Feasibility Report Addendum 02 - Proposed Eastern Expansion (WDNR License No. 3268)

Vernon County Landfill

Viroqua, Wisconsin

VERSW 167824 | June 17, 2026

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June 17, 2026

RE: Vernon County Landfill
Feasibility Report Addendum 02 -
Proposed Eastern Expansion
(WDNR License No. 3268)
Viroqua, Wisconsin
SEH No. VERSW 167824 4.00

Ms. Bridget Kelly, Region Program Manager
Wisconsin Department of Natural Resources
1027 W. St. Paul Ave.
Milwaukee, WI 53233

Dear Ms. Kelly:

Short Elliott Hendrickson Inc. (SEH®), on behalf of Vernon County, is submitting this Feasibility Report (FR) Addendum 02 to obtain the Wisconsin of Natural Resources (WDNR) approval for the proposed Eastern Expansion at the Vernon County Landfill (WDNR License No. 3268). Copies of the Feasibility Report Addendum 02 have been issued according to the attached distribution list. Delivery receipts for the Feasibility Report Addendum 02 will be forwarded to the WDNR upon our receipt.

Vernon County is requesting the WDNR review this Feasibility Report Addendum 02 and approve the Feasibility Report so Vernon County can continue to make progress with the landfill permitting process. Should you have any questions or would like to discuss the Feasibility Report Addendum 02 or Feasibility Report further, please contact me at 608.498.4844

Sincerely,

Brian L. Kent, CHMM
Project Manager

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Feasibility Report Addendum 02 - Proposed Eastern Expansion (WDNR License No. 3268)

Vernon County Landfill
Viroqua, Wisconsin

Prepared for:
Vernon County, Wisconsin
Viroqua, Wisconsin

Prepared by:
Short Elliott Hendrickson Inc.
329 Jay Street, Suite 301
La Crosse, WI 54601-4034
608.782.3161

I, Melanie G. Niday, PG, hereby certify that I am a licensed professional geologist in the State of Wisconsin in accordance with the requirements of ch. GHSS 2, Wis. Adm. Code; that the preparation of this document has not involved any unprofessional conduct as detailed in ch. GHSS 5, Wis. Adm. Code; and that, to the best of my knowledge, all information contained in this document is correct and the document was prepared in compliance with all applicable requirements in chs. NR 500 to 538, Wis. Adm. Code.

Melanie Niday — 672-013 — June 17, 2026

Melanie G. Niday, PG — PG Number — Date
Hydrogeologist

I, Trevor T. Romanko, PE, hereby certify that I am a licensed professional engineer in the State of Wisconsin in accordance with the requirements of ch. A-E 4, Wis. Adm. Code; that this document has been prepared in accordance with the Rules of Professional Conduct in ch. A-E 8, Wis. Adm. Code; and that, to the best of my knowledge, all information contained in this document is correct and the document was prepared in compliance with all applicable requirements in chs. NR 500 to 538, Wis. Adm. Code.

Trevor Romanko — E-100923-6 — June 17, 2026

Trevor T. Romanko, PE — PE Number — Date
Project Engineer

SEH

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Melanie Niday

Melanie G. Niday, PG	672-013	June 17, 2026
Hydrogeologist	PG Number	Date

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PROFESSIONAL GEOLOGIST

I, Trevor T. Romanko, PE, hereby certify that I am a licensed professional engineer in the State of Wisconsin in accordance with the requirements of ch. A-E 4, Wis. Adm. Code; that this document has been prepared in accordance with the Rules of Professional Conduct in ch. A-E 8, Wis. Adm. Code; and that, to the best of my knowledge, all information contained in this document is correct and the document was prepared in compliance with all applicable requirements in chs. NR 500 to 538, Wis. Adm. Code.

Trevor Romanko

Trevor T. Romanko, PE	E-100923-6	June 17, 2026
Project Engineer	PE Number	Date

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Trevor Romanko
7/27/2026

SEH

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Feasibility Report Addendum 02 - Proposed Eastern Expansion (WDNR License No. 3268)

Vernon County Landfill

Prepared for Vernon County, Wisconsin

1 Background

This document entitled Feasibility Report Addendum 02 - Proposed Eastern Expansion (WDNR License No. 3268) has been prepared to supplement previously submitted documents. Vernon County submitted a Feasibility Report (FR) to the Wisconsin Department of Natural Resources (WDNR) dated September 11, 2023, for a proposed expansion of the Vernon County Landfill. The FR included information required to determine the feasibility for the proposed Eastern Expansion of the Vernon County Landfill, WDNR License No. 3268. In response to the 2023 submittal, the WDNR sent an Incompleteness Determination of the Feasibility Report letter to Vernon County dated December 19, 2023 (December 2023 Incompleteness Determination), held a virtual meeting on January 19, 2024, and provided additional written comments via email on February 1, 2024. To address outstanding items, a Feasibility Report Addendum 01 – Proposed Eastern Addendum (WDNR License No. 3268) dated November 19, 2024, was provided to the WDNR.

In a letter to Vernon County dated March 11, 2025, the WDNR provided a Second Incompleteness Determination for the Feasibility Report (March 2025 Incompleteness Determination) denoting a primary issue centering around a groundwater mounding feature indicating that the feature was "…not adequately defined to the extent that would allow tracking of a hypothetical release from the landfill." As a result, Vernon County initiated a supplemental investigation in April 2025 focusing on refining conditions in the vicinity of the groundwater mounding feature. An additional meeting was held in Vernon County with WDNR on June 3, 2025, and WDNR staff held an internal meeting with representatives of the Wisconsin Geological and Natural History Survey (WGNHS) on June 25, 2025. The WDNR presented a Summary of Vernon County Feasibility Discussion in a memorandum dated July 15, 2025 (July 2025 Memorandum). An additional virtual meeting was held between representatives of WDNR, Vernon County, and SEH on August 11, 2025, with WDNR meeting minutes provided in a memorandum dated August 26, 2025 (August 2025 Memorandum). Draft sections of this feasibility addendum report were submitted to the WDNR in December 2025 for feedback and a virtual technical assistance meeting was held between representatives of WDNR, Vernon County and SEH on March 9, 2026 (March 2026 Status of Feasibility Report and Meeting Minutes).

A copy of the WDNR's March 2025 Incompleteness Determination letter is included in **Appendix A**. The WDNR's July 2025 Memorandum is provided in **Appendix B** and WDNR's August 2025 Memorandum is provided in **Appendix C**. WDNR's March 2026 Status of Feasibility Report and Meeting Notes provided in **Appendix D**.

Section 2.0 outlines the 2025-2026 addendum field investigations, **Section 3.0** provides additional responses to the WDNR's March 2025 Incompleteness Determination letter as well as any items associated with the WDNR's meetings held in June, July, and August 2025, and March 2026. **Section 4.0** summarizes recommendations and **Section 5.0** provides references.

2 2025-2026 Field Investigations

The intent of the 2025-2026 addendum field investigations was to supplement and expand the existing site knowledge of the soils, bedrock geology, and groundwater flow system particularly in the area southeast of the proposed expansion where the previously defined perched water table condition dissipates, percolates through unsaturated bedrock, and causes groundwater mounding in the underlying regional water table.

2.1 Field Investigations

A field investigation was conducted during April 2025 to further define bedrock conditions and install additional monitoring wells. Borings, well installation, and well development were performed by Cascade Environmental (Cascade) under the direction and supervision of an SEH Professional Geologist, licensed in Wisconsin. Groundwater sample collection, in-situ hydraulic conductivity testing, and survey was also conducted by SEH. Groundwater sample analysis was performed by Eurofins Environmental Testing (Eurofins). The monitoring well locations are shown on **Plan Sheet 3**, along with previously completed borings, wells, and piezometers in the proximity of the proposed expansion area.

Field investigation activities were also completed in April 2026 to collect additional information regarding geology and hydrogeology for the site and the area. Further investigation work included additional in-situ hydraulic conductivity testing of several previously installed monitoring wells/piezometers, as well as a visit to one of the nearby quarries (Seas Branch Quarry). Slug testing was completed to verify historical hydraulic conductivity values in wells near the proposed expansion area. In addition, following quarry visits by County staff and the WDNR in 2025, an SEH Professional Geologist also conducted visits to observe exposed bedrock along the inactive quarry walls of Seas Branch Quarry in order to allow a comparison to the geologic conditions encountered at the Landfill site.

A figure depicting Seas Branch Quarry, as well as photos from quarry visit, are provided in **Appendix E**. A summary of all field investigation methods and procedures is provided within the 2025-2026 Addendum Field Investigation Procedures Memo included within **Appendix F**. Results of the field investigation are discussed in subsequent sections.

2.2 Drilling and Well Locations

In the March 2025 Incompleteness Determination, the WDNR indicated that "…the transition of the perched aquifer to the east and southeast of the current landfill was a significant hydrogeologic change that requires site-specific data…". Therefore, the drilling investigation focused on collecting data from the transition area where the perched water table dissipates and the groundwater mounding of the regional water table system occurs.

The 2025 field investigation was completed to further define the hydrogeologic conditions as follows:

- MW-20WT and MW-20: Investigate the perched water table transition to the regional water table, a well nest was installed southeast of MW-18WT/MW-18. The perched water table was observed at this location (discussed below); therefore, a perched water table well (MW-20WT) and a regional water table well (MW-20) were installed at this location.

In 2026, additional field investigation work was completed to further define bedrock geologic and hydrogeologic conditions including:

- Visual inspection of exposed bedrock at Sea Branch Quarry (an inactive quarry located about 0.5 miles north of the Landfill property).
- In-situ hydraulic conductivity testing of several previously installed monitoring wells/piezometers within 300 feet of the proposed eastern expansion area (MW-3, MW-4P, MW-5, and MW-10).

Note that information on quarry inspections completed by others in 2025 are also incorporated into the discussion below.

2.3 Subsurface Data Analysis

Based on a proposed horizontal landfill expansion area of 4 acres, a geotechnical investigation including 10 soil borings, five water table monitoring wells, and four piezometers is required. The accepted Alternative Geotechnical Investigation Program (AGIP) includes utilization of data from 18 existing soil borings, three existing perched water table monitoring wells (MW-4P, MW-5A, and MW-12), two existing regional water table monitoring wells (MW-5 and MW-14), and five existing nested piezometers (MW-3, MW-6, MW-10, MW-11, and MW-14Z).

In order to meet the regulatory requirements and further investigate the subsurface in the area of the proposed expansion, the following has been completed to date:

- In 2022, eight new borings (B-18, B-19, B-20, B-21, MW-14WT, MW-15WT, MW-16, and MW-17WT, MW-18) were performed as part of the initial investigation to provide bedrock data and additional soil data. Four new perched water table monitoring wells (MW-14WT, MW-15WT, MW-16WT, and MW-17WT), and one new regional water table monitoring well (MW-16) were also completed during the investigation of the proposed expansion area to meet regulatory requirements and provide groundwater data in accordance with the approved AGIP.
- In 2024, four additional borings (B-22, MW-16Z, MW-18, and MW-19Z) were performed to provide additional bedrock and groundwater data. One new perched water table monitoring well (MW-18WT), two new regional monitoring wells (MW-18 and MW-19), and two new piezometers (MW-16Z and MW-19Z) were completed during an addendum investigation of the proposed expansion area to provide additional groundwater data.
- In 2025, two borings (MW-20 and MW-20WT) were preformed to provide further additional bedrock and groundwater data. One new perched water table monitoring well (MW-20WT) and one new regional monitoring well (MW-20) were completed during the addendum investigation of the proposed expansion area to provide additional groundwater data.

- In 2025 and 2026, two bedrock quarries located in the vicinity of the Landfill (Gudgeon Pit Quarry and Seas Branch Quarry) were evaluated to assist in meeting geotechnical code requirements (as an alternative to further geophysical/drilling investigation work).

The following subsections provide additional information on and refine the original geology and hydrogeology as submitted within the Feasibility Report (September 11, 2023) and Feasibility Report Addendum 01 (November 19, 2024), including any updates based on the additional information gathered during the 2024, 2025, and 2026 addendum field investigations.

2.3.1 Site Geology

A description of geologic conditions was provided within Section 5.4.1 of the Feasibility Report and refined/expanded upon in the Feasibility Report Addendum 01; as a result, the discussion below provides further updates to the understanding of geologic conditions based on the evaluation of previous site investigations and new information obtained in 2025 and 2026 investigations.

The following sections describe the site geology based on cumulative resources as well as updated observations, evaluations, and/or assessments. A summary of new and previously completed soil borings located within 300 feet of the proposed expansion and extent at least 25 feet below subbase elevation are provided in **Table 1**. A table summarizing monitoring wells and piezometers withing 300 feet of the proposed expansion is provided in **Table 2**. The locations of the wells and boreholes are shown on **Plan Sheet 3**. Revised select soil boring logs are provided in **Appendix I**. Revised geologic cross-sections of the site are provided as additional sheets on **Plan Sheet 11** through **Plan Sheet 22**.

2.3.1.1 Definition of Karst

In site geology discussions for the Landfill site, the following definition of karst will be used as presented by WGNHS staff and the WDNR in the July 2025 Memorandum, provided in **Appendix B**:

> *“Karst is not a single feature such as a sinkhole or a cave; rather, karst is a landscape where dissolution of carbonate rock has created features such as sinkholes, conduits, and caves. In Wisconsin, groundwater flow often occurs in fracture networks in the carbonate rocks of the karst terrains. These networks can be dense and well connected or can be dominated by several larger scale fractures. And while karst terrain is common in many areas of Vernon County and much of southern WI, it does not necessarily mean that there are large sinkholes or caves that would impact the monitorability or stability of the landfill. It is well known from research studying the Prairie du Chien formation that it has small fractures and cavities and typically cavities are filled with soil. Substantive sinkhole development typically only occurs in the Prairie du Chien where bedrock is less than 30-feet deep, which is not the case at this site where bedrock is in excess of 40-feet from ground surface.”*

Therefore, based on this definition, site geologic conditions were evaluated in reference to those specific features associated with karst landscapes or terrain, where dissolution of carbonate rock has created features such as sinkholes, conduits, and caves. In the absence of those features, secondary features such as small dissolution cavities (vugs) and bedrock fractures were used to evaluate site geologic conditions as requested by the WDNR as “karst indicators”; physical properties noted included void size, mineralization, fracture density and interconnectedness. The observed physical properties along with bedrock classification, degree of weathering or cementation, and drilling observations are the conditions that ultimately contribute to groundwater flow and determine the monitorability of the site.

2.3.1.2 Boring Log Evaluations and Field Observations

To further evaluate site geologic conditions and to assess site stability/monitorability, all boring logs available for the site were reviewed (including any boring logs/test pits dating back to the original site investigation completed as early as 1988). A summary of observations related to fractures, dissolution cavities (vugs/voids), bit drops, fluid loss during drilling, or other observations are provided in **Table 6**. Assessment of site stability and monitorability based on these observations are discussed in later sections of this report.

<u>Sandstone and Residuum Re-classifications</u>
Drilling during 2025 using sonic methods confirmed the presence of a separate sandstone unit in the southeast corner of the site, outside the existing and proposed landfill expansion footprint. As a result, previously completed boring logs were evaluated to determine the extent of the sandstone unit. While reviewing boring logs, it was determined that this separate sandstone geologic unit was previously considered weathered sandy dolomite using other drilling methods. In addition, geologic units encountered in MW-16Z were reassigned as residuum.

As applicable, boring logs completed by SEH were revised to reflect the changes. Revised boring logs and photos of cores from sonic boreholes confirming these observations are included in **Appendix I**. Further discussion of the sandstone and residuum as it relates to interpretation of the bedrock surface and cross-sections is provided in **Section 2.3.2** and **Section 2.3.3**, below.

<u>Fractures and Dissolution Cavities (vugs/voids)</u>
As presented in Section 5.4.1 of the Feasibility Report, and further discussed in the Feasibility Report Addendum 01, fractures and dissolution cavities are present within the dolostone bedrock as is commonly observed in carbonate rocks. While fractures and dissolution cavities are present as “karst indicators”, it is also important to understand how and why the fractures and dissolution cavities were formed, the actual observed groundwater flow pathways, the likelihood of significant karst landscape development, and the limitations of other geophysical methods.

Dissolution cavities and fractures are present at the site, particularly in the unsaturated zone. As described in Section 5.4.1 of the Feasibility Report, assessment of bedrock coring completed during 2022, and historically at the site, resulted in the following observations and conclusions:

- Dissolution cavities occur primarily as small voids or vugs and do not appear to be interconnected. This is consistent with the published understanding of the Prairie du Chien Group and its hydraulic properties:
  - The uppermost bedrock is in the Oneota Dolomite which regionally has been defined as a confining unit; the overlying Shakopee Formation (not present at our site) is defined regionally as an aquifer (Tipping et al, 2006).
  - The predominant rock type/mineral in the Oneota Dolomite is dolomite (Tipping et al, 2006).
  - Dolomite is significantly less soluble than calcite, especially in the presence of calcite (Drever, 2002).
  - More dissolution of carbonates occurs in open systems with exposure to the atmosphere where CO_2 is readily available; that is why there is less modern

dissolution below the perched water table where atmospheric CO_2 would be less available.

  – The secondary porosity (fractures/vugs) are considerably lower in the Oneota Dolomite than the overlying Shakopee (Tipping et al, 2006).

- Shallow bedrock, in general, is often highly fractured and the fractures are likely more interconnected.

Drilling methods used on-site have varied over time. Traditional coring methods had a history of low recovery and therefore, in 2003, versa sonic was used to core borings MW-1RZ, MW-13P, and MW-14Z in attempts to improve recovery. While the use of sonic generally provided higher recovery within the unconsolidated units, it had variable success with accurately logging actual bedrock conditions. The following outlines the precautions that need to be used when interpreting the sonic boring logs completed on-site.

- As stated within the 2003 Feasibility Report, “Note that the cores obtained from MW-1RZ, MW-13P, and MW-14Z had generally higher fracture frequencies and lower RQD values than those obtained previously from MW-7 and MW-10. This probably reflects the fact that the recent cores were drilled using the versa-sonic method” (Central Wisconsin Engineers, Inc., August 2003).
- No further description is provided on the versa sonic boring logs (e.g. mineralization along fractures, freshness of breakage) for the fracture zones that are noted and therefore, it cannot be determined if they were naturally formed or mechanically formed.

Therefore, the “highly fractured zones” that are noted on the MW-14Z boring log are most likely less competent portions of bedrock (higher percentage of sand or silt) which fractured more readily during drilling. This is also most likely the case for other versa sonic boring logs completed on-site (MW-1RZ and MW-13P). The use of versa sonic provides high recovery and is useful but additional factors need to be considered when interpreting the boring logs.

Other boreholes on-site were further reviewed and assessed in reference to fractures, vugs, or crevices noted. Notes on these boreholes are provided below.

- Please note that MW-12 was not logged separately; MW-10 was cored, and the same log was used for the shallower nested wells MW-11 and MW-12. The boring log for MW-10 notes “occasional small vugs” and “numerous small vugs” but does not describe any fractures or crevices. A majority of RQD’s below the water table are above 70%, indicating competent bedrock.
- MW-7 was cored with methods similar to MW-10 and notes minor vugs throughout the boring, no fractures were observed. RQD percentage ranges from 16% to 90% between the depth to water table (approximately 118 feet bgs) and boring termination. The lowest RQD’s (16 to 23%) are present at depths where sandstone interbeds are noted and therefore, the low RQD’s are noting the change in lithology from a hard dolostone to an interbedded dolostone, which fracturing from drilling is more likely.
- MW-6 was logged from cuttings only. Dolomite is noted to be broken up with crevices in the upper 30 feet bgs. Fractures, vugs, or crevices were not noted below the water table.
- MW-5 was also logged from cuttings only and notes layers of broken up dolomite with crevices throughout the boring with two crevices below the water table. Since this borehole was not cored, the crevices noted are most likely notes from the driller on rods dropping during drilling. Monitoring well MW-5 was set at the depth of one of the crevices

noted within the boring log. Slug testing was then completed at MW-5 and a hydraulic conductivity of 2.6E-04 cm/sec was measured. This hydraulic conductivity value suggests that this crevice is not highly interconnected, as the formation responded predictably and not as turbulent flow.

During the 2024 and 2025 field investigations, sonic drilling methods were utilized to increase recovery and aid in determining depth to water (boring logs/core photos included in **Appendix I**). The boreholes were reviewed and assessed in reference to fractures, vugs, or crevices as summarized below:

- **B-22:** Sporadic vugs were noted throughout the dolostone encountered in B-22 from 55 to 105 feet bgs. No fractures or crevices were encountered within B-22.
- **MW-16Z:** Minor vugs were noted within dolostone encountered in MW-16Z from 80 to 85 feet bgs. A void was thought to occur from 98 to 100 feet bgs during drilling (as the driller's note a drop in the drilling rods) but once the soil was observed, it was discovered the "void" was most likely due to a transition from competent to weathered dolostone within unconsolidated residuum deposits.
- **MW-18:** No vugs, fractures, or crevices were encountered in MW-18.
- **MW-19Z:** No vugs, fractures, or crevices were encountered in MW-19Z
- **MW-20:** No vugs, fractures, or crevices were encountered in MW-20

As stated previously, fractures in carbonate bedrock are common and some fractures are likely to be interconnected. The 30 years of monitoring on-site groundwater elevations confirm that the perched water table and regional water table are consistent, which indicates a relatively dense fracture frequency that are interconnected. Static water elevations measured in monitoring wells at the site are predictable and confirm the monitorability of the site.

<u>Fluid Loss During Drilling</u>
During the 2022 drilling investigation, water or drilling mud loss was noted in both MW-15WT and MW-16.

- In MW-15WT, borehole began losing drilling fluid around 75 feet bgs and continued to termination (99 feet bgs). Fluid loss was first noted to begin <u>above the water table</u> within poorly consolidated sandstone and underlying sandy dolostone; however, fluid pressure was able to be maintained to termination.
- In MW-16, borehole began losing drilling fluid around 60 feet bgs and also continued to termination (98 feet bgs). Grout was also noted to be lost during the well construction of MW-16 between the depths of 60 and 78 feet bgs. Fluid loss was first noted to begin <u>above the water table</u> within residuum consisting of primarily weather sandy dolostone with a minor shale seam noted at 75 feet bgs; however, fluid pressure was able to be maintained to termination.

As a result, this loss of water was concluded to not be due to significant fractures or voids within the formation but was most likely due to the poorly consolidated sandstone and highly weathered sandy dolostone and residuum. The high head (more than 60 feet of head) exerted within the borehole from the mud rotary drilling method is able to force the mud or water into the unsaturated, more permeable layers of the formation.

While drilling with fluid, the ability of the borehole to maintain drilling fluid pressure indicates there are no significant interconnected fractures or solution cavities. As indicated in the report, the loss of drilling fluid occurred into unsaturated poorly consolidated sandstone and weathered sandy dolostone from more than 60 feet of fluid pressure within the borehole. The sandstone and weathered sandy dolostone encountered on-site appears to have a higher porosity and, as a result, provided a pathway for the drilling fluid to travel. While some drilling fluid was lost through termination of the borings, drilling fluid pressure returned allowing for borehole advancement without needing to seal off those portions of the boreholes; therefore, it was determined that the unsaturated pathway within the sandstone and weathered sandy dolostone could not be extensive in nature and likely a localized horizontal pathway as would be anticipated in any geologic condition.

2.3.1.3 Quarry Evaluations

Two bedrock quarries are located in the vicinity of the Vernon County Landfill (Gudgeon Pit Quarry and Seas Branch Quarry). To further evaluate the geologic conditions of the bedrock and unconsolidated units, each quarry was visited to visually document observations. Photos and documentation related to the evaluation of the two quarries are provided in **Appendix E**.

