

2026

ASSESSMENT OF CORRECTIVE MEASURES REPORT

**PAGE COUNTY SANITARY LANDFILL
73-SDP-01-75P
CLARINDA, IOWA**

**by:
HLW Engineering Group
204 West Broad Street
P.O. Box 314
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August 2026



P.N. 6047-26A.200

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Prepared by: _____



Todd Whipple, CPG

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2026 Assessment of Corrective Measures Report

Introduction

This Assessment of Corrective Measures (ACM) is offered in order to address apparent impact recorded at MW-16 and MW-18 at the Page County Sanitary Landfill in accordance with IAC 567, Chapter 113.10(7) through 113.10(9). The 2025 Annual Water Quality Report (Doc #115956) and the 2026 Water Quality Notification submitted April 2, 2026 (Doc # 116746) established that a Statistically Significant Level (SSL) for arsenic was documented at MW-16 and MW-18.

Figure 1, Site Plan and Figure 2, Site Plan – Area of Interest, are attached illustrating the study area.

Delineation of Impact

Figure 3, Groundwater Contours, illustrates the groundwater movement across the site and in the vicinity of MW-16 and MW-18.

The horizontal and vertical limits of the impacts were delineated as documented in the June 30, 2026 2026 Delineation Report and Groundwater Assessment Near MW-16 & MW-18 (Doc #117444). Water Quality testing performed semi-annually since September 18, 2024, confirms that the water quality at MW-16 did not experience an SSL until September 08, 2025.

Based on the 2026 Delineation Report and Groundwater Assessment Near MW-16 & MW-18 (Doc # 117444), endemic negative ORP values (reducing conditions) in the study area are interpreted to contribute to the elevated arsenic at MW-16 and MW-18. Landfill gas effects are also interpreted to be a potential source of the detected impacts at MW-16.

Water quality results in both the 2025 Annual Water Quality Report (Doc #115956) and the 2026 Water Quality Notification submitted April 2, 2026 (Doc # 116746) indicate that the SSL at MW-16 and MW-18 for arsenic persists.

Magnitude of the Impact

MW-16 and MW-18

The detected concentrations of arsenic at MW-16 and MW-18 have exceeded the Statewide Groundwater Protection Standard (GWPS) for arsenic (10.0 ug/L). The calculation of the SSL for arsenic exceed the GWPS (the 95% UCL continues to exceed the GWPS).

The difference between the actual arsenic concentrations recorded at MW-16 and MW-18 and the goal of having concentrations below the GWPS at MW-16 and MW-18 represents a small gap. Impacts appear to be isolated to MW-16 and MW-18 or to the immediate vicinity of MW-16 and MW-18. Figure 4, Natural Attenuation Zone Map is prepared to illustrate the restricted area of impact.

Assessment of Corrective Measures

The SSL recorded at MW-16 and MW-18 (arsenic) warrants Assessment of Corrective Measures (ACM) in accordance with IAC 567, Chapter 113.10(7) through 113.10(9).

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Objectives/Goals of the Remedy (IAC567-113.10(8))

- 1) Be protective of Human Health and the Environment – All proposed and completed corrective measures are considered to be protective of Human Health and the Environment as defined in State and Federal Rules.
- 2) Attain Groundwater Protection Standards - All proposed and completed corrective measures are intended to attain Groundwater Protection Standards in compliance with State and Federal Rules.
- 3) Control the Source of Release – The source of release is interpreted to be related to the landfill gas migration from the landfill, or more likely the secondary issues related to landfill gas and a methanogenic mass near to the perimeter monitoring wells. No additional waste will be placed in the original fill areas. At the same time, the leachate collection laterals are completed into the original landfill and the leachate conveyance system is operational. The Source of the release is anticipated to decrease with time as decomposition progresses in the closed landfill.
- 4) Comply with Standards for Management of Wastes – The waste management activities ceased at the time of closure in the Original Landfill.

Corrective Measures Completed to Date – The following corrective measures have been completed to date:

- 1) Step-out monitoring point MW-56 satisfying 113.10(6)g2 was installed north of MW-16 and northwest of MW-18, downgradient of the landfill and downgradient MW-16 and MW-18. Based on the sample collected June 3, 2026, MW-56 (the new POC) demonstrates compliance with arsenic GWPS along the north and northwest side of the area of impact.

Proposed Corrective Measures

The subsurface conditions related to water quality appear relatively static over time at MW-16 and MW-18 between 2014 and present. The extent of impact (horizontal and vertical) is documented to be significantly small.

Corrective measures proposed herein are intended to address the general IDNR requirement for source control (control of the documented landfill gas source) to augment the natural attenuation already occurring in the area of interest. Corrective measures are proposed herein to encourage landfill gas venting and to increase atmospheric oxygen infiltration to the subsurface to further control the anaerobic boundaries adjacent to the waste mass and to augment the natural attenuation already occurring in the area of interest.

Corrective Measures are presented herein as Primary Corrective Measures (Category 1) and Secondary Corrective Measures (Category 2).

Any selected Category 1 corrective measure will be coupled with Natural Attenuation. Further, only a Category 1 corrective measure coupled with Natural Attenuation will initially be selected by the Owner.

The Category 2 Corrective Actions are included herein as a possible follow-on corrective action if the selected primary Category 1 option is demonstrated over time to be ineffective. Including this Category 2 Corrective Action(s) is in accordance with the IAC 113.10(9)"b" and affords the owner a future means to implement additional corrective measures in accordance with rule.

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The Primary Corrective Measures proposed herein are summarized as:

- A) Category 1, Option 1 – Individual Landfill Gas Vents in the waste area of the Original Landfill coupled with Natural Attenuation within proposed attenuation zones (Figure 5).
- B) Category 1, Option 2 – Individual Landfill Gas Vents in the waste area of the Original Landfill and outside the north waste boundary coupled with Natural Attenuation within proposed attenuation zones (Figure 6).
- C) Category 1, Option 3 – Landfill Gas Vent Trench inside the waste boundary coupled with Natural Attenuation within proposed attenuation zones outside the waste boundary (Figure 7).

Figure 4 is included illustrating the existing/proposed attenuation zone near MW-16 and MW-18. Figures 5-7 illustrate three (3) different options to promote landfill gas venting and/or to promote infiltration of atmospheric oxygen to the subsurface environs.

Source control by landfill gas venting through construction of individual gas vents in waste (Figure 5), by source control by landfill gas venting through construction of individual gas vents inside and outside of the waste boundary (Figure 6), or by gas venting trenches in the waste (Figures 7) are considered primarily a means to vent gas out, but it is anticipated that the vent mechanisms will also allow increased atmospheric intrusion as a secondary means to change anaerobic boundaries. The source control by landfill gas venting is designated as Category 1 in this report.

The Secondary Category 2 Corrective Measures proposed herein are summarized as:

- A) Category 2, Option 1 – A dewatering line located beyond the waste boundary with connection to leachate collection system (Figure 8).

The dewatering line located outside the waste boundary (Figures 8) is not considered to be a primary landfill gas source control mechanism, rather it is a secondary mechanism to increase atmospheric oxygen intrusion by lowering the water table along the dewatering line. Venting in/out through the vertical stacks and the open ends of the line may also occur. The dewatering and oxygen intrusion mechanism is designated Category 2 in this report.

