MONITORING WELL VDM-9 DECOMMISSIONING AND REPLACEMENT

Vanchlor Landfill
Town of Lockport
Niagara County, New York

REPORT

Submitted To: VanDeMark Chemical Inc.
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July 11, 2014 **14-03185**

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1.0 INTRODUCTION

Golder Associates Inc. (Golder) has prepared this report which describes the activities associated with the abandonment and re-installation of groundwater monitoring well VDM-9 at the Vanchlor Company Inc. (Vanchlor) closed landfill located in the Town of Lockport, New York.

Pursuant to Part 373 requirements of Title 6 of the New York Codes, Rules and Regulations (6 NYCRR),

VanDeMark Chemical Inc. (VanDeMark) performs semi-annual groundwater monitoring and related monitoring and maintenance services under an agreement with Vanchlor. This monitoring was required under the former RCRA post closure permit and will be continued as part of a Site Management Plan that is being prepared under a Consent Order that will replace the RCRA permit. Golder was retained by VanDeMark with approval from Vanchlor to provide well abandonment/relocation oversight services for existing site groundwater-monitoring well VDM-9 at the Vanchlor Landfill.

VanDeMark personnel had observed that the well water production had recently been decreasing significantly during sampling events and the well riser integrity was compromised making collection of representative samples more and more difficult. VanDeMark discussed the status of the well with Mr. Stan Radon of the New York State Department of Environmental Conservation and it was agreed that the well should be abandoned and replaced with an equivalent groundwater monitoring well (VDM-9R).

As part of this project, one (1) existing groundwater monitoring well, VDM-9, was decommissioned and replaced approximately 10-feet to the east of the original well location. No other wells were decommissioned or installed at this location.

The VDM-9 monitoring well abandonment and replacement well installation was performed in general accordance with the NYSDEC CP-43: Groundwater Monitoring Well Decommissioning Policy. .

1.1 Site Description and Background

The following section is excerpted from the semi-annual water quality data evaluation reports prepared by VanDeMark.

Vanchlor Landfill is located between Mill Street and Eighteen Mile Creek in Lockport, New York. The landfill consists of a 2.5 acre plateau located on a bluff approximately 80 feet above Eighteen Mile Creek. The landfill was closed during the summer of 1988 in accordance with the NYSDEC approved closure plan. Closure was designed to minimize the potential for hazardous constituents to be leached from the wastes and released to the groundwater. Vanchlor is required to monitor the effectiveness of the final cover system, inspect and maintain the integrity of the final cover, and continue to conduct groundwater monitoring for a minimum of 30 years from the date of closure. Vanchlor contracts with VanDeMark to perform the annual monitoring and maintenance activities.

Groundwater monitoring is performed on a semiannual basis in accordance with Module IV of the RCRA permit. The groundwater monitoring program has been designed to assess groundwater quality impacts at the landfill site. The groundwater monitoring program consists of sample collection and analysis of groundwater from monitoring wells VDM-9, VDM-10, VDM-11, VDM-14 and D-55 (background) for volatile organic compounds and select inorganic parameters. Samples are also collected from Eighteen Mile Creek just downstream of the site. Groundwater and surface water from Eighteen Mile Creek is analyzed for volatile organic compounds, metals and pH.

The groundwater quality for each analytical parameter at each well location is compared to background water quality data for down gradient monitoring wells having compounds with concentrations exceeding groundwater protection standards. A statistical method is used to evaluate long-term changes in groundwater quality by plotting the life of the well trend for wells for each the compounds in the groundwater protection standards.

1.2 Purpose

The purpose of this report is to provide an overview and description of the VDM-9 monitoring well abandonment and replacement well installation procedures that were completed as part of this project. This report is organized in a format to provide the following information:

- The scope of work completed;
- Information regarding methods employed for the abandonment of existing site groundwater monitoring well VDM-9;
- Information regarding methods employed for the installation of replacement site groundwater monitoring well VDM-9R; and

2.0 MONITORING WELL DECOMMISSIONING

As mentioned in Section 1.0, monitoring well VDM-9 was decommissioned and replaced with an equivalent well into the underlying bedrock unit. Monitoring well decommissioning was performed by Nothnagle Drilling (Nothnagle) and decommissioning activities were overseen by Golder and VanDeMark personnel.

The monitoring well decommissioned (VDM-9) was reportedly installed in 1983 using 4.25-inch inside diameter (ID) hollow stem augers (HSAs). Well decommissioning was performed by Nothnagle using 6.25-inch ID HSAs to overdrill the borehole.

The following activities and procedures were performed to complete VDM-9 well decommissioning:

- Placement of a temporary stone drilling platform constructed on side slope around existing well in preparation for decommissioning activities;
- Overdrilling of the well to eight (8)-feet bgs using 6.25 inch ID HSAs, with minimal to no concrete surface seal present;
- Removal (pulling) of the majority of well assembly (14.5-ft of solid casing) from hole;
- Grouting of the remaining well casing and screen section (5-feet) in place within the borehole;
- Backfilling of the borehole from the bottom of the borehole with grout placed using tremie methods to near ground surface (see decommissioning log presented in Appendix B); and,
- Placement of soil in the remaining portion of borehole.
- Removal and surface restoration of the temporary stone drilling bench following installation of replacement well (see Section 3.0 below).

