MANAGEMENT OF STORMWATER FACILITY MAINTENANCE RESIDUALS

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by

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16. Abstract

The Oregon Department of Transportation is conducting a study to determine roadwaste management options. Phase 1 consisted of a thorough review of regulations and standards, roadwaste characterization, current management practices, and new technology. This report documents the finds from Phase 1, focusing on road sweepings and stormwater vactor residuals, though the findings also help to clarify proper management of other roadwaste materials. No one set of regulations was identified that covers roadwaste management. Consequently, hazardous and solid waste, water quality, cleanup, and other rules are reviewed. Roadwaste characterization evolved during the 1990s; many tests were run and results varied widely. Total petroleum hydrocarbon (TPH) tests, used at underground storage tank *UST) cleanup sites, are not appropriate for evaluation of roadwaste due to H-C bond interference from natural organic constituents. Now, carcinogenic PAHs (seven heavy petroleum compounds) and heavy metals drive evaluation of risk. Fine particles (clays and silts) are more contaminated than coarse fractions. Dissolved contaminants in vactor liquids are low; however, high contamination loadings are often adsorbed to suspended solids. Identifying and separating differing roadwastes allows more ready management while requiring less frequent analysis. Practices reviewed address hot load separation, mainstream roadwaste, and vactor waste management. Many possibilities are identified for trials; it is expected that Phase 2 (Trial Implementation) will lead to further important finds. The report recommends that trials lead to the development of Best Management Practices to support statewide plan development by ODOT in Phase 3.

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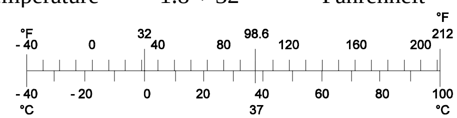
SI* (MODERN METRIC) CONVERSION FACTORS

APPROXIMATE CONVERSIONS TO SI UNITS

Symbol	When You Know	Multiply By	To Find	Symbol
		LENGTH		
in	inches	25.4	millimeters	mm
ft	feet	0.305	meters	m
yd	yards	0.914	meters	m
mi	miles	1.61	kilometers	km
		AREA		
in^2	square inches	645.2	millimeters squared	mm^2
ft^2	square feet	0.093	meters squared	m^2
yd^2	square yards	0.836	meters squared	m^2
ac	acres	0.405	hectares	ha
mi^2	square miles	2.59	kilometers squared	km^2
		VOLUME		
fl oz	fluid ounces	29.57	milliliters	mL
gal	gallons	3.785	liters	L
ft^3	cubic feet	0.028	meters cubed	m^3
yd^3	cubic yards	0.765	meters cubed	m^3
NOTE: Volumes greater than 1000 L shall be shown in m^3.				
		MASS		
oz	ounces	28.35	grams	g
lb	pounds	0.454	kilograms	kg
T	short tons (2000 lb)	0.907	megagrams	Mg
		TEMPERATURE (exact)		
°F	Fahrenheit temperature	5(F-32)/9	Celsius temperature	°C

APPROXIMATE CONVERSIONS FROM SI UNITS

Symbol	When You Know	Multiply By	To Find	Symbol
		LENGTH		
mm	millimeters	0.039	inches	in
m	meters	3.28	feet	ft
m	meters	1.09	yards	yd
km	kilometers	0.621	miles	mi
		AREA		
mm^2	millimeters squared	0.0016	square inches	in^2
m^2	meters squared	10.764	square feet	ft^2
ha	hectares	2.47	acres	ac
km^2	kilometers squared	0.386	square miles	mi^2
		VOLUME		
mL	milliliters	0.034	fluid ounces	fl oz
L	liters	0.264	gallons	gal
m^3	meters cubed	35.315	cubic feet	ft^3
m^3	meters cubed	1.308	cubic yards	yd^3
		MASS		
g	grams	0.035	ounces	oz
kg	kilograms	2.205	pounds	lb
Mg	megagrams	1.102	short tons (2000 lb)	T
		TEMPERATURE (exact)		
°C	Celsius temperature	1.8 + 32	Fahrenheit	°F



***** SI is the symbol for the International System of Measurement (4-7-94 jbp)

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MANAGEMENT OF STORMWATER FACILITY MAINTENANCE RESIDUALS

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1.0 INTRODUCTION AND BACKGROUND

As the regulation of non-point source pollution becomes more prevalent, public agencies and private landowners are realizing an increasing need to maintain storm sewer systems. Much of this need is arising from increasing federal and state regulatory requirements to address water quality. To meet the needs of the Clean Water Act a new environmental paradigm is being integrated into the fabric of road maintenance organizations whose fundamental concerns have been on structural repair such as road surfacing, pipeline maintenance, etc. New methods and procedures are being developed to enable these organizations to achieve positive results in protecting the environment.

All indications are that a proliferation of stormwater quality facilities owned and operated by municipalities, departments of transportation, and private owners will greatly increase the volume of residuals removed from the facilities and hence require some form of handling and disposal. The economic implications are significant, not only in the first costs of facility installation but in the notion of providing some form of perpetual maintenance of these facilities. This becomes problematic in a climate where budgets are being cut rather than increased.

With the increase in generation of stormwater maintenance residuals, concerns have been raised regarding how the materials are managed, treated and ultimately disposed. Current research has revealed that the nature of these materials is extremely variable, that regulation of these materials can be ambiguous, and handling can be costly and difficult. In many cases, when facing the problem with no solution at hand, the answer has been to do nothing.

The objective of this report is to provide an overview of the current methods for handling storm system residuals and to provide a recommendation as to how the Oregon Department of Transportation (ODOT) can work toward a practical and economic solution.

1.1 STORM SYSTEM MAINTENANCE

Historically, the need to collect residuals from storm sewers has centered on keeping drainage ways free of obstructions such as accumulated sediments and debris. An agency responsible for public safety must maintain storm sewer appurtenances to minimize the incidence of localized flooding due to obstructed drainage ways.

1.1.1 Maintenance of Storm Drain Appurtenances

Storm drain appurtenances include catch basins, pipelines, ditches, sumps and manholes. To facilitate maintenance, crews use specialized equipment, such as large vacuum operated eductor trucks. This equipment is also used to handle a wide variety of tasks such as vault de-watering, excavation of mud, pole hole drillings, etc.

This wide variety of uses and materials require operators to have an good understanding of the nature of the materials being excavated to avoid commingling of wastes, which can substantially increase disposal costs. For example, if a truck spends the majority of the day cleaning out mud from a small slope failure, the material does not need to be treated prior to disposal. However, the operator should know not to mix this material with other waste streams or both wastes could face higher disposal costs.