A preliminary visual assessment of both the Gudgeon Pit Quarry and Seas Branch Quarry were made by reviewing digital photographs of exposed bedrock outcrops along the quarry walls provided by SEH and Vernon County staff, taken in October 2025.

Based on the initial assessment, the following observations were made:

- Exposed bedrock is representative of Oneota Dolomite present at both quarry locations.
- Dolomite corresponds to dolomite recovered in cores during completion of coring and sonic boreholes on the landfill property.
- Where exposed, dolomite appeared to be overlain only by a thin layer of saprolite with a more significant unconsolidated, reddish residuum consisting of residuum, colluvium, loess (where present), and topsoil.
- There is evidence of small fractures throughout the rock face (with evidence of blasting/quarrying activities leading to some larger fractures). Based on the photos no significant voids, groundwater, sandstone, or features associated with a karst terrain were observed.

WDNR department staff also visited both the Seas Branch Quarry and the Gudgeon Pit Quarry on March 3, 2026. Quarry observations made by WDNR staff were discussed in a meeting on March 9, 2026, in reference to geotechnical code requirements that were incomplete, particularly as an alternative to further geophysical/drilling investigation work. These additional items included observations of the degree/nature of fractures observed along the outcrops, secondary evidence of groundwater seepage (such as staining on rock faces), and discussion of voids in upper portions of quarry walls. A copy of the letter received from the WDNR in March 2026 addressing the status of the feasibility report and a summary of the meeting notes from the March 9th meeting (with a matrix outlining the suggested additional information to provide) is provided in **Appendix D**.

To address the WDNR's list of additional information to meet geotechnical code requirements, further evaluation of bedrock outcrops at Seas Branch Quarry was completed during a site visit on April 1, 2026. An SEH Professional Geologist, licensed in Wisconsin, completed an on-site visual inspection. Photos and observation notes were collected documenting the bedrock units, size/frequency of fractures, weathering, voids or vugs, and presence of groundwater to compare with soil boring records and other investigation work completed (**Appendix E**). It should be noted that due to safety concerns, all observations were made away from the quarry walls to avoid potential for falling rocks from the quarry walls. The following observations were recorded:

Seas Branch Quarry: Located about 0.5 miles north of the Vernon County Landfill, the wall of the inactive quarry provides an approximate 130-foot profile of Oneota Dolomite (approximately 1080 to 1210 feet above mean sea level [amsl]). The rocks and soils present at the quarry are representative of the Hager City Member of the Oneota Dolomite of the Prairie du Chien Group along with 10 to 20 feet of overlying unconsolidated soils near the top of the outcrop (residuum, colluvium, and/or loess). Within the Oneota Dolomite, two distinct layers are visible, separated by a thin shaley layer of the dolomite unit. The upper bedrock layer is about 75 feet thick; near the surface or directly underlying the unconsolidated material the upper layer exhibits thinner bedding with more heterogeneity, fracturing, and vugs/cavities while the lower bedrock layer is about 55 feet thick and is more thickly bedded, less fractured, and more competent.

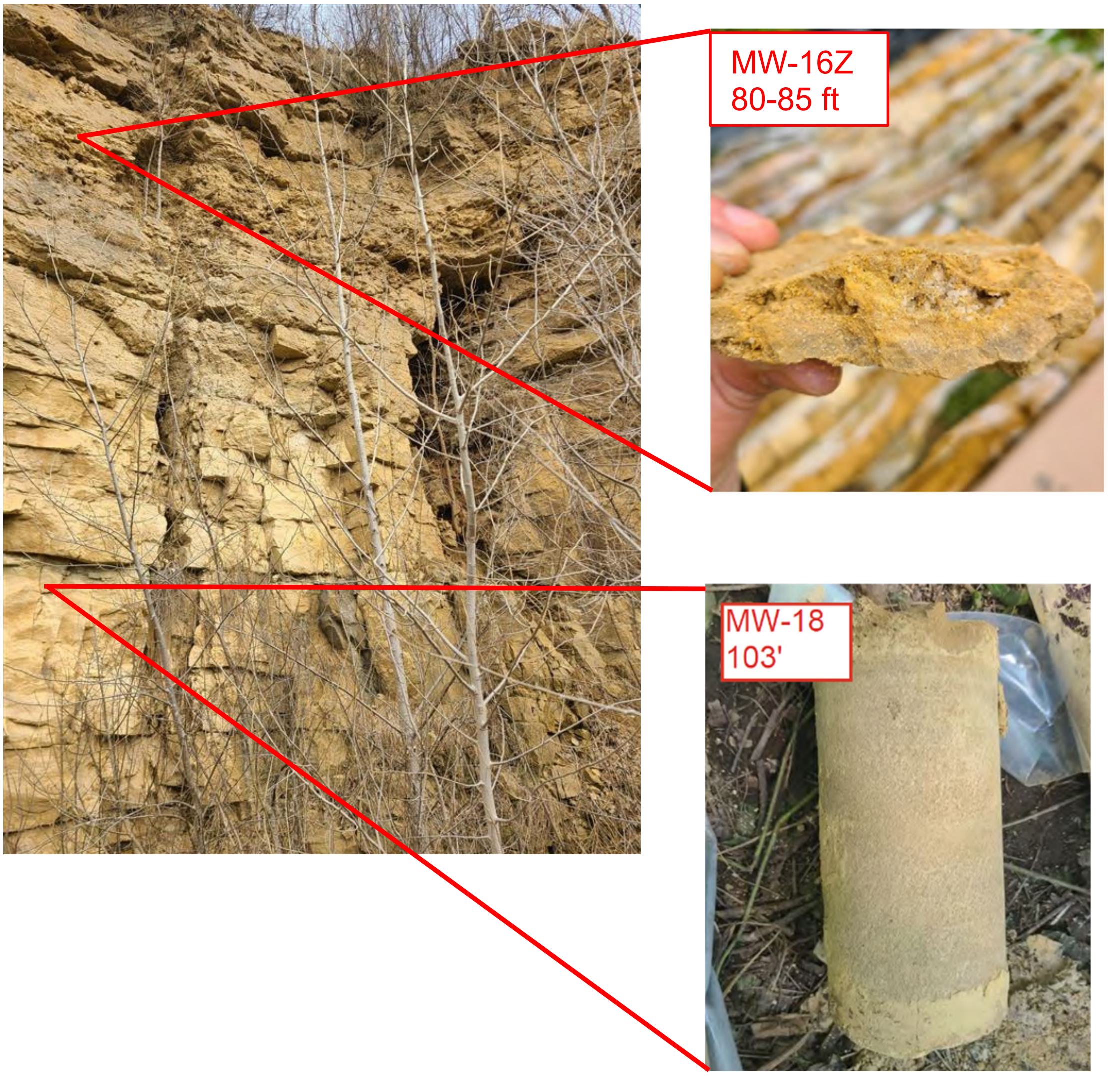
Depth to the uppermost water table is estimated to be approximately 90 feet below the quarry floor. Following precipitation events, that portion of surface water that percolates into the overlying soil and eventually enters bedrock is conveyed along fractures in the unsaturated upper bedrock layer; these pathways in the unsaturated bedrock layer may locally intersect the quarry wall, forming local seeps that are primarily indicated by black mineral precipitates on the rock face (also some epilithic algae) and seasonally the presence of wetness. No evidence of sinkholes or caverns was observed at the site. As commonly found in carbonate bedrock conditions, the frequency and size of voids decrease with depth on the quarry wall as dissolved carbon dioxide concentrations generally decrease with depth. The concentration of dissolved carbon dioxide nearer the surface generally contributes to the dissolution of minerals.

Gudgeon Pit Quarry: Located about 1.5 miles south of the Vernon County Landfill, the wall of the active quarry provides an approximate 120-foot profile of Oneota Dolomite, the lower formation of the Prairie du Chien Group (approximately 1080 to 1200 feet amsl). Similar to Seas Branch Quarry, the rocks and soil present at the quarry are representative of the Oneota Dolomite of the Prairie du Chen Group along with 10-15 feet of overlying unconsolidated soils near the top of the outcrop (residuum, colluvium, and/or loess). Within the Oneota Dolomite, two distinct bedrock layers are visible, separated by a shaley layer of the dolomite unit serving as a contact. The upper bedrock layer is about 70 feet thick. Similar to Seas Branch Quarry, near the surface or directly underlying the unconsolidated material, the upper bedrock layer exhibits thinner bedding with more heterogeneity, fracturing, and vugs/cavities while the lower bedrock layer is about 50 feet thick and is more thickly bedded, less fractured, and more competent.

Depth to the uppermost water table is estimated to be approximately 130 to 140 feet below the quarry floor. Similar to Seas Branch Quarry, water that infiltrates the bedrock from the surface travels along fractures in the upper bedrock layer and locally seeps from the quarry wall as primarily indicated by the seasonal presence of wetness on the rock face and black mineral precipitates (also some epilithic algae). No evidence of sinkholes or caverns occurs at the site. As anticipated under the bedrock conditions, the frequency and size of voids decrease with depth on the quarry wall as dissolved carbon dioxide concentrations decrease with depth. The concentration of atmospheric carbon dioxide nearer the surface generally contributes to the dissolution of minerals.

To compare quarry observations with groundwater conditions, static water levels estimated for the Seas Branch Quarry and Gudgeon Pit are based on water levels from the Wisconsin Well Inventory (Wisconsin Department of Natural Resources). Filtering the well inventory for wells located within Vernon County and for wells containing a static water level reading, the resulting points were then exported to Excel for analysis and confirmation that the wells are in the correct location. The points in Excel were then input into the contouring software Surfer® to create static water level contour lines between the well static water levels. Once complete, the contours were then overlain on the quarry and pit locations (as points) in a map using ArcGIS Pro® and a visual estimate was ascertained for the static water level at each location. Groundwater contours discussed above are presented in **Appendix E** (Figure 4).

The photos below show a comparison of bedrock encountered in sonic drilling core from the field investigations at the landfill property to the bedrock outcrops observed at the Seas Branch Quarry.



The observations made at the quarry outcrops generally align with the bedrock data collected from soil borings completed across the landfill property and concur with the overall observation of the geologic conditions of the Oneota Dolomite, saprolite, and residuum (described above) originally presented as part of the Feasibility Report. In reference to properties of the Oneota Dolomite, the following conclusions have been made:

- Dissolution cavities and fractures as “karst indicators” are present within the Oneota Dolomite.
- Dissolution cavities or vugs tend to be isolated and not interconnected.
- The decrease in the size and frequency of dissolution cavities or vugs with depth corresponds with anticipated conditions due to depth to groundwater where the presence of atmospheric carbon dioxide that forms the dissolving carbonic acid also would decrease with depth.
- The moderate fracture network observed in the Oneota Dolomite in the quarries align with the poor recovery and equipment damage that occurred during bedrock coring of the dolomitic rock at the landfill.

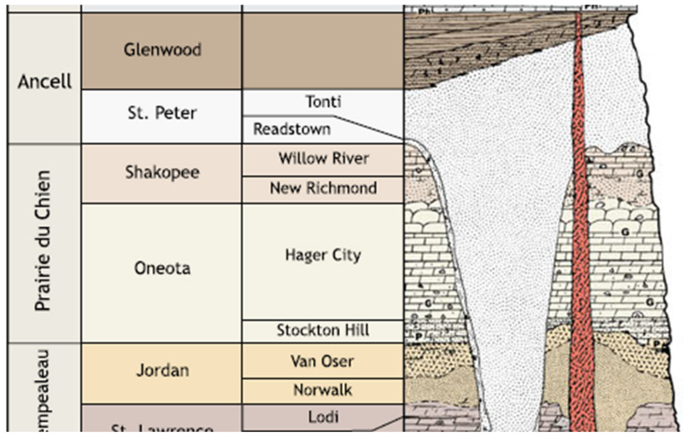
- The moderate fracture network of the Oneota Dolomite includes sufficient density to be interconnected for percolating water that seeps downward from the surface.
- The Oneota Dolomite is unsaturated at the quarries with groundwater 90 to 130 feet below the quarry floor, similar to the perched and regional water table conditions at the landfill.
- Following precipitation events, that portion of surface water that percolates into the overlying soil and eventually enters bedrock is conveyed along the moderate fracture network in the unsaturated upper bedrock layer; these pathways form localized seeps in the unsaturated bedrock layer that intersect the quarry wall.
- No evidence of sinkholes or caverns was observed at the site.

2.3.1.4 Updated Site Stratigraphy

Based on the additional information gathered in the addendum field investigations completed between 2024 and 2026, the following provides an updated summary of the uppermost site geologic units defined in reference to four primary depositional environments:

- **Unconsolidated deposits:**
  - Loess: Windblow fine-grained sediment.
  - Residuum: Red, residual clay formed by the chemical weathering of carbonate bedrock and locally synonymous with the Rountree Formation (Knox, et al., 1990). Residuum no longer retains the structural features or details of its bedrock. Based on the variable depositional environment for the Rountree Formation including downslope movement (colluvium), the residuum includes clay with pebbles, cobbles, and boulders (Clayton and Attig, 1990).
- **Saprolite:** Weathered dolomitic bedrock retaining details or structural features of the bedrock. Due to the poorly consolidated nature, saprolite associated with sandstone is not segregated from the sandstone unit described below.
- **Poorly Consolidated Sandstone:** Visual inspection of sonic boring core during recent drilling (photos included in **Appendix I**) confirms the presence of a separate sandstone geologic unit previously considered weathered sandy dolomite using other drilling methods. Publications have not identified this separate stratigraphic unit to be present in this area. Based on review of publications and correspondence with Minnesota and Wisconsin geological survey staff, the poorly consolidated sandstone likely represents one of the following stratigraphic units illustrated in the Wisconsin stratigraphy column (WHNHS, 2011):
  - <u>New Richmond Member of the Shakopee Formation</u>: The contact between the Shakopee and the underlying Oneota represents an unconformity. Where present, the New Richmond Member is described as a sandstone, but there is little documentation on whether the New Richmond Member occurs within such deep channels in the Oneota Dolomite as found at the landfill site.

– Readstown and Tonti Members of the St. Peter Sandstone: Particularly in western Wisconsin, the St. Peter Sandstone is more likely to be deposited within channels often deep into the Oneota Dolomite as shown below.



- **Dolostone Bedrock**: The Hager City Member of the Oneota Dolomite represents the uppermost bedrock of the Prairie du Chien Group.

2.3.2 Bedrock Surface Map (Addendum Field Investigation Updates)

Based on the establishment of a separate sandstone stratigraphic unit (discussed in the previous sections above), the bedrock surface map included on **Plan Sheet 10** has been revised.

On the bedrock surface map, the black contours represent the top of dolomite (and saprolite) of the Prairie du Chien Group which is present over most of the site. To contrast, the poorly consolidated sandstone has been overlain as isopach contours indicating the thickness of sandstone. As a result, a clearly defined west-east channel carved in the dolomite surface is present along the southern boundary within 200 feet of the landfill footprint; the west-east channel has been infilled with 0 to 60 feet of sandstone with the thickness increasing to the east. Similarly, a north-south channel was carved in the dolomite surface along the eastern boundary of the landfill expansion; the north-south channel has been infilled with 0 to more than 100 feet of sandstone with the thickness increasing to the south. Near well nest MW-16 (MW-16WT, MW-16, and MW-16Z), there is evidence that the steep sidewall of the channel collapsed at some point resulting in unconsolidated deposition of residuum with colluvium primarily consisting of a clay matrix and designated as part of the on-site residuum.

The modified bedrock surface map does not change the separation distance of a minimum of 20 feet between the base of the landfill and the uppermost bedrock. In areas where the landfill expansion falls above or near to sandstone, residuum is much thicker with the separation distance generally 30 to 50 feet.

2.3.3 Geologic Cross-sections (Addendum Field Investigation Updates)

Eleven geologic cross-sections (Sections A through K) created across the landfill property for the Feasibility Report evaluated the subsurface conditions across the site and within the proposed expansion area. The geologic cross-sections were updated in Addendum 01 and are now revised to update information and geologic units as described above. The cross-section location map is included on **Plan Sheet 11**, with revised geologic cross-sections provided as additional sheets on

Plan Sheet 12 through **Plan Sheet 22**. Updated descriptions for the cross-sections are provided below.

- **Geologic Cross-Section A-A' (Plan Sheet 12):** No changes were made to geologic presentation. Static water levels were updated to August 2025.
- **Geologic Cross-Section B-B' (Plan Sheet 13):** No changes were made to geologic presentation. Static water levels were updated to August 2025.
- **Geologic Cross-Section C-C' (Plan Sheet 14):** The sandstone unit has been established on the eastern side of the cross-section for the north-south trending channel. About 30 feet of sandstone was encountered in the boring for MW-15WT. Static water levels were updated to August 2025.
- **Geologic Cross-section D-D' (Plan Sheet 15):** The sandstone unit has been established on the eastern side of the cross-section for the north-south trending channel. About 57 feet of sandstone was encountered in the boring MW-18. Static water levels were updated to August 2025.
- **Geologic Cross-Section E-E' (Plan Sheet 16):** The sandstone unit has been established on the eastern side of the cross-section for the north-south trending channel. More than 75 feet of sandstone was encountered in the boring for MW-20; no dolomite was encountered for the depth drilled. Static water levels were updated to August 2025.
- **Geologic Cross-section F-F' (Plan Sheet 17):** The saprolite and dolomite units have been adjusted on the eastern side of the cross-section near well nest MW-16. Weathered to competent dolomite (previously considered to be saprolite overlying the top of the dolomite bedrock surface) is now thought to be more likely residuum. The deposition of the residuum is thought to be associated with a second channelization event that eroded through both sandstone and underlying dolomite in the area, then infilled with residuum (including significant colluvium containing weathered dolomite bedrock) from the channel walls to the north, west, and south. The residuum channel appears to trend west-east with more than 110 feet of residuum encountered in the boring for MW-16Z; top of bedrock surface was not encountered before termination of boring to set piezometer. Static water levels were updated to August 2025.
- **Geologic Cross-section G-G' (Plan Sheet 18):** The sandstone unit has been established on the eastern side of the cross-section for the north-south trending channel; in addition, given the southern position of the cross-section and need to include well MW-13P, a small portion of the west-east trending channel is also depicted in the vicinity of MW-13P. Approximately 26 feet of sandstone was encountered in MW-13P and more than 118 feet of sandstone was encountered in the boring for MW-19Z; no dolomite was encountered. Static water levels were updated to August 2025.
- **Geologic Cross-Section H-H' (Plan Sheet 19):** No significant changes were made to geologic presentation. Static water levels were updated to August 2025.
- **Geologic Cross-Section I-I' (Plan Sheet 20):** The sandstone unit has been established on the southern side of the cross-section for the west-east trending channel. About 26 feet of sandstone was encountered in boring MW-13P. Static water levels were updated to August 2025.
- **Geologic Cross-Section J-J' (Plan Sheet 21):** The sandstone unit has been established on the southern side of the cross-section for the west-east trending channel. About 40 feet of sandstone was included based on the sandstone isopach provided on **Plan Sheet 10**. Static water levels were updated to August 2025.

- **Geologic Cross-Section K-K' (Plan Sheet 22):** The sandstone unit has been established outside the landfill footprint for the north-south trending channel. Based on four borings completed for MW-15WT, MW-17WT, MW-18, and MW-20, the sandstone ranges in thickness from 20 feet to more than 82 feet in the southeast corner of the site (MW-17WT) where no dolomite was encountered. The residuum channel discussed above for cross-section F-F' was also established, intersected generally perpendicular to the west-east trending channel. The residuum channel (greater than 120 feet deep) is shown cutting down through the relatively thick sandstone unit present at MW-20 and MW-17WT; top of bedrock surface was not encountered in MW-16Z before boring was terminated to set piezometer. Static water levels were updated to August 2025.

2.3.4 Site Hydrogeology

Although a description of site hydrogeology is provided within **Section 5.4.2** of the Feasibility Report (September 11, 2023), the following discussion updates the hydrogeology discussion based on new information obtained during recent site investigations. It has been determined that a perched water table and regional water table exist on-site. A summary of the wells and their construction that are located within 300 feet of the proposed expansion used for assessing groundwater conditions is provided in **Table 2**. An updated Groundwater Monitoring Well and Point Information Form for 2025 well installations is provided within **Appendix G**.

Groundwater elevations measured in the monitoring wells and piezometers across the entire landfill property between 2020 and 2025 are summarized in **Table 3**. Monthly groundwater measurements were recorded between March 2025 and August 2025. The highest measurements previously presented on **Plan Sheet 4** through **Plan Sheet 9** illustrate these high and low events within the Perched Water Table, Regional Water Table, upper potentiometric surface, and lower potentiometric surface.

After installation of the 2025 monitoring wells, baseline groundwater monitoring events were completed for all wells installed in 2024 and 2025 with data included in **Appendix F**. The May and August 2025 groundwater elevations are illustrated in **Appendix H** for the perched water table and regional water table. These most recent groundwater elevation contour maps have been submitted in an appendix as opposed to including in the Plan Sheet drawings since additional details (such as the use of color) were used to more clearly present groundwater conditions and do not match the overall style of the other drawings/figures. Additional groundwater contour maps will be provided at the time of Plan of Operation submittal as needed.

2.3.5 Perched Water Table Contour Maps

The high perched water table contour map generated for the May 2023 monitoring event is included on **Plan Sheet 4**. The low perched water table contour map generated for the January 2023 monitoring event is included on **Plan Sheet 5**. The perched water table surface slopes generally from north to south-southeast across the site. The highest water table elevations are along the northern boundary of the existing landfill and proposed landfill Expansion area. The lowest water table elevations are on the southeastern edge of the proposed landfill expansion area within a bedrock valley.

As discussed above, the perched water table flows to the south-southeast and the head loss decreases dramatically within the southeast edge of the proposed landfill Expansion area near well nest MW-16WT/-16/-16Z. This is due to the increase in weathered bedrock and changing lithology to the poorly consolidated sandstone within this area causing the perched water table to diminish and transition to the underlying regional water table.

2.3.5.1 2024 through 2026 Field Investigation Updates

Field documentation associated with the 2025-2026 Addendum Field Investigations are included in **Appendix F** (field documentation associated with the 2024 Addendum Field Investigation was included in the previous Feasibility Report Addendum 01). The results of the additional investigations confirm and refine previous perched water table conditions. The following items from the 2024 through 2026 Addendum Field Investigations aided in further refinement of the perched water table within the southeast portion of the proposed expansion area:

- Confirmation of no perched water table within the MW-16 location.
- Perched water table well MW-18WT.
- No perched water table within the MW-19 location.
- Perched water table well MW-20WT screened in sandstone confirmed the approximate edge of the perched system with the ability to be purged dry with slow seepage to recharge.
- Regional water table well MW-20 confirmed the vertical relationship to the perched water level observed in nested well MW-20WT.
- Perched water found at an approximate elevation of 1220 feet in soil boring B-22 within the landfill footprint.

Perched water table maps for May and August 2025 data are provided within **Appendix H**. The perched water table surface slopes generally from north to south-southeast across the site, with head loss decreasing noticeably within the southeast corner near wells MW-16WT, MW-19, and MW-20WT due to the increase in weathered bedrock and changing lithology into sandstone within this area causing the perched water table to diminish and transition to the underlying regional water table. The lack of sustainable perched conditions in wells MW-16WT and MW-20WT verifies that the sandstone promotes vertical seepage to the underlying regional water table in the southeast corner of the landfill property.