It should be noted that due to the placement of a stone drilling bench around the well on the south slope of the landfill for safe drilling purposes, the referenced well was only overdrilled to approximately eight (8) feet into the well borehole to minimize the potential for undermining the stone drilling bench during auger removal. Prior to overdrilling existing well VDM-9 with 6.25-inch ID HSAs, the driller attempted to insert AW-size drilling rods down the inside of the 2-inch outside diameter (O.D.) PVC well riser casing but was unable to lower the rods due to the undersized inner casing annulus of the well. Therefore, approximately 40-50% of the well riser was able to be pulled out after overdrilling with augers and the remaining well assembly, including the 5-foot screened section, was grouted in place within the borehole, following approval by the NYSDEC. Cuttings and well materials were placed at the well location for management and disposal by VanDeMark

A monitoring well decommissioning field log and a marked-up copy of the monitoring well installation diagram was prepared for well VDM-9. The forms summarize the materials used to decommission the

well and the length of the well overdrilled. The monitoring well decommissioning field log as prepared by Golder and the marked-up copy of the monitoring well installation log are presented in Appendix A. The VDM-9 well decommissioning and VDM-9R replacement well installation field notes are provided in Appendix B.

3.0 MONITORING WELL INSTALLATION PROCEDURES

3.1 General

This section of the report outlines the general procedures followed for installation of the replacement overburden groundwater monitoring well, in accordance with the NYSDEC guidance for new well installations and to be consistent with the installation approach used for the original well where feasible. One well was installed as part of this project and installation oversight for replacement well VDM-9R was provided by Golder.

Nothnagle installed the replacement groundwater monitoring well, with Golder providing field oversight of the drilling and well installation activities. Drilling activities for well installation were completed on May 29, 2014. The installed well location is depicted on Figure 2.

3.2 Installation of Bedrock Replacement Well

Replacement well VDM-9R was installed to approximately the same depth as the original well location for VDM-9 (i.e., approximately 31 feet below grade surface [bgs]) into the underlying weathered bedrock unit and is designated as a replacement well (R). The following is a discussion of the procedures that were used to install the bedrock unit well at replacement well location VDM-9R:

1. All drilling equipment (i.e., drill rig, all tools and tool boxes, and all drill rods, plugs, water tank and augers) was decontaminated with potable water using a pressure washer prior to arrival on site. Decontamination procedures are discussed in Section 3.4 of this report.

2. The drillers and Golder's oversight geologist arrived at the landfill site and prepared the rig for drilling. The well location was staked by Golder and VanDeMark personnel to minimize the distance from the original VDM-9 location but provide a sufficient buffer (i.e., 8-10 feet) to minimize potential impacts from the grouting of the decommissioned well. The bedrock unit replacement well VDM-9R was installed (per specifications) no more than ten feet east of the corresponding abandoned well VDM-9, parallel with the southern embankment of the landfill.

3. Drilling began with 4¼-inch inside diameter HSAs. No split spoon sampling was performed during drilling activities for the replacement well installation.

4. Drilling with HSAs continued to approximately 11-feet below ground surface (bgs). Driller then switched over to rotary bit air-drilling using a 3 $^{7/8}$-inch tri-cone roller bit due to difficult augering conditions encountered. Rotary bit drilling continued until target depth was reached and saturated conditions were encountered in the bedrock unit (based on existing soil boring log for original well VDM-9).

5. Total depth of the boring was measured and the borehole was prepared for installation of the monitoring well.

6. Drilling rods were pulled from the borehole prior to well installation.

7. The well screen and riser, being cleaned, wrapped, and heat sealed at the factory, were not steam cleaned prior to installation.

8. The well was constructed of two-inch inside diameter (ID) schedule 40 polyvinyl chloride (PVC) riser and five-foot machine-slotted PVC screen with a slot opening of 0.01-inches (10 slot). Screen and riser pipe sections were threaded together (hand-tightened) to construct the well and the factory installed Viton "O" rings on the male ends of the screens and risers were left in place prior to threading the pipe sections together. The well was installed in such a way that the top of the well had approximately a 30-inch stickup above ground surface. The screen and riser pipe sections were placed into the borehole with both end caps in place.

9. #0 N Morie graded sand was next dropped to the bottom of the borehole from the surface through the annulus of the HSAs with frequent and careful measurements of the sand pack thickness. The sand pack was allowed to settle for a minimum of 20 minutes. The sand pack, when complete, was extended a minimum 2 feet above the well screen within the borehole.

10. A layer of dry bentonite chips approximately three feet thick was added above the sand pack. Since the bentonite seal was placed above the ground water level within the borehole, potable water was added to hydrate the bentonite chips. The chips were allowed to hydrate for approximately 30 minutes and the depth to the top of the bentonite seal was measured and recorded.

11. Grout slurry composed of bentonite, cement, and water was mixed in general accordance with the following specifications:

    1.5% to 3.0% weight - Dry Bentonite
    40% to 60% weight - Cement (Portland Type I)
    35% to 55% weight - Potable Water

    Bentonite and water were premixed prior to adding cement.

12. The grout slurry was pumped under pressure into the borehole up to within 1 foot of the ground surface (below the 4-foot thick temporary stone drilling bench).

13. Upon removal of the stone drilling bench, the area for the well seal was excavated around the well and an 18-inch diameter “sono tube” was placed into the excavation to a minimum depth of approximately 1-foot. The area around the sono tube was backfilled with excavated soil. The sono tube was then filled with cement to a depth of approximately 1-foot, (approximately the top of cement/bentonite grout) and shaped at the surface to prevent surface runoff from ponding and entering the well protective casing.

14. A four inch diameter, anodized stainless steel square protective casing with locking cap was pushed into the cement surface so that the top of the protective casing was from a minimum of 0.5 foot above the top of the riser pipe. A drain hole was drilled into the protective casing near the bottom of the casing.