1.1.2 Maintenance of Water Quality Facilities

Since about 1990, there has been an increased need to address the pollutants transported from "developed surfaces" such as roadways, parking lots, rooftops, landscape area, etc. Types of facilities that trap these pollutants include ponds, swales, created wetlands, infiltration systems, sand filters, StormFilters™, and sedimentation/separation devices. These devices include oil/water separators, sediment manholes, Stormceptors™ and vortexing separators such as HIL Technology, Vortechnics™, and CDS *(Watershed Management Institute, 1997)*.

Based on the increased need to maintain these facilities, the following considerations should be made:

- There will be a significant increase in the volume of residuals once these facilities and devices become integrated into maintenance programs.
- It is likely that the nature of the residuals taken from water quality facilities will change. These residuals will have more vegetative matter and finer sediments than those seen in sumps and catch basins.

1.2 THE CLEAN WATER ACT AND THE REGULATORY ENVIRONMENT

It is beyond the scope of this report to provide interpretation of state and local regulations. The way these residuals are handled and classified is still being reviewed by the Oregon Department of Environmental Quality (DEQ). However, it is important to gain an understanding of what is driving these issues and how the need for water quality will impact maintenance of public roadways.

The 1972 amendments to the Federal Water Pollution Control Act of 1948 (referred to as The Clean Water Act [CWA]) were passed with two major strategies. First, the CWA mandated that the federal government provide financial assistance for the construction of local sewage treatment plants to treat wastewater before release into waterways. Second, the CWA required that all industrial and municipal wastewater discharged directly into navigable waters receive a permit through the National Pollutant Discharge Elimination System (NPDES). Navigable waters mean waters of the United States, including territorial seas, interstate waters, waters used in commerce, lakes, rivers, streams, certain wetlands, mudflats, sandflats and ponds. Cities were to achieve secondary treatment of wastewater to meet water quality standards. Industries were to meet pollution control limits first by use of Best Practicable Technology and later by improved Best Available Technology.

Initial CWA strategies primarily focused on controlling water pollution from industrial process wastewater and municipal sewage, known as “point source” water pollution. Because of the CWA, the United States has experienced success at managing point source water pollution as evidenced by cleaner waterways today in comparison to those years preceding the 1972 amendment. Yet, as industrial and municipal sources have abated pollution, uncontrolled non-point sources have become a relatively larger portion of remaining water quality problems – contributing between 50% to 80% of the nation’s water pollution. The term “non-point source” water pollution (also known as “wet weather”, “stormwater” and “urban runoff” pollution) is defined as water runoff, snowmelt runoff and surface runoff and drainage. Non-point source pollutants include heavy metals, damaging nutrients, sediment and pesticides. The EPA and state water quality authorities have identified wet weather flows as the largest remaining threat to water quality. The 1992 National Water Quality Inventory Report to Congress concluded “that stormwater runoff from a number of diffuse sources including … urban runoff is a leading cause of water quality impairment.”

Accordingly, EPA’s clean water programs are now focusing to a large extent on solving non-point source pollution problems. However, because non-point source pollutants cannot be traced to any identifiable (point) sources and because of the huge number of non-point sources, remedies for non-point source pollutants are more complicated than those for point source pollutants. As a result, non-point source pollution presents a formidable challenge to policy makers.

Section 402 (p) was added to the Clean Water Act in 1987 to require implementation of a comprehensive two-phase approach for addressing stormwater discharges under the NPDES program. Phase I established that a NPDES permit is required for stormwater discharge from municipalities with separate storm sewer system that serve a population greater than 100,000 and for certain defined industrial activities. Phase I also includes departments of transportation, flood control districts, special districts and port authorities. To receive a NPDES permit, the municipality or specific industry has to develop a stormwater management plan and identify Best Management Practices for stormwater treatment and discharge.

Best Management Practices (BMPs) are measures, systems, processes or controls that reduce pollutants at the source to prevent the pollution of stormwater runoff discharged from the site. NPDES does not require specific BMPs because the practices should be selected on a case-by-case basis depending on the particular activities ongoing at the facility and other factors.

Phase II regulations are currently in draft form for review. However, it appears that municipalities with populations greater than 50,000 or population densities greater then 1,000 people per square mile (2.59 km^2) will be subject to the regulations.

The EPA is the federal governing body of the CWA. However, much of the implementation and enforcement actions have been delegated to the states and their local jurisdictional authority. Although the CWA is the foundation for stormwater discharge regulations, each of these states and local jurisdictional authorities have interpreted the CWA federal regulations independently and enacted their own stormwater discharge rules and regulations.

1.3 REGULATIONS AT THE STATE LEVEL

"Some municipalities quietly state that with continuously decreasing budgets, it is now unfortunately preferable to avoid potential problems and costs by leaving the grit on the streets and in the catch basins, cleaning only on an emergency basis, and letting it wash away to the potential detriment of water quality. Obviously, that would be an example of environmental regulations having an undesired negative impact. We believe it is important for the sake of water quality and municipal budgets that more realistic test methods and policies be adopted." (Perla, 1994)

Presently, the classification of stormwater residuals is in question. Since the distribution and source of these residuals is ubiquitous, interpretation of how they are classified is problematic. In addition, the highly variable nature of the residuals raises significant questions about the need for analytical testing, the kinds of tests used, the timing of sampling events and sampling protocol.

DEQ has asked ODOT to investigate how these materials are best regulated. ODOT plans to propose roadwaste BMPs to DEQ for approval. A proactive approach of developing a plan and presenting it to DEQ may yield the best result.

2.0 A GENERAL STORMWATER RESIDUALS CHARACTERIZATION

Numerous characterization studies of residuals have been performed in both Oregon and Washington. To gain an understanding of the nature of these materials, one needs to understand the generation of the residuals and how they are transported through the storm sewer system.

Historically, storm systems are put in place and improved with development. As development becomes denser, land values increase, and drainage ways are converted from natural systems to constructed conveyance systems largely owned and maintained by public agencies. In many cases, runoff (and associated pollutants) from privately owned property is tributary to these storm systems owned and operated by the agency.

Pollutants transported in storm systems have both natural and man induced origins. Natural materials include leaves, soils, and airborne particulates. These materials are not necessarily pollutants, though they do adsorb oils and greases, nutrients and heavy metals. Many municipalities have leaf pick up programs to prevent leaf matter from clogging the storm drains and increasing the need for catch basin and storm pipe maintenance. Some man induced pollutants from paved surfaces include incompletely combusted petroleum, greases and oils, tire dust, heavy metals, detergents, deicing sand and salt, antifreeze, etc. Additional sources are pollutants from roof drainage including decomposing roof materials, zinc and copper discharge from roof drains onto streets or directly to the storm sewer system. Litter composed of plastic, paper, glass, metal components also frequently find their way into drainage systems.

