



# **THIRD PERIODIC REVIEW REPORT FINAL**

**CENTRALIA LANDFILL  
Facility Site ID#: 1154  
Cleanup Site ID#: 2657**

**1411 South Tower Road  
Centralia, Washington 98531**

**Southwest Regional Office  
TOXICS CLEANUP PROGRAM**

**May 2021**

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## 1.0 INTRODUCTION

This document is a review by the Washington State Department of Ecology (Ecology) of post-cleanup site conditions and monitoring data at the Centralia Landfill. Ecology is the lead agency for cleanup of Centralia Landfill as stipulated by an agreement with Region 10 of the Environmental Protection Agency (EPA). Accordingly, cleanup at this Site was implemented under the Model Toxics Control Act (MTCA) regulations, Chapter 173-340 Washington Administrative Code (WAC)

The purpose of this periodic review is to determine whether the cleanup remedy at the City of Centralia's Landfill Superfund Site (Site) continues to be protective of human health and the environment. The second periodic review for this Site was conducted in September 2014.

Cleanup activities at this Site were completed under Cleanup Action Plan Consent Decree No. C91-5100 (T) WD (CD) between Ecology, Lewis County, City of Chehalis, City of Centralia, City of Morton, City of Mossyrock, Town of Pe Ell, and City of Vader, as executed in 2001. Additional filings were made under this Consent Decree to include a Remedial Investigation/Feasibility Study (RI/FS) and Cleanup Action Plan (CAP). The cleanup actions were necessary because of arsenic and manganese concentrations in groundwater. In addition, the remedy involved the containment of hazardous materials typically found in municipal solid waste landfills. Contaminants remaining at the Site exceed MTCA cleanup levels. The MTCA cleanup levels for soil were established under WAC 173-340-740. The MTCA cleanup levels for groundwater were established under WAC 173-340-720.

WAC 173-340-420 (2) requires that Ecology conduct a periodic review of a site every five years under the following conditions:

- (a) Whenever the department conducts a cleanup action.
- (b) Whenever the department approves a cleanup action under an order, agreed order or consent decree.
- (c) Or, as resources permit, whenever the department issues a no further action opinion (NFA).
- (d) and one of the following conditions exists:
  - 1. Institutional controls or financial assurance are required as part of the cleanup.
  - 2. Where the cleanup level is based on a practical quantitation limit.
  - 3. Where, in the department's judgment, modifications to the default equations or assumptions using site-specific information would significantly increase the concentration of hazardous substances remaining at the site after cleanup or the uncertainty in the ecological evaluation or the reliability of the cleanup action is such that additional review is necessary to assure long-term protection of human health and the environment.

When evaluating whether human health and the environment are being protected, the factors the department shall consider include [WAC 173-340-420(4)]:

- (a) The effectiveness of ongoing or completed cleanup actions, including the effectiveness of engineered controls and institutional controls in limiting exposure to hazardous substances remaining at the Site.
- (b) New scientific information for individual hazardous substances of mixtures present at the Site.
- (c) New applicable state and federal laws for hazardous substances present at the Site.
- (d) Current and projected Site use.
- (e) Availability and practicability of higher preference technologies.
- (f) The availability of improved analytical techniques to evaluate compliance with cleanup levels.

The department shall publish a notice of all periodic reviews in the Site Register and provide an opportunity for public comment.

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## 2.0 SUMMARY OF SITE CONDITIONS

### 2.1 Site Operational History

The Centralia Landfill is a closed municipal solid waste landfill located in the City of Centralia, Lewis County, Washington, in Section 17, Township 14N, and Range 2W of the Willamette Meridian. A vicinity map is available as Appendix 6.1. The unlined Landfill operated from 1958 until April 1, 1994. Originally, the Landfill encompassed adjacent property that is currently owned by the Centralia Christian School [formally owned by the Centralia Holding Corporation (CHC)] and Harold and Mary Vassar (Vassar), as well as the City of Centralia]. Because refuse has been placed on all three parcels of land, this area constitutes the Site.

The City of Centralia began operating the unlined Landfill in 1958. The closed Northend portion of the Landfill was filled from 1958 to 1965 using the "trench fill" method. With this method, trenches were excavated an estimated 40 feet wide by 300 feet long by 7 feet below ground surface (bgs). Waste was placed in the trenches and covered with 2 to 3 feet of soil. After completion of filling in the closed Northend area, the trench fill method continued in the northeast, southeast, and southwest areas and a final cover was placed over these areas in 1978; subsequently the operation was changed to an "area fill" method. With this method, waste was placed in lifts 3 to 8 feet thick above the ground surface, compacted, and covered with daily or intermediate cover soil of 0.5 to 1 foot thick. The area fill method continued over all of the Final Cover Area until the Site stopped accepting waste on April 1, 1994. A total of about 55 acres of the 87-acre Site have received the solid waste. The Final Cover Area encompasses about 46 acres and the Closed Northend area consists of about 12 acres. A Site plan is available as Appendix 6.2.

The Closed Northend Landfill refers to the northernmost fill area of the Site and is a separate fill area from the Final Landfill Closure Area. Filling in the Closed Northend Landfill area was completed prior to promulgation of solid waste regulations by Ecology in 1972 (Chapter 173-301 WAC). Lewis County Environmental Services determined in 1987 that this area was closed in compliance with WAC 173-301-611 for abandoned disposal sites. When the Landfill stopped accepting the waste in 1994, it received final closure with a permanent cover system.

To accommodate waste disposal after closure of the Landfill, the Lewis County Central Transfer Station facility was constructed on the Closed North end of the Landfill and began operation in 1994. In addition to the transfer station, the facility includes an administrative office building and a moderate risk waste facility (Hazo-Hut). Administrative Building No.1 and the Hazo-Hut were completed in 1996 and 1997, respectively. During the operational history of the Site, two other structures were built on or adjacent to the Closed Northend Landfill. In 1977, the City of Centralia sold 5 acres of Landfill property to United Graphics, Inc. On this property, a building was constructed immediately north of the waste boundary of the Closed Northend Landfill to house a check printing facility that operated until its closure in 1997. The Centralia Christian School purchased the property in March 1999 and opened a school. In about 1980, the City sold 1-2/3 acres of the Closed Northend Landfill property to Harold and Mary Vassar. The Vassar's

constructed a metal-framed building on the east side of the property and began operating a petroleum equipment servicing and underground storage tank removal company.

## 2.2 Regulatory History

Several regulatory actions led to the negotiation of a Consent Decree (CD) with Ecology requiring completion of a Remedial Investigation/Feasibility Study (RI/FS) and a Cleanup Action Plan (CAP) for the Centralia Landfill. These actions included:

- **Preliminary Assessment.** A potential hazardous waste Site Preliminary Assessment (PA) was conducted in October 1985 by Ecology in conjunction with the U.S. Environmental Protection Agency (EPA) to make an initial evaluation of the potential risk posed by the Site and to recommend possible additional actions.
- **Site Inspection.** EPA conducted a site inspection (SI) in 1986 because the PA screening indicated additional information was required to accurately profile the impact from landfill-derived contaminants on adjacent surface water and ground water.
- **Preliminary Health and Resource Assessment.** The U.S. Public Health Service Agency for Toxic Substances and Disease Registry (ATSDR) visited the Landfill on March 16, 1989, and issued a preliminary health assessment in April 1990.
- **National Priorities List.** On the basis of the PA and SI, the Centralia Landfill was scored in accordance with the federal Hazard Ranking System (HRS) and was determined to be a hazardous waste site resulting in the placement of the Site on the federal National Priorities List (NPL) and the Washington State Hazardous Sites List (HSL) in August 1990. At this time, Ecology was designated the lead agency for Site cleanup.

After the Centralia Landfill was listed on the NPL and HSL, Ecology, the Centralia Landfill Closure Group (CLCG), Vassar, and CHC entered into two consent decrees for the completion of interim actions and an RI/FS. The CLCG was formed under an inter-local agreement to oversee the remediation of the Site and is composed of the following jurisdictions: Lewis County, the City of Centralia, the City of Chehalis, the City of Morton, the City of Mossyrock, the City of Vader, and the Town of Pe Ell. In 1991, the CLCG, Vassar, and CHC entered into a CD (C91-5100) with Ecology to implement an interim action (hereafter termed the First Interim Action). The first interim action involved installing a temporary geomembrane cover and utilizing existing low-permeability soil to cover over portions of the landfill that had achieved final grade, installing a landfill gas collection system and temporary exhaust flare facility, installing a temporary leachate seep collection system associated with the temporary cover, upgrading surface water and erosion-control facilities, and constructing a fence around most of the Landfill property. In addition, a comprehensive leachate study was developed and conducted in 1992 and 1993 pursuant to the First Interim Action. The purpose of this study was to identify and evaluate near- and long-term leachate treatment and disposal options.

In March 1993, the CLCG, Vassar, and CHC entered into the RI/FS CD with Ecology. The RI/FS CD specifies the process whereby the CLCG is to conduct the RI/FS and Ecology prepared a CAP for

the Centralia Landfill. Ecology and the CLCG mutually agreed to delay the work on RI/FS to focus on completing the Landfill final cover system.

In 1994, the Landfill stopped accepting waste, and Ecology, the CLCG, Vassar, and CHC amended the Interim Action CD to include the implementation of a permanent landfill cover system over the Final Cover Area, as an interim cleanup action at the Landfill. The final cover system was designed and construction was completed by the end of 1995. The Landfill final cover system consists of a low-permeability composite cap placed over the refuse and associated engineering controls necessary to protect its integrity. These controls address:

- Surface water run-on/runoff and erosion
- Landfill gas collection and treatment
- Access restrictions

Remedial Investigation began in May 1996 and continued through June 1997. The field investigations included the installation of seven new groundwater monitoring wells, and sampling and analysis of groundwater, surface water, and sediment at the Site. A domestic well use survey was performed to determine the number and location of domestic supply wells within a one-mile radius of the Landfill. Five domestic wells located downgradient and/or cross gradient from the Landfill were sampled. The quality of groundwater from these wells did not appear to be impacted by Centralia Landfill. However, elevated levels of inorganic water quality parameters and metals were present in surface water and groundwater at the Site. Quarterly groundwater, surface water, and landfill gas monitoring are continuing at the Site in accordance with the Washington State Criteria for Municipal Solid Waste Landfills (Chapter 173-351 WAC).

### **2.3 Landfill Closure**

The final landfill cover was placed in 1994 as an Interim Action. The final landfill cover consisted of a composite geomembrane and low-permeability soil barrier layer, a drainage layer, and a vegetative soil layer. The final cover system was designed to eliminate infiltration of precipitation into refuse at the Site, and direct clean surface water runoff into a wetland enhancement and mitigation area south of the Landfill. In addition to the final cover system, a permanent landfill gas collection system was installed beneath the final cover, and a permanent landfill gas flare system was installed adjacent to the Landfill entrance facilities for gas treatment. Perimeter fencing was completed around the Landfill to enclose all of the Final Cover Area and much of the Closed Northend Landfill. The Landfill was closed according to the requirements of the Washington State Criteria for Municipal Solid Waste Landfills (Chapter 173-351 WAC). In addition, closure of the Landfill was an interim remedial action under MTCA.

The final remedial action was selected in 1999 as part of the CAP prescribed in the CD. The selected action determined that the closed Landfill would continue to be managed as required by the Washington State Criteria for Municipal Solid Waste Landfills (Chapter 173-351 WAC) and the Ecology approved operation & maintenance (O&M) manual. Post-closure activities include continued O&M of the landfill gas control system, maintenance of the final cover and

surface water control systems, and monitoring of groundwater and surface water. In addition, a wetlands mitigation plan would continue to be implemented. The selected action also provided for institutional controls and compliance monitoring. Institutional controls included establishment of Ecology-approved restrictive deed covenants to protect the final cover system and associated engineering controls. Monitoring would include the preparation and implementation of an Ecology-approved compliance monitoring plan that meets MTCA requirements and includes supplemental background groundwater monitoring.

## **2.4 Cleanup Levels**

Cleanup levels for surface water and groundwater were established using MTCA Method B (WAC 173-340-705) which references to applicable, relevant and appropriate requirements (ARARs) based on applicable state and federal laws in addition to providing methods for calculating cleanup levels on the basis of toxicity or carcinogenic risk.

### **2.4.1 Surface Water Cleanup Levels**

A surface water cleanup level for arsenic of 0.27 micrograms per liter ( $\mu\text{g/l}$ ) was calculated based on background concentrations. However, 0.27  $\mu\text{g/l}$  is less than the Practical Quantitation Limit (PQL). The PQL is the lowest concentration that can be reliably measured during routine laboratory operating conditions, using Ecology approved methods. In these cases when the cleanup level is less than the PQL, the cleanup level may be considered to be attained if the parameter is undetected at the PQL. The current PQL for arsenic is 0.5  $\mu\text{g/l}$ , and is defined as the compliance level for arsenic in surface water. Iron and manganese are other contaminants of concern for surface water at the Site. Since there are no surface water ARARs for iron or manganese, surface water cleanup levels are not needed for these parameters. Groundwater and surface water monitoring parameters and cleanup (reporting limit) and compliance levels (Table 5-3 and Table 4-2) are available in Appendix 6.3.

### **2.4.2 Surface Water Point of Compliance**

MTCA requires that the point of compliance for surface water be the point at which hazardous substances are released to surface waters of the state [WAC 173-340-730 (6)]. For the Centralia Landfill, the point of compliance for surface water is monitoring station SW-14, which is located in Weyerhaeuser Ditch at the southwest corner of the Site. This location is at a point just before flows into Weyerhaeuser Ditch pass the Site property boundary and discharge into the Salzer Creek (Appendix 6.1, Figure 1, Site Vicinity Map).

### **2.4.3 Groundwater Cleanup Levels and Point of Compliance**

Under WAC 173-340-720(1)(a), cleanup levels for groundwater are established on the basis of the highest beneficial use of the affected groundwater and the reasonable maximum exposure expected to occur under both current and potential future Site use conditions. The highest beneficial use of groundwater from both the Upper Unit and the Lower Unit is for drinking water. Therefore, cleanup levels were established based on exposure to hazardous substances

via ingestion of drinking water. In addition, contaminant concentrations in the Upper Unit must also protect nearby surface water because Upper Unit groundwater discharges to Weyerhaeuser Ditch and Salzer Creek. Cleanup levels for contaminants in the Upper Unit are established using MTCA Method B for groundwater and surface water [WAC 173-340-720(3) and WAC 173-340-730(3)]. Cleanup levels for contaminants in the Lower Unit are established using MTCA Method B for groundwater [WAC 173-340-720(3)].

#### **2.4.3.1 Upper Unit Cleanup Levels**

Since this unit discharges into surface water (Weyerhaeuser Ditch) near the Site, surface water and groundwater ARARs were considered to establish cleanup levels. Surface water ARARs were more stringent than groundwater ARARs for arsenic and were used to establish the cleanup level for arsenic. As discussed above, a compliance level of 0.5 µg/l is used for arsenic. Groundwater ARARs are the most stringent ARARs for the other contaminants. Cleanup levels for chloride, manganese, pH, sulfate, total dissolved solids, iron and zinc are established based on federal and state secondary maximum contaminant levels (MCLs) for drinking water, which are the most stringent ground water ARARs for these parameters. A list of cleanup levels for the Site is available as Appendix 6.3.

#### **2.4.3.2 Lower Unit Cleanup Levels**

Since this unit does not discharge to surface water near the Site, only groundwater ARARs were used to establish cleanup levels. Cleanup levels for manganese and iron are established based on federal and state secondary MCLs for drinking water. Since there is only one background monitoring well in the Lower Unit, continued and expanded background monitoring is needed to determine if background contaminant concentrations are higher than the cleanup levels established for the Lower Unit. If background concentrations of arsenic, iron, and/or manganese are higher than cleanup levels, background based alternative cleanup levels will be established in accordance with MTCA guidance. A table of cleanup levels is available in Appendix 6.3.

