



# Hydrologic Monitoring System Plan (HMSP)

John Deere Dubuque Works Landfill  
Dubuque, Iowa

April 2024

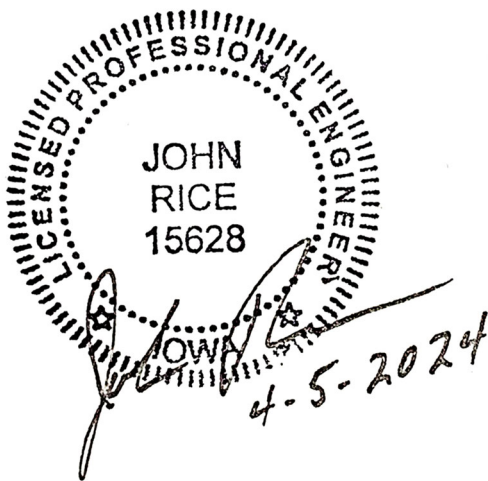
**Permit No. 31-SDP-01-75C**

**Prepared For:**

John Deere Dubuque Works  
Dubuque, Iowa

**Prepared By:**

TRC  
999 Fourier Dr., Suite 101  
Madison, Wisconsin 53717



John M. Rice, P.E. #15628  
Senior Hydrologist

Lydia Auner  
Project Geologist

Erica Lawson  
Project Manager

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## 1.0 Introduction

### 1.1 Background

The John Deere Dubuque Works (JDDW) industrial waste landfill covers approximately 12 acres and is located in the North  $\frac{1}{2}$  of the Southwest  $\frac{1}{4}$  of Section 27, Township 90 North, Range 2 East in Dubuque County, Iowa (Figure 1). The facility began operations in 1974 and is owned and operated by JDDW. The landfill was developed in two phases, which are identified as Stage 1 and Stage 2. The landfill waste stream consisted primarily of powerhouse ash generated by JDDW. The landfill is permanently closed and no longer receives waste, with the final cover construction completed in 2012.

A Hydrologic Monitoring System Plan (HMSP) for the landfill was originally developed by James M. Montgomery Consulting Engineers, Inc. in June 1990. The HMSP was approved by the Iowa Department of Natural Resources (IDNR) on August 14, 2009 and was later modified for landfill closure by permit #31-SDR-01-75C, dated May 24, 2012.

Changes over time have resulted in the need to update the HMSP. In 2018, the HMSP was updated to reflect modifications to the sampling parameter list and to specify low-flow sampling as the preferred sampling method for this site. This 2024 update to the HMSP was prepared to incorporate changes including:

- additional sampling parameters in the groundwater monitoring program as required in the Closure Permit amendment dated August 17, 2023;
- a change in the deadline for the Annual Water Quality Report (AWQR) from November 30 to January 31, as granted in the variance approved December 20, 2021 (Appendix A);
- the semiannual evaluation of well recharge rates in lieu of in-situ permeability testing, as granted in the variance approved December 20, 2021 (Appendix A);
- the addition of analysis for measured turbidity, as requested by the IDNR upon review of the 2020 AWQR in a letter dated March 22, 2021 (Appendix A);
- updates to procedures for groundwater monitoring and the evaluation of groundwater results.

### 1.2 Purpose and Scope

The purpose of the hydrologic monitoring system is to enable early detection of the potential release of contaminants of concern from the closed landfill. This HMSP is based on the requirements outlined in 567 Iowa Administrative Code (IAC) 115.20, 115.21, and 115.26(3) through (8), except where those requirements have been modified by the Closure Permit. Surface water sampling is not required for the landfill under the Permit #31-SDP-01-75C.

## 2.0 Monitoring Well Network

### 2.1 Description

The groundwater monitoring system at this facility consists of one upgradient groundwater monitoring well (MW-1), and two downgradient wells (MW-2 and MW-3). The locations of the monitoring wells are shown on Figure 2. Each groundwater monitoring well is labeled with a permanent and unique identification that will be used in reporting well information.

A summary of the groundwater monitoring well construction can be found in Table 1, which has been updated based on the Fall 2023 resurvey of the monitoring wells. A figure showing the updated top of casing and ground surface elevations from the Fall 2023 survey is included in Appendix B. The total depths of the wells were assumed to be the same after the survey as they were before the survey. Refer to the 2023 AWQR for additional discussion regarding top of casing elevations and well construction information.

### 2.2 Monitoring Well Maintenance and Performance Reevaluation

Groundwater wells will be maintained by JDDW. JDDW will keep the monitoring wells securely capped and locked when not in use, repair cracks and maintain the ground surface surrounding well protective casings, control vegetation height around the wells, and redevelop the wells as needed.

Monitoring well maintenance and performance is evaluated consistent with 567 IAC 115.21(2) except where modified by Closure Permit, Section X, Paragraph 4[m] (IDNR, 2023). This evaluation is intended to confirm that the site monitoring wells are adequately functioning and can provide data useable in assessing the groundwater flow and groundwater quality near the site. The monitoring well maintenance and performance reevaluation plan includes the following:

- Monthly water level measurements<sup>1</sup>
- Biennial examination of high and low water levels and hydrologic setting
- Annual measurement of well depths
- Annual evaluation of recharge rates (i.e., low flow purge rates during groundwater sampling)

This data will be used to determine if there are changes in the hydrologic setting or flow path; confirm that wells are intact and not filling with sediment; and confirm that the wells are functioning as originally constructed.

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<sup>1</sup> Monthly water level measurements are not specified in the requirements for monitoring well maintenance and performance reevaluation in 567 IAC 115.21(2), but are required by 567 IAC 115.26(4)b and Closure Permit, Section X, Paragraph 4[j].

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If for any reason a groundwater monitoring well is destroyed or otherwise fails to properly function, the IDNR will be notified. Necessary repairs will be completed as soon as possible upon discovery. If repair is not possible, the well will be properly abandoned and replaced, unless JDDW is notified otherwise in writing by the IDNR. Well abandonment will be consistent with 567 IAC 115.24 and documented with form 542-0699. Well replacement will be consistent with 567 IAC 115.23 and documented using form 542-1277. Documentation of monitoring well abandonment and replacement will be submitted to the IDNR.

