QUALITY ASSURANCE PROJECT PLAN (QAPP)

Florence Urban Waters
Surface and Groundwater Monitoring Program

Prepared by:

City of Florence, Oregon
250 Highway 101
Florence, Oregon 97439

For:

USEPA Region 10
1200 6th Ave Seattle WA 98101

February 2013

Title and Approval Sheet

Title: Florence Urban Waters, Surface and Groundwater Monitoring Program

Approving Officials:

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Mike Miller, City of Florence Date
Public Works Director and Project Manager

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Shawn Penrod, Executive Assistant, Florence Public Works Date
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Gina Grepo-Grove, Quality Assurance Manager, USEPA Date

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Acronyms and Abbreviations

DEQ Oregon Department of Environmental Quality
DO dissolved oxygen
DQOs data quality objectives
IOC inorganic chemical
OBMP Oregon Beach Monitoring Program
ORP oxidation-reduction potential
SOCs synthetic organic chemicals, e.g., pesticides
TOC total organic carbon
UGB Urban Growth Boundary
USGS U.S. Geological Survey
VOCs volatile organic chemicals, e.g., fuels, solvents

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This project has been funded wholly or in part by the United States Environmental Protection Agency under assistance agreement WC-00J54001-0 to City of Florence. The contents of this document do not necessarily reflect the views and policies of the Environmental Protection Agency, nor does mention of trade names or commercial products constitute endorsement or recommendation for use.

A. Project Management

1. Project/Task Organization

The project team shall be comprised of a consortium of experts and stakeholders needed to shepherd the completion of a Surface- and Groundwater Monitoring Program. Personnel responsible for project implementation are:

Florence Public Works Director/Project Manager

Mike Miller, Florence Public Works Director, is the Project Manager (PM) for the Florence Urban Waters Project. The PM shall be responsible for overall project coordination, including the production of all project deliverables, collection and submittal of environmental samples to the designated laboratories for the chemical and physical analyses, and data reporting and management as specified in this QAPP. The Project Manager is responsible for coordinating these tasks with the other interested and involved parties associated with this monitoring effort, and ensuring that the monitoring plan is implemented as specified.

Carol Heinkel, Planning Consultant, is responsible for Project Coordination. She will provide project coordination, grant administration support, facilitate the Interdisciplinary Team and Stakeholder Group, and support policy and public involvement.

Project QA/QC Manager

Shawn Penrod, or Water Quality Monitoring Designee, will serve as the Project QA/QC Manager, responsible for coordinating with the analytical laboratories, ensuring conformance with data quality objectives, overseeing data validation, and managing project quality assurance and quality control.

Contract Laboratory Project Manager

Rory White, Analytical Labs Services, Inc., will serve as the Laboratory Project Manager. The laboratory project manager will provide analytical support to this project and is responsible for ensuring that laboratory analyses are performed in accordance with the protocols, quality control criteria, and other specifications detailed in this QAPP.

PARTNERS: Partners that have committed to participate on the team are listed below with an *. Additional agencies listed below will be invited to participate on the Interdisciplinary Team or the Stakeholder Group, as appropriate.

Table 1. Project Partners		
Local Government, Tribes & Non-Profits	**State Agencies**	**Federal Agencies**
*Confederated Tribes of Coos, Lower Umpqua, and Siuslaw Indians	*Oregon Department of Environmental Quality	*U.S. Environmental Protection Agency
*Lane County	*Oregon Department of Fish and Wildlife	*U.S. Geological Survey
Heceta Water District	*Oregon Department of Human Services, Drinking Water Program	*U.S. Bureau of Land Management
*Siuslaw Watershed Council	*Oregon Department of Land Conservation and Development	*U.S. Army Corps of Engineers
*Siuslaw Water and Soil Conservation District	*Oregon Department of State Lands	National Oceanic and Atmospheric Administration, Marine Fisheries Service
Port of Siuslaw	*Oregon Department of Water Resources	*USFS, Siuslaw National Forest
Port of Coos Bay	*Oregon Department of Transportation	

2. Problem Definition/Background

Florence, Oregon, a city of 8,427 people covering 5 square miles of land and 0.6 square miles of water along the Siuslaw River estuary and Pacific Ocean, is Lane County's major coastal town and the largest city in the watershed. The urban growth boundary (UGB) population is projected to grow to 16,323 by 2030, almost double the UGB population in 2000. This growth is expected to occur primarily through urbanization of "urbanizable" land within the UGB.

Land cover includes urban development within city limits and vacant and rural land uses outside. The Siuslaw River estuary, designated a Shallow Draft Development estuary under the Oregon Estuary Classification System, is managed for navigation and other public needs with jetties and a main channel maintained by dredging at 22 feet or less. The geomorphology of the area is that of a Drowned River Mouth estuary. The estuary's broad floodplain, numerous wetlands, and tidal islands, lead to the dunes along the coastal plain at Florence. Here the land is characterized by barren sand dunes interspersed with pine woodlands and deflation plain lakes or wetlands. Since the decline of the forest industry, most of the revenue generated in the area is from tourism, recreation, and commercial fishing. Local community members, both tribal and nontribal, engage in subsistence fishing for marine and stream resources. The area is an important recreational area providing opportunities for fishing, boating, beach walking, shopping, dining, bird watching, and many other active and passive recreational activities.

The Siuslaw Watershed is a significant natural area that provides critical habitat for endangered and threatened animal species, contains sensitive plant species, and provides valuable habitat for sensitive animal species (U.S. Natural Resources Conservation Service; Oregon Natural Heritage Program). Under the federal Endangered Species Act, the brown pelican is listed as endangered; the bald eagle, western snowy plover, marbled murrelet, Aleutian Canada Goose, northern spotted owl, Nelson's checker mallow, Oregon silverspot butterfly and Oregon Coast coho salmon are listed as threatened; and the estuary is proposed for critical habitat for the threatened Southern District Population segment of green sturgeon. The purple martin is listed as critical, and American marten as vulnerable, by Oregon. Twelve plant species in the area are listed as threatened, endangered, or possibly extirpated from Oregon. The estuary also supports shellfish resources, including clams, crab, mussels, and shrimp. Large animals include black bear, black-tailed deer, and mountain lion. In all, about 23 species of fish, almost 200 species of birds, and 40 species of marine mammals use the estuary and the surrounding wetlands, lakes, riparian and upland areas. The watershed supports spawning runs of fall Chinook, chum, winter steelhead, coho, and sea-run cutthroat; and receives significant waterfowl use. The estuary has retained a relatively large proportion of its tidal marshes (764 acres) and contains large eel grass beds, and very productive intertidal (sand and mud flats) and subtidal habitats, emergent marsh, scrub-shrub, and forested wetlands. The estuary has been designated an Important Bird Area by the National Audubon Society. There has been at least one winter count of more than 1,000 shorebirds. In addition, the South Jetty wetlands adjacent to the lower river are one of the two most important wintering areas for tundra swans on the Oregon coast.

The North Florence Dunal Aquifer, designated a sole source aquifer by the EPA in 1987, is the only sole source aquifer in the State of Oregon. It encompasses the entire continuous body of sand north of the Siuslaw River and east of the Pacific Ocean, the primary discharge points for the aquifer. About 85 percent of the rain percolates into the water table. Groundwater moves rapidly and almost uniformly toward a discharge point. Multiple seeps and springs occur along the coastline and riverbank, although the aquifer discharges mostly as underflow. Few streams cross the dunal area since most rainfall quickly infiltrates to the water table which is at the surface most of the year. Where streams flow across the sand, they are hydrologically connected with the groundwater system, as are Munsel Lake and Clear Lake, which is the only surface source of drinking water. When the last comprehensive testing of the aquifer was done 23 years ago, the groundwater was of good quality "from a human health standpoint." The 1987 EPA Sole Source Aquifer Resource Document states, "Possible sources of aquifer contamination include fuel storage tank failure, accidental spills of hazardous material, septic tank effluent, storm runoff, pesticides, and chemical fertilizers." Discharge of pharmaceutical by-products is also an environmental threat.

Historically, the Siuslaw Basin was one of the most abundant anadromous fish producers in the Pacific Northwest. Once the Oregon Coast's largest Coho-producing system next to the Columbia, the Siuslaw River is estimated to be at 1% of historic salmon production levels. The lower Siuslaw River watershed health is degraded and a significant amount of restoration action is needed to improve watershed conditions (Oregon Watershed Enhancement Board, 2007). The watershed is limited by all factors in aquatic/instream areas, tideland, riparian, freshwater wetlands, and upland areas. The Siuslaw River and a number of nearby waterways and lakes are classified as Water Quality Limited under the Clean Water Act and are included on the state's 303(d) list of Impaired Waterbodies by the Oregon Department of Environmental Quality. The River is failing in all these parameters: Dissolved Oxygen, Fecal Coliform, Habitat Modification, and Temperature, and potentially Alkalinity. Beneficial Uses impaired by these listed parameters include resident fish and aquatic life; salmonid fish spawning and rearing; anadromous fish passage; trout rearing and migration; and shellfish growing. In 1992, DEQ developed Total Maximum Daily Loads for Clear Creek/Clear Lake and Collard Lake due to year-round phosphorus impairments. In addition, Mercer Creek and Mercer Lake are impaired due to chlorophyll and aquatic weeds/algae, and there is a potential concern of impairment from nitrate. DEQ is currently developing the Total Maximum Daily Load for the Mid-Coast Basin with a target completion date of 2012.

Urbanization of the UGB, development of rural areas along stream corridors for housing, and climate change will exacerbate long-term watershed changes caused by established land use patterns, including altered sediment and detritus deposition patterns, changed peak flows, water circulation patterns, flooding regimes, and surface and groundwater contamination from septic systems and non-point source pollution. The presence and increased discharge of nitrates and other pollutants into the ecosystem through urban groundwater and surface water activities, and the loss of riparian and floodplain function, can be expected to further degrade the system. Another deleterious effect is increased erosion, which is already a problem in developed portions of the estuary and along Munsel Creek. Existing contamination will likely increase recovery time for these impacted waterways.