#### **2.4.3.3 Groundwater Point of Compliance**

The point of compliance for groundwater cleanup at the Centralia Landfill will be the existing property boundary.

### **2.5 Surface and Groundwater Conditions**

#### **2.5.1 Surface Water Conditions**

Runoff from the landfill surface collects in the Weyerhaeuser Ditch that discharges to Salzer Creek. In compliance with 1999 Compliance Monitoring Plan, the surface water monitoring consists of a single station, SW-14. This surface water station is located on the Weyerhaeuser Ditch at the southwest corner of the landfill just before water in the ditch flows off the landfill property boundary and discharges into Salzer Creek. As per the requirements of CAP/CD, surface water

sampling is being done biannually, first in March during the wet season and then again in September during the dry season.

During the latest monitoring events (2021 wet season), the surface water was sampled at SW-14 location. However, during the dry season, surface water was not sampled at SW 14, the point of compliance location. No water was present this dry season in the Weyerhaeuser Ditch. Monitoring in Salzer Creek upstream and downstream of the Landfill has not revealed impacts from the Landfill. The wet season sampling results of surface water monitoring in Weyerhaeuser Ditch indicated elevated levels of total and soluble arsenic, total iron, and total and soluble manganese at SW 14, the point of compliance, down gradient of the landfill. The detected total and dissolved arsenic concentrations of 0.00087 mg/l and 0.00062 mg/l, respectively at the point of compliance, exceeded its cleanup level of 0.00027 mg/l as well as the compliance level of 0.0005 mg/l. There are no surface water cleanup levels/ARARs for iron or manganese. Total mercury was not detected (below the laboratory detection limit of 0.00002 mg/l) during this sampling event. However, mercury was detected only once during the RI but is a concern because it has been sporadically detected during historical surface water sampling and testing. Potential risks to aquatic organisms were identified for total mercury.

Historical Weyerhaeuser Ditch surface water monitoring data show that there are concentrations of total cadmium, total copper, total lead, total silver, and total zinc. However, the ARARs for these metals apply to the soluble form of the metal. Soluble metals concentrations have exceeded ARARs on only rare occasions. However, continued monitoring is being conducted on Ecology approved frequency to ensure that these metals are not present in concentrations that are an environmental concern. The 2021 wet season surface water sampling results are available as Appendix 6.4.

## **2.5.2 Groundwater Conditions**

The compliance groundwater monitoring is being conducted in a network of seventeen (17) monitoring wells. Eleven monitoring wells are completed in shallow Upper Unit (B-1SU, B-1S, B-2SU, B-2S, MW-1S, MW-2SU, MW-2S, MW-3S, MW-4S, MW-5S, and MW-CNE-1S) and 7 wells are completed in the Lower Unit (B-6DR, B-8DR, MW-1D, MW-2D, MW-3D, and MW-CNE-1D). The shallow Upper Unit and Lower Unit monitoring well locations are shown on Figure 2 and Figure 5 in Appendix 5.

### **2.5.2.1 Upper Groundwater Unit**

The results of groundwater monitoring in the Upper Unit during the RI in 1996-1997, indicated elevated levels of conductivity, chloride, and soluble arsenic, iron, and manganese downgradient of the Landfill. Of these contaminants, arsenic and manganese were identified as potential risks to human health from the consumption of groundwater. An analysis of risks associated with groundwater flow into surface water indicate that arsenic also poses potential risks to human health in surface water through the consumption of water and organisms. Soluble arsenic is present in the upgradient Upper Unit groundwater monitoring wells, but at lower concentrations than those detected downgradient of the Landfill.



Historically, mercury has been inconsistently detected in Upper Unit groundwater monitoring wells. During the RI, four rounds of groundwater monitoring were performed. No mercury was detected in any Upper Unit monitoring wells during round 1 and round 2 of monitoring. However, during round 3, mercury was detected in eight monitoring wells (including all 3 upgradient wells) at concentrations at or just above the method detection limit of 0.1 µg/l. During round 4, mercury was detected only in one well at a concentration of 0.11 µg/l. Since the RI was completed, mercury was detected only one time at a concentration exceeding the cleanup level. In May 2000, mercury was detected in monitoring well B-1S at 160 µg/l. All other sampling events at B-1S have not detected mercury above laboratory detection limits.

### **2.5.2.2 Lower Groundwater Unit**

The results of groundwater monitoring in the Lower Unit during the RI in 1996-1997, identified elevated levels of soluble arsenic, manganese, and iron in both upgradient and downgradient monitoring wells. The range of concentrations for these contaminants is similar for upgradient and downgradient monitoring wells. During the third round of RI groundwater monitoring, mercury was detected at or just above the 0.1 µg/l method detection limit in four of the five Lower Unit monitoring wells (including the upgradient monitoring well).

Five private supply wells identified during the domestic well use survey were sampled and analyzed during the RI. Total metals concentrations in these supply wells near the Site (two located downgradient, and three cross gradient of the Landfill) were compared to MCLs for drinking water. Total iron exceeded the 300 µg/l secondary MCL in all of the water supply wells during each RI monitoring round, and total manganese exceeded the 50 µg/l secondary MCL in all but one of the water supply wells during each RI monitoring round. Total cadmium exceeded the 5 µg/l MCL in one well during one monitoring round, but was undetected during the other three rounds of RI monitoring. In addition to the five private supply wells sampled, six additional private supply wells located upgradient of the landfill were sampled and analyzed for total and soluble arsenic. Arsenic concentrations in all monitoring and supply wells exceed the 0.06 µg/l MTCA Method B cleanup level. The range of concentrations of soluble arsenic and manganese is similar in both the supply wells and Lower Unit monitoring wells. However, there appears to be higher soluble iron concentrations in the water supply wells than in Lower Unit monitoring wells. Of the contaminants identified in Lower Unit groundwater, arsenic and manganese were identified as potential risks to human health.

During the third round of RI groundwater monitoring, mercury was detected at or just above the 0.1 µg/l method detection limit in two supply wells, both located cross gradient of the Landfill. Mercury concentrations detected in Lower Unit monitoring and supply wells are well below the 2 µg/l primary MCL, which is the applicable ARAR for Lower Unit ground water.

## **2.6 Latest Rounds of Groundwater and Landfill Gas Monitoring**

During the most recent biannual dry and wet seasons, groundwater and landfill gas monitoring were conducted during the second and fourth quarter of 2020. Seventeen (17) groundwater monitoring wells (11 shallow Upper Aquifer and 6 Lower Aquifer) were sampled. All

groundwater samples were analyzed for alkalinity, ammonia, chloride, chemical oxygen demand (COD), hardness, nitrate+nitrite, total dissolved solids (TDS), sulfate, nine dissolved metals (arsenic, calcium, iron, magnesium, mercury, potassium, sodium, and zinc), total mercury and total organic carbon (TOC). Handheld meters were used to measure pH, specific conductivity, and temperature in the field during sampling at each well. In addition, as part of landfill gas monitoring, 14 perimeter probe locations were sampled.

As discussed in section 2.4.3 above, cleanup levels were established in the Upper and Lower Units saturated zones (aquifers) for both primary and secondary water quality standards. The groundwater results of 2020 second and fourth quarters (wet and dry season) for the Shallow/Upper Unit and Lower Unit are briefly discussed below.

## **2.6.1 2020 Second Quarter Groundwater Monitoring Results**

### **2.6.1.1 Shallow/Upper Unit**

- The dissolved arsenic concentrations exceeded the Site compliance level of 0.0005 milligrams per liter (mg/L) in all wells except in two upgradient (MW-1S and MW-3S) and one cross-gradient (MW-4S) wells. The detected arsenic concentrations ranged from 0.00055 mg/L to 0.0202 mg/L in seven wells sampled in the Upper Unit.
- The dissolved iron concentrations exceeded the secondary groundwater standard of 0.3 mg/L in two wells, MW-2S (6.5 mg/L), MW-2SU (5.8 mg/L) and MW-CNE-1S (16.9 mg/L). The well MW-CNE-1S is located cross-gradient and well MW-2SU is located adjacent to the landfill.
- Concentrations of dissolved manganese exceeded the secondary groundwater standard of 0.05 mg/L in six wells [B-1S (0.874 mg/L), B-1SU (4.06 mg/L), MW-2S (8.94 mg/L), MW-2SU (7.84 mg/L), MW-5S (0.32 mg/L) and MW-CNE-1S (2.47 mg/L)] and manganese concentrations were below the secondary standard in other five wells (B-2S, B-2SU, MW-1S, MW-3S, MW-4S, and MW-5S). The well MW-3S is located upgradient. The maximum manganese concentration was detected in monitoring well MW2S (8.94 mg/L).
- Concentrations of chloride, nitrate+nitrite, sulfate, dissolved mercury, total mercury, and dissolved zinc concentrations were either less than the cleanup standards or were not detected in all samples collected from the Upper Shallow Unit wells.

### **2.6.1.2 Lower Unit**

- The concentration of dissolved arsenic in sample collected from well MW-1D (0.009 mg/L) and MW-2D (0.0061 mg/L) was above the cleanup level of 0.005 mg/L. The well MW-1D is located northeast and upgradient of the Centralia Landfill and well MW-2D is at western landfill boundary. The dissolved arsenic concentration in the other wells were either below the cleanup level or below the laboratory detection limits.

- The concentration of dissolved iron in sample collected from MW-3D (0.967 mg/L) exceeded the secondary groundwater standard for iron (0.3 mg/L). However, based on the groundwater contour maps, this well is located upgradient of the landfill.
- Manganese concentration in all six wells exceeded the cleanup level of 0.05 mg/L. The manganese concentrations ranged from 0.216 mg/L to 0.103 mg/L.

The 2020-second quarter Shallow and Lower aquifers groundwater sampling results and locations of groundwater monitoring wells are included as Appendix 6.5. The time series graphs of arsenic, iron, manganese, mercury, Nitrate+Nitrite, pH, total dissolved solids, specific-conductivity and chloride are included as Appendix 6.8.

## **2.6.2 2020 Fourth Quarter Groundwater Monitoring Results**

During this quarter, seventeen (17) groundwater monitoring wells (11 shallow Upper Aquifer and 6 Lower Aquifer) were sampled. All groundwater samples were analyzed for alkalinity, ammonia, chloride, chemical oxygen demand (COD), hardness, nitrate+nitrite, total dissolved solids (TDS), sulfate, nine dissolved metals (arsenic, calcium, iron, magnesium, mercury, potassium, sodium, and zinc), total mercury and total organic carbon (TOC). Handheld meters were used to measure pH, specific conductivity, and temperature in the field during sampling at each well. In addition, as part of landfill gas monitoring, 14 perimeter probe locations were sampled.

### **2.6.2.1 Shallow/Upper Unit**

The concentration of nitrate+nitrite of 23.6 mg/L in sample B-2S exceeded the primary groundwater standard of 10 mg/L. The well B-2S is located adjacent to and downgradient of the landfill.

The concentration of dissolved arsenic in all samples except for MW-2SU, MW-1S and MW-3S exceeded the Site compliance standard of 0.0005 mg/L. Wells MW-1S and MW-3S are both located upgradient of the landfill. The arsenic concentration ranged from 0.00065 mg/L to 0.025 mg/L.

The concentration of dissolved iron exceeded the secondary groundwater standard of 0.3 mg/L in samples collected from wells B-1SU, MW-2S, MW-2S, and MW-CNE-1S. Wells MW-2S and MW-CNE-1S are located downgradient and cross-gradient to the landfill, respectively. Wells B-1SU is located adjacent to the landfill.

The concentrations of dissolved manganese exceeded the secondary groundwater standard of 0.05 mg/L in all samples collected in Upper Shallow Unit wells with the exceptions of samples from wells B-2S, B-2SU, MW-1S, and MW-3S. Wells MW-1S and MW-3S are located upgradient of the landfill and well B-2S is located downgradient of the landfill.

Concentrations of chloride, sulfate, dissolved mercury, and dissolved zinc were either below the corresponding cleanup levels or were not detected in all samples collected from the USU wells.

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### **2.6.2.2 Lower Unit**

The dissolved arsenic concentrations in samples collected from B-6DR, and MW-2D were above the cleanup level of 0.005 mg/L. The arsenic concentrations were 0.0062 mg/L in both wells. Wells B-6DR and MW-2D are located adjacent to and downgradient of the landfill.

The dissolved manganese concentrations exceeded the secondary groundwater standard of 0.05 mg/L in all samples collected in the Lower Unit wells and concentrations ranged from 0.24 mg/L to 1.01 mg/L.

Fourth Quarter shallow and lower aquifers groundwater monitoring results are as Appendix 6.6. The time series graphs of arsenic, iron, manganese, mercury, Nitrate+Nitrite, pH, total dissolved solids, specific-conductivity and chloride are included as Appendix 6.8.

### **2.6.3 Landfill Gas Monitoring**

The landfill gas collection system is composed of gas trenches, extraction wells, and collection manifolds that carry the gas to a flare facility for destruction. Gas monitoring probes located around the perimeter of the Site provide feedback on the effectiveness of the gas collection system and off site gas migration. The gas probe-monitoring program includes the measurement of gas below the surface of the landfill and probes located off the Site. All 32 of gas production wells (the vertical wells and the horizontal trenches that are part of the collection system including the flare facility) still consistently produce gas, but at much lower rate than the gas production when the landfill was closed. The landfill gas-monitoring program includes the sampling of fourteen perimeter probes (GP-1 through GP-14, which indicate lateral landfill gas migration) on a quarterly basis. During the 2020 quarterly monitoring events, all fourteen-perimeter probes recorded zero readings. Perimeter gas data collected in 2020 are included as Appendix 6.7.

## **2.7 Environmental Covenant**

An environmental covenant (EC) was recorded for the Site in 2001. It was determined that contamination at the Site posed a limited threat to human health and the environment that could be mitigated by the use of institutional controls in the form of an EC. The EC imposes the following limitations:

### **Section 1:**

- a. Existing fencing shall not be removed and shall be maintained to prevent unauthorized access to the Property.
- b. No groundwater may be extracted for any use from the Property except as groundwater removal as part of monitoring activities associated with an Ecology-approved compliance monitoring plan.
- c. An area of the Property has been designated as a wetland enhancement area. The Owner of the Property must give thirty (30) day advance written notice to Ecology of any activities that may impact the wetland enhancement area and must obtain the

written approval of Ecology and other agencies of jurisdiction prior to commencement of any such activities.

- d. Any activity on the Property that may result in the release or exposure to the environment of a hazardous substance that remains on the Property as part of the Cleanup Action, or that may create a new exposure pathway, is prohibited. Such activities are permissible only if: (1) they are part of routine maintenance system requirements performed in accordance with the Centralia Landfill Second Interim Action Final Cover System Post-Closure Operations and Maintenance Manual; (2) they are allowed or required under the Centralia Landfill Cleanup Action Plan; (3) they are part of monitoring activities associated with an Ecology approved compliance monitoring plan, (4) immediate actions are necessary in response to emergency situations; or (5) Ecology provides prior written approval for such activities.
- e. No new structures shall be constructed on areas of the Property where solid waste has deposited without the written approval of Ecology and written approval by the local agency or agencies of jurisdiction.
- f. The Property shall be used only for industrial or commercial land uses, as described in WAC 173-340-740(1)(c), and defined in and allowed under the City of Centralia [or Lewis County] zoning regulations.

**Section 2:** Any activity on the Property that may interfere with the integrity of the Cleanup Action and continued protection of human health and the environment is prohibited without prior written approval from Ecology.

**Section 3:** The Owner of the Property must give thirty (30) day advance written notice to Ecology of the Owner's intent to convey any interest in the Property. No conveyance of title, easement, lease, or other interest in the Property shall be consummated by the Owner without adequate and complete provision for continued monitoring, operation, and maintenance of the Cleanup Action on the Property.