### **3.0 Groundwater Sampling Program**

Groundwater sampling is completed semiannually in April and October of each calendar year.

#### **3.1 Sampling Protocol**

Groundwater samples will be collected from the monitoring wells in the following order: MW-1, MW-2, and MW-3. Each well will be sampled using low-flow sampling techniques. A field duplicate and an equipment blank will be collected during each sampling event for quality assurance and quality control. Groundwater sampling procedures are included in Appendix C.

#### **3.2 Sampling Parameters**

The current groundwater sampling program for the landfill is summarized in Table 2. This table also includes analytical methods, sample preservation, and hold times. The samples will not be filtered.

#### **3.3 Laboratory Procedures**

All analyses will be completed using laboratories certified by the state of Iowa for each analytical procedure. Currently, JDDW uses Eurofins of Cedar Falls, Iowa; however, JDDW may select alternate Iowa-certified laboratories as needs and conditions require. A copy of Eurofins' Quality Assurance Manual is available and can be provided upon request.

Laboratory analyses will be performed according to methods specified in SW-846 or approved by the United States Environmental Protection Agency. Laboratory results will be documented in reports that show the precision of the data set, bias, and limit of detection.

#### **3.4 Sampling Records**

As required by 567 IAC 115.26(8)a, the sampling procedures, measurements, and observations will be recorded at the time of sampling in such a manner that is sufficient to document whether the procedures and requirements specified in the sampling protocol have been followed. The sampling records must include the name(s) of the persons conducting the sampling, the time and date each monitoring point was sampled, and the required field measurements or test results. Field records for groundwater sampling will include the IDNR groundwater sampling forms (542-1322), which may be modified for the project. Example groundwater sampling forms are provided in Appendix C.

## 4.0 Reporting

### 4.1 Exceedance Notification

Because background levels are calculated using different statistical methods than specified in the Closure Permit and because the downgradient groundwater monitoring results are generally consistent, if sample results from the downgradient wells (MW-2 or MW-3) exceed established groundwater protection standards, JDDW will notify the IDNR within 30 days of receipt of analytical results.

### 4.2 Annual Water Quality Report

JDDW will submit an AWQR to the IDNR by January 31<sup>st</sup> of each year. The AWQR will be prepared consistent with 567 IAC 115.26(8)d for the evaluation of groundwater quality, except as modified by the revised Closure Permit. Although not specified in the revised Closure Permit, the statistical methods for the evaluation of groundwater monitoring results have been updated as of the 2021 AWQR, as requested by the IDNR in their response to the 2020 AWQR, and the control limit calculations specified in IAC and the Closure Permit are no longer used. Refer to the 2023 AWQR for the most recent information on the statistical methods used for establishing background levels and evaluating groundwater results. The AWQR will also include the Leachate Control System Performance Evaluation (LCSPE), as required by the Closure Permit, Section X, Paragraph 5[d]. The AWQR may also document inspection of the facility conditions.

The AWQR may include the following:

- Field inspection and sampling forms
- Monitoring well network evaluation
  - Summary of groundwater level measurements
  - Monitoring well depth and recharge rates
  - Narrative on maintenance needed or completed on the monitoring network
- Laboratory analytical reports
- Groundwater quality assessment
  - Data summary tables for groundwater quality measurements
  - Background levels for sampling parameters with sufficient data to establish background
  - Graphs for each well that show concentration vs. time and background levels, if established
  - Narrative on effects to water quality
- Leachate collection system performance evaluation
  - Data summary tables for leachate measurements and leachate quality measurements
  - Summary of leachate discharged
  - Narrative on the operation, and any repairs needed or completed on the leachate collection system.

**Table 1: Summary of Monitoring Well Construction**  
**John Deere Dubuque Works Landfill**  
**Permit No. 31-SDP-01-75C**  
**Dubuque, Iowa**

| <b>Well ID</b> | <b>Ground Surface Elevation (ft MSL)</b> | <b>Top of Casing Elevation (ft MSL)</b> | <b>Well Depth (ft btoc)</b> | <b>Top of Screen Depth (ft btoc)</b> | <b>Bottom of Screen Depth (ft btoc)</b> | <b>Screen Length (ft)</b> | <b>Screen Midpoint Depth (ft btoc)</b> |
|----------------|--|---|-----------------------------|--------------------------------------|---|---------------------------|--|
| MW-1           | 840.33                                   | 842.05                                  | 198.78                      | 168.78                               | 198.78                                  | 30                        | 183.78                                 |
| MW-2           | 846.71                                   | 848.49                                  | 196.72                      | 166.72                               | 196.72                                  | 30                        | 181.72                                 |
| MW-3           | 772.26                                   | 774.06                                  | 127.06                      | 97.06                                | 127.06                                  | 30                        | 112.06                                 |

Notes:

1. Top of casing elevations were resurveyed 9/26/2023.
2. Ground surface elevations were resurveyed 10/30/2023.
3. Total Well depths assumed to be same as prior to 2023 resurvey.

Prepared by: L. Auner, 1/30/2023

Checked by: E. Lawson, 2/28/2024



**Table 2: Groundwater Sampling Program**  
**John Deere Dubuque Works Landfill**  
**Permit No. 31-SDP-01-75C**  
**Dubuque, Iowa**

