

TECHNICAL MEMORANDUM

Date:	June 30, 2021
To:	Kimberly Swan, Clackamas River Water Providers
From:	Jennifer Schmidt, Herrera Environmental Consultants
Subject:	GIS Point Source Pollutant Risk Analysis Results

INTRODUCTION

The Clackamas River is a source of drinking water for more than 300,000 people in Clackamas County and is an important resource for helping to meet future water demand in the region. The Clackamas River Water Providers (CRWP) represents five municipal surface water intakes on the Clackamas River: City of Estacada, Clackamas River Water, North Clackamas County Water Commission, South Fork Water Board, and City of Lake Oswego. Herrera Environmental Consultants (Herrera) was hired in 2011 to complete a series of geographic information system (GIS) analyses to help identify potential pathways for pollutant export to the Clackamas River from seven high-risk activity categories (Clackamas River Water Providers 2010):

- Septic Systems
- Agricultural Activities
- Forestry Activities
- Vulnerable Soils
- Urban Development
- Point-Source Pollutants
- Hazardous Materials

The goal of these GIS analyses was to map risk factors known to have a strong negative correlation with drinking water quality in the Clackamas River watershed. Mapped risk "hot spots" for each category provide a spatial context for both the geography and intensity of risk by activity that can be used by the CRWP to help prioritize mitigation efforts. In 2021, Herrera was hired to update these analyses to map changes that have may have occurred in the locations of risk "hot spots" in the watershed over the last decade based on new or updated GIS data. This memorandum focuses specifically on the results of the updated 2021 GIS Point Source Pollutant Risk Analysis.

POTENTIAL THREATS FROM POINT SOURCE POLLUTANTS

The CRWP has identified the need to implement a point source pollution subprogram to "inventory, track, evaluate, and monitor point sources (water quality and other permits) of potential pollution to understand these potential threats and work with regulatory agencies, facilities, and permittees to reduce the potential threat to drinking water" in the Clackamas River watershed (Clackamas River Water Providers 2010). The U.S. Environmental Protection Agency (EPA) defines point source pollution as "any discernible, confined and discrete conveyance, including but not limited to any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation, or vessel or other floating craft, from which pollutants are or may be discharged" (EPA 2012).

Risks to source water quality from fixed point source pollution in the Clackamas River watershed include contaminant releases to groundwater and surface water, hazardous spills, and effluent discharges. Much of point source pollution in Oregon is regulated under the U.S. Clean Water Act through National Pollution Discharge Elimination System (NPDES) permits (Clackamas River Water Providers 2010); there are, however, several other types of permits and reporting procedure requirements for point source facilities in the Clackamas River watershed that may be useful for assessing the overall threat to source water quality. These include hazardous waste generators; environmental cleanup site information (ECSI); underground storage tanks (UST); landfills and other solid waste generators; underground injection controls (UIC); and water pollution control facilities (WPCF).

GIS POINT SOURCE POLLUTANTS RISK ANALYSIS

Herrera obtained and mapped the locations of point source pollutant facilities in the Clackamas River watershed to help predict the overall potential risk to source water quality based on high density clustering of point source facilities. The primary objectives of this analysis were to:

- 1. Identify point source pollutant permitting and reporting requirements in Oregon.
- 2. Obtain the locations of point source facilities that must comply with these requirements and map their distribution the Clackamas River watershed.
- 3. Use the results of this analysis to identify and overlay areas in the watershed with the highest concentration of permitted point source facilities with surface water proximity to produce a map of cumulative predicted risk to source water quality from point source pollutants in the watershed.

The following sections provide more detailed information on this analysis, including data sources used and limitations, permit and regulatory background information, requirements, and facility distribution in the watershed, and methodology for calculating cumulative point source pollutant risk.



Data Source and Limitations

The primary data sources used to assess the risk of point source pollutants to source water quality in the Clackamas River watershed are the Oregon Department of Environmental Quality (DEQ) Facility Profiler-Lite Interactive Viewer and the DEQ Underground Injection Control (UIC) databases. The following sections describe these two data sources in more detail, including any major limitations that are important to keep in mind when interpreting the GIS point source pollutant risk analysis results.

