City of Portland, Oregon

Total Maximum Daily Load (TMDL) Implementation Plan

ANNUAL STATUS REPORT NO. 9

Fiscal Year 2016-2017

(July 1, 2016 – June 30, 2017)

Prepared for:

Oregon Department of Environmental Quality

Submitted by:

City of Portland

Submitted on:

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1.0 Introduction

This ninth Annual Status Report (report) summarizes key activities and accomplishments in accordance with the City of Portland's 2014 *Total Maximum Daily Load (TMDL) Implementation Plan for the Willamette River and Tributaries*. The report summarizes the implementation status of the City's activities and management strategies to reduce TMDL pollutants in local waterbodies during fiscal year (FY) 2016-17 (July 1, 2016, through June 30, 2017).

Many activities outlined in this TMDL report are also conducted to fulfill obligations under the City's National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System (MS4) Discharge Permit No. 101314 (MS4 permit).[1] A multitude of environmental programs and activities that the City employs provide an effective response to address both point and non-point sources of pollutants under MS4 and TMDL requirements. A separate annual report is submitted to the Oregon Department of Environmental Quality (DEQ) for compliance with the City's MS4 Permit and associated 2011 *Stormwater Management Plan* (SWMP). Results from the City's monitoring efforts during the fiscal year are provided in the MS4 annual compliance report.

Report Organization

This annual TMDL report covers implementation actions and accomplishments that occurred during FY 2016-17. The report is organized into the following sections:

- Adaptive Management
- Citywide Management Strategies
- Temperature Management Strategies

2.0 Adaptive Management

The City uses an adaptive management approach for its TMDL program to identify whether the TMDL Implementation Plan needs to be modified for improved effectiveness. This includes both an annual process and a more comprehensive longer-term process.

[1] TMDLs divide a total allowable pollutant load into allocations to point sources (called "waste load allocations") and non-point sources (called "load allocations") and several other input factors. Waste load allocations established in TMDLs are implemented through NPDES permits.

Annual Process

The City conducts an annual adaptive management process in conjunction with preparing each annual TMDL status report to determine if the City's TMDL program is being implemented in accordance with the TMDL Implementation Plan and identify whether any program adjustments are needed. For FY 2016-17, the City determined that the TMDL program is being implemented in accordance with the TMDL Implementation Plan and that no program adjustments are needed at this time.

Comprehensive Process

In 2013, the City conducted a comprehensive process as part of the TMDL Implementation Plan *Fifth Year Review Report,* which included in-stream water quality trends analyses for TMDL parameters for which data were available. Under MS4 permit requirements in 2014, the City also conducted waste load allocation (WLA) effectiveness evaluations and progress towards meeting benchmarks. In 2015, the City prepared updated benchmarks for addressing TMDL WLAs as part of the MS4 permit renewal package.

In summary, both the water quality trends analyses and the results of the NPDES MS4 progress to WLAs and associated benchmarks indicated that the TMDL program has been effective. Implementation of the strategies included in the MS4 SWMP and the TMDL Implementation Plan will continue to contribute to the overall reduction of TMDL pollutants. No major program adjustments were deemed necessary. The next 5-year review report is due November 1, 2018.

3.0 Citywide Management Strategies

Tables 1 through 8, provided on the following pages, summarize the City's activities conducted in FY 2016-17 to implement the citywide management strategies identified in Section 3 of the TMDL Implementation Plan. As mentioned, many of the strategies are based on the City's SWMP. Additional information and greater detail on SWMP best management practice (BMP) implementation can be found in the NPDES MS4 Annual Compliance Report for Permit Year 22, submitted to DEQ on November 1, 2017.

4.0 Temperature Management Strategies

Following the citywide management strategies in Tables 1 through 8, Table 9 provides a summary of activities conducted in FY 2016-17 to implement temperature management strategies identified in Section 4 of the TMDL Implementation Plan.

Activities Conducted to Implement Citywide Management Strategies

Table 1. Public Involvement (PI)	
Strategy	**Implementation Activities FY 2016-17**

1. Provide water quality education and curriculum resources for K-12 students.	• Reached a total of 6,916 students (grades K-12+) with a variety classroom programs that provide hands-on, interactive science education about stormwater and other environmental issues. Specific program activities include the following:
	  • Presented Clean Rivers Education's *Stormwater - Soak It U*p, a 75-minute classroom program for grades 4 to college.
	  • Presented Clean Rivers Education's Watershed Awareness classroom program to grades 3-6. This lesson focuses on non-point source pollution and pollution prevention.
	• Involved a total of 4,426 students (K-12) in education field programs that offer watershed investigations and field assessments, stormwater tours, boat tours, and restoration experiences. Specific program activities include the following:
	  • Provided canoe trips to students in the Columbia Slough watershed. These trips were preceded by classroom studies and stewardship projects related to stormwater pollution.
	  • Led green infrastructure tours where students visited swales, stormwater planters, ecoroofs, porous pavement, and creative downspout disconnections and learned how these facilities reduce runoff volume and filter pollutants.
	  • Led tours and provided education activities such as water quality testing at the City's Water Pollution Control Laboratory. The tour focuses on pollution prevention, onsite sustainable stormwater management at the Laboratory, and water-quality-based career awareness.
	• Reached a total of 11,067 students (K-12) through the Friends of Zenger Farm program, a BES-supported partnership. Zenger Farms provides classroom, field, and service-based education focused on stormwater management, watershed health, environmental stewardship, and sustainability.

2. Educate the public about stormwater and surface water quality protection/ pollution prevention and riparian and wetland protection via websites, workshops, fact sheets, and other outreach materials.	• Included inserts in City water/sewer bills mailed to more than 190,000 ratepayer properties:
	  • Fall 2016 insert: "Get Ready for the Rain" provided information on hydrology (one of the four factors of watershed health measured in the Portland Watershed Report Cards).
	  • Winter 2016 insert: "Old Sewers and New Technologies" provided information about BES work to protect and improve water quality in Portland's rivers and streams.
	  • Spring 2017 insert: "What is Stormwater Runoff?"
	  • Summer 2017 insert (Jun, Jul, Aug 2016): "Planning Some River Recreation? Check out the weekly Willamette River Recreation Index."
	• Updated and posted fact sheets, brochures, and educational materials on the BES website about:
	  • Sustainable stormwater management and the stormwater discount program (168,727 page views)
	  • Treebate incentive for planting yard trees (24,751 page views)
	  • Green Street Stewards Program (49,175 page views)
	  • Page stats were taken July 27, 2017.
	• Maintained the City Green blog and Facebook page to highlight BES's green infrastructure work and the work of partner organizations, including watershed councils, Friends of Trees, stewardship groups, soil and water conservation districts, and local governments. In FY 2016-17, it received over 372,000 hits.