The Project Partners are favorably positioned to document and, as resources allow, restore identified natural resources that are impaired in an effort to protect functions and values of these resources in the future. The City has upgraded its sewage treatment plant; extended lines into the UGB; adopted a wetland and riparian inventory; and requires stormwater BMPs. The City has updated the Comprehensive Plan for compliance with Statewide Planning Goals for Estuarine, Shoreland, and Ocean Resources. The City, Lane County, and Heceta Water District have begun to cooperate on water quality assessment and monitoring, and the City has set aside funds for an on-going monitoring program.

3. Project Approach

In October, 2009, the City and its partners from 18 federal, state, tribal, and local agencies, embarked on a three-year, EPA-funded project called the Siuslaw Estuary Partnership (see EPA Cooperative Agreement #WC-00J04801-0; www.SiuslawWaters.org). The mission of the project is to protect and improve water quality and fish and wildlife habitat in the lower Siuslaw watershed. The Partnership's water quality and quantity monitoring program was completed September 30, 2012, and included a Surface- and Groundwater Monitoring Program to protect the North Florence Sole Source Dunal Aquifer and to protect and improve water quality in Munsel and Ackerley Creeks and the Siuslaw River, classified as Water Quality Limited under the Clean Water Act and on the state's 303(d) list of Impaired Water Bodies.

At the end of the Partnership project, the City and its partners have collected, analyzed, and reported on two years of data on groundwater and surface water levels, flow, and quality. These data make a significant contribution to the local, state, and federal knowledge base about baseline conditions and issues in this highly sensitive urban environment. Through this Partnership, the City and its partners have also gained tools, such as groundwater monitoring wells, stream flow gauges, temperature sondes, and hand-held measuring devices, and training in data collection, analysis, and reporting. The City is also a part of the Oregon Department of Environmental Quality's Volunteer Monitoring Program through which the groundwater and surface water data are entered into state and federal databases. The Partnership project operated under an EPA-approved Quality Assurance Project Plan (QAPP). Sixteen groundwater "test wells" are installed throughout the aquifer to monitor flow and quality; and stream gauges, sondes, and grab sampling are used in Munsel and Ackerley Creeks to monitor stream flow and water quality. The data results will be integrated with data on the estuary from the Confederated Tribes of Coos, Lower Umpqua, and Siuslaw Indians and the Siuslaw Watershed Council.

The Florence Urban Waters Surface and Groundwater Monitoring Program project will use, and build upon, all of the tools and knowledge gained in the Siuslaw Estuary Partnership, which will ensure a smooth transition to the project. This includes utilizing and modifying the approved QAPP from the Siuslaw Estuary Partnership for the QAPP for the Florence Urban Waters Surface and Groundwater Monitoring Program project.

This continued monitoring program fills a critical need in the Florence UGB. The North Florence Dunal Aquifer, designated a sole source aquifer by the EPA in 1987, is the only sole source aquifer in the State of Oregon. It encompasses the entire continuous body of sand north of the Siuslaw River and east of the Pacific Ocean, the primary discharge points for the aquifer. About 85 percent of the rain percolates into the water table. Groundwater moves rapidly and almost uniformly toward a discharge point. Multiple seeps and springs occur along the coastline and riverbank, although the aquifer discharges mostly as underflow. Few streams cross the dunal area since most rainfall quickly infiltrates to the water table which is at the surface most of the year. Where streams flow across the sand, they are hydrologically connected with the groundwater system. The 1987 EPA Sole Source Aquifer Resource Document states, "Possible sources of aquifer contamination include fuel storage tank failure, accidental spills of hazardous material, septic tank effluent, storm runoff, pesticides, and chemical fertilizers." Discharge of pharmaceutical by-products is also an environmental threat.

Historically, the Siuslaw Basin was one of the most abundant anadromous fish producers in the Pacific Northwest. Once the Oregon Coast's largest Coho-producing system next to the Columbia, the Siuslaw River is dramatically reduced in salmon production. The lower Siuslaw River watershed health is degraded and a significant amount of restoration action is needed to improve watershed conditions (Oregon Watershed Enhancement Board, 2007). The watershed is limited by all factors in aquatic/instream areas, tideland, riparian, freshwater wetlands, and upland areas. The Siuslaw River and a number of nearby waterways and lakes are classified as Water Quality Limited under the Clean Water Act and are included on the state's 303(d) list of Impaired Waterbodies by the Oregon Department of Environmental Quality. The River is failing in all these parameters: Dissolved Oxygen, Fecal Coliform, Habitat Modification, and Temperature, and potentially Alkalinity. Beneficial Uses impaired by these listed parameters include resident fish and aquatic life; salmonid fish spawning and rearing; anadromous fish passage; trout rearing and migration; and shellfish growing. DEQ is currently developing the Total Maximum Daily Load for the Mid-Coast Basin.

As reported in monthly and annual monitoring reports on www.SiuslawWaters.org, the City has identified some contamination threats in both surface water and groundwater, including *E. coli*, coliform bacteria, caffeine, and elevated nitrate levels. Caffeine clearly indicates human impact on water quality. The City is working with its partner agencies to problem solve these findings. The City and its partners see the need to continue the monitoring program for at least two more years in order to get a better sense of the trends, beyond the data being collected now. At the same time, coho salmon, a threatened species, have been observed spawning in both creeks and City staff members are impressed by the numbers of fish they are seeing. The Confederated Tribes and the Watershed Council, partners in both the current project and the proposed project, are sharing data on water quality in the estuary in order to begin to identify associated trends; the additional two years of monitoring will better enable these partners to start to identify and address urban impacts on the estuary.

i. Relevance to Community Priorities

The Water Monitoring Program for the Sole Source Aquifer is top City Council Goal for 2012 and has been a top Council Goal since 2009. The City's long range Comprehensive Plan contains numerous policies related to protecting water quality in the aquifer. Public participation in the Siuslaw Estuary Partnership and the Surface and Groundwater Monitoring Program has been strong. Since 2010, over 240 members of the public attended the three Open House presentations and submitted positive feedback on the products. The 14-member Community Stakeholder Group and the 7-member Elected Official Stakeholder Group continue to be actively involved. The results of the Siuslaw Estuary Partnership Water Monitoring Program are posted to the project web site: www.SiuslawWaters.org and a link to that web site is provided on the City of Florence web site. With the Urban Waters grant, the City has added a page to the Public Works web site to post the progress and results of the Florence Urban Waters Surface and Groundwater Monitoring Program. It will also include contact information for the public.

ii. Success Potential/Feasibility

The City and its partners are well-positioned to proceed with this project because it is a continuation of partnerships that have already been formed and tasks that have already been undertaken; and it uses tools and training obtained in the previous EPA project. The Florence Urban Waters project has an excellent chance for success for these reasons and because it bases inter-governmental cooperation and actions on scientific data collected in accordance with a carefully thought-out approach to data collection, analysis, and reporting; and recognizes the hydrologic inter-connectedness of surface and groundwater in the aquifer. The additional two-years of data collected and analyzed as a result of this grant project will position the project partners to better understand water quality and quantity conditions and trends; and thus, enable them to be better able to identify and respond to threats. These partners have been working closely together and collaborating on the project since September 2009. The groundwater test wells and stream gauges and data loggers have been purchased and installed; data gathering and analysis regimes are already established; and EPA has already approved the Quality Assurance Project Plan for the Siuslaw Estuary Partnership, which this QAPP is based.

4. Project/Task Description

Project Objectives

a. **<u>Water Quality and Quantity Protection</u>**: The project will develop and implement a Surface- and Groundwater Monitoring Program. The Monitoring Program will conduct an on-going monitoring program; identify sources of contamination; take appropriate corrective action where problems exist; quantify groundwater flow and water table fluctuation within the aquifer; water table fluctuation; and determine and monitor flow patterns (hydrographs) in the surface streams.

Long-term outcomes are land use and water management policies and practices that maintain and protect rearing, migrating, and spawning habitat for resident and anadromous fish, and habitat for birds, mammals, amphibians and reptiles; conversion of rural lands to urban densities that do not impair water quality or result in dysfunctional stream conditions; enhanced floodplain functions and inter-connected wetlands and floodplain; and on-going surface and groundwater quality monitoring and remedial action to prevent contamination. Ultimately, the natural resource economy will be reinvigorated. People will be drawn to the area with a renewed appreciation for its rich and complex ecosystem; and the area will be a model for other small coastal cities faced with growth pressures.

