Stormwater Decant Facility
Basis of Design Report

Prepared for

City of Washougal, Washington

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Introduction

City of Washougal (City) maintenance personnel remove sediment and debris from roadways and stormwater facilities along city roadways. On the road surfaces, sweeper trucks are used. In ditches and swales, excavators and loaders may be used. In the case of catch basins, underground pipes, and vaults, sediment and debris is removed with a Vactor truck. These materials must be treated as solid waste—it is contained and stored under cover, and the leachate is discharged to a treatment system.

The City is currently dumping collected stormwater material at Clark County's GEM facility, also known as the Whatley Pit. With the 2014 Wastewater Treatment Plant Improvements project, the City is proposing a new Stormwater Decant Facility (SDF) to provide a site to dump all of its collected stormwater and street sweeping material. The material will be dewatered, stored, and ultimately disposed of either at a local landfill or through approved beneficial reuses.

Material Information

The contents of roadway stormwater facilities are contaminated with material from vehicle exhaust, engine fluids, and fuel. The levels of heavy metals, total petroleum hydrocarbons, and carcinogenic polycyclic aromatic hydrocarbons vary greatly from location to location, and from period to period.

The best source of information currently available regarding the characteristics of the liquids and solids removed from stormwater structures in the Pacific Northwest is the Washington State Department of Ecology (DOE) 1993 report titled *Contaminants in Vactor Truck Wastes*.

Table 1 compares the maximum daily limits (MDL) for contaminants in discharges to the Washougal sanitary sewer system (Washougal Municipal Code 14.24.080) to amounts found in decanted liquids (from the DOE report listed above). Levels in leachate from the solids may be lower, because of the filtering effect of the solid material.

Table 1. Contaminant Level Comparison

Parameter	Abbreviation	MDL	DOE reported amounts
Arsenic, total	As	0.08 mg/L	0.11 mg/L
Cadmium, total	Cd	0.05 mg/L	0.03 mg/L
Chromium, total	Cr III	1.3 mg/L	0.23 mg/L
Copper, total	Cu	1.5 mg/L	0.69 mg/L
Lead, total	Pb	0.4 mg/L	1.12 mg/L
Mercury, total	Hg	0.02 mg/L	0.0044 mg/L
Nickel, total	Ni	0.95 mg/L	0.32 mg/L
Silver, total	Ag	0.4 mg/L	0.02 mg/L
Zinc, total	Zn	3.0 mg/L	4.44 mg/L
Oil and grease		100 mg/L	11 mg/L
Settleable solids			27 mL/L

The DOE report also provides the physical characteristics of the sediments. Using the U.S. Department of Agriculture (USDA) soil classification guide, 12 percent of the sediments are gravel (particle size greater than 2 millimeters [mm] in diameter), 72 percent are sand (particle size between 0.05 and 2 mm), 10 percent are silt (particle size between 0.002 and 0.05 mm), and 2 percent are clay (size less than 0.002 mm).

The sediments would be classified as "sandy clay loam with high organic content" according to the USDA triangle. They would be classified as "sandy with fines" (SM) according to the American Society of Testing and Materials (ASTM) classification system.

Vactor Truck Decant Facility Treatment Train

The basic components of the Vactor truck decant facility treatment train are solids dewatering, leachate sedimentation, leachate oil/water separation, and conveyance to the treatment plant. Each process and the operational implications are discussed below.

Operational Information

A Vactor truck vacuums the contents of catch basins and other underground structures into a large holding tank. Fresh water (stored in a separate tank on board) is sprayed into the basin to loosen sediments and ease removal. The solid material settles in the truck holding tank, and much of the water can be decanted back into the storm system. The saturated solids will be dumped at the proposed treatment facility and allowed to dewater.

Total storage capacity of trucks currently in the City inventory is 10 cubic yards (yd^3) (270 cubic feet [ft^3]), which is 13,000 pounds of wet debris. When the debris tank is empty, the clean water tank can hold 1,500 gallons of water (200 ft^3) (information provided by the Transportation Equipment Fund office).

The normal load of the truck is 8 yd^3 of debris, approximately 2 yd^3 of which are liquid and can be decanted en route before the solids are dumped. Of the remaining 6 ft^3 of material, approximately 5 yd^3 (85 percent) will remain after dewatering (information provided by equipment operators).

In the lower range of operation, approximately four loads per week will be discharged in a 5-day, 40-hour work week. These loads will have been pre-decanted back to the storm drain.

In the upper range of operation, up to 10 loads per week will be discharged into the facility.