Activities Conducted to Implement Citywide Management Strategies

Table 1. Public Involvement (PI)	
Strategy	**Implementation Activities FY 2016-17**
3. Involve citizens in water quality improvement activities through community events, stewardship projects, and restoration projects.	**Columbia Watershed** • Co-sponsored and/or participated in 44 community events with the Columbia Slough Watershed Council. Events included Slough 101, Groundwater 101, Explorando El Columbia Slough, Canoe the Slough events, and the Columbia Slough Regatta. Efforts included engaging 541 volunteers. The total participation included approximately 2,900 people.
	Willamette Watershed • Co-sponsored and/or participated in 24 community events and public involvement and information activities for Willamette watershed. Events included presentations to neighborhood associations, outreach for the Willamette Water Resources Development Act package, town halls and public hearings for the Central City 2035 Plan, Multnomah Days, the Big Float, the Clean Rivers Festival, and rain gardens. Efforts included engaging 295 volunteers. The total participation included approximately 524 people. • Hosted citizens during 32 events through the SW Watershed Resource Center Partnership to enhance natural areas using volunteer support.
	Johnson Creek Watershed • Co-sponsored and/or participated in 36 community events with the Johnson Creek Watershed Council and community partners. Events and activities include various creek clean-up events, Coho spawning surveys, dragonfly surveys, the Salmon Celebration/ Sunday Parkways, and Crystal Springs Partnership planting and maintenance events. Efforts included over 2,100 volunteers. The total participation included approximately 1,200 people. • Through the Johnson Creek Watershed Interjurisdictional Committee, continued to work with multiple agencies and jurisdictions throughout the Johnson Creek Watershed to conduct watershed-wide monitoring, including water quality and macroinvertebrates. • Supported the Johnson Creek Watershed Council's 19th Annual Johnson Creek Watershed-Wide Restoration Event, where volunteers participated in watershed improvement activities. • Continue to support the Johnson Creek Watershed Council and the Crystal Springs Partnership in their efforts to educate the public about Crystal Springs, a tributary to Johnson Creek. Developed the Crystal Springs Virtual Tour.
	Fanno Creek and Tryon Creek • Co-sponsored and/or participated in 10 community events in the Fanno Creek watershed, including the April Hill Park Project. Efforts included over 420 volunteers. The total participation included approximately 320 people. • Co-sponsored and/or participated in five community events in the Tryon Creek watershed, including presentations, tabling events involving outreach and listening projects for the Falling Creek sub-watershed, and miscellaneous site visits with property owners. Efforts included engaging 66 volunteers. The total participation included approximately 260 people.
	Citywide • Continued the permanent storm drain curb marker program. There were 136 participants in the program during the year. • The Green Street Steward Program continues to educate and recruit volunteer Green Street Stewards. Hosted 42 tabling events and trainings, utilizing 87 volunteers and reaching over 900 individuals during the year. • BES's Tree Program conducts community events to educate Portlanders about the importance of urban trees for clean rivers; healthy watersheds; and livable, sustainable

Activities Conducted to Implement Citywide Management Strategies

Table 1. Public Involvement (PI)	
Strategy	**Implementation Activities FY 2016-17**
	communities. A total of 84 events, utilizing approximately 3,200 volunteers and reaching 6,482 people, were conducted in FY 2016-17.
4. Implement Multnomah County's pet waste pick-up ordinance in City parks.	Portland Parks & Recreation continued to encourage compliance with leash and scoop laws through education, enforcement, and by providing off-leash areas with waste bins as appropriate. Programs include: • Maintaining park signage to increase awareness and understanding of leash/scoop laws. • Implement Park Ranger patrols, which use park warnings and citations to increase leash and scoop law compliance.
5. Promote carpooling, use of public transportation, walking, and biking.	• Portland's Bureau of Transportation (PBOT) and Drive Less Connect continued to match carpooling partners and provide discounted carpool parking. • PBOT sponsored International Walk + Bike to School day with 71 schools participating. • PBOT continued to provide the Bicycle Lunch and Learn series, Portland by Cycle rides and classes, and Bike and Walk maps covering Portland. • PBOT coordinated the Safe Routes to School program, which included over 100 schools in the City of Portland. • PBOT coordinated Sunday Parkways, a series of free events that this year allowed 100,350 participants to use non-motorized modes of transportation along Portland streets. • The Portland bike share system, BIKETOWN, launched in July 2016. The system is one of the smartest and greenest, large-scale bike share systems in the nation and consists of 1,000 SMART bicycles, 100 stations, and 19 community stations across the central city area. In the first year of the system's operation, users rode 602,266 miles (to the moon and back!) – including 313,034 rides taken by over 3,519 annual membership riders and 72,002 casual riders (day-pass riders and single-ride users). With a reduced fare and cash payment option, 280 Portlanders living on low-incomes also became annual members through BIKETOWN for All program.
6. Coordinate and implement education and outreach programs and strategies with other jurisdictions.	• The City continues to participate in education and outreach opportunities with other jurisdictions as a member of the Oregon Association of Clean Water Agencies and other opportunistic and seasonal campaigns. • The City has been participating in coordination activities for the newly developing state-wide Clean Rivers Coalition (CRC). The CRC recently received a Meyer's Trust Grant providing initial funding for the development a viable large-scale water pollution prevention campaign. While no longer participating as a funding member of the Regional Coalition for Clean Rivers and Streams, the City anticipates sharing the Coalition's messaging and information on an informal basis. The Coalition's website and other media include information about proper disposal of pet waste; vehicle care, washing, and oil; organic/chemical-free lawn care; composting; native plants; trees; household chemicals; and dumping.
7. Post the TMDL Implementation Plan and annual reports on the City website.	• The City's TMDL Implementation Plan was posted February 2014, and the FY 2016-17 TMDL annual report was posted on or before November 1, 2017.