**Section 4:** The Owner must restrict leases to uses and activities consistent with the EC and notify all lessees of the restrictions herein on the use of the Property.

**Section 5:** The Owner must notify and obtain approval from Ecology prior to any use of the Property that is inconsistent with the terms of this EC. Ecology may approve an inconsistent use only after an opportunity for public notice and comment is provided.

**Section 6:** The Owner shall allow authorized representatives of Ecology the right to enter the Property at reasonable times for the purpose of evaluating the Cleanup Action; to take samples, to inspect remedial actions conducted at the Property, and to inspect records that are related to the Cleanup Action.

**Section 7:** The Owner of the Property reserves the right under WAC 173-340-440 to record an instrument that provides that this Restrictive Covenant shall no longer limit use of the Property

or be of any further force or effect. However, such an instrument may be recorded only if Ecology, after public notice and comment, concurs.

The EC is available as Appendix 6.9.

## **3.0 PERIODIC REVIEW**

### **3.1 Effectiveness of Completed Cleanup Actions**

#### **3.1.1 Soil and Direct Contact**

Based upon the site visit conducted on September 1, 2020, the landfill cover appears in good condition. Site personnel regularly perform well-head maintenance, vegetation control on the landfill cap surface, fence maintenance and Site security control.

The landfill cap continues to eliminate direct exposure pathways (ingestion, contact) to contaminated soils. No repair, maintenance or contingency actions have been required. A photo log is available as Appendix 6.10.

The EC for the Site was recorded and is in place. This EC prohibits activities that will result in the release of contaminants contained as part of the cleanup without Ecology's approval, and prohibits any use of the property that is inconsistent with the Covenant. The Covenant also requires fencing to restrict public access to the Site and restricts groundwater for any use other than compliance monitoring. This EC serves to assure the long-term property use and integrity of the property surface.

#### **3.1.2 Groundwater**

Remedial actions conducted at the Site appear generally protective of human health and the environment. Only arsenic exceeds primary groundwater standards at the Site. Only one well (B-1S) contained arsenic at a maximum concentration of 0.015 mg/L and 0.0167 mg/L during 2020 sampling events, which exceeds the primary standard of 0.01 mg/L.

Many wells exceed secondary groundwater standards at the Site for chloride, iron, manganese pH and total dissolved solids (TDS). Below is a discussion of each individual contaminant of concern.

##### **Arsenic**

All wells exceeded the secondary groundwater standard of 0.00005 mg/L. However, arsenic concentration in only one well exceeded the Primary Drinking Water Standard of 0.01 mg/l. Of those wells with detectable concentrations, upgradient and cross gradient wells contained arsenic levels equal to those down-gradient from the landfill.

##### **Iron**

Iron exceeds secondary groundwater standard of 0.3 mg/L in four wells at the Site with a maximum concentration of 24.3 mg/L. Three of the wells are on the western edge of the down-gradient pathway of the landfill and one well on the eastern edge of the landfill. As recently as 2020, several other wells within the footprint of the landfill have exceeded the secondary standard for iron; nonetheless, current concentrations remained similar without significant variation.

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## **Manganese**

Manganese exceeds secondary groundwater standards in all onsite wells except monitoring wells MW1S, MW3S, MW-4S, MW-5S, B2SU and B-2S. Up-gradient wells MW1D and MW3D, exceed the manganese secondary groundwater standard of 0.05 mg/L with concentrations of 0.538 mg/l and 1.03 mg/l, respectively. The maximum manganese concentration detected at the Site was 9.19 mg/L in MW-2S. Manganese does not present a human health or ecological risk at the concentrations present in groundwater at the Site, but could cause aesthetic problems such as staining of porcelain fixtures.

## **pH**

The pH levels were above the secondary groundwater standard in all wells at the Site with a minimum pH level of 7.84 (MW-3S). One of the six wells (MW-3S) is located upgradient of the landfill. The pH ranged from 7.84 to 9.51.

## **Total Dissolved Solids**

Total Dissolved Solids (TDS) concentrations in four wells at the Site exceeded the secondary groundwater standard of 500 mg/L with a maximum concentration of 1020 mg/L in MW-2SU. The TDS ranged from 73.6 mg/L to 1020 mg/L. All the wells are located on the western edge of the down-gradient pathway of the landfill. Several wells downgradient from these three wells did not contain TDS concentrations exceeding the secondary ground water standard.

Concentrations of contaminants of concern in groundwater at the Site have generally shown a downward trend since the final closure plan was implemented. Those contaminants that appear stable at elevated concentrations also appear stable at similar concentrations in up-gradient wells. Additionally, the most down-gradient wells near the property boundary that serve as points of compliance only exceed groundwater standards for arsenic and manganese, which are the same contaminants that are found in up-gradient wells at concentrations exceeding secondary ground water standards.

### **3.1.3 Summary**

The remedy at the Centralia Landfill can be considered protective of human health and the environment with respect to refuse encapsulation, landfill gas control, surface water quality maintenance, leachate capture, and groundwater quality protection.

The presence of engineered controls in the form of fencing and a landfill cap, combined with institutional controls in the form of an EC serves to protect human health and the environment from soil or ground water contamination remaining at the Site at concentrations exceeding regulatory standards.

## **3.2 New Scientific Information for Individual Hazardous Substances for Mixtures Present at the Site**

Cleanup levels at the site were based on regulatory standards rather than calculated risk for chemicals and/or media. These standards were sufficient to be protective of site-specific conditions.



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### **3.3 New Applicable State and Federal Laws for Hazardous Substances Present at the Site**

Cleanup levels at the Site are based on current primary and secondary groundwater standards. There are no new relevant state or federal standards applicable to the Site.

### **3.4 Current and Projected Site Use**

The southern portion of the Site is currently occupied by the closed Centralia Landfill and the northern portion of the Site is occupied by a solid waste transfer station and commercial building. These uses are not likely to change and have a negative impact on the risk posed by hazardous substances contained at the Site.

### **3.5 Availability and Practicability of Higher Preference Technologies**

The remedy implemented included containment of hazardous substances and it continues to be protective of human health and the environment. While higher preference cleanup technologies may be available, they are still not practicable at this Site.

### **3.6 Availability of Improved Analytical Techniques to Evaluate Compliance with Cleanup Levels**

The current analytical method (EPA 200.9 - Graphite Furnace Atomic Absorption Spectrometry) has a minimum Method Detection Limit (MDL) of 0.0005 mg/L for arsenic, which exceeds the secondary groundwater standard of 0.00005 mg/L. There are no other methods accepted for drinking water analysis with lower MDLs. The presence of improved analytical techniques would not affect decisions or recommendations made for the site.

## 4.0 CONCLUSIONS

- The cleanup actions completed at the Site appear to be protective of human health and the environment.
- Groundwater cleanup levels have not been met at the Site; however, under WAC 173-340-740(6) (d), the cleanup action is determined to comply with cleanup standards, since the long-term integrity of the containment system is ensured and the requirements for containment technologies in WAC 173-340-360(8) have been met.

Since the Site was a Municipal Landfill accepting only the solid waste, the model remedy, capping was selected as the remedial action. Hence, the CAP does not establish cleanup levels for soil; it only establishes cleanup levels for groundwater and surface water.

- The EC for the property is in place and will be effective in protecting public health from exposure to hazardous substances and protecting the integrity of the cleanup action.

Based on this review, Ecology has determined that the remedial actions conducted at the Site continue to be protective of human health and the environment. The requirements of the EC are being satisfactorily followed and no additional remedial actions are required at this time. It is the property owner's responsibility to continue to inspect the Site to assure that the integrity of the landfill cap is maintained. Additionally, the property owner shall continue to monitor groundwater, surface water and the landfill gas as per the requirements of the updated Centralia Landfill 2020 Compliance Groundwater Monitoring Plan.

### 4.1 Next Review

The next review for the site will be scheduled five years from the date of this periodic review. In the event that additional cleanup actions or institutional controls are required, the next periodic review will be scheduled five years from the completion of those activities.

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## 5.0 REFERENCES

Department of Ecology. Consent Decree No. C91-5100T. August 13, 1991.

CH2MHill. Field Sampling Plan. April 1996.

Department of Ecology. Cleanup Action Plan. September 1999.

United States Environmental Protection Agency. Analytical Methods Support Document. For Arsenic in Drinking Water. December 1999.

Department of Ecology. Cleanup Action Plan Consent Decree No. C91-5100. May 30, 2001.

Department of Ecology. Restrictive Covenant. July 28, 2001.

CH2MHill. Centralia Landfill 2000 Wetland Mitigation Report. November 26, 2001.

City of Centralia Public Works. Interim Monitoring Report for the Centralia Landfill. September 1, 2009.

Lewis County Department of Public Works. Compliance Monitoring for the Centralia Landfill, 1<sup>st</sup> Half 2017.

Lewis County Department of Public Works. Compliance Monitoring for the Centralia Landfill, 3rd Quarter 2017.

Lewis County Department of Public Works. Compliance Monitoring for the Centralia Landfill, 1st Quarter 2018.

Pacific groundwater Group. Centralia Landfill 2019 Compliance Monitoring Report, March 31, 2020.

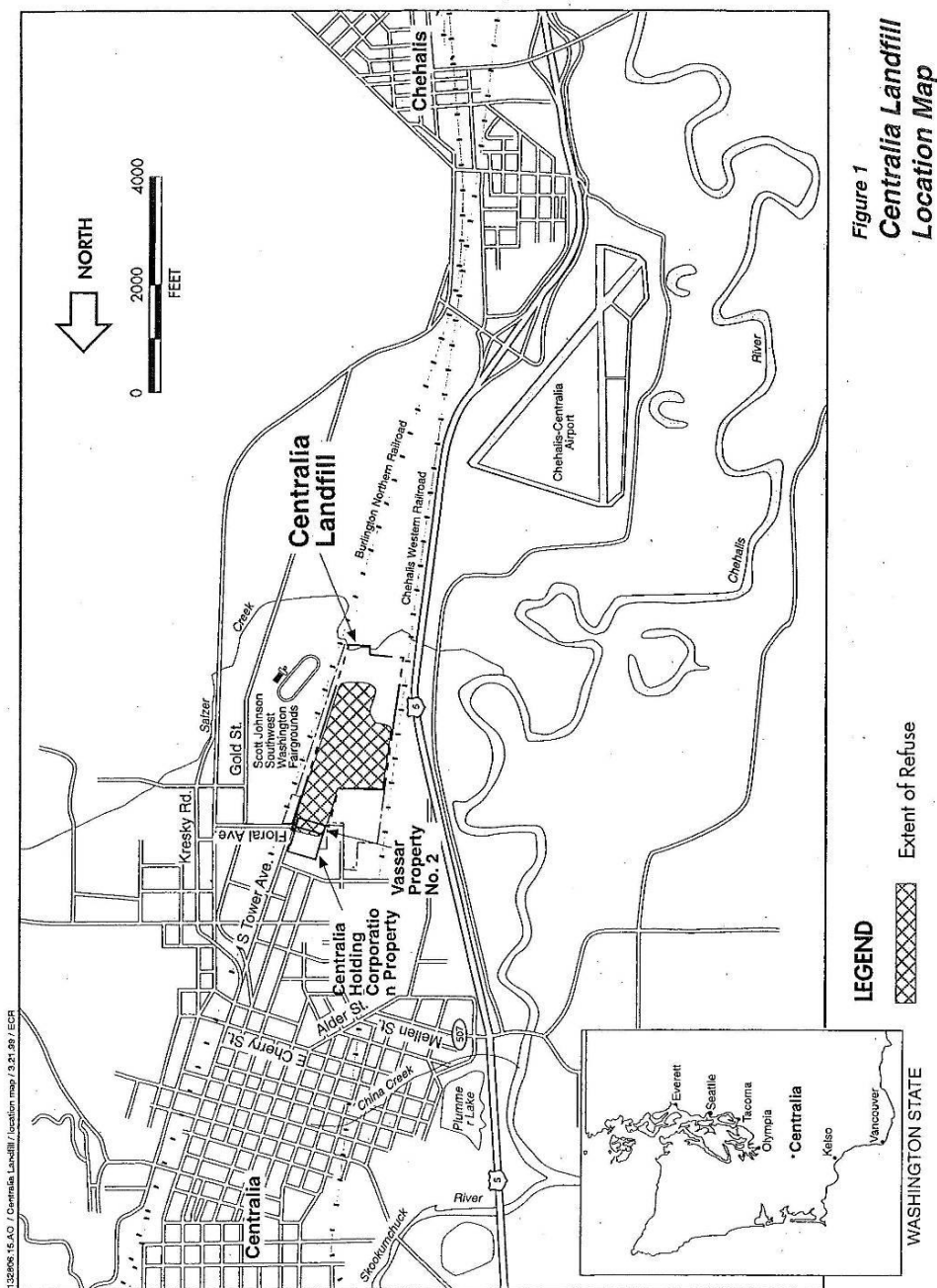
Pacific Groundwater Group. Centralia Landfill 2020, Updated Compliance Monitoring Plan, July 2020.

Department of Ecology. Site Visit, September 1, 2020.

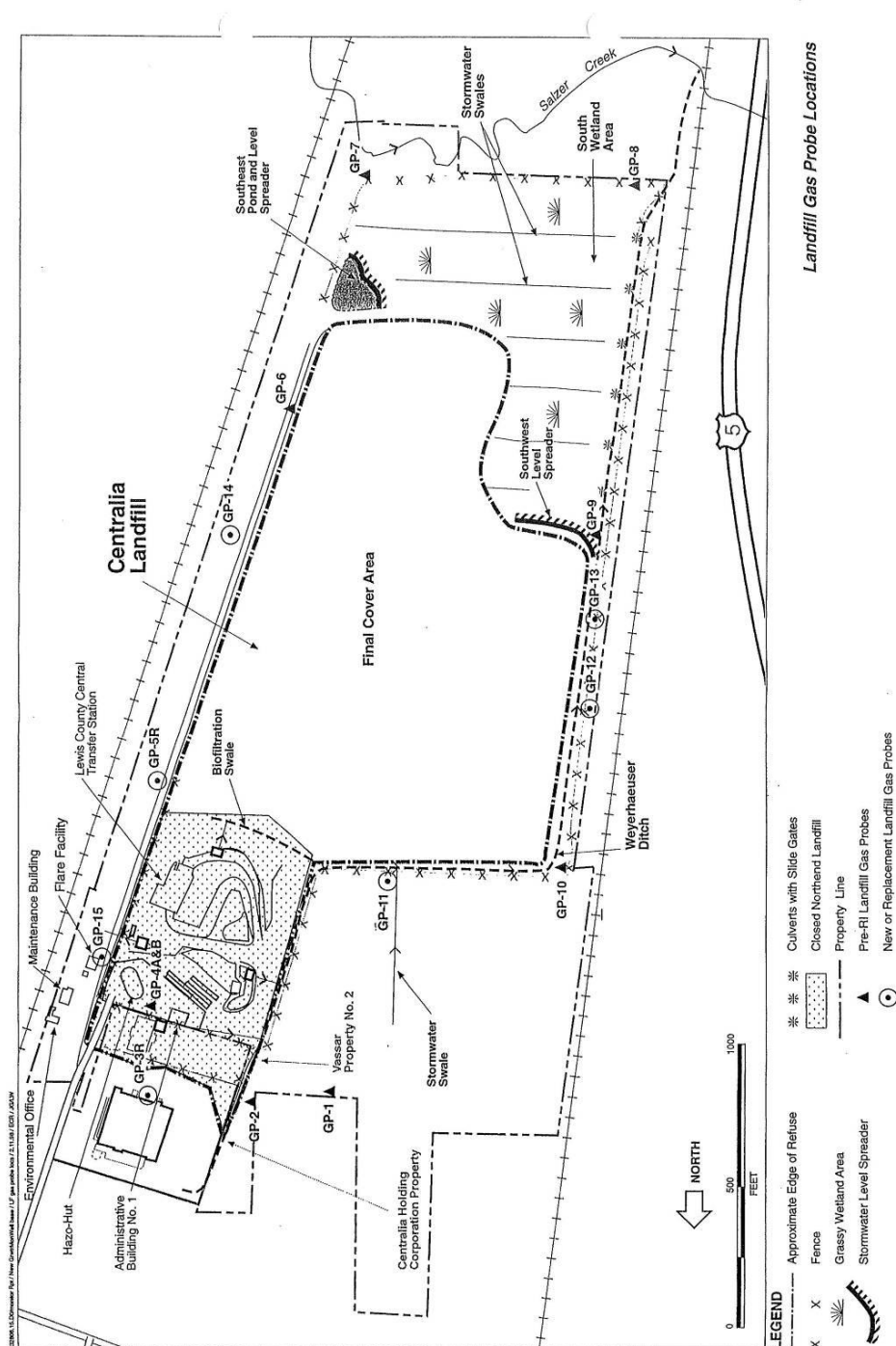
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## **6.0 APPENDICES**

## 6.1 Vicinity Map



## 6.2 Site Plan



### **6.3 Cleanup Levels**

#### **Ground Water Primary Standards:**

- Arsenic has two standards: a primary drinking water standard of 0.01 mg/L and a state ground water quality standard of 0.00005 mg/L. The Washington State Primary Drinking Water standard for Arsenic changed to 10 µg/L in 2006.
- Mercury has a primary standard of 0.002 mg/L.
- Nitrate has a primary standard of 10 mg/L.