4.1 Work Element Tasks

This QAPP shall cover work elements of Florence Urban Waters project and shall complete the following major tasks and activities at the estimated timeline:

Table 4-1: Activities, Target Completion Dates, and Deliverables

Activities	Start	Target Completion	Deliverables
1) Prepare a QAPP	10/1/12	12/20/12	Draft QAPP
2) Review and Approval of QAPP	12/20/12	2/1/2013	Review and Approval Memo from EPA
3) Develop scientific-based standard protocols	12/20/12	3/1/2013	Final QAPP
4) Collect baseline data	12/1/2012	9/30/2014	Technical Memorandum: Report on Baseline Data for Groundwater, Estuary, and Munsel and Ackerley Creeks
5) Identify existing contamination and source and pursue corrective actions with appropriate state agency(ies).	12/1/2012	9/30/2014, if and when indicated	Technical Memoranda: Report on Existing Contamination and Remedial Actions Taken and Planned
6) Identify contamination threats and source and plan corrective actions.	6/1/2013	9/30/2014	Technical Memorandum: Report on Contamination Threats and Remedial Actions Analyzed and Planned
7) Adjust monitoring program as needed and collect updated data and analyze results	1/1/2013	9/30/2014, if and when indicated	Amendments to QAPP
8) Establish routine monitoring program for surface and groundwater	9/1/2014	9/30/2014	Final Report on Monitoring Program (combining all Technical Memoranda and including plan for on-going program)

4.1.1. Primary Data Collection Activities:

Primary data collection activities for the project involve three scenarios:

Scenario #1: Groundwater (Dunal aquifer)
Scenario #2: Creeks
Scenario #3: The Estuary

4.1.1.1 Scenario #1: Groundwater (Aquifer)

It is the City's goal to maintain and protect a sustainable drinking water resource, from water quality and water quantity perspectives. The City is interested in protecting its current drinking water supply and protecting future water supplies within all portions of the Dunal Aquifer. The key elements of a groundwater protection program are:

- Identification of potential sources of groundwater contamination
- Implementation of control strategies (land use planning, zoning, ordinances) to help prevent releases that could degrade groundwater quality
- Periodic groundwater monitoring to characterize natural conditions and ensure that unacceptable contaminants are not affecting the use of the water for drinking

4.1.1.1.1 Scenario I Tasks:

I. Collect water samples for water quality. Wells have been placed up- and down-gradient in various land use areas (residential, commercial/industrial, transportation corridors, golf courses, etc.) and tailor analysis to dominant land use of monitored area and Potential Contaminant Source Inventory.

   Residential wells: monitor monthly for nitrate, conductivity, pH, ORP, temperature, and DO; bi-monthly for coliform; quarterly for caffeine; and annually for total phosphates, total organic carbon, alkalinity and common ions. Adjustments will be made to the monitoring frequency based on findings.

   Commercial/Industrial wells: monitor monthly for coliform, conductivity, pH, ORP, temperature, and DO; quarterly for nitrate; semi-annually for caffeine; and annually for alkalinity, common ions, VOC's, IOC's, Glyphosate and 2, 4 D. Adjustments will be made to the monitoring frequency based on findings.

II. Analyze the analytical data and determine contaminant problems and possible contaminant threats.

III. Identify the probable source(s) of the contamination and work with appropriate state agency to implement source control actions, if necessary, to mitigate or eliminate the source(s).

IV. Notify and work with the appropriate regulatory agencies that will determine whether the impacted water poses a health hazard and take necessary steps to protect public health and safety.

4.1.1.1.2 Monitoring Schedule:

The following schedule, as revised through mutual agreement with EPA and the project partners, will provide a representative and ongoing view of water quality and groundwater flow direction within the CITY and the CITY's urban growth boundary ("UGB"):

- Water Level Monitoring. The CITY will monitor the wells for static water levels semi-annually. Monitoring may also include periods following major storm events.

- Chemical Monitoring. Monitoring will be consistent with chemical monitoring requirements under the Safe Drinking Water Act at all wells to identify the seasonal trends and variability. The chemical constituents will be monitored as part of a comprehensive groundwater monitoring program.

i) Residential wells: monitor monthly for nitrate, conductivity, pH, ORP, temperature, and DO; bi-monthly for coliform; quarterly for caffeine; and annually for total phosphates, total organic carbon, alkalinity and common ions. Adjustments will be made to the monitoring frequency based on findings.

   Commercial/Industrial wells: monitor monthly for coliform, conductivity, pH, ORP, temperature, and DO; quarterly for nitrate; semi-annually for caffeine; and annually for alkalinity, common ions, VOC's, IOC's, Glyphosate and 2, 4 D. Adjustments will be made to the monitoring frequency based on findings.

ii) In all testing, follow the drinking water standards protocols in 40CFR141 and /or the 40CFR136 analytical methods. The frequency of testing may be reduced if the results are below drinking water standards.

iii) Confer with the Oregon Department of Environmental Quality (DEQ) and other appropriate parties to identify surface water sources to be tested. The CITY will test water from the identified sources for water quality parameters, including, coliform bacteria, pH, conductivity, nitrate, phosphorous, common ions, total organic carbon, and oxidation state.

- Microbial Monitoring. Conduct microbial monitoring for coliform bacteria and e-coli, following standard protocols for sampling, handling, etc., on a bi-monthly basis at all residential wells and monthly for commercial/industrial wells to further identify the seasonal trends and variability. Baseline is absent or non-detect for groundwater.

4.1.1.2 Scenario #2: Creeks

Munsel Lake occurs on the eastern boundary of the Florence Dunal Aquifer and is in hydraulic connection with the aquifer. The extent of this connection has a significant impact on groundwater flow to the west and south. In order to quantify the influence of the lake on groundwater, stream flow will be monitored in two streams. The first stream will be Ackerley Creek, which feeds into Munsel Lake from Ackerley and Clear Lake to the north. Although not the only feed into Munsel Lake, Ackerley Creek is the main inflow of water into Munsel Lake and is perennial in nature. The second stream to be monitored will be Munsel Creek. Three points on Munsel Creek will be monitored for stream flow, including just below Munsel Lake, to supply a measurement of the outflow from the lake.

Stream flow will be monitored using a pressure transducer with staff gage and a flowmeter.

4.1.1.2.1 Scenario 2 Tasks

I. Collect grab seep samples and outflows of surface water in Heceta Beach area where quality concerns have arisen if this is not already done by the Oregon Beach Monitoring Program;

II. Monitor stream flow at three points in Munsel Creek, and at one point in Ackerley Creek to determine and monitor flow patterns (hydrographs); a flow meter will be used monthly at all sites to measure stream flow, and pressure transducers at three sites will record water level data continuously, which will be used later to calculate stream flow.

III. Install three continuous three data loggers in Munsel Creek and one in Ackerley Creek to collect temperature data and use hand held devices and/or grab sampling to assess and monitor turbidity, conductivity, temperature, DO, pH, and oil/grease (total petroleum hydrocarbons (TPH)), zinc, and copper, VOC's, IOC's, glyphosate/2,4-D, common ions, total organic carbon, alkalinity, and caffeine. Collect stream samples monthly for turbidity, temperature, conductivity, DO, pH and total coliform/*E. coli*,; semi-annually for caffeine and nitrate; semi-annually for lead at only one site which is below the gun club; and for zinc and copper at the sampling site adjacent to the Public Works Department on Spruce Street; and annually at all stream sites for total phosphate, alkalinity, total organic carbon, common ions, TPH, VOC's, IOC's, and glyphosate/ 2, 4-D. Coordinate these sampling activities with U.S. Geological Survey, ODFW, OWRD, USFS, DEQ, and the Confederated Tribes.

4.1.1.2.2 Schedule

- Water level data will be collected continuously using a pressure transducer at two locations in Munsel Creek and one location in Ackerley Creek, which would capture changes in stream flow from a rain event. Data will be uploaded and stored electronically on a monthly basis, and the data will be used to determine stream flow. Stream flow also will be collected monthly at all sites using a flow meter.
- The data loggers will be programmed to measure temperature at one-hour intervals. Data will be uploaded and stored electronically on a monthly basis. This schedule may be modified during storm events.

4.1.1.3 Scenario #3: Estuary

4.1.1.3.1 Scenario 3 Tasks

- The City will include water quality data obtained by the Tribes in its report on baseline data (see Secondary Data).

4.1.2 Secondary Data Collection

4.1.2.1 Marine

Collate and evaluate marine testing data collected by OBMP for bacteria in the Heceta Beach area. Document established minimum QC criteria for data acceptance for this project for microbiological data.

4.1.2.2 North Fork

Continue to monitor the Tribes' monitoring using continuous data loggers for temperature, turbidity, DO, salinity, and pH; and bacteria sampling. Document established minimum QC criteria for data acceptance for this project for conventional analyses.

4.1.2.3 Estuary

Continue to monitor data conducted by: Army Corps of Engineers for sedimentation; Watershed Council (8 locations, grab sampling); and Tribes' monitoring with continuous data loggers for temperature, turbidity, DO, salinity, and pH; and bacteria sampling. Document established minimum QC criteria for data acceptance for this project for these analyses. The data will be collected and analyzed in accordance with the Tribes' EPA-approved QAPP. The City will received these data and incorporate them into its Water Quality Reports.

5. Data Quality Objectives

Data quality objectives (DQOs) are related to the specific investigation activities related to the water sampling activities planned for the Florence Urban Waters Project. DQOs are defined as the qualitative and quantitative statements that characterize the data needed to support a particular data usage. Therefore, DQOs for data collection and analysis are based on the end use of the data. All data will be gathered and handled in accordance with the USGS National Field Manual for the Collection of Water-Quality Data.

The data collected will be used to assess water quality trends, identify problem areas, calculate pollution loadings, and support overall water quality assessment in the Siuslaw River Watershed.

Objectives

Scenario #1 Groundwater, Objective:
To detect and address threats to water quality in the North Florence Sole Source Dunal Aquifer.

To meet the above objective, groundwater monitoring wells must be constructed in a manner to be able to collect representative samples. All wells have been constructed according to the Oregon Department of Water Resources guidelines for the construction of monitoring wells.

To obtain representative groundwater samples from the properly constructed monitoring wells. The sampling protocol for the monitoring wells is described below.

The laboratory analytical methods that will be used in this study, their detection limits and precision are given in Tables 4.1 and 4.2.

Static water level measurements within the monitoring wells will be conducted manually, at a minimum quarterly during the study. Additional contaminants may be monitored as indicated, e.g., lead near the gun range adjacent to Munsel Creek. Measurements will be accomplished by lowering a previously disinfected probe through the observation port and measuring the distance from ground surface to water level to the nearest 0.1 foot or 0.01 foot if feasible for manual measuring and recording.

Scenario #2 Creeks, Objective:
To assess and monitor water flow patterns between the Creeks and Lakes and the aquifer; evaluate the hydraulic connection between the Lakes and aquifer, and to detect and address threats to water quality in Munsel Creek and Ackerley Creek to protect fish and wildlife habitat.

