SIXTH FIVE-YEAR REVIEW REPORT FOR ONALASKA MUNICIPAL LANDFILL SUPERFUND SITE LA CROSSE COUNTY, WISCONSIN

Prepared by

Wisconsin Department of Natural Resources
Southeast Region
Milwaukee, Wisconsin

For

U.S. Environmental Protection Agency
Region 5
Chicago, Illinois

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Signed by: DOUGLAS BALLOTTI

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LIST OF ABBREVIATIONS & ACRONYMS

µg/L	micrograms per Liter
1,1-DCA	1,1-dichloroethane
1,1-DCE	1,1-dichloroethene
1,2,4 TMB	1,2,4 Trimethylbenzene
1,3,5 TMB	1,3,5 Trimethylbenzene
ARAR	Applicable or Relevant and Appropriate Requirement
BRRTS	Bureau for Remediation and Redevelopment Tracking System
CD	Consent Decree
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
COC	Contaminants of Concern
DMZ	Design Management Zone
EPA	United States Environmental Protection Agency
ES	Enforcement Standard
ESD	Explanations of Significant Differences
FYR	Five-Year Review
HQ	Hazard Quotient
IC	Institutional Control
MCL	Maximum Contaminant Level
MNA	Monitored Natural Attenuation
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NPL	National Priorities List
NR	Department of Natural Resources
O&M	Operation and Maintenance
OU	Operable Unit
PAH	Polycyclic Aromatic Hydrocarbons
PAL	Preventive Action Limit
PPB	Parts Per Billion
PFAS	Per- and Polyfluorinated Substances
PFOA	Perfluorooctanoic Acid
PRP	Potentially Responsible Party
RAO	Remedial Action Objective
RI/FS	Remedial Investigation/Feasibility Study
ROD	Record of Decision
RPM	Remedial Project Manager
Site	Onalaska Municipal Landfill Superfund Site
TCE	Trichloroethene
TCA	1,1,1-trichloroethane
TMB	Trimethylbenzene
USGS	United States Geological Survey
UU/UE	Unlimited Use and Unrestricted Exposure
VOC	Volatile Organic Compound
WAC	Wisconsin Administrative Code
WDNR	Wisconsin Department of Natural Resources

I. INTRODUCTION

The purpose of a Five-Year Review (FYR) is to evaluate the implementation and performance of a remedy in order to determine if the remedy is and will continue to be protective of human health and the environment. The methods, findings, and conclusions of reviews are documented in FYR reports such as this one. In addition, FYR reports identify issues found during the review, if any, and document recommendations to address them.

The Wisconsin Department of Natural Resources (WDNR) prepared this FYR pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Section 121, consistent with the National Contingency Plan (NCP) (40 C.F.R. Section 300.430(f)(4)(ii)) and considering EPA policy.

This is the sixth FYR for the Onalaska Municipal Landfill Superfund Site (Site). The triggering action for this FYR review is the completion of the fifth FYR in 2018. The FYR has been prepared because hazardous substances, pollutants, or contaminants remain at the site above levels that allow for unlimited use and unrestricted exposure (UU/UE).

The Site consists of one operable unit (OU) which is addressed and reviewed in this FYR. The sitewide OU includes the landfill, contaminated soil, and groundwater both on and off the property.

WDNR project manager BJ LeRoy led this FYR. Participants included Kathleen Meier, EPA Remedial Project Manager (RPM) and Amy Gahala, United States Geological Survey (USGS). The Town of Onalaska as the Site owner was notified of the five-year review initiation. The review began on 6/13/2022.

Site Background

The Site lies in the Township of Onalaska, approximately 10 miles north of La Crosse, Wisconsin. The 11-acre property includes the 7-acre former Township landfill, approximately 400 feet east of the Mississippi and Black River confluence. The Black River helps form the Upper Mississippi River Wildlife and Fish Refuge, a wetlands area supporting numerous migrating species of birds. The recreational area is also used for hiking, fishing, and hunting by area residents and visitors. See Figure 1 in Appendix B.

The Site began as a sand and gravel quarry in the early 1960s. Quarry operations ceased in the mid-1960s, and the Town of Onalaska (Town) began to use the Site as a municipal landfill, which for a time accepted both municipal and chemical wastes. An estimated 320,000 gallons of waste solvent had been disposed of at the landfill, including naphtha-based BTEX solvents (benzene, ethylbenzene, xylene, and toluene). In 1978, WDNR determined that the landfill operation did not meet state solid waste codes and ordered the Town to close the landfill by September 1980. After disposal operations ceased, the Town capped the landfill in June 1982.

The area surrounding the Site is generally rural, although several residences are located within 500 feet to the north, south, and east of the landfill. A subdivision of about 50 homes is located about 1.25 miles to the southeast. Agricultural land exists south of the landfill, and intermittent woods and grasslands border the Site to the east. A railroad line runs west-northwest approximately 200 feet north of the northern extent of the waste. A state recreational bike trail lies north of the rail line located on a former railroad bed. A public canoe landing provides access to the Black River about 500 feet north of the

landfill. The Site provides nesting area for turtles, including several threatened species. While there has been some discussion at the Town about creating recreational trails at the Site, this has not been officially proposed or discussed with either WDNR or EPA. Neither agency is aware of any other proposed land use changes in the area.

FIVE-YEAR REVIEW SUMMARY FORM

SITE IDENTIFICATION		
Site Name: Onalaska Municipal Landfill		
EPA ID: WID980821656		
Region: 5	**State:** WI	**City/County:** Town of Onalaska, La Crosse County
SITE STATUS		
NPL Status: Final		
Multiple OUs? No	**Has the site achieved construction completion?** Yes	
REVIEW STATUS		
Lead agency: State of Wisconsin, Department of Natural Resources		
Author name (Federal or State Project Manager): BJ LeRoy		
Author affiliation: WDNR		
Review period: 6/13/2022 - 1/3/2023		
Date of site inspection: 10/7/2022		
Type of review: Statutory		
Review number: 6		
Triggering action date: 4/3/2018		
Due date *(five years after triggering action date)*: 4/3/2023		

II. RESPONSE ACTION SUMMARY

Basis for Taking Action

In September 1982, WDNR sampled four landfill monitoring wells and several nearby residential wells for compliance with drinking-water standards, and found that one residential well, located southwest of the landfill, exceeded the federal drinking water standard for barium. The residential well sample also contained five organic compounds at concentrations above background levels. The Town replaced the contaminated residential well with a deep, uncontaminated well in January 1983.

Pursuant to CERCLA, EPA placed the Site on the National Priorities List in September 1984.

EPA, in consultation with WDNR, began a Remedial Investigation and Feasibility Study (RI/FS) at the Site in 1988. The RI/FS was completed in 1990 (CH2MHill, 1990).

Soils located above the water table and adjacent to the southwestern edge of the landfill were determined to be contaminated with naphtha solvents that migrated from the landfill. The aqueous phase plume consisted of organic and inorganic compounds. The RI identified the following contaminants of concern (COCs) in soil and groundwater: toluene, xylene, ethylbenzene, trichloroethene (TCE), lead, barium, and arsenic; and in groundwater only: benzene, 1,1,1-trichloroethane (TCA), 1,1-dichloroethane (1,1-DCA), and 1,1-dichloroethene (1,1-DCE). The predominant volatile organic compounds (VOCs) identified as COCs included toluene, xylene, 1,1-DCA, and TCE, based upon concentrations and potential impacts to human health and the environment.

The major exposure pathways of concern at the Site are the potential ingestion of contaminated groundwater, and the exposure to or ingestion of contaminated surface water and/or sediments in the Black River and the wetlands adjacent to the Site. The only exposure pathway determined to be of significance to the environmental risk analysis was the groundwater discharge of contaminants to the Black River wetlands. Both aquatic life, and any consumers of the affected aquatic life including humans, could be exposed to site-related contaminants.

Response Actions

EPA documented a cleanup decision in an August 1990 Record of Decision (ROD) (EPA, 1990). The ROD identified the following remedial action objectives (RAOs):

- Select remedies that are protective of human health and the environment, that maintain protection over-time, and that minimize untreated waste;
- Return usable ground waters to their beneficial use wherever practicable, within a time frame that is reasonable given the particular circumstances of the Site. Whenever restoration of groundwaters is not practicable, EPA expects to prevent further migration of the plume, prevent exposure to the contaminated groundwater, and evaluate further risk reduction; and
- Follow the state's groundwater protection goals as set forth in Chapter 160, Wisconsin Statutes (Wis. Stats.), which applies to all groundwaters in the state. Chapter 160, Wis. Stats., and Ch. NR 140, Wisconsin Administrative Code (WAC), are utilized by all Wisconsin state agencies which regulate facilities, practices, or activities that may affect groundwater quality. Consistent with these statutes and codes, the remedial alternatives evaluated in the FS must achieve adequate protection of human health and the environment (when implemented) and protect the groundwater resources of the state.

The ROD required the following remedial action components to accomplish the RAOs for the Site;

- Installation of a landfill cap in accordance with federal and state requirements;
- Installation of a groundwater extraction and treatment system to capture and treat organic contaminants in the groundwater immediately downgradient of the landfill;
- Installation of an air injection system within the area of soils contamination to enhance the bioremediation of organic contaminants;

- Implementation of a groundwater, surface water, and sediment monitoring program to ensure the adequacy of the cleanup; and
- Implementation of institutional controls (ICs) at the Site, including deed restrictions limiting surface water and groundwater use at the Site, in conjunction with state regulations governing groundwater use within 1200 feet of landfills and development on landfills.

On October 29, 1996, EPA entered into a Consent Decree (CD) with the Town (US District Court, 1996). The CD addressed the required ICs and outlined the operation and maintenance (O&M) requirements for the Site. EPA subsequently issued two Explanations of Significant Differences (ESDs) which modified the selected remedy as follows:

- September 29, 2000, ESD - revised the Site cleanup standards to reflect the then-current state groundwater cleanup standards (EPA, 2000).
- November 13, 2001, ESD - allowed for the temporary shutdown of the groundwater extraction and treatment system to evaluate the need for continuous operation of the system and to determine whether natural attenuation processes existed at the Site which might address the remaining groundwater contamination (EPA, 2001).

Groundwater sampling for EPA Priority Pollutants in 1999 detected groundwater contaminants for which analyses had not previously been conducted, most notably trimethylbenzenes (TMBs; 1,2,4 TMB and 1,3,5 TMB). In 2008, EPA conducted an initial evaluation of monitored natural attenuation (MNA) at the Site (Papadopulos, 2008). This evaluation, along with data collected afterwards showed that nearly all VOCs had remained significantly below cleanup standards, and the only remaining VOC found above standards was TMB which demonstrated a stable to decreasing trend.

In January 2011, Wisconsin adopted a new public health enforcement standard (ES) for manganese, which had previously been considered a public welfare parameter. The ES for manganese is 300 parts per billion (ppb)[1], equivalent to the EPA federal lifetime health advisory level. There is no federal Maximum Contaminant Level (MCL) for manganese.

On September 24, 2012, WDNR and EPA issued a ROD Amendment (WDNR and EPA, 2012). Components of the ROD Amendment are as follows:

- The groundwater extraction and treatment system would be shut down and MNA was designated as the remedy to treat remaining VOCs;
- Two private drinking water wells would be replaced with the new wells advanced into the deeper, uncontaminated portion of the aquifer. The highest levels of contaminants are limited to the upper 50 to 70 feet of this aquifer, the historical and current use of the aquifer as a source of drinking water from deep wells can continue, provided that nearby private water-supply wells are optimally placed and regularly monitored;
- Groundwater cleanup standards were updated from the Preventative Action Limits that were identified in the ROD to the federal MCLs and/or state ESs (whichever is more stringent), and added TMB compounds, Naphthalene and Manganese as COCs; and

[1] 1 ppb is the same as 1 microgram per liter (µg/L)

- Long-term ICs were to be placed on the real estate parcel on which the landfill itself is situated.

The point of standards application is any point within the property boundaries beyond the three-dimensional design management zone (DMZ), as well as any point of present groundwater use beyond the property boundaries. DMZs are established in ch NR 140 of the WAC.

The ROD Amendment also noted that continued monitoring for TMBs will be conducted to ensure that the contaminated groundwater plume does not contain levels that exceed state ESs beyond the DMZ and to ensure that the plume continues to appear stable, and established contingencies that could lead to reconsideration of the amended groundwater remedy. These contingencies include:

- If confirmed by four or more rounds of sampling:
    - Concentrations in groundwater showing increasing trends for any of the original VOCs listed under the 1990 ROD or for TMB (recognizing that there will likely be seasonable spikes in concentrations), indicating that other sources may be present, or;
    - The contaminant plume increases significantly in areal or vertical extent and/or volume. This would be noted by ES exceedances outside the DMZ during routine sampling of monitoring wells.
- If significant and unforeseeable changes in the pattern and distribution of VOCs occur during the implementation of this amended remedy which result in further ES exceedances outside the boundaries of the DMZ, then WDNR and/or EPA may collect additional soil data in the area of naphtha solvent disposal southwest of the landfill (near well nest MW-16) to determine whether there is soil outside the delineated waste boundaries that may be acting as an ongoing source of contamination to groundwater. If a source area in soil is found, it will be evaluated for possible further remediation. Monitoring wells MW-6S, MW-6M, MW-8S, and MW-8M will be considered key sentinel wells for purposes of detecting plume expansion.

The ROD Amendment also clarified the groundwater RAO described in the 1990 ROD by stating, “The ultimate RAO for the groundwater portion of this remedial action, and specifically for VOCs, is to restore contaminated groundwater to its anticipated beneficial uses.” And finally, the ROD Amendment stated that the Town of Onalaska would be allowed to take permanent possession of the building that housed the system, and all groundwater extraction and treatment system equipment will be decommissioned.

Neither EPA nor WDNR has selected a final groundwater remedy for inorganics. The ROD Amendment stated that replacement of the two private water-supply wells is an interim remedy for inorganics in groundwater. The ROD Amendment indicated that additional investigation would be conducted to determine whether additional actions need to be taken to address inorganics in groundwater, and that if any such actions are found to be necessary, they would be addressed in a future decision document. Table 1 below summarizes the current groundwater cleanup standards for the Site in accordance with the 2012 ROD Amendment.

Table 1: COCs and Associated Groundwater Cleanup Standards

COC	Wisconsin NR 140 Enforcement Standard (µg/L)	EPA MCL (µg/L)	Most stringent Cleanup Standard (µg/L)
Benzene	5	5	5
Toluene	800	1,000	800
Xylenes (total)	2,000	10,000	2,000
1,1-DCA	850	None	850
Lead	15	15	15
Arsenic[1]	10	10	10
Barium[1]	2,000	2,000	2,000
Ethylbenzene	700	700	700
1,1,1-TCA	200	200	200
1,1-DCE	7	7	7
TCE	5	5	5
Manganese[1]	300	None	300
Naphthalene	100	None	100
TMBs	480	None	480
Iron[1]*	300	None	300

[1] Naturally occurring background levels at the Site may be higher than these standards.
** Iron is a substance of public welfare concern and poses minimal health risks. The iron ES is a "secondary standard" which are guidelines established to address cosmetic and aesthetic effects of substances present in drinking water supplies.*

Status of Implementation

The implementation status of the selected remedy is summarized below.

- Construction of the multi-layer clay cap over the landfill was completed in November 1993.
- Construction of the groundwater extraction and treatment system was completed in June 1994. The groundwater extraction and treatment system operated from June 1994 until November 2001 and pumped 2.2 billion gallons of water for treatment (via air stripping).
- Construction of the soil bioremediation air injection system was completed in June 1994; the system was discontinued in 1998 after soil gas data showed that the system no longer contributed to the cleanup.
- EPA signed the Preliminary Close-Out Report on July 29, 1994, designating the Site as having achieved Construction Completion (EPA, 1994).
- On November 26, 2001, the groundwater extraction and treatment system was shut down in order to study the effectiveness of MNA as a more cost-effective alternative remedy for VOC contaminated groundwater.
- WDNR assumed the lead for O&M at the Site in June 2002 and conducted additional investigations in March 2006 to evaluate the potential for vapor intrusion at the Site and to

identify whether certain suspected areas of residual soil contamination were acting as a possible ongoing source of TMBs to groundwater.

- From 2001 to 2012, the Site was evaluated to determine whether MNA was a viable remedy to address the remaining VOC contamination in groundwater. In September 2012, EPA and WDNR issued a ROD Amendment approving the permanent shutdown of the groundwater extraction and treatment system and designating MNA as the remedy for VOCs in groundwater.
- In June 2013, two private water-supply wells, PW-3 and PW-4, with groundwater sampling results that consistently exceeded state arsenic and manganese standards were replaced as called for in the 2012 ROD Amendment. PW-3 and PW-4 were replaced with new wells advanced into the deeper, uncontaminated portion of the aquifer (175-190 feet below grade and 215-235 feet below grade respectively). PW-7 is a replacement well for PW-1, which occurred prior to this FYR. PW-5 and PW-6 were added to the monitoring program in April 2019, and those wells serve residences side-gradient of the landfill to the southeast.
- A Quit Claim Bill of Sale was executed by the State of Wisconsin on January 8, 2014, for the transfer of ownership of the former remediation building to the Town. The Town conducts routine maintenance of the landfill cap and mows designated portions of the prairie grass cap annually. In addition, the Town conducts maintenance of the passive gas venting system and sampling of landfill perimeter gas probes every three months.
- Reports are submitted to the WDNR after each sampling event and placed in the WDNR electronic Bureau for Remediation and Redevelopment Tracking System (BRRTS) database for public use.

Institutional Controls

ICs are non-engineered instruments, such as administrative and legal controls, that help to minimize the potential for exposure to contamination and that protect the integrity of the remedy. ICs are required to assure long-term protectiveness for those areas of a site that do not allow for UU/UE.

The following table summarizes the currently implemented ICs at the Site.