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Costs

General cost estimates for the Primary Category 1 and Category 2 options are presented below.

Category 1, Option 1 – Waste Area Gas Venting coupled with an Attenuation Zone – This option includes individual Gas Vents in the waste area of the Original Landfill with an attenuation zone adjacent to the waste boundary near MW-16 and MW-18. The point of compliance will be established at MW-56 on the downgradient side of the attenuation zone.

Estimated Cost – Twelve (12) vents as illustrated on Figure 5 & 10 - \$45,000 + \$0/year O&M costs.

Category 1, Option 2 – Waste Area and Adjacent Unfilled Area Gas Venting coupled with an Attenuation Zone – This option includes individual Gas Vents in the waste area of the Original Landfill and in the adjacent land north of the waste boundary with an attenuation zone adjacent to the MW-16 and MW-18. The point of compliance will be established at MW-56 on the downgradient side of the attenuation zone.

Estimated Cost – Twenty (20) vents as illustrated on Figure 6 & 10 - \$70,000 + \$0/year O&M costs.

Category 1, Option 3 – Landfill Gas Vent Trench inside the waste boundary coupled with Natural Attenuation – This option consists of a vent trench placed in the waste along the north edge of the waste near MW-16 and MW18.

Estimated Cost – Excavation of soil/waste as illustrated on Figures 7 & 9 - \$95,000 + \$100/year O&M costs.

Category 2, Option 1 – Dewatering Line with Integral Passive Vents – Lowering of the water table is intended to increase oxygenation in the vadose zone near to MW-16 and MW-18.

Estimated Cost – 500 feet as illustrated on Figure 8 & 9 - \$115,000 + \$2,000/year O&M costs.

Ability of the Proposed Remedies to Meet IAC567-113.10(7)c

Category 1 and Category 2 Options are evaluated. See next page.

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Category 1, Source Control by Landfill Gas Venting (Option 1 and/or Option 2) Coupled with Attenuation Zones - The criteria established by rule will be met as follows:

Criterion	Analysis
Performance	Landfill gas venting system from the waste mass as a source control measure is proposed (Option 1 or Option 2). The proposed venting system will be coupled with the use of natural attenuation in an attenuation zone immediately beyond impacted wells MW-16 and MW-18. The successful performance of the landfill venting system with the combined natural attenuation zone will be monitored at the Supplemental Wells MW-16 and MW-18 and at the proposed Attenuation Zone Point of Compliance (AZPOC) well MW-56. Compliance at AZPOC MW-56 will be considered to represent a system that meets the performance goals. Any improvements in water quality at impacted well MW-16 and MW-18 will be attributed to the landfill gas venting system and a diminished attenuation zone.
Reliability	Use of the combined system of landfill gas venting (Option 1 or Option 2) and proposed attenuation zone is considered a reliable means to remedy both organic and inorganic impacts at MW-16 and MW-18. The proposed system is based on a one-time modification of the site by the addition of the landfill gas venting system. The remedy will not change with time and the maintenance of the remedy is negligible.
Ease of Implementation	Implementation is straightforward. A contractor and contractor equipment will be utilized to install the landfill gas venting system (Option 1 or Option 2).
Safety Impacts	Additional safety impacts would be limited to the trained personnel that perform the one-time excavation and piping project.
Cross-Media impacts	Interim Corrective Action Monitoring to date indicates that surface water is not impacted. The installation of the designed landfill gas venting system (Option 1 or Option 2) will diminish the potential for subsurface gas migration and cross media impacts
Control of Exposure to Residual Contamination	Residual contamination will remain in the subsurface between the waste boundary and the edge of the proposed attenuation zone. The potential for exposure to workers or the Public within the restricted property boundary would be extremely unlikely.
Time to begin & complete remedy	2027-2028
Cost of the Remedy	\$45,000 to \$70,000 (Option 1 or Option 2) Annual O&M Cost - \$0/year
Institutional Requirements/Permits	By Amendment within the SDP Permit.
Other Public Requirements	N/A

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Category 1, Source Control by Landfill Gas Vent Trench inside the waste boundary (Option 3) coupled with Natural Attenuation Zones - The criteria established by rule will be met as follows:

Criterion	Analysis
Performance	Venting of landfill gas to the atmosphere near the edge of the waste mass as a source control measure is proposed (Option 3). The proposed venting system will be coupled with the use of natural attenuation in an attenuation zone immediately beyond impacted well MW-16 and MW-18. The successful performance of the venting system with the combined natural attenuation zone will be monitored at the Supplemental Wells (MW-16 and MW-18) and at the proposed Attenuation Zone Point of Compliance (AZPOC) well MW-56. Compliance at the AZPOC MW-56 will be considered to represent a system that meets the performance goals. Any improvements in water quality at impacted well MW-16 and MW-18 will be attributed to the venting of migrating landfill gas and a diminished attenuation zone.
Reliability	Use of the combined system of venting migrating landfill gas (Option 3) and proposed attenuation zone is considered a reliable means to remedy both organic and inorganic impacts at MW-16 and MW-18. The proposed system is based on a one-time modification of the site by the construction of vent trench. The remedy will not change with time and the maintenance of the remedy is negligible.
Ease of Implementation	Implementation is straightforward. A contractor and contractor equipment will be utilized to construct the vent trench (Option 3).
Safety Impacts	Additional safety impacts would be limited to the trained personnel that perform the one-time excavation project.
Cross-Media impacts	Interim Corrective Action Monitoring to date indicates that surface water is not impacted. The installation of the designed vent trench (Option 3) will diminish the potential for subsurface gas migration and cross media impacts
Control of Exposure to Residual Contamination	Residual contamination will remain in the subsurface between the waste boundary and the edge of the proposed attenuation zone. The potential for exposure to workers or the Public within the restricted property boundary would be extremely unlikely.
Time to begin & complete remedy	2027-2028
Cost of the Remedy	\$95,000 (Option 3) Annual O&M Cost - \$0 to \$100/year
Institutional Requirements/Permits	By Amendment within the SDP Permit.
Other Public Requirements	N/A

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Category 2, Dewatering Line with Integral Passive Vents (Option 1) - The criteria established by rule will be met as follows:

Criterion	Analysis
Performance	Installation of a dewatering line outside the waste boundary south of MW-16 and MW-18 near the waste boundary is proposed as follow-on Corrective Measure in the event that the Category 1 options implemented do not perform. The proposed dewatering system will create an enlarged oxygenation zone and will be coupled with discharge of groundwater to a Leachate Collection System. The successful performance of the dewatering line and increased oxygenation will be monitored at the Supplemental Wells MW-16 and MW-18. Compliance at MW-56 will be considered to represent a system that meets the performance goals. Any improvements in water quality at Supplemental Wells MW-16 and MW-18 will be attributed to the dewatering system and increased oxygenation.
Reliability	Use of the dewatering line is considered a reliable means to remedy both organic and inorganic impacts at MW-16 and MW-18. The proposed system is based on a one-time modification of the site by the addition of the dewatering line. The remedy will not change with time and the maintenance of the remedy is negligible.
Ease of Implementation	Implementation is straightforward. A contractor and contractor equipment will be utilized to install the dewatering line and connect the line to the leachate collection system.
Safety Impacts	Additional safety impacts would be limited to the trained personnel that perform the one-time excavation and piping project.
Cross-Media impacts	Interim Corrective Action Monitoring to date indicates that surface water is not impacted. The installation of the designed dewatering line with discharge to the leachate collection system will diminish the potential for subsurface gas migration and cross media impacts
Control of Exposure to Residual Contamination	Residual contamination may remain in the subsurface between the waste boundary and the dewatered zone. The potential for exposure to workers or the Public within the restricted property boundary would be extremely unlikely.
Time to begin & complete remedy	2032-2035, if required
Cost of the Remedy	\$115,000 Annual O&M Cost - \$2,000/year
Institutional Requirements/Permits	By Amendment within the SDP Permit.
Other Public Requirements	N/A