Scenario #3 Estuary, Objective:
To obtain water quality data in order to assess the contributions from stormwater runoff to the estuary.

5.1 Project Quality Objectives

The quality assurance objectives for this project are to develop and implement procedures that will ensure the collection of representative physical and chemical data of known and acceptable quality. Tables 5-1 and 5-2 summarize the quality assurance objectives for each type of water analysis in accordance with protocols for water analyses. The data quality parameters used to assess the acceptability of the data are precision, accuracy, representativeness, comparability, and completeness. These parameters are discussed below.

In order to identify and mitigate potential risks to water quality, the City, in consultation with the Oregon Department of Human Services' Drinking Water Program and the DEQ, will work together to establish chemical and microbial concentration action levels that, if exceeded, will result in response actions. Below are typical contaminants and their corresponding action levels.

Table 5: Typical Contaminants and Action Levels

Contaminant	Trigger Concentration[1]	Health Concern
E. coli	Presence	Acute response possible
Nitrate	5.0 mg/L[2]	Acute response possible
Phosphorous	0.1 mg/L	Nutrient
Fuels, solvents, etc.	Detection level	Chronic contaminant
Pesticides	Detection level	Chronic contaminant
Caffeine	Presence	Indicator
Arsenic, heavy metals	Half the MCL	Chronic contaminant

1 Source: E. coli, Safe Drinking Water Act MCL; phosphorous, DEQ adopted Clean Water Act Criteria, Fuels, Solvents, Pesticides, DHS monitoring requirements for Public Water Systems. If referenced agencies change the established trigger concentrations, new standards shall apply unless otherwise agreed to by the partners.
2. Trigger concentration to be 5 milligrams per liter (DHS standards for quarterly monitoring) unless otherwise determined by the partners based on analytical results of baseline monitoring. Since the naturally occurring nitrate level(s) is not known, a monitoring period of the groundwater for one year will be completed. A background or baseline level will be established through the testing program for groundwater in the areas outside of developed areas. Generally speaking, this would be areas north of the current Florence UGB.

5.2 Measurement Performance Criteria

Precision

Precision measures the reproducibility of measurements under a given set of conditions. Analytical precision is measured through matrix spike/matrix spike duplicate (MS/MSD) samples for organic analysis and through laboratory duplicate samples for inorganic analyses. Analytical precision measurements will be carried on project specific samples at a minimum frequency of 1 per laboratory analysis group or 1 in 20 samples, whichever is more frequent, per matrix analyzed. Laboratory precision will be evaluated against quantitative relative percent difference (RPD) performance criteria. General precision levels are presented in Table 5-1.

Field precision will be evaluated by the collection of blind field duplicates. One field duplicate per matrix will be collected. Currently, no performance criteria have been established for field duplicates. Field duplicate precision will therefore be screened against a RPD of 75 percent for water samples. However, no data will be qualified based solely on field duplicate precision. Precision measurements can be affected by the nearness of a chemical concentration to the method detection limit, where the percent error (expressed as either %RSD or RPD) increases. The equations used to express precision are as follows:

$$RPD = \frac{C1 - C2}{((C1 + C2)/2)} \times 100$$

Where:

RPD = relative percent difference
C1 = larger of the two observed values
C2 = smaller of the two observed values

%RSD = (SD/ Dave) x 100

Where:

SD = (*D - Dave* 1)/(n - 1)
D = sample value
Dave = average sample value
n = number of samples

Table 5-1 Quality Assurance Objectives						
Analyte	**Units**	**Precision**	**Accuracy**	**Completeness**	**EPA Method***	**Holding Times**
IOCs:Total and Dissolved Metals Cd, Cr, Cu, Pb, Hg, Ni, Zn)	mg/L	+/-20%	+/- 25%	90%		6 Months, 28 days for Hg
VOCs	mg/L	+/-20%	+/- 30%	90%		14 Days
SOCs	mg/L	+/-20%	+/- 30%	90%		7 days to extract / 40 days from collection to analysis
Alkalinity	mg/L as CaCO3	+/-20%	+/- 30%	90%		14 days
pH	pH units	+/-20%	+/- 30%	90%		Immediate
Fecal Coliform and *E. Coli*	mg/L	+/-20%	+/- 30%	90%		30 Hours for groundwater; 24 hours or less for creeks and storm runoff
Fecal Streptococcus and Enterococci	mg/L	+/-20%	+/- 30%	90%		8 Hours
Cyanide	mg/L	+/-20%	+/- 30%	90%		14 Days
Fluoride	mg/L	+/-20%	+/- 30%	90%		28 Days
Nitrate + Nitrite	mg/L	+/-20%	+/- 30%	90%		28 Days
Nitrate-N	mg/L	+/-20%	+/- 30%	90%		48 Hours
Nitrite-N	mg/L	+/-20%	+/- 30%	90%		48 Hours
Total Kjeldahl Nitrogen	mg/L	+/-20%	+/- 30%	90%		28 Days
Total Phosphorus	mg/L	+/-20%	+/- 30%	90%		28 Days
Total Organic Carbon	mg/L	+/-20%	+/- 30%	90%		28 Days
Total Suspended Solids	mg/L	+/-20%	+/- 30%	90%		7 Days
Ca, Mg, Na, K	mg/L	+/-20%	+/- 30%	90%		6 Months
SiO2	mg/L	+/-20%	+/- 30%	90%		28 Days
SO4, Cl,	mg/L	+/-20%	+/- 30%	90%		28 Days

Table 5-1
Quality Assurance Objectives

Analyte	Units	Precision	Accuracy	Completeness	EPA Method*	Holding Times
Oil & Grease, Total (HEM)	mg/L	+/-20%	+/- 30%	90%		28 Days
Caffeine	ng/L	+/-20%	+/- 30%	90%		14 Days
pH[2]	pH units	TBD	TBD	TBD	Data Logger	
Temperature[2]	°C	TBD	TBD	TBD	Data Logger	
DO[2]	mg/L	TBD	TBD	TBD	Data Logger	
Turbidity[2]	NTU	TBD	TBD	TBD	turbidimeter	

*See Table 5.2 for EPA Method and Reporting Limits for each analyte.
1 = For those analyses on which sample spiking cannot be performed, QC reference standards will be analyzed to determine accuracy.
2 = Environmental parameters that will be collected using a continuous data logger in each of Ackerley and Munsel Creeks
TBD = These values will be determined on site after data logger installation

Table 5-2. EPA Methods and Reporting Limits for Each Analyte

MISCELLANEOUS PARAMETERS

Analyte	Method			Reporting Limit		Units	
Coliform, E. Coli (CF-MPN)	SM 9223 B			1		MPN/100ml	
Fecal Coliform	SM 9221 C, E			2		MPN/100ml	
Fecal Streptococci	SM 9230 B			2		MPN/100 ml	
Enterococci	SM 9230 C			1		CFU/100 ml	
Nitrate-N	SM 4500-NO3 D			1.0		mg/L	
Total Kjeldahl Nitrogen	EPA 351.2			0.1		mg/L	
Phosphorus, Total	EPA 365.3			0.1		mg/L	
Total Organic Carbon	SM 5310 C	subcontracted		0.1		mg/L	
Alkalinity (as $CaCO_3$)	SM 2320 B			2		mg/L	
pH	SM 4500-H+B			0.1		pH units	
SiO2	SM 4500 SiO2 C			1		mg/L	
Total Suspended Solids	SM 2540 D			4		mg/L	
Common Ions:							
Bicarbonate (as $CaCO_3$)	SM 2320 B			2		mg/L	
Calcium	SM 3111 B			1.0		mg/L	
Chloride	EPA 300.0	subcontracted		1.0		mg/L	
Iron	SM 3111 B			0.025		mg/L	
Magnesium	SM 3111 B			1.0		mg/L	
Manganese	SM 3111 B			0.005		mg/L	
Potassium	SM 3111 B			0.05		mg/L	
Sodium	SM 3111 B			1.0		mg/L	
Sulfate	EPA 300.0	subcontracted		0.5		mg/L	
Oil & Grease, Total (HEM)	EPA 1664A			5.0		mg/L	
Zinc	EPA 200.8	subcontracted		0.001		mg/L	
Copper	EPA 200.8	subcontracted		0.0005		mg/L	

Table 5-2. EPA Methods and Reporting Limits for Each Analyte

Analyte	Method			Reporting Limit		Units	
Lead	EPA 200.8	subcontracted		0.0001		mg/L	

PUBLIC WATER SYSTEMS
INORGANIC CHEMICALS (IOCs)

Analyte	Method		PWS MCL	Reporting Limit		Units	
Antimony	SM 3113 B		0.006	0.0030		mg/L	
Arsenic	SM 3113 B		0.01	0.0040		mg/L	
Barium	SM 3113 B		2	0.100		mg/L	
Beryllium	SM 3113 B		0.004	0.0002		mg/L	
Cadmium	SM 3113 B		0.005	0.0005		mg/L	
Chromium	SM 3113 B		0.1	0.0030		mg/L	
Cyanide	SM 4500-CN F		0.2	0.1		mg/L	
Fluoride	SM 4500-F C		4	0.1		mg/L	
Mercury	SM 3112 B		0.002	0.0002		mg/L	
Nickel	SM 3113 B		0.1	0.0050		mg/L	
Nitrate-N	SM 4500-NO3 D		10	1.0		mg/L	
Nitrite-N	SM 4500-NO3 E		1	0.1		mg/L	
Nitrate+Nitrite-N	EPA 353.2		10	0.05		mg/L	
Selenium	SM 3113 B		0.05	0.0050		mg/L	
Sodium	SM 3111 B		20	5.0		mg/L	
Thallium	EPA 200.9		0.002	0.0010		mg/L	