Table 2: Summary of Planned and/or Implemented ICs

Media, engineered controls, and areas that do not support UU/UE based on current conditions	ICs Needed	ICs Called for in the Decision Documents	Impacted Parcel(s)	IC Objective	Title of IC Instrument Implemented and Date (or planned)
Landfill cap, waste limits, restricted land use.	Yes	Yes	10-1418-0	Prevent activity that compromises the cap or other landfill features.	WAC NR 506.085 prohibits use of the waste area for agriculture, construction and excavation.
			10-1418-0 10-1419-0	Prevent exposure to waste and	Environmental protection easement

				contaminated groundwater.	and declaration of restrictive covenants recorded on 9/26/2013.
Parcels surrounding landfill property	Yes	Yes	1417-4 1422-0 1423-0	Prevent activities that interfere with the selected remedy, prevent unapproved construction, and prevent residential use.	Declaration of restriction on use of real property recorded on April 14, 1997.
Contaminated groundwater	Yes	Yes	 1417-4 1422-0 1423-0 10-1418-0 10-1419-0	Prevent consumption or exposure to groundwater. Restrict the use of groundwater at specific parcels. Restrict structures, drinking water wells, recreational property use, and maintain landfill cap integrity.	WAC 812.08(4)(g) restricts construction of a water supply well within 1200 feet of a landfill. Declaration of restriction on use of a real property recorded on April 14, 1997. Environmental protection easement and declaration of restrictive covenants recorded on 9/26/2013.

An updated map that depicts the current conditions at the Site and areas which do not allow for UU/UE will be developed in the IC follow up actions discussed below. Figure 2 in Appendix B is the best current map depicting the waste limit. The updated map will show deed restrictions and other areas that are currently unsuitable for UU/UE.

Status of Access Restrictions and ICs: On April 14, 1997, a Declaration of Restriction on Use of Real Property was recorded for three properties adjoining the landfill, as required by the 1996 CD between EPA and the Town.

On September 26, 2013, an Environmental Protection Easement and Declaration of Restrictive Covenants were recorded at the La Crosse County Register of Deeds office, requiring maintenance of the landfill cap and restricting structures, drinking water wells, and recreational property use on the landfill property as well as on Town property directly south of the landfill.

The 2013 FYR stated that WDNR would perform an evaluation of the title for each property to which ICs apply to ensure that there are no prior-in-time encumbrances or interests (such as mortgage or utility easements) which could defeat the efficacy of the restrictive covenants. The 2013 Restrictive Covenant stated that the landfill property is free and clear of encumbrances; however, no other title evaluation for the other properties to which ICs apply has yet been performed. A title evaluation for the other properties to which ICs apply will be performed as part of the IC follow-up actions discussed below.

Current Compliance: Based on the 10/7/2022 FYR Site and other inspections and interviews, neither EPA nor WDNR is aware of any uses of the Site, including groundwater uses, which are inconsistent with the objectives which will be served by the ICs.

IC Follow up Actions Needed: A title evaluation for properties other than the landfill property to which ICs apply will be performed. The IC map will be updated to depict the Environmental Protection Easement and Declaration of Restrictive Covenants recorded on 9/26/2013. Long-term stewardship procedures will be documented in a long-term stewardship plan, institutional control implementation and assurance plan (ICIAP) or incorporated as an amendment to the existing O&M Plan (WDNR, 1997).

Long Term Stewardship: Because compliance with ICs is necessary to assure the protectiveness of the remedy, long-term stewardship is required. Long-term stewardship involves assuring effective procedures are in place to ensure that the ICs are maintained, monitored and enforced so that the remedy continues to function as intended. The requirements of the 1996 CD between EPA and the Town required that effective ICs were implemented, and that ICs are maintained and monitored. An amendment to the existing O&M Plan, an ICIAP or a long-term stewardship plan will be developed to include procedures for long-term stewardship. These procedures to ensure long-term IC stewardship will include regular inspections of the engineering controls and access controls at the Site and reviews of the ICs.

Systems Operations/Operation & Maintenance

The O&M activities conducted by state contractors during the period of this FYR included groundwater and drinking water sampling and analyses, monitoring well maintenance, gas probe monitoring and reporting. WDNR routinely reviews all analytical results, notifies private water-supply well owners of sampling results, and periodically modifies sampling locations, parameters, and frequencies as necessary during each successive contract period (typically biennially).

The Town conducts routine Site maintenance, including mowing and cover/fence repairs. Based on field observation, the remedy appears to be in place as designed. The wells and gas monitoring systems are operative and in good condition. The surface water at the Site appears diverted, and the cover is in-tact and maintained. There do not appear to be any problems with O&M. Annual reports are documented and reflect what was observed at the Site. O&M will continue, as well as inspections by WDNR.

III. PROGRESS SINCE THE LAST REVIEW

This section includes the protectiveness determinations and statements from the last FYR as well as the recommendations from the last FYR and the current status of those recommendations.

Table 3: Protectiveness Determinations/Statements from the 2018 FYR

OU #	Protectiveness Determination	Protectiveness Statement
OU1 and Sitewide	Short-term Protective	The remedy at the Onalaska Municipal Landfill Site currently protects human health and the environment. The landfill cap, passive gas venting, MNA of VOCs, O&M activities, ICs, and the 2013 replacement of two contaminated private water-supply wells protect human health and the environment by preventing exposure to contaminants in the landfill and in groundwater. However, in order for the remedy to be protective in the long term, the following actions need to be taken to ensure

		protectiveness: perform additional sampling and analysis of inorganics in groundwater in order to support the selection of an appropriate final remedy for inorganics; supplement the current sampling schedule with up to two additional private water-supply wells to confirm that there continue to be no receptors at risk and to assist in better characterizing proximal inorganic concentrations; evaluate 1,4-dioxane as a potential COC and determine whether further investigation is necessary to characterize this constituent; evaluate PFOA/PFOS as potential COCs and determine whether further investigation is necessary to characterize these constituents; develop a Long-term Stewardship Plan or amend the O&M Plan to incorporate procedures for long-term stewardship of ICs and implement; and direct the Town of Onalaska to inspect and repair the split rail fence surrounding the landfill cap and snow fencing which restricts access to the Site from Sportsman Club Road.

Table 4: Status of Recommendations from the 2018 FYR

OU #	Issue	Recommendations	Current Status	Current Implementation Status Description	Completion Date (if applicable)
OU1 and Sitewide	Degree and extent of elevated concentrations of manganese in groundwater is not fully characterized.	Perform additional sampling and analysis of inorganics in groundwater in order to support the selection of an appropriate final remedy for inorganics. Supplement the current sampling schedule with up to two additional private water-supply wells to confirm that there continue to be no receptors at risk and to assist in better characterizing proximal inorganic concentrations.	Completed	Groundwater monitoring continues sitewide to evaluate inorganics concentrations in groundwater. Manganese concentrations appear to be steady if not slightly higher at the plume edge during this FYR. Two additional side-gradient private wells were added to the study. They showed at least one manganese exceedance during the FYR period. Both wells will stay in the monitoring program.	1/1/2020
OU1 and Sitewide	1,4-dioxane has not yet been evaluated as a potential COC at the Site.	Evaluate 1,4-dioxane as a potential COC and determine whether further investigation is necessary to characterize this constituent.	Ongoing	WDNR will complete a desktop data review to evaluate if 1,4-dioxane is a potential COC that needs further investigation.	
OU1 and Sitewide	Perfluorooctanoic Acid (PFOA) / Per- and Polyfluorinated Substances (PFAS) have not yet been evaluated as potential COCs at the Site.	Evaluate PFOA/PFAS as potential COCs and determine whether further investigation is necessary to characterize these constituents.	Ongoing	The WDNR is currently working on contracting for PFAS sampling at the Site.	
OU1 and Sitewide	Site fencing needs repair.	Direct the Town of Onalaska to inspect and repair the split rail fence surrounding the landfill	Completed	The City of Onalaska made fence repairs following the 2018 FYR.	12/1/2019

		cap and snow fencing which restricts access to the Site from Sportsman Club Road.			
OU1 and Sitewide	Written long-term stewardship procedures are needed.	Develop a Long-term Stewardship Plan or amend the O&M Plan to incorporate procedures for long-term stewardship of ICs and implement.	Ongoing	WDNR will implement this IC activity during the next five-year period.	

Other Findings

In addition, the following recommendations were identified in the 2018 FYR which do not affect current nor future protectiveness of the remedy at the Site.

- WDNR will update the IC map to depict the Environmental Protection Easement and Declaration of Restrictive Covenants recorded on 9/26/2013. The milestone date for this recommendation is 12/31/2018.

  Status update: The map was not updated. WDNR will update the IC map during the next five-year period, including a revised site map and location of restrictive covenants. WDNR's milestone date for this recommendation is 4/1/2024.

- WDNR will put in place and implement a contract for abandonment of up to five former extraction wells and 29 air injection wells that are no longer required remedy components. The milestone date for this recommendation is 12/31/2019.

  Status update: Five unused groundwater extraction wells and 29 air injection wells were abandoned in 2019.

- WDNR will perform a title evaluation for the other properties to which ICs apply as part of the IC follow-up actions. WDNR's milestone date for this recommendation is 12/31/2018.

  Status update: A title evaluation was not completed. WDNR will perform a title search during the next five-year period. WDNR's milestone date for this recommendation is 4/1/2024.

IV. FIVE-YEAR REVIEW PROCESS

Community Notification, Involvement & Site Interviews

WDNR issued a public notice on 2/24/2023, which appeared in the La Crosse Tribune, the Coulee Courier, and the WDNR Public Notice portal at https://dnr.wisconsin.gov/topic/brownfields/publicnotices.html. The notice states that a FYR is underway and invited the public to submit any comments to WDNR. No comments were received. The final FYR report will be available at the Site information repository located in the WDNR BRRTS electronic database at https://dnr.wi.gov/botw/GetActivityDetail.do?detailSeqNo=33914. No formal

interviews were conducted for this FYR other than questions that arose during the Site inspection, which are documented in the Site Inspection section.

Data Review

Site Conceptual Model

The Site area exists along a slightly elevated ridge between the Black River and Mississippi River. It may provide a very local recharge area within a continental Mississippi discharge area. Water enters the Site area through infiltration from precipitation and from upland groundwater flow from the northeast. Infiltration moves downward toward the water table which lies approximately 10 to 15 feet below the ground surface. Site area groundwater flows from the northeast to the southwest toward the wetlands of the Black River and the Mississippi River. Groundwater flow may change to the south during periods of flooding, typically in the spring.

Groundwater Monitoring in Non-Private Wells

The Site Plan, Figure 2 in Appendix B, shows the locations of existing Site wells. Monitoring wells with an "S" suffix are water table wells. Monitoring wells with an "M" suffix are approximately 75 feet deep and have 10-foot screens. The wells labeled with "PZ" are piezometers screened at about 20 to 30 feet bgs. "EW" wells are former extraction wells, now abandoned. "AW" wells are former air injection wells associated with soil bioremediation, also abandoned. "PW" wells are private water-supply wells for area residences and have been considered separately below.

Groundwater contamination is the Site's main risk pathway. According to the RI, the upper groundwater aquifer consists primarily of sand and is approximately 135 feet thick. The upper 10 feet to 20 feet of the aquifer contained the highest levels of contaminants, with lower concentrations found at depths of 50 feet to 70 feet. Monitoring continues at wells both on- and off-site to protect humans and the environment from Site-related contaminants. The main compound categories include VOCs and metals. The table in Appendix C lists all groundwater exceedances of the ES cleanup standard during the five-year monitoring period from 2018-2022. Table 5 lists the wells and sampling frequency.

Table 5: Groundwater Monitoring Plan

Well Name	On-site or off-site	Sample Frequency	
		VOCs	Metals
MW-1SR	Off	5	A
MW-2S	On	5	A
MW-2M	On	5	A
MW-4S	On	5	S
MW-5S	On	5	S
MW-6S	Off	A	A
MW-6M	Off	A	A
MW-7M	On	5	A
MW-8S	Off	A	A
MW-8M	Off	A	A
MW-9M	Off	5	A

Well Name	On-site or off-site	Sample Frequency	
		VOCs	Metals
MW-10M	Off	5	A
MW-11M	Off	5	A
MW-12S	Off	A	A
MW-14S	Off	A	A
MW-15M	Off	5	A
MW-16S	On	A	A
MW-16M	On	A	A
MW-17S	On	S	S
MW-17M	On	5	A
PZ-1	On	5	A
PZ-2	On	5	A
PZ-3	Off	5	A
PZ-4	Off	5	A
PZ-5	On	S	S
PZ-6	On	S	S
PW-7	Off	A	A
PW-2	Off	A	A
PW-3	Off	A	A
PW-4	Off	A	A
PW-5*	Off	A	A
PW-6*	Off	A	A

A= Annual sample; S = Semi-annual sample; 5 = Five-year report sample.
** Wells not shown on Site Map. Location is side gradient to the southeast.*

VOCs

VOC compounds are rarely detected in groundwater samples, particularly off-site. TMBs, which were added to the monitoring program in the 2012 ROD amendment, were detected most often and concentrations are similar to the last FYR. During the 2018-2022 review period, there were ES exceedances in on-site wells of 1,2,4-TMB and benzene. There were no VOC ES exceedances in wells outside of the DMZ or off-site wells during this review period.

- The ES for 1,2,4-TMB is 480 µg/L. There were 17 1,2,4-TMB ES exceedances in shallow on-site wells MW-4S, MW-5S, MW-17S, PZ-5. ES exceedances ranged from 521 µg/L in 2021 in well MW-4S to 1790 µg/L in 2021 in well MW-5S. There were no 1,2,4-TMB ES exceedances beyond the DMZ or in any off-site well during this review period. There were, however, five off-site detections of 1,2,4-TMB that were significantly below the ES, with the highest concentration being 7.3 µg/L in well MW-14S in 2021. There were six detections of 1,3,5-TMB that were significantly below the ES of 480, with the highest concentration being 36.9 µg/L in well PZ-5 in 2018.

- The ES for benzene is 5 µg/L. There were two benzene ES exceedances in on-site wells MW-16M and MW-17S. ES exceedances ranged from 10 µg/L in 2020 in well MW-16M to 20.3 µg/L in 2020 in well MW-17S. There were no off-site detections of benzene during this review period.

TMB concentrations remain above the ES at several wells within the Site area; however, they have migrated off-site to sentinel well MW-14S, directly adjacent to the DMZ. Concentrations at MW-14S are significantly below the ES (the high concentration in this review period was 7.3 µg/L), and more than an order of magnitude below on-site concentrations.

Petroleum VOCs do not appear to mobilize off-site and are likely being remediated through natural attenuation both inside and outside the landfill property. The low and inconsistent off-site concentrations of VOCs suggests that the remedy remains effective at controlling the VOC plume. Despite low off-site concentrations, monitoring at sentinel wells remains warranted, particularly for TMBs. On-site TMB concentrations remain similar to those reported in the previous FYR. While attenuation may be occurring, the source of TMBs does not appear to have diminished since the last FYR. Current concentrations inside the DMZ will take time to attenuate, despite robust MNA conditions.

Metals

During the 2018-2022 review period, most groundwater quality exceedances occurred among metals. Iron, and manganese consistently appear in groundwater on- and off-site. While arsenic slightly exceeds the ES at many on-site wells, it has rarely been detected off-site, suggesting that it has limited mobilization. Iron, while found at concentrations above the ES, is on the Wis. Admin. Code NR 140 Public Welfare list as a "secondary" standard and is considered to pose minimal health risks. Iron concentrations may help indicate ongoing natural attenuation conditions. While barium and cobalt are frequently detected, there was only one barium ES exceedance during this review period.

Manganese consistently appears above the ES in groundwater at 12 of 13 on-site wells, and it continues to be the primary focus of monitoring and remediation efforts at the Site. While the landfill cover reduces infiltration from precipitation, shallow groundwater likely contacts waste, promoting reducing conditions that may help to mobilize naturally occurring manganese, and other naturally occurring metals, off-site. Higher reducing conditions may exist due to the wetlands adjacent to the Site, which in turn mobilizes manganese already in the soil and water. Upgradient well MW-1S shows a sporadic ES exceedance, though at approximately ten-fold lower than most other off-site wells nearest the landfill. The highest concentrations continue to appear at downgradient (southwest) plume edge wells MW-6S, PZ-3 and PZ-4. Manganese isoconcentration maps are presented in Appendix C.

- The ES for arsenic is 10 µg/L. ES exceedances for arsenic are primarily in on-site wells.
    - There were 35 arsenic ES exceedances in on site wells MW-2M, MW-2S, MW-4S, MW-5S, MW-16M, MW-16S, MW-17M, MW-17S, PZ-2, PZ-5, and PZ-6. ES exceedances ranged from 10.4 µg/L in wells MW-5S and MW-17S in 2021 and 2018 respectively, to 34.2 µg/L in 2018 in well MW-16M.
    - In 2019, there were three arsenic ES exceedances in off-site wells MW-8M, PZ-3, and PZ-4. ES exceedances ranged from 11.3 µg/L in well PZ-4 to 14 µg/L in well PZ-3.

- The ES for iron is 300 µg/L.

- There were 20 iron ES exceedances in on site wells MW-16M, MW-16S, MW-17M, MW-17S, MW-2M, MW-2S, MW-4S, MW-5S, PZ-2, PZ-5, and PZ-6. ES exceedances ranged from 1,870 µg/L in 2020 in well MW-7M to 41,700 µg/L in 2020 in well MW-2S.
- There were 25 iron ES exceedances in off-site wells MW-11M, MW-14S, MW-14S, MW-15M, MW-1SR, MW-6S, MW-9M, PZ-3. ES exceedances ranged from 307 µg/L in 2019 in well MW-1SR to 5,200 µg/L in 2018 in well MW-14S.

- The ES for manganese is 300 µg/L.
  - There were 80 manganese ES exceedances in on site wells MW-16M, MW-16S, MW-17M, MW-17S, MW-2M, MW-2S, MW-4S, MW-5S, MW-7M, PZ-1, PZ-2, and PZ-5. ES exceedances ranged from 535 µg/L in 2022 in well MW-2S to 4,160 µg/L in 2021 in well PZ-2.
  - There were 51 manganese ES exceedances in off-site wells MW-10M, MW-11M, MW-14S, MW-15M, MW-1SR, MW-6M, MW-6S, MW-8M, MW-9M, PZ-3, and PZ-4. ES exceedances ranged from 325 µg/L in 2018 in well MW-1SR to 5,340 µg/L in 2020 in well MW-6S

- The ES for barium is 2000 µg/L. There was one barium ES exceedance of 2,410 µg/L in off-site wells MW-6M in 2020.

