2022

CITY OF TROUTDALE
WASTEWATER SERVICES DIVISION
BIOSOLIDS MANAGEMENT PLAN

Purpose:

The purpose of this plan is to outline the criteria, methods and Best Management Practices required to manage the City of Troutdale's Biosolids inventory and land application program in accordance with 40 CFR Part 503 and Oregon Administrative Rule 340, Division 50 regulations.

Overview:

Troutdale is located in north central Multnomah County, Oregon, near the confluence of the Sandy and the Columbia Rivers. The urban growth boundary area encompasses approximately six square miles and growth estimates put the year 2025 population at approximately 25,000 citizens. The current population is 16,487. The City owns and operates an Activated Sludge Plant with an Average Daily Dry Weather Flow design of 3.0 MGD. The plant was commissioned and started discharging treated effluent on November 20, 2001. Troutdale's Water Pollution Control Facility (WPCF) is located at 1820 NW Graham Road. Troutdale has a small industrial/commercial base with no businesses currently under any Industrial Discharge Permits issued by the City. The authority to issue any discharge permits is contained in the City's Industrial Pretreatment Program, Chapter 12.07 ofthe Troutdale Municipal Code. New potential industrial user processes are reviewed and their potential discharge is evaluated and tested to determine if a City issued Discharge Permit would be required. The City's industrial base is approximately 10%, with the remainder of flow coming from domestic sources. The City's WPCF accepts no septage.

The Biosolids treatment and handling facilities at Troutdale are state ofthe art and produce a very stable and high quality product that meets the Part 503 regulations for class "B" Biosolids. These Biosolids are land applied at approximately 1.5% to 2.5% solids to agricultural lands under agreements with the owners of these lands as well as written approval from the Oregon Department of Environmental Quality.

General Description:

The City's existing sanitary wastewater collection system collects wastewater from residences, businesses, industries, and public facilities. Flow through the collection system is mostly by gravity. Ten lift stations pump wastewater from areas that cannot flow by gravity to the treatment plant. The sewage is conveyed to the Troutdale WPCF through a 30-inch-diameter pipe that enters the south end of the Headworks.

The Troutdale WPCF treatment process includes a headworks with automated mechanical screening and grit removal, a primary influent pumping station, two primary clarifiers, two activated sludge aeration basins, two secondary clarifiers, an ultraviolet (UV) light disinfection channel, an effluent pumping station, a gravity thickener, two anaerobic digesters, and a sludge storage lagoon. Treated and disinfected effluent is discharged into the Sandy River. Digested sludge is stored in the sludge storage lagoon prior to land application disposal.

The Troutdale WPCF is typically staffed from 6:00 a.m. to 4:30 p.rn., Monday through Friday. At times when there is no staff on-site, at least one operator will carry a city cellphone to allow receipt of alarm messages from the treatment facility supervisor control system, and provide prompt response to alarms. The on-call operator will have at least an Operation I level certification and/or have one years experience and the approval of the Super Intendant.

TREATMENT PROCESS NARRATIVE

Influent Screening and Grit Removal:

The influent screening process removes rags, plastics, and medium and large debris from the influent flow stream, preventing their passage to downstream processes. Removing this debris protects downstream pumps and equipment and reduces maintenance requirements for downstream facilities.

A mechanical bar screen with 1/4-inch bar spacing is located in the main influent channel. Flow will automatically divert to a bypass channel containing a manually cleaned bar screen if the mechanical bar screen fails or if the main influent channel gate upstream of the bar screen is closed. Screenings material is washed and compressed during its transport to a dumpster for off-site disposal.

A 12-foot-diameter vortex style grit removal chamber removes inert particulate matter from the screened raw sewage to reduce wear on downstream equipment and reduce the amount of material that settles in the primary, secondary, and process tanks. A recessed impeller centrifugal pump transports the grit slurry from the collection hopper to a cyclone concentrator to separate the solids from the water. The concentrated grit slurry then enters a classifier, where the grit particles are transported up an inclined ramp by a screw conveyor and discharged to a dumpster for off-site disposal.

Primary Influent Pumping:

The primary influent pumps convey screened and de-gritted sewage from the headworks to the primary clarifiers. Pumping is required to provide sufficient hydraulic head to convey the wastewater through the remainder of the treatment facilities. Additional effluent pumping is required to discharge the effluent to the Sandy River.

Four 40 H.P. 3.85 MGD (ea.) capacity submersible pumps operate automatically on the basis of level switches in the wet well. The pumps have variable speed motors. One of the pumps serves as a standby, redundant pump during the peak design flow.

Scum is periodically removed from the primary influent wet well via an overflow weir and pumped to the gravity thickener or directly to the anaerobic digesters. The wet well is covered, and odorous air in the wet well is collected and blown through a soil bio-filter to scrub odors.