| Parameter  | Method                           | Hold Time | Container Type and Preservative                                     | Temperature |
|--|----------------------------------|-----------|---|-------------|
| <b>Monthly</b>                                   |                                  |           |   |             |
| Groundwater elevation                            | --                               | --        | --  | --          |
| <b>Semi-Annually (April and October)</b>         |                                  |           |   |             |
| pH   | Field Measurement or Observation | --        | --  | --          |
| Conductivity                                     |                                  |           |   |             |
| Temperature                                      |                                  |           |   |             |
| Color  |                                  |           |   |             |
| Odor   |                                  |           |   |             |
| Turbidity (measured) <sup>(1)</sup>              |                                  |           |   |             |
| Turbidity (visual)                               | SW846 6010D                      | 6 months  | 250 mL plastic, nitric acid (HNO <sub>3</sub> )                     | --          |
| Barium (total) <sup>(2)</sup>                    |                                  |           |   |             |
| Boron (total) <sup>(3)</sup>                     |                                  |           |   |             |
| Calcium (total) <sup>(3)</sup>                   |                                  |           |   |             |
| Iron (total) <sup>(2)</sup>                      |                                  |           |   |             |
| Lithium (total) <sup>(3)</sup>                   |                                  |           |   |             |
| Magnesium (total) <sup>(2)</sup>                 |                                  |           |   |             |
| Molybdenum (total) <sup>(3)</sup>                | SM 2540C                         | 7 days    | 1 L plastic, unpreserved  | ≤6°C        |
| Chemical Oxygen Demand                           | SM 5220D LL                      | 28 days   | 250 mL plastic, sulfuric acid (H <sub>2</sub> SO <sub>4</sub> )     | ≤6°C        |
| Ammonia, as Nitrogen                             | EPA 350.1                        | 28 days   |   | ≤6°C        |
| Chloride   | SW846 9056A                      | 28 days   | 250 mL plastic, unpreserved   | ≤6°C        |
| Fluoride   |                                  |           |   |             |
| Sulfate  |                                  |           |   |             |
| Nitrates, as Nitrogen                            |                                  | 48 hours  |   |             |
| <b>Annually (October)</b>                        |                                  |           |   |             |
| Total phenols                                    | EPA 9066                         | 28 days   | 500 mL amber glass, sulfuric acid (H <sub>2</sub> SO <sub>4</sub> ) | ≤6°C        |
| <b>Every 5 Years (2023, 2028, etc.)</b>          |                                  |           |   |             |
| Volatile Organic Compounds (VOCs) <sup>(4)</sup> | EPA 8260D                        | 14 days   | 3 x 40 mL glass vials, hydrochloric acid (HCl)                      | <6°C        |

Notes:

-- = Not applicable

Alternate lab methods and bottle types may be selected if determined appropriate for project requirements.

Footnotes:

<sup>(1)</sup> Analysis for measured turbidity was requested by the IDNR in their review of the 2020 Annual Water Quality Report dated March 22, 2021.

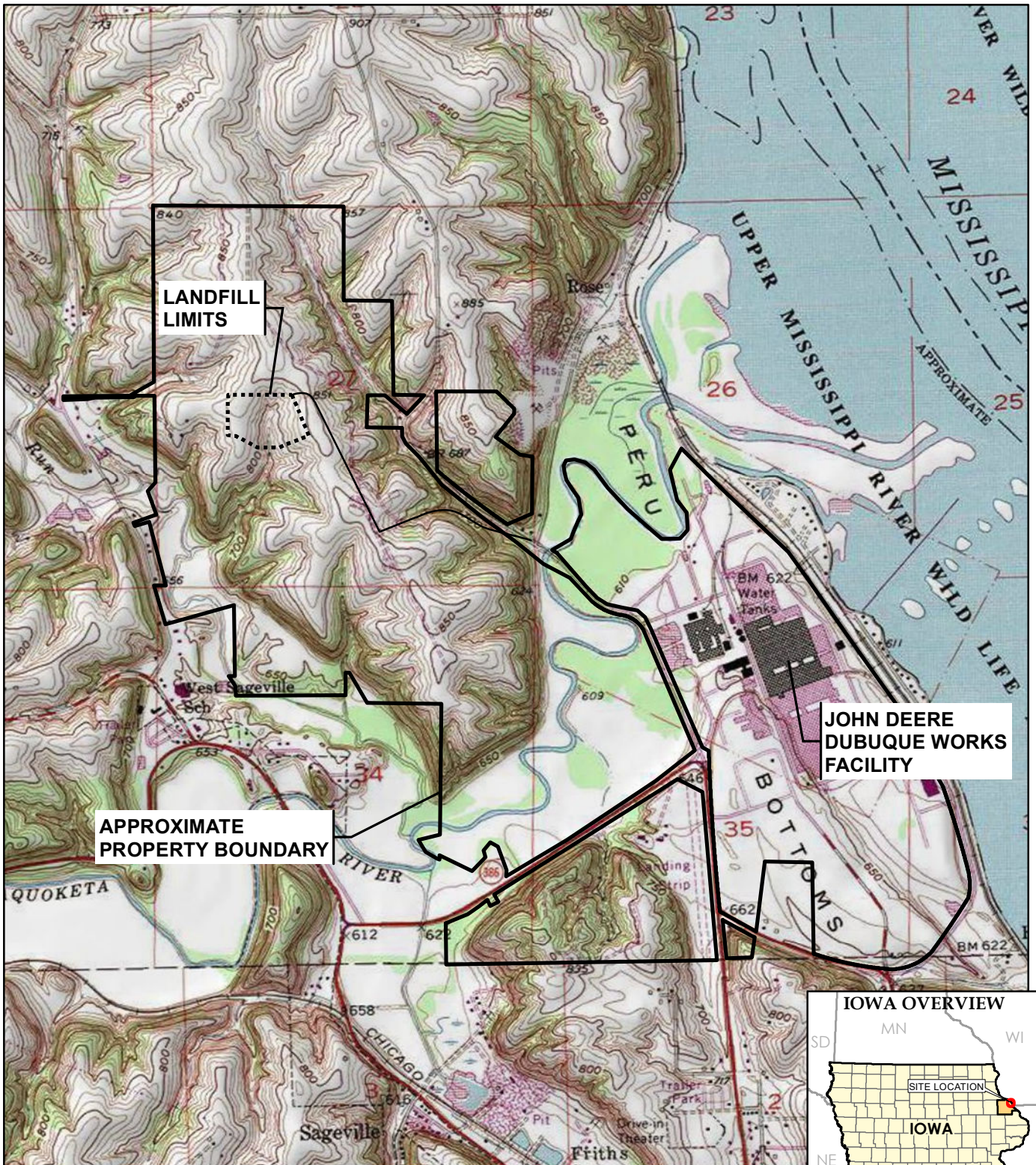
<sup>(2)</sup> Analysis for dissolved (filtered) metals was replaced with analysis for total (unfiltered) metals in May 2018.