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Corrective Action Monitoring Plan

Based upon the future landfill gas venting system construction and the establishment of the attenuation zones, the following monitoring points are proposed to demonstrate the effectiveness of the remedy in accordance with IAC 567, Chapter 113.10(9)a”1”.

Corrective Action Monitoring Points associated with MW-16 and MW-18.

MW-16 and MW-18 – The impacted wells (Supplemental Wells).

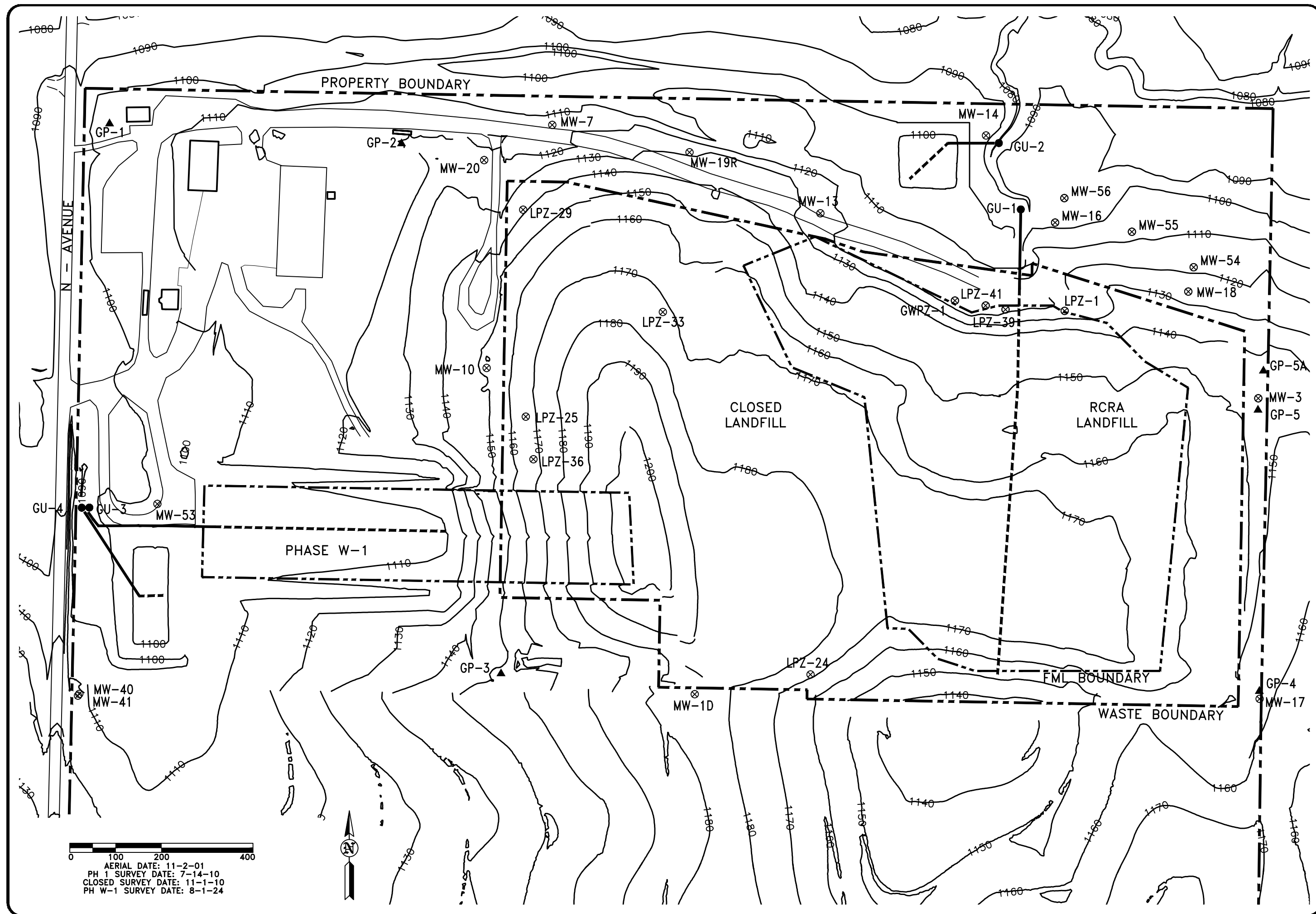
MW-56 – The Attenuation Zone Point of Compliance (AZPOC) Well will be MW-56. MW-56 satisfies 113.10(6)g2 and is installed toward the north landfill property line to demonstrate compliance with GWPS.

Schedule –

Day 1 –	IDNR Approval of this ACM.
Prior to Day 61 –	Public Meeting at the Page County Sanitary Landfill
Prior to Day 121 –	Formal Selection of Remedy by Page County Landfill Commission.
Prior to Day 135 -	Notify IDNR of the Selected Remedy.
Prior to Day 500 -	Complete the construction of landfill gas venting system (Category 1).
April, annually -	Corrective Action Monitoring
October, annually -	Corrective Action Monitoring
January, annually -	Annual Water Quality Report discussing compliance of Water Quality.

Conclusions and Conformance with Rule

The proposed ACM remedies currently demonstrate that compliance with the goals (IAC567, Chapter 113.10(7)c) can be achieved with the proposed ACM. The proposed schedules and remedies conform to requirements of IAC 567, Chapter 113.10(8). The proposed Corrective Action Monitoring Plan conforms to the requirements of IAC 567, Chapter 113.10(9)”a”(1).