As noted earlier, a remedy for inorganics in groundwater has not been selected. While MNA of inorganics may eventually be an appropriate final remedy, data from Site wells are not currently sufficient to determine whether changes in redox conditions will adequately immobilize dissolved inorganics within a reasonable time and/or distance from the landfill. This FYR recommends an inorganics background study to better understand site conditions as it relates to the mobilization of manganese and other metals. Continued sampling and analysis of inorganics is necessary to determine whether MNA is likely to be feasible as an appropriate final remedy for inorganics.

Private wells

Private well sampling continues annually to protect local residents from potential contaminants in groundwater. Private well locations are depicted in Appendix B. PW-7 through PW-4 closely surround the landfill, just outside the DMZ. Only PW-2 and PW-7 are truly downgradient from the landfill.

There were 22 ES exceedances of metals in private wells and no VOC exceedances. The private wells had the following manganese exceedances:

- PW-2 had two exceedances of 614 and 665 µg/L;
- PW-5 had four exceedances ranging from 310-398 µg/L; and
- PW-6 and one exceedance of 407 µg/L.

In 2022, PW-2 had a manganese detection of 665 µg/L, which results in a Hazard Quotient (HQ) of 2[2]. All other manganese detections at PW-2 in the last ten years have an HQ of 1 or less, and there are no other COCs that have ES exceedances, thus there is no cumulative risk. While an HQ of <1 is recommended for acceptable risk, a single detection with an HQ of 2 does not warrant action at this time. As policy, EPA selects an HQ of 3 as the upper, target risk level for calculating non-cancer

[2] EPA typically reports HQ to one significant digit for non-cancer risk. In the case of the manganese at PW-2, the 665 µg/L detection equates to an HQ of 1.53, which has been rounded up to an HQ of 2.

Removal Management Levels[3]. However, monitoring will continue at this well and appropriate actions will be taken in the future as needed.

PW-6, which is new to the monitoring program and side-gradient to the southeast, had one ES exceedance of arsenic (14.7 µg/L) in 2019. This was the only time arsenic was detected in the private wells during the review period. Iron exceedances were found in all private wells except PW-2 and ranged from 786 to 1,130 µg/L. Iron is a substance of public welfare concern, and although found at concentrations above the ES in private wells, it poses minimal health risks. There were no other ES exceedances in the private wells during this review period. Due to the depth, location relative to groundwater flow and low level of the detections, the inorganic concentrations in the private wells are likely attributable to background. However, private well sampling will continue to be protective of nearby neighbors.

Landfill Gas Monitoring

Landfill gas monitoring is not required in any of the four decision documents (two RODs, two ESDs). However, landfill gas is monitored by the Town quarterly at seven passive gas vents around the landfill for oxygen percent and lower explosive limit (LEL) percent, which likely measures mostly methane. Monitoring data is included in Appendix D.

Landfill gas production, by measurement at the passive gas probes, appears negligible during this FYR period. In 20 rounds of methane testing at seven gas probes, LG-5 had two detects, both above the 20 percent of the LEL. No other detections occurred during the FYR timeframe. Landfill gas monitoring appears to show that little to no gas is being produced and is not a threat to receptors.

Surface Water

The December 2001 Site Natural Attenuation Plan established that "[surface water monitoring would be necessary at some future date only if contaminants are detected in wells near the river and wetland area (PZ-2, PZ-3, or PZ-4) at concentrations approaching State of Wisconsin Water Quality criteria." The WDNR Wastewater program was consulted during the previous FYR review to calculate Site-specific secondary fish and aquatic life values (acute and chronic) for manganese in surface water, which are included in Appendix E. WDNR did not calculate a human threshold value for manganese in surface water because manganese is non-carcinogenic and is not considered significantly bioaccumulative.

The Site-specific acute fish and aquatic life value calculated for manganese is 525 µg/L, and the chronic value is 29.2 µg/L. The RI estimated a dilution factor of 120 in the Black River during low flow periods. Multiplying the chronic secondary life value of 29.2 µg/L by 120 yields 3,504 µg/L. This value represents the concentration in groundwater, before discharging to surface water, that could trigger a surface water exceedance.

The chronic secondary life value for manganese in groundwater discharging to surface water was exceeded in 9 of 15 samples collected during this review period, and similar concentrations were detected in the previous review period. PZ-3 is located near a large area of often stagnant water that creates a reducing environment, which may result in dissolved manganese that is not attributable to the landfill.

[3] https://www.epa.gov/risk/regional-removal-management-levels-rmls-users-guide

Table 6: Manganese Concentrations in PZ-2, PZ-3, and PZ-4

Well	Date	Manganese Concentration *(µg/L)*
PZ-2	4/29/2021	4160
PZ-3	4/26/2022	4860
PZ-3	4/23/2018	4800
PZ-3	7/29/2020	4550
PZ-3	4/27/2021	4300
PZ-3	4/23/2019	3880
PZ-4	4/27/2021	3840
PZ-4	4/26/2022	3740
PZ-4	4/23/2019	3680

Due to these exceedances, this FYR recommends further evaluation of the ecological risk associated with chronic manganese exposures, including potentially collecting surface water and sediment samples.

Site Inspection

The Site inspection occurred on 10/7/2022. Appendix F contains the Site Inspection Form. In attendance were Kathleen Meier (EPA RPM), BJ LeRoy (WDNR Project Manager) and Amy Gahala (USGS Geologist). The inspection focused on reviewing Site conditions and the remedy's effectiveness. The Site is largely unchanged since the last FYR. Site features including the fence, cap and monitoring wells remain intact and in good condition. Leachate seeps do not appear evident. Vegetation remains thick and in good condition. The cap has well established vegetation. Mostly notably, the Site cap requires mowing and grubbing. Trees growing outside the waste edge do not appear to affect the cover. The driveway remains in decent repair, with only slight and normally expected cracks in asphalt. Fencing repairs recommended during the 5th FYR are complete and the fence encloses the landfill area. Five extraction wells and 29 air injection wells slated for abandonment during the 5th FYR were removed, and the abandonment areas have been covered by new vegetation.

V. TECHNICAL ASSESSMENT

QUESTION A: Is the remedy functioning as intended by the decision documents?

Question A Summary:

Yes. The review of documents, data, applicable or relevant and appropriate requirements (ARARs), risk assumptions, and the Site Inspection show that the remedy functions as intended in the decision documents. A final remedy for inorganic parameters, particularly manganese, has yet to be determined and supplemental investigatory work will be needed to ascertain whether additional actions should be taken to address inorganics in groundwater; if any such actions are found to be necessary, they will be addressed in a future decision document.

Remedial Action Performance

- The landfill cap, passive gas venting, MNA of VOCs in groundwater, and IC components of the Site remedy continue to operate and function as intended. Ongoing private water-supply sampling ensures that potential immediate threats to water-supply wells in close proximity to the landfill (including two private wells replaced as a partial remedy for inorganics in groundwater) will continue to be addressed.

- Data indicates that cleanup levels of VOCs in groundwater are on a path to be achieved within a reasonable time frame. 1,2,4-TMB is now the only VOC which persists above its ES, and only within the DMZ boundary. While there are 1,2,4-TMB detections outside of the DMZ, they are significantly below the ES.

- A final remedy for inorganics in groundwater has not yet been determined. With the exception of sporadic barium and arsenic exceedances, manganese is the only site-related COC for which the ES of 300 µg/L is exceeded beyond the DMZ boundary. While iron exceeds the ES in various wells, it is a secondary pollutant with little health hazard, and concentrations in upgradient and private wells show that iron is likely to be naturally occurring. Manganese detections in private wells are likely to be attributed to background concentrations.

- Due to exceedances of the chronic life value in surface water, further evaluation of the ecological risk associated with chronic manganese exposures is recommended, including potential collection of surface water and sediment samples based on the results of the evaluation.

Operation and Maintenance

- The landfill cap, gas system, and O&M appear effective and are up to date. Ongoing maintenance of the landfill cap and passive gas venting system by the Town, as implemented, is working in a manner that will continue to maintain the effectiveness of the remedy.

Institutional Controls and Other Measures

- ICs are in place and are proving to be effective in preventing exposure. Restrictive covenants have been recorded on Town-owned parcels within and adjacent to the landfill property.

- Access controls (i.e., fencing and warning signs) are in place and are effective in preventing exposure. No activities were observed that violate the intent of the current ICs. The cap and the surrounding area were in good repair, there were no signs of unauthorized access, and no new uses of groundwater were observed.

- A long-term stewardship plan is needed to ensure that the ICs are maintained, monitored, and enforced, and the IC map will be updated to depict the Environmental Protection Easement and Declaration of Restrictive Covenants recorded on 9/26/2013. A title evaluation for properties other than the landfill property to which ICs apply will be performed.

QUESTION B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action

objectives (RAOs) used at the time of the remedy selection still valid?

Question B Summary:

Yes. The exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy selection (including the original ROD, two ESDs, and a ROD Amendment) are still valid. The exposure assumptions used to develop the Human Health Risk Assessment for the Site included: ingestion of contaminated groundwater; ingestion of and/or dermal contact with on-site soils; and direct contact with contaminated surface waters or sediments due to recreational use of the Black River and wetlands area.

More details regarding the various factors considered in response to Question B are provided below.

Changes in Standards and To-Be-Considered

There have been no changes in standards or to-be-considered since the last remedy selection decision document for the Site, the 2012 ROD Amendment.

Changes in Toxicity and Other Contaminant Characteristics

The exposure assumptions used to develop the Human Health Risk Assessment (CH2MHill, 1990) included both current exposures and potential future exposures. There have been no changes in the toxicity factors for the COCs that were used in the baseline risk assessment. These assumptions are considered to be conservative and reasonable in evaluating risk and developing risk-based cleanup levels. No change to these assumptions or the cleanup levels developed from them is warranted. There has been no change to the standardized risk assessment methodology that could affect the protectiveness of the remedy.

The Baseline Ecological Risk Assessment (CH2MHill, 1990) suggested that there would be no adverse effects to wildlife in the area from the chemicals at the Site. However, due to exceedances of the chronic life value in surface water, this FYR recommends a manganese background study. Pending the outcome of the background study, further evaluation of the ecological risk associated with chronic manganese exposures may be recommended, including potentially collecting surface water and sediment samples.

The MNA remedy is progressing as expected for most VOCs, with on-going evaluation of progress toward TMB attenuation. A final remedy for inorganic compounds has not yet been determined.

Changes in Exposure Pathways

The potential for emerging contaminants 1,4-dioxane and PFAS in the groundwater need to be evaluated. This FYR recommends that groundwater sampling and analysis for PFAS, and an evaluation for the potential 1,4-dioxane in the landfill. The WDNR requested all open cases in the Remediation/Redevelopment program to complete an evaluation of emerging contaminants, with specific attention to 1,4-dioxane and PFAS compounds.

1,4-dioxane has not yet been evaluated as a potential COC at this Site and may be a potential contaminant at the Site, due to the wide variety of waste that goes into a municipal landfill. The prevalence of 1,4-dioxane in many common household products makes the likelihood of detects possible, even if minimal. The likelihood of a 1,4 dioxane issue at the Site would be more likely if a local manufacturer was producing solvents, paint products, cosmetics or soaps, antifreeze products, or pesticides. Research into local manufacturing history may provide insight into the potential presence of 1,4-dioxane. This FYR recommends evaluating 1,4-dioxane as a potential COC and determining whether further investigation is necessary to characterize this constituent.

PFAS compounds are more likely to exist in the landfill, due to widespread prevalence in everyday items, and the lack of breakdown potential. Industrial, commercial, and municipal wastes are considered mixed throughout the Onalaska Landfill fill area. Wastes known to be deposited at the Site include the following: metal cleaning wastes; paint residues; cardboard, wood, and paper waste; full drums of paint wastes; and plastic waste. Production of PFAS continues to occur in Wisconsin, with a long history of manufacturing in the state (although typically in Northeast Wisconsin). In 2022, EPA and WDNR agreed to move forward with contracting a PFAS investigation, including sampling at several downgradient wells, and several depths. As of 2023, WDNR is working on a package to solicit bids from local contractors for Quality Assurance Project Plan development and PFAS sampling.

Private wells PW-5 and PW-6 were added to the monitoring program to better characterize COC concentrations. Replaced private wells PW-2 and PW-3, and private wells PW-5 and PW-6, each had either one or two manganese exceedances during the FYR period. Due to the depth, location relative to groundwater flow from the Site, and low level of the detections, some inorganics concentrations, such as the exceedances of iron and exceedance of arsenic, in the private wells are likely attributable to background. Redox fronts moving through zones of the aquifer reduce naturally occurring coatings of arsenic, manganese, and iron present on aquifer matrix grains, i.e., sand and gravel. As a result, the coatings dissolve, leaving the passing groundwater enriched in dissolved metals. These dissolved metals are commonly used indicator parameters for redox conditions in groundwater and are consistent with reducing conditions typically observed downgradient of landfills. The same reducing conditions are commonly created in wetlands. Through decaying organic matter, the geochemical conditions of the soil will provide the conditions favorable for reduced iron and manganese compounds and other redox-sensitive metals such as arsenic. However, a comprehensive background study has not yet been completed and private well sampling will continue.

Expected Progress Toward Meeting RAOs

The MNA remedy is progressing as expected for VOCs. Continued sampling and analysis of inorganics is necessary to determine whether MNA is likely to be feasible as an appropriate final remedy for inorganics. The remedy components are operating and being maintained. Data on remedy progress are compiled, evaluated, and routinely reported to WDNR and EPA.

QUESTION C: Has any other information come to light that could call into question the protectiveness of the remedy?

No. No other information has come to light during the FYR process that could call into question the protectiveness of the remedy. There was no information generated during this FYR or other information due to impact from natural disasters or vulnerabilities related to climate change impacts that calls into question the protectiveness of the remedy.

VI. ISSUES/RECOMMENDATIONS

Issues/Recommendations
OU(s) without Issues/Recommendations Identified in the Five-Year Review:
None.

Issues and Recommendations Identified in the Five-Year Review:

OU(s): OU1 and Sitewide	**Issue Category:** Monitoring			
	Issue: Inorganic concentrations continue to exceed the ES standards; background inorganics concentrations should be better characterized.			
	Recommendation: An inorganics background study is recommended to determine whether off-site inorganic concentrations, especially manganese, are attributable to the site. This study will be used to inform the potential need for a remedy for inorganics.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	State	EPA	6/1/2026

OU(s): OU1 and Sitewide	**Issue Category:** Monitoring			
	Issue: 1,4-dioxane has not yet been evaluated as a potential COC at the Site.			
	Recommendation: Evaluate 1,4-dioxane as a potential COC and determine whether further investigation is necessary to characterize this constituent.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	State	EPA	3/30/2027

OU(s): OU1 and Sitewide	**Issue Category:** Monitoring			
	Issue: PFAS have not yet been evaluated as potential COCs at the Site.			
	Recommendation: Evaluate PFAS as potential COCs and determine whether further investigation is necessary to characterize these constituents.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	State	EPA	6/1/2024

OU(s): OU1 and Sitewide	**Issue Category:** Operations and Maintenance			
	Issue: Written long-term stewardship procedures are needed.			
	Recommendation: Develop a Long-term Stewardship Plan or amend the O&M Plan to incorporate procedures for long-term stewardship of ICs and implement.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	State	EPA	6/1/2027

OU(s): OU1 and Sitewide	Issue Category: Monitoring			
	Issue: Manganese Site-Specific Secondary Chronic Value for evaluation of groundwater concentration migrating to surface water was exceeded at three wells near the Black River.			
	Recommendation: Evaluate potential ecological risk associated with chronic manganese exposures, and potentially collect surface water and sediment samples based on the outcome of the evaluation.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	State	EPA	6/1/2027

OTHER FINDINGS

In addition, the following are recommendations that were identified during the FYR but do not affect current nor future protectiveness:

- WDNR will update the IC map to depict the Environmental Protection Easement and Declaration of Restrictive Covenants recorded on 9/26/2013. WDNR's milestone date for this recommendation is 6/1/2027.
- WDNR will perform a title evaluation for the other properties to which ICs apply as part of the IC follow-up actions. WDNR's milestone date for this recommendation is 6/1/2027.

VII. PROTECTIVENESS STATEMENT

OU1 and Sitewide Protectiveness Statement
Protectiveness Determination: Short-term Protective
Protectiveness Statement: The remedy at the Onalaska Municipal Landfill Superfund Site currently protects human health and the environment. The landfill cap, passive gas venting, MNA of VOCs, O&M activities, and ICs protect human health and the environment by preventing exposure to contaminants in the landfill and in groundwater. However, in order for the remedy to be protective in the long term, the following actions need to be taken to ensure protectiveness: • An inorganics background study is recommended to determine whether off-site inorganic concentrations, especially manganese, are attributable to the site. This study will be used to inform the potential need for a remedy for inorganics. • Evaluate 1,4-dioxane as a potential COC and determine whether further investigation is necessary to characterize this constituent. • Evaluate PFAS as potential COCs and determine whether further investigation is necessary to characterize these constituents. • Develop a Long-term Stewardship Plan or amend the O&M Plan to incorporate procedures for long-term stewardship of ICs and implement.

- Evaluate potential ecological risk associated with chronic manganese exposures, and potentially collect surface water and sediment samples based on the outcome of the evaluation.

VIII. NEXT REVIEW

The next FYR report for the Onalaska Municipal Landfill Superfund Site is required five years from the completion date of this review.

Appendix A – References

AMEC Environment & Infrastructure, Inc., 2013. Geochemical Interpretation of Manganese in Groundwater, Onalaska Landfill, Letter Report to Braun Intertec.

CH2MHill, 1990. Feasibility Study, Onalaska Municipal Landfill.

EPA, 1994. Superfund Preliminary Close-Out Report, Onalaska Municipal Landfill Site.

OS Group, 2018. Annual Landfill Monitoring Report.

OS Group, 2019. Annual Landfill Monitoring Report.

OS Group, 2020. Annual Landfill Monitoring Report.

OS Group, 2021. Annual Landfill Monitoring Report.