<sup>(3)</sup> Parameter added starting in Fall 2023 based on the revised Closure Permit (IDNR, 2023).

<sup>(4)</sup> Annual sampling for total organic halogens (TOX) was previously completed at the site. In May 2018, IDNR approved removing TOX from the sampling program and replacing with analysis for volatile organic compounds (VOCs) every 5 years.

Prepared by: L. Auner, 2/12/2024

Checked by: E. Lawson, 2/28/2024



BASE MAP FROM USGS 7.5 MINUTE TOPOGRAPHIC QUADRANGLE SERIES.



999 Fourier Drive  
 Suite 101  
 Madison, WI 53717  
 Phone: 608.826.3663

**JOHN DEERE DUBUQUE WORKS  
 DUBUQUE, IOWA**











**SITE LOCATION MAP**

|              |                   |
|--------------|-------------------|
| DRAWN BY:    | A. FOJTIK         |
| APPROVED BY: | E. LAWSON         |
| PROJECT NO:  | 577511            |
| FILE NO.     | 577511-001slm.mxd |
| DATE:        | APRIL 2024        |

FIGURE 1

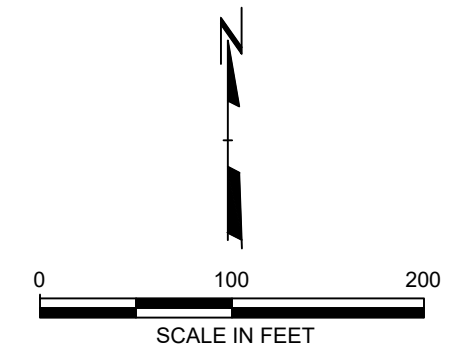
11x17 -- USER: E.Alexander -- ATTACHED XREFS: basecamp -- ATTACHED IMAGES: DRAWING NAME: M:\John DeereDubuque\5775110000\5775110000.03.dwg -- PLOT DATE: March 08, 2024 - 9:51AM -- LAYOUT: PSM OCT23  
Version: 2017-10-21


**LEGEND**

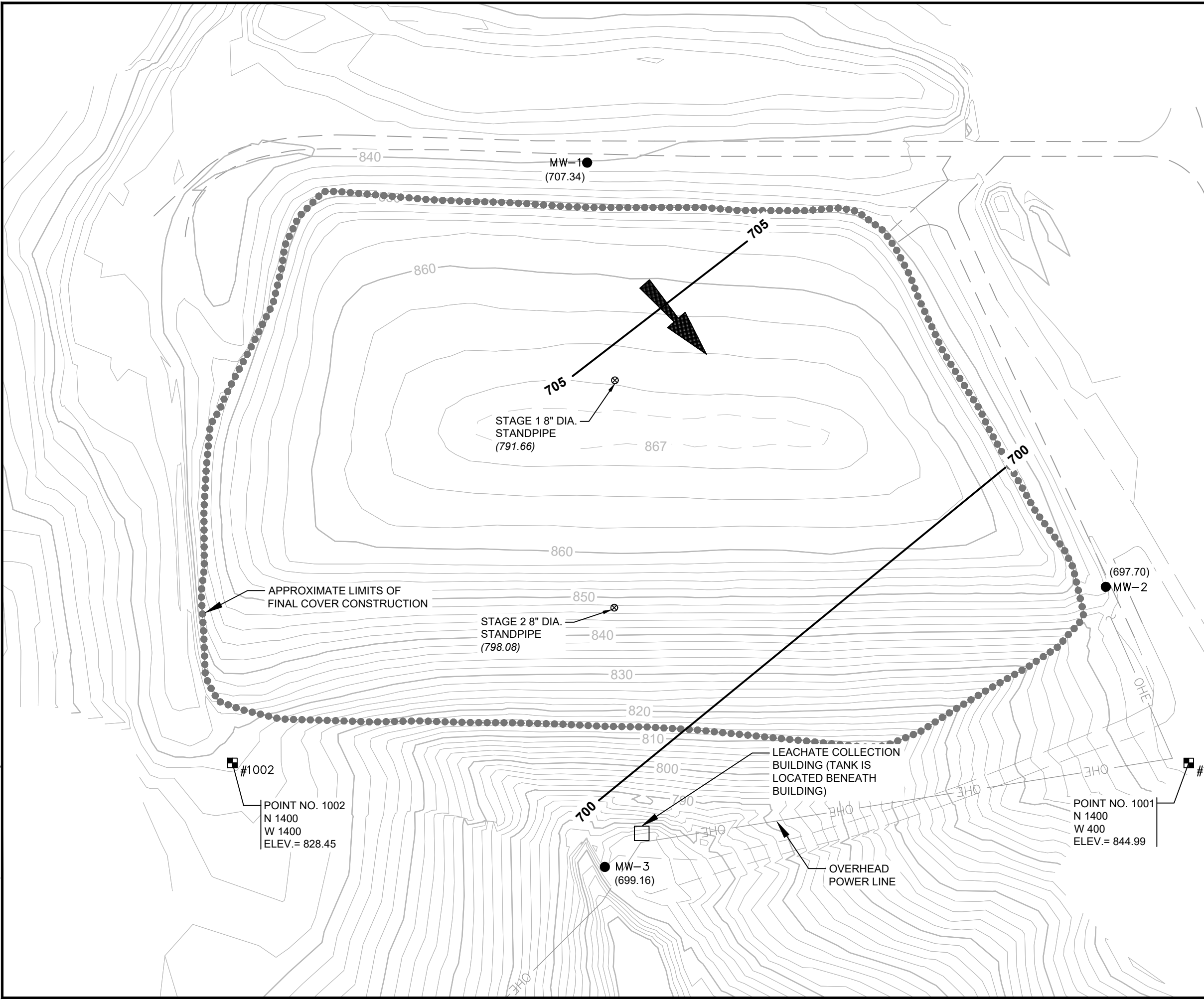
-  EXISTING PAVED ROAD
-  EXISTING UNPAVED ROAD
-  840 EXISTING 10' CONTOUR
-  EXISTING 2' CONTOUR
-  LIMITS OF FINAL COVER CONSTRUCTION
-  #1002 EXISTING SURVEY CONTROL MONUMENT
-  MW-3 (703.30) EXISTING MONITORING WELL LOCATION AND WATER ELEVATION
-  (793.17) LEACHATE STANDPIPE AND ELEVATION OF SATURATED WASTE
-  GROUNDWATER FLOW DIRECTION
-  705 GROUNDWATER CONTOUR (5' INTERVAL)