Primary Clarification:

Two 45-foot diameter 12 feet deep (142,718 gallon) primary clarifiers remove settleable solids, free oil and grease from the influent sewage stream. In addition, waste activated sludge (WAS) can be sent to the primary clarifiers to be co-thickened with the primary sludge if the gravity thickener is out of service. Progressive cavity pumps move primary sludge from the bottom of the clarifier to the gravity thickener for co-thickening prior to anaerobic digestion. Primary scum is skimmed from the surface of the clarifiers, directed to a common scum box for storage, and is then pumped periodically to the gravity thickener or directly to the anaerobic digesters.

The primary clarifier launders and center feed wells and the primary treatment flow distribution box are covered to reduce algae growth and provide odor control. Odorous air is collected and blown through a soil biofilter to scrub odors.

Secondary Treatment:

Primary effluent enters the two aeration basins through influent control gates in the primary treatment flow distribution box. Each basin is 225 feet long, 26 feet wide, 16 feet deep and contains 695,000 gallons. The first 44 feet of each basin is baffled off to provide an anoxic mixing zone prior to aeration. This zone is not aerated, but mixed with axial flow/pier mounted mixers. The purpose of this unaerated zone is to selectively promote growth of bacteria with good settling characteristics. Each aeration basin has membrane disc fine bubble diffusers along the floor of the basin. Air is supplied by centrifugal blowers located in the blower building. One blower is dedicated to each basin, with a third blower installed as a standby unit. Dissolved oxygen is measured in each basin and a control signal automatically throttles the blowers to provide the required air flow. One of the basins may be taken out of service during dry weather low or average flows. The sludge age will vary from about 8 days for complete nitrification during dry weather, down to about 3 days during high wet weather loadings. This range is designed to maintain the mixed liquor suspended solids (MLSS) concentration between 3,000 and 3,700 mg/L. Return activated sludge (RAS) pumps will pump return sludge from the bottom of the secondary clarifiers to the upstream end of the aeration basins where it is mixed with the aeration basin influent.

Waste activated sludge (WAS) is removed from the common RAS header and controlled with a V-port ball valve and magnetic flow meter. WAS is typically added to the gravity thickener; however, a secondary flow path is provided to allow wasting to the primary influent in the event that the gravity thickener is out of service.

Secondary Clarification:

The secondary clarifiers measure 76 feet in diameter, with 16 feet of sidewall. Each contains 542,868 gallons and receives mixed liquor from the aeration basin and allows particles to settle out of the mixture forming a sludge on the bottom of the clarifier. This sludge is drawn off the bottom of the clarifier and pumped to the aeration basins as RAS to improve process efficiency, or it is wasted from the RAS stream to the gravity thickener as WAS to be co-thickened with the primary sludge prior to anaerobic digestion for stabilization. Submersible RAS pumps are located in each secondary clarifier RAS pump station.

Scum floating on the clarifier surface is collected by skimmers, directed to the scum box, and pumped to the gravity thickener prior to treatment in the anaerobic digester.

Ultraviolet (UV) Light Disinfection:

The UV disinfection system provides effluent disinfection before it is discharged to the Sandy River. The UV disinfection system inactivates pathogens and other microorganisms for public health protection. The system consists of a single channel with 4 banks of lights totaling 32 lamps. The intensity ofthe UV light coming from the lamps in automatically adjustable based on flow rates.

Effluent Pumping and Outfall

The effluent pumps convey treated plant effluent from the UV disinfection facility to the outfall. Pumping is required to provide sufficient hydraulic head to convey the wastewater through the outfall pipe to the Sandy River.

Four 35 HP 3.56 MGD (each) capacity submersible pumps operate automatically on the basis of level switches in the wet well. The pumps have variable speed motors. One of the pumps serves as a standby, redundant pump during the peak design flow.

Effluent from the Troutdale WPCF is discharged to the Sandy River under compliance with a NPDES permit from the Oregon Department ofEnvironmental Quality (DEQ). The outfall consists of a 24-inch pipe with a single port 14-inch reducer. The effluent pumping system is designed to pass the peak instantaneous flow plus plant process water flows at the 100-year flood elevation in the Sandy River of 32.0 feet.

Effluent Flow Measurement:

Treatment facility effluent flow is measured just downstream of the effluent pump station using a magnetic flow meter.

Plant Drain:

The plant drain system collects wastewater generated on site from various processes and locations and directs it by gravity to the primary influent pump station downstream ofthe grit chamber for treatment. Although there is no dedicated plant drain pump station, both the headworks and digester complex buildings have lower level sumps and will pump to the primary influent pump station. The sources of wastewater for the plant drain system include the building fixtures and drains (Headworks Building, Blower Building, UV Disinfection Building, Digester Complex, Administration Building, and Relocated Maintenance Building), sump pump stations, UV channel drains, and the sludge truck loading area drain. All collected wastewater is incorporated back into the treatment process.