Monitoring well MW-16WT is directly downgradient of the proposed landfill expansion area and although it is dry due to the perched water table not existing within this area, for landfill monitoring purposes its nested monitoring well MW-16 screened within the regional water table system, which would provide water quality data downgradient of the perched water table system and upgradient of the regional water table system. Similar conditions are present in the vicinity of well MW-19 and nested wells MW-20WT/MW-20; as a result, an inferred boundary of sustainable perched groundwater conditions is illustrated on **Figure 1** and **Figure 3** in **Appendix H**.

2.3.6 Regional Water Table Contour Maps

The high regional water table contour map generated for the May 2023 monitoring event is included on **Plan Sheet 6**. The low regional water table contour map generated for the January 2023 monitoring event is included on **Plan Sheet 7**. The regional water table surface slopes generally from south to northeast across the site. The highest water table elevations are along the southeastern corner of the proposed landfill expansion near MW-18 and MW-16. The lowest water table elevations are on the northeastern edge of the proposed landfill expansion area.

As discussed above, the overlying perched water table is not present within the southeast edge of the proposed landfill expansion area near MW-16 and MW-19, meaning the regional water table is the uppermost saturated surface in this area.

2.3.6.1 2024 through 2026 Field Investigation Updates

Field documentation associated with the 2025-2026 Addendum Field Investigations are included in **Appendix F** (field documentation associated with the 2024 Addendum Field Investigation was included in the previous Feasibility Report Addendum 01). The results of the additional investigations confirm and refine previous regional water table conditions. The following items from the 2024 through 2026 Addendum Field Investigations aided in further refinement of the regional water table within the southeast portion of the proposed expansion area.

- Confirmation of regional water table conditions at MW-16 location.
- Installation of regional water table well MW-18.
- Installation of regional water table well MW-19.
- Installation of regional water table well MW-20.

Regional water table maps with the 2025 monitoring wells are provided within **Appendix H**. The regional water table surface slopes generally from south to northeast across the site, with a northwesterly component of flow in the southeastern corner near MW-16, MW-18, MW-19, and MW-20 because the perched water table is no longer sustainable due to loss of the confining unit and increases in vertical hydraulic conductivity in the sandstone. Due to groundwater from the perched water table percolating downward, local recharge of the regional water table occurs; the uniform hydraulic conductivity of a sandstone, as opposed to dolostones or shales, allows for a uniform dissipation of the recharge causing a mounding condition in the regional water table. The highest elevation occurs in the vicinity of well MW-20, approximately 220 feet east of the proposed expansion cells.

Extended groundwater flow lines were added to the August 2025 regional water table map in **Appendix H** to illustrate flow paths; flow lines are drawn perpendicularly to groundwater contours as indicated in Freeze & Cherry (1979) and Fetter (1988) indicating groundwater flow is following the path of steepest descent. In general, due to the *localized* recharge from the overlying perched system, groundwater flow is toward the west-northwest. However, in order to maintain flow along the steepest descent and perpendicular to groundwater contours, the groundwater flow lines approximately 220 feet south of the proposed landfill expansion must curve around to the north, rejoining the northward flow of regional groundwater flow across the rest of the site.

2.3.7 Potentiometric Surface

An upper and lower bedrock potentiometric map was also prepared using the data collected for the May 2023 monitoring event and are included on **Plan Sheet 8** and **Plan Sheet 9**, respectively. The potentiometric groundwater conditions indicate a flow pattern similar to the regional water table conditions with the highest elevations to the south and the lowest elevations to the northeast.

2.3.7.1 2024 through 2026 Field Investigation Updates

Field documentation associated with the 2025-2026 Addendum Field Investigations are included in **Appendix F** (field documentation associated with the 2024 Addendum Field Investigation was included in the previous Feasibility Report Addendum 01). The results of the additional investigations confirm and refine previous potentiometric surface conditions. The following items from the 2024 investigations aided in further refinement of the upper potentiometric surface within the southeast portion of the proposed expansion area.

- Installation of upper piezometer MW-16Z
- Installation of upper piezometer MW-19Z

Upper potentiometric surface maps with the 2024 monitoring wells are provided within **Appendix H** (Figure 5 and Figure 6). The potentiometric groundwater conditions indicate a flow pattern similar to the regional water table conditions with flow generally from south to north with a northwesterly component of flow in the southeastern corner near MW-16Z and MW-19Z.

2.3.8 Horizontal Hydraulic Conductivity

Values of hydraulic conductivity based on slug tests performed on 29 different wells/piezometers across the landfill property, including the 2025 and 2026 slug tests, are summarized in **Table 4**. The table presents results from all tests completed at each location (some locations tested multiple times). In cases where multiple tests have been performed, a representative value was established from the available results.

2.3.8.1 2024 through 2026 Field Investigation Updates

Field documentation and post collection analysis/results of in-field hydraulic conductivity testing associated with the 2025-2026 Addendum Field Investigations are included in **Appendix F** (field documentation and analysis/results associated with the 2024 Addendum Field Investigation was included in the previous Feasibility Report Addendum 01). The slug test results for the wells installed in 2025 (MW-20WT/MW-20) as well as the results from the additional slug tests completed in 2026 (MW-3, MW-4P, MW-5, and MW-10) fall within one order of magnitude of the previously collected hydraulic conductivity values (further discussion of results is presented in the following sections).

2.3.8.2 Comparison of Hydraulic Conductivity Analysis and Results

As presented in **Table 4**, in-field hydraulic conductivity testing has been completed at least twice for 11 of the 29 wells/piezometers across the landfill property with most recent field investigations focusing on wells/piezometers within 300 feet of the proposed eastern expansion footprint. When comparing results, hydraulic conductivity values for tests in the same well/piezometer are generally consistent but can vary up to an order of magnitude or more.

Although the same monitoring wells have been slug tested throughout time, it is important to note that different techniques have been used in the field, as well as variable assumptions applied during analyses. For hydraulic conductivity testing completed in 1989, previous reports show the testing utilized bail-down recovery testing methods. This method of testing estimates hydraulic conductivity by rapid removal (“bail-down”) of water from a well using a bailer and measuring recovery of the water level over time. Recovery data was collected manually using a hand-held tape and a clock/stopwatch. In 2003 and in the most recent testing, pressure transducers and slugs were used to displace water and record well recovery instead of the bail-down/manual measurement method. This allowed for much greater accuracy in determining changes in water level elevation during testing.

Because of changes in technology/methodology, it is likely that hydraulic conductivity values before 2003 are less accurate than those completed later. When comparing the results of more recent slug tests that utilized similar testing methods and equipment (2003 through 2026), the assumptions used during slug test analysis may account for hydraulic conductivity differences. Current analysis for slug tests generally uses the software AQTESOLV®; in 2003, the slug test package included in AQUIFER WIN[32] (written by Rumbaugh, 1998) was used for the analysis. As a result, for tests in 2003, the previous reporting documents lack information pertaining to the aquifer thickness and other input parameters required to conduct the slug test analysis. In particular, aquifer thickness is an important and sensitive parameter, where different values may lead to an order-of-magnitude difference in hydraulic conductivity results. Because of the lack of prior data, the assumptions made for recent slug test analysis may vary from the prior test assumptions in 2003. Due to these changes, the new software and assumptions are likely the reason for some discrepancy between slug tests conducted on the same monitoring well. As a result, representative values established from the available results were based on evaluation of previous documentation and current hydraulic conductivity results.

2.3.8.3 Hydraulic Conductivity Summary

Based on the minimum, geometric mean, and maximum values of hydraulic conductivity presented in **Table 4**, the hydrogeologic properties for all materials screened (dolomite, sandstone, and residuum) are relatively uniform despite wells being screened at the perched water table, regional water table, or a lower piezometric condition. Results are summarized as follows:

- Perched Water Table Wells – *Prairie du Chein Group* (8 slug tests): With groundwater flow reflective of intrinsic permeability of the dolostone, values range from 6.34E-04 cm/sec to 1.18E-02 cm/sec, within two orders of magnitude, and a geometric mean of 3.21E-03. Values are slightly variable but likely reflect heterogeneities in the geologic conditions at the perched water table.
- Perched Water Table Wells – *Poorly consolidated sandstone* (2 slug tests): Values ranged from 2.43E-05 cm/sec to 2.34E-03 cm/sec, within two orders of magnitude, and a geometric mean of 2.38E-04. Similar to the values calculated for the other perched water table wells, the slight variations likely reflect heterogeneities in the geologic conditions at the perched water table.
- Regional Water Table Wells – *Prairie du Chein Group* (7 slug tests): With groundwater flow reflective of intrinsic permeability of the dolostone, values are slightly more variable ranging from 1.18E-05 cm/sec to 6.67E-02 cm/sec with a geometric mean of 6.88E-04 cm/sec, which is reflective of the variable geologic conditions at the regional water table. Note, as the water table elevation decreases to the north across the site, the regional water table wells are screened in lower and different portions of the Oneota Dolomite; as visually observed at the quarries, the physical properties likely vary with depth. Overall, the hydraulic conductivity is only around 1 order of magnitude lower than the perched system.
- Regional Water Table Wells – *Poorly consolidated sandstone* (2 slug tests): Values range from 2.94E-05 cm/sec to 1.04E-04, within one order of magnitude, and a geometric mean of 5.53E-05. Overall, the hydraulic conductivity is only around 1 order of magnitude lower than the perched system. The low hydraulic conductivity of the sandstone is reflective of the fine-grained texture of the unit.
- Piezometers – *Prairie du Chein Group* (9 slug tests): Values are within two orders of magnitude ranging from 1.07E-04 cm/sec to 3.07E-2 cm/sec with a geometric mean of 1.34E-03 cm/sec. Similar to the regional water table above, slight variability likely reflect heterogeneities in the geologic conditions below the water table.

- Piezometers – *Poorly consolidated sandstone* (1 slug test): Hydraulic conductivity value of 2.13E-04 cm/sec. The value is within the range of values calculated for the regional water table wells also screened in poorly consolidated sandstone and reflective of generally uniform flow at and below the water table in the sandstone.

Over the 29 slug tests results available, the geometric mean of slug tests is 9.70E-04 cm/sec indicating a relatively uniform hydraulic conductivity condition occurs. No turbulent flow was observed during any testing. Due to the relative uniform hydraulic conductivity testing results for all formations across the landfill property, the continuum approach is applied in evaluating site hydrogeology which can spatially define values of hydraulic conductivity and porosity. Freeze (1979) indicates that this approach is valid if fracture spacing as observed at the quarry is sufficiently dense, acting similar to a granular porous media.

In bedrock, the horizontal hydraulic conductivity averages cannot be compared to the vertical hydraulic conductivity values described below, due to all groundwater being located within bedrock and representative undisturbed rock core samples could not be collected.

2.3.9 Vertical Hydraulic Conductivity

No additional samples were analyzed in the laboratory for coefficient of permeability tests during the 2025 investigation. See Section 5.4.2.7 of the Feasibility Report (September 11, 2023) for a full description of vertical hydraulic conductivity.

2.3.10 Horizontal Gradients

Horizontal hydraulic gradients for the perched water table and regional water table were calculated across the landfill property using high water table elevation data (May 2023) and the corresponding water table contour map provided on **Plan Sheet 4** and **Plan Sheet 6**, respectively. The horizontal hydraulic gradient measurements were made perpendicular to the direction of groundwater flow.

The horizontal gradient of the perched water table is reflective of a localized system that is more directly tied to precipitation and localized recharge and better mimics local topography. Within the perched water table, the head loss across the landfill property is approximately 30 feet, with the largest head loss in the southeast near MW-16WT and MW-17WT where the perched system diminishes, and transitions to the underlying regional water table. Based on the Spring 2023 water table elevation data, the horizontal gradient for the perched water table was approximately 0.062 to the south-southeast. The hydraulic gradient within the perched water table directly beneath the proposed landfill expansion area was similar at approximately 0.066 toward the south-southeast.

The horizontal gradient of the regional water table is reflective of a regional groundwater system that intercepts and discharges to nearby surface water features north of the landfill. Within the regional water table, the head loss across the landfill property is approximately 30 feet with overall flow to the north-northeast towards and discharging to Seas Branch Creek more than 1,700 feet to the north. Using the Spring 2023 water table elevation data, the horizontal gradient for the regional water table was approximately 0.020 to the north north-northeast. The hydraulic gradient within the regional water table across the proposed landfill expansion area was approximately 0.035 toward the north-northeast.

2.3.10.1 2024 through 2026 Field Investigation Updates

The results of the 2024 through 2026 Addendum Field Investigations aided in further refinement of horizontal hydraulic gradients for the perched water and regional water table. Horizontal hydraulic gradients were calculated across the landfill property using water table elevation data (August 2025) and corresponding water table contour map provided on **Figure 3** and **Figure 4** in **Appendix H**, respectively.

There are no significant changes to horizontal hydraulic gradients within the perched water table. With the addition of perched water table wells MW-18WT and MW-20WT, the new horizontal gradient for the perched water table is approximately 0.036 to the south-southeast. The hydraulic gradient within the perched water table directly beneath the proposed landfill expansion area is similar at approximately 0.035 toward the south-southeast. Where flow leaves the dolostone and enters the sandstone, the hydraulic gradient increases to 0.17 to the southeast.

For horizontal hydraulic gradients within the regional water table, the addition of regional water table wells MW-16, MW-18, MW-19, and MW-20 indicate a mounding condition in the southeast corner of the landfill property (as described in detail above in **Section 2.3.6**). The regional water table surface still slopes generally from south to north-northeast across the site but now has variable flow directions in the southeast corner (over 200 feet east of the proposed landfill expansion) due to the mounding effect. Horizontal gradients for the regional water table for August 2025 are summarized as follows:

- The revised horizontal gradient calculated for the northeasterly component of flow across the site is approximately 0.014.
- The horizontal gradient for northwest to west flow east of the proposed expansion and away from MW-20 is about an order of magnitude greater at 0.17.

2.3.11 Vertical Gradients

Vertical gradients were calculated for nested wells and all static water elevation data available from 2020 to 2025 and are provided within **Table 5**. Vertical gradients were calculated by subtracting the head in the deeper well from the head in the shallow well and then dividing by the distance between the midpoint of the monitoring well or piezometer screens. Three different groups of vertical gradients were calculated and are summarized below:

- <u>Perched Water Table vs Regional Water Table:</u> The average vertical gradients between the perched and regional water table ranges from 0.536 (MW-20WT/MW-20) to 1.106 (MW-1PR/MW-1R) downward. Vertical gradients greater than a value of one (1) are indicative of perched groundwater conditions formed due to the presence of low permeability formations restricting downward groundwater movement.
- <u>Regional Water Table vs Piezometer:</u> The average vertical gradient between the regional water table and piezometers ranges from 0.017 (MW-1R/MW-1RZ) to 0.311 (MW-16/MW-16Z) downward. With the exception of well nest MW-19/MW-19Z, where the vertical gradient varies from -0.060 upward to 0.052 downward.
- <u>Upper Piezometer vs Lower Piezometer:</u> The average vertical gradient between the upper and lower piezometers ranges from 0.175 (MW-8R/MW-7) to 0.225 (MW-3/MW-6) downward.

2.3.11.1 2024 through 2026 Field Investigation Updates

The 2024 through 2026 Addendum Field Investigations do not provide any significant changes to vertical gradients between the Perched vs Regional Water Tables or the Upper vs Lower Piezometers. With the exception of well nest MW-19/MW-19Z, all wells show consistently downward vertical gradients between the Perched Water Table vs Regional Water Table as well as between the Regional Water Table and Piezometers. Vertical gradients were calculated for nested wells and all static water elevation data available from 2020 to 2025 is provided within **Table 3**.

For well nest MW-19 (Regional Water Table Well) and MW-19Z (Upper Zone Piezometer), the additional water level measurements in 2025 resulted in a low upward trending vertical gradient between the Regional Water Table and the Piezometer (ranging from -0.015 to -0.060 in 2025) compared to very low downward gradients in 2024. The low vertical gradient indicates predominately horizontal flow occurs in the Regional Water Table at locations upgradient of the proposed landfill expansion area.

Assuming downward gradients between the Regional Water Table and the Upper Zone is conservative for landfill facilities. Therefore, given the limited data and the challenges associated with measuring water levels in deep wells, additional water level data will be collected and presented as part of the Plan of Operations.

2.3.12 2024 through 2026 Groundwater Flow Velocity

The average linear flow velocity of the groundwater is calculated using the modified Darcy's Law equation $v = Ki/n_e$, where v = average linear flow velocity, K = hydraulic conductivity, i = hydraulic gradient, and n_e = effective porosity. See Section 5.4.2.10 of the Feasibility Report (September 11, 2023) for a full description of Groundwater Flow Velocity. Values for each parameter were established as follows:

- <u>Hydraulic conductivity (K):</u> Based on the discussion of hydraulic conductivity presented above in **Section 2.3.8**, the hydrogeologic properties for all materials screened (dolomite, sandstone, and residuum) are relatively uniform despite wells being screened at the perched water table, regional water table, or a lower piezometric condition. For purposes of calculating average linear flow velocity, the geometric mean of each of the units described in Section 2.3.8 are used to represent conditions as follows:
  - Perched Water Table (Dolostone): 3.21E-03 cm/sec
  - Perched Water Table (Sandstone): 2.38E-04 cm/sec
  - Regional Water Table (Dolostone): 6.88E-04 cm/sec
  - Regional Water Table (Sandstone): 5.53E-05 cm/sec
- <u>Hydraulic gradient (i):</u> Horizontal gradients are based on the groundwater contour maps completed for August 2025. For purposes of calculating average linear flow velocity, the following average horizontal gradient values are applied as follows:
  - Perched Water Table (Dolostone): 0.035 south-southeast
  - Perched Water Table (Sandstone): 0.011 south-southeast
  - Regional Water Table (Dolostone): 0.014 northeast
  - Regional Water Table (Sandstone): 0.17 northwest (localized groundwater mound)

- Effective porosity (n_e): Recent research on fractured bedrock determined that total porosities of the carbonate rocks is low ranging from 0.89% to 10.35%, with effective porosities even lower between 0.6% and 6.12% (Gang, et al., 2025). Low values for effective porosity relate to groundwater flow directed to interconnected fractures and not within the dense matrix of the rock itself. Sandstone on the other hand generally has a much more uniform effective porosity (USGS, 1985 and Seaberg, 2000). Because the sandstone is fine-grained with a lower hydraulic conductivity, a lower effective porosity is applied. Therefore, for purposes of calculating average linear flow velocity, the median value of the published range for dolostone and a conservative value for sandstone are used to represent conditions as follows:
  - Dolostone: 3%
  - Sandstone: 20%

Using the values presented above and the modified version of Darcy's Law ($v = Ki/n_e$), the average linear flow velocities calculated across the site are as follows:

- Perched Water Table (Dolostone): 10.61 feet/day south-southeast
- Perched Water Table (Sandstone): 0.37 feet/day south-southeast
- Regional Water Table (Dolostone): 0.91 feet/day northeast
- Regional Water Table (Sandstone): 0.13 feet/day northwest

2.3.13 Conceptual Flow Model Summary

Hydrogeologic conditions at the landfill site primarily consist of a carbonate bedrock system associated with the Oneota Dolomite of the Prairie du Chien Group. Although the more than 200 feet of dolostone and sandy dolostone are moderately fractured and described in literature as typically well cemented, no interconnected dissolution cavities were observed, and no evidence of sinkholes or cavern development was found in the carbonate system. The southeast corner of the site historically experienced erosion to develop a channel later to be in-filled with more than 120 feet of fine-grained sand believed to be associated with the younger St. Peter Sandstone. Fracture spacing of the dolostone as observed at local quarries indicate they are sufficiently dense as secondary porosity in the formation acts similarly to a granular porous media. Above the water table, the bedrock surface itself is highly weathered with localized occurrences of up to 25 feet of saprolite as well as localized occurrences of over 100 feet of reddish-colored residuum believed to be the Rountree Formation commonly found above the Oneota Dolomite in southwestern Wisconsin.

Calculated vertical gradients greater than one (1) indicate the presence of a barrier layer within the dolostone preventing any significant downward component of flow and forming a perched water table system about 90 feet below the surface (~1145 feet amsl) with a hydraulic conductivity or intrinsic permeability of about 3.21E-03 cm/sec. As a result, groundwater within the perched water table system flows horizontally via secondary porosity in the dolostone toward the southeast at around 10 feet/day until it encounters the more uniform fine-grained sandstone unit present southeast of the landfill expansion that has a lower hydraulic conductivity of approximately 2.38E-04 cm/sec. The lower hydraulic conductivity of the sandstone results in a decreased average linear flow velocity of less than 0.5 feet/day; however, the lack of a barrier layer within the sandstone-filled channel allows the water to percolate downward through unsaturated conditions in the sandstone to the underlying regional water table system.

The hydraulic conductivity within the sandstone channel decreases with depth to approximately 5.53E-05 cm/sec at the regional water table approximately 160 feet below the surface (~1075 feet amsl). As a result, the percolating water from the overlying unsaturated sandstone collects within the deeper sandstone channel causing a localized groundwater mound exceeding a static water elevation of around 1105 feet amsl. The increased hydraulic head forming the groundwater mound results in recharge to the local regional water table system, acting as a local groundwater divide with a reversal of horizontal hydraulic gradient towards the dolostone to the northwest beneath the landfill at less than 0.2 feet/day to the northwest. With the downgradient dolostone having a slightly higher hydraulic conductivity or intrinsic permeability of 6.88E-04 cm/sec, groundwater flow rejoins regional flow toward the northeast at about 0.9 feet/day. The regional water table flow eventually intersects the Seas Branch stream located about one-quarter mile northeast of the landfill site. Deeper within the regional system, downward components of flow dominate but localized upward gradients also occur as deeper bedrock flow systems merge.

2.3.14 2024 and 2025 Water Quality Assessment

With the 2024 and 2025 Addendum Field Investigations, the Vernon County Landfill currently has 33 groundwater monitoring wells or piezometers used to assess groundwater conditions at the site. The groundwater monitoring program is conducted in accordance with the WDNR approved plan modification request (WDNR, February 9, 2021). A copy of the revised environmental monitoring plan for the landfill property is located in **Appendix J**. Per the approved monitoring plans, the groundwater wells are sampled semiannually in March and September. Sampling and laboratory analysis are typically conducted by personnel from MSA Professional Services Inc., and laboratory analysis is typically conducted by Eurofins Environmental Testing of University Park, Illinois.

Four rounds of baseline groundwater analytical data were collected from the monitoring wells and piezometers installed during 2024 (MW-16Z, MW-18WT, MW-18, MW-19, and MW-19Z) and 2025 (MW-20WT and MW-20). Note, analytical sampling could not be completed for MW-20WT due to insufficient recharge in well after purging. Groundwater samples collected from these wells were analyzed for the baseline and detection monitoring parameters summarized on **Table 5** within **Appendix F** in accordance with NR507 Appendix I, Table 1 and Table 3.

The laboratory analytical reports for the baseline groundwater quality monitoring results for the proposed expansion are provided in **Appendix F** (Attachment G). A summary of the analytical results for the background quality samples collected and analyzed in 2024 and 2025 are provided on **Table 6** within **Appendix F**. Note that NR140 Wis. Adm. Code groundwater standards are shown on the table and applicable exceedances to the respective ES and/or PAL values have been made evident by underlining or bolding the associated result.

The parameters listed below had at least one PAL or ES exceedance during the initial baseline monitoring events:

- **Arsenic:** Groundwater from MW-18WT had intermittent detections exceeding standards. The ES for arsenic (10 ug/L) was exceeded during the first round of baseline sampling for the well on August 27, 2024, at 11 ug/L. A second detection exceeded the PAL (1 ug/L) during the final round of baseline sampling for the well on April 14, 2025, at 1.4 ug/L. Groundwater from MW-19 also had a single detection exceeding standards. The PAL for arsenic was exceeded during only the first round of baseline sampling on August 27, 2024, at 5.3 ug/L.