Activities Conducted to Implement Citywide Management Strategies

Table 2. Operations and Maintenance (OM)	
Strategy	**Implementation Activities FY 2016-17**

1. Implement an inspection, maintenance, and repair program for public stormwater collection and treatment systems.	• The Stormwater Operations & Maintenance (OM) team at BES evaluates maintenance needs of MS4 assets and works in cooperation with PBOT to carry out needed activities. The following O&M activities occurred during the year:
	• Inspections:
	  • 3,039 trash rack inspections at 328 locations.
	  • 17,780 feet of storm pipes and culverts inspected.
	  • 3,078 green street inspections.
	  • 557 inspections of other water quality facilities (manufactured stormwater treatment facilities, constructed treatment wetlands, dry ponds, vegetated swales, spill ponds, wet ponds, sand filters, etc.).
	• Cleaned:
	  • 12,771 feet of storm pipes and culverts.
	  • 49,412 feet of storm conveyance ditches.
	  • 10,599 catch basins and inlets.
	  • 1,398 underground injection control (UIC)[2] sedimentation and sump manholes.
	  • 85 water quality facilities (not including green streets).
	  • All trash racks and green streets during or following an inspection, where necessary.
	• Repaired:
	  • 1,126 feet of storm pipes and culverts.
	  • 241 catch basins and inlets.
	  • 2 water quality facilities.

2. Implement an inspection program for private stormwater management facilities.	• Under the Maintenance Inspection Program, inspected 788 properties (tax lots) with 1,443 associated private stormwater management facilities. Provided technical assistance and education to ensure facilities are sufficiently operated and maintained. • Inspected 1,272 private stormwater management permit projects and associated facilities to ensure installation was properly conducted. These facilities account for treatment of 287.3 acres of impervious area.
3. Review BES stormwater facility operations and maintenance practices and update them as necessary.	• Continued to implement the BES Stormwater Operations and Maintenance Manual that was last updated in 2012-2013. • Continued to implement the BES Green Streets Maintenance Program using the Bureau's adopted Level of Service. The Stormwater OM staff perform Green Street inspections a minimum of 2x/year, and City contractors maintain Green Streets 3-4 times a year, or more frequently as needed, to ensure the facilities are functioning as intended.

[2] The City's UIC facilities are not technically part of the MS4 system and are regulated under a different City permit (WPCF Permit # 102830).

Activities Conducted to Implement Citywide Management Strategies

Table 2. Operations and Maintenance (OM)	
Strategy	**Implementation Activities FY 2016-17**
4. Operate and maintain public streets and roads in a manner that reduces the discharge of pollutants in stormwater.	• The 2011 PBOT *Maintenance Environmental Handbook* and the 2014 ODOT *Routine Road Maintenance Water Quality and Habitat Guide Best Management Practices* continue to be used by City road maintenance staff to ensure proper practices are used during maintenance and repair of streets. • During the 2016-17 reporting year, the City swept over 4,000 lane miles of curbed streets and removed 4,385 tons of sediment and material from entering receiving waters. • The City continued to use magnesium chloride ($MgCl_2$) for deicing roads. $MgCl_2$ is effective at lower temperatures and requires less use of sand and gravel. The City conducted a literature review and instream monitoring to evaluate future use of sodium chloride (NaCl) for deicing. Additionally, the City tested use of the material during the 2016-17 winter season, and water quality samples were taken downstream of the test areas. Sampling results showed chloride concentrations at the sampling locations remained well below instream water quality concentrations. Further testing and evaluation of this deicing agent will occur during future winter storm events.
5. Provide employee training on maintenance and construction practices to protect water quality.	• Provided annual construction inspector training to BES staff on December 6, 2016. • Conducted an Erosion Control Program Status and Goals presentation for upper management at the Bureau of Development Services and BES to consider opportunities for building the program on February 7, 2017. • Provided training on the PBOT *Maintenance Environmental Handbook* for street maintenance crews. Training is given to all new employees and to specific work crews as needed.

6. Implement the City's Integrated Pest Management (IPM) program to minimize the use and application of fertilizers, herbicides, and pesticides on publicly owned properties.	• Portland Parks & Recreation (PP&R) continued to use IPM practices throughout the parks system. By the end of 2016, PP&R's portfolio of parks facilities included 144 developed parks, 7,921 acres of natural areas, and 252 undeveloped acres.[3] Examples of the practices that the City uses include:
	  • Utilizing plants with natural resistance to pests.
	  • Proper mowing and irrigation of park turf to increase vigor and reduce weed populations.
	  • Mulching of planting beds to reduce establishment of weeds.
	  • Application of selected herbicides to control invasive weeds to prevent infestation spread.
	  • Release of natural biological control insects to control invasive weed infestations.

7. Maintain pet waste stations and signage in parks.	• Portland Parks & Recreation continued to encourage compliance with leash and scoop laws through education, enforcement, and by providing off-leash areas with waste bins as appropriate. Programs include:
	  • Maintaining park signage to increase awareness and understanding of leash/scoop laws.
	  • Implement Park Ranger patrols, which use park warnings and citations to increase leash and scoop law compliance.
	  • Participate in community and partner events like Doggie Dash and Arf in the Park.

8. Incorporate electric vehicles into the transportation fleet.	• Continued to incorporate electric and other low-carbon fuel vehicles into the City fleet as part of its Climate Action Plan and sustainability strategies. The City currently has 290 electric or hybrid sedan vehicles, representing approximately 39% of the sedan fleet to date.

[3] https://www.portlandoregon.gov/parks/article/422533

Activities Conducted to Implement Citywide Management Strategies

Table 3. Illicit Discharge Detection and Elimination (ILL)	
Strategy	**Implementation Activities FY 2016-17**
1. Require new development or properties using nonconforming sanitary sewer connections to connect to the public sewer system when a public sanitary sewer is available.	• Continued to conduct activities in conformance with Portland City Code (PCC) 17.33 (Required Public Sewer Connection) which mandates that properties using onsite wastewater disposal systems or nonconforming private sewer systems connect to an available public sewer and/or otherwise make approved sewer connection upon notice to comply with city code and/or failure of the existing system. The following work was completed during the year: • 23 properties converted from on-site sewage/septic disposal systems to the City's sanitary sewer • 1,048 properties successfully repaired existing faulty or non-conforming sewer lines