Gravity Thickening:

One 36-foot diameter gravity thickener blends and co-thickens the plant sludge prior to anaerobic digestion. Progressive cavity pumps move thickened primary and waste activated sludge to the digesters. Supernatant from the thickening process is returned to the primary influent pump station to be re-introduced to the plant flow stream.

The gravity thickener is provided with aluminum covers for odor control. Odorous air under the cover is collected and blown through a soil biofilter to scrub odors.

Anaerobic Digestion:

The sludge anaerobic digestion system stabilizes sludge biologically to allow for its ultimate land application disposal. The two anaerobic digesters each have a 430,000 gallon capacity. Co-thickened primary and secondary sludge is placed in the anaerobic digesters for an average sludge age of20 days at design loadings, and is heated (primary digester only) and mixed to promote the biological stabilization of the material. Stabilized sludge is pumped to the sludge storage lagoon prior to land application disposal.

Sludge Storage:

Approximately 3.5 million gallons of sludge storage is provided in a facultative sludge lagoon at the north end of the site. The primary purpose of the sludge lagoon is storage of stabilized biosolids to allow for flexible land application operation. The lagoon dredge from the old wastewater treatment plant has been relocated to the new lagoon for reuse. A truck loading station with load-out arm and controls are located along the south side ofthe lagoon. The sludge storage capacity equals an estimated three years of biosolids production. In addition, the #2 digester adds another month of storage.

Support Systems:

Various other systems are necessary to the operation of the Troutdale WPCF. These include potable water, electrical and standby power, HVAC, instrumentation and control, and treatment facility alarms.

Flow Measurement and Sampling:

Measurement of plant flow rates is provided by a magnetic flow meter downstream of the effluent pump station. Influent sampling is provided at the headworks, downstream ofthe mechanical bar screen but prior to the grit chamber, and effluent sampling is provided at the UV disinfection building downstream of the UV disinfection equipment. Automatic composite samplers collect samples based on an operator-specified schedule. Flow measurement and water quality sampling is important and necessary for regulatory compliance as well as optimization oftreatment processes.

SLUDGE THICKENING

OVERVIEW:

Purpose:

The thickening process removes water from the primary and waste activated sludge (WAS) prior to anaerobic digestion. Thickening reduces the volume of sludge to be treated in the anaerobic digesters.

Description:

Sludge is thickened in a 36-foot diameter Gravity Thickener. The Gravity Thickener operates like a circular clarifier where primary and waste activated sludge enter the center feed well of the clarifier, and supernatant from the thickening process discharges over V-notched weirs along the outer wall and is returned to the primary influent pump station. Thickened sludge is scraped by the clarifier mechanism to a center hopper while scum and other floating materials are skimmed off the top and directed towards a scum pit on the outer edge of the basin.

A sludge grinder and two thickened sludge pumps are located in the pump room of the Digester Complex. These pumps transfer thickened sludge and scum directly to the anaerobic digester for further treatment. The sludge grinder is used to break up scum and other solids prior to digestion.

The Gravity Thickener is covered and odorous air is collected and treated by an odor control biofilter system to reduce odors emitted from the treatment unit.

BIOSOLIDS PROCESS NARRATIVE

OVERVIEW:

Purpose:

The purpose of the anaerobic sludge digestion system is to stabilize and reduce waste solids and allow for their ultimate land application disposal. The 2021 raw and secondary sludge volumes yielded 152 dry tons of biosolids. Co-thickened primary and waste activated sludge, as well as scum from the clarifiers and thickener, are fed to the digesters where the biological action of the digestion process reduces the organic strength and the number of pathogens. As new sludge and scum is added to the digesters, digested sludge is pumped to the sludge storage lagoon. Methane gas is produced during the process and is used to heat the digester sludge.

Description:

The anaerobic digestion/digester control building complex contains two digesters and related solids, liquids, and gas handling equipment. The digesters are the tall cylinder types, each with a 430,000-gallon capacity, providing between 15 to 20 days of detention time individually, for maximum monthly loading. The bottom of the digester structure is designed with an inverted cone and sloped outer ring to two collection points. Hot water boiler systems bum digester gas or natural gas to heat the digester sludge. Pumping and mixing systems feed the digesters, mix digester contents, transfer sludge between digesters, and transfer digested sludge to the sludge storage lagoon.

The digesters are designed to operate both in parallel and series. Series operation is the standard mode ofoperation and is the operation that is depicted in the 0 & M manual. Parallel operation is very similar to series operation except that the sludge transfer pumps are required to transfer digested sludge from the first digester to the second digester prior to feeding the first digester with sludge.

