City of West Linn, Oregon

National Pollutant Discharge Elimination System Municipal Separate Storm Sewer System Discharge Permit and TMDL Implementation Plan

2014-2015 Annual Report

Prepared for the

Oregon Department of Environmental Quality

October 29, 2015

October 29th, 2015

Municipal (MS4) Stormwater Coordinator
Oregon Department of Environmental Quality
811 SW Fourth Ave.
Portland, OR 97204

Dear Lisa Cox,

On behalf of the City of West Linn, I am pleased to submit the enclosed 2014-2015 NPDES and the Willamette and Tualatin River TMDL Implementation Plans Annual Report. This report fulfills annual reporting requirements for the Clackamas County (and co-permittees) renewed NPDES MS4 Discharge Permit, issued March 16, 2012, and the City's Willamette River and Tualatin River TMDL Implementation Plans.

This annual report demonstrates progress implementing permit requirements, and meeting Stormwater Management Plan (SWMP) commitments and goals. Appendix A documents implementation activities applicable to the current 2012 SWMP.

Please call me at 503-722-5500 if you have any questions regarding the report.

Sincerely,

Lance Calvert
Public Works Director/ City Engineer
City of West Linn

cc: Mike Cardwell, City of West Linn

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1.0 Introduction

1.1 NPDES MS4 Permit Background

The Oregon Department of Environmental Quality (DEQ) regulates stormwater runoff from the City of West Linn through the Municipal Separate Storm Sewer System (MS4) National Pollutant Discharge Elimination System (NPDES) Permit No. 101348[1], issued to Clackamas County and its co-permittees. Clackamas County co-permittees include the City of West Linn along with the cities of Lake Oswego, Gladstone, Milwaukie, Oregon City, Wilsonville, Happy Valley, Johnson City, and Rivergrove, the Oak Lodge Sanitary District, and Clackamas County. Each co-permittee is a relatively small community, most having populations between 15,000 and 25,000 with some (Johnson City, Rivergrove) having significantly smaller populations.

The City's MS4 NPDES permit was reissued March 16, 2012, after a multi-year negotiation process with DEQ and an additional year-long delay related to an appeal. The 2012 reissued permit was not appealed, and thus maintains an effective date of March 16, 2012. In conjunction with the reissuance of the City's permit, Stormwater Management Plan (SWMP) updates to address requirements of the reissued permit were submitted and approved by DEQ on May 16, 2012.

Each co-permittee is required to submit an annual report, summarizing accomplishments and implementation of their individual SWMPs. This annual report documents stormwater management activity from July 1, 2014 to June 30, 2015 in conjunction with the City's reissued MS4 NPDES permit.

1.2 Document Organization

The following table (Table 1) outlines the organization of this annual report document, with respect to the annual reporting requirements per Schedule B(5) of the City's MS4 NPDES permit.

Annual reporting requirements		Section location in this NPDES Annual Report
a	Status of implementing SWMP elements, including progress in meeting measurable goals.	7.0 and Appendix A
b	Status of any public education effectiveness evaluation conducted during the reporting year, and a summary of how results were used in adaptive management.	3.0
c	Summary of the adaptive management process implementation during the reporting year including new BMPs**.**	2.1
d	Proposed changes to SWMP program elements to reduce TMDL pollutants to the MEP.	2.2
e	A summary of total stormwater program expenditures and funding sources over the reporting fiscal year, and those anticipated in the next fiscal year.	4.0
f	A summary of monitoring program results, including monitoring data that is accumulated throughout the reporting year.	5.0 and Appendix B
g	Any proposed modifications to the monitoring plan necessary to ensure that adequate data and information are collected to conduct stormwater program assessments.	5.2
h	A summary describing the number and nature of enforcement actions, inspections, and public education programs.	6.0 and Appendix A
i	An overview, as related to MS4 discharges, describing land use changes, UGB expansions, land annexations, and new development activities. The number of new post-construction permits issued and an estimate of new and replaced impervious surface must also be included.	6.0
j	A summary related to MS4 discharges describing concept planning or other activities in preparation of UGB expansions or land annexations.	6.0
k	Additional elements required for submittal by November 1, 2015:	These three items

[1] **The City's MS4 NPDES permit can be found at:**
http://www.deq.state.or.us/wq/wqpermit/docs/individual/npdes/ph1ms4/clackamas/ClackCoMS4Permit.pdf

	• The TMDL Pollutant Load Reduction Evaluation • The Wasteload Allocation Attainment Assessment • The 303(d) Evaluation	will be submitted to DEQ as separate documents.

1.2 Document Organization cont.

Each section of this report corresponds to the specific requirements for annual report submittals found in Schedule B.5. of the NPDES MS4 permit. This report emphasizes efforts and activities associated with individual Best Management Practices (BMPs) from the City's effective 2012 SWMP, as summarized in Appendix A.

In addition to annual report information required under the City's NPDES MS4 permit, Appendix C of this report includes the TMDL Implementation Plan annual reports for the Tualatin River and Willamette River TMDLs. The City submitted an updated Willamette River TMDL Implementation Plan to DEQ on April 30, 2014 and an updated Tualatin River TMDL Implementation Plan to DEQ on June 11, 2014. The TMDL Implementation Plans include strategies to address temperature as a parameter not otherwise addressed through implementation of the City's NPDES MS4 permit and SWMP.

2.0 Adaptive Management Process Implementation

2.1 Adaptive Management Program

In accordance with the issuance of the City's renewed MS4 NPDES permit (in 2012), the City was required to document their adaptive management approach to assess annually and modify, as necessary, existing and new SWMP components. The City submitted their adaptive management approach to DEQ on November 1, 2012, as required in the reissued NPDES MS4 permit.

Historically, the City has implemented adaptive management principals to annually refine implementation methods and data collection activities in conjunction with their effective SWMP and BMPs. More significant modifications to SWMP activities occur every five years, in conjunction with their permit renewal application and updated permit requirements. Documentation of the adaptive management approach was not explicitly required until issuance of this permit (2012). The City's adaptive management approach maintains consistency with the City's historical approach for implementing adaptive management principals.

Annually, as the City completes their NPDES MS4 annual report, the City reviews SWMP implementation through BMP-specific measureable goals and tracking measures. The City collects data and feedback from staff responsible for implementing and reporting on each BMP to gage whether implementation was deemed to be effective or whether there are suggested improvements to be made. Suggested adjustments to BMP implementation will include consideration of resource availability, budget/funding, and overall need. For this annual report, no adaptive management changes were made to the SWMP as a result of this annual process.

Every 5 years, during the permit renewal process and SWMP update effort, additional factors are considered as part of the City's overall adaptive management process. These factors include more detailed information related to BMP implementation, such as:

1. Whether technology or information is available that would help improve or refine BMPs.
2. How representative are the measurable goals and tracking measures to the BMP objective?
3. Are resources available to make changes to the measureable goals and BMP objectives?

Additionally, throughout the permit term, technical investigations and studies are required in conjunction with compliance dates outlined in the permit. Such studies include (but are not limited to) a water quality trends analysis, pollutant load reduction evaluation, waste load allocation attainment assessment, 303(d) evaluation, hydro-modification assessment and a retrofit assessment. All studies will help target and identify specific issues that need to be addressed to maintain waterbody health and help formulate BMP activities (measureable goals and tracking measures) that can be used to support improvements.

2.2 SWMP Updates for the 2014-2015 Reporting Year

The 2014-2015 reporting year is the third permit year in which the City's effective SWMP (dated 2012) has been implemented. No updates were made to the 2012 SWMP or BMP measureable goals and tracking measures beyond those submitted to DEQ in May 2012.

3.0 Status of Public Education Effectiveness Evaluation

In 2013, the Oregon Association of Clean Water Agencies (ACWA) facilitated a collaborative effort amongst members to conduct a statewide stormwater public education effectiveness analysis. ACWA hired Davis, Hibbitts & Midgal, Inc. (DHM Research) to compile local, state and regional survey data with regard to public awareness and actions that contribute and combat stormwater pollution. The collective data was evaluated to help establish a baseline of the public understanding and reported behaviors typically associated with stormwater pollution contributions. Findings are documented in a report format (HDM Report) and were distributed to participating jurisdictions for their individual use. The targeted findings are focused on pet care, car care, lawn and garden care, and home care, which are distinct municipal stormwater pollutant resources where source control activities (like public education) are generally a preferred treatment approach. The report was completed in February 2014 and was sent to DEQ in the form of a Summary as part of the NPDES MS4 Permit requirement Schedule A.4.d.vi, July 1st, 2015. See Appendix D to read the P.E. Effectiveness Evaluation Summary and the HDM Report.

4.0 Summary of Program Expenditures

A summary of the City of West Linn's funding sources, expenditures for the 2014-2015 fiscal year and a projection of the City's expenditures for the 2015-2016 fiscal year are provided in Tables 2, 3 and 4 respectively.

Table 2: Environ. Services Division - FY 2014-2015

Funding Sources	Amount
Charges for Services	$ 775,191
SDC Reimbursement Fees	$ 18,701
Misc.	$ 24,245
Total	$ 818,137

Table 3: Environmental Services-Expenditures FY 2014-2015

Expenditures	Amount
Personal services	$ 270,267
Materials and services	$ 143,119
Capital outlay	$ 214,229
Transfers	$ 338,000
Total	$ 965,615

Table 4: Projected Expenditures – FY 2015-2016

Expenditures	Amount
Personal services	$ 318,000
Materials and services	$ 225,000
Capital outlay	$ 430,000
Transfers	$328,000
Total	$ 1,301,000

5.0 Monitoring Data

5.1 Summary of the Comprehensive Clackamas County Stormwater Monitoring Plan (CCCSMP)

Per the 2004 MS4 NPDES permit requirements (Schedule B), the City of West Linn, along with Clackamas County and other co-permittees was required to develop and implement a stormwater monitoring program. Given the effort associated with implementing an effective environmental monitoring program that adequately met all permit requirements and objectives, Clackamas County (i.e., CCSD#1 and SWMACC) and six other co-permittees including the City of West Linn agreed to consolidate efforts and prepare one comprehensive stormwater monitoring plan. This plan, called the Comprehensive Clackamas County Stormwater Monitoring Plan (CCCSMP), was prepared for submittal with the 2006 NPDES Permit Annual Compliance Reports. The plan was implemented beginning July 1, 2007 and minor editorial changes were made in 2008.

In conjunction with requirements of the 2012 reissued NPDES MS4 permit, the 2007/2008 CCCSMP was reviewed for consistency with revised monitoring objectives. Monitoring locations and frequencies were adjusted to reflect requirements of the 2012 Permit. Additional efforts related to mercury monitoring, pesticide monitoring, macro invertebrate (biologic) monitoring and geomorphic monitoring were added to the CCCSMP. Detail related to use of a time composite sampling methodology was added. Additional information such as quality assurance procedures were also added in conjunction with Schedule B.2 of the 2012 Permit.

The updated (2012) CCCSMP was submitted to DEQ in September 2012. Comments from DEQ were received in October 2012 and final revisions to the 2012 CCCSMP were submitted to DEQ June 30, 2013. For this reporting year, the 2013 CCCSMP is the effective, implemented monitoring plan for the City of West Linn. The 2012 CCCSMP was implemented starting October 2012.

As described in the CCCSMP, the MS4 NPDES stormwater monitoring program requires two components. The first component is program monitoring, which involves the tracking and assessment of programmatic activities, as described in the individual permittees SWMP, through the use of performance indicators or metrics. Results of the program monitoring are reported in Appendix A as the annual tracking measures. The second component is environmental monitoring, which includes visual monitoring and the actual collection and analysis of samples. Visual monitoring efforts include dry weather field screening as described in the City's SWMP under the following BMP: "Implement the Illicit Discharge Elimination Program." Results of the visual monitoring efforts are reported in Appendix A and Section 6.0 under the applicable BMP. Environmental monitoring also consists of instream sample collection and outfall sample collection, and the City's sampling efforts are outlined in more detail in Section 5.2 and 5.3 and in the CCCSMP. Results of the instream and outfall sample collection efforts are provided in Appendix B.

5.2 CCCSMP Updates and Modifications for the 2014-2015 Reporting Year

There were no updates or modifications to the CCCSMP this reporting year.

5.3 Summary of Monitoring Data

The City's reissued MS4 NPDES permit (effective date: March 16, 2012) prescribed new monitoring requirements that were to take effect October 1, 2012. Monitoring requirements included instream and stormwater outfall monitoring, mercury monitoring, pesticide monitoring and biological monitoring.

In accordance with the 2012 CCCSMP, West Linn conducts instream and outfall monitoring. The City conducted instream monitoring at three locations:

1. Site #1: Trillium Creek at Caloroga Road, a tributary to the Willamette River
2. Site #2: Tanner Creek at Imperial Drive, a tributary to the Willamette River, and
3. Site #3: Unnamed Creek at Ryan Court & Johnson Road, a tributary to the Tualatin River

Outfall monitoring was conducted at an outfall to Barlow Creek, a tributary to the Willamette River (Site #4). In accordance with the frequencies outlined in the 2013 CCCSMP, time composite grab samples are taken at the instream monitoring locations a minimum of three times a year (during storm events). Single grab samples are taken during two additional monitoring events (not during storms) at the instream monitoring locations. For instream monitoring, 50% of the samples need to be collected during the wet weather season (October 1st - April 30th). Time composite grab samples are taken at the outfall monitoring location three times a year during rain events.

Since 2012, the City of West Linn has been participating in a coordinated pesticide monitoring effort with other Clackamas County co-permittees and the USGS. Sediment and instream water samples were collected in the summer of 2013. Preliminary results were provided by USGS to the participating jurisdictions in April 2014. The USGS submitted the draft report for final internal review and approval on October 8, 2015.

A first round of mercury sampling took place in March and April of 2013. As the initial obligations for mercury monitoring were fulfilled, and as DEQ was unclear in how they intended to use the data, in December 2014 we asked DEQ if we could forgo the second round of mercury sampling. DEQ agreed that a second round would not be necessary at this time.

Biological monitoring was conducted early in the permit cycle and a final report was prepared for the cities of Gladstone, Lake Oswego, Milwaukie, Wilsonville and West Linn in February 2014 and was submitted with last year's annual report.

Complete instream and stormwater outfall sampling results are included and summarized in Appendix B. The sampling results represented have been formatted to simplify the data review process.

6.0 Overview of Planning and Land Use Changes, UGB Expansions and New Development Activities

6.1 Stormwater Planning, Land Use Changes, and UGB Expansions

There were no land use or zoning changes, UBG Expansions or revisions to the CDC during the period from 7/1/2014 to 6/30/2015. The City of West Linn is located entirely within the urban growth boundary (UGB). There were several annexations that were approved by the City Council in the last Fiscal Year and were approved by the citizens in November 2014:

- (ANX-14-03) 2.95 ACRES AT 1430 ROSEMONT RD,
- (ANX-14-02) 4.90 ACRES AT 22850 & 22848 WEATHERHILL RD,
- (ANX-14-01) 2.126 ACRES AT 23128 S BLAND CIR

6.2 Summary of Development Activities within the UGB

Approximately 70% of West Linn's land use type is zoned residential while 7% is commercial/ industrial. One percent of land use is unincorporated county land, while 4% is Interstate 205 right-of-way, 6% is river and 12% is park and open space. Current development activities include residential infill, land divisions, commercial development and public projects. The City of West Linn requires stormwater management and erosion control for new and redevelopment activities exceeding 500 square feet of impervious surface in accordance with the City of Portland's Stormwater Management Manual. Stormwater quality facilities installed in the City include bio swales, rain gardens, ponds, and pervious pavement.

During fiscal year 2014-2015, five minor partitions were approved yielding a total of seven new lots. In this period, a 22 lot subdivision (2100 Weatherhill Road) and a six lot subdivision (2900 Haskins Road) were also approved. A 900 square foot concession stand was approved for Rosemont Middle School. An expansion of the City of West Linn's Cedaroak Boat ramp was approved with an 11,655 square foot increase in impermeable surfaces. The City of West Linn Police Station was completed. Commercial development was limited to a 1,200 square foot commercial structure at 19068 Willamette Drive. The commercial structure was approved by a building permit only, not a land use application. Stormwater treatment was addressed at each development site. One water quality facility was built at Weatherhill subdivision and will be owned and maintained by the City. The Haskins Road subdivision will use individual rain gardens for stormwater treatment. The Cedaroak boat ramp project includes a public water quality and detention facility and will be owned and maintained by the City. The Rosemont Middle School concession stand impervious surface stormwater runoff will be directed to an existing public stormwater quality facility already sized to accommodate this development and maintained by the City. The commercial development (19068 Willamette Drive) is within an established commercial site with an existing private stormwater quality and detention facility already sized to accommodate this development.

The Lake Oswego Tigard Water Treatment Plant Transmission Line is still under construction. The project

is part of a large, multi-jurisdictional project to increase treated water capacity for the residents in Lake Oswego and Tigard. A pipeline will be necessary to convey water to and from the WTP. The pipeline will be under separate Conditional Use and Public Improvement Permits. The City of West Linn is providing ongoing inspections to ensure among other things that erosion control measures are in place and closely monitored.

A breakdown of total and new/redeveloped impervious area for each development application is provided in Table 54. Stormwater treatment was addressed at each development site. Private development activities included the construction of 5 subdivisions, which included a total of 27 rain gardens (with 27 recorded maintenance agreements) and 1 commercial development.

Table 5: Public and Private BMP's

Name	Total drainage area, in sf	Impervious area (new or redeveloped), in sf
Private Raingardens (27)	89,321	89,321
Harper Partition - Public WQ Facility	8,197	8,197
Harper Partition - pervious concrete common private driveway	2,079	2,079
Weatherhill Partition - Public WQ Facility	116,131	57,014
Sunbreak Partition - Public WQ Facility	122,012	63,889
Rosemont Subdivision Public WQ Facility	13,015	11,415
Renaissance at Willamette (Ostman Road) Partition - Public WQ Facility	8,440	8,440
Police Station	48,518	48,518
Total (ac)	9.4	6.6

7.0 Additional Activities

The NPDES Permit's compliance items that were due July 1, 2015 were completed and included:

1. Hydromodification Assessment
2. Stormwater Retrofit Strategy Plan
3. Public Education Effectiveness Evaluation

The Hydromodification Assessment and Stormwater Retrofit Strategy Plan were prepared with support from our stormwater contractor, Brown & Caldwell. The city along with B & C, surveyed some of the streams in West Linn to complete this compliance item.