15. A lock was subsequently placed on the well protective casing.

Material quantities were also recorded for replacement well VDM-9R installation on the well installation log, including the amount of sand, bentonite pellets, grout, length of well screen and riser pipe footage.

The location of the well, elevation of the ground surface and the top of the riser pipe will be surveyed by VanDeMark.

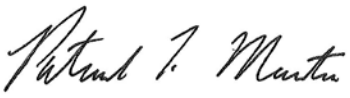
The well installation log prepared by Golder is provided as Appendix C. A photo log of the decommissioning and well replacement activities is provided in Appendix D.

3.3 Decontamination of Drill Rig and Equipment

Drilling equipment (i.e. drill rig, tools, drill rods, plugs and augers) used during the drilling program was decontaminated prior to decommissioning of the original well, between wells, and at the completion of the project. Decontamination was performed with potable water using a pressure washer at the drilling contractor's maintenance shop upon demobilization from site.

GOLDER ASSOCIATES INC.

Russell J. Marchese
Senior Project Geologist

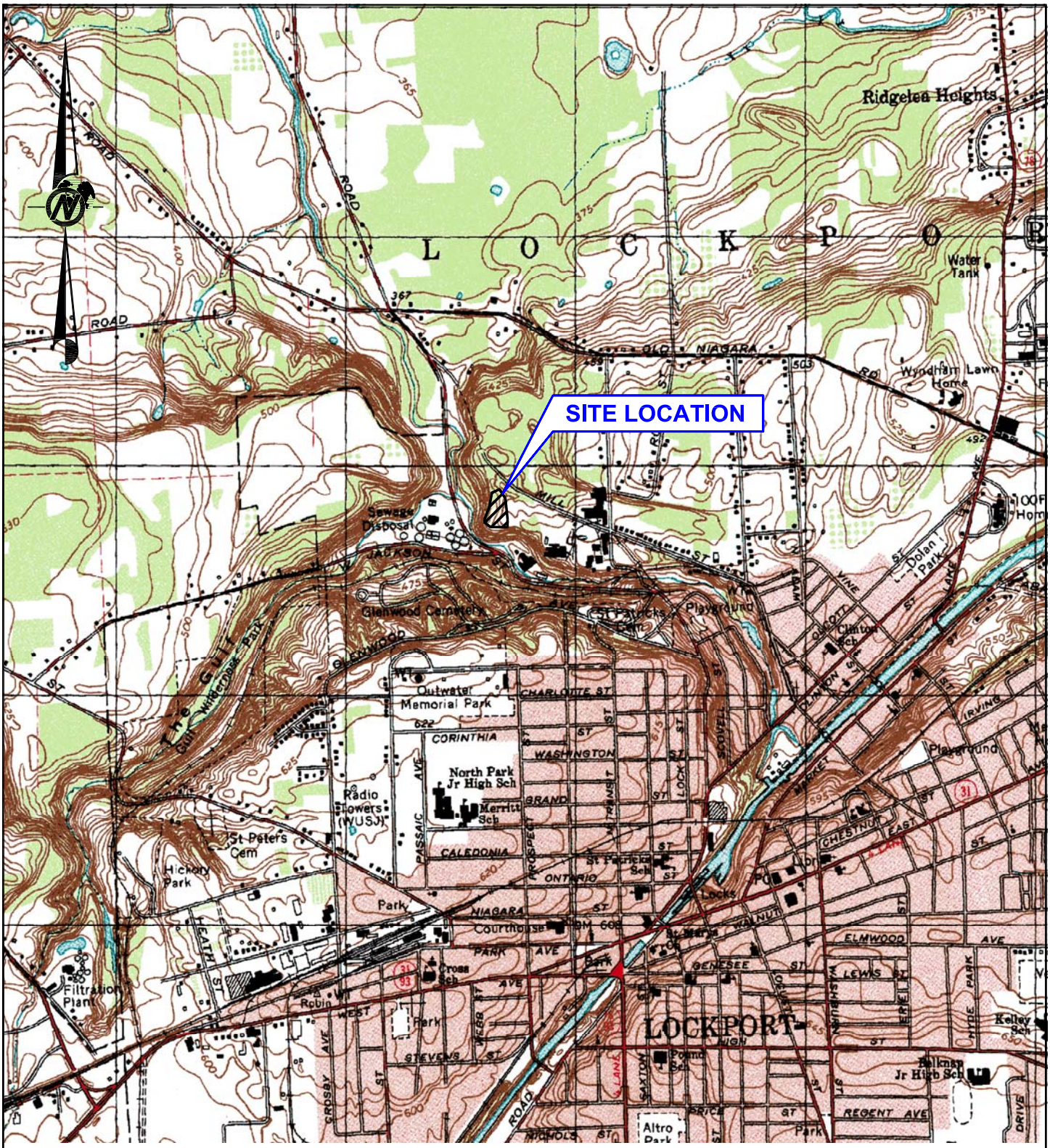


Patrick T. Martin, P.E.
Associate & Senior Consultant

4.0 REFERENCES

VanDeMark Chemical Inc., June 2012, “Semi-Annual Post-Closure Water Quality Data Evaluation Report, Vanchlor Landfill, Lockport, New York

FIGURES



REFERENCES

1.) BASE MAP TAKEN FROM U.S.G.S. 7.5 MINUTE QUADRANGLE OF LOCKPORT, NEW YORK DATED 1980.