Digester Mixing:

Four constant speed internal draft tube mixers, two per digester, are rated at 7.5 H.P. and 7,500 GPM each, and mix the contents of each digester. Digester gas will be present in each draft tube mixer roof access hatch and precautions need to be taken before taking any draft tube mixers out of the digester for service while the digester remains in service.

Sludge Heating:

Each internal draft tube mixer tube includes a hot water jacket heat exchanger to internally heat the sludge and maintain the sludge temperature between 94 and 96 degrees F. A hot water boiler and associated primary and secondary circulation water systems are located in the Digester Complex and will supply hot water to the digester mixer heat exchangers.

Digested Sludge Pumping:

The digested sludge pumps can perform multiple pumping operations including sludge transfer from digester to digester, sludge pumping to the sludge storage lagoon, digested sludge line back flushing and digester grit removal. Grit removal is the most important routine function of the digested sludge pumps. This operation should be initiated at least twice a month.

During series digester operation the sludge pumps should be utilized to transfer sludge from the primary digester to the secondary digester prior to feeding sludge to the primary digester.

Hot Water System:

Hot water is generated by the boiler and supplied to the sludge heat exchanger jackets on the internal draft tube mixers by the primary and secondary heating water pumps. The boiler is typically fueled by natural gas, but can also operate on digester gas.

The boiler heats water to provide sludge heating for the digester and provides building heat for the digester control building. The hot water system is composed of a primary hot water re-circulation loop and several secondary loops. Primary heating water pumps convey hot water through the boiler and around the primary hot water loop. The primary hot water loop has an expansion tank, makeup water connection, air separator, and chemical feeder. The sludge heat exchangers are supplied with hot water in the secondary loop by secondary heating hot water pumps.

Digester Gas System:

Methane gas and carbon dioxide are byproducts of the sludge digestion process. In combination, they are referred to as digester gas (DG). Digester gas is collected from a bonnet on the top of each digester and is combined in a common manifold. The gas is used as fuel for the hot water boilers or flared in the waste gas incinerator. Methane gas may be present near pressure relief valves, vents, foam separators, and sediment traps. The equipment items associated with the digester gas are described below.

Gas Bonnets:

The gas bonnets are located in the center of each digester roof. Digester gas is drawn out of the digester through the gas bonnet. Pressure relief valves, flame traps, a pressure indicator, pressure transmitters, and pressure switch are located at each digester bonnet.

Foam Separator:

The digester gas flows from each gas bonnet through a foam separator which operates by spraying non-potable water (W2) on the digester gas to remove foam. The water then drains from the foam separator into the digester overflow box and then into the Sludge Storage Lagoon.

Sediment Trap:

The sediment trap removes sediment and condensate from the digester as after it passes through the foam separator. The sediment trap is equipped with a manual drip trap and drain connection to remove condensate. The cover of the sediment trap must be removed for cleaning. The sediment trap is located in the gas handling room on the ground level of the Digester Complex.

Flame Trap:

Flame traps are located at each digester gas bonnet and in the DG piping ahead of the boiler, and the waste gas incinerator. The flame trap assemblies include a flame anestor and a thermal shutoff valve. The shutoff valve closes at a temperature of 260 degrees F, providing protection against a fire in the digester gas piping upstream.

Gas Flow Meters:

The gas flow meters measure DG flow to the boiler and the waste gas incinerator.

Drip Traps:

Manual drip traps allow condensate removal from low points in the gas piping. Each drip trap has a capacity of two and one-half quarts. An automatic drip trap is located at the waste gas incinerator to allow removal of condensate from the gas piping system.

Waste Gas Incinerator:

Reacting to pressures above 20-inch Water Column in the gas piping, the waste gas incinerator flares DG when digester gas production is higher than the digester gas consumption of the hot water boiler. The waste gas incinerator is located north of the Digester #1 and provides an alternative disposal for the methane gas produced during digestion.

Digester Hydraulic Retention Time:

The digester hydraulic detention time is the average time solids spend in a digester measured in days.

The detention time is calculated as:

V/Q = detention time (days)

Where:

V = Digester liquid volume (gallons)

Q = Sludge inflow rate (gallons/day)

The longer the detention time, the more complete the solids stabilization will be. The primary digester will not be operated with a detention time of less than 15 days.

Temperature:

For optimum perfo1mance, the digester temperature will be maintained within 2.0 to 3.0 degrees F of the selected operation temperature and uniform throughout the digester. This temperature will be between 94 and 96 degrees F for stable operation. To maintain stability the temperature will not be changed by more than 2 degrees F per day.

Mixing:

Proper mixing of the digester is essential to ensure that the blended sludge and heat is distributed evenly throughout the digester. Mixing will also decrease the chances of scum layer buildup in the reactor. The mixing pattern for the digesters can be adjusted by changing the height of the mixers in the digesters and direction of their discharge.