2. Limit infiltration of seepage from the sanitary sewer system to the MS4.	• BES continued to coordinate risk analysis efforts under the Stormwater System Plan to identify areas in the city where existing sewage collection systems may be in poor condition and have the potential to pose contamination threats to surface waters and groundwater. BES also continued to evaluate the sanitary and combined sewers under the BES System Plan to implement an inflow and infiltration program for these systems, which helps address sewer capacity problems. These combined efforts along with the Sanitary Sewer Overflow program help to minimize sewage releases to the environment and receiving waters. BES will continue to prioritize the repair, rehabilitation or replacement of system components in vulnerable areas. The following work was completed during the year:
	  • Inspection of 0.68 million feet (129 miles) of sewer pipe, or about 7% of the mainline sewer system
	  • Cleaning of 1.14 million feet (216 miles) of sewer pipe, or about 11% of the mainline sewer system
	  • Completion of mainline sewer maintenance repairs on 10,100 feet of pipe; 62% of the repairs were in response to collection system problems
	  • Repair of 588 service laterals totaling about 7,930 feet of pipe; 65%of those repairs were in response to discovered problems
	  • Treatment of 298,000 feet (56 miles) of sewer pipe for roots using chemical root foaming
	  • Completion of 500 inspections of manholes considered to be at greatest risk of failure
	  • Completion of ten Capital Improvement Program projects repairing and rehabilitating portions of the sanitary and combined collection system during the 2016 calendar year, resulting in an estimated risk reduction of $11.4 million. Maintenance activity on mainlines and service laterals also resulted in an estimated risk reduction of $12.5 million.
	• Under the on-going City-wide Sewer Extension Plan, BES identified properties that are currently not connected to the sanitary sewer system and are likely served by an on-site septic system. The information will be used as one of the criteria to prioritize sewer connection projects and evaluate related surface water quality impacts.

Activities Conducted to Implement Citywide Management Strategies

Table 3. Illicit Discharge Detection and Elimination (ILL)	
Strategy	**Implementation Activities FY 2016-17**
3. Implement and enforce designated prohibitions on discharges to the City MS4.	• BES responded to pollution complaints and issued enforcement actions for violations of PCC 17.39. During FY 2016-17, violations resulted in 34 enforcement actions against 27 responsible parties. The count by enforcement type includes: • 27 Notices of Violation • 5 Notices of Assessment of Cost • 1 Warning Notice • 1 Compliance Order Total penalties amounted to $34,532.
4. Identify, respond to, and eliminate illicit discharges and cross connections.	• Illicit discharge monitoring during dry weather included 128 inspections conducted at 106 major outfalls. Flow was observed at 50 outfalls. Based on samples and follow-up investigations, no illicit discharge was identified.
5. Require Porta-Potties at parks for public events and sporting events.	• Portland Parks & Recreation continued to require large events to provide one portable restroom for every 125 people of estimated attendance.

Activities Conducted to Implement Citywide Management Strategies

Table 4. New Development Standards (ND) (during construction and post-construction)	
Strategy	**Implementation Activities FY 2016-17**

1. Implement an erosion and sediment control program for ground-disturbing activities.	• Continued to implement Portland City Code (PCC) Title 10 and the City's 2008 *Erosion & Sediment Control Manual* (ESCM), which details requirements for development and construction-related activities to control the offsite release of sediment during construction and development activities. The City's erosion control regulations:
	  • Reduce sediment and pollutants in runoff from construction and development sites;
	  • Reduce the amount of sediment and pollutants entering storm drainage systems and surface waters from all ground disturbing activity;
	  • Reduce the potential for erosion from dirt and mud on public rights-of-way and surrounding properties during construction and development activities; and
	  • Reduce the amount of soil and dust released into the air from ground-disturbing activity.

2. Require erosion and sediment control plans, when applicable, during the building permit application phase.	• Continued to impose City requirements associated with Erosion, Sediment, and Pollutant Control Plans (ESPCPs) and PCC Title 10. • An ESPCP is required by the City for ground-disturbing activity that exceeds 500 square feet and that requires a City of Portland building, public works, or development permit (PCC 10.40). In addition, an ESPCP may be required for sites on steep slopes, in environmental zones, in greenway overlay zones, or in response to a violation of the City's erosion control requirements.
3. Require BMPs to prevent and control erosion and construction-associated pollutants.	• Continued to require specific BMPs targeting erosion and other construction related pollutants. • Chapter 4 of the ESCM lists the City-required BMPs for preventing erosion and controlling site sediment runoff. This includes BMPs specific to construction site entry and exit, site perimeter control, stormwater controls, general erosion prevention, and instream protection. Chapter 5 covers BMPs related to other site development activities, such as dewatering, spill prevention, solid waste, equipment fueling and maintenance, and concrete waste management.

4. Implement a hillside development protection code to minimize soil erosion from steep slopes.	• Continued to implement the following city codes:
	  • PCC 24.70.020 B, which requires a permit for all grading operations unless "there is no apparent danger, adverse drainage, or erosion effect on private/public property, or inspection is not necessary."
	  • PCC 24.70.020 C, which states that "Removal of trees six-inches and larger in diameter shall be reviewed with the clearing or grading permits as part of the Tree Plan review pursuant to Title 11. When removing 5 or more trees on a site with an average slope of at least 20 percent, applicants shall provide a geotechnical engineering report that assesses the stability of the site after tree felling and root grubbing operations."
	  • PCC 10.30.030, which includes additional requirements for slopes greater than 10 percent.

Activities Conducted to Implement Citywide Management Strategies

Table 4. New Development Standards (ND) (during construction and post-construction)	
Strategy	**Implementation Activities FY 2016-17**
5. Through the City's *Stormwater Management Manual*, implement stormwater management requirements for new development and redevelopment to treat stormwater and control post-development peak runoff rates to levels similar to pre-development levels.	• BES revised the 2014 *Stormwater Management Manual* (SWMM) in August 2016. Updates reinforced the stormwater management hierarchy (promoting infiltration) and shifted from citywide flow control and pollution reduction to system-specific (i.e., MS4, UIC, or CSO) requirements. • Continued to implement PCC Title 17.38 and the City's 2016 SWMM, which requires new and re-development project sites to treat stormwater runoff and maintain peak flow rates at pre-development levels for the 2-, 5-, and 10-year 24-hour runoff events.
6. Require new development and redevelopment to manage stormwater onsite to the maximum extent practicable.	• Continued to implement Section 1.3 of the City's 2016 SWMM, which requires onsite infiltration to the maximum extent feasible and establishes an infiltration and discharge hierarchy. The hierarchy stipulates that even if full onsite infiltration is not feasible, partial infiltration via unlined facilities may still be safe and appropriate prior to offsite discharge. If onsite infiltration is not feasible, onsite stormwater management that overflows to an offsite discharge location is required.
7. Promote the use of low-impact development techniques such as bioswales, rain gardens, and other vegetated stormwater management techniques.	• Continued to implement the City's 2016 SWMM, which includes an infiltration and discharge hierarchy that prioritizes vegetated stormwater management facilities for new and re-development. Category 1 of the SWMM hierarchy "Requires total onsite infiltration with vegetated infiltration facilities. Examples of vegetated infiltration facilities include: infiltration swales, planters [and] basins." Section 2.3 of the SWMM details the types of low-impact development techniques that are both allowed and required by the City to capture and treat stormwater runoff post-construction.

