City of Eugene Stormwater Monitoring Plan

for

National Pollutant Discharge Elimination System
Municipal Separate Storm Sewer System (MS4) Discharge
Permit 101244

November 2011

Rev. 1.0

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APPENDIXES

1 Overview

The City of Eugene has developed this Stormwater Monitoring Plan to meet requirements specified in its new, third-term National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System (MS4) Discharge Permit Number 107989 issued by the Oregon Department of Environmental Quality (DEQ) to the City in December 2010. This Monitoring Plan describes environmental monitoring elements that will be used to assist the City with ongoing efforts to characterize stormwater pollutant discharges, determine potential pollutant sources, assess the effects of stormwater runoff on streams, evaluate the effectiveness of stormwater management program elements in reducing those effects, and assist with the adaptive management of the stormwater program.

Since receiving its first stormwater NPDES permit in 1994, water quality data have been systematically collected at multiple locations on rivers and streams within the City's jurisdictional boundaries. Water quality trends indicate significant improvements have occurred over that time at many monitored locations, an indication that the City's stormwater management program is proving effective in reducing pollutants in stormwater runoff and improving receiving stream water quality. However, data also indicate that activities within the City continue to have a measurable impact on levels of pollutants observed in our rivers and streams. Many of Eugene's local waterbodies contain pollutant concentrations that are above Oregon's water quality criteria for the protection of human health and aquatic life. In response, the City continues to refine public policy and practices for addressing stormwater conveyance and urban stormwater quality issues through the development, implementation, and adaptive management of water quality controls such that pollutant loads are reduced to the maximum extent practicable (MEP).

The environmental monitoring requirements in the City's new stormwater NPDES permit include many elements that continue to build upon our knowledge of the complex issues related to pollutant characterization and source evaluation, the effectiveness of best management practices, and overall stormwater management efforts to improve stormwater quality. Continuation of historical monitoring programs combined with new environmental monitoring requirements add to this knowledge base and will prove essential in assessing the effectiveness of many stormwater quality control programs.

Monitoring elements in this plan include sampling for the analysis of pollutants in stormwater from the MS4, instream water quality monitoring, macroinvertebrate and bacteria monitoring, physical and hydrologic monitoring, and structural BMP monitoring. These elements are complimented by program monitoring elements associated with the 2010 Stormwater Management Plan (e.g. dry weather field screening, BMP tracking and measurable goals, etc.). Collectively, the environmental and program monitoring elements are intended to meet six monitoring objectives defined in the City's stormwater NPDES permit. Specifically, the objectives require the City to:

1. Evaluate the source(s) of the 2004/2006 303(d) listed pollutants applicable to Eugene's MS4 permit area;

2. Evaluate the effectiveness of Best Management Practices (BMPs) in order to help determine BMP implementation priorities;

3. Characterize stormwater runoff discharges based on land use type, seasonality, geography or other catchment characteristics;

4. Evaluate the status and long term trends in receiving waters associated with MS4 stormwater discharges;

5. Assess the chemical, biological, and physical effects of MS4 discharges on receiving waters; and

6. Assess progress towards meeting TMDL pollutant load reduction benchmarks.

The monitoring elements in this plan meet or exceed those required in Schedule B, Table B-1 of the City's new stormwater NPDES permit.

A monitoring objectives matrix is included in Appendix A-2, providing a synopsis of how each monitoring program element will be used to address each of the six monitoring objectives. For each monitoring element included in Schedule B, Table B-1 of the City's permit, there is a corresponding section in this Monitoring Plan with a more detailed "Purpose" section relating the monitoring element to one or more of the six monitoring objectives. These purpose statements collectively serve as a template for the analysis that will be done as data are acquired and progress assessed toward meeting stated objectives.

In general, data collected under this monitoring plan will be reviewed and utilized, as applicable, during the annual adaptive management process (for example, through identification of data anomalies, and water quality standards exceedances) and the permit cycle (5-year) adaptive management process (for example, to assist with BMP assessment and/or evaluation, assess data collection strategies, and assist with evaluation of overall effectiveness of the stormwater management program). The structured, iterative adaptive management process is intended to elicit informed decisions when refining stormwater program elements and monitoring strategies to assure that the City continues to improve its stormwater management programs and reduce the discharge of pollutants to the maximum extent practicable.

It is important to note that some of the planned or ongoing monitoring elements are long-term activities that generally do not yield immediate interpretable results over the course of a monitoring year or even a single permit cycle. For example:

- Water quality trends for some streams cannot be established immediately; generally, samples collected over multiple years covering all seasons are necessary to establish trends and make meaningful statistical comparisons.

- The use of storm-event sampling data in modeling to estimate MS4 pollutant loads is a complex undertaking in that numerous variables in the watershed can influence stormwater runoff quality including land use activities, topography, soils and vegetation, magnitude and duration of the storm events, seasonal influences, etc. Therefore, multiple storm sampling events are usually necessary, and even at that, the results may be at best a broad characterization of pollutant quantity.

- The measurable effects of shade on stream temperature, dissolved oxygen, and overall stream health following vegetation planting within a riparian area will likely not be known for many years after planting because maturity of riparian habitat generally takes many years after restoration.

2 Monitoring Program Organization

Monitoring elements described in this plan will be managed by City of Eugene staff in the Public Works Department. Program managers in the Engineering, Maintenance, Parks & Open Space, and Wastewater Divisions will be responsible for ensuring all plan elements are developed, implemented and managed as described.

The sections that follow describe each environmental monitoring element, a brief statement describing the intended purpose for the acquired information, and details of the monitoring effort, such as sampling location, frequency, analysis type and methods, and other criteria.