2000 0 2000
SCALE FEET

Golder Associates
Buffalo, New York

SCALE	AS SHOWN
DATE	7/11/14
DESIGN	AML
CADD	JGT
CHECK	
REVIEW	

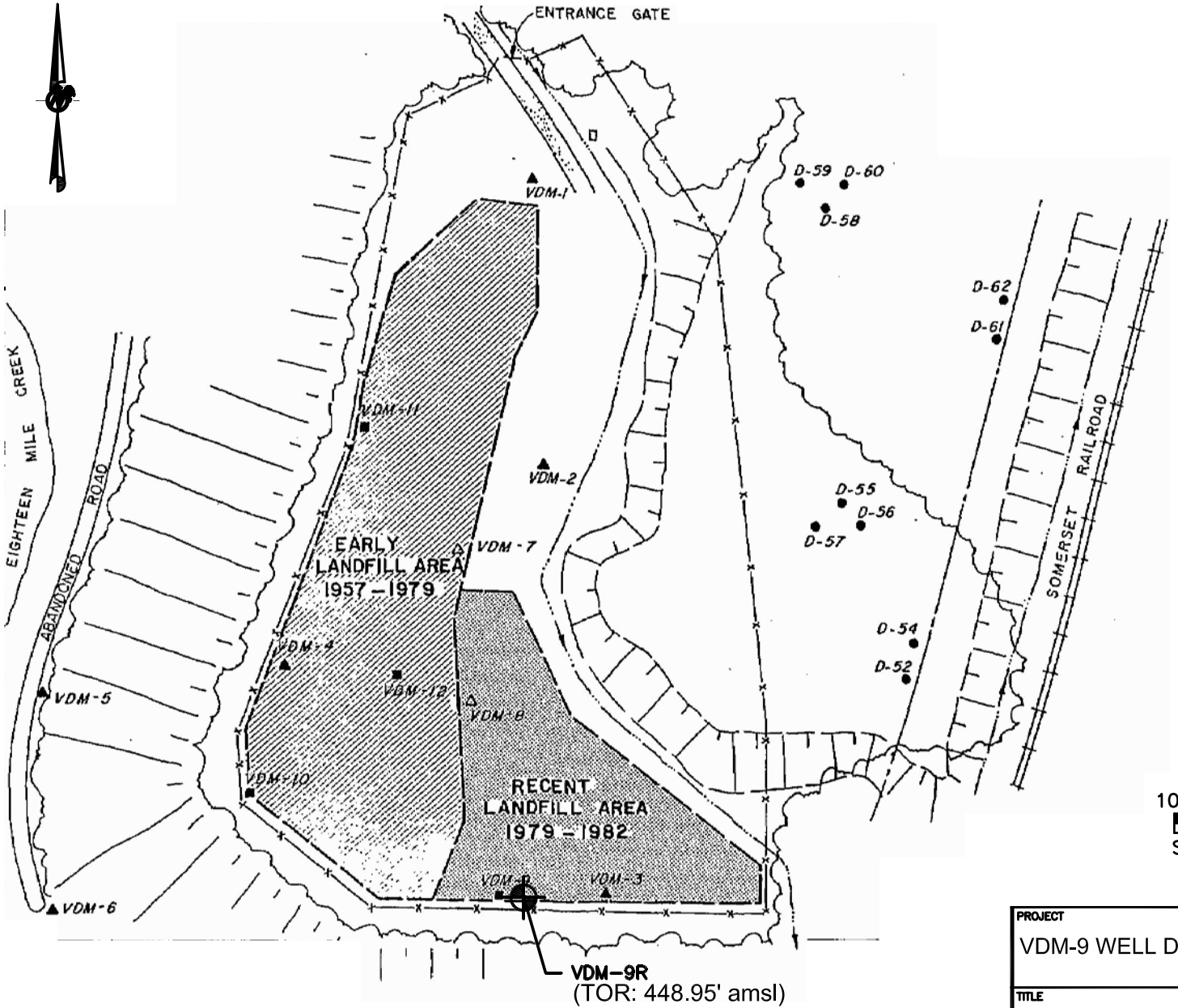
TITLE

SITE LOCATION MAP

FILE No.	1403185A224		
PROJECT No.	1403185	REV.	0

VANCHLOR CO. INC.

FIGURE 1



LEGEND

FENCE

MONITORING WELL LOCATION

100 0 100

SCALE FEET

REFERENCE

1.) BASE MAP SOURCE IS FIGURE 2, EARLY AND RECENT LANDFILL AREAS, VANDEMARK LANDFILL CLOSURE PLAN, CONESTOGA–ROVERS ASSOCIATES, FEBRUARY 1987.

2.) ELEVATION OF VDM–9R MEASURED FROM TOP OF RISER. (TOR)

3.) VDM–9R XY COORDINATES: n:1160547.2. e:1116396.7 (NAD83, NYSTATE PLANE)

PROJECT

VANCHLOR CO. INC.
VDM-9 WELL DECOMMISSIONING AND REPLACEMENT
LOCKPORT, NEW YORK

TITLE

REPLACEMENT WELL VDM-9R LOCATION MAP

Golder Associates
Buffalo, New York

PROJECT No.		1403185	FILE No.	1403185A224
DESIGN	PTM	6/25/14	SCALE AS SHOWN	REV. 0
CADD	GS/RJM	6/25/14		
CHECK	RJM	7/7/14		
REVIEW				

FIG 2

APPENDIX A

MONITORING WELL DECOMMISSIONING FIELD FORM AND MARK-UP OF ORIGINAL WELL INSTALLATION LOG

Golder Associates

WELL DECOMMISSIONING FORM

WELL NO. VDM-9

WELL INFORMATION

WELL INSTALLED BY	EARTH DIMENSIONS, INC.	DATE INSTALLED	December 9, 1983
DESIGN WELL DEPTH	31-FT btoc	MEASURED DEPTH	30.4-FT btoc
DEPTH TO WATER	23.95-FT btoc	WELL CASING TYPE	Sch. 40 PVC
INSIDE CASING DIA.	2-INCH	INSIDE CASING DEPTH	23.0-FT
SCREEN TYPE	Sch. 40 PVC 0.01-slot	SCREEN LENGTH	5-ft.
SURFACE CASING TYPE	Steel	SURFACE CASING DIA.	4-inch
BOREHOLE DIA.	8-inch	(KNOWN OR ASSUMED)	Assumed