Oregon DEQ Facility Profiler-Lite Interactive Viewer

The Oregon DEQ Facility Profiler-Lite Interactive Viewer is a web-base mapping application that displays information maintained by DEQ on regulated or permitted facilities and sites, including permitted air and water dischargers, hazardous and solid waste sites, cleanup sites, and leaking and underground storage tanks. Each regulated or permitted facility in the watershed includes basic information about the facility as well as a unique facility identifier that can be used to obtain more information at the relevant DEQ or EPA program website. It is not uncommon for facilities to belong to multiple programs. Datasets showing the locations of these facilities were obtained directly from DEQ in April 2021 and were mapped in GIS by program.

It is important to keep in mind that site information in the Facility Profiler-Lite Interactive Viewer is primarily summary in nature and does not include detailed site-specific information such as NPDES permitted discharge amounts. Without detailed facility-specific permit information, it is difficult to accurately compare the magnitude of risk between facilities; therefore, the focus of this risk analysis was on identifying clustering of facility locations rather than relative discharge rates. The amount of information available in the database varies significantly by program; full site-specific records can be obtained for an individual facility from DEQ on request.

Underground Injection Control (UIC) database

A summarized database of Underground Injection Control (UIC) sites is available online and is updated by DEQ on a weekly basis. Herrera downloaded the UIC database from the <u>DEQ</u> <u>Databases</u> website as a CSV file in May 2021 and mapped the locations in GIS based on latitude and longitude coordinates.

Methodology

This section describes the GIS methods used by Herrera to map regulated and permitted facilities in the Clackamas River watershed; and to assess the potential impact to source water quality from high-density clustering of all point sources in the watershed regardless of permit type or regulatory status.



Mapping National Pollutant Discharge Elimination System Permits

The Federal Water Pollution Control Act (Clean Water Act) and Oregon state law require any facility that discharges pollutants from a fixed point source location into wetlands, ponds, lakes, streams, and rivers or to groundwater to obtain an NPDES permit. NPDES permits are categorized as either "individual" or "general"; individual permits are facility specific, while general permits cover a category of similar discharges rather than a specific site. Individual permitted facilities require more frequent monitoring to make sure that permit requirements are being met and have more stringent monitoring requirements for a greater variety of pollutants. According to Oregon DEQ, approximately 70% of individual NPDES permits are issued for the treatment and disposal of sewage

(https://www.oregon.gov/deq/wq/wqpermits/Pages/FAQ.aspx).

General NPDES permits are issued by DEQ in more than 20 categories and regulate a wide range of discharges, including fish hatcheries, gravel mining, and petroleum hydrocarbon cleanups (<u>https://www.oregon.gov/deq/wq/wqpermits/Pages/All-Permits-Applications.aspx</u>). Because these permits are regulated by a set of conditions for each category rather than by individual facility, they tend to require less oversight.

Herrera used information extracted from the Oregon DEQ Facility Profiler-Lite Interactive Viewer to map 80 general and 8 individual active NPDES permits in 8 different categories in the Clackamas River watershed. Table 1 provides a summary of these permits by category; Figure 1 shows the distribution of permitted facilities in the watershed. Permitted Confined Animal Feed Operations (CAFOs) are addressed in the GIS Agricultural Activities Risk Analysis Results memorandum.

watersned.		
NPDES Permit Category	Permit Type	Number of Active Permits
General	GEN01: Cooling water/heat pumps	0
	GEN02: Filter backwash	2
	GEN1200A Stormwater: Sand, gravel, and other non-metallic mining	3
	GEN1200C Stormwater: Construction activities - 1 acre or more	52
	GEN 1200Z: Industrial stormwater	23
Individual	Domestic wastewater treatment facility	5
	Industrial stormwater discharges	1
	Industrial wastewater discharges	2

Table 1. Number of active NPDES permits issued by permit type in the Clackamas River watershed.

Source: Oregon DEQ Facility Profiler-Lite Interactive Viewer (May 2021)

As shown in Figure 1, the largest geographic concentration of facilities with active NPDES permits in the Clackamas River watershed is from the Highway 212/224 junction downstream to



the mouth of the watershed in the City of Gladstone. This includes the majority of the GEN1200Z: Industrial Stormwater permits. There are also concentrations of GEN1200C: Construction Activities permits in the areas near the Cities of Happy Valley, Sandy, and Estacada.