- **Benzene:** Groundwater from MW-19 exceeded the ES for benzene (5 ug/L) during the first round of baseline sampling for the well on August 27, 2024, at 47 ug/L. During the second round of baseline sampling for the well on October 2, 2024, benzene was detected at 0.38 ug/L within MW-19. MW-19 also had several other VOC detections during the August 27, 2024, sampling event and a few during the October 2, 2024, sampling event. Remaining baseline sampling for MW-19 had no detection of benzene above laboratory reporting limits.
- **Cadmium:** Groundwater from MW-16Z exceeded the PAL for cadmium (0.5 ug/L) during the second and third round of baseline sampling for the well on October 2, 2024 and March 7, 2025, at 0.5 ug/L and1.4 ug/L, respectively. The remaining baseline sampling event for MW-16Z on April 14, 2025, had no detection of cadmium above laboratory reporting limits.
- **Chromium:** Groundwater from MW-18WT and MW-19 exceeded the PAL for chromium (10 ug/L) during the first round of baseline sampling for each well on August 27, 2024, at 35 ug/L and 62 ug/L, respectively. The remaining baseline sampling events for MW-18WT and MW-19 had no additional detections exceeding standards.
- **Lead:** Groundwater from MW-18WT had intermittent detections exceeding standards. The ES for lead (15 ug/L) was exceeded during the first round of baseline sampling for the well on August 27, 2024, at 18 ug/L. A second detection exceeded the PAL (1.5 ug/L) during the final round of baseline sampling for the well on April 14, 2024, at 2.0 ug/L. Groundwater from MW-19 also had a single detection exceeding standards. The PAL for lead was exceeded during only the first round of baseline sampling on August 27, 2024, at 7.0 ug/L.
- **Manganese:** Groundwater from MW-16Z, MW-18WT, MW-19, MW-19Z, and MW-20 had detections exceeding standards during at least two baseline sampling events. Two exceedances in MW-16Z included the ES for manganese (300 ug/L) during the first round of baseline sampling on August 27, 2024 at 530 ug/L and the PAL for manganese (60 ug/L) during the second round of baseline sampling on October 2, 2024 at 71 ug/L. Two exceedances in MW-18WT included the ES during the first round of baseline sampling on August 27, 2024 at 1,800 ug/L and the PAL during the final baseline sampling event on April 14, 2025 at 220 ug/L. Four exceedances in MW-19 included the ES during the first three baseline sampling events on August 27, 2024 (2,400 ug/L), October 2, 2024 (1,400 ug/L), and March 7, 2025 (380 ug/L) as well as the PAL during the final baseline sampling event on April 14, 2025 at 240 ug/L. Two exceedances in MW-19Z included the ES during the first two rounds of baseline sampling on August 27, 2024 (69 ug/L) and October 2, 2024 (330 ug/L). Finally, four exceedances in MW-20 included the PAL during all four baseline sampling events on May 14, 2025 (280 ug/L), June 19, 2025 (220 ug/L), July 28, 2025 (140 ug/L), and August 27, 2025 (150 ug/L).
- **Nitrate+Nitrite (as N):** Groundwater from MW-18WT and MW-18 had intermittent detections exceeding standards. The PAL for nitrate+nitrite (2 mg/L) was exceeded during the first round of baseline sampling for both wells on August 27, 2024, at 3.9 and 5.2 mg/L, respectively. The PAL for nitrate+nitrite was again exceeded during the final round of baseline sampling for both wells on April 14, 2025, at 3.7 and 5.7 mg/L, respectively.
- **Vanadium:** Groundwater from MW-18WT exceeded the PAL for vanadium (6 ug/L) during the final baseline sampling event for the well on April 14, 2025, at 11 ug/L. Additional monitoring will be completed if necessary to confirm detection.

In accordance with NR140.28 Wis Adm. Code, based on the results of baseline and detection monitoring completed for the above reference monitoring wells installed during 2024 and 2025, exemptions to the groundwater quality standards outlined in NR140.10 and NR140.12 Wis. Adm. Code are requested. Following is a summary of the requested exemptions and justification.

MW-16Z: No exemptions requested. As noted above, two PAL exceedances were measured at MW-16Z for cadmium, however, the remaining baseline samples were below laboratory detection limits and the respective PAL. One ES and one PAL exceedance was measured for manganese during the first two baseline sampling events, respectively. Subsequent baseline sampling for manganese indicated that measured concentrations were below the PAL and continued to decrease. It is assumed that disturbance in the formation during drilling, or introduction of contaminants from the drilling fluid or well construction materials may have affected short-term water quality.

MW-18WT: See below requested exemptions.

Parameter	Well ID	Public Health (NR140.10)		Public Welfare (NR140.12)	
		ES	PAL	ES	PAL
Arsenic	MW-18WT		X		
Lead	MW-18WT		X		
Manganese	MW-18WT		X	X	
Nitrate+Nitrite (as N)	MW-18WT		X		

As noted above, one ES exceedance and one PAL exceedance were measured at MW-18WT for arsenic, lead, and manganese. While the respective concentrations decreased following the initial baseline sampling event, detections in exceedance of the respective PALs were measured during the final baseline sampling event. PAL exceedances were measured for nitrate+nitrite (N+N) at or near the PAL during three of the four baseline sampling events. It is assumed that disturbance in the formation during drilling, or introduction of contaminants from the drilling fluid or well construction materials may have affected short-term water quality. However, given the fluctuations in the above parameters, along with the apparent stability and consistency of other indicator parameters (conductivity, alkalinity, hardness, pH) suggest that arsenic, lead, and manganese may be naturally occurring. The presence of N+N is consistent with water quality observed in other site wells and is likely due to historic agricultural practices in the vicinity.

MW-18: See below requested exemption.

Parameter	Well ID	Public Health (NR140.10)		Public Welfare (NR140.12)	
		ES	PAL	ES	PAL
Nitrate+Nitrite (as N)	MW-18		X		

As noted above, two PAL exceedances were measured at MW-18 for N+N. It is assumed that disturbance in the formation during drilling, or introduction of contaminants from the drilling fluid or well construction materials may have affected short-term water quality. However, given the consistent detections on N+N, along with the apparent stability and consistency of other indicator parameters (conductivity, alkalinity, hardness, pH) suggest that the detections are not anomalous. The presence of N+N is consistent with water quality observed in other site wells and is likely due to historic agricultural practices in the vicinity.

MW-19: See below requested exemption.

Parameter	Well ID	Public Health (NR140.10)		Public Welfare (NR140.12)	
		ES	PAL	ES	PAL
Manganese	MW-19		X	X	

As noted above, one ES exceedance and one PAL exceedance were measured at MW-19 for benzene during the first two baseline sampling events. Subsequent baseline sampling for benzene indicated no further detections. Also, PAL exceedances were measured at MW-18WT for arsenic, chromium and during the initial baseline sampling event. Subsequent baseline sampling for these parameters indicated no further detection, or low-level detections below the applicable PAL. Baseline sampling completed for manganese indicated ES exceedances during the first three sampling events, and a PAL exceedance for the fourth.

It is assumed that disturbance in the formation during drilling, or introduction of contaminants from the drilling fluid or well construction materials may have affected short-term water quality. While the concentrations of manganese continue to decrease, it appears that a PAL exemption for the NR140.10 standard and ES exemption for the NR140.12 standard are warranted.

MW-19Z: See below requested exemption.

Parameter	Well ID	Public Health (NR140.10)		Public Welfare (NR140.12)	
		ES	PAL	ES	PAL
Manganese	MW-19				X

As noted above, two NR140.10 ES exceedances were measured at MW-19Z for manganese, however, the remaining baseline samples were below the respective PAL. However, while the last two events were less than the NR140.10 PAL, the measured concentrations were above the NR140.12 ES during the third event, and PAL during the fourth. It is assumed that disturbance in the formation during drilling, or introduction of contaminants from the drilling fluid or well construction materials may have affected short-term water quality. While manganese concentrations continue to appear to decrease, continued NR140.12 PAL exceedances suggest an exemption is warranted.

MW-20: See below requested exemption.

Parameter	Well ID	Public Health (NR140.10)		Public Welfare (NR140.12)	
		ES	PAL	ES	PAL
Manganese	MW-19		X	X	

As noted above, NR140.10 ES exceedances and NR140.12 ES exceedances were measured at MW-20 for manganese during all four baseline sampling events. It is assumed that disturbance in the formation during drilling, or introduction of contaminants from the drilling fluid or well construction materials may have affected short-term water quality. While manganese concentrations continue to appear to decrease slightly, continued NR140.10 PAL and NR140.12 ES exceedances suggest an exemption is warranted.

2.4 Environmental Monitoring Program

An environmental monitoring program will be implemented during the operation of the proposed expansion. Monitoring point locations are summarized in **Plan Sheet 30**. A copy of the proposed Environmental Monitoring Plan is presented in **Appendix J**.

The existing groundwater monitoring network for WDNR License No. 3268 will be maintained and expanded upon as part of the proposed expansion. Seven additional groundwater monitoring wells were installed during 2024 and 2025 for the proposed expansion, which included two perched water table monitoring wells (MW-18WT and MW-20WT), three regional water table wells (MW-18, MW-19, and MW-20), and two piezometers (MW-16Z and MW-19Z). One existing perched water table monitoring well (MW-5A), two existing regional water table monitoring wells (MW-5 and MW-14), and one existing piezometer (MW-14Z) will be abandoned during subsequent construction activities. Replacement wells for well nest MW-5A/-5 was installed during 2024 as well nest MW-18WT/MW-18. Replacement well MW-14R is proposed to be installed once the existing wells are abandoned.

Below is a summary of the monitoring wells and piezometers that are within 300-feet of the proposed expansion area and will be used to properly monitor groundwater quality for the proposed expansion area.

- Perched Water Table
  - Upgradient: MW-4P and MW-14WT
  - Downgradient/sidegradient: MW-5A, MW-12, MW-17WT, and MW-18WT
  - Downgradient (transitional zone): MW-16, MW-18, MW-19, and MW-20
- Regional Water Table
  - Upgradient: MW-16, MW-18, MW-19, and MW-20
  - Downgradient/sidegradient: MW-5 and MW-14
- Upper Potentiometric Surface
  - Upgradient: MW-11, MW-16Z, and MW-19Z
  - Downgradient: MW-3

- Lower Potentiometric Surface
  - Upgradient: MW-10
  - Downgradient/sidegradient: MW-6 and MW-14Z

Proposed Subtitle D wells include existing Subtitle D wells MW1PR, MW-9, MW-5A, MW-12, and new well MW-17WT. Prior to abandonment of MW-5 and MW-5A to accommodate future cells constructions, a replacement subtitle D well will be proposed. It is anticipated that the replacement Subtitle D well will be MW-16 or MW-18WT. Additional baseline sampling parameters required for Subtitle D wells will be completed for the selected well (if needed) prior to abandoning MW-5A.

2.5 Stability Assessment

From the WDNR's July 2025 Memorandum provided in **Appendix B**, the following comments regarding stability were included in the summary of discussion between WDNR and WGNHS staff:

> "There are several factors indicating that the site is relatively stable with regard to risk of sinkhole formation or other collapse features that may affect landfill stability. A landfill has already existed at the site for 30 years with no issues. There is a significant layer (approximately 40 feet) of residuum and saprolite separating the base of the existing and proposed landfill from bedrock. No significant voids or caves have been identified in the bedrock in the numerous boreholes that have been completed at the site (the largest indicators of voids have been a few 1-2 foot bit drops during drilling)."

An evaluation of site conditions has been completed by a geotechnical engineer at SEH and no stability issues associated with bedrock have been indicated. Bedrock conditions show no evidence of significant voids or caverns, no sinkholes, and no historic structural failures. No bedrock structural failures have occurred in the more than 10 acres of construction for the current landfill footprint over the past 30 years. The buried sandstone located outside of the landfill expansion to the southeast would not be a factor in stability from a geotechnical perspective.

Landfill construction generally occurs above the perched water table system and above the competent bedrock, primarily in the unsaturated, unconsolidated residuum. A slope stability analysis will be completed as part of the Plan of Operations, which will consider soil type and soil properties in the development of a slope stability model associated with unconsolidated soils. In addition, the slope stability model will also consider interfaces of the geosynthetic materials utilized as part of the landfill liner.

2.6 Conclusions

After reviewing data collected from the 2024 through 2026 Addendum Field Investigations and all previously completed subsurface investigations for the Landfill property, the following conclusions are drawn for the subsurface evaluation for the proposed landfill expansion area.

Geologic Conditions:

- The uppermost site geologic units have been defined in reference to four primary depositional environments as follows:
  - Unconsolidated deposits including loess and residuum (up to 100 feet)
  - Saprolite or weathered bedrock (up to 25 feet)
  - Poorly consolidated sandstone (up to 120 feet)
  - Dolostone bedrock (more than 200 feet)
- The dolostone bedrock unit is associated with the Oneota Dolomite of the Prairie du Chien Group that is less susceptible to dissolution of its carbonate minerals.
- Bedrock drilling, coring, and investigative programs at the site and observations made at nearby quarries have resulted in the following observations and conclusions:
  - Bedrock fractures and dissolution cavities associated with dolomitic rock are present in bedrock on-site. The dolomitic bedrock is moderately fractured and the fractures are interconnected. Dissolution cavities occur primarily as small voids and do not appear to be interconnected.
  - Although the more than 200 feet of dolostone and sandy dolostone at the site are moderately fractured, no interconnected dissolution cavities were observed, and no evidence of sinkholes or cavern development was found in the carbonate system. Fracture spacing as observed at the quarry is sufficiently dense, acting similar to a large-grained granular porous media.
  - Natural gamma radiation geophysics established five marker horizons (H1 to H5) across the site. Identification of the five marker horizons across the site confirms that the bedrock geology across the site is consistent and predictable and provides correlation between historic boring logs and current boring logs as well as correlation from weathered to unweathered bedrock.
  - Poorly consolidated sandstone occurs in the southeast corner of the proposed expansion area overlying dolostone bedrock.
- Geotechnical conditions of the bedrock have been determined to be stable for the landfill expansion; slope stability analysis of unconsolidated soils associated with design criteria will be addressed as part of the Plan of Operations.

Perched Water Table Conditions:

- Calculated vertical gradients confirm the presence of a barrier layer within the dolostone preventing any significant downward component of flow and forming a perched water table system about 90 feet below the surface (~1140 feet amsl).
- Groundwater within the perched water table system flows horizontally in the dolostone toward the southeast at about 10 feet/day until it encounters the more uniform fine-grained sandstone channel present southeast of the landfill expansion; the lack of the barrier layer within the sandstone-filled channel allows the water to percolate downward

through unsaturated conditions in the sandstone to the underlying regional water table system at less than 1 foot/day.

- The following wells have been determined to provide adequate groundwater monitoring for the proposed landfill expansion for the perched water table system:
  - Upgradient: MW-4P and MW-14WT
  - Downgradient/sidegradient: MW-5A, MW-12, MW-17WT, and MW-18WT
  - Downgradient (transitional zone): MW-16, MW-18, MW-19, and MW-20

Regional Water Table Conditions:

- The underlying regional water table is present approximately 160 feet below the surface (~1080 feet amsl).
- The percolating water from the overlying unsaturated sandstone collects within the deeper sandstone channel causing a localized groundwater mound exceeding a static water elevation of approximately 1105 feet amsl. The increased hydraulic head forming the groundwater mound results in recharge to the local regional water table system, promoting back flow toward the dolostone bedrock to the northwest at less than 1 foot/day.
- The northwest groundwater flow rejoins regional flow in the dolostone to flow toward the northeast.
- The following wells have been determined to provide adequate groundwater monitoring for the proposed landfill expansion for the regional water table system:

  <u>Region Water Table</u>
  - Upgradient: MW-16, MW-18, MW-19, and MM-20
  - Downgradient/sidegradient: MW-5 and MW-14

  <u>Upper Potentiometric Surface</u>
  - Upgradient: MW-11, MW-16Z, and MW-19Z
  - Downgradient: MW-3

  <u>Lower Potentiometric Surface</u>
  - Upgradient: MW-10
  - Downgradient/sidegradient: MW-6 and MW-14Z

Groundwater Quality:

- Baseline monitoring has been completed on all monitoring wells installed at the site.
- There is currently no evidence that the active MSW Landfill (WDNR License No. 3268) has caused groundwater contamination at the facility.

3 Responses to WDNR Comments

Representatives of both Vernon County and the WDNR have taken part in several discussions since submittal of the Feasibility Report Addendum 01. In addition, the WDNR has prepared written correspondence regarding completeness, internal discussions, and status of the Feasibility Report. Copies of WDNR correspondence and comments are included in **Appendix A**, **B**, **C** and **D**. Written responses are provided in the following sections:

3.1 Additional Responses to WDNR's Incompleteness Letter dated December 19, 2023, Section A

In the Feasibility Report Addendum 01, original WDNR comments were restated followed by a Vernon County Response. In the WDNR's March 2025 Incompleteness Determination letter, an additional comment was provided by the WDNR on several issues. Just the new comment is re-stated below followed by a new Vernon County response.

2. ***WDNR March 2025 Response Comment 2:*** *The installation of wells MW-18WT, MW-18, and MW-19 have provided information to better define, but not fully define, the relationship of the perched water table and the regional groundwater table to the east of the current landfill. However, the mounding in regional water table around MW-16 and MW-18 is not defined to the extent to allow tracking of hypothetical release from the landfill. Additional regional water table elevation data are needed to the east of the MW-16/MW-18 well nests. The text states that groundwater monitoring wells MW-5 and MW-14 serve as downgradient wells in the regional aquifer, but these wells do not define the flow paths to the east and northeast of the landfill should a release occur.*

   <u>Vernon County Additional Response:</u> In 2024 and 2025, two new well nests were established that are farther east than the MW-16 and MW-18 well nests. In 2024, MW-19 and MW-19Z act as a new regional water table well and piezometer, respectively. In 2025, MW-20 and MW-20WT were installed to investigate the perched water table transition to the regional water table. Since the perched water table was observed at this location, a perched water table well (MW-20WT) and a regional water table well (MW-20) were installed at this location. Additional details, such as groundwater elevations from the two new well nests, are presented in **Section 2.0** and in **Table 2** and **Table 3**.

6. ***WDNR March 2025 Response Comment 6:*** *The transition of the perched aquifer to the east and southeast of the current landfill is a significant hydrogeologic change that requires site-specific data to evaluate both groundwater flow and the potential stability of a landfill expansion. The existing geophysical assessment (gamma logging in the groundwater monitoring wells) that was proposed in lieu of wireline coring has not provided sufficient geological characterization to fully replace the wireline coring needs defined in s. NR 507.05(2), Wis. Adm. Code (assessment of fracture frequency, rock quality designation, and recovery). Further comments regarding SEH's response to Comment 6 are as follows.*

   - *The marker horizons identified in the gamma log interpretations are not sufficient in themselves to identify geological horizons and extend through an apparent facies change to sandstone in the direction of wells MW-17WT and MW-19 (meaning the marker horizons do not serve to indicate a homogenous, isotropic geology, as indicated in the report.).*

- *Sonic cores collected in bedrock are broken up and may have been mechanically fractured/partially pulverized during drilling, which is typical of the drilling method. However, given the absence of corroborating evidence the department assumes these cores are indicative of a highly fractured bedrock environment.*
- *The literature discussion regarding the origin of bedrock fractures and dissolution cavities is not pertinent to the site-specific scale of geologic characterization required to site a landfill and requires the type of field verification that either wireline coring or geophysical evaluation can help to provide.*
- *Regarding the reason's provided for not implementing the suggested geophysical methods, the limitations described with respect scale and the ability to draw connections between borings are potential limitations of all site specific investigations using soil borings and monitoring wells, and the limitations of interpretation posed by an individual process (descriptive logging of the borehole, coring, geophysics, other tests) can be enhanced by using many processes in tandem. SEH's reason to dismiss acoustic televiewer (mud-filled boreholes) is not relevant to the 2024 follow-up investigation, which utilized mud-free sonic drilling techniques. Furthermore, drilling mud can be developed out of the borehole after drilling to facilitate this and other geophysical methods.*

Vernon County Additional Response: Information presented in the WDNR's July 2025 Memorandum indicates the following understanding:

- Wireline rock coring of bedrock at the site would be difficult.
- It is well known from research and publications studying the Prairie du Chien formation that it has small fractures and cavities.
- Downhole geophysical surveys such as borehole video, optical borehole imaging, or acoustic borehole imaging appear to be feasible at the site.

An additional comment from the WDNR's July 2025 Memorandum reads:

> "There are several factors indicating that the site is relatively stable with regard to risk of sinkhole formation or other collapse features that may affect landfill stability. A landfill has already existed at the site for 30 years with no issues. There is a significant layer (approximately 40 feet) of residuum and saprolite separating the base of the existing and proposed landfill from bedrock. No significant voids or caves have been identified in the bedrock in the numerous boreholes that have been completed at the site (the largest indicators of voids have been a few 1-2 foot bit drops during drilling)."

An evaluation of site conditions has been completed by a geotechnical engineer and no slope stability issues associated with bedrock have been indicated. Landfill construction generally occurs above the perched water table system and above the competent bedrock, primarily in the unsaturated, unconsolidated residuum. A slope stability analysis will be completed as part of the Plan of Operations, which will consider soil type and soil properties in the development of a slope stability model associated with unconsolidated soils. Additional information regarding the potential stability of the landfill can be found in **Section 2.5**. Site-specific data for groundwater flow to the east and southeast of the landfill has been addressed in the Vernon County Additional Response for the WDNR March 2025 Response Comment 2.

8. ***WDNR March 2025 Response Comment 8:*** *The lack of wireline coring and geophysics makes it difficult to confirm the conclusions stated in the above response. The sonic cores were of sufficient recovery to indicate large voids do not appear to be present but are not of sufficient quality to evaluate the extent of fracturing within the formations. In absence of additional site-specific evidence, the department's default assumption is reported fractures in previous boring logs are accurate.*

   Vernon County Additional Response: SEH agrees with the WDNR assumption that reported fractures in previous boring logs are accurate. Information presented in the WDNR's July 2025 Memorandum indicates the following:

   - Wireline rock coring of bedrock at the site would be difficult.
   - It is well known from research and publications studying the Prairie du Chien formation that it has small fractures and cavities.
   - Where flow is primarily through fractures and no water levels are anomalously high or low supports that the site is dominated by porous media flow.

10. ***WDNR March 2025 Response Comment 10:*** *The flow net provided with cross-section J-J' has no data to confirm regional water levels at the MW-10/11/12 well nest or to evaluate regional water levels under B-22 (or in the entire transition zone where the perched aquifer migrates down to the regional water table). Therefore, the department considers the flow net to be inferred in this area, and that a more complex flow regime is likely. Regional water table data is also lacking at the MW-3/4P/6 well nest. In addition, please provide additional discussion and evidence to support the statement that two orders of magnitude hydraulic conductivity difference can represent a homogenous and isotropic aquifer.*

    Vernon County Additional Response: To represent groundwater flow three-dimensionally or as a flow net, the first step is the development of an equipotential surface with the contours representing equipotential lines or a groundwater contour map as provided in Feasibility Report Addendum 01, Appendix L. For this site, the regional water table surface is that equipotential surface representing a defined groundwater boundary condition that has been mathematically generated as a two-dimensional surface using multiple values of hydraulic head; if data isn't present at a particularly location (such as well nests MW-10/11/12 and MW-3/4P/6), the hydraulic head at those locations has been calculated based on other representative data points in the vicinity. Although the measurement of the regional water table elevation is not available directly at the well nests MW-10/11/12 and MW-3/4P/6, the water level measurements of the three nested wells at each location provide the critical vertical hydraulic gradient and hydraulic conductivity values to establish the "three-dimensional" groundwater flow net.

