DEPARTMENT OF ECOLOGY State of Washington

Submittals WQWebSubmittal

Annual Report

Number	Permit Section	Question
1	S5.A.2	Attach updated annual Stormwater Management Program Plan (SWMP Plan). (S5.A.2) Saved Document Name: Snohomish 2017 SWMP Final_1_03132017124533
2	S9.D.5	Attach a copy of any annexations, incorporations or boundary changes resulting in an increase or decrease in the Permittee's geographic area of permit coverage during the reporting period per S9.D.5. Saved Document Name: 2017 annexation docs_2_03132017123912
3	S5.A.3	Implemented an ongoing program to gather, track, and maintain information per S5.A.3, including costs or estimated costs of implementing the SWMP. Yes
4	S5.A.5.b	Coordinated among departments within the jurisdiction to eliminate barriers to permit compliance. (S5.A.5.b) Yes
5	S5.C.1.a.i and ii	Attach description of public education and outreach efforts conducted per S5.C.1.a.i and ii. Saved Document Name: Snohomish Education Efforts_5_03132017074338
6	S5.C.1.b	Created stewardship opportunities (or partnered with others) to encourage resident participation in activities such as those described in S5.C.1.b. Yes
7	S5.C.1.b	Used results of measuring the understanding and adoption of targeted behaviors among at least one audience in at least one subject area to direct education and outreach resources and evaluate changes in adoption of targeted behaviors. (Required no later than February 2, 2016, S5.C.1.b) Yes
7b	S5.C.1.b	Attach description of how this requirement was met. Saved Document Name: NatYardCareEval_FinalReport_20_7b_03132017074338
8	S5.C.2.a	Describe the opportunities created for the public to participate in the decision making processes involving the development, implementation and updates of the Permittee's SWMP. (S5.C.2.a) Annual public hearing to be held (this yr: March 14, 2017)
9	S5.C.2.b	Posted the updated SWMP Plan and latest annual report on your website no later than May 31. (S5.C.2.b) Yes

Number	Permit Section	Question
9b	S5.C.2.b	List the website address. http://www.ci.snohomish.wa.us/213/Stormwater
10	S5.C.3.a.i - vi	Maintained a map of the MS4 including the requirements listed in S5.C.3.a.i.-vi. Yes
11	S5.C.3.b.v	Implemented a compliance strategy, including informal compliance actions as well as enforcement provisions of the regulatory mechanism described in S5.C.3.b. (S5.C.3.b.v) Yes
12	S5.C.3.b.vi	Updated, if necessary, the regulatory mechanism to effectively prohibit illicit discharges into the MS4 per S5.C.3.b.vi. (Required no later than February 2, 2018) Not Applicable
12b		Cite the Prohibited Discharges code reference
13	S5.C.3.c.i	Implemented procedures for conducting illicit discharge investigations in accordance with S5.C.3.c.i. Yes
13b	S5.C.3.c.i	Cite methodology City's IDDE Program Manual created in 2011
14	S5.C.3.c.i	Percentage of MS4 coverage area screened in reporting year per S5.C.3.c.i. (Required to screen 40% of MS4 no later than December 31, 2017 (except no later than June 30, 2018 for the City of Aberdeen) and 12% on average each year thereafter. (S5.C.3) 16
15	S5.C.3.c.ii	List the hotline telephone number for public reporting of spills and other illicit discharges. (S5.C.3.c.ii) (360) 568-3115 and (360) 568-7070
15b	S5.C.3.c.ii	Number of hotline calls received. 8
16	S5.C.3.c.iii	Implemented an ongoing illicit discharge training program for all municipal field staff per S5.C.3.c.iii. Yes
17	S5.C.3.c.iv	Informed public employees, businesses, and the general public of hazards associated with illicit discharges and improper disposal of waste. (S5.C.3.c.iv) Yes
17b	S5.C.3.c.iv	Describe the information sharing actions. (S5.C.3.c.iv) See attachment "SnohEducEfforts.doc"

Number	Permit Section	Question
18	S5.C.3.d	Implemented an ongoing program to characterize, trace, and eliminate illicit discharges into the MS4 per S5.C.3.d. Yes
19	S5.C.3.d.iv	Number of illicit discharges, including illicit connections, eliminated during the reporting year. (S5.C.3.d.iv) 0
20	S5.C.3.d.iv	Attach a summary of actions taken to characterize, trace and eliminate each illicit discharge found by or reported to the permittee. For each illicit discharge, include a description of actions according to required timeline per S5.C.3.d.iv Not Applicable
21	S5.C.3.e	Municipal illicit discharge detection staff are trained to conduct illicit discharge detection and elimination activities as described in S5.C.3.e. Yes
22	S5.C.4.a	Implemented an ordinance or other enforceable mechanism to address runoff from new development, redevelopment and construction sites per the requirements of S5.C.4.a. Yes
23	S5.C.4.a.i-iii	Revised ordinance or other enforceable mechanism to effectively address runoff from new development, redevelopment and construction sites per the requirements of S5.C.4.a.i-iii. (Required no later than December 31, 2016, except no later than June 30, 2017 for Permittees in Lewis and Cowlitz counties, and no later than June 30, 2018 for the City of Aberdeen) Yes
23b	S5.C.4.a.i-iii	Cite code reference for revised ordinance or other enforceable mechanism to address runoff from new development, redevelopment and construction sites. SCC 15.16.020
24	S5.C.4.a.i	Number of exceptions granted to the minimum requirements in Appendix 1. (S5.C.4.a.i., and Section 6 of Appendix 1) 0
25	S5.C.4.a.i	Number of variances granted to the minimum requirements in Appendix 1. (S5.C.4.a.i., and Section 6 of Appendix 1) 0
26	S5.C.4.b.i	Reviewed Stormwater Site Plans for all proposed development activities that meet the thresholds adopted pursuant to S5.C.4.a.i. (S5.C.4.b.i) Yes
26b	S5.C.4.b.i	Number of site plans reviewed during the reporting period. 11
27	S5.C.4.b.ii	Inspected, prior to clearing and construction, permitted development sites that have a high potential for sediment transport as determined through plan review based on definitions and

Number	Permit Section	Question
		requirements in Appendix 7 Determining Construction Site Sediment Damage Potential, or alternatively, inspected all construction sites meeting the minimum thresholds adopted pursuant to S5.C.4.a.i. (S5.C.4.b.ii) Yes
27b	S5.C.4.b.ii	Number of construction sites inspected per S5.C.4.b.ii. 2
28	S5.C.4.b.iii	Inspected permitted development sites during construction to verify proper installation and maintenance of required erosion and sediment controls. (S5.C.4.b.iii) Yes
28b	S5.C.4.b.iii	Number of construction sites inspected per S5.C.4.b.iii. 4
29	S5.C.4.b.ii, iii and	Number of enforcement actions taken during the reporting period (based on construction phase inspections at new development and redevelopment projects). (S5.C.4.b.ii, iii and v) 0
30	S5.C.4.b.iv	Inspected all permitted development sites that meet the thresholds in S5.C.4.a.i upon completion of construction and prior to final approval or occupancy to ensure proper installation of permanent stormwater facilities. (S5.C.4.b.iv) Yes
31	S5.C.4.b.ii-iv	Achieved at least 80% of scheduled construction-related inspections. (S5.C.4.b.ii-iv) Yes
32	S5.C.4.b.iv	Verified a maintenance plan is completed and responsibility for maintenance is assigned for projects. (S5.C.4.b.iv) Yes
33	S5.C.4.c	Implemented provisions to verify adequate long-term operation and maintenance (O&M) of stormwater treatment and flow control BMPs/facilities that are permitted and constructed pursuant to S5.C.4. a and b. (S5.C.4.c) Yes
34	S5.C.4.c.i and ii	Updated provisions to verify long-term operation and maintenance of stormwater treatment and flow control BMPs/facilities that are permitted pursuant to S5.C.4.a and b. (Required no later than December 31, 2016, except no later than June 30, 2017 for Permittees in Lewis and Cowlitz counties, and no later than June 30 2018 for the City of Aberdeen, S5.C.4.c.i and ii Yes
35	S5.C.4.c.iii	Annually inspected stormwater treatment and flow control BMPs/facilities per S5.C.4.c.iii. Yes
35b	S5.C.4.c.iii	If using reduced inspection frequency for the first time during this permit cycle, attach documentation per S5.C.4.c.iii Not Applicable

Attachments:

View Files Attached to Submission

	DocDescr	DocName	DocExt	DocID	SubID	AppName
View	WAR045543_2_03132017123912	2017 annexation docs_2_03132017123912	.pdf	539905	1566952	wqwebportal
View	WAR045543_7b_03132017074338	NatYardCareEval_FinalReport_20_7b_03132017074338	.pdf	539559	1566952	wqwebportal
View	WAR045543_1_03132017124533	Snohomish 2017 SWMP Final_1_03132017124533	.pdf	539909	1566952	wqwebportal
View	WAR045543_5_03132017074338	Snohomish Education Efforts_5_03132017074338	.docx	539558	1566952	wqwebportal
View	WAR045543_41b_03142017073234	Snohomish LID Code Report_41b_03142017073234	.pdf	540307	1566952	wqwebportal
View	WAR045543_56_03132017075434	Snohomish Monitoring Report 20_56_03132017075434	.pdf	539575	1566952	wqwebportal
View	WAR045543_55_03132017094219	Snohomish TMDL Status 2016_55_03132017094219	.doc	539694	1566952	wqwebportal

Close

Attachments

CITY OF SNOHOMISH
Snohomish, Washington

ORDINANCE 2295

AN ORDINANCE OF THE CITY OF SNOHOMISH, WASHINGTON, ANNEXING CERTAIN PUBLIC RIGHT OF WAY KNOWN AS "13TH STREET AND AVENUE A", AND ESTABLISHING THE EFFECTIVE DATE OF SAID ANNEXATION

WHEREAS, on October 6, 2015, pursuant to RCW 35A.14.295, the City Council passed Resolution 1316 stating the intent of the City to annex the unincorporated public right of way known as the "13th Street and Avenue A Annexation", described in the attached Exhibit A legal description and as depicted on the attached Exhibit B map; and

WHEREAS, an annexation petition was not required because the annexation area is entirely within public right of way, is entirely contiguous to the corporate boundary of the City, and there are no voters residing within the said right of way; and

WHEREAS, on November 3, 2016, pursuant to RCW 35A.14.295, the City Council held a duly noticed public hearing regarding the annexation, and authorized the submittal of the proposed annexation to the Snohomish County Boundary Review Board; and

WHEREAS, on December 28, 2015, pursuant to RCW 36.93.110, the Chair of the Boundary Review Board for Snohomish County declared the Board's review of the 13th Street and Avenue A Annexation is not necessary for the protection of the interest of the various parties and therefore waived jurisdiction over the annexation; and

WHEREAS, RCW 43.21C.222 categorically exempts annexations from review under the State Environmental Policy Act, RCW Chapter 43.21C; and

WHEREAS, the City Council finds that the land proposed for annexation is dedicated public right-of-way with no land use designation shown on the adopted Land Use Map and therefore no zoning designation is applicable for the purposes of the Zoning Code; and

WHEREAS, it is the City Council's adopted policy to require annexing property to assume a proportionate share of the City's existing bonded indebtedness; and

WHEREAS, since the land proposed for annexation is currently dedicated public right-of-way not subject to property taxation and, if vacated, would attach by law to properties currently subject to the City's existing bonded indebtedness, the City Council finds that there is no utility and no benefit to the City and its taxpayers to require assumption of a proportionate share of the City's existing bonded indebtedness;

NOW, THEREFORE, THE CITY COUNCIL OF THE CITY OF SNOHOMISH, WASHINGTON DO HEREBY ORDAIN AS FOLLOWS:

Section 1. The 13th Street and Avenue A Annexation has been approved by the Boundary Review Board for Snohomish County without review. The City Council finds it to be in the best interest of the citizens of the City of Snohomish to annex, and does hereby annex, the public right of way known as the 13th Street and Avenue A Annexation situated in Snohomish County, Washington as contiguous, proximate, and within the present corporate limits of the City and as more particularly legally described in Exhibit A and depicted on Exhibit B, which are attached hereto and incorporated in full by this reference.

Section 2. The property shall be annexed as public right-of-way, as shown on the adopted Comprehensive Plan Land Use Map, and no zoning designation shall apply for the purposes of the Zoning Code, subject to future legislative action by the City Council.

Section 3. This ordinance shall take effect forty-five (45) days following passage. Following passage hereof, a summary of this ordinance shall be published along with the legal description of the annexation area and the effective date once each week for two weeks following the passage of this ordinance pursuant to RCW 35A.14.297.

Section 4. Pursuant to RCW 35A.14.297, this Ordinance shall be subject to referendum for forty-five days after passage.

Section 5. Upon passage of this ordinance a certified copy shall be filed with the Clerk of the Snohomish County Council and the Snohomish County Assessor.

ADOPTED AND PASSED by the City Council and **APPROVED** by the Mayor this 2nd day of February, 2016.

CITY OF SNOHOMISH

By _____
Karen Guzak, Mayor

Attest:

By _____
Pat Adams, City Clerk

Approved as to form:

By _____
Grant K. Weed, City Attorney

EXHIBIT A
LEGAL DESCRIPTION FOR PROPOSED ANNEXATION TO THE CITY OF SNOHOMISH

THAT PORTION OF GOVERNMENT LOT 3 AND GOVERNMENT LOT 6, LOCATED IN SECTION 7, TOWNSHIP 28 NORTH, RANGE 6 EAST, W.M., DESCRIBED AS FOLLOWS:
COMMENCING AT THE SOUTHEAST CORNER OF SAID GOVERNMENT LOT 6;
THENCE WEST 30 FEET MORE OR LESS ALONG THE SOUTH LINE OF SAID GOVERNMENT LOT 6 TO THE POINT OF INTERSECTION WITH THE WEST LINE OF PARK AVENUE RIGHT OF WAY PROJECTED SOUTHERLY, AND THE TRUE POINT OF BEGINNING, SAID POINT BEING 30.00 FEET WEST OF THE EAST LINE OF SAID GOVERNMENT LOT 6 AS MEASURED PERPENDICULAR THERETO, SAID POINT ALSO BEING THE SOUTHWESTERLY CORNER OF PARCEL 3 OF THAT CERTAIN TRACT OF LAND ANNEXED TO THE CITY OF SNOHOMISH PER CITY OF SNOHOMISH ANNEXATION ORDINANCE No. 934, DATED JUNE 4, 1963;
THENCE WEST ALONG THE SOUTH LINE OF SAID GOVERNMENT LOT 6 A DISTANCE OF 1300 FEET MORE OR LESS TO THE SOUTHWEST CORNER OF SAID GOVERNMENT LOT 6;
THENCE CONTINUE WEST ALONG THE SOUTH LINE OF AFOREMENTIONED GOVERNMENT LOT 3 A DISTANCE OF 60 FEET MORE OR LESS TO A POINT ON THE WEST LINE OF AVENUE A RIGHT OF WAY, SAID POINT BEING 60.00 FEET WEST OF THE EAST LINE OF SAID GOVERNMENT LOT 3 AS MEASURED PERPENDICULAR THERETO;
THENCE NORTH ALONG THE WEST LINE OF AVENUE A RIGHT OF WAY, PARALLEL WITH AND 60.00 FEET WEST OF SAID EAST LINE OF GOVERNMENT LOT 3 A DISTANCE OF 486 FEET MORE OR LESS TO THE NORTHEAST CORNER OF THAT CERTAIN TRACT OF LAND CONVEYED BY LOUIS KUHBANK BY DEED RECORDED IN VOLUME 126 OF DEEDS, PAGE 525, UNDER RECORDING NUMBER 182013, RECORDS OF SNOHOMISH COUNTY, WASHINGTON, SAID POINT BEING LOCATED ON THE SOUTH LINE OF THAT CERTAIN TRACT OF LAND ANNEXED TO THE CITY OF SNOHOMISH PER CITY OF SNOHOMISH ANNEXATION ORDINANCE No. 1302, DATED JANUARY 20, 1976;
THENCE EAST ALONG THE SOUTH LINE OF SAID ANNEXATION AND PERPENDICULAR TO THE EAST LINE OF SAID GOVERNMENT LOT 3 A DISTANCE OF 60.00 FEET TO A POINT ON THE EAST LINE OF SAID GOVERNMENT LOT 3, SAID POINT ALSO BEING THE SOUTHEAST CORNER OF THAT CERTAIN TRACT ANNEXED TO THE CITY OF SNOHOMISH PER CITY OF SNOHOMISH ANNEXATION ORDINANCE No. 1302, DATED JANUARY 20, 1976;
THENCE SOUTH ALONG THE EAST LINE OF SAID GOVERNMENT LOT 3 A DISTANCE OF 456 FEET MORE OR LESS TO A POINT ON THE NORTH LINE OF 13TH STREET RIGHT OF WAY, SAID POINT BEING 30.00 FEET NORTH OF THE SOUTH LINE OF SAID GOVERNMENT LOT 6 AS MEASURED PERPENDICULAR THERETO;
THENCE EAST ALONG THE NORTH LINE OF 13TH STREET RIGHT OF WAY, PARALLEL WITH AND 30.00 FEET NORTH OF THE SOUTH LINE OF SAID GOVERNMENT LOT 6 A DISTANCE OF 1300 FEET MORE OR LESS TO A POINT ON

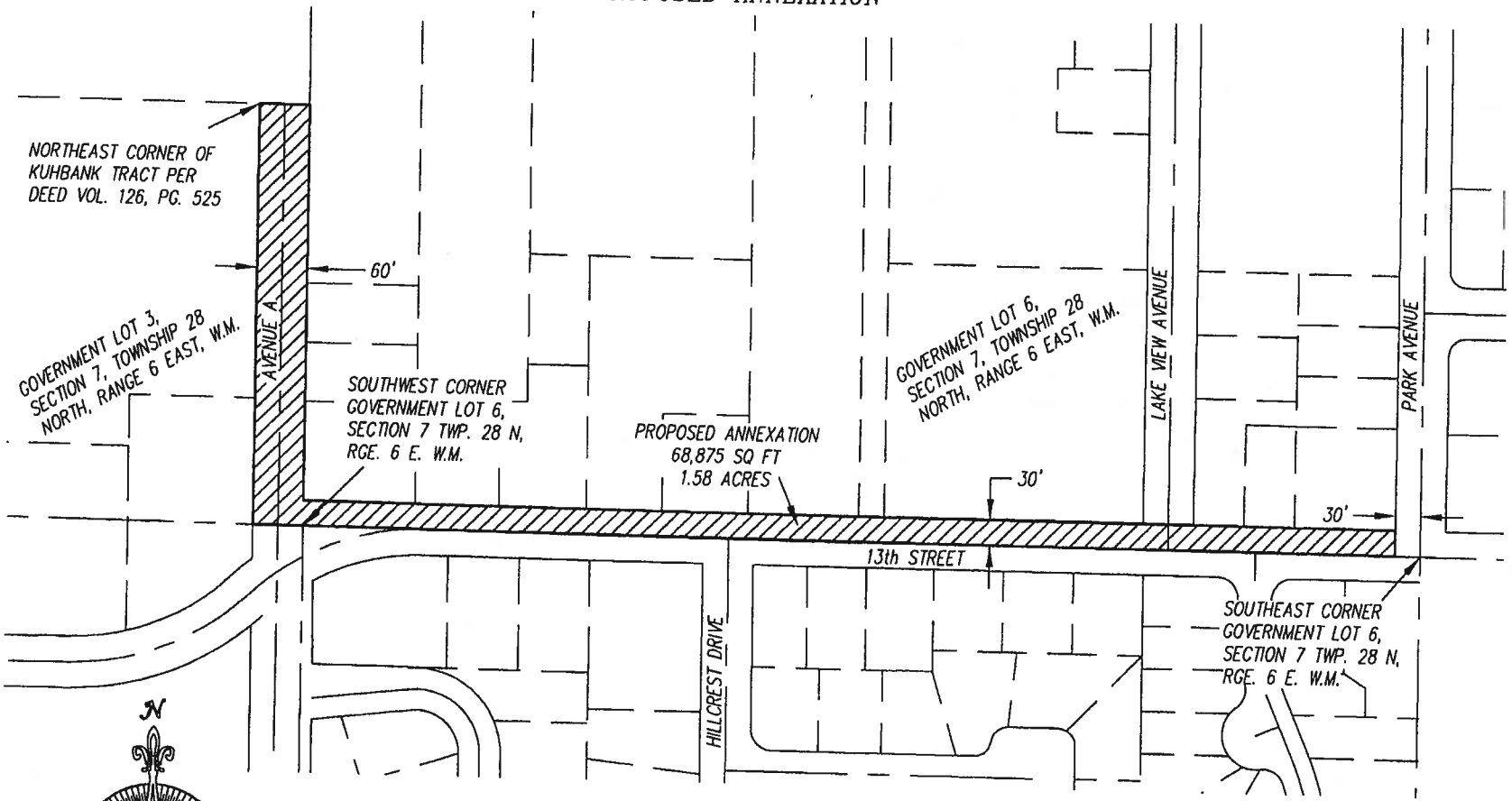
THE WEST LINE OF PARK AVENUE RIGHT OF WAY, SAID POINT BEING 30.00 FEET WEST OF THE EAST LINE OF SAID GOVERNMENT LOT 6 AS MEASURED PERPENDICULAR TO THE EAST LINE THEREOF;
THENCE SOUTH PARALLEL WITH AND 30.00 FEET WEST OF SAID EAST LINE OF GOVERNMENT LOT 6 A DISTANCE OF 30.00 FEET MORE OR LESS TO THE TRUE POINT OF BEGINNING.

SITUATE IN SNOHOMISH COUNTY, WASHINGTON.

IT IS THE INTENT OF THIS LEGAL DESCRIPTION TO FOLLOW THE EXISTING CORPORATE CITY LIMITS OF THE CITY OF SNOHOMISH. REFERENCES HEREIN ARE MEANT TO CONVEY THAT ALTHOUGH PRESENT RIGHTS OF WAY BOUNDARIES MAY BE DIFFERENT, THE RIGHTS OF WAY BOUNDARIES AT THE TIME OF THE ORIGINAL INCORPORATION AND SUBSEQUENTLY ADOPTED ORDINANCES ARE INTENDED TO BE FOLLOWED SO THAT NO GAP OR OVERLAP EXISTS BETWEEN THIS ANNEXATION AND THE EXISTING CITY LIMITS OF THE CITY OF SNOHOMISH.

1/5/15

EXHIBIT B
PROPOSED ANNEXATION



River City Land Services
PO Box 171, Snohomish, WA. 98291 (360) 568-6200

I, PAT ADAMS, City Clerk of the City of Snohomish, Washington, certify that the attached copy of Ordinance 2295 is a true and correct copy of the original Ordinance passed on the 2nd day of February 2016.

DATED this 4th day of February, 2016.

Pat Adams, City Clerk

North and South Sound Natural Yard Care Education Evaluation Report

Prepared for:
Snohomish County
City of Olympia

December 31, 2015

CASCADIA
CONSULTING GROUP
SEATTLE, WA | OAKLAND, CA
WWW.CASCADIACONSULTING.COM

Acknowledgments

We dedicate this work to Patricia Pyle. Her passion and energy led to the success of Olympia's Go Green natural lawn care program. Patricia was dedicated to teaching people every-day, science-based ways to protect water quality and aquatic habitats. She was a green champion and remains an inspiration to us all.

The project team was led by regional partners in the North and South Sound:

North Sound
Snohomish County

- Peggy Campbell
- Stef Frenzl
- Suzi Wong-Swint

South Sound
City of Olympia

- Patricia Pyle
- Susan McCleary

The project team would like to thank other partner agencies and their primary contacts:

North Sound

- Snohomish Conservation District (Kathryn Wells)
- Washington State University Snohomish County Extension Master Gardener Program (Philomena Kedziorski)
- City of Arlington (Bill Blake)
- City of Bothell (Janet Geer)
- City of Brier (Nicole Gaudette)
- City of Edmonds (Michael Cawrse, Steve Fisher)
- City of Everett (Apryl Hynes)
- City of Granite Falls (Brent Kirk)
- City of Lynnwood (Jared Bond)
- City of Marysville (Leah Grassl, Matthew Eyer)
- City of Mill Creek (Marci Chew)
- City of Monroe (Vince Bertrand)
- City of Mountlake Terrace (Penny Merkley, Mike Shaw)
- City of Mukilteo (Challis Stringer, Jennifer Adams)
- City of Snohomish (Max Selin)

South Sound

- City of Tumwater (Debbie Smith)
- Thurston County (Chris Maun, Anne Marie Pearce)

The evaluation was designed and conducted by Cascadia Consulting Group (Jessica Branom-Zwick), with statistical analysis by TerraStat Consulting Group (Tamre Cardoso).

This project was funded in part by the Washington State Department of Ecology, under GROSS Grant G1400481.

This project was been funded in part by the United States Environmental Protection Agency under Puget Sound Ecosystem Restoration and Protection Cooperative Agreement Grant PC-00J20101 with the Washington State Department of Ecology.

The contents of this document do not necessarily reflect the views and policies of the Department of Ecology or the Environmental Protection Agency, nor does mention of trade names or commercial products constitute endorsement or recommendation for use.

Table of Contents

Executive Summary

Project and Evaluation Overview

In 2014, Snohomish County and the City of Olympia, in partnership with 15 other local jurisdictions in the Puget Sound region, implemented two natural yard care education programs in two geographic regions using distinctly different delivery strategies. Both programs were designed to improve local water quality and protect Puget Sound by reducing pollutants associated with conventional residential yard care practices.

Both programs were implemented with a rigorous evaluation component designed to meet National Pollutant Discharge Elimination System (NPDES) permit for municipal separate storm sewer system (MS4) reporting requirements for measuring the understanding and adoption of targeted behaviors related to water quality. The evaluation, described in this report, assessed the results of each program and made comparisons where possible.

Program Models

Snohomish County, in partnership with thirteen cities, the Snohomish Conservation District, and the WSU Extension Master Gardener Program, implemented the North Sound program. This program consisted of a three-part evening lecture series with presentations covering a wide variety of natural yard care topics by landscape professionals. The City of Olympia, in partnership with the City of Tumwater and Thurston County, implemented the South Sound program. This program consisted of two lawn coach home visits, a demonstration workshop, and incentives to promote natural lawn care (covering only turf and grass areas of a yard). Incentives consisted of a free soil test and lawn measurement, free slow-release fertilizer, free lime, and a discount on renting an aerator.

Program Evaluation

The program evaluation was designed to assess each individual program in a statistically valid manner. The evaluation was also designed to compare the programs' effectiveness qualitatively but not statistically. Participants completed surveys before and after participating in the programs. Surveys were also administered to randomly selected non-participating households to measure whether they made changes during the same time period without participating in one of the programs. To obtain feedback on program implementation, the evaluation also included participant interviews and surveys of program staff, speakers, and coaches.

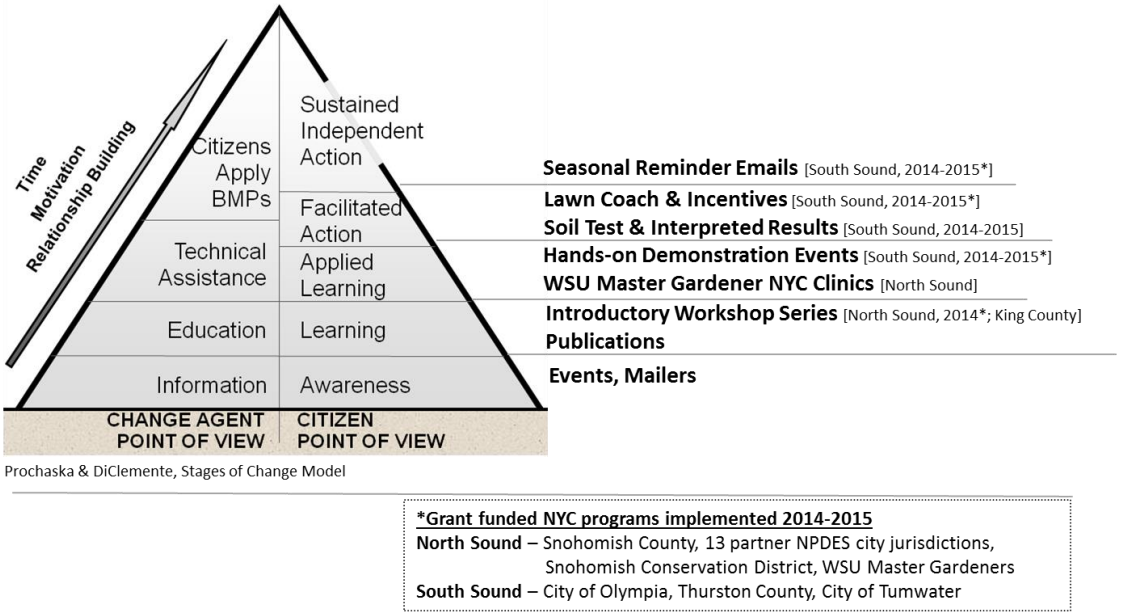
Program Comparisons

While the two programs addressed some of the same behaviors, they cannot be compared statistically, due to differences in the outreach models. When compared qualitatively, the results should be considered within each program's particular context. The two programs differed substantially in their target audiences, breadth of topics covered, goals, and level of outreach intensity.

Lawn care was the primary cross-over topic between the two programs. In the North Sound, participants received 50 minutes of lecture specific to natural lawn care in a large workshop format (up to 75 participants per lecture). In the South Sound, participants received six hours of hands-on education on natural lawn care, including two hours of personalized at-home education from lawn care professionals and four hours in small demonstration workshops (no more than 20 participants per workshop). The South Sound program also provided incentives that directly support the desired behavior change (free soil test, free lime and fertilizer, and discount aerator rental).

Figure 1 shows the elements of each program in the context of a continuum of public involvement. Programs that provide more intensive outreach with technical assistance (such as the South Sound program's site visits and demonstration workshops) are typically expected to result in more action and behavior change *per participant*, although they often reach a smaller number of *total participants*. In addition, incentives that directly support behavior change (such as the free lime and fertilizer provided by the South Sound program) are typically expected to increase behavior change, at least during the period in which the incentives are provided. Additional research is needed to determine whether specific incentives create lasting behavior change.

Figure 1. Natural Yard Care (NYC) programs, 2014 public involvement continuum



Prochaska & DiClemente, Stages of Change Model

*Grant funded NYC programs implemented 2014-2015
North Sound – Snohomish County, 13 partner NPDES city jurisdictions, Snohomish Conservation District, WSU Master Gardeners
South Sound – City of Olympia, Thurston County, City of Tumwater

Source: Snohomish County Surface Water Management, 2015

Executive Summary Organization

This executive summary presents an overview of key evaluation results in the following sections:

- North Sound Program
- South Sound Program
- North Sound and South Sound Comparisons
- Summary Recommendations

Notes on Data Presentation

Figures in this report are been rounded to the nearest percentage point. As a result, the sum of "baseline" and "change" figures may not appear to equal the "post-outreach" figure, but each figure is independently the most accurate rounded amount.

In the narrative findings, two icons indicate the **level of behavior change** (H, M, or L) from baseline to medium-term post-outreach surveys and the **post-outreach use** (✓, ▲, ●) as follows:

Behavior Change

H High behavior change
- 20 or more percentage points

M Moderate behavior change
- 10 to 19 percentage points

L Low behavior change
- Less than 10 percentage points

Post-Outreach Use

✓ High post-outreach use
- 70% or more for preferred practices
- 25% or less for harmful practices

▲ Moderate post-outreach use
- 40% to 69% for preferred practices
- 26% to 60% for harmful practices

● Low post-outreach use
- Less than 40% for preferred practices
- More than 60% for harmful practices

Unless otherwise noted, charts and tables use the following notations regarding the statistical analysis:

(P)	Indicates that only participants showed a statistically significant difference between baseline and medium-term post-outreach adoption levels.
(NP)	Indicates that only nonparticipants showed a statistically significant difference between baseline and medium-term post-outreach adoption levels.
(P)(NP)	Indicates that both participants and nonparticipants showed a statistically significant difference between baseline and medium-term post-outreach adoption levels.
(W)	Indicates that question wording was different between the baseline and medium-term post-outreach survey, requiring responses to be combined for statistical comparison. This notation can be combined with (P), (NP), and (P)(NP).

North Sound

The North Sound program's goal was to reduce pollutant runoff and improve yard health and resiliency by promoting natural yard care practices associated with lawns and other areas of yards. The North Sound program offered a three-part lecture series in seven locations across Snohomish County. Participants learned about six natural yard care topics during the series: *Natural Lawn Care*; *Smart Watering*; *Building Healthy Soil*; *Sustainable Landscape Design*; *Right Plant, Right Place*; and *Natural Pest, Weed & Disease Control*. In total, the North Sound program held 21 lecture workshops reaching a total of 451 households. Figure 2 presents participant understanding and use of natural yard care practices before and after the workshops.

Figure 2. North Sound yard care practices summary

Type	Yard Care Practice or Understanding	Baseline Use	Change in Behavior/Understanding	Post-Outreach Use
Using Weed-and-Feed	HARMFUL PRACTICE: Use weed-and-feed (any amount) (P)(W)	66%	H -53%	14% ✓
Fertilizing	HARMFUL PRACTICE: Use fast-release or weed-and-feed fertilizer (P)	50%	H -27%	23% ✓
	Use slow release, organic or natural fertilizer (P)	30%	H 24%	54% △
Managing Pests	HARMFUL PRACTICE: Pests/diseases: broadly apply product (P)(NP)	11%	L -8%	4% ✓
	Pests/diseases: remove, prune, use netting or collars, or tolerate	74%	L -2%	73% ✓
Applying Lime	Apply lime at least every 2 to 3 years (W)	22%	L 4%	26% ●
Aerating	Aerate at least every 2 years (W)	19%	L 8%	27% ●
	Top-dress with compost, if aerated (P)	23%	H 25%	48% △
Applying Mulch	HARMFUL PRACTICE: Bed cover: landscape fabric, plastic, or bare soil (W)	38%	M -12%	26% △
	Bed cover: mulch, grass clippings, or plants (W)	82%	L 5%	87% ✓
Mulch Mowing	Sometimes or always mulch mow in dry months (P)	48%	M 18%	67% △
	Sometimes or always mulch mow in wet months (P)	46%	M 18%	64% △
Mowing Height	Mow 2-3" or higher (P)	87%	L 9%	95% ✓
Choosing Plants	Always match plant to where it thrives (P)	23%	H 42%	65% △
	Always look for a plant's soil drainage needs (P)	27%	H 30%	57% △
	Always look for whether a plant is native to Pacific Northwest (P)	18%	H 28%	47% △
	Always look for a plant's pest and disease resistance (P)	15%	H 28%	43% △
	Always look for a plant's full-grown size (P)	50%	H 23%	73% ✓
	Always look for a plant's cold temperature tolerance (P)	35%	H 20%	54% △
	Always look for a plant's watering needs (P)	45%	M 18%	63% △
	Always look for a plant's sun/shade needs (P)	67%	M 17%	84% ✓
	Has sketched a map of the yard	NA	NA	25% ●
Preparing Soil	Know to prepare soil with compost (P)	65%	H 26%	91% ✓
	Know to mix materials into soil 6-8 inches deep	26%	M 11%	37% ●
Watering	Measure sprinkler watering rate (tuna can test), if waters	23%	M 12%	35% ●
	Water lawn once a week or less (P)	68%	L -8%	61% △
	ACCEPTABLE PRACTICE: Water lawn two to three times per week	26%	L 5%	31% ●
	HARMFUL PRACTICE: Water lawn daily or every other day	6%	L 2%	9% ✓

Note: The unusually dry weather in 2015, when participants took the medium-term post-outreach survey, may have affected watering practices.

As shown in Figure 2, North Sound participants reported varying levels of behavior change, with some practices showing large improvements and resulting in high levels of use after the program while other practices show mixed results—either moderate behavior change or moderate use after the program.

Practices that Protect Water Quality

After the program, at least 70% of participants were using several key practices that directly protect water quality, as shown in Figure 3. Notably, the program achieved a high level of behavior change in reducing weed-and-feed use—the share of participants who used this harmful product decreased from 66% to 14%. As described below, the program also achieved varying levels of behavior change in practices that support a healthy yard and reduce the weed, pest, and disease reasons people use toxic yard care products.

Figure 3. North Sound adoption of practices that protect water quality

H ✓	Avoiding weed-and-feed use
H ✓	Avoiding fast-release fertilizer use
L ✓	Avoiding broad application of pesticides
M △	Not leaving beds bare or covered in landscape fabric or plastics
H △	Top-dressing lawns with compost after aerating
L ○	Aerating every two to three years

Where the Program is Working Effectively

H ✓ Substantial change resulting in high post-outreach use

- Knowing to prepare the soil with compost.
- Not using fast-release fertilizer.
- Not using weed-and-feed.

M ✓ Moderate change resulting in high post-outreach use

- Always looking for a plant's sunlight and shade needs and full-grown size when planting.

L ✓ Little change because of high adoption levels before the workshops

- Mowing two to three inches or higher.
- Using at least one least-toxic weed management technique.

H △ Substantial change with room for additional improvement

- Always matching a plant to where it thrives.
- Always looking for a plant's soil drainage needs, pest and disease resistance, watering needs, cold temperature tolerance, and status as native to the Pacific Northwest.
- Using slow-release, organic, or natural fertilizer.

Where the Program Achieved Moderate Change but Room for Improvement Remains

M ▲ Moderate changes with moderate post-outreach use

- Mulch mowing, in both wet and dry months.
- Not leaving beds bare or covered in landscape fabric or plastics.

M ● Moderate changes with low post-outreach use or understanding levels

- Measuring their sprinkler watering rate.
- Knowing to mix materials six to eight inches deep in soil when planting.

Where the Program Achieved Little Change

L ▲ Little change with moderate post-outreach use

- Lawn watering frequency (recommended frequency is once a week; the dry weather in 2015 may have affected watering practices).
- Top-dressing with compost after aerating.

L ● Little change with low post-outreach use

- Aerating.
- Applying lime.

South Sound

The South Sound program's goal was to reduce nutrient and pesticide runoff resulting from traditional lawn care practices used on residential lawns and to improve yard health and resiliency by promoting natural lawn care practices. The South Sound program model featured two educational home visits by a lawn care professional, demonstration workshops, and incentives. The incentives included a free soil test, free lime and slow-release fertilizer, and a discount on renting an aerator. Participants were screened during registration to ensure they met program criteria, which included having applied fast-release fertilizer or weed-and-feed in the past year. A total of 190 households participated in the South Sound program in 2014.

Figure 4 presents participant understanding and use of natural lawn care practices before and after the workshops.

Figure 4. South Sound yard care practices summary

Type	Yard Care Practice or Understanding	Baseline Use	Change in Behavior/Understanding	Post-Outreach Use
Using Weed-and-Feed	HARMFUL PRACTICE: Using weed-and-feed (any amount) (P)(NP)	63%	H -47%	16% ✓
Choosing Fertilizer	Use slow release, natural, or organic fertilizer (P)	38%	H 55%	93% ✓
	HARMFUL PRACTICE: Use fast-release fertilizer or weed-and-feed (P)	60%	H -51%	9% ✓
	Calculate lawn area and application rate to determine fertilizer use (P)	18%	H 47%	65% △
	Calibrate spreader when using new fertilizer (P)(NP)	35%	H 36%	71% ✓
	Know how much nitrogen was applied (any amount) (P)	3%	H 25%	28% ●
Applying Fertilizer	Always sweep fertilizer back onto lawn	36%	M 11%	48% △
	Fertilize in May, September, or October	64%	L 7%	71% ✓
	HARMFUL PRACTICE: Fertilize in January or February	5%	L 6%	11% ✓
Managing Weeds	HARMFUL PRACTICE: Weed: broadly apply weed-and-feed or weed killer (P)	46%	H -35%	11% ✓
	Weeds: pull, dig, tolerate, or spot-treat	89%	L 6%	94% ✓
Soil Testing	Plan to test soil every 3 years or more often (P)	3%	H 59%	62% △
Applying Lime	Apply lime every 2-3 years (P)	31%	H 60%	91% ✓
Aerating	Aerate lawn every 2 years (P)(NP)	34%	H 49%	84% ✓
Mowing	Sharpen mower blade every year (P)	27%	H 37%	64% △
	Sometimes or always mulch mow in dry months (P)	51%	H 21%	72% ✓
	Sometimes or always mulch mow in wet months (P)	48%	M 17%	65% △
	Mow 2-3" or higher (P)	91%	L 6%	98% ✓
Watering	Measure sprinkler watering rate (tuna can test), if waters (P)	17%	H 43%	60% △
	Water once a week or less	36%	M 11%	47% △
	ACCEPTABLE PRACTICE: Water two to three times per week	46%	L -9%	36% ●
	HARMFUL PRACTICE: Waters daily or every other day	19%	L -2%	17% ✓

Notes: For measures of soil testing, baseline use describes actual past behavior, while the change in behavior reflects the intention of participants to conduct a soil test in the future. The unusually dry weather in 2015, when participants took the medium-term post-outreach survey, may have affected watering practices.

As shown in Figure 4, South Sound participants reported varying levels of behavior change, with some practices showing large improvements and resulting in high levels of use after the program, while other practices show mixed results—either moderate behavior change or moderate use after the program.

Practices that Protect Water Quality

After the program, at least 40% of participants were using all the key practices that directly protect water quality, as shown in Figure 5. At least 70% were avoiding products that harm water quality: weed-and-feed, fast-release fertilizer, and broadly applied weed killer.

Notably, the program achieved a high level of behavior change in reducing weed-and-feed use: the share of participants who used this product decreased from 63% to 16%. As described below, the program also achieved varying levels of behavior change in practices that support a healthy lawn and reduce the weed, pest, and disease reasons people use these toxic lawn care chemicals.

Figure 5. South Sound adoption of practices that protect water quality

H ✓	Avoiding weed-and-feed use
H ✓	Avoiding fast-release fertilizer use
H ✓	Aerating every two to three years
H ✓	Calibrating the fertilizer spreader when using a new fertilizer
H ✓	Avoiding broad application of weed killer
H △	Calculating the lawn area and fertilizer application rate
M △	Sweeping fertilizer back onto the lawn

Where the Program is Working Effectively

H ✓ Substantial change resulting in high post-outreach use

- Applying lime.
- Using slow-release or organic fertilizer.
- Aerating.
- Avoiding weed-and-feed use.
- Avoiding fast-release fertilizer use.
- Always calibrating spreaders when using a new fertilizer.
- Avoiding broad application of weed killers.
- Mulch mowing in dry months.

L ✓ Little change because of high adoption levels before the workshops

- Mowing two to three inches or higher.
- Using at least one least-toxic weed management technique.
- Lawn watering frequency (recommended frequency is once or twice a week; the dry weather in 2015 may have affected watering practices).
- Fertilizing in the proper months.

H ▲ Substantial change with room for additional improvement

- Intending to test soil within three years.
- Calculating lawn area to determine fertilizer use.
- Measuring sprinkler watering rates.
- Sharpening mower blades.

Where the Program Achieved Some Change but Room for Improvement Remains

H ● High change with low post-outreach use

- Knowing how much nitrogen they apply per year.

M ▲ Moderate changes with moderate post-outreach use

- Mulch mowing in wet months
- Always checking for and sweeping fertilizer back onto the lawn.

Overall Summary and Recommendations

Key Findings on Program Comparisons

As noted above, results comparing the two programs were not analyzed statistically; this analysis considers a difference of 10 percentage points in survey responses to be meaningful. This section compares changes in mowing, fertilizing, using lime, aerating, and watering. While both programs addressed weed management, making direct comparison is impractical because the South Sound survey instrument asked only about practices to manage weeds in lawns while the North Sound survey instrument also addressed practices to manage weeds in planting beds (such as covering bare soils with mulch to prevent weeds).

Figure 6: Comparison of lawn-focused North Sound and South Sound program behavior changes levels

Practice	North Sound Behavior Change	South Sound Behavior Change	South Sound Extra Strategies
Apply lime at least every 2-3 years	L 4%	H 60%	Incentive Demonstration
Aerate at least every 2 years	L 8%	H 49%	Incentive Demonstration
Used slow-release or organic fertilizer	H 24%	H 55%	Incentive Demonstration
HARMFUL PRACTICE: Used fast-release fertilizer or weed-and-feed	H -27%	H -51%	Incentive Demonstration
Measure sprinkler watering rate (tuna can test), if waters	M 12%	H 43%	Demonstration
ACCEPTABLE PRACTICE: Water two to three times per week	L 5%	L -9%	
HARMFUL PRACTICE: May use weed-and-feed in future	H -48%	H -36%	
Water once a week or less	L -8%	M 11%	
Always mulch mow in wet months	M 19%	L 5%	Demonstration
Sometimes or always mulch mow in dry months	M 18%	H 21%	Demonstration
HARMFUL PRACTICE: Used weed-and-feed (since outreach)	H -53%	H -47%	
Sometimes or always mulch mow in wet months	M 18%	M 17%	Demonstration
Mow 2-3" or higher	L 9%	L 6%	Demonstration
Always mulch mow in dry months	M 14%	M 12%	Demonstration
HARMFUL PRACTICE: Water daily or every other day	L 2%	L -2%	

Note: this table shows changes as a percentage of total surveyed participants, not scaled to the baseline level of behavior. For example, 22% of North Sound participants applied lime in the baseline and 26% applied lime post-outreach, for a change of 4% of participants (26% minus 22%).

Both programs resulted in significant and substantial behavior change in many of the practices they addressed.

This substantial behavior change indicates that both programs used effective program models and were well implemented. Both participants and program staff praised the programs and recommended continuing them in the future, with some modifications.

Both programs had varied results in behavior change and participant use of key practices after the programs.

While a few practices in each program showed little to no behavior change, most showed moderate to high levels of behavior change with remaining room for improvement.

South Sound incentives, supported by outdoor demonstrations, appear to have been a major factor in short-term behavior change.

After the programs, a much higher share of South Sound participants reported using practices that were supported by incentives (free fertilizer, free lime, and $30 discount on aerator rental) compared to North Sound participants. These practices were also supported by outdoor demonstrations. As a result, the incentives coupled with demonstrations appear to have contributed substantially to behavior change in the associated practices. However, additional research is needed to assess whether South Sound participants continue using slow-release fertilizer, applying lime, and aerating without the incentives and, if so, what is the optimal level and format of incentives to maximize behavior change while minimizing program costs.

South Sound outdoor demonstrations also appear to be a strong factor, although behavior change results varied by practice.

The South Sound program provided outdoor demonstrations without incentives for watering and mowing practices. South Sound participants had a higher level of behavior change for measuring sprinkler watering rates but similar or lower levels of behavior change for mulch mowing.

The South Sound program cost more than twice as much per participating household as the North Sound program while addressing fewer practices.

While the South Sound program achieved greater behavior change in specific lawn care practices, it also cost more than twice as much per household compared to the North Sound program ($550 South Sound and $250 North Sound) and did not address as many other yard care practices that can protect water quality. In addition, the South Sound program may not be scalable to larger audiences as staff reported that they had difficulty finding enough lawn care professionals who used natural lawn care practices, wanted to teach in a resident education program, and were effective instructors.

Jurisdictions would benefit from testing a hybrid program that combines large lectures and small outdoor demonstration workshops, with and without incentives.

Given the differences in program cost and results, jurisdictions would benefit from testing whether a program with lectures and outdoor demonstrations—but without the lawn coach home visits and incentives—results in a similarly high level of behavior change. In addition, the South Sound program should evaluate whether the incentives given to 2014 participants resulted in lasting behavior change in 2016 or 2017.

Recommendations

This section summarizes the top recommendations for future natural yard care programs. Recommendations are based on a survey of program staff; surveys and interviews of program participants; and the analysis of behavior change results from the program evaluation surveys.

Each natural yard care topic area (such as *Natural Lawn Care*, *Building Healthy Soil*, or *Smart Watering*) involves a separate set of specific natural yard care practices, and each practice may have a distinct set of barriers that participants must overcome to adopt the practice. As a result, education programs that engage participants more intensively than publications and lectures should be tailored to overcome the

specific barriers associated with the practices and topic areas covered. Lecture-based workshops can provide foundational knowledge, but more intensive programs should use market research and a social marketing process to determine the most effective way to change the relevant behaviors.[1]

Program Model Recommendations

Both program models were effective, but they had different cost levels and breadth of coverage. Accordingly, the evaluation team recommends that jurisdictions use a core program model consisting of lectures and outdoor demonstrations. These methods were found to be effective at a lower cost than lawn coach home visits, while covering a broader range of topics.

Core Program Delivery Model: Lecture and Demonstration Workshops

Combine lecture workshops with outdoor demonstration workshops. Workshops should be taught by yard care professionals who have proven expertise in both using natural yard care practices and in presenting these practices in lectures and demonstrations. This program model should include the following elements:

- Lectures presented by dynamic, engaging, and informed speakers using visuals and displays including photographs, visual aids, and display stations.
- Outdoor demonstration workshops focused on hands-on learning.
- Opportunities for personalized assistance at workshops from presenters, other natural yard care experts, or WSU Master Gardener volunteers.
- Take-home materials that support the core practices covered and list other local natural yard care resources.
- Seasonal emails with timely reminders that serve as prompts for key practices, keep past participants engaged, and enable participants to share information with others easily.

Optional Add-ons Elements to Core Program Model

As programs have additional budget, they should consider adding the following program elements:

- Online videos (the City of Olympia, in partnership with STORM, is currently developing natural lawn care videos).
- Periodic curriculum updates.
- Personalized assistance through home visits.
- Incentives (if shown to create lasting behavior change).

[1] Two excellent books on social marketing are *Fostering Sustainable Behavior: Community Based Social Marketing* by Doug McKenzie-Mohr (available for free online at www.cbsm.com/pages/guide/preface) and *Social Marketing: Changing Behaviors for Good* by Nancy Lee and Philip Kotler.

Yard and Lawn Care Topics

Jurisdictions should choose which topics to cover based on the goals of their program and the interests of their target audience. The North Sound program selected its goals and target audience based on successes and lessons learned from pilot implementation in Snohomish County of workshops initially developed by King County. The South Sound program conducted an ethnographic study to identify program goals and select its target audience. More information is available in the logistics guide for each program.

This section identifies strategies to increase the adoption of specific yard and lawn care practices included in the North Sound and South Sound programs.

To meet NPDES permit requirements, programs should ensure they address the following topic areas that directly reduce polluted runoff:

- Avoiding weed-and-feed use.
- Choosing and properly applying slow-release fertilizer.
- Controlling weeds, pests, and diseases using least-toxic methods.
- Applying mulch to planting beds.
- Aerating lawns and top-dressing with compost.
- Properly storing and using garden products.

Programs should then address relevant topic areas that reduce the need to use fertilizers and pesticides:

- Building healthy soil through soil testing, applying lime, and preparing soil with compost.
- Using “Right Plant, Right Place” principles and proper planting techniques.
- Mulch mowing to feed the soil.
- Using proper watering techniques for plant health and water conservation.

The recommendations section in the body of the report offers suggestions for increasing the adoption of these behaviors using the following types of strategies:

Outdoor demonstration—stations and hands-on activities to include in outdoor demonstration workshops.

Indoor display—displays to include in lecture workshops, for information conveyed visually on a poster, three-dimensional display, or hands-on activity that can be conducted indoors.

Tools and assistance—strategies that directly help participants use a practice by reducing barriers, such as difficulty recognizing recommended products in stores.

Information resource—such as fact sheets, guides, and webpages. Programs should avoid overwhelming participants with too much information by listing key resources in the core take-home materials and by providing supplemental resources online or by request. Programs should identify and use existing guides to avoid duplication before creating new materials.

Messaging—key points to convey when teaching a practice.

Videos—visual lessons, often on practices presented in outdoor demonstrations, to allow participants to review techniques at home.

Incentives—strategies that provide rewards or reduce costs to participants to encourage the use of practices.

Strategies are also labeled according to their recommended priority level:

- **High**—strategies that are expected to have high impact while being feasible and cost-effective to implement.
- **Moderate**—strategies that are expected to have moderate to high impact but may be more costly or otherwise difficult to implement.
- **Low**—strategies expected to have lower impact and be more difficult and costly to implement.

Other Recommendations

The recommendations section in the body of the report also includes recommendations on the following topics:

- Participant Recruitment
- Participant Communication
- Partner Coordination
- Program Logistics
- Take-Home Materials
- Program Evaluation

1. Introduction and Overview

In 2014, Snohomish County and the City of Olympia, in partnership with 15 other local jurisdictions in the Puget Sound region, implemented two natural yard care education programs in two geographic regions using distinctly different delivery strategies. Both programs were designed to improve local water quality and protect Puget Sound by reducing pollutants associated with conventional residential yard care practices.

Both programs were implemented with a rigorous evaluation component specifically designed to meet National Pollutant Discharge Elimination System (NPDES) permit for municipal separate storm sewer system (MS4) reporting requirements for measuring the understanding and adoption of targeted behaviors related to water quality (Phase I NPDES Permit- S5.C.10.c; Phase II NPDES Permit- S5.C.1.c). The evaluation, described in this report, assessed the results of each program and made comparisons where possible.

North Sound Program

Snohomish County, in partnership with thirteen cities, the Snohomish Conservation District, and the Washington State University (WSU) Master Gardener Program, implemented the North Sound program. This program consisted of a three-part evening lecture series with presentations covering a wide variety of natural yard care topics by landscape professionals. Each evening lecture lasted two hours, and participants received relevant handouts and had an opportunity to consult with WSU Master Gardener volunteers. A total of seven three-part lecture series were implemented in 2014: three sets in the spring and four in the fall.

South Sound Program

The City of Olympia, in partnership with the City of Tumwater and Thurston County, implemented the South Sound program. This program consisted of home visits, demonstration workshops, and incentives to promote natural lawn care (covering only grassy lawn areas of a yard). Participants received two home visits from a lawn care professional (referred to as a lawn coach); one or two demonstration workshops; and incentives including a free soil test and lawn measurement, free slow-release fertilizer, free lime, and a discount on renting an aerator.

Program Development Approach

Each natural yard care topic area (such as *Natural Lawn Care*, *Building Healthy Soil*, or *Smart Watering*) involves a separate set of specific natural yard care practices, and each practice may have a distinct set of barriers that participants must overcome to use the practice. As a result, education programs that engage participants more intensively than publications and lectures should be tailored to overcome the specific barriers associated with the practices and topic areas covered. Lecture-based workshops can

provide foundational knowledge, but more intensive programs should use market research and a social marketing process to determine the most effective way to change the relevant behaviors.[2]

The South Sound program applied a tailored approach specific to natural lawn care. Before developing its strategy, the program conducted an ethnographic blind study to identify its target audience and barriers related to natural lawn care practices. Following this initial research, the program was developed using a social marketing approach consisting of lawn coach home visits, demonstration workshops, and incentives.

Program Comparison

While the two programs addressed some of the same behaviors—such as proper mowing, fertilizer choices, using lime, and aerating—they cannot be compared statistically because the two programs differed substantially in their target audiences, breadth of topics covered, goals, and level of outreach intensity, as shown in Figure 7. When compared qualitatively, the results should be considered within each program's particular context.

Lawn care was the primary cross-over topic between the two programs. In the North Sound, participants received 50 minutes of lecture specific to natural lawn care in a large workshop format (up to 75 participants per lecture). In the South Sound, participants received six hours of hands-on education on natural lawn care, including two hours of personalized at-home education from lawn care professionals and four hours in small demonstration workshops (no more than 20 participants per workshop). The South Sound program also provided incentives that directly support the desired behavior change (free soil test, free lime and fertilizer, and discount aerator rental).

[2] Two excellent books on social marketing are *Fostering Sustainable Behavior: Community Based Social Marketing* by Doug McKenzie-Mohr (available for free online at www.cbsm.com/pages/guide/preface) and *Social Marketing: Changing Behaviors for Good* by Nancy Lee and Philip Kotler.

Figure 7. Summary of key differences between North and South Sound programs

	North Sound Program	South Sound Program
Target Audience	Residents of detached single-family homes on properties sized less than one acre within urban growth areas. The program reached 451 households in 2014.	Residents who (1) live in detached single-family homes on properties sized less than one acre, (2) own their home, (3) maintain the lawn themselves, and (4) currently use fast-release chemical fertilizers. The program reached 190 households in 2014.
Topics covered	Natural lawn and yard care practices including planting; "Right Plant, Right Place" principles; healthy soils; composting; sustainable landscape design; and natural pest, weed and disease control.	Natural lawn care practices, addressing grass lawns and not planting beds.
Goals	Reduce all pollutant runoff from lawns and planting beds.	Reduce nutrient and pesticide pollutant runoff from lawns.
Outreach intensity	Education and technical assistance, reaching more households at a lower level of engagement. ▪ Three 2-hour lecture workshops with up to 75 participants per workshop ▪ Diagnostic and identification technical assistance from WSU Master Gardeners at lecture workshops Participants received 6 hours total of education that included just under one hour on each of the following 6 topics: *Natural Lawn Care*; *Smart Watering*; *Right Plant, Right Place; Natural Pest, Weed & Disease Control*; *Growing Healthy Soil*; and *Sustainable Landscape Design*.	Education and technical assistance, reaching fewer participants at a higher level of engagement. ▪ 2 hours of personalized, at-home education from lawn care professionals, spread over two home visits ▪ 4 hours of hands-on demonstrations with no more than 20 participants per demonstration ▪ Ongoing lawn care email updates throughout the year-long program Participants received 6 hours of education on *Natural Lawn Care*.
Incentives	Small incentives used to reward participants for attending lectures and completing surveys.	Large incentives used to directly support behavior change: ▪ Free soil test ▪ Free lime and slow-release fertilizer ▪ Discount on aerator rental Small incentives also used to reward attending workshops and completing surveys.
Program History	Well-established program: ▪ Piloted in 2010 ▪ Full implementation in 2012 ▪ Refinements in 2013	New program: ▪ Piloted in 2012 ▪ Full implementation in 2014

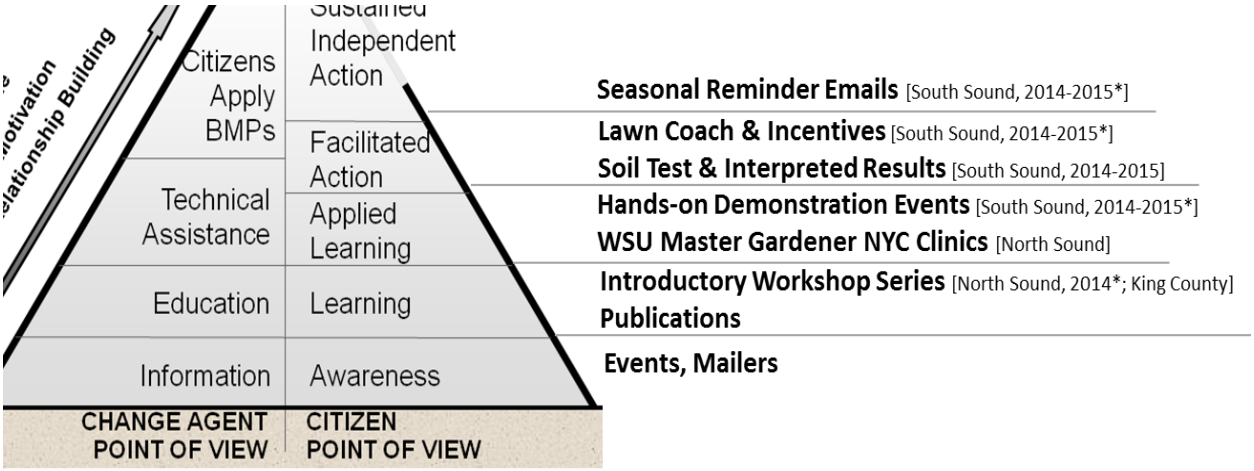
More information on the elements, activities, logistics, and details of each program can be found in:

- Appendix H-01—Final Project Report for G1400481
- Appendix H-02—North Sound Logistics Guide
- Appendix H-03—South Sound Logistics Guide

Public Involvement Continuum

Figure 8 shows the elements of each program in the context of a continuum of public involvement. Programs that provide more intensive outreach with technical assistance (such as the South Sound program's site visits) typically result in more action and behavior change *per participant*, although they often reach a smaller number of *total participants*. In addition, incentives that directly support behavior change (such as the free lime and fertilizer provided by the South Sound program) are typically expected to increase behavior change, at least during the period in which the incentives are provided. Additional research is needed to determine whether specific incentives create lasting behavior change.

Figure 8. Natural yard care (NYC) programs, 2014 public involvement continuum



aska & DiClemente, Stages of Change Model

*Grant funded NYC programs implemented 2014-2015
North Sound – Snohomish County, 13 partner NPDES city jurisdictions, Snohomish Conservation District, WSU Master Gardeners
South Sound – City of Olympia, Thurston County, City of Tumwater

irce: Snohomish County Surface Water Management, 2015

Core Project Team

The core project team included staff members from Snohomish County, Snohomish Conservation District, and the City of Olympia. The project team hired Cascadia Consulting Group in partnership with TerraStat Consulting Group (the evaluation team) to design and implement an evaluation to assess each individual program in a statistically valid manner. The evaluation was also designed to compare the programs' effectiveness qualitatively but not statistically.

Evaluation Goals

The project team and evaluation team conducted this evaluation for the following purposes and audiences:

1. To assess the effectiveness of the programs so program partners can decide how to continue each program in the future.
    a. To identify whether the programs yield a significant difference in knowledge and understanding of the selected practices.
    b. To identify whether the programs yield a significant difference in participants' adoption of the selected practices.
    c. To measure understanding of the potential impact of conventional yard care practices on water quality (South Sound program only).

2. To gather feedback and develop recommendations on program elements so agency partners can improve the programs in the future.
    a. To identify the demographic factors that influence the target audience's participation in the programs, motivators for behavior change, and barriers to behavior change.
    b. To identify whether participants are sharing natural yard and lawn care information with neighbors, including promoting the education programs.
    c. To develop recommendations on how to improve and/or streamline natural yard and lawn programs.
        – To receive input on the participants' perceptions of the technical level of the information, practicality of the information, and quality of presenters, coaches, presentations, and overall workshops.
        – To receive input from program implementers (such as presenters, coaches, and coordinators) on how to improve or streamline natural yard and lawn care programs.
        – To develop recommendations that will maximize effectiveness of future natural yard and lawn care programs by using evaluation findings and applying the principles of community-based social marketing and behavioral economics.

3. To obtain support for future funding from state and municipal officials to offer and refine the program, including demonstration of participant behavior change and (if possible) estimating the return on investment.

4. To compile information that will motivate and help nonparticipating organizations to replicate the program in their jurisdictions.

5. To enable participating jurisdictions to meet NPDES MS4 permit reporting requirements for measuring the understanding and adoption of targeted behaviors related to water quality.

6. To fulfill grant requirements by delivering a report to the state Department of Ecology and federal National Estuary Program that measures outputs and outcomes.

Evaluation Activities

To accomplish the evaluation goals described above, the evaluation team administered a total of 15 separate surveys to the more than 600 program participants; 4,000 randomly selected nonparticipating households assumed to be comparable to participants; and numerous program staff members. The evaluation team also conducted post-education interviews with program participants.

Participant and Nonparticipant Surveys

Participant Surveys

Participants completed surveys at three points during their participation:

- **Baseline** surveys, before receiving education.
- **Immediate post-outreach** surveys, directly after receiving education:
  - North Sound participants completed three immediate post-outreach surveys—one after each lecture workshop.
  - South Sound participants completed one immediate post-outreach survey in mid-summer (after the spring lawn coach visit and the demonstration workshops but before the fall lawn coach visit).
- **Medium-term post-outreach** surveys, conducted three to twelve months after receiving education; these surveys were not conducted long enough after the education to be considered long-term surveys. Surveys were conducted within this time frame to ensure that the partnering NPDES permittee jurisdictions could meet required NPDES permit education and outreach deadlines.

Nonparticipant Surveys

The evaluation team surveyed nonparticipating households (called nonparticipants) before the education programs and three to twelve months after the education programs, around the same time that participants took the baseline and medium-term post-outreach surveys. Nonparticipants were randomly selected from households expected to be similar to participants. Due to the voluntary nature of the survey, some nonparticipants responded to both surveys while others responded to only the baseline survey or only the medium-term post-outreach survey.

These “control surveys” were intended to measure the use of natural yard care practices by comparable nonparticipant households and to measure differences in knowledge, understanding, and behaviors between nonparticipants and participants.

Survey Data Analysis

The evaluation team analyzed survey results using statistical analysis to compare yard care practices reported by participants and nonparticipants before (baseline) and after (medium-term post-outreach) the programs. The demographics and attitudes of participants and nonparticipants were also statistically compared within each region (North Sound and South Sound). To match responses for all three surveys

while ensuring respondent confidentiality, respondents were assigned a unique identification number associated with each survey they completed. During the analysis phase, the evaluation team limited the comparison of practices before and after the program to participants who completed both a baseline and medium-term post-outreach survey.

Participant Interviews and Program Staff Surveys

To obtain more information on behavior changes and obtain participant feedback on the programs, the evaluation team interviewed 20 participants from each program after conducting the medium-term post-outreach surveys.

The evaluation team also distributed web-based surveys to program staff to obtain feedback on program successes, challenges, and recommended improvements.

Surveys of participants and program staff as well as interviews with participants were summarized in narrative reports (presented in the appendices) to identify program successes as well as opportunities for improvements.

Reporting

This evaluation report summarizes findings from these sources to develop recommendations for conducting natural yard care education programs in the future. Additional details on evaluation methods and results are presented in the appendices.

- Appendix A—Evaluation Plan: Participant recruitment methods, sample selection for nonparticipants, survey distribution methods, and evaluation considerations.
- Appendices B and D—Detailed survey summary tables.
- Appendices C and E—Survey instruments and interview guides.
- Appendix F—Statistical analysis of survey results.
- Appendix G—Summaries of program staff surveys and participant interviews.

Document Map

The remainder of this evaluation report presents evaluation findings and recommendations organized into the following sections:

2. North Sound Program Evaluation
3. South Sound Program Evaluation
4. North and South Sound Program Comparison
5. Summary Recommendations
6. Appendices

2. North Sound Program Evaluation

Program Goals and Overview

In 2014, Snohomish County—in partnership with Snohomish Conservation District and 13 local cities, the Snohomish Conservation District, and the WSU Master Gardener Program—implemented a natural yard care education program using a classroom-lecture model. Implemented in greater Snohomish County, this program is referred to as the North Sound program. The North Sound project team consisted of staff members from Snohomish County and Snohomish Conservation District.

The program's goal was to reduce pollutant runoff and improve yard health and resiliency by promoting natural yard care practices associated with lawns and other areas of yards.

Program History

In 2009, Snohomish County began developing an outreach program on "yard care practices protective of water quality" in response to a requirement it its 2007–2013 NPDES permit. Snohomish County's pilot program was based on the successful King County and Seattle models, which the county used with permission. Because these models had been developed for urban areas, Snohomish County adapted them for residents of suburban and rural areas.

In 2010, Snohomish County piloted lecture workshops after developing supporting resources, including a County webpage, locally appropriate versions of the *Natural Lawn & Garden Guides* (originally developed by the City of Seattle), and a regional website (in coordination with King County).

Snohomish County used social marketing techniques to refine the program's target audience, logistics, and program elements. The workshops were fully implemented in 2012, with additional refinements in 2013.

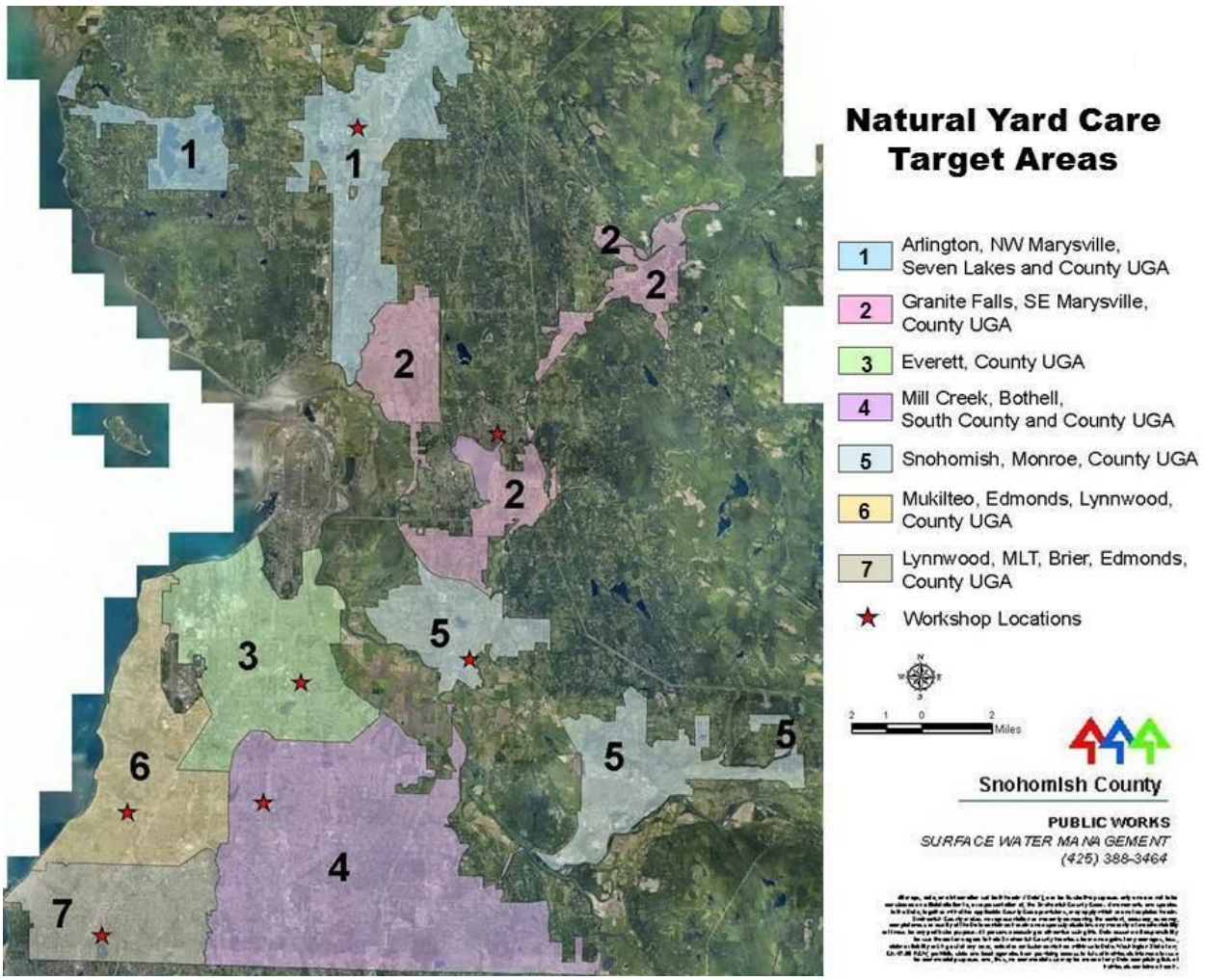
Participant Recruitment

In 2014, the North Sound project team offered a three-part lecture series in seven locations across Snohomish County, drawing from seven geographic areas shown in Figure 9. Snohomish County Surface Water Management used a geographic information system (GIS) to identify eligible households in each of the seven areas. All residents of detached single-family homes on properties sized less than one acre located within selected incorporated cities, urban growth areas (UGAs), or urban-type areas of unincorporated Snohomish County were eligible. Residents of eligible parcels were randomly selected and invited to attend the workshops. Workshop advertising included one direct mail flier and one postcard.

The seven areas can be categorized into two groups based on location within Snohomish County. The north county (areas 1, 2, and 5) is composed of areas generally considered to be in a rural setting; however, program staff noted that participants from area 5 appeared to come from more urban parts of north Snohomish County. The south county (areas 3, 4, 6, and 7) is considered to be an urban setting; however, program staff noted that participants from area 4 appeared to come from more rural parts of south Snohomish County. The program recruited from these different areas to assess whether there were differences between urban and rural participants. The lecture workshop series were held at two different times in 2014: in spring for areas 3, 4, and 6 and in fall for areas 1, 2, 5, and 7.

Appendix B-21 presents tables that compare behavior change by north versus south county, urban versus rural areas, and spring versus fall participation. These comparisons did not find substantial differences between participant based on geographic area or timing of participation.

Figure 9. North Sound program target areas



Yard Care Topics

Participants learned about six natural yard care topics during the three-evening lecture workshop series, mirroring topics from Snohomish County's www.naturalyard.surfacewater.info web site. Most lecture topics included a visual element or indoor demonstration, shown in Figure 10.

Figure 10: North Sound topics and lecture demonstrations

Topic	Lecture Demonstration
Natural Lawn Care	Sheet mulching
Smart Watering	(No demonstration)
Building Healthy Soil	What's in soil
Sustainable Landscape Design	Soil jar shake test
Right Plant, Right Place	Plant showcase
Natural Pest, Weed & Disease Control	Crop rotation

Program Delivery Model

At each lecture, participants learned about two natural yard care topics from landscape professionals, received take-home materials on each topic, and had the opportunity to consult with WSU Master Gardener volunteers. WSU Master Gardener volunteers assisting with this program had previously received 24 hours of intensive natural yard care training from Snohomish County to supplement their regular Master Gardener training. The North Sound program held a total of 21 lecture workshops reaching 451 households and 627 unique participants. Because many people attended multiple workshops within a series, the total "seats filled" were 1,272.

More details on program activities and logistics can be found in Appendix H-01—Final Project Report for G1400481 and Appendix H-02—North Sound Logistics Guide.

Evaluation Approach and Activities

The evaluation team evaluated the education program using surveys, interviews, and program data described in *Section 1—Introduction and Overview*. Immediate post-workshop surveys were distributed at each workshop for participants to complete and return before leaving. Figure 11 summarizes the schedule of evaluation and education activities for participants in each of the seven areas. Figure 12 on page 30 presents additional details on participant and nonparticipant surveys, including distribution methods and response rates.

