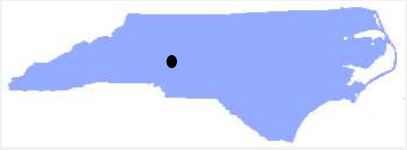
DENR/DEMLR
FACT SHEET FOR NPDES STORMWATER PERMIT DEVELOPMENT
NPDES Stormwater Permit NCS000548

Facility Information			
Applicant/Facility Name:	Duke Energy Carolinas, LLC – Marshall Steam Station		
Applicant Address:	P.O. Box 1006, Mail Code EC13K; Charlotte, North Carolina 28201		
Facility Address:	8320 East NC Highway 150, Terrell, North Carolina 28682		
Permitted Flow:	N/A (Stormwater Discharges Only)		
Industrial Activities:	Primary SIC Code: 4911 – Electric Services		
Permit Status:	New NPDES Stormwater Permit		
County:	Catawba County		
Miscellaneous			
Receiving Stream:	Catawba River (Lake Norman)	Regional Office:	Mooresville
Stream Classification:	WS-IV , B, CA	State Grid / USGS Quad:	Lake Norman North
303(d) Listed?	Hg, statewide	Permit Writer:	K. Pickle
Subbasin:	03-08-32	Date:	March 6, 2015



Facility Location: Lat. 35° 35' 50" N Long. 80° 57' 52" W

BACKGROUND

Duke Energy's Marshall Steam Station is a coal fired steam electric plant in Catawba County. The commercial operation of the facility began in 1965. Three historical stormwater outfalls have been abandoned in place: SW005, SW008A, and SW010 per info submitted by the company dated October 9, 2014.

In addition to NPDES wastewater discharge permit NC0004987, the facility also holds air permit #03676T49 and hazardous wastes permit NCD043678879. The facility is subject to federal requirements of 40 CFR §423 – Steam Electric Power Generation. This category is subject to federal NPDES stormwater discharge permit requirements per 40 CFR §122.26 (b)(14)(vii).

The company originally applied to the Stormwater Permitting Program (SPP) for a separate NPDES stormwater discharge permit for this facility in March 2011, with an amended application in June 2011. A draft permit was proposed and sent to public notice in July 2011. A subsequent revised draft went to the company in March 2012 but was never re-noticed or finalized. In October 2014, in response to NCDENR actions following the coal ash spill at the Dan River Steam Station in Eden, NC earlier that year, the company re-submitted complete materials to again request a stormwater discharge permit. The new proposed draft permit is based on more recent site activity information, sampling results, and visits by NCDENR staff.

This facility discharges to the Catawba River (Lake Norman). Lake Norman is not impaired, but there is a statewide total maximum daily load (TMDL) for mercury (Hg), approved in September 2012. No specific reductions or Hg limits are required from NPDES stormwater permittees at this time.

WHY THIS FACILITY IS SUBJECT TO A PERMIT

Federal NPDES regulations define **stormwater discharge associated with industrial activity** in 40 CFR §122.26 (b)(14) as:

> "the discharge from any conveyance that is used for collecting and conveying storm water and that is directly related to manufacturing, processing or raw materials storage areas at an industrial plant. The term does not include discharges from facilities or activities excluded from the NPDES program under this part 122. For the categories of industries identified in this section, the term includes, but is not limited to, storm water [sic] discharges from industrial plant yards; immediate access roads and rail lines used or traveled by carriers of raw materials, manufactured products, waste material, or by-products used or created by the facility; material handling sites; refuse sites; sites used for the application or disposal of process waste waters (as defined at part 401 of this chapter); sites used for the storage and maintenance of material handling equipment; sites used for residual treatment, storage, or disposal; shipping and receiving areas; manufacturing buildings; storage areas (including tank farms) for raw materials, and intermediate and final products; and areas where industrial activity has taken place in the past and significant materials remain and are exposed to storm water. For the purposes of this paragraph, material handling activities include storage, loading and unloading, transportation, or conveyance of any raw material, intermediate product, final product, by-product or waste product. The term excludes areas located on plant lands separate from the plant's industrial activities, such as office buildings and accompanying parking lots as long as the drainage from the excluded areas is not mixed with storm water [sic] drained from the above described areas."

As a result of the on-going generation of electrical power at Marshall, all stormwater-only discharges from the above named areas at the facility meet the definition of stormwater discharge associated with industrial activity.