Activities Conducted to Implement Citywide Management Strategies

Table 4. New Development Standards (ND) (during construction and post-construction)	
Strategy	**Implementation Activities FY 2016-17**
8. Promote and incorporate the use of green street facilities in public and private development.	• Continued to implement the City's "% for Green Funding" program, which provides support for the construction of green street facilities. The program takes 1 percent of construction costs from City infrastructure projects that don't trigger the SWMM and has a selection process to fund green street projects that meet City/bureau and community goals. • Continued to implement the City's 2016 SWMM, which promotes the installation of "curb extensions" or green streets as an approved stormwater management technique for applicable new and re-development projects. Six green street projects were built by private development to meet the requirements of the City's SWMM. These six green street projects collectively manage 28,300 square feet of public right-of-way runoff that would otherwise drain directly to Fanno Creek or the Willamette River. • PBOT constructed one green street facility (four total were constructed but three were outside the MS4 area) to manage 7,300 sf of runoff from SW California Avenue, west of SW 45th Avenue, that would otherwise drain to Fanno Creek. • In conjunction with roadside drainage and ditch improvements, the City installed green street facilities to help manage runoff at SW Hamilton, between SW 40th Avenue and SW 47th Avenue, and at SW Palatine Hill Road at Lewis and Clark College. A total of 1.6 acres is being managed associated with the Fanno Creek and Willamette River watersheds. • The City built three green streets to manage 44,900 square feet of runoff from NW Front Avenue prior to discharge into the Willamette.

9. Continue to review and update the Stormwater Management Manual.	• Worked on updates to the 2014 SWMM. After a public comment period, the revised SWMM was adopted and became effective in August 2016 (FY 2016-17) with implementation beginning in November 2016. Updates included:
	  • Refocused system-specific (i.e., MS4, UIC, or CSO) stormwater management requirements.
	  • Reinforced stormwater management hierarchy.
	  • Updated the user interface for the Presumptive Approach Calculator used to size BMPs.
	  • Moved Chapter 4 Source Controls into a separate administrative rule and stand-alone manual.
	  • Provided training and technical assistance on the proposed 2016 SWMM updates to City staff and the development community.

10. Enforce stormwater ordinances that protect water quality.	• Continued to implement BES Enforcement Program Administrative Rules (Portland Policy Document ([PPD] item ENB-4.15), which describe BES procedures for assessing violations of storm-system-related PCC provisions, administrative rules, and permits related to the following:
	  • Stormwater Management Manual [PPD item ENB-4.01]
	  • Sewer Development Services Program (PPD item ENB-4.07)
	  • Stormwater Discharge Program (PPD item ENB-4.13)
	  • Sewer and Drainage Facilities Design Manual (PPD item ENB-4.14)
	  • BES Public Works Enforcement (PPD item ENB-4.22)
	  • Title 10 Erosion Control (PPD item ENB-4.30)
	  • Maintenance Inspection Program (PPD item ENB-4.31)

Activities Conducted to Implement Citywide Management Strategies

Table 5. Natural Systems (NS)	
Strategy	**Implementation Activities FY 2016-17**
1. Implement provisions of City Code that protect floodways and floodplains.	• Continued to implement and enforce Chapter 24.50 of Portland City Code (PCC), Flood Hazard Areas. The purpose of the code is to protect public health, safety, and welfare by restricting or prohibiting uses that are dangerous to health, safety, or property in times of flood or that cause increased flood heights or velocities, and by requiring that uses and structures vulnerable to floods be protected from flood danger at the time of initial construction. • Continued to implement the City's Stormwater Management Manual (SWMM), updated in August 2016, which is designed to protect receiving waters from increased flow rates and volumes due to development and to minimize impacts to properties downstream and upstream from development. • Continued to implement environmental conservation and protection overlay zones related to development permitting via PCC 33.430. Environmental zones protect resources and functional values that have been identified by the City as providing benefits to the public. The environmental regulations encourage flexibility and innovation in site planning and provide for development that is carefully designed to be sensitive to the site's protected resources. These regulations also help meet other City goals, along with other regional, state, and federal goals and regulations. The environmental regulations also carry out Comprehensive Plan policies and objectives.
2. Implement programs to protect riparian buffers and corridors, headwaters, springs and seeps, wetlands, and native vegetation.	• The City continued to apply regulations intended to protect significant natural resources, including rivers, streams, drainageways, wetlands, riparian areas, forests, and other special habitat areas. Five of the City's overlay zones protect or conserve resources, functional values, and/or significant wildlife habitat: Environmental Conservation (c), Environmental Protection (p), Greenway River Water Quality (q), Greenway River Natural (n) and Pleasant Valley Natural Resources (v). Three of the City's overlay zones preserve and enhance the natural and scenic qualities of Portland's rivers while allowing for specific uses within the zones: Greenway River Recreational (r), Greenway River General (g), and River Industrial (i). Additionally, City-approved Plan Districts, Natural Resource Management Plans, and Comprehensive Natural Resource Plans may contain environmental protection regulations that supersede or supplement the overlay zones described above. Through the City's review of land division applications, important streams, seeps, and springs not already protected by environmental overlay zones were protected and maintained in their natural state within required platted tracts.
3. Restore riparian buffers by removing invasive species and planting with native shrubs and trees.	• In partnership with the SW Watershed Resource Center, installed 900+ native plants and planted 80 trees. Removed invasive plants and restored 0.03 acres of area. • Supported the Johnson Creek Watershed Council's 19th annual Johnson Creek Watershed-Wide Restoration Event, where volunteers planted 7,000 native trees and shrubs and cleared 5.0 acres of invasive plants. • Portland Parks & Recreation partnered with several non-profits, community groups, and schools to involve volunteers in the enhancement of natural areas. A total of 752 restoration events were conducted, resulting in 2,084 trees planted and 28,926 other native plants planted. • Under BES's Community Watershed Stewardship Grants Program, awarded 13 stewardship grants and mini-grants totaling approximately $84,000 for projects that included riparian plantings. Through this effort, 26,400 linear feet of streambank was restored. Six trees and over 3,500 other native plants were planted and 0.31 acres of invasives were removed. • Under the City's Watershed Revegetation Program, activities during the year included planting of trees and shrubs along 10,381 linear feet of streambank.