Figure 11. North Sound evaluation and education schedule

Evaluation and Education	Spring workshops (areas 3, 4, and 6)	Fall workshops (areas 1, 2, 5, and 7)
Baseline surveys	Spring 2014, before workshops	Fall 2014, before workshops
Lecture workshops and immediate post-outreach surveys (3 workshops)	Spring 2014, integrated with workshops	Fall 2014, integrated with workshops
Medium-term post-outreach surveys	Summer 2015	Summer 2015
Interviews (20 participants)	Summer 2015	Summer 2015

Survey data were analyzed to develop tables comparing responses by geographic subgroups. Participant data were analyzed to present comparisons for each of the seven workshop areas and by location within Snohomish County (north county versus south county). Data for nonparticipants in the North Sound area were summarized by north county (areas 1, 2, and 5) versus south county (areas 3, 4, 6, and 7), due to the limited number of households in certain areas of the county.

Additional details on evaluation methods and results for the North Sound are presented in the following appendices.

- Appendix A—Evaluation plan.
- Appendix B —Survey data summary tables.
- Appendix C—Survey instruments and interview guides.
- Appendix G—Summaries of program staff surveys, and summaries of participant interviews.

Figure 12. North Sound surveys and participation rates

	Evaluation Elements	Respondents & Response Rates
Baseline survey	**Participants:** Web-based survey on practices and understanding (spring and fall 2014, incorporated into registration form)	**Participants** Total attending households: 451 Survey respondents: 457, of which between 383 and 417 attended a workshop* Response rate: 85–92%
	Nonparticipants: Mail-based paper survey with link for web-based responses on practices and understanding (May–June 2014)	**Nonparticipants** Invited households: 2,000 Survey respondents: 453 Response rate: 23%
Immediate post-outreach survey	**Participants:** Paper surveys for program feedback and intended actions (after each workshop)	**Participants** **Workshop 1 (*Lawn Care/Smart Watering*)** Attending households: 334 Survey respondents: 288 Response rate: 86% **Workshop 2 (*Right Plant/Healthy Soil*)** Attending households: 314 Survey respondents: 303 Response rate: 96% **Workshop 3 (*Design/Pest & Weed Control*)** Attending households: 297 Survey respondents: 287 Response rate: 97%
Medium-term post-outreach survey	**Participants:** Web-based survey on practices, changes in practices, and program feedback (May–July 2015) Chinook Book incentive and mail-based paper version to obtain more responses (August–September 2015)	**Participants** Participating households: 451 Survey respondents: 284 Response rate: 63%
	Nonparticipants: Mail-based paper survey with link for web-based responses on practices (May–June 2015)	**Nonparticipants** Invited households: 2,000 Survey respondents: 521 Response rate: 26%
Medium-term post-outreach interviews	**Participants:** Phone interviews for more information on changes and program feedback (July–August 2015)	**Participants** 20 interviewees

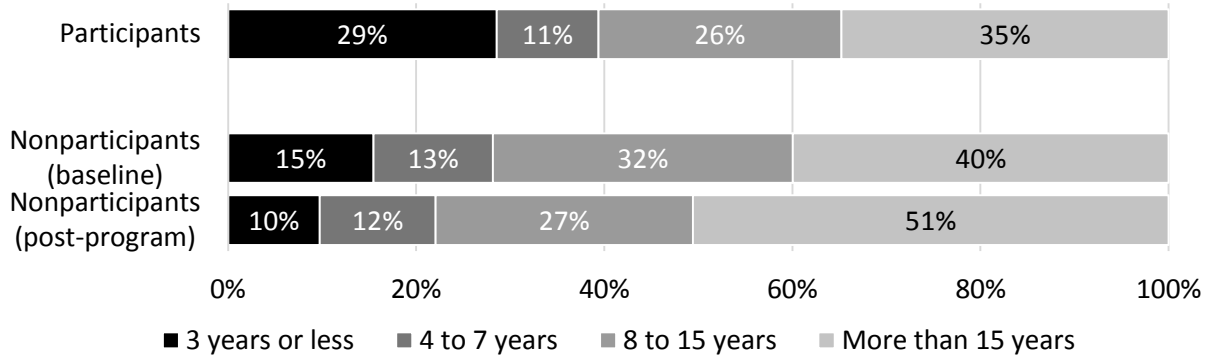
* Some households completed the survey but did not attend a workshop, while others attended but did not complete a survey. In addition, due to a tracking error, respondent IDs were not recorded for 30 baseline survey respondents from Areas 3 and 6, so these surveys cannot be categorized as belonging to an attending or non-attending household. It is not possible to estimate how these respondents might have influenced survey results.

Demographics

Both the baseline and post-outreach nonparticipant surveys included questions about demographics. Participants were asked demographic questions in only the baseline survey, under the assumption that these demographics did not change during the program. Figure 13 through Figure 18 summarize these key demographics. Chart captions notated with (PNP) indicate that differences in the demographics of participants and nonparticipants were statistically significant.

Years in Home

Figure 13. Years living in current home among North Sound participant and nonparticipants (PNP)



Participants were twice as likely to have lived in their homes three years or less, indicating that this audience is particularly receptive to attending natural yard care education.

While all types of residents attended the workshops, newer homeowners had a higher participation rate.

Subgroup Comparison by Years in Home

Participant baseline, post-outreach, and behavior change levels were cross-tabulated and compared for subgroups based on their years in their current home. Differences were not statistically tested and are reported in Figure 14 only when they were greater than 25 percentage points.

Figure 14. North Sound participant subgroup comparisions by years in home

Practice	Greatest change in behavior or understanding	Least change in behavior or understanding
HARMFUL PRACTICE: Using fast-release or weed-and-feed fertilizer	Three years or less (50% decrease) ■ 62% baseline ■ 12% post-outreach	Eight to fifteen years and fifteen or more years (16 to 25% decrease) ■ 45% to 47% baseline ■ 29% to 22% post-outreach
Aerating at least every 2 years	Three years or less (16% increase) ■ 18% baseline ■ 34% post-outreach	Four to seven years (11% decrease) ■ 30% baseline ■ 19% post-outreach
Always match a plant to where it thrives	Fifteen years or more (53% increase) ■ 13% baseline ■ 66% post-outreach	Four to seven years (27% increase) ■ 42% baseline ■ 69% post-outreach
Always look for a plant's watering needs	Fifteen years or more (29% increase) ■ 38% baseline ■ 66% post-outreach	Four to seven years (12% decrease) ■ 60% baseline ■ 48% post-outreach
Know to mix materials into soil 6-8 inches deep	Eight to fifteen years (28% increase) ■ 17% baseline ■ 45% post-outreach	Four to seven years (11% decrease) ■ 30% baseline ■ 19% post-outreach

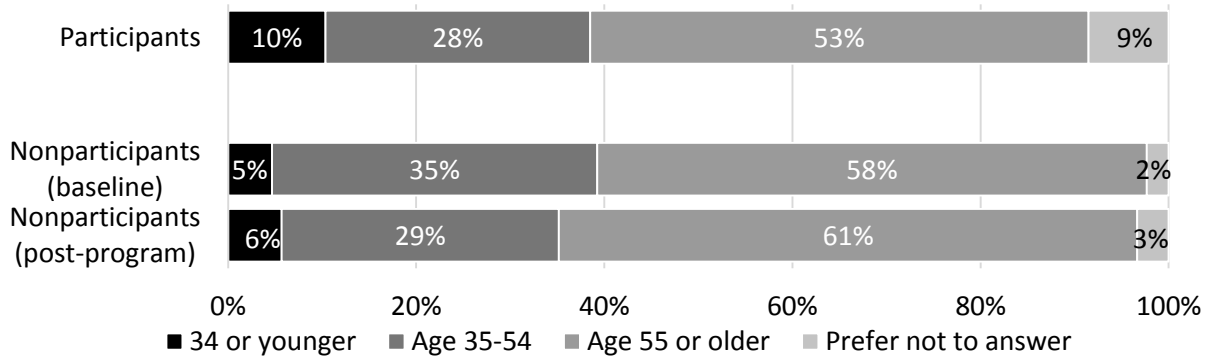
Unexpected decreases were observed among the following practices for those who had been in their home for four to seven years:

- Aerating at least every 2 years
- Always looking for a plants watering needs
- Knowing to mix materials into soil six to eight inches deep

Although the subgroup comparisons found differences among the subgroups for individual practices, there was no clear trend in natural yard care practices overall relative to length of time in the home. Appendix B-21 presents a summary table with complete subgroup comparison data.

Age

Figure 15. Age among North Sound participant and nonparticipants (PNP)

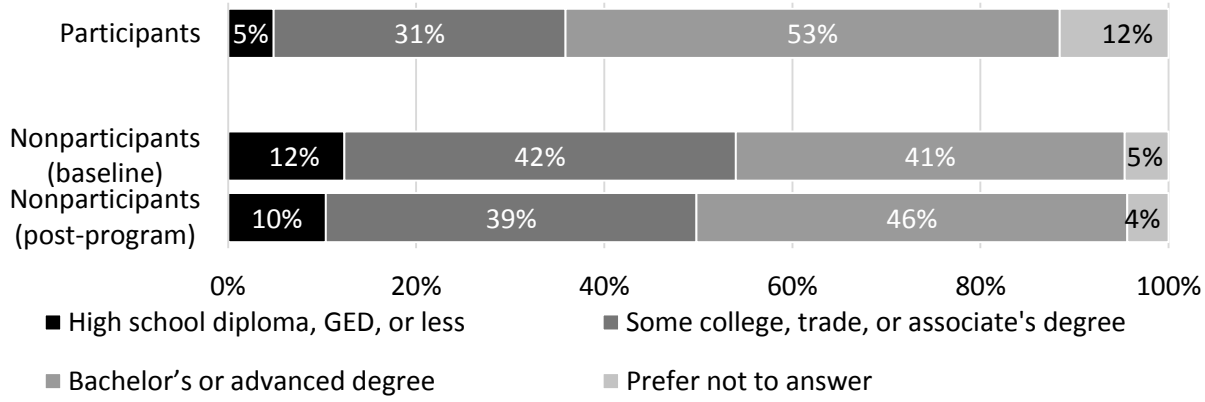


Participants were slightly more likely to be age 34 or younger

They are also less likely to provide their age, possibly because they were also providing identifiable contact information when completing the baseline survey.

Education

Figure 16. Highest level of education among North Sound participant and nonparticipants (PNP)



Participants were slightly less likely to have a high school diploma or GED as their highest level of education and more likely to have a college or advanced degree.

Participants were also less likely to provide their education level (possibly because they were also providing identifiable contact information when completing the baseline survey).

Home Ownership and Yard Appearance Guidelines

Figure 17. Home ownership among North Sound participant and nonparticipants

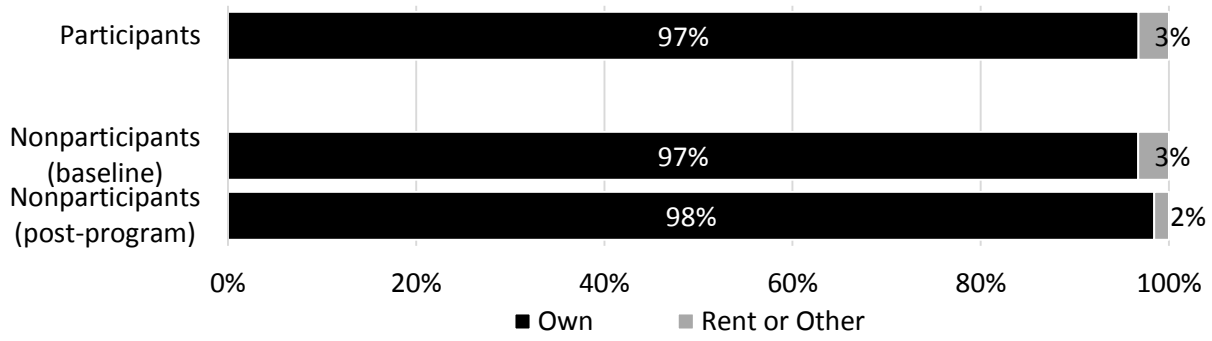
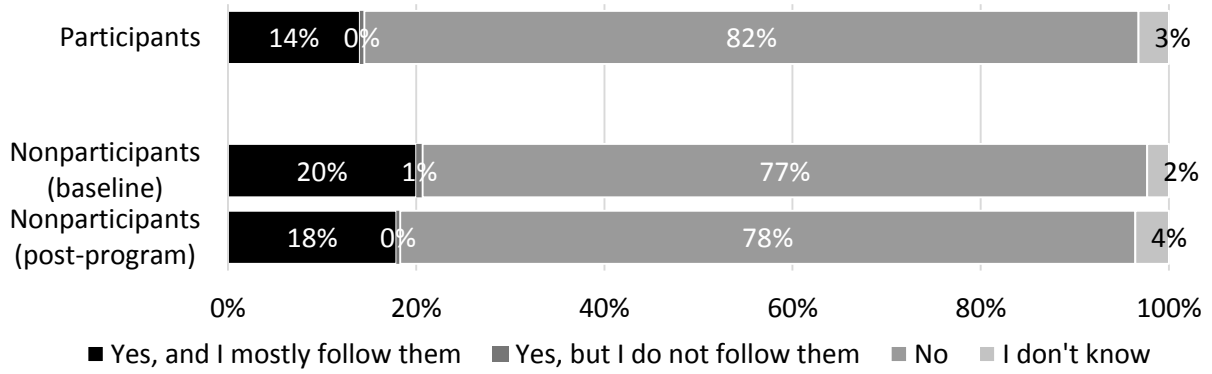


Figure 18. Whether a homeowners association or landlord sets guidelines for yard appearance among North Sound participant and nonparticipants



Differences in home ownership and whether a homeowners association or landlord sets guidelines for yard appearance were not statistically significant.

Almost all participants and nonparticipants owned their home.

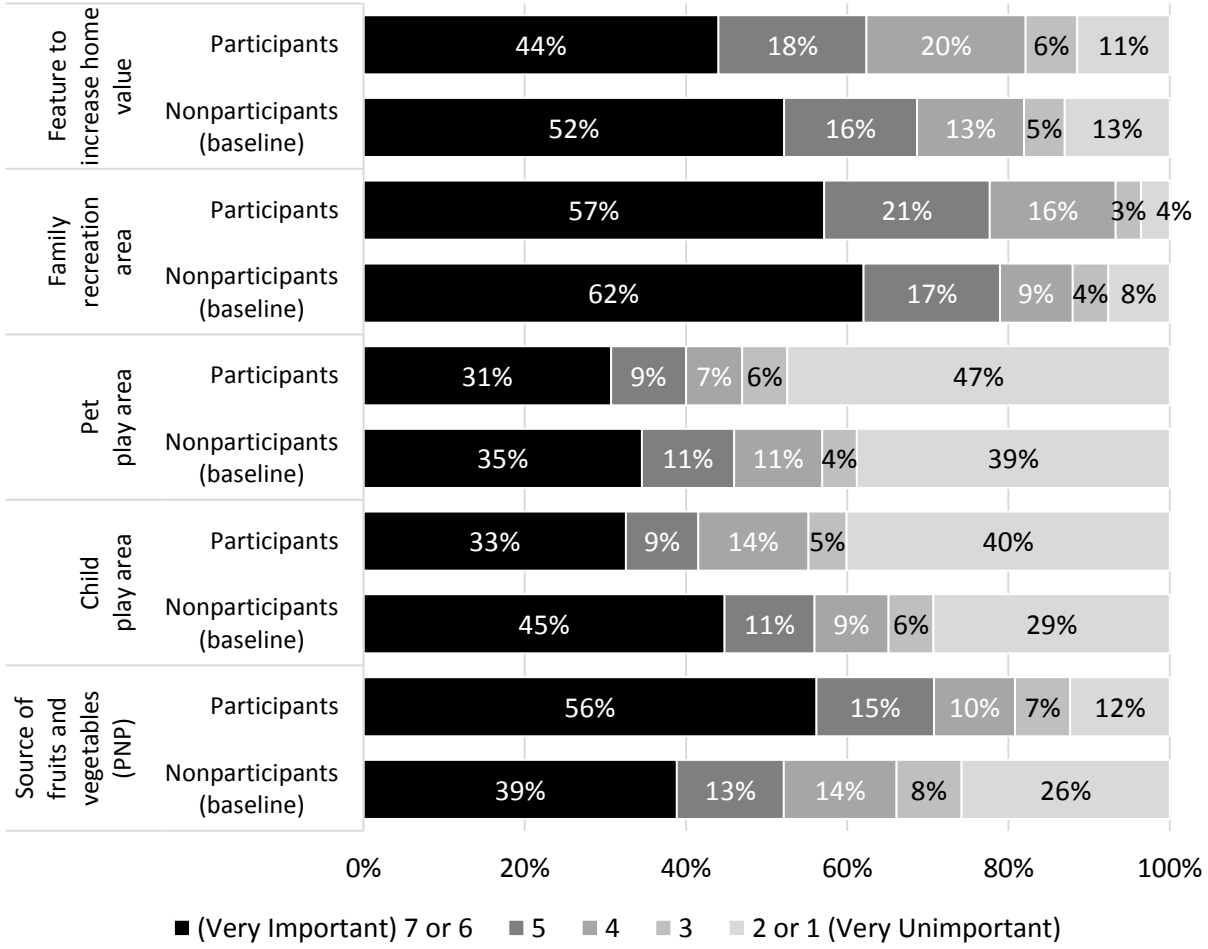
Attitudes and Understanding

Baseline surveys included several questions about attitudes and understanding related to yards and yard care. In this section, chart captions or axis labels notated with (PNP) indicate that differences in the attitudes, knowledge, and understanding of participants and nonparticipants were statistically significant.

Importance of Yard Uses

In baseline surveys, participants and nonparticipants were asked to rate how important they felt various uses of their yard were, on a seven-point scale from 7 (very important) to 1 (don't care at all).

Figure 19. North Sound participant and nonparticipant rating of importance of various uses of their yard



Compared to nonparticipants, workshop participants placed more importance on using their yard as a source of fruits and vegetables.

Residents who signed up for workshops may be interested in future specialized workshops dedicated to growing edible plants or may be more motivated to apply natural yard care practices when edible gardens are used as examples in lectures, displays, and demonstrations.

Subgroup Comparison by Important Yard Uses

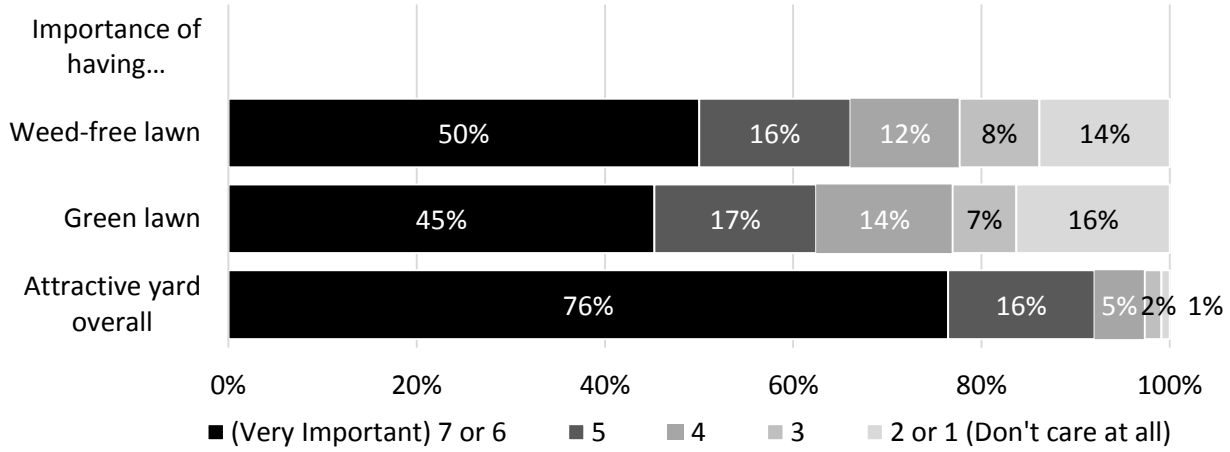
Participant baseline, post-outreach, and behavior change levels were cross-tabulated and compared for subgroups that placed high importance (a rating of six or seven on the seven-point scale) on each of the

five potential yard uses. Differences were not statistically tested and are not reported here because no difference was greater than 25 percentage points. Appendix B-21 presents a summary table with complete subgroup comparison data.

Importance of Yard Characteristics

Participants were also asked to rate the importance of having an attractive, weed-free, and green yard or lawn, on a seven-point scale from 7 (very important) to 1 (don't care at all). Nonparticipants were not asked these questions.

Figure 20. North Sound participant rating of importance of yard characteristics



Participants place more importance on having an attractive yard than on having a green or weed-free lawn.

The survey did not define "weed-free" or "attractive," so participants may have different ideas of what these terms mean.

Subgroup Comparison by Importance of Yard Characteristics

Participant baseline, post-outreach, and behavior change levels were cross-tabulated and compared for subgroups based on their importance ratings for having a weed-free lawn, green lawn, or attractive yard overall. Differences were not statistically tested and are reported in Figure 21 only when the difference was greater than 25 percentage points. Appendix B-21 presents a summary table with complete subgroup comparison data.

Figure 21. North Sound participant subgroup comparisions of behavior change by importance of yard characteristics

Practice	Greatest change in behavior or understanding	Least change in behavior or understanding
Always look for a plant's watering needs	Somewhat important (rating of 4 or 5) for weed-free lawn, green lawn, and attractive yard (30% to 39% increase) ■ 26% to 35% baseline ■ 64% to 70% post-outreach	Very important (rating of 6 or 7) for weed-free lawn, green lawn, and attractive yard (9% to 15% increase) ■ 46% to 48% baseline ■ 57% to 62% post-outreach

In this subgroup comparison, baseline levels for practices related to fertilizing, using weed-and-feed, and mulch mowing varied based on the importance participants placed on having a weed-free or green lawn (with slightly smaller differences in behavior change), as shown in Figure 22. At baseline, participants who placed high importance on a green or weed-free lawn were less likely to have implemented recommended practiced and more likely to have implemented harmful practices.

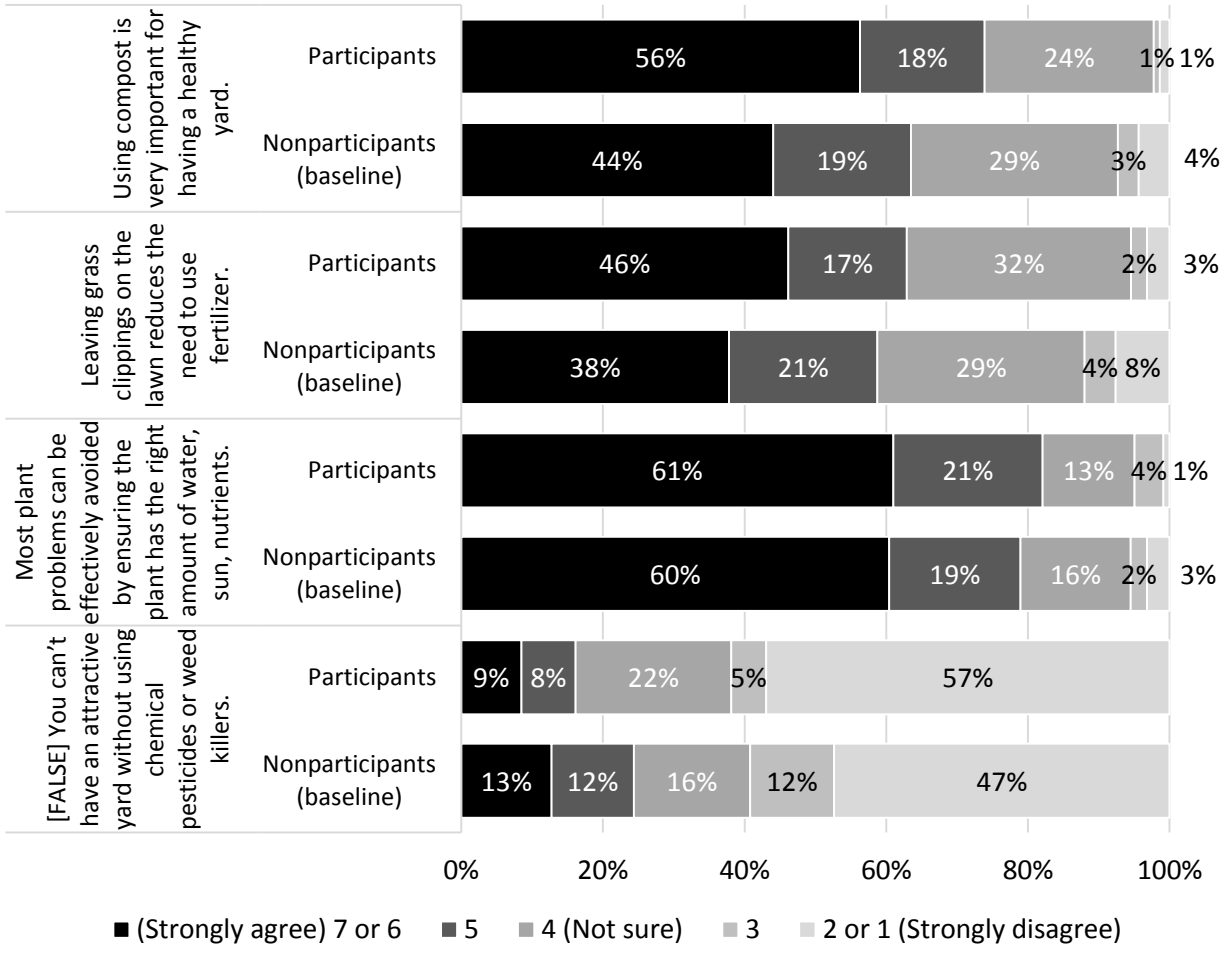
Figure 22. North Sound participant subgroup comparisions of baseline implementation by importance of yard characteristics

Practice	Highest baseline implementation	Lowest baseline implementation
"HARMFUL PRACTICE: Use weed-and-feed (any amount)	Very important (rating of 6 or 7) for green lawn (63% decrease) ■ 80% baseline ■ 10% post-outreach	Somewhat important (rating of 4 or 5) for green lawn (42% decrease) ■ 52% baseline ■ 5% post-outreach
HARMFUL PRACTICE: Use fast-release or weed-and-feed fertilizer	Very important (rating of 6 or 7) for weed-free or green lawn (36% decrease) ■ 62% to 63% baseline ■ 26% post-outreach	Somewhat important (rating of 4 or 5) for weed-free or green lawn (17% to 18% decrease) ■ 31% to 34% baseline ■ 14% to 17% post-outreach
Use slow release, organic or natural fertilizer	Somewhat important (rating of 4 or 5) for green lawn (10% increase) ■ 50% baseline ■ 60% post-outreach	Very important (rating of 6 or 7) for green lawn (34% increase) ■ 19% baseline ■ 53% post-outreach
Sometimes or always mulch mow in wet or dry wet months	Very important (rating of 6 or 7) for green lawn (24% to 26% increase) ■ 32% to 36% baseline ■ 56% to 62% post-outreach	Not important (rating of 1, 2 or 3) for green lawn (2% to 4% increase) ■ 64% to 71% baseline ■ 69% to 73% post-outreach

Understanding of Natural and Conventional Yard Care Practices

In baseline surveys, participants and nonparticipants were asked to rate their level of agreement with various statements about natural and conventional yard care practices, on a seven-point scale from 7 (strongly agree) to 1 (strongly disagree).

Figure 23. North Sound participant and nonparticipant knowledge and understanding of natural and conventional yard care practices



Participants and nonparticipants had similar baseline levels of understanding of key concepts related to natural yard care, showing some knowledge but also substantial room for increased education.

Baseline knowledge and understanding was highest for knowing that most plant problems can be avoided by proper plant care and lowest for knowing that mulch mowing reduces the need to use fertilizer.

Behavior Change, Knowledge, and Understanding Outcomes

Before the program, North Sound program participants took a baseline survey on their yard care habits regarding mowing; fertilizer use; lime and aeration; watering and mulching; pest, disease, and weed management; choosing new plants; and preparing soil for new plants. Six to twelve months after the program they took a follow-up survey covering many of these topics and changes they had made since the workshops. This section summarizes behavior change outcomes measured by these surveys. The medium-term post-outreach survey was conducted in spring and summer 2015 to meet the deadline for NPDES permit reporting requirements.

Randomly selected nonparticipants took similar "baseline" and "post-outreach" surveys; this report notes where similar changes in behavior were seen in nonparticipants.

Figures in this report are been rounded to the nearest percentage point. As a result, the sum of "baseline" and "change" figures may not appear to equal the "post-outreach" figure, but each figure is independently the most accurate rounded amount.

In the narrative findings, two icons indicate the **level of behavior change** (H, M, or L) from baseline to medium-term post-outreach surveys and the **post-outreach use** (✓, ▲, ●) as follows:

Behavior Change

H High behavior change
- 20 or more percentage points

M Moderate behavior change
- 10 to 19 percentage points

L Low behavior change
- Less than 10 percentage points

Post-Outreach Use

✓ High post-outreach use
- 70% or more for preferred practices
- 25% or less for harmful practices

▲ Moderate post-outreach use
- 40% to 69% for preferred practices
- 26% to 60% for harmful practices

● Low post-outreach use
- Less than 40% for preferred practices
- More than 60% for harmful practices

Unless otherwise noted, charts and tables use the following notations regarding the statistical analysis:

(P)	Indicates that only participants showed a statistically significant difference between baseline and medium-term post-outreach adoption levels.
(NP)	Indicates that only nonparticipants showed a statistically significant difference between baseline and medium-term post-outreach adoption levels.
(P)(NP)	Indicates that both participants and nonparticipants showed a statistically significant difference between baseline and medium-term post-outreach adoption levels.
(W)	Indicates that question wording was different between before and after survey, requiring responses to be combined for statistical comparison. This notation can be combined with (P), (NP), and (P)(NP).

Additional details on results are presented in Appendix B—North Sound Survey Data Summary Tables.

Key Findings

Figure 24. North Sound yard care practices, by practice type

Type	Yard Care Practice or Understanding	Baseline Use	Change in Behavior/Understanding	Post-Outreach Use
Using Weed-and-Feed	HARMFUL PRACTICE: Use weed-and-feed (any amount) (P)(W)	66%	H -53%	14% ✓
Fertilizing	HARMFUL PRACTICE: Use fast-release or weed-and-feed fertilizer (P)	50%	H -27%	23% ✓
	Use slow release, organic or natural fertilizer (P)	30%	H 24%	54% △
Managing Pests	HARMFUL PRACTICE: Pests/diseases: broadly apply product (P)(NP)	11%	L -8%	4% ✓
	Pests/diseases: remove, prune, use netting or collars, or tolerate	74%	L -2%	73% ✓
Applying Lime	Apply lime at least every 2 to 3 years (W)	22%	L 4%	26% ●
Aerating	Aerate at least every 2 years (W)	19%	L 8%	27% ●
	Top-dress with compost, if aerated (P)	23%	H 25%	48% △
Applying Mulch	HARMFUL PRACTICE: Bed cover: landscape fabric, plastic, or bare soil (W)	38%	M -12%	26% △
	Bed cover: mulch, grass clippings, or plants (W)	82%	L 5%	87% ✓
Mulch Mowing	Sometimes or always mulch mow in dry months (P)	48%	M 18%	67% △
	Sometimes or always mulch mow in wet months (P)	46%	M 18%	64% △
Mowing Height	Mow 2-3" or higher (P)	87%	L 9%	95% ✓
Choosing Plants	Always match plant to where it thrives (P)	23%	H 42%	65% △
	Always look for a plant's soil drainage needs (P)	27%	H 30%	57% △
	Always look for whether a plant is native to Pacific Northwest (P)	18%	H 28%	47% △
	Always look for a plant's pest and disease resistance (P)	15%	H 28%	43% △
	Always look for a plant's full-grown size (P)	50%	H 23%	73% ✓
	Always look for a plant's cold temperature tolerance (P)	35%	H 20%	54% △
	Always look for a plant's watering needs (P)	45%	M 18%	63% △
	Always look for a plant's sun/shade needs (P)	67%	M 17%	84% ✓
	Has sketched a map of the yard	NA	NA	25% ●
Preparing Soil	Know to prepare soil with compost (P)	65%	H 26%	91% ✓
	Know to mix materials into soil 6-8 inches deep	26%	M 11%	37% ●
Watering	Measure sprinkler watering rate (tuna can test), if waters	23%	M 12%	35% ●
	Water lawn once a week or less (P)	68%	L -8%	61% △
	ACCEPTABLE PRACTICE: Water lawn two to three times per week	26%	L 5%	31% ●
	HARMFUL PRACTICE: Water lawn daily or every other day	6%	L 2%	9% ✓

Note: The unusually dry weather in 2015, when participants took the medium-term post-outreach survey, may have affected watering practices.

Figure 25. North Sound yard care practices, by level of change

Type	Yard Care Practice or Understanding	Baseline Use	Change in Behavior/Understanding	Post-Outreach Use
Using Weed-and-Feed	HARMFUL PRACTICE: Use weed-and-feed (any amount) (P)(W)	66%	H -53%	14% ✓
Planting	Always match plant to where it thrives (P)	23%	H 42%	65% △
Planting	Always look for a plant's soil drainage needs (P)	27%	H 30%	57% △
Planting	Always look for a plant's pest and disease resistance (P)	15%	H 28%	43% △
Planting	Always look for whether a plant is native to Pacific Northwest (P)	18%	H 28%	47% △
Fertilizing	HARMFUL PRACTICE: Use fast-release or weed-and-feed fertilizer (P)	50%	H -27%	23% ✓
Preparing Soil	Know to prepare soil with compost (P)	65%	H 26%	91% ✓
Aerating	Top-dress with compost, if aerated (P)	23%	H 25%	48% △
Fertilizing	Use slow release, organic or natural fertilizer (P)	30%	H 24%	54% △
Planting	Always look for a plant's full-grown size (P)	50%	H 23%	73% ✓
Planting	Always look for a plant's cold temperature tolerance (P)	35%	H 20%	54% △
Planting	Always look for a plant's watering needs (P)	45%	M 18%	63% △
Mowing	Sometimes or always mulch mow in dry months (P)	48%	M 18%	67% △
Mowing	Sometimes or always mulch mow in wet months (P)	46%	M 18%	64% △
Planting	Always look for a plant's sun/shade needs (P)	67%	M 17%	84% ✓
Watering	Measure sprinkler watering rate (tuna can test), if waters	23%	M 12%	35% ○
Applying Mulch	HARMFUL PRACTICE: Bed cover: landscape fabric, plastic, or bare soil (W)	38%	M -12%	26% △
Preparing Soil	Know to mix materials into soil 6-8 inches deep	26%	M 11%	37% ○
Mowing	Mow 2-3" or higher (P)	87%	L 9%	95% ✓
Aerating	Aerate at least every 2 years (W)	19%	L 8%	27% ○
Managing Pests	HARMFUL PRACTICE: Pests/diseases: broadly apply product (P)(NP)	11%	L -8%	4% ✓
Watering	Water lawn once a week or less (P)	68%	L -8%	61% △
Watering	ACCEPTABLE PRACTICE: Water lawn two to three times per week	26%	L 5%	31% ○
Applying Mulch	Bed cover: mulch, grass clippings, or plants (W)	82%	L 5%	87% ✓
Applying Lime	Apply lime at least every 2 to 3 years (W)	22%	L 4%	26% ○
Watering	HARMFUL PRACTICE: Water lawn daily or every other day	6%	L 2%	9% ✓
Managing Pests	Pests/diseases: remove, prune, use netting or collars, or tolerate	74%	L -2%	73% ✓
Planting	Has sketched a map of the yard	NA	NA	25% ○

Note: The unusually dry weather in 2015, when participants took the medium-term post-outreach survey, may have affected watering practices.

Practices that Protect Water Quality

After the program, 70% or more of participants were using at least one key practice that directly protect water quality, as shown in Figure 26. Notably, the program achieved a high level of behavior change in reducing weed-and-feed use: the share of participants who used this product decreased from 66% to 14%. As described below, the program also achieved varying levels of behavior change in practices that support a healthy yard and reduce the weed, pest, and disease reasons people use toxic yard care products.

Figure 26. North Sound adoption of practices that protect water quality

H ✓	Avoiding weed-and-feed use
H ✓	Avoiding fast-release fertilizer use
L ✓	Avoiding broad application of pesticides
M △	Not leaving beds bare or covered in landscape fabric or plastics
H △	Top-dressing lawns with compost after aerating
L ○	Aerating every two to three years

Where the Program is Working Effectively

H ✓ Substantial change resulting in high post-outreach use

- Avoiding weed-and-feed.
- Avoiding fast-release fertilizer.
- Knowing to prepare the soil with compost.

Whether asked about the fertilizers they use or asked directly about weed-and-feed, less than one-quarter of participants reported using harmful weed-and-feed or fast-release fertilizers after the workshop, a substantial decrease.

Interviewed participants also frequently mentioned using compost and composting when asked to name the most useful thing they learned in the workshops.

M ✓ Moderate change resulting in high post-outreach use

- Always looking for a plant's sunlight and shade needs and full-grown size when planting.

Both sunlight and shade needs and full-grown size are often listed on plant tags, enabling participants to find this information easily when choosing plants.

L ✓ Little change because of high adoption levels before the workshops

- Mowing two to three inches or higher.
- Using at least one least-toxic weed management technique.
- Not broadly applying pesticides

While most participants were using some least-toxic pest management techniques before and after the program, interviewed participants reported that they need more information and resources to manage weeds and pests. Including this information in the workshops is helpful for reinforcing preferred behaviors and strengthening the audience's understanding of how these behaviors contribute to a healthy yard and result in less need to manage weeds and pests.

H ⚠ Substantial change with room for additional improvement

- Always matching a plant to where it thrives.
- Always looking for a plant's soil drainage needs, pest and disease resistance, watering needs, cold temperature tolerance, and status as native to the Pacific Northwest.
- Using slow-release, organic, or natural fertilizer.

While participants frequently mentioned "Right Plant, Right Place" principles when asked to name the most useful thing they learned from the workshops, they may need more hands-on education or tools to help them apply these practices.

While more participants reported using slow-release, organic, or natural fertilizer, nearly half were not using this product after the workshops.

Where the Program Achieved Moderate Change but Room for Improvement Remains

M ⚠ Moderate changes with moderate post-outreach use

- Mulch mowing, especially in wet months
- Not leaving beds bare or covered in landscape fabric or plastics.

After the program about two-thirds of participants reported mulch mowing at least sometimes (67% in dry months and 64% in wet months). Fewer reported that they *always* mulch mow (43% in dry months and 46% in wet months).

When asked why they did not always mulch mow, participants most frequently said they do not leave clippings when the grass is too long, they do not want to track grass clippings into the house, and they do not like lots of grass clippings on the lawn.

Participants may have multiple beds, some of which follow natural yard care practices and some of which do not.

M ● Moderate changes with low post-outreach use or understanding levels

- Measuring their sprinkler watering rate:
- Knowing to mix materials six to eight inches deep in soil when planting

Despite the unusually hot and dry year, many participants did not follow the important conservation practice of measuring their sprinkler watering rate. After the program, about 37% of participants selected the correct way to mix planting materials into the soil, although another 30% selected mixing in materials to a shallower depth of four to six inches deep.

Where the Program Achieved Little Change

L ▲ Little change with moderate post-outreach use

- Lawn watering frequency: participants did not reduce lawn watering frequency, with participants watering slightly more frequently after the workshop, potentially due to the unusually dry weather in 2015.

Watering lessons may need to emphasize more that this practice results in a healthier lawns. Education on proper watering and on other techniques to reduce the need to water (such as using mulch and top-dressing) during times of watering restrictions may be important given predictions that 2016 will also be unusually dry.

L ● Little change with low post-outreach use

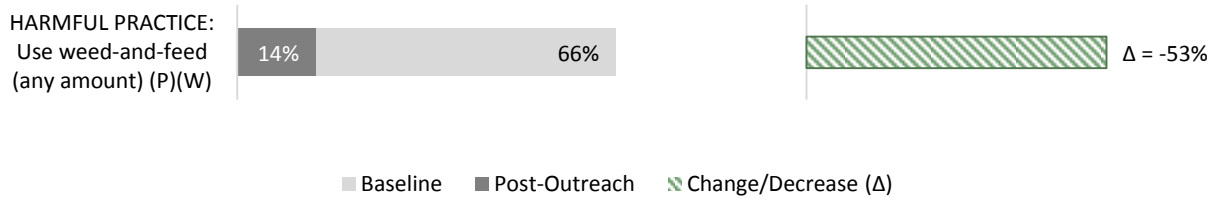
- Aerating: after the program 27% of participants reported having aerated, an increase of 8 percentage points compared to before the program
- Applying lime: after the program 26% of participants reported having applied lime, an increase of 4 percentage points compared to before the program.

The change in implementation of these practices after the program were statistically significant but relatively small—as were the levels of post-outreach use. While a larger percentage of participants say they *plan* to aerate (another 44% of respondents) and apply lime (another 44%), more education, hands-on demonstrations, or incentives may be needed to promote these practices. Although few participants aerated after the workshops, nearly half who did aerate said they also top-dressed with compost, an improvement from before the program (23% baseline and 48% post-outreach).

Detailed Findings

Weed-and-Feed Use

Figure 27. North Sound participant weed-and-feed use



H ✓ The share of participants who reported having used weed-and-feed decreased substantially after the workshops.

In this comparison, participants were asked directly about weed-and-feed, with a definition of the product, to help clearly identify the material.

H ✓ While 14% of participants used weed-and-feed after the program, slightly more (19%) plan to use it in the future.

Participants reduced their use of weed-and-feed but may not want to rule out all future use of weed-and-feed. However, two-thirds of participants (64%) who plan to use it in the future reported they would use it less than they did before the program.

Subgroup Comparison by Weed-and-Feed Use

Participant baseline, post-outreach, and behavior change levels were cross-tabulated and compared for subgroups based on their baseline use of weed-and-feed in the following categories:

- Never fertilized at all.
- Fertilized but never used weed-and-feed.
- Used weed-and-feed once a year or less.
- Used weed-and-feed two to three times per year.

Differences were not statistically tested and are reported in Figure 28 only when the difference was greater than 25 percentage points. The differences do not show a clear trend across the subgroups as baseline weed-and-feed use increases. Appendix B-21 presents a summary table with complete subgroup comparison data.

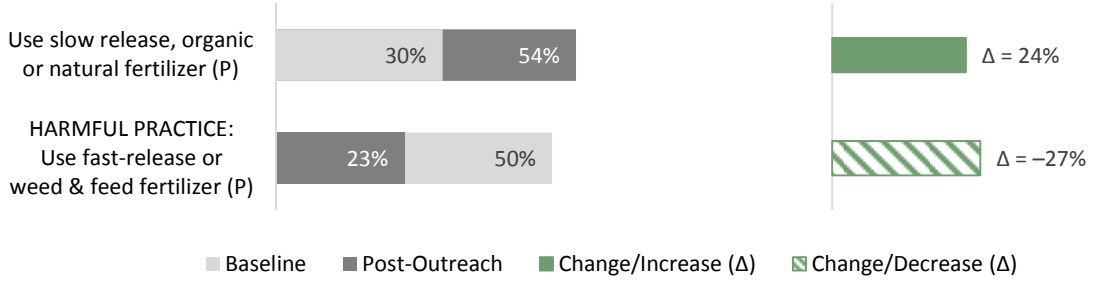
Figure 28. North Sound participant subgroup comparisions by baseline weed-and-feed use

Practice	Greatest change in behavior or understanding	Least change in behavior or understanding
Remove, prune, use netting or collars, or tolerate pests and diseases	Fertilized but never used weed-and-feed (13% increase) ■ 79% baseline ■ 92% post-outreach	Used weed-and-feed once a year or less or never fertilized (11% to 13% decrease) ■ 73% to 86% baseline ■ 60% to 75% post-outreach
Aerating	Never fertilized (11% increase) ■ 2% baseline ■ 13% post-outreach	Fertilized but never used weed-and-feed (15% decrease) ■ 45% baseline ■ 30% post-outreach
HARMFUL PRACTICE: Cover beds with landscape fabric, plastic, or bare soil	Used weed-and-feed two to three times per year (37% decrease) ■ 56% baseline ■ 19% post-outreach	Used weed-and-feed once per year (1% decrease) ■ 32% baseline ■ 31% post-outreach
Know to prepare soil with compost	Never fertilized (38% increase) ■ 55% baseline ■ 92% post-outreach	Fertilized but never used weed-and-feed (6% increase) ■ 89% baseline ■ 95% post-outreach

Fertilizer Choices

In this section, participants were asked to choose from a long list of fertilizer types, including weed-and-feed.

Figure 29. North Sound participant fertilizer type choices



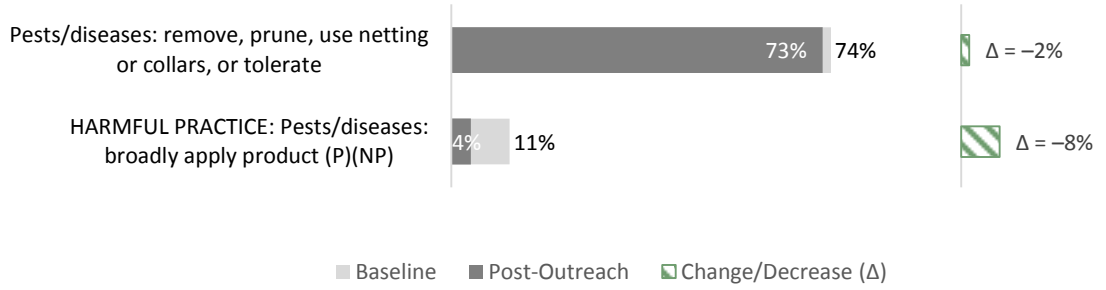
H ⚠ More participants who fertilize reported using slow-release, organic, or natural fertilizer after the workshops, but nearly half still do not use these products.

H ✓ Among those who fertilize, fewer participants reported using fast-release fertilizer or weed-and-feed after the workshops, although nearly a quarter still used at least one of these products.

This question came before the question focused on weed-and-feed, so participants may not have realized that they used the product without the extended definition that weed-and-feed contains both fertilizer and weed killer. Alternatively, participants who used weed-and-feed might have selected a different description of the product (such as “chemical fertilizer”) when asked to mark which fertilizers they use.

Pest and Disease Management

Figure 30. North Sound participant pest, disease, and weed management practices



L ✓ After the program, fewer participants broadly applied products while the share who used at least one non-toxic practice remained fairly constant.

Participants were allowed to mark that they used both harmful and preferred practices. Most participants were using at least one non-toxic pest and disease management practice—removing or pruning affected plants, using netting or collars to keep out pests, or tolerating pests and diseases—both before and after the workshops.

Fewer nonparticipants also reported broadly applying products (34% baseline and 13% post-outreach).

Soil Conditions

Applying Lime

Figure 31. North Sound participant lime practices (percentage who implemented the practice)

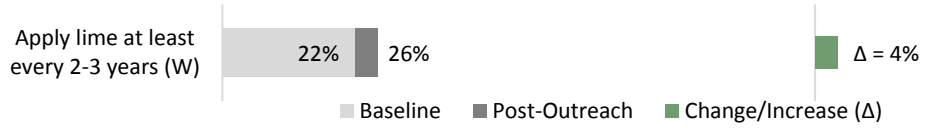
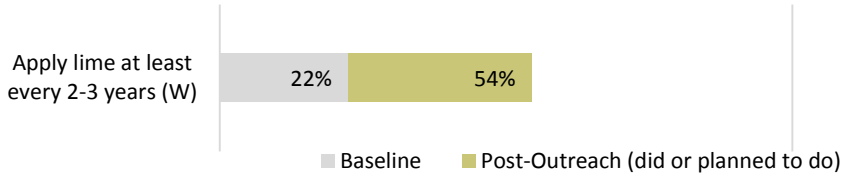


Figure 32. North Sound participant lime practices (percentages who implemented or *plan* to implement the practice)



Changes in the percentage of participants who applied lime after the workshop were not statistically significant. After the workshops, one-quarter of participants reported using this practice, although more participants said they *plan* to apply lime in the future.

Overall, 54% of participants either applied lime after the workshops or plan to apply lime; however, intentions do not necessarily translate into actions, particularly for practices that require substantial effort.

Aerating and Top-Dressing with Compost

Figure 33. North Sound participant aerating practices (percentage who implemented the practice)

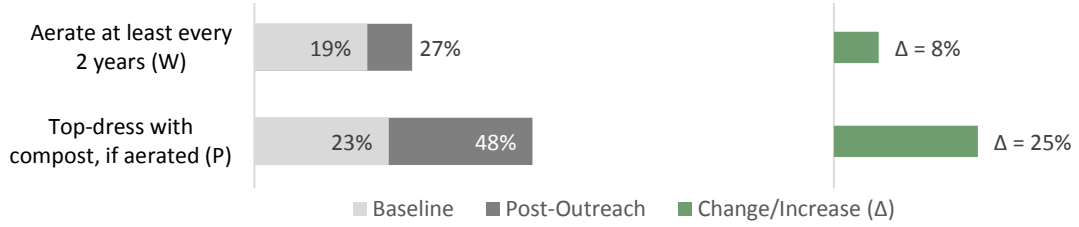
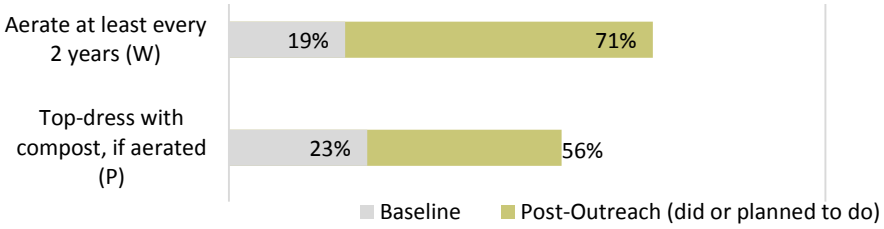


Figure 34. North Sound participant aerating practices (percentage who implemented or *plan* to implement the practice)



L ● Changes in the percentage of participants who aerated after the workshop were not statistically significant. After the workshops, just over one-quarter of participants reported using this practice although more participants said they *plan* to aerate in the future.

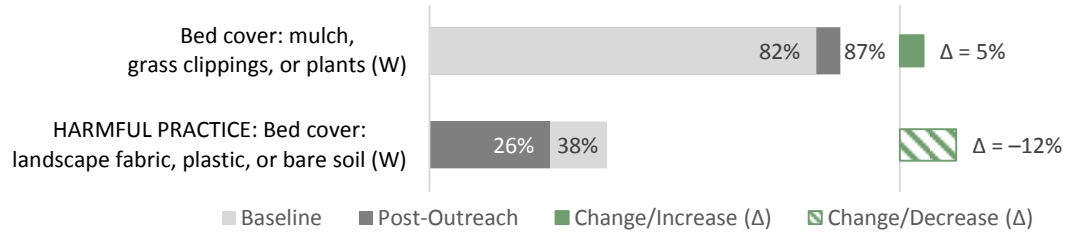
Overall, 71% of participants aerated since the workshop or plan to aerate; however, intentions do not necessarily translate into actions, particularly for practices that require substantial effort.

H ⚠ Among participants who expended the effort to aerate, more than twice as many participants reported top-dressing with compost after the workshops.

Overall, 56% of participant who did or plan to aerate *also* did or plan to top-dress with compost.

Applying Mulch to Landscaped Beds

Figure 35. North Sound participant watering and mulching practices



L ✓ Differences in mulching practices were not statistically significant. Most participants were already covering beds with mulch and plants before the workshops.

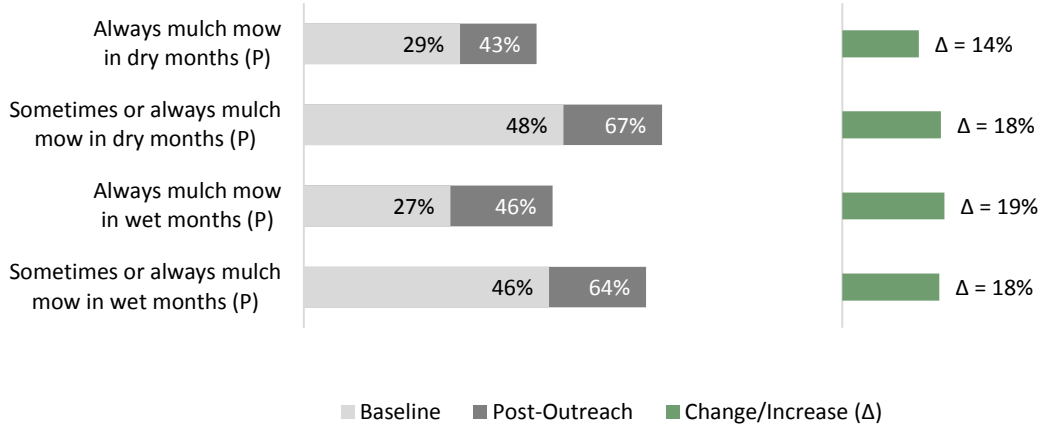
After the program a quarter of participants left soil bare or used landscape fabric or plastic.

Mowing

Lawn care practices were among the most common practices that interviewed participants mentioned when asked to name the most useful thing they learned in the workshops and the biggest change they had made since the workshops. However, the lawn and watering lecture (*Natural Lawn Care and Smart Watering*) had the lowest attendance of the three workshop evenings. Additional research is needed to determine whether participants are less interested in learning about these topics or whether a change in marketing messages could increase attendance for this topic.

Mulch Mowing

Figure 36. North Sound participant mulch mowing



M △ Participants increased mulch mowing in all months, but about one-third never mulch mow, and half do not always mulch mow.

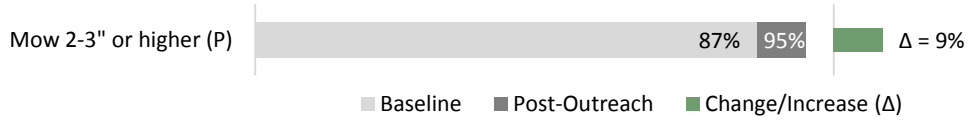
Program participants were more likely to say they had mulch mowed after the program than before in all months, including the wetter months of April, May, and October. While a dry fall 2014 and spring 2015 may have further encouraged participants to mulch mow in April and October, participants also reported increasing their mulch mowing in the typically dry months of June through September.

Barriers to Mulch Mowing

When asked what prevents them from mulch mowing, participants most frequently said they do not leave clippings when the grass is too long, they do not want to track grass clippings into the house, and they do not like lots of grass clippings on the lawn. Other common responses were that they do not have the right equipment or do not leave grass clippings when the lawn is wet. Respondents were allowed to write in other responses, commonly saying they use grass clippings in compost or mulch or they remove grass clippings to prevent the spread of weeds.

Mowing Height

Figure 37. North Sound participant mowing height



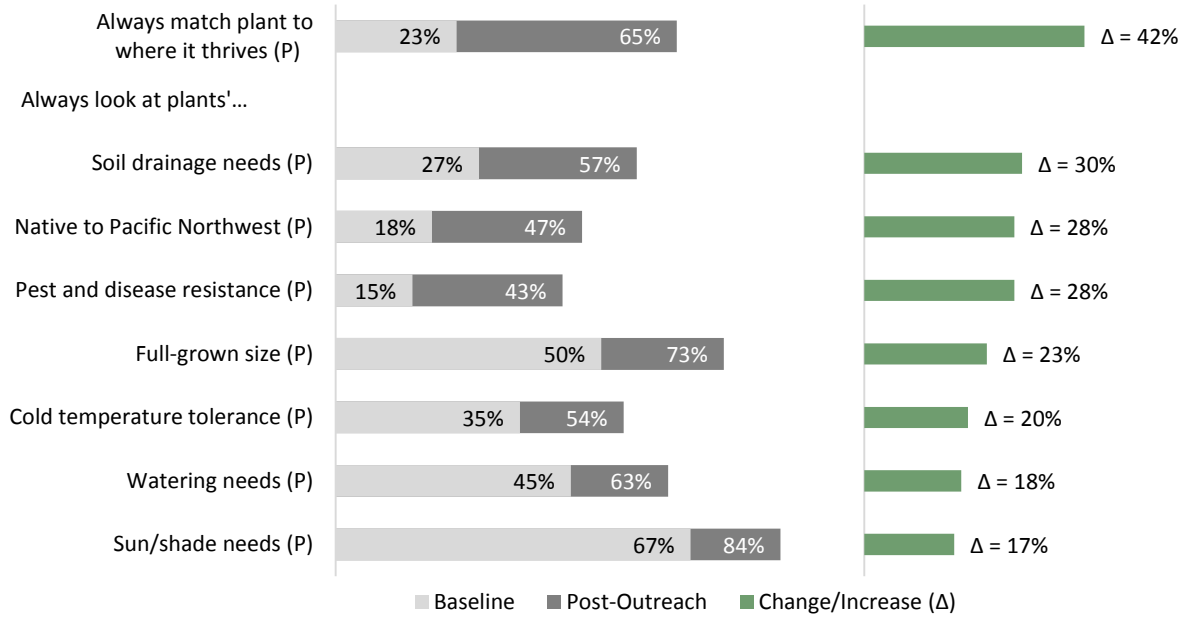
L ✓ Most participants mowed high both before and after the program, with 95% mowing two to three inches or higher after the program.

Planting

Choosing New Plants

When interviewed participants were asked to name the most useful thing they learned in the workshops or the biggest change they had made since the workshops, they most commonly mentioned plant selection and placement.

Figure 38. North Sound participant plant choices



H ⚠ Nearly three times more participants said they always match a plant to where it will thrive when planting compared to before the workshops, with two-thirds of participants adopting this principle.

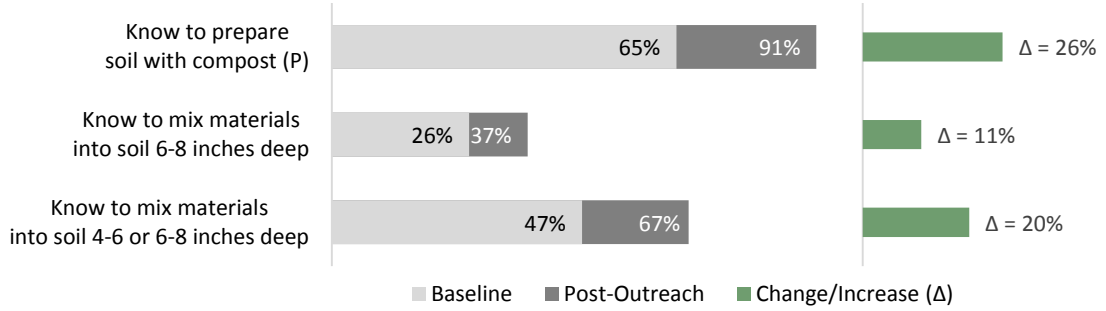
"Right Plant, Right Place" was frequently mentioned by participants when surveyed about the most useful thing they learned in the workshops.

M to H ⚠ to ✓ More participants say they always look for important characteristics when choosing new plants compared to before the workshops, but more room for improvement remains on looking for pest and disease resistance, native status, cold tolerance, and drainage needs.

The share of participants always looking for specific plant characteristics increased for all the characteristics listed, but participants were more likely to report looking for information that is typically listed on plant tags, such as sunlight needs and full-grown size, than for characteristics that may require additional research, such as pest and disease resistance. Participants may need additional demonstrations or resources on how to determine this information.

Preparing Soil for New Plants

Figure 39. North Sound participant understanding of preparing soil for planting beds



Note: the recommended practice is to mixing compost into the soil six to eight inches deep; the percentage of respondents who selected either four to six or six to eight inches is provided for context.

H ✓ Almost all participants now know to use compost when preparing soil for planting, a substantial increase from before the workshops.

Soil preparation, including adding compost, was frequently mentioned by participants when surveyed about the most useful thing they learned in the workshops.

M ● While participants learned to use compost, fewer learned *how* to use it.

Changes in the share of participants who knew that soil preparation materials should be mixed into soil six to eight inches deep throughout entire beds were not statistically significant. After the workshops, less than two-fifths of participants understood how to conduct this practice after the workshop. More participants gave a partially correct response (mix materials four or more inches deep), indicating that participants may just need a more compelling visual aid or reminder about how deep to mix materials.[3]

[3] Results for the partially correct were not statistically tested for significance.

Baseline Planting Knowledge and Understanding

Participants were asked questions to gauge baseline knowledge and understanding about how to plant a new plant. These questions were not asked on the post-outreach survey due to space constraints.

Figure 40. North Sound participant baseline understanding of how dig a hole for a new plant

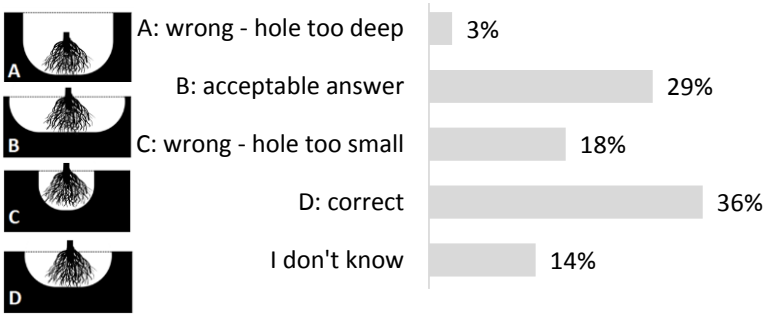


Figure 41. North Sound participant baseline understanding of how to place a plant in a planting hole

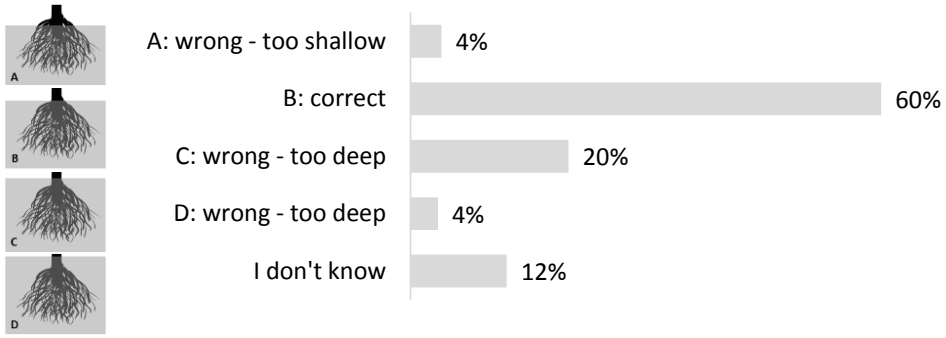
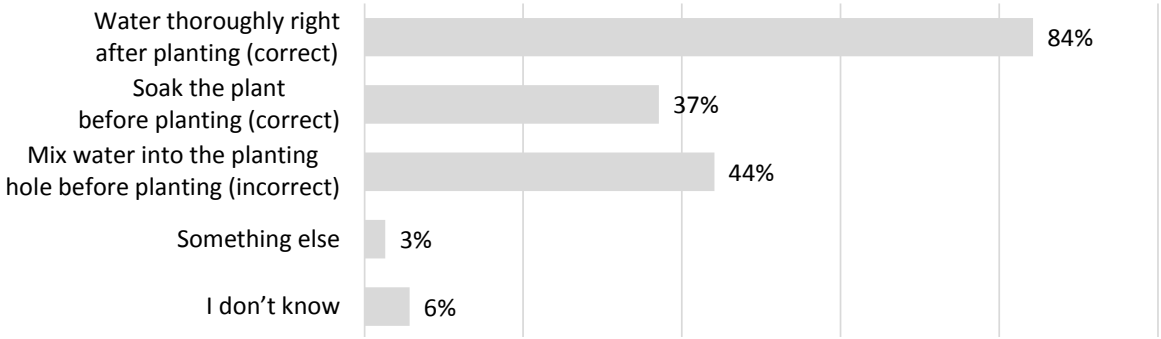


Figure 42. North Sound participant baseline understanding of how to water a newly planted plant



About two-thirds of participants knew how to dig and place a new plant into a planting hole, but some participants needed education on ensuring the hole is large enough and the plant is not planted too deeply.

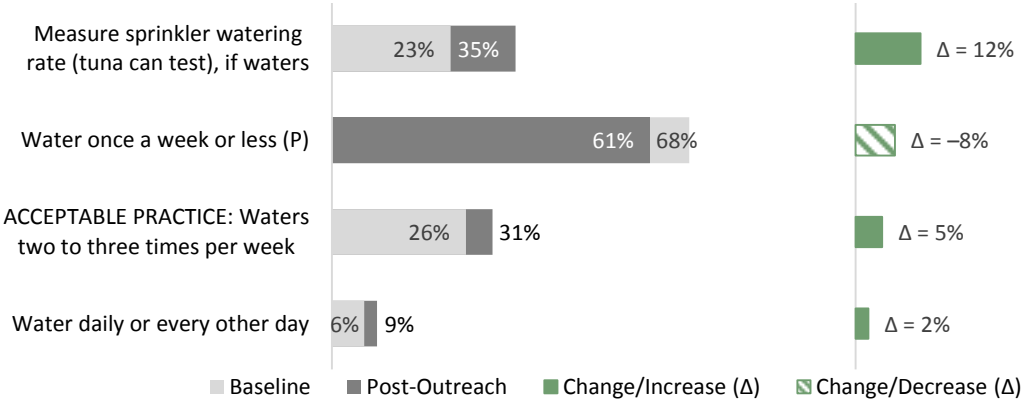
Similarly, most participants know to water a plant right after planting, but nearly two-thirds do not know they should also soak the plant *before* planting.

Watering

Participants took the survey baseline survey in either spring 2014 or fall 2014, depending on which lecture series they attended. Participants took the post-program survey in June through September 2015. The unusually hot and dry summer may have influenced changes in watering practices, particularly for participants who took the survey later in 2015 after the extent of the drought became clear.

Watering Measurement and Frequency

Figure 43. North Sound participant watering measurement and frequency



M ● More participants who water using a sprinkler said they measured their sprinkler watering rate (such as using tuna cans to track water depth after sprinkler use), but two-thirds of people using sprinklers did not use this one-time practice despite the unusually hot summer.

Nonetheless, additional education, tools, or incentives appear to be needed to encourage residents to adopt this important practice, as adoption remained low even during a drought when participants would have been expected to adopt water conservation practices.

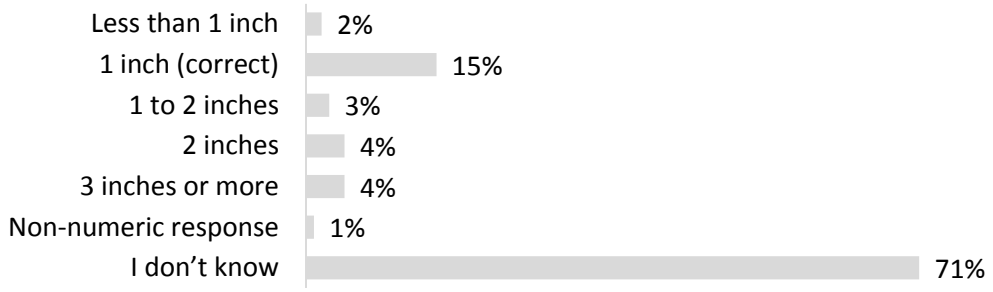
L ▲ Participants did not reduce lawn watering frequency, and some who had not watered before the workshop started watering, potentially because of the unusually hot summer.

Slightly fewer participants reported watering once a week or less while slightly more reported watering every other day or more. After the workshops, fewer participants reported never watering their lawn, potentially following a workshop recommendation to water once a month during the dry season to maintain soil health.

Knowledge and Understanding of Watering Amount per Week

Participants were asked about how much water a lawn needs per week to stay green in the summer to gauge baseline knowledge and understanding. This question was not asked on the post-outreach survey due to space constraints.

Figure 44. North Sound participant baseline knowledge and understanding of watering amount per week for a green lawn



Before the workshops, more than two-thirds of participants did not know how many inches of water a lawn needs per week to stay green in the summer. Half of participants who provided an amount wrote in the correct quantity of one inch per week.

Education on the correct amount to water per week for a green lawn, as well as for a brown lawn during a drought, will be important to conserve water in future years.

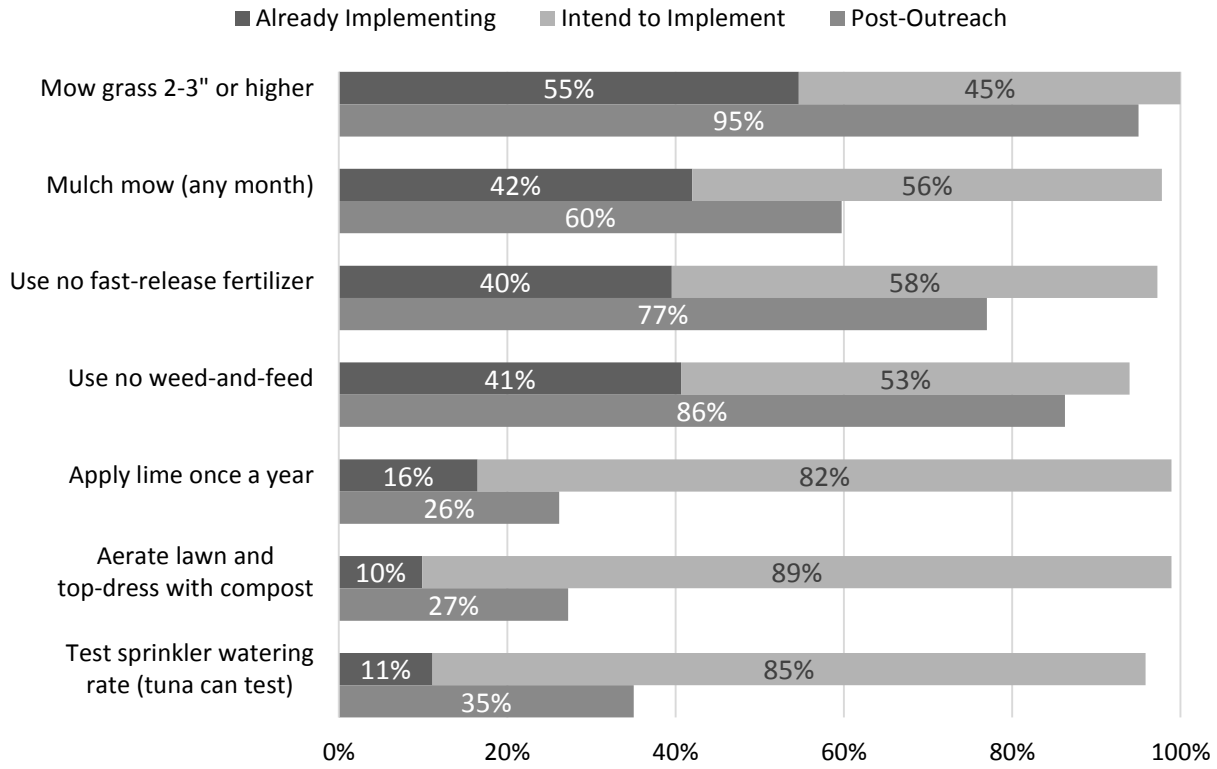
Comparison of Intentions and Reported Behaviors

Many programs can afford to administer a survey only at the end of the program asking about *intentions* to change but cannot afford to follow up with participants to learn whether they made the intended changes. This evaluation provides an opportunity to compare intentions to reported changes. For participants who completed both the immediate post-workshop surveys and the medium-term post-outreach survey, this section compares:

- Immediate post-outreach: percentage who reported at the workshop that they already implemented or intended to implement the practice.
- Medium-term post-outreach: percentage who reported doing the practice since the workshops.

These comparisons are presented below in Figure 45, Figure 46, and Figure 47.

Figure 45: Comparison of participant intentions and reported behaviors for lawn care and watering practices



Note: Use no fast-release fertilizer was compared to the question about fertilizer choices, while use no weed-and-feed was compared to the question specifically on weed-and-feed. The post-outreach percentage for aerate lawn and top-dress with compost includes only participants who used both practices together.

Figure 46. Comparison of participant intentions and reported behaviors for garden design and pest control practices

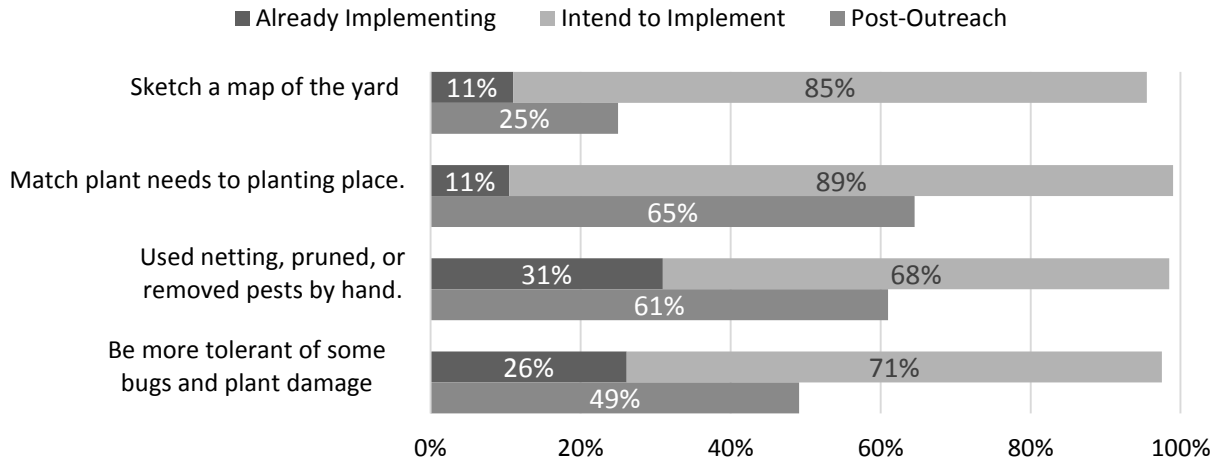
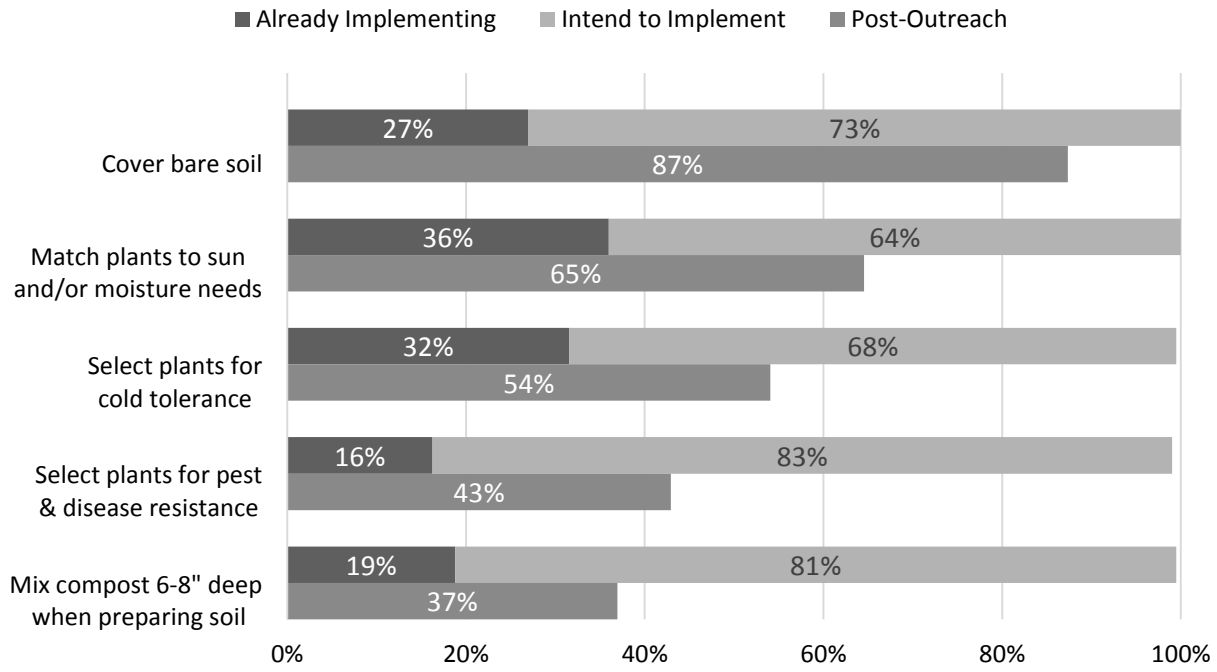


Figure 47. Comparison of participant intentions and reported behaviors for plants and soil practices



For all of the natural yard care practices presented above, at least 95% of the participants surveyed immediately post-outreach said they already did or intended to implement them.