DECOMMISSIONING INFORMATION

DECOMMISSIONING SUPERVISED BY	R. Marchese	DATE	5/29/2014
SURFACE CASING REMOVED?	Yes		
WELL CASING REMOVED?	Yes	(**PULLED OUT**-DRILLED OUT)	
OVERDRILLING METHOD	6 1/4-inch H.S.A.	DRILL RIG	CME-55 ATV
OVERDRILL DEPTH	8-Ft.	OVERDRILL DIA.	10-inch
GROUT TYPE	Portland	GROUT MIX RATIO	3-bags Portland
CALCULATED VOLUME REQUIRED	~40-50 gallons		~1/4-bag Bentonite
VOLUME TAKEN	~50-gallons tremied under pressure		

COMMENTS Began overdrilling well on 5/29/14; began by overdrilling steel surface casing with 6 1/4" I.D. HSAs through approx. 4-ft. thick stone drilling bench on slope; reached depth of approximately 8-ft. bgs with augers. Driller noted he will stop drilling for safety concerns when retrieving augers through stone drilling platform (potential for undermining drilling rig pad. Drillers note PVC well casing appears to be grouted to inside of steel protective casing. Attached slip strap to PVC casing inside steel casing and pulled out with rig winch. Steel casing removed with 14.5-ft. of PVC well casing; well assembly broke at threaded section. Call to Golder PM to confirm grouting remaining well assembly (including screen section) in place within borehole. Augers removed after grouting. Grouted borehole on 5/29/14 with approx. 50-gallons cement/bentonite grout. Protective casing, well casing and drill cuttings left at well site by Nothnagle for disposal by VDM. Upper 3-4 feet of borehole in filled with soil cuttings and stone pad later removed by Oregan's Contracting.

JOB NUMBER:	***14-03185***	**MADE BY:**	R. Marchese
PROJECT:	**VDM/LF Well Replacement/NY**	**DATE:**	5/30/2014