OS Group, 2022. Annual Landfill Monitoring Report.

S.S. Papadopulos & Associates, Inc., 2008. Evaluation of Monitored Natural Attenuation as a

Containment Remedy for the Onalaska Municipal Landfill Site.

U.S. District Court for the Western District of Wisconsin, Partial Consent Decree between the State of Wisconsin and the Town of Onalaska, Wisconsin, December 18, 1996.

EPA, Record of Decision, Selected Remedial Alternative for the Onalaska Municipal Landfill Site, August 14, 1990.

EPA, Explanation of Significant Difference. Onalaska Municipal Landfill Superfund Site, September 29, 2000.

EPA, Explanation of Significant Difference. Onalaska Municipal Landfill Superfund Site, November 13, 2001.

EPA and WDNR, 2012. ROD Amendment, Groundwater Operable Unit, Onalaska Municipal Landfill Superfund Site.

WDNR, 1997. Operation and Maintenance Plan, Onalaska Municipal Landfill Superfund Site.

WDNR, 2018. Fifth Five Year Review, Onalaska Municipal Landfill Superfund Site.

WDNR, 2013. Fourth Five Year Review, Onalaska Municipal Landfill Superfund Site.

WDNR, 2022. Bureau of Remediation and Redevelopment Tracking System (BRRTS), Onalaska Municipal Landfill Superfund Site.

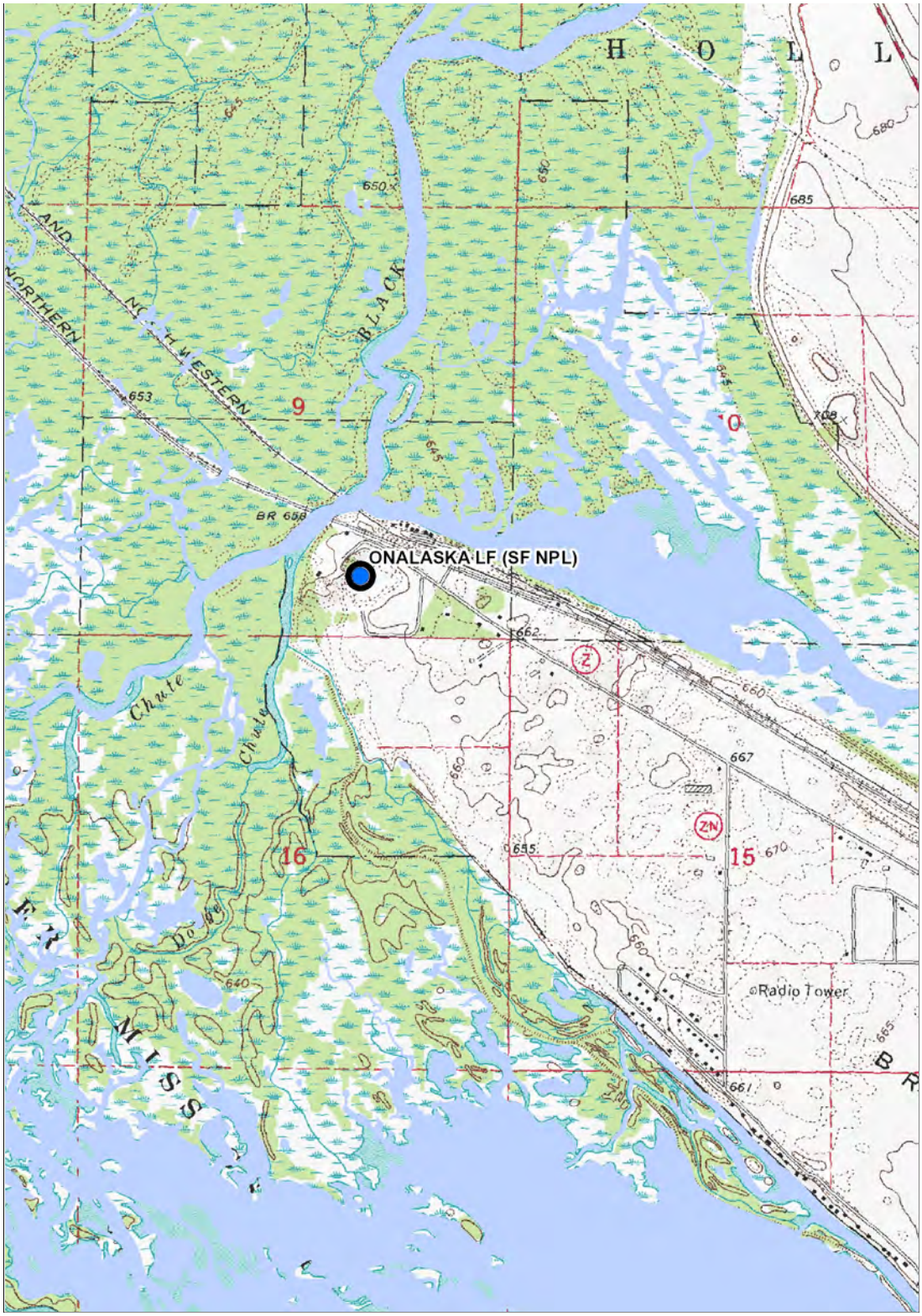
WDNR, 2022. Wisconsin Administrative Code NR 500.

WDNR. 2022. Wisconsin Administrative Code NR 700.

WDNR, 2022. Wisconsin Administrative Code NR 800.

Appendix B

Figure 1
Site Location Map



Legend

- Open Site
- Closed Site
- Continuing Obligations Apply
- Facility-wide Site
- Municipality
- State Boundaries
- County Boundaries
- Major Roads
  - Interstate Highway
  - State Highway
  - US Highway
- County and Local Roads
  - County HWY
  - Local Road
- Railroads
- Tribal Lands

0.8 0 Distance / 2 0.8 Miles

1: 23,760

NAD_1983_HARN_Wisconsin_TM

Note: Not all sites are mapped.

Notes

~830 ft.
PW-5 and PW-6

ABANDONED MONITORING WELL
MONITORING WELL
PIEZOMETER
EXTRACTION WELL
AIR WELL
POTABLE WELL

APPROXIMATE SITE BOUNDARY
APPROXIMATE LIMIT OF DESIGNATED MANAGEMENT ZONE
TREES
BLACK RIVER SHORELINE
LYTLE ROAD
STATE BIKE TRAIL
B.N.S.F. RAILROAD
COUNTY ROAD "Z"
SPORTSMANS CLUB ROAD
CANOE LANDING
PROCESS BUILDING
CONCRETE PIT
ASPHALT DRIVE
CLARIFIER
CROPLAND
PASTURE

MW-1SR
MW-1S
MW-1M
PW-4
PW-3
MW-2S
MW-2M
MW-2D
MW-4S
EW-1
EW-2
AW-28
AW-25
EW-3
AW-20
MW-16M
MW-5S
MW-16S
AW-1
EW-4
AW-13
AW-9
MW-17M
PZ-1
EW-5
MW-17S
PW-2
MW-14S
PZ-2
PZ-3
PZ-4
PZ-5
PZ-6
MW-7M
MW-12S
MW-8D
MW-8M
MW-8S
MW-15M
PW-1
MW-6S
MW-6M
MW-11M
MW-9M
MW-10M

100' 0 200'
SCALE: 1" = 200'

Site Plan View
Onalaska Municipal Landfill
Sportsman Club Road
Onalaska, WI

Base Dwg Provided By:
WISCONSIN DEPARMENT OF NATURAL RESOURCES

Project No:	1701119
Drawing No:	
Scale:	1" = 200'
Drawn By:	SJO
Date Drawn:	12/12/18
Checked By:	JCS
Last Modified:	12/13/18

Sheet: 1 of 1
Fig: 2

OnalaskaLandfill\WDNR_CADD\Onalaska_Landfill2\GW_As_Oct18

Appendix C - Exceedances of ES

Onalaska On-Site Exceedances from 2018-2022

Well Name	On/ Off	Sample Date	Parameter	Units	Result	NR140 ES	ES Exceed	Lab Code
MW-16M	On	4/27/2022	ARSENIC, DISSOLVED	ug/L	20.1	10	x	J
MW-16M	On	4/27/2022	IRON, DISSOLVED	mg/L	24.1	0.3	x	
MW-16M	On	4/27/2022	MANGANESE, DISSOLVED	ug/L	1710	300	x	
MW-16M	On	4/30/2021	ARSENIC, DISSOLVED	ug/L	28.6	10	x	
MW-16M	On	4/30/2021	IRON, DISSOLVED	mg/L	20.7	0.3	x	
MW-16M	On	4/30/2021	MANGANESE, DISSOLVED	ug/L	1420	300	x	
MW-16M	On	7/29/2020	ARSENIC, DISSOLVED	ug/L	24.4	10	x	J
MW-16M	On	7/29/2020	VINYL CHLORIDE IN WHOLE WATER SAM	ug/L	0.6	0.2	x	J
MW-16M	On	7/29/2020	BENZENE	ug/L	10	5	x	
MW-16M	On	7/29/2020	IRON, DISSOLVED	mg/L	14.6	0.3	x	
MW-16M	On	7/29/2020	MANGANESE, DISSOLVED	ug/L	949	300	x	
MW-16M	On	4/24/2019	ARSENIC, DISSOLVED	ug/L	25.4	10	x	
MW-16M	On	4/24/2019	IRON, DISSOLVED	mg/L	22.8	0.3	x	
MW-16M	On	4/24/2019	MANGANESE, DISSOLVED	ug/L	1400	300	x	
MW-16M	On	4/25/2018	ARSENIC, DISSOLVED	ug/L	34.2	10	x	
MW-16M	On	4/25/2018	IRON, DISSOLVED	mg/L	32.8	0.3	x	
MW-16M	On	4/25/2018	MANGANESE, DISSOLVED	ug/L	1920	300	x	
MW-16S	On	4/27/2022	IRON, DISSOLVED	mg/L	16.9	0.3	x	
MW-16S	On	4/27/2022	MANGANESE, DISSOLVED	ug/L	2050	300	x	
MW-16S	On	4/30/2021	IRON, DISSOLVED	mg/L	15.9	0.3	x	
MW-16S	On	4/30/2021	MANGANESE, DISSOLVED	ug/L	1820	300	x	
MW-16S	On	7/29/2020	IRON, DISSOLVED	mg/L	11.4	0.3	x	
MW-16S	On	7/29/2020	MANGANESE, DISSOLVED	ug/L	1390	300	x	
MW-16S	On	4/24/2019	ARSENIC, DISSOLVED	ug/L	18.7	10	x	J
MW-16S	On	4/24/2019	IRON, DISSOLVED	mg/L	13.7	0.3	x	
MW-16S	On	4/24/2019	MANGANESE, DISSOLVED	ug/L	1110	300	x	
MW-16S	On	4/25/2018	ARSENIC, DISSOLVED	ug/L	10.7	10	x	J
MW-16S	On	4/25/2018	IRON, DISSOLVED	mg/L	19.3	0.3	x	
MW-16S	On	4/25/2018	MANGANESE, DISSOLVED	ug/L	1690	300	x	
MW-17M	On	4/26/2022	ARSENIC, DISSOLVED	ug/L	10.7	10	x	J
MW-17M	On	4/26/2022	IRON, DISSOLVED	mg/L	5.27	0.3	x	
MW-17M	On	4/26/2022	MANGANESE, DISSOLVED	ug/L	791	300	x	
MW-17M	On	4/30/2021	IRON, DISSOLVED	mg/L	5.34	0.3	x	
MW-17M	On	4/30/2021	MANGANESE, DISSOLVED	ug/L	745	300	x	
MW-17M	On	7/27/2020	ARSENIC, DISSOLVED	ug/L	15.8	10	x	J
MW-17M	On	7/27/2020	IRON, DISSOLVED	mg/L	4.72	0.3	x	
MW-17M	On	7/27/2020	MANGANESE, DISSOLVED	ug/L	765	300	x	
MW-17M	On	4/24/2019	ARSENIC, DISSOLVED	ug/L	15.9	10	x	J
MW-17M	On	4/24/2019	IRON, DISSOLVED	mg/L	5.29	0.3	x	
MW-17M	On	4/24/2019	MANGANESE, DISSOLVED	ug/L	875	300	x	
MW-17M	On	4/25/2018	ARSENIC, DISSOLVED	ug/L	14.3	10	x	J
MW-17M	On	4/25/2018	IRON, DISSOLVED	mg/L	6.46	0.3	x	
MW-17M	On	4/25/2018	MANGANESE, DISSOLVED	ug/L	1110	300	x	
MW-17S	On	4/26/2022	IRON, DISSOLVED	mg/L	6.92	0.3	x	
MW-17S	On	4/26/2022	MANGANESE, DISSOLVED	ug/L	803	300	x	
MW-17S	On	10/19/2021	1,2,4-TMB	ug/L	847	480	x	
MW-17S	On	10/19/2021	IRON, DISSOLVED	mg/L	8.92	0.3	x	

MW-17S	On	10/19/2021	MANGANESE, DISSOLVED	ug/L	968	300	x	
MW-17S	On	4/30/2021	IRON, DISSOLVED	mg/L	7.34	0.3	x	
MW-17S	On	4/30/2021	MANGANESE, DISSOLVED	ug/L	804	300	x	
MW-17S	On	11/4/2020	ARSENIC, DISSOLVED	ug/L	18.2	10	x	J
MW-17S	On	11/4/2020	1,2,4-TMB	ug/L	1340	480	x	
MW-17S	On	11/4/2020	IRON, DISSOLVED	mg/L	9.86	0.3	x	
MW-17S	On	11/4/2020	MANGANESE, DISSOLVED	ug/L	1140	300	x	
MW-17S	On	7/27/2020	1,2,4-TMB	ug/L	1190	480	x	
MW-17S	On	7/27/2020	BENZENE	ug/L	20.3	5	x	
MW-17S	On	7/27/2020	IRON, DISSOLVED	mg/L	9.68	0.3	x	
MW-17S	On	7/27/2020	MANGANESE, DISSOLVED	ug/L	1160	300	x	
MW-17S	On	10/16/2019	ARSENIC, DISSOLVED	ug/L	14.7	10	x	J
MW-17S	On	10/16/2019	IRON, DISSOLVED	mg/L	7.67	0.3	x	
MW-17S	On	10/16/2019	MANGANESE, DISSOLVED	ug/L	1140	300	x	
MW-17S	On	4/24/2019	IRON, DISSOLVED	mg/L	8.65	0.3	x	
MW-17S	On	4/24/2019	MANGANESE, DISSOLVED	ug/L	1200	300	x	
MW-17S	On	10/24/2018	1,2,4-TMB	ug/L	1350	480	x	
MW-17S	On	10/24/2018	IRON, DISSOLVED	mg/L	11.1	0.3	x	
MW-17S	On	10/24/2018	MANGANESE, DISSOLVED	ug/L	1300	300	x	
MW-17S	On	4/25/2018	ARSENIC, DISSOLVED	ug/L	10.4	10	x	J
MW-17S	On	4/25/2018	IRON, DISSOLVED	mg/L	13.4	0.3	x	
MW-17S	On	4/25/2018	MANGANESE, DISSOLVED	ug/L	1540	300	x	
MW-17S	On	1/9/2018	ARSENIC, DISSOLVED	ug/L	18.3	10	x	J
MW-17S	On	1/9/2018	1,2,4-TMB	ug/L	1090	480	x	
MW-17S	On	1/9/2018	IRON, DISSOLVED	mg/L	16.3	0.3	x	
MW-17S	On	1/9/2018	MANGANESE, DISSOLVED	ug/L	1960	300	x	
MW-2M	On	4/27/2022	ARSENIC, DISSOLVED	ug/L	15.3	10	x	J
MW-2M	On	4/27/2022	IRON, DISSOLVED	mg/L	10.1	0.3	x	
MW-2M	On	4/27/2022	MANGANESE, DISSOLVED	ug/L	1030	300	x	
MW-2M	On	4/29/2021	ARSENIC, DISSOLVED	ug/L	18.2	10	x	J
MW-2M	On	4/29/2021	IRON, DISSOLVED	mg/L	9.75	0.3	x	
MW-2M	On	4/29/2021	MANGANESE, DISSOLVED	ug/L	906	300	x	
MW-2M	On	7/31/2020	ARSENIC, DISSOLVED	ug/L	17	10	x	J
MW-2M	On	7/31/2020	IRON, DISSOLVED	mg/L	10.2	0.3	x	
MW-2M	On	7/31/2020	MANGANESE, DISSOLVED	ug/L	893	300	x	
MW-2M	On	4/25/2019	ARSENIC, DISSOLVED	ug/L	23.2	10	x	J
MW-2M	On	4/25/2019	IRON, DISSOLVED	mg/L	13.7	0.3	x	
MW-2M	On	4/25/2019	MANGANESE, DISSOLVED	ug/L	1210	300	x	
MW-2M	On	4/26/2018	ARSENIC, DISSOLVED	ug/L	24.5	10	x	
MW-2M	On	4/26/2018	IRON, DISSOLVED	mg/L	9.15	0.3	x	
MW-2M	On	4/26/2018	MANGANESE, DISSOLVED	ug/L	822	300	x	
MW-2S	On	4/27/2022	IRON, DISSOLVED	mg/L	19	0.3	x	
MW-2S	On	4/27/2022	MANGANESE, DISSOLVED	ug/L	535	300	x	
MW-2S	On	4/29/2021	IRON, DISSOLVED	mg/L	32.7	0.3	x	
MW-2S	On	4/29/2021	MANGANESE, DISSOLVED	ug/L	946	300	x	
MW-2S	On	7/31/2020	IRON, DISSOLVED	mg/L	41.7	0.3	x	
MW-2S	On	7/31/2020	MANGANESE, DISSOLVED	ug/L	1170	300	x	
MW-2S	On	4/25/2019	ARSENIC, DISSOLVED	ug/L	27.6	10	x	
MW-2S	On	4/25/2019	IRON, DISSOLVED	mg/L	19.6	0.3	x	