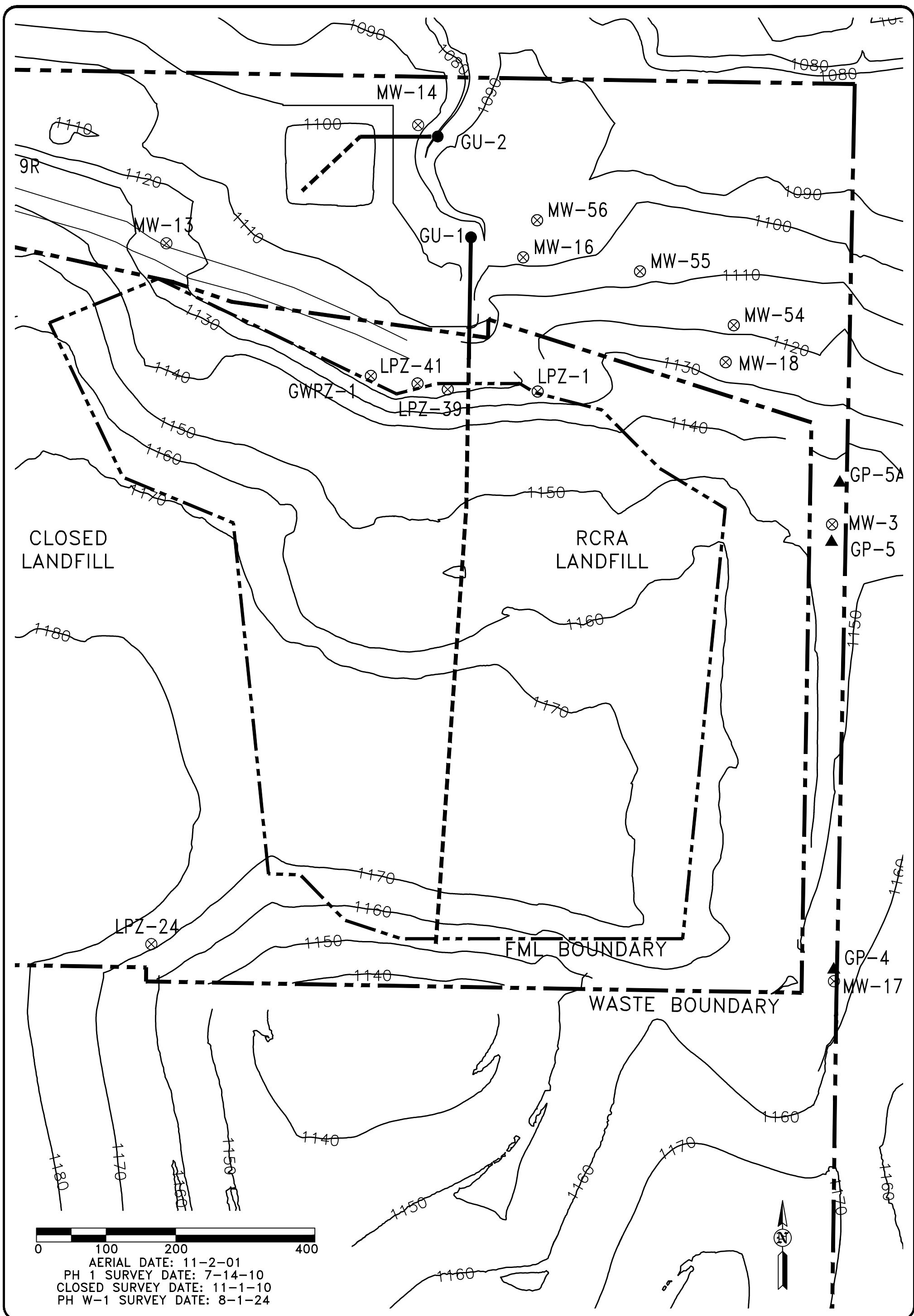


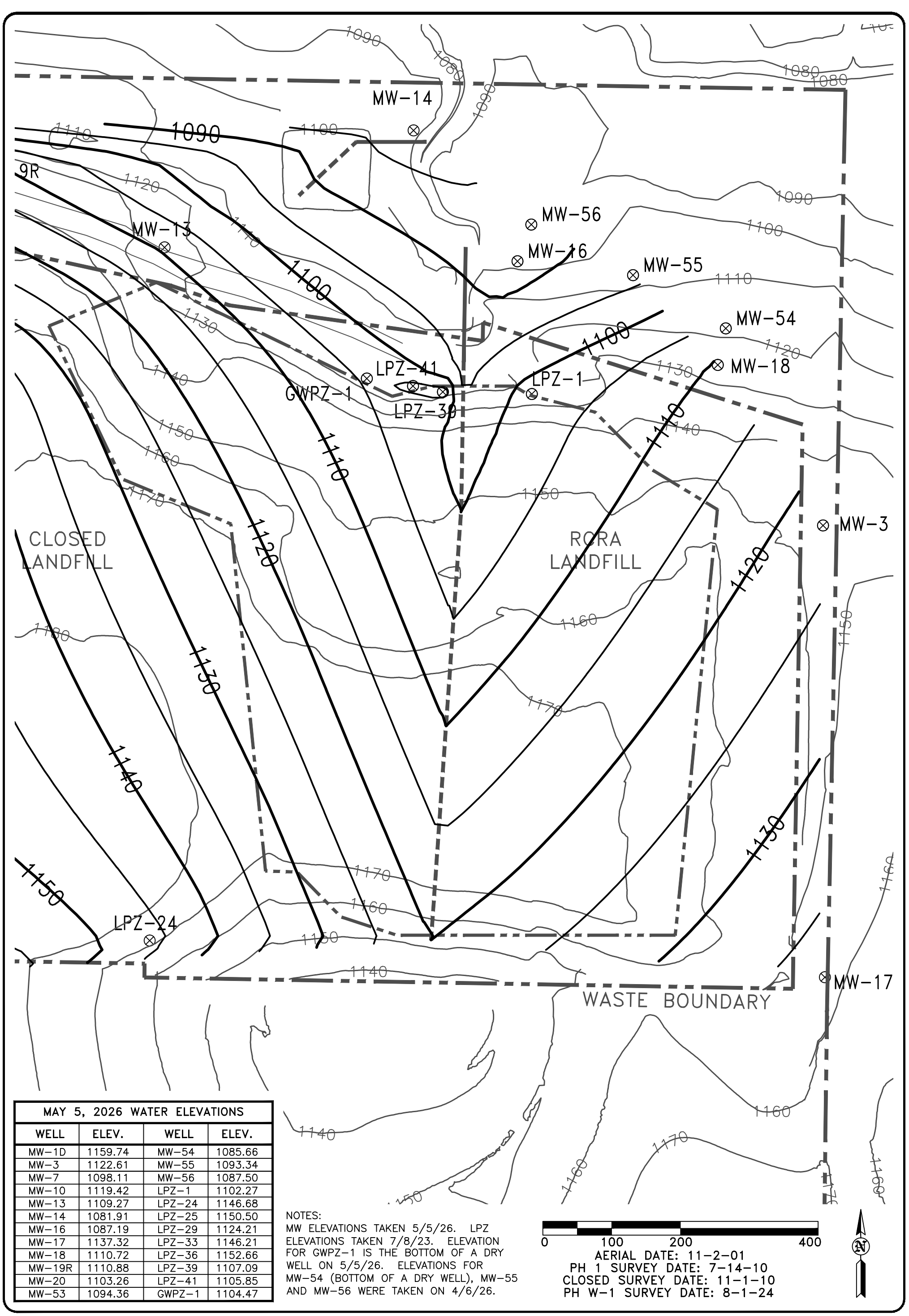
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 FAX: (515) 733-4146