Activities Conducted to Implement Citywide Management Strategies

Table 5. Natural Systems (NS)	
Strategy	**Implementation Activities FY 2016-17**
4. Implement an invasive species removal program, including education and outreach.	• The Portland City Council passed Resolution 36726 in August 2009 to establish the Invasive Plant Strategy as Portland's management plan for invasive plants. The resolution directed the City to adopt the 10-year management goals outlined in the Invasive Plant Strategy report. In addition to prohibiting the planting of nuisance plants in natural resource overlay zones and City-required landscaped areas, the City established a Required Eradication List in Title 29, Property Maintenance. The intent of this rule is to control the spreading of highly invasive plants that have not yet become widespread in Portland. • See the list in response to Strategy 3 (above) for specific fiscal year projects.
5. Implement tree protection ordinances that provide stormwater benefits and mitigate urban heat island effects.	• Continued implementation of Title 11, Trees. Title 11 includes tree preservation and planting requirements on development sites and standardizes the City's tree removal permit system. The tree code also applies to non-development related tree planting/pruning/and removal on private property and in public right-of-way planting strips. These new regulations help to preserve, expand, regenerate, and improve the quality of Portland's tree canopy. • Developed draft tree canopy targets for the central city, as a part of the Proposed Draft of the *Central City 2035 Plan*. These targets will be achieved through policies, programs, and regulations in the Plan. Twenty-year targets were generated for each sub-district within the central city. These tree canopy targets are expected to be finalized and adopted by resolution in FY 2017-18. • In 2015 the Bureau of Development Services (BDS) and Urban Forestry/Bureau of Parks & Recreation (UF/PP&R) began implementing the City's new tree regulations contained in Title 11. All building permit applications submitted to BDS are reviewed for compliance with the requirements. BDS Inspection Services training sessions for Title 11 were held on 6-17-16 for commercial inspectors and 7-19-16 for residential inspectors.
6. Implement a Revegetation Program.	• Under the City's Watershed Revegetation Program, many public agencies, businesses, and other landowners participated in and helped fund revegetation projects on their properties and neighboring properties. In FY 2016-17, 6,728 trees (4,493 deciduous and 2,235 coniferous) and 23,820 shrubs were planted on 37 acres.
7. Implement a street tree planting program.	• In partnership with Friends of Trees, planted 2,739 upland trees, which include street trees and yard trees in City of Portland rights-of-way, on school properties, and in private yards. • As part of community partnership planting efforts with contractors, planted 559 upland trees, which include street trees or trees within the right-of-way.
8. Work with watershed partners to support and coordinate tree planting and riparian restoration programs.	• Through PP&R, partnered with several non-profits, community groups, and schools to involve volunteers in their local natural areas. Activities include invasive plant species removal, native plant installation, trail building, installing fencing for sensitive resources, youth education, wildlife surveying, and litter removal. Efforts conducted for FY 2016-17 include planting 2,084 trees and 28,926 other native plants. • Through the Community Watershed Stewardship Program, restored 26,400 linear feet of streambank. Six trees and over 3,500 other native plants were planted and 0.31 acres of invasives were removed. • In partnership with Friends of Trees, planted 2,739 upland trees, which include street trees and yard trees in City of Portland rights-of-way, on school properties, and in private yards. • Under the City's Watershed Revegetation Program, planted 6,728 trees (4,493 deciduous and 2,235 coniferous) and 23,820 shrubs on 37 acres. Plantings were accomplished on over 10,300 linear feet of streambank. • In partnership with the SW Watershed Resource Center, facilitated restoration activities, including installation of 80 trees and 900+ native plants and removal of 0.03 acres of invasive plants.

Activities Conducted to Implement Citywide Management Strategies

Table 5. Natural Systems (NS)	
Strategy	**Implementation Activities FY 2016-17**
9. Implement stream restoration projects and provide floodplain reconnection.	• Acquired 3.0 acres in the Stephens Creek sub-watershed, 40 acres in the Johnson Creek watershed, 12 acres in Forest Park, and 18 acres in the Columbia Slough watershed as part of the Grey to Green and Johnson Creek Willing Seller programs.
10. Work with public and private partners on culvert replacement, stream, and wetland restoration projects.	• BES's Community Watershed Stewardship Program awarded 13 stewardship grants in FY 2016-17, totaling approximately $84,000. Some projects included the Pollinator Pathways ($5,889), the Johnson Creek clean up initiative ($5,500), and the Tryon Creek Watershed Restoration Mentor ($6,991). • Completed final design to replace an undersized culvert on Fanno Creek at SW 45th Avenue to alleviate flooding risk and enhance fish passage. • Completed final design to restore failing culverts along Leif Erikson Drive in Forest Park. The project will replace non-functioning culverts that are a source of sediment to drainage basins that discharge to the Willamette River. • Completed final design for two stream daylighting projects at Albert Kelly Park (SW Dosch Road and SW Mitchell Road) and Jackson Middle School (SW 35th Avenue and SW Caraway Court) to slow stormwater and reduce erosion to Falling and Restoration Creeks. • Completing 90 percent design efforts to replace an undersized culvert with a bridge on SW Boones Ferry Road at Arnold Street to improve fish passage. • Completing 30 percent design of three stream enhancement projects in the Stephens Creek headwaters to manage stormwater flows and enhance water quality and habitat. Project locations include SW 26th Avenue and SW Texas Street, Custer Park, and the Stephens Nature Park.
11. Identify and protect cold water refugia in the Willamette River.	• See Table 9 of this report.
12. Use updates to the citywide Natural Resource Inventory to inform zoning and planning updates.	• The City's recently updated *2035 Comprehensive Plan* includes goals and policies, updated land use designations, and other citywide systems plans that will support watershed health throughout the city over the next 20 years. • The City is continuing work on the *Central City 2035 Plan*, which sets a 20-year vision for the Central City and is a culmination of over 5 years of planning and public involvement. The plan includes a range of policies related to climate change resilience, sustainable development, and management of the Willamette River and its adjacent uses, among others. An updated Natural Resources Inventory for the Willamette River was prepared as part of this effort. Related zoning and planning updates during FY 2016-17 include establishment of a new Willamette River overlay zone and an expanded river setback requirement (from 25 feet to 50 feet).