MW-2S	On	4/25/2019	MANGANESE, DISSOLVED	ug/L	593	300	x	
MW-2S	On	4/26/2018	ARSENIC, DISSOLVED	ug/L	11.9	10	x	J
MW-2S	On	4/26/2018	IRON, DISSOLVED	mg/L	22.6	0.3	x	
MW-2S	On	4/26/2018	MANGANESE, DISSOLVED	ug/L	617	300	x	
MW-4S	On	4/26/2022	IRON, DISSOLVED	mg/L	6.78	0.3	x	
MW-4S	On	4/26/2022	MANGANESE, DISSOLVED	ug/L	618	300	x	
MW-4S	On	10/19/2021	1,2,4-TMB	ug/L	521	480	x	
MW-4S	On	10/19/2021	IRON, DISSOLVED	mg/L	8.96	0.3	x	
MW-4S	On	10/19/2021	MANGANESE, DISSOLVED	ug/L	822	300	x	
MW-4S	On	4/26/2021	IRON, DISSOLVED	mg/L	7.34	0.3	x	
MW-4S	On	4/26/2021	MANGANESE, DISSOLVED	ug/L	643	300	x	
MW-4S	On	11/4/2020	IRON, DISSOLVED	mg/L	7.52	0.3	x	
MW-4S	On	11/4/2020	MANGANESE, DISSOLVED	ug/L	638	300	x	
MW-4S	On	7/27/2020	IRON, DISSOLVED	mg/L	9.79	0.3	x	
MW-4S	On	7/27/2020	MANGANESE, DISSOLVED	ug/L	701	300	x	
MW-4S	On	10/16/2019	1,2,4-TMB	ug/L	878	480	x	
MW-4S	On	10/16/2019	IRON, DISSOLVED	mg/L	15	0.3	x	
MW-4S	On	10/16/2019	MANGANESE, DISSOLVED	ug/L	897	300	x	
MW-4S	On	4/24/2019	ARSENIC, DISSOLVED	ug/L	12.1	10	x	J
MW-4S	On	4/24/2019	IRON, DISSOLVED	mg/L	9.75	0.3	x	
MW-4S	On	4/24/2019	MANGANESE, DISSOLVED	ug/L	642	300	x	
MW-4S	On	10/24/2018	ARSENIC, DISSOLVED	ug/L	11.4	10	x	J
MW-4S	On	10/24/2018	IRON, DISSOLVED	mg/L	10	0.3	x	
MW-4S	On	10/24/2018	MANGANESE, DISSOLVED	ug/L	754	300	x	
MW-4S	On	4/26/2018	ARSENIC, DISSOLVED	ug/L	10.9	10	x	J
MW-4S	On	4/26/2018	1,2,4-TMB	ug/L	584	480	x	
MW-4S	On	4/26/2018	IRON, DISSOLVED	mg/L	11.9	0.3	x	
MW-4S	On	4/26/2018	MANGANESE, DISSOLVED	ug/L	892	300	x	
MW-4S	On	1/9/2018	IRON, DISSOLVED	mg/L	9.64	0.3	x	
MW-4S	On	1/9/2018	MANGANESE, DISSOLVED	ug/L	801	300	x	
MW-5S	On	4/25/2022	IRON, DISSOLVED	mg/L	18	0.3	x	
MW-5S	On	4/25/2022	MANGANESE, DISSOLVED	ug/L	1140	300	x	
MW-5S	On	10/19/2021	ARSENIC, DISSOLVED	ug/L	10.4	10	x	J
MW-5S	On	10/19/2021	1,2,4-TMB	ug/L	1790	480	x	
MW-5S	On	10/19/2021	IRON, DISSOLVED	mg/L	19.6	0.3	x	
MW-5S	On	10/19/2021	MANGANESE, DISSOLVED	ug/L	1350	300	x	
MW-5S	On	4/29/2021	IRON, DISSOLVED	mg/L	13.3	0.3	x	
MW-5S	On	4/29/2021	MANGANESE, DISSOLVED	ug/L	777	300	x	
MW-5S	On	11/4/2020	1,2,4-TMB	ug/L	1110	480	x	
MW-5S	On	11/4/2020	IRON, DISSOLVED	mg/L	16	0.3	x	
MW-5S	On	11/4/2020	MANGANESE, DISSOLVED	ug/L	1050	300	x	
MW-5S	On	7/27/2020	ARSENIC, DISSOLVED	ug/L	10.8	10	x	J
MW-5S	On	7/27/2020	1,2,4-TMB	ug/L	1090	480	x	
MW-5S	On	7/27/2020	IRON, DISSOLVED	mg/L	12.6	0.3	x	
MW-5S	On	7/27/2020	MANGANESE, DISSOLVED	ug/L	801	300	x	
MW-5S	On	10/16/2019	ARSENIC, DISSOLVED	ug/L	20	10	x	J
MW-5S	On	10/16/2019	1,2,4-TMB	ug/L	988	480	x	
MW-5S	On	10/16/2019	IRON, DISSOLVED	mg/L	19.6	0.3	x	
MW-5S	On	10/16/2019	MANGANESE, DISSOLVED	ug/L	1140	300	x	

MW-5S	On	4/24/2019	ARSENIC, DISSOLVED	ug/L	11.5	10	x	J
MW-5S	On	4/24/2019	1,2,4-TMB	ug/L	538	480	x	
MW-5S	On	4/24/2019	IRON, DISSOLVED	mg/L	19.6	0.3	x	
MW-5S	On	4/24/2019	MANGANESE, DISSOLVED	ug/L	1180	300	x	
MW-5S	On	10/24/2018	1,2,4-TMB	ug/L	1460	480	x	
MW-5S	On	10/24/2018	IRON, DISSOLVED	mg/L	14.8	0.3	x	
MW-5S	On	10/24/2018	MANGANESE, DISSOLVED	ug/L	1320	300	x	
MW-5S	On	4/25/2018	ARSENIC, DISSOLVED	ug/L	13.9	10	x	J
MW-5S	On	4/25/2018	1,2,4-TMB	ug/L	1020	480	x	
MW-5S	On	4/25/2018	IRON, DISSOLVED	mg/L	21.7	0.3	x	
MW-5S	On	4/25/2018	MANGANESE, DISSOLVED	ug/L	1390	300	x	
MW-5S	On	1/9/2018	ARSENIC, DISSOLVED	ug/L	17.6	10	x	J
MW-5S	On	1/9/2018	1,2,4-TMB	ug/L	1330	480	x	
MW-5S	On	1/9/2018	IRON, DISSOLVED	mg/L	18.6	0.3	x	
MW-5S	On	1/9/2018	MANGANESE, DISSOLVED	ug/L	1280	300	x	
MW-7M	On	4/25/2022	IRON, DISSOLVED	mg/L	1.9	0.3	x	
MW-7M	On	4/25/2022	MANGANESE, DISSOLVED	ug/L	696	300	x	
MW-7M	On	4/26/2021	IRON, DISSOLVED	mg/L	2.01	0.3	x	
MW-7M	On	4/26/2021	MANGANESE, DISSOLVED	ug/L	668	300	x	
MW-7M	On	7/27/2020	IRON, DISSOLVED	mg/L	1.87	0.3	x	
MW-7M	On	7/27/2020	MANGANESE, DISSOLVED	ug/L	670	300	x	
MW-7M	On	4/22/2019	IRON, DISSOLVED	mg/L	2.2	0.3	x	
MW-7M	On	4/22/2019	MANGANESE, DISSOLVED	ug/L	753	300	x	
MW-7M	On	4/23/2018	IRON, DISSOLVED	mg/L	2.39	0.3	x	
MW-7M	On	4/23/2018	MANGANESE, DISSOLVED	ug/L	778	300	x	
PZ-1	On	4/27/2022	MANGANESE, DISSOLVED	ug/L	1600	300	x	
PZ-1	On	4/29/2021	MANGANESE, DISSOLVED	ug/L	1190	300	x	
PZ-1	On	7/30/2020	MANGANESE, DISSOLVED	ug/L	1360	300	x	
PZ-1	On	4/24/2019	MANGANESE, DISSOLVED	ug/L	1560	300	x	
PZ-1	On	4/25/2018	MANGANESE, DISSOLVED	ug/L	2170	300	x	
PZ-2	On	4/27/2022	IRON, DISSOLVED	mg/L	20.9	0.3	x	
PZ-2	On	4/27/2022	MANGANESE, DISSOLVED	ug/L	3120	300	x	
PZ-2	On	4/29/2021	IRON, DISSOLVED	mg/L	36.1	0.3	x	
PZ-2	On	4/29/2021	MANGANESE, DISSOLVED	ug/L	4160	300	x	
PZ-2	On	7/30/2020	IRON, DISSOLVED	mg/L	24.4	0.3	x	
PZ-2	On	7/30/2020	MANGANESE, DISSOLVED	ug/L	3100	300	x	
PZ-2	On	4/23/2019	ARSENIC, DISSOLVED	ug/L	20.1	10	x	J
PZ-2	On	4/23/2019	IRON, DISSOLVED	mg/L	22.4	0.3	x	
PZ-2	On	4/23/2019	MANGANESE, DISSOLVED	ug/L	2560	300	x	
PZ-2	On	4/25/2018	IRON, DISSOLVED	mg/L	27.8	0.3	x	
PZ-2	On	4/25/2018	MANGANESE, DISSOLVED	ug/L	3190	300	x	
PZ-5	On	4/25/2022	IRON, DISSOLVED	mg/L	4.92	0.3	x	
PZ-5	On	4/25/2022	MANGANESE, DISSOLVED	ug/L	735	300	x	
PZ-5	On	10/19/2021	IRON, DISSOLVED	mg/L	5.59	0.3	x	
PZ-5	On	10/19/2021	MANGANESE, DISSOLVED	ug/L	889	300	x	
PZ-5	On	4/26/2021	IRON, DISSOLVED	mg/L	4.54	0.3	x	
PZ-5	On	4/26/2021	MANGANESE, DISSOLVED	ug/L	908	300	x	
PZ-5	On	11/4/2020	1,2,4-TMB	ug/L	535	480	x	
PZ-5	On	11/4/2020	IRON, DISSOLVED	mg/L	6.68	0.3	x	

PZ-5	On	11/4/2020	MANGANESE, DISSOLVED	ug/L	1050	300	x	
PZ-5	On	7/27/2020	IRON, DISSOLVED	mg/L	6.03	0.3	x	
PZ-5	On	7/27/2020	MANGANESE, DISSOLVED	ug/L	812	300	x	
PZ-5	On	10/16/2019	IRON, DISSOLVED	mg/L	5.06	0.3	x	
PZ-5	On	10/16/2019	MANGANESE, DISSOLVED	ug/L	626	300	x	
PZ-5	On	4/25/2019	ARSENIC, DISSOLVED	ug/L	15.2	10	x	J
PZ-5	On	4/25/2019	IRON, DISSOLVED	mg/L	5.22	0.3	x	
PZ-5	On	4/25/2019	MANGANESE, DISSOLVED	ug/L	709	300	x	
PZ-5	On	10/24/2018	IRON, DISSOLVED	mg/L	5.98	0.3	x	
PZ-5	On	10/24/2018	MANGANESE, DISSOLVED	ug/L	921	300	x	
PZ-5	On	4/23/2018	IRON, DISSOLVED	mg/L	6.54	0.3	x	
PZ-5	On	4/23/2018	MANGANESE, DISSOLVED	ug/L	1230	300	x	
PZ-5	On	1/9/2018	ARSENIC, DISSOLVED	ug/L	10.9	10	x	J
PZ-5	On	1/9/2018	IRON, DISSOLVED	mg/L	6.71	0.3	x	
PZ-5	On	1/9/2018	MANGANESE, DISSOLVED	ug/L	1280	300	x	
PZ-6	On	4/25/2019	ARSENIC, DISSOLVED	ug/L	13.9	10	x	J

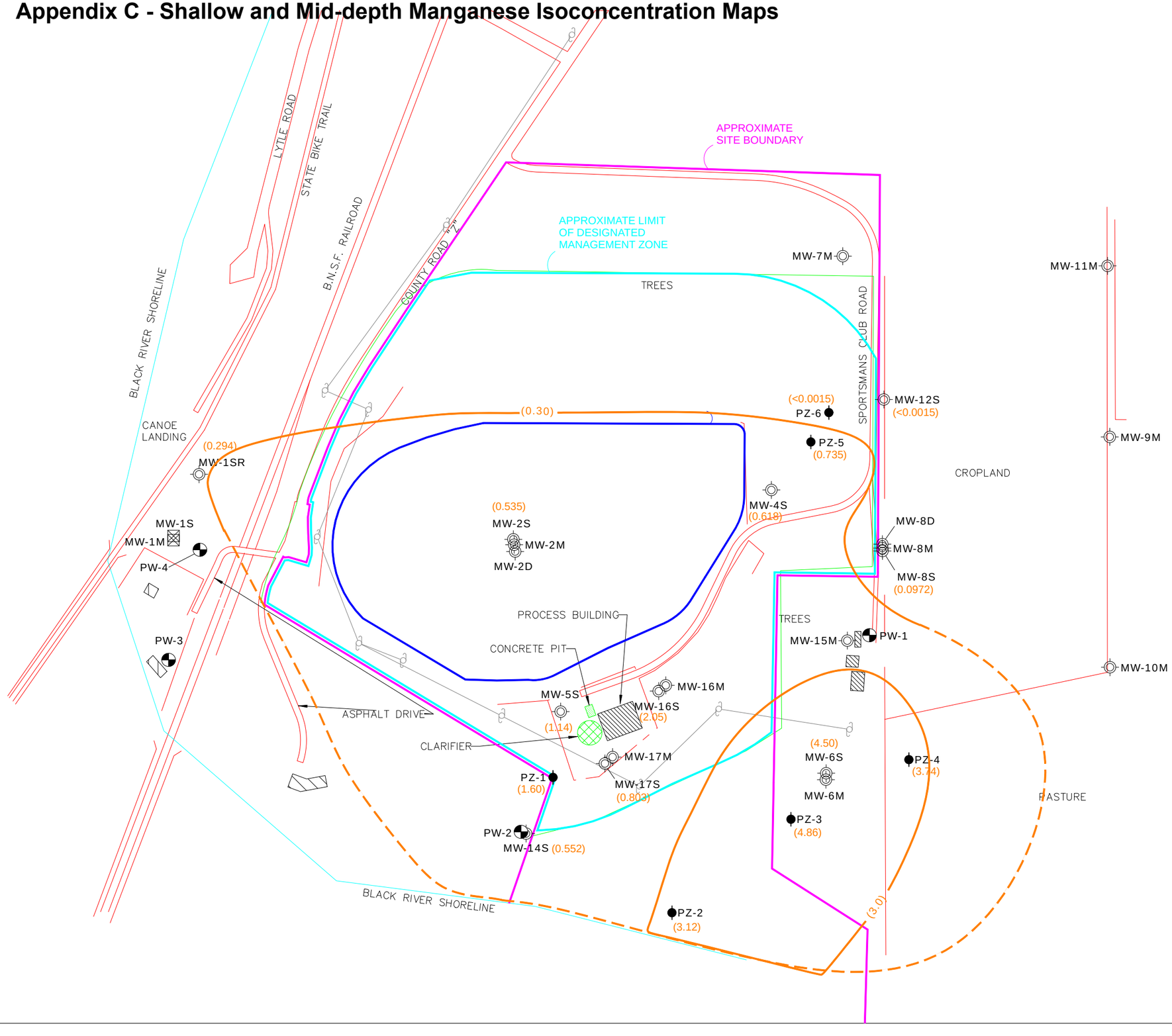
Onalaska Off-Site Exceedances from 2018-2022

Well Name	On/Off Site	Sample Date	Parameter	Units	Result	NR140 ES	ES Exceed	Lab Code
MW-10M	Off	4/26/2022	MANGANESE, DISSOLVED	ug/L	1620	300	x	
MW-10M	Off	4/27/2021	MANGANESE, DISSOLVED	ug/L	1260	300	x	
MW-10M	Off	7/30/2020	MANGANESE, DISSOLVED	ug/L	1370	300	x	
MW-10M	Off	4/23/2019	MANGANESE, DISSOLVED	ug/L	1740	300	x	
MW-10M	Off	4/24/2018	MANGANESE, DISSOLVED	ug/L	1790	300	x	
MW-11M	Off	4/28/2022	IRON, DISSOLVED	mg/L	3.52	0.3	x	
MW-11M	Off	4/28/2022	MANGANESE, DISSOLVED	ug/L	1310	300	x	
MW-11M	Off	4/27/2021	IRON, DISSOLVED	mg/L	3.07	0.3	x	
MW-11M	Off	4/27/2021	MANGANESE, DISSOLVED	ug/L	1190	300	x	
MW-11M	Off	7/30/2020	IRON, DISSOLVED	mg/L	2.54	0.3	x	
MW-11M	Off	7/30/2020	MANGANESE, DISSOLVED	ug/L	1080	300	x	
MW-11M	Off	4/24/2019	IRON, DISSOLVED	mg/L	3.47	0.3	x	
MW-11M	Off	4/24/2019	MANGANESE, DISSOLVED	ug/L	1200	300	x	
MW-11M	Off	4/24/2018	IRON, DISSOLVED	mg/L	3.61	0.3	x	
MW-11M	Off	4/24/2018	MANGANESE, DISSOLVED	ug/L	1260	300	x	
MW-14S	Off	4/27/2022	IRON, DISSOLVED	mg/L	4.19	0.3	x	
MW-14S	Off	4/27/2022	MANGANESE, DISSOLVED	ug/L	552	300	x	
MW-14S	Off	4/29/2021	IRON, DISSOLVED	mg/L	4.46	0.3	x	
MW-14S	Off	4/29/2021	MANGANESE, DISSOLVED	ug/L	646	300	x	
MW-14S	Off	7/30/2020	IRON, DISSOLVED	mg/L	5.12	0.3	x	
MW-14S	Off	7/30/2020	MANGANESE, DISSOLVED	ug/L	833	300	x	
MW-14S	Off	4/24/2019	IRON, DISSOLVED	mg/L	4.34	0.3	x	
MW-14S	Off	4/24/2019	MANGANESE, DISSOLVED	ug/L	612	300	x	
MW-14S	Off	4/25/2018	IRON, DISSOLVED	mg/L	5.2	0.3	x	
MW-14S	Off	4/25/2018	MANGANESE, DISSOLVED	ug/L	886	300	x	
MW-15M	Off	4/26/2022	MANGANESE, DISSOLVED	ug/L	1720	300	x	
MW-15M	Off	4/26/2021	IRON, DISSOLVED	mg/L	0.376	0.3	x	
MW-15M	Off	4/26/2021	MANGANESE, DISSOLVED	ug/L	1810	300	x	
MW-15M	Off	7/29/2020	IRON, DISSOLVED	mg/L	0.46	0.3	x	
MW-15M	Off	7/29/2020	MANGANESE, DISSOLVED	ug/L	3330	300	x	
MW-15M	Off	4/23/2019	MANGANESE, DISSOLVED	ug/L	2000	300	x	
MW-15M	Off	4/23/2018	MANGANESE, DISSOLVED	ug/L	2270	300	x	
MW-1SR	Off	4/27/2022	IRON, DISSOLVED	mg/L	0.418	0.3	x	
MW-1SR	Off	4/22/2019	IRON, DISSOLVED	mg/L	0.307	0.3	x	
MW-1SR	Off	4/26/2018	IRON, DISSOLVED	mg/L	0.42	0.3	x	
MW-1SR	Off	4/26/2018	MANGANESE, DISSOLVED	ug/L	325	300	x	
MW-6M	Off	4/26/2022	MANGANESE, DISSOLVED	ug/L	2110	300	x	
MW-6M	Off	4/27/2021	MANGANESE, DISSOLVED	ug/L	2810	300	x	
MW-6M	Off	7/29/2020	BARIUM, DISSOLVED	ug/L	2410	2000	x	
MW-6M	Off	7/29/2020	MANGANESE, DISSOLVED	ug/L	3960	300	x	
MW-6M	Off	4/23/2019	MANGANESE, DISSOLVED	ug/L	3190	300	x	
MW-6M	Off	4/24/2018	MANGANESE, DISSOLVED	ug/L	2150	300	x	
MW-6S	Off	4/26/2022	MANGANESE, DISSOLVED	ug/L	4500	300	x	
MW-6S	Off	4/27/2021	MANGANESE, DISSOLVED	ug/L	3770	300	x	
MW-6S	Off	7/29/2020	IRON, DISSOLVED	mg/L	0.415	0.3	x	
MW-6S	Off	7/29/2020	MANGANESE, DISSOLVED	ug/L	5340	300	x	
MW-6S	Off	4/22/2019	MANGANESE, DISSOLVED	ug/L	4280	300	x	
MW-6S	Off	4/24/2018	MANGANESE, DISSOLVED	ug/L	5010	300	x	