    Hydrogeology publications confirm two orders of magnitude hydraulic conductivity difference can represent a homogenous and isotropic aquifer. In the textbook **Groundwater** *Chapter 2 Physical Properties and Principles* (Freeze and Cherry; 1979), Freeze and Cherry provide an extensive discussion on variability of hydraulic conductivity and its relationship to heterogeneity, homogeneity, isotropic and anisotropic conditions. They state that "…K [hydraulic conductivity] values in most geological formations show internal heterogenous variations of 1-2 orders of magnitude". However, based on statistical observations by Greenhorn and Kessler (1969), Freeze and Cherry go on to redefine homogeneity having "…variations in K but maintaining a constant mean K through space". They also indicate that the primary cause of anisotropy on a small scale is the orientation of clay minerals in sedimentary rock, but that on a large scale each layer is commonly homogeneous and isotropic. Based on this approach, it is clear that every geologic medium is likely to have variable properties, but within formations of similar properties it is practical to consider the "mean" of those properties as homogeneous and isotropic.

15. ***WDNR Comment 15 - Proposed Physical Changes [s. NR 512.16(2)(b), Wis. Adm. Code]:*** *The discharge rates provided are anticipated during active operations and do not compare to existing rates or rates anticipated following closure conditions.*

Vernon County Response (November 19, 2024)

There should be no significant impacts or changes to aquatic resources including the potential impacts to streams, wetlands, ponds, lakes, and flowages. Primary local surface water flowages include the Seas Branch Creek and an unnamed tributary. The northern portion of the site drains to the north to Seas Branch Creek. Surface water from the southern portion of the site drains to an unnamed tributary which then flows northeast to Seas Branch Creek and then east to the west fork of the Kickapoo River. More regionally surface water drainage is to the southeast towards the Kickapoo River.

Relatively minor surface water modeling parameter changes account for pre- and post-development conditions. Less than 10 percent imperviousness is added with gravel for development. Surface water model runoff calculations for pre- and post-development vegetation and soil types representing existing and proposed expansion landfill areas are similar. Existing and proposed vegetation conditions are grassland and soils for each are specified hydrologic soils group D. The difference is that soils on the landfill cover are assumed to be compacted.

There are currently no direct discharge points or impacts to nearby wetlands. The surface water control system proposed for the expansion will not create any impacts to wetlands.

DNR Response Comment: *Provide narrative on the sequencing of the removal of the existing stormwater pond and the construction of the proposed stormwater pond and how stormwater will be handled during that time.*

Vernon County Additional Response: As the first phase of the proposed expansion overlays the existing sedimentation basin, routing of stormwater during construction poses a unique challenge. Due to the topography and the existing stormwater control system at the site, construction of the proposed sedimentation basin would pose the same issues as construction of a temporary stormwater pond.

Construction of the new sedimentation basin would be phased in a manner to be completed prior to abandonment of the existing sedimentation basin and drainage ways routed to the new sedimentation basin upon completion. Should the existing sedimentation basin require use of the overflow structure during construction of the proposed sedimentation basin, overflow would be captured within the berm created by the proposed sedimentation basin subgrade and dewatered according to Wisconsin Department of Natural Resources (DNR) Technical Standard 1061 - Dewatering Practices for Sediment Control.

Additional stormwater control BMP's will be placed down slope from the construction area to capture fugitive sediments from flowing off site. During construction, daily inspections of the stormwater BMP's will be conducted to ensure any deficiencies are addressed and remediated immediately to ensure no migration of sediment downstream.

16. ***WDNR Comment 16 - Environmental Review [s. NR 512.16(2)(e), Wis. Adm. Code]:*** *Please provide clarification regarding whether the perimeter access road will be designed on the east side of the proposed expansion and how that may affect perimeter storm water ditches, toe drains, and other engineering features. Revise the plan set for consistency in depiction of the eastern side of the landfill.*

    Vernon County Response (November 19, 2024)

    To conserve borrow soils, minimize site traffic, and minimize stormwater runoff, access roads will not be constructed on the eastern side of the final landfill expansion during final closure. Final access will be provided on the landfill's outboard slopes. Access roads will be presented on the Plan of Operation development drawings.

    WDNR Response Comment: *Provide further clarification on what final access will be provided on landfills outboard slope means and what that is compared to a traditional perimeter road. Provide clarification on if any operational or construction restrictions will come about due to not having an access road on the east face including but not limited to picking litter downslope of the landfill on the east face, leachate seeps on the landfills eastern outboard slope, perimeter fence, and constructability of final cover on the eastern face.*

    Vernon County Additional Response: With the landfill being developed and closed in a south-to-north manner, the current access road running along the southern limits of the existing landfill will be extended to provide access to the proposed Phase VII Leachate Extraction building. Additionally, a temporary access road will be graded and extended from the existing northern access road to the northern limits of Phase VII and removed to the northern limits of Phase VIII and Phase IX during development of those phases. Access into the waste placement areas will be constructed off of the permanent access roads and removed during cell and/or closure construction phases. As currently proposed, no final access roads will be constructed along the perimeter of the eastern slope of the landfill only along the northern and southern limits.

    As the landfill is filled, temporary access roads will be constructed into the waste filling area with the outboard edge of the access road following final waste grade elevations. Should windblown litter be an issue during hauling and waste placing activities, a litter fence will be constructed to eliminate the potential of fugitive windblown litter. Should a leachate seep be discovered on the eastern outboard slope, access will be provided through the temporary access road graded into the waste grades, similar to the access road existing on-site. During final closure construction, when access to the waste placement area or outboard eastern slope is no longer required, the access road will be filled with waste and covered with final cover materials. Any required access to the eastern portion of the site (maintenance, well installation, etc.) will be gained through temporary or permanent access roads or over areas of established final cover.

18. ***WDNR Comment 18 - Environmental Review [s. 512.16(2)(c), Wis. Adm. Code]:*** *The report does not discuss the miles of access roads (or estimated length using other units) to be constructed.*

Vernon County Response (November 19, 2024)

Final access road design will be completed in the Plan of Operation and shown on the development plans. Specific area quantities will be provided.

WDNR Response Comment: *The estimation of length of access roads is required during the feasibility determination phase by s 512.16(2)(c), Wis. Adm. Code. Please provide an estimate of the anticipated length of access roads. Please note that this is only an estimate and can be modified in the plan of operation.*

Vernon County Additional Response: As proposed in the Feasibility Study Drawings, an estimated 1,540 feet (0.29 miles) of permanent gravel access roads will be constructed as part of the proposed expansion.

25. ***WDNR Comment 25 - Plan Sheet 32, Detail 3-32, Leachate Extraction Building (Phase VII):*** *Please clarify the thickness of clay liner and rooting zone layer, as these thicknesses are inconsistent with other details provided on the plan sheets and in the narrative.*

Vernon County Response

The detail formerly recognized as Detail 3-32 on Plan Sheet 32 in the Feasibility Report has been revised and is attached as Detail 3-33 on **Plan Sheet 33** and depicts a 5 ft. thick clay liner and 2 ft. thick rooting zone.

WDNR Response Comment: *Provide clarification on revised detail 3-33 in the addendum, on if the final cover design is using a geocomposite drainage layer or a sand drainage layer. Feasibility addendum 01 detail 3-35 and the feasibility report narrative section 8.14.4 both note a sand drainage layer.*

Vernon County Additional Response: The final cover materials in Detail 3-33 will consist of a 6" Grading Layer, 2' Clay Layer, 40 Mil textured LLDPE geomembrane, 12" Sand Drainage Layer, 2' Rooting Zone and a 6" Topsoil Layer. An updated and corrected detail can be found in the attached **Plan Sheet 33**.

26. ***WDNR Comment 26 - Appendix R, Sub Appendix B, Sheet 16 Leachate Headwells:*** *This sheet notes that multiple headwells on the landfill are damaged; please provide a current list of the headwells on site and the status of them as well as provide a history of headwells that are damaged, lost, or abandoned.*

Vernon County Additional Response

Leachate Headwell	Status
LHW-1	Lost (presume buried and damaged)
LHW-2	Obstructed, buried and damaged
LHW-3	Obstructed, buried and damaged
LHW-4	Not constructed
LHW-5	Operational
LHW-6	Operational

A Plan Modification Request was submitted to the WDNR on October 2, 2020, summarizing the status of the headwells and requesting approval to use alternatives. This Plan

Modification Request proposed to perform head monitoring at leachate cleanouts CO-3S, CO-7S, CO-3N, and CO-6N and leachate headwells LHW-5 and LHW-6. This Plan Modification Request was approved by the WDNR on February 9, 2021. The Plan Modification Request and the WDNR Approval Letter are included within Appendix I of the Feasibility Report Addendum 01.

The following is a summary of the leachate headwells history that was summarized within the October 2, 2020, Plan Modification Request.

- The 2005 plan of operation approval (July 29, 2005) requires monthly leachate head well monitoring be conducted at six leachate head wells. The head wells specified included 3 vertical well heads (LHW-1, LHW-2 and LHW-3) that existed at the time of the approval, and three horizontal side slope head wells (LHW-4, LHW-5, and LHW-6). At the time of the 2005 approval, only horizontal LHW-5 was installed.
- Upon investigation, LHW-1 could not be located (presumably abandoned as its location is in the same vicinity as an access road), and LHW-2 and LHW-3 are obstructed approximately 20 feet below the waste surface, which is 10-15 feet above the bottom of the well and top of liner. The vertical wells are very apparently bent and bowed, likely due to waste settlement forces, especially on the side slope. Discussions with site personnel indicate the vertical leachate head wells have been hit several times during mowing and site operations. It is likely each well is damaged in multiple locations, and it is likely that attempts to repair or refurbish the wells would be unsuccessful and costly.
- It also does not appear that horizontal LHW-4 was installed during the 2008 Phase II, Module 3 liner construction. Of the original six leachate head wells in the plan of operation, only LHW-5 and LHW-6 remain in usable condition. Inspection of both leachate head wells did not indicate any damage or issue.

WDNR Response Comment: *Provide narrative on why LHW-5 and LHW-6 need to be abandoned as noted in addendum 01 plan sheet 25. Provide discussion on whether both need to be abandoned or if sweep bends can be installed to continue monitoring these two or what could be installed in their place to give each a replacement measurement and how they would be equivalent or greater.*

<u>**Vernon County Additional Response:**</u> Due to the location of side slope leachate head monitoring wells LHW-5 and LHW-6 along the proposed expansion liner splice, these headwells would be buried during waste placement activities. Due to the headwells being side slope risers and not vertical monitoring wells, a vertical extension is feasible from the end of the riser pipe but would be difficult to provide accurate head measurements due to the geometry of the combined vertical and side slope riser pipe. An equation to monitor leachate head levels can be developed, however this method introduces large margin for error due to installed vs proposed piping lengths and slack within the level indicator line.

A true vertical riser pipe would be the optimal solution to maintain the leachate head monitoring point but installation after waste filling in the location of the monitoring point introduces major risk to the integrity of the base liner system. It is the intention of the County to leave the head monitoring wells in place for as long as possible with decommissioning occurring only during liner tie-in at each location.

3.2 Additional Responses to WDNR's Email dated February 1, 2024

1. ***WDNR March 2025 Additional February 2024 Response Comment 1:*** *The purpose of the feasibility process is to determine site-specific feasibility of siting a landfill at a particular location. The literature cited in this response could be used to guide a site-specific investigation but does not replace the need for developing a site-specific understanding of the merger zone between the perched and regional aquifers. The relationship between the perched and regional aquifers is somewhat better defined with new well information, but mounding of regional water table near the MW-18 well nest is not fully defined or understood resulting in gaps in the monitoring network as mentioned in the response to Section 2.1, Comment 2. Additionally, the fact that MW-15WT is dry appears to present a data gap in the area of the merger zone as well.*

   Vernon County Additional Response: Information presented in the WDNR's July 2025 Memorandum indicated WGNHS representatives concurred their understanding of conditions in the Prairie du Chien formation is based on previous research by others and the applicability of their own experience in their own work.

   As mentioned in a previous comment, the installation of perched water table well MW-20WT and regional water table well MW-20 has provided additional site-specific geological and hydrogeological data near the MW-18 well nest. Additional information regarding these new wells, as well as improved interpretations of the geology and hydrogeology near the MW-18 well nest, are presented in **Section 2.3.4** through **Section 2.3.13**.

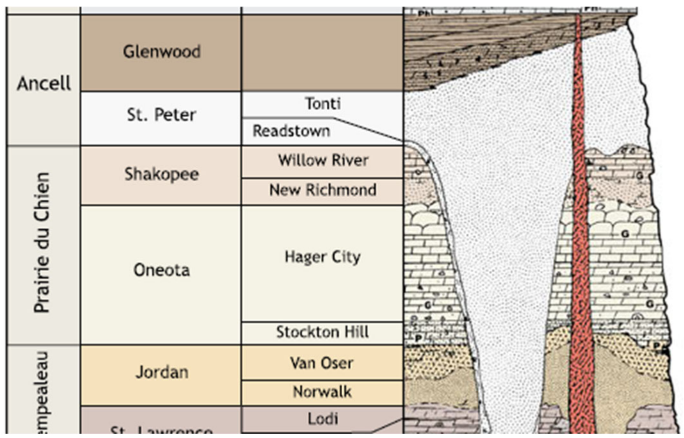
2. ***WDNR March 2025 Response Comment 2:*** *The department concurs that the additional data supports a gradual hydraulic gradient within the transition zone. However, as mentioned throughout, literature assumptions do not replace the development of a site-specific understanding of the geology of the transition zone.*

   Vernon County Additional Response: Site-specific understanding of the transition zone has been addressed by the reporting of geology observed during the 2026 Seas Branch Quarry and Gudgeon Pit site visits, as well as additional updates to the geology as discussed throughout **Section 2.3.1**. Specifically, refer to the updated stratigraphy of the four primary depositional environments discussed in **Section 2.3.1.4**:

   - **Unconsolidated deposits:**
     - Loess: Windblow fine-grained sediment.
     - Residuum: Red, residual clay formed by the chemical weathering of carbonate bedrock and locally synonymous with the Rountree Formation (Knox, et al., 1990). Residuum no longer retains the structural features or details of its bedrock. Based on the variable depositional environment for the Rountree Formation including downslope movement (colluvium), the residuum includes clay with pebbles, cobbles, and boulders (Clayton and Attig, 1990).
   - **Saprolite:** Weathered dolomitic bedrock retaining details or structural features of the bedrock. Due to the poorly consolidated nature, saprolite associated with sandstone is not segregated from the sandstone unit described below.
   - **Poorly Consolidated Sandstone:** Visual inspection of sonic boring core during recent drilling (photos included in **Appendix I**) confirms the presence of a separate sandstone geologic unit previously considered weathered sandy dolomite using other drilling

methods. Publications have not identified this separate stratigraphic unit to be present in this area. Based on review of publications and correspondence with Minnesota and Wisconsin geological survey staff, the poorly consolidated sandstone likely represents one of the following stratigraphic units illustrated in the Wisconsin stratigraphy column (WHNHS, 2011):

- <u>New Richmond Member of the Shakopee Formation</u>: The contact between the Shakopee and the underlying Oneota represents an unconformity. Where present, the New Richmond Member is described as a sandstone, but there is little documentation on whether the New Richmond Member occurs within such deep channels in the Oneota Dolomite as found at the landfill site.
- <u>Readstown and Tonti Members of the St. Peter Sandstone</u>: Particularly in western Wisconsin, the St. Peter Sandstone is more likely to be deposited within channels often deep into the Oneota Dolomite as shown below.



- **Dolostone Bedrock**: The Hager City Member of the Oneota Dolomite represents the uppermost bedrock of the Prairie du Chien Group.

3. ***WDNR March 2025 Additional February 2024 Response Comment 3:*** *Refer to the department's comments regarding the data gaps that remain in relation to the mounding of the regional water table near MW-18 (Response to comment 1 above and Section 2.1 comment 2). Additional test borings and well drilling performed in response to this letter could provide additional opportunity to utilize wire-line coring or geophysics to enhance site specific data and understanding.*

   <u>Vernon County Additional Response:</u> In 2025, MW-20 and MW-20WT were installed to investigate the perched water table transition to the regional water table. Since the perched water table was observed at this location, a perched water table well (MW-20WT) and a regional water table well (MW-20) were installed at this location. Additional details, such as groundwater elevations from the new well nest, are presented in **Section 2.0** and in **Table 2** and **Table 3**.

4. ***WDNR March 2025 Additional February 2024 Response Comment 4:*** *Refer to Section 2.1 Comment 6 response above.*

   <u>Vernon County Additional Response</u>: See the Vernon County Additional Response for March 2025 Response Comment 6.

3.3 Responses to WDNR's Section 4 of Addendum 01 New Comments

1. ***WDNR Comment 1 - Section 4.3.2.1:*** *The department does not concur that the gamma geophysical analysis confirms consistency of bedrock geology, given the extension of horizon markers through the apparent transition of sandstone to the east. In addition, the gamma geophysical analysis did not provide sufficient data regarding the specific geology and fracture zones to replace the requirement for wireline coring, which was the original intent of the geophysical investigation.*

   Vernon County Response: As indicated in the Feasibility Report, the use of natural gamma geophysical logging was intended to assist in lithologic correlation and interpretation of soil strata across the site since the data can be collected in new soil borings with drilling mud, through sonic steel core, and existing well construction. Some of these borings were drilled more than 30 years ago. No other downhole geophysical method could do that. We concur with the statement that natural gamma logging was not intended to identify fracture zones.

   Information presented in the WDNR's July 2025 Memorandum indicates that wireline rock coring of bedrock at the site would be difficult. To supplement onsite information, bedrock conditions were visually assessed at two nearby quarries as discussed further in **Section 2.3.1.3**.

2. ***WDNR Comment 2 - Section 4.3.6.1:*** *The extent of mounding and the northwesterly flow component near MW-18 requires further definition, as noted in previous comments.*

   Vernon County Response: See the Vernon County Response to WDNR March 2025 Additional February 2024 Response Comment 3.

3. ***WDNR Comment 3 - Section 4.3.8.1:*** *Flow net accuracy is uncertain in area of MW 10/11/12 and through the perched water transition zone due to lack of data, as noted in the response to the Section 2.1 comment 10 comment above.*

   Vernon County Response: As indicated in the response to WDNR March 2025 Response Comment 10, the regional water table map included in Feasibility Report Addendum 01, Appendix L was used to generate the regional water table boundary condition required in the development of the flow net on cross-section J-J'. The regional water table map was developed using available data; the interpretation of the regional water table contours conforms to anticipated conditions and is considered representative of groundwater flow for the site. Although the measurement of the regional water table elevation is not available directly at the well nests MW-10/11/12 and MW-3/4P/6, the water level measurements of the three nested wells at each location provide the critical vertical hydraulic gradient and hydraulic conductivity values to establish the "three-dimensional" groundwater flow net.

   Note: The natural conditions associated with the perched water table are not adequate to develop a separate flow net because the "saturated thickness" of the perched conditions is not sufficient to establish the vertical components of flow that are required in the development of a flow net.

4. ***WDNR Comment 4 - Section 4.3.13.1:*** *The department notes the change in perched water hydraulic conductivity is most noticeable toward sandstone zone (MW-17WT). Please further define the geology supporting the perched water zone in the MW-17WT area.*

   Vernon County Response: In preparation of this Addendum 02, additional data was obtained in a 2025 supplemental investigation to address WDNR questions regarding groundwater conditions and the transition from dolomite to sandstone in the southeast corner of the site. Results relating to the comment are presented in **Section 2.0**.

5. ***WDNR Comment 5 - Section 4.3.14.1:*** *Two rounds of analytical data have been reported to date for the five monitoring wells and piezometers installed during 2024 (MW-16Z, MW-18WT, MW-18, MW-19, and MW-19Z). Section NR 507.18(1)(b), Wis. Adm. Code requires a minimum of four baseline samples to be collected for a proposed facility prior to the plan of operation (with eight baseline rounds total). These four rounds of data are also necessary for the identification and review of any needed exemption requests under s. NR 140.28, Wis. Adm. Code. Please submit the minimum four rounds of data for the wells installed in 2024 as well as any additional wells installed as part of the feasibility investigation. Any additional exemptions needed under s. NR 140.28, Wis. Adm. Code, along with justification of the proposed exemptions, should be requested in an addendum to the feasibility report.*

   Vernon County Response: In preparation of this Feasibility Report Addendum 02, the final two rounds of the baseline analytical data have been completed for *MW-16Z, MW-18WT, MW-18, MW-19, and MW-19Z*. In addition, all four baseline monitoring events have been completed for new wells MW-20WT and MW-20 in accordance with Section NR 507.18(1)(b), Wis. Adm. Code. Results relating to the comment are discussed in **Section 2.3.14** and associated appendices of Feasibility Report Addendum 02. Laboratory reports are included in **Appendix F** (Attachment G).

3.4 Response to WDNR's Feasibility Additional Information Matrix dated March 20, 2026

Meetings between the WDNR and representatives of Vernon County were held on August 11, 2025, October 20, 2025, and March 9, 2026. The WDNR prepared a summary correspondence of those meetings titled Status of Feasibility Report and Meeting Notes dated March 20, 2026. In addition, the summary included a Feasibility Additional Information Matrix to suggest where additional information was needed. A copy of the summary correspondence is provided in **Appendix D**. Each of the suggested items is restated below followed by a response and reference to where the additional information is included in the Feasibility Report Addendum 02.

Item 1: *Site's stability with qualified (civil or geotechnical) engineer - qualitative assessment is good, if a simple qualitative model is available, it would be better.*

Additional Information Needed: Complete quantitative or qualitative assessment of stability of formations underlying the proposed landfill footprint.

Vernon County Response: An evaluation of site conditions has been completed by a geotechnical engineer at SEH and no stability issues associated with bedrock are indicated. A slope stability analysis will be completed as part of the Plan of Operations, which will consider soil type and soil properties in the development of a slope stability model associated with unconsolidated soils, and interfaces of the geosynthetic materials utilized as part of the landfill liner. Further discussion is included in **Section 2.5**.

Item 2: *Evaluation of core recovery in sonic boreholes.*

Additional Information Needed: Tabulate or discuss in narrative recoveries in sonic boreholes, noting gaps or lack of gaps within the boreholes.

Vernon County Response: Boring logs from recent as well as historic site investigations have been reviewed and observations tabulated to better understand bedrock conditions at the site. Unlike the poor recovery during coring of bedrock completed at the site using a diamond bit core barrel and drilling mud, borings completed with sonic or versa sonic technology generally have 100% recovery. Outside of sonic drilling methods, the poor recovery and damaged equipment experienced at the site is explained by the direct observation of the Oneota Dolomite in neighboring quarries where the fracture spacing of the dolostone is sufficiently dense as to act similar to a granular porous media. Tabulated boring log information is provided in **Table 6** and discussed in detail in **Section 2.3.1.2**.

Item 3: *Evaluation of gradient flow from perched to regional aquifer (assess presence of fractures).*

Additional Information Needed: Focus on gradient flow throughout the transition area, and the behavior of flow in the fractured dolomite (which must be present or there would be no groundwater flow within the dolomite). Expectations of non-uniform flow (water table losses, fingering of groundwater table contours) in karst-dominated flow and whether those conditions are seen at the site.