In addition, the following stormwater-related activities occurred within the City and are documented here to allow for more detail given the space constraints associated with providing text in Appendix A. A description of activities is provided by applicable BMP. The annual progress associated with all remaining BMPs is provided in Appendix A.

<u>BMP: Conduct Annual Dry Weather Field Screening</u>

Dry weather field screening was conducted at 6 locations on 8/11/14 and 8/12/14 (see Table 6 for results). There was no precipitation for more than 72 hours prior to the inspections.

The following are notes from Inspection sheets; the numbers correspond to High Priority Site numbers:

1. No observed problems.
2. 3.5 inches of standing water due to excessive vegetation, (tall grass) growing on the bottom of

pipe. Petroleum looking oil sheen and suds present too.

3. No problems however, the temperature of water is a lot warmer today (20.4℃) compared to last week's 16.4 ℃.
4. Water coming out of pipe is clear, but there is brown colored water, smelling faintly of sewage, coming out of the outside of the outfall pipe. Protocol dictates that we test the pH, conductivity, dissolved oxygen and temperature of the discolored water. All parameters were within normal ranges, so no water sample was taken. The probability of illicit discharge is "Potential".
5. No Problems.
6. No Problems.

Table 6: Annual Dry Weather Field Screening

Site Number	Site	Creek	Flow	Clarity	Odor	Color	Foam or	Wood	Fish?	Garbage
HP=High Priority		Name	Quantity				sheen	debris		
HP 1	Brandon Place	Tualatin	No flow	-	-	-	-	-	-	None
HP 2	13th St @ I-205	Bernert	Trickle	Clear	None	Clear	Both	None	No	None
HP 3	Imperial DR	Tanner	Trickle	Clear	None	Clear	None	No	No	None
HP 4	Hollowell	Cascade Springs	Low	Clear	Faint	Brown beside outflow	None	No	No	None
HP 5	Barclay @ Tompkins	Barlow	No flow	-	-	-	-	-	-	None
HP 6	Old River DR	Robin	No flow	-	-	-	-	-	-	None

BMPs: Ensure staff training for pest management, ensure staff training in spill response and promote staff education related to environmentally friendly solutions:

The following training activities were conducted to comply with these BMPs.

Table 7: City Training Activities

Name of Activity	Date Attended	Number of Staff
CCC 39th Annual Water Environmental School	3/25/2015 - 3/27/2015	4
ACWA Stormwater Committee Meeting	10/8/2014	1
ACWA Stormwater Committee Meeting	11/12/2014	1
Clackamas Co-permittee Meeting	1/14/2015	1
ACWA Stormwater Committee Meeting	1/14/2015	1
Phase 1 NPDES Permit Renewal Committee	2/20/2015 & 4/10/2015	1
ACWA Stormwater Summit - Eugene	5/13/2015	2
Map review & field work planning workshop for Hydromodification	5/11/2015	5
ACWA Stormwater Committee Meeting	4/8/2015	1
Regional Stormwater Outreach Discussion	11/21/2014	1
Mid-Willamette Erosion Control & Stormwater Management Summit	1/27/2014	2
River Network meeting "Willamette Restoration Coordination: Willamette Falls to Sellwood Bridge"	12/8/2014	1
River Network Meeting, Oak Grove	12/5/2014	1
Clackamas Comm. College Water Education Program	3/17/2015	1

Appendix A

West Linn SWMP
Implementation Status

Key to Pollutant Symbols: a full circle (○) indicates the BMP is expected to address the parameter. An empty circle (●) indicates the BMP may be expected to address the parameter. A blank cell indicates that the effect of the BMP is unknown at this time.

Appendix A. Status of Implementing components of West Linn's 2012 Stormwater management Plan (SWMP)								
BMP or Activity	**Addresses Bacteria?**	**Addresses Mercury and TVs?**	**Addresses Phosphorus?**	**Responsible Department**	**Measurable Goals (2012 SWMP)**	**Tracking Measures (2012 SWMP)**	**Annual report information: tracking measure status, Permit year 2014-2015**	**Additional detail related to activities conducted**
Element 1: Illicit Discharge Detection and Elimination								
Implement the Illicit Discharge Elimination Program	○	○	○	City of West Linn Public Works (COWL-PW)	• Document and implement the details of the City's IDDE program in a Standard Operating Procedures manual by November 1, 2012. • For identified illicit discharges, conduct appropriate actions to remove the discharge in conjunction with time frames outlined in the City's MS4 NPDES Permit. • Track and record all identified illicit discharges and how such discharges were removed.	1. Track the status of completing IDDE SOP Manual 2. Track the number, location, resolution, and enforcement activities related to any illicit discharge investigation conducted	1. The City of West Linn developed an IDDE SOP (effective 11/01/2012). The SOP includes guidelines for identification and enforcement of illicit discharges as well as how to inspect the priority outfalls for Dry Weather Inspections. 2. There were no illicit discharges discovered during the reporting year.	
Conduct Annual Dry Weather Field Screening	○	○	○	COWL-PW	• Conduct dry weather, illicit discharge inspections annually at all priority outfall locations • Develop pollutant parameter action levels to assist in the identification of non-permissible discharges by 11/01/2012. • If necessary, update existing mapping related to outfalls and priority outfall locations in accordance with field observations.	1. Track the number and location of high priority outfalls inspected during dry weather illicit discharge inspection activities. 2. Summarize inspection results and indicate outfalls requiring sampling and/or investigations. 3. Indicate the outcome and resolution of any investigation activities conducted.	1. 6 high priority outfalls were inspected as part of the annual dry weather field screening activities on 08/12/2014 and 8/13/2014. Please note that inspections occurred at the high priority outfall locations identified in the IDDE SOP. 2. Inspection results are provided in Section 6.0 of this report with overall good results. The only outfall of concern was Site HP#4 (Hollowell) where a faint sewage spill was evident and brownish looking water was flowing beside the outfall. Water parameters were taken with the following results: pH 7.6, conductivity 180.0 µS/cm, Dissolved Oxygen was 133.7% and the temperature was 21.1 °C. The water parameters were within normal ranges according to the IDDE SOP, so it wasn't necessary to take samples. 3. Inspection results are provided in Section 6.0 of this report. None of the inspection results warranted follow-up investigations. In accordance with the IDDE SOP, priority inspection locations were updated to better reflect outfalls with solely Stormwater contribution to receiving waters.	
Implement the Spill Response Program	○	○	○	COWL-PW & Tualatin Valley Fire and Rescue (TVF&R)	• Response to minor spills • Call TVF&R to respond to other spills	1. Indicate the number of spills reported to the City of West Linn Public Works 2. Track the number of spills responded to by the City of West Linn Public Works and Tualatin Valley Fire and Rescue 3. Indicate sources, causes, and types of discharges resulting from identified spill activities.	1. The City of West Linn Public Works division did not receive any reports of spills during the reporting year, 2014-2015 2. No spills were responded to by West Linn Public Works' personnel during the reporting period. TVF&R responded to many spills but only one would have a potential effect on West Linn's waterways. 3. Spill 1: (3/16/2015) Chevron Gas Station – a motorcycle was leaking fluids. Resolved with a small amount of absorbent.	
Element 2: Industrial and Commercial Facilities								
Screen Existing and New Industrial Facilities	○	○	○	COWL-PW	• Notify DEQ of any existing or new industrial facilities within the City of West Linn jurisdiction that may potentially be subject to an industrial Stormwater NPDES permit.	1. Track the number of existing or new facilities subject to a Stormwater industrial NPDES permit during the permit term	1. The City of West Linn has one active 1200-z permit holder – West Linn Paper Company. There were no new industrial facilities located in west Linn during the permit year.	Once during the permit term, the City of West Linn will review their existing business license inventory and new industrial development applications to determine whether any existing or new facilities would be subject to an industrial Stormwater NPDES permit.
Conduct Priority Facility Inspections	○	○	○	COWL-PW	• Inspect identified priority industrial or commercial facilities once during the permit term.	1. Track the number and outcome of priority facility inspections conducted over the permit term.	1. COWL-PW inspected 5 commercial complexes during the reporting year. They included: 1) Robinwood Shopping Center at the corner of Willamette Dr. and Hidden Springs Rd. 2) Polar Systems at 21890 Willamette Dr. 3) Tanner Springs Assisted Living Facility 4) River Falls Plaza on Blankenship Rd near Southbound I-205 5) 76 Gas Station on Willamette Dr. at Hwy 43.	Outcome: We had very good response to the commercial inspections. For the most part, the management companies of the commercial complexes did as we asked. This entailed cleaning up recycling, garbage, and oil bin areas and having professional vactoring companies clean their catch basins. There was 1 long overdue cleanup of a retention pond.

Appendix A. Status of Implementing components of West Linn's 2012 Stormwater management Plan (SWMP)								
BMP or Activity	**Addresses Bacteria?**	**Addresses Mercury and TVs?**	**Addresses Phosphorus?**	**Responsible Department**	**Measurable Goals (2012 SWMP)**	**Tracking Measures (2012 SWMP)**	**Annual report information: tracking measure status, Permit year 2014-2015**	**Additional detail related to activities conducted**
Element 3: Construction Site Runoff Control								
Implement the Erosion Control Manual	○	●	●	COWL-PW and COWL Planning Department	• Require submission of erosion control plans for development greater than 1000ft^2. • Require a copy of all 1200-c permit applications for development greater than five acres. • Assess new and redevelopment applications for erosion control compliance during plan review. Require erosion and sediment control plans not in compliance to be amended prior to approval in conjunction with provisions outlined in the Clackamas County Erosion Prevention and Sediment Control Manual (2008)	1. Report any updates or modifications to the Clackamas County Erosion Prevention and Sediment Control Planning and Design Manual (2008). 2. Record the number of erosion control permit (City issued and DEQ issued) applications received. 3. Track the number of erosion and sediment control plan reviews completed.	1. No updates or modifications to the 2008 Clackamas County Erosion Prevention and Sediment Control Planning and Design Manual of occurred. 2. West Linn issued a total of 44 Erosion Prevention Permits (all residential). 3. 7 erosion control plan reviews were completed in conjunction with land use development applications.	
Provide Educational Information to Construction Site Operators	○	○	○	COWL-PW and COWL Planning Department	Provide education information to construction site operators and the general public via brochures, flyers, pamphlets, and attachments to building and grading permit applications.	1. Verify that this BMP was conducted	1. The West Linn Building Department gave all builders and home owners who applied for an erosion control permit a copy of the West Linn Environmental Protection Guide that is included in the "Guide to Permits and Inspections" booklet. The Environmental Protection Guide is also available at City Hall and on the City Website.	
Conduct Erosion Control Inspections and Enforcement	○	●	●	COWL-PW	• Conduct initial and a final site inspection on all sites with an erosion control plan for appropriate erosion control. • As necessary, enforce appropriate erosion and sediment control in conjunction with the three-step progression as outlined on the City's website. • Require all disturbed areas to be permanently stabilized or vegetated prior to final engineering or building inspection. • Ensure a minimum of one additional erosion control inspection is conducted during active construction on all sites with an erosion control plan.	1. Track the number of erosion control inspections conducted each year. 2. Report the number of notices of non-compliance and stop work orders issued, and describe the measures used to resolve the issue.	1. The following number of erosion control inspection were conducted during the 2014-2015 reporting year: One additional erosion control inspection was added to the process and is entitled "Mid-level Inspections". Preliminary Inspections: 17 approved, 17 approved w/ conditions, 6 denied Mid-level Inspections: 7 approved, 6 approved w/ conditions, 2 denied Final Inspections: 56 Approved, 4 approved w/ conditions, 11 denied Total Inspections: 80 approved, 27 approved w/ conditions, 19 denied Total all EC Inspections: 118 2. No notices of non-compliance or stop work orders were issued during the 2014-2015 reporting year. Procedures for violations are listed under additional activities in the column to the right.	Permit violations are issued in a three step enforcement progression as follows: 1 – Written notice of the inspection findings and required corrections (warning) 2 – Should corrections not be implemented, a notice of non-compliance will be issued with the required corrections. 3 – Should corrections remain unaddressed, a stop work order will be issued. Additionally, a stop work order may be issued at any time a permit violation occurs.
Element 4: Education and Outreach								
Provide Public Education and Outreach Materials Regarding Stormwater Management	○	○	○	COWL-PW	• Utilize newsletters, brochures, bill inserts, City website, and radio advertisements to promote public awareness of stormwater quality issues and to provide information to encourage public reporting of illicit discharges. • Continue to make annual monetary contributions to TBPAC.	1. Track the number, types, and topics of public educational materials dispersed to the public annually. 2. Indicate any large-scale public educational campaigns initiated during a given year. 3. Track coordinated public outreach activities with local co-permittees. 4. Record the number of catch basins stenciled in a given year. 5. Track amount donated to TBPAC each year.	1. Put out 20 copies of "Stream Friendly Home & Yard Care" brochure, developed by TBPAC, at each of the following locations: Library, Senior Center, and Parks Department once per quarter during reporting year: July 2014, Oct. 2014, Jan. 2015, and April 2015. 2. Regional Coalition for Clean Rivers and Streams (RCCRS) started a public education campaign entitled "The River Starts Here". This campaign raises awareness about the fact that stormwater runoff is now the number one source of water pollution in America and inspires people to change behaviors in order to improve the health of our watersheds. Digital and print ads could be seen in the West Linn Tidings on June 18th and June 25th, 2015. 3. Coordinated efforts included: - One employee from West Linn's ESD staffed a stormwater display for the Clackamas County Water Education Team (CWET) 10th Annual "Celebrating Water" Event at Clack. Comm. College on March 17th, 2015. Additional efforts included:	The City website is a great source of public education materials. This reporting year the following documents were uploaded to the Stormwater section of the website: westlinnoregon.gov: Low Impact Development Approaches Handbook, OSU Field Guide for WQ Facilities Program, Yard Care Brochure, Rain Garden Guide, and the Weed Guide. Other items new to the City website are Tualatin River TMDL Implementation Plan and the Willamette River TMDL Implementation Plan, the Macro Invertebrate Report, Private Water Quality Management Program Inspection Guide and permeable paving information.

Appendix A. Status of Implementing components of West Linn's 2012 Stormwater management Plan (SWMP)								
BMP or Activity	**Addresses Bacteria?**	**Addresses Mercury and TVs?**	**Addresses Phosphorus?**	**Responsible Department**	**Measurable Goals (2012 SWMP)**	**Tracking Measures (2012 SWMP)**	**Annual report information: tracking measure status, Permit year 2014-2015**	**Additional detail related to activities conducted**
							- Donated $1084.00 to the Regional Coalition of Clean Rivers and Streams, (RCCRS). - Helped fund Tualatin Basin Public Awareness Committee's inventory on the stream crossing signage project. 4. No catch basins were stenciled during the 2014-2015 reporting year. We spent $565.14 on button style catch basin buttons but have not glued any down yet due to lack of employees. 5. We donated $1800 to TBPAC this year. We donated twice this fiscal year due to the fact that we didn't donate last year.	
Implement a Pet Waste Program	●			COWL – Parks and Recreation Department	• If pet waste is observed as a problem upon routine maintenance activities at public property, install educational signs and distribute educational door hangers at homes in the immediate vicinity of the identified problem areas. • Continue to provide pet waste baggies and disposal areas in City parks for disposal of domestic animal waste.	1. Report on activities conducted annually.	1. The City of West Linn currently has 50 dog waste bag dispensers installed throughout the parks and open spaces. During the 2014-2015 reporting year, the City spent $6,240 on bags. City staff monitors water quality facilities for pet waste issues. If a facility is observed to have issues, City staff distributes door hangers in the neighboring area to educate the public about pet waste. During the 2014-2015 reporting year, no facilities had pet waste issues. Also, the City participated in TBPAC's pet waste educational program.	
Participate in a Public Education Effectiveness Evaluation	○	○	○	COWL-PW	Coordinate with other local, Phase 1 jurisdictions in providing/compiling information regarding a public education effectiveness evaluation over the permit term.	1. Report on activities conducted annually.	1. The West Linn summary was sent to DEQ on July 1, 2015 of the DHM report entitled, "DHM Public Education Effectiveness Evaluation". The summary complies with the Permit's NPDES MS4 Permit requirement Schedule A.4.d.vi.	The ACWA Stormwater Committee initiated a coordinated effort to compile existing educational survey information and develop conclusions to inform how public education efforts result in behavioral change in 2013. DHM Consulting was awarded a contract to compile available survey information and formulate conclusions. ACWA coordinated with DEQ to ensure that the study would meet DEQ's intended requirements. Costs were shared amongst ACWA Phase I and Phase II communities, and West Linn participated in the effort.
Ensure Staff Training for Pest Management	○	○	○	COWL-PW and COWL-Parks and Recreations Department	Provide training to Public Works and Parks department crews once every two years on proper pesticide and fertilizer application rates and techniques in conjunction with guidelines outlined in the IPM Plan.	1. Report on training conducted every two years.	1. Appropriate staff within the Public Works department received a total of 62 hours of training in Pest Management. The Parks Department received a total of 47 hours of training.	
Ensure Staff Training in Spill Response	○	○	○	COWL-PW and TVF&R	Provide OSHA HAZWOPER training and refresher courses to staff initially responding to spills annually.	1. Track the number of employees receiving OSHA HAZWOPER training annually.	1. No City employee receives HAZWOPER training, instead we rely on TVF&R. Also, the City has a number of Emergency Response Contractors that we can call for spill emergencies: NW Hazmat, of Springfield, OR; Clearwater Environmental Services, in Wilsonville; Clean Harbors in Clackamas and NWFF Environmental of Portland.	
Promote Staff Education Related to Environmentally Friendly Solutions	○	○	○	COWL-PW	• Conduct municipal training for employees associated with stormwater management in the City. • Continue to participate in, and attend environmental and water quality related professional meetings and conferences. • Continue to maintain a budget for employee attendance of conferences. • Continue to coordinate with other local Phase 1 jurisdictions regarding regional water quality efforts	1. Track the number of employees receiving training in Stormwater management annually. 2. Track Operations and Engineering staff participation in professional organizations and attendance at relevant conferences.	1. Four employees attended the 38th Annual Oregon Environmental School (3/25/2014-3/27/2014). 2. Two employees attended both ACWA's Annual Stormwater Summit in Eugene in May 2015 and the Erosion Control Summit in January 2015. The Public Works Director attended the Seminar Group's Floodplain Development Seminar. Two employees of the street department attended an APWA conference in the spring of 2015. One employee of the street department attended a Deicing training in Gresham	