**NOTES**

1. BASE MAP DEVELOPED FROM PLAN SHEET PROVIDED BY JOHN DEERE DUBUQUE WORKS. INFORMATION TO DEFINE THE PROJECT GRID SYSTEM AND DATE OF SURVEY WAS NOT AVAILABLE.
2. WELL LOCATIONS ARE APPROXIMATE.
3. GROUNDWATER ELEVATIONS MEASURED BY TRC ON OCTOBER 24, 2023.
4. ELEVATIONS OF SATURATED WASTE MEASURED BY ORIGIN DESIGN ON OCTOBER 21, 2023.



|   |                    |  |             |
|---|--------------------|--|-------------|
| PROJECT:  |                    | <b>JOHN DEERE DUBUQUE WORKS LANDFILL<br/>DUBUQUE, IOWA</b>                 |             |
| TITLE:  |                    | <b>SITE LAYOUT AND<br/>POTENTIOMETRIC SURFACE MAP<br/>(OCTOBER 2023)</b>   |             |
| DRAWN BY:   | E. ALEXANDER       | PROJ NO.:  | 577511.0000 |
| CHECKED BY:   | L. AUNER           | <b>FIGURE 2</b>  |             |
| APPROVED BY:  | E. LAWSON          |  |             |
| DATE:   | APRIL 2024         |  |             |
|  |                    | 999 Fourier Drive<br>Suite 101<br>Madison, WI 53717<br>Phone: 608.826.3600 |             |
| FILE NO.:   | 577511.0000.03.dwg |  |             |



## **Appendix A: Variance Approvals and Correspondence**



March 22, 2021

Scott Hemesath  
John Deere Dubuque Works  
18600 South John Deere Road  
Dubuque, IA 52001

Re: John Deere Dubuque Works Industrial Waste Landfill  
2020 Annual Water Quality Report (AWQR)  
Permit #31-SDP-01-75C

Dear Mr. Hemesath:

The Iowa Department of Natural Resources (IDNR) has reviewed the *2020 Annual Water Quality Report* (AWQR), dated November 24, 2020, as prepared and submitted on your behalf by TRC Environmental Corporation (TRC).

Based on our review of the submittal, the IDNR has the following comments:

**Groundwater Quality**

1. The permit holder shall continue to conduct semiannual water quality analysis at all currently approved monitoring points as defined in the Special Provisions of the closure permit and/or any subsequent amendments.
2. In addition to the routine semiannual sampling parameters, the permit holder shall continue to conduct supplemental semiannual sampling and analysis at all monitoring points for fluorides, nitrates, barium, and magnesium, color, odor, turbidity; and every five years for volatile organic compounds (VOCs).
3. The 2020 reports states that the results of the semi-annual monitoring and inspection indicate that the landfill monitoring network continues to provide usable data and that the landfill is not having a significant impact on groundwater or surface water quality. And, that starting in April 2020, sampling for dissolved-phase metals was discontinued, and the groundwater samples were only tested for total metals (barium, iron, and magnesium). The results for total metals concentrations from MW-2 and MW-3 are now compared to the upper control limits (UCLs) calculated using the total metals beginning in October 2017.

The IDNR acknowledges that sampling and analysis for dissolved metals has been discontinued.

With regard to calculating control limits by using the mean plus/minus two standard deviations; the IDNR previously recommended that the permit holder implement more aggressive statistics to evaluate whether there are actual groundwater contamination issues.

Therefore, now that enough data has been collected the permit holder should move forward with using more aggressive statistics.

Please see the “Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities- Unified Guidance”, as published by EPA; or you can review the municipal solid waste chapter under IAC 567—113.10(455B) “Environmental Monitoring and Corrective Action Requirements for Groundwater and Surface Water”, for statistical method examples.

4. The 2020 AWQR shows that magnesium exceeded the calculated upper control limit during both sampling events at monitoring wells MW-2 and MW-3.

The calculated mean plus two standard deviations may be useful for comparison of sample results to background; however, it may not prove valid in determining whether there is a statistically significant increase (SSI) over background concentrations. Thus, the recommendation for more aggressive statistical analyses as described in item #3 above.

In addition, please evaluate turbidity in the site monitoring wells and the effect it may have on metals that exceed background values. It appears that low flow sampling has been implemented, however, turbidity is only visually screened and not actually measured. Please provide actual measured values for turbidity in future reports.

5. The 2020 AWQR states that the equipment blank was mistakenly not collected during the April 2020 sampling event. Please ensure that the proper quality control measures are followed while implementing sampling and analysis of groundwater quality.

### **Leachate Control System**

1. The 2020 AWQR continues to report high leachate head measurements above the liners in both Stages 1 and 2.

Please clarify the Leachate Collection Evaluation graphs and explain why the liner elevation on the graphs starts above the total monthly precipitation base values. Furthermore, explain what effect the precipitation has on the leachate head, if any.

2. The 2020 AWQR states that based upon the results of past studies and the monthly system monitoring, the leachate collection system meets the requirements in the facility closure permit and 567 IAC 115.26 (12)(b)(2). Additionally, it says that jetting the leachate wells and lines is recommended in the 2021 reporting period to clean out any solids that may have accumulated in the leachate head wells and may be restricting flow and creating artificially high heads.

The IDNR acknowledges this proposal. Please provide the results of the jetting in the 2021 AWQR.

3. The permit holder shall continue to maintain and operate the leachate control system in accordance with the closure permit to sufficiently collect leachate and maintain the lowest possible leachate head in the fill area.

**Final Cover**

The permit holder shall continue to ensure that the integrity and effectiveness of the final cover is maintained in accordance with the closure permit.

If you have any questions, you may contact me at (515) 537-4051.