The number of loads that will be dumped at the facility per year is estimated to be 296 (10 loads per week x 8 weeks per year, plus 6 loads per week x 20 weeks per year, plus 4 loads per week x 24 weeks per year). These values take into account the City's current operations, projected future growth, and an allowance for outside haulers. The calculations that follow demonstrate that the facility can easily handle the expected usage.

Between 20 and 50 yd^3 of dewatered solids per week would be produced at a facility supporting the operations described above. Such a volume will require frequent removal of dewatered solids, which will have the consistency of ordinary soil. Operators will have access to a wheel loader for removal of solids. A wheel loader with a 0.75 yd^3 bucket can move 1.1 yd^3 per minute, making it the most efficient means of moving the material. The overall width of a wheel loader ranges from 9 to 11 feet at the bucket, and they can travel on slopes of up to 20 percent when fully loaded.

Solids Dewatering

The solids dewatering area is where the Vactor trucks will dump their load of solids and leachate. The area is covered to prevent further addition of water from rainfall to the material. The Vactor truck owned by the City is no more than 8 feet wide and 25 feet long, and has an outside turning radius of

less than 60 feet; the inside turning radius is less than 30 feet. One large vehicle dumping bay is proposed, sized to accommodate two Vactor trucks. Optimally sized bays to accommodate each of these trucks would be not less than 14 feet wide. The single large bay is 30 feet wide. The bay will provide an optimum 4-foot working area (3-foot minimum) on all sides of the vehicles.

The dewatering pad has a compound slope greater than 2 percent that will allow leachate to drain from the dumped solids. At its shortest, the path of leachate along the pad will be 35 feet long, and can be up to 45 feet long, depending on where it is dumped. The length of the dewatering pad reflects economic limits on the required covering roof span. On the far, downslope end of the dewatering pad, a 4-foot-tall wall will contain the material and help direct the leachate toward a series of sedimentation basins. The wall's interior surface will be a seamless steel plate that will allow the wheel loader to gather the material without damaging the wall. A concrete access ramp next to the dumping area will provide access for the wheel loader. A sloped storage area will be provided adjacent to the dewatering pad, so the wheel loader can simply transfer dewatered material from the pad to the storage area without leaving the facility. The storage area will have 6-foot-high walls, and can be subdivided using Ecology Blocks as the operators see fit. During periods of heavy use, the dewatering pad may also have to be subdivided to allow one side to dewater while the other side is being filled.

For the 296 loads described in the Operational Information section above, approximately 1,480 yd^3 of dewatered material must be transferred from the dewatering pad annually. This requires approximately 30 hours of labor, about 2.5 hours per month. A similar amount of effort will be required annually to load the material again for disposal off site.

Sedimentation/Oil Flotation Basins

The leachate from the solids dewatering area will contain fine particles, which will be removed from the liquid in a sedimentation tank. The sedimentation process for solids also allows a de-emulsifying and flotation process for oil and grease.

Each load contains approximately 1 yd^3 of leachate and takes approximately 3 days to dewater. To calculate maximum flow rate into the sedimentation basin, it is estimated that 13.5 ft^3 will dewater from each load the day it is placed, 9 ft^3 will dewater on the second day, and 4.5 ft^3 will dewater on the third day.

At maximum operation, approximately two loads per day will be unloaded in a 5-day work week. As shown in Table 2, the maximum flow would be 54 ft^3 per day on the last 3 days of the work week.

Table 2. Daily Maximum Flows and Loads

Day	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
Load 1	13.5	9.0	4.5	0.0	0.0	0.0	0.0
Load 2	13.5	9.0	4.5	0.0	0.0	0.0	0.0
Load 3		13.5	9.0	4.5	0.0	0.0	0.0
Load 4		13.5	9.0	4.5	0.0	0.0	0.0
Load 5			13.5	9.0	4.5	0.0	0.0
Load 6			13.5	9.0	4.5	0.0	0.0
Load 7				13.5	9.0	4.5	0.0
Load 8				13.5	9.0	4.5	0.0
Load 9					13.5	9.0	4.5
Load 10					13.5	9.0	4.5
Total	27.0	45.0	54.0	54.0	54.0	27.0	9.0

The standards for design of a sedimentation/oil flotation basin for a sanitary sewage treatment facility are listed below, based on the 10 States Standards.

- Flow-through velocity: 0.005 foot per second (fps)
- Detention time: 1.5 to 2.5 hours
- Baffle inlet for energy dissipation
- Minimum freeboard: 1.5 feet
- Weir loading NGT: 10 gallons per minute (gpm) per foot
- Slope bottom toward hopper per outlet
- Expected solids reduction: 35 to 65 percent
- Preferred aspect ratio: 3:1 to 5:1

The solids being separated in the Vactor truck dump facility are expected to have larger particle sizes than those designed for in sanitary sewage treatment facilities; very fine material will have moved through the storm drain system, and only relatively coarse material will have remained to be cleaned out by the Vactor truck. Expected solids reduction may be as much as 85 percent.