Appendix A. Status of Implementing components of West Linn's 2012 Stormwater management Plan (SWMP)								
BMP or Activity	**Addresses Bacteria?**	**Addresses Mercury and TVs?**	**Addresses Phosphorus?**	**Responsible Department**	**Measurable Goals (2012 SWMP)**	**Tracking Measures (2012 SWMP)**	**Annual report information: tracking measure status, Permit year 2014-2015**	**Additional detail related to activities conducted**
Element 6: Post-Construction Site Runoff								
Implement Community Development Code and Public Works Design Standards for Stormwater Treatment	●	●	●	COWL-PW and Planning Department	Per City's Development Code, review all new development and applicable redevelopment for conformance with current City stormwater standards and ordinances.	1. Track the number of development applications reviewed for compliance with the current stormwater requirements for treatment and detention. 2. Track any modifications to the list of currently approved structural stormwater treatment facilities. 3. Track private BMPs that are implemented and their associated drainage areas.	1. A total of 10 land use development applications were reviewed for compliance with stormwater treatment and detention standards. 2. There were no modifications to the list of currently approved stormwater treatment and detention facilities. 3. There were 27 new private facilities added in FY2015 with 89,321 sq. ft. of drainage area treated. A summary of private water quality facilities (in accordance with the development applications) is provided in Table 5.	
Review and Update the Applicable Code and Development Standards related to Stormwater Control	●	●	●	COWL-PW and Planning Department	• Review the City's current stormwater treatment standards for compliance with new MS4 NPDES permit language. • Review the City's current public works development code provisions to ensure that applicable barriers related to the use of LID or GI techniques are minimized and eliminated where practicable. • Update the City's existing post-construction stormwater design standards and code language by November 1, 2014.	1. Track progress related to the review of the City's code and development standards per provisions in the MS4 NPDES Permit.	The most current version of the City of Portland Stormwater Management Manual has been adopted by the City of West Linn for design of stormwater facilities. West Linn codes have been reviewed and no known barriers exist to inhibit GI or LID use in projects. The City of West Linn Public Works Construction Standards requires all development or redevelopment creating 500 sq. ft. or more of new impervious area to meet its post-construction stormwater management codes. On-site low impact development (LID) and green infrastructure (GI), including rain gardens, detention ponds, and bio-swale water quality facilities are required for most developments reaching this impervious threshold to capture and treat stormwater to the standards specified in the MS4 NPDES permit. West Linn code defines site conditions where LID may be impracticable and provide alternates for stormwater management, including offsite facilities. Stormwater facility maintenance agreements are required to be recorded in the County Deed Records for all new private facilities and enforcement actions are tracked by our Environmental Services Division.	
Element 7: Pollution Prevention for Municipal Operations								
Conduct Street Area Repair	○	●	○	COWL-PW	Ensure all road maintenance and repair activities implement appropriate erosion and sediment control to address potential water quality impacts.		Both City crews and contractors are required to implement erosion control measures at all times.	The following verbiage is on all construction plans: "Contractor shall provide erosion control best management practices per CWL Standards. Provide catch basin protection and continual sweeping so that no mud, sediment, or rock is left on the streets with no additional compensation."
Maintain Public Streets	○	●	○	COWL-PW	Sweep each street between 3 and 6 times per year.	1. Track the number of sweeps conducted annually. 2. Track the volume of debris removed during sweeping activities. 3. Track the amount (volume) of deicing agent used annually.	1. 7 City-wide sweeps were conducted during the 2014-2015 reporting year. 2. Approximately 3000 cubic yards of material were removed. 3. 1000 Gallons of deicing agent was used in the winter of 2014-2015	
Implement an Integrated Pest Management Program	○	○	●	COWL-PW and COWL-Parks and Recreation Department	• Use the Portland Integrated Pest Management (IPM) Program as a guide for appropriate pesticide and fertilizer application procedures along roadways, within City Parks, and around water quality facilities. • Conduct work within public right-of-way only with certified, licensed applicators.	1. Track any updates or modifications to the referenced IPM procedures and protocols. 2. Track the amount of money spent on pest management chemicals each year.	The City of West Linn uses the City of Portland IPM Program as an informal guide. 1. No new updates were made to the City of Portland Integrated Pest Management Program Manual. 2. The City spent approximately: $4,474 on pest management chemicals.	Pest management chemical costs by departm Water Department $0 ESD: $50. Streets: $200 Parks: $4,224
Implement a Program to Reduce the Impact of Stormwater Runoff from Municipal Facilities	○	○	○	COWL-PW	• Inventory municipal facilities subject to this permit requirement by July 1, 2013. • By July 1, 2013, identify and implement strategies to reduce the impact of pollutant discharges from these facilities.	1. Track strategies used to minimize pollutant discharge.	1. The entire Public Works parking lot was paved and concrete was poured during the 14-15 FY. The yard was cleared of any rusting equipment, metal and trash dumpsters had lids installed on them, and gutters from the buildings were directed into catch basins.	

Appendix A. Status of Implementing components of West Linn's 2012 Stormwater management Plan (SWMP)								
BMP or Activity	**Addresses Bacteria?**	**Addresses Mercury and TVs?**	**Addresses Phosphorus?**	**Responsible Department**	**Measurable Goals (2012 SWMP)**	**Tracking Measures (2012 SWMP)**	**Annual report information: tracking measure status, Permit year 2014-2015**	**Additional detail related to activities conducted**
Control Infiltration and Cross Connections to the Stormwater Conveyance System	●			COWL-PW	• Annually investigate for cracking and breakage, and repair as necessary based on the results of the inspection, a minimum of 5,000 linear feet of sanitary lines. • Review new and redevelopment plan submittals for possible cross-connections. • Inspect for potential cross-connections during dry weather field screening activities.	1. Indicate whether any sanitary sewer cross-connections were identified during sanitary line testing, during the plan review process, or during dry-weather field screening activities on an annual basis. 2. Describe any follow-up activities required for identified cross-connections.	1. No cross connections were discussed during the reporting period. 2. NA	In Phase 5 of the Sanitary Sewer Rehabilitation Cured in Place Pipe (CIPP) Project, the following linear feet of SS mains were relined. • 8" – 19,647 LF • 10" – 3,406 LF • 12" – 351 LF • 15" – 1,865 LF • 18" – 3,410 LF • 21" – 595 LF **Total: 29,274 LF**
Conduct Master Planning for Stormwater Quality Improvement	●	●	●	COWL-PW	Ensure water quality is considered during the development of flood control CIPs.	1. Track any updates or modifications to the current Stormwater Master Plan approved by the City. 2. Track the number of CIP projects implemented each year and discuss the added benefit (water quality, habitat restoration, etc.) of each. 3. Map the location and drainage area of water quality CIPs as they are constructed.	1. No updates or modifications were made to the Master Plan in this reporting year. An update to the Surface Water Master Plan is budgeted for the 2015 and 2016 Fiscal Years. The Master Plan guides development as well as future City project needs by identifying current deficiencies, future anticipated deficiencies, and recommending improvements to correct deficiencies to provide for system needs. 2. The City constructed the following CIPs with stormwater elements: • PW-15-04 Storm and Wastewater(Masterplans) • PW-15-02 PW Operations Parking Lot (Fueling Area Runoff Containment) • PW-14-17 CIPP (Sanitary Sewer Rehab Phase 5) • PW-14-16 Road Program 2015 includes (Upgrade to stormwater pipe systems on Norfolk Street, Cornwall Street & Summit Street) 3. These locations are mapped in the City's GIS. Detailed information for the public to view for each project can be found at: **westlinnoregon.gov/publicworks/public-improvement-projects-0.**	
Element 8: Stormwater Management Faculties Operation and Maintenance								
Conduct Stormwater Conveyance System Cleaning and Maintenance	●	●	○	COWL-PW	Perform cleaning and repair promptly based on inspection results.	1. Track the length of conveyance system inspected. 2. Track the volume of debris removed during cleaning activities.	1. No linear feet of stormwater pipe was inspected 2. NA	Cleaning garbage/litter out of ditches and por regular part of COWL-PW employee tasks.
Conduct Catch Basin Cleaning and Maintenance	●	●	○	COWL-PW	• Inspect all public catch basins once per year, and clean as needed based on inspection results. • Repair or replace catch basins promptly based on inspection results. • Update tracking database during each maintenance cycle.	1. Track the number of catch basins inspected. 2. Track the volume of debris removed during cleaning activities.	1. 2719 Catch basins were inspected, and 760 catch basins were cleaned during the 2014-2015 reporting year. 2. 40 cubic yards of debris were removed.	
Public Structural Control Facility Cleaning and Maintenance	●	●	●	COWL-PW	Inspect public structural water quality facilities annually and maintain based on inspection results.	1. Track the number and frequency of structural facilities inspected and maintained. 2. Track the volume of debris removed during cleaning activities.	1. The following water quality facilities were inspected and maintained throughout the 2014-2015 reporting year: Pollution Control Manholes = 140 inspected and 140 were cleaned Detention Tanks = 30 inspected and 0 maintained Bio Swales = 20 inspected and 20 maintained Water quality ponds = 49 inspected and 49 maintained 2. Pollution Control manhole maintenance resulted in 20 cubic yards of debris removal.	Environmental Services Stormwater crews routinely perform the following maintenance on all public Stormwater control facilities: remove, trim & inventory trees, lay mulch, spray for bees & mosquitoes. Remove unwanted and/or overgrown brush, blackberries, and weeds.

Appendix A. Status of Implementing components of West Linn's 2012 Stormwater management Plan (SWMP)								
BMP or Activity	**Addresses Bacteria?**	**Addresses Mercury and TVs?**	**Addresses Phosphorus?**	**Responsible Department**	**Measurable Goals (2012 SWMP)**	**Tracking Measures (2012 SWMP)**	**Annual report information: tracking measure status, Permit year 2014-2015**	**Additional detail related to activities conducted**
Private Water Quality Facility Maintenance Program	●	●	●	COWL-PW	• Require new private water quality facilities to submit maintenance agreements to the City. • Require submittal of annual reports related to inspection and maintenance activities for private water quality facilities with existing maintenance agreements. • Continue to work to identify the responsible parties associated with private water quality facilities that do not have an existing maintenance agreement. • Provide formalized structural stormwater facilities inspection and maintenance documentation to private facility owners by July 1, 2013.	1. Track the number of new maintenance agreements submitted to the City each year. 2. Track number of new and existing annual maintenance reports received each year.	1. 28 new maintenance agreements were recorded through the City's Engineering Department and the Clackamas County Recorder's Office during the 2014-2015 reporting year. 2. A total of 39 inspection reports were received during the 2014-2015 reporting year. The inspection reports are due to our office by October 1st of each year for all facilities with or without recorded maintenance agreements.	The City added a section on the City website entitled Private Stormwater Facility Program and has many supporting documents that homeowners will find useful for maintaining their water quality facilities. Documents include a Private Water Quality Management Program Inspections Guide and Permeable Paving Information.

Appendix B

West Linn Monitoring Data

Appendix B

Instream Monitoring - West Linn 2014-2015
Location - Culvert near 3821 Calaroga Dr
Sample Site # WL_01
Stream Name - Trillium Creek

		Results								
		Grab Sample #1	Composite #1	Composite #2	Composite #3	Grab Sample #2	Statistics			Notes
		Dry Weather	Rain Event	Rain Event	Rain Event	Dry Weather	High	Low	Mean	
Analysis	Units	8/7/2014	12/4/2014	12/19/2014	3/23/2015	6/19/2015				
Dissolved Oxygen - Winkler	mg/L	9.6	10.2	11.2	11.0	9.4	11.2	9.4	10.3	1
BOD_SW	mg/L	< 2.1	1.3	0.68	< 4.0	2.3	< 4.0	0.68	2.06	
Total Phosphate Seal	mg/L	0.06	0.04	0.10	0.19	< 0.04	0.19	< 0.04	0.09	
Conductivity Field	uS	125.0	114.9	94.7	48.7	182.4	182.4	48.7	113.1	
Dissolved Oxygen - Field	mg/L	10.1	12.4	12.0	11.5	10.0	12.4	10.0	11.2	
pH Field	Std Units	7.4	7.2	7.2	6.8	7.3	7.4	6.8	7.2	
Temperature Field	°C	16.3	6.5	8.9	9.3	15.6	16.3	6.5	11.3	
Copper	ug/L	1.0	3.2	2.6	6.8	0.8	6.8	0.8	2.9	
Dissolved Copper	ug/L	0.6	1.8	1.4	1.8	0.5	1.8	0.5	1.2	
Lead	ug/L	0.13	0.86	< 0.01	2.07	0.10	2.07	< 0.01	1.04	
Dissolved Lead	ug/L	0.02	0.11	< 0.01	0.10	0.01	0.11	< 0.01	0.06	
Zinc	ug/L	11	17	382	47	7	382	7	92.8	
Dissolved Zinc	ug/L	6	14	320	13	2	320	2	71	
E. coli - Colilert	MPN/100mL	225	649	161	1733	206	1733	161	595	2, 3
Ammonia Nitrogen Low Seal	mg/L	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	
Nitrate-Nitrite Seal	mg/L	0.492	0.348	0.532	0.460	0.580	0.580	0.348	0.482	
Ortho Phosphate Seal	mg/L	0.06	0.06	< 0.04	< 0.04	0.07	0.07	< 0.04	0.06	
Total Dissolved Solids	mg/L	180.0	61	90	97	154	180	61	116.4	
Total Solids mg/L	mg/L	180.0	86	96	160	165	180	86	137.4	
Total Suspended Solids	mg/L	4.0	22	10	100	3	100	4	27.8	
Volatile Solids	mg/L	53.0	34	40	53	45	53	34	45.0	
Hardness	mg/L	75.0	20	35	23	75	75	20	45.6	
Rainfall	Inches	N/A	0.67	0.12	0.52	N/A				

Notes:

(1) Dissolved Oxygen (Winker Method) samples are taken once per sampling event at *Site # WL_1 only* as Q/C for eletronic meter.

(2) MPN = Most Probable Number.

(3) Shading indicates samples that exceed the E. coli standard of 406 MPN/100mL.

Appendix B

Instream Monitoring - West Linn 2014-2015
Location - Culvert near 4103 Imperial Dr
Sample Site # WL_02
Stream Name - Tanner Creek

		Results								
		Grab Sample #1	Composite #1	Composite #2	Composite #3	Grab Sample #2	Statistics			Notes
		Dry Weather	Rain Event	Rain Event	Rain Event	Dry Weather				
Analysis	Units	8/7/2014	12/4/2014	12/19/2014	3/23/2015	6/19/2015	High	Low	Mean	
BOD_SW	mg/L	< 2.1	1.2	0.55	< 4.0	2.4	< 4.0	1.2	2.05	
Total Phosphate Seal	mg/L	< 0.04	0.05	0.05	0.10	< 0.04	0.10	<0.04	0.07	
Conductivity Field	uS	82.6	83.0	82.6	61.9	118.7	118.7	61.9	85.8	
Dissolved Oxygen - Field	mg/L	10.1	12.2	11.6	11.3	10.2	12.2	10.1	11.1	
pH Field	Std Units	7.4	7.2	7.1	6.9	7.2	7.4	6.9	7.2	
Temperature Field	°C	16.4	7.1	9.7	10.9	15.6	16.4	7.1	11.9	
Copper	ug/L	1.1	3.3	2.4	5.3	0.9	5.3	0.9	2.6	
Dissolved Copper	ug/L	0.6	1.8	1.6	1.9	0.5	1.90	0.50	1.28	
Lead	ug/L	0.14	0.52	0.52	1.28	0.07	1.28	0.07	0.51	
Dissolved Lead	ug/L	0.01	0.07	< 0.01	0.08	0.02	0.08	0.01	0.05	
Zinc	ug/L	11	31	16	33	5	33	5	19.2	
Dissolved Zinc	ug/L	2	24	15	12	2	24	2	11	
E. coli - Colilert	MPN/100mL	179	387	211	1046	102	1046	102	385	2, 3
Ammonia Nitrogen Low Seal	mg/L	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	
Nitrate-Nitrite Seal	mg/L	0.686	0.518	0.689	0.480	0.760	0.760	0.480	0.627	
Ortho Phosphate Seal	mg/L	< 0.040	0.03	< 0.04	< 0.04	< 0.04	< 0.04	0.03	0.04	
Total Dissolved Solids	mg/L	120	81	72	53	115	120	53	88.2	
Total Solids mg/L	mg/L	120	88	82	93	103	120	82	97.2	
Total Suspended Solids	mg/L	2	14	4	45	3	45	2	13.6	
Volatile Solids	mg/L	47	43	40	38	32	47	32	40.0	
Hardness	mg/L	45	21	29	22	40	45	21	31.4	
Rainfall	Inches	N/A	0.67	0.12	0.52	N/A				

Notes:

(2) MPN = Most Probable Number.

(3) Shading indicates samples that exceed the E. coli standard of 406 MPN/100mL.