#### **Ground Water Secondary Standards:**

- Chloride has a secondary standard of 250 mg/L.
- Iron has a secondary standard of 0.3 mg/L.
- Manganese has a secondary standard of 0.05 mg/L.
- pH has a regulatory range of 6.5 to 8.5.
- Sulfate has a secondary standard of 250 mg/L.
- TDS has a secondary standard of 500 mg/L.
- Zinc has a secondary standard of 5 mg/L.

#### **Surface Water Standards**

- Arsenic has a calculated surface water standard of 0.27 µg/L, based on background concentrations. However, the practical quantitation limit of arsenic is 0.5 µg/L. In cases where the cleanup level is less than the PQL, the cleanup level may be considered to be attained if the parameter is undetected at the PQL. Therefore, the compliance level for arsenic in surface water is 0.5 µg/L.

**Table 5-3. Groundwater Monitoring Parameters**

Constituent	Analysis Method	Units	Reporting Limit	Compliance Level
Alkalinity, Carb as CaCO <sub>3</sub>	SM 2320B	mg/L	5	
Ammonia as N, Total	SM 4500-NH <sub>3</sub> D	mg/L	0.3	
Arsenic, Dissolved	EPA 200.8	mg/L	0.0005	0.001
Calcium, Dissolved	EPA 200.8	mg/L	0.05	
Carbon, Total Organic		mg/L	0.15	
Chemical Oxygen Demand (COD)	SM 5220D	mg/L	5	
Chloride	EPA 300.0	mg/L	0.1	
Hardness	SM 2340B	mg/L	1	
Iron, Dissolved	EPA 200.8	mg/L	0.05	0.3
Magnesium, Dissolved	EPA 200.8	mg/L	0.025	
Manganese, Dissolved	EPA 200.8	mg/L	0.0005	0.05
Mercury, Dissolved	EPA 200.8	mg/L	0.0001	0.002
Nitrate+Nitrite as N	EPA 300.0	mg/L	0.1	10
Potassium, Dissolved	EPA 200.8	mg/L	0.1	
Sodium, Dissolved	EPA 200.8	mg/L	0.1	
Solids, Total Dissolved	SM 2540C	mg/L	20	500
Sulfate	EPA 300.0	mg/L	0.2	250
Zinc, Dissolved	EPA 200.8	mg/L	0.001	5

Groundwater Standards presented in this table are consistent with Centralia Landfill Second Periodic Review, Appendix 6.3 (Washington Department of Ecology, January 2016)



**Table 4-2. Surface Water Monitoring Parameters**

Constituent	Analysis Method	Units	Reporting Limit	Compliance Level
Alkalinity, Carb as CaCO <sub>3</sub>	SM 2320B	mg/L	5	
Ammonia as N, Total	SM 4500-NH <sub>3</sub> D	mg/L	0.3	
Arsenic, Dissolved	EPA 200.8	mg/L	0.0005	0.0005
Arsenic, Total	EPA 200.8	mg/L	0.0005	0.0005
Calcium	EPA 200.8	mg/L	0.05	
Calcium, Dissolved	EPA 200.8	mg/L	0.05	
Carbon, Total Organic	SM5310B	mg/L	0.15	
Chemical Oxygen Demand (COD)	SM 5220D	mg/L	5	
Chloride	EPA 300.0	mg/L	0.1	
Hardness	SM 2340B	mg/L	1	
Iron, Dissolved	EPA 200.8	mg/L	0.05	
Iron, Total	EPA 200.8	mg/L	0.05	
Magnesium, Dissolved	EPA 7000	mg/L	0.025	
Magnesium, Total	EPA 200.8	mg/L	0.025	
Manganese, Dissolved	EPA 200.8	mg/L	0.0005	
Manganese, Total	EPA 200.8	mg/L	0.0005	
Mercury, Dissolved	EPA 200.8	mg/L	0.0001	
Mercury, Total	EPA 200.8	mg/L	0.0001	
Nitrate+Nitrite as N	EPA 300.0	mg/L	0.1	
pH, Field		std. units	0	
Potassium, Dissolved	EPA 7000	mg/L	0.1	
Potassium, Total	EPA 200.8	mg/L	0.1	
Sodium, Dissolved	EPA 200.8	mg/L	0.1	
Sodium, Total	EPA 200.8	mg/L	0.1	
Solids, Total Dissolved	SM 2540C	mg/L	20	
Specific Conductivity (at 25 deg C)		uS/cm	0	
Sulfate	EPA 300.0	mg/L	0.2	
Temperature, O F		O F	0	
Zinc, Dissolved	EPA 200.8	mg/L	0.001	
Zinc, Total	EPA 200.8	mg/L	0.001	

Groundwater Standards presented in this table are consistent with Centralia Landfill Second Periodic Review, Appendix 6.3 (Washington Department of Ecology, January 2016)

## 6.4 2020 Wet Season: Surface Water Sampling Results at Weyerhaeuser Ditch Compliance Point, SW-4

Table 3. Surface Water Quality Summary, 2020 Q2 **DRAFT**

Parameter Group	Constituent	Units	CAP Cleanup Level	CAP Compliance Level	SW-14
<b>Field Parameters</b>					
	pH, Field	std. units			8.88
	Specific Conductivity (at 25 deg C)	uS/cm			0.54
	Temperature, 0 C	0 C	0	0	11.25
<b>Conventional Parameters</b>					
	Alkalinity, Carb as CaCO <sub>3</sub>	mg/L			161
	Ammonia as N, Total	mg/L			0.3 U
	Carbon, Total Organic	mg/L			9.71
	Chemical Oxygen Demand (COD)	mg/L			38.6
	Chloride	mg/L			34
	Hardness	mg/L			166
	Nitrate+Nitrite as N	mg/L			0.1 U
	Solids, Total Dissolved	mg/L			254
	Sulfate	mg/L			1.9
<b>Dissolved Metals</b>					
	Arsenic, Dissolved	mg/L	0.00027	0.0005	0.00062
	Calcium, Dissolved	mg/L			33.2
	Iron, Dissolved	mg/L			0.217
	Magnesium, Dissolved	mg/L			18.5
	Manganese, Dissolved	mg/L			1.8
	Mercury, Dissolved	mg/L			0.0000013
	Potassium, Dissolved	mg/L			0.765
	Sodium, Dissolved	mg/L			12.5
	Zinc, Dissolved	mg/L			0.0237
<b>Total Metals</b>					
	Arsenic, Total	mg/L	0.00027	0.0005	0.00087
	Calcium, Total	mg/L			34.4
	Iron, Total	mg/L			1.51
	Magnesium, Total	mg/L			19.4
	Manganese, Total	mg/L			1.85
	Mercury, Total	mg/L			0.0000029
	Potassium, Total	mg/L			0.804
	Sodium, Total	mg/L			12.8
	Zinc, Total	mg/L			0.0164

CAP = Cleanup Action Plan (September, 1999)  
U = not detected at associated reporting limit  
J = estimated

2020 Q2

Page 1 of 1

## 6.5 2020 Second Quarter: Upper and Lower Aquifer Groundwater Monitoring Well Locations and Groundwater Monitoring Results

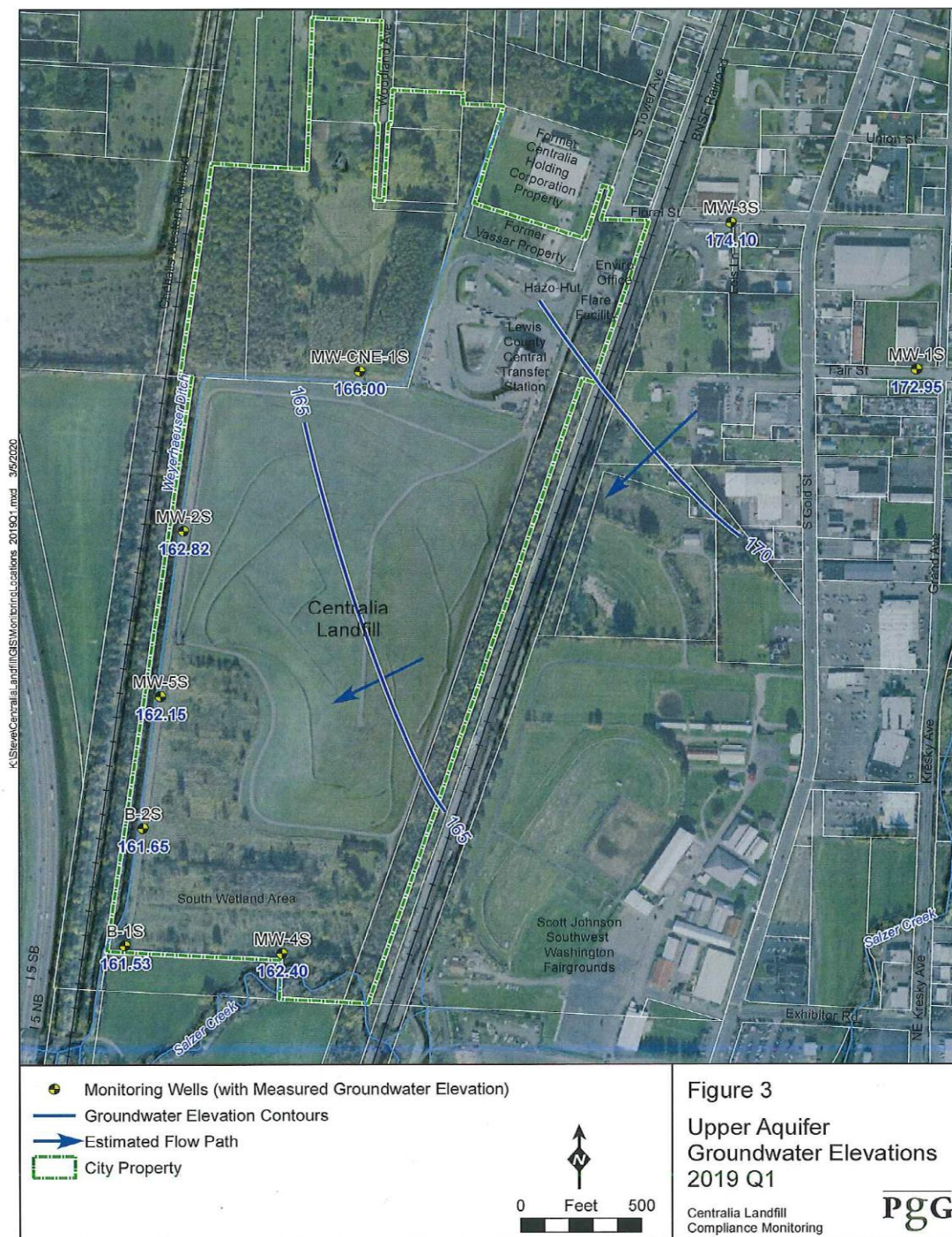




Table 1. Shallow Upper/Upper Groundwater Quality Summary, 2020 Q2 **DRAFT**

Parameter Group	Constituent	Units	CAP Cleanup Level	CAP Compliance Level	Groundwater Standards *	B-1S	B-1SU	B-2S	B-2SU	MW-1S	MW-2SU	MW-3S	MW-4S	MW-5S	MW/CNE-1S
<b>Field Parameters</b>															
	Depth to Water	feet				7.98	8.37	7.17	7.78	6.16	4.4	5.47	7.46	5.83	4.46
	pH, Field	std.			8.5	8.93	8.54	8.81	8.73	8.54	8.37	8.36	9.11	8.99	8.25
	Specific Conductivity (at 25 deg C) uS/c		700			0.376	1.08	0.272	0.459	0.198	2.13	2.27	0.223	0.155	1.46
	Temperature, 0 C	0 C	0	0	0	12.26	11.58	12.56	12.03	14.77	13.75	12.7	14.66	11.93	12.5
<b>Conventional Parameters</b>															
	Alkalinity, Carb as CaCO3	mg/				162	431	40	203	51	533	493	62	42	525
	Ammonia as N, Total	mg/				0.63 j	0.3 Uj	0.3 Uj	0.3 Uj	0.3 Uj	0.34 j	0.3 Uj	0.3 Uj	0.3 Uj	0.3 Uj
	Carbon, Total Organic	mg/				0.868	5	1.43	1.16	0.418	11	11.3	1.02	2.21	10.6
	Chemical Oxygen Demand (COD)	mg/				19.8 j	33 j	19.8 j	21.7 j	10 j	32.3 j	45.7 j	10 Uj	10 Uj	26.5 j
	Chloride	mg/	250			5.1	65.5	2.2	2.1	1.7	220	213	5	1.9	38
	Hardness	mg/		250		136	324	58.2	150	47.2	661	597	46	48.5	37.9
	Nitrate+Nitrite as N	mg/				0.1 U	0.1 U	2.5	0.62	1.3	0.13	0.12	0.95	0.55	0.1 U
	Solids, Total Dissolved	mg/				500	213	95.2	206	107	982	984	112	96.8	73.6
	Sulfate	mg/				0.2 U	0.25	8.7	9.3	10.6	1	0.53	16.7	5.1	3.9
															0.2 U
<b>Dissolved Metals</b>															
	Arsenic, Dissolved	mg/	0.00027	0.0005	0.00005	0.015	0.0021	0.00095	0.0012	0.0005 U	0.0202	0.0015	0.0005 U	0.00055	0.0063
	Calcium, Dissolved	mg/				32.9	61.5	12.5	26.5	11.7	136	141	12.3	11.2	90
	Iron, Dissolved	mg/	0.3			0.05 Uj	0.956 j	0.05 Uj	0.05 Uj	0.05 Uj	6.5 j	5.8 j	0.05 Uj	0.143 j	16.9 j
	Magnesium, Dissolved	mg/				12.3	48.3	4.29	21.7	3.95	74.2	76	3.14	5.59	4.11
	Manganese, Dissolved	mg/	0.05			0.874	4.06	0.0164	0.0095	0.0008	8.94	7.84	0.0126	0.0088	0.32
	Mercury, Dissolved	mg/				0.000007	0.0000012	0.000001	0.0000008	0.0000008	0.0000007	0.0000001	0.0000005	0.0000001	0.0000006
	Potassium, Dissolved	mg/				4.81	2.32	0.487	1.64	0.516	6.17	6.92	0.489	2.07	4.54
	Sodium, Dissolved	mg/				13	56.4	5.32	20.6	8.4	23.3	27.5	11	10.9	7.57
	Zinc, Dissolved	mg/			5	0.004 j	0.0171 j	0.0082 j	0.0089 j	0.0021 j	0.0055 j	0.0122 j	0.0071 j	0.0128 j	0.0047 j