While the reported current use of practices varied substantially, nearly all participants intended to use the practices after the workshops. Consequently, *willingness* to implement these practices does not appear to be a barrier, indicating that programs need to identify and address other barriers that arise after participants have left the workshop.

For all practices, more participants intended to change their behavior than reported actually doing so in the medium-term outreach survey.

Intentions overestimated the amount of behavior change that the program would achieve within the span of time between the workshop and the medium term survey.

Current and intended behaviors reported at the end of workshops do not vary predictably with behaviors reported six to twelve months later.

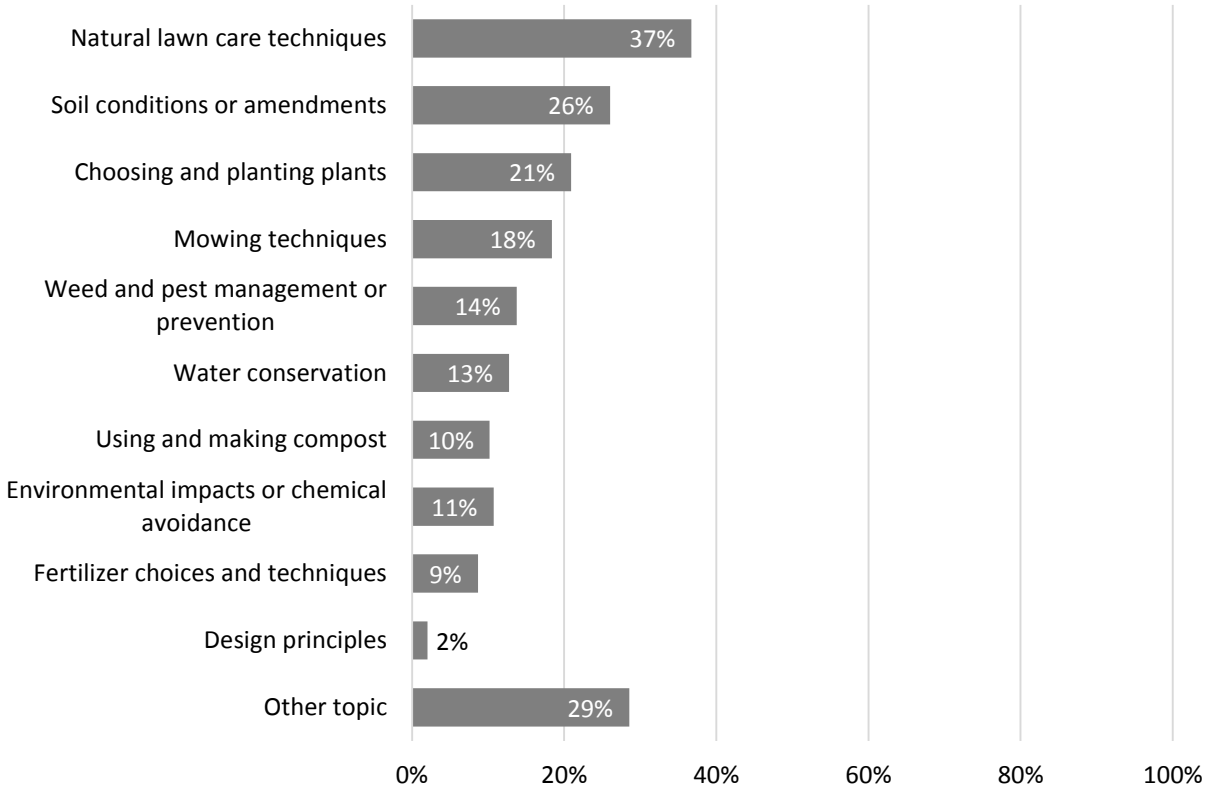
Results from surveys administered at the end of workshops cannot be used to project accurate, actual behavior change by participants. The relationship between current behavior, intentions, and reported behavior change does not appear to show a clear trend; instead it varies by practice which prevents programs from predicting behavior change based on immediate post-outreach surveys.

Most Useful Information and Social Diffusion

In the medium-term post-outreach survey, participants were asked about the most useful things they learned during the program and about whether they shared information with others (social diffusion).

Most Useful Information

Figure 48: North Sound participants—most useful topics learned during the program



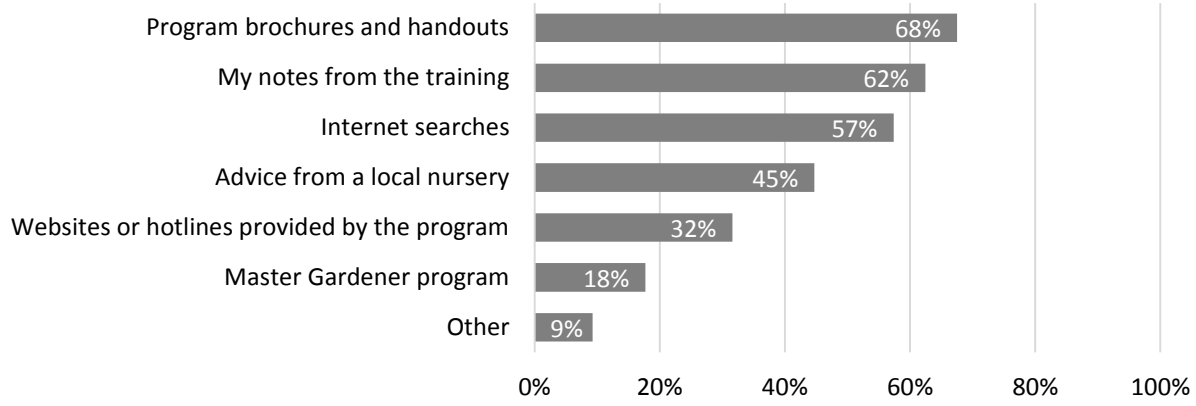
In the medium-term post-outreach survey, respondents were asked to write in the most useful things they learned in the workshops. Their responses were categorized into commonly mentioned topics, with some comments included in multiple categories. For example, a participant who mentioned mulch mowing and using slow-release fertilizer would have been counted in three topics: natural lawn care techniques, mowing techniques, and fertilizer choices and techniques.

More one-third of participants mentioned natural lawn care topics, particularly mulch mowing, using applying, and aerating. Approximately one-quarter of participants mentioned soil conditions or amendments (particularly using compost and mulch), and one-fifth mentioned planting (particularly "Right Plant, Right Place" principles along with choosing native plants). Some commonly mentioned topics correspond to practices that did not show large behavior change (such as applying lime and aerating) but that participants reported they *intend* to implement in the future.

In interviews conducted with 20 participants, four or five interviewees each stated that the most useful things they learned were proper mowing height, backyard composting, better watering practices, mulch mowing, plant selection and placement, and general yard care practices. When asked about topics for future education programs and educational videos, interviewed participants mentioned a wide variety of topics with no common themes.

Resources Used After Program

Figure 49: North Sound participants—resources used when trying practices after the workshops



The information and resources provided by the program were useful to participants. More than two-thirds of participants reported using the program brochures and handouts as they tried to implement the practices taught in the workshops, and almost as many used their workshop notes. Many participants also sought outside information by conducting internet searches (57%) or asking advice from a local nursery (45%).

Social Diffusion

Figure 50: North Sound participants—number of people shared with, among survey respondents

Note: As with other figures, these numbers include only participants who completed the medium-term post-outreach survey.

The North Sound program reached a total of 627 individuals in 451 households. Participating households were asked in the medium-term post-outreach survey whether they shared information about natural yard care with others. Three-quarters of survey respondents (77%, or 185 participating households) reported sharing information, reaching a total of nearly 1,040 additional people. As a result, survey respondents that reported sharing information are calculated to have reached an additional 5.6 people on average per household. These additional people increase the reach of the program from 627 individuals to 1,667 individuals.

Participants who did not complete the survey may also have shared information, further increasing social diffusion. If these calculations are applied to all 451 participating households, social diffusion may have reached a total of nearly 1,950 additional individuals (451 households x 77% x 5.6 people per household). Based on the estimates, social diffusion may have expanded the program reach more than four times to approximately 2,575 individuals.

Figure 51: North Sound participants—type of people shared with, among participants who shared

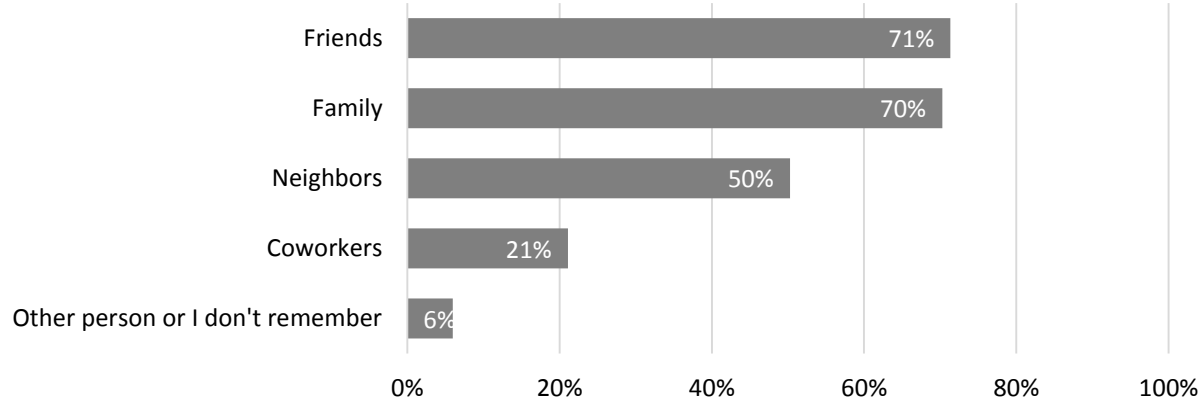
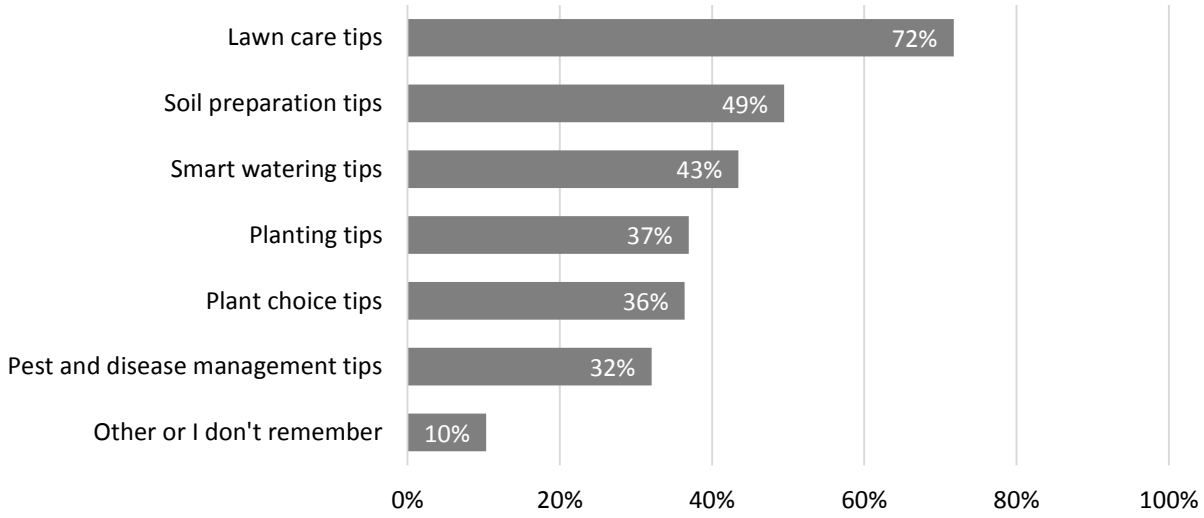


Figure 52: North Sound participants—topics shared, among participants who shared



Participants most frequently shared information with friends (71%), family (70%), and neighbors (50%). They most frequently shared information on lawn care (72%), soil preparation (49%), smart watering (43%), planting (37%), plant choices (36%), and pest and disease management (32%).

Program Costs

Snohomish County staff provided program cost figures for implementing the North Sound program in 2014. Costs for grant administration were excluded to enable comparison to the South Sound program, which was funded by a different grant with different administration requirements. Costs for program evaluation were excluded because future programs are not expected to conduct such intensive evaluations. Implementation costs do not include time spent by WSU Master Gardener volunteers at lecture workshops; however, Snohomish County contributes approximately $20,000 to $25,000 per year to implement a training and certification program to have trained Master Gardener volunteers support lecture workshops.

The 2015 North Sound program cost just over $113,000 to reach 451 households for a cost of $250 per household, as shown in Figure 53. Nearly half of program implementation costs went to staff time for workshop labor (46%). Staff time was significantly higher than in previous years due to the complexity of the project, coordination of and attendance by multiple partner jurisdictions, and the need to ensure consistent delivery across all seven series for the rigorous program evaluation. Recruitment expenses, including staff time to develop targeted mailing lists, accounted for 39% of costs. Snohomish County has consistently found that 1% of invited households register and attend the lectures when the county uses direct mail advertising.

Figure 53. North Sound 2014 program costs

Cost Category	Type	Total Cost (for 7 series)	Average Cost (for 1 series)
Recruitment costs		**$44,285**	**$7,376**
Printing mailers (postcard and flyer)	Expense	$16,962	$2,423
Postage	Expense	$24,383	$3,483
Mailing list generation and clean up (twice)	Staff time	$2,940	$1,470
Lecture workshop expenses		**$16,790**	**$2,720**
Presenters	Consultant	$9,275	$1,325
Language translation (two workshops)	Consultant	$900	$450
Facility rental	Expense	$3,255	$465
Take-home resources	Expense	$2,100	$300
Door prizes	Expense	$1,260	$180
Lecture workshop labor		**$52,500**	**$7,500**
Workshop coordination	Staff time	$15,540	$2,220
Project management	Staff time	$18,480	$2,640
City staff (2 people/series; 8 hours/person)	Staff time	$18,480	$2,640
Total program cost		$113,575	$17,596
Participating households	451		
Cost per household		$252	

Note: this table excludes costs for grant administration, program evaluation, and Master Gardener volunteers.

3. South Sound Program Evaluation

Program Goals and Overview

In 2014, the City of Olympia, in partnership with the City of Tumwater and Thurston County, implemented a natural lawn care education program using an intensive education model featuring home visits, demonstration workshops, and incentives. Implemented in Olympia, Tumwater, and unincorporated Thurston County, this program is referred to as the South Sound program. The South Sound project team consisted of staff members from the City of Olympia, with support from staff members from the City of Tumwater and Thurston County.

The program's goal was to reduce nutrient and pesticide runoff resulting from traditional lawn care practices used on residential lawns and to improve yard health and resiliency by promoting natural lawn care practices.

Program History

In 2009, the City of Olympia began developing an outreach program on "yard care practices protective of water quality" in response to a requirement in its 2007–2013 NPDES permit. Olympia commissioned two research studies to identify its target audience and the barriers and motivators to using natural lawn care practices.[4]

In 2012, Olympia piloted its natural lawn care education model (home visits, demonstration workshops, and incentives), with full implementation in 2014.

Participant Recruitment

Residents were eligible for the program if they (1) lived in detached single-family homes on properties sized less than one acre, (2) owned their home, (3) maintained their own lawn, and (4) applied fast-release chemical fertilizer to their lawn in the past year. The three jurisdictions recruited residents using the following methods:

- **Olympia**: Residents in the southeast quadrant of the city with the target property type received a direct-mail postcard; in addition, neighborhood association contacts and people within the southeast quadrant who had participated in previous city-sponsored lawn aeration or mulch mowing programs were sent emails.
- **Tumwater**: All city residents with the target property type received a direct-mail postcard.
- **Unincorporated Thurston County**: All residents in selected subareas of the county (urban growth areas around Olympia, Tumwater, and Lacey) with the target property type received a direct-mail postcard and all residents (of any property type) received a newsletter advertising the program.

Invited households were instructed to register on a webpage using a pre-screening form to determine eligibility. A total of 190 households participated in the South Sound program in 2014: 75 from Olympia, 30 from Tumwater, and 85 from unincorporated Thurston County. Olympia repeated the program in 2015 with minor modifications, reaching an additional 143 households. Because the 2015 program was still being implemented at the time the evaluation report was written, results presented in this document included data from only 2014 participants.

Lawn Care Topics

Participants learned the following key practices:

- Mulch mowing two to three inches high using a sharp mower blade.
- Testing soil to determine lawn nutrient needs and to accurately calculate needed fertilizer and lime.
- Using slow-release and natural fertilizers instead of fast-release fertilizers or weed-and-feed.

[4] City of Olympia, "Residential Community-Based Social Marketing Behavior Barriers and Motivators Research," conducted by Frause Research, 2009. City of Olympia, Homeowner Lawn and Garden Care Ethnographic Research," conducted by Ethnographic Insight, Inc., 2009.

- Improving soil health by aerating and applying lime.
- Overseeding and top-dressing with compost.
- Watering deeply and infrequently, and proper watering during summer drought dormancy.
- Replacing areas where lawn is unsuccessful with planting beds and native plants.

Program Delivery Model

The South Sound program's goal was to reduce nutrient and pesticide runoff resulting from traditional lawn care practices used on residential lawns and to improve yard health and resiliency by promoting natural lawn care practices. During the year-long program, South Sound participants received the following education and incentives:

- Free soil test in spring.
- Spring and fall lawn coach consultations through home visits covering current lawn and soil conditions based on soil test results and visual inspection, desired results, and recommended practices to achieve those results.
- Demonstration workshops covering:
  - Lawn and soil health and water quality protection.
  - Calibrating spreaders and proper application of fertilizer and lime.
  - Aerating, top-dressing with compost, and overseeding.
  - Mowing and watering.
- Free slow-release fertilizer and lime in quantities based on participants' soil test results.
- $30 rebate towards lawn aeration service or free rental of lawn aerator equipment.

More information on program activities, logistics, and details can be found in Appendix H-01—Final Project Report for G1400481 and Appendix H-03—South Sound Logistics Guide.

Evaluation Approach and Activities

The evaluation team evaluated the education program using surveys, interviews, and program data described in *Section* 1—*Introduction and Overview*. For the South Sound, immediate post-workshop surveys were distributed by email in summer 2014 after participants had received the spring lawn coach visit; received the incentives; and had attended the demonstration workshop. Figure 54 summarizes the schedule of evaluation and education activities for participants. Figure 55 on page 68 presents additional details on participant and nonparticipant surveys, including distribution methods and response rates.

Figure 54. South Sound evaluation and education schedule

Evaluation and Education	All participants
Baseline survey	Spring 2014, before soil test
Spring lawn coach visit; free soil test, fertilizer, and lime; aerator rental discount; demonstration workshop	Spring to early summer 2014
Immediate post-outreach survey	Summer 2014
Fall lawn coach visit	Fall 2014
Medium-term post-outreach survey	Summer 2015
Interview (20 participants)	Summer 2015

Survey data were analyzed to develop tables comparing responses by geographic subgroups (sometimes called cross-tabulation). Participant data were analyzed to present comparisons by each of the three participating jurisdictions: City of Olympia, City of Tumwater, and unincorporated Thurston County.

Additional details on evaluation methods and results for the South Sound are presented in the appendices.

- Appendix A—Evaluation Plan: Additional details on participant recruitment methods, sample selection for nonparticipants, survey distribution methods, and evaluation considerations.
- Appendix D—Detailed survey summary tables.
- Appendix E—Survey instruments and interview guides.
- Appendix G—Summaries of program staff surveys, and summaries of participant interviews.

The evaluation team evaluated the education programs using surveys, interviews, and program data. Evaluation elements intended to measure behavior change and obtain feedback from participants are listed in Figure 55.

Figure 55. South Sound surveys and participation rates

	Evaluation Elements	Respondents & Response Rates
Baseline survey	**Participants:** Web-based survey on practices and understanding before program (spring 2014 separate from application form and 2015 incorporated into application form)	**Participants** Participating households: 190* Survey respondents: 170 Response rate: 89%
	Nonparticipants: Mail-based paper survey with link for web-based responses on practices and understanding (May-June 2014)	**Nonparticipants** Invited households: 2,000 Survey respondents: 652** Response rate: 33%
Immediate post-outreach survey	**Participants:** Web-based survey for program feedback (June 2014)	**Participants** Participating households: 190 Survey respondents: 124 Response rate: 65%
Medium-term post-outreach survey	**Participants:** Web-based survey on practices, changes in practices, and program feedback, with incentive of free lime for completing the survey (May-July 2015)	**Participants** Participating households: 190 Survey respondents: 124 Response rate: 65%
	Nonparticipants: Mail-based paper survey with link for web-based responses on practices (May-June 2015)	**Nonparticipants** Invited households: 2,000 Survey respondents: 731* Response rate: 37%
Medium-term post-outreach interviews	**Participants:** Phone interviews for more information on changes and program feedback (July-August 2015)	**Participants** 20 interviewees

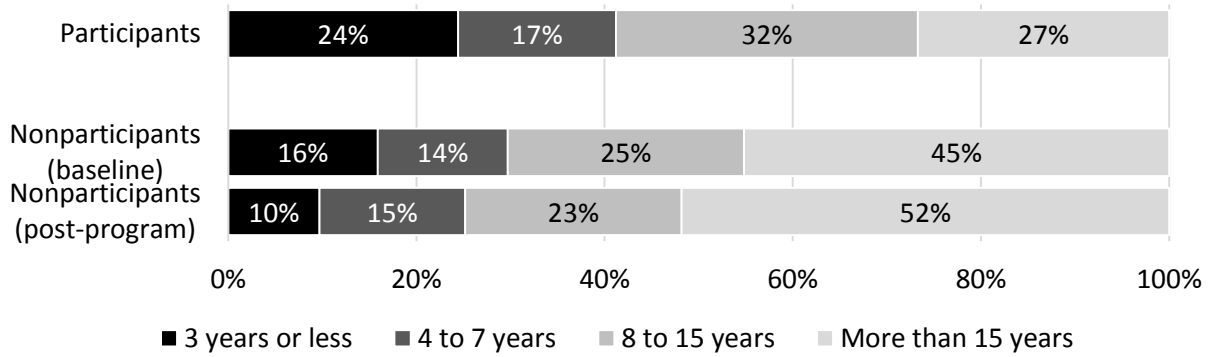
* For one housing development in unincorporated Thurston County, one resident coordinated all aspects of the program, including completing participant surveys.
** For parts of the analysis, nonparticipant respondents were limited to those who would have been eligible for the education program.

Demographics

Both the baseline and post-outreach nonparticipant surveys included questions about demographics. Participants were asked demographic questions in only the baseline survey, under the assumption that these demographics did not change during the program. Figure 56 through Figure 61 summarize these key demographics. Chart captions notated with (PNP) indicate that differences in the demographics of participants and nonparticipants were statistically significant.

Years in Home

Figure 56. Years living in current home among South Sound participants and nonparticipants (PNP)



Participants were more likely to have lived in their homes three years or less, indicating that this audience is particularly receptive to attending natural yard care education.

While all types of residents participated, newer homeowners had a higher participation rate.

Subgroup Comparison by Years in Home

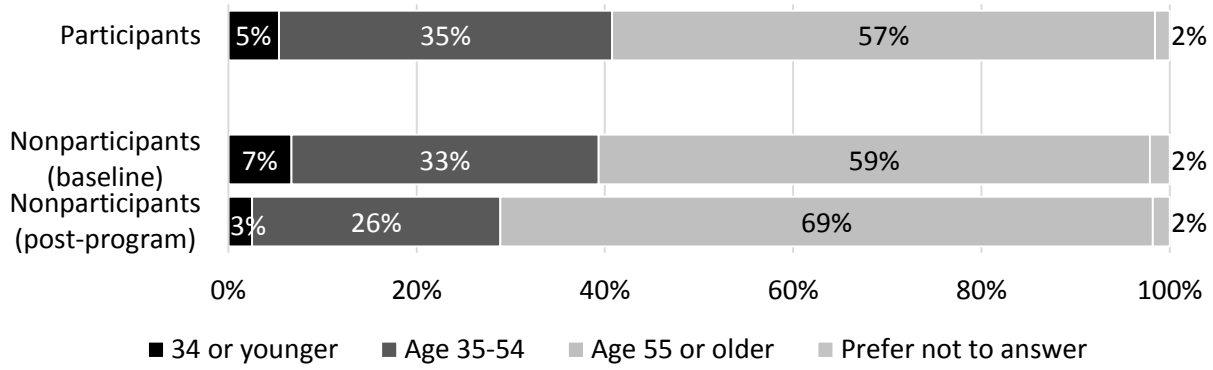
Participant baseline, post-outreach, and behavior change levels were cross-tabulated and compared for subgroups based on their years in their current home. Differences were not statistically tested and are reported in Figure 57 only when they were greater than 25 percentage points. Differences in practices do not appear substantial enough cause programs to target one group over another. Appendix D-14 presents a summary table with complete subgroup comparison data.

Figure 57. South Sound participant subgroup comparisions by years in home

Practice	Greatest change in behavior or understanding	Least change in behavior or understanding
Calibrate spreader when using new fertilizer	Seven years or less (52% increase) ■ 24% baseline ■ 76% post-outreach	More than fifteen years (22% increase) ■ 52% baseline ■ 73% post-outreach
Measure sprinkler watering rate, if waters	Seven years or less (54% increase) ■ 4% baseline ■ 58% post-outreach	Eight to fifteen years (18% increase) ■ 27% baseline ■ 45% post-outreach

Age

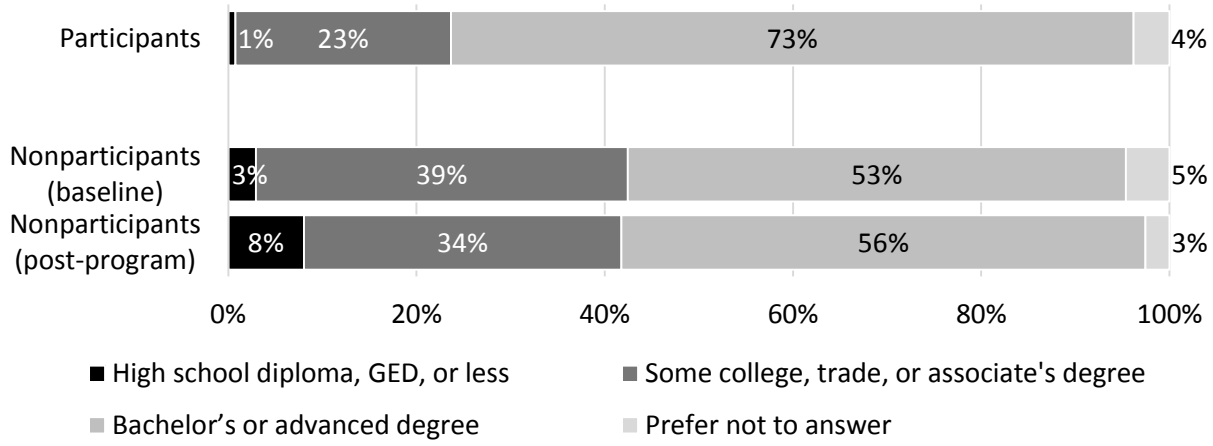
Figure 58. Age among South Sound participant and nonparticipants (PNP)



Participants had similar age profiles as nonparticipant respondents to the baseline survey but were generally younger than nonparticipant respondents to the post-program survey.

Education

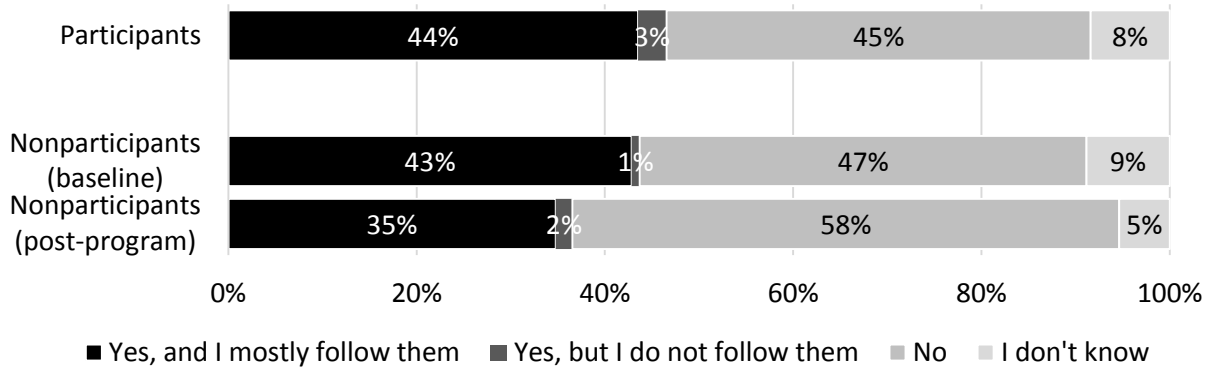
Figure 59. Highest level of education among South Sound participant and nonparticipants (PNP post-program)



Participants were more likely to have a college or advanced degree and slightly less likely to have a high school diploma or GED as their highest level of education.

Yard Appearance Guidelines

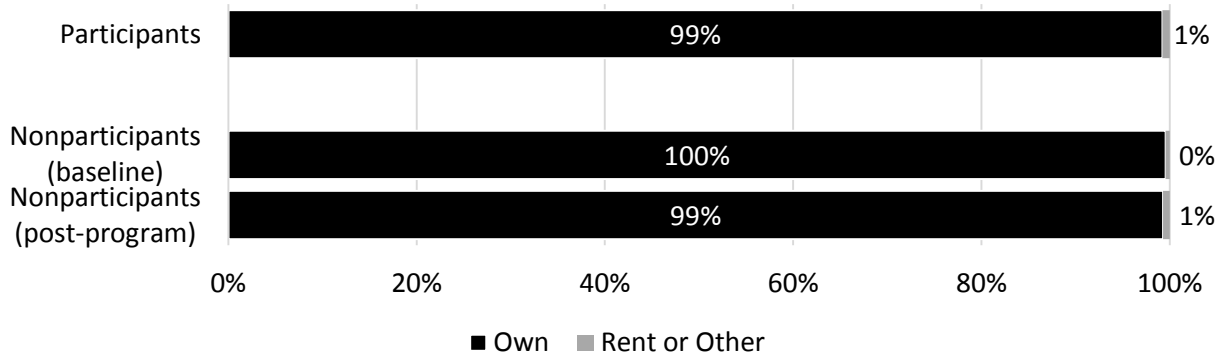
Figure 60. Whether a homeowners association or landlord sets guidelines for yard appearance among South Sound participant and nonparticipants (PNP post-program)



Survey respondents were asked whether a homeowners association or landlord sets guidelines for yard appearance. Similar shares of participants and nonparticipants in the baseline survey reported having and following guidelines, while nonparticipants in the post-program survey were less likely to have and follow guidelines.

Home Ownership

Figure 61. Home ownership among South Sound participant and nonparticipants



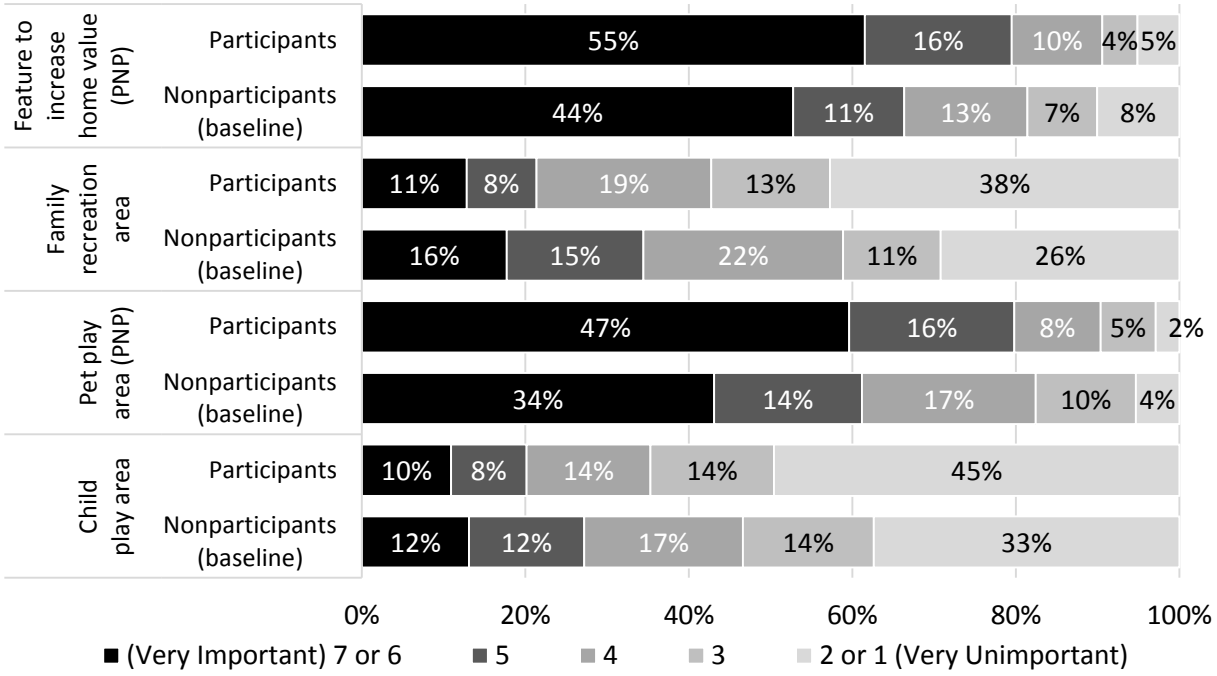
Nearly all participants and nonparticipants owned their homes. Individuals who reported renting were screened out of the program, although a few individuals who reported neither owning nor renting were not screened out.

Attitudes and Understanding

Baseline surveys included several questions about attitudes and understanding related to yards and yard care. In this section, chart captions or axis labels notated with (PNP) indicate that differences in the attitudes and understanding of participants and nonparticipants were statistically significant.

Importance of Lawn Uses

Figure 62. South Sound participant and nonparticipant rating of importance of various uses of their yard



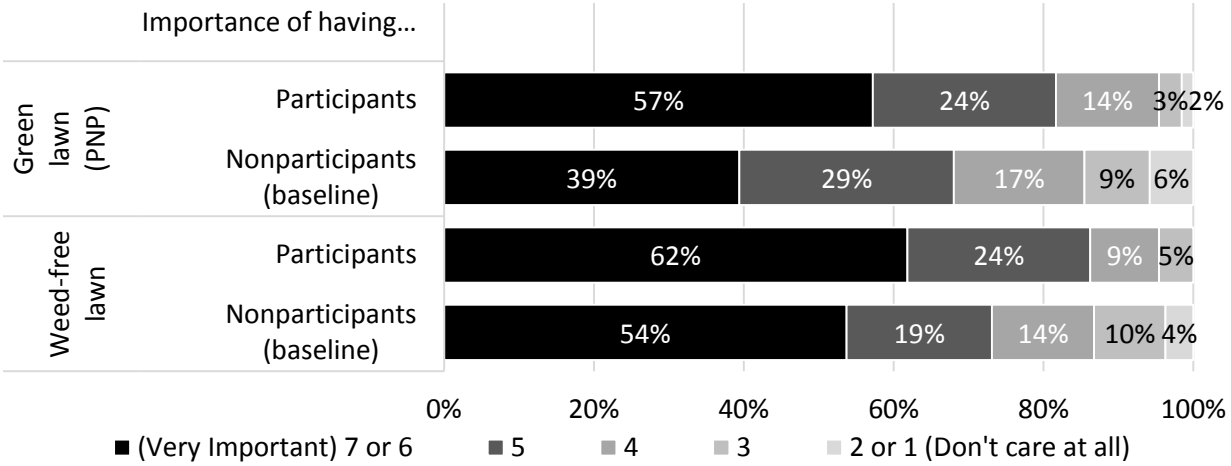
Participants placed more importance on using their yards as a feature to increase home value and as an area for pets to play.

Subgroup Comparison by Important Yard Uses

Participant baseline, post-outreach, and behavior change levels were cross-tabulated and compared for subgroups that placed high importance (a rating of six or seven on the seven-point scale) on each of the five potential yard uses. Differences were not statistically tested and are not reported here because no difference was greater than 25 percentage points. Appendix D-14 presents a summary table with complete subgroup comparison data.

Importance of Lawn Characteristics

Figure 63. South Sound participant rating of importance of yard characteristics



South Sound program participants placed more importance on having a green lawn when compared to nonparticipants.

Subgroup Comparison by Importance of Yard Characteristics

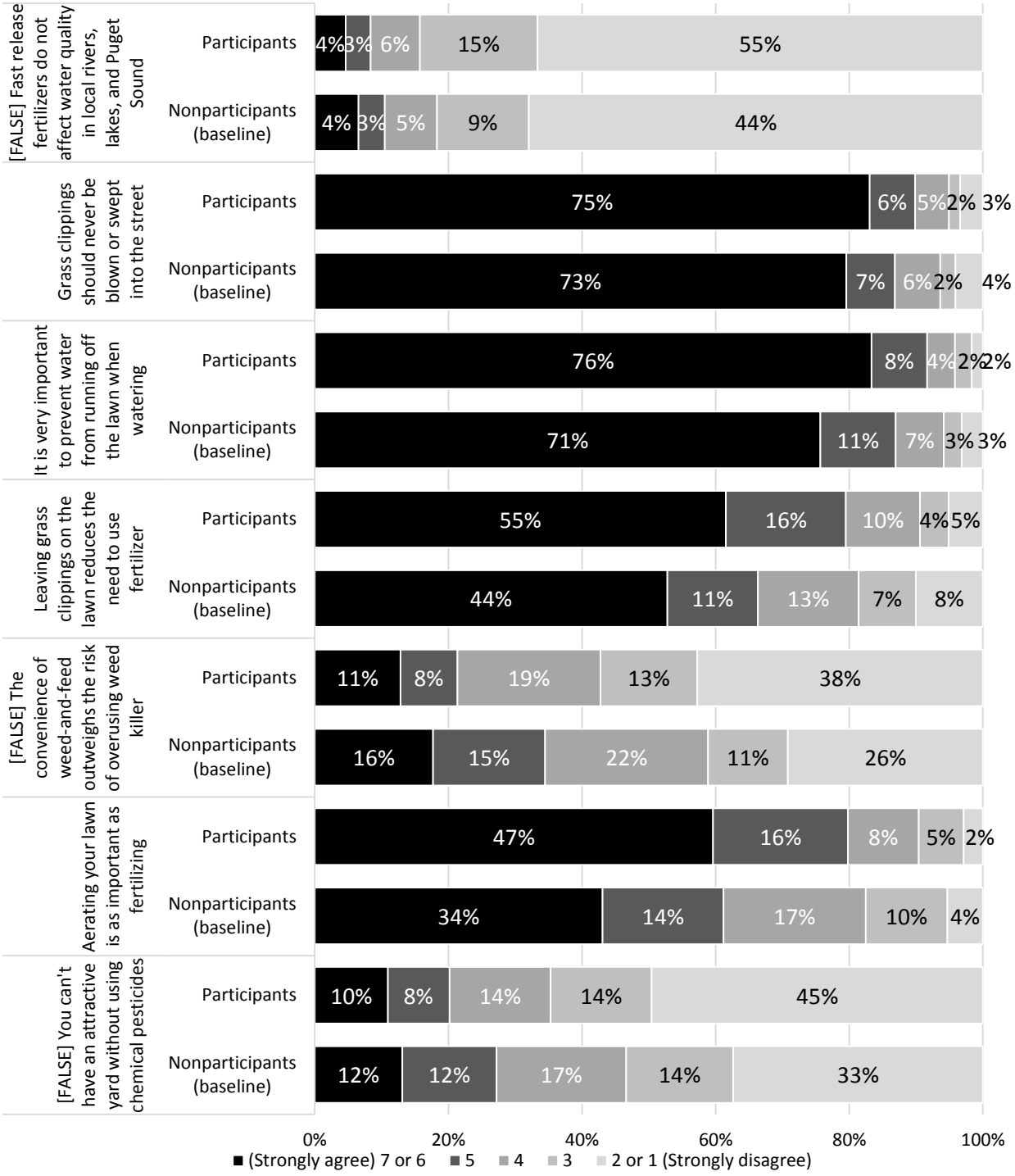
Participant baseline, post-outreach, and behavior change levels were cross-tabulated and compared for subgroups based on their importance ratings for having a weed-free lawn and green lawn. Differences were not statistically tested and are reported in Figure 64 only when the difference was greater than 25 percentage points. In general, participants who placed more importance on having a weed-free or green lawn showed lower levels of behavior change. Appendix D-14 presents a summary table with complete subgroup comparison data.

Figure 64. South Sound participant subgroup comparisions by importance of yard characteristics

Practice	Greatest change in behavior or understanding	Least change in behavior or understanding
Calculate lawn area and application rate to determine fertilizer use	Weed-free lawn, somewhat important (64% increase) ■ 11% baseline ■ 75% post-outreach	Weed-free lawn, very important (40% increase) ■ 22% baseline ■ 62% post-outreach
Always sweep fertilizer back onto the lawn	Weed-free lawn, somewhat important (37% increase) ■ 25% baseline ■ 62% post-outreach	Weed-free lawn, very important (2% increase) ■ 43% baseline ■ 45% post-outreach
Fertilize in May, September, or October	Weed-free lawn or green, somewhat important (27% to 29% increase) ■ 53% to 56% baseline ■ 79% to 85% post-outreach	Green or weed-free lawn, very important (8% decrease to 3% increase) ■ 71% to 69% baseline ■ 63% to 72% post-outreach

Understanding of Natural and Conventional Lawn Care Practices

Figure 65. South Sound participant and nonparticipant understanding of natural and conventional lawn care practices

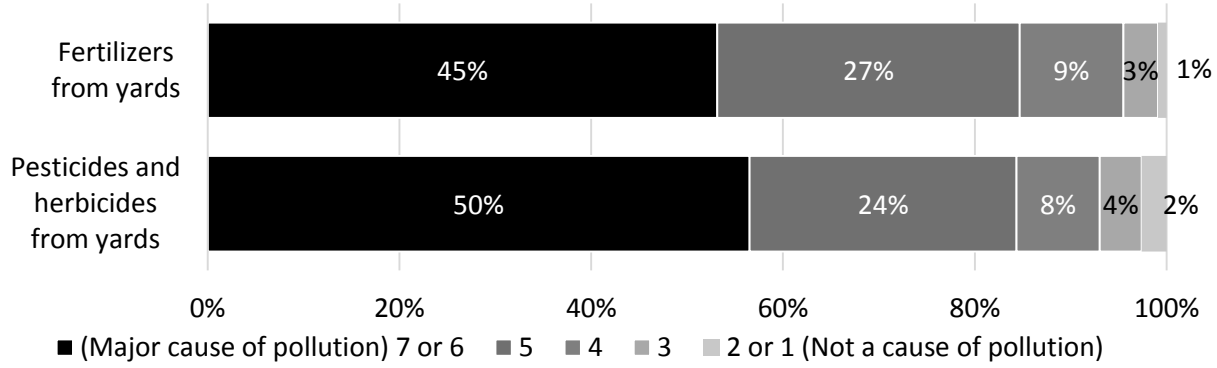


Participants and nonparticipants understanding of lawn care practices varied by practice.

Both groups had a strong baseline understanding regarding keeping grass clippings out of the street and preventing runoff when watering. About 70% of participants and 53% of nonparticipants disagreed with a false statement that fast-release fertilizers do not affect Puget Sound. About 51% of participants and 37% of nonparticipants disagreed with a false statement that the convenience of weed-and-feed outweighs the risk of overusing weed killer (meaning they agree that the risk is not worth using weed-and-feed); these lower percentages indicate that more outreach will be needed on the risks of weed killer and techniques for controlling weeds efficiently.

Understanding of Yard Care Product Contribution to Water Pollution

Figure 66. South Sound participant understanding of the contribution of yard care products to water pollution



At baseline, most participants understood that fertilizers, pesticides, and herbicides from yards were a major cause of water pollution.

Nonparticipants were not asked these questions. Participants may have signed up for the program because they had a greater baseline understanding of the effects of these products.

Subgroup Comparison by Understanding of Yard Care Product Contribution to Water Pollution

Participant baseline, post-outreach and behavior change levels were cross-tabulated and compared for subgroups based on their baseline understanding of whether key yard care products contribute to water pollution. Differences were not statistically tested and are reported in Figure 67 only when the difference was greater than 25 percentage points. In general, participants who strongly agreed that fertilizers and pesticides are a major cause of water pollution showed higher levels of behavior change for the practices where differences were substantial than participants who only somewhat agreed. Appendix D-14 presents a summary table with complete subgroup comparison data.

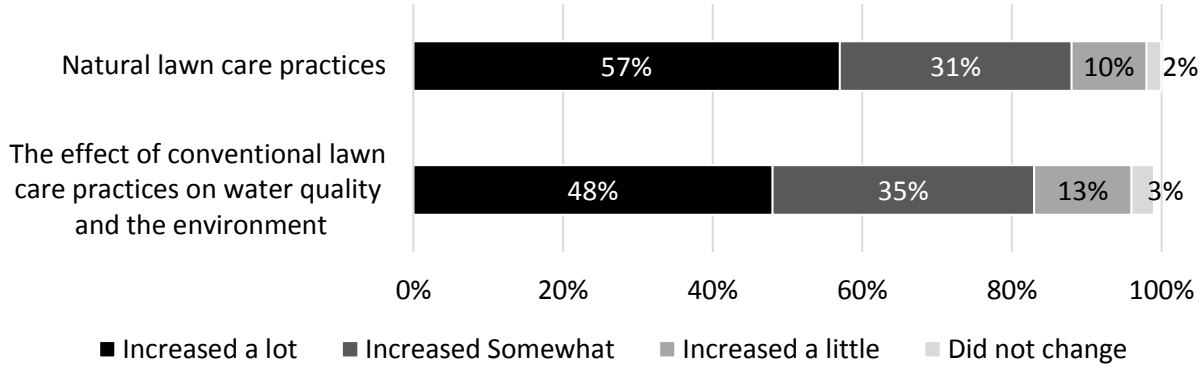
Figure 67. South Sound participant subgroup comparisions by understanding of yard care product contribution to water pollution

Practice	Greatest change in behavior or understanding	Least change in behavior or understanding
HARMFUL PRACTICE: Use weed-and-feed (any amount)	Strongly agree (6 or 7) that fertilizers and pesticides are a major cause of water pollution (64% decrease) ■ 69% to 70% baseline ■ 4% to 6% post-outreach	Somewhat agree (4 or 5) that fertilizers and pesticides are a major cause of water pollution (25% to 27% decrease) ■ 46% to 50% baseline ■ 21% to 23% post-outreach
HARMFUL PRACTICE: Use fast-release fertilizer or weed-and-feed	Strongly agree (6 or 7) that pesticides are a major cause of water pollution (61% decrease) ■ 67% baseline ■ 6% post-outreach	Somewhat agree (4 or 5) that pesticides are a major cause of water pollution (27% decrease) ■ 43% baseline ■ 17% post-outreach
Always sweep fertilizer back on the lawn	Strongly agree (6 or 7) that fertilizers and pesticides are a major cause of water pollution (33 to 34% increase) ■ 26% to 29% baseline ■ 61% to 62% post-outreach	Somewhat agree (4 or 5) that pesticides are a major cause of water pollution (11% decrease) ■ 41 baseline ■ 29% post-outreach
Fertilize in May, September, or October	Strongly agree (6 or 7) that fertilizers are a major cause of water pollution (29% increase) ■ 51% baseline ■ 80% post-outreach	Somewhat agree (4 or 5) that fertilizers are a major cause of water pollution (5% decrease) ■ 71% baseline ■ 67% post-outreach

Change in Understanding of Lawn Care Practices and Effects on Water Quality

In the post-outreach survey, participants were asked to self-assess their change in understanding about natural yard care practices and the effects of conventional yard care practices.

Figure 68: South Sound participant change in understanding of lawn care practices and effects on water quality



Almost all participants said the program increased their understanding of natural lawn care practices and of the effect of lawn care practices on water quality and the environment.

Supporting these survey results, 15% of participants mentioned avoiding chemical use as one of the most useful practices they learned from the program when asked in the medium-term post-outreach survey.

Behavior Change, Knowledge, and Understanding Outcomes

After being accepted into the program, South Sound participants took a baseline survey on their yard care habits regarding mowing; fertilizer use; watering; lime, aeration, and soil testing; pest, disease, and weed management; and general understanding of natural lawn care practices. While the final lawn care coach home visits took place in fall 2014, participants received program reminder emails and were able to claim the aeration rebate through March 2015. Six months after completing the lawn coaching and three months after the formal program end date, they took a follow-up survey covering many of these topics and changes they had made since the workshops.

This section summarizes behavior change outcomes measured by these surveys. Randomly selected nonparticipants took similar “before” and “after” surveys. This report notes where changes in participant behavior may be due to outside factors (such as weather, region-wide education, or yard care product manufacturer advertising) where similar changes were seen in nonparticipants.

Figures in this report are been rounded to the nearest percentage point. As a result, the sum of "baseline" and "change" figures may not appear to equal the "post-outreach" figure, but each figure is independently the most accurate rounded amount.

In the narrative findings, two icons indicate the **level of behavior change** (H, M, or L) from baseline to medium-term post-outreach and the **post-outreach use** (✓, △, ●) as follows:

Behavior Change

H High behavior change
- 20 or more percentage points

M Moderate behavior change
- 10 to 19 percentage points

L Low behavior change
- Less than 10 percentage points

Post-Outreach Use

✓ High post-outreach use
- 70% or more for preferred practices
- 25% or less for harmful practices

△ Moderate post-outreach use
- 40% to 69% for preferred practices
- 26% to 60% for harmful practices

● Low post-outreach use
- Less than 40% for preferred practices
- More than 60% for harmful practices

Unless otherwise noted, charts and tables use the following notations regarding the statistical analysis:

(P)	Indicates that only participants showed a statistically significant difference between baseline and medium-term post-outreach adoption levels.
(NP)	Indicates that only nonparticipants showed a statistically significant difference between baseline and medium-term post-outreach adoption levels.
(P)(NP)	Indicates that both participants and nonparticipants showed a statistically significant difference between baseline and medium-term post-outreach adoption levels.
(W)	Indicates that question wording was different between before and after survey, requiring responses to be combined for statistical comparison. This notation can be combined with (P), (NP), and (P)(NP).

Additional details on results are presented in Appendix D—South Sound Results Tables.

Key Findings

Figure 69. South Sound lawn care practices, sorted by practice type

Type	Yard Care Practice or Understanding	Baseline Use	Change in Behavior/Understanding	Post-Outreach Use
Using Weed-and-Feed	HARMFUL PRACTICE: Using weed-and-feed (any amount) (P)(NP)	63%	H -47%	16% ✓
Choosing Fertilizer	Use slow release, natural, or organic fertilizer (P)	38%	H 55%	93% ✓
	HARMFUL PRACTICE: Use fast-release fertilizer or weed-and-feed (P)	60%	H -51%	9% ✓
	Calculate lawn area and application rate to determine fertilizer use (P)	18%	H 47%	65% △
	Calibrate spreader when using new fertilizer (P)(NP)	35%	H 36%	71% ✓
	Know how much nitrogen was applied (any amount) (P)	3%	H 25%	28% ●
Applying Fertilizer	Always sweep fertilizer back onto lawn	36%	M 11%	48% △
	Fertilize in May, September, or October	64%	L 7%	71% ✓
	HARMFUL PRACTICE: Fertilize in January or February	5%	L 6%	11% ✓
Managing Weeds	HARMFUL PRACTICE: Weed: broadly apply weed-and-feed or weed killer (P)	46%	H -35%	11% ✓
	Weeds: pull, dig, tolerate, or spot-treat	89%	L 6%	94% ✓
Soil Testing	Plan to test soil every 3 years or more often (P)	3%	H 59%	62% △
Applying Lime	Apply lime every 2-3 years (P)	31%	H 60%	91% ✓
Aerating	Aerate lawn every 2 years (P)(NP)	34%	H 49%	84% ✓
Mowing	Sharpen mower blade every year (P)	27%	H 37%	64% △
	Sometimes or always mulch mow in dry months (P)	51%	H 21%	72% ✓
	Sometimes or always mulch mow in wet months (P)	48%	M 17%	65% △
	Mow 2-3" or higher (P)	91%	L 6%	98% ✓
Watering	Measure sprinkler watering rate (tuna can test), if waters (P)	17%	H 43%	60% △
	Water once a week or less	36%	M 11%	47% △
	ACCEPTABLE PRACTICE: Water two to three times per week	46%	L -9%	36% ●
	HARMFUL PRACTICE: Waters daily or every other day	19%	L -2%	17% ✓

Notes: For measures of soil testing, baseline use describes actual past behavior, while the change in behavior reflects the intention of participants to conduct a soil test in the future. The unusually dry weather in 2015, when participants took the medium-term post-outreach survey, may have affected watering practices.

Figure 70. South Sound lawn care practices, sorted by level of behavior change

Type	Yard Care Practice or Understanding	Baseline Use	Change in Behavior/Understanding	Post-Outreach Use
Applying Lime	Apply lime every 2-3 years (P)	31%	H 60%	91% ✓
Soil Testing	Plan to test soil every 3 years or more often (P)	3%	H 59%	62% △
Fertilizing	Use slow release, natural, or organic fertilizer (P)	38%	H 55%	93% ✓
Fertilizing	HARMFUL PRACTICE: Use fast-release fertilizer or weed-and-feed (P)	60%	H -51%	9% ✓
Aerating	Aerate lawn every 2 years (P)(NP)	34%	H 49%	84% ✓
Using Weed-and-Feed	HARMFUL PRACTICE: Using weed-and-feed (any amount) (P)(NP)	63%	H -47%	16% ✓
Fertilizing	Calculate lawn area and application rate to determine fertilizer use (P)	18%	H 47%	65% △
Watering	Measure sprinkler watering rate (tuna can test), if waters (P)	17%	H 43%	60% △
Mowing	Sharpen mower blade every year (P)	27%	H 37%	64% △
Fertilizing	Calibrate spreader when using new fertilizer (P)(NP)	35%	H 36%	71% ✓
Managing Weeds	HARMFUL PRACTICE: Weed: broadly apply weed-and-feed or weed killer (P)	46%	H -35%	11% ✓
Fertilizing	Know how much nitrogen was applied (any amount) (P)	3%	H 25%	28% ●
Mowing	Sometimes or always mulch mow in dry months (P)	51%	H 21%	72% ✓
Mowing	Sometimes or always mulch mow in wet months (P)	48%	M 17%	65% △
Watering	Water once a week or less	36%	M 11%	47% △
Fertilizing	Always sweep fertilizer back onto lawn	36%	M 11%	48% △
Watering	ACCEPTABLE PRACTICE: Water two to three times per week	46%	L -9%	36% ●
Fertilizing	Fertilize in May, September, or October	64%	L 7%	71% ✓
Mowing	Mow 2-3" or higher (P)	91%	L 6%	98% ✓
Managing Weeds	Weeds: pull, dig, tolerate, or spot-treat	89%	L 6%	94% ✓
Fertilizing	HARMFUL PRACTICE: Fertilize in January or February	5%	L 6%	11% ✓
Watering	HARMFUL PRACTICE: Waters daily or every other day	19%	L -2%	17% ✓

Notes: For measures of soil testing, baseline use describes actual past behavior, while the change in behavior reflects the intention of participants to conduct a soil test in the future. The unusually dry weather in 2015, when participants took the medium-term post-outreach survey, may have affected watering practices.

Practices that Protect Water Quality

After the program, at least 40% of participants were using all the key practices that directly protect water quality, as shown in Figure 71. At least 70% were avoiding products that harm water quality: weed-and-feed, fast-release fertilizer, and broadly applied weed killer.

Notably, the program achieved a high level of behavior change in reducing weed-and-feed use: the share of participants who used this product decreased from 62% to 16%.

As described below, the program also achieved varying levels of behavior change in practices that support a healthy yard and reduce the weed, pest, and disease reasons for which people typically use toxic yard care products.

Figure 71. South Sound adoption of practices that protect water quality

H ✓	Avoiding weed-and-feed use
H ✓	Avoiding fast-release fertilizer use
H ✓	Aerating every two to three years
H ✓	Calibrating the fertilizer spreader when using a new fertilizer
H ✓	Avoiding broad application of weed killer
H △	Calculating the lawn area and fertilizer application rate
M △	Sweeping fertilizer back onto the lawn

Where the Program is Working Effectively

H ✓ The largest reported percentage changes in participant behavior were in practices associated with program incentives: applying lime, using slow-release or organic fertilizer instead of fast-release fertilizer, aerating, and avoiding weed-and-feed.

The largest observed behavior changes after the program were in practices related to program demonstrations and incentives. Lime application, use of slow-release or organic fertilizer (with consequent avoidance of fast-release fertilizer and weed-and-feed), and aeration of lawns increased among participants by at least 45 percentage points each. More than three-quarters of participants were using these practices at the end of the program.

These results are consistent with participant survey responses indicating these practices were among the most useful things they learned during the program and the information they most commonly shared with others.

H ✓ Practices with the next largest reported percentage changes were related to calibrating spreaders, avoiding broad application of weed killers, and mulch mowing in dry months.

These practices are all associated with outdoor demonstrations. In addition, avoiding broad application of weed killers (which also includes weed-and-feed) could also be associated with the program incentives, which provided a free fertilizer that participants could use instead of pollution-generating alternatives.

L ✓ While there were low to no changes in fertilizing timing, mowing height, using at least one least-toxic weed management technique, and watering frequency, these practices were high to begin with.

While use of these practices was high before and after the program, these topics should not be removed from future programs. For example, while reported behavior change was relatively small, some participants mentioned in the post-outreach survey that mowing height (14% of participants) and mulch mowing (12%) were among the most useful things they learned. In contrast, while most participants were using at some least-toxic weed management techniques before and after the program, interviewed participants reported that they need more information and resources to manage weeds and pests, particularly large infestations.

H △ Participants made substantial changes but have room for improvement in planning to test their soil every three years, calculating lawn area to determine fertilizer use, measuring sprinkler watering rates, and sharpening mower blades.

While participants made substantial changes in these areas, the post-outreach use for the practices (60% to 65%) indicates that more education or incentives may be needed to motivate the remaining participants. For soil testing, 62% of participants plan to test their soil again within the recommended three years, although more plan to test within five years (73% total).

H ● A quarter more participants know how much nitrogen was applied to their lawn, but substantial room for improvement remains.

Before the program, almost no participants (3%) could state how much nitrogen was applied to their lawn, compared to 28% after the program. Even fewer reported that it was no higher than the recommended amount (16%).The low knowledge after the program may be due in part to the fertilizer incentive: participants were not required to calculate and purchase the correct quantity of fertilizer they needed because the program provided exactly the quantity they needed.

Where the Program Achieved Moderate Change but Room for Improvement Remains

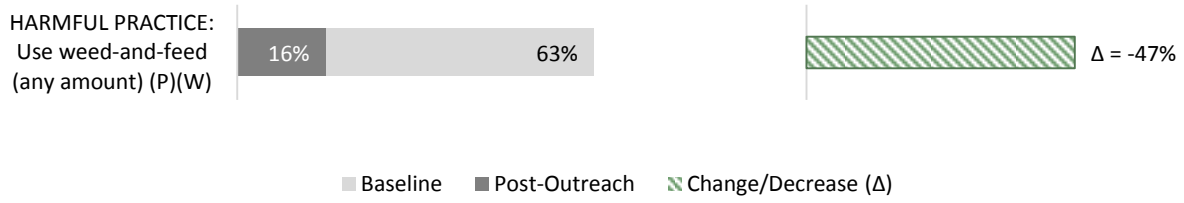
M ⚠ Participants made modest changes and have substantial room for improvement in mulch mowing in wet months and always sweeping fertilizer back onto the lawn.

While participants made modest changes in these areas, the post-outreach use for the practices indicate that more education or incentives may be needed to motivate participants. Fewer than half of participants reported always sweeping fertilizer (48%) after the program.

Detailed Findings

Weed-and-Feed Use

Figure 72: South Sound participant weed-and-feed use



H ✓ The share of participants who reported having used weed-and-feed decreased by nearly three-quarters after the workshops.

While the share of nonparticipants using weed-and-feed did not change substantially (32% in baseline and 35% post-outreach), those using it reported using it more frequently in the post-program survey compared to the baseline survey.

H ✓ While 16% of participants used weed-and-feed after the program, about one-quarter (27%) may use it in the future.

In the medium-term post-outreach survey, participants were presented with a list of the natural lawn care practices they had been taught during the program and asked to mark them as "will use," "won't use," and "not sure." One of the practices was "never use weed-and-feed." Approximately 27% of participants selected "won't use" for this practice, a higher share than reported using weed-and-feed in 2014. There are two likely explanations for this discrepancy. First, the results may be inaccurate as question wording may have confused participants into thinking they should mark "won't use" if they planned to follow the practice of "never use weed-and-feed" rather than "will use" (which they marked for the other BMPs in the list). Second, the results may be accurate if participants are not willing to rule out the possibility of ever using weed-and-feed in the future.

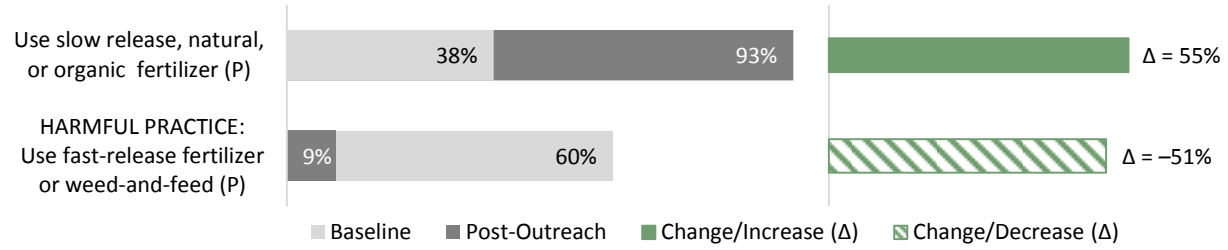
The evaluation team believes that it is equally or more likely that participants are reluctant to rule out all future use of weed-and-feed. When put in context of the entire question with the other practices, the question is less confusing than when presented alone. In addition, compared to other practices, many more participants said they were "not sure" whether they would never use weed-and-feed, supporting

the hypothesis that participants were hesitant to rule it out rather than confused. In addition, several interviewed participants mentioned challenges with or requested more information on eliminating weeds and pests without toxic chemicals, indicating they may not yet feel confident they can avoid chemicals such as weed-and-feed.

Fertilizer Choices

In this section, participants were asked to choose from a long list of fertilizer types. In this comparison, participants were asked to select from a long list of fertilizers, including weed-and-feed.

Figure 73: South Sound participant fertilizer type used



H ✓ Use of slow-release or organic fertilizers more than doubled, with almost all participants using these products after starting the program.

The statistically significant increase in the use of slow-release or organic fertilizer was supported by the free fertilizer provided to all program participants, in addition to hands-on lessons on why and how to use this product. While most participants (96%) plan to continue using slow-release fertilizer, jurisdictions may need to help them overcome key challenges mentioned by participant during interviews: they perceive that slow-release fertilizer is carried by few yard care stores and perceive the product to be costly.

H ✓ Participants also substantially decreased use of fast-release fertilizer or weed-and-feed after starting the program.

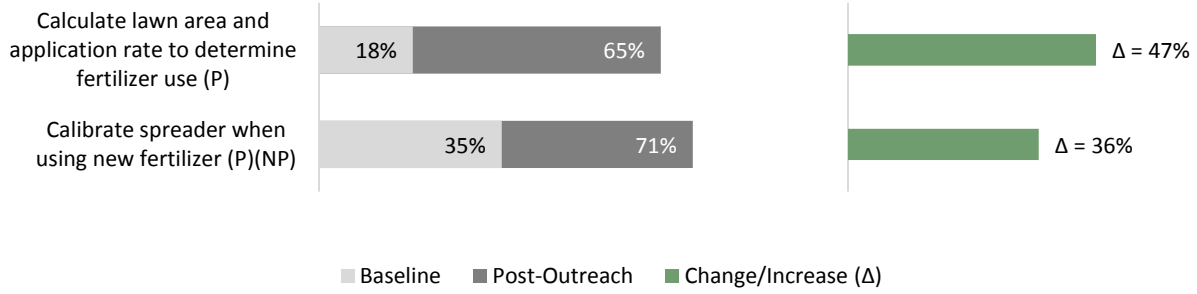
Again, this change was likely supported by the free slow-release fertilizer provided to participants. In this comparison, participants were asked to select from a long list of fertilizer types, including weed-and-feed.

Note that this question came before the question focused on weed-and-feed, so participants may not have realized that they used the product without the extended definition that weed-and-feed contains both fertilizer and weed killer. Alternatively, participants who used weed-and-feed might have selected a different description of the product (such as “chemical fertilizer”) when asked to mark which fertilizers they use.

Fertilizer Application Methods

Application Practices

Figure 74: South Sound participant fertilizer application practices



H ⚠ The share of participants who calculated their lawn area to determine how much fertilizer to use substantially increased, although one-third did not perform this practice.

During the program, program staff calculated lawn area and provided the recommended amount of fertilizer for the participants, which may have reduced the share who said they performed this practice in 2014. The vast majority of participants (88%) intend to continue this practice in the future.

H ✓ The share of participants who calibrated spreaders when using new fertilizer substantially increased after the program, although nearly one-third did not perform this practice.

Spreader calibration posed challenges that additional education, personalized assistance, or information on choosing spreaders that are easier to calibrate could address. Program staff said that the time allocated to fertilizer application demonstrations was too short, and several participants reported struggling with spreader settings in both surveys and phone interviews. Despite these challenges, most participants (79%) plan to continue calibrating their spreader in the future.

In the same period, more nonparticipants reported calibrating their spreaders (15% baseline and 26% post-outreach), but the increase was not nearly as large as the change among participants.

Awareness of Nitrogen Quantities

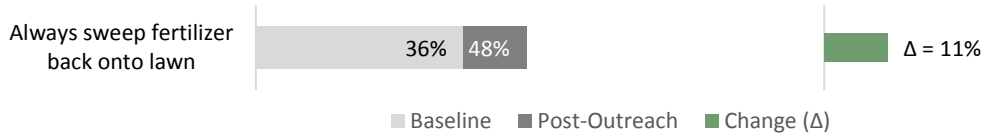
Figure 75: South Sound participant nitrogen awareness

H ● The share of participants who knew how much nitrogen was applied to their lawn substantially increased after the program, but most still did not know the amount.

One possible explanation is that the program provided participants with the amount of fertilizer they needed, so participants may not have fully absorbed the information in the same way they would have if they had to perform the calculations and purchase fertilizer themselves.

Fertilizer Clean-up Practices

Figure 76: South Sound participant fertilizer clean-up practices

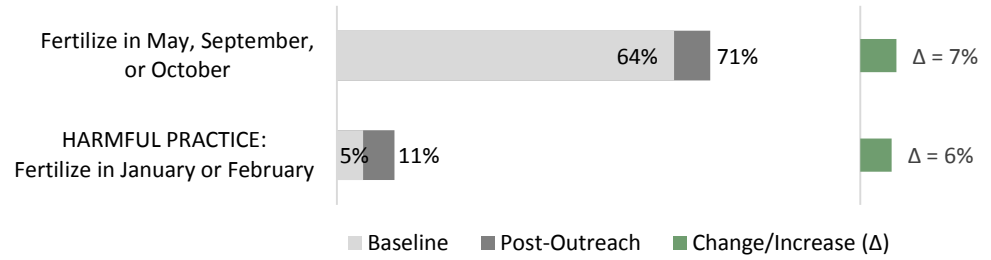


M ▲ The increase in participants who sweep excess fertilizer back onto their lawns was not statistically significant, and less than half of participants reported doing this practice in the post-program survey.

While almost all participants said they intend to perform this practice in the future (93%), it seems unlikely they will start sweeping without additional education or motivation if they did not do so during the program.

Fertilizer Timing

Figure 77: South Sound participant fertilizer timing

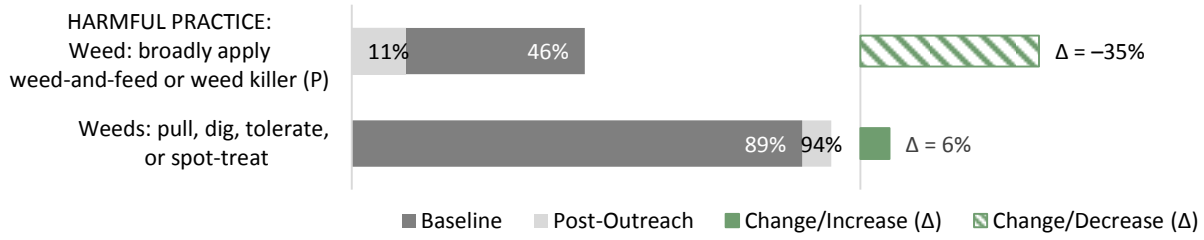


L ✓ There was no statistically significant difference in the months when participants fertilized, and one-quarter continued to fertilize during mid-winter and mid-summer.

Fertilizer is best applied in late spring or early fall (May, September, or October) and should not be applied in winter (January or February). Most participants were already fertilizing during the recommended periods, and the small change was not statistically significant. However, slightly more participants fertilized in mid-winter after the program (indication that behavior change went in the wrong direction, although the difference was not statistically significant).

Weed Management

Figure 78: South Sound participant pest, disease, and weed management practices



H ✓ Fewer participants used toxic weed management techniques, with one in ten using an undesirable technique after the program.

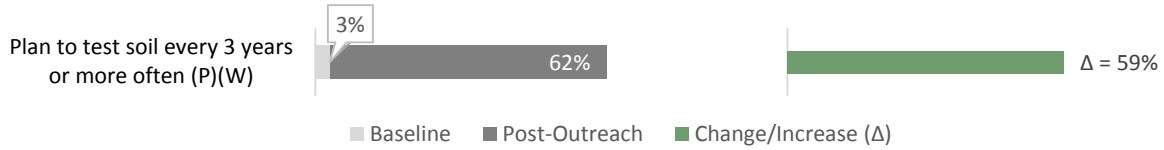
When asked how they manage weeds, fewer participants reported broadly applying weed-and-feed or weed killers after the program. While participants significantly improved this behavior, interview results indicate that participants still want more information on how to treat weeds, pests, and disease particularly large infestations. Without additional education and assistance, these behavior gains may be temporary. During interviews, several participants mentioned difficulty addressing weeds and pests without toxic products as a challenge and asked for more information on identifying and eliminating pests, weeds, and moss.

L ✓ Most participants were already using at least one least-toxic weed management technique before the program and continued doing so.

A large majority of participants reported using the recommended pest, disease, and weed management techniques of hand-pulling, digging, spot-treating with vinegar-based or clove oil products, or tolerating some weeds.

Soil Testing

Figure 79: South Sound soil testing intentions

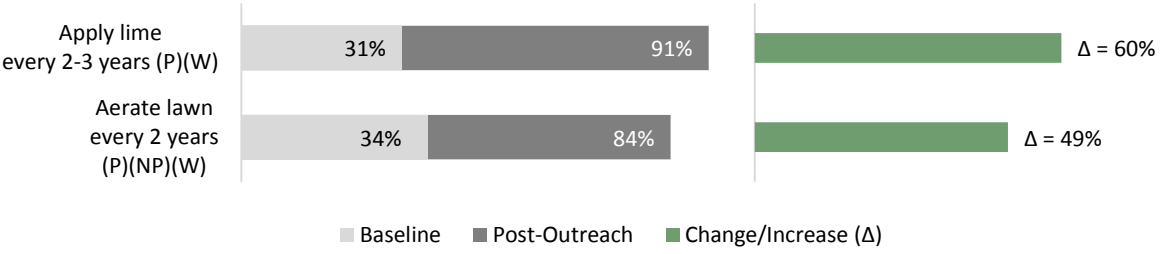


H ⚠ Participants learned the value of soil tests: more than 60% of them plan to test their soil within the next three years, whereas almost none had tested before the program.

73% plan to test their soil within five years. In an open-ended survey question about the most useful lessons from program, soil pH and the soil test results were frequently mentioned.

Lime and Aeration

Figure 80: South Sound lime and aeration practices



H ✓ Three times as many participants applied lime compared to before the program, and almost all plan to continue in the future.