Gas Production:

Gas Production is indicated by the volume of gas produced. The theoretical gas production calculation can be used to estimate the theoretical gas production from the primary digesters when 50 percent volatile solids destruction is being achieved.

<u>Common Units:</u>

Gas Production = cubic feet of gas produced per # ofVS destroyed

Where: # ofVS desu·oyed =#VS (IN) -#VS (OUT)

Usually calculated on a daily basis: cubic feet per day ofVS destroyed

The estimated theoretical gas production can be calculated by: Vg = (2.0) xVS

<u>Where:</u>

Vg = Theoretical gas volume produced (cu ft.)

Vs = Sludge volume digested (gal)

2.0 = Proportionality constant, assuming•

50% volatiles destruction

5% primary and 4% waste activated sludge solids

70% combined sludge volatile solids content

Emergency Procedures:

Anaerobic waste treatment normally proceeds with a minimum amount of control. A sudden change in environmental conditions or an introduction of toxic materials to the digester may cause an upset. Increasing volatile acid concentration in the sludge, increasing carbon dioxide concentration in the gas, and decreasing sludge pH, gas production, alkalinity, and waste stabilization are indicators of an upset digester.

When an upset is detected, the operator should maintain the pH near neutral, and should determine the cause of the upset and correct it. If an upset should occur, there are several options the operator can pursue to correct the upset. With the system being operated in the series mode, #1 Digester is the primary treatment unit with the #2 Digester used for storage. If an upset should occur in Digester #1 the operator can switch all sludge feeding and heating to Digester #2 making it the primary digester keeping the treatment of biosolids on line until such time as the upset in Digester #1 has been solved. The operator also has the option to use the 3.5 million gallon storage lagoon to store biosolids until such time as the upset has been corrected. Lagoon biosolids can then be pumped back to the primary digester for additional treatment before pumping back to the lagoon for storage.

This storage option may also be utilized for the following scenarios: extended periods of inclement weather; loss of authorized biosolids sites; loss of competent personnel to operate tank truck, tank truck mechanical breakdown.

In the event of a biosolids spill at the WPCF, the staff will correct the cause of the spill and use sand or other appropriate material to contain the biosolids. The spilled biosolids will be vacuumed up with the City's Vac-Con collection system truck. The collected material will be emptied at the WPCF influent pump station or back into the storage lagoon. The Oregon DEQ will be apprised of the spill by WPCF staff within one hour of the event, if the spillage exceeds 50 gallons.

Targets:

Parameter	Target
Volatile Solids Reduction Volatile	50 to 60 percent
Solids Loading Rate	0.10 to 0.20-lb/ft^3 day
Gas Production	15 to 18 cubic feet/# ofVS destroyed
Gas CO2 concentration	28- 36 percent
pH	6.8 to 7.2
Temperature	94 to 96 degrees F (as constant as possible)
Solids Concentration (in Digesters)	1.5 to 2.5 percent

Calculations:

Volatile Solids Concentration:

The volatile solids concentration is detemlined by the following

equation: (Ml"M2)
VS - ----------X 1000 mg/g
V s

Where:

M1= Mass ofevaporating dish plus residue after evaporation at 105 degrees

C, g M2 = Mass ofevaporating dish plus residue after ignition at 550 degrees

C, g Vs = Volume ofSample, L

Volatile Solids Reduction:

The volatile solids reduction tln·ough the digesters as a percent is determined by the following equation:

VS in- VS out
VSR -------------------x 100
VS in - (VS in x VS out)

BIOSOLIDS STORAGE AND HANDLING

OVERVIEW:

Purpose:

The biosolids storage and handling facilities at the Troutdale WPCF consist of approximately 3.5 million gallons of sludge storage provided in a facultative sludge storage lagoon at the north end of the treatment facility, including a sludge truck loading dock. The purpose of sludge storage is to allow for flexibility in the processing and handling of biosolids. The Troutdale WPCF will use land application of stabilized digested sludge as a disposal method for solids.

Land application ofstabilized sludge is normally performed only during a 6 month span of the year from late spring to fall. When not land applying, the sludge must be stored for the subsequent season's application schedule. For reasons of odor concerns, the sludge storage lagoon is provided with a 2 to 3 foot water cap to reduce odor generation.

Description:

Digested Sludge gravity flows or is pumped from the Digester Complex via the digested sludge pumps to the sludge storage lagoon. The sludge storage lagoon is an HDPE and concrete-lined earthen basin. Within the basin, sludge solids settle reaching a concentration of approximately 7 percent. In order to maintain a water cap on the basin to minimize odor generation, a 10-inch plant effluent line from the effluent pump station discharges to the lagoon to supply water when needed. Overflow from the lagoon enters the plant drain system and is returned to the primary influent side ofthe plant for treatment.