FIGURE: 1

REVISION	NO.	DATE
DRAWN	6047	7-22-26
DRA		

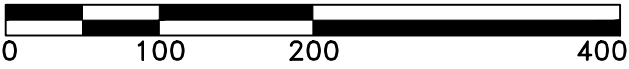
SITE PLAN - LANDFILL AREA
 PAGE COUNTY SANITARY LANDFILL
 CLARINDA, IOWA





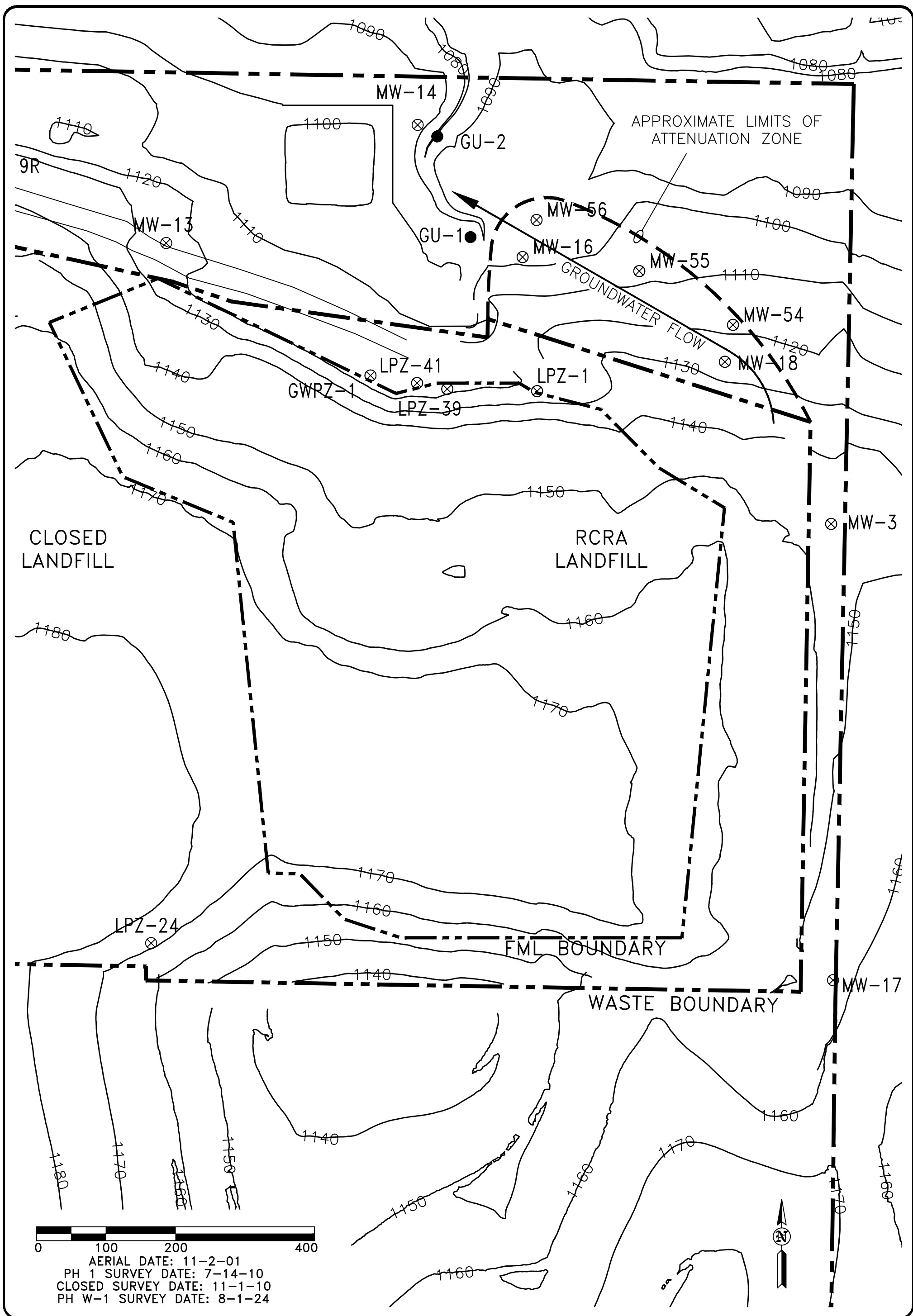
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MW-1D	1159.74	MW-54	1085.66
MW-3	1122.61	MW-55	1093.34
MW-7	1098.11	MW-56	1087.50
MW-10	1119.42	LPZ-1	1102.27
MW-13	1109.27	LPZ-24	1146.68
MW-14	1081.91	LPZ-25	1150.50
MW-16	1087.19	LPZ-29	1124.21
MW-17	1137.32	LPZ-33	1146.21
MW-18	1110.72	LPZ-36	1152.66
MW-19R	1110.88	LPZ-39	1107.09
MW-20	1103.26	LPZ-41	1105.85
MW-53	1094.36	GWPZ-1	1104.47

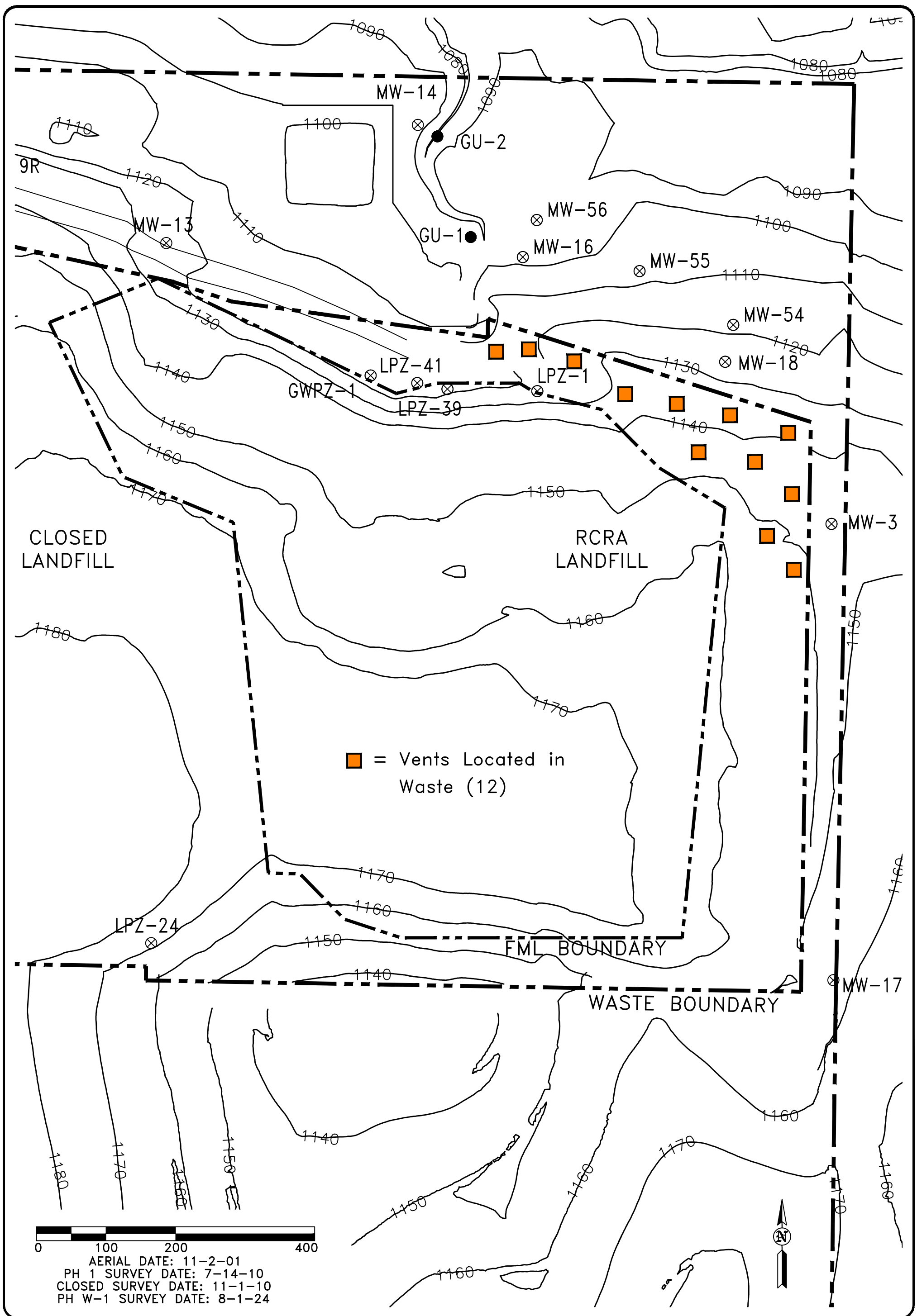
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MW ELEVATIONS TAKEN 5/5/26. LPZ
ELEVATIONS TAKEN 7/8/23. ELEVATION
FOR GWPZ-1 IS THE BOTTOM OF A DRY
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AND MW-56 WERE TAKEN ON 4/6/26.