Appendix B

Instream Monitoring - West Linn 2014-2015
Location - Culvert @ Johnson Rd & Ryan Ct
Sample Site # WL_03
Stream Name - Unnamed Creek

		Results								
		Grab Sample #1	Composite #1	Composite #2	Composite #3	Grab Sample #2	Statistics			Notes
		Dry Weather	Rain Event	Rain Event	Rain Event	Dry Weather				
Analysis	Units	8/7/2014	12/4/2014	12/19/2014	3/23/2015	6/19/2015	High	Low	Mean	
BOD_SW	mg/L	< 2.1	0.40	0.55	< 4.0	4.10	4.10	0.40	1.7	
Total Phosphate Seal	mg/L	< 0.04	< 0.04	0.06	< 0.08	< 0.04	< 0.08	< 0.04	0.05	
Conductivity Field	uS	90.8	100.0	112.6	82.4	138.7	138.7	82.4	104.9	
Dissolved Oxygen - Field	mg/L	9.7	11.4	11.1	11.1	9.4	11.4	9.4	10.5	
pH Field	Std Units	7.3	7.2	7.0	6.8	7.2	7.3	6.8	7.1	
Temperature Field	°C	17.7	8.0	9.8	10.4	16.8	17.7	8.0	12.5	
Copper	ug/L	0.9	4.2	1.9	2.7	0.90	4.20	0.90	2.12	
Dissolved Copper	ug/L	0.7	3.2	1.2	1.3	0.50	3.20	0.50	1.38	
Lead	ug/L	0.12	0.22	0.48	0.70	0.07	0.70	0.07	0.32	
Dissolved Lead	ug/L	0.01	0.07	< 0.1	0.07	0.02	0.07	< 0.1	0.04	
Zinc	ug/L	14	113	207	51	23	207	14	81.6	
Dissolved Zinc	ug/L	12	107	172	34	13	172	12	67.6	
E. coli - Colilert	MPN/100mL	980	228	816	435	365	980	228	565	2, 3
Ammonia Nitrogen Low Seal	mg/L	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	
Nitrate-Nitrite Seal	mg/L	0.348	0.671	0.569	0.390	0.430	0.671	0.348	0.482	
Ortho Phosphate Seal	mg/L	< 0.040	0.05	< 0.04	< 0.04	< 0.04	0.05	0.05	0.05	
Total Dissolved Solids	mg/L	110	91	80	98	111	111	80	98	
Total Solids mg/L	mg/L	130	100	90	80	118	130	80	103.6	
Total Suspended Solids	mg/L	2.0	5.0	6.0	19.0	4.0	19.0	2.0	7.2	
Volatile Solids	mg/L	45	41	39	47	30	47	30	40.4	
Hardness	mg/L	48	34	36	22	48	48	22	37.6	
Rainfall	Inches	N/A	0.67	0.12	0.52	N/A				

Notes:
(2) MPN = Most Probable Number.
(3) Shading indicates samples that exceed the E. coli standard of 406 MPN/100mL.

Appendix B

Outfall Monitoring - West Linn 2014-2015

Location - Horton Rd. @ Summit St. Outfall

Sample Site # WL_04

Stream Name - Barlow Creek

		Results								
		Grab Sample #1	Composite #1	Composite #2	Composite #3	Grab Sample #2	Statistics			Notes
		Dry Weather	Rain Event	Rain Event	Rain Event	Dry Weather				
Analysis	Units	Not Required	12/4/2014	12/19/2014	3/23/2015	Not Required	High	Low	Mean	
BOD_SW	mg/L		0.3	1.0	< 4.0		< 4.0	0.30	0.65	
Total Phosphate Seal	mg/L		< 0.04	0.05	< 0.04		0.05	< 0.04	0.045	
Conductivity Field	uS		101.2	62.3	50.8		101.2	50.8	71.4	
Dissolved Oxygen - Field	mg/L		9.7	10.5	10.3		10.5	9.7	10.2	
pH Field	Std Units		6.5	6.4	6.6		6.6	6.4	6.5	
Temperature Field	°C		13.7	10.8	12.1		13.7	10.8	12.2	
Copper	ug/L		7.9	12.1	14.4		14.4	7.9	11.5	
Dissolved Copper	ug/L		6.7	10.0	10.0		10.0	6.7	8.9	
Lead	ug/L		0.38	0.49	0.62		0.62	0.38	0.50	
Dissolved Lead	ug/L		0.17	< 0.01	0.12		0.17	0.12	0.15	
Zinc	ug/L		30	34	32		34	30	32	
Dissolved Zinc	ug/L		30	32	28		32	28	30	
E. coli - Colilert	MPN/100mL		20	525	135		525	20	227	2, 3
Ammonia Nitrogen Low Seal	mg/L		< 0.05	< 0.05	< 0.05		< 0.05	< 0.05	< 0.05	
Nitrate-Nitrite Seal	mg/L		1.240	0.388	0.360		1.240	0.360	0.663	
Ortho Phosphate Seal	mg/L		0.04	< 0.04	< 0.04		0.04	< 0.04	0.04	
Total Dissolved Solids	mg/L		85	45	60		85	45	63.3	
Total Solids mg/L	mg/L		95	44	47		95	44	62	
Total Suspended Solids	mg/L		7.0	2.0	10.0		10.0	2.0	6.3	
Volatile Solids	mg/L		42	25	34		42	25	33.7	
Hardness	mg/L		25	14	10		25	10	16.3	
Rainfall	Inches		0.67	0.12	0.52					

Notes:

(2) MPN = Most Probable Number

(3) Shading indicates samples that exceed the E. coli standard of 406 MPN/100mL

Appendix C

West Linn
TMDL Implementation Plan

Appendix C

Tualatin and Willamette TMDL Implementation Plan Annual Report

This annual report provides a summary of the City's efforts to implement pollutant reduction measures specified in the Total Maximum Daily Load Implementation Plans (TMDL IPs) for the Willamette River and the Tualatin River.

Willamette River TMDL IP

The City of West Linn originally submitted its Willamette River TMDL IP to the Oregon Department of Environmental Quality (DEQ) on March 31, 2008. The DEQ approved the plan on May 9, 2009. The most recent version of the Willamette River TMDL IP was dated April 30, 2014 and was approved by DEQ with conditions on August 18, 2014.

The TMDL parameters of concern for the Willamette River are: 1) bacteria 2) mercury and 3) temperature. The management strategies for these pollutant parameters are summarized in the Willamette River TMDL IP.

Tualatin River TMDL IP

The Tualatin River TMDL IP was originally submitted to DEQ in August 2003. It was revised and submitted to DEQ in June 2014 and was approved with conditions on August 18, 2014. There are five TMDL pollutant parameters of concern for the Tualatin River: 1) bacteria, 2) mercury, 3) temperature, 4) pH and chlorophyll a, with total phosphorus as a surrogate parameter, and 5) dissolved oxygen, with settleable volatile solids (SVS) as a surrogate parameter. The management strategies for reducing these pollutants are summarized in the Tualatin River TMDL IP.

As shown in Table C-1, the City's MS4 NPDES permit serves as the Willamette River and Tualatin River TMDL IPs for bacteria, mercury, total phosphorus, and SVS. Progress toward implementing best management practices (BMPs) to address these parameters is summarized in Appendix A of this document.

This combined TMDL IP Progress Report summarizes last year's progress implementing temperature management strategies in accordance with the Willamette and the Tualatin River TMDL IPs (see Table C-2).

Table C-1: Applicable TMDL Pollutant Management Documents

Pollutant	NPDES Permit	Willamette TMDL IP	Tualatin TMDL IP	Applicable TMDL
Bacteria	•			Willamette and Tualatin
Mercury	•			Willamette (including the Tualatin River as a tributary)
Temperature		•	•	Willamette and Tualatin
Total Phosphorus	•			Tualatin
SVS = DO	•			Tualatin

Table C-2 shows the City's progress in implementing temperature management strategies for the 2014-2015 reporting year. Since temperature management strategies are consistently referenced in both the Willamette River TMDL IP and the Tualatin River TMDL IP, only one reporting table is used. Table C-2 is formatted to be consistent with the updated TMDL IPs submitted to DEQ in 2014.

Table C-2: TMDL Implementation Plan Progress Report 2014-2015 (Summary of Temperature Management Strategies to Address the Willamette River TMDL IP [Year 2 of 5] and the Tualatin River TMDL IP (Year 2 of 5)

Pollutant	General Strategy	Commitment	Implementation Strategies	Tracking/Performance Measure *(Interim milestones)*	2014-2015 Activities and Accomplishments	Timeline/Responsible Party(s)
Temperature	Public Education and Outreach	• Promote riparian enhancement efforts through the distribution of information in a variety of media outlets. • Ensure a minimum of 1 temperature-related piece of educational material during the 5-year implementation period. • Provide funding support for agencies and organizations to aid in temperature management.	• Ensure Library, Senior Center, City Hall, and Parks Department all have an adequate supply of educational materials on hand at beginning of each new quarter. • Provide funding for U.S. Geological Survey (USGS) to continue hydrologic and water quality monitoring on the Tualatin River. • Continue coordination efforts with the Tualatin Basin Public Awareness Committee (TBPAC). • Continue coordination efforts with the Regional Coalition for Clean Rivers and Streams (RCCRS).	• Annually document the date, content, and distribution method of temperature related educational materials. • Annually document financial contributions to USGS. • Annually Document participation and funding contributions to TBPAC and RCCRS.	• Put out 20 each: "Stream Friendly Home & Yard Care" brochures, developed by TBPAC, at Library, Senior Center, and Parks Department each new quarter during the reporting year: July 2014, Oct. 2014, Jan. 2015, and April 2015. • The City donated $1,230 to USGS for the Hydrologic Data Collection Program for the Tualatin River. • Made donations to TBPAC of $1800 and to the RCCRS of $1084.	• Each new quarter. • Ongoing for Public Works Department and Administration. • Donation contribution to USGS, TBPAC and RCCRS once per year. • Continually in the loop of emails and events put on by TBPAC.
	Stormwater Design Standards	• Implement the City's Surface Water Management Plan (SWMP) and Community Development Codes (CDC), to support use of infiltration-based stormwater treatment systems and tree planting.	• Implement design standards that include LID and additional infiltration-based guidelines for stormwater treatment. • Evaluate the coverage of LID facilities and applications throughout the City.	• In the MS4 annual report, annually track modifications to the City's Development Standards related to the use of LID and BMPs for new and redevelopment. • In the MS4 annual report, annually track LID system installations in order to assess the feasibility and success of applications.	West Linn codes define site conditions where LID may be impracticable and provide alternates for stormwater management, including offsite facilities. Stormwater facility maintenance agreements are required to be recorded in the County Deed Records for all new private facilities and enforcement actions are tracked by our Environmental Services Division.	• Ongoing for Planning Department & Public Works Department - Engineering Division for each land use application.
	Preservation of Existing Forest Canopy	• Implement provisions of Chapters 28 and 32 and Ordinance 1542 of the City's Development Code, which defines protection and improvement of the City's waterways and encourages tree planting. • Continue to implement Chapter 32 - Water Resource Area Protection to be in compliance with OR Statewide Planning Goal 5 and Metro's Title 3 which relates to natural resources that address water quality and flood management. • Implement Chapter 28 - Willamette and Tualatin River Protection of the City's Development Code to further address Metro's Title 13 requirements to protect fish and wildlife habitat.	Establish working relationships with neighborhood organizations e.g., Tualatin Basin Neighborhood Group, to conduct activities to protect natural areas. The group has several goals and key issues that complement the Tualatin TMDL IP such as, Policy 3.1, Open Space Plan which reads in part: "... Identify and protect significant natural areas and sufficient open space." And Policy 4.1 under Natural Resources: Protect rare Oregon white oaks and significant, heritage, threatened and endangered species".	• Track any enforcement actions taken to protect existing shade. • Track modifications to the City's development code.	In the first full year since adoption of amendments to the CDC Chapter 32: Water Resource Areas (WRA), it has had the intended effect of directing or deflecting development away from the water resource areas (wetlands, streams and riparian areas). By encouraging this approach, property owners avoid the land use permitting process, costs, paperwork and delays while the City benefits from the continued protection of the WRA. *No enforcement actions had to be taken and no modifications were made to the CDC.*	Ongoing for Public Works and Planning Departments.
	Planting Activities for Identified Shade Opportunity Areas	• Maintain a priority project list for shading. • Conduct planting, plant maintenance, and supplemental irrigation activities for the identified shade opportunity areas. • Utilize annual committed funds towards shading and planting activities for identified opportunity areas. (Approximately $5,000 covers both TMDL watersheds). • Promote protection of natural and riparian areas through coordination and participation in citizen groups and organizations.	• Inventory land features and conditions; prioritize riparian and wetland areas; select sites for planting. (Ground-truthing). • Review and update/revise the existing inventory identifying potential sites. • Continue to explore available options for partnering on shading projects via the City of West Linn Parks Department. • Identify watershed partners and projects that support implementation efforts and participate/support of riparian restoration and LID projects. • Enforce all riparian violations.	• Annually document coordination efforts (meeting attendance, outreach activities) with the Tualatin Basin Neighborhood Plan with regards to protection of natural areas. • Track ground-truthing activities • Track planting activities for publically owned, high priority areas. • Track planting activities for other identified shade opportunity areas. • Track any re-vegetation and maintenance activities required. • Maintain a current list of watershed partners and projects.	• Groups and individual volunteers have donated their time on the second Saturday of each month, (Oct. – April) at Mary S. Young Park in the FY 14-15. They are dedicated to the restoration of the riparian habitat. M.S. Young Park is one of our High Priority areas for shading and has 3 significant riparian areas: Heron Creek, Turkey Creek and M.S. Young Creek. The volunteer leader keeps a very detailed spreadsheet on the where, when and who related to work performed at the park. • The 3rd Saturday of each month, volunteers remove invasive plants, restore and enhance stream banks, plant trees and spread mulch at Maddax Woods Park and Burnside Park. Each park has 1 significant riparian area. Bolton Creek runs through Burnside Park and Maddax Creek is in Maddax Woods. • During Arbor Week 2015, 120 students from the West Linn High School Ecology class planted shrubs and trees at Robinwood Park. The park has a significant riparian area with Robinwood Creek flowing through it. Approximately $2000 was spent on plants for this project alone. • Ground-truthing was conducted in the spring of 2015 along 9 creeks. They include Arbor, Trillium, Cascade Pond Springs, Bernert, Salamo, Tanner, Fern, Fritchie & McLean Creeks. Most of the streams have some invasive blackberry or ivy issues however, well established riparian woody vegetative cover and shade trees are present on all creeks with plenty of room for flood water expansion. Trillium Creek was the only creek with less than 100% shade but has adjacent meadow land instead. The City will continue to do ground-truthing activities in the future. • More than $23 K was spent on shade trees and other plants to beautify medians and to offer more tree cover in the city in general. No planting was done in shade priority zones because it was discovered at 9 creeks that they were almost 100% shaded already. More Ground-truthing will help us to locate places to plant shade trees.	• 3rd Saturday of each month Burnside Park & Maddax Woods. • Ongoing throughout the cycle. • Parks Dept. & Public Works.

Appendix D

West Linn
P.E. Effectiveness Evaluation Summary
And HDM Report

Public Education Effectiveness Evaluation Summary for the City of West Linn
MS4 Permit Requirement Schedule A.4.d.vi

July 1st, 2015

I. Introduction

This document represents compliance with the City of West Linn's National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System (MS4) permit, Schedule A.4.d.vi., which requires completion of an individual or coordinated public education effectiveness evaluation to measure the success of public education activities over the term of the permit. Per Schedule A.4.d., the public education effectiveness evaluation must:

> *vi. ….focus on assessing changes in targeted behaviors. The results of the effectiveness evaluation must be used in the adaptive management of the education and outreach program…..*

The stormwater management program that is described in the City of West Linn Stormwater Management Plan (SWMP) includes various program activities or best management practices (BMPs) to address permit requirements, including those related to public education and outreach.

West Linn's education and outreach program focuses heavily on the website. The city's website has a large variety of public education for citizens and builders relating to weed and rain garden guides, Low Impact Development Approaches, private water quality management inspection guide etc.

Beginning in 2013, the Oregon Association of Clean Water Agencies (ACWA) facilitated a collaborative effort amongst members to conduct a statewide stormwater public education effectiveness analysis. ACWA hired Davis, Hibbitts, & Midgall, Inc. (DHM Research) to compile local, state, and regional survey data with regard to public awareness and actions that contribute and combat stormwater pollution. The collective data was evaluated to help establish a baseline of the public understanding and reported behaviors typically associated with stormwater pollution contributions. Findings are documented in a report format (DHM report) and were distributed to participating jurisdictions for their individual use (see Attachment A: DHM Research Summary about Stormwater Behavior).

The City of West Linn used the collective information from the DHM report to reflect on their individual education and outreach program during this permit term and to advise the adaptive management of activities over the next permit term.

This document outlines results and conclusions of that review. Organization of the document is as follows:

Section II:	DHM Report Summary and Major Findings
Section III:	City of West Linn Current Public Education Strategy
Section IV:	Conclusions and Next Steps related to City of West Linn's Ongoing Public Education Program

II. DHM Report Summary

For reference the DHM report is included as Attachment A. Information used in the DHM report was developed from research conducted by ACWA members, related work by DHM Research, and select relevant regional and national studies.

Statewide data was included to ensure that findings represent the population that exists across all ACWA member communities. Much of the current, local research in Oregon has been conducted in the state's highest population centers, especially the Portland Metro area. Results and differences between urban and rural communities, where defined in a study, were highlighted and discussed. The report notes that certain local results may have an urban bias. In all, a total of 40 regional, state, and local stormwater-related surveys were evaluated. [Eighteen were cited in the findings and within these, 4 were Oregon statewide data, 5 were regional (WA, ID) and 6 were local]

Results from the DHM report are described below as pertaining to general findings and targeted findings. Targeted findings are most applicable to ACWA members in conjunction with the NPDES MS4 permit requirement to conduct a public education effectiveness evaluation. The targeted findings are focused on pet care, car care, lawn and garden care, and home care, which are distinct municipal stormwater pollutant sources where source control activities (like public education) are generally a preferred treatment approach.