3 Instream Monitoring

Streams that receive MS4 stormwater runoff generated by the permittee will be sampled and analyzed for water quality. Instream sampling will be conducted under direction of the Sampling Team Supervisor in the Wastewater Division.

3.1 Purpose and Study Design

Instream sampling and analysis is designed to enable water quality assessments coincident with geographic areas within the permitted boundary and as delineated by MS4 systems within these areas. In addition, monitoring will be used to:

3.1.1 Assess 303(d) listed pollutants in streams and MS4 stormwater contributions from the permittee.

3.1.2 Serve as an indicator of the overall effectiveness of applied BMPs.

3.1.3 Support assessment of stormwater pollutant contributions based on catchment characteristics.

3.1.4 Build upon existing data or establish new data to assess water quality characteristics and trends; when applicable and available other monitoring data and/or sampling efforts will be used to support this task, including sources such as other Oregon communities, the Oregon DEQ and U.S. Geological Survey.

3.1.5 Assess chemical and physical effects of MS4 runoff on receiving waters.

3.1.6 Assess progress toward meeting applicable TMDL pollutant load reduction benchmarks.

3.1.7 Assess the effectiveness of a new Water Quality Waterways ordinance establishing water quality setbacks for specific headwaters and other waterways.

3.2 Locations

Stream monitoring locations will consist of those previously sampled with established historical trends in the Amazon Basin and Willamette River, and new stations to meet monitoring program interests or concerns. The following basins or streams that receive MS4 stormwater runoff from the City of Eugene will be sampled:

3.2.1 Amazon Basin

3.2.1.1 Six (6) sites on streams within the Amazon Basin including:

- Amazon Creek at 29th Avenue
- Amazon Creek at Railroad Crossing
- Amazon Creek at Royal Avenue
- Amazon Diversion Channel at Royal Avenue
- A3 Channel at Terry Street
- Willow Creek north of 18th Avenue

3.2.1.2 Two (2) sites will be selected on a rotational basis between the A3 Channel and Amazon Creek for organics as listed in Table 1. Rotation will be done annually such that sampling at both sites reflects seasonal influences.

3.2.2 Willamette River

3.2.2.1 Five (5) sites on the Willamette River including:

- Upstream of Urban Growth Boundary (River Mile 186.9)
- At Knickerbocker Bridge (River Mile 183.9)
- At Owosso Bridge (River Mile 178.6)
- Downstream of Randy Papè Beltline Bridge (River Mile 176.8)

- Delta Ponds Near Randy Papè Beltline Bridge & Upstream of Willamette River Confluence

3.2.2.2 Two (2) sites will be selected on the Willamette River for organics as listed in Table 1. The monitoring location may vary to enable source evaluation with respect to MS4 outfalls.

3.2.3 Urban stream: Spring Creek is an urban stream flowing to the Willamette River. Samples will be collected near East Beacon Drive for a limited time in order to develop water quality profiles for small urban streams for which no current data are available. Other urban streams may be substituted for this site at any time during the monitoring period to fulfill monitoring objectives. This monitoring plan will be updated at the end of the reporting year to reflect any monitoring site location changes.

3.2.4 Coordinated monitoring may be done to meet any of the stormwater quality monitoring requirements in Table 1 subject to an agreement established prior to conducting such activities.

3.3 Frequency

Sampling events will be scheduled every other month for a total of six (6) events per year. The following sampling schedule criteria also apply:

3.3.1 Wet Season Sampling: Three (3) sampling events will be done during wet season months from November through April; and

3.3.2 Dry Season Sampling: Three (3) sampling events will be done during dry season months from May through October.

3.3.3 In the event sampling must be rescheduled due to safety or logistical reasons, a minimum of fourteen (14) days must separate sampling events while also meeting criteria 3.3.1 and 3.3.2 above.

3.4 Sample Type and Sequence

Grab sampling methods will be used to collect instream samples. This type of sample refers to an individual sample collected at a particular time and place, and represents conditions at the time it was collected. In general, sampling on a single waterway is done such that the sequence is from downstream to upstream sites to maintain location independence of the water samples.

3.5 Analytes

Stream samples will be analyzed for water quality parameters listed in Table 1. The table is a modified version of Table B-1 in Schedule B of the permit in that it lists only those parameters associated with instream monitoring (the remainder of the monitoring requirements for other elements is specified in subsequent sections).

Select monitoring sites will be sampled for those organic pollutants for which the water body is listed as being water quality limited as shown in Table 1 and as site-qualified for organics in Sections 3.2.1.2 and 3.2.2.2 above.

Laboratory analysis will be done by the Eugene/Springfield Environmental Services Laboratory under direction of the Laboratory Supervisor in the Wastewater Division. The services of an accredited laboratory will be used for the analysis of organic compounds listed in Table 1.

3.5.1 Analytes listed in Table 1 meet the monitoring requirements specified in the City's

permit, and will be used to achieve the six objectives described in Section 1. A list of analytes, methodologies, and reporting limits are included in Tables 5.1 and 14.1 in Appendix B.

3.5.2 Recently the U.S. EPA proposed modified filtration requirements for the analysis of Ortho Phosphorous in water samples, specifying that samples be filtered immediately upon collection in the field to prevent hydrolysis of particulate phosphorous to ortho phosphorous in slightly acidic samples; however, these requirements pose several logistical issues and may confound interpretation of observed historical trends.

No significant benefits are realized from the new filtration requirements to achieve a precise ortho phosphorus concentration since there is no potential to underestimate the quantity of this nutrient in the receiving waterbody, nor will the results likely change the City's adaptive management strategies or development and application of BMPs to address this pollutant. Continuation of the previous sampling and analysis protocol will not measurably detract from the integrity of data used to meet the objectives of instream water quality monitoring for ortho phosphorus.