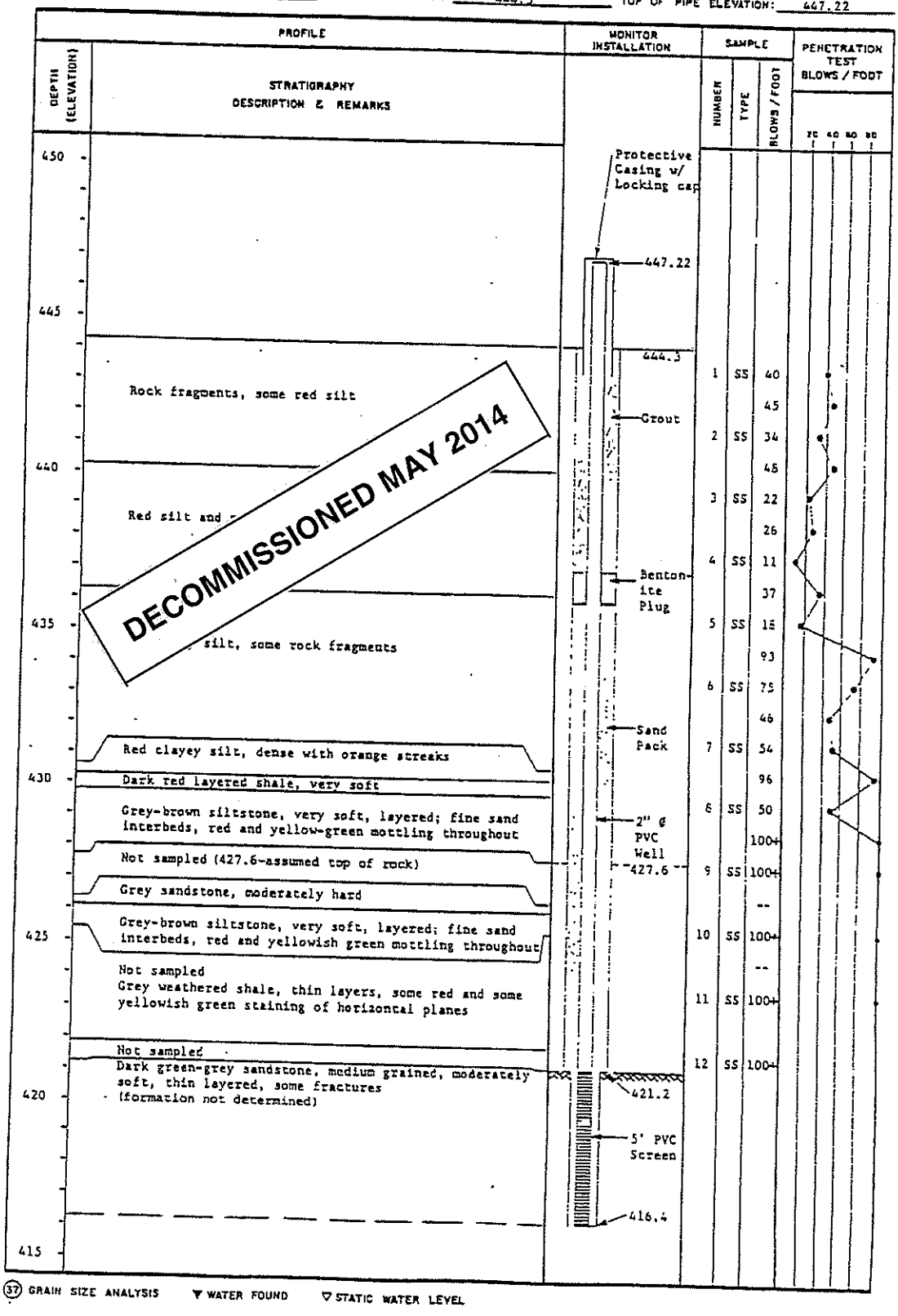
STRATIGRAPHIC AND INSTRUMENTATION LOG

PROJECT NAME: VAN DE MARK LANDFILL SITE JOB NO.: 1277 HOLE NO.: VDH-9

CLIENT: VAN DE MARK CHEMICAL COMPANY DATE COMPLETED: DECEMBER 9, 1983

HOLE TYPE: 8" ø HOLLOW STEM AUGER LOCATION: MID-SOUTHERN LIMIT OF LANDFILL

GEOLOGIST / ENGINEER: DAVE BLACK GROUND ELEVATION: 444.3 TOP OF PIPE ELEVATION: 447.22



(37) GRAIN SIZE ANALYSIS ▼ WATER FOUND ▽ STATIC WATER LEVEL

APPENDIX B

DECOMMISSIONING AND REPLACEMENT WELL INSTALLATION FIELD NOTES

14-03185

57°F, P.Cloudy — VanDemark Well Replacement — 5/29/14

0820- Arrive @ guard shack & sign in
↳ Brian Low stops down to provide access to landfill area

0835- Nothnagle Drillers (Zimmerman crew) arrive. Head up to landfill area. (Rubber tracked ATV CME-55)
Tom Mangefrida, John Wilkins (Nothnagle).

0850- Mob rig in to well VDM-9; assess stone bench around drilling area w/ Brian Low (Kerry).
↳ will need additional stone placed further to the west of VDM-9 by Oregon's Contracting

0925- Call to P. Martin to update.
↳ we will start augering for replacement well VDM-9R in the meantime.
→ New well location approx. 8-10 Ft to east of existing well VDM-9.

1000- Current depth @ VDM-9R approx. 11-Ft bgs; driller will switch to air rotary due to encountering harder till. For safety reasons, augering further may undermine stone drill bench.
↳ Switch drilling head over to air rotary setup.
↳ Air-hammer attachment: 3 7/8" air rotary tri-cone

1025- Begin air-rotary drilling from ~~11+ Ft bgs~~ 4 1/4" HSAs set to approx. 11-Ft bgs.

58°F, Overcast 14-03185

VOM-9R Drill Log Start: 0945 5/29/14

Depth	PID	Notes:
0-2 Ft.	0.0 ppm	(Stone bench)
2-5 Ft.	0.0 ppm	(Stone bench) - ground @ approx 4 FT below stone pad.
5-8 Ft.	0.0 ppm	(Native Soil).
8-11 Ft.	0.0 ppm	(Hard till) - Top of augers reading
11-15 Ft.	0.0 ppm	(3 7/8" tri-cone drilling).
15-18 Ft.	0.0 ppm	tri-Cone, dry cuttings
18-21 Ft.	0.0 ppm	" " , dry cuttings
21-24 Ft.	0.0 ppm	" " , dry cuttings
24-27 Ft.	0.0 ppm	" " , dry cuttings
27-30 Ft	0.0 ppm	" " , " "
30-33 Ft.	0.0 ppm	" " , " "
33-34 Ft.	0.0 ppm	" " , " "

VOM-9 Drill Log 5/29/14

0-2 Ft.	0.0 ppm	(Pre-casing)
2-5 Ft.	0.0 ppm	dry cuttings.
5-8 Ft.	0.0 ppm	
8-11 Ft.	0.0 ppm	
		* pulled out casing.

14-03185

63°F, Overcast VOM-9R Well Replacement 5/29/14

1050 - Current depth @ 24-Ft bgs; will drill to target depth of 28-Ft. bgs and assess groundwater conditions.
↳ Dry drill cuttings to 25-Ft. bgs.

1110 - Call to P. Martin w/ Brian Lent; agree to drill to appx 35-Ft. bgs (another 7-Ft From current depth) and reassess.

1115 - Resume air rotary drilling From 28-Ft bgs.

1140 - Drilled to 34-Ft. bgs; drill head slipped off during drilling.
↳ Pull drill rods and take hole For total depth.
→ TD of VOM-9R @ 34.4 Ft. bgs; some moisture on outside of drill rods and on depth tape, appx 2-3 Ft of GW possibly present in Bh.

1150 - Call to Pat Martin (Golden); update him on drilling progress.
↳ Waiting For response From Stan Radon (DEC).

1200 - Drillers break For lunch; wait For call back From P. Martin.

1210 - Response From P. Martin; per S. Radon (NYSDEC) install well @ VOM-9R due to signs of water.

14-03185

Vandemark well Replacement 5/29/14

1245 - Drillers back on site, retype Bit for water temp
↳ approx. 5-6 Ft. of water present.
→ Set 5-Ft. Screen w/ 2-3 Ft of sand above screen -

1310 - Well screen set to approx 34-Ft bgs using 5-Ft screen (0.01"-Slot), sand placed to ~24.3 Ft bgs, bent chip seal to ~21.3' bgs. Water added (~5 gals) to hydrate chips. Wait approx. 20 minutes for chips to hydrate. Clean off drill cuttings & remove wooden cuttings pad.