Vernon County Response: Groundwater within the perched water table system flows horizontally via secondary porosity in the dolostone toward the southeast until it encounters the more uniform fine-grained sandstone unit east of the landfill. The lack of a barrier layer within the sandstone allows the water to percolate downward through unsaturated conditions in the sandstone to the underlying regional water table system. The percolating water from the overlying unsaturated sandstone collects within the deeper sandstone channel causing a localized groundwater mound, which creates recharge for the local regional water table system, acting as a local groundwater divide with a reversal of horizontal hydraulic gradient towards the dolostone to the northwest. Groundwater flow then rejoins regional flow toward the northeast. Additional details such as hydraulic conductivities and groundwater flow rates that expand upon the general flow of groundwater in and among the perched and regional aquifers discussion can be found in **Section 2.3.13**.

Item 4: *Evaluation of how heterogeneities, such as facies change to sandier formations to east, affect groundwater flow (if any).*

Additional Information Needed: See above- degree of uniformity of flow across facies change.

Vernon County Response: As referenced in previous comments, **Section 2.3.13** provides a comprehensive outlook on the regional hydrogeology and how the heterogeneity of the geology and the hydraulic conductivity affect groundwater flow. One such example is the decreasing linear flow velocity of groundwater as groundwater flows from the dolostone at 10 feet/day to the sandstone at 0.5 feet/day.

Item 5: *Evaluate fluid loss during drilling.*

Additional Information Needed: Expand on degree of fluid loss (or lack thereof) during drilling and how it compares to what might be expected in karstic conditions.

Vernon County Response: At the end of **Section 2.3.1.2**, a brief summary is provided that describes drill fluid loss occurring at MW-15WT and MW-16. For MW-15WT, fluid loss was first noted to begin above the water table within poorly consolidated sandstone and underlying sandy dolostone. For MW-16, fluid loss was first noted to begin above the water table within residuum consisting of primarily weathered sandy dolostone with a minor shale seam noted at 75 feet bgs. More details on fluid loss during drilling can be found at the end of **Section 2.3.1.2**. Additionally, fluid loss during drilling has been noted in **Table 6**.

Item 6: *Reassess any bit drops that may have occurred.*

Additional Information Needed: Tabulation or narrative of bit drops encountered and the significance of those drops with respect to site monitorability and stability. Could compare recovery data requested above with degree/lack of bit drops to correlate degree or lack of expected voids.

Vernon County Response: According to **Table 6**, MW-1R drilled in 1994 noted two rod drops at 94 feet below ground surface and 112 feet below ground surface and MW-16Z drilled in 2024 noted a drop in rods from 98 to 100 feet below ground surface with the additional comment that the drop was *likely due to transition from competent to weathered dolostone in the residuum*. In **Section 2.3.1.2**, MW-5 was logged from cuttings only and notes layers of broken up dolomite with crevices throughout the boring with two crevices below the water table. Since this borehole was not cored, the crevices noted are most likely notes from the driller on rods dropping during drilling. All other borings did not note any bit drops. Additionally, an excerpt from the WDNR's July 2025 Memorandum (presented in **Appendix B**) summarizing a discussion held between WDNR and WGNHS staff states:

> "There are several factors indicating that the site is relatively stable with regard to risk of sinkhole formation or other collapse features that may affect landfill stability. A landfill has already existed at the site for 30 years with no issues. There is a significant layer (approximately 40 feet) of residuum and saprolite separating the base of the existing and proposed landfill from bedrock. No significant voids or caves have been identified in the bedrock in the numerous boreholes that have been completed at the site (the largest indicators of voids have been a few 1-2 foot bit drops during drilling)."

Further discussion on the monitorability of the site with respect to bit drops can be found in **Section 2.3.1.2** heading "Fractures and Dissolution Cavities (vugs/voids)."

Item 7: *Consider review of local geology (county owned property to SE of landfill (soil borrow location – North N Asbury Rd)) - shallower portions of PdC exposed, privately owned Milestone quarry near Vernon Cty landfill).*

Additional Information Needed: Degree and nature of fractures observed at the quarries, discussion of relative spacing and uniformity. Secondary evidence of groundwater seepage, such as staining on the rock face (direct evidence of groundwater seeps were noted during department's winter site visit). Discussion of voids in upper portion of quarry walls and the degree *of significance of those voids (i.e. whether they are above or below groundwater table and therefore likelihood they would affect groundwater flow.*

Vernon County Response: To further evaluate the geologic conditions of local bedrock and unconsolidated units, The Gudgeon Pit Quarry and Seas Branch Quarry was visited to visually document observations. Photos and documentation related to the evaluation of the two quarries are provided in **Appendix E**.

WDNR department staff also visited both the Seas Branch Quarry and the Gudgeon Pit Quarry on March 3, 2026. Quarry observations included observations of the degree/nature of fractures observed along the outcrops, secondary evidence of groundwater seepage (such as staining on rock faces), and discussion of voids in upper portions of quarry walls. Further evaluation of bedrock outcrops at Seas Branch Quarry was completed during a site visit on April 1, 2026. An SEH Professional Geologist, licensed in Wisconsin, completed an on-site visual inspection. Photos and observation notes were collected documenting the bedrock units, size/frequency of fractures, weathering, voids or vugs, and presence of groundwater to compare with soil boring records and other investigation work completed (**Appendix E**). It should be noted that due to safety concerns, all observations were made away from the quarry walls to avoid potential for falling rocks from the quarry walls. Additional details are provided in **Section 2.3.1.3**.

Item 8: *Consider calibrating groundwater contours to local surface water. May help enhance understanding of local flow (WGNHS idea - assess local surface water flow in nearby Seas Branch with what's known in GW system to corroborate flow).*

Additional Information Needed: Consider brief narrative of correlation of regional water table elevations to nearby surface water and/or observations on quarry faces.

Vernon County Response: From **Section 2.3.1.3**, a comparison between quarry observations and groundwater conditions has been made. Static water levels estimated for the Seas Branch Quarry and Gudgeon Pit were based on water levels from the Wisconsin Well Inventory (Wisconsin Department of Natural Resources). Filtering the well inventory for wells located within Vernon County and for wells containing a static water level reading, the resulting points were then exported to Excel for analysis and confirmation that the wells are in the correct location. The points in Excel were then input into the contouring software Surfer® to create static water level contour lines between the well static water levels. Once complete, the contours were then overlain on the quarry and pit locations (as points) in a map using ArcGIS Pro® and a visual estimate was ascertained for the static water level at each location.

Item 9: *Based on the available information, can the inferred groundwater contours be extended out around the ridge the landfill sits on and sensibly tied into the surface water elevations?*

Additional Information Needed: Consider narrative as above.

Vernon County Response: As indicated above, water levels from local wells were evaluated in addition to the site data. Water levels of surface features were also reviewed. Static water elevations of the regional water table do generally mimic the topography and surface water features, except where localized recharge is occurring in the southeast corner of the landfill site. So, yes, regional water table contours likely extend out around the ridge, but the extent of the sandstone and the perched groundwater systems beyond the site investigations are not known.

Item 10: *Do contour lines for perched and regional aquifers (as shown by SEH) make sense? Also, small, interconnected fractures could lend to a gradient flow system.*

Additional Information Needed: Nature of what is observed in flow versus what might be expected in a karst environment.

Vernon County Response: Yes, the contours for both the perched and regional water table maps conform to anticipated conditions of merging perched and regional systems. Based on the empirically-derived Darcy's law, groundwater flow is a function of hydraulic conductivity or coefficient of permeability; in bedrock the intrinsic permeability is dependent on the size of openings in the medium, the degree of interconnection, and the amount of open space. Within karst terrain, the amount of open space dominates flow conditions in large voids like caverns causing turbulent movement of water. The results of hydraulic conductivity testing at the landfill, the presence of a predictable and uniform groundwater systems, and the groundwater mounding within sandstone clearly indicate that turbulent flow does not occur.

Item 11: *A karst aquifer would potentially show concentric circles, fingering of contours, etc. where water loss or rapid movement is occurring because of voids and unmeasurable high hydraulic conductivities. Are the groundwater contours displaying these types of orientation?*

Additional Information Needed: Consider adding this discussion.

Vernon County Response: The groundwater contours do not display these types of orientation. However, the 30 years of monitoring on-site groundwater elevations confirm that the perched water table and regional water table are consistent which indicates a relatively dense fracture frequency that are interconnected between the dolostone and sandstone. Additionally, discussion throughout **Section 2.3.1.2** under the heading "Fractures and Dissolution Cavities (vugs/voids)" indicates that the secondary porosity (fractures/vugs) are considerably lower in the Oneota Dolomite than the overlying Shakopee (Tipping et al, 2006). This is supported by the boring logs in **Table 6** presenting only a handful of voids and highly fractured zones.

Item 12: *Is there physical evidence indicating the bedrock system primarily consists of small, interconnected fractures, rather than large, unconnected fractures or voids?*

Additional Information Needed: Consider adding this discussion.

Vernon County Response: **Table 6** provides a fracture and void summary from all of the drilling logs executed throughout the site. Additionally, **Section 2.3.1.2** under the heading "Fractures and Dissolution Cavities (vugs/voids)" indicates that the secondary porosity (fractures/vugs) are considerably lower in the Oneota Dolomite than the overlying Shakopee (Tipping et al, 2006).

Item 13: *Hydraulic conductivities were generally determined from slug tests. 1988 slug test results appear to be biased low due to older measurement technique (WL meter/stopwatch) and quick recovery. Consider doing new slug tests with pressure transducers or some pumping tests to check hydraulic conductivities and how well interconnected the fractures are.*

Additional Information Needed: Consider adding this discussion.

Vernon County Response: In 2003 and in the most recent testing (2023 through 2026), pressure transducers and slugs were used to displace water and record well recovery instead of the bail-down/manual measurement method. This allowed for much greater accuracy in determining changes in water level elevation during testing. Slug tests completed across the landfill property, including 2025 and 2026 tests, are summarized in **Table 4**. Additional discussion on the comparison of the 1988 slug tests and slug tests completed more recently can be found in **Section 2.3.8.2**.

Item 14: *All Subtitle D wells should be identified during feasibility and relevant baseline monitoring completed.*

Additional Information Needed*: Consider adding this discussion.*

Vernon County Response: As discussed in **Section 2.4**, the proposed Subtitle D wells include existing Subtitle D wells MW1PR, MW-9, MW-5A, MW-12, and new well MW-17WT. Prior to abandonment of MW-5 and MW-5A to accommodate future cells constructions, a replacement subtitle D well will be proposed. It is anticipated that the replacement Subtitle D well will be MW-16 or MW-18WT. Additional baseline sampling parameters required for Subtitle D wells will be completed for the selected well (if needed) to prior to abandoning MW-5A.

Item 15: *Review needs and site life and update as needed.* Response to WDNR's Feasibility Additional Information Matrix Response to WDNR's Feasibility Additional Information Matrix *Are there overlaps of other landfills to service area? Are there permanent changes to contracts that would affect needs and site life calculations.*

Additional Information Needed*: Consider adding this discussion.*

Vernon County Response: Vernon County has reviewed need and site life in light of WDNR's comment regarding service area overlap and potential permanent contract changes using updated system data. Please see attached in **Appendix K** for updated **Tables 11-1** through **11-4** reflecting updates to tonnage and population estimates since 2023.

As described in Section 11 of the Feasibility Report, the landfill's service area is Vernon County based on local waste management practices, hauling economics, and the County's longstanding intent to manage waste generated by County residents, businesses, and institutions within Vernon County. The Feasibility Report recognized that some overlap can occur with nearby regional facilities; however, that overlap has not been considered a significant driver of Vernon County municipal solid waste disposal demand because Vernon County has not operated, and does not intend to operate, as a regional facility. Consistent with NR 512.17, the need analysis evaluates other existing and proposed disposal capacity in the region while maintaining Vernon County as the appropriate local disposal facility for the waste generated within the County. Updated **Table 11-1** identifies remaining site capacity of 18,194 cubic yards as of January 2026, with the service area population estimated at 31,388 for 2025.

Since submittal of the 2023 Feasibility Report, there have been changes in waste service area that should be understood in context. Southwest Sanitation was sold to GFL, and GFL also purchased Southwest Sanitation's transfer station located in Viroqua. Historically, a portion of the Southwest's contracted waste volume was transferred out of County to a GFL owned landfill. Since that transaction, GFL has been transferring all of their contracted waste out of the Vernon County system. Also, during this time, several other private waste haulers started competing for Contracts within Vernon County. These haulers rely on the landfill as a direct stable outlet for disposal as they do not have a transfer station and cannot haul the waste a significant distance and stay competitive with local pricing.

Vernon County also conducted extensive outreach to municipalities during 2023 regarding future use of the landfill. The County had agreements in place with 21 of 33 municipalities and anticipated additional participation, and the outreach confirmed support from municipalities representing approximately 80 percent of the Vernon County population. Because the landfill has limited remaining airspace while feasibility review is pending, municipalities have delayed their commitment and allowed their hauler to divert waste to alternate facilities until the feasibility study is approved. This temporary diversion, together with the Southwest Sanitation/GFL transaction and diversion, is reflected in recent landfill receipts, which declined to 12,336 tons in 2024 and 9,323 tons in 2025. Vernon County does not consider those short-term reductions to represent the permanent long-term service-area demand for County-generated waste. Rather, they reflect interim conditions associated with constrained remaining capacity and pending expansion approval.

Based on the updated 2026 tables, Vernon County's need analysis remains supportable, but the County acknowledges that actual waste receipts during the pending review period have been affected by temporary diversion and the loss of certain contracted waste following the Southwest Sanitation sale. Updated **Table 11-4** estimates annual service area disposal at approximately 43,777 tons per year, or 58,370 cubic yards per year, using the 2021-2025 statewide average disposal rate and the 2025 Vernon County population. At the same time, the 2024 and 2025 actual tonnage data demonstrate that current landfill receipts are materially below the broader service-area disposal estimate due to the temporary conditions described above. However, if 80% of the service area volume demand is realized, approximately 46,700 CY of annual air space demand could be experienced. The annual air space demand used to calculate the 430,000 CY net airspace in the Feasibility Report assumed historic volume consumption (25,234 CY plus 1.56% annual growth) and did not reflect the outreach efforts with the County municipalities.

The County's position is that these developments do not negate the need for the proposed expansion; rather, they confirm that without additional permitted airspace, local waste is more likely to continue to be diverted outside the County, and options for local residents and business will decrease. Continued diversion of local waste to transfer or disposal facilities controlled by larger regional operators may reduce competition and options available to residents, businesses, and municipalities within the service area and may increase disposal and transportation costs over time. In that regard, the Eastern Expansion is important not only to preserve local disposal capacity, but also to maintain competitive, cost-effective waste management options within Vernon County. Assuming the expansion is approved and constructed, it is also reasonable to conclude that GFL may utilize the system as well to stay competitive as it is currently transferring the waste greater than 100 miles away one way. This does not seem to be a sustainable option if other competition in the service area is not burdened with that expense.

Item 16: *Reminder to include exemption requests for ES exceedances and corresponding cause and significance of exceedance.*

Additional Information Needed: Consider adding this discussion.

Vernon County Response: In accordance with NR140.28 Wis Adm. Code, based on the results of baseline and detection monitoring completed for the above reference monitoring wells installed during 2024 and 2025, exemptions to the groundwater quality standards outlined in NR140.10 and NR140.12 Wis. Adm. Code are requested. Following is a summary of the requested exemptions and justification.

MW-16Z: No exemptions requested. As noted above, two PAL exceedances were measured at MW-16Z for cadmium, however, the remaining baseline samples were below laboratory detection limits and the respective PAL. One ES and one PAL exceedance was measured for manganese during the first two baseline sampling events, respectively. Subsequent baseline sampling for manganese indicated that measured concentrations were below the PAL and continued to decrease. It is assumed that disturbance in the formation during drilling, or introduction of contaminants from the drilling fluid or well construction materials may have affected short-term water quality.

MW-18WT: See below requested exemptions.

Parameter	Well ID	Public Health (NR140.10) ES	Public Health (NR140.10) PAL	Public Welfare (NR140.12) ES	Public Welfare (NR140.12) PAL
Arsenic	MW-18WT		X		
Lead	MW-18WT		X		
Manganese	MW-18WT		X	X	
Nitrate+Nitrite (as N)	MW-18WT		X		

As noted above, one ES exceedance and one PAL exceedance were measured at MW-18WT for arsenic, lead, and manganese. While the respective concentrations decreased following the initial baseline sampling event, detections in exceedance of the respective PALs were measured during the final baseline sampling event. PAL exceedances were measured for nitrate+nitrite (N+N) at or near the PAL during three of the four baseline sampling events. It is assumed that disturbance in the formation during drilling, or introduction of contaminants from the drilling fluid or well construction materials may have affected short-term water quality. However, given the fluctuations in the above parameters, along with the apparent stability and consistency of other indicator parameters (conductivity, alkalinity, hardness, pH) suggest that arsenic, lead, and manganese may be naturally occurring. The presence of N+N is consistent with water quality observed in other site wells and is likely due to historic agricultural practices in the vicinity.

MW-18: See below requested exemption.

Parameter	Well ID	Public Health (NR140.10) ES	Public Health (NR140.10) PAL	Public Welfare (NR140.12) ES	Public Welfare (NR140.12) PAL
Nitrate+Nitrite (as N)	MW-18		X		

As noted above, two PAL exceedances were measured at MW-18 for N+N. It is assumed that disturbance in the formation during drilling, or introduction of contaminants from the drilling fluid or well construction materials may have affected short-term water quality. However, given the consistent detections on N+N, along with the apparent stability and consistency of other indicator parameters (conductivity, alkalinity, hardness, pH) suggest that the detections are not anomalous. The presence of N+N is consistent with water quality observed in other site wells and is likely due to historic agricultural practices in the vicinity.

MW-19: See below requested exemption.

Parameter	Well ID	Public Health (NR140.10) ES	Public Health (NR140.10) PAL	Public Welfare (NR140.12) ES	Public Welfare (NR140.12) PAL
Manganese	MW-19		X	X	

As noted above, one ES exceedance and one PAL exceedance were measured at MW-19 for benzene during the first two baseline sampling events. Subsequent baseline sampling for benzene indicated no further detections. Also, PAL exceedances were measured at MW-18WT for arsenic, chromium and during the initial baseline sampling event. Subsequent baseline sampling for these parameters indicated no further detection, or low-level detections below the applicable PAL. Baseline sampling completed for manganese indicated ES exceedances during the first three sampling events, and a PAL exceedance for the fourth.

It is assumed that disturbance in the formation during drilling, or introduction of contaminants from the drilling fluid or well construction materials may have affected short-term water quality. While the concentrations of manganese continue to decrease, it appears that a PAL exemption for the NR140.10 standard and ES exemption for the NR140.12 standard are warranted.

<u>MW-19Z:</u> See below requested exemption.

Parameter	Well ID	Public Health (NR140.10)		Public Welfare (NR140.12)	
		ES	PAL	ES	PAL
Manganese	MW-19				X

As noted above, two NR140.10 ES exceedances were measured at MW-19Z for manganese, however, the remaining baseline samples were below the respective PAL. However, while the last two events were less than the NR140.10 PAL, the measured concentrations were above the NR140.12 ES during the third event, and PAL during the fourth. It is assumed that disturbance in the formation during drilling, or introduction of contaminants from the drilling fluid or well construction materials may have affected short-term water quality. While manganese concentrations continue to appear to decrease, continued NR140.12 PAL exceedances suggest an exemption is warranted.

<u>MW-20:</u> See below requested exemption.

Parameter	Well ID	Public Health (NR140.10)		Public Welfare (NR140.12)	
		ES	PAL	ES	PAL
Manganese	MW-19		X	X	

As noted above, NR140.10 ES exceedances and NR140.12 ES exceedances were measured at MW-20 for manganese during all four baseline sampling events. It is assumed that disturbance in the formation during drilling, or introduction of contaminants from the drilling fluid or well construction materials may have affected short-term water quality. While manganese concentrations continue to appear to decrease slightly, continued NR140.10 PAL and NR140.12 ES exceedances suggest an exemption is warranted.

4 Recommendation

Vernon County believes that the responses presented in Feasibility Report Addendum 01 and Addendum 02 satisfactorily address the additional information requested by the WDNR in their Incompleteness Letter dated December 19, 2023, and Incompleteness Letter dated March 2025, and associated correspondence. Vernon County is requesting the WDNR review this Feasibility Report Addendum 02 and approve the Feasibility Report so Vernon County can continue to make progress with the landfill permitting process.

5 References

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Tables

Tables

Table 1
Soil Borings within 300 feet of Proposed Expansion and Extend at Least 25 feet below Subbase Elevation
Vernon County Landfill - Proposed Eastern Expansion

Soil Boring Nomenclature	Year Completed	Drilling Company	Ground Elevation (feet NAVD)	Depth to Saprolite (feet bgs)	Saprolite Elevation (feet NAVD)	Depth to Bedrock (feet bgs)	Bedrock Elevation (feet NAVD)	Total Depth of Boring (feet bgs)	Bottom Elevation of Boring (feet NAVD)	Sub-base Elevation (feet NAVD)	Depth Below Sub-base Elevation (feet)(1)
Existing Borings within 300-feet											
TB-4	1988	Wisconsin Test Drilling	1232.9	12.0	1220.9	14.5	1218.4	15.0	1217.9	1255	37.4
TB-5	1988	Wisconsin Test Drilling	1221.0	22.0	1199.0	NE	NE	25.0	1196.0	1222	26.3
TB-7	1988	Wisconsin Test Drilling	1245.4	38.0	1207.4	NE	NE	47.5	1197.9	1239	41.0
TB-8	1988	Wisconsin Test Drilling	1249.4	42.0	1207.4	45.0	1204.4	45.5	1203.9	1251	47.1
TB-15	1989	Exploration Technology	1193.5	11.5	1182.0	NE	NE	12.0	1181.5	1220	38.5
B-18	2022	Braun Intertec	1239.0	18.0	1221.0	24.0	1215.0	30.0	1209.0	1238	29.4
B-19	2022	Braun Intertec	1233.3	20.0	1213.3	24.0	1209.3	28.0	1205.3	1232	26.5
B-20	2022	Braun Intertec	1215.8	20.8	1195.0	24.0	1191.8	30.0	1185.8	1219	33.5
MW-5	1988	Ace Well Drilling	1223.3	20.0	1203.3	35.0	1188.3	180.0	1043.3	1238	195.2
MW-6	1988	Ace Well Drilling	1233.0	14.0	1219.0	14.0	1219.0	210.0	1023.0	1255	232.3
MW-10	1989	Exploration Technology	1215.6	24.5	1191.1	61.0	1154.6	181.0	1034.6	1220	185.4
MW-14Z	2003	Traut Hydro Tech	1247.5	NONE	NONE	27.5(2)	1220.0	210.0	1037.5	1254	216.3
MW-14WT	2022	Braun Intertec	1247.2	28.5	1218.7	30.0	1217.2	109.0	1138.2	1255	117.1
MW-15WT	2022	Braun Intertec	1220.6	39.5	1181.1	69.5	1151.1	99.0	1121.6	1244	122.2
MW-16	2022	Braun Intertec	1184.3	34.5	1149.8	79.5	1104.8	98.0	1086.3	1225	139.1
MW-17WT	2022	Braun Intertec	1196.4	11.0	1185.4	65.0	1131.4	93.0	1103.4	1220	116.6
Borings completed during 2024 within 300-feet											
B-22	2024	Cascade Drilling	1225.6	23.0	1202.6	55.0	1170.6	105.0	1120.6	1210	89.4
MW-16Z	2024	Cascade Drilling	1184.5	59.0	1125.5	79.0	1105.5	120.0	1064.5	1225	160.5
MW-18	2024	Cascade Drilling	1209.8	30.0	1179.8	87.0	1122.8	117.0	1092.8	1234	141.2
MW-19Z	2024	Cascade Drilling	1190.2	10.0	1180.2	28.0	1162.2	130.0	1060.2	1220	159.8
Borings completed during 2025 within 300-feet											
MW-20	2025	Cascade Drilling	1174.3	5.0	1169.3	38.0	1136.3	80.0	1094.3	1176	81.7

Notes:

bgs	- Below ground surface.
NE	- Not encountered.
NONE	- No Saprolite present at this location.
(1)	- Only page 1 of the soil boring log is available.
(2)	- Depth to bedrock on the boring log appears to be skewed due to the Rotosonic drilling method used. The depth to bedrock provided here was determined using surrounding boring logs and geologic cross-section interpretations.

