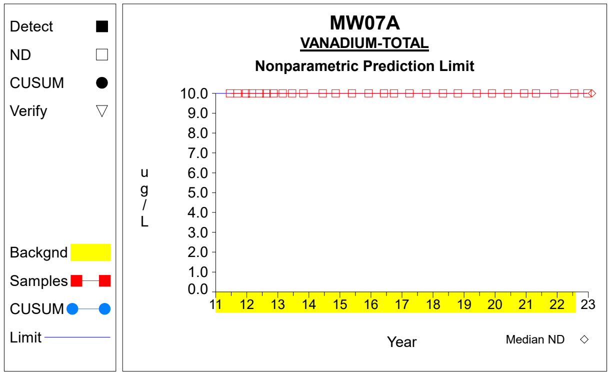
Graph 56



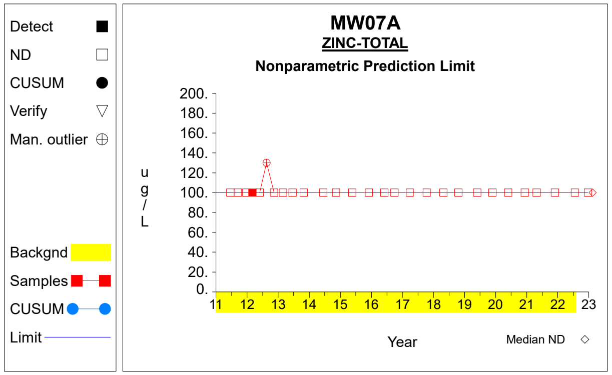
Graph 57



Graph 58

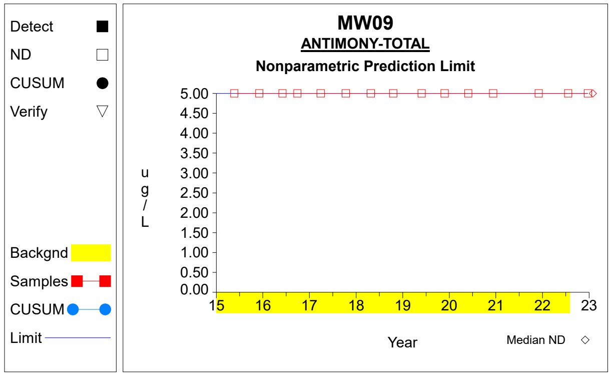


Graph 59

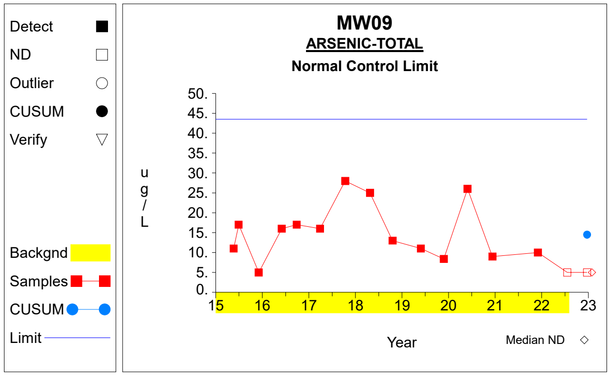


Graph 60

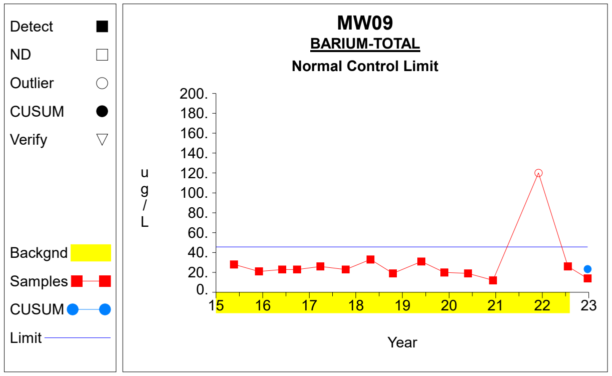
Intra-Well Control Charts / Prediction Limits



Graph 61



Graph 62



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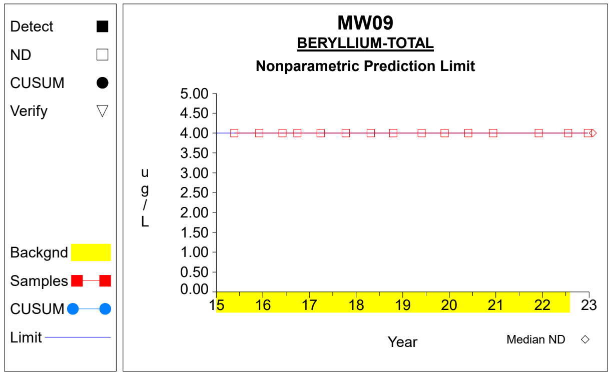

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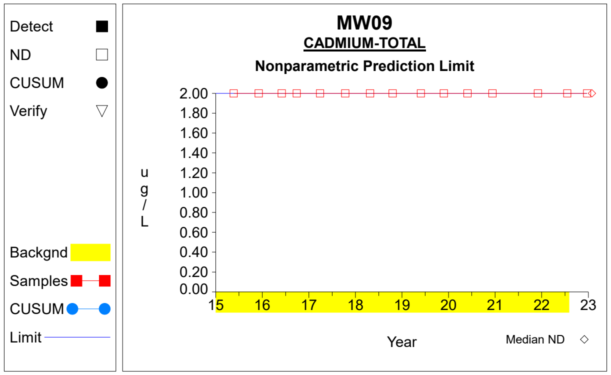

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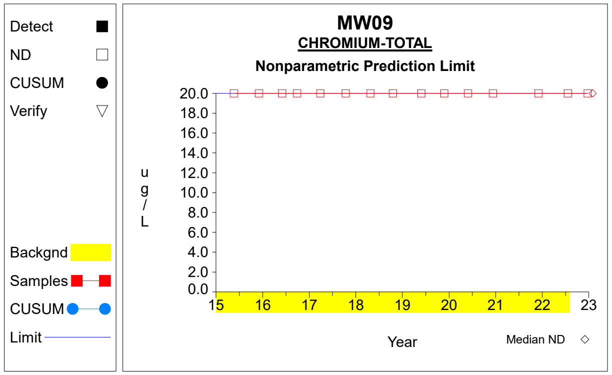

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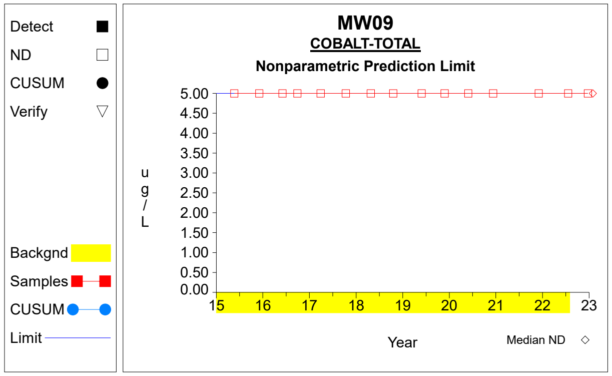

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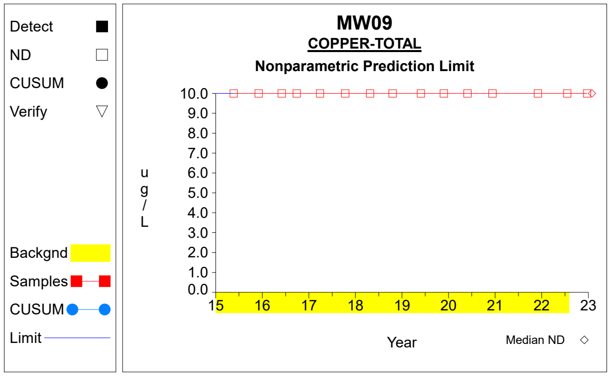
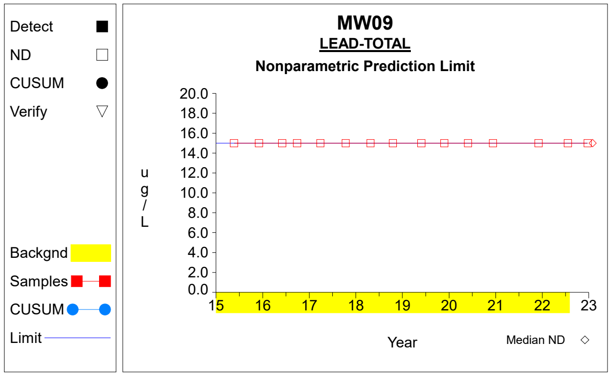
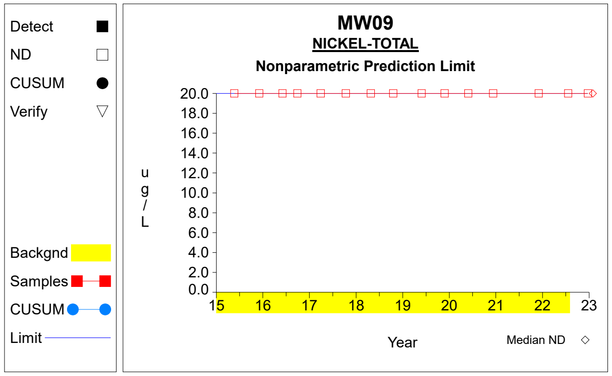


Graph 68

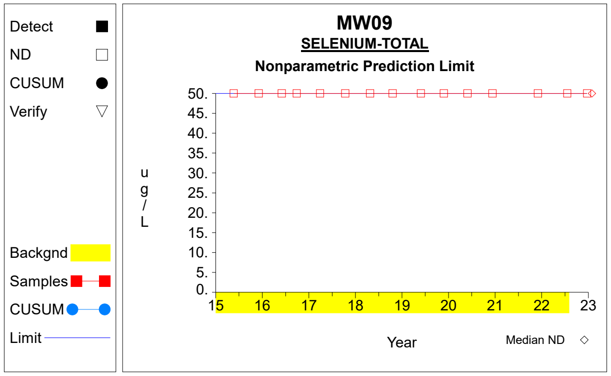


Graph 69

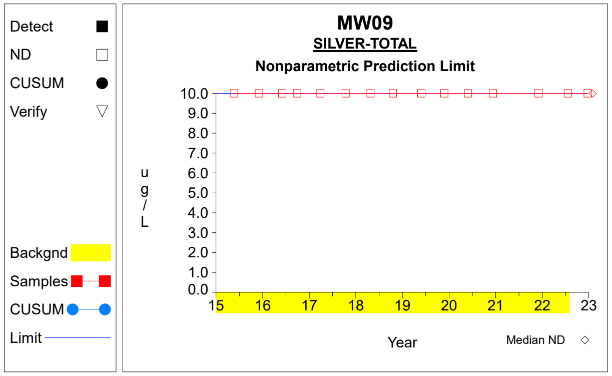
Intra-Well Control Charts / Prediction Limits



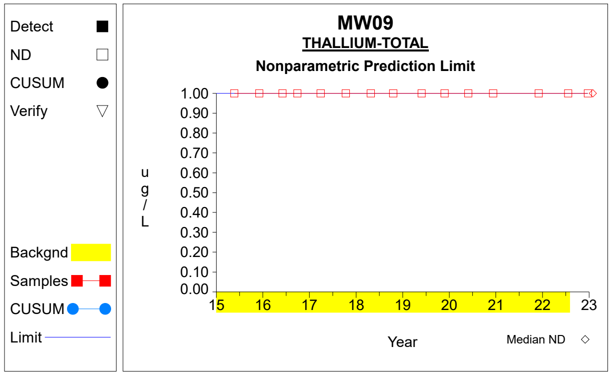
Graph 70



Graph 71



Graph 72



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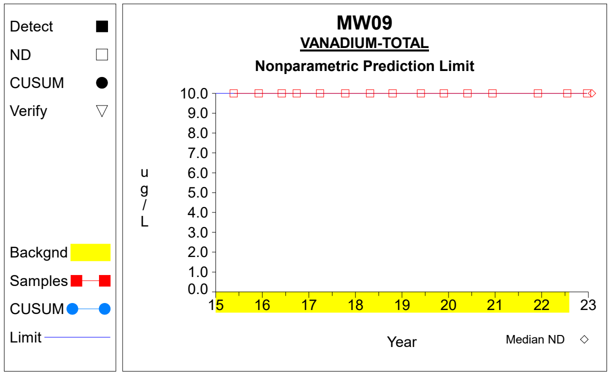
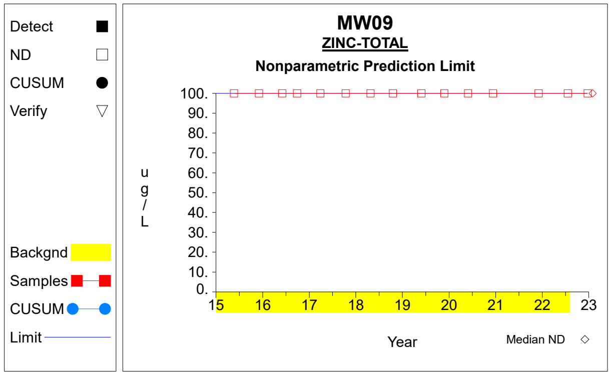
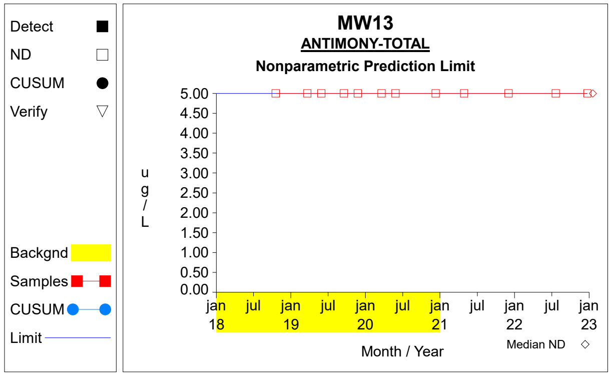


Graph 74

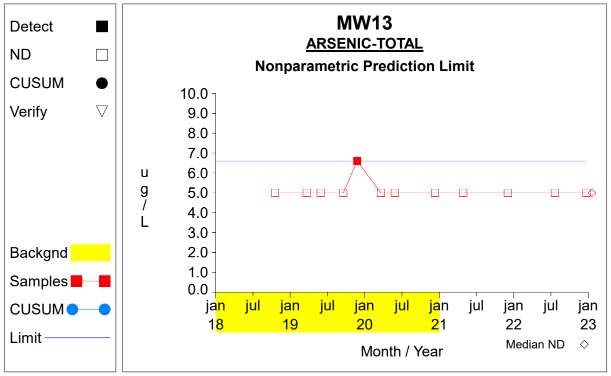


Graph 75

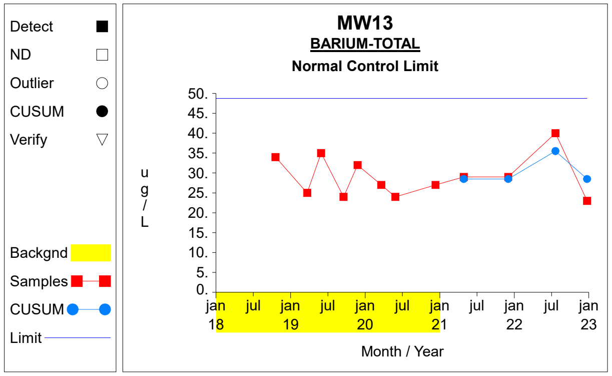
Intra-Well Control Charts / Prediction Limits



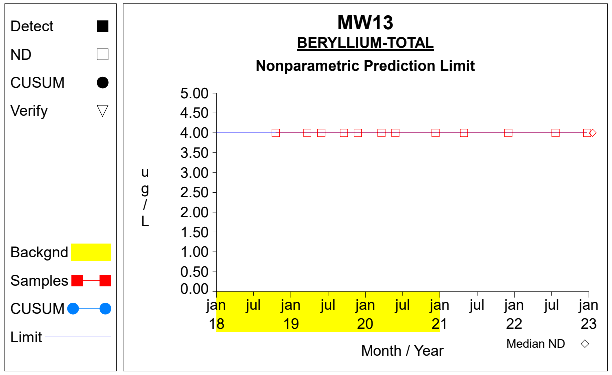
Graph 76



Graph 77



Graph 78



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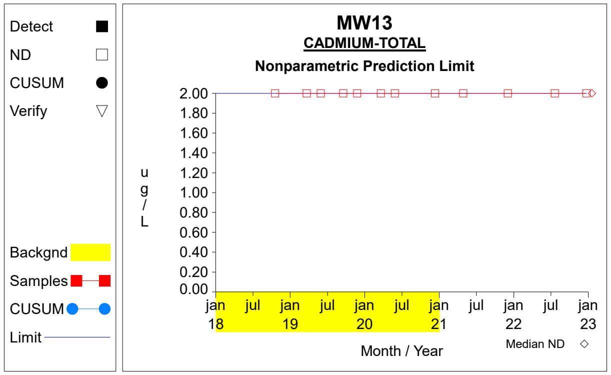

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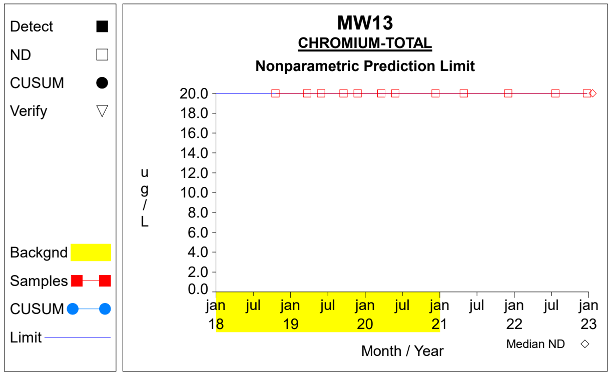
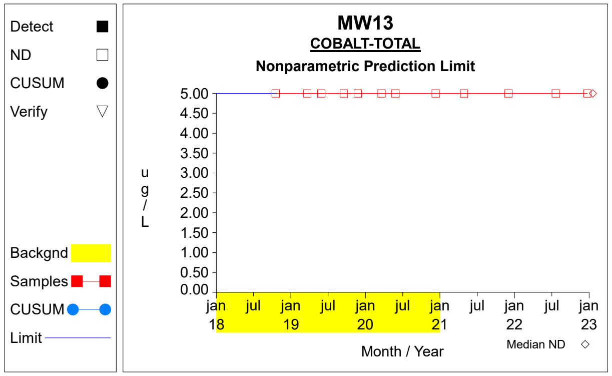
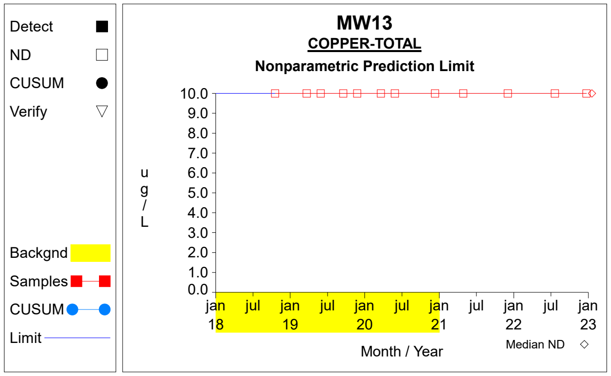


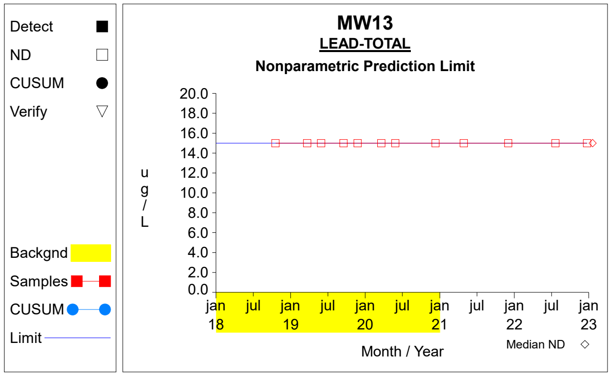
Graph 81



Graph 82

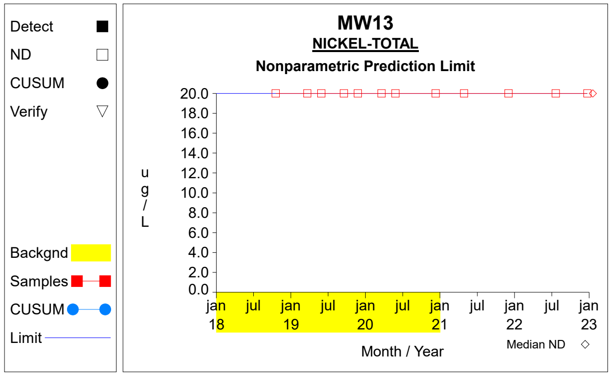


Graph 83

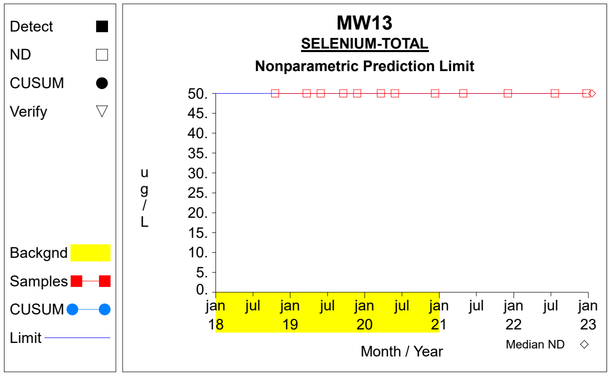


Graph 84

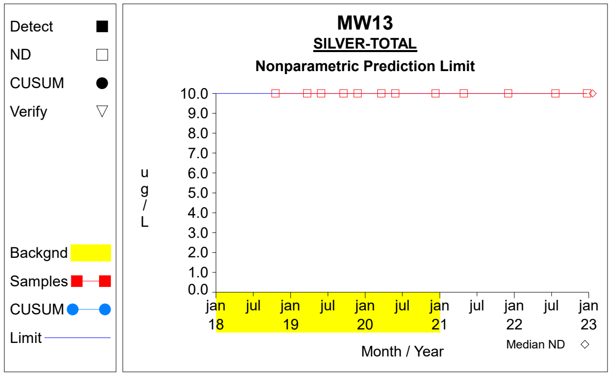
Intra-Well Control Charts / Prediction Limits



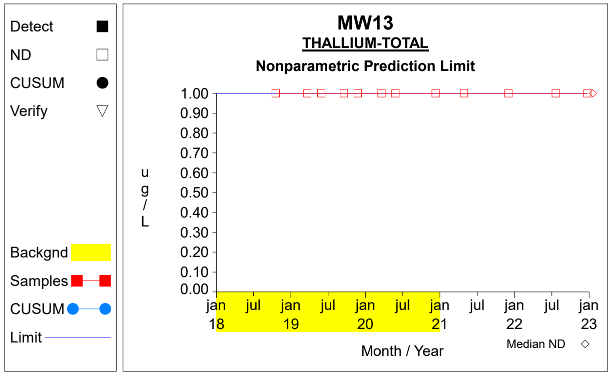
Graph 85



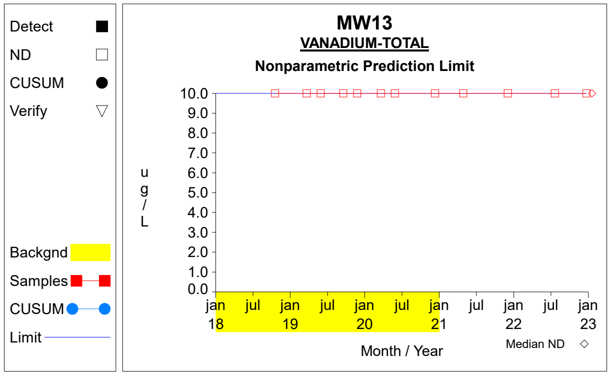
Graph 86



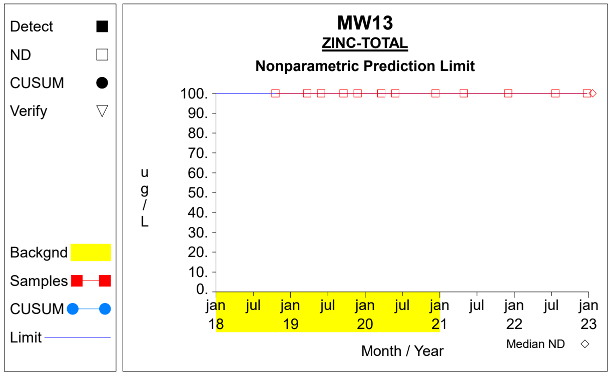
Graph 87



Graph 88

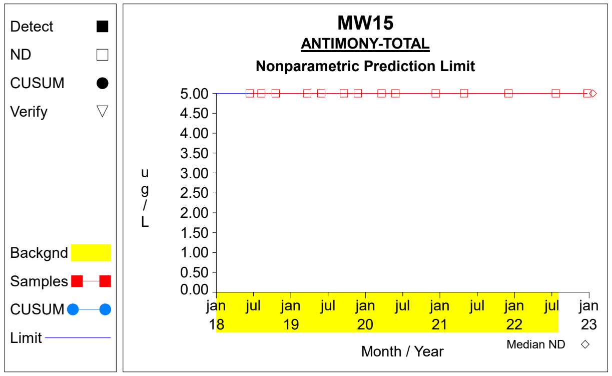


Graph 89

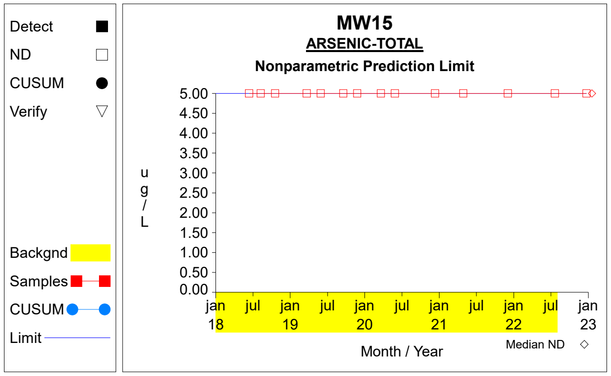


Graph 90

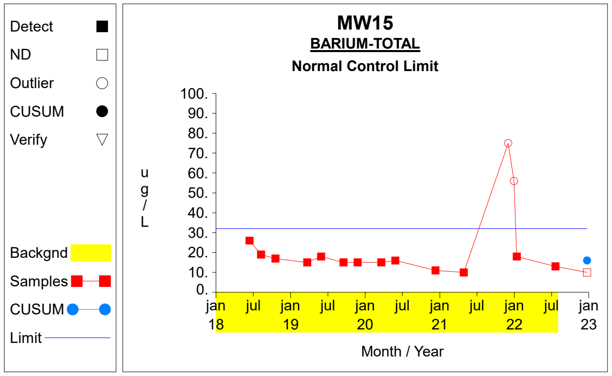
Intra-Well Control Charts / Prediction Limits



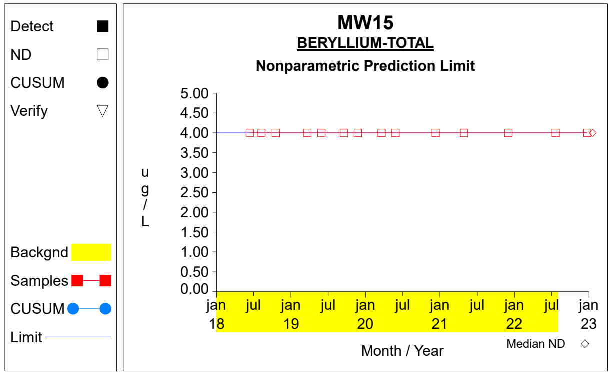
Graph 91



Graph 92



Graph 93



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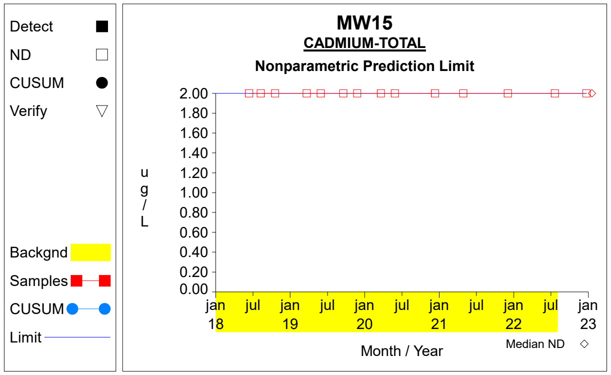
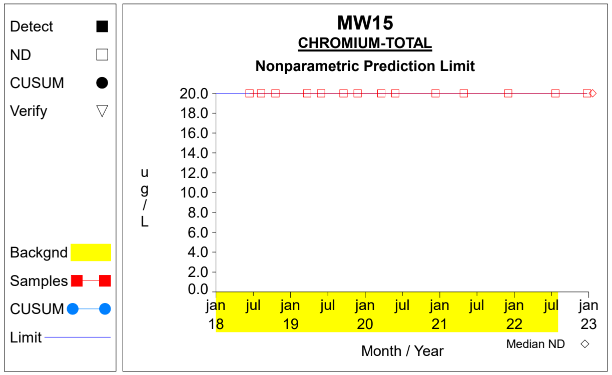
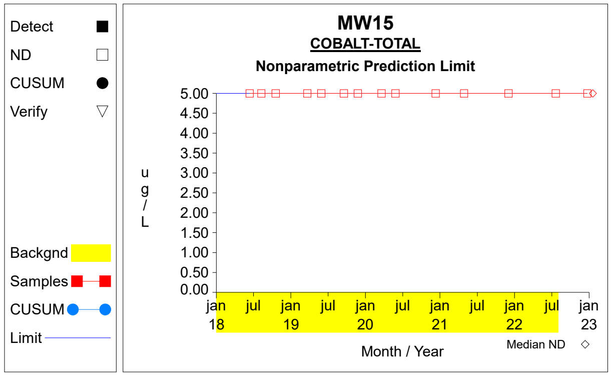


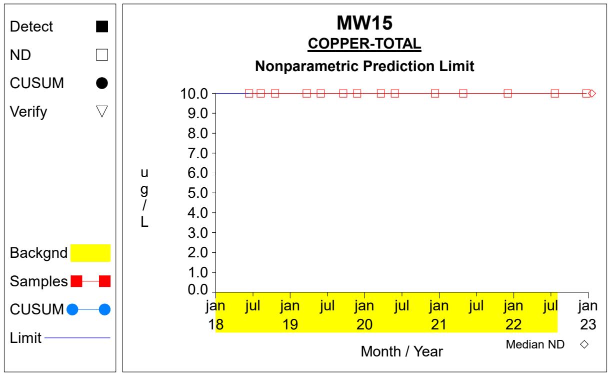
Graph 95



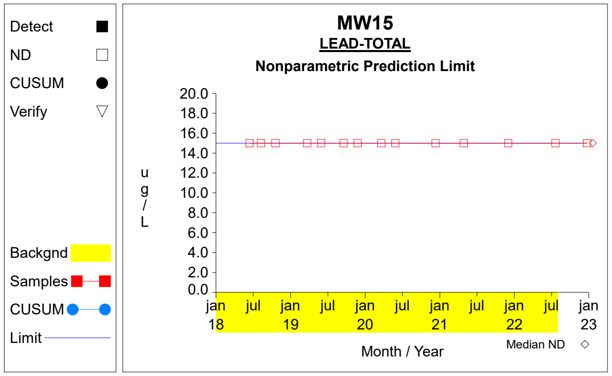
Graph 96



Graph 97

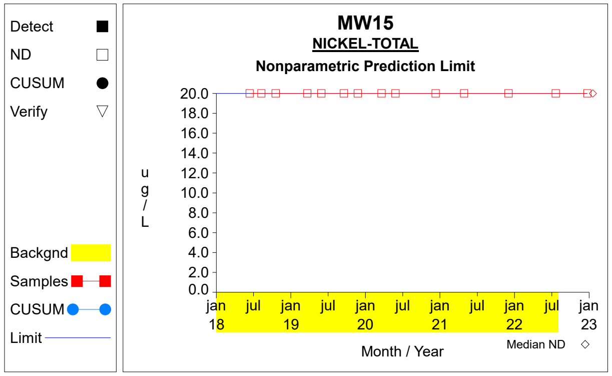


Graph 98

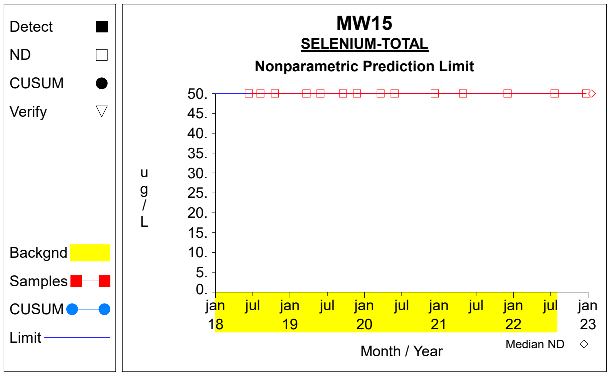


Graph 99

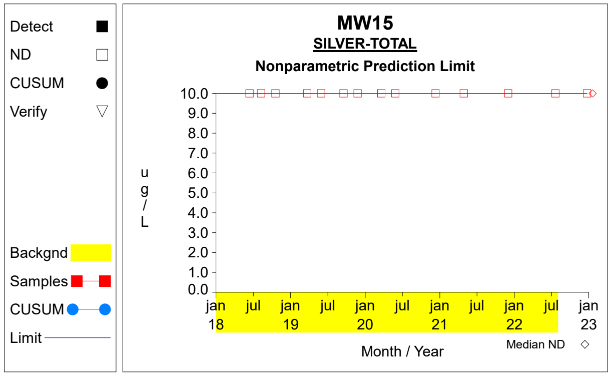
Intra-Well Control Charts / Prediction Limits



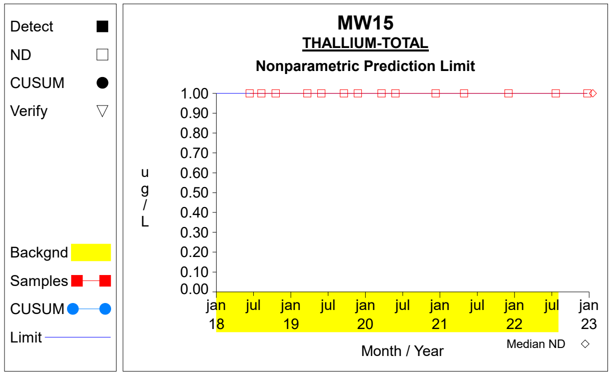
Graph 100



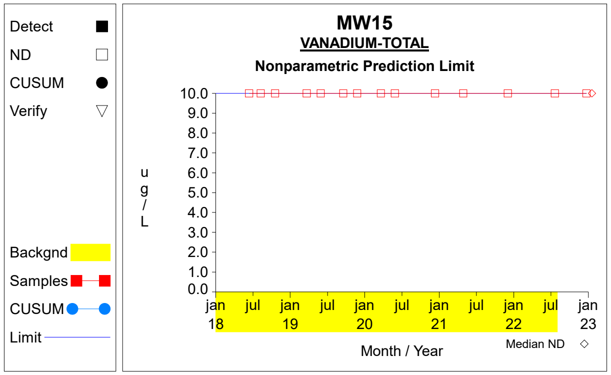
Graph 101



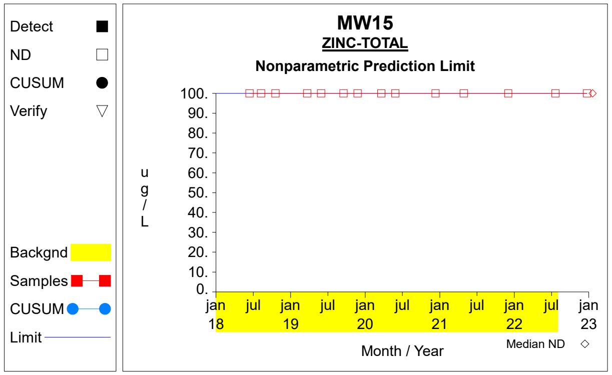
Graph 102



Graph 103

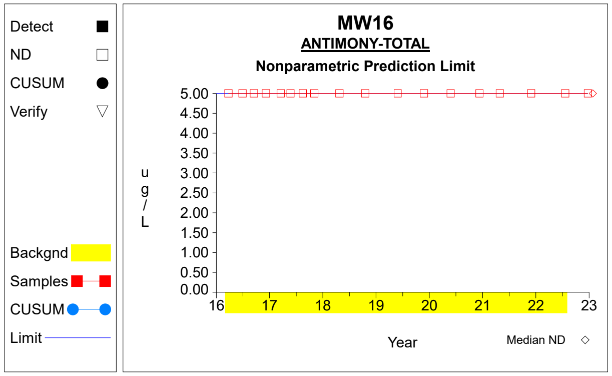


Graph 104



Graph 105

Intra-Well Control Charts / Prediction Limits



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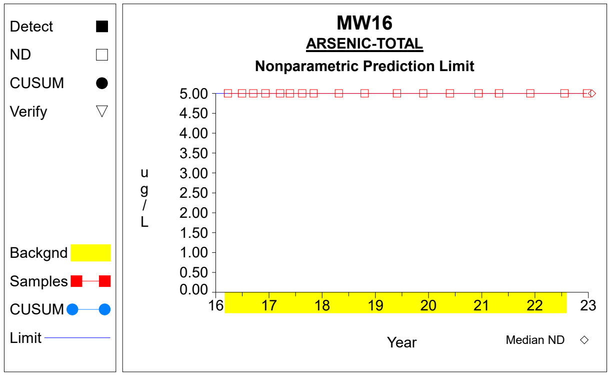
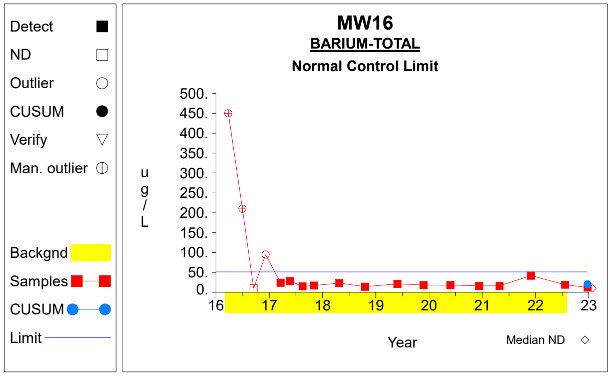
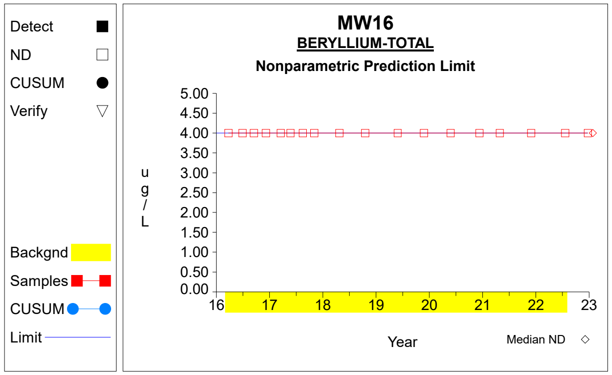


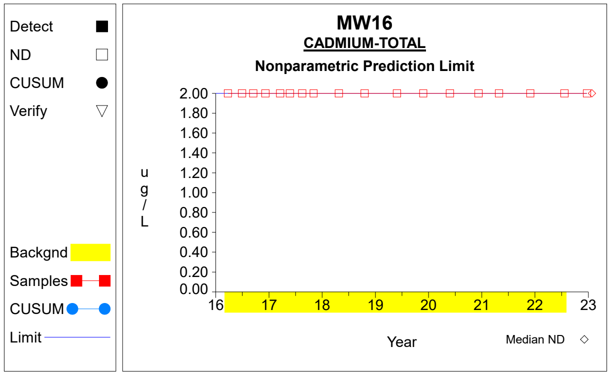
Graph 107



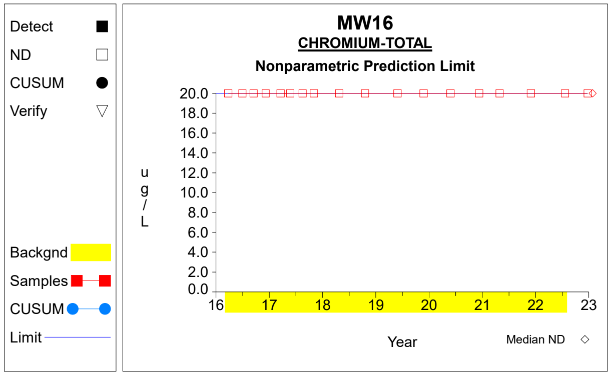
Graph 108



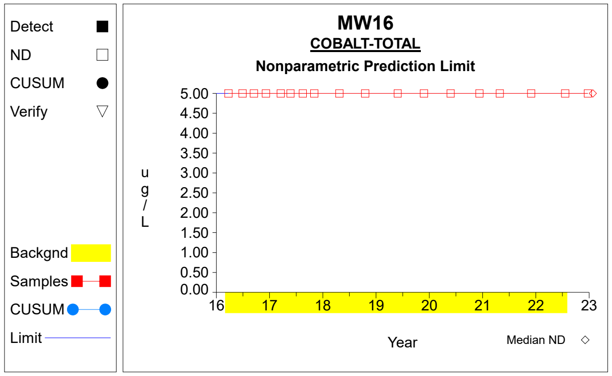
Graph 109



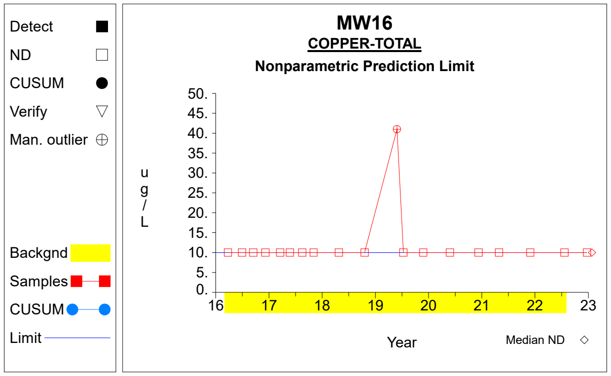
Graph 110



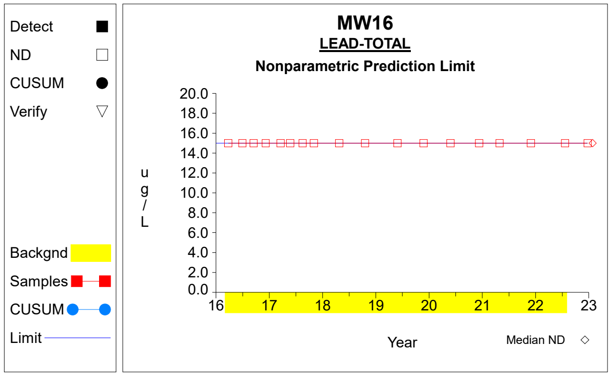
Graph 111



Graph 112

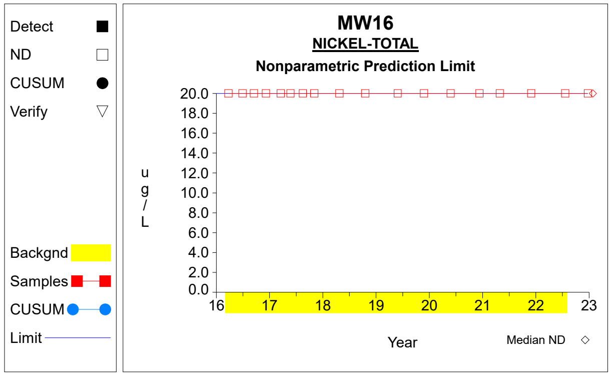


Graph 113

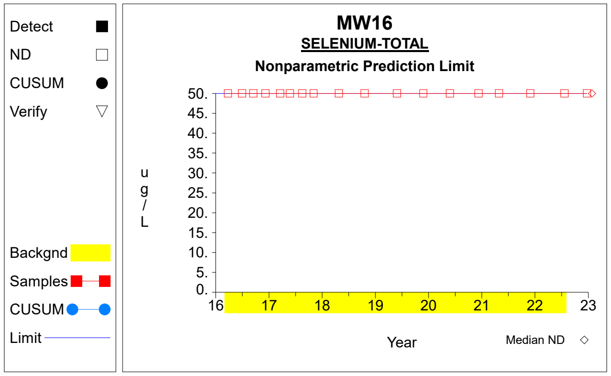


Graph 114

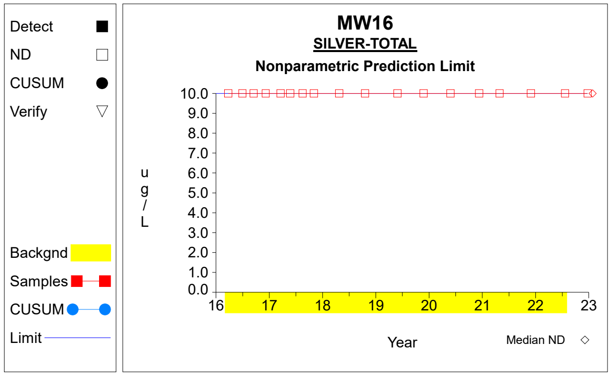
Intra-Well Control Charts / Prediction Limits



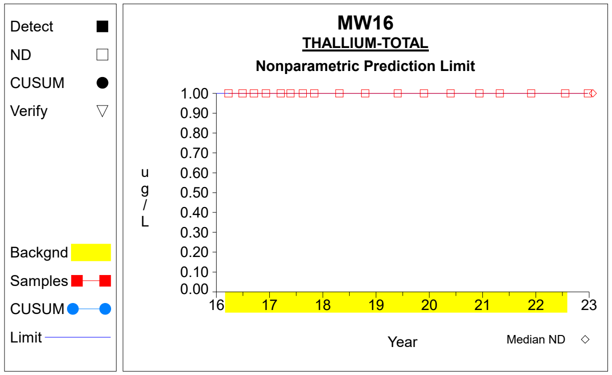
Graph 115



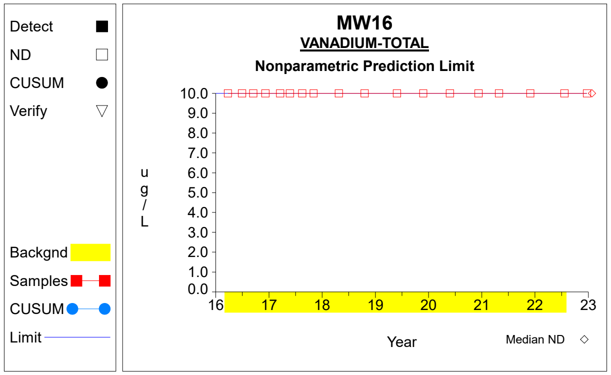
Graph 116



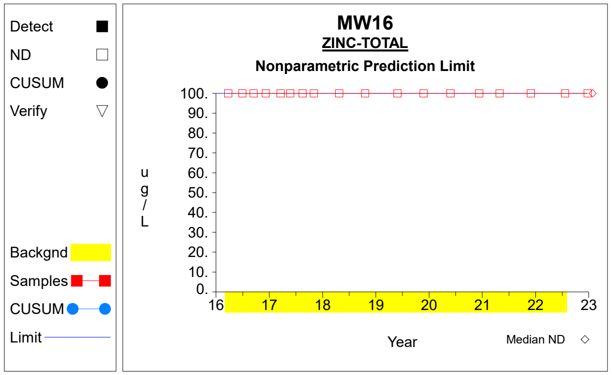
Graph 117



Graph 118

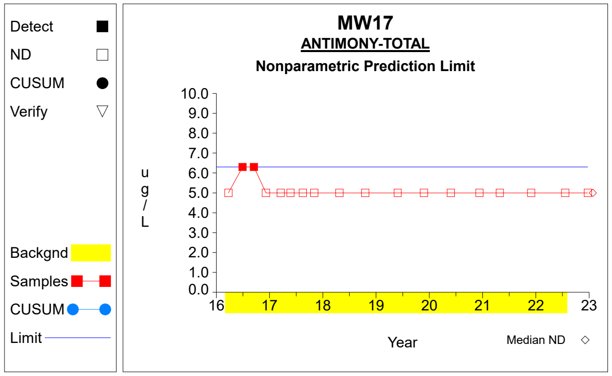


Graph 119

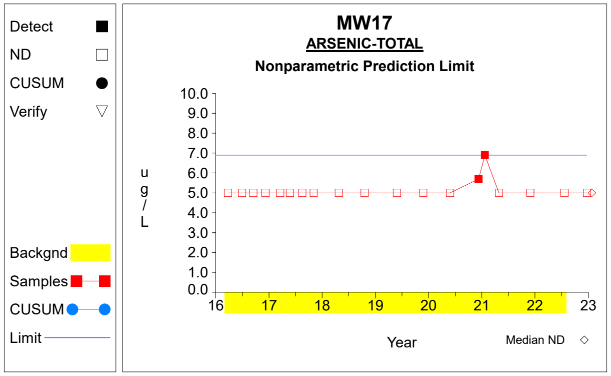


Graph 120

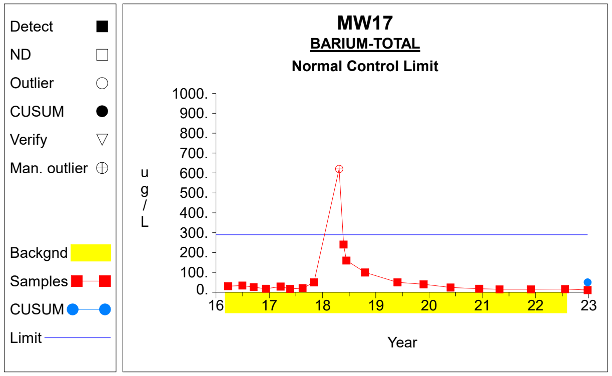
Intra-Well Control Charts / Prediction Limits



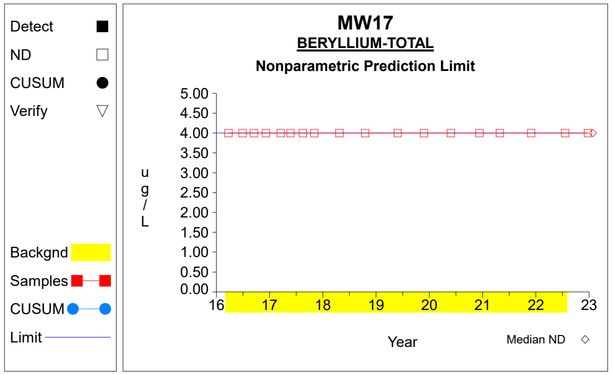
Graph 121



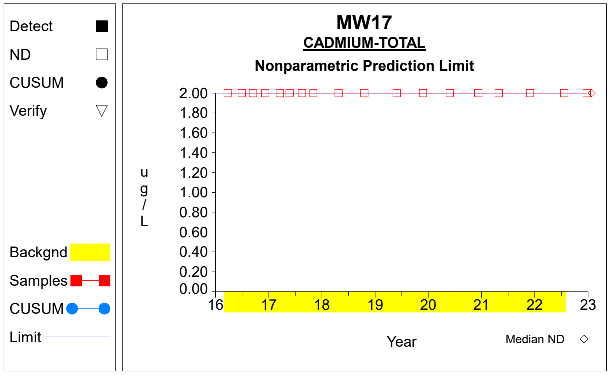
Graph 122



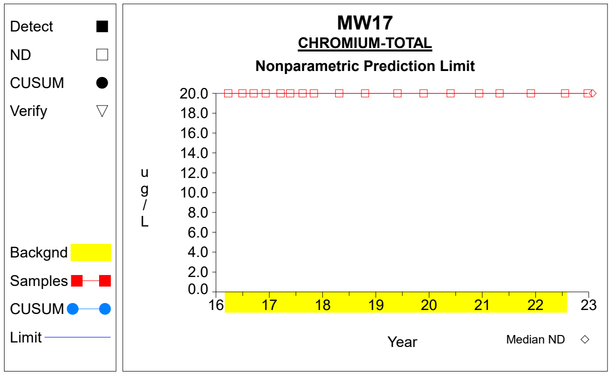
Graph 123



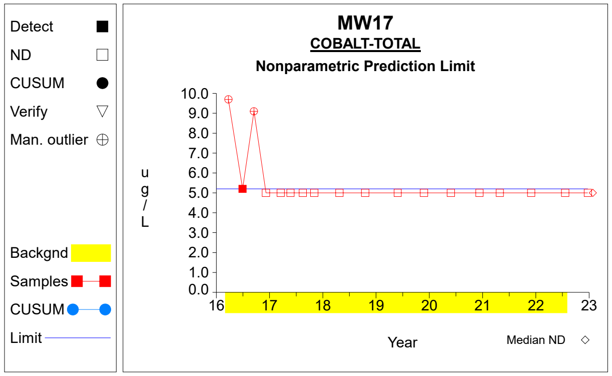
Graph 124



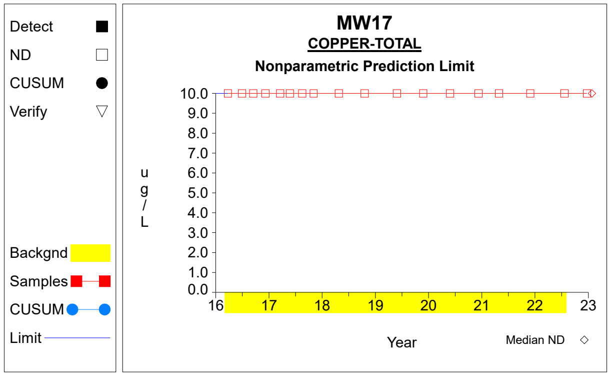
Graph 125



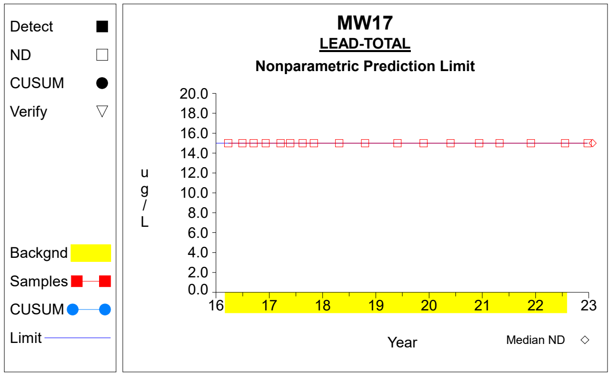
Graph 126



Graph 127

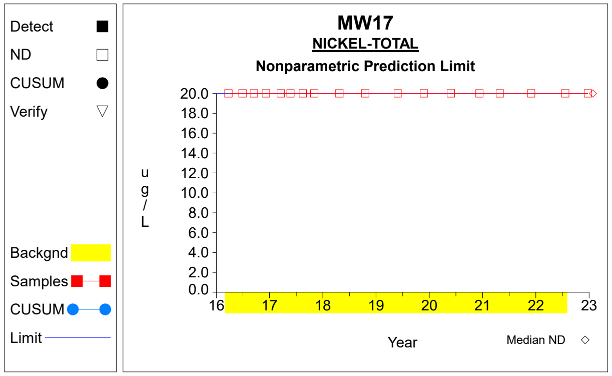


Graph 128

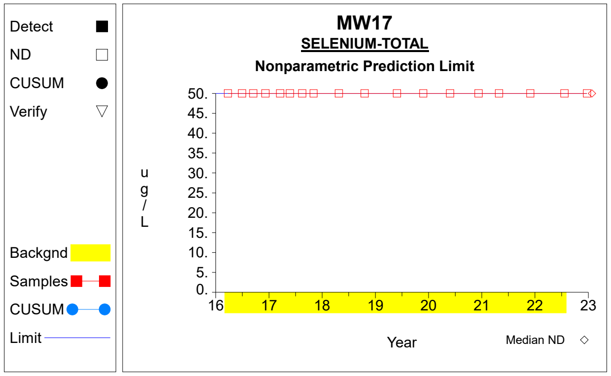


Graph 129

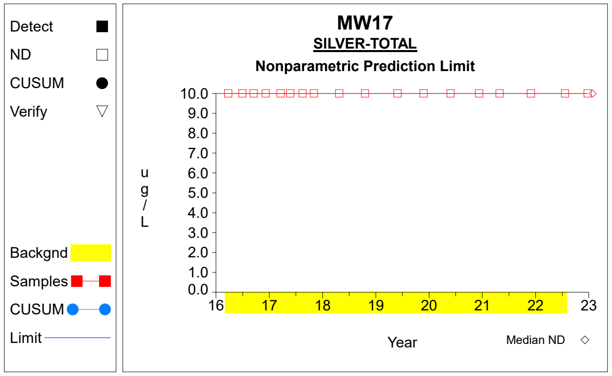
Intra-Well Control Charts / Prediction Limits



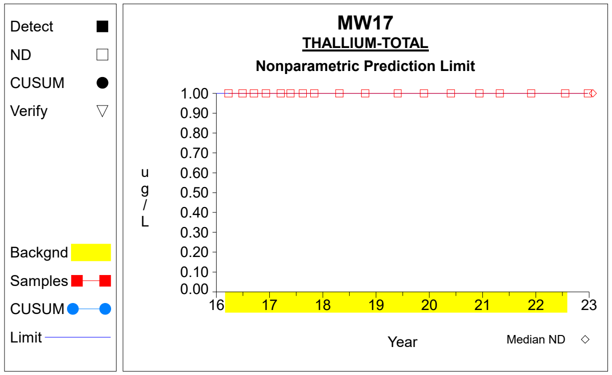
Graph 130



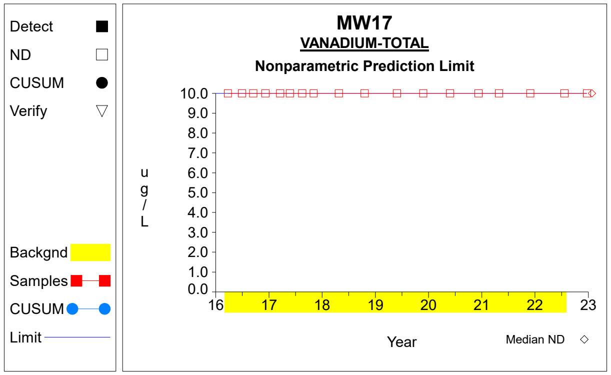
Graph 131



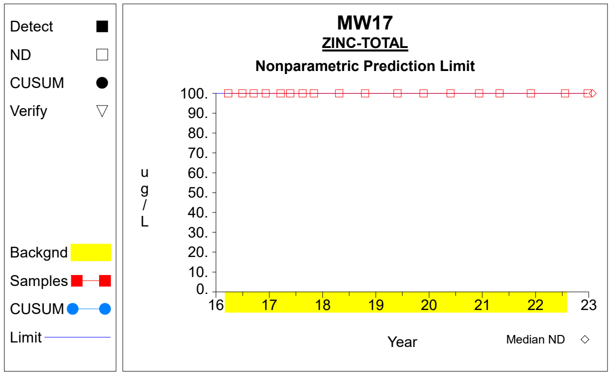
Graph 132



Graph 133

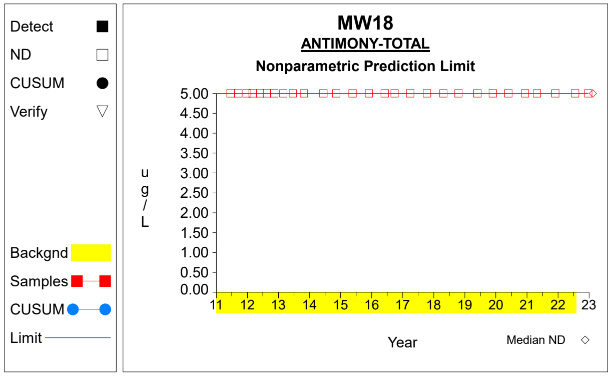


Graph 134

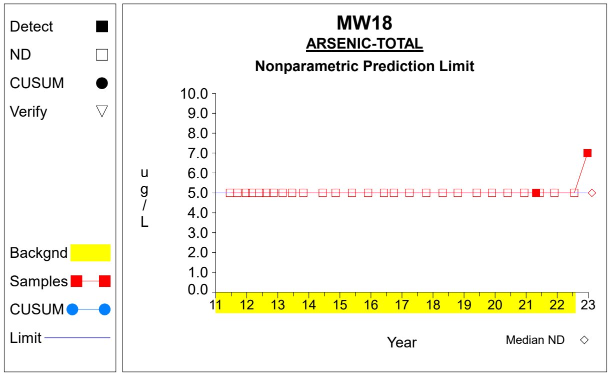


Graph 135

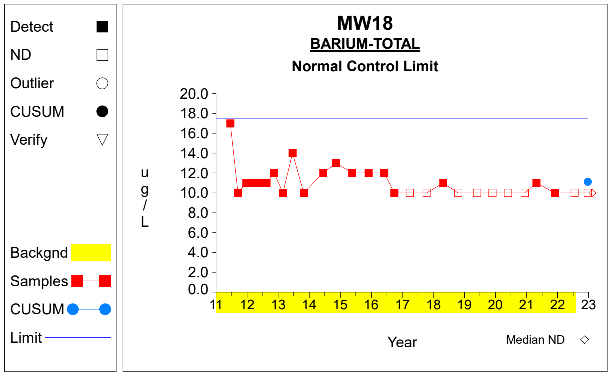
Intra-Well Control Charts / Prediction Limits



Graph 136



Graph 137



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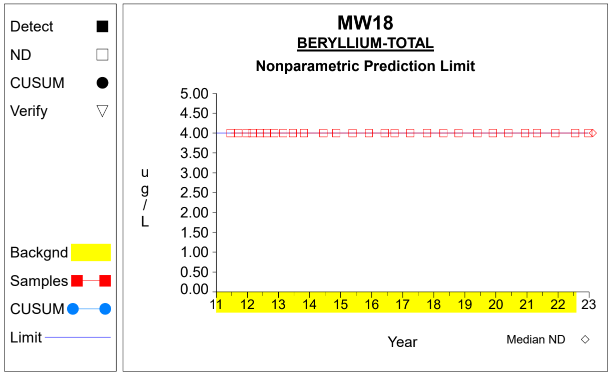
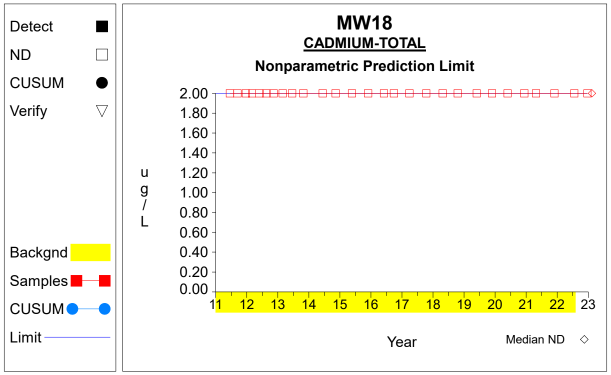


Graph 139



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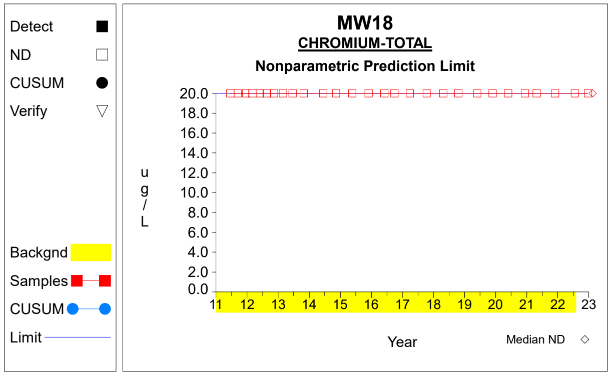

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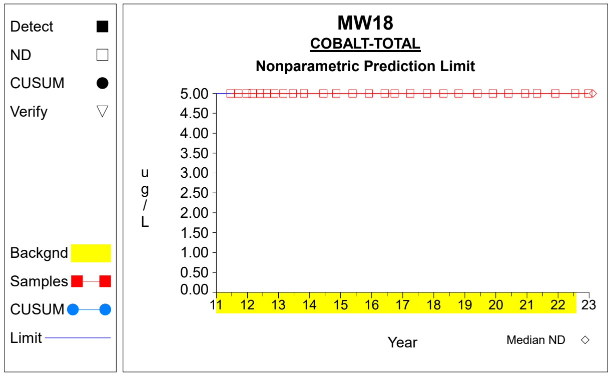

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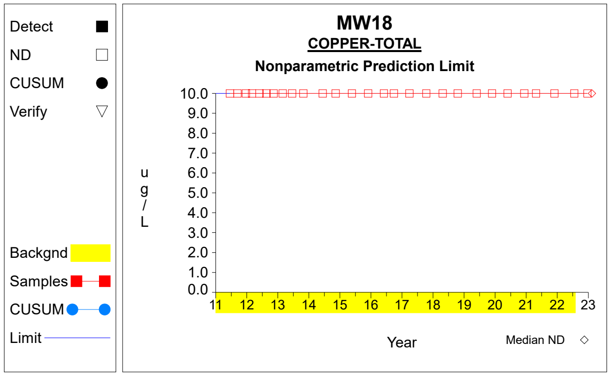
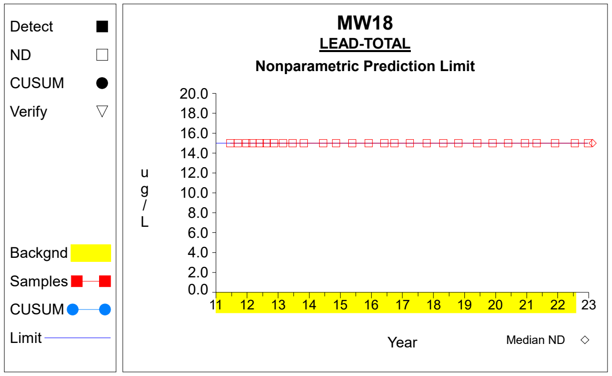
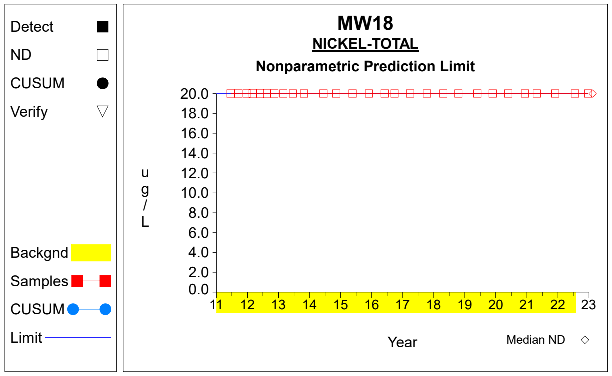


Graph 143



Graph 144

Intra-Well Control Charts / Prediction Limits



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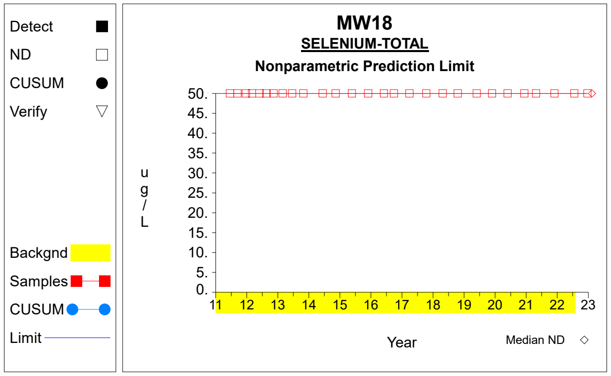
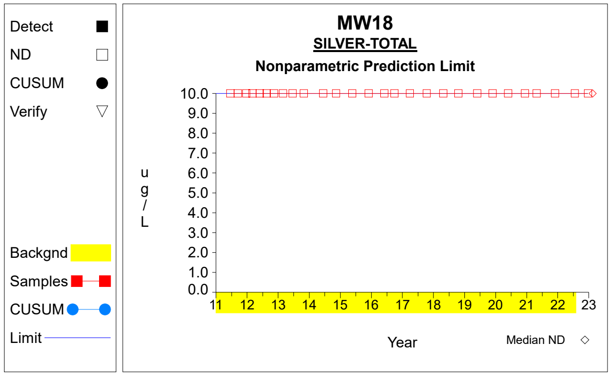
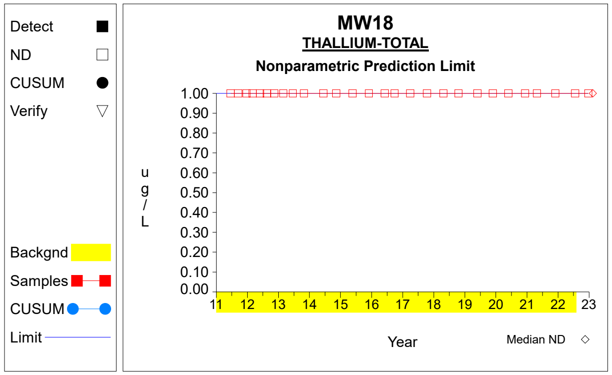


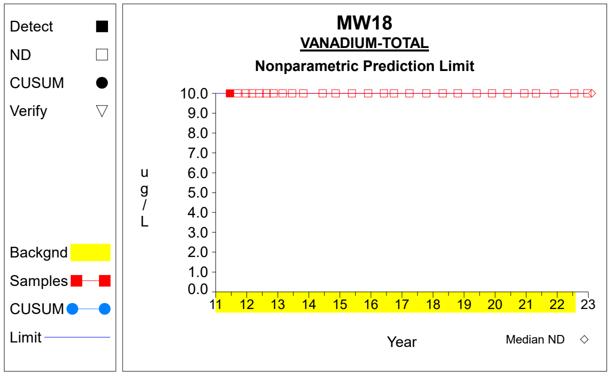
Graph 146



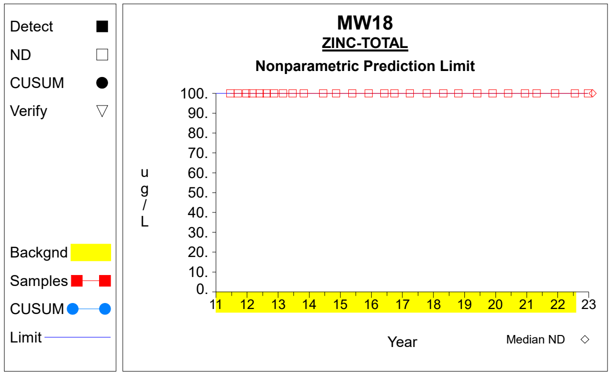
Graph 147



Graph 148

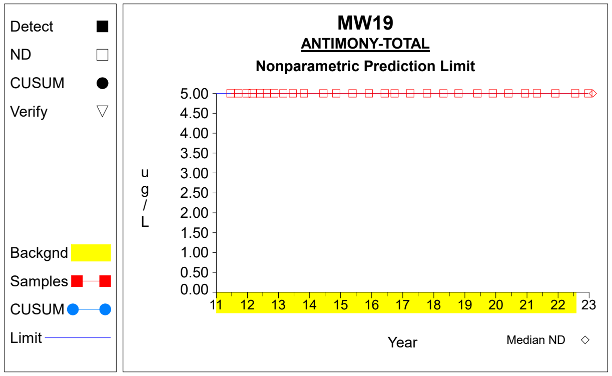


Graph 149



Graph 150

Intra-Well Control Charts / Prediction Limits



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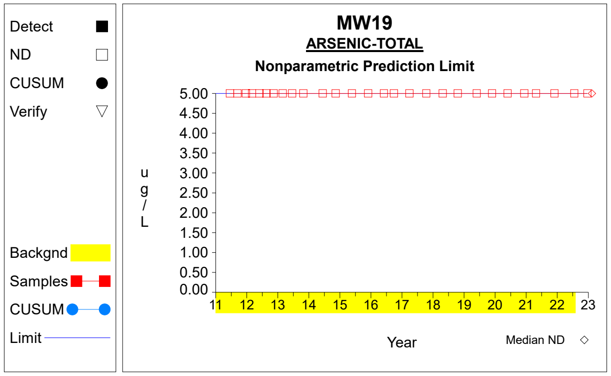
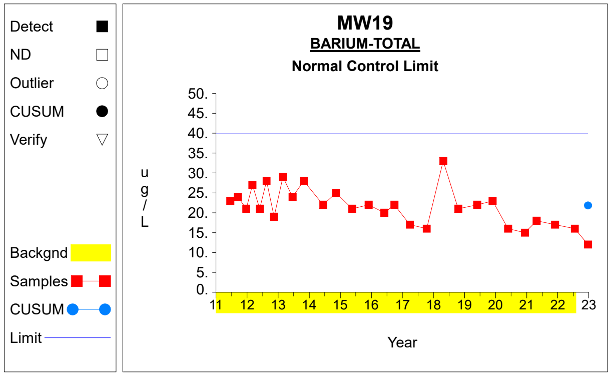


Graph 152



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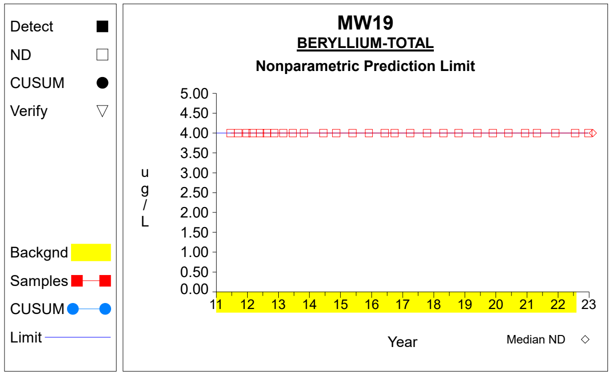

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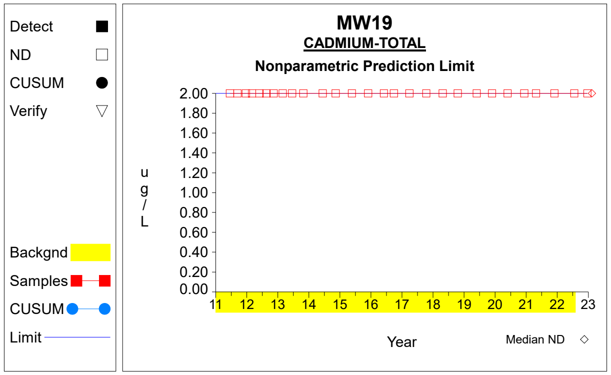
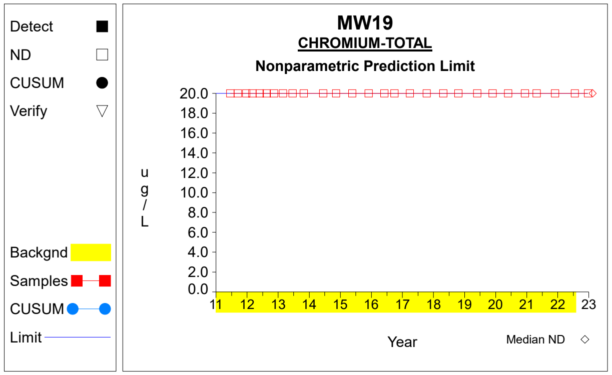
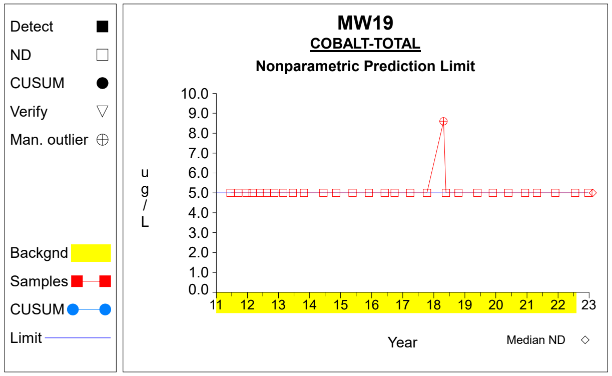


Graph 155



Graph 156



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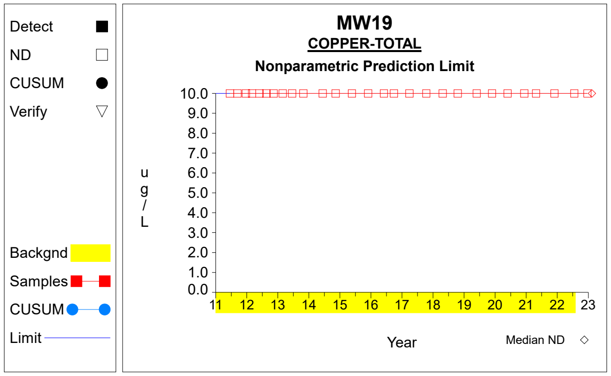
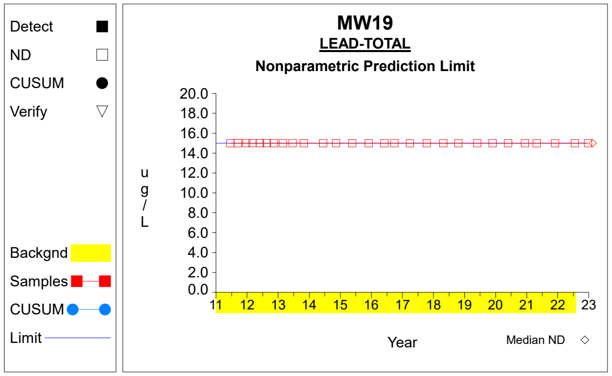
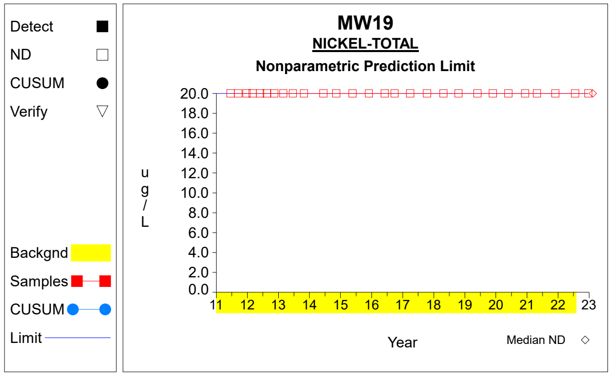


Graph 158



Graph 159

Intra-Well Control Charts / Prediction Limits



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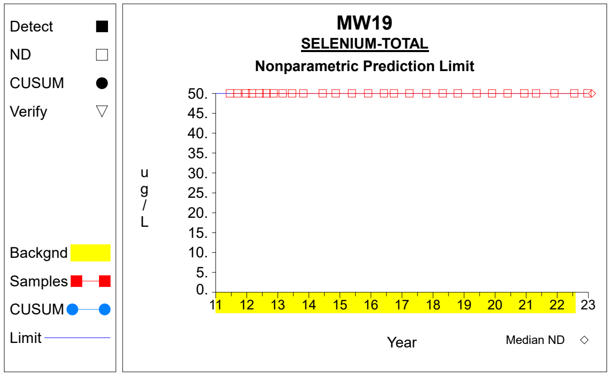

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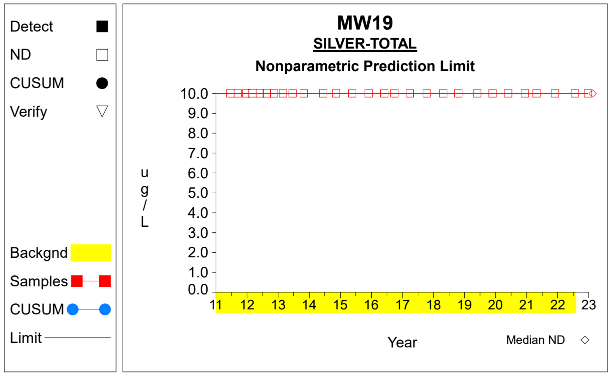
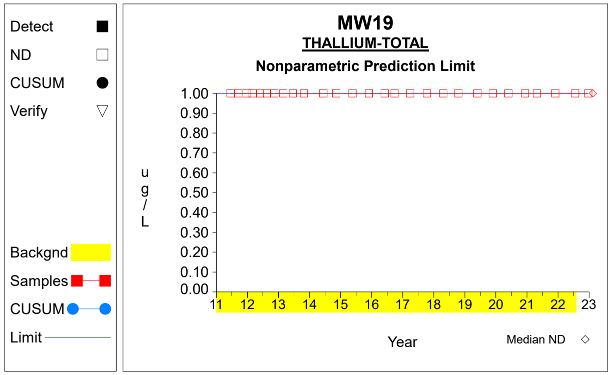
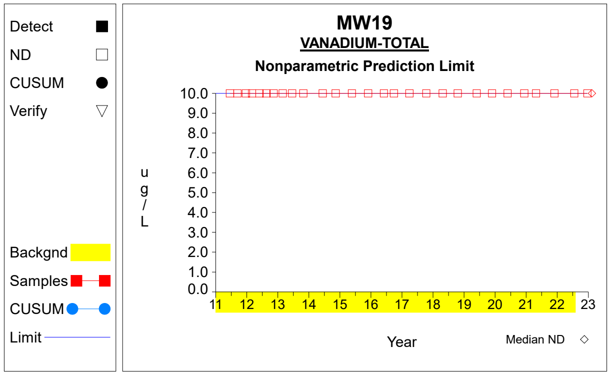


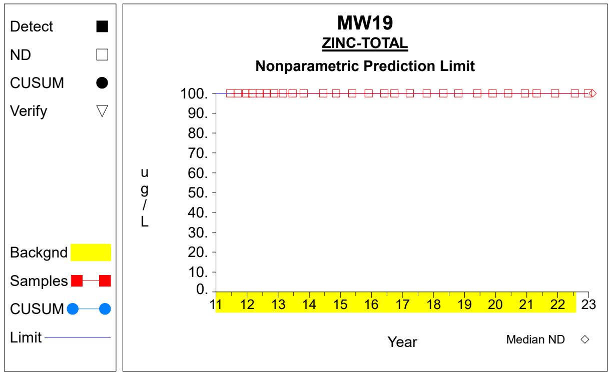
Graph 162



Graph 163

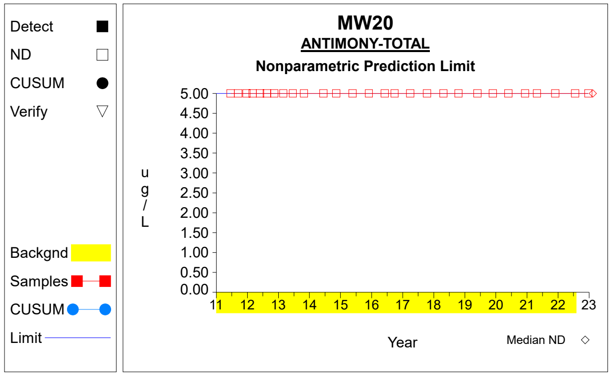


Graph 164

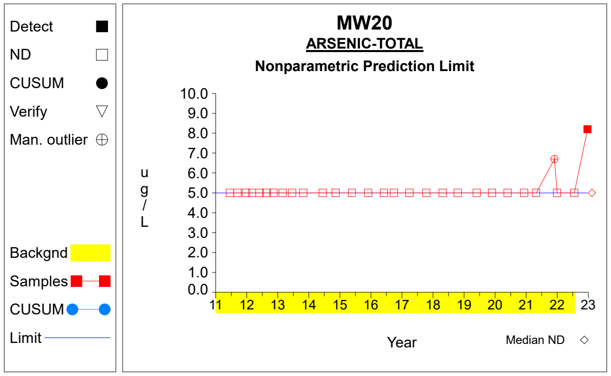


Graph 165

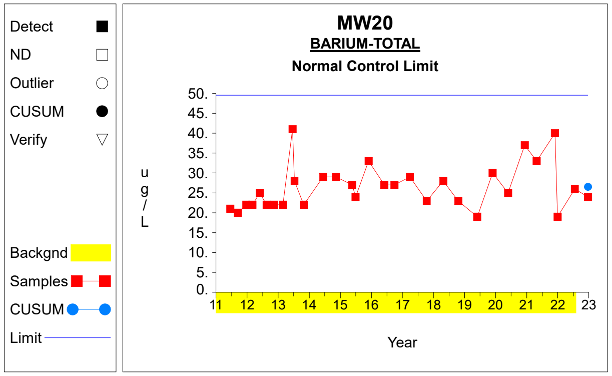
Intra-Well Control Charts / Prediction Limits



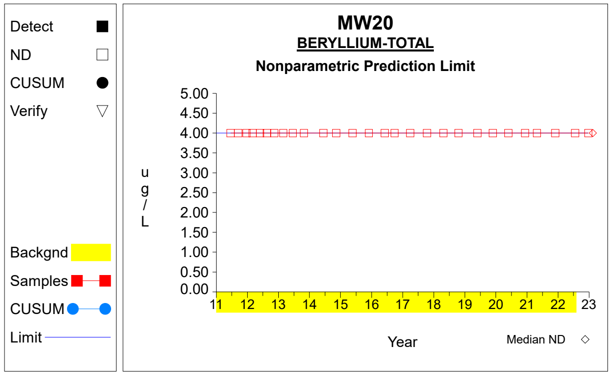
Graph 166



Graph 167



Graph 168



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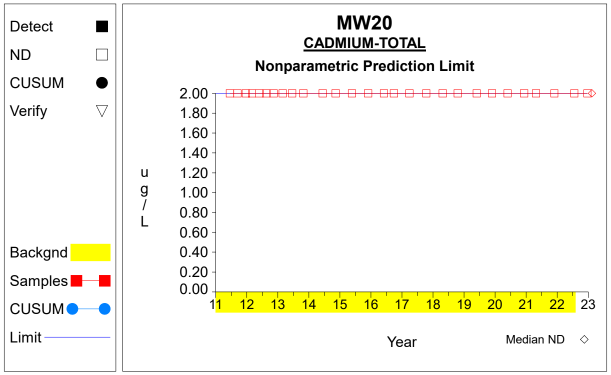

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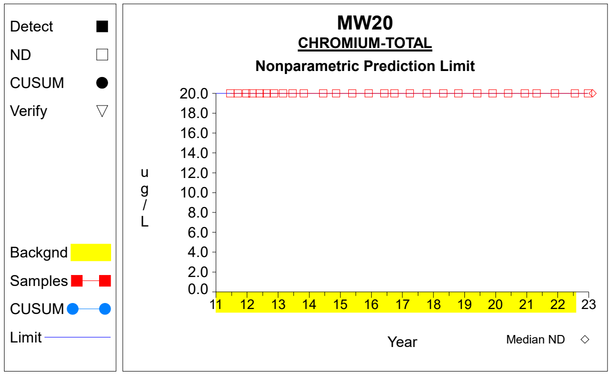

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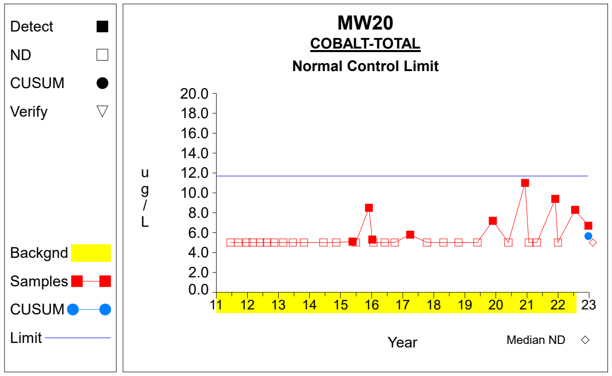
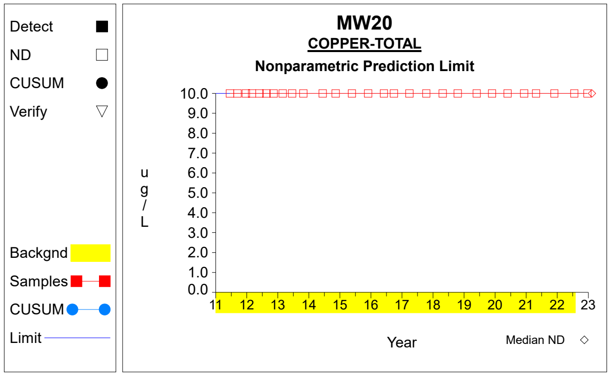
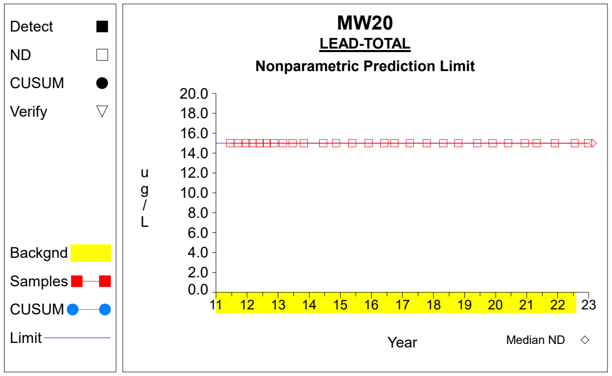


Graph 172

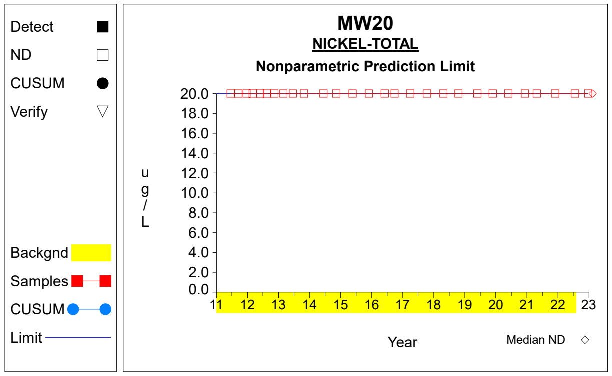


Graph 173

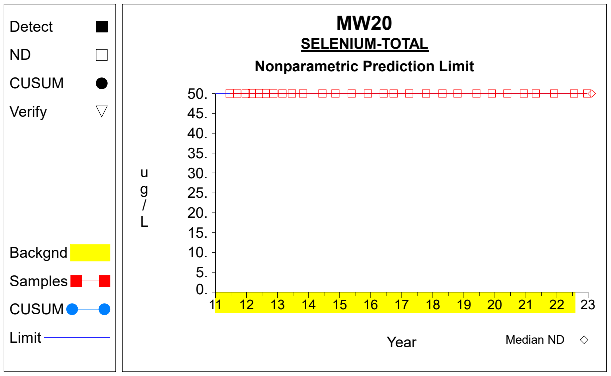


Graph 174

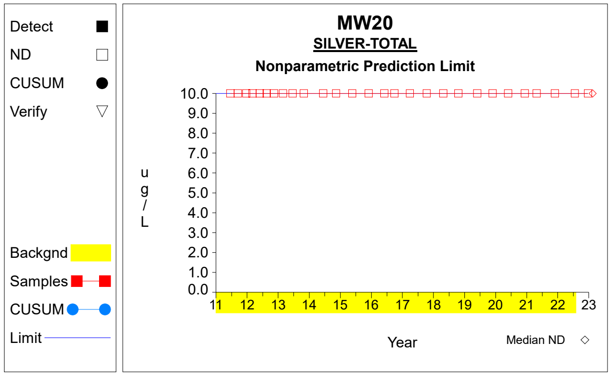
Intra-Well Control Charts / Prediction Limits



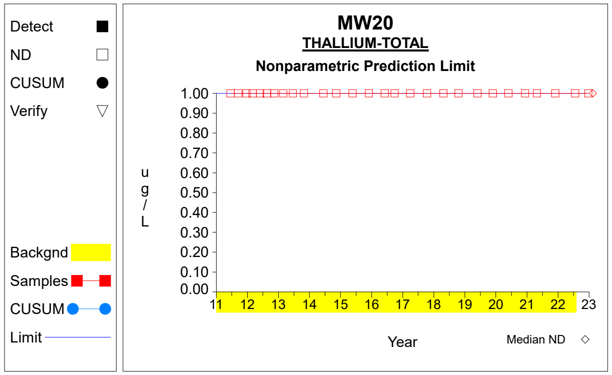
Graph 175



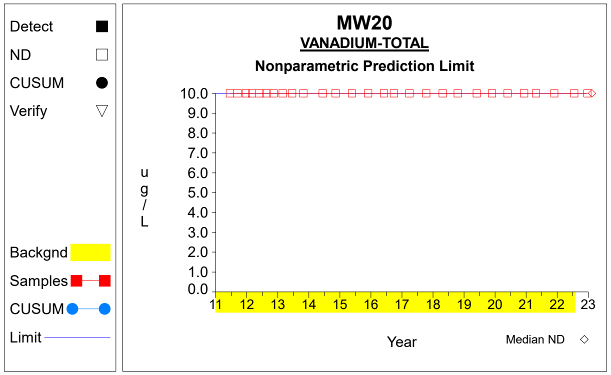
Graph 176



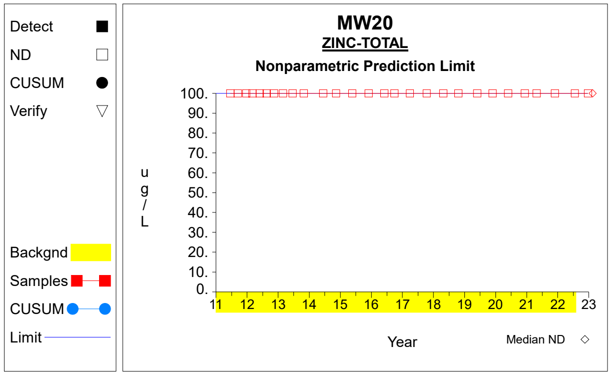
Graph 177



Graph 178

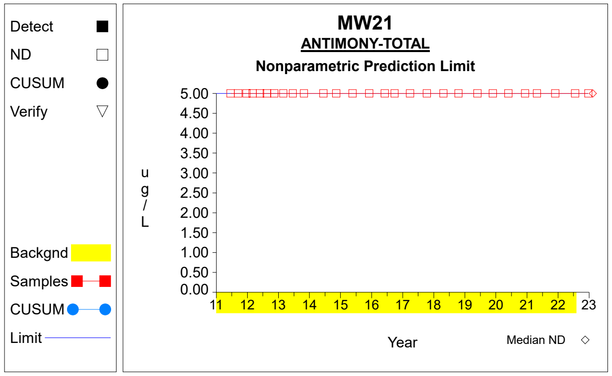


Graph 179

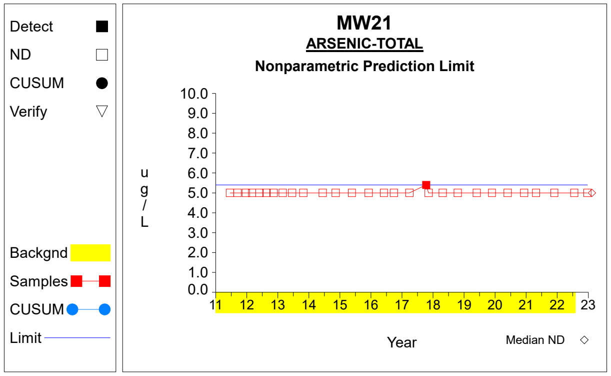


Graph 180

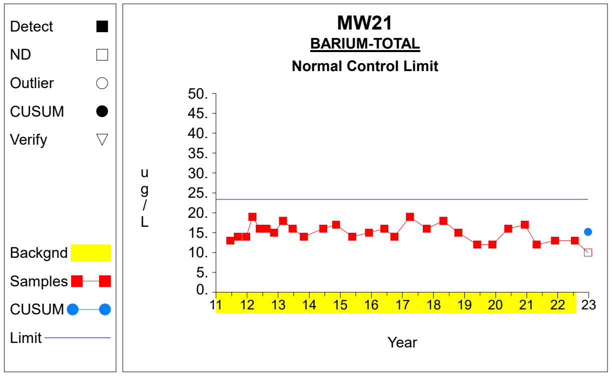
Intra-Well Control Charts / Prediction Limits



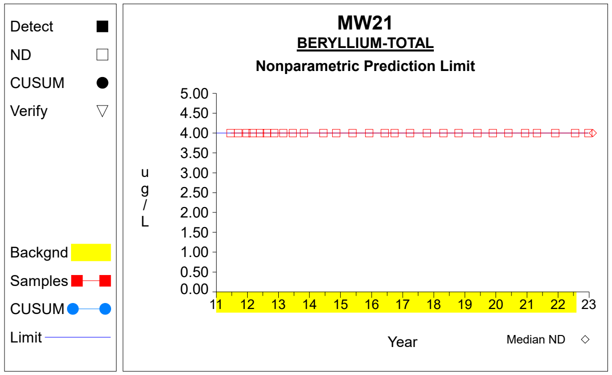
Graph 181



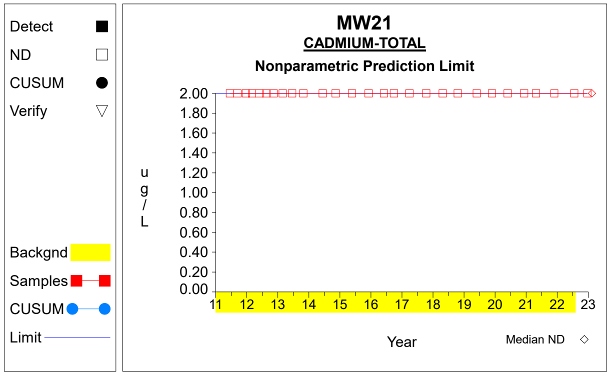
Graph 182



Graph 183



Graph 184



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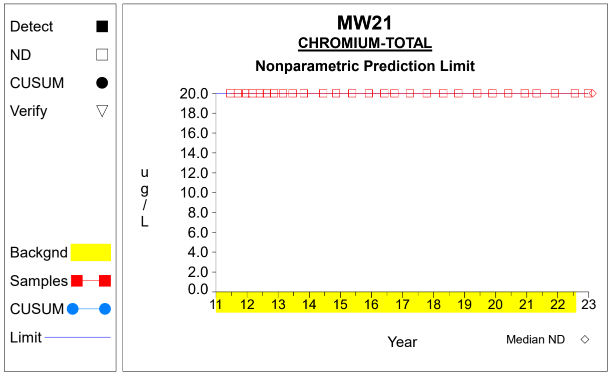
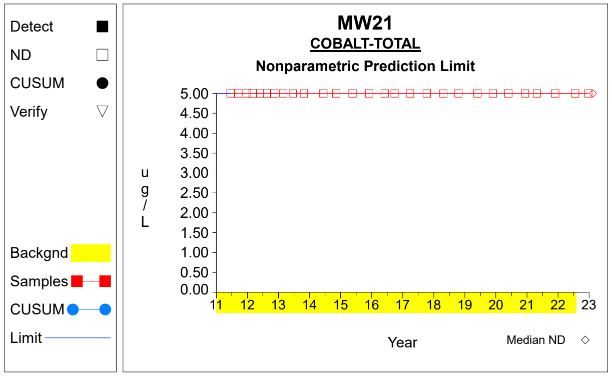
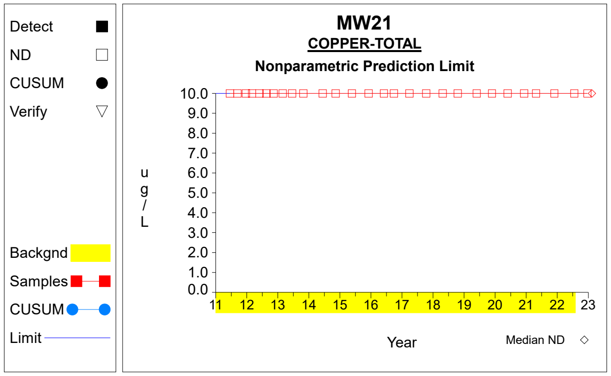


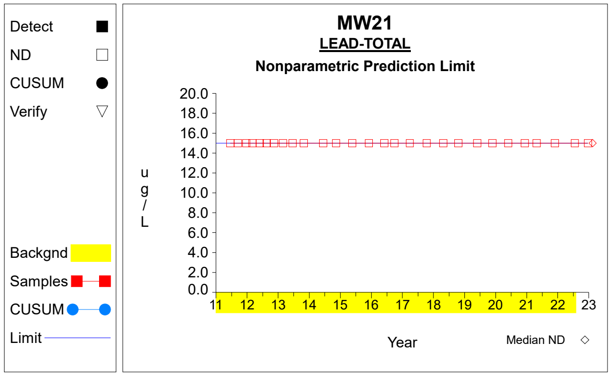
Graph 186



Graph 187

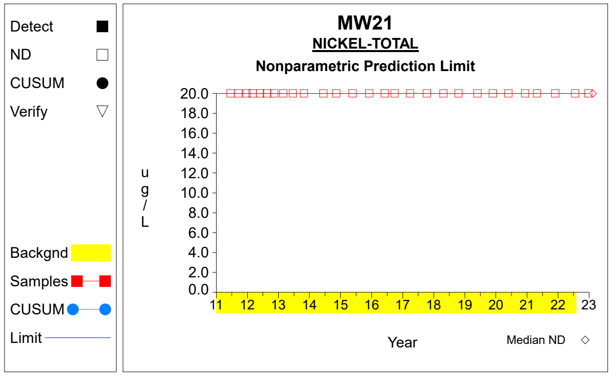


Graph 188

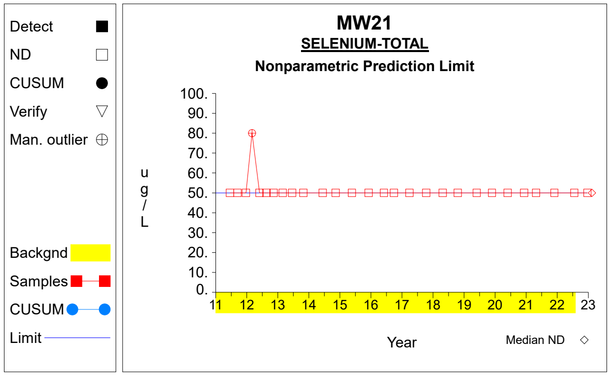


Graph 189

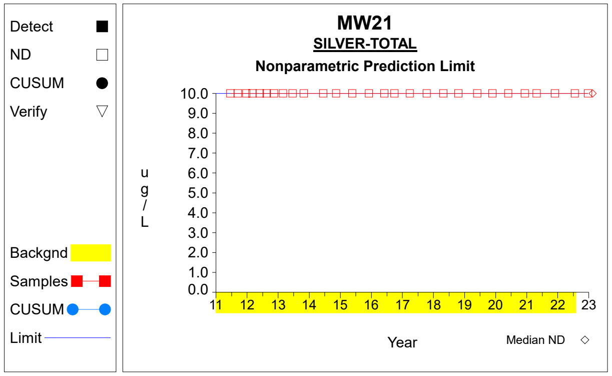
Intra-Well Control Charts / Prediction Limits



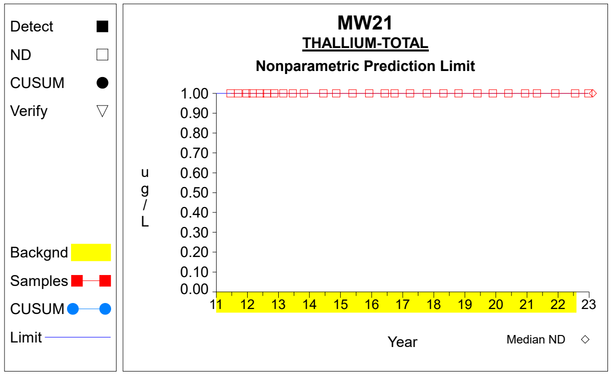
Graph 190



Graph 191



Graph 192



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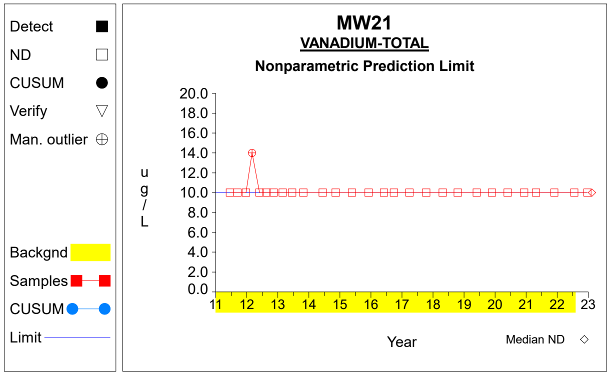
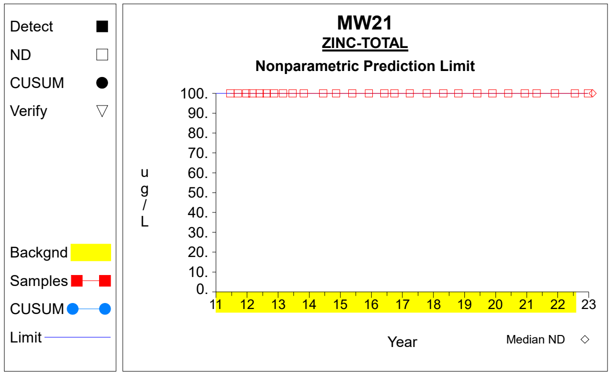
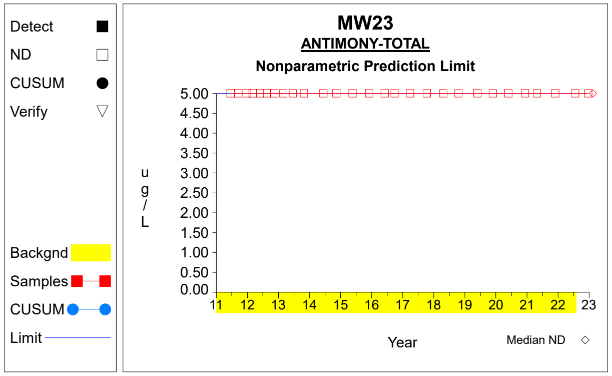


Graph 194

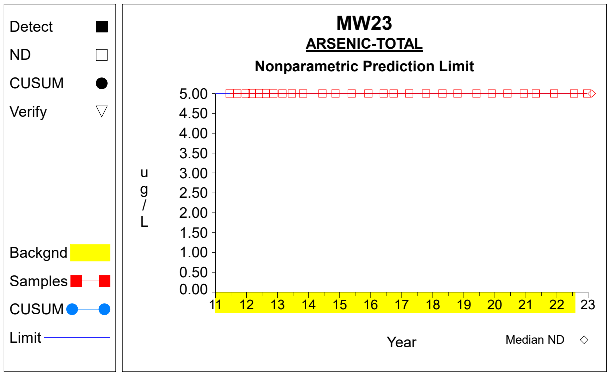


Graph 195

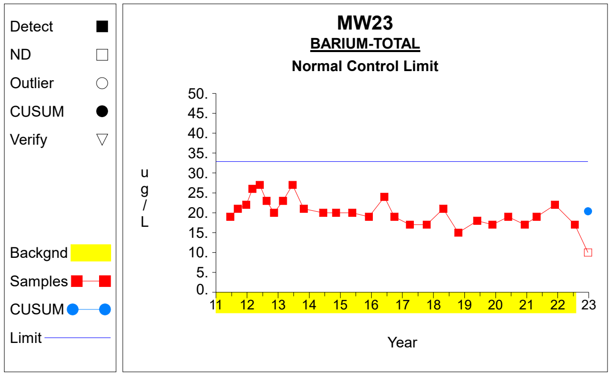
Intra-Well Control Charts / Prediction Limits



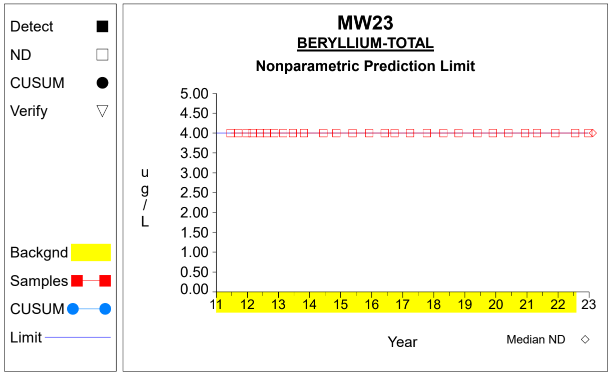
Graph 196



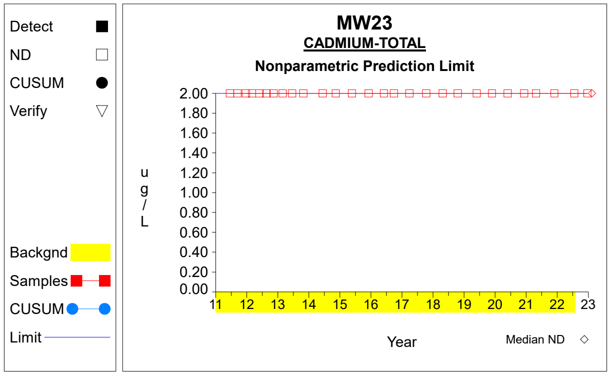
Graph 197



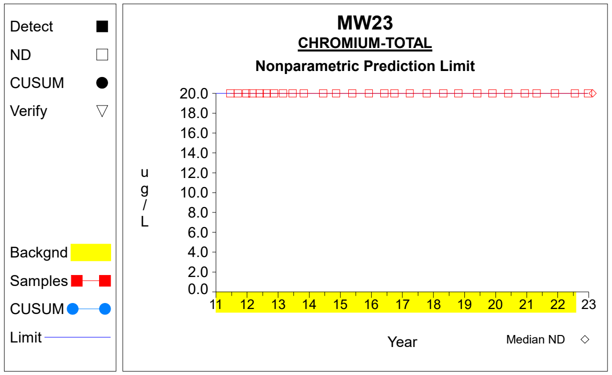
Graph 198



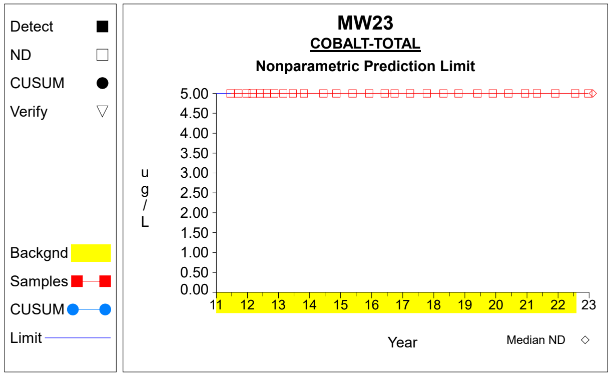
Graph 199



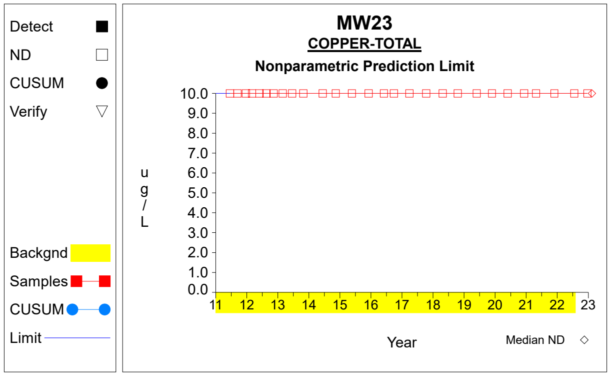
Graph 200



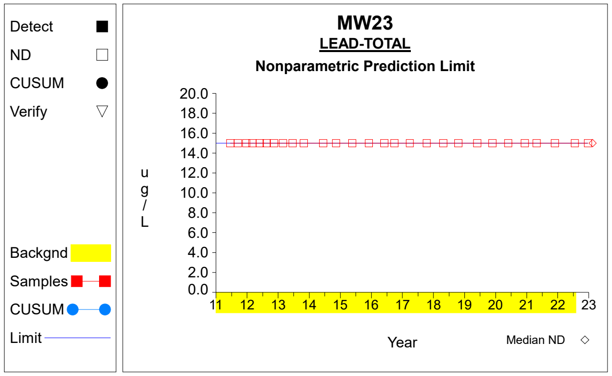
Graph 201



Graph 202

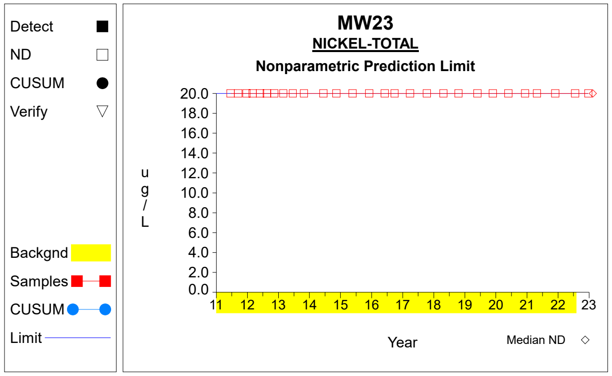


Graph 203

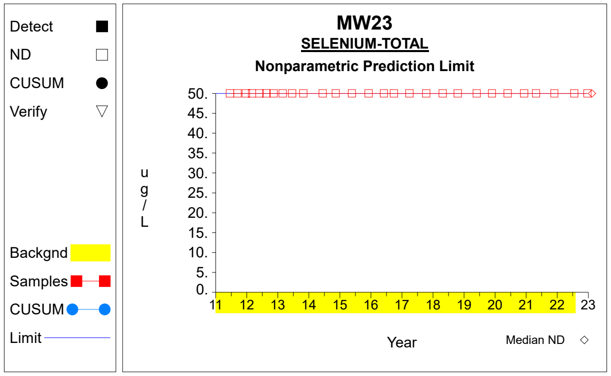


Graph 204

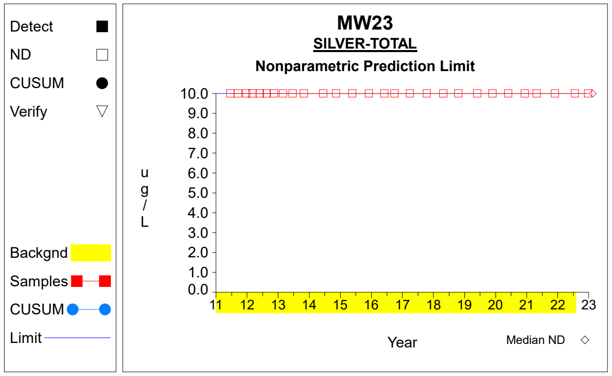
Intra-Well Control Charts / Prediction Limits



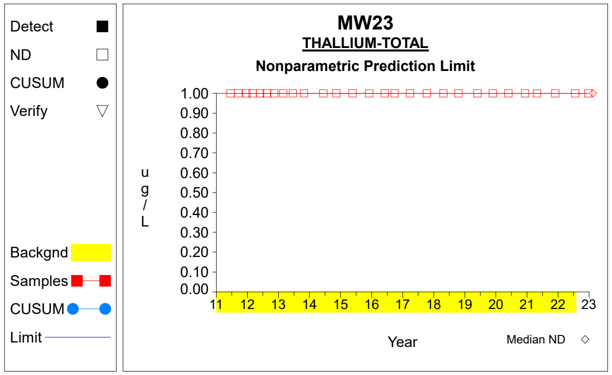
Graph 205



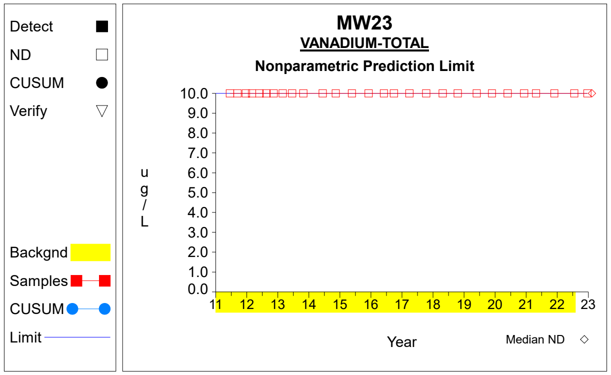
Graph 206



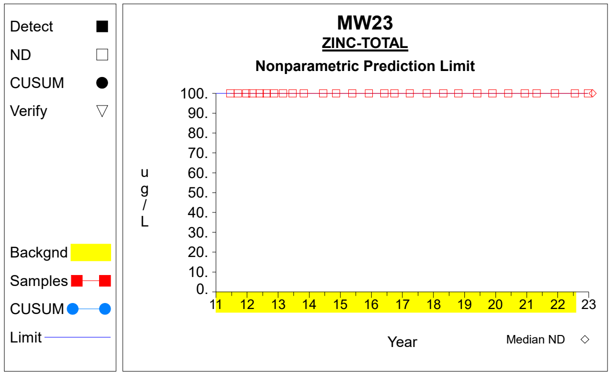
Graph 207



Graph 208

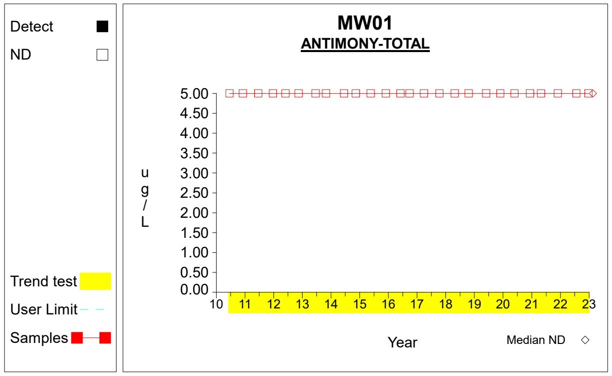


Graph 209

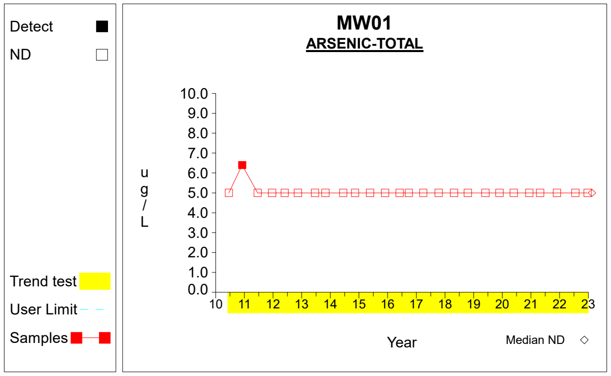


Graph 210

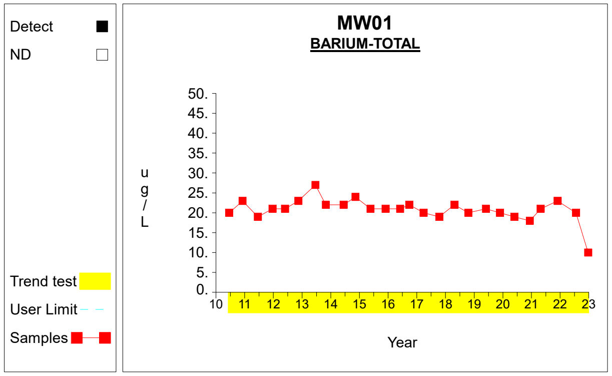
Time Series



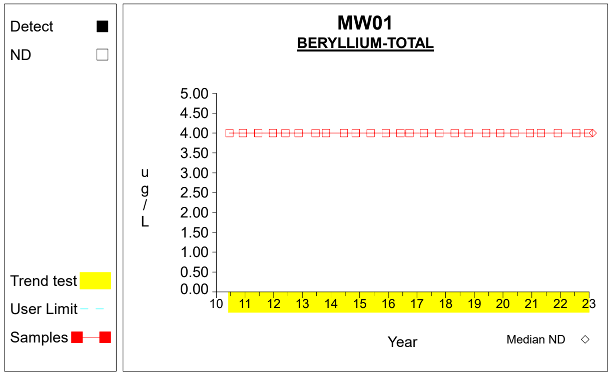
Graph 1



Graph 2



Graph 3



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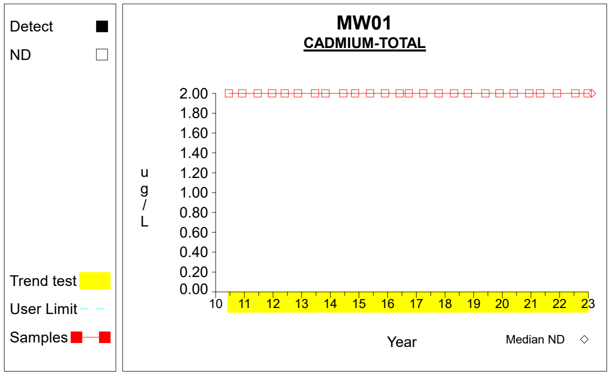
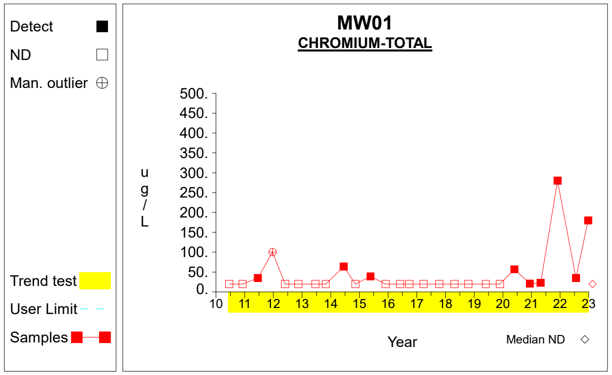
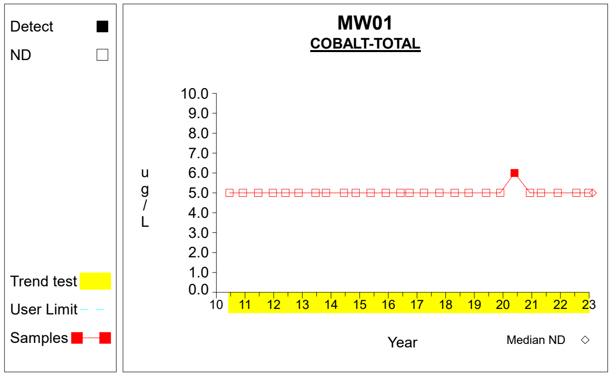


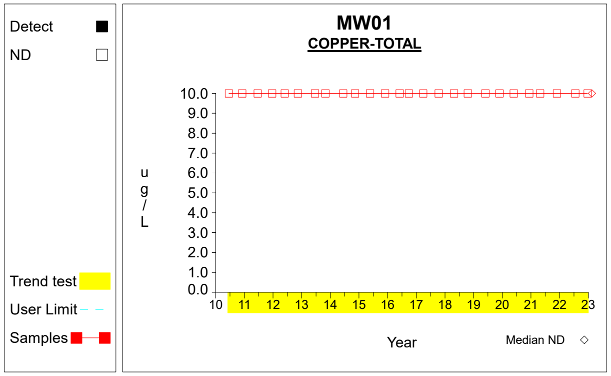
Graph 5



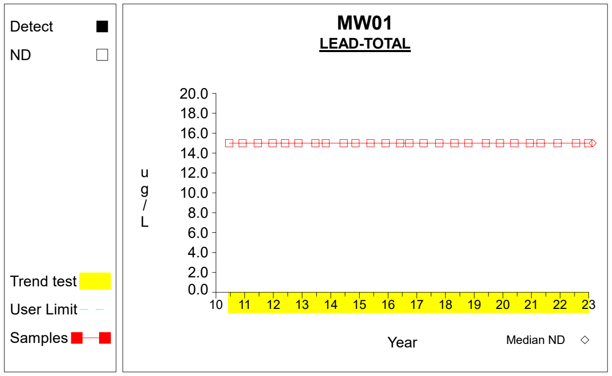
Graph 6



Graph 7

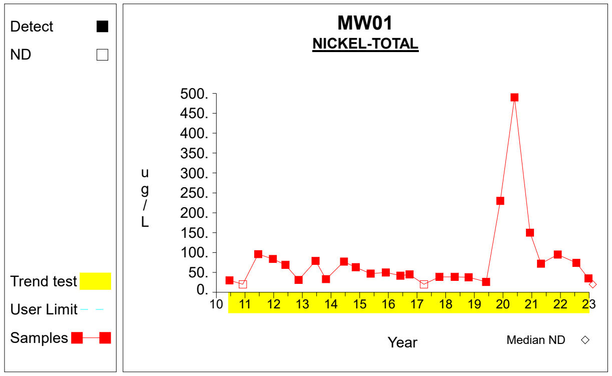


Graph 8



Graph 9

Time Series



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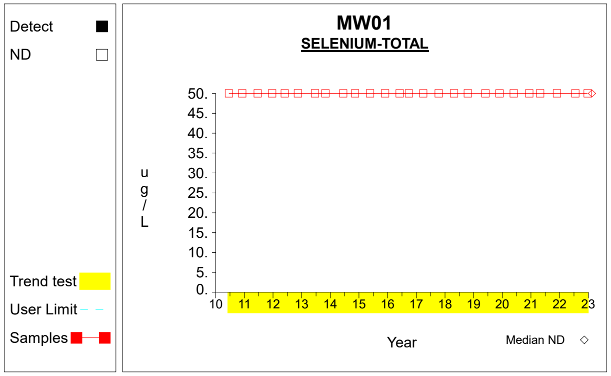

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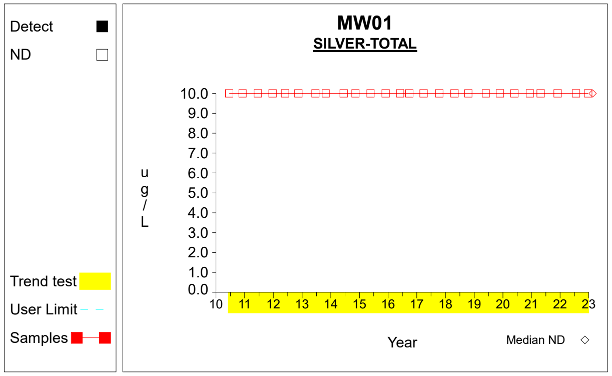
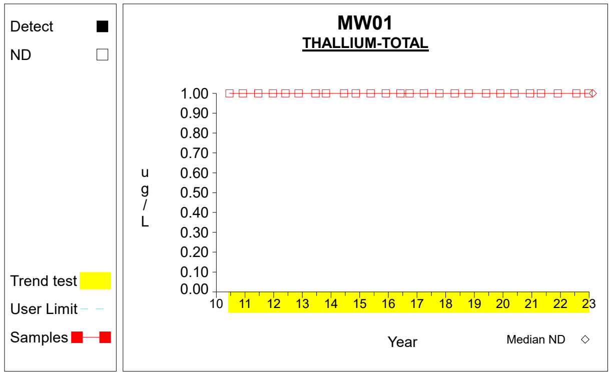
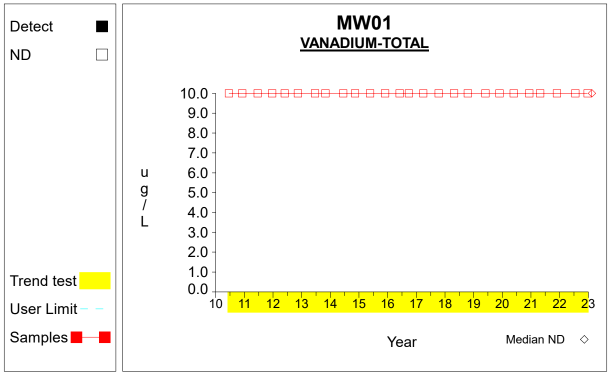


Graph 12



Graph 13



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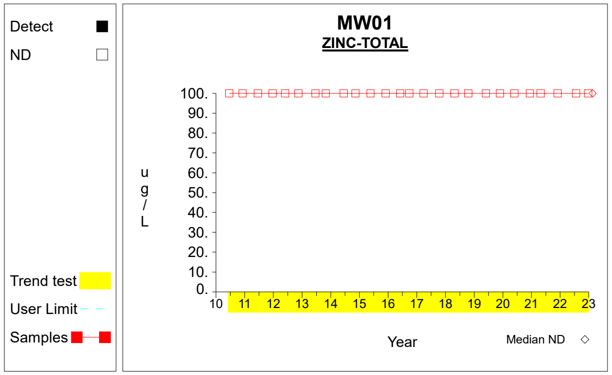
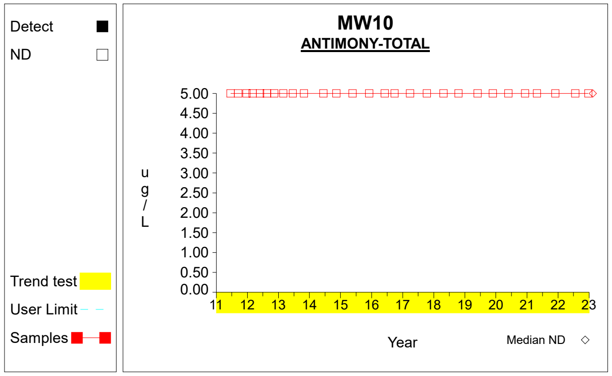
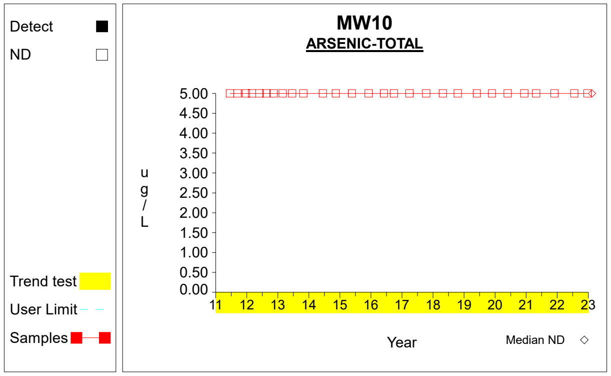


Graph 15

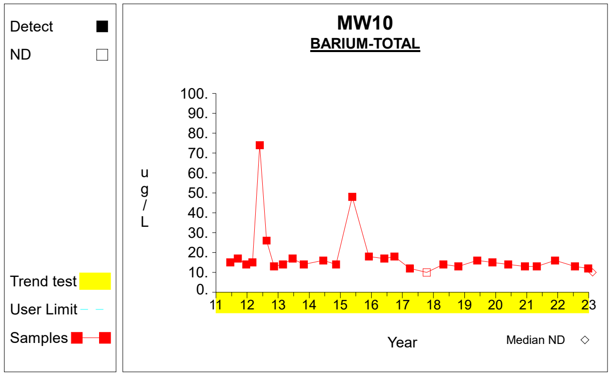
Time Series



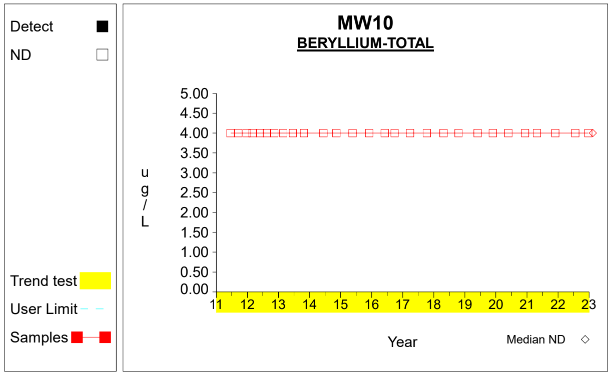
Graph 16



Graph 17



Graph 18



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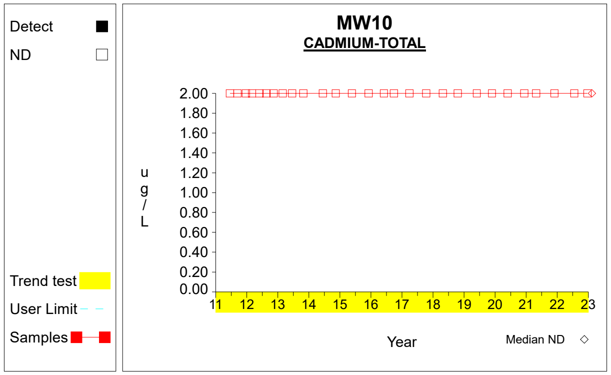
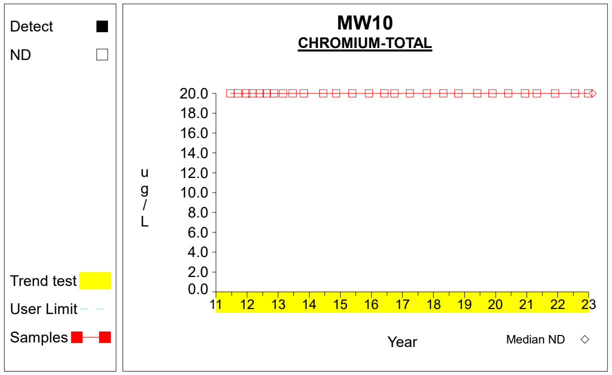
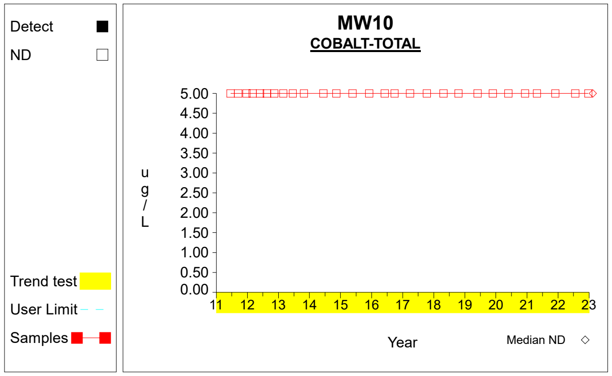


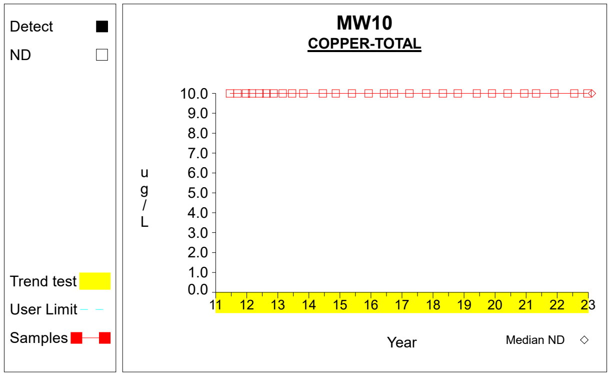
Graph 20



Graph 21



Graph 22



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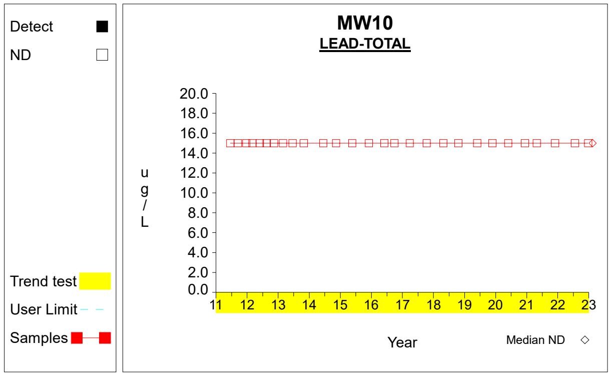
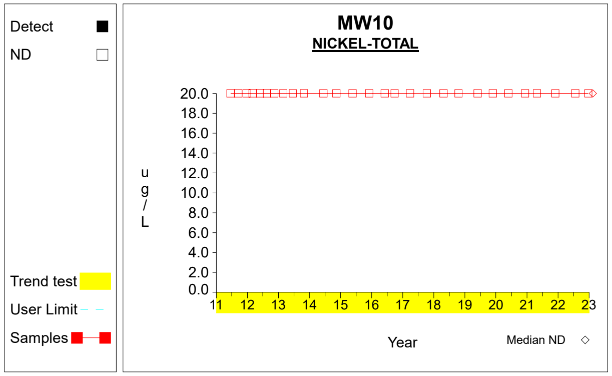


Graph 24

Time Series



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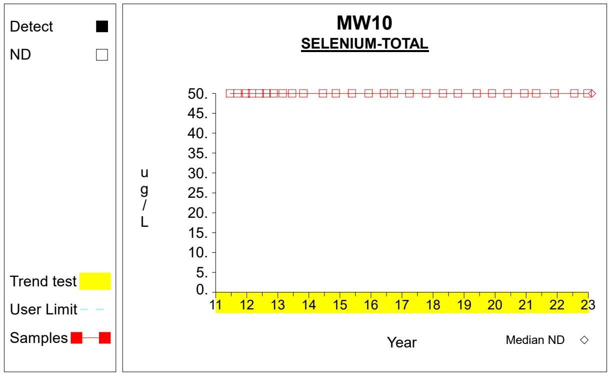
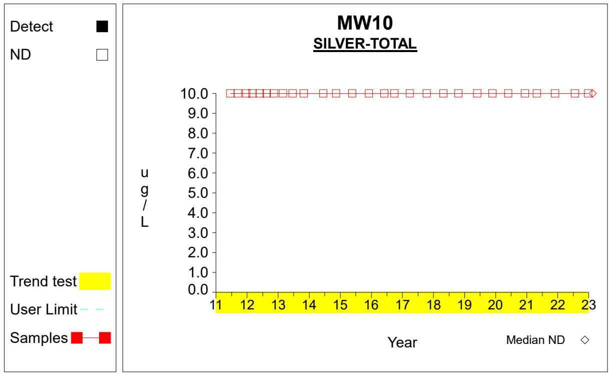
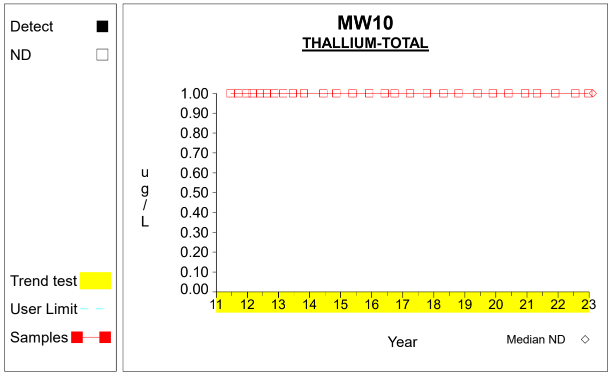


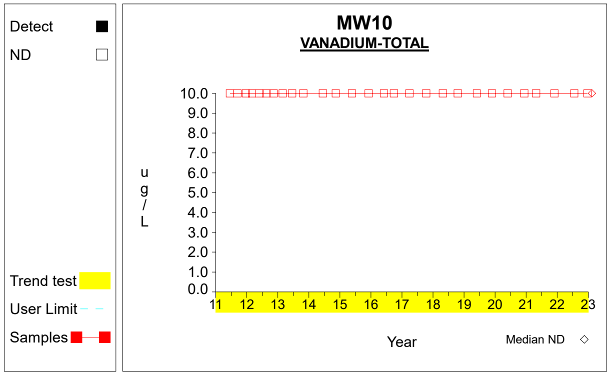
Graph 26



Graph 27



Graph 28



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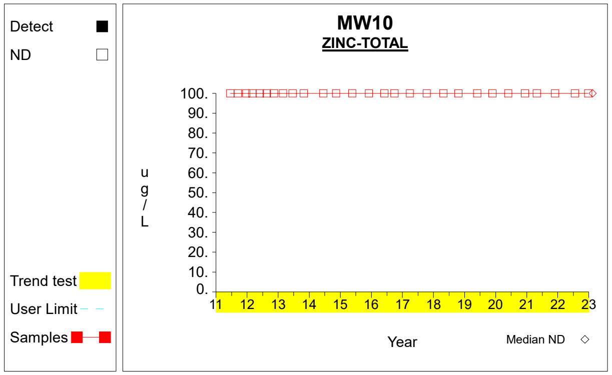
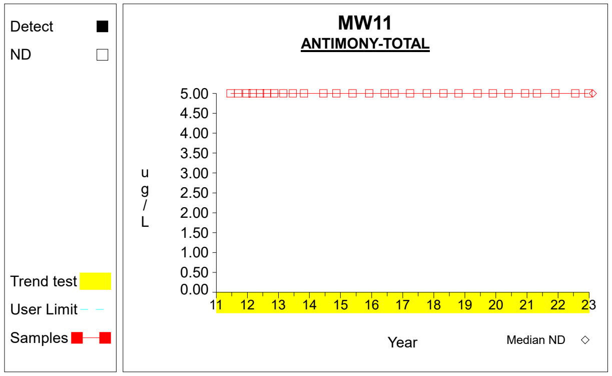


Graph 30

Time Series



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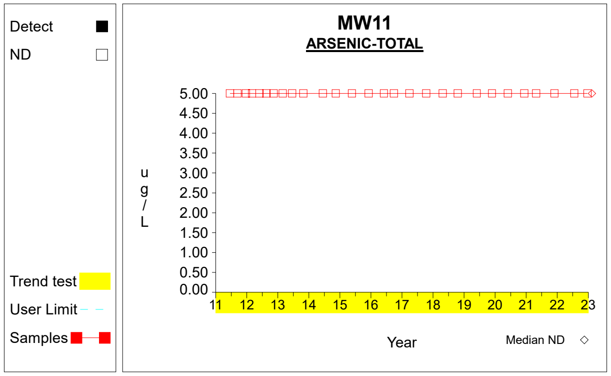
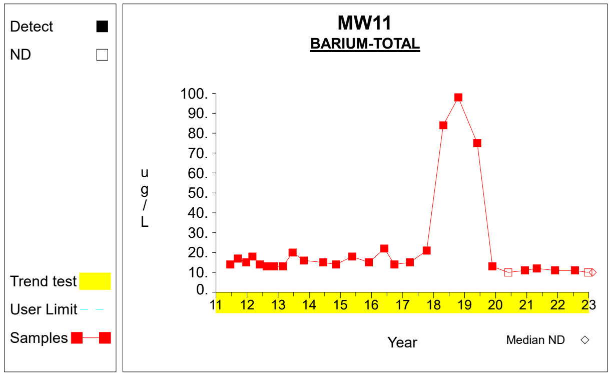
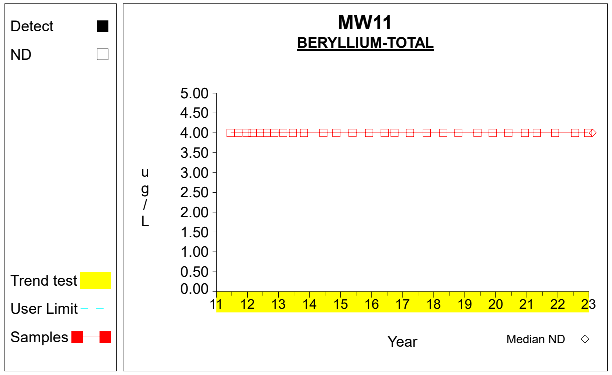


Graph 32



Graph 33



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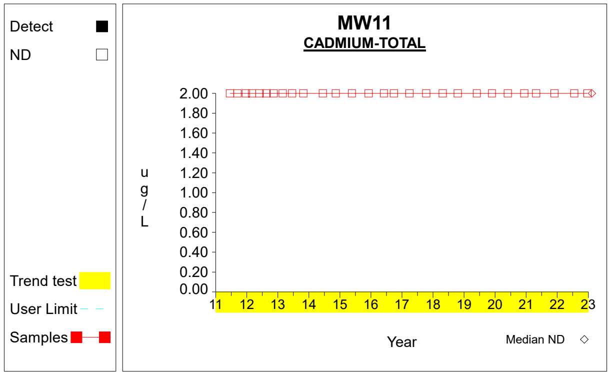

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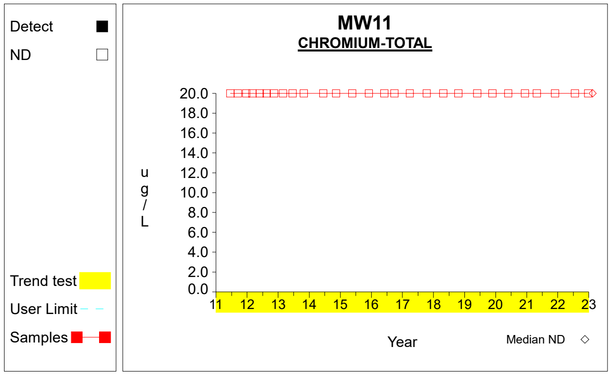

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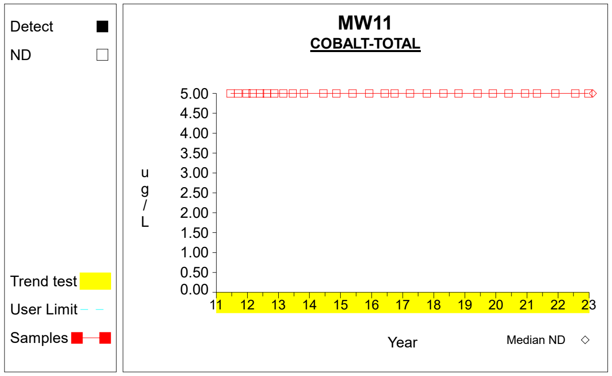

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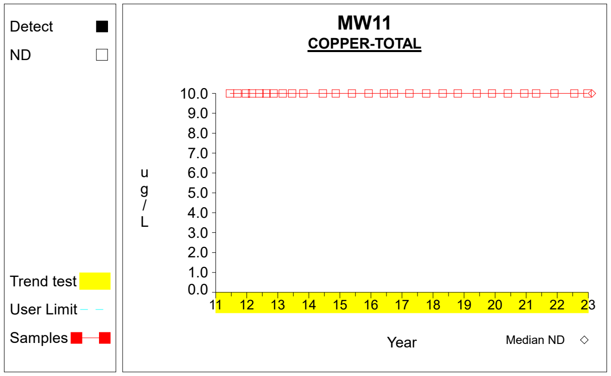

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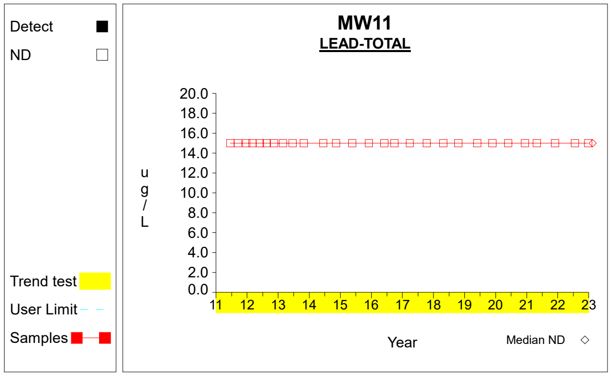
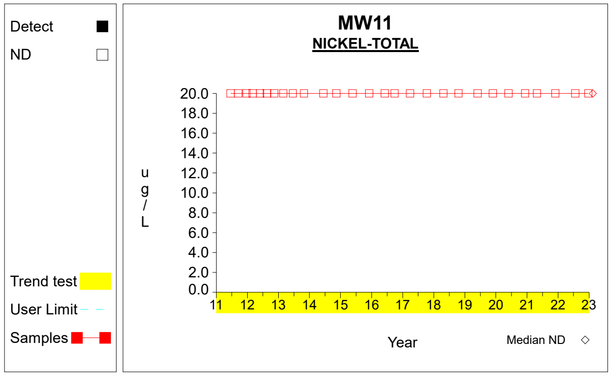


Graph 39

Time Series



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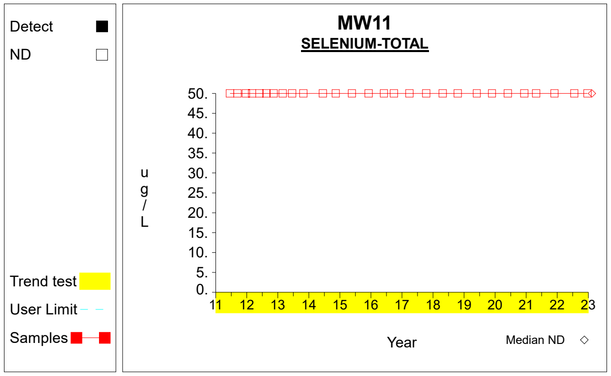
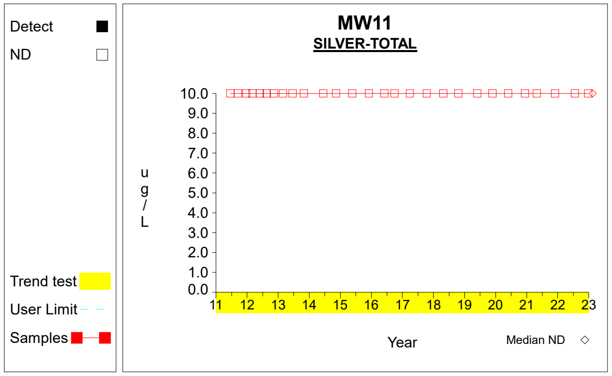


Graph 41



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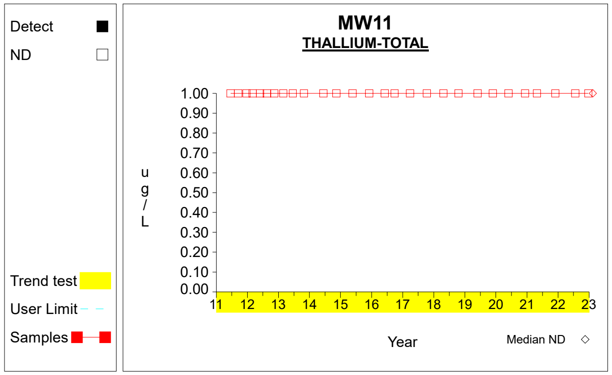
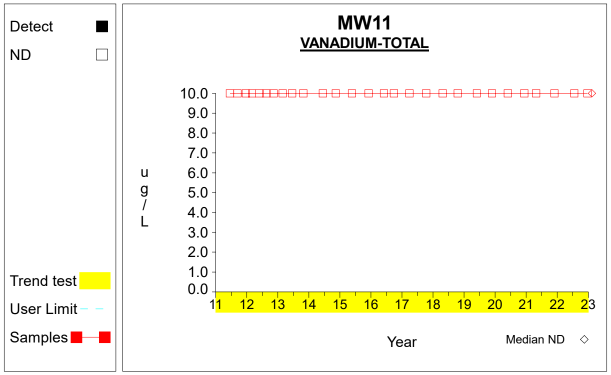
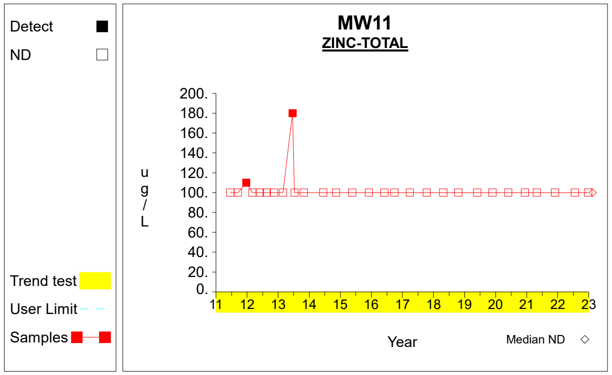


Graph 43

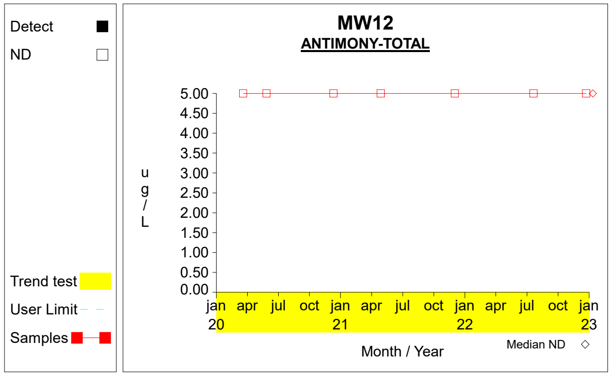


Graph 44



Graph 45

Time Series



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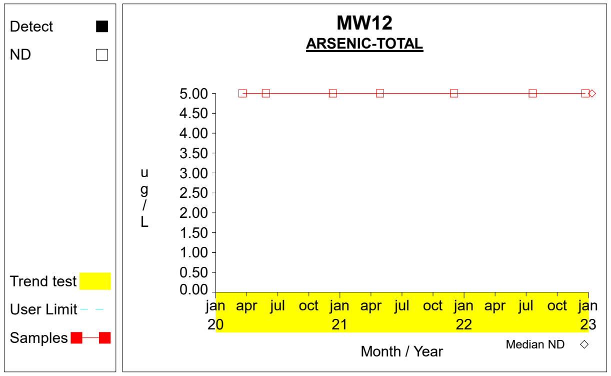

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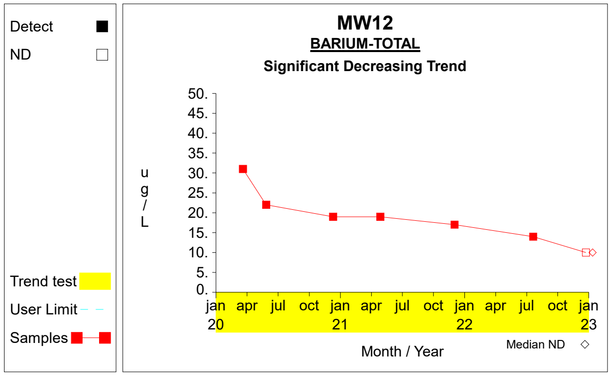
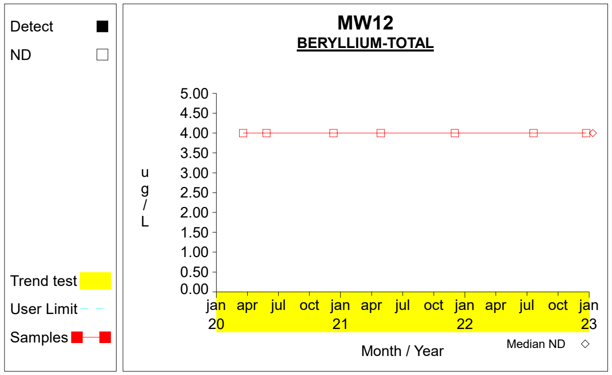


Graph 48



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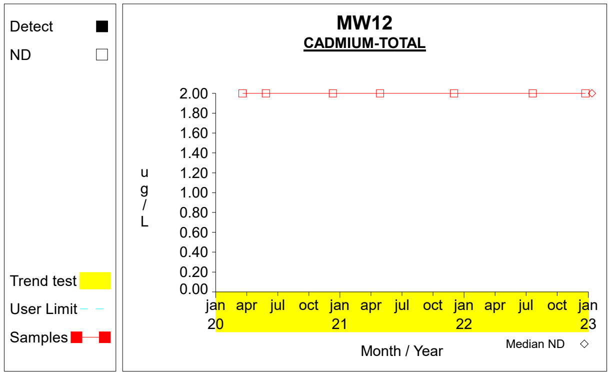

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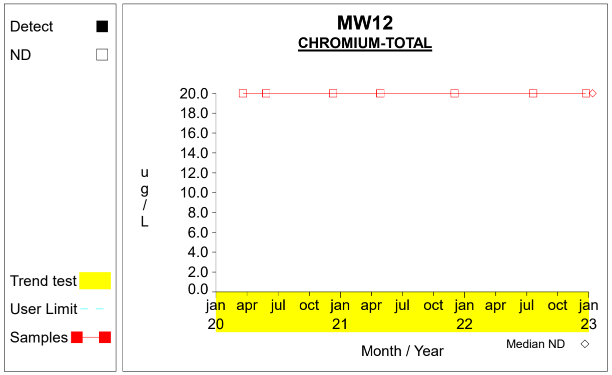
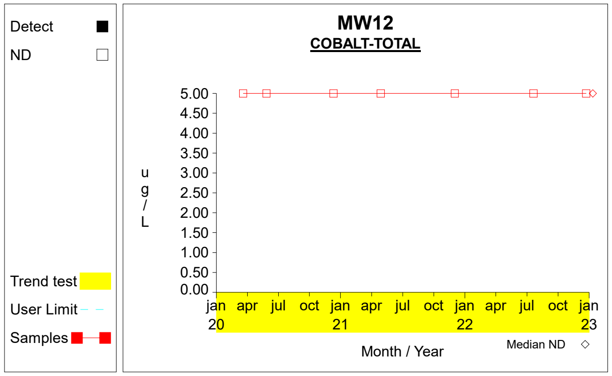
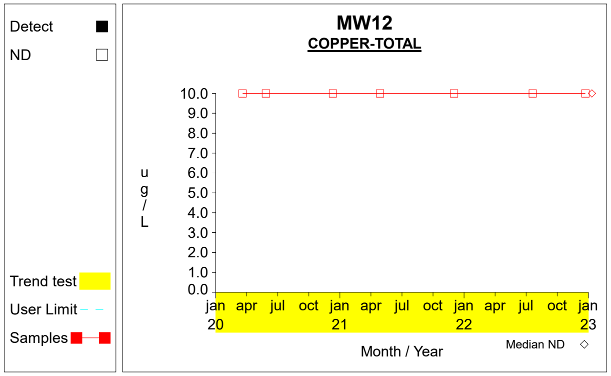


Graph 51



Graph 52



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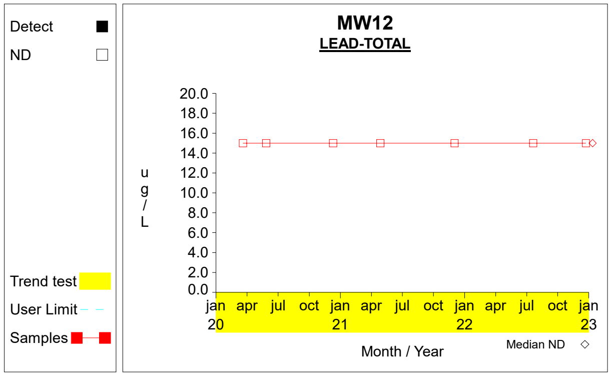
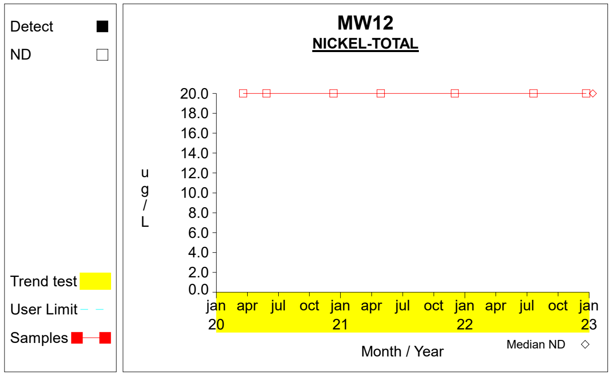
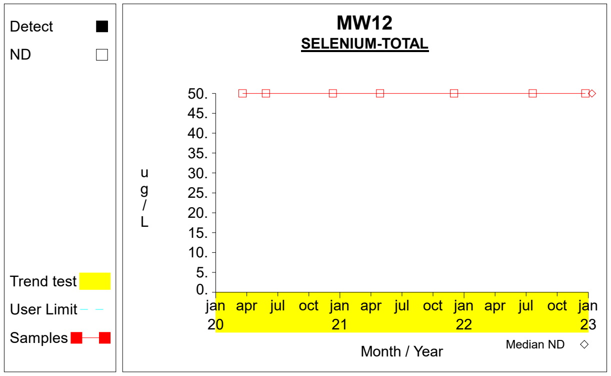


Graph 54

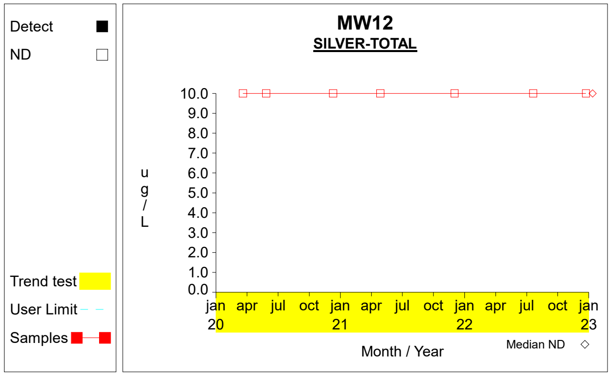
Time Series



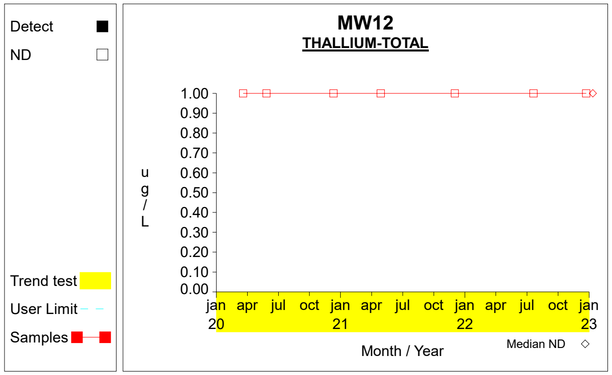
Graph 55



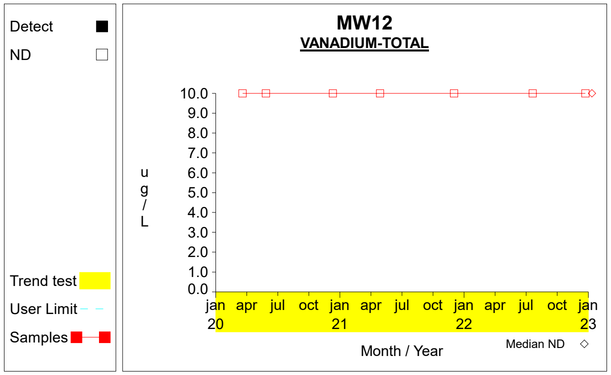
Graph 56



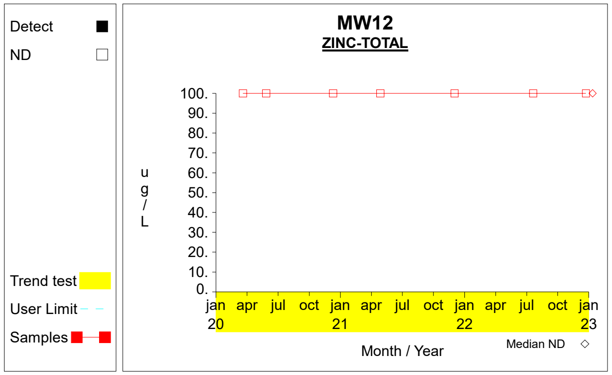
Graph 57



Graph 58

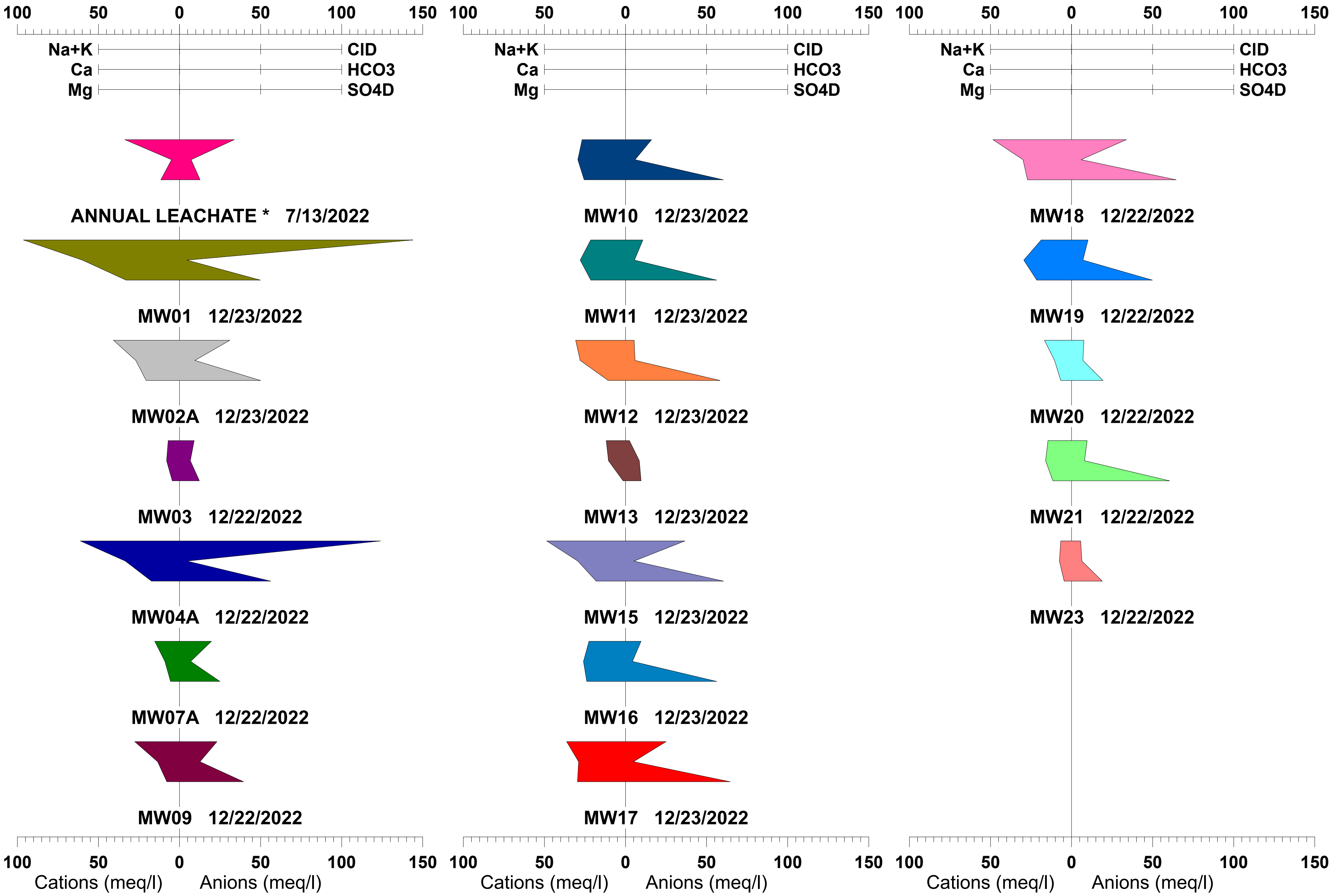


Graph 59



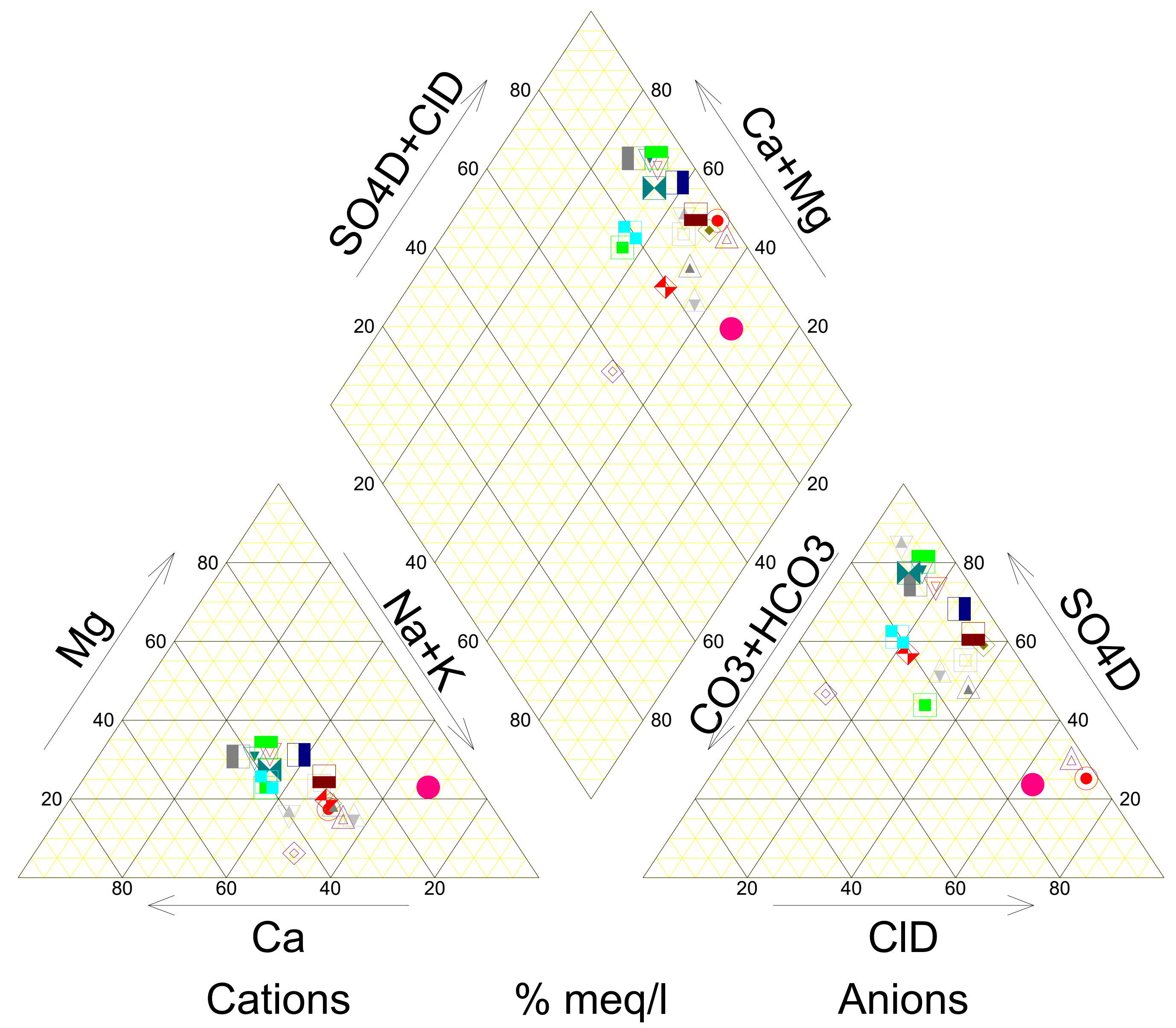
Graph 60

Mesquite Creek

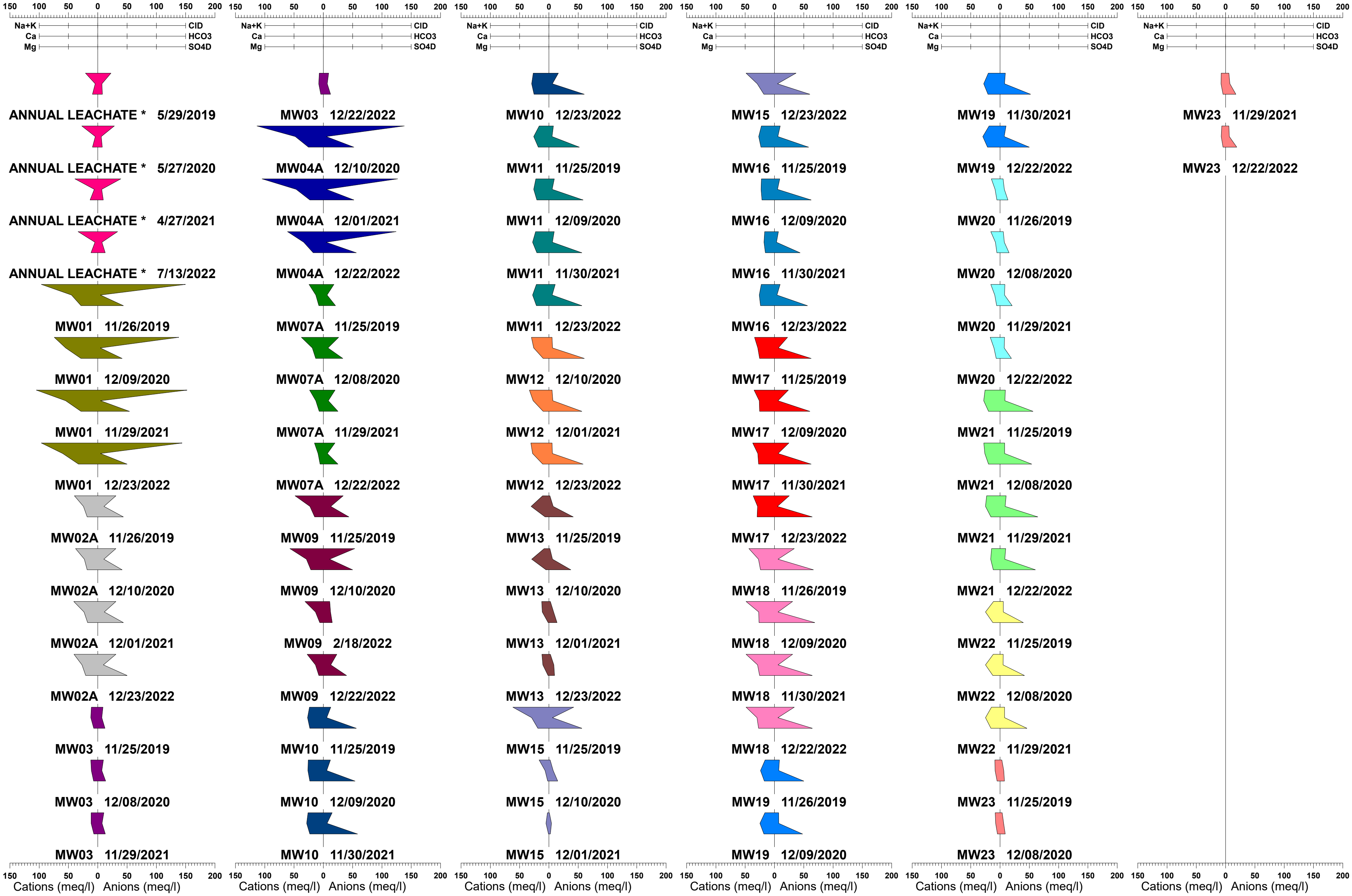


Mesquite Creek

●	ANNUAL LEACHATE	7/13/2022
⊙	MW01	12/23/2022
□	MW02A	12/23/2022
▣	MW03	12/22/2022
△	MW04A	12/22/2022
▲	MW07A	12/22/2022
▼	MW09	12/22/2022
▽	MW10	12/23/2022
▼	MW11	12/23/2022
▲	MW12	12/23/2022
◇	MW13	12/23/2022
◆	MW15	12/23/2022
▬	MW16	12/23/2022
◧	MW17	12/23/2022
⬓	MW18	12/22/2022
◧	MW19	12/22/2022
◆	MW20	12/22/2022
⧓	MW21	12/22/2022
▚	MW23	12/22/2022



Mesquite Creek

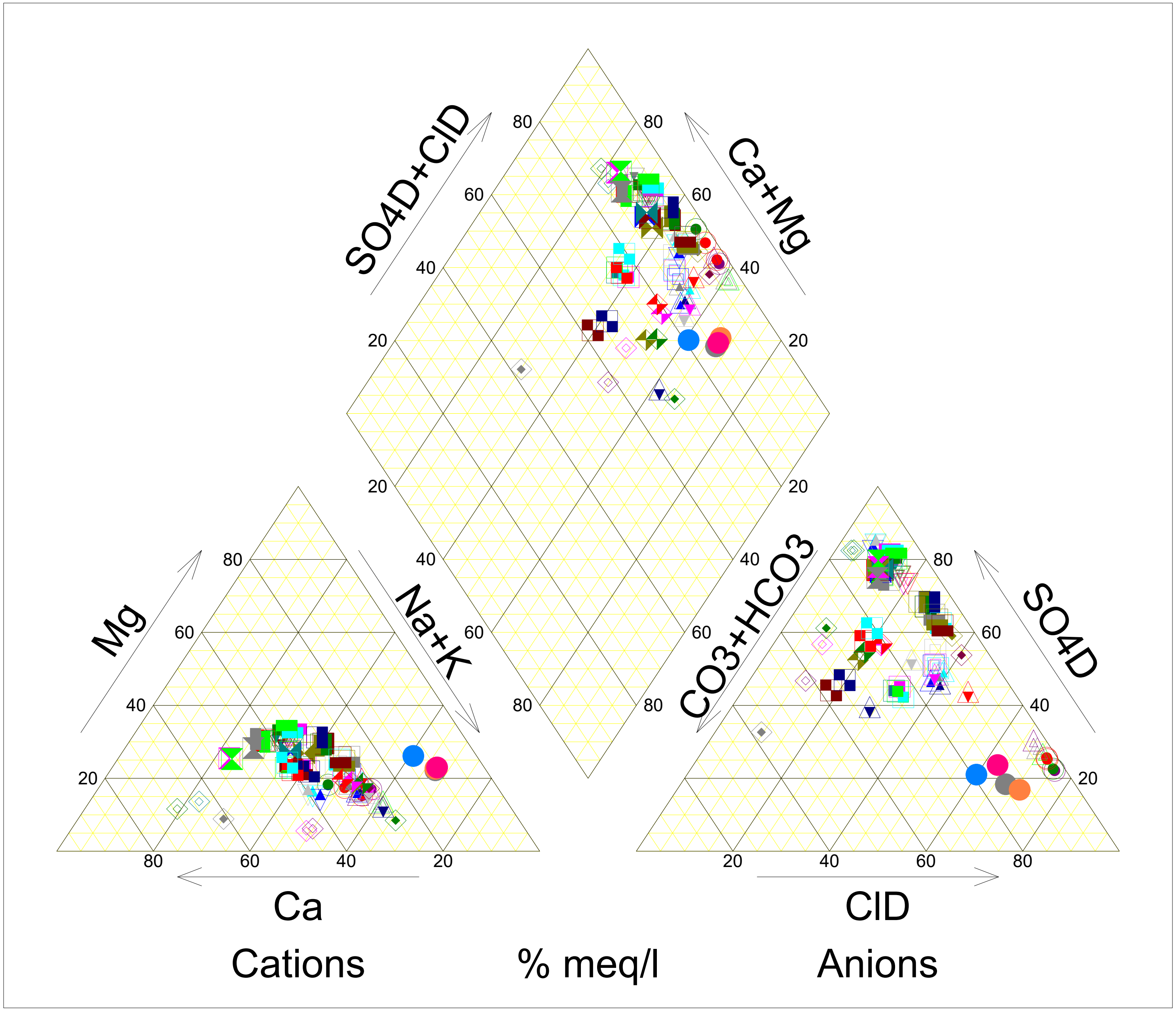


Prepared by: Otter Creek Environmental

October 2023

Mesquite Creek

●	ANNUAL LEACHATE	5/29/2019
●	ANNUAL LEACHATE	5/27/2020
●	ANNUAL LEACHATE	4/27/2021
●	ANNUAL LEACHATE	7/13/2022
◉	MW01	11/26/2019
◉	MW01	12/09/2020
◉	MW01	11/29/2021
◉	MW01	12/23/2022
☐	MW02A	11/26/2019
☐	MW02A	12/10/2020
☐	MW02A	12/01/2021
☐	MW02A	12/23/2022
▣	MW03	11/25/2019
▣	MW03	12/08/2020
▣	MW03	11/29/2021
▣	MW03	12/22/2022
△	MW04A	12/10/2020
△	MW04A	12/01/2021
△	MW04A	12/22/2022
▲	MW07A	11/25/2019
▲	MW07A	12/08/2020
▲	MW07A	11/29/2021
▲	MW07A	12/22/2022
▲	MW09	11/25/2019
▲	MW09	12/10/2020
▲	MW09	2/18/2022
▲	MW09	12/22/2022
▽	MW10	11/25/2019
▽	MW10	12/09/2020
▽	MW10	11/30/2021
▽	MW10	12/23/2022
▼	MW11	11/25/2019
▼	MW11	12/09/2020
▼	MW11	11/30/2021
▼	MW11	12/23/2022
▼	MW12	12/10/2020
▼	MW12	12/01/2021
▼	MW12	12/23/2022
◇	MW13	11/25/2019
◇	MW13	12/10/2020
◇	MW13	12/01/2021
◇	MW13	12/23/2022
◆	MW15	11/25/2019
◆	MW15	12/10/2020
◆	MW15	12/01/2021
◆	MW15	12/23/2022
▬	MW16	11/25/2019
▬	MW16	12/09/2020
▬	MW16	11/30/2021
▬	MW16	12/23/2022
◧	MW17	11/25/2019
◧	MW17	12/09/2020
◧	MW17	11/30/2021
◧	MW17	12/23/2022
▬	MW18	11/26/2019
▬	MW18	12/09/2020
▬	MW18	11/30/2021
▬	MW18	12/22/2022
◧	MW19	11/26/2019
◧	MW19	12/09/2020
◧	MW19	11/30/2021
◧	MW19	12/22/2022
◆	MW20	11/26/2019
◆	MW20	12/08/2020
◆	MW20	11/29/2021
◆	MW20	12/22/2022
⧓	MW21	11/25/2019
⧓	MW21	12/08/2020
⧓	MW21	11/29/2021
⧓	MW21	12/22/2022
⧗	MW22	11/25/2019
⧗	MW22	12/08/2020
⧗	MW22	11/29/2021
▚	MW23	11/25/2019
▚	MW23	12/08/2020
▚	MW23	11/29/2021



Prepared by: Otter Creek Environmental
October 2023

ATTACHMENT 4G

SLUG TEST DATA

2023 GEOSYNTEC SLUG TEST DATA

MESQUITE CREEK LANDFILL
2023 SLUG TESTS
SUMMARY OF AQTESOLV INPUT PARAMETERS AND RESULTS

			GB-33						GB-41						GB-50					
			Slug In			Slug Out			Slug In			Slug Out			Slug In			Slug Out		
Well Information	Well Diameter (in)		2.00						2.00						2.00					
	Borehole Diameter		8						8						8					
	Screen interval (ft bls)		54-64						50-60						55-65					
	Well Depth (ft bls)		64						60						65					
	Screen Length (ft) [AQTESOLV "L"]		10.0						10.0						10.0					
	Confined or Unconfined Aquifer		Unconfined						Unconfined						Unconfined					
	Ground Surface Elevation (ft)		702.90						676.20						689.60					
	TOC Elevation (ft NGVD 29)		705.7						678.4						691.4					
Input Parameters	Slug Test Trial #		1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
	Test Date		4/11	4/12	4/13	4/11	4/12	4/13	4/11	4/12	4/13	4/11	4/12	4/13	4/11	4/12	4/13	4/11	4/12	4/14
	Pre-test Depth-to-groundwater (ft)		40.42	40.13	39.77	40.42	40.13	39.77	39.26	39.10	38.86	39.26	39.10	38.86	26.06	26.05	25.98	26.06	26.05	25.98
	Pre-test water column height (ft) [AQTESOLV H]		23.58	23.87	24.23	23.58	23.87	24.23	20.74	20.90	21.14	20.74	20.90	21.14	38.94	38.95	39.02	38.94	38.95	39.02
	Initial displacement (ft) [AQTESOLV H(0)]		-	0.02	-	0.06	0.12	0.07	0.03	0.04	-	0.05	0.08	0.04	0.03	0.04	0.03	0.03	0.11	0.05
	Water level above top of well screen [AQTESOLV d]		13.58	13.87	14.23	13.58	13.87	14.23	10.74	10.90	11.14	10.74	10.90	11.14	28.94	28.95	29.02	28.94	28.95	29.02
	Inside Radius of Well Casing (ft) [AQTESOLV r(c)]		0.083			0.083			0.083			0.083			0.083			0.083		
	Radius of Well (ft) [AQTESOLV r(w)]		0.083			0.083			0.083			0.083			0.083			0.083		
	Well Skin Radius (ft) [AQTESOLV r(sk)]		0.333			0.333			0.333			0.333			0.333			0.333		
Output	Bouwer-Rice (1976)	k (ft/day)	-	-	-	2.3E-02	9.5E-03	2.1E-02	-	-	-	1.6E-02	1.2E-02	1.6E-02	1.6E-02	1.6E-02	1.4E-02	1.4E-02	4.3E-03	1.3E-02
		k (cm/sec)	-	-	-	8.1E-06	3.4E-06	7.4E-06	-	-	-	5.5E-06	4.2E-06	5.6E-06	5.6E-06	5.6E-06	5.0E-06	4.9E-06	1.5E-06	4.6E-06
	KGS Model (1994)	k (ft/day)	-	-	-	2.7E-02	1.4E-02	1.5E-02	-	-	-	1.7E-02	1.1E-02	1.0E-02	2.0E-02	1.0E-02	8.0E-03	9.0E-03	6.5E-03	1.9E-02
		k (cm/sec)	-	-	-	9.5E-06	5.0E-06	5.1E-06	-	-	-	6.0E-06	3.9E-06	3.5E-06	7.1E-06	3.5E-06	2.8E-06	3.2E-06	2.3E-06	6.5E-06
	Overall Geomean (ft/day)	**1.3E-02**	**GB-33 k Geometric Mean (ft/day)**		**1.7E-02**				**GB-41 k Geometric Mean (ft/day)**		**1.3E-02**				**GB-50 k Geometric Mean (ft/day)**		**1.1E-02**			
	Overall Geomean (cm/sec)	**4.6E-06**	**GB-33 k Geometric Mean (cm/sec)**		**6.1E-06**				**GB-41 k Geometric Mean (cm/sec)**		**4.7E-06**				**GB-50 k Geometric Mean (cm/sec)**		**4.0E-06**			

Notes:

in = inch

ft = feet

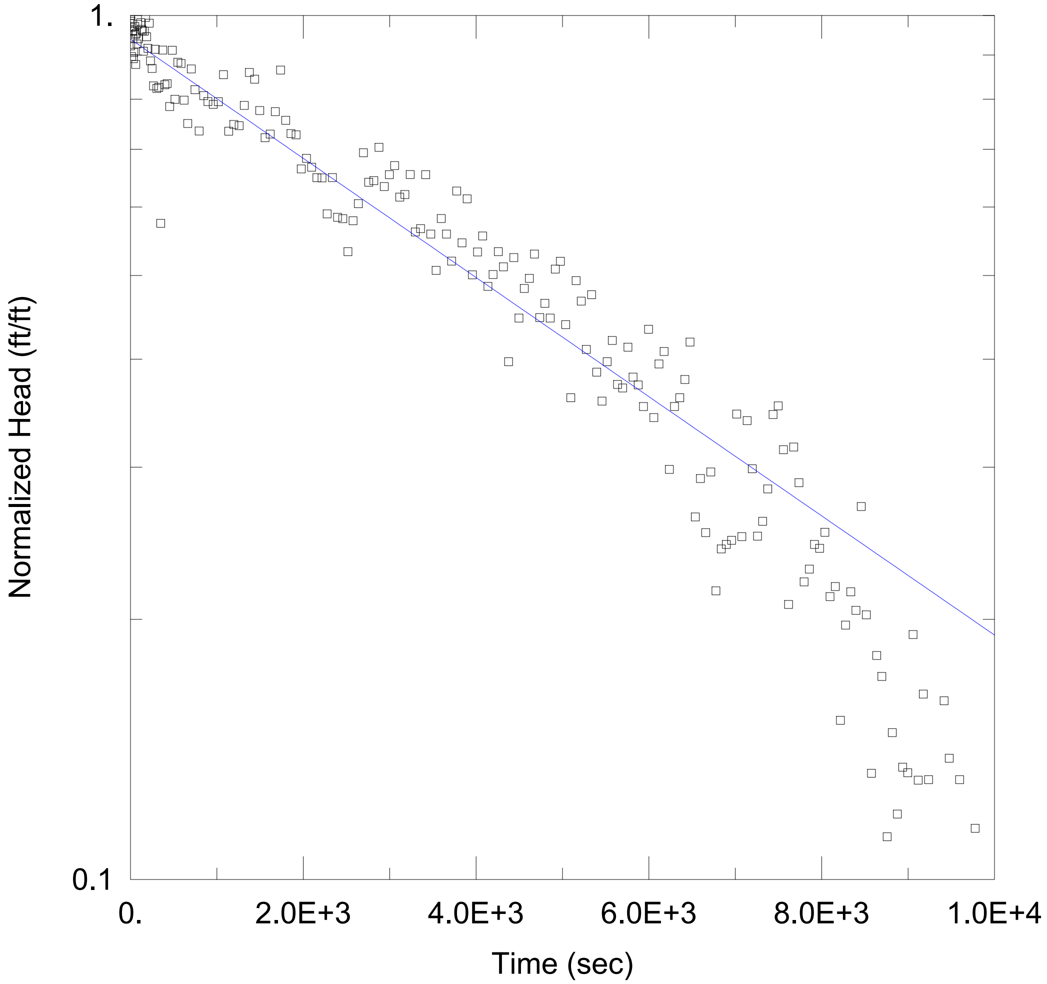
ft BTOC = feet below top of casing

ft BLS = feet below land surface

NGVD = National Geodetic Vertical Datum of 1929

ft/day = feet per day

k = hydraulic conductivity



GB-33 SLUG OUT TRIAL #1

Data Set: \...\GB-33 Slug out Trial #1 (BR).aqt
Date: 04/27/23 Time: 16:09:56

PROJECT INFORMATION

Company: Geosyntec Consultants
Project: GW8636
Location: Mesquite Creek
Test Well: GB-33
Test Date: 4/11/2023

AQUIFER DATA

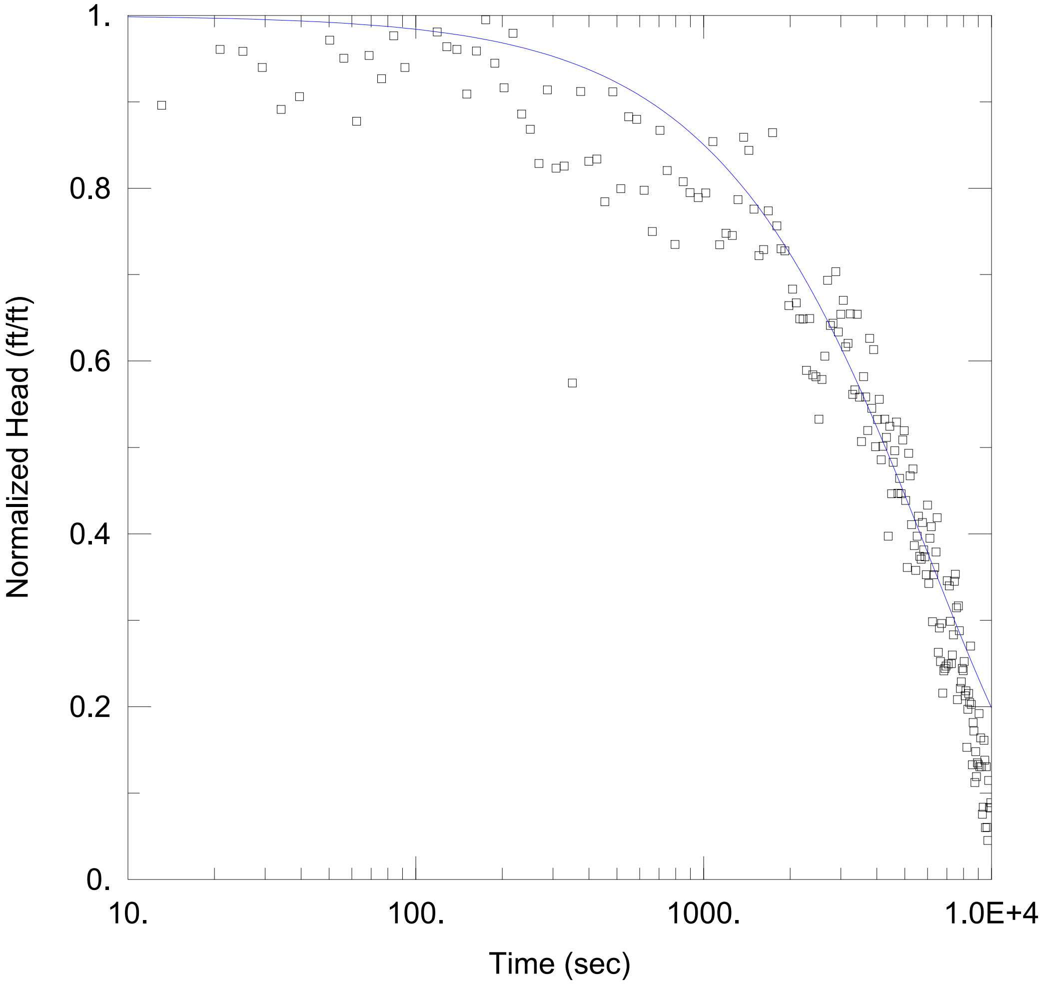
Saturated Thickness: 23.58 ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (GB-33)

Initial Displacement: 0.05864 ft
Total Well Penetration Depth: 23.38 ft
Casing Radius: 0.083 ft
Static Water Column Height: 23.58 ft
Screen Length: 10. ft
Well Radius: 0.083 ft
Gravel Pack Porosity: 0.