A. General Findings

The DHM report includes general findings taken from state and regional surveys and deemed to be common to all ACWA members:

Observation 1: In addition to readily identified sources of pollution (e.g., industrial sites and activities, farming activities, wastewater treatment plants and sanitary sewer overflows), stormwater runoff from roads and hard surfaces is also thought to be a likely cause of water pollution.

Observation 2: A primary concern for residents in Oregon is drinking water protection. Oregonians care about fish and other wildlife, agriculture and recreational uses, but these uses are all rated as less important motivators for change.

Such observations may aid municipalities/agencies in understanding the audience to which educational information is provided. However, the report notes that in certain communities (e.g., Bend, Oregon), recreation and tourism have larger effects on people's motivation and may be important for message shaping in communities whose economies are driven by ecotourism type activities.

B. Targeted Findings

The DHM report focused on data that describes personal behavior related to pet care, car care, lawn and garden care and home care. Such targeted findings are applicable to ACWA members, because the majority of current education and outreach efforts are geared to the residential areas and populations across the state.

Observation 3: Pet waste control outside of the home is a normative behavior, but pet waste control on private property is less common.

Observation 4: The majority of the residential populations wash their cars at home. However, urbanites use commercial car washes more frequently.

Observation 5: Lawn and home care activities vary by household income and geography. As a whole, a majority of residents who conduct their own lawn care report using some form of pest management or fertilizer product. Use of lawn products increases as household income rises. Rural residents tend to engage in more high intensity lawn care activities and product use. About 20% of Oregonians report using moss control products on their roofs.

Observation 6: Dumping waste or household products into storm drains is not a normative behavior. Intended product use is typically adhered to, and recycling of unused products is common.

Observation 7: Only about half of septic tank owners conduct regular maintenance checks.

C. Key Considerations for ACWA Members

Targeted findings (Section II.B) were evaluated by the ACWA Public Education Committee to develop key questions/considerations for agencies looking to apply the targeted findings to their public education program. Application of the targeted findings can be used to minimize barriers to behavior change and develop a more targeted messaging framework. Education and outreach programs have varying levels of staffing and funding depending on each permittees need to balance operations and maintenance, capital projects, retrofits, stormwater monitoring and other required permit elements. This list of targeted findings does not presume that any permittee will be able to or need to address all potential pollution sources from the residential sector in a given permit year. Rather, this list provides a framework for considering what the priorities might be for a given permit year or term in order to most efficiently and effectively allocate limited resources to the maximum extent practicable.

Key Considerations (Pet waste):

1) Does your agency have a pet waste pick-up program? Although Oregon residents typically see the importance of pet waste clean-up, inconvenience is a significant

barrier towards behavior change. Forgetting to bring a bag is a common issue. Depending on local resources, efforts to improve convenience and accessibility may be beneficial.

2) Is residential, private property (i.e., backyard) runoff a significant source of discharge to the public stormwater system based on typical lot slope, driveway alignment, and connectivity? Because pet waste cleanup is much less common at home or on private property, understanding of the contribution of such potential pollutant source will help establish whether targeted outreach should occur.

Key Considerations (Car care/use):

1) Are there opportunities to promote or provide incentives for residents to use commercial carwashes? Partnering with commercial car washes can promote multiple water quality benefits. Commercial car washes are required to use specialized soaps that do not impact receiving water health. Commercial car washes are also required to collect, contain, and discharge wash water to the sanitary collection system, thereby eliminating the potential for surface runoff.

2) Are there opportunities to promote car washing on the 'lawn', especially in communities where properties may have more space?

3) Are there opportunities to distribute environmentally-friendly car wash kits to organizations or fundraising groups? Environmentally-friendly car wash kits can provide organizations and non-profits with supplies that limit impact to receiving water while allowing the fulfillment of fundraising obligations.

4) Are there opportunities to easily dispose/recycle motor oil, antifreeze, and other automotive related fluids that can be promoted? Although Oregon residents generally recognize that storm drains are not an allowable disposal location, inconvenience and cost can be a significant barrier towards behavior change. Either providing for or advertising accessible and convenient locations for disposal/ recycling may help minimize the potential for illicit discharges.

5) Is use of alternative transportation methods (walking, biking, and public transit) actively publicized for your community?

Key Considerations (Lawn care):

1) Are high intensity lawn care practices used in your community? Are there opportunities to educate residents (through HOAs, environmental organizations, mothers' organizations) and publicize the negative impacts of high intensity lawn

care practices on wildlife, pets, and children? Messaging that connects lawn care activities to the health and well-being of pets and children will apply to stream health and water quality as well. Mothers in particular are considered strong messengers to advocate for improving health of families.

2) If a significant portion of residents use commercial landscapers and lawn care providers, are there opportunities to provide education to the local landscape firms to help ensure that eco-friendly services are offered to customers?

Key Considerations (Home care):

1) Are there opportunities to easily dispose/recycle paint, cleaners, and other related home care fluids? Although Oregon residents generally recognize that storm drains are not an allowable disposal location, inconvenience and cost can be a significant barrier towards behavior change. Either providing for or advertising accessible and convenient locations for disposal/ recycling may help minimize the potential for illicit discharges.

2) Are there opportunities to educate residents on less toxic alternatives for home care products (via farmers markets, street fairs, etc.)? Providing coupons and samples for preferred products may be one activity that would address the fear of more environmentally-friendly alternatives being less effective while considering potential cost implications of using a more organic/ natural product.

3) Does your community have a significant number of residents that own septic systems? That own and use RVs for recreation? Septic tanks and drainfields require maintenance to ensure they are effective, yet a number of owners are not aware of such need. Waste disposal from RVs is also a potential high pollutant source activity that can affect surface water quality. Targeted education and outreach efforts may be conducted for these sources, depending of frequency and coverage in the community.

III. City of West Linn Current Public Education Strategy

Demographics Summary: West Linn is located at the confluence of the Tualatin and Willamette Rivers. The city covers approximately 7.4 square miles with a population of 25,000. It is entirely within Clackamas County. 54.9 adult's older than 25 years have earned their college degree or higher. The median value of owner-occupied housing units is $384,000 and homeownership is around 78.2 %. Median household income is $84,100.

Table A: ACWA Phase I Communities 2013 Population and Demographic Data[1]

	Population Demographic				
	Total Population (in 100,000's)	< 18 years (%)	> 65 years (%)	White (%)	Latino (%)
Oregon (Statewide)	3,900	22	16	88	12
By City					
Portland	609	19	10	73	9
Gresham	109	26	11	69	19
Salem	161	25	12	79	20
Eugene	159	18	13	86	8
Beaverton	94	23	10	73	16
West Linn	25	26.3%	11.1%	90.7%	4%
By County					
Washington	555	25	11	83	16
Clackamas	388	23	16	91	8
Multnomah	766	20	12	81	11
Lane	356	19	17	90	8

[1] 2013 Population Estimates: http://quickfacts.census.gov/qfd/states/41/4147000.html

A. Current Public Education Strategy:

a. Pet Waste: West Linn currently provides doggie bag holders in area parks and includes reminder messages on the importance of picking up their pet waste.

b. The city website has many articles, fact sheets and resources for more information that are informative, and provide a lot of ways to get involved.

c. The city has many Plans that complement each other in the efforts to conserve our environment, all of which are accessible to the public on the website, such as:

i. 2006 Sustainable West Linn Strategic Plan
ii. 2013 Trails Master Plan
iii. 2008 Comprehensive Plan
iv. 2006 Surface Water Management Plan
v. 2014 Tualatin River TMDL Implementation Plan
vi. 2014 Willamette River TMDL Implementation Plan
vii. 2012 Emergency Operations Plan
viii. 2014 Natural Hazards Mitigation Plan.

d. The city puts out Stream Friendly Home & Yard brochures at city buildings such as the library, city hall, and the senior center.

e. Coordinated efforts include: member and participate with the Regional Coalition of Clean Rivers and Streams, Clackamas Community College WET program and member and funder of the Tualatin Basin Public Awareness Committee. The Stormwater Environmental Technician is an active member of ACWA.

f. The Clackamas County Sustainability Office makes contact with businesses in West Linn and are given a stormwater markers for their catch basins as well as educating them on good housekeeping and having their oil traps vactored.

B. Current Adaptive Management Process

In the recent past, the City of West Linn has begun to communicate with its citizenry via Facebook and other social media. The city also recently added the app, “YourGOV”, which allows citizens to quickly email and send pictures of problems (i.e. illicit discharges) they encounter in the city. The city website is very comprehensive and is used as a communication tool between the city and the citizens. Completing this summary was a great way for us to see where the city is at in regards to public education.

IV. Conclusions and Next Steps

A. Correlation of DHM Report findings to current strategy.

Findings from the DHM report were applied to the City of West Linn to identify conclusions in support of the following questions:

1. *Are my public education resources targeted in the most effective manner?* We think more targeted messaging would be beneficial, especially concerning pesticide usage.
2. *What are the best motivators for targeted behavior change in my community?* Children and pet safety is good motivator for West Linn residents. West Linn is a "dog town". Walkers are very rarely seen without an accompanying dog or a stroller.
3. *What are some areas for potential improvement (messaging, audience, activities)?* Send out brochures with specific messaging for what we know of that neighborhood.

The next steps are to review the pesticide report that was done by the U.S. Geological Survey for the Clackamas County co-permittees and determine the exact drainage basins that are prone to pesticide polluting and target those homes with pesticide brochures. We will also continue to fund the organizations that are getting the word out about protecting our water

.

Appendix A

DHM Public Education Effectiveness Evaluation

February 2014

1 | INTRODUCTION

This summary and observations document is a high-level analysis of public attitudes and priorities about stormwater in Oregon. The focus is on residential customers and the general population. A few national studies are included to add perspective on the issue. The objective of this summary is to provide added context and inform and/or validate existing information, especially as the Oregon Association of Clean Water Agencies (ACWA) interacts with the public.

Much of the information is developed from recent research conducted by ACWA members, related work by DHM Research, and select national studies conducted on relevant topics. Attempts were made to include a geographically diverse set of research to review. Where data exists at the state level and at a city level, the report provides these for comparisons. Much of the existing research in Oregon has been conducted in the state's population centers and specifically the Portland Metro area. Thus, the results in this report have an urban bias, which should be taken into account. However, although water resources and quality are highly localized, much of the general public's knowledge and values about water are independent of geography.

The summary is grouped into five main areas:

1) **Values** – what do Oregonians value in general, and how does it relate to stormwater
2) **Behaviors** – what are the key behaviors of the public that impact stormwater; what are the emerging issues
3) **Barriers, motivations, messaging** – what are the barriers and motivations to behavior change
4) **Media review** – how is stormwater covered in the media
5) **Gaps in research** – where are the gaps, if any, in existing research

Any observations and recommendations are general guidelines and specific to Oregon; while much of the advice may apply outside of the state, it would be wise to conduct independent research to test their effectiveness in other areas.

Research sources reviewed include the list below. A more detailed listing of research provided to DHM by ACWA members and a discussion of methodology is found at the end of this summary.

1. Bend Community Survey (2007)
2. Bend Environmental Issues Survey (1999)
3. Clackamas County Water Environment Services Survey (2006)
4. Clark County Stormwater Research (2012)
5. Clean Water Services Customer Service Surveys (2002, 2006, 2008, 2010, 2012)
6. Clean Water Services Stream Habits Survey (2002)
7. Clean Water Services Stormwater Survey (2012)
8. Clean Water Services Customer Values Survey (2013)
9. Earthfix Survey (2012)
10. Eugene Stormwater Management Survey (2013)
11. Gresham Lawn Care Pre and Post Surveys (2007, 2009)
12. Gresham Stormwater Survey (2008)
13. Hillsboro Water Supply Residential Customer Focus Groups (2010, 2011)
14. Keizer Community Survey (2011)
15. Lake Oswego-Tigard Water Partnership Focus Groups (2010)
16. Lake Oswego Community Survey (2013)
17. Metro Household Hazardous Products Survey (2007)
18. Metro Toxic Reduction Focus Group (2009)
19. Metro Sustainable Living Survey (2012)
20. Oak Lodge Satisfaction Survey (2012)
21. Oregon Department of Environmental Quality Household Hazardous Waste Survey (2008)
22. Oregon Forests Research Institute/Oregon Department of Forestry Forest Values and Beliefs Survey (2010)
23. Oregon Values and Beliefs Study (2013)
24. Portland Bureau of Environmental Services Surveys (1999, 2005)
25. Portland City Community Surveys (2011, 2012)
26. Puget Sound Partnership Survey (2011)
27. Regional Coalition for Clean Rivers and Streams (2011)
28. Rogue Valley Sewer Services Public Education Survey (2012, 2013)

National Sources used for Reference:

1. Environmental Protection Agency National Menu of Best Management Practices and website (http://cfpub.epa.gov/npdes/home.cfm?program_id=6)
2. American Veterinary Medical Association pet ownership statistics (https://www.avma.org/KB/Resources/Statistics/Pages/Market-research-statistics-US-Pet-Ownership-Demographics-Sourcebook.aspx)
3. Killmuss, Anja and Angyeman, Julian. 2002. Mind The Gap: Why Do People Act Environmentally And What Are The Barriers To Pro-Environmental Behavior? *Environmental Education Research.* 8(3): 240-260
4. 2012 Value of Water Index: Americans on the U.S. Water Crisis, Xylem Inc. (http://www.xyleminc.com/valueofwater/)
5. Stormwater Pollution Prevention Behavior of Corvallis Residents, Oregon State University, 2010 (http://www.corvallisoregon.gov/modules/showdocument.aspx?documentid=4617)
6. Stormwater Knowledge, Attitude and Behaviors: A 2005 Survey of North Carolina Residents, Chrystal Barlett (http://www.ncstormwater.org/pdfs/stormwater_survey_12506.pdf)
7. Universities Council on Water Resources Journal survey on public perception of stormwater, 2010 (http://ucowr.org/issue-146/survey-says-implications-of-a-public-perception-survey-on-stormwater-education-programming)
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9. Understanding Watershed Behavior, *Watershed Protection Techniques*, 3(3): 671-679. (http://www.northinlet.sc.edu/training/media/resources/Understanding%20Watershed%20Behavior.pdf)
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3 | SUMMARY AND OBSERVATIONS

Oregonians place a high value on the environment and natural beauty of the state, especially as it relates to water.

- DHM Research's 2013 Values and Beliefs study found the features that Oregonians most value about the state are its beauty and scenery, weather and climate, outdoor recreation, and its forest and trees.
- Other statewide surveys have consistently shown that Oregonians are concerned about, and prioritize, protecting water.

Protecting *drinking water* is the most paramount water issue for Oregonians.

- Other issues are important, but secondary. They include, water as a source of fish and wildlife habitat, irrigation for agricultural, and recreational opportunities.

Oregonians have limited knowledge and awareness of stormwater.

- Their low level of awareness means that the average person does not have a well-developed understanding of the relationship between drinking, sewer and stormwater.
- Nationally, more than three-fourths do not believe that stormwater runoff is the largest source of water pollution. Rather, a majority believe that industry is the largest source of water pollution.

Individual perceptions and behaviors related to stormwater are specific to the source, and need to be addressed as such. For example:

- Pet waste: while most pet owners pick up their pet waste when out in the community, just one-quarter pick it up on a daily basis at home and one-third pick it up once a week or less. Many simply don't believe it is impactful on water.
- Car washing: evidence suggests that most car owners wash their car at home rather than at a commercial carwash because they perceive it as cheaper, less likely to damage the car, and more effective.
- Lawn and garden care: decisions about lawn and garden care are strongly influenced by cultural values and community standards. There is also a common assumption that if a product sold at a local home and garden store, than it must be safe to use.

Motivations to change stormwater behavior should be connected to other important values. For example:

- Drinking water: draw a connection between stormwater runoff and the quality and safety of drinking water.
- Children and pets: survey and focus group research has consistently shown that the safety of children and pets ranks in the top tier of concern for the use of chemical products in lawns, gardens, and in the home. This is particularly true with women.
- Saving money and discounts: for a segment of consumers, saving money is strong motivator. To change behavior, however, consumers must feel that that they are not sacrificing effectiveness or convenience.
- Natural areas, wildlife habitats, green spaces and outdoor recreation: Oregonians place a high value on the environment and enjoying outdoor recreational opportunities. When possible, link stormwater projects to these key values.

Other considerations for messaging

- Consider mothers as messengers to target the strongest base of supporters – females, Democrats, and people with higher education/income. Other research also shows that women are strong messengers, often the most effective messengers, around improving the health of families.
- Partner with community organizations, small businesses, retailers, and university experts as spokespeople around preferred stormwater behaviors. They are often better messengers than government, environmental groups, and utilities that may be viewed by the public with skepticism.
- Use a positive tone and focus on outcomes. This is more easily understood and resonates with the public. It also communicates a message that there is a plan for the future.
- Suggest simple steps to behavior change and be specific.

4 | VALUES

4.1 | General values in Oregon

Oregonians place high value on the natural beauty of our state, outdoor recreation opportunities, and clean air and water. Residents across the state, whether living in Bend or Portland, place similar importance to the natural beauty of Oregon. DHM's recent study on Oregonian's Values & Beliefs (2013) found people value most about living in Oregon (in this order):

1. **Beauty and scenery**
2. **Weather and climate**
3. **Sense of community**
4. **Outdoors and outdoor activities**
5. **Forests and trees**
6. **Ocean and easy access**
7. **Nature**
8. **Mountains and easy access**

These values are consistent across all areas of the state. The order may vary slightly from one region to another – for instance, people in Central Oregon may place greater emphasis on outdoor activities – but the general list is the same across the Metro area, Valley, Central, Eastern, or Southern Oregon.

Water can be linked to almost all of these key values. ACWA has the rare opportunity to connect to what Oregonians value most about their state. Public outreach should include references to how water, particularly stormwater, connects people to these key values about Oregon.

During economic downturns, values around water and the environment in general can easily get lost with pressing issues facing the state and national concerns.

