FINAL

Quality Assurance Project Plan Municipal Separate Storm Sewer System Discharge Sampling

City of Coeur d'Alene, Idaho

NPDES Permit No. IDS-028215

Prepared for

City of Coeur d'Alene, Idaho

February 2010

Prepared by

CH2MHILL

Quality Assurance Project Plan

Municipal Separate Storm Sewer System Discharge Sampling

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NPDES Permit No. IDS-028215

Plan approvals:

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USEPA NPDES Compliance Unit	Idaho Department of Environmental Quality

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Distribution List

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[1] Information in parenthesis indicates the applicable QAPP element or group prescribed by Chapter 3 of USEPA (2001) to be addressed in a QAPP. This is also consistent with Uniform Federal Policy for Quality Assurance Plans.

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Acronyms and Abbreviations

CCC	Chronic Criteria
CLP	Contract Laboratory Program [USEPA]
DQO	data quality objective
HSP	Health and Safety Plan
IDEQ	Idaho Department of Environmental Quality
MS	matrix spike
MS4	municipal separate storm sewer system
NPDES	National Pollutant Discharge Elimination System
PCB	polychlorinated biphenyl
PM	project manager
QA	quality assurance
QAPP	Quality Assurance Project Plan
QA/QC	quality assurance/quality control
QC	quality control
RPD	Relative percent difference
RSD	Relative standard deviation
RTL	review team leader
SRM	standard reference material
USEPA	U.S. Environmental Protection Agency
USGS	U.S. Geological Survey

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SECTION 1

Introduction

This Quality Assurance Project Plan (QAPP) presents the policies, organizations, objectives, and functional activities/procedures for discharge sampling of the municipal separate storm sewer system (MS4) for the City of Coeur d'Alene, Idaho (City) identified in Section IV of National Pollutant Discharge Elimination System (NPDES) Permit Number IDS-028215. The QAPP and its supporting attachment (Attachment A, Data Quality Objectives) have been developed to document the type, quantity, and quality of data needed for developing pollutant load estimates and making decisions regarding the effectiveness and adequacy of control measures implemented under the NPDES permit. This QAPP has sufficient detail to also serve as the work plan for the MS4 NPDES discharge monitoring program activities.

This QAPP follows Uniform Federal Policy for Quality Assurance Project Plans and USEPA guidelines contained in *USEPA Guidance for Quality Assurance Project Plans* (USEPA, 1998, 2002a), and *USEPA Requirements for Quality Assurance Project Plans* (USEPA, 2001). The development review, approval, and implementation of the QAPP is part of USEPA's mandatory Quality System, which requires all organizations to develop and operate management structures and processes to ensure that data used in decisions are of the type and quality needed for their intended use. The following sections of this document correlate with the subtitles found in the USEPA guidelines (USEPA, 2001) and are consistent with Uniform Federal Policy for Quality Assurance Project Plans.

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SECTION 2

Project Management

2.1 Project/Task Organization (A4)

The City of Coeur d'Alene MS4 NPDES discharge monitoring program will begin no later than June 2010 and will be conducted by the City of Coeur d'Alene. The activities included in the QAPP are managed by the City project manager (PM), Dennis Grant. The PM manages the financial, schedule, staffing, and technical aspects of the work.

Gordon Dobler is the review team leader (RTL) for the City. The RTL will review project planning documents, data evaluation, and deliverables. The primary responsibility for project quality rests with the PM, and independent quality control (QC) is provided by the RTL.

Analysis of water samples, with the exception of polychlorinated biphenyl (PCB) samples, will be performed at SVL Analytical in Kellogg, Idaho. Analysis of water samples for PCBs will be performed at Anatek Labs, Inc in Spokane, Washington. The analytical laboratories are responsible for assuring that the analyses performed meet the requirements of this QAPP, the laboratory standard operating procedures, and the laboratory-specific QAPP.

All samples will be sent from the City directly to SVL Analytical. SVL will be responsible for packaging and shipping the sample for PCB testing to Anatek Labs, as well as overseeing Anatek's quality assurance/quality control (QA/QC) procedures.

Contact information for SVL Analytical is:

Christine Meyer, Client Services Manager

SVL Analytical

One Government Gulch Road

P.O. Box 929

Kellogg, ID 83837-0929

208-784-1258

Contact information for Anatek Labs, Inc is:

Kathy Sattler

Anatek Labs, Inc

504 E Sprague Ste D

Spokane, WA 99202

509-838-3999

Where quality assurance problems or deficiencies requiring special action may be uncovered, the PM will identify the appropriate corrective action to be initiated by field data collection teams or the laboratory.

2.2 Problem Definition/Background (A5)

2.2.1 Purpose

This QAPP presents the policies, organizations, objectives, and functional activities/procedures for the City's MS4 NPDES discharge monitoring program. The QAPP was developed by CH2M HILL under contract to the City of Coeur d'Alene to document the type, quantity, and quality of data needed for environmental decisions and to describe the methods for collecting and assessing those data.

2.2.2 Problem Statement

The goal of the MS4 NPDES discharge monitoring program is to address the monitoring requirements identified in the NPDES permit. Section IV.A.6 of the permit requires the development and implementation of a QAPP for all monitoring required under Section IV of the permit. In Section IV of the permit, the following monitoring objectives are identified:

a) Estimate the pollutant load currently discharged from the MS4s;

b) Assess the effectiveness and adequacy of control measures implemented through the permit; and

c) Identify and prioritize those portions of the MS4 requiring additional controls.

Data collected by the MS4 NPDES discharge monitoring program will be used to address the monitoring objectives listed above.

The City's MS4 (Figure 2-1) services an area of approximately 1,600 acres within the Coeur d'Alene Urbanized Area. There are a total of 12 outfalls associated with the MS4, seven discharge to Lake Coeur d'Alene and five discharge to the Spokane River. Currently, there are no hydrologic or water quality data available for MS4 discharge.

2.3 Project Description (A6)

Under the NPDES permit, the City is required to collect water quality and discharge data from two of the MS4 outfalls, one to Lake Coeur d'Alene and one to the Spokane River.

Data collected as part of monitoring will be used to estimate pollutant loading from the City's MS4, assess the effectiveness and adequacy of control measures implemented as part of the permit, and to identify and prioritize those portions of the City's MS4 system that may require additional control measures beyond those identified in the NPDES permit to address MS4 water quality.

2.3.1 Description of Work Tasks

Activities to be performed as part of the City of Coeur d'Alene MS4 NPDES monitoring includes:

- Acquisition and installation of monitoring locations (new manholes) and water quality and discharge monitoring equipment.
- Collection of discharge and water quality data at two MS4 outfalls using the monitoring schedule and parameter list provided in the permit.
- Data evaluation, including estimating pollutant loading from the MS4 system and the impacts of control measures on water quality.

2.3.2 Project Schedule

Acquisition and installation of monitoring location equipment, structures, and associated infrastructure components are expected to occur in late 2009. Sample collection, data acquisition, and analysis activities are expected to begin upon USEPA and Idaho Department of Environmental Quality (IDEQ) review and approval of this QAPP.

2.4 Quality Objectives and Criteria (A7)

2.4.1 Project Quality Objectives

Project-specific data quality objectives (DQOs) were identified through the DQO process/planning tool (USEPA, 1994a, 2000b, and 2006) to meet the data user's needs for each activity. The specific data needs for the MS4 NPDES discharge monitoring focus on the collection of storm water discharge flow and water quality data to estimate pollutant loads and the adequacy and effectiveness of control measures implemented as part of the NPDES permit. Appendix A presents the DQO decision-making process findings for the MS4 NPDES discharge monitoring program.