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VECTOR ATTRACTION REDUCTION

Vector attraction reduction is achieved by reducing the sludge volatile solids content by more than 38% via Troutdale's mesophilic anaerobic digestion process, in which raw sludge is mixed and heated to 95° F for greater than 15 days in the City's 430,000 gallon primary digester.

As the primary digester fills to capacity, a small amount of sludge is pumped to a secondary digester of equal size. This digester, though not heated, maintains tank temperatures ranging from 86 to 94 degrees Fahrenheit year-round; thus, further reduction is achieved.

The finished biosolids product is pumped in small quantities each day to 3.5 million gallon biosolids storage lagoon for future land application.

The 2021 fractional volatile solids reduction ranged from 30% to a high of 74%; the average being 56%.

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PATHOGEN REDUCTION

Pathogen reduction in Troutdale's biosolids is achieved by mesophilic anaerobic digestion. Raw sludge is mixed and heated to 95° F for greater than 15 days in the City's 430,000 gallon primary digester. After sufficient detention, the sludge is transfered to a secondary digester of like size in which the sludge is mixed for an additional 15+ days before being pumped to a one acre, 3,500,000 gallon biosolids storage lagoon.

The 2021 fecal counts in the City's biosolids ranged from a low of 3,255 to a high of 271,000 per gram, with an geometric mean of 20,428.

PUBLIC NOTIFICATION FOR PROPOSED NEW BIOSOLIDS LAND APPLICATION SITES

A process of public notice is conducted for the site authorization of proposed new biosolids land application sites. The public notification methods utilized by the City of Troutdale will be by letter, door knocking, or by phone. Phone contacts will be followed up with a letter. Once public notice is completed, the documentation for such is submitted to the Oregon DEQ as part of the DEQ biosolids site submittal checklist. This public notice informs occupants and/or owners of property adjacent to the proposed site of the WPCF intention to land apply biosolids; the characteristics of biosolids; the location of the site and approximate time and duration of applications via the City-owned tank trucks; and the City's contact agent for biosolids applications and his/her phone number.

Public notice documentation will include a listing of the public notice contacts, including name, status-owner/occupant, address, phone number, legal description, method and results of contact, as well as a map showing the location of the adjacent property owner and/or occupant in relation to the site proposed for biosolids land application.

SOLIDS MONITORING
SAMPLING/RECORD KEEPING

Biosolids accumulation in the storage lagoon is monitored semi-annually by WPCF staff. A grid map is generated from the collected data indicating the rate of accumulation in various parts of the lagoon. The lagoon is divided into ten areas with markers on the shoreline.

For quarterly lagoon testing, A WPCF staff member equipped with a sanitized biosolids core sample bucket, a smaller sludge sample container and stir stick will collect 7-10 samples from the filling station as the barge transverses which provides a true and representative sample of the biosolids lagoon. The biosolids will immediately be poured into sealed sample containers provided by an independent testing laboratory. These samples will be placed into either a refrigerator or cooled in a ice chest. Sampling will be completed in one day and biosolids samples will be sent/transported the same day to the laboratory for analysis as per U.S. Environmental Protection Agency (EPA) 503 sludge regulations, and for fecal coliform testing. The resulting laboratory data is reported annually to the Oregon Department of Environmental Quality and U.S. Environmental Protection Agency, Region 7.

Besides lagoon testing, biosolids in the secondary digester are tested on-site in the WPCF laboratory. Weekly digester testing includes pH, volatile acids and alkalinity, and fractional volatile solids reduction. Lagoon biosolids metals and pathogen densities are monitored quarterly and vector attraction reduction is monitored weekly.

Biosolids records are retained for a minimum of five years. These records include the following: pollutant concentrations; management practice certification and description; site restriction certification and description; pathogen reduction certification and description; vector attraction reduction certification and description.

SITE SELECTION

Currently, biosolids application sites are selected with the following desired characteristics in mind

- Site is less than 25 miles from the WPCF.
- Site is larger than 5 acres, gross.
- Site cropping excludes products for human consumption.
- Site is not prone to flooding.
- Site groundwater level at time of application is 4 feet or below.
- Site soil is at least moderately well-draining.
- Site slopes are less than 12 percent.
- Site is accessible by the City's tank trucks.

BIOSOLIDS LAND APPLICATION PLAN

As of spring 2022, the City has thirteen (13) authorized biosolids sites totaling 171.10 acres.

Future biosolids application land will be sited in Multnomah and Clackamas counties. These future biosolids sites shall meet the following criteria:

- Sites will be no farther than twenty five (25) miles from the City's WPCF.
- Crops raised on these sites will not be for human consumption.
- The size of these sites will be at least five (5) acres gross.
- These sites will not have a history of recent flooding.
- The permanent groundwater level will be at least four feet and the temporary groundwater level at least one foot.
- Sites will possess moderate to well-draining soil characteristics.
- Sites will not be used by the general public.
- Sites will possess slopes of less than 12 percent.
- Site conditions will permit access by the City's tank trucks.