Mapping Water Pollution Control Facilities (WPCF) Permits

WPCF permits are required by Oregon DEQ for all facilities that discharge wastewater to the ground (<u>https://www.oregon.gov/deq/wq/wqpermits/Pages/FAQ.aspx</u>). The primary purpose of a WPCF permit is to protect groundwater from contamination and to prevent discharges to surface waters; no discharge to surface water is allowed under a WPCF permit. As with the NPDES program, WPCF permits are issued as either "individual" or "general"; they prevent groundwater contamination from facilities like wastewater lagoons and onsite sewage disposal systems. General WPCF permits are issued in approximately a dozen categories.

Herrera used information extracted from the Oregon DEQ Facility Profiler-Lite Interactive Viewer to map 6 general and 38 individual active WPCF permits in 6 different categories in the Clackamas River watershed. Table 2 provides a summary of these permits by category. Figure 1 shows the distribution of permitted facilities in the watershed.

Table 2. Number of active WPCF permits issued by permit type in the Clackamas River watershed.				
WPCF Permit Category	Permit Type	Number of Active Permits		
General	GEN 1400A: Wineries, seasonal crop preparation, and fresh pack produce	2		
	GEN 1400B: Canneries, food/animal processing, and extracts	0		
	GEN1000: Gravel mining	4		
Individual	Domestic on-site sewage system	35		
	Domestic wastewater treatment facility	2		
	Industrial wastewater discharges	1		

Source: Oregon DEQ Facility Profiler-Lite Interactive Viewer (May 2021)

As shown in Figure 1, the geographic distribution of active WPCF permits in the watershed is more dispersed than the NPDES permits. This is likely because the majority of the WPCF permits issued are for domestic on-site sewage systems in the portion of the watershed that is outside of treated sewer districts.

Mapping Environmental Contaminant Site Information (ECSI)

The Oregon DEQ ECSI database has been used since 1989 to 1) track sites in Oregon with known or potential contamination from hazardous substances in groundwater, surface water, soil, or sediments; and 2) document sites where DEQ has determined that no further cleanup action is



required (https://www.oregon.gov/deq/Hazards-and-Cleanup/env-cleanup/Pages/ecsi.aspx). Sites contaminated or potentially contaminates with hazardous materials (solvents, metals, PCVs, petroleum hydrocarbons, etc.) that are added to the ECSI are reported to DEQ through a variety of sources, including investigative efforts, referral from other DEQ programs or agencies, reports of chemical spills, citizen complaints, and data submitted voluntarily by site owners and operators. ECSI includes both potentially contaminated sites as well as sites known to be contaminated; therefore, it is important to keep in mind that inclusion in the ECSI database does not necessarily confirm site contamination.

No regulatory significance is attached to the ECSI database itself; however, two subcategories of sites on the ECSI, the Confirmed Release List (CRL) and Inventory of Hazardous Substances (Inventory), do carry regulatory significance. Sites are added to the CRL when a hazardous release has been confirmed, regardless of the quantity, potential impacts, or clean-up actions taken; sites are added to the Inventory when removal or remedial action are needed to protect human health or the environment. Sites can be removed from the CRL and Inventory following a formal delisting process, whereas sites are not removed from the ECSI database following remediation.

Herrera used information from the Oregon DEQ Facility Profiler-Lite Interactive Viewer to map 82 ECSI sites in the Clackamas River watershed; 13 of these sites are included on either the CRL or Inventory, 36 sites are suspected to be contaminated and require further investigation, and 33 sites require no further clean-up action. Figure 2 shows the distribution of these sites in the watershed. As shown in Figure 2, the largest geographic concentration of ECSI sites is from the Highway 212/224 junction downstream to the mouth of the watershed in the City of Gladstone, including 56% of sites listed on the CRL or Inventory. Potentially contaminated sites in the rest of the watershed tend to be concentrated primarily around highways and major arterials.

Mapping Hazardous Waste Generators

Hazardous waste generators in Oregon are regulated by U.S. EPA and Oregon DEQ and fit into the following three categories: 1) Conditionally Exempt Generators (CEG); 2) Small Quantity Generators (SQG); and 3) Large Quantity Generators (LQG). Table 3 provides a summary of the criteria used to determine what category a facility falls in. Table 3 provides a summary of the criteria used to determine what category a facility falls in. Under the federal Resource Conservation and Recovery Act (RCRA), all SQG and LQG facilities must notify DEQ of hazardous material activity and be assigned a DEQ/EPA identification number prior to treating, storing, disposing of, transporting, or offering for transportation any hazardous materials. CEG facilities are not required to notify DEQ, although many do "as an aid to record keeping and to obtain the identification number necessary to ship hazardous waste off-site for recycling or for permanent disposal" (DEQ 2017).