2.1 TRASH AND DEBRIS

Basically, anything found on the street will end up in the storm system. Scraps of paper, plastic wrappers, cigarette butts, nuts and bolts, loose or damaged car parts, and glass are all commonplace. Though not common, other items such as hypodermic needles pose potential hazards to maintenance workers.

Many of these pollutants are wind blown from garbage receptacles or discarded by careless drivers. Primary control mechanisms are public education and awareness, litter laws, litter patrols and street sweeping. In some cases, the presence of debris and litter will prevent the reuse of stormwater residuals. However these materials can be screened and the litter disposed as municipal solid waste.

2.2 SEDIMENTS

Sediments are prevalent in stormwater. Commonly measured as Total Suspended Solids (TSS), sediment particle sizes range from cobbles to clays. The particle size distribution for sediments is highly variable, but sand appears to be a major component. The large sand component is probably due to sand settling in sumps while finer particles are transported through the conveyance system. Larger sizes move as bed load in pipes and settle quickly into sumps or channels where water velocities slow. The finer particles remain in suspension anywhere from a few minutes to many hours. Extremely small clay and colloid particles can remain in suspension indefinitely.

Sediments originate from natural soil erosion processes, construction sites, atmospheric deposition, and particulate decomposition of natural and manmade materials including fecal material, paints, and metals. One significant source of sediments is road sanding material. There are two problems typically associated with sediments:

1. Sediments can physically impede flows causing changes in channel morphology, accelerated erosion, wildlife habitat impacts, destruction of aquatic habitat and fish spawning beds, and/or flood storage reduction.

2. Sediments transport pollutants such as oils and grease, heavy metals, and bacteria. These pollutants can attach themselves to the surface of the sediment particles, particularly clay particles, which have a negative charge and can bond with cationic pollutants.

Because of the association with other pollutants, TSS is being used by some agencies as a benchmark to regulate pollutant removal efficiencies for approved stormwater quality facilities. However, removal of TSS does not address solubilized pollutants.

Vactor solids are composed of storm water sediments, organic material such as decayed leaves or wood, and litter including metals, paper and plastics. Sediment material is typically characterized as a grit due to the high sand fraction averaging 72% *(Serder, 1993)*. However, the sediment materials range from clays, 2%, to cobbles, some of which approach diameters of 15.0 cm.

Again, the content of the solids is variable depending on what sites are being maintained. In addition to servicing catch basins, vactor trucks are also used for excavation of ditches, trenches and the hydraulic jetting of pipes.

After de-watering, vactor solids water content is around 20%. Total Petroleum Hydrocarbons (TPH) and metals contents vary from near non-detectable to all levels of regulated waste. Again, it can be generalized that industrial sites tend to have higher pollutant levels than residential but residential areas frequently have high pollutant concentrations due to illegal dumping into single catch basins.

2.2.1 Total Petroleum Hydrocarbons (TPH)

Total petroleum hydrocarbons are commonly associated with oil and grease, gas, and diesel from vehicles. However, depending on the analytical methodology used, organic materials such as pine needles can interfere with results and lead to misinterpretation and misclassification of stormwater residuals. The State of Washington's Department of Ecology has been evaluating this issue and how it relates to the solid fraction of residuals. The general consensus seems to be that TPH is a general measure of automotive hydrocarbons but this position is not definitive. There is also evidence that much of the actual petroleum is "weathered" and may not pose a risk in terms of mobility. To summarize these findings the following important points are made:

- There appears to be a particular problem with the measure of petroleum hydrocarbons since there is significant interference with common organic materials such as pine needles. Interpretation of analytical data can be misleading.

- TPH may be used as a one sided test. If TPH is below some value then the material is not regulated. If above some threshold value, then it may be regulated, and depending on the disposal method, may require more sophisticated analytical tests.

- Smell and visual sheen seem to be two strong indicators of transportation related fuel and greases and can be used in the field to evaluate the possibility of a "hot spot."

2.2.2 Heavy Metals

Though the presence of heavy metals is a concern, Toxicity Characteristic Leaching Procedure (TCLP) testing has repeatedly shown that the leaching of heavy metals is at very low concentrations with lead periodically exceeding regulatory limits. Based on available data, the leaching of heavy metals from the solids fraction does not appear to be a concern *(Perla, 1996, WsDOT, 1993, Jacobson, 1993, and Woodward-Clyde, 1996)* and it is likely that frequent TCLP testing of solids will not be required.

2.2.3 Polycyclic Aromatic Hydrocarbons (PAH's)

PAH's are recognized as hazardous organic compounds, some being carcinogenic. Generated from automotive combustion *(Takada, 1991)* and tire dust *(Harris, City of Everett, WA; personal communication, 1998)*, they have been detected in soils and sediments in urban environments. These pollutants are still being evaluated with respect to how they impact the classification and management of stormwater residuals. Though detected, there are considerations that these compounds are not mobile in the environment and perhaps under correct management do not pose a substantial risk. *(Woodward-Clyde, 1996, and Personal Communication, Tony Barrett, Ecology, 1998)*

2.2.4 Biological Pollutants

Biological pollutants are of primary concern when being handled by maintenance workers. Fecal coliform bacteria are consistently found in stormwater runoff. Typical sources of these bacteria are animal fecal material, sanitary sewer overflows, leaking septic systems, etc.

Training of maintenance workers needs to include sanitation practices to minimize the exposure to soil and waterborne pathogens.

2.3 VACTOR FLUIDS

Vactor fluids are generally characterized as an aqueous suspension of fine sediments, sometimes with a visible sheen of oils and greases. The ratios of vactor fluids to the vactor solids varies with frequency of catch basin cleaning and how much water the operator uses to clean the solids from the containment vessel when dumping a load. The nature of the fluid is highly variable and dependent on the source and the length of time between catch basin cleaning. For example, industrial sites can have TPH levels in excess of 20,000 ppm while some residential sites have means TPH levels near 500 ppm. Vactor fluids typically have pH ranging from 6 to 8. Decant fluids and fluids drained from de-watering operations are typically high in suspended solids. Laboratory TSS values of 111,000 mg/l have been recorded *(Serder, 1993)*.

Though generalities about the fluids can be tied to land use, it has been well established that even areas, which typically have low pollutant loadings, can still have occasional spikes. For example, the illegal dumping of motor oil and paint solvents is well documented in the Bellevue NURP report *(Pitt, 1984)* and from personal communication with maintenance workers.