The management practices which will be implemented at these future sites are delineated in the preceding biosolids site management section.

TRANSPORTATION AND LAND APPLICATION

Prior to any biosolids removal from the City of Troutdale's storage lagoon, WPCF staff will develop specific, detailed plans for removing and utilizing the biosolids, and will submit these plans to the Oregon DEQ for approval. Approval is required from the DEQ before implementation.

Biosolids are removed from the lagoon located at the north end of the WPCF. A barge-mounted pump moves the biosolids from the lagoon to a truck loading station situated on the south shoreline. There two 3,500-gallon capacity tank trucks are loaded and then driven by a competent, licensed WPCF staff member to the authorized site for application.

At the site, the truck is slowly driven overland and the liquid biosolids will be applied at an agronomic rate consistent with the particular crop's nutrient requirements. No biosolids are stored at the authorized application site. In the fall of the year in which biosolids are land applied, each authorized site which has received biosolids for two or more consecutive years will be tested for soil nitrate levels. Soil samples collected will be representative of all portions of the field receiving biosolids. A grid system will be utilized when sampling site soils. Subsequent to the receipt of a site authorization, that site's soil will be tested for the same parameters used to establish the lagoon biosolids profile, minus fecal coliform. The parameters include ammonia nitrogen, nitrate nitrogen, total nitrogen, phosphorus, potassium, total solids, volatile solids, pH, arsenic, cadmium, copper, chromium, lead, mercury, molybdenum, nickel, selenium, and zinc.

For each day of land application to a site, a log sheet is completed indicating the following: driver, date, field I.D.; beginning, ending, and total tank truck mileage; number of loads applied and total gallonage; groundwater level, weather conditions, and the percent of solids of the biosolids applied. In addition, a site map showing the day's application is maintained. All biosolids site records are retained for a minimum of five years.

CITY OF TROUTDALE
BIOSOLIDS MANAGEMENT PLAN
STANDARD OPERATING PROCEDURE
SOIL SAMPLING AT BIOSOLIDS LAND APPLICATION SITES
July 2022

PURPOSE

The purpose of this procedure is to detail the protocols for sampling soils at the City of Troutdale biosolids land application sites as required under the city's "Biosolids Management Plan."

SOIL TESTING FOR NITRATES

Soil nitrate sampling and testing must be completed at all repeat biosolids application sites where biosolids are applied at agronomic rates two out of three successive years [OAR 340-050-0080(5)(a)].

SAMPLING EQUIPMENT

Below is a listing of sampling equipment to be utilized under this sampling plan. Equipment listed here may be substituted with other equipment where appropriate.

- Trenching shovel capable of producing a core one-half to one inch in diameter from soil sampling depths.
- 950cc (32oz) polyethylene plastic bottles with seals.
- Five-gallon polyethylene, stainless steel, or aluminum pail(s).
- Stainless steel or polypropylene spoon, trowel, or spatula.
- Permanent ink marker.
- Stiff, plastic bristle brush and paper towels.
- Deionized/distilled water.
- Tap water.
- Good quality laboratory detergent (Alconox or equivalent).
- Rubber gloves.
- Ice chest.
- Ice or Blue Ice.

SAMPLING EQUIPMENT PREPARATION

The following procedures should be followed for cleaning equipment before sampling and between new sampling areas or different fields.

a) Use a stiff brush to remove all visible particles.
b) Rinse with tap water.
c) Wash with good quality laboratory detergent (Alconox or equivalent).
d) Rinse once with tap water.
e) Rinse at least twice with deionized/distilled water.
f) Air dry or dry with paper towel.

SAMPLE COLLECTION

All repeat biosolids sites or fields must be sampled separately in the late fall preferably after the last harvest for nitrate-nitrogen (NO_3-N) as follows:

a) Identify fields that need to be sampled.
b) Clean all sampling equipment as detailed in the preceding section.
c) Label sample bottles to identify sampling areas per the Sample Labels section below (Note: one polyethylene plastic bottle will be required for each area or field sampled).
d) Clear the area to be sampled of any surface debris (twigs, rocks, litter).
e) Insert stainless steel sampling tube to the designated depth (For pasture or hay fields, sampling the upper 6-12 inches of soils is appropriate).
f) Pull tube carefully from the soil and place the samples in a five-gallon polyethylene, stainless steel, or aluminum pail(s).
g) Collect at least 15 to 20 subsamples pursuant to f) above across each field in a random and scattered fashion to provide a representative sample.
h) After all required subsamples have been collected (15 to 20 core samples per site or field), thoroughly mix (any clods or clumps of soil should be broken-up) the subsamples in the pail(s) using a stainless steel or polypropylene spoon, trowel, or spatula to form a homogeneous composite sample.
i) Using the stainless steel or polypropylene spoon, trowel, or spatula, transfer the mixed composite soil sample from the pail(s) to the labeled sample bag(s). Approximately, two dry pints of soil per sampling area or field will be needed for soil testing.
j) Place the samples in a cooler with ice and ship to a qualified agricultural soil testing laboratory.