All SQG and LQF facilities are required to submit an annual report to DEQ by March 1st providing a summary of activities performed in the previous calendar year (<u>https://www.oregon.gov/deq/Hazards-and-Cleanup/hw/pages/HW-reporting.aspx</u>). These

facilities are also required to comply with the Oregon Toxic Use and Hazardous Waste Reduction Act of 1989 (most recently revised in 2005) mandating pollution prevention planning. CEQ facilities may, but are not required, to join the Toxics Use and Hazardous Waste Reduction program (<u>https://www.oregon.gov/deq/Hazards-and-Cleanup/hw/Pages/TUHWR.aspx</u>).

Herrera used information extracted from the Oregon DEQ Facility Profiler-Lite Interactive Viewer to map 80 hazardous waste generators in the Clackamas River watershed; 68 are CEQ facilities; 4 are SQG facilities; and 8 are LQG facilities. Figure 3 shows the distribution of these sites in the watershed. As shown in Figure 3, the largest geographic concentration of hazardous waste generators in the Clackamas River watershed are 1) in the area north of the Clackamas River near the junction of Highway 212/224 (including both LQG facilities); and 2) within the City of Sandy.

Table 3. Criteria used to determine hazardous waste generator categories and associated regulatory requirements for facilities in the Clackamas River watershed.

Hazardous Waste Generator Category	Acute Hazardous Waste Generated (lbs)	Hazardous Waste Generated (Ibs)	Spill Cleanup Containing Hazardous Waste Generated (lbs)	Spill Cleanup Containing Acute Hazardous Waste Generated (lbs)	Acute Hazardous Waste Onsite (Ibs)	Hazardous Material On-site (Ibs)
Conditionally Exempt Generator (CEG)	< 2.2 ¹	< 220 ¹	< 220 ¹			< 2,200 ³
Small Quantity Generator (LQG)		220 - 2,200 ²	220 - 2,200 ²			>2,200 ²
Large Quantity Generator (LQG)	> 2.2	> 2,200 ²	> 2,200 ²	> 220 ²	2.2 ²	

Source: DEQ (2017)

1: Quantities listed apply to every calendar month

2: Quantities listed apply to any one calendar month

3: Quantities apply at any time

Mapping Solid Waste Disposal Sites and Landfill (SWIFT) Permits

Oregon DEQ requires the following types of facilities to apply for a Solid Waste Disposal Permit prior to starting operations (<u>https://www.oregon.gov/deq/mm/swpermits/Pages/default.aspx</u>):

- Municipal solid waste landfills
- Industrial solid waste landfills, demolition landfills, wood waste landfills, and nonmunicipal land disposal sites



- Energy recovery facilities and incinerators
- Composting facilities
- Disposal site, land application disposal sites and land use for deposit, spreading, lagooning or disposal of sewage sludge, septage, and other sludges
- Transfer stations and material recovery facilities
- Treatment facilities and petroleum contaminated soil remediation facilities

Herrera used information extracted from the Oregon DEQ Facility Profiler database to map 15 Solid Waste Disposal permits in the Clackamas River watershed, including 3 composting facilities, 5 industrial facilities, 5 municipal facilities, and 2 short-term Solid Waste Letter Authorizations (SWLA) permits. Figure 4 shows the distribution of these sites in the watershed. There is no significant clustering of facilities.

Mapping Underground Storage Tanks (UST) & Leaking Underground Storage Tanks (LUST)

The Federal Resource Conservation and Recovery Act (RCRA) and Oregon DEQ require an Underground Storage Tank (UST) General Permit Registration Certificate to Operate to be obtained for all commercial tanks storing gasoline, ethanol, diesel, and other listed substances with a capacity of more than 110 gallons or residential or farm use tanks with a capacity of more than 1,100 gallons. Only tanks with operating permit certificates are allowed to receive fuel; tanks without operating permit certificates are not authorized to receive fuel and are considered out of service, including tanks with temporary closures

(https://www.oregon.gov/deq/tanks/Pages/Cleanup-Guidance.aspx).