PROPOSED MONITORING FOR STORMWATER DISCHARGES

The Division considered potential pollutants from the regulated industrial activities as well as data submitted in both October 2014 and December 2014. Single samples at seven outfalls included measurements of O&G, COD, Cl, Fl, SO_4, Hg, Al, As, Ba, B, Ca, Cd, Cr, Cu, Fe, Mg, Mn, Mo, Ni, Pb, Se, Sb, Tl, Zn, TDS, TSS, conductivity, hardness, and pH. The previous application from 2011 included analyses from a single outfall for a similar, but slightly different, suite of parameters. *See attached information for sampling results.*

Unlike most stormwater permits in its program, the Division is proposing a permit structure with outfall-specific monitoring for discharges. The Division considered including parameters based on anticipated potential pollutants in the drainage area and on the sampling results. Below is a table of the proposed monitoring for each outfall at the Marshall site. All outfalls ultimately discharge to the Catawba River (Lake Norman).

Stormwater Discharge Outfall (SDO) Monitoring	
SW001, SW001A, SW002, SW003 *Draining the miscellaneous materials storage areas along the intake canal.*	
Total Suspended Solids (TSS)	Semi-annual monitoring. **BASIS:** Potential pollutant from gravel laydown area and BMP effectiveness indicator.
pH	Semi-annual monitoring. **BASIS:** Pollutant indicator and important to interpreting toxicity potential of metals.
Priority Pollutant Metals Ag, As, Be, Cd, Cr, Cu, Hg, Ni, Pb, Sb, Se, Tl, and Zn.	Semi-annual monitoring *only if coal or coal ash transported through this drainage area*. **BASIS:** Coal combustion waste (CCW) constituents are currently present in the adjacent Ash Silos area. Roads crossing these drainage areas may incur, or may have incurred, ash truck traffic.
Boron	Semi-annual monitoring *only if coal or coal ash transported through this drainage area*. **BASIS:** CCW constituent / coal tracer.
SW004 *Draining a portion of the Ash Silos area into the intake canal.*	
Polychlorinated Biphenyls (PCBs)	Semi-annual monitoring; **may be discontinued after the first year (two samples) if not detected**. **BASIS:** Electrical equipment in this drainage area may have contained PCBs, which persist in the environment if ever released. If all PCBs have been removed and past releases cleaned up, these compounds should not be detected.
Total Suspended Solids (TSS)	Semi-annual monitoring. **BASIS:** Potential pollutant from drainage area and BMP effectiveness indicator.
pH	Semi-annual monitoring. **BASIS:** Pollutant indicator and important to interpreting toxicity potential of metals.
Priority Pollutant Metals Ag, As, Be, Cd, Cr, Cu, Hg, Ni, Pb, Sb, Se, Tl, and Zn.	Semi-annual monitoring. **BASIS:** CCW constituents are present.
Boron	Semi-annual monitoring. **BASIS:** CCW constituent / coal tracer.
SW005 *Previously draining into the intake canal.*	
Abandoned in place; applicant reports no discharge.	
SW006 *Draining the northern portion of the Warehouse roof and yard into the intake canal.*	
Total Suspended Solids (TSS)	Semi-annual monitoring. **BASIS:** Potential pollutant from drainage area and BMP effectiveness indicator.
pH	Semi-annual monitoring. **BASIS:** Pollutant indicator.
SW007 *Draining the switchyard, Powerhouse yard, rail lines, and areas extending west to the gypsum haul road, all into the intake canal. The largest single stormwater discharge sub-drainage area on the site.*	
Polychlorinated Biphenyls (PCBs)	Semi-annual monitoring; **may be discontinued after the first year (two samples) if not detected**. **BASIS:** Electrical equipment in this drainage area may have contained PCBs, which persist in the environment if ever released. If all PCBs have been removed and past releases cleaned up, these compounds should not be detected.
Total Suspended Solids (TSS)	Semi-annual monitoring. **BASIS:** Potential pollutant from drainage area and BMP effectiveness indicator.
pH	Semi-annual monitoring. **BASIS:** Pollutant indicator and important to interpreting toxicity potential of metals.
Non-polar Oil & Grease (1664 SGT-HEM)	Semi-annual monitoring. **BASIS:** Potential pollutant from lubricants; Method 1664 SGT-HEM targets petroleum-based O&G.
Priority Pollutant Metals Ag, As, Be, Cd, Cr, Cu, Hg, Ni, Pb, Sb, Se, Tl, and Zn.	Semi-annual monitoring. **BASIS:** Rail lines hauling coal are present in the drainage area.
Boron	Semi-annual monitoring. **BASIS:** Coal tracer.