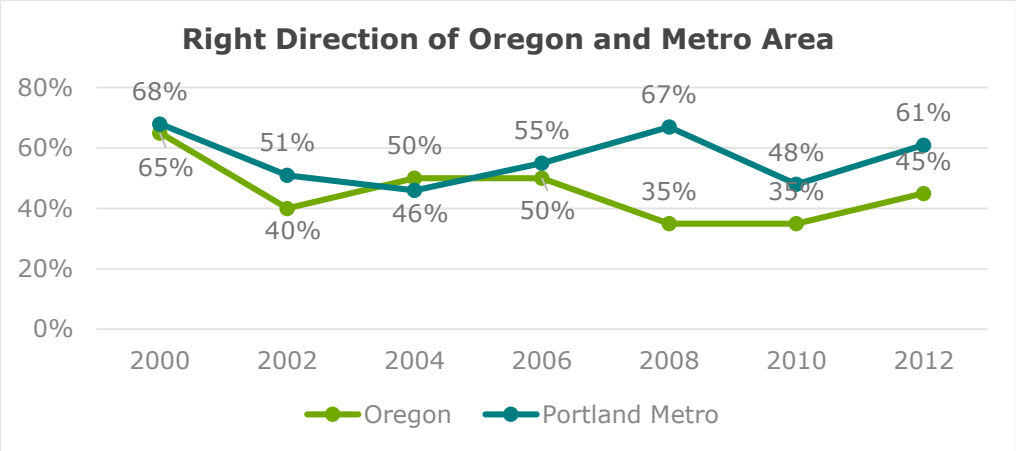
Most Important Issues in Oregon

Before recession (2007 and earlier)	During recession (2008 to today)
Public education	**Jobs / economy**
Healthcare	**Public education**
Taxes / government spending	**Healthcare**
Environment	**Government waste**

Environmental issues, including water quality, have taken a back seat to what residents consider higher priorities – the economy, unemployment, public education, healthcare, and government waste. However, Oregonians clearly value a healthy environment. In the Oregon Values and Beliefs Survey, Oregonians mention **environmental awareness** as the number one reason Oregon will be a better

place to live in 10 years (24%), even ahead of a stronger economy and economic growth (18%).

The public mood, as framed by whether people believe we are heading in the "right direction," shows that Oregonians continue to be pessimistic about the direction of the state, although recent numbers show some improvement.



Source: DHM Research

When right direction numbers are higher (60%+), the public expresses heightened awareness and concern for environmental issues, including water. In other words, when the public mood is more optimistic Oregonians care more about issues that affect the environment. Current right direction numbers hover around 45% across Oregon. As we would expect, then, residents express greater concern about the economy and less concern about the environment, and much less concern about stormwater issues. In the Portland Metro area, right direction numbers are closer to 60%. Residents in the Portland area are more likely to have a heightened awareness and sensitivity to environmental issues, including issues about stormwater. Portland residents are frequently more optimistic than other areas of the state, with lower unemployment, more job opportunities, and a larger population of younger residents who are generally more upbeat.

Public pessimism creates sensitivities for communications and public outreach. This applies particularly to the government or messengers that are linked to government. Many national and state surveys show that trust in government is declining and is at an all-time low. Thus, any outreach may be viewed with skepticism. Public outreach about stormwater would benefit from making the connection to what Oregonians value about their state – beauty, nature, outdoors – in order to resonate more strongly with the public.

4.2 | Top water values in Oregon

Water is highly valued by Oregonians. The quality of water is of high concern, especially in the context of drinking water.

90%+ are very and somewhat concerned about water quality (ODF, 2013)
75%+ believe it is very and somewhat important to fund protection of water and air quality (Oregon Values and Beliefs, 2013)
70% worry most about quality of drinking water and the health of rivers and streams, compared to 10% for industrial pollution and 5% for agricultural pollution (Earthfix, 2012)
47% value their local rivers most for a source for drinking water, followed by 19% who value rivers as a habitat for fish and wildlife (CWS, 2013)

Drinking water. People place a higher value on water issues that impact directly household activities, such as access to clean and good tasting tap water or sufficient supply of water for home and lawn use, than on overarching concerns for the water system or infrastructure. Water is most highly valued as a source for drinking water, as seen in a recent Clean Water Services study and across other local and national studies.

Water Values

Values about rivers and streams	Most important
Source for drinking water (current and future supply)	47%
Habitat for fish and wildlife	19%
Indicator of a healthy environment	14%
Natural beauty and open space	7%
Source of water for farming and agriculture	5%
Natural areas for recreation activities (fishing, hiking, swimming, paddling, bird watching, etc.)	5%
Drain away rain water	3%
Other	0%
Don't know	1%

Source: CWS, 2013

Women in particular have a tendency to rate water quality as a higher priority, which ultimately connects them to issues that impact drinking water. In general, women are consistently more concerned with environmental issues than men. People living near a river or stream also evidence greater connection and awareness about water issues than those who are "non-streamside" residents (CWS, 2013).

Habitat for fish and wildlife. Another top-tier water value is the protection of habitat for fish and wildlife. Focus groups have shown that residents in the region link the well-being of fish and wildlife in rivers and streams to the quality of water – if fish and wildlife are thriving then rivers and streams must be clean and healthy. Not surprisingly, streamside residents rank the importance of habitat for fish and wildlife higher than non-streamside residents (CWS, 2013).

> **93%+** support improving flow of water to support fish, wildlife and water quality (CWS, 2013)
> **90%+** agree that native fish are an asset to Portland (Portland BES, 1999)
> **70%+** consider the Tualatin River important as a habitat for fish and wildlife (CWS, 2013)
> **7.9 mean** out of 10-point scale on importance of restoring healthy salmon runs (Clark County Environmental Issues, 1999)

Many residents have at least a basic understanding of the potential impact they have on water quality which impact habitat for fish and wildlife. In a recent survey of residents in Clackamas, Clark, Multnomah, and Washington counties, 54% feel "somewhat informed" about what they can do to maintain the health and water quality of local rivers and streams and 20% feel "very informed" (Regional Coalition of Clean Rivers and Streams, 2011). However, over 25% are not informed or report that they didn't know.

Little research examines public awareness about declines in number of fish and health of habitats. Residents seem to make a connection to less personal behaviors; when asked specifically about reasons for declines in salmon runs, 38% said it's due to overfishing and 36% said from water pollution generally, without being able to identify a primary source. This is compared to 6% who specifically identify of runoff from homes and other human activities.

Other water values. Second tier water values that are important to residents include public health, recreation, and natural areas. Because this summary is focused on stormwater, our analysis will not explore these second tier values as related to water in general. Instead, these same values are linked to stormwater issues and are addressed later in this report under motivations for stormwater behavior change.

5 | STORMWATER

5.1 | Stormwater awareness

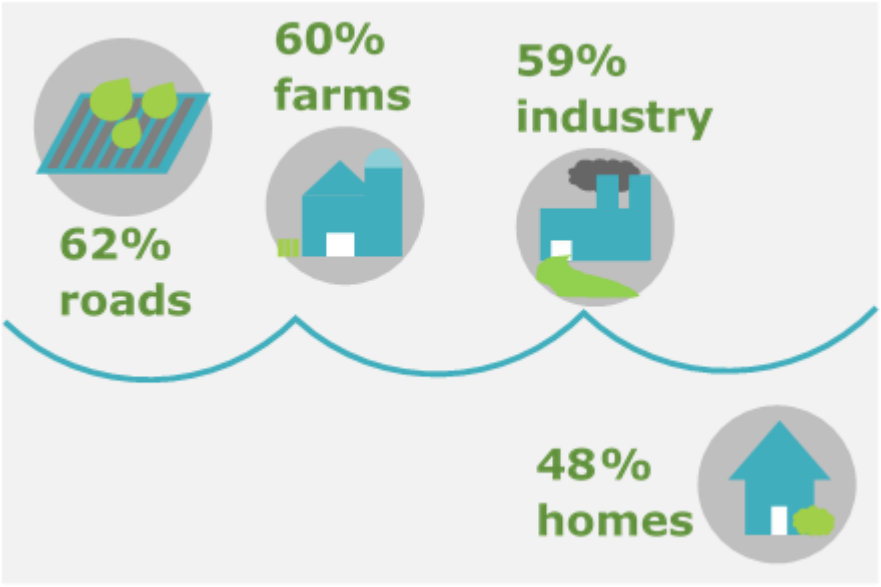
Residents in Oregon believe the greatest source of pollution in rivers and streams is:

a. Stormwater runoff from roads and hard surfaces
b. Factories and industry dumping waste
c. Farming and agricultural products from fields
d. Untreated sewage dumped into waterways
e. Discharge from sewage treatment plants

An EPA report shows 78% of the American public does not understand that stormwater runoff is now the most common source of water pollution and nearly half of Americans believe industry is the problem (EPA, 2009).

From a study conducted with residents in Oregon, Idaho, and Washington, at least 60% believe the most likely causes of water pollution are runoff from roads, pollution from industry, and chemicals from farms and agriculture (Earthfix, 2012). The perception of pollution from sewage is much higher in Oregon (60%) than in Washington (50%) or Idaho (30%). A majority of residents are uncertain or believe only a little pollution comes from households through the use of chemicals on lawns and gardens or from personal products like laundry detergent or prescription drugs.

Perceived Causes of Water Pollution in Pacific NW

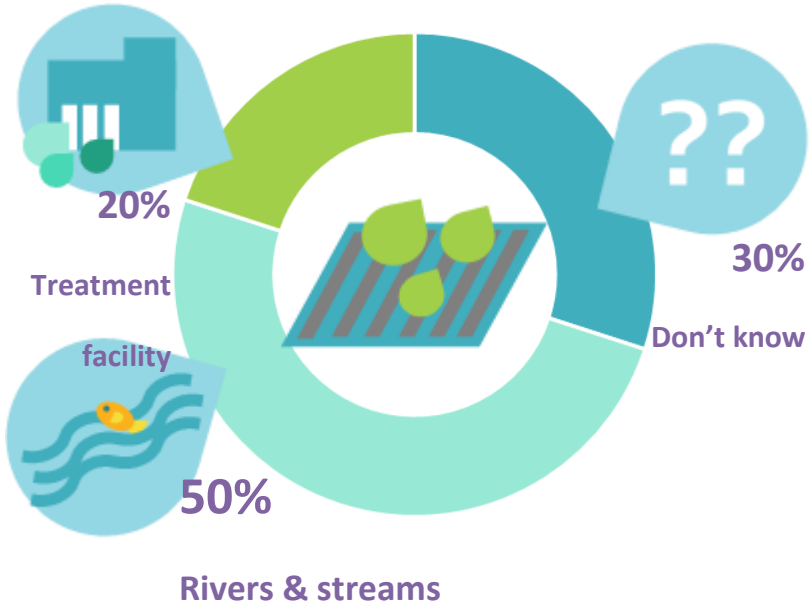


Source: Earthfix, 2012

In the Pacific Northwest, a recent Puget Sound study found 67% don't believe *fertilizers, oil, and other contaminants running off yards and streets* is the greatest source of water pollution in the sound. Instead, most cite industrial discharge, development, sewage treatment plants or other reasons, and about 25% report they don't know (Puget Sound Partnership, 2011).

People show uncertainty or general lack of knowledge regarding what happens to stormwater when it enters storm drains. For example, in Portland metro survey about one-third of residents said they aren't sure of the destination of their stormwater runoff. Inconsistent methodology across research studies makes it difficult to determine more detailed trends in awareness about stormwater, however, in focus group research that DHM has conducted, it has often been the case that people make assumptions about their water but when pressed they are not confident in their assertions.

Perceived Destination of Stormwater Runoff



Source: EPA, 2009, various studies

5.2 | Stormwater behaviors

We reviewed multiple regional, statewide, and national studies carried out from 1999 to 2013 in order to identify personal behavior related to stormwater runoff in Oregon. The specific stormwater behaviors can be grouped into four key areas:

1. Pet care
2. Car care
3. Lawn and garden care
4. Home care

Pet care

An EPA report in 2009 reported that residents do not recognize the extent to which pet waste is a threat to water quality. According to the U.S. Pet Ownership & Demographics Sourcebook (2012), Oregon has one of the highest pet ownership rates in the country at 64%. While it is difficult to accurately report the local percentage, a 2011 Regional Coalition for Clean Rivers and Streams study found that 40%+ of respondents in Clackamas, Clark, Multnomah, and Washington counties own a dog. In Gresham, dog ownership ranges from 21% of streamside renters (Gresham Stormwater Survey, 2008) to 59% of lawn-owning individuals (Gresham Lawn Care Behavior Surveys, 2007, 2009).

People are more likely to immediately pick up their pet waste when walking their dogs compared to when dogs are let out in a yard. When walking their dog, upwards of 90% pick up pet waste immediately. Only 2% of dog owners in Gresham who take their dog to the park report not picking up after them (Gresham Stormwater Survey, 2008).

The rate of pick up drops when compared to what happens at home: only one quarter (26%) pick up pet waste in their yards regularly (daily), another quarter pick up every 2-3 days, and a third pick up once a week or a couple times each month (Regional Coalition of Clean Rivers and Streams, 2011). Overall, 21% of Gresham dog owners report never taking their dog on walks or to the park (Gresham Stormwater Survey, 2008).

A study in nearby Pierce County, Washington (2009) showed "proper behavior" (picking up droppings, bagging, and placing in the trash) was more common in cities than in unincorporated areas (44% vs. 26%).

Picking up Pet Waste in Oregon

Source: Regional Coalition of Clean Rivers and Streams, 2011

Top reasons for not picking up after pets include inconvenience and unpleasantness. Incentives for picking up more often were:

1) free collection device (scoopers or bags)
2) monetary fine
3) health of family and pets

In Gresham, 35% of dog owners going to the park use the available dog bag dispensers, suggesting that the convenience of city-provided dispensers plays an important role in whether pet owners pick up after pets. Usage varies widely across demographic groups, however, from over six in ten renters to four in ten non-streamside homeowners and two in ten streamside homeowners (Gresham Stormwater Survey, 2008).

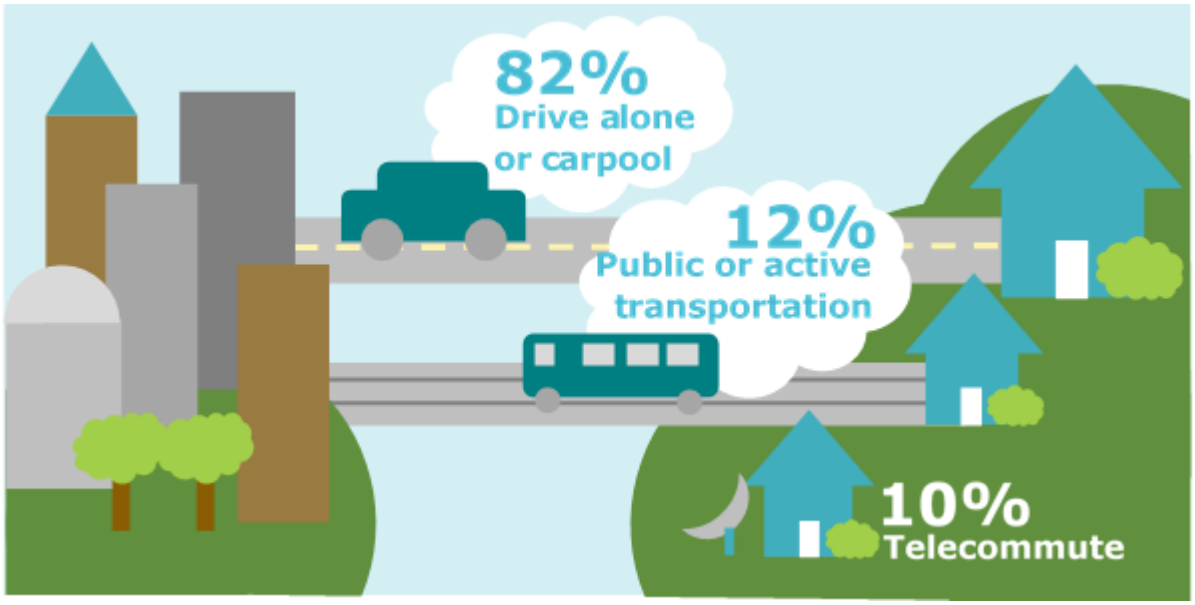
Residents do not automatically make the connection between improved water quality or household health and picking up pet waste. General values around water are not top of mind for this specific behavior (Regional Coalition of Clean Rivers and Streams, 2011). Any public outreach and communications to change behavior will require connecting the dots to water values, providing a clear message about picking up pet waste and the connection to improved water quality.

Car care

Most of the research on car care involves hazardous materials on impervious surfaces or materials washed directly into storm drains. Common activities that contribute to stormwater runoff include vehicle washing and maintenance. We discuss how these individual behaviors and general trends in car usage affect stormwater issues.

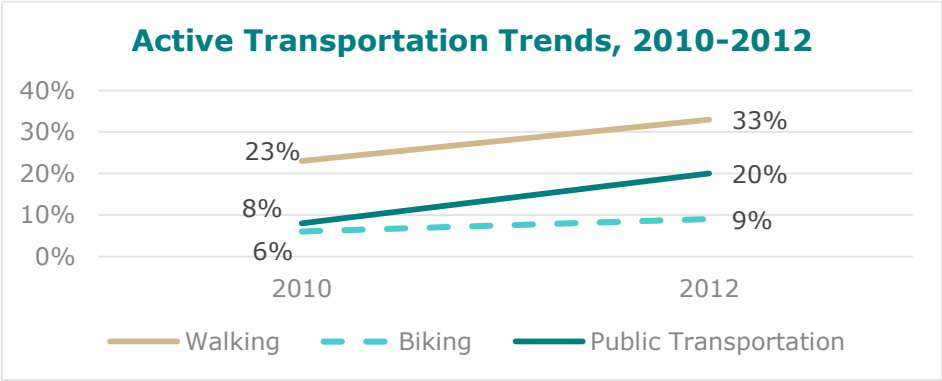
Cars are still the most frequent mode of transportation in Oregon with 82% driving alone or choosing carpool to get to work or school, and about 12% using alternative modes like public transportation.