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 0.02325 ft/day
y0 = 0.05504 ft



GB-33 SLUG OUT TRIAL #1

Data Set: \...\GB-33 Slug out Trial #1 (KGS).aqt
Date: 04/27/23 Time: 16:11:23

PROJECT INFORMATION

Company: Geosyntec Consultants
Project: GW8636
Location: Mesquite Creek
Test Well: GB-33
Test Date: 4/11/2023

AQUIFER DATA

Saturated Thickness: 23.58 ft

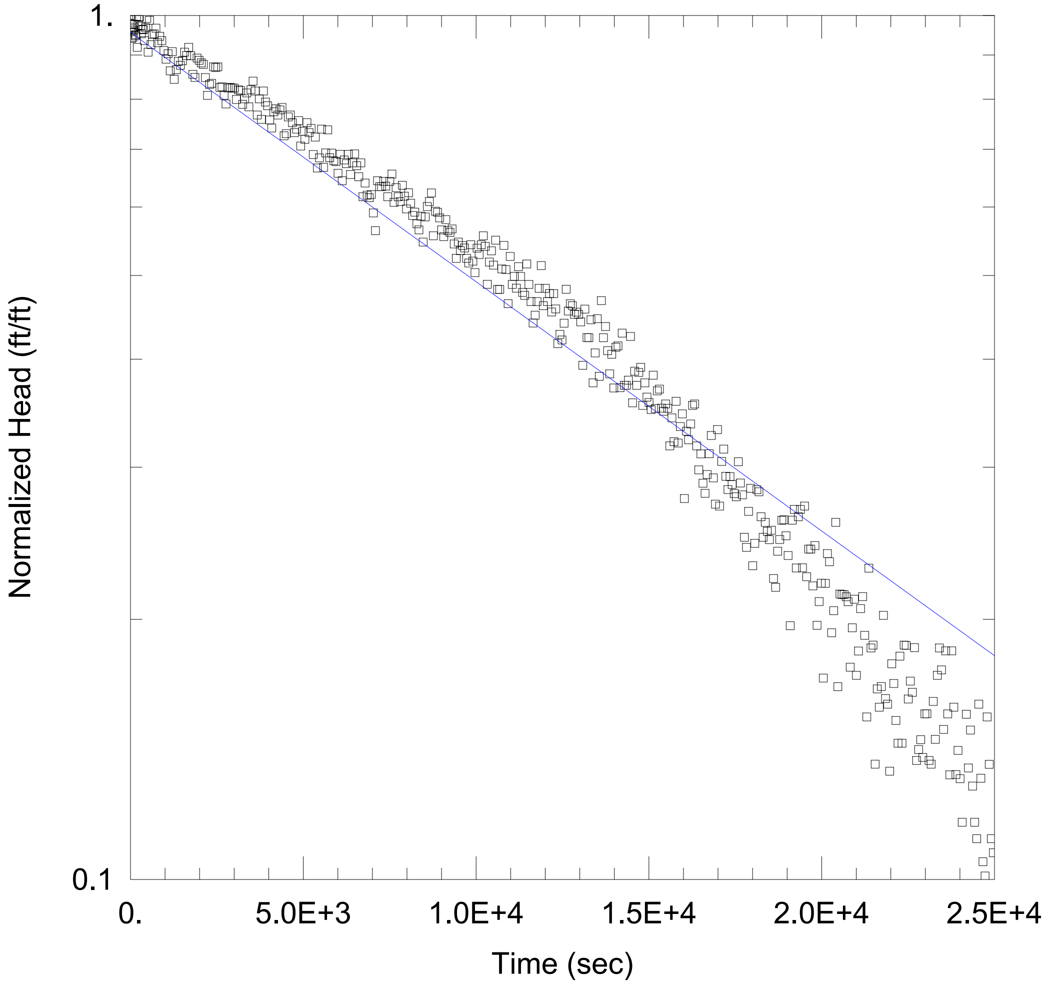
WELL DATA (GB-33)

Initial Displacement: 0.05864 ft
Total Well Penetration Depth: 23.38 ft
Casing Radius: 0.083 ft
Static Water Column Height: 23.58 ft
Screen Length: 10. ft
Well Radius: 0.083 ft
Gravel Pack Porosity: 0.

SOLUTION

Aquifer Model: Unconfined
Solution Method: KGS Model

Kr = 0.02696 ft/day
Kz/Kr = 0.1
Ss = 1.0E-11 ft^{-1}



GB-33 SLUG OUT TRIAL #2

Data Set: \...\GB-33 Slug out Trial #2 (BR).aqt
Date: 04/27/23 Time: 16:12:05

PROJECT INFORMATION

Company: Geosyntec Consultants
Project: GW8636
Location: Mesquite Creek
Test Well: GB-33
Test Date: 4/11/2023

AQUIFER DATA

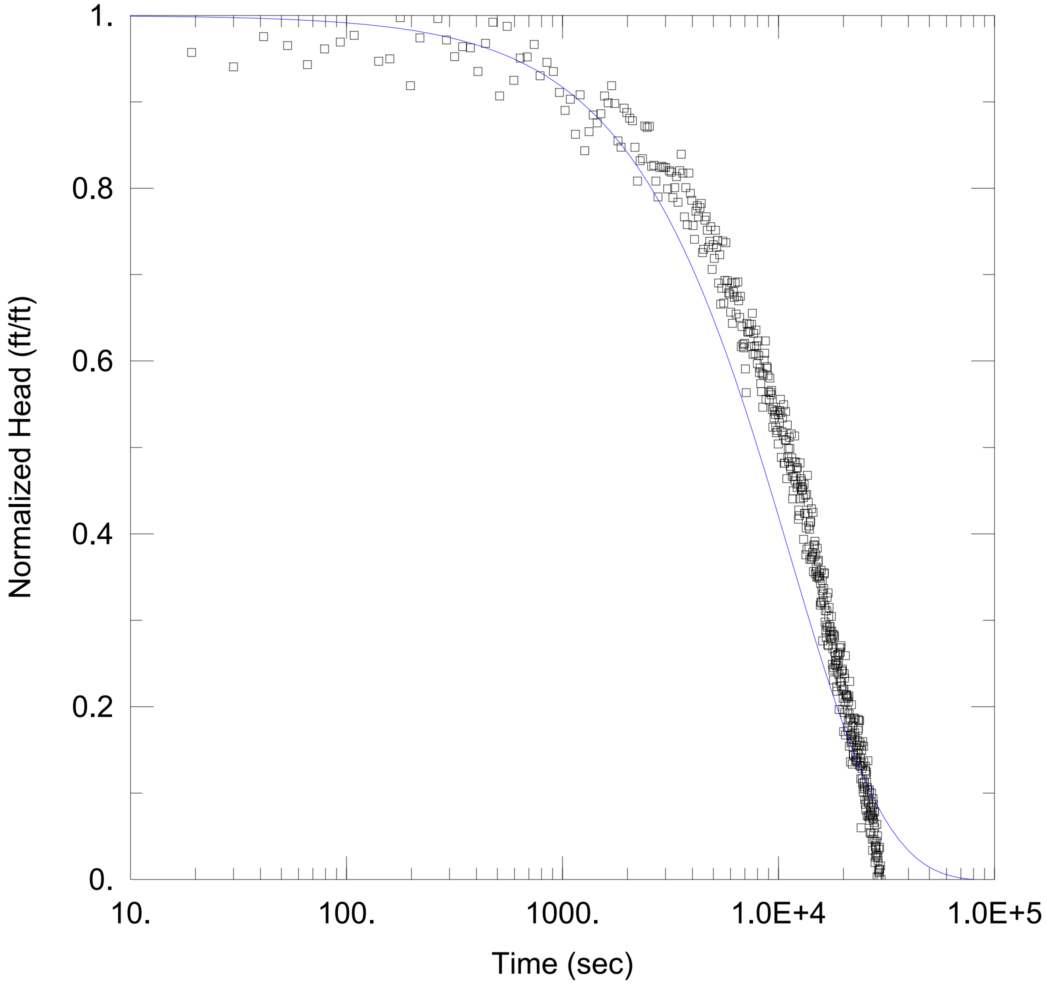
Saturated Thickness: 23.87 ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (GB-33)

Initial Displacement: 0.1175 ft
Total Well Penetration Depth: 23.38 ft
Casing Radius: 0.083 ft
Static Water Column Height: 23.87 ft
Screen Length: 10. ft
Well Radius: 0.083 ft
Gravel Pack Porosity: 0.

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 0.009516 ft/day
y0 = 0.1123 ft



GB-33 SLUG OUT TRIAL #2

Data Set: \...\GB-33 Slug out Trial #2 (KGS).aqt
Date: 04/27/23 Time: 16:12:50

PROJECT INFORMATION

Company: Geosyntec Consultants
Project: GW8636
Location: Mesquite Creek
Test Well: GB-33
Test Date: 4/11/2023

AQUIFER DATA

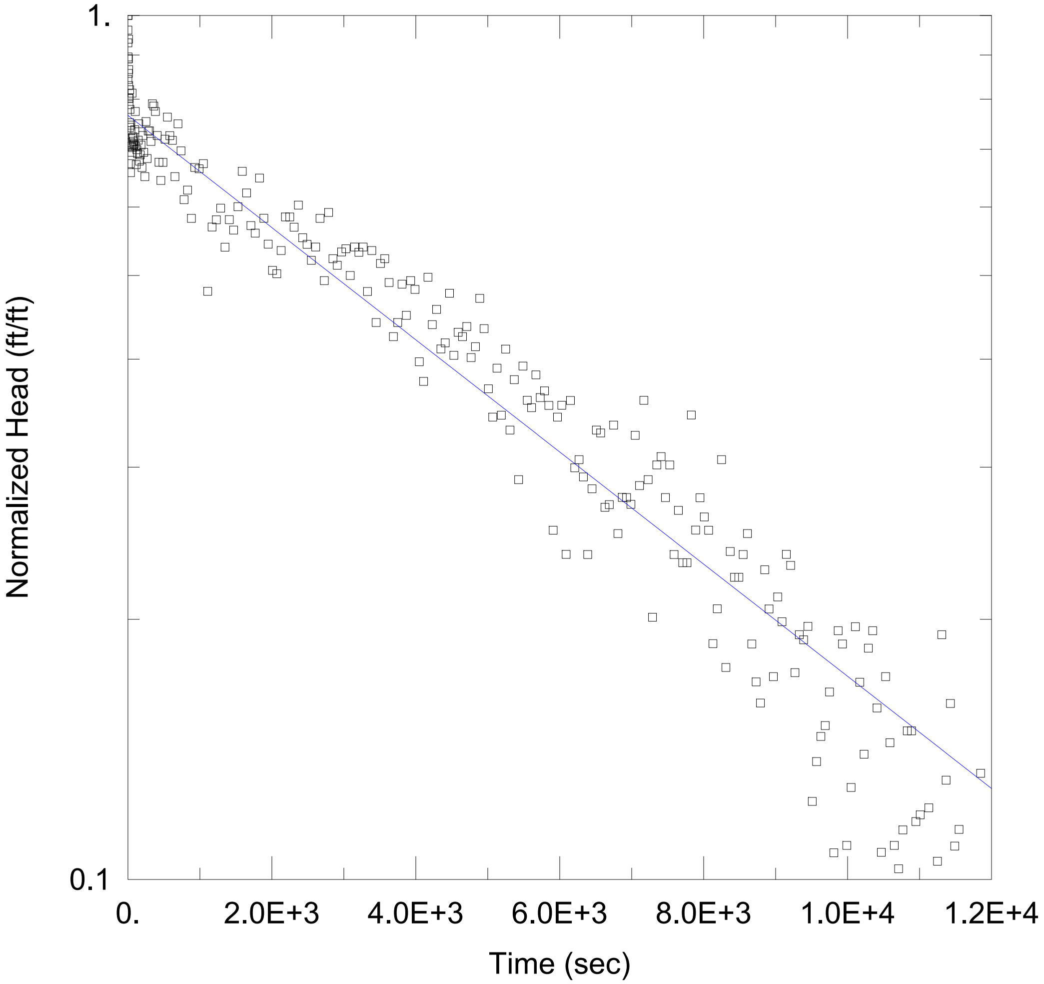
Saturated Thickness: 23.87 ft

WELL DATA (GB-33)

Initial Displacement: 0.1175 ft
Total Well Penetration Depth: 23.38 ft
Casing Radius: 0.083 ft
Static Water Column Height: 23.87 ft
Screen Length: 10. ft
Well Radius: 0.083 ft
Gravel Pack Porosity: 0.

SOLUTION

Aquifer Model: Unconfined
Solution Method: KGS Model
Kr = 0.01429 ft/day
Ss = 1.0E-11 ft^{-1}
Kz/Kr = 0.1



GB-33 SLUG OUT TRIAL #3

Data Set: \...\GB-33 Slug out Trial #3 (BR).aqt
Date: 04/27/23 Time: 16:13:31

PROJECT INFORMATION

Company: Geosyntec Consultants
Project: GW8636
Location: Mesquite Creek
Test Well: GB-33
Test Date: 4/11/2023

AQUIFER DATA

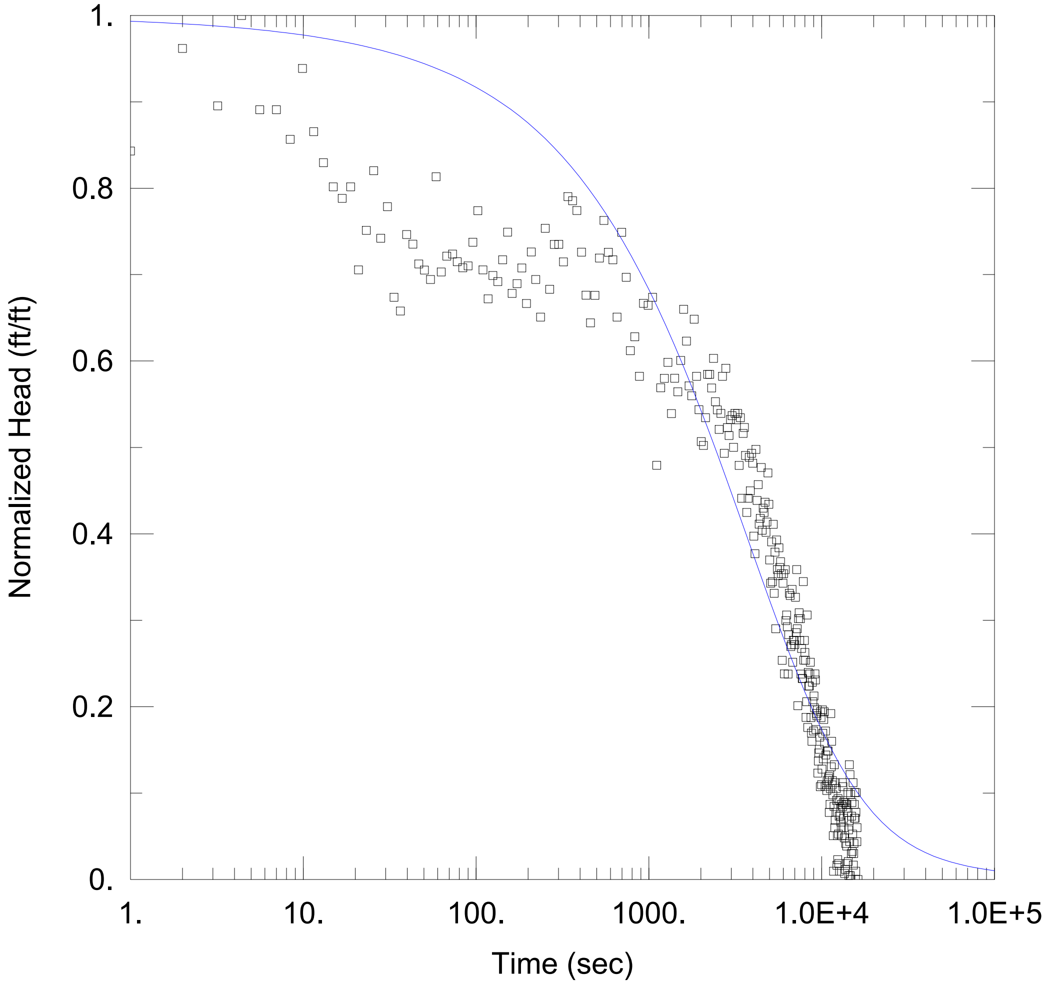
Saturated Thickness: 24.23 ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (GB-33)

Initial Displacement: 0.06669 ft
Total Well Penetration Depth: 23.38 ft
Casing Radius: 0.083 ft
Static Water Column Height: 24.23 ft
Screen Length: 10. ft
Well Radius: 0.083 ft
Gravel Pack Porosity: 0.

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 0.02114 ft/day
y0 = 0.05109 ft



GB-33 SLUG OUT TRIAL #3

Data Set: \...\GB-33 Slug out Trial #3 (KGS).aqt
Date: 04/27/23 Time: 16:13:59

PROJECT INFORMATION

Company: Geosyntec Consultants
Project: GW8636
Location: Mesquite Creek
Test Well: GB-33
Test Date: 4/11/2023

AQUIFER DATA

Saturated Thickness: 24.23 ft

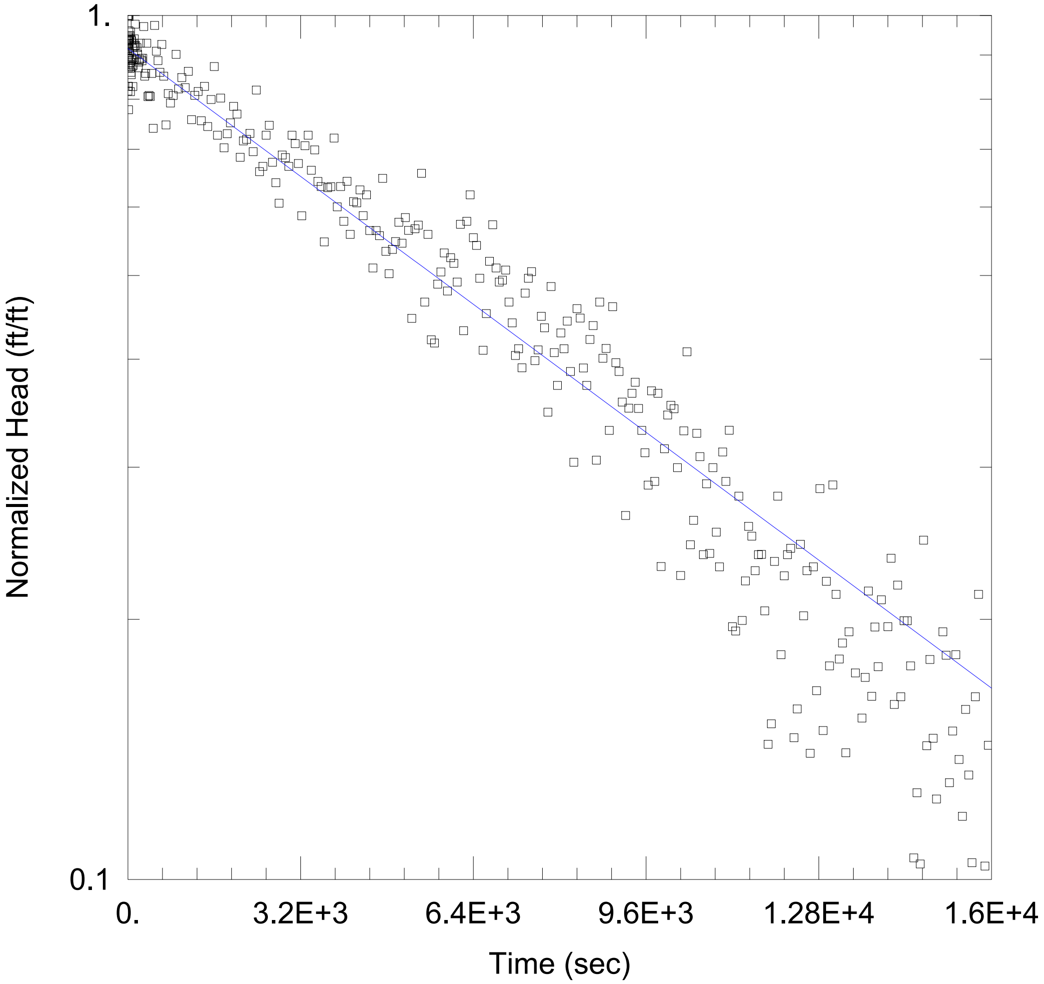
WELL DATA (GB-33)

Initial Displacement: 0.06669 ft
Total Well Penetration Depth: 23.38 ft
Casing Radius: 0.083 ft
Static Water Column Height: 24.23 ft
Screen Length: 10. ft
Well Radius: 0.083 ft
Gravel Pack Porosity: 0.

SOLUTION

Aquifer Model: Unconfined
Solution Method: KGS Model

Kr = 0.0145 ft/day
Ss = 0.003 ft^{-1}
Kz/Kr = 0.1



GB-41 SLUG OUT TRIAL #1

Data Set: \...\GB-41 Slug out Trial #1 (BR).aqt

Date: 04/27/23 Time: 16:14:51

PROJECT INFORMATION

Company: Geosyntec Consultants
Project: GW8636
Location: Mesquite Creek
Test Well: GB-41
Test Date: 4/11/2023

AQUIFER DATA

Saturated Thickness: 20.74 ft

Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (GB-41)

Initial Displacement: 0.05231 ft
Total Well Penetration Depth: 20.64 ft
Casing Radius: 0.083 ft

Static Water Column Height: 20.74 ft
Screen Length: 10. ft
Well Radius: 0.083 ft
Gravel Pack Porosity: 0.

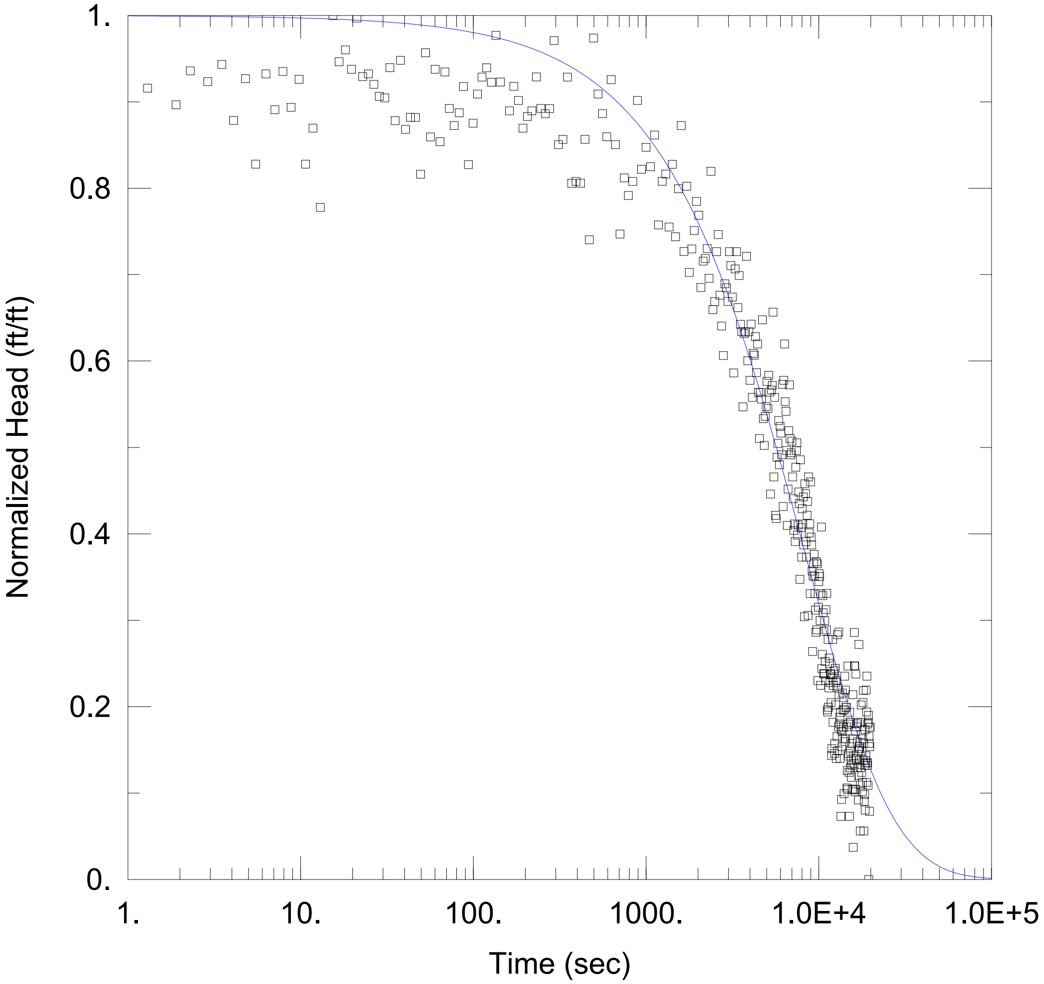
SOLUTION

Aquifer Model: Unconfined

Solution Method: Bouwer-Rice

K = 0.01562 ft/day

y0 = 0.04789 ft



GB-41 SLUG OUT TRIAL #1

Data Set: \...\GB-41 Slug out Trial #1 (KGS).aqt
Date: 04/27/23 Time: 16:15:22

PROJECT INFORMATION

Company: Geosyntec Consultants
Project: GW8636
Location: Mesquite Creek
Test Well: GB-41
Test Date: 4/11/2023

AQUIFER DATA

Saturated Thickness: 20.74 ft

WELL DATA (GB-41)

Initial Displacement: 0.05231 ft
Total Well Penetration Depth: 20.64 ft
Casing Radius: 0.083 ft

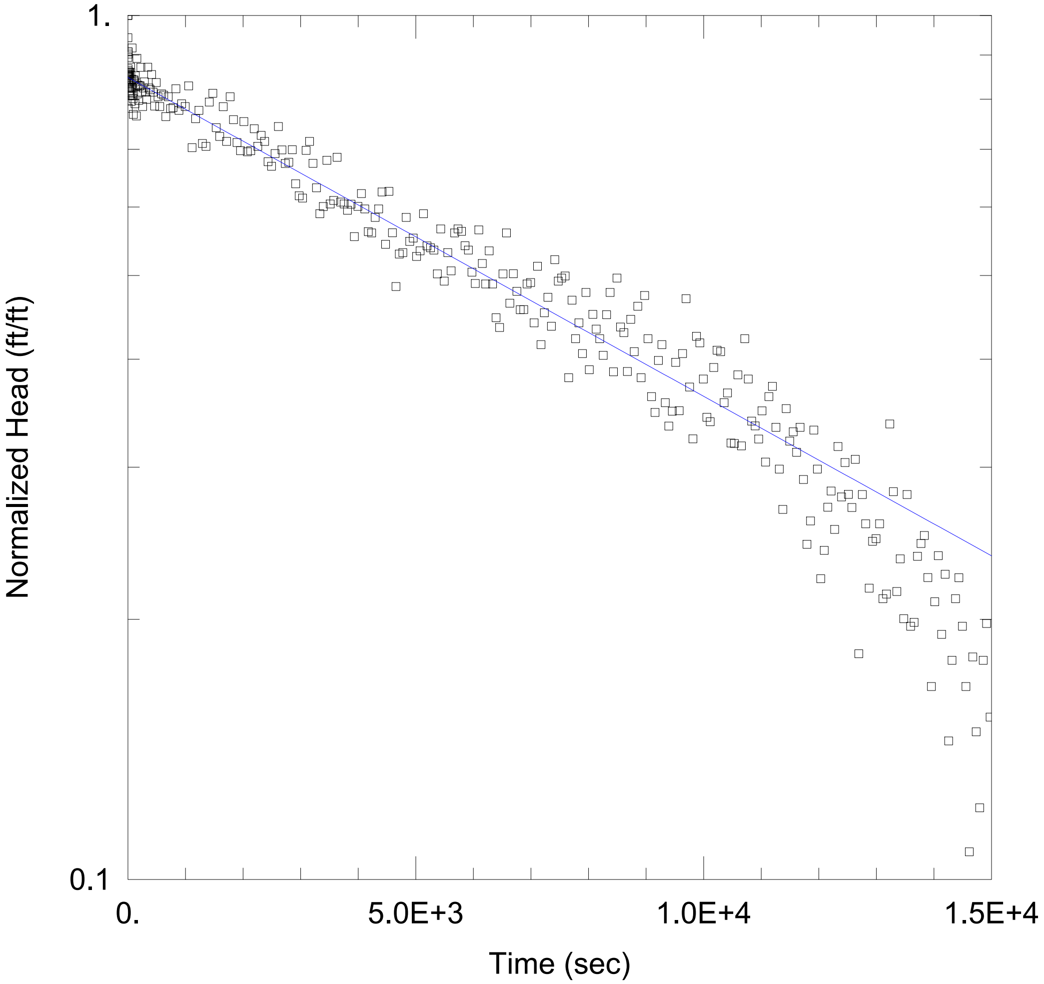
Static Water Column Height: 20.74 ft
Screen Length: 10. ft
Well Radius: 0.083 ft
Gravel Pack Porosity: 0.

SOLUTION

Aquifer Model: Unconfined
Solution Method: KGS Model

Kr = 0.01733 ft/day
Kz/Kr = 0.1

Ss = 5.28E-6 ft^{-1}



GB-41 SLUG OUT TRIAL #2

Data Set: \...\GB-41 Slug out Trial #2 (BR).aqt
Date: 04/27/23 Time: 16:15:50

PROJECT INFORMATION

Company: Geosyntec Consultants
Project: GW8636
Location: Mesquite Creek
Test Well: GB-41
Test Date: 4/11/2023

AQUIFER DATA

Saturated Thickness: 20.9 ft
Anisotropy Ratio (Kz/Kr): 0.1

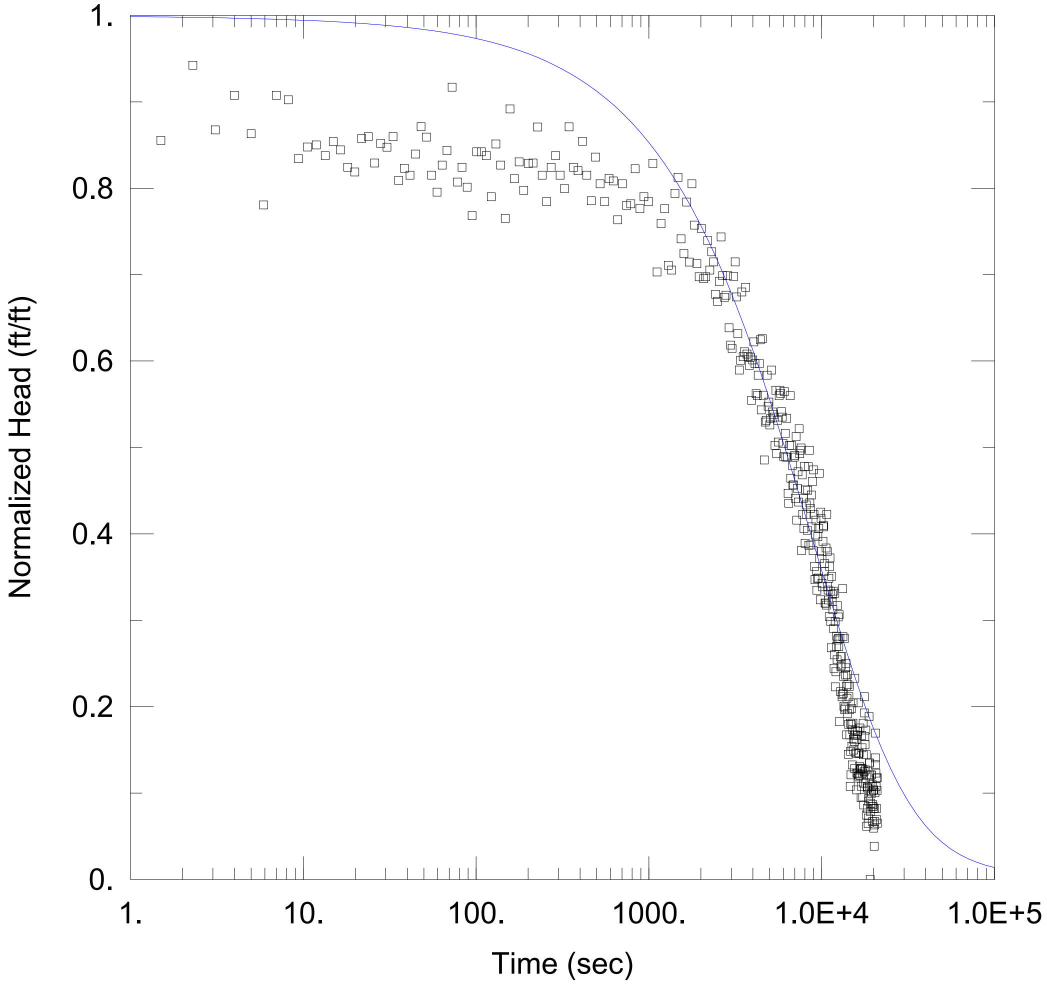
WELL DATA (GB-41)

Initial Displacement: 0.07618 ft
Total Well Penetration Depth: 20.64 ft
Casing Radius: 0.083 ft
Static Water Column Height: 20.9 ft
Screen Length: 10. ft
Well Radius: 0.083 ft
Gravel Pack Porosity: 0.

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 0.01218 ft/day
y0 = 0.06459 ft



GB-41 SLUG OUT TRIAL #2

Data Set: \...\GB-41 Slug out Trial #2 (KGS).aqt
Date: 04/27/23 Time: 16:16:12

PROJECT INFORMATION

Company: Geosyntec Consultants
Project: GW8636
Location: Mesquite Creek
Test Well: GB-41
Test Date: 4/11/2023

AQUIFER DATA

Saturated Thickness: 20.9 ft

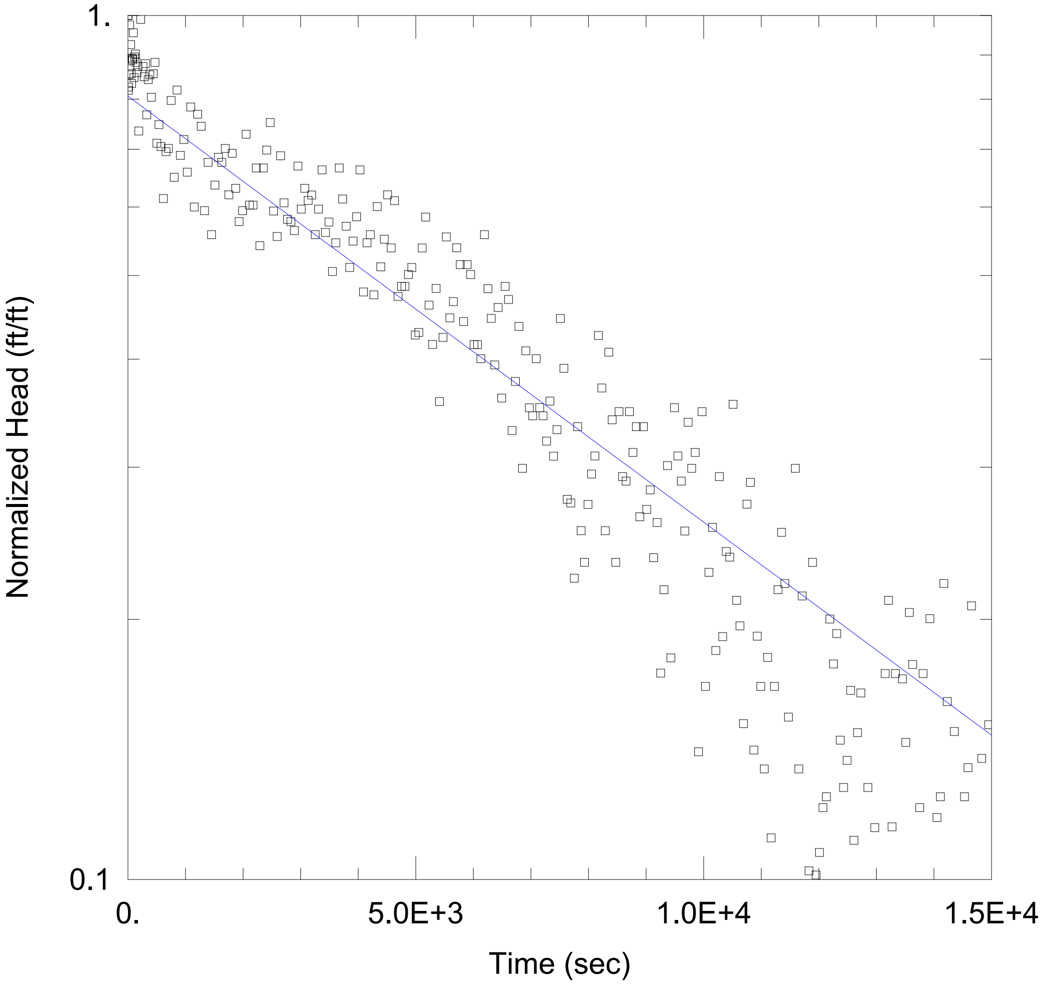
WELL DATA (GB-41)

Initial Displacement: 0.07618 ft
Total Well Penetration Depth: 20.64 ft
Casing Radius: 0.083 ft
Static Water Column Height: 20.9 ft
Screen Length: 10. ft
Well Radius: 0.083 ft
Gravel Pack Porosity: 0.

SOLUTION

Aquifer Model: Unconfined
Solution Method: KGS Model

Kr = 0.011 ft/day
Ss = 0.00014 ft^{-1}
Kz/Kr = 0.1



GB-41 SLUG OUT TRIAL #3

Data Set: \...\GB-41 Slug out Trial #3 (BR).aqt
Date: 04/27/23 Time: 16:16:39

PROJECT INFORMATION

Company: Geosyntec Consultants
Project: GW8636
Location: Mesquite Creek
Test Well: GB-41
Test Date: 4/11/2023

AQUIFER DATA

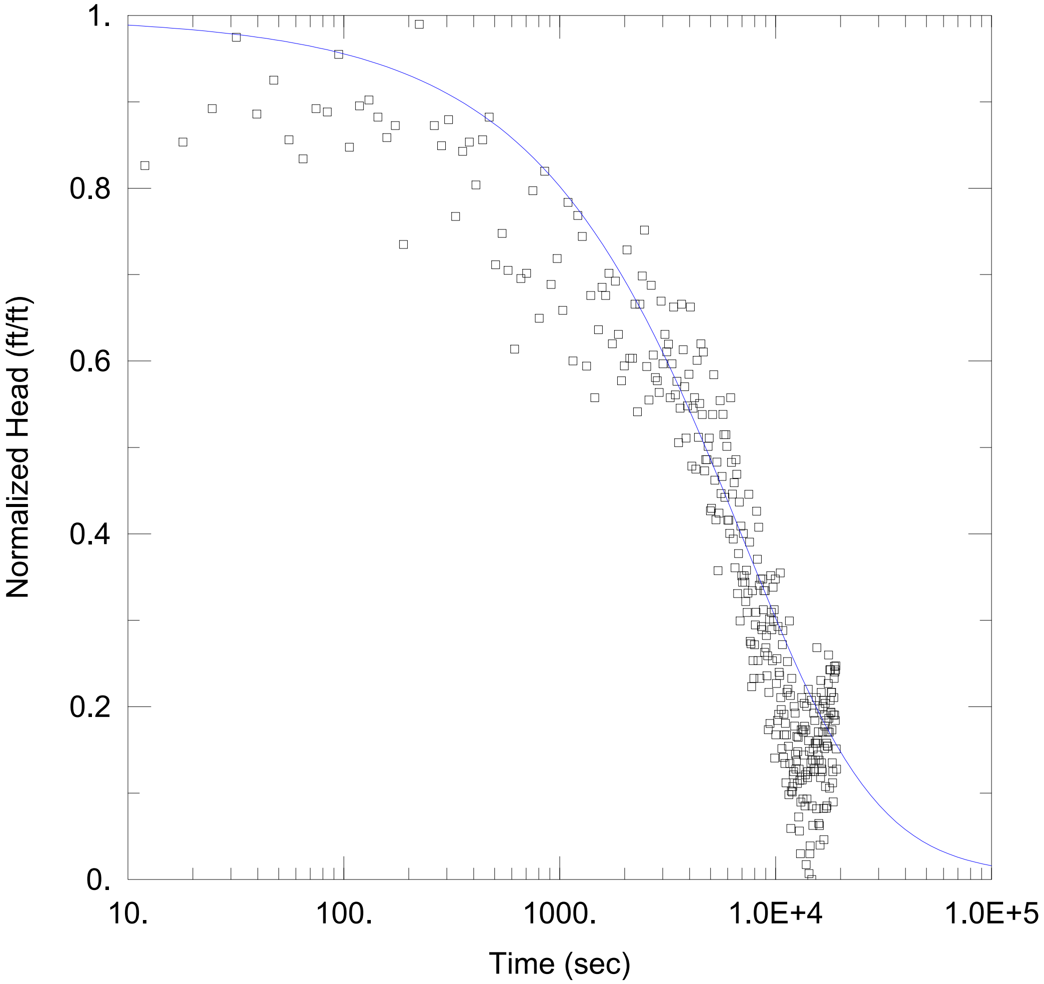
Saturated Thickness: 21.14 ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (GB-41)

Initial Displacement: 0.04477 ft
Total Well Penetration Depth: 20.64 ft
Casing Radius: 0.083 ft
Static Water Column Height: 21.14 ft
Screen Length: 10. ft
Well Radius: 0.083 ft
Gravel Pack Porosity: 0.

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 0.01601 ft/day
y0 = 0.03611 ft



GB-41 SLUG OUT TRIAL #3

Data Set: \...\GB-41 Slug out Trial #3 (KGS).aqt
Date: 04/27/23 Time: 16:17:02

PROJECT INFORMATION

Company: Geosyntec Consultants
Project: GW8636
Location: Mesquite Creek
Test Well: GB-41
Test Date: 4/11/2023

AQUIFER DATA

Saturated Thickness: 21.14 ft

WELL DATA (GB-41)

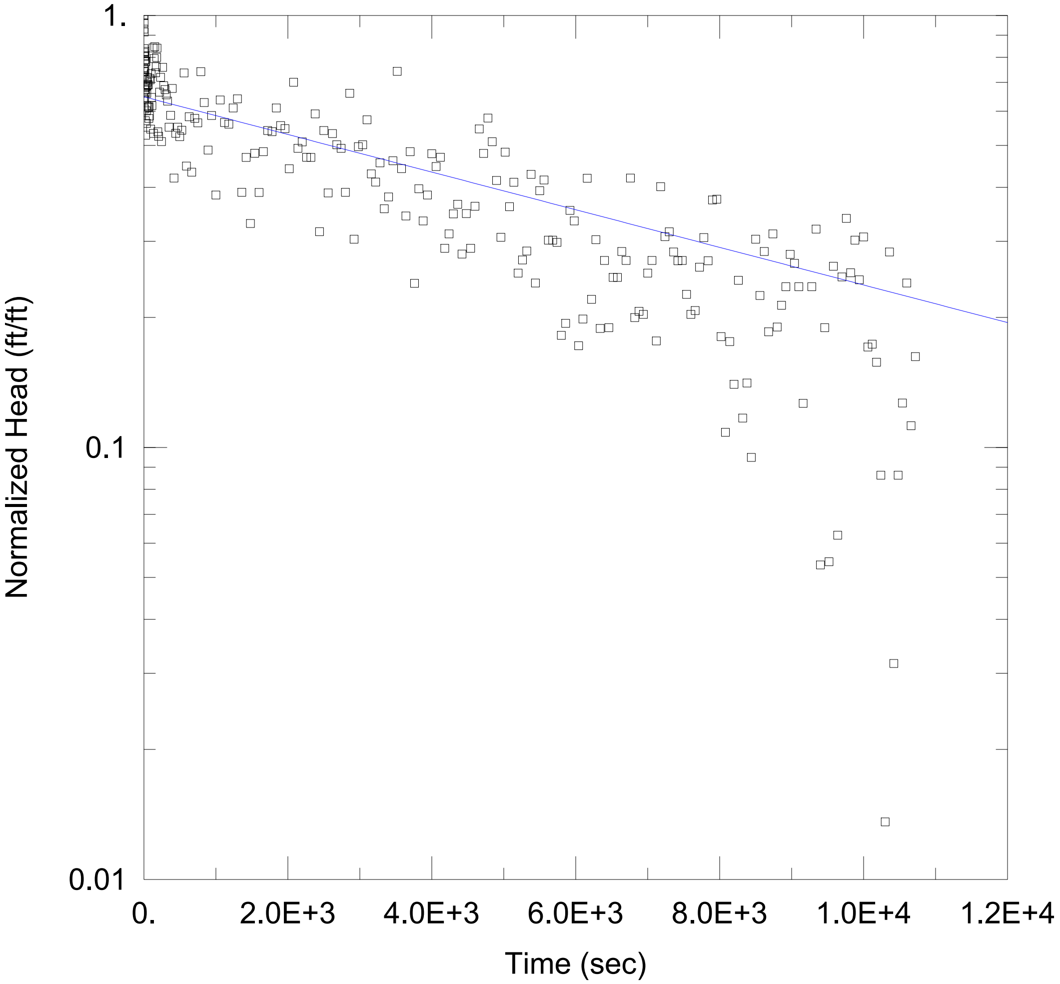
Initial Displacement: 0.04477 ft
Total Well Penetration Depth: 20.64 ft
Casing Radius: 0.083 ft

Static Water Column Height: 21.14 ft
Screen Length: 10. ft
Well Radius: 0.083 ft
Gravel Pack Porosity: 0.

SOLUTION

Aquifer Model: Unconfined
Solution Method: KGS Model

Kr = 0.01 ft/day
Ss = 0.00095 ft^{-1}
Kz/Kr = 0.1



GB-50 SLUG IN TRIAL #1

Data Set: \...\GB-50 Slug in Trial #1 (BR).aqt
Date: 04/27/23 Time: 16:17:43

PROJECT INFORMATION

Company: Geosyntec Consultants
Project: GW8636
Location: Mesquite Creek
Test Well: GB-50
Test Date: 4/11/2023

AQUIFER DATA

Saturated Thickness: 38.94 ft
Anisotropy Ratio (Kz/Kr): 0.1

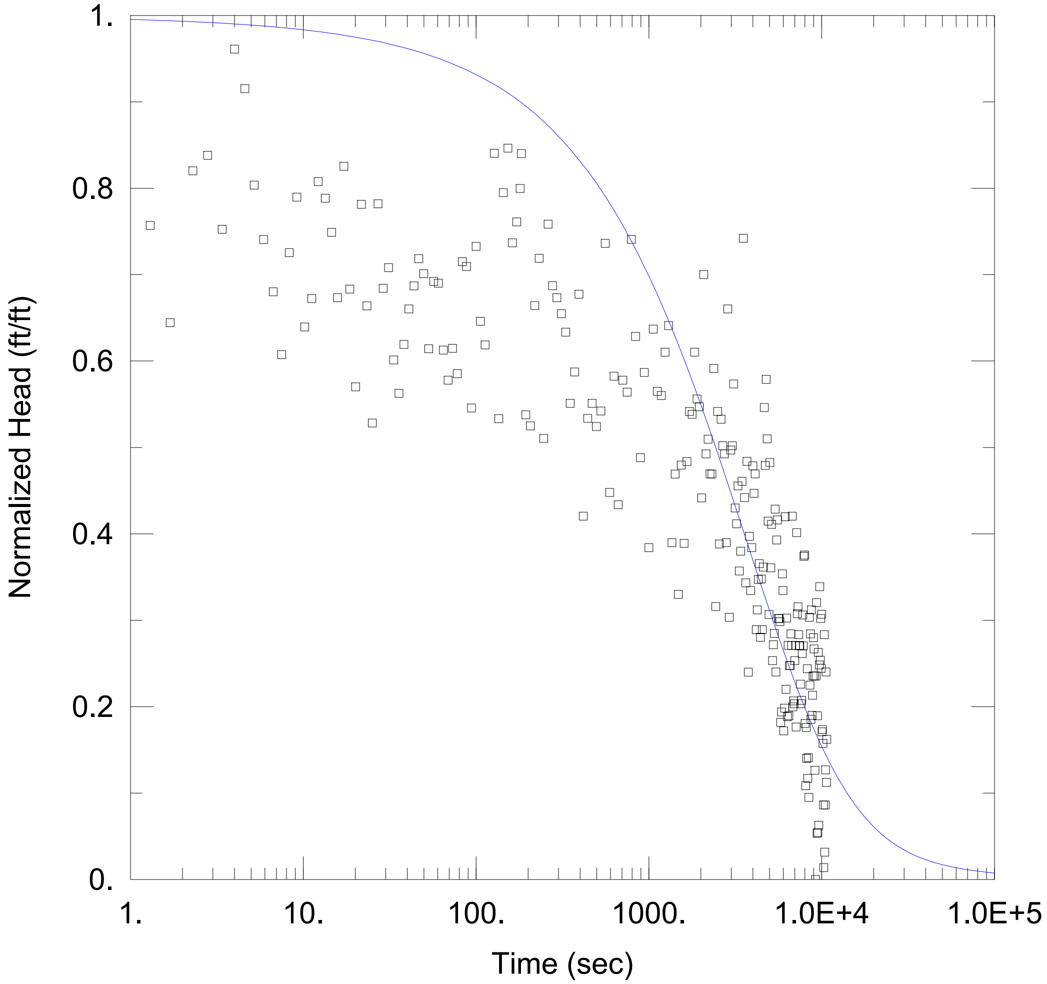
WELL DATA (GB-50)

Initial Displacement: 0.03385 ft
Total Well Penetration Depth: 39.12 ft
Casing Radius: 0.083 ft
Static Water Column Height: 38.94 ft
Screen Length: 10. ft
Well Radius: 0.083 ft
Gravel Pack Porosity: 0.

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 0.016 ft/day
y0 = 0.02193 ft



GB-50 SLUG IN TRIAL #1

Data Set: \...\GB-50 Slug in Trial #1 (KGS).aqt
Date: 04/27/23 Time: 16:18:12

PROJECT INFORMATION

Company: Geosyntec Consultants
Project: GW8636
Location: Mesquite Creek
Test Well: GB-50
Test Date: 4/11/2023

AQUIFER DATA

Saturated Thickness: 38.94 ft

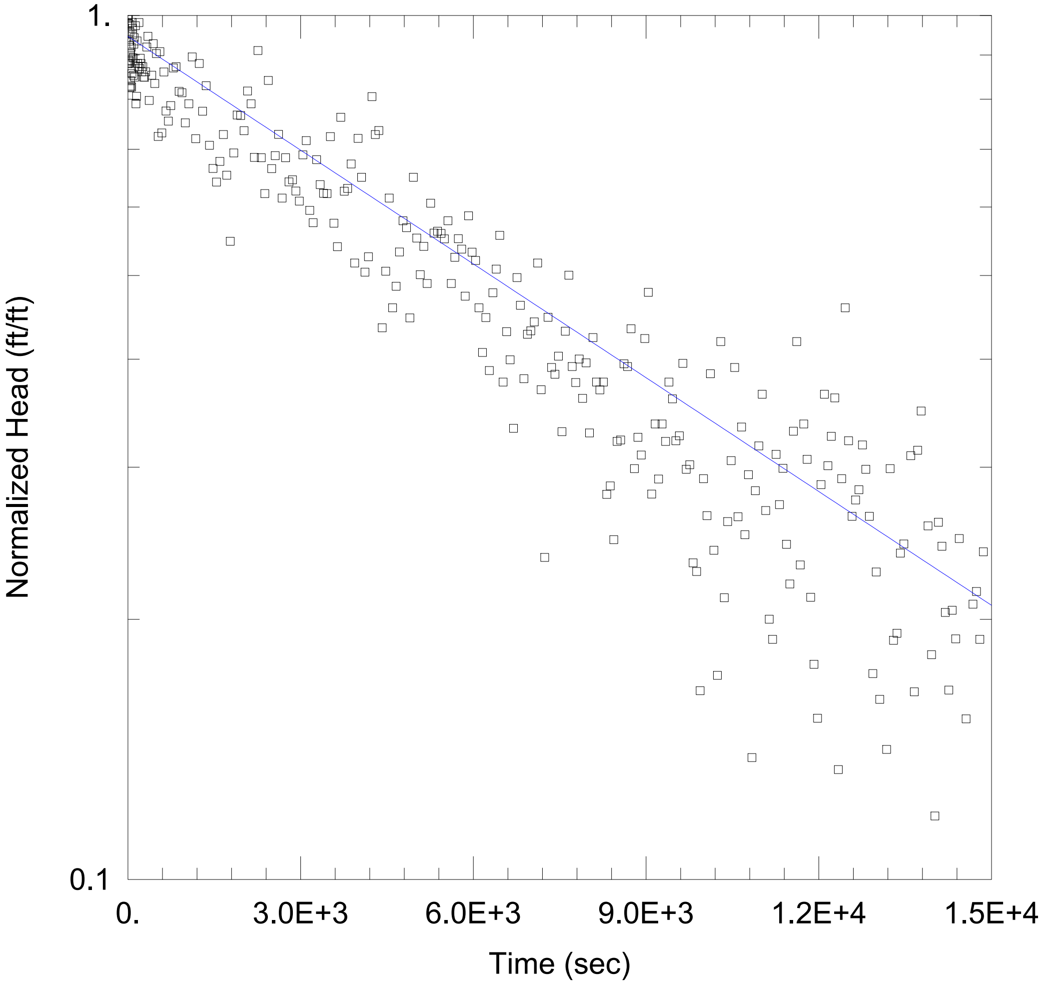
WELL DATA (GB-50)

Initial Displacement: 0.03385 ft
Total Well Penetration Depth: 39.12 ft
Casing Radius: 0.083 ft
Static Water Column Height: 38.94 ft
Screen Length: 10. ft
Well Radius: 0.083 ft
Gravel Pack Porosity: 0.

SOLUTION

Aquifer Model: Unconfined
Solution Method: KGS Model

Kr = 0.02 ft/day
Ss = 0.001 ft^{-1}
Kz/Kr = 0.1



GB-50 SLUG IN TRIAL #2

Data Set: \...\GB-50 Slug in Trial #2 (BR).aqt

Date: 04/27/23 Time: 16:19:08

PROJECT INFORMATION

Company: Geosyntec Consultants
Project: GW8636
Location: Mesquite Creek
Test Well: GB-50
Test Date: 4/11/2023

AQUIFER DATA

Saturated Thickness: 38.95 ft

Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (GB-50)

Initial Displacement: 0.03918 ft
Total Well Penetration Depth: 39.12 ft
Casing Radius: 0.083 ft

Static Water Column Height: 38.95 ft
Screen Length: 10. ft
Well Radius: 0.083 ft
Gravel Pack Porosity: 0.

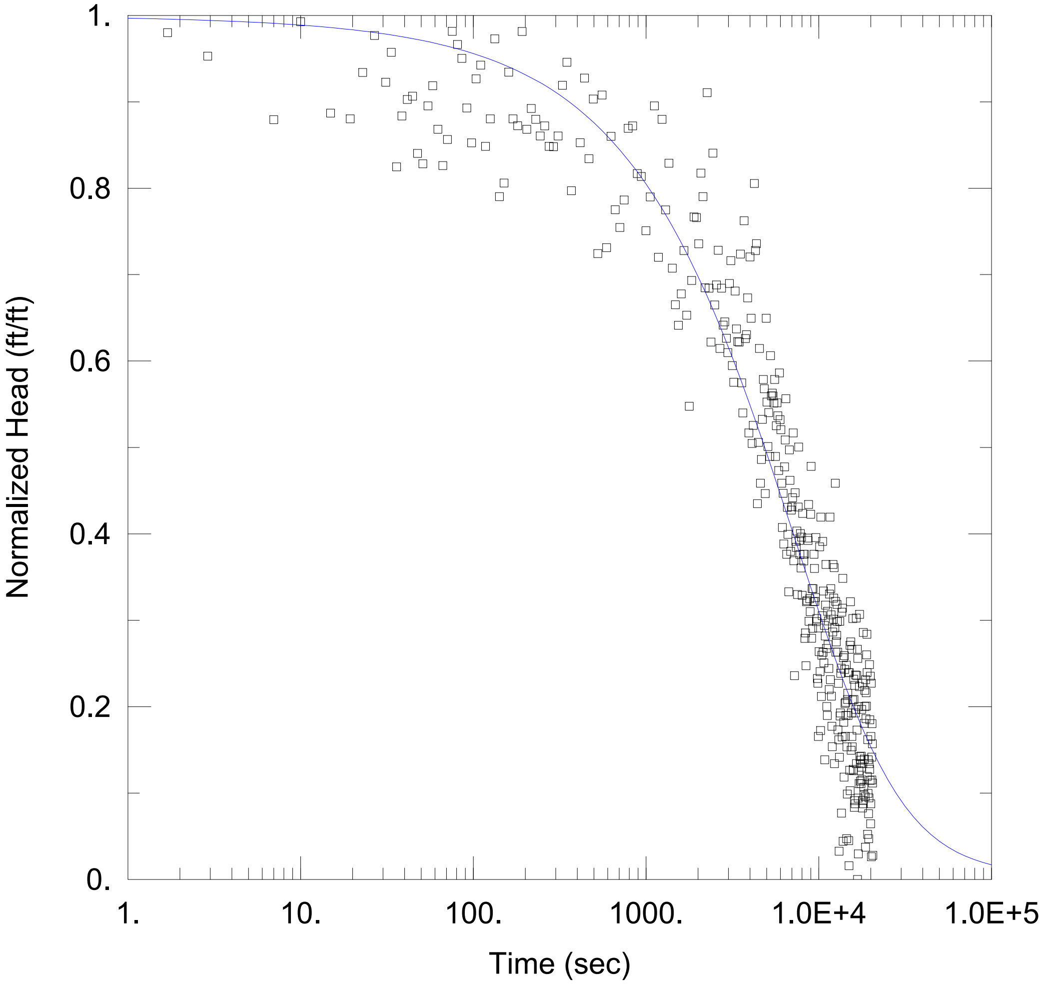
SOLUTION

Aquifer Model: Unconfined

Solution Method: Bouwer-Rice

K = 0.01613 ft/day

y0 = 0.03705 ft



GB-50 SLUG IN TRIAL #2

Data Set: \...\GB-50 Slug in Trial #2 (KGS).aqt
Date: 04/27/23 Time: 16:19:45

PROJECT INFORMATION

Company: Geosyntec Consultants
Project: GW8636
Location: Mesquite Creek
Test Well: GB-50
Test Date: 4/11/2023

AQUIFER DATA

Saturated Thickness: 38.95 ft

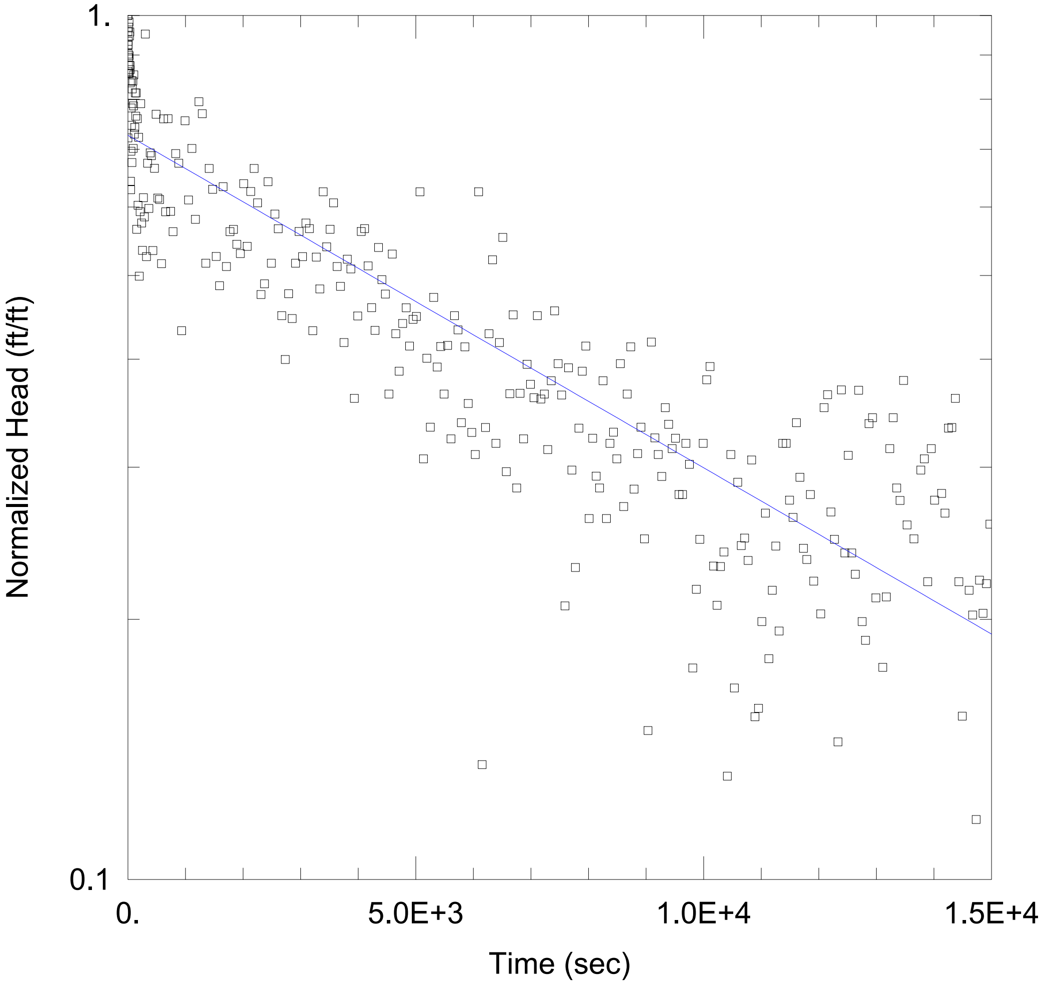
WELL DATA (GB-50)

Initial Displacement: 0.03918 ft
Total Well Penetration Depth: 39.12 ft
Casing Radius: 0.083 ft
Static Water Column Height: 38.95 ft
Screen Length: 10. ft
Well Radius: 0.083 ft
Gravel Pack Porosity: 0.

SOLUTION

Aquifer Model: Unconfined
Solution Method: KGS Model

Kr = 0.01 ft/day
Kz/Kr = 0.1
Ss = 0.001 ft^{-1}



GB-50 SLUG IN TRIAL #3

Data Set: \...\GB-50 Slug in Trial #3 (BR).aqt
Date: 04/27/23
Time: 16:20:13

PROJECT INFORMATION

Company: Geosyntec Consultants
Project: GW8636
Location: Mesquite Creek
Test Well: GB-50
Test Date: 4/11/2023

AQUIFER DATA

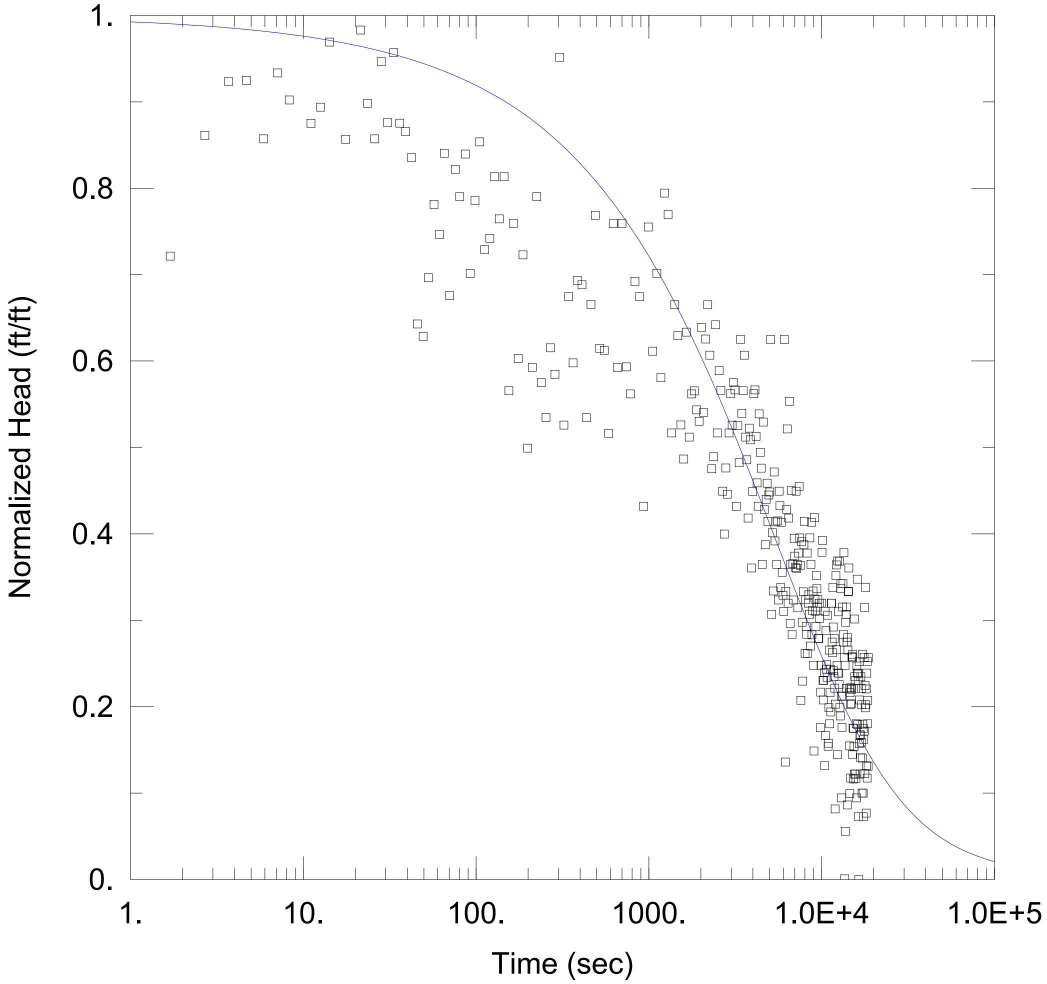
Saturated Thickness: 39.02 ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (GB-50)

Initial Displacement: 0.0341 ft
Static Water Column Height: 39.02 ft
Total Well Penetration Depth: 39.12 ft
Screen Length: 10. ft
Casing Radius: 0.083 ft
Well Radius: 0.083 ft
Gravel Pack Porosity: 0.

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 0.01414 ft/day
y0 = 0.02477 ft



GB-50 SLUG IN TRIAL #3

Data Set: \...\GB-50 Slug in Trial #3 (KGS).aqt
Date: 04/27/23
Time: 16:20:35

PROJECT INFORMATION

Company: Geosyntec Consultants
Project: GW8636
Location: Mesquite Creek
Test Well: GB-50
Test Date: 4/11/2023

AQUIFER DATA

Saturated Thickness: 39.02 ft

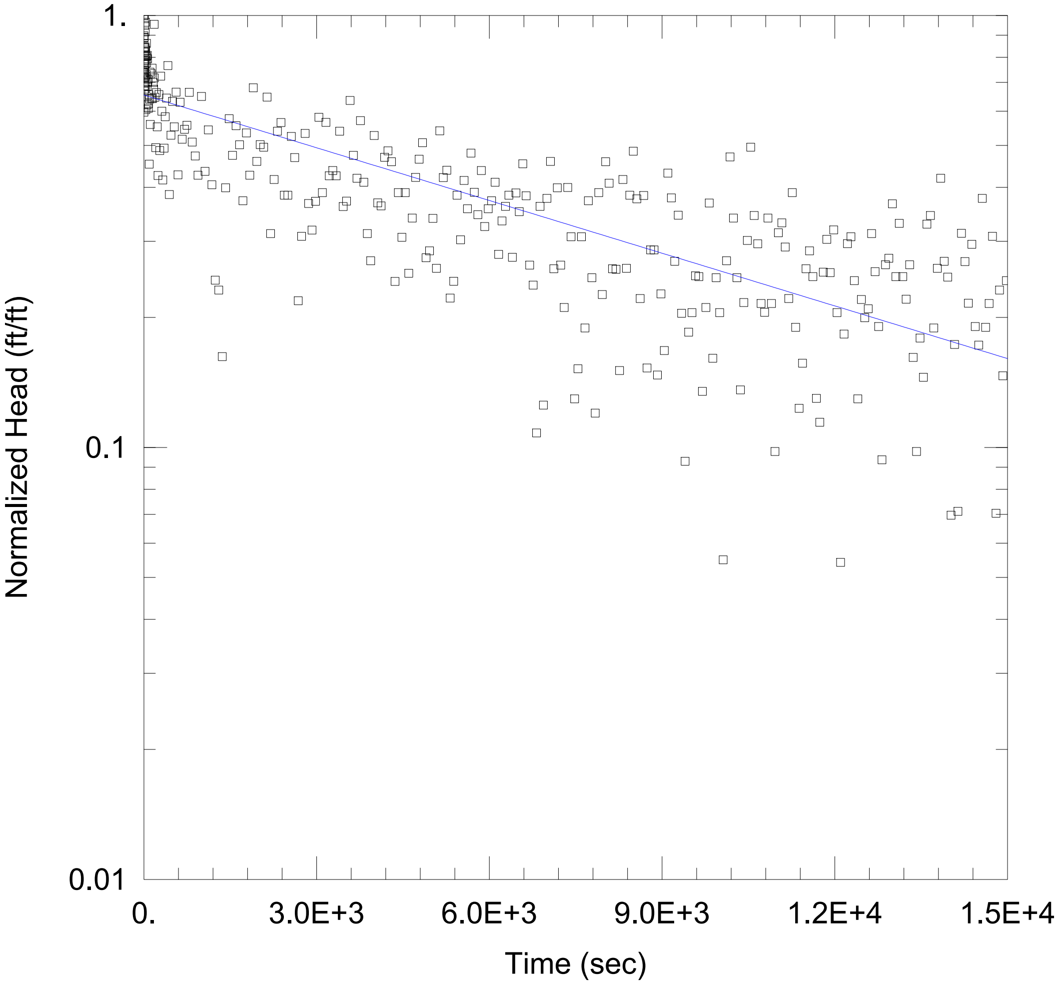
WELL DATA (GB-50)

Initial Displacement: 0.0341 ft
Total Well Penetration Depth: 39.12 ft
Casing Radius: 0.083 ft
Static Water Column Height: 39.02 ft
Screen Length: 10. ft
Well Radius: 0.083 ft
Gravel Pack Porosity: 0.

SOLUTION

Aquifer Model: Unconfined
Solution Method: KGS Model

Kr = 0.008 ft/day
Ss = 0.007 ft^{-1}
Kz/Kr = 0.1



GB-50 SLUG OUT TRIAL #1

Data Set: \...\GB-50 Slug out Trial #1 (BR).aqt
Date: 04/27/23 Time: 16:21:02

PROJECT INFORMATION

Company: Geosyntec Consultants
Project: GW8636
Location: Mesquite Creek
Test Well: GB-50
Test Date: 4/11/2023

AQUIFER DATA

Saturated Thickness: 38.94 ft Anisotropy Ratio (Kz/Kr): 0.1

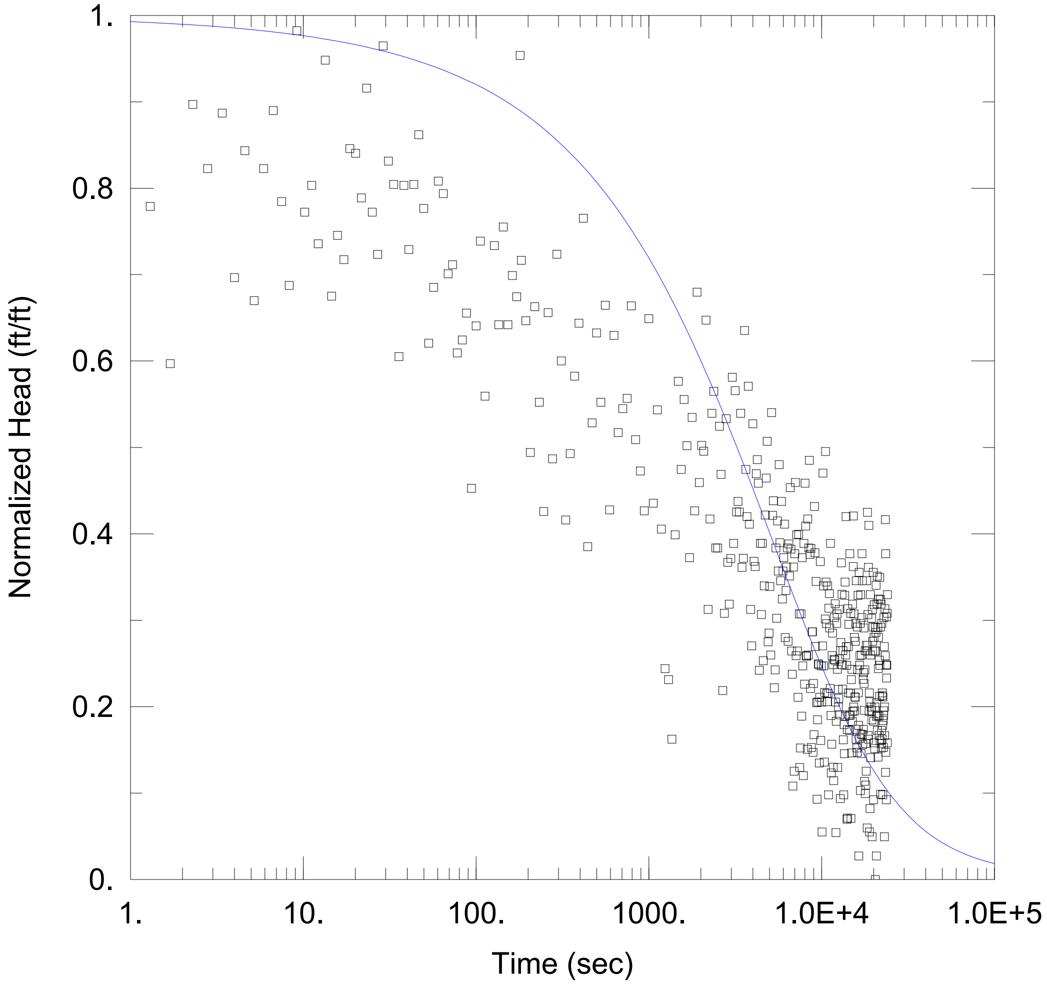
WELL DATA (GB-50)

Initial Displacement: 0.02841 ft
Total Well Penetration Depth: 39.12 ft
Casing Radius: 0.083 ft
Static Water Column Height: 38.94 ft
Screen Length: 10. ft
Well Radius: 0.083 ft
Gravel Pack Porosity: 0.

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice

K = 0.01494 ft/day y0 = 0.01858 ft



GB-50 SLUG OUT TRIAL #1

Data Set: \...\GB-50 Slug out Trial #1 (KGS).aqt
Date: 04/27/23 Time: 16:21:35

PROJECT INFORMATION

Company: Geosyntec Consultants
Project: GW8636
Location: Mesquite Creek
Test Well: GB-50
Test Date: 4/11/2023

AQUIFER DATA

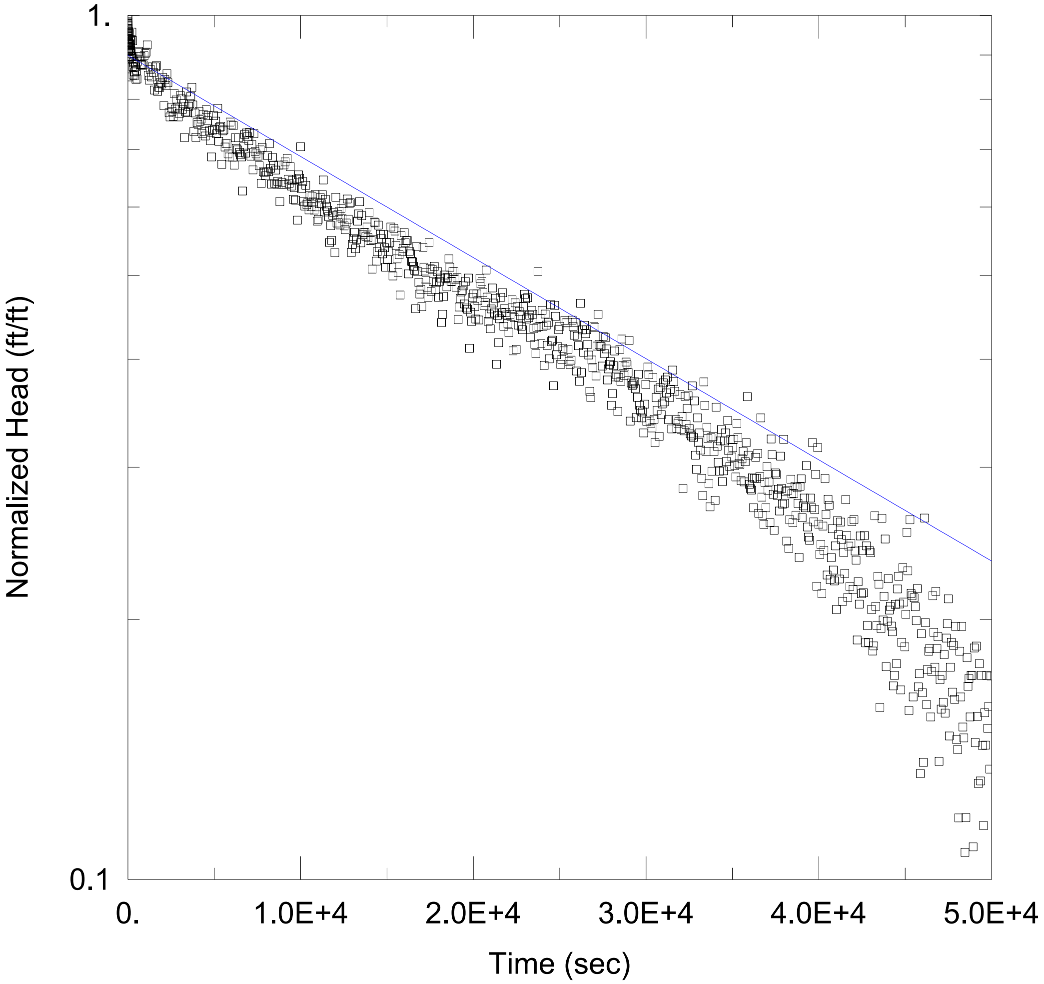
Saturated Thickness: 38.94 ft

WELL DATA (GB-50)

Initial Displacement: 0.02841 ft
Total Well Penetration Depth: 39.12 ft
Casing Radius: 0.083 ft
Static Water Column Height: 38.94 ft
Screen Length: 10. ft
Well Radius: 0.083 ft
Gravel Pack Porosity: 0.

SOLUTION

Aquifer Model: Unconfined
Solution Method: KGS Model
Kr = 0.009 ft/day
Ss = 0.006 ft^{-1}
Kz/Kr = 0.1



GB-50 SLUG OUT TRIAL #2

Data Set: \...\GB-50 Slug out Trial #2 (BR).aqt
Date: 04/27/23 Time: 16:21:55

PROJECT INFORMATION

Company: Geosyntec Consultants
Project: GW8636
Location: Mesquite Creek
Test Well: GB-50
Test Date: 4/11/2023

AQUIFER DATA

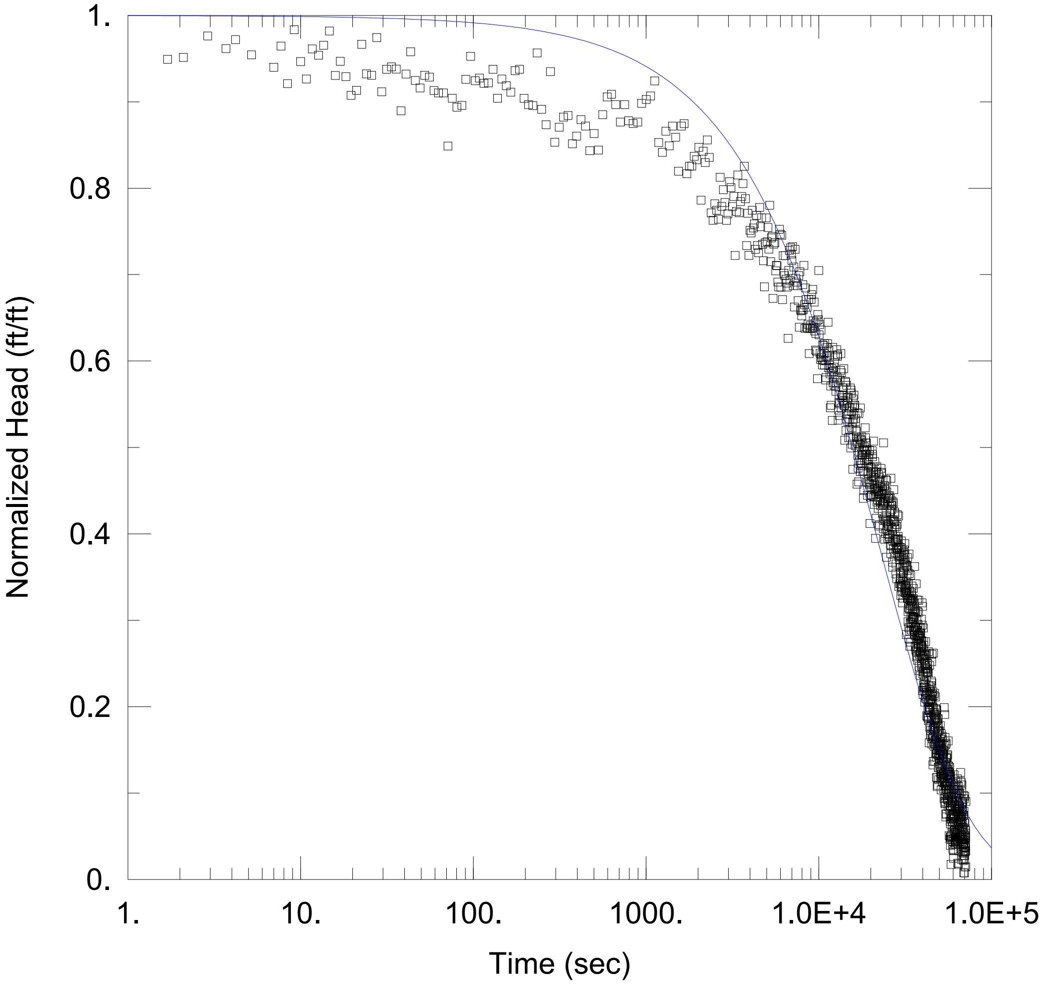
Saturated Thickness: 38.95 ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (GB-50)

Initial Displacement: 0.1051 ft
Total Well Penetration Depth: 39.12 ft
Casing Radius: 0.083 ft
Static Water Column Height: 38.95 ft
Screen Length: 10. ft
Well Radius: 0.083 ft
Gravel Pack Porosity: 0.

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 0.0043 ft/day
y0 = 0.09446 ft



GB-50 SLUG OUT TRIAL #2

Data Set: \...\GB-50 Slug out Trial #2 (KGS).aqt
Date: 04/27/23 Time: 16:22:16

PROJECT INFORMATION

Company: Geosyntec Consultants
Project: GW8636
Location: Mesquite Creek
Test Well: GB-50
Test Date: 4/11/2023

AQUIFER DATA

Saturated Thickness: 38.95 ft

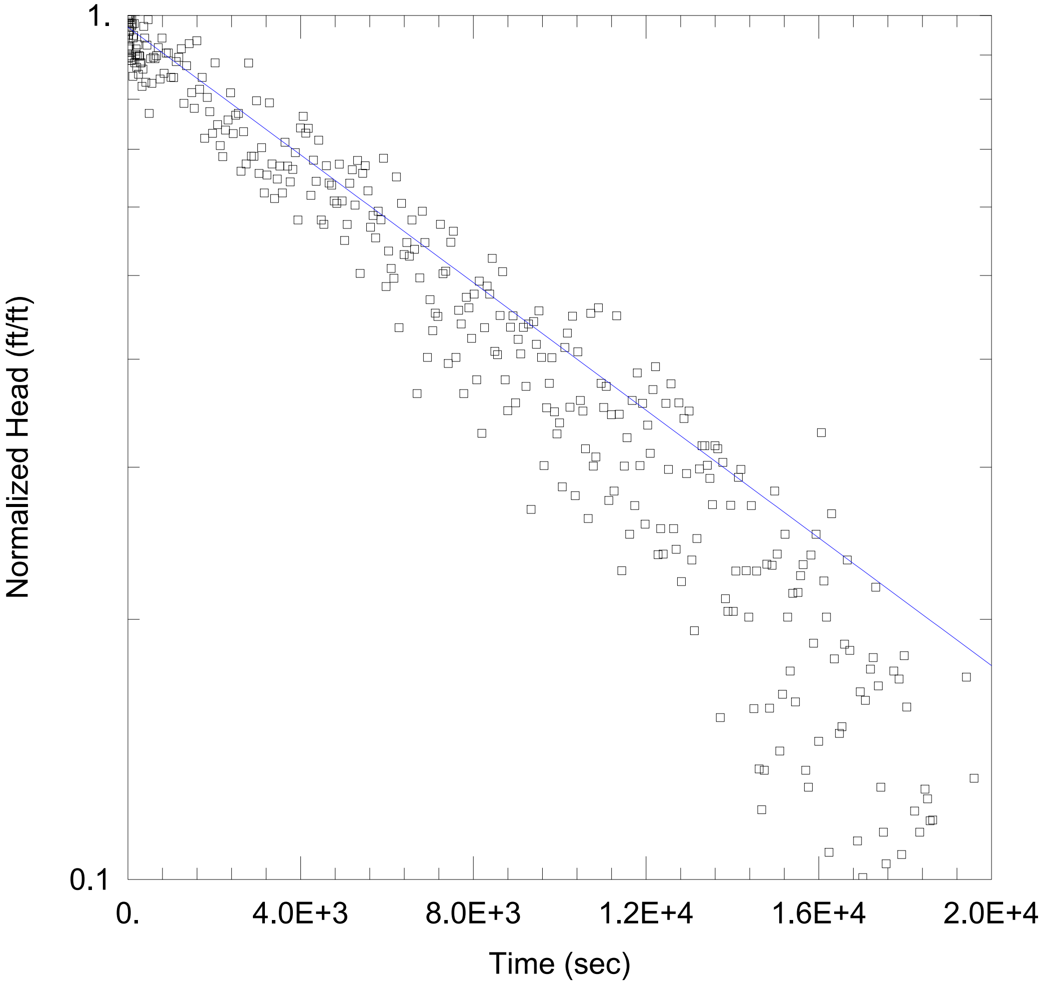
WELL DATA (GB-50)

Initial Displacement: 0.1051 ft
Total Well Penetration Depth: 39.12 ft
Casing Radius: 0.083 ft
Static Water Column Height: 38.95 ft
Screen Length: 10. ft
Well Radius: 0.083 ft
Gravel Pack Porosity: 0.

SOLUTION

Aquifer Model: Unconfined
Solution Method: KGS Model

Kr = 0.0065 ft/day
Kz/Kr = 0.1
Ss = 5.278E-6 ft^{-1}



GB-50 SLUG OUT TRIAL #3

Data Set: \...\GB-50 Slug out Trial #3 (BR).aqt
Date: 04/27/23 Time: 16:22:42

PROJECT INFORMATION

Company: Geosyntec Consultants
Project: GW8636
Location: Mesquite Creek
Test Well: GB-50
Test Date: 4/11/2023

AQUIFER DATA

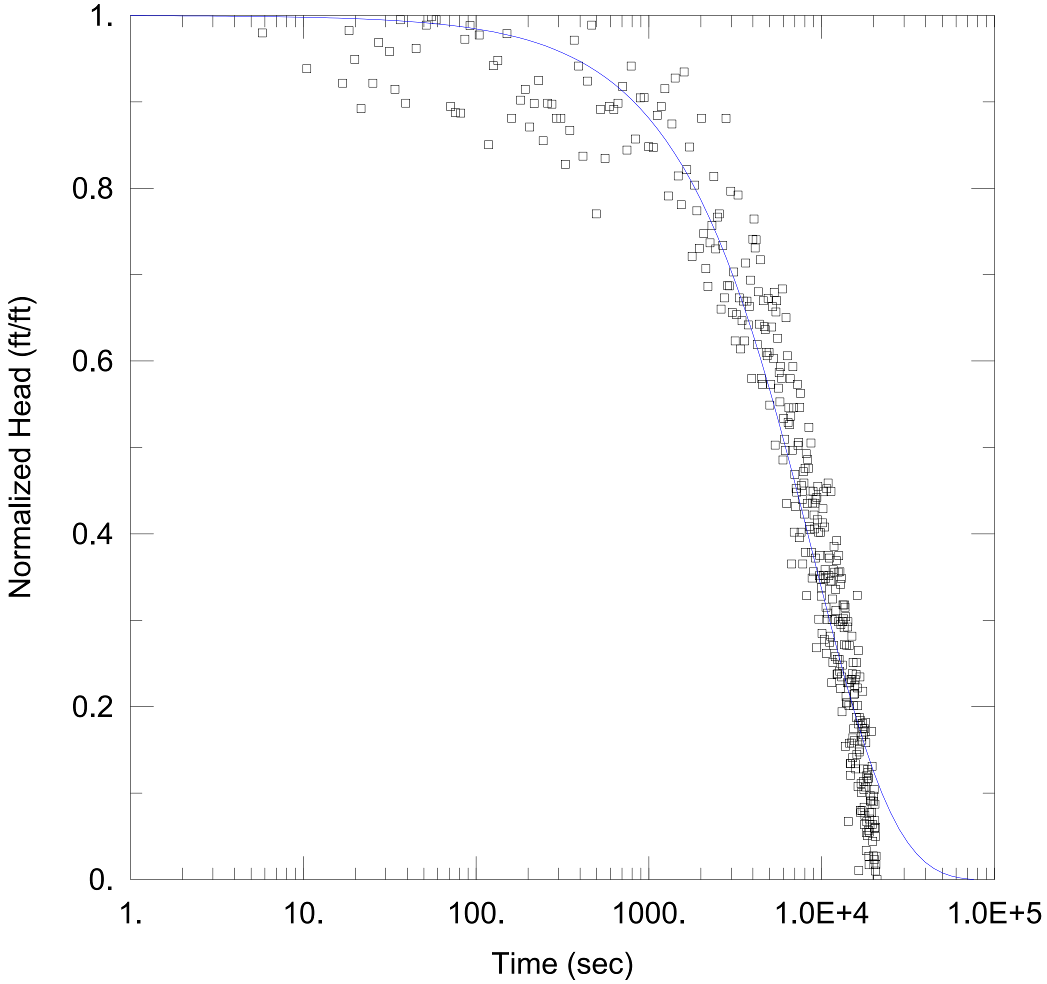
Saturated Thickness: 39.02 ft
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (GB-50)

Initial Displacement: 0.04567 ft
Total Well Penetration Depth: 39.12 ft
Casing Radius: 0.083 ft
Static Water Column Height: 39.02 ft
Screen Length: 10. ft
Well Radius: 0.083 ft
Gravel Pack Porosity: 0.

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 0.01357 ft/day
y0 = 0.04425 ft



GB-50 SLUG OUT TRIAL #3

Data Set: \...\GB-50 Slug out Trial #3 (KGS).aqt
Date: 04/27/23 Time: 16:23:04

PROJECT INFORMATION

Company: Geosyntec Consultants
Project: GW8636
Location: Mesquite Creek
Test Well: GB-50
Test Date: 4/11/2023

AQUIFER DATA

Saturated Thickness: 39.02 ft

WELL DATA (GB-50)

Initial Displacement: 0.04567 ft
Total Well Penetration Depth: 39.12 ft
Casing Radius: 0.083 ft
Static Water Column Height: 39.02 ft
Screen Length: 10. ft
Well Radius: 0.083 ft
Gravel Pack Porosity: 0.

SOLUTION

Aquifer Model: Unconfined
Solution Method: KGS Model

Kr = 0.0185 ft/day
Ss = 5.805E-7 ft^{-1}
Kz/Kr = 0.1

HISTORICAL SLUG TEST DATA

```
 ***************************************
       SLUG OUT TEST - WELL PZ-1        *
 ***************************************

 METHOD OF BOUWER AND RICE (1976)

Formulas: K = 86,400*(rc**2/(2tL))*ln(Re/rw)*ln(h1/h2)     T = K*D
        and:
         ln(Re/rw) = [1.1/ln(H/rw)+(A+Bln(D-H)/rw)/(L/rw)]**-1 for D>H, or
         ln(Re/rw) = [1.1/ln(H/rw)+C/(L/rw)]**-1 for D=H

        where:
         K = hydraulic conductivity (ft/day)
         T = transmissivity (ft**2/day)
         rc= radius of well casing if water level is above well screen (ft);
             if water level is in screen, see reference for formula
         rw= radial distance between the center of the well screen and the
             undisturbed aquifer (ft)
         L = length of screened interval or H, whichever is smallest (ft)
         Re= radius over which head change is dissipated in the aquifer (ft)
         h1= change in head at time = t1 (ft)
         h2= change in head at time = t2 (ft)
         t = t2 - t1 (sec)
         A,B,C = dimensionless parameters that are functions of L/rw
         D = saturated aquifer thickness (ft)
         H = height of original water table above the bottom of the screen

nput parameters: rc=   .69 inches
                 rw=  4.50 inches
                 L = 10.00 feet
                 D = 28.86 feet
                 H = 28.86 feet
                 h1= 1.169 feet
                 h2= 1.072 feet
                 t = 1.1441E+04 seconds
                 C =  1.92

olution: K =  1.2E-07 cm/sec
        K =  .33E-03 ft/day
        T =  .96E-02 ft**2/day
```

SLUG TEST DATA

Well Number: PZ-1 Date Tested: 11/21/91

Type of Test: SLUG-OUT

Well Radius (r_c): 0.69 in = 0.0575 ft

Borehole Radius (r_w): 4.5 in = 0.375 ft

Screen Length (L): 10.0 ft

Shape Factor (F) = L/r_w): 2.22

Screen Interval: 32.0 to 42.0 ft BGL

Filter Pack Interval: 29.5 to 43.2 ft BGL

Casing Stickup: 1.84 ft AGL

Static Water Level (H): 15.26 ft BTOC = 13.42 ft BGL

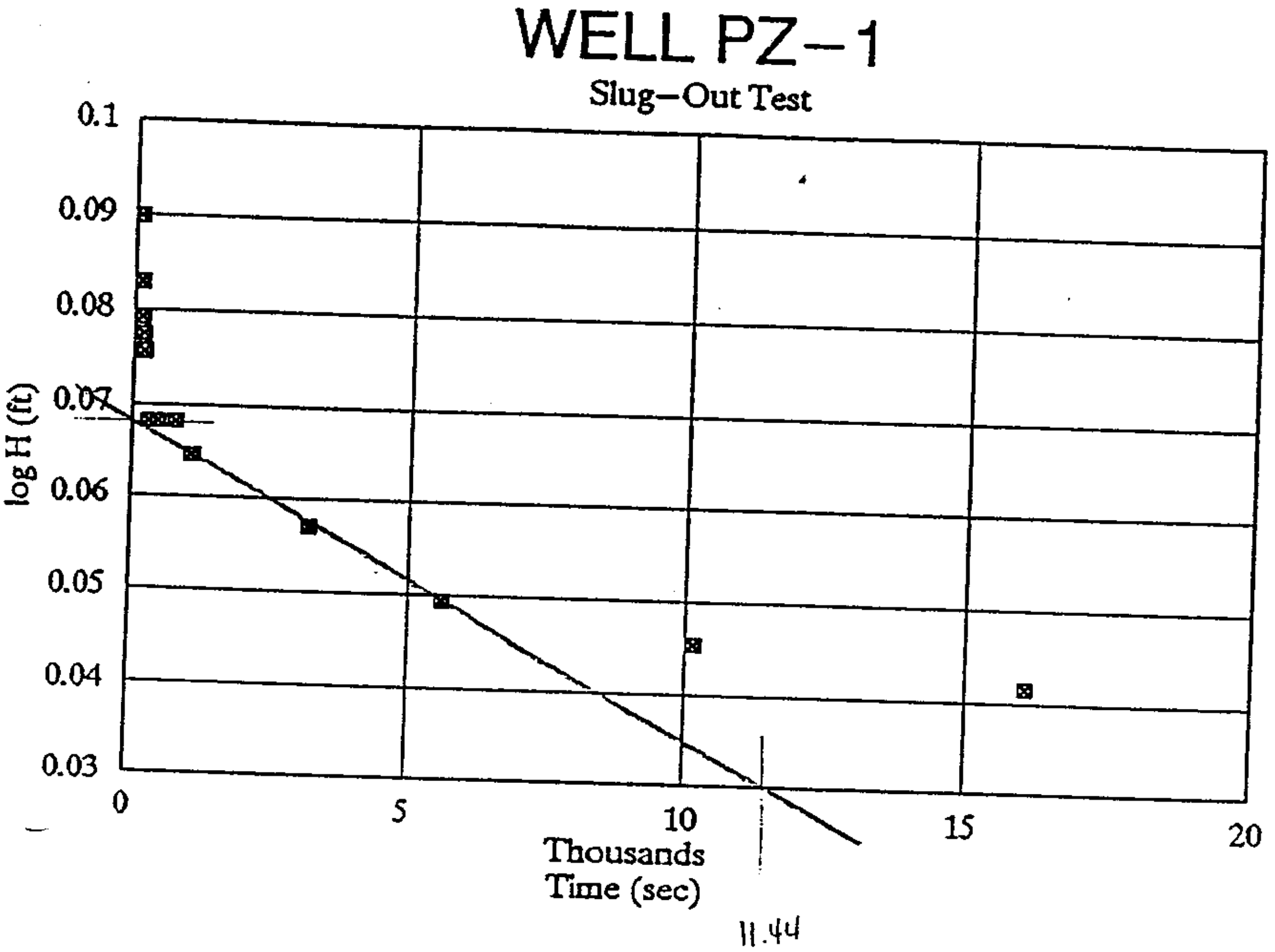
Type of Slug: 1/2" PVC, 5' long

Slug Volume: 0.0192 ft^3 = 0.144 gal

Expected rise/decline in water level in piezometer due to inserting/removing slug: 1.85 ft

Explanation:

ft BGL = feet below ground level
ft AGL = feet above ground level
ft BTOC = feet below top of casing



$\log y_0 = 0.068$ ✓

$y_0 =$ ~~1.170 ft~~ 1.169 ft ✓

$\log y_t = 0.03$ ✓

$y_t =$ ~~1.07 ft~~ 1.072 ft ✓

$t =$ 11441 secs ✓

```
SLUG-OUT TEST:  WELL PZ-1

TIME OF DAY IN MINUTES AT WHICH TEST STARTED:        627
NUMBER OF SEC INTO MIN AT WHICH TEST STARTED:          0
INITIAL DEPTH TO WATER BELOW TOP OF CASING:        15.26 FEET
SLUG VOLUME:   0.0192 FT**3

||******* OBSERVED *******||**************** CALCULATED ***************||
|| TIME OF |  DEPTH TO   ||  DELTA  |  TIME IN  |   LOG    |   LOG    ||
||   DAY   |  WATER (FT) ||  H (FT) |   SEC.    |   TIME   | DELTA H  ||

   10:27:00       15.26        0.00         0.0       ERR       ERR
   10:28:45       16.49        1.23       105.0      2.02      0.09
   10:29:15       16.47        1.21       135.0      2.13      0.08
   10:29:30       16.46        1.20       150.0      2.18      0.08
   10:30:00       16.46        1.19       180.0      2.26      0.08
   10:30:30       16.45        1.19       210.0      2.32      0.08
   10:32:00       16.43        1.17       300.0      2.48      0.07
   10:35:00       16.43        1.17       480.0      2.68      0.07
   10:40:00       16.43        1.17       780.0      2.89      0.07
   10:45:00       16.42        1.16      1080.0      3.03      0.06
   11:20:00       16.40        1.14      3180.0      3.50      0.06
   12:01:00       16.38        1.12      5640.0      3.75      0.05
   13:16:00       16.37        1.11     10140.0      4.01      0.05
   14:55:00       16.36        1.10     16080.0      4.21      0.04
```

```
 *************************************
        SLUG IN TEST - WELL PZ-3        *
 *************************************

 METHOD OF BOUWER AND RICE (1976)

Formulas: K = 86,400*(rc**2/(2tL))*ln(Re/rw)*ln(h1/h2)     T = K*D
         and:
          ln(Re/rw) = [1.1/ln(H/rw)+(A+Bln(D-H)/rw)/(L/rw)]**-1 for D>H, or
          ln(Re/rw) = [1.1/ln(H/rw)+C/(L/rw)]**-1 for D=H
         where:
          K = hydraulic conductivity (ft/day)
          T = transmissivity (ft**2/day)
          rc= radius of well casing if water level is above well screen (ft);
              if water level is in screen, see reference for formula
          rw= radial distance between the center of the well screen and the
              undisturbed aquifer (ft)
          L = length of screened interval or H, whichever is smallest (ft)
          Re= radius over which head change is dissipated in the aquifer (ft)
          h1= change in head at time = t1 (ft)
          h2= change in head at time = t2 (ft)
          t = t2 - t1 (sec)
          A,B,C = dimensionless parameters that are functions of L/rw
          D = saturated aquifer thickness (ft)
          H = height of original water table above the bottom of the screen

nput parameters: rc=   .69 inches
                 rw=  4.50 inches
                 L = 10.00 feet
                 D = 14.59 feet
                 H = 14.59 feet
                 h1=  .918 feet
                 h2=  .881 feet
                 t = 2.0000E+04 seconds
                 C =  1.92

lution: K =  2.8E-08 cm/sec
        K =  .79E-04 ft/day
        T =  .12E-02 ft**2/day
```

SLUG TEST DATA

Well Number: PZ-3 Date Tested: 11/20/91

Type of Test: SLUG-IN

Well Radius (r_c): 0.69 in = 0.0575 ft

Borehole Radius (r_w): 4.5 in = 0.375 ft

Screen Length (L): 10.0 ft

Shape Factor (F) = L/r_w): 2.22

Screen Interval: 15.0 to 25.0 ft BGL

Filter Pack Interval: 13.0 to 26.0 ft BGL

Casing Stickup: 2.46 ft AGL

Static Water Level (H): 13.41 ft BTOC = 10.95 ft BGL

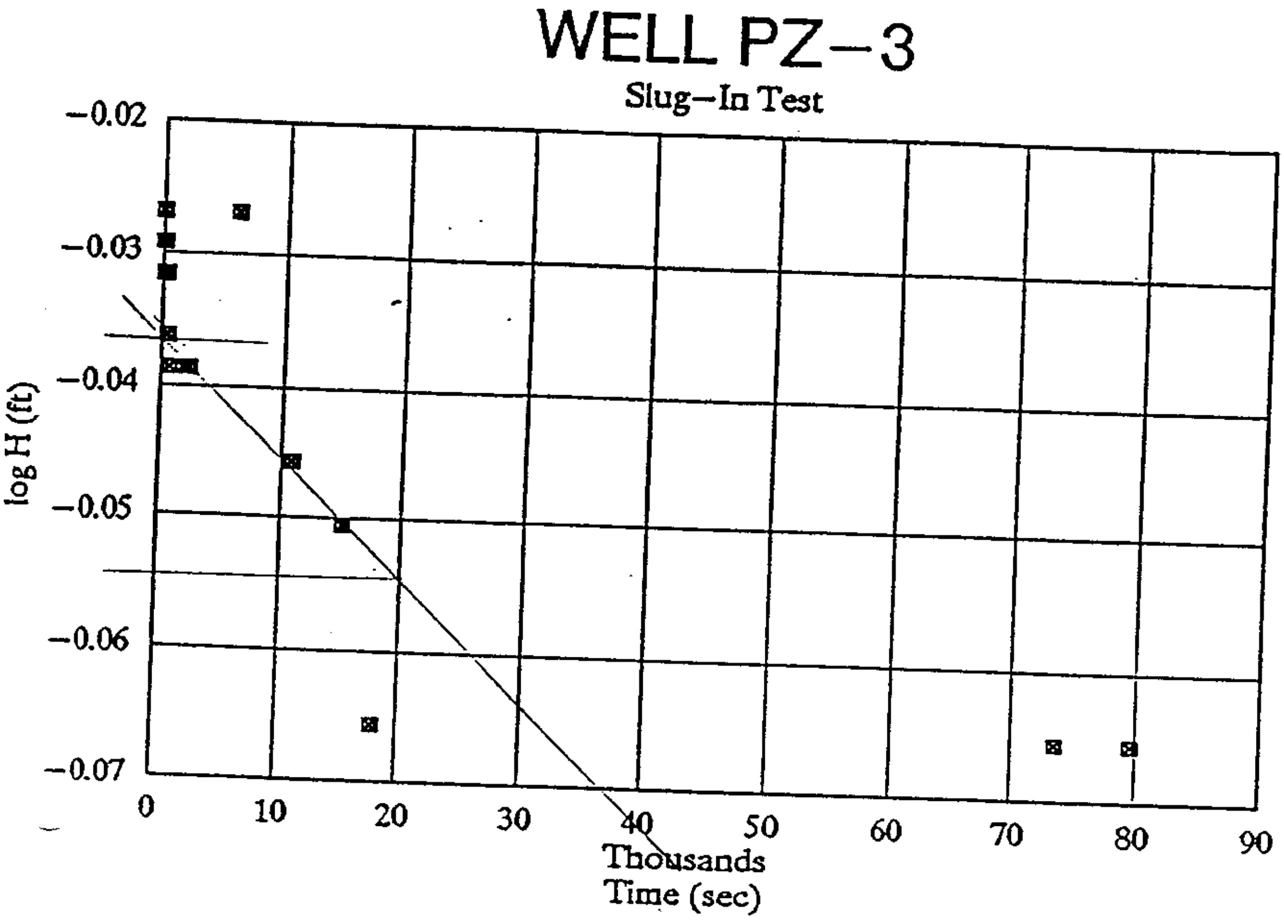
Type of Slug: 1/2" PVC, 5' long

Slug Volume: 0.0192 ft³ = 0.144 gal

Expected rise/decline in water level in piezometer due to inserting/removing slug: 1.85 ft

Explanation:

ft BGL = feet below ground level
ft AGL = feet above ground level
ft BTOC = feet below top of casing



$\log y_0 = -0.037$

$y_0 = 0.918$ ft

$t = 20000$ secs

$\log y_t = -0.055$

$y_t = 0.881$ ft

```
SLUG-IN TEST:  WELL PZ-3

TIME OF DAY IN MINUTES AT WHICH TEST STARTED:        813
NUMBER OF SEC INTO MIN AT WHICH TEST STARTED:          0
INITIAL DEPTH TO WATER BELOW TOP OF CASING:        13.41 FEET
SLUG VOLUME:   0.0192 FT**3

||******* OBSERVED *******||**************** CALCULATED ***************||
|| TIME OF |  DEPTH TO   ||  DELTA   |  TIME IN  |   LOG    |   LOG    ||
||   DAY   |  WATER (FT) ||  H (FT)  |   SEC.    |   TIME   | DELTA H  ||

  13:33:00       13.41        0.00         0.0       ERR       ERR
  13:33:30       12.47        0.94        30.0       1.48     -0.03
  13:34:00       12.48        0.93        60.0       1.78     -0.03
  13:34:30       12.48        0.93        90.0       1.95     -0.03
  13:35:00       12.48        0.93       120.0       2.08     -0.03
  13:36:00       12.48        0.93       180.0       2.26     -0.03
  13:37:00       12.48        0.93       240.0       2.38     -0.03
  13:38:00       12.48        0.93       300.0       2.48     -0.03
  13:40:00       12.48        0.93       420.0       2.62     -0.03
  13:42:00       12.49        0.92       540.0       2.73     -0.04
  13:44:00       12.50        0.92       660.0       2.82     -0.04
  14:04:00       12.50        0.92      1860.0       3.27     -0.04
  14:12:00       12.50        0.92      2340.0       3.37     -0.04
  15:15:00       12.47        0.94      6120.0       3.79     -0.03
  16:34:00       12.51        0.90     10860.0       4.04     -0.05
  17:45:00       12.52        0.89     15120.0       4.18     -0.05
  18:33:00       12.55        0.86     18000.0       4.26     -0.07
  10:00:00       12.55        0.86     73620.0       4.87     -0.07
  11:41:00       12.55        0.86     79680.0       4.90     -0.07
```

```
**************************************
      SLUG OUT TEST - WELL PZ-3      *
**************************************

 METHOD OF BOUWER AND RICE (1976)

Formulas: K = 86,400*(rc**2/(2tL))*ln(Re/rw)*ln(h1/h2)     T = K*D
        and:
         ln(Re/rw) = [1.1/ln(H/rw)+(A+Bln(D-H)/rw)/(L/rw)]**-1 for D>H, or
         ln(Re/rw) = [1.1/ln(H/rw)+C/(L/rw)]**-1 for D=H
        where:
         K = hydraulic conductivity (ft/day)
         T = transmissivity (ft**2/day)
         rc= radius of well casing if water level is above well screen (ft);
             if water level is in screen, see reference for formula
         rw= radial distance between the center of the well screen and the
             undisturbed aquifer (ft)
         L = length of screened interval or H, whichever is smallest (ft)
         Re= radius over which head change is dissipated in the aquifer (ft)
         h1= change in head at time = t1 (ft)
         h2= change in head at time = t2 (ft)
         t = t2 - t1 (sec)
         A,B,C = dimensionless parameters that are functions of L/rw
         D = saturated aquifer thickness (ft)
         H = height of original water table above the bottom of the screen

nput parameters: rc=    .69 inches
                 rw=   4.50 inches
                 L =  10.00 feet
                 D =  14.59 feet
                 H =  14.59 feet
                 h1=   .883 feet
                 h2=   .800 feet
                 t = 3.0000E+04 seconds
                 C =   1.92

lution: K =  4.5E-08 cm/sec
        K =  .13E-03 ft/day
        T =  .18E-02 ft**2/day
```

SLUG TEST DATA

Well Number: PZ-3 **Date Tested:** 11/21/91

Type of Test: SLUG-OUT

Well Radius (r_c): 0.69 **in =** 0.0575 **ft**

Borehole Radius (r_w): 4.5 **in =** 0.375 **ft**

Screen Length (L): 10.0 **ft**

Shape Factor (F) = L/r_w): 2.22

Screen Interval: 15.0 **to** 25.0 **ft BGL**

Filter Pack Interval: 13.0 **to** 26.0 **ft BGL**

Casing Stickup: 2.46 **ft AGL**

Static Water Level (H): 12.55 **ft BTOC =** 10.09 **ft BGL**

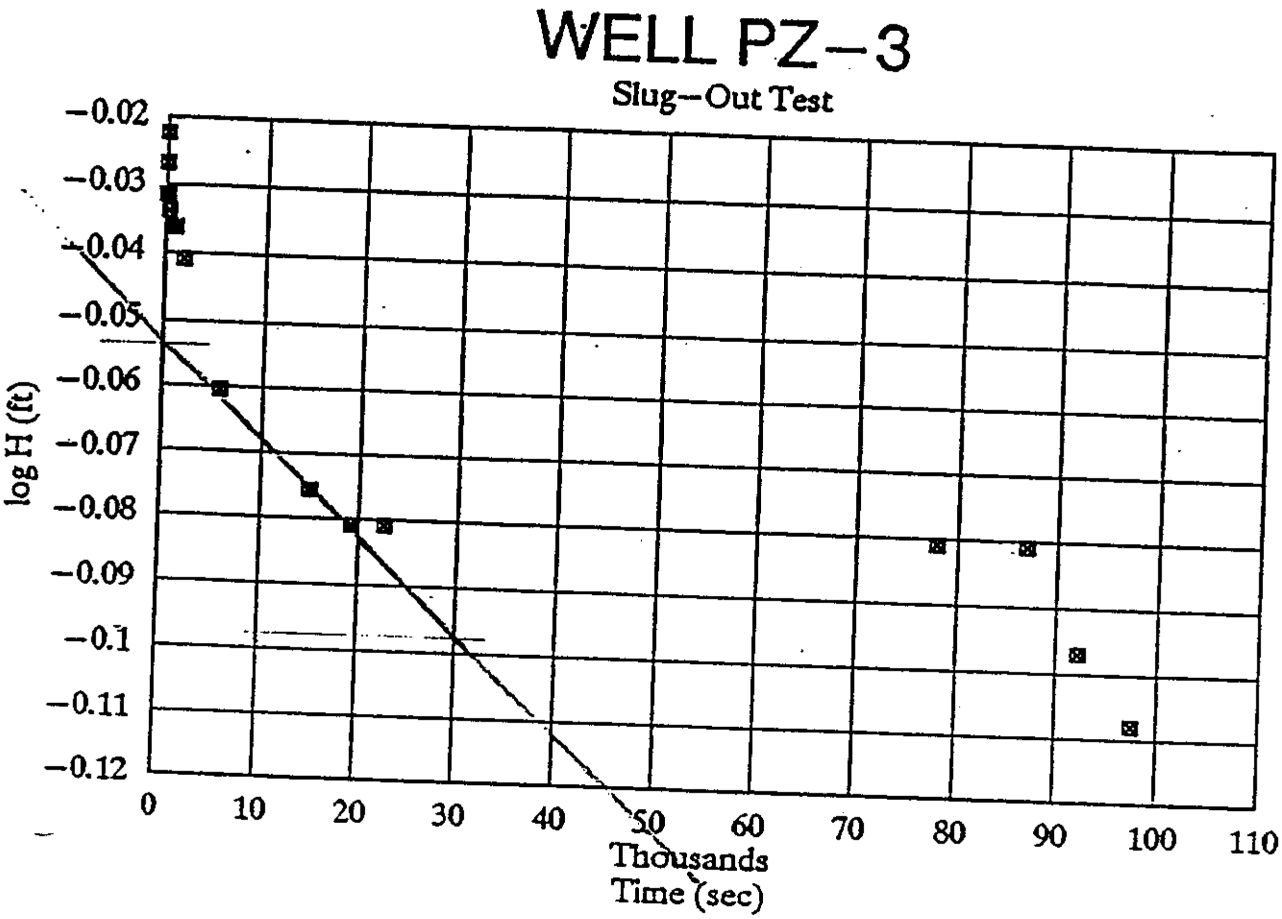
Type of Slug: 1/2" PVC, 5' long

Slug Volume: 0.0192 **ft³ =** 0.144 **gal**

Expected rise/decline in water level in piezometer due to inserting/removing slug: 1.85 **ft**

Explanation:

ft BGL = feet below ground level
ft AGL = feet above ground level
ft BTOC = feet below top of casing



log y_0 = -0.054 ✓

y_0 = 0.883 ft ✓

t = 30000 secs ✓

log y_t = − 0.097 ✓

y_t = 0.800 ft ✓

```
SLUG-OUT TEST:  WELL PZ-3

TIME OF DAY IN MINUTES AT WHICH TEST STARTED:       703
NUMBER OF SEC INTO MIN AT WHICH TEST STARTED:         0
INITIAL DEPTH TO WATER BELOW TOP OF CASING:       12.55 FEET
SLUG VOLUME:   0.0192 FT**3

||******* OBSERVED *******||**************** CALCULATED ***************||
|| TIME OF |  DEPTH TO   ||  DELTA   | TIME IN  |   LOG   |   LOG     ||
||   DAY   |  WATER (FT) ||  H (FT)  |   SEC.   |   TIME  | DELTA H   ||

  11:43:00       12.55         0.00         0.0      ERR       ERR
  11:43:30       13.50         0.95        30.0      1.48     -0.02
  11:44:00       13.49         0.94        60.0      1.78     -0.03
  11:44:30       13.48         0.93        90.0      1.95     -0.03
  11:45:00       13.48         0.93       120.0      2.08     -0.03
  11:46:00       13.48         0.93       180.0      2.26     -0.03
  11:48:00       13.48         0.93       300.0      2.48     -0.03
  11:53:00       13.47         0.92       600.0      2.78     -0.04
  12:01:00       13.47         0.92      1080.0      3.03     -0.04
  12:16:00       13.46         0.91      1980.0      3.30     -0.04
  13:20:00       13.42         0.87      5820.0      3.76     -0.06
  15:53:00       13.39         0.84     15000.0      4.18     -0.08
  17:05:00       13.38         0.83     19320.0      4.29     -0.08
  17:59:00       13.38         0.83     22560.0      4.35     -0.08
  09:22:00       13.38         0.83     77940.0      4.89     -0.08
  11:53:00       13.38         0.83     87000.0      4.94     -0.08
  13:21:00       13.35         0.80     92280.0      4.97     -0.10
  14:49:00       13.33         0.78     97560.0      4.99     -0.11
```

```
   **************************************
   *     SLUG IN TEST - WELL PZ-4       *
   **************************************

   METHOD OF BOUWER AND RICE (1976)

Formulas: K = 646,272*(rc**2/(2tL))*ln(Re/rw)*ln(yo/yt)    T = K*D
        and:
         ln(Re/rw) = [1.1/ln(H/rw)+(A+Bln(D-H)/rw)/(L/rw)]**-1 for D>H, or
         ln(Re/rw) = [1.1/ln(H/rw)+C/(L/rw)]**-1 for D=H

        where:
         K = hydraulic conductivity (gpd/ft**2)
         T = transmissivity (gpd/ft)
         rc= radius of well casing if water level is above well screen (ft)
             if water level is in screen, see reference for formula
         rw= radial distance between the center of the well screen and the
             undisturbed aquifer (ft)
         L = length of screened interval or H, whichever is smallest (ft)
         Re= radius over which head change is dissipated in the aquifer (ft
         yo= change in head at time = 0 (ft)
         yt= change in head at an arbitrary time = t (ft)
         t = time corresponding to yt (sec)
         A,B,C = dimensionless parameters that are functions of L/rw
         D = saturated aquifer thickness (ft)
         H = height of original water table above the bottom of the screen


Input parameters: rc=   .63 inches
                  rw=  4.50 inches
                  L = 20.00 feet
                  D = 25.00 feet
                  H = 25.00 feet
                  yo= 1.580 feet
                  yt=  .890 feet
                  t = 8.0000E+03 seconds
                  C =  2.70


Solution: K = 1.01E-02 gpd/ft**2  (4.74E-07 cm/sec)
          T =  .25     gpd/ft
          Re=  9.2     feet
```

SLUG TEST DATA

Well Number: PZ-4 Date Tested: 6-1-90

Type of Test: Slug-in

Well Radius (r_c): 0.625 in = 0.052 ft

Borehole Radius (r_w): 4.5 in = 0.375 ft

Screen Length (L): 20 ft

Shape Factor (F) = L/r_w: 53.3

Screen Interval: 22 to 42 ft BGL

Filter Pack Interval: 19.7 to 42.0 ft BGL

Casing Stickup: 3 ft AGL

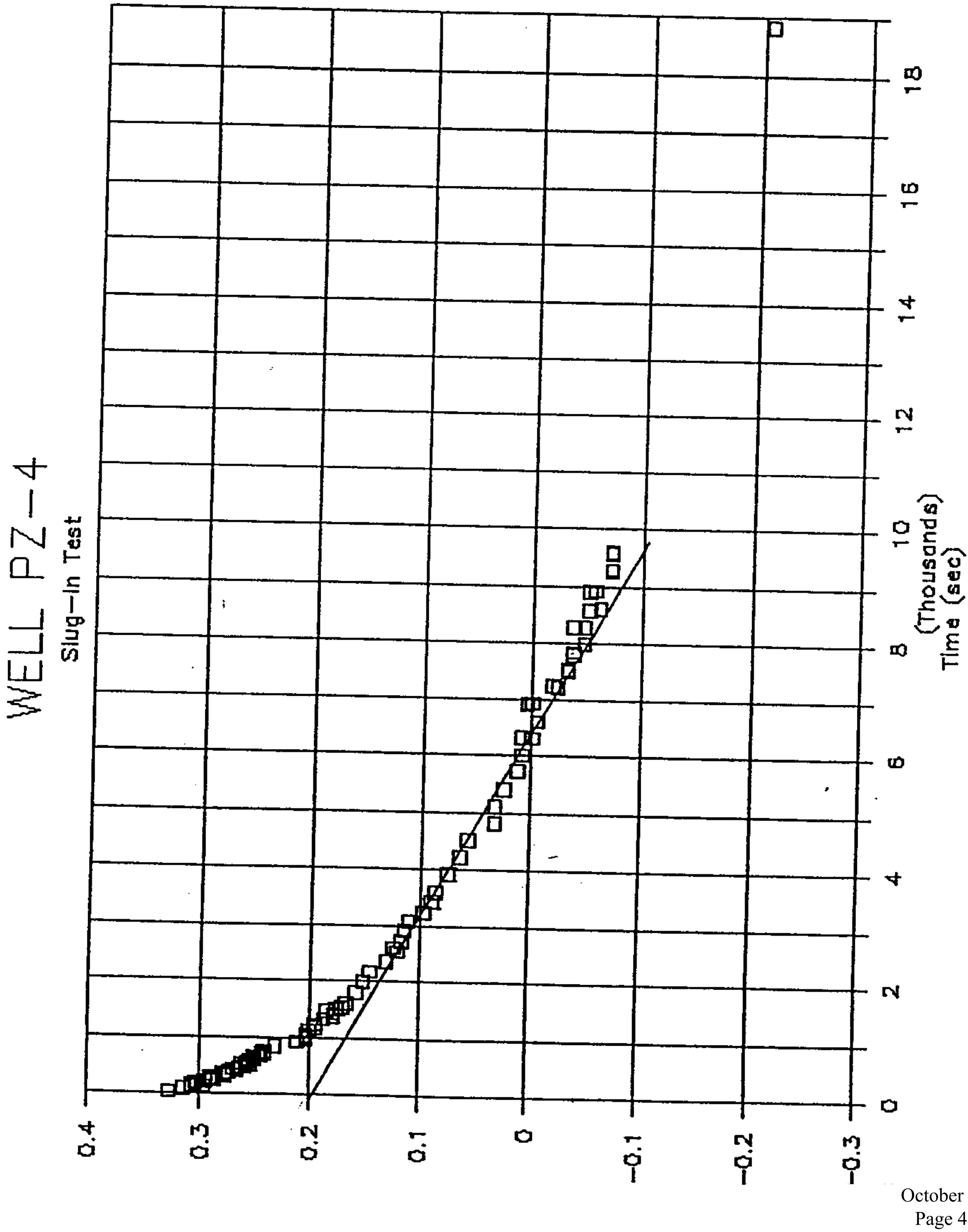
Static Water Level (H): 20.0 ft BTOC = 17.0 ft BGL

Type of Slug: 3/4 inch PVC 9.81 Ft in Length

Slug Volume: 0.062 ft^3 0.46 Gal

Expected rise/decline in water level in well due to inserting/removing slug: 73 ft

Explanation:
ft BGL = feet below ground level
ft AGL = feet above ground level
ft BTOC = feet below top of casing


WELL PZ-4
Slug-In Test
0.4
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
0
2
4
6
8
10
12
14
16
18
(Thousands)
Time (sec)

```
SLUG-IN TEST:  WELL PZ-4

TIME OF DAY IN MINUTES AT WHICH TEST STARTED:        587
NUMBER OF SEC INTO MIN AT WHICH TEST STARTED:          0
INITIAL DEPTH TO WATER BELOW TOP OF CASING:        20.02 FEET
SLUG VOLUME:   0.062

||******* OBSERVED *******||**************** CALCULATED ***************||
|| TIME OF |  DEPTH TO   ||  DELTA   | TIME IN  |   LOG    |   LOG    ||
||   DAY   | WATER (FT)  ||  H (FT)  |   SEC.   |   TIME   | DELTA H  ||

  09:47:00       20.02        0.00        0.0       ERR       ERR
  09:47:30       17.90        2.12       30.0      1.48      0.33
  09:48:25       17.96        2.06       85.0      1.93      0.31
  09:49:00       18.00        2.02      120.0      2.08      0.31
  09:49:10       18.04        1.98      130.0      2.11      0.30
  09:49:30       18.00        2.02      150.0      2.18      0.31
  09:49:50       18.01        2.01      170.0      2.23      0.30
  09:50:10       18.02        2.00      190.0      2.28      0.30
  09:50:30       18.05        1.97      210.0      2.32      0.29
  09:50:50       18.07        1.95      230.0      2.36      0.29
  09:51:10       18.08        1.94      250.0      2.40      0.29
  09:51:30       18.08        1.94      270.0      2.43      0.29
  09:51:45       18.07        1.95      285.0      2.45      0.29
  09:52:10       18.12        1.90      310.0      2.49      0.28
  09:52:35       18.12        1.90      335.0      2.53      0.28
  09:52:50       18.12        1.90      350.0      2.54      0.28
  09:53:15       18.14        1.88      375.0      2.57      0.27
  09:53:45       18.17        1.85      405.0      2.61      0.27
  09:54:05       18.16        1.86      425.0      2.63      0.27
  09:54:30       18.18        1.84      450.0      2.65      0.26
  09:55:00       18.20        1.82      480.0      2.68      0.26
  09:55:20       18.22        1.80      500.0      2.70      0.26
  09:55:40       18.19        1.83      520.0      2.72      0.26
  09:56:00       18.21        1.81      540.0      2.73      0.26
  09:56:25       18.22        1.80      565.0      2.75      0.26
  09:56:45       18.22        1.80      585.0      2.77      0.26
  09:57:10       18.24        1.78      610.0      2.79      0.25
  09:57:35       18.23        1.79      635.0      2.80      0.25
  09:58:00       18.25        1.77      660.0      2.82      0.25
  09:58:30       18.26        1.76      690.0      2.84      0.25
  09:58:45       18.27        1.75      705.0      2.85      0.24
  09:59:05       18.26        1.76      725.0      2.86      0.25
  09:59:25       18.27        1.75      745.0      2.87      0.24
  10:00:45       18.31        1.71      825.0      2.92      0.23
  10:02:15       18.39        1.63      915.0      2.96      0.21
  10:03:05       18.42        1.60      965.0      2.98      0.20
  10:03:45       18.42        1.60     1005.0      3.00      0.20
  10:04:15       18.42        1.60     1035.0      3.01      0.20
  10:05:30       18.43        1.59     1110.0      3.05      0.20
```

```
SLUG-IN TEST:  WELL PZ-4

TIME OF DAY IN MINUTES AT WHICH TEST STARTED:       587
NUMBER OF SEC INTO MIN AT WHICH TEST STARTED:         0
INITIAL DEPTH TO WATER BELOW TOP OF CASING:       20.02 FEET
SLUG VOLUME:   0.062

||******* OBSERVED *******||**************** CALCULATED ***************||
|| TIME OF |   DEPTH TO   ||  DELTA   | TIME IN  |   LOG    |   LOG   ||
||   DAY   |  WATER (FT)  ||  H (FT)  |   SEC.   |   TIME   | DELTA H ||

  10:06:30       18.45         1.57     1170.0      3.07      0.20
  10:07:15       18.45         1.57     1215.0      3.08      0.20
  10:08:55       18.48         1.54     1315.0      3.12      0.19
  10:09:50       18.51         1.51     1370.0      3.14      0.18
  10:10:30       18.51         1.51     1410.0      3.15      0.18
  10:11:15       18.49         1.53     1455.0      3.16      0.18
  10:11:50       18.52         1.50     1490.0      3.17      0.18
  10:12:30       18.54         1.48     1530.0      3.18      0.17
  10:13:40       18.55         1.47     1600.0      3.20      0.17
  10:17:00       18.58         1.44     1800.0      3.26      0.16
  10:20:00       18.60         1.42     1980.0      3.30      0.15
  10:23:00       18.62         1.40     2160.0      3.33      0.15
  10:26:00       18.67         1.35     2340.0      3.37      0.13
  10:29:00       18.70         1.32     2520.0      3.40      0.12
  10:30:15       18.69         1.33     2595.0      3.41      0.12
  10:32:07       18.71         1.31     2707.0      3.43      0.12
  10:35:30       18.72         1.30     2910.0      3.46      0.11
  10:38:15       18.73         1.29     3075.0      3.49      0.11
  10:41:00       18.77         1.25     3240.0      3.51      0.10
  10:44:00       18.79         1.23     3420.0      3.53      0.09
  10:47:00       18.80         1.22     3600.0      3.56      0.09
  10:52:00       18.83         1.19     3900.0      3.59      0.08
  10:52:10       18.83         1.19     3910.0      3.59      0.08
  10:57:20       18.86         1.16     4220.0      3.63      0.06
  11:02:00       18.88         1.14     4500.0      3.65      0.06
  11:07:00       18.94         1.08     4800.0      3.68      0.03
  11:12:00       18.94         1.08     5100.0      3.71      0.03
  11:17:10       18.96         1.06     5410.0      3.73      0.03
  11:22:15       18.99         1.03     5715.0      3.76      0.01
  11:27:00       19.00         1.02     6000.0      3.78      0.01
  11:32:00       19.02         1.00     6300.0      3.80      0.00
  11:32:20       19.00         1.02     6320.0      3.80      0.01
  11:37:00       19.03         0.99     6600.0      3.82     -0.00
  11:42:00       19.01         1.01     6900.0      3.84      0.00
  11:42:30       19.02         1.00     6930.0      3.84      0.00
  11:47:10       19.07         0.95     7210.0      3.86     -0.02
  11:47:30       19.06         0.96     7230.0      3.86     -0.02
  11:52:00       19.09         0.93     7500.0      3.88     -0.03
  11:52:20       19.09         0.93     7520.0      3.88     -0.03
```

```
****************************************
*     SLUG OUT TEST - WELL PZ-4        *
****************************************

METHOD OF BOUWER AND RICE (1976)

Formulas: K = 646,272*(rc**2/(2tL))*ln(Re/rw)*ln(yo/yt)    T = K*D
          and:
           ln(Re/rw)  = [1.1/ln(H/rw)+(A+Bln(D-H)/rw)/(L/rw)]**-1 for D>H, or
           ln(Re/rw)  = [1.1/ln(H/rw)+C/(L/rw)]**-1 for D=H

          where:
           K = hydraulic conductivity (gpd/ft**2)
           T = transmissivity (gpd/ft)
           rc= radius of well casing if water level is above well screen (ft).
               if water level is in screen, see reference for formula
           rw= radial distance between the center of the well screen and the
               undisturbed aquifer (ft)
           L = length of screened interval or H, whichever is smallest (ft)
           Re= radius over which head change is dissipated in the aquifer (ft)
           yo= change in head at time = 0 (ft)
           yt= change in head at an arbitrary time = t (ft)
           t = time corresponding to yt (sec)
           A,B,C = dimensionless parameters that are functions of L/rw
           D = saturated aquifer thickness (ft)
           H = height of original water table above the bottom of the screen

Input parameters: rc=    .63 inches
                  rw=   4.50 inches
                  L =  20.00 feet
                  D =  25.00 feet
                  H =  25.00 feet
                  yo=  1.660 feet
                  yt=   .850 feet
                  t =  1.0000E+04 seconds
                  C =   2.70

Solution: K = 9.39E-03 gpd/ft**2  (4.43E-07 cm/sec)
          T =   .23     gpd/ft
          Re=   9.2     feet
```

SLUG TEST DATA

Well Number: PZ-4 Date Tested: 6-1-90

Type of Test: Slug-out

Well Radius (r_c): 0.625 in = 0.052 ft

Borehole Radius (r_w): 4.5 in = 0.375 ft

Screen Length (L): 20 ft

Shape Factor (F) = L/r_w: 53.3

Screen Interval: 22 to 42 ft BGL

Filter Pack Interval: 19.7 to 42.0 ft BGL

Casing Stickup: 3 ft AGL

Static Water Level (H): 20.0 ft BTOC = 17.0 ft BGL

Type of Slug: 3/4 inch PVC 9.81 Ft in length

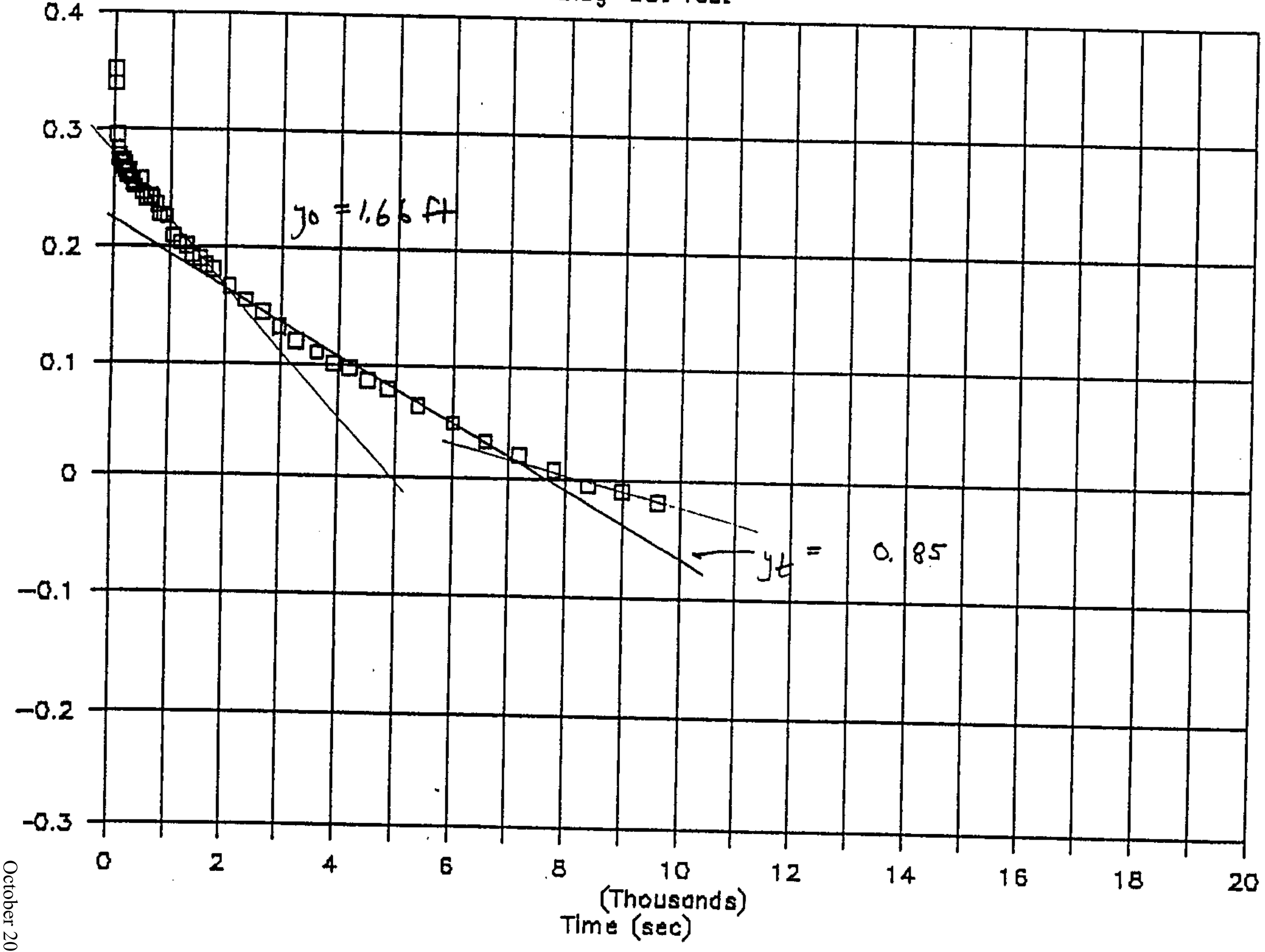
Slug Volume: 0.062 ft^3 0.46 Gal

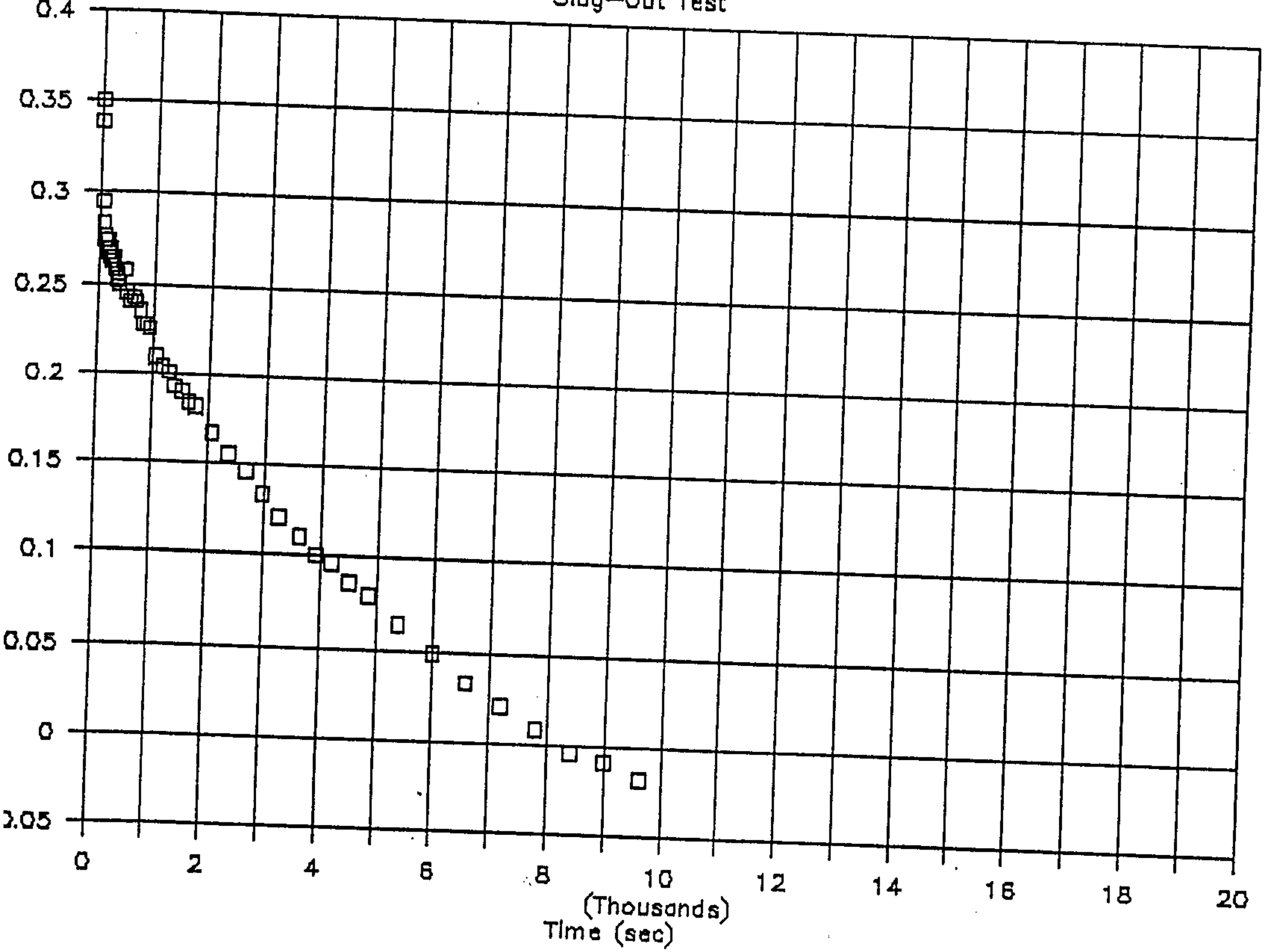
Expected rise/decline in water level in well due to inserting/removing slug: 7.3 ft

Explanation:
ft BGL = feet below ground level
ft AGL = feet above ground level
ft BTOC = feet below top of casing

WELL PZ-4

Slug-Out Test



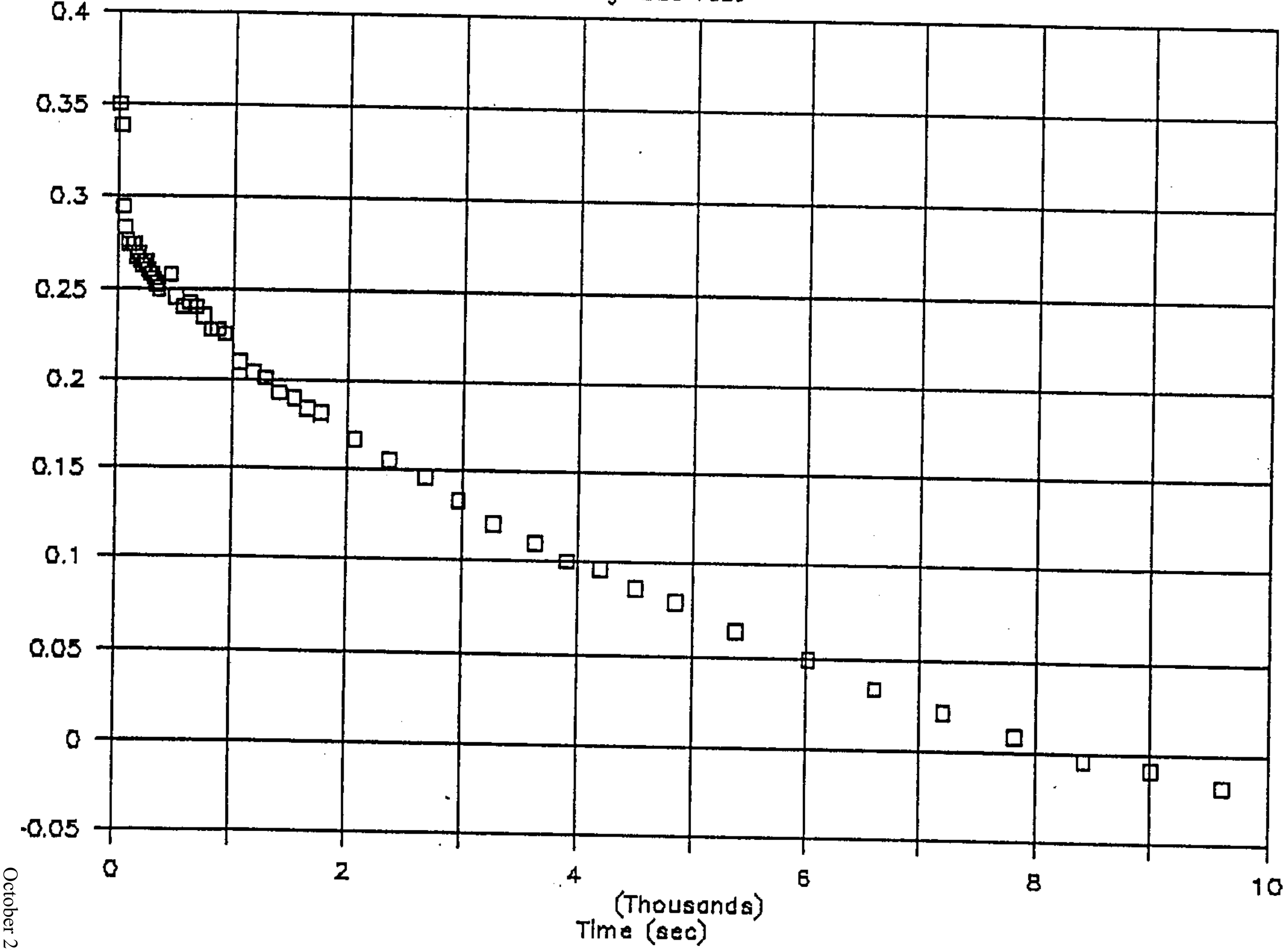


WELL PZ-4

Slug-Out Test

WELL PZ-4

Slug-Out Test



```
SLUG-OUT TEST:  WELL PZ-4

TIME OF DAY IN MINUTES AT WHICH TEST STARTED:        900
NUMBER OF SEC INTO MIN AT WHICH TEST STARTED:         30
INITIAL DEPTH TO WATER BELOW TOP OF CASING:         19.4 FEET
SLUG VOLUME:   0.062

||******* OBSERVED *******||**************** CALCULATED ****************||
|| TIME OF |  DEPTH TO   ||  DELTA  | TIME IN |   LOG   |   LOG    ||
||   DAY   |  WATER (FT) ||  H (FT) |   SEC.  |   TIME  | DELTA H  ||

   15:00:30       19.40       0.00       0.0      ERR      ERR
   15:00:40       21.64       2.24      10.0     1.00     0.35
   15:00:50       21.58       2.18      20.0     1.30     0.34
   15:01:15       21.37       1.97      45.0     1.65     0.29
   15:01:30       21.32       1.92      60.0     1.78     0.28
   15:01:55       21.29       1.89      85.0     1.93     0.28
   15:02:05       21.28       1.88      95.0     1.98     0.27
   15:02:40       21.28       1.88     130.0     2.11     0.27
   15:02:55       21.28       1.88     145.0     2.16     0.27
   15:03:10       21.25       1.85     160.0     2.20     0.27
   15:03:25       21.26       1.86     175.0     2.24     0.27
   15:03:45       21.24       1.84     195.0     2.29     0.26
   15:04:00       21.23       1.83     210.0     2.32     0.26
   15:04:15       21.24       1.84     225.0     2.35     0.26
   15:04:30       21.23       1.83     240.0     2.38     0.26
   15:04:45       21.24       1.84     255.0     2.41     0.26
   15:04:57       21.22       1.82     267.0     2.43     0.26
   15:05:15       21.21       1.81     285.0     2.45     0.26
   15:05:35       21.21       1.81     305.0     2.48     0.26
   15:05:45       21.20       1.80     315.0     2.50     0.26
   15:06:00       21.19       1.79     330.0     2.52     0.25
   15:06:15       21.19       1.79     345.0     2.54     0.25
   15:06:30       21.18       1.78     360.0     2.56     0.25
   15:08:15       21.21       1.81     465.0     2.67     0.26
   15:09:00       21.16       1.76     510.0     2.71     0.25
   15:10:00       21.14       1.74     570.0     2.76     0.24
   15:11:00       21.15       1.75     630.0     2.80     0.24
   15:12:00       21.14       1.74     690.0     2.84     0.24
   15:13:00       21.12       1.72     750.0     2.88     0.24
   15:14:00       21.09       1.69     810.0     2.91     0.23
   15:15:00       21.09       1.69     870.0     2.94     0.23
   15:16:00       21.08       1.68     930.0     2.97     0.23
   15:18:15       21.02       1.62    1065.0     3.03     0.21
   15:20:10       21.00       1.60    1180.0     3.07     0.20
   15:22:00       20.99       1.59    1290.0     3.11     0.20
   15:24:00       20.96       1.56    1410.0     3.15     0.19
   15:26:10       20.95       1.55    1540.0     3.19     0.19
   15:28:00       20.93       1.53    1650.0     3.22     0.18
   15:30:00       20.92       1.52    1770.0     3.25     0.18
```

```
SLUG-OUT TEST:  WELL PZ-4

TIME OF DAY IN MINUTES AT WHICH TEST STARTED:        900
NUMBER OF SEC INTO MIN AT WHICH TEST STARTED:         30
INITIAL DEPTH TO WATER BELOW TOP OF CASING:         19.4 FEET
SLUG VOLUME:    0.062

||******* OBSERVED *******||**************** CALCULATED ***************||
|| TIME OF |  DEPTH TO   ||  DELTA   |  TIME IN  |   LOG    |   LOG    ||
||   DAY   |  WATER (FT) ||  H (FT)  |   SEC.    |   TIME   | DELTA H  ||

  15:35:00      20.87        1.47       2070.0      3.32      0.17
  15:40:00      20.83        1.43       2370.0      3.37      0.16
  15:45:10      20.80        1.40       2680.0      3.43      0.15
  15:50:00      20.76        1.36       2970.0      3.47      0.13
  15:55:00      20.72        1.32       3270.0      3.51      0.12
  16:01:00      20.69        1.29       3630.0      3.56      0.11
  16:05:40      20.66        1.26       3910.0      3.59      0.10
  16:10:30      20.65        1.25       4200.0      3.62      0.10
  16:15:40      20.62        1.22       4510.0      3.65      0.09
  16:21:30      20.60        1.20       4860.0      3.69      0.08
  16:30:15      20.56        1.16       5385.0      3.73      0.06
  16:40:40      20.52        1.12       6010.0      3.78      0.05
  16:50:30      20.48        1.08       6600.0      3.82      0.03
  17:00:30      20.45        1.05       7200.0      3.86      0.02
  17:10:40      20.42        1.02       7810.0      3.89      0.01
  17:20:40      20.39        0.99       8410.0      3.92     -0.00
  17:30:40      20.38        0.98       9010.0      3.95     -0.01
  17:40:40      20.36        0.96       9610.0      3.98     -0.02
```

```
  **************************************
  *     SLUG IN TEST - WELL PZ-5       *
  **************************************

  METHOD OF BOUWER AND RICE (1976)

Formulas: K = 646,272*(rc**2/(2tL))*ln(Re/rw)*ln(yo/yt)    T = K*D
        and:
          ln(Re/rw) = [1.1/ln(H/rw)+(A+Bln(D-H)/rw)/(L/rw)]**-1 for D>H, or
          ln(Re/rw) = [1.1/ln(H/rw)+C/(L/rw)]**-1 for D=H

        where:
          K = hydraulic conductivity (gpd/ft**2)
          T = transmissivity (gpd/ft)
          rc= radius of well casing if water level is above well screen (ft);
              if water level is in screen, see reference for formula
          rw= radial distance between the center of the well screen and the
              undisturbed aquifer (ft)
          L = length of screened interval or H, whichever is smallest (ft)
          Re= radius over which head change is dissipated in the aquifer (ft)
          yo= change in head at time = 0 (ft)
          yt= change in head at an arbitrary time = t (ft)
          t = time corresponding to yt (sec)
          A,B,C = dimensionless parameters that are functions of L/rw
          D = saturated aquifer thickness (ft)
          H = height of original water table above the bottom of the screen

Input parameters: rc=    .63 inches
                  rw=   4.50 inches
                  L =  10.00 feet
                  D =   8.74 feet
                  H =   8.74 feet
                  yo=   .300 feet
                  yt=   .140 feet
                  t = 1.8000E+04 seconds
                  C =   2.00


Solution: K = 8.75E-03 gpd/ft**2   (4.12E-07 cm/sec)
          T = 7.64E-02 gpd/ft
          Re=  4.0      feet
```

SLUG TEST DATA

Well Number: Pz-5 Date Tested: 6-1-90

Type of Test: Slug-In

Well Radius (r_c): 0.625 in = 0.052 ft

Borehole Radius (r_w): 4.5 in = 0.375 ft

Screen Length (L): 10 ft

Shape Factor (F) = L/r_w: 26.7

Screen Interval: 15 to 25 ft BGL

Filter Pack Interval: 13.4 to 26.0 ft BGL

Casing Stickup: 3 ft AGL

Static Water Level (H): 19.26 ft BTOC = 16.26 ft BGL

Type of Slug: 3/4 inch PVC 10.07 Ft in length

Slug Volume: 0.064 ft^3 0.49 Gal

Expected rise/decline in water level in well due to inserting/removing slug: 0.45* ft

Explanation:
ft BGL = feet below ground level
ft AGL = feet above ground level
ft BTOC = feet below top of casing

* Based on an effective radius of 0.21 ft calculated from the equation:

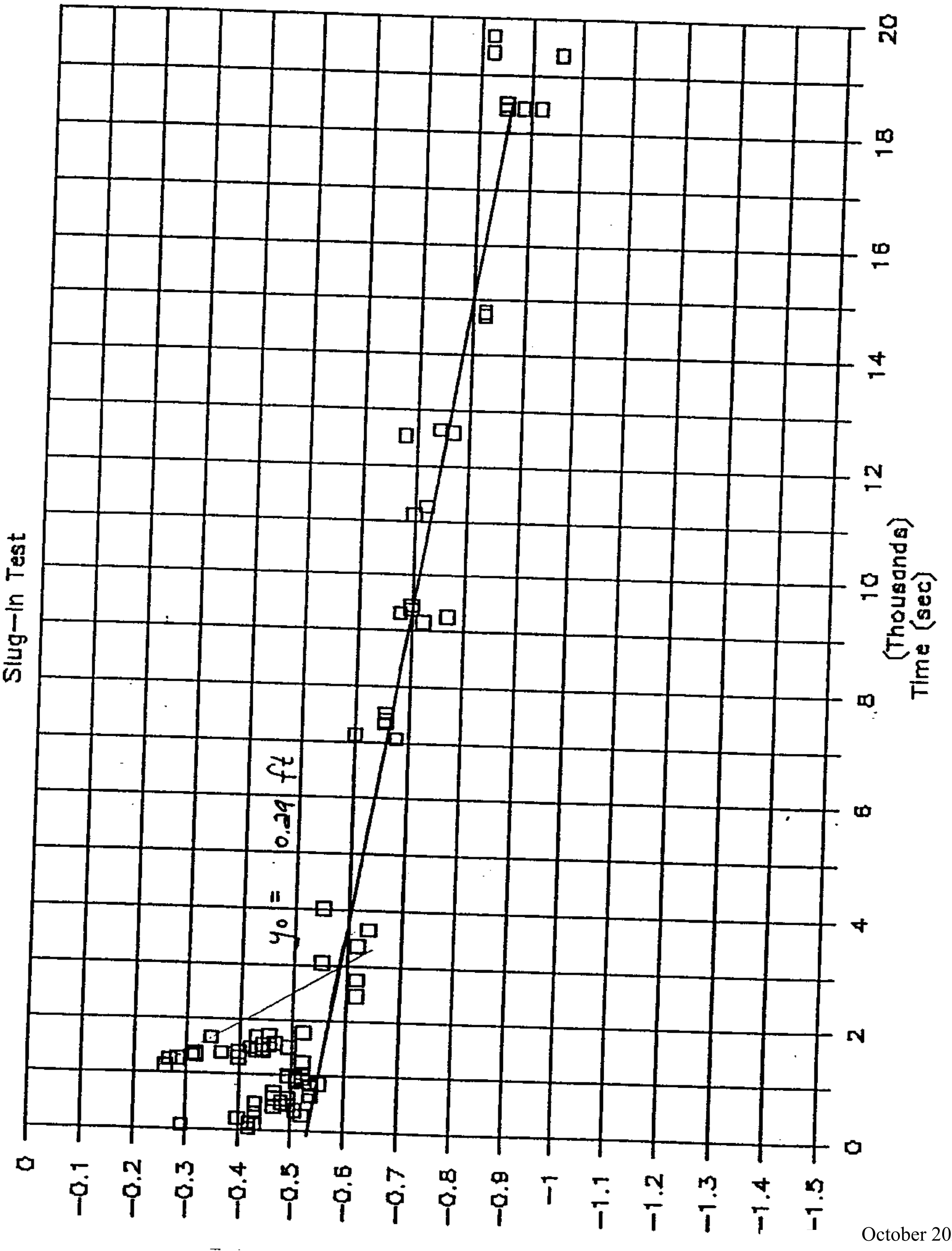
$$r_e = \sqrt{r_c^2 + \phi \ (r_w^2 - r_c^2}$$

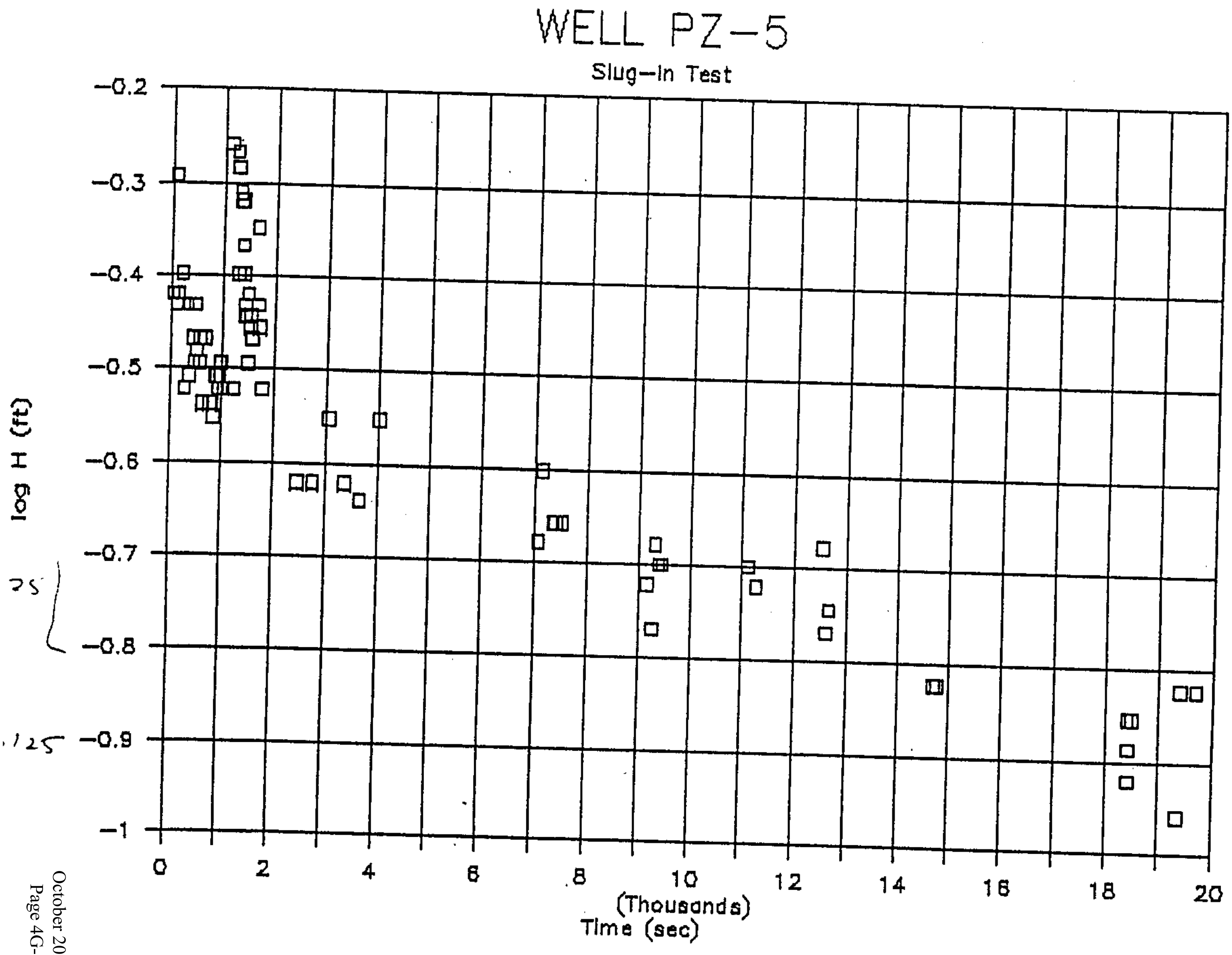
where porosity of the filter pack is assumed

0.30

WELL. PZ-5

Slug-In Test




WELL PZ-5
Slug-In Test
log H (ft)
-0.2
-0.3
-0.4
-0.5
-0.6
-0.7
-0.8
-0.9
-1
.25
.125
0
2
4
6
8
10
12
14
16
18
20
(Thousands)
Time (sec)

```
SLUG-IN TEST:  WELL PZ-5

TIME OF DAY IN MINUTES AT WHICH TEST STARTED:        498
NUMBER OF SEC INTO MIN AT WHICH TEST STARTED:          0
INITIAL DEPTH TO WATER BELOW TOP OF CASING:        19.41 FEET
SLUG VOLUME:    0.064

||******* OBSERVED *******||**************** CALCULATED ***************||
|| TIME OF |   DEPTH TO   ||   DELTA   |  TIME IN  |   LOG    |   LOG    ||
||   DAY   |  WATER (FT)  ||   H (FT)  |   SEC.    |   TIME   | DELTA H  ||

  08:18:00        19.41        0.00          0.0      ERR       ERR
  08:18:30        19.03        0.38         30.0      1.48     -0.42
  08:19:00        18.90        0.51         60.0      1.78     -0.29
  08:19:55        19.04        0.37        115.0      2.06     -0.43
  08:20:15        19.03        0.38        135.0      2.13     -0.42
  08:21:30        19.01        0.40        210.0      2.32     -0.40
  08:22:30        19.11        0.30        270.0      2.43     -0.52
  08:23:10        19.04        0.37        310.0      2.49     -0.43
  08:24:00        19.10        0.31        360.0      2.56     -0.51
  08:24:50        19.07        0.34        410.0      2.61     -0.47
  08:25:25        19.09        0.32        445.0      2.65     -0.49
  08:25:53        19.04        0.37        473.0      2.67     -0.43
  08:26:30        19.08        0.33        510.0      2.71     -0.48
  08:27:20        19.09        0.32        560.0      2.75     -0.49
  08:27:40        19.07        0.34        580.0      2.76     -0.47
  08:28:35        19.12        0.29        635.0      2.80     -0.54
  08:29:10        19.07        0.34        670.0      2.83     -0.47
  08:31:00        19.12        0.29        780.0      2.89     -0.54
  08:31:50        19.12        0.29        830.0      2.92     -0.54
  08:32:10        19.13        0.28        850.0      2.93     -0.55
  08:32:45        19.10        0.31        885.0      2.95     -0.51
  08:33:10        19.10        0.31        910.0      2.96     -0.51
  08:33:30        19.11        0.30        930.0      2.97     -0.52
  08:34:00        19.09        0.32        960.0      2.98     -0.49
  08:34:10        19.10        0.31        970.0      2.99     -0.51
  08:34:35        19.09        0.32        995.0      3.00     -0.49
  08:35:15        19.11        0.30       1035.0      3.01     -0.52
  08:36:50        18.86        0.55       1130.0      3.05     -0.26
  08:38:20        19.11        0.30       1220.0      3.09     -0.52
  08:38:40        18.87        0.54       1240.0      3.09     -0.27
  08:39:00        18.89        0.52       1260.0      3.10     -0.28
  08:39:40        19.01        0.40       1300.0      3.11     -0.40
  08:39:50        18.92        0.49       1310.0      3.12     -0.31
  08:40:00        18.93        0.48       1320.0      3.12     -0.32
  08:40:40        18.93        0.48       1360.0      3.13     -0.32
  08:41:00        18.98        0.43       1380.0      3.14     -0.37
  08:41:15        19.01        0.40       1395.0      3.14     -0.40
  08:41:40        19.04        0.37       1420.0      3.15     -0.43
  08:42:00        19.05        0.36       1440.0      3.16     -0.44
```

```
SLUG-IN TEST:  WELL PZ-5

TIME OF DAY IN MINUTES AT WHICH TEST STARTED:        498
NUMBER OF SEC INTO MIN AT WHICH TEST STARTED:          0
INITIAL DEPTH TO WATER BELOW TOP OF CASING:        19.41 FEET
SLUG VOLUME:   0.064

||******* OBSERVED *******||**************** CALCULATED ***************||
|| TIME OF |  DEPTH TO   ||  DELTA   | TIME IN  |   LOG    |   LOG    ||
||   DAY   | WATER (FT)  ||  H (FT)  |   SEC.   |   TIME   | DELTA H  ||

  08:42:15      19.05         0.36      1455.0      3.16     -0.44
  08:42:45      19.03         0.38      1485.0      3.17     -0.42
  08:43:00      19.09         0.32      1500.0      3.18     -0.49
  08:43:30      19.06         0.35      1530.0      3.18     -0.46
  08:43:45      19.05         0.36      1545.0      3.19     -0.44
  08:44:10      19.07         0.34      1570.0      3.20     -0.47
  08:45:40      18.96         0.45      1660.0      3.22     -0.35
  08:46:00      19.04         0.37      1680.0      3.23     -0.43
  08:46:30      19.06         0.35      1710.0      3.23     -0.46
  08:47:40      19.11         0.30      1780.0      3.25     -0.52
  08:59:00      19.17         0.24      2460.0      3.39     -0.62
  09:04:00      19.17         0.24      2760.0      3.44     -0.62
  09:09:00      19.13         0.28      3060.0      3.49     -0.55
  09:14:00      19.17         0.24      3360.0      3.53     -0.62
  09:19:00      19.18         0.23      3660.0      3.56     -0.64
  09:25:10      19.13         0.28      4030.0      3.61     -0.55
  10:16:00      19.20         0.21      7080.0      3.85     -0.68
  10:17:15      19.16         0.25      7155.0      3.85     -0.60
  10:20:30      19.19         0.22      7350.0      3.87     -0.66
  10:21:30      19.19         0.22      7410.0      3.87     -0.66
  10:23:30      19.19         0.22      7530.0      3.88     -0.66
  10:51:00      19.22         0.19      9180.0      3.96     -0.72
  10:52:45      19.24         0.17      9285.0      3.97     -0.77
  10:53:30      19.20         0.21      9330.0      3.97     -0.68
  10:54:30      19.21         0.20      9390.0      3.97     -0.70
  10:55:45      19.21         0.20      9465.0      3.98     -0.70
  11:23:15      19.21         0.20     11115.0      4.05     -0.70
  11:25:45      19.22         0.19     11265.0      4.05     -0.72
  11:46:45      19.20         0.21     12525.0      4.10     -0.68
  11:48:00      19.24         0.17     12600.0      4.10     -0.77
  11:48:45      19.23         0.18     12645.0      4.10     -0.74
  12:23:00      19.26         0.15     14700.0      4.17     -0.82
  12:24:00      19.26         0.15     14760.0      4.17     -0.82
  13:24:45      19.27         0.14     18405.0      4.26     -0.85
  13:25:00      19.28         0.13     18420.0      4.27     -0.89
  13:25:15      19.29         0.12     18435.0      4.27     -0.92
```

```
    ***************************************
    *     SLUG OUT TEST - WELL PZ-5       *
    ***************************************

    METHOD OF BOUWER AND RICE (1976)

 Formulas: K = 646,272*(rc**2/(2tL))*ln(Re/rw)*ln(yo/yt)    T = K*D
          and:
           ln(Re/rw) = [1.1/ln(H/rw)+(A+Bln(D-H)/rw)/(L/rw)]**-1 for D>H, or
           ln(Re/rw) = [1.1/ln(H/rw)+C/(L/rw)]**-1 for D=H

          where:
           K = hydraulic conductivity (gpd/ft**2)
           T = transmissivity (gpd/ft)
           rc= radius of well casing if water level is above well screen (ft);
               if water level is in screen, see reference for formula
           rw= radial distance between the center of the well screen and the
               undisturbed aquifer (ft)
           L = length of screened interval or H, whichever is smallest (ft)
           Re= radius over which head change is dissipated in the aquifer (ft)
           yo= change in head at time = 0 (ft)
           yt= change in head at an arbitrary time = t (ft)
           t = time corresponding to yt (sec)
           A,B,C = dimensionless parameters that are functions of L/rw
           D = saturated aquifer thickness (ft)
           H = height of original water table above the bottom of the screen

 Input parameters: rc=    .63 inches
                   rw=   4.50 inches
                   L =  10.00 feet
                   D =   8.74 feet
                   H =   8.74 feet
                   yo=   .330 feet
                   yt=   .190 feet
                   t = 1.0000E+04 seconds
                   C =   2.00


Solution: K = 1.14E-02 gpd/ft**2  (5.38E-07 cm/sec)
          T = 9.97E-02 gpd/ft
          Re=  4.0     feet
```

```
SLUG-OUT TEST:  WELL PZ-5

TIME OF DAY IN MINUTES AT WHICH TEST STARTED:       827
NUMBER OF SEC INTO MIN AT WHICH TEST STARTED:         0
INITIAL DEPTH TO WATER BELOW TOP OF CASING:       19.26 FEET
SLUG VOLUME:   0.064

||******* OBSERVED *******||**************** CALCULATED ***************||
|| TIME OF |   DEPTH TO   ||  DELTA   | TIME IN  |   LOG    |   LOG    ||
||   DAY   |  WATER (FT)  ||  H (FT)  |   SEC.   |   TIME   | DELTA H  ||

   14:04:35       19.59        0.33      1055.0      3.02     -0.48
   14:06:30       19.60        0.34      1170.0      3.07     -0.47
   14:07:30       19.60        0.34      1230.0      3.09     -0.47
   14:09:30       19.59        0.33      1350.0      3.13     -0.48
   14:11:55       19.58        0.32      1495.0      3.17     -0.49
   14:13:40       19.58        0.32      1600.0      3.20     -0.49
   14:15:30       19.58        0.32      1710.0      3.23     -0.49
   14:17:30       19.57        0.31      1830.0      3.26     -0.51
   14:22:30       19.55        0.29      2130.0      3.33     -0.54
   14:27:42       19.54        0.28      2442.0      3.39     -0.55
   14:32:40       19.54        0.28      2740.0      3.44     -0.55
   14:37:40       19.54        0.28      3040.0      3.48     -0.55
   14:42:30       19.54        0.28      3330.0      3.52     -0.55
   14:48:25       19.52        0.26      3685.0      3.57     -0.59
   14:52:40       19.52        0.26      3940.0      3.60     -0.59
   14:53:10       19.52        0.26      3970.0      3.60     -0.59
   15:19:00       19.52        0.26      5520.0      3.74     -0.59
   15:20:00       19.51        0.25      5580.0      3.75     -0.60
   15:21:00       19.50        0.24      5640.0      3.75     -0.62
   15:25:00       19.50        0.24      5880.0      3.77     -0.62
   15:31:30       19.49        0.23      6270.0      3.80     -0.64
   15:50:00       19.49        0.23      7380.0      3.87     -0.64
   16:05:00       19.48        0.22      8280.0      3.92     -0.66
   16:15:00       19.48        0.22      8880.0      3.95     -0.66
   16:25:00       19.46        0.20      9480.0      3.98     -0.70
   16:35:00       19.46        0.20     10080.0      4.00     -0.70
   16:45:00       19.46        0.20     10680.0      4.03     -0.70
```

```
   *************************************
        SLUG OUT TEST - WELL PZ-6          *
  *************************************

  METHOD OF BOUWER AND RICE (1976)

ormulas: K = 86,400*(rc**2/(2tL))*ln(Re/rw)*ln(h1/h2)     T = K*D
        and:
         ln(Re/rw) = [1.1/ln(H/rw)+(A+Bln(D-H)/rw)/(L/rw)]**-1 for D>H, or
         ln(Re/rw) = [1.1/ln(H/rw)+C/(L/rw)]**-1 for D=H

        where:
         K = hydraulic conductivity (ft/day)
         T = transmissivity (ft**2/day)
         rc= radius of well casing if water level is above well screen (ft);
             if water level is in screen, see reference for formula
         rw= radial distance between the center of the well screen and the
             undisturbed aquifer (ft)
         L = length of screened interval or H, whichever is smallest (ft)
         Re= radius over which head change is dissipated in the aquifer (ft)
         h1= change in head at time = t1 (ft)
         h2= change in head at time = t2 (ft)
         t = t2 - t1 (sec)
         A,B,C = dimensionless parameters that are functions of L/rw
         D = saturated aquifer thickness (ft)
         H = height of original water table above the bottom of the screen

iput parameters: rc=  1.03 inches
                 rw=  4.50 inches
                 L =  2.57 feet
                 D =  2.57 feet
                 H =  2.57 feet
                 h1=  .207 feet
                 h2=  .152 feet
                 t = 1.0000E+04 seconds
                 C =   .98

 Because the water level was below the top of the screen, adjustments
 must be made to the well radius to account for the filter pack
 storage.  The new casing radius is calculated using the
 following relationship: rc=sqrt(rc**2 + n(rw**2-rc**2))
           where n = porosity of the filter pack = 30.%
           new rc =   2.61 inches

lution: K =  1.2E-05 cm/sec
        K =  .34E-01 ft/day
        T =  .89E-01 ft**2/day
```

SLUG TEST DATA

Well Number: Pz - 6 Date Tested: 11/21/91

Type of Test: SLUG - OUT

Well Radius (r_c): 1.034 in = 0.086 ft

Borehole Radius (r_w): 4.5 in = 0.375 ft

Screen Length (L): 10.0 ft

Shape Factor (F) = L/r_w): 2.22

Screen Interval: 9.5 to 19.5 ft BGL

Filter Pack Interval: 7.0 to 22.0 ft BGL

Casing Stickup: 2.91 ft AGL

Static Water Level (H): 18.93 ft BTOC = 16.02 ft BGL

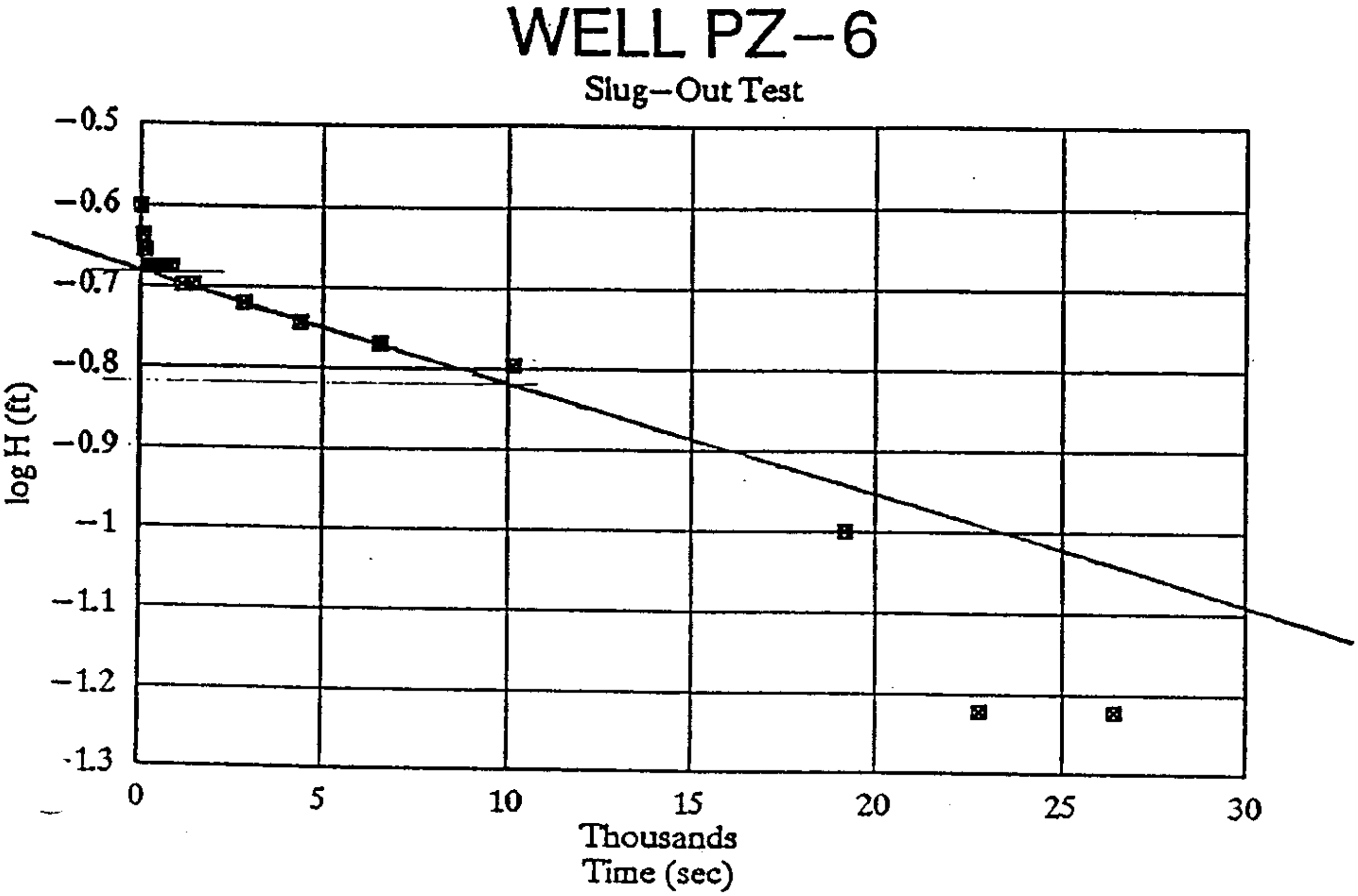
Type of Slug: 3/4" PVC , 2' long

Slug Volume: 0.0122 ft^3 = 0.091 gal

Expected rise/decline in water level in piezometer due to inserting/removing slug: 0.52 ft

Explanation:

ft BGL = feet below ground level
ft AGL = feet above ground level
ft BTOC = feet below top of casing



$\log y_0 = -0.683$ ✓

$y_0 = 0.207$ ft ✓

$t = 10000$ secs ✓

$\log y_t = -0.819$ ✓

$y_t = 0.152$ ft ✓

```
SLUG-OUT TEST:  WELL PZ-6

TIME OF DAY IN MINUTES AT WHICH TEST STARTED:        620
NUMBER OF SEC INTO MIN AT WHICH TEST STARTED:          0
INITIAL DEPTH TO WATER BELOW TOP OF CASING:        18.93 FEET
SLUG VOLUME:   0.012 FT**3

||******* OBSERVED *******||**************** CALCULATED ***************||
|| TIME OF |  DEPTH TO   ||  DELTA   |  TIME IN  |   LOG    |   LOG    ||
||   DAY   | WATER (FT)  ||  H (FT)  |   SEC.    |   TIME   | DELTA H  ||

  10:20:00       18.93        0.00         0.0        ERR       ERR
  10:20:30       19.18        0.25        30.0       1.48     -0.60
  10:21:30       19.16        0.23        90.0       1.95     -0.64
  10:22:00       19.15        0.22       120.0       2.08     -0.66
  10:22:30       19.15        0.22       150.0       2.18     -0.66
  10:23:00       19.15        0.22       180.0       2.26     -0.66
  10:24:30       19.14        0.21       270.0       2.43     -0.68
  10:26:00       19.14        0.21       360.0       2.56     -0.68
  10:30:00       19.14        0.21       600.0       2.78     -0.68
  10:32:00       19.14        0.21       720.0       2.86     -0.68
  10:35:00       19.14        0.21       900.0       2.95     -0.68
  10:40:00       19.13        0.20      1200.0       3.08     -0.70
  10:45:00       19.13        0.20      1500.0       3.18     -0.70
  11:08:00       19.12        0.19      2880.0       3.46     -0.72
  11:34:00       19.11        0.18      4440.0       3.65     -0.74
  12:10:00       19.10        0.17      6600.0       3.82     -0.77
  13:09:00       19.09        0.16     10140.0       4.01     -0.80
  15:40:00       19.03        0.10     19200.0       4.28     -1.00
  16:40:00       18.99        0.06     22800.0       4.36     -1.22
  17:40:00       18.99        0.06     26400.0       4.42     -1.22
  09:05:00       18.90       -0.03     81900.0       4.91       ERR
  11:37:00       18.88       -0.05     91020.0       4.96       ERR
  13:03:00       18.87       -0.06     96180.0       4.98       ERR
  14:14:00       18.87       -0.06    100440.0       5.00       ERR
```

```
 ***************************************
       SLUG OUT TEST - WELL PZ-7       *
 ***************************************

  METHOD OF BOUWER AND RICE (1976)

'ormulas: K = 86,400*(rc**2/(2tL))*ln(Re/rw)*ln(h1/h2)     T = K*D
        and:
         ln(Re/rw) = [1.1/ln(H/rw)+(A+Bln(D-H)/rw)/(L/rw)]**-1 for D>H, or
         ln(Re/rw) = [1.1/ln(H/rw)+C/(L/rw)]**-1 for D=H

        where:
         K = hydraulic conductivity (ft/day)
         T = transmissivity (ft**2/day)
         rc= radius of well casing if water level is above well screen (ft);
             if water level is in screen, see reference for formula
         rw= radial distance between the center of the well screen and the
             undisturbed aquifer (ft)
         L = length of screened interval or H, whichever is smallest (ft)
         Re= radius over which head change is dissipated in the aquifer (ft)
         h1= change in head at time = t1 (ft)
         h2= change in head at time = t2 (ft)
         t = t2 - t1 (sec)
         A,B,C = dimensionless parameters that are functions of L/rw
         D = saturated aquifer thickness (ft)
         H = height of original water table above the bottom of the screen

put parameters: rc=  1.03 inches
                rw=  4.50 inches
                L =  8.14 feet
                D =  8.14 feet
                H =  8.14 feet
                h1=  .385 feet
                h2=  .245 feet
                t = 4.0000E+04 seconds
                C =  1.69

 Because the water level was below the top of the screen, adjustments
 must be made to the well radius to account for the filter pack
 storage.  The new casing radius is calculated using the
 following relationship: rc=sqrt(rc**2 + n(rw**2-rc**2))
          where n = porosity of the filter pack = 30.%
          new rc =   2.61 inches

ution: K =  2.3E-06 cm/sec
       K =  .65E-02 ft/day
       T =  .53E-01 ft**2/day
```