1330 - Grout added to bottom of auger (11 Ft bgs) Ram ~~ground level (dirt pad/ground surface)~~. Will install for VDM-9R complete. Pull augers (15-Ft).

1415 - Nothnagle cut metal cap off VDM-9 casing; Inc. @ 23.95' btoc; TD @ 30.4' btoc.
↳ Casing cut w/ hand grinder.

1430 - Begin overdrilling of VDM-9 steel casing using 6 1/4" HSAs in attempt to break up any concrete pad @ base of well casing.

1440 - 8 Ft of 6 1/4" HSAs drilled; Drillers Note: Appears

14-03185

GET, RCI. Vandemark Well Replacement 5/29/14

2" PVC casing may be grouted to inside of steel protective casing.
↳ Driller stopped augering for safety reasons w/ inside of drill pad.
↳ Will attempt to send down split spoon w/ sand and Acu-Rods to grip inside of PVC and pull out PVC casing.

1500 - Slipped strap over casing and pulled out approx. 14.5 Ft of casing (solid) w/ steel casing (~5-Ft). PVC casing was grouted to inside of protective casing.
↳ Screen length still in borehole (5-Ft) + ~40+ Ft. of PVC riser.

1505 - Brian Law notes should be OK to grout remaining PVC riser + screen in borehole.
↳ Call to Pat Martin to inform. He agrees to have Nothnagle grout remaining VDM-9 casing in Borehole.

→ 1515 - Nothnagle proceeds w/ grouting procedures for VDM-9 boring location. (Tremie grouting)

1545 - Grouting of abandoned VDM-9 well completed.
↳ Clean up site. Nothnagle stores drums of drill cuttings on pallet for removal by Onegara.
→ Well casing pieces also left near pallet for disposal

14-03188

Vandewark Well Replacement 5/29/14

Nothnagle will be on site (Vandewark plant) on Monday, June 2, 2014 for other drilling work and may set concrete pad @ replacement well VDM-9R.

↳ Organ's scheduled to tentatively dig out stone drill pad tomorrow (Friday, May 30, 2014)

→ 1605 - Head off site; Nothnagle will lock gates behind them when leaving.

End of Day

Rtn

APPENDIX C

REPLACEMENT WELL VDM-9R WELL INSTALLATION LOG

MONITORING WELL INSTALLATION LOG

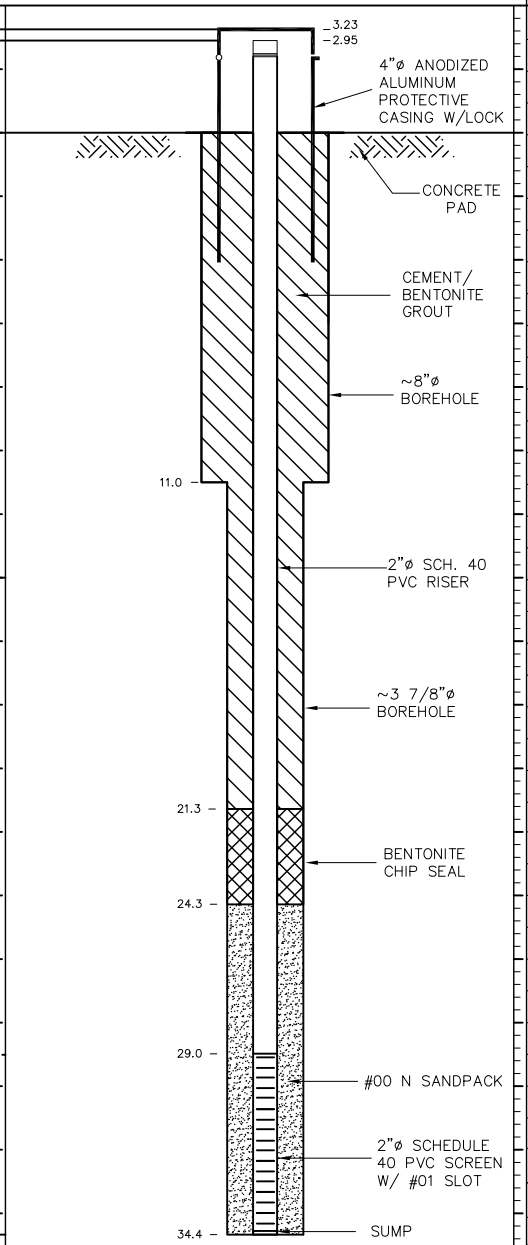
JOB NO.	14-03185	PROJECT	VANDEMARK/LANDFILL WELL REPLACEMENT/NY	WELL NO.	VDM-9R	SHEET	1 of 1
GA INSP.	RJM	DRILLING METHOD	4 1/4" I.D. HOLLOW STEM AUGERS	CONC.PAD ELEV.	~444.0 Ft.	WATER DEPTH	~29.0 Ft. BGS
WEATHER	P. CLOUDY	DRILLING COMPANY	NOTHNAGLE DRILLING, INC.	COLLAR ELEV.	~447.0 Ft.	DATE/TIME	1245/05-29-14
TEMP.	65° F	DRILL RIG	CME-55 ATV	DRILLER	T. MANGEFRIDA	STARTED	1250/05-29-14 TIME / DATE
LOCATION / COORDINATES	N , E (APPROXIMATELY 10-FT EAST OF VDM-9 LOCATION)					COMPLETED	1330/05-29-14 TIME / DATE