The data needs as determined through the DQO process for the MS4 NPDES discharge monitoring program are presented in Table 2-1. This table lists the specific analytes; data uses, data users, and needed detection levels. The listed detection levels in Table 2-1 represent the same detection limits identified in the *QAPP for the Coeur d'Alene Lake Management Plan* (IDEQ and Coeur d'Alene Tribe, 2009) where common monitoring parameters are present. For those parameters that are required to be monitored as part of the permit, the needed detection limit corresponds with the lowest regulatory, risk, or technical criterion identified for the specific analyte.

The required levels shown in Table 2-1 were taken into consideration in selecting appropriate analytical methodology. The selected analytical methodology and associated laboratory and field analytical reporting limits are shown in Table 2-2 and described in Section 2.4.2. For PCBs, the reporting limit used is for waters designated for aquatic life uses. The regulatory limit for PCBs for waters designated for human health for the consumption of water and organisms is lower than that for aquatic life uses. The higher limit was used because no practicable methodology for lower detection is available.

2.4.2 Measurement Performance Criteria

The quality assurance (QA) objective of this plan is to identify procedures and criteria that will provide data of known and appropriate quality for the needs identified in Section 2.4.1. Data quality is assessed by representativeness, comparability, accuracy, precision, and completeness. These parameters, the applicable procedures, and level of effort are described below.

The applicable quality control (QC) procedures, quantitative target limits, and level of effort for assessing data quality are dictated by the intended use of the data as well as the nature of the analytical methods. Analytical parameters, analytical methods, applicable detection levels, analytical precision, accuracy, and completeness in alignment with needs identified in Section 2.4.1 and are presented in Table 2-2. Analytical methods and quality control procedures are further detailed in Section 3.

Following are definitions and levels of effort for the data assessment parameters:

Representativeness is a measure of how closely the results reflect the actual concentration or distribution of the chemical compounds in the matrix samples. Sampling plan design, sampling techniques, and sample-handling protocols (for example, for storage, preservation, and transportation) have been developed, and are discussed in subsequent sections of this document. The proposed documentation will establish that protocols have been followed and sample identification and integrity are ensured.

Comparability expresses the confidence with which one data set can be compared to another. Data comparability will be maintained using defined procedures and the use of consistent methods and consistent units.

Accuracy is an assessment of the closeness of the measured value to the true value. For samples, accuracy of chemical test results is assessed by spiking samples with known standards and establishing the average recovery. For a matrix spike, known amounts of a standard compound identical to the compounds being measured are added to the sample. A quantitative definition of average recovery accuracy is given in Section 5.3. Accuracy measurement will be carried out with a minimum frequency of 1 in 20 samples analyzed or once per sampling event.

Precision of the data is a measure of the data spread, when more than one measurement has been taken on the same sample. Precision can be expressed as the relative percent difference; a quantitative definition is given in Section 5.3. The level of effort for precision measurements will be a minimum of 1 in 20 samples or once per sampling event.

Completeness is a measure of the amount of valid data obtained from the analytical measurement system and the complete implementation of defined field procedures. The quantitative definition of completeness is given in Section 5.3. The target completeness objective will be 95 percent; the actual completeness may vary depending on the intrinsic nature of the samples. The completeness of the data will be assessed during QC reviews.

2.5 Special Training/Certification (A8)

All project staff working on the site will follow the health and safety policies set forth by the City. The City's health and safety policies describe the specialized training required for personnel on this project. Documentation and tracking of this training will be the responsibility of the PM.

2.6 Documents and Records (A9)

Field activities, discharge monitoring, sampling results, and data analysis and evaluation will be documented as required in Section IV.B. This information will also be summarized in the Storm Water Discharge Monitoring Report and subsequent annual reports as identified in Section IV.C of the permit.

Laboratory documentation will be provided in accordance with methods and QA protocols listed in Sections 3.4 and 3.5 of this QAPP. Laboratory data will be recorded in USEPA Contract Laboratory Program (CLP) or similar format, including sample identification, analysis data, parameter values, and detection limits.

Analytical data from the laboratory and field collected measurements will be managed and retained in hard copy and electronically by the PM as required in Section IV.B of the permit.

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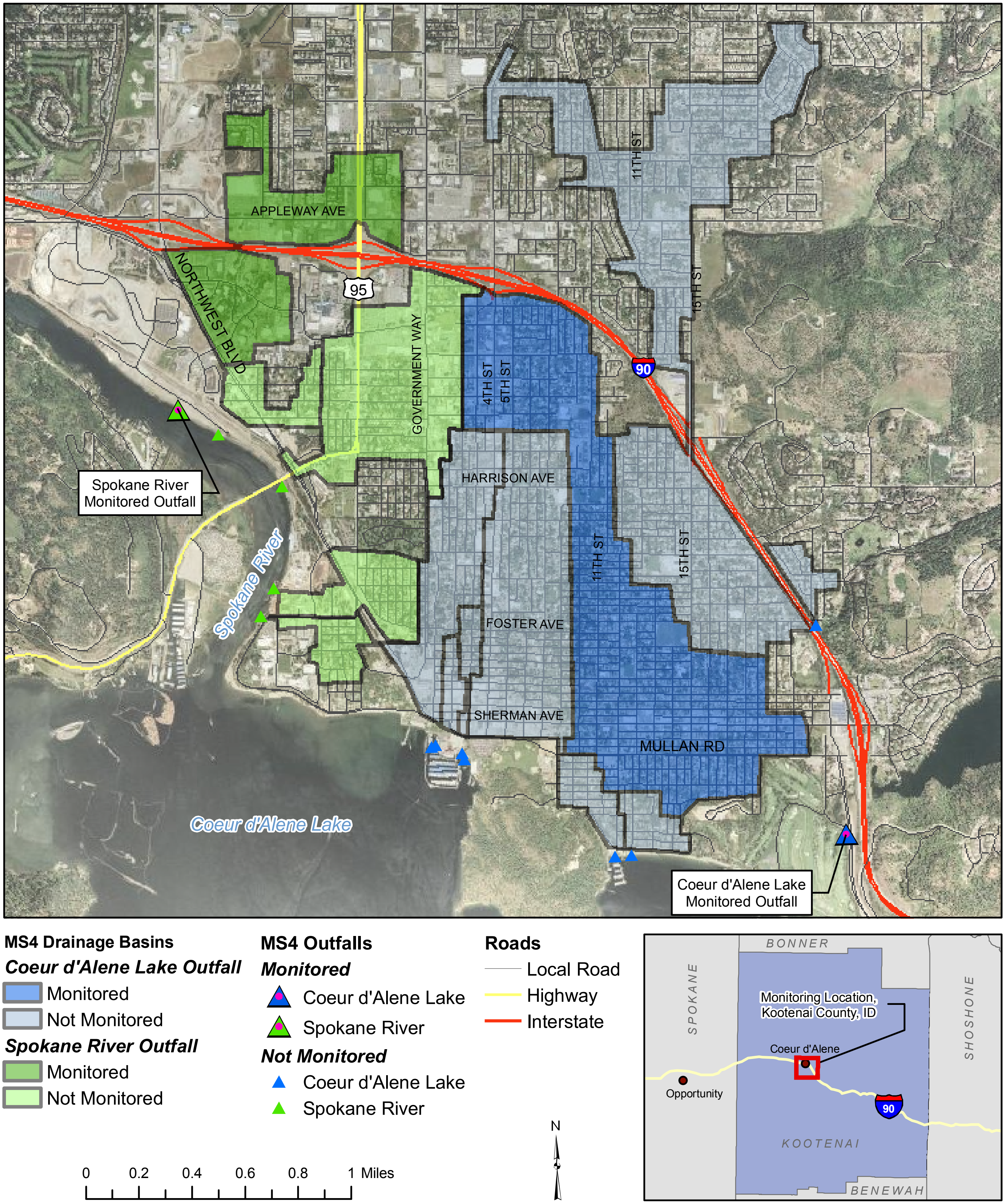