Table 2
Summary of Monitoring Wells and Piezometers within 300 feet of Proposed Expansion
Vernon County Landfill - Proposed Eastern Expansion

WDNR Point ID Number	Well Name	Date Installed	Ground Elevation (feet NAVD)	Top of Casing Elevation (feet NAVD)	Well Depth (feet bgs)	Screen Length (feet)	Screen Interval Elevation (feet NAVD)	Monitoring Point	Geologic Description of Screened Interval
Monitoring Wells and Piezometers Inside Expansion Footprint									
109	MW-5A	11/8/1989	1224.0	1225.81	103.3	15.0	1120.7 - 1135.7	Perched Water Table	dolomite, hard
108	MW-5	2/17/1988	1223.3	1225.32	150.6	10.0	1072.7 - 1082.7	Regional Water Table	dolomite, hard
119	MW-14Z	3/7/2003	1247.5	1250.22	210.8	5.0	1036.7 - 1041.7	Piezometer, Lower Zone	silty dolomitic sandstone
Monitoring Wells and Piezometers Within 150-feet									
118	MW-14	3/12/2003	1247.5	1249.69	186.1	15.0	1061.4 - 1076.4	Regional Water Table	fractured dolomite and sandy dolomite
125	MW-14WT	9/20/2022	1247.2	1249.70	106.0	15.0	1141.2 - 1156.2	Perched Water Table	dolostone
127	MW-15WT	9/28/2022	1220.6	1223.24	85.0	10.0	1135.6 - 1145.6	Perched Water Table	sandy dolostone
129	MW-16WT*	9/21/2022	1184.7	1186.97	75.0	10.0	1109.7 - 1119.7	Perched Water Table	sandy dolostone to shale
131	MW-16	8/25/2022	1184.3	1186.92	97.0	5.0	1087.3 - 1092.3	Regional Water Table	sandy dolostone
135	MW-16Z	8/6/2024	1184.5	1186.50	120.0	5.0	1064.5 - 1069.5	Piezometer, Upper Zone	weathered sandy dolostone
133	MW-17WT	9/26/2022	1196.4	1199.18	92.0	10.0	1104.4 - 1114.4	Perched Water Table	weathered sandstone
137	MW-18WT	8/2/2024	1210.1	1212.24	87.0	10.0	1123.1 - 1133.1	Perched Water Table	weathered sandy dolostone
139	MW-18	7/31/2024	1209.8	1212.00	117.0	10.0	1092.8 - 1102.8	Regional Water Table	sandy dolostone
Monitoring Wells and Piezometers Within 300-feet									
105	MW-3	2/2/1988	1233.0	1235.25	180.0	5.0	1053.0 - 1058.0	Piezometer, Upper Zone	dolomite, hard
107	MW-4P	1/29/1988	1232.9	1235.19	95.0	10.0	1137.9 - 1147.9	Perched Water Table	dolomite, hard
110	MW-6	2/20/1988	1233.0	1235.37	202.2	5.0	1030.8 - 1035.8	Piezometer, Lower Zone	sandy dolomite
114	MW-10	9/15/1989	1215.6	1217.52	183.5	5.0	1032.1 - 1037.1	Piezometer, Lower Zone	dolomitic sandstone to sandy dolomite
115	MW-11	9/29/1989	1216.4	1218.56	162.5	15.0	1053.9 - 1068.9	Piezometer, Upper Zone	sandy dolomite to dolomitic sandstone
116	MW-12	9/22/1989	1216.4	1218.36	98.5	15.0	1117.9 - 1132.9	Perched Water Table	dolomite with occasional small vugs
141	MW-19	8/13/2024	1190.5	1192.82	103.0	10.0	1087.5 - 1097.5	Regional Water Table	sandstone
143	MW-19Z	8/9/2024	1190.2	1192.34	130.0	5.0	1060.2 - 1065.2	Piezometer, Upper Zone	clayey sandstone
145	MW-20WT	4/24/2025	1174.4	1176.32	53.0	10.0	1123.3 - 1133.3	Perched Water Table	sandstone, poorly consolidated
147	MW-20	4/23/2025	1174.3	1176.58	79.0	10.0	1097.6 - 1107.6	Regional Water Table	sandstone, poorly consolidated

Notes:

bgs - Below ground surface.

* - TOC revised and re-surveyed on 07/22/2024.

Table 3
Existing Static Water Elevations for Landfill Property (2020-2025)
Vernon County Landfill - Proposed Eastern Expansion

WDNR Point ID Number	Well Name	Date Installed	Ground Elevation (feet NAVD)	Top of Casing Elevation (feet NAVD)	Well Depth (feet bgs)	Screen Length (feet)	Screen Interval Elevation (feet NAVD)	Well Type/ Groundwater Zone	Static Water Elevation by Date (feet NAVD)																					
									3/9/2020	9/14/2020	3/1/2021	9/1/2021	3/1/2022	9/22/2022	12/20/2022	1/24/2023	3/1/2023	3/27/2023	4/28/2023	5/30/2023	9/11/2023	3/11/2024	8/27/2024	10/2/2024	3/7/2025	4/14/2025	5/14/2025	6/19/2025	7/28/2025	8/27/2025
102	MW-1P	12/30/1987	1236.4	1238.41	111.1	10.0	1125.4 - 1135.4	Perched Water Table	1132.6	1132.56	1131.67	1131.76	1131.42	1130.90	1130.02	1131.71	1131.70	1131.59	1131.98	1132.64	1132.58	1132.85	1132.63	1132.43	1132.26	1132.31	1131.91	1131.88	1131.92	1132.05
101	MW-1	12/30/1987	1236.4	1238.11	158.0	10.0	1078.5 - 1088.5	Regional Water Table	1103.09	1102.14	1096.58	1093.67	1091.85	1089.95	1089.70	1089.62	1089.62	1090.36	1092.19	1094.43	1093.24	1089.42	1090.20	1090.17	1088.42	1089.23	1088.36	1088.46	1088.49	1088.44
121	MW-1PR	1/12/1994	1245.0	1247.61	127.7	15.0	1119.9 - 1134.9	Perched Water Table	1135.4	1135.22	1134.80	1134.34	1134.23	1133.50	1134.07	1134.04	1134.22	1134.14	1134.72	1134.97	1134.09	1133.50	1134.47	1134.35	1134.41	1134.30	1134.30	1134.35	1134.32	1134.38
120	MW-1R	1/12/1994	1244.6	1247.25	164.6	15.0	1082.6 - 1097.6	Regional Water Table	1102.97	1102.03	1096.50	1093.58	1091.81	1089.95	1090.85	1090.60	1089.61	1090.36	1092.13	1094.46	1093.06	1088.64	1090.46	1090.48	1088.54	1087.75	1088.39	1088.15	1088.35	1086.50
123	MW-1RZ	3/12/2003	1244.0	1245.45	186.5	5.0	1057.5 - 1062.5	Piezometer, Upper Zone	1102.54	1101.58	1096.12	1093.19	1091.28	1089.51	1088.33	1089.11	1089.15	1089.84	1090.72	1093.86	1092.61	1088.21	1089.86	1089.43	1088.17	1087.84	1088.04	1087.83	1088.03	1088.20
104	MW-2P	1/17/1988	1252.5	1254.88	124.8	10.0	1128.0 1138.0	Perched Water Table	1141.03	1140.76	1139.87	1139.39	1139.33	1138.79	1138.81	1138.45	1139.36	1139.24	1139.98	1141.11	1139.41	1138.69	1138.98	1139.65	1139.51	1139.63	1139.70	1139.69	1139.63	1139.67
103	MW-2	1/17/1988	1252.5	1254.35	174.6	10.0	1078.3 - 1088.3	Regional Water Table	1095.32	1094.86	1091.56	1089.58	1087.79	1085.92	1086.19	1085.23	1086.01	1086.60	1087.51	1090.35	1089.29	1085.27	1086.88	1086.37	1083.66	1085.53	1085.59	1085.33	1085.69	1085.86
105	**MW-3**	**2/2/1988**	**1233.0**	**1235.25**	**180.0**	**5.0**	**1053.2 - 1058.2**	**Piezometer, Upper Zone**	**1080.42**	**1080.22**	**1076.06**	**1073.14**	**1070.69**	**1069.14**	**1068.69**	**1068.66**	**1068.69**	**1069.06**	**1069.19**	**1071.08**	**NM**	**1068.83**	**1068.90**	**1068.30**	**1067.49**	**1066.63**	**1067.87**	**1067.57**	**1067.62**	**1067.75**
107	**MW-4P**	**1/29/1988**	**1232.9**	**1235.19**	**95.0**	**10.0**	**1138.3 - 1148.3**	**Perched Water Table**	**1150.88**	**1151.96**	**1149.32**	**1149.32**	**1148.16**	**1148.92**	**1147.07**	**1146.72**	**1148.30**	**1148.18**	**1148.24**	**1151.19**	**1149.58**	**1147.14**	**1150.67**	**1149.96**	**1148.73**	**1147.96**	**1148.68**	**1148.74**	**1148.74**	**1149.82**
109	**MW-5A**	**11/8/1989**	**1224.0**	**1225.81**	**103.3**	**15.0**	**1122.9 - 1137.9**	**Perched Water Table**	**1137.72**	**1138.27**	**1136.34**	**1135.86**	**1135.52**	**1135.74**	**1134.78**	**1134.27**	**1134.29**	**1135.12**	**1135.58**	**1136.90**	**1135.73**	**1135.52**	**1135.50**	**1135.29**	**1135.19**	**1134.99**	**1135.18**	**1135.26**	**1135.41**	**1135.52**
108	**MW-5**	**2/17/1988**	**1223.3**	**1225.32**	**150.6**	**10.0**	**1072.6 - 1082.6**	**Regional Water Table**	**1085.93**	**1086.23**	**1084.59**	**1084.36**	**1083.94**	**1084.05**	**1081.46**	**1082.51**	**1082.60**	**1083.14**	**1083.50**	**1086.28**	**1084.20**	**1083.29**	**1083.31**	**1082.90**	**1082.35**	**1080.27**	**1082.50**	**1083.14**	**1083.18**	**1082.85**
110	**MW-6**	**1/12/1900**	**1233.0**	**1235.37**	**202.2**	**5.0**	**1025.7 - 1030.7**	**Piezometer, Lower Zone**	**1073.88**	**1073.53**	**1069.39**	**1067.35**	**1065.30**	**1063.84**	**1062.81**	**1062.48**	**1062.35**	**1062.48**	**1062.25**	**1063.27**	**1066.09**	**1062.71**	**1064.13**	**1063.81**	**NM[1]**	**NM[1]**	**NM[1]**	**NM[1]**	**NM[1]**	**NM[1]**
111	MW-7	11/7/1989	1255.7	1258.03	234.5	5.0	1023.5 - 1028.5	Piezometer, Lower Zone	1079.32	1078.89	1074.92	1072.83	1070.92	1069.39	1069.50	1068.20	1069.34	1074.93	1069.71	1070.14	1071.57	1068.29	1069.56	1069.25	1068.33	1068.32	1068.58	1068.49	1068.50	1068.46
112	MW-8R	11/13/1989	1256.1	1258.84	202.5	15.0	1056.3 - 1071.3	Piezometer, Upper Zone	1087.42	1086.93	1082.78	1079.31	1077.00	1075.30	1076.74	1075.12	1075.04	1075.74	1076.15	1079.52	1078.77	1074.93	1077.32	1077.24	1074.19	1073.97	1073.17	1072.87	1074.22	1074.23
113	MW-9	8/29/1989	1255.4	1257.50	126.8	15.0	1130.7 - 1145.7	Perched Water Table	1140.92	1141.14	1140.16	1139.74	1139.22	1138.73	1139.07	1139.25	1139.35	1139.24	1139.13	1139.79	1139.65	1138.94	1145.25	1143.16	1139.59	1139.78	1139.83	1139.81	1139.80	1139.89
114	**MW-10**	**9/15/1989**	**1215.6**	**1217.52**	**183.5**	**5.0**	**1034.0 - 1039.0**	**Piezometer, Lower Zone**	**1098.09**	**1096.89**	**1090.39**	**1086.65**	**1084.18**	**1082.08**	**1083.12**	**1081.66**	**1080.14**	**1082.75**	**1081.73**	**1086.63**	**1085.79**	**1080.78**	**1081.67**	**1081.25**	**1080.17**	**1080.18**	**1080.57**	**1080.29**	**1080.40**	**1080.20**
115	**MW-11**	**9/29/1989**	**1216.4**	**1218.56**	**162.5**	**15.0**	**1056.0 - 1071.0**	**Piezometer, Upper Zone**	**1100.85**	**1102.01**	**1093.69**	**1089.81**	**1089.22**	**1085.59**	**1086.25**	**1086.73**	**1086.75**	**1087.68**	**1090.31**	**1092.04**	**1189.51**	**1084.33**	**1087.06**	**1087.21**	**1085.27**	**1085.69**	**1085.46**	**1085.42**	**1085.46**	**1089.13**
116	**MW-12**	**9/22/1989**	**1216.4**	**1218.36**	**98.5**	**15.0**	**1119.9 - 1134.9**	**Perched Water Table**	**1132.29**	**1132.13**	**1130.62**	**1130.50**	**1129.69**	**1130.45**	**1128.48**	**1130.17**	**1130.87**	**1131.77**	**1133.62**	**1133.71**	**1130.34**	**1129.07**	**1132.66**	**1132.02**	**1130.49**	**1129.86**	**1131.39**	**1131.23**	**1131.10**	**1131.81**
117	MW-13P	2/26/2003	1224.5	1227.42	102.4	15.0	1122.1 - 1137.1	Perched Water Table	1134.6	1134.56	1134.00	1133.64	1133.46	1132.81	1133.40	1133.40	1133.21	1133.60	1134.40	1134.33	1133.34	1132.76	1133.89	1133.53	1133.58	1132.89	1133.61	1133.50	1133.64	1133.77
125	**MW-14WT**	**9/20/2022**	**1247.2**	**1249.70**	**106.0**	**15.0**	**1141.2 - 1156.2**	**Perched Water Table**	**--**	**--**	**--**	**--**	**--**	**--**	**1141.87**	**1146.01**	**1145.92**	**1146.67**	**1146.77**	**1146.98**	**NM**	**NM**	**1146.52**	**1146.16**	**1146.24**	**1146.07**	**1146.16**	**1146.31**	**1146.25**	**1146.28**
118	**MW-14**	**3/12/2003**	**1247.5**	**1249.69**	**186.1**	**15.0**	**1061.4 - 1076.4**	**Regional Water Table**	**1086.34**	**1086.00**	**1081.36**	**1077.76**	**1075.24**	**1073.32**	**1073.63**	**1072.80**	**1072.54**	**1073.44**	**1073.91**	**1077.46**	**1076.76**	**1072.71**	**1074.77**	**1074.63**	**1071.25**	**1071.04**	**1068.52**	**1070.34**	**1071.43**	**1071.37**
119	**MW-14Z**	**3/7/2003**	**1247.5**	**1250.22**	**210.8**	**5.0**	**1036.7 - 1041.7**	**Piezometer, Lower Zone**	**1082.78**	**1083.11**	**1078.69**	**1073.19**	**1072.26**	**1071.89**	**1071.20**	**1071.17**	**1071.09**	**1071.30**	**1071.96**	**1072.58**	**1075.15**	**1068.74**	**1072.01**	**1071.80**	**1070.23**	**1070.21**	**1069.97**	**1069.90**	**1070.56**	**1066.22**
127	**MW-15WT**	**9/28/2022**	**1220.6**	**1223.24**	**85.0**	**10.0**	**1135.61 - 1145.6**	**Perched Water Table**	**--**	**--**	**--**	**--**	**--**	**--**	**DRY**	**DRY**	**DRY**	**DRY**	**DRY**	**DRY**	**NM**	**NM**	**DRY**	**DRY**	**DRY**	**DRY**	**DRY**	**DRY**	**DRY**	**DRY**
129	**MW-16WT****	**9/21/2022**	**1184.7**	**1186.97**	**75.0**	**10.0**	**1109.7 - 1119.7**	**Perched Water Table**	**--**	**--**	**--**	**--**	**--**	**--**	**DRY**	**DRY**	**DRY**	**DRY**	**DRY**	**DRY**	**NM**	**NM**	**DRY**	**DRY**	**DRY**	**DRY**	**DRY**	**DRY**	**DRY**	**DRY**
131	**MW-16**	**8/25/2022**	**1184.3**	**1186.92**	**97.0**	**5.0**	**1087.27 - 1092.3**	**Regional Water Table**	**--**	**--**	**--**	**--**	**--**	**--**	**1093.09***	**1101.68**	**1102.48**	**1104.29**	**1104.38**	**1107.62**	**NM**	**NM**	**1099.47**	**1099.37**	**1100.37**	**1100.51**	**1103.04**	**1102.05**	**1102.16**	**1102.80**
135	**MW-16Z**	**8/13/2024**	**1184.5**	**1186.50**	**120.0**	**5.0**	**1064.54 - 1069.5**	**Piezometer, Upper Zone**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**1093.88**	**1093.94**	**1093.85**	**1093.47**	**1094.81**	**1094.16**	**1094.11**	**1095.00**
133	**MW-17WT**	**9/26/2022**	**1196.4**	**1199.18**	**92.0**	**10.0**	**1104.4 - 1114.4**	**Perched Water Table**	**--**	**--**	**--**	**--**	**--**	**--**	**1116.64**	**1117.78**	**FROZEN**	**1121.62**	**1124.88**	**1122.04**	**NM**	**NM**	**1120.55**	**1119.75**	**1117.67**	**1117.82**	**1120.58**	**1119.60**	**1119.86**	**1119.18**
137	**MW-18WT**	**8/6/2024**	**1210.1**	**1212.24**	**87.0**	**10.0**	**1123.06 - 1133.1**	**Perched Water Table**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**1130.15**	**1132.41**	**1130.29**	**1130.23**	**1130.93**	**1130.53**	**1130.56**	**1130.80**
139	**MW-18**	**7/31/2024**	**1209.8**	**1212.00**	**117.0**	**10.0**	**1092.8 - 1102.8**	**Regional Water Table**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**1104.35**	**1104.20**	**1103.43**	**1103.26**	**1103.53**	**1103.79**	**1103.55**	**1103.92**
141	**MW-19**	**8/8/2024**	**1190.5**	**1192.82**	**103.0**	**10.0**	**1087.55 - 1097.5**	**Regional Water Table**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**1095.60**	**1092.96**	**1089.97**	**1091.18**	**1093.43**	**1093.43**	**1093.26**	**1092.45**
143	**MW-19Z**	**8/12/2024**	**1190.2**	**1192.34**	**130.0**	**5.0**	**1060.23 - 1065.2**	**Piezometer, Upper Zone**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**1192.34**	**1192.34**	**1091.75**	**1091.89**	**1093.87**	**1094.02**	**1093.85**	**1093.09**
145	**MW-20WT**	**4/24/2025**	**1174.4**	**1176.32**	**53.0**	**10.0**	**1121.4 - 1131.4**	**Perched Water Table**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**1121.92**	**1124.05**	**1123.44**	**1121.37**
147	**MW-20**	**4/23/2025**	**1174.3**	**1176.58**	**79.0**	**10.0**	**1095.3 - 1105.3**	**Regional Water Table**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**1108.10**	**1108.63**	**1108.91**	**1109.16**

Notes:

bgs - Below ground surface.

NM - Not measured.

-- - Data not available due to monitoring point not yet installed.

* - Groundwater elevation not representative due to well still stablizing post-well development.

** - TOC revised and re-surveyed on 07/22/2024.

BOLD -Monitoring well or piezometer used in monitoring of the proposed landfill expansion area.