SLUG TEST DATA

Well Number: PZ-7 Date Tested: 11/21/91

Type of Test: SLUG-OUT

Well Radius (r_c): 1.034 in = 0.086 ft

Borehole Radius (r_w): 4.5 in = 0.375 ft

Screen Length (L): 10.0 ft

Shape Factor (F) = L/r_w: 2.22

Screen Interval: 14.8 to 24.8 ft BGL

Filter Pack Interval: 12.5 to 27.3 ft BGL

Casing Stickup: 2.67 ft AGL

Static Water Level (H): 18.66 ft BTOC = 15.99 ft BGL

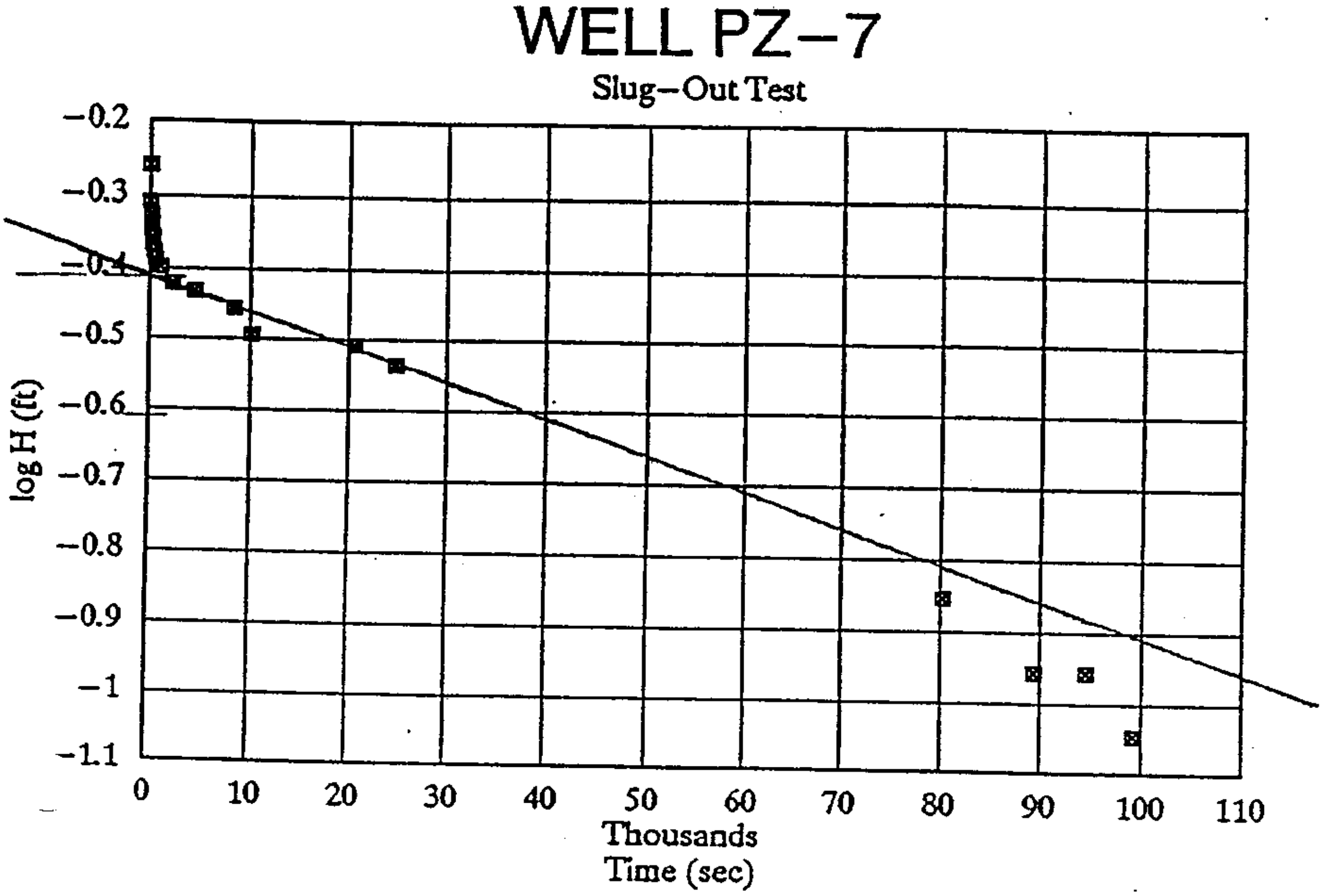
Type of Slug: 3/4" PVC, 5' long

Slug Volume: 0.030 ft³ = 0.227 gal

Expected rise/decline in water level in piezometer due to inserting/removing slug: 1.29 ft

Explanation:

ft BGL = feet below ground level
ft AGL = feet above ground level
ft BTOC = feet below top of casing



log y_0 = −0.415 ✓

y_0 = 0.385 ft ✓

t = 40000 secs ✓

log y_t = −0.611 ✓

y_t = 0.245 ft ✓

```
SLUG-OUT TEST:  WELL PZ-7

TIME OF DAY IN MINUTES AT WHICH TEST STARTED:       653
NUMBER OF SEC INTO MIN AT WHICH TEST STARTED:         0
INITIAL DEPTH TO WATER BELOW TOP OF CASING:       18.66 FEET
SLUG VOLUME:   0.030 FT**3

||******* OBSERVED *******||**************** CALCULATED ****************||
|| TIME OF |  DEPTH TO   ||  DELTA   |  TIME IN  |   LOG    |   LOG    ||
||   DAY   | WATER (FT)  ||  H (FT)  |   SEC.    |   TIME   | DELTA H  ||

   10:53:00       18.66        0.00          0.0        ERR       ERR
   10:54:00       19.21        0.55         60.0       1.78     -0.26
   10:54:45       19.15        0.49        105.0       2.02     -0.31
   10:55:20       19.13        0.47        140.0       2.15     -0.33
   10:56:00       19.12        0.46        180.0       2.26     -0.34
   10:56:30       19.11        0.45        210.0       2.32     -0.35
   10:57:30       19.10        0.44        270.0       2.43     -0.36
   10:59:00       19.09        0.43        360.0       2.56     -0.37
   11:00:30       19.08        0.42        450.0       2.65     -0.38
   11:04:00       19.07        0.41        660.0       2.82     -0.39
   11:11:00       19.06        0.40       1080.0       3.03     -0.40
   11:31:00       19.04        0.38       2280.0       3.36     -0.42
   12:07:00       19.03        0.37       4440.0       3.65     -0.43
   13:12:00       19.01        0.35       8340.0       3.92     -0.46
   13:42:00       18.98        0.32      10140.0       4.01     -0.49
   16:37:00       18.97        0.31      20640.0       4.31     -0.51
   17:47:00       18.95        0.29      24840.0       4.40     -0.54
   09:10:00       18.80        0.14      80220.0       4.90     -0.85
   11:42:00       18.77        0.11      89340.0       4.95     -0.96
   13:07:00       18.77        0.11      94440.0       4.98     -0.96
   14:26:00       18.75        0.09      99180.0       5.00     -1.05
```

```
 **************************************
 *      SLUG OUT TEST - WELL PZ-11     *
 **************************************

 METHOD OF BOUWER AND RICE (1976)

ormulas: K = 86,400*(rc**2/(2tL))*ln(Re/rw)*ln(h1/h2)     T = K*D
        and:
         ln(Re/rw)  = [1.1/ln(H/rw)+(A+Bln(D-H)/rw)/(L/rw)]**-1 for D>H, or
         ln(Re/rw)  = [1.1/ln(H/rw)+C/(L/rw)]**-1 for D=H

        where:
         K = hydraulic conductivity (ft/day)
         T = transmissivity (ft**2/day)
         rc= radius of well casing if water level is above well screen (ft);
             if water level is in screen, see reference for formula
         rw= radial distance between the center of the well screen and the
             undisturbed aquifer (ft)
         L = length of screened interval or H, whichever is smallest (ft)
         Re= radius over which head change is dissipated in the aquifer (ft)
         h1= change in head at time = t1 (ft)
         h2= change in head at time = t2 (ft)
         t = t2 - t1 (sec)
         A,B,C = dimensionless parameters that are functions of L/rw
         D = saturated aquifer thickness (ft)
         H = height of original water table above the bottom of the screen

nput parameters: rc=  1.03 inches
                 rw=  4.50 inches
                 L =  3.69 feet
                 D =  3.69 feet
                 H =  3.69 feet
                 h1=  .329 feet
                 h2=  .133 feet
                 t = 6.0000E+04 seconds
                 C =  1.18

 Because the water level was below the top of the screen, adjustments
 must be made to the well radius to account for the filter pack
 storage.  The new casing radius is calculated using the
 following relationship: rc=sqrt(rc**2 + n(rw**2-rc**2))
          where n = porosity of the filter pack = 30.%
          new rc =   2.61 inches

ution: K =  4.9E-06 cm/sec
       K =  .14E-01 ft/day
       T =  .51E-01 ft**2/day
```

SLUG TEST DATA

Well Number: PZ-11 Date Tested: 11/21/91

Type of Test: SLUG-OUT

Well Radius (r_c): 1.034 in = 0.086 ft

Borehole Radius (r_w): 4.5 in = 0.375 ft

Screen Length (L): 10.0 ft

Shape Factor (F) = L/r_w: 2.22

Screen Interval: 36.0 to 46.0 ft BGL

Filter Pack Interval: 33.0 to 46.0 ft BGL

Casing Stickup: 3.02 ft AGL

Static Water Level (H): 44.28 ft BTOC = 41.26 ft BGL

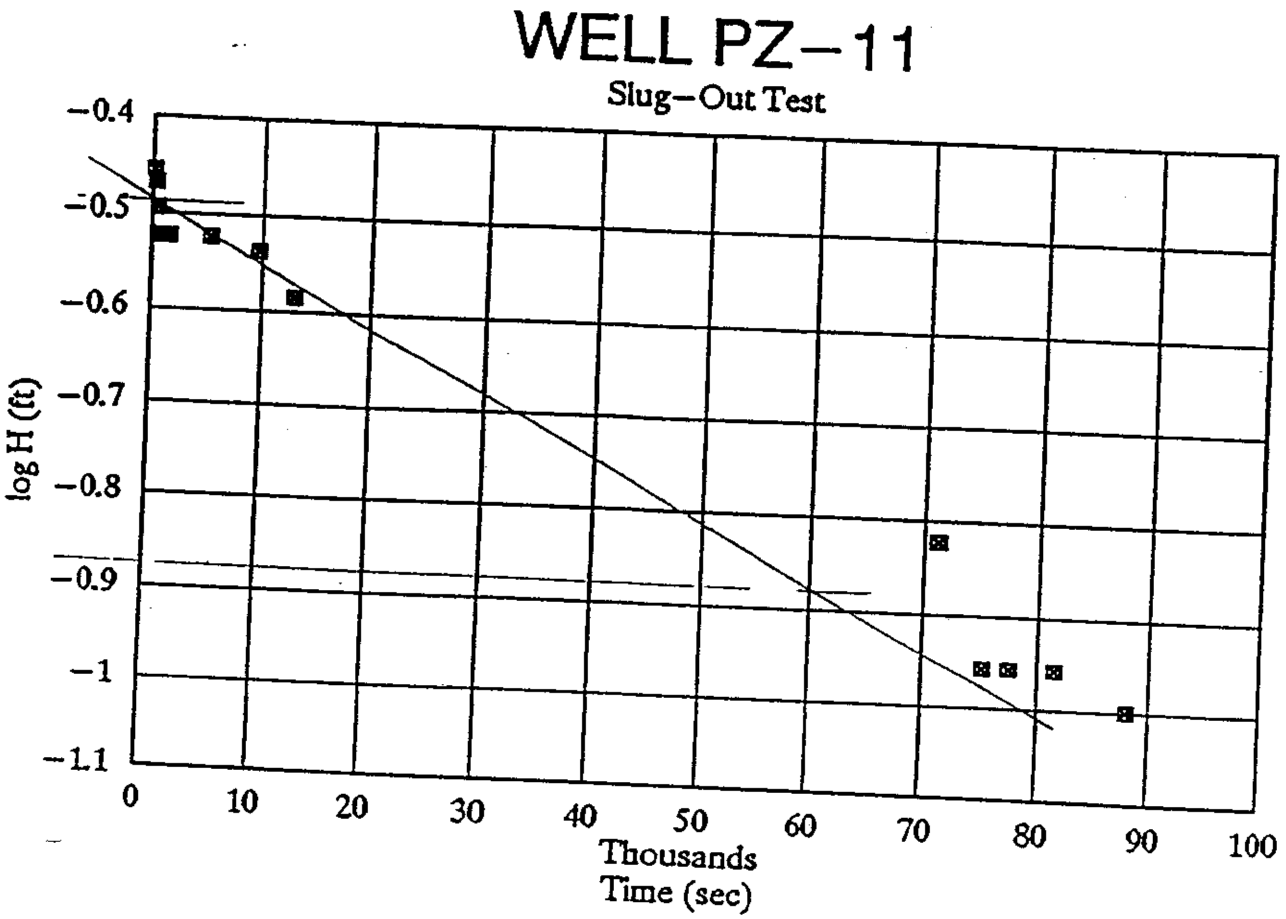
Type of Slug: 3/4" PVC, 5' long

Slug Volume: 0.030 ft^3 = 0.227 gal

Expected rise/decline in water level in piezometer due to inserting/removing slug: 1.29 ft

Explanation:

ft BGL = feet below ground level
ft AGL = feet above ground level
ft BTOC = feet below top of casing



7)

log y_0 = − 0.483 ✓

y_0 = 0.329 ft ✓

t = 60000 secs ✓

log y_t = −0.876 ✓

y_t = 0.133 ft ✓

```
SLUG-OUT TEST:  WELL PZ-11

TIME OF DAY IN MINUTES AT WHICH TEST STARTED:         873
NUMBER OF SEC INTO MIN AT WHICH TEST STARTED:           0
INITIAL DEPTH TO WATER BELOW TOP OF CASING:        44.28 FEET
SLUG VOLUME:    0.030 FT**3

||******* OBSERVED *******||***************** CALCULATED ***************||
|| TIME OF |   DEPTH TO    ||  DELTA   | TIME IN  |   LOG     |   LOG     ||
||   DAY   |  WATER (FT)   ||  H (FT)  |   SEC.   |   TIME    | DELTA H   ||

   14:35:00        44.63        0.35       120.0       2.08      -0.46
   14:37:00        44.62        0.34       240.0       2.38      -0.47
   14:39:00        44.62        0.34       360.0       2.56      -0.47
   14:41:00        44.60        0.32       480.0       2.68      -0.49
   14:42:00        44.60        0.32       540.0       2.73      -0.49
   14:43:00        44.58        0.30       600.0       2.78      -0.52
   14:46:00        44.58        0.30       780.0       2.89      -0.52
   14:47:00        44.58        0.30       840.0       2.92      -0.52
   14:49:00        44.58        0.30       960.0       2.98      -0.52
   14:52:00        44.58        0.30      1140.0       3.06      -0.52
   14:55:00        44.58        0.30      1320.0       3.12      -0.52
   15:00:00        44.58        0.30      1620.0       3.21      -0.52
   16:01:00        44.58        0.30      5280.0       3.72      -0.52
   17:16:00        44.57        0.29      9780.0       3.99      -0.54
   18:10:00        44.54        0.26     13020.0       4.11      -0.59
   10:20:00        44.43        0.15     71220.0       4.85      -0.82
   11:27:00        44.39        0.11     75240.0       4.88      -0.96
   12:06:00        44.39        0.11     77580.0       4.89      -0.96
   13:14:00        44.39        0.11     81660.0       4.91      -0.96
   15:00:00        44.38        0.10     88020.0       4.94      -1.00
```

```
 `*************************************
        SLUG OUT TEST - WELL PZ-12       *
  *************************************

  METHOD OF BOUWER AND RICE (1976)

'ormulas: K = 86,400*(rc**2/(2tL))*ln(Re/rw)*ln(h1/h2)     T = K*D
        and:
         ln(Re/rw) = [1.1/ln(H/rw)+(A+Bln(D-H)/rw)/(L/rw)]**-1 for D>H, or
         ln(Re/rw) = [1.1/ln(H/rw)+C/(L/rw)]**-1 for D=H

        where:
         K = hydraulic conductivity (ft/day)
         T = transmissivity (ft**2/day)
         rc= radius of well casing if water level is above well screen (ft);
             if water level is in screen, see reference for formula
         rw= radial distance between the center of the well screen and the
             undisturbed aquifer (ft)
         L = length of screened interval or H, whichever is smallest (ft)
         Re= radius over which head change is dissipated in the aquifer (ft)
         h1= change in head at time = t1 (ft)
         h2= change in head at time = t2 (ft)
         t = t2 - t1 (sec)
         A,B,C = dimensionless parameters that are functions of L/rw
         D = saturated aquifer thickness (ft)
         H = height of original water table above the bottom of the screen

put parameters: rc=  1.03 inches
                rw=  4.50 inches
                L =  4.04 feet
                D =  4.04 feet
                H =  4.04 feet
                h1=  .262 feet
                h2=  .126 feet
                t = 5.0000E+04 seconds
                C =  1.23

Because the water level was below the top of the screen, adjustments
must be made to the well radius to account for the filter pack
storage.  The new casing radius is calculated using the
following relationship: rc=sqrt(rc**2 + n(rw**2-rc**2))
          where n = porosity of the filter pack = 30.%
          new rc =   2.61 inches

ution: K =  4.5E-06 cm/sec
       K =  .13E-01 ft/day
       T =  .52E-01 ft**2/day
```

SLUG TEST DATA

Well Number: PZ-12 Date Tested: 11/21/91

Type of Test: SLUG-OUT

Well Radius (r_c): 1.034 in = 0.086 ft

Borehole Radius (r_w): 4.5 in = 0.375 ft

Screen Length (L): 10.0 ft

Shape Factor (F) = L/r_w): 2.22

Screen Interval: 54.0 to 64.0 ft BGL

Filter Pack Interval: 52.0 to 66.5 ft BGL

Casing Stickup: 2.86 ft AGL

Static Water Level (H): 61.93 ft BTOC = 59.07 ft BGL

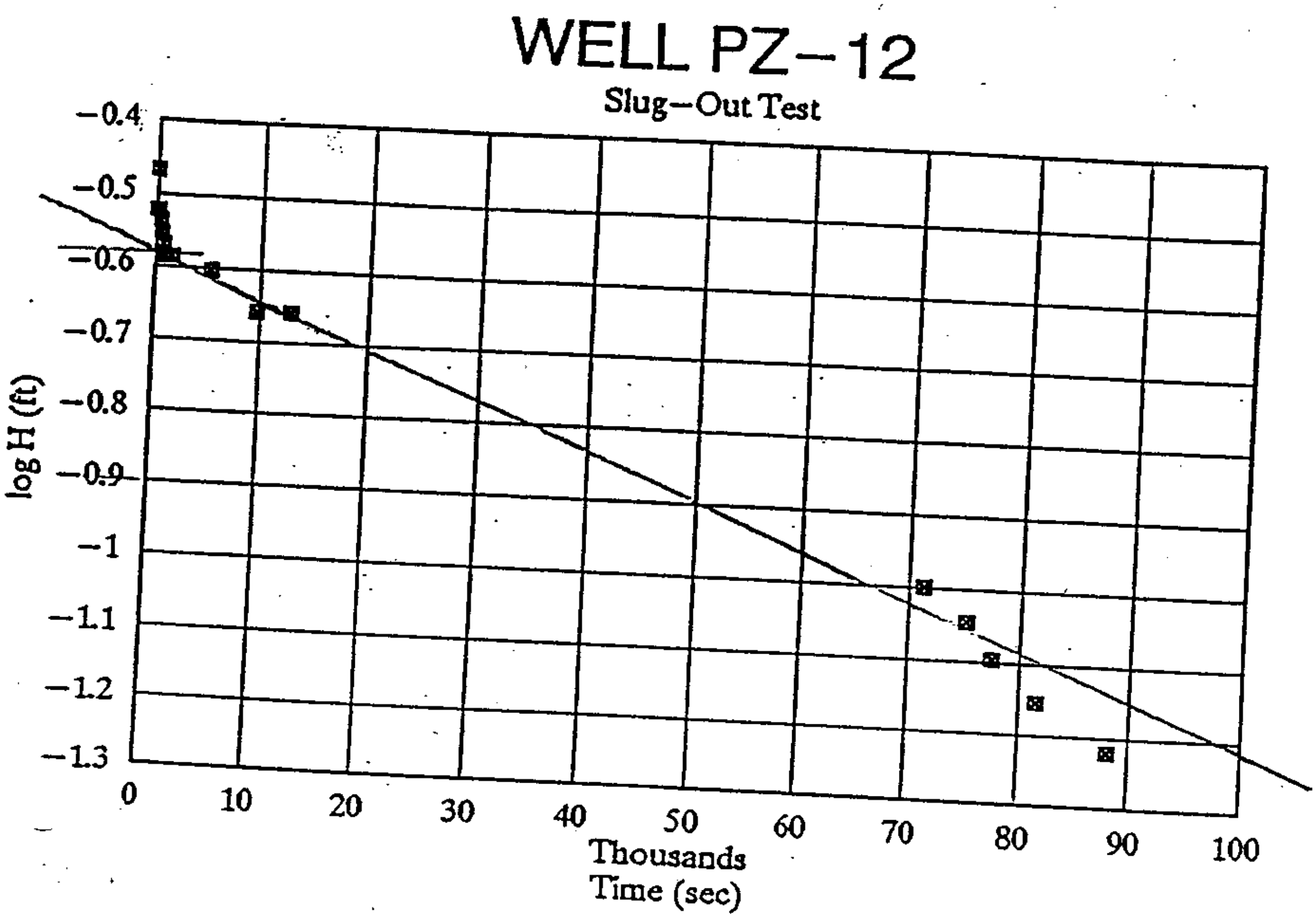
Type of Slug: 3/4" PVC, 3' long

Slug Volume: 0.018 ft³ = 0.136 gal

Expected rise/decline in water level in piezometer due to inserting/removing slug: 0.77 ft

Explanation:

ft BGL = feet below ground level
ft AGL = feet above ground level
ft BTOC = feet below top of casing



$\log y_0 = -0.582$ ✓

$y_0 = 0.262$ ft ✓

$t = 50000$ secs ✓

$\log y_t = -0.9$ ✓

$y_t = 0.126$ ft ✓

```
SLUG-OUT TEST:  WELL PZ-12

TIME OF DAY IN MINUTES AT WHICH TEST STARTED:       872
NUMBER OF SEC INTO MIN AT WHICH TEST STARTED:         0
INITIAL DEPTH TO WATER BELOW TOP OF CASING:       61.93 FEET
SLUG VOLUME:   0.0180 FT**3

||******* OBSERVED *******||**************** CALCULATED ***************||
|| TIME OF |  DEPTH TO    ||  DELTA   |  TIME IN  |   LOG     |   LOG    ||
||   DAY   |  WATER (FT)  ||  H (FT)  |   SEC.    |   TIME    | DELTA H  ||

   14:32:00       61.93        0.00         0.0        ERR       ERR
   14:32:30       62.27        0.34        30.0       1.48     -0.47
   14:33:30       62.23        0.30        90.0       1.95     -0.52
   14:35:00       62.23        0.30       180.0       2.26     -0.52
   14:38:00       62.22        0.29       360.0       2.56     -0.54
   14:40:00       62.21        0.28       480.0       2.68     -0.55
   14:45:00       62.20        0.27       780.0       2.89     -0.57
   14:50:00       62.19        0.26      1080.0       3.03     -0.59
   15:00:00       62.19        0.26      1680.0       3.23     -0.59
   16:00:00       62.18        0.25      5280.0       3.72     -0.60
   17:15:00       62.15        0.22      9780.0       3.99     -0.66
   18:08:00       62.15        0.22     12960.0       4.11     -0.66
   10:20:00       62.03        0.10     71280.0       4.85     -1.00
   11:26:00       62.02        0.09     75240.0       4.88     -1.05
   12:05:00       62.01        0.08     77580.0       4.89     -1.10
   13:12:00       62.00        0.07     81600.0       4.91     -1.15
   15:00:00       61.99        0.06     88080.0       4.94     -1.22
```

```
   ****************************************
   *     SLUG IN TEST - WELL P-6          *
   ****************************************

   METHOD OF BOUWER AND RICE (1976)

Formulas: K = 86,400*(rc**2/(2tL))*ln(Re/rw)*ln(h1/h2)     T = K*D
          and:
           ln(Re/rw) = [1.1/ln(H/rw)+(A+Bln(D-H)/rw)/(L/rw)]**-1 for D>H, or
           ln(Re/rw) = [1.1/ln(H/rw)+C/(L/rw)]**-1 for D=H

          where:
           K = hydraulic conductivity (ft/day)
           T = transmissivity (ft**2/day)
           rc= radius of well casing if water level is above well screen (ft);
               if water level is in screen, see reference for formula
           rw= radial distance between the center of the well screen and the
               undisturbed aquifer (ft)
           L = length of screened interval or H, whichever is smallest (ft)
           Re= radius over which head change is dissipated in the aquifer (ft)
           h1= change in head at time = t1 (ft)
           h2= change in head at time = t2 (ft)
           t = t2 - t1 (sec)
           A,B,C = dimensionless parameters that are functions of L/rw
           D = saturated aquifer thickness (ft)
           H = height of original water table above the bottom of the screen

nput parameters: rc=    .69 inches
                 rw=   1.98 inches
                 L =   5.00 feet
                 D =  36.86 feet
                 H =  36.86 feet
                 h1=   .482 feet
                 h2=   .243 feet
                 t = 1.0000E+04 seconds
                 C =   2.06

lution: K =  2.5E-06 cm/sec
        K =  .72E-02 ft/day
        T =  .27     ft**2/day
```

SLUG TEST DATA

Well Number: P-6 Date Tested: 11/21/91

Type of Test: SLUG-IN

Well Radius (r_c): 0.69 in = 0.0575 ft

Borehole Radius (r_w): 1.98 in = 0.165 ft

Screen Length (L): 5 ft

Shape Factor (F) = L/r_w): 15.15

Screen Interval: 40 to 45 ft BGL

Filter Pack Interval: 20 to 45 ft BGL

Casing Stickup: 3.32 ft AGL

Static Water Level (H): 10.14 ft BTOC = 6.82 ft BGL

Type of Slug: 1/2" PVC, 2' long

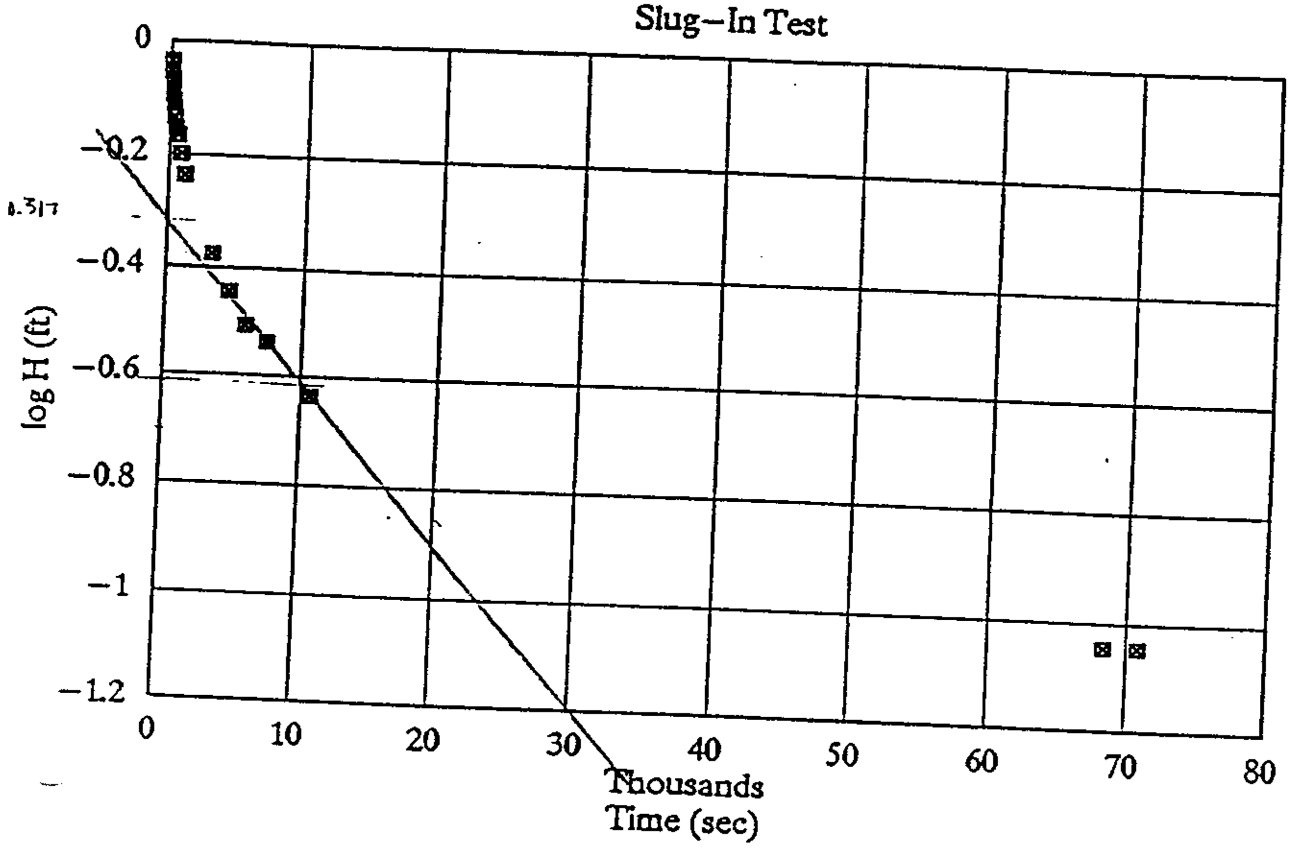
Slug Volume: 0.0077 ft³ = 0.0576 gal

Expected rise/decline in water level in piezometer due to inserting/removing slug: 0.74 ft

Explanation:
ft BGL = feet below ground level
ft AGL = feet above ground level
ft BTOC = feet below top of casing

WELL P-6

Slug-In Test



$\log y_0 = -0.317$ ✓

$y_0 = 0.482$ ft ✓

$t = 10000$ secs ✓

$\log y_t = -0.614$ ✓

$y_t = 0.243$ ft ✓

1¼" casing

ID = ~~1.138"~~ 1.38"

$r_c = 0.69"$

$r_w = 1.98"$

L = 5.0 ft

borehole diameter = 0.3

= 3.96'

```
SLUG-IN TEST:  WELL P-6

TIME OF DAY IN MINUTES AT WHICH TEST STARTED:       915
NUMBER OF SEC INTO MIN AT WHICH TEST STARTED:         0
INITIAL DEPTH TO WATER BELOW TOP OF CASING:       10.14 FEET
SLUG VOLUME:   0.0077 FT**3

||******* OBSERVED *******||**************** CALCULATED ***************||
|| TIME OF |  DEPTH TO   ||  DELTA   |  TIME IN  |   LOG    |   LOG    ||
||   DAY   | WATER (FT)  ||  H (FT)  |   SEC.    |   TIME   | DELTA H  ||

  15:15:00        10.14        0.00         0.0        ERR       ERR
  15:15:30         9.22        0.92        30.0       1.48     -0.04
  15:16:00         9.26        0.88        60.0       1.78     -0.06
  15:16:45         9.29        0.85       105.0       2.02     -0.07
  15:17:20         9.32        0.82       140.0       2.15     -0.09
  15:18:00         9.34        0.80       180.0       2.26     -0.10
  15:18:30         9.36        0.78       210.0       2.32     -0.11
  15:19:15         9.37        0.77       255.0       2.41     -0.11
  15:21:00         9.41        0.73       360.0       2.56     -0.14
  15:23:00         9.44        0.70       480.0       2.68     -0.15
  15:25:00         9.46        0.68       600.0       2.78     -0.17
  15:30:00         9.51        0.63       900.0       2.95     -0.20
  15:35:00         9.56        0.58      1200.0       3.08     -0.24
  16:11:00         9.72        0.42      3360.0       3.53     -0.38
  16:33:00         9.78        0.36      4680.0       3.67     -0.44
  16:54:00         9.83        0.31      5940.0       3.77     -0.51
  17:20:00         9.85        0.29      7500.0       3.88     -0.54
  18:15:00         9.91        0.23     10800.0       4.03     -0.64
  10:15:00        10.05        0.09     68400.0       4.84     -1.05
  10:57:00        10.05        0.09     70920.0       4.85     -1.05
```

```
     *****************************************
           SLUG OUT TEST - WELL P-6            *
     *****************************************

    METHOD OF BOUWER AND RICE (1976)

Formulas: K = 86,400*(rc**2/(2tL))*ln(Re/rw)*ln(h1/h2)     T = K*D
          and:
           ln(Re/rw) = [1.1/ln(H/rw)+(A+Bln(D-H)/rw)/(L/rw)]**-1 for D>H, or
           ln(Re/rw) = [1.1/ln(H/rw)+C/(L/rw)]**-1 for D=H

          where:
           K = hydraulic conductivity (ft/day)
           T = transmissivity (ft**2/day)
           rc= radius of well casing if water level is above well screen (ft);
               if water level is in screen, see reference for formula
           rw= radial distance between the center of the well screen and the
               undisturbed aquifer (ft)
           L = length of screened interval or H, whichever is smallest (ft)
           Re= radius over which head change is dissipated in the aquifer (ft)
           h1= change in head at time = t1 (ft)
           h2= change in head at time = t2 (ft)
           t = t2 - t1 (sec)
           A,B,C = dimensionless parameters that are functions of L/rw
           D = saturated aquifer thickness (ft)
           H = height of original water table above the bottom of the screen

nput parameters: rc=   .69 inches
                 rw=  1.98 inches
                 L =  5.00 feet
                 D = 36.95 feet
                 H = 36.95 feet
                 h1=  .520 feet
                 h2=  .155 feet
                 t = 1.5000E+04 seconds
                 C =  2.06

lution: K =  3.0E-06 cm/sec
        K =  .85E-02 ft/day
        T =  .31     ft**2/day
```

SLUG TEST DATA

Well Number: P-6 Date Tested: 11/22/91

Type of Test: SLUG - OUT

Well Radius (r_c): 0.69 in = 0.0575 ft

Borehole Radius (r_w): 1.98 in = 0.165 ft

Screen Length (L): 5 ft

Shape Factor (F) = L/r_w): 15.15

Screen Interval: 40 to 45 ft BGL

Filter Pack Interval: 20 to 45 ft BGL

Casing Stickup: 3.32 ft AGL

Static Water Level (H): 10.05 ft BTOC = 6.73 ft BGL

Type of Slug: 1/2" PVC, 3' long

Slug Volume: 0.0077 ft³ = 0.0576 gal

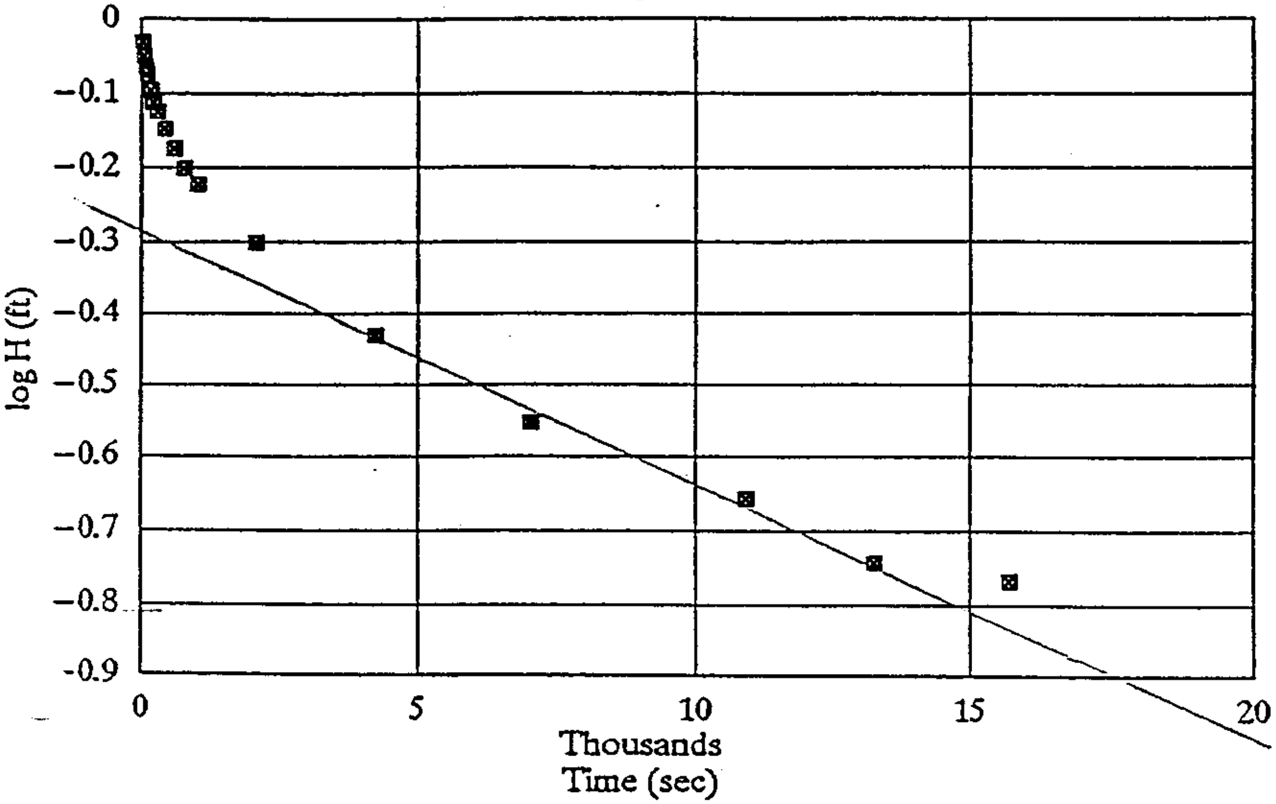
Expected rise/decline in water level in piezometer due to inserting/removing slug: 0.74 ft

Explanation:

ft BGL = feet below ground level
ft AGL = feet above ground level
ft BTOC = feet below top of casing

WELL P–6

Slug–Out Test



log y_0 = -0.284 ✓

y_0 = ~~1.924~~ ft 0.520 ft ✓

log y_t = -0.811 ✓

y_t = ~~6.47 ft~~ 0.155 ft ✓

t = 15000 secs ✓

```
SLUG-OUT TEST:  WELL P-6

TIME OF DAY IN MINUTES AT WHICH TEST STARTED:       658
NUMBER OF SEC INTO MIN AT WHICH TEST STARTED:         0
INITIAL DEPTH TO WATER BELOW TOP OF CASING:       10.05 FEET
SLUG VOLUME:-   0.0077 FT**3

||******* OBSERVED *******||**************** CALCULATED ***************||
|| TIME OF |   DEPTH TO   ||  DELTA   |  TIME IN  |   LOG    |   LOG    ||
||   DAY   |  WATER (FT)  ||  H (FT)  |   SEC.    |   TIME   | DELTA H  ||

   10:58:00        10.05        0.00         0.0        ERR       ERR
   10:58:30        10.98        0.93        30.0       1.48     -0.03
   10:59:00        10.94        0.89        60.0       1.78     -0.05
   10:59:30        10.91        0.86        90.0       1.95     -0.07
   11:00:00        10.89        0.84       120.0       2.08     -0.08
   11:01:00        10.85        0.80       180.0       2.26     -0.10
   11:02:00        10.82        0.77       240.0       2.38     -0.11
   11:03:00        10.80        0.75       300.0       2.48     -0.12
   11:05:00        10.76        0.71       420.0       2.62     -0.15
   11:08:00        10.72        0.67       600.0       2.78     -0.17
   11:11:00        10.68        0.63       780.0       2.89     -0.20
   11:15:00        10.65        0.60      1020.0       3.01     -0.22
   11:32:00        10.55        0.50      2040.0       3.31     -0.30
   12:09:00        10.42        0.37      4260.0       3.63     -0.43
   12:56:00        10.33        0.28      7080.0       3.85     -0.55
   14:00:00        10.27        0.22     10920.0       4.04     -0.66
   14:39:00        10.23        0.18     13260.0       4.12     -0.74
   15:20:00        10.22        0.17     15720.0       4.20     -0.77
```

```
 ***************************************
 *     SLUG OUT TEST - WELL P-7        *
 ***************************************

 METHOD OF BOUWER AND RICE (1976)

Formulas: K = 86,400*(rc**2/(2tL))*ln(Re/rw)*ln(h1/h2)     T = K*D
        and:
         ln(Re/rw) = [1.1/ln(H/rw)+(A+Bln(D-H)/rw)/(L/rw)]**-1 for D>H, or
         ln(Re/rw) = [1.1/ln(H/rw)+C/(L/rw)]**-1 for D=H
        where:
         K = hydraulic conductivity (ft/day)
         T = transmissivity (ft**2/day)
         rc= radius of well casing if water level is above well screen (ft);
             if water level is in screen, see reference for formula
         rw= radial distance between the center of the well screen and the
             undisturbed aquifer (ft)
         L = length of screened interval or H, whichever is smallest (ft)
         Re= radius over which head change is dissipated in the aquifer (ft)
         h1= change in head at time = t1 (ft)
         h2= change in head at time = t2 (ft)
         t = t2 - t1 (sec)
         A,B,C = dimensionless parameters that are functions of L/rw
         D = saturated aquifer thickness (ft)
         H = height of original water table above the bottom of the screen

iput parameters: rc=   .69 inches
                 rw=  1.98 inches
                 L =  5.00 feet
                 D = 30.26 feet
                 H = 30.26 feet
                 h1=  .980 feet
                 h2=  .877 feet
                 t = 2.0000E+04 seconds
                 C =  2.06

lution: K =  2.0E-07 cm/sec
        K =  .57E-03 ft/day
        T =  .17E-01 ft**2/day
```

SLUG TEST DATA

Well Number: P-7 Date Tested: 11/22/91

Type of Test: SLUG-OUT

Well Radius (r_c): 0.69 in = 0.0575 ft

Borehole Radius (r_w): 1.98 in = 0.165 ft

Screen Length (L): 5 ft

Shape Factor (F) = L/r_w): 15.15

Screen Interval: 73.0 to 78.0 ft BGL

Filter Pack Interval: 53.0 to 78.0 ft BGL

Casing Stickup: 3.27 ft AGL

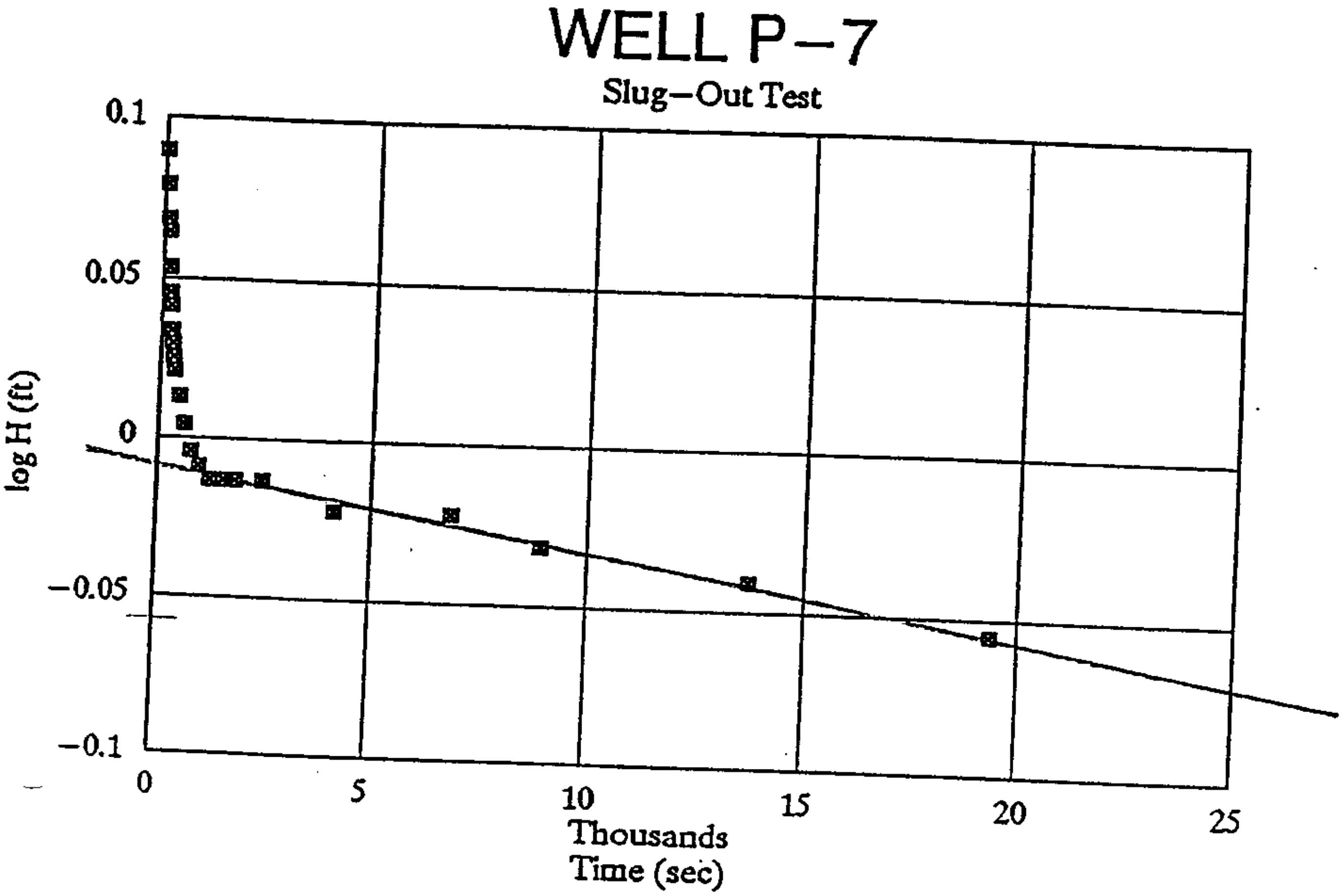
Static Water Level (H): 49.74 ft BTOC = 46.47 ft BGL

Type of Slug: 1/2" PVC, 3' long

Slug Volume: 0.0115 ft^3 = 0.086 gal

Expected rise/decline in water level in piezometer due to inserting/removing slug: 1.11 ft

Explanation:
ft BGL = feet below ground level
ft AGL = feet above ground level
ft BTOC = feet below top of casing



log y_0 = − 0.009

y_0 = ~~1.021 ft~~ 0.980 ft

t = 20000 secs

log y_t = -0.057

y_t = ~~0.876~~ 0.877 ft

```
SLUG-OUT TEST:  WELL P-7

TIME OF DAY IN MINUTES AT WHICH TEST STARTED:       569
NUMBER OF SEC INTO MIN AT WHICH TEST STARTED:         0
INITIAL DEPTH TO WATER BELOW TOP OF CASING:       49.74 FEET
SLUG VOLUME:   0.0115 FT**3

||******* OBSERVED *******||**************** CALCULATED ***************||
|| TIME OF |  DEPTH TO   ||  DELTA   |  TIME IN  |   LOG    |   LOG    ||
||   DAY   | WATER (FT)  ||  H (FT)  |   SEC.    |   TIME   | DELTA H  ||

  09:29:00       49.74        0.00         0.0       ERR       ERR
  09:29:45       50.97        1.23        45.0      1.65      0.09
  09:30:15       50.94        1.20        75.0      1.88      0.08
  09:30:45       50.91        1.17       105.0      2.02      0.07
  09:31:15       50.90        1.16       135.0      2.13      0.06
  09:31:45       50.87        1.13       165.0      2.22      0.05
  09:32:15       50.85        1.11       195.0      2.29      0.05
  09:32:45       50.84        1.10       225.0      2.35      0.04
  09:33:15       50.82        1.08       255.0      2.41      0.03
  09:33:45       50.81        1.07       285.0      2.45      0.03
  09:34:15       50.80        1.06       315.0      2.50      0.03
  09:35:00       50.79        1.05       360.0      2.56      0.02
  09:37:00       50.77        1.03       480.0      2.68      0.01
  09:39:00       50.75        1.01       600.0      2.78      0.00
  09:42:00       50.73        0.99       780.0      2.89     -0.00
  09:45:30       50.72        0.98       990.0      3.00     -0.01
  09:50:00       50.71        0.97      1260.0      3.10     -0.01
  09:55:00       50.71        0.97      1560.0      3.19     -0.01
  10:00:00       50.71        0.97      1860.0      3.27     -0.01
  10:10:00       50.71        0.97      2460.0      3.39     -0.01
  10:38:00       50.69        0.95      4140.0      3.62     -0.02
  11:23:00       50.69        0.95      6840.0      3.84     -0.02
  11:58:00       50.67        0.93      8940.0      3.95     -0.03
  13:17:00       50.65        0.91     13680.0      4.14     -0.04
  14:52:00       50.62        0.88     19380.0      4.29     -0.06
```

```
 ***************************************
       SLUG OUT TEST - WELL P-10       *
***************************************

 METHOD OF BOUWER AND RICE (1976)

'ormulas: K = 86,400*(rc**2/(2tL))*ln(Re/rw)*ln(h1/h2)     T = K*D
        and:
         ln(Re/rw) = [1.1/ln(H/rw)+(A+Bln(D-H)/rw)/(L/rw)]**-1 for D>H, or
         ln(Re/rw) = [1.1/ln(H/rw)+C/(L/rw)]**-1 for D=H

        where:
         K = hydraulic conductivity (ft/day)
         T = transmissivity (ft**2/day)
         rc= radius of well casing if water level is above well screen (ft);
             if water level is in screen, see reference for formula
         rw= radial distance between the center of the well screen and the
             undisturbed aquifer (ft)
         L = length of screened interval or H, whichever is smallest (ft)
         Re= radius over which head change is dissipated in the aquifer (ft)
         h1= change in head at time = t1 (ft)
         h2= change in head at time = t2 (ft)
         t = t2 - t1 (sec)
         A,B,C = dimensionless parameters that are functions of L/rw
         D = saturated aquifer thickness (ft)
         H = height of original water table above the bottom of the screen

nput parameters: rc=    .69 inches
                 rw=   1.98 inches
                 L =   4.25 feet
                 D =   4.25 feet
                 H =   4.25 feet
                 h1=   .621 feet
                 h2=   .570 feet
                 t = 2.0000E+04 seconds
                 C =   1.88

 Because the water level was below the top of the screen, adjustments
 must be made to the well radius to account for the filter pack
 storage.  The new casing radius is calculated using the
 following relationship: rc=sqrt(rc**2 + n(rw**2-rc**2))
           where n = porosity of the filter pack = 30.%
           new rc =   1.23 inches

lution: K =  3.9E-07 cm/sec
        K =  .11E-02 ft/day
        T =  .47E-02 ft**2/day
```

SLUG TEST DATA

Well Number: P-10 Date Tested: 11/20/91

Type of Test: SLUG-OUT

Well Radius (r_c): 0.69 in = 0.0575 ft

Borehole Radius (r_w): 1.98 in = 0.165 ft

Screen Length (L): 5.0 ft

Shape Factor (F) = L/r_w): 15.15

Screen Interval: 69.0 to 74.0 ft BGL

Filter Pack Interval: 60.0 to 74.0 ft BGL

Casing Stickup: 3.00 ft AGL

Static Water Level (H): 71.75 ft BTOC = 68.75 ft BGL

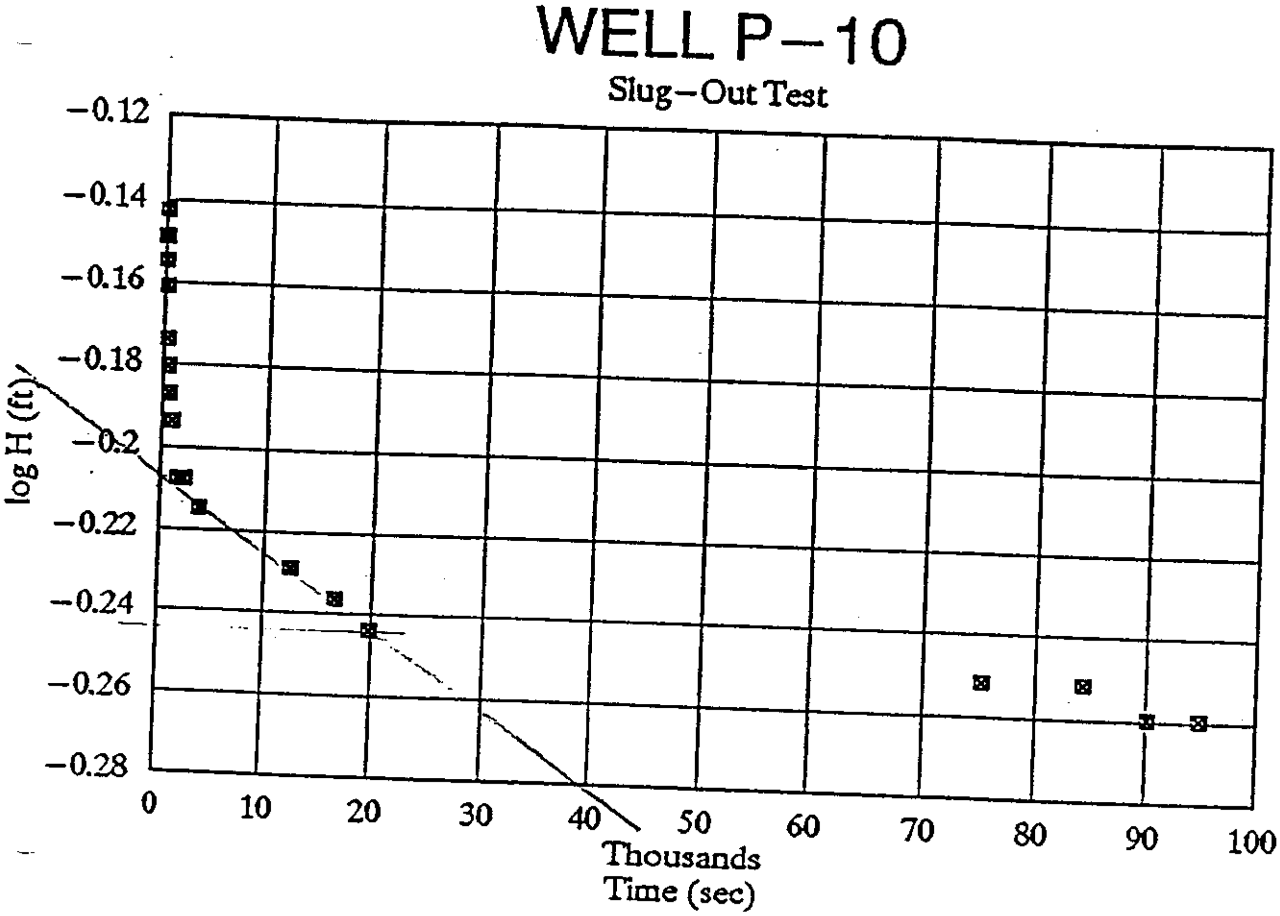
Type of Slug: 1/2" PVC, 2' long

Slug Volume: 0.0077 ft³ = 0.0576 gal

Expected rise/decline in water level in piezometer due to inserting/removing slug: 0.74 ft

Explanation:

ft BGL = feet below ground level
ft AGL = feet above ground level
ft BTOC = feet below top of casing



log y_0 = -0.207 /

y_0 = 0.621 ft /

t = 20000 secs /

log y_t = -0.244 /

y_t = 0.570 /

```
        SLUG-OUT TEST:  WELL P-10

        TIME OF DAY IN MINUTES AT WHICH TEST STARTED:        743
        NUMBER OF SEC INTO MIN AT WHICH TEST STARTED:          0
        INITIAL DEPTH TO WATER BELOW TOP OF CASING:        71.75 FEET
        SLUG VOLUME:   0.0077 FT**3

||******* OBSERVED *******||**************** CALCULATED ***************||
|| TIME OF |  DEPTH TO   ||  DELTA   |  TIME IN  |   LOG    |   LOG    ||
||   DAY   | WATER (FT)  ||  H (FT)  |   SEC.    |   TIME   | DELTA H  ||

   12:23:00         71.75        0.00        0.0        ERR       ERR
   12:24:00         72.46        0.71       60.0       1.78     -0.15
   12:25:00         72.47        0.72      120.0       2.08     -0.14
   12:25:30         72.46        0.71      150.0       2.18     -0.15
   12:26:00         72.46        0.71      180.0       2.26     -0.15
   12:26:30         72.45        0.70      210.0       2.32     -0.15
   12:28:00         72.44        0.69      300.0       2.48     -0.16
   12:30:00         72.42        0.67      420.0       2.62     -0.17
   12:32:00         72.41        0.66      540.0       2.73     -0.18
   12:35:00         72.40        0.65      720.0       2.86     -0.19
   12:41:00         72.39        0.64     1080.0       3.03     -0.19
   12:51:00         72.37        0.62     1680.0       3.23     -0.21
   13:01:00         72.37        0.62     2280.0       3.36     -0.21
   13:25:00         72.36        0.61     3720.0       3.57     -0.21
   15:50:00         72.34        0.59    12420.0       4.09     -0.23
   17:00:00         72.33        0.58    16620.0       4.22     -0.24
   17:54:00         72.32        0.57    19860.0       4.30     -0.24
   09:17:00         72.31        0.56    75240.0       4.88     -0.25
   11:48:00         72.31        0.56    84300.0       4.93     -0.25
   13:25:00         72.30        0.55    90120.0       4.95     -0.26
   14:45:00         72.30        0.55    94920.0       4.98     -0.26
```

SUMMARY REPORT
GEOSYNTEC RISING HEAD PERMEABILITY TESTS
MESQUITE CREEK LANDFILL

Overview

In order to evaluate the hydraulic parameters of the groundwater bearing unit at the site GeoSyntec performed 8 rising head permeability tests (slug out tests) in GB-01, GB-03, GB-04, GB-11, GB-13, GB-15, GB-21 and GB-22. This select group of piezometers was chosen after evaluation of the piezometer development data for all 15 piezometers. The development data was evaluated to determine if there were large disparities in the recovery rate of groundwater levels in the piezometer after the piezometer was pumped at a low rates. The 8 piezometers were chosen to represent the low, median and high recovery piezometers, comparative to one another.

Slug Test Field Procedures

Prior to mobilizing to perform the tests, field data forms were generated and relevant data (i.e. depth to bottom of piezometer, piezometer radius, gravel pack size, etc.) was compiled for each individual piezometer to be tested.

The tests were performed by removing the polyvinyl chloride (PVC) water-tight locking cap of the piezometer to be tested and allowing the water levels to equilibrate to atmospheric conditions. The depth to water was measured from the top of the inner PVC casing. A 3-foot long 1.6 outer diameter bottom-loading bailer was placed in the piezometer. The water level was allowed to equilibrate to near static levels for up to 15 minutes. The bailer was removed, thus removing the "slug of water" and the electronic water level indicator was used to record water level changes on a periodic basis to monitor water level changes over time. The elapsed time and water level measurements were recorded on the field test form. A preliminary analysis of the data was performed in the field to determine when to terminate the test. At the end of the test the piezometer cap was replaced and the piezometer locked.

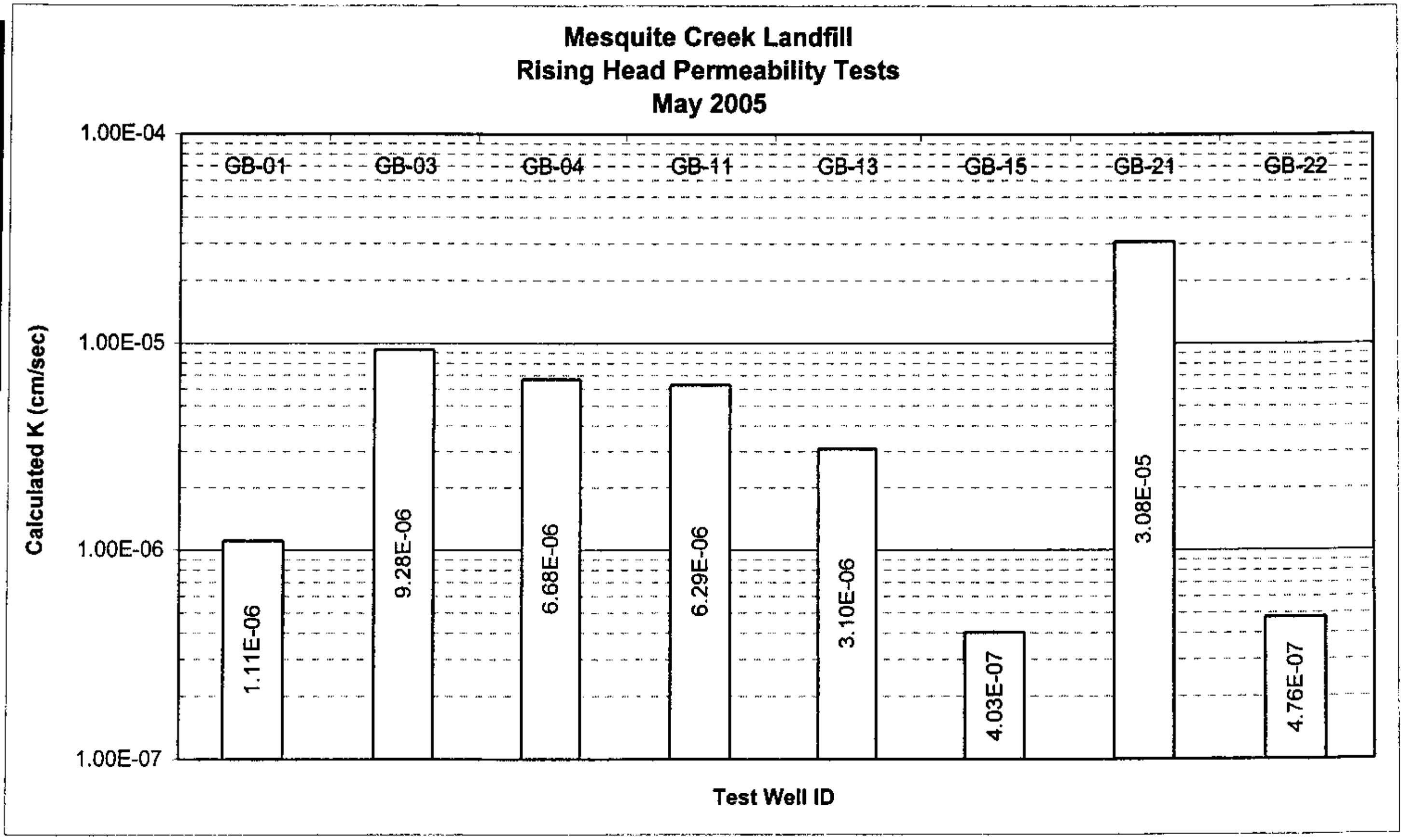
Data Analysis

The test data was analyzed using HydroSOLVE, Inc.'s Aqtesolv (version 3.5) data analysis program. The data was analyzed using the Bouwer & Rice (1976) for an unconfined aquifer. The test data was matched to the Bouwer and Rice type curve taking into account the need to not analyze the early gravel pack influenced data. The analysis curves and test data are presented in the following pages.

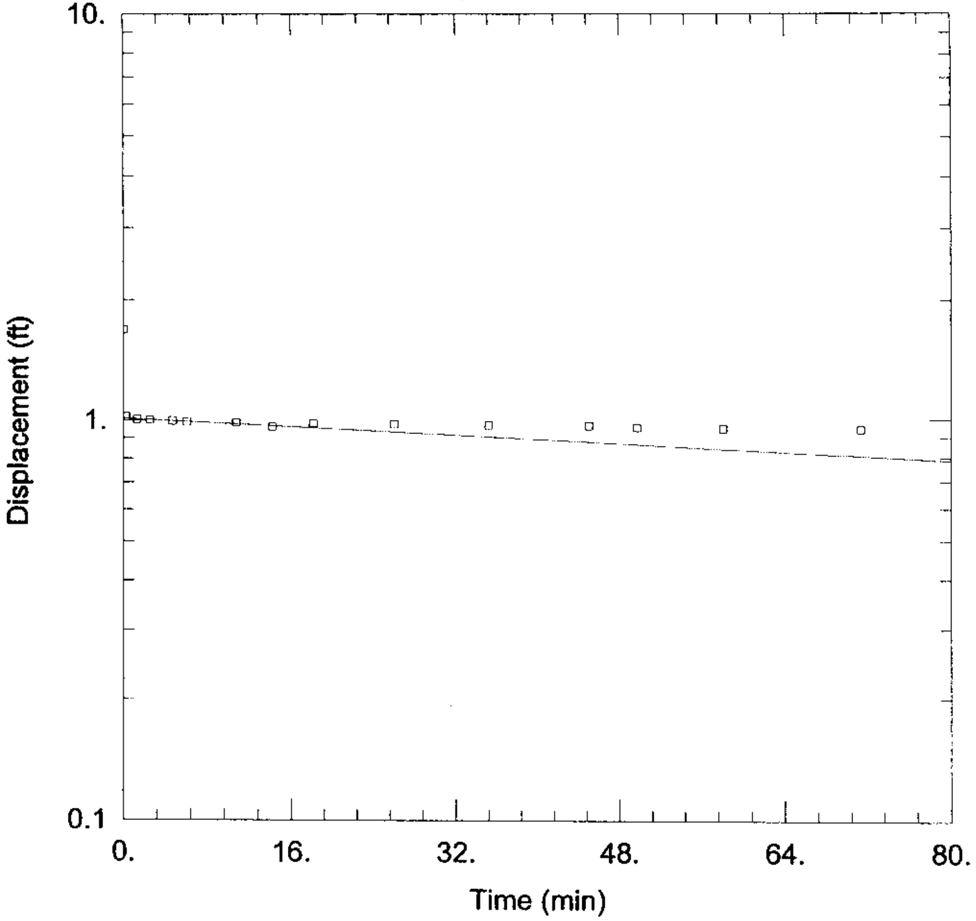
Bouwer, H., 1989. The Bouwer and Rice slug test--an update, Ground Water, vol. 27, no. 3, pp. 304-309.

Bouwer, H. and R.C. Rice, 1976. A slug test method for determining hydraulic conductivity of unconfined aquifers with completely or partially penetrating wells, Water Resources Research, vol. 12, no. 3, pp. 423-428.

Well ID	Calculated K value (ft/min)	Calculated K value (cm/sec)
GB-01	2.19E-06	1.11E-06
GB-03	1.83E-05	9.28E-06
GB-04	1.32E-05	6.68E-06
GB-11	1.24E-05	6.29E-06
GB-13	6.10E-06	3.10E-06
GB-15	7.93E-07	4.03E-07
GB-21	6.06E-05	3.08E-05
GB-22	9.38E-07	4.76E-07
Geometric Mean	6.048E-06	3.072E-06



GB-01



WELL TEST ANALYSIS

Data Set: P:\GeoSyntec\0_PROJECTS\Comal County Landfill\Slug Test\GB-01.aqt
Date: 10/10/05 Time: 10:58:40

PROJECT INFORMATION

Company: GeoSyntec Consultants
Client: Waste Management
Project: GT3435
Location: Comal County Landfill Exp.
Test Well: GB-01
Test Date: 6/8/05

AQUIFER DATA

Saturated Thickness: 20. ft
Anisotropy Ratio (Kz/Kr): 1.

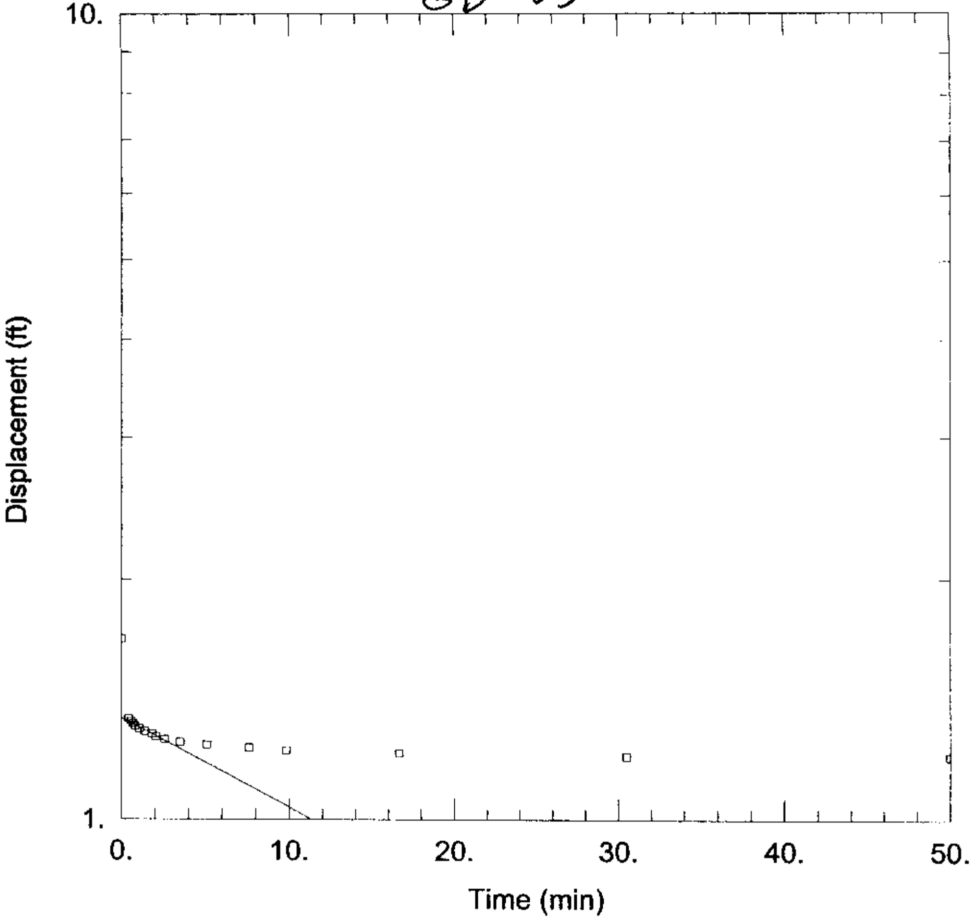
WELL DATA (GB-01)

Initial Displacement: 1.69 ft
Total Well Penetration Depth: 10. ft
Casing Radius: 0.083 ft
Static Water Column Height: 20. ft
Screen Length: 10. ft
Wellbore Radius: 0.42 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 1.112E-6 cm/sec
y0 = 1.01 ft

GB-03



WELL TEST ANALYSIS

Data Set: P:\GeoSyntec\0_PROJECTS\Comal County Landfill\Slug Test\GB-03.aqt
Date: 10/10/05 Time: 10:58:09

PROJECT INFORMATION

Company: GeoSyntec Consultants
Client: Waste Management
Project: GT3435
Location: Comal County Landfill Exp.
Test Well: GB-03
Test Date: 6/8/05

AQUIFER DATA

Saturated Thickness: 20. ft
Anisotropy Ratio (Kz/Kr): 1.

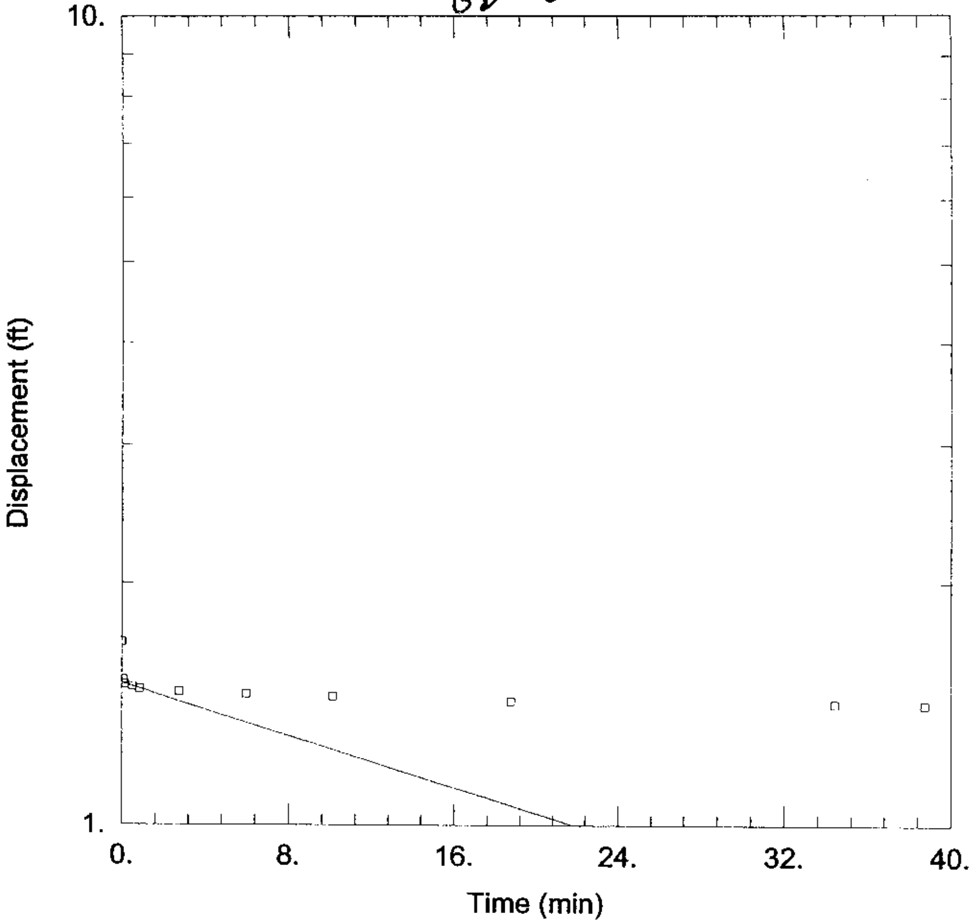
WELL DATA (GB-03)

Initial Displacement: 1.69 ft
Total Well Penetration Depth: 10. ft
Casing Radius: 0.083 ft
Static Water Column Height: 20. ft
Screen Length: 10. ft
Wellbore Radius: 0.42 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 1.828E-5 ft/min
y0 = 1.343 ft

GB-04



WELL TEST ANALYSIS

Data Set: P:\GeoSyntec\0_PROJECTS\Comal County Landfill\Slug Test\GB-04.aqt
Date: 10/10/05 Time: 10:57:34

PROJECT INFORMATION

Company: GeoSyntec Consultants
Client: Waste Management
Project: GT3435
Location: Comal County Landfill Exp.
Test Well: GB-04
Test Date: 6/8/05

AQUIFER DATA

Saturated Thickness: 20. ft
Anisotropy Ratio (Kz/Kr): 1.

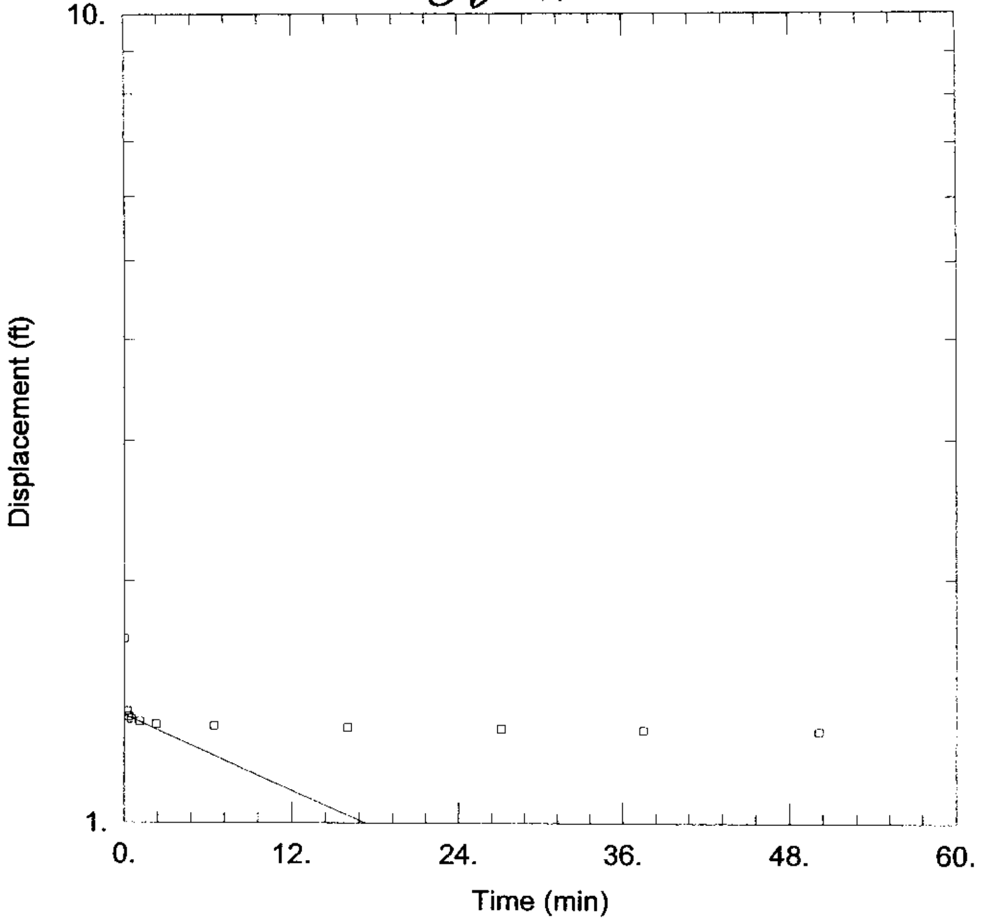
WELL DATA (GB-04)

Initial Displacement: 1.69 ft
Total Well Penetration Depth: 10. ft
Casing Radius: 0.083 ft
Static Water Column Height: 20. ft
Screen Length: 10. ft
Wellbore Radius: 0.42 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 1.316E-5 ft/min
y0 = 1.504 ft

GB-11



WELL TEST ANALYSIS

Data Set: P:\GeoSyntec\0_PROJECTS\Comal County Landfill\Slug Test\GB-11.aqt
Date: 10/10/05 Time: 10:55:26

PROJECT INFORMATION

Company: GeoSyntec Consultants
Client: Waste Management
Project: GT3435
Location: Comal County Landfill Exp.
Test Well: GB-11
Test Date: 6/8/05

AQUIFER DATA

Saturated Thickness: 20. ft
Anisotropy Ratio (Kz/Kr): 1.

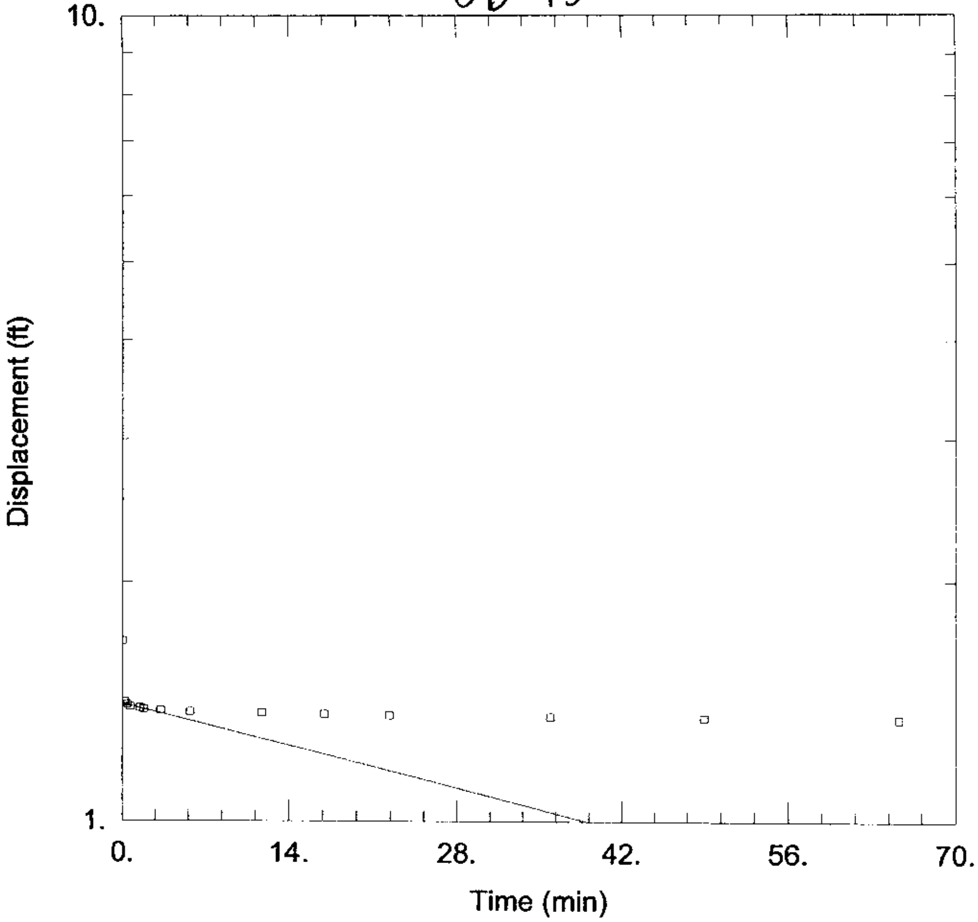
WELL DATA (GB-11)

Initial Displacement: 1.69 ft
Total Well Penetration Depth: 10. ft
Casing Radius: 0.083 ft
Static Water Column Height: 20. ft
Screen Length: 10. ft
Wellbore Radius: 0.42 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 1.24E-5 ft/min
y0 = 1.355 ft

GB-13



WELL TEST ANALYSIS

Data Set: P:\GeoSyntec\0_PROJECTS\Comal County Landfill\Slug Test\GB-13.aqt
Date: 10/10/05 Time: 10:56:59

PROJECT INFORMATION

Company: GeoSyntec Consultants
Client: Waste Management
Project: GT3435
Location: Comal County Landfill Exp.
Test Well: GB-13
Test Date: 6/8/05

AQUIFER DATA

Saturated Thickness: 20. ft
Anisotropy Ratio (Kz/Kr): 1.

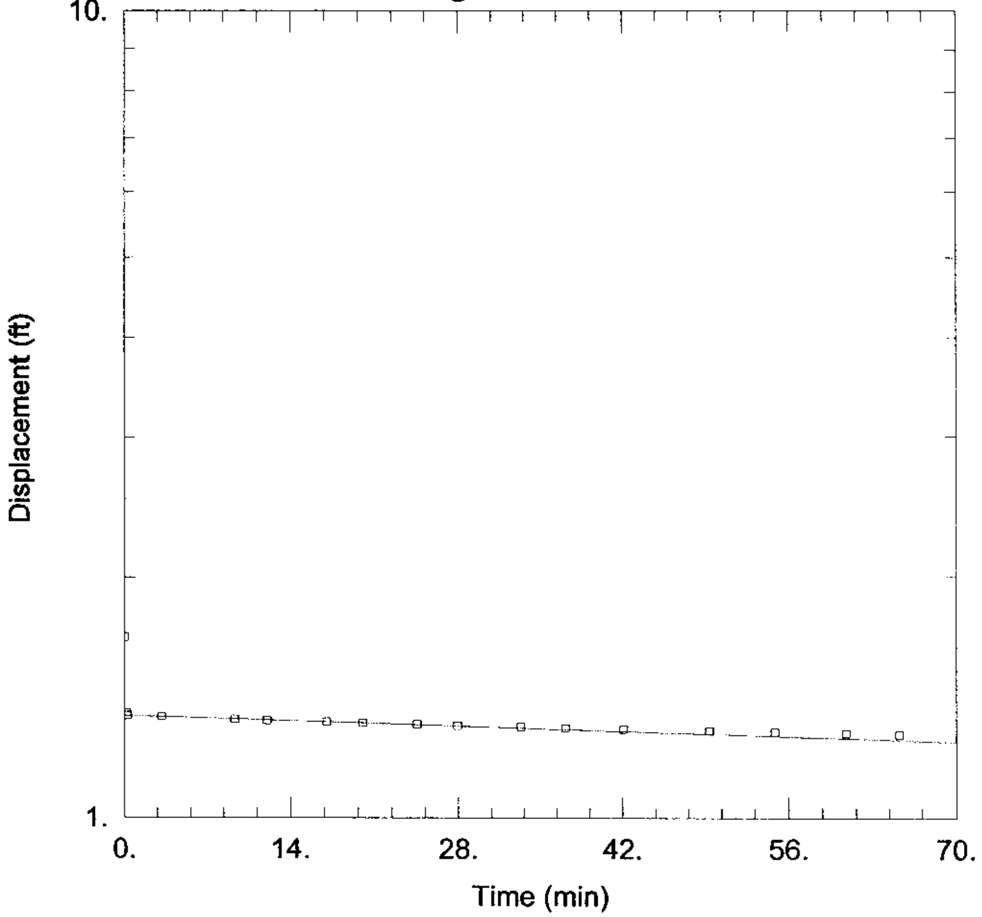
WELL DATA (GB-13)

Initial Displacement: 1.69 ft
Total Well Penetration Depth: 10. ft
Casing Radius: 0.083 ft
Static Water Column Height: 20. ft
Screen Length: 10. ft
Wellbore Radius: 0.42 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 6.096E-6 ft/min
y0 = 1.402 ft

GB-15



WELL TEST ANALYSIS

Data Set: P:\GeoSyntec\0_PROJECTS\Comal County Landfill\Slug Test\GB-15.aqt
Date: 10/10/05 Time: 10:56:15

PROJECT INFORMATION

Company: GeoSyntec Consultants
Client: Waste Management
Project: GT3435
Location: Comal County Landfill Exp.
Test Well: GB-15
Test Date: 6/8/05

AQUIFER DATA

Saturated Thickness: 20. ft
Anisotropy Ratio (Kz/Kr): 1.

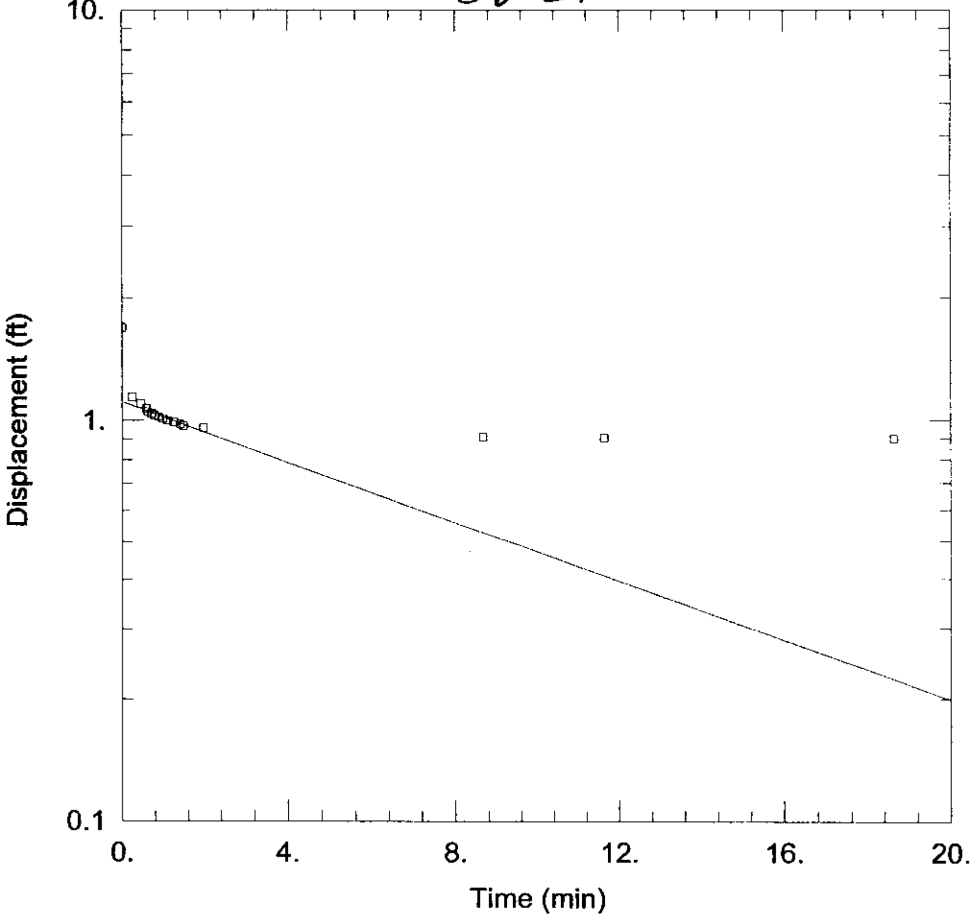
WELL DATA (GB-15)

Initial Displacement: 1.69 ft
Total Well Penetration Depth: 10. ft
Casing Radius: 0.083 ft
Static Water Column Height: 20. ft
Screen Length: 10. ft
Wellbore Radius: 0.42 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 7.928E-7 ft/min
y0 = 1.35 ft

GB-21



WELL TEST ANALYSIS

Data Set: P:\GeoSyntec\0_PROJECTS\Comal County Landfill\Slug Test\GB-21.aqt
Date: 10/10/05 Time: 10:45:30

PROJECT INFORMATION

Company: GeoSyntec Consultants
Client: Waste Management
Project: GT3435
Location: Comal County Landfill Exp.
Test Well: GB-21
Test Date: 6/8/05

AQUIFER DATA

Saturated Thickness: 20. ft
Anisotropy Ratio (Kz/Kr): 1.

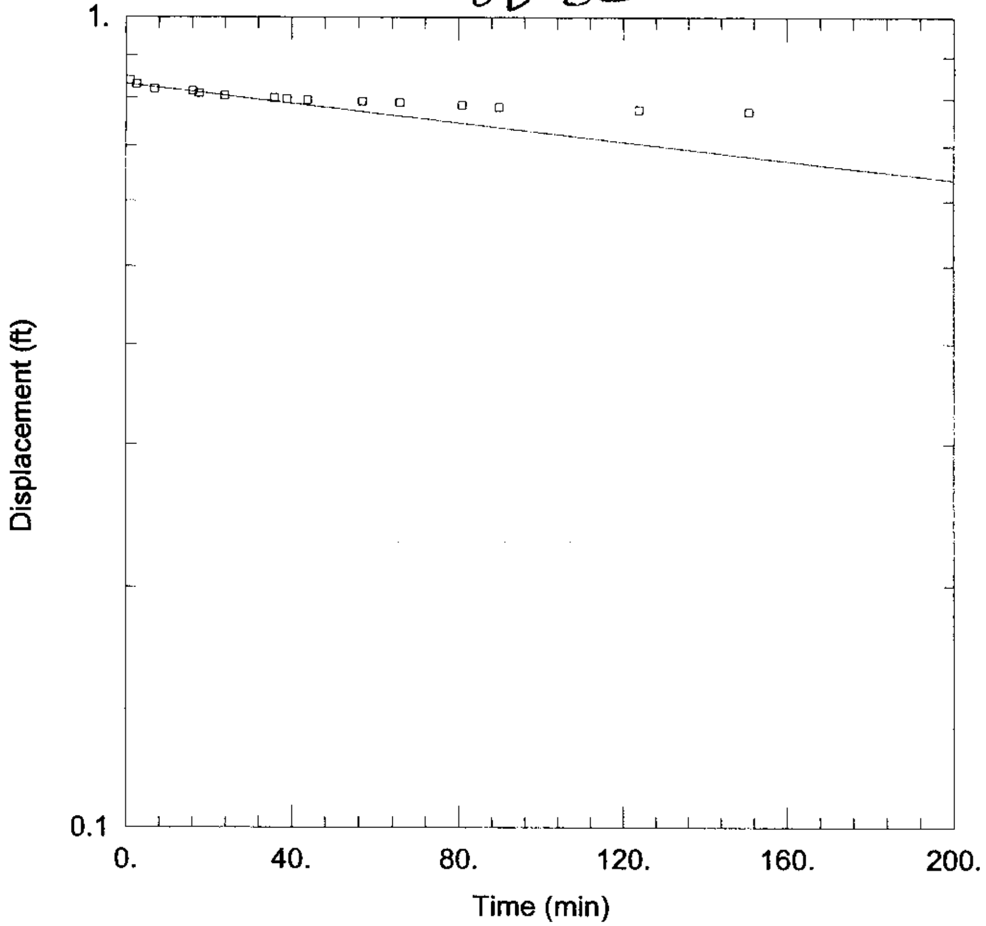
WELL DATA (GB-21)

Initial Displacement: 1.69 ft
Total Well Penetration Depth: 10. ft
Casing Radius: 0.083 ft
Static Water Column Height: 20. ft
Screen Length: 10. ft
Wellbore Radius: 0.42 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 6.055E-5 ft/min
y0 = 1.111 ft

GB-22



WELL TEST ANALYSIS

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Date: 10/10/05 Time: 10:54:34

PROJECT INFORMATION

Company: GeoSyntec Consultants
Client: Waste Management
Project: GT3435
Location: Comal County Landfill Exp.
Test Well: GB-22
Test Date: 6/8/05

AQUIFER DATA

Saturated Thickness: 20. ft
Anisotropy Ratio (Kz/Kr): 1.

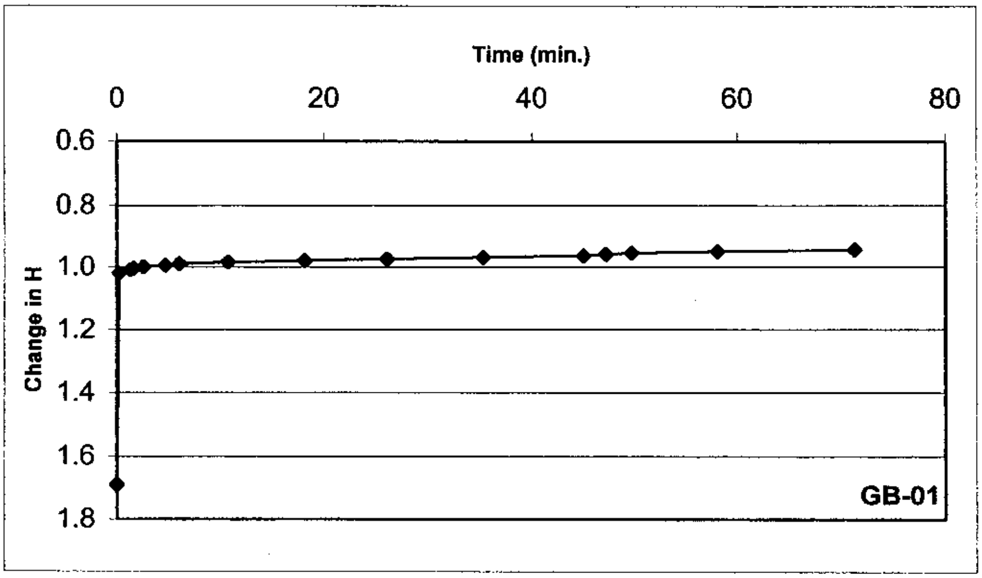
WELL DATA (GB-22)

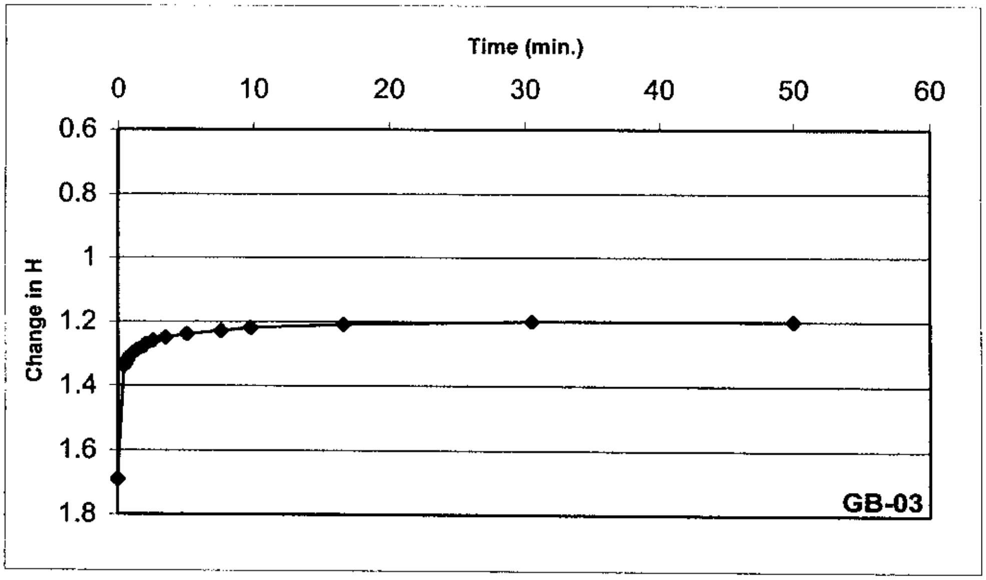
Initial Displacement: 1.69 ft
Total Well Penetration Depth: 10. ft
Casing Radius: 0.083 ft
Static Water Column Height: 20. ft
Screen Length: 10. ft
Wellbore Radius: 0.42 ft

SOLUTION

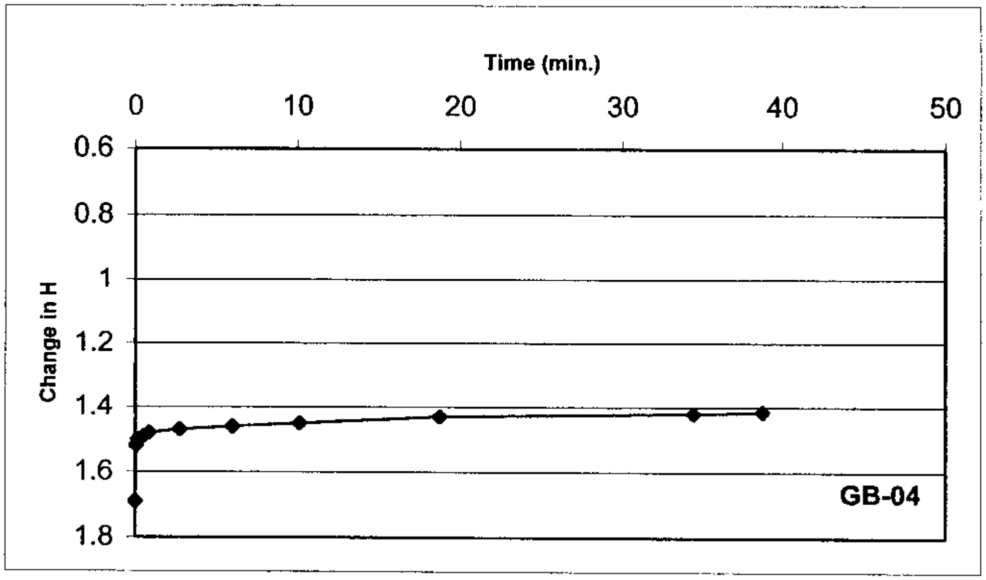
Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 9.376E-7 ft/min
y0 = 0.8306 ft

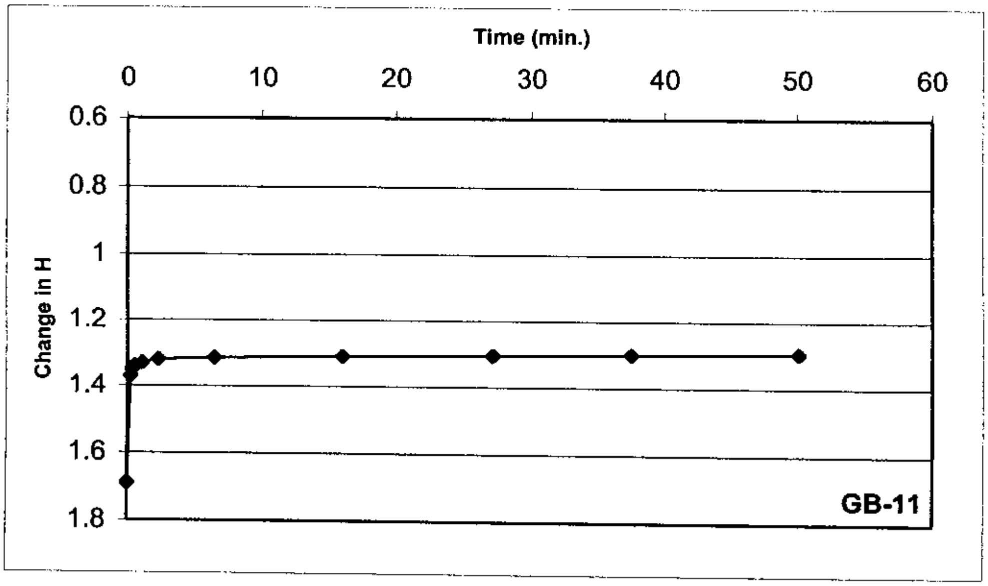
MESQUITE CREEK LANDFILL
RISING HEAD PERMEABILITY TESTS
MAY 2005, GEOSYNTEC CONSULTANTS



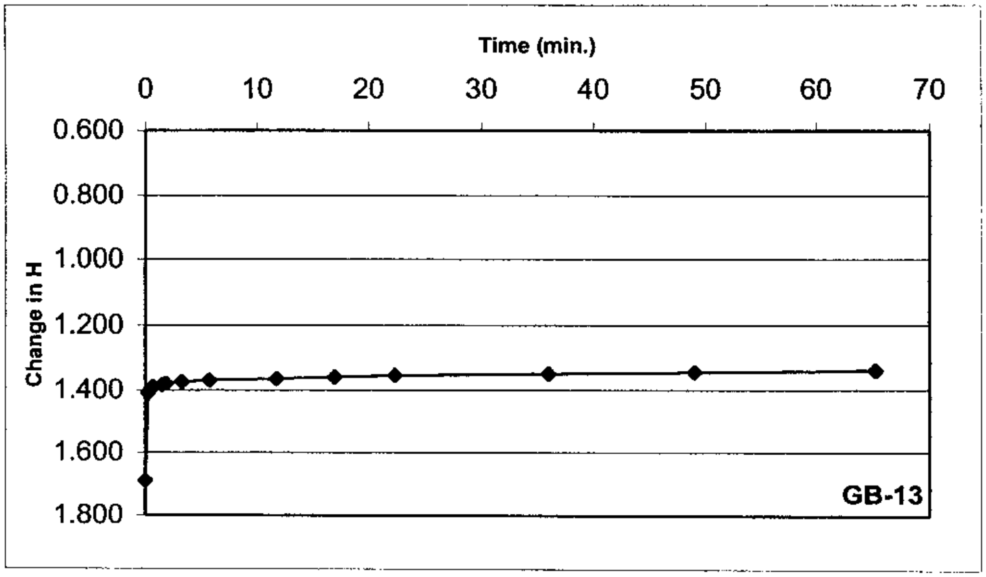


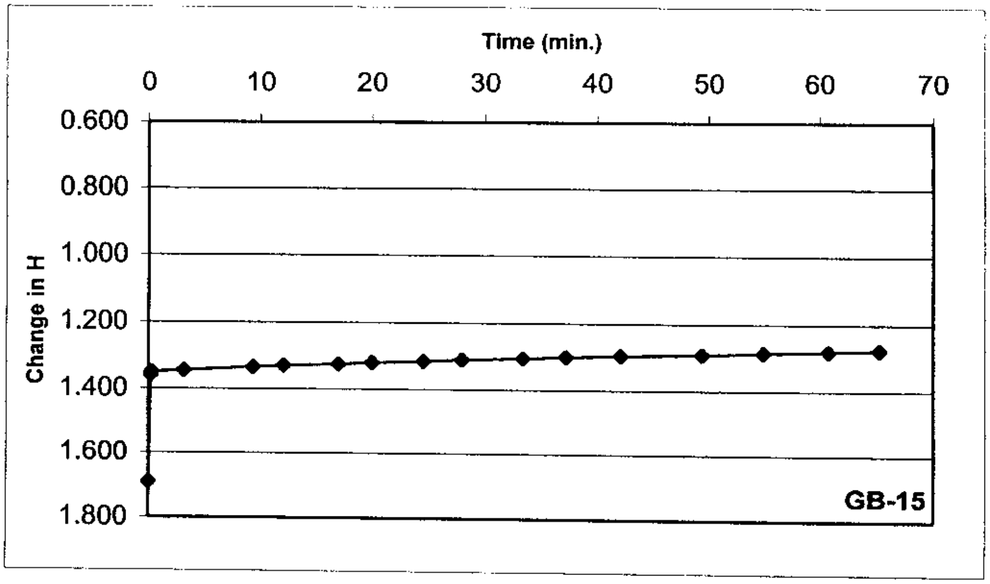
MESQUITE CREEK LANDFILL
RISING HEAD PERMEABILITY TESTS
MAY 2005, GEOSYNTEC CONSULTANTS



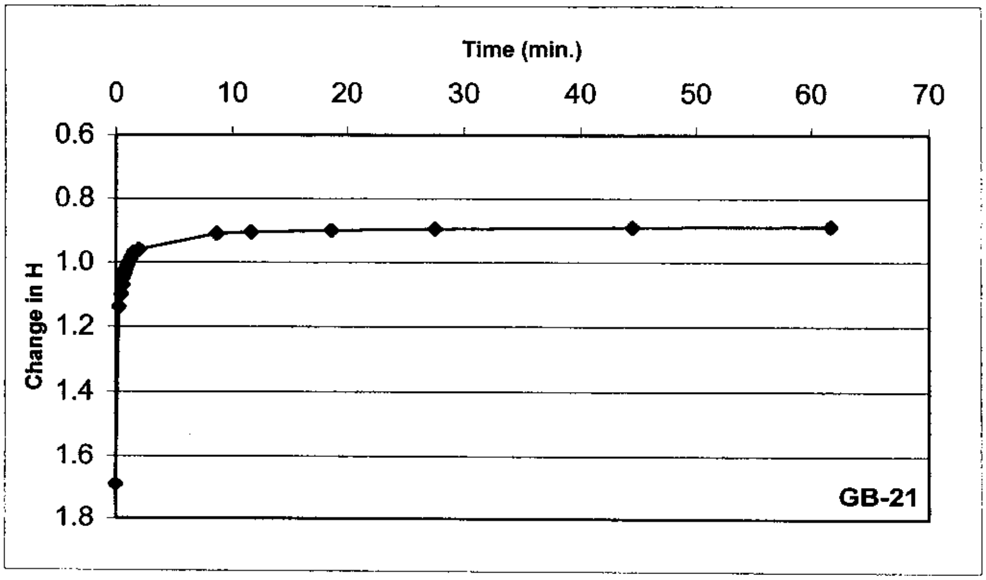


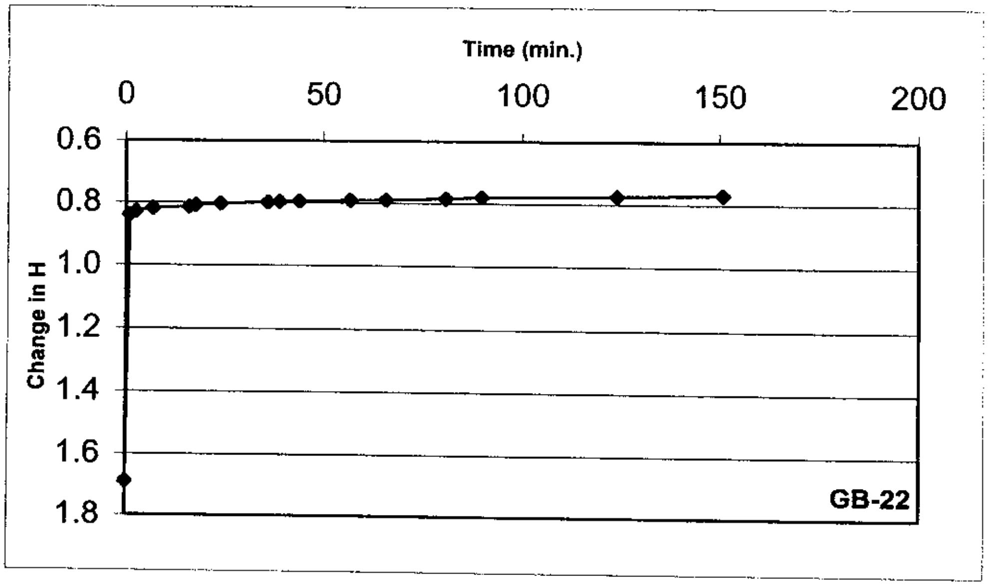
MESQUITE CREEK LANDFILL
RISING HEAD PERMEABILITY TESTS
MAY 2005, GEOSYNTEC CONSULTANTS





MESQUITE CREEK LANDFILL
RISING HEAD PERMEABILITY TESTS
MAY 2005, GEOSYNTEC CONSULTANTS





MESQUITE CREEK LANDFILL
RISING HEAD PERMEABILITY TESTS
MAY 2005, GEOSYNTEC CONSULTANTS

			Time	Water Level	DH
Boring #	GB-01				
Static Water Level	11.96				
			0.000		1.690
	0	14	0.233	12.980	1.020
	1	18	1.300	12.970	1.010
	1	36	1.600	12.965	1.005
	2	32	2.533	12.960	1.000
	4	41	4.683	12.955	0.995
	6	2	6.033	12.950	0.990
	10	43	10.717	12.945	0.985
	18	8	18.133	12.940	0.980
	26	0	26.000	12.935	0.975
	35	12	35.200	12.930	0.970
	45	0	45.000	12.925	0.965
	47	10	47.167	12.920	0.960
	49	40	49.667	12.915	0.955
	58	4	58.067	12.910	0.950
	71	19	71.317	12.905	0.945

		Time	WL	DH
GB-03				
9.36 (9.14)				
		0.000		1.69
0	26	0.433	10.700	1.340
0	36	0.600	10.690	1.330
0	43	0.717	10.680	1.320
0	50	0.833	10.670	1.310
1	5	1.083	10.660	1.300
1	24	1.400	10.650	1.290
1	51	1.850	10.640	1.280
2	3	2.050	10.630	1.270
2	36	2.600	10.620	1.260
3	31	3.517	10.610	1.250
5	7	5.117	10.600	1.240
7	37	7.617	10.590	1.230
9	48	9.800	10.580	1.220
16	39	16.650	10.570	1.210
30	30	30.500	10.560	1.200
50	0	50.000	10.560	1.200

			Time	WL	DH
Boring #	GB-04				
Static Water Level	12.08				
			0.000		1.69
	0	4	0.067	13.600	1.520
	0	8	0.133	13.580	1.500
	0	30	0.500	13.570	1.490
	0	51	0.850	13.560	1.480
	2	45	2.750	13.550	1.470
	5	59	5.983	13.540	1.460
	10	7	10.117	13.530	1.450
	18	45	18.750	13.510	1.430
	34	25	34.417	13.500	1.420
	38	45	38.750	13.495	1.415

		Time	WL	DH
GB-11				
18.42				
		0.000		1.69
0	13	0.217	19.790	1.370
0	20	0.333	19.770	1.350
0	30	0.500	19.760	1.340
1	6	1.100	19.750	1.330
2	18	2.300	19.740	1.320
6	28	6.467	19.735	1.315
16	0	16.000	19.730	1.310
27	8	27.133	19.725	1.305
37	30	37.500	19.720	1.300
50	8	50.133	19.715	1.295

MESQUITE CREEK LANDFILL
RISING HEAD PERMEABILITY TESTS
MAY 2005, GEOSYNTEC CONSULTANTS

			Time	WL	DH
Boring #	GB-13				
Static Water Level	18.24				
			0.000		1.690
	0	14	0.233	19.650	1.410
	0	25	0.417	19.640	1.400
	0	39	0.650	19.630	1.390
	1	30	1.500	19.625	1.385
	1	48	1.800	19.620	1.380
	3	15	3.250	19.615	1.375
	5	44	5.733	19.610	1.370
	11	44	11.733	19.605	1.365
	16	56	16.933	19.600	1.360
	22	19	22.317	19.595	1.355
	35	56	35.933	19.590	1.350
	49	0	49.000	19.585	1.345
	65	14	65.233	19.580	1.340

		Time	WL	DH
GB-15				
8.01				
		0.000		1.690
0	12	0.200	9.370	1.360
0	16	0.267	9.360	1.350
3	9	3.150	9.355	1.345
9	20	9.333	9.345	1.335
12	4	12.067	9.340	1.330
17	0	17.000	9.335	1.325
19	59	19.983	9.330	1.320
24	32	24.533	9.325	1.315
27	57	27.950	9.320	1.310
33	20	33.333	9.315	1.305
37	10	37.167	9.310	1.300
42	5	42.083	9.305	1.295
49	23	49.383	9.300	1.290
54	53	54.883	9.295	1.285
60	47	60.783	9.290	1.280
65	15	65.250	9.285	1.275
73	11	73.183		

			Time	WL	DH
Boring #	GB-21				
Static Water Level	62.2				
			0.000		1.690
	0	15	0.250	63.340	1.140
	0	27	0.450	63.300	1.100
	0	35	0.583	63.270	1.070
	0	37	0.617	63.250	1.050
	0	43	0.717	63.240	1.040
	0	47	0.783	63.230	1.030
	0	53	0.883	63.220	1.020
	0	59	0.983	63.210	1.010
	1	6	1.100	63.200	1.000
	1	15	1.250	63.190	0.990
	1	24	1.400	63.180	0.980
	1	29	1.483	63.170	0.970
	1	58	1.967	63.160	0.960
	8	40	8.667	63.110	0.910
	11	38	11.633	63.105	0.905
	18	38	18.633	63.100	0.900
	27	33	27.550	63.095	0.895
	44	29	44.483	63.090	0.890
	61	38	61.633	63.088	0.888

		Time	WL	DH
GB-22				
38.06				
		0.000		1.6900
0	54	0.900	38.9000	0.8400
2	26	2.433	38.8900	0.8300
6	46	6.767	38.8800	0.8200
16	0	16.000	38.8750	0.8150
17	33	17.550	38.8700	0.8100
23	45	23.750	38.8650	0.8050
35	47	35.783	38.8600	0.8000
38	47	38.783	38.8575	0.7975
43	47	43.783	38.8550	0.7950
56	47	56.783	38.8525	0.7925
65	47	65.783	38.8500	0.7900
80	47	80.783	38.8450	0.7850
89	47	89.783	38.8400	0.7800
123	47	123.783	38.8350	0.7750
150	47	150.783	38.8300	0.7700

ATTACHMENT 5

GROUNDWATER MONITORING PLAN

PART III – ATTACHMENT 5
GROUNDWATER MONITORING PLAN

MESQUITE CREEK LANDFILL
COMAL AND GUADALUPE COUNTIES, TEXAS
PERMIT AMENDMENT APPLICATION
MSW PERMIT NO. 66C

Prepared for:
Waste Management of Texas, Inc.

Prepared by:
Geosyntec
consultants
Texas Board of Professional Geoscientists Firm Registration No. 50256
8217 Shoal Creek Blvd, Suite 200
Austin, Texas 78757
(512) 451-4003

MATTHEW WISSLER
GEOLOGY
13242

10/10/2023

October 2023

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GEOSYNTEC CONSULTANTS, INC.
TEXAS GEOSCIENCE FIRM REGISTRATION #50256

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ATTACHMENTS

STATE OF TEXAS
MATTHEW WISSLER
GEOLOGY
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LICENSED
PROFESSIONAL GEOSCIENTIST

10/10/2023

GEOSYNTEC CONSULTANTS, INC.
TEXAS GEOSCIENCE FIRM REGISTRATION #50256

CERTIFICATION STATEMENT

GROUNDWATER MONITORING SYSTEM DESIGN
MSW Permit No. 66C

I, Matthew Wissler, am a licensed professional geoscientist in the State of Texas and a qualified groundwater scientist as defined in 30 TAC §330.3(125). I have reviewed the groundwater monitoring system and supporting data contained herein. In my professional opinion, the groundwater monitoring system is designed to be in compliance with the applicable groundwater monitoring requirements for Type I landfills specified in 30 TAC §330.401 through §330.421. This system has been designed for specific application to the Mesquite Creek Landfill under MSW Permit No. 66C. 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.

Geosyntec Consultants, Inc.
8217 Shoal Creek Boulevard Suite 200
Austin, Texas 78757

Matthew Wissler, PG
P.G. Texas No. 13242

10/10/2023
Date

MATTHEW WISSLER
GEOLOGY
13242

10/10/2023

FOR PERMIT PURPOSES

Geosyntec Consultants, Inc.
Texas Board of Professional
Geoscientists Firm Registration No.
50256

1. INTRODUCTION

1.1 Scope

Pursuant to 30 TAC Chapter 330, Subchapter J, this Groundwater Monitoring Plan (plan) was prepared for the Mesquite Creek Landfill (the “Site”) in conjunction with municipal solid waste (MSW) permit amendment application No. 66C, which proposes to laterally expand the existing landfill. The facility is an existing, active Type I MSW disposal facility (landfill) located in Comal and Guadalupe Counties, Texas, approximately 5 miles northeast of the central business district of the City of New Braunfels. This plan has been prepared by a qualified professional geoscientist (P.G.) who is a qualified groundwater scientist. This plan presents the information required by 30 TAC §330.63(f) pertaining to the proposed groundwater monitoring program; and the associated Groundwater Sampling and Analysis Plan (GWSAP) is included as a stand-alone document included with this plan as “Attachment 5C”.

The facility is operating under an existing groundwater monitoring system that has been approved by the Texas Commission on Environmental Quality (TCEQ). Changes to the groundwater monitoring program are proposed and this plan has been prepared to demonstrate that the modified groundwater monitoring system complies with the requirements of 30 TAC §330.403, as well as to address the other applicable requirements of 30 TAC Chapter 330, Subchapter J for Type I landfills.

1.2 Report Organization

This plan was developed based on relevant geologic and hydrogeologic information presented in the facility’s Geology Report (Part III, Attachment 4); recent annual groundwater monitoring reports prepared by various consultants; and information from various published technical literature and documents as referenced hererin. It also is based on the information obtained by Geosyntec during a site subsurface investigation conducted for this project in 2022-2023 pursuant to the September 2022 Soil Boring Plan (approved by TCEQ on 4 October 2022). This plan includes a narrative description of the hydrogeology in the vicinity of the Site, the existing and proposed groundwater monitoring systems, and groundwater quality; and is accompanied by groundwater monitoring system drawings, monitoring well construction logs, and a GWSAP. The attachments are organized as follows:

- Attachment 5A, *Groundwater Monitoring System Drawings*, illustrates the location of the landfill and the proposed groundwater monitoring well network including the point of compliance (Drawings 5A-1A and 1B); and provides a typical detail for a groundwater monitoring well (Drawing 5A-2);

- Attachment 5B, *Monitoring Well Construction Logs*, presents as-built logs providing details for each of the existing groundwater monitoring wells; and
- Attachment 5C, *Groundwater Sampling and Analysis Plan (GWSAP)*, is provided pursuant to 30 TAC §330.63(f), addressing the applicable groundwater sampling and analysis requirements of 30 TAC §330.405, describing the detection monitoring program pursuant to 30 TAC §330.407, and providing related information on constituents for detection monitoring, assessment monitoring, and corrective action, per 30 TAC Chapter 330, Subchapter J.

Consistent with this program, an updated groundwater monitoring system has been designed for the facility to incorporate both existing and expansion landfill areas, and in accordance with the requirements of 30 TAC Chapter 330, Subchapter J for Type I landfills, based on site-specific technical information including the identification of the uppermost aquifer and the lower confining unit beneath the uppermost aquifer that also includes a thorough characterization of the aquifer thickness and groundwater flow rate and direction (including the possibility of seasonal and temporal effects on the groundwater flow direction and rate). The design also considered the thickness, stratigraphy, lithology, and hydraulic characteristics of the geologic units above the groundwater, the materials of the uppermost aquifer, and the materials and characteristics of the lower confining unit beneath the uppermost aquifer.

2. SITE HYDROGEOLOGY

2.1 Overview of Site Stratigraphy

Site stratigraphy is discussed in detail in Section 5.2 of Attachment 4 (Geology Report). In summary, the subsurface conditions beneath the site are divided into four strata (i.e., "layers"), as follows:

- Stratum I: Surficial fine-grained Quaternary weathered soil deposits, generally dry, brown to dark gray medium to high-plasticity clay, stiff to hard in consistency (with occasional thin gravelly clay zones).
- Stratum II: Quaternary-Tertiary alluvium (possibly equivalent to Uvalde Gravel), generally clayey gravel to gravelly clay, dry, white or gray limestone gravel and/or chert gravel within a dark brown clay matrix, commonly cemented by caliche, and firm in consistency.
- Stratum III: Weathered Lower Taylor Group, brownish yellow/yellow to light gray weathered and oxidized calcareous clay with thin bedding planes, very stiff to hard in consistency.
- Stratum IV: Unweathered Lower Taylor Group, dry, calcareous green-gray to dark gray unweathered/unoxidized claystone, very hard in consistency.

Landfill development at the existing Unit 1 and Unit 2 landfill areas of the Site has completely removed Strata I and II (at areas where they were naturally present prior to landfill development) within the landfill footprint. The base of the landfill is keyed-in to (i.e., founded within) Stratum III in a large majority of the landfill areas, with the few exceptions being localized instances where the base grades encountered and are founded on the upper portion of the Stratum IV claystone.

In the lateral expansion area of Unit 2, Strata I and II (where present) will also be completely removed from within the waste disposal footprint. The expansion area base (floor) liner system will be founded almost entirely on weathered clays of Stratum III, with only small interior areas of the cell floors being keyed slightly within the interpreted upper portion of the Stratum IV claystone.

2.2 Groundwater Occurrence and Uppermost Aquifer

Groundwater occurrence, site hydrogeology, and flow regimes are discussed in detail in Section 7 of Attachment 4 (Geology Report). A summary is provided below.

Stratum I and II – Unsaturated Zone

As described above, Stratum I and II (recent fine-grained weathered soil deposits and alluvium possibly equivalent to Uvalde Gravel) are first encountered at the ground surface and are described as a dark gray to brown medium to high plasticity clay, and a clayey gravel to a gravelly clay, respectively. No groundwater has been encountered in Strata I or II during previous site subsurface investigations, and the materials in these strata were consistently reported as dry to moist (unsaturated). During construction of existing landfill cells, occasional small pockets of seepage were sometimes observed on excavation sideslopes at Stratum II, but only in isolated instances (not in an interconnected, recurring, or widespread manner). There was no evidence of a continuous or connected zone of saturation or perched water table, and from a hydrogeologic perspective, these strata are part of the unsaturated zone. Because the permeability of Strata I and II tends to be generally similar to Stratum III, these strata do not serve as upper confining units (i.e., Stratum III described below is unconfined, and may receive recharge from water percolating downward from the surface through Strata I and/or II).

Stratum III – Uppermost Aquifer

As described above, Stratum III consists of weathered and oxidized clay of the Lower Taylor Group. Consistent with previous investigations by Geosyntec and others, the recent data collected during the site investigation of the expansion area have confirmed that Stratum III is the uppermost water-bearing zone where groundwater is first encountered beneath the Site (i.e., uppermost aquifer for groundwater monitoring purposes). The lower part of Stratum III exhibits a greater occurrence of secondary features (e.g., higher density of fractures, seams, and fissures), allowing it to contain and transmit groundwater. Furthermore, piezometers and monitoring wells screened at the base of Stratum III generally contain sufficient quantities of groundwater for gauging and/or sampling and analysis purposes – i.e., the presence of groundwater has been observed and measured over time. Groundwater occurs as unconfined conditions at the lower part of Stratum III, where it is perched above the lower confining unit (aquiclude) of the thick, massive, less-fractured, and very low permeability Stratum IV unweathered claystone.

The presence of groundwater and capacity for water movement within Stratum III is likely dependent on secondary features, notably degree of cementation, fracture density, interconnection (or lack thereof), orientation, and the extent that the fractures have been filled by secondary mineralization. Slug tests in Stratum III show a comparatively higher average in-situ hydraulic conductivity (1.5×10^{-6} cm/s) relative to the underlying aquiclude. This field permeability of Stratum III is about two orders of magnitude (i.e., 100x) greater than the measured vertical hydraulic conductivity of underlying Stratum IV. Stratum III also has about 2x greater field permeability than that of Stratum IV (from the limited number of slug tests performed in Stratum IV). These differences in hydraulic conductivity help explain the observed flow regime, with groundwater in Stratum III accumulating in a perched manner above the lower confining unit, and preferentially flowing laterally due to the higher relative permeability in Stratum III, following the slopes and orientation of the confining unit surface (which also generally mimics the patterns of surface topography, albeit in a subdued manner).

Stratum IV – Aquiclude (Lower Confining Unit for Stratum III)

As discussed, the oxidized clays of Stratum III are underlain by Stratum IV, which is composed of unweathered, primarily unoxidized, minimally fractured (and decreasing fracture density with depth), continuous, tight claystone, dry/unsaturated, and with low hydraulic conductivity. The full thickness of Stratum IV was not determined at this site because the drilling depths terminated above the bottom of the geologic unit. However, regional geology presented in Attachment 4 suggests that the thickness of this stratum exceeds 290 feet (ft). Stratum IV acts as an aquiclude that confines groundwater above it and prevents hydraulic interconnection with deeper aquifers.

Deeper beneath the Site, the top of the Edwards Aquifer formations are approximately 500 to 600 ft below ground surface (ft bgs). Here, the upper Glen Rose Formation and Del Rio Formation serve as lower and upper confining layers to the Edwards Aquifer, respectively. As described by Maclay and Small (1986), the upper Glen Rose Formation generally has little vertical permeability and is a confining bed, with vertical movement restricted by marls with negligible permeability. The Del Rio Formation also has little permeability as it is composed of clay and includes beds of thin, nearly impermeable limestone in the lower portion of the unit. Furthermore, the formations above the Glen Rose at the Site include overlying low-permeability and non-water-bearing strata (including but not limited to the clays/claystones of the Taylor Group). As such, the Edwards Acquifer is confined above and below, and not hydraulically connected to any shallow groundwater or aquifer (or deeper aquifer) beneath the Site.

2.3 Groundwater Flow Rate

Horizontal groundwater flow (i.e., seepage) velocity is calculated using the following equation derived from Darcy's Law (Freeze and Cherry, 1979):

$$v_s = k * i / n_e$$

where: v_s = seepage velocity (cm/s);

k = hydraulic conductivity (cm/s);

i = hydraulic gradient (ft/ft); and

n_e = effective porosity (-).

The hydraulic gradient (feet/feet (ft/ft), which also can be expressed as percent (%)) is the difference in hydraulic head (feet) between a pair of wells selected for the computation, divided by the distance (feet) between the pair of wells selected for the computation. Using the hydraulic conductivity data and potentiometric maps in the Geology Report in Part III, Attachment 4, the groundwater flow gradients and seepage velocities in the uppermost aquifer (i.e., Stratum III) are presented below for several cases (in order to provide a range of representative conditions).

- The average hydraulic conductivity of Stratum III from slug tests taken at the Site is 1.5 x 10^{-6} cm/s. Examination of groundwater potentiometric maps presented in Attachment 4E reveals typical hydraulic gradients across the Site generally range from about 0.015 to 0.03 ft/ft. Effective porosity values for clay can range from 0.01 to 0.18 and average 0.06, as reported by McWhorter and Sunada (1977). An effective porosity of 0.05 (slightly below this reported average, but a typical value used in various investigations for the Site, and reasonable for such clays) is used in this calculation. Input of these hydraulic conductivity and effective porosity values into the equation above, and using a hydraulic gradient of 0.03 ft/ft (3%) [taken as the July 2023 groundwater map difference in groundwater levels at the existing Unit 2 area of about 72.6-ft between MW-11 and MW-21, located about 2,593-ft apart – and rounded up slightly from 0.028 ft/ft to 0.03 ft/ft], the average seepage velocity of groundwater in the water-bearing zone of Stratum III at the Site is approximately 9.0 x 10^{-7} cm/s (2.6 x 10^{-3} ft/d), or about 0.9 feet per year (ft/yr).
- Focusing on the existing Unit 1 area, using the December 2022 groundwater map provided in Attachment 4E, a typical recent average hydraulic gradient across the existing Unit 1 landfill area is about 0.015 ft/ft (1.5%) [taken as the difference in groundwater levels of about 37.3-ft between MW-01 and MW-07A, located about 2,458-ft apart]. As noted above, a hydraulic conductivity of 1.5 x 10^{-6} cm/s and a porosity of 0.05 were also selected. Input of these values into the equation above, the average seepage velocity of Stratum III groundwater at the existing Unit 1 landfill area is approximately 4.6 x 10^{-7} cm/s (1.3 x 10^{-3} ft/d), or about 0.5 ft/yr.
- Focusing on the proposed Unit 2 expansion area south-southeast of existing Unit 2, using a subset of data representative of the expansion area, Stratum III has a slightly higher average measured hydraulic conductivity of 4.6 x 10^{-6} cm/s from slug tests in that portion of the Site. Using the July 2023 groundwater map provided in Attachment 4E, a typical recent average hydraulic gradient across the Unit 2 expansion area is about 0.029 ft/ft (2.9%) [taken as the difference in groundwater levels of about 69.2-ft between GB-33(P) and GB-32(P), located about 2,394-ft apart]. Input of these values into the equation above and using a porosity of 0.05, the average seepage velocity of Stratum III groundwater at the Unit 2 expansion area is approximately 2.7 x 10^{-6} cm/s (7.5 x 10^{-3} ft/d), or about 2.8 ft/yr.

The groundwater flow patterns in the unconfined uppermost water-bearing zone of Stratum III generally mimic the slopes and orientation of the natural ground surface (i.e., generally consistent with natural surface topography, albeit in a subdued manner). The groundwater flow direction at Unit 1 is south-southeasterly (towards Mesquite Creek). The groundwater flow direction at existing areas of Unit 2 is primarily north-northwesterly (towards Mesquite Creek), with minor components of flow on the east side of existing Unit 2 being towards the northeast and east. The groundwater flow direction at the Unit 2 expansion area is primarily towards the east, and based on the flow regime described above it is possible there could be a component of flow towards the southeast (flowing away from the natural topographic (high) ridge located on the northwest edge of the expansion area).

3. PERMIT 66B GROUNDWATER MONITORING SYSTEM

The facility's current groundwater monitoring system network of monitoring wells and piezometers under MSW Permit No. 66B, as approved by TCEQ, is presented in the Groundwater Characterization Report (Geosyntec, 2006; last revised 2021) of the Site Development Plan for Permit No. 66B.

The uppermost water-bearing zone beneath the site (i.e., uppermost aquifer for groundwater monitoring purposes) is Stratum III. There, groundwater occurs under unconfined conditions, and tends to be present the lower part of Stratum III where it is perched above the lower confining unit (aquiclude) of the thick, massive, and very low permeability Stratum IV unweathered claystone. Under the currently-approved program, groundwater at the Site is monitored using two separate groundwater monitoring systems – one for Unit 1, and one for Unit 2. Collectively, they comprise the groundwater monitoring system for the facility. These existing monitoring wells are noted below.

- Unit 1 – One (1) background (upgradient) monitoring well (MW-1), and seven (7) point-of-compliance (POC) (downgradient) monitoring wells (MW-2A, MW-3, MW-4A, MW-6, MW-7A, MW-8A, and MW-9) [screened at the base of Stratum III].

- Unit 2 – Two (2) background (upgradient) monitoring wells (MW-10 and MW-11), and twelve (12) POC (downgradient) monitoring wells (MW-12 through MW-23) [screened at the base of Stratum III].

From the above, on a facility-wide basis there are currently three (3) background wells and 19 POC groundwater monitoring wells. Monitoring well installation dates and construction details for the current well network are summarized in Table 5-1 at the end of this report. Installation logs are provided in Attachment 5B.

4. PROPOSED GROUNDWATER MONITORING SYSTEM

4.1 Overview

Stratum III is the uppermost water-bearing zone where groundwater is first encountered beneath the Site (i.e., uppermost aquifer for groundwater monitoring purposes). Groundwater occurs as unconfined conditions in the lower part of Stratum III, where it is perched above the lower confining unit (aquiclude) of the thick, massive, and very low permeability Stratum IV unweathered claystone. Consistent with the currently-approved groundwater monitoring program, two separate groundwater monitoring systems are proposed – one for Unit 1, and one for Unit 2. Collectively, they will comprise the groundwater monitoring system for the facility. The proposed groundwater monitoring system is summarized below.

- Unit 1 – One (1) background (upgradient) monitoring well (MW-1), and seven (7) POC (downgradient) monitoring wells (MW-2A, MW-3, MW-4A, MW-6, MW-7A, MW-8A, and MW-9) [screened at/near the base of Stratum III]. There are no proposed changes to the Unit 1 groundwater monitoring system.

- Unit 2 – One (1) background (upgradient) monitoring well (MW-40), and 29 POC (downgradient) monitoring wells (MW-11, MW-12A, MW-13A, and MW-14 through MW-39) [screened at/near the base of Stratum III]. Changes to the Unit 2 groundwater monitoring system are to encompass the expansion area and related updates to the POC.

From the above, on a facility-wide basis the proposed groundwater monitoring system will have two (2) background wells and 36 POC groundwater monitoring wells.

4.2 Well Status – Existing and Proposed

Some existing groundwater monitoring wells will remain in use as part of the groundwater monitoring system, and others will be plugged and abandoned. New groundwater monitoring wells will also be installed to encompass the lateral expansion area. Based on these updates, an overview status of existing and proposed groundwater monitoring wells is tabulated below. Refer to Table 5-1 at the end of this document for the timing of installations and plugging/abandonments.

WELL ID	STATUS FOR PERMIT 66C
UNIT 1 - BACKGROUND, UPGRADIENT	
MW-1	RETAIN IN SYSTEM
UNIT 1 - POINT-OF-COMPLIANCE (POC)	
MW-2A	RETAIN IN SYSTEM
MW-3	RETAIN IN SYSTEM
MW-4A	RETAIN IN SYSTEM

WELL ID	STATUS FOR PERMIT 66C
MW-6	RETAIN IN SYSTEM
MW-7A	RETAIN IN SYSTEM
MW-8A	RETAIN IN SYSTEM
MW-9	RETAIN IN SYSTEM
UNIT 2 - BACKGROUND, UPGRADIENT	
MW-40	INSTALL (NEW)
UNIT 2 - POINT-OF-COMPLIANCE (POC)	
MW-10	PLUG & ABANDON
MW-11	RETAIN IN SYSTEM (CHANGE TO POC)
MW-12	PLUG & ABANDON
MW-12A	INSTALL (NEW)
MW-13	PLUG & ABANDON
MW-13A	INSTALL (NEW)
MW-14	RETAIN IN SYSTEM
MW-15	RETAIN IN SYSTEM
MW-16	RETAIN IN SYSTEM
MW-17	RETAIN IN SYSTEM
MW-18	RETAIN IN SYSTEM
MW-19	RETAIN IN SYSTEM
MW-20	RETAIN IN SYSTEM
MW-21	RETAIN IN SYSTEM
MW-22	RETAIN IN SYSTEM
MW-23	RETAIN IN SYSTEM
MW-24	INSTALL (NEW)
MW-25	INSTALL (NEW)
MW-26	INSTALL (NEW)
MW-27	INSTALL (NEW)
MW-28	INSTALL (NEW)
MW-29	INSTALL (NEW)
MW-30	INSTALL (NEW)
MW-31	INSTALL (NEW)
MW-32	INSTALL (NEW)
MW-33	INSTALL (NEW)
MW-34	INSTALL (NEW)
MW-35	INSTALL (NEW)
MW-36	INSTALL (NEW)
MW-37	INSTALL (NEW)
MW-38	INSTALL (NEW)
MW-39	INSTALL (NEW)

4.3 Groundwater Monitoring Well Location Map

A map of the proposed groundwater monitoring system is shown on attached Drawings 5A-1A and 5A-1B. These maps, for Unit 1 and Unit 2, respectively, present a site plan, along with existing topography, the limits of waste disposal (waste management unit areas), the permit boundary, and the point of compliance boundary.

4.4 Monitoring Well Design and Phasing Schedule

Existing groundwater monitoring wells have been installed in accordance with the previously approved permits. Information on the depth and screened intervals of these existing wells is provided in Table 5-1 at the end of this plan, and monitoring well construction logs are provided in Attachment 5B.

Table 5-1 also presents the planned depths and screened intervals of the proposed wells. New proposed groundwater monitoring wells and any replacement well(s) that become necessary will be installed in accordance with the typical monitoring well detail provided on Drawing 5A-2. The timing of the phased installation and plugging/abandoning of wells is given in Table 5-1. Installation and decommissioning procedures will follow those given subsequently in Section 4.6.

4.5 Basis for Groundwater Monitoring System Design

The proposed groundwater monitoring system has been designed based on site-specific technical information from a thorough characterization of aquifer thickness, groundwater flow rate, groundwater flow direction (including its seasonal and temporal fluctuations), effect of site construction and operations; and thickness, stratigraphy, lithology, and hydraulic characteristics of saturated and unsaturated geologic units and fill materials overlying the uppermost aquifer, and materials of the lower confining unit of the uppermost aquifer. Further descriptions of the basis for groundwater monitoring system design are provided in the subsections below.

4.5.1 Most Likely Pathway for Potential Pollutant Migration

The most likely pathway for pollutant migration from the landfill via a groundwater pathway, in the improbable event that waste constituents migrate through a penetration (e.g., a flaw or hole) in the primary barrier (the liner system), is vertically downward through the compacted clay liner and unsaturated portion of Stratum III (driven by gravity as unsaturated flow percolating downward), followed by transport horizontally in the direction of groundwater flow (i.e., lateral flow driven by gradients from the difference in hydraulic head along the groundwater potentiometric surface within saturated portions of the lower part of Stratum III, perched on the Stratum IV confining unit). The basis for this, and further description of the most likely migration scenario, is given below.

Strata I and II have been entirely excavated and removed within the existing landfill footprint, and will be entirely removed within the proposed expansion footprint. Strata I and II will only be present around the landfill perimeter adjacent to the upper portion of the liner sideslopes. In the event of a penetration of the primary barrier liner system in the upper portion of the landfill sideslopes adjacent to Strata I and/or II, the preferential flow direction of leachate would remain within the geocomposite drainage layer of the leachate collection system inside the landfill, due to its relatively steep sideslopes oriented towards and draining to the base of the landfill, and the high permeability/transmissivity of the geocomposite relative to the much lower permeability of the liner system. This would preclude the formation of a sustained hydraulic head acting on an opening in the liner to cause outward migration of pollutants. Furthermore, both Strata I and II have low permeabilities and lack of continuous zones of saturation (minimal to no groundwater observed). Even if groundwater heads were to buildup in Strata I and/or II next to a flaw or hole in the liner, this would likely result in a higher hydraulic head outside the landfill compared to inside the landfill. The lack of an outward driving force due to negligible (essentially zero) possible hydraulic head buildup on the upper sideslopes of the liner, along with an inward gradient (if any) due to the hydrogeologic setting, makes pollutant migration into Strata I and/or II a very unlikely scenario, even if there was a penetration at that portion of the liner.

At the lower portions of the landfill liner sideslopes at both Units 1 and 2, Stratum III is present adjacent to the liner. Additionally, as mentioned the base of the landfill is keyed-into (i.e., founded within) Stratum III in a large majority of the landfill areas (with the few exceptions being localized instances where the base grades encountered and are founded on the upper portion of the Stratum IV claystone). In areas where the landfill sideslopes are adjacent to Stratum III, the same discussion as was given above for sideslopes adjacent to Strata I and/or II applies for mechanisms limiting outward pollutant migration. At the base of the landfill, where it is founded within Stratum III (most areas), the design and operation of the leachate collection system will limit leachate buildup (head) inside the landfill. In base areas where the liner is below the groundwater table with hydraulic head outside the landfill being greater than the leachate head on the liner, the inward gradient situation described previously would limit outward pollutant migration. Over time, the presence of the liner system is expected to be a significant barrier to groundwater recharge, probably lowering groundwater levels over time. This decrease may result in unsaturated conditions beneath the base of the landfill, potentially eliminating the aforementioned inward gradient condition. This situation is judged as having the potential to cause the most likely pathway for pollutant migration out of the landfill via a groundwater pathway in the improbable event that waste constituents migrate through a penetration in the primary barrier liner system. In this situation, migration would be vertically downward through the compacted clay liner and any unsaturated portion of Stratum III, followed by transport horizontally in the direction of groundwater flow.

Finally, it is noted that limited areas of the landfill are keyed-in to the Stratum IV confining layer (claystone – aquiclude). The very low hydraulic conductivity and lack of groundwater in Stratum IV make pollutant migration from the landfill and through this stratum vertically or laterally to any significant degree a negligible possibility. In particular, with respect to the Edwards Aquifer formations much deeper beneath the Site, the base of the landfill will be separated from the aquifer by over 400 ft of aquiclude materials. The groundwater in the Edwards Aquifer below the site does not receive recharge from vertical seepage and movement of water from above. The Glen Rose formation and overlying clays/claystones of the Taylor Group are confining beds with negligible permeability, that prevent hydraulic connection of any shallow groundwater at the site to the Edwards Aquifer. Given these factors, the potential pollutant pathway does not exist for landfill constituent migration from the landfill to the Edwards Aquifer (nor any other regional or local aquifers used in the area) during the active life, closure, and post-closure care period.

4.5.2 Uppermost Aquifer

Based on the hydrogeologic characteristics of Stratum III and the pollutant pathway analysis presented above for the most likely scenario, Stratum III (and in particular, the lower part that exhibits observed and documented presence of groundwater) is the uppermost groundwater-bearing zone where groundwater is first encountered at the Site that is designated as the uppermost aquifer at the site for groundwater monitoring purposes. This is consistent with the current approved groundwater monitoring program under MSW Permit No. 66B, and is proposed to continue under the the proposed permit amendment for MSW Permit No. 66C.

4.5.3 Site Construction and Operation

Construction of the liner system at remaining to-be-constructed areas of the landfill will excavate and remove Strata I and II and the upper part of Stratum III. The process of developing the landfill with lined cells will prevent natural recharge of this unconfined groundwater setting. These factors would be expected to reduce natural groundwater infiltration and flow over time, partially block up-gradient groundwater flow coming towards the Site to the extent it exists at elevations above the essentially impermeable bottom liner system, and redirect such flow around the landfill perimeter towards down-gradient areas. The point-of-compliance groundwater monitoring well network has wells positioned in locations that would likely intercept groundwater.

4.5.4 Well Layout and Spacing

The layout of the groundwater monitoring system is shown on attached Drawings 5A-1A and 5A-1B. The point-of-compliance around each unit is identified on these drawings, and was selected based on examination of historical potentiometric maps of groundwater flow direction, the mapped top-of-confining layer which is a lower boundary condition that influences current and anticipated future groundwater flow directions, the base of landfill liner system elevation and grades, and in consideration of the potential effects of landfill construction and operations on groundwater flow. These conditions are what led to (historically, and proposed to continue) separate groundwater monitoring systems for each landfill unit.

As required by 30 TAC §330.403(a), the background monitoring wells are located hydraulically upgradient from the waste management areas; and the proposed point-of-compliance monitoring system has a network of detection monitoring wells spaced less than 600-ft apart.

4.6 Monitoring Well Installation, Decommissioning, and Maintenance

Monitoring well construction will be completed in accordance with 30 TAC §§330.403 and 330.421. The groundwater monitoring well construction details including screen intervals, filter pack and bentonite seal elevations, and surface completion will be as specified on Drawing 5A-2.

The well(s) will be drilled by a Texas-licensed driller who is qualified to drill and install groundwater monitoring wells. The installation and development will be supervised by a licensed professional geoscientist or engineer who is familiar with the geology of the area. The licensed professional will prepare a boring log or assign the task to a designee under their direct supervision, and the licensed professional will seal, sign, and date the boring log.

Wells will be drilled by a method that will not introduce contaminants into the borehole or casing.

If any fluids are necessary in drilling and/or installing of groundwater monitoring wells, clean, treated potable water will be used and documented within the monitoring well installation report. If city water is used, a current chemical analysis of the city water shall be provided with the monitoring well report. Monitoring well construction will not involve the use of any glues or solvents.

After installation, groundwater monitoring wells will be developed if/when water is present in the well to remove artifacts of drilling (e.g., clay films, fluid, cuttings, etc.), and to open the water-bearing zone for maximum flow into the well to the extent practical and reasonable given the sometimes intermittent presence of groundwater in Site monitoring wells. Development will be continued until water introduced or affected during drilling activities is removed and field parameters (pH, specific conductance, and temperature) are stabilized.

A registered professional surveyor will survey the well locations and elevations. The elevation will be surveyed to the nearest 0.01 foot above mean sea level and the point on the well casing for which the elevation was determined will be permanently marked on the casing. New well locations will be recorded in terms of the latitude and longitude at least to the nearest tenth of a second or recorded with respect to the landfill grid system.

In accordance with 30 TAC §330.421(e), monitoring well installation and construction details will be submitted to TCEQ on forms available from the commission within 60 days of completion of a monitoring well or any other part of a monitoring system.

In accordance with 30 TAC §330.421(f), damaged groundwater 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. Any plugging and abandonment of monitoring wells, if needed, will be performed in accordance with 16 TAC §§76.72 and 76.104. No abandonment will be performed without prior written authorization.

Each component of the groundwater monitoring system will be operated and maintained so that they perform at least to design specifications throughout the life of the groundwater monitoring system.

The facility must notify TCEQ Executive Director, and any local pollution agency with jurisdiction that has requestd to be notified, in writing if changes in Site construction, operation, and/or changes in adjacent property affect or are likely to affect the direction and rate of groundwater flow and the potential for detecting groundwater contamination from the facility.

4.7 Groundwater Monitoring Program - Sampling and Analysis

Groundwater sampling and analysis will be performed in accordance with the GWSAP presented in Attachment 5C. The GSWAP provides details on the required monitoring program with respect to the monitoring frequency, constituents, sampling, analysis, statistical comparison procedures, and reporting requirements.

5. GROUNDWATER QUALITY

Ongoing groundwater monitoring (sampling and analysis) is being conducted on a semi-annual basis for the detection monitoring program at the facility in accordance with the current permit (MSW-66B) and its approved GWSAP. Annual Detection Monitoring Reports have been submitted to TCEQ as required, and include analytical results, a potentiometric map, time series plots of constituent concentrations, and descriptive analysis of the groundwater flow and groundwater quality indicator results. Historical groundwater quality data is provided in Attachment 4F of the Geology Report.

Recent groundwater monitoring has been performed by Bullock, Bennett & Associates, LLC (BBA), with statistical evaluation of the data performed by Otter Creek Environmental Services, LLC. The most recent Annual Detection Monitoring Report for calendar year 2022 (report submitted to TCEQ in March 2023) indicates the following takeaways regarding recent groundwater quality conditions at the Site:

- There were no verified detections of volatile organic compounds (VOCs) in the groundwater in 2022.

- MW-02A underwent an annual assessment event during the first 2022 semi-annual monitoring event and revealed no VOC detections; and a request was submitted to TCEQ dated September 16, 2022 to remove MW-02A from assessment monitoring following two consecutive sampling events of all 40 CFR Part 258 Appendix II constituents being detected at or below background values. In a TCEQ letter dated May 22, 2023 regarding the Annual Detection Monitoring Report for the calendar year 2022, the TCEQ stated that MW-02A may return to detection monitoring due to two consecutive monitoring events below limits.

- MW-09 was removed from assessment monitoring (confirmed by TCEQ in a letter dated July 22, 2022) following two consecutive sampling events of all 40 CFR Part 258 Appendix II constituents being detected at or below background values.

- During the first 2022 semi-annual monitoring event there were initial control limit exceedances at MW-22 for arsenic and at MW-04A for chromium and nickel. There were also initial detections for arsenic at MW-07A that exceeded the control limit, and for barium at MW-07A that was below the control limit (however, the CUSUM value exceeded the control limit). Due to the historical presence of similar constituent concentrations in MW-07A, the operator elected not to collect verification resamples for arsenic and barium at MW-07A, confirming the apparent statistically significant increases

(SSIs) over background. There were no other control limit exceedances during the first 2022 semi-annual detection monitoring event.

- A verification resampling event was conducted in August 2022 at MW-22 and MW-04A. The verification resample results for chromium and nickel at MW-04A were non-detect (ND); therefore, there was no confirmed SSI over background for chromium or nickel at MW-04A. The verification resample process for arsenic at MW-22 confirmed the SSI over background for arsenic at this well. There were no other control limit exceedances detected using intrawell statistics. The arsenic result at MW-22 (10.0 µg/L) matched the USEPA Maximum Contaminant Level (MCL) for arsenic (10.0µg/L) during this event. However, this detection is significantly less than the Class 3 groundwater critical protective concentration level PCL. There were no other MCL exceedances during the first 2022 semi-annual monitoring event. An Alternate Source Demonstration (ASD) was submitted on December 13, 2022 for arsenic and barium detections in MW-07A and the arsenic detections in MW-22.

- During the second 2022 semi-annual monitoring event there were initial control limit exceedances at MW-18 and MW-20 for arsenic; however, both verification resample results were ND, thus the detections were not verified. Furthermore, there were no other control limit exceedances for any constituent at any monitoring well during the second 2022 semi-annual monitoring event, and therefore no confirmed SSIs.

As of the most recent (2022) Annual Detection Monitoring Report, no changes to the groundwater monitoring program were recommended, and detection monitoring continues in accordance with the GWSAP. Based on the foregoing, there is no known plume of contamination that has entered the groundwater from an MSW management unit at the site (i.e., the landfill).

6. REFERENCES

Freeze, R.A., and Cherry, J.A., 1979. Groundwater, Prentice-Hall, Englewood Cliffs, NJ.

Geosyntec Consultants, 2006. *Groundwater Characterization Report, Mesquite Creek Landfill, Site Development Plan Attachment 5, MSW Permit No. 66B*. Technically Complete July 2006; last revised February 2021.

Maclay, R.W. and Small, T.A., *Carbonate Geology and Hydrology of the Edwards Aquifer, San Antonio Area, Texas*, Texas Water Development Board Report 296, 90 p.

McWhorter, David B., and Daniel K. Sunada, 1977. *Ground-water Hydrology and Hydraulics*. Water Resources Publication.

TABLE

TABLE 5-1
GROUNDWATER MONITORING SYSTEM - WELL INFORMATION

							Filter Pack		Screen			
Well ID	**Install Date**	**Northing**	**Easting**	**Ground Surface Elevation (ft, MSL)**	**Top of Casing Elevation (ft, MSL)**	**Total Depth of Well Casing from Surface (ft, bgs)**	**Top Elevation (ft, MSL)**	**Bottom Elevation (ft, MSL)**	**Top Elevation (ft, MSL)**	**Bottom Elevation (ft, MSL)**	**Screen Length (ft)**	**Status for Permit MSW-66C**
Unit 1 - Background												
MW-1	2/20/1992	13818827.6	2276471.6	662.4	664.9	45.0	635.9	619.4	631.9	621.9	10	Existing - no changes
Unit 1 - Point-of-Compliance												
MW-2A	3/17/2009	13817069.0	2278162.0	609.0	611.8	37.0	585.0	572.0	583.0	572.9	10	Existing - no changes
MW-3	2/18/1992	13816695.3	2277745.6	603.5	606.0	34.0	591.0	574.5	587.0	577.0	10	Existing - no changes
MW- 4A	5/11/2020	13813671.2	2280075.2	609.4	610.9	30.0	592.4	579.4	590.4	580.4	10	Existing - no changes
MW-6	11/8/1995	13817972.8	2275468.2	632.9	635.3	63.5	593.9	567.9	591.9	581.9	10	Existing - no changes
MW-7A	3/11/2009	13816498.0	2277256.0	603.4	606.3	27.0	592.9	576.4	591.4	581.4	10	Existing - no changes
MW-8A	3/19/2009	13817143.0	2276302.0	625.5	628.5	55.0	585.5	570.5	583.5	573.5	10	Existing - no changes
MW-9	3/24/2009	13817565.0	2275906.0	626.0	629.1	50.0	592.0	576.0	589.5	579.5	10	Existing - no changes

Table continues on following pages. Notes provided at end of table.

TABLE 5-1 (CONTINUED)
GROUNDWATER MONITORING SYSTEM - WELL INFORMATION

							Filter Pack		**Screen**			
Well ID	**Install Date**	**Northing**	**Easting**	**Ground Surface Elevation (ft, MSL)**	**Top of Casing Elevation (ft, MSL)**	**Total Depth of Well Casing from Surface (ft, bgs)**	**Top Elevation (ft, MSL)**	**Bottom Elevation (ft, MSL)**	**Top Elevation (ft, MSL)**	**Bottom Elevation (ft, MSL)**	**Screen Length (ft)**	**Status for Permit MSW-66C**
Unit 2 - Background												
MW-10	11/4/2009	13814602	2278767	670.5	673.5	57.0	627.0	613.5	625.0	615.0	10	Discontinue monitoring upon installation of MW-40; Plug and abandon
MW-40	Future	13811898	2277051	707.5	710.5	63.5	659.0	644.0	656.0	646.0	10	New well; Install before waste placement in Unit 2, Phase VIII
Unit 2 - Point-of-Compliance												
MW-11	3/5/2009	13814064.0	2279299.0	679.0	682.1	63.0	635.0	616.0	633.0	618.0	15	Formerly background; Change designation to POC (see Note 5)
MW-12	5/23/2018	13813666.3	2280080.1	709.3	712.2	76.0	647.8	633.3	645.8	635.8	10	Discontinue monitoring upon installation of MW-12A; Plug and abandon
MW-12A	Future	13813325	2280908	646.8	649.8	58.8	603.0	588.0	600.0	590.0	10	New well (replacement for MW-12); Install before waste placement in Unit 2, Phase VII
MW-13	4/10/2018	13814058.7	2280515.9	688.7	691.4	56.0	648.7	632.7	645.7	635.7	10	Discontinue monitoring upon installation of MW-13A; Plug and abandon

TABLE 5-1 (CONTINUED)
GROUNDWATER MONITORING SYSTEM - WELL INFORMATION

							Filter Pack		Screen			
Well ID	**Install Date**	**Northing**	**Easting**	**Ground Surface Elevation (ft, MSL)**	**Top of Casing Elevation (ft, MSL)**	**Total Depth of Well Casing from Surface (ft, bgs)**	**Top Elevation (ft, MSL)**	**Bottom Elevation (ft, MSL)**	**Top Elevation (ft, MSL)**	**Bottom Elevation (ft, MSL)**	**Screen Length (ft)**	**Status for Permit MSW-66C**
MW-13A	Future	13813916	2280900	650.5	653.5	62.5	603.0	588.0	600.0	590.0	10	New well (replacement for MW-13); Install before waste placement in Unit 2, Phase VII
MW-14	4/10/2018	13814514.5	2280890.1	654.0	656.7	57.5	615.0	596.5	612.0	602.0	10	Existing - no changes
MW-15	4/11/2018	13815072.8	2280885.4	647.2	650.2	53.0	608.2	594.2	604.7	594.7	10	Existing - no changes
MW-16	1/21/2005	13815626.5	2280863.5	643.4	646.5	58.0	597.7	585.4	595.7	585.7	10	Existing - no changes
MW-17	1/25/2016	13815851.0	2280330.0	655.4	659.1	63.0	608.4	592.4	605.4	595.4	10	Existing - no changes
MW-18	3/18/2009	13815985.8	2279745.5	635.1	638.2	60.0	588.1	575.1	586.1	576.1	10	Existing - no changes
MW-19	3/2/2009	13816167.0	2279219.0	633.2	636.3	55.0	600.2	578.2	598.7	578.7	20	Existing - no changes
MW-20	3/3/2009	13816584.0	2278784.0	606.3	609.5	40.0	583.3	566.3	581.8	566.8	15	Existing - no changes
MW-21	3/10/2009	13816481.0	2278358.0	606.8	609.6	43.0	575.8	563.8	574.3	564.3	10	Existing - no changes
MW-22	3/10/2009	13816113.0	2278083.0	612.2	615.8	37.0	587.7	575.2	586.2	576.2	10	Existing - no changes
MW-23	3/6/2009	13816006.0	2277841.0	621.2	624.2	35.0	600.2	586.2	597.2	587.2	10	Existing - no changes

TABLE 5-1 (CONTINUED)
GROUNDWATER MONITORING SYSTEM - WELL INFORMATION

Well ID	Install Date	Northing	Easting	Ground Surface Elevation (ft, MSL)	Top of Casing Elevation (ft, MSL)	Total Depth of Well Casing from Surface (ft, bgs)	Filter Pack		Screen			Status for Permit MSW-66C
							Top Elevation (ft, MSL)	Bottom Elevation (ft, MSL)	Top Elevation (ft, MSL)	Bottom Elevation (ft, MSL)	Screen Length (ft)	
MW-24	Future	13812727	2280914	647.9	650.9	54.9	608.0	593.0	605.0	595.0	10	New well; Install before waste placement in Unit 2, Phase VII
MW-25	Future	13812307	2280679	656.1	659.1	54.0	617.1	602.1	614.1	604.1	10	New well; Install before waste placement in Unit 2, Phase VIII
MW-26	Future	13811898	2280269	666.7	669.7	58.6	623.1	608.1	620.1	610.1	10	New well; Install before waste placement in Unit 2, Phase VIII
MW-27	Future	13811572	2279942	663.3	666.3	62.3	616.0	601.0	613.0	603.0	10	New well; Install before waste placement in Unit 2, Phase X
MW-28	Future	13811304	2279673	659.7	662.7	58.7	616.0	601.0	613.0	603.0	10	New well; Install before waste placement in Unit 2, Phase X
MW-29	Future	13811014	2279374	666.1	669.1	60.1	621.0	606.0	618.0	608.0	10	New well; Install before waste placement in Unit 2, Phase X
MW-30	Future	13810601	2278962	669.6	672.6	66.6	618.0	603.0	615.0	605.0	10	New well; Install before waste placement in Unit 2, Phase XIII
MW-31	Future	13810286	2278649	666.2	669.2	67.2	614.0	599.0	611.0	601.0	10	New well; Install before waste placement in Unit 2, Phase XIII

TABLE 5-1 (CONTINUED)
GROUNDWATER MONITORING SYSTEM - WELL INFORMATION

Well ID	Install Date	Northing	Easting	Ground Surface Elevation (ft, MSL)	Top of Casing Elevation (ft, MSL)	Total Depth of Well Casing from Surface (ft, bgs)	Filter Pack		Screen			Status for Permit MSW-66C
							Top Elevation (ft, MSL)	Bottom Elevation (ft, MSL)	Top Elevation (ft, MSL)	Bottom Elevation (ft, MSL)	Screen Length (ft)	
MW-32	Future	13810707	2278232	673.6	676.6	63.6	624.9	609.9	621.9	611.9	10	New well; Install before waste placement in Unit 2, Phase XIII
MW-33	Future	13811121	2277822	686.5	689.5	66.9	634.6	619.6	631.6	621.6	10	New well; Install before waste placement in Unit 2, Phase XIII
MW-34	Future	13811485	2277461	700.5	703.5	62.5	653.0	638.0	650.0	640.0	10	New well; Install before waste placement in Unit 2, Phase XIII
MW-35	Future	13812264	2277420	708.8	711.8	61.6	662.2	647.2	659.2	649.2	10	New well; Install before waste placement in Unit 2, Phase XIII
MW-36	Future	13812631	2277789	707.1	710.1	58.1	664.0	649.0	661.0	651.0	10	New well; Install before waste placement in Unit 2, Phase XII

TABLE 5-1 (CONTINUED)
GROUNDWATER MONITORING SYSTEM - WELL INFORMATION

							Filter Pack		Screen			
Well ID	**Install Date**	**Northing**	**Easting**	**Ground Surface Elevation (ft, MSL)**	**Top of Casing Elevation (ft, MSL)**	**Total Depth of Well Casing from Surface (ft, bgs)**	**Top Elevation (ft, MSL)**	**Bottom Elevation (ft, MSL)**	**Top Elevation (ft, MSL)**	**Bottom Elevation (ft, MSL)**	**Screen Length (ft)**	**Status for Permit MSW-66C**
MW-37	Future	13812997	2278158	707.0	710.0	64.1	657.9	642.9	654.9	644.9	10	New well; Install before waste placement in Unit 2, Phase X
MW-38	Future	13813364	2278527	701.5	704.5	65.0	651.5	636.5	648.5	638.5	10	New well; Install before waste placement in Unit 2, Phase X
MW-39	Future	13813730	2278896	706.4	709.4	78.3	643.2	628.2	640.2	630.2	10	New well; Install before waste placement in Unit 2, Phase VIII

Notes:

MSL = Mean Sea Level; bgs = below ground surface

(1) Norting and Easting coordinates refer to Texas State Plane, North American Datum (NAD)-83, Texas Central Zone.

(2) Information for existing groundwater monitoring wells taken from construction logs.

(3) All existing wells have 2-inch diameter casing. All future wells will have 2-inch (min) diameter casing.

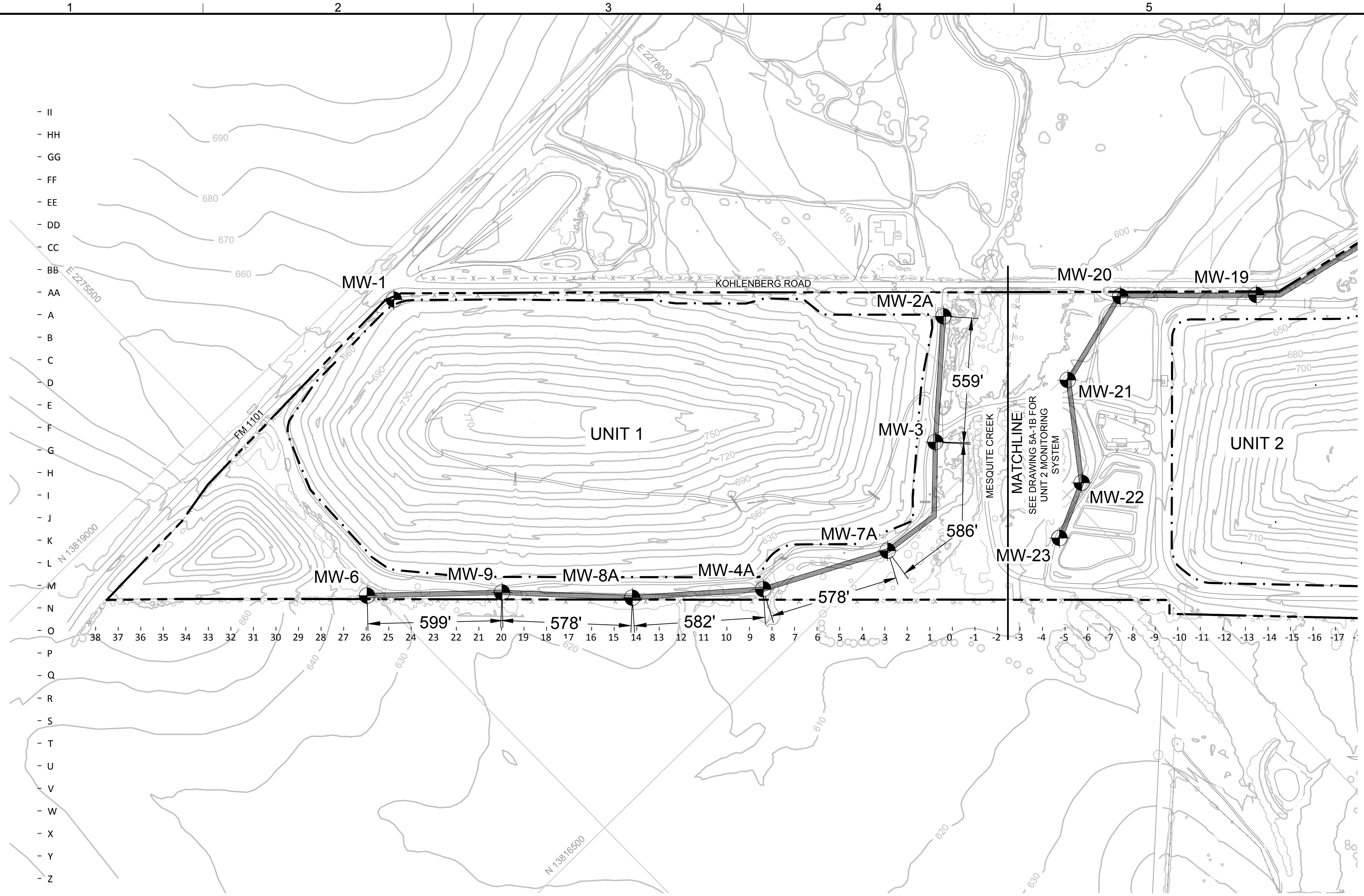
(4) Information for proposed (future) groundwater monitoring wells is approximate based on anticipated subsurface characterization at the given well location. The tabulated well location and information for proposed wells and may vary based on slight field adjustments (e.g., drill rig access), and based on actual subsurface conditions observed during drilling. Actual as-built installation data will be reported on the well construction reports. Monitoring wells will be constructed in accordance with the detail shown on Drawing 5A-2.

(5) Existing wells MW-10 and MW-11 will remain designated as background wells until waste disposal begins in Unit 2, Phase VIII - at which time their status will be as indicated in the above table.

ATTACHMENT 5A

GROUNDWATER MONITORING SYSTEM DRAWINGS

LIST OF DRAWINGS		
Drawing No.	Title	Drawing Date (latest revision)
5A-1A	Groundwater Monitoring Well Location Map – Unit 1	October 2023
5A-1B	Groundwater Monitoring Well Location Map – Unit 2	October 2023
5A-2	Monitoring Well Details	October 2023



LEGEND

580	EXISTING GROUND ELEVATION CONTOUR (FT, MSL) (NOTES 1, 2)
	EXISTING ROAD
	EXISTING VEGETAION / TREE
x x	EXISTING FENCE
▭	EXISTING BUILDING
	EXISTING WATER LINE
13 A	SITE GRID
	PERMIT BOUNDARY
	LIMIT OF WASTE
	POINT OF COMPLIANCE
MW-6S	GROUNDWATER MONITORING WELL

NOTES:

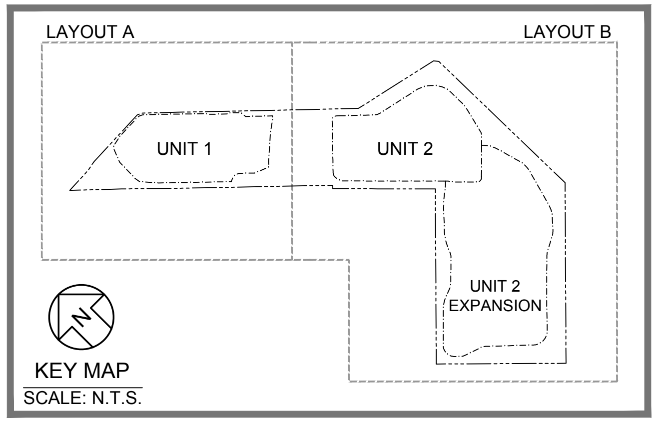
1. TOPOGRAPHIC BASE MAP OF EXISTING SITE CONDITIONS WAS GENERATED BY PHOTOGRAMMETRIC METHODS BASED ON AN AERIAL SURVEY FLOWN ON 01 FEBRUARY 2022 BY HYDREX ENVIRONMENTAL, AND BY DALLAS AERIAL SURVEYING (DAS) FLOWN IN 2018-2019. EXISTING TOPOGRAPHY OUTSIDE OF PROPERTY WHERE SHOWN SUPPLEMENTED WITH THE UNITED STATES GEOLOGIC SURVEY (USGS) 3DEP PROGRAM PUBLISHED IN NOVEMBER 2021.
2. ELEVATIONS ARE IN FEET ABOVE MEAN SEA LEVEL (FT, MSL) AND ADJUSTED TO A DEFINED WASTE MANAGEMENT DATUM. DRAWING COORDINATES ARE BASED ON TEXAS STATE PLANE SOUTH CENTRAL ZONE US FOOT.
3. PERMIT BOUNDARY AND PROPERTY BOUNDARY COINCIDE.
4. SEE PART III, ATTACHMENT 5, TABLE 5-1 FOR MONITORING WELL COORDINATES, DEPTHS, SCREENED INTERVALS AND OTHER DATA, IDENTIFICATION OF WHICH WELLS EXIST, IDENTIFICATION OF WHICH WELLS ARE PROPOSED, AND THE SCHEDULE FOR INSTALLATION OR PLUGGING AND ABANDONING AS APPROPRIATE.

0 300' 600'
SCALE IN FEET

MATTHEW WISSLER
GEOLOGY
13242

10/10/2023

FOR PERMIT PURPOSES ONLY



KEY MAP
SCALE: N.T.S.

PERMIT DRAWING

REV	DATE	DESCRIPTION	DRN	APP

WASTE MANAGEMENT
WASTE MANAGEMENT OF TEXAS, INC.
1700 KOHLENBERG ROAD
NEW BRAUNFELS, TEXAS 78130
PHONE: 830.685.7894

Geosyntec consultants
GEOSYNTEC CONSULTANTS, INC.
TEXAS PROF. GEOSCIENTISTS FIRM REG. NO. 50256
8217 SHOAL CREEK BLVD, SUITE 200
AUSTIN, TEXAS 78757
PHONE: 512.451.4003

TITLE:

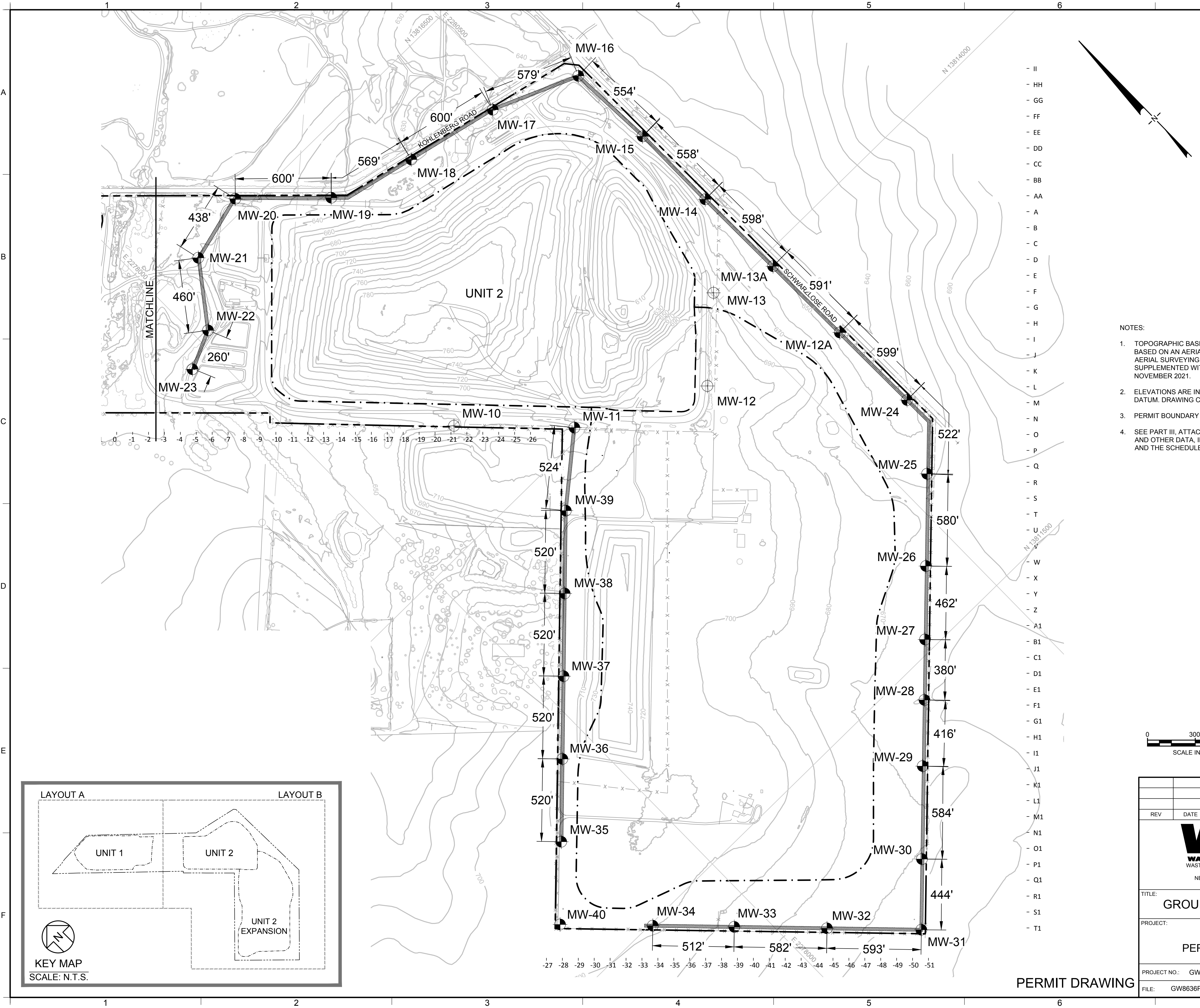
GROUNDWATER MONITORING WELL LOCATION MAP UNIT 1

PROJECT:

MESQUITE CREEK LANDFILL EXPANSION
PERMIT AMENDMENT APPLICATION - MSW PERMIT NO. 66C

PROJECT NO.:	GW8636	DESIGN BY:	MW	REVIEWED BY:	PP/YB	PART NO.:	DRAWING:
FILE:	GW8636P5A-1A	DRAWN BY:	JJV / KH	APPROVED BY:	MW	III	5A-1A

AUS-01\\P:\CADD\PROJECTS\MMESQUITE CREEK LANDFILL\PERMIT\EXPANSION 66C (GW8636)\04-07 DRAWINGS PARTS I-IV\GW8636P5A-1A.DWG



LEGEND

580	EXISTING GROUND ELEVATION CONTOUR (FT, MSL) (NOTES 1, 2)
	EXISTING ROAD
	EXISTING VEGETAION / TREE
x x	EXISTING FENCE
	EXISTING BUILDING
	EXISTING WATER LINE
13 A	SITE GRID
	PERMIT BOUNDARY
	LIMIT OF WASTE
	POINT OF COMPLIANCE
MW-6S	GROUNDWATER MONITORING WELL
MW-12	EXISTING MONITORING WELL TO BE PLUGGED AND ABANDONED (NOTE 4)

NOTES:

1. TOPOGRAPHIC BASE MAP OF EXISTING SITE CONDITIONS WAS GENERATED BY PHOTOGRAMMETRIC METHODS BASED ON AN AERIAL SURVEY FLOWN ON 01 FEBRUARY 2022 BY HYDREX ENVIRONMENTAL, AND BY DALLAS AERIAL SURVEYING (DAS) FLOWN IN 2018-2019. EXISTING TOPOGRAPHY OUTSIDE OF PROPERTY WHERE SHOWN SUPPLEMENTED WITH THE UNITED STATES GEOLOGIC SURVEY (USGS) 3DEP PROGRAM PUBLISHED IN NOVEMBER 2021.
2. ELEVATIONS ARE IN FEET ABOVE MEAN SEA LEVEL (FT, MSL) AND ADJUSTED TO A DEFINED WASTE MANAGEMENT DATUM. DRAWING COORDINATES ARE BASED ON TEXAS STATE PLANE SOUTH CENTRAL ZONE US FOOT.
3. PERMIT BOUNDARY AND PROPERTY BOUNDARY COINCIDE.
4. SEE PART III, ATTACHMENT 5, TABLE 5-1 FOR MONITORING WELL COORDINATES, DEPTHS, SCREENED INTERVALS AND OTHER DATA, IDENTIFICATION OF WHICH WELLS EXIST, IDENTIFICATION OF WHICH WELLS ARE PROPOSED, AND THE SCHEDULE FOR INSTALLATION OR PLUGGING AND ABANDONING AS APPROPRIATE.

0 300' 600'
SCALE IN FEET

MATTHEW WISSLER
GEOLOGY
13242
10/10/2023

FOR PERMIT PURPOSES ONLY

PERMIT DRAWING

REV	DATE	DESCRIPTION	DRN	APP

WASTE MANAGEMENT
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1700 KOHLENBERG ROAD
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Geosyntec
consultants
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TEXAS PROF. GEOSCIENTISTS FIRM REG. NO. 50256
8217 SHOAL CREEK BLVD, SUITE 200
AUSTIN, TEXAS 78757
PHONE: 512.451.4003

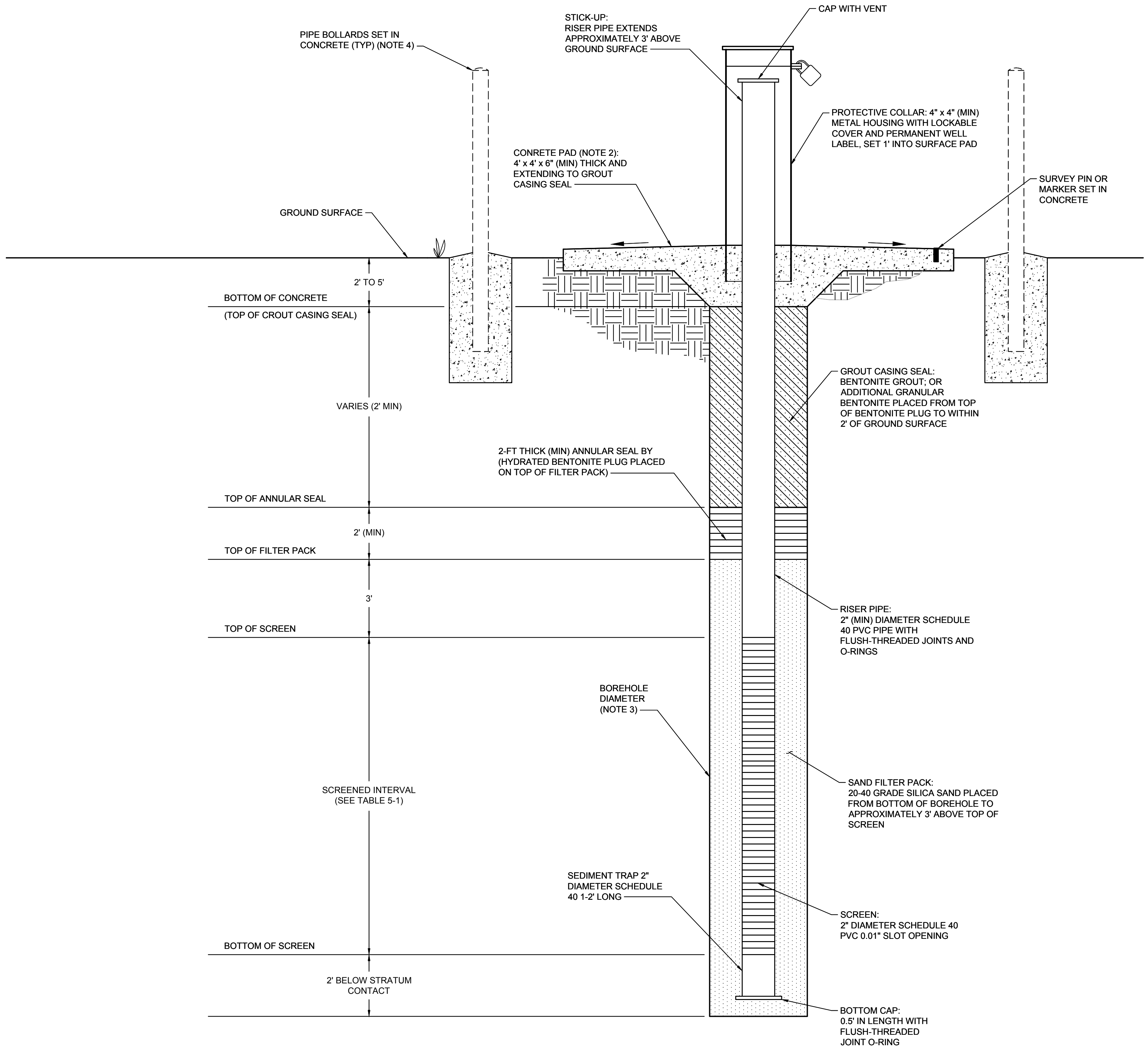
TITLE:

GROUNDWATER MONITORING WELL LOCATION MAP UNIT 2

PROJECT:

MESQUITE CREEK LANDFILL EXPANSION
PERMIT AMENDMENT APPLICATION - MSW PERMIT NO. 66C

PROJECT NO.:	GW8636	DESIGN BY:	MW	REVIEWED BY:	PP/YB	PART NO.:	DRAWING:
FILE:	GW8636P5A-1B	DRAWN BY:	JJV / KH	APPROVED BY:	MW	III	5A-1B



1
5A-2

DETAIL
GROUNDWATER MONITORING WELL
(NOTE 1)
SCALE: N.T.S.

NOTES:

1. GROUNDWATER MONITORING WELL DETAIL SHOWN REFERS TO THE DESIGN FOR FUTURE MONITORING WELLS THAT ARE NEEDED AS EITHER REPLACEMENTS OR NEW WELLS.
2. CONCRETE PAD SHALL BE NOT LESS THAN 4 FEET (PREFERABLY 6 FEET) SQUARE OR 5 FEET (PREFERABLY 6 FEET) IN DIAMETER. PAD SHALL BE COMPOSED OF HIGH-QUALITY STRUCTURAL-TYPE CONCRETE AND PAD SHALL CONTAIN SUFFICIENT REINFORCING STEEL TO ENSURE STRUCTURAL INTEGRITY IN THE EVENT SOIL SUPPORT IS LOST. SLOPE CONCRETE PAD SURFACE AWAY FROM CASING TO PREVENT PONDING.
3. DIAMETER OF BOREHOLES USED FOR MONITORING WELL INSTALLATION WILL BE AT LEAST 4 INCHES LARGER THAN THE DIAMETER OF THE CASING USED FOR THE MONITORING WELL.
4. THE PURPOSE OF THE PIPE BOLLARDS IS TO PROVIDE A PROTECTIVE BARRIER AROUND THE WELL. AT EACH WELL, THREE OR FOUR PIPE BOLLARDS WILL BE INSTALLED. THE MINIMUM PIPE DIAMETER IS 4 INCHES, UNLESS A WELL IS IN A LOCATION WHERE IT IS LIKELY TO BE DAMAGED OR IN HEAVILY TRAVELED AREAS, IN WHICH CASE THE PIPE DIAMETER SHOULD BE 6 INCHES (MIN) TO 12 INCHES.

MATTHEW WISSLER
GEOLOGY
13242
10/10/2023

FOR PERMIT PURPOSES ONLY

REV	DATE	DESCRIPTION	DRN	APP

WASTE MANAGEMENT
WASTE MANAGEMENT OF TEXAS, INC.
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TEXAS PROF. GEOSCIENTISTS FIRM REG. NO. 50256
8217 SHOAL CREEK BLVD, SUITE 200
AUSTIN, TEXAS 78757
PHONE: 512.451.4003

TITLE:
MONITORING WELL DETAILS

PROJECT:
MESQUITE CREEK LANDFILL EXPANSION
PERMIT AMENDMENT APPLICATION - MSW PERMIT NO. 66C

PERMIT DRAWING

PROJECT NO.: GW8636
FILE: GW8636P5A-2
DESIGN BY: MW
DRAWN BY: JJV / KH
REVIEWED BY: PP/YB
APPROVED BY: MW
PART NO.: III
DRAWING: 5A-2

ATTACHMENT 5B

MONITORING WELL CONSTRUCTION LOGS

A. Monitor Well Data Sheet

Texas Department of Health
Division of Solid Waste Management
SE. 67 (3/29/88)

Permittee or Site Name: WMI - Comal County Landfill

unty: Comal

TDH Permit No.: 66

of Monitor Well Installation: 2/20/92

Monitor Well I.D. No.: MW-1

Monitor Well: Latitude: ____ Longitude: ____

Date of Monitor Well Development: 2/26/92 (Well Dry)

Monitor Well Groundwater Gradient: Upgradient X Downgradient ____

Monitor Well Driller Name: Wes Kowser

License No.: 3226 M

NOTE:

(A)The information shown in the sketch below should be considered the minimum required for an installed ground-water monitor well.
(B) Report All Depths from Surface Elevation and all Elevations relative to Mean Sea Level.
(C) The minimum distance between the inside wall of the Bore Hole and the outside of the Well Casing shall be 3/4".
(D) Use Flush Screw Joint Casing only, 2" diameter or larger. Recommend 4" diameter minimum & Teflon Taping Casing Joints.

Geologist, Hydrologist or Engineer Supervising Well Installation: Emmett Hudson

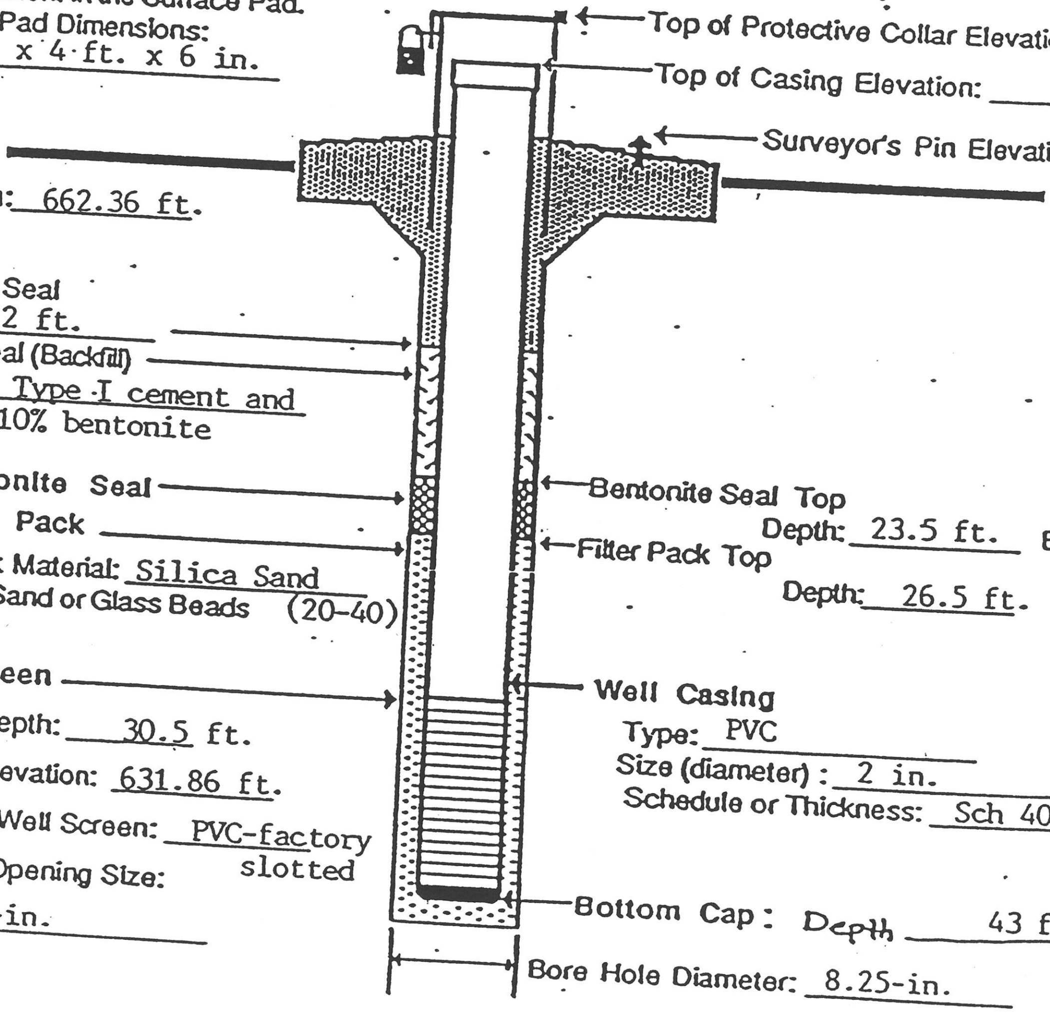
Static Water Level Elevation (with respect to MSL) after Well Developement: Dry

Name of Geologic Formation(s) in which Well is completed: Navarro

ype of Locking Device: Padlock

Type of Casing Protection: 5'x 4" Locking Aluminum

Concrete Surface Pad - Recommend steel einforcement in the Surface Pad.
urface Pad Dimensions:
4 ft. x 4 ft. x 6 in.



Top of Protective Collar Elevation: 665.23 ft.

Top of Casing Elevation: 664.92 ft.

Surveyor's Pin Elevation: 662.86 ft.

n: 662.36 ft.

ncrete Seal
pth: 2 ft.

sing Seal (Backfill)
terial: Type I cement and 10% bentonite

Bentonite Seal

Filter Pack

er Pack Material: Silica Sand
ilized Sand or Glass Beads (20-40)

Bentonite Seal Top
Depth: 23.5 ft. Elevation: 638.86 ft.

Filter Pack Top
Depth: 26.5 ft. Elevation: 635.86 ft.

ll Screen
op Depth: 30.5 ft.
op Elevation: 631.86 ft.

ype of Well Screen: PVC-factory slotted

reen Opening Size: .010-in.

Well Casing
Type: PVC
Size (diameter): 2 in.
Schedule or Thickness: Sch 40

Bottom Cap: Depth 43 ft.

Bore Hole Diameter: 8.25-in.