PUBLIC WATER SYSTEMS SYNTHETIC ORGANIC CHEMICALS - PARTIAL
subcontracted

Analyte	Method		PWS MCL	Reporting Limit		Units	
2,4,5-TP (Silvex)	EPA 515.3		0.05	0.005		mg/L	
2,4-D	EPA 515.3		0.07	0.005		mg/L	
Dalapon	EPA 515.3		0.2	0.005		mg/L	
Dicamba	EPA 515.3		N/A	0.005		mg/L	
Dinoseb	EPA 515.3		0.007	0.0005		mg/L	
Glyphosate	EPA 547		0.7	0.05		mg/L	
Pentachlorophenol	EPA 515.3		0.001	0.00008		mg/L	
Picloram	EPA 515.3		0.5	0.005		mg/L	

PUBLIC WATER SYSTEMS
VOLATILE ORGANIC COMPOUNDS - REGULATED

Analyte	Method		PWS MCL	Reporting Limit		Units	
1,1,1-Trichloroethane	EPA 524.2		0.2	0.0005		mg/L	
1,1,2-Trichloroethane	EPA 524.2		0.005	0.0005		mg/L	

Table 5-2. EPA Methods and Reporting Limits for Each Analyte

Analyte	Method		PWS MCL	Reporting Limit		Units	
1,1-Dichloroethylene	EPA 524.2		0.007	0.0005		mg/L	
1,2,4-Trichlorobenzene	EPA 524.2		0.07	0.0005		mg/L	
1,2-Dichloroethane	EPA 524.2		0.005	0.0005		mg/L	
1,2-Dichloropropane	EPA 524.2		0.005	0.0005		mg/L	
Benzene	EPA 524.2		0.005	0.0005		mg/L	
Carbon Tetrachloride	EPA 524.2		0.005	0.0005		mg/L	
Chlorobenzene	EPA 524.2		0.1	0.0005		mg/L	
cis-1,2-Dichloroethylene	EPA 524.2		0.07	0.0005		mg/L	
Dichloromethane	EPA 524.2		0.005	0.0005		mg/L	
Ethylbenzene	EPA 524.2		0.7	0.0005		mg/L	
o-Dichlorobenzene	EPA 524.2		0.6	0.0005		mg/L	
p-Dichlorobenzene	EPA 524.2		0.075	0.0005		mg/L	
Styrene	EPA 524.2		0.1	0.0005		mg/L	
Tetrachloroethylene	EPA 524.2		0.005	0.0005		mg/L	
Toluene	EPA 524.2		1	0.0005		mg/L	
trans-1,2-Dichloroethylene	EPA 524.2		0.1	0.0005		mg/L	
Trichloroethylene	EPA 524.2		0.005	0.0005		mg/L	
Vinyl Chloride	EPA 524.2		0.002	0.0005		mg/L	
Xylenes	EPA 524.2		10	0.0005		mg/L	

PUBLIC WATER SYSTEMS
VOLATILE ORGANIC COMPOUNDS - UNREGULATED

Analyte	Method			Reporting Limit		Units	
1,1-Dichloroethane	EPA 524.2			0.0005		mg/L	
1,1-Dichloropropene	EPA 524.2			0.0005		mg/L	
1,1,1,2-Tetrachloroethane	EPA 524.2			0.0005		mg/L	
1,1,2,2-Tetrachloroethane	EPA 524.2			0.0005		mg/L	
1,2,3-Trichloropropane	EPA 524.2			0.0005		mg/L	
1,3-Dichloropropane	EPA 524.2			0.0005		mg/L	
cis-1,3-Dichloropropene	EPA 524.2			0.0005		mg/L	
trans-1,3-Dichloropropene	EPA 524.2			0.0005		mg/L	
2,2-Dichloropropane	EPA 524.2			0.0005		mg/L	
Bromobenzene	EPA 524.2			0.0005		mg/L	
Bromodichloromethane	EPA 524.2			0.0005		mg/L	
Bromoform	EPA 524.2			0.0005		mg/L	
Bromomethane	EPA 524.2			0.0005		mg/L	
Chlorodibromomethane	EPA 524.2			0.0005		mg/L	
Chloroethane	EPA 524.2			0.0005		mg/L	
Chloroform	EPA 524.2			0.0005		mg/L	
Chloromethane	EPA 524.2			0.0005		mg/L	
Dibromomethane	EPA 524.2			0.0005		mg/L	
m-Dichlorobenzene	EPA 524.2			0.0005		mg/L	
o-Chlorotoluene	EPA 524.2			0.0005		mg/L	
p-Chlorotoluene	EPA 524.2			0.0005		mg/L	

Table 5-2. EPA Methods and Reporting Limits for Each Analyte

ENDOCRINE DISRUPTOR CHEMICALS (EDC) / PHARMACEUTICAL & PERSONAL CARE PRODUCTS (PPCP) subcontracted

Analyte	Method			Reporting Limit		Units	
17-alpha-estradiol	EPA 1694M			1		ng/L	
17-alpha-ethynylestradiol	EPA 1694M			2		ng/L	
17-beta-estradiol	EPA 1694M			2		ng/L	
Bisphenol A	EPA 1694M			10		ng/L	
Diethylstillbestrol	EPA 1694M			2		ng/L	
Estriol	EPA 1694M			1		ng/L	
Estrone	EPA 1694M			1		ng/L	
Fluoxetine	EPA 1694M			1		ng/L	
Acetominophen	EPA 1694M			1		ng/L	
Androstenedione	EPA 1694M			10		ng/L	
Atrazine	EPA 1694M			1		ng/L	
Caffeine	EPA 1694M			5		ng/L	
Carbamazepine	EPA 1694M			1		ng/L	
DEET	EPA 1694M			5		ng/L	
Diazepam	EPA 1694M			1		ng/L	
Hydrocodone	EPA 1694M			1		ng/L	
Meprobamate	EPA 1694M			5		ng/L	
Oxybenzone	EPA 1694M			2		ng/L	
Pentoxifyline	EPA 1694M			1		ng/L	
Progesterone	EPA 1694M			10		ng/L	
Sulfamethoxazole	EPA 1694M			1		ng/L	
Testosterone	EPA 1694M			10		ng/L	
Trimethoprim	EPA 1694M			5		ng/L	
Methadone	EPA 1694M			5		ng/L	
Diclofenac	EPA 1694M			2		ng/L	
Dilantin	EPA 1694M			5		ng/L	
Gemfibrozil	EPA 1694M			1		ng/L	
Ibuprofen	EPA 1694M			5		ng/L	
Naproxen	EPA 1694M			1		ng/L	
Iopromide	EPA 1694M			10		ng/L	
Triclosan	EPA 1694M			10		ng/L	
Salicylic Acid	EPA 1694M			10		ng/L	

Accuracy

Accuracy is an expression of the degree to which a measured or computed value represents the true value. Field accuracy is controlled by adherence to sample collection procedures outlined in the monitoring plan. To assess the potential for cross contamination in the field, one rinseate blank from the sampling device will be collected.

Analytical accuracy may be assessed by analyzing “spiked” samples with known standards (surrogates, laboratory control samples, and/or matrix spike) and measuring the percent recovery. Accuracy measurements on matrix spike samples will be carried out at a minimum frequency of one in 20 samples per matrix analyzed. Surrogate recoveries will be determined for every sample analyzed for organics.

Laboratory accuracy will be evaluated against quantitative matrix spike and surrogate spike recovery performance criteria as presented in the tables. Accuracy can be expressed as a percentage of the true or reference value, or as a percent recovery in those analyses where reference materials are not available and spiked samples are analyzed. The equation used to express accuracy is as follows:

$$\%R = 100\% \times (S-U)/Csa$$

Where:
%R = percent recovery
S = measured concentration in the spiked aliquot
U = measured concentration in the unspiked aliquot
Csa = actual concentration of spike added

Representativeness

Representativeness expresses the degree to which data accurately and precisely represent an environmental condition. For this program, the selected analyte has been identified as a constituent of concern based on numerous studies indicating the typical pollutants associated with groundwater.

Critical to the issue of representativeness is the sampling procedure. Samples must be collected in a manner that they reflect the sampling target. Individual sampling protocols are described below.

Representative water quality data had previously been obtained from other groundwater studies conducted by the EPA and USGS.

Comparability

Comparability expresses the confidence with which one data set can be evaluated in relation to another data set. For this monitoring program, comparability of data will be established through the use of standard analytical methodologies and reporting formats and of common National Institute of Standard and Technology or other traceable calibration and reference materials. Data will be used to evaluate trends over time and evaluate areas that appear to be contributing high pollution loads to the aquifer, the lakes, creeks, and the estuary.

Completeness

Completeness is a measure of the amount of data that is determined to be valid in proportion to the amount of data collected. Completeness will be calculated as follows:

C = (Number of acceptable data points) x100
(Total number of data points)

The data quality objective for completeness for all components of this project is 90 percent. Data that have been qualified as estimated because the quality control criteria were not met will be considered valid for the purpose of assessing completeness. Data that have been qualified as rejected will not be considered valid for the purpose of assessing completeness.