The fluids are typically drained from the solids, pretreated by extended settling, and then disposed to the local wastewater treatment plant. With sufficient settling time, facility operators indicate that there are few problems in meeting the discharge standards set by the treatment plant. Indications are that a 24-hour settling time should bring the fluids into compliance for discharge to the STP *(Eugene Public Works, 1995)*.

Discharge of vactor fluids to storm systems or natural drainage ways should be prohibited.

2.4 THE VARIABILITY OF STORMWATER RESIDUALS

If any one common theme has been continuously found in characterization reports it is the extreme variability in the physical and chemical characteristics of both the fluids and solids taken from stormwater. Though generalizations can be made about land use the abundance of variables which are dependent on the time of year, land use, geographic location, and frequency of maintenance preclude the ability to predict pollutant loads and/or the presence of a regulated or hazardous material. This is analogous to rolling dice. The probabilistic properties are well known, yet no one can tell exactly what the next roll will be.

There appear to be some well-defined seasonal characteristics to stormwater residuals. Many municipalities will schedule increased maintenance operations to account for seasonal loadings. During the summer pollutants tend to accumulate on paved surfaces. In addition, construction projects, car washing, lawn and garden fertilization also contribute to pollutant and potential sediment accumulation on paved surfaces. It is well known that first flush runoff from early fall rains typically have the higher pollutant concentrations. In addition, the first high-energy rains of the season will have the highest sediment loadings. During the late fall there is a high organic loading associated with leaves. During the winter and spring there may be a residual of deicing sand. The volume and nature of these residuals is strongly dependent on the weather.

Many of the samples are not drawn from the same populations. For example the Snohomish County PUD takes their samples from a very narrow set of conditions, specifically pole hole drillings and electrical vaults. There would be no reason to expect that there is any connection (in contaminant levels) with catch basin residuals from a main arterial. Combining data from two populations will not give an accurate picture of either population.

In addition, any single sample population is non stationary, i.e. the statistical parameters continuously change with time. Some municipalities maintain catch basins on a fairly regular basis and some not at all. It has been demonstrated that regularly maintained catch basins will typically have lower pollutant contents than ones maintained less frequently. In many cases, some catch basins are cleaned annually while others once every decade.

Differences in sampling populations suggest that a source separation program could be cost effective. This in turn suggests that operator training will be key to a successful management program.

It has been demonstrated that there is a large variance in waste characteristics which can be loosely associated with land use. For example many residential areas have high loadings of landscape bark or gravel. Industrial sites tend to have higher TPH loadings. In fact, verbal accounts from truck operators clearly show that many catch basins have unique “personalities” and can be totally different from all the surrounding catch basins.

Since ODOT is a statewide organization, there will be significant spatial variation in the nature of the materials. One would expect that solids from urban areas will have increased pollutant level and thus higher probabilities of triggering some regulatory limit. Hence, management practices in heavily urbanized areas will need to be more intensive.

3.0 REVIEW OF EXISTING DECANT FACILITIES/WASTE MANAGEMENT

A number of jurisdictions who operate decant facilities were interviewed or visited with regards to how they are managing their stormwater residuals. Below is a summary of interviews and observations.

3.1 CITY OF EVERETT

The City provides maintenance of catch basins, manholes, pipes and water quality facilities. Through an aggressive water quality focused maintenance plan, the City has progressed significantly in managing both street sweeping and stormwater residuals.

The City has developed a source separation program and provided training to the operators to make field determinations as to the nature of the residuals they are going to pick up. If the crew suspects by odor, color, or sheen that a load may be contaminated, they mark it on their route sheets and proceed to the next destination without removing the waste. A "special run" is then scheduled to handle the waste in accordance with state and local regulations.

Under normal circumstances the City will clean out the storm appurtenance. Field decanting is practiced. When required, the operator will discharge the free liquids to a sanitary sewer main only. They are considering the use of flocculents to the truck to reduce solids loading to the STP.

The City has a three-step process to separate the liquid and solid phases. The steps are as follows:

1) Allow the solids to settle in the back of the truck for about ½ hour, and then decant the liquids to a series of trapped settling catch basins. Effluent from these catch basins is discharged to the STP.

2) The remaining solids, (still not able to pass a paint filter test) are then dumped into a concrete box measuring about 6 m high X 4 m X 4.6 m with one end sloped for equipment access. One end of the box has a series of wood flashboards which retain the solids. Over a period of days to a week the solids lose most of the remaining free water which seeps though cracks in the boards and drains to the STP.

3) Once the solids are sufficiently de-watered they are removed from the vault with a loader and paced on a sloped asphalt surface. The solids are then allowed to remain on the asphalt for up to four months (dependent on the time of year) until the solids are dry enough to dispose.

The City's primary mechanism of disposal is recycling. The solids are passed through a ½" screen. The "bigs" are used as aggregate material and the fines are used for various purposes in areas where there is little chance human contact and drainage is not directly to streams or wetlands. Example uses are medians and selected roadsides. These materials are tested for TPH, TCLP and PAH's prior to reuse. To date, they have not cause a "spike" using draft guidelines prepared by Ecology.

The City manages a total of 69,000 m^3 of street sweepings, vactor solids, and excavation material annually. They sweep their streets every two weeks. System improvements include planning for the addition of a salting shed to store the drying materials to minimize rewetting from rainfall. *(Personal Communication with Mr. Roy Harris, City of Everett)*

In conversations with Mr. Harris, it is clear that the City of Everett is integrating the need for clean water into the maintenance paradigm. Mr. Harris should be considered as a source of information as to how ODOT could provide operator training in the future.

3.2 CITY OF PORTLAND

The City is presently constructing a new facility. Prior operations at the Inverness facility used a sloped dump pad with a central de-watering trough. This facility is being replaced due to its small size relative to the City's needs and difficulty in getting the material to sufficiently de-water. *(Communication with Doug McCourt, City of Portland)*

3.3 LANE COUNTY IN SPRINGFIELD

Lane County partners with the City of Springfield and the City of Eugene for the maintenance of catch basins and other storm drain appurtenances. Lane County practices field decanting to designated manholes in the sanitary sewer system.

Lane County operates a $250,000 facility measuring 24 m x 24 m with walls on three sides. About three to four loads are processed at the station daily. A de-watering trough runs along the back wall. Liquids collected in the trench discharge to a settling tank and then to the sanitary sewer. The facility has a high roof.