Monitor Well Data Sheet

Permittee or Site Name: WMTX – Mesquite Creek Landfill
County: Comal and Guadalupe
Date of Monitor Well Installation: 03/17/09
Monitor Well Latitude: 29° 44’ 15.77” Longitude: 98° 01’ 27.16”
Monitor Well Groundwater Gradient Position:
Upgradient ________ Downgradient __X______

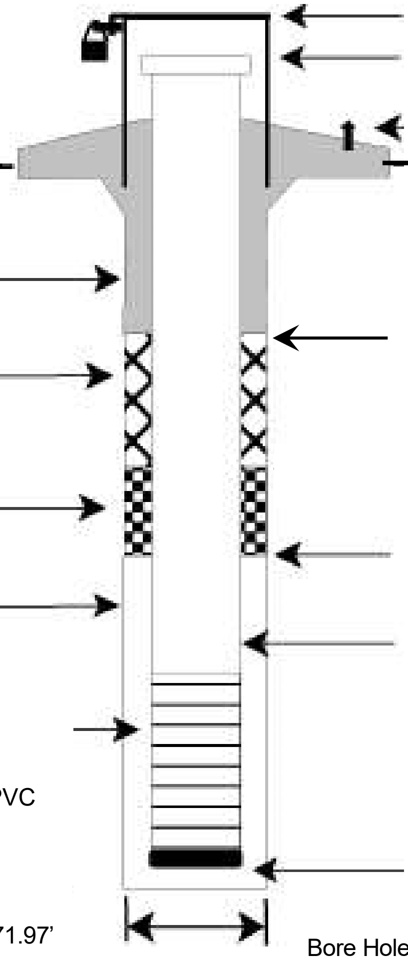
MSW Permit No. MSW-66B
Monitor Well I.D. No.: MW-2A
Date of Monitor Well Development: 04/24/09
Monitor Well Driller Name: Brian Kern
License No.: 54611M

NOTES:

Report all depths from Surface Elevation and all Elevations relative to Mean Sea Level (MSL), to nearest hundredth of a foot.
Diameter of boring should be at least 4 inches larger than diameter of well casing.
Use flush screw joint casing only, 2-inch diameter or larger, with o-rings or PTFE tape in joints (4-inch diameter recommend).
Well development should continue until water is clear, and pH and conductivity are stable.

Geologist, Hydrologist, or Engineer Supervising Gas Probe Installation: Mohammad Z. Islam, under supervision of Edward B. Dolan, P.G.
Static Water Level Elevation (with respect to MSL) after Well Development: 572.71’
Name of Geologic Formation(s) in which probe is completed: Stratum III of site-specific characterization, which is predominantly Lower Taylor Group oxidized clay or claystone with fractures.

Type of Locking Device: Padlock
Type of Casing Protection: Metal Stick-Up
Concrete Surface Pad Dimensions: 4’x4’x6”



Top of Protective Collar Elevation: 612.34’
Top of Casing Elevation: 611.78’
Surveyor's Pin Elevation: N/A

Ground Surface Elevation: 608.97’

Concrete Seal Depth: 1.5’

Casing Seal (backfill)
Material: 3/8” bentonite pellets
Note: Material for Casing Seal and Bentonite Seal is the Same.

Bentonite Seal Top Depth: 1.5’ Elevation: 586.97’

Bentonite Seal

Filter Pack Top Depth: 24.0’ Elevation: 584.97’

Filter Pack: 20/40 silica sand

Well Casing Type: PVC

Size (diameter): 2” Thickness: Schedule 40

Well Screen
Top Depth: 26.0’
Top Elevation: 582.97’
Type of Well Screen: Slotted PVC
Screen Opening Size: 0.010”
Bottom Depth: 36.1’
Bottom Elevation: 572.87’
Total depth of borehole: 37.0’
Bottom Elevation of borehole: 571.97’

Bottom Cap Depth: 36.35’

Bore Hole Diameter: 8.0”

A. Monitor Well Data Sheet

Texas Department of Health
Division of Solid Waste Management
SE. 67 (3/29/85)

Permittee or Site Name: WMI - Comal County Landfill

unty: Comal

TDH Permit No.: 66

of Monitor Well Installation: 2/18/92

Monitor Well I.D. No.: MW - 3

Monitor Well: Latitude: ______ Longitude: ______

Date of Monitor Well Development: 2/26/92

Monitor Well Groundwater Gradient: Upgradient ___ Downgradient X

Monitor Well Driller Name: Henry Gompert

License No.: 2881 M

NOTE:

A) The information shown in the sketch below should be considered the minimum required for an installed ground-water monitor well.
B) Report All Depths from Surface Elevation and all Elevations relative to Mean Sea Level.
) The minimum distance between the inside wall of the Bore Hole and the outside of the Well Casing shall be $\frac{3}{4}$".
) Use Flush Screw Joint Casing only, 2" diameter or larger. Recommend 4" diameter minimum & Teflon Taping Casing Joints.

eologist, Hydrologist or Engineer Supervising Well Installation: Emmett Hudson

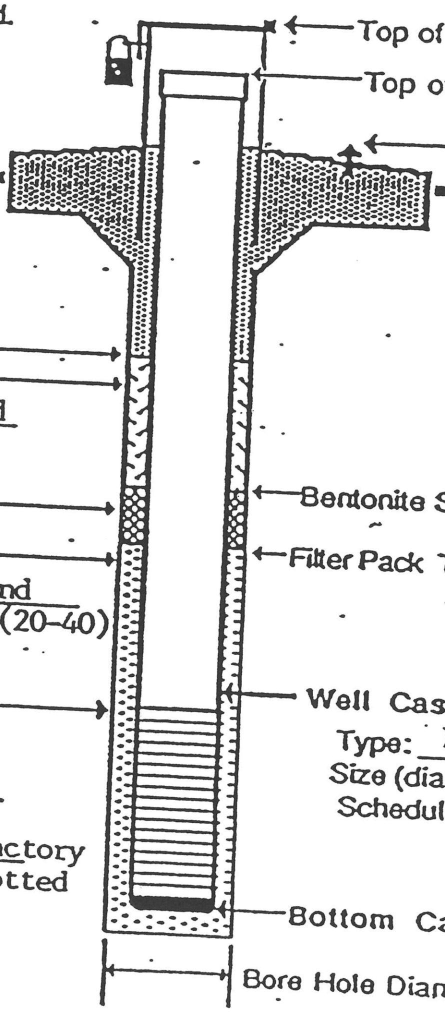
atic Water Level Elevation (with respect to MSL) after Well Developement: 597.26 ft.

ame of Geologic Formation(s) in which Well is completed: Navarro

pe of Locking Device: Padlock

Type of Casing Protection: 5'x 4" Locking Aluminum

oncrete Surface Pad - Recommend steel inforcement in the Surface Pad.
urface Pad Dimensions:
ft. x 4 ft. x 6 in.



Top of Protective Collar Elevation: 606.33 ft.

Top of Casing Elevation: 606.02 ft.

Surveyor's Pin Elevation: 603.96 ft.

: 603.48 ft.

ncrete Seal
pth: 2 ft.

ing Seal (Backfill)
erial: Type I cement and 10% bentonite

Bentonite Seal

Filter Pack

r Pack Material: Silica Sand
ized Sand or Glass Beads (20-40)

Bentonite Seal Top
Depth: 9.5 ft Elevation: 12.5 ft

Filter Pack Top
Depth: 12.5 ft. Elevation: 590.98 ft.

l Screen
p Depth: 16.5 ft.
p Elevation: 586.98 ft.

pe of Well Screen: PVC-factory slotted

reen Opening Size: .010-in.

Well Casing
Type: PVC
Size (diameter): 2 in.
Schedule or Thickness: Sch 40

Bottom Cap: Depth 29 ft.

Bore Hole Diameter: 8.25 in.

Monitor Well Data Sheet

Texas Commission on Environmental Quality
Waste Permits Division

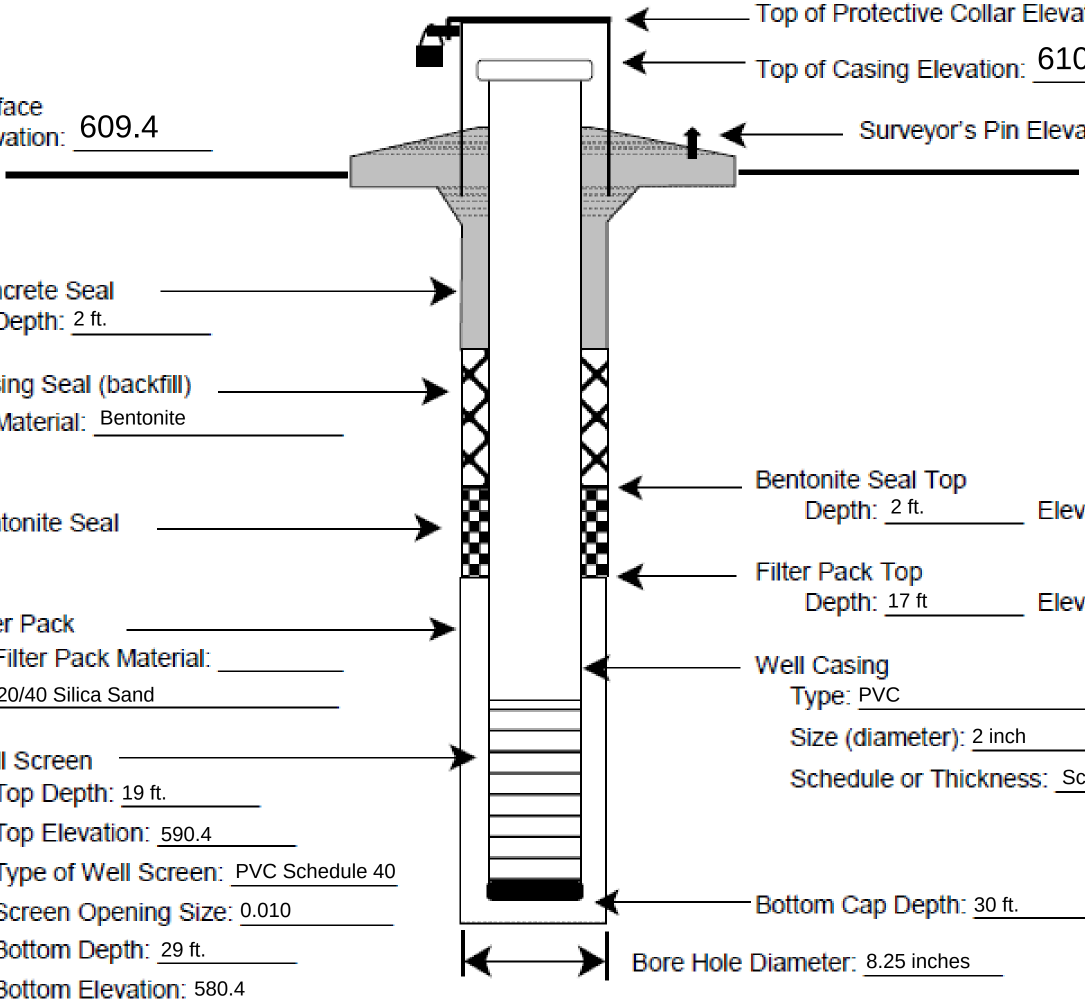
Permittee or Site Name: Mesquite Creek Landfill
County: New Braunfels, Comal & Guadalupe Counties
Date of Monitor Well Installation: 5/11/2020
Monitor Well Latitude: 29.7369129133 Longitude: -98.0286980642
Monitor Well Hydraulic Position:
Upgradient _______ Downgradient X

MSW Permit No.: 66B
Monitor Well I.D. No.: MW-4A
Date of Well Development: 5/14/2020
Monitor Well Driller
Name: James E. Neal
License No.: 4868

Geologist, Hydrologist, or Engineer Supervising Well Installation: Craig E. Bennett, PG
Static Water Level Elevation (with respect to MSL) after Well Development: 26.95
Name of Geologic Formation(s) in which Well is completed: Lower Taylor Group
Type of Locking Device: Keyed Alike Pad Lock Type of Casing Protection: Anodized Aluminum Stand Pipe
Concrete Surface Pad (with steel reinforcement) Dimensions: 6 ft x 6 ft

Notes:

- Report all depths from Surface Elevation and all Elevations relative to Mean Sea Level (MSL), to nearest hundredth of a foot.
- Diameter of boring should be at least 4 inches larger than diameter of well casing.
- Use flush screw joint casing only, 2-inch diameter or larger, with o-rings or PTFE tape in joints (4-inch diameter recommend).
- Well development should continue until water is clear, and pH and conductivity are stable.



Top of Protective Collar Elevation: 611.32
Top of Casing Elevation: 610.87
Surface Elevation: 609.4
Surveyor's Pin Elevation: 608.35

Concrete Seal
Depth: 2 ft.

Casing Seal (backfill)
Material: Bentonite

Bentonite Seal

Bentonite Seal Top
Depth: 2 ft. Elevation: 607.4

Filter Pack Top
Depth: 17 ft Elevation: 592.4

Filter Pack
Filter Pack Material: 20/40 Silica Sand

Well Casing
Type: PVC
Size (diameter): 2 inch
Schedule or Thickness: Schedule 40

Well Screen
Top Depth: 19 ft.
Top Elevation: 590.4
Type of Well Screen: PVC Schedule 40
Screen Opening Size: 0.010
Bottom Depth: 29 ft.
Bottom Elevation: 580.4

Bottom Cap Depth: 30 ft.

Bore Hole Diameter: 8.25 inches

Monitor Well Data Sheet

TEXAS NATURAL RESOURCE
CONSERVATION COMMISSION
MSWD-SE87

F..ittee or Site Name: **Comal County RDF**
County: **Comal County**
Date of Monitor Well Installation: **November 8, 1995**
Monitor Well: Latitude: **29° 44' 24.98"**
Longitude: **98° 01' 57.82"**
Monitor Well Groundwater: Upgradient: **X**
Downgradient:

MSW Permit No.: **66**
Monitor Well I.D. No.: **MW-8** 6
Date of Monitor Well Development: **Pending**
Monitor Well Driller Name: **Mr. John Webb**
License No.: **3023M**

NOTE:
(A) The information shown in the sketch below should be considered the minimum required for an installed ground-water monitor well.
(B) Report All Depths from Surface Elevation and all Elevations relative to Mean Sea Level.
(C) The minimum distance between the inside wall of the Bore Hole and the outside of the Well Casing shall be 3".
(D) Use Flush Screw Joint Casing only. 2" diameter or larger. Recommend 4" diameter minimum & Teflon Taping Casing Joints.
(E) Well development should continue until water is clear, and pH and conductivity are stable.

Geologist, Hydrologist or Engineer Supervising Well Installation: **David Smith**

Static Water Level Elevation (with respect to MSL) after Well Development: **dry**

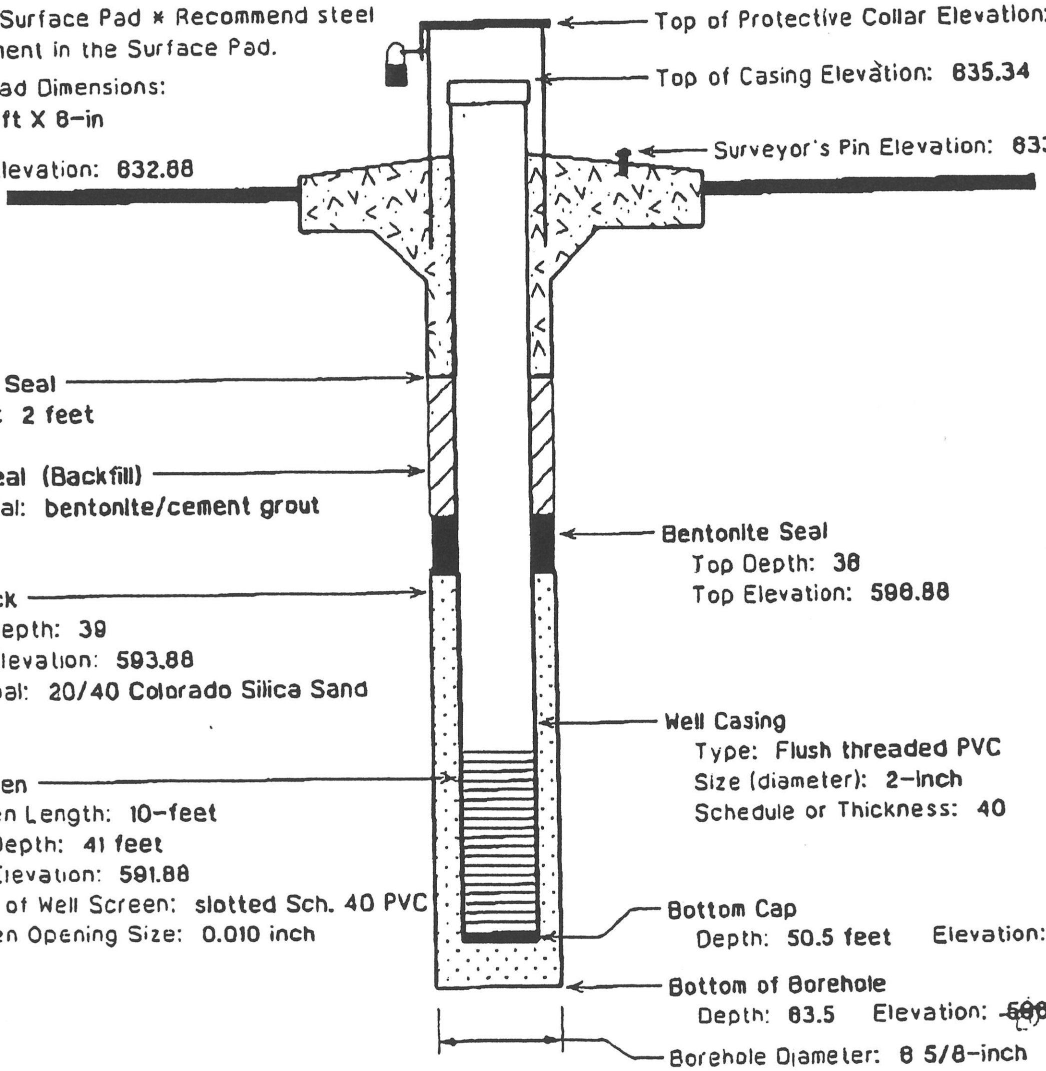
Name of Geologic Formation (s) in which Well is completed: **Navarro Formation**

Type of Locking Device: **Key-lock**

Type of Casing Protection: **4-inch metal protective casing**

Concrete Surface Pad * Recommend steel reinforcement in the Surface Pad.
'ace Pad Dimensions:
: X 8-ft X 8-in

Surface Elevation: **632.88**



Top of Protective Collar Elevation: **635.95**

Top of Casing Elevation: **635.34**

Surveyor's Pin Elevation: **633.28**

Concrete Seal
Depth: **2 feet**

Casing Seal (Backfill)
Material: **bentonite/cement grout**

Bentonite Seal
Top Depth: **36**
Top Elevation: **598.88**

Filter Pack
Top Depth: **39**
Top Elevation: **593.88**
Material: **20/40 Colorado Silica Sand**

Well Casing
Type: **Flush threaded PVC**
Size (diameter): **2-inch**
Schedule or Thickness: **40**

Well Screen
Screen Length: **10-feet**
Top Depth: **41 feet**
Top Elevation: **591.88**
Type of Well Screen: **slotted Sch. 40 PVC**
Screen Opening Size: **0.010 inch**

Bottom Cap
Depth: **50.5 feet** Elevation: **581.38**

Bottom of Borehole
Depth: **63.5** Elevation: ~~588.38~~ 569.38

Borehole Diameter: **8 5/8-inch**

Monitor Well Data Sheet

Permittee or Site Name: WMTX – Mesquite Creek Landfill
County: Comal and Guadalupe
Date of Monitor Well Installation: 03/11/09
Monitor Well Latitude: 29° 44' 10.19" Longitude: 98° 01' 37.49"
Monitor Well Groundwater Gradient Position:
Upgradient ________ Downgradient X

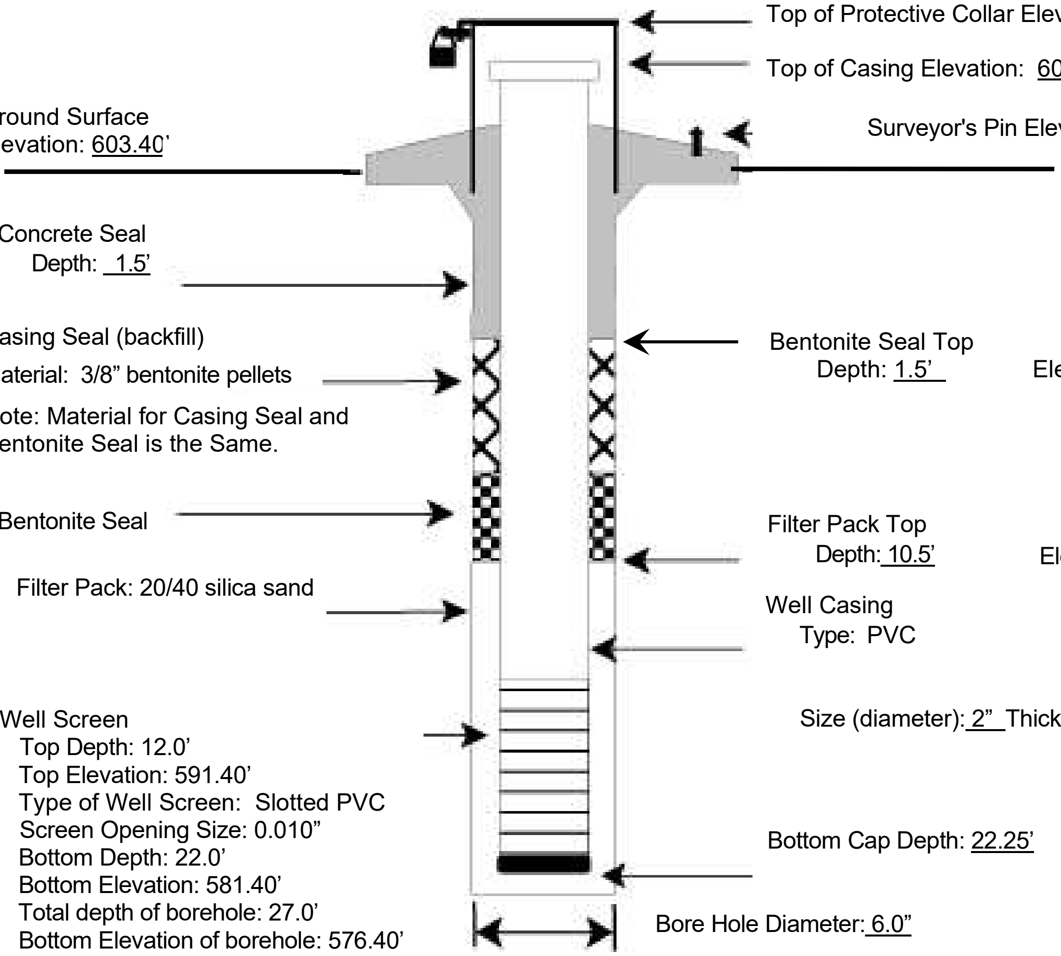
MSW Permit No. MSW-66B
Monitor Well I.D. No.: MW-7A
Date of Monitor Well Development: 04/24/09
Monitor Well Driller
Name: Brian Kern
License No.: 54611M

NOTES:

Report all depths from Surface Elevation and all Elevations relative to Mean Sea Level (MSL), to nearest hundredth of a foot.
Diameter of boring should be at least 4 inches larger than diameter of well casing.
Use flush screw joint casing only, 2-inch diameter or larger, with o-rings or PTFE tape in joints (4-inch diameter recommend).
Well development should continue until water is clear, and pH and conductivity are stable.

Geologist, Hydrologist, or Engineer Supervising Gas Probe Installation: Mohammad Z. Islam, under supervision of Edward B. Dolan, P.G.
Static Water Level Elevation (with respect to MSL) after Well Development: 582.17'
Name of Geologic Formation(s) in which probe is completed: Stratum III of site-specific characterization, which is predominantly Lower Taylor Group oxidized clay or claystone with fractures.

Type of Locking Device: Padlock
Type of Casing Protection: Metal Stick-Up
Concrete Surface Pad Dimensions: 4'x4'x6"



Top of Protective Collar Elevation: 606.73'
Top of Casing Elevation: 606.27'
Ground Surface Elevation: 603.40'
Surveyor's Pin Elevation: N/A
Concrete Seal Depth: 1.5'
Casing Seal (backfill)
Material: 3/8" bentonite pellets
Note: Material for Casing Seal and Bentonite Seal is the Same.
Bentonite Seal Top Depth: 1.5' Elevation: 594.90'
Bentonite Seal
Filter Pack Top Depth: 10.5' Elevation: 592.90'
Filter Pack: 20/40 silica sand
Well Casing Type: PVC
Size (diameter): 2" Thickness: Schedule 40

Well Screen
Top Depth: 12.0'
Top Elevation: 591.40'
Type of Well Screen: Slotted PVC
Screen Opening Size: 0.010"
Bottom Depth: 22.0'
Bottom Elevation: 581.40'
Total depth of borehole: 27.0'
Bottom Elevation of borehole: 576.40'

Bottom Cap Depth: 22.25'
Bore Hole Diameter: 6.0"

Monitor Well Data Sheet

Permittee or Site Name: WMTX – Mesquite Creek Landfill

County: Comal and Guadalupe

Date of Monitor Well Installation: 03/19/09

Monitor Well Latitude: 29° 44’ 16.66” Longitude: 98° 01’ 48.25”

Monitor Well Groundwater Gradient Position:

Upgradient ________ Downgradient X

MSW Permit No. MSW-66B

Monitor Well I.D. No.: MW-8A

Date of Monitor Well Development: 04/24/09

Monitor Well Driller

Name: Brian Kern

License No.: 54611M

NOTES:

Report all depths from Surface Elevation and all Elevations relative to Mean Sea Level (MSL), to nearest hundredth of a foot.

Diameter of boring should be at least 4 inches larger than diameter of well casing.

Use flush screw joint casing only, 2-inch diameter or larger, with o-rings or PTFE tape in joints (4-inch diameter recommend).

Well development should continue until water is clear, and pH and conductivity are stable.

Geologist, Hydrologist, or Engineer Supervising Gas Probe Installation: Mohammad Z. Islam, under supervision of Edward B. Dolan, P.G.

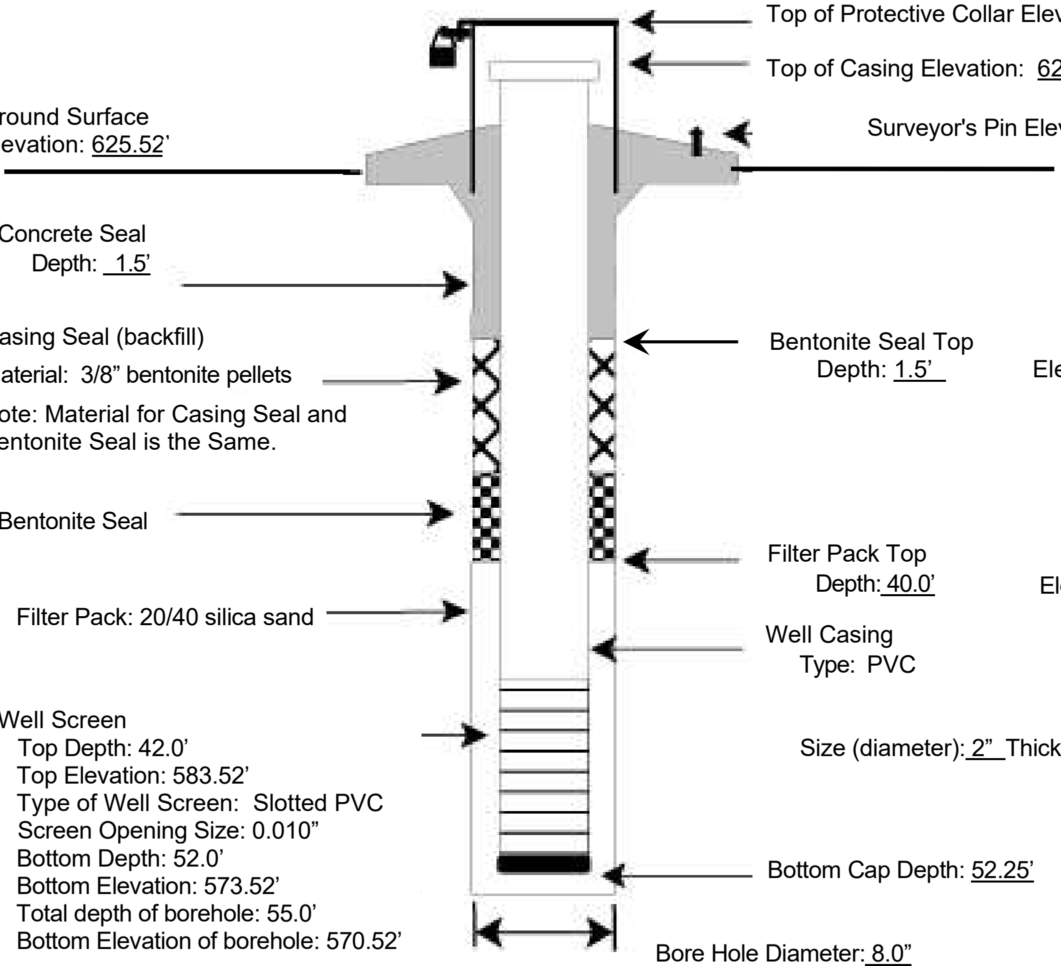
Static Water Level Elevation (with respect to MSL) after Well Development: 573.47’

Name of Geologic Formation(s) in which probe is completed: Stratum III of site-specific characterization, which is predominantly Lower Taylor Group oxidized clay or claystone with fractures.

Type of Locking Device: Padlock

Type of Casing Protection: Metal Stick-Up

Concrete Surface Pad Dimensions: 4’x4’x6”



Top of Protective Collar Elevation: 629.01’

Top of Casing Elevation: 628.52’

Ground Surface Elevation: 625.52’

Surveyor's Pin Elevation: N/A

Concrete Seal Depth: 1.5’

Casing Seal (backfill)
Material: 3/8” bentonite pellets

Note: Material for Casing Seal and Bentonite Seal is the Same.

Bentonite Seal Top
Depth: 1.5’ Elevation: 587.52’

Bentonite Seal

Filter Pack Top
Depth: 40.0’ Elevation: 585.52’

Filter Pack: 20/40 silica sand

Well Casing
Type: PVC

Size (diameter): 2” Thickness: Schedule 40

Well Screen
Top Depth: 42.0’
Top Elevation: 583.52’
Type of Well Screen: Slotted PVC
Screen Opening Size: 0.010”
Bottom Depth: 52.0’
Bottom Elevation: 573.52’
Total depth of borehole: 55.0’
Bottom Elevation of borehole: 570.52’

Bottom Cap Depth: 52.25’

Bore Hole Diameter: 8.0”

Modified from TCEQ-10308

Monitor Well Data Sheet

Permittee or Site Name: WMTX – Mesquite Creek Landfill

County: Comal and Guadalupe

Date of Monitor Well Installation: 03/24/09

Monitor Well Latitude: 29º 44' 20.87" Longitude: 98º 01' 52.70"

Monitor Well Groundwater Gradient Position:

Upgradient ________ Downgradient X

MSW Permit No. MSW-66B

Monitor Well I.D. No.: MW-9

Date of Monitor Well Development: 04/24/09

Monitor Well Driller Name: Brian Kern

License No.: 54611M

NOTES:

Report all depths from Surface Elevation and all Elevations relative to Mean Sea Level (MSL), to nearest hundredth of a foot.

Diameter of boring should be at least 4 inches larger than diameter of well casing.

Use flush screw joint casing only, 2-inch diameter or larger, with o-rings or PTFE tape in joints (4-inch diameter recommend).

Well development should continue until water is clear, and pH and conductivity are stable.

Geologist, Hydrologist, or Engineer Supervising Gas Probe Installation: Mohammad Z. Islam, under supervision of Edward B. Dolan, P.G.

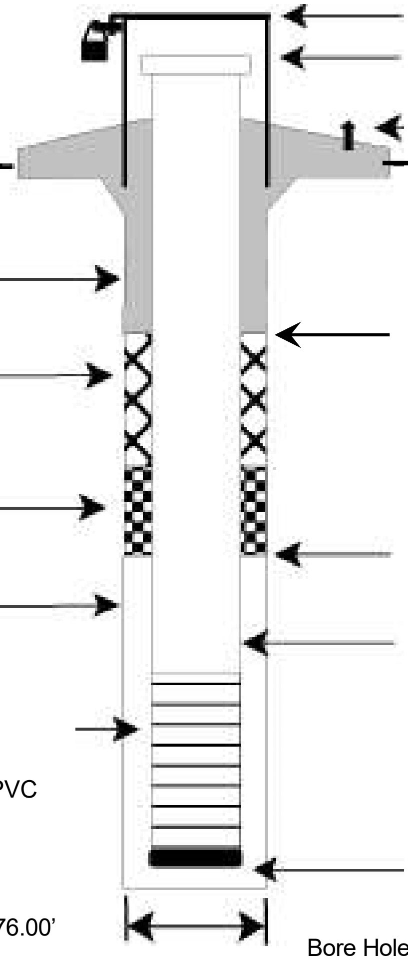
Static Water Level Elevation (with respect to MSL) after Well Development: 580.06'

Name of Geologic Formation(s) in which probe is completed: Stratum III of site-specific characterization, which is predominantly Lower Taylor Group oxidized clay or claystone with fractures.

Type of Locking Device: Padlock

Type of Casing Protection: Metal Stick-Up

Concrete Surface Pad Dimensions: 4'x4'x6"



Top of Protective Collar Elevation: 629.48'

Top of Casing Elevation: 629.06'

Ground Surface Elevation: 626.00'

Surveyor's Pin Elevation: N/A

Concrete Seal Depth: 1.5'

Casing Seal (backfill) Material: 3/8" bentonite pellets

Bentonite Seal Top Depth: 1.5' Elevation: 594.00'

Note: Material for Casing Seal and Bentonite Seal is the Same.

Bentonite Seal

Filter Pack Top Depth: 34.0' Elevation: 592.00'

Filter Pack: 20/40 silica sand

Well Casing Type: PVC

Well Screen

Top Depth: 36.5'

Top Elevation: 589.50'

Type of Well Screen: Slotted PVC

Screen Opening Size: 0.010"

Bottom Depth: 46.5'

Bottom Elevation: 579.50'

Total depth of borehole: 50.0'

Bottom Elevation of borehole: 576.00'

Size (diameter): 2" Thickness: Schedule 40

Bottom Cap Depth: 46.75'

Bore Hole Diameter: 8.0"

Modified from TCEQ-10308

Monitor Well Data Sheet

Permittee or Site Name: WMTX – Mesquite Creek Landfill

County: Comal and Guadalupe

Date of Monitor Well Installation: 11/04/2009

Monitor Well Latitude: 29° 43’ 51” Longitude: 98° 01’ 21”

Northing: 13814602.17 Easting: 2278766.64

Monitor Well Groundwater Gradient Position:

Upgradient ____X____ Downgradient________

Piezometer – Not applicable

MSW Permit No. MSW-66B

Monitor Well I.D. No.: MW-10

Date of Monitor Well Development: 11/06/2009

Monitor Well Driller Name: Brian Kern

License No.: 54611M

NOTES:

Report all depths from Surface Elevation and all Elevations relative to Mean Sea Level (MSL), to nearest hundredth of a foot.

Diameter of boring should be at least 4 inches larger than diameter of well casing.

Use flush screw joint casing only, 2-inch diameter or larger, with o-rings or PTFE tape in joints (4-inch diameter recommend).

Well development should continue until water is clear, and pH and conductivity are stable.

Geologist, Hydrologist, or Engineer Supervising Well Installation: Mohammad Z. Islam, under supervision of Scott M. Graves, P.E.

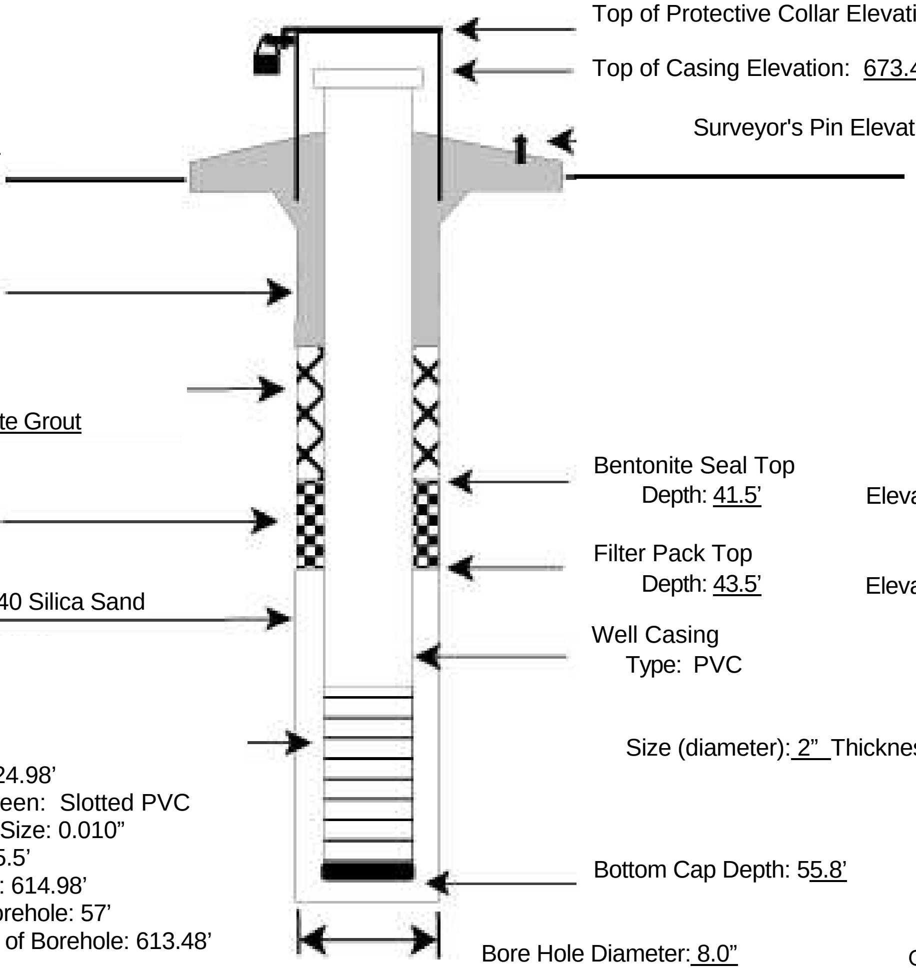
Static Water Level Elevation (with respect to MSL) after Well Development: 615.98’

Name of Geologic Formation(s) in which Well is completed: Stratum III of site-specific characterization, which is predominantly Lower Taylor Group oxidized clay or claystone with fractures.

Type of Locking Device: Padlock

Type of Casing Protection: Metal Stick-Up

Concrete Surface Pad (with steel reinforcement) Dimensions: 4’x4’x6”



Top of Protective Collar Elevation: 673.94’

Top of Casing Elevation: 673.49’

Surveyor's Pin Elevation: N/A

Ground Surface Elevation: 670.48’

Concrete Seal Depth: 1.5’

Casing Seal (backfill) Material: Cement/Bentonite Grout

Bentonite Seal Top Depth: 41.5’ Elevation: 628.98’

Bentonite Seal

Filter Pack Top Depth: 43.5’ Elevation: 626.98’

Filter Pack: 20/40 Silica Sand

Well Casing Type: PVC

Size (diameter): 2” Thickness: Schedule 40

Well Screen
Top Depth: 45.5’
Top Elevation: 624.98’
Type of Well Screen: Slotted PVC
Screen Opening Size: 0.010”
Bottom Depth: 55.5’
Bottom Elevation: 614.98’
Total Depth of Borehole: 57’
Bottom Elevation of Borehole: 613.48’

Bottom Cap Depth: 55.8’

Bore Hole Diameter: 8.0”

Modified from TCEQ-10308

Monitor Well Data Sheet

Permittee or Site Name: WMTX – Mesquite Creek Landfill
County: Comal and Guadalupe
Date of Monitor Well Installation: 03/05/09
Monitor Well Latitude: 29° 43' 45.93" Longitude: 98° 01' 14.55"
Monitor Well Groundwater Gradient Position:
Upgradient X Downgradient

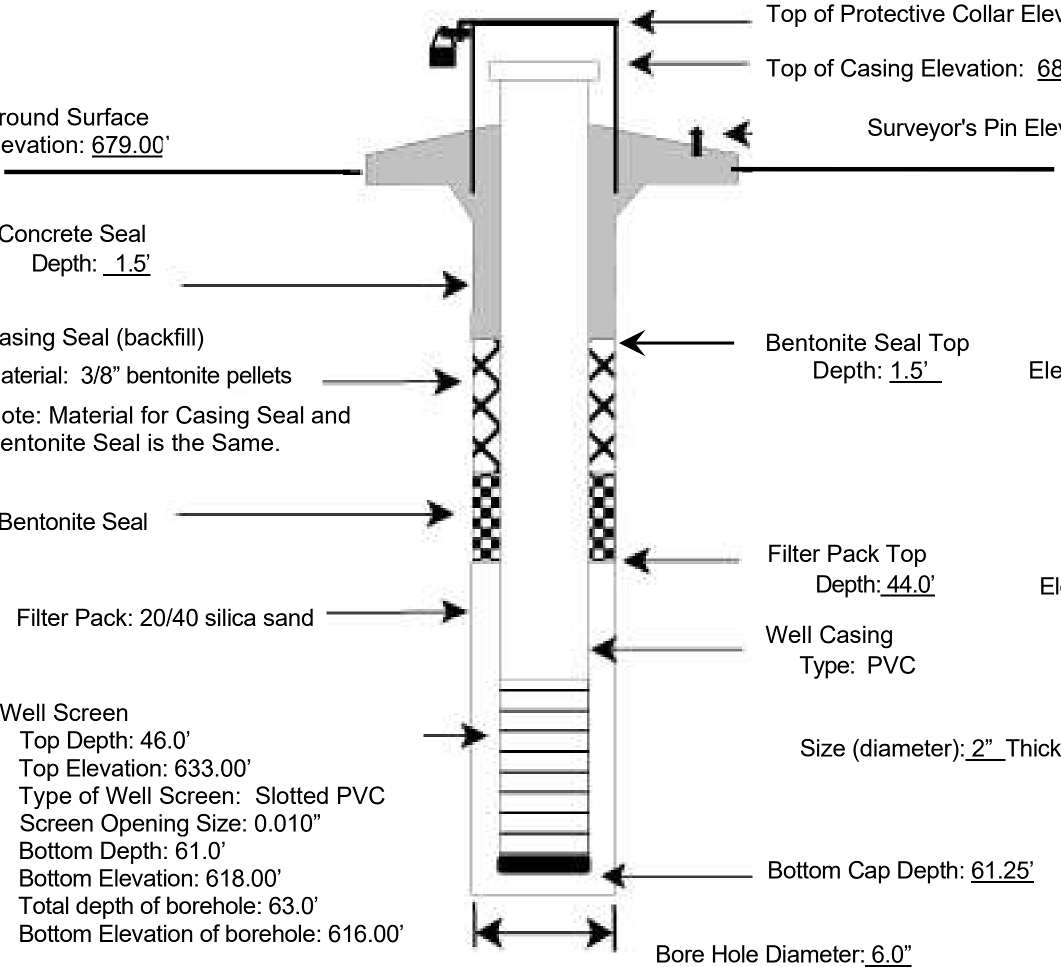
MSW Permit No. MSW-66B
Monitor Well I.D. No.: MW-11
Date of Monitor Well Development: 04/23/09-04/24/09
Monitor Well Driller
Name: Brian Kern
License No.: 54611M

NOTES:

Report all depths from Surface Elevation and all Elevations relative to Mean Sea Level (MSL), to nearest hundredth of a foot.
Diameter of boring should be at least 4 inches larger than diameter of well casing.
Use flush screw joint casing only, 2-inch diameter or larger, with o-rings or PTFE tape in joints (4-inch diameter recommend).
Well development should continue until water is clear, and pH and conductivity are stable.

Geologist, Hydrologist, or Engineer Supervising Gas Probe Installation: Mohammad Z. Islam, under supervision of Edward B. Dolan, P.G.
Static Water Level Elevation (with respect to MSL) after Well Development: 617.79'
Name of Geologic Formation(s) in which probe is completed: Stratum III of site-specific characterization, which is predominantly Lower Taylor Group oxidized clay or claystone with fractures.

Type of Locking Device: Padlock
Type of Casing Protection: Metal Stick-Up
Concrete Surface Pad Dimensions: 4'x4'x6"



Top of Protective Collar Elevation: 682.62'
Top of Casing Elevation: 682.05'
Ground Surface Elevation: 679.00'
Surveyor's Pin Elevation: N/A
Concrete Seal Depth: 1.5'
Casing Seal (backfill)
Material: 3/8" bentonite pellets
Note: Material for Casing Seal and Bentonite Seal is the Same.
Bentonite Seal Top Depth: 1.5' Elevation: 637.00'
Bentonite Seal
Filter Pack Top Depth: 44.0' Elevation: 635.00'
Filter Pack: 20/40 silica sand
Well Casing Type: PVC
Size (diameter): 2" Thickness: Schedule 40

Well Screen
Top Depth: 46.0'
Top Elevation: 633.00'
Type of Well Screen: Slotted PVC
Screen Opening Size: 0.010"
Bottom Depth: 61.0'
Bottom Elevation: 618.00'
Total depth of borehole: 63.0'
Bottom Elevation of borehole: 616.00'

Bottom Cap Depth: 61.25'
Bore Hole Diameter: 6.0"

Monitor Well Data Sheet

Permittee or Site Name: Mesquite Creek Landfill
County: Comal and Guadalupe
Date of Monitor Well Installation: 5/23/2018
Monitor Well Latitude: -98.018257 Longitude: 29.728313
Monitor Well Groundwater Gradient Position:
Upgradient ______ Downgradient X

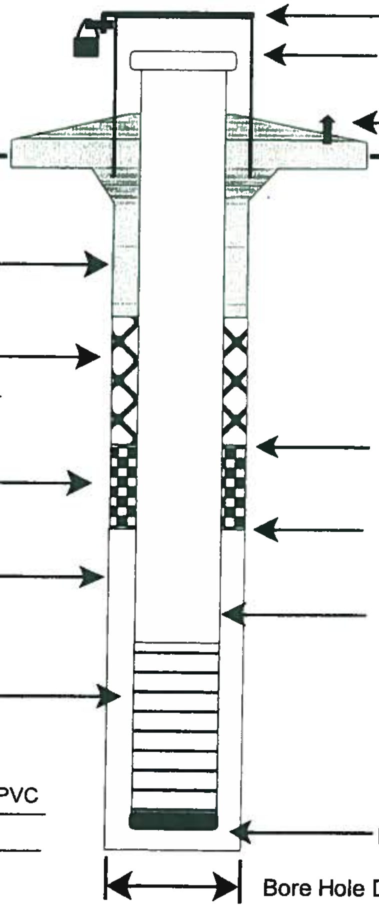
MSW Permit No.: 66B
Monitor Well I.D. No.: MW-12
Date of Monitor Well Development: On-going
Monitor Well Driller Name: Jim Neal
License No.: 4868 MPKT

NOTES:

- Report all depths from Surface Elevation and all Elevations relative to Mean Sea Level (MSL), to nearest hundredth of a foot.
- Diameter of boring should be at least 4 inches larger than diameter of well casing.
- Use flush screw joint casing only, 2-inch diameter or larger, with o-rings or PTFE tape in joints (4-inch diameter recommend).
- Well development should continue until water is clear, and pH and conductivity are stable.

Geologist, Hydrologist, or Engineer Supervising Well Installation: Christian M. Llull, P.G. # 5884
Static Water Level Elevation (with respect to MSL) after Well Development: Dry @ completion
Name of Geologic Formation(s) in which Well is completed: Lower Taylor Group (Predominantly Site-Specific Stratum III)

Type of Locking Device: Padlock
Type of Casing Protection: Anodized Aluminum
Concrete Surface Pad (with steel reinforcement) Dimensions: 4' x 4' x 6"



Top of Protective Collar Elevation: 712.27'
Top of Casing Elevation: 712.22'
Surface Elevation: 709.31'
Surveyor's Pin Elevation: 709.54'

STATE OF TEXAS
CHRISTIAN M. LLULL
GEOLOGY
No. 5884
LICENSED PROFESSIONAL GEOSCIENTIST

7-13-18

Concrete Seal Depth: 2'
Casing Seal (backfill) Material: Cement Bentonite Grout
Bentonite Seal
Bentonite Seal Top Depth: 59.5' Elevation: 649.81'
Filter Pack Top Depth: 61.5' Elevation: 647.81'
Filter Pack
Filter Pack Material: 20/40 Sand
Well Casing
Type: PVC, FJT
Size (diameter): 2"
Schedule or Thickness: Sch. 40
Well Screen
Top Depth: 63.5'
Top Elevation: 645.81'
Type of Well Screen: 2" Sch. 40 PVC
Screen Opening Size: 0.010"
Bottom Depth: 73.5'
Bottom Elevation: 635.81'
Bottom Cap Depth: 73.8'
Bore Hole Diameter: 8"

TCEQ-10308

Monitor Well Data Sheet

Permittee or Site Name: Mesquite Creek Landfill
County: Comal and Guadalupe
Date of Monitor Well Installation: 4/10/2018
Monitor Well Latitude: -98.01007379 Longitude: 29.43457739
Monitor Well Groundwater Gradient Position:
Upgradient ____ Downgradient X

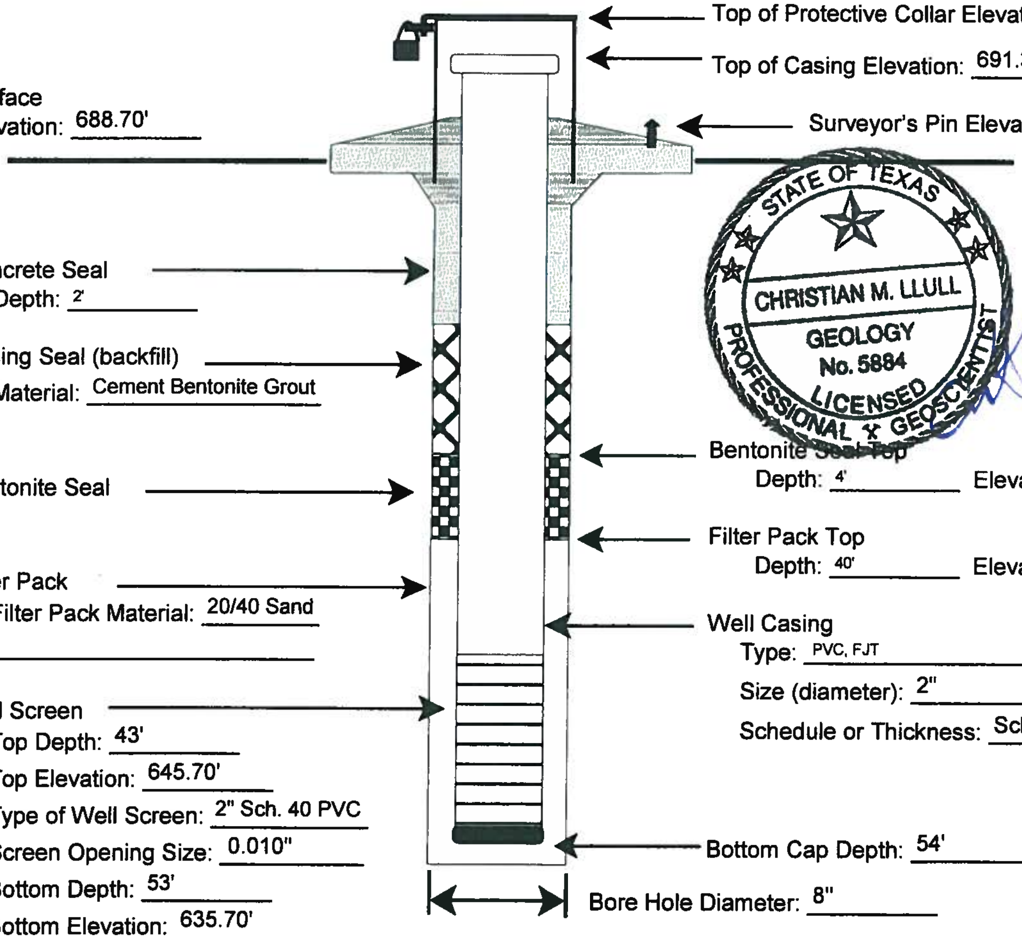
MSW Permit No.: 66B
Monitor Well I.D. No.: MW-13
Date of Monitor Well Development: Dry @ completion
Monitor Well Driller Name: Jim Neal
License No.: 4868 MPKT

NOTES:

- Report all depths from Surface Elevation and all Elevations relative to Mean Sea Level (MSL), to nearest hundredth of a foot.
- Diameter of boring should be at least 4 inches larger than diameter of well casing.
- Use flush screw joint casing only, 2-inch diameter or larger, with o-rings or PTFE tape in joints (4-inch diameter recommend).
- Well development should continue until water is clear, and pH and conductivity are stable.

Geologist, Hydrologist, or Engineer Supervising Well Installation: Christian M. Llull, P.G. # 5884
Static Water Level Elevation (with respect to MSL) after Well Development: Dry @ 24 Hours
Name of Geologic Formation(s) in which Well is completed: Lower Taylor Group (Predominantly Site-Specific Stratum III)

Type of Locking Device: Padlock
Type of Casing Protection: Anodized Aluminum
Concrete Surface Pad (with steel reinforcement) Dimensions: 4' x 4' x 6"



Top of Protective Collar Elevation: 691.58'
Top of Casing Elevation: 691.38'
Surface Elevation: 688.70'
Surveyor's Pin Elevation: 688.80'

CHRISTIAN M. LLULL
GEOLOGY
No. 5884

6/6/18

Concrete Seal Depth: 2'
Casing Seal (backfill) Material: Cement Bentonite Grout
Bentonite Seal
Bentonite Seal Top Depth: 4' Elevation: 684.70'
Filter Pack Top Depth: 40' Elevation: 648.70'
Filter Pack
Filter Pack Material: 20/40 Sand
Well Casing
Type: PVC, FJT
Size (diameter): 2"
Schedule or Thickness: Sch. 40
Well Screen
Top Depth: 43'
Top Elevation: 645.70'
Type of Well Screen: 2" Sch. 40 PVC
Screen Opening Size: 0.010"
Bottom Depth: 53'
Bottom Elevation: 635.70'
Bottom Cap Depth: 54'
Bore Hole Diameter: 8"

Monitor Well Data Sheet

Permittee or Site Name: Mesquite Creek Landfill
County: Comal and Guadalupe
Date of Monitor Well Installation: 4/10/2018
Monitor Well Latitude: -98.0056449 Longitude: 29.43502577
Monitor Well Groundwater Gradient Position:
Upgradient ____ Downgradient X

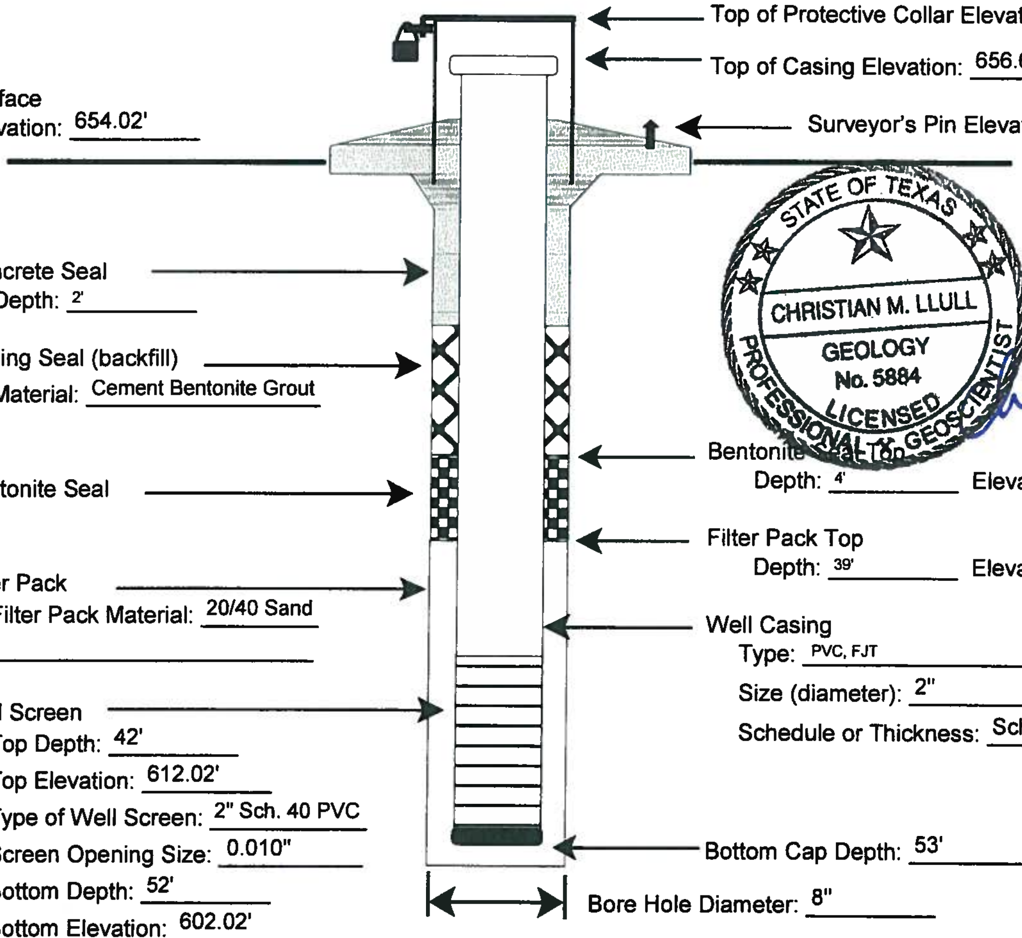
MSW Permit No.: 66B
Monitor Well I.D. No.: MW-14
Date of Monitor Well Development: Dry @ completion
Monitor Well Driller Name: Jim Neal
License No.: 4868 MPKT

NOTES:

- Report all depths from Surface Elevation and all Elevations relative to Mean Sea Level (MSL), to nearest hundredth of a foot.
- Diameter of boring should be at least 4 inches larger than diameter of well casing.
- Use flush screw joint casing only, 2-inch diameter or larger, with o-rings or PTFE tape in joints (4-inch diameter recommend).
- Well development should continue until water is clear, and pH and conductivity are stable.

Geologist, Hydrologist, or Engineer Supervising Well Installation: Christian M. Llull, P.G. # 5884
Static Water Level Elevation (with respect to MSL) after Well Development: Dry @ 24 hours
Name of Geologic Formation(s) in which Well is completed: Lower Taylor Group (Predominantly Site-Specific Stratum III)

Type of Locking Device: Padlock
Type of Casing Protection: Anodized Aluminum
Concrete Surface Pad (with steel reinforcement) Dimensions: 4' x 4' x 6"



Top of Protective Collar Elevation: 656.89'
Top of Casing Elevation: 656.69'
Surface Elevation: 654.02'
Surveyor's Pin Elevation: 654.02'
Concrete Seal Depth: 2'
Casing Seal (backfill) Material: Cement Bentonite Grout
Bentonite Seal
Bentonite Seal Top Depth: 4' Elevation: 650.02'
Filter Pack Top Depth: 39' Elevation: 615.02'
Filter Pack
Filter Pack Material: 20/40 Sand
Well Casing Type: PVC, FJT
Size (diameter): 2"
Schedule or Thickness: Sch. 40
Well Screen
Top Depth: 42'
Top Elevation: 612.02'
Type of Well Screen: 2" Sch. 40 PVC
Screen Opening Size: 0.010"
Bottom Depth: 52'
Bottom Elevation: 602.02'
Bottom Cap Depth: 53'
Bore Hole Diameter: 8"

STATE OF TEXAS
CHRISTIAN M. LLULL
GEOLOGY
No. 5884
LICENSED
PROFESSIONAL GEOSCIENTIST

6/6/18

Monitor Well Data Sheet

Permittee or Site Name: Mesquite Creek Landfill

County: Comal and Guadalupe

Date of Monitor Well Installation: 4/11/2018

Monitor Well Latitude: -98.00564535 Longitude: 29.43557832

Monitor Well Groundwater Gradient Position:

Upgradient ______ Downgradient X

MSW Permit No.: 66B

Monitor Well I.D. No.: MW-15

Date of Monitor Well Development: On-going

Monitor Well Driller Name: Jim Neal

License No.: 4868 MPKT

NOTES:

- Report all depths from Surface Elevation and all Elevations relative to Mean Sea Level (MSL), to nearest hundredth of a foot.
- Diameter of boring should be at least 4 inches larger than diameter of well casing.
- Use flush screw joint casing only, 2-inch diameter or larger, with o-rings or PTFE tape in joints (4-inch diameter recommend).
- Well development should continue until water is clear, and pH and conductivity are stable.

Geologist, Hydrologist, or Engineer Supervising Well Installation: Christian M. Llull, P.G. # 5884

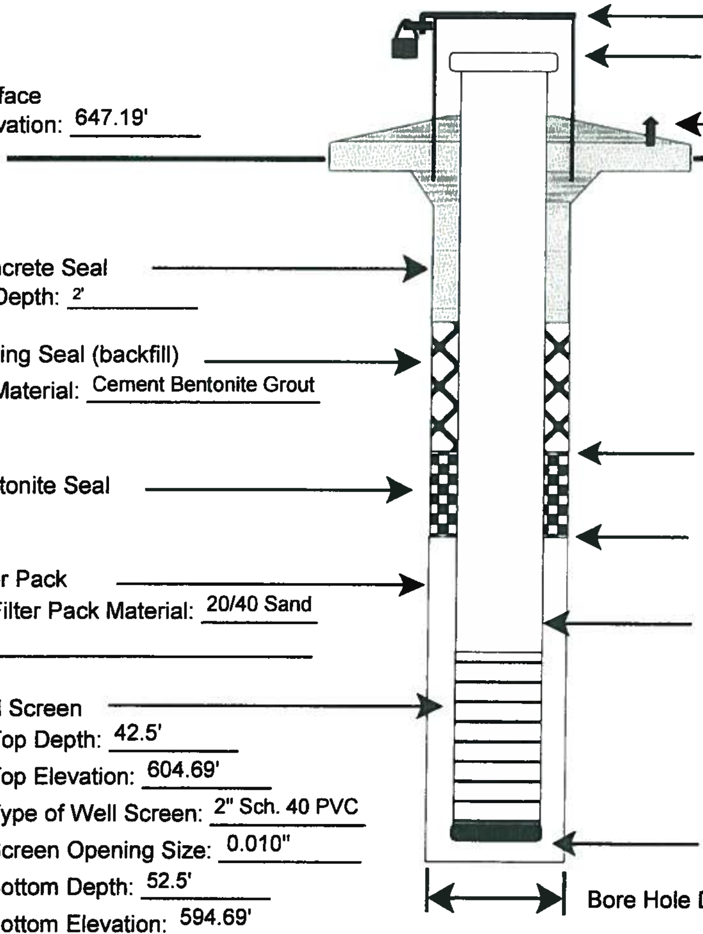
Static Water Level Elevation (with respect to MSL) after Well Development: 599.64' MSL @ 24 Hours

Name of Geologic Formation(s) in which Well is completed: Lower Taylor Group (Predominantly Site-Specific Stratum III)

Type of Locking Device: Padlock

Type of Casing Protection: Anodized Aluminum

Concrete Surface Pad (with steel reinforcement) Dimensions: 4' x 4' x 6"



Top of Protective Collar Elevation: 650.47'

Top of Casing Elevation: 650.24'

Surface Elevation: 647.19'

Surveyor's Pin Elevation: 647.47'

Concrete Seal Depth: 2'

Casing Seal (backfill) Material: Cement Bentonite Grout

Bentonite Seal

Bentonite Seal Top Depth: 4' Elevation: 643.19'

Filter Pack Top Depth: 39' Elevation: 608.19'

Filter Pack

Filter Pack Material: 20/40 Sand

Well Casing

Type: PVC, FJT

Size (diameter): 2"

Schedule or Thickness: Sch. 40

Well Screen

Top Depth: 42.5'

Top Elevation: 604.69'

Type of Well Screen: 2" Sch. 40 PVC

Screen Opening Size: 0.010"

Bottom Depth: 52.5'

Bottom Elevation: 594.69'

Bottom Cap Depth: 53.5'

Bore Hole Diameter: 8"

STATE OF TEXAS
CHRISTIAN M. LLULL
GEOLOGY
No. 5884
LICENSED
PROFESSIONAL GEOSCIENTIST

6/6/18

Piezometer Data Sheet

Permittee or Site Name: WMTX – Mesquite Creek Landfill

County: Guadalupe

Date of Monitor Well Installation: 01/21/05

Monitor Well Latitude: 29 44' 01.27" Longitude: 98 00' 56.65"

Northing: 13815626.49 Easting: 2280863.47

Monitor Well Groundwater Gradient Position:

Upgradient ______ ______Downgradient __X

Piezometer – Not applicable

MSW Permit No. 66B

Monitor Well I.D. No.: GB-15 / MW-16

Date of Monitor Well Development: 02/08/05-02/09/05

Monitor Well Driller Name: GeoProjects/ Jose Landeros

License No.: 2551W

NOTES:

Report all depths from Surface Elevation and all Elevations relative to Mean Sea Level (MSL), to nearest hundredth of a foot.

Diameter of boring should be at least 4 inches larger than diameter of well casing.

Use flush screw joint casing only, 2-inch diameter or larger, with o-rings or PTFE tape in joints (4-inch diameter recommend).

Well development should continue until water is clear, and pH and conductivity are stable.

Geologist, Hydrologist, or Engineer Supervising Well Installation: Ed Dolan

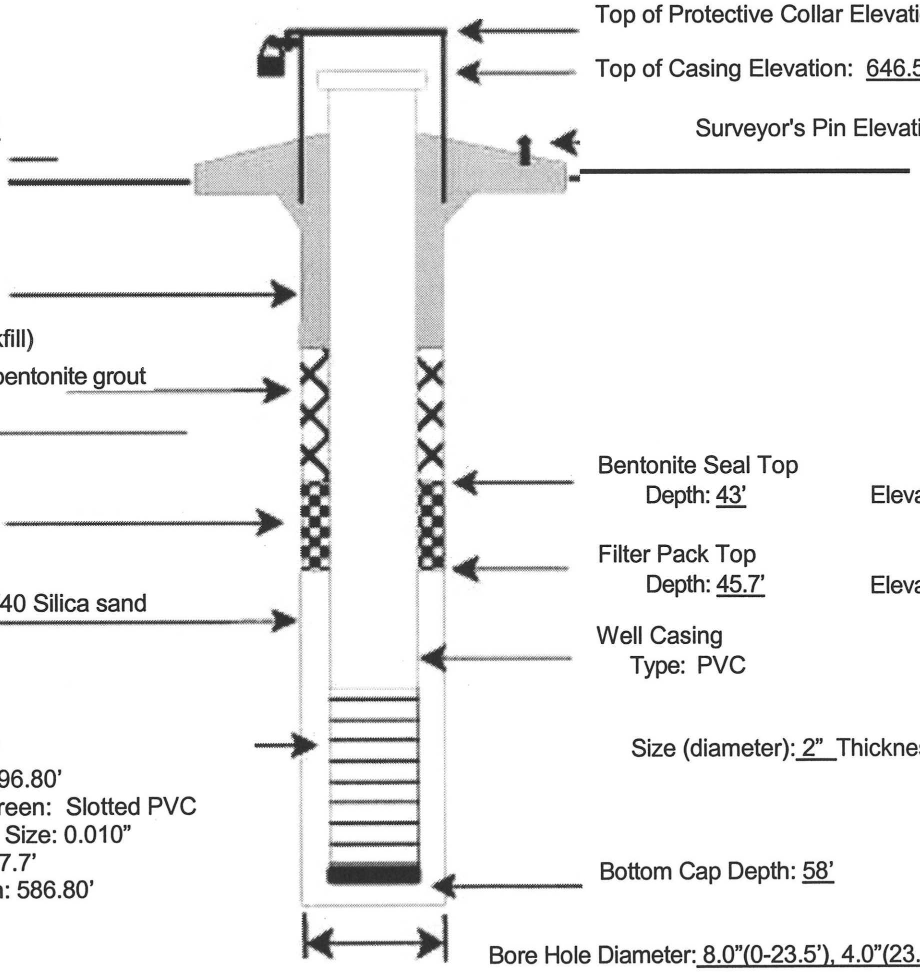
Static Water Level Elevation (with respect to MSL) after Well Development: 638.49'

Name of Geologic Formation(s) in which Well is completed: Lower Taylor Group (Stratum III of site-specific characterization)

Type of Locking Device: Padlock

Type of Casing Protection: Metal Stick-Up

Concrete Surface Pad (with steel reinforcement) Dimensions: 4'x4'



Top of Protective Collar Elevation: 646.86'

Top of Casing Elevation: 646.53'

Surface Elevation: 643.39'

Surveyor's Pin Elevation: N/A

Concrete Seal Depth: 2'

Casing Seal (backfill) Material: cement/bentonite grout

Bentonite Seal

Bentonite Seal Top Depth: 43' Elevation: 600.39'

Filter Pack: 20/40 Silica sand

Filter Pack Top Depth: 45.7' Elevation: 597.69'

Well Casing Type: PVC

Size (diameter): 2" Thickness: Schedule 40

Well Screen
Top Depth: 47.7'
Top Elevation: 596.80'
Type of Well Screen: Slotted PVC
Screen Opening Size: 0.010"
Bottom Depth: 57.7'
Bottom Elevation: 586.80'

Bottom Cap Depth: 58'

Bore Hole Diameter: 8.0"(0-23.5'), 4.0"(23.5-144')

Monitor Well Data Sheet

Permittee or Site Name: Mesquite Creek Landfill
County: Comal and Guadalupe
Date of Monitor Well Installation: 1/25/16
Monitor Well Latitude: 29.734310 Longitude: -98.017410
Monitor Well Groundwater Gradient Position:
Upgradient ____ Downgradient X

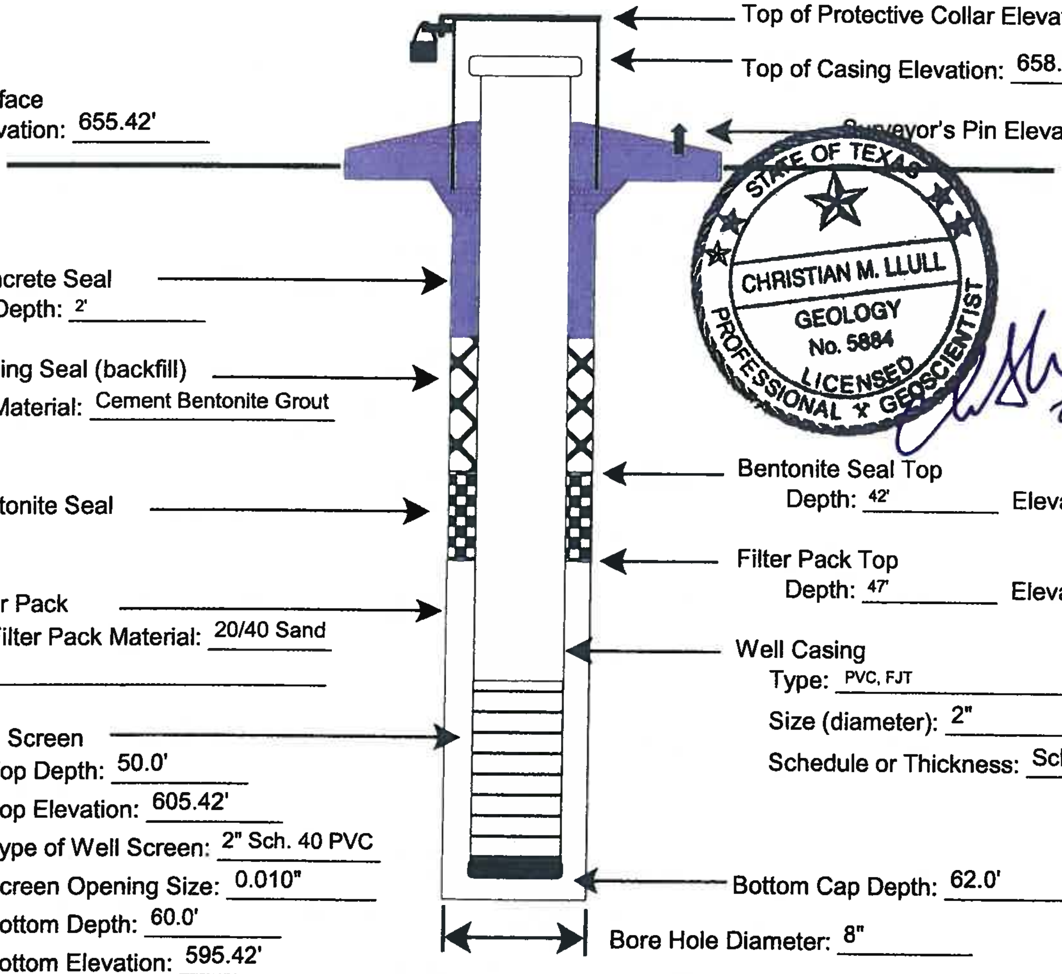
MSW Permit No.: 66B
Monitor Well I.D. No.: MW-17
Date of Monitor Well Development: Dry @ Completion
Monitor Well Driller Name: Jim Neal
License No.: 4868 WKPT

NOTES:

- Report all depths from Surface Elevation and all Elevations relative to Mean Sea Level (MSL), to nearest hundredth of a foot.
- Diameter of boring should be at least 4 inches larger than diameter of well casing.
- Use flush screw joint casing only, 2-inch diameter or larger, with o-rings or PTFE tape in joints (4-inch diameter recommend).
- Well development should continue until water is clear, and pH and conductivity are stable.

Geologist, Hydrologist, or Engineer Supervising Well Installation: Christian M. Llull, P.G. # 5884
Static Water Level Elevation (with respect to MSL) after Well Development: Dry @ Completion
Name of Geologic Formation(s) in which Well is completed: Lower Taylor Group

Type of Locking Device: Padlock
Type of Casing Protection: Anodized Aluminum
Concrete Surface Pad (with steel reinforcement) Dimensions: 4' x 4' x 6"



Top of Protective Collar Elevation: 659.05'
Top of Casing Elevation: 658.69'
Surface Elevation: 655.42'
Surveyor's Pin Elevation: 655.95
Concrete Seal Depth: 2'
Casing Seal (backfill) Material: Cement Bentonite Grout
Bentonite Seal
Bentonite Seal Top Depth: 42' Elevation: 613.42'
Filter Pack Top Depth: 47' Elevation: 608.42'
Filter Pack
Filter Pack Material: 20/40 Sand
Well Casing
Type: PVC, FJT
Size (diameter): 2"
Schedule or Thickness: Sch. 40
Well Screen
Top Depth: 50.0'
Top Elevation: 605.42'
Type of Well Screen: 2" Sch. 40 PVC
Screen Opening Size: 0.010"
Bottom Depth: 60.0'
Bottom Elevation: 595.42'
Bottom Cap Depth: 62.0'
Bore Hole Diameter: 8"

STATE OF TEXAS
CHRISTIAN M. LLULL
GEOLOGY
No. 5884
LICENSED
PROFESSIONAL GEOSCIENTIST

2-26-16

Monitor Well Data Sheet

Permittee or Site Name: WMTX – Mesquite Creek Landfill

County: Comal and Guadalupe

Date of Monitor Well Installation: 03/18/09

Monitor Well Latitude: 29° 44' 04.92" Longitude: 98° 01' 09.29"

Monitor Well Groundwater Gradient Position:

Upgradient ______ Downgradient X

MSW Permit No. MSW-66B

Monitor Well I.D. No.: MW-18

Date of Monitor Well Development: 04/23/09

Monitor Well Driller

Name: Brian Kern

License No.: 54611M

NOTES:

Report all depths from Surface Elevation and all Elevations relative to Mean Sea Level (MSL), to nearest hundredth of a foot.

Diameter of boring should be at least 4 inches larger than diameter of well casing.

Use flush screw joint casing only, 2-inch diameter or larger, with o-rings or PTFE tape in joints (4-inch diameter recommend).

Well development should continue until water is clear, and pH and conductivity are stable.

Geologist, Hydrologist, or Engineer Supervising Gas Probe Installation: Mohammad Z. Islam, under supervision of Edward B. Dolan, P.G.

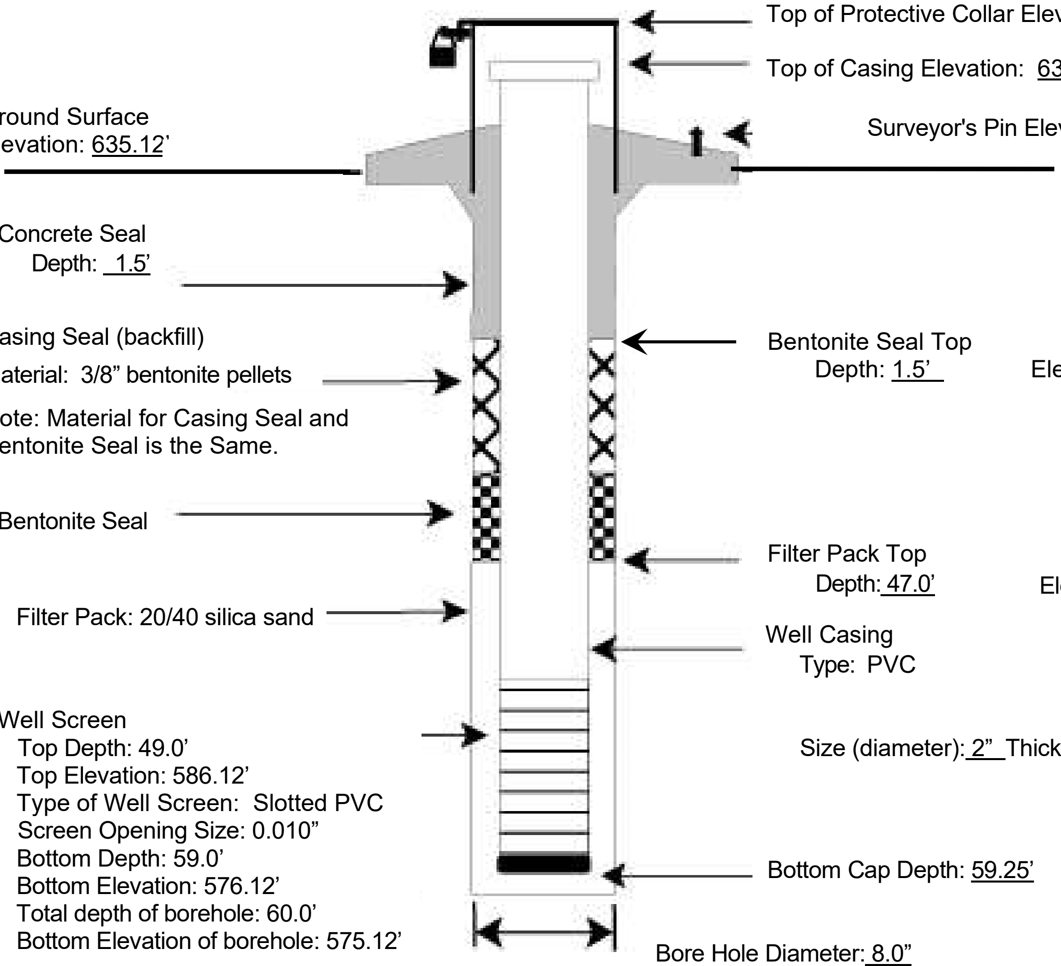
Static Water Level Elevation (with respect to MSL) after Well Development: 576.75'

Name of Geologic Formation(s) in which probe is completed: Stratum III of site-specific characterization, which is predominantly Lower Taylor Group oxidized clay or claystone with fractures.

Type of Locking Device: Padlock

Type of Casing Protection: Metal Stick-Up

Concrete Surface Pad Dimensions: 4'x4'x6"



Top of Protective Collar Elevation: 638.68'

Top of Casing Elevation: 638.16'

Ground Surface Elevation: 635.12'

Surveyor's Pin Elevation: N/A

Concrete Seal Depth: 1.5'

Casing Seal (backfill)

Material: 3/8" bentonite pellets

Note: Material for Casing Seal and Bentonite Seal is the Same.

Bentonite Seal Top Depth: 1.5' Elevation: 590.12'

Bentonite Seal

Filter Pack Top Depth: 47.0' Elevation: 588.12'

Filter Pack: 20/40 silica sand

Well Casing Type: PVC

Size (diameter): 2" Thickness: Schedule 40

Well Screen

Top Depth: 49.0'

Top Elevation: 586.12'

Type of Well Screen: Slotted PVC

Screen Opening Size: 0.010"

Bottom Depth: 59.0'

Bottom Elevation: 576.12'

Total depth of borehole: 60.0'

Bottom Elevation of borehole: 575.12'

Bottom Cap Depth: 59.25'

Bore Hole Diameter: 8.0"

Monitor Well Data Sheet

Permittee or Site Name: WMTX – Mesquite Creek Landfill

County: Comal and Guadalupe

Date of Monitor Well Installation: 03/02/09

Monitor Well Latitude: 29º 44' 06.75" Longitude: 98º 01' 15.26"

Monitor Well Groundwater Gradient Position:

Upgradient ______ Downgradient X

MSW Permit No. MSW-66B

Monitor Well I.D. No.: MW-19

Date of Monitor Well Development: 04/23/09

Monitor Well Driller

Name: Brian Kern

License No.: 54611M

NOTES:

Report all depths from Surface Elevation and all Elevations relative to Mean Sea Level (MSL), to nearest hundredth of a foot.

Diameter of boring should be at least 4 inches larger than diameter of well casing.

Use flush screw joint casing only, 2-inch diameter or larger, with o-rings or PTFE tape in joints (4-inch diameter recommend).

Well development should continue until water is clear, and pH and conductivity are stable.

Geologist, Hydrologist, or Engineer Supervising Gas Probe Installation: Mohammad Z. Islam, under supervision of Edward B. Dolan, P.G.

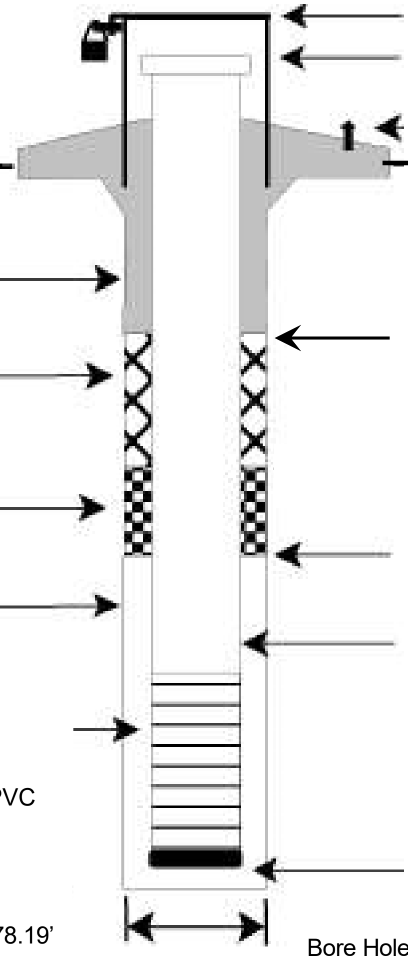
Static Water Level Elevation (with respect to MSL) after Well Development: 579.63'

Name of Geologic Formation(s) in which probe is completed: Stratum III of site-specific characterization, which is predominantly Lower Taylor Group oxidized clay or claystone with fractures.

Type of Locking Device: Padlock

Type of Casing Protection: Metal Stick-Up

Concrete Surface Pad Dimensions: 4'x4'x6"



Top of Protective Collar Elevation: 636.58'

Top of Casing Elevation: 636.29'

Ground Surface Elevation: 633.19'

Surveyor's Pin Elevation: N/A

Concrete Seal Depth: 1.5'

Casing Seal (backfill) Material: 3/8" bentonite pellets

Note: Material for Casing Seal and Bentonite Seal is the Same.

Bentonite Seal Top Depth: 1.5' Elevation: 602.19'

Bentonite Seal

Filter Pack Top Depth: 33.0' Elevation: 600.19'

Filter Pack: 20/40 silica sand

Well Casing Type: PVC

Size (diameter): 2" Thickness: Schedule 40

Well Screen
Top Depth: 34.5'
Top Elevation: 598.69'
Type of Well Screen: Slotted PVC
Screen Opening Size: 0.010"
Bottom Depth: 54.5'
Bottom Elevation: 578.69'
Total depth of borehole: 55.0'
Bottom Elevation of borehole: 578.19'

Bottom Cap Depth: 54.75'

Bore Hole Diameter: 8.0"

Monitor Well Data Sheet

Permittee or Site Name: WMTX – Mesquite Creek Landfill

County: Comal and Guadalupe

Date of Monitor Well Installation: 03/03/09

Monitor Well Latitude: 29° 44' 10.92" Longitude: 98° 01' 20.15"

Monitor Well Groundwater Gradient Position:

Upgradient ________ Downgradient __X_____

MSW Permit No. MSW-66B

Monitor Well I.D. No.: MW-20

Date of Monitor Well Development: 04/23/09

Monitor Well Driller

Name: Brian Kern

License No.: 54611M

NOTES:

Report all depths from Surface Elevation and all Elevations relative to Mean Sea Level (MSL), to nearest hundredth of a foot.

Diameter of boring should be at least 4 inches larger than diameter of well casing.

Use flush screw joint casing only, 2-inch diameter or larger, with o-rings or PTFE tape in joints (4-inch diameter recommend).

Well development should continue until water is clear, and pH and conductivity are stable.

Geologist, Hydrologist, or Engineer Supervising Gas Probe Installation: Mohammad Z. Islam, under supervision of Edward B. Dolan, P.G.

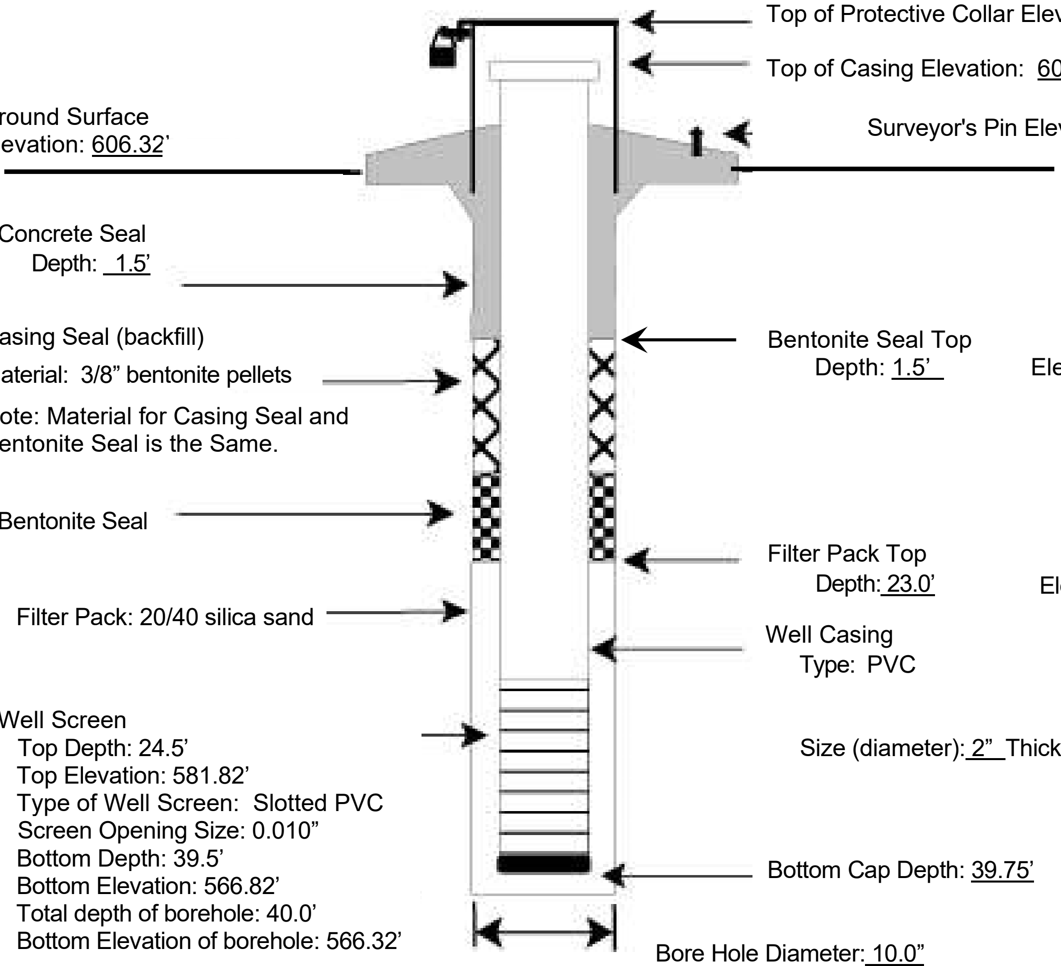
Static Water Level Elevation (with respect to MSL) after Well Development: 575.33'

Name of Geologic Formation(s) in which probe is completed: Stratum III of site-specific characterization, which is predominantly Lower Taylor Group oxidized clay or claystone with fractures.

Type of Locking Device: Padlock

Type of Casing Protection: Metal Stick-Up

Concrete Surface Pad Dimensions: 4'x4'x6"



Top of Protective Collar Elevation: 609.89'

Top of Casing Elevation: 609.47'

Ground Surface Elevation: 606.32'

Surveyor's Pin Elevation: N/A

Concrete Seal Depth: 1.5'

Casing Seal (backfill)

Material: 3/8" bentonite pellets

Note: Material for Casing Seal and Bentonite Seal is the Same.

Bentonite Seal Top Depth: 1.5' Elevation: 585.32'

Bentonite Seal

Filter Pack Top Depth: 23.0' Elevation: 583.32'

Filter Pack: 20/40 silica sand

Well Casing Type: PVC

Size (diameter): 2" Thickness: Schedule 40

Well Screen

Top Depth: 24.5'

Top Elevation: 581.82'

Type of Well Screen: Slotted PVC

Screen Opening Size: 0.010"

Bottom Depth: 39.5'

Bottom Elevation: 566.82'

Total depth of borehole: 40.0'

Bottom Elevation of borehole: 566.32'

Bottom Cap Depth: 39.75'

Bore Hole Diameter: 10.0"

Monitor Well Data Sheet

Permittee or Site Name: WMTX – Mesquite Creek Landfill
County: Comal and Guadalupe
Date of Monitor Well Installation: 03/10/09
Monitor Well Latitude: 29º 44' 09.93" Longitude: 98º 01' 24.99"
Monitor Well Groundwater Gradient Position:
Upgradient ____ Downgradient X

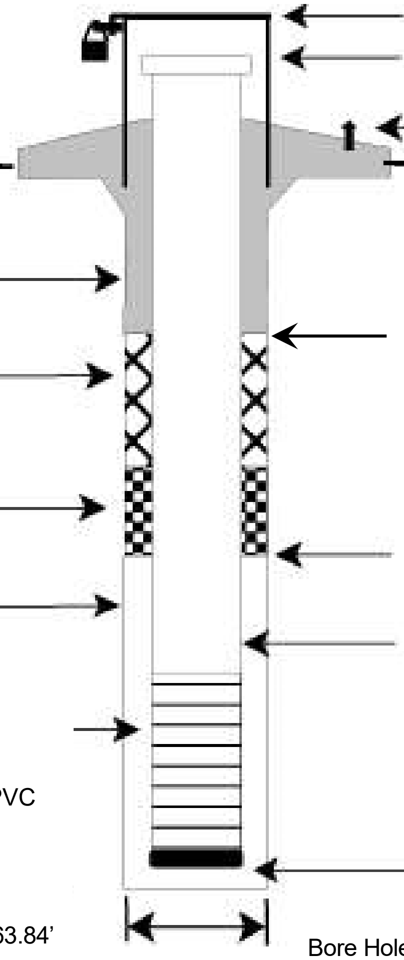
MSW Permit No. MSW-66B
Monitor Well I.D. No.: MW-21
Date of Monitor Well Development: 04/24/09
Monitor Well Driller
Name: Brian Kern
License No.: 54611M

NOTES:

Report all depths from Surface Elevation and all Elevations relative to Mean Sea Level (MSL), to nearest hundredth of a foot.
Diameter of boring should be at least 4 inches larger than diameter of well casing.
Use flush screw joint casing only, 2-inch diameter or larger, with o-rings or PTFE tape in joints (4-inch diameter recommend).
Well development should continue until water is clear, and pH and conductivity are stable.

Geologist, Hydrologist, or Engineer Supervising Gas Probe Installation: Mohammad Z. Islam, under supervision of Edward B. Dolan, P.G.
Static Water Level Elevation (with respect to MSL) after Well Development: 564.73'
Name of Geologic Formation(s) in which probe is completed: Stratum III of site-specific characterization, which is predominantly Lower Taylor Group oxidized clay or claystone with fractures.

Type of Locking Device: Padlock
Type of Casing Protection: Metal Stick-Up
Concrete Surface Pad Dimensions: 4'x4'x6"



Top of Protective Collar Elevation: 610.15'
Top of Casing Elevation: 609.58'
Ground Surface Elevation: 606.84'
Surveyor's Pin Elevation: N/A
Concrete Seal Depth: 1.5'
Casing Seal (backfill)
Material: 3/8" bentonite pellets
Note: Material for Casing Seal and Bentonite Seal is the Same.
Bentonite Seal Top Depth: 1.5' Elevation: 577.84'
Bentonite Seal
Filter Pack Top Depth: 31' Elevation: 575.84'
Filter Pack: 20/40 silica sand
Well Casing Type: PVC
Size (diameter): 2" Thickness: Schedule 40

Well Screen
Top Depth: 32.5'
Top Elevation: 574.34'
Type of Well Screen: Slotted PVC
Screen Opening Size: 0.010"
Bottom Depth: 42.5'
Bottom Elevation: 564.34'
Total depth of borehole: 43'
Bottom Elevation of borehole: 563.84'

Bottom Cap Depth: 42.75'
Bore Hole Diameter: 6.0"

Modified from TCEQ-10308

Monitor Well Data Sheet

Permittee or Site Name: WMTX – Mesquite Creek Landfill
County: Comal and Guadalupe
Date of Monitor Well Installation: 03/10/09
Monitor Well Latitude: 29° 44’ 06.31” Longitude: 98° 01’ 28.15”
Monitor Well Groundwater Gradient Position:
Upgradient ______ Downgradient X

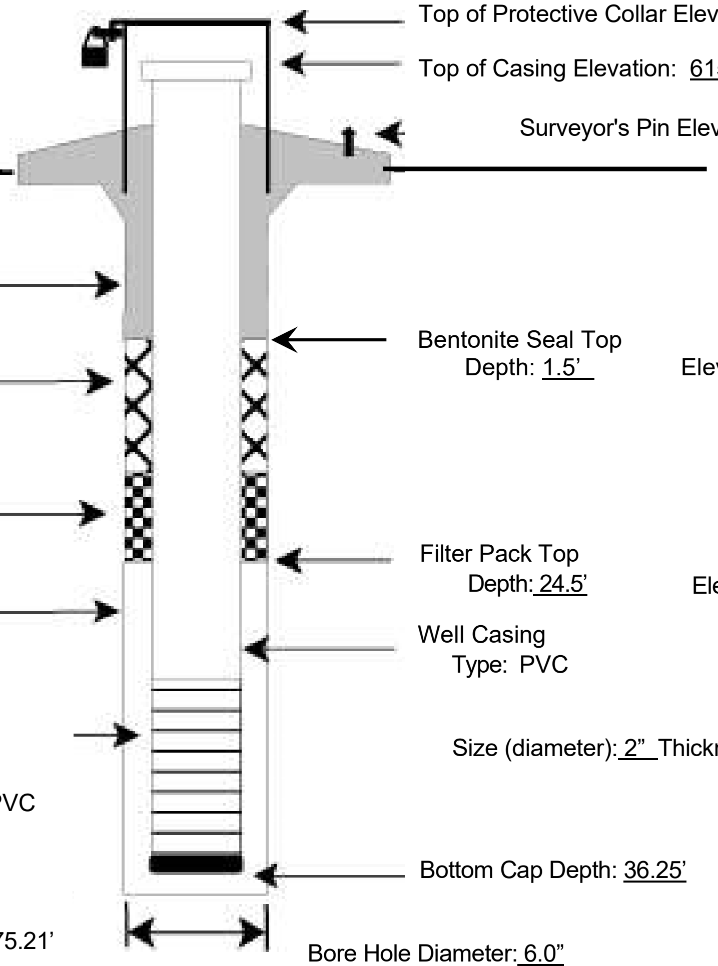
MSW Permit No. MSW-66B
Monitor Well I.D. No.: MW-22
Date of Monitor Well Development: 04/24/09
Monitor Well Driller
Name: Brian Kern
License No.: 54611M

NOTES:

Report all depths from Surface Elevation and all Elevations relative to Mean Sea Level (MSL), to nearest hundredth of a foot.
Diameter of boring should be at least 4 inches larger than diameter of well casing.
Use flush screw joint casing only, 2-inch diameter or larger, with o-rings or PTFE tape in joints (4-inch diameter recommend).
Well development should continue until water is clear, and pH and conductivity are stable.

Geologist, Hydrologist, or Engineer Supervising Gas Probe Installation: Mohammad Z. Islam, under supervision of Edward B. Dolan, P.G.
Static Water Level Elevation (with respect to MSL) after Well Development: 577.81’
Name of Geologic Formation(s) in which probe is completed: Stratum III of site-specific characterization, which is predominantly Lower Taylor Group oxidized clay or claystone with fractures.

Type of Locking Device: Padlock
Type of Casing Protection: Metal Stick-Up
Concrete Surface Pad Dimensions: 4’x4’x6”



Top of Protective Collar Elevation: 616.24’
Top of Casing Elevation: 615.81’
Ground Surface Elevation: 612.21’
Surveyor's Pin Elevation: N/A
Concrete Seal Depth: 1.5’
Casing Seal (backfill)
Material: 3/8” bentonite pellets
Note: Material for Casing Seal and Bentonite Seal is the Same.
Bentonite Seal Top Depth: 1.5’ Elevation: 589.71’
Bentonite Seal
Filter Pack Top Depth: 24.5’ Elevation: 587.71’
Filter Pack: 20/40 silica sand
Well Casing Type: PVC
Size (diameter): 2” Thickness: Schedule 40

Well Screen
Top Depth: 26.0’
Top Elevation: 586.21’
Type of Well Screen: Slotted PVC
Screen Opening Size: 0.010”
Bottom Depth: 36.0’
Bottom Elevation: 576.21’
Total depth of borehole: 37.0’
Bottom Elevation of borehole: 575.21’

Bottom Cap Depth: 36.25’
Bore Hole Diameter: 6.0”

Monitor Well Data Sheet

Permittee or Site Name: WMTX – Mesquite Creek Landfill

County: Comal and Guadalupe

Date of Monitor Well Installation: 03/06/09

Monitor Well Latitude: 29° 44' 05.27" Longitude: 98° 01' 30.90"

Monitor Well Groundwater Gradient Position:

Upgradient ____ Downgradient X

MSW Permit No. MSW-66B

Monitor Well I.D. No.: MW-23

Date of Monitor Well Development: 04/23/09

Monitor Well Driller

Name: Brian Kern

License No.: 54611M

NOTES:

Report all depths from Surface Elevation and all Elevations relative to Mean Sea Level (MSL), to nearest hundredth of a foot.

Diameter of boring should be at least 4 inches larger than diameter of well casing.

Use flush screw joint casing only, 2-inch diameter or larger, with o-rings or PTFE tape in joints (4-inch diameter recommend).

Well development should continue until water is clear, and pH and conductivity are stable.

Geologist, Hydrologist, or Engineer Supervising Gas Probe Installation: Mohammad Z. Islam, under supervision of Edward B. Dolan, P.G.

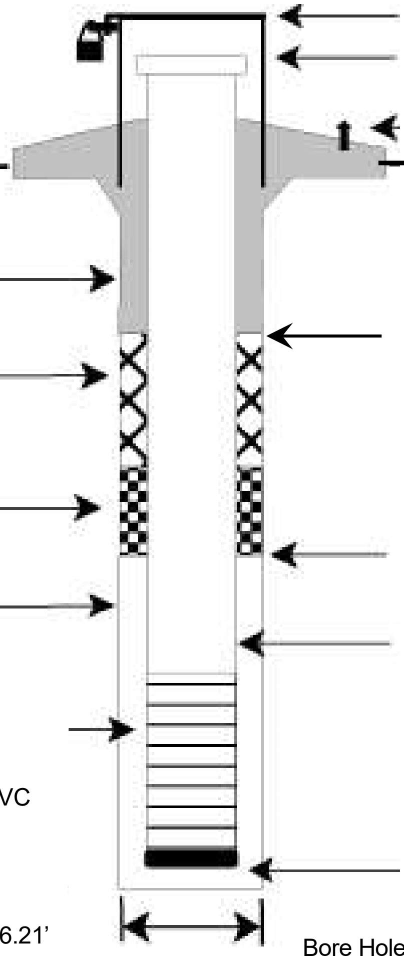
Static Water Level Elevation (with respect to MSL) after Well Development: 587.82'

Name of Geologic Formation(s) in which probe is completed: Stratum III of site-specific characterization, which is predominantly Lower Taylor Group oxidized clay or claystone with fractures.

Type of Locking Device: Padlock

Type of Casing Protection: Metal Stick-Up

Concrete Surface Pad Dimensions: 4'x4'x6"



Top of Protective Collar Elevation: 624.80'

Top of Casing Elevation: 624.24'

Ground Surface Elevation: 621.21'

Surveyor's Pin Elevation: N/A

Concrete Seal Depth: 1.5'

Casing Seal (backfill)
Material: 3/8" bentonite pellets

Note: Material for Casing Seal and Bentonite Seal is the Same.

Bentonite Seal Top
Depth: 1.5' Elevation: 602.21'

Bentonite Seal

Filter Pack Top
Depth: 21.0' Elevation: 600.21'

Filter Pack: 20/40 silica sand

Well Casing
Type: PVC

Size (diameter): 2" Thickness: Schedule 40

Well Screen
Top Depth: 24.0'
Top Elevation: 597.21'
Type of Well Screen: Slotted PVC
Screen Opening Size: 0.010"
Bottom Depth: 34.0'
Bottom Elevation: 587.21'
Total depth of borehole: 35.0'
Bottom Elevation of borehole: 586.21'

Bottom Cap Depth: 34.25'

Bore Hole Diameter: 6.0"

ATTACHMENT 5C

GROUNDWATER SAMPLING AND ANALYSIS PLAN (GWSAP)

PART III – ATTACHMENT 5C
GROUNDWATER SAMPLING AND ANALYSIS PLAN (GWSAP)

MESQUITE CREEK LANDFILL
COMAL AND GUADALUPE COUNTIES, TEXAS
PERMIT AMENDMENT APPLICATION
MSW PERMIT NO. 66C

Prepared for:
Waste Management of Texas, Inc.

Prepared by:
Geosyntec
consultants

Texas Board of Professional Geoscientists Firm Registration No. 50256
8217 Shoal Creek Blvd, Suite 200
Austin, Texas 78757
(512) 451-4003

MATTHEW WISSLER
13242

02/16/2024

Submitted October 2023
Revised February 2024

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GROUNDWATER SAMPLING AND ANALYSIS PLAN (GWSAP)

STATE OF TEXAS
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PROFESSIONAL GEOSCIENTIST

02/16/2024

GEOSYNTEC CONSULTANTS, INC.
TEXAS GEOSCIENCE FIRM REGISTRATION #50256

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APPENDIX

MATTHEW WISSLER
GEOLOGY
13242

02/16/2024

GEOSYNTEC CONSULTANTS, INC.
TEXAS GEOSCIENCE FIRM REGISTRATION #50256

1. INTRODUCTION

1.1 Purpose

This Groundwater Sampling and Analysis Plan (GWSAP) was prepared as part of the permit amendment application for the proposed lateral expansion of the Mesquite Creek Landfill (Site). This GWSAP has been prepared to address the applicable requirements of 30 TAC Chapter 330, Subchapter J for Type I landfills.

This GWSAP provides sampling and analysis procedures to be used for the groundwater monitoring program that will be implemented at this Type I municipal solid waste (MSW) facility. An overview of the site hydrogeologic setting and details of the groundwater monitoring system design are presented in Part III, Attachment 5 (Groundwater Monitoring Plan) of the permit amendment application. Attachment 5 also addresses current groundwater quality and provides a description of the most likely pathway(s) for pollutant migration in the event the primary barrier liner is penetrated.

1.2 Overview

This GWSAP describes the monitoring frequencies and constituents to be analyzed for each monitoring point and outlines specific sampling and analysis procedures as well as the procedures that will be used to evaluate and report the monitoring results. The groundwater monitoring program at the Site is based on the site hydrogeologic characteristics and the landfill design, and this GWSAP has been prepared to include consistent sampling and analysis procedures to provide an accurate representation of groundwater quality at the background and point of compliance wells or other monitoring system. The procedures outlined in this document have been designed to be protective of human health and the environment.

This GWSAP will be used by properly trained personnel to conduct the Site groundwater monitoring program during the active life of the facility and during closure and post-closure care periods. The landfill operator will be responsible for conducting groundwater sampling and analysis, and data review to evaluate if the facility has contaminated or is contaminating the uppermost aquifer, with the potential to impact human health and the environment. The accuracy, validity, and sufficiency of submittals of groundwater data and interpretations for the Site are fully the responsibility of the owner and/or operator. The owner and/or operator will employ competent, qualified, and trained consultants and laboratories to assist in each aspect of the groundwater monitoring program requirements.

The facility will place a copy of the reports and groundwater quality monitoring data collected in accordance with this plan into the Site Operating Record. The facility will retain this information within the operating record for the life of the facility including the post-closure care period.

2. GROUNDWATER SAMPLING PROCEDURES

2.1 Health and Safety

The groundwater sampling procedures and frequency described herein are developed to be protective of human health and the environment. Developing a Health and Safety Plan specific to the groundwater sampling and field activities is the responsibility of the party performing the work.

2.2 Field Preparation

2.2.1 General

The laboratory who will perform the groundwater analysis will supply the necessary transportation coolers, pre-cleaned sample containers, quality assurance/quality control (QA/QC) trip blanks, chemical preservatives, sample container labels, custody seals, and chain-of-custody (COC) record forms. All field data specified herein to be measured and/or recorded will be documented on a form(s) as part of the Field Records documentation (see Section 3.4).

2.2.2 Sample Containers

Containers used to store and transport samples for laboratory analysis will be provided by the laboratory performing the analyses and will be the appropriate size, material, and compatibility for the constituent it is designed to contain. See Section 2.6.2 for further details.

2.2.3 Field Equipment Calibration

Before sampling activities, all measuring devices will be cleaned and checked for any malfunctions. All meters, measuring devices, instruments, etc. must be calibrated before using them in the field, in accordance with manufacturer calibration instructions and requirements.

2.2.3 Equipment Decontamination

All equipment used for the measurement of water levels, measurement of field parameters, and collection of groundwater samples will be decontaminated prior to initial use, and prior to use at each well location (unless the equipment is dedicated to a specific well). An appropriate decontamination procedure consists of scrubbing all equipment with a solution of a laboratory-grade non-phosphate detergent (such as Alconox) and deionized or distilled water and triple rinsing with deionized or distilled water. Decontamination will be sufficient to avoid (and prevent) the introduction of any contaminant into a well and to not allow any contaminant to be transported between wells that will create false sample results or otherwise harm the environment.

Decontamination water will be collected, stored, and disposed of in the same manner as the well purge water (see Section 2.5).

2.3 Monitoring Well Inspection

Prior to performing any level/depth measurements, purging, or sampling of a monitoring well, the well will be inspected to assess its integrity and security, and evaluate if damage has occurred since the prior sampling event. Following inspection, the condition of each monitoring well will be recorded as part of the Field Records documentation (see Section 3.4). If a monitoring well is found to be in poor condition, the owner or operator will take the appropriate actions required to return the well to working condition.

To complete the visual inspection component of this task, the above ground condition of each monitoring well and its surface completion will be observed during each sampling event. The outer protective casing, the visible portion of the well, and the concrete pad will be checked for cracks or fissures. The identification label, well lock, and area around the well pad will also be checked. If insects are observed inside of the protective casing or in the immediate vicinity of the monitoring well, organic sprays or other potential contaminants will not be used to remove them. Similarly, organic lubricants will not be used on well components (e.g., locks, top hinges).

2.4 Groundwater Level Measurements

Prior to groundwater purging and sampling at each well, a water level measurement is required. The water level will be gauged at each well location using a portable and chemically inert electronic water level indicator (“e-line”) or other suitable and chemically inert measuring device, calibrated according to manufacturer’s instructions and decontaminated prior to arrival on the Site and between well readings. The measured water level will be recorded as part of the Field Records documentation (see Section 3.4). Water levels will be measured from a permanent and clearly marked reference datum point at the top of the well casing. Measurements will be recorded to a precision of ±0.01 ft. The depth-to-water measurement will be subtracted from the reference datum to provide the water level elevation expressed in relation to mean sea level. Water level measurements will be collected over a period of time short enough to avoid temporal variations in water levels which could preclude an accurate determination of groundwater flow rate and/or direction. To prevent the potential for cross-contamination between sampling points, the measuring instrument will be properly decontaminated before use in each well following the procedures previously discussed in Section 2.2, including proper management of decontamination water.

The depth to the bottom of each well will be measured at a frequency determined by the rate of sediment buildup in the site monitoring wells, but at a minimum frequency of once every two years. When depths are measured, the measurement will be recorded as part of the Field Records documentation (see Section 3.4). The total depth measurements will be used to evaluate if an appreciable amount of sediment has settled in the bottom of the well to the extent it could potentially be obstructing the lower portion of the screened interval of the well. Measurements to evaluate sediment accumulation should be performed following completion of the sampling of the well in order to minimize movement of the water column in the well, and the introduction of suspended solids as artifacts to collected samples. Depth to the bottom measurements will also be conducted after completion and development of any new monitoring well. The entire length of the water level measuring tape that comes into contact with the well will be decontaminated following total depth measurements.

2.5 Well Purging

2.5.1 Purge Equipment and Procedures

Groundwater wells may be purged and sampled mechanically using dedicated pumps, or by hand using bailers. Purging and sampling techniques used will be noted as part of the Field Records documentation (see Section 3.4). Appropriate gloves will be used during purging and sampling procedures and changed after each groundwater monitoring well to avoid cross-contamination.

If purging and sampling activities are conducted by dedicated pumps, either standard-flow (non-low-flow) techniques or low-flow/micropurge techniques may be used, as deemed appropriate based on the well's recharge capacity/characteristics and the capability of the installed pump. For non-low-flow purging, bladder pumps are recommended. Non-low-flow purging will be conducted until three casing volumes have been removed or the well is purged to dryness.

Low-flow purging will be conducted at a rate of approximately 50 to 250 milliliters per minute until at least two pump and tubing volumes are removed, and field parameters are stable. Purge field parameters for low-flow purging are listed below in Section 2.5.2.

If purging and sampling activities are conducted by hand, dedicated or disposable bailers will be used to maximize the likelihood of obtaining a clean sample and to minimize cross-contamination. Bailer purging will be conducted until three casing volumes of water have been removed or the well is purged to dryness. During purging and sampling, care will be taken to reduce disturbance of the water column in the monitoring well and suspension of sediment accumulated within the bottom of the well casing by minimizing the movement of dedicated sampling equipment and the water level probe. Purging and sampling equipment will be slowly and carefully lowered into the well.

2.5.2 Field Parameter Stabilization

The following water quality parameters will be measured during purging for low-flow purging and sampling: pH, temperature, specific conductance (SC), and turbidity. If water quality and turbidity meters are used, they will be calibrated and decontaminated as described herein. Water quality measurements will be measured and recorded approximately every three to five minutes or as appropriate during purging. Visual observations related to water quality (color, clarity, etc.) will also be recorded. Water quality parameters will be considered stabilized when three successive readings are obtained within the approximate target range listed below. Parameters are listed in the anticipated order of stabilization:

Target Stability Range for Water Quality Parameters

pH	Temperature	SC	Turbidity
SU	˚C	*µmhos/cm*	*NTU*
+/-0.2	+/-10%	+/-10%	+/-10%

Note: SU indicates Standard Units, °C indicates degrees Celsius, µmhos/cm indicates micromhos per centimeter, and NTU indicates nephelometric turbidity units.

The collection, storage, and disposal of purged groundwater (as well as excess sample water and decontamination water generated during groundwater monitoring activities) will be handled/managed appropriately, in accordance with Section 2.5.4 below.

2.5.3 Purge Volume Measurement

Purged water quantities will be measured in a graduated container to accurately determine the purge volume. The volume of water in a well casing can be calculated by subtracting the gauged depth to water from the recorded total depth of the well casing. For reference, the volume of water contained in one foot of 2-inch diameter Schedule 40 poly-vinyl chloride (PVC) well casing/screen is 0.163 gallons. The total amount of water present in one well casing (one casing volume) is calculated by multiplying the depth of water by the appropriate conversion value for the well casing diameter (e.g., 0.163 gallons/foot for example given). The following is an example calculation:

Total depth of well casing (feet)	28.00
Depth to groundwater (feet)	-12.23
Depth of water column (feet)	15.77
Conversion value (gallons/ft)	x 0.163
One casing volume of water (gallons)	= 2.57

2.5.4 Purge Water Management

All purge water (as well as excess sample water) should be considered as potentially contaminated water, stored in a properly labeled drum or container until the analytical results have been received and a proper disposal method has been selected. Disposable sampling equipment (e.g., tubing, bailers) and supplies (e.g., gloves) should be containerized separately from the purge water.

The purge water and excess sample water is considered contaminated if the analytical results indicate that any detected constituent statistically exceeds the constituent's background concentration. Contaminated water will be handled in the same manner as leachate. Uncontaminated water may be discharged to the ground surface away from the well.

2.6 Sample Collection

2.6.1 Timing and Order of Well Sampling

If non-dedicated sampling devices are used, sampling at each monitoring event should generally proceed from the well with the highest water-level elevation to those with successively lower elevations unless impacts are known to be present. If dedicated or disposable sampling devices are used, it will not be necessary for the sampling to proceed from wells with higher water elevations to those with lower elevations (nor is it applicable to decontaminate the device). However, if impacts to groundwater have been documented at levels that could adversely affect non-dedicated sampling devices, the wells will be sampled in a progression corresponding to the degree of impact, as based upon water quality data generated during previous sampling event(s) – such that wells exhibiting no impact are sampled first, followed by wells showing the least impact, and ending with those wells showing the greatest impact (unless an alternative procedure is approved by the Executive Director). Groundwater sampling will be completed following purging and after the monitoring well has sufficiently recharged with water to the extent that the sample volume can be obtained. The elapsed time between purging and sample collection should be as short as possible (preferably, sampling should be done within 24 hours of purging). If a monitoring well is very slow to recharge after purging, sampling will be completed as soon as possible, but not more than seven (7) days after purging. If after seven (7) days a well has not recovered sufficiently, the well will be declared dry and the sampling team will not complete sampling. Whether or not the sampling team is able to complete the sampling, occurrences and conditions will be indicated as part of the Field Records documentation (see Section 3.4).

2.6.2 Sample Containers

Containers used to store and transport samples for laboratory analysis will be provided by the laboratory performing the analyses and will be the appropriate size and material for the constituents to be analyzed. The bottles will be prepared according to specifications for environmental sampling described in the current edition of SW-846 [USEPA, 1994] or other equivalent method accepted by USEPA. Chemical preservatives, when appropriate to the analyte, will be added to the sample bottle by the laboratory prior to delivery of the bottles to the facility. Once the chemical preservative has been added, bottles will be sealed by the laboratory for transport to the Site. Documentation of bottle preparatory procedures and chemical preservatives will be maintained by the laboratory and available to the owner or operator upon request. Substitutions of bottle type and sample volumes may be allowed if agreeable with the owner or operator and the laboratory performing the analyses and if compatible with recommendations for bottle type and preservation stated in the current version of SW-846 [USEPA, 1994] or the specified analytical method.

Sample labels will be placed on the provided containers and completed with identifying information, in order to ensure proper identification of each collected aliquot. Sample label requirements are presented in Section 5.

2.6.3 Collection for Laboratory Analysis

Prior to sample collection, field parameters will be collected to determine if groundwater quality is representative of historical groundwater quality in the well. Then, samples should be collected and containerized in a sequence according to the volatilization sensitivity (from the most to least volatile). The specific collection order is as follows:

- Volatile Organic Compounds;
- Semi-Volatile Organic Compounds (if collected);
- Total Metals; and
- Inorganics (if collected).

The same dedicated and/or disposable equipment (e.g., bailer, submersible pump) used for purging will be used for groundwater sampling. Groundwater samples will be collected in containers for transport to the laboratory for analysis using the following protocol.

- Samples will be collected as close to the well head as practical.
- If bailers are used, samples will be collected by slowly pouring water from the bailer into the sampling containers to reduce aeration and turbulence. The sampling device will not touch the sampling container but will be held as close as possible to the container to reduce aeration.

- If mechanical equipment is used, the pumping rate should be the same or less than the purging rate in that well, and should be sufficiently low to minimize sample aeration. If purging is accomplished using low-flow methods, then low-flow sampling will also be used. Samples will be collected by slowly filling the sampling containers from the discharge tubing of the pump. The tubing will not touch the sampling container but will be held as close as possible to the container to reduce aeration.
- Field measurements will be taken for the water quality parameters listed in Section 2.5.2 by slowly pouring an unfiltered portion of the water sample into a clean container (if bailers are used) or passing purge water through an in-line flow-through cell equipped with the appropriate water quality meter (if mechanical equipment is used). If bailers are used, temperature must be measured immediately. Specific conductance will be measured next to avoid any effect on the sample from salts from the pH probe, and pH will be measured last. The color, odor, foaming, presence of more than one phase of liquid, and turbidity of the sample will be recorded. The same calibration and decontamination procedures described in Section 2.2 will be followed during sample collection.
- Transfer containers will not be used during sample collection because of the likelihood of cross-contamination.
- If non-dedicated sampling devices are used, they will be decontaminated using the procedures described herein before sampling each well.
- Soiled sample bottles, bailer rope, rubber hose, tubing, and/or gloves will not be reused.
- Clean equipment will be kept off the ground to prevent contamination once the equipment is cleaned. Disposable plastic sheeting may be spread around a well before beginning purging and sampling. If sheeting is used, it will not be reused at other wells. The area around the sampling point will be checked for possible sources of air contamination.
- Excess sample volume must be handled and managed appropriately.
- From each sample location, sample containers will be filled in the order listed above, with collected aliquots immediately placed on ice.
- The sample identification, collection time/date, container type, sample preservation, and requested analyses will be recorded on the COC record form (a typical example is presented in Appendix 1).

Groundwater samples will not be field filtered prior to laboratory analysis.

The number of sample containers, the volume of samples, and the types of sample containers required for each sample location depends on the parameters to be analyzed.

2.6.4 Field Quality Assurance/Quality Control

Field QA/QC begins prior to arrival at the Site with the proper preparation of purge and sampling devices. This preparation includes minimum decontamination procedures for water level indicator(s); dedicated and/or disposable equipment (e.g., bailer(s), submersible pump(s)); and water quality meters (if used) as described herein, as well as proper calibration of applicable equipment before each sampling event.

The field QA/QC program includes collection of a field blank, equipment (rinsate) blank, trip blank, and duplicate sample with each sampling event. The concentration levels of any artifacts found in the blanks will be noted and compared to the groundwater sample results. Corrective action will be taken to identify and address the source of the artifact(s). Methods for collecting each blank are described below. The laboratory QA/QC program is described in Section 4.

2.6.4.1 Field Blank

The field blank sample will be used to evaluate potential contamination that may occur as a result of ambient conditions during collection and potential chemical artifacts that originate from the sample containers, the chemical preservative (if applicable), or the shipping and handling process. At least one field blank will be collected per day of sampling, or one for every 10 wells sampled, whichever is greater. The field blank will be collected by filling bottles provided for metals and VOC analyses (or in the case of a resample only the constituents being resampled will be collected) with organic-free (reagent-grade or distilled) water.

2.6.4.2 Equipment (Rinsate) Blank

The equipment (rinsate) blank will be used to evaluate the field decontamination of non-dedicated equipment used in the field and new equipment used for the first time in the field (when applicable). An equipment rinsate blank will not be collected when using dedicated equipment. At least one equipment (rinsate) blank will be collected per sampling event and analyzed for metals and VOCs (or in the case of a resample, only the constituents being resampled will be collected). The equipment (rinsate) blank will be prepared in the field immediately following decontamination of any non-dedicated equipment used for purging or sampling. Following decontamination, field supply organic-free (reagent-grade or distilled) water is passed through the non-dedicated equipment in the same manner as a groundwater sample.

2.6.4.3 Trip Blank

The trip blank sample will be used to detect and quantify potential chemical artifacts occurring in the groundwater sample that originate from the sample containers, the organic-free (reagent-grade or distilled) water and chemical preservative (if applicable) comprising the blank, or the shipping and handling process. At least one trip blank will be used per sampling event, to be included by the laboratory, along with the sample containers. These blanks will be transported with the sample containers to the Site and returned to the laboratory without opening. The trip blank will be analyzed for VOCs only and will only be analyzed if VOCs are included in the sampling event. In the case of a resample, only the constituents being resampled will be collected.

2.6.4.4 Duplicate Sample

The field duplicate sample will be used to document the precision of the sampling and analytical process. A field duplicate is an extra sample taken at a monitoring point and labeled "Field Duplicate." The original sample from a monitoring point and the associated field duplicate are independent samples which are collected as close as possible to the same point in space and time. They are two separate samples taken from the same source, stored in separate containers and analyzed independently. Samples will be collected in proper alternating order (e.g., collect metals sample, then metals duplicate, etc.) and analyzed for metals and VOCs. A least one field duplicate will be used for every 20 wells sampled, with at least one per each background or semiannual detection monitoring event.

The field duplicate sample will be labeled only as "Field Duplicate." The duplicate sample location will be recorded in the field records but not on the bottle labels or COC.

2.6.5 Sample Preservation, Handling, Storage, and Transport

Sample preservation is intended to retard biological action, retard hydrolysis, and reduce absorption effects. Methods which will be used to preserve groundwater samples collected at the Site, as needed, include pH adjustment of selected samples, cooling, and protection from light.

The pH adjustment of samples will be completed through the addition of a chemical preservative to the collected samples. The laboratory performing the analysis will add the appropriate chemical preservative to the containers used to collect sample aliquots for the specified analytical method. The chemical preservative may be added prior to shipment of the containers to the Site.

Collected groundwater samples will also be kept cold by placing the samples on ice or refreezeable materials in an insulated ice chest/container immediately after collection, cooling samples to approximately 4 degrees Celsius (°C). If ice is used, it will be double bagged in leak proof type bags to minimize leakage of water as the ice melts. Dry ice will not be used to chill the samples.

Samples will be transported to the laboratory as soon as possible, preferable within 48 hours of sampling. If the samples are shipped, shipment must comply with applicable U.S. Department of Transportation regulations regarding shipment procedures and packaging.

Upon receipt of samples at the laboratory, the authorized laboratory personnel will promptly measure the temperature of the inside of the sample ice chest/container and record this on the COC or laboratory record. The laboratory will store or prepare the samples for analysis, taking into consideration sample holding times for each analytical parameter.

3. SAMPLE DOCUMENTATION AND CHAIN-OF-CUSTODY

3.1 Overview

The sample documentation program documents possession (COC) and handling of groundwater samples from the time the sample containers leave the laboratory to field collection and finally laboratory analysis. Any information related to each sampling event will be recorded and entries will be legible and made in indelible ink. Entry errors will be crossed out with a single line, dated, and initialed by the person making the corrections. Sufficient information will be recorded so that the sampling situation can be reconstructed without relying on the sampler's memory. The program includes:

- Sample labels which clearly identify each sample;
- A security seal on the ice chest/container to preserve the integrity of the samples and control their handling from the time a sample is collected until it is opened in the laboratory;
- Field records to document equipment and procedures used to complete the field calibration of equipment, sampling, measurement of field parameters, and number and type of samples collected;
- A COC record to establish sample possession from the time of collection to analysis, and to document the specific laboratory analyses being requested for each collected sample; and
- A laboratory log maintained by the laboratory documenting pertinent information relating to the laboratory's processing of the sample.

3.2 Sample Labels

To prevent misidentification of samples, a legible label will be affixed to each sample container. Each label will be sufficiently durable to remain legible even when wet and will contain the following information:

- Facility name and project information;
- Sampling point identification name and/or number;
- Name or initials of individual collecting the samples;
- Date and time of sample collection;
- Analysis required, if space allows on the label; and
- Preservative inside bottle, if applicable and if space allows on the label.

3.3 Shipping Seal

In cases where samples are to be shipped off-site by commercial carrier, a security seal will be placed on the shipping container holding the collected samples to ensure the samples have not been tampered with during transportation.

3.4 Field Records

Field logs will be used to enter the data gathered during each monitoring event (including well inspections, water level/depth measurements, purging, and sampling activities), including the applicable units for numerical values. The following specific information will be recorded, as applicable, in a field log form(s):

- identification of the well or sampling point;
- name of individual(s) performing the sample collection;
- date and time;
- climatic (weather) conditions, including approximate ambient outdoor air temperature;
- initial depth to water in wells;
- well depth, height of the water column, and volume of the water column (well volume);
- well purging and sampling method and equipment used;
- desired volume to purge;
- as appropriate the purging discharge rate, drawdown, purged volume, date, time, and name or initials of individual completing the well purging;
- calibration of field equipment;
- measurements of field parameters (pH, temperature, specific conductance, and turbidity) and identification of units of measurement;
- sample observations (color, odor, etc.);
- sample withdrawal procedure and identification of equipment used;
- type and volume of sample container used for collection of samples for laboratory analysis;
- preservatives used, if required, in addition to ice;
- field observations relating to well conditions, including results of visual inspection and the measured well depth (if performed); and
- any other data deemed pertinent to the field sampling event.

3.5 Chain of Custody Record

It is important to demonstrate that the samples were obtained from the locations stated and reached the laboratory without alteration. Evidence of collection, shipment, laboratory receipt, and laboratory custody until completion of analyses must be documented. This documentation shall be maintained using a COC record of the signatures of the individuals collecting, transporting, and receiving each sample.

A COC record form will be used by personnel to record collection and shipment of the samples. A qualified laboratory will not accept samples collected for analysis without a correctly-prepared COC record. The COC record will include a list of analyses for each sample container that is listed on the form. The COC record may contain the following information (typical example is provided in Appendix 1):

- name and address of originating location of samples;
- name and address of laboratory where samples are sent;
- any pertinent directions and instructions to the laboratory;
- sample type (e.g., water);
- listing of sample containers, size and preservative, if any, and type of analysis to be performed by the laboratory;
- sample identification name or number;
- date and time of sample collection;
- signature of collector as relinquishing the samples, with date and time relinquished; and
- signature of individual to whom samples are relinquished.

The anticipated COC for groundwater samples collected at the Site is listed below.

- The COC for samples and blanks will be initiated in the field by the person collecting the sample or blank and will accompany samples shipped to the laboratory. The name(s) of each member(s) of the sampling team will be listed on the COC. Each sample will be assigned a unique identification number or name that is entered on the COC.
- Each time responsibility for custody of the samples changes, the receiving and relinquishing custodians will sign the COC record form and record the date and time.
- If the samples are shipped to the laboratory by commercial carrier, the COC will be sealed in a watertight container, placed in the ice chest/shipping container, and the shipping container sealed prior to giving it to the carrier. The carrier waybill will serve as an extension of the COC between the final field custodian and receipt in the laboratory.

- The COC procedure is complete when ownership of the samples is assumed by the receiving laboratory. Samples not consumed during analysis will be kept by the laboratory as requested by the owner or operator.
- COC records, including waybills if generated, will be maintained by the owner or operator as part of the project records.

3.6 Laboratory Record

A handwritten or electronic log will be maintained by the laboratory in order to document the processing steps that are applied to each sample. The laboratory log will include the date, time and condition of the sample upon check-in, the date and method used to extract and/or analyze the sample, and the identity of the analyst.

4. LABORATORY ANALYSIS METHODS AND QA/QC

4.1 Approved Methods

For constituents to be analyzed as specified herein (discussed in subsequent sections), the analyses will be performed in accordance with Texas Commission on Environmental Quality (TCEQ)-recommended USEPA test methods of SW-846 [USEPA, 1994] and USEPA approved editions of Standard Methods (SM) [SM, 2012]; or alternative methods with equivalent or better performance. The laboratory will determine detection limits using the protocol in the mandated test method or applicable federal or state regulation or guidance. All samples will be analyzed within the required holding times for the particular analyses to be tested.

4.2 Practical Quantitation Limit (PQL)

Analytical results will be measured and reported for each constituent to its practical quantitation limit (PQL) concentration, so that the requirements of 30 TAC §330.405(f)(5) are met for the statistical method chosen to evaluate the groundwater monitoring data.

The PQL is defined as the lowest concentration level that can be reliably achieved within specified limits of precision and accuracy during routine laboratory operating conditions. The PQL is method-, instrument-, and analyte-specific and may be updated as more data become available. The following describes the PQL required:

- For each constituent listed in 40 Code of Federal Regulations (CFR), Part 258, Appendix I or Appendix II, or for each groundwater parameter that has a groundwater protection standard (GWPS) per 30 TAC §330.409(h), the PQL will be at or below the GWPS, and the laboratory will be able to demonstrate that the method and procedure used in the analysis can attain a PQL at or below the GWPS.
- The PQL will be determined from laboratory quality control samples that meet the precision and accuracy data-quality objectives that are listed in the table below.

QC Specification Limit for the PQL and Lower Limit of Quantification Check Samples

Constituent of Concern	Precision *(% RSD)*	Accuracy *(% Recovery)*
Metals	10	70-130
Volatiles	20	50-150
Semi-Volatiles	30	50-150

Note: % RSD indicates percent relative standard deviation.

- The precision and accuracy of the PQL initially will be determined from the PQLs reported over the course of a minimum of eight groundwater monitoring events. The results obtained from these events will be used to demonstrate that the PQLs meet the specified precision and accuracy limits. The PQL may be updated as more data become available.

- The PQL will be supported by analysis of a PQL check sample, consisting of a laboratory reagent grade sample matrix spiked with constituents of concern at concentrations equal to less than the PQL. At a minimum, a PQL check sample will be performed quarterly during the calendar year to demonstrate that the PQL continues to meet the specified limits for precision and accuracy.

- The laboratory will report non-detected results as less than the value of the established PQL limit that meets those precision and accuracy requirements.

When the limits for precision and accuracy tabulated above cannot be met, the owner or operator will submit information to support a recommendation for using alternative precision and accuracy limits. This information will be reported to the Executive Director by the owner or operator and will be evaluated on a case by case basis.

4.3 Laboratory Selection

The owner or operator will select a laboratory accredited through the TCEQ's Texas Laboratory Accreditation Program, known as the National Environmental Laboratory Accreditation Program (NELAP). The laboratory will maintain a written QA/QC program that conforms, as a minimum standard, to QA/QC protocol set forth in the latest edition of USEPA's SW-846 or ISO/EIC 17025, and/or National Environmental Laboratory Accreditation Conference (NELAC) standards, as appropriate.

Elements of the QA/QC Plan may include:

- Documentation of methods employed for sample receipt and handling;
- Description of procedures used to prepare standards and reagents;
- Documentation of instrument calibration;
- Documentation of methods for sample preparation and analysis; and
- Documentation of methods used to determine detection and quantitation limits.

The laboratory will provide a copy of the QA/QC Plan to the owner or operator for review upon request.

Analytical data submitted under the requirements of this permit will be examined by the owner or operator to ensure that the data quality objectives are considered and met. The owner or operator will determine if the results representing the sample are accurate and complete. Prior to submitting the analytical data to TCEQ as a portion of the reporting described in Section 5.6, the QA/QC of the data packages will be reviewed, including but not limited to review of the reporting limits (RLs) to the Inter-Laboratory Quantitation Estimation (IQE)-based MSW-PQL "benchmark" concentrations established for the 40 CFR Part 258 Appendix I constituents (TCEQ, 2010).

The quality control results, supporting data, and data review by the laboratory must be included when the owner or operator reviews the data. Any potential impacts will be reported, such as a bias on the quality of the data, footnotes in the report, and anything of concern that was identified in the laboratory case narrative summary.

The owner or operator will ensure that the laboratory documents and reports any problems or observed anomalies associated with the analysis, as described below in Section 4.4 If analysis of the data indicates that the data fail to meet the quality control goals for the laboratory's analytical data analysis program, the owner or operator will conduct a data validation process to determine if the data are usable. If the owner and/or operator determines the analytical data may be utilized, any and all problems and corrective action that the laboratory identified during the analysis will be included in the report submitted to the TCEQ (see Section 5.6 of this GWSAP).

4.4 Laboratory Report and Quality Assurance/Quality Control

The information presented in this section will be included in the laboratory report(s) submitted to the owner or operator electronically or in hardcopy format. This includes the following basic information:

- title;
- identification on each page of the test report ensuring that the page is recognized as part of the test report;
- name and address of the owner or operator;
- report date;
- test results and units of measurement; and
- names, functions, and signatures of persons authorizing the report.

Also, the following laboratory QA/QC data will also be reported with groundwater analyses to verify the precision and accuracy of the laboratory analyses:

- identification of the method used to prepare and analyze the sample;
- sample collection date, the date the sample was extracted, and/or the date the sample was analyzed by the laboratory;
- method blank results reported to method detection limits;

- laboratory control standard and laboratory control standard duplicate percent recoveries and relative percent difference;
- matrix spike and matrix spike duplicate percent recoveries and relative percent difference; and
- post-digestion spike percent recovery, if analyzed.

Also, a Laboratory Case Narrative (LCN) for all problems and anomalies observed will be submitted by the owner or operator. The LCN will provide the following information:

1. The exact number of samples, constituents analyzed, and sample matrices.
2. The name of the laboratory performing analyses. If more than one laboratory is used, all laboratories will be identified.
3. Explanation of each failed precision and accuracy measurement determined to be outside of the laboratory or method control limits.
4. Explanation if the failed precision and accuracy measurements cause a positive or negative bias on the results.
5. Identification and explanation of problems associated with the sample results, along with the limitations on data usability.
6. When appropriate and when requested, a statement on the estimated uncertainty of the analytical results of the samples.
7. A statement of compliance or noncompliance with data-quality objectives. Holding-time exceedances and matrix interferences must be identified. Dilutions must be identified, and if dilutions are necessary, they must be done to the smallest dilution possible to effectively minimize matrix interferences and bring the sample into control for analysis.
8. Identification of all applicable quality assurance and quality control samples that will require special attention by the reviewer.

A statement on the QA/QC of the analytical method and the analytical recoveries information will be provided when appropriate and/or when requested. In addition to the LCN and other required information, a laboratory report will include the following:

1. A table identifying the field-sample name with the sample identification in the laboratory report.
2. Chain-of-custody.
3. For each sample, a report (certificate of analysis) of the constituents analyzed, the analytical methods, and the laboratory PQLs.

4. A release statement provided by the laboratory, with the following wording:

   "I am responsible for the release of this laboratory data package. This data package has been reviewed by the laboratory and is complete and technically compliant with the requirements of the methods used, except where noted by the laboratory in the attached exception reports. By my signature below, I affirm to the best of my knowledge that all problems or anomalies that were observed by the laboratory as having the potential to affect the quality of the data have been identified by the laboratory in the Laboratory Review Checklist, and no information or data have been knowingly withheld that would affect the quality of the data."

   If an in-house laboratory is used, the laboratory release statement must also include the following: *"This laboratory is an in-house laboratory controlled by the person responding to the rule. The official signing the cover page of the rule-required report in which these data are used is responsible for releasing this data package and is by signature affirming that the above release statement is true."*

5. A Laboratory Review Checklist (LRC). For every response of "No," "NA," or "NR" on the checklist, the permittee will ensure that the laboratory provides a detailed description of the "exception report" in the summary of the LCN or by adding additional explanations to the checklist.

Analytical data are maintained by the laboratory indefinitely. The laboratory ensures that security measures are in place to guarantee the integrity of the data. Standard Operating Procedures are in place for computer security, computer data storage, and back-up. Furthermore, the owner or operator will ensure that all QA/QC records are legible and readily retrievable.

5. DETECTION MONITORING PROGRAM

5.1 Establishment of Background

Background groundwater quality that has not been affected by leakage from a solid waste management unit must be established for each of the monitoring parameters required under 30 TAC §330.419 (constituents for detection monitoring, listed in Section 5.3) as described herein.

Background groundwater quality has been established for all upgradient and point-of-compliance (POC)/downgradient wells in the existing groundwater monitoring system. For new or replacement monitoring wells, the procedures outlined in the following paragraphs will be used to establish background groundwater quality. Background monitoring will begin within 90 days of well completion for new or replacement monitor wells.

Constituents to be monitored for the establishment of background groundwater quality are listed in Section 5.3. The number of samples to be collected to establish background groundwater quality data will be consistent with the appropriate statistical procedures. To establish intrawell background concentrations, a minimum of eight (8) statistically independent samples will be collected from each monitoring well in the groundwater monitoring system. Background data collection monitoring events will be conducted on a quarterly basis.

Following completion of background data collection for a given monitoring well, background constituent concentration data will be evaluated to ensure that the data are representative of background groundwater quality that has not been affected by leakage from a solid waste management unit; and the data will be used to develop site-specific groundwater quality statistical limits using the intrawell statistical methods contained in the USEPA (2009) statistical guidance document ("*Statistical Analysis of Ground-Water Monitoring Data at RCRA Facilities, Unified Guidance*") or those referenced by the Gibbons (1994) *Statistical Methods for Ground-Water Monitoring at Waste Disposal Facilities*. POC groundwater monitoring wells will be statistically evaluated using the combined Shewhart-CUSUM control chart method; and non-POC (e.g., upgradient) monitoring wells will be statistically evaluated via trend analysis. The information will be documented in a report and submitted to TCEQ prior to the facility's next scheduled semiannual groundwater detection monitoring event.

5.2 Updating Background

Background limits should be periodically reviewed and updated as necessary with valid semiannual detection monitoring results that are representative of background groundwater quality not affected by landfill activities. For intrawell statistical comparisons, new data may be incorporated into background as frequently as once every two (2) years. The updated background information will be documented in a report and submitted to TCEQ prior to the facility's next scheduled semiannual groundwater detection monitoring event.

5.3 Detection Monitoring Parameters

The minimum list of constituents (i.e., parameters) that are to be collected and analyzed under the detection monitoring program are listed below (consistent with the constituents required by 30 TAC §330.419(a), as listed in 40 CFR Part 258, Appendix I).

Inorganic constituents:

- Antimony, Total
- Arsenic, Total
- Barium, Total
- Beryllium, Total
- Cadmium, Total
- Chromium, Total
- Cobalt, Total
- Copper, Total
- Lead, Total
- Nickel, Total
- Selenium, Total
- Silver, Total
- Thallium, Total
- Vanadium, Total
- Zinc, Total

Organic Compounds

- 1,1,1,2-Tetrachloroethane
- 1,1,1-Trichloroethane
- 1,1,2,2-Tetrachloroethane
- 1,1,2-Trichloroethane
- 1,1-Dichloroethane
- 1,1-Dichloroethene
- 1,2,3-Trichloropropane
- 1,2-Dibromo-3-chloropropane
- 1,2-Dibromoethane
- 1,2-Dichlorobenzene
- 1,2-Dichloroethane
- 1,2-Dichloropropane
- 1,4-Dichlorobenzene
- 2-Butanone
- 2-Hexanone
- 4-Methyl-2-pentanone
- Acetone
- Acrylonitrile
- Benzene
- Bromochloromethane
- Bromodichloromethane
- Bromoform
- Bromomethane
- Carbon disulfide
- Carbon tetrachloride
- Chlorobenzene
- Chloroethane
- Chloroform
- Chloromethane
- *cis*-1,2-Dichloroethene
- *cis*-1,3-Dichloropropene
- Dibromochloromethane
- Dibromomethane
- Ethylbenzene
- Iodomethane
- Methylene chloride
- Styrene
- Tetrachloroethene
- Toluene
- *trans*-1,2-Dichloroethene
- *trans*-1,3-Dichloropropene
- *trans*-1,4-Dichloro-2-butene
- Trichloroethene
- Trichlorofluoromethane
- Vinyl acetate
- Vinyl chloride
- Xylenes (Total)

5.4 Detection Monitoring Frequency

Under the detection monitoring program, routine sampling and analysis for all facility background and POC detection monitoring wells will be conducted on a semiannual basis for all constituents listed above in Section 5.3 during the active life, closure, and post-closure care periods of this facility.

5.5 Evaluation of Results

No later than 60 days after each sampling event, the owner or operator shall determine whether there has been a statistically significant increase (SSI) over background of any tested constituent at any monitoring well. If there has been a SSI, the owner or operator shall notify the TCEQ, and any local pollution agency with jurisdiction that has requested to be notified, in writing within 14 days of this determination. The statistical analysis methods that will be used are presented in Section 6 of this GWSAP.

If a SSI over background of any tested constituent at any monitoring well has occurred, the owner or operator shall immediately place a notice in the Site Operating Record 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 SSI determination notice to the TCEQ, except as provided for in the following two paragraphs:

(1) If a SSI over background of any tested constituent at any monitoring well has occurred, the owner or operator may submit the results of up to two (2) verification resamples within 60 days of determining the SSI. The resample data may be used to statistically confirm or disprove the SSI determination.

(2) If a SSI over background of any tested constituent at any monitoring well has occurred and the owner or operator has reasonable cause to think that a source other than a landfill unit caused the contamination or that the SSI resulted from an error in sampling, analysis, or statistical evaluation, or from natural variation in groundwater quality, then the owner or operator may submit a report providing documentation to this effect. In making this alternate source demonstration (ASD), the owner or operator will 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 owner or operator intends to prepare and submit an ASD. Within 90 days of determining a SSI, the owner or operator will submit an ASD 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 an error in sampling, analysis, or statistical evaluation, or from natural variation in groundwater quality. The ASD must be prepared and certified by a qualified groundwater scientist. The owner or operator will not filter the groundwater sample for constituents addressed by the ASD prior to laboratory analysis. The owner or operator may provide analyses of the landfill leachate to support the demonstration. The owner or operator will continue to monitor in accordance with the detection monitoring program established under 30 TAC §330.407.

If the owner or operator does not make a demonstration satisfactory to the Executive Director within 90 days after the date of the notice to the TCEQ required under this subsection, the owner or operator shall initiate an assessment monitoring program as required in 30 TAC §330.407(b)(1) [and as further described in Section 7.1 of this GWSAP]. The owner or operator may install additional wells at the point of compliance to further characterize the release.

5.6 Detection Monitoring Reporting

The owner or operator shall submit an annual detection monitoring report within 90 days after the facility's last groundwater monitoring event in a calendar year in accordance with 30 TAC §330.407(c) that will include the following information determined since the previously submitted annual report:

- A statement regarding whether a SSI has occurred over background values in any well during the previous calendar year period and the status of any SSI events.
- A summary of the groundwater monitoring events with the monitoring status of each well.
- Results of all monitoring, testing, resampling, and analytical work obtained or prepared in accordance with the requirements of this permit during the sampling events for the year at the facility, including the following;
  - groundwater sampling results on form TCEQ-0312;
  - summary of background water quality values, groundwater monitoring analyses, statistical limits and analyses, graphs, and drawings;
  - the LCN described in Section 4.4 and either a completed laboratory review checklist included in the laboratory report(s) or the laboratory QA/QC data and laboratory analytical data; and
  - the COC record for the samples.
- Descriptions of the groundwater flow rate and direction in the uppermost aquifer. These values will be calculated using data collected during the preceding year's sampling events from the groundwater monitoring wells of the Site detection monitoring program. The report will include all data or documentation used to determine the groundwater flow rate and direction.
- A contour map of piezometric water levels based at a minimum on concurrent measurement in each of the monitoring wells. Data or documentation used to establish the contour map should be included in the report. Piezometric groundwater elevations and the potentiometric contour map should be compared to historical elevations and maps developed from previous submittals and sampling events to evaluate and comment in the report on any relevant changes or trends in the groundwater levels or surface[1].

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[1] Also note that the historical high groundwater levels as of the initial date of submittal of the permit amendment application for Permit 66C are tabulated in Part III, Attachment 3C, Appendix 3C-1 and accompanied by a map. Similarly, historical contour maps of groundwater potentiometric surfaces measured over time through December 2022 are included in Part III, Attachment 4E.

- Recommendations for any changes to the groundwater monitoring program, if any, including a re-evaluation of sample collection methods to determine if a change in the collection methodology would be appropriate.
- Any other items requested by the Executive Director.

The report may be provided in digital or hardcopy format.

In accordance with 30 TAC §330.407(d), if the owner or operator determines that the detection monitoring program no longer satisfies the requirements, the owner or operator must, within 90 days of this determination, submit an application for a permit amendment or modification to make any appropriate changes to the program.

6. STATISTICAL EVALUATION OF GROUNDWATER DATA

6.1 Statistical Analysis

The statistical method used to evaluate the groundwater data was prepared in accordance with the facility's statistical plan in this section, the USEPA (2009) statistical guidance document ("*Statistical Analysis of Ground-Water Monitoring Data at RCRA Facilities, Unified Guidance"*), and ASTM standard D6312-98 (*"Standard Guide for Developing Appropriate Statistical Approaches for Ground-Water Detection Monitoring Programs").* The statistical test(s) shall be conducted separately for each tested constituent in each well.

The inorganic parameters listed in Section 5.3 will be compared to historical background data using intrawell statistics. Intrawell statistics compare new measurements to the historical data at each groundwater monitoring well independently. The statistical analysis used for this facility will be in accordance with §330.405(e) and §330.405(f)(1-6), as appropriate, and will include control charts, prediction limits, confidence limit, or other methods approved for use in Detection or Assessment Monitoring. For Detection Monitoring, the methodology will employ the use of the combined Shewhart-CUSUM control chart method in accordance with §330.405(e)(4), or prediction limit (normal, log-normal, or non-parametric) in accordance with §330.405(e)(3), depending on the detection frequency and distribution of the data set. Combined Shewhart-CUSUM control charts will detect releases both in terms of the constituent concentration and cumulative increases. These methods are to be utilized on Section 5.3 metals only since many of these constituents may be found naturally in soils and groundwater samples. Section 5.3 organic constituents will be evaluated based upon a verified detection of a concentration greater than their respective PQLs since many, if not all, of these constituents are not expected to be found naturally in groundwater. Details on verification procedures are provided in Section 5.5.

To remove the possibility of historical outliers and trends creating false statistical limits, the data for each well and each constituent will be tested for the existence of outliers. The DUMPStat® program uses the method described by Dixon (1953) to define outliers in the background data set. If a sample collected during background is found to be above the critical value for the sample of size (n-1), then the value is not used in the establishment of the statistical limit from the background data set. Outliers may be removed from consideration during the establishment of all statistical limits. The statistical outlier and trend detection procedure will be performed for those wells that have had at least five measurements for a given constituent. Once the background database is established, the outlier procedure described above may be applied and appropriate statistical limits set.

6.2 Detection Verification Procedure

Once groundwater analysis results have been collected, checked for QA/QC consistency, and determined to be above the appropriate statistical level, the results must be verified in accordance with the objectives of 40 CFR §258.53. The following procedure will be performed for each compound determined to be initially above its statistical limit. Only compounds that initially exceed their statistical limit will be sampled for verification purposes. In order to verify an initial SSI, up to two verification resamples will be taken within 60 days of the initial SSI determination. If one of the two verification resamples is determined to be in control, then the initial SSI is considered to be not statistically significant (i.e., the SSI is not verified). A second verification resample is collected only if the first resample fails statistically (i.e., statistically significant). The initial exceedance is disconfirmed in the concentration in the first or second resample does not exceed the prediction limit (pass one of two). If both verification resamples fail statistically, then the SSI is verified and a written notice that a verified SSI has occurred will be submitted to the Executive Director, placed in the site operating record no later than 90 days of the initial SSI determination.

6.3 Volatile Organic Compounds

If one or more VOCs are detected above their statistical limit (i.e., PQL), up to two verification resamples will be scheduled. A SSI will be recorded if any single VOC is verified in any of the scheduled resampling events if a concentration is greater than the statistical limit.

6.4 Inorganic Constituents

If one or more of the inorganic parameters are detected above their statistical limit, up to two verification resamples will be collected with the resampling event. A SSI will be recorded if verification of one elevated parameter is confirmed in a concentration greater than the control/prediction limit for each of the discrete verification resamples. If the resampling program confirms that the initial sample represented a laboratory or sampling-induced outlier, the verification sample will replace the original reported value to eliminate bias from the statistical calculation which considers all data points collected at the Site.

7. ASSESSMENT MONITORING AND CORRECTIVE ACTION

7.1 Assessment Monitoring Plan

Assessment monitoring will be performed on a site-specific basis pursuant to this Assessment Monitoring Plan (AMP) and in accordance with 30 TAC §330.409 whenever it is determined that there has been a SSI over background for one or more of the constituents listed in Section 5.3. The purpose of this AMP is to provide the procedures and statistical methodology that will be used to evaluate inorganic and/or organic compound detections in groundwater against background and health-based groundwater protection standards, in order to address the requirements of 30 TAC §330.409 and federal RCRA Subtitle D (40 CFR Part 258) regulations.

In accordance with 30 TAC §330.409(b), within 90 days of determining that a SSI has occurred pursuant to 30 TAC §330.407(b), (i.e., after verification of the SSI and completion of any ASDs, if conducted), and not less than annually thereafter, the groundwater monitoring system will be sampled and analyzed for the full set of constituents in Appendix II to 40 CFR Part 258. Groundwater samples collected as part of assessment monitoring will not be filtered in the field or the laboratory prior to laboratory analysis.

If a SSI is verified, assessment monitoring will be initiated at the well(s) exhibiting the SSI and at the immediately adjacent wells on each side of the well(s) exhibiting the SSI, unless an alternative subset of wells is designated by the Executive Director. Note that although wells adjacent to the well(s) that are in assessment should be sampled for Appendix II constituents, they are not considered to be in assessment monitoring unless new statistical exceedances are detected during the initial Appendix II sampling. For any new constituent(s) detected in wells as a result of the complete Appendix II analysis, a minimum of four statistically independent samples from each background well shall be collected and analyzed to establish background levels for the additional constituent(s). After sampling the wells for Appendix II constituents, the TCEQ may specify an appropriate subset of wells to be sampled and analyzed for the Appendix II constituents during assessment monitoring and may delete any of the Appendix II constituents if the owner or operator can document that the removed constituents are not reasonably expected to be in or derived from the waste contained in the unit. All other groundwater wells will continue to be monitored in accordance with the existing detection monitoring protocols and statistical program.

Statistical analysis of the assessment monitoring constituents detected above background is based on the USEPA (2009) *Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities, Unified Guidance*. The statistical methodology will closely follow the methods presented in ASTM D-7048-04, *Standard Guide for Applying Statistical Methods for Assessment and Corrective Action Environmental Monitoring Programs* (2004), and includes the following methods:

For each constituent, set background to the upper 95% confidence prediction limit as described in ASTM D-7804-04 and Gibbons (1994). The prediction limits are computed from all available data collected from upgradient wells only. The data are first screened for outliners and then tested for normality and log normality.

(1) If the test of normality cannot be rejected, background is equal to the 95% confidence normal prediction limit.
(2) If the test of normality is rejected but the test of log normality cannot be rejected, background is equal to the 95% confidence lognormal prediction limit.
(3) If the data are neither normal nor lognormal, or the detection frequency is less than 50%, background is the nonparametric prediction limit, which is computed as the maximum number of upgradient measurements.

Data evaluation during assessment monitoring will consist of the establishment of 95% Lower Confidence Limits (LCLs) for any Appendix II constituent detected in concentrations greater than the PQL, assuming that a minimum of four background samples exist for each parameter detected during the assessment monitoring program. If inadequate background data exists, sufficient background data will be collected to provide an adequate sample size for statistical analysis. According to USEPA technical guidance, if the 95% LCL of one parameter exceeds action levels defined as maximum contaminant levels (MCLs), if applicable, or a health-based alternate GWPS, the facility is to initiate an assessment of corrective measures.

In accordance with 30 TAC §330.409(d), within 60 days of each sampling event, the results from the initial and subsequent sampling events will be evaluated to determine if constituents were detected at statistically significant levels above the GWPS, and the assessment monitoring results will be submitted to the Executive Director along with an assessment monitoring report, and placed in the Site Operating Record. The assessment monitoring report will include a statement documenting whether any constituent was present at a statistically significant level above a GWPS during the calendar year.

If the concentrations of all 40 CFR Part 258, Appendix II constituents are detected at or below background values, in accordance with the facility's statistical procedures, for two consecutive sampling events, the owner or operator will notify the Executive Director and return to detection monitoring if approved.

If the concentrations of any 40 CFR Part 258, Appendix II constituents are detected above background values but are below the GWPS, the owner or operator will continue assessment monitoring.

If the GWPS has been exceeded, the Executive Director and appropriate local government officials will be notified in writing within seven days of this determination. Additionally, if the GWPS has been exceeded, in accordance with 30 TAC §330.409(g)(1), the owner or operator will 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 in accordance with 30 TAC §330.409(d)(1); notify in writing all persons that own or occupy the land that directly overlies any part of the plume of contamination; and initiate an assessment of corrective measures within 90 days of the notice to the Executive Director.

The owner or operator may conduct an ASD in accordance with 30 TAC §330.409(g)(2). The Executive Director will be notified in writing within 14 days of the exceedance determination that the owner or operator intends to submit an ASD. The ASD report will be prepared and certified by a qualified groundwater scientist and will be submitted within 90 days of the exceedance determination. The owner or operator will not filter the groundwater sample for constituents addressed by the demonstration prior to laboratory analysis. The Executive Director may also require the owner or operator to provide analyses of the landfill leachate to support the demonstration. The owner or operator will continue to monitor in accordance with the assessment monitoring program. If a successful ASD is made, the owner or operator will continue monitoring in accordance with the assessment monitoring program. If the owner or operator determines that the assessment monitoring program no longer satisfies the applicable regulatory requirements, the owner or operator will, within 90 days, submit an application for a permit amendment or modification to make any appropriate changes to the program, in accordance with 30 TAC §330.409(g)(4).

7.2 Assessment of Corrective Measures

Within 90 days of finding that any of the 40 CFR, Part 258, Appendix II constituents have been detected at a statistically significant level above a GWPS, the owner or operator will initiate an assessment of corrective measures. This assessment must be completed within 180 days of initiating the assessment.

The assessment will analyze the effectiveness of potential corrective measures, including performance, reliability, ease of implementation, and potential impacts. The assessment will also discuss the control of exposure to residual contamination, time required to begin and complete the remedy, costs of remedy implementation, and institutional requirements, such as state or local permit requirements that may substantially affect implementation of the remedy or remedies.

Prior to selecting a remedy, the owner or operator will discuss the results of the assessment of corrective measures in a public meeting with interested and affected parties. The owner or operator will arrange the meeting and provide notice in accordance with the provisions of 30 TAC §39.501(e).

Groundwater monitoring for the purpose of corrective action assessment and implementation will be conducted in accordance with 30 TAC §330.411 through §330.415, in consultation with and approved by TCEQ.

7.2.1 Selection of Remedy

Within 30 days of completing the assessment of corrective measures, the facility will select a remedy and prior to the corrective action taking place, submit a report to TCEQ for review and approval in accordance with 30 TAC §330.413(a). The report will describe the remedy or remedies proposed for selection and how the selected remedy or remedies meet the standards in 30 TAC §330.413(b).

7.2.2 Implementation of the Corrective Action

The facility will implement a corrective action groundwater monitoring program following the schedule specified for the selected remedy. The corrective action is considered complete when the 95% UCL concentrations of all assessment constituents are shown to be at or below GWPSs for a period of three consecutive years using the statistical procedures in 30 TAC §330.405(e) and (f) and performance standards in 30 TAC §330.409(h), (i), or (j). The owner or operator will also take any interim measures necessary to ensure the protection of human health and the environment. Interim measures will, to the greatest extent practicable, be consistent with the objectives of and contribute to the performance of the approved remedy.

7.2.3 Corrective Action Report

If the facility is performing corrective action, an annual corrective action report shall be submitted to TCEQ by March 1 of each year.

8. REFERENCES

ASTM International (ASTM), 1998. ASTM Standard D6312-98 *Standard Guide for Developing Appropriate Statistical Approaches for Ground-Water Detection Monitoring Programs*, 1998.

Dixon, W. J. *Processing Data for Outliers*, Biometrics, 1953, Vol 9, pp. 74-89.

Gibbons, Dr. Robert. 1994. *Statistical Methods for Ground-Water Monitoring at Waste Disposal Facilities*, June 1994.

Standard Methods (SM), 2012. *Standard Methods for the Examination of Water and Wastewater*, 22nd edition.

TCEQ, 2010. *Progression of the Inter-Laboratory MSW-Practical Quantification Limit Study*, Letter to Owners and/or Operators of Type I and Type IV Municipal Solid Waste (MSW) Landfills, May 25, 2010.

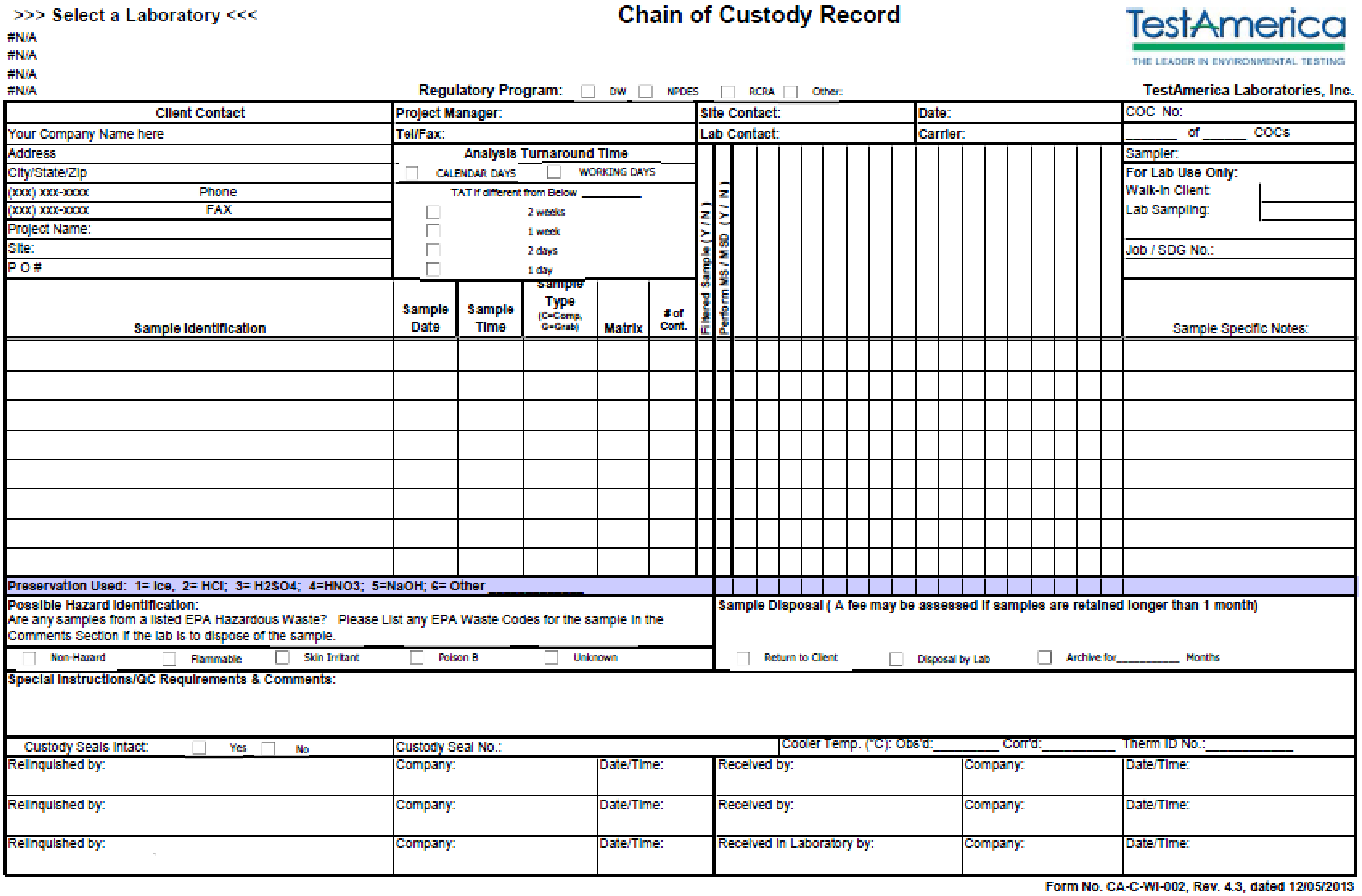
TCEQ, 2018. *Guidelines for Preparing a Groundwater Sampling and Analysis Plan*, RG-074, Revised May 2018.

USEPA, 1994. *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods*, SW-846, third edition with updates.

USEPA, 2009. *Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities, Unified Guidance*.

APPENDIX 1 OF ATTACHMENT 5C

EXAMPLE CHAIN-OF-CUSTODY RECORD



>>> Select a Laboratory <<<
#N/A
#N/A
#N/A
#N/A

Chain of Custody Record

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING
TestAmerica Laboratories, Inc.

Regulatory Program: ☐ DW ☐ NPDES ☐ RCRA ☐ Other:

Client Contact	**Project Manager:**	**Site Contact:**	**Date:**	COC No:
Your Company Name here	**Tel/Fax:**	**Lab Contact:**	**Carrier:**	_______ of ______ COCs
Address	**Analysis Turnaround Time**			Sampler:
City/State/Zip	☐ CALENDAR DAYS ☐ WORKING DAYS			**For Lab Use Only:**
(xxx) xxx-xxxx Phone	TAT if different from Below ________			Walk-in Client:
(xxx) xxx-xxxx FAX	☐ 2 weeks			Lab Sampling:
Project Name:	☐ 1 week			
Site:	☐ 2 days			Job / SDG No.:
P O #	☐ 1 day			

Sample Identification	Sample Date	Sample Time	Sample Type (C=Comp, G=Grab)	Matrix	# of Cont.	Filtered Sample (Y / N)	Perform MS / MSD (Y / N)	Sample Specific Notes:

Preservation Used: 1= Ice, 2= HCl; 3= H2SO4; 4=HNO3; 5=NaOH; 6= Other ____________

Possible Hazard Identification:
Are any samples from a listed EPA Hazardous Waste? Please List any EPA Waste Codes for the sample in the Comments Section if the lab is to dispose of the sample.
☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
☐ Return to Client ☐ Disposal by Lab ☐ Archive for_________ Months

Special Instructions/QC Requirements & Comments:

Custody Seals Intact: ☐ Yes ☐ No
Custody Seal No.:
Cooler Temp. (°C): Obs'd:_________ Corr'd:_________ Therm ID No.:___________

Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
Relinquished by:	Company:	Date/Time:	Received in Laboratory by:	Company:	Date/Time:

Form No. CA-C-WI-002, Rev. 4.3, dated 12/05/2013

ATTACHMENT 6

LANDFILL GAS MANAGEMENT PLAN

PART III – ATTACHMENT 6
LANDFILL GAS MANAGEMENT PLAN

MESQUITE CREEK LANDFILL
COMAL AND GUADALUPE COUNTIES, TEXAS
PERMIT AMENDMENT APPLICATION
MSW PERMIT NO. 66C

Prepared for:
Waste Management of Texas, Inc.

Prepared by:
Geosyntec consultants
Texas Board of Professional Engineers Firm Registration No. F-1182
8217 Shoal Creek Blvd, Suite 200
Austin, Texas 78757
(512) 451-4003

SCOTT M. GRAVES
86557

10/11/2023

FOR PERMIT PURPOSES ONLY

October 2023

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LANDFILL GAS MANAGEMENT PLAN

SCOTT M. GRAVES
86557

10/11/2023

FOR PERMIT PURPOSES ONLY

GEOSYNTEC CONSULTANTS, INC.
TEXAS ENG. FIRM
REGISTRATION NO. F-1182

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FOR PERMIT PURPOSES ONLY

GEOSYNTEC CONSULTANTS, INC.
TEXAS ENG. FIRM
REGISTRATION NO. F-1182

1. INTRODUCTION

This Landfill Gas Management Plan (plan) was prepared for the Mesquite Creek Landfill (the facility) to describe the program that will be implemented to monitor for potential off-site methane migration and potential accumulation of methane in on-site structures, and a description of how landfill gas (LFG) will be managed and controlled.

LFG is a byproduct of waste decomposition. In general, LFG may contain approximately 50% to 60% methane by volume. Methane is an odorless gas, yet potentially explosive in concentrations between 5% and 15% by volume in air (i.e., the lower explosive limit (LEL) and upper explosive limit (UEL), respectively). The LEL and UEL are defined as the lowest and highest percent by volume of a mixture of explosive gases in air, respectively, that will propagate a flame at 25º Celsius (C) and atmospheric pressure.

Texas Commission on Environmental Quality (TCEQ) landfill gas management rules, 30 TAC §330.371(a), require that the landfill is operated to ensure that the concentration of methane gas generated by the facility does not exceed:

1. One and a quarter percent (1.25%) methane by volume (i.e., twenty-five percent (25%) of the LEL for methane) in facility structures (excluding gas control or recovery system components); and

2. Five percent (5%) methane by volume (i.e., one hundred percent (100%) of the LEL for methane) in monitoring points, probes, subsurface soils, and other matrices at the facility permit boundary.

Per 30 TAC §330.371(b), a routine methane monitoring program, as described herein, will be implemented to ensure that the above standards are met. Accordingly, this plan describes subsurface monitoring for methane along the facility permit boundary and monitoring for methane in on-site enclosed structures. This plan also presents a description of assessment and remediation procedures that may potentially be required at the facility. Finally, this plan discusses the planned LFG controls that will be implemented.

The methane monitoring and control program set forth in this plan will be in effect during the active life of the landffill and will continue for a period of 30 years after the certification of final closure or until the owner or operator receives written authorization from TCEQ to revise or discontinue the program. Authorization to reduce gas monitoring and control shall be based on a demonstration that there is no potential for gas migration beyond the property boundary or into on-site structures. Demonstration of such a proposal shall be supported by data collected and additional studies, as required. Post-closure land use at the site must not interfere with the function of any landfill gas monitoring and control systems.

2. SITE DESCRIPTION

2.1 Site Type and Location

The facility is an existing and active Type I municipal solid waste (MSW) facility located in Comal and Guadalupe Counties, Texas, approximately 5 miles northeast of the central business district of the City of New Braunfels. The facility has received and is allowed to continue to receive the waste stream/type(s) allowed to be received at Type I MSW landfills as set forth in its approved and issued permit, of which the majority volumes are expected to be generally categorized as MSW. The facility is located approximately two miles (nominal) east of the intersection of the Interstate Highway (IH)-35 Kohlenberg Road exit, on the south side of Kohlenberg Road between Farm-to-Market Road (FM) 1101 to the west, and Schwarzlose Road to the east. The main site entrance/exit point is an existing set of side-by-side driveways (one for entrance, and one for exit) on the south side of Kohlenberg Road, approximately 0.8 miles east of FM 1101. The physical address is 1700 Kohlenberg Rd, New Braunfels, TX 78130. A site plan is shown on Drawings 6A-1A and 6A-1B, included in Attachment 6A of this plan.

2.2 Climate

The facility is located near the City of New Braunfels in the South Central climate division of Texas on the eastern edge of the Gulf Coastal Plain, and as a result has a modified subtropical climate. This location is situated between a semi-arid area to the west and a much wetter and more humid area to the east. Such a location allows for relatively large variations in monthly and annual precipitation amounts. The average annual precipitation for New Braunfels is 32.52 inches according to the Desert Research Institute's Western Regional Climate Center, although it may range from near 10 to about 60 inches of precipitation from one year to another. The January-February period is typically the driest, along with August. May tends to be among the wettest months, along with June and October. Average high temperatures vary from approximately 62°F to 96°F between Winters (January) and Summers (August), respectively. Average low temperatures vary from approximately 39°F to 73°F between Winters (January) and Summers (July-August), respectively. Below freezing temperatures during the winter occur on approximately 24 days each year on average. Above 90°F days occur on approximately 115 days each year on average. Normal relative humidity is about 72% on an annual average basis, and typically varies seasonally and with time of day, between ranges of about 51% to 88%.

2.3 Surrounding Land Use

The land surrounding the site is low population density open/agricultural land, composed of open land that is undeveloped or agricultural, and light residential (mobile homes and scattered single-family residences on acreages). Overall, these surroundings can be described as suburban to the west-southwest at the outer fringes of a one-mile offset radius from the site, transitioning to a rural character near the site and to the north, east, and south. Maps and a report presenting information on the surrounding land use are included in Part I/II of the permit amendment application (see Part I/II – Supplemental Technical Report). Compared to the average population density of Comal and Guadalupe Counties, the area within one mile of the site has a substantially lower population density (33 vs. 289 and 243 people per square mile, respectively). Additional information on relevant (to landfill gas management) surrounding land use immediately adjacent to the site is summarized below:

- The land located to the north and northeast is primarily open/agricultural land with few commercial and some residential low density land uses. Northeast of the middle portion of the existing facility (northeast of Unit 1, on the north side of Kohlenberg Road adjacent to the Mesquite Creek Landfill site), an off-site landfill gas recovery for beneficial use (gas-to-energy plant) exists, which receives landfill gas from this facility (operated by WMTX as authorized by TCEQ registration as a Type IX MSW facility). Further to the north and northeast are several scattered residences and agricultural land.

- The land east, southeast, and south of the site is almost entirely open/agricultural land with few residential low-density areas.

- The area west and southwest of the site is primarily open/agricultural land with some residential low density, residential medium density, and commercial uses.

- The area northwest of the site consists of open/agricultural land.

A map of inhabitable buildings and structures on-site and within a 500-ft offset from the permit boundary is shown on Part I/II, Appendix I/IIA, Drawing I/IIA-14. This information on surrounding land use and inhabitable buildings was considered during development of the methane monitoring program described subsequently.

2.4 On-Site Enclosed Structures

No structures are located or planned to be located on top of waste. On-site enclosed building structures at the facility are shown on Drawing 6A-1A and 6A-1B in Attachment 6A of this plan.

- The existing scale house/site office is located in the northeastern side of the property along the main access road into the site, and near Kohlenberg Road. Also, an existing on-site maintenance shop building exists northwest of existing Unit 2.

- There is one on-site residence located in the southern portion of the property in the expansion area. There are also three on-site barns. This residence and the barns are on

WMTX property (i.e., within the expansion area of the facility boundary) and will be vacated and removed in the future before landfill development progresses to these areas.

2.5 Underground Utilities

A map of the drainage, pipeline, and utility easements within or adjacent to the permit boundary is presented in Part I/II of the permit amendment application (see Drawing I/IIA-17 in Appendix I/IIA). As shown, there is an existing underground raw water pipeline and associated easement adjacent to Schwarzlose Road that traverses in a general north-south direction on the east side of the site.

2.6 Hydrogeology, Soils, and Surface Hydrology

LFG has the potential to migrate in the subsurface through the vadose zone (i.e., unsaturated zone) through preferential soil strata of relatively higher air permeability, if present. Surface hydrology features (creeks, ponds, etc.) can act as barriers for gas migration depending on whether there is sustained water present (perennial features), and the subsurface conditions beneath them. This section presents an overview of the basic hydrogeology, soils, and hydrology encountered at the site, in order to describe the subsurface conditions relevant to potential subsurface gas migration pathways.

The subsurface conditions beneath the site are divided into four strata (i.e., “layers”). The geologic description of the site stratigraphy, as well as a hydrogeologic characterization, is presented in the Geology Report (Part III, Attachment 4). The detailed geotechnical characterization of the soils is presented in Part III, Attachment 3D.1. The subsurface hydrogeology, geotechnical characteristics, and potential of the subsurface soil layers to act as potential pathway for gas migration are summarized below:

- Stratum I – Surficial fine-grained Quaternary weathered soil deposits: Generally dry, brown to dark gray medium to high-plasticity clay, stiff to hard in consistency (with occasional thin gravelly clay zones). Stratum I is occasionally absent, but usually present across the site where not already removed by landfill excavation activities. Stratum I has low hydraulic conductivity (and corresponding low air permeability in the vadose zone) and does not readily yield or transmit water. This layer has low potential to be a pathway for landfill gas migration due to its low-permeability composition of predominantly clays.

- Stratum II – Quaternary-Tertiary alluvium (possibly equivalent to Uvalde Gravel), generally clayey gravel to gravelly clay, dry, white or gray limestone gravel and/or chert gravel within a dark brown clay matrix, commonly cemented by caliche and firm in consistency. Stratum II is sporadically absent or present across most of the existing site where not already removed by landfill excavation activities, but is notably present on the natural topographic ridge (highs) along much of the east-southeastern portions of the Unit 2 area. Due to the clayey soil matrix structure in which any gravelly material is embedded, this stratum has a low hydraulic conductivity (and corresponding low air permeability in the vadose zone). Stratum II does not readily yield or transmit water (small localized seeps have been occasionally observed). While this layer has a low-permeability composition of predominantly particles embedded in a clayey matrix, the presence of more coarse particles and observance of occasional seeps makes it a potential pathway for landfill gas migration.

- Stratum III – Weathered Lower Taylor Group, brownish yellow/yellow to light gray weathered and oxidized calcareous clay with thin bedding planes, very stiff to hard in consistency. The base of the landfill is keyed-in to (i.e., founded within) Stratum III in a large majority of the landfill areas, with the few exceptions being localized instances where the base grades are founded in the upper portion of the Stratum IV claystone. The lower part of Stratum III exhibits a greater occurrence of secondary features (e.g., higher density of fractures, seams, and fissures), allowing it to contain and transmit groundwater. Furthermore, piezometers and monitoring wells screened at the base of Stratum III generally do contain sufficient quantities of groundwater for gauging and/or sampling and analysis purposes – i.e., the presence of groundwater has been observed and measured over time. However, site investigations have usually reported initial observations of generally dry soil conditions (few indications of wet or saturated material). Installed piezometers generally have been slow to fill with groundwater, indicating there is slow rate of groundwater movement, and that there may not be a distinct, continuous zone of saturation within Stratum III. The presence of groundwater and capacity for water movement within Stratum III is likely dependent on secondary features, notably the degree of cementation, fracture density, interconnection (or lack thereof), orientation, and the extent that the fractures have been filled by secondary mineralization. While this layer has a low-permeability clayey composition, the presence of secondary features and the discontinuous nature of groundwater make Stratum III a potential pathway for landfill gas migration.

- Stratum IV – Unweathered Lower Taylor Group, dry, calcareous green-gray to dark gray calcareous unweathered/unoxidized claystone, very hard in consistency. Stratum IV is composed of unweathered, primarily unoxidized, minimally fractured (and decreasing fracture density with depth), continuous, tight claystone, dry/unsaturated, and with low hydraulic conductivity. Occasionally, deeper parts of the landfill base are founded on Stratum IV, but it has generally been avoided (i.e., most of the liner grades kept in Stratum III, above the top of Stratum IV). The formation is a confining layer (aquiclude) beneath the site. Given these characteristics, Stratum IV is not considered a potential pathway for landfill gas migration.

With respect to surface hydrology, Mesquite Creek traverses the middle of the site, flowing towards the north-northeast. There are man-made perimeter drainage channels that flow around the landfill units and drain towards various on-site stormwater ponds. As landfill development progresses, additional perimeter drainage channels and stormwater ponds are proposed and will be constructed. The on-site stormwater ponds will operate as “dry ponds” (i.e., detention ponds with outlet structures designed to attenuate peak flows and slowly release stormwater after rain events, but ultimately will be emptied by gravity flow through the outlet structures).

3. LANDFILL GAS MONITORING

3.1 Overview of Landfill Gas Monitoring Program

The landfill gas methane monitoring program includes a perimeter monitoring network and monitoring of indoor air inside facility structures. An overview of the monitoring program is provided in Table 6-1 below.

TABLE 6-1
SUMMARY OF FACILITY LANDFILL GAS MONITORING PROGRAM

LOCATION	TYPE	FREQUENCY (1)(2)	MAXIMUM ALLOWABLE GAS CONC.	INSTALLATION REPORTING	ROUTINE MONITORING REPORTING	EXCEEDANCE ACTIONS
Facility Permit Boundary	Gas Monitoring Probes	Quarterly	5% methane by volume (i.e., 100% LEL)	Installation Report to TCEQ and Place Copy in Site Operating Record (See Section 4.1 of this Plan)	Place Copy in Site Operating Record (See Section 4.2 of this Plan)	Implement Contingency Plan (See Section 5 of this Plan)
Underground Utility Lines	Gas Vents	Quarterly	5% methane by volume (i.e., 100% LEL)	Place Copy of Installation Report in Site Operating Record		
Facility Structures	Ambient Indoor Air	Quarterly	1.25% methane by volume (i.e., 25% LEL)	None		

Notes:
(1) Monitoring frequency will be performed for the life of the landfill and during the 30-year post-closure period, unless written authorization to reduce the program is received by the TCEQ Executive Director. The authorization shall be based on a demonstration, supported by collected data and studies, by facility that there is no potential for gas migration beyond the facility boundary or inside site structures.
(2) All gas monitoring probes and on-site structures will be sampled for methane. Sampling for specified trace gases may be required by the TCEQ Executive Director when there is a possibility of acute or chronic exposure due to carcinogenic or toxic compounds. Also, more frequent monitoring will be required if monitoring results indicate gas migration/accumulation.

3.2 Facility Boundary Monitoring

3.2.1 Overview

Landfill gas monitoring along the facility permit boundary will be performed at a perimeter network of permanent subsurface landfill gas monitoring probes (GPs) at the locations shown on Drawings 6A-1A and 6A-1B presented in Attachment 6A of this plan, and detailed in Table 6-2 below.

TABLE 6-2
LANDFILL GAS MONITORING PROBE INFORMATION

GAS PROBE I.D.	COORD.[1]	ADJACENT LOWEST TOP OF LINER ELEV.[4]	GROUND SURFACE ELEV.	GAS PROBE DETAILS[2][3]							STATUS/TIMING
				GAS PROBE BOTTOM ELEV.	TOTAL GAS PROBE DEPTH[4]	DEPTH OF SCREENED INTERVAL		SCREEN LENGTH	ELEV. OF SCREENED INTERVAL		
		(ft, MSL)	(ft, MSL)	(ft, MSL)	(ft, bgs)	(ft, bgs)		(ft)	(ft, MSL)		
						FROM	TO		FROM	TO	
Existing Gas Probes[2]											
GP-1	N 13,818,826 E 2,275,954	Note 4	641.9	617.9	24.0	4.0	24.0	20.0	637.9	617.9	No Changes Proposed
GP-2	N 13,818,783 E 2,276,542	Note 4	662.8	627.8	35.0	5.0	35.0	30.0	657.8	627.8	No Changes Proposed
GP-3RA	N 13,817,931 E 2,277,413	Note 4	641.0	619.0	22.0	2.0	22.0	20.0	639.0	619.0	No Changes Proposed
GP-4	N 13,817,123 E 2,278,238	568	602.8	566.8	36.0	4.5	34.5	30.0	598.3	568.3	No Changes Proposed
GP-5A	N 13,816,549 E 2,277,564	564	609.1	557.1	52.0	6.0	51.0	45.0	603.1	558.1	No Changes Proposed
GP-6R	N 13,817,051 E 2,276,398	584	623.5	580.2	43.3	5.0	42.0	37.0	618.5	581.5	No Changes Proposed
GP-7	N 13,817,956 E 2,275,490	612	632.0	610.0	22.0	5.0	21.0	16.0	627.0	611.0	No Changes Proposed
GP-8	N 13,817,956 E 2,275,490	563	605.3	556.3	49.0	8.0	48.0	40.0	597.3	557.3	No Changes Proposed
GP-9	N 13,817,956 E 2,275,490	584	625.0	577.0	48.0	7.0	47.0	40.0	618.0	578.0	No Changes Proposed
GP-10	N 13,817,956 E 2,275,490	646	663.9	616.4	47.5	6.0	46.0	40.0	657.9	617.9	No Changes Proposed
GP-11	N 13,817,956 E 2,275,490	571	615.9	558.9	57.0	6.0	56.0	50.0	609.9	559.9	No Changes Proposed
GP-12	N 13,817,956 E 2,275,490	586	610.0	579.0	31.0	6.0	30.0	24.0	604.0	580.0	No Changes Proposed
GP-13	N 13,817,956 E 2,275,490	597	639.9	577.9	62.0	8.5	61.0	52.5	631.4	578.9	No Changes Proposed
GP-14	N 13,817,956 E 2,275,490	616	657.7	602.7	55.0	5.0	55.0	50.0	652.7	602.7	No Changes Proposed
GP-15	N 13,817,956 E 2,275,490	621	637.7	607.7	30.0	5.0	30.0	25.0	632.7	607.7	No Changes Proposed
GP-16	N 13,817,956 E 2,275,490	595	654.8	624.8	30.0	5.0	30.0	25.0	649.8	624.8	No Changes Proposed
GP-17	N 13,817,956 E 2,275,490	630	699.8	623.8	76.0	6.0	76.0	70.0	693.8	623.8	Discontinue Gas Monitoring Upon Installation of Replacement GP-17A; Plug and Abandon
GP-18	N 13,817,956 E 2,275,490	641	708.7	634.7	74.0	4.0	74.0	70.0	704.7	634.7	Discontinue Gas Monitoring Upon Installation of Replacement GP-18A; Plug and Abandon
GP-19	N 13,817,956 E 2,275,490	634	676.5	621.5	55.0	5.0	55.0	50.0	671.5	621.5	No Changes Proposed
GP-20	N 13,817,956 E 2,275,490	626	664.2	600.2	64.0	9.0	64.0	55.0	655.2	600.2	No Changes Proposed
GP-21	N 13,817,956 E 2,275,490	599	637.8	588.8	49.0	8.0	48.0	40.0	629.8	589.8	No Changes Proposed

GAS PROBE I.D.	COORD.(1)	ADJACENT LOWEST TOP OF LINER ELEV.(4)	GROUND SURFACE ELEV.	GAS PROBE DETAILS(2)(3)							STATUS/TIMING
				GAS PROBE BOTTOM ELEV.	TOTAL GAS PROBE DEPTH(4)	DEPTH OF SCREENED INTERVAL		SCREEN LENGTH	ELEV. OF SCREENED INTERVAL		
		(ft, MSL)	(ft, MSL)	(ft, MSL)	(ft, bgs)	(ft, bgs)		(ft)	(ft, MSL)		
						FROM	TO		FROM	TO	
Proposed Gas Probes(3)											
GP-17A	N 13,813,481 E 2,280,891	636	648.3	631	17	5	17	12	643.3	631.0	New Probe; Install No Later than Start of Unit 2, Phase VII, to replace GP-17
GP-18A	N 13,812,564 E 2,280,903	626	652.1	620	32	5	32	27	647.1	620.0	New Probe; Install No Later than Start of Unit 2, Phase VII, to replace GP-18
GP-22	N 13,812,000 E 2,280,334	627	668.2	622	46	5	46	41	663.2	622.0	New Probe; Install No Later than Start of Unit 2, Phase VII
GP-23	N 13,811,407 E 2,279,740	627	662.1	621	41	5	41	36	657.1	621.0	New Probe; Install No Later than Start of Unit 2, Phase IX
GP-24	N 13,810,816 E 2,279,148	628	671.3	623	48	5	48	43	666.3	623.0	New Probe; Install No Later than Start of Unit 2, Phase XI
GP-25	N 13,810,415 E 2,278,557	640	667.8	635	33	5	33	28	662.8	635.0	New Probe; Install No Later than Start of Unit 2, Phase XIII
GP-26	N 13,811,099 E 2,277,870	652	686.0	646	40	5	40	35	681.0	646.0	New Probe; Install No Later than Start of Unit 2, Phase XIII
GP-27	N 13,811,782 E 2,277,183	672	706.7	667	40	5	40	35	701.7	667.0	New Probe; Install No Later than Start of Unit 2, Phase XIII
GP-28	N 13,812,370 E 2,277,586	654	708.8	649	60	5	60	55	703.8	649.0	New Probe; Install No Later than Start of Unit 2, Phase XI
GP-29	N 13,812,962 E 2,278,179	650	707.5	645	62	5	62	57	702.5	645.0	New Probe; Install No Later than Start of Unit 2, Phase IX
GP-30	N 13,813,541 E 2,278,737	653	702.7	647	56	5	56	51	697.7	647.0	New Probe; Install No Later than Start of Unit 2, Phase VII

Notes:

MSL = Mean Sea Level; bgs = below ground surface

(1) Coordinates refer to Texas State Plane, North American Datum (NAD)-83, Texas Central Zone.

(2) Information from existing gas probes taken from construction logs.

(3) Proposed gas probe (i.e., new probe) locations are approximate and may be slightly field-adjusted as necessary (e.g., for drill rig access, actual subsurface findings, etc.). Proposed gas probes must be installed to a depth at least as deep as tabulated above.

(4) Lowest elevation of adjacent liner is within an approximately 500-ft distance from each probe, taken from the base grading plan (Drawing 3A-3A and 3A-3B). Pre-subtitle D elevations of Unit 1, Phase I are not available; existing Unit 1 area probes to remain as-is.

3.2.2 Basis for Gas Monitoring Probe Locations

Status of Existing Gas Monitoring Probes. The basis for the existing gas probe layout of the 21 probes identified as GP-1 through GP-21 was to provide monitoring locations at approximately 1000-ft spacing (or less) around the perimeter of the current landfill units. Existing gas probes will continue as-is, except gas probes GP-17 and GP-18, which are located in areas of future landfill fooptrint (i.e., the expansion area). As such, these two gas probes will need to be properly decommissioned (plugged and abandoned) once their replacements are in-place and before landfill development of the expansion area takes place affecting those probe locations. The resulting proposed gas monitoring probe network at this facility is described below.

Proposed Facility Gas Monitoring Probe Network. The gas monitoring probe locations and depths have been appropriately selected based on the geometry of the landfill in relation to the permit boundary, the subsurface characterization, surface hydrology/hydraulics features, the depth of the landfill (in relation to unsaturated strata), and the land use of adjacent properties. The basis for the gas monitoring probe locations is further described below:

- There are no changes proposed along the north, east, and west sides of the existing facility boundary.
- Along the south side of the existing facility boundary, GP-17 and GP-18 will be decommissioned and replaced by GP-17A and GP-18A along the east/southeast side of the proposed facility boundary adjacent to Schwarzlose Road.
- Along the south, west, and north sides of the facility boundary in the proposed expansion area, GP-22 through GP-30 will be added, providing a line of gas probes along the expansion area facility boundary spaced at intervals less than or equal to 1,000-ft apart.

The resulting gas monitoring network along the facility permit boundary, as described above, will be comprised of 30 permanent landfill gas monitoring probes.