FIGURE 2-1
MS4 Drainage Basins and Outfalls
NPDES MS4 Permit Monitoring Requirements
City of Coeur d'Alene, Idaho

Data Sources: Aerial Image, 2006, Inside Idaho GIS Server, Northern Idaho 1 meter resolution

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TABLE 2-1
Data Needs and Uses for MS4 Sampling
QAPP for the City of Coeur d'Alene, ID

Analyte	Units	Criterion Continuous Concentration for Aquatic Life (chronic criteria)	Criterion Maximum Concentration for Aquatic Life (acute criteria)	Data Use	Data User
Flow	cfs	N/A	N/A	Develop estimated pollutant loading currently discharged from the MS4s and to determine the effectiveness and adequacy of control measures implemented through the permit.	Regulators, Hydrologists, Biologists, Engineers
Temperature	deg. C	22C	Max. daily avg. of no greater than 19C		
Total suspended solids	mg/L	Narrative crieria	IDAPA 58.01.02.200.05		
Total phosphorous [1]	mg/L	Narrative crieria	IDAPA 58.01.02.200.06		
Total Nitrogen [1]	mg/L	Narrative crieria	IDAPA 58.01.02.200.06		
Total lead	µg/L	0.7 µg/L [2]	17 µg/L [2]		
Total zinc	µg/L	42 µg/L [2]	42 µg/L [2]		
Hardness	mg/L	0.30 mg/L	0.30 mg/L		
Total Polychlorinated Biphenyls (PCB)	µg/L	0.014 µg/L [3]	N/A		

Notes:
[1] Other criteria may also apply to these pollutants.

[2] Calculated using a hardness of 30 mg/L.

[3] Both the Spokane River and Coeur d'Alene Lake have designated uses that include drinking water. The PCB human health criteria for consumption of water and organisms is 0.000064 µg/L.

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TABLE 2-2
Analytical Methods for MS4 Sampling
QAPP for the City of Coeur d'Alene, ID

Analyte	Analytical Method	Target Reporting Limit	Precision & Accuracy/ Completeness
Flow	N/A	N/A	N/A
Temperature	SM 2550B	N/A	N/A
Total suspended solids	SM 2540D	N/A	
Total phosphorous [1]	EPA 365.3 / SM 4500-P-E	2 µg/L	
Total Nitrogen [1]	SM D-5176	50 µg/L	
Total lead [1]	EPA 200.8	0.13 µg/L	+/- 25% 95%
Total zinc [1]	EPA 200.7	5.0 µg/L	
Hardness [1]	SM 2340B	0.30 mg/L	
Total Polychlorinated Biphenyls (PCB)	EPA 608	0.014 µg/L [2]	

Notes:

[1] Analytical methods are from the Quality Assurance Project Plan, Addendum 2009 for Coeur d'Alene Lake, ID.

[2] The numeric criterion listed for PCB is the Aquatic Life Chronic Critera (CCC).

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SECTION 3
Data Generation and Acquisition (EPA Group B)

3.1 Sampling Design (Experimental Design) (B1)

The sampling design for the MS4 NPDES discharge monitoring program is dictated by the requirements of the permit. Therefore, sampling locations, frequencies, and parameters/analytes are consistent with the requirements of the permit.

3.1.1 Monitoring Locations

The locations of the MS4 outfalls and their associated service areas within the Coeur d'Alene Urbanized Area are shown on Figure 2-1. A total of 12 outfalls are associated with the City's MS4, seven discharge to Lake Coeur d'Alene and five discharge to the Spokane River. The service areas associated with the outfalls are variable.

Section IV.A.5.a of the permit requires that two outfalls that represent the largest or highest discharges from the MS4 system to the Spokane River and Lake Coeur d'Alene be monitored as part of the MS4 NPDES discharge monitoring program. Currently, no hydrologic data regarding the volumes or flows of discharge from the MS4 outfalls is available. Therefore, the outfall locations and service areas were used to select the two MS4 NPDES discharge monitoring outfall locations shown in Figure 2-1 and described below:

Lake Coeur d'Alene Outfall – This storm sewer drainage basin is located in the southeast portion of the City and is bordered by Coeur d'Alene Lake to the south and Interstate 90 (I-90) to the northeast. The basin is approximately 554 acres. This outfall is located near the intersection of S. Floating Green Dr. and S. 24th St.

Spokane River Outfall – This storm sewer drainage basin contains area to the north and south of I-90. It collects stormwater along Northwest Boulevard, south of I-90, and also collects runoff from a large area north of I-90 on both the east and west sides of U.S. 95. The basin is approximately 222 acres. This outfall is adjacent to Bellerive Ln, near the end of N. Lakewood Dr.

During high water conditions in Lake Coeur d'Alene and the Spokane River, the majority of the City's MS4 outfalls are located below the high water elevation. Therefore, in order to collect discharge and water quality data that is representative of actual MS4 conditions, it is necessary to move the monitoring locations upstream within the MS4 system. At each of the MS4 NPDES discharge monitoring locations, new manholes and automated sampling and discharge monitoring equipment will be installed.

3.1.2 Monitoring Frequency and Timing

The permit requires a minimum of 4 samples to be collected from the two monitoring locations listed above during the calendar year. The four monitoring time periods identified in the permit are: March – April, May – June, August, and September – October.

The timing for the collection of water quality samples from the MS4 NPDES discharge monitoring locations is dictated by the occurrence of storm events. In the *NPDES Storm Water Sampling Guidance Document* (USEPA, 1992) a storm event is defined to mean the following: the depth of the storm must be greater than 0.1 inch accumulation; the storm must be preceded by 72 hours of dry weather; and where feasible, the depth of the rain and duration of the event should not vary by more than 50 percent of the average depth and duration. For the MS4 NPDES discharge monitoring program, precipitation will be tracked using the weather station located at the Coeur d'Alene Municipal Airport (http://www.wunderground.com/US/ID/Coeur_D_Alene.html or http://weather.noaa.gov/cgi-bin/iwszone3#t1). When the above conditions are met, water quality samples will be collected from the outfalls within the first 30 to 60 minutes of the storm event.

In the event that precipitation data from the Coeur d'Alene Municipal Airport weather station is found to be insufficient to quantify storm events in a manner that allows for sampling to occur in a timely manner, a separate precipitation monitoring location within the MS4 service area may be established.

The sampling and monitoring equipment at each outfall will be hard-wired for both electricity and telephony. The telephony feature will allow the sampling and monitoring equipment to relay real-time information to data users and allow for remote activation of sampling equipment in response to weather conditions. It is anticipated that as monitoring of the MS4 continues, that a correlation between storm events and changes in discharge monitored at the MS4 outfalls may be developed. This would allow automated sampling of the MS4 outfalls to occur in response to actual discharge conditions measured within the outfall.

3.1.3 Monitoring Parameters

Parameters required for monitoring as part of the MS4 NPDES discharge monitoring program are defined in the NPDES permit and are shown in Tables 2-1 and 2-2. Table 3-1 provides a summary of recommended container sizes, container types, sample preservation and holding times for each analysis along with the number of samples and QC samples to be collected during monitoring event. The standard practices and protocols for the collection of physical measurements and water quality samples are detailed in Section 3.2.