SAMPLE LABELS

Sample labels will be utilized to prevent misidentification of samples. Gummed paper labels will be utilized and include the following information:

- Sample Site Name or Number
- Soil Sample Depth (0-12 inches for pasture sites)
- Name of Collector
- Time and Date of Collection

The sample label will always be directly affixed to the sample container and will always be completed using indelible ink.

SAMPLE PRESERVATION

Soil samples will be preserved on the same day they are collected. While awaiting shipping, samples will be stored at a temperature of approximately 4 degrees C.
Samples will be packed on ice in coolers and delivered same day service to the analytical laboratory.

FIELD LOG

All information pertinent to sampling activities will be recorded in a logbook or electronically for recall or reference. At a minimum, the following shall be recorded.

- Fields or areas sampled.
- Sample depths.
- Date(s) of sampling activities.
- Individual(s) performing the sampling.
- Number of samples collected.
- Name of laboratory where samples were sent for analyses.

LABORATORY TESTING

The soil samples collected at the biosolids land application sites will be tested by a qualified analytical laboratory that routinely performs soil analyses on agricultural soils.

Refer to the OSU List of Analytical Laboratories Serving Oregon, EM 8677, at https://catalog.extension.oregonstate.edu/em8677). This OSU list includes various labs that participate in the North American Proficiency Testing (NAPT) program at www.naptprogram.org.

The soil samples collected for nitrate analyses will be tested according to protocols published by the American Society of Agronomy (ASA) and Oregon State University [OAR 340-50-0080(5)(b)].

For agricultural soils in Oregon, soil nitrates should be measured using the Potassium Chloride (2M KCl)/ Cd-Reduction Method.

DATA REVIEW

For sites located east of the Cascades, soil nitrate testing will need to be factored as a nitrogen credit with biosolids application rates being adjusted accordingly per the Pacific Northwest Extension "Worksheet for Calculating Biosolids Application Rates in Agriculture" (https://puyallup.wsu.edu/soils/biosolids/).

For other sites located west of the Cascades, this data may be used to gauge post-harvest soil nitrate levels to evaluate nitrogen management. High or excessive amounts of nitrate remaining in the soil after harvest can leach during winter rains, potentially contaminating surface and groundwater. If residual soil nitrate levels are consistently high or excessive, biosolids and/or fertilizer nitrogen inputs may have to be reduced in future growing seasons. The table below developed by the Oregon State University Extension Service may be used as a guide for evaluating residual soil nitrates at farm sites located west of the Cascades.

Residual Soil Nitrate-Nitrogen for Evaluating Nitrogen Management

Evaluation	NO_3-N in surface foot (ppm)
Low	<10
Medium	10-20
High	20-30
Excessive	>30

Source: Soil Test Interpretation Guide, Oregon State University Extension Service, EC 1478, Reprinted August 1999.

REPORTING

Soil sampling/testing results collected pursuant to this procedure must be attached to the city's Annual Biosolids Report due to the Department of Environmental Quality (DEQ) by February 19th. A copy of DEQ's Annual Biosolids Report Form may be downloaded at https://www.oregon.gov/deq/wq/programs/Pages/Biosolids-Assistance.aspx.

OTHER SOIL SAMPLING CONSIDERATIONS

It is recommended (but not required by DEQ) that soils at all of the city's active biosolids reuse sites be sampled/tested every two years for the following and that site soils be amended, if necessary, based on this testing to achieve the highest crop yields at these sites.

- pH (1:2 Soil Water Ratio)
- Lime Requirement Test (SMP Buffer Method)
- Plant-Available Phosphorus (P) (Bray P1 Method)
- Ammonium Acetate Extractable Potassium (K), Calcium (Ca), and Magnesium (Mg)
- Organic Matter (Loss on Ignition)

This sampling/testing may be completed at the same time as the soil nitrate sampling/testing.

REFERENCES

Oregon State University Extension Service. 2019. Nutrient Management for Pasture: Western Oregon and Western Washington. EM 9224. January 2019. https://catalog.extension.oregonstate.edu/em9224

Oregon State University Extension Service. 2018. A Guide to Collecting Soil Samples for Farms and Gardens. EC 628. Revised October 2018. https://catalog.extension.oregonstate.edu/sites/catalog/files/project/pdf/ec628.pdf

Oregon State University Extension Service. 1999. Soil Interpretation Guide. EC 1478. Reprinted August 1999.