

2012 DEMONSTRATION SWALES TECHNICAL REPORT



Demonstration Swale Project - Technical Summary 2012
October 2012

Methodology: A twelve-inch, dry soil, core sampler was used. Four samples were taken from each swale at selective corners to incorporate a composite representation of the soil. The four samples were then combined. Field samples were site tested for soil moisture. Each sample was divided. Half was placed in sampling jars and taken to Test America Laboratory to be analyzed for hydrocarbons. The remaining soil was placed in zip lock bags and sent to Northwest Agricultural Consultants to be analyzed for Cation Exchange Capacity (CEC), Organic Matter, Free Lime, and pH.

North Side Swales – sampled 9/27/2012 – Average soil samples were a depth of ten inches. Measured precipitation for the month of September was 0.67in. No rain within the past 24 hours. Twenty four core soil samples were taken, four from each of the six north side swales. Swales are identified as the following:

Swale Name: N1
Location: 12303 N. Denver Dr.
Type: Grassed swale
Soil Observations: Bottom one inch of all core samples appeared to be lighter in color than the upper portion, typical of north side native sand. Samples were not as wet as previous year and mostly dark in color. Moisture reading was 35%.

Swale Name: N2
Location: 12017 N. Morton Dr.
Type: Grassed swale
Soil Observations: Samples were extremely wet and mostly dark in color, sticky, clay like soil. No standing water. Moisture reading was 60%.

Swale Name: N3
Location: 12025 N. Morton Dr.
Type: Grassed swale
Soil Observations: All four samples were sandy soil, not much engineered soil. Samples were slightly damp. Moisture reading was 48%.

Swale Name: N4
Location: 906/912 Chatham Ct.
Type: Plant swale
Soil Observations: 906 side of swale very wet. 912 side of swale very dry. Both sides show mostly sandy soil, no evidence of engineered soil. Moisture reading was lower at 30%.

Swale Name: N5
Location: 1116/1124 E. Chantel Dr.
Type: Plant swale
Soil Observations: The bottom two inches of each core sample was native sandy soil, lighter in color, and course grained. Samples were moderately dry. Moisture reading was 25%.

Swale Name: N6
Location: 12321 N. Denver Dr.
Type: Plant swale
Soil Observations: Bottom one inch of core samples were native sand. Moisture reading was 42%.

Southeast Swales – sampled 9/27/2012 – Average soil samples were ten inches in depth. Measured precipitation for the month of September was 0.67 in. No rain within the past 24 hours. Twenty four core soil samples were taken, four from each of the six southeast swales. Swales are identified as the following:

Swale Name: SE1
Location: 17324 E. Galaxy Ln. / 2421 S. Sumner Ln.
Type: Grass swale
Soil Observations: Core sampler only able to collect six to eight inches of soil. The engineered soil was prevalent. Moisture reading was 37%.

Swale Name: SE2
Location: 17606/17602 E. Ridge Ct.
Type: Plant swale
Soil Observations: Intermittent standing water throughout swale floor. Decorative rock mulch is sparse and low in some spots. Soil was extremely wet, dark in color, and holds together. Moisture reading was again high at 72%.

Swale Name: SE3
Location: 1134/1138 S. Moen Rd.
Type: Grass/Plant swale
Soil Observations: Difficult to get core sampler into soil. Left side (1138) samples were dark treatment soil, able to push sampler into soil. Right side (1134) showed a lighter clay soil and evidence of ground compaction. Toys and bicycles left in the swale indicate that children have been playing in the swale. Soil was moist. Moisture reading was higher at 52%.

Swale Name: SE4
Location: 18115 E. 11th Ave.
Type: Grass swale
Soil Observations: Soil extremely wet and dark in color. Swale floor was mushy, and had some standing water. Moisture reading was at 60%.

Swale Name: SE5
Location: 18418/18506 E. 11th Ave.
Type: Plant swale
Soil Observations: No standing water. Soil was dark in color. Evidence of improved drainage compared to last year. Plants look healthy and large. Swale is being maintained. Soil was moist with a reading of 55%.