Activities Conducted to Implement Citywide Management Strategies

Table 6. Structural Controls (STR)	
Strategy	**Implementation Activities FY 2016-17**

1. Implement retrofits to the existing storm drainage system, including use of green infrastructure.	• The following retrofit projects were either in construction or were completed during the year:
	  • One green street facility to manage 7,300 square feet of runoff from SW California Avenue (west of SW 45th Avenue).
	  • Completed construction of green street and shoulder improvements on SW Hamilton Street between SW 40th and 47th avenues.
	  • Completing construction of the Centennial Oaks Stormwater project in Willamette Park to treat 1.4 acres.
	  • Completed construction of a green street on SW Palatine Hill Road at Lewis and Clark to treat 3,590 square feet of runoff.
	  • Beginning construction of a green street and stormwater facility on SW 19th Avenue and Taylors Ferry Road.
	  • Completed construction of three green streets to manage 44,900 square feet of NW Front Avenue.
	• The following retrofit projects were in the design phase during the year:
	  • Over 50 green street facilities to treat approximately 30 acres of City right-of-way on NE Sandy Boulevard from NE 122nd Avenue to NE 138th Avenue.
	  • Green street improvements along SW Capital Highway.
	  • Green street on SW Palatine Hill Road/Corbett Lane.
	  • Restore failing culverts along Leif Erikson Drive.
	  • Stormwater management improvements at SE Harney Street between SE 45th Avenue and Johnson Creek to treat 1.2 acres of impervious area.
	  • Phase 1 of a stormwater management improvement for the intersection of SW Shattuck and Beaverton-Hillsdale Hwy.
	  • Two stream daylighting projects at Albert Kelly Park and Jackson Middle School.

2. Identify, prioritize, and construct new stormwater management facilities.	• The City has been designing and constructing stormwater management facilities since the beginning of the first MS4 permit term (1995) to reduce water quality impacts from development. Various City policies, programs, and plans facilitate the implementation of stormwater management facilities:
	  • Capital Program: The Capital Improvement Program (CIP) includes a Surface Water Management program area. The CIP project list is developed through a multi-step process to identify, develop, review, score, and rank projects for funding and scheduling priority.
	  • The City has constructed green streets and other stormwater management facilities under other City programs to treat stormwater from existing rights-of-ways in select areas to reduce total suspended solids loadings.
	  • See the list in response to Strategy 1 (above) for specific projects.

3. Maintain stormwater conveyance system maps and database to track system components and conditions.	• BES continued to track assets, such as inlets, pipes, and conveyance infrastructure, and the number, type, size, drainage, and location of water quality facilities (i.e., structural BMPs and green streets) constructed annually.
4. Develop a comprehensive Stormwater System Plan.	• Continued to develop the Stormwater System Plan, a multi-year project to fully define and plan for the City's stormwater system needs and natural drainage operations. • Continued development of a preliminary citywide analysis for each stormwater service category to inform the next stage of system planning and risk assessment. Service categories include stormwater system deficiencies that impede community

Activities Conducted to Implement Citywide Management Strategies

Table 6. Structural Controls (STR)	
Strategy	**Implementation Activities FY 2016-17**
	development, disruption of the hydrologic cycle, habitat degradation, landslide hazards, localized nuisance flooding, risks to surface waters from sanitary sewer infrastructure, and water quality degradation. • Continued predesign of several water quality and flow control projects in the Stephens Creek watershed, in partnership with the Westside Watershed team. • Continued preliminary design and community outreach to explore retrofit options for the underserved Errol Heights neighborhood in Southeast Portland, in partnership with the Eastside Watershed team. • Continued preliminary design and community outreach to explore retrofit options for Capitol Highway in Southwest Portland, in partnership with the Westside Watershed Team.

Table 7. Program Management (PM)	
Strategy	**Implementation Activities FY 2015-16**
1. Develop annual reports by November 1 that provide an overview of the TMDL Implementation Plan status.	• The FY 2016-17 TMDL Annual Report will be completed on or by November 1, 2017.

Table 8. Monitoring	
Strategy	**Implementation Activities FY 2016-17**
1. Implement a monitoring program that includes stormwater and surface water.	• The Monitoring Compliance Report is published as part of the NPDES MS4 Permit Annual Compliance Report submitted to DEQ on or by November 1, 2017. Table B-1 in Schedule B of the 2011 NPDES permit summarizes required monitoring types, locations, frequency, and analytic parameters. The required monitoring information is included in Section 3 of the Annual Compliance Report. • In 2016, BES updated the Monitoring Plan that describes the City's instream and stormwater monitoring activities for MS4 Permit compliance. The Monitoring Plan and associated sampling efforts were implemented at the beginning of FY 2016-17.