The City will continue to utilize EPA's previous sampling and analysis protocol for instream samples to provide continuity of observed statistically significant concentration trends; specifically, instream samples will be filtered in the laboratory immediately upon receipt and within six hours of sample collection.

3.5.3 Reported Non-Detects: Any analyte whose value is reported as Not Detected (i.e., less than the method reporting limit) greater than 90% of the time after 18 in-stream monitoring events at a specific location may be eliminated from routine sampling.

Table 1.
Instream Water Quality Monitoring Parameters

Field Parameters	**Metals, Total and Dissolved**	**Organics**
pH	Arsenic[2]	***Willamette River***
Temperature[1]	Cadmium	Dioxin (2,3,7,8-TCDD)[1]
Dissolved Oxygen[1,2]	Chromium	
	Copper[2]	***A3 Channel***
Conventional Parameters	Lead[2]	Dichloroethylenes[2]
Biochemical Oxygen Demand	Mercury[2]	Tetrachloroethylene[2]
Chemical Oxygen Demand	Molybdenum	
Calcium (Total)	Nickel	***Amazon Creek***
Magnesium (Total)	Selenium	Dichloroethylenes[2]
Hardness (Calculated)	Silver	Trichloroethylene[2]
Specific Conductance	Zinc	Tetrachloroethylene[2]
Total Dissolved Solids		
Total Suspended Solids	**Nutrients**	
Turbidity[1]	Ammonia – as Nitrogen	
Escherichia coli[1]	Nitrate+Nitrite – as Nitrogen	
Fecal Coliform[1]	Total Kjeldahl Nitrogen	
	Ortho Phosphorus	
	Total Phosphorus	

Table 1 Notes:

[1] Annotated analytes indicates TMDL applies to one or more water bodies included in the monitoring program.

[2] Annotated analytes indicates 2004/2006 303(d) listing for one or more water bodies included in the monitoring program.

4 Stormwater Storm-Event Monitoring using Focused Basin Approach

Stormwater runoff at select sites will be sampled and analyzed during select storm events for water quality. Storm-event sampling will be done under direction of the Sampling Team Supervisor in the Wastewater Division.

4.1 Purpose and Study Design

Stormwater event sample collection and analysis is designed to enable stormwater quality assessments coincident with geographic areas within the permitted boundary and as delineated by MS4 systems within these areas. In addition, monitoring will be used to:

4.1.1 Assess 303(d) listed pollutants in stormwater runoff.

4.1.2 Assist with pollutant source evaluations.

4.1.3 Characterize overall effectiveness of applied BMPs.

4.1.4 Characterize stormwater quality; when applicable and available other monitoring data and/or sampling efforts will be used to support this task, including data sources such as other communities nationwide.

4.1.5 Support assessment of in-stream water quality characteristics and trends.

4.1.6 Support evaluation of MS4 discharge chemical and biological effects on receiving waters.

4.1.7 Enhance pollutant load models to assess progress towards meeting TMDL pollutant load reduction benchmarks as applicable.

4.2 Locations

Specific locations within the MS4 will be monitored to characterize water quality from defined catchment areas.

4.2.1 A minimum of two (2) MS4 locations will be sampled per storm event; sampling locations may be rotated among multiple locations within the MS4 to support stormwater pollutant source evaluations.

4.2.2 MS4 to Willamette River, Amazon Creek and A3 Channel: Two (2) MS4 locations will be sampled per storm event; sampling locations will be rotated between these three waterbodies to support organic pollutant source evaluations.

4.2.2.1 The locations listed below with the respective receiving water body and land use type, will be sampled for a limited time to in order to develop water quality profiles for stormwater entering the respective receiving waterbody. Other locations may be substituted for these sites at any time during the monitoring period to fulfill monitoring objectives. This monitoring plan will be updated at the end of the reporting year to reflect any monitoring site location changes.

- West 5th Avenue at Seneca Road; MH 63693 – A3 Channel; Industrial
- West 18th Avenue at Chambers; MH 55404 – Amazon Creek; Commercial
- Willow Creek at West 18th Avenue; MH 71037 – Amazon Creek; Rural/Undeveloped
- Copping Street; MH 77793 – Willamette River; Residential

4.2.3 Under some circumstances co-location of a specific storm event may occur to satisfy requirements for multiple monitoring types described in Table B-1 of Schedule B in the City's NPDES Permit. For example, a storm event conducted to meet the pollutant monitoring requirements for the Focused Basin monitoring type may also include collection of additional sample to satisfy the pesticide, organics, or bacteria monitoring type requirements. The factors affecting this sampling scenario are listed in Section 4.2.4.

4.2.4 Factors that will be considered when selecting monitoring locations will generally include the following as applicable:

- MS4 outfall location and system characteristics;
- receiving water body characteristics and whether 303(d) listing(s) or TMDL(s) apply;
- representative current and/or historical land use type(s);
- pollutant(s) of concern based on knowledge of MS4 basin characteristics;
- potential for illicit discharges;
- permeability of surface areas; and
- surface/soil type, infiltration capacity, slope, and stability within the catchment area.

4.2.5 Coordinated monitoring may be done to meet any of the stormwater quality monitoring requirements in Table 2 subject to an established agreement prior to conducting such activities.