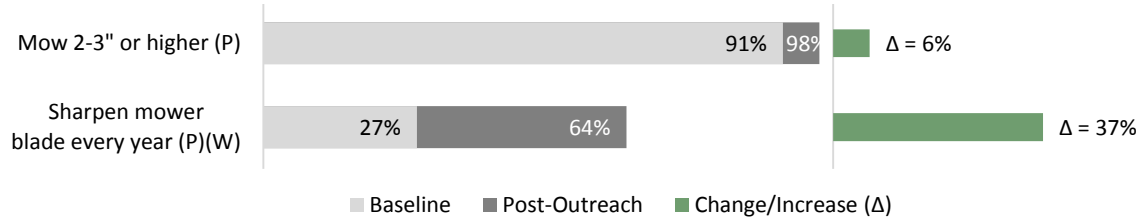
Similar to slow-release fertilizer, the significant increase in the use of lime was supported by the free lime incentive. Also similarly, most participants (93%) plan to continue using lime in the future.

H ✓ More than twice as many participants aerated compared to before the program.

While high overall, the share of participants who aerated their lawn showed a smaller increase and lower post-outreach use than the share who used slow-release fertilizer and lime practices. While participants received a free aerator rental, several interviewed participants mentioned experiencing challenges in renting and transporting the aerator. Participants were also offered a $30 discount on hiring a professional lawn aeration service, but interviewed participants did not mention this option. Participants were not asked whether they plan to continue aerating lawns in the future. Because aerating is important for maintaining healthy soil, additional education or assistance may be needed to increase this practice. While nonparticipants also changed their use of this practice, the difference appears minor, particularly in comparison to the change in participant practices. In the same period, nonparticipants were slightly more likely to aerate their lawn every three years or more (15% baseline and 19% post-outreach).

Mowing

Figure 81: South Sound participant mowing practices



L ✓ Slightly more participants reported mowing two to three inches or higher after the workshops.

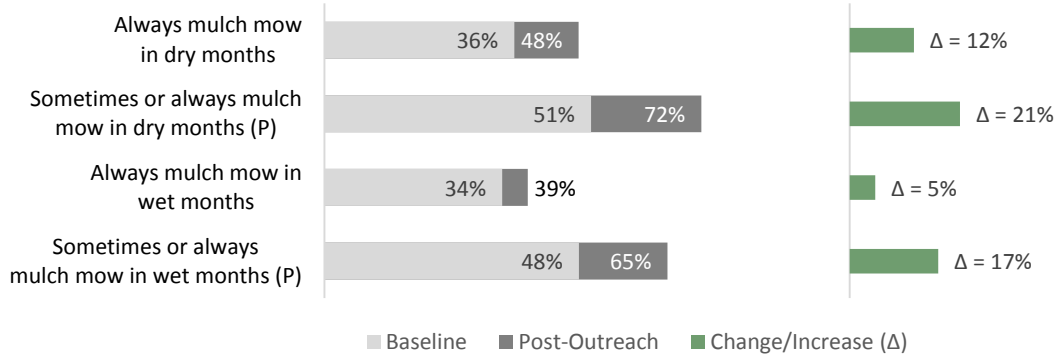
After the workshops, more participants reported mowing two to three inches or higher (91% baseline to 98% post-outreach). When asked what practices they plan to continue in the future, 97% selected mowing two to three inches high.

Despite the small amount of reported behavior change measured in the surveys, during the interviews and surveys, participants frequently mentioned mowing higher as among the most useful things they learned or biggest changes they made.

H ⚠ More than twice as many participants reported sharpening their mower blades compared to before the program, and even more plan to do so in the future.

The number of participants who sharpened their mower blades at least once in the last year increased substantially (27% baseline and 64% post-outreach). More participants (85%) said they would continue to sharpen mower blades at least annually in the future. Despite the large behavior change, some room for improvement remains.

Figure 82: South Sound participant mowing practices



H ✓ Participants reported a large behavior change in sometimes or always mulch mowing in dry months, but nearly 30% never mulch mow even in dry months.

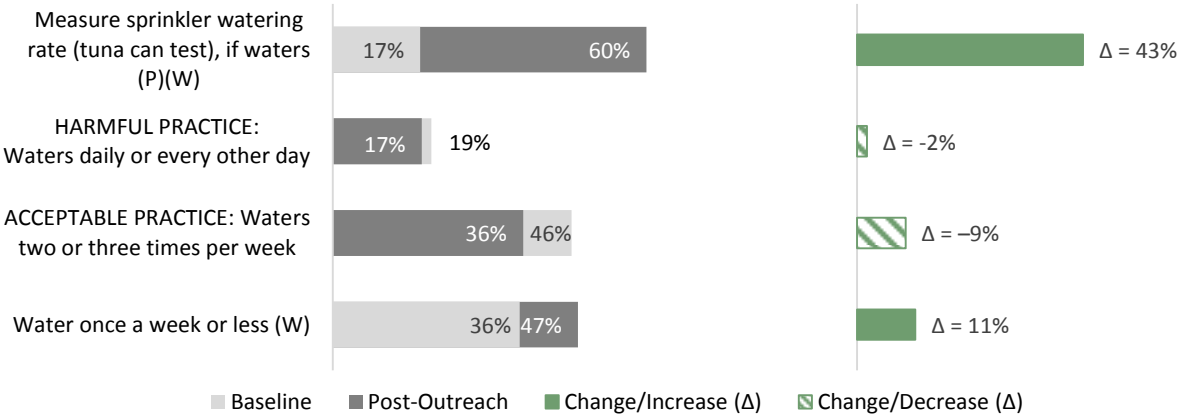
M ⚠ Participants reported a smaller change in always mulch mowing in dry months and in mulch mowing in wet months.

While a dry fall 2014 and spring 2015 may have further encouraged participants to mulch mow in the typically wet months of April, May, and October, participants also reported increasing mulch mowing in the typically dry months of June through September. The majority of participants (71%) say they plan to continue mulch mowing, although they may not intend to leave clippings on the lawn every time they mow.

In contrast, *fewer* nonparticipants reported always mulch mowing in dry months in the post-program survey (31% baseline and 24% post-program).

Watering

Figure 83: South Sound participant watering practices



H ⚠ More than three times as many participants measured their sprinkler water time compared to before the program, but half of participants using sprinklers did not conduct this one-time practice, despite the unusually hot summer.

Despite the unusually dry summer (participants were surveyed in June through August 2015) and rising cost of water (for example, in Olympia), additional education or tools appears to be required to cause residents to adopt this important yet simple practice.

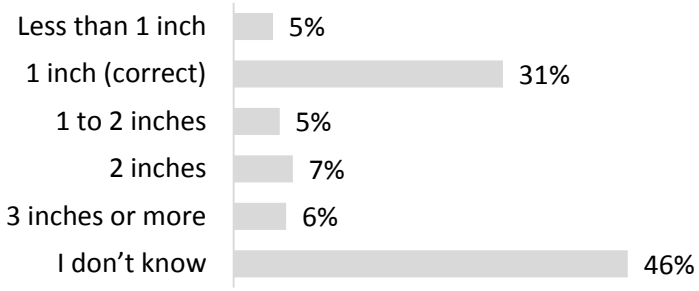
M ⚠ More participants watered once a week or less, primarily shifting from watering two to three times a week before the program.

At the same time, some participants started watering daily or every other day. These mixed results may have been, in part, due to an unusually hot summer. The program's recommendation was to water one inch per week spread over two watering sessions.

Understanding of Watering Amount per Week

Participants were asked about how much water a lawn needs per week to stay green in the summer to gauge baseline understanding. This question was not asked on the post-outreach survey due to space constraints, although participants may have increased their knowledge and understanding by attending the workshops.

Figure 84. South Sound participant baseline knowledge and understanding of watering amount per week for a green lawn



Before the program, nearly half of participants (46%) said they did not know how many inches of water a lawn needs per week to stay green in the summer.

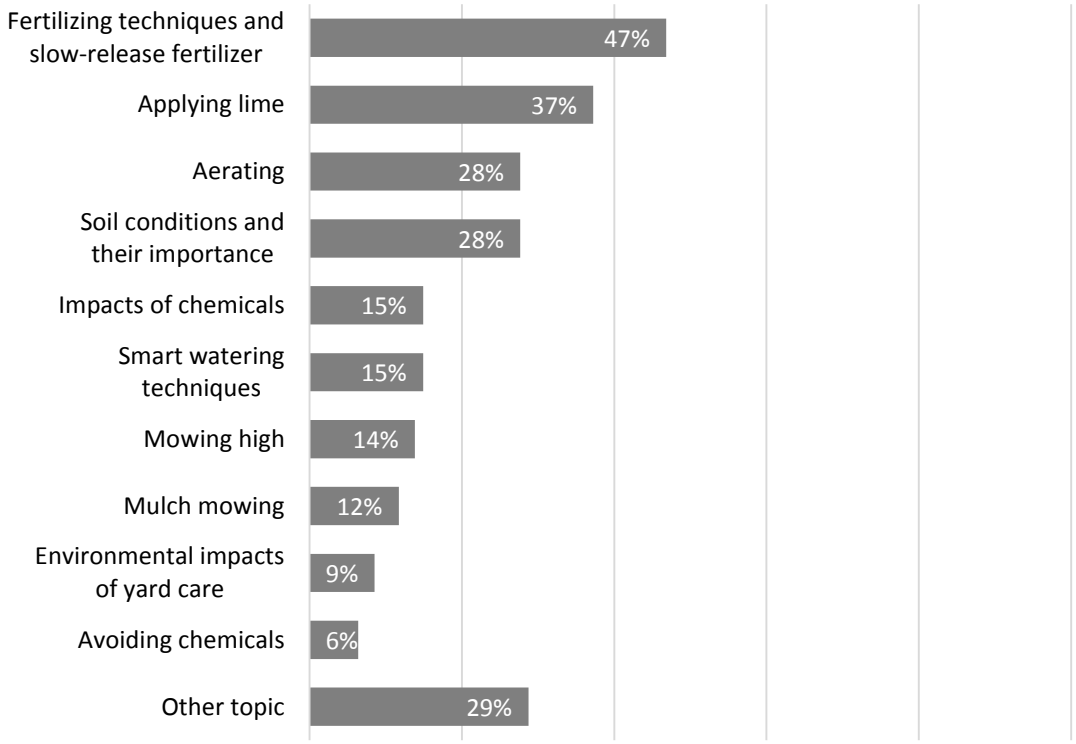
In contrast, nearly one-third of participants wrote in the correct quantity of one inch per week on the baseline survey. Watering amount was not asked on the medium-term survey, so the change in understanding was not measured. Education on the correct amount to water per week for a green lawn, as well as for a brown lawn during drought dormancy, will be important to water conservation efforts in future years.

Most Useful Information and Social Diffusion

In the medium-term post-outreach survey, participants were asked about the most useful things they learned during the program and about whether they shared information with others (social diffusion).

Most Useful Information

Figure 85: South Sound participants—most useful topics learned about during the program



When asked in the medium-term post-outreach survey to name most useful things they learned in the program, nearly half of participants (47%) mentioned fertilizer, including using slow-release fertilizer and proper measurement and application techniques. Other frequently mentioned topics were applying lime (37%), aerating (28%), and understanding soil conditions (28%). Participants also mentioned the impacts of chemicals (15%), smart watering methods (15%), and mowing higher (14%).

In interviews conducted with 20 participants, more than a third of interviewees stated that the most useful thing they learned was the need to switch to environmentally friendly products. Many interviewees appreciated learning about how to build and maintain healthy soil by fertilizing properly, applying lime, and aerating. Several also mentioned proper mowing technique—particularly mowing higher and mulch mowing—as one of the most useful things they learned. When asked about topics for future education programs and educational videos, interviewed participants commonly suggested non-toxic weed and pest management along with the core soil and mowing practices.

Social Diffusion

Figure 86: South Sound participants—number of people shared with, among survey respondents

Note: As with other figures, these numbers include only participants who completed the medium-term post outreach survey.

Participants were asked in the medium-term post-outreach survey whether they shared information about natural yard care with others. Four-fifths of respondents (82%) reported sharing information, reaching an estimated 500 additional people. Social diffusion more than tripled the program's reach from a base of 190 households.

The South Sound program reached a total of 190 households; the number of individuals represented by those households was not measured. Participating households were asked in the medium-term post-outreach survey whether they shared information about natural yard care with others. Four-fifths of respondents (82%, or 98 households) reported sharing information, reaching a total of 500 additional people. As a result, survey respondents that reported sharing information are calculated to have reached an additional 5.1 people on average per household.

Participants who did not complete the survey may also have shared information, further increasing social diffusion. If these calculations are applied to all 190 participating households, social diffusion may have reached a total of 800 additional individuals (190 households x 82% x 5.1 people per household).

Figure 87: South Sound participants—type of people shared with, among participants who shared

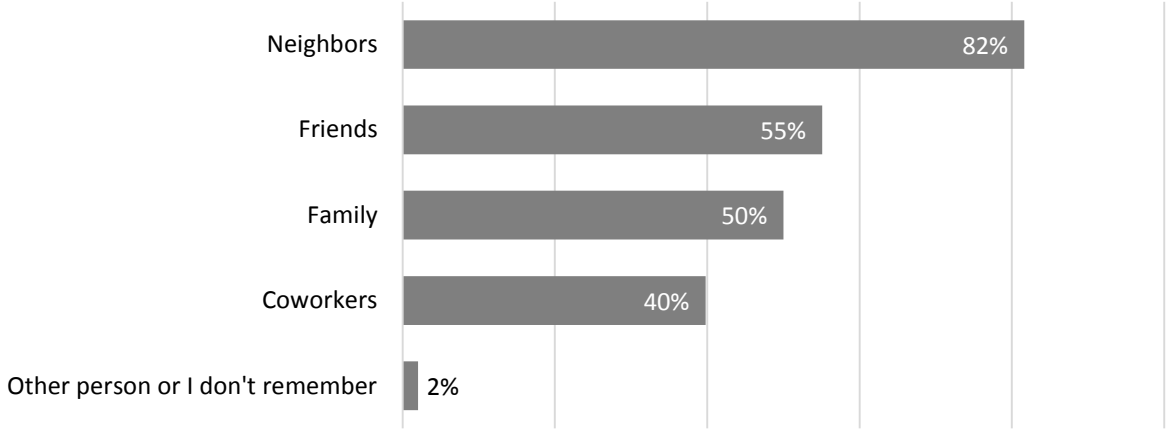
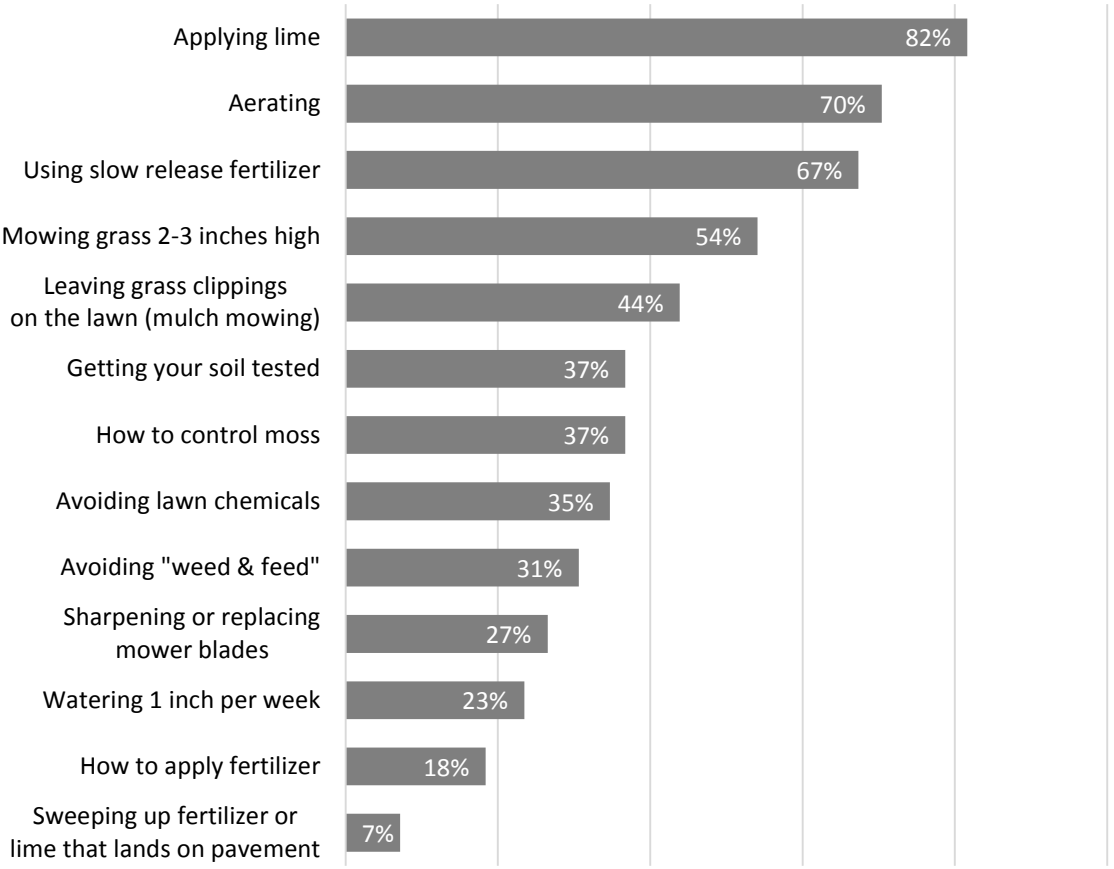


Figure 88: South Sound participants—topics shared, among participants who shared



Participants most frequently shared information with neighbors (82%) and also shared information with friends (55%), family (50%), and coworkers (40%). They most frequently shared information on applying lime (82%), aerating (70%), using slow-release fertilizer (67%), and mowing two to three inches high (54%).

Program Costs

City of Olympia staff provided program cost figures for implementing the South Sound program. The core project team and evaluation team determined that program costs in 2015 would better represent the costs of this program model because Olympia incurred one-time startup costs in 2014—the first year this program was fully implemented—that it will not incur in the future. Costs for grant administration were excluded to enable comparison to the North Sound program, which was funded by a different grant with different administration requirements. Costs for program evaluation were excluded because future programs are not expected to conduct such intensive evaluations. Implementation costs do not include 34 hours of time from volunteers at the demonstration workshops.

The 2015 South Sound program cost approximately $77,000 to reach 141 households for a cost of nearly $550 per household, as shown in Figure 89. Nearly half of program implementation costs went to lawn coach home visits (49%), while incentives and the demonstration workshops accounted for 23% of costs

each. Although lawn coach visits and incentives were costly, participants rated these elements highly in helping change their lawn care practices.

Figure 89. South Sound 2015 program costs

Cost Category	Type	Total Cost
Recruitment		**$3,615**
Recruitment mailing	Expense	$1,552
Recruitment and participant selection	Staff time	$2,063
Lawn coach home visits		**$37,712**
Meetings with lawn coaches	Staff time	$834
134 spring and 112 fall visits	Consultant	$30,448
Assessment forms (printing expenses)	Expense	$203
Data entry for property evaluations	Staff time	$6,227
Free soil test incentive (151 properties)		**$6,618**
Soil analysis (Wilbur Ellis)	Expense	$5,220
Sample collection and lawn measurement (Washington Conservation Corps)	Consultant	$1,398
Free fertilizer and lime incentive		**$8,570**
Fertilizer and lime purchase	Expense	$8,570
Aerator rental $30 rebate incentive		**$2,508**
33 rebates	Expense	$990
Rebate processing	Staff time	$1,518
Demonstration workshops (7 workshops on 3 days)		**$18,092**
Planning	Staff time	$5,189
Implementation	Staff time	$4,068
Presenters	Consultant	$7,771
Door prizes	Expense	$275
Space rental	Expense	$664
Supplies	Expense	$125
Total program cost		$77,115
Participating households	141	
Cost per household		$547

Note: this table excludes costs for grant administration and program evaluation.

4. North Sound and South Sound Comparisons

Overview

While the two programs addressed some of the same behaviors—such as proper mowing, fertilizer choices, using lime, and aerating—they cannot be compared statistically because the two programs differed substantially in their target audiences, breadth of topics covered, goals, and level of outreach intensity, as shown in Figure 90. When compared qualitatively, the results should be considered within each program's particular context.

For instance, in the North Sound, participants received 50 minutes of lecture on natural lawn care in a large workshop format (up to 75 participants per lecture). In the South Sound, participants received six hours of hands-on education on this topic area including two hours in a personalized home visit and four hours in small demonstration workshops (no more than 20 participants per workshop). The South Sound program also provided incentives that directly support the desired behavior change (free soil test, free lime and fertilizer, and discount aerator rental).

More information on the elements, activities, logistics, and details of each program can be found in:

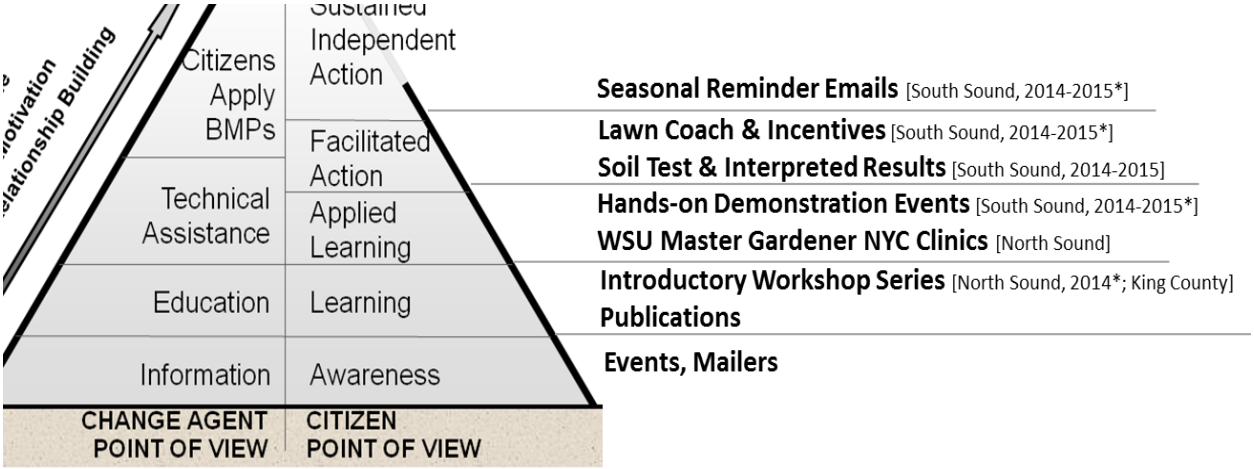
- Appendix H-01—Final Project Report for G1400481
- Appendix H-02—North Sound Logistics Guide
- Appendix H-03—South Sound Logistics Guide

Figure 90. Summary of key differences between North and South sound programs

	North Sound Program	South Sound Program
Target Audience	Residents of detached single-family homes on properties sized less than one acre within urban growth areas. The program reached 451 households in 2014.	Residents who (1) live in detached single-family homes on properties sized less than one acre, (2) own their home, (3) maintain the lawn themselves, and (4) currently use fast-release chemical fertilizers. The program reached 190 households in 2014.
Topics covered	Natural lawn and yard care practices including planting; "Right Plant, Right Place" principles; healthy soils; composting; sustainable landscape design; and natural pest, weed and disease control.	Natural lawn care practices addressing grass lawns and not planting beds.
Goals	Reduce all pollutant runoff from lawns and planting beds.	Reduce nutrient and pesticide pollutant runoff from lawns.
Outreach intensity	Education and technical assistance, reaching more households at a lower level of engagement. ▪ Three 2-hour lecture workshops with up to 75 participants per workshop ▪ Diagnostic and identification technical assistance from WSU Master Gardeners at lecture workshops Participants received 6 hours total of education that included just under one hour on each of the following 6 topics: *Natural Lawn Care*; *Smart Watering*; *Right Plant, Right Place*; *Natural Pest, Weed & Disease Control*; *Growing Healthy Soil*; and *Sustainable Landscape Design*.	Education and technical assistance, reaching fewer participants at a higher level of engagement. ▪ 2 hours of personalized, at-home education from lawn care professionals, spread over two home visits ▪ 4 hours of hands-on demonstrations with no more than 20 participants per demonstration ▪ Ongoing lawn care email updates throughout the year-long program Participants received 6 hours of education on *Natural Lawn Care*.
Incentives	Small incentives used to reward participants for attending lectures and completing surveys.	Large incentives used to directly support behavior change: ▪ Free soil test ▪ Free lime and slow-release fertilizer ▪ Discount on aerator rental Small incentives also used to reward attending workshops and completing surveys.
Program History	Well-established program: ▪ Piloted in 2010 ▪ Full implementation in 2012 ▪ Refinements in 2013	New program: ▪ Piloted in 2012 ▪ Full implementation in 2014

Figure 91 shows the elements of each program in the context of a continuum of public involvement. Programs that provide more intensive outreach with technical assistance (such as the South Sound program's site visits) are typically expected to result in more action and behavior change *per participant*, although they often reach a smaller number of *total participants*. In addition, incentives that directly support behavior change (such as the free lime and fertilizer provided by the South Sound program) are typically expected to increase behavior change, at least during the period in which the incentives are provided. Additional research is needed to determine whether specific incentives create lasting behavior change.

Figure 91. Natural yard care (NYC) programs, 2014 public involvement continuum



aska & DiClemente, Stages of Change Model

*Grant funded NYC programs implemented 2014-2015
North Sound – Snohomish County, 13 partner NPDES city jurisdictions, Snohomish Conservation District, WSU Master Gardeners
South Sound – City of Olympia, Thurston County, City of Tumwater

irce: Snohomish County Surface Water Management, 2015

Key Findings

As noted above, results were not analyzed statistically; this analysis considers a difference of 10 percentage points in survey responses to be meaningful. This section compares changes in mowing, fertilizing, using lime, aerating, and watering. While both programs addressed weed management, making direct comparison is impractical because the South Sound survey instrument asked only about practices to manage weeds in lawns while the North Sound survey instrument also addressed practices to manage weeds in planting beds (such as covering bare soils with mulch to prevent weeds).

Figure 92: Comparison of lawn-focused North Sound and South Sound program behavior changes levels

Practice	North Sound Behavior Change	South Sound Behavior Change	South Sound Extra Strategies
Apply lime at least every 2-3 years	L 4%	H 60%	Incentive Demonstration
Aerate at least every 2 years	L 8%	H 49%	Incentive Demonstration
Used slow-release or organic fertilizer	H 24%	H 55%	Incentive Demonstration
HARMFUL PRACTICE: Used fast-release fertilizer or weed-and-feed	H -27%	H -51%	Incentive Demonstration
Measure sprinkler watering rate (tuna can test), if waters	M 12%	H 43%	Demonstration
ACCEPTABLE PRACTICE: Water two to three times per week	L 5%	L -9%	
HARMFUL PRACTICE: May use weed-and-feed in future	H -48%	H -36%	
Water once a week or less	L -8%	M 11%	
Always mulch mow in wet months	M 19%	L 5%	Demonstration
Sometimes or always mulch mow in dry months	M 18%	H 21%	Demonstration
HARMFUL PRACTICE: Used weed-and-feed (since outreach)	H -53%	H -47%	
Sometimes or always mulch mow in wet months	M 18%	M 17%	Demonstration
Mow 2-3" or higher	L 9%	L 6%	Demonstration
Always mulch mow in dry months	M 14%	M 12%	Demonstration
HARMFUL PRACTICE: Water daily or every other day	L 2%	L -2%	

Note: this table shows changes in behavior as a percentage of total surveyed participants, not scaled to the baseline level of behavior. For example, 22% of North Sound participants applied lime in the baseline and 26% applied lime post-outreach, for a change of 4% of participants (26% minus 22%).

Both programs resulted in significant and substantial behavior change in many of the practices they addressed.

This substantial behavior change indicates that both programs used effective program models and were well implemented. Both participants and program staff praised the programs and recommended continuing them in the future, with some modifications.

Both programs had varied results in behavior change and participant use of key practices after the programs.

While a few practices in each program showed little to no behavior change, most showed moderate to high levels of behavior change with remaining room for improvement.

South Sound incentives, supported by outdoor demonstrations, appear to have been a major factor in short-term behavior change.

After the programs, a much higher share of South Sound participants reported using practices that were supported by incentives (free fertilizer, free lime, and $30 discount on aerator rental) compared to North Sound participants. These practices were also supported by outdoor demonstrations. As a result, the incentives coupled with demonstrations appear to have contributed substantially to behavior change in the associated practices. However, additional research is needed to assess whether South Sound participants continue using slow-release fertilizer, applying lime, and aerating without the incentives and, if so, what is the optimal level and format of incentives to maximize behavior change while minimizing program costs.

South Sound outdoor demonstrations also appear to be a strong factor, although behavior change results varied by practice.

The South Sound program provided outdoor demonstrations without incentives for watering and mowing practices. South Sound participants had higher levels of behavior change for measuring sprinkler watering rates but similar or lower levels of behavior change for mulch mowing.

The South Sound program cost more than twice as much per participating household as the North Sound program while addressing fewer practices.

While the South Sound program achieved greater behavior change in specific lawn care practices, it also cost more than twice as much per household compared to the North Sound program ($550 South Sound and $250 North Sound) and did not address as many other yard care practices that can protect water quality.

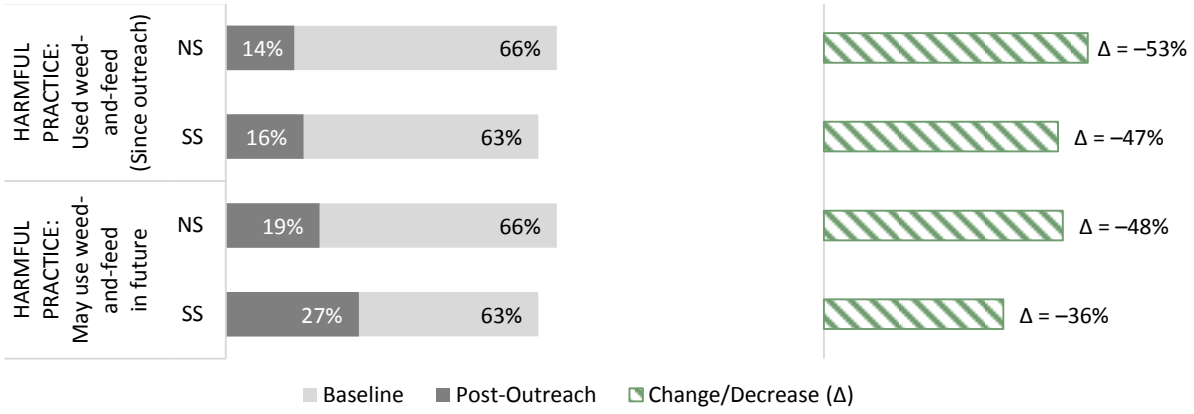
Jurisdictions would benefit from testing a hybrid program that combines large lectures and small outdoor demonstration workshops, with and without incentives.

Given the differences in program cost and results, jurisdictions would benefit from testing whether a program with lectures and outdoor demonstrations—but without the lawn coach home visits and incentives—results in a similarly high level of behavior change. In addition, the South Sound program should evaluate whether the incentives given to 2014 participants resulted in lasting behavior change in 2016 or 2017.

Detailed Findings

Weed-and-Feed Use

Figure 93. North and South Sound weed-and-feed use

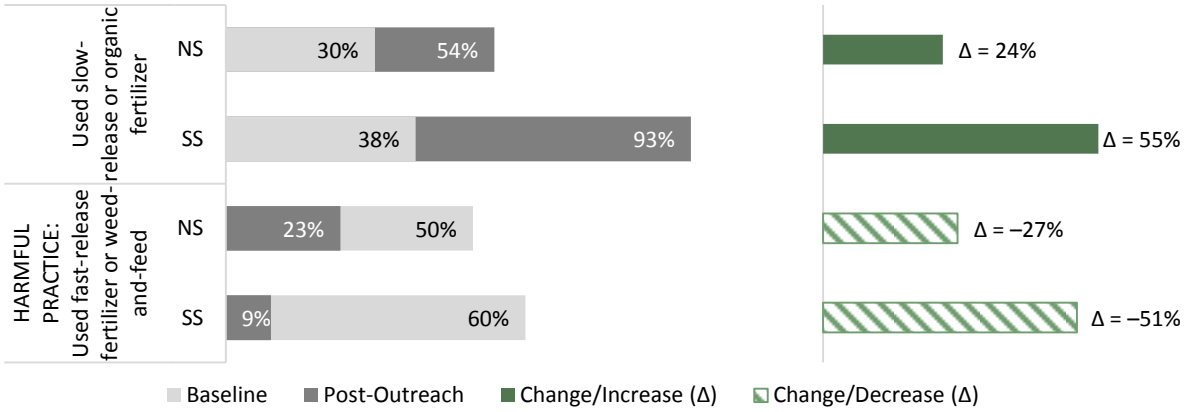


Both programs decreased the use of weed-and-feed in similar amounts, when participants were asked directly about this product.

More participants reported using weed-and-feed when asked directly about the product than when asked as part of a broader question about fertilizer use. When asked this way, similar percentages of participants reported using weed-and-feed before (66% North Sound and 63% South Sound) and after (14% North Sound and 16% South Sound) the outreach.

Fertilizer Choices

Figure 94. North and South Sound fertilizing practices

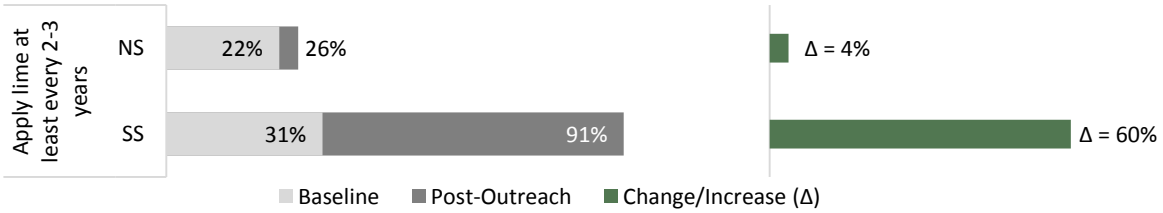


While both programs increased the use of recommended fertilizers and decreased the use of discouraged fertilizers, free fertilizer combined with a hands-on demonstration appears to have made the South Sound program more effective.

Participants in both programs increased their use of recommended slow-release, natural, or organic fertilizers and decreased their use of discouraged fast-release fertilizer and weed-and-feed. The South Sound program's larger behavior change, resulting in almost all participants (93% South Sound) using the recommended fertilizer, was likely due to three factors (1) participants signed an agreement to use these products during the program, (2) the program gave participant free slow-release fertilizer, and (3) participants received more intensive education including a hands-on demonstration of how to use this product. To adopt this practice, North Sound participants needed to find and purchase fertilizer on their own, leading a smaller share (54% North Sound) of participants to use the recommended fertilizer. While most South Sound participants said they would continue using recommended fertilizers, future research is needed to assess whether this behavior change will be sustained over time once they must obtain fertilizer on their own.

Applying Lime

Figure 95. North and South Sound lime use



While both programs increased the use of lime, South Sound participants were more likely to have used these practices than North Sound participants.

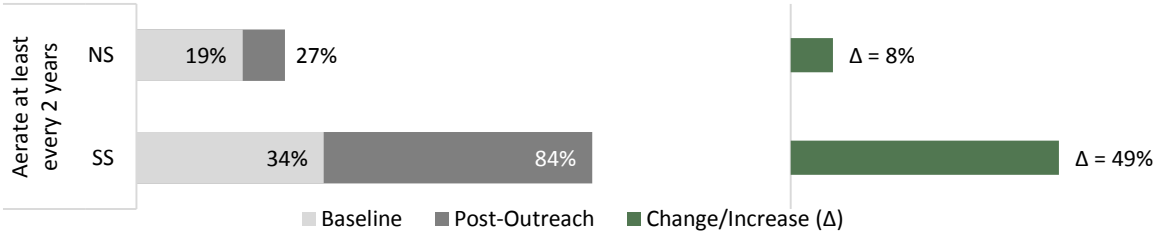
Applying lime nearly tripled among South Sound participants (31% baseline and 91% post-outreach). While the reported application of lime increased only slightly among North Sound participants (22% baseline and 26% post-outreach), many participants said they plan to apply lime in the future (56% did or plan to apply). Some potential explanations for these differences include that South Sound participants:

- Received a free soil test.
- Heard a lecture on the importance of soil pH on lawn health.
- Received a hands-on demonstration on how to apply lime.
- Had access to spreader equipment (also used for applying fertilizer).
- Were given free lime.

In contrast, the North Sound lecture workshops spent minimal time on the importance and use of lime. As with fertilizer use, future research is needed to determine whether South Sound participants will continue to use this practice without the free lime incentive.

Aerating

Figure 96. North and South Sound aerating practices

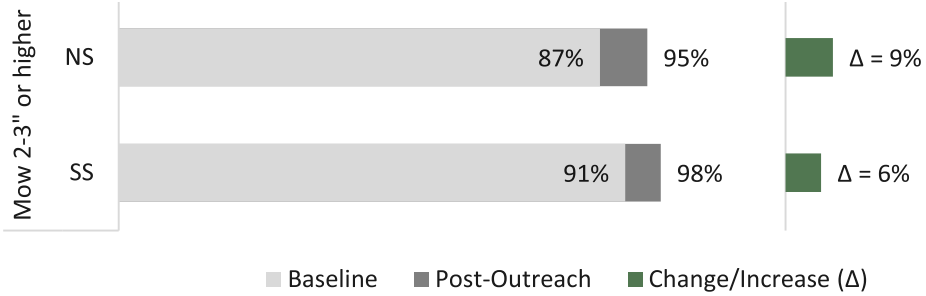


Similarly, both programs increased the use of aeration, with South Sound participants more likely to have used these practices than North Sound participants.

While the reported use of aeration increased among North Sound participants (19% baseline and 27% post-outreach) about the same amount as reported lime use, more participants said they plan to aerate in the future (71% did or plan to apply). In the South Sound, participants substantially increased use of aeration (34% baseline and 84% post-outreach).

Mowing

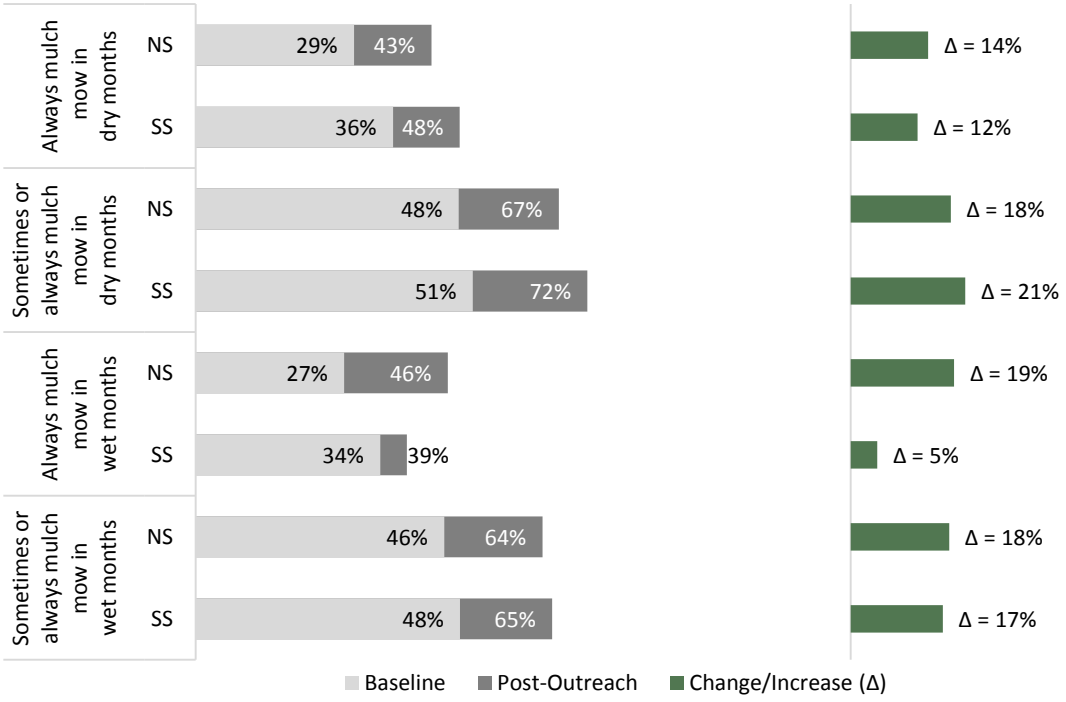
Figure 97. North and South Sound mowing height



Both programs had similar effects on mowing two to three inches or higher, with most participants doing this practice both before and after the programs.

While participants in both programs reported similar levels of mowing two to three inches or higher both before and after the programs.

Figure 98. North and South Sound mulch mowing practices (for participants who mowed)

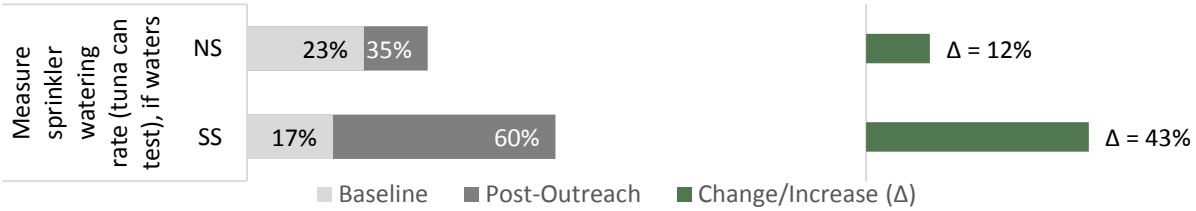


Both programs had similar effects on always or sometimes mulch mowing in dry months, but the North Sound program yielded greater change in reporting always mulch mowing in wet months.

Participants who reported "always" mulch mowing or "not mowing" at all during specific months were characterized as always mulch mowing when they mowed. A second analysis added in participants who reported "sometimes" mulch mowing. Most behavior change levels were similar between the two programs except that North Sound participants reported a larger increase in always mulch mowing in wet months compared to South Sound participants.

Watering

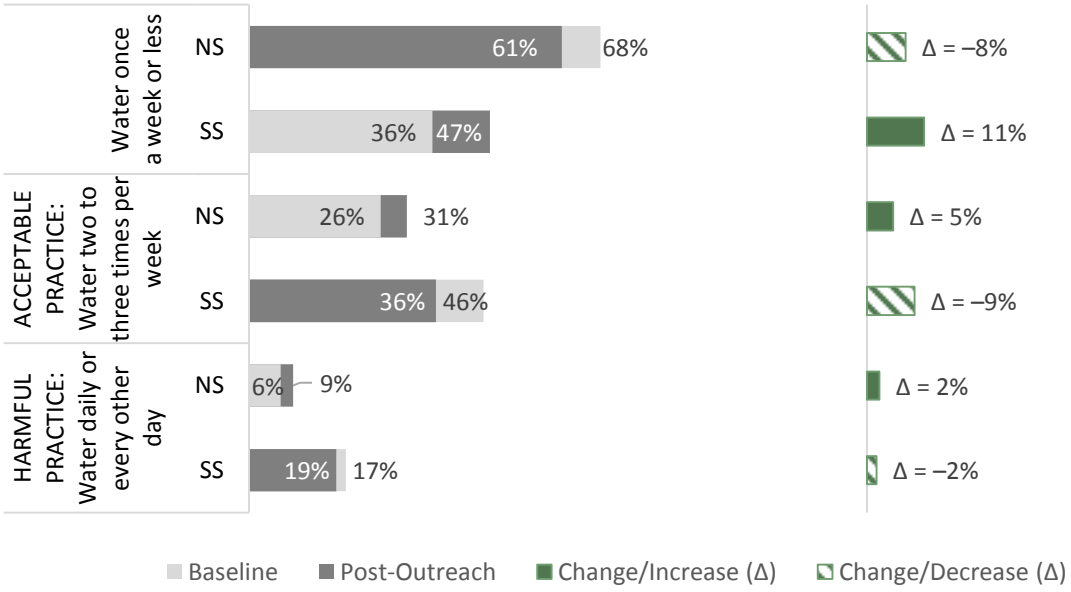
Figure 99. North and South Sound watering measurement practices



More participants in the North and South Sound measured the watering rate of their sprinkler after the programs, with a much larger increase in the South Sound.

The share of South Sound participants who had measured their sprinkler watering rate more than doubled after the program, whereas the share of North Sound participants increased at a lower rate. While the South Sound program did not provide an incentive for this practice, it was included in the outdoor demonstration workshops. South Sound participants received visual, hands-on learning for this practice; North Sound participants did not.

Figure 100. North and South Sound watering frequency practices



North Sound participants slightly increased watering frequency while of South Sound participants reduced their watering.

While the South Sound program recommended watering one inch per week spread over two watering sessions, 11%% of participants shifted from watering two to three times per week to watering once a week or less. After the outreach, fewer North Sound participants watered once a week or less.

Social Diffusion

Participants in both programs shared information widely, expanding the reach of both programs. While slightly more participants in the South Sound shared information with others, each participant in the North Sound who shared information reached slightly more people (Figure 101 and Figure 102).

Figure 101: North Sound participants—number of people shared with, among survey respondents

Figure 102: South Sound participants—number of people shared with, among survey respondents

Social diffusion was measured to have more than double the reach of the North Sound program from a base of 627 participants to an additional 1,040 people. If participating households that did not respond to the survey shared information at the same level, social diffusion may have expanded the program's reach more than four times to about 2,575 individuals (additional reach = 451 total households x 77% x 5.6 people per household). North Sound participants who shared information were more likely to have shared with friends (71%) and family (70%) than with neighbors (50%).

In the South Sound, social diffusion also expanded the program's reach from a base of 190 households to an estimated 500 additional people. If participating households that did not respond to the survey shared information at the same level, social diffusion may have expanded the program's reach to approximately 800 additional individuals (190 households x 82% x 5.1 people per household). South Sound participants who shared information were more likely to have shared with neighbors (82%) than with friends (55%) or family (50%). The South Sound program did not track the number of individuals in each participating household, preventing direct comparison with social diffusion in the North Sound.

Seeking and sharing information in yard care from friends and neighbors is common nationwide. A national gardening survey in 2014 found that half of consumers with a lawn or garden (51%) obtained plant and gardening information from friends and family.[5]

[5] Garden Writers Association Foundation, "Garden Trends Research Report: October 2014 Survey," conducted by TechnoMetrica Market Intelligence, 2014.

5. Recommendations

This section presents the evaluation team's recommendations for improving natural yard and lawn care education programs in the Puget Sound region. Recommendations are based on a survey of program leads, staff members, workshop presenters, lawn coaches, and WSU Master Gardener volunteers (described collectively as "program staff"); surveys and interviews of program participants; and the analysis of behavior change results from the program evaluation surveys.

Detailed results, findings, and additional recommendations from the interviews and surveys used to develop these recommendations can be found in the following appendices:

- Appendix G-01—Participant Interview Summary
- Appendix G-02—Program Leads, Staff, Instructor, and WSU Master Gardener Survey Summary

Logistics Guides

These recommendations should be used in conjunction with the North Sound Logistics Guide (Appendix H-02) and South Sound Logistics Guide (Appendix H-03), which provide more details on how these programs were conducted. The recommendations in this section are intended to highlight program activities that were particularly successful and should be repeated as well as to identify areas where the logistics guide could be modified to reflect lessons learned from this evaluation.

Regional Programs and Resources

In considering these recommendations, it is important to understand that these programs benefit from the support of other regional programs and resources, such as those described below. Without these other programs and resources, the North Sound and South Sound programs would be less effective.

WSU Master Gardener Program

The North Sound lecture workshops rely on WSU Master Gardener volunteers certified through additional training to provide recommendations on natural yard care. Snohomish County contributes $20,000 to $25,000 per year to implement the Master Gardener training and certification program so that trained volunteers are available to support the North Sound program's lecture workshops.

Publications by Other Local Jurisdictions

Both the North Sound and South Sound programs also rely on information resources developed by other local jurisdictions. The North Sound program uses *Natural Lawn & Garden Guide* publications developed by the City of Seattle and revised with permission for Snohomish County audiences. The South Sound program uses *Common Sense Gardening* publications developed by Thurston County based on previous publications by WSU, the City of Seattle, King County, and others.

Grow Smart, Grow Safe

Both programs also rely on the www.growsmartgrowsafe.org website, a unique resource that residents can use to research the toxicity of yard care products and identify the least-toxic techniques and products to address their weed, pest, and disease problems. The website provides a user-friendly way to look up the hazard rating of specific yard care products registered for sale in Washington State. This resource is currently funded by King County, Thurston County, and Metro (Oregon).

Recommendations Organization

The recommendations are organized into the following sections:

- Program Model
- Strategies for Teaching Specific Practices
- Participant Recruitment
- Participant Communication
- Partner Coordination
- Program Logistics
- Take-Home Materials
- Program Evaluation

Program Model

This section provides guidance for choosing a program model. Because similar natural yard and lawn care practices can be used throughout the Puget Sound region, state and local jurisdictions should coordinate to develop curriculum modules that individual jurisdictions can use as starting points and can provide as a model for contracted presenters to use. Modules should include detailed outlines, talking points, key messages, photos and other visuals (as feasible), demonstration ideas or materials, electronic versions of take-home materials, videos, and online resources that any jurisdiction in the region can customize and use. One example of regional cooperation is the effort to update the *Natural Lawn & Garden Guides*.[6]

Both program models were effective, but they had different cost levels and breadth of coverage. Accordingly, the evaluation team recommends that jurisdictions use a core program model consisting of lectures and outdoor demonstrations. These methods were found to be effective at a lower cost than lawn coach home visits, while covering a broader range of topics. Though they are effective, lawn coach home visits are not recommended as a core program model because jurisdictions are not likely to be able to sustain the substantially higher costs and more intensive staff time for coordination that this model requires.

[6] Snohomish County hosts these guides on its website.
Natural Yard Care: http://snohomishcountywa.gov/DocumentCenter/View/7260
Natural Lawn Care: http://snohomishcountywa.gov/DocumentCenter/View/7258

Core Program Delivery Model: Lecture and Demonstration Workshops

Combine lecture workshops with an outdoor demonstration workshop. Workshops must be taught by dynamic, engaging, and informed yard care professionals who have proven expertise both in using natural yard care practices (such as ecoPRO-certified professionals) and in presenting these practices in workshops, lectures, and demonstrations. Program should use engaging experts as speakers to achieve the same level of results measured in the North and South Sound programs.

Visuals and Displays

Workshops should involve extensive use of photographs, visual aids, and hands-on demonstrations. Lecture workshops should include display stations with additional information resources, visual or hands-on demonstrations, and experts to provide personalized education. Outdoor workshops should primarily consist of hands-on demonstrations, described in more detail in strategies for teaching specific practices.

Opportunity for Personalized Assistance

Lecture and outdoor workshops should offer participants the opportunity to ask questions and receive personalized assistance from lawn and yard care professionals and WSU Master Gardener volunteers who can identify plants and diagnose problems. Participants should be strongly encouraged to bring plant samples, information on site conditions, lawn measurements, soil test results, and photos of their yards or of plant problems.

Take-home Materials

All programs should provide take-home materials that support the core practices covered and list other reliable and locally appropriate yard care resources including the city or county natural yard care website (if available), www.naturalyardcare.info (if the local city or county site does not provide the same resources), WSU Master Gardener volunteers, the local conservation district (if it provides resources on natural yard care), www.growsmartgrowsafe.org, pertinent WSU Extension websites, and books. Programs should balance providing participants with resources that cover the wide range of their information needs with not overwhelming participants with too many resources. Programs might achieve this balance by listing available resources in the core take-home materials and offering supplemental resources only in a self-serve kiosk at the workshop or on a program website.

Outdoor Demonstrations

Demonstration workshops can be structured in two main ways: with a set schedule through which all participants are rotated or a more flexible model in which participants choose which demonstration sessions to attend. We recommend an approach similar to the South Sound demonstration workshops in which participants rotate through demonstration stations on a set schedule, with time for questions at the end of each session. This structure works well for a demonstration event with three to six stations where it is important that participants learn key information from each station.

However, a more flexible model may work better for a workshop that covers a wider variety of topics and where some practices may not be relevant to some participants (such as turf aeration is not relevant for participants without lawns). In the flexible model, presenters would start their demonstrations on a published schedule, and participants would choose which demonstrations to visit.

Programs should choose the demonstration sessions that address the key practices covered in the lectures. Suggested lists of sessions are presented in the demonstration workshop logistics section on page 140.

If the program requires multiple workshops to reach all participants, continue to hold more than one workshop on the same day (if held on a weekend) to reduce staff time for set-up and clean-up and to reduce facility rental or custodial fees.

As with lectures, continue to use dynamic, engaging, and experienced yard or lawn care professionals as instructors. In the South Sound program, these experts supplied the majority of demonstration equipment in addition to being professional, knowledgeable, and trusted by participants.

Seasonal or Monthly Email Prompts

Programs should also invite participants to sign up for seasonal emails providing timely reminders that serve as prompts for key practices, such as an email in spring about slow-release fertilizer and an email in summer about smart watering. Programs can invite participants to sign up both during registration and at each workshop.

Emails can also remind past participants how to use key resources (such as WSU Master Gardener volunteers) and to use alternatives to chemical pesticides. Emails also keep past participants engaged and enable social diffusion of program messages through ease of forwarding to neighbors, friends, and family. Each email should include both subscribe and unsubscribe features.

Natural Yard Care Information Website

A well-organized website with natural yard and lawn care tips, detailed information, videos, and links to other resources will support past participants who need reminders or more information and will enable them to share information easily with others. Hosting this information on a collaborative regional website, such as www.naturalyardcare.info, with links to local jurisdiction websites as appropriate, would allow jurisdictions to pool funding and provide a wider range of information resources than if each jurisdiction produced a separate website. In addition, cost savings from regional collaboration could be used to optimize the website and resources for use on mobile devices.

The City of Olympia is developing video and radio advertisements promoting natural yard care and the www.naturalyardcare.info website, to be completed in early 2016. STORM should collaborate to bulk-purchase regional advertising space for these promotions, after modifying to include information for all funding partners.

Optional Add-on Elements to Core Program Model

Online Videos

Online videos showing key practices from demonstration workshops allow participants to review lessons after the workshop and share information with others to extend the reach of the program. Many videos demonstrating natural yard care practices have been created by jurisdictions around the country. Local programs should assess whether existing, publicly available videos can meet their needs, rather than creating new videos. Using existing videos greatly reduces the cost of providing these valuable resources to participants.

Videos should focus on step-by-step demonstrations (such as how to choose, use, and maintain equipment; how to assess a yard's sunlight and drainage conditions; and how to plant new plants). If new videos or locally appropriate adaptions must be created, STORM and local governments should participate in a joint effort because videos will be relevant region-wide. New videos created in a regional partnership with STORM should use the *Puget Sound Starts Here* brand and have a consistent style within a video series.

The City of Olympia, in partnership with STORM, is developing a natural lawn care video series that will be available online in 2016 on the regional www.naturalyardcare.info website. The series covers the following topics:

- Introduction and overview of natural lawn care.
- Mowing: how to mulch mow, proper mowing height, and how to sharpen a mower blade.
- Soil testing—how to collect soil samples.
- Fertilizer and lime—how to choose and apply slow-release fertilizer and lime, avoid weed-and-feed, and when and how much product to apply.
- Watering—how much, how often, and how to care for lawns during drought.
- Aerating, top-dressing with compost, and overseeding as the best defense against weeds and moss.

Jurisdictions and STORM should collaborate to develop additional videos covering other natural yard care topics, such as:

- Weed, pest, and disease problems—how to collect samples, use WSU Master Gardener volunteers and other resources to diagnose the problem, and use www.growsmartgrowsafe.org to choose the least-toxic management method.
- Mulch in beds—how to apply mulch to beds, factors to consider when choosing a mulch, benefits of applying mulch, and how to sheet-mulch to replace lawns with beds.
- Planting—how to prepare soil and new plants for planting.
- "Right Plant, Right Place"—how to sketch a map of the sunny versus shady and wet versus dry areas of a yard, perform a soil jar shake test, and use the *Right Plant, Right Place* guide to choose plants.

Curriculum Updates

Periodically expand the curriculum with new topics. Consider offering two-year programs rotated through target geographic areas with an introductory series in one year and a series with specialized topics in the second year.

Consider pilot-testing additional, shorter series on more advanced or specialized topics that build on the current workshops and that may include more hands-on or demonstration components. In addition, cross-promote workshops offered by local agencies (university extensions, conservation districts, cities, and counties). Advanced or specialized topics may include:

- Edible plants, including fruits and vegetables.
- Backyard composting.
- Rain gardens.
- Pruning for plant health.
- Container gardening.
- "Right Plant, Right Place" topics for specific garden challenges such as dry shade gardening, plants for wet areas, or native plants.
- Water-saving irrigation techniques such as drip irrigation, timers, and irrigation audits.

Personalized Assistance through Home Visits

Providing personalized assistance through home visits increases both the amount of total education provided and the amount of education that is relevant to each participant, but it also substantially increases costs. These increased costs per participant may limit the number of participants a program can reach. In addition, programs that want to reach many participants may not be able to find enough yard and lawn care professionals who are also experts in educating about natural yard and lawn care. For example, South Sound program staff reported difficulties in finding and engaging qualified lawn coaches from their area who used natural yard care practices.

Incentives

The South Sound program plans to survey 2014 participants again in spring 2016 or 2017 to evaluate whether they continue to use slow-release fertilizer, apply lime, and aerate when no additional incentives are provided. If incentives are shown to create lasting behavior change, consider adding incentives that reduce participant costs and other barriers to using recommended practices. Incentives should directly address real or perceived barriers faced by participants, such as the cost or difficulty of obtaining natural yard care products or equipment. If incentives are not shown to create lasting behavior change, focus on offering or developing program elements that are effective and easier to obtain funding for (such as demonstration workshops, more personalized education, or ongoing prompts such as reminder emails).

To avoid confusing participants, incentives should be uniform for all participants in a given program, unless the program is testing the effects of different incentive levels or formats.

If the South Sound program's additional survey of 2014 participants indicates that incentives offered only once result in long-term change, jurisdictions should test different incentive models and amounts that could reduce program costs, including:

- Provide the product for free: this incentive model is most costly but reduces multiple barriers, including cost and finding the product.
- Provide a coupon or rebate that participants use at private retailers: this model may be easier to implement but does not reduce barriers other than cost to participants. However, because participants who take advantage of this incentive implement all the steps for obtaining the product, coupons and rebates may foster the habit of identifying and purchasing natural yard care products for themselves.
- Provide the product at cost or a discount (sold by the program): this incentive model reduces barriers to finding and obtaining the product but recoups some of the expense to reduce program costs. This incentive model may require a nongovernmental partner to facilitate the sale of the products.

When using incentives, incorporate a natural lawn care pledge to use the practices in the long term and offer participants a yard sign to display their commitment to natural lawn and yard care. Social marketing research shows that written pledges and public commitments increase the likelihood that participants will follow through on conducting the covered activities.

Engagement of Local Nurseries or Corporate Home and Garden Stores

When possible, engage local nurseries or corporate home and garden stores in natural yard care education, either through selling and promoting recommended products or through staff training to provide natural yard care advice to customers. Programs can use point-of-sale shelf stickers or notices that promote using the GrowSmartGrowSafe.org website or mobile app and that help identify natural yard care products the store carries. Nurseries and garden stores may also be willing to offer discounts or promotions for recommended products such as compost, mulch, slow-release fertilizer, lime, drought-resistant plants, pest- and disease-resistant plants, drip irrigation, and other water-saving devices.

Natural Yard Care Stewards

In an intensive program (such as the South Sound program), invite and train past participants to receive additional training to become natural yard care stewards. These trained stewards can help support demonstrations and recruitment in their neighborhoods. Feature the yards of active past participants as examples of success.

Self-Guided Tours of Public Demonstrations of Natural Yard Care

Develop a self-guided tour of public gardens and parks that use and demonstrate natural yard care.

Strategies for Teaching Specific Practices

Jurisdictions should choose which topics to cover based on the goals of their program and the interests of their target audience. This section identifies strategies to increase the adoption of specific yard and lawn care practices included in the North Sound and South Sound programs.

To meet NPDES permit requirements, programs should ensure they address the following topic areas that directly reduce polluted runoff:

- Avoiding weed-and-feed use.
- Choosing and properly applying slow-release fertilizer.
- Controlling weeds, pests, and diseases using least-toxic methods.
- Applying mulch to planting beds.
- Aerating and top-dressing with compost.
- Storage and use of garden products.

Programs should then address relevant topic areas that reduce the need to use fertilizers and pesticides:

- Building healthy soil through soil testing, applying lime, and preparing soil with compost.
- Using “Right Plant, Right Place” principles and proper planting techniques.
- Mulch mowing to feed the soil.
- Using proper watering techniques for plant health and water conservation.

When teaching natural yard care, programs should integrate information on the connection between yard care practices and the health of people, pets, and Puget Sound into lessons rather than presenting environmental hand health information in a stand-alone workshop introduction session.

Strategies in this section are labeled by type using the following icons:

Outdoor demonstration—stations and hands-on activities to include in outdoor demonstration workshops.

Indoor display—displays to include in lecture workshops, for information conveyed visually on a poster, three-dimensional display, or hands-on activity that can be conducted indoors.

Tools and assistance—strategies that directly help participants use a practice by reducing barriers, such as difficulty recognizing recommended products in stores.

Information resource—such as fact sheets, guides, and webpages. Programs should avoid overwhelming participants with too much information by listing key resources in the core take-home materials and by providing supplemental resources online or by request. Programs should identify and use existing guides to avoid duplication before creating new materials.

Messaging—key points to convey when teaching a practice.

Videos—visual lessons, often on practices presented in outdoor demonstrations, to allow participants to review techniques at home.

Incentives—strategies that provide rewards or reduce costs to participants to encourage the use of practices.

Strategies are also labeled according to their recommended priority level:

- **High**—strategies that are expected to have high impact while being feasible and cost-effective to implement.
- **Moderate**—strategies that are expected to have moderate to high impact but may be more costly or otherwise difficult to implement.
- **Low**—strategies expected to have lower impact and be more difficult and costly to implement.

Fertilizer Use

Use Slow-Release, Natural, or Organic Fertilizer and Avoid Weed-and-Feed

In both programs, large changes in participant behaviors indicate that education on avoiding use of weed-and-feed was very effective. South Sound participants who were given free slow-release fertilizer used the product instead of fast-release fertilizer or weed-and-feed and said they intend to continue using it. However, programs will need to help participants overcome two key barriers to obtaining slow-release fertilizer: having stores carry the product and having participants identify the product in stores. Snohomish County has found that stores are increasingly carrying slow-release fertilizer but that residents may not know how to identify the product in stores. Thurston County and Olympia have found that stores in their area do not reliably keep slow-release fertilizer in stock; some national retailers may not restock slow-release fertilizer after selling out in early spring and require customers to special-order the product. When stores run out of slow-release fertilizer, residents may be more likely to use the fast-release fertilizer that is readily available in stock.

Figure 103. Strategies for fertilizer choices

Type	Description	Priority
	In lectures, videos, and a webpage, show participants how to identify and choose slow-release fertilizer: ▪ How to read the guaranteed analysis (NPK numbers). ▪ Words that signal the fertilizer contains slow-release nitrogen. ▪ Benefits and drawbacks between types of slow-release nitrogen. Fertilizer is covered in the City of Olympia's new video series, but information on how to identify slow release fertilizer will need to be added.	High
	Offer a coupon with a discount on slow-release fertilizer redeemable at stores that have agreed to promote this product. In addition to providing a discount, the coupon is intended to inform participants how to identify slow-release fertilizer and which stores carry the product. Consider asking retailers and manufacturers of slow-release fertilizer if they would fund the coupon values while the local jurisdiction funds the design, printing, and distribution costs.	High

Type	Description	Priority
	Through a STORM natural yard care work group, coordinate on a local level with individual stores and store managers to regularly stock and promote slow-release fertilizer—and list participating stores and fertilizer information on program webpages. While independent nurseries are often more receptive than national retailers, Northwest Natural Yard Days had some success in the past working with individual store managers of chain stores. In addition, a community effort on Vashon Island successfully worked with local store managers of both national chain stores and local retailers to remove the most toxic pesticides. Thurston County and Seattle Tilth are also working on point-of-purchase programs to promote recommended yard care products. Programs should review the successes and challenges faced by these programs before implementing a similar campaign.	Moderate (because costly and takes a lot of coordination)
	If additional research on the South Sound program shows that providing a one-time incentive of free slow-release fertilizer creates lasting behavior change, seek funding to provide free fertilizer sufficient for one application for each participant (based on soil test results and lawn measurements). This incentive could also be used to encourage participants to pay for a professional soil test.	Low (because costly)

Fertilizer Application Techniques

Participants in the South Sound made moderate to high changes in fertilizer application techniques, but room remains for increasing the use of recommended practices. North Sound participants were not taught these practices.

Figure 104. Strategies for fertilizer application techniques

Type	Description	Priority
	Offer an outdoor demonstration and create or promote an easy-to-use online calculator that allows participants to use their lawn measurement figures and soil test results to calculate the amount of: ■ Nitrogen in each bag or pound of fertilizer they are purchasing. ■ Fertilizer per square foot their lawn needs. ■ Total fertilizer they would need to buy. Ideally, participants would need to have measured their lawn and obtained a soil test before the workshop. Consider raffling a prize (such as slow-release fertilizer) to participants who complete this task using their actual lawn size and soil results. Make sure to emphasize that no more than one pound of nitrogen per 1,000 square feet should be applied in any one application. Demonstrate how to weigh fertilizer and properly store leftover fertilizer.	High
	Offer a video on how to apply fertilizer (covered in the City of Olympia's new video series).	High
	Offer an outdoor demonstration and website information on: ■ How to choose an easy-to-calibrate spreader. ■ Links to instruction on how to calibrate the spreaders most commonly sold by local retailers. If the demonstration is small enough, invite participants to bring their spreaders for one-on-one calibration assistance after the sessions.	High
	In fertilizer application lectures, fact sheets, and demonstrations, include messages about the importance of sweeping fertilizer off hard surfaces and the effects of fertilizer running off into local waterways (e.g., algae blooms that close beaches for swimming and shellfish harvesting, fish kills)	High

Fertilizer Timing

Participants in the South Sound made low changes in the timing of fertilizer application, and room for improving this practice remains. North Sound participants were not taught these practices.

Figure 105. Strategies for fertilizer timing

Type	Description	Priority
	Provide a one-page calendar on paper and online that identifies the proper months for fertilizing and how to time fertilizing around aerating, top-dressing with compost, and applying lime. Similar to the South Sound information and record-keeping sheet (See example in the South Sound Logistics Guide in Appendix H-03), include a space on the calendar for participants to record their soil conditions, fertilizer needs, and spreader calibration. On the reverse side, include key natural lawn care tips and links or phone numbers for more resources. Consider using cardstock so the calendar can be hung in a garden shed or garage.	High
	If creating a natural yard care blog or sending seasonal or monthly email updates, include timely reminders of the proper times to fertilize (and cautions during times people improperly fertilize). Include tips and links to resources on how to choose and apply fertilizer properly. Encourage recipients to share emails and messaging through social media.	High

Weed, Pest, and Disease Control

Many participants in both programs reported using at least one recommended technique before and after the outreach. Participants in both programs reported large reductions in using weed-and-feed. Nonetheless, in interviews many participants from both programs asked for more information on weed, pest, and disease control methods.

Figure 106. Strategies for weed, pest, and disease control

Type	Description	Priority
	Continue to emphasize: ■ The importance of correctly diagnosing yard and plant problems before applying a treatment. ■ The availability of and how to use key resources: — WSU Master Gardener volunteers (including how to find them) — *Grow Smart, Grow Safe* (www.growsmartgrowsafe.org) — WSU Hortsense website (http://hortsense.cahnrs.wsu.edu/Home/HortsenseHome.aspx) — Fact sheets available from the lecture program, such as the *Natural Pest, Weed, & Disease Guide*. ■ Preventing problems is easier and cheaper in the long run and protects the resident, pets, children, the local environment, and Puget Sound. ■ Problems can be prevented through using "Right Plant, Right Place" principles, creating a healthy soil ecosystem, and maintaining a thick, healthy lawn that can outcompete problems such as moss or weeds. During the lecture, guide participants through the process of diagnosing and choosing a control method for one or two of the most common weeds, pests, or diseases.	High
	Continue to have WSU Master Gardener volunteers available at workshops and strongly encourage participants to bring plant samples for diagnosis.	High
	Work regionally to preserve and maintain www.growsmartgrowsafe.org website. This guide is a unique resource that residents can use easily to research the toxicity of yard care products and identify the least-toxic techniques and products to address their weed, pest, and disease problems. This resource provides a user-friendly way to look up the hazard rating of specific yard care products registered for sale in the State of Washington. Communicate and collaborate with King County and other funding partners (such as Thurston County and Metro in Oregon) to preserve and maintain this resource. Explore developing and implementing a regional campaign to inform the general public about this resource and how to use it.	High

Type	Description	Priority
	Encourage participants to use the WSU Extension's online fact sheets that show how to diagnose and manage common weeds, pests, and diseases that affect yards in Puget Sound. Collaborate with WSU as needed to make the fact sheets more visual, address commonly misdiagnosed issues (such as crane flies, which rarely damage lawns in this region), and cover emerging problems. Many information resources already exist that programs could use with or without customizing. Examples of sources include WSU, Seattle Public Utilities (*ProIPM* series), and Seattle Tilth.	High
	Demonstrate crop rotation in a lecture demonstration or display. The North Sound used this demonstration in its "Pest, Weed, and Disease Control" lecture.	High
	Provide lecture displays showing how to diagnose and manage the top one or two weed, pest, and disease problems that relate to the lecture topic. For example, provide a display on managing moss and dandelions at a lecture on lawn care.	Moderate
	Consider supporting a coordinated, region-wide effort to train all WSU Master Gardener volunteers consistently on how to use www.growsmartgrowsafe.org. Master Gardener volunteers can use this web resource at their in-store clinics, once they diagnose a problem, to help residents know and understand which control techniques are least toxic for the issue at hand. As budget allows, provide more comprehensive training on natural yard care practices to supplement the regular Master Gardener volunteer training.	Moderate
	Create a video showing the steps to diagnose and manage problems: ▪ Collect samples properly. ▪ Consult with WSU Master Gardener volunteers or use other information resources. ▪ Use www.growsmartgrowsafe.org to select the least-toxic management method.	Moderate

Soil Conditions

Soil Testing

While soil testing is important for understanding soil conditions, residents rarely test their soil. Few South Sound participants had tested their soil before the outreach, although many planned to test it again in the future now that they understand the importance of soil testing.

Figure 107. Strategies for soil testing

Type	Description	Priority
	Demonstrate the components of soil and how it affects plants in a lecture display or demonstration. The North Sound program used a lecture demonstration titled "What's in soil" in the "Healthy Soil and Composting" lecture. Include pictures of the effects of improving soil conditions.	High
	Demonstrate in a lecture display how to find a soil-testing service (listing local options if possible) and how to read, interpret, and act on soil test reports. The South Sound program used a lecture and slide presentation at its outdoor demonstration workshops. Include pictures of the effects of applying the proper amount of lime and fertilizer.	High
	Provide a fact sheet or webpage on how to find a soil-testing service and how to read, interpret, and act on soil test reports. Include an annotated soil test in the fact sheet as an example.	High
	Create a video showing how to collect a soil sample properly for soil testing (covered by the City of Olympia's new video series).	High

Type	Description	Priority
	Facilitate soil testing through partnering with a local agencies or soil-testing service to offer a low-cost soil test in conjunction with the workshop. Work with the soil-testing entity to: ■ Use a standardized, easy-to-interpret report. ■ Measure lawn or bed area while collecting the soil test (unless cost-prohibitive). ■ Provide clear instructions on how to use the test results. WSU encouraged residents to register for a reduced-cost soil test during the first two sessions of its 10-part Growing Grocers Education Series held in 2015. The first two sessions covered healthy soil. Conduct additional research with WSU to assess the cost and effectiveness of this strategy. To ensure accurate results, program staff or partners (such as a soil-testing service provider) should collect soil samples or provide detailed instructions and guidance for the homeowner to collect soil samples; past programs have found that residents sometimes collect samples improperly (such as by collecting potting soil). To make sample collection more efficient, try to concentrate participants in one neighborhood and collect soil samples all on one day.	Moderate

Applying Lime

In the South Sound program, the combination of information on the importance of proper soil pH (to allow nutrient uptake and support lawn health) along with the hands-on demonstration and incentive of free lime appeared effective. In the North Sound, few participants applied lime after the program, indicating substantial room for improvement. Unlike slow-release fertilizer, lime is sold by many stores that carry yard care products, although residents may not understand why and how to use it properly.

Figure 108. Strategies for applying lime

Type	Description	Priority
	Continue to emphasize that applying lime to improve soil conditions (in conjunction with aerating) is important to: ■ Help lawns use the nutrients from fertilizer. ■ Prevent moss (if soil pH is the key contributor). ■ Support overall lawn health.	High
	Refer participants to online resources that provide instructions for how to apply lime and show conditions of lawns before and after lime and aeration.	High

	Demonstrate how to apply lime in an outdoor demonstration or video, in conjunction with demonstrations on how to apply fertilizer. Applying lime is covered by the City of Olympia's new video series.	High
	If additional research shows that providing a one-time incentive of free or discounted lime creates lasting behavior change, seek funding to provide free lime sufficient for one application (based on soil test results and lawn measurements). This incentive could also be used to encourage participants to pay for a professional soil test.	Moderate to High (if incentives shown to produce lasting behavior change)

Aerating and Top-Dressing with Compost

In the South Sound program, the hands-on demonstration and the incentive of a discount on renting an aerator appeared effective, at least in the short term. Other strategies (described below) may also increase aerating of lawns. In the North Sound, few participants aerated their soil after the outreach, indicating substantial room for improvement.