CAP = Cleanup Action Plan (September, 1999)  
 CAP Level = Cleanup Level for Arsenic, Cadmium, Chromium, Lead, Mercury, and Manganese. Groundwater Secondary Standards for remaining parameters. Arsenic has a primary drinking water quality standard of 0.0005 mg/L. Groundwater Standards presented in this table are consistent with Centralia Landfill Second Periodic Review, Appendix 6.3 (Washington Department of Ecology, January 2016)  
 U = not detected at associated reporting limit  
 j = estimated  
 MX = matrix spike recovery outside control limits  
 2020 Q2

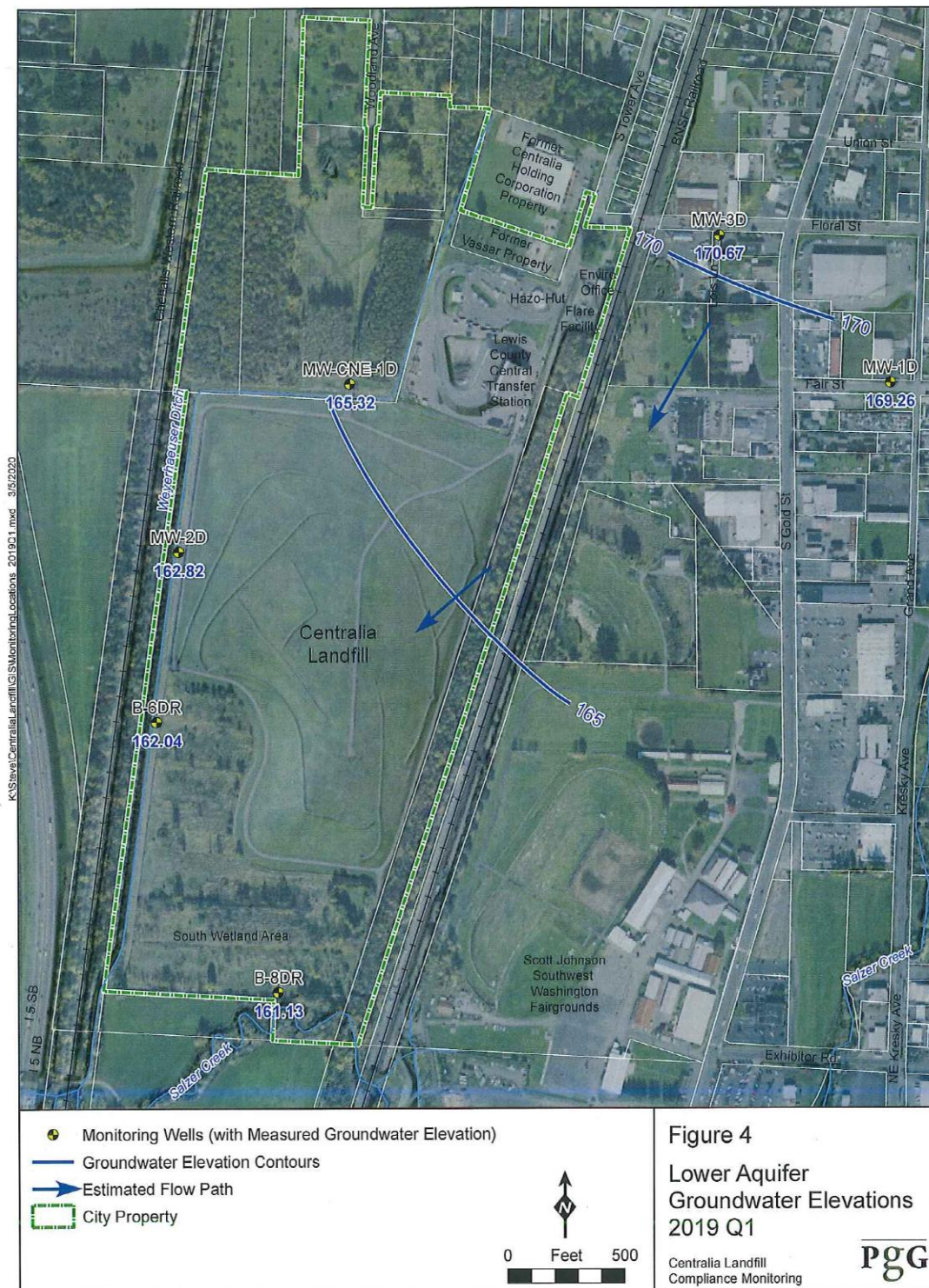


Table 2. Lower Unit Groundwater Quality Summary, 2020 Q2 **DRAFT**

Parameter Group	Constituent	Units	CAP Cleanup Level	Groundwater Standards *	B-6DR	B-8DR	MW-1D	MW-2D	MW-3D	MW-CNE-1D
<b>Field Parameters</b>										
	Depth to Water	feet			7.45	8.48	8.6	5.57	10.38	5.32
	pH, Field	std. units		8.5	9.07	9.05	9.07	8.91	8.59	8.56
	Specific Conductivity (at 25 deg C) uS/cm				0.234	0.679	0.462	0.519	0.344	0.426
	Temperature, 0 C	0 C	0	0	12.99	12.47	14.26	13.61	14.19	12.37
<b>Conventional Parameters</b>										
	Alkalinity, Carb as CaCO3	mg/L			86	208	162	161	104	151
	Ammonia as N, Total	mg/L			0.49 J	0.67 J	1.6 J	1.7 J	0.73 J	0.92 J
	Carbon, Total Organic	mg/L			3.02	1.96	3.77	1.84	1.11	1.45
	Chemical Oxygen Demand (COD)	mg/L			18 J	22.9 J	10 U	10 U	10 U	10 U
	Chloride	mg/L			6	5.1	5.6	10.9	5.4	6.4
	Hardness	mg/L			142	54.1	107	130	80.4	103
	Nitrate-Nitrite as N	mg/L			0.23	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
	Solids, Total Dissolved	mg/L			115	273	201	204	174	162
	Sulfate	mg/L			1.6	21	0.2 U	0.2 U	0.2 U	0.2 U
<b>Dissolved Metals</b>										
	Arsenic, Dissolved	mg/L	0.005	0.005	0.0017	0.0005 U	0.009	0.0061	0.0015	0.0005 U
	Calcium, Dissolved	mg/L			15.5	35.5	24.3	31	19.1	28.3
	Iron, Dissolved	mg/L	0.3	0.3	0.125 J	0.05 U	0.0891 J	0.05 U	0.967 J	0.107 J
	Magnesium, Dissolved	mg/L			5.16	13.7	8.75	12.2	7.99	7.71
	Manganese, Dissolved	mg/L	0.05	0.05	0.37	0.256	0.538	0.838	1.03	0.216
	Mercury, Dissolved	mg/L			0.0000011	0.0000005 U	0.0000007	0.0000006	0.0000009	0.0000007
	Potassium, Dissolved	mg/L			2.16	1.84	1.68	2.39	2.27	1.95
	Sodium, Dissolved	mg/L			8.88	42.2	24.9	17.3	13.2	21.6
	Zinc, Dissolved	mg/L			0.0059 J	0.0055 J	0.0056 J	0.0018 J	0.0038 J	0.001 U

CAP = Cleanup Action Plan (September, 1999)  
 \*Groundwater Standards presented in this table are consistent with Centralia Landfill Second Periodic Review, Appendix 6.3 (Washington Department of Ecology, January 2016)  
 U = not detected at associated reporting limit  
 J = estimated  
 2020 Q2



## 6.6 2020 Fourth Quarter: Shallow/Upper and Lower Aquifers Groundwater Monitoring Results

Table 4. Shallow Upper/Upper Groundwater Quality Summary, 2020 Q4 DRAFT

Parameter Group	Constituent	Units	CAP Cleanup Level	CAP Compliance Level	Groundwater Standards *	B-1S	B-1SU	B-2S	B-2SU	MW-1S	MW-2S	MW-2SU	MW-3S	MW-4S	MW-5S	MW-CNE-1S
<b>Field Parameters</b>																
Conventional Parameters	Depth to Water	feet				10.81	11.33	10.85	11.5	9.3	8.35	9.3	13.1	9.5	9.63	9.11
	pH, Field	std.			8.5	9.08	9.05	9.13	9	9.28	9.31	9.23	9.51	9.03	8.99	9.43
	Specific Conductivity (at 25 deg C) us/c		700			0.432	0.69	0.442	0.527	0.159	2.11	1.24	0.23	0.237	0.309	1.39
	Temperature, 0 C	0 C	0			14.59	13.75	15.07	15.62	15.66	14.86	15.34	15.66	15.31	15.37	14.28
Conventional Parameters	Alkalinity, Carb as CaCO3	mg/				115	183	32	117	25	330	292	26	45	54	431
	Ammonia as N, Total	mg/				0.68	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.61	0.3 U	0.3 U	0.3 U	0.3 U
	Carbon, Total Organic	mg/				0.914	3.48	1.32	0.639	0.207	12	6.78	0.561	1.06	1.24	8.35
	Chemical Oxygen Demand (COD)	mg/				10 U	11.1	10 U	10 U	3.4	41.9	22.6	40.9	10 U	10 U	30.3
	Chloride	mg/	250			7.9	12.3	4.2	2.3	1.7	223	129	4.9	2.6	3.7	54.6
	Hardness	mg/				136	198	139	187	42.4	890	678	48.9	63.7	87.6	442
	Nitrate+Nitrite as N	mg/				0.21	0.1 U	23.6	0.2	0.67	0.48	0.28	2.1	0.1 U	0.79	0.3
	Solids, Total Dissolved	mg/	500			196	236	256	316	272 h	780 h	1020	166 h	138	366	606
	Sulfate	mg/	250			0.32	0.24	5.1	5.8	8.1	0.87	8.15	15.2	6.8	6	0.15
<b>Dissolved Metals</b>																
Dissolved Metals	Arsenic, Dissolved	mg/	0.00027	0.0005	0.00005	0.0167	0.0071	0.00084	0.002	0.0005 U	0.025	0.0034	0.0005 U	0.0007	0.00065	0.0092
	Calcium, Dissolved	mg/				32.4	39.8	36.9	36.3	10.1	142	115	12.7	13.7	17.6	102
	Iron, Dissolved	mg/	0.3			0.0576	4.18	6.36	0.05 U	0.05 U	8.81	15.6	0.05 U	0.05 U	0.05 U	24.3
	Magnesium, Dissolved	mg/				12.1	28.6	12.5	24.5	3.21	73.8	55.1	3.28	6.21	8.87	67.7
	Manganese, Dissolved	mg/	0.05			0.926	2.72	0.0253	0.0732	0.0005 U	9.19	5.55	0.02986	0.2437	0.253	2.42
	Mercury, Dissolved	mg/				0.0000099	0.0000032	0.0000013	0.0000082	0.0000006	0.0000036	0.000006	0.000005 U	0.000007	0.000007	0.0000023
	Potassium, Dissolved	mg/				5.58	2.55	0.916	2.06	0.489 MX	6.21	5.95	0.573	0.985	2.19	4.36
	Sodium, Dissolved	mg/				13.7	26.4	11	20.2	7.42	23.2	32.3	11.6	9.42	12.2	21.9
	Zinc, Dissolved	mg/			5	0.001	0.001 U	0.0069	0.0018	0.001 U/MX	0.002	0.0055	0.0084	0.0036	0.0049	0.0011

CAP = Cleanup Action Plan (September, 1999)  
\*Groundwater Primary Standards for Nitrate, Arsenic, and Mercury; Groundwater Secondary Standards for remaining parameters. Arsenic has a primary drinking water quality standard of 0.01 mg/L and a state ground water quality standard of 0.00005 mg/L. Groundwater Standards presented in this table are consistent with Centralia Landfill Second Periodic Review, Appendix 6.3 (Washington Department of Ecology, January 2016)

U = not detected at associated reporting limit  
J = estimated  
MX = matrix spike recovery outside control limits  
2020 Q4

Table 5. Lower Unit Groundwater Quality Summary, 2020 Q4 **DRAFT**

Parameter Group	Constituent	Units	CAP Cleanup Level	Groundwater Standards *	B-6DR	B-8DR	MW-1D	MW-2D	MW-3D	MW-CNE-1D
<b>Field Parameters</b>										
	Depth to Water	feet			10.14	10.98	11.6	8.75	15	8.87
	pH, Field	std. units		8.5	8.95	9.05	9.42	9.17	9.51	9.31
	Specific Conductivity (at 25 deg C)	uS/cm			0.334	0.569	0.283	0.7	0.326	0.505
	Temperature, O C	O C	0	0	13.52	14.55	14.61	14.66	14.72	13.11
<b>Conventional Parameters</b>										
	Alkalinity, Carb as CaCO3	mg/L			79	144	52	102	93	98
	Ammonia as N, Total	mg/L			1.22	0.63	0.36	1.6	0.62	0.37
	Carbon, Total Organic	mg/L			2.92	1.78	1.92	2.1	1.25	1.62
	Chemical Oxygen Demand (COD)	mg/L			10 U	10 U	10 U	10 U	10 U	10 U
	Chloride	mg/L			13.3	5.4	2.6	11.7	5.5	6.7
	Hardness	mg/L			125	166	71.6	153	91.2	112
	Nitrate+Nitrite as N	mg/L			0.1 U	0.1 U	0.12	0.1 U	0.1 U	0.1 U
	Solids, Total Dissolved	mg/L			240	302	126 h	250	206 h	470
	Sulfate	mg/L			0.43	27.3	3.1	0.2 U	0.2 U	0.2 U
<b>Dissolved Metals</b>										
	Arsenic, Dissolved	mg/L	0.005	0.005	0.0062	0.0005 U	0.0013	0.0062	0.0018	0.0005 U
	Calcium, Dissolved	mg/L			29	41.4	21	34	18.8	33.3
	Iron, Dissolved	mg/L	0.3	0.3	0.276	0.05 U	0.05 U	0.05 U	0.956	0.077
	Magnesium, Dissolved	mg/L			10.4	16	2.93	11.3	7.55	8.21
	Manganese, Dissolved	mg/L	0.05	0.05	0.72	0.293	0.115	0.798	1.01	0.24
	Mercury, Dissolved	mg/L			0.0000045 j	0.0000011 j	0.0000006 j	0.0000005 U j	0.0000024 j	0.0000006 j
	Potassium, Dissolved	mg/L			3.2	2.3	1.35	2.36	2.21	2.18
	Sodium, Dissolved	mg/L			14.2	48	11.9	16.3	12.6	24.1
	Zinc, Dissolved	mg/L			0.001 U	0.001 U	0.0044	0.001 U	0.001 U	0.001 U