4.3 Frequency

The frequency of storm-event sampling will be as follows:

4.3.1 At least three (3) storm events will be sampled per year for locations described in Sections 4.2.1 and 4.2.2.

4.3.2 At least three (3) storm events will be sampled per permit term for pesticides listed in Table 2 below.

4.3.3 Storm event sampling for Total and Dissolved Mercury and Total and Dissolved Methyl Mercury will be sampled as follows:

4.3.3.1 Wet Season Sampling: At least one (1) sampling event per year for two (2) years will be done during wet season months from November through April; and

4.3.3.2 Dry Season Sampling: At least one (1) sampling event per year for two (2) years will be done during dry season months from May through October.

4.3.3.3 After two (2) years of monitoring (minimum of four (4) total samples), storm event sampling for Total and Dissolved Mercury and Total and Dissolved Methyl Mercury can be eliminated upon written approval by the DEQ.

4.4 Storm Event Criteria

Storm event sampling is a difficult task requiring meticulous planning and cooperative weather that often does not materialize as predicted. The following storm event criteria apply to MS4 storm event monitoring:

4.4.1 Qualified Storm Event: Precipitation for a qualified storm event must be greater than or equal to one-tenth (≥0.1) inch.

4.4.2 Antecedent Dry Period: The antecedent dry period must be at least twenty-four (24) hours before a storm event sample can be collected. Antecedent dry period is defined as receiving less than one-tenth (<0.1) inch of precipitation for the 24-hour period before a sample can be collected.

4.4.3 Intra-Event Dry Period: The intra-event dry period must not exceed six (6) hours, unless a 24-hour flow-weighted composite sample collection method is employed. Intra-event dry period is defined as the period of time during which stormwater flow ceases during a sampling event. Stormwater flow may not cease for a period greater than 6 hours for the sampling event to be valid.

4.5 Sample Type

Storm event samples will consist of the sample types listed below. The sample type selected is dependent on the types of analytes required and the sampling objective. Peak flow estimates will be calculated for the sampled basin and models such as the Rational Method or other techniques will be considered for this purpose. This information, along with other basin characteristics, will be considered in selecting sampling periods during a storm event.

4.5.1 Grab samples: Grab sample can be collected at any time stormwater runoff occurs for a storm event. To minimize potential bias in the results the time at which sampling is done during a storm event will be varied among sampling events.

4.5.2 Flow-weighted composite samples: These sample types are collected for the entire duration of the storm event or for a time period based on the estimated peak flow for the MS4 drainage basin. .

4.5.3 24-Hour flow-weighted composite samples: These samples (as noted in exception for intra-event dry period in Section 4.4.3), will be collected utilizing automated samplers programmed to initiate and complete a sampling event over a 24-hour period.

4.6 Analytes

MS4 stormwater runoff samples will be analyzed for water quality parameters listed in Table 2 following the schedules described under Sections 4.2 and 4.3 for location and frequency. The table is a modified version of Table B-1 in Schedule B of the permit in that it lists only those parameters associated with storm event monitoring (the remainder of the monitoring requirements for other elements is specified in previous or subsequent sections).

Laboratory analysis will be done by the Eugene/Springfield Environmental Services Laboratory under direction of the Laboratory Supervisor in the Wastewater Division. The services of an accredited laboratory will be used for the analysis of methyl mercury and organic compounds listed in Table 2.

4.6.1 Analytes listed in Table 2 meet the monitoring requirements specified in the City's permit, and will be used to achieve the six objectives described in Section 1. A list of analytes, methodologies, and reporting limits are included in Tables 5.1 and 14.1 in Appendix B.

4.6.2 Table B-1 in Schedule B of the permit requires sampling and analysis for three pesticides that the City identified as potential contaminants of concern because of their widespread use and effects on aquatic organisms. However, to better target pesticide use within the permit area the City will utilize a screening technique for multiple pesticide residues. A list of pesticides included in the multiple residues analysis, methodologies, and reporting limits are specified in Appendix C.

4.6.3 Recently the U.S. EPA proposed modified filtration requirements for the analysis of Ortho Phosphorous in water samples, specifying that samples be filtered immediately upon collection in the field to prevent hydrolysis of particulate phosphorous to ortho phosphorous in slightly acidic samples; however, these requirements pose several logistical issues and may confound interpretation of observed historical trends.

No significant benefits are realized from the new filtration requirements to achieve a precise ortho phosphorus concentration since there is no potential to underestimate the quantity of this nutrient in stormwater samples, nor will the results likely change the City's adaptive management strategies or development and application of BMPs to address this pollutant. Continuation of the previous sampling and analysis protocol will not measurably detract from the integrity of data used to meet the objectives of stormwater quality monitoring for ortho phosphorus.

The City will continue to utilize EPA's previous sampling and analysis protocol for instream samples to provide continuity of observed statistically significant concentration trends; specifically, stormwater samples will be filtered in the laboratory immediately upon receipt and within six hours of sample collection.

4.6.4 Reported Non-Detects: Any analyte whose value is reported as Not Detected (i.e., less than the method reporting limit) greater than 90% of the time after nine (9) stormwater monitoring events may be eliminated from routine sampling.

Table 2.
Stormwater Runoff Water Quality Monitoring Parameters

Field Parameters	**Metals, Total and Dissolved**	**Organics**
pH	Arsenic[2]	***MS4 to Willamette River***
Temperature	Cadmium	Dioxin (2,3,7,8-TCDD)[1]
Dissolved Oxygen[1,2]	Chromium	
Flow Rate[3]	Copper[2]	***MS4 to A3 Channel***
	Lead[2]	Dichloroethylenes[2]
Conventional Parameters	Mercury[2]	Tetrachloroethylene2
Biochemical Oxygen Demand	Methyl Mercury	
Chemical Oxygen Demand	Molybdenum	***MS4 to Amazon Creek***
Calcium (Total)	Nickel	Dichloroethylenes[2]
Magnesium (Total)	Selenium	Trichloroethylene[2]
Hardness (Calculated)	Silver	Tetrachloroethylene[2]
Specific Conductance	Zinc	
Total Dissolved Solids		**Pesticides**
Total Suspended Solids	**Nutrients**	2,4-D
Turbidity[1]	Nitrate+Nitrite – as Nitrogen	Chlorpyrifos
Escherichia coli[1]	Total Kjeldahl Nitrogen	Diazinon
Fecal Coliform[1]	Ortho Phosphorus	
Silica Gel Treated Hexane Extractable Material (Oil & Grease)	Total Phosphorus	

Table 2 Notes:

[1] Annotated analytes indicates TMDL applies to one or more water bodies receiving MS4 stormwater runoff included in the monitoring program.