Figure 109. Strategies for aerating and top-dressing with compost

Type	Description	Priority
	Offer an outdoor demonstration and video showing: ▪ How to use an aerator. ▪ How to top-dress with compost after aerating. ▪ The difference that aerating and top-dressing with compost makes to soil and soil health. Aerating and top-dressing with compost is covered by the City of Olympia's new video series.	High
	Encourage participants who live in the same neighborhood to coordinate on renting an aerator and compost top-dressing equipment.	High
	Help participants hold an aeration day in which all participants in a neighborhood can jointly rent an aerator and top-dressing equipment (or can jointly hire a professional to aerate and top-dress). ▪ For example, Snohomish Conservation District offers free "compost parties," typically reaching three to six households per party. ▪ If facilitating a fee-based aeration day, consider offering a financial incentive (such as free compost for their yard) to the participant who leads the coordination for their neighborhood to compensate them for their additional effort. ▪ As another example, the City of Olympia's Neighborhood Lawn Aeration Program offers reimbursement for one-day rental of lawn aerator equipment when three or more residents team up to aerate their lawns. Invite participants who sign up when they register for lectures and demonstrations and again at the workshops.	Moderate
	Consider offering a rebate on renting top-dressing equipment or purchasing a top-dresser to loan to participants, in addition to offering a rebate on renting aeration equipment or hiring an aeration professional.	Moderate

Applying Mulch

By the end of the outreach, most North Sound participants reported keeping planting beds covered and not using landscape fabric or plastic. However, they may benefit from additional visual displays or demonstrations on mulching techniques.

Figure 110. Strategies for applying mulch

Type	Description	Priority
	Demonstrate in a lecture display and lead attendees through information in the *Building Healthy Soils* guide: ■ Problems caused by bare soil, landscape plastic, and landscape fabric. ■ Benefits of applying mulch, including water conservation. ■ Proper materials to use for mulching. ■ Factors to consider when choosing the proper mulching material, including photos showing the different looks achievable with each mulching material. ■ How to apply the different mulch materials, including tools to use, the depth of mulch to apply, and how to calculate how much mulch is needed. ■ How to tell when to apply more mulch.	High
	Demonstrate in an outdoor workshop or video: ■ How to apply the different mulch materials, including tools to use, the depth of mulch to apply, and how to calculate how much mulch is needed. ■ Reinforce information taught in the lecture display: — Problems caused by bare soil, landscape plastic, and landscape fabric. — Proper materials to use for mulching. — Factors to consider when choosing the proper mulching material, including photos showing the different looks achievable with each mulching material. — How to tell when to apply more mulch.	High
	If the program is teaching participants how to remove or replace lawn, present sheet mulching visually in a lecture display using photographs or videos or in an outdoor demonstration workshop. Provide samples of different mulches and photos showing how they look in application.	Moderate

Preparing Soil for Planting

After the North Sound lecture workshops, most participants reported following recommendations for mulching beds. While most also knew to use compost when preparing soil for planting, room for improvement remains on knowing to mix compost into the soil six to eight inches deep across the entire planting bed (not to individual planting holes).

Figure 111. Strategies for preparing soil for planting

Type	Description	Priority
	Offer an outdoor demonstration and a video showing: ■ That compost is the proper soil amendment. ■ How to mix compost 6 to 8 inches into the soil across an entire bed (visually showing how deep this is and explaining why this depth is important). ■ How to prepare soil when planting a single plant rather than an entire bed. ■ How large a hole to dig and how deep to plant the plants. ■ How to handle plants when planting them. Refer participants to the *Right Plant, Right Place* guide for more information and for plant lists.	High

Mowing

Mulch Mowing

Both programs created moderate behavior change with moderate post-outreach use of mulch mowing, indicating some room for improvement.

Figure 112. Strategies for mulch mowing

Type	Description	Priority
	Education should emphasize that mulch mowing supplies 25% to 50% of a lawn's nitrogen needs, reducing the need for fertilizer.	High
	Offer an outdoor demonstration or video using several mowers to show: ▪ How to determine if a mower is a mulching or non-mulching mower. ▪ How to choose and install a mulching blade (as an alternative to replacement). ▪ Mulch mowing tips for wet and dry months. Mulch mowing is covered by the City of Olympia's new video series.	Moderate
	Offer a coupon or rebate for purchasing an electric mulching mower or a mulching blade for an existing mower.	Low

Mowing Height

Little additional education is needed because use of recommended mowing heights was high both before and after outreach.

Figure 113. Strategies for mowing height

Type	Description	Priority
	Lecture display or webpage with photographs showing grass cut at different heights and different cutting amounts (e.g., cutting one-third per mowing), with notes on how each height and amount of cutting affects lawn health. Mowing height is also covered by the City of Olympia's new video series.	High

Blade Sharpening

South Sound participants made substantial changes but have room for improvement in sharpening or replacing mower blades.

Figure 114. Strategies for blade sharpening

Type	Description	Priority
	Offer an outdoor demonstration or video showing how to sharpen a blade at home (covered in the City of Olympia's new video series).	High
	Provide a lecture display or webpage showing: ▪ The difference between mowing with a sharp versus a dull blade. ▪ When to replace a blade versus sharpen a blade. ▪ How quickly a blade becomes dull. ▪ How to find a blade-sharpening professional. ▪ The typical cost for professional blade sharpening. ▪ A blade-sharpening guide with photos for homeowners.	High

Right Plant, Right Place

In the North Sound program, participants reported large changes in understanding and using "Right Plant, Right Place" principles, but additional room for improvement remains. Few participants reported having sketched a map of the sunlight and drainage conditions in their yard. Participants may also need assistance choosing plants for their yard conditions.

Figure 115. Strategies for "Right Plant, Right Place"

Type	Description	Priority
	Continue to provide lists of plants that thrive in specific (especially challenging) conditions and resources for finding more information and plant lists. Walk participants through the *Choosing the Right Plants* guide, which includes a template with instructions on how to identify and sketch a map of wet versus dry, sunny versus shady, and heat sink areas of their yard.	High
	Use a plant showcase display or slide show in lecture workshops to show examples of plants that thrive in specific (especially challenging) conditions.	High
	Continue to demonstrate the importance of soil conditions when following "Right Plant, Right Place" principles using a "soil jarshake test" in a lecture display with both a jar and photographs.	High

	Demonstrate in a lecture display or outdoor workshop how to conduct research to determine a plant's needs and characteristics, particularly pest and disease resistance, cold temperature tolerance, and drainage needs. Show participants how to: ▪ Look up plant information online using common and Latin names. ▪ Use online resources and books for information. ▪ Seek information from Master Gardener volunteers and nursery professionals.	High
	Hold a workshop or create a video on how to sketch a map of their yard and provide a template that participants can use at home. This workshop should involve each participant sketching one designated area of the workshop site with the demonstration instructor. Alternatively, the program could ask participants to bring a satellite view of their yard from an online mapping service (such as Google Maps, Yahoo Maps, Mapquest, and Bing Maps) for the sketching workshop.	Moderate

Watering

While the South Sound program created high behavior change in measuring the sprinkler watering rate, room for improvement remains. Most participants in both programs who watered their lawns watered three times per week or less, with 47% to 61% watering once a week or less. Given predictions of a dry year in 2016, programs should consider partnering with water purveyors to increase education on efficient watering techniques, including during a drought.

Figure 116. Strategies for watering

Type	Description	Priority
	Demonstrate measuring the sprinkler watering rate in outdoor workshops (potentially as a display rather than as part of an active session) and in a video (many already exist online). Watering is covered in the City of Olympia's new video series.	High
	Watering lessons may need to better emphasize that proper watering frequency results in a healthier lawn. Include instructions on how to water lawns during a drought, either to keep a green lawn or to allow the lawn go dormant. Continue to provide visuals demonstrating the connection between watering frequency and lawn rooting depth.	High

Type	Description	Priority
	Provide a fact sheet, such as the *Smart Watering* guide, with instructions on how to measure the sprinkler watering rate, a calculation template for determining how long to water, instructions on watering frequency for green and dormant lawns, and visuals showing the connection between watering frequency and lawn rooting depth.	High
	Given predictions for drier and hotter summers in the future, consider developing a lecture, lecture display, or outdoor demonstration focused on protecting and maintaining a landscape through extended dry seasons. STORM should consider reaching out to regional water purveyors to collaboratively develop and implement education campaigns that increase awareness of and teach residents practices including: ▪ Make every drop count by measuring the sprinkler watering rate, fixing leaks, adjusting watering times, and using drip irrigation for garden beds. ▪ Aerate and top-dress lawns with compost to retain moisture. ▪ Mulch landscaped beds with compost or other appropriate materials to retain moisture. ▪ Determine a plant's watering needs before buying and match the plant's needs to your garden conditions.	High
	Provide containers that participants can use to measure their lawn sprinkler watering rate. If using educational home visits, have the lawn coach set out the containers at the end of the site visit to encourage participants to conduct the test immediately.	Moderate to Low

Participant Recruitment

Program staff in both programs reported that recruitment worked well, and participants interviewed recommended expanding recruitment to reach more people. North Sound program staff were very positive about the mailers used for recruitment, with many noting that they must have worked well given the large attendance at workshops. Program staff from both programs also expressed that methods used to communicate with participants (primarily email) worked well and that similar methods should be used for future efforts.

Recommendations for recruitment in the future are described in the sections below.

Continue to Recruit Using Direct Mail and Flyers

Continue to use direct mailing for recruitment. For programs targeting specific geographic areas, continue to use geographically targeted mailers and add other location-specific recruitment methods as budget allows (such as flyers at community centers and utility bill inserts).

For multi-jurisdictional programs, continue inter-jurisdictional partnerships so that more widespread workshop promotions can include residents of multiple jurisdictions. For instance, in the North Sound program, a sign at the Mill Creek post office may be seen by residents that reside within the nearby jurisdictions of Lynnwood, Everett, Mill Creek, Bothell, and unincorporated Snohomish County.

Update Marketing Materials Periodically

Vary the look of marketing materials periodically and test alternative materials for rural residents (who appeared to have lower participation rates than urban residents in the North Sound). Include messages and visuals that address the benefits of natural yard care:

- Using the yard for a family recreation area; amenity to increase home value; pet play area; and source of fruits, vegetables, and herbs. Participants identified these as important ways they use their yard or lawn.
- Improving the look and function of yards and making yard care more efficient.
  - North Sound interviewed participants most commonly reported improving the look and function of yards and making yard care more efficient as motivating their changes to yard care practices.
  - North Sound nonparticipants who reported making changes in the post-outreach survey said their motivations were to make their yard look better (59%); spend less time on their yard (36%); and avoid toxic pesticides, weed killers, or fertilizers (25%).[7]
  - South Sound nonparticipants who reported making changes in the post-outreach survey most frequently said their motivations were to make their yard look better (39%). About quarter of respondents each chose the other responses: to avoid toxic pesticides, weed killers, or fertilizers; to protect local water resources; because they learned new information about lawn care; and to spend less time on their yard.

Expand Recruitment Methods

Expand recruitment methods

Recruit Using Past Participants

Recruit past participants to serve as neighborhood stewards who can invite and assist new participants. Also feature lawns of past participants as examples of success. Offer participants lawn signs that promote the program.

[7] Respondents were allowed to select multiple responses.

Encourage Participants to Invite Others

In the marketing materials and reminder emails to past participants, encourage participants to invite their neighbors, friends, and family so they can share information and support each other after the workshops. The North and South Sound programs did not use this tactic in 2014 so that the evaluation could assess randomly selected participants and nonparticipants.

Promote Online

Promote the program through community websites (such as NextDoor.com) and social media.

Continue to Offer Translations at Workshops

Continue to offer language translation at workshops and consider conducting market research and a pilot project to market a lecture series specifically for Spanish speakers as demand increases.

Consider Recruiting Door-to-Door in Target Neighborhoods

Other programs, such as Natural Yard Care Neighborhoods in Bothell, have found door-to-door recruitment more effective than mailings alone. While this method reduces mailing costs, it increases staff time, and King County jurisdictions have reported variable results, including high "no-show" rates at workshops. When successful, this method could help a program to concentrate participants in one neighborhood to obtain the following benefits:

- Increase the effects of social norming (that is, natural yard care practices become normal and expected in that neighborhood).
- Reduce costs for collecting soil samples (if offering this service or incentive),
- Enable the program to hold an aeration day for multiple participants.
- Enable the program to locate workshops in a convenient location for all participants.

Future programs should obtain more information from jurisdictions that have used this method on its challenges and successes.

Use Online Registration

Continue to use an online registration form, integrated with a baseline survey.

For programs that accept only participants who meet certain criteria, continue to include the clearly defined participant selection criteria in recruitment materials and the registration form.

Place the registration link on an established webpage that has been optimized for search engines, such as directly on the program's main page (for example, on www.naturalyardcare.info as a regional portal or on www.naturalyard.surfacewater.info for Snohomish County programs).

Audience Targeting

Consider focusing recruitment on residents who have purchased a home within the past three years (based on information from county auditor or assessor offices) because these residents were more likely to register for the program than residents who had lived in their homes longer than three years. However, programs should continue to accept all residents who otherwise meet program criteria.

Programs addressing practices related to fertilizing, using weed-and-feed, and mulch mowing should target participants who place high importance on having a green or weed-free lawn. In the North Sound at baseline, these participants were less likely to have implemented recommended practices and more likely to have implemented harmful practices compared to participants who placed less importance on these yard characteristics. However, these participants may also need extra encouragement or incentives to make changes. In the South Sound, participants who placed more importance on having a weed-free or green lawn showed *lower* levels of behavior change for the three practices where differences in behavior change were substantial.

A comparison of subgroups in the South Sound found that participants who strongly agreed in the baseline survey that fertilizer and pesticides are a major cause of water pollution showed higher levels of behavior change than other participants for practices related to use of these products. At the same time, participants who strongly agreed with these statements before the program were also *less* likely at *baseline* to be implementing natural lawn care practices related to these products. Accordingly, programs should consider including messages about protecting water quality in recruitment materials.

Otherwise, comparing survey results by subgroups did not identify clear trends to inform audience targeting.

Participant Communication

Communicate Primarily by Email

Continue to use email, supplemented by phone calls as needed, for participant communication. For its efficiency and effectiveness, email is recommended as the main communication method. In addition, continue to provide a phone number that residents can call for questions and to register if they lack internet access.

For efficient communication, continue to use pre-scripted welcome and reminder emails with mail-merge tools, updated as needed.

Increase Participant Engagement

Participants interviewed expressed enthusiasm about the program and requested ways to connect with other participants in their neighborhood, obtain follow-up assistance, and continue participating in the program.

Maintain Contact with Participants

Maintain contact with participants throughout the program by sending monthly emails with tips and updates and by providing a contact person, or at least a handbook, reference guide or website, for when participants have questions or need reminders.

Foster Neighborhood Connections

Create opportunities for participants in the same neighborhood to connect. Options include:

- List neighborhoods on participant nametags at workshops and encourage participants to arrive early and mingle over coffee or refreshments to promote community.
- Provide program yard signs so participants can see which neighbors are participating or have participated in the past.
- Work through established homeowners' associations or key community organizers, if known. Consider creating a program listserv or invitation-only Facebook group where participants in a given program can share information and ask questions of each other. A listserv would also allow the program coordinator to communicate easily with all participants, when personalized communication is not needed.

Maintain Contact after the Program

Interviewed participants in the South Sound also requested ways to obtain follow-up assistance and continue participating in the program. Continued engagement with past participants in all programs can support behavior change through prompts, reminders, and information on new recommended behaviors.

- Offer a quarterly email with reminders to perform season-specific natural yard care practices (such as when to aerate and top-dress with compost), prompts to contact the WSU Master Gardener program (or other resources when appropriate) with questions, and promotions for natural yard care educational videos and how-to demonstrations after the program. Contact Seattle Public Utilities to learn what worked well with their quarterly "Savvy Gardener" email communication to past participants, as well as the reasons it was discontinued.
- Maintain contact with past participants and consider having them serve as neighborhood ambassadors to share lawn care information with friends, family, and neighbors and to recruit new program participants.
  - Invite past participants to demonstration workshops or hold dedicated follow-up workshops with reminders on key practices, information on new topics of interest, and the opportunity to ask experts for advice.
  - Feature the lawns of past participants as examples of success. Invite participants to take part in a "before-and-after" series in which the program photographs their yard every year or two to show change over time.

- For intensive programs, such as in the South Sound, consider training past participants to become yard or lawn stewards who can help support demonstrations (led by yard or lawn care professionals) and recruitment in their neighborhoods for future educational efforts.

Partner Coordination

Communication among Program Partners

Frequent communication among program partners was essential. Recommendations for future multi-jurisdictional efforts are described below.

Designate a Lead Entity and Delegate Work to Partners

Continue to have one lead organization responsible for managing the overall program in a defined geographic area, but delegate work among partnering jurisdictions to share the burden of costs not covered by grant funding. For example, each STORM Stormwater Outreach Group can coordinate activities within its area, with one jurisdiction taking the lead while other jurisdictions provide support.

Communicate Regularly Using Email, Meetings, and Calls

Continue to use regular email updates and reminders, standing inter-jurisdictional meetings, and dedicated conference calls among partner jurisdictions.

Continue to communicate after the workshops have ended through debrief meetings after each series and through periodic email updates, such as on evaluation progress if appropriate.

Post Materials and Schedules on a Central Website

Continue to post locally appropriate materials and schedules to the STORM Natural Yard Care internal web pages as appropriate and needed. Post documents to the web pages and send emails to partners with hyperlinks to appropriate documents.

Curriculum Development and Communication with Presenters

Comments on the curriculum development process generally were positive for both programs. However, in the South Sound, communication between the program staff and lawn coaches posed some challenges in 2014 that were addressed in the 2015 program.

Establish Clear Expectations with Presenters and Communicate Regularly

Continue establishing clear expectations between presenters and program staff on communication protocols, project schedule, recommended practices, and workshop content before the program begins. For home site visits, such as lawn coaches, also establish clear expectations with program staff regarding site visits and reporting requirements. Incorporate these expectations into the presenter or lawn coach

contract, potentially using Olympia's 2015 contract as a template. Include in the contract any required planning and debrief meetings designed to tailor the curricula and presentation format.

Continue frequent, consistent communication with instructors and staff before workshops.

Develop Curriculum Guidelines Using Existing Resources or New Research

For a program covering a broad range of yard care topics, such as the North Sound program, continue to base curriculum on the *Natural Lawn & Garden Guides* developed by the City of Seattle, updated and tailored to local conditions as needed.

For programs developing or updating guidelines or curriculum, such as the South Sound program, continue to conduct literature reviews and internet research on best practices for lawn and yard care and also consult lawn and yard care professionals. South Sound program staff reported that the research and consultation they conducted was very helpful.

Give Presenters Clear Curriculum Objectives

Continue to give presenters and instructors clear objectives and program information as they develop curriculum, particularly if they will be required to teach specific practices.

Emphasize that presenters are expected to cover all specified topics they are contracted to lecture on and to ensure their lectures do not conflict with the curriculum guideline document (such as the *Natural Lawn & Garden Guides*). Work with the planning team and presenters to adjust curricula or workshop length to cover all specific topics within an appropriate amount of workshop or demonstration time.

Require Visuals or Demonstrations in Lectures

Require lecture presenters to include a hands-on demonstration in their presentation intended to convey how to implement a key practice. This element may be as simple as showing a brief video which conveys "how to."

Help Presenters Tailor Curriculum to Local Conditions

If applicable, hold a briefing meeting or share information on county- and city-specific yard care programs, resources, and landscape examples (such as local demonstration gardens or parks).

At least one week before the workshop, provide presenters with a list of the top three or four relevant questions that participants most frequently asked during registration. As feasible, presenters should incorporate these topics into the regularly scripted lecture or be prepared to answer these questions after the lecture.

Program Logistics

Program Planning and Timing

Begin Planning at Least Six Months Ahead

Start upfront planning at least six months before the first workshop. This schedule allows sufficient time for activities such as booking presenters, creating program and evaluation forms, designing and testing the registration process, preassembling packets, and determining the timing and script for email evaluations. Plan to finalize and test all forms and processes at least one month before beginning recruitment.

Lecture Workshops Logistics

Comments from North Sound program staff about workshop logistics were generally positive. They offered suggestions on keys to success and opportunities for improvement, as summarized below.

Select Appropriate Venues and Ensure Adequate Venue Staffing

Continue to use venues with good locations, sizes, parking availability, functionality, and venue staffing:

- Continue to meet with venue staff ahead of time to understand particular venue considerations and set-up needs, including acoustics, sightlines, sound equipment, and lighting.
- Consider using venue staff, if possible, to help with set-up and take-down to give program staff and WSU Master Gardener volunteers more time to interact with participants.
- If using translators, locate them where they will not distract other attendees.

Facilitate a Smooth Check-in Process

Continue to ensure participant check-in at the workshops runs smoothly.

- For large workshops (50 or more participants) continue splitting participant check-in into two lines by last name and having two dedicated staff members for check-in.
- Provide an incentive to arrive early to reduce the check-in rush before the presentation starts, such as by advertising that WSU Master Gardener table will be available for consultation at least half an hour before the presentation starts or by offering a door prize to people who arrive by a set time.
- Continue to meet with check-in staff before every workshop to review the process, roles, and expectations to ensure consistent, excellent customer service across all workshops.

Engage Residents during Workshops

For multi-jurisdictional programs, continue to involve city staff in engaging their residents:

- Encourage city staff to be proactive in greeting and checking in participants, collecting evaluations, and handing out door prizes.
- Consider budgeting for the host jurisdictions to provide a refreshment table or an information booth to create a place where participants can connect and learn about city programs and resources.

Involve WSU Master Gardener Volunteers

Continue to invite WSU Master Gardener volunteers and continue to encourage participants in emails and announcements at lectures to arrive early or stay late to ask questions one-on-one or in small groups with these yard care experts.

Ask WSU Master Gardener volunteers to bring resources primarily on identifying plants and diagnosing problems. Continue to provide additional natural yard care training to WSU Master Gardener volunteers. Train WSU Master Gardener volunteers to know and point to the information in the take-home materials when providing advice to participants. Continue to hold debrief meetings with participating WSU Master Gardeners volunteers after each workshop series season.

Modify Lecture Content

Integrate *Smart Watering* into Other Relevant Presentations

Integrate watering and irrigation into other yard care presentations rather than presenting it as a standalone topic (such as integrating lawn irrigation with lawn care and bed irrigation with plant care). According to program staff, several participants left during the break before the *Smart Watering* session and some commented that they "already know how to water." Integrating watering into other presentations will ensure participants learn about this topic.

Reduce Overlap between *Right Plant, Right Place* and *Sustainable Garden Design*

Revise the *Right Plant, Right Place* and *Sustainable Garden Design* presentations to avoid overlap and to focus more on practical, concrete information, including the following topics:

- How to determine a plant's needs and characteristics when choosing new plants, particularly pest and disease resistance, cold temperature tolerance, and drainage needs (also cover these topics in demonstration workshops).
- How to use the *Plant List* booklet provided during the lectures to find plants that thrive in specific (especially challenging) conditions and resources for more information and other plant lists.
- More emphasis that the right plants fail in the wrong place.
- More details on how to handle and plant new plants (also cover in demonstration workshops).

- How to use the *Choosing the Right Plants* guide, which includes a template with instructions on how to identify and sketch a map of wet versus dry, sunny versus shady, and heat sink areas of their yard.

Integrate Edibles, Where Appropriate

When asked to rate various uses of their yard, North Sound participants gave higher importance ratings than did nonparticipants for using their yard as a source of fruits, vegetables, and herbs. For practices presented in general workshops that apply to both edible and ornamental plants, include examples of both types of plants.

Demonstration Workshop Logistics

South Sound participant feedback regarding the workshop implementation was positive. At least 85% of participants for each of the sessions rated the workshop as very good or good, and 90% overall found it to be worth attending. Nearly 80% said they experienced a moderate to large increase to their understanding of how to implement lawn care practices. Based on program staff, lawn coach, and participant feedback, the evaluation team offers the following recommendations for holding demonstration workshops.

Cover Key Lecture Practices in Demonstration Sessions

Programs should choose the demonstration sessions that address the key practices covered in the lectures. Figure 117 presents suggestions for sessions to include in outdoor demonstration workshops, with notes on timing and possible incentives to offer as “door prizes” for attending. Ensure participants have adequate time for questions by scheduling time for questions both at the end of each session and at a dedication question session at the end of each workshop so participants can return to stations where they had additional questions. Encourage participants to bring paper and pens for notetaking.

Figure 117: Suggested outdoor demonstration sessions

Topics	Potential Incentives	Spring	Fall
Soil conditions, interpreting soil test results, and calculating lawn fertilizer and lime amounts	Free or discounted soil test	X	
Applying fertilizer and lime to lawns, weighing quantities, and calibrating spreaders	Free or discounted fertilizer or lime	X	X
Aerating, overseeding, and top-dressing with compost	Free or discounted aeration, aerator rental, or compost		X
Mowing (height, mulch mowing, and blade sharpening)	Free blade sharpening at event	X	
Watering lawns (measuring sprinkler watering rate and calculating watering times)	Free cups or timer to measure watering	X	
Controlling weeds and pests in lawns		X	X
Assessing yard conditions by sketching a yard map and testing soil (shake test)	Free or discounted soil test	X	X
Choosing the right plant for the right place (hold in same workshop and planting right)		X	X
Planting right: preparing soil, digging and filling planting holes, handling plants, watering new plants (hold in same workshop as choosing the right plant)	Free or discounted compost	X	X
Choosing and applying mulch	Free or discounted mulch	X	X
Watering: choosing, inspecting, and adjusting irrigation systems	Free watering timer or quick disconnect fitting	X	
Preventing weeds, pests, and diseases in planting beds		X	X

Continue to Use Yard Care Professionals as Presenters

Continue to use yard care professionals as instructors at the demonstration workshops, which allows participants an opportunity to ask their questions to trusted experts. In addition, yard care professionals often can supply equipment to use in demonstrations.

Ensure All Sessions Cover All Key Learning Objectives

To ensure all sessions cover all key learning objectives:

- Develop a schedule and a script or key talking points for each workshop session.
- Continue to ask presenters to rehearse and time their presentations on their own. If using yard care professionals who are not experienced presenters, consider holding a dress rehearsal to provide feedback as needed.

Incentive Logistics

Lessons learned on incentives logistics are based on the South Sound program's experience.

Provide Door Prices for Attending Workshops

The North Sound and South Sound programs both found that drawing for small "door prize" incentives related to the workshop topic, such as a watering timer during a watering lecture, were effective for encouraging attendance, engaging participants, and demonstrating natural yard and lawn care items.

Distribute Incentives in Conjunction with Workshops

If possible, distribute lime and fertilizer only on the same days as the workshops for participant convenience and as an added incentive to attend the workshop. If possible, hold the workshops at or near where the lime and fertilizer are delivered; transporting these incentives on workshop days is usually not feasible.

If incentives cannot be delivered on workshop days, distribute them after the workshops only to participants who attended the workshops, ideally from one central location during a short period of time to reduce staffing requirements.

Assure Participants that Fertilizer and Lime Quantities are Accurate for their Lawn

When handing out fertilizer, explain that participants are being given the correct amount and explain why they need less than they may have used in the past. Potentially provide a handout with the free fertilizer that shows their soil test results, lawn size, and the calculations used to determine their fertilizer amount. Consider holding a demonstration session or pre-workshop homework in which participants calculate their fertilizer and lime needs using an easy-to-use worksheet; use the free fertilizer and lime as an incentive for completing this exercise.

Increase Promotion of Discount Aerator Rental Incentive

While all participants received the free soil test and most participants used the free lime and slow-release fertilizer, fewer participants aerated their lawn. Ask lawn coaches to more strongly encourage participants to take advantage the aerator rental incentive (if continuing) and to better emphasize the benefits of aeration.

Continue to Offer the Free Soil Test

Continue to offer the free soil test. Although the soil test was less popular with the lawn coaches, participants rated it as among the most useful program elements that helped them make changes. Because the South Sound program was focused on reducing nutrient runoff, a soil test is vital so participants can accurately determine how much fertilizer and lime to apply.

Yard or Lawn Coach Home Visit Logistics

These recommendations apply only to programs that choose to offer a yard or lawn coach home visit as an add on to the core program. As discussed previously, this program model is costly and should be used only if the core program model of lecture and outdoor demonstration workshops are not achieving the desired level of behavior change.

Consider Offering Only One Home Visit

Consider offering only one lawn coach home visit per participant, potentially with an option to purchase a second site visit for participants who request it. In interviews, some participants did not think the second lawn coach visit was needed. In addition, lawn coaches noted that it was harder to schedule the second lawn coach visit, possibly indicating that many participants did not value it as much as the first visit.

In addition, consider replacing the second home visit with a second set of demonstration workshops to serve as a refresher with more time given to questions. Ask participants to bring photos of their lawns and of any pest, weed, or other issues they are concerned about with their lawn. Include a session on how to care for their lawn the following year.

Ensure Smooth Coordination of Lawn Coach Visits

To ensure smooth coordination and communication between lawn coaches, jurisdiction staff, and participants:

- Streamline lawn coach visit scheduling by using an online scheduling system and providing contact information only for participants who are ready for their visits.
- Improve the system for obtaining permission to collect soil samples, potentially by obtaining permission electronically during registration or by asking all registrants to print, sign, and mail the permission form when registering (even before they know whether they have been accepted to the program).

- Communicate to participants before both the first and second visits regarding the importance of scheduling and following through with visits, especially before the second visit, which participants appeared less interested in.

Lawn Coach Home Visit Program Timing and Schedule

The South Sound program had been designed to recruit participants before they applied fertilizer for that year, requiring the early recruitment. However, the South Sound program staff found recruitment to be a challenge in December when residents may have been thinking about holidays rather than their lawns. A surge of late applications delayed other program activities such as soil testing and resulted in scheduling challenges.

Consider Starting Lawn Program in Fall

Consider starting the program in fall to avoid the spring rush and test whether residents will sign up earlier in the recruitment process if recruitment is conducted during summer. Otherwise, use additional tools to encourage residents to sign up in January and February, such as asking previous participants to recruit their friends and neighbors, going door-to-door in targeted neighborhoods, or offering extra incentives for signing up by a specific date. For programs offering a soil test, ensure participants know not to apply any lawn care products for eight weeks before the soil test.

Consider Alternative Schedule for Spring Start

If continuing to start the lawn program in spring, consider the following alternative program schedule:

- Spring: soil test, lawn coach visit, and workshop on spring and summer practices (mowing, watering, applying fertilizer and lime, and pest and weed management).
- Early fall: workshop on fall practices (aerating, top-dressing, overseeding, applying fertilizer and lime, and pest and weed management) with optional lawn coach visit.

Take-Home Materials

Program staff in both programs recommended continuing to provide the take-home materials. North Sound program staff particularly noted that they were attractive, informative, and gave participants something to refer to later.

Continue to Provide Core Printed Take-Home Materials Used in Previous Programs

More than two-thirds of North Sound participants reported using the program brochures and handouts as they tried to implement the practices taught in the workshops, and almost as many used their workshop notes. For handouts created by the program, consider formatting to leave space for participants to take notes.

For the South Sound program, consider including individual soil test results and recommendations in participant handouts.

For the North Sound program, organize the materials by workshop to provide them to participants who missed a particular workshop.

Teach Participants How to Use Key Information Resources

As applicable, teach participants how to use the key take-home materials and information resources (such as www.growsmartgrowsafe.org) either by requiring presenters to incorporate them into their lectures or by having program staff demonstrate them in a short presentation before or after the lectures.

Continue to Provide Additional Take-Home Materials in a Self-Serve Display and Online

Continue to provide additional take-home materials in a self-serve display at lecture and demonstration workshops along with information on how to access additional information online. Additional resources for natural yard care programs could include existing pamphlets (such as *How to Landscape a Septic Drainfield*, *How to be a Salmon-Friendly Gardener*, *Garden-Wise*, and *Noxious Weeds that Harm Washington State*), videos, information on alternatives to invasive plants, and information on rain gardens and backyard composting.

Provide a Summary of Information Resources

Refer participants to the various *Natural Lawn and Garden Guides* for a summary of information resources including links to:

- Online versions of the take-home materials (and/or host an easy-to-find page on the jurisdiction's website, such as www.naturalyard.surfacewater.info, with these links organized by workshop).
- Additional resources including:
  - WSU Master Gardener volunteers (office locations, hours, and phone numbers).
  - The local conservation district (contact information and services provided).
  - Other website such as www.growsmartgrowsafe.org, www.naturalyardcare.info (a regional portal), and WSU Extension websites.
  - Reliable books.

Give participants the website address for online access on an item they are likely to keep (such the workshop handouts or a refrigerator magnet) so they can easily refer to and share information, including through social media.

Program Evaluation

These programs were implemented with a rigorous evaluation component specifically to meet National Pollutant Discharge Elimination System (NPDES) permit reporting requirements for measuring the understanding and adoption of targeted behaviors related to water quality. Because this evaluation demonstrated that both program models significantly affect behavior, future education programs using these models will not need to conduct such a rigorous evaluation unless they are conducting research on specific program elements. All future programs should include:

- Short baseline survey (7–10 questions on key practices) conducted as part of an online registration form.
- Signed pledge form on which participants commit to using key practices.
- Questionnaire to obtain participant feedback and suggestions, to be completed at the workshop.
- Short post-outreach survey (7–10 questions on key practices) conducted online 12–18 months after education.

The North and South Sound programs should also conduct additional research to assess the long-term effects of their education and to evaluate specific program elements in more detail. Due to grant and NPDES permit reporting requirements, this present program evaluation was not able to obtain long-term survey data (12–24 months) from South Sound participants.

Recommendations for Additional Research

Evaluate Long-Term Effects of South Sound Incentives

The evaluation team strongly recommends surveying South Sound participants again in 2016 or 2017 to evaluate whether behavior changes during the program proved lasting, particularly those related to the program incentives: fertilizer choices (including weed-and-feed use), lime, and aeration. This additional research is vital to determine whether future programs should offer incentives. (Note: the South Sound program offered one free bag of lime to participants who completed the medium-term post-outreach survey, so the survey would need to address whether they used only the free lime or also purchased additional lime on their own).

In addition, another survey of South Sound participants could help assess the extent to which the weather (hot and dry versus cool and wet) affects mulch mowing practices.

The South Sound program should send the survey using email and an online survey system and be prepared to make follow-up phone calls or send paper surveys if the response rate is low.

Evaluate Long-Term Changes by North Sound Participants

In addition, consider surveying North Sound participants again in 2016 or 2017 to evaluate whether planned behavior changes during the program took place, particularly among fall workshop attendees who had less time to use the practices. In addition, another survey of North Sound participants could

help assess the extent to which the weather (hot and dry versus cool and wet) affects mulch mowing practices.

Based on the medium-term survey response rates, the North Sound program will likely need to send a paper survey to obtain a sufficient number of responses.

Research the Effectiveness of Incentive Structures

If this additional research shows that South Sound participants continued using practices associated with incentives, the evaluation team also recommends conducting additional research to separate the effects of the incentives from the more intensive education that South Sound participants received by providing education to two groups of participants: give one group lawn coach home visits without incentives and a second group incentives without home visits.

A lecture and demonstration workshop program that is large enough could offer incentives or additional program elements (such as personalized onsite assistance) for research purposes in a drawing for participants who attend all the workshops. Allocating these add-ons by drawing after the workshops would enable random selection of otherwise similar participants, ensure that costly add-ons are offered only to participants who completed the core program, and provide participants with a fair and transparent explanation for why some did not receive the add-ons. Programs should consult with jurisdictions, such as the City of Bellevue, that have offered drawings in the past to learn from their experience.

Compile and Summarize Information on Regional Natural Yard Care Programs

Many jurisdictions in the Puget Sound region have conducted natural yard care education programs, such as King County's Northwest Natural Yard Days. In addition, the water purveyors Seattle Public Utilities and Cascade Water Alliance have conducted water-conservation programs using natural yard care practices. Future programs should compile evaluation reports from these programs and conduct a meta-analysis to assess the results of various program models, common elements of successful programs, practices that are more and less adopted by participants, and common themes among participant characteristics.

King County may be leading an effort to improve overall awareness of yard care impact on Puget Sound and promote natural yard care by allowing all STORM members to use the regional www.naturalyardcare.info website to post workshop and event information. The effort may also seek to cooperate on purchasing mass-media advertising across Puget Sound to promote the website, natural yard care practices, workshops, and demonstration events as well as conduct evaluation surveys to allow for regional comparison.

Recommendations for Ongoing Program Evaluations

Define Program Goals and Targeted Practices before Beginning Evaluation Planning

If conducting the North Sound and South Sound programs again and if the program schedule allows, develop and test all the surveys (participant and nonparticipant, baseline and medium-term post-outreach) at the same time. (Note the program and grant schedules did not allow the project and evaluation team to develop all survey instruments before implementing the baseline participant surveys.)

If possible, define program goals and specific practices that participants should either start or stop before beginning evaluation planning. At a minimum, begin evaluation planning at least three months before launching the program to allow time to:

- Select, refine, and define practices the evaluation will cover, to focus the evaluation on the most important practices with clear and consistent definitions of recommended and discouraged practices.
- Test baseline surveys online at least one month before registration begins.
- Develop baseline and follow-up surveys at the same time.

Separate a Pledge to Use Practices from a Survey to Obtain Participant Feedback

At the end of each workshop, use separate documents to record intent to use natural yard care practices and to obtain participant feedback on the program.

- Pledge to use key practices—ask participants to sign a pledge to use key practices covered in the workshop. Programs should recognize that actual behavior change is likely to be lower than pledged intent to change and cannot necessarily be estimated based on the share of participants pledging to use the practices.
- Survey for participant feedback—Use a survey completed at the end of workshops primarily to obtain participant feedback on the education program, such rating speaker effectiveness.

Continue to give participants time to complete the pledge and the survey during the workshop and offer small prizes in a drawing as an incentive for completing both items.

Conduct Shorter Baseline and Post-Outreach Surveys to Measure Behavior Change

To measure of behavior change and if budget allows, conduct a much shorter baseline survey before the program and a shorter post-outreach survey one full growing season after all education has ended. If budget allows, continue to use a unique identification number system to remove responses from participants who did not attend the program or who did not complete both the baseline and post-outreach surveys.

Conduct Baseline Survey during Registration

Continue to integrate the baseline survey into an online registration form. Consider requiring participants to complete the survey in order to participate in the program.

Conduct Post-Outreach Surveys by Email and Online for More Intensive Programs

Use email and an online survey system for programs in which participants were highly engaged and received and responded to emails during the program, such as the South Sound program. Email and online surveys cost less per respondent but require participants to recognize and be motivated to read the program's email, without losing it in a junk mail folder.

Email worked well for the South Sound program's survey, although program staff needed to conduct phone calls to obtain a high response rate for the medium-term post-outreach survey. The South Sound program also gave respondents a bag of lime as an incentive to complete the survey.

Conduct Post-Outreach Surveys by Postal Mail for Less Intensive Programs

Use a paper mail-based survey for programs in which participants were less engaged and received but did not need to respond to emails during the program, such as the North Sound program. When participants are less engaged and more likely to ignore a program email, a paper copy with a self-addressed, stamped envelope can increase response rates.

The North Sound program sent a paper survey to participants who did not respond by email. To increase response rates after sending the survey invitation and two reminder emails, the North Sound program added an incentive of a one-year subscription to the Chinook Book phone app to the subsequent reminder email and mailed paper version.

Recommendations on Shortening Participant Surveys

Focus Surveys on the Most Important Practices the Program Covers

After clearly defining program goals and the specific practices the program will cover, review surveys to remove questions not related to those practices and prioritize the remaining questions based on environmental or human health impact of the practices and on the amount of time spent on the practice during the program.

Remove Questions Not Related to Yard Care Practices

Unless conducting audience research or needed to satisfy grants, NPDES permits, or other requirement remove questions on attitudes, opinions, and information resources. If a program promotes one or two specific resources, consider including them in a direct question asking whether participants had used that resource (rather than presenting them with a long list of resources they may have used).

Remove or reduce demographic questions unless including to track participant diversity or gender or to meet outside requirements.

Remove or Revise Questions on Certain Practices

Consider removing or revising questions on the following practices that showed little change and remained in high use after the programs:

- Mowing height: remove this question because most participants mow the proper height.
- Mulch mowing: collapse question to ask about mulch mowing in wet months versus dry months rather than in each month individually.
- Fertilizer choices: ask directly in two separate questions whether they use slow-release fertilizer and whether they use weed-and-feed (providing a definition for this product). Include an option for "I do not fertilize."
- Weed, pest, and disease management: revise these questions to ask how frequently participants use the recommended practices (either individually or as a set of practices) and how frequently they use harmful practices.

6. Appendices

The following appendices follow this report:

Appendix A. Evaluation Plan

Appendix B. North Sound Survey Data Summary Tables

- B-01. North Sound participant baseline data (all respondents, cross-tabulated by Areas 1–7)
- B-02. North Sound participant baseline data (all respondents, cross-tabulated by North vs. South County)
- B-03. North Sound participant baseline survey comments
- B-04. North Sound participant baseline data (took both baseline and medium-term surveys, cross-tabulated by Areas 1–7)
- B-05. North Sound participant baseline data (took both baseline and medium-term surveys, cross-tabulated by North vs. South County)
- B-06. North Sound participant immediate post-outreach survey data (lawn and watering)
- B-07. North Sound participant immediate post-outreach survey comments (lawn and watering)
- B-08. North Sound participant immediate post-outreach survey data (plants, soil, and compost)
- B-09. North Sound participant immediate post-outreach survey comments (plants, soil, and compost)
- B-10. North Sound participant immediate post-outreach survey data (garden design and pest control)
- B-11. North Sound participant immediate post-outreach survey comments (garden design and pest control).
- B-12. North Sound participant medium-term post-outreach survey data (all respondents, cross-tabulated by Areas 1–7)
- B-13. North Sound participant medium-term post-outreach survey data (all respondents, cross-tabulated by North vs. South County)
- B-14. North Sound participant medium-term post-outreach survey comments
- B-15. North Sound participant medium-term post-outreach survey data (took both baseline and medium-term surveys, cross-tabulated by Areas 1–7)
- B-16. North Sound participant medium-term post-outreach survey data (took both baseline and medium-term surveys, cross-tabulated by North vs. South County)
- B-17. North Sound nonparticipant baseline survey data, cross-tabulated by North vs. South County
- B-18. North Sound nonparticipant baseline survey comments
- B-19. North Sound nonparticipant medium-term survey data, cross-tabulated by North vs. South County
- B-20. North Sound nonparticipant medium-term survey comments
- B-21. North Sound participant high-level summary data (additional cross-tabulations)

Appendix C. North Sound Survey Instruments

C-01. North Sound participant baseline (survey instrument)

C-02. North Sound participant immediate post-outreach (survey instruments for three lectures)

C-03. North Sound participant medium-term term post-outreach (survey instrument)

C-04. North Sound nonparticipant baseline (invitation postcard, invitation letter, survey instrument, reminder postcard)

C-05. North Sound nonparticipant medium-term (invitation postcard, invitation letter, survey instrument, reminder postcard)

C-06. North Sound participant post-outreach interview guide

C-07. North Sound staff and instructor survey instrument

Appendix D. South Sound Survey Data Summary Tables

D-01. South Sound participant baseline survey data, cross-tabulated by Olympia, Tumwater, and Thurston (all respondents)

D-02. South Sound participant baseline survey data, cross-tabulated by Olympia, Tumwater, and Thurston (took both baseline and medium-term)

D-03. South Sound participant baseline survey comments

D-04. South Sound participant immediate post-outreach survey data, cross-tabulated by Olympia, Tumwater, and Thurston

D-05. South Sound participant medium-term post-outreach survey data, cross-tabulated by Olympia, Tumwater, and Thurston (all respondents)

D-06. South Sound participant medium-term post-outreach survey comments

D-07. South Sound participant medium-term post-outreach survey data, cross-tabulated by Olympia, Tumwater, and Thurston (took both baseline and medium-term)

D-08. South Sound nonparticipant baseline survey data, cross-tabulated by Olympia, Tumwater, and Thurston (all respondents)

D-09. South Sound nonparticipant baseline survey data, cross-tabulated by Olympia, Tumwater, and Thurston (all respondents eligible for the program)

D-10. South Sound nonparticipant baseline survey comments

D-11. South Sound nonparticipant medium-term post-outreach survey data, cross-tabulated by Olympia, Tumwater, and Thurston (all respondents)

D-12. South Sound nonparticipant medium-term post-outreach survey data, cross-tabulated by Olympia, Tumwater, and Thurston (all respondents eligible for the program)

D-13. South Sound nonparticipant medium-term post-outreach survey comments

D-14. South Sound participant high-level summary data (additional cross-tabulations)

Appendix E. South Sound Survey Instruments

E-01. South Sound participant baseline (survey instrument)

E-02. South Sound participant immediate post-outreach (survey instruments for lawn coach visits and demonstration workshops)

E-03. South Sound participant medium-term post-outreach (survey instrument)

E-04. South Sound nonparticipant baseline (invitation postcard, invitation letter, survey instrument, reminder postcard)

E-05. South Sound nonparticipant medium-term (invitation postcard, invitation letter, survey instrument, reminder postcard)

E-06. South Sound participant post-outreach interview guide

E-07. South Sound staff and instructor survey instrument

Appendix F. Statistical Analysis Report

Appendix G. Participant Interview and Staff Survey Summaries

G-01. North Sound and South Sound participant post-outreach interview summaries

G-02. North Sound and South Sound staff and instructor survey summaries

Appendix H. Logistics Guides and Related Reports

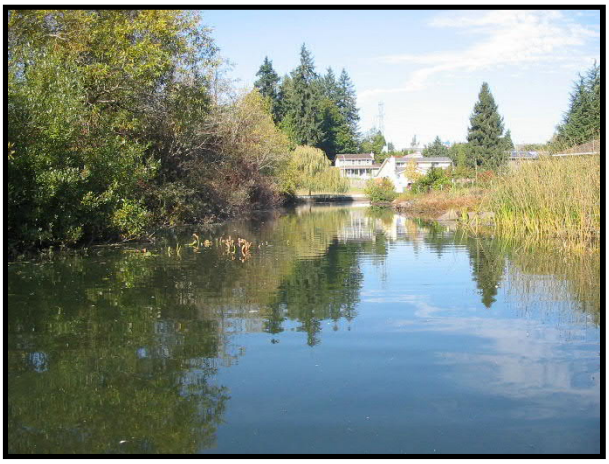
H-01. GROSS Grant Final Report

H-02. North Sound Logistics Guide

H-03. South Sound Logistics Guide

SNOHOMISH

STORMWATER MANAGEMENT PROGRAM




CITY OF SNOHOMISH

2017

1.0 INTRODUCTION

This document has been prepared to satisfy the Western Washington Phase II Municipal Stormwater Permit (Permit) requirement for the continued development and updating of the Stormwater Management Program (SWMP). The purpose of the SWMP is to reduce the discharge of pollutants from the municipal stormwater system to the maximum extent practicable and to protect water quality.

The National Pollutant Discharge Elimination System (NPDES) Permit is a federal permit that regulates stormwater and wastewater discharges to waters of the State. While it is a federal permit, the regulatory authority was delegated to the Washington State Department of Ecology (Ecology). In response, Ecology developed and issued the Western Washington Phase II Municipal Stormwater Permit. The Permit was issued by Ecology on January 17, 2007, and was modified in 2009 and 2012. A new permit was issued August 1, 2013, and will be in effect until July 31, 2018. It is the intent of this SWMP to recognize the current permit requirements and to plan for these requirements where appropriate.

All municipalities affected by the permit must create and implement a SWMP which addresses the following required program elements:

- Public Education and Outreach
- Public Involvement and Participation
- Illicit Discharge Detection and Elimination
- Controlling Run-Off from New Development, Redevelopment and Construction Sites
- Municipal Operations and Maintenance
- Total Maximum Daily Loads (TMDLs), if applicable to the jurisdiction

The City of Snohomish SWMP will be updated annually and submitted with the City's Annual Report to Ecology. The City of Snohomish is posting this document on the City web site (http://www.ci.snohomish.wa.us/213/Stormwater) so it can be reviewed by the public. Comments on the SWMP can be made by submitting comments in writing to City of Snohomish. Comments can be delivered or mailed to City of Snohomish, 116 Union Ave., Snohomish, WA 98290 ATTN: Max Selin, P.E., Senior Utilities Engineer. Email comments may be sent to: selin@snohomishwa.gov.

2.0 PUBLIC EDUCATION AND OUTREACH PROGRAM

The following section describes the Permit requirements related to Public Education and Outreach and the planned activities the City intends to conduct to meet these requirements.

2.1 Permit Requirements

The 2013 Permit (Section S5.C.1) requires the City to:

- Include an education and outreach program designed to reduce or eliminate behaviors and practices that cause or contribute to adverse stormwater impacts

and encourages public participation. The target audiences include the general public, engineers/contractors/developers/land use planners, residents, landscapers and property managers/owners.

- Create stewardship opportunities to participate in such activities as stream teams, storm drain marking, volunteer monitoring, education, and riparian plantings.
- Measure the understanding and adoption of the targeted behaviors for at least one target audience no later than February 2, 2016.

2.2 Planned Activities

Future activities planned to meet the Public Education and Outreach requirement of the permit are listed in Table 2-1.

Table 2-1

Planned Activities for Public Education and Outreach Program

Task ID	Task Description	Schedule
EDUC-1	Engineers/Contractors/Developers/Land Use Planners – Stormwater treatment and flow control BMPs/facilities: Pamphlet passed out with permits	Ongoing
EDUC-2	General public – pet waste handling facilities/education located at parks	Ongoing
EDUC-13	General public – Create stewardship activities by advertising the Sound Salmon Solutions and Snohomish Conservation District websites on the City website	Ongoing
EDUC-14	Volunteers to be used for LID and rain garden projects within City Parks directed by the Parks Department	Ongoing
EDUC-15	Farmer's Market informational booth to educate the general public on IDDE, pet waste and other general stormwater topics	Annually, May – Sept. (weekly)
EDUC-3	General public – general impacts of stormwater: Utility bill insert on stormwater topics	Annually
EDUC-16	Implement Environmental Coalition of South Seattle (ECOSS) spill kit distribution and education/outreach program. Revisit/evaluate businesses visited in 2013 and measure targeted behaviors.	Early 2017
EDUC-18	Community Stormwater Education and Outreach Event on stormwater pollution prevention	March 28, 2017

3.0 PUBLIC INVOLVEMENT AND PARTICIPATION PROGRAM

The following section describes the Permit requirements related to Public Involvement and Participation and the planned activities the City intends to conduct to meet these requirements.

3.1 Permit Requirements

The 2013 Permit (Section S5.C.2) requires the City to:

- Provide ongoing opportunities for public involvement and participation through advisory councils, public hearings, watershed committees, participation in developing rate structures or other similar activities.
- Provide the opportunity for the public to participate in the decision making processes involving the SWMP.
- The SWMP and Annual Report shall be posted to the City's website no later than May 31st of each year.

3.2 Planned Activities

Future activities planned to meet the Public Involvement and Participation requirement of the permit are listed in Table 3-1.

Table 3-1

Planned Activities for Public Involvement and Participation

Task ID	Task Description	Schedule
PI-1	Hold public meeting on the Annual SWMP via the City Council	By May (each year)
PI-2	Post final SWMP and Annual Report to City Website	By April 30th (each year)
PI-3	Post final SWMP in City Hall foyer.	By April 30th (each year)
PI-4	Post public opportunities to get involved on City website (i.e. links to Sound Salmon Solutions, Snohomish Conservation District, Snohomish County, Dept. of Ecology, etc.)	Ongoing

4.0 ILLICIT DISCHARGE DETECTION AND ELIMINATION

The following section describes the Permit requirements related to Illicit Discharge Detection and Elimination (IDDE) and the planned activities the City intends to conduct to meet these requirements.

4.1 Permit Requirements

The 2013 Permit (Section S5.C.3) requires the City to:

- Provide ongoing program designed to prevent, detect, characterize, trace and eliminate illicit connections and illicit discharges.
- Field assess at least one high priority waterbody in 2013 for IDDE purposes. *(Completed in 2015.)*
- Update City stormwater basemap which shall include all known outfalls, receiving waters, stormwater treatment and flow control facilities, conveyances where the outfall is 24-inches in diameter (or larger), and land use.
- Maintain an ordinance that effectively prohibits non-stormwater, illicit discharges into the storm system to the maximum extent allowable under state and federal law. The ordinance shall describe the allowable discharges and shall have an escalating enforcement procedure. This ordinance shall be reviewed and revised (if necessary) by February 2, 2018. The City shall have a compliance strategy to enforce the ordinance such as public education, technical assistance, source control and/or maintenance of stormwater facilities.
- Implement IDDE program that includes field screening of the system for illicit discharges/connections (40% of the system to be inspected no later than December 31, 2017 and then an average of 12% each year thereafter), procedures for detecting illicit discharges/connection and related enforcement, training for City staff, and informing businesses of hazards with illicit discharges,
- Publicize hotline for public reporting of spills and illicit discharges.

4.2 Planned Activities

Future activities planned to meet the Illicit Discharge and Detection and Elimination requirement of the permit are listed in Table 4-1.

Table 4-1

Planned Activities for Illicit Discharge Detection and Elimination

Task ID	Task Description	Schedule
IDDE–1	Provide general public with information related to IDDE including hotline on City website	Ongoing
IDDE-2	Maintain stormwater basemap	Ongoing
IDDE-3	Review IDDE ordinance for compliance with the Permit and effectiveness	▪ November 2017 *(needs to be adopted by Feb. 2, 2018)*
IDDE-4	Field Screen 10% of system for IDDE each year from 2013 through 2017 and then 12% of the system each year thereafter (Maintain records of which areas have been field screened and date inspected).	▪ 40% of total system inspected by Dec. 31, 2017 *(74% inspected as of Dec. 2016)* ▪ Beginning 2018, average of 12% to be inspected.
IDDE-5	Renew IDDE training for field staff and public employees (Track each training session with names of employees and date)	▪ November 2018
IDDE–6 / EDUC- 9	Provide businesses with brochures related to IDDE (track number of brochures and date delivered).	▪ Businesses: Ongoing ▪ Construction: Ongoing with permit handouts

5.0 CONTROLLING RUNOFF FROM NEW DEVELOPMENT, REDEVELOPMENT, AND CONSTRUCTION SITES

The following section describes the Permit requirements related to controlling runoff from new development, redevelopment and construction sites. It also describes the planned activities the City intends to conduct to meet these requirements.

5.1 Permit Requirements

The 2013 Permit (Section S5.C.4) requires the City to:

- Implement and enforce a program to reduce pollutants in stormwater runoff from new development, redevelopment and construction site activities.
- Adopt an ordinance to address runoff from new development, redevelopment and construction site activities that will be effective no later than December 31, 2016.
    - The ordinance addressing specific requirements in S5.C5.a(i) through (iii) shall apply to all applications submitted on or after January 1, 2017 and shall apply to projects approved prior to January 1, 2017 which have not started construction by January 1, 2022.
    - Adopt Minimum Requirements, thresholds and definitions in Appendix 1 of the Permit.
    - Include legal authority to inspect and enforce maintenance standards for private stormwater facilities for new development or redevelopment.
- Implement a site plan review process, inspection and enforcement to meet development standards for both private and public projects.
    - Review all stormwater site plans.
    - Inspect all permitted sites that have a high potential for sediment transport.
        - Prior to clearing and construction
        - During construction (for erosion control)
        - After construction (permanent stormwater facilities; maintenance plan in place for treatment/flow control BMPS/facilities). If an inspection identifies an exceedance of the maintenance standard, then the following maintenance should be performed:
            - Inspections to be held within 1 year for typical maintenance, except catch basins
            - Within 6 months for catch basins
            - Within 2 years for maintenance that requires capital construction of less than $25,000.
        - Maintain records of all inspections, warning letters, notices of violations, and other enforcement records.
    - Include provision to verify adequate long-term operation and maintenance of stormwater treatment and flow control BMPs/facilities. The ordinance must:
        - Clearly identify the party responsible for maintenance

        - Establish maintenance standards as protective as Chapter 4, Volume V of the *Stormwater Management Manual for Western Washington*.
        - Address annual inspections of all permitted stormwater treatment and flow control BMPs/Facilities unless there are maintenance records to justify a different frequency.
        - Address inspections of all permitted stormwater treatment and flow control BMPs/Facilities and catch basins in new residential developments every six months until 90% of the lots are constructed (or when construction is stopped and the site is fully stabilized).
- At least 80% of scheduled inspections need to be completed to be in compliance with the permit.
- Make available the "Notice of Intent for Construction Activity" and "Notice of Intent for Industrial Activity" to developers.
- Train staff in the site plan review process, inspections, and enforcement. Maintain records of this training and names of staff trained.
- Implement low impact development (LID) code no later than December 31, 2016.
    - Conduct review of LID codes using Integrating LID into *Local Codes: A Guidebook for Local Governments* (Puget Sound Partnership).
    - Submit summary of the review with annual report by March 31, 2017. The summary is to include existing LID requirements, a list of participants (job title, brief job description, department represented), the codes, rules, standards, and revisions made which incorporate LID principles and LID BMPs. It shall be organized into a) measures to minimize impervious surfaces, (b) measures to minimize loss of native vegetation and c) other measures to minimize stormwater runoff.
- Watershed-scale stormwater planning (i.e. provide support to NPDES Phase I Permittee if the County chooses a watershed that includes the City of Snohomish).

5.2 Planned Activities

Future activities planned to meet the Control Runoff from New Development, Redevelopment and Construction Sites requirement of the permit are listed in Table 5-1.

Table 5-1

Planned Activities for Controlling Runoff from New Development, Redevelopment and Construction Sites

Task ID	Task Description	Schedule
CTRL-1	Review site plans for compliance with City Code (Keep track of number of site plans reviewed)	Ongoing

Task ID	Task Description	Schedule
CTRL-2	Provide post construction inspections prior to approval for compliance with City Code (Maintain inspection records; see CTRL-4).	Ongoing
CTRL-3	Inspect constructions sites prior to and during construction for erosion control (Maintain inspection records; see CTRL-4).	Ongoing
CTRL-4	Maintain records of inspections (Include name of inspector, date, findings, warning letters, notices of violations, enforcement actions).	Ongoing *(Need to complete 80% of scheduled inspections)*
CTRL-5	Provide annual inspections of all stormwater treatment and flow control BMPs/facilities. ▪ Maintain inspection records; see CTRL-4. ▪ Document if a reduced inspection frequency is used. ▪ If inspection reveals that a maintenance standard is not being maintained, need to perform maintenance: o within 1 year (all facilities except catch basins) o within 6 months (catch basins) or o within 2 years (maintenance that requires capital construction of less than $25,000).	Ongoing *(Need to complete 80% of scheduled inspections)*
CTRL-6	Train staff in the site plan review process, inspections, and enforcement. Maintain records of this training and names of staff trained.	Ongoing/New Hires By Dec. 31, 2018
CTRL-7	Make available the "Notice of Intent for Construction Activity" and "Notice of Intent for Industrial Activity" to developers.	Ongoing
CTRL-13	Summary Report (per Permit requirement). Report to include: ▪ Existing LID requirements ▪ A list of participants (job title, brief job description, department represented), ▪ The codes, rules, standards, and revisions made which incorporate LID principles and LID BMPs. ▪ Organized into a) measures to	To be completed and submitted with March 31, 2017 annual report

Task ID	Task Description	Schedule
	minimize impervious surfaces, (b) measures to minimize loss of native vegetation and c) other measures to minimize stormwater runoff	

6.0 MUNICIPAL OPERATIONS AND MAINTENANCE

The following section describes the Permit requirements related to the City's stormwater operation and maintenance practices. It also describes the planned activities the City intends to conduct to meet these requirements.

6.1 Permit Requirements

The 2013 Permit (Section S5.C.5) requires the City to:

- Implement an operations and maintenance (O&M) program that includes a training component and has the ultimate goal of preventing or reducing pollutant runoff from municipal operations.
- Implement maintenance standards as protective as Chapter 4, Volume V of the *Stormwater Management Manual for Western Washington* .
- If an inspection identifies an exceedence of the maintenance standard, then the following maintenance should be performed:
    - Inspections to be held within 1 year for typical maintenance, except catch basins
    - Within 6 months for catch basins
    - Within 2 years for maintenance that requires capital construction of less than $25,000.
- Perform annual inspections and take appropriate maintenance actions of all permitted stormwater treatment and flow control BMPs/Facilities unless there are maintenance records to justify a different frequency.
- Spot check and if necessary, repair potentially damaged permanent stormwater treatment and flow control BMPs/facilities after major storm events (24 hour storm event with a 10 year or greater recurrence interval).
- Inspect (and clean if necessary) all catch basins and inlets owned by the City at least once no later than August 1, 2017 and every two years thereafter. Alternatives to this schedule include:
    - Revised inspection frequency allowed if maintenance records for double the length of the proposed inspection frequency warrant a reduced inspection frequency. If these records are not available, certified (per G19), written statements to document a specific, less frequent inspection schedule may be submitted and shall be based on actual inspection and maintenance experiences.
    - Conduct inspections by "circuit basis" whereby 25% of catch basins and inlets within each circuit are inspected. Include an inspection of the catch basin immediately upstream of any system outfall if applicable. Clean all catch basins within a given circuit for which the inspection indicates cleaning is needed.
    - Clean all pipes, ditches, catch basins and inlets within a circuit once during the permit term. Circuits selected for this alternative must drain to a single point.

- Implement practices, policies and procedures to reduce stormwater impacts associated with runoff from all lands owned by the City including streets, parking lots, roads highways, buildings, parks, open space, road right-of-ways, maintenance yards, and stormwater treatment and flow control BMPs/facilities.
    - The following activities are to be addressed: pipe cleaning, cleaning of culverts that convey stormwater in ditch systems, ditch maintenance, street cleaning, road repair and resurfacing (including pavement grinding), snow and ice control, utility installation, pavement striping maintenance, maintaining roadside areas, including vegetation management, dust control, applications of fertilizers/pesticides/herbicides (including reducing nutrients and pesticides using alternatives that minimize environmental impacts), sediment and erosion control, landscape maintenance and vegetation disposal, trash and pest waste management, and building exterior cleaning and maintenance.
- Implement training program for employees on O&M practices. Follow up training and documentation of training shall be conducted. A list of trained staff shall be maintained.
- Implement a Stormwater Pollution Prevention Plan (SWPPP) for all heavy equipment maintenance or storage yards and material storage facilities owned by the City. A schedule for implementation of structural BMPs and periodic visual observation of discharges from the facility to evaluate the effectiveness of the BMP shall be included in the SWPPP. Generic SWPPPs applicable to multiple sites may be used.
- Maintain records of inspection and maintenance or repair activities.

6.2 Planned Activities

Future activities planned to meet the Municipal Operations and Maintenance requirement of the permit are listed in Table 6-1.

Table 6-1

Planned Activities for Municipal Operations and Maintenance

Task ID	Task Description	Schedule
O&M-1	Maintain records of inspections and maintenance activities.	Ongoing
O&M-2	Provide annual inspections of all stormwater treatment and flow control BMPs/facilities. ▪ Maintain inspection records; see O&M-1. ▪ Document if a reduced inspection frequency is used. ▪ If inspection reveals that a maintenance standard is not being maintained, need to perform maintenance: o within 1 year (all facilities except catch basins) o within 6 months (catch basins) or o within 2 years (maintenance that requires capital construction of less than $25,000).	Ongoing
O&M-3	Spot check treatment and flow control facilities/BMPs and repair if necessary.	After 24-hour/10-year storms (Ongoing)
O&M-4	Train staff in O&M operations, inspection procedures, reporting water quality concerns, and on efforts to reduce pollutants to runoff. Maintain records of this training and names of staff trained.	Ongoing/New Hires ▪ By Dec. 31, 2018
O&M-8	Inspect all catch basins and inlets	To be completed by Aug. 1, 2017

7.0 COMPLIANCE WITH TOTAL MAXIMUM DAILY LOAD (TMDL) REQUIREMENTS

The following section describes the Permit requirements related to the City's participation associated with the Snohomish River Tributaries' Total Maximum Daily Load (TMDL). It also describes the planned activities the City intends to conduct to meet these requirements.

7.1 Permit Requirements

The 2013 Permit (Appendix 2) requires the City to:

- Business Inspections: Inspect commercial animal handling areas (veterinary and pet care/boarding services, animal slaughtering, and support activities for animal production) and commercial composting facilities to ensure implementation of source control BMPs for bacteria by August 1, 2016. Implement an ongoing inspection program to re-inspect facilities with bacteria source control problems a minimum of every three years.
- Public Education and Outreach: Conduct public education and outreach activities to increase awareness of bacterial pollution problems and promote proper pet waste management behavior.
- Operations and Maintenance: Install and maintain animal waste collection and/or education stations at municipal parks and other City owned lands reasonably expected to have dog and horse use and the potential for pollution of stormwater.
- IDDE: During IDDE-related field screening, screen for bacteria sources in any screened MS4 subbasins which discharge to surface waters in the TMDL area.
- Targeted Source Identification and Elimination: By February 2, 2014, the City shall review the fecal coliform data collected per approved QAPPs under the 2007 Permit and identify a minimum of one high priority area (such as a tributary or a stream segment) that will be the focus of source identification and elimination efforts. Prepare written documentation of this review and the identified high priority area and submit it with the 2014 Annual Report. The City shall begin to implement source identification and elimination efforts in the MS4 subbasins discharging to the identified high priority area no later than August 1, 2014. Stormwater quality sampling for bacteria sources is required. Each annual report's TMDL summary shall include qualitative and quantitative information about the source identification and elimination activities, including procedures followed and sampling results, implemented in the selected high priority area(s).
- Surface Water Monitoring: Review the fecal coliform data collected per approved QAPPs under the 2007 Permit and select surface water monitoring location(s) as appropriate for continued characterization and long term trends evaluation of fecal coliform. Submit a draft revised QAPP to Ecology for review and approval, no later than February 2, 2015. If Ecology does not request changes within 60 days, the draft QAPP is considered approved. At a minimum, the monitoring program shall:

- Begin by August 1, 2015.
- Collect 12 samples in at least one location per calendar year.
- Submit available data to the Environmental Information Management (EIM) database by May 31st of each year.
- Provide data summaries and narrative evaluation of the data in each annual report's TMDL summary.
- Be documented in a QAPP which follows Guidelines for Preparing Quality Assurance Project Plans for Environmental Studies, July 2004, Ecology Publication No. 04-03-030.

7.2 Planned Activities

Future activities planned to meet the TMDL requirement of the permit are listed in Table 7-1.

Table 7-1

Planned Activities for TMDL Requirements

Task ID	Task Description	Schedule
TMDL–4/ IDDE-4	Field screen for bacteria sources during IDDE screenings (i.e. look for fungus, algae, color, rotten egg or musty smell)	Annually (August)
TMDL–5	Continue stormwater sampling for fecal coliform (w/ revised sites)	Monthly *(or frontload toward summer…min. 12 samples per year, begin by Aug. 1, 2015)*
TMDL-6/ REP-2	Include TMDL Summary with Annual Report regarding source identification and elimination activities (procedures followed, sampling results from TMDL-5, Show figure with results)	March, Annually *(Due Mar. 31st)*
TMDL–7	Submit data to EIM database	May, Annually *(by May 31st)*
TMDL-8	Inspect veterinary offices for source control BMPs	April 2018 (re-inspect problem areas)
TMDL–9/ EDUC-2	Promote proper pet waste management behavior with pet waste stations at parks	Ongoing

8.0 MONITORING

The following section describes the Permit requirements related to monitoring. It also describes the planned activities the City intends to conduct to meet these requirements.

8.1 Permit Requirements

The 2013 Permit (Section S8) requires the City to:

- Describe any monitoring related studies conducted throughout the year in the Annual Report.
- Reporting involved with the Regional Stormwater Management Program is not necessary as part of the Annual Report. The regional program includes status and trends monitoring, stormwater management program effectiveness studies, and source identification/diagnostic monitoring.

8.2 Planned Activities

Future activities planned to meet the monitoring requirement of the permit are listed in Table 8-1.

Table 8-1

Planned Activities for TMDL Requirements

Task ID	Task Description	Schedule
MON-1	Opt into Regional Stormwater Management Program by paying the following fees: ▪ Status and Trends Monitoring: $2,276 ▪ Stormwater Program Effectiveness: $3,792 ▪ Source Identification and Diagnostic Monitoring: $352	Aug. 15th, each year
MON-2	Describe any stormwater monitoring conducted for the year in the Annual Report	By March 31st, each year

9.0 REPORTING REQUIREMENTS

The following section describes the Permit requirements related to reporting. It also describes the planned activities the City intends to conduct to meet these requirements.

9.1 Permit Requirements

The 2013 Permit (Section S9) requires the City to:

- Submit an Annual Report by March 31st of each year with the first reporting period being from January 1, 2014 to December 31, 2014. The report will include:
  - Copy of the current SWMP
  - Annual Report Form (per DOE)
  - Attachments (summaries, descriptions, reports, etc.)
  - Certification and signature
  - Notification of any annexations, incorporations or jurisdictional boundary changes
- Keep all records related to the permit and the SWMP for at least five years.
- All records related to the permit shall be available to the public at reasonable times during business hours.

9.2 Planned Activities

Future activities planned to meet the monitoring requirement of the permit are listed in Table 9-1.

Table 9-1

Planned Activities for Reporting Requirements

Task ID	Task Description	Schedule
REP-1	Submit Annual Report	March 31st, each year
REP-2 / TMDL-6	Include TMDL Summary with Annual Report regarding source identification and elimination activities (procedures followed, sampling results in TMDL-5, can show figure with results)	March 31st, each year

City of Snohomish
Education Efforts associated with the NPDES Phase II Permit

The Western Washington Phase II Municipal Stormwater Permit (August 2013) requires the City of Snohomish to provide an education program designed to target certain audiences. These audiences and topics are presented in Tables 1 through 4 along with the education activity provided by the City to address these areas.

TABLE 1
General Public and Business
Education Efforts for General Awareness

Education Activity	General Impacts of Stormwater	Impacts from Impervious Surfaces	Impacts of Illicit Discharges	LID (Principles/ BMPs)	Stewardship Opportunities
Utility bill insert on stormwater topics	✓	✓	✓		
Puget Sound posters at library/city hall	✓	✓	✓		
Link to rain garden handbook on city website	✓	✓		✓	
Link to LID Technical Guidance Manual on website				✓	
Draft of SWMP available on City website for comment					✓
Link to Sound Salmon Solutions on City website	✓		✓		✓
Link to Snohomish Conservation District on City website	✓			✓	✓
Wrapped Public Works trailers w/ IDDE related messages	✓		✓		
BMP poster to all restaurants	✓		✓		
Worked with ECOSS to provide spill kits to businesses	✓		✓		

Education Activity	General Impacts of Stormwater	Impacts from Impervious Surfaces	Impacts of Illicit Discharges	LID (Principles/ BMPs)	Stewardship Opportunities
Link to EPA website on City's website	✓	✓	✓	✓	
Make available free car wash kit to fundraising entities complete with brochure	✓	✓	✓		
City occupies a booth at local farmer's market May-Sept. for stormwater educational purposes	✓	✓	✓		
Kla Ha Ya Days – Drive wrapped truck educating about IDDE related issues while passing out brochures during the parade; Occupy booth as well.	✓	✓	✓		
Auto Maintenance Flyer on website and City Hall	✓		✓		

TABLE 2
Engineers, Contractors, Developers, and Land Use Planner
Education Efforts for General Awareness

Education Activity	Tech. Stds. for Stormwater Site and Erosion Control Plans	LID (Principles/ BMPs)	Stormwater Treatment and Flow Control BMPs/facilities
Pamphlet passed out with permits			✓
Link to rain garden handbook on city website		✓	✓
Link to LID Technical Guidance Manual on website	✓	✓	✓

TABLE 3
General Public and Business
Education Efforts for Behavior Change

Education Activity	Use and Storage of Automotive Chemicals, Hazardous Cleaning Supplies, Carwash Soaps and other Haz. Materials	Equipment Maintenance	Prevention of Illicit Discharges
Brochure to mobile pet groomers	✓	✓	✓
Brochure to mobile carpet cleaners	✓		✓
BMP poster to all restaurants in the city	✓		✓
Worked with ECOSS to provide spill kits to businesses	✓		✓
Emailed tip sheet to power washers to prevent illicit discharges	✓		✓

TABLE 4
Residents, Landscapers and Property Managers/Owners
Education Efforts for Behavior Change

Education Activity	Yard Care Techniques	Use/Storage of Pesticides/Fertilizers/ Household Chemicals	Carpet Cleaning and Auto Repair/ Maintenance	Vehicle/ Equipment/ Home Building Maintenance
Workshop w/ Conservation District for property owners along streams	✓	✓		
Natural Yard Care Workshop w/ Snohomish County	✓	✓		
Natural Yard Care Education Evaluation (Regional Study)	✓	✓		
Education Activity	Pet Waste Management	LID (Principles/ BMPs)	Stormwater Facility Maintenance	Dumpster / Trash Compactor Maintenance
Pet waste handling facilities/education at parks	✓			
Brochure to landscapers/HOAs on how to do detention pond maintenance			✓	
Link to rain garden handbook on city website		✓	✓	

City of Snohomish

LID Related Code and Standards Review Summary

March 2017

Prepared By:

City of Snohomish

Gray & Osborne, Inc.

Introduction

This document summarizes the review process conducted by the City of Snohomish (City) to implement low impact development (LID) principles and facilities within the City's codes and standards. This review is mandated by Section S5.C.4.f.i of the Washington State Department of Ecology (Ecology) National Pollution Discharge Elimination System (NPDES) Western Washington Phase II Municipal Stormwater Permit issued August 1, 2012 and modified January 16, 2015.

In accordance with Ecology's *"Integrating LID into Local Codes"* guidelines, the review process consists of six steps:

Step 1 – {Who} Assemble the Project Team
Step 2 – {What} Understand General Topics to Address
Step 3 – {Where} Review Existing Codes and Standards
Step 4 – {Fill the Gaps} Amend Existing Codes and Develop New Codes
Step 5 – {Review and Adopt} Public Review and Adoption Process
Step 6 – {Implement} Ensure Successful Implementation

The following discusses the City's efforts in completing each of these steps.

Step 1 – Assemble the Project Team

The following team was assembled to review the applicable City codes and documents related to LID principles and facilities.

Table 1. Project Team

Name	Job Title (Department)	Job Description	Contact Information	Role on Team
Glen Pickus	Planning Director (Planning)	Administers day to day management of Planning Department	pickus@snohomishwa.gov	Reviewer
Yoshihiro Monzaki	City Engineer (Public Works)	Administers day to day management of Engineering Department	monzaki@snohomishwa.gov	Reviewer
Andrew Sics	Project Engineer (Public Works)	Development review and Public Works projects	sics@snohomishwa.gov	Reviewer
Brooke Eidem	Associate Planner (Planning)	Development review, implement and maintain planning measures/codes	eidem@snohomishwa.gov	Reviewer
Stacey Clear	Engineering Consultant (Public Works)	Assists City with NPDES Compliance and Public Works projects	sclear@g-o.com	Reviewer

Step 2 – Understand General Topics to Address

When determining the LID related topics to review, the City used the topics identified in Ecology's *"Low Impact Development Code Update and Integration Toolkit."* These topics are identified in Table 2. In accordance to the permit requirements, this Summary Report is to be organized into the following categories:

1) Measures to minimize impervious surfaces;

2) Measures to minimize loss of native vegetation; and

3) Other measures to minimize stormwater runoff.