MW-8M	Off	4/28/2022	MANGANESE, DISSOLVED	ug/L	3640	300	x	
MW-8M	Off	4/26/2021	MANGANESE, DISSOLVED	ug/L	3080	300	x	
MW-8M	Off	7/29/2020	MANGANESE, DISSOLVED	ug/L	2580	300	x	
MW-8M	Off	4/22/2019	ARSENIC, DISSOLVED	ug/L	11.5	10	x	J
MW-8M	Off	4/22/2019	MANGANESE, DISSOLVED	ug/L	2270	300	x	
MW-8M	Off	4/23/2018	MANGANESE, DISSOLVED	ug/L	2800	300	x	
MW-9M	Off	4/28/2022	IRON, DISSOLVED	mg/L	2.51	0.3	x	
MW-9M	Off	4/28/2022	MANGANESE, DISSOLVED	ug/L	974	300	x	
MW-9M	Off	4/27/2021	IRON, DISSOLVED	mg/L	2.36	0.3	x	
MW-9M	Off	4/27/2021	MANGANESE, DISSOLVED	ug/L	870	300	x	
MW-9M	Off	7/30/2020	IRON, DISSOLVED	mg/L	2.33	0.3	x	
MW-9M	Off	7/30/2020	MANGANESE, DISSOLVED	ug/L	868	300	x	
MW-9M	Off	4/23/2019	IRON, DISSOLVED	mg/L	2.33	0.3	x	
MW-9M	Off	4/23/2019	MANGANESE, DISSOLVED	ug/L	866	300	x	
MW-9M	Off	4/24/2018	IRON, DISSOLVED	mg/L	2.53	0.3	x	
MW-9M	Off	4/24/2018	MANGANESE, DISSOLVED	ug/L	914	300	x	
PZ-3	Off	4/26/2022	IRON, DISSOLVED	mg/L	0.354	0.3	x	
PZ-3	Off	4/26/2022	MANGANESE, DISSOLVED	ug/L	4860	300	x	
PZ-3	Off	4/27/2021	IRON, DISSOLVED	mg/L	0.357	0.3	x	
PZ-3	Off	4/27/2021	MANGANESE, DISSOLVED	ug/L	4300	300	x	
PZ-3	Off	7/29/2020	IRON, DISSOLVED	mg/L	0.358	0.3	x	
PZ-3	Off	7/29/2020	MANGANESE, DISSOLVED	ug/L	4550	300	x	
PZ-3	Off	4/23/2019	ARSENIC, DISSOLVED	ug/L	14	10	x	J
PZ-3	Off	4/23/2019	MANGANESE, DISSOLVED	ug/L	3880	300	x	
PZ-3	Off	4/23/2018	IRON, DISSOLVED	mg/L	0.485	0.3	x	
PZ-3	Off	4/23/2018	MANGANESE, DISSOLVED	ug/L	4800	300	x	
PZ-4	Off	4/26/2022	MANGANESE, DISSOLVED	ug/L	3740	300	x	
PZ-4	Off	4/27/2021	MANGANESE, DISSOLVED	ug/L	3840	300	x	
PZ-4	Off	7/30/2020	MANGANESE, DISSOLVED	ug/L	3240	300	x	
PZ-4	Off	4/23/2019	ARSENIC, DISSOLVED	ug/L	11.3	10	x	J
PZ-4	Off	4/23/2019	MANGANESE, DISSOLVED	ug/L	3680	300	x	
PZ-4	Off	4/24/2018	MANGANESE, DISSOLVED	ug/L	3220	300	x	

Well Name	On/Off Site	Sample Date	Parameter	Units	Result	NR140 ES	ES Exceed	Lab Code
Private Well 2	Off	4/27/2022	MANGANESE, TOTAL	ug/L	665	300	x	
Private Well 2	Off	4/28/2021	MANGANESE, TOTAL	ug/L	614	300	x	
Private Well 3	Off	4/24/2019	IRON, TOTAL	mg/L	11.3	0.3	x	
Private Well 4	Off	4/28/2022	IRON, TOTAL	mg/L	4.65	0.3	x	
Private Well 4	Off	7/31/2020	IRON, TOTAL	mg/L	2.92	0.3	x	
Private Well 4	Off	4/23/2019	IRON, TOTAL	mg/L	6.83	0.3	x	
Private Well 4	Off	4/25/2018	IRON, TOTAL	mg/L	7.58	0.3	x	
Private Well 5	Off	4/27/2022	IRON, TOTAL	mg/L	1.01	0.3	x	
Private Well 5	Off	4/27/2022	MANGANESE, TOTAL	ug/L	380	300	x	
Private Well 5	Off	4/28/2021	IRON, TOTAL	mg/L	0.786	0.3	x	
Private Well 5	Off	7/30/2020	IRON, TOTAL	mg/L	0.954	0.3	x	
Private Well 5	Off	7/30/2020	MANGANESE, TOTAL	ug/L	310	300	x	
Private Well 5	Off	5/14/2019	MANGANESE, TOTAL	ug/L	398	300	x	
Private Well 5	Off	4/23/2019	IRON, TOTAL	mg/L	0.799	0.3	x	
Private Well 5	Off	4/23/2019	MANGANESE, TOTAL	ug/L	368	300	x	
Private Well 6	Off	4/28/2021	IRON, TOTAL	mg/L	1.39	0.3	x	
Private Well 6	Off	5/14/2019	MANGANESE, TOTAL	ug/L	407	300	x	
Private Well 6	Off	4/23/2019	ARSENIC, TOTAL	ug/L	14.7	10	x	J
Private Well 7	Off	4/26/2022	IRON, TOTAL	mg/L	5.73	0.3	x	
Private Well 7	Off	7/30/2020	IRON, TOTAL	mg/L	3.56	0.3	x	
Private Well 7	Off	4/23/2019	IRON, TOTAL	mg/L	5.44	0.3	x	
Private Well 7	Off	4/24/2018	IRON, TOTAL	mg/L	10.4	0.3	x	

Appendix C - Shallow and Mid-depth Manganese Isoconcentration Maps



The OS Group LLC

Groundwater Manganese Isoconcentration - Shallow - April 25 - 28, 2022
Onalaska Municipal Landfill
Sportsman Club Road
Onalaska, WI

Base Dwg Provided By:
WISCONSIN DEPARMENT
OF NATURAL RESOURCES

Project No:	1701119
Drawing No:	
Scale:	1" = 200'
Drawn By:	SJO
Date Drawn:	06/07/22
Checked By:	JCS
Last Modified:	06/07/22

Sheet: 1 of 1

Fig: 8

Groundwater Manganese Isoconcentration - Mid Depth - April 25-28, 2022
Onalaska Municipal Landfill
Sportsman Club Road
Onalaska, WI

ABANDONED MONITORING WELL

MONITORING WELL

PIEZOMETER

POTABLE WELL

(2.27) MANGANESE CONCENTRATION (mg/l)

Note: NR 140 Enforcement Standard for Manganese is 0.3 mg/l

APPROXIMATE SITE BOUNDARY

APPROXIMATE LIMIT OF DESIGNATED MANAGEMENT ZONE

BLACK RIVER SHORELINE

LYTLE ROAD

STATE BIKE TRAIL

B.N.S.F. RAILROAD

COUNTY ROAD "Z"

SPORTSMANS CLUB ROAD

CANOE LANDING

TREES

CROPLAND

PASTURE

PROCESS BUILDING

CONCRETE PIT

ASPHALT DRIVE

CLARIFIER

MW-1SR

MW-1S

MW-1M

PW-4

PW-3

MW-2S

MW-2M (1.03)

MW-2D

MW-4S

MW-5S

MW-16M (1.71)

MW-16S

MW-17M (0.791)

MW-17S

PZ-1

PW-2

MW-14S

PZ-2

PZ-3

PZ-4

PZ-5

PZ-6

MW-6S

MW-6M (2.11)

MW-7M (0.696)

MW-8D

MW-8M (3.64)

MW-8S

(3.0)

MW-9M (0.974)

MW-10M (1.62)

MW-11M (1.31)

MW-12S

MW-15M (1.81)

PW-1

(1.0)

N

100' 0 200'

SCALE: 1" = 200'

Base Dwg Provided By:
WISCONSIN DEPARMENT OF NATURAL RESOURCES

Project No: 1701119

Drawing No:

Scale:	1" = 200'
Drawn By:	SJO
Date Drawn:	06/07/22
Checked By:	JCS
Last Modified:	06/07/22

Sheet: 1 of 1

Fig: 9

Appendix D ***(only showing data tables for relevant five-year review period)***

BRAUN INTERTEC
The Science You Build On.

Braun Intertec Corporation
2309 Palace Street
La Crosse, WI 54603

Phone: 608.781.7277
Fax: 608.781.7279
Web: braunintertec.com

November 22, 2022 Project LC-07-04279A

Ms. Mary Rinehart, Town Clerk
Town of Onalaska
Town Hall
N5589 Commerce Road
Onalaska, WI 54650

Re: Third Quarter 2022 Onalaska Landfill Gas Monitoring
Onalaska Municipal Landfill Site
Onalaska, Wisconsin

Dear Ms. Rinehart:

Braun Intertec Corporation (Braun Intertec) is presenting gas-monitoring data for the referenced site. The landfill gas monitoring is based on requirements of item number 18 of the Consent Decree with the United States Environmental Protection Agency (USEPA). Item number 18 states that the "settling Defendant shall take explosimeter and oxygen readings at all landfill gas monitoring wells on a quarterly basis according to procedures to be established by USEPA and Wisconsin Department of Natural Resources (WDNR), unless approval is obtained from the USEPA in consultation with WDNR to perform such readings on a less frequent basis." Mr. Larry Lester of the WDNR—South Central Region Headquarters, provided the Consent Decree information to Braun Intertec.

On November 22, 2022, Braun Intertec personnel collected oxygen and explosimeter (LEL) readings at seven landfill gas monitoring wells, identified on the landfill gas piping map, for the Onalaska municipal landfill site as LG-1 through LG-7. November oxygen level readings at gas monitoring points LG-1, LG-2, LG-3, LG-4, LG-5, LG-6 and LG-7 were higher than the previous gas monitoring. Figure 1 depicts the oxygen level readings versus time. The LEL readings at gas monitoring points LG-1, LG-2, LG-3, LG-4, LG-5, LG-6 and LG-7 remained the same as the previous gas monitoring. Figure 2 depicts the LEL readings versus time. Tables 1A and 1B provide a historical summary of oxygen and LEL readings. The LEL and oxygen field readings, along with site observations, are provided on the Site Visit Sheet.

If you have any questions or comments regarding this project, please call David Bradshaw at 608.781.7277.