Stormwater Discharge Outfall (SDO) Monitoring	
SW008 *Draining a small area (0.1A) east of the Powerhouse into the intake canal.*	
Total Suspended Solids (TSS)	Semi-annual monitoring. **BASIS:** Potential pollutant from drainage area and BMP effectiveness indicator.
pH	Semi-annual monitoring. **BASIS:** Pollutant indicator.
SW008A *Previously draining into the intake canal.*	
Abandoned in place; applicant reports no discharge.	
SW009 *Draining a portion of the Powerhouse roof, Precipitators 3 and 4 roof, trailer and laydown areas, all draining into the intake canal.*	
Polychlorinated Biphenyls (PCBs)	Semi-annual monitoring; **may be discontinued after the first year (two samples) if not detected**. **BASIS:** Electrical equipment in this drainage area may have contained PCBs, which persist in the environment if ever released. If all PCBs have been removed and past releases cleaned up, these compounds should not be detected.
Total Suspended Solids (TSS)	Semi-annual monitoring. **BASIS:** Potential pollutant from drainage area and BMP effectiveness indicator.
pH	Semi-annual monitoring. **BASIS:** Pollutant indicator.
SW010 *Previously draining into the discharge canal.*	
Abandoned in place; applicant reports no discharge.	
SW011 *Draining the raw water storage tank area into the discharge canal. Applicant reports historical sandblasting and repainting of the raw water storage tank. Limestone and gypsum conveyors cross the drainage area.*	
Total Suspended Solids (TSS)	Semi-annual monitoring. **BASIS:** Potential pollutant from drainage area and BMP effectiveness indicator.
pH	Semi-annual monitoring. **BASIS:** Pollutant indicator and important to interpreting toxicity potential of metals.
Cadmium (Cd)	Semi-annual monitoring. **BASIS:** Potential constituent of paint pigments applied or removed by sandblasting.
Chromium (Cr)	Semi-annual monitoring. **BASIS:** Potential constituent of paint pigments applied or removed by sandblasting.
Lead (Pb)	Semi-annual monitoring. **BASIS:** Potential constituent of paint pigments applied or removed by sandblasting.
Zinc (Zn)	Semi-annual monitoring. **BASIS:** Potential constituent of paint pigments applied or removed by sandblasting.
SW012, SW012A, SW023 *Gravel yard areas north and west of the FGD installation draining to the intake canal.*	
Total Suspended Solids (TSS)	Semi-annual monitoring. **BASIS:** Potential pollutant from drainage area and BMP effectiveness indicator.
pH	Semi-annual monitoring. **BASIS:** Pollutant indicator.
SW022 *Draining a gravel laydown area and FGD access road area into the discharge canal.*	
Total Suspended Solids (TSS)	Semi-annual monitoring. **BASIS:** Potential pollutant from drainage area and BMP effectiveness indicator.
pH	Semi-annual monitoring. **BASIS:** Pollutant indicator.

STORMWATER BENCHMARKS AND TIERED RESPONSE

Rather than limits, North Carolina NPDES Stormwater permits contain benchmark concentrations. Stormwater benchmarks are numerical action levels for stormwater monitoring. **Benchmarks are not effluent limits, and benchmark exceedances are not permit violations.** Benchmarks provide facilities a tool for assessing the significance of pollutants in stormwater discharges and the effectiveness of best management practices (BMPs). Benchmark concentrations are intended as guidelines for the facility's development and implementation of the Stormwater Pollution Prevention Plan (SPPP).

Benchmark exceedances require the permittee to increase monitoring, increase management actions, increase record keeping, and/or install stormwater BMPs in a tiered program. The permit establishes a tiered approach to specify actions the permittee must take in response to analytical results above benchmark concentrations (Part II, Section B., following Table 11 in the permit). The tiered structure of the permit provides the permittee and NCDEMLR wide flexibility to address issues that may arise with one or more parameters and/or outfalls.