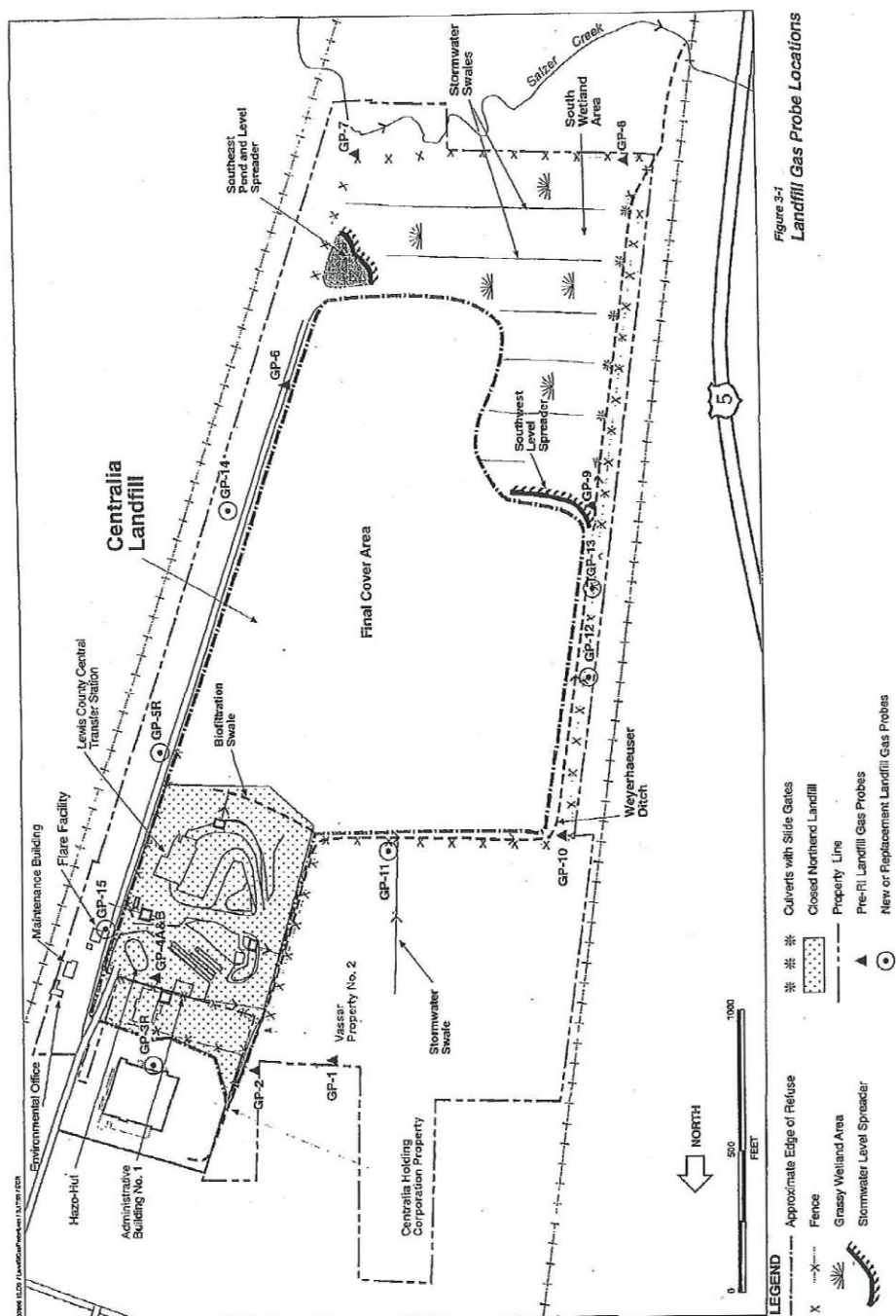
CAP = Cleanup Action Plan (September, 1999)  
\*Groundwater Standards presented in this table are consistent with Centralia Landfill Second Periodic Review, Appendix 6.3 (Washington Department of Ecology, January 2016)  
U = not detected at associated reporting limit  
j = estimated

2020 Q4

Page 1 of 1



## 6.7 Landfill Perimeter Gas Probes Locations and 2020 Quarterly Monitoring Results



**Table 6. Centralia Landfill Gas Monitoring Summary, 2020**

**DRAFT**

Event, Date	Station	Pressure, Field (inches)	Oxygen, Field (percent)	Methane, Field (ppm)	Methane LEL, Field (percent)
<b>2020 Q1 LG, 3/30/2020</b>					
	Barometer	29.87			
	GP-1	0.005	20.9	0	0
	GP-11	0.006	20.9	0	0
	GP-12	0.007	20.9	0	0
	GP-13	0.005	20.9	0	0
	GP-14	0.005	20.9	0	0
	GP-15	0.006	20.9	0	0
	GP-2	0.008	20.9	0	0
	GP-4A	0.016	20.9	0	0
	GP-4B	0	20.9	0	0
	GP-5R	0.009	20.9	0	0
	GP-7	0.013	20.9	0	0
	GP-8	0.005	20.9	0	0
	GP-9	0.008	20.9	0	0
<b>2020 Q2 LG, 5/14/2020</b>					
	Barometer	29.98			
	GP-1	0.001	20.9	0	0
	GP-10	0	18.8	0	0
	GP-11	0.001	20.9	0	0
	GP-12	0	20.5	0	0
	GP-13	0.002	20.9	0	0
	GP-14	0	20.9	0	0
	GP-15	0.002	19	0	1
	GP-2	0.001	20.9	0	0
	GP-4A	0	20.9	0	0
	GP-4B	0	19	0	0
	GP-5R	2	20.9	0	0
	GP-7	0	21	0	0
	GP-8	0	18	0	0
	GP-9	0	20.9	0	0

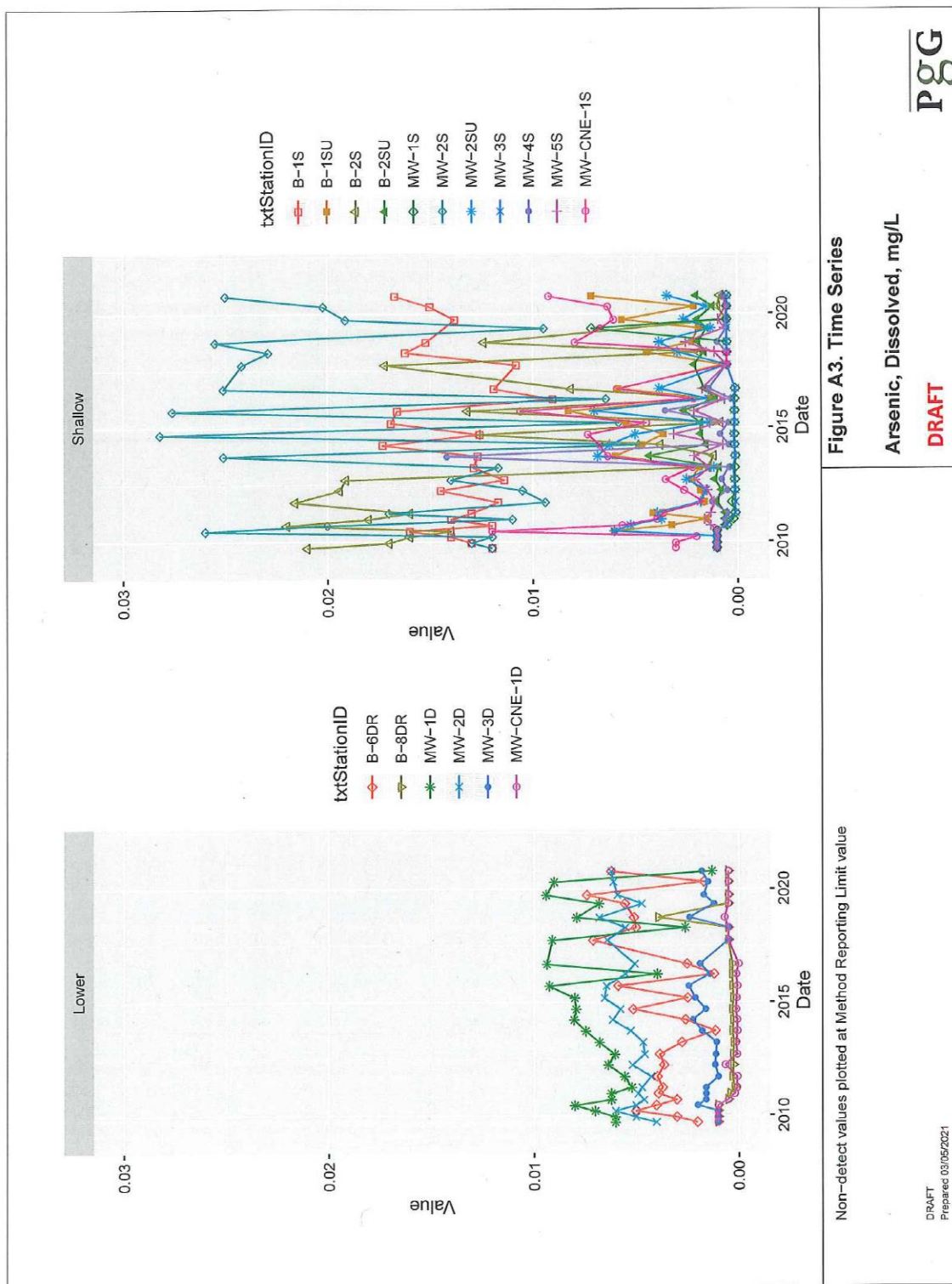
**Table 6. Centralia Landfill Gas Monitoring Summary, 2020**

**DRAFT**

Event, Date	Station	Pressure, Field (inches)	Oxygen, Field (percent)	Methane, Field (ppm)	Methane LEL, Field (percent)
<b>2020 Q3 LG, 9/11/2020</b>					
	Barometer	30.1			
	GP-1	0	20.9	0	0
	GP-10	0	20	0	0
	GP-11	0	18	0	0
	GP-12	0	20.9	0	0
	GP-13	0	16	0	0
	GP-14	0	20.9	0	0
	GP-15	0	18	0	0
	GP-2	0	20.9	0	0
	GP-4A	0	19.3	0	0
	GP-4B	0	17.6	0	0
	GP-5R	0	20.9	0	0
	GP-7	0	19.8	0	0
	GP-8	0	20	0	0
	GP-9	0	18	0	0
<b>2020 Q4 LG, 10/20/20</b>					
	Barometer	30.22			
	GP-1	0.003	20.9	0	0
	GP-10	0.002	20.5	0	0
	GP-11	0.002	18	0	0
	GP-12	0.004	20.9	0	0
	GP-13	0.005	18	0	0
	GP-14	0.002	20.9	0	0
	GP-15	0.001	19	0	1
	GP-2	0.003	19.4	0	1
	GP-4A	0	20.9	0	0
	GP-4B	0.003	20.9	0	0
	GP-5R	0.008	20.9	0	0
	GP-7	0.001	20.9	0	0
	GP-8	0.001	19	0	0
	GP-9	0.013	22.2	0	0