The topics below may fall under more than one of these categories. Therefore, Table 2 lists each topic and which of the permit categories the topic may pertain to.

Table 2. Code Related Topics Reviewed for LID Purposes

	Ecology Category		
Topic	Measures to Minimize Impervious Surfaces	Minimize Loss of Native Vegetation	Other Measures to Minimize Stormwater Runoff
Site Planning and Assessment	✓	✓	✓
Healthy Soils			✓
Landscaping, Native Vegetation and Street Landscaping		✓	
Hard and Impervious Surfaces	✓		✓
Bulk and Dimensional Considerations	✓		
Clearing and Grading		✓	✓
Street and Roads	✓		✓
Parking	✓		✓
Design Guidelines and Standards			✓
Stormwater Management and Maintenance			✓
Subdivision and Planned Unit Development (PUD)			✓
Critical Areas and Shoreline Management			✓

Step 3 – Review Existing Codes and Standards

Based on the topics to be addressed, the following documents were reviewed:

- City Code
    - Chapter 14.20 Classification of Permits by Type
    - Chapter 14.210 Dimensional and Other Requirements
    - Chapter 14.212 Pilchuck District Development Regulations
    - Chapter 14.215 Subdivisions
    - Chapter 14.220 Planned Residential Developments
    - Chapter 14.235 Off-Street Parking, Loading, and Access Requirements
    - Chapter 14.237 Clearing and Grading (New)
    - Chapter 14.240 Landscaping, Screening, Fencing and Retaining Walls
    - Chapter 14.255 Critical Areas – General
    - Chapter 14.260 Wetlands
    - Chapter 15.16 Stormwater Management

- City Engineering Design and Construction Standards (March 2004)

Using the questions listed in the subfocus topic sheets found within the *Low Impact Development Code Update and Integration Toolkit* , a spreadsheet was created to aid staff in documenting the review process. Appendix A contains the results of the City's review of both the municipal code chapters as well as the City Engineering Standards. This spreadsheet identifies the topics reviewed, cites the reference to the specific code section or standard that were applicable to the topic, and whether or not the code was revised. Where necessary, explanation was also provided for the codes or standards that were to remain unchanged.

Dates pertaining to the initial and final reviews are included in Table 3.

Table 3. Dates for LID Code/Standards Review

Document Name	Date	Initial Review Completed	Final Review Completed	Reviewers
Municipal City Code	As of September 2015	September 2015, July 2016, September 2016	October 2016	Pickus, Monzaki, Sics, Eidem, Clear
Engineering Standards	March 2004	September 2015, July 2016, September 2016	October 2016	Pickus, Monzaki, Sics, Eidem, Clear

Step 4 – Amend Existing Codes and Develop New Codes

Upon review of the City municipal code and standards, revisions were agreed upon internally amongst the project team. Appendix B is the final recommended code revisions which is included as a section of Ordinance 2315.

Step 5 – Public Review and Adoption Process

To allow for public review, City staff presented the recommended code and standard revisions to the Planning Commission and City Council at multiple public meetings, as follows:

- August 3, 2016 – Planning Commission meeting. Present an overview of the NPDES Phase II Permit and introduce the requirement for the implementation of LID principles and facilities within the City's codes and standards.
- August 16, 2016 – City Council meeting. Present an overview of the NPDES Phase II Permit and introduce the requirement for the implementation of LID principles and facilities within the City's codes and standards.
- September 7, 2016 – Planning Commission meeting. Present and discuss the recommended code and standard revisions.
- October 5, 2016 – Planning Commission meeting. Present and discuss the recommended code and standard revisions after incorporating comments from the September 7th meeting.
- November 1, 2016 – City Council meeting. Present the recommended code and standard revisions and conduct a public hearing for the adoption of Ordinance 2315 to revise the applicable codes and standards to implement the LID principles and facilities. No comments were received during the public hearing. The City Council unanimously adopted Ordinance 2315 during this meeting.

As stated in Step 4, Ordinance 2315 adopting the revised codes and standards is located in Appendix B.

Step 6 – Implement the Changes

Once adopted, the City implemented the new codes and standards immediately. Internal training regarding the revisions was minimal as those who would apply this information were already part of the Project Team and were familiar with the new codes and standards. As developers submit applications, City staff will verbally inform them of the update to the 2012 Ecology Stormwater Management Manual for Western Washington (Manual) and will assist these developers as necessary to understand the new stormwater related changes. On an ongoing basis, City field staff will work with contractors to understand the best management practices associated with the 2012 Manual and any other pertinent sections of the code and/or standards.

APPENDIX A

LID Related Code/Standards Review Results

Item No.		Questions Reviewed	Section Reference	Code/Comments	Topic Reviewed			Conflict/Gap Id'd			Step Taken				
					Y	N	N/A	Y	N	N/A	Leave As Is	Amend Existing	Develop New Code/Std	Decided Not to Incorporate New Changes	Reason for Not Incorporating
	Site Planning and Assessment														
1	Building Locations	Can the code be revised to require that buildings are located away from critical areas and preserve soils with good infiltration potential for stormwater management?	14.255.120(H)	14.255.120 Substantive Requirements H. Unless otherwise provided, buildings and other structures shall be set back a distance of ten feet from the edges of all critical areas and critical area buffers. The same protrusions into this setback area shall be allowed as the development code allows into property line setback areas. ***(No change to code section. Building setback addressed by code. Soils preservation addressed in other items.)***	✓				✓		✓				
2	Parking Area Locations	Can the code be revised to encourage positioning parking areas near the entrance to the site to reduce long driveways?	14.210.130, 14.235.090	14.210.130 Access Ways, Setbacks – Alleys, Easements, Private Roads. Vehicle access points from garages, carports, or fenced parking areas shall be set back from the alley property line, easement line, or private roadway, so that an approach apron of at least twenty-five (25) feet is provided. 14.235.090 Location of Parking Spaces. Off-street parking spaces shall be located as specified herein. Where a distance is specified, the distance shall be the walking distance measured from the nearest point of the parking facilities to the nearest point of the building which it serves. These requirements do not apply to an area in which off-street parking is paid for by the participants of a parking improvement district. A. Parking facilities for all single-family residences, mobile home parks, and multi-family dwellings shall be located on the same lot with the building they serve or on a lot within one hundred (100) feet from the nearest boundary and in the same ownership of the lot on which such structure is located. B. Parking facilities for all hospitals, sanitariums, homes for the aged, asylums, orphanages, rooming houses, boarding houses, hotels, and community clubs shall be located not more than two hundred (200) feet from the building they serve. C. For uses other than those specified above, parking facilities shall be located not over three hundred (300) feet from the building they are required to serve; provided, that for buildings situated within the Historic Business land use designation, off-street parking facilities may be provided up to one thousand (1,000) feet from the building. ***(No change to code section.)***	✓			✓			✓			✓	25-foot approach apron allows for vehicles to queue on site rather than on the street. Avoids traffic impacts. For residential areas, it allows for on-site parking.
3		Are there any incentives to developers to provide parking within garages rather than surface parking lots?	14.212.410, 14.212.530	Chapter 14.212 PILCHUCK DISTRICT DEVELOPMENT REGULATIONS 14.212.410 Allowed Uses. A. Uses listed. Table IV-1 designates permitted and provisional land uses in the Pilchuck District zones. ***(No change to code section. Table IV-1 allows parking garages in the Pilchuck District.)*** 14.212.530 Building Height Provisions. E. In a parking structure or garage, each above-ground level shall count as a single story regardless of its relationship to the habitable stories, except that podium parking levels less than 6 feet above the height of the adjacent sidewalk shall not be considered a story for the purpose of determining maximum building height. ***(No change to code section.)***	✓			✓			✓			✓	Parking garages are allowed, but are not typically used in a small community.
4	Stormwater treatment/flow control BMP/ facility locations	Can the code be revised to require infiltrating LID facilities in areas with good infiltration potential?	15.16.020	15.16.020 Stormwater Management Manual Adopted. The ~~2005~~ 2012 State Department of Ecology Stormwater Management Manual for Western Washington , as amended by Sections 1-6 of Appendix 1 of the Western Washington Phase II Municipal Stormwater Permit, as now or hereafter amended, is hereby adopted as the City's minimum stormwater regulations and as a technical reference manual and is hereinafter referred to as the "Stormwater Manual." ***(Revise code section. Addressed in SWMM, Volume I, Minimum Requirement #5 - LID Performance Standard)***	✓			✓				✓			

Item No.		Questions Reviewed	Section Reference	Code/Comments	Topic Reviewed			Conflict/Gap Id'd			Step Taken				
					Y	N	N/A	Y	N	N/A	Leave As Is	Amend Existing	Develop New Code/Std	Decided Not to Incorporate New Changes	Reason for Not Incorporating
5		Can the code include a site planning approach that emphasizes prioritizing the location of stormwater management facilities on site?	15.16.060	15.16.060 Low Impact Development – Alternative Standards. A. The City allows and encourages low impact development (LID) best management practices (BMPs), as an alternative to conventional stormwater management systems that rely on detention ponds and closed conveyance. Low impact development is intended to manage runoff close to the source of generation and to mimic the predeveloped hydrologic condition of a site. ***(No change to code section. Code encourages development of site to "mimic the predeveloped hydrologic condition of a site.")***	✓				✓		✓				
	Healthy Soils														
6	Protecting and Restoring Healthy Soil	Is a soil management plan in place that identifies soil protection zones during construction and describes quantities of compost amendment?	15.16.020	15.16.020 Stormwater Management Manual Adopted. The ~~2005~~ 2012 State Department of Ecology Stormwater Management Manual for Western Washington, as amended by Sections 1-6 of Appendix 1 of the Western Washington Phase II Municipal Stormwater Permit, as now or hereafter amended, is hereby adopted as the City's minimum stormwater regulations and as a technical reference manual and is hereinafter referred to as the "Stormwater Manual." ***(Revise code section. Addressed in SWMM Volume I Minimum Requirement #2, Elements 1 and 13 discuss soil protection and Minimum Requirement #5 refers to BMP T5.13 regarding soil and compost amendments.)***	✓			✓				✓			
7	Compost Amendments	Can code be revised to require amendment of disturbed soils?	15.16.020	15.16.020 Stormwater Management Manual Adopted. The ~~2005~~ 2012 State Department of Ecology Stormwater Management Manual for Western Washington, as amended by Sections 1-6 of Appendix 1 of the Western Washington Phase II Municipal Stormwater Permit, as now or hereafter amended, is hereby adopted as the City's minimum stormwater regulations and as a technical reference manual and is hereinafter referred to as the "Stormwater Manual." ***(Revise code section. Addressed in SWMM Volume I Minimum Requirement #2, Elements 1 and 13 discuss soil protection and Minimum Requirement #5 refers to BMP T5.13 regarding soil and compost amendments.)***	✓			✓				✓			
8		Could compost be provided to incentivize small projects?	15.16.020	15.16.020 Stormwater Management Manual Adopted. The ~~2005~~ 2012 State Department of Ecology Stormwater Management Manual for Western Washington, as amended by Sections 1-6 of Appendix 1 of the Western Washington Phase II Municipal Stormwater Permit, as now or hereafter amended, is hereby adopted as the City's minimum stormwater regulations and as a technical reference manual and is hereinafter referred to as the "Stormwater Manual." ***(Revise code section. Addressed in SWMM Volume I Minimum Requirement #2, Elements 1 and 13 discuss soil protection and Minimum Requirement #5 refers to BMP T5.13 regarding soil and compost amendments.)***	✓			✓				✓			
9	Compaction	Can the code be revised to include types of equipment for clearing and grading that minimize compaction of soils?	14.237.060(E) (Clearing and Grading)	14.237.060 Minimum Standards. Following minimum standards must be satisfied: E. Clearing and grading shall be the minimum necessary for the structure and to make installation and function of infrastructure feasible and economic for future service extensions to adjacent properties. ***(Adopt 14.237 Clearing and Grading code section. Clearing and grading equipment will not be included in code.)***	✓			✓						✓	✓	Specific equipment will not be identified in code. Contractor is responsible for construction methods.
10		Can clearing, grading, and soil disturbance outside the building footprint be limited or restricted?	14.237.060(E) (Clearing and Grading)	14.237.060 Minimum Standards. Following minimum standards must be satisfied: E. Clearing and grading shall be the minimum necessary for the structure and to make installation and function of infrastructure feasible and economic for future service extensions to adjacent properties. ***(Adopt 14.237 Clearing and Grading code section.)***	✓			✓						✓		

Item No.		Questions Reviewed	Section Reference	Code/Comments	Topic Reviewed			Conflict/Gap Id'd			Step Taken				
					Y	N	N/A	Y	N	N/A	Leave As Is	Amend Existing	Develop New Code/Std	Decided Not to Incorporate New Changes	Reason for Not Incorporating
11		Consider requiring contractors to reestablish permeability of soils that have been compacted by construction vehicles.	15.16.020	15.16.020 Stormwater Management Manual Adopted. The ~~2005~~ 2012 State Department of Ecology Stormwater Management Manual for Western Washington, as amended by Sections 1-6 of Appendix 1 of the Western Washington Phase II Municipal Stormwater Permit, as now or hereafter amended, is hereby adopted as the City's minimum stormwater regulations and as a technical reference manual and is hereinafter referred to as the "Stormwater Manual." ***(Revise code section. SWMM Volume I Minimum Requirement #5 refers to BMP T5.13 regarding soil and compost amendments.)***	✓			✓				✓			
	Landscaping, Native Vegetation, and Street Landscaping														
12	Tree Preservation	Are there regulatory controls over tree clearance and removal of mature trees/forest stands?	14.240.030(D)	14.240.030 Existing Vegetation ~~C~~D. Significant tree protection required. Any deciduous and evergreen trees eight (8)~~six (6)~~ inches or greater in diameter, as measured four (4) feet above the ground, is considered a significant tree, with the exception that alders and cottonwoods (Alnas rubra and Populis trichocarpa) are not considered significant. The property owner shall either furnish a site plan showing all free standing significant trees in areas proposed to be disturbed and the edge of tree cover in areas not proposed to be disturbed, or shall have an arborist provide a certificate stating there are no significant trees on the property. For property proposed for single-family detached residential development and capable of being subdivided, applicants shall retain significant trees, except in the following areas: utility corridors, roads, and building pads and the yard areas around the proposed residences. For one of these exceptions to apply, the applicant shall depict the area on a site plan showing all free standing significant trees in areas proposed to be disturbed and the edge of tree cover in areas not proposed to be disturbed. The applicant shall retain significant trees on the subject property to the maximum extent that is practical taking into consideration the nature of the proposed development. ***(Revise code section.)***	✓				✓		✓				
13		Can the code be revised to place greater emphasis on preservation of conifers?	14.240.030(D)	14.240.030 Existing Vegetation ~~C~~D. Significant tree protection required. Any deciduous and evergreen trees eight (8)~~six (6)~~ inches or greater in diameter, as measured four (4) feet above the ground, is considered a significant tree, with the exception that alders and cottonwoods (Alnas rubra and Populis trichocarpa) are not considered significant. The property owner shall either furnish a site plan showing all free standing significant trees in areas proposed to be disturbed and the edge of tree cover in areas not proposed to be disturbed, or shall have an arborist provide a certificate stating there are no significant trees on the property. For property proposed for single-family detached residential development and capable of being subdivided, applicants shall retain significant trees, except in the following areas: utility corridors, roads, and building pads and the yard areas around the proposed residences. For one of these exceptions to apply, the applicant shall depict the area on a site plan showing all free standing significant trees in areas proposed to be disturbed and the edge of tree cover in areas not proposed to be disturbed. The applicant shall retain significant trees on the subject property to the maximum extent that is practical taking into consideration the nature of the proposed development. ***(Revise code section.)***	✓				✓		✓				
14		Can the code include strategies to orient retained vegetation and open space to disconnect impervious surfaces?	14.240.030(C)	14.240.030 Existing Vegetation C. Retained vegetation shall be oriented, wherever possible, to disconnect adjacent impervious surfaces. ***(Revise code section. New item C.)***	✓			✓				✓			

Item No.		Questions Reviewed	Section Reference	Code/Comments	Topic Reviewed			Conflict/Gap Id'd			Step Taken				
					Y	N	N/A	Y	N	N/A	Leave As Is	Amend Existing	Develop New Code/Std	Decided Not to Incorporate New Changes	Reason for Not Incorporating
15	Screening	Can the screening requirements be revised to include provisions for retaining native vegetation or replanting?	14.240.030(A), 14.240.040(A)	14.240.030 Existing Vegetation A. General. ~~The applicant may be required to retain existing vegetation on the subject property to the maximum extent possible, where such vegetation is considered equal to or better than that required by this chapter and can be saved without serious disruption of the proposed development.~~New development shall retain all existing significant trees unless the retention of such trees would unreasonably burden the development or cause a significant safety problem, as determined by the City. 14.240.040 Landscape and Screening Requirements for Parking Lot and Site Development A. Plant materials. Landscape plant materials shall be selected from the landscape plant lists and street tree lists, as set forth below. Plants used for Low Impact Development facilities shall be selected from the Bioretention Plant Lists contained in Appendix 3 of the LID Technical Guidance Manual for Puget Sound. Selected plants must be suited to local soil conditions, if the site is not irrigated. Native plant species shall be preferred. ***(Revise code sections.)***	✓			✓				✓			
16		Can vegetation planted within LID facilities count towards site, parking, or perimeter screening requirements?	14.240.040	14.240.040 Landscape Requirements for Parking Lot and Site Development Requirements for landscaping of parking lots and site development are set forth in the two Snohomish Design Standards documents: the *Design Standards and Guidelines for the City's Historic District and Design Standards and Guidelines for Areas Outside of the Historic District* . Landscape plant materials used in Low Impact Development facilities may be considered for review by the City Planner when evaluating compliance to the landscape and screening requirements. ***(Revise code section.)***	✓			✓				✓			
17	Landscaping requirements for street frontages	Can the street frontage code be revised to include LID or other vegetation besides trees between the sidewalk and the street?	14.240.040(A), 14.210.230(D.3)	14.240.040 Landscape and Screening Requirements for Parking Lot and Site Development A. Plant materials. 1. Street Trees and Landscape Materials. a. All subdivisions shall supply street trees along the entire frontage of the property and any interior streets. Landscape materials, including for the purpose of Low Impact Development facilities, may be considered for frontage plantings. c. All trees and other landscape materials, including for the purpose of Low Impact Development facilities, planted adjacent to streets or in street right(s)-of-way must have approval from the City prior to planting and conform to the ROW vegetation maintenance regulations. 14.210.230 Business Park and Airport Industry. D. Landscaping and Open Space. 3. Landscaping Adjacent to Streets. All uses which adjoin a street will also provide a landscape corridor of trees, planted no more than fifty (50) feet on center. Landscape plant materials used in Low Impact Development facilities may also be considered. Such landscaping shall not obscure the sight distance for traffic and pedestrians at the intersection of streets or driveways. ***(Revise code sections.)***	✓			✓				✓			

Item No.		Questions Reviewed	Section Reference	Code/Comments	Topic Reviewed			Conflict/Gap Id'd			Step Taken				
					Y	N	N/A	Y	N	N/A	Leave As Is	Amend Existing	Develop New Code/Std	Decided Not to Incorporate New Changes	Reason for Not Incorporating
18		Can vegetation planted within LID facilities count towards open space or landscaping requirements?	14.210.030(E), 14.240.040	14.210.030 Measurement Methods. The following measurement methods shall be used to determine compliance with the dimensional standards in this Chapter: E. Open space calculations shall include areas of turf, landscaping, natural vegetation, or surface water retention/ detention facilities, including vegetated areas within Low Impact Development facilities. 14.240.040 Landscape and Screening Requirements for Parking Lot and Site Development Requirements for landscaping of parking lots and site development are set forth in the two Snohomish Design Standards documents: the *Design Standards and Guidelines for the City's Historic District and Design Standards and Guidelines for Areas Outside of the Historic District* . Landscape plant materials used in Low Impact Development facilities may be considered for review by the City Planner when evaluating compliance to the landscape and screening requirements. ***(Revise code sections.)***	✓			✓				✓			
19	Landscaping requirements for parking lots	Are minimum tree canopy or vegetation requirements specified for parking lots?	14.240.040	14.240.040 Landscape and Screening Requirements for Parking Lot and Site Development Requirements for landscaping of parking lots and site development are set forth in the two Snohomish Design Standards documents: the *Design Standards and Guidelines for the City's Historic District and Design Standards and Guidelines for Areas Outside of the Historic District* . Landscape plant materials used in Low Impact Development facilities may be considered for review by the City Planner when evaluating compliance to the landscape and screening requirements. ***(Revise code sections.)***	✓				✓			✓			
	Hard and Impervious Surfaces														
20	Maximum impervious surface allowances	Does the code include maximum impervious surface limits for different land use types?	14.210.330	14.210.330 Dimensional Requirements ***(Code section includes maximum impervious surface limits. No change to code section.)***	✓				✓		✓				
21		Can the maximum impervious surface limits be reduced in residential areas?	14.210.330	14.210.330 Dimensional Requirements ***(Code section includes maximum impervious surface limits. No change to code section.)***	✓			✓			✓			✓	City code identifies maximum allowable lot coverage percentage. Does not specify impervious surface. City allows and encourages the use of pervious materials.
22		Can a portion of the impervious surface be designated as non-pollution generating impervious surface?	14.210.330	14.210.330 Dimensional Requirements ***(Code section includes maximum impervious surface limits. No change to code section.)***	✓			✓			✓			✓	City code identifies maximum allowable lot coverage percentage. Does not specify impervious surface. City allows and encourages the use of pervious materials.

Item No.		Questions Reviewed	Section Reference	Code/Comments	Topic Reviewed			Conflict/Gap Id'd			Step Taken				
					Y	N	N/A	Y	N	N/A	Leave As Is	Amend Existing	Develop New Code/Std	Decided Not to Incorporate New Changes	Reason for Not Incorporating
23	Shared driveways	Are shared (or common) driveways for multiple single-family dwellings, multi-family structures, and/or commercial development allowed?	14.235.070(A)(D), 14.235.130(M)	14.235.070 Joint Uses of Parking Facilities. The City Planner may, upon application by the owner or lessee of any property, authorize the joint use of parking facilities by the following uses or activities under the conditions specified herein: A. Up to 50 percent of the parking facilities required by this chapter for primarily nighttime uses, which may include theaters, bowling alleys, bars, restaurants and related uses, may be supplied by other types of buildings or uses which are primarily daytime uses such as banks, offices, retail, personal service shops, clothing, food, furniture, manufacturing or wholesale and related uses. D. Multiple family uses having at least 5 units and motels having at least 10 units shall be considered nighttime uses for the purpose of shared parking calculations; however no more than 10 percent of their required parking may be provided by daytime uses. 14.235.130 Minimum Requirements for Off-Street Parking. M. Tandem Parking. Tandem parking is permitted only for detached single-family residences. ***(No changes to code sections.)***	✓				✓		✓				
24		Can the use of shared driveways (for up to 4 or 6 houses) be incorporated?	14.210,280, 14.235.130(M)	14.210.280 Street Frontage – Easements. Every lot in a residential or urban horticulture land use designation shall either adjoin a public street or have access to a public street by a private corridor. Such corridors shall be permanently committed as access for this lot by recorded document. Private corridors shall have a minimum width of twenty (20) feet, when serving property with a maximum development potential of four (4) standard lots and/or four (4) residential units, as defined by the minimum lot size and density of the respective land use designation. Property with a development potential in excess of four lots and/or four residential units shall require a minimum private corridor width of forty (40) feet. 14.235.130 Minimum Requirements for Off-Street Parking. M. Tandem Parking. Tandem parking is permitted only for detached single-family residences. ***(No changes to code sections.)***	✓				✓		✓				
25	Minimum driveway width	Is a minimum driveway width specified?	DS 3-19.3(6), DS 3-19.3(7), 14.235.130(B)	DS 3-19.3(6) COMMERCIAL DRIVEWAYS ***(No change to code section.)*** DS 3-19.3(7) RESIDENTIAL DRIVEWAYS A. Width: The maximum width shall be ~~24~~20 feet at dimension "1" on Standard Plan Nos. 307, 308, and 309. <u>The minimum width shall be 8 feet per SMC 14.235.130(B).</u> 14.235.130 Minimum Requirements for Off-Street Parking. B. Driveway Dimensions. When off-street parking is provided, the access driveway or lane shall be paved and have a minimum width of ~~twelve (12)~~<u>eight (8) feet</u>. The City Planner shall have the discretionary authority to require driveways to have a minimum of two eight-foot (8') moving lanes when unusual site problems, access for vehicles, or high traffic usage requires such. Driveway widths and construction standards within the public right-of-way shall be determined by the City Engineer. <u>Shared and two-track driveway designs are allowed.</u> ***(Revise code sections.)***	✓			✓				✓			

Item No.		Questions Reviewed	Section Reference	Code/Comments	Topic Reviewed			Conflict/Gap Id'd			Step Taken				
					Y	N	N/A	Y	N	N/A	Leave As Is	Amend Existing	Develop New Code/Std	Decided Not to Incorporate New Changes	Reason for Not Incorporating
26		Can the minimum driveway width be reduced to 9 feet or less (one lane), 18 feet (two lanes) or 16 feet (shared driveway)?	DS 3-19.3(7), 14.235.130(B)	DS 3-19.3(7) RESIDENTIAL DRIVEWAYS A. Width: The maximum width shall be ~~24~~20 feet at dimension "1" on Standard Plan Nos. 307, 308, and 309. The minimum width shall be 8 feet per SMC 14.235.130(B). 14.235.130 Minimum Requirements for Off-Street Parking. B. Driveway Dimensions. When off-street parking is provided, the access driveway or lane shall be paved and have a minimum width of ~~twelve (12)~~eight (8) feet. The City Planner shall have the discretionary authority to require driveways to have a minimum of two eight-foot (8') moving lanes when unusual site problems, access for vehicles, or high traffic usage requires such. Driveway widths and construction standards within the public right-of-way shall be determined by the City Engineer. Shared and two-track driveway designs are allowed. ***(Revise code sections.)***	✓			✓				✓			
27	Use of permeable pavement for driveways	Are alternative surfaces (other than conventional concrete or asphalt) allowed?	DS 3-19.2, 14.235.130(I)	3-19.2 MATERIALS Materials shall meet the requirements of the following sections of WSDOT/APWA Standard Specifications: Portland Cement 9-01 Fine Aggregate 9-03 Coarse Aggregate 9-03 Joint Materials 9-04 Curing and Admixtures 9-23 The concrete mix shall be as specified for Class 3000 and the slump of the concrete shall not exceed three inches. Pervious asphalt or porous concrete satisfying the requirements of the adopted Stormwater Management Manual may be used subject to approval of the City Engineer. 14.235.130 Minimum Requirements for Off-Street Parking. I. Surfacing. All off-street parking areas and vehicle sales areas, including ingress and egress lanes, shall be paved with a hard-surfaced material that may include permeable concrete or asphalt pavement. Marked, unpaved parking areas are permitted in Urban Horticulture, Public Parks, and Open Space zones, when a professional parking study shows the area will be for parking spaces in excess of those required pursuant to this Chapter. ***(Revise code sections.)***	✓			✓				✓			
28		Can the code be revised to include incentives for use of permeable pavement for driveways?	15.16.020	15.16.020 Stormwater Management Manual Adopted. The ~~2005~~ 2012 State Department of Ecology Stormwater Management Manual for Western Washington , as amended by Sections 1-6 of Appendix 1 of the Western Washington Phase II Municipal Stormwater Permit, as now or hereafter amended, is hereby adopted as the City's minimum stormwater regulations and as a technical reference manual and is hereinafter referred to as the "Stormwater Manual." ***(Revise code section. Addressed in SWMM Volume I Minimum Requirement #5)***	✓			✓				✓			
29	Two-track driveway design	Is a two-track driveway design allowed?	14.235.130(B)	14.235.130 Minimum Requirements for Off-Street Parking. B. Driveway Dimensions. When off-street parking is provided, the access driveway or lane shall be paved and have a minimum width of ~~twelve (12)~~eight (8) feet. The City Planner shall have the discretionary authority to require driveways to have a minimum of two eight-foot (8') moving lanes when unusual site problems, access for vehicles, or high traffic usage requires such. Driveway widths and construction standards within the public right-of-way shall be determined by the City Engineer. Shared and two-track driveway designs are allowed. ***(Revise code section.)***	✓			✓				✓			
	Bulk and Dimensional Considerations														

Item No.		Questions Reviewed	Section Reference	Code/Comments	Topic Reviewed			Conflict/Gap Id'd			Step Taken				
					Y	N	N/A	Y	N	N/A	Leave As Is	Amend Existing	Develop New Code/Std	Decided Not to Incorporate New Changes	Reason for Not Incorporating
30	Building setbacks	Can setback distances be minimized in residential areas to increase flexibility in regard to house location?	14.210.330	14.210.330 Dimensional Requirements ***(No change to code section.)***	✓			✓			✓			✓	Setback distances will not be changed at this time.
31		Can frontage areas requirements be reduced in open space residential developments?	14.220.100(C)	14.220.100 Special Design and Bulk and Dimensional Requirements C. The minimum lot width at the road frontage shall be forty (40) feet. To provide flexibility for innovative lot layouts and use of common space, at the City's discretion and on a case- by-case basis the minimum lot width at the road frontage may be reduced to twenty (20) feet, provided that the minimum lot width at the building line is forty (40) feet. ***(No change to code section.)***	✓				✓		✓				
32		Are irregular lot shapes (i.e. pie, flag, zipper, angled) allowed?	14.220.100(C)	14.220.100 Special Design and Bulk and Dimensional Requirements C. The minimum lot width at the road frontage shall be forty (40) feet. To provide flexibility for innovative lot layouts and use of common space, at the City's discretion and on a case- by-case basis the minimum lot width at the road frontage may be reduced to twenty (20) feet, provided that the minimum lot width at the building line is forty (40) feet. ***(No change to code section.)***	✓				✓		✓				
33	Height Limits	Can the maximum building height be increased if building footprints are reduced?	14.210.230(F), 14.210.330	14.210.230 Business Park and Airport Industry. F. Height Limitation. Building heights shall not exceed 45 feet. One additional foot of building height may be added for each additional foot of setback on all sides provided that the total building height shall not exceed 60 feet. 14.210.330 Dimensional Requirements ***(No change to code sections.)***	✓				✓		✓				
34	Maximum square footage	Can code be revised to incentivize or encourage minimizing building footprints?	14.210.330, 15.16.020	14.210.330 Dimensional Requirements ***(No change to code section.)*** 15.16.020 Stormwater Management Manual Adopted. The ~~2005~~ 2012 State Department of Ecology Stormwater Management Manual for Western Washington , as amended by Sections 1-6 of Appendix 1 of the Western Washington Phase II Municipal Stormwater Permit, as now or hereafter amended, is hereby adopted as the City's minimum stormwater regulations and as a technical reference manual and is hereinafter referred to as the "Stormwater Manual." ***(Revise code section. Addressed in SWMM Volume I Minimum Requirement #5)***	✓			✓				✓			
35	Clustering	Are cluster development designs allowed?	14.220.010(D)	14.220.010 Purpose D. Provide for choices in the layout of streets, utility networks, and other public improvements through superior site design and the use of clustering. ***(No change to code sections.)***	✓				✓		✓				
36		Are cluster development designs allowed "by right" (no special permit or zoning variance required)?	14.220.010(D)	14.220.010 Purpose D. Provide for choices in the layout of streets, utility networks, and other public improvements through superior site design and the use of clustering. ***(No change to code sections.)***	✓				✓		✓				

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					Y	N	N/A	Y	N	N/A	Leave As Is	Amend Existing	Develop New Code/Std	Decided Not to Incorporate New Changes	Reason for Not Incorporating
37		Are flexible site design criteria available for developers that utilize cluster design options?	14.220.010(D), 14.220.100(C)	14.220.010 Purpose D. Provide for choices in the layout of streets, utility networks, and other public improvements through superior site design and the use of clustering. 14.220.100 Special Design and Bulk and Dimensional Requirements C. The minimum lot width at the road frontage shall be forty (40) feet. To provide flexibility for innovative lot layouts and use of common space, at the City's discretion and on a case- by-case basis the minimum lot width at the road frontage may be reduced to twenty (20) feet, provided that the minimum lot width at the building line is forty (40) feet. ***(No change to code sections.)***	✓				✓		✓				
	Clearing and Grading														
38	Protecting existing infiltration	Do clearing and grading regs include provisions for minimizing site disturbance and protecting native vegetation and soils?	14.237.060(B) Clearing and Grading, 14.240.030(A)	14.237.060 Minimum Standards. B. Grading. The following are the minimum standards for grading unless otherwise modified by an approved grading plan: 2. Natural land and water features, vegetation, drainage and other natural features of the site shall be reasonably preserved. 4. Groundcover and tree disturbance shall be minimized. Tree retention and/or removal shall be in accordance with the provision of Chapter 14.240 SMC. 7. The duff layer and native soils shall be retained in an undisturbed state to the maximum extent practicable in areas not intended for building pads, access ways or other impervious surfaces. ***(Adopt 14.237 Clearing and Grading code section.)*** 14.240.030 Existing Vegetation A. General. ~~The applicant may be required to retain existing vegetation on the subject property to the maximum extent possible, where such vegetation is considered equal to or better than that required by this chapter and can be saved without serious disruption of the proposed development.~~New development shall retain all existing significant trees unless the retention of such trees would unreasonably burden the development or cause a significant safety problem, as determined by the City. ***(Revise code section.)***	✓			✓					✓		
39	Conserving native vegetation/soils	Is there an existing ordinance that requires or encourages the preservation of natural vegetation?	14.237.060(B) Clearing and Grading, 14.240.030(A)	14.237.060 Minimum Standards. B. Grading. The following are the minimum standards for grading unless otherwise modified by an approved grading plan: 2. Natural land and water features, vegetation, drainage and other natural features of the site shall be reasonably preserved. 4. Groundcover and tree disturbance shall be minimized. Tree retention and/or removal shall be in accordance with the provision of Chapter 14.240 SMC. 7. The duff layer and native soils shall be retained in an undisturbed state to the maximum extent practicable in areas not intended for building pads, access ways or other impervious surfaces. ***(Adopt 14.237 Clearing and Grading code section.)*** 14.240.030 Existing Vegetation A. General. ~~The applicant may be required to retain existing vegetation on the subject property to the maximum extent possible, where such vegetation is considered equal to or better than that required by this chapter and can be saved without serious disruption of the proposed development.~~New development shall retain all existing significant trees unless the retention of such trees would unreasonably burden the development or cause a significant safety problem, as determined by the City. ***(Revise code section.)***	✓			✓				✓	✓		

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					Y	N	N/A	Y	N	N/A	Leave As Is	Amend Existing	Develop New Code/Std	Decided Not to Incorporate New Changes	Reason for Not Incorporating
40		Is wholesale clearing (mass grading) of sites prohibited or limited?	14.237.060(B) Clearing and Grading, 14.240.030(A)(B)	14.237.060 Minimum Standards. B. Grading. The following are the minimum standards for grading unless otherwise modified by an approved grading plan: 2. Natural land and water features, vegetation, drainage and other natural features of the site shall be reasonably preserved. 4. Groundcover and tree disturbance shall be minimized. Tree retention and/or removal shall be in accordance with the provision of Chapter 14.240 SMC. 7. The duff layer and native soils shall be retained in an undisturbed state to the maximum extent practicable in areas not intended for building pads, access ways or other impervious surfaces. ***(Adopt 14.237 Clearing and Grading code section.)*** 14.240.030 Existing Vegetation A. General. ~~The applicant may be required to retain existing vegetation on the subject property to the maximum extent possible, where such vegetation is considered equal to or better than that required by this chapter and can be saved without serious disruption of the proposed development.~~New development shall retain all existing significant trees unless the retention of such trees would unreasonably burden the development or cause a significant safety problem, as determined by the City. B. Site clearing. No site clearing, grading or removal of significant trees or other vegetation shall take place prior to approval of the proposed landscaping plan. Wholesale clearing or mass grading of sites is discouraged. ***(Revise code section.)***	✓			✓				✓	✓		
41		Are developments required to set aside an undeveloped portion of the site?	14.210.330	14.210.330 Dimensional Requirements ***(Code section includes open space requirements. No change to code section.)***	✓				✓		✓				
42		Are there specific native vegetation retention standards based on land use and density?	14.240.030(A)	14.240.030 Existing Vegetation A. A. General. ~~The applicant may be required to retain existing vegetation on the subject property to the maximum extent possible, where such vegetation is considered equal to or better than that required by this chapter and can be saved without serious disruption of the proposed development.~~New development shall retain all existing significant trees unless the retention of such trees would unreasonably burden the development or cause a significant safety problem, as determined by the City. ***(Revise code section.)***	✓				✓			✓			
43		Is there any incentive to developers or landowners to conserve land (open space design, density bonuses, stormwater credits, or lower property tax rates)?	Chapter 14.220	Chapter 14.220 PLANNED RESIDENTIAL DEVELOPMENTS ***(No changes to code section. Open space requirements for density bonus.)***	✓				✓		✓				
44		Does the native vegetation definition (or other code section) include minimum tree density, minimum retention requirements, protecting native vegetation areas, replanting requirements, soil amendment standards, management plan specifications, and maintenance requirements?	Chapters 14.240, 14.237, 15.16	***(Chapters 14.240, 14.237 Clearing and Grading, and 15.16 address this item.)***	✓				✓		✓				

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45	Construction sequencing	Does the code include methods for effective construction sequencing to minimize site disturbance and soil compaction?	15.16.020	15.16.020 Stormwater Management Manual Adopted. The ~~2005~~ 2012 State Department of Ecology Stormwater Management Manual for Western Washington , as amended by Sections 1-6 of Appendix 1 of the Western Washington Phase II Municipal Stormwater Permit, as now or hereafter amended, is hereby adopted as the City's minimum stormwater regulations and as a technical reference manual and is hereinafter referred to as the "Stormwater Manual." ***(Revised code section. Addressed in SWMM, Volume II)***	✓			✓				✓			
46		Do engineering and street standards outline construction sequencing and practices for protecting pervious areas and LID BMPs during construction?	15.16.020	15.16.020 Stormwater Management Manual Adopted. The ~~2005~~ 2012 State Department of Ecology Stormwater Management Manual for Western Washington , as amended by Sections 1-6 of Appendix 1 of the Western Washington Phase II Municipal Stormwater Permit, as now or hereafter amended, is hereby adopted as the City's minimum stormwater regulations and as a technical reference manual and is hereinafter referred to as the "Stormwater Manual." ***(Revised code section. Addressed in SWMM, Volume II)***	✓			✓				✓			
47		Can the code be revised to limit clearing to the building footprint and area needed for maneuvering machinery?	14.237.060(E)	14.237.060 Minimum Standards. Following minimum standards must be satisfied: E. Clearing and grading shall be the minimum necessary for the structure and to make installation and function of infrastructure feasible and economic for future service extensions to adjacent properties. ***(Adopt 14.237 Clearing and Grading code section.)***	✓			✓					✓		
	Street and Roads														
48	Travel Lane Widths	What minimum travel lane widths are required based on street classifications?	DS	***(Travel lane widths vary from 10- (local) to 12-feet (arterial).)***	✓				✓		✓				
49		Is the travel lane wider than required by the fire dept.?	DS 3-4	***(No, Fire requires 20-foot access.)***	✓				✓		✓				
50		Can street widths be reduced for local access streets?	DS 3-2.1 (detail 300)	***(Detail 300, note 6, City Engineer may allow variance for local right of way width.)***	✓				✓		✓				
51		Are narrower pavement widths allowed along sections of roadway where there are no houses, building, or intersections, and where on-street parking is not anticipated?		***(Not a standard.)***	✓			✓			✓			✓	Modifications to the Standards may be granted by the City Engineer. This could be considered on a project specific basis.
52		Are queuing lanes (i.e. cars wait between parked cars while the approaching traffic passes) allowed?		***(Not a standard.)***	✓			✓			✓			✓	Traffic flows in the City have not identified a need to standardize this technique.
53	Right-of-way (ROW) widths	Can the minimum ROW width be reduced or include flexibility for LID considerations?	DS 3-2.1 (detail 300)	***(Detail 300, note 6, City Engineer may allow variance for local right of way width.)***	✓				✓		✓				
54		Can sidewalks be placed on one side of the street only in low-density residential areas.	DS 3-2.1 (detail 300)	***(Addressed in Street Standard Detail 300, note 5, City Engineer may allow sidewalk on one side...)***	✓				✓		✓				
55		Can alternate pedestrian networks (e.g. trails through common areas) be substituted for sidewalks?		***(Not specifically identified.)***	✓			✓			✓			✓	Easements or dedication would be required. Modifications to the Standards may be granted by the City Engineer. This could be considered on a project specific basis.

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56	Use of permeable pavement for streets and roads	Can permeable pavement be used for road shoulders, parking lanes, and emergency parking areas?		***(Not allowed on public street and roads.)***	✓			✓			✓			✓	Although City codes encourage the use of LID techniques and materials, having two different material types in a road could create future maintenance, trench patching and replacement problems.
57		Does the code require or encourage use of permeable pavement for future street/road resurfacing projects?	15.16.060	15.16.060 Low Impact Development – Alternative Standards. A. The City allows and encourages low impact development (LID) best management practices (BMPs), as an alternative to conventional stormwater management systems that rely on detention ponds and closed conveyance. Low impact development is intended to manage runoff close to the source of generation and to mimic the predeveloped hydrologic condition of a site. ***(Do not revise.)***	✓			✓			✓			✓	Although City codes encourage the use of LID techniques and materials, having two different material types in a road could create future maintenance, trench patching and replacement problems.
58	Placement of utilities under paved areas in the ROW	Does the code allow utilities to be placed under the paved section of the ROW? [Allows fewer conflicts for installation of roadside LID BMPs]	DS detail 322	***(Addressed in Street Standard Detail 322, utilities are allowed under the paved section of ROW.)***	✓				✓		✓				
59	Required turnaround area	Is the minimum street section necessary for safe access and emergency response being used?	DS 3-4, DS detail 304	***(Yes.)***	✓				✓		✓				
60	Sidewalk widths	What is the minimum sidewalk width allowed?	DS detail 306	***(Addressed in Street Standard Detail 306, Typically 5-feet, varies up to 15-feet in the Pilchuck District.)***	✓				✓		✓				
61		Can sidewalk width requirements be reduced in areas where LID BMPs are present?		***(No, ADA requirements must be satisfied.)***	✓			✓			✓			✓	Sidewalk widths must satisfy ADA requirements.
62	Sidewalk slope	Does the code contain sidewalk slope direction requirements?	DS detail 306	***(Addressed in Street Standard Detail 306, 2% slope to curb.)***	✓				✓		✓				
63	Use of permeable pavement for sidewalks	Is permeable pavement allowed for sidewalks?	DS 3-17.1, DS detail 306	**3-17 CEMENT CONCRETE SIDEWALKS** **3-17.1 DESCRIPTION** This work shall consist of constructing cement concrete sidewalks, thickened edge for sidewalks, curb ramps, and bus shelter pads, including excavation for the depth of the sidewalk and subgrade preparation, in accordance with these Specifications, the WSDOT/APWA Standard Specifications and Standard Drawings Nos. 306, 306A, 310A thru 310C, and 311. Porous concrete sidewalks may be used subject to approval of the City Engineer. ***(Revise code section.)***	✓			✓				✓				
64	Minimum cul-de-sac radius	What is the minimum cul-de-sac radius (35' optimal depending on emergency vehicle needs).	DS detail 304	***(Addressed in Street Standard Detail 304, Radius varies from 30-to 45-feet.)***	✓				✓		✓				
65		Can a landscaped island be placed in the center of the cul-de-sac and used for stormwater flow control and treatment?	DS detail 304	NOTE: CENTER LANDSCAPE ISLAND MAY BE ALLOWED. CITY ENGINEER APPROVAL REQUIRED. ***(Revise standard detail.)***	✓			✓				✓			
66	Alternatives to cul-de-sacs	Can hammerhead turnarounds or loop roads be used instead of standard cul-de-sacs?	DS detail 323	***(Addressed in Street Standard Detail 323, hammerheads turnarounds allowed on temporary dead end streets.)***	✓				✓		✓				

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	Parking														
67	Minimum parking ratios	What is your minimum parking ratio for the office bldg., shopping center, SFR?	14.235.170 to 14.235.240	***(No change to code sections. Parking requirements addressed in various tables in referenced code section.)***	✓				✓		✓				
68		Can the number of required parking spaces be reduced due to shared parking, proximity to transit, car sharing, etc.?	14.235.170 to 14.235.240	***(No change to code sections. Parking requirements addressed in various tables in referenced code section.)***	✓			✓			✓			✓	Shared parking and car share are not common in the City.
69	Maximum parking ratios	Are the parking requirements set as maximum or median (rather than minimum) requirements?	14.235.170 to 14.235.240	***(No change to code sections. Parking requirements addressed in various tables in referenced code section. Set as minimum.)***	✓			✓			✓			✓	Parking spaces are based on land use. No plans to change requirement.
70		Can a maximum number of parking spaces be specified?	14.235.170 to 14.235.240	***(No change to code sections. Parking requirements addressed in various tables in referenced code section.)***	✓			✓			✓			✓	Parking spaces are based on land use. No plans to change requirement.
71	Permeable paving use	Can permeable pavement be used for parking areas, parking lanes, and/or parking spaces?	14.235.130(I)(J)	14.235.130 Minimum Requirements for Off-Street Parking. I. Surfacing. All off-street parking areas and vehicle sales areas, including ingress and egress lanes, shall be paved with a hard-surfaced material <u>that may include permeable concrete or asphalt pavement. Marked, unpaved parking areas are permitted in Urban Horticulture, Public Parks, and Open Space zones, when a professional parking study shows the area will be for parking spaces in excess of those required pursuant to this Chapter.</u> J. Surface Water Runoff. All off-street parking areas and car sales areas shall be graded and drained in order to dispose of surface water runoff, subject to the approval of the City Engineer. All hard-surface areas shall be drained to an approved catch basin within the confines of the lot and disposed of through a drainage system as approved by the City Engineer. The use of low impact development technology in the construction of such areas is encouraged by the City providing it produces a surface that can be safely walked upon, can be marked to define parking spaces and other necessary information, and has been determined to be as serviceable as conventional asphalt paving. ***(Revise code section.)***	✓			✓				✓			
72		Can permeable pavement be incentivized for spillover (infrequently used) parking areas?	14.235.130(J), 15.16.020	14.235.130 Minimum Requirements for Off-Street Parking. J. Surface Water Runoff. All off-street parking areas and car sales areas shall be graded and drained in order to dispose of surface water runoff, subject to the approval of the City Engineer. All hard-surface areas shall be drained to an approved catch basin within the confines of the lot and disposed of through a drainage system as approved by the City Engineer. The use of low impact development technology in the construction of such areas is encouraged by the City providing it produces a surface that can be safely walked upon, can be marked to define parking spaces and other necessary information, and has been determined to be as serviceable as conventional asphalt paving. ***(No changes to code section.)*** 15.16.020 Stormwater Management Manual Adopted. The ~~2005~~ <u>2012</u> State Department of Ecology Stormwater Management Manual for Western Washington , as amended by Sections 1-6 of Appendix 1 of the Western Washington Phase II Municipal Stormwater Permit, as now or hereafter amended, is hereby adopted as the City's minimum stormwater regulations and as a technical reference manual and is hereinafter referred to as the "Stormwater Manual." ***(Revise code section.)***	✓			✓			✓			✓	Adopting the 2012 Manual encourages LID; by doing so, if permeable pavement is used, there is less volume to be detained and therefore, less cost for detention.

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73	Parking Stall Dimensions	What is the min. stall length and width for a standard parking space?	14.235.130(A)	14.235.130 Minimum Requirements for Off-Street Parking. A. Minimum Dimensions. The size and dimensions of individual parking stalls shall be eight and one-half (8½) feet wide and eighteen (18) feet long, and shall include an additional one hundred (100) square feet of maneuvering area. Parking areas including more than four (4) stalls of parking shall comply with the parking area dimensions as described in Figure 1 and Figure 2. ***(No changes to code section.)***	✓				✓		✓				
74		Can the parking stall length and/or width be reduced?	14.235.130(A)	14.235.130 Minimum Requirements for Off-Street Parking. A. Minimum Dimensions. The size and dimensions of individual parking stalls shall be eight and one-half (8½) feet wide and eighteen (18) feet long, and shall include an additional one hundred (100) square feet of maneuvering area. Parking areas including more than four (4) stalls of parking shall comply with the parking area dimensions as described in Figure 1 and Figure 2. ***(No changes to code section.)***	✓			✓			✓			✓	Standard parking dimensions are used. No plans to change requirement.
75		Are a fixed percentage of stalls (15-35%) assigned to compact cars?	14.235.120(A)	14.235.120 Allowance for Compact Cars. A. When parking standards require ten (10) or more parking spaces, up to 40 percent of the off-street parking spaces required by this chapter may be designated for compact cars in accordance with Table 10 and Table 11. ***(No changes to code section.)***	✓			✓			✓			✓	Up to 40% is allowed.
76	Driving aisle dimensions	Is the driving aisle wider than required by the fire department?	14.235.130(C), 14.235.260, 14.235.270	14.235.130 Minimum Requirements for Off-Street Parking. C. Required Access and Fire Lanes. The Fire Marshal shall determine when access for fire lanes shall be required. Such access and fire lanes shall be designed with not less than twenty-five (25) feet in width, forming a continuous route or loop connecting at both ends with streets, or as stipulated by the Fire Marshal. ***(No changes to code section. Driving aisle width stated in tables in SMC 14.235.260 and 14.235.270 vary from 11- to 25-feet which is equal to or less than the required fire lane width.)***	✓				✓		✓				
77		Can one-way aisle be used in conjunction with angled parking stalls instead of two-way aisles?	14.235.260, 14.235.270, 14.235.280, 14.235.290	***(No changes to code section. Table and figures shown in SMC 14.235.260, 14.235.270, 14.235.280, and 14.235.290 allow one-way aisles.)***	✓				✓		✓				
78	Off-street parking regulations	Can mechanisms be integrated to reduce parking requirements (e.g. shared parking, proximity to transit, car share, etc..?)	14.235.170 to 14.235.240	***(No change to code section. Parking requirements addressed in various tables in referenced code section.)***	✓			✓			✓			✓	Shared parking and car share are not common in the City.
79		Can structured or tuck-under parking be incentivized?	14.212.410, 14.212.530	Chapter 14.212 PILCHUCK DISTRICT DEVELOPMENT REGULATIONS 14.212.410 Allowed Uses. A. Uses listed. Table IV-1 designates permitted and provisional land uses in the Pilchuck District zones. ***(No change to code section. Table IV-1 allows parking garages in the Pilchuck District.)*** 14.212.530 Building Height Provisions. E. In a parking structure or garage, each above-ground level shall count as a single story regardless of its relationship to the habitable stories, except that podium parking levels less than 6 feet above the height of the adjacent sidewalk shall not be considered a story for the purpose of determining maximum building height. ***(No change to code section. Incentive provided related to determining maximum building height.)***	✓			✓			✓			✓	Parking garages are allowed, but are not typically used in a small community.
Design Guidelines and Standards															

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					Y	N	N/A	Y	N	N/A	Leave As Is	Amend Existing	Develop New Code/Std	Decided Not to Incorporate New Changes	Reason for Not Incorporating
80	Trees and bioretention	Are specific street tree species included in the design guidelines and standards?	14.240.040(A)	***(SMC 14.240.040(A) includes street tree list.)***	✓				✓		✓				
81		Can flexibility be incorporated to allow alternative tree species that are compatible with bioretention and can also meet similar street tree aesthetic requirements?	14.240.040(A.1.a.)	14.240.040 Landscape and Screening Requirements for Parking Lot and Site Development A. Plant materials. Landscape plant materials shall be selected from the landscape plant lists and street tree lists, as set forth below. Plants used for Low Impact Development facilities shall be selected from the Bioretention Plant Lists contained in Appendix 3 of the LID Technical Guidance Manual for Puget Sound. Selected plants must be suited to local soil conditions, if the site is not irrigated. Native plant species shall be preferred. 1. Street Trees and Landscape Materials. a. All subdivisions shall supply street trees along the entire frontage of the property and any interior streets. Landscape materials, including for the purpose of Low Impact Development facilities, may be considered for frontage plantings. ***(Revise code section.)***	✓			✓				✓			
82	Continuous curb requirements	Are conventional curbs and gutters required?	DS 3-18	**3-18 CURB AND GUTTER** **3-18.1 DESCRIPTION** The standard curb and gutter section used in Snohomish shall by Type A-1 per Standard Plan No. 305A. No new curb and gutter is to be placed until forms have been checked and approved for line, grade, and compaction by the Public Works Inspector. Curb cuts or "invisible" curbs may be used subject to approval of the City Engineer. ***(Revise code section.)***	✓				✓			✓			
83		Can the curb and gutter requirement be eliminated or adjusted to allow the use of curb cuts or "invisible" curbs (flush with the road surface)?	DS 3-18	**3-18 CURB AND GUTTER** **3-18.1 DESCRIPTION** The standard curb and gutter section used in Snohomish shall by Type A-1 per Standard Plan No. 305A. No new curb and gutter is to be placed until forms have been checked and approved for line, grade, and compaction by the Public Works Inspector. Curb cuts or "invisible" curbs may be used subject to approval of the City Engineer. ***(Revise code section.)***	✓			✓				✓			

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84	Curb radii	Are minimum curb radii requirements specified for street intersections or pedestrian bulbs?	DS 3-2.2, 3-2.3	**3-2.2 HORIZONTAL ALIGNMENT** **3-2.2(1) CURB RETURN RADII** Radii of 40 feet or more should be three centered compound curves or simple curves with tapers to fit the paths of appropriate design vehicles. **3-2.2(2) LOCAL STREETS** For the intersection of two local streets, the minimum allowable curb radius shall be 25 feet, which is to be measured from the radius point to the face of curb. For the intersection of a local street with any collector or arterial, the minimum radius shall be 30 feet. **3-2.2(3) OTHER STREETS** On all other street intersections, the minimum allowable radii shall be 30 feet. **3-2.2(4) TRUCKS AND BUSES** Radii of 40 feet or more should be provided where large truck combinations and buses turn frequently. Larger radii are also desirable where speed reductions would cause problems. **3-2.3 INTERSECTIONS** Intersections Angle of Intersection 80o to 90o Minimum Centerline Radius N/A Minimum Curb Radius 25 feet ***(No changes to code section.)***	✓				✓		✓				
85		Can curb radii requirements be reduced to provide additional space for LID BMPs?		***(No.)***	✓			✓			✓			✓	Curb radii must allow for safe turning movements and ADA facilities.
	Stormwater Management and Maintenance														
86	Maintenance Provisions	Does the adopted stormwater manual outline maintenance standards and/or procedures	15.16.020	15.16.020 Stormwater Management Manual Adopted. The ~~2005~~ *2012* State Department of Ecology Stormwater Management Manual for Western Washington , as amended by Sections 1-6 of Appendix 1 of the Western Washington Phase II Municipal Stormwater Permit, as now or hereafter amended, is hereby adopted as the City's minimum stormwater regulations and as a technical reference manual and is hereinafter referred to as the "Stormwater Manual." ***(SWMM, Volume V, Section 4.6)***	✓			✓				✓			
87	Inspection Access (covenants, easements)	Does the code allow access to inspect, maintain, and repair the facility if a private property owner fails to maintain the facility?	15.16.070(B)	15.16.070 Construction and Maintenance of Stormwater Facilities. B.2. The City shall have authority to periodically enter upon the property and inspect the facilities to ensure such compliance and to issue orders requiring maintenance and/or repair. In event that the titleholders or other responsible parties do not effect such maintenance and/or repairs, the City may perform such work, and the cost thereof shall be recoverable by the City from said titleholders or other responsible parties and/or by filing a lien against the property. ***(No changes to code section.)***	✓				✓		✓				

Item No.		Questions Reviewed	Section Reference	Code/Comments	Topic Reviewed			Conflict/Gap Id'd			Step Taken				
					Y	N	N/A	Y	N	N/A	Leave As Is	Amend Existing	Develop New Code/Std	Decided Not to Incorporate New Changes	Reason for Not Incorporating
88	Enforcement	Does the code include mechanisms to ensure reimbursement for any maintenance activities conducted?	15.16.070(B.2), 15.16.100 (B.4)	15.16.070 Construction and Maintenance of Stormwater Facilities. B.2. The City shall have authority to periodically enter upon the property and inspect the facilities to ensure such compliance and to issue orders requiring maintenance and/or repair. In event that the titleholders or other responsible parties do not effect such maintenance and/or repairs, the City may perform such work, and the cost thereof shall be recoverable by the City from said titleholders or other responsible parties and/or by filing a lien against the property. 15.16.100 Administration, Inspection, and Fees. B.4. Property owners shall provide proper ingress and egress to any stormwater facility to the Director or a designee to inspect, monitor, or perform any duty imposed upon the Director by this chapter. The Director shall notify the responsible party in writing of failure to comply with this access requirement. Failing to obtain a response within 7 days from the receipt of notification, the Director may order the work required completed or otherwise address the cause of improper access. The obligation for the payment of all costs that may be incurred or expended by the City in causing such work to be done shall thereby be imposed on the person holding title to the subject property and/or imposed against the subject property by filing a lien. ***(No changes to code section.)***	✓				✓		✓				
89		Are public easements, maintenance covenants, or other legal agreements required?	15.16.060(E)	15.16.060 Low Impact Development – Alternative Standards. E. A covenant or easement shall be recorded with the Snohomish County Auditor's office for each lot containing or served by bioretention facilities in a form approved by the City Attorney. The covenant shall identify requirements and liability for preservation and maintenance of low impact development facilities approved under this chapter and privately held in individual or undivided ownership or intended for public ownership, shall restrict conversion of LID facilities, and shall grant the City access to low impact development facilities on private property to allow inspection, maintenance, and repair. ***(No changes to code section.)***	✓				✓		✓				
90		Are incentives (reduction in stormwater fees) provided for private property owners that meet their maintenance requirements?		***(Incentive program not proposed.)***	✓			✓			✓			✓	Homeowners Associations are required to maintain stormwater facilities according to City code and plat requirements.
Subdivision and Planned Unit Development (PUD)															
91	Individual open space requirements	Does a minimum percentage of open space have to be managed in natural condition?	14.220.105, 14.220.110	14.220.105 Open Space and Recreation Area Requirements Total open space shall be provided in every PRD consistent with the following standards: A. Within a PRD, a minimum of 20 percent of the gross site area shall be established as total open space; 14.220.110 Preservation of Existing Features A. Existing trees and other natural and unique features shall be subject to the significant tree preservation requirements of SMC 14.240.030 Existing Vegetation. The location of these features must be considered when planning the open space, location of buildings, underground services, walks, paved areas, playgrounds, parking areas, and finished grade levels. ***(No changes to code sections.)***	✓				✓		✓				
92		Can the open space requirement be increased?	14.210.330, 14.215.125(G), 14.220.105	***(No changes to code sections. SMC 14.210.330, 14.215.125(G) and 14.220.105 includes open space requirements.)***	✓			✓			✓			✓	Open space requirements will not be changed at this time.
93		Are open space areas required to be consolidated into larger units?	14.220.105(C)	14.220.105 Open Space and Recreation Area Requirements C. Where possible, open space tracts shall be located adjacent to permanently designated open space areas on adjacent properties; ***(No changes to code section.)***	✓				✓		✓				

Item No.		Questions Reviewed	Section Reference	Code/Comments	Topic Reviewed			Conflict/Gap Id'd			Step Taken				
					Y	N	N/A	Y	N	N/A	Leave As Is	Amend Existing	Develop New Code/Std	Decided Not to Incorporate New Changes	Reason for Not Incorporating
94	Passive vs. active (recreation) open space requirements	Are allowable and prohibited uses for open space defined?	14.220.105(H)	14.220.105 Open Space and Recreation Area Requirements H. Usable open space shall be provided as a component of total open space and shall be consistent with the following standards: 2. Usable open space shall be developed for active and/or passive recreation purposes that serve the needs of the PRD residents; 3. The following are examples of active and passive recreation activities that may be allowed in usable open space: ***(No changes to code section.)***	✓				✓		✓				
95		Can LID BMPs such as bioretention count towards passive open space requirements?	14.210.030(E)	14.210.030 Measurement Methods. The following measurement methods shall be used to determine compliance with the dimensional standards in this Chapter: E. Open space calculations shall include areas of turf, landscaping, natural vegetation, or surface water retention/ detention facilities, including vegetated areas within Low Impact Development facilities. ***(Revise code section.)***	✓			✓				✓			
96		Are native vegetation areas that integrate pervious passive recreation areas, stormwater dispersion facilities, and/or stormwater restoration projects allowed?	14.210.030(E)	14.210.030 Measurement Methods. The following measurement methods shall be used to determine compliance with the dimensional standards in this Chapter: E. Open space calculations shall include areas of turf, landscaping, natural vegetation, or surface water retention/ detention facilities, including vegetated areas within Low Impact Development facilities. ***(Revise code section.)***	✓				✓			✓			
97	Opportunities for performance based designs/PUDs	Are PUDs required for high density areas, such as city centers?	Chapter 14.220	***(No.)***	✓				✓		✓				
98		Are native vegetation and maximum impervious surface standards for PUDs and high density dwellings specified?	14.210.330, 14.220.105(A)	14.210.330 Dimensional Requirements ***(No change to code section. Code section includes maximum impervious surface limits.)*** 14.220.105 Open Space and Recreation Area Requirements Total open space shall be provided in every PRD consistent with the following standards: A. Within a PRD, a minimum of 20 percent of the gross site area shall be established as total open space; ***(No change to code section.)***	✓				✓		✓				
Critical Areas and Shoreline Management															
99	Allowance of LID BMPs in critical areas/shorelines when compatible	Are allowable or prohibited uses of buffers defined?	14.255.120(B.1.)	14.255.120 Substantive Requirements B. Critical areas and their buffers shall be left undisturbed, except that the following may be permitted if best management practices are used: 1. Authorized functional restoration or enhancement including native vegetation associated with Low Impact Development facilities, removal of invasive species, and trimming of significant trees in a manner consistent with best horticultural practices that does not negatively impact the trees' health and survivability; ***(No change to code section.)***	✓				✓		✓				

Item No.		Questions Reviewed	Section Reference	Code/Comments	Topic Reviewed			Conflict/Gap Id'd			Step Taken				
					Y	N	N/A	Y	N	N/A	Leave As Is	Amend Existing	Develop New Code/Std	Decided Not to Incorporate New Changes	Reason for Not Incorporating
100		Are LID BMPs allowed within or adjacent to critical areas/shoreline/sensitive area/ wetland buffers?	14.255.120(B.1.), 14.260.040(H)	14.255.120 Substantive Requirements B. Critical areas and their buffers shall be left undisturbed, except that the following may be permitted if best management practices are used: 1. Authorized functional restoration or enhancement <u>including native vegetation associated with Low Impact Development facilities, removal of invasive species, and trimming of significant trees in a manner consistent with best horticultural practices that does not negatively impact the trees' health and survivability;</u> 14.260.040 Substantive Requirements H. Except as provided elsewhere in the Critical Areas Code, all existing native vegetation in wetland buffers shall be retained without disturbance, mowing, or hard surfacing, nor shall any action be taken to inhibit volunteer re growth of native vegetation. Invasive weeds shall be removed for the duration of the monitoring period. Stormwater management facilities, bioswales, <u>Low Impact Development facilities,</u> and treated-water outfalls are permitted in the outer 50 percent of the buffer of Category <u>II,</u> III, or IV wetlands, provided that wetland functions and values are not significantly lost through fluctuations in wetland hydrology and construction integrates best management practices. ***(Revise code sections.)***	✓			✓				✓			
101		Can native vegetation associated with LID BMPs be used to meet buffer enhancement requirements?	14.255.120(B.1.)	14.255.120 Substantive Requirements B. Critical areas and their buffers shall be left undisturbed, except that the following may be permitted if best management practices are used: 1. Authorized functional restoration or enhancement <u>including native vegetation associated with Low Impact Development facilities, removal of invasive species, and trimming of significant trees in a manner consistent with best horticultural practices that does not negatively impact the trees' health and survivability;</u> ***(Revise code sections.)***	✓			✓				✓			

APPENDIX B

Ordinance 2315
Adoption of LID Related Codes and Standards Revisions

CITY OF SNOHOMISH
SNOHOMISH, Washington

ORDINANCE 2315

AN ORDINANCE OF THE CITY OF SNOHOMISH, WASHINGTON, ADOPTING AND REVISING STORMWATER MANAGEMENT REGULATIONS PURSUANT TO THE WESTERN WASHINGTON PHASE II MUNICIPAL STORMWATER PERMIT ISSUED TO THE CITY BY THE WASHINGTON STATE DEPARTMENT OF ECOLOGY; AMENDING SNOHOMISH MUNICIPAL CODE (SMC) SECTIONS 14.20.010 ENTITLED "CLASSIFICATION", 14.100.020 ENTITLED "DEFINITIONS", 14.210.030 ENTITLED "MEASUREMENT METHODS, 14.210.230 ENTITLED "BUSINESS PARK AND AIRPORT INDUSTRY", 14.235.130 ENTITLED "MINIMUM REQUIREMENTS FOR OFF-STREET PARKING", ADDING SMC CHAPTER 14.237 ENTITLED "CLEARING AND GRADING", AMENDING SMC 14.240.030 ENTITLED "EXISTING VEGETATION", 14.240.040 ENTITLED "LANDSCAPE AND SCREENING REQUIREMENTS FOR PARKING LOT AND SITE DEVELOPMENT", 14.255.060 ENTITLED "EXEMPTIONS", 14.255.120 ENTITLED "SUBSTANTIVE REQUIREMENTS", 14.260.040 ENTITLED "SUBSTANTIVE REQUIREMENTS", AMENDING SMC 15.16.020 ENTITILED "STORMWATER MANAGEMENT MANUAL ADOPTION"; AND AMENDING THE CITY ENGINEERING DESIGN AND CONSTRUCTION STANDARDS; PROVIDING FOR SEVERABILITY AND EFFECTIVE DATE

WHEREAS, the Federal Clean Water Act, 33 U.S.C. 1251 et seq. (the Act), requires certain local governments such as the City of Snohomish to implement stormwater management programs and regulations within prescribed time frames, and pursuant to said Act the United States Environmental Protection Agency (EPA) has adopted rules for such stormwater programs and regulations; and

WHEREAS, the EPA has delegated authority to the Washington State Department of Ecology (Ecology) to administer such stormwater programs and regulations, and Ecology has reissued the National Pollutant Discharge Elimination System (NPDES) Western Washington Phase II Municipal Stormwater Permit, effective August 1, 2013 through July 31, 2018, which requires local governments such as the City of Snohomish to implement numerous stormwater management requirements, including adopting Ecology's 2012 Stormwater Management Manual for Western Washington, and incorporating into the SMC the encouragement and allowance of Low Impact Development techniques by December 31, 2016; and

WHEREAS, in 2009, the City Council adopted Ordinance 2173, which established stormwater regulations including the adoption of Ecology's 2005 Stormwater Management Manual for Western Washington, as set forth in Ch. 15.16 SMC; and

WHEREAS, in 2011, the City Council adopted Ordinance 2211, which readopted the City Engineering Design and Construction Standards; and

WHEREAS, in order to comply with the currently effective NPDES Phase II Permit, the City has prepared proposed Stormwater Management regulations, which amend and update the City's current stormwater regulations and related municipal code provisions; and

WHEREAS, on September 7, 2016 the City's SEPA Responsible Official complied with the State Environmental Policy Act (SEPA) by issuing a Determination of Nonsignificance (DNS) for the adoption of the proposed Stormwater Management regulations and by complying with SEPA's procedural requirements for issuing the DNS; and

WHEREAS, on October 5, 2016 the Planning Commission conducted a duly noticed public hearing on the proposed code amendments, as set forth below; and

WHEREAS, on November 1, 2016 the City Council conducted a duly noticed public hearing on the proposed code amendments, as set forth below; and

WHEREAS, the City Council has determined that it is in the public interest and in furtherance of the public health and welfare to adopt the proposed Stormwater Management regulations, as set forth below; and

WHEREAS, the City contracted with the professional engineering consulting firm Gray & Osborne, Inc. to perform a review of the City Municipal Codes and Engineering Design and Construction Standards to determine conflicts or gaps that would need to be addressed to allow the use of Low Impact Development techniques as required by the NPDES Phase II Permit;

NOW THEREFORE, THE CITY COUNCIL OF THE CITY OF SNOHOMISH, WASHINGTON DO ORDAIN AS FOLLOWS:

Section 1. SMC Section 14.20.010 entitled "Classification" is hereby amended to read as follows and all other provisions not addressed herein shall remain in full force and effect:

14.20.010 Classification

Permit Type	Permit Classification Number
administrative development plans, SEPA-exempt	1
building permits, SEPA-exempt	1
land clearing permits (provisional)	1
clearing and grading permits	1
lot line adjustments	1
lot line eliminations	1
minor variances	1
sign permits	1
temporary permits (provisional)	1
final plats	2

short plats, SEPA-exempt	**3**
administrative development plans, SEPA-applicable building permits, SEPA-applicable short plats, SEPA-applicable clearing and grading permits, ~~SEPA-applicable~~	**4** **4** **4**
SEPA-exempt conditional use permits, recorded development plans, variances	**5** **5**
amendments to Development Code's Land Use Designation Map, SEPA-applicable conditional use permits, recorded development plans, preliminary plats, planned residential developments, and shoreline substantial development permits / variances / conditional uses	**6** **6** **6** **6** **6** **6**

Section 2. SMC Chapter 14.100 entitled "Definitions" is hereby amended to read as follows and all other provisions not addressed herein shall remain in full force and effect:

Garage, public ("Public garage") means a building or a portion of a commercial building designed or used primarily for temporary shelter or storage of vehicles in exchange for a fee, or accessory to a commercial use.

Low Impact Development (LID) is a stormwater and land use management strategy that strives to mimic pre-disturbance hydrologic processes of infiltration, storage, and transpiration by emphasizing conservation, use of on-site natural features, site planning, and distributed stormwater management practices that are integrated into a project design.

Low Impact Development (LID) Facilities are distributed stormwater management practices, integrated into a project design, that emphasize pre-disturbance hydrologic processes of infiltration, filtration, storage, evaporation, and transpiration. LID best management practices include, but are not limited to, bioretention, rain gardens, permeable materials, roof downspout controls, dispersion, soil quality and depth, minimal excavation foundations, vegetated roofs, and water re-use.

Vegetated Low Impact Development (LID) facilities include bioretention, rain gardens, dispersion, vegetated roofs, and natural treatment areas.

Section 3. SMC Section 14.210.030 entitled "Measurement Methods" is hereby amended to read as follows:

14.210.030 Measurement Methods. The following measurement methods shall be used to determine compliance with the dimensional standards in this Chapter:

A. Street setbacks shall be measured from the existing edge of a street right-of-way or temporary turnaround.

B. Lot widths shall be measured by scaling a circle of the applicable diameter within the boundaries of the lot, provided that an access easement shall not be included within the circle.

C. For any calculation which ends in a fraction of .5 or greater, the number will be rounded up to the next whole number. Any fraction less than .5 will be rounded down to the next whole number.

D. Lot area shall be the total horizontal land area contained within the boundaries of a lot.

E. Open space calculations shall include areas of turf, landscaping, natural vegetation, or surface water retention/ detention facilities, including vegetated areas within Low Impact Development facilities.

Section 4. SMC section 14.210.230 entitled "Business Park and Airport Industry" is hereby amended to read as follows and all other provisions not addressed herein shall remain in full force and effect:

14.210.230 Business Park and Airport Industry.

A. Chapters 14.205 and 14.207 SMC govern permitted land uses in the Business Park and Airport Industry designations.

B. Minimum Area. A minimum of five (5) acres will normally be required for a Business Park development; however, existing smaller parcels that cannot be aggregated together to establish a 5 acre project will be allowed, subject to appropriate review and conditions.

C. Setbacks. Structures shall be a minimum distance of 50 feet from any property line abutting a residential land use designation. Where not abutting a residential designation, the minimum setback shall be zero, subject to compliance with the landscape screening requirements in Chapter 14.240 SMC.

D. Landscaping and Open Space.

1. The site shall consist of not less than 20 percent landscaping and/or open space, which open space may consist of undisturbed vegetation or water and will include the 5% area of required landscaping. In addition, any parking lot of over twenty (20) cars must provide a minimum of one contiguous one hundred (100) square foot landscaped island within the parking area for each ten (10) spaces. Up to 50% of the landscaping and open space requirement for a business park development may be provided by permanent dedication of a conservation easement to the City, a land trust, or another entity acceptable to the City of Snohomish, which easement shall restrict property to remain in open space in perpetuity within the same business park designation as the development in question.

2. At least 5% of the site must be in formal developed landscaping no less than two thousand (2,000) square feet in area and oriented towards the main entrance and public right-of-way.

3. Landscaping Adjacent to Streets. All uses which adjoin a street will also provide a landscape corridor of trees, planted no more than fifty (50) feet on center. Landscape plant materials used in Low Impact Development facilities may also be considered. Such landscaping shall not obscure the sight distance for traffic and pedestrians at the intersection of streets or driveways.

Section 5. SMC Section 14.235.130 entitled "Minimum Requirements for Off-Street Parking" is hereby amended to read as follows:

14.235.130 Minimum Requirements for Off-Street Parking.

A. Minimum Dimensions. The size and dimensions of individual parking stalls shall be eight and one-half (8½) feet wide and eighteen (18) feet long, and shall include an additional one hundred (100) square feet of maneuvering area. Parking areas including more than four (4) stalls of parking shall comply with the parking area dimensions as described in Figure 1 and Figure 2.