Metals benchmarks are calculated to mimic acute water quality standards and with the guidance of NC's Division of Water Resources (DWR). NC DWR follows established federal procedures for calculating acute standards when developing the benchmarks. Just like the acute standards, metals benchmarks normally reflect one half of the calculated Final Acute Value (the "½ FAV"). In most cases, translation into total recoverable values is based on an assumed hardness of 25 mg/l and a total suspended solids (TSS) concentration of 10 mg/L. Acute standards protect aquatic life from negative impacts of short-term exposure to higher levels of chemicals where the discharge enters a waterbody. The Stormwater Permitting Program applies this approach because of the ephemeral nature of rainfall events and the associated discharges.

The Division may evaluate results to determine if a smaller suite of parameters for some outfalls is adequate to characterize potential pollution or BMP effectiveness. For example, one or more metals or other parameters may serve as an adequate tracer for the presence of ash pollution during disturbance or ash removal in specific drainage areas at this site. For parameters that do not have a stormwater benchmark, the Division may develop a benchmark value if appropriate toxicity data become available or if rising trends in concentrations suggest a persistent source.

A summary of the benchmarks in the draft permit, and their basis, is below:

Parameter	Benchmark	Basis
Antimony (Sb), mg/L (Total)	0.09	Acute Aquatic Criterion, ½ FAV
Arsenic (As), mg/L (Total)	0.34	Acute Aquatic Criterion, ½ FAV
Beryllium (Be), mg/L (Total)	0.065	Acute Aquatic Criterion, ½ FAV
Cadmium (Cd), mg/L (Total)	0.003	Acute Aquatic Criterion, ½ FAV
Chromium (Cr), mg/L (Total)	0.9	½ FAV, based on (Cr III + Cr VI) acute thresholds and assumption that industrial activities here are not a source of hexavalent chromium.
Copper (Cu), mg/L (Total)	0.010	Acute Aquatic Criterion, ½ FAV
Lead (Pb), mg/L (Total)	0.075	Acute Aquatic Criterion, ½ FAV
Mercury (Hg), ng/L (Total)	N/A	Monitoring only, CCW/Coal Constituent. Hg influenced by regional transport and wet deposition. Values above 12 ng/L (NC WQ standard) should be noted on the DMR but do not trigger Tier Responses.

Parameter	Benchmark	Basis
Nickel (Ni), mg/L (Total)	0.335	Acute Aquatic Criterion, ½ FAV
Polychlorinated biphenyl compounds (PCBs), µg/L	Detected	NC Water Quality Standards vs. present Arochlors quantitation levels (higher than standard)
Selenium (Se), mg/L (Total)	0.056	½ FAV, NC-specific, based on 1986 Study on Se impacts in North Carolina
Silver (Ag), mg/L (Total)	0.0003	Acute Aquatic Criterion, ½ FAV. (The Division notes this value is below the practical quantitation level (PQL) of 1 µg/L of EPA Method 200.8)
Boron (B), mg/L	N/A	Monitoring only, CCW/Coal Constituent. Narrative National Recommended Water Quality Criterion.
Thallium (Tl), mg/L (Total)	N/A	Monitoring Only, CCW/Coal constituent. National Recommended Human Health Criterion.
Zinc (Zn), mg/L (Total)	0.126	Acute Aquatic Criterion, ½ FAV
Total Suspended Solids (TSS), mg/L	100	National Urban Runoff Program (NURP) Study, 1983
Non-Polar Oil & Grease, *EPA Method 1664 (SGT-HEM)*, mg/L	15	Review of other state's daily maximum benchmark concentration for this more targeted O&G; NC WQ Standard that does not allow oil sheen in waters.
pH	6-9	NC Water Quality Standard (Range)

STORMWATER POLLUTION PREVENTION PLAN

The proposed permit conditions reflect the Environmental Protection Agency's (EPA) and North Carolina's pollution prevention approach to stormwater permitting. The Division's maintains that implementation of Best Management Practices (BMPs) and traditional stormwater management practices that control the source of pollutants meets the definition of Best Available Technology (BAT) and Best Conventional Pollutant Control Technology (BCT). The permit conditions are not numeric effluent limitations but are designed to be flexible requirements for implementing site-specific plans to minimize and control pollutants in stormwater discharges associated with the industrial activity. Title 40 Code of Federal Regulations (CFR) §122.44(k)(2) **authorizes the use of BMPs in lieu of numeric effluent limitations in NPDES permits when the agency finds numeric effluent limitations to be infeasible.** The agency may also impose BMP requirements which are "reasonably necessary" to carry out the purposes of the Act under the authority of 40 CFR 122.44(k)(3). The conditions proposed in this draft permit are included under the authority of both of these regulatory provisions. In essence, the pollution prevention and BMP requirements operate as limitations on effluent discharges that reflect the application of BAT/BCT.