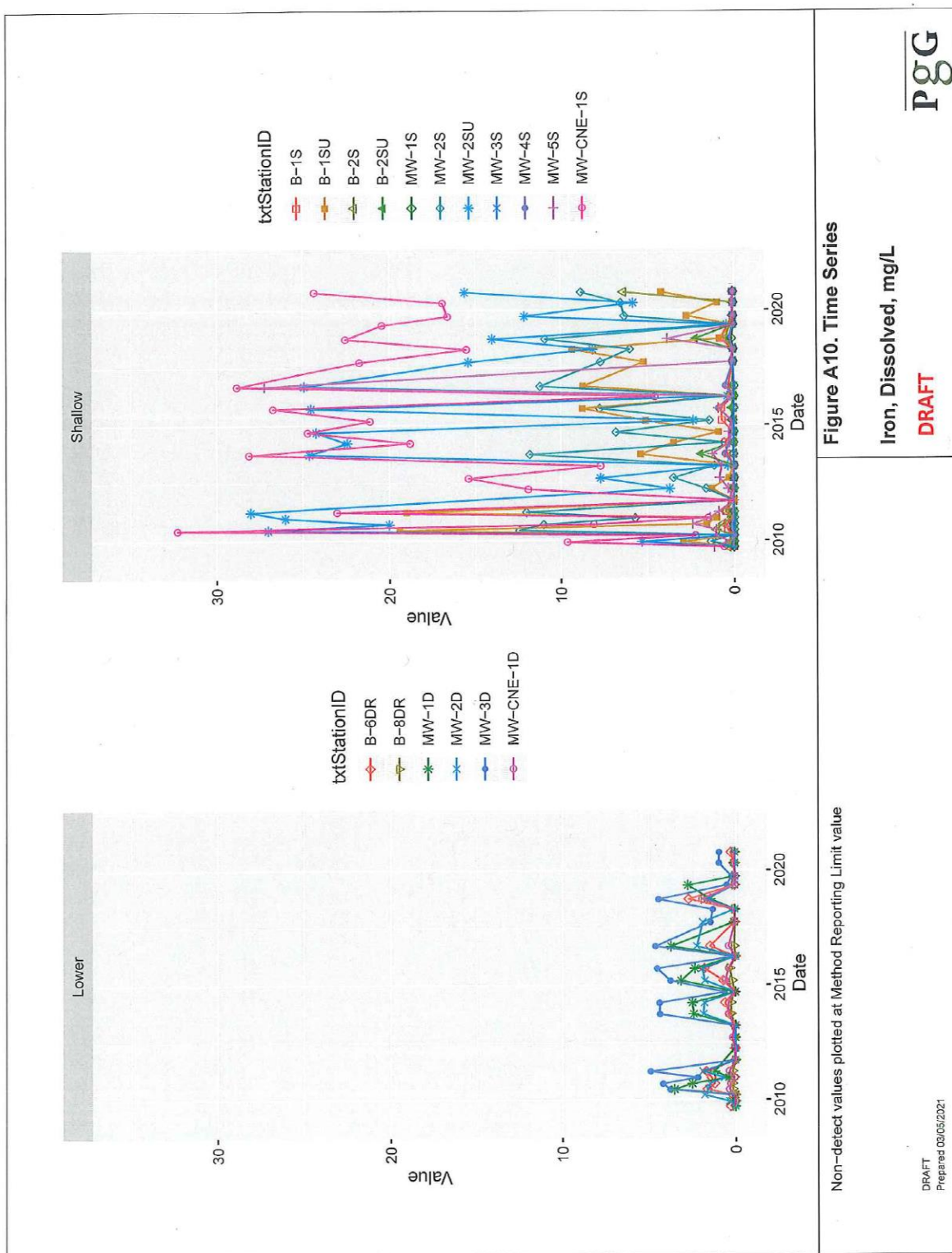
## 6.8 Time Series Graphs

### Arsenic, Shallow and Lower Aquifers

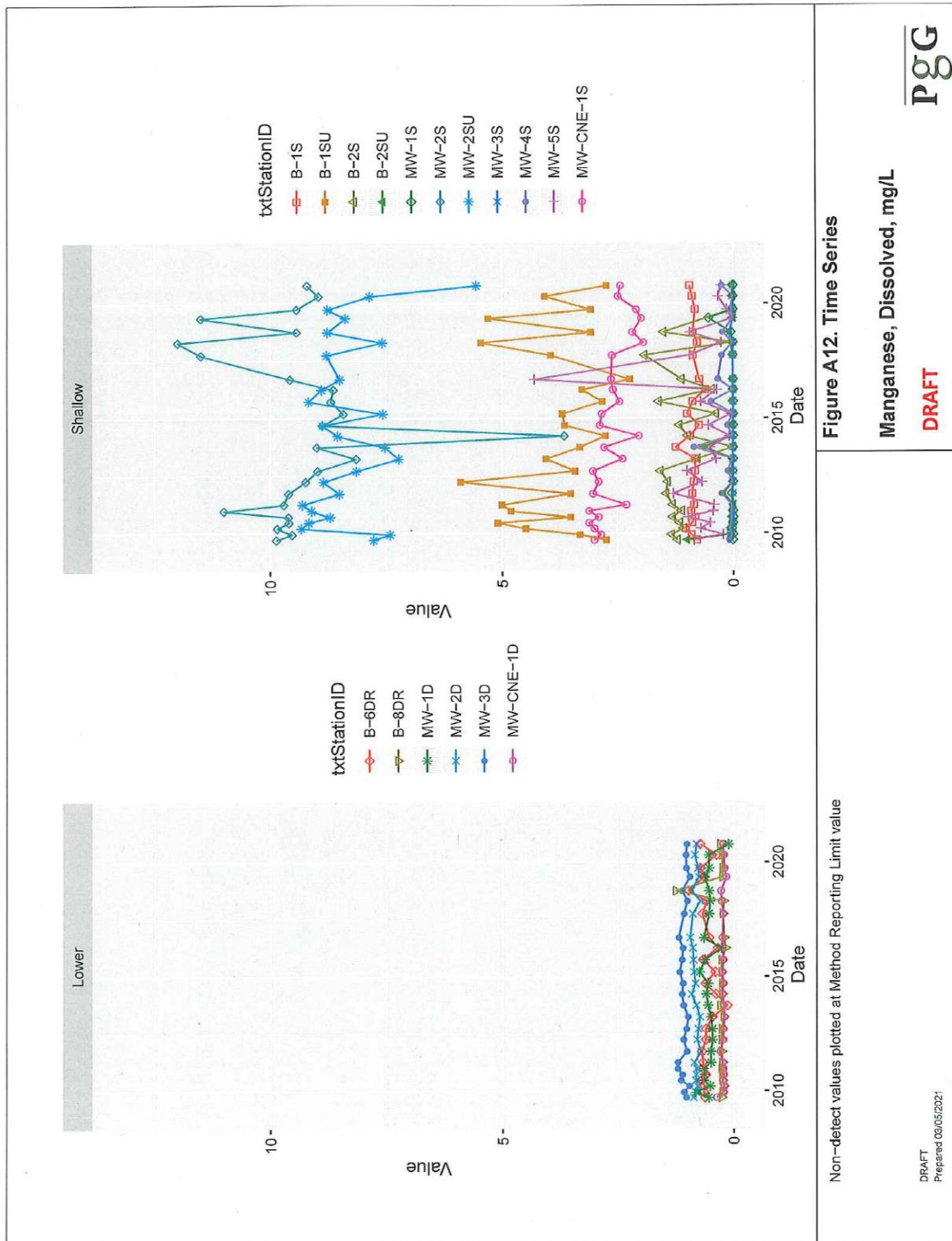




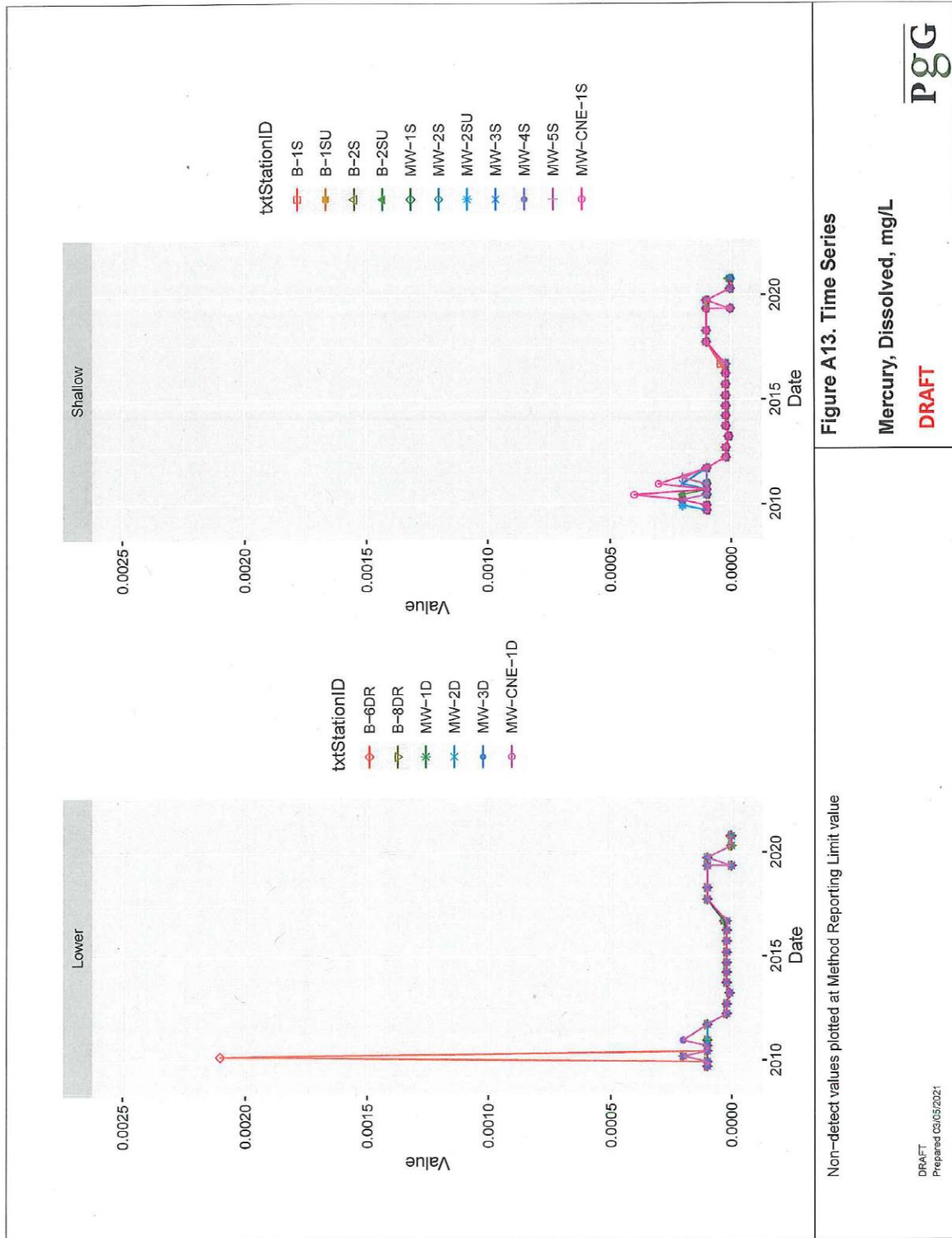
# Iron, Shallow and Lower Aquifers



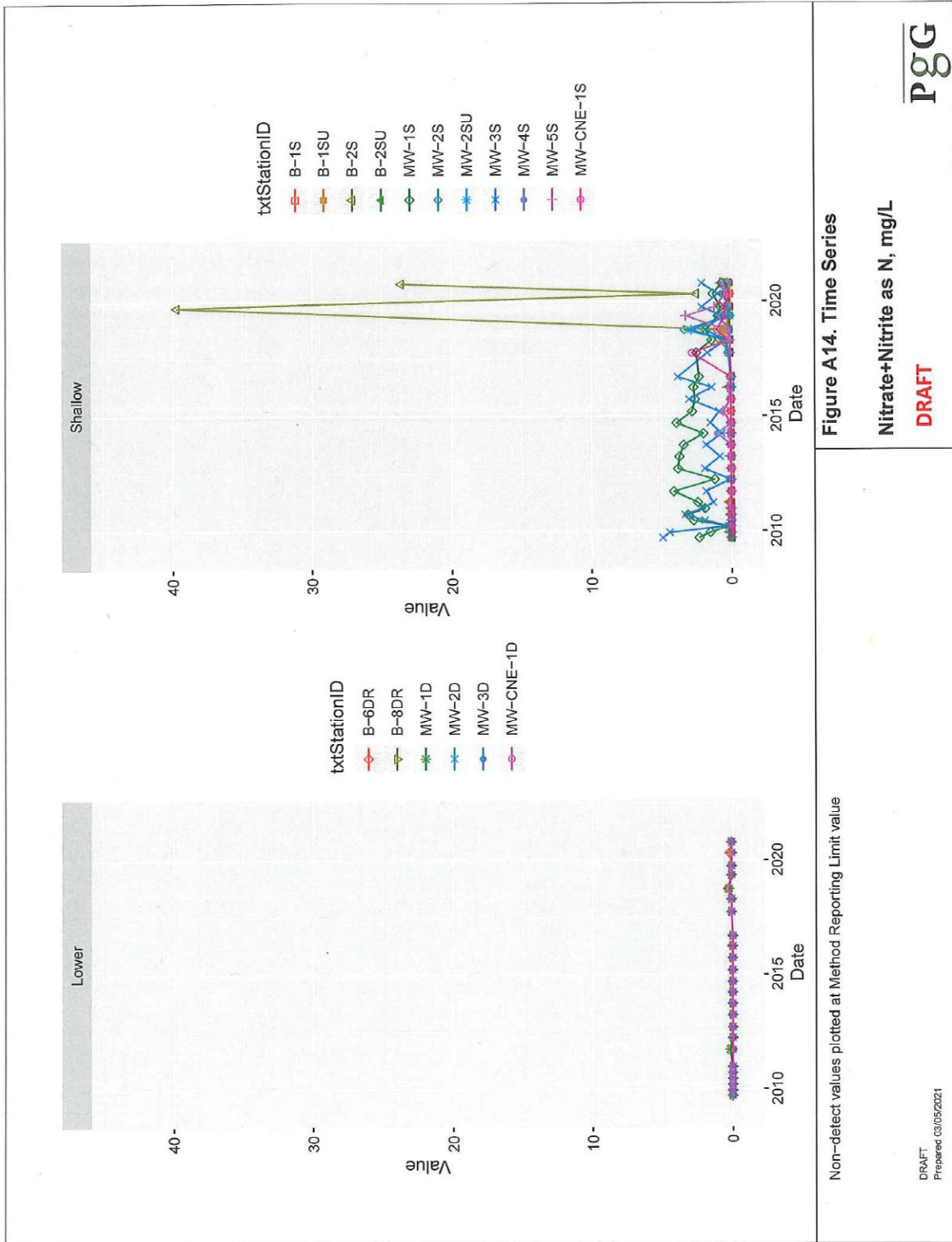
Manganese, Shallow and Lower Aquifers



Mercury, Shallow and Lower Aquifers

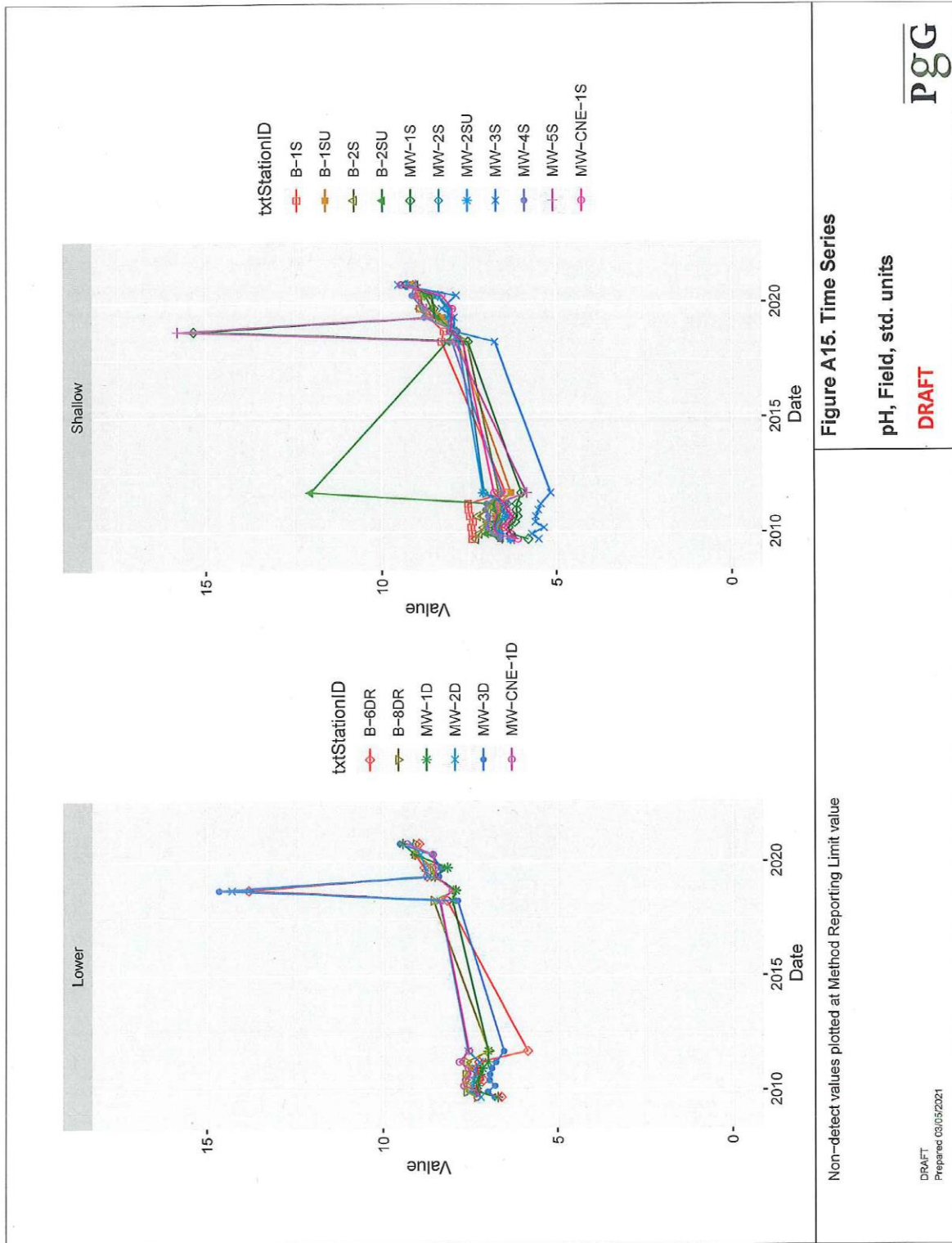


Nitrate+Nitrite, Shallow and Lower Aquifers

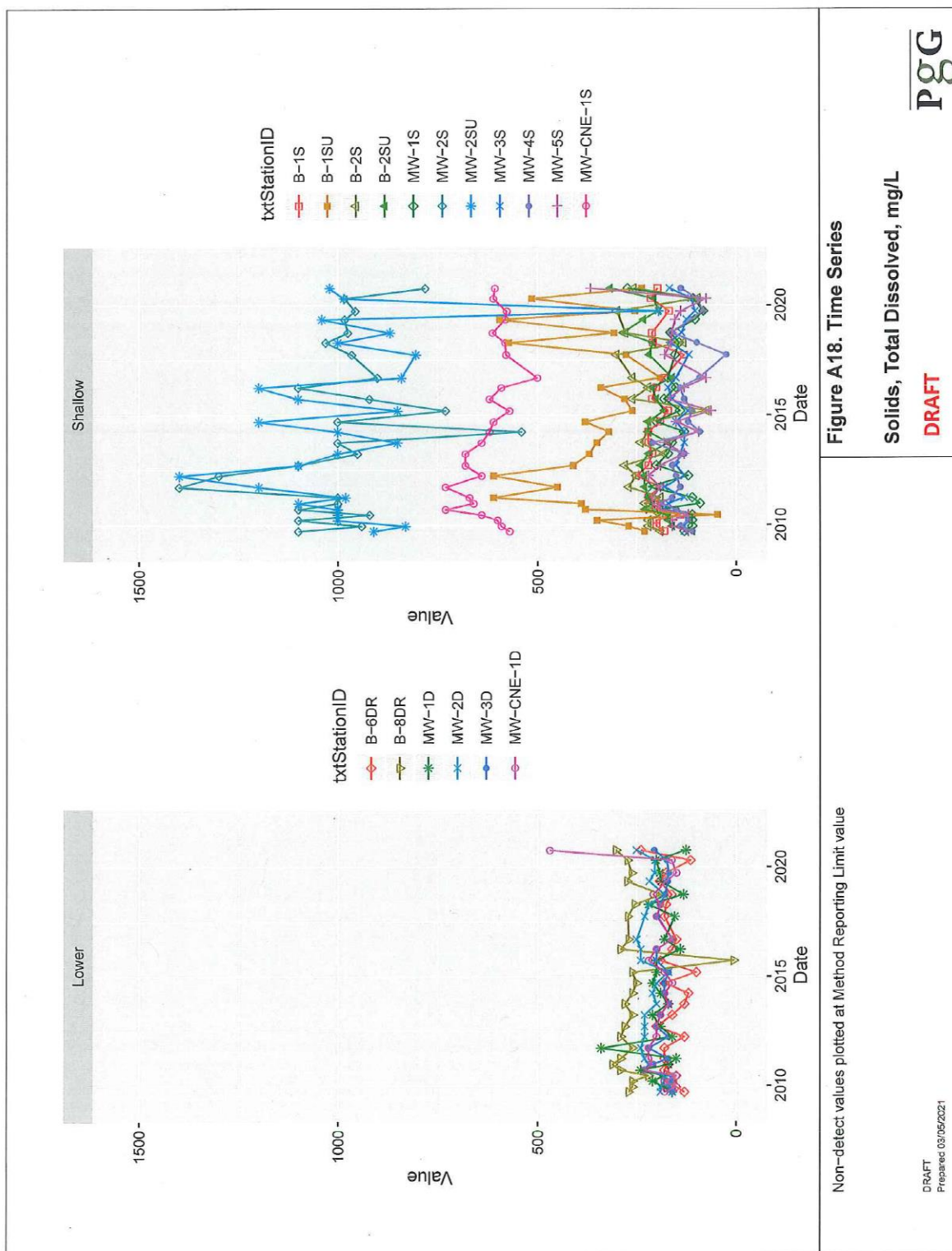




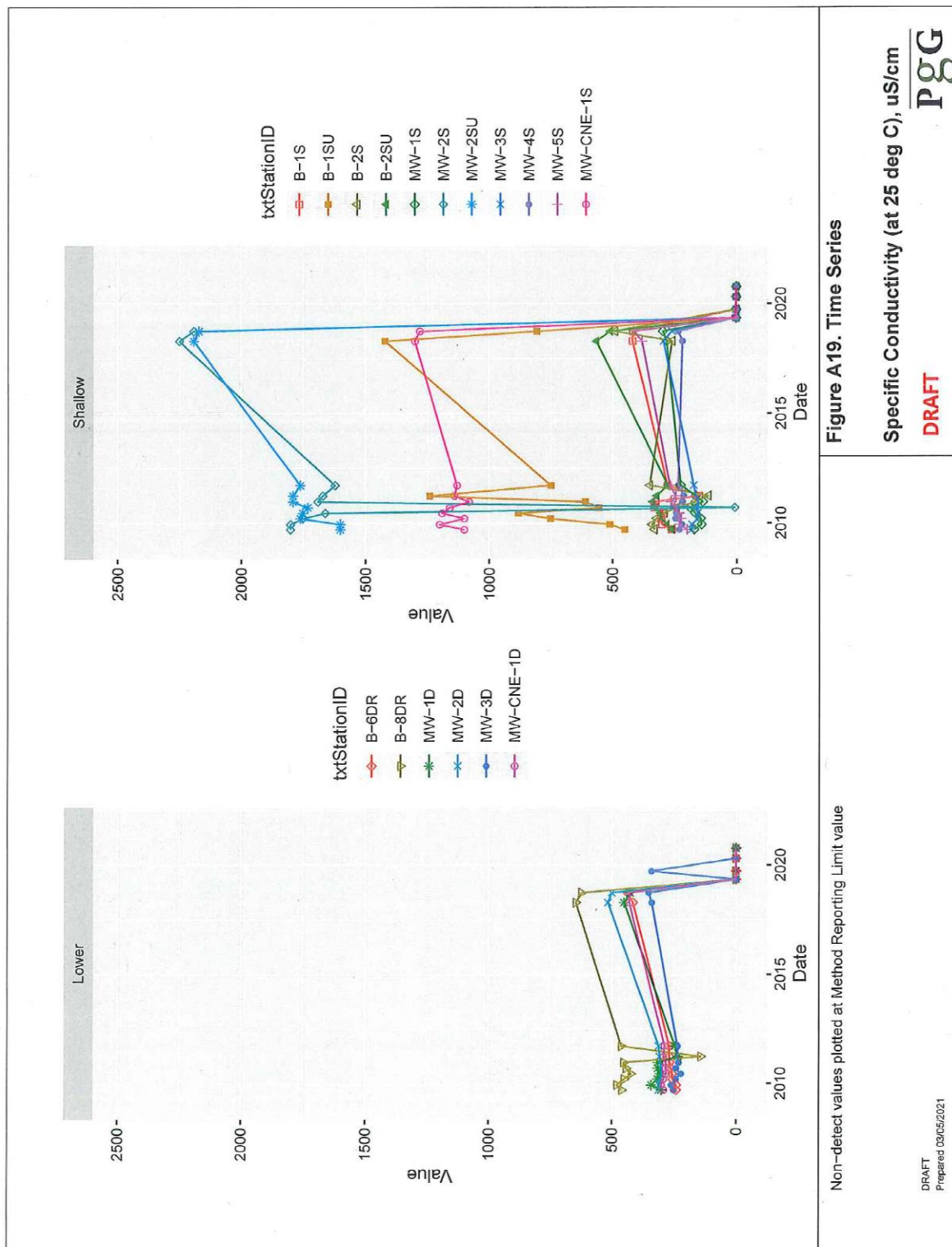
pH, Shallow and Lower Aquifers



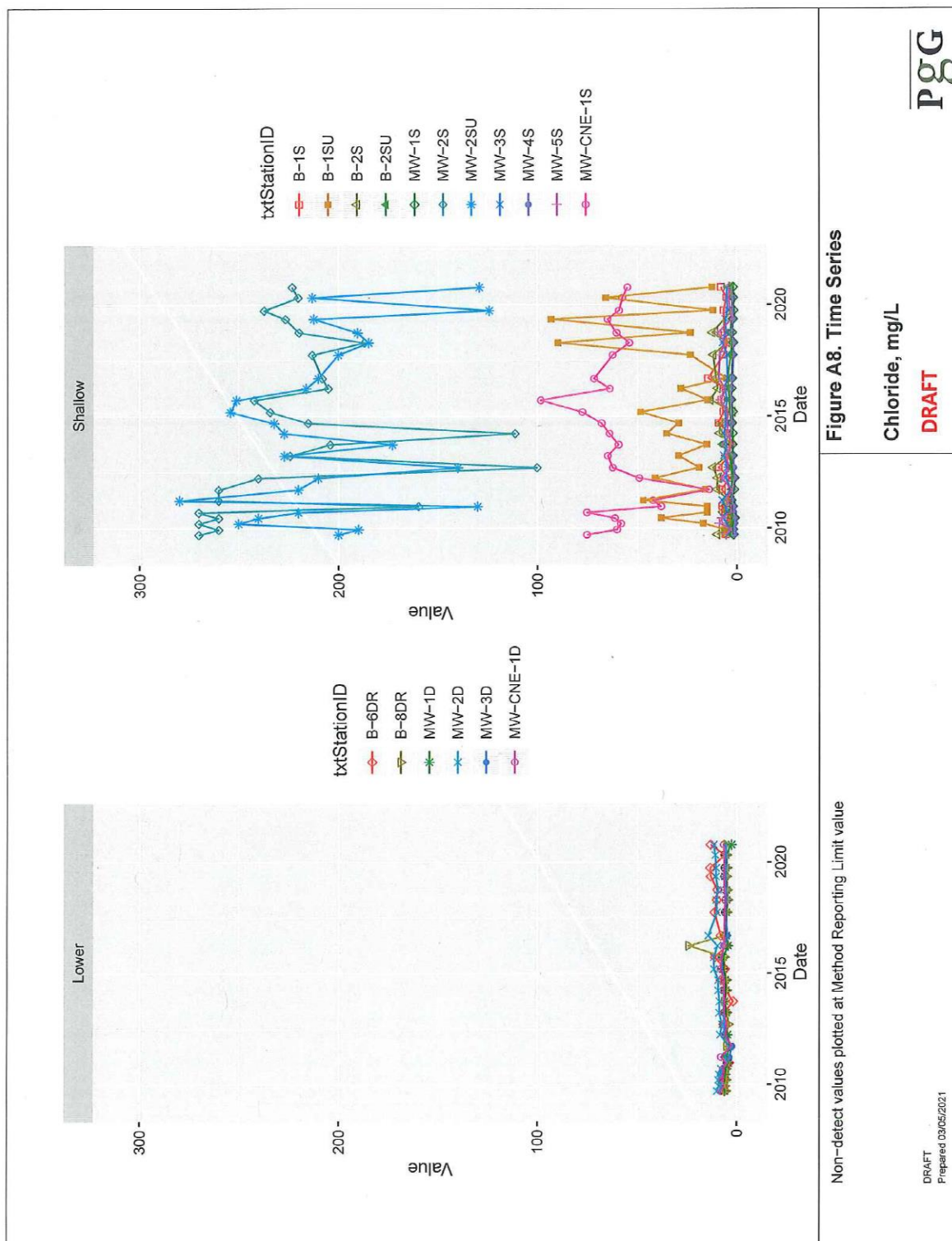
Total Dissolved Solids, Shallow and Lower Aquifers



Specific Conductivity, Shallow and Lower Aquifers



# Chloride, Shallow and Lower Aquifers



## 6.9 Environmental Covenant

### EXHIBIT D

#### RESTRICTIVE COVENANT

##### CENTRALIA LANDFILL

Pursuant to the Model Toxics Control Act, Chapter 70.105D RCW, a remedial action was conducted at the property that is the subject of this Restrictive Covenant. The work that will be done to remediate the property and conduct long-term operation and maintenance (hereafter the “Cleanup Action”) is described in the Consent Decree entered in State of Washington Department of Ecology v. Lewis County, City of Centralia, City of Chehalis, City of Morton, City of Mossyrock, Town of Pe Ell, and City of Vader, United State District Court – Western District of Washington Cause No. C91-5100(T) WD, and in attachments to the Consent Decree and in documents referenced in the Consent Decree.

The Cleanup Action conducted at the property is described in the following documents:

*Centralia Landfill Cleanup Action Plan*, Washington State Department of Ecology, Southwest Regional Office, September 1999.

*Centralia Landfill Feasibility Study Report*, CH2M HILL, Inc., April 1998.

*Centralia Landfill Remedial Investigation Report*, CH2M HILL, Inc., April 1998.

*Centralia Landfill Second Interim Action Final Cover System Post-Closure Operations and Maintenance Manual*, CH2M HILL, Inc., September 1995.

*Centralia Landfill As-Built Report for the Construction of the Final Cover System*, CH2M HILL, Inc., September 1995.

*Centralia Landfill Second Interim Action Cover System Engineering Report*, CH2M HILL, Inc., March 1994.

These documents are on file at Ecology’s Southwest Regional Office.

This Restrictive Covenant is made pursuant to RCW 70.105D.030(1)(f) and (g) and WAC 173-340-440 by Lewis County, City of Centralia, City of Chehalis, City of Morton, City of Mossyrock, Town of Pe Ell, and City of Vader (hereafter the “Defendants” or “Centralia Landfill Closure Group” or “CLCG”), their successors and



assigns, and the Washington State Department of Ecology (hereafter “Ecology”), its successors and assigns.

This Restrictive Covenant is required by Ecology under WAC 173-340-440 because the Cleanup Action resulted in hazardous substances remaining on the property beneath a final cover system, and because groundwater concentrations of hazardous substances exceed Method B cleanup levels established under WAC 173-340-720.

The undersigned, [NAME OF PROPERTY OWNER], is the fee owner of real property (hereafter “the Property”) in the County of Lewis, State of Washington that is subject to this Restrictive Covenant. The property is legally described in Exhibit A to the Consent Decree entered in State of Washington Department of Ecology v. Lewis County, City of Centralia, City of Chehalis, City of Morton, City of Mossyrock, Town of Pe Ell, and City of Vader, United State District Court – Western District of Washington Cause No. C91-5100(T) WD, and that legal description is hereby incorporated by reference.

The undersigned, [NAME OF PROPERTY OWNER], makes the following declaration as to limitations, restrictions, and uses to which the Property may be put and specifies that such declarations shall constitute covenants to run with the land, as provided by law and shall be binding on all parties and all persons claiming under them, including all current and future owners of any portion of or interest in the Property (hereafter “Owner”).

Section 1.

- a. Existing fencing shall not be removed and shall be maintained to prevent unauthorized access to the Property.