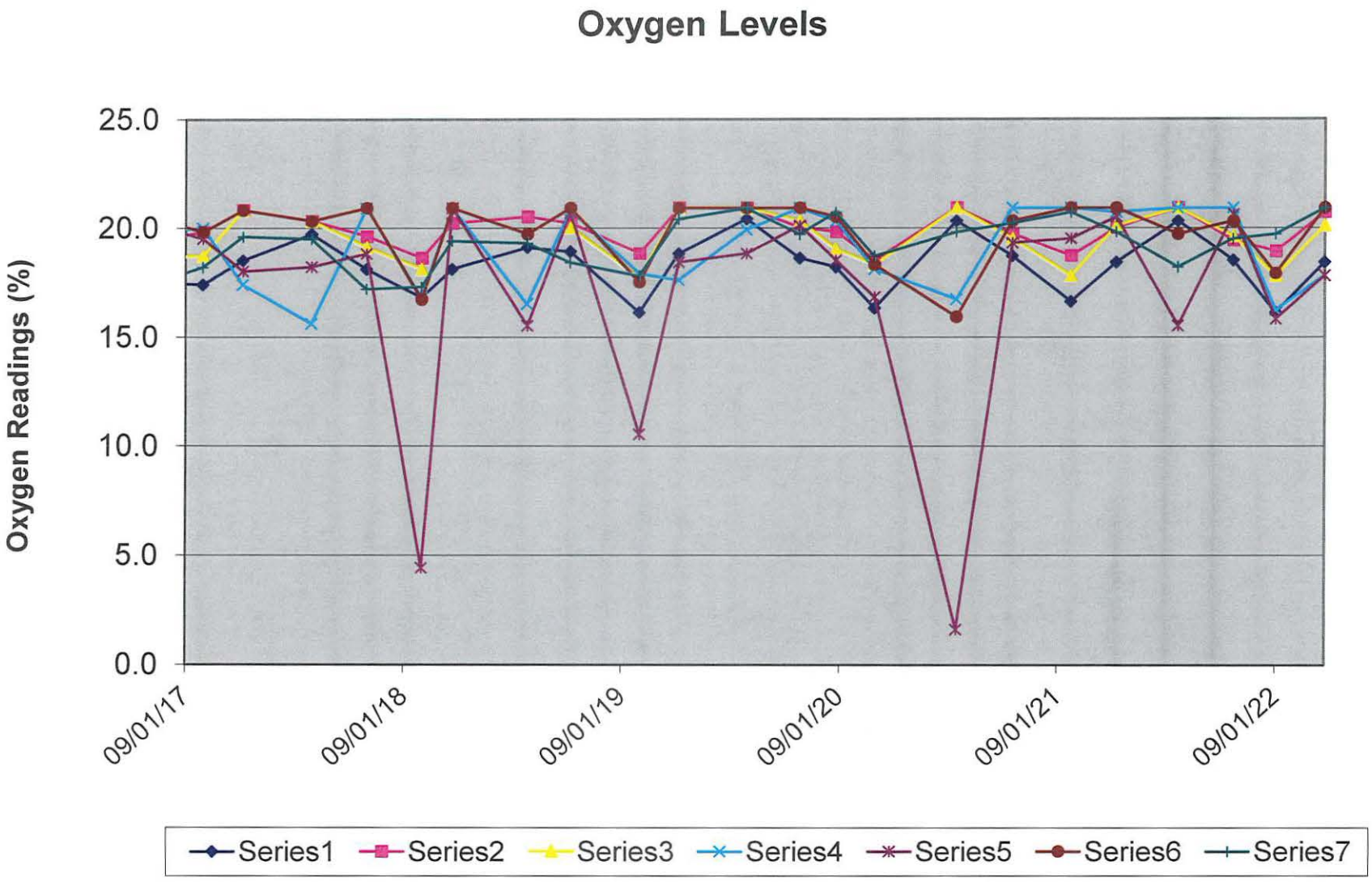
Sincerely,

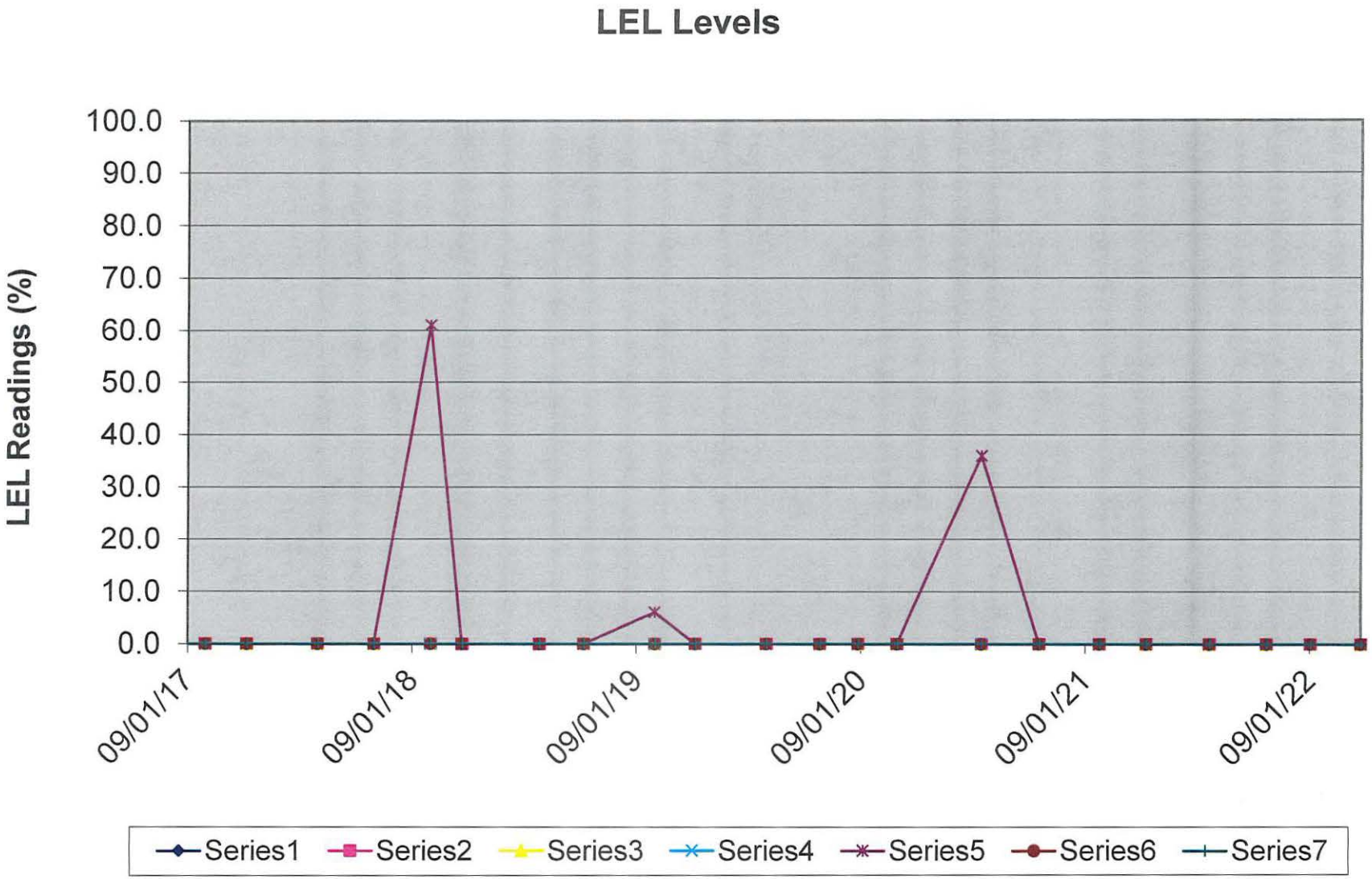
BRAUN INTERTEC CORPORATION

David M. Bradshaw
Environmental Field Scientist

Attachments:
Figure 1 - Oxygen Level Trends
Figure 2 - LEL Concentration Trends
Table 1A - Landfill Oxygen Monitoring Results
Table 1B - Landfill LEL Monitoring Results
Site Visit Sheet

AA/EOE


Oxygen Levels
Oxygen Readings (%)
25.0
20.0
15.0
10.0
5.0
0.0
09/01/17
09/01/18
09/01/19
09/01/20
09/01/21
09/01/22
Series1
Series2
Series3
Series4
Series5
Series6
Series7


LEL Levels
LEL Readings (%)
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
09/01/17
09/01/18
09/01/19
09/01/20
09/01/21
09/01/22
Series1
Series2
Series3
Series4
Series5
Series6
Series7

Onalaska Municipal Landfill
LC-07-04279

TABLE 1A
Landfill Gas Monitoring

Oxygen Readings (%)

Site Visit Date	Gas Monitoring Points						
	LG-1	LG-2	LG-3	LG-4	LG-5	LG-6	LG-7
06/29/11	18.3	20.5	19.5	18.0	15.4	19.3	18.5
09/30/11	15.4	19.6	17.9	20.8	13.3	18.8	18.5
12/07/11	19.2	20.9	21.9	20.1	19.7	20.9	20.4
03/28/12	19.8	20.8	20.7	20.9	20.8	20.8	19.8
06/26/12	17.9	19.9	19.2	14.5	3.7	14.9	18.1
09/30/12	16.6	20.4	18.6	17.9	4.4	20.1	19.3
12/20/12	19.9	20.9	20.1	17.6	10.4	16.4	19.8
03/27/13	20.0	20.5	20.0	20.3	20.8	20.8	19.8
06/28/13	18.2	20.2	19.4	20.7	16.5	19.9	17.0
09/25/13	17.2	20.1	19.0	19.8	17.0	20.3	19.1
12/05/13	18.3	20.4	20.9	20.5	16.8	20.8	19.7
03/14/14	19.9	20.7	20.7	20.6	18.4	20.3	20.2
06/10/14	18.9	20.1	19.9	20.5	18.3	20.1	18.7
10/01/14	16.4	18.8	18.1	18.3	9.4	18.1	17.3
12/12/14	18.7	20.8	20.5	20.4	20.1	20.7	19.8
03/30/15	19.9	20.5	20.5	20.8	17.2	20.0	20.0
06/03/15	20.8	20.4	19.7	17.3	8.5	18.4	19.6
09/10/15	16.0	19.3	17.9	14.8	13.7	16.4	18.0
12/05/15	18.4	20.3	20.8	20.4	20.8	20.8	20.3
03/29/16	19.7	20.8	20.8	19.3	18.7	20.8	20.1
08/03/16	16.6	19.0	18.2	18.7	14.0	19.5	16.4
09/29/16	14.2	18.4	20.7	20.3	15.7	18.5	16.0
12/02/16	17.6	19.9	19.7	20.3	18.5	19.5	18.6
03/31/17	19.8	20.5	20.6	18.7	18.4	19.8	20.1
07/14/17	17.5	19.4	18.7	19.8	20.1	20.4	17.5
09/29/17	17.4	19.8	18.7	20.0	19.5	19.8	18.2
12/05/17	18.5	20.8	20.8	17.4	18.0	20.8	19.6
03/30/18	19.7	20.3	20.3	15.6	18.2	20.3	19.5
06/30/18	18.1	19.6	19.1	20.9	18.8	20.9	17.2
09/30/18	16.8	18.6	19.1	16.8	4.4	16.7	17.3
11/20/18	18.1	20.2		20.9	20.9	20.9	19.4
03/26/19	19.1	20.5		16.5	15.5	19.7	19.3
06/06/19	18.9	20.2	20.0	20.8	20.7	20.9	18.4
09/30/19	16.1	18.8	17.7	17.9	10.5	17.5	17.8
12/05/19	18.8	20.9	20.9	17.6	18.4	20.9	20.4
03/28/20	20.4	20.9	20.9	19.9	18.8	20.9	20.9
06/25/20	18.6	20.0	20.3	20.9	20.1	20.9	19.7
08/25/20	18.2	19.8	19.0	20.3	18.5	20.5	20.7
10/29/20	16.3	18.5	18.3	18.1	16.8	18.3	18.7
03/15/21	20.3	20.9	20.9	16.7	1.6	15.9	19.8
06/17/21	18.7	19.7	19.5	20.9	19.3	20.3	20.2
09/23/21	16.6	18.7	17.8	20.9	19.5	20.9	20.7
12/08/21	18.4	20.0	20.1	20.7	20.5	20.9	19.8
03/21/22	20.3	20.9	20.9	20.9	15.5	19.7	18.2
06/22/22	18.5	19.4	19.6	20.9	20.6	20.3	19.5
09/01/22	16.1	18.9	17.8	16.2	15.8	17.9	19.7
11/22/22	18.4	20.7	20.1	17.8	17.8	20.9	20.9

Onalaska Municipal Landfill
LC-07-04279

TABLE 1B
Landfill Gas Monitoring

LEL Readings (%)

Site Visit Date	Gas Monitoring Points						
	LG-1	LG-2	LG-3	LG-4	LG-5	LG-6	LG-7
06/29/11	0.0	0.0	1.0	0.0	1.0	0.0	1.0
09/30/11	1.0	1.0	1.0	0.0	2.0	1.0	1.0
12/07/11	1.0	0.0	0.0	1.0	1.0	0.0	2.0
03/28/12	1.0	0.0	1.0	0.0	0.0	0.0	1.0
06/26/12	1.0	1.0	1.0	1.0	9.0	2.0	1.0
09/30/12	1.0	0.0	1.0	1.0	2.0	0.0	1.0
12/20/12	0.0	0.0	0.0	0.0	21.0	0.0	0.0
03/27/13	0.0	0.0	0.0	0.0	0.0	0.0	0.0
06/28/13	0.0	0.0	0.0	0.0	0.0	0.0	0.0
09/25/13	1.0	1.0	1.0	0.0	0.0	0.0	0.0
12/05/13	0.0	0.0	0.0	0.0	0.0	0.0	0.0
03/14/14	0.0	0.0	0.0	0.0	0.0	0.0	0.0
06/10/14	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10/01/14	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12/12/14	0.0	0.0	0.0	0.0	0.0	0.0	0.0
03/30/15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
06/03/15	0.0	0.0	0.0	0.0	33.0	0.0	0.0
09/10/15	0.0	0.0	0.0	0.0	12.0	0.0	0.0
12/05/15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
03/29/16	0.0	0.0	0.0	0.0	0.0	0.0	0.0
08/03/16	0.0	0.0	0.0	0.0	0.0	9.0	0.0
09/29/16	0.0	0.0	0.0	0.0	4.0	0.0	0.0
12/02/16	2.0	2.0	1.0	0.0	0.0	0.0	0.0
03/31/17	0.0	0.0	0.0	2.0	2.0	0.0	0.0
07/14/17	0.0	0.0	0.0	0.0	0.0	0.0	0.0
09/29/17	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12/05/17	0.0	0.0	0.0	0.0	0.0	0.0	0.0
03/30/18	0.0	0.0	0.0	0.0	0.0	0.0	0.0
06/30/18	0.0	0.0	0.0	0.0	0.0	0.0	0.0
09/30/18	0.0	0.0	0.0	0.0	61.0	0.0	0.0
11/20/18	0.0	0.0		0.0	0.0	0.0	0.0
03/26/19	0.0	0.0		0.0	0.0	0.0	0.0
06/06/19	0.0	0.0	0.0	0.0	0.0	0.0	0.0
09/30/19	0.0	0.0	0.0	0.0	6.0	0.0	0.0
12/05/19	0.0	0.0	0.0	0.0	0.0	0.0	0.0
03/30/20	0.0	0.0	0.0	0.0	0.0	0.0	0.0
06/25/20	0.0	0.0	0.0	0.0	0.0	0.0	0.0
08/25/20	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10/29/20	0.0	0.0	0.0	0.0	0.0	0.0	0.0
03/15/21	0.0	0.0	0.0	0.0	36.0	0.0	0.0
06/17/21	0.0	0.0	0.0	0.0	0.0	0.0	0.0
09/23/21	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12/08/21	0.0	0.0	0.0	0.0	0.0	0.0	0.0
03/21/22	0.0	0.0	0.0	0.0	0.0	0.0	0.0
06/22/22	0.0	0.0	0.0	0.0	0.0	0.0	0.0
09/01/22	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11/22/22	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Landfill Gas Monitoring
LC-07-04279A
Town of Onalaska

Date: 11 / 22/2022
Technician: David Bradshaw
Weather: Sunny, light breeze, 42°

Well Number	Time Monitored	Oxygen Readings	LEL Readings	Coments
LG-1	13:00	18.4	0.0	
LG-2	13:10	20.7	0.0	
LG-3	13:17	20.1	0.0	
LG-4	13:29	17.8	0.0	
LG-5	13:40	17.8	0.0	
LG-6	13:53	20.9	0.0	
LG-7	14:10	20.9	0.0	

Additional Notes

APPENDIX E

Fish and Aquatic Life Secondary Values For Manganese

Appendix E

Fish and Aquatic Life Secondary Values
Manganese
May 29th, 2015

Reviewed by
Sarah Yang

PART I: SECONDARY ACUTE VALUE

Step 1A) Find all acceptable acute toxicity test results

Species Scientific Name	Test Duration	LC50 (µg/L)	Reference
Daphnia magna	48 hr	40000	1
Daphnia magna	48 hr	9800	2
Daphnia magna	48 hr	4700	3
Daphnia magna	48 hr	20000	3
Daphnia magna	48 hr	22800	3
Daphnia magna	48 hr	32300	3
Daphnia magna	48 hr	34500	3
Daphnia magna	48 hr	56100	3
Asellus aquaticus	96-hr	333000	4
Crangonyx pseudogracilis	96-hr	694000	4
Orconectes limosus	96-hr	51000	5
Chironomus plumosus	96-hr	4200	6

Step 1B) Determine if database requirements are met

Database Requirement	Genus	Species	Common Name
1. Salmonid	None		
2. Secondary fish family	None		
3. Planktonic crustacean	Daphnia	*magna*	Waterflea
4. Benthic crustacean	Asellus Crangonyx Orconectes	*aquaticus* *pseudogracilis* *limosus*	Aquatic sowbug Scud Crayfish
5. Insect	Chironomus	*plumosus*	Midge
6. Chordata	None		
7. Rotifer, Annelid, Mollusc	None		
8. Other insect or mollusc	None		

3 out 8 requirements met.
Cannot calculated water quality criteria
Must calculate Secondary Value instead

Step 2) Calculate the species mean acute value (SMAV)

Species Scientific Name	LC50 (µg/L)		SMAV
Daphnia magna	40000 9800 4700 20000 22800 32300 34500 56100	Geomean ⟹	21880
Asellus aquaticus	333000	Geomean ⟹	333000
Crangonyx pseudogracilis	694000	Geomean ⟹	694000
Orconectes limosus	51000	Geomean ⟹	51000
Chironomus plumosus	4200	Geomean ⟹	4200

Step 3) Calculate the genus mean acute value (GMAV)

Species Scientific Name	SMAV		GMAV
Daphnia magna	21880	Geomean ⟹	21880
Asellus aquaticus	333000	Geomean ⟹	333000
Crangonyx pseudogracilis	694000	Geomean ⟹	694000
Orconectes limosus	51000	Geomean ⟹	51000
Chironomus plumosus	4200	Geomean ⟹	4200

Step 4) Assign each genus to its appropriate designated use classification

Species Scientific Name	GMAV	CW	WW	LFF	LAL
Daphnia magna	21880	X	X	X	X
Asellus aquaticus	333000	X	X	X	X
Crangonyx pseudogracilis	694000	X	X	X	X
Orconectes limosus	51000	X	X	X	X
Chironomus plumosus	4200	X	X	X	X

Step 5) Find the lowest GMAV for each designated use classification

Species Scientific Name	GMAV	CW	WW	LFF	LAL
Crangonyx pseudogracilis	694000	X	X	X	X
Asellus aquaticus	333000	X	X	X	X
Orconectes limosus	51000	X	X	X	X
Daphnia magna	21880	X	X	X	X
Chironomus plumosus	4200	X	X	X	X

Step 6) Determine the SAF

Number of MDRs met	SAF
1	21.9
2	13
3	8
4	7
5	6.1
6	5.2
7	4.3

Step 7) Calculate the Secondary Acute Value

	CW	WW	LFF	LAL
Lowest GMAV (µg/L):	4200	4200	4200	4200
SAF:	8	8	8	8
$\text{SAV } (\mu g/L) = \frac{\text{Lowest GMAV}}{\text{SAF}}$	525	525	525	525

PART II: SECONDARY CHRONIC VALUE

Step 1A) Find all acceptable chronic toxicity test results

Scientific Name	Test Duration	Effect	Endpoint	Mean (µg/L)	Reference*
Salmo trutta	30 d	Development	LOEC	742	7
Salmo trutta	30 d	Development	LOEC	805	7
Salmo trutta	30 d	Growth	NOEC	742	7
Salmo trutta	30 d	Growth	NOEC	805	7
Salmo trutta	62 d	Growth	NOEC	2780	8
Salmo trutta	62 d	Growth	NOEC	4550	8
Salmo trutta	62 d	Growth	LOEC	4410	8
Salmo trutta	62 d	Growth	LOEC	8680	8
Salmo trutta	62 d	Mortality	NOEC	510	8
Salmo trutta	62 d	Mortality	NOEC	4410	8
Salmo trutta	62 d	Mortality	LOEC	7380	8
Salmo trutta	62 d	Mortality	LOEC	8680	8
Salmo trutta	62 d	Mortality	LOEC	8810	8
Salmo trutta	62 d	Mortality	LOEC	16210	8

*Because of the limited amount of data available, data was not evaluated for acceptability outside of selecting for the appropriate endpoint, duration, and effects.

Step 1B) Determine if database requirements are met

Database Requirement	Genus	Species	Common Name
9. Salmonid	Salmo	*trutta*	Brown trout
10. Secondary fish family	None		
11. Planktonic crustacean	None		
12. Benthic crustacean	None		
13. Insect	None		
14. Chordata	None		
15. Rotifer, Annelid, Mollusc	None		
16. Other insect or mollusc	None		

1 out 8 requirements met.
Cannot calculated water quality criteria

Step 1C) Determine if the Acute-Chronic Ratio method can be used

Because chronic data is not available for any of the species with acute data, the ACR method cannot be used to calculate a chronic toxicity criterion.
A Secondary Chronic Value must be calculated instead.