3.2 Sampling Methods (B2)

This section describes the procedures to be used for sample collection and laboratory analysis of stormwater samples collected under the MS4 monitoring program.

3.2.1 Physical Parameters Measured by Instrumentation

Flow measurements will be collected using an area-velocity sensor (Isco 4250 or equivalent) to monitor open-channel flow at the two monitoring locations. This flow meter will continuously record flow rate and temperature data. Figure 3-1 shows a schematic of the monitoring location. The sensor is mounted with a scissor ring in the influent pipe to the manhole and is connected via cable to the module, which is housed in an above-ground box nearby. The box will be located inside the city right-of-way at an easily accessible location along the road. This configuration will remove the need to reroute traffic and access the manhole to obtain discharge measurements.

Also housed in the box will be a telephone modem (Isco 4200 series telephone modem or equivalent) which will transmit data from the flow meter. The modem will allow for remote retrieval of flow meter data, providing two-way communication between the on-site flow meter and a base computer. A computer running appropriate software (Isco Flowlink 5.1 or equivalent) will interrogate the flow meter at programmed increments. The software can also be used to organize, graph and report the data.

The system is powered with battery packs (Isco 913 or equivalent) which are plugged into AC-powered chargers.

3.2.2 Water Sample Collection

Water quality samples will be collected using an automated sampling device (Isco 3700 or equivalent) that will be collocated with the flow monitoring equipment discussed above and shown in Figure 3-1.

As mentioned in 3.1.2, it will be necessary at the beginning of the monitoring program for the PM or designated staff to remotely trigger the sampling system when storm event conditions are met. This will be required until a correlation can be developed between precipitation and changes in flow rates measured at the outfalls. When a correlation has been developed, the sampling system will be set to collect samples when flow conditions exhibit a change consistent with the storm event. When these conditions are met, the sampling system will automatically trigger water quality sample collection and the phone modem will dial up to three pre-programmed phone numbers and send messages that sampling is underway.

Once the sampling process is initiated, the automatic sampling system will draw eight 1-liter samples of stormwater at each outfall. The glass 1-liter bottles in the sampling unit will be purchased from the manufacturer of the automatic sampler to ensure proper functionality of the system.

After the automatic sampler has completed sample withdrawal, the 1-liter bottles will then be retrieved as soon as possible from the sampling unit and composited using a churn sample splitter. Samples for laboratory analysis will be withdrawn from the churn sample splitter into the appropriate sample bottles identified in Table 3-1. Where preservatives are required, pre-preserved sample bottles will be used. QC samples will be collected at each outfall as identified in Table 3-1.

Following sample collection and bottling, the samples will be labeled, placed in a Ziploc bag, and placed in a cooler with ice. The ice will be double bagged in Ziploc bags to prevent leakage during shipment. The samples will be shipped via express carrier for same-day or overnight delivery to SVL Analytical in Kellogg, Idaho. At the discretion of the PM, samples may be hand delivered to the laboratory depending on the timing of sample collection. Samples for PCB analysis will be shipped from SVL to Anatek for analysis.

Samples collected from the two different outfalls will be kept separate at all times and shipped in separate coolers. The churn splitter and 1-liter glass bottles from the automatic sampler will be decontaminated after sample collection using a 5% HCL wash (per USGS methods) and an Alconox/water solution, followed by a rinse with deionized water.

3.3 Sample Handling and Custody (B3)

A sample is physical evidence collected from the immediate environment, or from another source. Because of the potential evidentiary nature of samples, the possession of samples must be traceable from the time the samples are collected until they are introduced as evidence. In addition to field notebooks, there are a number of documents for tracking sample custody.

Field documents including sample custody seals, and chain-of-custody records will be obtained from the laboratory. Chain-of-custody procedures will be used to maintain and document sample collection and possession. After sample packaging, the appropriate chain-of-custody form will be completed. The PM will be responsible for retaining and tracking chain-of-custody forms for the program.

Copies of the form will be filled out and distributed in accordance with the instructions for sample shipping and documentation.

The following subsections detail the sample management and documentation procedures that will be used during the MS4 NPDES discharge monitoring program.

3.3.1 Chain of Custody

Because samples collected during monitoring could be used as evidence, their possession must be traceable from the time the samples are collected until they are introduced as evidence in legal proceedings. Chain-of-custody procedures are followed to document sample possession as described below:

Definition of Custody

A sample is under custody if one or more of the following criteria are met:

- It is in your possession
- It is in your view, after being in your possession
- It was in your possession and then you locked it up to prevent tampering
- It is in a designated secure area

Field Custody

In collecting samples for evidence, only enough volume to provide a good representation of the media being sampled will be collected. To the extent possible, the quantity and types of samples and sample locations are determined before the actual fieldwork. As few people as possible should handle samples.

The field sampler is personally responsible for the care and custody of the samples collected until they are transferred or dispatched properly.

The PM determines whether proper custody procedures were followed during the field work, and decides whether additional samples are required.

Transfer of Custody and Shipment

Samples are accompanied by a chain-of-custody record. When transferring samples, the individuals relinquishing and receiving the samples sign, date, and note the time on the record. This record documents custody transfer from the sampler, often through another person, to the analyst at the laboratory.

Samples are packaged properly for shipment and dispatched to the appropriate laboratory for analysis, with a separate chain-of-custody record accompanying each shipping container. Shipping containers will be sealed with custody seals for shipment to the laboratory. Courier names and other pertinent information are entered in the "Received by" section of the chain-of-custody record.

All shipments are accompanied by the chain-of-custody record identifying its contents. The original record and one copy accompany the shipment to the laboratory, and a second copy is retained by the PM.

Freight bills, postal service receipts, and bills of lading are retained as part of the permanent documentation.

3.3.2 Custody Seals

When samples are shipped to the laboratory, they must be placed in containers sealed with custody seals. One or more custody seals must be placed on each side of the shipping container.

3.3.3 Field Notebooks

In addition to chain-of-custody records, a bound field notebook will be maintained by the PM or sample collection staff to provide a daily record of significant events, observations, and measurements during sample collection. All entries will be signed and dated. The notebook will be retained by the City as a permanent record.

These notebooks are intended to provide sufficient data and observations to enable participants to reconstruct events that occurred during the project, and to refresh the memory of the field personnel if called upon.

3.3.4 Corrections to Documentation

All original data recorded in field notebooks, sample identification tags field data forms, and receipts-for-sample forms will be written in waterproof ink, unless prohibited by weather conditions. Chain of custody forms will be obtained from the laboratory. None of these accountable documents are to be destroyed or thrown away, even if they are illegible or contain inaccuracies that require a replacement document.

If an error is made on an accountable document the field team leader may make corrections simply by drawing a single line through the error and entering the correct information. The erroneous information should not be obliterated. Any subsequent error discovered on an accountable document should be corrected by the person who made the entry. All subsequent corrections must be initialed and dated.

3.4 Analytical Methods (B4)

Project analytes, methods, and required detection levels are listed in Table 2-2. The recommended container sizes, container types, sample preservation, and holding times for each analysis as well as the number of samples and QC samples to be collected during each monitoring event are presented in Table 3-1.

3.5 Quality Control (B5)

QC requirements are detailed in the following subsections.

3.5.1 Field Quality Control Procedures

QC requirements related to the sample collection process (i.e., sample design, sampling methods, sample handling, and sample custody) are described in Sections 3.1 to 3.3.

The sampling program includes collection of field QC samples, including field duplicates and laboratory QC samples (for matrix spikes [MSs]). The QC samples will be collected immediately following collection of target samples and using the same procedures as the collection of the target sample. QC samples will be collected from alternating sampling locations for each sampling event.