6. Documentation and Records

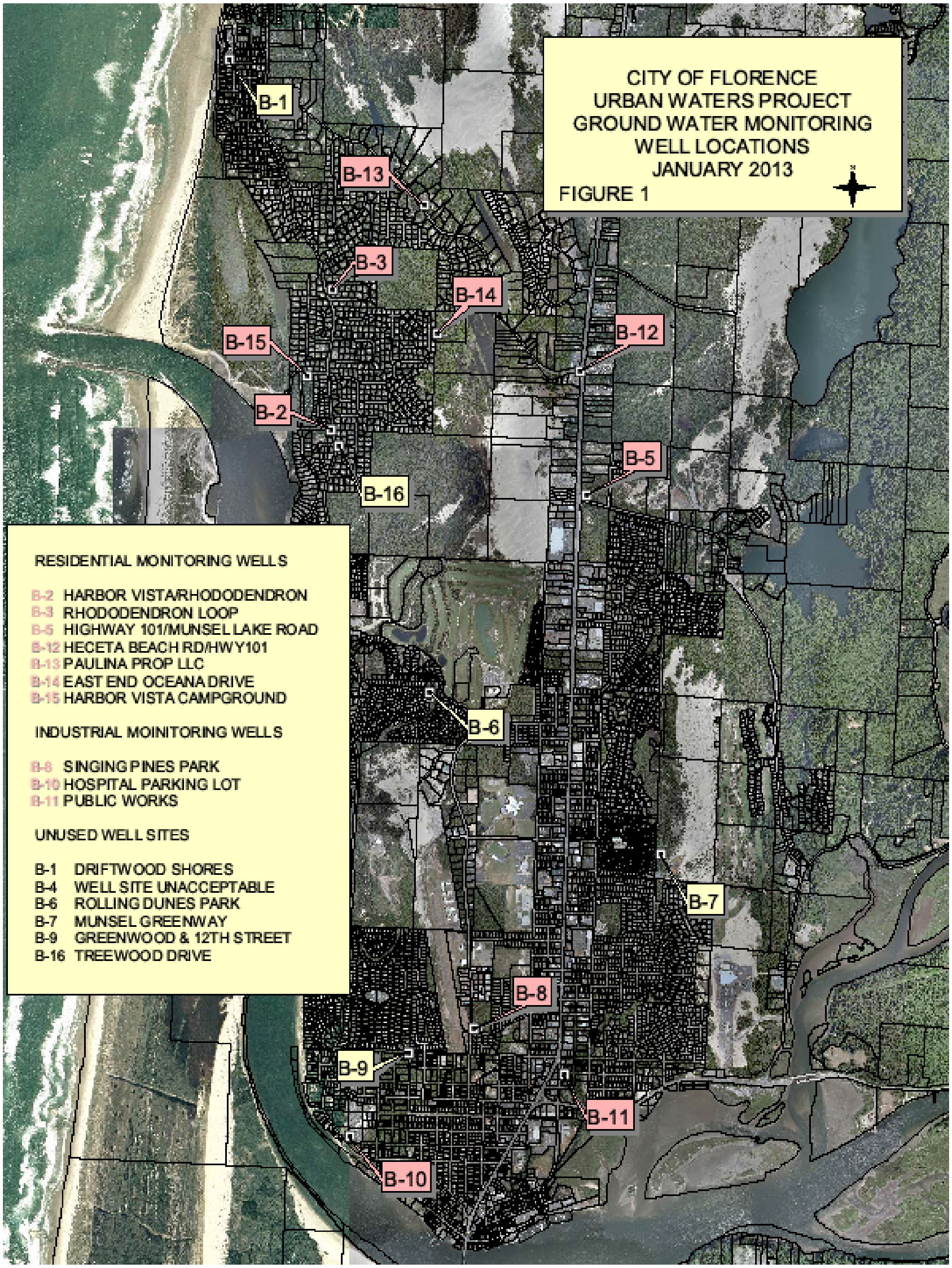
The data reports will be stored in digital files on City's local area network as well as in EPA files. The data will be retained in accordance with the public records retention requirements in State law and the Cooperative Agreement with EPA. The reports will be posted to the staff intranet site and stored in project binders. The data will be used in final reports. Final results will be posted to the project web page for public review.

B. Measurement Data Acquisition

7. Sampling Process Design

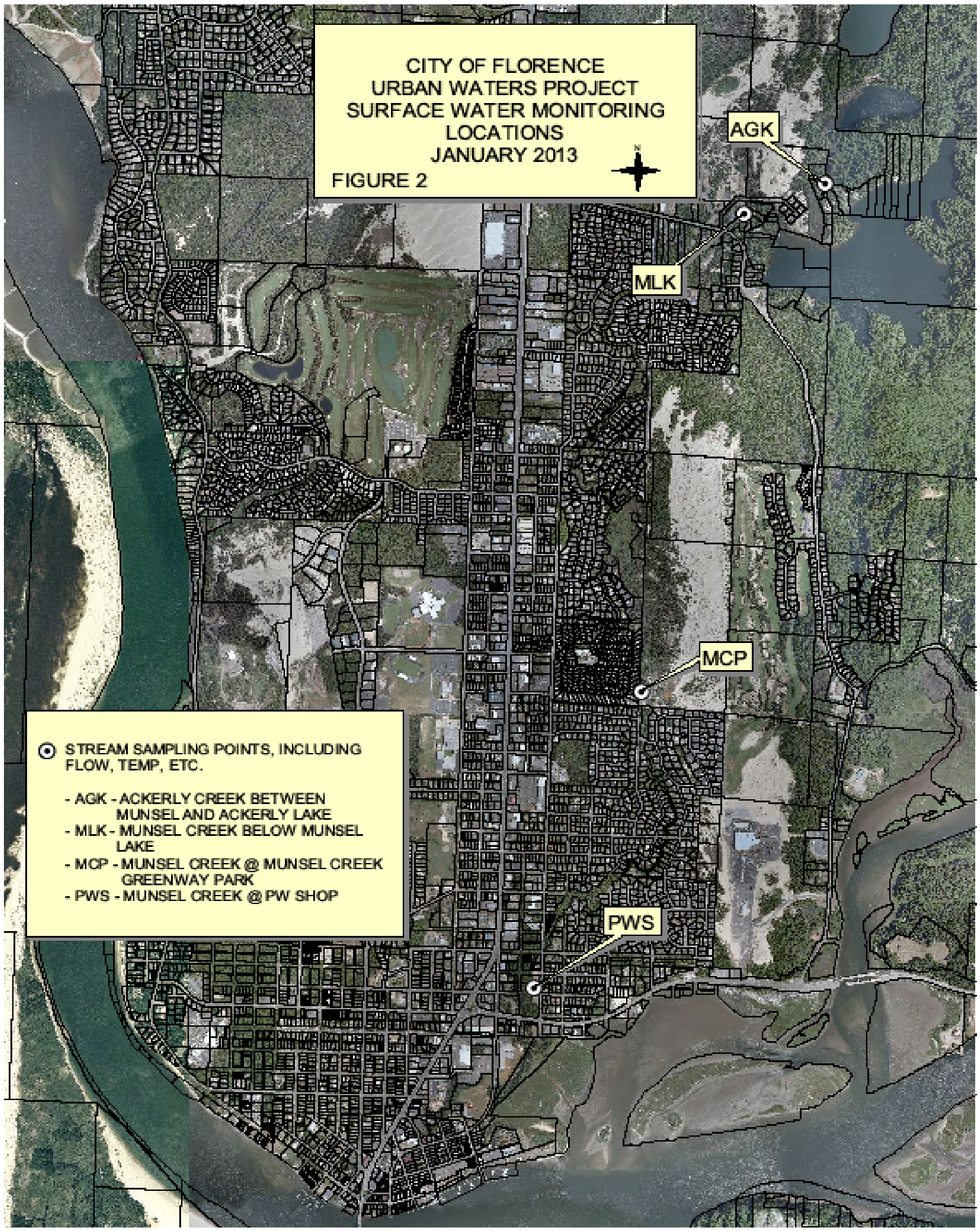
The Florence Urban Waters Groundwater and Surface Water Monitoring Project is an extension of the EPA-funded project Siuslaw Estuary Partnership (see EPA Cooperative Agreement #WC-00J04801-0; www.SiuslawWaters.org). With the groundwater and surface water data that has already been collected and in an effort to stay within the our budget for the project we have identified seven (7) groundwater wells that are influenced by residential development and three (3) groundwater wells that are influenced by commercial/industrial development at utilized in the sampling program for the Florence Urban Waters project.

The groundwater monitoring well locations are as follows (also see figure 1 below, page 20): monitoring well B-2 (Harbor Vista and Rhododendron Drive); monitoring well B-3 (Rhododendron Loop); monitoring well B-5 (Hwy 101 and Munsel Lake Road); monitoring well B-12 (Hwy 101 and Heceta Beach Road); monitoring well B-13 (Heceta Beach Road – Paulina Properties LLC); monitoring well B-14 (east end of Oceana Drive); and monitoring well B-15 (North Jetty Road – Harbor Vista Campground). Besides temperature, pH, specific conductivity, water level depth (depth to groundwater), dissolved oxygen, and oxygen reduction potential, the typical analytes to be tested include: coliform bacteria; phosphorus; total organic carbon; nitrate, alkalinity; common ions; VOC's; IOC's; glyphosate; 2,4-D; and caffeine.



The surface water portion of the project will continue to utilize the stream sampling locations that were utilized in the EPA-funded project Siuslaw Estuary Partnership. The stream sampling locations are as follows (also see figure 2 below, page 21): Ackerley Creek between Ackerley and Munsel lakes (AGK); Munsel Creek below Munsel Lake

(MLK); Munsel Creek at Munsel Creek Greenway Park (MCP); and Munsel Creek at Florence Public Works (PWS). In addition to stream temperature, flow, pH, specific conductivity, turbidity, dissolved oxygen, oxygen reduction potential, the typical analytes to be tested include: coliform bacteria; caffeine; nitrate; phosphorus; alkalinity; total organic carbon; common ions; zinc and copper (PWS site only); lead (below the gun club); VOC's; IOC's; glyphosate; 2,4-D; and grease and oil (as HEM).



Sampling procedures for this investigation will follow Oregon DEQ Lab's Field Sampling Reference Guide and are described in more detail below. Sampling procedures are designed to ensure that all samples collected are consistent with project objectives and samples are identified, handled, and transported in a manner such that data are representative of actual site conditions and that information is not lost in sample transferal. The data collected will ultimately be used in determining whether there is groundwater contamination that is a threat to the drinking water system. To meet project objectives, special consideration is given to sample procurement, sample containers, holding times and preservation, field duplicates, equipment decontamination, blanks, (rinseate and field), sample documentation, transport and storage. Trace contaminants from sources external to the sample must be minimized through the use of good sampling techniques and proper cleaning of sampling equipment that comes in contact with the material being sampled.