[2] Annotated analytes indicates 2004/2006 303(d) listing for one or more water bodies receiving MS4 stormwater runoff included in the monitoring program.

[3] Cumulative precipitation from the beginning of the storm event and for the duration of the sampling event may substitute for flow rate.

5 Stormwater Monitoring for Bacteria

Stormwater samples will be collected during storm events and analyzed for bacteria. This monitoring supports the Bacteria Pilot Study, BMP P2; Parks and Open Space will provide general coordination of BMP P2. Bacteria sampling will be done under direction of the Sampling Team Supervisor in the Wastewater Division.

5.1 Purpose

The collection of stormwater runoff for the analysis of bacteria will be used to:

5.1.1 Continue efforts underway to characterize stormwater bacteria contributions from the MS4 to receiving streams; when applicable and available other monitoring data and/or sampling efforts will be used to support this task, including communities nationwide.

5.1.2 Evaluate pre- and post- Bacteria Pilot Study BMP implementation data and effectiveness of BMPs applied to MS4 catch basins that discharge to Amazon Basin streams.

5.1.3 Assess bacteria contributions based on stormwater catchment characteristics.

5.1.4 Assess site-specific stormwater bacteria data from the MS4 for effects on bacteria trends observed in Amazon Basin streams.

5.1.5 Evaluate the effects of stormwater bacteria from the MS4 on receiving streams.

5.1.6 Evaluate stormwater bacteria data for potential to enhance pollutant load models and progress toward meeting TMDL pollutant load reduction benchmarks.

5.2 Locations

Specific discharge points within the MS4 system will be monitored to characterize bacteria contributions from defined catchment areas.

5.2.1 A minimum of two (2) MS4 locations will be sampled per storm event; sampling locations may be rotated among multiple locations within the MS4 to support bacteria source evaluations.

5.2.2 Select locations in MS4 receiving waterbodies may be sampled in conjunction with sampling done under Section 5.2.1 to assist with enhancement of pollutant load models and progress toward meeting TMDL pollutant load reduction benchmarks.

5.2.3 Select locations in the MS4 may be sampled for sediment to enhance knowledge of MS4 basin characteristics and bacteria source evaluations.

5.2.4 Factors that will be considered when selecting monitoring locations will generally include the following:

- MS4 outfall location and system characteristics;
- receiving waterbody characteristics and whether a 303(d) listing or TMDL(s) applies;
- representative current and/or historical land use type(s);
- knowledge of MS4 basin characteristics;
- potential for illicit discharges;
- permeability of surface areas; and
- surface/soil type, infiltration capacity, slope, and stability.

5.3 Frequency

The frequency of storm-event sampling will be as follows:

5.3.1 At least three (3) storm events will be sampled per year before BMP implementation.

5.3.2 At least three (3) storm events will be sampled per year after BMP implementation.

5.3.3 The sampling frequency of MS4 receiving waterbodies and sediment in the MS4 (Sections 5.2.2 and 5.2.3 respectively) will be defined on a case-by-case basis and will consider those factors described in Section 5.2.4.

5.4 Storm Event Criteria

The storm event criteria described in Section 4.4 as applied to general storm event monitoring are applicable to stormwater monitoring for MS4 stormwater bacteria grab samples described in Section 5.5.1.

5.5 Sample Type

Grab sampling methods will be used to collect samples for bacteria analysis.

5.5.1 MS4 stormwater grab samples can be collected at any time stormwater runoff occurs during the storm event. To minimize potential bias in the results the time at which sampling is done during a storm event will be varied among sampling events.

5.5.2 When collected, MS4 receiving waterbody samples will consist of grab samples and may be collected in conjunction with MS4 storm event samples.

5.5.3 When collected, MS4 sediment samples will consist of grab samples and may not necessarily coincide with a specific storm event or MS4 stormwater sampling activity described in Sections 5.5.1 and 5.5.2.

5.6 Analytes

5.6.1 MS4 stormwater runoff samples will be analyzed for water quality parameters listed Table 3. A list of analytes, methodologies, and reporting limits are included in Tables 5.1 and 14.1 in Appendix B.

Table 3 is a modified version of Table B-1 in Schedule B of the permit in that it lists only those parameters associated with bacteria monitoring (the remainder of the monitoring requirements for other elements is specified in previous or subsequent sections).

Laboratory analysis will be done by the Eugene/Springfield Environmental Services Laboratory under direction of the Laboratory Supervisor in the Wastewater Division.

5.6.2 When collected, MS4 receiving waterbody samples will be analyzed for water quality parameters listed in Table 3.

Table 3. Stormwater Monitoring for Bacteria	
Field Parameters	**Bacteria Parameters**
pH	Fecal Coliform[1]
Temperature	*Escherichia coli* [1]
Dissolved Oxygen[1,2]	

Table 3 Notes:

[1] Annotated analytes indicates TMDL applies to one or more water bodies receiving MS4 stormwater runoff included in the monitoring program.