3.5.2 Laboratory Quality Control Procedures

Laboratory QC procedures will include the following:

- Analytical methodology and QC according to methods listed in Table 2-2
- Instrument calibration and standards as defined in the methods listed in Table 2-2
- Laboratory blank measurements at a minimum 5 percent or 1-per-batch frequency
- Accuracy and precision measurements at a minimum of 1 in 20, 1 per set
- Data reduction and reporting according to the methods listed in Table 2-2
- Laboratory documentation equivalent to the USEPA CLP

3.6 Instrument/Equipment Testing, Inspection, and Maintenance (B6)

Instrument maintenance logbooks are maintained in laboratories at all times. The logbooks, in general, contain a schedule of maintenance as well as a complete history of past maintenance, both routine and non-routine.

Preventative maintenance is performed according to the procedures described in the manufacturer's instrument manuals, including lubrications, source cleaning, detector cleaning, and the frequency of such maintenance. Precision and accuracy data are examined for trends and excursions beyond control limits to determine evidence of instrument malfunction. Maintenance will be performed when an instrument begins to degrade as evidenced by the degradation of peak resolution, shift in calibration curves, decrease in sensitivity, or failure to meet one or another of the QC criteria.

Instrument downtime is minimized by keeping adequate supplies of all expendable items, where expendable means an expected lifetime of less than 1 year. These items include gas tanks, filters, syringes, ferrules, printer paper and ribbons, and pump oil. Preventative maintenance for field equipment (for example, pH meters) will be carried out in accordance with procedures and schedules outlined in the particular model's operation and maintenance handbook.

3.7 Instrument/Equipment Calibration and Frequency (B7)

Laboratory calibration procedures are specified in the methods referenced in Table 2-2. All calibrations unless specified otherwise by method (such as for metals), at a minimum will be at the following level of effort:

Initial calibration unless specified otherwise by standard EPA method will include, at a minimum, three-point calibration before a run.

Continuing calibration for all methods will include a mid-range (or as defined by method) calibration standard after every tenth sample or every 12 hours

3.8 Inspection/Acceptance of Supplies and Consumables (B8)

Supplies and consumables will be acquired and inspected in accordance with acquisition specifications upon receipt. All sample containers that will be used for the project will be "certified clean".

3.9 Nondirect Measurements (B9)

This section describes data that were obtained from non-direct measurement sources such as computer databases, programs, literature files, and historical databases that may be used in making decisions. During the course of the MS4 NPDES monitoring program, precipitation data from the weather station located at the Coeur d'Alene Municipal Airport (http://www.wunderground.com/US/ID/Coeur_D_Alene.html or http://weather.noaa.gov/cgi-bin/iwszone3#t1) will be used to determine the timing for sampling events. Where this data is used, it will be identified in the records for the project and required reporting documents.

3.10 Data Management (B10)

Data obtained as part of the MS4 NPDES discharge monitoring program will be maintained in Excel spreadsheets and other electronic databases (continuous discharge/temperature data), as required. All data will undergo review and validation as described in Section 5.

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FIGURE 3-1
Monitoring System Schematic

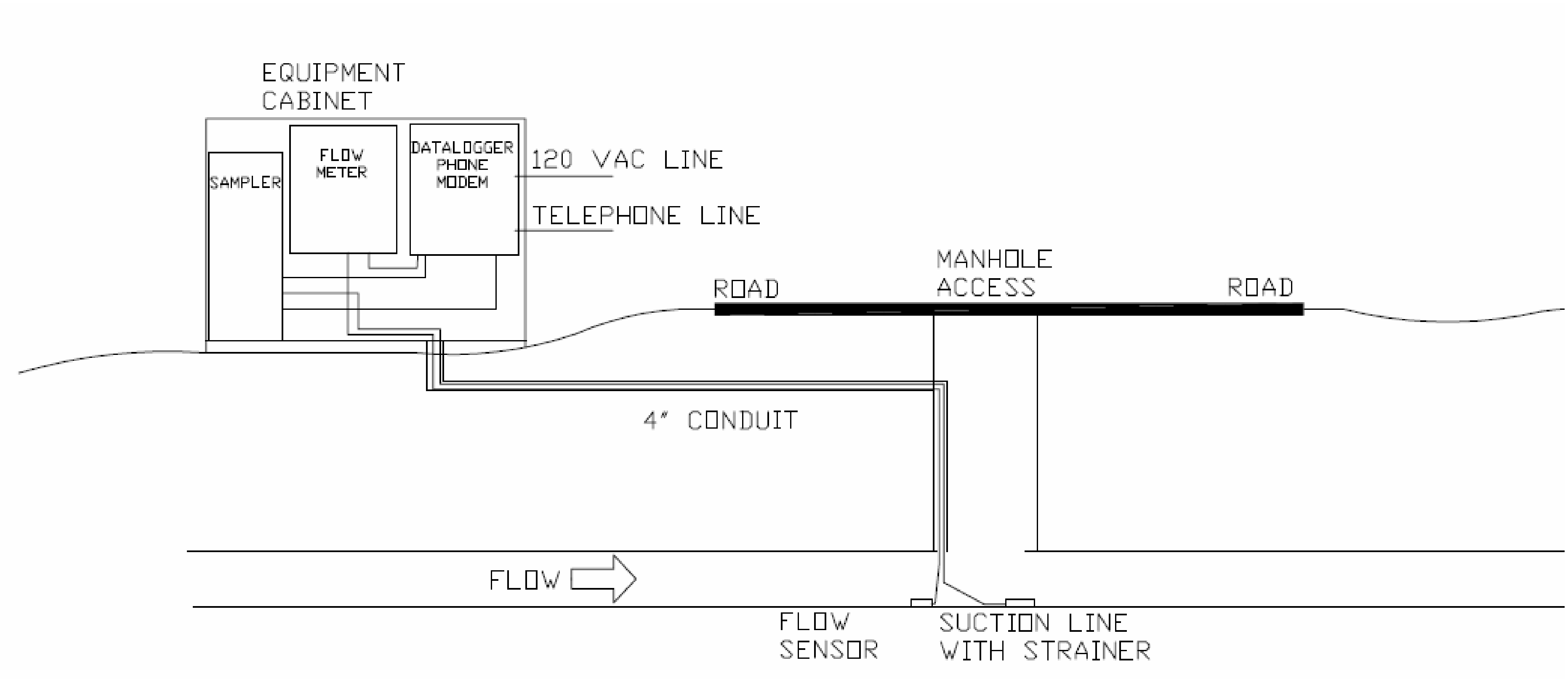

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TABLE 3-1
MS4 Sampling Containers, Preservation, Holding Times, and Sample Number
QAPP for the City of Coeur d'Alene, ID

Analyte	Container Type	Container Preparation	Container Size	Preservation	Holding Times	Number of Samples Per Event, Per Outfall [2]
Flow	N/A	N/A	N/A	N/A	N/A	N/A
Temperature	N/A	N/A	N/A	N/A	N/A	N/A
Total suspended solids	Resistant-glass or plastic bottles	N/A	500 mL	Cool to 4C	24hrs (7 days max)	2
Total phosphorous [1]	Opaque polyethylene	Pre-preserved with H_2SO_4 to pH<2	500 mL	Cool to 4C	28 days	2
Total nitrogen [1]	Opaque polyethylene	2-40mL glass vials preloaded with HCL, supplied by lab	500 mL	Cool to 4C	28 days	2
Total lead [1]	Certified clean, pre-acid rinsed opaque polyethylene	Pre-preserved with HNO_3 to pH<2	500 mL		6 months	2
Total zinc [1]	Certified clean, pre-acid rinsed opaque polyethylene	Pre-preserved with HNO_3 to pH<2	500 mL		6 months	2
Hardness [1]	Certified clean, pre-acid rinsed polyethylene	Pre-preserved with HNO_3 to pH<2	500 mL		6 months	2
Total Polychlorinated Biphenyls (PCB)	Amber glass with Teflon lid	N/A	500 mL	Cool to 4C	72 hrs	2

Notes:

[1] Data from the Quality Assurance Project Plan, Addendum 2009 for Coeur d'Alene Lake, ID.