Sincerely,



Nina M. Booker  
Environmental Engineer Senior  
Land Quality Bureau

cc: DNR Field Office #1

John M. Rice, P.E.  
TRC  
708 Heartland Trail  
Suite 3000  
Madison, WI 53717



December 20, 2021

MARK DICKSON, GENERAL MANAGER  
JOHN DEERE DUBUQUE WORKS  
18600 SOUTH JOHN DEERE ROAD  
DUBUQUE, IA 52001

Re: John Deere Dubuque Works Industrial Waste Landfill  
Variance Request  
Permit #31-SDP-01-75C

Dear Mr. Dickson:

This letter is to inform you that the requested variance to 567 Iowa Administrative Code 115.26(8)"d"; relative to allowing the permit holder to submit the Annual Water Quality Report on January 31 rather than on November 30 each year; is approved.

This variance was granted based on the *Request for Variance and Amendment #4*, dated November 3, 2021, from TRC.

This variance is applicable as long as the justification for the request remains the same. The approval of this variance will be amended into the permit for the referenced facility.

If you have any questions, you may contact me at (515) 537-4051.

Sincerely,

Nina M. Booker  
Environmental Engineer Senior  
Land Quality Bureau

cc: DNR Field Office #1

TRC  
708 Heartland Trail  
Suite 3000  
Madison, WI 53717



Daniel Mai  
John Deere Dubuque Works  
18600 South John Deere Road  
Dubuque, IA 52001



December 20, 2021

MARK DICKSON, GENERAL MANAGER  
JOHN DEERE DUBUQUE WORKS  
18600 SOUTH JOHN DEERE ROAD  
DUBUQUE, IA 52001

Re: John Deere Dubuque Works Industrial Waste Landfill  
Variance Request  
Permit #31-SDP-01-75C

Dear Mr. Dickson:

This letter is to inform you that the requested variance to 567 IAC Chapter 115.21(2)"d", relative to the requirement to "Every five years conduct in-situ permeability tests on monitoring wells to compare test data with those collected originally to determine if well deterioration is occurring", is approved.

The permit holder requests that semiannual evaluations of well recharge rates be performed to determine if well deterioration is occurring, in lieu of in-situ permeability testing, as described in 567 IAC 115.21(2) "d".

This variance was granted based on the *Request for Variance and Amendment #4*, dated November 3, 2021, from TRC.

This variance is applicable as long as the justification for the request remains the same. The approval of this variance will be amended into the permit for the referenced facility.

If you have any questions, you may contact me at (515) 537-4051.

Sincerely,

Nina M. Booker  
Environmental Engineer Senior  
Land Quality Bureau

cc: DNR Field Office #1

TRC  
708 Heartland Trail  
Suite 3000  
Madison, WI 53717

Daniel Mai  
John Deere Dubuque Works  
18600 South John Deere Road  
Dubuque, IA 52001

## Appendix B: Survey Map

**M**  
MONITORING WELL 1  
T.O.C. = 842.05'  
GROUND SURFACE = 840.33'

**M**  
STAGE 1 STANDPIPE  
T.O.C. = 869.32'  
GROUND SURFACE = 865.43'

**M**  
STAGE 2 STANDPIPE  
T.O.C. = 850.76'  
GROUND SURFACE = 846.83'

**M**  
MONITORING WELL 2  
T.O.C. = 848.49'  
GROUND SURFACE = 846.71'

828.45  
CONTROL PT 1002

844.99  
CONTROL PT 1001

844.40  
ORIGIN CONTROL PT 7

**M**  
MONITORING WELL 3  
T.O.C. = 774.06'  
GROUND SURFACE = 772.26'



HORIZONTAL SCALE IN FEET



DRAWING MAY HAVE BEEN REDUCED

**origin**  
design®

800 556-4491 [origindesign.com](http://origindesign.com)

NOTES:

1. SURVEY PERFORMED ON 9/26/23
  2. GROUND SURFACES SURVEYED 10/30/23
- T.O.C = TOP OF PVC CASING

|   |         |           |         |
|---|---------|-----------|---------|
| DRAWN                                     | SAF     | PLAT NO.  | #       |
| CHECKED                                   | CLG     | PROJ. NO. | 2301929 |
| DATE                                      | 1-08-24 | SHEET     | 1 of 1  |
| P:\23\019\01929\DRAWINGS\SURVEY\2301929 - |         |           |         |
| MONITORING WELLS=LANDFILL                 |         |           |         |

## **Appendix C: Groundwater Sampling Procedures**

**Groundwater Sampling Procedures**  
**John Deere Dubuque Works Landfill – Dubuque, Iowa**  
**Permit No. 31-SDP-01-75C**

Wells will be sampled using low-flow sampling techniques in the following order: MW-1, MW-2, and MW-3.

1. Calibrate water quality meter and check turbidimeter calibration (or calibrate if required by meter-specific requirements).
2. Gauge water level to 0.01 ft using an electronic water level indicator.
3. Measure depth to bottom of the well using an appropriate measuring device, such as a measuring tape with a weight attached. If measuring depth to bottom generates turbidity, wait to do so until after sampling. Make sure to include the tape correction factor, if applicable, when recording depth to bottom measurements.
4. Set portable bladder pump at depth corresponding to the middle of each well screen (see table below). Use dedicated tubing (if available) or new tubing. Dedicated tubing is stored in labeled bags between each sampling event. Each set of tubing is marked for the middle of the well screen for the dedicated well. Attach a string and tubing to bladder pump. Slowly lower the pump down the well. Be careful to generate as little turbidity as possible.

| <b>Location</b> | <b>Well Depth (ft btoc)</b> | <b>Top of Screen (ft btoc)</b> | <b>Bottom of Screen (ft btoc)</b> | <b>Screen Length (ft)</b> | <b>Screen Midpoint (ft btoc)</b> |
|-----------------|-----------------------------|--------------------------------|-----------------------------------|---------------------------|----------------------------------|
| MW-1            | 198.78                      | 168.78                         | 198.78                            | 30                        | 183.78                           |
| MW-2            | 196.72                      | 166.72                         | 196.72                            | 30                        | 181.72                           |
| MW-3            | 127.06                      | 97.06                          | 127.06                            | 30                        | 112.06                           |