The design water depth in the sedimentation basins will be approximately 2.0 feet. At a maximum flow of 54 ft^3/day, a detention time of 2.5 hours could be obtained in a basin with an area of 2.8 square feet. Using the aspect ratio of 3 (length) to 1 (width), the minimum dimensions of a rectangular sedimentation tank would be 3.0 feet long and 1.0 foot wide. The proposed sedimentation basins have total dimensions (7 feet 6 inches x 39 feet 0 inches), much larger than the minimum size required for detention.

The basin will be able to contain the solids from at least 6 months of operation. The annual operation will produce 2,966 loads, each producing 1 yd^3 of leachate that contains a maximum of 27 milliliters per liter (mL/L) settleable solids. If all solids were to settle, 108 ft^3 (4.0 yd^3) of material would be stored at the end of each 6-month cycle. This represents a layer 0.36 foot deep spread across the entire sedimentation basin area. When taking into account the loss of basin volume in this condition, the detention time under this condition is still more than 213 hours.

Oil/Water Separation

Oil/water separation will be achieved in the final sedimentation basin via the submerged outlet. Oil that has floated to the surface over the prolonged detention time will be trapped on the surface of the basin while pretreated water is allowed to escape beneath the surface. The outlet pipe was sized to minimize velocities and any suction effect. The trapped oil and other floatables will have to be skimmed from the surface of the basin by operators on a regular basis.

Conveyance System

The target velocity for the conveyance system is 2 fps. Because of the intermittent use of the facility, pipes should be cleaned annually to remove sediment and debris. Valves will be located on the outlet pipes of the sedimentation basins to prevent any flow to the treatment plant when the pad is not in active use. The valves will also allow operators to isolate the SDF from the treatment plant if high levels of contaminants are detected.

Sweeper Truck Decant Facility Treatment Train

The sweeper truck decant facility treatment train consists primarily of solids dewatering.

Operational Information

A sweeper truck vacuums the materials from the road surface into a large holding tank. Fresh water (stored in a separate tank on board) is sprayed onto the roadway to loosen sediments and control dust. The solids are generally damp, but not saturated, and will be dumped at the proposed treatment facility and allowed to dewater.

Useable storage capacity of typical sweeper trucks is approximately 6 cubic yards (yd^3) (162 cubic feet [ft^3]), which is 7,000 pounds of wet debris. Almost all of this materials volume will remain after dewatering.

During typical operation, approximately six loads per week will be discharged in a 5-day, 40-hour work week. The number of loads that will be dumped at the facility per year is estimated to be 312. These values take into account the City's current operations, projected future growth, and an allowance for outside haulers.

Approximately 36 yd^3 of dewatered solids per week would be produced at a facility supporting the operations described above. Such a volume will require frequent removal of dewatered solids. Operators will have access to a wheel loader for removal of solids.

Operation and Maintenance of Facility

An operations and maintenance plan has been developed by City personnel. It covers the following items:

- Remove trash from the dewatering pad as soon as it is found, and dispose of it in the dumpster provided next to the pad.
- Remove solids from the dewatering pad when they are approximately 6 inches high at the mouth of the pad.
- Remove solids from the liquids decanting sump as needed
- Remove sediment from the settling basin semiannually. Place on the dewatering pad to dewater for approximately 1 week; store dried solids.
- When about 0.5 inch of oil has collected on the surface of the water in the oil/water separator, skim the oil from the surface and dispose of it as hazardous waste.

Site Information

The SDF is located at the Washougal Wastewater Treatment Plant. The site is fenced and traffic areas are paved. All stormwater collected from impervious surfaces on the site is treated on site in the regular wastewater treatment process. The Decant Facility will be provided with ample lighting for occasional after-hours operation. A maneuvering area not less than 30 feet long will be required in front of each bay, and approximately twice that much space is available in the proposed layout.

A commercial hauler access control panel and software will be installed at the facility. Haulers, both from the City and potential outside users, will be required to enter an access code at the control panel before dumping their load. The software will track user data and provide the City with a reliable means of assessing trends in the operation.

Limitations

This document was prepared solely for the City of Washougal (City) in accordance with professional standards at the time the services were performed and in accordance with the contract between the City and Brown and Caldwell dated October 28, 2014. This document is governed by the specific scope of work authorized by the City; it is not intended to be relied upon by any other party except for regulatory authorities contemplated by the scope of work. We have relied on information or instructions provided by the City and other parties and, unless otherwise expressly indicated, have made no independent investigation as to the validity, completeness, or accuracy of such information.