Swale Name: SE6
Location: 11th Avenue Common Area
Type: Plant swale
Soil Observations: No standing water. Soil was dark in color. Shows evidence of improved drainage compared to last year. Plants look great. Soil was very moist with a reading of 68%.

2012 Demonstration Swale Soil Test Results
Oct- 2012 North side Swales

Hydrocarbons are gas, diesel, heavy oil (mg/kg, dry)												
Location	CEC Meg/100g 15 to 25	gasoline (MRL)	gasoline (actual)	diesel (MRL)	diesel (actual)	heavy oil (MRL)	heavy oil (actual)	pH	% OM	Free Lime %	% Moisture	
Acceptable range					<500		<500	6.5 - 7.2	5% - 10%	0% to 2+%	35% to 50%	
N1	19.6	10.0	NT	11.7	12.6	29.3	59.4	6.8	9.07	ND	35%	
N2	22.1	10.0	NT	13.0	14.9	32.4	58.6	7.3	6.20	0.25%	60%	
N3	6.4	10.0	NT	11.5	ND	28.7	ND	7.8	1.94	ND	48%	
N4	3.1	10.0	NT	11.1	ND	27.7	34.2	7.9	1.25	ND	30%	
N5	17.1	10.0	NT	12.1	18.3	30.3	69.3	7.0	6.57	ND	25%	
N6	20.8	10.0	NT	11.6	12.8	28.9	57.8	7.2	7.28	ND	42%	
average	14.9	10.0	NT	11.8	* 9.8	29.6	* 46.6	7.3	5.4%	0.2%	40%	
Southeast Swales												
Hydrocarbons are gas, diesel, heavy oil (mg/kg, dry)												
Location	CEC Meg/100g 15 to 25	gasoline (MRL)	gasoline (actual)	diesel (MRL)	diesel (actual)	heavy oil (MRL)	heavy oil (actual)	pH	% OM	Free Lime%	% Moisture	
Acceptable range					<500		<500	6.5 - 7.2	5% - 10%	0% to 2+%	35% to 50%	
SE1	22.7	10.0	NT	11.7	ND	29.4	30.7	7.1	6.58%	ND	37%	
SE2	19.4	10.0	NT	12.3	18.6	30.8	88.5	7.0	9.06%	ND	72%	
SE3	19.3	10.0	NT	11.7	13.7	29.3	64.4	6.8	8.24%	ND	52%	
SE4	21.2	10.0	NT	12.4	19.3	31.0	76.6	6.6	7.79%	ND	60%	
SE5	14.1	10.0	NT	11.6	14.0	29.0	118	7.9	3.85%	0.35%	55%	
SE6	20.4	10.0	NT	12.5	20.2	31.3	114	7.2	7.41%	ND	68%	
average	19.5	10.0	NT	12.0	* 14.3	30.2	* 82.0	7.1	7.20%	ND	57.3%	

MRL = Method Reporting Limit ND = Not Detected NT = Not Tested

* Values may not reflect accurate amounts due to the laboratory data qualifier methods' inability to duplicate results per industry standards.

* According to the Washington State Model Toxics Control Act, clean-up regulation levels of soil for diesel, and heavy oil is 2000 mg/kg dry.

Conclusions:

- Average **Cation Exchange Capacity (CEC)** values for the engineered, “Garrison” soil placed in the swales should have a range of 15 to 25 meq/100g (milliequivalent of hydrogen per 100 grams).
 - The **north side swales average 14.9meq/100g**, and the **southeast swales average 19.5meq/100g**. The average CEC values for 2012 show the north side swales decreased an average of 25%, and the southeast swales decreased an average of 6% compared to the 2011 values.
 - 2012 average CEC values show an decrease this year. The north side swales N3 & N4 dropped significantly, also indicated by low organic matter readings.
 - Values for **organic matter (OM)** average **5.4% for the north side**, and **7.2% for the southeast**, which is an average total decrease of 2.6% from the 2011 totals. An acceptable range for organic matter in treatment soil should be between 5% and 10%. The goal for water quality treatment is for organic matter and CEC values to continue to increase. Unfortunately, the average values for organic matter decreased in 2012.
 - Acceptable values for treatment soil pH should be between 6.5 and 7.2. The **average pH value for 2012 is 7.2**, indicating a near neutral soil. pH is a measurement of the soil acidity or alkalinity, and is used as a general indicator of available nutrients in the soil, presence of free lime (calcium carbonate), excess sodium, and excess hydrogen.
 - Free Lime or “Calcium Carbonate” present in the soil usually indicates a pH of 7.3 to 8.3. The absence of free lime in soil will produce a lower pH below 7.0. Presence of free lime means a less acid (or more alkaline) soil which promotes the availability of nutrients from the organic matter.
 - **Average diesel values for 2012** show a decrease in the north side swales from **10.7 mg/kg in 2011 to 9.8 mg/kg in 2012**, and a significant decrease in the southeast swales from **35.3 mg/kg in 2011 to 14.3 mg/kg in 2012**. **Due to the drastic shift in hydrocarbon values, numbers may not reflect accurate amounts due to the laboratory data qualifier methods’ inability to duplicate results per industry standards.*
 - **Average heavy oil values for 2012** show a decrease in the **north side swales from 55.0 mg/kg in 2011 to 46.6 mg/kg in 2012**; and a significant decrease for the southeast swales from **186.5 mg/kg in 2011 to 82.0 mg/kg in 2012**. **Due to the drastic shift in hydrocarbon values, numbers may not reflect accurate amounts due to the laboratory data qualifier methods’ inability to duplicate results per industry standards.*
 - Diesel and heavy oil values that reach 2000mg/kg dry indicate contaminated soil that will need to be cleaned up according to the Washington State Model Toxics Control Act.
- Soil moisture tests show **north side swales with average soil moisture of 40.0%**, which is a slight decrease from the 2011 average value of 45.6%. **Southeast swales show an average of 57.3%**, which is a slight increase from the 2011 average value of 46.5%.
- Some swales showed individual signs of increased moisture such as: **SE2**, which previously had a moisture reading of **70%**, increased this year by **2%**, for a total of **72% soil moisture**. The SE2 swale was again inundated with standing water, and the soil was saturated at the time of sampling with a moisture reading of 72%.

- Four locations, **SE2, SE4, SE6 and N2** appear to have excessive irrigation applied to their swales. Water conservation and proper irrigation practices will again be addressed in the yearly letter to swale demonstration participants.
- Swale identified as SE3 continues to have evidence of compacted soil, as the core sampler tool is very difficult to drive into the soil. This location was found to have heavy clay soil beneath the swale, and it was re-constructed with one foot of drain rock wrapped in fabric below the one foot of treatment soil, to help with drainage. Moisture reading @ 52%, over double from last year, % Organic Matter doubled, Heavy Oil & Diesel readings down.
- North side soil samples continue to show evidence that the native base soil is slowly moving into the bottom one to three inches of the Garrison treatment soil mix.

Recommendations:

- Swale soil testing should continue for a few more years to gather sufficient data to make educated, scientific, conclusions regarding the difference in treatment capacity between grass and plants in swale floor areas. The project is meant to show that swales planted intensively with shrubs will treat stormwater as well as grass.
- Owners of swales should try to be sure that children are not using the swale as a play area, to ensure the soil is not being compacted. Once the swale becomes compacted, it may no longer drain adequately and likely have a tendency to pond.
- Testing for gasoline should still NOT be conducted due to previous tests showing results of ND = none detected.
- Testing for diesel and heavy oil values may not reflect accurate amounts due to the laboratory data qualifier methods inability to duplicate results. A recommendation has been made to make sure we are always checking the QA/QC data testing from the laboratory, and to call the lab if there are any questions due to extreme increases or decreases in results.
- Demonstration Swale participants should be sure to NOT over irrigate their swales, as soil moisture readings should not exceed 50%. Excessive moisture will likely reduce CEC and organic matter by leaching it from the soil.
- WSU Spokane County Extension web page should continue to be updated with a current report each year.
- If you wish to obtain copies of previous Swale Demonstration Technical Summaries, please contact Spokane County Stormwater at 477-3600.