The material is piled to a depth of about 1.3 m to express the liquids. Solids are disposed at the sanitary landfill. Some changes the County is implementing are:

- The County wants to increase the pile depth.
- The County is in the process of establishing fees for the dumping of solids from a private maintenance company.

(Summary of field visit by Jay Collins, ODOT, 1998)

3.4 CITY OF GRESHAM

The City of Gresham has a two-year-old facility operating with mixed results. Appendix A contains a set of plans for the facility. The $200,000 two-year-old facility has a footprint of 15 m x 15 m with a wash rack. Designed with a drainage trough down the middle that discharges the liquids of a 2.4 m x 5.5 m x 1.8 m deep baffled vault which allows for extended settling. The liquids then discharge to the City's wastewater treatment plant. To date, the effluent meets the discharge standards.

The City provides primarily for the maintenance of sumps and catch basins. Their field practices include a source separation program. For example, if the operator knows the solids are originating from a construction site, they will be kept separate from "regular" street dirt catch basins and handled separately. They also practice some field decanting when water is being drawn from water line breaks, vault de-watering, etc. Field decanting is to the sanitary sewer. The City is the sole user of the facility as it is small, even for them.

The de-watering process has been reported to be to slow, ranging from three to four weeks in the winter and two weeks in the summer. The City does not pile the solids as high as other municipalities such as the City of Olympia. In addition the City does not "pre-decant" the free liquids from the truck prior to dumping into the de-watering slab. The capacity of the slab is about 30 to 38 m^3 of material.

The City disposes of the solids at $63.80 per metric ton at the Hillsboro Landfill. Solids are tested quarterly for TCLP and TPH.

The City reports some successes and problems with the new facility. Some general comments are:

- The facility is too small.
- The roof is too high relative to the footprint and does not keep out the rain.
- The vertical drop for the trucks to dump their load has worked well. This prevents the "slop" from getting the truck and the operator dirty.
- The City suggested that a small "runway" extend from the vertical drop to allow the operator a good vantage point from which to clean out the back of the truck containment vessel.
- Compartmentalize the solids to prevent dry solids getting wet from new solids and to gain more height on the pile.
- Operators need more training and the facility needs more management than anticipated.

(Site visit with Mr. Haig Valenzuela, City of Gresham)

3.5 CITY OF OLYMPIA

The City of Olympia collects residuals from catch basins, sumps, and some general excavation, for example in the event of a water line break. The City shares their facility with the cities of Lacey and Tumwater and Thursten County. They charge \$137.00 per m^3 to accept the material. Prior to discharge, they inspect the load with the right to refuse it. They can process a maximum of about 20 m^3 per week. In 1996, operational costs were about \$30,000 for 217 $m^3$of material.

The City of Olympia has a \$140,000 covered facility that has been in operation for about four years. The facility is about 12 m by 18 m with a drainage trough running down the center. In addition it includes a decant manhole which is used to decant the free liquids prior to dumping to the de-watering pad. This seems to significantly reduce the residence time on the pad.

Liquids are run through an oil/grit separator and discharged to the STP. To date, they have always met the discharge standards. For \$53.00/ metric ton, solids are taken to Holnam Concrete for casting into ecology blocks after thermal destruction of TPH and organics.

Anticipated improvements are raising of side and end walls to enable deeper piles of dried material. Piles can exceed two meters. Comments provided by the City are:

- The facility is undersized,
- The sides need to be shielded from the rain,
- The deeper the material is piled, the better.

(Site Visit with Dick Lee, City of Olympia)

3.6 CITY OF NEW YORK

The city of New York has a container dewatering program. Information was not available at the time of this writing. We recommend that ODOT contact this program at a later time. *[editors note: information regarding this program is available in the report "Roadwaste: Issues and Options" available through the ODOT Research Unit]*

3.7 CITY OF SEATTLE

The City operates the two facilities all year accepting residuals from catch basins and electrical vaults. The facilities are concrete pits, which overflow to catch basins that allow for settling prior to discharging to the sanitary sewer. The solids are taken to the solid waste landfill. They do not allow private companies to access their facility. *(Information provided on survey sheet)*

3.8 LIST OF CONTACTS

Below is a list of persons involved with the generation of this report**.**

Table 3.1: List of Contacts

Name	Title	Organization	Telephone
Mr. Roy Harris	Maintenance and Operations Supervisor	City of Everett	(425) 257-8893
Mr. Bob Campbell	Operations Planning Specialist	Snohomish County	(425) 388-3113
Mr. Steve Emmons	Manager	TPS Technology	(800) 828-8778
Mr. Tony Barrett	Environmental Planner	Washington Department of Ecology	(360) 407-6427
Mr. James Lenhart	V.P. Engineering	Stormwater Management	(503) 240-3393
Mr. Jay Collins	Environmental Projects Coordinator	Oregon Department Environmental Quality	(503) 229-5165
Ms. Gail Arnold	Sr. Environmental Analyst	City of Seattle	(206) 684-7613
Mr. Keith Stone	Maintenance Manager	City of Beaverton	(503) 526-2568
Mr. Larry Geffner	Street Supervisor	City of Marysville	(360) 651-5100
Mr. Dale Pierce	Manager	Flo-Trend Systems	(713) 699-0152
Mr. Haig Valenzuela	Stormwater Supervisor	City of Gresham	(503) 669-2381
Mr. Dick Lee	Stormwater & Sewer Section Supervisor	City of Olympia	(360) 753-8220

4.0 A DESCRIPTION OF THE RESIDUAL COLLECTION AND AVAILABLE TREATMENT PROCESSES

Though the nature of the wastes is highly variable, with significant pollutant loads, to date the treatment approach of these residuals has been relatively low tech. Treatment practices typically range from finding a convenient disposal site such as an abandoned quarry or unused low lying portion of a maintenance facility to constructing facilities to separate the solids and liquids to accommodate disposal needs. To date, it appears that most jurisdictions have either constructed or designated facilities.

Figure 4.1 on the next page is a generalized process diagram for the handling of stormwater residuals. Residuals are extracted from the source, typically using an eductor type vehicle. The truck will continue from one source to the next until either container is full or it is convenient to discharge the load to the decant facility.

4.1 FIELD DECANTING

Some municipalities practice "field decanting". Field decanting is performed when the truck is full, mostly with liquids. Typically the operator will find a sanitary sewer line and decant the fluids from the tank to accommodate more space in the truck tank. Though done in the past, decanting to storm systems appears to be no longer an acceptable practice. Since the liquids typically have a high TSS and may have a high oil and gas fraction, the point of discharge needs to be selected carefully. On occasion, it is more economical and efficient to field decant rather than have to return to a decant facility every time the tank is full.