B. Driveway Dimensions. When off-street parking is provided, the access driveway or lane shall be paved and have a minimum width of ~~twelve (12~~eight (8) feet. The City Planner shall have the discretionary authority to require driveways to have a minimum of two eight-foot (8') moving lanes when unusual site problems, access for vehicles, or high traffic usage requires such. Driveway widths and construction standards within the public right-of-way shall be determined by the City Engineer. Shared and two-track driveway designs are allowed.

C. Required Access and Fire Lanes. The Fire Marshal shall determine when access for fire lanes shall be required. Such access and fire lanes shall be designed with not less than twenty-five (25) feet in width, forming a continuous route or loop connecting at both ends with streets, or as stipulated by the Fire Marshal.

D. Required Traffic-Control Devices. All traffic control devices, such as parking stripes designating car stalls and directional arrows, shall be completed and installed as shown on the approved plans. Hard-surfaced parking areas shall use paint or similar devices to delineate car stalls and directional arrows.

E. Requirements for Pedestrian Walks. Pedestrian walks shall be required in parking lots of over ten (10) stalls and shall be for the use of foot traffic only. They shall be delineated in a manner acceptable to the City. When wheel stops or bumper stops are provided, sidewalks may be constructed on grade with the parking lot.

F. Border Barricades. All parking areas and car sales areas that are not separated by a fence or landscaped buffer from any street or alley upon which they abut shall be provided with a suitable concrete curb not less than six (6) inches in height,

located not less than four (4) feet from the street or alley. The curb or barrier shall be securely installed and maintained; provided, that no such curb or barrier shall be required across any driveway or entrance to such parking area.

G. Backing into Streets. Parking facilities for all uses shall be so designed that vehicles are not required to back from the parking facility into any street. Such requirement shall be mandatory for all uses except for detached single-family residential uses and vehicles entering local access or collector streets from the driveway of an individual duplex structure.

H. Ingress and Egress Provisions. The City Engineer shall have the authority to fix the location, width and manner of approach of vehicular ingress or egress from a building or parking area to a street and to alter existing ingress and egress as may be required to control street traffic in the interest of the public safety and general welfare.

I. Surfacing. All off-street parking areas and vehicle sales areas, including ingress and egress lanes, shall be paved with a hard-surfaced material that may include permeable concrete or asphalt pavement. Marked, unpaved parking areas are permitted in Urban Horticulture, Public Parks, and Open Space zones, when a professional parking study or other reliable data shows the area will be for parking spaces in excess of those required pursuant to this Chapter.

J. Surface Water Runoff. All off-street parking areas and car sales areas shall be graded and drained in order to dispose of surface water runoff, subject to the approval of the City Engineer. All hard-surface areas shall be drained to an approved catch basin within the confines of the lot and disposed of through a drainage system as approved by the City Engineer. The use of low impact development technology in the construction of such areas is encouraged by the City providing it produces a surface that can be safely walked upon, can be marked to define parking spaces and other necessary information, and has been determined to be as serviceable as conventional asphalt paving.

K. Illumination. All lights provided to illuminate any public parking area, any semi-public parking area, or car sales area permitted by this title shall be arranged so as to direct the light away from any dwelling unit and the public right-of-way.

L. Maintenance of Off-street Parking Areas. Maintenance of all areas provided for off-street parking shall include removal and replacement of dead and dying trees, maintenance of landscaping grass, shrubs and trees, removal of trash and weeds, and repair of traffic-control devices, signs, light standards, fences, walls, surfacing material, curbs and railings.

M. Tandem Parking. Tandem parking is permitted only for detached single-family residences.

Section 6.
New SMC Chapter 14.237 entitled "Clearing and Grading" is hereby adopted and shall read as follows:

Chapter 14.237
CLEARING AND GRADING

Sections:

14.237.010 Purpose. It is the purpose of this chapter to regulate, by permit, activities that involve construction, disturbance, and permanent and temporary modification of lands in the City of Snohomish in the interest of public health, safety, and welfare to ensure that the activities minimize impacts to the environment and storm drainage facilities.

14.237.020 Permit Required. A site civil permit for clearing and grading activities (hereunder referred to as "permit") is required for the following activities:

A. Any clearing, filling, or excavation in an environmentally sensitive area or regulated buffer.

B. Fill and/or excavation totaling a minimum of 100 cubic yards. Quantities of fill and excavation are separately calculated and then added together. However if excavated material is used as fill on the same site, the quantity is not calculated separately and then added together.

C. Over 1,000 square feet of clearing, as measured at the ground level. Clearing includes disturbance of over 1,000 square feet at grade due to felling or topping of trees.

14.237.030 Exempt Activities. Following activities are exempt from the requirements for a permit:

A. Agricultural management of existing farmed areas.

B. Routine landscape maintenance of existing landscaped areas totaling less than 1,000 square feet on developed lots and other activities associated with maintaining an already established landscape.

C. Work needed to correct an immediate danger to life or property in an emergency situation as declared by the Mayor or the City Manager or their designee.

D. Cemetery graves.

E. Work, when approved by the City Engineer, in an isolated self-contained area, if there is no danger or impact to public or private property.

14.237.040 Permit Issuance.

A. Permit shall be issued by the Engineering Department upon proper application therefore and upon payment of fees to be set by separate Council resolution. Unless provided otherwise on the face of the permit, the permit shall be effective for one year, but may, with cause shown, be extended by the City Engineer for an additional one-year period.

B. Permit shall be issued only in conjunction with one or more of the following:

1. Approved building permit;
2. Approved administrative development plan;
3. Utility extension;
4. Property access road;
5. Approved conditional use permit;
6. Approved street, water, storm and sanitary sewer construction drawings for a preliminary plat or short plat;
7. Approved shoreline permit;
8. Special permission of the permit authority based on a demonstration that extenuating and/or special circumstances are present and that the project is consistent with the grading and drainage plan with landscaping, soil stabilization and surface groundcover elements including continuous maintenance;

   a. Decision Criteria. The permit authority may approve or approve with modifications an application submitted under this subsection only if:

      i. The proposal is in accord with the comprehensive plan, comprehensive drainage plan, land use development code, drainage management code and other city codes and adopted standards,

      ii. The approval of the proposal will not pose a threat to or be detrimental to the public health, safety and welfare, and

      iii. The applicant has demonstrated that approval of the proposal independent of obtaining other permits is appropriate for the reasonable development or maintenance of the property and when the

application specifies the size, location, and type of proposed uses for the project when it is completely developed.

b. Time Limits May Be Imposed. For any permit authorized under this subsection the permit authority may impose a time limit within which the proposed site work must be completed, generally not to exceed one year.

c. Conditions May Be Imposed. For any permit authorized under this subsection the permit authority may impose any conditions deemed necessary to mitigate potential adverse impacts on the environment and the public's health, safety, and general welfare.

14.237.050 General Conditions (required of all applicants). Permittees shall comply with the following conditions, which shall apply to all permits:

A. Comply with all applicable City ordinances, City design and construction standards, specifications, policies, and administrative procedures.

B. Agree to defend, indemnify, and hold harmless the City of Snohomish, its officers, employees, and agents, for any and all suits, claims, causes of action, or liabilities caused by or arising out of any activities conducted by the permittee resulting from issuance of the permit.

C. Agree to special project notification of the City, affected property owners and tenants, or other agencies as specified by the City Engineer.

D. Notify the City 48 hours before installation of temporary erosion and sediment control measures and commencing any land-disturbing activity.

E. Install all temporary erosion and sediment control measures as identified in the approved plans prior to commencing any land-disturbing activity.

F. Delimit all potentially impacted critical areas and their buffers with a construction limits fence prior to any disturbance of the soil.

G. Notify the City within 24 hours after the temporary erosion and sediment control measures installation is completed and do not commence any land disturbing activity until notified by the City that the installation of the temporary erosion and sediment control measures and construction limits fencing has been approved.

H. Obtain permission in writing from the City prior to modifying any of the plans.

I. Maintain all road drainage systems, storm water drainage systems, control measures, and other facilities identified in the plans.

J. Protect areas to remain undisturbed and identified for low impact development facilities/uses and minimize equipment encroachment into these areas.

K. Repair siltation or erosion damage to adjoining surfaces and drainage ways resulting from land developing or disturbing activities.

L. Inspect the erosion construction control measures at least once each week during construction after each rain of 0.5 inch or more (over a 24-hour period), and immediately make any needed repairs.

M. Allow the City to enter the site for the purpose of inspecting compliance with the plans or for performing any work necessary to bring the site into compliance with the plans.

N. Keep an up-to-date, approved copy of the plans on the site.

O. Understand and agree that the City Engineer may, at his or her discretion, attach other special conditions to any permit. Such condition(s) shall be necessary to satisfy the purpose of this Chapter, compliance with the Ecology Stormwater Management Manual or to protect the public health, safety, and welfare.

P. Understand and agree that all construction, workmanship and materials shall be in accordance with the City Engineering Design standards, City adopted Department of Ecology Stormwater Management Manual for Western Washington, and where applicable, the most current edition of the State of Washington Standard Specifications for Road, Bridge and Municipal Construction.

14.237.060 Minimum Standards. Following minimum standards must be satisfied as a condition of issuance of any development permit:

A. Temporary Erosion and Sediment Control. Temporary erosion and sediment control plan shall be in accordance with the City Engineering Design standards and the City adopted Department of Ecology Stormwater Management Manual for Western Washington.

B. Grading. The following are the minimum standards for grading unless otherwise modified by an approved grading plan:

1. Grading shall not contribute to or create landslides, accelerated soil creep, or settlement of soils.

2. Natural land and water features, vegetation, drainage and other natural features of the site shall be reasonably preserved.

3. Grading shall not create or contribute to flooding, erosion, increased turbidity, or siltation of a watercourse.

4. Groundcover and tree disturbance shall be minimized. Tree retention and/or removal shall be in accordance with the provision of Chapter 14.240 SMC.

5. Grading operations shall be conducted so as to expose the smallest practical area to erosion for the least possible time.

6. Grading shall not divert existing watercourses.

7. The duff layer and native soils shall be retained in an undisturbed state to the maximum extent practicable in areas not intended for building pads, access ways or other impervious surfaces.

C. Aesthetic and spatial impact of altered grades on adjacent properties both public and private shall be considered in site design.

D. Sites shall be developed to promote continuity and to minimize abrupt grade changes between sites.

E. Clearing and grading shall be the minimum necessary for the structure and to make installation and function of infrastructure feasible and economic for future service extensions to adjacent properties.

F. Natural topography and the proposed layout of the development shall be considered when siting roads in order to anticipate grading needs and minimize extensive grading.

G. Sensitive Areas. No land-disturbing activity shall be permitted in a regulated sensitive area, except as otherwise allowed by applicable laws and permits.

H. Clean-Up. Persons and/or firms engaged in clearing, grading, filling, or drainage activities shall be responsible for the maintenance of work areas free of debris or other material that may cause damage to or siltation of existing or new facilities or have the potential of creating a safety hazard.

I. Dust Suppression. Dust from clearing, grading and other construction activities shall be minimized at all times. Impervious surfaces on or near the construction area shall be swept, vacuumed, or otherwise maintained to suppress dust entrainment. Any dust suppressants used shall be approved by the director. Petrochemical dust suppressants are prohibited.

14.237.070 Permit Restrictions. All clearing, grading, filling, and excavation activities, regardless of whether or not a permit is required, are subject to the following restrictions:

A. No clearing, grading, filling, or excavation is allowed in a critical area and its buffers where such activities are prohibited by SMC Title 14.

B. For clearing and grading activities conducted between October 1st and March 31st, no more than one acre may be moved or graded at any one time.

C. Between October 1st and March 31st, grading of individual building lots in a subdivision shall be phased, with no more than ten lots being graded in a subdivision at any one time. Before additional lots can be graded, the previously graded lots shall be hydro-seeded and mulched, sodded, or otherwise protected.

14.237.080 Inspections.

A. Prior to any clearing, grading, filling, and/or drainage facility construction, the contractor may be required to conduct a preconstruction conference with the City's Engineering Construction Inspector to coordinate the project.

B. All projects which include clearing, grading, filling or drainage shall be subject to inspection by the city engineer or his designee, who shall be granted reasonable right of entry to the work site by the permittee. When required by the City engineer, special inspection of the grading operations and special testing shall be performed by qualified professionals employed by the permittee.

C. Each site that has an approved clearing and grading, temporary erosion and sediment control or other required plans must be inspected as necessary to ensure that the temporary erosion and sediment control measures are installed and

effectively maintained in compliance with the approved plan and permit requirements. Where applicable, the permittee must obtain inspection by the City at the following stages:

1. Following the installation of sediment control measures or practices and prior to any other land-disturbing activity;
2. During the construction of sediment basins or storm water management structures;
3. During rough grading, including hauling of imported or wasted materials;
4. Prior to the removal or modification of any sediment control measure or facility; and
5. Upon completion of final grading, including establishment of groundcover and planting, installation of all vegetative measures, and all other work in accordance with an approved plan and/or permit.

14.237.090 Completion of Work.

A. Construction Changes. Whenever changes must be made to the original, approved plan, the changes shall be submitted in writing and approved by the City Engineer in writing in advance of the construction of those changes.

B. Final Reports. Upon completion of the rough grading and at the final completion of the work, the City Engineer may require the following reports, drawings, and supplements thereto to be prepared and submitted by the owner and/or an appropriate qualified professional approved by the City Engineer:

   1. An as-built grading plan, including original ground surface elevations, final surface elevations, lot drainage patterns, and locations and elevations of all surface and subsurface drainage facilities.
   2. A soils grading and/or geologic grading report, including locations and elevations of field density tests and geologic features, summaries of field and other laboratory tests, and other substantiating data and comments or any other changes made during grading and their effect on the recommendations made in the approved grading plan.

C. Notification of Completion. The permittee or their agent shall notify the City Engineer when the grading operation is ready for final inspection. Final approval shall not be given until all work has been completed in accordance with the final approved grading, erosion sedimentation control and other required plans, and the required reports have been submitted and accepted.

14.237.100 Permit Suspension or Revocation. The City Engineer may, in writing, suspend or revoke a permit issued under the provisions of this chapter for any of the following reasons:

A. Whenever the permit was issued in error or on the basis of incorrect information supplied by the applicant.

B. Whenever the work does not proceed in accordance with the plans as approved, or conditions of approval.

C. Whenever, in the judgment of the City Engineer, the work is not being performed in compliance with the requirements of this chapter, other City ordinances, or state or federal law.

D. Whenever the City has been denied reasonable access to investigate and permitted work is proceeding.

E. Whenever any excavation or fill endangers or may reasonably be expected to endanger the public, the adjoining property or street, or utilities.

14.237.110 Liability. The obligation of complying with the requirements of this ordinance rests upon the permittee, and no provision is intended to impose any special duty upon the City, or any of its officers, employees, or agents. Nothing contained in this chapter or any procedures adopted hereunder is intended to be or shall be construed to create a special relationship with any contractor, owner, permittee, or member of the public, or form the basis for liability on the part of the City, or its officers, employees, or agents, for any injury or damage resulting from the failure of the permittee to comply with the provisions hereof, or by reason or in consequence of any act or omission in connection with the implementation of enforcement of this ordinance or any procedures adopted hereunder by the City, its officers, employees, or agents.

The City Engineer and other employees charged with the enforcement and administration of this ordinance or agents of the City, acting for the City in good faith and without malice in the discharge of their duties, shall not thereby render themselves liable personally for any damages which may accrue to persons or property as a result of any act required or by reason of any act or omission in the discharge of such duties.

14.237.120 Severability. If any one or more sections, subsections, or sentences of this chapter are held to be unconstitutional or invalid, such decisions shall not affect the validity of the remaining portions of this code, and the same shall remain in full force and effect.

Section 7. SMC Sections 14.240.030 entitled "Existing Vegetation" is hereby amended to read as follows:

14.240.030 Existing Vegetation

A. General. ~~The applicant may be required to retain existing vegetation on the subject property to the maximum extent possible, where such vegetation is considered equal to or better than that required by this chapter and can be saved without serious disruption of the proposed development.~~New development shall retain all existing significant trees unless the retention of such trees would unreasonably burden the development or cause a significant safety problem, as determined by the City.

B. Site clearing. No site clearing, grading or removal of significant trees or other vegetation shall take place prior to approval of ~~the~~a proposed landscaping plan. Wholesale clearing or mass grading of sites is discouraged.

C. Retained vegetation shall be oriented, wherever possible, to disconnect adjacent impervious surfaces.

~~C.~~ D. Significant tree protection required. Any deciduous and evergreen trees eight (8)~~six (6)~~ inches or greater in diameter, as measured four (4) feet above the ground, is considered a significant tree, with the exception that alders and cottonwoods (*Alnas rubra* and *Populis trichocarpa*) are not considered significant. The property owner shall either furnish a site plan showing all free standing significant trees in areas proposed to be disturbed and the edge of tree cover in areas not proposed to be disturbed, or shall have an arborist provide a certificate stating there are no significant trees on the property.

For property proposed for single-family detached residential development and capable of being subdivided, applicants shall retain significant trees, except in the following areas: utility corridors, roads, and building pads and the yard areas around the proposed residences. For one of these exceptions to apply, the applicant shall depict the area on a site plan showing all free standing significant trees in areas proposed to be disturbed and the edge of tree cover in areas not proposed to be disturbed. The applicant shall retain significant trees on the subject property to the maximum extent that is practical taking into consideration the nature of the proposed development.

1. Protection techniques. In order to provide the best possible conditions for the retention of significant trees, the applicant shall comply with the following requirements.

   a. The applicant may not fill, excavate, stack, or store any equipment, or disturb or compact the earth in any way within the critical root zone (CRZ) where feasible, which may extend beyond the drip line of existing tree branches ~~area defined by the drip line~~ of any tree to be retained. A drip line is defined as a perimeter formed by the points farthest away from the trunk of a tree where precipitation from the branches of that tree falls on the ground.

   b. The applicant shall construct a temporary but immovable four (4) foot high sturdy fence around each tree to be retained, generally corresponding to the drip line of that tree.

   c. If the grade level around a tree to be retained is to be raised, the applicant shall construct a dry rock wall or rock well around the tree. The diameter of this wall or well must be equal to the diameter of the tree's drip line.

   d. The applicant may not install impervious surface material within the area defined by the drip line of any tree to be retained, unless specifically approved by the City's Planning and Development Services Department.

e. The grade level around any tree to be retained may not be lowered within the area defined by the drip line of the tree.

f. The applicant shall prune branches and roots as necessary, and fertilize and water plant material as appropriate.

2. Replacement if significant trees designated to be retained are removed.

a. For trees other than alders and cottonwoods (which are not protected as significant trees), the following shall apply: For any trees to be removed (except for diseased or dying trees) the City shall require the applicant to re plant in an appropriate manner. Replacement trees must be at least two and one-half (2½) inches in diameter as measured four (4) feet above grade for deciduous trees and a minimum of ten (10) feet in height for evergreen trees. Trees shall be replaced according to a plan prepared by the applicant and approved by the City. For the removal of diseased or dying trees, an arborist hired by the City at the applicant's expense shall determine which trees are healthy and shall provide a written report on its findings. Any tree which poses an immediate threat to property may be removed if a report from a qualified consultant is submitted and approved by the City. A two-year maintenance bond shall be provided for all replacement trees in an amount equal to no less than 200 percent of the arborist's estimate.

b. In the event that a property owner believes that a threat to life or property exists with regard to an existing tree, the property owner may request that the City Planner or designee evaluate the tree, and, if the City Planner concurs that a hazardous condition exists, the property owner may remove the tree without a report from a qualified consultant.

i. Replacement trees may be located in the street planter strip adjacent to the property.

ii. Subdivision development involving the removal of significant trees may locate replacement trees in the street planter strip on or adjacent to the development. If the number of replacement trees exceeds the number of trees required for street planters, then the developer may locate the trees off-site in street planter strips. The location of off-site replacement trees shall be reviewed and approved by the Hearing Examiner.

a) For properties capable of being subdivided, one (1) significant tree for each legal lot area may be removed annually. Property owners shall provide the City with written notice of removal within 30 days of removal.

3. Removal of Trees Designated to Remain. If any tree designated for retention or required to be planted is damaged or destroyed during construction, as a result of on-site construction practices, or within two years following the end of construction, as a result of on-site construction practices, the City shall require the planting of up to three approved trees, each at least two and one-half (2½) inches in diameter as measured four (4) feet above grade for deciduous trees and ten (10) feet in height for evergreen trees, in the immediate vicinity of the damaged or destroyed tree, as determined by the Planning and Development Services Department. The City may require the applicant to remove the damaged or destroyed tree.

Section 8. SMC Section 14.240.040 entitled "Landscape and Screening Requirements for Parking Lot and Site Development" is hereby amended to read as follows and all other provisions not addressed herein shall remain in full force and effect:

14.240.040 Landscape and Screening Requirements for Parking Lot and Site Development

Requirements for landscaping of parking lots and site development are set forth in the two Snohomish Design Standards documents: the *Design Standards and Guidelines for the City's Historic District* and *Design Standards and Guidelines for Areas Outside of the Historic District*. Landscape plant materials used in Low Impact Development facilities may be considered for review by the City Planner when evaluating compliance with the landscape and screening requirements.

A. Plant materials. Landscape plant materials shall be selected from the landscape plant lists and street tree lists, as set forth below. Plants used for Low Impact Development facilities shall be selected from the Bioretention Plant Lists contained in Appendix 3 of the *LID Technical Guidance Manual for Puget Sound*. Selected plants must be suited to local soil conditions, if the site is not irrigated. Native plant species shall be preferred.

1. Street Trees and Landscape Materials.

a. All subdivisions shall supply street trees along the entire frontage of the property and any interior streets. Landscape materials, including for the purpose of Low Impact Development facilities, may be considered for frontage plantings.

b. The following land use actions shall require the installation of street trees:

i. Short subdivision

ii. Subdivision

iii. Recorded development plan

iv. Conditional use permit

v. Any activity involving street frontage improvements

vi. Rebuilding or installation of a street.

c. All trees and other landscape materials, including for the purpose of Low Impact Development facilities, planted adjacent to streets or in street right(s)-of-way must have approval from the City prior to planting and conform to the ROW vegetation maintenance regulations.

(. . .)

Section 9. SMC Section 14.255.120 entitled "Substantive Requirements" is hereby amended to read as follows:

14.255.120 Substantive Requirements

A. All treatment of critical area shall be in accordance with best available science as defined in WAC 365-195-900 through 195-925, which is hereby adopted by reference, along with the Washington State Department of Community Development's *Citations of Recommended Sources of Best Available Science for Designating and Protecting Critical Areas.*

B. Critical areas and their buffers shall be left undisturbed, except that the following may be permitted if best management practices are used:

1. Authorized functional restoration or enhancement including native vegetation associated with Low Impact Development facilities, removal of invasive species, and trimming of significant trees in a manner consistent with best horticultural practices that does not negatively impact the trees' health and survivability;

2. In buffers: utility poles and utility lines which do not require excavation or clearing;

3. In the outer 50 percent of buffers: permeable-surfaced walkways, trails, and minimal wildlife viewing structures;

4. Developments for which mitigation is allowed per subsection E; and

5. Other uses specifically authorized by the Critical Areas Code.

C. No development shall occur which results in a net loss of the functions or values of any critical area except reasonable use variances per SMC 14.255.130.B. The pre- and post-development functional comparison shall be on a per function basis unless otherwise authorized by the Critical Areas Code.

D. No development shall occur in critical areas and their buffers, which results in an unreasonable hazard to the public health and safety.

E. These substantive requirements shall be met via one or more of the following methods, listed in preferential sequence (commonly known as "sequencing"). The methods used shall be those which are highest on the list yet consistent with the objectives of the proposed development:

1. Avoiding the impact altogether by not taking a certain action or parts of an action;

2. Minimizing impacts by limiting the degree or magnitude of the action and its implementation, by using appropriate technology, or by taking affirmative steps, such as project redesign, relocation, or timing, to avoid or reduce impacts;

3. Rectifying the impact to wetlands, critical aquifer recharge areas, frequently flooded areas, and habitat conservation areas by repairing, rehabilitating, or restoring the affected environment to the historical conditions or the conditions existing at the time of the initiation of the project;

4. Minimizing or eliminating the hazard by restoring or stabilizing the hazard area through engineered or other methods;

5. Reducing or eliminating the impact or hazard over time by preservation and maintenance operations during the life of the action;

6. Compensating for the impact to wetlands, critical aquifer recharge areas, frequently flooded areas, and habitat conservation areas by replacing, enhancing, or providing substitute resources or environments; and

7. Monitoring the hazard or other required mitigation and taking remedial action when necessary. Mitigation for individual actions may include a combination of the above measures.

F. As a condition of any permit approval, the City may require that:

1. The outer edge of the critical area or buffer be marked, signed, or fenced to protect the resource. Such protection may be temporary, during construction, or permanent such as to protect the resource from livestock or people. The City Planner shall specify the design and sign message if applicable, of such markers, signs, and fencing.

2. The applicant file a notice with the county records and elections division stating the presence of the critical area or buffer and the application of this Critical Areas Code to the property, in order to inform subsequent purchasers of the property.

3. The critical area and/or buffer be placed in a critical area tract or conservation

easement, the purpose of which is to set aside and protect the critical area. The critical area tract or conservation easement shall be:

a. Held by the City, a homeowner's association, a land trust or similar conservation organization, or by each lot owner within the development in an undivided interest;

b. Recorded on all documents of title of record for the affected parcels;

c. Noted on the face of any plat or recorded drawing; and

d. Delineated on the ground with permanent markers and/or signs in accordance with local survey standards.

G. The City may allow averaging of buffer widths, if a qualified professional demonstrates that:

1. Functions and values are not adversely affected;

2. The total buffer area is not reduced; and

3. At no location is the buffer width reduced more than 40 percent.

H. Unless otherwise provided, buildings and other structures shall be set back a distance of ten feet from the edges of all critical areas and critical area buffers. The same protrusions into this setback area shall be allowed as the development code allows into property line setback areas.

I. Critical areas and buffers shall not be allowed within any lot of a subdivision and/or short plats unless the plat was vested prior to the effective date and implementation of this ordinance. Subdivision and or/short plats shall show, on their face, any applicable critical area limitations.

J. When any existing regulation, easement, covenant, or deed restriction conflicts with this Critical Areas Code, the one which provides more protection to the critical areas shall apply.

K. When critical areas of two or more types coincide, the more restrictive buffer and requirements shall apply.

L. Subject to approval through the planned residential development process, or approval by the City Planner, depending on who is the applicable decision-maker, in calculating allowable residential units per acre, up to 100% of the acreage of critical areas and buffers may be counted and this density transferred to buildable portions of the site.

M. The substantive requirements unique to the type of critical area shall also be complied with, as set forth in the applicable chapter of the Critical Areas Code.

Section 10. SMC Section 14.260.040 entitled "Substantive Requirements" is hereby amended to read as follows:

14.260.040 Substantive Requirements

In addition to the substantive requirements of SMC 14.255.120, the requirements of this section shall apply to developments in wetlands, except as exempted above.

A. The higher the wetland category (Category I is highest), the greater shall be the emphasis on higher-priority "sequencing" methods per SMC 14.255.120.E.

B. The following buffer width requirements are established as the minimum wetland buffer widths:

1. The standard buffer widths in this section are based on the fact that most impacts adjacent to wetlands in the City of Snohomish will be high intensity impacts characteristic of an urban area. Accordingly, one baseline buffer will generally apply to each category of wetland, as provided in subsection 14.060.040(B)(2), unless the habitat function score requires increasing the buffer width, as provided in subsection 14.260.040(B)(3), or unless the buffer width is increased, decreased, and/or averaged, as provided in subsections 14.260.040(D, E, F, and G).

2. Standard/baseline buffer widths shall be:

Category I	**150** feet
Category II	**100** feet
Category III	**50** feet (exempt if smaller than 1000 square feet: see SMC 14.255.060(S); between 1000 square feet and 3000 square feet in area shall be exempt from the normal sequencing process but shall be fully mitigated: see SMC 14.255.060(T))
Category IV	**50** feet (exempt if smaller than 1000 square feet: see SMC 14.255.060(S); between 1000 square feet and 3000 square feet in area shall be exempt from the normal sequencing process but shall be fully mitigated: see SMC 14.255.060(T)

1. The standard/baseline buffer widths shall be increased for each Category of wetland to the following wetland buffer widths, if the habitat function scores (derived from the 2004 Wetland Rating System for Western Washington) meet the following thresholds:

Category I	**200** feet, if habitat function score is at least 28
Category II	**150** feet, if habitat function score is at least 28

Category III	**100** feet, if habitat function score is at least 20
Category IV	**50** feet, i.e. no increase regardless of habitat function score.

C. Buffers shall be measured from the wetland boundary as surveyed in the field. If wetland enhancement is proposed, the requirements for the category of the wetland after enhancement shall apply.

D. The above standard buffer widths presume the following:

1. The buffer is at least moderately endowed with healthy native vegetation (i.e., 75% ground cover) and other factors affecting its ability to protect the wetland, such as favorable topography.

2. The City Planner may increase the required buffer width or require buffer enhancement if the buffer is poorly endowed with healthy native vegetation or is otherwise handicapped in its ability to protect the wetland as specified in 14.260.040(E).

3. The City Planner may reduce the required buffer width if the buffer is, or after enhancement will be, well endowed with healthy native vegetation or otherwise unusually able to protect the wetland as specified in 14.260.040(E).

E. The City Planner may increase or reduce the standard buffer width if the function(s) served by the particular wetland need(s) more or less buffer width, as indicated by a wetland functional analysis. Buffer widths may be reduced not more than 25% of the standard/baseline buffer width and only if restoration or enhancement occurs within the remaining buffer such that no net loss of function is realized.

F. The City Planner shall have the authority to average buffer widths on a case-by-case basis, where a qualified professional demonstrates to the City Planner's satisfaction that all the following criteria are met:

1. The total area contained in the buffer area after averaging is no less than that which would be contained within the standard buffer.

2. The buffer averaging does not reduce the functions or values of the wetland.

3. The wetland contains variations in sensitivity due to existing physical characteristics or the character of the buffer varies in slope, soils, or vegetation.

4. The director shall have the authority to increase the minimum width of the standard buffer on a case-by-case basis when such increase is necessary.

5. Buffer width averaging does not reduce the original buffer width by more 50% at any one point.

G. The City Planner may combine the use of buffer restoration or enhancement to reduce buffer width, as provided in subsection 14.260.040(E), with the use of buffer width averaging, as provided in subsection 14.260.040(F), provided that there is no net loss of function and the original buffer width is not reduced by more than 50% at any one point.

H. Except as provided elsewhere in the Critical Areas Code, all existing native vegetation in wetland buffers shall be retained without disturbance, mowing, or hard surfacing, nor shall any action be taken to inhibit volunteer re growth of native vegetation. Invasive weeds shall be removed for the duration of the monitoring period. Stormwater management facilities, bioswales, Low Impact Development facilities, and treated-water outfalls are permitted in the outer 50 percent of the buffer of Category II, III, or IV wetlands, provided that wetland functions and values are not significantly lost through fluctuations in wetland hydrology and construction integrates best management practices.

Section 11. SMC Section 15.16.020 entitled "Stormwater Management Manual Adopted" is hereby amended to read as follows:

15.16.020 Stormwater Management Manual Adopted. The ~~2005~~ 2012 State Department of Ecology Stormwater Management Manual for Western Washington , as amended by Sections 1-6 of Appendix 1 of the Western Washington Phase II Municipal Stormwater Permit, as now or hereafter amended, is hereby adopted as the City's minimum stormwater regulations and as a technical reference manual and is hereinafter referred to as the "Stormwater Manual."

ENGINEERING DESIGN AND CONSTRUCTION STANDARDS

Section 12. Engineering Design and Construction Standards Section 1-6.2 entitled "WARRANTY." is hereby amended to read as follows and all other provisions not addressed herein shall remain in full force and effect:

1-6.2 WARRANTY

Warranty guarantees shall be required at the time of final acceptance of the public improvements and/or improvements required by City ordinance. The guarantee amount will be ~~10%~~ 15% of the documented final cost of the improvements in accordance with SMC 14.215.080. The warranty guarantee is required prior to release of the performance guarantee. Methods of posting warranty guarantee shall be the same as for performance guarantee and shall be for the lengths of time as listed below:

Street/Alley	Drainage (private)	Utilities (public)
~~Two~~ One Year	~~Two~~ One Years (will be extended for one year if City elects to assume maintenance)	~~Two~~ One Year

Section 13. Amendment of EDS Section 3 Table of Contents
Engineering Design and Construction Standards Section 3 entitled "TABLE OF CONTENTS" is hereby amended to read as follows:

TABLE OF CONTENTS

SECTION 3

STREETS AND RELATED WORK

(...)
3-5. ~~PARKING LOTS~~ STREET PAVEMENT PRESERVATION.....3-6
~~3-5.1 General .....3-6~~
~~3-5.2 Construction .....3-6~~
~~3-5.3 Handicap Requirements .....3-6~~
~~3-5.4 Illumination .....3-7~~
~~3-5.5 Pedestrian Concerns .....3-7~~
(...)

Section 14. Engineering Design and Construction Standards Section 3-5 entitled "PARKING LOTS" is hereby replaced with a "STREET PAVEMENT PRESERVATION" section and is to read as follows:

3-5 ~~PARKING LOTS~~ STREET PAVEMENT PRESERVATION

No permit shall authorize an open cut crossing of a newly paved or overlaid asphalt street for a period of five years after paving, and directional bore shall be required in such

circumstances. The City Engineer or designee may grant exemptions to this requirement in order to facilitate development on adjacent properties, to provide for emergency repairs to subsurface facilities, to provide for underground service connections to adjacent properties or to allow the upgrading of underground utility facilities.

When granting exceptions to this restriction, the City Engineer may impose conditions determined appropriate to insure complete restoration of the street and the surface paving. In addition to complying with the City Engineering Design and Construction Standards, conditions may include ADA improvements, surface grinding, base and sub-base repairs, or other related work as needed, and up to full-width surface paving of the roadway. The length of restoration will be determined by the City Engineer.

In addition to a right of way permit, any person who is required to partially or fully repave a street shall be responsible for the full cost of plan review, construction inspection, material testing, bonding, other permits and all other City fees related to the work.

If the City Engineer determines that final repaving of the street is not appropriate at that particular time for reasons relating to weather or other short term problems, the City Engineer may grant a delay until proper conditions allow for repaving subject to bonding or other acceptable security as deemed appropriate by the City Engineer.

~~**3-5.1 GENERAL**~~

~~Off-street parking lots shall be constructed in conformance with the requirements for number of stalls and landscaping as noted in the Land Use Code. Additionally, if all of the following are met, a maximum of 25% of the required number of stalls may be sized for compact cars, as shown on Standard Plan Nos. 334A and 334B. Aisle widths may be required to be widened if multiple utility lines are located within the aisle corridor. Note the compact stalls should not be intermixed with standard stalls.~~

~~A. The parking lot contains 12 or more parking spaces.~~

~~B. The parking area is defined as long-term parking, i.e., more than three to four hours and does not involve packages. For example, a shopping center could not meet this criterion, but an apartment complex could.~~

~~**3-5.2 CONSTRUCTION**~~

~~All parking lot construction shall be inspected by the Public Works Department for conformance to plans for size, layout, drainage control, and structural section. The minimum acceptable structural section for parking lots shall be two inches of class "B" asphalt placed over four inches of crushed surfacing top course, unless otherwise approved by the City Engineer. Prior to placing any surfacing material on the roadway, it will be the responsibility of the developer/contractor to provide density test reports certified by a professional engineer registered in the State of Washington.~~

~~Crushed surfacing top course shall be compacted to 95% maximum density. Density testing for asphalt pavement including the necessity and frequency of core samples will be determined by the City Engineer on a case-by-case basis.~~

~~**3-5.3 HANDICAP REQUIREMENTS**~~

~~Handicap parking stalls shall meet the requirements of Washington State Regulations for Barrier Free Facilities (WAC 51-20).~~

~~Safe, convenient handicap access is required from the street to all buildings on site. This is in addition to safe, convenient handicap access between buildings. See Section 3-5.5.~~

~~**3-5.4 ILLUMINATION**~~

~~Parking lot illumination shall be provided for all parking lots containing more than ten (10) parking spaces, and shall be designed and constructed so as to:~~

~~A. Provide security lighting to all parking spaces.~~

~~B. Be shielded in a manner that does not disturb residential uses.~~

~~**3-5.5 PEDESTRIAN CONCERNS**~~

~~Pedestrian walkways may be required within commercial parking lots as determined by City Engineer.~~

~~Internal vehicle and pedestrian circulation for parking lots shall be approved by the planning director and traffic engineer. Parking lot circulation shall allow for access so pedestrians and wheelchairs can easily gain access from public sidewalks and bus stops to building entrances through the use of pedestrian paths which are physically separated from vehicle traffic and maneuvering areas. In shopping center parking lots containing more than 100 spaces, such pedestrian/wheelchair paths shall be a minimum of five feet wide and constructed in a manner that they cannot be used as a holding area for shopping carts.~~

~~Access driveways for parking areas shall be located so as to cause the least possible conflict with vehicular and pedestrian traffic on public rights-of-way.~~

~~The Traffic Engineer may require joint use of driveways by more than one property.~~

Section 15. Engineering Design and Construction Standards Section 3-17.1 entitled "DESCRIPTION" is hereby amended to read as follows:

3-17.1 DESCRIPTION

This work shall consist of constructing cement concrete sidewalks, thickened edge for sidewalks, curb ramps, and bus shelter pads, including excavation for the depth of the sidewalk and subgrade preparation, in accordance with these Specifications, the WSDOT/APWA Standard Specifications and Standard Drawings Nos. 306, 306A, 310A thru 310C, and 311. Porous concrete sidewalks may be used subject to approval of the City Engineer.

Section 16. Engineering Design and Construction Standards Section 3-18.1 entitled "DESCRIPTION" is hereby amended to read as follows:

3-18.1 DESCRIPTION

The standard curb and gutter section used in Snohomish shall by Type A-1 per Standard Plan No. 305A. No new curb and gutter is to be placed until forms have been checked

and approved for line, grade, and compaction by the Public Works Inspector. Curb cuts or "invisible" curbs may be used subject to approval of the City Engineer.

Section 17. Engineering Design and Construction Standards Section 3-19.2 entitled "MATERIALS" is hereby amended to read as follows:

3-19.2 MATERIALS

Materials shall meet the requirements of the following sections of WSDOT/APWA Standard Specifications:

Portland Cement 9-01

Fine Aggregate 9-03

Coarse Aggregate 9-03

Joint Materials 9-04

Curing and Admixtures 9-23

The concrete mix shall be as specified for Class 3000 and the slump of the concrete shall not exceed three inches. Pervious asphalt or porous concrete satisfying the requirements of the adopted Stormwater Management Manual may be used subject to approval of the City Engineer.

Section 18. Engineering Design and Construction Standards Section 3-19.3(7) entitled "RESIDENTIAL DRIVEWAYS" is hereby amended to read as follows:

3-19.3(7) RESIDENTIAL DRIVEWAYS

A. **Width:** The maximum width shall be ~~24~~ 20 feet at dimension "1" on Standard Plan Nos. 307, 308, and 309. The minimum width shall be 8 feet per SMC 14.235.130(B).

B. **Grade:** The maximum recommended grade is 15%. Grade changes that exceed 16% shall require vertical curves to connect tangents.

Section 19. Engineering Design and Construction Standards Section entitled "DRAWING INDEX" is hereby amended to read as follows and all other provisions not addressed herein shall remain in full force and effect:

DRAWING INDEX

STREETS AND RELATED WORK — Last Revision Date

(...)

~~334a Typical Parking Layout..... 4-01-04~~

~~334b Parking Lot Details..... 4-01-04~~

Section 20. Engineering Design and Construction Standard Details to be revised or deleted are as follows:

Revise Standard Detail 304. (See Exhibit A.)

Revise Standard Detail 306. (See Exhibit A.)

Revise Standard Detail 316. (See Exhibit A.)

Delete Standard Detail 334a. (See Exhibit A.)

Delete Standard Detail 334b. (See Exhibit A.)

Section 21. Severability. If any section, subsection, paragraph, sentence, clause, or phrase of this ordinance or its application to any person or circumstance be declared unconstitutional or otherwise invalid for any reason, or should any portion of this ordinance be preempted by state or federal law or regulation, such a decision or preemption shall not affect the validity or constitutionality of the remaining portions of this ordinance or its application to any other persons or circumstances.

Section 22. Effective Date. This ordinance shall be effective five days after adoption and publication by summary.

ADOPTED by the City Council and **APPROVED** by the Mayor this 15th day of November, 2016.

CITY OF SNOHOMISH

By _____
MAYOR KAREN GUZAK

ATTEST:

By _____
PAT ADAMS, CITY CLERK

APPROVED AS TO FORM:

By _____
GRANT K. WEED, CITY ATTORNEY

Date of Publication:

Effective Date:

CITY OF SNOHOMISH

SNOHOMISH COUNTY
WASHINGTON

Water Quality Monitoring Report (2008-2016)

February 2017

G&O #17411
PREPARED BY:

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CONSULTING ENGINEERS

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INTRODUCTION

PURPOSE

In June 2003, the Department of Ecology published the *Lower Snohomish Tributaries Fecal Coliform Bacteria Total Maximum Daily Load (TMDL): Detailed Implementation Plan*. This Plan recognized that at the time, many of the streams in the Lower Snohomish Watershed did not meet State Water Quality Standards for swimming due to the high amounts of bacteria present. To address this issue, a TMDL was issued and an Implementation Plan was put into effect. The goal of the TMDL was to have 75% of sampled stations throughout the Lower Snohomish River tributaries to be in compliance with State Water Quality Standards (WAC 173-201A) by 2007. It was anticipated that by 2009, all sampled stations would be in compliance.

The TMDL Implementation Plan found that at the mouth of the Pilchuck River, near the town of Snohomish, water quality improves. During the dry season, there are occasional spikes observed near the city of Snohomish that cause the 90th percentile to be exceeded. The Plan indicated that a constant source of bacteria from the Catherine Creek system (upstream, near Lake Stevens) should be a priority for investigation due to the high levels of bacteria observed and the high concentration of people living in the Lake Stevens area. The Plan also noted that the sources of fecal coliform are likely to be livestock access to the stream, inadequate pasture management, and failing on-site sewage disposal systems.

As a requirement to the Western Washington Phase II Municipal Stormwater Permit issued initially in 2007 and again in 2013, jurisdictions with upstream tributaries to the Snohomish River were required to meet the TMDL Implementation Plan by having them address commercial animal handling and compost areas as well as to develop a Bacterial Pollution Control Plan. These actions were required with the intent to help reduce the amount of bacteria within the Snohomish River and its tributaries.

In an effort to address the issued TMDL on the Snohomish River, the City of Snohomish began monitoring for fecal coliform and other parameters such as temperature, pH, dissolved oxygen, conductivity, and turbidity in 2008. Prior to monitoring, the City of Snohomish prepared a Quality Assurance Project Plan (QAPP) that was reviewed and approved by Ecology in 2007. The QAPP identified ten locations throughout the city that were to be monitored for the intended parameters (see Figure 1). These sites were selected to best represent areas throughout the City where fecal coliform could be entering the tributary system to the Snohomish River. In March 2010, the City received approval from Ecology to relocate two of the sample site locations (SNOH1 and SNOH2) in order to better address potential problem areas revealed by the first 3 years of sample analysis. In 2011, the City removed two of the sample sites due to employee safety (SNOH9 and SNOH12) and in 2015 removed one site (SNOH10) due to redundancies and site complications. In February 2015, the City has revised their QAPP to reflect these site changes which was subsequently approved by the Department of Ecology. In addition to conducting monitoring, the City of Snohomish developed a Bacterial Pollution Control

Plan in 2011. The Plan was intended to assist the City in attaining the goal of reducing the ecological impacts of stormwater runoff and stormwater bacterial pollution.

The following Water Quality Report summarizes the data collected from 2008 through 2016. The Report will detail the results from the monitoring data collected and will also analyze the trends that were observed over the past eight years as they relate to water quality improvement.

AREAS OF ANALYSIS

The fecal coliform samples collected throughout the city were located at sites chosen to provide a well-mixed and representative sample (See Figure 1). Table 1 lists the locations of the sampling sites. It should be noted that sampling sites "SNOH1" and "SNOH2" were removed from the list of sampling sites for 2010 due to the fact that data from both sites indicated that these areas were not affecting areas downstream in terms of water quality degradation due to fecal coliform. In 2011, SNOH11 was removed from the list of sampling sites. In addition, sites "SNOH9" and "SNOH12" were removed due to safety reasons. SNOH10 was removed from the 2015 sampling schedule due to its close proximity to SNOH5 and the fact that it traditionally runs dry throughout most of the year.

Table 1
Sampling Sites for Fecal Coliform in Snohomish

Station name	Site Description	Latitude/Longitude
SNOH1	*Fobes Rd. (Concrete Box Culvert)*	*N 47º56.771/ W 122º06.889*
SNOH2	*Near SR 2, E. of 52nd St. S.E. (Arch CMP)*	*N 47º56.895/ W 122º05.173*
SNOH3	**Weaver Rd. (CMP)**	**N 47º56.279/ W 122º06.626**
SNOH4	**72nd St. SE, Near SR 9 (Concrete Box Culvert)**	**N 47º55.879/ W 122º06.409**
SNOH5	**64th St. S.E. (Concrete Pipe under Road)**	**N 47º56.306/ W 122º05.759**
SNOH6	**13th St., Near Ave. A**	**N 47º55.640/ W 122º05.581**
SNOH7	**E. of Ave. A, Near 8th St. in Park (CMP)**	**N 47º55.292/ W 122º05.559**
SNOH8	**Cady Park (CMP)**	**N 47º54.593/ W 122º05.599**
SNOH9	*N. of Riverview, W. of Ludwig Rd.*	*N 47º55.204/ W 122º06.706*
SNOH10	*S. end of Lake Crest Dr. (stream)*	*N 47º56.190/ W 122º05.708*
SNOH11	*Upper Swifty Creek (Near Cedar/Third)*	*N 47º54.335/ W 122º05.25*
SNOH12	*Lower Swifty Creek (12" outfall near Glen/Second)*	*N 47º54.46/ W 122º05.29*

*Note: Sampling Sites SNOH1 and SNOH2 were removed from the selected set of sampling sites and were replaced with SNOH 11 and SNOH12 in 2010. Sites SNOH 9 (2011), SNOH10 (2015) and SNOH 12 (2011) were removed for safety reasons.

The following will discuss data pertaining to the results found at each of these sites.

WATER QUALITY MONITORING PARAMETERS

DESCRIPTION

To obtain an understanding of the water quality in the streams and conveyance areas surrounding the City of Snohomish, a number of parameters were monitored. These parameters include fecal coliform, temperature, pH, dissolved oxygen, conductivity, and turbidity. All parameters were observed for the twelve sampling sites located throughout the City from 2008 to 2010. In 2011 and 2012, the City was understaffed to provide this information. The following describes the state of these waters and the trends they are anticipated to follow over the next few years. It is important to note that this data represents only a snap shot of time. By observing only this brief period of time as opposed to looking at data representing numerous years, expected trends may be skewed.

FECAL COLIFORM

The presence of fecal coliform bacteria in aquatic environments indicates that the water has been contaminated with the fecal material of man or other animals. At the time this occurred, the source water may have been contaminated by pathogens or disease producing bacteria or viruses which can also exist in fecal material. Some waterborne pathogenic diseases include typhoid fever, viral and bacterial gastroenteritis and hepatitis A. The presence of fecal contamination is an indicator that a potential health risk exists for individuals exposed to this water. Fecal coliform bacteria may occur in ambient water as a result of the overflow of domestic sewage or nonpoint sources of human and animal waste.

The City began monitoring for fecal coliform in March 2008. Appendix A displays the resulting graphs of this data for 2008 through 2016. The raw data can be found in Appendix B. Samples since March 2008 reveal results that exceed the State Water Quality Standards for the Snohomish River. The State Standard for the river includes having an annual geometric mean that does not exceed 100 colonies/100 mL due to the classification of the river being a “primary contact recreational” area. Any surface waters running into Blackmans Lake are subject to the state standard of having a geometric mean that does not exceed 50 colonies/100 mL. In addition, for runoff entering Snohomish River, not more than 10% of the annual samples taken can exceed 200 colonies/100mL whereas runoff entering Blackmans Lake is subject to having no greater than 10% of the samples taken exceed 100 colonies/100mL. Table 1 shows a summary of the annual geometric means whereas Table 2 shows the sampling sites that have exceeded the 10% threshold designated by the State Standard.

TABLE 1
Annual Geometric Mean for Fecal Coliform Samples

Site	2008	2009	2010	2011	2012	2013	2014	2015	2016
SNOH1	110	61	45						
SNOH2	14	9	14						
SNOH3	84	44	77	47	56	46	20	28	46
SNOH4	39	85	80	38	51	47	70	18	46
SNOH5	16	22	18	32	11	45	7	5	16
SNOH6	202	49	38	55	69	90	73	79	143
SNOH7	266	240	119	84	111	87	44	122	127
SNOH8	201	179	120	56	52	53	43	35	31
SNOH9	48	54	40						
SNOH10	38	114	68	21	18	11	11		
SNOH11									
SNOH12									

1) Black shading represents exceedance of State Water Quality Standard of an annual geometric mean greater than 100 colonies/100 mL (or 50 colonies/100 mL for SNOH5 and SNOH10).

TABLE 2
Fecal Coliform Results Exceeding 10% of Annual Sample Collected

Site	2008	2009	2010	2011	2012	2013	2014	2015	2016
SNOH1	x	x	x						
SNOH2									
SNOH3	x	x	x	x	x				
SNOH4		x	x		x	x	x		
SNOH5	x	x	x	x	x	x	x		
SNOH6	x	x		x	x	x	x	x	x
SNOH7	x	x	x	x	x	x	x	x	x
SNOH8	x	x	x	x	x	x	x		
SNOH9		x	x						
SNOH10		x	x	x			x		
SNOH11			x						
SNOH12			x						

1) "x" represents sites that had over 10% of the annual fecal coliform results (or one minimum) greater than 200 colonies/100 mL (or 100 colonies/100 mL for SNOH5 and SNOH10).

From Table 1, it is apparent that sampling sites "SNOH7" (East of Ave. A, near Park St.) and "SNOH8" (Cady Park) had a consistent violation of state water quality standards in 2008 through 2010. SNOH8 has shown relative improvement over the past six years, resulting in a lower geometric mean of fecal coliform samples. This improvement is evident by the reduction from 201 colonies/100 mL in 2008 to 31 colonies/100 mL in 2016. The SNOH7 site revealed a geometric mean of 266 colonies/100 mL in 2008 and a reduced geometric mean of 44 colonies/100 mL in 2014. However, SNOH7 shows an increase in fecal coliforms, rising to 122 colonies/100 mL in 2015 and 127 colonies/100mL in 2016. SNOH6 fecal coliform levels increased from 79 colonies/100 mL in 2015 to 143 colonies/100 mL in 2016. This spike, and to a lesser extent the SNOH7 fecal coliform increase, likely resulted from the Blackmans Lake Outlet Control re-channelization project which began in August, 2016. The City will elect to further examine the SNOH6 and SNOH7 sites due to their proximity to Blackmans Lake and due to the fact that the annual geometric mean for SNOH6 has been increasing over the past eight years and the annual geometric mean for SNOH7 increased in 2016 to levels that violate the State Water Quality Standard. Last year, the City sent an informational flyer to the residents along the stream as a measure to address the rising fecal coliform levels in this area.

The remaining sites were fairly consistent over the past six years in meeting the state water quality standard of a geometric mean below 100 colonies/100 mL or 50 mL for waters flowing into Blackmans Lake. These sites also met the state standard requiring less than 10% of the samples collected having less than 200 colonies/100 mL or 50 mL for waters flowing into Blackmans Lake. Sites SNOH6 and SNOH7 were not in compliance with the 10% standard (see Appendices A and B for further detail). If necessary, the City may want to do additional testing just upstream and downstream of areas that violate the 10% rule to get a better understanding of the sources at hand and to narrow down the potential source of bacterial contamination. Sampling shall be taken to represent both dry and wet weather seasons since wet weather seasons typically reveal higher results due to high sediment loads during storms.

If results throughout the increased monitoring period still exceed state standards, the City may want to investigate methods such as DNA typing, observing land use, or doing stream reconnaissance to determine the origin of the bacteria so as to minimize pollution of the water in the future.

TEMPERATURE

Temperature data was intermittently collected from 2008-2010. Although the data was not consistent, observations can be noted from the data that was collected. In observing the temperature data presented graphically in Appendix A, it is apparent that the temperature had generally risen for all sites. This may simply be due to the general warming of the atmosphere but it may also be attributable to a decrease of vegetation along the sides of a stream or open conveyance system. Increased development and a lack of knowledge by homeowners can lead to the reduction of necessary buffers along streams. If the increase in temperature is simply due to a lack of vegetation, the City may

want to focus on enforcing required buffers around streams and continue promoting positive landscaping features to homeowners located adjacent to these areas. By implementing these measures, the temperature of the water surface should remain constant throughout the years to come.

pH

Critical to streams is the pH value. pH is a measurement of hydrogen ions present in a solution and is expressed on a scale of 1 to 14. Water with a pH less than 7 is considered a more acidic solution whereas a pH greater than 7 indicates a more alkaline solution. A low pH increases the solubility of toxic metals, causing damage to fish and other aquatic life within a stream. The State Water Quality Standards require the pH within a salmon and/or trout spawning stream to be within the range of 6.5 to 8.5. As a whole, pH at the sampling sites throughout 2008 through 2010 generally varied from 6.5 to 8.5. A few spikes around 9 were noticed in 2008 at SNOH2, SNOH4 and SNOH10 however the pH appeared lower in subsequent years. As shown in Appendix A, the linear trendline shown on the graphs indicate a decreasing amount of pH at each of the sampling sites with the exception of SNOH11 and SNOH12. Since sampling just began for the SNOH11 and SNOH12 sites in 2010, an insufficient amount of data exists to determine an appropriate trend for these sites. Although the trend shows a decreasing pH for the majority of the sampled sites, the data lies within the range required in State's water quality standard for pH. Overall, the pH in tributary creeks and conveyance channels is expected to continue with minimal change as shown over the past few years however the City may wish to continue to monitor this parameter and observe trends in future years.

Dissolved Oxygen

Dissolved oxygen is necessary for aquatic habitat to thrive within tributary streams. Like temperature, dissolved oxygen was not collected on a consistent basis and the data appears somewhat sparse however, from the data collected (see Appendix A), it appears that sites SNOH1, SNOH2, SNOH7, SNOH8 and SNOH12 show a decreasing amount of dissolved oxygen within the water whereas sites SNOH4 through SNOH6, and SNOH9 through SNOH11 show an increase in dissolved oxygen during the period between 2008 and 2010. Dissolved oxygen generally coincides with temperature. The sites that show a decrease in dissolved oxygen would coincide with the fact that the temperature has been slightly increasing over previous years. An increase in temperature results in decreased dissolved oxygen levels. As with temperature, this may be due to a lack of vegetation along the streams or conveyance channels. With the heightened awareness of how critical stream buffers are, it is expected that as vegetation is replaced along these streams, the temperature will decrease in the short term and remain constant in the long term, thereby allowing the dissolved oxygen levels to stabilize in the future. The sites that appear to have increased in dissolved oxygen should continue to be protected by monitoring vegetation along these corridors.

Conductivity

Conductivity is a measure of the ability of a solution to conduct a current which is a property attributable to the ions in the solution. Conductivity typically increases with the

rise in urbanization and is affected by the presence of inorganic dissolved solids such as chloride, nitrate, sulfate and phosphate anions. A rise in conductivity could be caused by the chemistry of the surrounding soil, wastewater, urban runoff, agricultural runoff or atmospheric input. Sampling sites SNOH1, SNOH 2, SNOH 5, and SNOH 6 appear to have increased in conductivity between 2008 and 2010. Further data needs to be collected at sites SNOH11 and SNOH12 to determine a trend. Conductivity at these sites should continue to be monitored for if it continues to increase, the City may want to investigate the possibility of pollutants entering the water via a source related to wastewater (i.e. septic tanks) or agricultural runoff. Throughout the future however, conductivity in watersheds that are mostly developed are expected to remain unchanged.

TURBIDITY

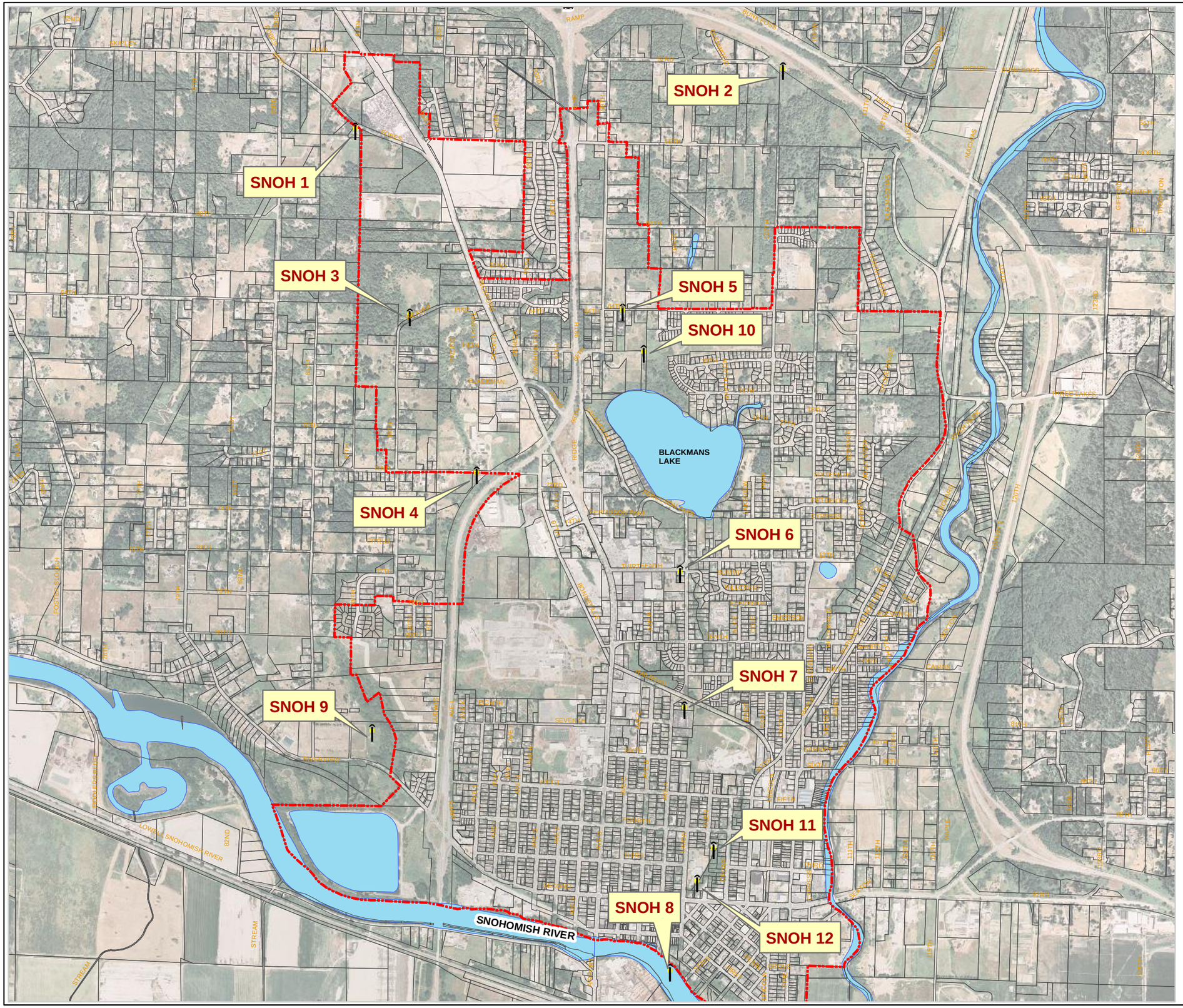
Turbidity is defined in the Department of Ecology's *Stormwater Management Manual for Western Washington* as the "the dispersion or scattering of light in a liquid caused by suspended solids and other factors…". A high turbidity level may make living conditions difficult for fish and other aquatic life. With increased development, it is expected that turbidity would increase. However, if BMPs are enforced and implemented correctly during the time of development, turbidity should not pose a threat to the city's tributaries and conveyance systems. As with the other water quality parameters monitored, the sites at SNOH11 and SNOH12 need further data collection to observe trends. The other sites generally revealed decreasing turbidity with the exception of SNOH2 and SNOH3. The decreasing turbidity may be due to successful inspection of developed sites or may possibly be due to a decrease in development seen in the past. The increase in turbidity at SNOH2 and SNOH3 is a trend that should continue to be monitored throughout the following years. More detailed inspection of construction sites or stormwater runoff draining to these areas may help prevent this upward trend from continuing in the future.

SNOHOMISH WATER QUALITY SUMMARY

Overall, it appears that most of the sampled sites fell within the water quality standards for fecal coliform over the past nine years with the exception of SNOH6 located near 13 th St. west of Ave. A and SNOH7 located east of Ave. A. Both SNOH7 and SNOH8 sites violated the 100 colonies/100mL standard from 2008 through 2010. SNOH7 violated the standard in 2012, 2015, and 2016 as well. SNOH6 violated the standard in 2008 and again in 2016. Although the past nine years have shown decreased fecal coliform levels for the SNOH8 site, the historical dissolved oxygen data for this site and the SNOH 7 site revealed a decreasing trend. Therefore, it is recommended that the city continue to observe these sites in the future for potential pollutants related to fecal coliform and factors pertaining to a decline in dissolved oxygen. In addition, SNOH6 should be observed in detail as the geometric mean has been increasing over the past nine years. The City may want to add additional monitoring sites upstream to narrow the region responsible for polluting the area. DNA typing, observation of land use or stream reconnaissance at these sites may also help to identify the source at hand.

Beyond fecal coliform sampling, particular attention should be given to turbidity monitoring for the SNOH3 site. In addition, due to temperature levels increasing slightly at all sites and an apparent decline in dissolved oxygen at various sampling sites throughout the City, it is recommended that the City continue to encourage vegetation retention near water bodies. Although budget constraints have prevented the City from monitoring water quality parameters outside of fecal coliform, it is recommended that the City continue to monitor these parameters should funds become available. Water quality indicators such as dissolved oxygen and temperature are vital in determining the overall health of the hydraulic system.

Figure 1
Sampling locations



3

0 750 1,500 3,000 Feet

SCALE 1" = 1500'

LEGEND:

- SAMPLING STATIONS
- CITY LIMITS
- PARCELS
- WATER

CITY OF SNOHOMISH

FIGURE 1
SAMPLING SITES

Gray & Osborne, Inc.
CONSULTING ENGINEERS

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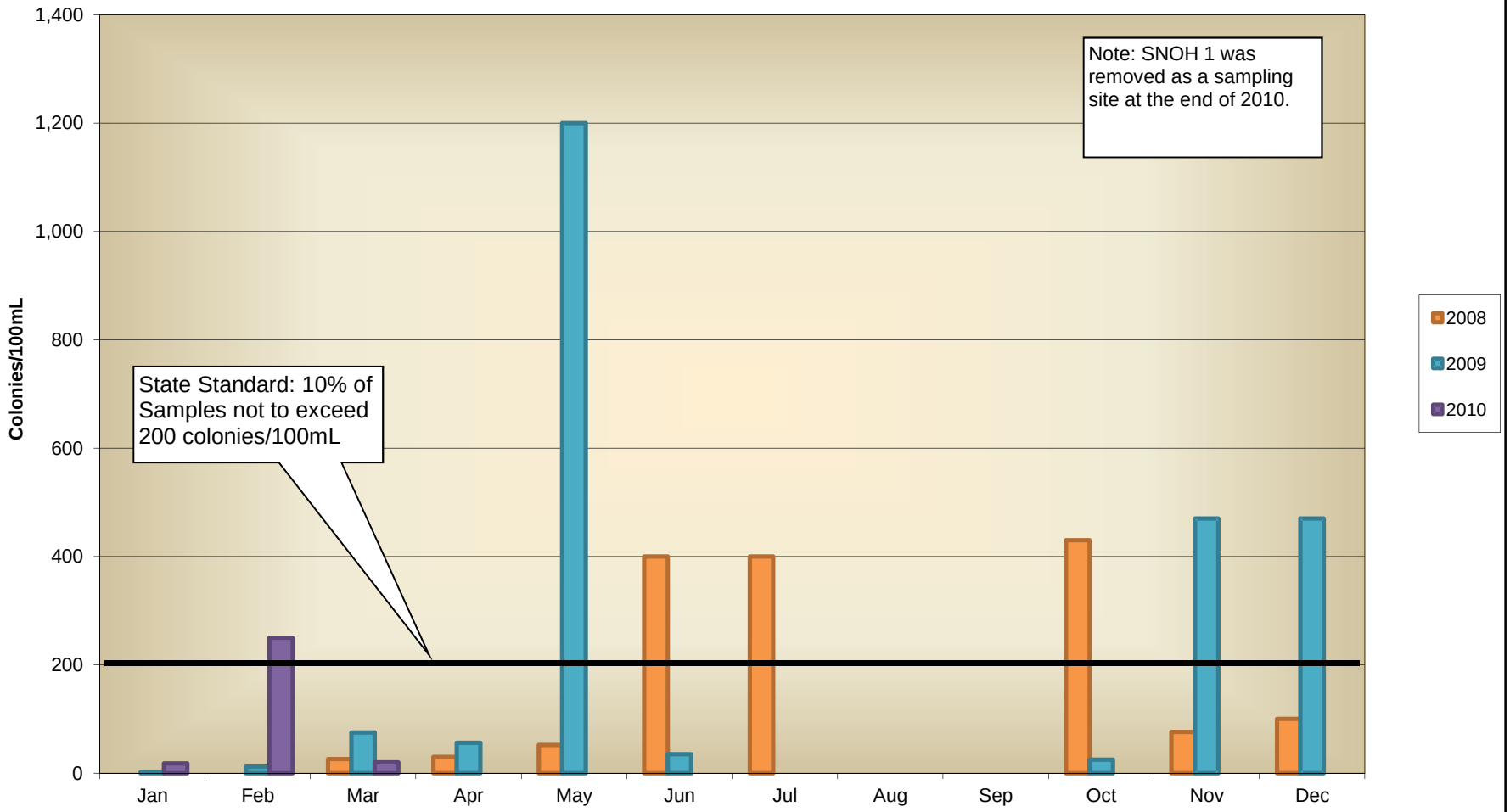
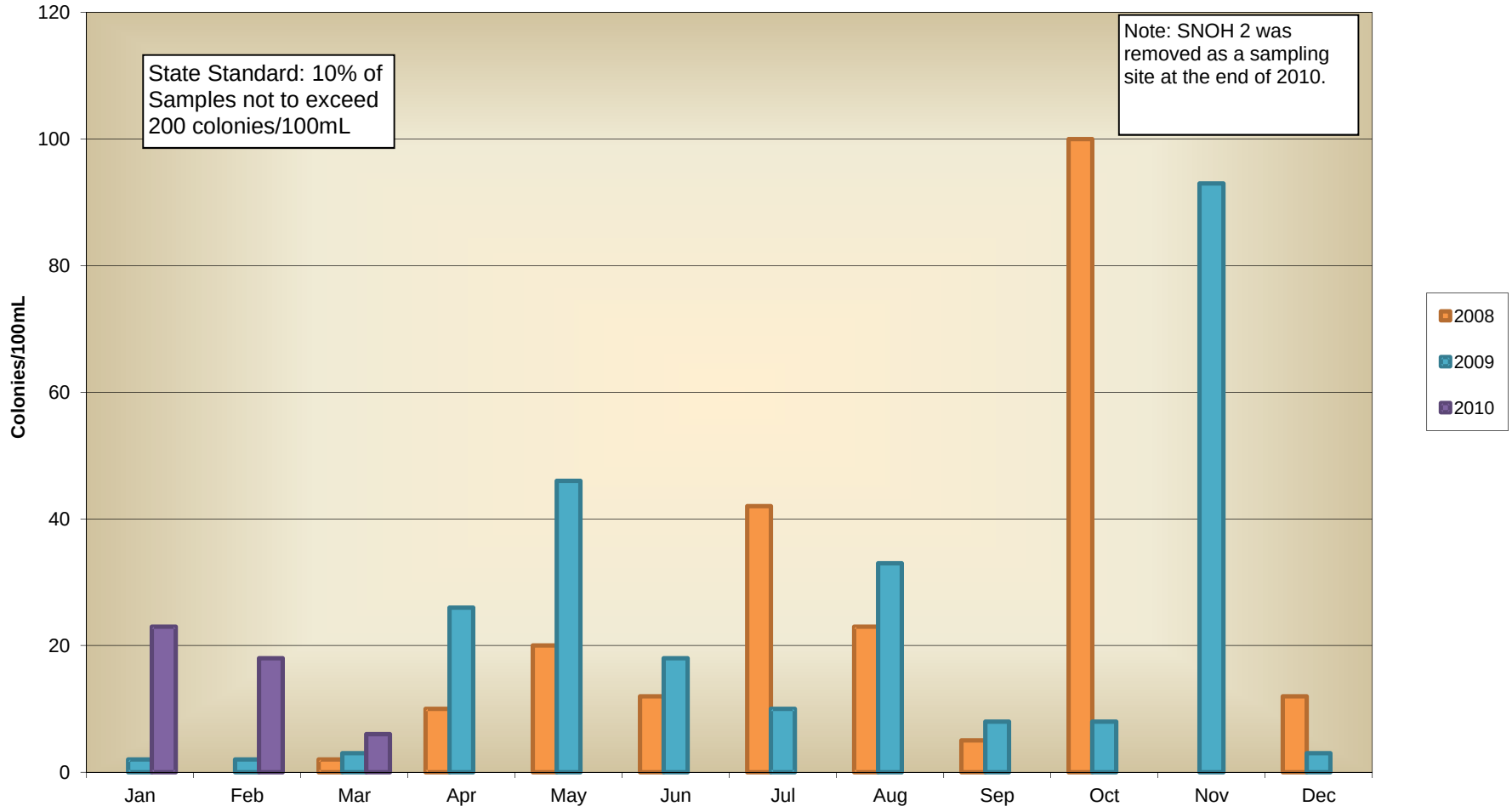
Appendix A
Graphs

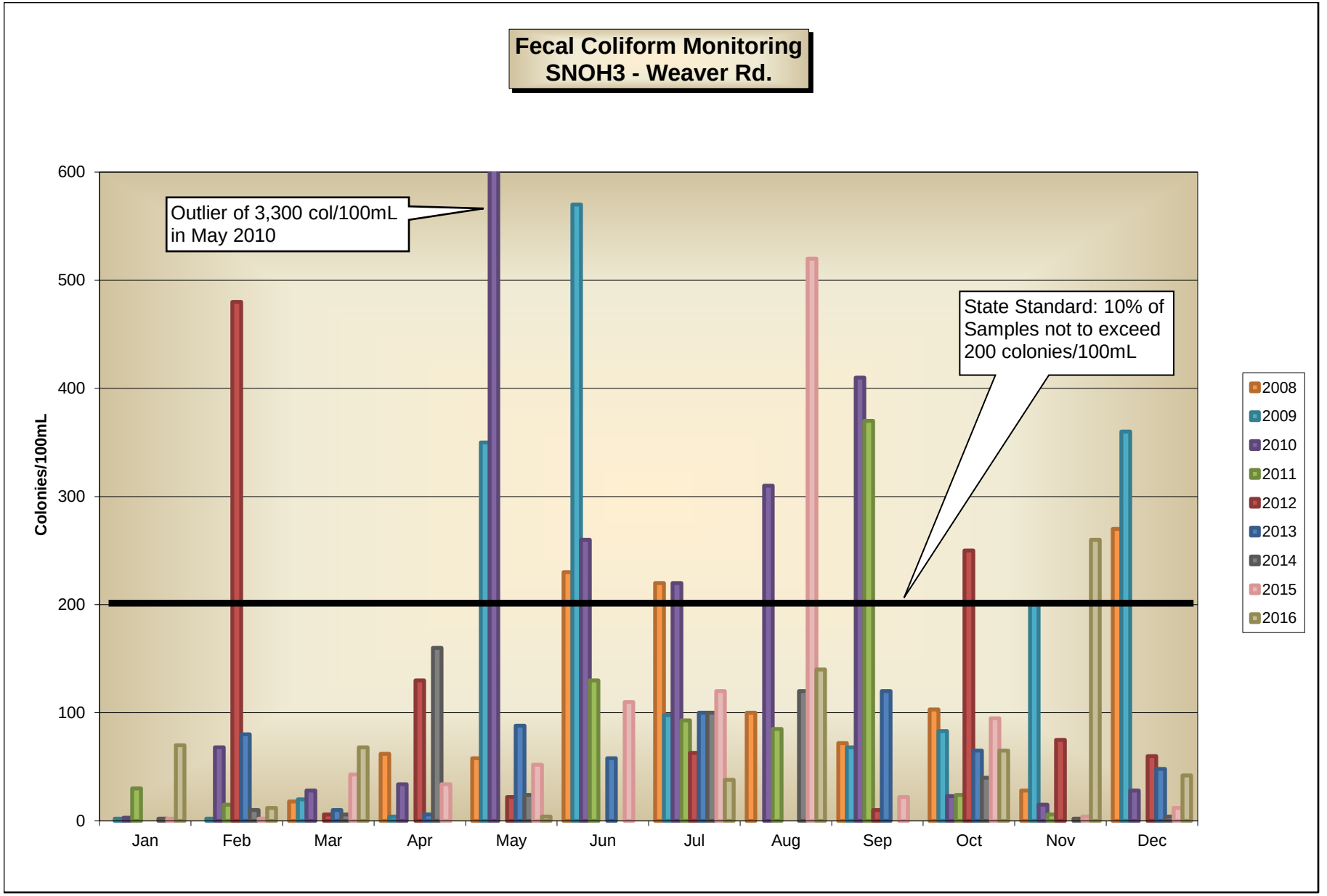
Fecal Coliform Graphs (2008-2016)

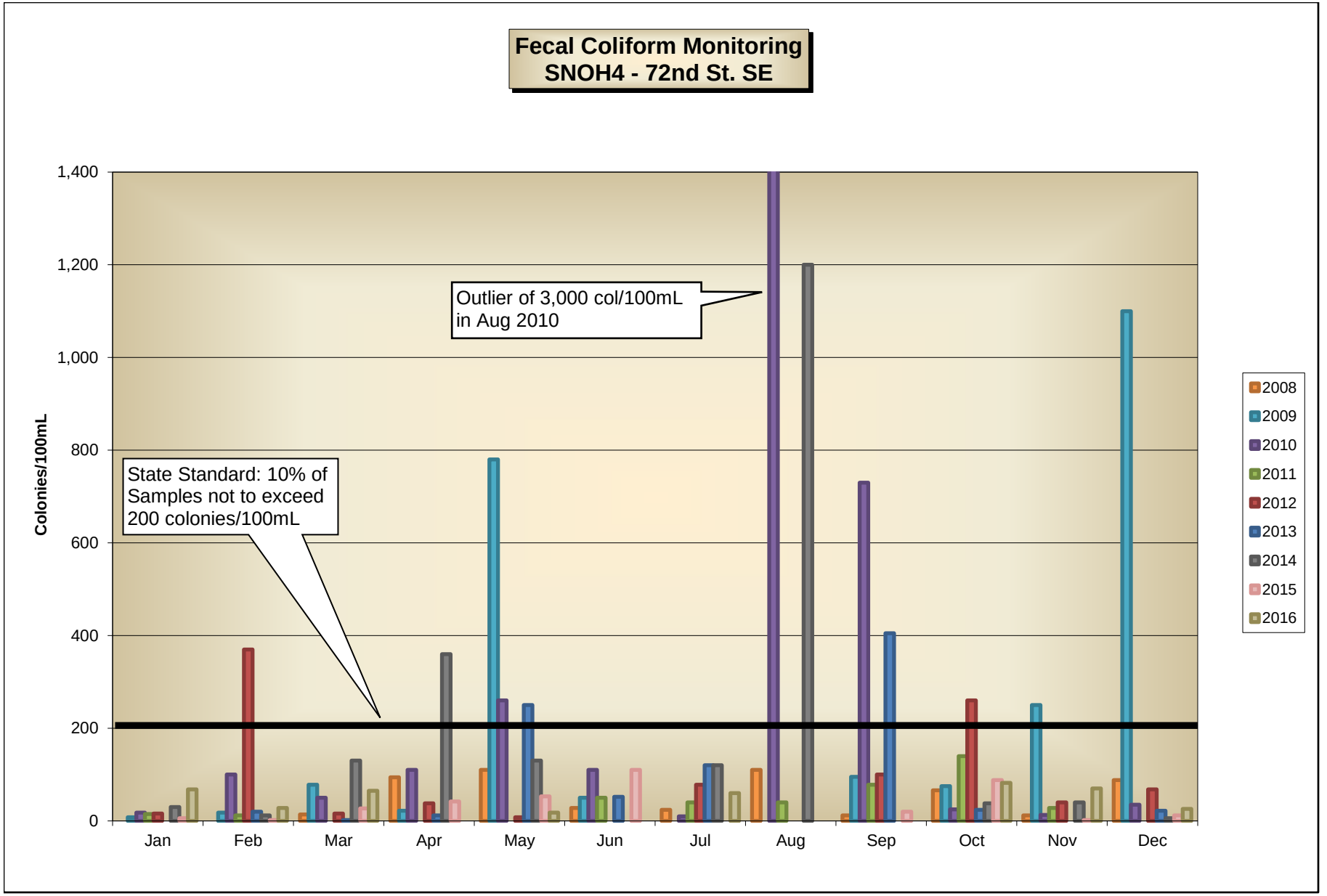
Fecal Coliform Monitoring
SNOH1 - Fobes Rd.