5. Slowly lower water level indicator to take water level readings during pumping.
6. Begin pumping at a low purge rate (typically 100-500 ml/min). Aim to minimize drawdown.
7. Connect tubing to the flow through cell for the water quality meter. Record pH, conductivity, oxidation reduction potential (ORP), dissolved oxygen (DO), temperature, turbidity, and depth to water (ft btoc) every 5 minutes.
8. Continue recording until stabilization parameters and water level have stabilized. Stability is achieved when three consecutive readings are within the following ranges, based on the USEPA Guidance (2021)<sup>1</sup>:
  - pH:  $\pm 0.1$  SU
  - Conductivity: 3%
  - Turbidity: within 10%, or <10 NTU
  - DO (optional): 10% or 0.2 mg/L, whichever is greater
  - ORP (optional):  $\pm 10$  millivolts

<sup>1</sup> USEPA Region 5. 2021. *Groundwater Sampling Procedures*. May 13, 2021.

9. Remove flow through cell after parameters have stabilized and collect groundwater sample for laboratory analysis in sample containers provided by the laboratory.
  - See Table 2 for sampling parameter list.
  - Select one well each event from which to collect a duplicate sample.
10. Turn off the pump and remove equipment from the well after filling all sample bottles.
11. If dedicated tubing was used, save the dedicated tubing in a labeled plastic bag to be used during the next sampling event.
12. Verify that each bottle is labeled with the correct time, date, and sample identifier and place bottles on ice to chill to 4°C.
13. Disassemble the bladder pump and decontaminate the equipment using Alconox solution and rinse three times using distilled water. Replace the bladder and grab plate with a new bladder and grab plate. Check the O-rings for excessive wear or damage and replace if needed.
14. Decontaminate the water level indicator and measuring device used for depth to bottom measurements (if separate equipment used) using Alconox solution and rinse three times using distilled water.
15. Proceed to the next well, and start back at Step 1.
16. Collect an equipment blank after all three wells have been sampled and equipment is decontaminated for the last time.
17. Complete the chain-of-custody (COC) form with the sample ID, date, and time, and the parameter list for each sample.
  - Sign the COC with the date and time.
  - Place COC in a sealed plastic bag on top of the filled cooler (beneath the lid).
  - Tape the lid shut with a custody seal(s) in place.
  - Schedule pickup by a laboratory courier or ship for overnight delivery to the laboratory. Ship samples on the day that they were collected in order to meet hold time requirements.
18. At the end of the day, complete post-sampling calibration checks.





### LOW-FLOW WATER SAMPLE LOG

|   |  |       |  |       |   |         |   |         |   |       |       |
|---|--|-------|--|-------|---|---------|---|---------|---|-------|-------|
| PROJECT NAME:   |  |       |  |       | PREPARED  |         |   | CHECKED |   |       |       |
| PROJECT NUMBER:   |  |       |  |       | BY:   |         | DATE:   |         | BY:   |       | DATE: |
| SAMPLE ID:  |  |       |  |       | WELL DIAMETER:     in   |         |   |         |   |       |       |
| WELL MATERIAL: <input type="checkbox"/> PVC <input type="checkbox"/> SS <input type="checkbox"/> GS <input type="checkbox"/> IRON |  |       |  |       | <input type="checkbox"/> OTHER:   |         |   |         |   |       |       |
| SAMPLE TYPE: <input type="checkbox"/> GW <input type="checkbox"/> WW <input type="checkbox"/> SW <input type="checkbox"/> DI      |  |       |  |       | <input type="checkbox"/> LEACHATE <input type="checkbox"/> OTHER:   |         |   |         |   |       |       |
| PURGING   |  | TIME: |  | DATE: |   | SAMPLE: |   | TIME:   |   | DATE: |       |
| PUMP TYPE:        BLADDER PUMP (Non-Dedicated)  |  |       |  |       | PH:   |         | SU  |         | CONDUCTIVITY:          umhos/cm   |       |       |
| STABILIZATION CRITERIA: EPA R5 (2021)   |  |       |  |       | DO:   |         | mg/l  |         | ORP:                        mV  |       |       |
| DEPTH TO WATER:    T/ PVC   |  |       |  |       | TURBIDITY:                  NTU   |         |   |         |   |       |       |
| DEPTH TO BOTTOM:  T/ PVC  |  |       |  |       | <input type="checkbox"/> NONE <input type="checkbox"/> SLIGHT <input type="checkbox"/> MODERATE <input type="checkbox"/> VERY |         |   |         |   |       |       |
| WELL VOLUME: <input type="checkbox"/> LITERS <input type="checkbox"/> GALLONS   |  |       |  |       | TEMPERATURE:          °C  |         | OTHER:                    --  |         |   |       |       |
| VOLUME REMOVED: <input type="checkbox"/> LITERS <input type="checkbox"/> GALLONS  |  |       |  |       | COLOR:  |         |   | ODOR:   |   |       |       |
| COLOR:                                    ODOR:   |  |       |  |       | FILTRATE (0.45 um) <input type="checkbox"/> YES <input type="checkbox"/> NO   |         |   |         |   |       |       |
| TURBIDITY   |  |       |  |       | FILTRATE (0.45 um) <input type="checkbox"/> YES <input type="checkbox"/> NO   |         | FILTRATE (0.45 um) <input type="checkbox"/> YES <input type="checkbox"/> NO |         | FILTRATE (0.45 um) <input type="checkbox"/> YES <input type="checkbox"/> NO |       |       |
| <input type="checkbox"/> NONE <input type="checkbox"/> SLIGHT <input type="checkbox"/> MODERATE <input type="checkbox"/> VERY     |  |       |  |       | QC SAMPLE: <input type="checkbox"/> MS/MSD  |         | <input type="checkbox"/> DUP-   |         |   |       |       |
| DISPOSAL METHOD: <input type="checkbox"/> GROUND <input type="checkbox"/> DRUM <input type="checkbox"/> OTHER                     |  |       |  |       | COMMENTS:   |         |   |         |   |       |       |