One possible solution to minimize sediment transport to the STP is to establish field decant facilities which utilize a primary settling vault to remove a fraction of the solids and oil and greases. The same operators can then periodically clean out this facility. Some issues and considerations are:

- Permitting needs to be coordinated through local Publicly Owned Treatment Works (POTW)
- Field decanting sites should be selected to provide for complete mixing prior to entering the Sewage Treatment Plant (STP)
- Field decanting to storm drains should not be allowed.
- Under circumstances where the vactor fluids are originating from a known source which is not subject to contamination by runoff, e.g. sucking of water from a waterline break, the operator may discharge the liquids to an area when sediment laden water will not runoff to a water body, but would infiltrate into the soil.

Recent research by Snohomish County reports that adding flocculents, namely VGT-2000 by Delta Pollution Control to the eductor tank will substantially increase water quality before decanting (Snohomish County, 1997).

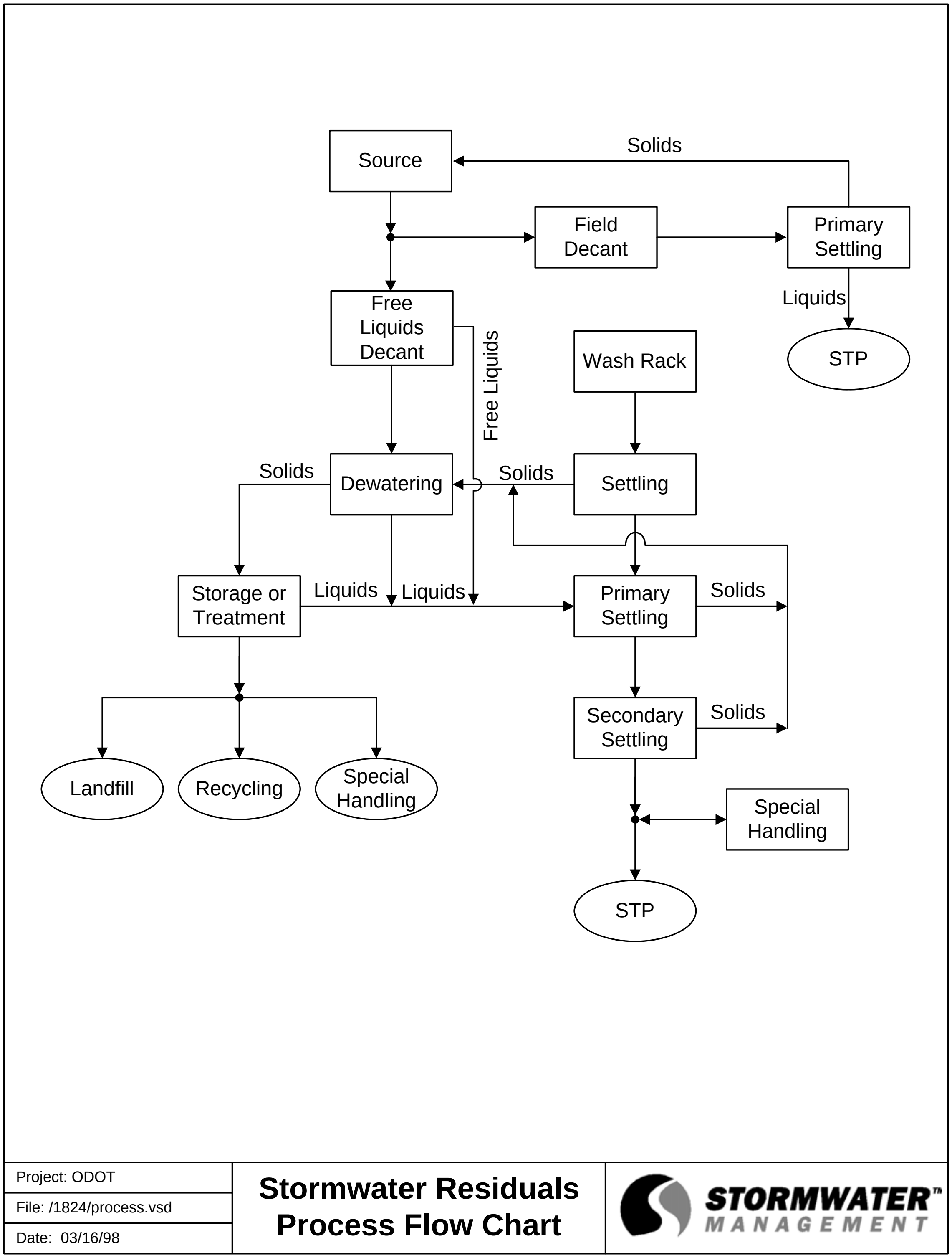

Figure 4.1: Stormwater Residuals Process Flow Chart

4.2 DE-WATERING PAD

Most existing decant facilities consist of a de-watering pad which includes a flat or sloped concrete floor. The contents of the eductor truck are dumped onto the pad surface with the notion that the fluids will run to a collection drain, leaving the solids behind. In some cases the free liquids are drawn off into a settling manhole or vault prior to dumping onto the de-watering pad.

Providing for effective and economic de-watering has proven to be one of the most significant challenges to facility design, particularly in the Pacific Northwest. The following common threads are found in these facilities:

- The pads are too small both not long enough and not wide enough.
- The solids take too long to de-water, frequently many weeks are needed to reduce the moisture content to a level the solids can be disposed. If disposal costs are based on the weight of the solids, than it is desirable to minimize moisture contents.
- Facilities first costs are too high particularly ones with roofs and complex concrete slabs.
- A roof is typically needed to keep rain from wetting the solids and delaying the drying process. However, the roof height needs to be high to accommodate dumping of the loads which allows wind blown rain to enter the facility.
- A ledge in the pad appears to be preferable to minimize splashing of the material around the truck.
- Access by a loader to work the material is needed.
- The material in the facility needs to be managed. Practices of source separation, multistage de-watering processes, and different disposal options are all needed for a successful program.
- Facilities need to consider the practice of decanting the free liquids prior to dumping on the de-watering pad.
- Facilities are having a difficult time establishing the best type of solids barrier as plugging happens very quickly.

4.3 DE-WATERING PROCESSES

De-watering of the solids is typically done by allowing the solids to sit long enough and let the liquids drain or evaporate out. In all facilities, this appears to be the most significant challenge, as de-watering can take weeks, particularly in the Pacific Northwest. Some significant design considerations are listed below.