3.2.3 Basis for Gas Monitoring Probe Depths

The existing gas monitoring probe depths were designed and installed in accordance with prior approvals. None of the probes are located above or within any existing or proposed waste. The bottom depth of each new proposed probe, as shown in Table 6-2, was selected to correspond to an elevation that is 5-ft (min) below the lowest liner system elevation adjacent to (within 500-ft of) each probe, and will be screened up to within approximately 5-ft of the ground surface, to encompass predominantly Stratum III, but also the more surficial soil layers (Strata I and II), where present. Each existing probe has/will have a surface seal (e.g., cement-bentonite and bentonite), and is/will be screened to the length of the borehole (full column) from the bottom of the casing up to the bentonite seal (discussed further in the next subsection).

3.2.4 Gas Monitoring Probe Design

The installation logs for the existing gas monitoring probes are presented in Attachment 6B of this plan. New probes that are installed will be installed in accordance with the gas probe design shown on Drawing 6A-2 presented in Attachment 6A of this plan. As shown, the gas monitoring probes will have a single screened interval for the full column of the borehole, along with the surface seal and completion.

3.2.5 Gas Monitoring Probe Installation

A gas monitoring probe will be constructed in the following typical manner by a qualified drilling contractor and logged by a geologist or engineer. A drill rig equipped with a hollow stem auger (or other suitable equivalent drilling equipment as determined by the professional who is overseeing the installation) is positioned above the desired probe location. A borehole is drilled vertically down to at least the design bottom elevation (with the actual final depth adjusted deeper if necessary, based on geologic data collected and observations made during drilling if it is judged that the strata/soils at the bottom of the design depth may be potentially conducive to gas migration and necessitate extending the depth of the probe to encompass such materials). After the borehole is completed, the gas monitoring probe casing is inserted. The bottom of the probe casing should be capped to prevent soil from plugging any portion of the perforated pipe section. Granular material (filter pack) is poured into the borehole to backfill the annular space surrounding the perforations/screened interval. This will facilitate gas movement into the gas probe from the surrounding soil. Above the filter pack, a bentonite seal is installed in the borehole. This will prevent gas from migrating up the borehole and surface water from infiltrating the probe. The gas probe will be clearly marked and protected by an outer protective pipe/collar. A concrete pad will be poured on the ground surface around the collar, and bollard posts may be installed around the concrete pad as further protection.

Details of the gas monitoring probe installation reporting requirements are given subsequently in Section 4.1 of this plan. Once installed, the integrity of the gas monitoring probes will be inspected during each routine quarterly monitoring event, and maintenance/repairs will be made as needed based on inspection findings (e.g., repair any damage to probe collar or casing, trim or remove unwanted vegetation, etc.).

3.3 Facility Structures Monitoring

The locations of existing on-site structure(s) are shown on Drawing 6A-1A and 6A-1B. If on-site structures are added, they will be monitored too, such that routine quarterly methane monitoring of the on-site structure(s) that exist at the time of monitoring will be performed as described in Section 3.5 of this plan.

It is noted that the facility may at its discretion elect to install continuous gas monitors/alarms within on-site building(s). However, continuous monitors are outside the scope of this plan, and as noted, facility structures will be monitored in the manner described in Section 3.5 of this plan.

3.4 Utility Monitoring Vents

As noted, an underground utility (raw water pipeline) crosses the east/southeast border of the site along Schwarzlose Road as shown on Drawing 6A-3B. There are two existing utility vents installed to monitor for the presence of landfill gas along this underground utility (see Figures 1 and 2 in Attachment 6D). These vents will continue to be monitored. Sampling at each vent will be conducted at least quarterly to observe for potential methane migration. Each utility trench vent will be open to the atmosphere. A hand-held combustible gas indicator will be used to measure the concentrations of methane present at the vent opening. The integrity of the utility monitoring vents will be inspected during each routine quarterly monitoring event, and maintenance/repairs will be made as needed based on inspection findings (e.g., repair any damage to vents, trim or remove unwanted vegetation, etc.).

Additional utility monitoring vents will be installed if needed. If additional vent(s) are needed, a record drawing of each vent installed will be prepared at the time of installation and submitted to TCEQ with that quarter's methane monitoring report. The drawing will include a cross-section of the ground surface, position of the underground utility, trench backfill, and the location of the vent relative to the backfill. Vent components and installation details will be shown.

3.5 Monitoring Procedures

Routine methane monitoring at each sampling location (gas monitoring probes and structures/buildings) will be performed using the following equipment:

- combustible gas indicator (CGI), or an equivalent instrument (e.g., Landtec® GA-5000, GEM-5000, photo/flame ionization detector, etc.) capable of detecting methane gas at concentrations of 0.5% to 100% by volume.
- Barometer and thermometer.

These instruments will be calibrated, used, and maintained in accordance with the equipment manufacturers' recommended procedures. The information, measurements, and observations required to be taken at each sampling location during each monitoring event will include:

- Documentation of the sampling location designation, date and time of each measurement, ambient atmospheric temperature and barometric pressure, general weather conditions, general condition/integrity of the gas monitoring probe, and name(s) of sampling personnel.

- Monitoring equipment used and date of last calibration.
- Methane concentrations in units of percent by volume methane and percent LEL.

The monitoring records will be recorded on data sheets similar to the sample one attached to this plan (see Attachment 6C). The exact format of the monitoring form may be modified from the example attached to this plan, but the data recorded during each monitoring event will at a minimum include the information identified above.

3.6 Maintenance Procedures

Each methane monitoring event will include an inspection of the integrity of gas monitoring probes, to check for the following:

- verify that the gas monitoring probe is clearly labeled on the outer casing or lid;
- verify that the protective casing is intact and not bent or excessively corroded;
- verify that the concrete pad is intact (no evidence of excessive cracking or heaving);
- verify that the padlock is functional; and
- verify that the inner casing is intact.

If damage or excessive wear to the gas monitoring probe is observed, it will be reported to the Site Manager. If it is not possible to repair the gas monitoring probe and the damage could potentially affect the accuracy of future monitoring results, the gas monitoring probe will be decommissioned (plugged and abandoned) and replaced with a new gas monitoring probe of the same design and at the same general location and documented in accordance with Section 4.1.

3.7 Gas Monitoring System Backup Plan

The following is a back-up plan to be used if any installed gas monitoring probes become unusable or inoperative.

1. Damaged or inoperative perimeter probes will be promptly repaired. If they need to be replaced, the replacement will be installed within 60 days from the TCEQ approval date of the permit modification requesting replacement.
2. Upon completion of the replacement probe, an installation report including boring logs and construction details will be submitted to the TCEQ.

3. Should a monitoring event occur prior to replacement of a damaged probe, a bar hole will be placed next to the damaged probe or vent and a portable gas monitor used until the probe is replaced.

3.8 Gas Monitoring System Revisions

LFG monitoring systems will be revised as needed (and with prior TCEQ Executive Director approval) to maintain current and effective gas monitoring systems. As noted previously, post-closure land use at the site must not interfere with the function of gas monitoring systems.

4. RECORDKEEPING AND REPORTING

4.1 Gas Monitoring Probe Installation Report

A gas monitoring probe installation report will be prepared upon completion of each new/replacement gas monitoring probe installation project and submitted to TCEQ. The installation report will include the following:

- A figure showing the site plan and gas monitoring probe locations/designations (e.g., copy of Drawings 6A-1A and 6A-1B in Attachment 6A of this plan, or similar figure).
- Boring logs for each new gas monitoring probe installed, including the drilling date and method, name(s) of the engineer or geologist who logged the hole, and information on the subsurface findings (soil types and depths, groundwater depth, if present, etc.).
- Construction summary logs for each new installed gas monitoring probe, providing the surveyed location coordinates of the probe, surveyed elevation of existing ground and top of probe riser casing, and identification of the probe materials, dimensions and depths/elevations, screen type and interval length, extent and types of filter pack, extent and types of annular seal, material and extent of backfill, presence of concrete pad, protective bollards, etc.

As previously discussed, GP-1 through GP-21, are existing gas monitoring probes. Installation information for these existing gas monitoring probes is presented in Attachment 6B of this plan. When gas monitoring probes are installed, their installation records will be submitted to TCEQ as mentioned above, and the records will be added to Attachment 6B of this plan.

4.2 Quarterly Gas Monitoring Records

Quarterly monitoring records for the gas monitoring probes and facility structures will be maintained in the facility’s Site Operating Record throughout the active life of the facility and during the post-closure period. The monitoring records will be recorded on data sheets similar to the one attached to this plan (Attachment 6C). The exact format of the monitoring form may be modified from the example attached to this plan, but the data recorded during each monitoring event will at a minimum include the information identified in Section 3.5 of this plan.

In the event that the maximum allowable methane concentrations set forth in Section 3.1 of this plan are exceeded, the facility must report the results to TCEQ and take other steps required by 30 TAC §330.371(c)(1) through (3), and as described subsequently in Section 5 of this plan.

5. ACTION PLAN

The steps outlined in this section will be taken if the monitoring reveals that methane is detected above the following allowable limits:

- One and a quarter percent (1.25%) methane by volume (i.e., twenty-five percent (25%) of the LEL for methane) in facility structures (excluding gas control or recovery system components); and

- Five percent (5%) methane by volume (i.e., one hundred percent (100%) of the LEL for methane) in monitoring points, probes, subsurface soils, and other matrices at the facility permit boundary.

1. <u>Immediate Actions</u>.
   a. If methane is detected above the allowable limits, the facility must immediately take necessary steps to protect human health. For example, the area around the exceedance will be inspected for any potential flame or spark sources; these will be removed, and the area may be roped-off to prevent unwanted entry. For on-site structures, the building will be evacuated and ventilated. Periodic follow-up methane readings will be taken to check whether the building is safe to be re-inhabited.
   b. After taking steps to protect human health, the facility will begin verification procedures to determine if the methane levels detected are accurate, or if erroneous levels have been detected due to equipment malfunction or other reasons:
      - In facility buildings/structures where the exceedance occurred, methane monitoring will be performed daily for one week. If concentrations of methane above the regulatory limit are not detected (i.e., a malfunction or erroneous reading is suspected), daily monitoring will cease, and routine monitoring will resume. Otherwise, step “c” below will be performed.
      - At the permit boundary where the exceedance occurred, a verification reading will be taken within 24 hours, and again within seven (7) days. If concentrations of methane above the regulatory limit are not detected (i.e., a malfunction or erroneous reading is suspected), monitoring will cease, and routine monitoring will resume. Otherwise, step “c” below will be performed.
   c. If the initial detection is verified to be an exceedance, the following parties will be notified of the situation via one of the following - email, telephone, fax, letter, or in-person communication:
      - The Manager of the MSW Permits Section of TCEQ’s Waste Permits Division in Austin;

- TCEQ Region Office;
- The local Fire and Health Departments;
- Neighboring landowners within 1,000-ft of the exceedance location; and
- Owners of underground utility easements which cross the facility within approximately 1,000 ft of the exceedance location.

By making the TCEQ notifications identified above, this will constitute providing notice to the TCEQ Executive Director in accordance with 30 TAC §330.371(c)(1).

2. Within Seven Days of Verified Exceedance. A record of the methane gas levels detected and a description of the immediate actions taken to protect human health will be placed in the Site Operating Record.

3. Within 60 Days of Verified Exceedance.
    a. A detailed evaluation will be made to determine the potential source and extent of the methane gas migration. A Remediation Plan will be prepared and must be submitted to the TCEQ Executive Director. The Remediation Plan will present the results of the detailed evaluation, along with the remedial measures taken, which may include additional monitoring, source control (e.g., supplemeting the active gas collection and control system (GCCS) by installing additional gas extraction wells or gas recovery vents/trenches near the affected area, installing an interceptor trench/barrier system, increasing the vacuum on nearby wells, etc.), installing active building ventilation systems, etc., depending on the specifics of the situation and outcome of the detailed evaluation.
    b. The Remediation Plan will incorporate remediation performance monitoring. The remediation performance monitoring will be conducted on a monthly basis at the affected gas monitoring location(s) and will submitted to TCEQ, until methane concentrations in the affected gas monitoring location(s) are below the allowable limits specified at the beginning of this section for six (6) consecutive months.

As allowed by 30 TAC §330.371(d), alternate schedules to those given above may be established by the TCEQ Executive Director.

6. LANDFILL GAS COLLECTION AND CONTROL SYSTEM (GCCS)

6.1 Overview

Currently, an active GCCS exists at the facility. The GCCS will continue and be expanded and revised as needed as landfill development progresses, in order to help maintain effective control of landfill gas, and in accordance with applicable federal new source performance standards (NSPS) requirements. Post-closure land use at the site will not interfere with the function of any landfill gas control systems.

6.2 Existing GCCS

Landfill gases are controlled and managed through an active landfill gas extraction system (i.e., the GCCS) – see Drawings 14-4A and 14-4B in Attachment 6D. The main components of this system are:

- gas extraction wells extending into the waste;
- the gas collection system of connected piping and a blower/compressor unit(s); and
- a gas header pipe that transfers landfill gas to the aforementioned gas-to-energy plant (adjacent to the Mesquite Creek Landfill, and as authorized as a Type IX MSW facility registration).

Gas extraction wells have been drilled through waste and, at the wellhead, are connected to a network of lateral and header piping. A blower/compressor is used to apply vacuum pressure to the system to extract gas from the waste. The extracted landfill gas is then conveyed to the aforementioned adjacent off-site gas-to-energy plant, where energy-conversion or flaring of the gas occurs. Ancillary components to the GCCS include the following:

- condensate sumps for removal of condensed landfill gas accumulations (handled in the same manner as leachate);
- various control valves, meters, and equipment needed to operate and monitor the GCCS;
- landfill gas ventilation and gas recovery trenches that have been installed along the facility perimeter to help control landfill gas migration (see Drawing 14-9 in Attachment 6D); and
- soil vapor extraction (SVE) wells that have been installed in correlation with a gas recovery trench to help control landfill gas migration (see Drawing 14-9 in Attachment 6D).

Information on the existing and proposed landfill gas control system, including GCCS layout and features, is shown on Drawings 6A-3A and 6A-3B in Attachment 6A of this plan.

6.3 Future GCCS Installation

As waste filling progresses, the GCCS will be expanded to maintain effective control of landfill gas and compliance with applicable NSPS requirements. A drawing presenting the GCCS completion plan are presented on Drawings 6A-3A and 6A-3B in Attachment 6A of this plan. The GCCS completion plan represents typical industry-standard spacing of gas extraction wells and layout of piping components routed to the aforementioned adjacent off-site gas-to-energy plant. The installed system will be consistent with this concept, but may be adjusted to facilitate proper operations (e.g., wells installed at a closer spacing, adjustments for actual observed gas generation rates, on-site flare station added if needed, or pipe layouts adjusted based on interim staging and slope/geometry constraints).

The GCCS component types will be the same as described above for the existing system, and will be installed using consistent typical details as shown on drawings presented in Attachment 6A. The as-built information for each phase of GCCS installation will be maintained in the Site Operating Record, documenting the location of the extraction wells, piping, and related GCCS components. Following each GCCS installation project, an as-built drawing(s) will be submitted to TCEQ to incorporate the updated GCCS information, as installed, into the existing permitted information. This will be submitted in the form of a revision/supplement to Attachment 6D (e.g., revised/added drawings).

6.4 GCCS Operation and Maintenance

Operation and maintenance (O&M) of the GCCS components will be performed consistent with industry guidelines and practices, and will include the following elements:

- Routine inspections of the components of the GCCS for proper operation.
- Tuning (adjusting) the wellfield to maintain compliance with landfill gas emission and migration requirements and to reflect changing on-site and adjacent site conditions.
- Operation of the blower and flare system (if applicable) to maintain a vacuum on the wellfield, and ensure that the flare (if applicable) operates within applicable air permit requirements.
- Preventative maintenance of the blower, flare (if applicable), air compressor, and control systems.

- Extraction wells, SVE wells, lateral and header pipes, and other features of the control sytems will be repaired or replaced when necessary due to settlement or other conditions that prevent them from conveying landfill gas. Repair work that is conducted on components installed beneath the final cover will require proper repair of the final cover, including replacement of cover components consistent with the original final cover construction.

- Compressed air lines, condensate sumps, and condensate conveyance pipes will be repaired or replaced as necessary.

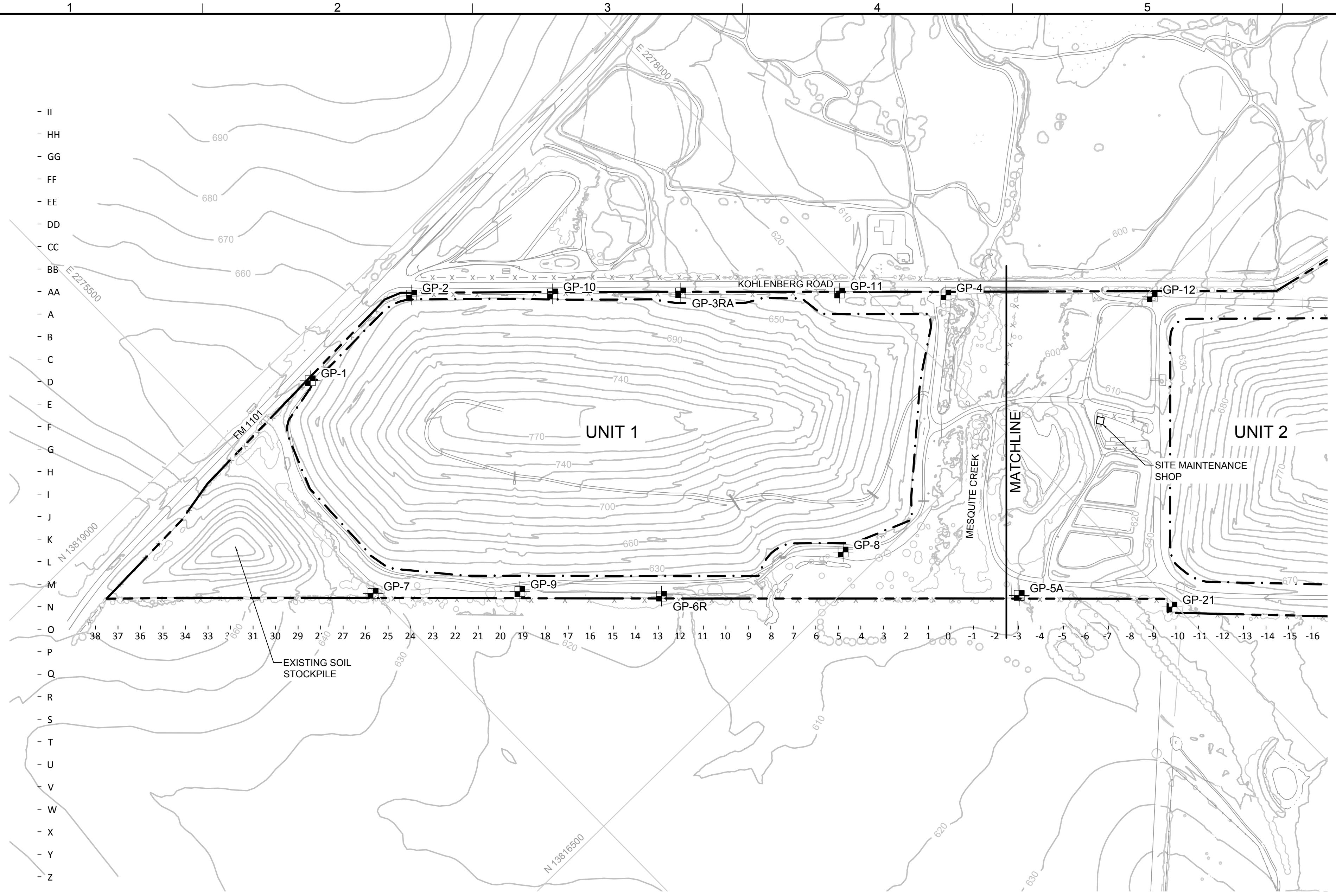
- Above-ground components of the landfill gas ventilation trenches and SVE wells will be inspected quarterly during the monitoring of gas probes and maintained as necessary.

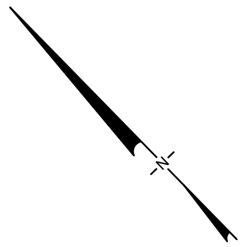
Backup Plan for GCCS. If the main GCCS breaks down, facility personnel or contractors will respond and make repairs. The O&M items presented above also address steps that will be taken if the system becomes ineffective (e.g., check components of GCCS that may be damaged and make repairs, increase vacuum in areas where gas exceedances are discovered by the monitoring program, add additional wells, etc.). If the main GCCS is ineffective in controlling landfill gas or otherwise operating in compliance with applicable NSPS requirements, it will be revised and updated (e.g., supplemeting the system with additional gas extraction wells or gas recovery vents/trenches to help control landfill gas migration and tied to the overall system, or installation of an interceptor trench with passive gas vents).

ATTACHMENT 6A

LANDFILL GAS MANAGEMENT SYSTEM DRAWINGS

LIST OF DRAWINGS		
Drawing No.	Title	Drawing Date (latest revision)
6A-1A	Landfill Gas Monitoring System Plan Unit 1	October 2023
6A-1B	Landfill Gas Monitoring System Plan Unit 2	October 2023
6A-2	Landfill Gas Monitoring System Details	October 2023
6A-3A	Landfill Gas Collection System Plan Unit 1	October 2023
6A-3B	Conceptual Landfill Gas Collection System Plan Unit 2	October 2023
6A-4	Typical Landfill Gas Management System Details I	October 2023
6A-5	Typical Landfill Gas Management System Details II	October 2023
6A-6	Typical Landfill Gas Management System Details III	October 2023





LEGEND

- 580 EXISTING GROUND ELEVATION CONTOUR (FT, MSL) (NOTES 1, 2)
- EXISTING ROAD
- EXISTING VEGETATION / TREE
- x x EXISTING FENCE
- EXISTING BUILDING
- EXISTING WATER LINE
- 13 A SITE GRID
- PERMIT BOUNDARY (NOTE 5)
- LIMIT OF WASTE
- GP-1 LANDFILL GAS MONITORING PROBE

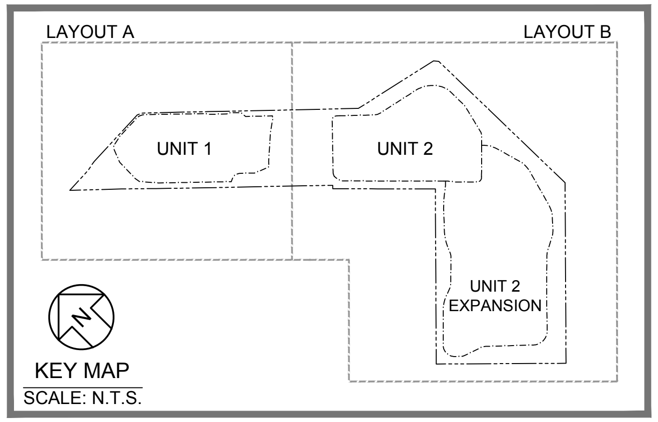
NOTES:

1. TOPOGRAPHIC BASE MAP OF EXISTING SITE CONDITIONS WAS GENERATED BY PHOTOGRAMMETRIC METHODS BASED ON AN AERIAL SURVEY FLOWN ON 01 FEBRUARY 2022 BY HYDREX ENVIRONMENTAL, AND BY DALLAS AERIAL SURVEYING (DAS) FLOWN IN 2018-2019. EXISTING TOPOGRAPHY OUTSIDE OF PROPERTY WHERE SHOWN SUPPLEMENTED WITH THE UNITED STATES GEOLOGIC SURVEY (USGS) 3DEP PROGRAM PUBLISHED IN NOVEMBER 2021.
2. ELEVATIONS ARE IN FEET ABOVE MEAN SEA LEVEL (FT, MSL) AND ADJUSTED TO A DEFINED WASTE MANAGEMENT DATUM. DRAWING COORDINATES ARE BASED ON TEXAS STATE PLANE SOUTH CENTRAL ZONE US FOOT.
3. GAS MONITORING PROBE LOCATIONS MAY VARY SLIGHTLY (E.G., BASED ON DRILL RIG ACCESSIBILITY, ETC.).
4. REFER TO LANDFILL GAS MANAGEMENT PLAN NARRATIVE FOR INFORMATION ON THE DEPTH, SCREENED INTERVALS, AND TIMING OF INSTALLATION AND DECOMMISSIONING (AS APPLICABLE) OF THE LANDFILL GAS MONITORING PROBES.
5. PERMIT BOUNDARY AND PROPERTY BOUNDARY COINCIDE.

0 300' 600'
SCALE IN FEET

SCOTT M. GRAVES
86557
10/11/2023

FOR PERMIT PURPOSES ONLY



KEY MAP
SCALE: N.T.S.

PERMIT DRAWING

REV	DATE	DESCRIPTION	DRN	APP

WASTE MANAGEMENT
WASTE MANAGEMENT OF TEXAS, INC.
1700 KOHLENBERG ROAD
NEW BRAUNFELS, TEXAS 78130
PHONE: 830.625.7894

Geosyntec consultants
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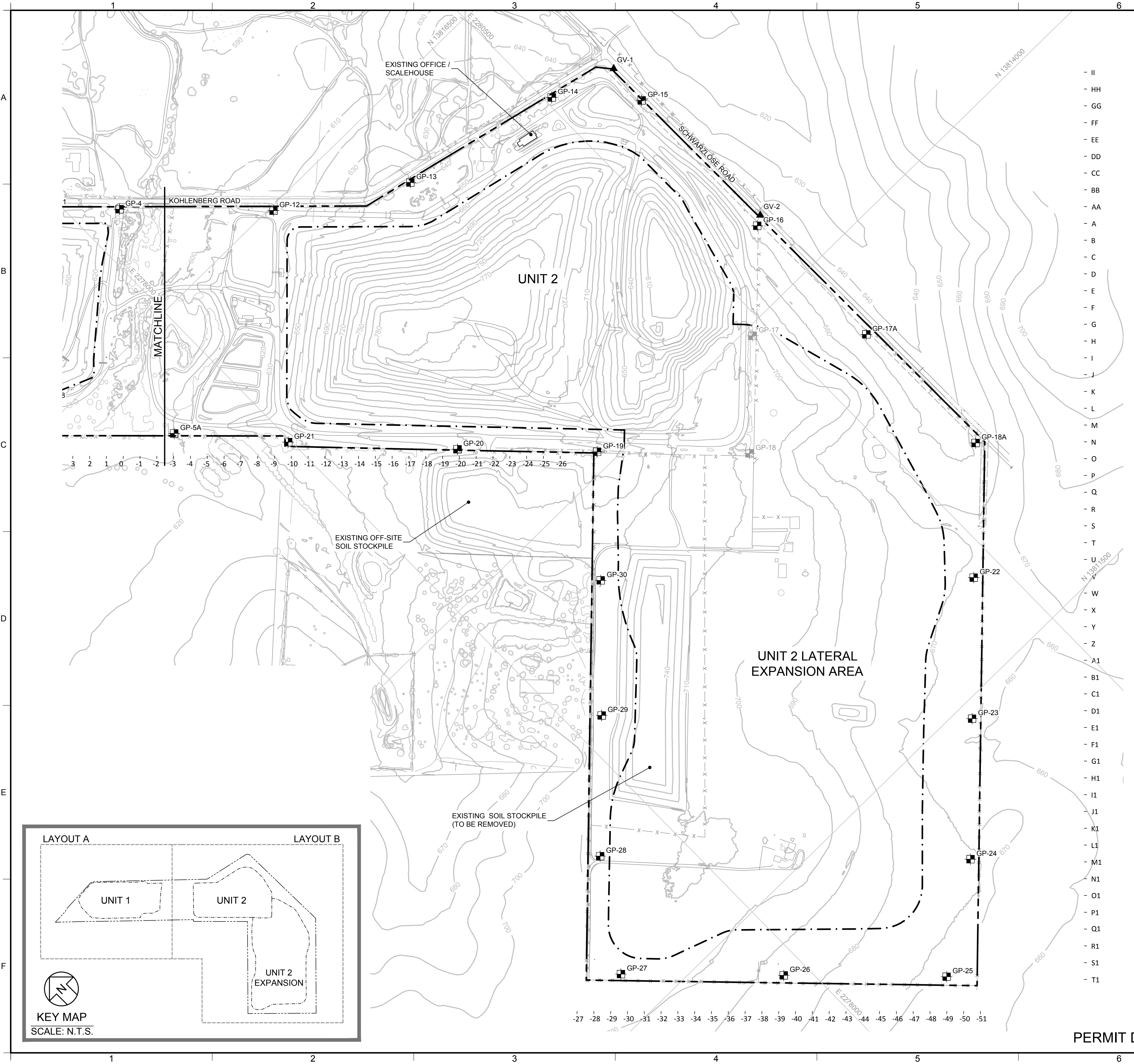
TEXAS ENGINEERING FIRM REGISTRATION NUMBER F-1182
8217 SHOAL CREEK BLVD, SUITE 200
AUSTIN, TEXAS 78757
PHONE: 512.451.4003

TITLE:
LANDFILL GAS MONITORING SYSTEM PLAN UNIT 1

PROJECT:
MESQUITE CREEK LANDFILL EXPANSION
PERMIT AMENDMENT APPLICATION - MSW PERMIT NO. 66C

PROJECT NO.: GW8636	DESIGN BY:	SMG	REVIEWED BY:	YB	PART NO.:	III	DRAWING: 6A-1A
FILE: GW8636P6A-1A	DRAWN BY:	JJV / KH	APPROVED BY:	SMG			

AUS-01\\P:\CADD\PROJECTS\WM\MESQUITE CREEK LANDFILL\PERMIT\EXPANSION 66C (GW8636)\04-07 DRAWINGS PARTS I-IV\GW8636P6A-1A.DWG



LEGEND

580	EXISTING GROUND ELEVATION CONTOUR (FT, MSL) (NOTES 1, 2)
	EXISTING ROAD
	EXISTING VEGETATION / TREE
— x — x —	EXISTING FENCE
☐	EXISTING BUILDING
	EXISTING WATER LINE
13 A	SITE GRID
	PERMIT BOUNDARY (NOTE 5)
	LIMIT OF WASTE
GP-1	LANDFILL GAS MONITORING PROBE
GP-17	EXISTING LANDFILL GAS MONITORING PROBE TO BE PLUGGED AND ABANDONED (NOTE 4)
▲ GV-1	GAS VENT (NOTE 6)

NOTES:

1. TOPOGRAPHIC BASE MAP OF EXISTING SITE CONDITIONS WAS GENERATED BY PHOTOGRAMMETRIC METHODS BASED ON AN AERIAL SURVEY FLOWN ON 01 FEBRUARY 2022 BY HYDREX ENVIRONMENTAL, AND BY DALLAS AERIAL SURVEYING (DAS) FLOWN IN 2018-2019. EXISTING TOPOGRAPHY OUTSIDE OF PROPERTY WHERE SHOWN SUPPLEMENTED WITH THE UNITED STATES GEOLOGIC SURVEY (USGS) 3DEP PROGRAM PUBLISHED IN NOVEMBER 2021.
2. ELEVATIONS ARE IN FEET ABOVE MEAN SEA LEVEL (FT, MSL) AND ADJUSTED TO A DEFINED WASTE MANAGEMENT DATUM. DRAWING COORDINATES ARE BASED ON TEXAS STATE PLANE SOUTH CENTRAL ZONE US FOOT.
3. GAS MONITORING PROBE LOCATIONS MAY VARY SLIGHTLY (E.G., BASED ON DRILL RIG ACCESSIBILITY, ETC.).
4. REFER TO LANDFILL GAS MANAGEMENT PLAN NARRATIVE FOR INFORMATION ON THE DEPTH, SCREENED INTERVALS, AND TIMING OF INSTALLATION AND DECOMMISSIONING (AS APPLICABLE) OF THE LANDFILL GAS MONITORING PROBES.
5. PERMIT BOUNDARY AND PROPERTY BOUNDARY COINCIDE.
6. GV-1 AND GV-2 ARE EXISTING - SEE FIGURES 1 AND 2 IN ATTACHMENT 6D.

0 300' 600'
SCALE IN FEET

SCOTT M. GRAVES
86557

10/11/2023

FOR PERMIT PURPOSES ONLY

REV	DATE	DESCRIPTION	DRN	APP

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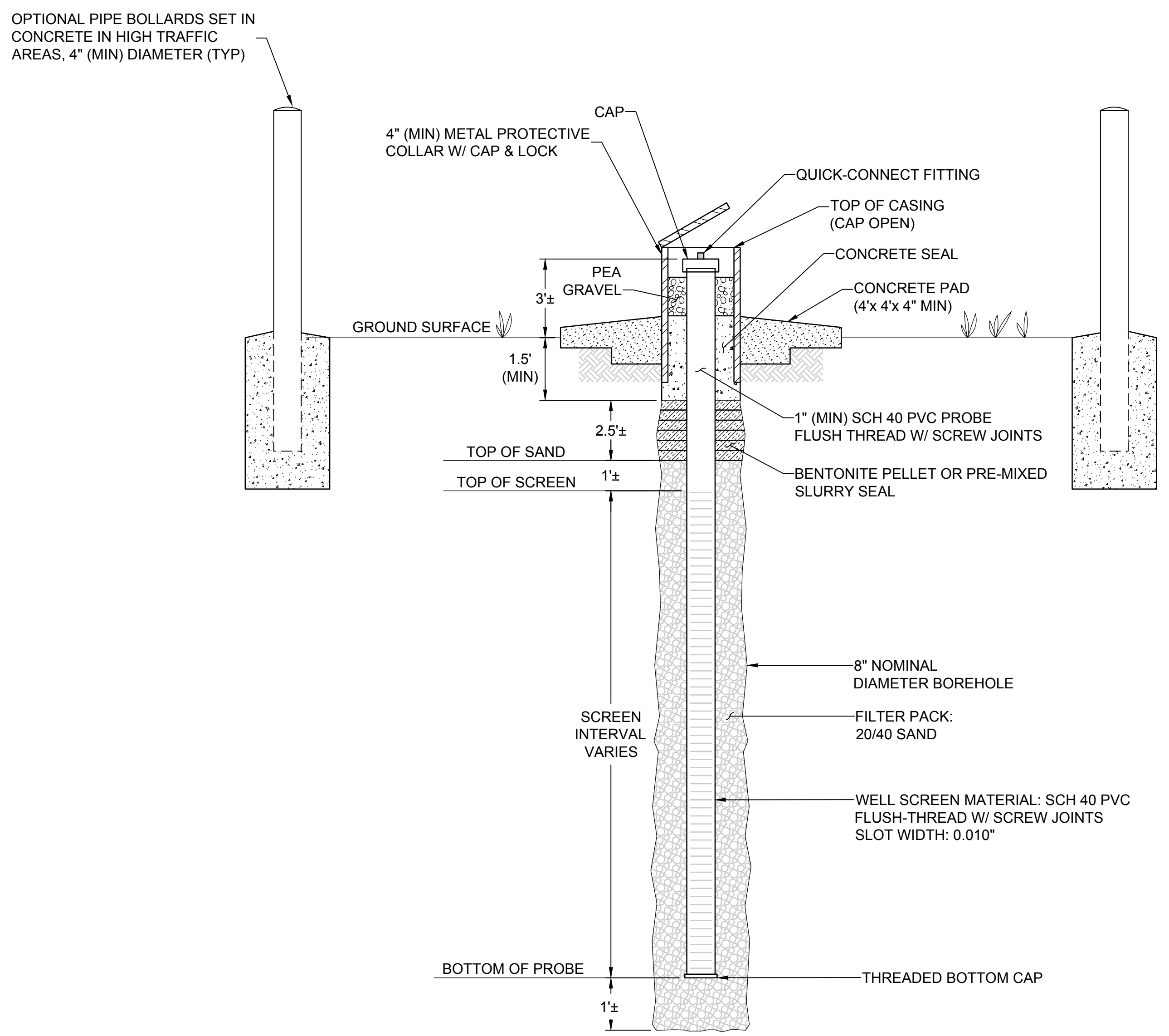
TEXAS ENG. FIRM REGISTRATION NO. 1182
8217 SHOAL CREEK BLVD, SUITE 200
AUSTIN, TEXAS 78757
PHONE: 512.451.4003

TITLE:
LANDFILL GAS MONITORING SYSTEM PLAN UNIT 2

PROJECT:
MESQUITE CREEK LANDFILL EXPANSION
PERMIT AMENDMENT APPLICATION - MSW PERMIT NO. 66C

PERMIT DRAWING

PROJECT NO.:	GW8636	DESIGN BY:	SMG	REVIEWED BY:	YB	PART NO.:	DRAWING:
FILE:	GW8636P6A-1B	DRAWN BY:	JJV / KH	APPROVED BY:	SMG	III	6A-1B



1
6A-2

DETAIL
LANDFILL GAS MONITORING PROBE

SCALE: N.T.S

SCOTT M. GRAVES
86557
10/11/2023

FOR PERMIT PURPOSES ONLY

PERMIT DRAWING

REV	DATE	DESCRIPTION	DRN	APP

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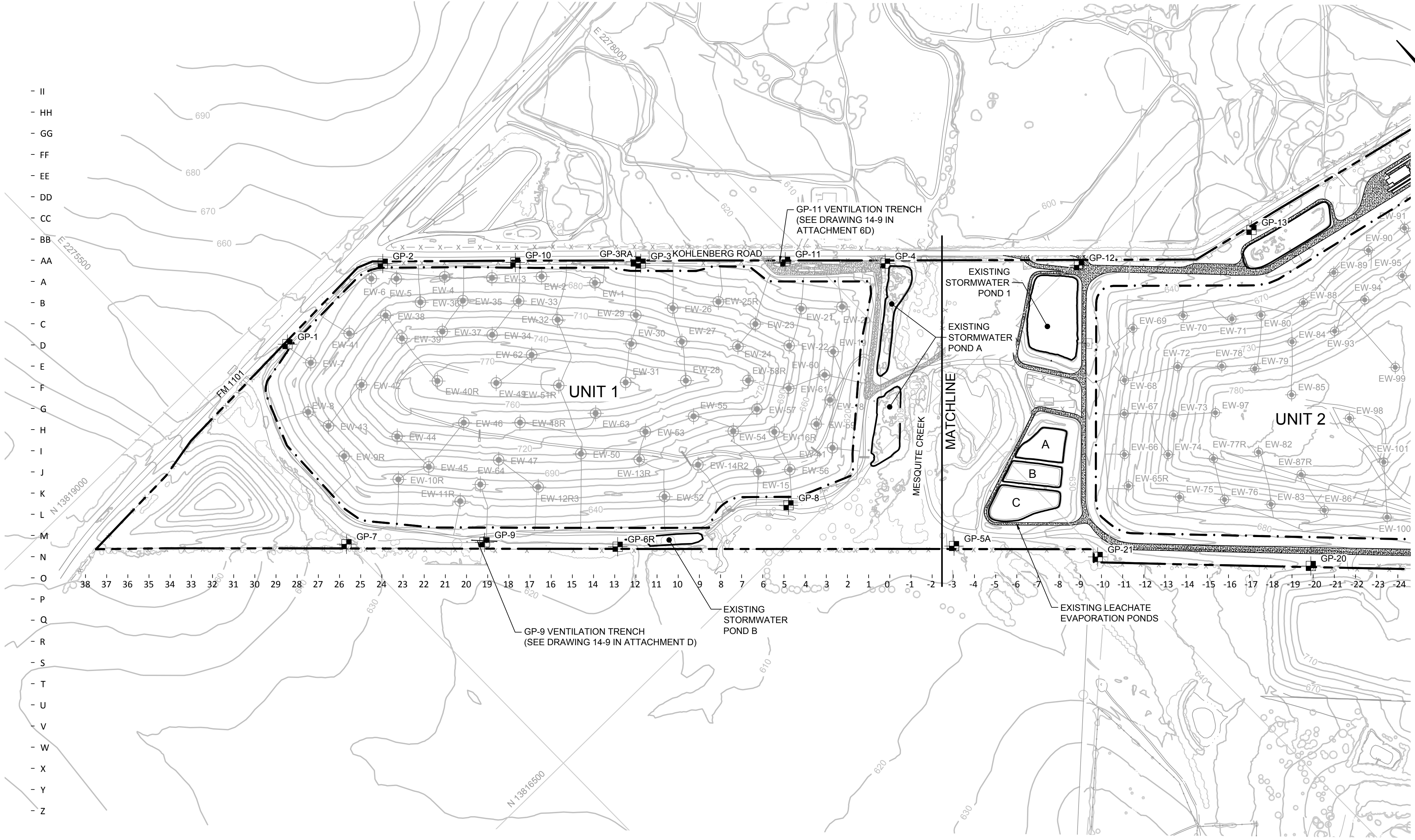
AUSTIN, TEXAS 78757
PHONE: 512.451.4003

TITLE:
LANDFILL GAS MONITORING SYSTEM DETAILS

PROJECT:
MESQUITE CREEK LANDFILL EXPANSION
PERMIT AMENDMENT APPLICATION - MSW PERMIT NO. 66C

PROJECT NO.:	GW8636	DESIGN BY:	SMG	REVIEWED BY:	YB	PART NO.:	DRAWING:
FILE:	GW8636P6A-2	DRAWN BY:	JJV / KH	APPROVED BY:	SMG	III	6A-2



LEGEND

580	EXISTING GROUND ELEVATION CONTOUR (FT, MSL) (NOTES 1, 2)
	EXISTING ROAD
	EXISTING VEGETATION / TREE
x x	EXISTING FENCE
	EXISTING BUILDING
	EXISTING WATER LINE
A 13	SITE GRID
	PERMIT BOUNDARY
	LIMIT OF WASTE
690	PROPOSED GROUND ELEVATION (FT, MSL) (NOTE 3)
▨	LANDFILL ENTRANCE/EXIT AND PERIMETER ROAD
	EXISTING LFG COLLECTION PIPING (NOTE 4)
EW-66	EXISTING LFG EXTRACTION WELL (NOTE 4)
GP-13	LANDFILL GAS MONITORING PROBE

NOTES:

1. TOPOGRAPHIC BASE MAP OF EXISTING SITE CONDITIONS WAS GENERATED BY PHOTOGRAMMETRIC METHODS BASED ON AN AERIAL SURVEY FLOWN ON 01 FEBRUARY 2022 BY HYDREX ENVIRONMENTAL, AND BY DALLAS AERIAL SURVEYING (DAS) FLOWN IN 2018-2019. EXISTING TOPOGRAPHY OUTSIDE OF PROPERTY WHERE SHOWN SUPPLEMENTED WITH THE UNITED STATES GEOLOGIC SURVEY (USGS) 3DEP PROGRAM PUBLISHED IN NOVEMBER 2021.
2. ELEVATIONS ARE IN FEET ABOVE MEAN SEA LEVEL (FT, MSL) AND ADJUSTED TO A DEFINED WASTE MANAGEMENT DATUM. DRAWING COORDINATES ARE BASED ON TEXAS STATE PLANE SOUTH CENTRAL ZONE US FOOT.
3. PROPOSED GROUND WITHIN THE LIMIT OF FINAL COVER REFERS TO TOP OF FINAL COVER SYSTEM (TOP OF THE TOPSOIL COMPONENT OF THE FINAL COVER SYSTEM). LIMIT OF FINAL COVER SYSTEM REFERS TO THE TOE OF SLOPE OF THE TOPSOIL LAYER. OUTSIDE OF THE LIMIT OF FINAL COVER, THE PROPOSED CONTOURS REFER TO FINISHED GRADE.
4. THE PURPOSE OF THIS DRAWING IS TO PRESENT THE EXISTING AND CONCEPTUAL LAYOUT OF THE MAIN COMPONENTS OF THE LANDFILL GAS COLLECTION AND CONTROL SYSTEM (GCCS) ON THE FINAL COMPLETION PLAN OF THE LANDFILL. THE GCCS FEATURES IN UNIT 1 AND A PORTION OF UNIT 2 ARE EXISTING AS ILLUSTRATED ON THIS DRAWING. EXISTING WELL LOCATIONS AND EXISTING PIPING CONNECTING THE WELLS WERE PROVIDED BY WASTE MANAGEMENT IN JANUARY 2023. THE PROPOSED GCCS FEATURES WILL BE INSTALLED IN PHASES; LOCATIONS OF THESE GCCS FEATURES ARE APPROXIMATE, AND MAY BE FIELD ADJUSTED DURING INSTALLATION. REFER TO THE LANDFILL GAS MANAGEMENT PLAN NARRATIVE FOR A DESCRIPTION OF THE PROCESS FOR DOCUMENTING AND SUBMITTING AS-BUILTS OF THE GCCS.

SCOTT M. GRAVES
86557
10/11/2023

0 300' 600'
SCALE IN FEET

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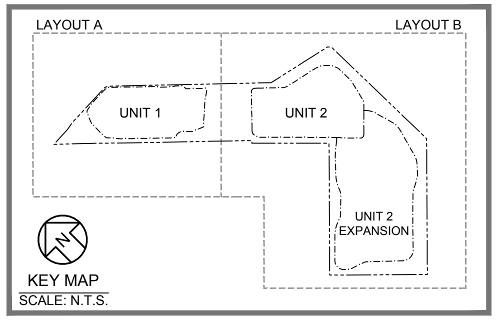

KEY MAP
SCALE: N.T.S.

PERMIT DRAWING

REV	DATE	DESCRIPTION	DRN	APP

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AUSTIN, TEXAS 78757
PHONE: 512.451.4003

TITLE:

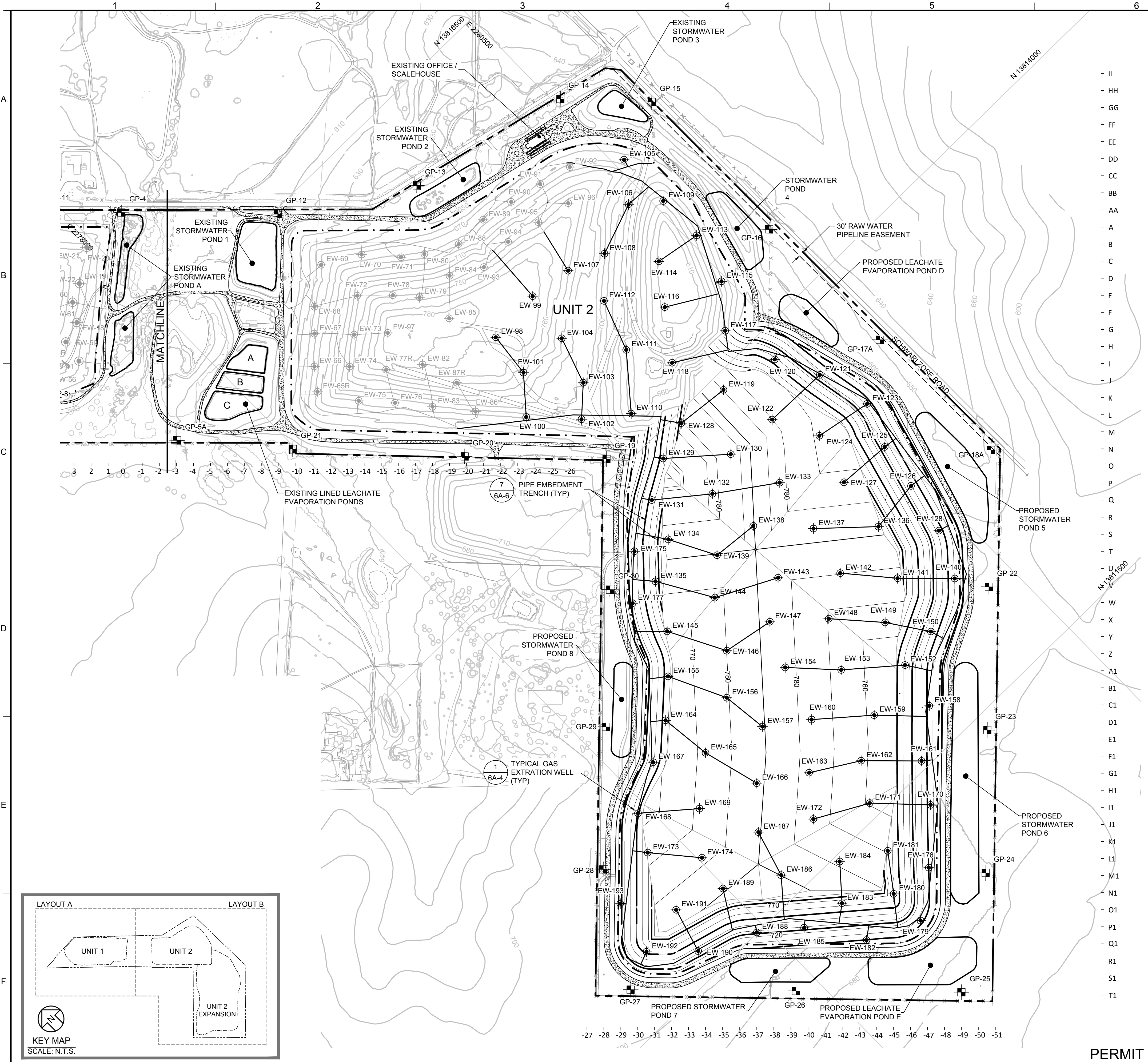
LANDFILL GAS COLLECTION SYSTEM PLAN UNIT 1

PROJECT:

MESQUITE CREEK LANDFILL EXPANSION
PERMIT AMENDMENT APPLICATION - MSW PERMIT NO. 66C

PROJECT NO.: GW8636	DESIGN BY: SMG	REVIEWED BY: YB	PART NO.: III	DRAWING: 6A-3A
FILE: GW8636P6A-3B	DRAWN BY: JJV / KH	APPROVED BY: SMG		

AUS-01\\P:\CADD\PROJECTS\MMESQUITE CREEK LANDFILL\PERMIT\EXPANSION 66C (GW8636)\04-07 DRAWINGS PARTS I-IV\GW8636P6A-3B.DWG



	LEGEND
580	EXISTING GROUND ELEVATION CONTOUR (FT, MSL) (NOTES 1, 2)
	EXISTING ROAD
	EXISTING VEGETATION / TREE
x x	EXISTING FENCE
	EXISTING BUILDING
	EXISTING WATER LINE
13 A	SITE GRID
	PERMIT BOUNDARY
	LIMIT OF WASTE
760	PROPOSED GROUND ELEVATION (FT, MSL) (NOTE 3)
	LANDFILL ENTRANCE/EXIT AND PERIMETER ROAD
	EXISTING LFG COLLECTION PIPING (NOTE 4)
EW-92	EXISTING LFG EXTRACTION WELL (NOTE 4)
	LFG COLLECTION PIPING (NOTE 4)
EW-133	LFG EXTRACTION WELL (NOTE 4)
GP-13	LANDFILL GAS MONITORING PROBE

NOTES:

1. TOPOGRAPHIC BASE MAP OF EXISTING SITE CONDITIONS WAS GENERATED BY PHOTOGRAMMETRIC METHODS BASED ON AN AERIAL SURVEY FLOWN ON 01 FEBRUARY 2022 BY HYDREX ENVIRONMENTAL, AND BY DALLAS AERIAL SURVEYING (DAS) FLOWN IN 2018-2019. EXISTING TOPOGRAPHY OUTSIDE OF PROPERTY WHERE SHOWN SUPPLEMENTED WITH THE UNITED STATES GEOLOGIC SURVEY (USGS) 3DEP PROGRAM PUBLISHED IN NOVEMBER 2021.
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3. PROPOSED GROUND WITHIN THE LIMIT OF FINAL COVER REFERS TO TOP OF FINAL COVER SYSTEM (TOP OF THE TOPSOIL COMPONENT OF THE FINAL COVER SYSTEM). OUTSIDE OF THE LIMIT OF FINAL COVER, THE PROPOSED CONTOURS REFER TO FINISHED GRADE.
4. THE PURPOSE OF THIS DRAWING IS TO PRESENT THE EXISTING AND CONCEPTUAL LAYOUT OF THE MAIN COMPONENTS OF THE LANDFILL GAS COLLECTION AND CONTROL SYSTEM (GCCS) ON THE FINAL COMPLETION PLAN OF THE LANDFILL. THE GCCS FEATURES IN UNIT 1 AND A PORTION OF UNIT 2 ARE EXISTING AS ILLUSTRATED ON THIS DRAWING. EXISTING WELL LOCATIONS AND EXISTING PIPING CONNECTING THE WELLS WERE PROVIDED BY WASTE MANAGEMENT IN JANUARY 2023. THE PROPOSED GCCS FEATURES WILL BE INSTALLED IN PHASES; LOCATIONS OF THESE GCCS FEATURES ARE APPROXIMATE, AND MAY BE FIELD ADJUSTED DURING INSTALLATION. REFER TO THE LANDFILL GAS MANAGEMENT PLAN NARRATIVE FOR A DESCRIPTION OF THE PROCESS FOR DOCUMENTING AND SUBMITTING AS-BUILTS OF THE GCCS.

SCOTT M. GRAVES
86557

10/11/2023

0 300' 600'
SCALE IN FEET

FOR PERMIT PURPOSES ONLY

KEY MAP
SCALE: N.T.S.

REV	DATE	DESCRIPTION	DRN	APP

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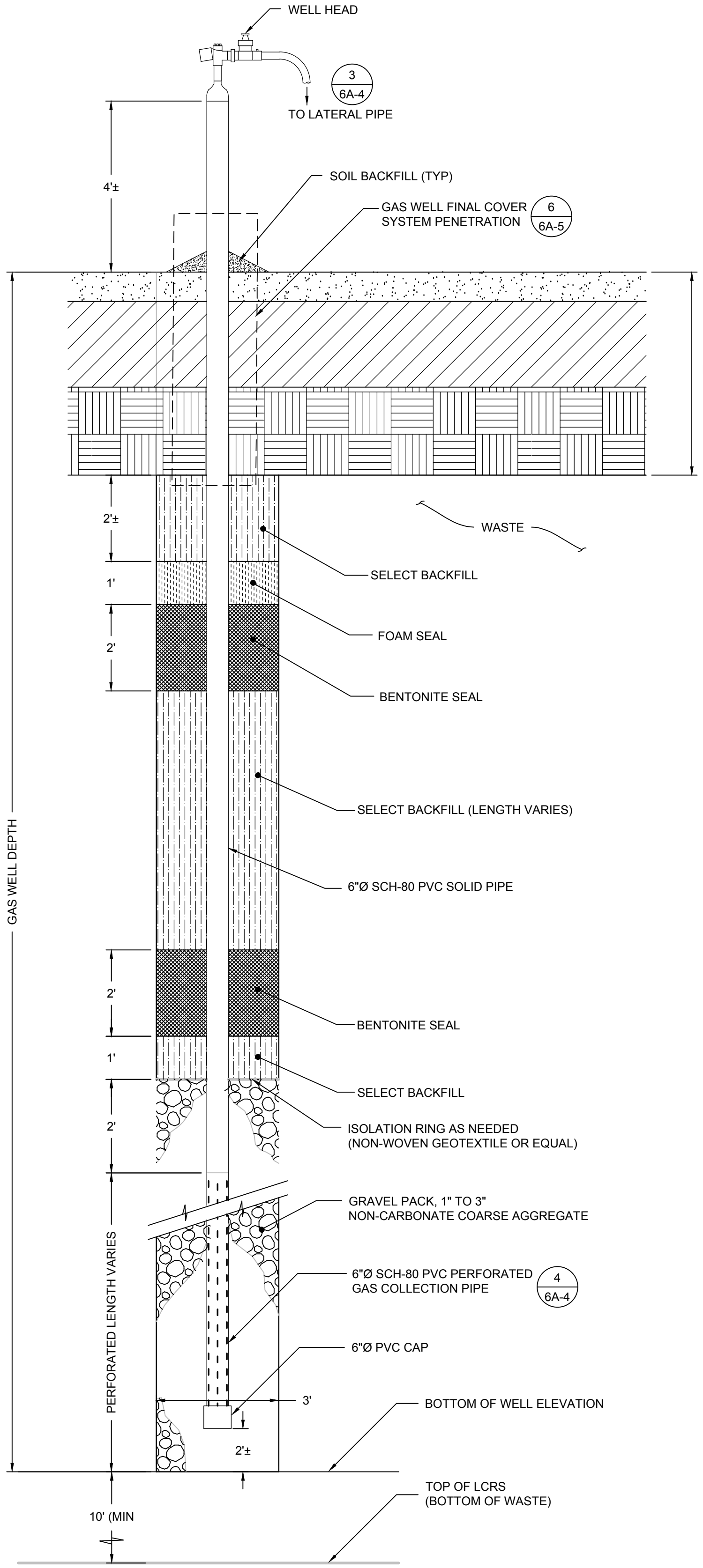
8217 SHOAL CREEK BLVD, SUITE 200
AUSTIN, TEXAS 78757
PHONE: 512.451.4003

TITLE:
CONCEPTUAL LANDFILL GAS COLLECTION SYSTEM PLAN UNIT 2

PROJECT:
MESQUITE CREEK LANDFILL EXPANSION
PERMIT AMENDMENT APPLICATION - MSW PERMIT NO. 66C

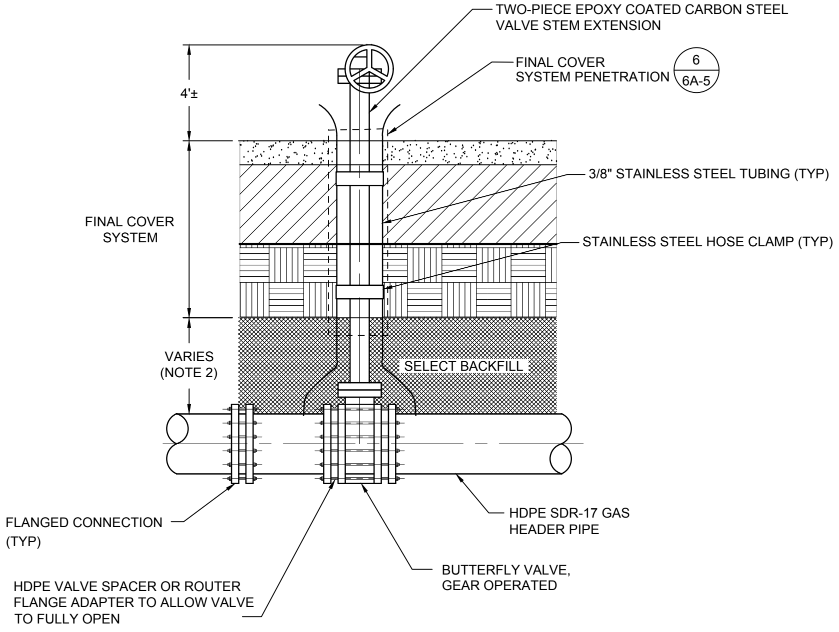
PROJECT NO.:	GW8636	DESIGN BY:	SMG	REVIEWED BY:	YB	PART NO.:	III	DRAWING:	6A-3B
FILE:	GW8636P6A-3A	DRAWN BY:	JJV / KH	APPROVED BY:	SMG				



1
6A-3B

DETAIL
TYPICAL GAS EXTRATION WELL

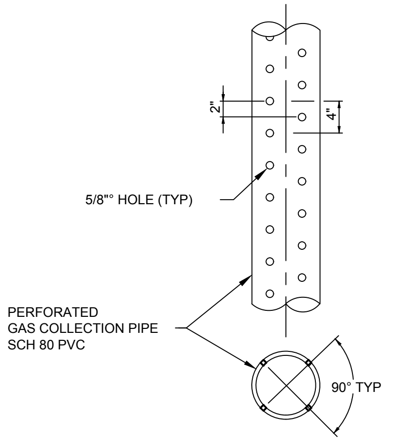
SCALE: NOT TO SCALE (N.T.S.)



2
6A-4

DETAIL
TYPICAL CONTROL VALVE (ISOLATION VALVE)

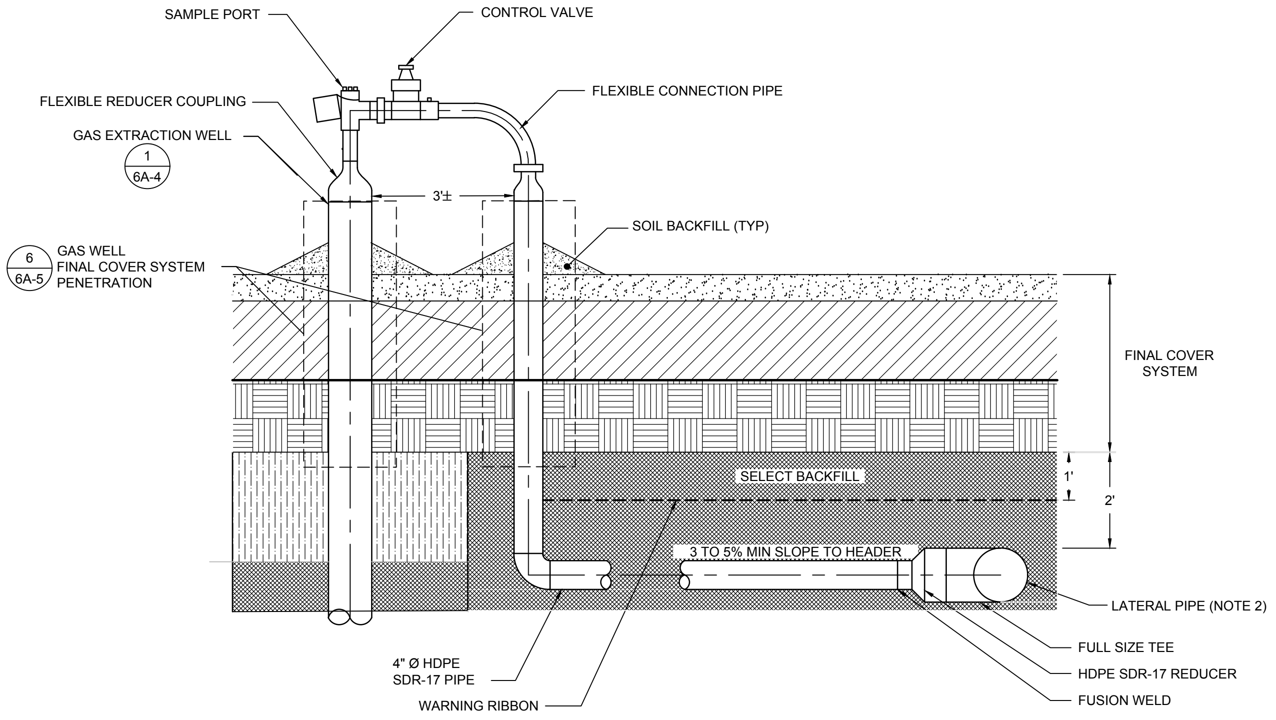
SCALE: N.T.S



4
6A-4

DETAIL
TYPICAL PERFORATION IN GAS COLLECTION PIPE

SCALE: N.T.S.



3
6A-4

DETAIL
TYPICAL WELLHEAD TO LATERAL

SCALE: N.T.S.

NOTES:

1. ALL SIZES AND DIMENSIONS ARE APPROXIMATE.
2. THE HEADER AND LATERAL PIPE ARE TYPICALLY PLACED APPROXIMATELY 2' BELOW THE FINAL COVER SYSTEM AND SLOPED WITH THE COVER GRADE. THESE PIPES, HOWEVER, MAY BE PLACED EITHER ABOVE OR BELOW THE FINAL COVER SYSTEM AT THE OWNER'S DISCRETION AND SLOPED DIFFERENTLY FROM THE COVER GRADE IF NECESSARY (TYPICALLY IN RELATIVELY FLAT AREAS) TO ENSURE A MINIMUM OF 3 TO 5% SLOPE IN THE PIPE FROM THE HIGH POINTS TO THE LOW POINTS (I.E., CONDENSATE KNOCKOUT).
3. THE GAS EXTRACTION SYSTEM DETAILS AND COMPONENTS SHOWN ON THIS DRAWING ARE TYPICAL CONCEPTUAL DETAILS AND ARE BASED ON THE CURRENT INDUSTRY PRACTICE FOR LANDFILL GAS MANAGEMENT. ADJUSTMENTS TO THESE DETAILS AND COMPONENTS MAY BE MADE DURING FINAL DESIGN OR IN THE FIELD DURING CONSTRUCTION TO ACCOMMODATE FIELD CONDITIONS AND FACILITATE INSTALLATION CONSISTENT WITH INDUSTRY STANDARDS, AND TO ACCOMPLISH REQUIRED PERFORMANCE FOR PROPER CONTROL AND COLLECTION OF LANDFILL GAS.

SCOTT M. GRAVES
86557

10/11/2023

FOR PERMIT PURPOSES ONLY

REV	DATE	DESCRIPTION	DRN	APP

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PHONE: 830.625.7894

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AUSTIN, TEXAS 78757
PHONE: 512.451.4003

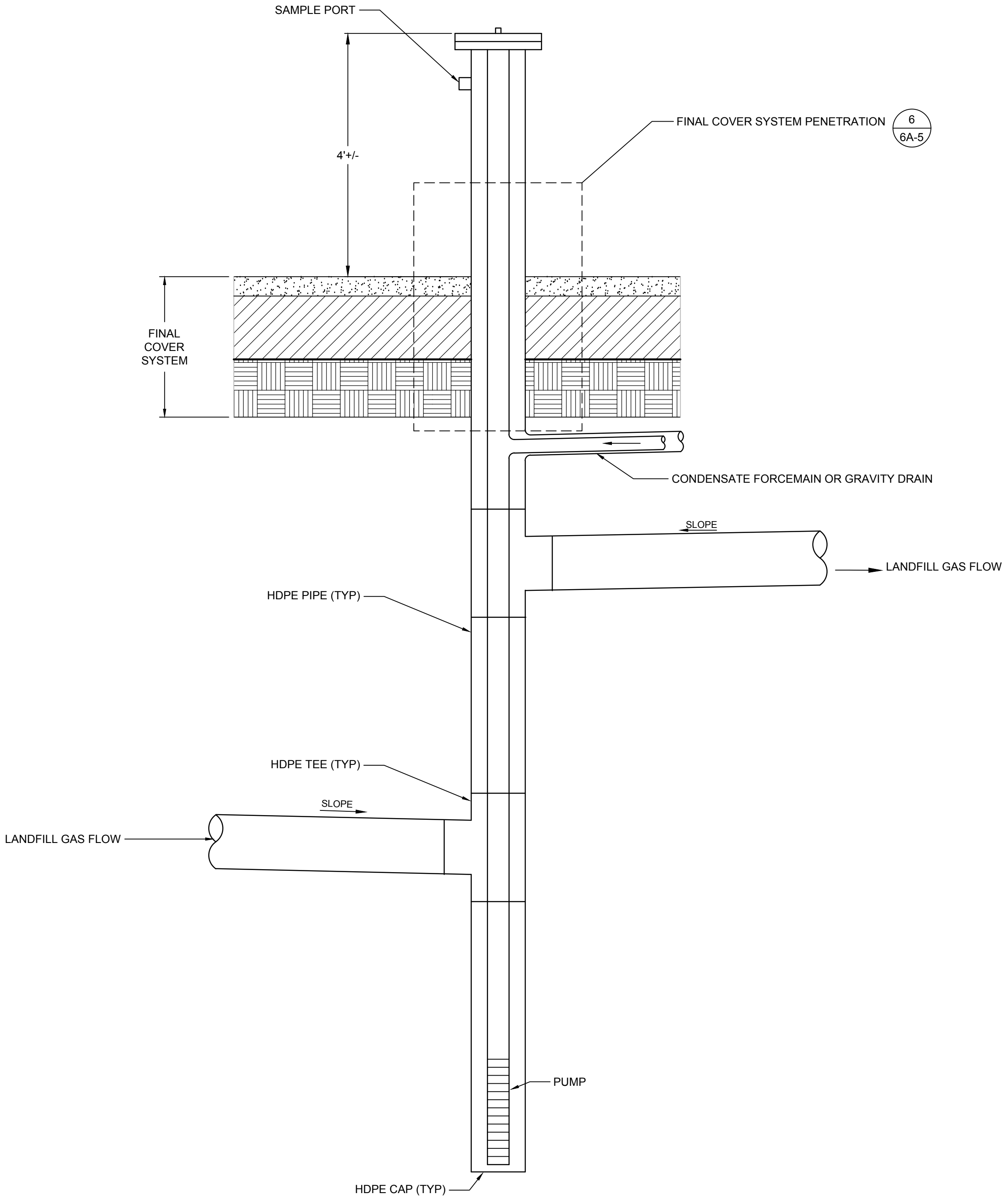
TITLE:
TYPICAL LANDFILL GAS MANAGEMENT SYSTEM DETAILS I

PROJECT:
MESQUITE CREEK LANDFILL EXPANSION
PERMIT AMENDMENT APPLICATION - MSW PERMIT NO. 66C

PROJECT NO.: GW8636
FILE: GW8636P6A-4
DESIGN BY: SMG
DRAWN BY: JJV / KH
REVIEWED BY: YB
APPROVED BY: SMG
PART NO.: III
DRAWING: 6A-4

PERMIT DRAWING

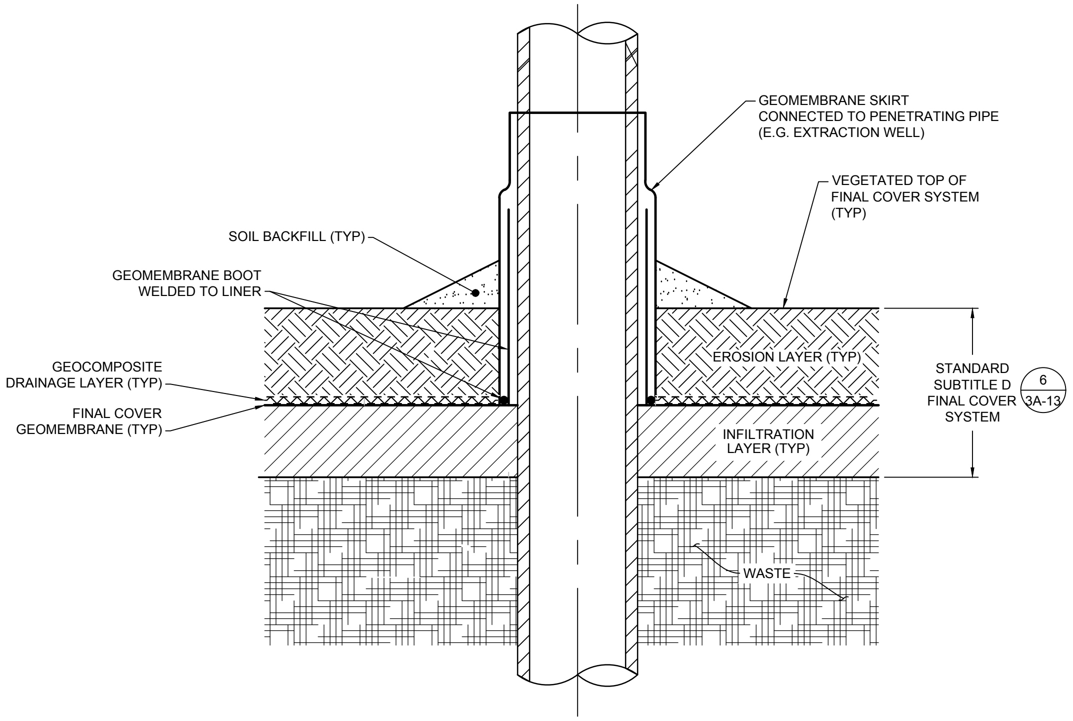
AUS-01\\P:\CADD\PROJECTS\WM\MESQUITE CREEK LANDFILL\PERMIT\EXPANSION 66C (GW8636)\04-07 DRAWINGS PARTS I-IV\GW8636P6A-4.DWG



5
6A-5

DETAIL
TYPICAL CONDANSATE SUMP

SCALE: NOTE TO SCALE (N.T.S.)



6
6A-4

DETAIL
TYPICAL FINAL COVER SYSTEM PENETRATION

SCALE: N.T.S.

NOTES:

1. ALL SIZES AND DIMENSIONS ARE APPROXIMATE.
2. THE GAS EXTRACTION SYSTEM DETAILS AND COMPONENTS SHOWN ON THIS DRAWING ARE TYPICAL CONCEPTUAL DETAILS AND ARE BASED ON THE CURRENT INDUSTRY PRACTICE FOR LANDFILL GAS MANAGEMENT. ADJUSTMENTS TO THESE DETAILS AND COMPONENTS MAY BE MADE DURING FINAL DESIGN OR IN THE FIELD DURING CONSTRUCTION TO ACCOMMODATE FIELD CONDITIONS AND FACILITATE INSTALLATION CONSISTENT WITH INDUSTRY STANDARDS, AND TO ACCOMPLISH REQUIRED PERFORMANCE FOR PROPER CONTROL AND COLLECTION OF LANDFILL GAS.

SCOTT M. GRAVES
86557

10/11/2023

FOR PERMIT PURPOSES ONLY

REV	DATE	DESCRIPTION	DRN	APP

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PHONE: 512.451.4003

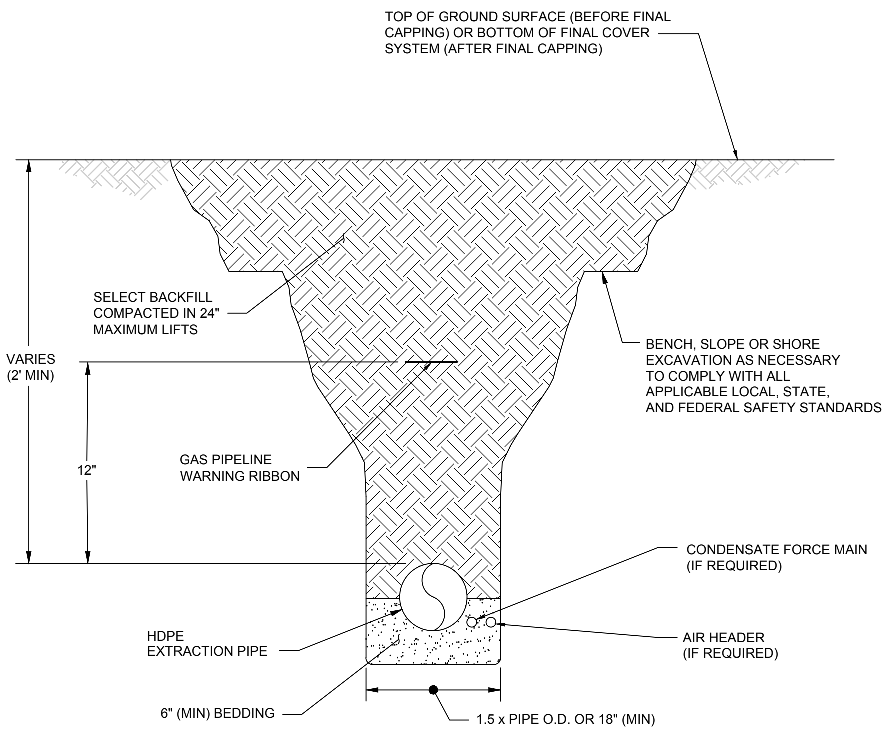
TITLE:
TYPICAL LANDFILL GAS MANAGEMENT SYSTEM DETAILS II

PROJECT:
MESQUITE CREEK LANDFILL EXPANSION
PERMIT AMENDMENT APPLICATION - MSW PERMIT NO. 66C

PERMIT DRAWING

PROJECT NO.:	GW8636	DESIGN BY:	SMG	REVIEWED BY:	YB	PART NO.:	DRAWING:
FILE:	GW8636P6A-5	DRAWN BY:	JJV / KH	APPROVED BY:	SMG	III	6A-5

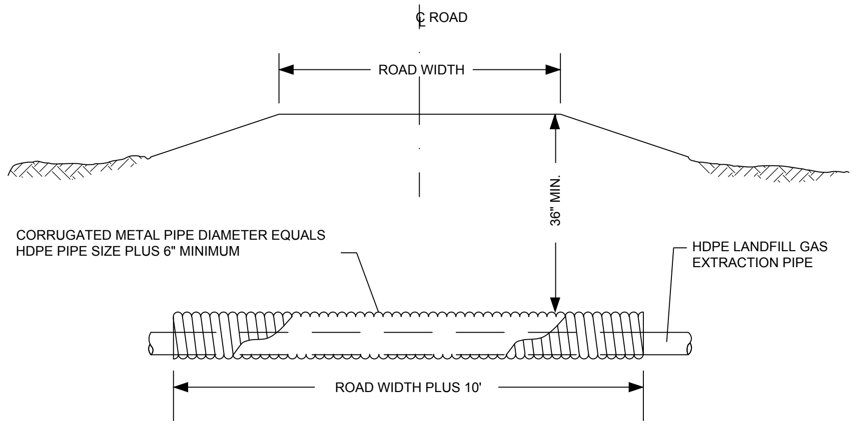
AUS-01\P:\CADD\PROJECTS\MMESQUITE CREEK LANDFILL\PERMIT\EXPANSION 66C (GW8636)\04-07 DRAWINGS PARTS I-IV\GW8636P6A-5.DWG



7
6A-3B

DETAIL
PIPE EMBEDMENT TRENCH

SCALE: NOT TO SCALE (N.T.S.)



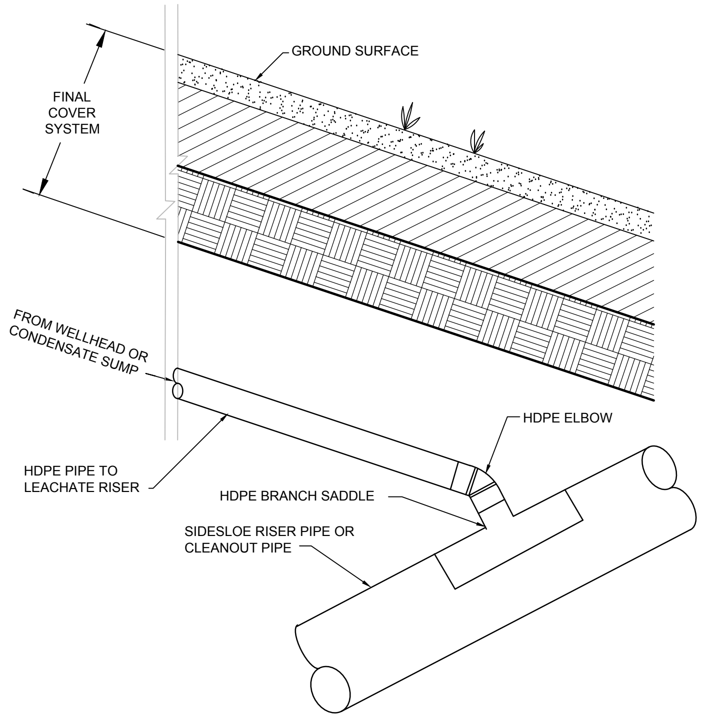
8
6A-6

DETAIL
EXTRACTION PIPE AT ROAD CROSSING

SCALE: N.T.S.

NOTES:

1. ALL SIZES AND DIMENSIONS ARE APPROXIMATE.
2. THE GAS EXTRACTION SYSTEM DETAILS AND COMPONENTS SHOWN ON THIS DRAWING ARE TYPICAL CONCEPTUAL DETAILS AND ARE BASED ON THE CURRENT INDUSTRY PRACTICE FOR LANDFILL GAS MANAGEMENT. ADJUSTMENTS TO THESE DETAILS AND COMPONENTS MAY BE MADE DURING FINAL DESIGN OR IN THE FIELD DURING CONSTRUCTION TO ACCOMMODATE FIELD CONDITIONS AND FACILITATE INSTALLATION CONSISTENT WITH INDUSTRY STANDARDS, AND TO ACCOMPLISH REQUIRED PERFORMANCE FOR PROPER CONTROL AND COLLECTION OF LANDFILL GAS.



9
6A-6

DETAIL
CONDENSATE DRAIN TO LEACHATE RISER PIPE

SCALE: N.T.S.

SCOTT M. GRAVES
86557

10/11/2023

FOR PERMIT PURPOSES ONLY

PERMIT DRAWING

REV	DATE	DESCRIPTION	DRN	APP

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8217 SHOAL CREEK BLVD, SUITE 200
AUSTIN, TEXAS 78757
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TITLE:

TYPICAL LANDFILL GAS MANAGEMENT SYSTEM DETAILS III

PROJECT:

MESQUITE CREEK LANDFILL EXPANSION
PERMIT AMENDMENT APPLICATION - MSW PERMIT NO. 66C

PROJECT NO.:	GW8636	DESIGN BY:	SMG	REVIEWED BY:	YB	PART NO.:	DRAWING:
FILE:	GW8636P6A-6	DRAWN BY:	JJV / KH	APPROVED BY:	SMG	III	6A-6

ATTACHMENT 6B

GAS MONITORING PROBE INSTALLATION DOCUMENTATION

LOG OF BORING GP-1

FUGRO McClelland

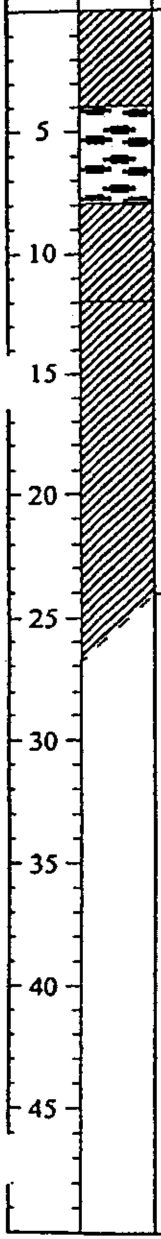
Gas Migration Monitor Well Installation
Comal County Landfill
Comal County, Texas

TYPE: 8" Hollow Stem Auger

LOCATION:
North: C+90
East: 28+46

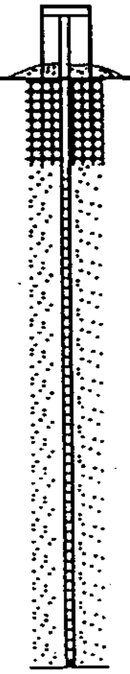
SURF. EL. 641.9 ft±

Job No. 1001-1466



STRATUM DESCRIPTION	LAYER DEPTH/ ELEV. (ft)
Dark brown fat CLAY, w/ few limestone fragments. (Residual soil)	637.9 4.0
Brown CLAYEY GRAVEL. (Alluvium)	633.9 8.0
Light tan fat CLAY, w/ some gravel, calcareous pockets. (Pecan Gap)	629.9 12.0
Tan fat CLAY, moist. (Pecan Gap)	617.9 24.0

GAS MIGRATION MONITOR WELL



COMPLETION DEPTH: 24.0 ft
DATE: 7-24-91

DEPTH TO WATER: Dry
DATE: 7-24-91
PLATE 1

LOG OF BORING GP-2

FUGRO McClelland

Gas Migration Monitor Well Installation
Comal County Landfill
Comal County, Texas

TYPE: 8" Hollow Stem Auger

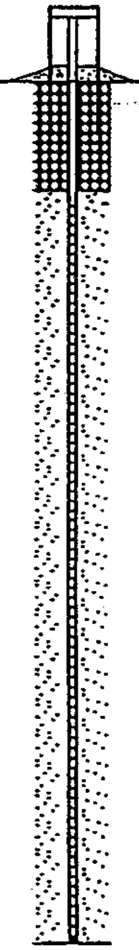
LOCATION:
North: Fence+10
East: 23+95

SURF. EL. 662.8 ft±

Job No. 1001-1466

DEPTH, FT	SYMBOL	SAMPLES	STRATUM DESCRIPTION	LAYER DEPTH/ ELEV. (ft)
0-6	▨		Dark brown fat CLAY, w/ few limestone fragments and calcareous particles. (Residual soil) - lighter and more calcareous below 5.0 ft.	656.8 6.0
6-7	▨		Tan CLAY w/ gravel. (Alluvium)	655.8 7.0
7-35	▨		Tan fat CLAY, moist. (Pecan Gap)	627.8 35.0

GAS MIGRATION MONITOR WELL



COMPLETION DEPTH: 35.0 ft

DATE: 7-23-91

DEPTH TO WATER: Dry

DATE: 7-24-91

PLATE 2

LOG OF BORING GP-3

FUGRO McClelland

Gas Migration Monitor Well Installation
Comal County Landfill
Comal County, Texas

TYPE: 8" Hollow Stem Auger

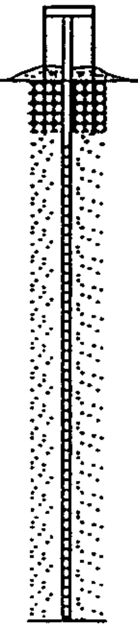
LOCATION:
North: Fence+13
East: 11+68

SURF. EL. 641.0 ft±

Job No. 1001-1466

DEPTH, FT	STRATUM DESCRIPTION	LAYER DEPTH/ ELEV. (ft)
0–3	Dark brown fat CLAY, w/ some limestone and chert fragments, and calcareous particles. (Residual Soil)	638.0 3.0
3–22	Light brown fat CLAY. (Pecan Gap)	619.0 22.0

GAS MIGRATION MONITOR WELL



COMPLETION DEPTH: 22.0 ft
DATE: 7-24-91

DEPTH TO WATER: Dry
DATE: 7-24-91

PLATE 3

LOG OF BORING GP-4

Fugro McClelland

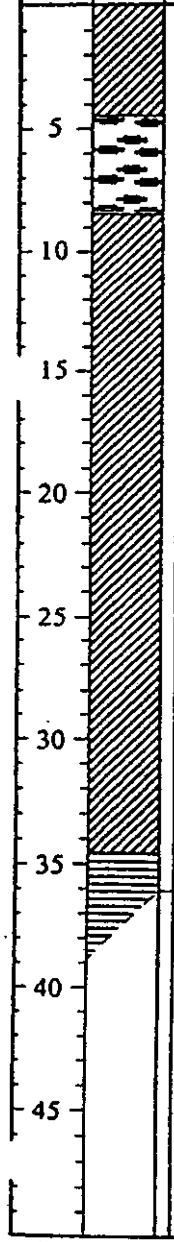
Gas Migration Monitor Well Installation
Comal County Landfill
Comal County, Texas

TYPE: **8" Hollow Stem Auger**

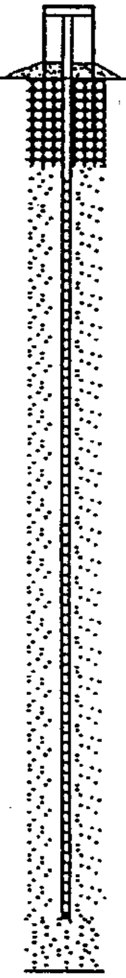
LOCATION:
North: Fence+15
East: 0+22

SURF. EL. 602.8 ft±

Job No. 1001-1466



STRATUM DESCRIPTION	LAYER DEPTH/ ELEV. (ft)
Very dark brown fat CLAY. (Residual soil)	598.3 4.5
Brown CLAYEY GRAVEL. (Alluvium)	594.3 8.5
Tan fat CLAY. (Pecan Gap) - dry and hard at 11.0 ft - slight amount of water added to soften the clay. - interbedded tan and gray clay transitional zone below 27.0 ft.	568.3 34.5
Gray CLAYSTONE. (Pecan Gap)	566.8 36.0



COMPLETION DEPTH: 36.0 ft
DATE: 7-22-91

DEPTH TO WATER: Dry
DATE: 7-22-91

PLATE 4

Gas Probe Data Sheet

Permittee or Site Name: WMTX – Mesquite Creek Landfill

County: Comal and Guadalupe

Date of Gas Probe Installation: 03/09/09

Gas Probe Latitude: 29° 44' 04.65" **Longitude:** 98° 01' 34.38"

MSW Permit No. MSW-66B

Gas Probe I.D. No.: GP-5A

Gas Probe Driller

Name: Brian Kern

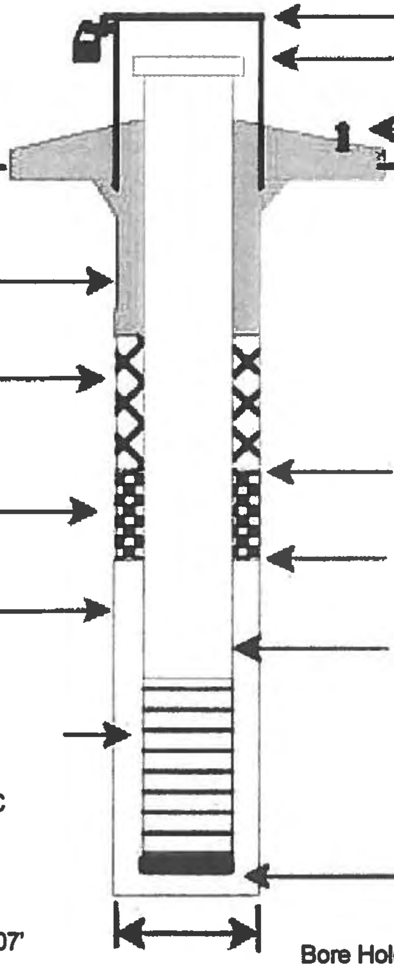
License No.: 54611M

NOTES:

Report all depths from Surface Elevation and all Elevations relative to Mean Sea Level (MSL), to nearest hundredth of a foot.
Diameter of boring should be at least 4 inches larger than diameter of well casing.
Use flush screw joint casing only, 2-inch diameter or larger, with o-rings or PTFE tape in joints (4-inch diameter recommend).
Well development should continue until water is clear, and pH and conductivity are stable.

Geologist, Hydrologist, or Engineer Supervising Gas Probe Installation: Mohammad Z. Islam, under supervision of Scott M. Graves, P.E.
Static Water Level Elevation (with respect to MSL) after Well Development: Not Applicable (N/A) – gas probe, not a well
Name of Geologic Formation(s) in which probe is completed: Strata I-IV of site-specific characterization, which is predominantly Lower Taylor Group clay. See Section 2.6 of Attachment 14 of the Site Development Plan for formation names and descriptions for all four strata.

Type of Locking Device: Padlock
Type of Casing Protection: Metal Stick-Up
Concrete Surface Pad Dimensions: 4'x4'x6"



Top of Protective Collar Elevation: 612.51'
Top of Casing Elevation: 611.87'
Ground Surface Elevation: 609.07'
Surveyor's Pin Elevation: N/A
Concrete Seal Depth: 1.5'
Casing Seal (backfill) Material: 3/8" bentonite pellets
Bentonite Seal Top Depth: 3.0' Elevation: 606.07'
Bentonite Seal
Filter Pack Top Depth: 5.0' Elevation: 604.07'
Filter Pack: 20/40 silica sand
Well Casing Type: PVC
Size (diameter): 2" Thickness: Schedule 40

Well Screen
Top Depth: 6'
Top Elevation: 603.07'
Type of Well Screen: Slotted PVC
Screen Opening Size: 0.010"
Bottom Depth: 51'
Bottom Elevation: 558.07'
Total depth of borehole: 52'
Bottom Elevation of borehole: 557.07'

Bottom Cap Depth: 51.25'
Bore Hole Diameter: 6.0"

Modified from TCEQ-10308

Project: Gas Probe Installation,Mesquite Creek Landfill. **Project Location: 1000 Kohlenberg Lane, New Braunfels, TX** **Project Number: TXL0054-01**	**Log of Boring GP-5A** Sheet 1 of 2

Date(s) Drilled **03/09/2009**	Logged By **Mohammad Z. Islam**	Checked By **Scott M. Graves, P.E.**
Drilling Method **Rotary Wash**	Drill Bit Size/Type **6 inch**	Total Depth of Borehole **52 feet bgs**
Drill Rig Type **Mobil B59**	Drilling Contractor **Total Support Services, Inc.**	Approximate Surface Elevation **609.07 feet MSL**
Groundwater Level and Date Measured **Not Encountered**	Sampling Method(s) **SPT**	Hammer Data **140 lb, 30 in drop, safety**
Borehole Backfill **Well Completion**	Location **N 13,815,940, E 2,277,535**	

Elevation, feet	Depth, feet	Sample Type	Sample Number	Sampling Resistance, blows/foot	Relative Consistency	USCS Symbol	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	REMARKS AND OTHER TESTS
609.1	0					CH	▨	Mud appears to be dark grey color.		
604.1	5					CH	▨	Mud appears to be light tan color.		
599.1	10					CH	▨	Mud appears to be tan color.		
594.1	15					CH	▨	Same as above.		
589.1	20					CH	▨	Same as above.		
584.1	25					CH	▨	Same as above		
579.1	30									

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Project: Gas Probe Installation,Mesquite Creek Landfill.
Project Location: 1000 Kohlenberg Lane, New Braunfels, TX
Project Number: TXL0054-01

Log of Boring GP-5A

Sheet 2 of 2

Elevation, feet	Depth, feet	Sample Type	Sample Number	Sampling Resistance, blows/foot	Relative Consistency	USCS Symbol	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	REMARKS AND OTHER TESTS
579.1	30					CH	▨	Mud appears to be light grey color.		
574.1	35					CH	▨	Mud appears to be grey color		
569.1	40					CH	▨	Same as above		
564.1	45	▧	1	39, 50/5", 50/3", 50/2.5".		Claystone	▤	Hard and dark grey CLYSTONE with trace silt.		
559.1	50	▧	50/2.5"	50/2.3", 50/2.3".	50/2.3",	Claystone	▤	Same as above.		
								Bottom of Boring at 52 feet bgs.		
554.1	55									
549.1	60									
544.1	65									

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WELL No. GP-6R

Boring No X-Ref. GP-6R

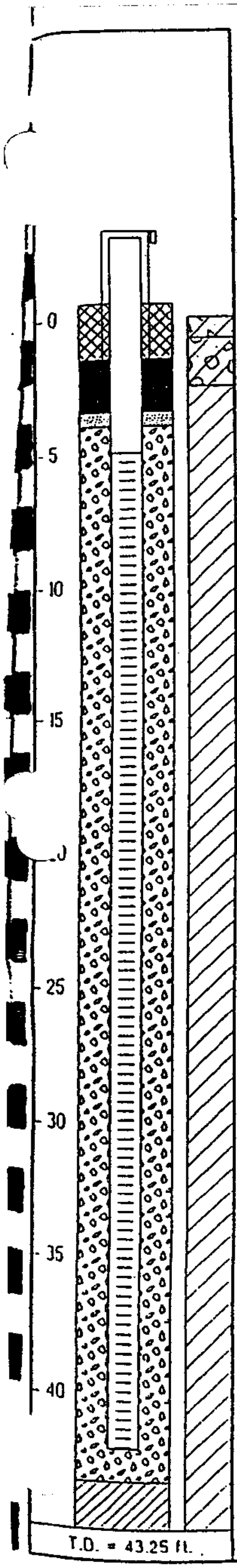
LANDFILL GAS MONITORING PROBE CONSTRUCTION SUMMARY

Survey Coords N= 13,817,050.79
E= 2,276,398.79

Elevation Ground Level 623.45

Pin Elevation 624.07 Top of Casing 626.55

SITE NAME Canal County Recycling and Disposal Center



Drilling Summary

Total Depth (ft): 43.25
Borehole Diameter (in): 6 5/8-inch
Casing Stickup Height (ft): 3.10
Driller: Jack Holt & Associates
John Webb, Driller
License # 3023M
Rig: Truck mounted CME-75
Bit (s): Hollowstem Auger -
6 5/8-inch diameter tooth bit
Drilling Fluid: NONE

Protective Casing: 4-inch anodized aluminum (square)

Construction Time Log

Task	Start Date	Start Time	Finish Date	Finish Time
Drilling HSA 0 - 45 feet	11/8/95	14: 50	11/8/95	15: 54
Casing:				
C_1 Prot.:	11/9/95	15: 20	11/9/95	15: 35
C_2 1" PVC and S_1 1" PVC:	11/8/95	16: 21	11/8/95	16: 35
Filter Placement:	11/9/95	9: 04	11/9/95	9: 17
Bentonite Seal:	11/9/95	9: 17	11/9/95	9: 22
Cementing/pad:	11/9/95	15: 20	11/9/85	15: 45
Development: N/A				

Probe Design & Specifications

Basis: Geologic Log ☒ Geophysical Log ☐
Casing String (s): C = Casing S = Screen

Depth	String (s)	Elevation
+3.71 - 1.29	C_1	627.16 -622.16
+3.10 - 5.0	C_2	626.55 -618.45
5.0 - 42.0	S_1	618.45 -581.45
-		-
-		-

Casing: C1

Casing: C2 1-inch diameter PVC, Sch. 40, flush joint,
Trilock (+3.1 to 5.0 ft)

Screen: S1 1-inch diameter PVC, Sch.40, flush joint,
Trilock 0.020-inch Slot (5.0 to 42 ft)

Grout Seal: Concrete (0 - 1.5 ft.)

Bentonite Seal: 1/4-inch bentonite pellets
(1.5 - 3.5 ft.)

Filter Pack: 3/8-inch pea gravel (4 - 43.25 ft.)
20/40 colorado Silica Sand (3.5 - 4.0 ft.)

Probe Comments

Original Hole drilled to 45 feet, hole caved to 43.2

SUPERVISED BY D. Smith

Gas Probe Data Sheet

Permittee or Site Name: WMTX – Mesquite Creek Landfill
County: Comal
Date of Gas Probe Installation: 10/06/05
Gas ProbeLatitude: 29 44' 24.77" Longitude: 98 01' 57.38"
Northing: 13817956.20 Easting: 2275490.16

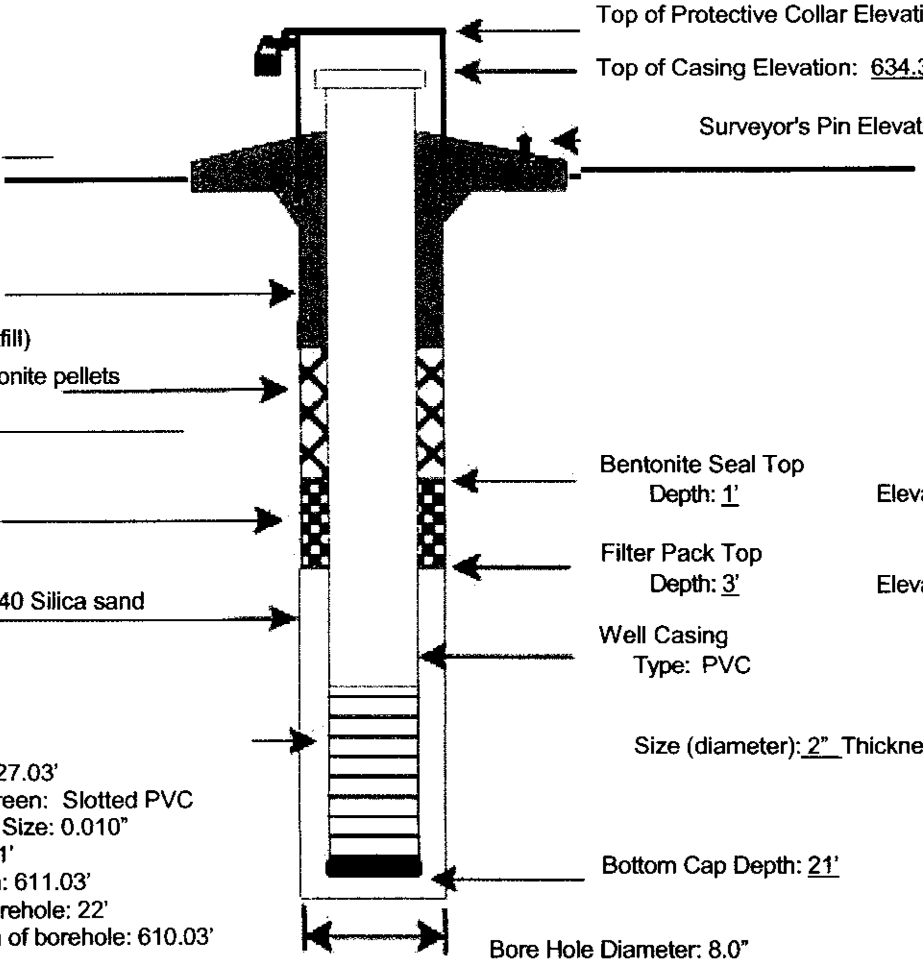
MSW Permit No. 66A
Gas Probe I.D. No.: GP-07
Monitor Well Driller
Name: GeoProjects/ Lee Gebbert
License No.: 2525W

NOTES:

Report all depths from Surface Elevation and all Elevations relative to Mean Sea Level (MSL), to nearest hundredth of a foot.
Diameter of boring should be at least 4 inches larger than diameter of well casing.
Use flush screw joint casing only, 2-inch diameter or larger, with o-rings or PTFE tape in joints (4-inch diameter recommend).
Well development should continue until water is clear, and pH and conductivity are stable.

Geologist, Hydrologist, or Engineer Supervising Gas Probe Installation: Janet Meaux
Static Water Level Elevation (with respect to MSL) after Well Development: NA
Name of Geologic Formation(s) in which Well is completed: Lower Taylor Group (Stratum III of site-specific characterization)

Type of Locking Device: Padlock
Type of Casing Protection: Metal Stick-Up
Concrete Surface Pad (with steel reinforcement) Dimensions: 4'x4'



Top of Protective Collar Elevation: 634.97'
Top of Casing Elevation: 634.34'
Surface Elevation: 632.03'
Surveyor's Pin Elevation: N/A
Concrete Seal Depth: 1'
Casing Seal (backfill) Material: 3/8" bentonite pellets
Bentonite Seal Top Depth: 1' Elevation: 631.03'
Bentonite Seal
Filter Pack Top Depth: 3' Elevation: 629.03"
Filter Pack: 20/40 Silica sand
Well Casing Type: PVC
Size (diameter): 2" Thickness: Schedule 40

Well Screen
Top Depth: 5'
Top Elevation: 627.03'
Type of Well Screen: Slotted PVC
Screen Opening Size: 0.010"
Bottom Depth: 21'
Bottom Elevation: 611.03'
Total depth of borehole: 22'
Bottom Elevation of borehole: 610.03'

Bottom Cap Depth: 21'
Bore Hole Diameter: 8.0"

TCEQ-10308

Gas Probe Data Sheet

Permittee or Site Name: WMTX – Mesquite Creek Landfill
County: Comal and Guadalupe
Date of Gas Probe Installation: 03/16/09
Gas Probe Latitude: 29° 44' 11.47" Longitude: 98° 01' 39.11"

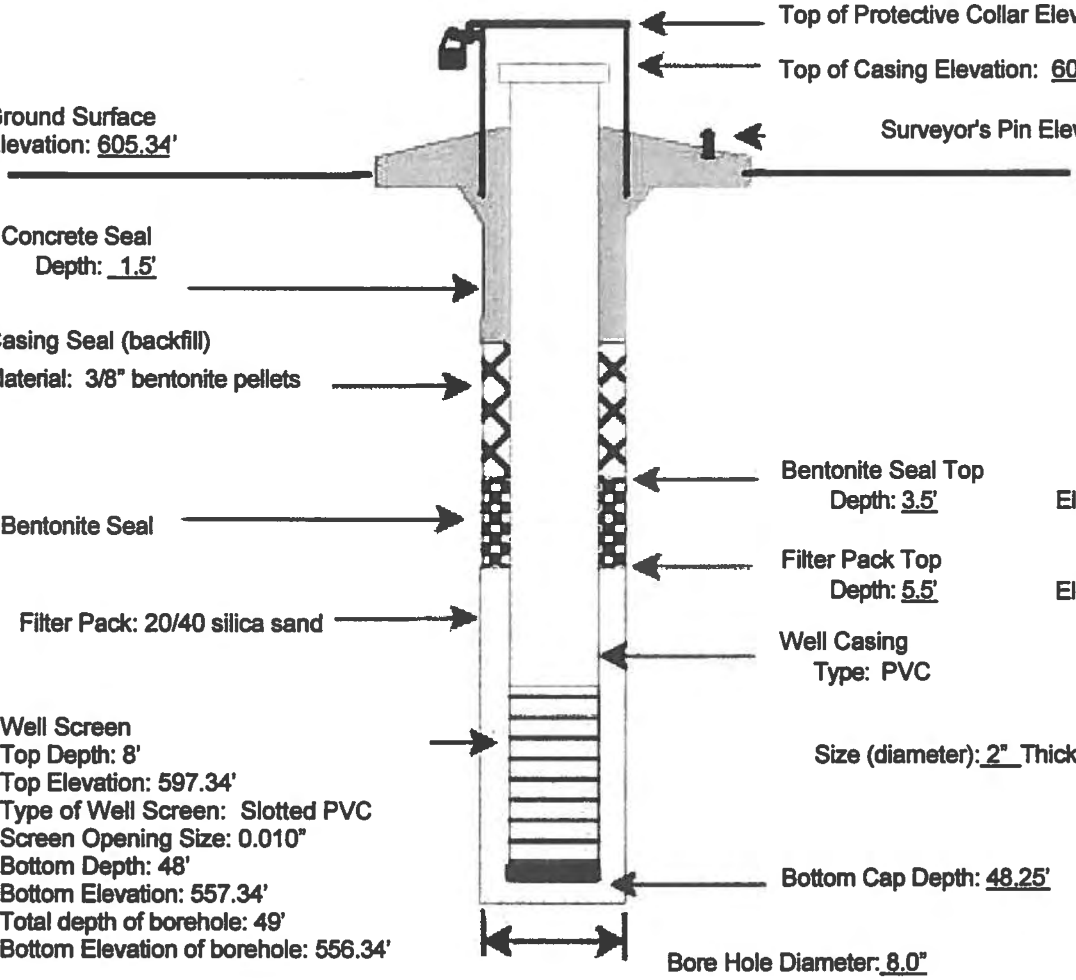
MSW Permit No. MSW-66B
Gas Probe I.D. No.: GP-8
Gas Probe Driller
Name: Brian Kern
License No.: 54611M

NOTES:

Report all depths from Surface Elevation and all Elevations relative to Mean Sea Level (MSL), to nearest hundredth of a foot.
Diameter of boring should be at least 4 inches larger than diameter of well casing.
Use flush screw joint casing only, 2-inch diameter or larger, with o-rings or PTFE tape in joints (4-inch diameter recommend).
Well development should continue until water is clear, and pH and conductivity are stable.

Geologist, Hydrologist, or Engineer Supervising Gas Probe Installation: Mohammad Z. Islam, under supervision of Scott M. Graves, P.E.
Static Water Level Elevation (with respect to MSL) after Well Development: Not Applicable (N/A) – gas probe, not a well
Name of Geologic Formation(s) in which probe is completed: Strata I-IV of site-specific characterization, which is predominantly Lower Taylor Group clay. See Section 2.6 of Attachment 14 of the Site Development Plan for formation names and descriptions for all four strata.

Type of Locking Device: Padlock
Type of Casing Protection: Metal Stick-Up
Concrete Surface Pad Dimensions: 4'x4'x6"



Top of Protective Collar Elevation: 608.99'
Top of Casing Elevation: 608.35'
Ground Surface Elevation: 605.34'
Surveyor's Pin Elevation: N/A
Concrete Seal Depth: 1.5'
Casing Seal (backfill) Material: 3/8" bentonite pellets
Bentonite Seal Top Depth: 3.5' Elevation: 601.84'
Bentonite Seal
Filter Pack Top Depth: 5.5' Elevation: 599.84'
Filter Pack: 20/40 silica sand
Well Casing Type: PVC
Size (diameter): 2" Thickness: Schedule 40

Well Screen
Top Depth: 8'
Top Elevation: 597.34'
Type of Well Screen: Slotted PVC
Screen Opening Size: 0.010"
Bottom Depth: 48'
Bottom Elevation: 557.34'
Total depth of borehole: 49'
Bottom Elevation of borehole: 556.34'

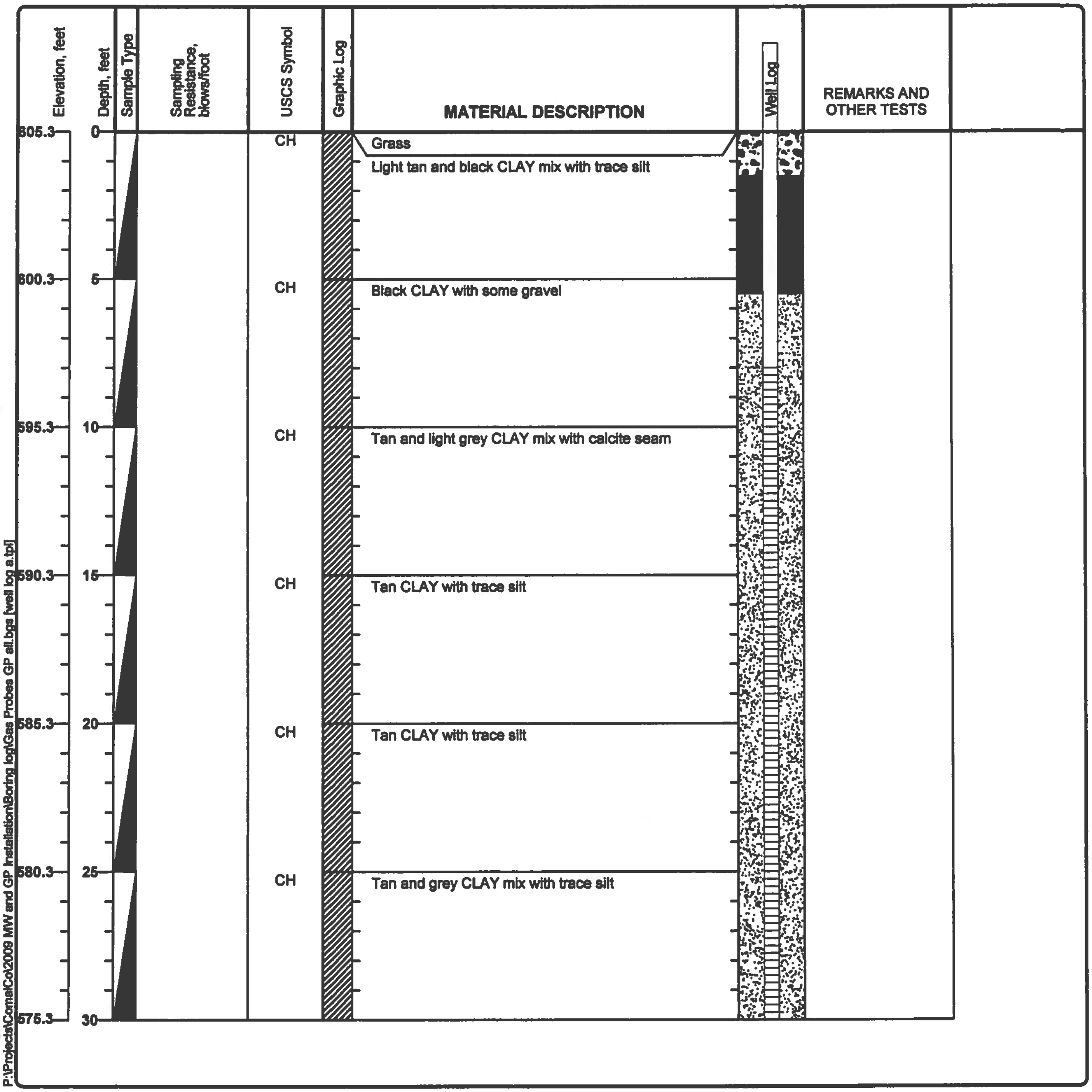
Bottom Cap Depth: 48.25'
Bore Hole Diameter: 8.0"

Project: Mesquite Creek Landfill, Gas Probe Installation
Project Location: 1000 Kohlenberg Lane, New Braunfels, TX
Project Number: TXL0054-01

Log of Boring GP-8

Sheet 1 of 2

Date(s) Drilled **03/16/2009**	Logged By **Mohammad Z. Islam**	Checked By **Scott M. Graves, P.E.**
Drilling Method **Hollow Stem Auger**	Drill Bit Size/Type **8 inch**	Total Depth of Borehole **49 feet bgs**
Drill Rig Type **Mobil B59**	Drilling Contractor **Total Support Services, Inc.**	Approximate Surface Elevation **605.34 feet MSL**
Groundwater Level and Date Measured **Not Encountered**	Sampling Method(s) **Other**	Hammer Data **N/A**
Borehole Backfill **Well Completion**	Location **N 13,816,626, E 2,277,112**	



Elevation, feet	Depth, feet	Sample Type	Sampling Resistance, blows/foot	USCS Symbol	Graphic Log	MATERIAL DESCRIPTION	Well Log	REMARKS AND OTHER TESTS
605.3	0			CH		Grass Light tan and black CLAY mix with trace silt		
600.3	5			CH		Black CLAY with some gravel		
595.3	10			CH		Tan and light grey CLAY mix with calcite seam		
590.3	15			CH		Tan CLAY with trace silt		
585.3	20			CH		Tan CLAY with trace silt		
580.3	25			CH		Tan and grey CLAY mix with trace silt		
575.3	30							

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Project: Mesquite Creek Landfill, Gas Probe Installation
Project Location: 1000 Kohlenberg Lane, New Braunfels, TX
Project Number: TXL0054-01

Log of Boring GP-8

Sheet 2 of 2

Elevation, feet	Depth, feet	Sample Type	Sampling Resistance, blows/foot	USCS Symbol	Graphic Log	MATERIAL DESCRIPTION	Well Log	REMARKS AND OTHER TESTS
575.3	30			CH		Same as above		
				Claystone		Hard and dry dark grey CLAYSTONE with trace silt		
570.3	35			Claystone		Same as above		
				Claystone		Same as above		
565.3	40			Claystone		Same as above		
				Claystone		Same as above		
560.3	45			Claystone		Same as above		
				Claystone		Same as above		
						Bottom of Boring at 49 feet bgs		
555.3	50							
550.3	55							
545.3	60							
540.3	65							

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Gas Probe Data Sheet

Permittee or Site Name: WMTX – Mesquite Creek Landfill
County: Comal and Guadalupe
Date of Gas Probe Installation: 03/25/09
Gas Probe Latitude: 29° 44' 20.27" Longitude: 98° 01' 52.05"

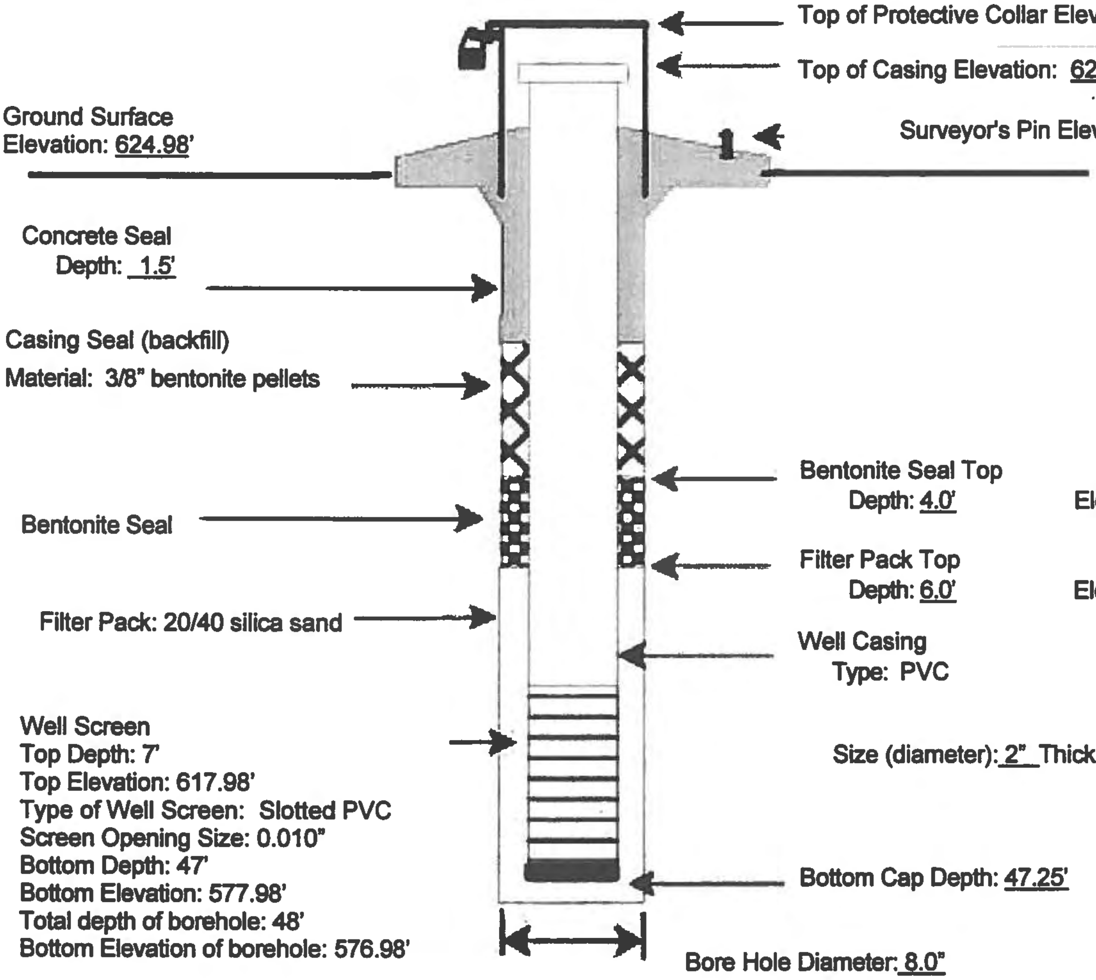
MSW Permit No. MSW-66B
Gas Probe I.D. No.: GP-9
Gas Probe Driller
Name: Brian Kern
License No.: 54611M

NOTES:

Report all depths from Surface Elevation and all Elevations relative to Mean Sea Level (MSL), to nearest hundredth of a foot.
Diameter of boring should be at least 4 inches larger than diameter of well casing.
Use flush screw joint casing only, 2-inch diameter or larger, with o-rings or PTFE tape in joints (4-inch diameter recommend).
Well development should continue until water is clear, and pH and conductivity are stable.

Geologist, Hydrologist, or Engineer Supervising Gas Probe Installation: Mohammad Z. Islam, under supervision of Scott M. Graves, P.E.
Static Water Level Elevation (with respect to MSL) after Well Development: Not Applicable (N/A) – gas probe, not a well
Name of Geologic Formation(s) in which probe is completed: Strata I-III of site-specific characterization, which is predominantly Lower Taylor Group clay. See Section 2.6 of Attachment 14 of the Site Development Plan for formation names and descriptions for all three strata encountered at this probe.

Type of Locking Device: Padlock
Type of Casing Protection: Metal Stick-Up
Concrete Surface Pad Dimensions: 4'x4'x6"



Top of Protective Collar Elevation: 628.48'
Top of Casing Elevation: 628.06'
Ground Surface Elevation: 624.98'
Surveyor's Pin Elevation: N/A
Concrete Seal Depth: 1.5'
Casing Seal (backfill) Material: 3/8" bentonite pellets
Bentonite Seal Top Depth: 4.0' Elevation: 620.98'
Bentonite Seal
Filter Pack Top Depth: 6.0' Elevation: 618.98'
Filter Pack: 20/40 silica sand
Well Casing Type: PVC
Size (diameter): 2" Thickness: Schedule 40

Well Screen
Top Depth: 7'
Top Elevation: 617.98'
Type of Well Screen: Slotted PVC
Screen Opening Size: 0.010"
Bottom Depth: 47'
Bottom Elevation: 577.98'
Total depth of borehole: 48'
Bottom Elevation of borehole: 576.98'

Bottom Cap Depth: 47.25'
Bore Hole Diameter: 8.0"

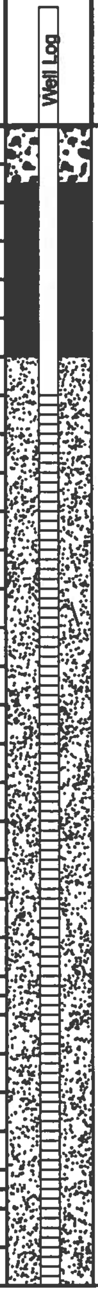
Project: Gas Probe Installation,Mesquite Creek Landfill.
Project Location: 1000 Kohlenberg Lane, New Braunfels, TX
Project Number: TXL0054-01

Log of Boring GP-9

Sheet 1 of 2

Date(s) Drilled 03/25/2009	Logged By Mohammad Z. Islam	Checked By Scott M. Graves, P.E.
Drilling Method Hollow Stem Auger	Drill Bit Size/Type 8 inch	Total Depth of Borehole 48 feet bgs
Drill Rig Type Mobil B59	Drilling Contractor Total Support Services, Inc.	Approximate Surface Elevation 624.98 feet MSL
Groundwater Level and Date Measured Not Encountered	Sampling Method(s) Core	Hammer Data N/A
Borehole Backfill Well Completion	Location N 13,817,505, E 2,275,964	

Elevation, feet	Depth, feet	Sample Type	Sampling Resistance, blows/foot	USCS Symbol	Graphic Log	MATERIAL DESCRIPTION	Well Log	REMARKS AND OTHER TESTS
625	0		Core	CH		Medium stiff light grey CLAY between 0 and 3 ft, medium stiff black CLAY between 3 and 5 ft, few gravel.		
620	5		Core	CH		No sample recovered, drill cutting appears to be light grey CLAY.		No sample recovered, a 3.5 in. gravel plugged at the sampler tip.
615	10		Core	CH		Medium stiff light tan CLAY with trace silt.		2 ft sample recovered.
610	15		Core	CH		Medium stiff tan and light grey CLAY with trace silt		
605	20		Core	CH		Same as above		
			Core	CH		Same as above		
600	25		Core	CH		Same as above		
			Core	CH		Same as above		
595	30							



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Project: Gas Probe Installation,Mesquite Creek Landfill.
Project Location: 1000 Kohlenberg Lane, New Braunfels, TX
Project Number: TXL0054-01

Log of Boring GP-9

Sheet 2 of 2

Elevation, feet	Depth, feet	Sample Type	Sampling Resistance, blows/foot	USCS Symbol	Graphic Log	MATERIAL DESCRIPTION	Well Log	REMARKS AND OTHER TESTS
595	30	◢	Core	CH	▨	Same as above		
		◢	Core	CH	▨	Same as above		
590	35	◢	Core	CH	▨	Same as above		
		◢	Core	CH	▨	Same as above		
585	40	◢	Core	CH	▨	Same as above		
		◢	Core	CH	▨	Same as above		
580	45	◢	Core	CH	▨	Dark grey and tan CLAY with trace silt.		
						Bottom of Boring at 48 feet bgs		
575	50							
570	55							
565	60							
560	65							

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Gas Probe Data Sheet

Permittee or Site Name: WMTX – Mesquite Creek Landfill

County: Comal and Guadalupe

Date of Gas Probe Installation: 03/24/09

Gas Probe Latitude: 29° 44' 28.53" Longitude: 98° 01' 40.31"

MSW Permit No. MSW-66B

Gas Probe I.D. No.: GP-10

Gas Probe Driller

Name: Brian Kern

License No.: 54611M

NOTES:

Report all depths from Surface Elevation and all Elevations relative to Mean Sea Level (MSL), to nearest hundredth of a foot.
Diameter of boring should be at least 4 inches larger than diameter of well casing.
Use flush screw joint casing only, 2-inch diameter or larger, with o-rings or PTFE tape in joints (4-inch diameter recommend).
Well development should continue until water is clear, and pH and conductivity are stable.

Geologist, Hydrologist, or Engineer Supervising Gas Probe Installation: Mohammad Z. Islam, under supervision of Scott M. Graves, P.E.

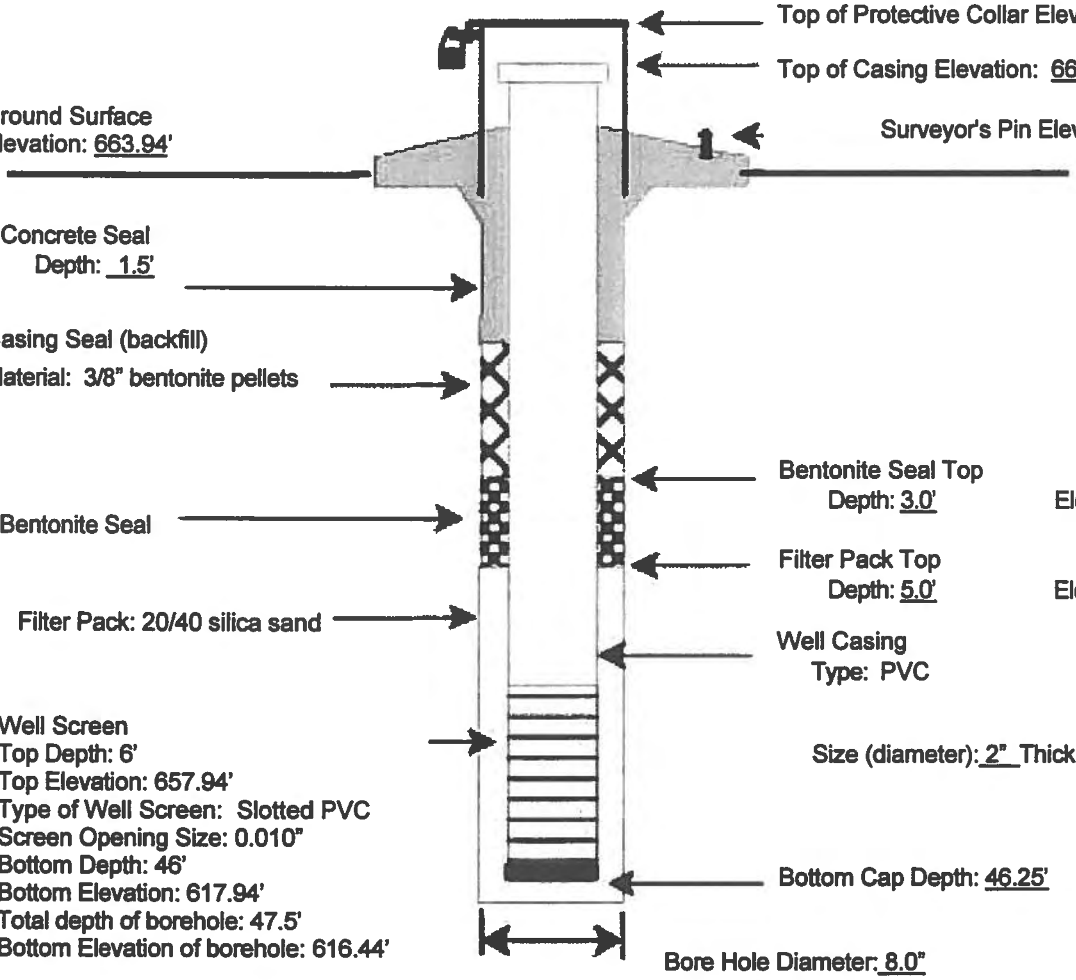
Static Water Level Elevation (with respect to MSL) after Well Development: Not Applicable (N/A) – gas probe, not a well

Name of Geologic Formation(s) in which probe is completed: Strata I-IV of site-specific characterization, which is predominantly Lower Taylor Group clay. See Section 2.6 of Attachment 14 of the Site Development Plan for formation names and descriptions for all four strata.

Type of Locking Device: Padlock

Type of Casing Protection: Metal Stick-Up

Concrete Surface Pad Dimensions: 4'x4'x6"



Top of Protective Collar Elevation: 667.25'

Top of Casing Elevation: 666.73'

Ground Surface Elevation: 663.94'

Surveyor's Pin Elevation: N/A

Concrete Seal Depth: 1.5'

Casing Seal (backfill) Material: 3/8" bentonite pellets

Bentonite Seal Top Depth: 3.0' Elevation: 660.94'

Bentonite Seal

Filter Pack Top Depth: 5.0' Elevation: 658.94'

Filter Pack: 20/40 silica sand

Well Casing Type: PVC

Size (diameter): 2" Thickness: Schedule 40

Well Screen
Top Depth: 6'
Top Elevation: 657.94'
Type of Well Screen: Slotted PVC
Screen Opening Size: 0.010"
Bottom Depth: 46'
Bottom Elevation: 617.94'
Total depth of borehole: 47.5'
Bottom Elevation of borehole: 616.44'

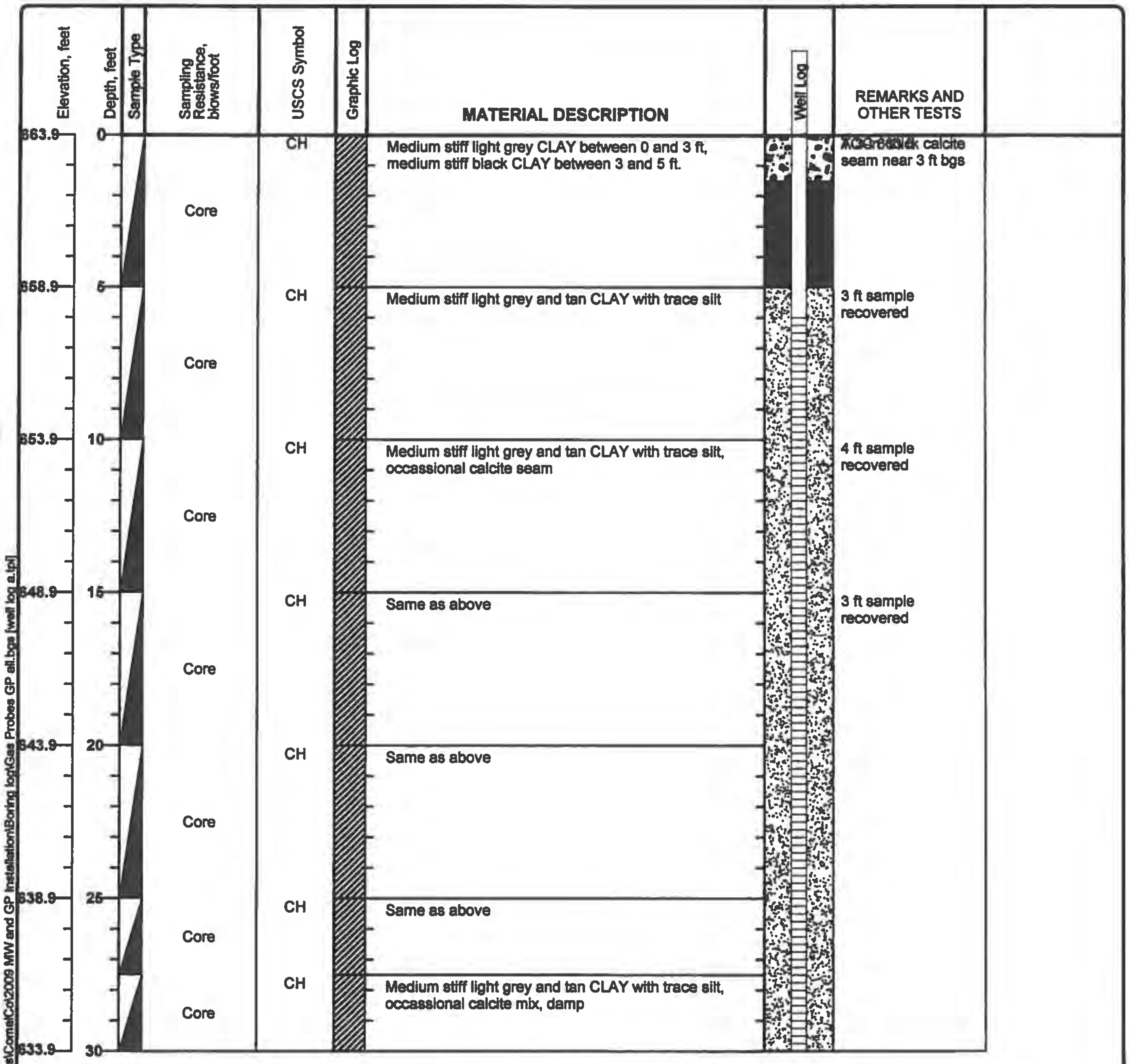
Bottom Cap Depth: 46.25'

Bore Hole Diameter: 8.0"

Modified from TCEQ-10308

Project: Gas Probe Installation,Mesquite Creek Landfill. **Project Location:** 1000 Kohlenberg Lane, New Braunfels, TX **Project Number:** TXL0054-01	**Log of Boring GP-10** Sheet 1 of 2

Date(s) Drilled **03/24/2009**	Logged By **Mohammad Z. Islam**	Checked By **Scott M. Graves, P.E.**
Drilling Method **Hollow Stem Auger**	Drill Bit Size/Type **8 inch**	Total Depth of Borehole **47.5 feet bgs**
Drill Rig Type **Mobil B59**	Drilling Contractor **Total Support Services, Inc.**	Approximate Surface Elevation **663.94 feet MSL**
Groundwater Level and Date Measured **Not Encountered**	Sampling Method(s) **Core**	Hammer Data **N/A**
Borehole Backfill **Well Completion**	Location **N 13,818,348, E 2,276,992**	



Elevation, feet	Depth, feet	Sample Type	Sampling Resistance, blows/foot	USCS Symbol	Graphic Log	MATERIAL DESCRIPTION	Well Log	REMARKS AND OTHER TESTS
663.9	0		Core	CH		Medium stiff light grey CLAY between 0 and 3 ft, medium stiff black CLAY between 3 and 5 ft.		[illegible] calcite seam near 3 ft bgs
658.9	5		Core	CH		Medium stiff light grey and tan CLAY with trace silt		3 ft sample recovered
653.9	10		Core	CH		Medium stiff light grey and tan CLAY with trace silt, occassional calcite seam		4 ft sample recovered
648.9	15		Core	CH		Same as above		3 ft sample recovered
643.9	20		Core	CH		Same as above		
638.9	25		Core	CH		Same as above		
			Core	CH		Medium stiff light grey and tan CLAY with trace silt, occassional calcite mix, damp		
633.9	30							

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Project: Gas Probe Installation,Mesquite Creek Landfill.
Project Location: 1000 Kohlenberg Lane, New Braunfels, TX
Project Number: TXL0054-01

Log of Boring GP-10

Sheet 2 of 2

Elevation, feet	Depth, feet	Sample Type	Sampling Resistance, blows/foot	USCS Symbol	Graphic Log	MATERIAL DESCRIPTION	Well Log	REMARKS AND OTHER TESTS
633.9	30		Core	CH	▨	Same as above		
			Core	CH	▨	Same as above		
628.9	35		Core	CH	▨	Same as above		
			Core	CH	▨	Same as above		
623.9	40		Core	CH	▨	Same as above		
			Core	CH	▨	Same as above		
618.9	45		Core	Claystone	▤	Medium stiff grey CLAYSTONE with trace silt, damp.		
						Bottom of Boring at 47.5 feet bgs		
613.9	50							
608.9	55							
603.9	60							
598.9	65							

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Gas Probe Data Sheet

Permittee or Site Name: WMTX – Mesquite Creek Landfill
County: Comal and Guadalupe
Date of Gas Probe Installation: 03/16/09
Gas Probe Latitude: 29° 44' 19.65" Longitude: 98° 01' 30.03"

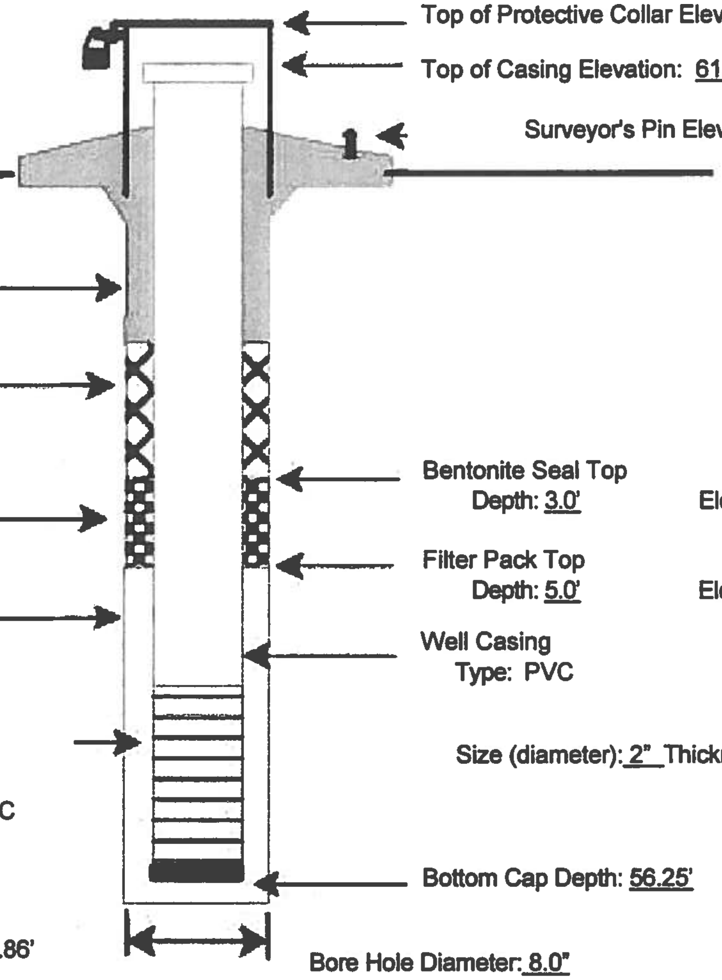
MSW Permit No. MSW-66B
Gas Probe I.D. No.: GP-11
Gas Probe Driller
Name: Brian Kern
License No.: 54611M

NOTES:

Report all depths from Surface Elevation and all Elevations relative to Mean Sea Level (MSL), to nearest hundredth of a foot.
Diameter of boring should be at least 4 inches larger than diameter of well casing.
Use flush screw joint casing only, 2-inch diameter or larger, with o-rings or PTFE tape in joints (4-inch diameter recommend).
Well development should continue until water is clear, and pH and conductivity are stable.

Geologist, Hydrologist, or Engineer Supervising Gas Probe Installation: Mohammad Z. Islam, under supervision of Scott M. Graves, P.E.
Static Water Level Elevation (with respect to MSL) after Well Development: Not Applicable (N/A) – gas probe, not a well
Name of Geologic Formation(s) in which probe is completed: Strata I-IV of site-specific characterization, which is predominantly Lower Taylor Group clay. See Section 2.6 of Attachment 14 of the Site Development Plan for formation names and descriptions for all four strata.

Type of Locking Device: Padlock
Type of Casing Protection: Metal Stick-Up
Concrete Surface Pad Dimensions: 4'x4'x6"



Top of Protective Collar Elevation: 619.39'
Top of Casing Elevation: 618.89'
Surveyor's Pin Elevation: N/A
Ground Surface Elevation: 615.86'
Concrete Seal Depth: 1.5'
Casing Seal (backfill) Material: 3/8" bentonite pellets
Bentonite Seal Top Depth: 3.0' Elevation: 612.86'
Bentonite Seal
Filter Pack Top Depth: 5.0' Elevation: 610.86'
Filter Pack: 20/40 silica sand
Well Casing Type: PVC
Size (diameter): 2" Thickness: Schedule 40

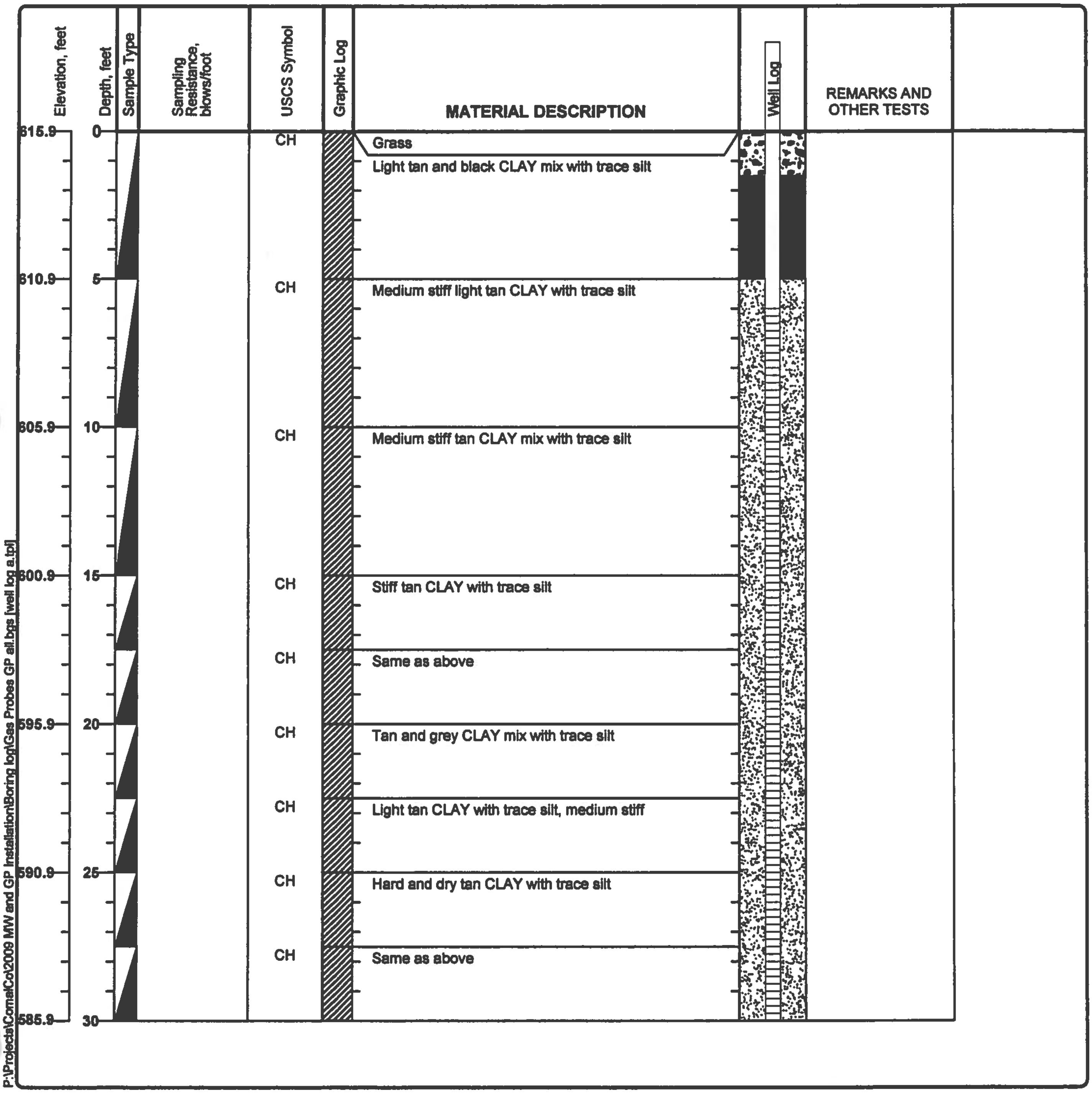
Well Screen
Top Depth: 6'
Top Elevation: 609.86'
Type of Well Screen: Slotted PVC
Screen Opening Size: 0.010"
Bottom Depth: 56'
Bottom Elevation: 559.86'
Total depth of borehole: 57'
Bottom Elevation of borehole: 558.86'

Bottom Cap Depth: 56.25'
Bore Hole Diameter: 8.0"

Modified from TCEQ-10308

Project: Gas Probe Installation,Mesquite Creek Landfill. **Project Location:** 1000 Kohlenberg Lane, New Braunfels, TX **Project Number:** TXL0054-01	**Log of Boring GP-11** Sheet 1 of 2

Date(s) Drilled **03/16/2009**	Logged By **Mohammad Z. Islam**	Checked By **Scott M. Graves, P.E.**
Drilling Method **Hollow Stem Auger**	Drill Bit Size/Type **8 inch**	Total Depth of Borehole **57 feet bgs**
Drill Rig Type **Mobil B59**	Drilling Contractor **Total Support Services, Inc.**	Approximate Surface Elevation **615.86 feet MSL**
Groundwater Level and Date Measured **Not Encountered**	Sampling Method(s) **Other**	Hammer Data **N/A**
Borehole Backfill **Well Completion**	Location **N 13,817,459, E 2,277,906**	



Elevation, feet	Depth, feet	Sample Type	Sampling Resistance, blows/foot	USCS Symbol	Graphic Log	MATERIAL DESCRIPTION	Well Log	REMARKS AND OTHER TESTS
615.9	0			CH		Grass Light tan and black CLAY mix with trace silt		
610.9	5			CH		Medium stiff light tan CLAY with trace silt		
605.9	10			CH		Medium stiff tan CLAY mix with trace silt		
600.9	15			CH		Stiff tan CLAY with trace silt		
				CH		Same as above		
595.9	20			CH		Tan and grey CLAY mix with trace silt		
				CH		Light tan CLAY with trace silt, medium stiff		
590.9	25			CH		Hard and dry tan CLAY with trace silt		
				CH		Same as above		
585.9	30							

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Project: Gas Probe Installation,Mesquite Creek Landfill.
Project Location: 1000 Kohlenberg Lane, New Braunfels, TX
Project Number: TXL0054-01

Log of Boring GP-11

Sheet 2 of 2

Elevation, feet	Depth, feet	Sample Type	Sampling Resistance, blows/foot	USCS Symbol	Graphic Log	MATERIAL DESCRIPTION	Well Log	REMARKS AND OTHER TESTS
585.9	30			CH		Same as above		
				CH		Same as above		
580.9	35			CH		Hard dry grey and tan CLAY with trace silt		
				Claystone		Hard grey CLAYSTONE with trace silt		
575.9	40			Claystone		Same as above		
				Claystone		Same as above		
570.9	45			Claystone		Same as above		
				Claystone		Same as above		
565.9	50			Claystone				
				Claystone		Same as above		
560.9	55			Claystone		Same as above		
						Bottom of Boring at 57 feet bgs.		
555.9	60							
550.9	65							

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Gas Probe Data Sheet

Permittee or Site Name: WMTX – Mesquite Creek Landfill
County: Comal and Guadalupe
Date of Gas Probe Installation: 03/18/09
Gas Probe Latitude: 29° 44' 09.83" Longitude: 98° 01' 19.00"

MSW Permit No. MSW-66B
Gas Probe I.D. No.: GP-12
Gas Probe Driller
Name: Brian Kern
License No.: 54611M

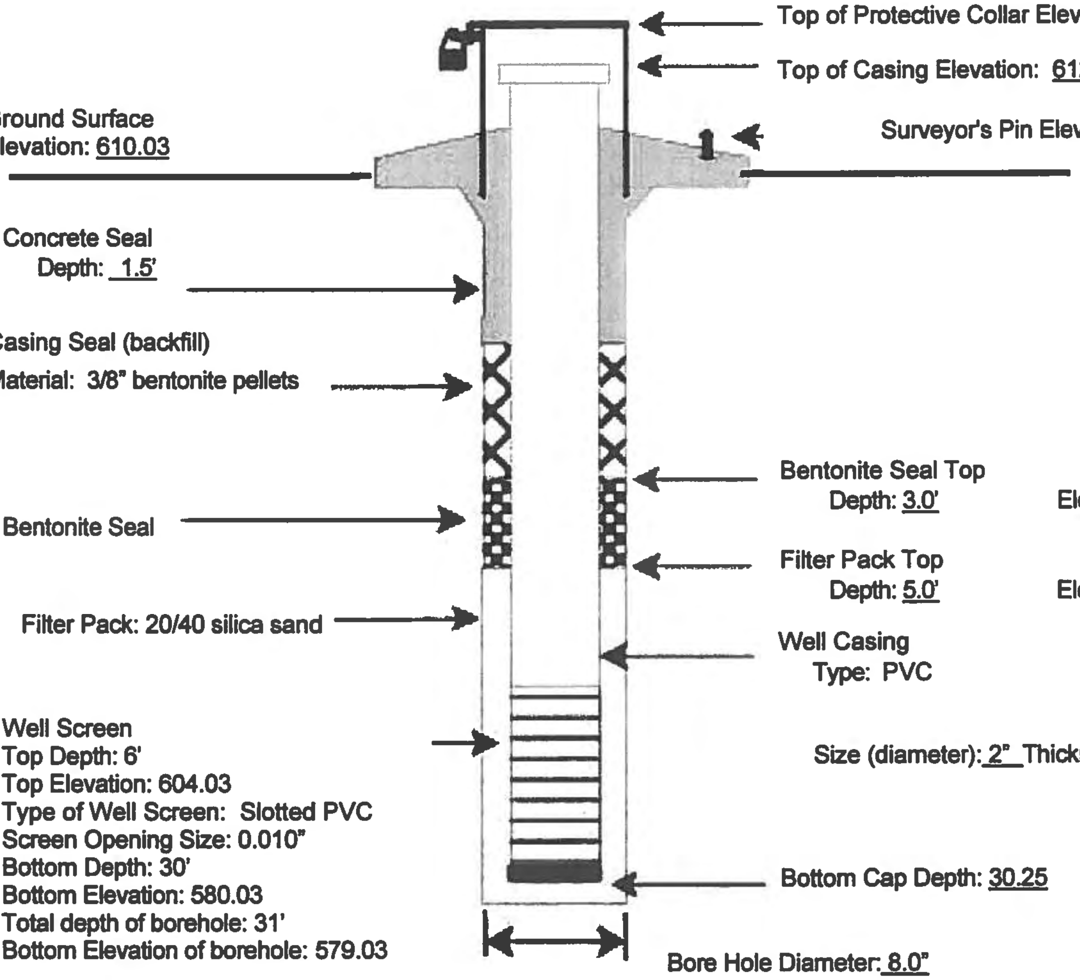
NOTES:

Report all depths from Surface Elevation and all Elevations relative to Mean Sea Level (MSL), to nearest hundredth of a foot.
Diameter of boring should be at least 4 inches larger than diameter of well casing.
Use flush screw joint casing only, 2-inch diameter or larger, with o-rings or PTFE tape in joints (4-inch diameter recommend).
Well development should continue until water is clear, and pH and conductivity are stable.

Geologist, Hydrologist, or Engineer Supervising Gas Probe Installation: Mohammad Z. Islam, under supervision of Scott M. Graves, P.E.
Static Water Level Elevation (with respect to MSL) after Well Development: Not Applicable (N/A) – gas probe, not a well
Name of Geologic Formation(s) in which probe is completed: Strata I-III of site-specific characterization, which is predominantly Lower Taylor Group clay. See Section 2.6 of Attachment 14 of the Site Development Plan for formation names and descriptions for all three strata encountered at this probe.

Type of Locking Device: Padlock
Concrete Surface Pad Dimensions: 4'x4'x6"

Type of Casing Protection: Metal Stick-Up



Top of Protective Collar Elevation: 613.51
Top of Casing Elevation: 612.93
Surveyor's Pin Elevation: N/A

Ground Surface Elevation: 610.03

Concrete Seal Depth: 1.5'

Casing Seal (backfill) Material: 3/8" bentonite pellets

Bentonite Seal Top Depth: 3.0' Elevation: 607.03

Bentonite Seal

Filter Pack Top Depth: 5.0' Elevation: 605.03'

Filter Pack: 20/40 silica sand

Well Casing Type: PVC

Size (diameter): 2" Thickness: Schedule 40

Well Screen
Top Depth: 6'
Top Elevation: 604.03
Type of Well Screen: Slotted PVC
Screen Opening Size: 0.010"
Bottom Depth: 30'
Bottom Elevation: 580.03
Total depth of borehole: 31'
Bottom Elevation of borehole: 579.03

Bottom Cap Depth: 30.25

Bore Hole Diameter: 8.0"

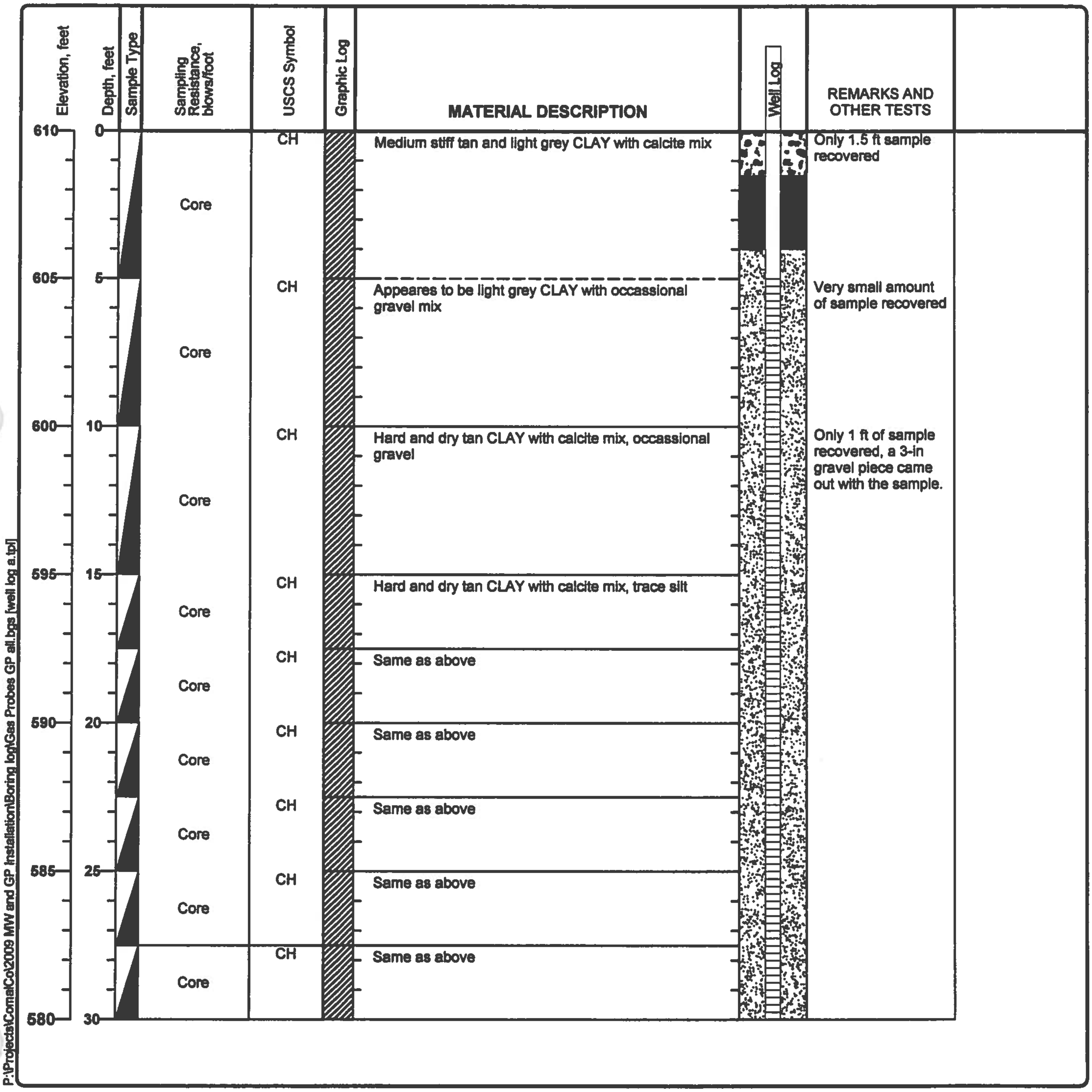
Modified from TCEQ-10308

Project: Gas Probe Installation,Mesquite Creek Landfill.
Project Location: 1000 Kohlenberg Lane, New Braunfels, TX
Project Number: TXL0054-01

Log of Boring GP-12

Sheet 1 of 2

Date(s) Drilled	03/18/2009	Logged By	Mohammad Z. Islam	Checked By	Scott M. Graves, P.E.
Drilling Method	Hollow Stem Auger	Drill Bit Size/Type	8 inch	Total Depth of Borehole	31 feet bgs
Drill Rig Type	Mobil B59	Drilling Contractor	Total Support Services, Inc.	Approximate Surface Elevation	610.03 feet MSL
Groundwater Level and Date Measured	Not Encountered	Sampling Method(s)	Core	Hammer Data	N/A
Borehole Backfill	Well Completion	Location	N 13,816,475, E 2,278,886		



Elevation, feet	Depth, feet	Sample Type	Sampling Resistance, blows/foot	USCS Symbol	Graphic Log	MATERIAL DESCRIPTION	Well Log	REMARKS AND OTHER TESTS
610	0		Core	CH		Medium stiff tan and light grey CLAY with calcite mix		Only 1.5 ft sample recovered
605	5		Core	CH		Appeares to be light grey CLAY with occassional gravel mix		Very small amount of sample recovered
600	10		Core	CH		Hard and dry tan CLAY with calcite mix, occassional gravel		Only 1 ft of sample recovered, a 3-in gravel piece came out with the sample.
595	15		Core	CH		Hard and dry tan CLAY with calcite mix, trace silt		
			Core	CH		Same as above		
590	20		Core	CH		Same as above		
			Core	CH		Same as above		
585	25		Core	CH		Same as above		
			Core	CH		Same as above		
580	30							

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Project: Gas Probe Installation,Mesquite Creek Landfill.
Project Location: 1000 Kohlenberg Lane, New Braunfels, TX
Project Number: TXL0054-01

Log of Boring GP-12

Sheet 2 of 2

Elevation, feet	Depth, feet	Sample Type	Sampling Resistance, blows/foot	USCS Symbol	Graphic Log	MATERIAL DESCRIPTION	Well Log	REMARKS AND OTHER TESTS
580	30	◣	Core	CH	▨	Same as above (cont.)	▨	
						Bottom of Boring at 31 feet bgs		
575	35							
570	40							
565	45							
560	50							
555	55							
550	60							
545	65							

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Gas Probe Data Sheet

Permittee or Site Name: WMTX – Mesquite Creek Landfill

County: Comal and Guadalupe

Date of Gas Probe Installation: 03/23/09

Gas Probe Latitude: 29° 44' 05.30" Longitude: 98° 01' 11.12"

MSW Permit No. MSW-66B

Gas Probe I.D. No.: GP-13

Gas Probe Driller

Name: Brian Kern

License No.: 54611M

NOTES:

Report all depths from Surface Elevation and all Elevations relative to Mean Sea Level (MSL), to nearest hundredth of a foot.

Diameter of boring should be at least 4 inches larger than diameter of well casing.

Use flush screw joint casing only, 2-inch diameter or larger, with o-rings or PTFE tape in joints (4-inch diameter recommend).

Well development should continue until water is clear, and pH and conductivity are stable.

Geologist, Hydrologist, or Engineer Supervising Gas Probe Installation: Mohammad Z. Islam, under supervision of Scott M. Graves, P.E.

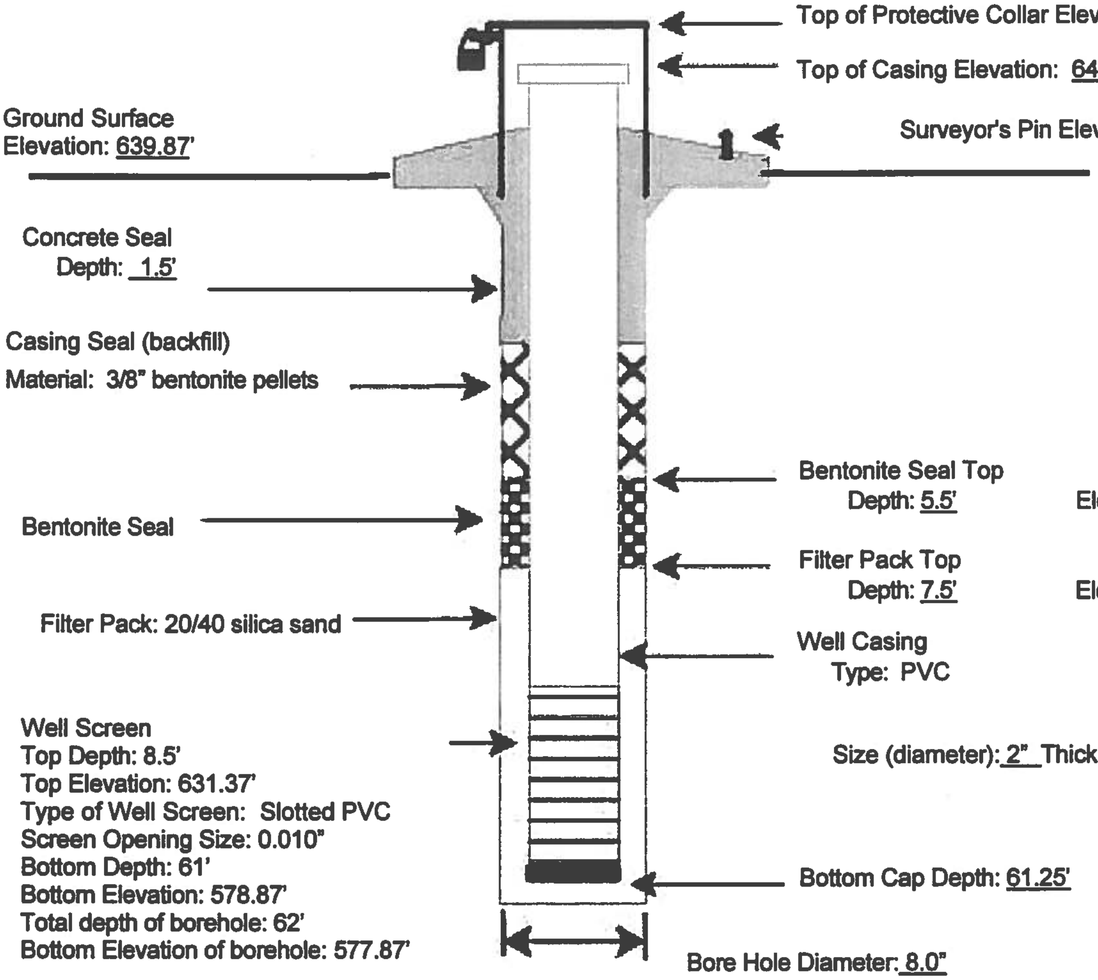
Static Water Level Elevation (with respect to MSL) after Well Development: Not Applicable (N/A) – gas probe, not a well

Name of Geologic Formation(s) in which probe is completed: Strata I-IV of site-specific characterization, which is predominantly Lower Taylor Group clay. See Section 2.6 of Attachment 14 of the Site Development Plan for formation names and descriptions for all four strata.

Type of Locking Device: Padlock

Type of Casing Protection: Metal Stick-Up

Concrete Surface Pad Dimensions: 4'x4'x6"



Top of Protective Collar Elevation: 643.18'

Top of Casing Elevation: 642.78'

Ground Surface Elevation: 639.87'

Surveyor's Pin Elevation: N/A

Concrete Seal Depth: 1.5'

Casing Seal (backfill) Material: 3/8" bentonite pellets

Bentonite Seal Top Depth: 5.5' Elevation: 634.37'

Bentonite Seal

Filter Pack Top Depth: 7.5' Elevation: 632.37'

Filter Pack: 20/40 silica sand

Well Casing Type: PVC

Size (diameter): 2" Thickness: Schedule 40

Well Screen
Top Depth: 8.5'
Top Elevation: 631.37'
Type of Well Screen: Slotted PVC
Screen Opening Size: 0.010"
Bottom Depth: 61'
Bottom Elevation: 578.87'
Total depth of borehole: 62'
Bottom Elevation of borehole: 577.87'

Bottom Cap Depth: 61.25'

Bore Hole Diameter: 8.0"

Project: Gas Probe Installation,Mesquite Creek Landfill.
Project Location: 1000 Kohlenberg Lane, New Braunfels, TX
Project Number: TXL0054-01

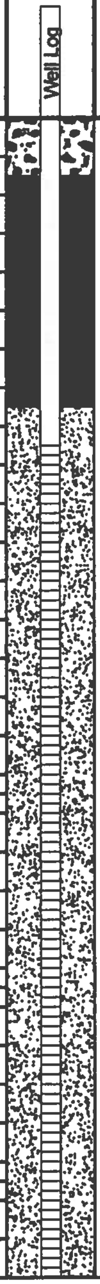
Log of Boring GP-13

Sheet 1 of 2

Date(s) Drilled 03/23/2009	**Logged By** Mohammad Z. Islam	**Checked By** Scott M. Graves, P.E.
Drilling Method Hollow Stem Auger	**Drill Bit Size/Type** 8 inch	**Total Depth of Borehole** 62 feet bgs
Drill Rig Type Mobil B59	**Drilling Contractor** Total Support Services, Inc.	**Approximate Surface Elevation** 639.87 feet MSL
Groundwater Level and Date Measured Not Encountered	**Sampling Method(s)** Core	**Hammer Data** N/A
Borehole Backfill Well Completion	**Location** N 13,816,023, E 2,279,585	

Elevation, feet	Depth, feet	Sampling Resistance, blows/foot	USCS Symbol	MATERIAL DESCRIPTION	REMARKS AND OTHER TESTS
639.9	0	Core	CH	Dry light grey clay with some silt, occassional gravel mix	Only about 2 ft sample recovered
634.9	5	Core	CH	Dry and stiff tan CLAY with trace silt	
629.9	10	Core	CH	Dry and stiff tan CLAY with calcite mix	
624.9	15	Core	CH	Stiff tan CLAY with trace silt	
		Core	CH	Same as above	
619.9	20	Core	CH	Same as above	
		Core	CH	Same as above	
614.9	25	Core	CH	Same as above	
		Core	CH	Same as above	
609.9	30				

Well Log



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Project: Gas Probe Installation,Mesquite Creek Landfill.
Project Location: 1000 Kohlenberg Lane, New Braunfels, TX
Project Number: TXL0054-01

Log of Boring GP-13

Sheet 2 of 2

Elevation, feet	Depth, feet	Sample Type	Sampling Resistance, blows/foot	USCS Symbol	Graphic Log	MATERIAL DESCRIPTION	Well Log	REMARKS AND OTHER TESTS
609.9	30		Core	CH	▨	Same as above		
			Core	CH	▨	Same as above		
604.9	35		Core	CH	▨	Tan CLAY with ocassional calcite seam		
			Core	CH	▨	Tan CLAY with trace silt		
599.9	40		Core	CH	▨	Tan CLAY with trace silt, occassional calcite seam		
			Core	Claystone	▤	Hard dark grey CLAYSTONE with trace silt, dry		
594.9	45		Core	Claystone	▤	Same as above		
			Core	Claystone	▤	Same as above		
589.9	50		Core	Claystone	▤	Same as above		
			Core	Claystone	▤	Same as above		
584.9	55		Core	Claystone	▤	Same as above		
			Core	Claystone	▤	Same as above		
579.9	60		Core	Claystone	▤	Same as above		
				Claystone		Bottom of Boring at 62 feet bgs		
574.9	65							

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Gas Probe Data Sheet

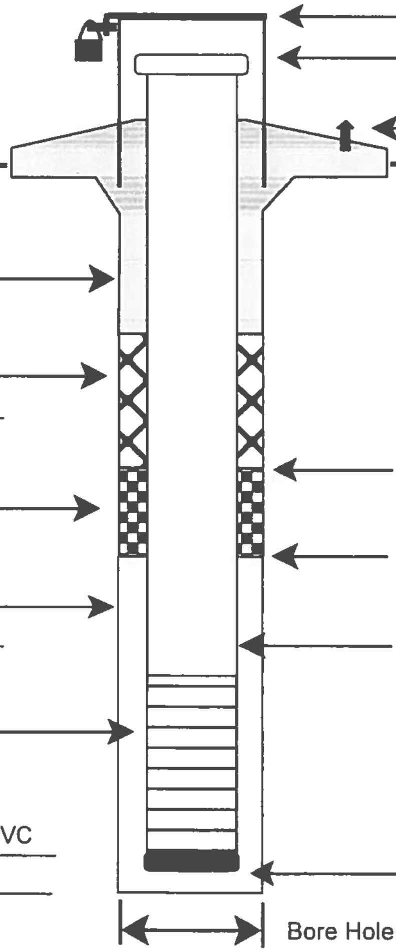
Permittee or Site Name: Mesquite Creek Landfill
MSW Permit No.: MSW-66B
County: New Braunfels, Comal and Guadalupe Counties
Gas Probe I.D. No.: GP-14
Date of Gas Probe Installation: December 4, 2013
Date of Monitor Well Development: N/A - Dry
Gas Probe Latitude: 29° 44' 2.99" Longitude: -98° 1.0' 0.29"
Gas Probe Groundwater Gradient Position:
Upgradient N/A Downgradient N/A
Gas Probe Driller:
Name: Jim Neal
License No.: WPKT 4868

NOTES:

- Report all depths from Surface Elevation and all Elevations relative to Mean Sea Level (MSL), to nearest hundredth of a foot.
- Diameter of boring should be at least 4 inches larger than diameter of well casing.
- Use flush screw joint casing only, 2-inch diameter or larger, with o-rings or PTFE tape in joints (4-inch diameter recommend).
- Well development should continue until water is clear, and pH and conductivity are stable.

Geologist, Hydrologist, or Engineer Supervising Well Installation: Christian M. Llull, P.G. #5884
Static Water Level Elevation (with respect to MSL) after Well Development: Dry at completion
Name of Geologic Formation(s) in which Well is completed: Lower Taylor Group (Stratum III of site-specific characterization)

Type of Locking Device: Padlock
Type of Casing Protection: Anodized Aluminum
Concrete Surface Pad (with steel reinforcement) Dimensions: 4' x 4' x 6"



Top of Protective Collar Elevation: 661.34'
Top of Casing Elevation: 660.57'
Surface Elevation: 657.72'
Surveyor's Pin Elevation: 658.02'
Concrete Seal Depth: 2
Casing Seal (backfill) Material: 3/8" bentonite pellets
Bentonite Seal Top Depth: 2' Elevation: 655.72'
Bentonite Seal
Filter Pack Top Depth: 4' Elevation: 653.72'
Filter Pack
Filter Pack Material: 20/40 Sand
Well Casing
Type: PVC
Size (diameter): 2"
Schedule or Thickness: Sch. 40
Well Screen
Top Depth: 5'
Top Elevation: 652.72'
Type of Well Screen: Sch. 40 PVC
Screen Opening Size: 0.010"
Bottom Depth: 55'
Bottom Elevation: 602.72'
Bottom Cap Depth: 55'
Bore Hole Diameter: 8"

TETRA TECH, INC.
8911 N. Capital of Tx Hwy
Bldg. 2, Suite 2310
Austin, Texas 78759
(512) 338-1667

Mesquite Creek Landfill

MSW Permit 66B

New Braunfels/Comal/Guadalupe Counties

LOG OF BORING:

GP-14

DATE: 12/4/13
HOLE DIAMETER: 8"
DRILLING METHOD: HSA
SAMPLING METHOD: SPT
LOGGED BY: Samantha K. Abbott

DRILLING COMPANY: Vortex Drilling, Inc.
DRILLER: Jim Neal
DRILLER'S LICENSE #: 4868 WPKT
DRILLING RIG: Mobile Drill B59
LATITUDE: 29.734163
LONGITUDE: -98.016748

TOTAL DEPTH: 56'
TOP OF CASING: 660.57'
SURFACE ELEVATION: 657.72'
DEPTH TO WATER: Dry @ Completion
CASING DIAMETER: 2"
SURFACE COMPLETION: Anodized Riser

FIELD DATA

Depth (feet)	Sample	Sampler Type	Recovery %
0	0-2.5	☒	20%
	2.5-5	☒	100%
5	5-7.5	☒	100%
	7.5-10	☒	100%
10	10-12.5	☒	100%
	12.5-15	☒	100%
15	15-17.5	☒	100%
	17.5-20	☒	100%
20	20-22.5	☒	100%
	22.5-25	☒	100%
25	25-27.5	☒	100%
	27.5-30	☒	100%
30	30-32.5	☒	100%
	32.5-35	☒	100%
35	35-37.5	☒	100%
	37.5-40	☒	100%
40	40-42.5	☒	100%
	42.5-45	☒	100%
45	45-47.5	☒	100%
	47.5-50	☒	100%
50	50-52.5	☒	100%
	52.5-55	☒	100%
55			
60			

MATERIAL DESCRIPTION

FAT CLAY (CH) medium stiff to stiff, dark brown, with silt and roots, moist.

FAT CLAY (CH) very stiff, dark brown, with calcareous material and gravel.

SILT (ML) stiff, light tan to white, heavily calcareous, loosely cemented/friable, dry.

SILTY CLAY (CL) stiff, tan to light brown, with some calcareous material; mineralization (black and red flecks in shear zones), with some gray weathered zones.

SILTY CLAY (CL) very stiff, tan, with zones of oxidation and mineralization, gray weathered zones, damp.

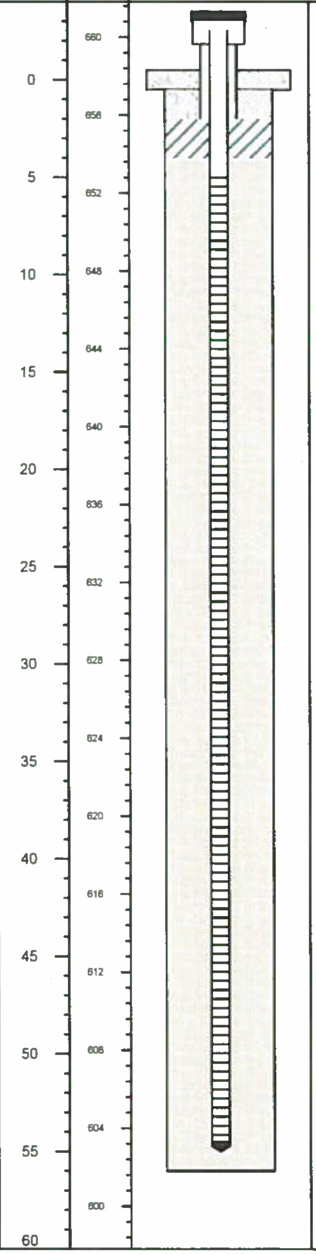
-- medium stiff to very stiff @ 32', more FAT CLAY (CH), damp.

-- calcite mineralization zone @ 40.5' - 46'.

FAT CLAY (CH) stiff to very stiff, gray brown, some SILT (CL).

CLAYSTONE very stiff to hard, dark gray, with some silt, homogenous.

WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS



Anodized Aluminum Riser

4'x4'x6" Reinforced Concrete Surface Pad

Concrete Seal

Bentonite Chip Seal

2" diameter Schedule 40 PVC Casing

20/40 Sand Filter Pack

2" diameter Schedule 40 PVC 0.010" Slotted Screen

Bottom Cap @ 55'

Ground Water Level Data

▽ Free water first encountered ▼ Water Level after 15 minutes

Sampler Type

☒ Split Spoon ▯ Auger ■ Shelby Tube ☒ No Recovery ▯ Cuttings

STATE OF TEXAS WELL REPORT for Tracking #348548

Owner:	Waste Mgmt.of TX/Mesquite Creek Landfill	Owner Well #:	GP-14
Address:	1700 Kohlenberg Road New Braunfels , TX 78130	Grid #:	68-24-3
Well Location:	1700 Kohlenberg Road New Braunfels , TX 78130	Latitude:	29° 43' 52" N
Well County:	Comal	Longitude:	098° 01' 05" W
Elevation:	No Data	GPS Brand Used:	Google Earth
Type of Work:	New Well	Proposed Use:	Monitor

Drilling Date:	Started: 12/4/2013 Completed: 12/4/2013
Diameter of Hole:	Diameter: 8 in From Surface To 56 ft
Drilling Method:	Hollow Stem Auger
Borehole Completion:	Gravel Packed From: 56 ft to 3 ft Gravel Pack Size: 20/40
Annular Seal Data:	1st Interval: From 0 ft to 2 ft with 1 Cement (#sacks and material) 2nd Interval: From 2 ft to 3 ft with 0.50 Bentonite (#sacks and material) 3rd Interval: No Data Method Used: Hand Mixed Cemented By: Vortex Drilling, Inc. Distance to Septic Field or other Concentrated Contamination: No Data Distance to Property Line: No Data Method of Verification: No Data Approved by Variance: No Data
Surface Completion:	Surface Sleeve Installed
Water Level:	Static level: No Data Artesian flow: No Data
Packers:	N/A
Plugging Info:	Casing left in well: Cement/Bentonite left in well: From (ft) To (ft) From (ft) To (ft) Cem/Bent Sacks Used N/A
Type Of Pump:	No Data
Well Tests:	No Data
Water Quality:	Type of Water: No Data Depth of Strata: No Data Chemical Analysis Made: No Data Did the driller knowingly penetrate any strata which contained undesirable constituents: No Data
Certification Data:	The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the log(s) being returned for completion and resubmittal.
Company Information:	

Vortex Drilling, Inc.
4412 Bluemel Road
San Antonio , TX 78240

Driller License Number:	4868
Licensed Well Driller Signature:	James E. Neal
Registered Driller Apprentice Signature:	Heriberto Martinez
Apprentice Registration Number:	59190
Comments:	No Data

IMPORTANT NOTICE FOR PERSONS HAVING WELLS DRILLED CONCERNING CONFIDENTIALITY

TEX. OCC. CODE Title 12, Chapter 1901.251, authorizes the owner (owner or the person for whom the well was drilled) to keep information in Well Reports confidential. The Department shall hold the contents of the well log confidential and not a matter of public record if it receives, by certified mail, a written request to do so from the owner.

Please include the report's Tracking number (Tracking #348548) on your written request.

Texas Department of Licensing & Regulation
P.O. Box 12157
Austin, TX 78711
(512) 463-7880

DESC. & COLOR OF FORMATION MATERIAL

From (ft) To (ft) Description
0 - 3 Fat clay,med.stiff/stiff,dk.brw.w/silt and roots, moist
3 - 4 Fat clay,v.stiff,dk.brw.w/calcar.material and gravel
4 - 7 Silt,stiff,lt.tan/white,heavily calcar.,loosely cemented/friable,dry
7 - 21 Silty clay,stiff,tan/lt.brw.w/some calcar. material,mineralization,blk.and red flecks in shear zones w/some gray weathered zones
21 - 46.5 Silty clay,v.stiff,tan w/zones of oxidation and mineralization,gray weathered zones,damp, @32'med.stiff/v.stiff,more fat clay,damp,@40.5'-46' calcite mineralization zone
46.5 - 51 Fat clay,stiff/v.stiff,gray brw.,some silt
51 - 56 Claystone,v.stiff/hard,dk.gray w/some silt,homogenous

CASING, BLANK PIPE & WELL SCREEN DATA

Dia. New/Used Type Setting From/To
2 New Schedule 40 PVC .010 56 - 5 Screen
2 New Schedule 40 PVC 5 - 0 Riser
2 New Top Cap
2 New Bottom Cap

Gas Probe Data Sheet

Permittee or Site Name: Mesquite Creek Landfill
County: Comal and Guadalupe
Date of Gas Probe Installation: 1/25/16
Gas Probe Latitude: 29.733090 Longitude: -98.015600
Gas Probe Groundwater Gradient Position:
Upgradient ______ Downgradient ______

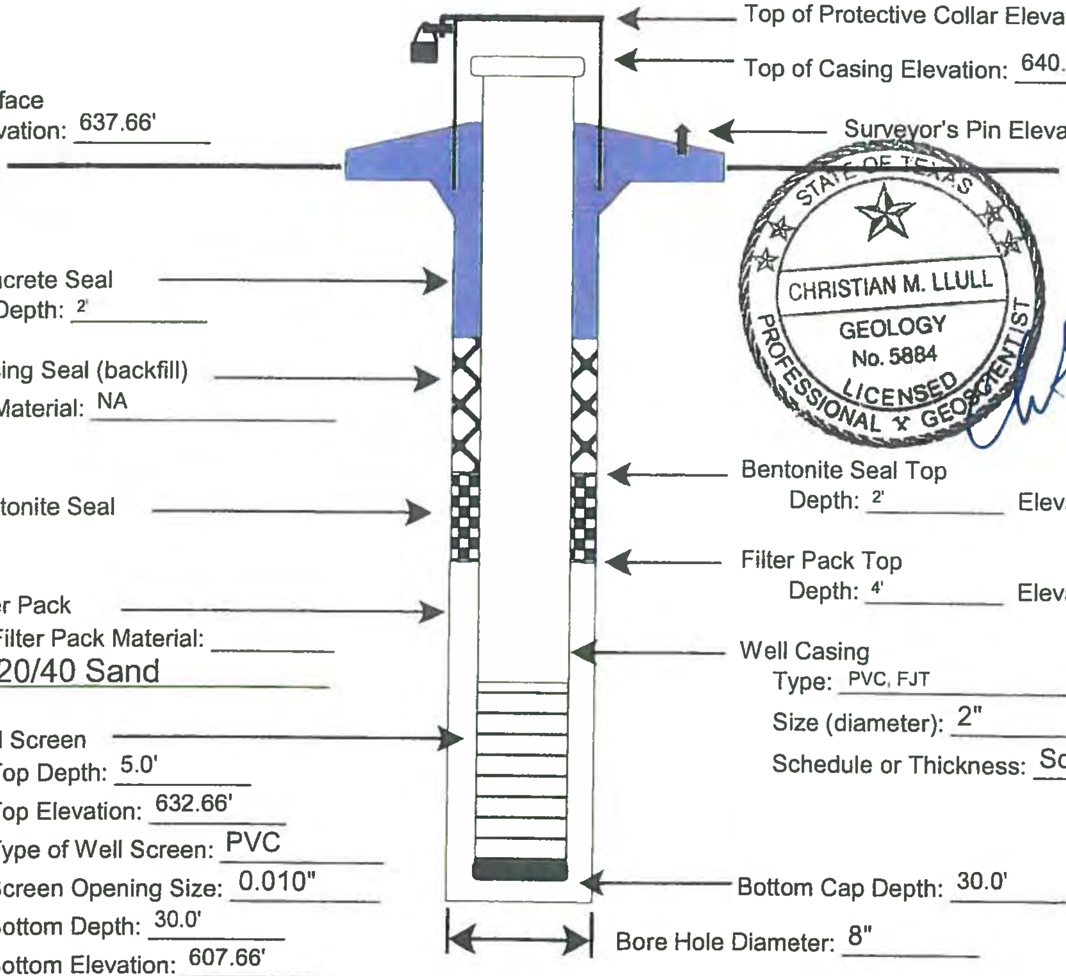
MSW Permit No.: 66B
Gas Probe I.D. No.: GP-15
Date of Monitor Well Development: Dry @ Completion
Gas Probe Driller Name: Jim Neal
License No.: 4868 WKPT

NOTES:

- Report all depths from Surface Elevation and all Elevations relative to Mean Sea Level (MSL), to nearest hundredth of a foot.
- Diameter of boring should be at least 4 inches larger than diameter of well casing.
- Use flush screw joint casing only, 2-inch diameter or larger, with o-rings or PTFE tape in joints (4-inch diameter recommend).
- Well development should continue until water is clear, and pH and conductivity are stable.

Geologist, Hydrologist, or Engineer Supervising Probe Installation: Christian M. Llull, P.G. #5884
Static Water Level Elevation (with respect to MSL) after Probe Development: Dry @ Completion
Name of Geologic Formation(s) in which Well is completed: Stratum III

Type of Locking Device: Padlock
Type of Casing Protection: Anodized Aluminum
Concrete Surface Pad (with steel reinforcement) Dimensions: 4' x 4' x 6"



Top of Protective Collar Elevation: 641.29'
Top of Casing Elevation: 640.88'
Surface Elevation: 637.66'
Surveyor's Pin Elevation: 638.35'
Concrete Seal Depth: 2'
Casing Seal (backfill) Material: NA
Bentonite Seal
Bentonite Seal Top Depth: 2' Elevation: 635.66'
Filter Pack Top Depth: 4' Elevation: 633.66'
Filter Pack
Filter Pack Material: 20/40 Sand
Well Casing Type: PVC, FJT
Size (diameter): 2"
Schedule or Thickness: Sch. 40
Well Screen
Top Depth: 5.0'
Top Elevation: 632.66'
Type of Well Screen: PVC
Screen Opening Size: 0.010"
Bottom Depth: 30.0'
Bottom Elevation: 607.66'
Bottom Cap Depth: 30.0'
Bore Hole Diameter: 8"

CHRISTIAN M. LLULL
GEOLOGY
No. 5884

2-26-16

TETRA TECH, INC.
8911 N. Capital of Tx Hwy
Bldg. 2, Suite 2310
Austin, Texas 78759
(512) 338-1667

Mesquite Creek Landfill

MSW Permit 66B

New Braunfels/Comal/Guadalupe Counties

LOG OF BORING:

GP-15

DATE: 1/25/16
HOLE DIAMETER: 8"
DRILLING METHOD: HSA
SAMPLING METHOD: SPT
LOGGED BY: Ryan C. Dickerson

DRILLING COMPANY: Vortex Drilling, Inc.
DRILLER: Jim Neal
DRILLER'S LICENSE #: 4868 WKPT
DRILLING RIG: Mobile Drill B59
LATITUDE: 29.73309
LONGITUDE: -98.0156

TOTAL DEPTH: 33'
TOP OF CASING: 640.88'
SURFACE ELEVATION: 637.66'
DEPTH TO WATER: Dry @ Completion
CASING DIAMETER: 2"
SURFACE COMPLETION: Anodized Riser

FIELD DATA

Depth (feet) | Sample | Sampler Type | Recovery % | Lithology | MATERIAL DESCRIPTION | Depth (feet) | Elevation (feet MSL) | WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS

FAT CLAY (CH) medium stiff, tan and gray, with yellowish-brown mottling, roots @ 0'-6.0', moist.

SILTY CLAY (CL) medium stiff, tan and gray, with yellowish-brown mottling, occasional crystallization, trace root material @ 6.0' - 10.0', trace shell fragments @ 6.0' - 10.0'.

-- oxidation staining throughout @ 12.0'.

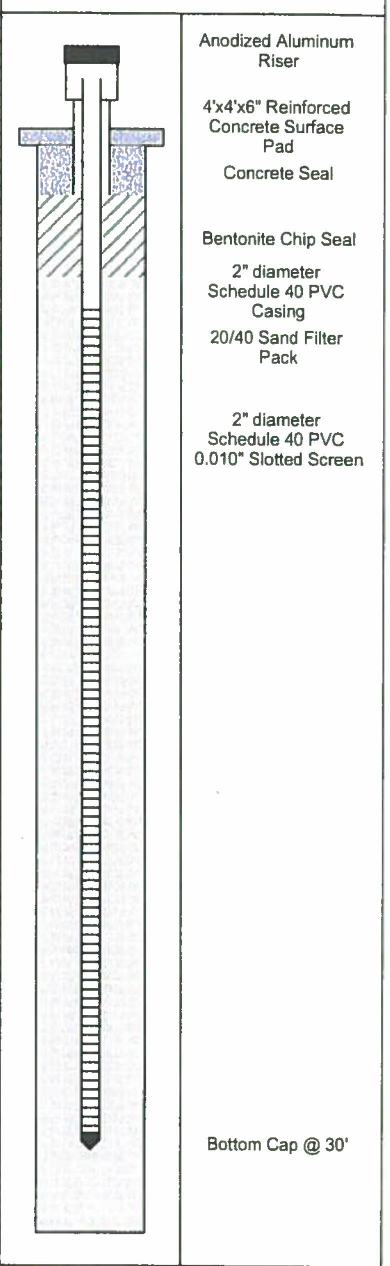
-- large shell fragments @ 21.0' - 21.5'.

SILTY CLAY (CL) medium stiff, light tan and light gray, with occasional oxidation staining throughout, trace shell fragments, moist.

SILTY CLAY (CL) soft to medium stiff, tan and yellowish-brown, with occasional oxidation staining throughout, friable, trace calcareous material.