Activities Conducted to Implement Citywide Management Strategies

Table 9. Temperature Management Strategies	
Strategy	**Implementation Activities FY 2016-17**
1. Riparian Protection	• Under the City's Watershed Revegetation Program, planted 6,728 trees (4,493 deciduous and 2,235 coniferous) and 23,820 shrubs on 37 acres. Plantings were done on over 10,300 linear feet of streambank. • Supported the Johnson Creek Watershed Council's 19th annual Johnson Creek Watershed-Wide Restoration Event, where volunteers planted 2,500 native trees and 4,500 shrubs and cleared 5.0 acres of invasive plant material. • Under BES's Community Stewardship Grants Program, distributed 13 stewardship grants totaling approximately $84,000 for projects that included planting approximately 3,575 native trees, shrubs, and groundcover; 0.31 acres of invasive removal; and restoration of 26,400 linear feet of stream bank. • Continued to protect riparian vegetation through natural resource inventories, protection plans, and environmental overlay zones.
2. Revegetation Program	**Willamette River** • Planted 4.3 acres. This included 950 deciduous trees, 200 coniferous trees, and 4,848 shrubs. **Columbia Slough** • Planted 12,920 plants on 1,836 linear feet of riverbanks composing 10.2 acres. This included 1,840 deciduous trees, 210 coniferous trees, and 4,005 shrubs. **Johnson Creek** • Planted 2,261 linear feet of streambank on 2.5 acres. This included 455 deciduous trees, 225 coniferous trees, and 2,800 shrubs. **Tryon Creek** • Planted 6,020 linear feet of streambank on 17.6 acres. This included 1,173 deciduous trees, 1,450 coniferous trees, and 11,300 shrubs. **Fanno Creek** • Planted 264 linear feet of streambank on 2.0 acres. This included 75 deciduous trees, 150 coniferous trees, and 867 shrubs.
3. Coldwater Refugia	• The City paused its planning on the Powers Marine logjam project in response to a lack of funding and partnerships. However, the City initiated planning at Eastbank Crescent, a large riverbank restoration effort on the eastside of the Willamette River in and around OMSI. The Eastbank Crescent Plan was approved by Council in June 2017. The project will include installation of large wood structures into a laid bank with native vegetation. The City is exploring funding the project as a mitigation bank. The project does not have any direct cold-water inputs but will create micro-refugia and shaded riverbanks. The riverbank in front of OMSI is characteristic of much of the habitat in Portland and the City is looking at the Eastbank Crescent Project as a pilot for how to create versus enhance existing cold water refugia. The City's strategy is derived from Willamette River fish sampling that is finding high densities of juvenile salmonids in areas of submerged vegetation even when cold water inputs are absent (i.e., Sellwood Park). • The City is contributing temperature data and expertise to the DEQ and EPA in response to the 2015 Temperature Biological Opinion. In 2016, BES added temperature monitoring at additional Willamette River sites to explore non-tributary cold-water inputs into the Lower Willamette River. • In 2016, the City constructed its final two projects of the Crystal Springs restoration effort. The 2016 project replaced the SE Bybee and SE Glenwood culverts with fish passable culverts, restored riverbanks, and added large wood. In addition, the project narrowed the creek to increase flow to minimize sedimentation and solar heating. With the conclusion of this project, the City has restored over half of the entire length of Crystal Springs and the entire length is fish passable. Crystal Springs is a spring-fed cold-water stream and tributary of lower Johnson Creek. The Johnson Creek confluence is an important off-channel refuge for migrating salmon

Activities Conducted to Implement Citywide Management Strategies

Table 9. Temperature Management Strategies

Strategy	Implementation Activities FY 2016-17
	and Crystal Springs feeds uniform flows to Johnson Creek and the lower Willamette River, accounting for over 75% of the total flow of lower Johnson Creek in the summer. Restoration efforts along the creek, including Westmoreland Park, has added large logs, root wads, and boulders to slow water and create pools for fish. Restoration included replacing old culverts with fish passable structures at Glenwood, Bybee, Tenino, and Umatilla streets, as well as a railroad bridge and streambank enhancement. Temperature monitoring has indicated that the Westmoreland Park restoration reduced temperature by 3 degrees Celsius. Additionally, the pools created by the restoration are stratifying in the summer, providing cold water in the deeper parts pools. The City also commissioned a USGS study of the remaining lakes, Reed Lake and Crystal Lake, at the headwaters of the creek, which identified those lakes, especially Crystal Lake, as the remaining heat sources in the watershed. The City is exploring how to reduce these remaining heat sources to keep the entire 2.3 miles of Crystal Springs Creek below 18 degrees Celsius year-round. • Continued work on the Oaks Bottom Wildlife Refuge Tidal Restoration Project. The Oaks Bottom Wildlife Refuge is a 160-acre park with diverse habitats including an extensive floodplain located along the east bank of the Lower Willamette River at approximately River Mile (RM) 16 in southeast Portland. The project area is within the 100-year floodplain of the Willamette River, which is within the tidal zone of the Columbia River. Oaks Bottom offers a unique opportunity for a large, natural, tidally influenced floodplain and wetland area to be restored in the heart of the city. The channel is spring-fed and supplies cool water to the Willamette River. The purpose of the proposed action is to restore a more natural tidal hydrologic connection between Oaks Bottom and the Lower Willamette River, improve diverse fish and wildlife habitats, reduce non-native species populations, and provide unhindered fish passage into and out of Oaks Bottom. In January 2016, the city entered into a formal Water Resources Development Act Section 206 Project Partnership Agreement with the U.S. Army Corps of Engineers which provides a cost share 65/35 federal/city. Currently the project is at final design and a construction contract has been awarded by the Corps for work in the summer of 2018. • In December 2016, Congress reauthorized the Water Resources Development Act that included the Lower Willamette River Dredging and Ecological Restoration projects. The City is partnering with the Army Corps of Engineers on 5 projects totaling over $30 million: replacement of the Highway 43 culvert over Tryon Creek to open all of Tryon Creek to migrating salmon and steelhead; restoration of off channel habitat at Sellwood Park (modeled after Oaks Bottom); creation of off channel habitat at Kelly Point Park; and in the Columbia Slough, restoration of Kenton Cove and reconnection of an off-channel wetland at the BES wastewater treatment plant. The City is working on securing federal funding and has identified the Highway 43 project as the highest priority. • In 2016, Portland became the first city to become Salmon Safe Certified. A number of conditions of certification will benefit temperature including stormwater management, restoration and coordinated monitoring. In response to the Salmon Safe Certification and the success of the Crystal Springs restoration, in late 2016 Portland City Council directed the City to create the concept of "Salmon Sanctuaries." The City identified the top 10 watershed criteria for salmon recovery and graded all salmon bearing streams against the criteria. Streams that meet key criteria are designated as Salmon Sanctuaries. Temperature is one of the criteria. Crystal Springs was designated as the first Salmon Sanctuary in 2017. Additional work is needed to develop criteria for key reaches of the Willamette River. Once streams meet the criteria, Council will designate them as Salmon Sanctuaries.
4. Land Acquisition	• Acquired 3.0 acres in the Stephens Creek subwatershed, 40 acres in the Johnson Creek watershed, 12 acres in Forest Park, and 18 acres in the Columbia Slough watershed.