Determining specific BMPs that are appropriate for the site and activities are the permittee's responsibility, and the permit strives not to limit what BMPs can be used. The permittee should also refer to the BMPs described in both EPA's Multi-Sector Permit (MSGP) and Industrial Stormwater Fact Sheet for Steam Electric Power Generating Facilities (Sector O) for guidance on pollution prevention measures.

It is important to note that the largest portion of stormwater runoff at this facility is ultimately routed into the waste treatment system (ash pond), and those discharges are regulated by the NPDES *wastewater* permit.

MERCURY MONITORING REQUIREMENTS

The proposed permit requires mercury to be measured in stormwater samples by EPA Method 1631E, which can detect levels as low as 0.5 ng/L. This requirement is consistent with recent federal rule-making that requires NPDES permittees to monitor discharges with sufficiently sensitive test procedures approved under 40 CFR §136. Modifications to 40 CFR §122.44(i) require a method that has a minimum level (ML) at or below the effluent limit (not applicable here), or the lowest minimum level (ML) of EPA approved analytical methods for the measured parameter. Based on results, Method 1631E will be required to quantify levels in these discharges. NC DEMLR understands that this method is more costly and requires a more intensive sampling protocol than most other parameters, and that fish tissue sampling will be provided during the permit cycle. Therefore, no benchmark applies that would trigger tiered response actions. Proposed permit provisions also allow the permittee to use field blank and/or method blank concentrations to adjust reported mercury levels as long as documentation is submitted with the Discharge Monitoring Report (DMR).

FLEXIBILITY IN TIER RESPONSES

Tier Two actions (upon two consecutive benchmark exceedances at an outfall) proposed in this draft permit differ slightly from the Program's standard template and includes **step 5**. That step provides an opportunity for the permittee to propose an **alternative monitoring plan for approval** by the Region:

4. *Alternatively,* in lieu of steps 2 and 3, the permittee may, after two consecutive exceedances, exercise the option of contacting the DEMLR Regional Engineer as provided below in Tier Three. The Regional Engineer may direct the response actions on the part of the permittee as provided in Tier Three, including reduced or additional sampling parameters or frequency.
5. If pursuing the alternative above after two consecutive exceedances, the permittee may propose an **alternative monitoring plan** for approval by the Regional Engineer.

The permit therefore allows the permittee to petition the Regional Office for monitoring changes *sooner than* **Tier Three** (upon any four benchmark exceedances) and gives guidance on one option to take. For example, the permitttee may request that mercury only be monitored semi-annually under the tiers, or that only parameters over the benchmark be monitored more frequently. In this way, changes to the monitoring scheme for any outfall could be handled outside of a permit modification.

OTHER PROPOSED REQUIREMENTS

- It is standard for Stormwater Pollution Prevention Plan (SPPP) requirements to include an annual certification that stormwater outfalls have been evaluated for the presence of *non-stormwater* discharges, and if any are identified, how those discharges are permitted or otherwise authorized. The draft permit requires this **facility to submit the first certification to DEMLR no later than 90 days after the effective date of the permit** (Part II, Section A.).
- Requirement to submit a request for permit modification if the facility identifies or creates any new outfalls, removes outfalls, or alters any drainage area that changes potential pollutants.
- Proposed federal regulations will require electronic submittal of all discharge monitoring reports (DMRs). If a state does not establish a system to receive such submittals, then permittees must submit DMRs electronically to the Environmental Protection Agency (EPA). The Division anticipates that these regulations will be adopted and is beginning

implementation. Permit provisions addressing this impending requirement is included in Part III, Section B. (General Conditions), 3.e.

- **Quarterly** Qualitative/Visual Monitoring to assure regular observation of outfalls throughout year.