STATE OF TEXAS
CHRISTIAN M. LLULL
GEOLOGY
No. 5884
LICENSED PROFESSIONAL GEOSCIENTIST

2-26-16



Ground Water Level Data
▽ Free water first encountered ▼ Water Level after 15 minutes

Sampler Type
☒ Split Spoon ◫ Auger ■ Shelby Tube ⧄ No Recovery ◫ Cuttings

STATE OF TEXAS WELL REPORT for Tracking #414249

Owner:	**Waste Management of Texas**	Owner Well #:	**GP-15**
Address:	**Mesquite Creek Landfill** **1000 Kohlenberg Lane** **New Braunfels, TX 78130**	Grid #:	**68-24-3**
		Latitude:	**29° 43' 59.12" N**
Well Location:	**1000 Kohlenberg Lane** **New Braunfels, TX 78130**	Longitude:	**098° 00' 56.16" W**
Well County:	**Guadalupe**	Elevation:	**638 ft. above sea level**

Type of Work: **New Well**

Proposed Use: **Monitor**

Drilling Start Date: **1/25/2016** Drilling End Date: **1/26/2016**

Borehole:

Diameter (in.)	*Top Depth (ft.)*	*Bottom Depth (ft.)*
8.25	0	33

Drilling Method: **Hollow Stem Auger**

Borehole Completion: **Filter Packed**

Filter Pack Intervals:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Filter Material*	*Size*
4	33	Sand	20/40

Annular Seal Data:

Top Depth (ft.)	*Bottom Depth (ft.)*	*Description (number of sacks & material)*
0	2	Concrete 1.16 Bags/Sacks
2	4	Bentonite 0.91 Bags/Sacks

Seal Method: **Hand Mixed**

Sealed By: **Driller**

Distance to Property Line (ft.): **No Data**

Distance to Septic Field or other concentrated contamination (ft.): **No Data**

Distance to Septic Tank (ft.): **No Data**

Method of Verification: **No Data**

Surface Completion: **Surface Sleeve Installed**

Surface Completion by Driller

Water Level: **No Data**

Packers: **No Data**

Type of Pump: **No Data**

Well Tests: **No Test Data Specified**

	Strata Depth (ft.)	Water Type
Water Quality:	No Data	No Data

Chemical Analysis Made: No

Did the driller knowingly penetrate any strata which contained injurious constituents?: No

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Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the report(s) being returned for completion and resubmittal.

Company Information: **VORTEX DRILLING INC.**

4412 Bluemel Road
San Antonio, TX 78240

Driller Name: **James E Neal** License Number: **4868**

Apprentice Name: **Tony Elmendorf**

Comments: **No Data**

Report Amended on 2/22/2016 by Request #16121

Lithology:
DESCRIPTION & COLOR OF FORMATION MATERIAL

Top (ft.)	Bottom (ft.)	Description
0	6	FAT CLAY (0-6) tan and gray, medium stiff.
6	21.5	SILTY CLAY (6-21.5) tan and gray, medium stiff.
21.5	29	SILTY CLAY (21.5-29) light tan and light gray, medium stiff.
29	33	SILTY CLAY (29-33) tan and yellowish-brown, soft to medium stiff.

Casing:
BLANK PIPE & WELL SCREEN DATA

Dia (in.)	Type	Material	Sch./Gage	Top (ft.)	Bottom (ft.)
2	Top Cap (Locking)	New Plastic (PVC)	40		
2	Bottom Cap	New Plastic (PVC)	40		
2	Riser	New Plastic (PVC)	40	-4	5
2	Screen	New Plastic (PVC)	40 / 0.010	5	30

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Please include the report's Tracking Number on your written request.

Texas Department of Licensing and Regulation
P.O. Box 12157
Austin, TX 78711
(512) 463-7880

Gas Probe Data Sheet

Permittee or Site Name: Mesquite Creek Landfill
County: Comal and Guadalupe
Date of Gas Probe Installation: 4/10/2018
Gas Probe Latitude: -98.00565857 Longitude: 29.43490904
Gas Probe Groundwater Gradient Position:
Upgradient ____ Downgradient X

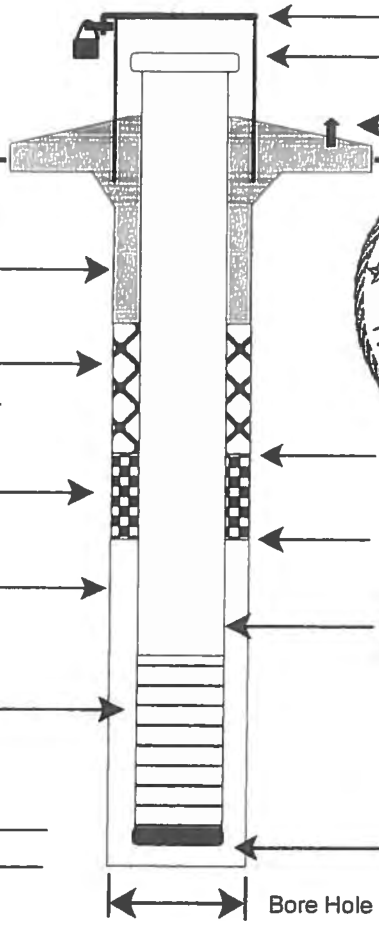
MSW Permit No.: 66B
Gas Probe I.D. No.: GP-16
Date of Monitor Well Development: Dry @ Completion
Gas Probe Driller Name: Jim Neal
License No.: 4868 WPKT

NOTES:

- Report all depths from Surface Elevation and all Elevations relative to Mean Sea Level (MSL), to nearest hundredth of a foot.
- Diameter of boring should be at least 4 inches larger than diameter of well casing.
- Use flush screw joint casing only, 2-inch diameter or larger, with o-rings or PTFE tape in joints (4-inch diameter recommend).
- Well development should continue until water is clear, and pH and conductivity are stable.

Geologist, Hydrologist, or Engineer Supervising Probe Installation: Christian M. Llull, P.G. #5884
Static Water Level Elevation (with respect to MSL) after Probe Development: 629.85' MSL @ 24 hours
Name of Geologic Formation(s) in which Well is completed: Lower Taylor Group (Predominantly Site-Specific Stratum III)

Type of Locking Device: Padlock
Type of Casing Protection: Anodized Aluminum
Concrete Surface Pad (with steel reinforcement) Dimensions: 4' x 4' x 6"



Top of Protective Collar Elevation: 658.03'
Top of Casing Elevation: 657.54'
Surface Elevation: 654.81'
Surveyor's Pin Elevation: 654.91'

Concrete Seal Depth: 2'
Casing Seal (backfill) Material: Bentonite
Bentonite Seal

CHRISTIAN M. LLULL
GEOLOGY
No. 5884

6/6/18

Bentonite Seal Top Depth: 2' Elevation: 652.81'
Filter Pack Top Depth: 4' Elevation: 650.81'

Filter Pack
Filter Pack Material: 20/40 Sand

Well Casing
Type: PVC, FJT
Size (diameter): 2"
Schedule or Thickness: Sch. 40

Well Screen
Top Depth: 5'
Top Elevation: 649.81'
Type of Well Screen: PVC
Screen Opening Size: 0.010"
Bottom Depth: 30'
Bottom Elevation: 624.81'

Bottom Cap Depth: 30.5'
Bore Hole Diameter: 8"

TETRA TECH, INC
8911 N. Capital of Tx Hwy
Bldg. 2, Suite 2310
Austin, Texas 78759
(512) 338-1667

Mesquite Creek Landfill

MSW Permit 66B

New Braunfels/Comal/Guadalupe Counties

LOG OF BORING: GP-16

DATE: 4/10/18
HOLE DIAMETER: 8"
DRILLING METHOD: HSA
SAMPLING METHOD: SPT
LOGGED BY: Ryan C. Dickerson

DRILLING COMPANY: Vortex Drilling, Inc.
DRILLER: Jim Neal
DRILLER'S LICENSE #: 4868 WKPT
DRILLING RIG: Mobile Drill B59
LATITUDE: -98.00565857
LONGITUDE: 29.43490904

TOTAL DEPTH: 31.5'
TOP OF CASING: 657.54'
SURFACE ELEVATION: 654.81'
DEPTH TO WATER: Dry @ Completion
CASING DIAMETER: 2"
SURFACE COMPLETION: Anodized Riser

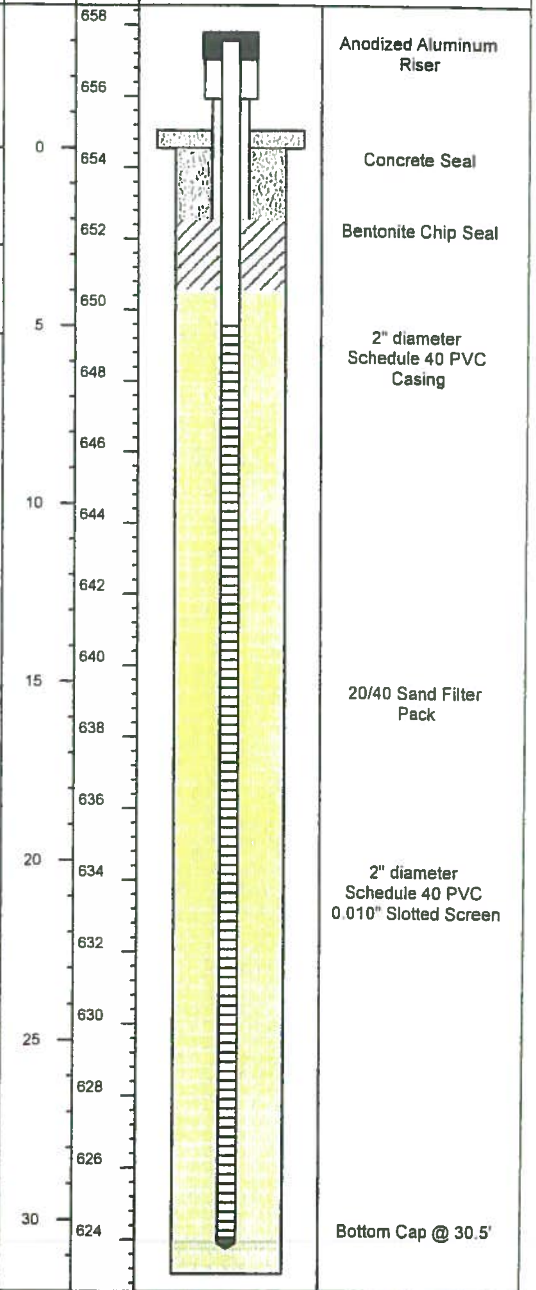
FIELD DATA

Depth (feet)	Sample	Sampler Type	Recovery %	Lithology	MATERIAL DESCRIPTION
0		☒		▨	FAT CLAY: Dark brown, soft to medium stiff, with abundant chert gravel and plant material, trace brown SILT, slightly moist.
		☒		▨	FAT CLAY: Brown with tan mottling, soft to medium stiff, with calcareous material throughout, slightly moist.
5		☒		▨	SILTY CLAY: Light brown with gray and yellowish brown mottling, stiff, with occasional calcareous material and oxidation staining, slightly moist.
15		☒		▨	-- Slightly moist @ 15'
20		☒		▨	-- Shell fragment @ 19.5' -- Abundant iron oxidation @ 19.75'
		☒		▨	-- Light tan SILT @ 22.25'-22.5' (dry)
		☒		▨	-- Large shell fragment @ 23.75'
25		☒		▨	-- Abundant calcite crystallization @ 25'-29' -- Abundant iron oxidation @ 25'-28'
30		☒		▨	

STATE OF TEXAS
CHRISTIAN M. LLULL
GEOLOGY
No. 5884
LICENSED PROFESSIONAL GEOSCIENTIST

6-6-18

WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS



Ground Water Level Data
▽ Free water first encountered ▼ Water Level after 15 minutes

Sampler Type
☒ Split Spoon ▯ Auger ■ Shelby Tube ⧄ No Recovery ▯ Cuttings

STATE OF TEXAS WELL REPORT for Tracking #478569

Owner:	**Waste Management of Texas**	Owner Well #:	**GP-16**
Address:	**Mesquite Creek Landfill** **1000 Kohlenberg Lane** **New Braunfels, TX 78130**	Grid #:	**68-24-3**
		Latitude:	**29° 43' 49.09" N**
Well Location:	**1000 Kohlenberg Lane** **New Braunfels, TX 78130**	Longitude:	**098° 00' 56.58" W**
Well County:	**Guadalupe**	Elevation:	**658 ft. above sea level**
Type of Work:	**New Well**	Proposed Use:	**Monitor**

Drilling Start Date: **4/9/2018** Drilling End Date: **4/12/2018**

	Diameter (in.)	*Top Depth (ft.)*	*Bottom Depth (ft.)*
Borehole:	**7.25**	**0**	**31.5**

Drilling Method: **Hollow Stem Auger**

Borehole Completion: **Filter Packed**

	Top Depth (ft.)	*Bottom Depth (ft.)*	*Filter Material*	*Size*
Filter Pack Intervals:	**4**	**31.5**	**Sand**	**20/40**

	Top Depth (ft.)	*Bottom Depth (ft.)*	*Description (number of sacks & material)*
Annular Seal Data:	**0**	**2**	**Concrete 1.16 Bags/Sacks**
	2	**4**	**Bentonite 0.91 Bags/Sacks**

Seal Method: **Hand Mixed**

Sealed By: **Driller**

Distance to Property Line (ft.): **No Data**

Distance to Septic Field or other concentrated contamination (ft.): **No Data**

Distance to Septic Tank (ft.): **No Data**

Method of Verification: **No Data**

Surface Completion: **Surface Sleeve Installed** **Surface Completion by Driller**

Water Level: **No Data**

Packers: **No Data**

Type of Pump: **No Data**

Well Tests: **No Test Data Specified**

	Strata Depth (ft.)	Water Type
Water Quality:	No Data	No Data

Chemical Analysis Made: No

Did the driller knowingly penetrate any strata which contained injurious constituents?: No

---

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the report(s) being returned for completion and resubmittal.

Company Information: **VORTEX DRILLING INC.**

4412 Bluemel Road
San Antonio, TX 78240

Driller Name: **James E. Neal** License Number: **4868**

Apprentice Name: **Tony Elmendorf**

Comments: **No Data**

Lithology:
DESCRIPTION & COLOR OF FORMATION MATERIAL

Top (ft.)	Bottom (ft.)	Description
0	2.75	-CH- FAT CLAY: Dark brown, soft to medium stiff, with abundant chert gravel and plant material, trace brown SILT, slightly moist.
2.75	5.25	-CH- FAT CLAY: Brown with tan mottling, soft to medium stiff, with calcareous material throughout, slightly moist.
5.25	31.5	-CL- SILTY CLAY: Tan with gray and yellowish brown mottling, stiff, with occasional calcareous material and oxidation staining, slightly moist.
15	15	-- Becoming moist @ 15'
19.5	19.5	-- Shell fragment @ 19.5'
19.75	19.75	-- Abundant iron oxidation @ 19.75'
22.25	22.5	-- Light tan SILT @ 22.25'-22.5' (dry)
23.75	23.75	-- Large shell fragment @ 23.75'
25	28	-- Abundant iron oxidation @ 25'-28'

Casing:
BLANK PIPE & WELL SCREEN DATA

Dia (in.)	Type	Material	Sch./Gage	Top (ft.)	Bottom (ft.)
2	Top Cap (Locking)	New Plastic (PVC)	40		
2	Bottom Cap	New Plastic (PVC)	40		
2	Riser	New Plastic (PVC)	40	-4	5.5
2	Screen	New Plastic (PVC)	40 / 0.010	5.5	30.5

25	29	-- Abundant calcite crystallization @ 25'-29'

IMPORTANT NOTICE FOR PERSONS HAVING WELLS DRILLED CONCERNING CONFIDENTIALITY

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Please include the report's Tracking Number on your written request.

Texas Department of Licensing and Regulation
P.O. Box 12157
Austin, TX 78711
(512) 334-5540

Gas Probe Data Sheet

Permittee or Site Name: Mesquite Creek Landfill

County: Comal and Guadalupe

Date of Gas Probe Installation: 4/9/2018

Gas Probe Latitude: -98.01020465 Longitude: 29.43446891

Gas Probe Groundwater Gradient Position:

Upgradient ______ Downgradient X

MSW Permit No.: 66B

Gas Probe I.D. No.: GP-17

Date of Monitor Well Development: Dry @ Completion

Gas Probe Driller Name: Jim Neal

License No.: 4868 WPKT

NOTES:

- Report all depths from Surface Elevation and all Elevations relative to Mean Sea Level (MSL), to nearest hundredth of a foot.
- Diameter of boring should be at least 4 inches larger than diameter of well casing.
- Use flush screw joint casing only, 2-inch diameter or larger, with o-rings or PTFE tape in joints (4-inch diameter recommend)
- Well development should continue until water is clear, and pH and conductivity are stable.

Geologist, Hydrologist, or Engineer Supervising Probe Installation: Christian M. Llull, P.G. #5884

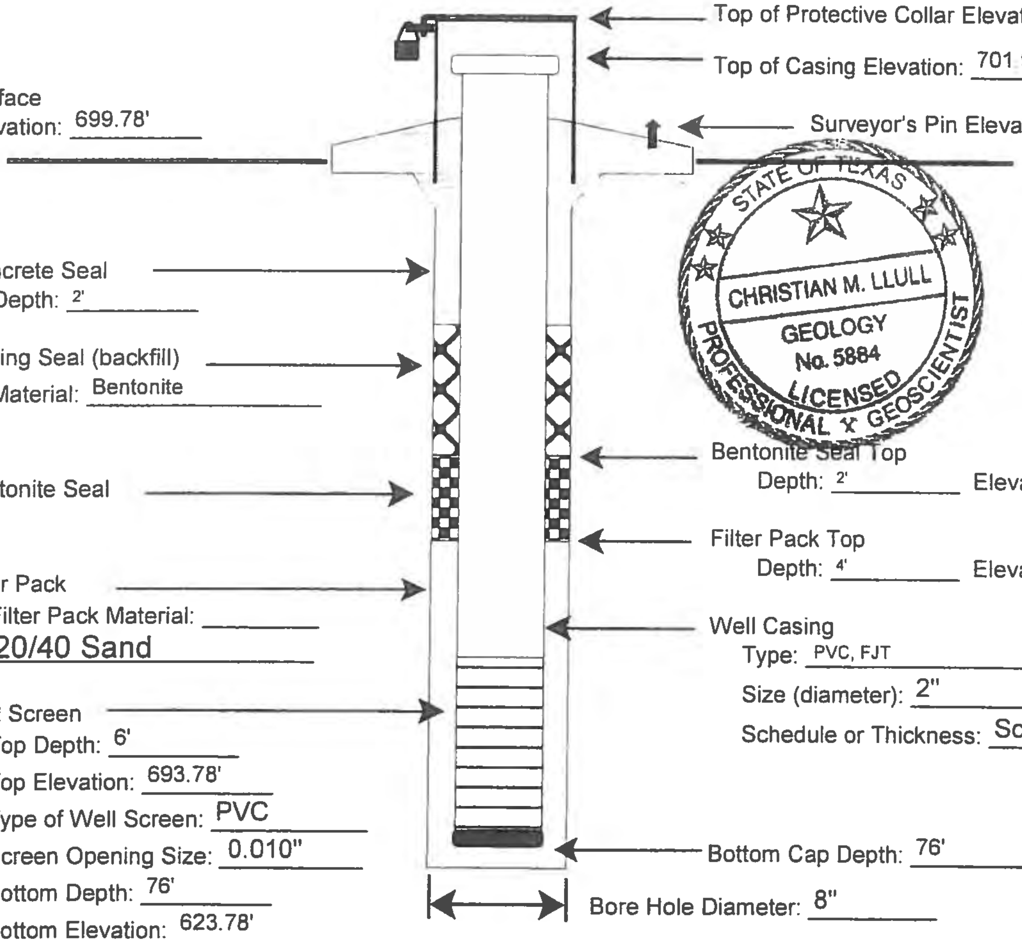
Static Water Level Elevation (with respect to MSL) after Probe Development: Dry @ Completion

Name of Geologic Formation(s) in which Well is completed: Lower Taylor Group (Predominantly Site-Specific Stratum III)

Type of Locking Device: Padlock

Type of Casing Protection: Anodized Aluminum

Concrete Surface Pad (with steel reinforcement) Dimensions: 4' x 4' x 6"



Top of Protective Collar Elevation: 702.28'

Top of Casing Elevation: 701.98'

Surface Elevation: 699.78'

Surveyor's Pin Elevation: 699.73'

STATE OF TEXAS
CHRISTIAN M. LLULL
GEOLOGY
No. 5884
LICENSED
PROFESSIONAL GEOSCIENTIST

Concrete Seal Depth: 2'

Casing Seal (backfill) Material: Bentonite

Bentonite Seal

Bentonite Seal Top Depth: 2' Elevation: 697.78'

Filter Pack Top Depth: 4' Elevation: 695.78'

Filter Pack

Filter Pack Material: 20/40 Sand

Well Casing Type: PVC, FJT

Size (diameter): 2"

Schedule or Thickness: Sch. 40

Well Screen

Top Depth: 6'

Top Elevation: 693.78'

Type of Well Screen: PVC

Screen Opening Size: 0.010"

Bottom Depth: 76'

Bottom Elevation: 623.78'

Bottom Cap Depth: 76'

Bore Hole Diameter: 8"

TETRA TECH, INC.
8911 N. Capital of Tx Hwy
Bldg. 2, Suite 2310
Austin, Texas 78759
(512) 338-1667

Mesquite Creek Landfill

MSW Permit 66B

New Braunfels/Comal/Guadalupe Counties

LOG OF BORING:

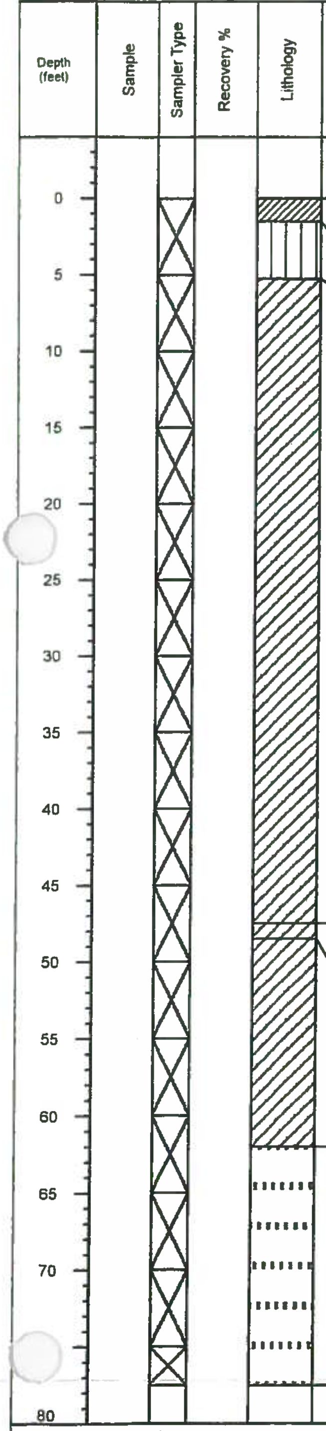
GP-17

DATE: 4/9/18
HOLE DIAMETER: 8"
DRILLING METHOD: HSA
SAMPLING METHOD: SPT
LOGGED BY: Ryan C. Dickerson

DRILLING COMPANY: Vortex Drilling, Inc.
DRILLER: Jim Neal
DRILLER'S LICENSE #: 4868 WKPT
DRILLING RIG: Mobile Drill B59
LATITUDE: -98.01020465
LONGITUDE: 29.43446891

TOTAL DEPTH: 77.5'
TOP OF CASING: 701.98'
SURFACE ELEVATION: 699.78'
DEPTH TO WATER: Dry @ Completion
CASING DIAMETER: 2"
SURFACE COMPLETION: Anodized Riser

FIELD DATA



MATERIAL DESCRIPTION

FAT CLAY: Dark brown, medium stiff, with abundant gravel and plant material.

SILT: Light tan, loose, with trace brown silt, abundant calcareous layers.

SILTY CLAY: Tan with gray and yellowish brown mottling, medium stiff, blocky, with occasional iron and manganese oxidation staining, occasional iron nodules, occasional shell fragments.

-- Light tan SILT @ 26.5'-26.75'
-- Occasional thin, brown SILT layers @ 27'-40'

-- Small shell fragments becoming more abundant @ 34.5'

-- Large shell fragment @ 42.25'

SILTY CLAY: Dark gray and light brown, very stiff, with iron oxidation staining, slightly moist.

SILTY CLAY: Light brown with gray and yellowish brown mottling, medium stiff, blocky, with occasional iron and manganese oxidation staining, occasional iron nodules, occasional shell fragments, slightly moist.

-- Abundant calcite crystallization @ 56'-60'

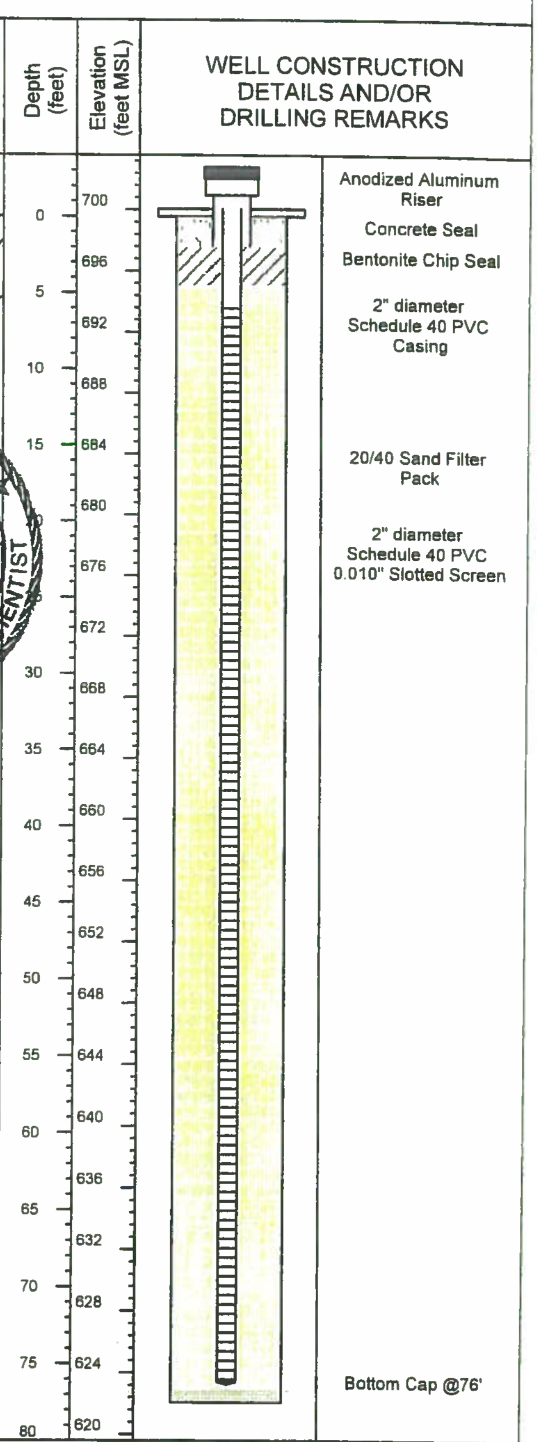
-- Transition zone @ 59.75'-62': Alternating layers of light brown and dark gray clay.

CLAYSTONE: Dark gray, very stiff to hard, brittle, with calcareous material, homogeneous.

-- Weathered bands @ 67' and 68.5'

CHRISTIAN M. LLULL
GEOLOGY
No. 5884

6-6-18



Ground Water Level Data

▽ Free water first encountered ▼ Water Level after 15 minutes

Sampler Type

☒ Split Spoon ▯ Auger ■ Shelby Tube ⧄ No Recovery ▯ Cuttings

STATE OF TEXAS WELL REPORT for Tracking #478574

Owner:	**Waste Management of Texas**	Owner Well #:	**GP-17**
Address:	**Mesquite Creek Landfill** **1000 Kohlenberg Lane** **New Braunfels, TX 78130**	Grid #:	**68-24-3**
		Latitude:	**29° 43' 44.69" N**
Well Location:	**1000 Kohlenberg Lane** **New Braunfels, TX 78130**	Longitude:	**098° 01' 02.05" W**
		Elevation:	**702 ft. above sea level**
Well County:	**Guadalupe**		

Type of Work: **New Well**

Proposed Use: **Monitor**

Drilling Start Date: **4/9/2018**

Drilling End Date: **4/12/2018**

	Diameter (in.)	*Top Depth (ft.)*	*Bottom Depth (ft.)*
Borehole:	**7.25**	**0**	**77.5**

Drilling Method: **Hollow Stem Auger**

Borehole Completion: **Filter Packed**

	Top Depth (ft.)	*Bottom Depth (ft.)*	*Filter Material*	*Size*
Filter Pack Intervals:	**5.5**	**77.5**	**Sand**	**20/40**

	Top Depth (ft.)	*Bottom Depth (ft.)*	*Description (number of sacks & material)*
Annular Seal Data:	**0**	**2**	**Concrete 1.16 Bags/Sacks**
	2	**5.5**	**Bentonite 1.21 Bags/Sacks**

Seal Method: **Hand Mixed**

Sealed By: **Driller**

Distance to Property Line (ft.): **No Data**

Distance to Septic Field or other concentrated contamination (ft.): **No Data**

Distance to Septic Tank (ft.): **No Data**

Method of Verification: **No Data**

Surface Completion: **Surface Sleeve Installed**

Surface Completion by Driller

Water Level: **No Data**

Packers: **No Data**

Type of Pump: **No Data**

Well Tests: **No Test Data Specified**

	Strata Depth (ft.)	*Water Type*
Water Quality:	**No Data**	**No Data**

Chemical Analysis Made: **No**

Did the driller knowingly penetrate any strata which contained injurious constituents?: **No**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the report(s) being returned for completion and resubmittal.

Company Information: **VORTEX DRILLING INC.**

4412 Bluemel Road
San Antonio, TX 78240

Driller Name: **James E. Neal**

License Number: **4868**

Apprentice Name: **Tony Elmendorf**

Comments: **No Data**

Report Amended on 5/8/2018 by Request #25017

Lithology:
DESCRIPTION & COLOR OF FORMATION MATERIAL

Top (ft.)	*Bottom (ft.)*	*Description*
0	**1.5**	**-CH- FAT CLAY: Dark brown, medium stiff, with abundant gravel and plant material.**
1.5	**5.25**	**-ML- SILT: Light tan, loose, with trace brown silt, abundant calcareous layers.**
5.25	**10**	**-- Abundant calcareous layers @ 5.25'-10'**
5.25	**47.5**	**-CL- SILTY CLAY: Tan with gray and yellowish brown mottling, medium stiff, blocky, with occasional iron and manganese oxidation staining, occasional iron nodules, occasional shell fragments.**
12.25	**12.5**	**-- Reddish brown SILT with coarse grained sand @ 12.25'-12.5'**
14.5	**14.75**	**-- Reddish brown SILT with coarse grained sand @ 14.5'-14.75'**
26.5	**26.75**	**-- Light tan SILT @ 26.5'-26.75'**
27	**40**	**-- Occasional thin, brown SILT layers @ 27'-40'**

Casing:
BLANK PIPE & WELL SCREEN DATA

Dia (in.)	*Type*	*Material*	*Sch./Gage*	*Top (ft.)*	*Bottom (ft.)*
2	**Top Cap (Locking)**	**New Plastic (PVC)**	**40**		
2	**Bottom Cap**	**New Plastic (PVC)**	**40**		
2	**Riser**	**New Plastic (PVC)**	**40**	**-4**	**6**
2	**Screen**	**New Plastic (PVC)**	**40 0.010**	**6**	**76**

33	33	-- Light tan SILT @ 33'
34.5	34.5	-- Small shell fragments becoming more abundant @ 34.5'
42.25	42.25	-- Large shell fragment @ 42.25'
47.5	48.5	-CL- SILTY CLAY: Dark gray and light brown, very stiff, with iron oxidation staining, slightly moist
48.5	48.75	-- Light tan SILT @ 48.5'-48.75'
48.5	62	-CL- SILTY CLAY: Tan with gray and yellowish brown mottling, medium stiff, blocky, with occasional iron and manganese oxidation staining, occasional iron nodules, occasional shell fragments, slightly moist.
52.5	53	-- Dark gray mottling @ 52.5'-53'
54.5	54.5	-- Shell fragments @ 54.5'
55.5	55.75	-- Dark gray mottling @ 55.5'-55.75'
56	60	-- Abundant calcite crystallization @ 56'-60'
59.75	62	-- Transition zone @ 59.75'-62'
62	77.5	-CLAYSTONE- CLAYSTONE: Dark gray, very stiff to hard, brittle, with calcareous material, homogeneous.
67	68.5	-- Weathered bands @ 67' and 68.5'

IMPORTANT NOTICE FOR PERSONS HAVING WELLS DRILLED CONCERNING CONFIDENTIALITY

TEX. OCC. CODE Title 12, Chapter 1901.251, authorizes the owner (owner or the person for whom the well was drilled) to keep information in Well Reports confidential. The Department shall hold the contents of the well log confidential and not a matter of public record if it receives, by certified mail, a written request to do so from the owner.

Please include the report's Tracking Number on your written request.

Texas Department of Licensing and Regulation
P.O. Box 12157
Austin, TX 78711
(512) 334-5540

Gas Probe Data Sheet

Permittee or Site Name: Mesquite Creek Landfill

County: Comal and Guadalupe

Date of Gas Probe Installation: 4/9/2018

Gas Probe Latitude: -98.01077945 Longitude: 29.43399063

Gas Probe Groundwater Gradient Position:

Upgradient ____ Downgradient X

MSW Permit No.: 66B

Gas Probe I.D. No.: GP-18

Date of Monitor Well Development: Dry @ Completion

Gas Probe Driller Name: Jim Neal

License No.: 4868 WPKT

NOTES:

- Report all depths from Surface Elevation and all Elevations relative to Mean Sea Level (MSL), to nearest hundredth of a foot.
- Diameter of boring should be at least 4 inches larger than diameter of well casing.
- Use flush screw joint casing only, 2-inch diameter or larger, with o-rings or PTFE tape in joints (4-inch diameter recommend).
- Well development should continue until water is clear, and pH and conductivity are stable.

Geologist, Hydrologist, or Engineer Supervising Probe Installation: Christian M. Llull, P.G. #5884

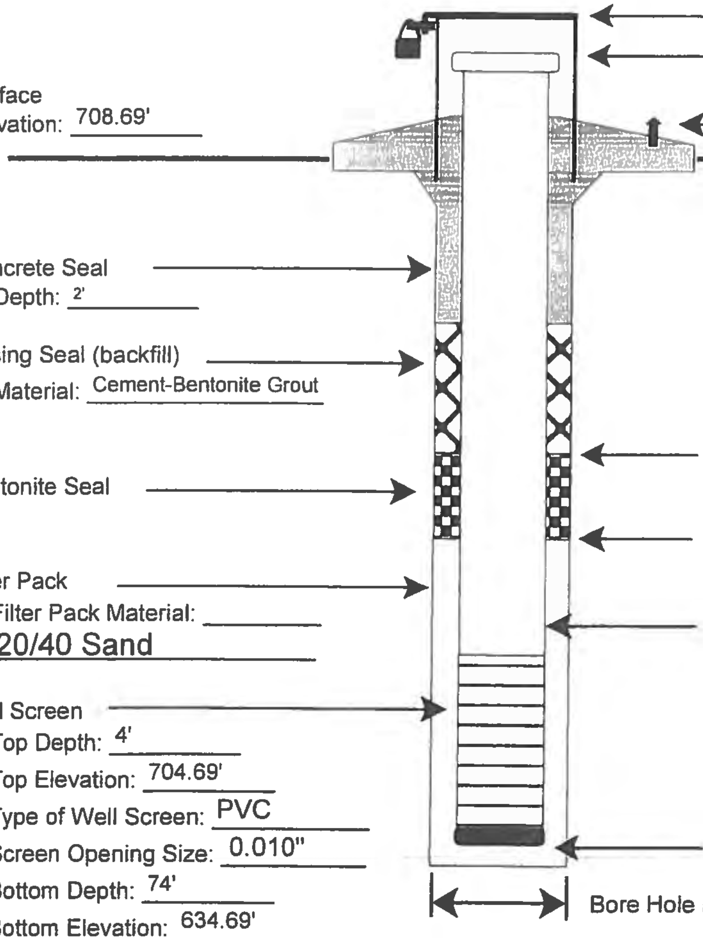
Static Water Level Elevation (with respect to MSL) after Probe Development: Dry @ Completion

Name of Geologic Formation(s) in which Well is completed: Lower Taylor Group (Predominantly Site-Specific Stratum III)

Type of Locking Device: Padlock

Type of Casing Protection: Anodized Aluminum

Concrete Surface Pad (with steel reinforcement) Dimensions: 4' x 4' x 6"



Top of Protective Collar Elevation: 710.93'

Top of Casing Elevation: 710.61'

Surface Elevation: 708.69'

Surveyor's Pin Elevation: 708.33'

Concrete Seal Depth: 2'

Casing Seal (backfill) Material: Cement-Bentonite Grout

Bentonite Seal

Bentonite Seal Top Depth: 1.5' Elevation: 707.19'

Filter Pack Top Depth: 3' Elevation: 705.69'

Filter Pack Filter Pack Material: 20/40 Sand

Well Casing Type: PVC, FJT

Size (diameter): 2"

Schedule or Thickness: Sch. 40

Well Screen Top Depth: 4'

Top Elevation: 704.69'

Type of Well Screen: PVC

Screen Opening Size: 0.010"

Bottom Depth: 74'

Bottom Elevation: 634.69'

Bottom Cap Depth: 74'

Bore Hole Diameter: 8"

CHRISTIAN M. LLULL
No. 5884

6/6/18

TETRA TECH, INC
8911 N. Capital of Tx Hwy
Bldg. 2, Suite 2310
Austin, Texas 78759
(512) 338-1667

Mesquite Creek Landfill

MSW Permit 66B

New Braunfels/Comal/Guadalupe Counties

LOG OF BORING:

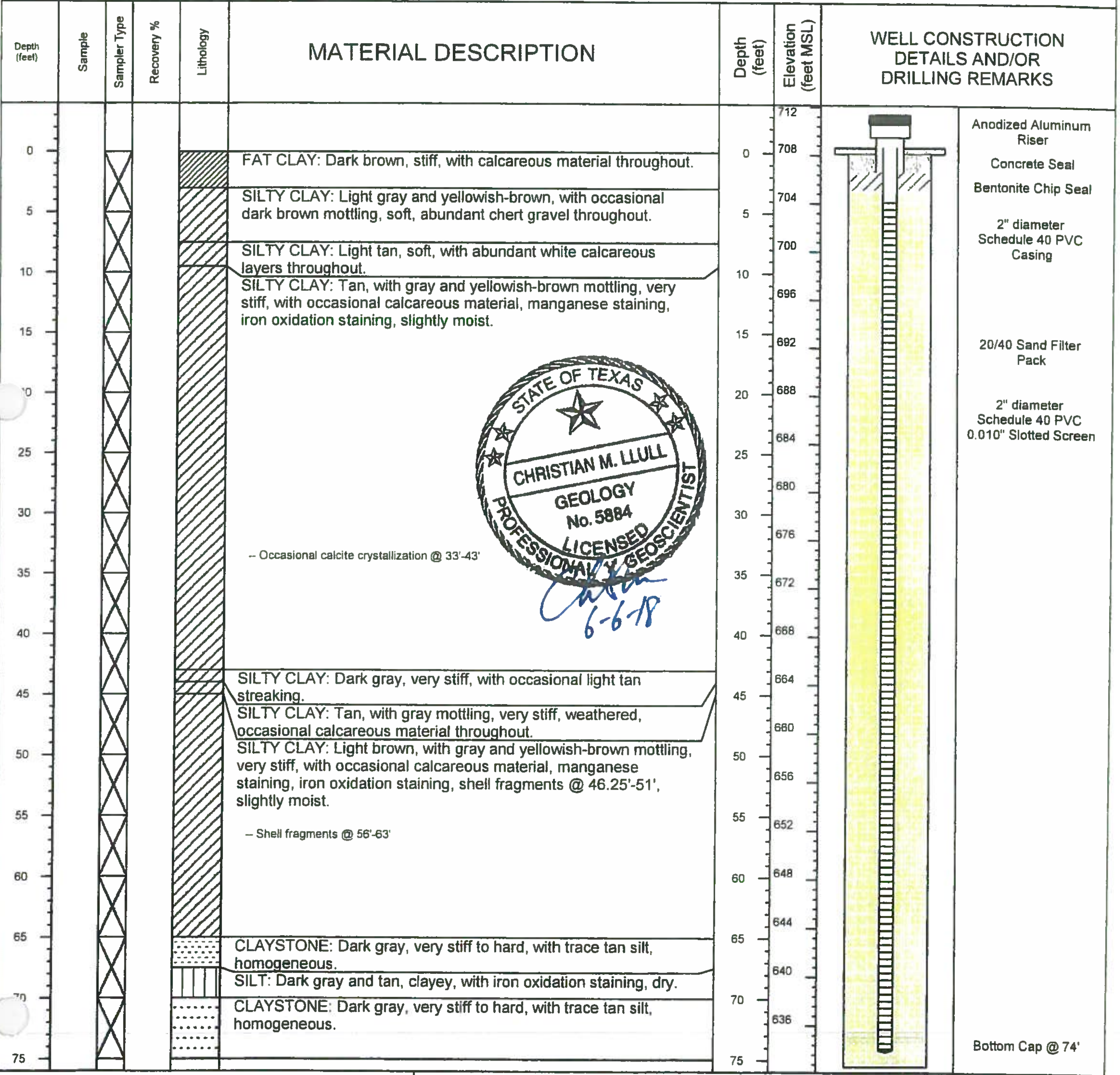
GP-18

DATE: 4/9/18
HOLE DIAMETER: 8"
DRILLING METHOD: HSA
SAMPLING METHOD: SPT
LOGGED BY: Ryan C. Dickerson

DRILLING COMPANY: Vortex Drilling, Inc.
DRILLER: Jim Neal
DRILLER'S LICENSE #: 4868 WKPT
DRILLING RIG: Mobile Drill B59
LATITUDE: -98.01077945
LONGITUDE: 29.43399063

TOTAL DEPTH: 75'
TOP OF CASING: 710.61'
SURFACE ELEVATION: 708.69'
DEPTH TO WATER: Dry @ Completion
CASING DIAMETER: 2"
SURFACE COMPLETION: Anodized Riser

FIELD DATA



FAT CLAY: Dark brown, stiff, with calcareous material throughout.

SILTY CLAY: Light gray and yellowish-brown, with occasional dark brown mottling, soft, abundant chert gravel throughout.

SILTY CLAY: Light tan, soft, with abundant white calcareous layers throughout.

SILTY CLAY: Tan, with gray and yellowish-brown mottling, very stiff, with occasional calcareous material, manganese staining, iron oxidation staining, slightly moist.

-- Occasional calcite crystallization @ 33'-43'

CHRISTIAN M. LLULL
GEOLOGY
No. 5884
6-6-18

SILTY CLAY: Dark gray, very stiff, with occasional light tan streaking.

SILTY CLAY: Tan, with gray mottling, very stiff, weathered, occasional calcareous material throughout.

SILTY CLAY: Light brown, with gray and yellowish-brown mottling, very stiff, with occasional calcareous material, manganese staining, iron oxidation staining, shell fragments @ 46.25'-51', slightly moist.

-- Shell fragments @ 56'-63'

CLAYSTONE: Dark gray, very stiff to hard, with trace tan silt, homogeneous.

SILT: Dark gray and tan, clayey, with iron oxidation staining, dry.

CLAYSTONE: Dark gray, very stiff to hard, with trace tan silt, homogeneous.

Ground Water Level Data

▽ Free water first encountered ▼ Water Level after 15 minutes

Sampler Type

☒ Split Spoon ▯ Auger ■ Shelby Tube ⧄ No Recovery ▥ Cuttings

STATE OF TEXAS WELL REPORT for Tracking #478578

Owner: **Waste Management of Texas**

Owner Well #: **GP-18**

Address: **Mesquite Creek Landfill**
1000 Kohlenberg Lane
New Braunfels, TX 78130

Grid #: **68-24-3**

Latitude: **29° 43' 39.91" N**

Well Location: **1000 Kohlenberg Lane**
New Braunfels, TX 78130

Longitude: **098° 01' 07.8" W**

Elevation: **711 ft. above sea level**

Well County: **Guadalupe**

Type of Work: **New Well**

Proposed Use: **Monitor**

Drilling Start Date: **4/9/2018** Drilling End Date: **4/12/2018**

	Diameter (in.)	*Top Depth (ft.)*	*Bottom Depth (ft.)*
Borehole:	**7.25**	**0**	**75**

Drilling Method: **Hollow Stem Auger**

Borehole Completion: **Filter Packed**

	Top Depth (ft.)	*Bottom Depth (ft.)*	*Filter Material*	*Size*
Filter Pack Intervals:	**3**	**75**	**Sand**	**20/40**

	Top Depth (ft.)	*Bottom Depth (ft.)*	*Description (number of sacks & material)*
Annular Seal Data:	**0**	**2**	**Concrete 1.16 Bags/Sacks**
	2	**3**	**Bentonite 0.35 Bags/Sacks**

Seal Method: **Hand Mixed**

Sealed By: **Driller**

Distance to Property Line (ft.): **No Data**

Distance to Septic Field or other concentrated contamination (ft.): **No Data**

Distance to Septic Tank (ft.): **No Data**

Method of Verification: **No Data**

Surface Completion: **Surface Sleeve Installed** **Surface Completion by Driller**

Water Level: **No Data**

Packers: **No Data**

Type of Pump: **No Data**

Well Tests: **No Test Data Specified**

Water Quality:

Strata Depth (ft.)	Water Type
No Data	**No Data**

Chemical Analysis Made: **No**

Did the driller knowingly penetrate any strata which contained injurious constituents?: **No**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the report(s) being returned for completion and resubmittal.

Company Information: **VORTEX DRILLING INC.**

4412 Bluemel Road
San Antonio, TX 78240

Driller Name: **James E. Neal** License Number: **4868**

Apprentice Name: **Tony Elmendorf**

Comments: **No Data**

Report Amended on 6/8/2018 by Request #25306

Lithology:
DESCRIPTION & COLOR OF FORMATION MATERIAL

Top (ft.)	Bottom (ft.)	Description
0	**3**	**-CH- FAT CLAY: Dark brown, stiff, with calcareous material throughout. -- Transition zone @ 2.5'-3.5'**
3	**7.5**	**-CL- SILTY CLAY: Light gray and yellowish brown, with occasional dark brown mottling, soft, abundant chert gravel throughout.**
7.5	**9.5**	**-CL- SILTY CLAY: Light tan, soft, with abundant white calcareous layers throughout.**
9.5	**43**	**-CL- SILTY CLAY: Tan, with gray and yellowish brown mottling, very stiff, with occasional calcareous material, manganese staining, iron oxidation staining, slightly moist.**
14.25	**14.5**	**-- Abundant iron oxidation staining @ 14.25'-14.5'**
16	**16**	**-- Becoming blocky @ 16'**
33	**43**	**-- Occasional calcite crystallization @ 33'-43'**

Casing:
BLANK PIPE & WELL SCREEN DATA

Dia (in.)	Type	Material	Sch./Gage	Top (ft.)	Bottom (ft.)
2	**Top Cap (Locking)**	**New Plastic (PVC)**	**40**		
2	**Bottom Cap**	**New Plastic (PVC)**	**40**		
2	**Riser**	**New Plastic (PVC)**	**40**	**-4**	**4**
2	**Screen**	**New Plastic (PVC)**	**40 0.010**	**4**	**74**

43	44	-CL- SILTY CLAY: Dark gray, very stiff, with occasional light tan streaking.
44	45	-CL- SILTY CLAY: Light tan, with gray mottling, very stiff, weathered, occasional calcareous material throughout.
45	65	-CL- SILTY CLAY: Tan, with gray and yellowish brown mottling, very stiff, with occasional calcareous material, manganese staining, iron oxidation staining, slightly moist.
46.25	51	-- Shell fragments @ 46.25'-51'
49	49	-- Iron nodules @ 49'
53	53	-- Iron nodules @ 53'
56	63	-- Shell fragments @ 56'-63'
65	67.5	-CLAYSTONE- CLAYSTONE: Dark gray, very stiff to hard, with trace tan silt, homogeneous.
67.5	70	-ML- SILT: Dark gray and tan, clayey, with iron oxidation staining, dry.
70	75	-CLAYSTONE- CLAYSTONE: Dark gray, very stiff to hard, with trace tan silt, homogeneous.

IMPORTANT NOTICE FOR PERSONS HAVING WELLS DRILLED CONCERNING CONFIDENTIALITY

TEX. OCC. CODE Title 12, Chapter 1901.251, authorizes the owner (owner or the person for whom the well was drilled) to keep information in Well Reports confidential. The Department shall hold the contents of the well log confidential and not a matter of public record if it receives, by certified mail, a written request to do so from the owner.

Please include the report's Tracking Number on your written request.

Texas Department of Licensing and Regulation
P.O. Box 12157
Austin, TX 78711
(512) 334-5540

Gas Probe Data Sheet

Permittee or Site Name: Mesquite Creek Landfill
County: New Braunfels, Comal and Guadalupe Counties
Date of Gas Probe Installation: December 4, 2013
Gas Probe Latitude: 29° 43' 46.3" Longitude: -98° 1.0' 15.0"
Gas Probe Groundwater Gradient Position:
Upgradient N/A Downgradient N/A

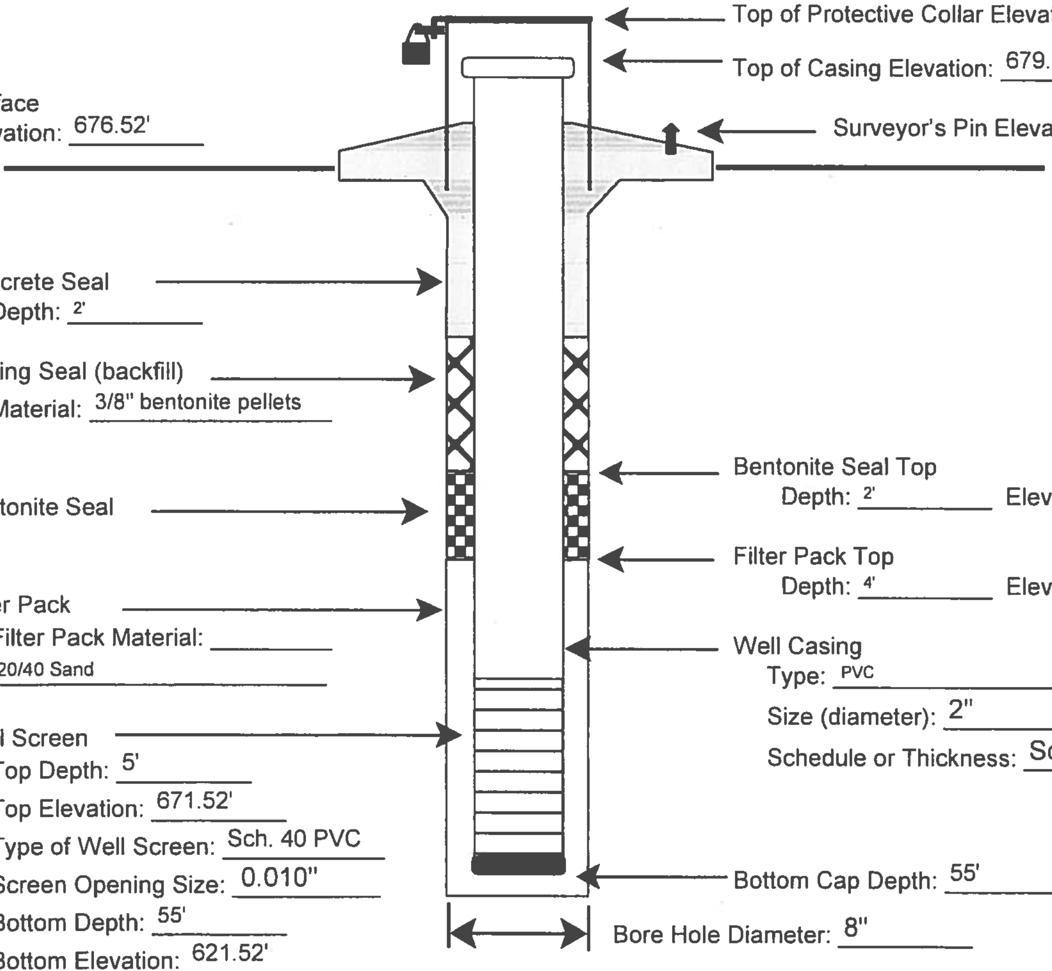
MSW Permit No.: MSW-66B
Gas Probe I.D. No.: GP-19
Date of Monitor Well Development: N/A - Dry
Gas Probe Driller:
Name: Jim Neal
License No.: WPKT 4868

NOTES:

- Report all depths from Surface Elevation and all Elevations relative to Mean Sea Level (MSL), to nearest hundredth of a foot.
- Diameter of boring should be at least 4 inches larger than diameter of well casing.
- Use flush screw joint casing only, 2-inch diameter or larger, with o-rings or PTFE tape in joints (4-inch diameter recommend).
- Well development should continue until water is clear, and pH and conductivity are stable.

Geologist, Hydrologist, or Engineer Supervising Well Installation: Christian M. Llull, P.G. #5884
Static Water Level Elevation (with respect to MSL) after Well Development: Dry at completion
Name of Geologic Formation(s) in which Well is completed: Lower Taylor Group (Stratum III of site-specific characterization)

Type of Locking Device: Padlock
Type of Casing Protection: Anodized Aluminum
Concrete Surface Pad (with steel reinforcement) Dimensions: 4' x 4' x 6"



Top of Protective Collar Elevation: 679.75'
Top of Casing Elevation: 679.18'
Surface Elevation: 676.52'
Surveyor's Pin Elevation: 676.66'
Concrete Seal Depth: 2'
Casing Seal (backfill) Material: 3/8" bentonite pellets
Bentonite Seal
Bentonite Seal Top Depth: 2' Elevation: 674.52'
Filter Pack Top Depth: 4' Elevation: 672.52'
Filter Pack
Filter Pack Material: 20/40 Sand
Well Casing
Type: PVC
Size (diameter): 2"
Schedule or Thickness: Sch. 40
Well Screen
Top Depth: 5'
Top Elevation: 671.52'
Type of Well Screen: Sch. 40 PVC
Screen Opening Size: 0.010"
Bottom Depth: 55'
Bottom Elevation: 621.52'
Bottom Cap Depth: 55'
Bore Hole Diameter: 8"

TETRA TECH, INC.
8911 N. Capital of Tx Hwy
Bldg. 2, Suite 2310
Austin, Texas 78759
(512) 338-1667

Mesquite Creek Landfill
MSW Permit 66B
New Braunfels/Comal/Guadalupe Counties

LOG OF BORING:
GP-19

DATE: 12/4/13
HOLE DIAMETER: 8"
DRILLING METHOD: HSA
SAMPLING METHOD: SPT
LOGGED BY: Samantha K. Abbott

DRILLING COMPANY: Vortex Drilling, Inc.
DRILLER: Jim Neal
DRILLER'S LICENSE #: 4868 WPKT
DRILLING RIG: Mobile Drill B59
LATITUDE: 29.729532
LONGITUDE: -98.020837

TOTAL DEPTH: 56'
TOP OF CASING: 679.18'
SURFACE ELEVATION: 676.52'
DEPTH TO WATER: Dry @ Completion
CASING DIAMETER: 2"
SURFACE COMPLETION: Anodized Riser

FIELD DATA

Sample	Sampler Type	Recovery %
0-2.5	☒	100%
2.5-5	☒	100%
5-7.5	☒	100%
7.5-10	☒	100%
10-12.5	☒	100%
12.5-15	☒	100%
15-17.5	☒	100%
17.5-20	☒	100%
20-22.5	☒	100%
22.5-25	☒	100%
25-27.5	☒	100%
27.5-30	☒	100%
30-32.5	☒	100%
32.5-35	☒	100%
35-37.5	☒	100%
37.5-40	☒	100%
40-42.5	☒	100%
42.5-45	☒	100%
45-47.5	☒	100%
47.5-50	☒	100%
50-52.5	☒	100%
52.5-55	☒	100%

MATERIAL DESCRIPTION

FAT CLAY (CH) soft to medium stiff, very dark brown, with gravel (medium) and abundant roots.

FAT CLAY (CH) medium stiff, gray brown, with zones of calcareous silt/chalk, with some oxidation, with medium gravel.

SILT (ML) stiff, light tan to white, with abundant calcareous material, with some CLAY, with gravel (transition).

CLAYEY SILT (ML) loose to medium stiff, light tan and white, friable, heavily calcareous/chalky, with common oxidation staining.

SILTY CLAY (CL) very stiff, light brown, with occasional weathered gray zones.

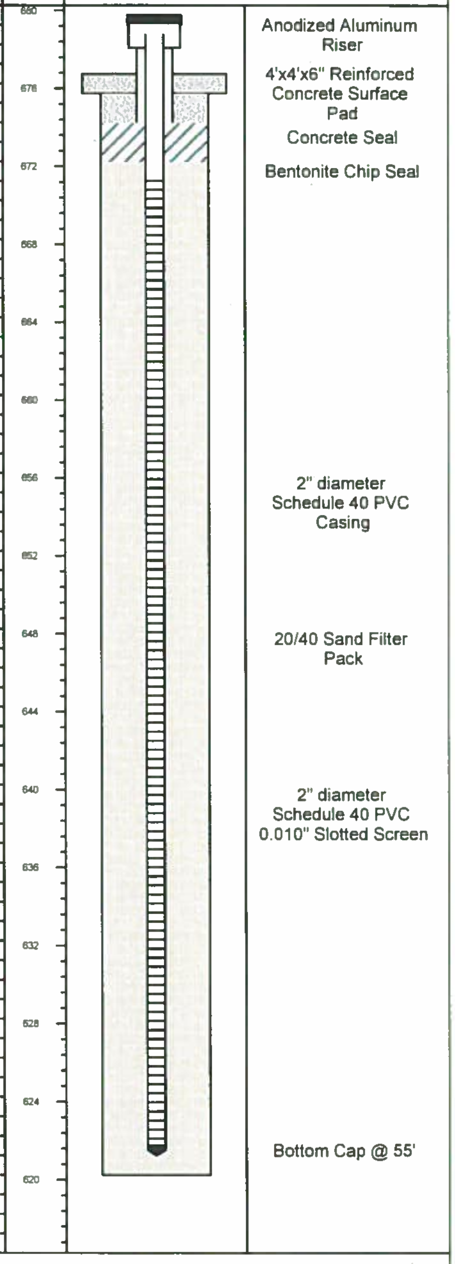
-- very stiff to hard, more FAT CLAY (CH)/less SILT (ML) @ 31'.

-- horizontal zones of calcite mineralization/crystallization, wet @ 35'-51'.

FAT CLAY (CH) stiff to medium stiff, gray-brown, with some SILT.
-- transition zone 50'-52.5'.

CLAYSTONE hard, dark gray, homogenous.

WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS



Ground Water Level Data
▽ Free water first encountered ▼ Water Level after 15 minutes

Sampler Type
☒ Split Spoon ▯ Auger ■ Shelby Tube ⧄ No Recovery ▯ Cuttings

STATE OF TEXAS WELL REPORT for Tracking #348553

Owner:	**Waste Mgmt.of TX/Mesquite Creek Landfill**	Owner Well #:	**GP-19**
Address:	**1700 Kohlenberg Road** **New Braunfels , TX 78130**	Grid #:	**68-24-3**
Well Location:	**1700 Kohlenberg Road** **New Braunfels , TX 78130**	Latitude:	**29° 43' 52" N**
Well County:	**Comal**	Longitude:	**098° 01' 05" W**
Elevation:	**No Data**	GPS Brand Used:	**Google Earth**
Type of Work:	**New Well**	Proposed Use:	**Monitor**

Drilling Date:	Started: **12/4/2013** Completed: **12/4/2013**
Diameter of Hole:	Diameter: **8 in From Surface To 56 ft**
Drilling Method:	**Hollow Stem Auger**
Borehole Completion:	Gravel Packed From: **56 ft to 3 ft** Gravel Pack Size: **20/40**
Annular Seal Data:	1st Interval: **From 0 ft to 2 ft with 1 Cement (#sacks and material)** 2nd Interval: **From 2 ft to 3 ft with 0.50 Bentonite (#sacks and material)** 3rd Interval: **No Data** Method Used: **Hand Mixed** Cemented By: **Vortex Drilling, Inc.** Distance to Septic Field or other Concentrated Contamination: **No Data** Distance to Property Line: **No Data** Method of Verification: **No Data** Approved by Variance: **No Data**
Surface Completion:	**Surface Sleeve Installed**

Water Level:	Static level: **No Data** Artesian flow: **No Data**
Packers:	**N/A**
Plugging Info:	Casing left in well: Cement/Bentonite left in well: From (ft) To (ft) From (ft) To (ft) Cem/Bent Sacks Used **N/A**
Type Of Pump:	**No Data**
Well Tests:	**No Data**

Water Quality:	Type of Water: **No Data** Depth of Strata: **No Data** Chemical Analysis Made: **No Data** Did the driller knowingly penetrate any strata which contained undesirable constituents: **No Data**
Certification Data:	The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the log(s) being returned for completion and resubmittal.
Company Information:	

Vortex Drilling, Inc.
4412 Bluemel Road
San Antonio , TX 78240

Driller License Number:	4868
Licensed Well Driller Signature:	James E. Neal
Registered Driller Apprentice Signature:	Heriberto Martinez
Apprentice Registration Number:	59190
Comments:	No Data

IMPORTANT NOTICE FOR PERSONS HAVING WELLS DRILLED CONCERNING CONFIDENTIALITY

TEX. OCC. CODE Title 12, Chapter 1901.251, authorizes the owner (owner or the person for whom the well was drilled) to keep information in Well Reports confidential. The Department shall hold the contents of the well log confidential and not a matter of public record if it receives, by certified mail, a written request to do so from the owner.

Please include the report's Tracking number (Tracking #348553) on your written request.

Texas Department of Licensing & Regulation
P.O. Box 12157
Austin, TX 78711
(512) 463-7880

DESC. & COLOR OF FORMATION MATERIAL

From (ft) To (ft) Description
0 - 2.5 Fat clay,soft/med.stiff,v.dk.brw.w/gravel med.,abundant roots
2.5 - 5 Fat clay,med.stiff,gray brw.w/zones of calcar.silt/chalk w/some oxidation,w/med.gravel
5 - 8 Silt,stiff,lt.tan/white w/abundant calcar. material w/some clay w/gravel
8 - 12 Clayey silt,loose/med.stiff,lt.tan,white, friable,heavily calcar./chalky w/oxidation staining
12 - 47 Silty clay,v.stiff,lt.brw.w/occasional weathered gray zones,@31' v.stiff/hard,more fat clay,@35'-51'horizontal zones of calcite mineralization/crystallization,wet
47 - 52 Fat clay,stiff/med.stiff,gray brw. w/some silt,@50'-52.5' transition zone
52 - 56 Claystone,hard,dk.gray,homogenous

CASING, BLANK PIPE & WELL SCREEN DATA

Dia. New/Used Type Setting From/To
2 New Schedule 40 PVC .010 56 - 5 Screen
2 New Schedule 40 PVC 5 - 0 Riser
2 New Top Cap
2 New Bottom Cap

Gas Probe Data Sheet

Permittee or Site Name: WMTX – Mesquite Creek Landfill
County: Comal and Guadalupe
Date of Gas Probe Installation: 03/25/09
Gas Probe Latitude: 29° 43' 52.23" Longitude: 98° 01' 21.57"

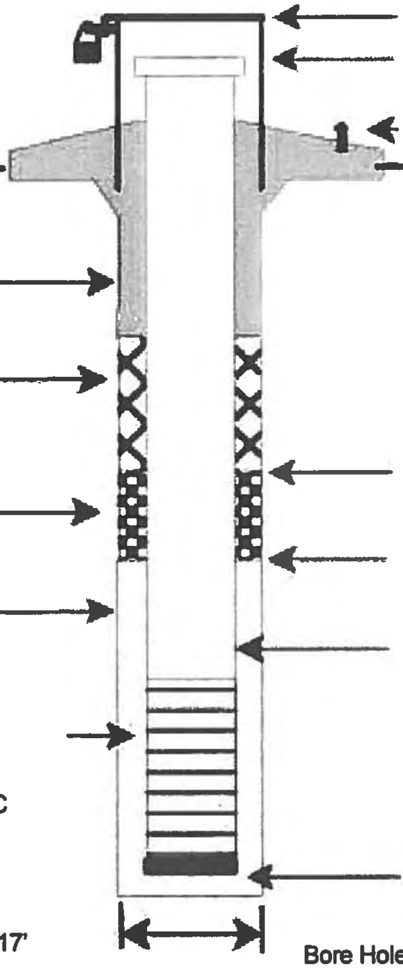
MSW Permit No. MSW-66B
Gas Probe I.D. No.: GP-20
Gas Probe Driller
Name: Brian Kern
License No.: 54611M

NOTES:

Report all depths from Surface Elevation and all Elevations relative to Mean Sea Level (MSL), to nearest hundredth of a foot.
Diameter of boring should be at least 4 inches larger than diameter of well casing.
Use flush screw joint casing only, 2-inch diameter or larger, with o-rings or PTFE tape in joints (4-inch diameter recommend).
Well development should continue until water is clear, and pH and conductivity are stable.

Geologist, Hydrologist, or Engineer Supervising Gas Probe Installation: Mohammad Z. Islam, under supervision of Scott M. Graves, P.E.
Static Water Level Elevation (with respect to MSL) after Well Development: Not Applicable (N/A) – gas probe, not a well
Name of Geologic Formation(s) in which probe is completed: Strata I-IV of site-specific characterization, which is predominantly Lower Taylor Group clay. See Section 2.6 of Attachment 14 of the Site Development Plan for formation names and descriptions for all four strata.

Type of Locking Device: Padlock
Type of Casing Protection: Metal Stick-Up
Concrete Surface Pad Dimensions: 4'x4'x6"



Top of Protective Collar Elevation: 667.73'
Top of Casing Elevation: 667.03'
Ground Surface Elevation: 664.17'
Surveyor's Pin Elevation: N/A
Concrete Seal Depth: 1.5'
Casing Seal (backfill) Material: 3/8" bentonite pellets
Bentonite Seal Top Depth: 6.0' Elevation: 658.17'
Bentonite Seal
Filter Pack Top Depth: 8.0' Elevation: 656.17'
Filter Pack: 20/40 silica sand
Well Casing Type: PVC
Size (diameter): 2" Thickness: Schedule 40

Well Screen
Top Depth: 9'
Top Elevation: 655.17'
Type of Well Screen: Slotted PVC
Screen Opening Size: 0.010"
Bottom Depth: 64'
Bottom Elevation: 600.17'
Total depth of borehole: 65'
Bottom Elevation of borehole: 599.17'

Bottom Cap Depth: 64.25'
Bore Hole Diameter: 8.0"

Modified from TCEQ-10308

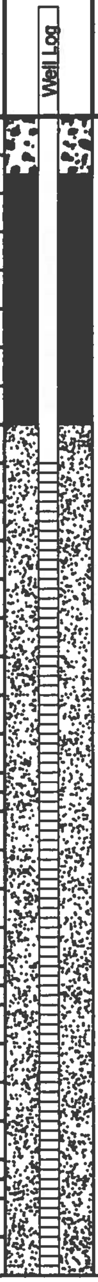
Project: Gas Probe Installation,Mesquite Creek Landfill.
Project Location: 1000 Kohlenberg Lane, New Braunfels, TX
Project Number: TXL0054-01

Log of Boring GP-20

Sheet 1 of 2

Date(s) Drilled **03/25/2009**	Logged By **Mohammad Z. Islam**	Checked By **Scott M. Graves, P.E.**
Drilling Method **Hollow Stem Auger**	Drill Bit Size/Type **8 inch**	Total Depth of Borehole **65 feet bgs**
Drill Rig Type **Mobil B59**	Drilling Contractor **Total Support Services, Inc.**	Approximate Surface Elevation **664.17 feet MSL**
Groundwater Level and Date Measured **Not Encountered**	Sampling Method(s) **Core**	Hammer Data **N/A**
Borehole Backfill **Well Completion**	Location **N 13,814,695, E 2,278,675**	

Elevation, feet	Depth, feet	Sample Type	Sampling Resistance, blows/foot	USCS Symbol	Graphic Log	MATERIAL DESCRIPTION	Well Log	REMARKS AND OTHER TESTS
664.2	0		Core	CH		Medium stiff black clay with some silt.		About 2.5 ft sample recovered
659.2	5		Core	CH		Dry and hard tan CLAY with trace silt		Drilling very hard at 8 ft.
654.2	10		Core	CH		Dry and stiff tan CLAY with calcite mix		
649.2	15		Core	CH		Same as above.		
			Core	CH		Medium stiff tan CLAY with trace silt, occassional calcite seam.		
644.2	20		Core	CH		Same as above		
			Core	CH		Same as above		
639.2	25		Core	CH		Same as above		
			Core	CH		Same as above		
634.2	30							



Project: Gas Probe Installation,Mesquite Creek Landfill.
Project Location: 1000 Kohlenberg Lane, New Braunfels, TX
Project Number: TXL0054-01

Log of Boring GP-20

Sheet 2 of 2

Elevation, feet	Depth, feet	Sample Type	Sampling Resistance, blows/foot	USCS Symbol	Graphic Log	MATERIAL DESCRIPTION	Well Log	REMARKS AND OTHER TESTS
634.2	30		Core	CH		Same as above		
			Core	CH		Same as above		
629.2	35		Core	CH		Same as above		
			Core	CH		Same as above		
624.2	40		Core	CH		Same as above		
			Core	CH		Same as above		
619.2	45		Core	CH		Same as above		
			Core	CH		Same as above		
614.2	50		Core	CH		Same as above		
			Core	Claystone		Hard tan CLAY with trace silt between 52.5 and 53.5 ft, hard dark grey CLAYSTONE with trace silt between 53.5 and 55 ft.		
609.2	55		Core	Claystone		Hard tan CLAY with trace silt between 55 and 56 ft, hard dark grey CLAYSTONE with trace silt between 56 and 57.5 ft.		
			Core	Claystone		Grey and tan CLAY mix with trace silt		
604.2	60		Core	Claystone		Same as above		
			Core	Claystone		Hard dark grey CLAY with trace silt		
599.2	65					Bottom of Boring at 65 feet bgs		

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Gas Probe Data Sheet

Permittee or Site Name: WMTX – Mesquite Creek Landfill

County: Comal and Guadalupe

Date of Gas Probe Installation: 03/18/09

Gas Probe Latitude: 29° 43' 59.55" Longitude: 98° 01' 29.32"

MSW Permit No. MSW-66B

Gas Probe I.D. No.: GP-21

Gas Probe Driller

Name: Brian Kern

License No.: 54611M

NOTES:

Report all depths from Surface Elevation and all Elevations relative to Mean Sea Level (MSL), to nearest hundredth of a foot.

Diameter of boring should be at least 4 inches larger than diameter of well casing.

Use flush screw joint casing only, 2-inch diameter or larger, with o-rings or PTFE tape in joints (4-inch diameter recommend).

Well development should continue until water is clear, and pH and conductivity are stable.

Geologist, Hydrologist, or Engineer Supervising Gas Probe Installation: Mohammad Z. Islam, under supervision of Scott M. Graves, P.E.

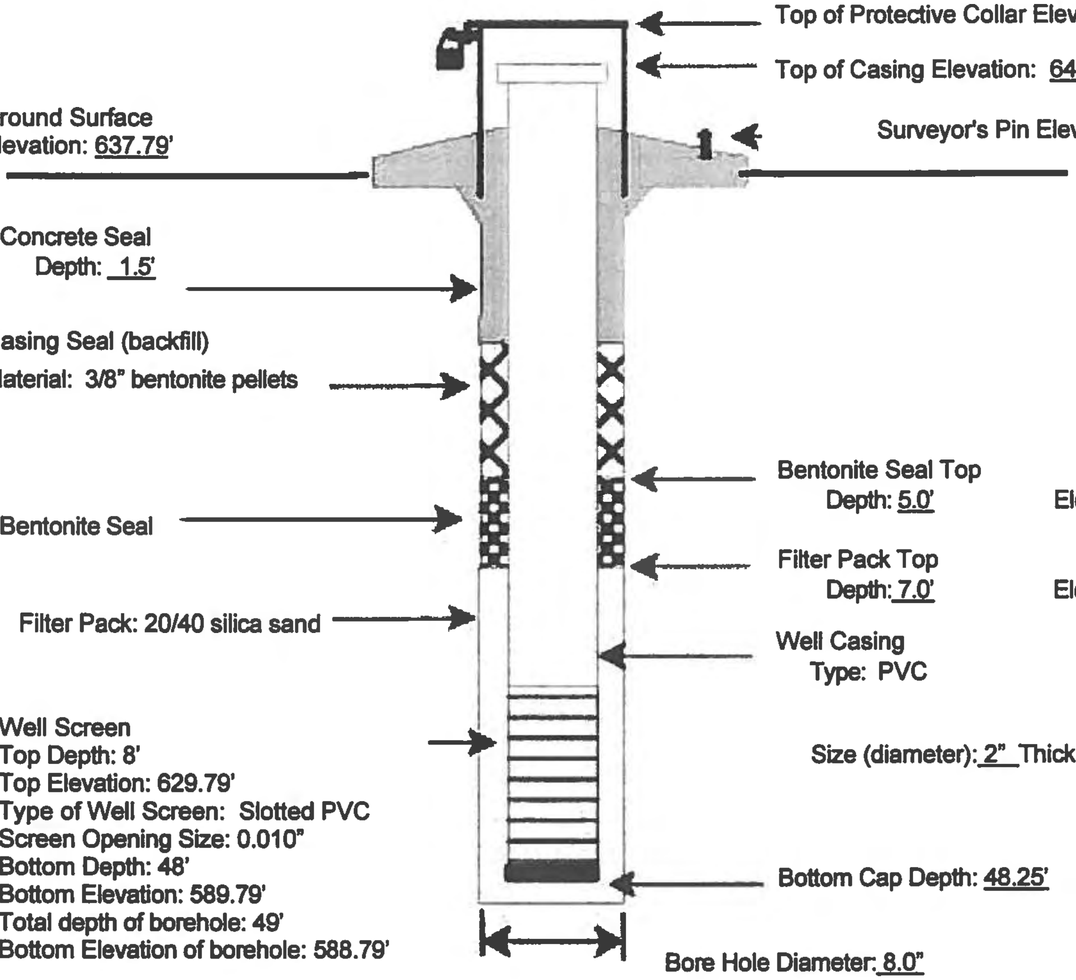
Static Water Level Elevation (with respect to MSL) after Well Development: Not Applicable (N/A) – gas probe, not a well

Name of Geologic Formation(s) in which probe is completed: Strata I-III of site-specific characterization, which is predominantly Lower Taylor Group clay. See Section 2.6 of Attachment 14 of the Site Development Plan for formation names and descriptions for all three strata encountered at this probe.

Type of Locking Device: Padlock

Type of Casing Protection: Metal Stick-Up

Concrete Surface Pad Dimensions: 4'x4'x6"



Top of Protective Collar Elevation: 641.40'

Top of Casing Elevation: 640.80'

Ground Surface Elevation: 637.79'

Surveyor's Pin Elevation: N/A

Concrete Seal Depth: 1.5'

Casing Seal (backfill) Material: 3/8" bentonite pellets

Bentonite Seal Top Depth: 5.0' Elevation: 632.79'

Bentonite Seal

Filter Pack Top Depth: 7.0' Elevation: 630.79'

Filter Pack: 20/40 silica sand

Well Casing Type: PVC

Size (diameter): 2" Thickness: Schedule 40

Well Screen

Top Depth: 8'

Top Elevation: 629.79'

Type of Well Screen: Slotted PVC

Screen Opening Size: 0.010"

Bottom Depth: 48'

Bottom Elevation: 589.79'

Total depth of borehole: 49'

Bottom Elevation of borehole: 588.79'

Bottom Cap Depth: 48.25'

Bore Hole Diameter: 8.0"

Modified from TCEQ-10308

Project: Gas Probe Installation,Mesquite Creek Landfill.
Project Location: 1000 Kohlenberg Lane, New Braunfels, TX
Project Number: TXL0054-01

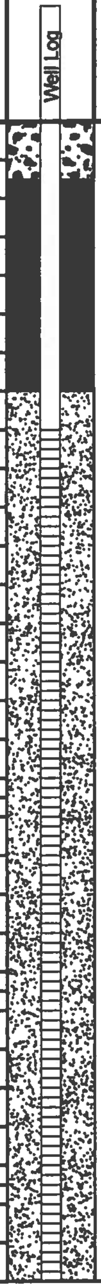
Log of Boring GP-21

Sheet 1 of 2

Date(s) Drilled **03/18/2009**	Logged By **Mohammad Z. Islam**	Checked By **Scott M. Graves, P.E.**
Drilling Method **Hollow Stem Auger**	Drill Bit Size/Type **8 inch**	Total Depth of Borehole **49 feet bgs**
Drill Rig Type **Mobil B59**	Drilling Contractor **Total Support Services, Inc.**	Approximate Surface Elevation **637.79 feet MSL**
Groundwater Level and Date Measured **Not Encountered**	Sampling Method(s) **Core**	Hammer Data **N/A**
Borehole Backfill **Well Completion**	Location **N 13,815,429, E 2,277,985**	

Elevation, feet	Depth, feet	Sample Type	Sampling Resistance, blows/foot	USCS Symbol	Graphic Log	MATERIAL DESCRIPTION	REMARKS AND OTHER TESTS
637.8	0	◪	Core	CH	▨	Medium stiff tan CLAY with occassional gravel mix	Only 1.5 ft sample recovered
632.8	5	◪	Core	CH	▨	Stiff tan CLAY with occassional calcite seam	
627.8	10	◪	Core	CH	▨	Stiff tan CLAY with trace silt	Only 2.5 ft sample recovered
622.8	15	◪	Core	CH	▨	Stiff tan CLAY with trace silt	
		◪	Core	CH	▨	Same as above	
617.8	20	◪	Core	CH	▨	Same as above	
		◪	Core	CH	▨	Same as above	
612.8	25	◪	Core	CH	▨	Same as above	
		◪	Core	CH	▨	Same as above	
607.8	30						

Well Log



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Project: Gas Probe Installation,Mesquite Creek Landfill.
Project Location: 1000 Kohlenberg Lane, New Braunfels, TX
Project Number: TXL0054-01

Log of Boring GP-21

Sheet 2 of 2

Elevation, feet	Depth, feet	Sample Type	Sampling Resistance, blows/foot	USCS Symbol	Graphic Log	MATERIAL DESCRIPTION	Well Log	REMARKS AND OTHER TESTS
607.8	30		Core	CH		Same as above		
			Core	CH		Same as above		
602.8	35		Core	CH		Same as above		
			Core	CH		Same as above		
597.8	40		Core	CH		Same as above		
			Core	Claystone		Hard grey CLAYSTONE with trace silt.		
				CH		Tan CLAY with trace silt, occassional calcite seam.		
592.8	45			CH		Hard tan and grey CLAY mix with trace silt		
			Core	CH		Same as above		
						Bottom of Boring at 49 feet bgs		
587.8	50							
582.8	55							
577.8	60							
572.8	65							

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ATTACHMENT 6C

SAMPLE LANDFILL GAS MONITORING FORM

LANDFILL GAS MONITORING FORM
MESQUITE CREEK LANDFILL

Name: ______________________

Date of Monitoring: ______________________

General Weather Conditions: ______________________

Ambient Temperature (deg. F): ______________________

Ambient Barometric Pressure (in. Hg): ______________________

Gas Instrument: ______________________

Serial No.: ______________________

Date Last Calibrated: ______________________

Method: ______________________

GAS MONITORING PROBES

MONITORING POINT I.D.	TIME	METHANE CONC. (% by Volume)	GAS PROBE CONDITION (Note 1)	COMMENTS

(Attach additional sheets as needed)

Note: 1. Check integrity of each gas probe for adequate labeling, protective casing, concrete pad, padlock, and inner casing. Report damage or excessive wear. If adequate, note "OK".

Page ______ of ______

Note: This form is provided as a guideline. The format of this form may be changed by the facility, but will be consistent with the information shown on this form.

STRUCTURES					
STRUCTURE	MONITORING LOCATION	DATE	TIME	METHANE CONC. (% by Volume)	COMMENTS
	North Face				
	East Face				
	South Face				
	West Face				
	Continuous Monitor Reading (if present)				
	North Face				
	East Face				
	South Face				
	West Face				
	Continuous Monitor Reading (if present)				
	North Face				
	East Face				
	South Face				
	West Face				
	Continuous Monitor Reading (if present)				
	North Face				
	East Face				
	South Face				
	West Face				
	Continuous Monitor Reading (if present)				

(Attach additional sheets as needed)

Note: This form is provided as a guideline. The format of this form may be changed by the facility, but will be consistent with the information shown on this form.

ATTACHMENT 6D

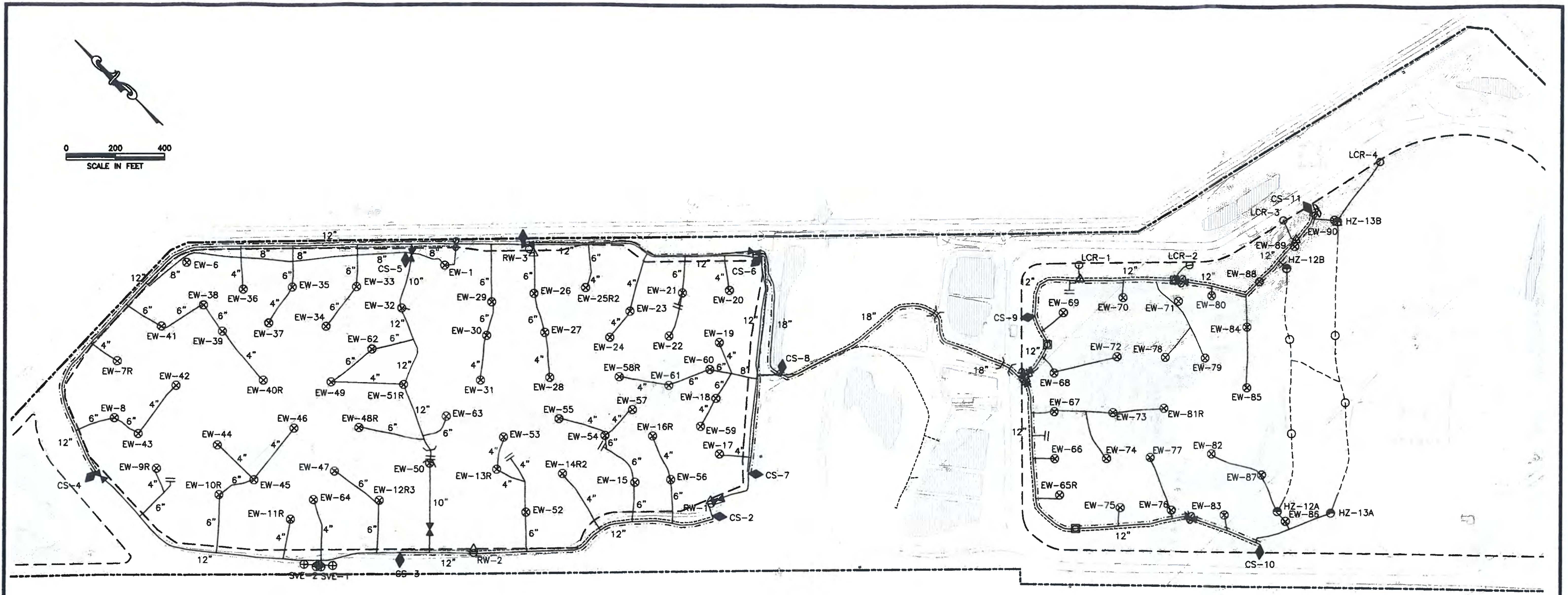
EXISTING GAS CONTROL SYSTEM INFORMATION

The following items provided in this attachment are copies taken from the current-permitted Landfill Gas Management Plan under MSW Permit No. 66B.

- **Drawing 14-4A – As-Constructed GCCS System Layout**
- **Drawing 14-4B – 2020 GCCS Expansion**
- **Drawing 14-9 – GCCS Ventilation Trench Details**
- **Figure 1 – Detail Utility Trench Gas Vent: GV-1**
- **Figure 2 – Detail Utility Trench Gas Vent: GV-2**

As indicated in Section 6.3 of this plan, as gas control systems are added, after an installation event an as-built drawing(s) will be submitted to TCEQ to incorporate the updated information, as-installed, into the existing permitted information. This will be provided the form of a revision/supplement to the information in this attachment.

O:\Waste Management\Mesquite Creek\LFG\2020 GCCS Upgrades\As-Built Submittal\1- .Jwg Layout: Existing – Mesquite Creek User: CWilborn



LEGEND

- PERMIT BOUNDARY
- APPROXIMATE LIMITS OF EXISTING AND FUTURE WASTE
- EXISTING CONTOUR
- STATE PLANE COORDINATE
- CELL BOUNDARY
- ⊕ EW-37 EXISTING LFG EXTRACTION WELL
- ○ LCR-4 EXISTING LEACHATE CLEANOUT RISER CONNECTION
- EXISTING LFG COLLECTION PIPING
- EXISTING AIR SUPPLY LINE
- EXISTING CONDENSATE FORCEMAIN
- EXISTING HORIZONTAL LFG COLLECTION PIPING
- ○ EXISTING HORIZONTAL COLLECTION RISER
- ▣ EXISTING HEADER ACCESS RISER
- ⊘ EXISTING AIR/FORCEMAIN VALVE
- ⋈ EXISTING LFG ISOLATION VALVE
- ◆ CS-2 EXISTING CONDENSATE SUMP
- △ EXISTING REMOTE WELLHEAD
- ⊩ EXISTING BLIND FLANGE
- EXISTING HDPE CAP
-) (EXISTING ROAD CROSSING

NOTE:

1. EXISTING CONTOURS AND ELEVATIONS BASED ON AERIAL PHOTOGRAPHY COMPILED BY DALLAS AERIAL SURVEYS, INC. FLOWN FEBRUARY 20, 2020.

J. HEATH PARKER
94764

J. Heath Parker
09/15/2020

FOR PERMITTING PURPOSES ONLY

REVISIONS

REV	DATE	DESCRIPTION	DWN BY	DES BY	CHK BY	APP BY

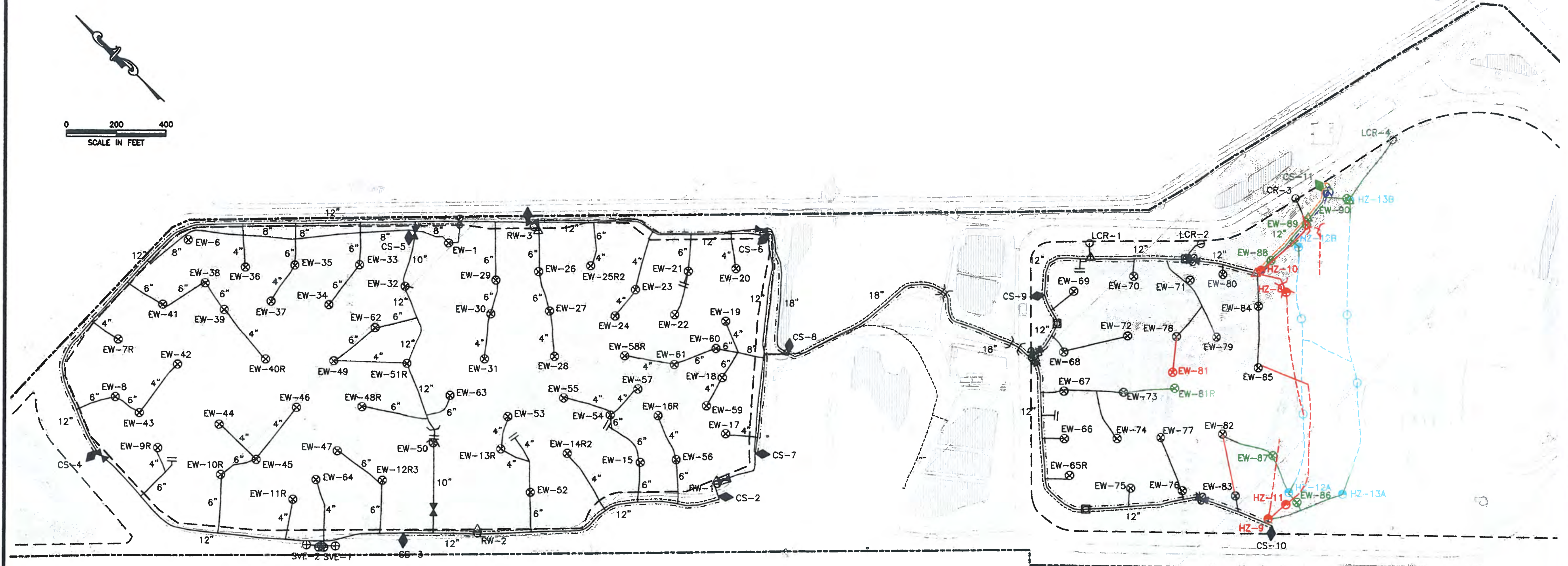
AS-CONSTRUCTED GCCS SYSTEM LAYOUT

WASTE MANAGEMENT OF TEXAS, INC.
MESQUITE CREEK LANDFILL

BIGGS & MATHEWS
ENVIRONMENTAL
CONSULTING ENGINEERS
MANSFIELD • WICHITA FALLS
817-563-1144

TBPE FIRM NO. F-256
TBPG FIRM NO. 50222

DSN.	JCW	DATE	09/2020	DRAWING
DWN.	SRC	SCALE	GRAPHIC	14-4A
CHK.	JHP	DWG	14-4A.dwg	



LEGEND

─ ─ · ─ ─	PERMIT BOUNDARY
— — — —	APPROXIMATE LIMITS OF EXISTING AND FUTURE WASTE
	EXISTING CONTOUR
	STATE PLANE COORDINATE
⊕ EW-37	EXISTING LFG EXTRACTION WELL
○ LCR-3	EXISTING LEACHATE CLEANOUT RISER CONNECTION
────	EXISTING LFG COLLECTION PIPING
— — — —	EXISTING AIR SUPPLY LINE
········	EXISTING CONDENSATE FORCEMAIN
◙	EXISTING HEADER ACCESS RISER
⊘	EXISTING AIR/FORCEMAIN VALVE
⧓	EXISTING LFG ISOLATION VALVE
◆ CS-2	EXISTING CONDENSATE SUMP
△	EXISTING REMOTE WELLHEAD
⊩	EXISTING BLIND FLANGE
⊣	EXISTING HDPE CAP
) (	EXISTING ROAD CROSSING
⊕ EW-89	INSTALLED LFG EXTRACTION WELL
○ LCR-4	INSTALLED LEACHATE CLEANOUT RISER CONNECTION
────	INSTALLED LFG COLLECTION PIPING
─ · ─ · ─	INSTALLED AIR SUPPLY LINE
────	INSTALLED CONDENSATE FORCEMAIN
HZ-12A	INSTALLED HORIZONTAL LFG COLLECTION PIPING
○	INSTALLED HORIZONTAL COLLECTION RISER
⊘	INSTALLED AIR/FORCEMAIN VALVE
◆ CS-11	INSTALLED CONDENSATE SUMP
△	INSTALLED REMOTE WELLHEAD
⊩	INSTALLED BLIND FLANGE
⊕ EW-81	ABANDONED LFG EXTRACTION WELL
────	ABANDONED LFG COLLECTION PIPING
HZ-11	ABANDONED HORIZONTAL LFG COLLECTION PIPING
△	ABANDONED REMOTE WELLHEAD
) (	ABANDONED ROAD CROSSING

NOTE:

1. EXISTING CONTOURS AND ELEVATIONS BASED ON AERIAL PHOTOGRAPHY COMPILED BY DALLAS AERIAL SURVEYS, INC. FLOWN FEBRUARY 20, 2020.

STATE OF TEXAS
J. HEATH PARKER
94764
LICENSED PROFESSIONAL ENGINEER

J. Heath P
09/15/2020

FOR PERMITTING PURPOSES ONLY

REVISIONS						
REV	DATE	DESCRIPTION	DWN BY	DES BY	CHK BY	APP BY

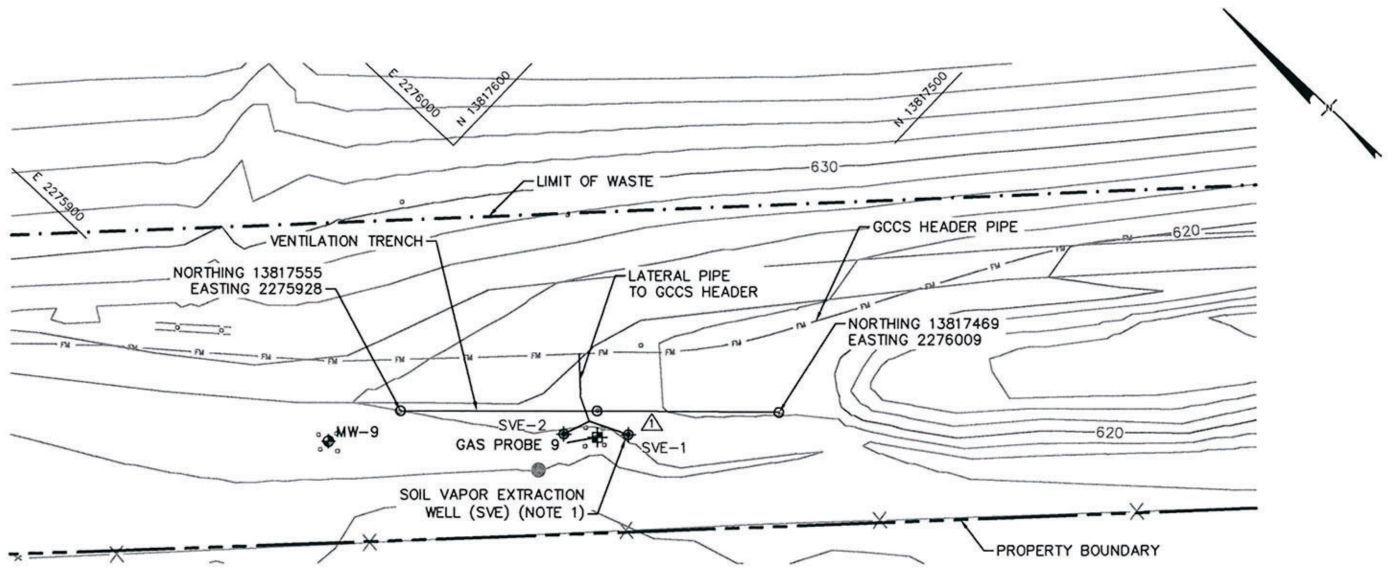
2020 GCCS EXPANSION

WASTE MANAGEMENT OF TEXAS, INC.
MESQUITE CREEK LANDFILL

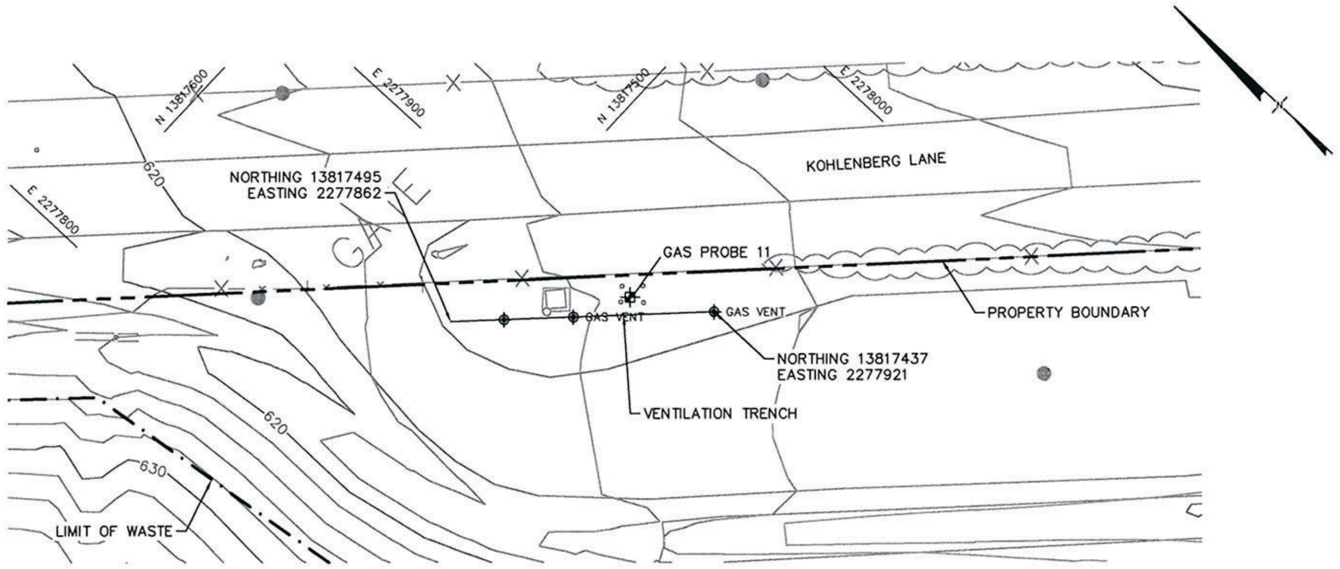
BIGGS & MATHEWS
ENVIRONMENTAL
CONSULTING ENGINEERS
MANSFIELD • WICHITA FALLS
817-563-1144

TBPE FIRM NO. F-256		TBPG FIRM NO. 50222	
DSN. JCW	DATE : 09/2020	DRAWING	
DWN. SRC	SCALE : GRAPHIC	14-4B	
CHK. JHP	DWG : 14-4A.dwg		

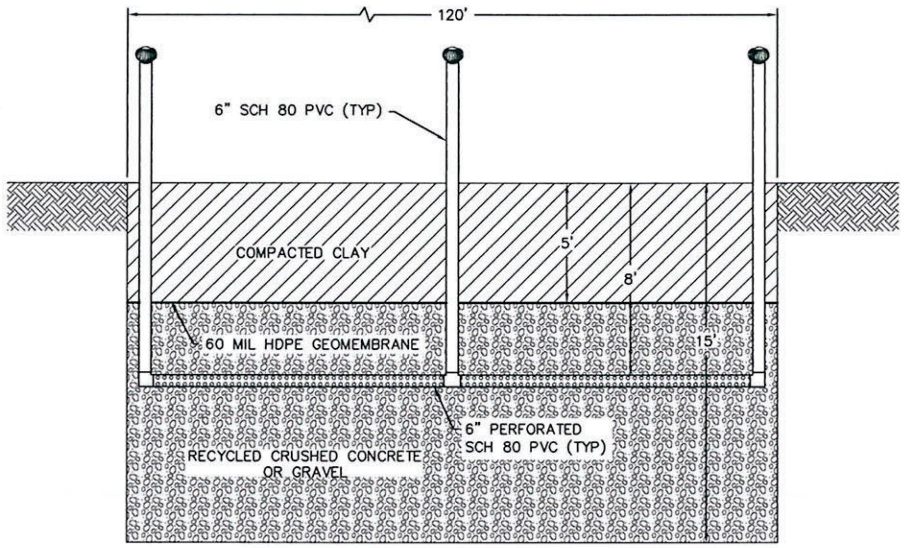
O:\Waste Management\Mesquite Creek\LFG\2020 GCCS Upgrades\As-Built Submittal\1 .dwg Layout: 2020 GCCS Expansion User: CWilborn



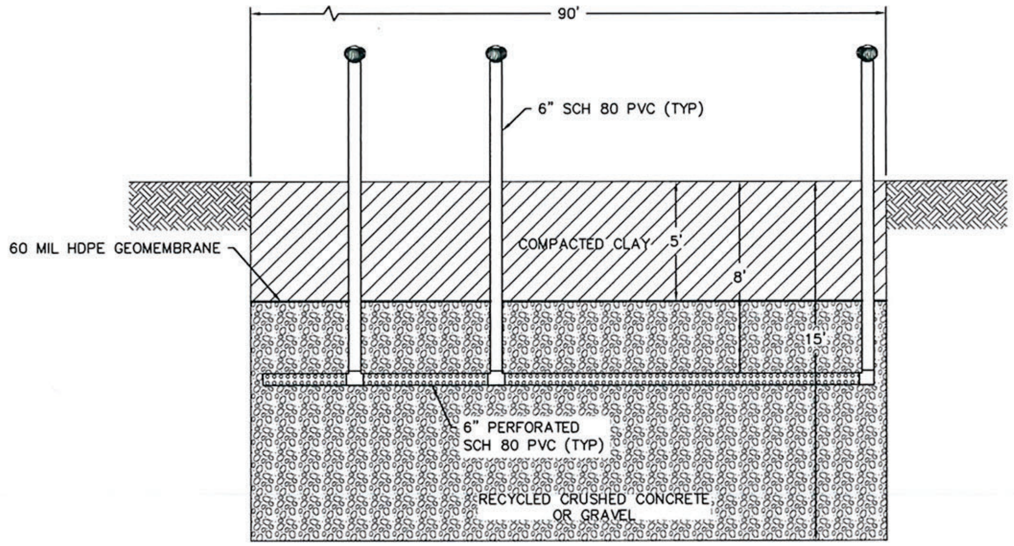
△ PLAN
GP-9 VENTILATION TRENCH
SCLAE: 1" = 60'



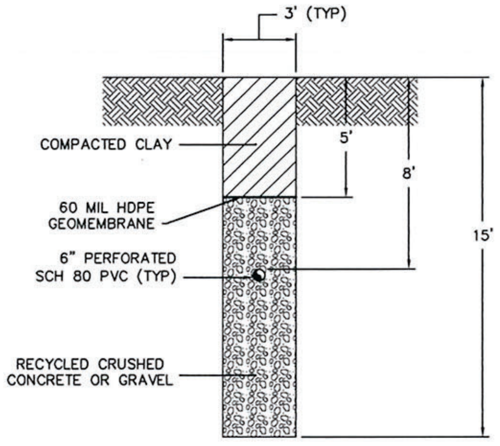
PLAN
GP-11 VENTILATION TRENCH
SCLAE: 1" = 60'



DETAIL
GP-9 VENTILATION TRENCH
SCALE: 1" = 8'
XREF: 0144-XD-01



DETAIL
GP-11 VENTILATION TRENCH
SCALE: 1" = 8'
XREF: 0144-XD-02



DETAIL
TRENCH SECTION
SCALE: 1" = 8'
XREF: 0144-XD-03

NOTE:

1. SOIL VAPOR EXTRACTION (SVE) WELLS SVE-1 AND SVE-2 WERE INSTALLED ON 23 MAY 2011 TO A DEPTH OF APPROXIMATELY 28 FEET BELOW GROUND SURFACE (FT BGS), BY TRI CON WORKS LP. THE SVE WELLS WERE CONSTRUCTED OF 6-INCH DIAMETER PVC PIPE AND ARE SCREENED FROM APPROXIMATELY 22 TO 28 FT BGS.

11/2/2011

SCOTT M. GRAVES
86557

FOR PERMIT PURPOSES ONLY

REV	DATE	DESCRIPTION	DRN	APP
△1	11/2/11	ADDED SVE-1 AND SVE-2 TO GP-9 TRENCH	JJV	SMG
–	08/26/10	NEW DRAWING ADDED	JJV	SMG

WASTE MANAGEMENT
WASTE MANAGEMENT OF TEXAS, INC.
1700 KOHLENBERG LANE
P.O. BOX 311657
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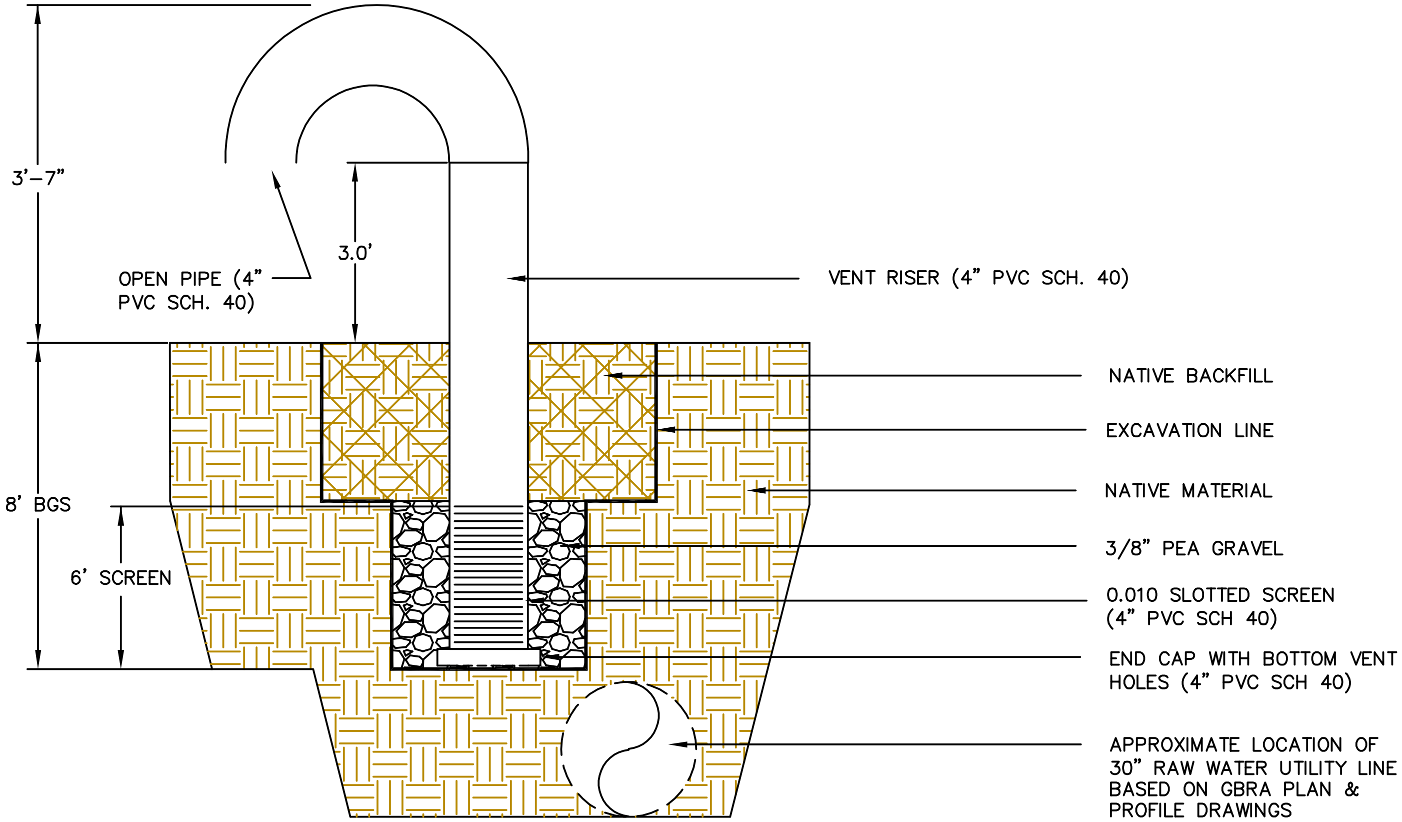
Geosyntec consultants
GEOSYNTEC CONSULTANTS, INC.
TEXAS FIRM REGISTRATION NUMBER 1182
3600 BEE CAVES ROAD, SUITE 101
AUSTIN, TEXAS 78746
PHONE: 512.451.4003

TITLE:
GCCS VENTILATION TRENCH DETAILS

PROJECT:
MESQUITE CREEK LANDFILL
PERMIT APPLICATION – PERMIT NO. MSW – 66 B

PROJECT NO.: TXL0144
FILE: 0144-02
DESIGN BY: MCC/LAO
DRAWN BY: JJV
REVIEWED BY: LAO
APPROVED BY: SMG
PART NO.: III
DRAWING NO.: 14-9



NOT TO SCALE

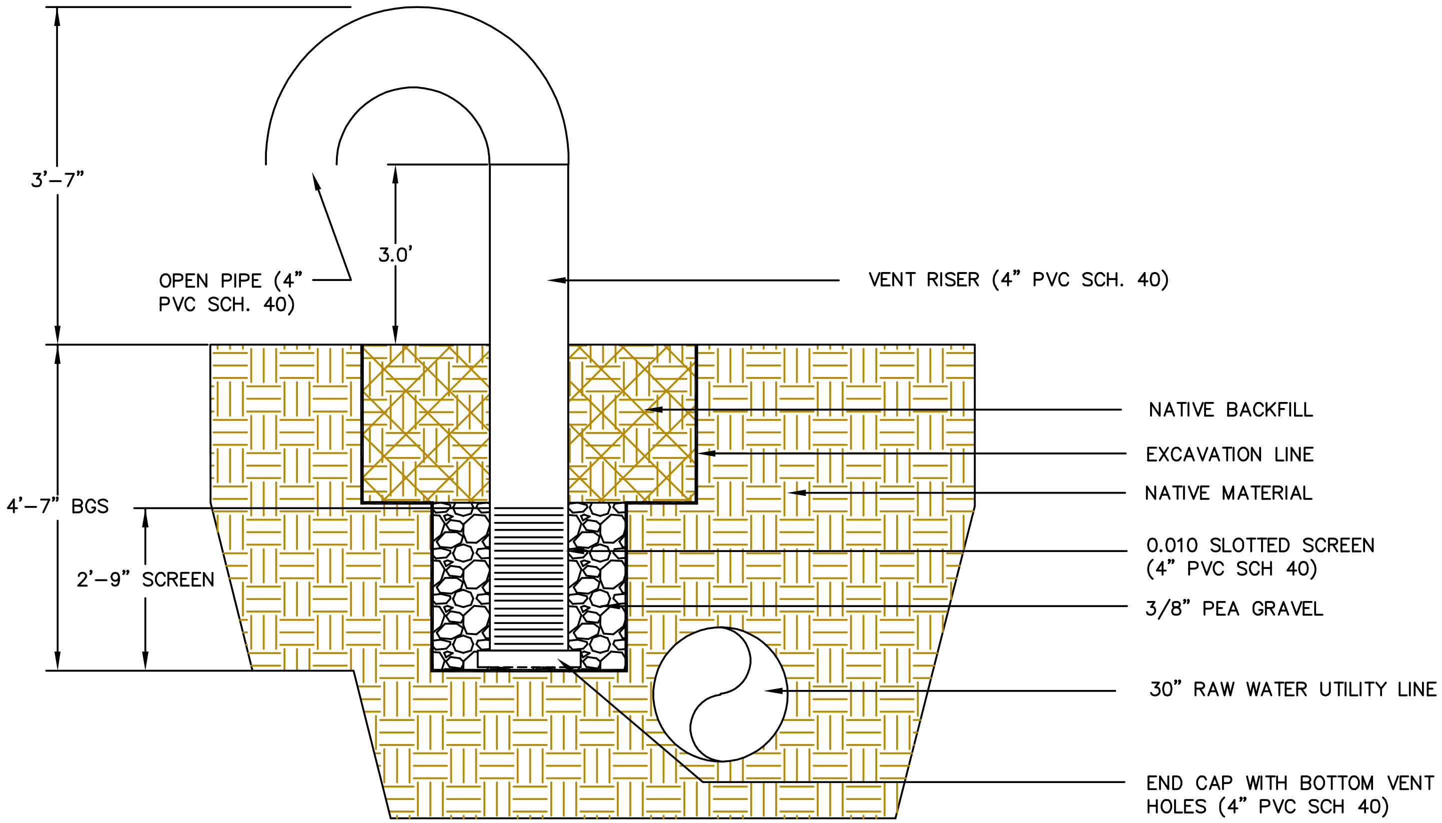
WASTE MANAGEMENT
MESQUITE CREEK LANDFILL

Figure 1

DETAIL UTILITY TRENCH
GAS VENT: GV-1

PROJECT: 212C-AU-00073	BY: ARM	REVISIONS
DATE: SEPT 2020	CHECKED: CML	

TETRA TECH
Complex World, Clear Solutions



NOT TO SCALE

WASTE MANAGEMENT
MESQUITE CREEK LANDFILL

Figure 2

DETAIL UTILITY TRENCH
GAS VENT: GV-2

PROJECT: 212C–AU–00073	BY: ARM	REVISIONS
DATE: SEPT 2020	CHECKED: CML	

TETRA TECH
Complex World, Clear Solutions

ATTACHMENT 7

CLOSURE PLAN

PART III – ATTACHMENT 7
CLOSURE PLAN

MESQUITE CREEK LANDFILL
COMAL AND GUADALUPE COUNTIES, TEXAS
PERMIT AMENDMENT APPLICATION
MSW PERMIT NO. 66C

Prepared for:
Waste Management of Texas, Inc.

Prepared by:
Geosyntec
consultants
Texas Board of Professional Engineers Firm Registration No. F-1182
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SCOTT M. GRAVES
86557
10/11/2023

FOR PERMIT PURPOSES ONLY

October 2023

TABLE OF CONTENTS
CLOSURE PLAN

STATE OF TEXAS
SCOTT M. GRAVES
86557
LICENSED PROFESSIONAL ENGINEER

10/11/2023

FOR PERMIT PURPOSES ONLY

GEOSYNTEC CONSULTANTS, INC.
TEXAS ENG. FIRM
REGISTRATION NO. F-1182

1. INTRODUCTION

1.1 Closure Plan Contents

The Closure Plan (Plan) for the Mesquite Creek Landfill (facility) is composed of the following items:

- this written narrative portion of the closure plan;
- completed Form TCEQ-20720 ("Closure Plan for Municipal Solid Waste Type I Landfill and Facility") presented in Attachment 7A at the end of this document; and
- a Final Cover Quality Control Plan (FCQCP) presented in Attachment 7B at the end of this document.

Also, throughout this Plan, cross-references are made to various other Part I through Part IV drawings, reports, plans, and attachments/appendices. Such cross-references refer to the latest versions of these items contained in Parts I through IV of the permit application for MSW Permit No. 66C (and as updated via any approved amendments, corrections, or modifications issued by the Texas Commission on Environmental Quality (TCEQ) for this permit).

Collectively, the items included with this Plan or cross-referenced herein were prepared to meet the requirements of 30 TAC §330.63(h) and 30 TAC Subchapter K for a Type I municipal solid waste (MSW) facility. This Plan addresses closure of the landfill, as well as the on-site storage and processing areas. This Plan will be placed in the site operating record prior to the initial receipt of waste.

1.2 Organization – Remainder of Written Narrative

The main component of the Closure Plan to provide/address required closure information is the completed Form TCEQ-20720 in Attachment 7A. To avoid duplication, this written narrative is kept intentionally brief – serving as a companion document to the extent necessary to provide further background or elaboration on the information contained in the form or otherwise needed to describe closure.

2 GENERAL CLOSURE INFORMATION

2.1 Current Areas with Final Cover

A map showing the current areas that have received approved and certified final cover as of the date of this initial permit amendment application is provided on Drawing 7-1 attached to this Plan.

2.2 Largest Area Requiring Closure

The estimated largest area of the landfill that will require a final cover during any time during the active life is of the facility is provided in Table 8 of Closure Plan Form TCEQ-20720 (see Attachment 7A).

It is planned that the final cover system will be installed incrementally, and the area reported in Table 8 of Form TCEQ-20720 is estimated as the worst-case condition (current or future) when the largest area not yet final covered could occur. This condition is illustrated on Drawing 7-1 attached to this Plan.

2.3 Maximum Waste Inventory

The maximum waste inventory is provided in Table 1 of Closure Plan Form TCEQ-20720 in Attachment 7A.

3. DESCRIPTION OF FINAL COVER SYSTEM DESIGN, METHODS, AND PROCEDURES

3.1 Final Capping To-Date Using Final Cover System Options Under MSW Permit No. 66B

Final cover system construction (i.e., “final capping”) has been completed over all of Unit 1, with more construction currently in progress on portions of Unit 2, in accordance with the approved Closure Plan under MSW Permit No. 66B. For completeness of information, this subsection describes the previously-approved final cover system options. The yet-to-be-final-covered areas as of the date of approval and issuance of MSW Permit No. 66C must follow the final cover system types and design, methods, and procedures set forth below in subsections 3.2 through 3.4. As such, this subsection 3.1 does not apply to future final capping, and is only being provided to carry-forward background information on final cover options allowed under the previous permit that have now been used in certain areas of the facility. These previously-approved final cover system options were:

1. Pre-Subtitle D final cover system (Unit 1 Pre-Subtitle D areas only) with 18-inches of low-permeability compacted soil (hydraulic conductivity (k) $\leq 1 \times 10^{-7}$ cm/s) overlain by 6-inches of topsoil (i.e., vegetated erosion layer).

2. Subtitle D Soil-Only final cover system with 18-inches of low-permeability compacted clay (hydraulic conductivity (k) $\leq 1 \times 10^{-5}$ cm/s) overlain by 2-ft of cover soil, overlain by 6-inches of topsoil (i.e., vegetated erosion layer).

3. Standard Subtitle D final cover system consistent with 30 TAC §330.457(a)(1).

Cross-sectional view engineering details for these final cover system types that have already been installed (or are in-progress) are presented on Drawing 3A-13 in Part III, Attachment 3A. Also, Drawing 7-1 of this Closure Plan shows areas of completed and certified final cover to-date, as well as identifying an approximately 19.9-acre portion of Unit 2 that is currently under final cover system construction in Fall 2023.

The remaining subsections below focus on the final cover system design, methods, and procedures that will be used for areas of the landfill that were not already final covered under MSW Permit No. 66B.

3.2 Unit 2 Final Cover System Options Under MSW Permit No. 66C

Upon approval and issuance of MSW Permit No. 66C, which will put this Closure Plan into effect superseding the previous Closure Plan, the remaining areas of Unit 2 that have not already been final covered under the previous permit will be final covered using either of the following options:

1. Standard Subtitle D final cover system consistent with 30 TAC §330.457(a)(1); or

2. Alternate Subtitle D equivalent final cover system using water balance (WB) soil-only cover, which may be used as an alternative to the standard Subtitle D final cover system. The selected WB final cover system uses the "Option 1" WB-type cover for this geoclimatic region [San Antonio Region], selected based on TCEQ Publication RG-494, Guidance for Requesting a Water Balance (WB) Alternative Final Cover for a Municipal Solid Waste Landfill, TCEQ Waste Permits Division, March 2017[1].

The components of these proposed final cover systems are described in Table 5 of Closure Plan Form TCEQ-20720 in Attachment 7A. A drawing that depicts cross-sectional views of the construction details of each proposed final cover system is presented on Drawing 3A-13 in Part III, Attachment 3A.

3.3 Landfill Layout Details, Drainage Features, and Vegetation

This information is provided in Item III of the Closure Plan Form TCEQ-20720 in Attachment 7A.

3.4 Final Contour Map

As indicated in Item III.E of the Closure Plan Form TCEQ-20720 in Attachment 7A, a final contour map, showing the proposed final cover system elevation contours, slopes, and surface-water drainage features is presented on Drawings 2A-1A and 2A-1B in Part III, Attachment 2A (Landfill Surface Water Management System Drawings), for Units 1 and 2, respectively.

A detailed description of 100-year flood conditions at the site and a demonstration of how the waste disposal, storage, and processing areas are protected from flooding is provided in Part III, Attachment 2 (Drainage Report). From this information, Drawing 2A-1A shows the calculated site-specific 100-year flood limits associated with Mesquite Creek (while also noting that there are no FEMA-defined 100-year floodplains or floodways at the site). The information shows that the 100-year flood limits will not encroach on the landfill footprint (nor into the leachate evaporation

---

[1] Figure 1 of RG-494 shows that Comal and Guadalupe Counties (where the site is located) are in Geoclimatic Region 5 (San Antonio). An as-built hydraulic conductivity of 5×10^{-8} cm/sec is selected for the storage layer (as specified in the FCQCP in Attachment 7B). Using Table 3 of RG-494, a minimum storage layer thickness of 2 ft-11 inches is required (i.e., 2.92 ft when expressed in decimal feet).

ponds), and that these features are protected from 100-year flooding by perimeter roads/berms in the vicinity of potential flooding at Mesquite Creek, thereby serving as a protective barrier against potential flooding. Therefore, special provisions for protection from a 100-year flood are not applicable to the facility or this Plan.

3.5 Installation Methods and Procedures

Final cover system installation methods and procedures, and associated drawing references, are provided in Item IV of the Closure Plan Form TCEQ-20720 in Attachment 7A.

In particular, it is noted that the the final cover system will be installed in accordance with the FCQCP in Attachment 7B, which describes the final cover system materials, components, construction, testing, and QA/QC (quality assurance and quality control) criteria for all the elements of the final cover systems.

The FCQCP also addresses the required documentation of final cover system construction and testing.

4. CLOSURE PROCEDURES

4.1 Final Cover Placement

It is planned that the final cover system will be installed incrementally during the active life of the landfill, as sections of the landfill reach final permitted waste grades, as practicable for constructability considerations. When an increment of final cover is constructed, the following general procedures will be followed:

- Surveying will be conducted to check and control the filling of solid waste to the top of daily/intermediate cover layer elevations and grades.
- At the increment to be constructed, after subgrade preparation and associated survey verifications, the final cover system layers will be constructed in accordance with the FCQCP.
- When construction is complete, a final cover system evaluation report (FCSER), with associated as-built surveys, will be prepared and submitted to TCEQ for approval in accordance with the procedures and required contents/documentation described in the FCQCP.
- The TCEQ approved FCSER will be maintained in the site operating record, and the final cover log (Part IV Site Operating Plan (SOP), Section 24) will be updated to reflect the area(s) where final cover has been placed. The TCEQ region office will also be notified that final cover placement has occurred at the site.

Note that placement of a section/increment of final cover at a landfill unit does not represent closure of the entirety of that unit. Requirements for landfill unit closure are discussed below; and post-closure care at a unit will not begin until of all closure activities for that landfill unit are completed.

For portions of the final cover that are installed and are in-place during the active life of a landfill unit, the provisions set forth in Section 24.5 of the SOP will be followed regarding final cover inspections, repairing erosion, and maintaining the final cover including its grassy vegetation, along with associated documentation requirements.

4.2 Landfill Unit Closure During Active Life

Final closure of a landfill unit is planned to commence when the permitted disposal capacity of that unit has been completely exhausted. However, it could commence prior to completely exhausting the permitted disposal capacity of the unit (e.g., if the operator electively chooses to, it becomes necessary, or it is required to final close the facility at an earlier time than planned (i.e., premature closure)). Should premature closure be elected, become necessary, or be required at any time during the active life of the landfill, the following steps will be taken:

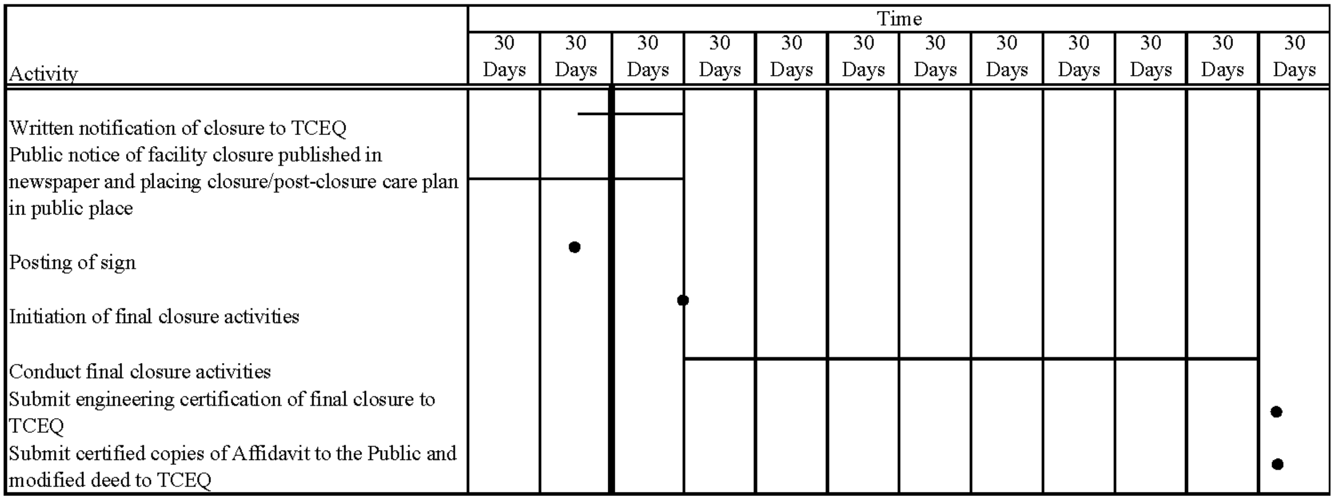
- Revised closure engineering plans will be developed consistent with TCEQ requirements to address closure at the time of discontinued waste filling.
- The final waste received will be placed and properly compacted.
- Excavations (if any) will be filled with suitable material, and the site will be graded to promote runoff and prevent ponding.
- Consistent with the closure engineering plans, portions of the landfill that are above-grade will be regraded and reshaped as needed to provide the proper slope for positive drainage.
- The final cover system will be constructed in accordance with the FCQCP.
- A surface water management system consistent with the closure engineering plans and the surface water drainage plan of Part III, Attachment 2 will be constructed to minimize erosion.
- Following completion of final cover construction and other site construction work, the site will be vegetated with appropriate grasses to minimize erosion, and to provide the minimum vegetation coverage percentage provided in this Closure Plan (see Form TCEQ-20720).
- A closure certification will be prepared by an independent licensed professional engineer and submitted to TCEQ for approval.
- All proper notices and documentation will be filed with the appropriate agencies.

4.3 Final Closure of a Landfill Unit

As noted, Unit 1 has already been closed via the final cover system construction that has been completed and approved by TCEQ. To satisfy final closure criteria for a landfill unit, the activities enumerated in Item V.A of the Closure Plan Form TCEQ-20720 in Attachment 7A will be conducted for the remaining landfill unit (Unit 2).

Following completion of all closure activities for that landfill unit, the owner or operator will comply with the post-closure care requirements specified in 30 TAC §330.463(b) (provided in the Post-Closure Plan in Part III, Attachment 8).

A graphical figure of the final landfill closure schedule for the remaining landfill unit is presented below as Figure 1.



Notes:

Heavy vertical line signifies final receipt of waste.

Schedule is based on anticipated date of beginningfinal closure activities and is for reference purposes only. Implementation of closure activities shall follow the TCEQ approved closure plan and applicable rules.

Figure 1. Final Closure Schedule

4.4 Closure of Waste Storage/Processing Areas

Waste storage and processing areas will be closed in accordance with the activities described in Item V.B of the Closure Plan Form TCEQ-20720 in Attachment 7A.

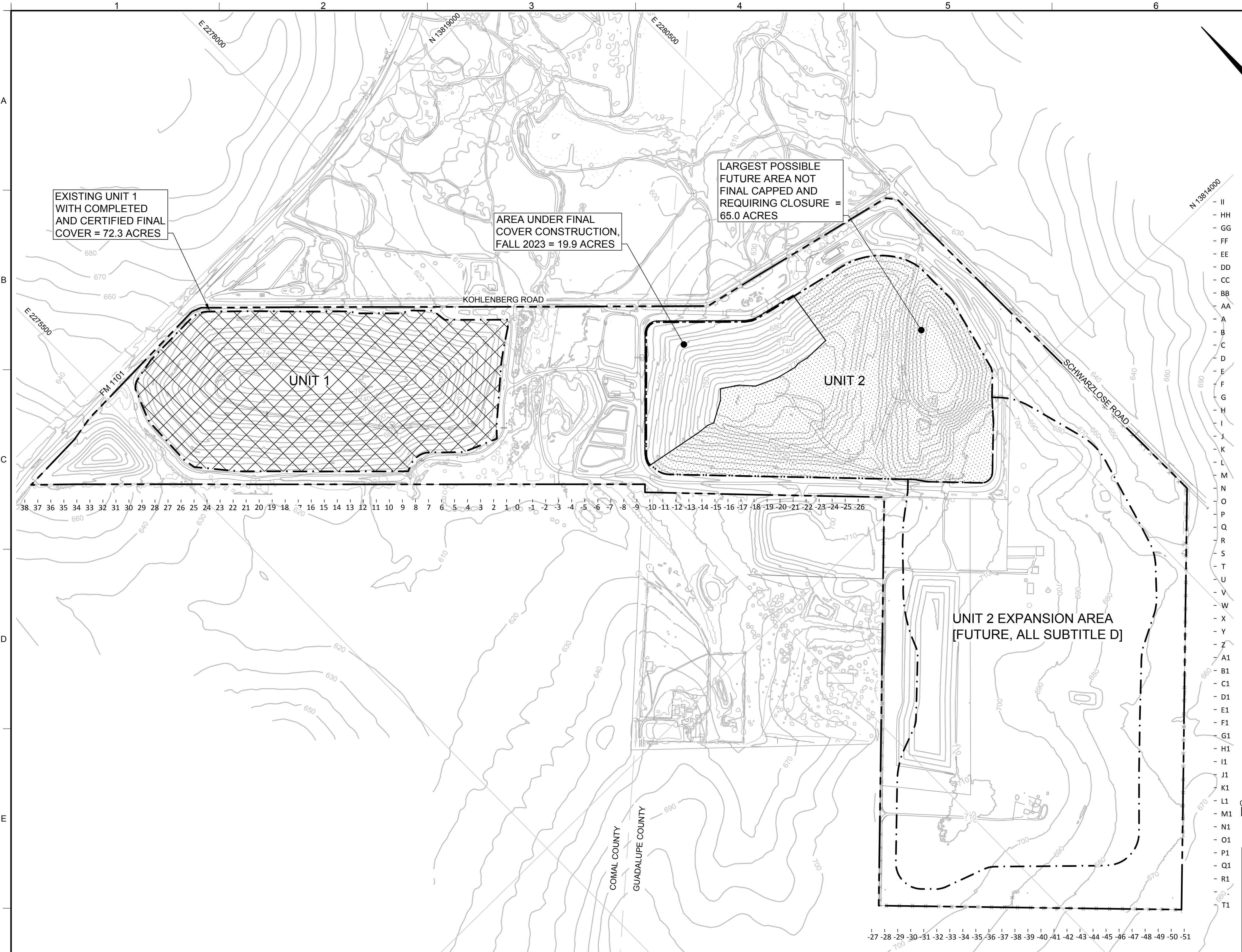
It is noted that the leachate evaporation ponds and leachate storage tanks are planned to continue to operate after closure (i.e., during the post-closure care period). Once the post-closure care period has ended, the remaining leachate will be transferred to a properly permitted off-site treatment or disposal facility, general cleanup will be performed, and the evaporation ponds and leachate storage tanks will be decommissioned and removed.

4.5 Final Closure of the Entire Facility

In addition to the activities for final closure of the remaining landfill unit and the waste storage/processing areas as indicated in the sections above (referencing appropriate items in the Closure Plan Form TCEQ-20720 in Attachment 7A), the activities enumerated in Item V.C of the Closure Plan Form TCEQ-20720 in Attachment 7A will be conducted for closure of the entire facility.

CLOSURE PLAN DRAWING

LIST OF DRAWING(S)		
Drawing No.	Title	Drawing Date (latest revision)
7-1	Largest Area Requiring Final Cover	October 2023



LEGEND

580	EXISTING GROUND ELEVATION CONTOUR (FT, MSL) (NOTES 1, 2)
	EXISTING ROAD
	EXISTING VEGETATION / TREE
x x	EXISTING FENCE
	EXISTING BUILDING
	EXISTING WATER LINE
N 13814000 E 2280000	COORDINATE GRID (NOTE 2)
A 13	SITE GRID
	PERMIT BOUNDARY (NOTE 3)
	LIMIT OF WASTE
▨	COMPLETED AND CERTIFIED FINAL COVER
░	LARGEST AREA REQUIRING FINAL COVER

NOTES:

1. TOPOGRAPHIC BASE MAP OF EXISTING SITE CONDITIONS WAS GENERATED BY PHOTOGRAMMETRIC METHODS BASED ON AN AERIAL SURVEY FLOWN ON 15 FEBRUARY 2023 BY HYDREX ENVIRONMENTAL, AND BY DALLAS AERIAL SURVEYING (DAS) FLOWN IN 2018-2019. EXISTING TOPOGRAPHY OUTSIDE OF PROPERTY WHERE SHOWN SUPPLEMENTED WITH THE UNITED STATES GEOLOGIC SURVEY (USGS) 3DEP PROGRAM PUBLISHED IN NOVEMBER 2021.
2. ELEVATIONS ARE IN FEET ABOVE MEAN SEA LEVEL (FT, MSL). DRAWING COORDINATES ARE BASED ON TEXAS STATE PLANE SOUTH CENTRAL ZONE (4204) US FOOT COORDINATE SYSTEM, NORTH AMERICAN DATUM OF 1983 (NAD-83).
3. PERMIT BOUNDARY AND PROPERTY BOUNDARY COINCIDE.

SCOTT M. GRAVES
86557

10/11/2023

FOR PERMIT PURPOSES ONLY

REV	DATE	DESCRIPTION	DRN	APP

WASTE MANAGEMENT
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Geosyntec consultants
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AUSTIN, TEXAS 78757
PHONE: 512.451.4003

TITLE:
LARGEST AREA REQUIRING FINAL COVER

PROJECT:
MESQUITE CREEK LANDFILL EXPANSION
PERMIT AMENDMENT APPLICATION - MSW PERMIT NO. 66C

PERMIT DRAWING

PROJECT NO.:	GW8636	DESIGN BY:	SMG	REVIEWED BY:	YB	PART NO.:	DRAWING:
FILE:	GW8636P7-1	DRAWN BY:	JJV / KH	APPROVED BY:	SMG	III	7-1

AUS-01\P:\CADD\PROJECTS\MMESQUITE CREEK LANDFILL\PERMIT\EXPANSION 66C (GW8636)\04-07 DRAWINGS PARTS I-IV\GW8636P7-1.DWG

ATTACHMENT 7A

FORM TCEQ-20720
CLOSURE PLAN FORM
FOR MUNICIPAL SOLID WASTE TYPE I LANDFILL UNITS AND FINAL FACILITY CLOSURE

Texas Commission on Environmental Quality

Closure Plan for Municipal Solid Waste Type I Landfill Units and Final Facility Closure

This form is for use by applicants or site operators of Municipal Solid Waste (MSW) Type I landfills to detail the plan for closure of a landfill unit, closure of associated storage or processing units, and final closure of the facility to meet the requirements in 30 TAC Chapter 330, §330.63(h) and 30 TAC Chapter 330 Subchapter K for a MSW Type I facility.

If you need assistance in completing this form, please contact the MSW Permits Section in the Waste Permits Division at (512) 239-2335.

I. General Information

Facility Name: Mesquite Creek Landfill

MSW Permit No.:66C

Site Operator/Permittee Name: Waste Management of Texas, Inc.

II. Landfill and Other Waste Management Units and Operations Requiring Closure at the Facility

A. Facility Units

Table 1. Description of Landfill Units.

Name or Descriptor of Unit	Operating Status of Unit	Type of Liner System Under Unit	Above Grade Class 1 Disposal Cells in this Unit	Below Grade Class 1 Disposal Cells in this Unit	Other Class 1 Disposal Cells in this Unit (describe)	Size of Unit's Waste Footprint (acres)	Maximum Inventory of Waste Ever in Unit (indicate cubic yards or tons)	Other Necessary Information that Pertains to the Unit
MSW Landfill – Unit 1	Inactive (all final-covered)	Pre-Subtitle D and Subtitle D	☐	☐	☐	72.3	5,572,630 CY	
MSW Landfill – Unit 2	Active	Subtitle D	☐	☐	☐	219.3	36,257,925 CY	
			☐	☐	☐			
Totals						291.6	41,830,555 CY	

Table 2. Description of Waste Storage or Processing Units or Operations Associated with this Permit.

Type of Storage or Processing Unit or Operation (individual units may be closed at any time prior to or during the final facility closure as described in this plan)	Operational Status of Unit	Size of the Area Used for the Storage or Processing Unit or Operation (Acres)	Maximum Inventory of Waste Ever in Storage or Processing Unit or Operation (indicate cubic yards or tons)	Other Information (enter other necessary information that pertains to the unit)
Large/heavy / bulky item	Active	0.23	60 ☒cubic yards ☐tons	Approx. equiv. to 2 x 30 cy rolloffs
Wood recycling	Active	2	5,000 ☒cubic yards ☐tons	
C&D material recycling	Active	1	2,500 ☒cubic yards ☐tons	
Tire management	Active	1	60 ☒cubic yards ☐tons	1 trailer (max. 500 tires)
Liquid waste solidification	Active	0.46	950 ☒cubic yards ☐tons	2 basins
Leachate storage	Active	6.3	Leachate storage expressed in gallons, see next column ☐cubic yards ☐tons	2 future tanks @ combined 40,000 gallons + lined ponds A-E at combined 12,100,000 gallons
Totals		11	8,570 cubic yards	

B. Waste Inventory Summary

Table 3. Maximum Inventory of Wastes Ever On Site.

Item	Quantity (indicate cubic yards or tons)
Maximum inventory of waste in landfill units (total from Table 1)	41,830,555 ☒cubic yards or ☐tons
Maximum inventory of waste in storage or processing units or operations (total from Table 2)	8,570 (solid waste) ☒cubic yards or ☐tons

Item	Quantity (indicate cubic yards or tons)
Total Maximum Inventory of Wastes ever on site over the active life of the MSW facility (sum of totals from Tables 1 and 2)	41,839,125 ☒cubic yards or ☐tons

C. Drawings Showing Details of the Waste Management Units at Closure

Table 4. Location of the Drawings showing Details of the Waste Management Units at Closure (outlines, dimensions, maximum elevations of waste and final cover of landfill units, and waste storage or processing units or operations at closure of the facility).

Drawing Location in the SDP	Drawing Figure Number	Drawing Title	Waste Management Units Details Shown
Att 3A	3A-2	Facility Layout Plan	Outlines , waste footprints, and dimensions of the landfill unit; outlines of leachate storage areas
Att 3A	3A-5A and 3A-5B	Overall Final Cover Grading Plan (Unit 1 and Unit 2)	Maximum elevations of waste and final cover of the landfill unit
Part IV, Appendix IV-C	IV-C-1	Liquid Waste Solidification Area	Outlines and dimensions of the liquid waste processing area

III. Description of the Final Cover System Design

A. Types and Descriptions of the Final Cover Systems

Table 5. Types and Descriptions of the Final Cover Systems Permitted or Proposed for Closure of the Landfill Units.

Landfill Unit Name or Descriptor	Type of Final Cover System	Final Cover System Components Description	Other Information (Enter other information as applicable)
MSW Landfill – Existing Final Covered Pre-Subtitle D Areas of Unit 1	Pre-Subtitle D – existing (as already constructed)	Existing System (not proposed for any future final cover areas): 1.5-ft thick low permeability ($\leq 1 \times 10^{-5}$ cm/sec) compacted soil infiltration layer overlain by a 0.5-ft thick topsoil (i.e., vegetated erosion layer).	See cross-section detail shown on Att. 3A, Dwg 3A-13

Landfill Unit Name or Descriptor	Type of Final Cover System	Final Cover System Components Description	Other Information (Enter other information as applicable)
MSW Landfill – Existing Final Covered Subtitle D Areas of Units 1 and 2	Subtitle D Soil-Only – existing (as already constructed)	Existing System (not proposed for any future final cover areas): 1.5-ft thick low permeability (≤1 x 10^{-5} cm/sec) compacted clay infiltration layer overlain by a 2-ft thick cover soil, overlain by a 0.5-ft thick topsoil (i.e., vegetated erosion layer).	See cross-section detail shown on Att. 3A, Dwg 3A-13
MSW Landfill – Unit 2 (for areas not already final covered)	Standard Subtitle D	Proposed Option for Future Final Cover Areas: 1.5-ft thick low permeability (≤1 x 10^{-5} cm/sec) soil infiltration layer overlain by a 40-mil linear low-density polyethylene (LLDPE) geomembrane, overlain by a geocomposite drainage layer, overlain by a 2-ft thick vegetated erosion layer.	See cross-section detail shown on Att. 3A, Dwg 3A-13
MSW Landfill – Unit 2 (for areas not already final covered)	Alternate Subtitle D (Water Balance)	Proposed Option for Future Final Cover Areas: 2-ft 11-inch (i.e., 2.92-ft) thick low permeability (≤5 x 10^{-8} cm/sec) soil storage layer overlain by a 6-in. or 12-in thick topsoil (i.e., vegetated erosion layer).	See cross-section detail shown on Att. 3A, Dwg 3A-13

B. Design Details

Table 6. Design Details of the Final Cover Top and Side Slopes for the Landfill Units.

Landfill Unit Name or Descriptor	Maximum Final Elevation of Waste (feet above mean sea level [ft-msl])	Maximum Elevation of Top of Final Cover (ft-msl)	Minimum Grade of the Final Cover Top Slope (%)	Maximum Grade of the Final Cover Side Slope (%)	Other Information (enter other information as applicable, e.g. above-grade Class 1 Cell Dikes)
MSW Landfill, Unit 1	791.2	798.4	5	33.33 (between benches)	
MSW Landfill, Unit 2	786.6	790.0	5	33.33 (between benches)	

C. Final Cover Drainage Features

Storm water drainage and erosion and sediment control features incorporated on the final cover of the landfill units to protect the integrity and effectiveness of the final cover system include *(please list and describe the drainage features to be installed on the final cover at or prior to closure for each landfill unit, or list the drainage features and provide cross references on the location(s) of the descriptive and details (drawing) information in other parts of the SDP)*:

On landfill final cover: vegetated final cover surfaces, top-deck drainage terraces; sideslope drainage terraces; downdrain pipes; perimeter ditches. For more information:

- Narrative description in Part III, Attachment 2 (Drainage Report);
- Drawings provided in Part III, Attachment 2A (Drainage Report – Drawings)

D. Final Cover Vegetation or Other Ground Cover Material

The final cover will be seeded and/or sodded with native plants immediately following the application of the final cover in order to minimize erosion. Other materials, including **mulch as BMP while establishing permanent vegetation**, may be incorporated over the final cover soil surface to ensure sufficient coverage of the ground surface to minimize erosion. The estimated percent ground cover to minimize soil loss and maintain long-term erosional stability of the final cover top and side slopes is: **70% and 92%, for the top-deck and sideslopes, respectively**. The minimum material specifications for other ground cover materials are summarized in the table below.

For a landfill with water balance final cover design, the percentage vegetation cover (excluding other ground cover types) will not be less than that assumed in the water balance final cover model.

Table 7. Minimum Specification for Ground Cover Materials Other Than Vegetation, if Applicable.

Other Ground Cover Material	Maximum Particle Size (inches)	Minimum Particle Size (inches)	Material Placement Method	Thickness of Layer (inches)	Percentage Coverage (%)	Other (specify)
Mulch (temporary BMP)	3	N/A	Spread/ broadcast	1-2	60%	N/A

E. Final Contour Map

Drawing **2A-1A and 2A-1B [Part III, Att 2A]**, a facility final contour map is attached. The map shows the final contours of the landfill units and the entire facility at closure.

Drawings **3A-6 through 3A-10 [Part III, Att 3A]** showing the cross–sections of the landfill units at closure are also provided.

The facility final contour and cross-section maps/drawings depict the following information:

(1) Final constructed contours of the landfill at closure.

(2) Top slopes and side slopes of the landfill units.

(3) Surface drainage features.

(4) 100-year floodplain, as applicable.

(5) Constructed features providing protection of/from the 100-year floodplain.

(6) Other (specify):

IV. Description of the Final Cover System Installation Procedure

A. Mode of Installation

Table 8. Mode of Final Cover Installation on the Landfill Units.

Landfill Unit Name or Descriptor	Largest Area of Unit Ever Requiring Final Cover (Acres)	Check this Column if Final Cover will be Placed in Installments as Permitted Elevation is Reached	Check this Column if Final Cover will be Placed when Entire Unit Area Reaches Permitted Elevation	Final Cover Installation Status
MSW Landfill – Unit 1 (already final covered)	0 (already covered – see last column) (see also Table 9)	☒	☐	All Unit 1 final cover has been installed
MSW Landfill – Unit 2	65.0 (see also Table 9)	☒	☐	Unit 2 is active. Approx. 19.9 acres of final cover is being constructed currently. The largest-area ever requiring final cover refers to the largest anticipated uncovered condition at any given time (current or future)
		☐	☐	

B. Installation Drawings for Final Cover and Drainage Features

The following attached plan and cross-section drawings show the final cover design details, the largest area requiring final cover, details of the sequence of installation of the final cover system, and all drainage features.

Table 9. List of Attached Installation Drawings for Final Cover and Drainage Features.

Drawing No.	Drawing Title	Description of Information Contained in Drawing
Drawings 2A-1A and 2A-1B to 2A-17 (Part III, Att 2A)	Varies (Surface Water Management System Drawings)	Final cover layout and cross section details with references to base drawings – incorporated into this Closure Plan by reference.
Drawing 7-1 (included with narrative Closure Plan, this attachment)	Largest Area Requiring Final Cover (7-1)	Drawing 7-1 shows current final cover status (installed final cover areas, and largest area requiring final cover requiring final cover (based on the facility's anticipated planning).
N/A		Other: N/A

C. Final Cover Quality Control Plan

A final cover quality control plan (FCQCP), Attachment **7B**, is attached. The FCQCP describes the final cover system design, construction, and evaluation protocol and processes, including the personnel, materials, methods, sampling and testing standards, procedures, and practices to be used in procuring, handling, installing, and evaluating all elements of the final cover system. It establishes the material requirements; personnel qualifications and roles; installation requirements; quality control and quality assurance monitoring, testing, documentation, and reporting programs to be used during construction of each component of the final cover system to assure and to verify that the final cover system is constructed as designed and in accordance with applicable rules and technical standards.

D. Documentation and Reporting of Final Cover System Construction and Testing

The professional of record will document all aspects and stages of the final cover installation, including materials used, equipment and construction methods, and the type and rate of sampling and quality control testing performed. Following completion of construction of the final cover, the site operator/permittee will submit to the TCEQ executive director, a Final Cover System Evaluation Report (FCSER) for each landfill unit.

V. Closure Activities and Completion Schedules for Each Landfill Unit and for the Final Facility Closure

A. Closure of a Landfill Unit

The following activities will be conducted to satisfy the closure criteria for a landfill unit:

(1) Closure Notification to the TCEQ Executive Director:

The site operator will inform the executive director of the TCEQ, in writing, of the intent to close the unit no later than 45 days prior to the initiation of closure activities and place this notice of intent in the operating record.

(2) Stoppage of Waste Acceptance and Commencement of Other Closure Activities for the Unit:

The site operator will stop accepting waste upon receiving the known final receipt of waste. The site operator will ensure that the permitted top elevations of the in-place waste, as depicted in/derived from the unit’s final contour map approved by the TCEQ executive director, are not exceeded at any section or part of the landfill unit. The site operator will begin closure activities for the unit no later than:

- Thirty days after the date on which the unit receives the known final receipt of wastes; or
- One year after the most recent receipt of wastes if the unit has remaining capacity and there is a reasonable likelihood that the unit will receive additional wastes.

(3) Request for Extension Beyond the 1-Year Deadline for Commencing Closure Activities for a Unit:

The site operator may submit a written request to the executive director of the TCEQ for review and approval for an extension beyond the one-year deadline for the initiation of closure. The request will include the following:

(a) All applicable documentation necessary to demonstrate that the unit has the capacity to receive additional waste; and

(b) All documentation necessary to demonstrate that the site operator has taken and will continue to take all steps necessary to prevent threats to human health and the environment from the MSW landfill unit.

(4) Construction of Final Cover:

The site operator will construct the permitted final cover over the waste mass utilizing methods, procedures, and specifications described in the FCQCP. The final constructed contours, elevations, and slopes of the installed final cover will match the permitted final cover contours, elevations, and slopes shown in closure drawings contained in this closure plan.

(5) Construction of Drainage Features:

The site operator will construct the drainage structures shown in drawings referenced or contained in this closure plan or in the facility surface water drainage report.

(6) Completion of Outstanding or Replacement of Damaged Groundwater or Landfill Gas Monitoring Components:

The site operator will complete installation of any outstanding or replacement of any damaged groundwater or landfill gas monitoring system components and landfill gas control systems as needed to maintain current and effective groundwater or landfill gas monitoring and control systems.

(7) Submittal of Final Cover System Evaluation Report (FCSER) to the TCEQ Executive Director:

Following completion of construction of the final cover for the subject landfill unit, the site operator will submit to the TCEQ executive director for review and acceptance, a FCSER for the unit.

(8) Completion of Closure Activities for the Landfill Unit:

The site operator will complete closure activities for the unit within 180 days following the start of closure activities, unless the executive director of the TCEQ grants an extension as described in Item V.A.8(a) below.

(a) Request for Extension of the Completion of Closure Activities for the Landfill Unit:

The site operator may submit a written request for an extension for the completion of closure activities to the TCEQ for review and approval. The extension request will include:

- All applicable documentation necessary to demonstrate that closure will, of necessity, take longer than 180 days; and
- All applicable documentation necessary to document that all steps have been taken and will continue to be taken to prevent threats to human health and the environment from the unclosed MSW landfill unit.

(9) Submittal of Engineer’s Certification of Closure to the TCEQ Executive Director and Request of Closure Inspection to TCEQ Regional Office:

Following completion of all closure activities for the landfill unit, the site operator will submit:

(a) Closure Inspection

A written request to the local TCEQ regional office for a closure inspection of the unit.

(b) Closure Certification

A certification, signed by an independent licensed professional engineer, to the executive director of the TCEQ for review and approval verifying that closure has been completed in accordance with this closure plan. The site operator will submit the certification via registered mail, and the submittal will contain all applicable documentation necessary for certification of closure of the unit, including:

- A final cover system evaluation report (FCSER) documenting the installation of the final cover. The FCSER may be submitted as a separate document for review and approval following the completion of the final cover installation. In that case, the certification of closure will be submitted subsequently;
- A final contour map as described under Section III.E that includes the relevant unit; and
- Copy of the letter to the TCEQ regional office requesting a closure inspection of the relevant unit.

(10) TCEQ's Acknowledgement of Termination of Operation and Closure of a Unit:

Upon receipt, the TCEQ executive director will review the closure documents for completeness and accuracy; and following receipt of the closure inspection report from the agency's regional office verifying proper closure of the MSW landfill unit according to this closure plan, the executive director will, in writing, acknowledge the termination of operation and closure of the unit and deem it properly closed. Thereafter, the site operator will comply with the post-closure care requirements described in the post-closure care plan for the unit.

(11) Deed Recordation for Disposed Regulated Asbestos Containing Materials (RACM):

Upon closure of the unit that accepted RACM, the site operator will place a specific notation that the unit accepted RACM in the deed records for the facility with a diagram identifying the RACM disposal areas. Concurrently, the site operator will submit to the TCEQ executive director, a notice of the deed recordation and a copy of the diagram identifying the asbestos disposal areas.

(12) Placement of all Closure Documentation in the Site Operating Record:

Once approved, the closure certification and all other documentation of closure will be placed in the site operating record.

(13) Closure Schedule for the Landfill Unit:

A closure schedule, Figure 1 (contained within Closure Plan Narrative), is attached. The schedule shows all the closure activities listed within Section V.A and the timelines for commencing and completing each activity. Also, the schedule shows that closure activities for the landfill unit will be completed within 180 days following the initiation of closure activities as required, unless an extension is granted by the TCEQ executive director.

(14) Other: (enter as applicable).

N/A

B. Closure of the Waste Storage or Processing Units or Operations

Closure of the waste storage or processing units or operations authorized under this permit will include removal of all waste, waste residues, and any recovered materials. The facility units and operations will either be dismantled and removed off-site or decontaminated. The site operator will dispose at the landfill or evacuate all materials (including feedstock, in process, and processed) to an authorized facility and disinfect all leachate handling units, tipping areas, processing areas, and post-processing areas. If there is evidence of a release from a unit or operation, the site operator will conduct an investigation, as approved by the TCEQ executive director, into the nature and extent of the release and an assessment of measures necessary to correct an impact to groundwater.

C. Final Closure of the Facility

In addition to the closure activities listed in Section V.A above for closing a landfill unit, the site operator will conduct the following activities for the closure of the entire facility:

(1) Publish Final Closure Notice and Place the closure Plan in a Public Place:

No later than 90 days prior to the initiation of the final facility closure, the site operator will:

(a) Publication of Notice:

The site operator will publish notice in the newspaper(s) of largest circulation in the vicinity of the facility to inform the public of the final closure of the facility. This notice will include:

- The name of the facility;
- The address, and physical location of the facility;
- The facility’s permit number; and
- The last date of intended receipt of waste.

(b) Place Copies of the Closure Plan in a Public Place:

The site operator will also make available an adequate number of copies of the approved final closure and post-closure plans for public access and review at the (state public place within the area, including address, where the plan will be available for public access and review): Sequin Public Library, 313 N Nolte St, Seguin, TX 78155.

(2) Submit Written Notice of "Intent to Close the Facility" to the TCEQ Executive Director:

The site operator will provide written notification to the TCEQ executive director of the intent to close the facility. This notice will be provided to the executive director no later than 90 days prior to the initiation of the final facility closure, and thereafter be placed in the site operating record.

(3) Post Signs and Install Barriers:

Upon notifying the executive director of the intent to close the facility and no later than 90 days prior to the initiation of final facility closure, the site operator will:

(a) Post Final Closure Signs:

The site operator will post a minimum of one sign at the main entrance and all other frequently used points of access for the facility notifying all persons who may utilize the facility of the date of closing for the entire facility and the prohibition against further receipt of waste materials after the stated date.

(b) Install Barriers:

Also, the site/operator will install suitable barriers at all gates or access points to adequately prevent the unauthorized dumping of solid waste at the closed facility.

(4) Filling of "Affidavit to the Public" and Performance of the Final Deed Recording:

Upon closure of all the landfill units or upon final closure of the facility, the site operator will:

(a) File Affidavit

File with the county deed records an "Affidavit to the Public" in a form provided by the TCEQ executive director that includes an updated metes and bounds description of the extent of the disposal areas at the facility and the restrictions to future use of the land in accordance with applicable provisions under 30 TAC Chapter 330, Subchapter T.

(b) Record a Notation on the Deed

Record a certified notation on the deed to the facility property, or on some other instrument that is normally examined during title search, that will in perpetuity notify any potential purchaser of the property that the land has been used as a landfill facility and use of the land is restricted according to the provisions under 30 TAC Chapter 330, Subchapter T.

(c) Place Documents in the Operating Record

Place a copy of the "Affidavit to the Public" and a copy of the modified deed in the site operating record.

(5) Submittal of a Copy of the "Affidavit to the Public" and the "Modified Deed" to the TCEQ Executive Director:

Within ten days after completion of final closure activities of the facility, the site operator will submit the following to the TCEQ executive director by registered mail:

(a) A certified copy of the "Affidavit to the Public";

(b) A certified copy of the modified deed to the facility property; and

(c) A certification, signed by an independent licensed professional engineer, verifying that final facility closure has been completed in accordance with the approved closure plan. The submittal will contain all applicable documentation necessary for certification of final facility closure, including:

- Final Cover System Evaluation Report (FCSER) documenting the installation of the final cover. The FCSER may be submitted earlier as a separate document for review and approval following the completion of the final cover installation. In that case, the certification of closure will be submitted subsequently;
- A final contour map as described under Item III.G above;
- Copy of a letter to the TCEQ regional office requesting a final closure inspection of the facility; and
- Copies of documents verifying newspaper publication of the notice of the final facility closure.

(6) Other

Additional items relating to the schedule for final facility closure, and additional closure activities specific to the final closure of this facility include:
N/A

(7) TCEQ's Acceptance of Termination of Operation and Closure of a Landfill Facility:

Following the TCEQ executive director's receipt and completion of the review of the professional engineer's certification of the completion of facility closure and the final closure documents, and receipt of the inspection report from the agency's regional office verifying proper closure of the facility according to this closure plan, the executive director will, in writing, accept the termination of operation and closure of the facility and deem it properly closed. Thereafter, the site operator will comply with the post closure care requirements described in the post closure plan for the facility.

(8) Final Closure Schedule for the Facility:

The attached Figure 1 (contained within the Closure Plan Narrative), Final Closure Schedule, provides the closure schedule for the final facility closure. It incorporates the schedule for closure of a unit as discussed in Section V.A and also shows the commencement and completion timelines for the final closure activities listed within this Section.

VI. Summary of Attachments

A. Drawings and Maps

The following Drawings and Maps are incorporated by reference as part of this plan.

- Closure Plan Drawing 7-1, Largest Area Requiring Final Cover.
- Part III, Att 2A, Drawing 2A-1A and 2A-1B Final Contour Map, and Drawings 2A-2 to 2A-17, Final Cover and Drainage Features Installation Drawings.
- Part III, Att 3A, Drawings 3A-6 to 3A-10 Cross-Section Drawings of the Landfill Units at Closure.
- Other Drawings/Maps:
  Part III, Att 3A, Drawing 3A-13 (Final Cover System Details).

B. Documents

- Attachment 7B, Final Cover Quality Control Plan (FCQCP).
- Figure 1 (contained in Closure Plan Narrative) Final Closure Schedule Chart.
- Other: N/A

C. Additional Items Attached (enter as applicable)

N/A

VII. Professional Engineer's Statement, Seal, and Signature

Name: Scott M. Graves, P.E.

Title: Senior Principal

Date: 10/11/2023

Company Name: Geosyntec Consultants, Inc.

Firm Registration Number: 1182

Professional Engineer's Seal

STATE OF TEXAS
SCOTT M. GRAVES
86557
LICENSED PROFESSIONAL ENGINEER

10/11/2023

FOR PERMIT PURPOSES ONLY

Signature

ATTACHMENT 7B

FINAL COVER QUALITY CONTROL PLAN (FCQCP)

ATTACHMENT 8

POST-CLOSURE PLAN

PART III – ATTACHMENT 7B
FINAL COVER QUALITY CONTROL PLAN (FCQCP)

MESQUITE CREEK LANDFILL
COMAL AND GUADALUPE COUNTIES, TEXAS
PERMIT AMENDMENT APPLICATION
MSW PERMIT NO. 66C

Prepared for:
Waste Management of Texas, Inc.

Prepared by:
Geosyntec consultants
Texas Board of Professional Engineers Firm Registration No. F-1182
8217 Shoal Creek Blvd, Suite 200
Austin, Texas 78757
(512) 451-4003

2/19/2024

SCOTT M. GRAVES
86557

FOR PERMIT PURPOSES ONLY

Submitted October 2023
Revised February 2024

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2/19/2024

STATE OF TEXAS
SCOTT M. GRAVES
86557
LICENSED PROFESSIONAL ENGINEER

FOR PERMIT PURPOSES ONLY

GEOSYNTEC CONSULTANTS, INC.
TEXAS ENG. FIRM
REGISTRATION NO. F-1182

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REGISTRATION NO. F-1182

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FOR PERMIT PURPOSES ONLY

GEOSYNTEC CONSULTANTS, INC.
TEXAS ENG. FIRM
REGISTRATION NO. F-1182

1. INTRODUCTION

1.1 Purpose

This Final Cover Quality Control Plan (FCQCP) for the Mesquite Creek Landfill (facility) was prepared to address 30 TAC §330.457(e)(1) by providing a description of the final cover design and methods and procedures to be used to install the cover. The FCQCP establishes the material requirements; construction installation requirements; quality control program; and quality assurance monitoring, testing, documentation, and reporting procedures that will be used during construction of the soils and geosyntheteics of the final cover system at the Mesquite Creek Landfill landfill. This FCQCP will be followed during closure of the disposal cells to verify that the final cover is constructed in accordance with the site-specific permitted design and with the applicable state regulations for final closure.

In this FCQCP, where cross-references are made to various other Part I through Part IV reports, plans, attachments/appendices, and drawings, they refer to the latest versions of these items contained in Parts I through IV of the permit application for MSW Permit No. 66C (and as updated via any approved amendments, corrections, or modifications issued by the Texas Commission on Environmental Quality (TCEQ) for this permit).

A copy of the current version of this FCQCP must be maintained on-site at all times. The FCQCP will also be made available to facility employees, construction personnel, and testing personnel at the outset of each final cover system project, and at any time upon request by TCEQ inspectors. Revisions to this FCQCP must receive written approval from TCEQ before implementation.

1.2 Final Cover System Design

Three types of final cover systems are addressed in this FCQCP: one for the pre-Subtitle D area of Unit 1 that is already final-covered but mentioned herein for completeness, and two options for the yet-to-be-final-covered Subtitle D areas of the landfill. A drawing that depicts cross-sectional views of the construction details of each proposed final cover system is presented on Drawing 3A-13 in Part III, Attachment 3A. The components of the proposed final cover systems are described below.

Pre-Subtitle D Final Cover System (at Unit 1 only) (components from top to bottom):

- an erosion layer of earthen material composed of a 6-inch (min) thick topsoil layer capable of sustaining native plant growth, and seeded or sodded immediately following the application of final cover in order to minimize erosion; and

- 1.5-ft (min) thick compacted soil layer composed of clayey earthen material and having a coefficient of permeability (i.e., a hydraulic conductivity) no greater than 1 × 10^{-5} cm/sec (i.e., $k \leq 1 \times 10^{-5}$cm/sec).

Standard Subtitle D Final Cover System Option (components from top to bottom):

- 2-ft (min) thick erosion layer, subdivided into:
  - a 6-inch (min) thick topsoil layer on the top surface, capable of sustaining native plant growth, and seeded or sodded immediately following the application of final cover in order to minimize erosion; and
  - underlying the topsoil, an 18-inch (min) thick cover soil layer;
- geocomposite drainage layer (double-sided on sideslopes, using geonet with nonwoven geotextiles bonded on both the top and bottom sides; single-sided on the 5% top-deck areas using geonet with a nonwoven geotextile bonded on the top side);
- 40-mil thick linear low-density polyethylene (LLDPE) geomembrane (textured on sideslopes, smooth or textured on the 5% top-deck areas); and
- 1.5-ft (min) thick compacted soil infiltration layer composed of clayey earthen material and having a coefficient of permeability (i.e., a hydraulic conductivity) no greater than 1 × 10^{-5} cm/sec (i.e., $k \leq 1 \times 10^{-5}$cm/sec).

Alternate Subtitle D Final Cover System Option Using Water-Balance (WB) Soil-Only Cover (components from top to bottom):

- an erosion layer of earthen material composed of a 6-inch or 12-inch thick topsoil layer(1) capable of sustaining native plant growth, and seeded or sodded immediately following the application of final cover; and
- 2-ft 11-inch (min) thick compacted soil storage layer composed of clayey earthen material and having a coefficient of permeability (i.e., a hydraulic conductivity) no greater than 5 × 10^{-8} cm/sec (i.e., $k \leq 5 \times 10^{-8}$ cm/sec).

(1)If the underlying compacted soil layer is classified by the unified soil classification system as SC (clayey sand) or CL (lean clay), the minimum topsoil thickness is 6-inches. If the underlying compacted soil layer is classified as CH (fat clay), the minimum topsoil thickness is 12-inches.

1.3 Definitions of Quality Assurance and Quality Control

In the context of this document, it is important to distinguish between construction quality assurance and construction/manufacturer quality control. Consistent with the 1993 U.S. Environmental Protection Agency (USEPA) Technical Guidance Document: *Quality Assurance and Quality Control for Waste Containment Facilities* [EPA/600-R-93/182] September 1993, these terms are defined as follows:

- Construction Quality Assurance (CQA) is a planned system of activities that provides the owner and permitting agency assurance that the facility is constructed as specified in the design. CQA includes observations and evaluations of materials and workmanship necessary to determine and document the quality of the construction, to assure conformity of final cover system construction with the requirements of the permitted design, as shown in this FCQCP, the permit drawings, and in project-specific Construction Documents. CQA is provided by a party who is independent from production and installation (i.e., independent of the Contractor, Geosynthetics Manufacturer(s), Geosynthetics Installer, and any other material suppliers).

- Construction Quality Control (CQC) and Manufacturing Quality Control (MQC) refers to those actions taken by the Contractor(s)/Installer(s) and by the Manufacturer (a.k.a. “Suppliers”), respectively, to ensure that the materials and the workmanship meet the requirements of the permitted design, as shown on project-specific Construction Documents including this FCQCP.

1.4 Manufacturer, Contractor, and Installer Responsibilities

In this document, the terms Manufacturer, Contractor, and Installer refer to those parties who are either manufacturing/supplying a geosynthetic material, or who are constructing and installing the final cover system components. It is the responsibility of the Manufacturer, Contractor, and Installer (as appropriate for various aspects of the work) to provide materials meeting the physical specifications provided herein, to construct the final cover system in accordance with the construction/installation specifications provided herein, and to follow at least the minimum QC requirements set forth in this document.

1.5 CQA Personnel Roles and Responsibilities

1.5.1 CQA Professional of Record (POR)

Each phase of the final cover system installation evaluation will be conducted by the CQA POR (hereafter referred to simply as “POR”) or by a qualified representative (described subsequently) under the direct supervision of the POR. It is the responsibility of the POR to oversee implementation of the FCQCP during closure construction at the disposal units to verify that the final cover system (materials, construction and installation activities, and QA/QC activities) is constructed in accordance with the site-specific permitted design and with the applicable state regulations for final closure. The POR will be an independent third-party professional engineer (P.E.) registered in Texas and experienced in geotechnical engineering and soils testing. In addition, the POR must also be familiar with the use of soils and geosynthetics for landfill construction and with the applicable regulatory requirements.

1.5.2 CQA Qualified Engineering Technician (QET)

A properly qualified QET may work under the direct supervision of the POR to monitor, test, and document the final cover system construction. As such, the QET's responsibility is to serve as a field representative of the POR, to monitor, test, and document that the final cover system is constructed in accordance with the requirements of this FCQCP and as further directed and overseen by the POR. The QET will have one of the following minimum levels of experience: (i) National Institute for Certification in Engineering Technologies (NICET) certification in geotechnical engineering technology at Level 2 (or higher); (ii) Geosynthetic Certification Institute's Inspectors Certification Program (GCI-ICP) certification; (iii) a minimum of four years of directly related landfill construction experience (or experience with similar low permeability compacted soil layers and geosynthetics installation used in other environmental containment applications); or (iv) for a graduate engineer or geologist with a bachelor of science degree, a minimum of one year of directly related experience. If there is more than one QET on-site at the same time on a project, a Lead QET meeting the above QET requirements will be designated.

1.6 Construction Timing, Sequencing, and Full-Time CQA

Final cover system components and related surface water management features will be constructed in a systematic and timely manner. Once construction is started, delays should be avoided unless adverse weather conditions prevent construction progress. Reasons for any final cover construction project delays should be fully explained in the Final Cover System Evaluation Report (FCSER). Work areas for final cover system construction should be selected, sized, and sequenced so that each day's work can be protected from adverse weather conditions. Furthermore, the selection of size and shape of work areas will be consistent, so that uniform construction/installation techniques and equipment can be selected.

Full-time on-site CQA will be provided during construction and installation of the final cover system soil and geosynthetics layers by the POR or his/her qualified representative(s) serving as QETs as described above. In the remainder of this document, the term "CQA personnel" refers collectively to either the POR or the QET(s) working on-site under direct supervision of the POR.

2. COMPACTED SOIL INFILTRATION LAYER

2.1 Introduction

This section addresses the specifications and CQA requirements for the compacted soil infiltration layer (i.e., low-permeability compacted soil layer, hereafter referred to simply as the "compacted soil"). Full-time on-site CQA will be provided during construction of the compacted soil layer by the POR or his/her qualified representative(s) serving as QET(s).

Note that this section *does not* address the requirements for the compacted soil *storage layer* component of the water balance final cover system. The storage layer of the water balance final cover system alternative is addressed separately in Section 7 of this FCQCP.

2.2 Compacted Soil Specifications

2.2.1 Compacted Soil Material Property Requirements

Material requirements for the physical properties of the compacted soil are presented in Table 7B-1.

2.2.2 Compacted Soil Moisture-Density Target Compaction Requirements

Each lift of the compacted soil layer will be compacted to at least 95% of the standard Proctor maximum dry density and a corresponding standard Proctor moisture content range between 0% to 5% wet of the optimum moisture content, as determined by standard Proctor test results (ASTM D 698) conducted on similar representative material during the pre-construction testing program, and provided that the required hydraulic conductivity specified herein for the type of final cover system being installed is achieved.

The above compaction criteria will be used, unless the pre-construction (i.e., borrow source materials) CQA laboratory testing program reveals the need for requiring higher densities or moisture contents (i.e., a more stringent set of criteria) to meet the required hydraulic conductivity specified herein, in which case the higher density and moisture values will be used as field compaction minimums. The maximum moisture contents listed above have been selected in consideration of compacted clay behavior for achieving shear strength, and minimizing the possibility of rutting under construction equipment or excessive desiccation cracking upon drying.

2.2.3 Compacted Soil Construction Requirements

2.2.3.1 Subgrade Preparation

A. The term "subgrade" refers to the surface on which the compacted soil layer component of the final cover system will be constructed. The subgrade will be either daily cover, intermediate cover, or earthen fill described below in Item B of this section. The subgrade will be graded to be relatively smooth and uniform, with positive drainage, and within general accordance of the specified lines and grades shown on the drawings. As shown on the final cover grading plan (Drawings 3A-5A and 3A-5B in Part III, Attachment 3A), the landfill is designed with top-deck slopes at 5% (nominal), and either 3.5 horizontal to 1 vertical (3.5H:1V) (i.e., 28.6%) (nominal) or 3H:1V (33.3%) (nominal) sideslopes between benches, depending on landfill area as reflected on the final cover grading plan. The subgrade will be free of exposed waste, debris, organic matter (i.e., roots, vegetation), standing water, or excessive moisture. To achieve the lack of organic matter specified in the preceding sentence, the subgrade will be cleared as necessary (e.g., using a bulldozer blade) to remove roots and vegetation from the subgrade surface.

B. For areas requiring placement of additional fill to achieve the subgrade elevations for the compacted soil layer, earthen fill will be placed and compacted using the same soil material and placed in the same manner as is used for daily and intermediate cover (e.g., tracked-in with a dozer, if that was the method for daily/intermediate cover). The purpose of this provision is to result in the entire subgrade being on a consistently firm layer (i.e., minimize the potential for differential conditions due to overly firm areas).

C. For areas requiring cut to achieve the subgrade elevations for the compacted soil layer, once design elevations are reached the subgrade surface will be proof-rolled and observed by CQA personnel for evidence that the surface provides support to adequately place and compact subsequent lifts of the overlying compacted soil layer (e.g., lack of excessive pumping, rutting, deflection of ground surface, etc.).

D. Soft, excessively wet, or otherwise deleterious subgrade areas as identified by CQA personnel will be removed (over-excavated) and replaced with earthen fill resulting in a consistently firm layer, to achieve the design elevations and to provide a sufficient foundation (base) capable of supporting placement and compaction of subsequent overlying lifts of the compacted soil layer of the final cover. The extent of over-excavation will be identified by CQA personnel so that the affected area provides a firm foundation and ties in to surrounding areas with acceptable proof-roll results or properly placed earthen fill.

2.2.3.2 Groundwater and Standing Water Considerations

A. Compacted soil layer construction will not take place in standing (ponded) water.

B. Completed compacted soil layer areas, both during ongoing construction and after submittal of the FCSER, will have sufficient surface-water drainage controls to prevent the accumulation of water. Any ponded water that accumulates on newly constructed compacted soil layer surfaces will be promptly removed.

2.2.3.3 Placement and Compaction

A. Scarification. Prior to placing a lift, the existing surface (i.e., top of subgrade or previous lifts) will be scarified by tracking with a dozer, making a pass with the compactor, or similar as approved by the POR to promote bonding between the top of subgrade and the first lift, and between adjacent lifts. The depth of scarification for the top of surface should be at least 2 inches.

B. Lift Thickness. Compacted soil material will be placed in loose lifts of uniform thickness generally not exceeding 8-inches thick after spreading and leveling, resulting in a compacted thickness of approximately 6-inches thick. In all cases, the loose lift thickness must not be greater than the pad/prong length of the compactor to promote bonding between lifts, reduce individual clods, and help blend and knead the soil matrix.

C. Soil Processing. Compacted soil material will be processed as needed either in-place on the loose lift or in a separate processing area to yield a relatively uniform soil matrix devoid of large clods or macrostructural features that may contribute to excessively high hydraulic conductivity. Clod size in the compacted soil should not exceed approximately 1 inch in diameter, and in all cases will be reduced to the smallest size necessary to achieve acceptable hydraulic conductivity during the pre-construction CQA laboratory testing. Processing may be achieved by disking, grading, compacting, or pulverizing.

D. Moisture Conditioning. Moisture conditioning (either adding water to the soil or drying the soil) of the compacted soil layer will be performed as needed to adjust the in-place moisture content to within the specified range of allowable moistures and densities. If water addition is required, the water will be uniformly distributed over the lift using water trucks with pressure-spray capabilities or similar. Proper hydration time, as evaluated by CQA personnel, will be allowed so the added water blends and mixes with the soil. Care will be taken to prevent over-watering and ponding of water within the loose lift, as this excess water is difficult to redistribute. If drying is necessary, it will be accomplished by disking or similar techniques to lower the moisture content to the required range in a relatively uniform and controlled manner.

E. Moisture Content and Density, and Hydraulic Conductivity. Each lift of compacted soil will be compacted to meet the required range of moisture contents and densities, expressed as a percentage of the maximum dry density and corresponding moisture content percentage as developed and specified based on the compaction testing as described in Section 2.2.2. These compacted soils must, upon testing via the laboratory conformance testing program described hererin, demonstrate a coefficient of permeability (i.e., hydraulic conductivity) of no greater than that specified in Table 7B-1 for the type of final cover system being used.

F. Equipment. Compaction equipment must have (i) either pad/tamping-foot rollers or prong-feet (sheepsfoot) rollers and (ii) an operating weight and characteristics capable of kneading and compacting the soil to within the specified range of moisture contents and densities). Use of bulldozers, pneumatic rollers, rubber-tired equipment, or flat-wheel rollers as the compaction equipment is not allowed.

G. Equipment Passes. Compaction equipment should conduct a sufficient number of passes across a lift to ensure adequate remolding and lift bonding of each soil lift. The number of equipment passes to achieve the desired results may vary depending on the liner material and the field CQA test results.

H. Non-Conforming Tests. Should the CQA field tests (described subsequently in this FCQCP) indicate that the moisture content or density of any layer of compacted soil material, or portion thereof, is not within the range of allowable moistures and densities, the representative portions of that particular layer will be reworked and retested.

2.2.3.4 Compacted Soil Layer Tie-In

A. Tie-in of a new section of compacted soil to an older (i.e., previously constructed) section of compacted soil will be accomplished by either: (i) stair-step method; or (ii) slope method.

    1) For the stair-step method, the older compacted soil layer will be cut back at least 2.5-feet on 6-inch thick offset layers and the surface scarified so that the edge of each lift of the existing layer is tied-in to new construction without superimposed construction joints.

    2) For the slope method, the older section of compacted soil layer will be cut back at a 5H:1V (horizontal:vertical) slope and the surface scarified, so that the edge of the existing layer is tied-in to new construction without superimposed construction joints.

2.2.3.5 Sideslope Construction Considerations

A. All of the proposed final cover system sideslopes are designed at a slope of 3H:1V or flatter. The compacted soil layer on the sideslopes will be constructed in lifts parallel to the slope.

    1) For parallel lift construction, compaction equipment will run up and down the slope.

2) Visual observation will be made by construction and CQA personnel to verify that the eccentric weight of the equipment (with its tendency to slide down the slope) does not cause shearing of the upper portion of the lift.

2.2.3.6 Top of Compacted Soil Layer Preparation and Maintenance

A. The top surface of the compacted soil layer will be relatively smooth and uniform and free of irregularities, dimples, loose soil, or abrupt changes in grade. The surface on which the geomembrane will be installed (subgrade) should be free of sharp stones, stones larger than 3/8-inch, sticks, or other debris/deleterious materials that can cause damage to the geomembrane.

B. The top surface of the compacted soil layer should not exhibit excessive desiccation prior to placement of the overlying geomembrane and will be maintained (e.g., kept moist, smooth-drum rolled) as needed to prevent formation of excessive desiccation cracks.

C. The surface of the compacted soil layer will also be kept free of standing water from rainfall events. Damage caused by precipitation will be repaired, and if the lift must be reworked as determined by CQA personnel, then appropriate retesting of the lift will be performed.

2.3 <u>CQA of Compacted Soil</u>

2.3.1 General

This section of the FCQCP addresses the CQA program to be implemented with regard to the compacted soil component of the final cover system. The following CQA activities are discussed in the remainder of this section:

- Pre-Construction (i.e., Borrow Source) Evaluation of Material Sources;
- Material Conformance Testing During Construction;
- Field Evaluation/Monitoring During Construction;
- Conformance Testing of Constructed Work Product;
- Deficiencies, Problems, and Repairs;
- Thickness Verification; and
- Compacted Soil Documentation.

2.3.2 Pre-Construction (i.e., Borrow Source) Evaluation of Material Sources

Prior to construction of the compacted soil layer, CQA personnel will obtain a soil sample from the proposed borrow source(s). Each such borrow source will be evaluated for potential use as compacted soil by performing the pre-construction laboratory tests presented in Table 7B-2.

2.3.3 Conformance Testing of Borrow Source During Construction

When soil from the borrow/stockpile area is easily distinguished and consistent with the soil characterized during pre-construction testing, additional ongoing laboratory conformance testing of material at the borrow source, beyond the initial pre-construction tests, is not required. USCS testing may be used to help determine whether there has been a change in borrow source soil material. Testing for the liquid limit (LL) and plasticity index (PI) may also be used to help determine if there has been a change in borrow source material. Any time the compacted soil material being used becomes variable, or soils vary or appear inappropriate or questionable compared to the results from the initial pre-construction test program, additional material conformance testing of the tests and methods outlined in Table 7B-2 should be performed at a frequency of one series of tests per 20,000 cubic yards of compacted soil layer material or until a consistent soil type is easily distinguished.

2.3.4 Field Evaluation/Monitoring During Construction

CQA personnel will be on-site at all times when compacted soil layer construction is ongoing, so that all relevant activities can be observed and documented. The POR will visit the site periodically as construction progress warrants. Such visits will be frequent enough so that the POR is fully knowledgeable of the construction methods and performance, so that the POR can determine that QC monitoring and testing activities are adequate to meet the terms and intent of this FCQCP. CQA personnel will visually monitor and document that construction of the compacted clay layer is in accordance with the specifications and requirements set forth previously in this FCQCP. These observations will include, but not be limited to, monitoring of:

- moisture content and distribution, particle size, and other physical properties of the soil during processing, placement, and compaction;
- type and level of compactive effort, including roller type and weight, drum size and foot length, and number of passes;
- action of compaction equipment on soil surface (i.e. foot penetration, rolling, pumping, or shearing);
- maximum clod size and breakdown of soil structure;

- method of bonding lifts together and making layer tie-ins;

- stones or other inclusions which may damage adversely affect compaction, lift bonding, and in-place testing/sampling; and

- areas where damage due to excess moisture, insufficient moisture, or freezing may have occurred.

2.3.5 Conformance Testing of Constructed Work Product

2.3.5.1 Routine Field Testing

Field testing (e.g., density and moisture content testing) and conformance sampling and testing of placed/compacted soil will be performed by CQA personnel during construction to evaluate the Contractor's work product with respect to the requirements of the specifications as set forth in this FCQCP. The test methods and minimum frequencies for routine CQA field/conformance testing of the compacted soil are given in Table 7B-3. Sampling and test locations will be selected by CQA personnel.

The compacted soil moisture and density field testing results will be expressed as a percentage of the maximum dry density and corresponding moisture content percentage, and the results of undisturbed sampling and testing must demonstrate a coefficient of permeability (i.e., hydraulic conductivity) no greater than that specified (per Table 7B-1 for the appropriate type of final cover system being constructed).

2.3.5.2 Special Testing

A special testing frequency will be implemented at the discretion of CQA personnel when observations indicate potential problems, or as requested by the facility. Additional testing for suspected areas will be considered when:

- the compactor rollers slip during rolling operations;
- the lift thickness is greater than specified;
- the material is at improper and/or highly variable moisture content;
- fewer than the anticipated number of roller passes are made;
- dirt-clogged rollers are used to compact the material;
- the fill materials differ substantially from those specified; or
- the degree of compaction is doubtful.

During construction, the frequency of testing may also be increased in the following situations:

- adverse weather conditions;
- breakdown of equipment;
- at the start and finish of grading;
- if the material fails to meet specification requirements;
- the work area is reduced; or
- as otherwise requested by the facility.

2.3.5.3 Perforations

Perforations are holes in the compacted soil layer that must be filled, and may include, but are not limited to, the following:

- nuclear density test probe locations;
- undisturbed hydraulic conductivity test tube locations; and
- sand cone test locations or other density verification test methods.

All perforations in the compacted soil layer created during any sampling or testing will be backfilled using a mixture of at least 20% bentonite by volume mixed with compacted soil material and compacted in place with a tamping rod, or using an appropriate bentonite grout.

2.3.5.4 Placement of Overlying Layers

All testing and evaluation of the compacted soil layer will be complete prior to installing the overlying layers.

2.3.6 Deficiencies, Problems, and Repairs

If a deficiency or noncompliance in the compacted soil is discovered, CQA personnel will promptly evaluate the extent and nature of the defect. The extent of the deficient area will be evaluated by additional tests, observations, a review of records, or other means deemed appropriate.

Sections of compacted soil layer that do not pass the required field tests (including failures due to not meeting the required hydraulic conductivity) will be reworked as appropriate (e.g., water added, additional compaction passes, etc.) and retested until the section in question does pass. If a failure occurs, first the failing area will be defined. This will be accomplished by performing additional tests between the failed test and the nearest adjacent passing test locations. If those additional tests pass, then the area between the failed test and the additional passing tests must be reworked and retested until passing. If the additional tests fail, then additional tests must be performed halfway between the initial additional tests and the adjacent passing tests to further define the failing area. This procedure must be repeated until the failing area is defined, reworked, and retested with passing results. All field moisture-density results will be reported in the FCSER whether they indicate passing or failing values, and all passing hydraulic conductivity test results will be reported in the FCSER.

2.3.7 Thickness Verification

Compacted soil layer thickness verification will be performed at the frequency given in Table 7B- 3 by making survey comparisons of the subgrade vs. the top of compacted soil layer (at the same verification point) to calculate and verify thickness.

2.3.8 Compacted Soil Layer Documentation

Documentation of the compacted soil layer will be included in the FCSER. The required FCSER contents are described subsequently in Section 9 of this FCQCP.

TABLE 7B-1
MATERIAL SPECIFICATIONS FOR COMPACTED SOIL

PROPERTY	QUALIFIER	UNITS	SPECIFIED VALUES for STANDARD SUBTITLE D AND PRE-SUBTITLE D COMPACTED SOIL LAYER(2)	STANDARD TEST METHOD(1)
Percent Passing 1-inch Sieve	Minimum	Percent	100	ASTM D 422
Percent Passing #200 Sieve	Minimum	Percent	50	ASTM D 422 or D 1140
Liquid Limit	Minimum	Percent	24	ASTM D 4318
Plasticity Index	Minimum	Percent	12	ASTM D 4318
Hydraulic Conductivity	Maximum	cm/sec	1×10^{-5}	ASTM D 5084(3,4)

Notes:

(1) CQA testing minimum frequencies for compacted soil are provided in Tables 7B-2 and 7B-3 of this FCQCP.

(2) Compacted soil material should also be classified and be within a Unified Soil Classification System (USCS) group category per ASTM D 2487 that meets the particle size and plasticity requirements given above.

(3) Hydraulic conductivity refers to a coefficient of permeability measured by either ASTM D 5084, “Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter” as indicated in the above table; or the falling head testing procedures in Appendix VII of the Corps of Engineers Manual EM 1110-2-1906 may be used as an alternative method.

(4) Tables 7B-2 and 7B-3 provide CQA testing requirements with additional details on the required hydraulic conductivity test method and associated testing conditions.

TABLE 7B-2
PRE-CONSTRUCTION TESTING REQUIREMENTS FOR COMPACTED SOIL
SOIL TEST CATEGORY: BORROW SOURCE MATERIALS

TYPE OF TEST	STANDARD TEST METHOD	MINIMUM FREQUENCY OF TESTING for STANDARD SUBTITLE D AND PRE-SUBTITLE D COMPACTED SOIL LAYER(1)
Unified Soil Classification	ASTM D 2487	1 per soil type
Particle Size (Sieve) Analysis	ASTM D 422	1 per soil type
Atterberg Limits	ASTM D 4318	1 per soil type
Natural (as-received) Moisture Content	ASTM D 2216	1 per soil type
Moisture/Density Relationship	ASTM D 698	1 per soil type
Remolded Hydraulic Conductivity(2)(3)	ASTM D 5084	1 per moisture/density relationship

Notes:

(1) The testing frequency of one per soil type refers to a relatively consistent and distinguishable soil type at a borrow source location based on visual observations and field classification procedures. See Section 2.3.3 for the frequency of additional testing of a borrow area with observed soil characteristics that become variable/inconsistent, or otherwise appear questionable compared to the results from the initial pre-construction test program. If the same soil type and source are utilized for the soil supply of more than one final cover area project, results from previous pre-construction tests are allowed to continue to be used provided that the soil type remains consistent, distinguishable, and representative.

(2) Hydraulic conductivity testing will be performed using tap water or a 0.05N solution of $CaSO_4$ and at an effective stress of 2 psi. Distilled or deionized water will not be used. The permeant should be deaired. Hydraulic conductivity test data will be submitted with the FCSER. The test method should be ASTM D 5084, "Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter," as indicated in the above table, or the falling head testing procedures in Appendix VII of the Corps of Engineers Manual EM 1110-2-1906 may be used as an alternative method.

(3) Perform remolded hydraulic conductivity test on a remolded sample that is compacted greater than or equal to 95% of the maximum dry density and at the optimum moisture content as determined from the Standard Proctor test.

(4) Also see Section 8 of this FCQCP for interface shear strength conformance testing requirements that include the compacted soil interface for final cover systems using a geomembrane.

TABLE 7B-3
CONFORMANCE TESTING REQUIREMENTS FOR COMPACTED SOIL
SOIL TEST CATEGORY: CONSTRUCTED SOIL LAYERS

TYPE OF TEST	STANDARD TEST METHOD	MINIMUM FREQUENCY OF TESTING
In-Place Field Density & Moisture Content (Nuclear Gauge)	ASTM D 6938	1 per 16,000 ft^2 per 6-inch lift (minimum 3 tests per lift)
Particle Size (Sieve) Analysis	ASTM D 422	1 per 100,000 ft^2 per 6-inch lift (minimum 1 test per lift)
Atterberg Limits	ASTM D 4318	1 per 100,000 ft^2 per 6-inch lift (minimum 1 test per lift)
Undisturbed Hydraulic Conductivity	ASTM D 5084(1)	1 per acre evenly distributed through all lifts (test each 6-inch lift at a minimum of 1 test per 3 acres, and at least a minimum of 1 test per lift)
Layer Thickness Verification	See Section 2.3.8	1 per 10,000 ft^2 of surface area using uniform grid pattern (minimum two verification points)

Notes:

(1) Undisturbed hydraulic conductivity tests will be performed using tap water or a 0.05N solution of $CaSO_4$ and at an effective stress of 2 psi. Distilled or deionized water will not be used. The permeant should be deaired. Hydraulic conductivity test data will be submitted with the FCSER. The test method should be ASTM D 5084, "Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter," as indicated in the above table, or the falling head testing procedures in Appendix VII of the Corps of Engineers Manual EM 1110-2-1906 may be used as an alternative method.