Modes of Transportation in Oregon



Source: US Census, 2012

Transportation patterns are similar across the country and there is evidence that use of alternative modes of transportation is increasing. A recent telephone survey of Metro area residents conducted for Metro Regional Transportation Options showed an increase from 2010 figures in the number of people walking, using transit, and biking at least weekly as a form of transportation.



Source: Metro RTO, 2012

Vehicle washing. According to the EPA, "outdoor car washing has the potential to result in high loads of nutrients, metals, and hydrocarbons during dry weather conditions in many watersheds, as the detergent-rich water used to wash the grime

off our cars flows down the street and into the storm drain" (EPA, 2009). Commercial car washes are the preferred alternative, as most capture waste water which is subsequently treated before it goes into the sewer system. Another alternative option is washing vehicles on pervious surfaces such as a lawn or dirt in order to filter residue.

Across Oregon, upwards of three quarters of residents wash their vehicles at home, though this number varies depending on geography and demographics. In the Portland Metro area, 45% never wash at home while 32% wash their vehicle 1-3 times per year at home (Regional Coalition for Clean Rivers and Streams, 2011). In Eugene, 61% wash their vehicle at a commercial car wash, and 36% at home on a paved driveway or street (Eugene Stormwater Management Report, 2013). The Gresham Stormwater Survey (2008) found that about one third of home owners never wash their car at home, while the rate was about 50% for renters. However, one third of those washing their car at home reported a willingness to use a car wash.

Further afield, 31% of Puget Sound residents always use a commercial carwash facility and 69% wash their vehicles at home (Puget Sound Partnership, 2011). This high variability in behavior may be due to a combination of lifestyle factors including time of year, urban or rural locations, access to facilities, cost, and general knowledge of alternatives.

Those washing vehicles at home are most likely to be homeowners, those with children and/or dogs, and those who do not have a college degree (Gresham Stormwater Report, 2008; Eugene Stormwater Management Report, 2013). In Gresham, these same groups are also less willing to change their behavior and begin using a car wash facility (Gresham Stormwater Report, 2008).

The top reasons for washing their vehicle at home rather than a carwash facility typically include:

1) perceived expense or higher cost
2) perception that hand washing is better for vehicle care
3) perception that hand washing gets the car cleaner

A primary incentive for washing vehicles at a carwash and motivation for changing behavior is discounts or coupons (reducing the perception of higher cost). Messages about the environmental benefits of commercial car washing, such as *facility uses recycled water* or that it *protects water quality or wildlife*, can help to supplement motivations but tend not to be primary drivers of behavior change (Regional Coalition for Clean Rivers and Streams, 2011).

Vehicle maintenance. Relevant behaviors related to home vehicle maintenance include changing oil and antifreeze, addressing leaks in a timely manner, and proper disposal of vehicle related chemicals such as oil, solvent, grease, and fuel.

In the Gresham Stormwater Survey (2008), about 25% of residents change their own oil or antifreeze. Of those, 86% report using an acceptable disposal[2] method. Although 7% reporting placing it in the trash, an undesired behavior, none reported pouring it on the ground or into a storm drain. In the Puget Sound area, roughly one half of residents perform maintenance on their cars at home and most say they properly dispose of hazardous materials (Puget Sound Partnership, 2011).

In the Metro Household Hazardous Products Survey (2007), very few people dump chemicals in storm drains (<1%) and the vast majority take leftover motor oil to a facility or recycle at curbside with their regular pick-up (31%-96% depending on product type). The survey also found that even if residents use a less preferred method to dispose of other household hazardous materials (throwing in trash, pouring down sink, or pouring into a storm drain), they seem to take extra care with vehicle materials like motor oil.

Addressing unintentional spills of hazardous materials on driveways or fixing vehicle leaks in order to prevent further spills or damage is another car maintenance issue. In the Puget Sound (2011), 74% of respondents report fixing oil and fluid leaks promptly either always or most of the time, 12% report doing so sometimes or rarely/never, and 14% weren't sure. Existing research does not speak clearly as to whether residents link prevention of vehicle leaks and spills to protection of water quality. More research may be needed to explore motivations around this behavior change.

Vehicle trends. National and local studies highlight changes in travel behavior that may ultimately impact the number of vehicles. A 2013 study by the Public Interest Research Group showed that "for eight years in a row, Americans have been driving less on a per person basis than the year before." Younger generations are driving less and are also less likely to have a driver's license than any generation before them. A study done this year by the Centers for Disease Control and Prevention found that the percentage of high school seniors who had a driver's license fell from 85% in 1996 to 73% in 2012. Furthermore, it appears that this generation is not merely postponing acquisition of a driver's license; rather, many of those without a license do not ever intend to get one.

[2] Curbside recycling, take back center, or collection event.

Other studies also indicate that Millennials (people born between 1983 and 2000) are more multi-modal than previous generations. This group is quickly embracing newer alternatives such as car-sharing, bike-sharing and ride-sharing, modes of transportation that require less or better vehicle-related care. Another trend is foregoing a vehicle altogether, mostly in urban regions. Currently, about 15% of Portlanders and 8% of Oregonians do not own a vehicle (U.S. Census), and that trend will likely increase as more Millennials choose a no-car lifestyle.

High School Seniors without a Driver's License Nationally

Source: US Census, 2012

Lawn and garden care

Roughly 80% of residents have a lawn or garden in the Portland Metro area (Metro Sustainable Living, 2012). Lawn ownership increases with incomes greater than $75,000 (95%+).

Nationally, upwards of 75% of homeowners use at least some lawn and garden chemicals some of the time with roughly 25% classified as "heavy users." The exact rate of usage for each varies by geography and time of year. People in colder climates tend to use herbicide application to kill the weeds that arrive with the onset of spring whereas people in warmer climates use more pesticides where insect-control is a year-round problem (EPA Best Management Practices, 2009).

Lawn and Garden Behavior Nationwide

Source: Various Surveys Nationwide, EPA 2009

Similarly, in a statewide DEQ study (DEQ Household Hazardous Waste Survey, 2008), 70% of residents managing their lawns purchase lawn and garden chemicals. Half (52%) report using a spot spray or weed and feed product, another quarter (24%) report using both a chemical and a natural type product, and 18% report not knowing which type of product they apply (chemical or natural).

Specifically, when asked what products they apply to their entire lawn, the responses were as follows:

- Weed and feed: 43%
- Weed killer: 31%
- Fertilizer: 48%
- Insecticide: 18%
- Moss controller[3]: 20%

The DEQ survey (2008) also found that about 40% of Oregonians practice low-intensity turf management practices (less watering, setting the mowing blades higher, and grasscycling), whereas 64% report watering twice or more per week. Results also showed that use of lawn care products was lowest among households with less than $25,000 and highest among those earning $75,000 or more. The majority (51%) of those earning more than $50,000 reported using weed and feed and were significantly more likely than those earning less than $50,000 (only 33% use) to do so.

Many residents seem to have an awareness of the harmful effects of lawn and garden care products. Any resistance toward alternative products or methods stems primarily from the perceived inconvenience and cost (common barriers to behavior change). One of the largest barriers to reducing or eliminating the use of lawn care

[3] More information on Moss controllers included in the home care and maintenance section.

products is the perception that a "lush" green lawn is necessary (EPA Best Management Practices). Research shows that this cultural ideal may be more difficult to overcome than other barriers.

There is some difference in lawn care between rural and urban areas, with those in rural areas using more lawn and garden chemicals that those in urban areas. The statewide DEQ Household Hazardous Waste Survey (2008) found that those living in rural areas are more likely than urban residents to use high intensity turf management (lots of watering, mowing and fertilizing) as well as lawn chemicals. Roughly 15-20% more residents in Clackamas and Washington Counties report using chemical products in their lawn or garden compared to those in Multnomah County (Metro Sustainable Living Survey, 2012). In the Tri-County region, one third use chemical products, another third use organic products, and the remaining third use a combination or forego products altogether. When asked, close to 80% believe it's important to have a chemical-free lawn or garden.

Focus group research has shown residents are most concerned about the health of children and pets when considering the use of lawn and garden products, rather than about the impact on our waterways (Coalition for Clean Rivers and Streams, 2011). Messages around safety of children and pets were highly effective in focus group testing. Additionally, the Gresham Lawn Care Behavior Surveys (2007, 2009) found that 82% of women (and 74% of men) feel that weed and feed products are potentially harmful to children and pets.

Other findings from the statewide DEQ survey (2008) show that 7% of those using products on their lawn report using organic products, while 69% of those using products on their own lawn report not trying natural products because they do not know enough about them. More than 50% believe that chemicals are easier and more effective to use than natural products.

Research often shows demographic differences in lawn and garden care behaviors. Women, more than men, tend to have a greater awareness of harmful effects of lawn chemicals on water systems. Women also have significant influence over changing behavior in the household. Of the 80% of respondents who believe having a chemical-free lawn is at least somewhat important, the majority were women, living in Multnomah and Washington Counties, and under the age of 55. Those who use organic or less toxic products were primarily women, residents of Multnomah County, and those in the higher income brackets (Metro Sustainable Living Survey, 2012). In Gresham, a 2009 Lawn Care Survey found that younger residents, women, and those with children were more likely to let their lawn go brown during the summer, while those preferring to keep a green lawn were male, older, and in households without children.

Demographics for Lawn and Garden Behavior

Chemical-free Lawn	Organic/Less Toxic Products	Let their Lawn "Go Brown"
Women	Women	Women
Multnomah County	Multnomah & Washington Counties	Households with children at home
Younger Ages	Higher incomes	Younger ages

Source: DHM Research, 2012

A smaller segment of the population uses outside companies to manage their lawn or have Home Owner Associations (HOA) that dictate the standards for the outward appearance of lawns and gardens. In the Gresham Stormwater Survey (2008), 15% report hiring a landscape service for all lawn care or just for fertilization. Statewide, the rate of landscape service use was 7% (DEQ Household Hazardous Waste Survey, 2008). The Gresham survey also found that 20% use organic options, but most (78%) do not use an organic option and do not know if their company offers that service.

Survey respondents in Gresham who use a landscape service report that they would select natural or organic products for their lawns if offered the choice (93%) (Gresham Stormwater Report, 2008). While landscape service users comprise a small portion of the population, the Gresham findings suggest that education of landscape firms or landscape service customers to use and/or request organic products could lead to fewer chemicals being used for lawn care.

In the Pacific Northwest, another consideration for lawn and garden care is proper application of product during our long rainy season. A recent survey in Clark County found that residents are split on whether it is best to water their lawn after applying fertilizer: 46% believe it is best to fertilize when rain is forecasted and 33% when no rain is forecasted (11% say it doesn't make a difference, and 10% don't know; Clark County Stormwater Report, 2011). This is an opportunity to further educate the public on smart application of lawn products.

Little research has examined the extent to which residents dump extra grass clippings in natural areas. The Gresham Stormwater Survey (2008) found that 25% of streamside homeowners and 16% of non-streamside homeowners put extra grass clippings and pruning in a nearby natural area. Only 5% of streamside renters dump extra clippings, but this rises to 20% for non-streamside renters. Groups most likely to perform this behavior include women and those with dogs.

Home care and maintenance

Existing research on home care behaviors that impact stormwater is minimal. The most relevant studies are from Metro (Sustainable Living 2012 and Household Hazardous Products 2007). For this report, home care includes:

1. Household chemicals and paint
2. Illegal burning/burying of trash
3. Septic systems and Recreational Vehicles
4. Home exterior care

Most research studies have focused on household chemical use, typically in the context of impacting treated water supplies. Dumping chemicals into storm drains is an extremely uncommon practice across the board; most residents opt to completely use the product. At least 20% of residents take products to recycle centers, while less than 10% place it in the garbage (Metro Household Hazardous Products, 2007). In Metro's Sustainable Living Survey (2012), when asked how they dispose of chemical products from their home such as solvents, cleaning supplies, old paint or pesticides, 37% either bring it to Metro or a recycling center. While "dumping" was not listed as an option, only 3% or less chose all other responses. There may be an opportunity to persuade residents to consider alternatives, as close to 80% express apprehension about the chemical products they use in their homes (Metro Household Hazardous Products, 2007).

Very few people bury or burn their trash. Nonetheless, like dumping chemicals, this is an area of research that could be expanded. In the Gresham Stormwater Survey (2008), one of the few surveys which mentions this practice, respondents clearly understand that burning garbage is illegal and very few use this method of waste management (5-10% depending on streamside location). Even fewer bury their garbage; fewer than one in twenty report this behavior.

Use and maintenance of septic tanks is another area under home care that impacts water issues. Among those who have septic tanks, regular maintenance appears to be uncommon. Most respondents in the Puget Sound (Water Pollution in Puget Sound, 2009) report that they would wait for a smell, wet ground, or a back-up to "know that they had a problem." Only half schedule maintenance checks every 2-3 years. In Gresham, septic tanks are most common among streamside residents, although relatively uncommon in the region as a whole (Gresham Stormwater Report, 2008). More research needs to be done on this correlation.

Proper disposal of septic waste by Recreational Vehicle (RV) owners also impacts water quality. RV ownership in the region is relatively uncommon and the few residents who do own RVs are very likely to be disposing of septic waste at a pump station. The Gresham Stormwater Survey (2008) found that about 10% of homeowners own an RV and no renters report owning one. When asked about

disposal practices for RV septic waste, 88% report disposing of the waste using an acceptable method, 5% do not know how it was disposed, and 5% report dumping waste onto the street or storm drain.

Few research studies address the application of fungicides on roofs to prevent moss. Use of fungicides may be more pertinent to regions west of the Cascades. Nonetheless, only a small portion of the population reports using fungicides. In a Clean Water Services Stream Habits Survey (2002), a majority of respondents indicate that they never treat their roofs (62%) and those who do, typically do so once a year or less. A similar number in Clark County (Stormwater Report, 2012) also report never applying a fungicide to their roof, walkway, or hard surface. A statewide DEQ survey (DEQ Household Hazardous Waste Survey, 2008) found that 20% of respondents apply moss controller on or around their home.

Future research should also consider issues related to downspouts, especially in conjunction with roof application of fungicides. Most houses have some sort of downspout. Downspouts can release runoff onto hard surfaces such as driveways rather than collection containers or pervious surfaces. More research needs to be done on local awareness of this issue and alternative approaches.

6 | MOTIVATIONS FOR BEHAVIOR CHANGE

People's motivations to change behavior around stormwater issues tend to be consistent across the nation. Although most of the research evaluated for this summary is in urban areas (specifically Portland Metro), there is little indication that primary motivations would differ between urban and nonurban residents. One area for further research is to examine motivations among communities of color – there is little to no research currently available in Oregon on ethnic differences in motivations for change.

Top motivations for stormwater behavior change include:

1) Safety of children and pets
2) Saving money or discounts
3) Protection of drinking water and public health
4) Fish and wildlife
5) Natural resource and recreation

Safety of children and pets. In both survey and focus group research, the safety of children and pets ranks in the top tier of concern for the use of chemical products in lawns, gardens, and in the home. Message testing in focus groups often shows that the presence of children and pets drives changes in behavior – households with these vulnerable groups are also more likely to use organic products or forego chemical use altogether in their home. Research also shows women are more likely to be concerned about chemical products (and water quality); they are often the best drivers of change in households.

> **Recommendation:** Link stormwater behaviors to the safety of children and pets, as appropriate. Consider mothers as messengers to target other females. Provide alternatives to chemical products in messaging – direct residents to safer and other effective alternatives.

Saving money or discounts. For some, saving money is the biggest motivation to change. With regards to car washing, this would be in the form of coupons to commercial car washes. For proper pet waste disposal, it could simply be free bags or scoopers. Saving money is a nuanced motivator when it comes to stormwater behaviors; it can be a key driver for some and not as effective for others. The perceived benefit of saving money will reach a cap if individuals feel any particular behavior is inconvenient or does not make much of a difference.

> **Recommendation:** Partner with organizations and businesses in the community to offer discounts for preferred behaviors. Communicate that saving money is an added benefit and not the first benefit.

Protection of drinking water and public health. Studies show that the public is more likely to change their behaviors if water conservation and preservation outreach includes a reference to the protection of drinking water. The impact is greater if residents know the source of their drinking water. Protection of drinking water is closely associated with Oregonians' values. Both focus groups and surveys show residents closely associate quality drinking water to good public health.

> **Recommendation:** Strengthen the connection between stormwater and drinking water. Inform the public about how clean rivers and streams equate to clean drinking water. Messages that make explicit the connection to drinking water will be more effective motivators than ones about general water pollution. Water pollution does not necessarily resonate with the public because a large portion of the population is unaware of the source of their drinking water.

Fish and wildlife. The value and importance of fish and wildlife habitat in Oregon remains high. Natural habitat is consistently in the top tier when ranking protection of water quality and natural areas across urban, rural, and suburban areas. Oregonians connect the health of fish and wildlife to the quality of water.

> **Recommendation:** Messages about stormwater should connect more directly to fish and wildlife habitat – stronger habitat means healthier rivers and streams, which are better for all of us.

Natural areas and recreation. Oregonians value the bounty and variety of natural areas and open spaces the state has to offer and they actively enjoy the outdoors. Natural beauty, scenery, and easy access to recreation and the outdoors are some of the strongest values for residents about Oregon. Though these values are generally high across the state, some communities may place greater importance on natural areas and access to recreation. Residents of Central Oregon and Bend, as an example, may emphasize access to recreation more highly than other motivators.

> **Recommendation:** Link stormwater projects to not only improving water quality but also creating natural areas and green spaces. As appropriate, make the connection to recreation and access to recreation, and how stormwater projects help to maintain a key value for Oregonians.

Note: People may mention **disincentives** as a motivation for behavior change. However, people are more likely to suggest disincentives as a way to change other peoples' behavior rather than as an effective method to modify their own behavior. As an example, dog owners would like to see fines for other dog owners who do not pick up after their pet. Disincentives or additional charges can be effective in some contexts but traditionally are not a major motivating factor and should be considered a last option.