INSTREAM MONITORING

The facility historically had monitoring stations located upstream and downstream. Instream sampling has been for balanced and indigenous populations assessment (BIPA) near the Marshall Steam Station and for *wastewater permit* in-stream monitoring requirements. Upstream sampling for the **wastewater permit** is approximately one mile upstream of the ash pond discharge (station 15.9), and the downstream sampling (station 14) is approximately one mile downstream of that discharge. Monitored parameters were As, Cd, Cr, Cu, Hg, Pb, Se, Zn, and Total Dissolved Solids. All constituents were below water quality standards for the sampling events at each location.

In-stream monitoring is not proposed in this draft NPDES **stormwater permit.**

FISH TISSUE MONITORING

Wastewater permit NC0004987 required fish tissue monitoring for As, Se, and Hg near the ash pond discharge once every five years. Sunfish and bass tissue were analyzed. The results were below action levels for Se and Hg and below screening value for As. The proposed stormwater permit requires the permittee to **submit a copy of future monitoring results to the DEMLR Stormwater Permitting Program** (Central Office) within 30 days of receiving results and indicate the location of sampling in relation to stormwater discharge outfalls. *DEMLR is requiring the fish tissue analysis results be submitted separately because the proposed NC0004987 permit does not require submittal to DWR until application for permit renewal.*

PROPOSED SCHEDULE FOR PERMIT ISSUANCE:

Draft Permit to Public Notice: March 2015 (est.)
Permit Scheduled to Issue: June 2015 (est.)

STATE CONTACT:

If you have any questions about any of the above information or the attached permit, please contact Ken Pickle at (919) 807-6376 or bethany.georgoulias@ncdenr.gov.

STORMWATER SAMPLING RESULTS FROM MARSHALL (SUBMITTED OCTOBER 2014):

Parameter	Units	Sample Location	
		SW007	SW012
COD	mg/L	26	< 20
Cl - Chloride (00940)	mg/L	1.3	6.8
Fluoride	mg/L	0.68	0.45
SO4 - Sulfate (00945)	mg/L	64	220
Oil & Grease	mg/L	< 5	< 5
Hg - Mercury (71900)	µg/L	< 1	< 0.05
Al - Aluminum (01105)	mg/L	35	0.941
Ba - Barium (01007)	mg/L	0.469	0.042
B - Boron (01022)	mg/L	0.181	0.064
Ca-Calcium	mg/L	52.6	103
Hardness	mg/L (CaCO3)	187	262
Fe - Iron (01045)	mg/L	54.9	0.896
Mg-Magnesium	mg/L	13.5	1.32
Mn - Manganese (01055)	mg/L	0.748	0.016
Zn - Zinc (01092)	mg/L	0.91	0.075
Sb - Antimony (01097)	µg/L	1.4	1.11
As - Arsenic (01002)	µg/L	32.2	1.06
Cd - Cadmium (01027)	µg/L	1.42	< 1
Cr - Chromium (01034)	µg/L	60.3	1.53
Cu - Copper (01042)	µg/L	96.3	4.79
Pb - Lead (01051)	µg/L	48.5	< 1
Molybdenum (Mo)	µg/L	10.9	2.74
Ni - Nickel (01067)	µg/L	52.8	1.4
Se - Selenium (01147)	µg/L	19.6	6.76
Tl - Thallium (01059)	µg/L	1.08	0.426
pH	SI Units	7.75	7.71
Specific conductance	µS/cm	224	428
TDS - Total Diss. Solids (70300)	mg/L	290	370
Temperature	°C	--	--
TSS-Total Suspended Solids	mg/L	1100	27

Note: temperatures were not taken during the sampling event.

STORMWATER SAMPLING RESULTS FROM MARSHALL (DECEMBER 2014):