- b. No groundwater may be taken for any use from the Property unless the groundwater removal is part of monitoring activities associated with an Ecology-approved compliance monitoring plan.
- c. An area of the Property has been designated as a wetland enhancement area. The Owner of the Property must give thirty (30) day advance written notice to Ecology of any activities that may impact the wetland enhancement area and must obtain the written approval of Ecology and other agencies of jurisdiction prior to commencement of any such activities.

- d. Any activity on the Property that may result in the release or exposure to the environment of a hazardous substance that remains on the Property as part of the Cleanup Action, or that may create a new exposure pathway, is prohibited. Such activities are permissible only if: (1) they are part of routine maintenance system requirements performed in accordance with the Centralia Landfill Second Interim Action Final Cover System Post-Closure Operations and Maintenance Manual; (2) they are allowed or required under the Centralia Landfill Cleanup Action Plan; (3) they are part of monitoring activities associated with an Ecology-approved compliance monitoring plan, (4) immediate actions are necessary in response to emergency situations; or (5) Ecology provides prior written approval for such activities.
- e. No new structures shall be constructed on areas of the Property where solid waste has deposited without the written approval of Ecology and written approval by the local agency or agencies of jurisdiction.
- f. The Property shall be used only for industrial or commercial land uses, as described in WAC 173-340-740(1)(c), and defined in and allowed under the City of Centralia [or Lewis County] zoning regulations.

Section 2. Any activity on the Property that may interfere with the integrity of the Cleanup Action and continued protection of human health and the environment is prohibited without prior written approval from Ecology.

Section 3. The Owner of the Property must give thirty (30) day advance written notice to Ecology of the Owner's intent to convey any interest in the Property. No conveyance of title, easement, lease, or other interest in the Property shall be consummated by the Owner without adequate and complete provision for continued monitoring, operation, and maintenance of the Cleanup Action on the Property.

Section 4. The Owner must restrict leases to uses and activities consistent with the Restrictive Covenant and notify all lessees of the restrictions herein on the use of the Property.

Section 5. The Owner must notify and obtain approval from Ecology prior to any use of the Property that is inconsistent with the terms of this Restrictive Covenant. Ecology may approve an inconsistent use only after an opportunity for public notice and comment is provided.

Section 6. The Owner shall allow authorized representatives of Ecology the right to enter the Property at reasonable times for the purpose of evaluating the Cleanup Action; to take samples, to inspect remedial actions conducted at the Property, and to inspect records that are related to the Cleanup Action.

Section 7. The Owner of the Property reserves the right under WAC 173-340-440 to record an instrument that provides that this Restrictive Covenant shall no longer limit use of the Property or be of any further force or effect. However, such an instrument may be recorded only if Ecology, after public notice and comment, concurs.

\_\_\_\_\_  
[NAME OF PROPERTY OWNER]

\_\_\_\_\_  
[DATE SIGNED]

**[NOTE: The Property Owner must have this Restrictive Covenant notarized.]**



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## 6.10 Photo log

Photo 1: Landfill Entrance; Eastern Edge of the Landfill; Part of Landfill Cap to the Right  
– From the North



Photo 2: Transfer Station Northeast Corner of the Landfill – From the Southeast





Photo 3: Western Edge of Landfill Cap (Drainage System) - From the South



Photo 4: Weyerhaeuser Ditch (Western Edge Of Landfill) and Surface Water Sampling Point – From the South





Photo 5: Downgradient Groundwater Monitoring Wells – Western Edge of the Landfill



Photo 6: Landfill Gas Flares – From the Northwest





Photo 7: Landfill Cap and Landfill Gas Collection System – From the South



Photo 8: Landfill Gas Extraction Well, Groundwater Monitoring Well and Landfill Cap - From the Southwest