[2] There are four sampling events per year. One of the two samples from each sampling event will be a QC sample: either a duplicate or MS sample. The source of these QC samples will alternate between outfalls between sampling events. The QC samples should include field blanks using certified inorganic bland water (IBW) or equivalent (USGS).

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SECTION 4

Assessment and Oversight (EPA Group C)

4.1 Assessments and Response Actions (C1)

The RTL and PM will monitor the performance of the QA procedures. If problems arise the RTL may conduct an audit. The audit may be scheduled to evaluate (1) the execution of sample identification, chain-of-custody procedures, field notebooks, sampling procedures, and field measurements; (2) whether trained personnel staffed the sample event; (3) whether equipment was in proper working order; (4) availability of proper sampling equipment; (5) whether appropriate sample containers, sample preservatives, and techniques were used; (6) whether sample packaging and shipment were appropriate; and (7) whether QC samples were properly collected.

Audits will be followed up with an audit report prepared by the auditor. The auditor will also debrief the PM or field team at the end of the audit and request that the field team comply with the corrective action report.

If QC audits result in detection of unacceptable conditions or data, the PM will be responsible for developing and initiating corrective action. The PM will decide whether any corrective action should be pursued. Corrective action may include the following:

- Reanalyzing samples if holding time criteria permit
- Re-sampling and analyzing
- Evaluating and amending sampling and analytical procedures
- Accepting data acknowledging a level of uncertainty

4.2 Reports to Management (C2)

The RTL may request a QA report to be made by the PM on the performance of sample collection and data quality. The report will include the following:

- Assessment of measurement data accuracy, precision, and completeness
- Results of performance audits
- Results of systems audits
- Significant QA problems and recommended solutions

Progress reports, prepared as needed, will summarize overall project activities and any problems encountered. QA reports generated on sample collection and data quality will focus on specific problems encountered and solutions implemented. Alternatively, in lieu of a separate QA report, sampling and field measurement data quality information may be summarized and included in the annual reports summarizing sampling activities. The objectives, activities performed, overall results, sampling, and field measurement data quality information for the project will be summarized and included in reports along with any QA reports.

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SECTION 5

Data Validation and Usability (EPA Group D)

5.1 Data Review, Verification, and Validation (D1)

Data verification will be conducted by the laboratory prior to submission to the City. The PM will review the data to determine if the data are of sufficient quality to support the project objectives. After the data review is completed, data qualifiers may be appended to the measurement values.

5.2 Verification and Validation Methods (D2)

Initial data reduction, validation, and reporting at the laboratory will be performed as described in the laboratory standard operating procedures. The PM will review the laboratory data reduction, validation, and reporting. The PM will communicate with the laboratory QA manager to determine the cause of any poor results noted and plot out a corrective action that will be documented in the project records.

5.3 Reconciliation with User Requirements (D3)

Results obtained from the project will be reconciled with the requirements specified in Table 2-2. Assessment of data for precision, accuracy, and completeness will be performed by the City in accordance with the quantitative definitions in the following subsections and will be documented in the annual reports.

5.3.1 Precision

If calculated from duplicate measurements, use the following:

$$RPD = \frac{(C_1 - C_2) \times 100\%}{(C_1 + C_2) / 2}$$

where:

RPD = relative percent difference
C_1 = larger of the two observed values
C_2 = smaller of the two observed values

If calculated from three or more replicates, use relative standard deviation (RSD) rather than relative percent difference (RPD), as follows:

$$RSD = (s/\bar{y}) \times 100\%$$

where:

RSD = relative standard deviation
s = standard deviation
$\bar{y}$ = mean of replicate analyses

Standard deviation, s, is defined as follows:

$$s = \sqrt{\sum_{i=1}^{n} \frac{(y_i - \bar{y})^2}{n-1}}$$

where:

s = standard deviation
y_i = measured value of the i[th] replicate
$\bar{y}$ = mean of replicate analyses
n = number of replicates

5.3.2 Accuracy

For measurements where matrix spikes are used, use the following:

$$\%R = 100\% \times \left[\frac{S - U}{C_{sa}}\right]$$

where:

%R = percent recovery
S = measured concentration in spiked aliquot
U = measured concentration in unspiked aliquot
C_{sa} = actual concentration of spike added

For situations where a standard reference material (SRM) is used instead of or in addition to matrix spikes, use the following:

$$\%R = 100\% \times \left[\frac{C_m}{C_{sm}}\right]$$

where:

%R = percent recovery
C_m = measured concentration of SRM
C_{sm} = actual concentration of SRM

5.3.3 Completeness (Statistical)

Defined as follows for all measurements:

$$\%C = 100\% \times \left[\frac{V}{T}\right]$$

where:

%C	=	percent completeness
V	=	number of measurements judged valid
T	=	total number of measurements

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SECTION 6

References

Guidelines Establishing Test Procedures for the Analysis of Pollutants. Code of Federal Regulations Title 40, Pt. 136, 2009.

Idaho Department of Environmental Quality and Coeur d'Alene Tribe. 2009. *Continued Monitoring of Water Quality Status and Trends in Coeur d'Alene Lake, Idaho – Quality Assurance Plan, Addendum 2009*.

The Uniform Federal Policy for Implementing Environmental Quality Systems (UFP-QS), ANSI/ASQ E4.

U.S. Environmental Protection Agency (USEPA). 1998 and 2002a. *EPA Guidance for Quality Assurance Project Plans. (QA/G-5).* (EPA/240/R-02-009). Washington, D.C.

USEPA. 1992. *NPDES Storm Water Sampling Guidance Document.* (EPA/833/B-92-001).

USEPA. 1994b, 1999, 2002 and 2004. *Contract Laboratory Program National Functional Guidelines for Inorganic/Organic Data Review.* OSWER 9240.1-45. (EPA/540/R-04-004). Washington, D.C.

USEPA. 2006. *Guidance on Systematic Planning Using the Data Quality Objectives Process* (EPA QA/G-4).

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APPENDIX A

Data Quality Objectives

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APPENDIX A

Data Quality Objectives

On November 19, 2008, the United States Environmental Protection Agency (USEPA) authorized Permit Number IDS-028215 under the National Pollutant Discharge Elimination System (NPDES) to the City of Coeur d'Alene, Idaho (City) for storm water discharges from the City's existing municipal separate storm sewer system (MS4) outfalls to Lake Coeur d'Alene, the Spokane River, and other waters of the United States within the Coeur d'Alene Urbanized Area. Monitoring requirements for the City's MS4 outfalls are presented in Section IV of the permit. In Section IV, the following monitoring objectives are identified:

a) Estimate the pollutant load currently discharged from the MS4s;

b) Assess the effectiveness and adequacy of control measures implemented through this permit; and

c) Identify and prioritize those portions of the MS4 requiring additional controls.

Based on these monitoring objectives and the monitoring requirements identified in Section IV of the permit, data quality objectives (DQOs) have been developed to ensure that the right type, quantity, and quality of data needed to develop pollutant loading estimates and support decisions associated with permit requirements are collected.

This attachment contains three sections: Section A.1 describes the data quality objectives (DQO) process, Section A.2 presents the DQOs for the monitoring program, and Section A.3 presents the references used to develop this attachment.