MATERIALS INVENTORY

WELL CASING	2.0 in. dia. 28.5 l.f.	WELL SCREEN	2.0 in. dia. 5 l.f.	BENTONITE SEAL	MEDIUM BENTONITE CHIPS
CASING TYPE	SCH. 40 PVC	SCREEN TYPE	MACHINE SLOTTED PVC	INSTALLATION METHOD	POUR THROUGH AUGERS
JOINT TYPE	FLUSH THREADED	SLOT SIZE	0.01"-SLOT	FILTER PACK QTY.	1.0-BAG
GROUT QUANTITY	12-GALLONS	CENTRALIZERS	NOT USED	FILTER PACK TYPE	#00-N SIZE SAND
GROUT TYPE	CEMENT/BENTONITE	DRILLING MUD TYPE	NOT USED	INSTALLATION METHOD	POUR THROUGH AUGERS

ELEV./DEPTH	SOIL/ROCK DESCRIPTION
449.23	TOP OF CASING
448.95	TOP OF RISER
446.0	EXISTING GROUND SURFACE*
0.0	(CL), SILTY CLAY to (ML) CLAYEY SILT, some f-c gravel red to red-brown; dry, as interpreted from drill cuttings and original VDM-9 well log.
432.0	
14.0	Grey-brown siltstone and grey weathered shale, over dark green-grey sandstone, as interpreted from drill cuttings and original VDM-9 well log.
	29.0' PRE-INSTALLATION
411.6	
34.4	EOB @ 34.4 FT. BGS

WELL SKETCH



INSTALLATION NOTES

BORING LOCATION AUGERED WITH 4 1/4" I.D. HOLLOW STEM AUGERS (HSAs) WITH NO SAMPLING PERFORMED TO APPROX. 11.0-FT BELOW GROUND SURFACE (bgs). DRILLER SWITCHED TO 3 7/8" TRI-CONE ROTARY AIR DRILLING DUE TO HARD DRILLING. DRILLED TO 34.4-FT. bgs USING AIR DRILLING. DRILL RODS REMOVED AND WELL MATERIALS PLACED IN BOREHOLE USING 5.0 FT. WELL SCREEN, THREADED FLAT-END CAP, 29.0 FT. OF WELL RISER AND SLIP TOP CAP FOR OVERALL LENGTH OF 34.4-FT. WELL MATERIALS PLACED TO 34.4-FT WITH APPROX. 2.5 FT. STICKUP. #00-N SAND POURED THROUGH AUGERS 34.3-24.3 FT. bgs. 3/8" BENTONITE CHIP SEAL PLACED BY HAND 24.3-21.3 FT. bgs. CHIPS ALLOWED TO HYDRATE 30 MINUTES. CEMENT/BENTONITE GROUT ADDED 21.3-0.0 FT. bgs. FOLLOWING REMOVAL OF STONE DRILLING BENCH, 4" DIAMETER ANODIZED ALUMINUM SQUARE PROTECTIVE CASING PLACED OVER RISER AND CEMENTED INTO CONCRETE PAD WITH 2.5 FT. STICKUP ON 06/02/14. NO SAND PLACED IN ANNULUS OF PROTECTIVE CASING BY DRILLERS.

* MEASUREMENTS REFERENCED FROM GROUND SURFACE AS OF DATE OF INSTALLATION (05/29/14).

WELL DEVELOPMENT NOTES

DATE DEVELOPED: N/A

DEVELOPMENT METHOD: N/A

VOLUME PURGED: N/A

FOR FURTHER DETAILS SEE ACCOMPANYING WELL DEVELOPMENT FIELD RECORD.

APPENDIX D

PHOTO LOG

VANDEMARK LANDFILL – MONITORING WELL VDM-9 ADANDONMENT & REPLACEMENT

PHOTO 1

Nothnagle drill rig setup on stone drilling bench for abandonment and replacement of existing groundwater monitoring well VDM-9. View looking west.

PHOTO 2

Nothnagle drilling replacement groundwater monitoring well VDM-9R using 4 ¼" Hollow Stem Augers (HSAs) and 3 7/8" Tri-Cone air rotary drilling techniques. View looking west.

PHOTO 3

Nothnagle drilling replacement groundwater monitoring well VDM-9R, approximately 10-feet east of existing well VDM-9, visible in stone drilling bench (center-photo). View looking east.

PHOTO 4

Nothnagle driller cutting steel casing for access to PVC well riser during groundwater monitoring well VDM-9 abandonment activities. View looking west.

Photos taken by Russell J. Marchese May 29, 2014

PHOTO 5

Overdrilling of existing groundwater monitoring well VDM-9 using 6 ¼" HSAs. View looking west.

PHOTO 6

Nothnagle pulling out existing groundwater monitoring well VDM-9 protective steel casing (grouted to PVC well riser). View looking west.

Photos taken by Russell J. Marchese May 29, 2014

PHOTO 7 Section of recovered groundwater monitoring well casing at abandoned VDM-9 (approx. 14.5 linear feet). PVC well casing was grouted to inside of protective steel casing and snapped at flush threaded joint during removal. Remaining PVC riser and well screen were grouted in place.	
PHOTO 8 Grouting of abandoned groundwater monitoring well VDM-9 after overdrilling and casing removal during abandonment activities.	

Photos taken by Russell J. Marchese May 29, 2014

At Golder Associates we strive to be the most respected global group of companies specializing in ground engineering and environmental services. Employee owned since our formation in 1960, we have created a unique culture with pride in ownership, resulting in long-term organizational stability. Golder professionals take the time to build an understanding of client needs and of the specific environments in which they operate. We continue to expand our technical capabilities and have experienced steady growth with employees now operating from offices located throughout Africa, Asia, Australasia, Europe, North America and South America.

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