[2] Annotated analytes indicates 2004/2006 303(d) listing for one or more water bodies receiving MS4 stormwater runoff included in the monitoring program.

5.6.3 When collected, sediment samples will be analyzed for bacteria parameters listed in Table 3. Analytical methods for bacteria in water samples will follow those specified in 40 CFR 136; modification of these methods will be necessary to address matrix differences when analyzing sediment samples for bacteria.

5.6.4 Technological advances in bacteria genotyping have progressed significantly such that it has potential to become a cost-effective tool in characterizing bacteria source contributions. A pilot study using this technology may be considered during the permit term should an opportunity occur for its application.

5.7 Field Condition Assessments

Field condition assessments are field surveys of the bacteria study areas to document basin conditions such as amount, type and location of wildlife and domestic pets; human behaviors; location and number of wildlife and domestic animal waste; conditions within commercial loading areas, recycling areas and garbage dumpster areas, etc. A check-sheet has been developed and will be used to standardize observations; digital field photos will supplement documentation.

5.7.1 Discrete areas within the City's MS4 will be selected for field condition assessments.

5.7.2 Field condition assessment efforts have focused on areas within the Polk Street sub-basin, including the areas listed below. Assessments will continue at these sites until project objectives are complete.

- Westmoreland Park sub-areas;
- Chambers Street and 18th Avenue commercial sub-areas;
- Amazon Creek between Chambers and Jefferson Streets;
- Area bound by Amazon Creek to 20th Avenue and Friendly to Madison Streets;
- Area bound by Ingalls Way, Tiara and Adams Streets; and
- Other areas as needed to meet study objectives.

5.7.3 Other areas for field condition assessment may be identified as beneficial to the objectives of the bacteria pilot study and may be added to the list of assessment areas or replace one or more areas listed in Section 5.7.2 as needed.

5.7.4 Each year a goal of six (6) field condition assessments is planned, generally occurring every other month, with the objective of allowing sufficient time between assessments for measureable field condition change to occur.

5.7.5 Field condition assessments will be scheduled during dry weather periods throughout the year with the objective of capturing activities that may contribute to excessive bacteria loads within the study area. Field condition assessments may not necessarily immediately precede a storm-event.

6 Macroinvertebrate Monitoring

Macroinvertebrate monitoring will be done in the Amazon Creek and Willamette River basins to characterize current macroinvertebrate community conditions compared to reference sites, assess the effects of stormwater runoff on receiving waters, and to assess opportunities for and effects of future riparian restoration projects.

6.1 Purpose

Site-specific macroinvertebrate monitoring will be used to:

6.1.1 Support characterization of stream health and overall effects of stormwater pollutants.

6.1.2 Support efforts to identify opportunities for and characterize overall effectiveness of applied BMPs and stream enhancement/restoration projects.

6.1.3 Characterize overall stormwater quality; when applicable and available other monitoring data and/or sampling efforts will be used to support this task.

6.1.4 Support instream trend evaluation; evaluate metrics for trend analysis as applicable.

6.1.5 Assess the biological effects of MS4 runoff on receiving water.

6.1.6 Assess the effectiveness of a new Water Quality Waterways ordinance establishing water quality setbacks for specific headwaters and other waterways.

6.2 Locations

Macroinvertebrate monitoring locations will consist of Amazon Basin sites with established historical trends and new stations on the Willamette River and its tributaries. The following basins or streams that receive MS4 stormwater runoff from the City of Eugene will be sampled:

6.2.1 Amazon Basin: Five (5) sites on streams within the Amazon Basin including:

- Amazon Creek at Kinney Park
- Amazon Creek near 31st Avenue
- Amazon Creek near Garfield Street
- A3 Channel near Terry Street
- Amazon Diversion Channel near Royal Avenue

6.2.2 Willamette River: Five (5) sites on the Willamette River will be selected. Locations will generally be in proximity to the monitoring site locations specified in Section 3.2.2.1.

6.2.3 Urban stream: Spring Creek is an urban stream flowing to the Willamette River. Other urban streams may be substituted for this site at any time during the monitoring

period in order to develop profiles of macroinvertebrates for small urban streams for which no current data are available. This monitoring plan will be updated at the end of the reporting year to reflect any monitoring site location changes

6.2.4 Reference Site: One (1) reference site will be selected to represent "undeveloped" conditions, either on Middle Fork Spencer Creek or Willow Creek south of 18th Avenue. Spencer Creek is currently used as the reference site for the Amazon drainage basin although it is not located within the basin. If a more suitable reference location within the Amazon drainage basin is identified, this will be used for reference purposes. Willow Creek is within the basin, however, it is an ephemeral stream and often does not have flow during the months when the macroinvertebrate survey would normally be done.

6.3 Frequency

Macroinvertebrate surveys will be scheduled once every three (3) years and will be done in the fall before seasonal rains begin.

6.4 Methodology

Macroinvertebrate surveys will be done using the following methodology:

6.4.1 Habitat Surveys: Modified Rapid Stream Assessment Protocols (RSAT).

6.4.2 Macroinvertebrate Collection: Oregon Department of Environmental Quality (DEQ) Benthic Macroinvertebrate Protocol for Wadeable Rivers and Streams.

6.4.3 Macroinvertebrate Taxonomic Analysis: PREDATOR (PREDictive Assessment Tool for Oregon) model. A set of community metrics are also calculated to support the PREDATOR analysis.

7 Physical Monitoring

Physical monitoring will be conducted at select locations to characterize the current physical condition of receiving waterbodies, assess the effects of stormwater runoff on receiving waters, and the effects of future restoration efforts.

Field condition assessments will be done by Parks & Open Space staff under direction of the Natural Areas Restoration Supervisor.