3. GEOMEMBRANE

3.1 Introduction

This section addresses the specifications and CQA requirements for the 40-mil linear low-density polyethylene (LLDPE) geomembrane component of the final cover system. Full-time on-site CQA will be provided during geomembrane installation by the POR or his/her qualified representative(s) serving as QET(s).

3.2 Geomembrane Specifications

3.2.1 Geomembrane Material Property Requirements

A. Geomembrane Resin Formulation. The geomembrane resin properties shall be in accordance with the properties listed below, taken from the most recent version of Geosynthetics Research Institute (GRI) Test Method GM-17 for LLDPE geomembranes (i.e., the current industry standard).

1) the resin density (per ASTM D 792 or D 1505) should be generally in the range of 0.926 grams per milliliter (g/ml) or lower, and have a melt flow index per ASTM D 1238 of less than 1.0 grams per 10 minutes (g/10 min).

2) The resin shall be virgin material with no more than 10% rework. If rework is used, it must be a similar LLDPE formulation as the parent material.

3) No post-consumer resin (PCR) of any type shall be added to the formulation.

B. Geomembrane Property Requirements. The geomembrane material properties shall meet the minimum values set forth in the most recent version of GRI Test Method GM-17. These requirements, taken from GRI GM-17, are provided in Tables 7B-4a and 7B-4b for textured and smooth geomembranes, respectively.

3.2.2 Manufacturing Quality Control (MQC)

A. The geomembrane Manufacturer shall implement a MQC program for materials related to geomembrane manufacturing, which shall include MQC sampling and testing to demonstrate the geomembrane quality and suitability for use.

B. For the resin, MQC tests for resin density and melt flow index shall be performed in accordance with GRI GM-17 and at a minimum frequency of one per batch and every resin lot.

C. For the geomembrane, MQC tests shall be performed in accordance with GRI GM-17 (see Tables 7B-4a and 7B-4b (textured and smooth, respectively) for the required MQC tests, methods, and minimum frequencies, per GRI GM-17).

D. Prior to shipping, the geomembrane Manufacturer shall provide CQA personnel with the required MQC information presented subsequently in Section 3.3.2 of this FCQCP, including results of the required MQC tests. Any sample that does not comply with the requirements shall result in rejection of the roll from which the sample was obtained.

3.2.3 Shipping, Delivery, Handling, and Storage

A. Geomembrane will be shipped in rolls (folded or creased sections of panels are not acceptable), each labeled with the manufacturer’s name and product identification (e.g., batch and roll numbers, dimensions, weight, etc.). Upon delivery, the material will be unloaded using appropriate equipment such as cranes or backhoes, forklifts, or similar equipment and stored in a manner that avoids damaging the material, such as not pushing, sliding, or dragging the rolls.

B. The delivered geomembrane rolls will be inspected by CQA personnel for pinholes, excessive surface blemishes/scratches, or other defects (e.g., non-uniform color, discernible agglomorates of carbon black or other additives, etc.).

C. The geomembrane rolls should be stacked no more than five rolls high, and stored in a manner as to avoid shifting or other adverse movements that could damage the geomembrane or crush the roll cores.

D. The stored geomembrane will be in an area where water cannot accumulate and will also be protected from soft/wet ground or rocky/rough ground, and from excessive ultraviolet (UV) exposure in accordance with manufacturer’s recommendations. Temporary cover or shelter should be provided for rolls of geomembranes expected to be stored longer than six months at the facility to protect against precipitation, UV exposure, and/or accidental damages.

3.2.4 Geomembrane Installation Requirements

3.2.4.1 General

A. The geomembrane must be installed in accordance with the manufacturer’s recommendations, and in a manner that achieves direct and uniform contact with the underlying compacted soil. The geomembrane should not be placed during inclement weather such as high winds, rain, or freezing temperatures.

3.2.4.2 Geomembrane Subgrade Preparation

A. The geomembrane subgrade (i.e., top of compacted soil layer surface on which geomembrane will be deployed) will be prepared and maintained in accordance with the requirements previously set forth in Section 2.2.3.6 of this FCQCP. In particular, the geomembrane subgrade will be smooth, free of sharp stones, stones larger than 3/8-inch, sticks, or other debris, and must not exhibit excessive moisture, nor excessive desiccation prior to geomembrane deployment. The Geosynthetics Installer and CQA personnel will document their acceptance of the geomembrane subgrade prior to geomembrane deployment.

3.2.4.3 Equipment on Geomembrane

A. Lightweight and low ground pressure geomembrane installation support equipment such as a four-wheeled rubber-tired all terrain vehicle (ATV) or similar equipment may be allowed on the geomembrane, but must not engage in any activity that could damage the geomembrane. A rub sheet or similar equivalent protection may be used as an additional temporary protective measure for low ground pressure geomembrane support equipment.

B. No construction equipment will be allowed on the geomembrane. CQA personnel will have any damaged areas of geomembrane due to vehicular traffic repaired appropriately. Personnel working on the geomembrane should not smoke, wear damaging shoes, or engage in any other activity likely to damage the geomembrane.

3.2.4.4 Deployment

A. Only those panels of geomembrane that are to be placed and seamed in one day should be unrolled. Panels left unseamed at the end of each day or an installation segment should be anchored with sand-bags or similar weights (staples or other penetrating items should not be used). Sheets should be positioned with the overlap recommended by the manufacturer for the type of seam welding to be performed, but no less than 3 inches.

B. Panels should generally be oriented parallel to the line of maximum slope (i.e., up and down the slope, not across the slope). In corners and irregular shaped areas, the number of seams will be minimized. Rolls will be carefully pulled or rolled down the slope to avoid damage.

C. Wrinkles will be minimized, and will be walked-out or removed as much as possible prior to seaming.

3.2.4.5 Field Seaming

A. Field seaming will be performed using only dual-track hot wedge fusion welding (hereafter referred to simply as “fusion welding”) or extrusion fillet welding (hereafter referred to simply as “extrusion welding”), in strict accordance with methods and protocols recommended by the manufacturer and all requirements presented herein. Tack welds (if used) will use heat only; no double-sided tape, glue, solvent, or other method will be permitted when fusion or extrusion welding is used for bonding.

B. Field seaming should not take place when ambient temperatures are below 32 degrees Fahrenheit (°F), unless the cold-weather seaming procedures set forth in the GRI Test Method GM-9 are followed. Seaming will not be permitted at ambient temperatures above 104°F unless the Geosynthetics Installer can demonstrate through acceptable trial seams that the seam quality is not compromised.

C. Foreign matter (soil, water, oil, debris, etc.) will be removed from the geomembrane edges to be bonded (seamed). For extrusion welds, the bonding surfaces must be thoroughly cleaned by mechanical abrasion or alternate methods in accordance with manufacturers recommendations.

D. Large wrinkles, "fish-mouths," or folds will not be allowed in the seam. Where wrinkles, fish-mouths, or folds occur, the material will be cut along the ridge of the wrinkle in order to achieve a flat overlap, followed by repair/patching of the cut. The repairs will be accomplished such that constructed seams are not required to carry significant tensile loads. Wrinkle, fish-mouth, or fold repairs may not require a 3-inch minimum overlap if approved by CQA personnel.

E. Seaming will extend to the outside edge of the geomembrane panels that are to be placed in anchor trenches.

3.2.4.6 Trial Seaming

A. Each day prior to commencing field seaming, trial seams will be made on fragment pieces of geomembrane material to verify that seaming conditions are adequate for production seaming. Trial seams should be made on the types of geomembrane that the seamer intends to seam in the field. Trial seam testing will also be conducted at shift changes, after each extended break during the workday, upon significant change in ambient environmental conditions, and when equipment has been turned off for more than 30 minutes. For extrusion welding, each welder and their seaming apparatus must be tested. For fusion welding, only the apparatus must be tested. Requirements for trial seams are as follows:

  1) The test seam sample will be at least 3 feet long by 1 foot wide with the seam centered lengthwise. Four to six adjoining specimens 1 inch wide each will be die cut from the test seam sample. These specimens will be tested in the field with a tensiometer (i.e., "extensometer") for both shear (at least 2 specimens) and peel (at least 2 specimens, 4 when possible if testing both inner and outer welds for dual-track fusion welding). Test seams will be tested by the Geosynthetics Installer under observation of CQA personnel. The specimens should not fail in the weld; they must exhibit an acceptable locus-of-break pattern/code as specified in the most current version of GRI Test Method GM-19a. The Geosynthetics Installer will supply all necessary knowledgeable personnel and

testing equipment. The extensiometer testing apparatus used for peel and shear tests must have an up-to-date calibration certificate traceable to the National Bureau of Standards or other appropriate state or federal agency. No strain measurements need be obtained in the field.

2) A passing fusion or extrusion welded test seam will be achieved when the criteria presented in Table 7B-5a are satisfied (with the exception that elongation/separation field measurements/requirements may be eliminated). If a test seam fails, the entire trial seam operation will be repeated. If the additional test seam fails, the seaming apparatus or seamer will not be accepted and must not be used for field seaming until the deficiencies are corrected and two consecutive successful full test seams are achieved. Test seam failure is defined as failure in either shear or peel. For double-weld seams, both welds must meet the test seam criteria.

3.2.4.7 Nondestructive Seam Field Testing

A. Production seams will be tested by the Geosynthetics Installer continuously (100% of seams) using non-destructive techniques, under the continuous observation of CQA personnel, using the methods and at the minimum frequencies given in Table 7B-5b. Further descriptions of the testing requirements are provided below.

1) Dual-Track Fusion Welded Seams – Air-Pressure Testing. The Geosynthetics Installer will perform air pressure testing of all dual-track fusion seams in accordance with the standard test methods specified in Table 7B-5b. A loss of < 4 psi is acceptable if it is determined that the air channel is not blocked between the sealed ends. A loss of ≥ 4 psi indicates the presence of a seam leak that must then be isolated and repaired (described below).

2) Extrusion Welded Seams – Vacuum Box Testing. The Geosynthetics Installer will perform continuous vacuum box testing on all extrusion welds that can be tested in this manner, in accordance with the standard test methods specified in Table 7B-5b. Extrusion welds at pipe boots and other similar appurtenances do not easily lend themselves to vacuum testing due to their irregular shape and curved welded surface. The vacuum box test will be performed by applying a suction of approximately 4 to 8 psi and holding the suction at least 10 seconds while observing for leaks.

B. All seams which cannot be nondestructively tested will be overlain (capped) with the same geosynthetic material.

C. Seam leaks as identified through failing nondestructive tests will be repaired using extrusion welding by installing patches or cap strips of the same geosynthetic material for a distance of at least 6 inches on each side of the faulty spot or area detected. These repairs will then be re-tested nondestructively (at a minimum) and passing results must be obtained in order for CQA personnel to accept the seam.

3.2.4.8 Destructive Seam Field Testing

A. Destructive testing will be performed on production seams using the methods and at the frequency given in Table 7B-5a. At a minimum, a destructive test will be performed for each welding machine used for seaming or repairs. The locations will be selected by CQA personnel. The samples obtained by the Geosynthetics Installer will be of sufficient size to provide one sample to the archive, one sample to CQA personnel for independent laboratory testing, and two samples to be retained by the Geosynthetics Installer for both field and laboratory testing.

B. All field-tested samples must exhibit acceptable shear and peel strengths and locus-of-break pattern as specified in Table 7B-5a. Independent laboratory testing must confirm that passing results (for locus-of-break pattern, strength, elongation, and percent peel separation) are achieved.

C. Destructive seam testing locations will be cap-stripped with the same geosynthetic material, for a distance of at least 6 inches on each side of the testing location and have the cap completely seamed by extrusion welding and verified acceptable by nondestructive testing as described above.

D. Samples that do not pass the shear and peel tests will be re-sampled from locations at least 10 feet on each side of the original location. These two re-test samples must pass both shear and peel testing. If these two samples do not pass, then additional samples will continue to be obtained until the questionable seam area is defined, and the failed seam will be reconstructed.

E. All acceptable repaired seams must be bounded by two locations from which samples passing laboratory destructive tests have been taken.

3.2.4.9 Anchor Trench and Backfilling

A. An anchor trench should be completed around all portions of the geomembrane where the leading edge(s) of the geomembrane will not be needed for a future tie-in (i.e., next area to be lined). The inside edge of the trench should be rounded to help protect the geomembrane from excessive stresses. Excessive amounts of loose soil will not be allowed underneath the geomembrane in the trench. The anchor trench will then be backfilled and compacted as deemed suitable by the POR (target compaction of at least 90% standard Proctor maximum dry density), while using care to prevent damage to the geomembrane during backfilling. Anchor trench excavations and backfilling should be timed closely with the installation of geomembrane (i.e., completed at the earliest practicable time following geosynthetics deployment).

3.2.4.10 Geomembrane Protection

A. Unapproved equipment must not be operated directly on the geomembrane. Other than the geomembrane installation support equipment described previously, construction equipment or vehicles must not be operated above the geomembrane unless the equipment or vehicles meet the following ground pressure requirements and the corresponding required thickness of overlying soil is present.

Allowable Equipment Ground Pressure (psi)	Minimum Thickness of Soil Overlying Geomembrane (in.)
<5	12
<10	18
<20	24
>20	36

3.3 CQA of Geomembrane

3.3.1 Overview

This section of the FCQCP addresses the CQA program to be implemented with regard to the geomembrane component of the final cover system. The following activities are discussed in the remainder of this section:

- Pre-Installation Qualifying of Material Sources;
- Material Conformance Testing;
- Field Evaluation/Monitoring During Installation;
- Field Testing of Work Product;
- Deficiencies, Problems, and Repairs; and
- Geomembrane Documentation.

3.3.2 Pre-Installation Qualifying of Material Sources

Prior to installation of any geomembrane, the Manufacturer will provide CQA personnel with manufacturer's certification statements and quality control information, including the following:

- Certification statement from the resin supplier stating that the resin properties are met for the specified test procedures and properties listed in the specifications presented in Section 3.2.1.
- Copies of dated quality control certificates issued by the resin supplier for the resin density and melt flow index at the minimum frequency of one per each resin lot for the resin used in geomembrane production.
- Written certification, signed by a responsible party employed by the Manufacturer, indicating that the specified roll values are met for physical, mechanical, and environmental properties corresponding to the test procedures for the required geomembrane properties listed in the specifications presented previously in this section (Tables 7B-4a and 4b).
- MQC certificates with test results, signed by a responsible party employed by the Manufacturer. Each quality control certificate will include date, roll identification numbers, testing procedures, and results of quality control tests performed using the methods specified and at the required minimum frequencies given in the specifications presented previously in Section 3.2.2.

CQA personnel will examine all Manufacturer’s certifications to verify that the property values listed on the certifications meet or exceed the specifications and that proper and complete documentation has been provided for all geomembranes to be used at the site. CQA personnel will report any deviations from the above requirements to the Manufacturer, Installer, and the Owner prior to installation of the geomembrane. Any sample that does not comply with the requirements will result in rejection of the roll from which the sample was obtained, and additional testing of rolls from the same lot or batch until a pattern of acceptable test results is established.

3.3.3 Material Conformance Testing

Conformance testing requirements for the geomembrane are presented in Table 7B-6. Conformance testing will be performed by an independent, third-party geosynthetics testing laboratory. Conformance sampling may be performed either at the manufacturing plant [by the POR or his/her representative, or by an independent, third-party “in-plant sampling” firm arranged for and agreed upon by the POR or his/her representative (typically personnel from the third-party geosynthetics laboratory)] or upon delivery of rolls to the site [by the POR or his/her representative], as requested by the Owner. Conformance samples will be taken across the entire roll width. The conformance samples should be obtained in a manner consistent with GRI Standard GS16, “Geosynthetic Sampling for Subsequent Laboratory Conformance Testing.” All conformance test results will be reviewed by CQA personnel prior to deployment of the material. Any nonconformance will be immediately reported to the Owner. When a sample fails a conformance test, the material from the lot represented by the failing test should be considered out-of-specification and rejected.

Additional conformance samples may be taken to isolate the portion of the lot not meeting the specifications. To isolate the out-of-specification material, two additional conformance samples should be taken from the closest numerical roll numbers to the failing sample. If both samples pass, only the initial failed roll will be rejected. If any one of the additional tests fail, then the entire lot will be rejected and the procedure may be repeated with additional tests to further bracket the failing rolls within the lot.

3.3.4 Field Evaluation/Monitoring During Installation

3.3.4.1 General

Installation of the geomembrane will have continuous monitoring by CQA personnel.

Prior to construction, CQA personnel and the Owner will review the proposed panel layout plan prepared by the Geosynthetics Installer. The purpose of the review is to become familiar with the proposed orientation of the panels, the general installation sequencing, the quantities of materials needed for the job, and to assess whether the proposed installation layout complies with the relevant specifications.

3.3.4.2 Transportation, Handling, and Storage

CQA personnel will inspect and inventory the geomembrane rolls in their storage area prior to use. Any damaged rolls will be repaired or replaced.

3.3.4.3 Condition of Geomembrane Subgrade

Prior to deployment of geomembrane, CQA personnel will observe the work area, and verify that the top of compacted soil surfaces (i.e., surface on which geomembrane will be deployed) have been fully approved. It is the responsibility of CQA personnel to provide subgrade acceptance forms to the Geosynthetics Installer and verify that they have been signed by CQA personnel and the Geosynthetics Installer prior to deployment.

3.3.4.4 Field Panel Identification

Each field panel will be given an identification code, which will be used for CQA records. CQA personnel will monitor field panel placement and will record the field panel identification code, manufacturers roll number, location, date of installation, and dimensions of each field panel. CQA personnel will label each panel in the field with its panel identification number using a semi-permanent marker (e.g., paint stick).

3.3.4.5 Geomembrane Deployment and Seaming

CQA personnel will continuously monitor geomembrane deployment and verify compliance with the geomembrane installation specifications presented previously. CQA personnel will then observe the geomembrane panels, after placement and prior to seaming, for damage, and will advise the Geosynthetics Installer which panels, or portions of panels, should be rejected, repaired, or accepted. Damaged panels or portions of damaged panels which have been rejected will be marked and their removal from the work area will be confirmed by CQA personnel.

Field panel seaming will be continuously monitored by CQA personnel to verify and document compliance with the seaming specifications presented previously in this document.

3.3.5 Field Testing of Work Product

3.3.5.1 Trial Seams

Trial seam testing will be performed by the Geosynthetics Installer. CQA personnel will observe and document the Installer's trial seam testing procedures and verify that they are in accordance with the specifications at set forth herein. CQA personnel will document identification numbers of trial seam samples and record results. Each sample will also be marked with the date, time, machine temperature(s), setting(s), number of seaming unit, and name of seaming technician.

3.3.5.2 Nondestructive Seam Testing

Nondestructive field seam testing will be performed on all seams by the Geosynthetics Installer to check the continuity of seams. During the Installer's nondestructive testing of field seams, CQA personnel will continuously monitor and confirm that seams are tested over their full length using either the vacuum test (for extrusion welds) or the air pressure test (for double fusion seams). CQA personnel will also continuously monitor nondestructive testing and document the results, including at a minimum the test location, date, test identification number, name of tester, and result of testing.

CQA personnel will notify the Geosynthetics Installer of any required repairs. Any required seam repairs identified as a result of failed nondestructive seam testing must be made by the Installer in accordance with the specifications, and CQA personnel will observe and document that adequate repair is made and retesting performed.

3.3.5.3 Destructive Testing

Location and Frequency
CQA personnel will select all destructive seam test sample locations in order to accomplish the sampling and minimum testing frequencies given in Table 7B-5a. Sample locations will be established by CQA personnel according to the guidelines given below.

- Test locations will be determined during seaming at CQA personnel's discretion. Selection of such locations may be prompted by suspicion of excess crystallinity, contamination, offset welds, or any other potential cause of imperfect welding.

- The Installer will not be informed in advance of the locations where the seam samples will be taken.

Sampling Procedures

The Geosynthetics Installer will cut the destructive samples at the locations designated by CQA personnel, under observation of the CQA personnel when possible. CQA personnel will mark each sample accordingly and record the sample location. At a given sampling location, two types of samples will be taken: (i) field test samples; and (ii) laboratory test samples. A minimum of two field samples (i.e., test strips) should be taken for field testing. Each of these test strips should typically be 1 inch wide by 12 inches long, with the seam centered parallel to the width. The distance between these two specimens should typically be 42 inches. If both specimens pass the field test described in this Section, a full laboratory destructive sample will be taken/shipped for testing by an independent, third-party geosynthetics testing laboratory, as follows:

- The full destructive sample should be located between the two field test strips. The sample should typically be 12 inches wide by 42 inches long with the seam centered lengthwise. The sample will be cut into three parts and distributed as follows:

    - one 12 inch by 12 inch portion retained by the Geosynthetics Installer;

    - one 12 inch by 12 inch portion archived by CQA personnel; and

    - the remaining 12 inch by 18 inch portion should be forwarded immediately by CQA personnel to the CQA Geosynthetics Testing Laboratory.

All holes in the geomembrane resulting from destructive seam test sampling will be immediately repaired by the Geosynthetics Installer in accordance with repair procedures described herein. The continuity of the new seams in the repaired area will be nondestructively tested.

Field Testing

The test strips will be tested in the field by the Geosynthetics Installer, using a gauged tensiometer (i.e., extensometer). CQA personnel will observe the field tests and mark all samples and portions of samples with their test number. CQA personnel will also document using the appropriate standardized field forms: the date, number of seaming unit, seaming technician identification, destructive sampling, and pass or fail description.

Laboratory Testing

Destructive test samples will be tested by the independent, third-party geosynthetics testing laboratory. The methods are given in Table 7B-5a. Results will be reviewed by CQA personnel as soon as they become available. The POR and Owner will be notified of any inconsistencies or nonconformances.

Procedures for Destructive Test Failure

The following procedures will apply whenever a sample fails a destructive test, whether that test was conducted in the field or by the Geosynthetics Testing Laboratory. CQA personnel will monitor that the Geosynthetics Installer follows one of two options or between points defined by CQA personnel to represent conditions of the failed seam (e.g., the extent of seams between passing test locations):

- The Geosynthetics Installer may reconstruct the entire seams (e.g., remove the old seams and reseam) between any two passed destructive test locations.

- The Geosynthetics Installer may trace the welding path to an intermediate location a minimum of 10 feet from the point of the failed test in each direction and take a small sample for additional field testing in accordance with the destructive test procedure at each location. If these additional isolation samples pass the field test, then full laboratory samples are taken at both locations. If these laboratory samples meet the specified strength criteria, then the seam is reconstructed between these locations. If either sample fails, then the process is repeated to establish the zone in which the seam should be reconstructed.

In all cases, failed seams must be bounded by two locations from which samples passing laboratory destructive tests have been taken or the entire seam is reconstructed and retested. In cases exceeding 150 feet of reconstructed seam, a sample taken from the zone in which the seam has been reconstructed must pass destructive testing. CQA personnel will document all actions taken in conjunction with destructive test failures.

3.3.6 Deficiencies, Problems, and Repairs

3.3.6.1 Inspection for Defects

All seams and non-seam areas of the geomembrane will be examined by CQA personnel for identification of defects, holes, blisters, undispersed raw materials, and any sign of contamination by foreign matter. Because light reflected by the geomembrane helps to detect defects, the surface of the geomembrane should be clean at the time of examination.

3.3.6.2 Repair Procedures

Any portion of the geomembrane exhibiting a flaw, or failing a destructive or non-destructive test, must be repaired by the Geosynthetics Installer in accordance with the specifications. Several procedures exist for the repair of these areas. The final decision as to the appropriate repair procedure will be agreed upon between the Geosynthetics Installer, the POR, and the Owner.

3.3.6.3 Verification of Repairs

Each repair will be numbered, logged, and non-destructively tested using approved methods. Repairs which pass the non-destructive test will be taken as an indication of an adequate repair. Large caps may be of sufficient extent to require destructive test sampling, at the discretion of CQA personnel or as previously specified. CQA personnel will observe all non-destructive testing of repairs and will record the number of each repair, date, and test outcome.

3.3.7 Geomembrane Documentation

Upon completion of all required construction and evaluation of the geomembrane component of the final cover system, the POR will prepare and submit a FCSER to TCEQ, containing a construction report along with relevant test data and related documentation. The required FCSER contents are described subsequently in Section 9 of this FCQCP.

TABLE 7B-4a

MATERIAL SPECIFICATIONS and MQC TESTING REQUIREMENTS*

40-mil LINEAR LOW-DENSITY POLYETHYLENE (LLDPE) GEOMEMBRANE – TEXTURED

TEST CATEGORY: GEOMEMBRANE MANUFACTURER

PROPERTY	**QUALIFIER**	**UNITS**	**SPECIFIED VALUES**	**STANDARD TEST METHOD**	**MQC TESTING FREQUENCY (Minimum)**
Thickness:	Min. Avg.	mils	38(2)	ASTM D 5994	per roll
8 out of 10 values must exceed		mils	36		
all 10 values must exceed		mils	34		
Asperity Height(3)	Min. Avg.	mils	16	ASTM D 7466	every 2nd roll
Formulated Density	Min. Avg.	g/cc	0.939	ASTM D 1505/D 792	200,000 lb
Tensile Properties (each direction) • Break Strength • Break Elongation	Min. Avg. Min. Avg.	lb/in. percent	60 250	ASTM D 6693(4) Type IV	20,000 lb
2% Modulus	Max.	lb/in	2400	ASTM D 5323	Per each formulation
Tear Resistance	Min. Avg.	lb	22	ASTM D 1004	45,000 lb
Puncture Resistance	Min. Avg.	lb	44	ASTM D 4833	45,000 lb
Axi-Symmetric Break Resistance Strain	Min.	percent	30	ASTM D 5617	Per each formulation
Carbon Black Content	Range	percent	2.0 to 3.0	ASTM D 4218(5)	45,000 lb
Carbon Black Dispersion		category	Note(6)	ASTM D 5596	45,000 lb
Oxidative Induction Time (OIT)(7) 1. Standard OIT or 2. High Pressure OIT	Min. Avg. Min. Avg.	minutes minutes	100 400	ASTM D 8117 ASTM D 5885	200,000 lb
Oven Aging at 85 deg. C(8) 1. Using Standard OIT or 2. Using High Pressure OIT	Min. Avg. Min. Avg.	% retained after 90 days Same as 1.	35 60	ASTM D 5721 ASTM D 8117 ASTM D 5885	Per each formulation
UV Resistance(9) (using High Pressure OIT)	Min. Avg.	Percent retained after 1600 hours(10)	35	ASTM D 5885	Per each formulation

Notes:

(1) MQC testing in this table is to be performed by the manufacturer. Welded seam specifications are provided in Tables 7B-5a and 7B-5b of this FCQCP. See Table 7B-6 of this FCQCP for geomembrane conformance testing requirements by independent third-party laboratory.

(2) The nominal specified thickness is 40 mils. Per GRI-GM17 the minimum average is required to be thicker than -5% of the nominal.

(3) Alternate the measurement side for double-sided textured sheet.

(4) Machine direction (MD) and cross machine direction (XMD) average values should be on the basis of 5 test specimens each direction. Yield elongation is calculated using gage length of 1.3 inches. Break elongation is calculated using gage length of 2.0 inches.

(5) Other methods such as D 1603 (tube furnace) or D 6370 (TGA) are acceptable if an appropriate correlation to D 4218 can be established.

(6) Carbon black dispersion (only near spherical agglomerates) for 10 different views shall have at least 9 in Categories 1 or 2 and no more than 1 in Category 3.

(7) The manufacturer has the option to select either one of the OIT methods listed to evaluate the antioxidant content in the geomembrane.

(8) It is also recommended to evaluate samples at 30 and 60 days to compare with the 90 day response.

(9) The condition of the test should be 20 hr. UV cycle at 75 deg. C, followed by 4 hr. condensation at 60 deg. C.

(10) UV resistance is based on percent retained value regardless of the original HP-OIT value.

*Note – This specification and the MQC requirements are based on the Revision 14 (3/17/2021) of Geosynthetic Research Institute (GRI) GM-17 Specification, currently the industry standard. Specified test methods and parameters may be modified by the POR, after confirming it is acceptable to TCEQ, to be consistent with changes to the industry standard ASTM or GRI methods for 40 mil textured LLDPE geomembranes.

TABLE 7B-4b
MATERIAL SPECIFICATIONS and MQC TESTING REQUIREMENTS*
40-mil LINEAR LOW-DENSITY POLYETHYLENE (LLDPE) GEOMEMBRANE – SMOOTH
TEST CATEGORY: GEOMEMBRANE MANUFACTURER

PROPERTY	**QUALIFIER**	**UNITS**	**SPECIFIED VALUES**	**STANDARD TEST METHOD**	**MQC TESTING FREQUENCY (Minimum)**
Thickness:	Min. Avg.	mils	40[2]	ASTM D 5199	per roll
Lowest individual of 10 values		mils	36		
Formulated Density	Min. Avg.	g/cc	0.939	ASTM D 1505/D 792	200,000 lb
Tensile Properties (each direction) • Break Strength • Break Elongation	 Min. Avg. Min. Avg.	 lb/in. percent	 152 800	ASTM D 6693[3] Type IV	20,000 lb
2% Modulus	Max.	lb/in	2400	ASTM D 5323	Per each formulation
Tear Resistance	Min. Avg.	lb	22	ASTM D 1004	45,000 lb
Puncture Resistance	Min. Avg.	lb	56	ASTM D 4833	45,000 lb
Axi-Symmetric Break Resistance Strain	Min.	percent	30	ASTM D 5617	Per each formulation
Carbon Black Content	Range	percent	2.0 to 3.0	ASTM D 4218[4]	45,000 lb
Carbon Black Dispersion		category	Note[5]	ASTM D 5596	45,000 lb
Oxidative Induction Time (OIT)[6] 1. Standard OIT or 2. High Pressure OIT	 Min. Avg. Min. Avg.	 minutes minutes	 100 400	 ASTM D 8117 ASTM D 5885	200,000 lb
Oven Aging at 85 deg. C[7] 1. Using Standard OIT or 2. Using High Pressure OIT	 Min. Avg. Min. Avg.	 % retained after 90 days Same as 1.	 35 60	ASTM D 5721 ASTM D 8117 ASTM D 5885	Per each formulation
UV Resistance[8] (using High Pressure OIT)	Min. Avg.	Percent retained after 1600 hours[9]	35	ASTM D 5885	Per each formulation

Notes:

(1) MQC testing in this table is to be performed by the manufacturer. Welded seam specifications are provided in Tables 7B-5a and 7B-5b of this FCQCP. See Table 7B-6 of this FCQCP for geomembrane conformance testing requirements by independent third-party laboratory.

(2) The nominal specified thickness is 40 mils. Per GRI-GM17 the minimum average is required to meet or exceed the nominal.

(3) Machine direction (MD) and cross machine direction (XMD) average values should be on the basis of 5 test specimens each direction. Yield elongation is calculated using gage length of 1.3 inches. Break elongation is calculated using gage length of 2.0 inches.

(4) Other methods such as D 1603 (tube furnace) or D 6370 (TGA) are acceptable if an appropriate correlation to D 4218 can be established.

(5) Carbon black dispersion (only near spherical agglomerates) for 10 different views shall have at least 9 in Categories 1 or 2 and no more than 1 in Category 3.

(6) The manufacturer has the option to select either one of the OIT methods listed to evaluate the antioxidant content in the geomembrane.

(7) It is also recommended to evaluate samples at 30 and 60 days to compare with the 90 day response.

(8) The condition of the test should be 20 hr. UV cycle at 75 deg. C, followed by 4 hr. condensation at 60 deg. C.

(9) UV resistance is based on percent retained value regardless of the original HP-OIT value.

*Note – This specification and the MQC requirements are based on the Revision 14 (3/17/2021) of Geosynthetic Research Institute (GRI) GM-17 Specification, currently the industry standard. Specified test methods and parameters may be modified by the POR, after confirming it is acceptable to TCEQ, to be consistent with changes to the industry standard ASTM or GRI methods for 40 mil textured LLDPE geomembranes.

TABLE 7B-5a
WELDED SEAM SPECIFICATIONS – DESTRUCTIVE TESTS*
40-mil LINEAR LOW-DENSITY POLYETHYLENE (LLDPE) GEOMEMBRANE – TEXTURED and SMOOTH
TEST CATEGORY: DESTRUCTIVE SEAM TESTING

PROPERTY/TYPE OF TEST	QUALIFIER	UNITS	VALUES$^{(3)}$	STANDARD TEST METHOD	FREQUENCY OF TESTING (min)
Fusion Seams					
Shear Strength	Minimum	lb/in.	60	ASTM D 6392	(1) and (2)
Shear Elongation at Break	Minimum	%	50		
Peel Strength	Minimum	lb/in.	50		
Peel Separation	Maximum	%	25		
Extrusion Seams					
Shear Strength	Minimum	lb/in.	60	ASTM D 6392	(1) and (2)
Shear Elongation at Break	Minimum	%	50		
Peel Strength	Minimum	lb/in.	44		
Peel Separation	Maximum	%	25		

Notes:

(1) Trial seam testing frequency will be as described in Section 3.2.4.6 of this FCQCP. Elongation/separation measurements may be eliminated for field testing.

(2) Destructive sampling and testing will be at a minimum frequency of one per 500 linear ft of welded production seam. Individual leak repairs of more than 10 ft long and individual repairs of more than 10 ft long for failed seams must also be counted towards the total footage and destructively tested at the minimum frequency. The above tests will be performed by the independent, third-party geosynthetics testing laboratory.

(3) Assessment of seam results should be in accordance with GRI GM-19a, including that the locus-of-break patterns must meet the acceptable break codes given therein.

*Note – The above specification and minimum testing frequencies are based on the Geosynthetic Research Institute (GRI) GM-19a Specification, currently the industry standard for welded LLDPE seams. Specified test methods and parameters may be modified by the POR, after confirming it is acceptable to TCEQ, to be consistent with changes to the industry standard for 40-mil LLDPE geomembrane seams.

TABLE 7B-5b
WELDED SEAM SPECIFICATIONS – NON-DESTRUCTIVE TESTS
40-mil LINEAR LOW-DENSITY POLYETHYLENE (LLDPE) GEOMEMBRANE – TEXTURED and SMOOTH
TEST CATEGORY: NON-DESTRUCTIVE SEAM FIELD TESTING

TYPE OF TEST	QUALIFIER	UNITS	VALUES$^{(3)}$	STANDARD TEST METHOD	FREQUENCY OF TESTING (min)
Air Pressure	Maximum	psi loss	4	ASTM D 5280 or GRI GM-6	All dual-track fusion
Vacuum	Range	psi	4 to 8	ASTM D 4437 or D 5641	All non air-pressure-tested seams when possible

Note: (1) Non-destructive testing is further described in Sections 3.2.4.7 and 3.3.5.2 of this FCQCP.

TABLE 7B-6

CONFORMANCE TESTING(1) REQUIREMENTS FOR GEOMEMBRANE

TEST CATEGORY: INDEPENDENT THIRD-PARTY LABORATORY

TYPE OF TEST	STANDARD TEST METHOD(3)	MINIMUM FREQUENCY OF TESTING(2)
Thickness(4)	ASTM D 5994 / D 5199	1 per 100,000 ft^2
Specific Gravity (Sheet Density)	ASTM D 1505 or D 792	1 per 100,000 ft^2
Carbon Black Content	ASTM D 4218	1 per 100,000 ft^2
Carbon Black Dispersion	ASTM D 5596	1 per 100,000 ft^2
Tensile Properties	ASTM D 6693 Type IV	1 per 100,000 ft^2
Interface Shear Strength	ASTM D 5321	See Section 8 of this FCQCP

Notes:

(1) This table is for conformance testing by an independent third-party laboratory. Required manufacturer MQC testing methods and minimum frequencies are given in the geomembrane specifications of Section 3.2.2 and Tables 7B-4a and 4b of this FCQCP.

(2) CQA testing frequency must also be at a minimum of one per resin lot.

(3) Specified test methods may be replaced with new standard methods (e.g., ASTM method updates) by POR as they become available and after confirming it is acceptable to TCEQ, consistent with changes to the industry standard for LLDPE geomembranes.

(4) Use ASTM D 5994 for textured geomembranes; D 5199 for smooth geomembranes.

4. FINAL COVER SYSTEM DRAINAGE GEOCOMPOSITE

4.1 Introduction

This section addresses the specifications and CQA requirements for the final cover system geocomposite drainage layer component (i.e., geotextile-geonet-geotextile (double-sided geocomposite) and geotextile-geonet (single-sided geocomposite)) of the standard Subtitle D final cover system. Full-time on-site CQA will be provided during installation of the geocomposite drainage layer component of the final cover system by the POR or his/her qualified representative(s) serving as QET(s).

4.2 Final Cover System Geocomposite Drainage Layer Specifications

4.2.1 Geocomposite Drainage Layer Material Property Requirements

A. Material requirements for the geotextile, geonet, and geocomposite components are the same regardless of whether a single-sided or double-sided geocomposite is used. The required properties are provided in Table 7B-7.

4.2.2 Manufacturing Quality Control (MQC)

A. The geocomposite Manufacturer(s) shall implement a MQC program for materials related to geocomposite manufacturing, which shall include MQC sampling and testing to demonstrate the product quality and suitability for use.

B. The required MQC tests, methods, and minimum frequencies are presented in Table 7B-7.

C. Prior to shipping, the Manufacturer(s) shall provide CQA personnel with the required MQC information presented subsequently in Section 4.3.2 of this FCQCP, including results of the required MQC tests. Any sample that does not comply with the requirements shall result in rejection of the roll from which the sample was obtained.

4.2.4 Shipping, Delivery, Handling, and Storage

A. The geocomposite will be shipped in rolls each labeled with the Manufacturer's name and product identification (e.g., batch and roll numbers, dimensions or weight, etc.). Upon delivery, the material will be unloaded using appropriate equipment, such as cranes or backhoes, forklifts, or similar equipment, and stored in a manner that avoids damaging the material, such as pushing, sliding, or dragging the rolls. The geocomposite rolls should be stacked no more than five rolls high, and will be stored in a manner as to avoid shifting or movements that could damage the materials. The stored rolls will also be protected from soft/wet ground or rocky/rough ground, and protected from excessive UV exposure in accordance with Manufacturer's recommendations.

4.2.5 Installation Requirements

A. The geocomposite will be installed in accordance with Manufacturer's recommendations. The geosynthetics will not be placed during inclement weather, such as high winds, rain, or freezing conditions. The underlying surface (e.g., completed geomembrane) will be free of debris.

B. The geocomposite panels will be oriented and joined using methods and protocols recommended by the Manufacturer for their intended drainage application, and meeting all requirements presented on the permit and construction drawings (e.g., sewn seams where specified, heat bonded seams where allowed, overlaps as specified, etc.).

C. Unapproved equipment will not be operated directly on the geocomposite. Construction equipment or vehicles must not be operated above the geocomposite unless the equipment or vehicles meet the following ground pressure requirements and the corresponding required thickness of overlying soil is present:

Allowable Equipment Ground Pressure (psi)	**Minimum Thickness of Soil Overlying Geosynthetics (in.)**
<5	12
<10	18
<20	24
>20	36

4.3 CQA of Geocomposites

4.3.1 Pre-Installation Qualifying of Material Sources

Prior to installation of final cover system geocomposite drainage layer, the Manufacturer(s) will provide CQA personnel with Manufacturer's certification statements and quality control information, including the following:

- MQC certificates with test results, signed by a responsible party employed by the Manufacturer. Each quality control certificate will include date, roll identification numbers, testing procedures, and results of quality control tests performed using the methods specified and at the required minimum frequencies given in the specifications presented previously in Section 4.2.3.

CQA personnel will examine the Manufacturer's certificates and results to verify that the property values listed on the certifications meet or exceed the specifications, and that proper and complete documentation has been provided for the geocomposite to be used at the site. CQA personnel will report any deviations from the above requirements to the Contractor/Geosynthetics Installer and Owner prior to installation of that component. Any sample that does not comply with the requirements will result in rejection of the roll from which the sample was obtained, and additional testing of rolls from the same lot or batch until a pattern of acceptable test results is established.

4.3.2 Material Conformance Testing

Conformance sampling and testing of the final cover geocomposite drainage layer is not required. However, the Owner may elect to authorize voluntary conformance sampling and testing if CQA personnel or the Owner suspect a problem or defect with the material delivered to the site.

4.3.3 Field Evaluation/Monitoring During Installation

Installation of the final cover system geocomposite will have continuous monitoring by CQA personnel. The Installer/Contractor will be required to unload, store, and handle all geocomposite in such a manner as to ensure the materials are not damaged in any way. During installation, CQA personnel will verify compliance with the following:

- immediately prior to geocomposite placement, the subgrade (underlying surface, i.e., geomembrane) is free of sharp protrusions or other obstructions that could potentially damage the material;

- in the presence of wind, the geocomposites are weighted with sandbags (or equivalent), and the weights remain until the material is secured with an overlying layer;

- geocomposites are kept continually under slight tension to minimize the presence of wrinkles, and if necessary, the material is positioned by hand after being unrolled to minimize wrinkles;

- proper orientation and joining techniques are used (e.g., continuously sewn, spot bonded, overlapped, etc. as specified);

- the geocomposites are placed in the locations and to the dimensions shown on the applicable design details and drawings;

- a visual examination of the material is carried out over the entire surface, after installation, to verify that no potentially harmful foreign objects, such as needles or tools, are present; and

- the geocomposites are not left exposed for longer than the maximum allowable period (as recommended by the Manufacturer).

CQA personnel will also verify that the Contractor places all soil and aggregate materials on top of geocomposites in such a manner that:

- the geosynthetics and underlying materials are not damaged;
- wrinkles are minimized; and
- excess tensile stresses are not produced in the geosynthetics.

4.3.4 Geocomposite Documentation

Documentation of the leachate collection system geocomposite drainage layer component of the final cover system will be included in the FCSER. Additional details of the required FCSER contents are described subsequently in Section 9 of this FCQCP.

TABLE 7B-7
MATERIAL SPECIFICATIONS and MQC TESTING REQUIREMENTS
FINAL COVER GEOCOMPOSITE DRAINAGE LAYER
TEST CATEGORY: MANUFACTURER

PROPERTY	QUALIFIER	UNITS	SPECIFIED VALUES	TEST METHOD	MQC TESTING FREQUENCY
Geonet Resin					
Density	Minimum	g/cc	0.935	ASTM D792 or ASTM D1505	1 per resin lot
Melt Flow Index	Maximum	g/10 min	1.0	ASTM D1238	
Geonet Component					
Density	Minimum	g/cc	0.94	ASTM D792 or ASTM D1505	1 per 100,000 ft^2 and every resin lot
Mass Per Unit Area	Min. Avg.	lbs/ft^2	0.13	ASTM D5261	
Thickness	Min. Avg	mil	200	ASTM D5199	
Geotextile Component					
Mass Per Unit Area	Min. Avg	oz/yd^2	8	ASTM D5261	1 per 100,000 ft^2 and every resin lot
Grab Tensile Strength	Min. Avg	lbs	158	ASTM D4632	
Trapezoidal Tear Strength	Min. Avg	lbs	56	ASTM D4533	
CBR Puncture Strength	Min. Avg	lbs	320	ASTM D6241	
Apparent Opening Size	Max. Avg	US Sieve Number	70	ASTM D4751	
Permittivity	Min. Avg	sec^{-1}	1.2	ASTM D4491	
Geocomposite					
Transmissivity$^{(2)}$	minimum	m^2/s	7.7x 10^{-4}	ASTM D 4716	1 per product type

Notes:

(1) MQC testing in this table is to be performed by the Manufacturer.

(2) Transmissivity test refers to index transmissivity performed at: Applied stress of 240 psf; gradient of 0.05 (or may use 0.286 if the geocomposite being tested will only be used on the final cover sideslopes); load duration of 15 minutes. Test configuration between two steel plates.

(3) Specified test methods and parameters may be modified by the POR, after confirming it is acceptable to TCEQ, to be consistent with changes to the industry standard ASTM or GRI methods as they become available.

5. COVER SOIL LAYER

5.1 Introduction

This section addresses the specifications and CQA requirements for the cover soil component of the erosion layer of the standard Subtitle D final cover system. Full-time on-site CQA will be provided during construction of the cover soil layer component of the final cover system by the POR or his/her qualified representative(s) serving as QET(s).

5.2 Cover Soil Layer Specifications

5.2.1 Cover Soil Material Property Requirements

A. The the cover soil will be free of deleterious materials such as woody material or vegetation (e.g., roots or branches), angular rocks, foreign objects, or other particles/materials that could damage the underlying geosynthetic layers or impede their performance as designed. The protective cover soil will have a maximum particle size of 2 inches.

5.2.2 Cover Soil Placement Requirements

A. Cover soil does not require compaction control (i.e., density or moisture controlled construction procedures). The material should be given relatively low compactive effort to make the layer stable (and to enhance vegetative growth), through placement and spreading using low-ground pressure bulldozers or similar lightweight equipment.

B. Cover soil will be placed as soon as possible after installation of the geomembrane and its overlying geosynthetics.

C. Cover soil should be placed in “fingers” along the surface, and should generally be placed in an up-slope direction for sideslopes to minimize the stress on the geomembrane.

D. Care will be exercised in placement so as not to shift, wrinkle, or damage the underlying geosynthetic layers. Drivers should proceed with caution when trafficking on the protective cover materials on or adjacent to the leachate collection system. Drivers should prevent spinning of tires and shall not make quick stops or sharp turns.

E. Cover soil will be placed such that the minimum soil thickness given below is maintained between construction equipment and underlying geosynthetics.

Allowable Equipment Ground Pressure (psi)	**Minimum Thickness of Soil Overlying Geosynthetics (in.)**
<5	12
<10	18
<20	24
>20	36

5.3 CQA of Cover Soil Layer

5.3.1 Field Evaluation/Monitoring During Construction

Installation of the cover soil layer will have full-time monitoring by CQA personnel. Field testing is not required. CQA personnel will visually observe and document that construction of the cover soil is in accordance with the specifications and requirements set forth herein. These observations will include, but not be limited to, visual monitoring and documentation of:

- the cover soil material composition, to evaluate the visual material classification and check for the presence of deleterious materials that could damage the geosynthetic barrier or drainage layer components or impede their performance as designed;

- the thickness and dimensions of the material as loosely placed and spread, for compliance with the drawings and engineering details;

- proper placement techniques (generally in the up-slope direction) for cover on sideslope areas;

- the construction equipment used during placement of the material over geosynthetics and at haul roads over geosynthetics to verify that the minimum clearance thickness is maintained between the equipment and the geomembrane and that only lightweight (low-ground pressure) equipment traverses over geosynthetics-lined areas until the specified material thickness above the geosynthetics is attained; and

- verifying that underlying installed geosynthetics are not damaged during placement operations, including verifying that wrinkles or excess tensile stresses to underlying geosynthetics are minimized.

5.3.3 Thickness Verification

For thickness verification purposes, the cover soil layer and its overlying topsoil layer (described subsequently) may be combined into one layer, since these two components together make up the "erosion layer" of the standard Subtitle D final cover system. Upon completion of placement operations, thickness verification will be determined by survey methods. The verification points for record purposes will be at a spacing (e.g., grid) not exceeding 10,000 square feet. A minimum of two (2) survey points will be used for all constructed areas regardless of size. The beginning survey will be the previously completed top of compacted soil layer survey. The finished elevations of the erosion layer will be taken using the same horizontal survey locations, so that thicknesses can be calculated and verified.

5.3.4 Cover Soil Layer Documentation

The cover soil layer documentation will be included in the FCSER. The required FCSER contents are described subsequently in Section 9 of this FCQCP.

6. TOPSOIL LAYER AND PERMANENT STABILIZATION

6.1 Introduction

This section addresses the specifications and CQA requirements for the topsoil layer component of the final cover system (i.e., the upper portion of the erosion layer consisting of earthen material capable of sustaining native plant growth). This section also addresses the specifications and other requirements for permanent stabilization of the final cover to establish vegetative cover.

6.2 Topsoil Layer Specifications

6.2.1 Topsoil Layer Material Requirements

The topsoil layer material will be earthen material with a 2-in. diameter maximum particle size, and without deleterious materials. In addition, the topsoil layer soil will have suitable properties that provide a layer capable of sustaining native vegetation. Surficial topsoil sources from on-site (from topsoil stockpiles or stripped from the natural ground surface) have been observed to support grassy vegetation and have suitable properties.

If an alternate source of topsoil layer soil is proposed (besides the topsoil stripped from on-site), or if the owner or POR question the ability of the soil to perform and support plant growth, agronomic tests can be performed to evaluate the soil and obtain recommendations for fertilization rates or other related nutrient and/or organic matter additives).

6.2.2 Topsoil Layer Placement Requirements

Topsoil layer placement does not require compaction control. Instead, to enhance vegetative growth, the material should be given relatively low compactive effort through placement and spreading using a low-ground pressure bulldozer or similar equipment. This layer will be placed in a manner that is not detrimental to the compacted soil layer or other underlying layers.

6.3 Topsoil Layer CQA

6.3.1 General

This section of the FCQCP addresses the CQA program to be implemented with regard to the topsoil layer. The following CQA activities are discussed in the remainder of this section:

- Field Evaluation/Monitoring During Construction;
- Thickness Verification; and

- Topsoil Layer Documentation.

Pre-construction evaluation of material sources, material conformance testing during construction, and field testing of the topsoil layer is not required.

6.3.2 Field Evaluation/Monitoring During Construction

CQA personnel will be on-site at all times when topsoil layer construction is ongoing, so that all relevant activities can be observed and documented. CQA personnel will visually monitor and document that construction of the topsoil layer is in accordance with the specifications and requirements set forth previously in this FCQCP. These observations will include, but not be limited to visual monitoring and documentation of:

- the topsoil layer soil material to evaluate the visual material classification and check for the presence of deleterious materials;
- the thickness and dimensions of the material as spread for compliance with the drawings and engineering details; and
- the construction equipment used during placement of the material to verify that only low-ground pressure equipment traverses over the topsoil layer.

6.3.3 Thickness Verification

For topsoil that is part of the standard Subtitle D final cover system, for thickness verification purposes the cover soil layer and its overlying topsoil layer (described subsequently) may be combined into one layer, since these two components together make up the "erosion layer." This will be accomplished in accordance with Section 5.3.3.

For topsoil that is part of the pre-Subtitle D final cover system or the alternative WB final cover system, a topsoil layer verification will be determined upon completion of topsoil placement operations. The verification points for record purposes will be at a spacing (e.g., grid) not exceeding 10,000 square feet. A minimum of two (2) survey points will be used for all constructed areas regardless of size. The location and ground surface elevation of the verification points will be determined using surveying methods. The thickness verification may be made by hand-excavating a small hole from the ground surface down to the bottom of the topsoil layer (i.e., top of the compacted soil layer) and measuring the thickness at that location using either surveying instruments to take the elevation of the top and bottom of the hole, or by similar hand measurements (e.g., ruler or tape). After the measurement is taken, the small hole will be re-filled with topsoil and lightly tamped back into place. Alternatively, thickness verification is allowed to be made without the small hand-excavated holes using surveyed elevations taken at the top of the topsoil and the top of the compacted soil layer (at the same location, to allow for elevation comparisons that represent the measured topsoil layer thickness).

6.3.4 Topsoil Layer Documentation

Upon completion of all required construction and evaluation of the final cover system, the POR will prepare and submit a FCSER to TCEQ containing a construction report along with relevant test data and related documentation. The required FCSER contents are described subsequently in Section 9 of this FCQCP.

6.4 Permanent Stabilization with Vegetative Cover

This section of the FCQCP provides guidance through example specifications for permanent stabilization to establish vegetative cover, representing typical practices. At the discretion of the professional engineer (P.E.) licensed in Texas who prepares the issued-for-construction closure drawings and specifications at the time of final cover installation (i.e., the design engineer), these procedures may be adjusted based on compatibility with product manufacturer recommendations, along with guidelines from other vegetation standards/manuals or practices published by relevant State or local agencies, appropriate for the area.

6.4.1 Seeding Specifications

Seed the final cover system surface (along with earthen storm water conveyances on the landfill final cover that are to be vegetated, and other disturbed areas) using an appropriate rate and species or mixture native to or well-adapted to the local climate, soil conditions, and season. A native or otherwise locally-adapted grass species/mix is recommended for final (permanent) vegetative cover. Naturally-occurring wildflowers mixed with prairiegrass species appropriate for this site climate and setting may also be used. Seeding for final (permanent) stabilization should be performed within the recommended planting dates for the selected species/mix; or, if final cover construction is completed outside of those planting dates, also overseed with a temporary grass mixture such as ryegrass, winter wheat, or other cool-weather vegetation appropriate for the season.

Resources for selection of grass species/mix(es), seeding rates, planting seasons, and application techniques include but are not limited to: (i) consultation with the local office of the Natural Resource Conservation Service (NRCS) or Texas AgriLife Extension Service for selection of proper species and application technique; (ii) Item 164 (seeding) of the *Texas Department of Transportation (TxDOT) Standard Specification for Construction and Maintenance of Highways, Streets, and Bridges* for selection of seed type and application rate appropriate for the site location and planting season; or (iii) City of New Braunfels Standard Specifications for Construction, Section 1.8, Seeding.

6.4.2 Permanent Stabilization Installation Schedule and Procedures

Recommended general procedures for permanent stabilization of the final cover topsoil surfaces are listed below:

- Seed in accordance with the appropriate seed mix/species and planting season as described in Section 6.4.1, as soon as possible after completing final cover topsoil layer placement and grading to minimize erosion.

- Prepare seedbed as needed, such as by loosening and/or raking the soil surface.

- For slopes at 5% or flatter, evenly apply seed of the to the ground surface using a seed drill, cultipacker, terraseeder, hydroseeder, or other similar methods. Apply fertilizer and nutrient addition as needed. Finish by applying mulch to the seeded surface (or may use hydraulic mulching as the seed and mulch application method such as indicated below).

- For slopes steeper than 5% and along final cover drainage terraces, apply seed and mulch (along with fertilizer and nutrient additions as needed) using the hydraulic mulching (i.e., “hydromulching”) technique. Either rolled erosion control blanket products or polymer/binder mulch additives are recommended for mulching on sideslopes (3.5H:1V and 3H:1V slopes, and on drainage terraces.

As an alternative to the above procedures, sodding may be performed in accordance with Item 162 (sodding) of the *Texas Department of Transportation (TxDOT) Standard Specification for Construction and Maintenance of Highways, Streets, and Bridges*, or similar published State or local agency specifications for sodding (e.g., City of New Braunfels Standard Specifications for Construction).

Refer to the Closure Plan (Part III, Attachment 7A) for long-term ground cover requirements, established as minimum percent ground cover, to minimize soil loss and maintain long-term erosional stability of the top-deck and sideslopes. Implement temporary erosion and sediment control best management practices (BMPs), including, but not limited to, temporary mulch until permanent stabilization is achieved.

7. WATER BALANCE COVER SYSTEM

7.1 Introduction

This section addresses the specifications and CQA requirements for the alternate Subtitle D final cover system option using a WB (soil-only) cover. In general, a WB cover limits percolation through the cover by use of silty and clayey soils to store water and sustain vegetation until the water is removed by evapotranspiration.

If this option is selected, full-time on-site CQA will be provided during construction of the WB cover by the POR or his/her qualified representative(s) serving as QET(s).

7.2 WB Cover Storage Layer Soil Specifications

7.2.1 Storage Layer Soil Material Property Requirements

Material requirements for the physical properties of the WB cover storage layer are presented in Table 7B-8.

7.2.2 WB Cover Storage Layer Moisture-Density Target Compaction Requirements

The target compaction requirements for each lift of the WB cover storage layer are within an "acceptance window" as follows:

- The minimum dry density is 90% of the standard Proctor maximum dry density;
- The maximum moisture content is left of (i.e., on the dry side of) the line-of-optimums represented by a curve oriented parallel to the 100% saturation (zero air voids) curve on a graph of Proctor results (moisture content vs. dry density) for a family of Proctor curves (standard and modified) that represent a given borrow source.

Besides the above criteria, the left side of the "acceptance window" when plotted on a graph of Proctor results (moisture content vs. dry density), will be as needed to achieve the required hydraulic conductivity specified in Table 7B-8 for the WB cover storage layer. The minimum density listed above was selected in consideration of silty/clayey soil behavior for achieving workability, constructability, and shear strength.

Once established, each lift of the WB cover storage layer will be compacted to within the "acceptance window" of moisture content and density. A small number of outliers outside this acceptance window are allowed (defined as no more than 5% of the total number of in-place moisture/density tests, and provided that the outliers are spatially distributed, not clustered in one area). Regardless of meeting the acceptance window criteria, the required hydraulic conductivity specified herein for the WB cover storage layer must be achieved. Accordingly, more stringent set of criteria may be used if found necessary to relicably meet the required hydraulic conductivity specified herein.

7.2.3 WB Cover Storage Layer Construction Requirements

A. General. The construction requirements for the WB cover storage layer are consistent with those for the compacted soil cover as presented in Section 2.2.3, with regard to: (i) subgrade preparation; (ii) groundwater and standing water considerations; (iii) placement and compaction; and (iv) layer tie-ins.

B. Moisture Content and Density, and Hydraulic Conductivity. Each lift of the WB cover storage layer will be compacted to meet the required range of moisture contents and densities within the “acceptance window” established as described in Section 7.2.2, while still achieving the low-permeability requirements [i.e., the WB cover storage layer soils must, upon testing via the laboratory conformance testing program described hererin, demonstrate a coefficient of permeability (i.e., hydraulic conductivity) of no greater than that specified in Table 7B-8].

C. Optional Test Pad. A test pad may be constructed prior to the start of full-scale construction of the WB cover storage layer. Although not required, a test pad may be helpful and aide in more efficient and effective full-scale construction by assessing the equipment and procedures necessary to achieve the aforementioned compaction moisture density (“acceptance window”) and permeability requirements. For example, a test pad could help assess whether a soil processor is helpful to reduce clod size, identify effective compaction equipment, determine loose lift thickness requirements to produce a 6-inch (maximum) thick compacted lift, experiment with moisture conditioning techniques, and identify the sufficient/minimum number of equipment passes. If a test pad is constructed and is successful (demonstrates that requirements are met), the full-scale WB cover storage layer should be constructed in the same manner as those used for the successful test pad.

D. Previous Construction of WB Cover Storage Layer. Instead of the optional test pad, if a previous section of WB cover storage layer has been successfully constructed at this site (using a same or similar borrow source), the equipment, procedures, and related construction practices that have been used successfully in the past are recommended to continue to the extent practicable.

E. Non-Conforming Tests. Should the CQA field tests (described subsequently in this FCQCP) indicate that the moisture content or density of any layer of storage layer material, or portion thereof, is not within the range of allowable moistures and densities, the representative portions of that particular layer will be reworked and retested.

7.3 CQA of WB Cover Storage Layer

7.3.1 General

This section of the FCQCP addresses the CQA program to be implemented with regard to the WB cover storage layer component of the alternate WB final cover system option. The following CQA activities are discussed in the remainder of this section:

- Pre-Construction (i.e., Borrow Source) Evaluation of Material Sources;
- Material Conformance Testing During Construction;
- Field Evaluation/Monitoring During Construction;
- Conformance Testing of Constructed Work Product;
- Deficiencies, Problems, and Repairs;
- Thickness Verification; and
- WB Cover Storage Layer Soil Documentation.

7.3.2 Pre-Construction (i.e., Borrow Source) Evaluation of Material Sources

Prior to construction of the WB cover storage layer, CQA personnel will obtain a soil sample from the proposed borrow source(s). Each such borrow source will be evaluated for potential use as WB cover storage layer soil by performing the pre-construction laboratory tests presented in Table 7B-9.

7.3.3 Conformance Testing of Borrow Source During Construction

In addition to pre-construction testing, ongoing material conformance testing at the test methods and frequencies outlined in Table 7B-9 should be performed on an ongoing basis during construction of the WB cover storage layer.

7.3.4 Field Evaluation/Monitoring During Construction

CQA personnel will be on-site at all times when WB cover storage layer construction is ongoing, so that all relevant activities can be observed and documented. The POR will visit the site periodically as construction progress warrants. Such visits will be frequent enough so that the POR is fully knowledgeable of the construction methods and performance, so that the POR can determine that QC monitoring and testing activities are adequate to meet the terms and intent of this FCQCP. CQA personnel will visually monitor and document that construction of the compacted clay layer is in accordance with the specifications and requirements set forth previously in this FCQCP. These observations will include, but not be limited to, monitoring of:

- moisture content and distribution, particle size, and other physical properties of the soil during processing, placement, and compaction;
- type and level of compactive effort, including roller type and weight, drum size and foot length, and number of passes;
- action of compaction equipment on soil surface (i.e. foot penetration, rolling, pumping, or shearing);
- maximum clod size and breakdown of soil structure;
- method of bonding lifts together and making layer tie-ins;
- stones or other inclusions which may damage adversely affect compaction, lift bonding, and in-place testing/sampling; and
- areas where damage due to excess moisture, insufficient moisture, or freezing may have occurred.

7.3.5 Conformance Testing of Constructed Work Product

7.3.5.1 Routine Field Testing

Field testing (e.g., density and moisture content testing) and conformance sampling and testing of placed/compacted WB cover storage layer soil will be performed by CQA personnel during construction to evaluate the Contractor's work product with respect to the requirements of the specifications as set forth in this FCQCP. The test methods and minimum frequencies for routine CQA field/conformance testing of the WB cover storage layer are given in Table 7B-10. Sampling and test locations will be selected by CQA personnel.

The WB cover storage layer moisture and density field testing results will be expressed as a percentage of the maximum dry density and corresponding moisture content percentage, and the results of undisturbed sampling and testing must demonstrate a coefficient of permeability (i.e., hydraulic conductivity) no greater than that specified (per Table 7B-8).

7.3.5.2 Special Testing

A special testing frequency will be implemented at the discretion of CQA personnel when observations indicate potential problems, or as requested by the facility. Additional testing for suspected areas will be considered when:

- the compactor rollers slip during rolling operations;
- the lift thickness is greater than specified;
- the material is at improper and/or highly variable moisture content;
- fewer than the anticipated number of roller passes are made;
- dirt-clogged rollers are used to compact the material;
- the fill materials differ substantially from those specified; or
- the degree of compaction is doubtful.

During construction, the frequency of testing may also be increased in the following situations:

- adverse weather conditions;
- breakdown of equipment;
- at the start and finish of grading;
- if the material fails to meet specification requirements;
- the work area is reduced; or
- as otherwise requested by the facility.

7.3.5.3 Perforations

Perforations are holes in the WB cover storage layer that must be filled, and may include, but are not limited to, the following:

- nuclear density test probe locations;
- undisturbed hydraulic conductivity test tube locations; and
- sand cone test locations or other density verification test methods.

All perforations in the WB cover storage layer created during any sampling or testing will be backfilled using a mixture of at least 20% bentonite by volume mixed with compacted soil material and compacted in place with a tamping rod, or using an appropriate bentonite grout.

7.3.5.4 Placement of Overlying Layer(s)

All testing and evaluation of the WB cover storage layer will be complete prior to installing the overlying layer(s).

7.3.6 Deficiencies, Problems, and Repairs

If a deficiency or noncompliance in the WB cover storage layer is discovered, CQA personnel will promptly evaluate the extent and nature of the defect. The extent of the deficient area will be evaluated by additional tests, observations, a review of records, or other means deemed appropriate.

Sections of WB cover storage layer that do not pass the required field tests (including failures due to not meeting the required hydraulic conductivity) will be reworked as appropriate (e.g., material dried or moistened, additional compaction passes, etc.) and retested until the section in question does pass. If a failure occurs, first the failing area will be defined. This will be accomplished by performing additional tests between the failed test and the nearest adjacent passing test locations. If those additional tests pass, then the area between the failed test and the additional passing tests must be reworked and retested until passing. If the additional tests fail, then additional tests must be performed halfway between the initial additional tests and the adjacent passing tests to further define the failing area. This procedure must be repeated until the failing area is defined, reworked, and retested with passing results. All field moisture-density results will be reported in the FCSER whether they indicate passing or failing values, and all passing hydraulic conductivity test results will be reported in the FCSER.

7.3.7 Thickness Verification

WB cover storage layer layer thickness verification will be performed at the frequency given in Table 7B- 10 by making survey comparisons of the subgrade vs. the top of storage layer (at the same verification point) to calculate and verify thickness.

7.3.8 WB Cover Storage Layer Documentation

Documentation of the WB cover storage layer will be included in the FCSER. The required FCSER contents are described subsequently in Section 9 of this FCQCP.

7.4 WB Cover Erosion Layer and Vegetation Requirements

7.4.1 WB Cover Erosion Layer

The WB cover erosion layer earthen material will be composed of a 6-inch or 12-inch thick topsoil layer capable of sustaining native plant growth, seeded or sodded immediately following the application of final cover. If the underlying WB cover storage layer is classified by the USCS as SC (clayey sand) or CL (lean clay), the minimum erosion layer thickness is 6-inches. If the underlying compacted soil layer is classified as CH (fat clay), the minimum erosion layer thickness is 12-inches.

The material properties, construction requirements, and CQA/documentation requirements for the WB cover erosion layer are the same as for the topsoil layer as specified in Section 6 of this FCQCP.

7.4.2 WB Cover Vegetation

Similar to the discussion above for the erosion layer, the permanent stabilization with vegetative cover (i.e., seeding or sodding) requirements when installing the WB cover system are the same as specified in Section 6 of this FCQCP.

In particular, it is noted for clarification that the WB cover that will be used follows “Option 1” of the TCEQ Statewide Design Tables [per TCEQ Regulatory Guidance Document RG-494] for the geoclimatic region where this site is located. The WB cover “Option 1” is based on model inputs and assumptions performed by Khire (2016), Geoclimatic Design of Water Balance Covers for Municipal Solid Waste Landfills – and it can be thought of as essentially a “default” option based on geoclimatic region, eliminating the need for more rigorous modeling/analysis or field-scale test plots and cover performance verifications (unlike Options 2, 3, or 4 of RG-494). Khire (2016) notes that transpiration was not simulated in the development of the (Option 1) design tables, though “plants are expected to be maintained to minimize erosion and to maintain aesthetics”. This explains the rationale for implementing the same seeding/sodding requirements as for a standard final cover (per Section 6 of this FCQCP). The Post-Closure Plan (Part III, Attachment 9) provides target long-term ground cover percentages, as well as provisions for ongoing inspections and maintenance. Temporary erosion and sediment control best management practices (BMPs), including, but not limited to, temporary mulch or periodically re-seeding, should be conducted until permanent stabilization is achieved.

TABLE 7B-8
MATERIAL SPECIFICATIONS FOR WB COVER STORAGE LAYER

PROPERTY	QUALIFIER	UNITS	SPECIFIED VALUES for WATER BALANCE COVER STORAGE LAYER(2)	STANDARD TEST METHOD(1)
Percent Passing 1-inch Sieve	Minimum	Percent	100	ASTM D 422
Percent Passing #200 Sieve	Minimum	Percent	30	ASTM D 422 or D 1140
Liquid Limit	Minimum	Percent	30	ASTM D 4318
Plasticity Index	Minimum	Percent	15	ASTM D 4318
Hydraulic Conductivity	Maximum	cm/sec	5×10^{-8}	ASTM D 5084(3,4)

Notes:

(1) CQA testing minimum frequencies for WB cover storage layer soil are provided in Tables 7B-9 and 7B-10 of this FCQCP.

(2) Soil material should also be classified and be within a Unified Soil Classification System (USCS) group category per ASTM D 2487 that meets the particle size and plasticity requirements given above.

(3) Hydraulic conductivity refers to a coefficient of permeability measured by either ASTM D 5084, “Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter” as indicated in the above table; or the falling head testing procedures in Appendix VII of the Corps of Engineers Manual EM 1110-2-1906 may be used as an alternative method.

(4) Tables 7B-9 and 7B-10 provide CQA testing requirements with additional details on the required hydraulic conductivity test method and associated testing conditions.

TABLE 7B-9
PRE-CONSTRUCTION AND ONGOING CONFORMANCE TESTING REQUIREMENTS FOR WB COVER STORAGE LAYER
SOIL TEST CATEGORY: BORROW SOURCE MATERIALS

TYPE OF TEST	STANDARD TEST METHOD	MINIMUM FREQUENCY OF TESTING for WATER BALANCE COVER STORAGE LAYER(1)
Unified Soil Classification	ASTM D 2487	1 per 20,000 yd^3 (min. 1 per soil type)
Particle Size (Sieve) Analysis	ASTM D 422	1 per 20,000 yd^3 (min. 1 per soil type)
Atterberg Limits	ASTM D 4318	1 per 20,000 yd^3 (min. 1 per soil type)
Natural (as-received) Moisture Content	ASTM D 2216	1 per 20,000 yd^3 (min. 1 per soil type)
Moisture/Density Relationship (1 Standard Proctor Test & 1 Modified Proctor Test)	ASTM D 698	1 per 20,000 yd^3 (min. 1 per soil type)
6-inch Diameter Remolded Hydraulic Conductivity(2)(3)	ASTM D 5084	2 per 20,000 yd^3 (min. 2 per moisture/density relationship)

Notes:

(1) The testing frequency refers to a relatively consistent and distinguishable soil type at a borrow source location based on visual observations and field classification procedures. Additional testing of a borrow area should be performed as appropriate if observed soil characteristics become variable/inconsistent, or otherwise appear questionable compared to the results from the pre-construction and ongoing conformance tests.

(2) Hydraulic conductivity testing will be performed on 6-inch (minimum) diameter remolded specimens using tap water or a 0.05N solution of $CaSO_4$ and at an effective stress of 2 psi. Distilled or deionized water will not be used. The permeant should be deaired. Hydraulic conductivity test data will be submitted with the FCSER. The test method should be ASTM D 5084, "Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter," as indicated in the above table, or the falling head testing procedures in Appendix VII of the Corps of Engineers Manual EM 1110-2-1906 may be used as an alternative method.

(3) Perform at least two (2) remolded hydraulic conductivity tests on 6-inch (minimum) diameter remolded samples. Both samples should be compacted to the left of (i.e., on the dry side of) the line-of-optimums developed from the results of the standard and modified Proctor tests specified above. The following target compaction conditions are recommended: One sample should be compacted to 90% of the standard Proctor maximum dry density and 1% dry of the line-of-optimums. The other sample should be compacted to 100% of the standard Proctor maximum dry density and 1% to 3% dry of the line-of-optimums. These targets are guidelines, and the POR may adjust the target compaction conditions, provided that the tests are always conducted to the left of (i.e., on the dry side of) the line-of-optimums, and that the material density selected is adequate for constructability, workability, and strength.

TABLE 7B-10
CONFORMANCE TESTING REQUIREMENTS FOR WB COVER STORAGE LAYER
SOIL TEST CATEGORY: CONSTRUCTED SOIL LAYERS

TYPE OF TEST	STANDARD TEST METHOD	MINIMUM FREQUENCY OF TESTING
In-Place Field Density & Moisture Content (Nuclear Gauge)	ASTM D 6938	1 per 16,000 ft^2 per 6-inch lift (minimum 3 tests per lift)
Particle Size (Sieve) Analysis	ASTM D 422	1 per 100,000 ft^2 per 6-inch lift (minimum 1 test per lift)
Atterberg Limits	ASTM D 4318	1 per 100,000 ft^2 per 6-inch lift (minimum 1 test per lift)
3-inch Diameter Undisturbed Hydraulic Conductivity	ASTM D 5084(1)	1 per 2.5 acres per lift (and at least a minimum of 1 test per lift)
Layer Thickness Verification	See Section 2.3.8	1 per 10,000 ft^2 of surface area using uniform grid pattern (minimum two verification points)

Note:

(1) Undisturbed hydraulic conductivity tests on large-diameter (3-inch minimum diameter) undisturbed specimens taken from the as-constructed WB cover storage layer will be performed using tap water or a 0.05N solution of $CaSO_4$ and at an effective stress of 2 psi. Distilled or deionized water will not be used. The permeant should be deaired. Hydraulic conductivity test data will be submitted with the FCSER. The test method should be ASTM D 5084, "Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter," as indicated in the above table, or the falling head testing procedures in Appendix VII of the Corps of Engineers Manual EM 1110-2-1906 may be used as an alternative method.

8. FINAL COVER INTERFACE SHEAR STRENGTH REQUIREMENTS

This section addresses the requirements for conformance interface shear strength testing to measure shear strengths of the compacted soil-to-geomembrane interface of the standard Subtitle D final cover system for the 3H:1V or 3.5H:1V (depending on landfill area as reflected on the final cover grading plan) sideslopes. The purpose of the conformance testing program is to verify that the minimum strengths established from the slope stability analyses presented in the Site Development Plan (Part III, Attachment 3D.2) are achieved for the project-specific materials that will be used.

The testing program will be overseen by the POR and performed by an independent third-party laboratory. Table 7B-11 presented below provides the requirements of this testing program.

TABLE 7B-11
FINAL COVER INTERFACE SHEAR STRENGTH REQUIREMENTS AND CONFORMANCE TESTING REQUIREMENTS
TEST CATEGORY: INDEPENDENT THIRD-PARTY LABORATORY

PROPERTY/TYPE OF TEST	**QUALIFIER**	**UNITS**	**SPECIFIED VALUES**	**STANDARD TEST METHOD**	**FREQUENCY OF TESTING (Minimum)**
Interface Shear Strength (textured geomembrane to compacted soil material) – Peak Strength	minimum	psf	205	ASTM D 5321 (3)	1 per project (4)

Notes:

(1) Interface shear strength testing applies to the standard Subtitle D final cover on sideslopes (i.e., 3H:1V or 3.5H:1V slopes depending on landfill area) and will be performed prior to product shipping as part of the CQA conformance testing program by a qualified, independent third-party laboratory, using representative samples of geomembrane and site-specific compacted soil material.

(2) The interface of the final cover sideslope between the geomembrane and the underlying compacted soil will be tested. This interface must have peak effective-stress interface strength that meets or exceeds the specified value. The specified value was obtained from the final cover system veneer slope stability analyses presented in Part III, Attachment 3D.2. For reference, the shear strength value specified above at the normal stress specified in Note 3 equates to an equivalent secant friction angle of 22.3 degrees. Note that a specification for large-displacement strength of the final cover interface is not applicable for the reasons explained in Attachment 3D.2 (consistent with technical literature recommendations for final cover design).

(3) The interface shear test should be performed at a single normal stress of 500 psf. Use a maximum shear rate of 1 mm/minute for geosynthetics-to-soil interfaces. Compacted clay liner material used for interface test shall be recompacted in the lab to approximately 95% of the standard Proctor max. dry density and approximately 4 to 5% wet of the optimum moisture content.

(4) If the geomembrane product and compacted soil source/properties have not changed since the prior project that included interface shear strength testing, those test results may continue to be used, and additional testing need to be repeated.

9. DOCUMENTATION

Upon completion of all required final cover system construction and evaluation, the POR will prepare and submit in triplicate a FCSER to TCEQ for review and approval. All LERs should be signed and sealed by the POR performing the evaluation, and signed by an authorized representative of the site operator. The FCSER will be prepared in accordance with this plan, and will include the following items at a minimum:

- A narrative construction report describing the conduct of the work for each final cover system component and testing programs implemented as required by the FCQCP, including provision of CQA by the POR or their representative(s) during final cover system construction or evaluation.
- A statement of compliance signed and sealed by the POR indicating the area under evaluation met the applicable FCQCP, permit, and regulatory requirements.
- A clear and legible figure or drawing (map) showing the location of the subject final cover system evaluation area being submitted for approval in relation to the overall final cover system layout and previous FCSER submittals. The map should depict the site grid system, graphic scale, and north arrow.
- Soil layer as-built survey record drawing(s) showing confirmation of the compacted soil layer and cover soil/topsoil layer elevations and thicknesses (or equivalent data for the layers of the WB cover option if it is used).
- All field and laboratory test documentation of the compacted soil layer, with its borrow source test results and constructed soil layer test results (including hydraulic conductivity results) including test and sample locations plotted on a location plan (or equivalent data for the WB cover storage layer if it is used).
- If the WB final cover is used, provide details on type of vegetation used, the target percent coverage, and details on erosion control methods (including any plants that will be used for erosion control).
- Geomembrane as-built survey record drawing(s) documenting the geomembrane panel layout (identifying the location of panels, destructive tests, patches, and repairs).
- Geomembrane manufacturer’s certifications and MQC testing documentation, independent (conformance) testing results, seaming and repair records, and seam test (destructive and non-destructive) results.
- Geocomposite drainage layer manufacturer’s certification and MQC testing documentation.

Post-Closure Care Plan for Municipal Solid Waste Type I Landfill Units and Facilities

This form is for use by applicants or site operators of Municipal Solid Waste (MSW) Type I landfills to provide landfill unit or final facility post-closure care closure plans to meet the requirements in 30 TAC Chapter 330, §330.63(h) and as set out under 30 TAC Chapter 330 Subchapter K for a MSW Type I facility.

If you need assistance in completing this form, please contact the MSW Permits Section in the Waste Permits Division at (512) 239-2335.

I. General Information

Facility Name: Mesquite Creek Landfill

MSW Permit No.: 66C

Site Operator/Permittee Name: Waste Management of Texas, Inc.

II. Party Responsible for Overseeing and Conducting Post Closure Care Activities

Name (Person or Office Responsible): Site Manager

Position or Title: Site Manager

Mailing Address: 1700 Kohlenberg Road

City: New Braunfels

State: Texas

Zip Code: 78130

Telephone Number: (830) 625-7894

III. Post-Closure Care Status of Landfill Units at the Facility

Check the applicable box for the post-closure care status of the units at the facility and complete the applicable tables as indicated:

A. ☒ No landfill unit is in post-closure care in this facility at the time this application is submitted (skip Table 1 and complete Table 2 below if you check this item)

B. ☐ This facility includes landfill units currently in post-closure care and landfill units that are not yet in post-closure care (complete Tables 1 and 2 below if you check this item).

C. ☐ This facility contains only landfill units currently in post-closure care (complete Table 1 below if you check this item; do not complete Table 2).

Table 1: Landfill Units Currently in Post-Closure Care

Landfill Unit Name	Drawing Number Showing the Landfill Unit	Date TCEQ Acknowledged Closure of Unit	Date Post-Closure Care Commenced	Projected Date of End of Post-Closure Care

Table 2: Landfill Units Not yet in Post-Closure Care

Category of Landfill Unit (Regarding Status of Waste Receipt)	Landfill Unit Names or Descriptors	Site Development Plan Drawing Titles and Numbers Showing the Units
Stopped Receiving Waste Prior to October 9, 1993	None [All units received waste after October 9, 1993]	N/A
Received Waste on or after October 9, 1993	Both Landfill Units 1 and 2 received waste after this date	Part III, Attachment 3A, Drawings 3A-1, 3A-2
Proposed to be Constructed	Landfill Unit 2 (expansion area)	Part III, Attachment 3A, Drawings 3A-1, 3A-2
Other (enter as applicable)	N/A	N/A

IV. Post-Closure Care Maintenance Requirements and Activities to be Conducted

A. Categories of Landfill Units and Applicable Post-Closure Care Maintenance Requirements and Activities

Check the appropriate boxes to indicate the categories of landfill units at the facility and complete the applicable section of the post-closure care maintenance requirements and activities below.

This facility includes landfill units that:

☐ Stopped receiving waste prior to October 9, 1993

If you check this item, complete the post-closure care maintenance requirements and activities specified in Subsection IV.B below. Skip Subsection IV.B if this item does not apply to your facility.

☒ Received waste on or after October 9, 1993

If you check this item, complete the post-closure care maintenance requirements and activities specified in Subsection IV.C below. Skip Subsection IV.C if this item does not apply to your facility.

☒ Are proposed to be constructed

If you check this item, complete the post-closure care maintenance requirements and activities specified in Subsection IV.C below. Skip Subsection IV.B, unless your facility also contains units that stopped receiving waste prior to October 9, 1993.

B. Post-Closure Care Maintenance Requirements and Activities for the Landfill Units that Stopped Receiving Waste Prior to October 9, 1993

The site operator will commence and conduct post-closure care maintenance of the units that stopped receiving waste prior to October 9, 1993 for a minimum of the first **five years** following commencement of post-closure care as specified below and in accordance with applicable rules under 30 TAC §330.463(a). Post-closure care maintenance will start on the date the professional engineer's certification of the completion of closure is accepted in writing by the TCEQ executive director and the site operator will carry out the following activities and operations during the period.

1. Maintenance of Right of Entry and Rights of Way

The site operator will retain the right of entry to and maintain all rights-of-way of the closed units in order to conduct periodic inspections of the units throughout the post-closure care period. TCEQ staff will have access to the site to conduct inspection or investigation that may be necessary during the period.

2. Inspection Activities and Correction of Problems

The site operator will conduct inspection of the closed landfill units at the frequencies indicated in Table 3 below, utilizing the inspection protocol maintained in the site operating record, and will correct all identified problems as needed.

Table 3: Inspection Activities Schedule

Post-Closure Care Inspection Item	Frequency of Inspection	Types of Deficiency Conditions to be looked for during Inspection
Final Cover Condition	N/A	
Vegetation	N/A	
Leachate Management Systems	N/A	
Landfill Gas Monitoring and Control Systems	N/A	
Groundwater Monitoring Systems	N/A	
Drainage Structures	N/A	
Ponding of Water	N/A	
Other:	N/A	

3. Continuation of Monitoring Programs during Post-Closure Care Period

The site operator will continue the monitoring programs listed in Table 4 during the post-closure care period. The monitoring programs will be conducted as specified in the applicable section of the facility's Site Development Plan and applicable rules.

Table 4: Monitoring and Reporting Schedule

Monitoring Program	Frequency of Monitoring	Frequency of Reporting of Results
Groundwater monitoring	N/A	
Landfill gas monitoring	N/A	
Other:	N/A	

4. Detection of a Release, Nature and Extent Investigation, and Corrective Action to Address Release from the MSW Unit

Upon detection of any evidence of a release from the landfill or other associated waste management units at the facility, the site operator will:

- Notify the executive director of the TCEQ of the condition detected;
- Investigate, if so directed by the executive director of the TCEQ, whether a release from the landfill or other associated waste management units at the facility has occurred;
- Investigate the nature and extent of the release, if a release is confirmed;
- Assess measures necessary to correct any impact to groundwater;
- Submit a corrective action plan via a permit modification for TCEQ executive director's review and approval; and
- Conduct corrective action as approved by the TCEQ executive director.

5. Extension of Post-Closure Care Period

If any of the problems listed in Table 3 occurs, or corrective action as indicated in Subsection IV.B.4 above continues, after the end of the five-year post-closure care period or persists for longer than the first five years of post-closure care, the site operator will be responsible for their correction and will continue to conduct post-closure care maintenance until the TCEQ executive director determines that all problems have been adequately resolved.

6. Reduction of Post-Closure Care Period

The site operator may request in writing for the TCEQ executive director to reduce the post-closure care period for the units if all wastes and waste residues have been removed during closure and any new or on-going corrective action to address confirmed releases from the landfill have been completed as acknowledged in writing by the executive director.

C. Post-Closure Care Requirements and Activities for Municipal Solid Waste Landfill Units that Receive Waste on or after October 9, 1993 and for New Units

The site operator will commence and conduct post-closure care maintenance of the units that receive waste on or after October 9, 1993 and new units constructed under this permit as follows and in accordance with applicable rules under 30 TAC §330.463.

1. Commencement of Post-Closure Care

Post-closure care maintenance will start on the date the professional engineer’s certification of the completion of closure is accepted in writing by the TCEQ executive director and the site operator will carry out the following activities and operations during the period.

2. Period of Post-Closure Care

The site operator will conduct post-closure care for the landfill units for a period of **30 years**, unless this time period is increased or reduced by the executive director as discussed in Subsection IV.C.11.

3. Maintenance of Right of Entry and Rights of Way

The site operator will retain the right of entry to the closed units and the facility and will maintain all rights-of-way of the closed units in order to conduct periodic inspection and maintenance of the closed units until the end of the post-closure care period.

4. Inspection Activities

The site operator will conduct periodic inspection of the closed units to identify and document deficiency conditions and conduct maintenance and corrective action to maintain compliance. Sections IV.C. 8.(a)-(c) provide information on the inspection items and deficiency conditions that the site operator will look for during inspection of the major components of the landfill and the site during the post-closure care period. Other inspection and maintenance provisions that apply during the post-closure care period as specified in the facility's site operating plan, site development plan, or applicable rules will remain in effect.

5. Documentation of Inspection

The site operator will document and maintain records of the post-closure care inspections in the site operating record. The records will include:

- The date of inspection;
- Components and items inspected;
- Problems detected or observed; and
- The name of the personnel who conducted the inspection.

6. Corrective Actions

Based on the results of the inspection activities, the site operator will conduct needed restoration and remediation actions on the closed unit no later than the next scheduled inspection event. Also, the site operator will conduct maintenance action on regular periodic schedule in order to:

- Maintain the integrity and effectiveness of all final cover, facility vegetation, and drainage control systems;
- Correct any effects of settlement, subsidence, ponded water, erosion, or other events or failures detrimental to the integrity of the closed unit; and
- Prevent any surface run-on and run-off from eroding or otherwise damaging the final cover system during the post-closure care period.

7. Documentation of Corrective Actions

The site operator will document and maintain, in the facility's site operating record, records of the restoration, remediation, and maintenance activities performed, including the date of completion of the activities.

8. Inspection Activities Schedules

(a) Final Cover Inspection

Inspection Frequency: Semi-annual

Other Inspection Occasions/Events:

Table 5: Final Cover Inspection Items

Inspection Item	Types of Deficiency Conditions to be looked for during Inspection
Vegetation and other Ground Cover Materials	Stressed or dead vegetation, lack of adequate vegetation coverage, improper vegetation types (e.g., shrubs or trees), erosion rills or gullies, vegetation overgrowth or die-out.
Settlement	Areas of excessive landfill settlement of a magnitude that has caused or may imminently cause water to pond (e.g., grade reversals), disruption or poor function of drainage features, or final cover cracking/strains.
Subsidence	Localized location(s) of differential settlement (e.g., depressions) of a magnitude that has caused or may imminently cause water to pond (e.g., grade reversals), disruption or poor function of drainage features, or final cover cracking/strains.
Ponded Water	Standing water on the final cover, or signs where water was previously standing but has dried up at the time of the inspection.
Erosion	Erosion gullies, surficial soil erosion (loss of final cover thickness, lack of vegetation), washed-out vegetation, deposition of eroded materials downgradient (e.g., accumulated sediment).
Other (enter other events or failures detrimental to the integrity and effectiveness of the final cover):	Animal burrows, surface cracks, slope instability (e.g., sloughed areas), leachate seeps, landfill gas odors or evidence of uncontrolled emissions.

(b) *Drainage Control System Inspection*

Inspection Frequency: Semi-annual (concurrent with final cover inspection)

Other Inspection Occasions/Events:

Table 6: Drainage Control System Inspection Items

Inspection Item	Types of Deficiency Conditions to be looked for during Inspection
Vegetation within Drainage Control Structures	Distressed or dead vegetation, lack of adequate vegetation coverage, improper vegetation types (e.g., shrubs or trees), erosion, vegetation overgrowth.
Component Failures	Erosion gullies, eroded drainage feature channel lining, blocked flow paths, undermining or piping, flow short-circuiting, shifted pipes/culverts, overtopping, failed outlet structures and aprons.
Wash Outs	Washouts causing component failures described above, loss of channel lining materials/integrity.
Sediment Build Up	Accumulated sediment in drainage conveyances that could block or impede flow (restrict capacity), deposition of sediment at grade reversals, accumulated sediment in storm water ponds (including at their outlet structures/outfalls).
Other (enter other events or failures detrimental to the integrity and effectiveness of drainage structures):	Cracking, distress, or shifting of drainage structures (ascertain potential causes such as settlement/subsidence, slope instability, physical degradation, high velocity flows).

(c) *Access and Rights-of-Way*

Inspection Frequency: Semi-annual (concurrent with final cover inspection)

Other Inspection Occasions/Events:

Table 7: Access and Rights of Way Inspection Items

Inspection Item	Types of Deficiency Conditions to be looked for During Inspection
Gates, Gate Locks and Barriers	Broken, damaged, or missing gates, locks, lock chains, or barriers.
Fence and other Access Control Barriers	Damaged, missing, or intentionally breached (e.g., vandalized, collapsed, cut/moved) fencing. Excessive degradation of fencing materials.
Vegetation Control in Areas of the Facility other than the Final Cover	Vegetation overgrowth impeding accessibility (site roads and footpaths, benchmark, monitoring points) or blocking signage.
Other (enter other access control and rights-of-way inspection items):	Damaged or missing signage, integrity of site entrance driveway and on-site roads.

9. Continuation of Operation and Maintenance of the Leachate Collection and Removal Systems (LCRS)

The site operator will continue the operation and maintenance of the LCRS and disposal of leachate during the post-closure care period in accordance with the facility's leachate management plan found in Attachment 3E (Leachate and Contaminated Water Plan) of the Site Development Plan and consistent with applicable provisions under 30 TAC Sections 330.331 and 330.333.

(a) Performance Monitoring and Inspection of the LCRS

During the post-closure care period, the site operator will monitor the performance of the LCRS on a quarterly basis to assure continuous compliance with the design criteria and inspect the LCRS components on a quarterly basis, at a minimum, to determine the need for repair or maintenance. Inspection and monitoring will follow the procedure described in the facility's leachate management plan found in Attachment/Appendix/Section Attachment 3E (Leachate and Contaminated Water Plan) of the Site Development Plan or in the written inspection protocol maintained in the facility’s site operating record. Results of the monitoring and inspection activities will be documented in the site operating record. The items and components of the leachate collection and removal system to be inspected will include but are not limited to the items in Table 8 below.

Table 8: Leachate Collection and Removal System Inspection

Inspection Item/Component	Types of Deficiency Conditions to be looked for during Inspection
Pumps and riser pipes	Broken or inoperable pumps, inaccessible pumps (may indicate riser pipe collapse)
Controls	Damaged control panels, valves and fittings, gages
Transmission pipes	Signs of leakage (wet or eroded areas along alignment, vegetation distress, inability to maintain system pressure), shifted or damaged/crushed/ruptured pipes.
Head levels in sumps	Excessive leachate head levels in sumps, high level alarm, significant increase in leachate generation/withdrawal rates

(b) LCR Maintenance and Repairs

During the post-closure care period, the site operator will perform routine and needed maintenance or repairs of the LCRS items and components based on the monitoring and inspection results. Maintenance and repair will be completed prior to the next scheduled monitoring event and documented within the site operating record.

(c) Discontinuation of Leachate Management

The site operator may submit data and information from the closed units to the TCEQ executive director to demonstrate that leachate no longer poses a threat to human health and the environment. Upon the executive director’s approval of the demonstration, the site operator will be allowed to stop managing leachate at the closed unit.

10. Continuation of Monitoring Systems Operation and Maintenance:

The site operator will continue to conduct monitoring systems operation and maintenance activities to ensure the integrity of the containment system and to promptly detect and control releases to the environment during the post-closure care period as follows.

(a) Groundwater Monitoring System

The site operator will continue groundwater monitoring activities (including sampling, analysis, reporting, etc.) in accordance with the approved site-specific Groundwater Sampling and Analysis Plan (GWSAP) found in Attachment 5C of the Site Development Plan, the Groundwater Monitoring System Design found in Attachment 5 of the Site Development Plan and consistent with the provisions under 30 TAC Chapter 330 Subchapter J. Groundwater monitoring will be conducted semiannually or as otherwise approved by the TCEQ executive director during the post-closure care period.

i. Inspection of the Groundwater Monitoring System

During each groundwater monitoring event, the site operator will perform inspection of all the groundwater monitoring wells that are part of the groundwater monitoring system and other items discussed in the GWSAP or the Groundwater Monitoring System Design. The items and components of the groundwater monitoring system to be inspected are included in Table 9:

Table 9: Groundwater Monitoring Systems Inspection

Inspection Item/Component	Types of Deficiency Conditions to be looked for during Inspection
Groundwater Monitoring Well	Cracked, shifted, or eroded (undermined) well pads. Damaged or missing well protective casing, locking device, signs/labels, bollard posts. Damaged or shifted well casing. Anything else unusual (changed physical appearance since previous monitoring event).

ii. Maintenance and Repair of the Groundwater Monitoring System

The site operator will perform needed maintenance and/or repairs of the groundwater monitoring system items and components based on the inspection results. Maintenance and/or repairs will be performed no later than the next scheduled monitoring event.

iii. Documentation of Inspection, Maintenance, and Repairs

The site operator will document and discuss the results of the groundwater monitoring system inspection, maintenance, and repair activities in the groundwater monitoring report submitted to the TCEQ executive director, and maintain the documents in the site operating record.

(b) Landfill Gas Management System

During the post-closure care, the site operator will continue landfill gas monitoring operations and activities, documentation, and reporting in accordance with the facility’s landfill gas management plan and consistent with the requirements under 30 TAC Chapter 330, Subchapter I.

i. LFG Monitoring and Monitoring System Inspection

All structures and perimeter gas monitoring probes will be sampled quarterly or more frequently as approved by the TCEQ executive director. The site operator will conduct routine inspections of the landfill gas management system components as provided in the landfill gas management plan during the post-closure care period. The items and components to be inspected are included in Table 10.

Table 10: Landfill Gas Management System Inspection

Inspection Item/Component	Types of Deficiency Conditions to be looked for during Inspection
Gas Monitoring Probe	Cracked, shifted, or eroded (undermined) well pads. Damaged or missing well protective casing, locking device, signs/labels, bollard posts. Damaged or shifted well casing. Anything else unusual (changed physical appearance since previous monitoring event).
Active Gas Collection and Control System (GCCS)	Damaged gas collection and control system components (gas extraction wells, control system piping and mechanical equipment). System not operating, or operating incorrectly.

ii. LFG Management System Maintenance

The site operator will perform routine and needed maintenance of the landfill gas management system including calibration of the monitoring equipment. Needed maintenance and/or repair work will be performed based on the inspection and monitoring results no later than the next scheduled monitoring event.

(c) Continuation of Earth Electrical Resistivity Survey

The site operator will, if applicable, continue earth electrical resistivity surveys as applicable at the frequency stated in the approved site development plan or as otherwise approved by the TCEQ executive director.

11. Detection of a Release, Nature and Extent Investigation, and Corrective Action to Address Release from the MSW Unit

If there is evidence of a release from the landfill or other associated waste management units at the facility, the site operator will:

- Notify the executive director of the TCEQ of the condition detected;

- Investigate, if so directed by the executive director of the TCEQ, whether a release from the landfill or other associated waste management units at the facility has occurred;
- Investigate the nature and extent of the release, if a release is confirmed;
- Assess measures necessary to correct any impact to groundwater;
- Submit a corrective action plan via a permit modification for TCEQ executive director's review and approval; and
- Conduct corrective action as approved by the TCEQ executive director.

12. Revision of the Length of Post-Closure Care Period

(a) The Post-Closure Care Period May Be Decreased

The length of the post-closure care period may be decreased by the TCEQ executive director if the site operator submits a documented certification signed by a licensed professional engineer and including all applicable supporting documentation that demonstrates that the reduced period is sufficient to protect human health and the environment, and the executive director approves the decrease in writing after review.

(b) The Post-Closure Care Period May be Increased

The length of the post-closure care period may be increased by the TCEQ executive director if it is determined that the longer period is necessary to protect human health and the environment.

V. Recordkeeping

The site operator will place a copy of this post-closure plan in the facility's site operating record by the initial receipt of waste at the units proposed at the time of this application. Also, the site operator will document and maintain records of all inspection, monitoring, maintenance, repair, or remediation activities, and detail the results of any inspection and schedules of any other actions to be taken to maintain compliance, in the site operating record.

VI. Planned Use of the Land during and after the Post-Closure Care Period

Post-closure use of the property will not disturb the final cover, liners, or other containment or monitoring systems unless such disturbance is necessary for the proposed use or to protect human health and the environment and is authorized by the TCEQ executive director consistent with provisions under 30 TAC Chapter 330 Subchapter T.

Description of the Planned Use of the Land during or after the Post-Closure Care Period *(describe the planned use of the land during or after the post-closure care period; if not known at this time, enter "NOT KNOWN")*:

Open space.

VII. Post-Closure Care and Corrective Action Cost Estimates

A detailed written cost estimate in current dollars for conducting post closure care is provided in *(enter location of the post-closure care cost estimate in the application/permit document)*:

Part III, Attachment 9.

The cost estimate for corrective action will be provided as needed, via a permit modification, during the life and/or post-closure care period of the unit or facility.

VIII. Certification of Completion of Post-Closure Care

Upon completion of the post-closure care maintenance period for each municipal solid waste landfill unit, the site operator will submit to the TCEQ executive director for review and approval a certification, signed by an independent licensed professional engineer, verifying that post-closure care has been completed in accordance with the approved post-closure plan. The submittal to the executive director shall include all applicable documentation necessary for the certification of completion of post-closure care. These will include information relating to the condition and status of:

- The final cover integrity and stability, including the condition of the soil, vegetation, drainage structures, etc.
- Groundwater quality at the site, as determined from on-going groundwater detection or assessment monitoring or corrective measures data during the period.
- Landfill gas (methane) migration, as determined from on-going landfill gas monitoring and remediation data during the period.

- Leachate generation rate and quantity as determined from on-going leachate management data over the period.
- The surface water management system.
- Access control structures.

The engineer's certification of post-closure will show that, based on a summary of monitoring and inspection results, the final cover system continues to maintain its integrity, stability, and function; groundwater remains uncontaminated and monitoring is no longer required; landfill gas is not migrating beyond the facility boundary or accumulating in structures at action levels and monitoring is no longer required; leachate generation rate and quantity will not result in greater than 12 inches of head above the liner, no breakouts have occurred, and all slopes remain as approved and leachate management is no longer required; the surface water management system continues to function as designed; and the access control structures remain intact.

Documentation supporting the professional engineer's certification will be furnished to the TCEQ executive director upon request and will be maintained in the site operating record until the executive director acknowledges termination of post-closure in writing.

IX. Voluntary Revocation Request

Upon completion of the post-closure care period for the final unit at the facility, the site operator will submit to the executive director a request for voluntary revocation of the facility permit.

X. Attachments

The following figures and documents are attached as part of this post-closure care plan:

N/A

XI. Engineer's Seal and Signature

Name: Scott M. Graves, P.E. Title: Senior Principal

Date: 10/11/2023

Company Name: Geosyntec Consultants, Inc.; Firm Registration Number: 1182

Professional Engineer's Seal

STATE OF TEXAS
SCOTT M. GRAVES
86557
LICENSED PROFESSIONAL ENGINEER

10/11/2023

FOR PERMIT PURPOSES ONLY

Signature

ATTACHMENT 9

COST ESTIMATES FOR CLOSURE AND POST-CLOSURE CARE

ATTACHMENT 9 TABLE OF CONTENTS

FORM TCEQ-20721
CLOSURE COST ESTIMATE FORM
FOR MUNICIPAL SOLID WASTE TYPE I LANDFILLS

Texas Commission on Environmental Quality

Closure Cost Estimate Form for Municipal Solid Waste Type I Landfills

This form is for use by applicants or site operators to provide cost estimates for closure of MSW Type I landfills to meet the requirements in 30 Texas Administrative Code (TAC) Chapter 330, Section 330.63(j) and 30 TAC Chapter 330 Subchapter L. The costs to be provided herein are cost estimates for hiring a third party to close the largest waste fill area that could potentially be open in the year to follow and those areas that have not received final cover. If you need assistance in completing this form, please contact the MSW Permits Section in the Waste Permits Division at (512) 239-2335.

Facility Name: Mesquite Creek Landfill

MSW Permit No.: 66C

Site Operator/Permittee Name and Mailing Address: Waste Management of Texas, Inc., 1700 Kohlenberg Rd, New Braunfels, TX 78130

Total Closure Cost Estimate (2023 Dollar Amount): $7,924,988

I. Professional Engineer's Statement, Seal, and Signature

I am a licensed professional engineer in the State of Texas. To the best of my knowledge, this Closure Cost Estimate has been completed in substantial conformance with the facility Closure Plan and, in my professional opinion, is in compliance with Title 30 of the Texas Administrative Code, Chapter 330.

Name: Scott M. Graves, P.E.

Title: Senior Principal

Date: 10/11/2023

Company Name: Geosyntec Consultants, Inc.

Firm Registration Number: 1182

Professional Engineer's Seal

SCOTT M. GRAVES
86557

10/11/2023

FOR PERMIT PURPOSES ONLY

Professional Engineer's Signature

II. Annual Review of Permit Conditions, Cost Estimates, Inflation Factor, and Financial Assurance

The permittee/site operator acknowledges that he/she will:

(1) Review the facility’s permit conditions on an annual basis and verify that the current active and inactive waste fill areas of the landfill match the areas on which closure cost estimates are based.

(2) Request in writing via a permit modification application for an increase in the closure cost estimate and the amount of financial assurance provided if changes to the closure plan or the landfill conditions increase the maximum cost of closure at any time during the remaining active life of the landfill.

(3) Request in writing via a permit modification application for a reduction in the cost estimate and the amount of financial assurance provided if the cost estimate exceeds the maximum cost of closure at any time during the remaining active life of the landfill. The permit modification application will include a description of the situation and a detailed justification for the reduction of the closure cost estimate and the amount of financial assurance.

(4) Establish financial assurance for closure of the unit in an amount no less than the current closure cost estimate in accordance with 30 TAC Chapter 37, Subchapter R.

(5) Adjust the current cost estimate for inflation within 60 days prior to the anniversary date of the first establishment of the financial assurance mechanism.

(6) Provide annual inflation adjustments to the closure costs and financial assurance during the active life of the facility, until the facility is officially placed under the post closure care period and all requirements of the final closure plan have been approved in writing by the TCEQ executive director. The adjustment will be made using an inflation factor derived from the most recent annual Implicit Price Deflator for Gross National Product published by the United States Department of Commerce in its Survey of Current Business, as specified in paragraphs (1) and (2) of 30 TAC §37.131. The inflation factor is the result of dividing the latest published annual Deflator by the Deflator for the previous year.

(7) Provide continuous financial assurance coverage for closure until the facility is officially placed under the post-closure care period.

III. Description of the Closure Cost Estimates Worksheet

The following descriptions of the items on the closure cost estimates worksheet provide guidance for identifying the minimum work or cost elements and estimating the unit or lump sum cost of each item as applicable. Enter additional detail for each item in the field following the item as necessary and as site-specific condition warrants. The cost items are grouped under closure costs for engineering, construction, and storage and processing units. Include attachments to detail any additional work and associated costs necessary to close the site that is not already included as a line item on the worksheet. Reference the attachments and list the work or cost items in the fields under "Additional Engineering Cost Items Not Listed on the Worksheet," "Additional Construction Cost Items Not Listed on the Worksheet," or "Additional Storage and Processing Units Items Not Listed on the Worksheet" as applicable. Provide the total cost of the additional work or cost items in each cost category on the worksheet line that precedes the cost subtotal for each cost group.

1. Engineering Costs

The engineering tasks have been subdivided into seven items and are described below. Other related costs may be added as site-specific issues warrant.

1.1. Topographic Survey

A topographic survey will be required to verify the existing elevation and slopes of the landfill to ensure conformance with the final cover system, drainage system, and final grading designs.

Enter additional topographic survey work or cost element details as site-specific conditions warrant: No additional information.

1.2. Boundary Survey

The metes and bounds description is required for filing of the affidavit of closure and deed recording of any area of the site which has received waste. Other activities to be included here are publication of the public notice of closing activities.

Enter additional boundary survey work or cost element details as site-specific conditions warrant: No additional information.

1.3. Site Evaluation

The evaluation includes a site inspection to identify waste disposal areas, analyze drainage and erosion protection needs, and to determine other site operational features that are not in compliance with the permit. The site evaluation also includes verifying the need for new or relocation of existing groundwater monitoring wells and landfill gas monitoring probes, analysis of groundwater samples, and review of site operating record. The third party consultant who performed the site evaluation will prepare and submit an engineering report to the executive director to document the status of the site.

The report will identify all areas of work and the associated implementation costs necessary to safely close the landfill operations with recommendations on how to fulfill these needs.

Enter additional site evaluation work or cost element details as site-specific conditions warrant: No additional information.

1.4. Development of Plans

The final closure, plan the final cover system design and specifications, grading and drainage plans, specification for revegetation, design of any other improvements to bring the site into compliance with the permit, the closure schedule, and coordination with the TCEQ and provision of closure notice to the public.

Enter additional development of plans work or cost element details as site-specific conditions warrant: No additional information.

1.5. Contract Administration (bidding and award)

The third-party consultant will advertise the project, receive the bids, evaluate the bids, award the closure construction contract and administer the contract during construction.

Enter additional contract administration work or cost element details as site-specific conditions warrant: No additional information.

1.6. Closure Inspection and Testing

The professional of record will observe closure construction, perform cover thickness and permeability verification, and prepare an evaluation report upon completion of closure.

Enter additional closure inspection or testing work or cost element details as site-specific conditions warrant: No additional information.

1.7. TPDES and other Permits

The third-party consultant will prepare plans, specifications, and other documents necessary for compliance with applicable federal and state laws and requirements, including the Clean Water Act, for the proper closure of the site.

Enter additional TPES or other permits work or cost element details as site-specific conditions warrant: No additional information.

1.8. Additional Engineering Cost Items Not Listed on the Worksheet

List the Attachment(s) detailing any additional engineering cost items necessary to close the site that is not already included as a line item on the worksheet: None. Also, reference these Attachments in the "Units" column on this line of the worksheet. Provide the total cost of all additional engineering cost items in the "Cost" column.

1.9. Engineering Costs Subtotal

1.9.1. Enter the sum of engineering costs in Items 1.1 through 1.8.

2. Construction Costs

Closure construction costs include those for construction of the final cover system, site grading, and drainage improvements. Other costs may be added as site-specific issues warrant.

2.1. Mobilization

2.1.1. Mobilization of Personnel and Equipment

The cost of mobilizing personnel and construction heavy equipment must be included as part of the construction costs.

Enter additional work or cost element details for mobilization of personnel and equipment as site-specific conditions warrant: No additional information.

2.2. Final Cover System

The owner or operator must install a final cover system that is designed to minimize infiltration and erosion. The final cover system is subdivided into the sideslope cover and cap cover with their associated components to facilitate cost calculations. If an alternative final cover is proposed, the closure cost estimate will still be based on a design that utilizes the conventional composite cover system.

Enter additional final cover system work or cost element details as site-specific conditions warrant: No additional information.

2.2.1. Side Slope Cover

Enter information for Items 2.2.1a through 2.2.1h.

2.2.2. Top Slope Cover

Enter information for Items 2.2.2a through 2.2.2h.

2.2.3. Cells for Class 1 Nonhazardous Industrial Waste

2.3. Site Grading

Site grading includes the final grading of the site, including the landfill cap and sideslopes.

Enter additional site grading work or cost element details as site-specific conditions warrant: No additional information.

2.4. Site Fencing and Security

Site fencing and security must be included for the area which has received waste and have no existing approved fencing.

Enter additional site fencing and security work or cost element details as site-specific conditions warrant: *No additional information.*

2.5. Landfill Gas Monitoring and Control Systems

Enter information for Items 2.5.1 through 2.5.6.

Final installation of the landfill gas monitoring and control systems must include the installation costs of pipes and appurtenances. In the event of a forced closure, the systems may not have been completed, thus, the estimated costs to complete the landfill gas monitoring and control system must be provided.

Enter additional landfill gas monitoring and control systems work or cost element details as site-specific conditions warrant: *No additional information.*

2.6. Groundwater Monitoring System

2.6.1. Monitor Well Installation

Upon closure of the site, it may be necessary to relocate the compliance boundary. This requires the installation of new monitor wells.

Enter additional groundwater monitoring system work or cost element details as site-specific conditions warrant: *No additional information.*

2.6.2. Piezometer and Monitor Well Plugging and Abandonment

Piezometer or monitor well abandonment is the cost of abandoning (plugging) piezometers or monitor wells that are no longer needed. Determine the number of piezometers or monitor wells to be abandoned and include the total cost.

Enter additional plugging and abandonment work or cost element details as site-specific conditions warrant: *No additional information.*

2.7. Leachate Management

2.7.1. Completion of Existing Leachate Collection System

In the event of a forced closure, there may be circumstances where the leachate collection system has not been completed. In this event, the leachate collection system must be closed with a permanent outfalls and permanent cleanouts installed.

Enter additional leachate management work or cost element details as site-specific conditions warrant: No additional information.

2.8. Stormwater Management

2.8.1. Stormwater Drainage Management System

To reduce the potential long-term impacts of the landfill on surface water quality, drainage features must be incorporated into the final cover design to direct runoff, minimize erosion, control sediments, and avoid ponding of stormwater. The drainage system construction costs must be included.

Enter additional stormwater drainage management work or cost element details as site-specific conditions warrant: No additional information.

2.9. Additional Construction Cost Items Not Listed on Worksheet

List the Attachments detailing any additional construction cost items necessary to close the site that is not already included as a line item on the worksheet: None. Also, reference these Attachments in the "Units" column on this line of the worksheet. Provide the total cost of all additional construction cost items in the "Cost" column.

2.10. Construction Costs Subtotal

2.10.1. Enter the sum of construction costs in Items 2.1 through 2.9.

3. Storage and Processing Unit Closure Costs

For landfills that incorporate storage and/or processing operations that are not separately authorized, all waste and processed and unprocessed materials associated with storage and/or processing units must be removed during the closure process.

3.1. Waste Disposal

The cost of disposal of waste at an authorized facility. *Enter additional waste disposal work or cost element information as necessary.*

Dispose of all waste in recycling and solidification areas in the landfill; except tires, which will be removed from site.

3.2. Material Removal and Disinfection

The cost of removal, including transportation, of any remaining processed and unprocessed materials to an authorized off-site location. *Enter additional material removal and disinfection work or cost element information as necessary.*

Trailer of tires to be removed from site and transported to authorized scrap tire management facility.

3.3. Demolition and Disposal

The cost of dismantling and/or disinfection of storage and/or processing units and disposal, as applicable. *Enter additional demolition and disposal work or cost element information as necessary.*

Regrade recycling areas to drain and revegetate. Dismantle and backfill solidification basins.

3.4. Additional Storage and Processing Unit Closure Cost Items Not Listed in Worksheet

List the Attachments detailing any additional storage and processing unit closure cost items necessary to close the site that is not already included as a line item on the worksheet. None. Also, reference these Attachments in the "Units" column on this line of the worksheet. Provide the total cost of all additional storage and processing unit closure cost items in the "Cost" column.

3.5. Storage and Processing Unit Closure Costs Subtotal

4. Sum of Cost Subtotals

4.1. Enter the sum of engineering, construction, and storage and processing unit closure cost subtotals from lines 1.9.1, 2.10.1, and 3.5.1.

5. Contingency

5.1. Add an amount equal to at least 10 percent of the sum of cost subtotals to cover unanticipated events during implementation of closure activities.

6. Contract Performance Bond

6.1. Add an amount equal to at least 2 percent of the sum of cost subtotals for purchase of a surety bond to guarantee satisfactory completion of the closure activities.

7. Third Party Administration and Project Management Costs

7.1. Add an amount equal to at least 2.5 percent of the sum of cost subtotals to cover the cost for a third party hired by TCEQ to administer the closure activities.

8. Total Closure Cost

8.1. Enter the sum of the amounts on lines 4.1, 5.1, 6.1, and 7.1.

IV. Closure Cost Estimates Worksheet

A. Landfill Data

Total Permitted Waste Disposal Area: 291.6 acres

Largest Area Requiring Final Cover in the year to follow: 65.0 acres

Total Filled Area with Constructed Final Cover: 72.3 acres

Total Area Certified Closed: 72.3 acres

Number of Monitor Wells to be Installed for Closure: 0

Number of Gas Probes to be Installed for Closure: 0

Total Acreage Needing LFG Collection and Control System: 30 acres

The unit or lump sum cost for each item is based on the work items and cost elements described in Section III of this Closure Cost Estimate document:

Yes ☒ No ☐ Partially ☐

(if "No" or "Partially" is checked, please include attachments describing the additional work items and detailing the unit, quantities, and costs for the additional items)

B. Facility Drawings and Financial Assurance Documentation

- Facility drawings
  - Attach facility drawings showing the closure areas to which the closure cost estimates apply.
- Financial assurance documentation
  - For an existing facility, attach a copy of the documentation required to demonstrate financial assurance as specified in 30 TAC Chapter 37, Subchapter R.
  - For a new facility, a copy of the required documentation shall be submitted 60 days prior to the initial receipt of waste.

C. Attachments

- Additional Engineering, Construction, and Storage and Processing Units Cost Items Details

D. Closure Cost Estimates Worksheet

If any item listed in this worksheet is not applicable to the subject facility, enter "NA" (Not Applicable) in the affected field.

Table 1. Closure Cost Estimates Worksheet.

Item No.	Item Description	Units[1]	Quantity	Unit Cost	Cost	Source of Unit Cost Estimate[2]
1. Engineering Costs						
1.1	Topographic Survey	Lump Sum	NA	NA	$12,000	Recent project experience
1.2	Boundary Survey	Lump Sum	NA	NA	$20,000	Recent project experience
1.3	Site Evaluation	Lump Sum	NA	NA	$10,000	Third Party Estimate
1.4	Development of Plans	Lump Sum	NA	NA	$37,500	Third Party Estimate
1.5	Contract Administration (bidding and award)	Lump Sum	NA	NA	$15,000	Third Party Estimate
1.6	Closure Inspection and Testing	Acres	65.0	$4,500	$292,500	Third Party Estimate
1.7	TPDES and other Permits	Lump Sum	NA	NA	$6,000	Third Party Estimate
1.8	Additional Engineering Cost Items (describe in attachments)	identify attachments	NA	NA	N/A	NA
1.9 Engineering Costs Subtotal						
1.9.1	Engineering Costs Subtotal	NA	NA	NA	$393,000	NA
2. Construction Costs						
2.1 Mobilization						
2.1.1	Mobilization of Personnel and Equipment	Lump Sum	NA	NA	$157,681	2.5% of construction costs
2.2 Final Cover System						
2.2.1 Side Slope Cover and Top Cover - Subtitle D Areas						
2.2.1a	Infiltration Layer – Compacted Clay	Cubic Yards	157,300	$3.85	$605,605	Recent Construction Experience

Closure Cost Estimate for MSW Type I Landfill

Facility Name: Mesquite Creek Landfill Revision No.: 0

Permit No: MSW-66C Date: October 2023

Item No.	Item Description	Units^1	Quantity	Unit Cost	Cost	Source of Unit Cost Estimate^2
2.2.1b	Infiltration Layer – Geosynthetic Clay Liner	Square Feet	NA	NA	NA	NA
2.2.1c	Flexible Membrane Cover – HDPE	Square Feet	NA	NA	NA	NA
2.2.1d	Flexible Membrane Cover – LLDPE	Square Feet	2,831,400	$0.54	$1,528,956	Third Party Estimate
2.2.1e	Drainage Layer – Aggregate	Cubic Yards	NA	NA	NA	NA
2.2.1f	Drainage Layer – Drainage Geocomposite Material	Square Feet	2,831,400	$0.76	$2,151,864	Third Party Estimate
2.2.1g	Erosion Layer	Cubic Yards	209,740	$2.75	$576,785	Recent Construction Experience
2.2.1h	Vegetation	Acres	65.0	$4,000	$260,000	Recent Construction Experience
2.2.2 Top Slope Cover - Subtitle D Areas [included in above]						
2.2.2a	Infiltration Layer – Compacted Clay	Cubic Yards	NA	NA	NA	NA
2.2.2b	Infiltration Layer – Geosynthetic Clay Liner	Square Feet	NA	NA	NA	NA
2.2.2c	Flexible Membrane Cover – HDPE	Square Feet	NA	NA	NA	NA
2.2.2d	Flexible Membrane Cover – LLDPE	Square Feet	NA	NA	NA	NA
2.2.2e	Drainage Layer – Aggregate	Cubic Yards	NA	NA	NA	NA
2.2.2f	Drainage Layer – Drainage Geocomposite Material	Square Feet	NA	NA	NA	NA
2.2.2g	Erosion Layer	Cubic Yards	NA	NA	NA	NA
2.2.2h	Vegetation	Acres	NA	NA	NA	NA
2.2.3 Cells for Class 1 Nonhazardous Industrial Waste						
2.2.3a	Dike Construction	specify	NA	NA	NA	NA
2.2.4 Pre-Subtitle D Cover [includes top and sideslope areas]						
2.2.4a	Infiltration Layer – Compacted Clay	Cubic Yards	NA	NA	NA	NA

Closure Cost Estimate for MSW Type I Landfill

Facility Name: Mesquite Creek Landfill

Revision No.: 0

Permit No: MSW-66C

Date: October 2023

Item No.	Item Description	Units[1]	Quantity	Unit Cost	Cost	Source of Unit Cost Estimate[2]
2.2.4b	Erosion Layer	Cubic Yards	NA	NA	NA	NA
2.2.4c	Vegetation	Acres	NA	NA	NA	NA
2.3 Site Grading						
2.3.1	Site Grading	Acres	65.0	$4,000	$260,000	Recent Construction Experience
2.4 Site Fencing and Security						
2.4.1	Site Fencing and Security	specify	NA	NA	NA	Access controls already in place
2.5 Landfill Gas Monitoring and Control System						
2.5.1	Gas Control Wells	specify	NA	NA	NA	Covered in 2.5.6
2.5.2	Gas Header Piping	specify	NA	NA	NA	Covered in 2.5.6
2.5.3	Gas Lateral Piping	specify	NA	NA	NA	Covered in 2.5.6
2.5.4	Flare Station	Lump Sum	NA	NA	NA	Covered in 2.5.6
2.5.5	Condensate Sumps	specify	NA	NA	NA	Covered in 2.5.6
2.5.6	Completion of LFG Monitoring System	Acres	30.0	$16,500	$495,000	Recent Construction Experience
2.6 Groundwater Monitoring System						
2.6.1	Groundwater Monitoring Well Installation	Each	NA	NA	NA	NA
2.6.2	Piezometer and Monitor Well Plugging and Abandonment	Each	NA	NA	NA	NA
2.7 Leachate Management						
2.7.1	Completion of Leachate Management System	specify	NA	NA	NA	NA
2.8 Stormwater Management						
2.8.1	Stormwater Drainage Management System	specify	65.0	$6,600	$429,000	Recent Construction Experience

Closure Cost Estimate for MSW Type I Landfill

Facility Name: Mesquite Creek Landfill	Revision No.: 0
Permit No: MSW-66C	Date: October 2023

Item No.	Item Description	Units^1	Quantity	Unit Cost	Cost	Source of Unit Cost Estimate^2
2.9 Other Cost Items						
2.9.1	Additional Construction Cost Items (describe in attachments)	identify attachments	NA	NA	NA	NA
2.10 Construction Costs Subtotal						
2.10.1	Construction Costs Subtotal	NA	NA	NA	$6,464,891	NA
3. Storage and Processing Unit Closure Costs						
3.1	Waste Disposal	☐ Tons ☒ Cubic Yards	8,570	$3.85	$32,995	Recent Construction Experience
3.2	Material Removal and Disinfection	specify	NA	NA	$3,000	Recent Construction Experience
3.3	Demolition and Disposal Units	specify	NA	NA	$27,500	Recent Construction Experience
3.4	Additional Storage and Processing Unit Closure Cost Items (describe in attachments)	identify attachments	NA	NA	NA	NA
3.5 Storage and Processing Unit Closure Costs Subtotal						
3.5.1	Storage and Processing Unit Closure Costs Subtotal	NA	NA	NA	$63,495	NA
4. Sum of Engineering, Construction, and Storage and Processing Unit Closure Costs						
4.1	Sum of Engineering, Construction, and Storage and Processing Unit Closure Cost Subtotals	NA	NA	NA	$6,921,386	NA
5. Contingency						
5.1	Contingency (10% of Sum of Engineering, Construction, and Storage and Processing Unit Closure Cost Subtotals)	NA	NA	NA	$692,139	NA

Closure Cost Estimate for MSW Type I Landfill

Facility Name: Mesquite Creek Landfill	Revision No.: 0
Permit No: MSW-66C	Date: October 2023

Item No.	Item Description	Units[1]	Quantity	Unit Cost	Cost	Source of Unit Cost Estimate[2]
6. Contract Performance Bond						
6.1	Contract Performance Bond (2% of Sum of Engineering, Construction, and Storage and Processing Unit Closure Cost Subtotals)	NA	NA	NA	$138,428	NA
7. Third Party Administration and Project Management Costs						
7.1	Third Party Administration and Project Management Costs (2.5% of Sum of Engineering, Construction, and Storage and Processing Unit Closure Cost Subtotals)	NA	NA	NA	$173,035	NA
8. Total Closure Costs						
8.1	Total Closure Costs (sum of amounts in Sections 4, 5, 6, and 7)	NA	NA	NA	$7,924,988	NA

---

[1] For items marked "specify," the responsible professional engineer will enter appropriate unit of measurement

[2] Sources of Unit Costs for Cost Estimates table may include:
(1) Published Cost Estimator Manuals (e.g., RS Means);
(2) Third Party Quotes (e.g., Environmental Field Services Contractors);
(3) Verifiable Data based on Actual Operations; or
(4) Other sources of cost acceptable to the executive director of the TCEQ.

FORM TCEQ-20723
POST-CLOSURE CARE COST ESTIMATE FORM FOR MUNICIPAL SOLID WASTE TYPE I LANDFILLS

Texas Commission on Environmental Quality

Post-Closure Care Cost Estimate Form for Municipal Solid Waste Type I Landfills

This form is for use by applicants or site operators to provide post-closure care cost estimates for post-closure care of MSW Type I landfills to meet the requirements in 30 Texas Administrative Code (TAC) Chapter 330, Section 330.63(j) and 30 TAC Chapter 330 Subchapter L. The costs to be provided herein are cost estimates for hiring a third party to conduct post-closure care of the largest waste fill area that has been certified closed in writing by the TCEQ executive director.

If you need assistance in completing this form, please contact the MSW Permits Section in the Waste Permits Division at (512) 239-2335.

I. General Information

Facility Name: Mesquite Creek Landfill

MSW Permit No.: 66C

Date: October 2023

Revision Number: 0

Site Operator/Permittee Name and Mailing Address: Waste Management of Texas, Inc., 1700 Kohlenberg Rd, New Braunfels, TX 78130

Total Post-Closure Care Cost Estimate (2023 Dollar Amount): $9,533,700

II. Professional Engineer's Statement, Seal, and Signature

I am a licensed professional engineer in the State of Texas. To the best of my knowledge, this Post- Closure Care Cost Estimate has been completed in substantial conformance with the facility Post-Closure Care Plan and, in my professional opinion, is in compliance with Title 30 of the Texas Administrative Code, Chapter 330.

Name: Scott M. Graves, P.E. Title: Senior Principal

Date: 10/11/2023

Company Name: Geosyntec Consultants, Inc. Firm Registration Number: 1182

Professional Engineer's Seal

SCOTT M. GRAVES
86557

10/11/2023

FOR PERMIT PURPOSES ONLY

Signature

III. Annual Review of Permit Conditions, Cost Estimates, Adjustments for Inflation, and Financial Assurance

The site operator/permittee acknowledges that he/she will:

1. Revise and increase the post-closure care cost estimate and the amount of financial assurance provided whenever changes in the post-closure care plan or the landfill conditions increase the maximum cost of post-closure care at any time during the remaining active life of the landfill and until the facility is officially released from the post-closure care period in writing by the executive director.
2. Request a reduction in the post-closure care cost estimate and the amount of financial assurance as a permit modification whenever the post-closure care cost estimate exceeds the maximum cost of post-closure care remaining over the post-closure period. The permit modification will include a detailed justification for the reduction of the post-closure care cost estimate and the amount of financial assurance.
3. Establish financial assurance for post-closure care of the unit in an amount no less than the current post-closure care cost estimate in accordance with 30 TAC Chapter 37
4. Adjust the current post-closure care cost estimate for inflation within 60 days prior to the anniversary date of the first establishment of the financial assurance mechanism.
5. Provide annual inflation adjustments to the post-closure care costs and financial assurance during the active life of the facility and during the post closure care period. The adjustment will be made using an inflation factor derived from the most recent annual Implicit Price Deflator for Gross National Product published by the United States Department of Commerce in its Survey of Current Business, as specified in 30 TAC Chapter 37. The inflation factor is the result of dividing the latest published annual Deflator by the Deflator for the previous year.
6. Provide continuous financial assurance coverage for post-closure care until the facility is officially released in writing by the executive director from the post-closure care period in accordance with all requirements of the post-closure care plan.

IV. Description of Worksheet Items of the Post-Closure Care Cost Estimates

The following descriptions of the worksheet items provide guidance for identifying the minimum work or cost elements for estimating the unit or lump sum cost of each item as applicable. Enter additional detail for each item in the field following the item as necessary and as site-specific conditions warrant. The cost items are grouped under post-closure care costs for engineering, construction, and leachate management. Include attachments to detail any additional work and associated costs necessary for the post-closure care of the unit or facility that is not already included as a line item on the worksheet. Reference the attachments and list the work or cost items in the fields under "Additional Engineering Cost Items Not Listed on the Worksheet," "Additional Construction Cost Items Not Listed on the Worksheet," or Additional Leachate Management Costs Not Listed on the Worksheet" as applicable. Provide the total cost of additional work or cost items in each cost category on the worksheet line that precedes the cost subtotal for each cost group.

1. Engineering Costs

1.1. Site Inspection and Recordkeeping

Regularly scheduled and event-driven site inspection must be performed to identify areas experiencing settlement, subsidence, erosion, or other drainage related problems, and note the conditions of the environmental control and monitoring systems, including leachate collection, groundwater monitoring, and landfill gas monitoring systems*. Enter additional site inspection and recordkeeping work or cost element detail as site-specific conditions warrant.*

No additional information.

1.2. Correctional Plans and Specifications

The cost for an engineering consultant to prepare corrective measure construction plans and specifications to correct problems identified during site inspections. *Enter additional work or cost element details for correctional plans and specifications as site-specific conditions warrant.*

From Geosyntec post-closure care experience, typically such corrections are necessary about once every 5 years, at a cost of $27,500. Equates to annual cost of $5,500/yr.

1.3. Site Monitoring

The cost of performing semiannual groundwater (including costs for sampling and analyzing parameters, and assessment and reporting) and quarterly landfill gas monitoring (including costs for sampling and reporting) and the monitoring of other site-specific systems at the landfill during the post-closure period. *Enter additional site monitoring work or cost element details as site-specific conditions warrant.*

No additional information.

1.4. Additional Engineering Cost Items Not Listed on the Worksheet

List the Attachments detailing additional post-closure care engineering cost items not already included as a line item on the worksheet. (Also, reference these Attachments in the "Units" column of this line of the worksheet. Provide the total cost of all additional engineering cost items in the "Cost" column).

None.

2. Construction Costs

2.1. Cap and Sideslopes Repairs and Revegetation

The cost of repair of the cap and cap drainage control structures due to erosion or structural integrity failures and maintaining final cover vegetation to minimize erosion. *Enter additional cap and sideslopes repair and revegetation work or cost element details as site-specific conditions warrant.*

No additional information.

2.2. Mowing and Vegetation Control

The cost of controlling vegetation growth on the final cover and other areas of the landfill. *Enter additional mowing and vegetation control work or cost element details as site-specific conditions warrant.*

No additional information.

2.3. Groundwater Monitoring System Maintenance

The cost of repairs/replacement and routine maintenance. *Enter additional groundwater monitoring system maintenance work or cost element details as site-specific conditions warrant.*

No additional information.

2.4. LFG Monitoring Probes Maintenance

The cost of repairs/replacement and routine maintenance. Enter additional LFG monitoring probes maintenance work or cost element details as site-specific conditions warrant.

No additional information.

2.5. LFG Collection System Maintenance

The cost of repairs and routine maintenance. *Enter additional LFG collection system maintenance work or cost element details as site-specific conditions warrant.*

No additional information.

2.6. Perimeter Fence and Gates Maintenance

The cost of maintaining perimeter fence and gates to restrict unauthorized access to the closed landfill. *Enter additional perimeter fence and gates maintenance work or cost element details as site-specific conditions warrant.*

From Geosyntec post-closure care experience, typically such corrections are necessary about once every 5 years, at a cost of $5,000. Equates to annual cost of $1,000/yr.

2.7. Access and Rights of Way Maintenance

The cost of maintaining the access roads and other rights of way to the closed landfill to conduct inspections, environmental sampling, routing maintenance and other post-closure activities. *Enter additional access and rights of way maintenance work or cost element details as site-specific conditions warrant.*

From Geosyntec post-closure care experience, typically such corrections are necessary about once every 5 years, at a cost of $2,500. Equates to annual cost of $500/yr.

2.8. Drainage System Cleanout and Repairs

The cost to include costs for maintaining and repairing ditches, conveyance structures, and ponds/basins. *Enter additional drainage system cleanout and repairs work or cost element details as site-specific conditions warrant.*

No additional information.

2.9. Additional Construction and Maintenance Cost Items Not Listed on the Worksheet

List the Attachments detailing any additional construction and maintenance cost items necessary for post-closure care that are not already covered on the worksheet. (Also, reference these Attachments in the "Units" column on this line of the worksheet. Provide the total cost of all additional construction and maintenance cost items in the "Cost" column.)

None.

3. Leachate Management Costs

3.1. Leachate Collection and Removal System Operation and Maintenance

The cost of operation, routine maintenance and repairs. *Enter additional work or cost element details for leachate collection and removal system operation and maintenance as site-specific conditions warrant.*

No additional information.

3.2. Leachate Disposal

The cost of leachate disposal off-site. *Enter additional work or cost element details for leachate disposal as site-specific conditions warrant*.

NA - Facility will use evaporation ponds (evap. rate exceeds precip. rate).

3.3. Additional leachate management cost items not listed on the worksheet.

List the Attachments detailing any additional leachate management cost items necessary for post-closure care that are not already covered on the worksheet. (Also, reference these Attachments in the “Units” column on this line of the worksheet. Provide the total cost of all additional leachate management cost items in the “Cost” column.)

None.

4. Sum of Cost Subtotals

Enter the sum of engineering, construction, and storage and leachate management post-closure care cost subtotals from lines 1.5.1, 2.10.1, and 3.5.1.

5. Contingency

The cost added to cover unanticipated events during implementation of post-closure activities. (Enter additional work or cost element information as necessary)

Included in Item 5.1 of Cost Estimate Table.

6. Third Party Administration and Project Management Costs

The cost for the third party hired by TCEQ to administer the post-closure activities. (Enter additional work or cost element information as necessary)

Included in Item 6.1 of Cost Estimate Table.

V. Post-Closure Care Cost Estimates Worksheet

Post-Closure Care Period – 30 years

Total Permitted Acreage: 435.49 acres

Total Permitted Waste Footprint: 291.6 acres

Number of Groundwater Monitoring Wells: 38

Number of GW Monitoring Events: 2/year

Number of Gas Probes: 30

Number of LFG Monitoring Events: 4/year

The unit or lump sum cost for each item is based on the work items and cost elements described in Section III of this Post-Closure Cost Estimate document:

Yes ☒ No ☐ Partially ☐

If “No” or “Partially” is checked, please attach a written description of work items and cost elements which form the bases of unit or lump sum cost for the affected items.

(NOTE: If any item listed in this worksheet is not applicable to the subject facility, enter Not Applicable (N/A) in the affected fields)

Attachments

Additional Engineering, Construction, and Leachate Management Cost Items Details.

Table 1: Post-Closure Care Cost Estimates

Item No.	Item Description	Units	Annual Qty.	Unit Cost	Annual Cost	Source of Unit Cost Estimate[i]
1.0 Engineering Costs						
1.1	Site Inspection and Recordkeeping[ii]	Per Event	2	$7,500	$15,000	Third Party Estimate
1.2	Correctional Plans and Specifications	Year	1	$5,500	$5,500	Third Party Estimate
1.3 Site Monitoring						
1.3.1 Groundwater Monitoring System						
1.3.1(a)	Sampling and Analysis of GW Monitoring Wells (Quantity = 2 x Number of wells)	Wells	76	$1,100	$83,600	Third Party Estimate
1.3.1(b)	Piezometers/Well Abandonment	Each	NA	NA	NA	NA
1.3.2 LFG Monitoring System						
1.3.2(a)	LFG Quarterly Monitoring (Quarterly)	Each	4	$ 2,000	$8,000	Third Party Estimate
1.3.2(b)	LFG Probe Plugging and Abandonment	Each	NA	NA	NA	NA
1.4 Additional Engineering Cost Items (Detail in Attachments)						
1.4.1	Additional Engineering Cost Items (describe in attachments)	Identify attachments	NA	NA	NA	NA
1.5 Engineering Costs Subtotal						
1.5.1	Engineering Costs Subtotal	NA	NA	NA	$112,100	NA
2.0 Construction and Maintenance Costs						
2.1	Cap and Sideslopes Repairs and Revegetation	Acres	291.6	$300	$87,480	Post-Closure Project Data
2.2	Mowing and Vegetation Management	Acres	included in 2.1	included in 2.1	included in 2.1	NA

Item No.	Item Description	Units	Annual Qty.	Unit Cost	Annual Cost	Source of Unit Cost Estimate[i]
2.3	Groundwater Monitoring System Maintenance	specify	included in monitoring	included in monitoring	included in monitoring	NA
2.4	LFG Monitoring Probes Maintenance	specify	included in monitoring	included in monitoring	included in monitoring	NA
2.5	LFG Collection System Maintenance	Acres	291.6	$250	$72,900	Post-Closure Project Data
2.6	Perimeter Fence and Gates Maintenance	Year	1	$1,000	$1,000	Post-Closure Project Data
2.7	Access Roads Maintenance	Year	1	$500	$500	Post-Closure Project Data
2.8	Drainage System Cleanout/Repairs	specify	included in 2.1	included in 2.1	included in 2.1	NA
2.9 Additional Construction and Maintenance Cost Items (Details in Attachments)						
2.9.1	Additional Construction and Maintenance Cost Items (details in attachments)	Identify attachments	NA	NA	NA	NA
2.10 Construction and Maintenance Costs Subtotal						
2.10.1	Construction and Maintenance Costs Subtotal	NA	NA	NA	$161,880	NA
3.0 Leachate Management						
3.1	Leachate Management System Operation and Maintenance	Year	1	$8,500	$8,500	Post-Closure Project Data
3.2	Leachate Disposal	Gals	NA	NA	NA	NA
3.3 Additional Leachate Management Cost Items (Details in Attachments)						

Item No.	Item Description	Units	Annual Qty.	Unit Cost	Annual Cost	Source of Unit Cost Estimate[i]
3.4	Additional Leachate Management Cost Items (details in attachments)	Identify attachments	NA	NA	NA	NA
3.5 Leachate Management Costs Subtotal						
3.5.1	Leachate Management Costs Subtotal	NA	NA	NA	$8,500	NA
4.0 Sum of Engineering, Construction, and Leachate Management Costs						
4.1	Sum of Engineering, Construction, and Leachate Management Cost Subtotals	NA	NA	NA	$282,480	NA
5.0 Contingency						
5.1	Contingency (10% of Sum of Engineering, Construction, and Leachate Management Cost Subtotals)	NA	NA	NA	$28,248	NA
6.0 Third Party Administration and Project Management Costs						
6.1	Third Party Administration and Project Management Costs (2.5% of Sum of Engineering, Construction, and Leachate Management Cost Subtotals)	NA	NA	NA	$7,062	NA
7. Total Post-Closure Cost						
7.1	Total Annual Post-Closure Cost (Sum of amounts in Sections 4, 5, and 6)	NA	NA	NA	$317,790	NA
7.2	30 Year Post-Closure Costs (Total Annual Post-Closure Cost x 30)	NA	NA	NA	$9,533,700	NA

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[i] Sources of Unit Cost Estimates may include:

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(1) Published Cost Estimator Manuals (e.g., RS Means);
(2) Third Party Quotes (e.g., Environmental Field Services Contractors); or
(3) Verifiable Data based on Actual Operations

[ii] Example Description for Item No. 1.1 – "Includes costs for site inspection performed at least annually for identification of areas experiencing settlement or subsidence, erosion or other drainage-related problems, inspection of the leachate collection system, gas monitoring system and LFG monitoring system."

FINANCIAL ASSURANCE DOCUMENTATION

This bond will replace and supersede bond number 1005403.

PERFORMANCE BOND

Date bond executed: July 12, 2023

Effective date: August 1, 2023

Principal: Waste Management of Texas, Inc.

Kohlenberg Lane #2, New Braunfels, TX 78130

Type of organization: Corporation

State of incorporation: Texas

Surety(ies): Endurance Assurance Corporation

4 Manhattanville Road, Purchase, NY 10577

Permit number, name, physical and mailing addresses, and closure, post closure, or corrective action amounts(s) for each facility guaranteed by this bond:

MSW 66B
Mesquite Creek Landfill
Kohlenberg Lane
New Braunfels, TX 78130

Closure Cost Amount:	$ 8,923,976.00
Post Closure Cost Amount:	$ 6,618,592.00
Corrective Action:	$ 0.00
Total Penal Sum of Bond:	$ 15,542,568.00

Surety's bond **number:** EACX4028426

Know All Persons By These Presents, That We, the Principal and Surety(ies) hereto are firmly bound to the Texas Commission on Environmental Quality, hereinafter called TCEQ, in the above penal sum for the payment of which we bind ourselves, our heirs, executors, administrators, successors, and assigns jointly and severally; provided that, where the Surety(ies) are corporations acting as co-sureties, we, the Sureties, bind ourselves in such sum "jointly and severally" only for the purpose of allowing a joint action or actions against any or all of us, and for all other purposes each Surety binds itself, jointly and severally with the Principal, for the payment of such sum only as is set forth opposite the name of such Surety, but if no limit of liability is indicated, the limit of liability shall be the full amount of the penal sum.

Whereas said Principal is required, under the appropriate program area, to comply with permit requirements in order to own or operate each facility identified above, and

Whereas said Principal is required to provide financial assurance for closure, post closure, or corrective action as a condition of the permit or other applicable requirements, and

Whereas said Principal shall establish a standby trust fund as is required when a surety bond is used to provide such financial assurance;

Now, therefore, the conditions of this obligation are such that if the Principal shall faithfully perform closure, post closure, or corrective action, whenever required to do so, of each facility for which this bond guarantees closure or post closure in accordance with the closure plan or post closure plan and other applicable requirements of the permit, or perform corrective action in accordance with the permit or other applicable requirements as may be amended, pursuant to all applicable laws, statutes, rules and regulations, as such laws, statutes, rules, and regulations may be amended,

Or, if the Principal shall provide alternate financial assurance, as specified in 30 Texas Administrative Code, Chapter 37 (relating to Financial Assurance) and obtain the TCEQ executive director's written approval of such assurance, within 90 days after the date of notice of cancellation is received by both the Principal and the TCEQ executive director from the Surety(ies), then this obligation shall be null and void, otherwise it is to remain in full force and effect.

The Surety(ies) shall become liable on this bond obligation only when the Principal has failed to fulfill the conditions described above.

Upon notification by the TCEQ executive director that the Principal has been found in violation of the closure, post closure, or corrective action requirements for a facility for which this bond guarantees performance of closure, post closure, or corrective action, the Surety(ies) shall either perform closure, post closure, or corrective action in accordance with the closure plan or post closure plan and other applicable requirements of the permit, or perform corrective action in accordance with the permit or other applicable requirements, or place the amount guaranteed for the facility in the standby trust fund as directed by the TCEQ executive director.

Upon notification by the TCEQ executive director that the Principal has failed to provide alternate financial assurance, as specified in 30 Texas Administrative Code, Chapter 37, and obtain written approval of such assurance from the TCEQ executive director during the 90 days following receipt by both the Principal and the TCEQ executive director of a notice of cancellation of the bond, the Surety(ies) shall place funds in the amount guaranteed for the facility(ies) into the standby trust fund.

The surety(ies) hereby waive(s) notification of amendments to closure plans or post closure plans and other applicable requirements of the permit, or permits requiring corrective action or other applicable requirements for corrective action, applicable laws, statutes, rules, and regulations and agrees that no such amendment shall in any way alleviate its (their) obligation on this bond.

The liability of the Surety(ies) shall not be discharged by any payment or succession of payments hereunder, unless and until such payment or payments shall amount in the aggregate to the penal sum of the bond, but in no event shall the obligation of the Surety(ies) hereunder exceed the amount of said penal sum.

The Surety(ies) may cancel the bond by sending notice of cancellation by certified mail to the owner and operator and to the TCEQ executive director provided, however, that cancellation shall not occur during the 120 days beginning on the date of receipt of the notice of cancellation by both the Principal and the TCEQ executive director, as evidenced by the return receipts.

The principal may terminate this bond by sending written notice to the Surety(ies), provided, however, that no such notice shall become effective until the Surety(ies) receive(s) written authorization for termination of the bond by the TCEQ executive director.

Principal and Surety(ies) hereby agree to adjust the penal sum of the bond yearly so that it guarantees a new closure, post closure, or corrective action amount, provided that the penal sum does not increase by more than 20 percent in any one year, and no decrease in the penal sum takes place without the written permission of the TCEQ executive director.

In Witness Whereof, The Principal and Surety(ies) have executed this Performance Bond and have affixed their seals on the date set forth above.

The persons whose signatures appear below hereby certify that they are authorized to execute this surety bond on behalf of the Principal and Surety(ies) and that the wording on this surety bond is identical to the wording specified in 30 Texas Administrative Code §37.321 as such regulation was constituted on the date this bond was executed.

Principal

Waste Management of Texas, Inc.

(Signature(s))____________________

(Name(s)) Susan Ritter

(Title(s)) Attorney-in-Fact

(Corporate seal)

Corporate Surety(ies)

Endurance Assurance Corporation
4 Manhattanville Road
Purchase, NY 10577

State of Incorporation: Delaware

Liability limit: $ 292,559,000.00

(Signature(s)) Theresa Hintzman

(Name(s) and title(s)) Theresa Hintzman, Attorney-in-Fact

(Corporate seal)

Bond Premium: $69,942.00

POWER OF ATTORNEY

KNOWN ALL MEN BY THESE PRESENTS that Waste Management, Inc. and each of its direct and indirect majority owned subsidiaries (the "WM Entities"), have constituted and appointed and do hereby appoint Theresa Hintzman, Kelsy Hoagland, and Susan Ritter of Acrisure, LLC DBA Smith Manus, each its true and lawful Attorney-in-fact to execute under such designation in its name, to affix the corporate seal approved by the WM Entities for such purpose, and to deliver for and on its behalf as surety thereon or otherwise, bonds of any of the following classes, to wit:

1. Surety bonds to the United States of America or any agency thereof, and lease and miscellaneous surety bonds required or permitted under the laws, ordinances or regulations of any State, City, Town, Village, Board or any other body or organization, public or private.

2. Bonds on behalf of WM Entities in connection with bids, proposals or contracts.

The foregoing powers granted by the WM Entities shall be subject to and conditional upon the written direction of a duly appointed officer of the applicable WM Entity (or any designee of any such officer) to execute and deliver any such bonds.

The signatures and attestations of such Attorneys-in fact and the seal of the WM Entity may be affixed to any such bond, policy or to any certificate relating thereto by facsimile and any such bond, policy or certificate bearing such facsimile signatures or facsimile seal shall be valid and binding upon the applicable WM Entity when so affixed.

IN WITNESS WHEREOF, the WM Entities have caused these presents to be signed by the Vice President and Treasurer and its corporate seal to be hereto affixed. This power of attorney is in effect as of July 12, 2023.

Witness:

On behalf of Waste Management, Inc. and
each of the other WM Entities

Leslie Nagy

Leslie Nagy
Vice President and Treasurer

SOMPO INTERNATIONAL
INSURANCE

POWER OF ATTORNEY

11078

KNOW ALL BY THESE PRESENTS, that **Endurance Assurance Corporation**, a Delaware corporation, **Endurance American Insurance Company**, a Delaware corporation, **Lexon Insurance Company**, a Texas corporation, and/or **Bond Safeguard Insurance Company**, a South Dakota corporation, each, a "Company" and collectively, "**Sompo International**," do hereby constitute and appoint: **Brook T. Smith, Raymond M. Hundley, Jason D. Cromwell, James H. Martin, Barbara Duncan, Mark A Guidry, Jill Kemp, Lynnette Long, Amy Smith, Deborah Neichter, Theresa Hintzman, Beth Frymire, Leigh McCarthy, Michael Dix, Susan Ritter, Ryan Britt, Kelsy Hoagland, Jacob Motto, Jennifer Edwards** as true and lawful Attorney(s)-In-Fact to make, execute, seal, and deliver for, and on its behalf as surety or co-surety; bonds and undertakings given for any and all purposes, also to execute and deliver on its behalf as aforesaid renewals, extensions, agreements, waivers, consents or stipulations relating to such bonds or undertakings provided, however, that no single bond or undertaking so made, executed and delivered shall obligate the Company for any portion of the penal sum thereof in excess of the sum of **One Hundred Million Dollars ($100,000,000.00).**

Such bonds and undertakings for said purposes, when duly executed by said attorney(s)-in-fact, shall be binding upon the Company as fully and to the same extent as if signed by the President of the Company under its corporate seal attested by its Corporate Secretary.

This appointment is made under and by authority of certain resolutions adopted by the sole shareholder of each Company by unanimous written consent effective the 15th day of June, 2019, a copy of which appears below under the heading entitled "Certificate".

This Power of Attorney is signed and sealed by facsimile under and by authority of the following resolution adopted by the sole shareholder of each Company by unanimous written consent effective the 15th day of June, 2019 and said resolution has not since been revoked, amended or repealed:

RESOLVED, that the signature of an individual named above and the seal of the Company may be affixed to any such power of attorney or any certificate relating thereto by facsimile, and any such power of attorney or certificate bearing such facsimile signature or seal shall be valid and binding upon the Company in the future with respect to any bond or undertaking to which it is attached.

IN WITNESS WHEREOF, each Company has caused this instrument to be signed by the following officers, and its corporate seal to be affixed this 15th day of June, 2019.

Endurance Assurance Corporation	**Endurance American Insurance Company**	**Lexon Insurance Company**	**Bond Safeguard Insurance Company**
By: Richard M Appel	By: Richard M Appel	By: Richard M Appel	By: Richard M Appel
Richard Appel; SVP & Senior Counsel	**Richard Appel; SVP & Senior Counsel**	**Richard Appel; SVP & Senior Counsel**	**Richard Appel; SVP & Senior Counsel**
SEAL 2002 DELAWARE	SEAL 1996 DELAWARE	SEAL MARCH 16, 1984	

ACKNOWLEDGEMENT

On this 15th day of June, 2019, before me, personally came the above signatories known to me, who being duly sworn, did depose and say that he/they is an officer of each of the Companies; and that he executed said instrument on behalf of each Company by authority of his office under the by-laws of each Company.

By: Amy Taylor
Amy Taylor, Notary Public – My Commission Expires 3/9/27

CERTIFICATE

I, the undersigned Officer of each Company, DO HEREBY CERTIFY that:

1. That the original power of attorney of which the foregoing is a copy was duly executed on behalf of each Company and has not since been revoked, amended or modified; that the undersigned has compared the foregoing copy thereof with the original power of attorney, and that the same is a true and correct copy of the original power of attorney and of the whole thereof;
2. The following are resolutions which were adopted by the sole shareholder of each Company by unanimous written consent effective June 15, 2019 and said resolutions have not since been revoked, amended or modified:

   "RESOLVED, that each of the individuals named below is authorized to make, execute, seal and deliver for and on behalf of the Company any and all bonds, undertakings or obligations in surety or co-surety with others: RICHARD M. APPEL, BRIAN J. BEGGS, CHRISTOPHER DONELAN, SHARON L. SIMS, CHRISTOPHER L. SPARRO, MARIANNE L. WILBERT

   ; and be it further

   RESOLVED, that each of the individuals named above is authorized to appoint attorneys-in-fact for the purpose of making, executing, sealing and delivering bonds, undertakings or obligations in surety or co-surety for and on behalf of the Company."
3. The undersigned further certifies that the above resolutions are true and correct copies of the resolutions as so recorded and of the whole thereof.

IN WITNESS WHEREOF, I have hereunto set my hand and affixed the corporate seal this 12th day of July, 2023.

By:
Daniel S. Lurie, Secretary

NOTICE: U. S. TREASURY DEPARTMENT'S OFFICE OF FOREIGN ASSETS CONTROL (OFAC)

No coverage is provided by this Notice nor can it be construed to replace any provisions of any surety bond or other surety coverage provided. This Notice provides information concerning possible impact on your surety coverage due to directives issued by OFAC. **Please read this Notice carefully.**

The Office of Foreign Assets Control (OFAC) administers and enforces sanctions policy, based on Presidential declarations of "national emergency". OFAC has identified and listed numerous foreign agents, front organizations, terrorists, terrorist organizations, and narcotics traffickers as "Specially Designated Nationals and Blocked Persons". This list can be located on the United States Treasury's website – https://www.treasury.gov/resource-center/sanctions/SDN-List.

In accordance with OFAC regulations, if it is determined that you or any other person or entity claiming the benefits of any coverage has violated U.S. sanctions law or is a Specially Designated National and Blocked Person, as identified by OFAC, any coverage will be considered a blocked or frozen contract and all provisions of any coverage provided are immediately subject to OFAC. When a surety bond or other form of surety coverage is considered to be such a blocked or frozen contract, no payments nor premium refunds may be made without authorization from OFAC. Other limitations on the premiums and payments may also apply.

Any reproductions are void.
Surety Claims Submission: LexonClaimAdministration@sompo-intl.com
Telephone: 615-553-9500 Mailing Address: Sompo International; 12890 Lebanon Road; Mount Juliet, TN 37122-2870

Schedule A
Standby Trust Agreement for Waste Management of Texas, Inc. dated March 1, 2001
U. S. Bank, Successor Trustee
Revised 7/11/2023

	Facility	Address	Permit No.	Closure	Post-Closure	Total Bond
1	Austin Community Landfill Gas-to-Energy Facility	9900 Giles Road Austin, Texas 78754	MSW 48019	$ 157,187.00	$ -	$ 157,187.00
2	Bluebonnet Recycling and Disposal Facility	10050 Highway 90 Houston, Texas 77213	MSW 1279	$ -	$ 2,941,380.00	$ 2,941,380.00
3	Camelot Landfill (Farmers Branch) Gas-to-Energy Facility	580 Huffines Blvd. Lewisville, Texas 75056	MSW 48028	$ 78,623.00	$ -	$ 78,623.00
4	Coastal Plains Recycling and Disposal Facility	21000 East Highway 6 Alvin, Texas 77511	MSW 1721-A	$ 13,269,034.69	$ 6,289,818.45	$ 19,558,853.14
5	Comal County Landfill Transfer Station	Kohlenberg Lane New Braunfels, Texas 78130	MSW 40200	$ 174,750.69	$ -	$ 174,750.69
6	Covel Gardens Recycling and Disposal Facility	8611 Covel Road San Antonio, Texas 78252	MSW 2093-B	$ 17,402,081.00	$ 9,618,585.00	$ 27,020,666.00
7	DFW Recycling and Disposal Facility	1600 South Railroad Street Lewisville, Texas 75057	MSW 1025-B	$ 13,009,447.00	$ 12,265,967.00	$ 25,275,414.00
8	Hillside Material Recovery & Transfer Facility	Route 7, Nelson Road Sherman, Texas 75091	MSW 40082	$ 58,325.00	$ -	$ 58,325.00
9	Hillside Recycling and Disposal Facility	Route 7, Nelson Road Sherman, Texas 75091	MSW 523	$ 4,497,055.00	$ 3,302,126.00	$ 7,799,181.00
10	Kingsland Transfer Station	2.1 Miles from 2545 off Old Dump Road Kingsland, Texas 78639	MSW 40003	$ 13,244.00	$ -	$ 13,244.00
11	Lacy Lakeview Recycling and Disposal Facility	6777 Selby Lane Waco, Texas 76705	MSW 1646A	$ 1,766,858.00	$ 2,473,938.00	$ 4,240,796.00
12	Mesquite Creek Landfill	Kohlenberg Lane New Braunfels, Texas 78130	MSW 66B	$ 8,923,976.00	$ 6,618,592.00	$ 15,542,568.00
13	Mesquite Creek Landfill Gas-to-Energy Facility	1001 Kohlenberg Road New Braunfels, Texas 78130	MSW 48029	$ 186,983.00	$ -	$ 186,983.00
14	Paris Landfill	1800 South Church Paris, Texas 75460	MSW 1454-B	$ 14,857,789.00	$ 4,077,747.00	$ 18,935,536.00
15	Pecan Prairie Recycling and Disposal Facility	County Road 1038 at Highway 69 North Celeste, Texas 75423	MSW 1503	$ 1,851,980.00	$ 1,076,863.00	$ 2,928,843.00
16	Skyline Recycling and Disposal Facility	1201 North Central Avenue Ferris, Texas 75125	MSW 42-C	$ 22,673,669.00	$ 12,814,694.00	$ 35,488,363.00
17	Temple Landfill	706 Landfill Road Temple, Texas 76501	MSW 692-A	$ 9,915,377.00	$ 3,962,886.00	$ 13,878,263.00
18	Westside Recycling and Disposal Facility	3500 West Lincrest Drive Aledo, Texas 76008	MSW 1019A	$ -	$ 3,199,519.00	$ 3,199,519.00
19	Westside Transfer Station	12280 Camp Bowie W. Aledo, Texas 76008	MSW 40186	$ 68,161.00	$ -	$ 68,161.00
20	Williamson County Recycling and Disposal Facility	600 County Road 128 Hutto, Texas 78634	MSW 1405B	$ 17,709,104.00	$ 2,828,895.00	$ 20,537,999.00

Schedule A
Standby Trust Agreement for Waste Management of Texas, Inc. dated March 1, 2001
U. S. Bank, Successor Trustee
Revised 7/11/2023

	Facility	Address	Permit No.	Closure	Post-Closure	Total Bond
21	WM Renewable Energy, LLC (Skyline Gas to Energy)	1201 N.Central Avenue Ferris, Texas 75125	MSW 48018	$ 158,373.00	$ -	$ 158,373.00
22	WM Curbside, LLC	1223 E. Industrial Drive New Braunsfels, Texas 78130	SWR 89069	$ 104,200.00	$ -	$ 104,200.00
23	WM Curbside, LLC	1223 E. Industrial Drive New Braunsfels, Texas 78130	EPA # TXR 000080103	$ 2,136.10	$ -	$ 2,136.10
24	WM Curbside, LLC	5025 Cash Road Dallas, Texas, 75247	SWR90760	$ 100,000.00	$ -	$ 100,000.00
25	Burnet County Transfer Station	2411 Farm to Market Road 963 Burnet, Texas 78611	40035	$ 186,494.00	$ -	$ 186,494.00
26	Skyline Renewable Natural Gas Facility Type IX Registration Permit	1201 North Central Street Ferris, Texas 75125	MSW-Rule No. 48048	$410,571.00	$ -	$ 410,571.00
	TOTAL			**$ 127,575,418.48**	**$ 71,471,010.45**	**$ 199,046,428.93**

PART IV

SITE OPERATING PLAN (SOP)

PART IV

SITE OPERATING PLAN (SOP)

MESQUITE CREEK LANDFILL
COMAL AND GUADALUPE COUNTIES, TEXAS
PERMIT AMENDMENT APPLICATION
MSW PERMIT NO. 66C

Physical Site Address:
1700 Kohlenberg Rd
New Braunfels, TX 78130
(830) 625-7894

Prepared for:
Waste Management of Texas, Inc.

Prepared by:
Geosyntec Consultants, Inc.
Texas Board of Professional Engineers Firm Registration No. F-1182
8217 Shoal Creek Blvd, Suite 200
Austin, Texas 78757
(512) 451-4003

SCOTT M. GRAVES
86557

10/11/2023

FOR PERMIT PURPOSES ONLY

October 2023

TABLE OF CONTENTS
SITE OPERATING PLAN (SOP)

STATE OF TEXAS
SCOTT M. GRAVES
86557
LICENSED PROFESSIONAL ENGINEER

10/11/2023

FOR PERMIT PURPOSES ONLY

GEOSYNTEC CONSULTANTS, INC.
TEXAS ENG. FIRM
REGISTRATION NO. F-1182

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SCOTT M. GRAVES
86557
10/11/2023

FOR PERMIT PURPOSES ONLY

GEOSYNTEC CONSULTANTS, INC.
TEXAS ENG. FIRM
REGISTRATION NO. F-1182

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STATE OF TEXAS
SCOTT M. GRAVES
86557
LICENSED PROFESSIONAL ENGINEER

10/11/2023

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GEOSYNTEC CONSULTANTS, INC.
TEXAS ENG. FIRM
REGISTRATION NO. F-1182

SITE OPERATING PLAN (SOP)

1. INTRODUCTION

1.1 Terms of Reference

The Mesquite Creek Landfill (hereafter referred to as the “facility”, “landfill”, or “site”) is a Type I municipal solid waste (MSW) facility. This Site Operating Plan (SOP) provides general operating procedures and instructions for site management and operating personnel to operate the facility on a day-to-day basis in a manner protective of human health and the environment, consistent with the design of the facility, facility permit requirements, and the applicable rules of the Texas Commission on Environmental Quality (TCEQ). This SOP complies with the general and site-specific requirements of 30 TAC Chapter 330, Subchapter D of TCEQ’s Municipal Solid Waste Management Rules (MSWMR) “Operational Standards for Solid Waste Land Disposal Sites” for Type I landfills.

The specific procedures outlined in this SOP are operational requirements and must be understood, acknowledged, and followed by the appropriate site personnel. This SOP will be retained during the active life of the facility and throughout the post-closure care maintenance period. This SOP is considered part of the facility’s Site Operating Record. Section 3 of this SOP provides a comprehensive list of the documents and plans that are considered part of the operating record of the facility. Per 30 TAC §330.121(a), any deviation from the permit and incorporated plans and other related documents associated with the permit is a violation of this chapter (i.e., Chapter 330).

References to the “Executive Director” in this SOP refer to the Executive Director of the TCEQ or the designated representative of the TCEQ Executive Director. References to information in the “permit” or “permit application” for this facility refer to the most current version of those documents, including any amendments, modifications, or revisions as approved.

The Site Manager has overall responsibility for implementation and adherence to this SOP. Wherever this SOP describes procedures or requirements without naming a specific individual or position responsible for those requirements, the Site Manager shall have primary responsibility for those requirements. Where a specific position is responsible for a particular task, that responsibility is described. Otherwise, the Site Manager may assign any qualified personnel to accomplish the requirements of this SOP.

1.2 Facilities Addressed by this SOP

Disposal of waste in the landfill is the primary site activity. In addition to waste disposal in the landfill, the following storage and/or processing areas/facilities are authorized to occur on-site, and are addressed in this SOP:

- recycling-related areas as follows:
    - large/heavy/bulky item (e.g., white goods/household appliances, large metal pieces, etc.) area;
    - brush collection/chipping/mulching area (hereafter, "wood recycling area");
    - construction and demolition (C&D) material recycling area; and
    - tire storage area.
- liquid waste solidification; and
- leachate evaporation ponds and tanks for storage of leachate, gas condensate, and contaminated water generated by this facility.

This SOP addresses the relevant operational requirements and activities associated with these on-site storage/processing areas, as well as waste disposal operations.

1.3 Sequence of Landfill Operations

The facility is designed to operate as a multi-level, modified aerial fill landfill, with above and below-grade filling. The general sequence of anticipated landfill operations is shown on the drawings presented in Part I/II, Appendix I/IIA (see Drawings I/IIA-23 through I/IIA-26).

2. PRE-OPERATION NOTICE

At least 14 days prior to placement of waste in any newly constructed disposal area (i.e., sector, cell, or portion thereof) the owner or operator will provide written notice to the Executive Director in the form of a Soils and Liner Evaluation Report (SLER) and/or a Geosynthetic Liner Evaluation Report (GLER) [collectively, “liner evaluation reports”] detailing the final construction and lining of the new disposal area. Placement of waste in a newly constructed disposal area shall not occur unless either: (i) the Executive Director provides verbal or written approval of the liner evaluation reports; or (ii) by the end of the 14th day following submittal of the liner evaluation reports, no verbal or written response is received from Executive Director indicating that the placement of waste should not commence. Following one of these two events, the operator may begin placing waste in the newly constructed cell.

3. RECORDKEEPING REQUIREMENTS

A Site Operating Record will be maintained by the facility in an organized format (either digitally or as a physical hardcopy), where information is readily locatable and retrievable. The Site Operating Record will contain the required records to be maintained (listed below in Section 3.1 and Table IV-1) to document operating-related and other information required by TCEQ. A copy of the permit, the approved site development plan, the SOP, the final closure plan, the post-closure maintenance plan, the landfill gas management plan, and any other required plan or other related document shall be maintained at the facility, or an alternate location or format as discussed subsequently. These documents are considered part of the Site Operating Record for the facility.

Table IV-1 presented below in Section 3.1 provides a list and description of the required documents that will be maintained in the Site Operating Record. In the remainder of Section 3, additional details are provided to address accessibility of information, record retention and location, and other recordkeeping-related requirements.

3.1 Required Records to be Maintained

The documents that will be maintained in the Site Operating Record are, at minimum, those listed below in Table IV-1 (plus any other document(s) as specified by the approved permit or by the Executive Director). The recordkeeping information listed in Table IV-1 will be placed and retained in the Site Operating Record in either digital or physical format within seven (7) working days of the completion of listed activities or the receipt of analytical data.

Table IV-1. Recordkeeping Requirements

Records to be Maintained	Description of Contents	Frequency	Rule Citation (30 TAC)
MSW Permit	Issued TCEQ MSW Permit No. 66C	Upon Issuance of Permit	§330.121(a) and §330.125(a)
Approved Permit Application (including all modifications and amendments)	Parts I through IV, including but not limited to: a. Site Development Plan b. Site Operating Plan c. Closure Plan d. Post-Closure Plan e. Landfill Gas Management Plan	Upon Issuance of Permit and Upon Approval of Modifications and Amendments	§330.121(a) and §330.125(a)
Location Restriction Demonstrations	Demonstrations made to show that the site is in compliance with location restriction criteria.	Submittal of Permit Amendment Application	§330.125(b)(1)

Records to be Maintained	Description of Contents	Frequency	Rule Citation (30 TAC)
Information on Excluding Prohibited Waste	Record and retain inspection records, training procedures, and notification procedures relating to excluding the receipt of prohibited waste, including a record of unauthorized material incidents (receipt of prohibited waste and removal/remediation of the incident)	Per Occurrence	§330.125(b)(2) and §330.133(b)
Gas Monitoring Results and Remediation Plans	Results from gas monitoring and any remediation plans related to explosive and other gases.	Gas Monitoring - Quarterly; Remediation Plans - Per Occurrence	§330.125(b)(3)
Unit Design Documentation	Documentation of unit design for the placement of (i.e., recirculation of) leachate or gas condensate in a municipal solid waste landfill.	Part of Site Development Plan – (see above) Update Upon Approval of Unit Design Modifications and Amendments	§330.125(b)(4)
Groundwater Monitoring and Corrective Action Information	Demonstrations, certifications, findings, monitoring, testing, and analytical data relating to groundwater monitoring and/or corrective action.	Monitoring – Semi-Annual; Corrective Action and Other Documentation - As Required	§330.125(b)(5)
Closure and Post-Closure Care Data	Closure and Post-Closure Plans and applicable monitoring, testing, or analytical data relating to post-closure requirements.	Monitoring and Data – Annual	§330.125(b)(6)
Cost Estimates and Financial Assurance Documentation	Cost estimates and financial assurance documentation relating to financial assurance for closure and post-closure care.	Annual	§330.125(b)(7)
Small Community Exemption Criteria	Information demonstrating compliance with the small community exemption criteria.	Per Occurrence	§330.125(b)(8)
Correspondence	Copies of correspondence and responses relating to the operation of the facility, modifications to the permit, approvals and other matters pertaining to technical assistance.	Per Occurrence	§330.125(b)(9)
Special Waste Documentation	Documents, manifests, shipping documents, trip tickets, etc., involving special waste.	Per Occurrence	§330.125(b)(10)

Records to be Maintained	**Description of Contents**	**Frequency**	**Rule Citation (30 TAC)**
Spray-Applied Alternative Daily Cover (ADC) Records	Records of the application rate and total amount ADC applied to the working face on those days in which ADC is applied for any spray-applied ADC material.	Per Occurrence	§330.125(b)(11)
Other Document(s)	Any other document(s) as specified by the approved permit or by the Executive Director.	Per Occurrence	§330.125(b)(12)
Liner Evaluation Reports, Ballast Evaluation Reports, and Liner Interim Status Reports	Documentation of construction of the liner for a new disposal area, along with evaluation and documentation of ballast (if required), and interim status of liner (if needed).	Per Occurrence	§330.125(b)(12)
Landfill Gas System Inspections	Documentation of inspection of the landfill gas monitoring system indicating the findings and documenting any repairs made.	Inspect Gas Monitoring System - Quarterly	§330.125(b)(12) and §330.159
Personnel Training Records	Training records for all personnel will be maintained in accordance with 30 TAC §335.586(d) and (e).	As Needed (Minimum Annually)	§330.125(e)
Required Personnel Operator Licenses	Licensing records will be maintained in accordance with 30 TAC Chapter 30, Subchapter F.	As Needed	§330.125(f)
Waste Acceptance Rate Documentation	Records to document the annual waste acceptance rate for the facility. Include documentation in the form of quarterly and annual solid waste summary reports as required by 30 TAC §330.675.	Quarterly and Annually, As Appropriate	§330.125(h)
Load Inspection Reports	A copy of the load inspection reports.	Per Occurrence	§330.127(5)(B)
Fire Occurrence Notices	Written description of waste-related fire that is not extinguished within 10 minutes of detection, including record of required notifications.	Per Occurrence	§330.129
Access Control	A record of the required access inspections, findings, and any repairs made and notification of breach if applicable.	Inspect - Monthly; Repair/ Notification - As Needed, if not repairable within 8 hours of detection	§330.131
Records of Alternate Operating Hours	Documentation of any dates, times, and durations when alternate operating hours are utilized.	As Required	§330.135(d)
Landfill Marker Inspections	A record of the landfill marker inspections, findings, and any repairs.	Monthly	§330.143(a)

Records to be Maintained	**Description of Contents**	**Frequency**	**Rule Citation (30 TAC)**
Water, Crude Oil, and/or Natural Gas Well Location and Plugging Reports	Documentation of notification, certification of plugging, and a copy of the well plugging report.	Within 30 Days of Discovery	§330.161(a)-(c)
Cover Inspection Record	A record of the required cover inspections, findings, and any corrective actions (e.g., repairs) taken. Includes inspecting for and remedy of ponded water.	Active Facility - Weekly (and after storm events); Closed Facility - Per Post-Closure Plan (Semi-Annually)	§330.165(h)
Cover Application Log	A record showing site grid areas where daily cover, ADC, and/or intermediate cover has been placed each week.	Weekly (when site is in operation)	§330.165(h)
Ponded Water Inspections	Inspection of the landfill waste fill areas to check for ponded water, and corrective actions to remove ponded water.	Part of Cover Inspections (see above)	§330.167
Regulated Asbestos-Containing Materials (RACM) Acceptance Records	A record of each load of RACM accepted as to its location, depth, and volume of material.	Per Occurrence	§330.171(c)(3)(B)

3.2 Report Signatories

As applicable, reports and other information requested by the Executive Director, as described in 30 TAC §305.44(a), will be signed by the owner or operator or a duly authorized representative of the owner or operator if:

- The authorization is made in writing by the owner or operator, per 30 TAC §305.44(a);
- The authorization specifies either an individual or a position having responsibility for the overall operation of the regulated facility or activity or for environmental matters for the owner or operator (e.g., environmental manager, or a position of equivalent responsibility). A duly authorized representative may thus be either a named individual or any individual occupying a named position; and
- The written authorization is submitted to the Executive Director.

If an authorization under this section is no longer accurate because of a change in individuals or position, a new authorization satisfying the requirements of this section must be submitted to the

Executive Director prior to, or together with, any reports, information, or applications to be signed by an authorized representative.

Any person signing a report shall make the certification in 30 TAC §305.44(b).

3.3 Executive Director Access to Information

All information contained in the Site Operating Record will be furnished to the Executive Director upon request and will be made available at the facility for inspection by the Executive Director during normal operating hours. Records stored off-site will be retrieved as quickly as is practicable (within 72 hours or less) upon request by the Executive Director, and furnished/made available for inspection upon retrieval.

3.4 Record Retention and Location(s)

The facility will maintain and keep current the Site Operating Record for the active life of the facility and throughout the post-closure care maintenance period. The Site Operating Record will be kept in digital or physical hardcopy format either: (i) on-site; (ii) at an off-site third-party storage unit or document storage facility (such as an Iron Mountain® records storage facility or similar establishment); (iii) at an off-site office location of the facility owner or operator; (iv) using cloud-based digital storage via the Internet; or (v) at an alternate location other than the aforementioned options, if approved by the Executive Director.

3.5 Alternative Schedules for Recordkeeping and Notifications

The Executive Director may set alternative schedules for recordkeeping and notification requirements pursuant to the terms of 30 TAC §330.125(g).

3.6 Personnel Training Records and Operator License Records

The facility will maintain personnel training records in accordance with 30 TAC §335.586(d) and (e), as indicated in Table IV-1. Personnel training requirements will be as set forth in Section 5.4 of this SOP. Training records on current personnel will be kept until closure of the facility and training records on former employees must be kept for at least three years from the date the employee last worked at the facility. Personnel training records may accompany personnel transferred within the same company.

The facility will maintain operator licenses in accordance with 30 TAC Chapter 30, Subchapter F, as indicated in Table IV-1. Operator licensing requirements are presented in Section 5.1 of this SOP.

3.7 Waste Acceptance Rate and Waste Acceptance Records

As indicated in Table IV-1, the facility will maintain records in the Site Operating Record to document the annual waste acceptance rate for the facility. Refer to Section 4 of this SOP for more information on the waste acceptance rate and associated recordkeeping and tracking.

4. WASTE ACCEPTANCE RATES

4.1 Estimated Waste Acceptance Rates

The facility's Waste Acceptance Plan, as required by 30 TAC §330.61(b), is presented in Part I/II, Appendix I/IIG, and includes information on the estimated annual waste acceptance rates. These estimated waste acceptance rates are not a limiting parameter of the facility's permit and do not otherwise limit waste acceptance or operations at the site. Elements of site operation(s) that are related to the waste acceptance rate (e.g., personnel, equipment, etc.) are shown in this SOP in matrix tables of requirements versus annual waste receipt tonnage (see Tables IV-2 and IV-3).

4.2 Actual Waste Acceptance Rate Tracking

The actual waste acceptance rate will be tracked by quarter, and the actual annual waste acceptance rate will be a rolling average based on the sum of the previous four quarterly summary reports. The quarterly solid waste summary reports, and the annual solid waste summary reports required by 30 TAC §330.675, will be submitted to TCEQ. These quarterly and annual solid waste summary reports for the facility will be maintained in the Site Operating Record. If the actual annual waste acceptance rate, as established by the sum of the previous four quarterly summary reports, exceeds the operating rate upon which equipment and personnel staffing has been based, and the exceedance is not due to a temporary occurrence, the facility will adjust operations with regard to personnel and equipment needed to manage the waste as specified in Sections 5.1 and 5.2 of this SOP (see Tables IV-2 and IV-3), without the need for a permit modification, provided that the actual annual waste acceptance rate is within the ranges covered by this SOP.

If the actual annual waste acceptance rate exceeds the ranges covered by this SOP based on the sum of the last four quarterly summary reports, and the exceedance is not due to a temporary occurrence, the facility will file a permit modification within 90 days of the rate exceedance. The permit modification will identify any needed changes to the SOP to manage the increased waste acceptance rate to protect human health and the environment. These requirements do not make estimated waste acceptance rates a limiting parameter of the facility's permit.

The general factors to be considered by the facility to evaluate whether an increase is temporary may include: storm events; natural disasters or other emergency conditions; increases in the receipt of wastes, such as construction or demolition debris, brush, and/or rubbish, due to non-recurring commercial activity; receipt of waste diverted from other waste management facilities on a temporary basis; and similar occurrences that are not reflective of permanent or long-term increases in the tonnage/volumetric acceptance rate of solid waste to be managed by the facility.

5. GENERAL SITE OPERATING REQUIREMENTS

5.1 Facility Personnel

The general organizational structure for facility personnel will be as shown on the organizational chart in Figure IV-1 below. The Site Manager will have overall responsibility for day-to-day facility operations. Individual job titles and personnel are subject to change based on changes in operational conditions and changes in roles and responsibilities. However, the total number of key site personnel will be sufficient to meet the requirements outlined in Table IV-1, as addressed in this SOP. In addition, training will be maintained regarding duties and responsibilities to ensure ongoing compliance with the requirements of this SOP.

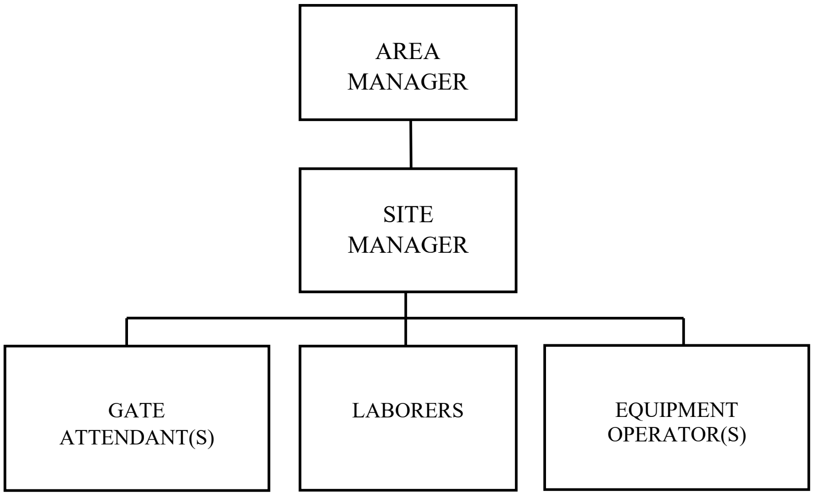

Figure IV-1. Mesquite Creek Landfill Organizational Chart

At least one individual who supervises or manages the operation of this facility will have and maintain an MSW Facility Class A License as a municipal solid waste facility supervisor in accordance with 30 TAC Chapter 30, Subchapter F.

A detailed description of roles and responsibilities of facility personnel are described in the remainder of this section.

5.1.1 Area Manager

The Area Manager (also sometimes having a job title of "District Manager") is responsible for overall landfill management and the general direction of the operation of this facility, and typically is responsible in this role for other solid waste facilities as well. As such, the Area Manager will not necessarily always be physically located (i.e., work full-time on-site) at this facility. The Area

Manager has the authority to hire necessary supervisory and operating personnel for the landfill and to arrange or provide for their training and orientation. This individual also ascertains the facility's equipment needs and initiates requests to replace or obtain additional equipment. The Area Manager may also engage outside contractors, as needed, to provide necessary supplemental equipment, construction, or other services as deemed necessary for site operation. The Area Manager, or individual(s) designated by the Area Manager, is the designated regulatory contact.

At minimum, the Area Manager must be knowledgeable and experienced in aspects of solid waste disposal operations, including relevant regulations, permit requirements, waste-handling, and safe management practices for disposal of MSW, non-hazardous industrial waste, and special waste; and will have at least three (3) years of landfill operations experience with a proven work history in the waste services industry.

5.1.2 Site Manager

The Site Manager will be responsible for day-to-day on-site facility operations. The Site Manager will be directly responsible for staff and equipment allocation to ensure operation of the facility in accordance with the approved Site Development Plan, SOP, and applicable local, state, and federal regulations. The Site Manager serves as the emergency contact and coordinator for the facility, and will be responsible for maintaining the Site Operating Record and required logs. The Site Manager has the authority and responsibility to reject unauthorized loads, require unauthorized materials to be removed by the transporter, or otherwise require unauthorized wastes to be removed from the facility.

The Site Manager has overall responsibility for implementation of and adherence to this SOP. Wherever this SOP describes procedures or requirements without naming a specific individual or position responsible for those requirements, the Site Manager shall have primary responsibility for those requirements. Where a specific individual or position is responsible for a particular task, that responsibility is described. Otherwise, the Site Manager may delegate authority and assign qualified personnel to accomplish the requirements of this SOP. The Site Manager will designate an individual(s) to fulfill his or her duties during periods when the Site Manager is unavailable.

The minimum qualifications for the Site Manager are to be an experienced personnel manager, with a minimum of two (2) years of experience in the solid waste industry (with experience in earthmoving and landfill/solid waste facility operational management) who is familiar with and has the aptitude to be trained as described in Section 5.4 of this SOP, and to have the ability to implement operational aspects of solid waste disposal operations, including knowledge of relevant regulations and permit requirements, waste-handling and safe management practices for disposal of municipal solid waste, health and safety, and waste identification. The Site Manager will have or obtain and maintain a MSW Facility Class A License as a MSW facility supervisor in accordance with 30 TAC Chapter 30, Subchapter F; and, as such, must meet the specific qualification standards (training, education, experience, applicable examination) contained in that Subchapter to obtain and maintain a license.

5.1.3 Gate Attendant

The Gate Attendant, stationed at the scale house, is primarily responsible for receiving incoming vehicles, collecting waste disposal fees, maintaining complete and accurate records of vehicles and solid waste entering the facility, conducting initial screening for prohibited wastes, and conducting visual inspection of select incoming trucks as described in Sections 5.6.3 and 5.6.4 of this SOP. The Gate Attendant records specific hauler information, volume estimates or weight, and provides directions to the driver with respect to on-site rules and the current unloading areas. At all times when the facility is open to receive waste from the general public, a Gate Attendant will be responsible for waste screening duties as outlined in Section 5.6 of this SOP. Accordingly, the minimum qualifications for a Gate Attendant are the ability to perform clerical duties; operate scale house equipment (computers and scales); possess basic communication skills; and comprehend and implement training on prohibited waste identification, health and safety, recordkeeping, and the other training topics relevant to their duties as described in Section 5.4 of this SOP.

5.1.4 Equipment Operators

Equipment Operators’ primary duties will include safe operation of landfill-related and other facility equipment. Equipment Operators will be trained to identify prohibited/unacceptable waste materials as they are unloaded from incoming trucks at the working face. Equipment Operators will notify the Site Manager or designated alternate should any instance of suspected prohibited or otherwise unacceptable wastes be observed at the working face. Equipment Operators’ waste screening duties are further discussed in Section 5.6 of this SOP.

Equipment Operators may also perform maintenance and repair of heavy equipment, support equipment, and vehicles as directed by the Site Manager or designated alternate. Duties may include regular servicing of light and heavy equipment. Tasks may also include fueling equipment, maintaining the equipment maintenance yard and shop, construction, checking for and picking up litter and windblown trash, and performing other duties as assigned. The minimum qualifications for Equipment Operators are to have a demonstrated proficiency to safely and effectively operate the types of heavy equipment that they will be using and have the ability to comprehend and implement training in landfill operations, health and safety, prohibited waste identification, and the other training topics relevant to their duties as described in Section 5.4 of this SOP.

5.1.5 Other Personnel (Laborers/Part-Time)

The Site Manager may hire other personnel or third-party outside workers to perform mechanic duties (e.g., equipment repairs, servicing and fueling) as well as laborer activities (e.g., patrolling for and collecting windblown trash, other manual labor and site maintenance activities). These personnel will be employed on an as-needed basis (e.g., part-time) and accordingly, are not specifically reflected on the table of minimum personnel requirements.

5.1.6 Minimum Required Number of Personnel

Table IV-2 provides a list of operational personnel that represent the minimum staffing levels required to maintain safe and efficient landfill operations for a broad range of waste acceptance rates, encompassing the current and projected ranges of waste acceptance rates.

Table IV-2. Minimum Facility Staffing Levels

Estimated Waste Acceptance Rate in tons per year (tpy):	Less than 400,000	400,000 to 800,000	800,001 to 1,200,000	1,200,001 to 1,600,000
Staff Position	**Number of Personnel**			
Site Manager(1)	1	1	1	1
Gate Attendant	1	1	2	3
Equipment Operators	3	5	7	10

(1) The Site Manager may perform other staff position duties, and may designate an alternate to perform Site Manager duties when necessary.

Required staff will not necessarily be on-site at the same time (e.g., Equipment Operators and other staff may work different shift schedules throughout the day). As changes in waste acceptance rates dictate, hours of operation and staff changes will be made to meet the staffing requirements listed above in Table IV-2. Additional staff will have qualifications commensurate with their duties, and key personnel will meet the minimum qualifications previously presented. The designated level of staffing will be maintained as required by operating conditions to ensure operations will be conducted in compliance with TCEQ's MSWMR and the facility's permit.

5.2 Equipment

Equipment requirements at the facility will vary based on actual operational requirements. Table IV-3 provides a list of equipment that represents the minimum needed to undertake safe and efficient landfill operations for a range of waste acceptance rates. Equipment will be added or removed as needed to meet changes in waste disposal demands and supporting operational requirements.

Table IV-3. Minimum Equipment Dedicated to the Facility

Estimated Waste Acceptance Rate in tons per year (tpy):			Less than 400,000	400,000 to 800,000	800,001 to 1,200,000	1,200,001 to 1,600,000
Equipment Type	**Typical Size$^{(1)}$**	**Function**	**Minimum Number**			
Landfill Compactor	CAT 836 or similar	Waste spreading and compaction; fire protection	1	1	2	3
Bulldozer	CAT D6 or similar	Movement and placement of soil; waste spreading and compaction; fire protection	1	1	2	2
Excavator$^{(2)}$	CAT 330 or similar	Excavation of soil; fire protection	1	1	1	2
Haul Truck$^{(2)}$	10 to 40 ton	Hauling of soil; fire protection	1	1	2	3
Pickup Truck or ATV	Standard pickup truck or 4-wheeled ATV	Personnel use, litter control, maintenance	1	1	1	1
Water Truck	2,500 gallons	Dust control; fire protection; earthfill compaction	1	1	1	1
Portable Water Pump	50 gallons per minute	Stormwater pumping	1	1	1	1
Portable Litter Screens	20-ft wide by 6-ft high panels	Active face litter control	3	7	9	11
Rotary Broom Sweeper	4-ft broom width	Road maintenance (cleaning/sweeping)	1	1	1	1

(1) The equipment typical size is the minimum size to be provided. The actual equipment manufacturers/model numbers of the heavy equipment and miscellaneous vehicles and equipment may vary. Compactor(s) shall have a minimum weight of 40,000 lbs. A Bulldozer meeting the minimum weight of a Compactor may be used in place of a Compactor while the Compactor is being maintained, repaired, or the site is awaiting the arrival of backup equipment.

(2) Soil excavation and hauling will be conducted with an excavator working in tandem with haul truck(s). The equivalent function of soil excavation and transport may be met by a scraper(s). Thus, at the facility's discretion, the excavator(s) and haul truck(s) may be replaced by a scraper(s) that provides sufficiently equivalent production rates to meet the soil management requirements at the facility.

(3) In the event of equipment breakdown or maintenance, backup equipment will be provided from other company-affiliated facilities, or from contractors or local rental companies, to avoid interruption of waste services and required facility operations.

The above list identifies the minimum number and size of equipment that will be utilized based on the actual annual waste acceptance rate. Additional equipment may be used to meet operational needs beyond that specified in the above table. Changes in equipment required for temporary increases or decreases in waste acceptance rates will be left to the discretion of the Site Manager. In addition to the equipment listed above, portable lighting, instruments, and safety and training equipment may also be on-site as necessary to support operations.

Equipment will be routinely maintained, repaired, replaced, or supplemented with additional equipment as required to maintain uninterrupted operations. The equipment fleet at the facility is sized to meet operating requirements, practices, and experience, and to account for periodic scheduled maintenance or short-term breakdowns. If additional equipment is needed within 24 hours of primary equipment breakdown, the facility has access to back-up waste spreading, compaction, and earthmoving equipment with equivalent performance capabilities from other operator company-affiliated facilities, or from local equipment dealers or contractors. Emergency back-up equipment will be rented or made available from other operator company-affiliated facilities. Additional equipment may also be utilized or added as necessary to adequately perform all required operations. Construction may be performed by an outside contractor that will provide the additional construction equipment required, including earthwork equipment such as excavators, trucks, and soil compactors.

The following is a brief description of the function of the heavy equipment used for site operations.

- <u>Landfill Compactor</u> – used to spread and compact the volume of waste received at the working face. Also used to spread earthen material for fire protection and fire-fighting.

- <u>Bulldozer</u> – used to spread waste in conjunction with compactors; place, spread or remove cover material; prepare turnaround areas; and aid in preparation and construction of liners. Other tasks involving the placement and movement of earthen material will also be completed with bulldozers, including fire protection and fire-fighting.

- <u>Excavator</u> – used to excavate soil and load dump trucks for use as daily, intermediate, or final cover. Also used for fire protection and fire-fighting.

- <u>Dump Truck</u> – utilized to haul soil for construction of liners, hauling earthen material for cover operations, for fire protection and fire-fighting, and for associated soil needs.

- <u>Scraper</u> – (if used) used for excavation and hauling of soil for construction of liners, hauling earthen material for cover operations, for fire protection and fire-fighting, and for associated soil needs.

- <u>Water Truck</u> – used to control dust on site roads, to haul water for irrigation of vegetation at the facility, to supply construction water, and as fire control equipment.

- Portable Litter Fencing – used to control windblown litter as discussed subsequently in Section 11.

- Motorized Power Broom - used to clean paved roads throughout the site.

As stated above, this list is subject to change as necessary to maintain effective site operations, including compliance with permit provisions and regulatory requirements. The minimum number and types of equipment specified in Table IV-3 will be maintained.

5.3 General Instructions for Operating Personnel

This SOP contains the procedures necessary for daily operations of the facility and instructions for compliance with applicable regulations, including:

- Recordkeeping requirements;
- Personnel training requirements;
- Detection and prevention of disposal of prohibited waste, hazardous waste, and polychlorinated biphenyl (PCB) wastes;
- Fire protection;
- Access control;
- Unloading waste;
- Facility operating hours;
- Site signage;
- Control of windblown waste and litter;
- Easements and buffer zones;
- Landfill markers and benchmark;
- Materials along the route to the site;
- Disposal of large items;
- Odor management criteria;
- Disease vector control;
- Site access roads;
- Salvaging and scavenging;
- Endangered/threatened species protection;
- Landfill gas control;
- Oil, gas and water wells;
- Compaction;
- Landfill cover;
- Ponded water;
- Disposal of special wastes;

- Disposal of industrial wastes;
- Visual screening of deposited waste; and
- Contaminated water discharge.

The procedures and instructions are included in the subsequent sections of this SOP.