8. Analytical Methods Requirements

The Analytical Methods Requirements are summarized in Table 8-1.

Table 8-1 Summary of Analytical Requirements

Analyte	Vol. Req. (mL)	Container	Preservation	Filter	EPA Method*	Holding Times
Inorganic chemicals,Total and Dissolved Metals - (As, Cd, Cr, Cu, Pb, Hg, Ni, Zn)	100	250 ml poly bottle	25 drops Nitric Acid (pH<2) Cool to ≤ 6° C	No (for Total); 0.45 um filter for dissolved metals		6 Months 28 Days for Hg
Volatile Organic Compounds	25 ml	40 ml VOC vials 3 @ 40 mL, glass w/PTFE lined septum	Ascorbic acid or sodium thiosulfate, pH < 2, 1:1 HCL, store at 4° C	No		14 Days
Synthetic Organic Compounds	800	1000 ml amber jar	Ice Cool to ≤ 6° C	No		7 Days to extract, 40 Days from extraction to analysis
Alkalinity	100	1000 ml poly bottle	Ice Cool to ≤ 6° C	No		14 days
pH	100	1000 ml poly bottle	Ice Cool to ≤ 6° C	No		Immediate
Cyanide	100	500 ml poly bottle	Add NaOH to pH >12 Cool to ≤ 6° C	No		14 Days
Fluoride	100	250 ml glass or poly bottle	Cool to ≤ 6° C	No		28 Days
Fecal Coliform and *E. Coli*	75	150 ml poly bottle	Ice Cool to < 10°C	No		30 Hours for groundwater; 6-24 hours for creeks and runoff
Fecal Streptococcus and Enterococci	75	150 ml poly bottle	Ice Cool to < 10°C	No		8 Hours
Nitrate + Nitrite	100	500 ml poly bottle	12 drops sulfuric acid (pH<2)	No		28 Days

Table 8-1 Summary of Analytical Requirements						
Analyte	**Vol. Req. (mL)**	**Container**	**Preservation**	**Filter**	**EPA Method***	**Holding Times**
			Cool to ≤ 6° C			
Nitrate N	100	150 ml poly bottle	Cool to ≤ 6° C	No		48 Hours
Nitrite N	100	150 ml poly bottle	Cool to ≤ 6° C	No		48 Hours
Total Kjeldahl Nitrogen	500	500 ml poly bottle	12 drops sulfuric acid (pH<2) Cool to ≤ 6° C	No		28 Days
Total Phosphorus	50	500 ml poly bottle	Add 12 drops concentrated H2SO4 – refrigerate Cool to ≤ 6° C	No		28 Days
Total Organic Carbon	20	500 ml poly bottle	Add 12 drops concentrated H2SO4 – refrigerate Cool to ≤ 6° C	No		28 Days
Total Suspended Solids	200	500 ml poly bottle	Ice Cool to ≤ 4° C	No		7 Days
Ca, Mg, Na, K, Fe	100	250 ml poly bottle	25 drops HNO3 (pH<2) Cool to ≤ 6° C	No for total, 0.45 um filter for dissolved		6 Months
SiO2	100	250 ml poly bottle	Cool to ≤ 6° C	No		28 Days
SO4, Cl	100	250 ml poly bottle	Cool to ≤ 6° C	No for total, 0.45 um filter for dissolved		28 Days
Oil & Grease, Total (HEM)	1000	1000 ml glass jar with PTFE-lined screw cap	Ice Cool to 0-4° C	No		28 Days
Caffeine	2000	1000 ml amber glass	Cool to ≤ 6° C	No		7 Days to extract (within 48 hours is strongly encouraged), 40 Days from extraction to analysis.
pH[2]	pH units	On-site	NA	NA	Data Logger	
Temperature[2]	°C	On-site	NA	NA	Data Logger	
DO[2]	Mg/L	On-site	NA	NA	Data Logger	
Turbidity[2]	NTU	On-site	NA	NA	Turbidimeter	

*EPA Methods and Reporting Limits for Each Analyte are listed in Table 5-2.
1 = For those analyses on which sample spiking cannot be performed, QC reference standards will be analyzed to determine accuracy.
2 = Environmental parameters that will be collected using a continuous data logger in each of Ackerley and Munsel Creeks
TBD = To be determined on site after recorder installation.

9. Quality Control Requirements

9.1 Field QC Requirements

<u>All Scenarios</u>

Sample Handling
Sample collection and handling procedures are detailed in the Oregon DEQ Lab's Field Sampling Reference Guide. To control the integrity of the samples during transit to the laboratory and during hold prior to analysis, established preservation and storage measures would be taken. Table 8-1 presents sample volume, container type, preservation, and maximum holding times for the various analyses of groundwater samples.

Sample Custody Documentation
The Laboratory Standard Operating Procedures (SOP) provided by the contract analytical laboratory will describe in detail the chemical analytical procedures for this study. These SOPs will be kept in the project file at the analytical laboratory and will include written protocols for the analytical methods used.

<u>Scenario #1</u>

Field sampling procedures are detailed in the Oregon DEQ Lab's Field Sampling Reference Guide. To control the quality of field samples, one field duplicate and one rinseate blank will be analyzed. Although validation guidelines have not been established for field quality control samples, their analysis is useful in identifying possible problems resulting from sample collection or sample processing in the field. All field quality control samples will be documented in the field logbook. The field quality control samples that will be collected as part of the groundwater monitoring program are discussed below.

Field Duplicates. For all water samples collected, one homogenized field duplicate will be collected and submitted for analysis. One field duplicate will be collected per 20 water samples.

Rinseate Blanks. A rinsate blank, consisting of analyte-free media which has been used to rinse the sampling equipment, will be collected after completion of equipment decontamination and prior to sampling. Water and sample bottles used in the collection of rinsate blanks shall be supplied by the laboratory which will be performing the analysis. Rinseate blanks are used to determine if cross contamination has occurred during sampling. One rinseate blank will be collected from DI water that has come in contact with the sampling device and will be submitted for analysis of organic and inorganic constituents being monitored during that given sampling event.

Trip Blanks. One trip blank consisting of organic-free water will be collected and carried through the sampling handling and analysis procedure. A trip blank will be included in each shipping container containing one or more samples to be analyzed for VOCs. All trip blanks submitted for analysis will be analyzed for VOCs.

Samples from the monitoring wells will be collected using a previously disinfected peristaltic pump or a sample bailer. We will be using typical low volume flow to prepare well for sampling, i.e., we will monitor temperature and/or conductivity during the pumping and will not collect samples until the values of these parameters stabilize, indicating that we are drawing directly from the aquifer.

Samples from Clear Lake will be collected in quiet water from the intake structure. Any samples collected will be collected from the lake at a minimum of six inches below the surface.

Scenario #2: Creeks

Continuous data loggers will be placed on Ackerley and Munsel Creek for temperature. Hand held devices and/or grab sampling will be used for pH, DO, and turbidity. Of prime importance in the placement of these data collection devices is that they are located in a manner that will reflect as close as possible the stream as a whole. Of equal importance is that the data loggers are properly calibrated, prior to and during the time frame of the study. The City will ensure that this is done and that the loggers are checked on a monthly basis, to ensure that the individual probes do not become fouled and on a monthly basis the data will be uploaded. . As experience is gained with this process, less frequent checking will be employed, consistent with local conditions. Laboratory reproducibility of these instruments are generally reported to be within ± 1%, however, this value can be influenced by the matrix being analyzed. Data loggers will be set to record over short intervals initially to evaluate on site precision. During routine data collection, the frequency of measurement will be set at one hour.

Scenario #3: Estuary

The City will include the reports from the Tribes in its discussion of potential contributions of urbanization on the estuary (see Secondary Data Collection).

9.2 Laboratory QC Requirements

The contract laboratory is expected to meet the following minimum requirements:

1. Be certified as a drinking water laboratory Adhere to the methods outlined in the Oregon Environmental Laboratory Accreditation Program which is the DHS program that certifies labs, including those that conduct drinking water analysis.;
2. Deliver fax, hard copy, and electronic data as specified;
3. Meet reporting requirements for deliverables;
4. Meet turnaround times for deliverables;
5. Implement QA/QC procedures, including the QAPP data quality requirements, laboratory analysis plan requirements, and performance evaluation testing requirements;
6. Allow laboratory and data audits to be performed, if deemed necessary; and
7. Follow documentation, chain of custody, and sample logbook procedures.

Changes in the laboratory procedures specified in the QAPP will not be permitted without written documentation of the intended change and the rationale. The Project QA/QC Manager must approve all changes in advance.

The analyst will review results of the quality control samples from each sample group immediately after a sample group has been analyzed. The quality control sample results will then be evaluated to determine if control limits have been exceeded. If control limits are exceeded in the sample group, the Project Manager or Project QA Manager will be contacted immediately and corrective action (e.g., method modifications followed by reprocessing the affected samples) will be initiated prior to processing a subsequent group of samples.

All primary chemical standards and standard solutions used in this project will be traceable to the National Institute of Standards and Technology, Environmental Resource Associates, National Research Council of Canada, or other documented, reliable, commercial sources. Standards will be validated to determine their accuracy by comparison with an independent standard. Any impurities found in the standard will be documented.

10. Instrument Calibration and Frequency

The laboratory will calculate the method detection limit for each analyte in each matrix of interest and will establish an initial calibration curve for all analytes. The methods of analysis, associated reporting limits, and screening levels for the water analyses are identified in Table 5-2. Reporting limits have been set at or below ambient.

The following sections summarize the procedures that will be used to assess data quality throughout sample analysis.