Parameter	Units	Sample Locations				
		SW001A	[1]SW002	SW012A	SW022	SW023
COD	mg/L	< 20	< 20	47	< 20	22
Cl - Chloride (00940)	mg/L	1.3	1.5	4.3	< 0.5	1.4
Fluoride	mg/L	< 0.1	0.14	< 1	< 0.5	0.15
SO_4 - Sulfate (00945)	mg/L	24	28	580	190	34
Oil & Grease	mg/L	< 5	< 5	< 5	< 5	< 5.0
Hg - Mercury (71900)	µg/L	< 0.05	< 0.05	0.23	< 0.05	< 0.05
Al - Aluminum (01105)	mg/L	1.62	0.744	8.47	4.39	0.967
Ba - Barium (01007)	mg/L	0.026	0.03	0.128	0.064	0.036
B - Boron (01022)	mg/L	< 0.05	< 0.05	0.093	< 0.05	< 0.05
Ca-Calcium	mg/L	12.3	12.9	261	89	13.8
Hardness	mg/L ($CaCO_3$)	35.4	37.7	673	232	40.3
Fe - Iron (01045)	mg/L	1.77	1	10.8	5.72	1.27
Mg-Magnesium	mg/L	1.15	1.33	5.18	2.36	1.41
Mn - Manganese (01055)	mg/L	0.025	0.019	0.322	0.122	0.042
Zn - Zinc (01092)	mg/L	0.007	0.015	0.057	0.072	0.02
Sb - Antimony (01097)	µg/L	< 1	< 1	1.02	< 1	< 1
As - Arsenic (01002)	µg/L	1.14	1.03	4.66	2.03	1.08
Cd - Cadmium (01027)	µg/L	< 1	< 1	< 1	< 1	< 1
Cr - Chromium (01034)	µg/L	1.21	< 1	16.3	4.83	6.73
Cu - Copper (01042)	µg/L	3.76	3.55	20.6	6.78	5.87
Pb - Lead (01051)	µg/L	1.42	< 1	4.14	2.38	< 1
Mo - Molybdenum	µg/L	2.23	3.16	7.06	< 1	1.35
Ni - Nickel (01067)	µg/L	< 1	< 1	13.1	2.64	1.08
Se - Selenium (01147)	µg/L	< 1	1.07	27.2	2.48	3
Tl - Thallium (01059)	µg/L	< 0.2	< 0.2	0.208	< 0.2	< 0.2
pH	SI Units	7.28	6.98	7.56	7.01	7.06
Specific conductance	µS/cm	85.7	108	1031	421	108
TDS - Total Diss. Solids (70300)	mg/L	76	78	980	260	80
Temperature	°C	11.9	11.5	10.3	10.0	9.6
TSS-Total Suspended Solids	mg/L	25	21	150	230	17

[1] Samples were collected from the pipe inlet

STORMWATER SAMPLING RESULTS FROM MARSHALL (MARCH 2011 ORIGINAL APPLICATION):

Parameters	Benchmark	Outfall SW007	Outfall SW007
Oil and Grease	30 mg/l	ND mg/l	
Aluminum	0.75 mg/l	**3.310 mg/l**	**4.010 mg/l**
Arsenic	0.36 mg/l	ND mg/l	0.0074 mg/l
Barium		0.0636 mg/l	0.0716 mg/l
Boron		0.030 mg/l	ND mg/l
Cadmium	0.001 mg/l	ND mg/l	ND mg/l
Chromium	1.0 mg/l	ND mg/l	0.0054 mg/l
Cobalt	0.03 mg/l	ND mg/l	ND mg/l
Copper	0.007 mg/l	**0.0161 mg/l**	**0.018 mg/l**
Iron	1.0 mg/l	**6.120 mg/l**	**7.480 mg/l**
Magnesium	32 mg/l	2.460 mg/l	2.590 mg/l
Manganese		0.135 mg/l	0.152 mg/l
Nickel	0.26 mg/l	0.006 mg/l	0.0064 mg/l
Selenium	0.056 mg/l	ND mg/l	ND mg/l
Silver	0.001 mg/l	ND mg/l	ND mg/l
Titanium		0.270 mg/l	0.326 mg/l
Zinc	0.067 mg/l	**0.108 mg/l**	**0.117 mg/l**
Mercury	0.000012 mg/l	ND mg/l	ND mg/l
Apparent Color		100 units	
TSS	100 mg/l	**136 mg/ l**	
BOD	30 mg/l	8.0 mg/l	8.0 mg/l
Nitrogen, Ammonia	7.2 mg/l	ND mg/l	
Nitrogen, Kjeldahl, Total	20 mg/l	0.91 mg/l	
Nitrogen NO2 plus NO3	10 mg/l	0.40 mg/l	
Phosphorus	2 mg/l	0.20 mg/l	
Phenol	4.5 mg/l (trout)	ND mg/l	
Chloride	860 mg/l	ND mg/l	
COD	120 mg/l	**178 mg/l**	
Sulfate	500 mg/l	25.7 mg/l	