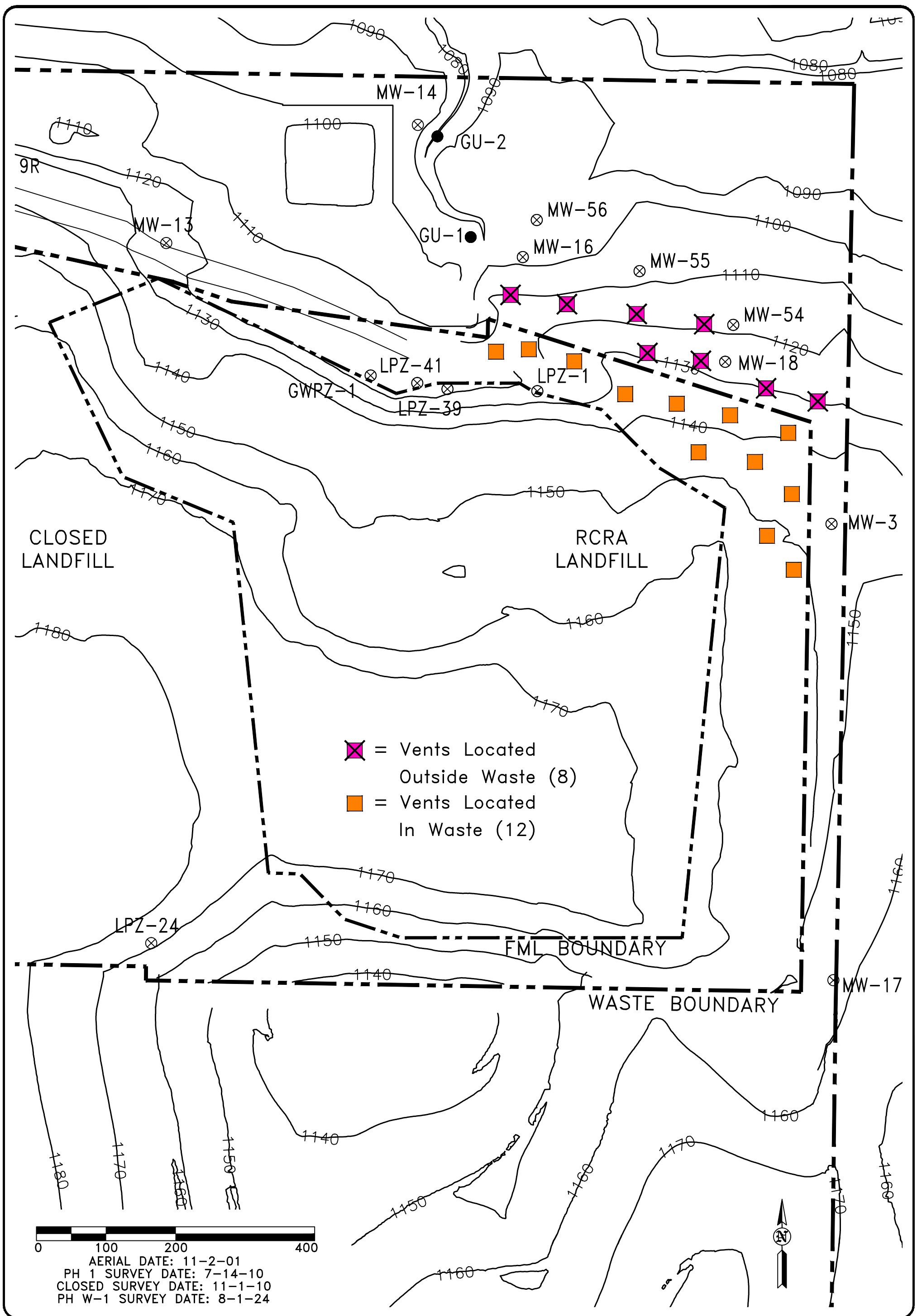


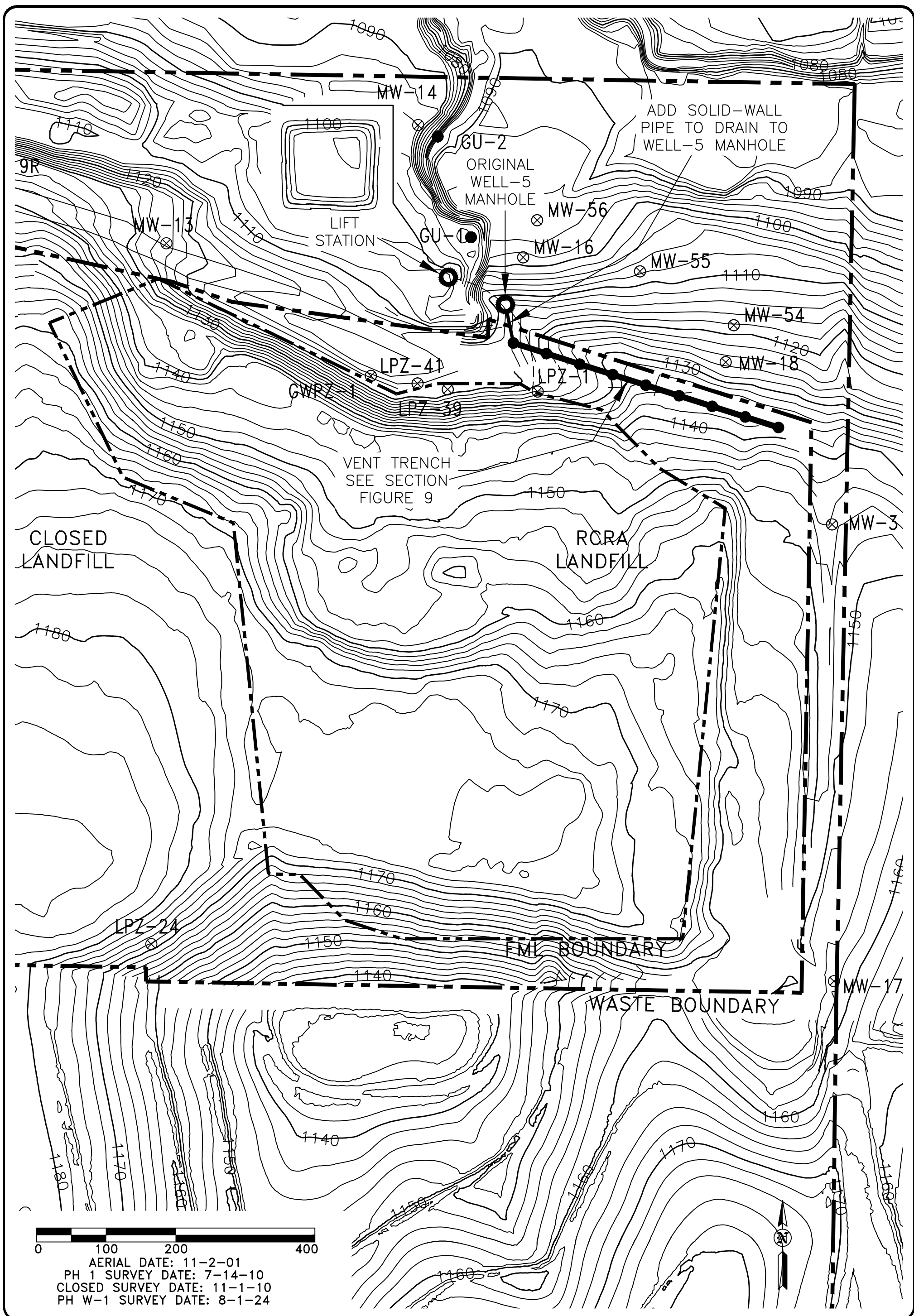
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PH 1 SURVEY DATE: 7-14-10
CLOSED SURVEY DATE: 11-1-10
PH W-1 SURVEY DATE: 8-1-24