- Deeper materials tend to gravitationally de-water quicker than materials spread thin on a surface, similar to a sponge set on end loosing more water than a sponge set flat.
- If disposal costs are related directly to the weight of the material, then the material needs to be as dry as possible.
- To some extent the materials need to be managed.

The Clean Washington Center Report (Clean Washington Center, 1997) provides an extensive summary of other types of technologies which may be used to provide for liquids and solids separation. These technologies include screw washing, screening, log washing (a method of solids separation by liquid floatation), and others.

4.4 WASH RACK

Typically decant facilities have a wash rack to service the trucks and use the same treatment facilities prior to disposal to the sanitary sewer. Trucks should be washed off so they do not transport solids back onto the streets.

Note that DEQ is in the process of completing a set of regulations that address vehicle washing. As this relates to ODOT maintenance operations it is recommended that any decant facility operation be in conjunction with a vehicle washing operation.

4.5 LIQUIDS PATH

Liquids resulting from the de-water operation are directed to a structure for extended settling. It appears that standard oil/water separators utilizing multiple chambers and baffles provide sufficient pretreatment prior to discharging to the STP. Over a period of time the sediments need to be cleaned from the facility. This is done by using the eductor equipment and using the facility to de-water the solids. This circular feedback process is used to continuously recycle the material and separate liquids from solids.

The STP is typically designated as the final destination for the liquids. Once the primary and secondary settling are complete, the liquids are then discharged to the STP. This is the methodology used by most of the systems reviewed and does not appear to be a problem with the STP operators. This practice maintains the liquids within the POTW waste stream and simplifies permitting and testing issues. It is also the most economical solution as it avoids construction and operation costs associated with on-site treatment systems which would discharge to surface or groundwater.

- If TSS is an issue with discharge to the STP, the use of flocculents should easily solve this problem. This is evidenced by some early “in the truck” studies by Snohomish County.
- In the dryer portions of the state, it may be possible to evaporate the liquids rather than discharge to the STP. However if a STP is available this option is probably not cost effective.

5.0 SOLIDS DISPOSAL OPTIONS

Once de-watered, the solids may then be stockpiled until the volume reaches some predetermined level for testing and transporting to the final destination. Once this point is reached the solids can then be recycled, landfilled or require some form of special handling such as thermal de-sorption. As a matter of course the disposal option selected will be the most economic but the types of disposal options available will depend on how the solids are classified. Some disposal options are listed below.

5.1 LANDFILLING

Landfilling is always an option, but is costly. There are a number of considerations associated with landfilling. These considerations are:

- Travel distance to the landfill.
- Need to pass the paint filter test.
- Increasing requirements to show the material has been tested.
- Since payment is by the ton, payment includes the cost for the disposal of water. Therefore, the dryer the material the better.
- Tipping fees are high, for example $63.90/ metric ton at the Hillsboro landfill. Other non-regulated landfills, such as the Farmington Landfill (AGI, 1997) are as low as $7.43 per metric ton.

5.2 RECYCLING OPTIONS

Recycling of the solids is very attractive, due to the low costs.

5.2.1 Re-Use as Aggregate Materials

Once de-watered to the desired moisture content the larger, coarse fraction of sand and gravel can be passed through trommel screens to be recovered. Aggregates can be used for road base, mixing with concrete or asphalt. Road sanding material can be recycled, especially if it is picked up fairly quickly after it is laid down during a winter storm. Finer fractions can be mixed with compost for landscaping soils.

Listed below are some concerns with recycling options:

- Environmental concerns about possibly contaminated solids, and how they are regulated and redistributed into the environment.
- Since clay particles and small organic particles tend to sorb pollutants, finer fraction solids will tend to have the highest probability of triggering some regulatory level.

5.2.2 Thermal De-Sorption

Thermal de-sorption is a process by which hydrocarbons can be removed from soils by heating the soil to about 200°C to drive off the adsorbed hydrocarbons. The vapor phase is then heated in a separate chamber to about 1,300°C which breaks downs the hydrocarbons. The sterilized soil can then be used as clean certified fill.

In the Portland Metro area, this service is provided by TPS Technologies, Inc. located in the Rivergate District. For qualified soils it costs about $60 per metric ton to treat the soil. It may also be interesting to note that periodically the fill is offered at no cost to whoever needs it.

Other companies such as United Soil Recycling (Woodburn) and Copeland Paving (Grants Pass) have facilities located in other areas which may be closer, and hence less costly to utilize.

5.2.3 Use in Concrete and Asphalt

The City of Olympia reports that Holnam Concrete will take the dried solids, mix it with cement and make ecology blocks with it. Reported costs are at $33 to $38 per metric ton. Mixing with asphalt should also be an option for the coarser fractions.

This is another methodology that ODOT could investigate. It may be possible to extend this concept to the production of jersey barriers or other non-structural concrete uses.

5.2.4 Composting

There is considerable interest in the possibility of mixing the fines from the decant facility and using them in a composting operation to reduce hydrocarbons and bind heavy metals to humic substances.

Solid residual can be screened to remove the coarse fraction to be used for structural aggregate. The fines and organic material can then be mixed with a compost feed stock such as mixed yard debris, straw, leaves, etc. The AGI report *(AGI, 1997)* states that Washington Department of Transportation (WsDOT) mixes the solids with mulch and bark and uses it as topsoil for roadside medians and shoulders.

Some studies by Snohomish County *(Clean Washington Center, 1997)* indicate that degradation of PAH's may be difficult. However, the sorption of PAH's to complex organic compounds such as humic acids in compost may render them non-mobile.

The Kitsap County report *(Woodward-Clyde, 1996)* reports that Fife Sand and Gravel provides composting of the solids at $33.00 per metric ton and will provide certification that the end product meets Ecology standards. However there are concerns as to how this can be done on a regular basis.

The Department of Environmental Protection of the State of Massachusetts allows composting of street sweepings for restricted use in public ways, above groundwater and away from waterways and wetlands.

As this is a promising disposal methodology ODOT should consider further investigation of past work in this area and consider sponsoring a pilot project for co-composting with mixed yard debris.

6.0 A SUGGESTED TREATMENT APPROACH FOR ODOT

There is another possible methodology of handling de-watering that may be attractive for statewide use by ODOT. This methodology utilizes containers for the de-watering and storage of solids. There are manufactured containers with storage volumes up to 19 m^3.