Step 2) Calculate the Secondary Chronic Value

	CW	WW	LFF	LAL
SAV (µg/L):	525	525	525	525
Default ACR:	18	18	18	18
$SCV\ (\mu g/L) = \frac{SAV}{ACR}$	29.2	29.2	29.2	29.2

References

1. Bowmer, C.T., et al. 1998. The ecotoxicity and the biodegradability of lactic acid, alkyl lactate esters and lactate salts. Chemosphere 37(7):1317-1333.
2. Biesinger, K.E and G.M. Christensen. 1972. Effects of various metals on survival, growth, reproduction and metabolism of *Daphnia magna*. J. Fish. Res. Board Can. 29:1691-1700.
3. Baird, D.J., et al. 1991. A comparative study of genotype sensitivity to acute toxic stress using clones of *Daphnia magna* straus Ecotoxicol Environ. Safety 21 (3): 257-265.
4. Martin, T.R. and D.M. Holdich. 1986. The acute lethal toxicity of heavy metals to Peracarid crustaceans (with particular reference to freshwater Asellids and Gammarids. Water Research 20(9):1137-1147.
5. Boutet, C. and C Chaisemartin. 1973. Specific toxic properties of metallic salts in *Austropotamobius pallipes pallipes* and *Orconectes limosus*. C.R. Soc. Biol. (Paris) 167(12).1933-1938.
6. Vedamanikam, V.J. and N.A.M. Shazilli. 2008. Comparative Toxicity of Nine Metals to Two Malaysian Aquatic Dipterian Larvae with Reference to Temperature Variation. Bull Environ. Contamin. Toxicol. 80. 516-520.
7. Reader, J.P., et al. 1989. The Effects of Eight Trace Metals in Acid Soft Water on Survival, Mineral Uptake and Skeletal Calcium Deposition in Yolk-Sac Fry of Brown Trout, *Salmo trutta*. J. Fish Biol. 35.187-198.
8. Stubblefield,W A , et al 1997. Effects of Water Hardness on the Toxicity of Manganese to Developing Brown Trout (*Salmo trutta*). Environ. Toxicol. Chem 16(10): 2082-2089

Appendix F – Site Inspection Form

OSWER No. 9355.7-03B-P

Five-Year Review Site Inspection Checklist

(Working document for site inspection. Information may be completed by hand and attached to the Five-Year Review report as supporting documentation of site status. "N/A" refers to "not applicable.")

Site inspection completed by B.J. LeRoy (WDNR), Kathy Meier and Any Gahala (USEPA)

I. SITE INFORMATION	
Site name: Onalaska Landfill	**Date of inspection: October 7, 2022**
Location and Region: Onalaska,WI Region 5	**EPA ID:** WID980821656
Agency, office, or company leading the five-year review: Wisconsin DNR with EPA	**Weather/temperature: 55 degrees, sunny**

Remedy Includes: (Check all that apply)

- ☒ Landfill cover/containment
- ☒ Access controls
- ☒ Institutional controls
- ☐ Groundwater pump and treatment
- ☐ Surface water collection and treatment
- ☐ Other: _____
- ☒ Monitored natural attenuation
- ☐ Groundwater containment
- ☐ Vertical barrier walls

Attachments: ☐ Inspection team roster attached ☐ Site map attached

II. INTERVIEWS (Check all that apply)

1. **O&M site manager** ____ ___ ____
   Name Title Date
   Interviewed ☐ at site ☐ at office ☐ by phone Phone no. _____
   Problems, suggestions; ☐ Report attached ____ Annual reports submitted_____
   _____

2. **O&M staff** _____ _____ _____
Name Title Date
Interviewed ☐ at site ☐ at office ☐ by phone Phone no. _____
Problems, suggestions; ☐ Report attached _____
_____

3. **Local regulatory authorities and response agencies** (i.e., State and Tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds, or other city and county offices, etc.) Fill in all that apply.

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____
_____

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____
_____

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____
_____

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____
_____

4. **Other interviews** (optional) ☐ Report attached.

III. ON-SITE DOCUMENTS & RECORDS VERIFIED (Check all that apply)

1. **O&M Documents**
   O&M manual — Readily available — Up to date — ☐ N/A
   ☐ As-built drawings — Readily available — Up to date — ☐ N/A
   ☒ Maintenance logs — ☐ Readily available — ☐ Up to date — ☐ N/A
   ☒ Remarks____Submitted annually by contractor hired by WDNR.

2. **Site-Specific Health and Safety Plan** — ☐ Readily available — ☐ Up to date — ☐ N/A
   ☐ Contingency plan/emergency response plan — ☐ Readily available — Up to date — ☐ N/A
   Remarks__Held by contractor._____

3. **O&M and OSHA Training Records** — ☐ Readily available — ☐ Up to date — ☐ N/A
   Remarks_____Held by contractor_____

4. **Permits and Service Agreements**
   Air discharge permit — ☐ Readily available — ☒ Up to date — ☐ N/A
   ☐ Effluent discharge — ☐ Readily available — ☐ Up to date — ☐ N/A
   Waste disposal, POTW — Readily available — ☐ Up to date — ☐ N/A
   ☐ Other permits_____ ___ — ☐ Readily available — ☐ Up to date — ☐ N/A
   Remarks_____

5. **Gas Generation Records** — ☒ Readily Avaiable — ☒ Up to date — N/A
   Remarks_____Gas monitoring only. _____

6. **Settlement Monument Records** — ☐ Readily available — ☐ Up to date — ☐ N/A
   Remarks_____

7. **Groundwater Monitoring Records** — ☒ Readily available — ☒ Up to date — ☐ N/A
   Remarks_____

8. **Leachate Extraction Records** — Readily available — Up to date — ☐ N/A
   Remarks_____NA_____

9. **Discharge Compliance Records**
   ☐ Air — ☐ Readily available — ☐ Up to date — N/A
   ☐ Water (effluent) — ☐ Readily available — ☐ Up to date — ☐ N/A
   Remarks____NA_____

10. **Daily Access/Security Logs** — ☐ Readily available — ☐ Up to date — ☒ N/A
    Remarks_____

IV. O&M COSTS

1. **O&M Organization**
☐ State in-house ☒ Contractor for State
☐ PRP in-house ☐ Contractor for PRP
☐ Federal Facility in-house ☐ Contractor for Federal Facility
☐ Other_____
_____

2. **O&M Cost Records**
☒ Readily available ☒ Up to date
☒ Funding mechanism/agreement in place
Original O&M cost estimate_____ ☐ Breakdown attached

Total annual cost by year for review period if available

From__2017____ To__2022____ $12,000 (approximate annual cost) ☐ Breakdown attached
Date Date Total cost
From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost
From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost
From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost
From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost

3. **Unanticipated or Unusually High O&M Costs During Review Period**
Describe costs and reasons: ___Monitoring remains consistent._____
_____
_____
_____

V. ACCESS AND INSTITUTIONAL CONTROLS ☒ Applicable ☐ N/A

A. Fencing

1. **Fencing damaged** ☐ Location shown on site map ☐ Gates secured ☒ N/A
Remarks_____Fencing intact._____
_____

B. Other Access Restrictions

1. **Signs and other security measures** ☐ Location shown on site map ☐ N/A
Remarks____"No trespassing" signs intact._____
_____

C. Institutional Controls (ICs)

1. **Implementation and enforcement**

Site conditions imply ICs not properly implemented ☐ Yes ☒ No ☐ N/A
Site conditions imply ICs not being fully enforced ☐ Yes ☒ No ☐ N/A

Type of monitoring (*e.g.*, self-reporting, drive by) __Self-reporting, site inspection_____
Frequency _____Site is active and monitored daily. _____
Responsible party/agency ____WDNR (annual)__
Contact __BJ LeRoy ____ ____WDNR Project Manager_____10/7/2022_

Name	Title	Date	Phone no.

Reporting is up-to-date ☒ Yes ☐ No ☐ N/A
Reports are verified by the lead agency ☒ Yes ☐ No ☐ N/A

Specific requirements in deed or decision documents have been met ☒ Yes ☐ No ☐ N/A
Violations have been reported ☐ Yes ☐ No ☒ N/A
Other problems or suggestions: ☐ Report attached

_____
_____
_____
_____

2. **Adequacy** ☒ ICs are adequate ☐ ICs are inadequate ☐ N/A
Remarks_____
_____
_____

D. General

1. **Vandalism/trespassing** ☐ Location shown on site map ☒ No vandalism evident
Remarks_____
_____

2. **Land use changes on site**
Remarks_____No planned changes._____
_____

3. **Land use changes off site** ☒ N/A
Remarks_____

VI. GENERAL SITE CONDITIONS

A. Roads ☒ Applicable ☐ N/A

1. **Roads damaged** ☐ Location shown on site map ☐ Roads adequate ☐ N/A
Remarks_____Good condition and maintained._____
_____

B. Other Site Conditions

Remarks_____
_____
_____
_____

VII. LANDFILL COVERS X Applicable ☐ N/A

A. Landfill Surface

1. ☐ **Settlement** (Low spots) ☐ Location shown on site map X Settlement not evident
   Areal extent_____ Depth_____
   Remarks:

2. **Cracks** ☐ Location shown on site map X Cracking not evident
   Lengths_____ Widths_____ Depths_____
   Remarks_____
   _____

3. **Erosion** ☐ Location shown on site map X Erosion not evident
   Areal extent_____ Depth_____
   Remarks_____
   _____

4. **Holes** ☐ Location shown on site map X Holes not evident
   Areal extent_____ Depth_____
   Remarks_____
   _____

5. **Vegetative Cover** ☐ Grass X Cover properly established ☐ No signs of stress
   ☐ Trees/Shrubs (indicate size and locations on a diagram)
   ☐ Remarks_____Cover could use mowing/grubbing._____
   _____

6. **Alternative Cover (armored rock, concrete, etc.)** X N/A
   Remarks_____
   _____

7. **Bulges** ☐ Location shown on site map X Bulges not evident
   Areal extent_____ Height_____
   Remarks_____
   _____

8. **Wet Areas/Water Damage** ☒ Wet areas/water damage not evident
   - ☐ Wet areas — ☐ Location shown on site map — Areal extent_____
   - Ponding — ☐ Location shown on site map — Areal extent_____
   - ☐ Seeps — ☐ Location shown on site map — Areal extent_____
   - ☐ Soft subgrade — ☐ Location shown on site map — Areal extent_____

   Remarks_____

9. **Slope Instability** ☐ Slides ☐ Location shown on site map ☒ No evidence of slope instability
   Areal extent_____
   Remarks_____

B. Benches Applicable ☒ N/A

1. **Flows Bypass Bench** ☐ Location shown on site map ☒ N/A or okay
   Remarks_____

2. **Bench Breached** ☐ Location shown on site map ☒ N/A or okay
   Remarks_____

3. **Bench Overtopped** ☐ Location shown on site map ☒ N/A or okay
   Remarks_____

C. Letdown Channels ☐ Applicable ☒ N/A

1. **Settlement** ☐ Location shown on site map ☐ No evidence of settlement
   Areal extent_____ Depth_____
   Remarks_____

2. **Material Degradation** ☐ Location shown on site map ☐ No evidence of degradation
   Material type_____ Areal extent_____
   Remarks_____

3. **Erosion** ☐ Location shown on site map ☐ No evidence of erosion
   Areal extent_____ Depth_____
   Remarks_____

4. **Undercutting** ☐ Location shown on site map ☒ No evidence of undercutting
Areal extent_____ Depth_____
Remarks_____

5. **Obstructions** Type_____ ☒ No obstructions
☐ Location shown on site map Areal extent_____
Size_____
Remarks_____

6. **Excessive Vegetative Growth** Type_____
No evidence of excessive growth
☐ Vegetation in channels does not obstruct flow
☐ Location shown on site map
☐ Areal extent_____
☐ Remarks_____Site could use mowing/grubbing. _____

D. ~~Cover Penetrations~~ ☒ Applicable ~~N/A~~

1. **Gas Vents** ☐ Active ☒ Passive
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance
N/A
Remarks_____In place and maintained. _____

2. **Gas Monitoring Probes**
Properly secured/locked Functioning Routinely sampled Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☒ N/A
Remarks_____

3. **Monitoring Wells** (within surface area of landfill)
☒ Properly secured/locked ☒ Functioning ☒ Routinely sampled ☒ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A
Remarks_____

4. **Leachate Extraction Wells**
Properly secured/locked Functioning Routinely sampled Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☒ N/A
Remarks_____

5. **Settlement Monuments** ☐ Located ☐ Routinely surveyed ☐ N/A ☒
Remarks_____

E. Gas Collection and Treatment ☐ Applicable ☒ N/A

1. **Gas Treatment Facilities**
   Flaring ☐ ☐ Thermal destruction Collection for reuse
   ☐ Good condition ☐ Needs Maintenance
   Remarks_____ _____

2. **Gas Collection Wells, Manifolds and Piping**
   Good condition ☐ Needs Maintenance
   Remarks_____
   _____

3. **Gas Monitoring Facilities** (*e.g.*, gas monitoring of adjacent homes or buildings)
   ☐ Good condition ☐ Needs Maintenance ☒ N/A
   Remarks_____
   _____

F. Cover Drainage Layer ☐ Applicable ☒ N/A

1. **Outlet Pipes Inspected** ☐ Functioning ☐ N/A
   Remarks_____
   _____

2. **Outlet Rock Inspected** ☐ Functioning ☐ N/A
   Remarks_____
   _____

G. Detention/Sedimentation Ponds ☐ Applicable ☒ N/A

1. **Siltation** Areal extent_____ Depth_____ ☐ N/A
   ☐ Siltation not evident
   Remarks_____
   _____

2. **Erosion** Areal extent_____ Depth_____
   ☐ Erosion not evident
   Remarks_____
   _____

3. **Outlet Works** ☐ Functioning ☐ N/A
   Remarks_____
   _____

4. **Dam** ☐ Functioning ☐ N/A
   Remarks_____
   _____

H. Retaining Walls ☐ Applicable ☒ N/A

1. **Deformations** ☐ Location shown on site map ☐ Deformation not evident
   Horizontal displacement_____ Vertical displacement_____
   Rotational displacement_____
   Remarks_____

2. **Degradation** ☐ Location shown on site map ☐ Degradation not evident
   Remarks_____

I. Perimeter Ditches/Off-Site Discharge ☒ Applicable ☐ N/A

1. **Siltation** ☐ Location shown on site map Siltation not evident
   Areal extent_____ Depth_____
   Remarks_____

2. **Vegetative Growth** ☐ Location shown on site map ☒ N/A
   ☐ Vegetation does not impede flow
   Areal extent_____ Type_____
   Remarks_____

3. **Erosion** ☐ Location shown on site map ☒ Erosion not evident
   Areal extent_____ Depth_____
   Remarks_____

4. **Discharge Structure** Functioning ☒ N/A
   Remarks_____

VIII. VERTICAL BARRIER WALLS Applicable ☒ N/A

1. **Settlement** ☐ Location shown on site map ☐ Settlement not evident
   Areal extent_____ Depth_____ Remarks_____

2. **Performance Monitoring** Type of monitoring_____
   ☐ Performance not monitored
   Frequency_____ ☐ Evidence of breaching
   Head differential_____
   Remarks_____

IX. GROUNDWATER/SURFACE WATER REMEDIES Applicable X N/A

A. Groundwater Extraction Wells, Pumps, and Pipelines ☐ Applicable ☐ N/A

1. **Pumps, Wellhead Plumbing, and Electrical**

   Good condition All required wells properly operating ☐ Needs Maintenance ☐ N/A

   Remarks__Sumps, manholes and collection system operating as designed. __

2. **Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
   ☐Good condition ☐ Needs Maintenance
   Remarks_____

3. **Spare Parts and Equipment**
   ☐ Readily available ☐ Good condition ☐ Requires upgrade ☐ Needs to be provided
   Remarks_____NA_____

B. Surface Water Collection Structures, Pumps, and Pipelines ☒Applicable N/A

1. **Collection Structures, Pumps, and Electrical**
   Good condition ☐ Needs Maintenance
   Remarks_____

2. **Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
   ☐ Good condition ☐ Needs Maintenance
   Remarks_____NA_____

3. **Spare Parts and Equipment**
   ☐ Readily available ☐ Good condition☐ Requires upgrade ☐ Needs to be provided
   Remarks_____

C. Treatment System ☐ Applicable ☒ N/A

1. **Treatment Train** (Check components that apply)
   ☐ Metals removal ☐ Oil/water separation ☐ Bioremediation
   ☐ Air stripping ☐ Carbon adsorbers
   ☐ Filters_____
   ☐ Additive (*e.g.*, chelation agent, flocculent)_____
   ☐ Others_____
   ☐ Good condition ☐ Needs Maintenance
   ☐ Sampling ports properly marked and functional
   ☐ Sampling/maintenance log displayed and up to date
   ☐ Equipment properly identified
   ☐ Quantity of groundwater treated annually_____
   ☐ Quantity of surface water treated annually_____
   Remarks_____
   _____

2. **Electrical Enclosures and Panels** (properly rated and functional)
   ☐ N/A ☐ Good condition☐ Needs Maintenance
   Remarks_____
   _____

3. **Tanks, Vaults, Storage Vessels**
   ☐ N/A ☐ Good condition☐ Proper secondary containment ☐ Needs Maintenance
   Remarks_____
   _____

4. **Discharge Structure and Appurtenances**
   ☐ N/A ☐ Good condition☐ Needs Maintenance
   Remarks_____
   _____

5. **Treatment Building(s)**
   ☐ N/A ☐ Good condition (esp. roof and doorways) ☐ Needs repair
   ☐ Chemicals and equipment properly stored
   Remarks_____
   _____

6. **Monitoring Wells** (pump and treatment remedy)
   ☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
   ☐ All required wells located ☐ Needs Maintenance ☐ N/A
   Remarks_____
   _____

D. Monitoring Data

1. Monitoring Data
   ☒ Is routinely submitted on time ☒ Is of acceptable quality

2. Monitoring data suggests:
   Groundwater plume is effectively contained ☐ Contaminant concentrations are declining

D. Monitored Natural Attenuation

1. **Monitoring Wells** (natural attenuation remedy)
   ☒ Properly secured/locked ☒ Functioning ☒ Routinely sampled ☒ Good condition
   ☒ All required wells located ☐ Needs Maintenance ☐ N/A
   Remarks_____

X. OTHER REMEDIES

If there are remedies applied at the site which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

XI. OVERALL OBSERVATIONS

A. Implementation of the Remedy

Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.).

Based on field observation, the remedy appears to be in place designed. The cover is protective; the wells and gas monitoring systems operative and in good condition. The site surface water appears diverted, and the cover is in-tact and maintained. The site receives inspection every few years.

B. Adequacy of O&M

Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.

There do not appear to be any problems with O and M. Annual reports are documented, and reflect what was observed at the site. O and M will continue, as well as inspections by the WDNR.

C.	**Early Indicators of Potential Remedy Problems**
	Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs, that suggest that the protectiveness of the remedy may be compromised in the future. There are no indicators of remedy ineffectiveness based on field observations.
D.	**Opportunities for Optimization**
	Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy. The WDNR continues to evaluate the landfill monitoring for potential optimization.