Historical photo documentation will be done under direction of the Sampling Team Supervisor in the Wastewater Division.

7.1 Purpose

Physical monitoring waterway assessment ranking protocol will be used to/as:

7.1.1 Support assessment of pollutant contributions and evaluate overall stream health;

7.1.2 Support efforts to identify opportunities for and characterize overall effectiveness of applied BMPs and stream enhancement/restoration projects;

7.1.3 Indicators of stormwater runoff discharges and overall effects of stormwater runoff;

7.1.4 Support long-term trends of overall stream health that are directly or indirectly associated with MS4 stormwater discharges;

7.1.5 Assess the physical effects of MS4 discharges on receiving waters; and

7.1.6 Support assessment of progress toward meeting TMDL pollutant load reduction benchmarks.

7.2 Locations

7.2.1 Select locations for physical monitoring will be from among those publicly managed streams and waterways identified in the City of Eugene's Open Waterway Maintenance Plans. These will generally coincide with macroinvertebrate monitoring locations within the Amazon basin.

7.2.2 Key aquatic and riparian characteristics of select waterways will be photo-documented to accompany the physical assessment.

7.2.3 Amazon Creek Historical Photomonitoring will be done at the following locations:

- West Amazon Drive 200' north of Martin Street;
- West Amazon Drive at intersection with Martin Street;
- West Amazon Drive north of Hillside Drive;
- South of East Amazon Drive and Nectar Way intersection;
- North of East Amazon Drive and Nectar Way intersection;
- East and West Amazon Drive at Larch Street;
- East and West Amazon Drive at 39th Avenue;
- West of Hilyard between 33rd and 32nd Avenues; and
- At 29th Avenue.

7.3 Frequency

The frequency of physical assessments will be as follows:

7.3.1 Physical assessments will be done every three (3) years in the form of updates to the City's Open Waterway Maintenance Plans for selected streams and waterways; photo-documentation will be done for key aquatic and riparian characteristics at selected sites.

7.3.2 Photomonitoring will be done annually at Amazon Creek Historical Photomonitoring sites listed in section 7.2.3.

7.4 Methodology

Physical monitoring will follow the methodology used in the Eugene-Springfield Metro Waterways Study, which was done to assess existing problems and opportunities related to area waterways, and to identify solutions to improve their function. The U.S. Army Corps of Engineers, in partnership with the cities of Eugene and Springfield, Eugene Water & Electric Board, and Lane County, with the Bureau of Land Management as a Cooperating Agency (2009), has been conducting this multi-year study in the Eugene-Springfield metropolitan area and surrounding rural lands. The first phase of the study has focused on the Amazon Creek watershed.

The methodology consists of condition assessment ranking protocol for classifying stream and channel segments in terms of their water quality, natural resource, conveyance functions, and maintenance considerations. This information will also be used to update the City's 2003 Open Waterway Maintenance Plans (a task in SWMP BMP P5: Public Stormwater System – Open Waterways).

Key aquatic and riparian characteristics of select waterways (see Section 7.2.2) will be digitally photographed and annotated with appropriate contextual information to assist development of a visual record to accompany the physical assessment.

Digital photographs will be taken at locations listed in Section 7.2.3. These images will build upon historical photo documentation of locations along Amazon Creek to develop a visual record of any changes occurring to the waterbody or riparian zone.

8 Structural BMP Monitoring

Select structural BMPs will be monitored to assess their effectiveness in mitigating identified stormwater quality issues. Functionality and effectiveness are a function of the type(s) of BMP structure(s) installed; metrics for assessing functionality and effectiveness will be developed during design and specification of the structural BMP.

Structural BMP monitoring will be coordinated through multiple work sections, including Engineering, Maintenance, and Wastewater; storm-event sampling will be done under direction of the Sampling Team Supervisor in the Wastewater Division.

8.1 Purpose and Study Design

Structural BMP monitoring is designed to enable water quality assessments associated with a specific structural BMP applied to a defined geographic area within the permitted boundary and as delineated by MS4 systems within this discrete area. Each structural BMP study will be designed to assess its unique functional properties. In addition, monitoring will be used to/as:

8.1.1 Evaluate BMP effectiveness in reducing stormwater pollutants.

8.1.2 Support assessment of stormwater pollutant contributions to 303(d)-listed waterbodies under site-specific circumstances.

8.1.3 Support efforts to identify opportunities for and characterize overall effectiveness of applied BMPs.

8.1.4 Characterize stormwater runoff quality based on site-specific catchment characteristics.

8.1.5 Evaluate potential effects on instream water quality trends.

8.1.6 Evaluate their chemical, biological, and physical effects on receiving waters.

8.1.7 Support assessment of progress toward meeting TMDL pollutant load reduction benchmarks.

8.2 Locations

Structural BMPs in the MS4 system will be monitored to characterize stormwater quality entering and exiting the structure. At least one (1) structural BMP will be sampled per storm event. Factors that will be considered when selecting structural BMP monitoring locations will generally include the following:

- Purpose, location, and characteristics of the structural BMP;
- Availability of reliable data on the effectiveness of the particular type of BMP;
- Pollutant(s) of concern based on knowledge of MS4 basin characteristics;
- Receiving water body characteristics and whether a 303(d) listing or TMDL applies;

- Representative current and/or historical land use type(s);
- Potential for illicit discharges;
- Types of comparisons to be made, i.e., inflow/outflow characteristics, qualitative and/or quantitative; and
- Precipitation event characteristics.

8.3 Frequency

At least three (3) storm events will be sampled per permit term to characterize functionality and effectiveness of the structural BMP.