Initial and Continuing Calibration. Multipoint initial calibration will be performed on each instrument at the start of the project, after each major interruption to the analytical instrument, and when any ongoing calibration does not meet control criteria. Ongoing calibration will be performed daily for organic analyses and with every sample batch for conventional parameters (when applicable) to track instrument performance. Instrument blanks or continuing calibration blanks provide information on the stability of the baseline established. Continuing calibration blanks will be analyzed immediately prior to continuing calibration verification at a frequency of 1 continuing calibration blank for every 10 samples analyzed at the instrument for inorganic analyses and every 21 hours for organic analyses. If the ongoing calibration is out of control, the analysis must come to a halt until the source of the control failure is eliminated or reduced to meet control specifications. All project samples analyzed while instrument calibration was out of control will be reanalyzed.

Matrix Replicates. Analytical replicates provide information on the precision of the analysis and are useful in assessing potential sample heterogeneity and matrix effects. Analytical replicates are subsamples of the original sample that are prepared and analyzed as a separate sample. A minimum of 1 replicate will be analyzed per sample group or for every 20 samples, whichever is more frequent. When matrix spikes are not available or appropriate, a matrix triplicate will be analyzed per sample group or for every 20 samples, whichever is more frequent.

Matrix Spikes and Matrix Spike Duplicates. Analysis of matrix spike samples provides information on the extraction efficiency of the method on the sample matrix. By performing duplicate matrix spike analyses, information on the precision of the method is also provided for organic analyses. A minimum of 1 matrix spike will be analyzed for every sample group or for every 20 samples, whichever is more frequent, when possible Surrogate Spikes. All project samples analyzed for organic compounds will be spiked with appropriate surrogate compounds as defined in the analytical methods. The laboratories will report surrogate recoveries; however, no sample result will be corrected for recovery using these values.

Method Blanks. Method blanks are analyzed to assess possible laboratory contamination at all stages of sample preparation and analysis. A minimum of 1 method blank will be analyzed for every extraction batch or for every 20 samples (10 samples for conventional parameters), whichever is more frequent.

11. Non –Direct Data Acquisition Requirements

Types of data needed for project implementation and decision making that are obtained from non-measurement sources include such data as computer databases, programs, literature files, and historical databases. All data obtained from non-measurement sources will be fully documented as to source, data collection methodology, and any qualifications related to data accuracy and reliability.

Secondary Data Collection

Marine

Collate and evaluate marine testing data previously collected by OBMP, Siuslaw Watershed Council, and Surfriders for bacteria on beaches. Document established minimum QC criteria for data acceptance for microbiological data

North Fork

Continue to monitor the Tribes' monitoring data using continuous data loggers for temperature, turbidity, DO, salinity, and pH; and bacteria sampling. Document established minimum QC criteria for data acceptance for this project for conventional analyses.

Estuary

Continue to monitor monitoring data conducted by: Army Corps of Engineers for sedimentation; Watershed Council (8 locations, grab sampling); and Tribes' monitoring with continuous data loggers for temperature, turbidity, DO, salinity, and pH; and bacteria sampling. Document established minimum QC criteria for data acceptance for this project for these analyses.

Other examples are literature search results such as information on climate change effects; and data collected by agency partners.

12. Data Management

After environmental samples are collected in the field, they will be transported to the laboratory for analysis. Sample custody shall be maintained to preserve the integrity of the samples. Standard record-keeping procedures, chain-of custody and documented control systems, and the standard operating protocols used for data storage and retrieval on electronic media will be used.

The Project Manager will review the information gathered in the field with peer review of critical data elements. All errors will be corrected with oversight by the Project Manager.

All of the analytical results shall be reviewed and authorized for release by the contract laboratory's Project Manager. Standard data deliverables in Excel format shall be submitted by the laboratory.

At a minimum, all EPA data reporting requirements will be met. The format used to transmit the data to EPA will be compatible with EPA data format requirements.

C. Assessment/Oversight

13. Assessment and Response Actions

Performance Evaluation Audits

Laboratory and field performance audits and corrective action procedures are described in this section.

Laboratory and field performance audits consist of on-site reviews of quality assurance systems and equipment for sampling, calibration, and measurement. Laboratory audits will not be conducted as part of this study; however, all laboratory audit reports will be made available to the Project QC Coordinator upon request. All laboratories are required to have written procedures addressing internal QA/QC; these procedures will be submitted and reviewed by the Project QA/QC Manager to ensure compliance with the QAPP. All laboratories must ensure that personnel engaged in sampling and analysis tasks have appropriate training.

The Project Manager or QA/QC Manager will be notified immediately if any quality control sample exceeds the project-specified control limits. The analyst will identify and correct the anomaly before continuing with the sample analysis. The Laboratory Project Manager will document the corrective action taken in a memorandum submitted to the QA/QC Manager within five days of the initial notification. A narrative describing the anomaly, the steps taken to identify and correct the anomaly, and the treatment of the relevant sample batch (i.e., recalculation, reanalysis, re-extraction) will be submitted with the data package in the form of a cover letter.

Corrective Action for Field Sampling

The Project Manager will be responsible for correcting equipment malfunctions during the field sampling effort and for resolving situations in the field that may result in non-compliance with the QAPP. All corrective measures will be immediately documented in the field logbook.

Corrective Action for Laboratory Analyses

All laboratories are required to submit and comply with their Standard Operating Procedures (SOPs). The Laboratory Project Manager will be responsible for ensuring that appropriate corrective actions are initiated as required for conformance with this QAPP. All laboratory personnel will be responsible for reporting problems that may compromise the quality of the data.

14. Reports to Management

All data will undergo two levels of QA/QC evaluation: one at the laboratory, and one by the City’s consultant (a chemist). Initial data reduction, evaluation, and reporting at the laboratory will be carried out as described in the appropriate analytical protocols and the laboratory's QA Manual. Quality control data resulting from methods and procedures described in this document will also be reported.

Minimum Data Reporting Requirements

The following describes the minimum data reporting requirements necessary for proper QA/QC evaluation of the analytical data.

Sample IDs. Records will be produced that clearly match all blind duplicate QA samples with laboratory sample IDs.

Sample Receipt. Chain of custody forms will be filled out for all sample shipments to document problems in sample packaging, custody, and sample preservation upon receipt at the laboratory.

Reporting. For each analytical method run, analytes will be reported as a detected concentration or as less than the specific reporting limit. The laboratories will also report dilution factors for each sample as well as date of extraction (if applicable) and date of analysis. Standard data packages will consist of a case narrative, sample results, QA sample results, and chain of custody forms.

Internal Quality Control Reporting

Internal quality control samples will be analyzed at the rates specified in the applicable analytical method.

Laboratory Blanks. All analytes will be reported for each laboratory blank. All non-blank sample results shall be designated as corresponding to a particular laboratory blank in terms of analytical batch processing.

Surrogate Spike Samples. Surrogate spike recoveries will be reported with all organic reports where appropriate. The report shall also specify the control limits for surrogate spike results. Any out of control recoveries (as defined in the specified method) will result in the sample being rerun or the data being qualified.

Matrix Spike Samples. Matrix spike recoveries will be reported for all analyses. All general sample results will be designated as corresponding to a particular matrix spike sample. The report will indicate what sample was spiked. The report will also specify the control limits for matrix spike results for each method and matrix.

Laboratory Duplicates and/or Matrix Spike Duplicate Pairs. Relative percent differences will be reported for all duplicate pairs as well as analyte/matrix specific control limits.

Laboratory Control Samples (LCS). When run for internal quality control, LCS results will be reported with the corresponding sample data. Control limits for LCS will be reported as specified.

Blind Duplicates. Blind duplicates will be reported as any other sample. Relative percent differences will be calculated for duplicate samples and evaluated as part of the data quality review.

D. Data Validation and Usability

15. Data Review, Validation, and Verification Requirements

Once data are received from the laboratory, a number of QC procedures will be followed to provide an accurate evaluation of the data quality. Specific procedures will be followed to assess data precision, accuracy, and completeness.

A qualified environmental chemist will perform a data quality review. The laboratories will deliver complete data packages for all chemical analyses. The data will be evaluated in accordance with the QAPP. All chemical data will be reviewed with regard to the following, as appropriate to the particular analysis:

- Completeness;
- Holding times;
- Blanks;
- Detection limits;
- Surrogate recoveries;
- Matrix spike/matrix spike recoveries; and
- Laboratory and field duplicate relative percent differences.

This data review will result in the proper data qualifiers being applied to the data. The results of the data quality review will be summarized as part of the annual monitoring report. This report will be submitted to the project QA Manager for final review and confirmation of the validity of the data.

16. Reconciliation with Data Quality Objectives

16.1 Data Quality Assessment

Non-Direct Measurements
Water quantity, pump test data, water level, and other groundwater-related data records possessed by the City will be reviewed for potential use in constructing the groundwater flow model. Water quality records, compliance- related or otherwise, collected by the City will be included, as appropriate in the base-line water quality determination.

Corrective Action for Field Sampling
The Quality Assurance Officer will be responsible for correcting equipment malfunctions during the field sampling effort and for resolving situations in the field that may result in noncompliance with the QAPP. All corrective measures will be immediately documented in the field logbook.

Corrective Action for Laboratory Analyses
All laboratories are required to submit and comply with their Standard Operating Procedures (SOPs). The Laboratory Project Manager will be responsible for ensuring that appropriate corrective actions are initiated as required for conformance with this QAPP. All laboratory personnel will be responsible for reporting problems that may compromise the quality of the data.

The Project Manager or QA/QC Manager will be notified immediately if any quality control sample exceeds the project-specified control limits. The analyst will identify and correct the anomaly before continuing with the sample analysis. The Laboratory Project Manager will document the corrective action taken in a memorandum submitted to the QA/QC Manager within five days of the initial notification. A narrative describing the anomaly, the steps taken to identify and correct the anomaly, and the treatment of the relevant sample batch (i.e., recalculation, reanalysis, re-extraction) will be submitted with the data package in the form of a cover letter.