The Oregon DEQ Leaking Underground Storage Tank (LUST) program handles issues related to the cleanup of soil and groundwater contamination from spills and releases from regulated USTs. If it is necessary to treat petroleum-contaminated soil from a LUST, the UST owner is required to obtain a Solid Waste Letter of Authorization (SWLA) permit from DEQ (<u>https://www.oregon.gov/deq/mm/swpermits/Pages/Solid-Waste-Letter-Authorization.aspx</u>). Since Oregon began administering the federal LUST program in 1998, over 7,475 petroleum releases have been reported to DEQ. Approximately 6,625 of these sites have been cleaned up, leaving 850 active sites throughout the state. Oregon DEQ issues a "no further action" letter to a site when all regulatory cleanup requirements have been met (https://www.oregon.gov/deq/tanks/Pages/Cost-Recovery.aspx).

Herrera used information extracted from the Oregon DEQ Facility Profiler-Lite Interactive Viewer to map 103 active USTs with capacities ranging from 500 to more than 20,000 gallons. Many facilities have more than one active UST onsite. Herrera also mapped 222 active LUST sites; 14 of these have been reported to DEQ but have not had any cleanup, 9 are listed as having some



cleanup started, and 199 are listed as having completed cleanup but have not been issued "no further action" letters. 137 of the LUST sites are regulated by DEQ, and 85 are non-regulated (i.e., heating oil tanks).

The distribution of UST and LUST sites are shown in Figure 5. The largest concentration of permitted USTs is a cluster of 40 tanks upstream of the surface water intakes near the junction of Highway 212/224 downstream to the mouth of the watershed in the City of Gladstone. The largest concentration of regulated LUSTS are: 1) immediately north and northeast of the Clackamas River water surface intake; 2) on both side of the Clackamas River near the Lake Oswego surface water intake; and 3) west of the intersection of SE 242nd Ave and Highway 212.

Underground Injection Controls (UIC)

Injection systems are any man-made design, structure, or activity which discharges below the ground or subsurface. Most UIC systems in Oregon are shallow and widely used to dispose of stormwater, including rainfall runoff and snowmelt from properties, streets, and parking lots owned and operated by public or private entities. Business and industries may also use injection systems to dispose of water that has come in contact with any raw material, product, by-product, or waste during manufacturing or processing

(https://www.oregon.gov/deq/wq/wqpermits/Pages/UIC-faq.aspx). Common UIC system designs include wells that are dry except when injecting fluids, trenches, perforated piping, sumps, drain fields, drill holes, and floor drains.

All UIC systems in Oregon must be registered with and approved by Oregon DEQ, either through issuance of an authorization by rule or a Water Pollution Control Facility (WPCF) permit. If an owner or operator cannot obtain DEQ approval, the system must be formally closed. The following registration statuses may apply to UICs at various times during their operation:

- **Denied:** Failed to meet requirements and/or required data. Non-compliant with state and/or federal rules.
- **Cleanup Site:** The site is listed on the state cleanup database as needing remediation. Most are not registered and are non-compliant. No new UICs can be allowed and those existing must go through cleanup or be closed.
- Incomplete or Information Request: Failed to turn in required data, non-compliant.
- **Not Registered:** Site identified as having UICs because of site inspection, building permit application, complaints, or other means. Non-compliant.
- **Registered and Rule Authorized**: Meets state and federal requirements. DEQ letter sent to owner and municipality.



- **Registered only or Entered Old:** May predate existing rules and fails to meet all rule authorization requirements or partially completed registration with failure to submit all data. Does not qualify to operate. Non-compliant with state/federal rules.
- Permit: Applied for a permit or is operating under a WPCF permit. Compliant.
- **To Clean Up, ICP/VCP**: Site found during review to be contaminated. Referred to cleanup and added to the cleanup database. Must be remediated before existing or new UICs can be allowed or existing UICs must be closed.
- **Under Review**: Registration forms sent in and data entered. Awaiting Review.
- **Abandoned:** Cannot document that the UIC was closed following existing rules (state/federal) to protect groundwater. May be contaminated. Liable for further fines, fees, cleanup, or enforcement.
- **Decommissioned or Closed:** DEQ received and approved closure to meet federal/state standards. Compliant.

Herrera obtained and mapped a list of 22 UICs in the Clackamas County watershed from Oregon DEQ that is current as of June 2021. The number of UICs by registration status is provided in Table 4. The distribution of these features is shown in Figure 6.