A.1 Data Quality Objectives Process

The USEPA DQO process was used to identify the specific needs for the monitoring program and to establish decision rules for the collection and analysis of storm water monitoring data from the City's MS4 outfalls as required in the NPDES permit. The DQO process is a seven-step iterative planning approach used to prepare plans for environmental data collection activities and is intended to help site managers plan to collect data of the right type, quality, and quantity to support defensible site decisions. The seven steps are as follows:

1. State the Problem – Summarize the contamination problem that will require new environmental data, and identify the resources available to resolve the problem; develop the conceptual site model.

2. Identify the Decision – Identify the decision that requires new environmental data to address the problem.

3. Identify Inputs to the Decision – Identify the information needed to support decisions and specify which inputs require new environmental measurements.

4. Define the Study Boundaries – Specify the spatial and temporal aspects of the environmental media that the data must represent to support the decision.
5. Develop a Decision Rule – Develop a logical "if…then…" statement that defines the conditions that would cause the decision-maker to choose among alterative actions.
6. Specify Limits on Decision Errors – Specify the decision-maker's acceptable limits on decision errors, which are used to establish performance goals for limiting uncertainty in the data.
7. Optimize the Design for Obtaining Data – Identify the most resource-effective sampling and analysis design for generating data that are expected to satisfy the DQO

A.2 Municipal Separate Storm Sewer System Discharge Sampling Data Quality Objectives

This section details the DQOs as they relate to the City of Coeur d'Alene NPDES MS4 outfall monitoring program. This section uses the format presented in *Guidance on Systematic Planning Using the Data Quality Objectives Process* (EPA QA/G-4, EPA, 2006).

Step 1. State the Problem

1	Develop a concise description of the problem	As part of the NPDES Permit for the City of Coeur d'Alene's MS4 outfalls, monitoring of discharge and water quality at outfalls following storm events is required. The monitoring data are intended for use to estimate the current pollutant loading from the MS4, assess effectiveness and adequacy of control measures implemented as part of the permit, and to identify and prioritize portions of the MS4 that may require additional controls.
2	Identify the primary decision-maker and the planning team	Decisions regarding the MS4 NPDES outfall monitoring program will be made by the City of Coeur d'Alene with input from USEPA and the Idaho Department of Environmental Quality (IDEQ). The planning team for the development of the DQOs and QAPP for the MS4 NPDES outfall monitoring program included the City of Coeur d'Alene and their contractor CH2M HILL.
3	Specify available resources and relevant deadlines for the study	Available resources for the study include: • Climatological data from the weather station located at the Coeur d'Alene airport, north of the City of Coeur d'Alene • Surface water quality data from the USGS monitoring location on the Spokane River near the Coeur d'Alene Lake Outlet (USGS Number 12417610) • Schematics of the City of Coeur d'Alene MS4 system outfalls and service areas associated with each outfall. Relevant deadlines for the study include: • The NPDES permit requires that monitoring of 2 MS4 outfalls (one to Lake Coeur d'Alene and one to the Spokane River) be monitored four times per year in response to storm events (one sampling

		event for the following periods: March – April, May – June, July – August, and September – October). The permit requires that the MS4 outfall sampling program be initiated within 18 months of the permit effective date (June 1, 2010).

Step 2. Identify the Goal of the MS4 Monitoring Program

1	Identify the principal study questions.	A. What is the estimated pollutant loading currently discharged from the MS4s for the parameters identified in Table IV.A of the permit? B. What is the effectiveness and adequacy of control measures implemented through the permit? C. Is there a need for additional control measures for portions of the MS4 and what are the priority of these control measures?
2	Define alternative actions that could result from resolution of the principal study questions.	Principal study questions A and B are estimation problems. For Question A, the principal estimation measure will be the load of pollutants currently discharging from the City's MS4. Estimates of current pollutant loading will be based on measurements of discharge and water quality, at 2 monitoring locations, collected prior to the implementation of control measures required by the permit and will act as the baseline for future comparisons to address Question B. The impacts of the highly variable impacts of storm event based sampling on pollutant loadings will need to be taken into consideration when developing the estimates as hydrologic and weather conditions tend to be highly variable between years. Further, estimates for the entire MS4 will be based on conditions measured at 2 locations. If significant differences between service areas associated with outfalls are believed to be present then adjustments to the estimates may be necessary. For Question B, the principal estimation measure, pollutant loading from the City's MS4, will be the same as for Question A. MS4 pollutant loading data collected after the implementation of control measures required by the permit will be compared to the baseline conditions established in Question A. Similar to Question A above, the impact of the variability

		associated with hydrologic and weather conditions between years and potentially service areas will need to be evaluated. For Question C the alternative actions are: • No further control measures are necessary. • Additional data collection/evaluation is necessary to determine the need for additional control actions and to determine the priority of the actions. • Develop, prioritize, and implement additional control actions. Because pollutant loading is driven in large part by discharge, we anticipate that there will be a high degree of variability in the data between monitoring events over the span of the monitoring program. This is a direct result of changes in hydrologic and weather pattern conditions over time. Therefore, when comparing data, these conditions will need to be taken into consideration to determine the effectiveness and adequacy of control measures on pollutant loading. Similar to question A before, the concentrations of pollutants measured will be compared with baseline concentrations, Idaho water quality standards, and downstream water quality concentrations measured at the USGS monitoring station on the Spokane River. C. The alternative actions for question C are: No Action Additional data collection is required Develop and implement additional control measures. The estimates will be developed using discharge and water quality measurements collected at the 2 MS4 outfalls where monitoring will occur. The load estimates developed for the 2 monitored MS4 outfalls will be developed by using continuous discharge monitoring data and the water quality recorded during the 4 sampling events required by the NPDES permit. As discussed later in the DQOs and the QAPP, the water quality measured during the 4 sampling events will represent the likely "worst case" scenario for water quality from the outfalls and therefore, the sc and the size of the service areas associated with each

		outfall will be used to develop loading estimates for the remaining MS4 outfalls by assuming similar water quality for the remaining MS4 outfalls and scaling the contribution of total loading from the MS4 according to service area size of the remaining outfalls. monitored and 4 water quality samples collected throughout the water year. The results of these estimates will be used to develop estimates for other MS4 outfalls not monitored based on their service acreage with respect to the monitored outfalls. As discussed later in the DQOs and in the QAPP, the water quality samples collected will represent the likely "worst-case" water quality scenario for these outfalls and therefore, estimates generated for pollutant loading from the MS4s will be conservative. For question B, the principle estimation measure will be based on the difference in pollutant loading following the implementation of control measures identified in the Storm Water Management Plan. These estimates will be limited to control measures conducted in the service area of those MS4 outfalls being monitored. Effectiveness and adequacy estimates will be related to non-monitored outfalls based on the results obtained from monitored outfalls. In addition to the estimation of pollutant loading, the concentrations of pollutants identified for monitoring in the permit will also be compared against Idaho water quality standards and water quality measured at the USGS monitoring location on the Spokane River. C. The alternative actions for question C are: No Action Additional data collection is required Develop and implement additional control measures.
3	Combine the principal study questions and the alternative actions into a decision statement	A. Discharge from the 2 MS4 outfalls that are monitored will be combined with water quality data to determine loading occurring at these outfalls. The resultant loads from the measured outfalls will be used to estimate loading from non-monitored MS4 outfalls and estimate total loading from the MS4 system occurring prior to the

		implementation of control actions required in the permit. B. After the implementation of control measures identified in the Storm Water Management Plan, pollutant loading estimates for the 2 MS4 outfalls will be developed and to estimate loading from the MS4 system and compared with estimates generated as part of Question A. The comparison of pre- and post-implementation pollutant loading will be used to evaluate the effectiveness and adequacy of the control measures. C. After the implementation of control measures identified in the Storm Water Management Plan, pollutant loading estimates will be evaluated to determine if no action, additional data collection, or additional control measures are required.
4	Organize multiple decisions	A and B are estimation problems and the multiple decision statement is the same as shown above in Step 2, part 3. Principal Study Question C: 1. If the control measures identified in the Storm Water Management Plan are shown to be effective and adequate in controlling pollutant loading from the MS4 system, then no further action may be necessary. 2. If the control measures identified in the Storm Water Management Plan do not appear to be effective and adequate with a high level of uncertainty with respect to monitoring results and hydrologic and weather conditions, then additional data collection may be necessary. 3. If the control measures identified in the Storm Water Management Plan do not appear to be effective and adequate in controlling pollutant loading from the MS4 system with a low level of uncertainty with respect to monitoring results and hydrologic and weather conditions, then additional control measures may need to be developed.