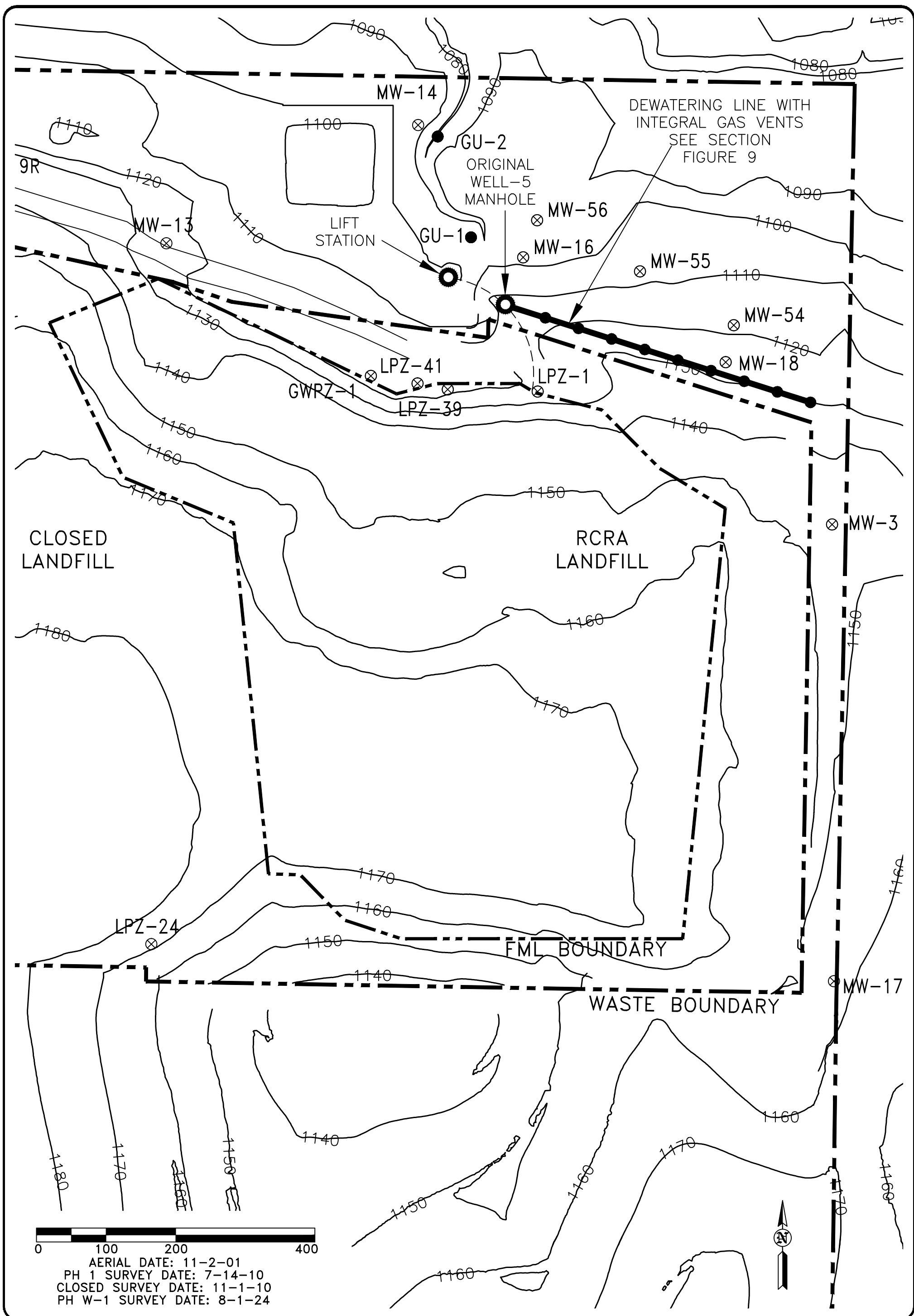


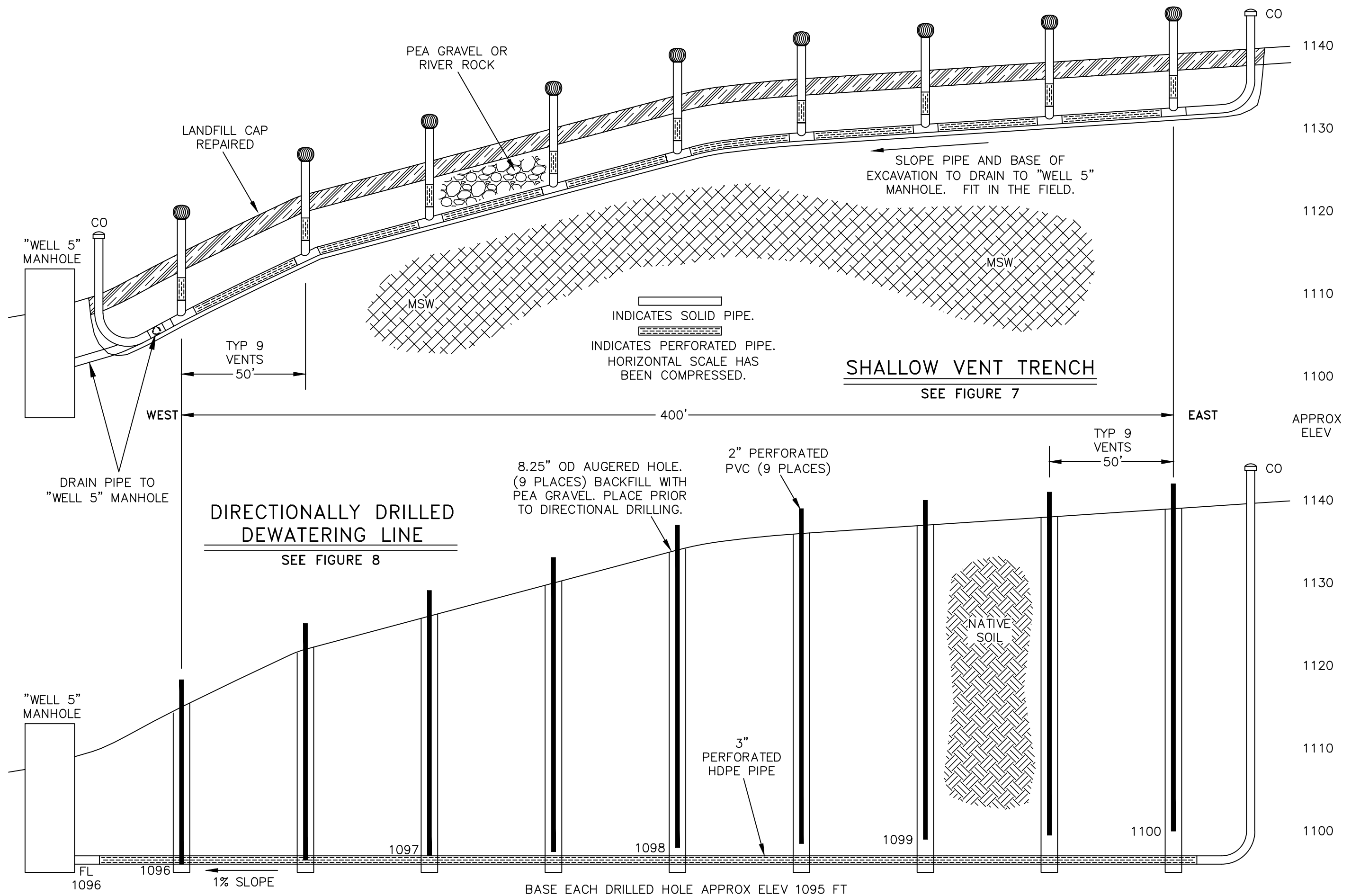












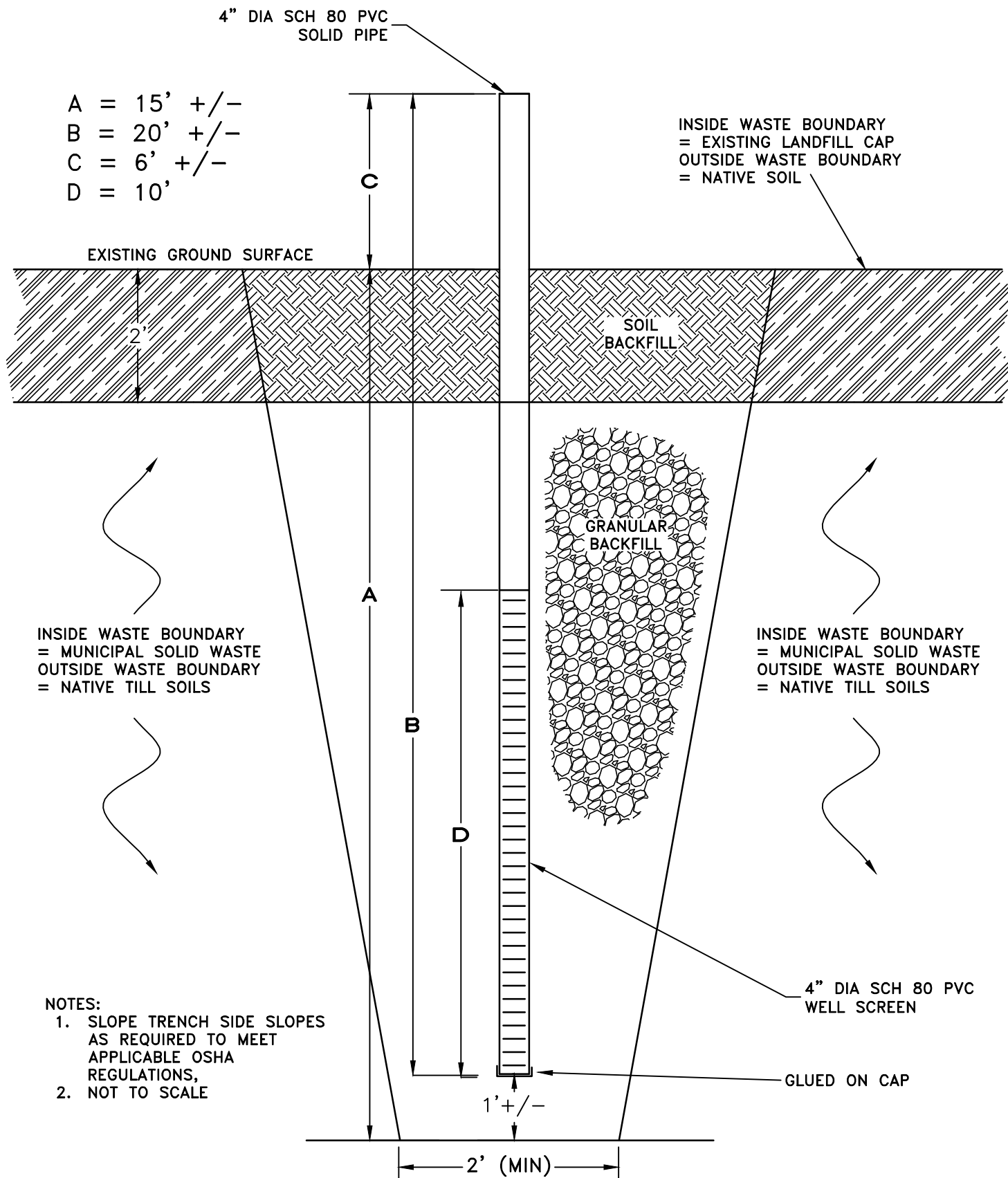
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CROSS SECTION
VENT & DEWATERING TRENCHES
PAGE COUNTY SANITARY LANDFILL
CLARINDA, IOWA

FIGURE:

9

REVISION	NO.	DATE
DRAWN	6047	7-22-26
DRA		



GAS VENT DETAIL PAGE COUNTY SANITARY LANDFILL TOWN, IOWA

FIGURE: 10

REVISION	NO.	DATE
DRAWN DRA	PROJECT NO. 6000	DATE 7-22-26