Table 4. Number of UICs by registration status in the Clackamas River watershed.			
UIC Registration Status	Number of UICs		
Applied for Permit	2		
Closure Review	2		
Formal Closure	1		
Registered and Not Rule Authorized	2		
Registered and Rule Authorized	8		
Registered with Permit	7		
Total	22		

As shown in Figure 6, the largest geographic concentration of UICs are located: 1) immediately north and northeast of the Clackamas River Water surface water intake; and 2) downstream of the City of Estacada.

Calculating Point Source Pollution Risk

Oregon DEQ completed an updated source water assessment for the CRWP Public Water Systems in May 2019 that identified potential contaminant sources (PCS) in the watershed (DEQ 2019). This work built upon a previous assessment completed in 2005. As part of these efforts,



Oregon DEQ has developed a matrix of relative risk to surface water from different categories of potential contaminant sources as part of their source water assessment framework (DEQ 2021). The relative risk assigned to each potential pollutant source described in the previous sections based on this framework is shown in Figure 7. For permitted facilities that have been licensed since the 2019 assessment, Herrera used the DEQ surface water assessment matrix to assign a relative risk to each point. Figure 7 also shows the PCS locations identified in the original 2005 analysis, filtered to show only point source pollutants. PCS risks specific to land use activities like agriculture, forestry, and hazardous material transport are addressed in the respective GIS risk analysis memos for those land uses.

To identify "hot spots" of point source pollutants classified with a high relative risk to surface water, Herrera created a 500-foot grid covering the entire watershed and calculated the number of unique point source pollutant records within each cell. The results of this analysis are shown in Figure 8. It is important to keep in mind that some facilities may have more than one record associated with them depending on what permits apply.

RESULTS AND RECOMMENDATIONS

Herrera mapped nearly 1,600 point source pollution permits, facility registrations, or potential point-source contaminant sources in the Clackamas River watershed. Many facilities in the watershed have permits or registrations in more than one category that contribute to this overall total. As indicated in Figure 8, the regions with the highest risk from point source pollutants are located: 1) near the bottom of the watershed; 2) just west of the junction of Highway 212 and Highway 26; and 3) near the City of Estacada. It is important to keep in mind that this analysis is not based on specific discharge data and represents density of high-risk facilities based on Oregon DEQ source water assessment criteria only. Additional surface water monitoring efforts should be considered for high-risk areas to evaluate water quality. Where impaired water quality is detected, this risk analysis can be used to support pollutant source tracking efforts.

Herrera recommends that the GIS datasets used in this analysis be updated every 3 to 5 years to make sure that the status of all facilities are current and that facilities that have been added or removed from the Oregon DEQ Facility Profiler-Lite Interactive Viewer are reflected. The results of the GIS maps and high-risk density analysis can be used to help identify specific high-risk regions to focus on or permit/registration categories to analyze, and detailed permits could then be obtained from DEQ for each facility. This would allow for the mapping of discharge rates and would provide for a better representation of risk from individual facilities to source water quality in the watershed. These more detailed data could also be used as potential inputs for future modeling efforts to quantify the overall risk of water quality impairment from point sources relative to other pathways (e.g., septic systems, agricultural areas).



REFERENCES

Clackamas River Water Providers. 2010. *Drinking Water Protection Plan for the Clackamas River*. September 2010. Obtained May 10, 2021, from agency website: <u>http://www.clackamasproviders.org/contacts/7.html</u>

Oregon Department of Environmental Quality (DEQ). 2021. *Source Water Assessments: Inventory List Potential Impacts from Land Uses and Activities*. Obtained June 10, 2021, from agency website: <u>https://www.oregon.gov/deq/FilterDocs/swainvimpacts.pdf</u>

DEQ. 2019. Updated Source Water Assessment for Clackamas River Water Providers Public Water Systems. May 2019. Obtained March 5, 2021, from agency website: <u>https://www.deq.state.or.us/wq/dwp/docs/uswareports/USWA_00279Estacada.pdf</u>

DEQ. 2017. *Small Quantity Generator Handbook*. January 2017. Obtained April 4, 2021, from agency website: <u>https://www.oregon.gov/deq/FilterDocs/SQGHandbook.pdf</u>

U.S. Environmental Protection Agency (EPA). 2012. What is Nonpoint Source Pollution? March 6, 2012. Obtained May 25, 2021, from agency website: http://water.epa.gov/polwaste/nps/whatis.cfm



FIGURES