Step 3. Identify Inputs to the Decision

1	Identify information that will be required to resolve the	The data needs for all principal study questions are

	decision statement	identical. • Precipitation data to determine the timing of sample collection with respect to storm event conditions. • Acreages of the service areas for each MS4 outfall • Continuous discharge data for monitored outfalls • Water quality data for the parameters listed in Table IV.A of the permit.
2	Determine the sources for each item of information required	Precipitation data will be obtained from the weather station located at the Coeur d'Alene Municipal Airport. If this data is found to be insufficient for the purpose of identifying sample collection times, then the establishment of a precipitation monitoring unit will be evaluated. The acreages of the service areas for each MS4 outfall will be estimated using a GIS system and drawings of the current layout of the MS4 system. Continuous discharge data collection devices will be installed in the outfalls identified for monitoring. Automatic samplers will be installed in the outfalls identified for monitoring. Automated samplers will be activated based on precipitation conditions that indicate a storm event is occurring. Over time, it is anticipated that a correlation between storm event occurrence and changes in discharge measured by the discharge data collection devices will be established and that automated sampling will be aligned with these changes.
3	Identify the information that is needed to establish the action level	Action levels for question B and C are based on pre- and post-control measure implementation water quality and pollutant loading. The concentrations of parameters listed in Table IV.A will also be compared with applicable water quality standards and with water quality data collected by the USGS at their monitoring location on the Spokane River.
4	Confirm the appropriate measurement methods exist to provide the necessary data	Methods consistent with the above needs are identified in the QAPP. The method reporting and detection limits selected are based on the Idaho water quality standards where appropriate.

Step 4. Define the Boundaries for the Study –

1	Specify the characteristics that define the population of interest	The population of interest is storm water conveyed by the MS4 system during storm events.
2	Define the spatial boundary of the decision statement	Estimates and decisions will be made for storm water conveyed by the MS4 system.
3	Define the temporal boundary of the decision statement	Monitoring of the MS4 storm water will be conducted in response to storm events four times per year in accordance with the permit until the expiration of the NPDES permit (December 31, 2014).
4	Define the scale of decision-making	Estimates and decisions will be made for storm water conveyed by the MS4 system.
5	Identify practical constraints on data collection	Discharge and water quality monitoring will be conducted using automated sampling devices located in manholes upstream of the outfalls. It was determined that sampling upstream of the actual outfall location was optimal because the majority of outfalls associated with the City's MS4 are typically submerged during high water conditions. Monitoring under this plan is conducted in response to storm events within a certain bracketed time period. The potential exists that during one of the bracketed time periods conditions that define a storm will not occur. This would result in no sampling of storm conditions for this time period. At this time, it is unclear if precipitation data measured at the Coeur d'Alene Municipal Airport will be indicative of conditions in the MS4 service area. If the precipitation data from the Coeur d'Alene Municipal Airport monitoring location are found to be insufficient for the purposes of this monitoring program, a precipitation monitoring location within the service area may be established.

Step 5. Develop a Decision Rule

1	Specify the statistical parameter that characterizes the population of interest	Instantaneous discharge measurements linked to the time of collection of water quality samples will be used to estimate instantaneous pollutant loads associated with the MS4 outfalls for discrete storm conditions. These loads will be used to correlate discharge with load (and/or concentrations) using

		standard curve fitting techniques available in Microsoft Excel to estimate pollutant loads (concentrations) under other storm and non-storm conditions that may not be monitored. Annual pollutant loads and concentration ranges will be estimated for the monitored outfalls based on the continuous discharge and discrete water quality samples. These estimates will be used to estimate pollutant loads for other unmonitored MS4 outfalls based on their service area with respect to the monitored area. The data will be further evaluated to estimate mean daily pollutant loading, median pollutant loading, and loading associated with various storm events to the extent that particular storm events occur and are monitored and that extrapolation can be performed.
2	Specify the action level for the study	The decision problems associated with the MS4 monitoring plan are estimate problems and therefore an action level is not applicable. However, water quality samples collected form the MS4 will be compared with applicable State and Federal water quality criteria/standards on a sample-specific basis.
3	Develop a decision rule (an "if….then…." statement	Principal study questions A and B are estimation problems and do not require a decision rule. For principal study question C see Step 2, part 4 above.

Step 6. Specify Performance Metrics and Acceptable Levels of Uncertainty

1	Determine the range of the parameters of interest	Current discharge and water quality associated with the MS4 outfalls is unknown.
2	Identify the decision errors and choose a null hypothesis	The sampling design for the MS4 monitoring is judgmental as the locations, frequency, and parameters are prescribed as part of the permit. Therefore, a null hypothesis is not applicable. The PARCC criteria in the QAPP will be used to evaluate the usability of data in estimating pollutant loads and comparing data with water quality criteria/standards.
3	Specify a range of possible values of the parameter of interest where the consequences of decision error are relatively minor	Because the error for precision and accuracy for water quality samples is on average about 35%, the consequences of estimate errors based on sample results are less than half the specified quantitation level or greater than twice the specified quantitation level are expected to be relatively small. In general, because the collection water quality samples is skewed

		to coincide with "first flush" conditions of storms, the estimates produced using this data are expected to be significant overestimates of actual conditions and therefore more conservative than other options.
4	Assign probability values to points above or below the action level that reflect the tolerable probability for the occurrence of decision errors.	As sampling is judgmental and pre-defined, probability values are not applicable.

Step 7. Optimize the Design

1	Review the DQO outputs and existing data	See steps 1 through 6.
2	Develop general data collection design alternatives	Data collection frequency (4 times per year at within specific time frames) is dictated by the conditions of the permit. Discharge measurements will collected on a continuous basis to assist with the correlation of pollutant concentrations with various discharge levels and conditions. Automated sampling devices triggered by storm events (initially in response to measured precipitation and then by recognizing changes in discharge at the monitoring location) will be used to collect water quality samples in a timely manner and within the time periods identified in the permit.
3	Formulate the mathematical expressions necessary for each design alternative	Statistical design was not used to develop the monitoring program, thus mathematical formulas are not applicable.
4	For each data collection design alternative, select the optimal size that satisfies the DQOs	The number of samples to be collected is consistent with the number of samples required by the permit.
5	Select the most resource-effective data collection design that satisfies the DQOs	The sampling design is consistent with the requirements of the permit and uses automated sampling and continuous recording devices to ensure that data can be collected using the most resource-effective methodology available.
6	Document the operational details and theoretical assumptions of the selected	Operational details of the selected design are included in the QAPP.

	design in the sampling and analysis plan	