8.4 Storm Event Criteria

The storm event criteria described in Section 4.4 as applied to general storm event monitoring are applicable to this stormwater BMP monitoring.

8.5 Sample Type

The type and application of structural BMP will dictate the type(s) of stormwater sample to be collected. In general, the sample types described in Section 4.5 would be applicable to this monitoring element.

8.6 Analytes

The type and application of structural BMP will dictate the types of water quality analyses to be performed. These will be defined at the time for each project identified

Laboratory analysis will be done by the Eugene/Springfield Environmental Services Laboratory under direction of the Laboratory Supervisor in the Wastewater Division.

Examples of factors that may be considered when selecting stormwater quality parameters include:

- The purpose of the structural BMP and the stormwater pollutant analytes it is designed to reduce;
- Types of comparisons to be made; e.g., BMP data compared to instream water quality data to determine if the permittee's MS4 discharge pollutant loads have potential to contribute to or cause instream water quality degradation;
- Whether there is reasonable potential for a specific MS4 pollutant to exceed the applicable pollutant load reduction benchmarks;
- Whether a specific pollutant in the MS4 causes or contributes to water quality degradation in 2004/2006 303(d)-listed streams;
- Whether there is a statistically significant concentration trend for a specific stormwater pollutant in the respective receiving stream;
- Knowledge gained from field screenings for illicit discharges; and
- Knowledge of catch basin characteristics.

9 Quality Assurance Plan, Standard Operating Procedures, and Methodology

The Eugene/Springfield Environmental Services Laboratory performs analytical services under a DEQ-approved Quality Assurance Plan (QAP). The QAP describes quality control procedures, including application of method blanks, laboratory control samples, matrix spikes, laboratory duplicates and duplicate matrix spikes, initial and continuing calibration verification standards, calibration and continuing calibration blanks and standards, and calibration standards. Sample handling procedures, quality control objectives, lists of analytical methods and reporting limits, data reduction, validation, and reporting, are also specified in the plan.

All stormwater samples will be analyzed following the protocol specified in the QAP to ensure the quality of laboratory results. Any pollutants that cannot be analyzed in house will be contracted to laboratories that likewise perform analytical services under a QAP that meets or exceeds the Division's laboratory standards.

All field sampling will be done following documented Standard Operating Procedures (SOPs) to ensure consistency, representativeness, and quality of results. Application of quality assurance/quality control (QA/QC) protocol for the collection of field samples will include chain-of-custody protocol, field instrument calibration techniques, the collection of field replicates or duplicates, field blanks, and trip blanks as appropriate. The Division Document Control System is used to control and maintain all of its documentation, including the documents referenced here, and are available upon request.

Analytical methodologies specified and referenced in 40CFR136 will apply, where appropriate, to the analysis of all instream and stormwater samples (noted exceptions are described in Sections 3.5.2 and 4.6.3 for Ortho Phosphorous).

Appendix B presents a copy of the QAP and associated reference tables; Appendix C contains SOPs applicable to this monitoring plan.

10 Data Management, Documentation and Record-Keeping

The Eugene/Springfield Water Pollution Control Facility maintains an Environmental Management System (EMS) for which it has earned certification under the International Organization for Standardization (ISO). Organizations that earn ISO certification under the 14001:2004(E) standard commit to develop an environmental policy, establish objectives and processes to achieve policy commitments, take action as needed to improve its performance and demonstrate the conformity of the system to the requirements of the ISO standard. ISO 14001 elements include establishing, implementing and maintaining procedures applicable to legal requirements, documentation and records determined to be necessary to ensure effective planning, operation and control of processes, control of records and documents, evaluation of legal compliance, defining roles, responsibilities and authority of staff, competence and training requirements, and management review. In addition, the E/S WPCF's EMS is audited by internal and external auditors on an annual basis to ensure conformance and compliance to the policies and objectives established by and applicable to the E/S WPCF.

As such, all sampling and analysis of stormwater and stream samples for this plan performed by staff at the E/S WPCF falls under the umbrella of the EMS program. Documents and records associated with stormwater monitoring elements are readily available through the E/S WPCF electronic document control system, including the QAP, associated tables and SOPs, and are available upon request. All laboratory and field measurements collected under this plan including QA/QC will be controlled through the E/S WPCF's Laboratory Information Management System (LIMS), which has strict data entry requirements and access restrictions.

11 Data Analysis

Multiple techniques are applicable to the analysis of stormwater data, including parametric and non-parametric statistical procedures, trend analysis, cluster techniques, etc. The techniques applied will largely depend on the characteristics of the data set and the types of comparisons desired. Commercial and non-commercial (e.g., IBM SPSS, USGS) software applications will be applied as needed. Application summaries and complete output information will accompany annual reports.

Data analysis will be performed by individuals within the City organization who have appropriate training and experience to assess laboratory and field data, or by consultants who are qualified to perform this task.

12 Revision History

Revision 1.0 16 November 2011

- Plan date updated from May 2011 to November 2011
- Clarified the purpose of the monitoring objectives matrix in Appendix A-2 and how this will be used to address each of the six monitoring objectives.
- Clarified the relationship between the environmental monitoring done under the plan and long-term monitoring strategies in terms of future stormwater program decision-making (p. 2, third paragraph).
- Updated list of monitored locations in Sections 3.2.3, 4.2.2.1, and 6.2.3.
- Updated SAMP-1805 to include reference to EPA Method 1669.
- Deleted Section 3.5.4 as this section was not applicable to instream water quality monitoring.
- Updated Tables 5.1 and 14.1 to reflect appropriate codes for low-level mercury.
- Refined the purposes of instream, stormwater, and BMP monitoring in Sections 3.1, 4.1, and 8.1 respectively.