7 | BARRIERS TO BEHAVIOR CHANGE

Barriers to behavior change related to stormwater can also be grouped into broader categories. Top barriers to behavior change include:

1) Inconvenience
2) Lack of knowledge
3) Higher cost
4) Perceived lack of impact
5) Perception that product is less effective
6) Mixed messages

Inconvenience. Behavioral changes that are perceived to be inconvenient or to take more time are difficult to effect. Cost savings alone provide insufficient motivation; residents report that saving money is not enough to change their behavior if the change is less convenient for them. It is worth noting that a portion of the population perceives any change in their current behavior to be inconvenient; this group is not a good target for behavior change.

> **Recommendation:** Provide easy resources, such as information on websites and through retailers, instruction stickers on recycle bins, and clear and simple instructions on products. Inform residents about alternative products or services; make it available and easy to find. Message around how simple steps can make a difference.

Lack of knowledge and awareness. A general lack of knowledge is a common barrier to behavior change, in particular as it relates to stormwater. A majority of residents are unaware of the source of their water, where runoff goes once it enters storm drains, the toxicity of household products, how pet waste is contributing to water pollution, or that carwash facilities are better for our waterways than washing vehicles at home. Many residents are simply unaware of the issues stormwater runoff poses to local rivers and streams.

> **Recommendation:** Connect common activities to their direct impact on local rivers and streams (and less on general waterways). Mention specific rivers and streams as much as possible; highlight rivers and streams as a source for drinking water.

Higher cost. A common perception is that alternative products or services cost more. Although cost is a key motivation for some, for most people it is not the primary driver of behavior change. However, because the perception of higher cost can easily prevent people from even considering alternatives, cost should be addressed in public outreach. Information and knowledge of resources and alternatives can overcome concerns over cost.

> **Recommendation:** Do not lead behavior change messages with mentions of cost or arguments that some alternatives cost less. Other benefits in tandem

with saving money are more effective to change behaviors; link to those benefits first before addressing perceptions around cost.

Perceived lack of impact. One of the easier barriers to overcome is the perception that individuals have little impact on improving water quality. Research consistently shows that the public perceives industry and farms to be the biggest contributors to water pollution and that they as individuals have less impact or are unable to make changes that count. Messages often link stormwater runoff to large bodies of water (global issue), and less on specific rivers and streams (local issue). In more recent years, a growing segment of the public is connecting runoff from roads and household behaviors as significant contributors to water quality.

Recommendation: Messaging should continue to connect how individual behaviors impact local rivers and streams (rather than general bodies of water). Name specific rivers or streams as much as possible to connect closer to "home." Be specific about the activity or preferred behavior, like picking up pet waste in the yard or reducing soapy water. Sometimes, simple suggestions that are easy enough to tackle are usually enough to persuade changes in behavior.

Perception that product is less effective. Some people believe that less toxic products will not be as effective as chemical products. This is especially the case for household products. Similar to perceptions of higher cost, outreach around the perception of a less effective product is better addressed with other benefits and more emotional motivations.

Recommendation: Do not lead behavior change messages by persuading residents of how alternative products and services are just as effective as products or services that use chemicals. Link to other benefits first, in particular ones that spark more emotion like the safety of children and pets.

Mixed or too many messages. We commonly hear in focus groups that messages around stormwater have too many instructions, aren't simple, sometimes conflict with product labels, or seem too big to tackle by one individual. Another barrier is mistrust in the messenger; government messengers are more effective around public health and less as a source for preferred behaviors, products, or services.

Recommendation: Give simple and easy suggestions around behavior change. Partner with local community organizations, small businesses, and university 'experts' as messengers. Save government messengers to message around improving the health of the community, or public health.

8 | MESSAGING FRAMEWORK

This framework for messaging is a general guideline for communications about stormwater in Oregon. Many of the recommendations are supported by focus group and survey research conducted for ACWA members, and the decades of past work by DHM Research on stormwater and related issues.

The framework is meant to present broad rules for communications, and may not apply uniformly to specific demographic groups such as communities of color or younger residents. Additional research is needed to determine if messages resonate differently among particular groups.

Messaging recommendations for stormwater communications:

- Connect to **Oregonians' values**, specifically to preserving the natural beauty of our state, the outdoors, water, trees, and nature. Water evokes strong emotions in people; this is an opportunity to engage Oregonians on something they care about.
- Use a **positive tone** and **focus on outcomes**. What are the benefits to individuals? How does it connect to their core values? Why change behaviors? Keep a focus on maintaining our quality of life, and specifically to improve our rivers and streams for future generations. This is more easily understood and resonates with the public. It also communicates a message that there is a plan for the future. Failed policies or consequences of bad behaviors are weak reasons for behavior change. Stick with a positive tone.
- Link stormwater more to **drinking water**. Protection of drinking water is one of the best motivations for changing behaviors. Mention and include **specific rivers and streams** to make a stronger "local" connection to a drinking water source. Relate how individuals' behaviors impact their community to more effectively address how individuals can make a difference in their own "backyard."
- Another top motivator is protecting the **health of children and pets**. Link stormwater behaviors to the safety of children and pets. This is highly effective in both focus groups and surveys, especially among women.
- Consider **mothers as messengers** to target the strongest base of supporters – females, Democrats, and people with higher education/income. Other research also shows that women are strong messengers, often the most effective messengers, around improving the health of families.
- Mention how stormwater projects create **natural areas and green spaces** and, when appropriate, improved recreation and access to recreation. This is another key reason why residents value living in Oregon – connect to values that resonate with the public.
- Suggest **simple steps** to behavior change. A large number of residents are uncertain or confused about what actions they can take. They are also unsure of where to find additional resources on alternatives. Provide simple changes and link those to outcomes. Be specific. "Use organic lawn and garden products to keep children and pets safe from chemicals." "Pick up pet waste to minimize

bacteria in yards and parks, which may drain into our source for drinking water." "Consider carwash facilities to reduce soapy water in our rivers and streams."

- **Partner** with community organizations, small businesses, retailers, and university experts as spokespeople around preferred stormwater behaviors. They are often better messengers than government, environmental groups, and utilities that may be viewed by the public with skepticism. A better angle for government and utilities is around public health. Protecting water quality, clean drinking water, and maintaining water and sewer systems are seen as good public services.

Other considerations for stormwater communications:

DO NOT lead with saving money as the key motivation for behavior change. Instead, lead with other values and include saving money as an added benefit.
DO NOT get bogged down in too many details and instructions. Keep it simple and easy.
DO NOT start with government messengers. They evoke a high sense of skepticism due to increasing distrust in government generally.
DO NOT talk about water pollution in general terms. It's too broad and global, and leaves people with a sense that their behavior won't make a difference. Link to local rivers and streams. Name them.
DO NOT persuade residents that alternative products are just as effective as chemical ones. Let them come to that conclusion. Instead, move people with other values like the safety of children and pets.
DO NOT use words like infrastructure, sustainable, herbicides, pesticides, etc. Use words that express benefits for the individual.

Words to use	Words to avoid
Water	Waste water, stormwater
Quality of life, communities	Sustainability, livability
Nature, maintain our water source	Infrastructure
Natural, organic, compost, native plants	Sustainable, green
Kills weeds	Herbicides
Kills insects	Pesticides

9 | MEDIA REVIEW

In order to gain a more comprehensive overview of stormwater issues, a simple media search was conducted to analyze how media approached stormwater, individual contributing behaviors, and related news in Oregon during the past year (January 2013 – November 2013). Newspapers with archives available online and with an adequate amount of content were searched for stories relating to stormwater runoff; this included The Oregonian, Oregon Public Broadcasting, The Portland Tribune, and The Bulletin (The Salem Statesman Journal was not included due to subscription requirements when viewing archives). A national search for stormwater issues during the same time was also conducted to provide additional context. This summary is intended to offer a broad overview of how the media is approaching stormwater related issues.

National coverage. Nationally, stormwater issues are covered infrequently by major news networks. Stories are often a 'side effect' of other issues, such as a court case or policy change. Two recent national stories exemplify this kind of reporting. One involves Senator Tom Udall (D-NM) proposing a bill to reduce pollution caused by stormwater runoff. The second story involves a successful appeal by a West Virginia chicken farmer who was threatened with fees by the EPA if the farm did not comply with stormwater permits. These stories were covered by several news agencies. News coverage on stormwater is more often linked to conflict versus education or general public knowledge.

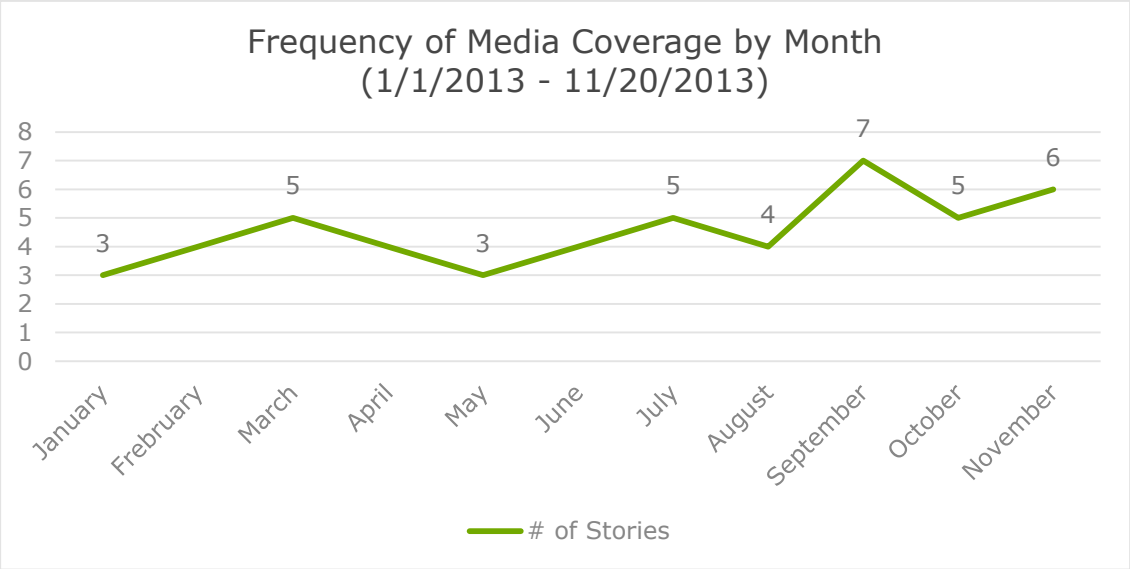
Local coverage. Statewide, individual news agencies were searched online for the terms "stormwater", "runoff", and "stormwater pollution". Relevant news stories were grouped into categories based on their major topic area:

- Environmental concerns: Pollution
- Infrastructure construction: Completed or planned projects regarding stormwater construction, bioswales, riparian growth, technology
- Court case: Court rulings, lawsuits, fines, etc.
- Development details: Master plans, open houses, updates
- Policy: Proposals, bills, city government decisions
- Stormwater advocacy: Information on stormwater as primary topic

Topic of Media Coverage	No. Stories
Infrastructure construction	**27**
Court case	8
Development details	7
Environmental concerns	3
Stormwater advocacy	3
Policy	2
Total	**50**

Type of Media Coverage	No. Stories
News	**40**
Public announcement	5
Photo/video feature	3
Editorial	2
Total	**50**

More often, local news highlights a local stormwater infrastructure related project, lawsuit, or development plan that also involves stormwater systems. Individuals relevant to the individual story are cited either as the source of a city project to help prevent stormwater runoff (city official) or as a specialist who can provide background information on why stormwater runoff is important to address (environmental advocacy group, for instance). Infrastructure is a common topic but often emphasizes threats of flooding or complying with regulations rather than pollution. Generally, detailed descriptions of stormwater pollution are brief unless highlighted in a feature article.



The Oregonian is by far the leading source of stormwater news, followed by OPB. Story frequency did not seem to be affected by any significant events. Significant stormwater related events occurring in recent months, including a conference on the topic, received no news coverage.

The tone of the news stories also varies. Most stories depict straight news in a neutral tone, closely followed by stories with a positive tone. Negative stories tend to have stormwater as a side issue, and not necessarily as the main story.

Source of Media Coverage	No. Stories
The Oregonian	**24**
OPB	17
Portland Tribune	8
The Bulletin	1
Total	**50**

Tone of Media Coverage	No. Stories
Neutral	**24**
Positive	21
Negative	5
Total	**50**

Messengers named in stormwater stories are most frequently city officials. This reflects the nature of the stories found: most relate to infrastructure plans and projects where stormwater is not the primary issue. A city official related to the project or topic is often cited in these cases. At times, larger environmental or water related advocacy groups are also cited.

Messengers in Media Coverage	Frequency
City officials (water, BES, environment)	**18**
City officials (planner, engineer, council, etc.)	**11**
Environment/water advocacy group	8
Tualatin Riverkeepers	5
State/regional officials	5
Attorney	3
Citizens	3
Project/construction member	2
Professor/expert	2
Water utility management	1
Other advocacy group	1
Author	1
Private stormwater management company	1
Private investment firm	1
Company CEO	1
HOA board member	1

10 | FUTURE RESEARCH

Oregon is fortunate to have a great number of nationally recognized leaders in stormwater services. We have also benefited from the depth and breadth of research that has been conducted across the state, as demonstrated in this review. Yet many opportunities exist to expand on this research to help guide our leaders and policy makers. The following are some suggestions for future research, and approximate costs to keep in mind for budgeting purposes.

Community research in rural communities
Unfortunately, much of the existing research has been conducted in Portland Metro Area. While there is reason to believe that Oregonians broadly share many values – particularly about the state's natural environment – it should not be assumed that knowledge and behaviors about stormwater are the same in every community. Not only may values differ across the state, but water issues are also varied. Concerns about the impact and causes of stormwater pollution are likely to be different in communities in the high desert, Willamette Valley, and along the coast. To learn how, and to what degree, it will be necessary to conduct research in those communities.

Methods: surveys, focus groups, and in-depth interview

Message testing
At a high level, this review has provided good guidance on the motivations and barriers to stormwater behavior. We know less about what specific messages are most effective, with which audiences, and using which communication mediums. More refined research that could demonstrate how to target key audiences could be an important line of research.

Methods: surveys and focus groups

Benchmark studies
While values are slow to change, awareness of issues and prioritization of those issues can change relatively quickly. The organizations most effective at maintaining public opinion in their favor regularly conduct benchmark studies. These are studies that are repeated over time, often once every one to three years, to measure changes in attitudes, behaviors, and responses to key messages.

Methods: surveys

Stakeholder and opinion leader studies

Key stakeholders and opinion leaders often shape the perspectives of the general public and are instrumental in driving public policy. It is advisable to conduct research with these individuals to better understand their specific concerns.

Method: in-depth interviews

Costs

The following are cost estimates for telephone surveys, focus groups, and in-depth interviews. The high dollar range is assuming a full service project including reporting and analysis. The low dollar range would provide less support in the research design, implementation and level of analysis.

Telephone surveys

N-size	Margin of Error	Length	*Cost*
300	±5.7%	5 minutes (~15 questions)	*~$9,000 - $11,000*
400	±4.9%	10 minutes (~30 questions)	*~$15,000 - $18,000*
500	±4.4%	15 minutes (~45 questions)	*~$23,000 - $28,000*

Focus groups

Focus groups are structured conversations with 8-10 people who are recruited from the population of interest. Often the participants are recruited at random from customer and voter registration lists. Quotas are established by key demographics (e.g., age, gender, household size) to ensure a representative sample. Multiple groups are recommended for group-to-group validation. Full service would include topic guide development, participant recruitment and honorariums, facility and hosting, moderation, professional videography, transcribed written exercises, and full reporting and analysis.

Cost: $6,000 - $8,000 per group

In-depth stakeholder interviews

In-depth stakeholder interviews are one-on-one structured conversations with key decision-makers and opinion leaders. They are typically 30-45 minutes in length. Full service would include interview guide development, participant recruitment and honorariums, interviews, and full reporting and analysis.

Cost: $200 - $400 per interview

11 | RESEARCH PROVIDED BY ACWA MEMBERS

The table below lists research studies provided by ACWA members and referenced in this report. DHM reviewed these and other studies to draw conclusions and make recommendations. These studies were selected for inclusion based on confidence in the methodology (e.g., survey sample size and design), the variety of populations reached (e.g., homeowners, community size), and whether they addressed the key topics of interest.

Year	Study	Sample Size	Method	Stormwater Awareness	Water Values	Household Hazardous Materials	Lawn and Garden Care	Car Care	Pet Care	Illegal Dumping	RV Waste
2013	Clean Water Services Customer Values Survey	944	Online		x						
2013	Eugene Stormwater Management Survey	400	Phone	x			x	x			
2012 2011	Portland Community Surveys	3,400 3,731	Mail	x	x						
2012 2010 2008 2006 2002	Clean Water Services Customer Service Surveys	400-1500	Phone Online	x	x	x					
2012	Clean Water Services Stormwater Survey	1696	Online	x	x	x	x				
2012	Metro/DHM Sustainable Living Survey	300	Phone			x	x				
2012	Oak Lodge Sanitary District Satisfaction Survey	907	Phone	x							
2011	Keizer Community Survey	838	Mail	x							
2011	Regional Coalition for Clean Rivers and Streams, Community Survey	1,090	Online	x	x	x		x	x		
2010	Lake Oswego-Tigard Water Partnership	20	Focus Groups		x						

Year	Study	Sample Size	Method	Stormwater Awareness	Water Values	Household Hazardous Materials	Lawn and Garden Care	Car Care	Pet Care	Illegal Dumping	RV Waste
	Focus Groups										
2009	Metro Toxic Reduction Focus Group	31	Focus Group	x			x		x		
2009 2007	Gresham Lawn Care Pre and Post Surveys	400	Phone				x				
2008	Gresham Stormwater Report	400	Phone		x	x	x	x	x	x	x
2007	Metro Household Hazardous Products Survey	412	Phone			x	x	x		x	
2006	Clackamas County Water Environment Services Survey	505	Phone	x	x						
2005 1999	Portland Bureau of Environmental Services Surveys	500	Phone	x	x		x	x	x		
2002	Clean Water Services Stream Habits Survey	430	Phone		x	x	x	x	x		
1999	Bend Environmental Issues Survey	415	Phone	x	x	x	x			x	