What is unique is the presence of an inner screen in the container that allows for the de-watering of solids. Using this approach, the liquids can be expressed for rapid de-watering, or drying with a blower. The steps include:

1. Construct a small, elevated dumping pad that "funnels" material and liquids from the eductor truck into containers.
2. Allow the container to gravitationally de-water to a sedimentation/oil water separator tank that discharges to the sanitary sewer.
3. Once the container is full, it is removed from the pad and set aside to completely de-water either by gravity or forced airflow. An empty container can then be moved into place.
4. The full container can be covered with a tarp to keep out the rain.
5. Once the solids are de-watered, the container can be put onto the back of a truck and taken to a disposal destination.

Listed below are some distinct advantages to this approach:

- Reduction in first costs.
- Reduced material handling and operational costs.
- Add or move containers as needed.
- Little or no roof is required.
- Allows for source separation.
- Allows for a uniform management approach throughout the State.

The City of New York has adopted a process similar to this. A mesh size of 30 (30 openings to the inch or 11.8 openings to the centimeter) appears to provide a good aperture size for de-watering. Within a 24-hour period this methodology reduced the water content by 49%. Attached in Appendix B is literature on these types of containers.

7.0 RECOMMENDATIONS

In the past the handling of stormwater residuals has not been an issue with public agencies. Typically these materials were stockpiled or used as fill material with little consideration given to the classification, handling or disposal of the material. With the advent of the Water Quality Act and other environmental rules and regulations there is an increasing need to provide for the maintenance of stormwater facilities; and tightening regulations as to how the residuals are disposed. Accordingly, ODOT is implementing programs to educate and train maintenance staff to recognize potential environmental impacts and how facilities maintenance is performed to comply with both regulatory and environmental needs. To accomplish this, the following criteria need to be met:

- Meet the regulatory requirements.
- Provide for water quality.
- Be cost efficient.
- Provide for the public safety and the safety of the maintenance worker.

7.1 SEEK TO SOLIDIFY REGULATORY DEFINITION

ODOT is working with Oregon Department of Environmental Quality to determine effective management strategies. Some recommended practices are:

- Field decanting to designated points along sanitary sewers only with the exception that known clean fluids can be discharged to areas which do not run off to waterways and will infiltrate instead.
- All decant station fluids are discharged to a STP.
- Suspect loads are determined by the operator and handled in accordance with state and local regulations as hazardous or dangerous wastes.
- De-watered solids can be recycled through a number of mechanisms including screening, composting and then used in areas away from human exposure, not tributary to surface waters, away from direct groundwater connectivity and at least 30 m from a stream or wetland.
- Investigate the ability to deal with private land owners who are discharging high levels of pollutants to publicly owned storm sewers. Actions can range from public education and implementation of source controls, the installation of water quality facilities prior to entry to the storm sewer conveyance system, or enforcement actions perhaps involving DEQ or local authorities.

Once ODOT establishes its desired practices, the plan should be outlined and submitted to DEQ for approval.

7.2 GENERATE A STATEWIDE COST ESTIMATE

ODOT staff are currently in the process of compiling records of how much of this material is being collected and how it is distributed throughout the state. Once these data are available, these numbers can be coupled with treatment options and statewide costs estimated.

These costs also need to incorporate first costs of constructing a facility, should that be the option for a particular area.

- The State should also begin to project the costs associated with the maintenance of stormwater quality facilities.
- Part of this analysis should consider the benefits of regular and frequent maintenance vs. emergency driven maintenance. Though no hard data have been presented there is a general consensus that frequently maintained facilities have lower pollutant loads and the workers would be more efficient since they are spending less time driving from one emergency to another and spending more time maintaining facilities.

7.3 SELECT AND DEVELOP A MANAGEMENT APPROACH

To have a successful program, a management structure needs to be established with two end goals in mind: public safety and water quality. To accomplish this, some key elements discussed below need to be integrated into its management.

One primary goal of roadway maintenance is water quality. To reach the goals set by the Clean Water Act the notion of clean water needs to be integrated into the management directive.

7.3.1 Develop and Provide Enhanced Maintenance Worker Training

A common thread to meeting regulatory needs while minimizing costs is empowering operators to make decisions in the field. To accomplish this for roadwaste management, ODOT needs to enhance its training program for operators and maintenance workers. Over and above OSHA training, elements of this program should include:

- An understanding of pollutant sources, impacts to the environment, and current regulations.
- Source separation program; if the operator thinks a load may be “hot” then they should keep it separate from other materials. The “hot” load should be handled separately to minimize costs.
- Development and training in the techniques in the field identification of “hot spots” based on odor, sheen color and consistency.
- Training in sanitation practices including personal sanitation and vehicle washing.
- Source detection – private and public sources. If a worker can identify the source of the pollutant, they should have a mechanism to report it either to the generator or to regulatory officials.
- Training on treatment facility operation to minimize costs through minimization of dewatering time and solids handling time.

7.3.2 Develop a Statewide Master Plan

A master plan should have two elements. The first element is the identification of locations where dewatering can take place. These locations include facilities that are ODOT owned and operated, partnering type facilities, or facilities owned and operated by others who will take residuals from ODOT at some pre-determined price. For all locations where ODOT operates the facility, permits need to be obtained from the local STP. This plan should also consider the opportunity and siting of field decant stations, where deemed appropriate.

Secondly the plan should identify solids disposal options for each facility that is operated by ODOT. Each facility would have a set of options based on the outcome of operator evaluation and the testing of suspect loads.

There needs to be some considerations for rural vs. urban residuals and respective disposal methods. In general it can be assumed that rural loads will have less contaminants than urban loads. This is probably true in the sense of a difference in the frequency distribution of contaminant concentrations. However, there will still be the occasional sump or catch basin which can be considered a hot load.

It may be of value to complete some further residuals characterization of materials generated outside the urban areas. The objective of this study would be to determine, in some rural areas, the feasibility of direct landfilling of select residuals in areas not tributary to waterways or in direct hydraulic contact with ground water.

7.4 CONSIDER PILOT STUDIES OF DEWATERING AND TREATMENT TECHNOLOGIES

A number of different treatment and recycling technologies have been evaluated by various agencies. Should ODOT establish existing technologies are either too costly or ineffective for their particular needs the following options can be evaluated:

- Establish a pilot study for the evaluation of using containers for dewatering. This could be an economic alternative to the high first costs of concrete structures with roofs.
- Perform a pilot study to recycle de-watered solids for use as aggregate and then for material for co-composting. The resulting compost can be used for roadside median top dressing or erosion control in cut slopes. ODOT can also evaluate the notion of immobilizing fines by mixing them with finished compost.

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APPENDIX A

SAMPLE PLAN SET – CITY OF GRESHAM DECANT FACILITY

APPENDIX B

INFORMATION ABOUT THE CONTAINER FILTER FROM FLO-TREND SYSTEMS