| TIME                   | PURGE RATE (mL/min)   | TEMPERATURE (°C) | SPECIFIC CONDUCTIVITY (µS/cm) | D.O. (mg/L)                                      | pH (SU) | ORP (mV)          | TURBIDITY (NTU)        | WATER LEVEL (ft btoc) | CUMULATIVE PURGE VOLUME (L) |
|------------------------|-----------------------|------------------|-------------------------------|--|---------|-------------------|------------------------|-----------------------|-----------------------------|
|                        | 100 mL/min-500 mL/min | None             | 3%                            | 10% or 0.2 mg/L, whichever is greater (optional) | ±0.1    | ±10 mV (optional) | within 10%, or <10 NTU | <0.1 ft               |                             |
| Stabilization Criteria |                       |                  |                               |  |         |                   |                        |                       |                             |
|                        |                       |                  |                               |  |         |                   |                        |                       |                             |
|                        |                       |                  |                               |  |         |                   |                        |                       |                             |
|                        |                       |                  |                               |  |         |                   |                        |                       |                             |
|                        |                       |                  |                               |  |         |                   |                        |                       |                             |
|                        |                       |                  |                               |  |         |                   |                        |                       |                             |
|                        |                       |                  |                               |  |         |                   |                        |                       |                             |
|                        |                       |                  |                               |  |         |                   |                        |                       |                             |
|                        |                       |                  |                               |  |         |                   |                        |                       |                             |
|                        |                       |                  |                               |  |         |                   |                        |                       |                             |
|                        |                       |                  |                               |  |         |                   |                        |                       |                             |
|                        |                       |                  |                               |  |         |                   |                        |                       |                             |
|                        |                       |                  |                               |  |         |                   |                        |                       |                             |
|                        |                       |                  |                               |  |         |                   |                        |                       |                             |
|                        |                       |                  |                               |  |         |                   |                        |                       |                             |
|                        |                       |                  |                               |  |         |                   |                        |                       |                             |
|                        |                       |                  |                               |  |         |                   |                        |                       |                             |
|                        |                       |                  |                               |  |         |                   |                        |                       |                             |
|                        |                       |                  |                               |  |         |                   |                        |                       |                             |
|                        |                       |                  |                               |  |         |                   |                        |                       |                             |
|                        |                       |                  |                               |  |         |                   |                        |                       |                             |
|                        |                       |                  |                               |  |         |                   |                        |                       |                             |
|                        |                       |                  |                               |  |         |                   |                        |                       |                             |
|                        |                       |                  |                               |  |         |                   |                        |                       |                             |
|                        |                       |                  |                               |  |         |                   |                        |                       |                             |
|                        |                       |                  |                               |  |         |                   |                        |                       |                             |
|                        |                       |                  |                               |  |         |                   |                        |                       |                             |
|                        |                       |                  |                               |  |         |                   |                        |                       |                             |
|                        |                       |                  |                               |  |         |                   |                        |                       |                             |
|                        |                       |                  |                               |  |         |                   |                        |                       |                             |
|                        |                       |                  |                               |  |         |                   |                        |                       |                             |
|                        |                       |                  |                               |  |         |                   |                        |                       |                             |

| BOTTLES FILLED |      |      |              |   |        |      |      |              |   |
|----------------|------|------|--------------|---|--------|------|------|--------------|---|
| NUMBER         | SIZE | TYPE | PRESERVATIVE | FILTERED  | NUMBER | SIZE | TYPE | PRESERVATIVE | FILTERED  |
|                |      |      |              | <input type="checkbox"/> Y <input type="checkbox"/> N |        |      |      |              | <input type="checkbox"/> Y <input type="checkbox"/> N |
|                |      |      |              | <input type="checkbox"/> Y <input type="checkbox"/> N |        |      |      |              | <input type="checkbox"/> Y <input type="checkbox"/> N |
|                |      |      |              | <input type="checkbox"/> Y <input type="checkbox"/> N |        |      |      |              | <input type="checkbox"/> Y <input type="checkbox"/> N |

|                  |  |               |  |
|------------------|--|---------------|--|
| SHIPPING METHOD: |  | DATE SHIPPED: |  |
| SIGNATURE:       |  | DATE SIGNED:  |  |

## Groundwater Sampling Field Sheet

Site Name: John Deere Dubuque Works Permit No.: 31-SDP-01-75  
 Well/Piezometer: \_\_\_\_\_ Weather: \_\_\_\_\_  
 Date: \_\_\_\_\_ Sampler: \_\_\_\_\_

### Monitoring Well Construction Information

Borehole diameter (in): \_\_\_\_\_ Ground surface elevation (ft. MSL): \_\_\_\_\_  
 Casing Diameter (in): \_\_\_\_\_ Top of Casing elevation (ft. MSL): \_\_\_\_\_  
 Casing material: \_\_\_\_\_ Depth to top of screen (ft TOC): \_\_\_\_\_

### Monitoring Well Field Observations

Locked (Y/N): \_\_\_\_\_

|                           | Before purging | After purging | Before sampling |
|---------------------------|----------------|---------------|-----------------|
| Depth to water (ft. TOC): |                |               |                 |
| Water Elevation (ft. MSL) |                |               |                 |

Screen submerged? (Y/N): \_\_\_\_\_

|                      | Constructed | Measured | Difference |
|----------------------|-------------|----------|------------|
| Well Depth (ft. TOC) |             |          |            |

Well conditions commentary: \_\_\_\_\_

### Sampling Equipment

Type of Sampling Equipment: \_\_\_\_\_  
 Equipment Name & Description: \_\_\_\_\_  
 Pump Type: \_\_\_\_\_  
 Dedicated/Disposable/Portable: \_\_\_\_\_  
 Decontamination for pump: \_\_\_\_\_  
 Tubing (Dedicated/Disposable): \_\_\_\_\_  
 Purge Method: \_\_\_\_\_

### Sample Info

Equipment depth (ft. TOC) \_\_\_\_\_  
 Flow Rate (mL/min): \_\_\_\_\_  
 Volume purged (L): \_\_\_\_\_  
 Volume sampled (L): \_\_\_\_\_  
 Odor? (Y/N) \_\_\_\_\_  
 Color? (Y/N) \_\_\_\_\_

Comments: \_\_\_\_\_

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