(1) - inaccessible (dedicated pump in the way)

Table 4
In-Field Hydraulic Conductivity Testing for the Landfill Property
Vernon County Landfill - Proposed Eastern Expansion

			Previous Results (1988-1989)			Previous Results (2003)			FS Addendum Results (2023-current)				Selected Represenative Value	
Well Name	Screen Interval Elevation (feet NAVD)	Geologic Description of Screened Interval	Method**	Hydraulic Conductivity (cm/sec)	Hydraulic Conductivity (ft/day)	Method	Hydraulic Conductivity (cm/sec)	Hydraulic Conductivity (ft/day)	Year Completed	Method	Hydraulic Conductivity (cm/sec)	Hydraulic Conductivity (ft/day)	Hydraulic Conductivity (cm/sec)	Hydraulic Conductivity (ft/day)
Perched Water Table Wells														
Prairie du Chien Group														
MW-1PR	1119.9 - 1134.9	sandy dolostone to dolomitic sandstone	--	--	--	Bouwer-Rice	5.97E-03	16.93	--	--	--	--	5.97E-03	16.93
MW-2P	1128.0 - 1138.0	dolostone, hard	--	--	--	--	--	--	2023	Bouwer-Rice	1.64E-03	4.64	1.64E-03	4.64
MW-4P	1138.3 - 1148.3	dolostone, hard	--	--	--	Bouwer-Rice	5.93E-03	16.82	2026	Bouwer-Rice	6.34E-04	1.80	6.34E-04	1.80
MW-5A	1122.9 - 1137.9	dolostone, hard	NA	3.64E-04	1.03	--	--	--	2024	Bouwer-Rice	3.98E-03	11.28	3.98E-03	11.28
MW-9	1130.7 - 1145.7	dolostone with occasional small vugs	NA	8.34E-04	2.36	Bouwer-Rice	1.18E-02	33.54	--	--	--	--	1.18E-02	33.54
MW-12	1119.9 - 1134.9	dolostone with occasional small vugs	NA	1.30E-04	0.37	Bouwer-Rice	1.27E-02	36.04	2023	Bouwer-Rice	1.18E-03	3.34	1.18E-03	3.34
MW-13P	1122.1 - 1137.1	dolostone with occasional small vugs	--	--	--	Bouwer-Rice	3.28E-03	9.29	--	--	--	--	3.28E-03	9.29
MW-14WT	1141.2 - 1156.2	dolostone	--	--	--	--	--	--	2023	Bouwer-Rice	9.94E-03	28.18	9.94E-03	28.18
												Average:	4.81E-03	13.63
												Geometric Mean:	3.21E-03	9.09
												Minimum:	6.34E-04	1.80
												Maximum:	1.18E-02	33.54
Poorly Consolidated Sandstone														
MW-17WT	1104.4 - 1114.4	sandstone	--	--	--	--	--	--	2023	Bouwer-Rice	2.43E-05	0.069	2.43E-05	0.069
MW-18WT	1125.2 - 1135.2	sandstone	--	--	--	--	--	--	2024	Bouwer-Rice	2.34E-03	6.62	2.34E-03	6.62
												Average:	1.18E-03	3.35
												Geometric Mean:	2.38E-04	0.68
												Minimum:	2.43E-05	0.069
												Maximum:	2.34E-03	6.62
Regional Water Table Wells														
Prairie du Chien Group														
MW-1	1078.5 - 1088.5	dolostone, hard	NA	1.86E-04	0.53	--	--	--	--	--	--	--	1.86E-04	0.53
MW-1R	1082.6 - 1097.6	dolostone, hard	--	--	--	--	--	--	2023	Bouwer-Rice	6.67E-02	189.18	6.67E-02	189.18
MW-2	1078.3 - 1088.3	dolostone, hard	NA	4.63E-04	1.31	--	--	--	--	--	--	--	4.63E-04	1.31
MW-5	1072.6 - 1082.6	dolostone, hard	NA	2.62E-04	0.74	--	--	--	2026	Bouwer-Rice	1.18E-05	0.034	1.18E-05	0.034
MW-14	1061.4 - 1076.4	fractured dolostone and sandy dolostone	--	--	--	Bouwer-Rice	1.39E-02	39.48	--	--	--	--	1.39E-02	39.48
MW-16	1087.3 - 1092.3	sandy dolostone (*residuum*)	--	--	--	--	--	--	2023	Bouwer-Rice	3.71E-04	1.05	3.71E-04	1.05
MW-18	1095.0 - 1105.0	sandy dolostone	--	--	--	--	--	--	2024	Bouwer-Rice	2.07E-04	0.59	2.07E-04	0.59
												Average:	1.17E-02	33.17
												Geometric Mean:	6.88E-04	1.95
												Minimum:	1.18E-05	0.034
												Maximum:	6.67E-02	189.18
Poorly Consolidated Sandstone														
MW-19	1089.8 - 1099.8	sandstone	--	--	--	--	--	--	2024	Bouwer-Rice	1.04E-04	0.29	1.04E-04	0.29
MW-20	1097.6 - 1107.6	sandstone	--	--	--	--	--	--	2025	Bouwer-Rice	2.94E-05	0.083	2.94E-05	0.083
												Average:	6.67E-05	0.19
												Geometric Mean:	5.53E-05	0.16
												Minimum:	2.94E-05	0.083
												Maximum:	1.04E-04	0.29
Piezometers														
Prairie du Chien Group														
MW-1RZ	1057.5 - 1062.5	sandy dolostone to dolomitic sandstone	--	--	--	Bouwer-Rice	3.07E-02	87.11	--	--	--	--	3.07E-02	87.11
MW-3	1053.2 - 1058.2	dolostone, hard	NA	1.16E-04	0.33	Bouwer-Rice	1.67E-03	4.73	2026	Bouwer-Rice	2.34E-04	0.66	2.34E-04	0.66
MW-6	1025.7 - 1030.7	sandy dolostone	NA	2.57E-04	0.73	Bouwer-Rice	1.59E-03	4.51	--	--	--	--	1.59E-03	4.51
MW-7	1023.5 - 1028.5	sandy dolostone with sandstone and shale interbeds	Report noted relatively high well recovery, estimated >=10^-3 cm/sec			Bouwer-Rice	1.05E-02	29.81	--	--	--	--	1.05E-02	29.81
MW-8R	1056.3 - 1071.3	sandy dolostone with sandstone interbeds	NA	1.84E-04	0.52	Bouwer-Rice	3.19E-03	9.05	--	--	--	--	3.19E-03	9.05
MW-10	1034.0 - 1039.0	dolomitic sandstone to sandy dolostone	NA	8.86E-04	2.51	Bouwer-Rice	2.01E-03	5.71	2026	Bouwer-Rice	1.28E-03	3.64	1.28E-03	3.64
MW-11	1056.0 - 1071.0	sandy dolostone to dolomitic sandstone	NA	9.59E-06	0.027	Bouwer-Rice	2.19E-04	0.62	--	--	--	--	2.19E-04	0.62
MW-14Z	1036.7 - 1041.7	silty dolomitic sandstone	--	--	--	Bouwer-Rice	1.18E-03	3.34	--	--	--	--	1.18E-03	3.34
MW-16Z	1066.5 - 1071.5	weathered sandy dolostone (*residuum*)	--	--	--	--	--	--	2024	Bouwer-Rice	1.07E-04	0.30	1.07E-04	0.30
												Average:	5.45E-03	15.45
												Geometric Mean:	1.34E-03	3.79
												Minimum:	1.07E-04	0.30
												Maximum:	3.07E-02	87.11
Poorly Consolidated Sandstone														
MW-19Z	1062.3 - 1067.3	sandstone	--	--	--	--	--	--	2024	Bouwer-Rice	2.13E-04	0.60	2.13E-04	0.60
												Average:	2.13E-04	0.60
												Geometric Mean:	2.13E-04	0.60
												Minimum:	2.13E-04	0.60
												Maximum:	2.13E-04	0.60

**1988-1989 testing utilized baildown recovery testing method (described by Bouwer, 1989)

Comparison of All "Seleceted Representative Values" from In-field Hydraulic Conductivity Testing Results	Hydraulic Conductivity (cm/sec)	Hydraulic Conductivity (ft/day)
Average:	5.94E-03	16.82
Geometric Mean:	9.70E-04	2.75
Minimum:	1.18E-05	0.034
Maximum:	6.67E-02	189.18

Table 5
Vertical Hydraulic Gradients
Vernon County Landfill - Proposed Eastern Expansion

						Vertical Gradient by Date																					
Well Name	**TOC Elevation (feet NAVD)**	**Ground Elevation (feet NAVD)**	**Screen Bottom Elevation (feet NAVD)**	**Screen Top Elevation (feet NAVD)**	**Screen Interval Elevation (feet NAVD)**	**3/9/2020**	**9/14/2020**	**3/1/2021**	**9/1/2021**	**3/1/2022**	**9/22/2022**	**12/20/2022**	**1/24/2023**	**3/1/2023**	**3/27/2023**	**4/28/2023**	**5/30/2023**	**8/27/2024**	**10/2/2024**	**3/7/2025**	**4/14/2025**	**5/14/2025**	**6/19/2025**	**7/28/2025**	**8/27/2025**	**Average**	**Direction**
Perched Water Table vs Regional Water Table																											
MW-1P	1238.41	1236.4	1125.4	1135.4	1125.4 - 1135.4	29.510	30.420	35.090	38.090	39.570	40.950	40.320	42.090	42.080	41.230	39.790	38.210	42.430	42.260	43.840	43.080	43.550	43.420	43.430	43.610		
MW-1	1238.11	1236.4	1078.5	1088.5	1078.5 - 1088.5	46.900	46.900	46.900	46.900	46.900	46.900	46.900	46.900	46.900	46.900	46.900	46.900	46.900	46.900	46.900	46.900	46.900	46.900	46.900	46.900		
MW-1P/MW-1						0.629	0.649	0.748	0.812	0.844	0.873	0.860	0.897	0.897	0.879	0.848	0.815	0.905	0.901	0.935	0.919	0.929	0.926	0.926	0.930	0.823	**Downward**
MW-1PR	1247.61	1245.0	1119.9	1134.9	1119.9 - 1134.9	32.430	33.190	38.300	40.760	42.420	43.550	43.220	43.440	44.610	43.780	42.590	40.510	44.010	43.870	45.870	46.550	45.910	46.200	45.970	47.880		
MW-1R	1247.25	1244.6	1082.6	1097.6	1082.6 - 1097.6	37.300	37.300	37.300	37.300	37.300	37.300	37.300	37.300	37.300	37.300	37.300	37.300	37.300	37.300	37.300	37.300	37.300	37.300	37.300	37.300		
MW-1PR/MW-1R						0.869	0.890	1.027	1.093	1.137	1.168	1.159	1.165	1.196	1.174	1.142	1.086	1.180	1.176	1.230	1.248	1.231	1.239	1.232	1.284	1.106	**Downward**
MW-2P	1254.88	1252.5	1128.0	1138.0	1128 - 1138	45.710	45.900	48.310	49.810	51.540	52.870	52.620	53.220	53.350	52.640	52.470	50.760	52.100	53.280	55.850	54.100	54.110	54.360	53.940	53.810		
MW-2	1254.35	1252.5	1078.3	1088.3	1078.3 - 1088.3	49.700	49.700	49.700	49.700	49.700	49.700	49.700	49.700	49.700	49.700	49.700	49.700	49.700	49.700	49.700	49.700	49.700	49.700	49.700	49.700		
MW-2P/MW-2						0.920	0.924	0.972	1.002	1.037	1.064	1.059	1.071	1.073	1.059	1.056	1.021	1.048	1.072	1.124	1.089	1.089	1.094	1.085	1.083	1.024	**Downward**
MW-5A	1225.81	1224.0	1122.9	1137.9	1122.9 - 1137.9	51.790	52.040	51.750	51.500	51.580	51.690	53.320	51.760	51.690	51.980	52.080	50.620	52.190	52.390	52.840	54.720	52.680	52.120	52.230	52.670		
MW-5	1225.32	1223.3	1072.6	1082.6	1072.6 - 1082.6	52.800	52.800	52.800	52.800	52.800	52.800	52.800	52.800	52.800	52.800	52.800	52.800	52.800	52.800	52.800	52.800	52.800	52.800	52.800	52.800		
MW-5A/MW-5						0.981	0.986	0.980	0.975	0.977	0.979	1.010	0.980	0.979	0.984	0.986	0.959	0.988	0.992	1.001	1.036	0.998	0.987	0.989	0.998	0.989	**Downward**
MW-18WT	1212.24	1210.1	1123.1	1133.1	1123.1 - 1133.1	--	--	--	--	--	--	--	--	--	--	--	--	25.806	28.216	26.866	26.976	27.406	26.746	27.016	26.886		
MW-18	1212.00	1209.8	1092.8	1102.8	1092.8 - 1102.8	--	--	--	--	--	--	--	--	--	--	--	--	30.300	30.300	30.300	30.300	30.300	30.300	30.300	30.300		
MW-18WT/MW-18						--	--	--	--	--	--	--	--	--	--	--	--	0.852	0.931	0.887	0.890	0.904	0.883	0.892	0.887	0.891	**Downward**
MW-20WT	1176.32	1174.4	1121.4	1131.4	1121.4 - 1131.4	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	13.820	15.420	14.530	12.210		
MW-20	1176.58	1174.3	1095.3	1105.3	1095.3 - 1105.3	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	26.100	26.100	26.100	26.100		
MW-20WT/MW-20						--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.530	0.591	0.557	0.468	0.536	**Downward**
Regional Water Table vs Piezometer																											
MW-1R	1247.25	1244.6	1082.6	1097.6	1082.6 - 1097.6	0.430	0.450	0.380	0.390	0.530	0.440	2.520	1.490	0.460	0.520	1.410	0.600	0.600	1.050	0.370	-0.090	0.350	0.320	0.320	-1.700		
MW-1RZ	1245.45	1244.0	1057.5	1062.5	1057.5 - 1062.5	30.100	30.100	30.100	30.100	30.100	30.100	30.100	30.100	30.100	30.100	30.100	30.100	30.100	30.100	30.100	30.100	30.100	30.100	30.100	30.100		
MW-1R/MW-1RZ						0.014	0.015	0.013	0.013	0.018	0.015	0.084	0.050	0.015	0.017	0.047	0.020	0.020	0.035	0.012	-0.003	0.012	0.011	0.011	-0.056	0.017	**Downward**
MW-14	1249.69	1247.5	1061.4	1076.4	1061.4 - 1076.4	3.560	2.890	2.670	4.570	2.980	1.430	2.430	1.630	1.450	2.140	1.950	4.880	2.760	2.830	1.020	0.830	-1.450	0.440	0.870	5.150		
MW-14Z	1250.22	1247.5	1036.7	1041.7	1036.7 - 1041.7	29.700	29.700	29.700	29.700	29.700	29.700	29.700	29.700	29.700	29.700	29.700	29.700	29.700	29.700	29.700	29.700	29.700	29.700	29.700	29.700		
MW-14/MW-14Z						0.120	0.097	0.090	0.154	0.100	0.048	0.082	0.055	0.049	0.072	0.066	0.164	0.093	0.095	0.034	0.028	-0.049	0.015	0.029	0.173	0.084	**Downward**
MW-16	1186.95	1184.3	1087.3	1092.3	1087.3 - 1092.3	--	--	--	--	--	--	--	--	--	--	--	--	5.587	5.427	6.517	7.037	8.227	7.887	8.077	7.827		
MW-16Z	1186.50	1184.5	1064.5	1069.5	1064.5 - 1069.5	--	--	--	--	--	--	--	--	--	--	--	--	22.757	22.757	22.757	22.757	22.757	22.757	22.757	22.757		
MW-16/MW-16Z						--	--	--	--	--	--	--	--	--	--	--	--	0.246	0.238	0.286	0.309	0.362	0.347	0.355	0.344	0.311	**Downward**
MW-19	1192.82	1190.5	1087.5	1097.5	1087.5 - 1097.5	--	--	--	--	--	--	--	--	--	--	--	--	1.556	-0.814	-1.784	-0.714	-0.444	-0.594	-0.594	-0.644		
MW-19Z	1192.34	1190.2	1060.2	1065.2	1060.2 - 1065.2	--	--	--	--	--	--	--	--	--	--	--	--	29.821	29.821	29.821	29.821	29.821	29.821	29.821	29.821		
MW-19/MW-19Z						--	--	--	--	--	--	--	--	--	--	--	--	0.052	-0.027	-0.060	-0.024	-0.015	-0.020	-0.020	-0.022	-0.017	**Varies**
Upper Piezometer vs Lower Piezometer																											
MW-3	1235.25	1233.0	1053.2	1058.2	1053.2 - 1058.2	6.540	6.690	6.670	5.790	5.390	5.300	5.880	6.180	6.340	6.580	6.940	7.810	4.770	4.490	--	--	--	--	--	--		
MW-6	1235.37	1233.0	1025.7	1030.7	1025.7 - 1030.7	27.500	27.500	27.500	27.500	27.500	27.500	27.500	27.500	27.500	27.500	27.500	27.500	27.500	27.500	--	--	--	--	--	--		
MW-3/MW-6						0.238	0.243	0.243	0.211	0.196	0.193	0.214	0.225	0.231	0.239	0.252	0.284	0.173	0.163	--	--	--	--	--	--	0.225	**Downward**
MW-8R	1258.84	1256.1	1056.3	1071.3	1056.3 - 1071.3	8.100	8.040	7.860	6.480	6.080	5.910	7.240	6.920	5.700	0.810	6.440	9.380	7.760	7.990	5.860	5.650	4.590	4.380	5.720	5.770		
MW-7	1258.03	1255.7	1023.5	1028.5	1023.5 - 1028.5	37.800	37.800	37.800	37.800	37.800	37.800	37.800	37.800	37.800	37.800	37.800	37.800	37.800	37.800	37.800	37.800	37.800	37.800	37.800	37.800		
MW-8R/MW-7						0.214	0.213	0.208	0.171	0.161	0.156	0.192	0.183	0.151	0.021	0.170	0.248	0.205	0.211	0.155	0.149	0.121	0.116	0.151	0.153	0.175	**Downward**
MW-11	1218.56	1216.4	1056.0	1071.0	1056 - 1071	2.760	5.120	3.300	3.160	5.040	3.510	3.130	5.070	6.610	4.930	8.580	5.410	5.390	5.960	5.100	5.510	4.890	5.130	5.060	8.930		
MW-10	1217.52	1215.6	1034.0	1039.0	1034 - 1039	27.000	27.000	27.000	27.000	27.000	27.000	27.000	27.000	27.000	27.000	27.000	27.000	27.000	27.000	27.000	27.000	27.000	27.000	27.000	27.000		
MW-11/MW-10						0.102	0.190	0.122	0.117	0.187	0.130	0.116	0.188	0.245	0.183	0.318	0.200	0.200	0.221	0.189	0.204	0.181	0.190	0.187	0.331	0.187	**Downward**

Notes:

(1) - MW-6 inaccessible for water elevation measurements (dedicated pump in the way)

Table 6
Fracture and Void Summary from Soil Borings
Vernon County Landfill - Proposed Eastern Expansion

Boring	Date	Drilling Method	Evidence of Factures/Voids	Surface Elevation (feet NAVD)	EOB Elevation (feet NAVD)	Boring Depth (feet bgs)	Average Groundwater Elevation (feet NAVD)
Borings within 300-feet of Proposed Expansion							
MW-3	1988	Mud Rotary	Several crevices noted between: 70 and 80 ft bgs (1163 to 1153) Dolomite with crevices noted between: 145 and 150 ft bgs (1088 to 1083)	1233	1053	180	1072.22
MW-4	1988	Mud Rotary	Broken up with small crevices between: 70 and 80 ft bgs (1162.9 to 1152.9) Several crevices noted between: 145 and 150 ft bgs (1087.9 to 1082.9)	1232.9	1072.9	160	~1070 (dry) Well screen interval: 1089.2 to 1079.2
MW-5	1988	Mud Rotary	Broken up with crevices noted at: 43 to 44 ft bgs (1180.3 to 1179.3) 65 to 67 ft bgs (1158.3 to 1156.3) 87 to 88 ft bgs (1136.3 to 1135.3) 93 to 94 ft bgs (1130.3 to 1129.3) 135 to 137 ft bgs (1088.3 to 1086.3) 158 to 160 ft bgs (1065 to 1065.3)	1223.3	1043.3	180	1083.82
MW-6	1989	Mud Rotary	Broken up with crevices noted at: 23 to 25 ft bgs (1210.0 to 1208.0) 28 to 29 ft bgs (1205.0 to 1204.0)	1233.0	1023	210.0	1067.38
MW-10	1990	Mud Rotary (w/ HSA and Coring)	Occasional small vugs noted from: 61 to 71.5 ft bgs (1154.6 to 1144.1) 74 to 100 ft bgs (1141.6 to 1115.6) Numerous small vugs noted from: 134 to 139 ft bgs (1081.6 to 1076.6) Few to no vugs noted from: 139 to 155 (1076.6 to 1060.6)	1215.6	1034.6	181	1086.40
MW-11	1990	Mud Rotary (w/ HSA and Coring)	Occasional small vugs noted from: 61 to 71.5 ft bgs (1155.4 to 1144.9) 74 to 100 ft bgs (1142.4 to 1116.4) Numerous small vugs noted from: 134 to 139 ft bgs (1082.4 to 1077.4) Few to no vugs noted from: 139 to 155 (1077.4 to 1061.4)	1216.4	1053.4	163	1094.71
MW-12	1990	Mud Rotary (w/ HSA and Coring)	Occasional small vugs noted from: 61 to 71.5 ft bgs (1155.4 to 1144.9) 74 to 103 ft bgs (1142.4 to 1113.4)	1216.4	1112.9	103.5	1131.50

Table 6
Fracture and Void Summary from Soil Borings
Vernon County Landfill - Proposed Eastern Expansion

Boring	Date	Drilling Method	Evidence of Factures/Voids	Surface Elevation (feet NAVD)	EOB Elevation (feet NAVD)	Boring Depth (feet bgs)	Average Groundwater Elevation (feet NAVD)
Borings within 300-feet of Proposed Expansion ***(CONTINUED)***							
MW-14WT	2022	Mud Rotary (w/ HSA and Coring)	Occasional small vugs noted from: 37 to 44.5 (1210.2 to 1202.7) 52.5 to 60.5 (1194.7 to 1186.7) Void noted from: 37 to 39 ft bgs (1210.2 to 1208.2) 48 to 49 ft bgs (1199.2 to 1198.2)	1247.2	1138.2	109	1076.87
MW-14Z	2003	Sonic	Occasional small vugs noted from: 100 to 126 ft bgs (1147.5 to 1121.5) Highly fractured zones noted from: 110 to 111 ft bgs (1137.5 to 1136.5) 118 to 120 ft bgs (1129.5 to 1127.5) Occasional small vugs noted from: 140 to 178 ft bgs (1107.5 to 1069.5) Highly fractured zones noted from: 142 to 143 ft bgs (1105.5 to 1104.5) 154 to 156 ft bgs (1093.5 to 1091.5) 158 to 159 ft bgs (1089.5 to 1088.5) 175 to 177 ft bgs (1072.5 to 1070.5) 183 to 186 ft bgs (1064.5 to 1061.5) 191 to 195 ft bgs (1056.5 to 1052.5) 198 to 199 ft bgs (1049.5 to 1048.5)	1247.5	1037.5	210	1074.33
MW-15WT	2022	Mud Rotary (w/ HSA)	Borehole lost mud from 75 ft bgs to EOB, no voids or rod drops noted.	1220.6	1121.6	99	~1135 (dry) Well screen interval: 1145.6 to 1135.6
MW-16	2022	Mud Rotary (w/ HSA)	Borehole lost mud starting at 60 ft bgs to EOB, no voids or rod drops noted.	1184.3	1086.3	98	1102.32
MW-16Z	2024	Sonic	Minor vugs noted from: 80 to 85 ft bgs (1104.5 to 1099.5) Drop in rods noted from: 98 to 100 ft bgs (1086.5 to 1084.5) *likely due to transition from competent to weathered dolostone in the residuum	1184.5	1064.5	120	1094.16
B-22	2024	Sonic	Sporadic vugs noted from: 55 to 105 ft bgs (1170.6 to 1120.6)	1225.6	1120.6	105	1121.60

Table 6
Fracture and Void Summary from Soil Borings
Vernon County Landfill - Proposed Eastern Expansion

Boring	Date	Drilling Method	Evidence of Factures/Voids	Surface Elevation (feet NAVD)	EOB Elevation (feet NAVD)	Boring Depth (feet bgs)	Average Groundwater Elevation (feet NAVD)
Borings outside 300-feet of Proposed Expansion							
MW-1PR	1994	Air Rotary	Void/fracture, no rod drop at: 76 ft bgs, 6-10in in width (1169)	1245	1119	126	1134.55
MW-1	1988	Mud Rotary	Crevices noted at: 145 to 148 ft bgs (1091.4 to 1088.4)	1236.4	1036.4	200	1093.86
MW-1R	1994	Air Rotary	Void/fracture w/ rod drop noted at: 94 ft bgs (1151) Void/fracture, no rod drop noted at: 112 ft bgs (1133) Fracture noted from: 162 to 164 ft bgs (1083 to 1081)	1245	1079	166	1093.77
MW-1RZ	2003	Sonic	Occasional small vugs noted from: 98 to 123 ft bgs (1146.0 to 1121.0) 138 to 162 ft bgs (1106.0 to 1082.0)	1244.0	1059.0	185.0	1093.26
MW-2	1989	Mud Rotary	Broken up with crevices between: 95 and 96 ft bgs (1157.5 to 1156.5)	1252.5	1062.5	190	1089.01
MW-7	1990	Mud Rotary (w/ HSA and Coring)	Occasional small vugs noted from: 44 to 58 ft bgs (1211.7 to 1197.7) Occasional large vugs noted from: 58 to 72 ft bgs (1197.7 to 1183.7) Occasional small vugs noted from: 72 to 130 ft bgs (1183.7 to 1125.7) Few to no vugs noted from: 130 to 148 ft bgs (1125.7 to 1107.7) Few small vugs noted from: 148 to 153 ft bgs (1107.7 to 1102.7) 155 to 169 ft bgs (1100.7 to 1086.7) Few to no vugs noted from: 169 to 186.5 ft bgs (1086.7 to 1069.2) 193 to 206 ft bgs (1062.7 to 1049.7)	1255.7	1046.7	209	1072.41
MW-8R	?	Mud Rotary	*Same as MW-7*	1256.1	1049.1	207	1079.09
MW-9	1989	Mud Rotary (w/ HSA and Coring)	*Same as MW-7*	1255.4	1123.9	131.5	1140.28
MW-13P	2003	Sonic	Occasional small vugs noted from: 75 to 81 ft bgs (1149.5 to 1143.5) Highly fractured zones noted from: 76-77 ft bgs (1142.5 to 1141.5) Occasional small vugs noted from: 81 to 100 ft bgs (1143.5 to 1124.5)	1224.5	1124.5	100	1133.82