5.4 Personnel Training

5.4.1 Overview of Training Program

Training of facility personnel will consist of classroom instruction and/or on-the-job training that instructs site personnel in the performance of their duties and compliance with this SOP, the facility's permit, and applicable regulations. Training will be directed by employees, supervisors, or other individuals experienced and trained in waste management procedures and operations, health and safety, and related subjects needed for satisfactory job performance. This may include in-house training by qualified individuals within the operator's company and its affiliates; as well as training at TCEQ-sponsored training courses or training events provided by other organizations as deemed appropriate by facility management. Training will include instruction in the solid waste management and related procedures relevant to each position.

The training program will also be designed to ensure that personnel are familiar with emergency response procedures, emergency equipment, and emergency systems relevant to their position so that the appropriate facility personnel are able to respond effectively to emergencies, including familiarity with the following, as applicable:

- using, inspecting, repairing and replacing facility emergency and monitoring equipment;
- communications or alarm systems;
- response to fires or explosions;
- response to groundwater contamination incidents; and
- shutdown of operations.

5.4.2 Training Frequencies and Position-Specific Training

Training will include both introductory and continuing training. Facility personnel must successfully complete initial training on topics relevant to their position within six (6) months after the date of their employment or assignment to the facility. When an existing employee is transferred or promoted to a new position at the facility with training requirements that differ from the previous position, that employee will receive the additional training required. Additional supervision will be provided to personnel during the training period, and personnel activities will be limited during the training period. Facility personnel will take part in an annual review of the initial training topics relevant to their position.

The position-specific training program will include instruction to appropriate facility personnel responsible for inspecting or observing loads on how to recognize prohibited waste. Please see Section 5.6.4 of this SOP for further training requirements specific to the program to prevent acceptance/disposal of prohibited wastes including hazardous waste and PCBs.

Table IV-4 presented below summarizes the position-specific training topics for facility personnel.

Table IV-4. Position-Specific Training Topics

Position	**Required Training Topics**												
	Site Orientation/Initial Training	Site Operations	Endangered and Threatened Species (See Section 20)	Health and Safety	Prohibited Waste, Hazardous Waste, & PCBs	Fire Prevention and Protection	Landfill Gas Management	Leachate System Management	Emergency Response	Spill Prevention and Response	Litter Control	Planned and Random Inspections	Storm-water Inspections
Site Manager	X	X	X	X	X	X	X	X	X	X	X	X	X
Gate Attendant	X			X	X	X			X		X	X	
Equipment Operators	X	X	X	X	X	X			X	X	X	X	
Laborers/Part-Time Laborers	X			X		X			X	X	X		

5.4.3 Training Recordkeeping

Documentation of training will be maintained in the Site Operating Record. Refer to Section 3.5 of this SOP for further description of the associated requirements.

5.5 Waste Acceptance – Authorized and Prohibited Waste Streams

A Waste Acceptance Plan is provided in Part I/II, as required by 30 TAC §330.61(b) [see Part I/II, Appendix I/IIG]. Refer to the Waste Acceptance Plan for a list of allowable wastes that may be accepted, as well as a list of prohibited wastes that shall not be accepted or knowingly disposed of.

5.6 Prevention of Acceptance/Disposal of Prohibited Waste

Per 30 TAC §330.127(5)(A), this section describes the program and procedures that will be implemented minimize the potential for acceptance and disposal of prohibited waste, including regulated hazardous and polychlorinated biphenyls (PCB) wastes, at the facility.

5.6.1 Overview of Methods

The following list presents the primary elements of the waste screening program that will be implemented to minimize the potential for accepting prohibited waste at the facility, and to detect and prevent the unauthorized disposal of prohibited waste at the facility:

1. Special Waste Evaluation Program. Customers proposing to bring special wastes to the facility will undergo a pre-arrival review and screening process. Refer to Section 5.6.2 below for more information on this Special Waste Evaluation Program.

2. Signage and Access Controls. Signs posted near the facility entrance in a conspicuous location inform potential customers of wastes that are prohibited or otherwise not allowed. Access controls at the facility will be used to prevent unauthorized access and unauthorized dumping as described in Section 7.

3. Screening Procedures for Incoming Loads. The screening procedures that will be followed for incoming loads are presented below in Section 5.6.3.

4. Program for Detection and Prevention of Prohibited Waste, Including Regulated Hazardous Wastes and Prohibited PCBs. This program (which includes a variety of attributes including training, load inspections, working face observations, etc.) is discussed below in Section 5.6.4.

The following sections discuss in detail the methods and procedures that will be used to prevent acceptance and disposal of prohibited wastes at the site.

5.6.2 Special Waste Evaluation Program

The Special Waste Evaluation Program that will be followed for management of such wastes, including acceptance, handling, and disposal criteria, is described in the Special Waste Acceptance Plan (SWAP) (see Appendix IV-A of this SOP). Also, additional procedures for acceptance, handling, and disposal criteria for RACM are provided in Appendix IV-B of this SOP.

5.6.3 Screening Procedures for Incoming Loads

1. Arrival Acceptance Procedures – All Incoming Loads. The Gate Attendant, who will be present at all hours when the facility is open to the public and receiving waste, will screen incoming customer loads to help ensure that no prohibited wastes are being brought to the site.

    a. On arrival of each incoming load, the Gate Attendant will answer inquiries the customer may have on the types of allowed and prohibited wastes, to inform the customer of wastes that are prohibited or otherwise cannot be accepted.

    b. The Gate Attendant (who will have received prohibited waste training) will observe waste hauling vehicles arriving at the scale for indications that any type of prohibited waste or otherwise unacceptable waste (e.g., hot load) may be present, and will question the driver concerning the type/origin of any suspected prohibited waste.

    c. As part of this screening, the Gate Attendant or appropriate field personnel will consider and look for potential issues, such as the type of transport vehicle, presence of liquids, strange odors, non-household size containers, smoke, vapors, unusual color or content, unusual compaction, powders or abnormal products, unusual or prohibited signage or labeling, and body language of driver (i.e., suspicious or nervous appearance or actions).

2. Additional Pre-Arrival and Arrival Acceptance for Special Waste. Additionally, for waste hauling vehicles arriving with special waste, the additional pre-arrival and arrival acceptance procedures set forth in the Special Waste Evaluation Plan (SWAP, Appendix IV-A) will be followed. The Gate Attendant will obtain and review shipping documentation accompanying the special waste load to confirm that the information is complete, the waste has previously been profiled and approved through the pre-arrival screening process, and that the waste matches the description on the shipping documentation and profile.

3. Any discrepancies (i.e., incomplete documentation, questionable waste characteristics) must be resolved prior to acceptance of the waste. In the event the discrepancies cannot be resolved, the waste load will be rejected.

4. Incoming loads will be subject to random inspections to check for prohibited wastes, as described subsequently in Section 5.6.4.

5. Besides the random load inspections, inspection of any other incoming waste loads will be conducted if indications of prohibited wastes have been detected or suspected.

6. Upon arrival of a waste load during unloading and at the working face, the waste load will be visually observed by equipment operators trained to recognize prohibited waste, for signs of any waste that may exhibit signs of being a hazardous, PCB, or otherwise prohibited waste. The equipment operators will have the authority and responsibility to reject unauthorized loads, have unauthorized material removed by the transporter, and/or have the unauthorized material removed by on-site personnel.

7. Should indications of prohibited wastes be suspected or detected, the procedures in Section 5.6.4 for discrepancies/rejected loads and management/notification of incidents will be followed.

Also refer to Section 5.7 of this SOP for information on removal of prohibited wastes that have been disposed of in the landfill and not immediately removed.

5.6.4 Program for Detection and Prevention of Regulated Hazardous Wastes and Prohibited PCBs

The program for detection and prevention of disposal of prohibited waste at the facility, including regulated hazardous waste and prohibited PCB wastes, includes the following elements:

1. Informing generators and transporters of unauthorized waste types, including regulated hazardous wastes and prohibited PCB wastes.

2. Strict incoming load screening and review of waste streams prior to acceptance as described previously in Section 5.6.2 (for special wastes, via the SWAP) and 5.6.3 (for all incoming loads).

3. Training for facility personnel to recognize regulated hazardous wastes, prohibited PCB wastes, and other prohibited wastes; and using these skills to screen the incoming wastes at the scale and at the working face.

4. Random inspections of incoming loads and records of these inspections.

5. Inspection of other waste loads where indications of prohibited wastes have been detected or are suspected.

6. Unloading/working face observations as described previously in Section 5.6.3.

7. Notification to TCEQ and any local pollution agency with jurisdiction that has requested to be notified of incidents involving the confirmed receipt or disposal of regulated hazardous wastes and prohibited PCB wastes.

8. Provisions for remediation of the incident.

Training. The overall personnel training program that will be implemented at the facility will be as previously described in Section 5.4 of this SOP. Documentation of training will be as described in Section 3.5 of this SOP. This program will include training on topics specifically related to detection and exclusion of regulated hazardous waste and prohibited PCB wastes, including the following:

- familiarization with Subtitle D requirements and other applicable regulations;
- waste recognition and/or waste screening requirements and procedures for acceptable and prohibited or otherwise unacceptable wastes;
- load inspection procedures;
- definition of and identification/recognition of special waste;
- definitions of and identification/recognition of regulated hazardous wastes, prohibited PCB wastes, and other prohibited wastes;
- requirements and procedures of the SWAP;
- waste handling procedures;
- health and safety;
- notification procedures; and
- recordkeeping.

Waste Load Inspections (Random Inspections, Other Load Inspections, Inspections Upon Waste Unloading/Disposal). Random inspections of incoming waste loads will be performed by facility personnel trained in the recognition of prohibited waste including regulated hazardous waste and prohibited PCB waste. In addition to the random load inspection program, incoming loads will also be subject to inspections when indications of the potential for prohibited wastes have been detected or are suspected. Also, each waste load will be visually observed at the working face by trained staff as described previously in Section 5.6.3. Waste loads from transfer stations [provided that the transfer station is permitted or registered by the TCEQ and conducts random screening (i.e., waste received from transfer stations is already subject to visual inspections and random screening prior to arrival at the facility)] are excluded from random inspections.

For the random load inspections, the Site Manager or designated alternate will objectively select an average of three (3) waste hauling vehicles per week on days that the facility accepts waste. The waste hauling vehicles will be selected at varying times. The driver of the randomly selected load will be notified and instructed to proceed to a lined area near the working face but out of the flow of normal disposal traffic. The waste will be spread sufficiently to determine the composition of the waste in order to inspect for regulated hazardous and prohibited PCB waste and other prohibited wastes.

Records of load inspections and results will be maintained in the Site Operating Record and will include the following information:

- date and time of inspection;
- inspector's name and signature;
- name and address of the transporter, or other identifying information (e.g., license plate);
- source of waste;
- type of vehicle;
- size and contents of load; and
- results of the inspection.

Documentation and Recordkeeping. As part of the program for detection and prevention of disposal of prohibited waste, the following documentation will be maintained in the Site Operating Record:

- shipping documentation for special wastes as described in Appendix IV-A;
- load inspection reports (random inspections, other waste load inspections);
- records of regulated hazardous waste or prohibited PCB waste incident notifications;
- records of unauthorized material removal; and
- personnel training.

Discrepancies and Rejected Loads. In the event of a discrepancy (e.g., that the description or physical characteristics of a waste load being received at the facility differs from that of an approved waste stream or if previously unidentified and potentially prohibited waste is suspected, or there are otherwise suspicions about the source or acceptability of the waste), the load will be stopped and the generator/customer will be asked to determine the identity of the material and provide additional information. For example, if the waste is a special waste, the generator/customer will be asked to provide documentation on process knowledge and/or chemical analysis data in order to determine the proper identity of the waste (per the SWAP procedures in Appendix IV-A). That information will be reviewed and approved by the facility's designated waste acceptance staff for acceptance or rejection, depending on the nature of the discrepancy (e.g. administrative versus waste composition issues). The facility will take reasonable steps to determine the identity of the material. The waste will not be authorized for disposal unless the discrepancy is resolved; if necessary this should include conducting a load inspection.

If regulated hazardous waste, prohibited PCB waste, or any other prohibited waste is detected before it is unloaded, the waste will not be authorized for disposal and the waste load will be rejected. The customer will be instructed to leave the site and return the material to the generator for proper disposal.

If regulated hazardous waste, prohibited PCB waste, or any other prohibited waste is detected after it is unloaded, the Site Manager will be notified to determine the appropriate course of action to properly manage the prohibited waste dependent on the type of waste and circumstances. This may involve contacting the generator (if known) and requiring them to remove the waste from the facility. Or, if appropriate, re-loading the waste back onto the customer's vehicle (if already discharged). If these steps are not feasible, the waste will be properly segregated and protected against the elements, secured against unauthorized removal, and isolated from other waste and landfill activities until arrangements can be made for appropriate handling and transportation back to the generator or to an appropriately authorized facility.

If the material is determined to be a regulated hazardous waste or contain regulated levels of PCB or radioactive material and the actions described above confirmed the receipt or disposal of such wastes, TCEQ and any local pollution agency with jurisdiction that has requested to be notified of such incidents will be notified of the incident and the planned disposition/remediation of the material. See the section below for "Management and Notification of Incidents." The proper disposition/remediation of such waste will be specific to that waste and will be implemented upon TCEQ concurrence and approval

Management and Notification of Incidents Involving Hazardous Waste or Prohibited PCB Waste. TCEQ (and any local pollution agency with jurisdiction who has requested to be notified) will be notified of any incident involving the confirmed receipt or disposal of regulated hazardous waste or prohibited PCB waste at the facility. A remediation plan will be submitted and coordinated with TCEQ for removal of regulated hazardous waste or prohibited PCB waste disposed of in the landfill. See Section 5.7 below for further information.

No notification will be provided for loads rejected by the facility or returned to the customer or generator (i.e., loads that were rejected/returned before being accepted for disposal at the facility).

5.7 Procedures for Removal of Disposed Prohibited Waste

Section 5.6 of this SOP described procedures that will be followed that are designed to detect and prevent the unauthorized acceptance and disposal of prohibited waste in the landfill. Section 5.6 also described actions that will be taken if prohibited waste is discovered (e.g., returned immediately to the transporter/generator of the waste or otherwise properly managed/secured by the facility).

This section describes procedures that will be followed if prohibited waste has been disposed of in the landfill and was not immediately removed. If it is discovered that a prohibited waste has been disposed of in the landfill and was not immediately removed, the facility will notify TCEQ of the occurrence and will prepare a Prohibited Waste Removal Plan (PWRP). The PWRP will be submitted to the TCEQ MSW Permits Section for review and approval before removing the disposed prohibited wastes. The PWRP will address the procedures for identifying, removing, and properly disposing of the prohibited waste, and will incorporate relevant guidance from the published TCEQ Regulatory Guidance (RG) document RG-546 ["Preparing Work Plans for Removing Prohibited Waste from Municipal Solid Waste Landfills," April 2021] as applicable for the specific situation (and provided that the guidance document is available and remains in effect at the time of the incident).

6. FIRE PROTECTION PLAN

6.1 Fire Protection Training

Facility operations personnel (not including personnel with administrative duties only) will receive annual training in fire prevention and fire-fighting. The training will include:

- review and discussion of this Fire Protection Plan;
- fire prevention and hazard awareness;
- location of fire-fighting equipment and materials;
- operation of fire extinguishers;
- fire-fighting methods, including source, size, and location of earthen material; earth-moving and placement equipment; and water truck;
- appropriate personnel protective equipment;
- properties of methane gas and proper safety procedures;
- facility evacuation procedures; and
- coordination with the local fire department.

Administrative personnel will receive annual training relating to fire prevention and hazard awareness, operation of fire extinguishers, and facility evacuation procedures. Records of training will be kept in the Site Operating Record.

6.2 Fire Prevention

The main potential fire hazard at this facility is operations associated with waste disposal (disposal truck traffic on-site, off-loading of waste at the working face, and handling waste during compaction for disposal). This is because waste disposal is the main operational activity that handles potentially combustible materials. Other ancillary site activities involving potentially combustible materials are vehicle fuel storage and dispensing, and operation of the landfill gas collection system (wells, piping, flare station. In order to minimize fire hazards at the site, the following standards are in effect.

- Smoking is allowed only in designated areas. Smoking is specifically prohibited:

    - on any area of the landfill waste footprint, whether active or closed;
    - at the wood recycling area;
    - at fuel storage and dispensing areas;
    - near landfill gas management system features (extraction wells, piping, flare station, gas monitoring probes, etc.); and
    - inside buildings.

- Fuels will be stored and dispensed only in authorized areas. Efforts will be made to contain and control fuel spills immediately upon discovery. Spilled fuel and impacted soil will be promptly collected, profiled, and properly disposed.

- No burning of solid waste will be permitted at the site.

- "Hot loads" (burning waste from incoming loads) will not be placed at the working face. The Gate Attendant and equipment operators will observe incoming loads for signs of burning waste, such as smoke, steam, or heat, and will manage hot loads as described in Section 6.4.2 of this SOP.

- Waste will be properly compacted and covered with daily cover or approved alternate daily cover as described in Sections 23 and 24 of this SOP.

- A source of earthen material of adequate size to cover the working face will be available at all times for use as described herein to extinguish a fire.

- All landfill equipment, vehicles, and buildings at the site will be equipped with fire extinguishers. Fire extinguishers will be maintained as required by the manufacturer.

- The emergency telephone contact numbers for the facility will be posted near the front entrance gate.

- All employees will be instructed in the control of small fires during the facility's required emergency response training.

6.3 General Fire-Fighting Procedures

The following procedures will be implemented in the event of a fire.

- If it can be done safely, small fires will be promptly extinguished by trained site personnel.
- If necessary:
    - Contact the local fire department by calling 911.
    - Notify the Site Manager and alert other facility personnel.
    - Assess the extent of the fire and the potential for the fire to spread.
    - If safe, attempt to contain or extinguish the fire until the local fire department arrives.
    - Assist the local fire department as appropriate.
    - Evacuate the facility as necessary.

In general, fire-fighting methods include smothering a fire with earthen material, spraying a fire with water, using a fire extinguisher, or separating burning material from other waste. Fire-fighting equipment available at the site includes: (i) a water truck; (ii) fire extinguishers; and (iii) landfill equipment for transporting and placing earthen material to extinguish any fires.

6.4 Area-Specific Fire-Fighting Procedures

6.4.1 Working Face

Working Face Fire-Fighting Procedures. If there is a fire at the working face, incoming waste receipts will be temporarily suspended or rerouted to another portion of the disposal area and another working face established there until the fire is extinguished. The following fire-fighting methods may be employed at the working face:

- isolate the burning material from other waste using bulldozers and compactors;
- smother with earthen material using bulldozers or compactors;
- apply water from the water truck (replenished from water sources);
- use a fire extinguisher on small fires;
- cut a firebreak using bulldozers or compactors around the fire to prevent it from spreading.

If a fire cannot be extinguished using the above methods, the local fire department will be contacted immediately by telephoning 911. Facility personnel will use reasonable measures to contain the fire until the fire department arrives.

Calculation of Fire-Fighting Earthen Material Source Size Requirements. The facility will maintain a source (or combination of sources) of earthen material in such a manner that it is available at all times to extinguish any fires. More specifically, the source(s) must have enough earthen material to cover the open area of the working face to a depth of six inches. Also, the source(s) should be at a location that allows for placement of a six-inch layer of earthen material to cover any waste not already covered with six inches of earthen material within one hour of detecting a fire, based on the capabilities of the on-site equipment (see additional discussion below). Based on the minimum equipment and anticipated ranges in size of an individual working face at the facility, the range of corresponding fire-fighting earthen material source sizes at that working face are tabulated below:

Area of a Working Face (ft^2)	**Minimum Required Fire-Fighting Earthen Material Source Size at that Working Face (yd^3)**
2,500 (i.e., about 50’ x 50’)	46
10,000 (i.e., about ¼ acre, or 100’ x 100’)	185
20,000 (i.e., about ½ acre; or 100’ x 200’)	370
40,000 (i.e., about one (1) acre; or 200’ x 200’)	741
62,500 (i.e., about 1.5-acres; or 250’ x 250’)	1,157
80,000 (i.e., about 2-acres; or 280’ x 280’)	1,481

The Site Manager or designated alternate will estimate and adjust the appropriate fire-fighting earthen material source size as needed using the above table and the actual working face dimensions, or by calculating the volume in cubic yards using the formula: [(working face length (ft) x width (ft) x 0.5’ thick)/27 ft^3/cy]. It is noted that the above table of working face areas and corresponding fire-fighting earthen material source sizes show the amount of earthen material that would be needed for typical conditions to cover the entire working face size. As daily landfill operations progress, the actual size of the open, uncovered portion of the working face may vary, and less earthen material may be required (i.e., just a portion of that day’s working face may be open at any one time).

The maximum allowable size of the working face will be based on the availability of equipment to provide the timely fire-fighting protection described below (i.e., six-inch layer of earthen material within one hour of detection). Further, the facility will limit the size of the active working face to be as small an area as practical for the safe operation of the incoming waste hauling vehicles, operation of compaction equipment, and placement of daily cover.

Calculation of Maximum Allowable Working Face Size from Fire-Fighting (Covering with Earthen Material) Requirements. Sufficient on-site equipment must be provided to place a six-inch layer of earthen material to cover any waste not already covered with six inches of earthen material within one hour of detecting a fire. Calculations demonstrating that the type and number of equipment listed previously in Table IV-3 in Section 5.2 of this SOP will be able to transport the volume of earthen material required are presented below. The calculations are performed to back-calculate (solve for) the maximum allowable size of the working face based on the soil source location, equipment present, and their earthmoving capabilities.

Case 1 – Earthen Material Source Present Next to a Working Face

- Case 1 is for a fire-fighting condition where the earthen material source is kept next to a working face and will be used to cover that working face in an hour. Three (3) scenarios are analyzed based on an assumed number of equipment pieces available at that working face. If more equipment is available, the methodology presented herein can be used by the facility to calculate the allowable working face size for the actual equipment condition.

- The equipment capabilities accompanying the scenarios are based on the following (using production rates published in Caterpillar Performance Handbook, Edition 31):
  - The earthmoving equipment will push earthen material kept next to the working face to cover the working face.
  - The average dozing distance of material being pushed and spread is 150'.
  - Each piece of equipment (bulldozer(s) and compactor, when present) will have production equivalent to a CAT D6R dozer pushing a loose soil stockpile – i.e., 480 cy/hr.

- The working face size in square feet is solved-for by dividing the production capacity by the required soil thickness, using consistent units. For example, with one bulldozer, the maximum allowable working face size is calculated as: [(480 cy/hr x 27 ft^3/cy) / 0.5 ft] = 25,920 ft^2. For a convenient frame of reference, this area can also be expressed as an equivalent square area by taking the square root of the calculated area. The resulting calculation for the three scenarios is tabulated below.

Scenario	Equipment Piece(s)	Production Capacity (cy/hr)	Area (ft^2) That Can Be Covered by 6-inches of Soil in One Hour [i.e., Maximum Working Face Size]	Approx. Equivalent Square Dimensions of Calculated Area (ft x ft)
1	1 Bulldozer	480	25,920	180 x 180
2	1 Bulldozer + 1 Compactor	960	51,840	230 x 230
3	2 Bulldozers + 1 Compactor	1,440	77,760	280 x 280

The above table presents the results of the calculation of the allowable working face size based on the different assumed scenarios of available equipment under Case 1 (when an earthen material source is kept next to the working face). As noted, if more equipment is available, the facility can apply the approach described above to calculate the allowable working face size for the actual equipment condition.

Case 2 – Earthen Material Transported from Borrow Area

- Case 2 is for a fire-fighting condition where earthen material will be obtained directly from a borrow area and transported to the working face (and then spread by at least one bulldozer) to cover the working face in an hour or less. As will be shown below, the limiting condition for this case is the production (i.e., transport) rate of the haul truck. Three (3) scenarios are analyzed based on the size range of the haul truck as presented in Table IV-3 in Section 5.2.

- The equipment capabilities accompanying the scenarios are as follows (based on production rates published in Caterpillar Performance Handbook, Edition 31):

  - A 10-ton haul truck would have similar hauling time performance capabilities as a 25-ton haul truck, except with a reduced capacity of 7.2 cubic yards. Using a conservative one-way haul distance of 1,500-ft based on the site layout plan, a round trip would take approximately 3.9 minutes (rounded up to 5-minutes to account for loading time). Thus, a 10-ton haul truck would able to deliver at least 12 loads in less than an hour, for a total of about 86 cubic yards.
  - Similarly, a 25-ton haul truck with a capacity of 18 cubic yards, delivering 12 loads in less than an hour, would provide a total of about 216 cubic yards.
  - Similarly, a 40-ton haul truck with a capacity of 28 cubic yards, delivering 12 loads in less than an hour, would provide a total of about 336 cubic yards.
  - The CAT 330 or equivalent excavator with a two cubic yard (cy) bucket and a 0.29 minute cycle time has an hourly capacity to load haul truck(s) of 420 cy/hr. As such, this is not the limiting piece of equipment for this case (the excavator has greater capacity than any of the haul truck options).
  - A single CAT D6R bulldozer spreading earthen material over the working face has a capacity of 480 cy/hr, as indicated for the preceding case. As such, this is not the limiting piece of equipment for this case (the bulldozer has greater capacity than the rate of haul truck transport/delivery).

- The working face size in square feet is solved-for by dividing the production capacity of the limiting equipment piece by the required soil thickness, using consistent units. For example, for one 25-ton haul truck, the maximum allowable working face size is calculated as: [(216 cy/hr x 27 ft^3/cy) / 0.5 ft] = 11,660 ft^2. For a convenient frame of reference, this area can also be expressed as an equivalent square area by taking the square root of the calculated area. The resulting calculation for the three scenarios is tabulated below.

Scenario	Limiting Equipment Piece	Production Capacity of Limiting Equipment (cy/hr)	Area (ft^2) That Can Be Covered by 6-inches of Soil in One Hour [i.e., Maximum Working Face Size]	Approx. Equivalent Square Dimensions of Calculated Area (ft x ft)
4	1 Haul Truck (10 tons)	86	4,640	68 x 68
5	1 Haul Truck (25 tons)	216	11,660	107 x 107
6	1 Haul Truck (40 tons)	336	18,140	134 x 134

> The above table presents the results of the calculation of the allowable working face size based on the range of limiting equipment (haul truck size) – i.e., of one haul truck working in-tandem with one bulldozer under Case 2 (when the earthen material source is the on-site borrow area and will be transported to the working face for spreading to cover the working face). If there are multiple haul trucks and bulldozers available, the facility can apply the approach described above to calculate the allowable working face size for the actual equipment condition. As noted, if the earthen material is kept next to the working face, Case 1 applies.

The Executive Director may approve alternate methods of fire protection. Also, it is noted that during a fire, various on-site equipment (e.g., water truck, fire extinguishers, excavator and dump truck delivering and placing earthen material, or scraper) can be used in combination with the above cases to obtain and transport earthen material from other sources to the working face to fight a fire. To be conservative, the earthen material covering/fire-fighting capabilities of these other combined equipment usage scenarios have not been factored into the above calculations. It should be recognized that these other equipment pieces used in combination will add to the fire-fighting capabilities at the facility, and through the calculation approach used in the cases given above, accounting for these other equipment pieces could support the ability to use a larger working face.

In addition to meeting the above fire-fighting requirements, the facility will also limit the size of the active working face to be as small an area as practical for the safe operation of the incoming waste hauling vehicles, operation of compaction equipment, and placement of daily cover.

6.4.2 Incoming Hot Load

“Hot loads” (incoming loads containing burning waste) can be identified by the presence of smoke, steam, heat, or flames being released from the load, or notification by the driver. Any truck perceived to be carrying a hot load will be directed to a portion of the disposal area away from the working face, where the load can be discharged without danger of spreading the fire. The fire will then be extinguished by smothering with earthen material or dousing with water. The waste will only be transported to the working face after the Site Manager or designated alternate has determined that the fire has been extinguished and no potential exists for the waste to re-ignite.

No smoldering or smoking waste will be moved to the working face. Hot loads inadvertently discharged at the working face will be handled in the manner described above for managing a fire at the working face.

6.4.3 Vehicle or Equipment

If site equipment or a site-operated vehicle catches fire, the operator will attempt to bring the unit to a stop away from fuel areas, exposed waste material, and other equipment or vehicles. If possible, the operator will shut off the engine and set the brake. Fire may be extinguished by fire suppression equipment installed on some equipment or by trained personnel that will attempt to extinguish the fire using fire extinguishers or water. If the fire cannot be extinguished using the above methods, the local fire department will be contacted immediately by calling 911. Facility personnel will use reasonable measures to contain the fire until the fire department arrives.

6.4.4 Structures

Personnel will follow the general procedures outlined in Section 6.3 of this SOP for fires occurring in on-site structures, including calling 911 if necessary. No site personnel will enter a structure that is on fire. The potential for fires occurring in on-site structures will be minimized by employing routine maintenance and cleanup.

6.4.5 Wood Recycling Area

If there is a fire at the wood recycling area, wood processing activities will be suspended in the affected area until the fire is extinguished, and incoming related loads will be redirected away from the affected area. The following fire-fighting methods may be employed at the wood recycling area:

- smother with earthen material;
- apply water from the water truck (replenished from on-site water sources);
- isolate the burning material from other wood materials;
- use a fire extinguisher on small fires;
- cut a firebreak around the fire to prevent it from spreading; and/or
- place earthen berms around the fire area to prevent it from spreading.

If a fire cannot be extinguished using the above methods, the local fire department will be contacted immediately by calling 911. Facility personnel will use reasonable measures to contain the fire until the fire department arrives. Upon extinguishing a wood recycling area fire, the portion of the area affected by the fire will remain closed while the area is inspected to verify that the fire is completely extinguished. Inspection of the fire area will be conducted by the Site Manager or designated alternate. A source of at least 300 cubic yards of earthen material will be maintained within 150 feet of the wood recycling area to be available for use in smothering small fires.

6.4.6 Other Areas

Fire-fighting procedures at the other storage/processing areas (i.e., the large/heavy/bulky items area, the C&D recycling area, the tire storage area, leachate evaporation ponds, leachate storage tanks, and liquid waste solidification area) will follow the general procedures in Section 6.3 and the same procedures as the working face fire-fighting procedures described in Section 6.4.1 of this SOP.

6.5 Notification of TCEQ

If a fire is not extinguished within 10 minutes of detection, the facility will make every reasonable effort to contact the TCEQ Region Office immediately, but not later than four (4) hours after detection. The facility will provide the Region Office with a written description of the fire and resulting response within 14 days of the event.

7. ACCESS CONTROL

7.1 Access Control Measures

Access control must be provided to prevent the entry of livestock, control public access, protect the public from exposure to potential health and safety hazards, protect human health and safety and the environment, and discourage unauthorized entry or uncontrolled disposal of solid waste or hazardous material. At this facility, access control is provided by: (i) fencing; (ii) control features at the main entrance/exit gates; (iii) locked gates at any other secondary site access point(s) around the facility perimeter; and (iv) site personnel awareness and observations for maintaining access control. The layout of the access controls around the site perimeter and the location of the main entrance/exit gates are shown on Part I/II, Attachment I/IIA, Drawing I/IIA-20.

Fencing and gates will serve as the primary landfill access controls. To discourage unauthorized entry into the landfill facility, the majority of the perimeter property around the facility will be protected by fencing (see Drawing I/IIA-20). Fencing will be composed of (at minimum) barbed wire, woven wire, wooden fencing, plastic fencing, pipe fencing, field fence, or other fence materials.

The site is accessed through lockable entry and exit gates at the main entrance. Secondary access gates along the perimeter fencing, if present, will be kept locked except when in use. Entry to the landfill is restricted to personnel whose entry is authorized by site management (e.g., facility employees and contractors, authorized waste haulers/customers, TCEQ personnel, properly identified visitors, etc.). Visitors entering the site are directed to the office location for check-in.

The Gate Attendant(s) will direct waste transport drivers to the proper disposal area. There, the drivers will be directed to a specific unloading area. The Gate Attendant(s) or other site personnel will also direct drivers needing access to other portions of the facility (e.g., construction contractors, haulers of material going to storage/processing areas). Additionally, when appropriate, signs with directional arrows and/or barricades may be placed along site roads to direct traffic and control interior access.

During normal operating hours, facility personnel will be on duty at the scale house and in the vicinity of landfill operations to control access and disposal operations. When the site is closed, the entry and exit gates will be closed to prevent site access, and locked when no personnel are present on-site.

7.2 Access Control Inspection, Maintenance, and Notifications

Access control features will be inspected monthly, and the results of the inspection will be documented. A breach in any perimeter fence or gate will be temporarily (or permanently, if possible) repaired within 24 hours of detection. If a breach of the perimeter fence or gate cannot be permanently repaired within 8 hours of detection of the breach, the facility will notify the TCEQ Regional Office, along with any local pollution control agency with jurisdiction that has requested to be notified, within 24 hours of detection. For a temporary repair, the notification will include a schedule for when a permanent repair will be completed. Once the permanent repair is complete, the facility will notify the TCEQ Regional Office of the completed repair. If a permanent repair is completed within 8 hours, no notification is required.

8. UNLOADING OF WASTE

8.1 Unloading at Working Face

Unloading of waste to be disposed of in the landfill will take place at the designated working face(s) under the supervision of trained site personnel. Multiple working faces at a time may be used for the receipt and disposal of waste. If multiple working faces are used, they will typically not be differentiated by waste type. Instead, their use could be based on vehicle capability/customer type for traffic control purposes. For example, commercial customers in large trucks may be routed to one working face, while individual disposal customers in pickup trucks may be routed to another working face area for traffic safety. Also, a separate working face/disposal area may be designated if deemed necessary for the safe management of RACM or other approved special waste streams. Equipment Operators will maintain the working face(s) to as small an area as practical for the safe operation of the incoming waste hauling vehicles, operation of compaction equipment, and placement of daily cover. Signs and barricades may be used in addition to instructions from site personnel to direct incoming loads to the designated unloading area.

Equipment Operators and other staff with responsibility for working face operations will be appropriately trained as specified in Section 5.4 of this SOP with regard to approved waste acceptance procedures and requirements. This will include an understanding of special waste, industrial waste, and prohibited waste (e.g., hazardous waste, PCBs, etc.) recognition and incident management methods. One or more of these trained employees will direct and visually monitor the disposal of incoming loads at the working face. Trained personnel will be on duty at all times when wastes are being unloaded at the working face and will have the authority and responsibility to reject unauthorized loads, to assess appropriate surcharges, and to have unauthorized material removed by the transporter or on-site personnel or otherwise properly managed by the facility. A sign at the site entrance will display the rules regarding authorized and prohibited waste restrictions for the facility. Additionally, as previously mentioned in Section 5, the Gate Attendant(s) will be trained to be on alert for signs of unauthorized waste in incoming loads.

8.2 Unloading Unauthorized and Prohibited Wastes

Unloading of waste in unauthorized areas is prohibited. Waste deposited in an unauthorized area will be removed immediately and disposed of properly.

The methods employed at the site to detect and prevent the disposal of prohibited wastes were discussed in Section 5.6 and are presented in the Special Waste Acceptance Plan in Appendix IV-A of this SOP, and will be followed during waste unloading. If unauthorized or prohibited waste is detected by site personnel after it has been unloaded, the procedures, notifications, and recordkeeping outlined in Sections 5.6.2 and 5.6.3 will be followed for the type of waste involved in the incident.

8.3 Large/Heavy/Bulky Item Area

An area to unload, collect, stage/sort, and store received/salvaged large/heavy/bulky items such as white goods (household appliances) will be maintained at the site. The area is allowed to be located either on properly-covered (per Section 24 of this SOP) waste within the current landfill footprint, or in areas within the future landfill footprint. Alternately, the facility may designate an area outside of the current or future landfill footprint, provided that it is greater than 50-feet from the permit boundary and does not interfere with site operations. This area will have a size not larger than 100 feet by 100 feet. This storage area is allowed to move from time to time based on landfill operational needs. The materials allowed in this area are only those large/bulky items that have been received/salvaged from the authorized waste streams that are allowed to be accepted at this facility. The items being collected and staged in this area are not expected to be combustible. The items will be removed often enough to prevent them from becoming a nuisance, to preclude the discharge of any pollutants from the area, and to prevent an excessive accumulation of the material at the site. The unloading of such items will be supervised by site personnel and the bulky items storage area will be inspected monthly to ensure that any waste materials other than large/bulky items are removed and deposited in the landfill.

8.4 Wood Recycling Area

An area to unload, segregate, and stockpile/store uncontaminated wood materials (e.g., trees, stumps, shrubs, brush, leaves, grass clippings, sawdust, pallets, other wood materials); to perform processing by grinding/chipping/mulching; and to store processed wood materials, is allowed to be maintained at the site. The wood recycling area is allowed to be located either on properly-covered (per Section 24 of this SOP) waste within the current landfill footprint, or in areas within the future landfill footprint. This area will have a size not larger than two (2) acres. This area is allowed to move from time to time based on landfill operational needs. The materials allowed in this area are only the uncontaminated wood materials that have been received from the authorized waste streams that are allowed to be accepted at this facility. The materials will be removed often enough to prevent them from becoming a nuisance, to preclude the discharge of any pollutants from the area, and to prevent an excessive accumulation of the material at the site. The collected materials will be removed from the site for recycling within 180 days or less, or disposed of at the working face within 180 days of acceptance at the facility. Processed wood materials may be reused by the facility. The unloading of wood materials to this area will be supervised by site personnel. The storage/processing area for these materials will be inspected monthly to ensure that any non-brush/wood materials are removed and deposited in the landfill.

8.5 C&D Material Recycling Area

An area to unload, stage/sort/process, and store potentially-recyclable C&D materials received/salvaged at the facility is allowed to be maintained at the site, either located on properly-covered (per Section 24 of this SOP) waste within the current landfill footprint, or in areas within the future landfill footprint. This area will have a size not larger than one (1) acre. This area is allowed to move from time to time based on landfill operational needs. The materials allowed in this area are only the non-combustible C&D materials (e.g., metal, concrete, bricks, drywall, land clearing debris, pavement, or other inert materials) that have been received from the authorized waste streams that are allowed to be accepted at this facility. The items being collected and staged in this area, as listed, are expected to have a low potential for the generation of contaminated water. The materials that will be stored and processed in this area are essentially inert or minimally soluble or degradable, do not contain free liquids, and are not expected to require washing or other cleaning operations. The materials will be removed often enough to prevent them from becoming a nuisance, to preclude the discharge of any pollutants from the area, and to prevent an excessive accumulation of the material at the site. The collected materials will be removed from the site for recycling within 180 days or less, or disposed of at the working face within 180 days of acceptance at the facility. Processed wood materials may be reused by the facility. The unloading of such items will be supervised by site personnel and the C&D recycling area will be inspected monthly to ensure that any non-recyclable C&D materials are removed and deposited in the landfill.

8.6 RACM Unloading Area

An area for unloading and disposal of RACM will be designated. Requirements for RACM acceptance, unloading, handling, and disposal are included in Appendix IV-B of this SOP.

8.7 Liquid Waste Solidification Area

An area to unload and process (solidify) liquid waste (that is of a type that is an authorized waste stream) is allowed to occur on-site at a “portable/movable” liquid waste solidification area. This area will be located on waste (over Subtitle D-lined areas), where one or more solidification basins recessed into the waste will be used to receive liquid waste and process it via mixing with solidification agents. The layout/location, design, and operational requirements of this liquid waste solidification area and the associated processing of liquid waste are presented in the Liquid Waste Solidification Plan in Appendix IV-C

8.8 Other Areas

Tire Storage Area. The facility’s Waste Acceptance Plan (Part I/II, Appendix I/IIG) prohibits disposal of whole tires, and only allows disposal of certain specified tire pieces. With respect to tire storage, whole tires or tire pieces are allowed to be unloaded, collected, and stored in an area not larger than 100 feet by 100 feet in in size that is allowed to be located either on properly-covered waste (per Section 24 of this SOP) within the current landfill footprint, or in areas within the future landfill footprint. This area is allowed to move from time to time based on landfill operational needs.

The unloading of such tire items will be supervised by site personnel and the tire storage area will be inspected monthly for compliance with the allowable storage requirements and quantities listed below. In general, the tires are allowed to be stored on-site for a period not to exceed 180 days. Tires will be removed from the site often enough to prevent the items from becoming a nuisance, to preclude the discharge of pollutants from the area, and to prevent excessive accumulation of material at the site. The site will not store more than 500 used or scrap tires (or the weight-equivalent in tire pieces or any combination thereof) at any one time. All tires shall be stored in a manner to prevent fires, ensure safety, control vectors, and prevent windblown solid waste and litter. All used or scrap tires or tire pieces, except for tires collected incidentally by MSW collection vehicles, are subject to the manifesting requirements provided in 30 TAC §328.58.

Empty Containers. Empty containers (not containing waste) such as roll-offs are allowed to be stored at the facility as long as they do not interfere with site operations. The containers are allowed to be moved from time to time. Containers will not be stored if they contain waste, and storage of the containers will be managed to preclude nuisance conditions or the discharge of pollutants from the area.

8.9 Additional Operating Requirements for Storage/Processing Areas

The following additional operations requirements pertain to the on-site storage/processing areas:

- When these areas are situated over existing landfill cover soil, they must be managed and maintained in a way that does not disturb the existing cover soil. For example, these areas must be operated to avoid impacts to the landfill cover soil due to traffic loads and operational equipment loads, including during wet weather conditions.

- The areas must be graded and maintained to promote runoff, prevent erosion, prevent ponding of surface water, and other related nuisance conditions. This will include using diversion berms and/or ditches at locations upgradient from the areas as needed to minimize stormwater run-on.

- Contaminated water management will be performed as described in Section 30 of this SOP. If wastewaters are generated at these storage/processing areas (e.g., from washing or cleaning that comes in contact with waste), they shall be managed as contaminated water.

9. FACILITY OPERATING HOURS

Waste Acceptance Hours. The operating times when the facility is allowed to accept waste are 4:00 a.m. to 8:00 p.m. Monday through Friday, and 4:00 a.m. to 3:00 p.m. on Saturday. The site will not accept waste on Sundays unless approved by TCEQ under the “Alternate/Additional Operating Hours” section below.

Operating Hours – Heavy Equipment/Transport. The operating times when the facility is allowed to operate heavy equipment for conducting landfill operations (e.g., waste compaction; earthmoving; cover soil excavation, spreading, and placement; heavy equipment operation for on-site construction or maintenance activities; etc.) and transport of non-waste materials on- or off-site are 4:00 a.m. through 9:00 p.m. Monday through Saturday, and 5:00 a.m. to 9:00 p.m. on Sunday.

Operating Hours – Other Activities. Site monitoring, surveying, maintenance, and other activities not involving heavy equipment operation do not require specific approval and may be performed seven days a week, 24 hours per day.

Alternate/Additional Operating Hours. The facility may request TCEQ approval of alternate waste acceptance or operating hours up to five (5) days in a calendar-year period to accommodate special occasions, special purpose events, holidays, and other special occurrences. Also, the TCEQ Regional Office may allow additional temporary waste acceptance or operating hours to address disasters, emergency situations, or other unforeseen circumstances that could result in the disruption of waste management services in the area. The facility will record in the Site Operating Record the dates, times, and durations when any alternate or additional operating hours are used.

Reasons for Proposed Operating Hours. Waste acceptance hours outside the default regulatory time periods in 30 TAC §330.135(a) are necessary to support the safe and efficient transportation, storage, processing, and disposal of MSW generated within the communities and other areas and customer base served by the facility. The reasons for the proposed waste acceptance hours and days outside of the default time periods are discussed below.

With respect to weekdays, TCEQ approved the same waste acceptance hours under the facility’s current Permit MSW-66B, which was issued in November 2008 (i.e., no changes are being proposed). As such, this facility has a well-established operating history that allows waste acceptance on weekdays between these hours. Certain customers request or require waste collection services in the early morning weekday hours. Such contracts are commonplace in the industry for municipal and commercial/institutional customers, and the operator expects that their waste hauling division, and other waste hauling companies who transport their waste to this facility, may enter into such contracts.

Collecting waste in the pre-dawn hours helps keep large waste collection and hauling vehicles out of commercial and institutional areas during times of heavier traffic – when people are arriving at work or school, or patronizing restaurants or other businesses. Collecting waste at later morning times in these areas can result in increased traffic congestion and at times it can be physically impossible to access the containers that need to be serviced due to the increased presence of other vehicles in the alleyways and parking lots where the containers are located.

As the facility's service area grows in population, if the Mesquite Creek Landfill was required to accept all waste loads within the hours of 7:00 a.m. to 7:00 p.m. on weekdays only, the limited waste acceptance hours would result in an increase in the amount of traffic to and from the landfill during the busiest traffic hours of the day, and as waste receipts grow over time, waste collection trucks could be lined up each morning in front of the facility waiting for the gates to open, creating significant traffic congestion and safety issues and increasing air emissions.

With respect to Saturdays, TCEQ has approved the same waste acceptance hours under the facility's current Permit MSW-66B, which was issued in November 2008 (i.e., no changes are being proposed). As such, this facility has a well-established operating history that allows waste acceptance on Saturdays during these hours. This offers a convenient window of hours on Saturdays to make waste deliveries. This will provide much-needed flexibility for customers, particularly for small haulers and members of the public for whom making waste deliveries during their typical Monday through Friday work week is not feasible.

The need for operating hours beyond the weekday hours of 7:00 a.m. to 7:00 p.m. is expected to increase in the coming years as the area economy continues to improve and as the population of Comal and Guadalupe counties and neighboring communities and counties in the facility's service area continue to grow.

The operator has historically managed the facility's active hours of waste acceptance and operation judiciously, opening the facility for waste acceptance and other operations in the early mornings only as necessary to accommodate the needs of its customers and the community. The operator will carry forward and continue to apply this managerial approach to the ongoing operations at the Mesquite Creek Landfill.

10. SITE SIGNS

A conspicuous sign measuring at least 4 feet by 4 feet will be maintained at the main entrance to the facility through which wastes are received. The sign will be readable from the facility entrance and will state, at a minimum, in letters at least 3 inches high:

- the name of the facility;
- the type of site (i.e., Type I);
- the hours and days of operation;
- a 24-hour emergency contact phone number(s);
- the phone number of the local fire department; and
- the facility MSW permit number.

The contact phone number(s) will reach an individual with the authority to obligate the facility at all times that the facility is closed.

Other signs will be posted at site entrance, the scale house area, or along roads within the site to provide pertinent rules, operational procedures, traffic control procedures, warnings, and other relevant site information, including unauthorized/prohibited wastes.

11. CONTROL OF WINDBLOWN SOLID WASTE AND LITTER

The site in general, and the working face in particular, will be operated in such a way as to minimize windblown solid waste. Windblown material and litter must be collected and properly managed in accordance with the procedures and measures described below, to control unhealthy, unsafe, or unsightly conditions.

- Incoming waste hauling vehicles will be encouraged to use adequate covers/tarps or other means of securing and containing the load during transport. The adequacy of covers will be checked at the scale house, and a sign will be prominently displayed at the scale house stating that all loads shall be properly covered or otherwise properly secured. Additionally, the facility may elect to add a surcharge, as appropriate, to encourage compliance.
- The active working face will be limited in size to as small an area as practical for the safe operation of the incoming waste hauling vehicles, operation of compaction equipment, and delivery/placement of daily cover.
- Waste will be compacted with heavy equipment as soon as practicable after is placed at the working face.
- Daily cover or approved alternate daily cover will be applied to the working face at least once each day (as described in Section 24 of this SOP).
- Engineering controls will be used during waste placement, including: (i) stationary and portable litter fences, as needed, placed at appropriate locations depending on operating and weather conditions; and (ii) the perimeter site fence.
- Temporary litter fences include portable panels with wire-mesh screens of varying heights that can be placed near and downwind side of the working face.

The number and location of temporary fences will be determined by the Site Manager or designated alternate as needed based on operating and weather conditions. See Table IV-3 for the minimum number of portable litter screen panels. Litter fences that are damaged shall be promptly repaired or replaced.

Weather conditions may result in material occasionally being blown away from the working face during waste placement operations, and along fences and access roads. Facility personnel (e.g., equipment operators and/or laborers) will collect litter within and around the site, including along fences and access roads at least once a day on each day that the facility is operating. This activity will be documented to demonstrate compliance. Windblown materials will be collected and returned to the active disposal area.

12. EASEMENTS AND SITE BUFFER ZONES

This section of the SOP describes easement protection and buffer zones at the site.

12.1 Easement Protection

Requirements: No solid waste unloading, storage, disposal, or processing operations shall occur within any easement, buffer zone, or right-of-way that crosses the site; and no solid waste disposal shall occur within 25 feet of the center line of any utility line or pipeline easement, unless otherwise authorized by the Executive Director. All pipeline and utility easements must be clearly marked with posts that extend at least six feet above ground level, spaced at intervals no greater than 300 feet.

Protection of Site Easements: Existing easements and rights-of-way on or adjacent to the site area presented in Section 15.1.1 of the Part I/II Report and "Easement Map" drawings are provided in Part I/II Appendix I/IIC. A drawing showing the drainage, pipeline, and utility easements in relation to the limits of waste is presented in Part I/II, Appendix I/IIA, Drawing I/IIA-17. As shown, there are no rights-of-way that cross the site. There is one raw water pipeline that crosses the far eastern edge of the site (identified as Easement Nos. 5 and 6 on Drawing I/IIA-17) along Schwarzlose Road, but its centerline and edges more than 25-ft away from the limits of waste disposal. At the final-closed landfill Unit 1 there are two electrical easements (identified as Easement Nos. 2 and 3 on Drawing I/IIA-17) that do not cross the site, but rather are overhead powerlines to supply electrical power to that area of the facility. At the landfill Unit 2 there are two electrical easements (identified as Easement Nos. 7 and 8 on Drawing I/IIA-17) that do not cross the site, but rather are legacy overhead powerlines that supplied electrical power to the old barns and dwelling in the southern (expansion) area of the site. These powerlines and associated easements will be abandoned prior to landfill development within these electrical easements. Upon abandonment of these easements, the Unit 2 waste disposal limits, as well as the storage/processing areas (discussed in Section 8, situated within the Unit 2 waste disposal footprint limits), will meet the above easement set-back requirements. Pipeline and utility easements shall be clearly marked and maintained as detailed in Section 13 of this SOP.

12.2 Buffer Zones

Requirements: A buffer zone is described as a zone free of MSW processing and disposal activities within and adjacent to the facility boundary on property owned or controlled by the owner or operator. For landfill permits that existed before the comprehensive rule revisions of 30 TAC Chapter 330 as adopted in 2006 became effective, the owner or operator is subject to the former rules and shall establish and maintain a buffer zone in compliance with the permit. For lateral expansions of existing Type I landfills, a minimum 125-ft buffer zone shall be established and maintained as measured from the edge of the expanded portion of the landfill (i.e., the edge of the horizontally expanded portion of the landfill). Alternatives to the buffer zone requirements of 30 TAC §330.543(b)(2) may only be implemented if they are approved by the Executive Director, pursuant to the demonstrations required by 30 TAC §330.543(b)(3).

Site Buffer Zones: For this facility, the buffer zones will be as follows:

- Existing Unit 2 of the landfill is designed and will be operated with a minimum 125-ft buffer zone.
- The lateral expansion area of the Unit 2 landfill is designed and will be operated with a minimum 125-ft buffer zone measured from the edge of the horizontally expanded portion of the landfill. Accordingly, all of the Unit 2 landfill will have a minimum 125-ft buffer zone.
- For solid waste storage and processing areas, a 50-ft (minimum) buffer zone will be established and maintained.
- Existing Unit 1 of the landfill was established and permitted before the aforementioned 2006 rule revisions. Unit 1 is completed (final covered and closed), and no further waste storage, processing, or disposal activities are proposed at Unit 1. Nevertheless, for completeness on describing site buffer zones, it is noted that the Unit 1 buffer zone varies between approximately 13-ft to 100-ft wide. In particular, buffers along FM 1101 and Kohlenberg Lane next to Unit 1 vary from between 13 feet to 36 feet wide. These buffer distances were initially authorized by the Texas Department of Health through previous waivers to the minimum allowable buffer distance, and approved in the initial site permit (MSW-66) and carried forward via subsequent permit amendments.

Refer to the facility layout plan presented in Part III, Attachment 3A, Drawing 3A-2, for a drawing showing buffer zones extending from the limit of waste to the facility boundary at various points around the landfill perimeter.

Buffer zones shall be clearly marked and maintained as detailed in Section 13 of this SOP. No solid waste unloading, storage, disposal, or processing operations will occur within any buffer zone. The buffer zone must not be narrower than necessary to provide for safe passage for fire-fighting and other emergency vehicles.

13. LANDFILL MARKERS AND BENCHMARK

13.1 Required Landfill Markers

Landfill markers, consisting of metal or wood (or other TCEQ-approved material) extending at least 6 feet above ground level will be used to clearly mark significant site features. The markers will be color-coded to differentiate between features and will be visible during operating hours. Markers must not be obscured by vegetation. Sufficient intermediate markers must be installed to show the required boundary. An existing landfill marker system is in place at the site and will be expanded as required upon approval of this permit amendment. The type, placement, and color-coding system for the markers are described below. The Executive Director may modify specific marker requirements to accommodate unique site-specific conditions.

1. Facility Boundary Markers (Black) - Facility boundary markers will be placed at each corner of the site and along each boundary line at intervals no greater than 300 feet. Fencing may be placed within these markers as required. In areas where the fence is located on the permit boundary, the fence posts may be painted black and used as site boundary markers. See Part III, Attachment 3A, Drawing 3A-2 for the location of the facility boundary.

2. Buffer Zone Markers (Yellow) - Markers identifying the buffer zone will be placed along each buffer zone boundary at all corners and between corners at intervals no greater than 300 feet. Placement of the landfill grid markers may be made along a buffer zone boundary. The buffer zone widths at various locations around the permit boundary perimeter are shown on Part III, Attachment 3A, Drawing 3A-2.

3. Easements and Rights-of-Way Markers (Green) - Easement and rights-of-way markers will be placed along the centerline of an easement and along the boundary of a right-of-way at intervals no greater than 300 feet and at each corner within the site and at the intersection of the site boundary. If a utility line has been constructed down the centerline, the marker may be offset on the easement or right-of-way. This off-set will be noted on the marker. See Part I/II, Appendix I/IIA, Drawing I/IIA-17, for the location of easements at the site.

4. Site Landfill Grid System Markers (White) - A site grid system must be installed. Grid markers must be maintained during the active life of the facility. See Part III, Attachment 3A, Drawing 3A-2, for the location and designations of the site grid system. The grid system consists of lettered markers along two opposite sides and numbered markers along the other two sides. The grid system will encompass at least the area expected to be filled within the next three-year period. Markers will be spaced no greater than 100 feet apart measured along perpendicular lines. Where markers cannot be seen from opposite boundaries, intermediate markers will be installed, where feasible.

5. SLER/GLER Area Markers (Red) – SLER/GLER area markers will be placed so that areas for which a SLER and GLER has been submitted and approved by TCEQ are readily determinable. Such markers are to provide site workers immediate knowledge of the extent of approved disposal areas. These markers will be located so that they are not susceptible to being damaged during operations. The location of the lined cell will be tied into the site grid system and will be used on each SLER/GLER submitted. SLER/GLER markers will typically be placed at the corners (boundaries) of the lined cell, and will be maintained for as long as the disposal cell for which they are marking is active. SLER/GLER area markers must not be placed inside constructed areas. See Part III, Attachment 3A, Drawing 3A-4, for the location/identification of existing and proposed lined areas.

6. 100-year Floodplain Markers (Blue) - Floodplain protection markers will be installed for any area within the facility that is within the 100-year floodplain. The area subject to flooding must be clearly marked by means of permanent posts not more than 300 feet apart or closer if necessary to retain visual continuity. At this facility, there are no FEMA-designated 100-year floodplains, but there are site-specific 100-year flood limits for low lying areas adjacent to Mesquite Creek where it flows between existing Unit 1 and Unit 2. See Part III, Attachment 3A, Drawing 3A-2, for the location of these 100-year flood limits at the site.

13.2 Permanent Benchmark

A permanent benchmark has been established at the site. The permanent benchmark has a bronze marker set in concrete with the benchmark elevation and survey date stamped on it. The benchmark is established at the site in an area that is readily accessible and will not be used for disposal. The location, coordinates, and elevation of the benchmark are shown on Part III, Attachment 3A, Drawing 3A-2. The benchmark elevation was established using a known existing United States Geological Survey (USGS) benchmark.

13.3 Inspection and Maintenance of Markers and Benchmark

The benchmark and all required site markers will be maintained so that they are visible and are not obscured by vegetation. Landfill markers will be inspected monthly to ensure that they comply with the requirements of this SOP; documentation of the inspections will be maintained at the facility in the Site Operating Record. Markers that are removed, destroyed, damaged, missing, or that have been determined to not meet the regulatory requirements, will be repaired or replaced within 15 days of discovery of the deficiency. All markers will be repainted or otherwise maintained as necessary to retain visibility.

14. MATERIALS ALONG THE ROUTE TO THE SITE

Waste hauling vehicles arriving at the landfill will be encouraged to use adequate covers/tarps or other means of securing and containing the load during transport to prevent the escape of any part of the load en route to the site or on the site by blowing or spilling. The adequacy of covers will be checked at the scale house, and a sign will be prominently displayed at the scale house stating that all loads shall be properly covered. Additionally, the facility may elect to add a surcharge, as appropriate, to encourage compliance.

At least once per day on days when the facility is receiving waste, site personnel will pick up existing litter spilled along and within the rights-of-way of public access roads serving the facility for a distance of two miles in either direction from any entrance(s) used for the delivery of waste to the facility. This activity will be documented to demonstrate compliance.

The landfill operator will consult with the Texas Department of Transportation (TxDOT), county, and/or local government officials with maintenance authority over the roads concerning cleanup of these public access roads and rights-of-way, consistent with 30 TAC §330.145.

15. LARGE, HEAVY, OR BULKY ITEMS

Large/heavy/bulky items received at the site will have a designated unloading, collection and staging area; and are allowed to be salvaged/recycled as described in Section 19.1 of this SOP, or may be disposed of at the working face provided that they can be incorporated in the regular spreading, compaction, and covering operations. Items classified as bulky items may include, but are not limited to, white goods (household appliances), air conditioner units, and large metal pieces. The materials allowed in this area are only those large/heavy/bulky items that have been received/salvaged from the authorized waste streams that are allowed to be accepted at this facility. These items will be removed often enough to prevent them from becoming a nuisance, to preclude the discharge of any pollutants from the area, and to prevent an excessive accumulation of the material at the site.

Care will be taken during disposal of large/bulky items to ensure they do not interfere with continued waste filling, spreading, compaction, and covering; that they are excluded from the initial 5-ft thick waste lift over the liner protective cover; and that smaller waste items are placed and compacted in and around the bulky/large item(s).

No chlorofluorocarbon (CFC)-containing appliances, or electrical equipment containing prohibited PCBs, will be accepted for disposal. Appliances such as refrigerators, freezers, and air conditioning units that have had CFCs removed and have certification of removal in accordance with Chapter 40 to the Code of Federal Regulations (40 CFR) §82.156(f)(2) as amended (now § 82.155(b)(2)) are allowed to be accepted for disposal. In accordance with 40 CFR §82.156(f)(3) as amended (now §82.155(b)(2)(ii)), signs will be posted indicating that appliances containing CFCs will not be accepted for disposal.

CFC-containing appliances such as refrigerators, freezers, and air conditioning units that are accepted for recycling (rather than disposal) will have a licensed CFC recovery technician come on-site to recover the CFCs, or will be sent to an off-site facility for CFC recovery, in accordance with 40 CFR §82.156(f) as amended (now §82.155(b)). These items are allowed to be stored as potentially recyclable materials as described in Section 19.1 of this SOP prior to CFC recovery or shipment to an off-site facility.

16. ODOR MANAGEMENT PLAN

16.1 Identification of Potential Odor Sources

Potential sources of odor at the facility may include:

- wastes being delivered to the landfill;
- wastes at the open working face;
- dead animals and/or slaughterhouse waste;
- septage and grease trap waste;
- landfill gas generated by degrading waste; and
- ponded water, contaminated water, or leachate.

16.2 Odor Control Measures

Odor control measures to minimize odor generation and odor emissions, and to address specific potential sources, are as follows:

- Incoming wastes will be promptly unloaded, landfilled, and compacted.

- Cover will be applied to freshly landfilled waste on a daily basis (and in accordance with Section 24 of this SOP), to limit air and water from further interacting with the wastes, which could result in odors.

- Waste that require special attention due to their potential to be more odorous, such as dead animals and/or slaughterhouse waste, septage, and grease trap waste (having no free liquids), will be promptly covered with daily cover or waste upon unloading.

- Odor control measures associated with the liquid waste processing area are addressed in Appendix IV-C.

- If there is an incoming load that is highly odorous as identified by the Gate Attendant, facility personnel at the working face will be immediately notified so they can be ready to promptly assist with unloading and covering of that load with other waste or cover material. Similarly, facility personnel at the working face will be alert for loads with significant odors, and will promptly cover that load.

- The facility will limit the size of the active working face to be as small an area as practical (e.g., for the safe operation of the incoming waste hauling vehicles, operation of compaction equipment, and delivery/placement of daily cover), which in turn will help prevent odors developing in a larger open waste area than necessary, and will facilitate covering waste more quickly.

- Landfill gas emissions, which may include odorous gases, will be controlled in accordance with the Landfill Gas Management Plan (see Part III, Attachment 6). This will include operating an active landfill gas collection and control system. The system will help minimize odors from landfill gas (degrading waste) by placing a vacuum at extraction wells spaced periodically in the waste, and conveying the collected gas to an on-site flare where it is burned (rendered non-odorous).

- Ponded water over waste disposal areas at the site will be controlled as described in Section 25 of this SOP, which will help eliminate the potential for occurrence of nuisance odors associated with ponded water.

- Contaminated water may become a source of odors, and will be segregated from clean surface water (i.e., stormwater runoff), and will be managed and disposed of in accordance with the Leachate and Contaminated Water Management Plan (see Part III, Attachment 3E).

- Leachate will be managed in such a way as to minimize odors by conveying leachate in pipes to lined evaporation ponds. The evaporation ponds are operated to minimize odors by keeping the leachate moving (not stagnant) with aerators. Details for leachate management are provided in the Leachate and Contaminated Water Management Plan (see Part III, Attachment 3E).

- Spills of odorous materials will be cleaned up as soon as possible.

- Fires will be prevented and controlled as described in Section 6 of this SOP.

16.3 Air Criteria

The landfill is subject to TCEQ rules concerning outdoor burning and air pollution control. The Site Manager will ensure that any unit of the landfill does not violate any applicable requirements of the approved State Implementation Plan developed under the Federal Clean Air Act. The open burning of waste will not be permitted at this facility. The site is operated in accordance with the federal New Source Performance Standards (NSPS) and under the TCEQ Title V General Operating Permit (GOP). The Site Manager or designated alternate will ensure that the site complies with and is evaluated in accordance with NSPS and Title V GOP requirements.

17. DISEASE AND VECTOR CONTROL

The facility will control on-site populations of disease vectors, such as rodents, excessive bird populations, flies, and mosquitoes. Experience has shown that the facility's standard operating procedures as outlined in this SOP (e.g., minimizing the size of the working face, proper compaction and covering of waste, and periodic grading/site-maintenance to eliminate potential environments that can attract vectors) will eliminate the need for additional methods of vector control under normal circumstances.

Notwithstanding the foregoing, facility personnel will monitor ongoing operations and be prepared to take additional action as necessary to control vectors. These actions may include, as deemed appropriate by the Site Manager, any of the following measures:

- temporarily applying daily cover more frequently than once per day;
- temporarily applying a thicker layer of daily cover;
- use of non-lethal bird control measures such as pyrotechnics, baiting, decoys, etc. to discourage birds at the site and scare them away if they become a nuisance; and
- contracting with professional exterminators, if necessary, to control rodents or other pests that may appear at the site.

If professional applications of pesticides are utilized, these will be documented in the Site Operating Record.

18. SITE ACCESS ROADS

18.1 Description of Site Roads

All-weather roadways will be used to provide access during wet weather from the site entrance on Kohlenberg Road (public roadway) to the waste unloading area being used during wet weather. On-site access roadways will be maintained in a clean and safe condition. At the facility, all-weather landfill access is provided by a road surface consisting of consist of compacted gravel, crushed stone, asphalt, concrete, or other road building material from the entrance driveway along Kohlenberg Road, continuing past the scales, and upon reaching the landfill area, continuing as an internal access road onto the landfill to the waste unloading area.

Additional internal roads needed to access waste unloading areas will be established to provide waste vehicle access and facilitate site operations as waste filling progresses. These internal roads will be accessed from the facility entrance road described above. Internal roads for use during wet weather conditions will be maintained so that continuous access to waste disposal areas is provided during both wet and dry weather. Reflective guideposts or other suitable reflective equipment may be used as needed along select internal access roads used between the scale house and disposal areas to help direct traffic during early morning or evening operations.

18.2 Mud and Dust Control Measures

The all-weather road surfacing on the site roads will help minimize dust generation and mud tracking by vehicles exiting the facility. The site will also utilize a motorized power broom or other equipment to remove debris and mud from the site access roads; and a water truck will be used to minimize dust generation, as needed and described further below.

Tracked mud and associated debris at the entrance to the facility on the public roadway must be removed at least once per day on days when mud and associated debris are being tracked onto the public roadway. Secondary site access points will also be inspected and cleaned as necessary when in use. If mud or other associated debris is observed, it will be removed using the power broom or other equipment; and if additional efforts are necessary to remove mud or other associated debris from the roads, by spray-washing the road surface using a water truck or other equipment. Site access roads will also be graded and maintained periodically, as deemed necessary by the Site Manager or designated alternate (and at the minimum frequency given below in Section 18.3) to minimize depressions, ruts, and potholes, which can lead to mud formation.

During dry weather, the operator will control dust by periodically watering site roads using the water truck. Sources of water for this may be a municipal water supply and/or outside sources.

18.3 Site Access Road Maintenance Frequencies

Litter and any other debris along site access roads will be picked up at least daily and taken to the working face or otherwise properly managed by facility personnel (e.g., equipment operators or laborers). Site access roads will be re-graded by equipment operators or hired contractors to minimize depressions, ruts, and potholes, as needed, but at a minimum frequency of once per six months.

19. SALVAGING AND SCAVENGING

19.1 Salvaging

Salvaging, defined as the "controlled removal of waste materials for utilization, recycling or sale," is allowed to be performed at the facility. Salvaging will not be allowed to interfere with prompt disposal of solid waste or otherwise create unsafe operating conditions or a public health nuisance. No items will be salvaged from the working face if the salvaging would endanger site personnel. Also, salvaging may not occur in areas that have already received daily cover.

Potentially recyclable items such as metal, concrete, bricks, sheetrock (drywall), cardboard, tires, land clearing debris, large items/white goods, or other inert materials are allowed to be salvaged. Special wastes received at the disposal facility will not be salvaged. Pesticide, fungicide, rodenticide, and herbicide containers will not be salvaged unless being salvaged through a state-supported recycling program.

Salvaged items will be temporarily stored in a designated area(s) at the site [i.e., large/heavy/bulky items area; the wood recycling area; the C&D material recycling area; and the tire storage area] described previously in Section 8 of this SOP. Due to the location of site access roads and waste placement, the location of these areas may vary over time. Concrete, bricks, or other inert materials are allowed to be used on-site for erosion control, road base materials, or other similar uses. Salvaged items will be removed often enough to prevent them from becoming a nuisance, to preclude the discharge of any pollutants from the area, and to prevent an excessive accumulation of the material at the site. Potentially recyclable materials will not be stored at the facility for more than 180 days.

19.2 Scavenging

Scavenging, defined as the "uncontrolled and unauthorized removal of materials at any point in the solid waste management system," will not be allowed at the facility. Scavenging will be prevented through the following controls:

- Access control measures such as fencing, gates, and facility personnel duties (described in Section 7.1);
- Access control inspections and maintenance (e.g., fence inspection and repair as described in Section 7.2);
- Litter control and pickup (described in Section 11);
- Vector control (described in Section 17); and
- Application of daily cover, and inspection/repairs to cover (described in Section 24).

20. ENDANGERED SPECIES PROTECTION

Requirement: A facility and the operation of the facility must not result in the destruction or adverse modification of the critical habitat of endangered or threatened species, or cause or contribute to the taking of any endangered or threatened species. Facilities must be operated in conformance with any endangered or threatened species protection plan required by TCEQ.

Site-Specific Conditions and Protection: The facility must be operated to meet the above requirement. An endangered and threatened species assessment was conducted for the site by qualified biologists, including review of United States Fish and Wildlife Service (USFWS) and Texas Parks and Wildlife Department (TPWD) lists of species that may occur in the area, a site-specific field investigation (survey), and coordination with these agencies (as discussed in Section 12 of the Part I/II Narrative Report). No federally- or state-listed endangered or threatened species, or any critical habitats for such species, were found at the site during the ecological survey. For this reason, ongoing facility development and operation is not expected to cause or result in the destruction or adverse modification of critical habitats or contribute to the taking or harming of any endangered or threatened species.

Operational Best Management Practices for Species Protection

Because the site-specific field investigation revealed no federally- or state-listed endangered or threatened species or any critical habitats for such species, and as long as no such species or habitats are discovered in the future, there is no requirement to implement an endangered and threatened species protection plan. Nevertheless, as an enhanced measure of protectiveness, the plan presented below has been prepared by a qualified biologist to detail several operational best management practices (BMPs). These BMPs will be followed to promote awareness and to provide added protection of potentially relevant species and habitats to help ensure that the requirements stated above are met.

- The facility will develop an educational brochure on species identification, habits, habitat preferences, and measures to avoid impacts for the following sensitive species judged to have the potential (even if unlikely) to be present in the general site area and the type of terrain and habitats at and near the site: Texas horned lizard (*Phrynosoma cornutum*), Mountain plover (*Charadrius montanus*), Texas tortoise (*Gopherus berlandieri*). The Site Manager or designee will provide this brochure to the site personnel and contractor personnel who will perform vegetation removal (clearing) activities at the outset of new cell construction. The pre-disturbance surveys and/or impact avoidance measures indicated in the brochure will be used as appropriate during such clearing work. A copy of the brochure will be placed in the Site Operating Record.

- To the extent practicable, vegetation removal (clearing) activities will be scheduled to occur between August and March to avoid potential impacts to individuals, nests, or eggs during migratory bird nesting season. If this is not practicable, and clearing will take place between March and August, the area to be disturbed will be either: (i) mowed before March and kept mowed (since short grass and consistent mowing activity should keep birds from nesting in the area); (ii) disked (plowed) before March to turn over the ground as another method to prevent nesting; or (iii) visually surveyed shortly before clearing to confirm there are no nests with eggs or young birds within the area to be cleared.

- A list of federally- and state-listed threatened and endangered species potentially occurring in Guadalupe County (i.e., the county where ongoing facility operations are taking place) is provided in Part I/II, Appendix I/IIM (see Geosyntec coordination letter to TPWD dated November 7, 2022).

- If federally- or state-listed endangered or threatened species are encountered at the facility, work in the affected area will stop, and the USFWS Austin Ecological Services Office (if federally-listed species are encountered) or TPWD Wildlife Division (if state-listed species are encountered) will be contacted regarding protocols for compliance with applicable federal or state laws before resuming work in the affected area.

The operator should also be aware of the responsibility to comply with other applicable federal, state, and local laws pertaining to wildlife protection.

21. LANDFILL GAS CONTROL

The monitoring and control of landfill gas will be in accordance with the approved Landfill Gas Management Plan presented in Part III, Attachment 6 of the Site Development Plan. As stated in Section 3.1 of this SOP, the Landfill Gas Management Plan, as well as related landfill gas monitoring records and submittals, will be included in the Site Operating Record. Submittals will be made to TCEQ as outlined in the Landfill Gas Management Plan.

22. OIL, GAS AND WATER WELLS

Information on on-site water wells and oil/gas wells, as applicable, is presented in Sections 10.1 and 10.2, respectively, of the Part I/II Narrative Report. Below are operational requirements pertaining to oil, gas, and water wells (if any) within the facility permit boundary.

22.1 Oil and Gas Wells

There are no known existing or abandoned oil/gas wells within the facility permit boundary. In the event that an on-site oil or gas well is discovered during site development, the facility will:

- Within 30 days of discovery, provide written notification to the Executive Director of the location of any oil well, natural gas well, or other well associated with mineral recovery.

- Expose and cut the casing a minimum of 2 feet below ground surface (or below the bottom of excavation for the liner if the well is within the proposed limits of waste disposal), followed by capping and plugging the well in accordance with all applicable rules and regulations of the Texas Railroad Commission, or other applicable state agency.

- Submit to the Executive Director a written certification that all such wells have been capped, plugged, and closed in accordance with all applicable rules and regulations of the Texas Railroad Commission.

- Submit to the Executive Director a copy of the well plugging report that was submitted to the appropriate state agency, within 30 days after the well has been plugged.

22.2 Water Wells

There are no existing or proposed on-site water wells that will be used to supply water at the facility that are located within the permit boundary. As described in Section 10.1 of the Part I/II Narrative Report and shown on Drawing I/IIA-15 in Part I/II, Appendix I/IIA, Drawing I/IIA-15, there is potentially one (1) on-site well according to the Texas Water Development Board (TWDB) database. This on-site well (ID 6824302) is located in the southeast corner of the proposed expansion area, adjacent to (but not within the waste disposal limits of) Unit 2, Phase XIII. This well is not in use or known to exist; there is no wellhead or other surface completion present at this location; and it is believed most likely to have been plugged and abandoned at the time of its drilling. Nevertheless, since TWDB has no data on its plugging or abandonment, prior to landfill-related construction adjacent to this location at Unit 2, Phase XIII, the facility will attempt to locate this well or its remnants (e.g., well casing or plugging materials). If the well is located and determined to be unplugged, it will be properly plugged and abandoned, following the plugging and abandonment requirements of the 2nd bullet listed in the paragraph below, and then the certification requirements listed in the 3rd bullet of the paragraph below will be completed.

In the event that an on-site water well is discovered during site development, the facility will:

- Within 30 days of discovery, provide written notification to the Executive Director of the location of the water well.

- Expose and cut the casing a minimum of 2 feet below ground surface (or below the bottom of excavation for the liner if the well is within the proposed limits of waste disposal), followed by capping and plugging the well in accordance with all applicable TCEQ rules and regulations, or the rules and regulations of any other applicable state agency.

- Provide the Executive Director with written certification that all such wells have been capped, plugged and closed in accordance with all applicable rules and regulations.

Other types of wells will be plugged in accordance with the rules and regulations of the applicable state agency, and a copy of the well plugging report will be submitted to the appropriate state agency and to TCEQ within 30 days after the well has been plugged.

The facility will submit a permit modification application to TCEQ identifying any proposed changes to the liner installation plan as a result of any oil, gas, or water well abandonment.

23. COMPACTION

Waste will be compacted to provide more efficient use of available disposal capacity, to minimize future consolidation and settlement, to help provide a firmer base for proper application of intermediate and final cover, and to aid in fire protection and litter control.

Upon unloading, incoming waste will be spread at the working face by a bulldozer or landfill compactor. Trained equipment operators will then use heavy equipment to move, shape, and make repeated passes on the material to sufficiently minimize voids and produce a compact mass. The number of passes will depend upon the nature of the waste that is being compacted.

In areas where the liner is constructed below the seasonal high groundwater table and waste is to be used as ballast, refer to Section 10.6.2 of the Liner Quality Control Plan (LQCP) in Part III, Attachment 3C, for associated operational requirements. For areas receiving waste placed as ballast, the Site Manager or designee will document on a daily basis the area of such waste placement, first-lift considerations, compaction equipment/methods used, and that the pressure relief/dewatering system (i.e., underdrain) was in operation. This documentation will be placed in the Site Operating Record and also will be attached to the Ballast Evaluation Report (BER) described in the LQCP.

24. LANDFILL COVER

This section contains the general provisions for daily, intermediate, and final cover for the facility. The Executive Director may grant a temporary waiver from the requirements for daily and intermediate cover if site management demonstrates that there are extreme seasonal climatic conditions that make meeting such requirements impractical.

24.1 Soil Management

The facility will maintain one or more sources of earthen material in such a manner that it is available as needed for facility operations described throughout this SOP, including proper and timely application of cover discussed in this section, and ability to provide adequate fire protection (to extinguish fires in a timely manner) as specified in Section 6.4 of this SOP.

24.2 Daily Cover

Cover will be placed at least daily on all solid waste received during that operating day. The purposes of daily cover include minimization of fire hazards, odors, blowing litter, vector food and harborage, and infiltration of precipitation. In addition, cover materials should discourage scavenging, limit erosion, and improve the aesthetic appearance of the facility.

24.2.1 Soil Daily Cover

For soil used as daily cover, a minimum thickness of six inches of well-compacted soil will be applied in one lift. Dump trucks or scrapers will transport cover soil to the working face. A bulldozer or compactor will apply the soil cover. Soil cover will be earthen material that has not been mixed with garbage, rubbish, or other solid waste. Care will be taken to avoid mixing the landfilled waste with the soil cover material. Stormwater runoff from areas that have intact daily cover is not considered as having come in contact with the working face, waste, or leachate (i.e., it is uncontaminated water).

The Site Manager or designated alternate will document the daily cover placement and indicate that he/she has visually verified the thickness and condition of the cover in a Cover Application Log (see Section 24.6 of this SOP).

24.2.2 Alternative Daily Cover (ADC)

Pursuant to 30 TAC §330.165(d), ADC may only be allowed by a temporary authorization followed by a major amendment or a permit modification. If authorized, use of ADC is limited to a 24-hour period after which either waste or daily cover as defined in subsection (a) of this section must be placed.

Prior to the use of ADC, the facility will request a temporary authorization that includes an ADC operating plan specific to the new type of ADC being requested [addressing the information required by 30 TAC §330.165(d)(1)(A) – (E)] and describing the necessary provisions to conduct the trial period of usage. The facility will submit the temporary authorization request per the provisions of 30 TAC §305.62(k). During the trial period, the facility will submit written status reports with usage logs indicating the days the ADC material was used, and describing the effectiveness of the ADC material, any problems that may have occurred, and any corrective action required as a result of such problems. Upon completion of the demonstration period, if the ADC material proves to be effective as daily cover, the facility may request a permit modification with notice under the provisions of 30 TAC §305.70(k)(1) or by an amendment in accordance with 30 TAC §305.62 to incorporate the ADC as an allowable option for use at the facility on a permanent basis. The alternative cover operating provisions may be revised as necessary upon completion of the demonstration period to incorporate any changes to the use of the alternative cover during the trial period.

24.3 Intermediate Cover

All disposal areas that will receive additional waste but have been inactive for longer than 180 days will be covered with intermediate cover. This intermediate cover will consist of an additional 6 inches of suitable earthen material applied over the daily cover, for a total of at least 12 inches of material. The top 6 inches of this intermediate cover shall be material that is capable of sustaining native plant growth, graded to help prevent ponding of water, and seeded or sodded to control erosion (or consist of a material approved by the Executive Director that will otherwise control erosion).

Plant growth or other erosion control features must be maintained; refer to the Intermediate Cover Erosion and Sediment Control Plan (ICESCP) presented in Attachment 2F of Part III (the Site Development Plan) for details on the erosion controls and management practices that shall apply to areas with intermediate cover draining to the site perimeter surface water management system. Stormwater runoff from areas that have intact intermediate cover is not considered as having come in contact with the working face, waste, or leachate (i.e., it is uncontaminated water).

When areas that have received intermediate cover are to become active again, the intermediate cover is allowed to be stripped off for use as daily cover.

24.4 Final Cover

Final cover placement will occur in accordance with the Closure Plan (Attachment 7 of the Site Development Plan).

The final cover grading plan (i.e., landfill completion plan showing final contours) and final cover system components are presented in the Part III Site Development Plan. Specifically, refer to Part III, Attachment 3A, Drawings 3A-5A and -5B for the final cover grading plan; and Section 4.12 of the Part III Site Development Plan Narrative Report describing the final cover system components.

The Closure Plan presents the specific requirements and schedules for closure activities, and related final cover system specifications, quality assurance/quality control (QA/QC) requirements, certification requirements, notifications, etc. This includes requirements for establishing vegetation on the final cover. During the early stages of vegetative growth, mulching, slope soil regrading, and mowing will be performed as required to promote a complete vegetative coverage and effective erosion control.

24.5 Cover Inspection, Repair of Erosion, and Final Cover Maintenance

24.5.1 Inspection

During the active life of the landfill, inspection of intermediate and final cover, including checking for erosion and ponded water, will be performed on a weekly basis. Records of these inspections will be maintained as part of the Site Operating Record.

24.5.2 Repair of Erosion

Erosion gullies or washed-out areas deep enough to jeopardize the intermediate or final cover (i.e., exceeding four (4) inches in depth as measured from the vertical plane of the erosion feature and its 90-degree intersection with the horizontal slope face or surface) shall be repaired within five (5) days of detection unless the TCEQ Regional Office approves an extension (e.g., due to inclement weather, unfavorable seasonal weather conditions, extent of the damage and resulting repair work needing more time to complete, etc.). Repairs will typically consist of regrading, backfilling, compacting, and seeding, as necessary. The dates of detection of erosion and completion of repairs, and reasons for any delay of repairs, will be documented in the Cover Inspection Record (see Section 24.6).

24.5.3 Final Cover Maintenance

Maintenance of the integrity and effectiveness of the final cover system (cap) shall include mowing and regular inspections and repairs to correct stressed or dead vegetation, erosion, settlement, cracking, and standing water.

- The final cover vegetation will be mowed periodically to maintain healthy vegetation, avoid die-out due to shading, eliminate woody-stemmed vegetation, and provide for adequate inspection of the cover system.

- The final cover will be inspected for conditions that could impact cover integrity, including settlement, ponding water, burrowing animals, erosion, stressed or dead vegetation, and seeps.

- Settled, depressed, or eroded areas will be filled with soil and graded to provide positive drainage, and then revegetated. The top six inches of soil fill used for repairs will be capable of supporting vegetation. Repair materials will be placed in a manner consistent with the original final cap system construction.

- Surface water conveyance devices on the cover will be inspected and maintained.

Areas with stressed or dead vegetation will be evaluated to determine the cause and appropriate actions will be taken, such as reseeding the areas or checking for the presence of landfill gas.

After final closure of the facility, the final cover will be inspected, and any necessary repairs will be made and documented, in accordance with the Post Closure Plan (Attachment 8 of the Site Development Plan).

24.6 Cover Documentation and Inspection Record

24.6.1 Cover Application Documentation

On a weekly basis, the Site Manager or designated alternate will maintain a Cover Application Log to document those site grid areas where daily cover and/or intermediate cover have been placed. The log will be kept at the site, readily available for inspection by TCEQ and authorized agents or employees of local governments having jurisdiction. The log for daily and intermediate cover will specify the date cover was placed, the method used, and the last area where cover was placed. For final cover, the log will specify the area covered, the date cover was applied, and the thickness applied that date. The Site Manager or designated alternate must sign each log entry to certify the work was accomplished as stated.

24.6.2 Cover Inspection Record

A Cover Inspection Record will also be maintained weekly and kept by the Site Manager or designated alternate to document the inspections described in Section 24.5, including the findings and any corrective actions (e.g., repairs) taken when necessary. For repairs made to the final cover system, the Cover Inspection Record will specify the area covered, the dates final cover was applied (repaired), and the thickness applied. The Site Manager or designated alternate will sign each entry to certify that the work was accomplished as stated in the record. The Cover Inspection Record will be placed in the Site Operating Record.

25. PONDED WATER

Ponding of water over waste-filled areas will be minimized to the extent possible. The techniques the site will use to minimize ponding of water will be: (i) thorough compaction of waste as described in Section 23 of this SOP, to limit differential waste settlement/consolidation; (ii) proper grading of final waste slopes to the elevations shown on the Final Cover Grading Plan (shown in Site Development Plan), which provide for positive surface water drainage without depressions or low spots; and (iii) proper grading of interim waste slopes to have positive surface water drainage.

Landfill areas will be inspected as described in Section 24.5 to identify areas where ponding has occurred, including inspections after specified storm events. In the event ponded water on the landfill is observed, action will be taken to remedy the problem (e.g., regrading, pumping out the ponded water, or grading a temporary drainage path at the down-gradient side), as appropriate. The area of ponding will be backfilled with clean soil and regraded within seven (7) days of the occurrence, weather permitting. Ponded water will be removed and managed as: (i) contaminated water if the ponded water has come in contact with waste; or (ii) as surface water if it has not come in contact with waste. Contaminated water will be managed in accordance with the Leachate and Contaminated Water Management Plan presented in Part III, Attachment 3E.

Potential actions to mitigate ponded water in advance of expected extended wet weather periods include inspecting for apparent low spots that could pond water and filling these areas, installing diversion berms to limit run-on, and installing a drainage outlet if possible. During and after extended wet weather conditions, potential corrective actions to remedy ponded water include using pumps to dewater ponded areas along with the aforementioned preventative measures as feasible. During or after periods of extended wet weather, access to pump and repair areas may be delayed.

As described in Section 24.5 and 24.6, inspections for ponded water and any corrective actions will be documented in the Cover Inspection Record.

NOTE OF CLARIFICATION: The above requirements, pursuant to 30 TAC §330.167, are for ponded water over waste/cover material on the landfill ground surface (i.e., puddles, water ponded in depressions or low-lying areas, or other free water retained/standing or collecting and being held from runoff on the ground surface over waste in the landfill), such as water resulting from rainfall events. Leachate recirculation (as discussed in Section 31 of this SOP and addressed in further detail in the Leachate and Contaminated Water Management Plan in Attachment 3E of the Site Development Plan), which involves the intentional re-introduction of liquid (leachate and/or gas condensate, not water) back into the waste, may include using infiltration trenches or similar methods where leachate/gas condensate is pumped to areas of existing waste and allowed to percolate into the waste. If performed, this leachate recirculation activity must be managed in accordance with the Leachate and Contaminated Water Management Plan in a way that does not cause ponding, and that minimizes odors and vectors.

26. ENCLOSED CONTAINERS – TYPE IV LANDFILLS (N/A)

The facility is a Type I landfill; thus, the requirements of 30 TAC §330.169 for Type IV landfills are not applicable to this site.

27. DISPOSAL OF SPECIAL WASTES

Special wastes are allowed to be accepted at the facility in accordance with the Waste Acceptance Plan required by 30 TAC §330.61(b) (presented in Part II, Appendix I/IIG). Also, for special waste that is not specifically identified in the facility's approved Waste Acceptance Plan or identified in in subsection (c) or (d) of 30 TAC §330.171, or in 30 TAC §330.173 (relating to Disposal of Industrial Wastes), acceptance and/or disposal of such special waste requires prior written approval from the Executive Director.

Acceptance and disposal of special waste will be in accordance with the Special Waste Evaluation Program presented in Section 5.6.2 of this SOP, and the SWAP provided in Appendix IV-A of this SOP. The Executive Director may revoke and authorization to accept special waste if the owner or operator does not maintain compliance with these applicable rules or conditions imposed in the authorization to accept special waste.

28. DISPOSAL OF INDUSTRIAL WASTES

28.1 Class 1 Industrial Solid Waste

Class 1 industrial solid waste (defined in 30 TAC §330.3(21)) will not be accepted at this facility, with the exception of wastes that are Class 1 only due to asbestos content.

Waste classified as Class1 only because of asbestos content will be managed in accordance with Appendix IV-B of this SOP. All shipments of industrial waste that are Class 1 only because of asbestos content must be manifested and the facility must comply with the requirements of subsections (g) and (h) of 30 TAC §330.173.

28.2 Class 2 and 3 Industrial Solid Waste

The facility is allowed to accept Class 2 and 3 industrial solid wastes for disposal provided the acceptance of such wastes does not interfere with facility operation. These types of wastes will be handled and disposed of in the same manner as MSW.

29. VISUAL SCREENING OF DEPOSITED WASTE

Visual screening of deposited waste materials at the MSW facility must be provided by the owner or operator if the Executive Director determines that screening is necessary, or as required by the permit. At this facility, visual screening of deposited waste materials will be provided in the following ways: (i) when waste placement is occurring below-grade and thereby hidden from view; (ii) by already-filled portions of the landfill that shield the working face from view at various vantage points on or adjacent to the site; (iii) through application of daily/ADC (as authorized), intermediate, and final cover; and (iv) by the buffer zones that will be maintained. The facility has and will continue to operate the landfill with these visual screening measures. Also, there are existing trees and hedgerow vegetation located around the perimeter areas of the site (east, south, west, and north) that help provide natural screening of deposited waste; such vegetation around the site perimeter will remain in-place to the extent it is practicable for the design and operating requirements of the facility.

30. CONTAMINATED WATER MANAGEMENT AND DISCHARGE

Contaminated water will be managed in accordance with the Leachate and Contaminated Water Management Plan presented in Part III, Attachment 3E. Potentially contaminated liquids resulting from the operation of the facility shall be disposed of in a manner that will not cause surface water or groundwater pollution, and the facility shall implement necessary steps to control and prevent the unauthorized discharge of contaminated water from the facility.

With respect to contaminated water management in landfill areas (in particular, at the active working face), and at the liquid waste processing area, the procedures and requirements set forth in the Leachate and Contaminated Water Management Plan will be followed.

With respect to contaminated water management at the on-site recycling-related storage/processing areas (large/heavy/bulky item area; the wood recycling area; the C&D material recycling area; and the tire storage area), the materials that will be stored and processed in these areas are expected to have a low potential for the generation of contaminated water. The materials that will be stored and processed in these areas are essentially inert or minimally soluble or degradable, do not contain free liquids, and are not expected to require washing or other cleaning operations. Accordingly, during the normal course of operations of these recycling areas, stormwater contacting these areas will not be considered contaminated water. Nevertheless, best management practices will be implemented to properly manage and control surface water drainage in the vicinity of these areas, as described in Section 2.4 of the Site Development Plan Narrative Report. Furthermore, if contaminated water generation is suspected or confirmed, contaminated water will be managed in accordance with 30 TAC §330.207, and the management measures will be implemented in a similar manner as those for the active working face.

31. FACILITY-GENERATED WASTES AND WASTEWATERS

The facility processing and storage areas (as described in Section 8 of this SOP) are not expected to generate wastes. To the extent that wastes are generated by the facility, such wastes must be processed or disposed at an authorized solid waste management facility.

The facility will generate leachate and also is expected to generate contaminated water and gas condensate. Such wastewaters will be managed in accordance with the Leachate and Contaminated Water Management Plan. With respect to facility-generated wastewaters at processing and storage areas (which if generated, would be a type of contaminated water), see Section 30 above.

32. LEACHATE AND GAS CONDENSATE RECIRCULATION

Leachate and/or gas condensate is authorized to be recirculated at the facility, if such recirculation is performed in accordance with the requirements and procedures set forth in Part III, Attachment 3E (Leachate and Contaminated Water Plan). In particular, Section 6 of Attachment 3E provides details, including operational procedures, on how and where (and to what quantity) leachate and/or gas condensate may be recirculated.

33. BIRD CONTROL PROGRAM

Overview of Requirements

The landfill must be designed and operated so as to not pose a bird hazard to aircraft.

The facility must be properly supervised to assure bird populations are not increasing (i.e., prevent increases in bird population attraction and persistent presence that could become a potential hazard to aircraft) and that appropriate wildlife control procedures are being followed (i.e., prevent the attraction of other wildlife vectors such as rodents that could be a food source/attractant for birds).

Increases in bird activity that might be hazardous to safe aircraft operations must be promptly mitigated, and any such increase in such bird activity must be reported to the Director of the New Braunfels National Airport.

Bird Control Program – Operational Measures and Procedures

The operational measures and procedures that will be implemented at the facility to assure proper supervision and that controls are accomplished are as follows:

- The facility will limit the size of the active working face to be as small an area as practical (per SOP Section 6.4.1), which will help minimize potential food sources that could attract birds and/or vectors.

- The working face will be covered with at least six inches of soil or approved alternative on at least a daily basis (per SOP Section 24.2) to minimize vector food and harborage (help prevent attraction of and access by birds and other vectors to potential food sources).

- Actions will be taken to mitigate and address standing water over waste-filled areas (control ponded water per SOP Section 25).

- The facility will control on-site populations of vectors (per SOP Section 17).

- Any increase in bird activity that might be hazardous to safe aircraft operations will result in prompt mitigation actions. These actions may include, but not be limited to, one or more of the following measures:

    - temporarily applying daily cover more frequently than once per day;

    - temporarily applying a thicker layer of daily cover;

    - use of active and/or passive bird control measures, such as pyrotechnics, baiting, decoys, etc., to discourage birds at the site and scare them away if they become a nuisance or bird populations become excessive;

  - contracting the services of a consultant specializing in wildlife damage management (as it relates to bird control assessments and recommendations) or with similar specialists at the United States Department of Agriculture (USDA); and/or
  - contracting with professional exterminators, if necessary, to control rodents or other pests that may appear at the site.

- The facility will report any increase in bird activity/populations that may be hazardous to aircraft operations to the Director of the New Braunfels National Airport.

APPENDIX IV-A

SPECIAL WASTE ACCEPTANCE PLAN (SWAP)

PART IV – APPENDIX IV-A
SPECIAL WASTE ACCEPTANCE PLAN (SWAP)

MESQUITE CREEK LANDFILL
COMAL AND GUADALUPE COUNTIES, TEXAS
PERMIT AMENDMENT APPLICATION
MSW PERMIT NO. 66C

Prepared for:
Waste Management of Texas, Inc.

Prepared by:
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SCOTT M. GRAVES
86557
10/11/2023
FOR PERMIT PURPOSES ONLY

October 2023

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10/11/2023

FOR PERMIT PURPOSES ONLY

GEOSYNTEC CONSULTANTS, INC.
TEXAS ENG. FIRM
REGISTRATION NO. F-1182

APPENDIX IV-A-1 : TABLE 1 - WASTE SPECIFIC SPECIAL WASTE MANAGEMENT PROCEDURES

APPENDIX IV-A-2: EXAMPLE GENERATOR WASTE PROFILE (GWP) FORM

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GEOSYNTEC CONSULTANTS, INC.
TEXAS ENG. FIRM
REGISTRATION NO. F-1182

1 INTRODUCTION & PURPOSE

1.1 Objectives of Special Waste Acceptance Plan (SWAP)

This Special Waste Acceptance Plan (SWAP) outlines the process that will be used to review, evaluate, and determine acceptance of all Texas Commission on Environmental Quality (TCEQ) defined “special wastes” for the Mesquite Creek Landfill. This preventive program specifically provides for waste pre-acceptance procedures to assure that a particular waste is nonhazardous and to determine the acceptability of a waste (and prevent the acceptance or disposal of unacceptable wastes) pursuant to facility permit conditions, applicable regulations, and operating capabilities to ensure safe and environmentally sound management of the waste.

1.2 Overview of Special Waste

TCEQ’s solid waste regulations (30 TAC §330.3(154)) define a special waste as “any solid waste or combination of solid wastes that because of its quantity, concentration, physical, or chemical characteristics or biological properties require special handling and disposal to protect human health or the environment.” Although this rule goes on to identify specific waste streams as special wastes, the broad “catch-all” provision of the definition also applies, and covers many other wastes that are routinely disposed of at Municipal Solid Waste Landfill Facilities (MSWLFs).

1.3 Facility-Specific Waste Acceptance (and Prohibitions)

It is important to note that this SWAP provides the “how to” of the process that will be used to review, evaluate, and determine acceptance of special wastes. This SWAP does not establish the “what” regarding which particular waste streams will or will not be accepted, as those are established elsewhere in the permit. The facility-specific waste streams that are authorized to be accepted are as indicated in the Waste Acceptance Plan included in Part II of the permit application as required by 30 TAC 330.61(b) [see Part I/II, Appendix I/IIG].

The prohibited wastes that shall not be accepted include, but are not necessarily limited to (see Waste Acceptance Plan, Part I/II, Appendix I/IIG for comprehensive list), the following:

1. Class 1 non-hazardous industrial solid waste (except if it is Class 1 only because of asbestos content);
2. Lead-acid storage batteries;
3. Do-it-yourself used motor vehicle oil except for do-it-yourself used motor oil mixed or commingled with solid waste that is incidental to, and the unavoidable result of, the mechanical shredding of motor vehicles, appliances, or other items of scrap, used, or obsolete metals;
4. Used-oil filters from internal combustion engines except as provided by paragraphs (1) and (2) of 30 TAC §330.171(d);
5. Whole used or scrap tires unless the tires have been quartered, chipped, shredded, or otherwise processed;
6. Refrigerators, freezers, air conditioners, and any other items containing chlorinated fluorocarbons (CFCs) unless the CFCs contained in that item has been handled in accordance with 40 Code of Federal Regulations §82.156(f) as amended (now §82.155(b)) (captured and sent to an approved CFC disposal site or recycling facility);
7. Except as allowed in 30 TAC §330.177, liquid waste, as defined in 30 TAC §330.3(83) - including:
    a. Bulk or non-containerized liquid waste shall not be accepted for disposal or disposed of in a MSW landfill unless the waste is household waste other than septic waste, or leachate or gas condensate derived from the Mesquite Creek Landfill managed and disposed of in accordance with the Site Development Plan (Part III).
    b. Containers holding liquid waste unless:

    i. The container is a small container similar in size to that normally found in household waste;
    ii. The container is designated to hold liquids for use other than storage; or
    iii. The waste is household waste;

8. Regulated hazardous waste as defined in 30 TAC §330.3(64) and §330.3(133);
9. Prohibited polychlorinated biphenyls (PCB) wastes, which are not authorized for disposal in Subtitle D Landfills, as defined under 40 CFR, Part 761 [waste containing PCB greater than or equal to 50 parts per million (ppm) PCB];
10. Radioactive materials as defined in 30 TAC Chapter 336 (relating to Radioactive Substance Rules), except as authorized in 30 TAC Chapter 336 or that are subject to an exemption of the Department of State Health Services; and
11. Wastes incompatible with landfilling activities.

The remainder of this SWAP describes the procedures that will be in place and used to evaluate, approve and accept special waste for disposal at the Mesquite Creek Landfill.

In particular, attention is drawn to Table 1 provided in Appendix IV-A-1 at the end of this SWAP. Table 1 provides a concise description of the waste specific special waste management procedures for the special waste categories specifically identified in 30 TAC § 330.3(154) Paragraphs (A) through (S); as well as for other special waste categories (e.g., types of special waste mentioned in §330.171; §330.173 and §330.15(e)). The intent of Table 1 is to provide a user-friendly format to readily identify common categories of special waste and the requirements that apply for its acceptance process and management.

1.4 Special Waste Approvals By Waste Type

Special Waste Approvals By Rule: The TCEQ rules specifically provide that the receipt of certain types of special waste does not require waste-specific or site-specific written approval of the TCEQ Executive Director if handled in accordance with the noted provisions for each waste (e.g., §330.171(c) and (d) and §330.173(c) and (i) - (j) of the rules). The special wastes enumerated in §330.171(c) and (d) and §330.173(c) and (i) - (j) are allowed to be accepted for disposal at the facility by operation of rule, without the necessity for any waste-specific or site-specific approvals. They will be managed at the facility in accordance with the techniques set forth in those rules and this SWAP (in particular, as noted in Table 1 of this SWAP). These waste types are identified in Table 1 of this SWAP. Specifically, the third column of the table ("Evaluation Method") indicates whether each given special waste category requires prior written waste-specific or site-specific authorization before disposal, or not. Accordingly, this column in Table 1 also indicates whether the Special Waste Evaluation Program described in Section 2 of this SWAP is applicable to each listed special waste category.

Special Wastes Requiring Waste Specific/Site-Specific Authorization: 30 TAC §330.171(b)(1) provides that approvals for any other (non-enumerated) wastes must be waste-specific and/or site–specific in nature (i.e., not authorized by operation of rule); however, §330.171(b)(2) allows a generator to request approval to dispose of special waste directly from a landfill operator who has an approved waste acceptance plan that authorizes the acceptance of such waste on a site-specific basis. These waste types include, but are not limited to, those identified in Table 1 of this SWAP. As mentioned, the third column of the table ("Evaluation Method") indicates which special waste categories that trigger the required review process of the Special Waste Evaluation Program described in Section 2 of this SWAP. This SWAP addresses requirements of the TCEQ rules allowing site-specific authorization to accept special waste meeting the facility's waste acceptance criteria set forth in Section 2 of the SWAP (the "Special Waste Evaluation Program"). Unless otherwise approved by the TCEQ Executive Director, only those non-enumerated special wastes that meet the facility's waste acceptance criteria and have been evaluated through the program described in this SWAP will be accepted. These special wastes will be managed at the facility in accordance with the techniques set forth in those rules and this SWAP (in particular, as noted in Table 1 of this SWAP).

2 SPECIAL WASTE EVALUATION PROGRAM

2.1 Applicability of This Special Waste Evaluation Program

The Special Waste Evaluation Program obligations described in this section of the SWAP are not applicable to the acceptance of municipal solid waste or any materials authorized for disposal by operation of rule under 30 TAC §§330.171 and 330.173.

Instead, the Special Waste Evaluation Program described in this section is applicable to wastes for which waste-specific and/or site-specific written approval is required under 30 TAC §330.171(b). These waste-specific and/or site-specific approval requests will be made in accordance with the provisions of 30 TAC §330.171(b)(2) and using this SWAP. As mentioned, the third column of Table 1 of this SWAP indicates whether each given special waste category requires prior written waste-specific/site-specific authorization before disposal or not; and accordingly, whether Section 2 of the SWAP applies.

2.2 Overview of Special Waste Evaluation Program

In accordance with 30 TAC §330.127(5)(A), 30 TAC §330.171, and 30 TAC §335.504, the Operator of this facility, a Waste Management (WM) affiliate company, has developed a program, as outlined in this SWAP and Section 5.6.3 of the Site Operating Plan (SOP), that is designed to take steps in addition to random inspections on incoming loads to prevent the receipt of hazardous waste, PCB waste, and other prohibited wastes at the landfill. This proactive policy minimizes the potential that hazardous or otherwise unacceptable waste will be transported to the site for disposal. Implementation of the program provides protection from the potential dangers that a special waste could pose to employees, the public, or the environment through improper management and serves as a hazardous waste, PCB waste, and other prohibited waste screening mechanism that minimizes the potential of these waste streams entering the landfill.

The program specifically provides for pre-acceptance procedures, prior to acceptance of an applicable special waste at the facility. This will help assure that a particular waste is nonhazardous and to determine the acceptability of a waste pursuant to facility permit conditions, applicable regulations, and operating capabilities. This process is implemented in two ways: (1) review of waste streams prior to acceptance, and (2) monitoring under qualified site personnel supervision of waste arriving at the gate and/or being disposed of at the working face. Specific procedures are also established for acceptance and handling of special wastes as defined by the TCEQ. Details of this program are presented below in the remainder of this section.

2.3 Hazardous Waste Determination and Class 1 Waste Determination

A Hazardous Waste Determination pursuant to 30 TAC §335.504 will be performed for all special wastes offered for disposal at the landfill. A Class 1 waste determination pursuant to 30 TAC §335.505 will also be performed for all special wastes offered for disposal at the landfill. Records of determination will be maintained in the site operating record either electronically and/or in hardcopy format, as discussed in Section 5, and will be made available for review at the request of TCEQ.

2.4 Digital Profiling

The primary procedures in place at WM for special waste evaluation and acceptance are electronic in nature. Profiles are submitted and processed electronically utilizing the WM electronic customer portal. First, the generator contacts WM and completes and online profile through proprietary software. Electronic forms are completed by the generator, including information to properly describe and profile the waste. The Profile documentation, which may include process knowledge, safety data sheets (SDSs), and/or analytical data, is then maintained in the Control Panel digitally, which is accessible by the WM Approvals group and the specific WM disposal facility. This profile information may include a description of the chemical composition as well as any handling procedures that need to be communicated to landfill personnel. The Gatehouse personnel view generator information on-line to compare the profile with shipping documents at the time of arrival to ensure consistency. Information retained including waste profiles will be maintained in the site operating record either electronically and/or in hardcopy format as discussed in Section 5, and will be made available for review at the request of TCEQ.

2.5 Waste Acceptance Process

Prior to acceptance of any industrial waste for disposal, information provided by the generator is screened to determine if any wastes proposed for disposal meet the definition of "Special Waste." Should any waste be identified as a special waste, the customer is required to state the characteristics and origin of the special waste proposed for disposal, if not already provided. In addition, if the waste is not readily identifiable, the generator will be required to provide other pertinent information regarding the waste that might aid in its identification. The following process is completed before waste is accepted:

a) The generator provides documentation of the nature of the waste stream to the landfill via the Generator's Waste Profile (GWP), which may be electronic or hardcopy in form or other similar documentation (an example Generator Waste Profile Form that may be used is provided in Appendix IV-A-2). The customer may be required to provide laboratory analyses data for the waste stream intended for disposal. If the generator is an industrial facility that is required to have specific waste codes assigned, whether self-assigned, TCEQ-assigned, or EPA-assigned, documentation used to assign the waste classifications must be provided for review. Dependent on the waste stream, sufficient documentation may be available in the GWP.

b) The Waste Approval Manager (WAM) or designee will review the electronic or hardcopy GWP and all information provided by the generator. This process may include an electronic review of certain standardized (express) profiles. The WAM or designee implements the Special Waste Acceptance Plan including the review and approval for the acceptance of special waste.

Pre-acceptance review will ensure that the analytical information when applicable meets the requirements as described later, TCEQ approval is given when appropriate, the necessary conditions/limitations on managing the waste are assigned, the intermediate transfer facility (if applicable) is permitted to accept the waste, and the waste is eligible for disposal at the landfill. If the waste is deemed eligible, an approval is granted, an expiration date is assigned, and all information is routed to the designated customer service representative. The customer will be informed of all conditions/limitations that apply to managing the special waste. The customer must comply with all conditions/limitations specified by the WAM.

3 QUALITY ASSURANCE/QUALITY CONTROL – ANALYTICAL INFORMATION

The laboratory analyses that will be required for review are dependent upon the type of waste stream to be disposed. Analytical data used to make a determination regarding a waste will use an EPA or TCEQ approved methodology and laboratory. Proper analytical results or equivalent information (i.e., 40 CFR §262.11 allows generator's knowledge of the waste and process generating the waste) must be obtained to ensure that the facility is not managing hazardous waste or other prohibited wastes. The generator is responsible for ensuring that a sample is representative of the waste stream and is analyzed in accordance with the appropriate methodology and laboratory prior to submitting the data for review to WM.

Information about a waste and the process which generates that waste will be used to evaluate or assist in the evaluation of a special waste. Examples of such information include, but are not limited to, material SDSs, manufacturers' literature, analytical results (e.g., an analysis may demonstrate that the potential constituents of concern are not present in the waste and therefore could not leach above the levels of concern), knowledge of how the waste was generated (e.g., a filter was used in painting operations and therefore does not contain any pesticides), and other such information generated in conjunction with a particular waste generation activity or process.

(A) When using "process knowledge" to address one or more special waste evaluation criteria, the requirements of §335.511 shall be followed.

(B) In addition to (A) above, all information that is used to evaluate special wastes shall be documented in accordance with §335.513.

Analytical reports and/or sampling documentation must clearly identify the generator and/or customer, description of the material sampled and analyzed, sample collection date and location, and when analyses were conducted.

The reference of methods employed must accompany the analytical data and be EPA/TCEQ approved method(s), as applicable. Laboratory QA/QC information must accompany the data submitted and may include sample handling, containerization and preservation techniques, chain of custody records, data on standards, duplicate analyses, spikes and blanks, and other pertinent statistical information.

Special waste that is delivered to the facility for disposal will receive a visual QA/QC inspection to verify contents and nature of waste. This inspection will take place either at the Gatehouse or at the working face while the waste is being unloaded by personnel trained in prohibited waste identification. Should visual inspection detect unusual characteristics, additional QA/QC will be performed, or the load will be rejected.

Any waste containing free liquids as determined using the Paint Filter Liquids Test (EPA Method 9095: Test Methods for Evaluating Solid Wastes, Physical/Chemical Methods, EPA Publication No. SW-846) will not be accepted for direct disposal. If the waste contains free liquids or is otherwise not certified as passing the Paint Filter Test, but is otherwise acceptable, it may be directed to the on-site liquid waste solidification area for processing in accordance with the Liquid Waste Management Plan included with the SOP. [Note that an exception to this, per 30 TAC §330.15(e)(6)(B), are special wastes that are nonhazardous containerized liquids in small containers similar in size to that normally found in household waste, or in a container that is designed to hold liquids for use other than storage. Refer to Table 1 for the acceptance, handling, and disposal criteria for this category of special waste.]

4 WASTE APPROVAL UPDATES

The GWP for special wastes will be assigned an expiration date not to exceed three years unless otherwise required or approved by the TCEQ. WM requires the generator/customer to provide notification and additional process and/or chemical analysis data in the event there are changes in the process from which the waste is produced. At a minimum, all special waste streams approved and accepted for disposal will be reevaluated prior to the expiration date or if the generator submits additional information after a process change. If there is no change in process or additional information, the reevaluation may consist of an electronic review only. Updated analytical may be requested but may not be required for the renewal if the generator certifies that there has not been a change in process.

5 DOCUMENTATION AND RECORDKEEPING

Shipping documentation for profiled wastes that arrive for management at WM landfills is provided to the facility upon arrival. Waste specific information included in the GWP, including any special handling or other requirements, is also made available to the facility, in hard copy and/or electronically. If the waste and associated documentation is missing, incomplete, or the characteristics of the waste are questionable, all discrepancies must be resolved prior to acceptance of the waste, as outlined in Section 6. All necessary and required paperwork relating to the acceptance of special waste will be maintained in the site operating record either electronically and/or in hardcopy format, and will be furnished upon request to the TCEQ Executive Director and must be made available for inspection/review by the TCEQ Executive Director. Refer to Appendix IV-A-2 for an example of a GWP. As the result of potential future internal WM revisions, the format and/or information contained in the GWP may change.

6 WASTE SCREENING, DISCREPANCIES, AND REJECTED LOADS

6.1 Screening Procedures for Incoming Loads

Refer to Section 5.6.2 of the SOP for the comprehensive required screening procedures that will be followed for incoming loads, at the gate and through the waste unloading process. A summary of the procedures upon arrival is presented below.

Arrival Acceptance Procedures – Special Waste. Gatehouse personnel will check all industrial generators and special waste arrivals to ensure that all special waste represented by the GWP has been identified; that all required paperwork, approvals, and documentation are in place; and that the pre-acceptance information matches the contents and nature of waste. If any associated documentation is missing, incomplete, or the characteristics of the waste are questionable, all discrepancies must be resolved prior to acceptance of the waste. In the event the discrepancies cannot be resolved, the waste load will be rejected. All waste discrepancies must be resolved before a waste can be accepted for disposal.

The gate attendant will monitor the special waste loads by observing the vehicle, and/or inspecting the load, and/or questioning the driver concerning the origin of the waste. Additional QA/QC may include pH testing, ignitability testing, and paint filter testing. If conducted, QA/QC results will be recorded and referenced by manifest document number and maintained in the site operating records. Wastes requiring special handling are diverted to the appropriate special management area.

6.2 Discrepancies and Rejected Loads

Refer to Section 5.6.3 of the SOP for the required procedures that will be followed should discrepancies be identified, and/or to reject loads.

For special waste, copies of the discrepancy resolution, including updated or missing documentation, will be maintained by the site in accordance with Section 5.

6.3 Management and Notification of Incidents

Refer to Section 5.6.3 of the SOP for the required procedures that will be followed should regulated hazardous or prohibited PCB waste be detected.

7 TRAINING OF PERSONNEL

In addition to the implementation of this SWAP, which provides for specific and detailed pre-acceptance procedures to prevent the receipt of hazardous waste, PCBs, and other prohibited wastes, appropriate facility personnel will receive training to recognize potential hazardous waste, PCBs, or other prohibited wastes. WM provides in-house company designed training to key site personnel, gatehouse personnel and field personnel. This in-house training is function specific and may include Subtitle D requirements, state specific requirements, regulations and procedures, waste recognition and/or waste screening requirements and procedures for acceptable and unacceptable wastes, definition and identification of special wastes, hazardous waste, PCB wastes or other prohibited waste, and the requirements and procedures of this SWAP. Appropriate landfill operations personnel will be trained in the proper use of PPE and on-site emergency equipment. Proper PPE includes a work uniform, work boots, and safety vest. Additional PPE may include Tyvek (or equivalent) suit or coveralls, hardhat, hearing protection, gloves, and safety glasses as conditions warrant. Documentation and a record of all training provided to key facility personnel will be maintained on site in the site operating record and available for inspection.

This required training is to help allow for effective monitoring of waste streams as they enter the facility, as well as during disposal, under the supervision of properly trained site personnel.

8 OPERATIONAL PROCEDURES

8.1 Arrival Acceptance Procedures

Special waste delivered to the landfill for disposal will be checked using the arrival acceptance procedures described in Section 6 of this SWAP.

8.2 Special Waste Handling Procedures

8.2.1 General

Special wastes approved for receipt at this facility and accepted in accordance with the procedures described in the SWAP will be managed in accordance with the handling and disposal criteria provisions applicable to that waste as presented in the last column of Table 1. In general, special wastes will be handled and disposed of at the site in a similar manner as municipal solid waste. The special waste will be off-loaded from transport trucks and disposed of at the appropriate unloading area/working face identified in the SOP based on how the waste is classified (e.g., MSW working face, regulated asbestos-containing material (RACM) disposal area). The special waste will then be placed and spread using standard landfill equipment listed in the SOP. Specific handling/disposal procedures for certain wastes will be in accordance with the TCEQ regulations governing their proper disposal and as described further in Table 1 of this SWAP. For emphasis, the subsections below identify wastes of a certain type or composition that require specific handling and disposal procedures.

8.2.2 On-Site Liquid Waste Processing

On-site liquid waste processing will be performed at the facility in accordance with the provisions and requirements of the Liquid Waste Solidification Plan (Appendix IV-C of the SOP).

8.2.3 Class 1 Waste

The facility is not authorized to accept Class 1 waste.

8.2.4 Odorous Wastes and Potentially Dusty/Windblown Wastes

Wastes with strong odors (such as dead animals, slaughterhouse wastes, sewage sludges, etc.), will be covered immediately upon disposal. These wastes may be placed in a select area of the working face to facilitate covering them immediately. See Table 1 of this SWAP for specific cover requirements that apply to dead animals and slaughterhouse wastes.

Potentially dusty (or otherwise prone to becoming windblown/airborne) special wastes will be transported and unloaded so as to minimize the potential for airborne particles. This includes positioning windbreaks at the working face, placing the dusty/windblown-prone special waste in contingency trenches or requiring the generator to containerize the waste. If needed, personnel may be required to wear personal protective equipment (PPE).

8.2.5 Asbestos Waste (RACM)

RACM will be managed, handled, and disposed of at the facility in accordance with the provisions and requirements of the Asbestos Management Plan (Appendix IV-B of the SOP).

9 CONTINGENCY PROCEDURES

For incidental spills that do not pose a threat to waters of the state, operations staff will contain and clean up the spill using appropriate equipment at the direction of the landfill manager. For solids, site staff will use shovels, brooms, and/or heavy equipment to pick up spilled materials. For liquids, typical cleanup materials would include oil dry, absorbent pads, or other available materials to contain the spilled material. Spill cleanup kits are maintained on site. Pumps might also be used, when appropriate, to transfer liquid material from the spill area into containers.

For larger spills, or where there is potential for the waste to impact waters in the state, the landfill manager will assess the situation and determine the appropriate means to contain and collect the material. If spilled material threatens to impact storm water discharge from the site, the landfill manager will use booms or diversionary dikes, or excavate holes or pits as needed to contain the spilled material. Equipment typically available for spill response includes excavators, backhoes, dozers, pumps, and haul trucks. In the event of a spill that cannot be picked up using handheld tools, this equipment will be used as needed to contain and collect spilled material. For larger spills of liquid wastes that cannot be adequately cleaned up with on-site equipment, an emergency cleanup contractor or vacuum truck company will be contacted to assist with cleaning up the spill. Once the liquids are removed, a visual inspection of the spill area will be made, and soils observed to be potentially impacted will be over-excavated and disposed with the collected material.

APPENDIX IV-A-1

TABLE 1

WASTE SPECIFIC SPECIAL WASTE MANAGEMENT PROCEDURES

TABLE 1 - WASTE SPECIFIC SPECIAL WASTE MANAGEMENT PROCEDURES

Special Waste Category	Authorized for Acceptance at This Facility? [YES/NO][1]	Evaluation Method[2]	Acceptance Determination Process[3, 5]	Handling and Disposal Criteria[4]
Special wastes specifically listed in 30 TAC §330.3(148):				
Hazardous waste from conditionally exempt small-quantity generators (CESQG) that may be exempt from full controls under 30 TAC Chapter 335, Subchapter N (relating to household materials which could be classified as hazardous waste)	YES	This waste does not require prior written waste-specific or site-specific authorization before disposal, provided that it is handled in accordance with the noted provisions specified in this table for this waste, and the facility is permitted to accept these wastes. Therefore, receipt of this waste does not require the review detailed in the Special Waste Evaluation Program (Section 2) of this SWAP.	There are no specific acceptance criteria for municipal hazardous waste from CESQG except for the liquid waste criteria [see Note 5] and provided the amount of waste does not exceed 220 lb (100 kg) per month per generator, and provided the facility authorizes acceptance of the waste.	These wastes arriving at the gate and containing free liquids will be directed to the on-site liquid waste solidification area for processing. These wastes containing no free liquids will be disposed of at the working face of the landfill.
Class 1 non-hazardous industrial waste	NO	Not Applicable (N/A) – Facility not authorized to accept Class 1 waste.	N/A – Facility not authorized to accept Class 1 waste.	N/A – Facility not authorized to accept Class 1 waste.
Untreated medical waste	Only if approved by the TCEQ Executive Director when necessary to protect human health and the environment from the effects of a natural or man-made disaster.	Receipt of this waste, if authorized for approval by the TCEQ Executive Director, requires the review detailed in the Special Waste Evaluation Program (Section 2) of this SWAP.	Acceptance will require, at a minimum, a completed waste profile sheet. Additional documentation (MSDS, analytical, etc.) may be required as determined by the Waste Approval Manager or designee. If this waste contains free liquids, see Note 5 for further requirements.	Handling and disposal of this waste is by special circumstances only and must be authorized in advance by the TCEQ Executive Director. Once approved, management will be in accordance with the conditions included in the TCEQ authorization and in accordance with all applicable federal, state, and local regulations.

TABLE 1 - WASTE SPECIFIC SPECIAL WASTE MANAGEMENT PROCEDURES

Special Waste Category	Authorized for Acceptance at This Facility? [YES/NO][1]	Evaluation Method[2]	Acceptance Determination Process[3, 5]	Handling and Disposal Criteria[4]
Municipal wastewater treatment plant sludges, other types of domestic sewage treatment plant sludges, and water-supply treatment plant sludges	YES	This waste does not require prior written waste-specific or site-specific authorization before disposal, provided that it is handled in accordance with the noted provisions specified in this table for these wastes and that the facility is permitted to accept these wastes. Therefore, receipt of this waste does not require the review detailed in the Special Waste Evaluation Program (Section 2) of this SWAP.	Sludges or liquid wastes from municipal sources must be tested in accordance with Test Method 9095B (Paint Filter Liquids Test) and certified to contain no free liquids for direct disposal at the landfill working face. If the waste contains free liquids, see Note 5 for further requirements.	These wastes arriving at the gate and containing free liquids will be directed to the on-site liquid waste solidification area for processing. These wastes containing no free liquids will be disposed of at the working face of the landfill. These wastes may pose a greater potential for objectionable odor. Odorous wastes of this type will be covered immediately upon disposal.
Septic tank pumpings	YES	This waste does not require prior written waste-specific or site-specific authorization before disposal, provided that it is handled in accordance with the noted provisions specified in this table for this waste and that the facility is permitted to accept these wastes. Therefore, receipt of this waste does not require the review detailed in the Special Waste Evaluation Program (Section 2) of this SWAP.	Septic tank pumpings from municipal sources must be tested in accordance with Test Method 9095B (Paint Filter Liquids Test) and certified to contain no free liquids for direct disposal at the landfill working face. If the waste contains free liquids, see Note 5 for further requirements.	These wastes arriving at the gate and containing free liquids will be directed to the on-site liquid waste solidification area for processing. These wastes containing no free liquids will be disposed of at the working face of the landfill. These wastes may pose a greater potential for objectionable odor. Odorous wastes of this type will be covered immediately upon disposal.

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Special Waste Category	Authorized for Acceptance at This Facility? [YES/NO][1]	Evaluation Method[2]	Acceptance Determination Process[3, 5]	Handling and Disposal Criteria[4]
Grease and grit trap wastes	YES	This waste does not require prior written waste-specific or site-specific authorization before disposal, provided that it is handled in accordance with the noted provisions specified in this table for this waste and that the facility is permitted to accept these wastes. Therefore, receipt of this waste does not require the review detailed in the Special Waste Evaluation Program (Section 2) of this SWAP.	Grease trap waste, grit trap waste, or liquid wastes from municipal sources must have been treated or processed and the treated/processed material must be tested in accordance with Test Method 9095B (Paint Filter Liquids Test) and certified to contain no free liquids for direct disposal at the landfill working face. If the waste contains free liquids, see Note 5 for further requirements.	These wastes arriving at the gate and containing free liquids will be directed to the on-site liquid waste solidification area for processing. These wastes containing no free liquids will be disposed of at the working face of the landfill. These wastes may pose a greater potential for objectionable odor. Odorous wastes of this type will be covered immediately upon disposal.
Wastes from commercial or industrial wastewater treatment plants; air pollution control facilities; and tanks, drums, or containers used for shipping or storing any material that has been listed as a hazardous constituent in 40 CFR Part 261, Appendix VIII but has not been listed as a commercial chemical product in 40 CFR §261.33(e) or (f)	YES	Receipt of this waste requires the review detailed in the Special Waste Evaluation Program (Section 2) of this SWAP.	Acceptance will require, at a minimum, a completed waste profile sheet. Additional documentation (MSDS, analytical, etc.) may be required as determined by the Waste Approval Manager or designee. If this waste contains free liquids, see Note 5 for further requirements. If it is determined that this waste classifies as a Class 1 waste, it shall not be accepted.	These wastes arriving at the gate and containing free liquids will be directed to the on-site liquid waste solidification area for processing. These wastes containing no free liquids will be disposed of at the working face of the landfill.

TABLE 1 - WASTE SPECIFIC SPECIAL WASTE MANAGEMENT PROCEDURES

Special Waste Category	Authorized for Acceptance at This Facility? [YES/NO][1]	Evaluation Method[2]	Acceptance Determination Process[3, 5]	Handling and Disposal Criteria[4]
Slaughterhouse wastes	YES	This waste does not require prior written waste-specific or site-specific authorization before disposal, provided that it is handled in accordance with the noted provisions specified in this table for this waste and that the facility is permitted to accept these wastes. Therefore, receipt of this waste does not require the review detailed in the Special Waste Evaluation Program (Section 2) of this SWAP.	There are no specific acceptance criteria for this waste that meets the requirements for disposal, except for the liquid waste criteria [see Note 5].	Slaughterhouse waste containing no free liquids will be covered by 3 feet of other solid waste or at least 2 feet of earthen material immediately upon receipt at the working face. Slaughterhouse waste arriving at the gate and containing free liquids will be directed to the on-site liquid waste solidification area for processing.
Dead animals	YES	This waste does not require prior written waste-specific or site-specific authorization before disposal, provided that it is handled in accordance with the noted provisions specified in this table for this waste and that the facility is permitted to accept these wastes. Therefore, receipt of this waste does not require the review detailed in the Special Waste Evaluation Program (Section 2) of this SWAP.	There are no specific acceptance criteria for this waste that meets the definition requirements for disposal.	Dead animals, other than single household pets and other single small animals, will be covered by 3 feet of other solid waste or at least 2 feet of earthen material immediately upon receipt at the working face.

TABLE 1 - WASTE SPECIFIC SPECIAL WASTE MANAGEMENT PROCEDURES

Special Waste Category	Authorized for Acceptance at This Facility? [YES/NO][1]	Evaluation Method[2]	Acceptance Determination Process[3, 5]	Handling and Disposal Criteria[4]
Drugs, contaminated foods, or contaminated beverages (other than those contained in normal household waste) [Note – For contaminated food/beverage special waste that is in the form of a small/non-storage container holding liquid waste, see the table entry for "Nonhazardous containerized liquids in small containers similar in size to that normally found in household waste, or in a container that is designed to hold liquids for use other than storage"]	YES	Receipt of this waste requires review and approval as detailed in the Special Waste Evaluation Program (Section 2) of this SWAP.	Acceptance will require, at a minimum, a completed waste profile sheet. Additional documentation (MSDS, analytical, etc.) may be required as determined by the Waste Approval Manager or designee. If this waste contains free liquids, see Note 5 for further requirements. If it is determined that this waste classifies as a Class 1 waste, it shall not be accepted.	These wastes arriving at the gate and containing free liquids will be directed to the on-site liquid waste solidification area for processing. These wastes containing no free liquids will be disposed of at the working face of the landfill. At the discretion of the Site Manager or designee, a minimum of 1 foot of other municipal solid waste or 6 inches of dirt may be placed on the waste immediately upon disposal and/or additional precautionary measures may be taken to prevent scavenging and salvaging of these types of waste. For controlled substances (Schedule I through Schedule V as identified in 12 CFR §1308.11-1308.15) approved for acceptance, the U.S. Drug Enforcement Agency must be contacted for approval and for specific destruction, disposal, or other requirements.

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Special Waste Category	Authorized for Acceptance at This Facility? [YES/NO][1]	Evaluation Method[2]	Acceptance Determination Process[3, 5]	Handling and Disposal Criteria[4]
Pesticide (insecticides, herbicides, fungicides, or rodenticide) containers (i.e., empty containers that have been used for pesticides)	YES	For containers that have been triple rinsed and rendered unusable, there is no required prior written waste-specific or site-specific authorization before disposal (provided that it is handled in accordance with the noted provisions specified in this table for this waste and that the facility is permitted to accept these wastes) nor does this waste require the review detailed in the Special Waste Evaluation Criteria (Section 3). For other containers that have been used for pesticides, receipt of this waste requires the review and approval as detailed in the Special Waste Evaluation Program (Section 2) of this SWAP.	Empty containers that have been triple rinsed prior to receipt at the site, and rendered unusable prior to or upon receipt at the site, may be accepted for disposal at the landfill. For those containers for which triple-rinsing is not feasible or practical (e.g., paper bags, cardboard containers), acceptance will require, at a minimum, a completed waste profile sheet. Additional documentation (MSDS, analytical, etc.) may be required as determined by the Waste Approval Manager or designee. Depending on the waste profile, those containers may be accepted for disposal under the provisions of 30 TAC §330.171(c)(6) [see CESQG entry in this table] or 30 TAC §330.173 [see Class 2, or 3 nonhazardous industrial waste entries in this table], as applicable. If it is determined that this waste classifies as a Class 1 waste, it shall not be accepted.	These wastes arriving at the gate and containing free liquids will be directed to the on-site liquid waste solidification area for processing. These wastes containing no free liquids will be disposed of at the working face of the landfill. Pesticide containers must be covered by the end of the same working day they are received.

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Special Waste Category	Authorized for Acceptance at This Facility? [YES/NO][1]	Evaluation Method[2]	Acceptance Determination Process[3, 5]	Handling and Disposal Criteria[4]
Discarded materials containing asbestos: Regulated asbestos-containing material (RACM) as defined in 40 CFR §61.141	YES	This waste does not require prior written waste-specific or site-specific authorization before disposal, provided that it is handled in accordance with the noted provisions specified in this table for this waste and that the facility is permitted to accept these wastes. Therefore, receipt of this waste does not require the review detailed in the Special Waste Evaluation Program (Section 2) of this SWAP.	Acceptance will require, at a minimum, a completed waste profile sheet. Additional documentation (MSDS, analytical, etc.) may be required as determined by the Waste Approval Manager or designee.	RACM will be handled and disposed in accordance with the facility's Asbestos Management Plan (SOP Appendix IV-B). With respect to handling and disposal, this includes the following criteria: The bags or containers holding the RACM should typically be placed below natural grade level. Where this is not possible or practical, provisions must be made to ensure that the waste will not be subject to future exposure through erosion or weathering of the intermediate and/or final cover. RACM that is placed above natural grade must be located in the landfill unit not less than 20 feet from any final side slope of the unit and must be at least ten feet below the final surface of the unit. RACM must only be accepted at the facility in tightly closed and unruptured containers or bags or must be wrapped with at least six-mil polyethylene. The bags or containers holding the RACM must be carefully unloaded and placed in the final disposal location. The RACM must be covered immediately with 12 inches of suitable soil or earthen material or three feet of solid waste containing no asbestos. Care must be exercised in the application of the cover so that the bags or containers are not ruptured.

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Special Waste Category	Authorized for Acceptance at This Facility? [YES/NO][1]	Evaluation Method[2]	Acceptance Determination Process[3, 5]	Handling and Disposal Criteria[4]
Discarded materials containing asbestos: Non-regulated asbestos-containing materials (non-RACM)	YES	This waste does not require prior written waste-specific or site-specific authorization before disposal, provided that it is handled in accordance with the noted provisions specified in this table for this waste and that the facility is permitted to accept these wastes. Therefore, receipt of this waste does not require the review detailed in the Special Waste Evaluation Program (Section 2) of this SWAP.	There are no specific acceptance criteria for this waste that meets the definition requirements for disposal.	Non-regulated asbestos-containing materials (non-RACM) will be disposed of at the working face of the landfill and covered in accordance with 30 TAC §330.171(c)(4). Under no circumstances may any material that contains non-RACM be placed on any surface or roadway that is subject to vehicular traffic or disposed by any means which the material could be crumbled into a friable state.
Discarded materials containing asbestos: Asbestos containing material from industrial sources that is only Class 1 due only to its regulated asbestos content.	YES	Receipt of this waste requires review and approval as detailed in the Special Waste Evaluation Program (Section 2) of this SWAP.	Acceptance will require, at a minimum, a completed waste profile sheet. Additional documentation (MSDS, analytical, etc.) may be required as determined by the Waste Approval Manager or designee.	Handle and dispose in the same manner as RACM – see above table entry for RACM.
Incinerator ash	YES	Receipt of this waste requires review and approval as detailed in the Special Waste Evaluation Program (Section 2) of this SWAP.	Acceptance will require, at a minimum, a completed waste profile sheet. Additional documentation (MSDS, analytical, etc.) may be required as determined by the Waste Approval Manager or designee. If it is determined that this waste classifies as a Class 1 waste, it shall not be accepted.	Incinerator ash will be disposed of at the working face of the landfill. The ash will be handled such that it does not become a public health nuisance, such as becoming airborne.

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Special Waste Category	Authorized for Acceptance at This Facility? [YES/NO][1]	Evaluation Method[2]	Acceptance Determination Process[3, 5]	Handling and Disposal Criteria[4]
Soil contaminated by petroleum products, crude oils, or chemicals in concentrations <u>less than</u> 1,500 milligrams per kilogram total petroleum hydrocarbons; or contaminated by constituents of concern that are <u>below</u> the concentrations listed in Table 1 of 30 TAC §335.521(a)(1).	YES	This table entry refers to soil material from industrial and nonindustrial sources lightly contaminated (in concentrations less than those indicated in column 1 of this table entry) by petroleum substances as defined in §335.1(132) (relating to Definition of Petroleum Substance) or chemicals listed in §335.521(a)(1) (relating to Appendices). Receipt of this waste requires review and approval as detailed in the Special Waste Evaluation Program (Section 2) of this SWAP.	Acceptance will require, at a minimum, a completed waste profile sheet. Additional documentation (MSDS, analytical, etc.) may be required as determined by the Waste Approval Manager or designee. If this waste contains free liquids, see Note 5 for further requirements. If it is determined that this waste exceeds the concentrations listed in the first column, the waste will be classified as a Class 1 waste and shall not be accepted	incinerator ash may be stored and handled only in a manner that is in accordance with the approved provisions for said material. These wastes containing no free liquids will be disposed of at the working face of the landfill.
Used oil [Note – see also the related item in this table for used oil filters from internal combustion engines]	<u>NO</u>	<u>Used oil is prohibited from disposal at MSW landfills</u>	<u>Prohibited</u>	<u>Prohibited</u>

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Special Waste Category	Authorized for Acceptance at This Facility? [YES/NO][1]	Evaluation Method[2]	Acceptance Determination Process[3, 5]	Handling and Disposal Criteria[4]
Waste from oil, gas, and geothermal activities subject to regulation by the Railroad Commission of Texas (RRC) when those wastes are to be processed, treated, or disposed of at the facility	YES [Only if meets the characteristics of Class 2 or Class 3 nonhazardous industrial waste]	Receipt of this waste requires the review detailed in the Special Waste Evaluation Program (Section 2) of this SWAP.	Waste not exempted under 40 CFR §261.4(b)(5) will require at a minimum, a completed waste profile sheet. Additional documentation (MSDS, analytical, etc.) may be required as determined by the Waste Approval Manager or designee. Waste exempted under 40 CFR §261.4(b)(5) will require a completed waste profile. If it is determined that this waste exhibits the characteristics of Class 1 waste, it shall not be accepted.	incinerator ash may be stored and handled only in a manner that is in accordance with the approved provisions for said material. These wastes containing no free liquids will be disposed of at the working face of the landfill. If the waste is of a type that has objectionable odors, the waste will be covered upon disposal.

TABLE 1 - WASTE SPECIFIC SPECIAL WASTE MANAGEMENT PROCEDURES

Special Waste Category	Authorized for Acceptance at This Facility? [YES/NO][1]	Evaluation Method[2]	Acceptance Determination Process[3, 5]	Handling and Disposal Criteria[4]
Waste generated outside the boundaries of Texas that contains any industrial waste; waste associated with oil, gas, and geothermal exploration, production, or development activities; or any item listed in the definition of a special waste in 30 TAC §330.3(154)	YES	Receipt of this waste requires the review detailed in the Special Waste Evaluation Program (Section 2) of this SWAP.	Waste generated outside the state boundaries of Texas that meets the definition of a special waste will be handled in accordance with the provisions and requirements of this plan for the same types of waste generated within Texas. Acceptance will require, at a minimum, a completed waste profile sheet. Additional documentation (MSDS, analytical, etc.) may be required as determined by the Waste Approval Manager or designee. Out-of-state industrial solid waste will be handled in accordance with §330.173 and §335.508(9). Out-of-state Class 2 and 3 industrial wastes shall require written authorization by the TCEQ. A copy of the approval must accompany the waste profile prior to initial approval. If it is determined that this waste is a Class 1 waste or exhibits the characteristics of a Class 1 waste, it shall not be accepted.	If the waste is of a type that has objectionable odors, the waste will be covered upon disposal. These wastes containing no free liquids will be disposed of at the working face of the landfill. If the waste is of a type that has objectionable odors, the waste will be covered immediately upon disposal.
Lead acid storage batteries	NO	Lead acid storage battery disposal is prohibited at MSW landfills by 30 TAC §330.15(e)	Prohibited	Prohibited

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Special Waste Category	Authorized for Acceptance at This Facility? [YES/NO][1]	Evaluation Method[2]	Acceptance Determination Process[3, 5]	Handling and Disposal Criteria[4]
Used-oil filters from internal combustion engines	YES – but only as follows: Used oil filters from internal combustion engines must not be intentionally and knowingly accepted for disposal at MSW landfills except as provided by paragraphs (1) and (2) of 30 TAC §330.171(d) [as outlined in Column 4]	Receipt of this waste requires the review detailed in the Special Waste Evaluation Program (Section 2) of this SWAP.	Evaluation of whether used oil filters may be accepted for disposal is as follows: • The filter must be crushed to less than 20% of its original volume to remove all free-flowing used oil; or processed by a method other than crushing to remove all free-flowing used oil. A filter is considered to have been processed if the filter has been separated into component parts and the free flowing used oil has been removed from the filter element by some means of compression in order to remove free-flowing used oil or the used filter element of a filter consisting of a replaceable filtration element in a reusable or permanent housing has been removed from the housing and pressed to remove free-flowing used oil or the housing is punctured and the filter is drained for at least 24 hours. • Used oil filters (to include filters that have been crushed and/or processed to remove free-flowing used oil) must not be offered for landfill disposal by any non-household generator.	Waste of this type that is determined to meet the acceptance criteria outlined herein will be disposed of at the working face of the landfill.

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Special Waste Category	Authorized for Acceptance at This Facility? [YES/NO][1]	Evaluation Method[2]	Acceptance Determination Process[3, 5]	Handling and Disposal Criteria[4]
<u>Other special waste categories that are types of special wastes identified in 30 TAC §330.171 and §330.173, or are categories of special wastes based on meeting the "catch-all" definition in 30 TAC §330.3(154) (See SWAP Section 1):</u>				
Class 2 and Class 3 non-hazardous industrial solid waste.	YES	These wastes do not require prior written waste-specific or site-specific authorization before disposal, provided that the facility is permitted to accept these wastes (and provided that it is handled in accordance with the noted provisions specified in this table for this waste and that that these wastes does not interfere with facility operations). Receipt of these wastes will typically include the review detailed in the Special Waste Evaluation Program (Section 2) of this SWAP.	Acceptance will require, at a minimum, a completed waste profile sheet. Additional documentation (MSDS, analytical, etc.) may be required as determined by the Waste Approval Manager or designee. If the waste contains free liquids, see Note 5 for further requirements.	If the waste is of a type that has objectionable odors, the waste will be covered upon disposal. These wastes containing no free liquids will be disposed of at the working face of the landfill.

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Special Waste Category	Authorized for Acceptance at This Facility? [YES/NO][1]	Evaluation Method[2]	Acceptance Determination Process[3, 5]	Handling and Disposal Criteria[4]
Nonhazardous containerized liquids in small containers similar in size to that normally found in household waste, or in a container that is designed to hold liquids for use other than storage.	YES	Receipt of this waste requires the review detailed in the Special Waste Evaluation Program (Section 2) of this SWAP.	Acceptance will require, at a minimum, a completed waste profile sheet. Additional documentation (MSDS, analytical, etc.) may be required as determined by the Waste Approval Manager or designee. If it is determined that this waste classifies as a Class 1 waste, it shall not be accepted.	Waste in small containers similar in size to that normally found in household waste, or in a container that is designed to hold liquids for use other than storage, or that is household waste may be disposed of at the working face of the landfill, provided the following takes place: The landfill cell in which this waste is to be disposed of shall have a minimum of 3 feet of waste in it prior to disposal of this waste.
Nonhazardous filter media (e.g., paint filters, glycol filters, molecular sieves and other types of filter media), but not including those contained in normal household waste or used oil filters from internal combustion engines.	YES	Receipt of this waste requires the review detailed in the Special Waste Evaluation Program (Section 2) of this SWAP.	Acceptance will require, at a minimum, a completed waste profile sheet. Additional documentation (MSDS, analytical, etc.) may be required as determined by the Waste Approval Manager or designee. If the waste contains free liquids, see Note 5 for further requirements. If it is determined that this waste classifies as a Class 1 waste, it shall not be accepted.	If the waste is of a type that has objectionable odors, the waste will be covered upon disposal. These wastes containing no free liquids will be disposed of at the working face of the landfill.

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Special Waste Category	Authorized for Acceptance at This Facility? [YES/NO][1]	Evaluation Method[2]	Acceptance Determination Process[3, 5]	Handling and Disposal Criteria[4]
Nonhazardous abrasive wastes (e.g., blasting grit, steel shot, etc.).	YES	Receipt of this waste requires the review detailed in the Special Waste Evaluation Program (Section 2) of this SWAP.	Acceptance will require, at a minimum, a completed waste profile sheet. Additional documentation (MSDS, analytical, etc.) may be required as determined by the Waste Approval Manager or designee. If the waste contains free liquids, see Note 5 for further requirements. If it is determined that this waste classifies as a Class 1 waste, it shall not be accepted.	If the waste is of a type that has objectionable odors, the waste will be covered upon disposal. These wastes containing no free liquids will be disposed of at the working face of the landfill.
Nonhazardous demolition debris from non-household sources contaminated with lead based paint.	YES	Receipt of this waste requires the review detailed in the Special Waste Evaluation Program (Section 2) of this SWAP.	Wastes from non-household sources containing lead-based paint will require, at a minimum, a completed waste profile sheet and analysis to determine that the concentration of lead meets the requirements of the Hazardous Waste and Class 1 Waste determination (i.e., that it does not classify as either). Additional documentation (MSDS, etc.) may be required as determined by the Waste Approval Manager or designee. If it is determined that this waste classifies as a Class 1 waste, it shall not be accepted.	These wastes will be disposed of at the working face of the landfill.

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Special Waste Category	Authorized for Acceptance at This Facility? [YES/NO][1]	Evaluation Method[2]	Acceptance Determination Process[3, 5]	Handling and Disposal Criteria[4]
Materials containing Polychlorinated biphenyls (PCBs) but that are not defined as PCB waste(s) under 30 TAC §330.3(113), nor that are regulated under 40 CFR §761.	YES [Note: PCB wastes as defined in 30 TAC §330.3(113) or that are regulated under 40 CFR §761 are prohibited and will not be accepted]	Receipt of this waste requires the review detailed in the Special Waste Evaluation Program (Section 2) of this SWAP.	Acceptance will require, at a minimum, a completed waste profile sheet. Additional documentation (MSDS, analytical, etc.) may be required as determined by the Waste Approval Manager or designee. PCB wastes as defined in 30 TAC §330.3(113) or that are regulated under 40 CFR §761 are prohibited and will not be accepted. Nonhazardous light ballasts and nonhazardous small capacitors containing PCB compounds as defined in 40 CFR §761.3 (relating to federal PCB/TSCA regulations) will be accepted for disposal at the facility only if the PCB-containing light ballasts and electrical capacitors are generated during routine maintenance only and are not leaking, provided that the total weight of such wastes does not exceed 3 pounds of ballast per day.	These wastes will be disposed of at the working face of the landfill.

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Special Waste Category	Authorized for Acceptance at This Facility? [YES/NO][1]	Evaluation Method[2]	Acceptance Determination Process[3, 5]	Handling and Disposal Criteria[4]
Treated medical wastes per 30 TAC §330.326.75(r).	YES [Note: With the exception of treated recognizable human body parts, tissues, fetuses, organs, and the products of human abortions, spontaneous or induced – which shall not be accepted or disposed of in the landfill.]	This waste does not require prior written waste-specific or site-specific authorization before disposal, provided that it is handled in accordance with the noted provisions specified in this table for this waste and that the facility is permitted to accept these wastes. Therefore, receipt of this waste does not require the review detailed in the Special Waste Evaluation Program (Section 2) of this SWAP.	Medical waste that has been treated in accordance with the provisions of 25 TAC §1.136 may be managed as routine municipal solid waste for acceptance and disposal unless otherwise specified in paragraphs (1) through (5) of 30 TAC §330.326.75(r).	Incinerator ash that is treated medical waste will be handled and disposed of in accordance with the table entry of this table for incinerator ash. Treated microbiological waste, blood, blood products, body fluids, laboratory specimens of blood and tissue, and animal bedding must be containerized and labeled as required by 30 TAC §330.326.75(r)(2). These wastes will be disposed of at the working face of the landfill. Treated carcasses and body parts of animals designated as a medical waste will (after treatment) be disposed of at the working face of the landfill. Treated sharps or unused sharps must be containerized as required by 30 TAC §330.326.75(r)(5). These wastes will be disposed of at the working face of the landfill.

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Special Waste Category	Authorized for Acceptance at This Facility? [YES/NO][1]	Evaluation Method[2]	Acceptance Determination Process[3, 5]	Handling and Disposal Criteria[4]
Wastes that contain or are contaminated by naturally occurring radioactive material (NORM) or other radioactive substances.	YES [Only if meets exemption requirements and is below the concentration limits given in Column 4]	Receipt of this waste requires the review detailed in the Special Waste Evaluation Program (Section 2) of this SWAP.	Acceptance will require, at a minimum, a completed waste profile sheet. Additional documentation (MSDS, analytical, etc.) may be required as determined by the Waste Approval Manager or designee. If the waste contains free liquids, see Note 5 for further requirements. NORM containing wastes must be exempt from state licensing per 25 TAC §289.259, including being below the concentration limits set forth in 25 TAC §289.259(d). Other wastes with radioactive substances must be below the radionuclide concentration and annual activity limit requirements of 30 TAC §336.365 Appendix H.	If the waste is of a type that has objectionable odors, the waste will be covered upon disposal. These wastes containing no free liquids will be disposed of at the working face of the landfill.

Notes:

1 – The facility may only accept special wastes that the landfill is permitted to accept or that has been given prior written waste-specific and/or site-specific authorization by the TCEQ Executive Director (and provided that the special waste is also evaluated in accordance with this SWAP and meets the criteria specified herein for evaluation, acceptance, and disposal).

2 – Describes the level of evaluation/evaluation method that will be used to determine acceptance requirements.

3- Describes the pre-acceptance process that will be used by the Waste Approval Manager (WAM) or designee to verify that the waste meets the required criteria prior to acceptance at the facility.

TABLE 1 - WASTE SPECIFIC SPECIAL WASTE MANAGEMENT PROCEDURES

4- Describes the gate acceptance, handling, and disposal requirements for the special waste. Refer to Section 8.2 of the SWAP for additional operational requirements that apply to certain types/compositions of special wastes.

5 – Note that sludges, grease trap waste, grit trap waste, liquid wastes, and other waste categories that are suspected of having free liquids [other than nonhazardous containerized liquids in small containers similar in size to that normally found in household waste, or in a container that is designed to hold liquids for use other than storage] must be tested in accordance with EPA Test Method 9095B (Paint Filter Liquids Test, Test Methods for Evaluating Solid Wastes, Physical/Chemical Methods, EPA Publication No. SW-846) and certified to contain no free liquids for direct disposal at the landfill working face. If the waste contains free liquids or is otherwise not certified as passing the Paint Filter Test but is otherwise acceptable, it may be directed to the on-site liquid waste solidification area for processing in accordance with the Liquid Waste Management Plan included with the SOP.

APPENDIX IV-A-2

EXAMPLE GENERATOR WASTE PROFILE (GWP) FORM

Note: This appendix contains an example of a GWP Form used by the Operator of this facility. As the result of potential future internal company revisions, the format and/or information contained in the GWP Form may change.

WASTE MANAGEMENT

EZ Profile™

Requested Facility: ____________________ ☐ Unsure Profile Number: ____________

☐ Multiple Generator Locations (Attach Locations) ☐ Request Certificate of Disposal ☐ Renewal? Original Profile Number: ____________

A. GENERATOR INFORMATION (MATERIAL ORIGIN)

1. Generator Name: ____________________
2. Site Address: ____________________
(City, State, ZIP) ____________________
3. County: ____________________
4. Contact Name: ____________________
5. Email: ____________________
6. Phone: ____________ 7. Fax: ____________
8. Generator EPA ID: ____________ ☐ N/A
9. State ID: ____________ ☐ N/A

B. BILLING INFORMATION ☐ SAME AS GENERATOR

1. Billing Name: ____________________
2. Billing Address: ____________________
(City, State, ZIP) ____________________
3. Contact Name: ____________________
4. Email: ____________________
5. Phone: ____________ 6. Fax: ____________
7. WM Hauled? ☐ Yes ☐ No
8. P.O. Number: ____________________
9. Payment Method: ☐ Credit Account ☐ Cash ☐ Credit Card

C. MATERIAL INFORMATION

1. Common Name: ____________________

Describe Process Generating Material: ☐ See Attached

2. Material Composition and Contaminants: ☐ See Attached

1.	
2.	
3.	
4.	
Total composition must be equal to or greater than 100%	≥100%

3. State Waste Codes: ____________ ☐ N/A
4. Color: ____________________
5. Physical State at 70˚F: ☐ Solid ☐ Liquid ☐ Other: ________
6. Free Liquid Range Percentage: ________ to ________ ☐ N/A
7. pH: ________ to ________ ☐ N/A
8. Strong Odor: ☐ Yes ☐ No Describe: ____________
9. Flash Point: ☐ <140˚F ☐ 140˚–199˚F ☐ ≥200˚ ☐ N/A

D. REGULATORY INFORMATION

1. EPA Hazardous Waste? ☐ Yes* ☐ No
Code: ____________________
2. State Hazardous Waste? ☐ Yes ☐ No
Code: ____________________
3. Is this material non-hazardous due to Treatment, Delisting, or an Exclusion? ☐ Yes* ☐ No
4. Contains Underlying Hazardous Constituents? ☐ Yes* ☐ No
5. From an industry regulated under Benzene NESHAP? ☐ Yes* ☐ No
6. Facility remediation subject to 40 CFR 63 GGGGG? ☐ Yes* ☐ No
7. CERCLA or State-mandated clean-up? ☐ Yes* ☐ No
8. NRC or State-regulated radioactive or NORM waste? ☐ Yes* ☐ No

***If Yes, see Addendum (page 2) for additional questions and space.**

9. Contains PCBs? → If Yes, answer a, b and c. ☐ Yes ☐ No
   a. Regulated by 40 CFR 761? ☐ Yes ☐ No
   b. Remediation under 40 CFR 761.61 (a)? ☐ Yes ☐ No
   c. Were PCB imported into the US? ☐ Yes ☐ No
10. Regulated and/or Untreated Medical/Infectious Waste? ☐ Yes ☐ No
11. Contains Asbestos? ☐ Yes ☐ No
→ If Yes: ☐ Non-Friable ☐ Non-Friable – Regulated ☐ Friable

E. ANALYTICAL AND OTHER REPRESENTATIVE INFORMATION

1. Analytical attached ☐ Yes

Please identify applicable samples and/or lab reports:

2. Other information attached (such as MSDS)? ☐ Yes

F. SHIPPING AND DOT INFORMATION

1. ☐ One-Time Event ☐ Repeat Event/Ongoing Business
2. Estimated Quantity/Unit of Measure: ____________
☐ Tons ☐ Yards ☐ Drums ☐ Gallons ☐ Other: ________
3. Container Type and Size: ____________
4. USDOT Proper Shipping Name: ☐ N/A
____

G. GENERATOR CERTIFICATION (PLEASE READ AND CERTIFY BY SIGNATURE)

By signing this EZ Profile™ form, I hereby certify that all information submitted in this and all attached documents contain true and accurate descriptions of this material, and that all relevant information necessary for proper material characterization and to identify known and suspected hazards has been provided. Any analytical data attached was derived from a sample that is representative as defined in 40 CFR 261 - Appendix 1 or by using an equivalent method. All changes occurring in the character of the material (i.e., changes in the process or new analytical) will be identified by the Generator and be disclosed to Waste Management prior to providing the material to Waste Management.

If I am an agent signing on behalf of the Generator, I have confirmed with the Generator that information contained in this Profile is accurate and complete.

Name (Print): ____________ Date: ________
Title: ____________________
Company: ____________________

Certification Signature

Revised September 12, 2014

EZ Profile™ Addendum

Only complete this Addendum if prompted by responses on EZ Profile™ (page 1) or to provide additional information. Sections and question numbers correspond to EZ Profile™.

Profile Number: ______________

C. MATERIAL INFORMATION

Describe Process Generating Material (Continued from page 1): If more space is needed, please attach additional pages.

Material Composition and Contaminants (Continued from page 1): If more space is needed, please attach additional pages.

5.	
6.	
7.	
8.	
9.	
Total composition must be equal to or greater than 100%	≥100%

D. REGULATORY INFORMATION

Only questions with a "Yes" response in Section D on the EZ Profile™ form (page 1) need to be answered here.

1. EPA Hazardous Waste
   - a. Please list all USEPA listed and characteristic waste code numbers:
   - b. Is the material subject to the Alternative Debris standards (40 CFR 268.45)? ☐ Yes ☐ No
   - c. Is the material subject to the Alternative Soil standards (40 CFR 268.49)? → If Yes, complete question 4. ☐ Yes ☐ No
   - d. Is the material exempt from Subpart CC Controls (40 CFR 264.1083)? ☐ Yes ☐ No
     - → If Yes, please check **one** of the following:
       - ☐ Waste meets LDR or treatment exemptions for organics (40 CFR 264.1082(c)(2) or (c)(4))
       - ☐ Waste contains VOCs that average <500 ppmw (CFR 264.1082(c)(1)) – will require annual update.
2. State Hazardous Waste → Please list all state waste codes: ______________
3. For material that is Treated, Delisted, or Excluded → Please indicate the category, below:
   - ☐ Delisted Hazardous Waste
   - ☐ Treated Hazardous Waste Debris
   - ☐ Excluded Waste under 40 CFR 261.4 → Specify Exclusion: ______________
   - ☐ Treated Characteristic Hazardous Waste → If checked, complete question 4.
4. Underlying Hazardous Constituents → Please list all Underlying Hazardous Constituents:
5. Industries regulated under Benzene NESHAP include petroleum refineries, chemical manufacturing plants, coke by-product recovery plants, and TSDFs.
   - a. Are you a TSDF? → If yes, please complete Benzene NESHAP questionnaire. If not, continue. ☐ Yes ☐ No
   - b. Does this material contain benzene? ☐ Yes ☐ No
     - 1. If yes, what is the flow weighted average concentration? __________ ppmw
   - c. What is your facility's current total annual benzene quantity in Megagrams? ☐ <1 Mg ☐ 1–9.99 Mg ☐ ≥10 Mg
   - d. Is this waste soil from a remediation? ☐ Yes ☐ No
     - 1. If yes, what is the benzene concentration in remediation waste? __________ ppmw
   - e. Does the waste contain >10% water/moisture? ☐ Yes ☐ No
   - f. Has material been treated to remove 99% of the benzene or to achieve <10 ppmw? ☐ Yes ☐ No
   - g. Is material exempt from controls in accordance with 40 CFR 61.342? ☐ Yes ☐ No
     - → If yes, specify exemption: ______________
   - h. Based on your knowledge of your waste and the BWON regulations, do you believe that this waste stream is subject to treatment and control requirements at an off-site TSDF? ☐ Yes ☐ No
6. 40 CFR 63 GGGGG → Does the material contain <500 ppmw VOHAPs at the point of determination? ☐ Yes ☐ No
7. CERCLA or State-Mandated clean up → Please submit the Record of Decision or other documentation with process information to assist others in the evaluation for proper disposal. A "Determination of Acceptability" may be needed for CERCLA wastes not going to a CERCLA approved facility.
8. NRC or state regulated radioactive or NORM Waste → Please identify Isotopes and pCi/g: ______________

Revised September 12, 2014

THINK GREEN.

QUESTIONS? CALL 800 963 4776 FOR ASSISTANCE

WASTE MANAGEMENT

Additional Profile Information

Profile Number: ______________

C. MATERIAL INFORMATION

Material Composition and Contaminants (Continued from page 2): If more space is needed, please attach additional pages.

10.	
11.	
12.	
13.	
14.	
15.	
16.	
17.	
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28.	
29.	
30.	
31.	
32.	
33.	
34.	
35.	
36.	
37.	
38.	
39.	
40.	
Total composition must be equal to or greater than 100%	≥100%

D. REGULATORY INFORMATION

1. EPA Hazardous Waste
   a. Please list all USEPA listed and characteristic waste code numbers (Continued from page 2):

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APPENDIX IV-B

REGULATED ASBESTOS-CONTAINING MATERIAL (RACM) MANAGEMENT PLAN

PART IV – APPENDIX IV-B
REGULATED ASBESTOS-CONTAINING MATERIAL (RACM) MANAGEMENT PLAN

MESQUITE CREEK LANDFILL
COMAL AND GUADALUPE COUNTIES, TEXAS
PERMIT AMENDMENT APPLICATION
MSW PERMIT NO. 66C

Prepared for:
Waste Management of Texas, Inc.

Prepared by:

Geosyntec consultants

Texas Board of Professional Engineers Firm Registration No. F-1182
8217 Shoal Creek Blvd, Suite 200
Austin, Texas 78757
(512) 451-4003

SCOTT M. GRAVES
86557

10/11/2023

FOR PERMIT PURPOSES ONLY

October 2023

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REGULATED ASBESTOS-CONTAINING MATERIAL (RACM) MANAGEMENT PLAN

SCOTT M. GRAVES
86557

10/11/2023

FOR PERMIT PURPOSES ONLY

GEOSYNTEC CONSULTANTS, INC.
TEXAS ENG. FIRM
REGISTRATION NO. F-1182

1. INTRODUCTION

Regulated asbestos-containing material (RACM), as defined in 40 Code of Federal Regulations Part 61, is a type of special waste, has been accepted previously at this facility, and the operator intends to continue to accept RACM. This plan has been prepared to help ensure proper handling practices are used for the management of RACM during disposal operations at the Mesquite Creek Landfill. More specifically, this site-specific plan has been developed to provide specific operational guidance to protect the health and safety of landfill personnel and the surrounding environment during times that RACM is being handled, disposed, and/or otherwise managed at the facility. This plan may be expanded, modified, or adapted to incorporate any changes in environmental regulations at the federal, state, or local level.

The requirements, procedures, and criteria presented in this plan will be followed for the management of municipal and industrial sources of RACM wastes at the facility. This plan is intended to provide additional guidance to site personnel implementing the Site Development Plan (SDP) and Site Operating Plan (SOP) for the facility.

Clarifications and references to other plans:

- This plan addresses management, handling, and disposal requirements for RACM once it has been accepted at the facility. This plan does not address the waste acceptance process or the procedures for the prevention of acceptance/disposal of prohibited wastes. Refer to Section 5.6 of the SOP and the Special Waste Acceptance Plan (SWAP) provided in Appendix IV-A of the SOP for such requirements.

- This plan addresses RACM. The facility is also allowed to accept nonregulated asbestos-containing materials (non-RACM) as a special waste. The SWAP in Appendix IV-A of the SOP provides the handling and disposal criteria applicable to non-RACM.

- RACM that has been designated as Class 1 industrial waste due to its asbestos content is allowed to be accepted, provided such RACM waste is handled in accordance with the provisions of this plan, and that the operator complies with the provisions of 30 TAC §330.173(g) through (i).

2. DISPOSAL LOCATIONS

2.1 Areas to Receive RACM

The entire permitted waste disposal area of the landfill will be considered as the allowable RACM disposal area, subject to the location requirements indicated below.

- Bags or containers (or equivalent wrapping) holding RACM are preferred to be placed in landfill areas below natural grade. Below-grade placement must be in areas no closer than 3-ft to the bottom and sidewall liner and RACM.

- Should below natural grade placement not be possible or practicable, placement of bags or containers (or equivalent wrapping) holding RACM in landfill areas above natural grade will take place within interior landfill areas at least 20-ft away from any design finished sideslope of the unit. In addition, above-grade RACM disposal will be at least 10-ft below the design finished top final surface elevations of the unit. These precautions are to help ensure the RACM waste is not subject to future exposure through erosion or weathering of the immediate and/or final cover.

2.2 Surveying and Marking RACM Locations

Each area that is designated for RACM disposal will be surveyed and marked by a registered professional land surveyor prior to commencing RACM disposal operations. The site diagram will be revised to incorporate a new survey. A copy of the current site diagram identifying the RACM area will be maintained at the facility and will be revised as needed to include additional constructed areas as being disposal areas for RACM. As landfill cell construction and operations progress, the site diagrams will be revised and submitted to the TCEQ immediately upon their completion. The boundary locations of these RACM disposal areas will be marked in the field as the site diagram is revised.

3. OPERATIONAL REQUIREMENTS

3.1 Delivery, Unloading, and Placement

Delivery of RACM will be coordinated with the on-site supervisory (Site Manager or designee) so that the waste arrives at the facility at a known and scheduled/expected time so that adequate personnel and equipment are available so it can be properly handled and covered.

RACM must only be accepted at the facility if it is in tightly closed and unruptured containers or bags; or it must be wrapped with at least six-mil polyethylene. Loads that are improperly packaged will be refused for acceptance at the facility.

In general, a minor depression (i.e., about 3 to 5-ft feet deep) in the waste will be made with a dozer or compactor prior to unloading, or similarly, a cut may be made into the refuse working face that is deep enough to contain the volume of RACM anticipated.

The Site Manager or designee will supervise unloading of the RACM. The bags or containers holding the RACM must be carefully unloaded and placed in the final disposal location. Care will be taken to not rupture any bags or containers.

No waste will be accepted under this plan when it is foreseen that a disturbance of normal facility operations will occur.

3.2 Covering

Upon unloading, RACM must be covered immediately with a minimum of 12 inches of earthen material or 3-ft of solid waste containing no asbestos.

3.3 Recordkeeping

A record will be kept by the operator, documenting disposal location, depth, and volume of material of each load of RACM accepted and disposed of at the facility. Such records will be placed in the Site Operating Record.

4. CLOSURE OF LANDFILL UNIT – DEED RECORDING AND NOTICE

Upon final closure of the landfill unit that accepted RACM, a specific notation that the facility accepted RACM must be placed in the deed records for the facility with a site diagram identifying the RACM disposal areas. Concurrently, a notice of the deed recordation and a copy of the site diagram identifying the asbestos disposal areas shall be submitted to the Executive Director.

5. PERSONNEL PROTECTIVE EQUIPMENT

Protection from RACM will be accomplished by minimizing exposure. During typical unloading operations, facility operations personnel will remain inside equipment or upwind of the RACM disposal area. While not planned to occur, if personnel are outside their equipment while involved in unloading operations or other RACM handling (e.g., cleanup of spills) or are otherwise in immediate proximity to such areas, those personnel will use personal protective equipment including disposable Tyvek or similar coveralls, gloves when necessary, foot coverings when necessary, and wearing a filtered and National Institute of Occupational Safety Hazards (NIOSH) approved respirator for asbestos protection.

6. PERSONNEL TRAINING

Each employee involved in the receipt and disposal of RACM will receive training in the proper management of asbestos and RACM, what it is, and its potential health effects. The scope of training will include:

- Federal and state policies and regulations pertaining to RACM transportation and disposal;
- RACM waste acceptance procedures;
- Operating procedures and recordkeeping requirements provided in this document;
- Proper use of protective equipment; and
- Procedures for responding to spills, and review of the contingency plan in this document.

Training will be documented and records will be maintained as required.

7. CONTINGENCY PLAN

7.1 Spill Control

In the event that a bag, container, or load of RACM is ruptured ("spill") on-site during movement to the disposal area or before it can be covered at the working face, the Site Manager or designee will be immediately notified. The following response actions will take place:

- The area of the spill will be cordoned-off, affected operations stopped, and access limited to appropriately trained and properly outfitted personnel.
- Personnel involved with the response will be suited with appropriate personal protective equipment.
- The immediate spill area, and an area with a minimum diameter of at least 3-ft, will be wetted with water or a suitable wetting agent. In the event of windy weather, burlap, or appropriate material may be used.
- Handheld equipment will be used to sweep or scoop away visible signs of asbestos waste and contaminated surroundings. The materials obtained will be sealed within an appropriate bag or container and labeled, and disposed of in the landfill in accordance with the procedures set forth in this document.
- If the spill occurs on-site outside the limits of the landfill and the spill involves in excess of 1 pound of RACM, the National Response Center (NRC) and the central office of the TCEQ will be notified.

7.2 Disturbance of Previously Disposed RACM

Contractors and others conducting excavation or grading work close to the RACM disposal areas (e.g., landfill gas well installation or trenching, waste regrading, etc.) will be informed of the RACM disposal practices and locations. Should any planned intrusive work that could encounter and expose RACM be necessary in areas of previous RACM disposal, the operator's notice to TCEQ pursuant to 40 CFR 61.154(j) will be made prior to such potential disturbance. Also, the disposal location will be identified and personnel working in that vicinity will wear the appropriate protective clothing. Any excavated or exposed RACM will be handled in the same manner as if the waste had just been brought in for disposal (i.e., re-disposed of in a proper manner as outlined in this plan).

APPENDIX IV-C

LIQUID WASTE SOLIDIFICATION PLAN

PART IV – APPENDIX IV-C
LIQUID WASTE SOLIDIFICATION PLAN

MESQUITE CREEK LANDFILL
COMAL AND GUADALUPE COUNTIES, TEXAS
PERMIT AMENDMENT APPLICATION
MSW PERMIT NO. 66C

Prepared for:
Waste Management of Texas, Inc.

Prepared by:

Geosyntec
consultants

Texas Board of Professional Engineers Firm Registration No. F-1182
8217 Shoal Creek Blvd, Suite 200
Austin, Texas 78757
(512) 451-4003

SCOTT M. GRAVES
86557

10/11/2023

FOR PERMIT PURPOSES ONLY

October 2023

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LIQUID WASTE SOLIDIFICATION PLAN

SCOTT M. GRAVES
86557

10/11/2023

FOR PERMIT PURPOSES ONLY

GEOSYNTEC CONSULTANTS, INC.
TEXAS ENG. FIRM
REGISTRATION NO. F-1182

1. INTRODUCTION

1.1 Terms of Reference

This Liquid Waste Solidification Plan (LWSP) provides general instructions for site management and personnel to conduct liquid waste solidification operations in a manner consistent with the design of the facility, and with the Texas Commission on Environmental Quality's (TCEQ) rules to protect human health and the environment. The specific operational procedures outlined in this LWSP have been identified to aid in the solidification operations and in the implementation of this Plan. The LWSP for the facility will be maintained at the site as part of the Site Operating Record in an easily accessible location to allow the site operating personnel to review the LWSP as needed. The Site Manager has overall responsibility for the implementation of this LWSP. Wherever this LWSP describes procedures or tasks without naming a specific individual or position responsible for those tasks, the Site Manager shall have primary responsibility for those tasks. Where a specific position is responsible for a particular task, that responsibility is described. Otherwise, the Site Manager may assign any qualified personnel to accomplish the requirements of this LWSP.

1.2 Solidification Overview and Processing Area Location

The facility will accept allowable liquid wastes and will process the waste through solidification. Incoming waste loads will be evaluated for acceptance in accordance with the facility's waste acceptance procedures given in the Site Operating Plan (SOP). Once the waste is deemed appropriate for acceptance, drivers will be directed to the processing area where they will empty their liquid waste into the offloading basins for processing by mixing liquid waste with solidifying agent(s) in basins. After confirming that the processed waste has no free liquids (i.e., it passes the paint filter test), the solid waste will be disposed of at the working face.

Liquid waste processing will occur on-site at a portable/movable liquid waste processing area located on waste in Unit 2, above lined and approved landfill areas, and generally situated in proximity to the active working face. Because the location of the working face changes over time as waste placement progresses in the landfill, the location of the liquid waste solidification area will change accordingly. Solidification will take place within metal basins underlain by a 2-ft (min) thick layer of compacted clay-rich soil. The layout of the solidification area and a typical cross section is presented on a drawing included at the end of this plan (Drawing IV-C-1). As shown, the area will be surrounded by earthen containment berms, and within the containment area the ground surface will be graded to drain storm-water runoff towards a low side away from the basins but within the contained area.

2. WASTE ACCEPTANCE AND ANALYSIS

2.1 Acceptance Procedures and Properties and Characteristics of Waste

Only liquid waste streams authorized by the facility permit for disposal (once solidified/processed) and meeting applicable acceptance criteria will be accepted (unless otherwise authorized by rule, permit, order, or other approval of the TCEQ). The liquid wastes will be subject to the acceptance procedures and criteria described in Sections 5.5 and 5.6 of the SOP – along with further provisions required by the Special Waste Acceptance Plan (Appendix IV-A of the SOP). Subject to the foregoing, liquid waste streams that may be accepted for processing are summarized as:

- those specified in 30 TAC §§ 330.11(d) and 330.171(c)(7), including sludge, grease trap waste, grit trap waste, septage, or liquid wastes from municipal sources; and
- non-hazardous Class 2 industrial wastes that are liquid wastes, wastes that are not classified as bulk liquids but do not pass the paint filter test, and other non-hazardous bulk liquids.

2.2 Volumes

Initial liquid waste volumes are expected to be small as the market is developed. For facility planning purposes, over time the facility forecasts it may receive liquid waste at an estimated daily rate of approximately 125 cubic yards per day. This quantity is based on market projections, and is not intended as a limiting value; the actual daily quantity of liquid waste may be more or less than this estimated quantity. The solidification basins and their maximum dimensions are shown Drawing IV-C-1; the basins and general layout of the solidification area were developed to accommodate fluctuations in rates from day to day. Based on the basins shown on Drawing IV-C-1 and their maximum dimensions (and accounting for maintaining a minimum 1-ft of freeboard), the maximum theoretical capacity of each basin would be about 475 cubic yards. However, not all of this capacity would be taken up by liquid waste because the facility will need to maintain room in the basins for the addition and mixing of solidifying agents. As such, the maximum liquid waste volume in a given basin would be about 1/3 of the total capacity. As such, the maximum amount of liquid waste that may be stored at any one point in time is 950 cubic yards. Note that storage and processing times are addressed in Section 5.1 of this plan.

3. DESCRIPTION OF LIQUID WASTE PROCESSING OPERATIONS

3.1 Solidification Process

The solidification of liquid wastes will be accomplished by mixing and processing the liquid with a solidifying agent(s). Acceptable solidification agents include soil, lime, fly ash, cement kiln dust, Portland cement, dried sludge, sawdust, dirt, woodchips, auto fluff, dry material, other non-hazardous absorbent materials or any combination of these materials. Liquid waste trucks will discharge their waste directly into the solidification basins. Mixing will be accomplished using a backhoe or other appropriate machinery to combine the solidifying agent(s) with the liquid waste. When receipt of liquid waste and solidification operations are not occurring during a rainfall event, the basins will be covered to prevent the accumulation of rainfall within the basins, or the potential discharge of contaminated liquids from the basins.

After mixing, each batch of solidified material will be tested for free liquids in accordance with Method 9095 (Paint Filter Liquids Test), as described in "Test Methods for Evaluating Solid Wastes, Physical/Chemical Method" (EPA Publication Number SW-846), as amended. Upon verification that the solidified material passes the paint filter test, the mixture will be removed from the basin and transported to the landfill working face for disposal. In the event the solidified liquid does not pass the paint filter test, additional solidifying agent(s) will be added and mixed until the desired solidification is achieved.

3.2 Basin Inspections

At least once per month, each basin will be emptied and inspected for holes or other signs of damage, and if found the basin will not be used until repairs are made. Also, each month the earthen berms surrounding the solidification area will be visually inspected to check their integrity and dimensions, with repairs made as needed. Each time the portable/movable solidification area is moved and the associated basins are relocated, each basin will be inspected for holes or other signs of leakage. If holes are observed during inspection of the basin, the basin will be removed and the clayey soil pit within the waste will be observed for the presence of free liquids. If present, free liquids will be removed to an alternate basin, and the basin will be repaired or replaced prior to further use.

4. CONTAMINATED WATER MANAGEMENT

The facility will take the steps necessary to control and prevent the discharge of contaminated water from the liquid waste solidification area. Liquids associated with the solidification process will be managed and disposed of in a manner that will not cause surface water or groundwater pollution. Furthermore, the liquid waste solidification area will be operated in accordance with 30 TAC §330.15(h) regarding discharge of solid wastes or pollutants into waters of the United States.

Water coming in contact with waste will be treated as contaminated water and will be either solidified along with the waste contents of the basin or otherwise handled as contaminated water in accordance with the provisions of the facility Leachate and Contaminated Water Management Plan (Part III – Attachment 3E). Also, any washout water collected in the basins and rainfall collected in the basins that has come in contact with waste will also be solidified along with the waste contents of the basin (and in the timeframes indicated in Section 5.1), or removed from the basin within 24-hours and handled as contaminated water.

The portable/movable area will be surrounded by earthen containment berms as shown on Drawing IV-C-1, which will serve the function of providing both runon and runoff control. The contained area and the surrounding berms will be graded as shown on the drawing, and the containment berms will be at a constant top elevation around all four sides. By doing so, this will ensure that the runon from the 25-year, 24-hour storm event (i.e., about 7.4 inches) can be contained within the bermed area with additional freeboard provided.

5. STORAGE AND PROCESSING REQUIREMENTS

5.1 Liquid Waste Storage and Processing Times

The facility will not accumulate liquid waste in quantities that cannot be solidified within such time as will preclude the creation of odors, insect breeding, or harborage of other vectors, and as set forth below. Care shall be taken such that the storing of waste does not constitute a fire, safety, or health hazard or provide food or harborage for animals and vectors.

Pursuant to the above requirements, storage of liquid waste or contaminated water in the portable/movable basins will be a short-term interim period between when a load of liquid waste is received and discharged into the basin and when it is solidified. Accordingly, processing (solidification) of liquid wastes in these basins will be accomplished within an average (i.e., under typical operating conditions) of 24-hours of the waste being placed in the basin, and a maximum of 72-hours. The solidified waste will be removed the same day that solidification is completed, unless prevented by extreme and unsafe weather conditions. As previously mentioned, the intended destination of the solidified waste is on-site disposal at this landfill.

5.2 Approved Containers

Liquid waste entering the facility is typically transported in vacuum trucks, tanker trucks, or sealed containers. These are designed to prevent spillage or leakage during storage, handling, or transport. The solidification basins themselves will be recessed below grade and will be composed of the materials described on Drawing IV-7-1. Section 3.1 discussed how the basins will be covered to prevent the accumulation of rainfall within the basins. The solidification basins will be maintained in a manner so that they do not constitute a nuisance and to retard the harborage, feeding, and propagation of vectors.

6. RECORDKEEPING AND REPORTING REQUIREMENTS

The recordkeeping and reporting requirements set forth in Section 3 of the SOP apply to liquid waste processing. Additionally, the following information specific to the liquid waste solidification area and its operations will also be maintained in the Site Operating Record.

Records to be Maintained in the Site Operating Record[1]	Minimum Frequency
Results of basin inspection described in Section 3.2 of this LWSP.	Monthly
Additional analytical testing performed at the facility to verify compliance with this plan.	As needed

[1] In addition to the information required by Section 3.1 of the SOP.

7. FIRE PROTECTION PLAN

The Fire Protection Plan set forth in Section 6 of the SOP shall apply to the liquid waste solidification area, and as indicated therein, employees who work at this area shall be trained in its contents and use.

By its nature, the liquid wastes are not expected to be flammable (the liquid component of these wastes is primarily water, and any other chemical constituents are of low concentrations). As such, a dedicated supply of fire-fighting water at the liquid waste solidification area is not applicable. The fire prevention measures, fire-fighting procedures and associated equipment at the liquid waste solidification area will follow the general procedures of Sections 6.2 and 6.3 of the SOP.

8. OTHER OPERATIONAL PROCEDURES

Access Control

Access control to the liquid waste solidification area will be provided via the facility-side access control measures and procedures described in Section 7 of the SOP.

Waste Unloading Procedures

Once a load of liquid waste has been accepted, the liquid waste transport vehicle will be directed to the liquid waste solidification area by the Gate Attendant. Personnel working at the liquid waste solidification area will inspect the load and direct the transport vehicle to the proper solidification basin. The unloading of waste will be directed by personnel working at the liquid waste solidification area.

Spill Prevention and Control

As mentioned, the liquid waste processing area will be surrounded by earthen berms to prevent stormwater run-on and run-off, and these berms will also prevent migration of spills outside of the area. For incidental spills associated with the unloading and transfer of liquid waste in the processing area, the spill will be contained and cleaned up using soil or other available materials at the direction of the Site Manager or their designee. For larger spills, the Site Manager or designee will use mechanisms such as booms or diversionary dikes, or excavate holes or pits as needed to contain the spilled liquid. Once the liquids are removed to the solidification basin(s), a visual inspection of the spill area will be made, and soils observed to be potentially impacted will be over-excavated and disposed of.

Operating Hours

The liquid waste solidification area is allowed to operate during the operating hours of the facility (refer to Section 9 of the SOP).

Facility Sign

Facility signs will be placed in accordance with Section 10 of the SOP.

Control of Windblown Material and Litter

The liquid waste solidification area will be operated in such a way as to minimize windblown material, using the measures described below:

- In general, solidifying agents will be stored in close proximity to the liquid waste solidification basins to minimize the handling and transport of these materials. Care will be taken to minimize fugitive dust from the solidifying agents and mixing process. Any solidifying agents that are particularly fine-grained that could become windblown (e.g., fly ash, Portland cement) will be kept in a covered (e.g., tarped and anchored) stockpile or covered container when not in use, sprinkled with water, or stored on-site under an enclosed area.
- The solidification basins will be recessed below grade, which will help protect the mixing operation from wind and resulting potential for windblown waste.

Materials Along the Route to the Facility

The requirements that will be followed pertaining to control and cleanup of materials along the route to the facility are presented in Section 14 of the SOP.

Facility Access Roads

The requirements that will be followed pertaining to provision of facility access roads and related maintenance and mud/dust controls are presented in Section 18 of the SOP.

Noise Pollution and Visual Screening

The solidification of liquid waste will be conducted at the liquid waste solidification area, which will be situated on waste over lined areas. As such, the area will achieve the set-back buffers from the permit boundary, and this distance will help noise to be attenuated and provide a means of visual screening. The earthen containment berms surrounding the area will also provide a visual screen and will help to minimize adverse visual and noise impacts.

Overloading and Breakdown

In the event that equipment of critical importance breaks down or is otherwise unavailable, equipment with equivalent performance that is performing a non-critical function may be temporarily reassigned to the critical function until the primary equipment is repaired. The site will limit the receiving of liquid wastes when a significant work stoppage occurs. Under such circumstances, the transporter of the incoming liquid waste will be informed that they should divert their load to another facility. If the work stoppage is anticipated to last long enough to create objectionable odors, insect breeding, or harborage of vectors, steps will be taken to remove the accumulated waste materials from the liquid waste solidification area to an approved permitted offsite disposal facility.

Sanitation

When in use, the solidification basin surfaces that have come in contact with waste will be washed down on a weekly basis at the completion of processing. During times when the solidification area is operating on a continuous basis, the solidification basin surfaces that have come in contact with waste will be washed down at least two times per week. Wash water will be contained within the mixing basin and will be solidified with the liquid waste material within the timeframes indicated in Section 5 of this plan, or will be removed from the mixing basins and managed as contaminated water in accordance with the Leachate and Contaminated Water Management Plan.

Ventilation and Air Pollution Control (including Odor Control)

No significant air pollution emissions are expected to result from the operation of the solidification area based on the operator's experience with the liquid waste streams and the operational techniques that will be employed. The continuous process of liquids handling, solidification/processing, and removal are expected to minimize the chance for "stagnation" of liquid and any odors that could result. As previously noted, care will be taken to minimize and mitigate fugitive dust from the solidifying agents and mixing process. The liquid waste solidification operation will be conducted in accordance with applicable provisions of the facility's air permit.

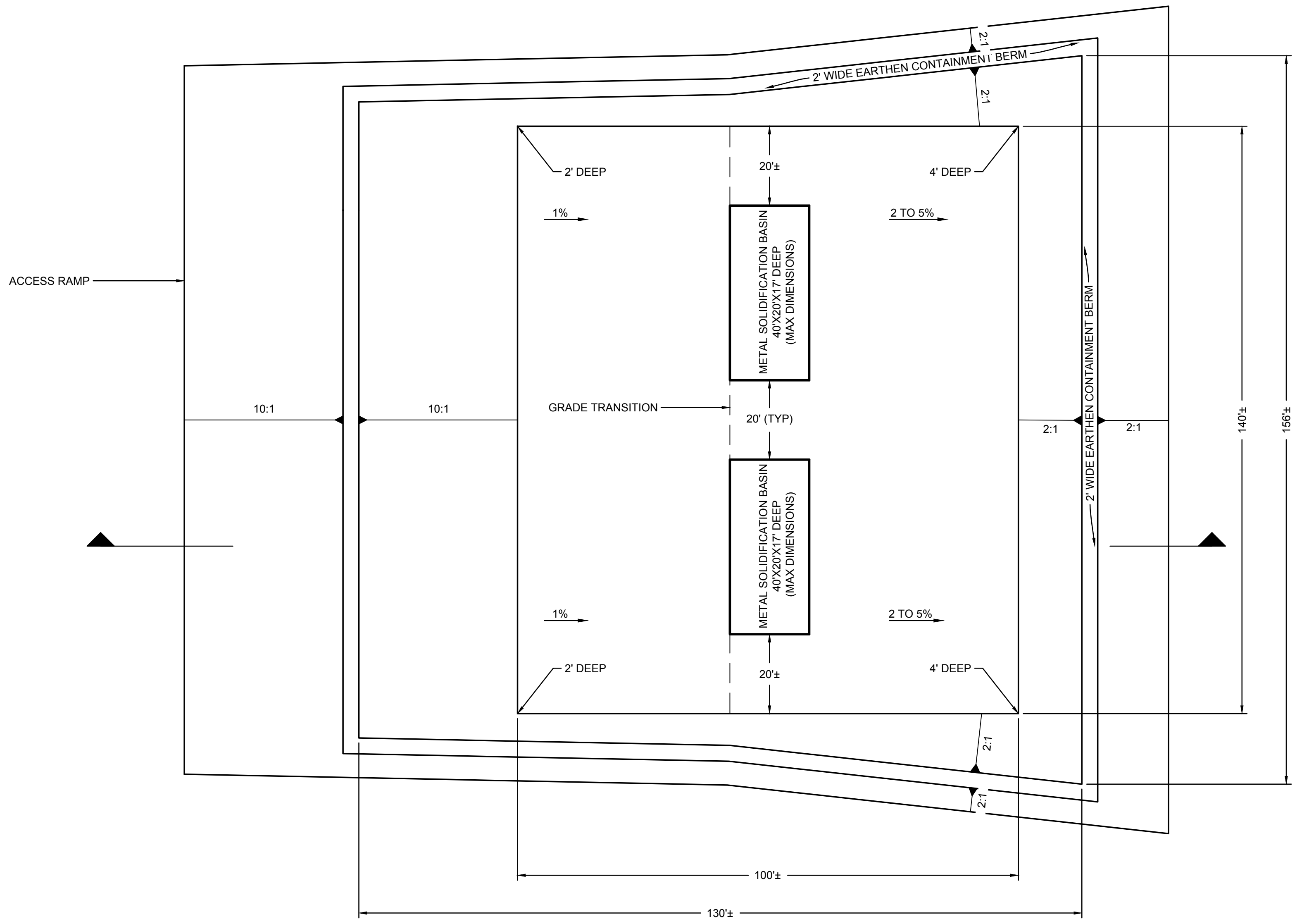
The solidification area is designed to be conducted under ambient conditions (i.e., outdoors) and as such will have natural ventilation to the atmosphere. Accordingly, it will be operated to provide adequate ventilation for odor control and employee safety. The operator will prevent nuisance odors from leaving the boundary of the facility. If nuisance odors are found to be passing the facility boundary, the site will immediately take action to abate the nuisance, for example, by promptly solidifying and disposing of the odorous material.

Health and Safety

Personnel training requirements that will be followed are set forth in Section 5.4 of the SOP. This will include training on health and safety topics.

Employee Sanitation Facilities

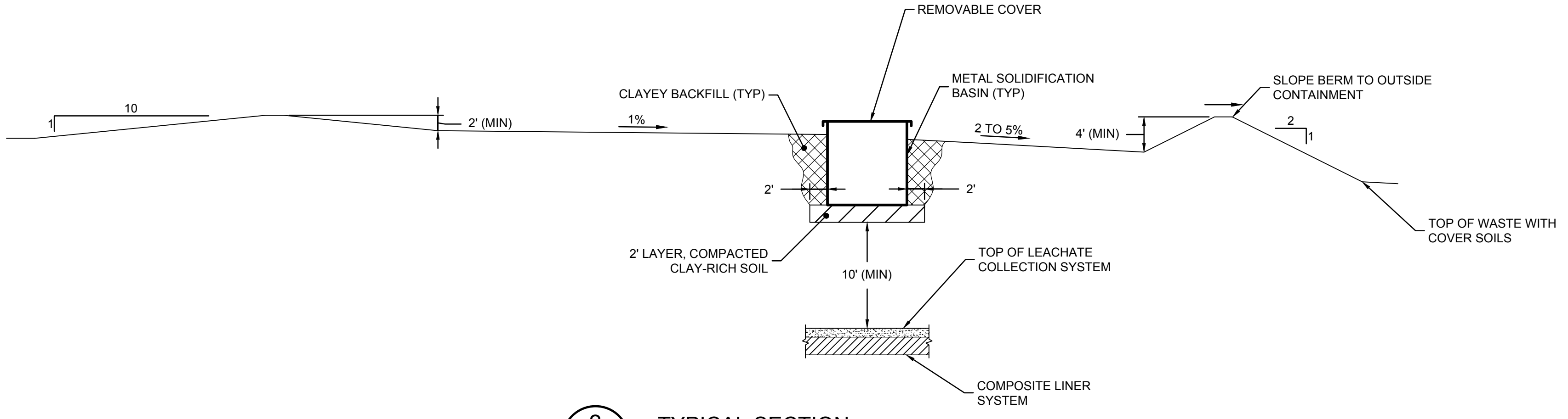
Potable water and sanitary facilities are provided for all employees and visitors and are located at the facility's office/scale house.



1 / IV-C-1 PLAN

PORTABLE MOVABLE LIQUID WASTE SOLIDIFICATION AREA

SCALE: N.T.S.



2 / IV-C-1 TYPICAL SECTION

METAL SOLIDIFICATON BASIN

SCALE: N.T.S.

NOTES:

1. ACTUAL PAD BERM DIMENSIONS MAY VARY, BUT BERM HEIGHTS AND CONSTANT TOP ELEVATION MUST BE MAINTAINED. IN DOING SO, THIS AREA WILL CONTAIN THE 25-YR, 24-HR STORM EVENT OF 7.4 INCHES WITH AT LEAST 1 FOOT OF FREEBOARD.
2. ADDITIONAL BASINS MAY BE ADDED WITHIN THE SOLIDIFICATION AREA AT THE FACILITY'S DISCRETION TO ACCOMMODATE WASTE QUANTITIES NEEDING SOLIDIFICATION.
3. METAL SOLIDIFICATION BASINS SHALL BE ROLL-OFF CONTAINER OR SIMILAR METALLIC BOX, REINFORCED WITH STEEL PLATES WELDED TO ALL INTERIOR WALLS AND BASE, OR EQUIVALENT PREFABRICATED METAL BINS, TRUCK BEDS, OR BASINS.

SCOTT M. GRAVES
86557

10/11/2023

FOR PERMIT PURPOSES ONLY

REV	DATE	DESCRIPTION	DRN	APP

WASTE MANAGEMENT
WASTE MANAGEMENT OF TEXAS, INC.
1700 KOHLENBERG ROAD
NEW BRAUNFELS, TEXAS 78130
PHONE: 830.625.7894

Geosyntec
consultants
GEOSYNTEC CONSULTANTS, INC.
TEXAS ENG. FIRM REGISTRATION NUMBER 1182
8217 SHOAL CREEK BLVD, SUITE 200
AUSTIN, TEXAS 78757
PHONE: 512.451.4003

TITLE:
PORTABLE-MOVABLE LIQUID WASTE SOLIDIFICATION AREA

PROJECT:
MESQUITE CREEK LANDFILL EXPANSION
PERMIT AMENDMENT APPLICATION - MSW PERMIT NO. 66C

PERMIT DRAWING

PROJECT NO.:	GW8636	DESIGN BY:	SMG	REVIEWED BY:	YB	PART NO.:	IV	DRAWING: IV-C-1
FILE:	GW8636PIV-C-1	DRAWN BY:	JJV / KH	APPROVED BY:	SMG			

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