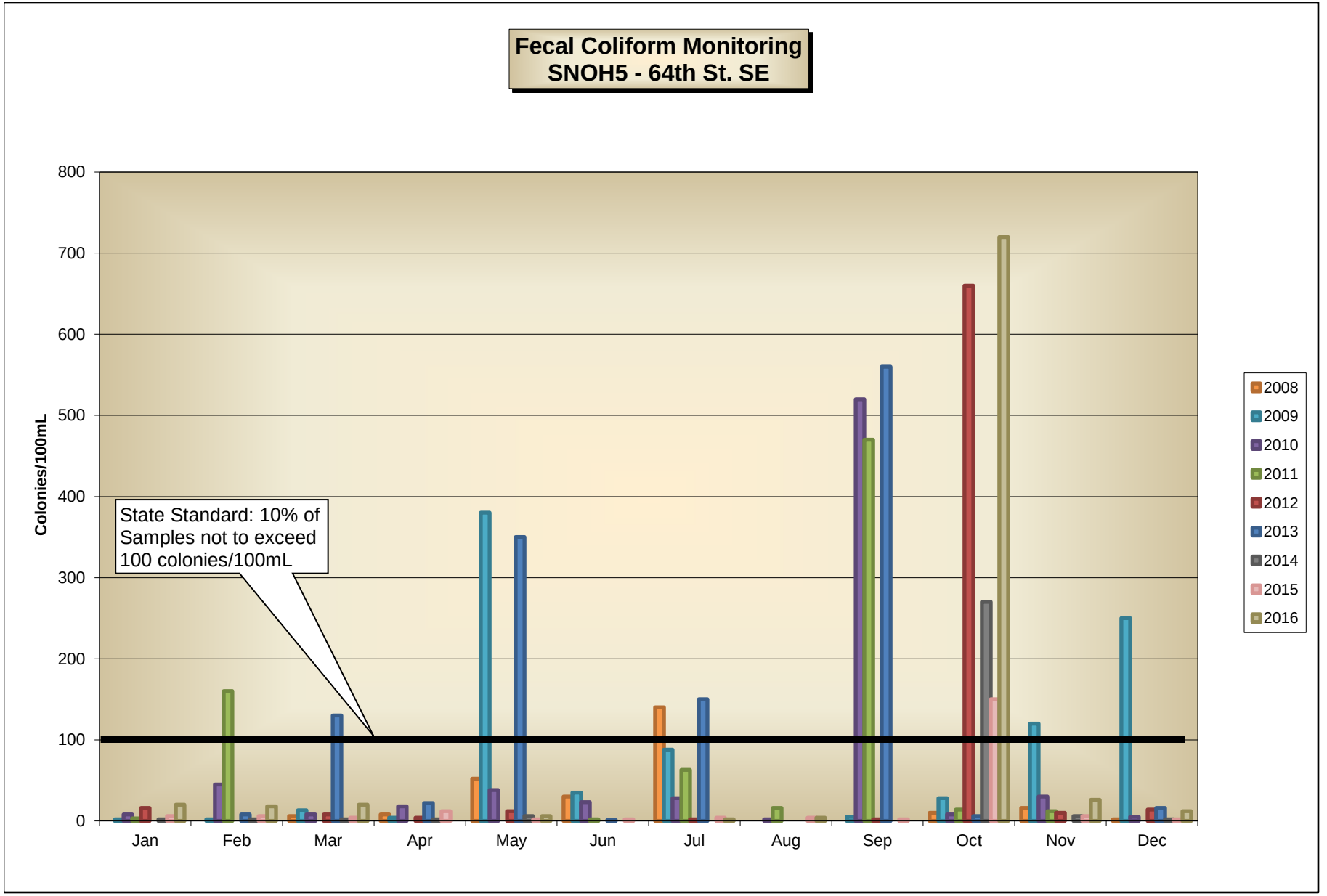


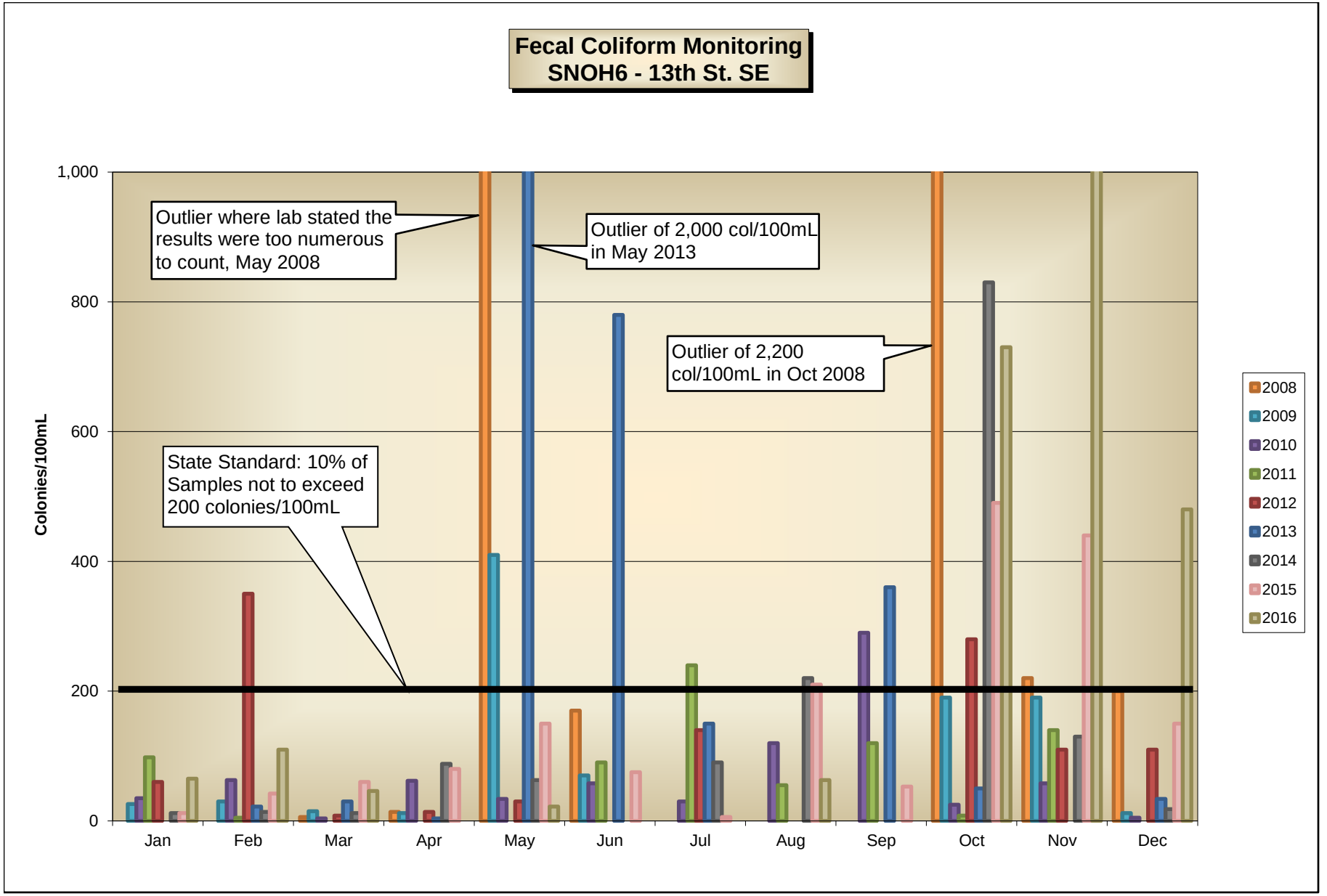
Fecal Coliform Monitoring
SNOH2 - Near SR 2, E. of 52nd

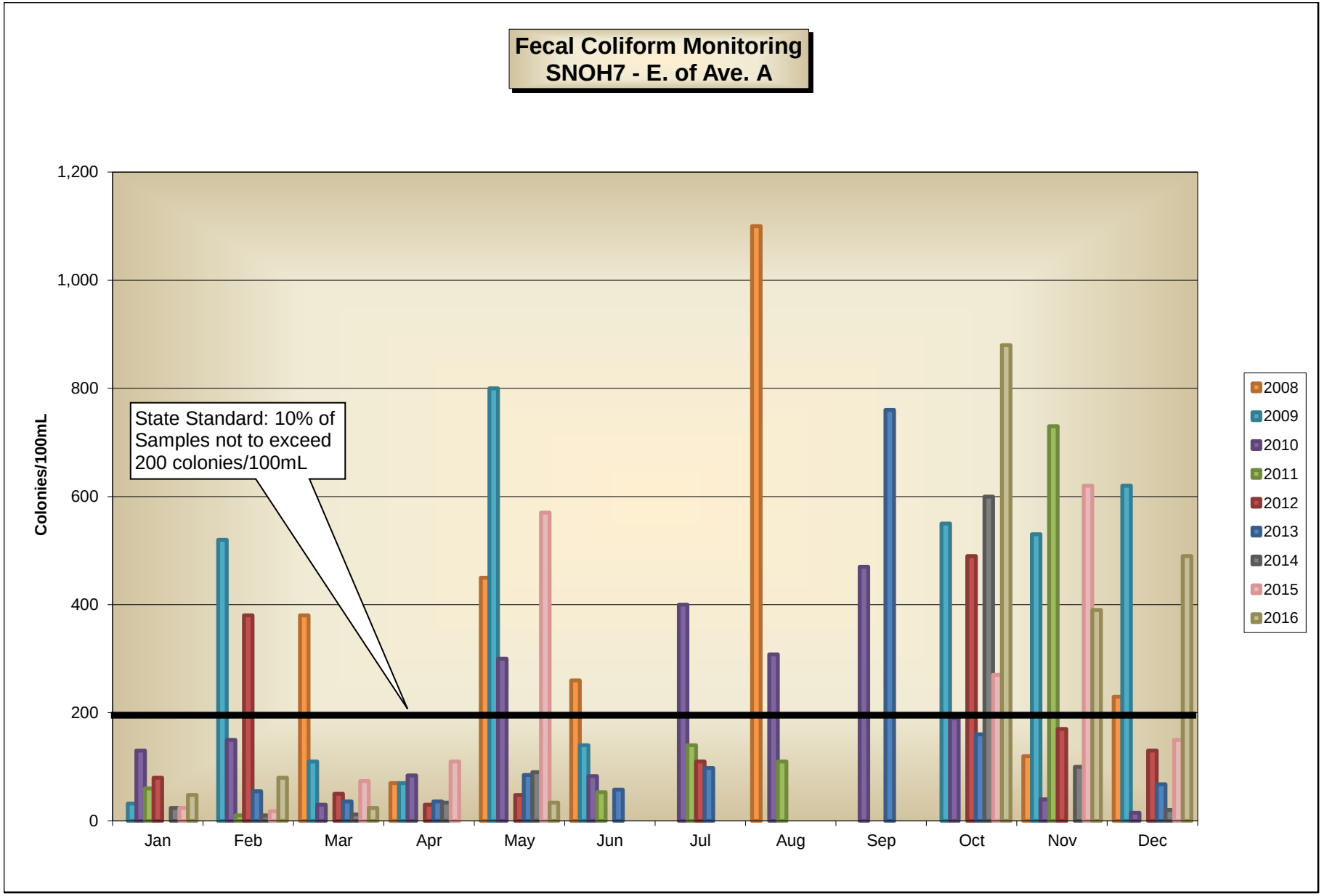


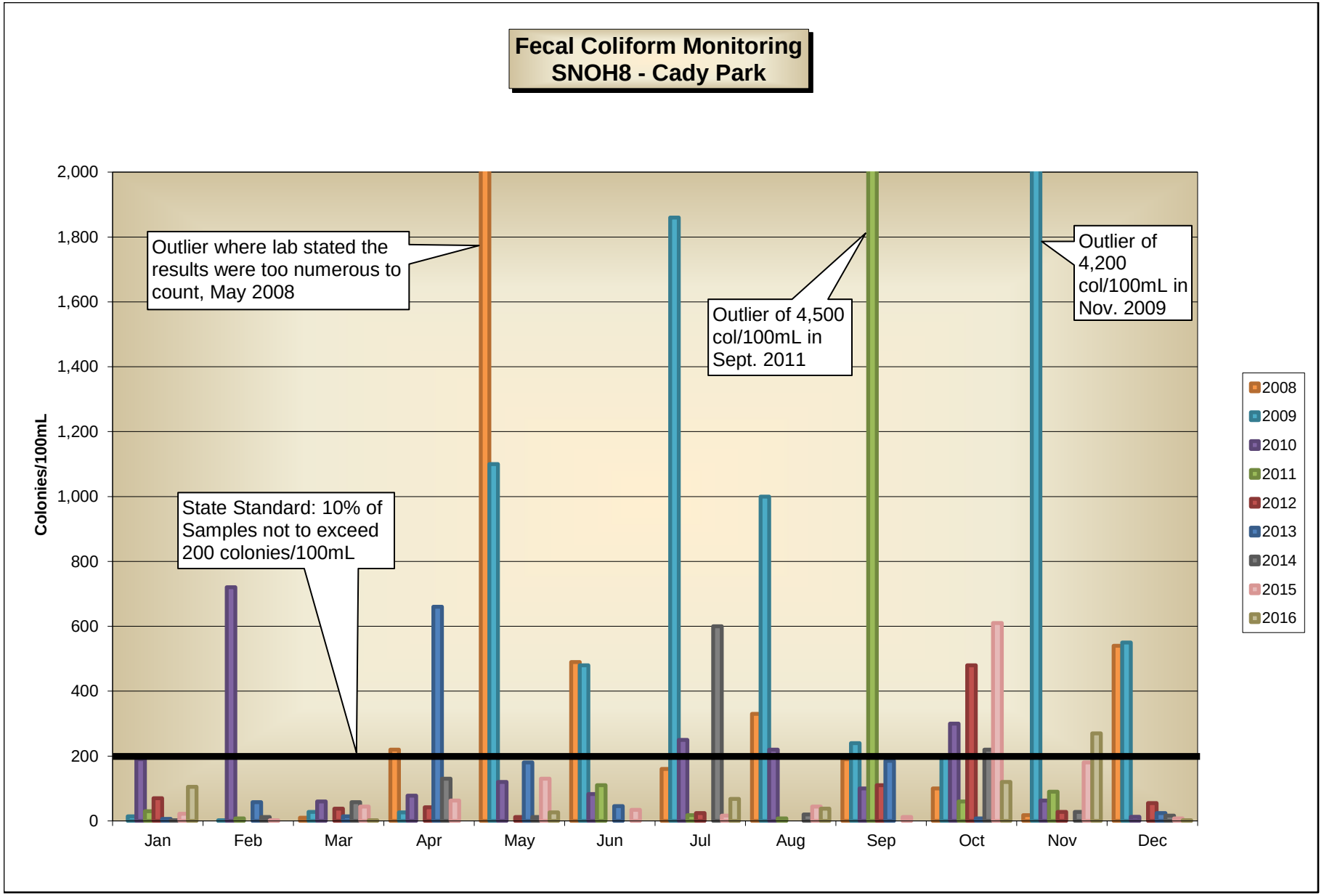

Fecal Coliform Monitoring
SNOH3 - Weaver Rd.
Outlier of 3,300 col/100mL in May 2010
State Standard: 10% of Samples not to exceed 200 colonies/100mL
Colonies/100mL
600
500
400
300
200
100
0
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
2008
2009
2010
2011
2012
2013
2014
2015
2016


Fecal Coliform Monitoring
SNOH4 - 72nd St. SE
Colonies/100mL
1,400
1,200
1,000
800
600
400
200
0
Outlier of 3,000 col/100mL
in Aug 2010
State Standard: 10% of
Samples not to exceed
200 colonies/100mL
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
2008
2009
2010
2011
2012
2013
2014
2015
2016

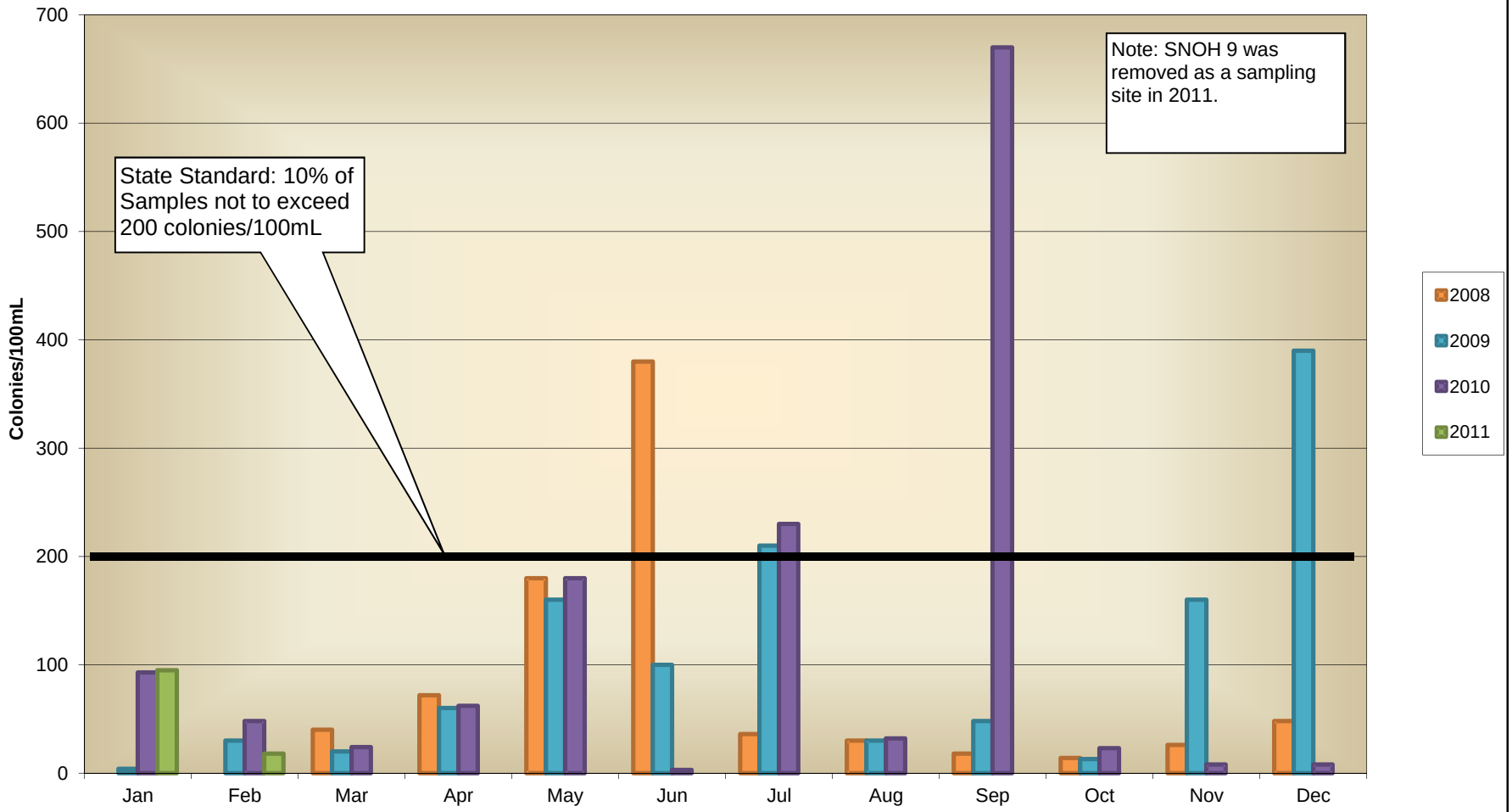

Fecal Coliform Monitoring
SNOH5 - 64th St. SE
Colonies/100mL
800
700
600
500
400
300
200
100
0
State Standard: 10% of Samples not to exceed 100 colonies/100mL
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
2008
2009
2010
2011
2012
2013
2014
2015
2016

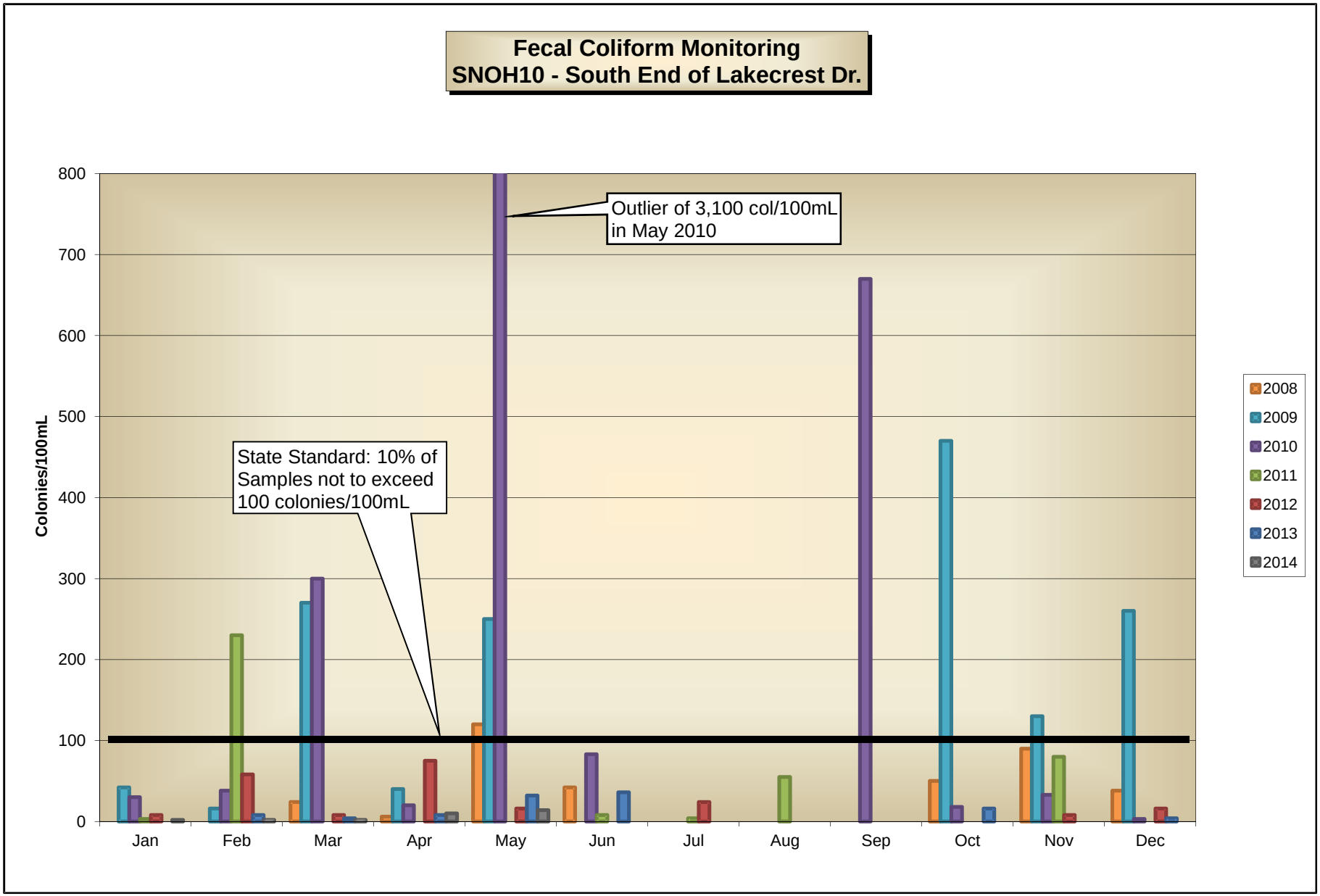

Fecal Coliform Monitoring
SNOH6 - 13th St. SE
Colonies/100mL
1,000
800
600
400
200
0
Outlier where lab stated the results were too numerous to count, May 2008
Outlier of 2,000 col/100mL in May 2013
Outlier of 2,200 col/100mL in Oct 2008
State Standard: 10% of Samples not to exceed 200 colonies/100mL
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
2008
2009
2010
2011
2012
2013
2014
2015
2016

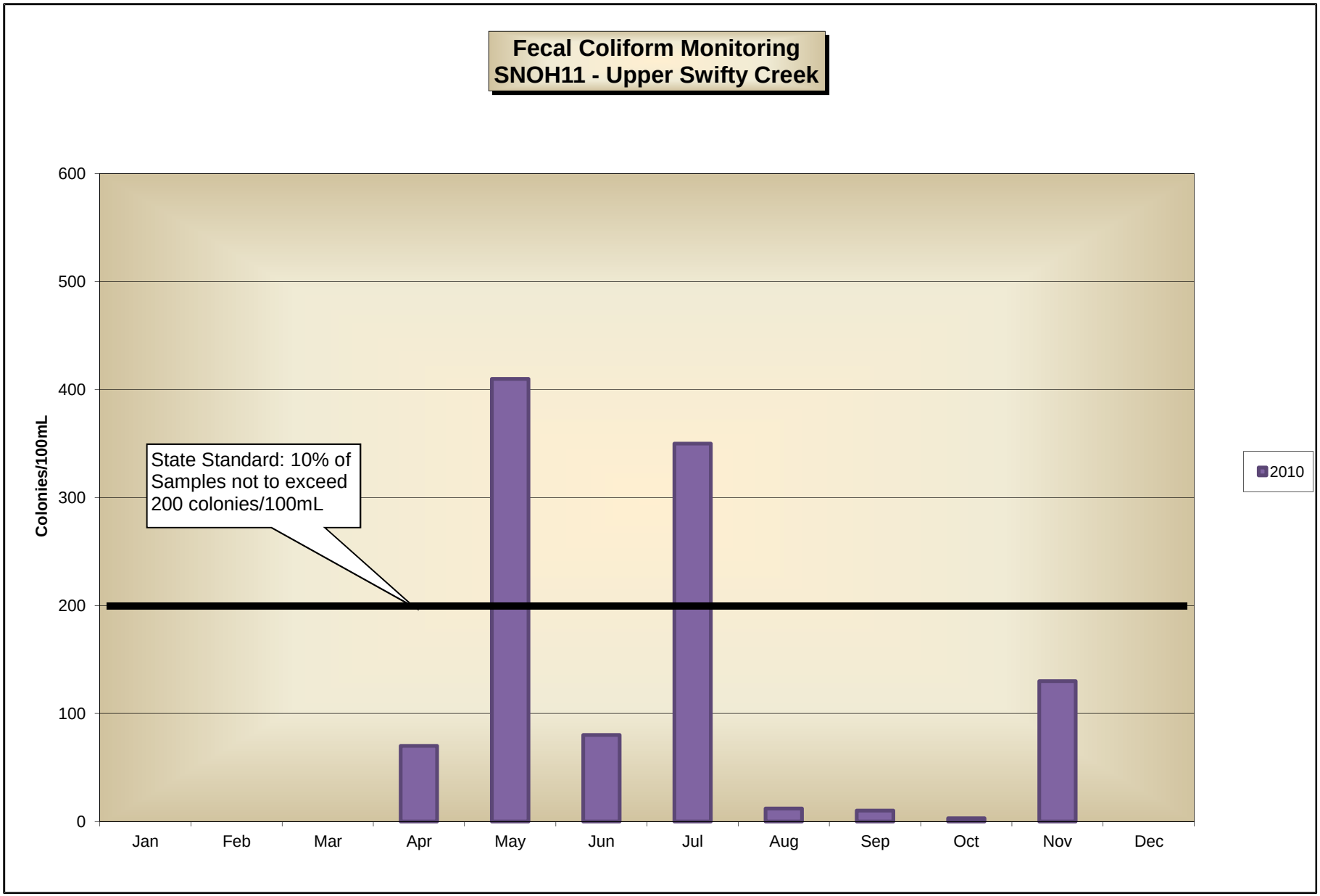

Fecal Coliform Monitoring
SNOH7 - E. of Ave. A
Colonies/100mL
1,200
1,000
800
600
400
200
0
State Standard: 10% of Samples not to exceed 200 colonies/100mL
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
2008
2009
2010
2011
2012
2013
2014
2015
2016

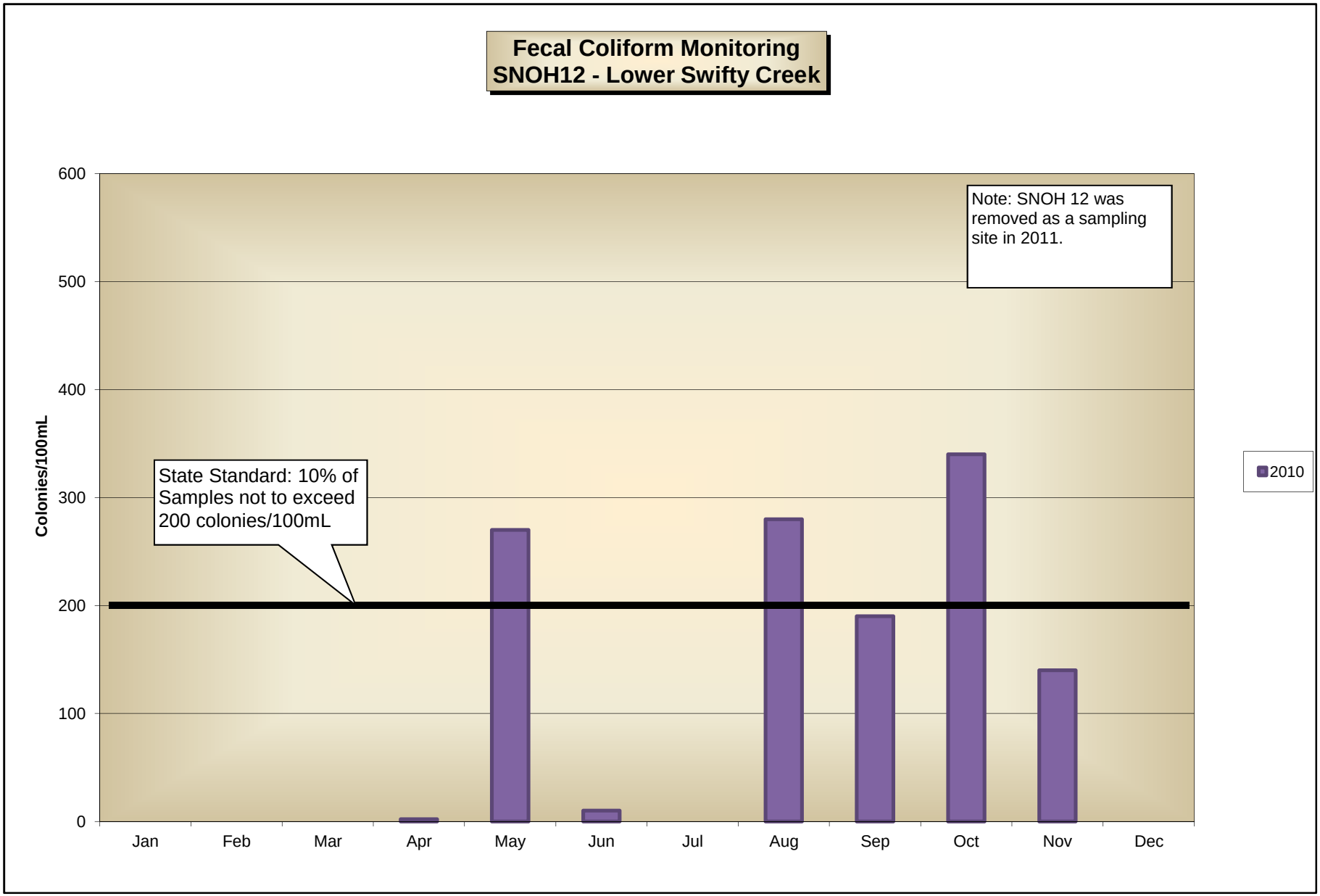

Fecal Coliform Monitoring
SNOH8 - Cady Park
Colonies/100mL
2,000
1,800
1,600
1,400
1,200
1,000
800
600
400
200
0
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Outlier where lab stated the results were too numerous to count, May 2008
State Standard: 10% of Samples not to exceed 200 colonies/100mL
Outlier of 4,500 col/100mL in Sept. 2011
Outlier of 4,200 col/100mL in Nov. 2009
2008
2009
2010
2011
2012
2013
2014
2015
2016

Fecal Coliform Monitoring
SNOH9 - North of Riverview

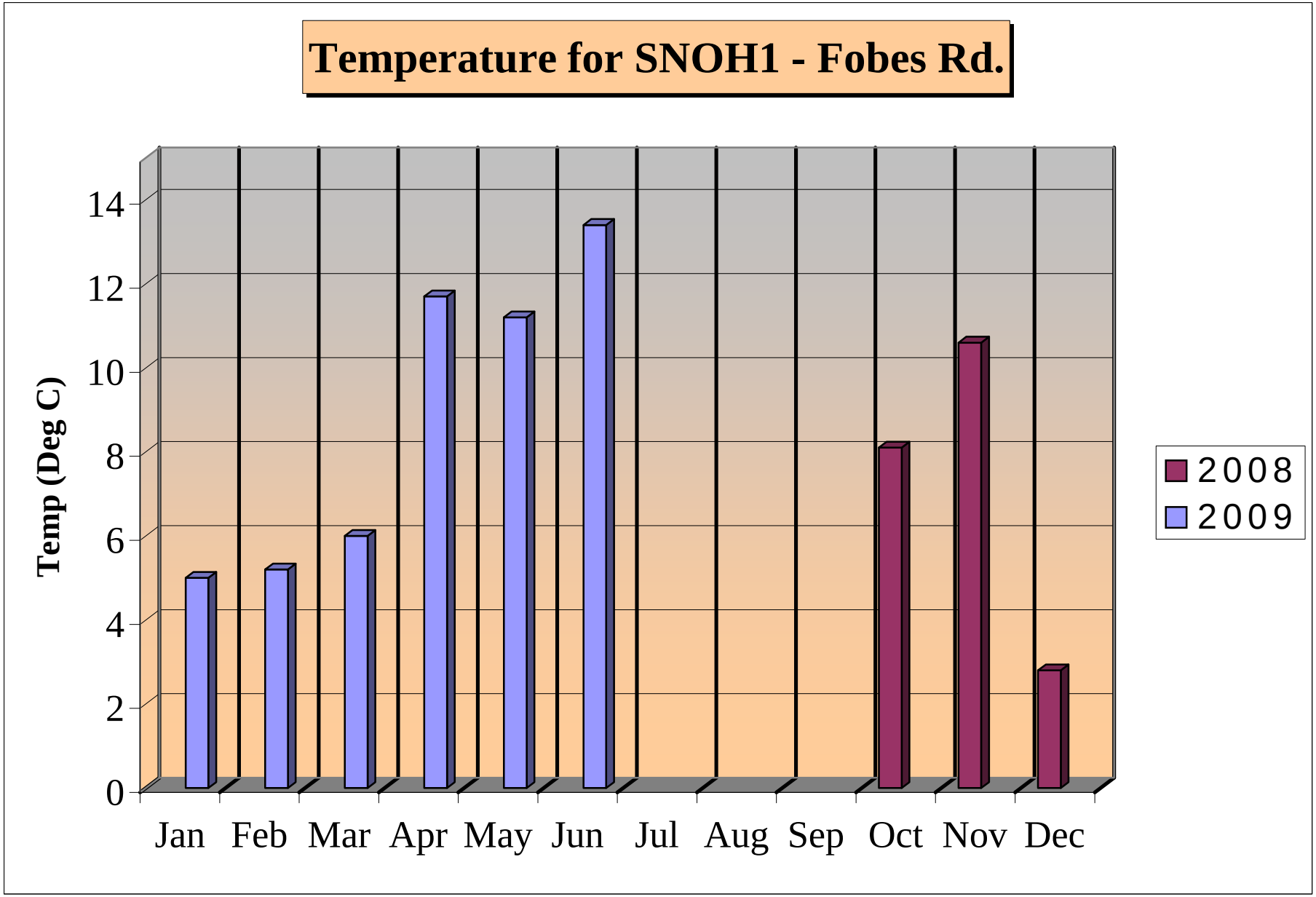


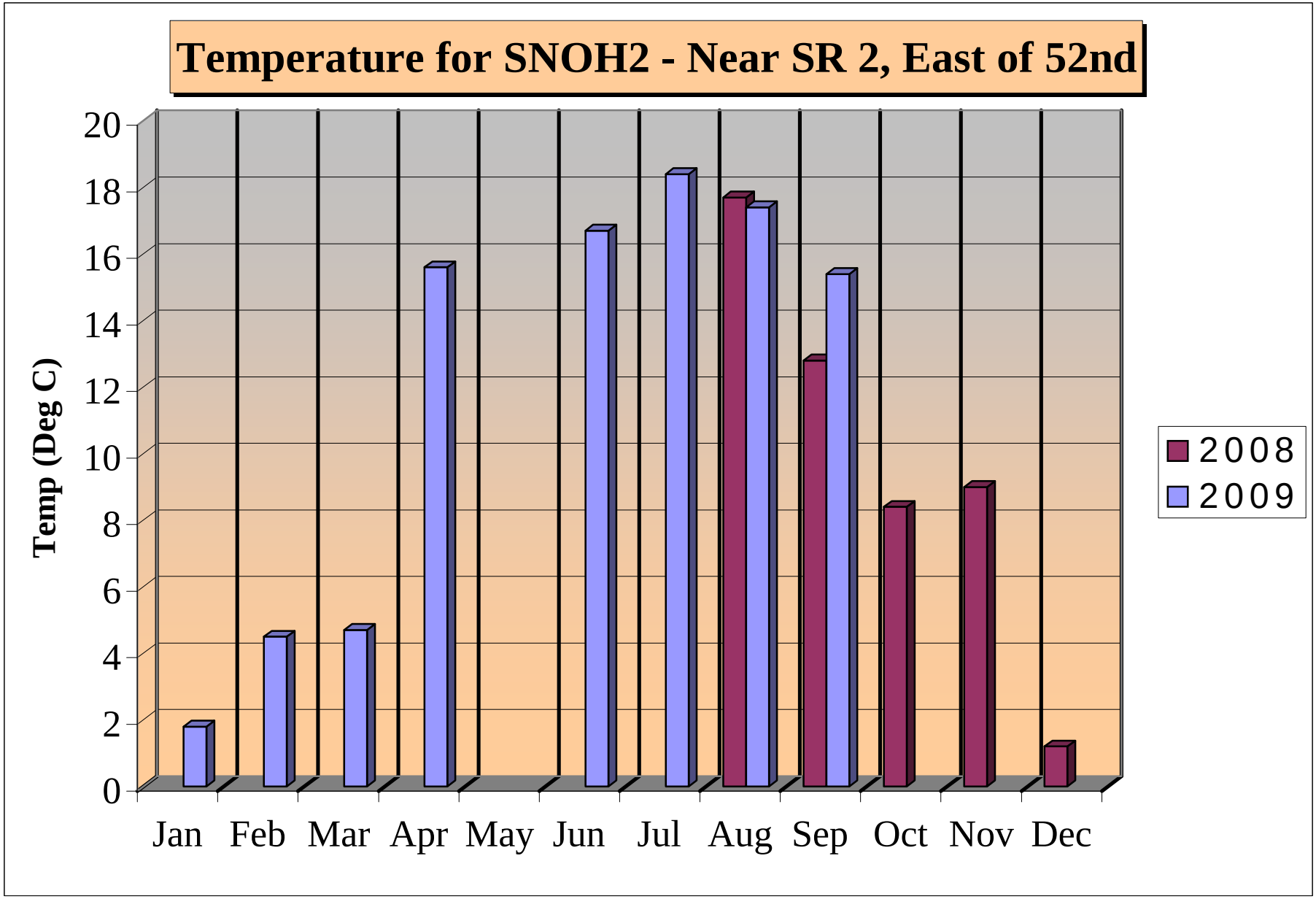

Fecal Coliform Monitoring
SNOH10 - South End of Lakecrest Dr.
Colonies/100mL
800
700
600
500
400
300
200
100
0
Outlier of 3,100 col/100mL
in May 2010
State Standard: 10% of
Samples not to exceed
100 colonies/100mL
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
2008
2009
2010
2011
2012
2013
2014

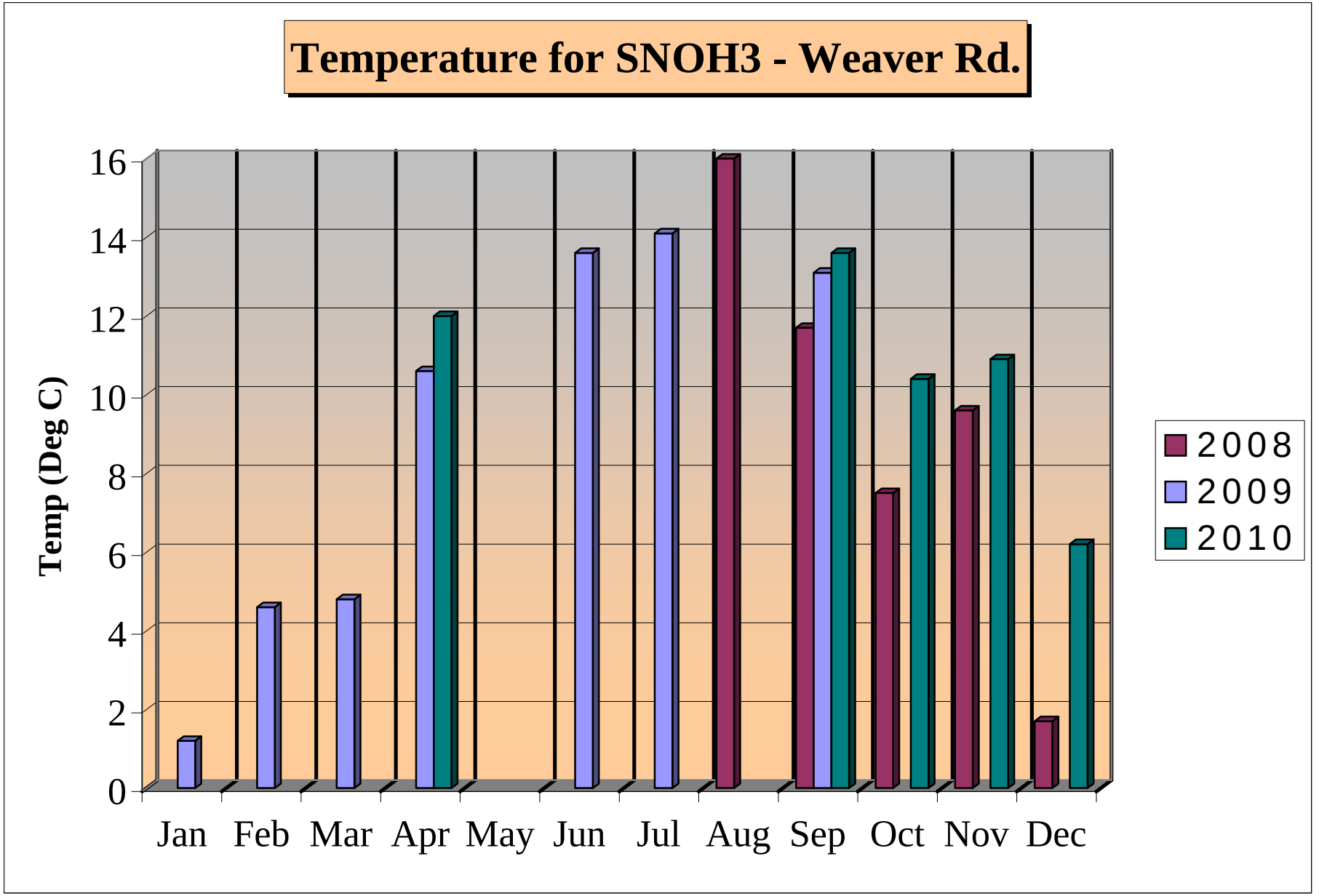

Fecal Coliform Monitoring
SNOH11 - Upper Swifty Creek
Colonies/100mL
600
500
400
300
200
100
0
State Standard: 10% of Samples not to exceed 200 colonies/100mL
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
2010

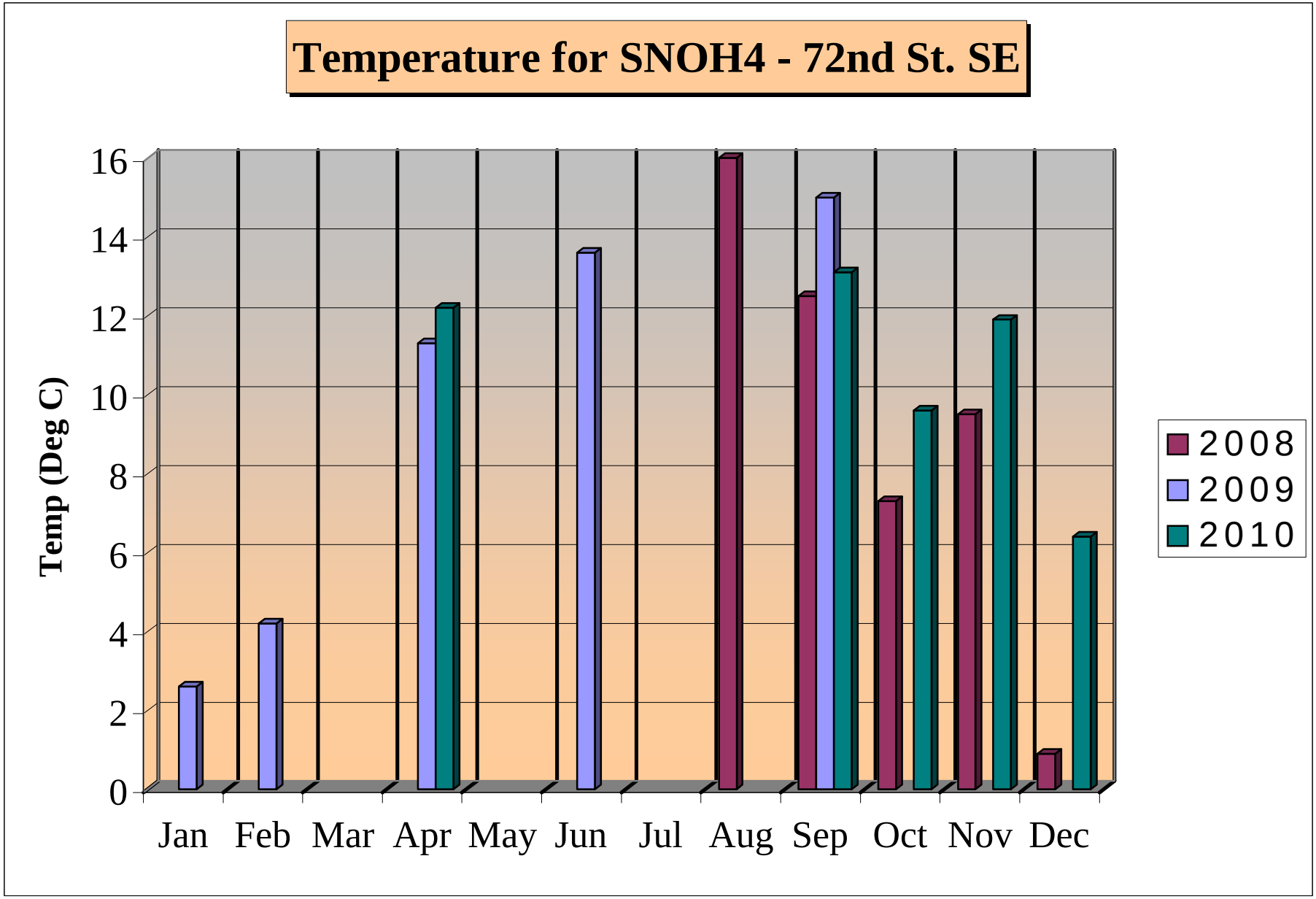

Fecal Coliform Monitoring
SNOH12 - Lower Swifty Creek
Note: SNOH 12 was removed as a sampling site in 2011.
State Standard: 10% of Samples not to exceed 200 colonies/100mL
Colonies/100mL
600
500
400
300
200
100
0
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
2010

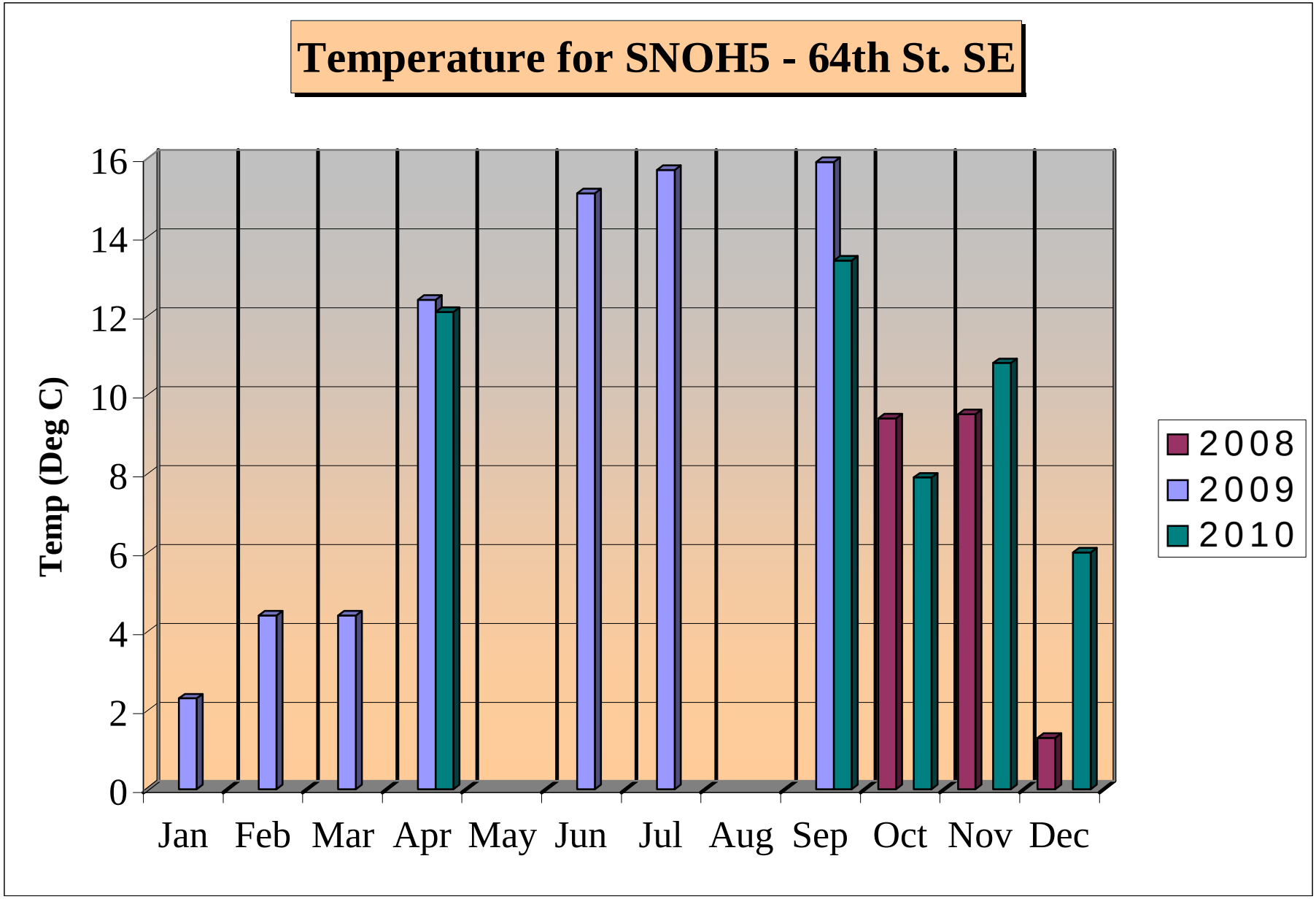
Temperature Graphs (2008-2010)

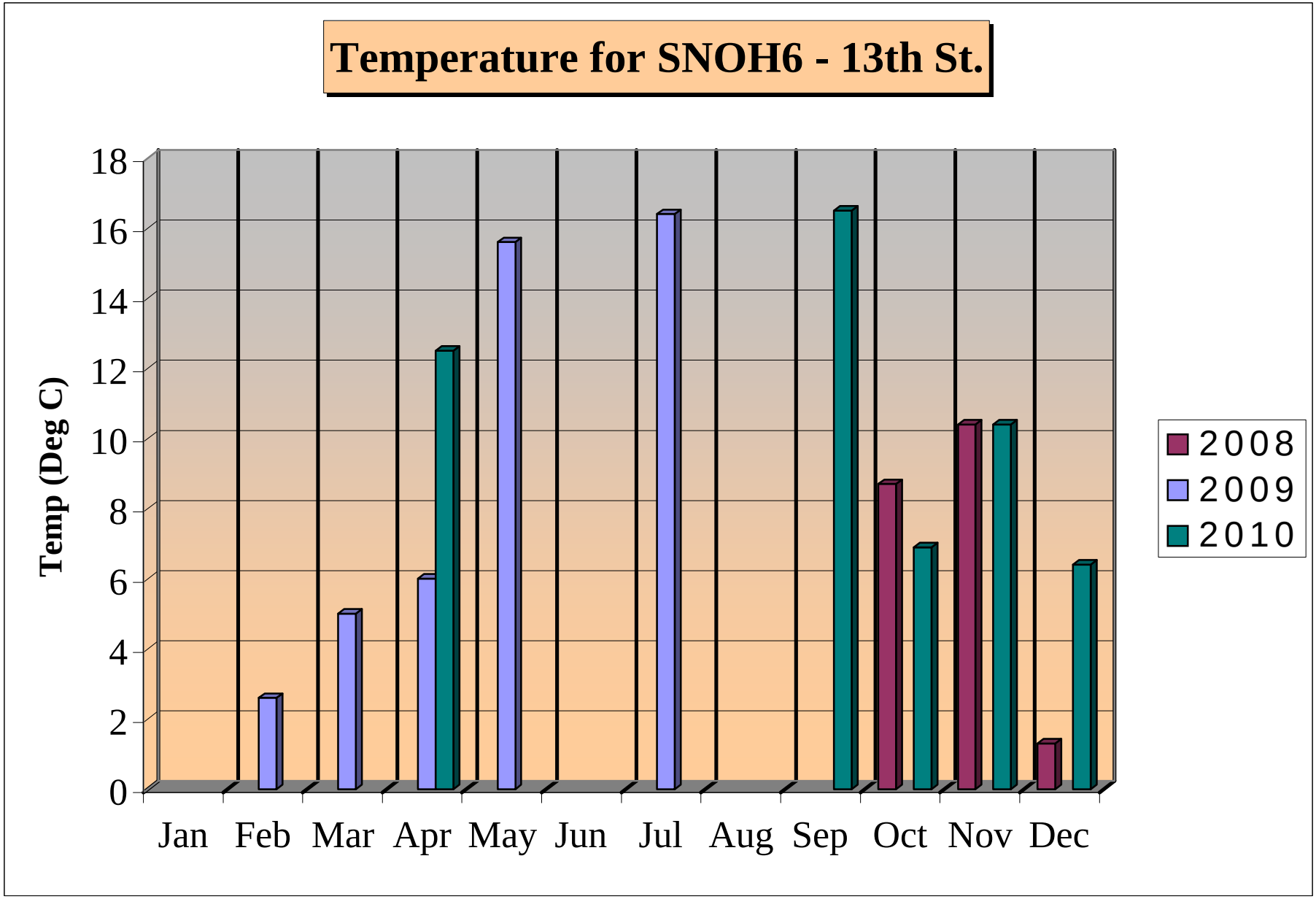

Temperature for SNOH1 - Fobes Rd.
Temp (Deg C)
0
2
4
6
8
10
12
14
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
2008
2009

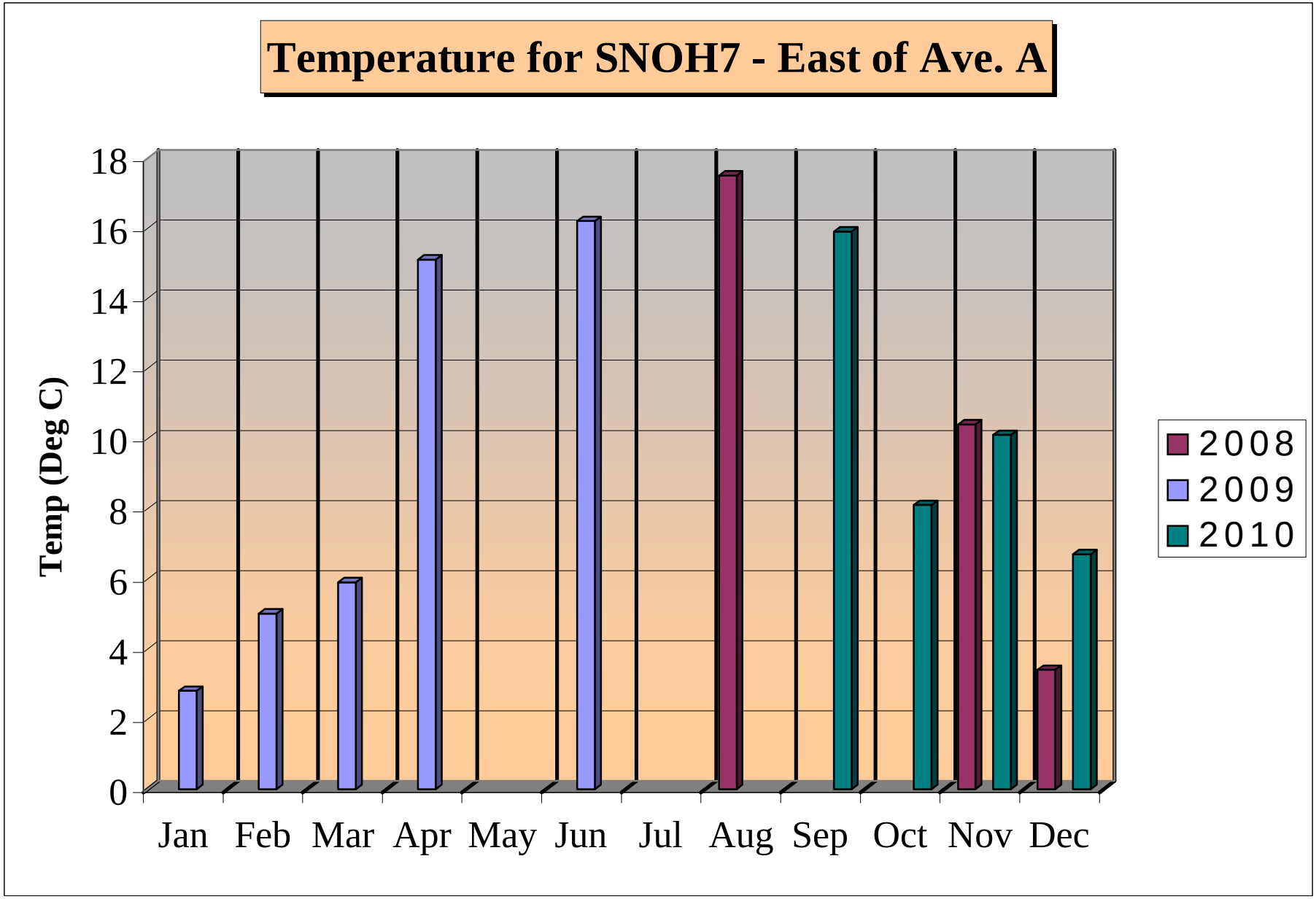

Temperature for SNOH2 - Near SR 2, East of 52nd
Temp (Deg C)
0
2
4
6
8
10
12
14
16
18
20
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
2008
2009

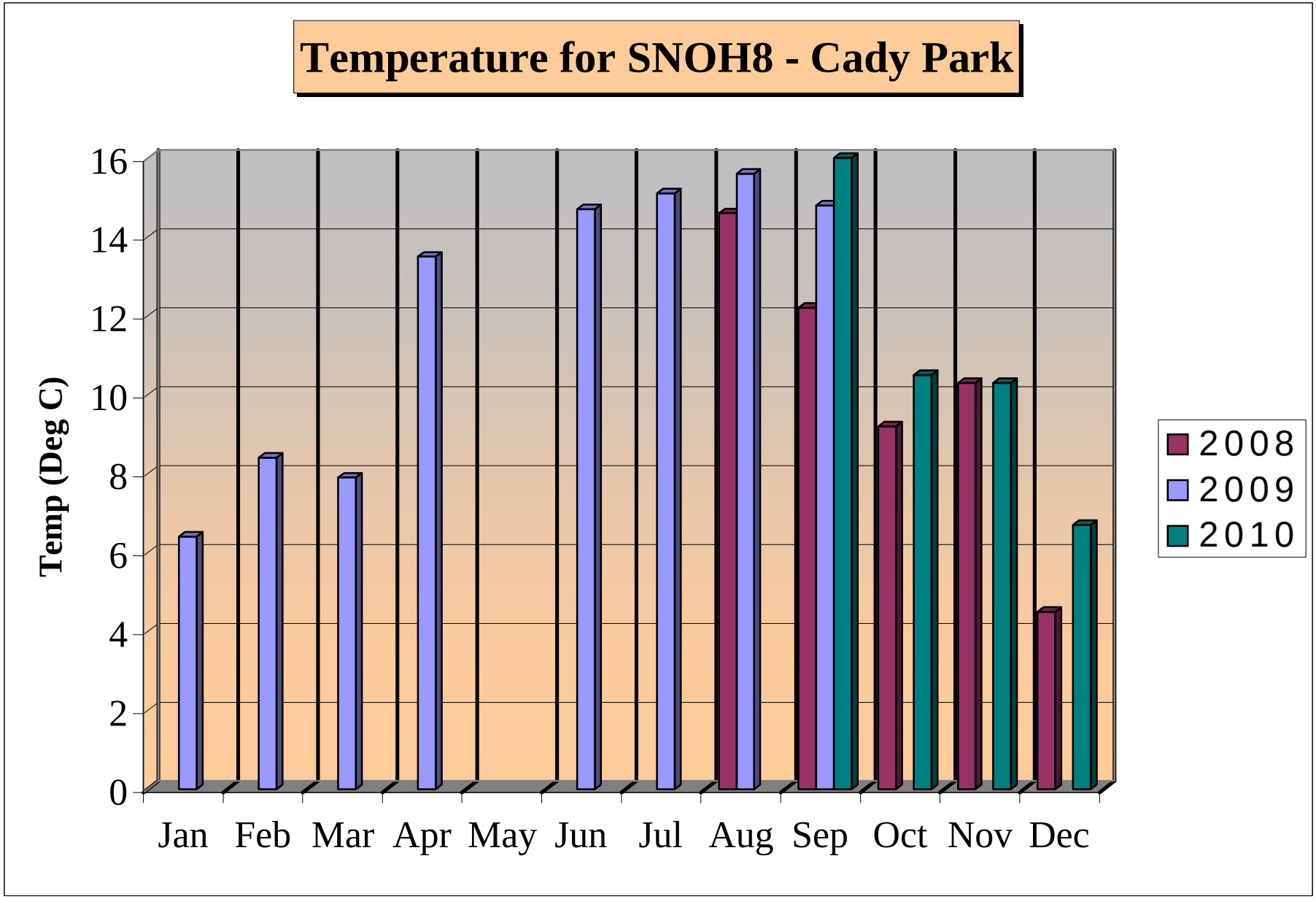

Temperature for SNOH3 - Weaver Rd.
Temp (Deg C)
16
14
12
10
8
6
4
2
0
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
2008
2009
2010

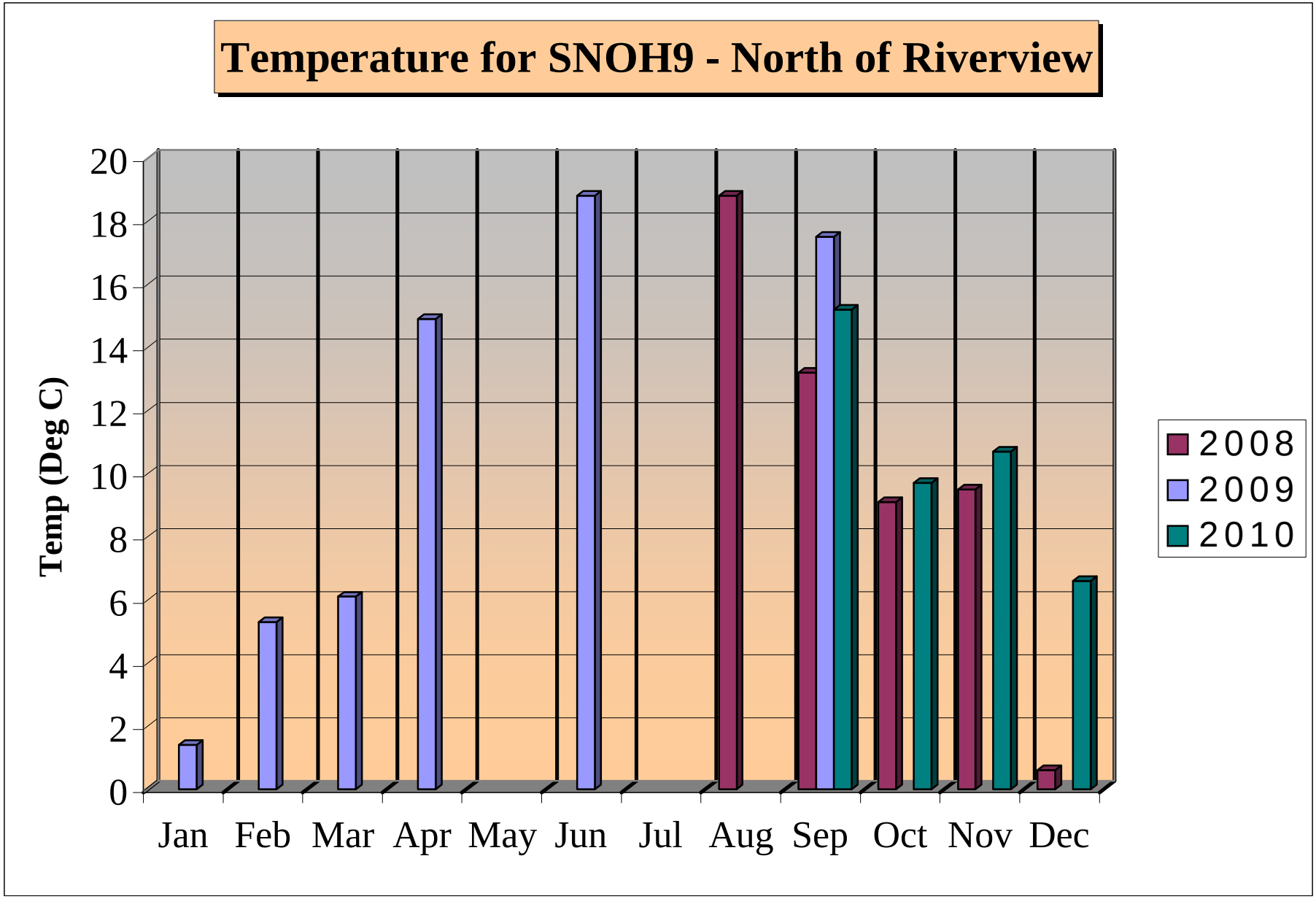

Temperature for SNOH4 - 72nd St. SE
Temp (Deg C)
16
14
12
10
8
6
4
2
0
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
2008
2009
2010

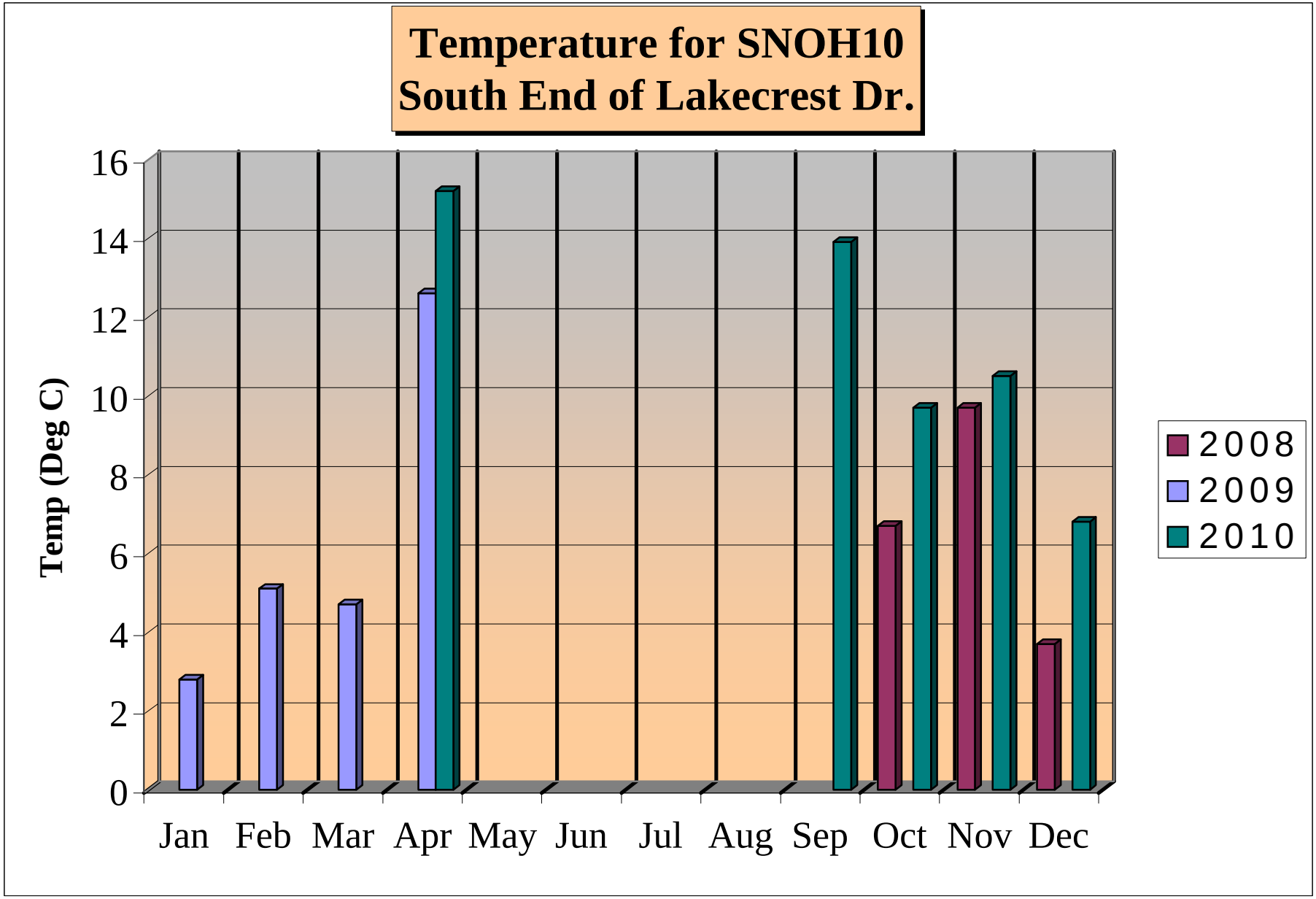

Temperature for SNOH5 - 64th St. SE
Temp (Deg C)
16
14
12
10
8
6
4
2
0
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
2008
2009
2010

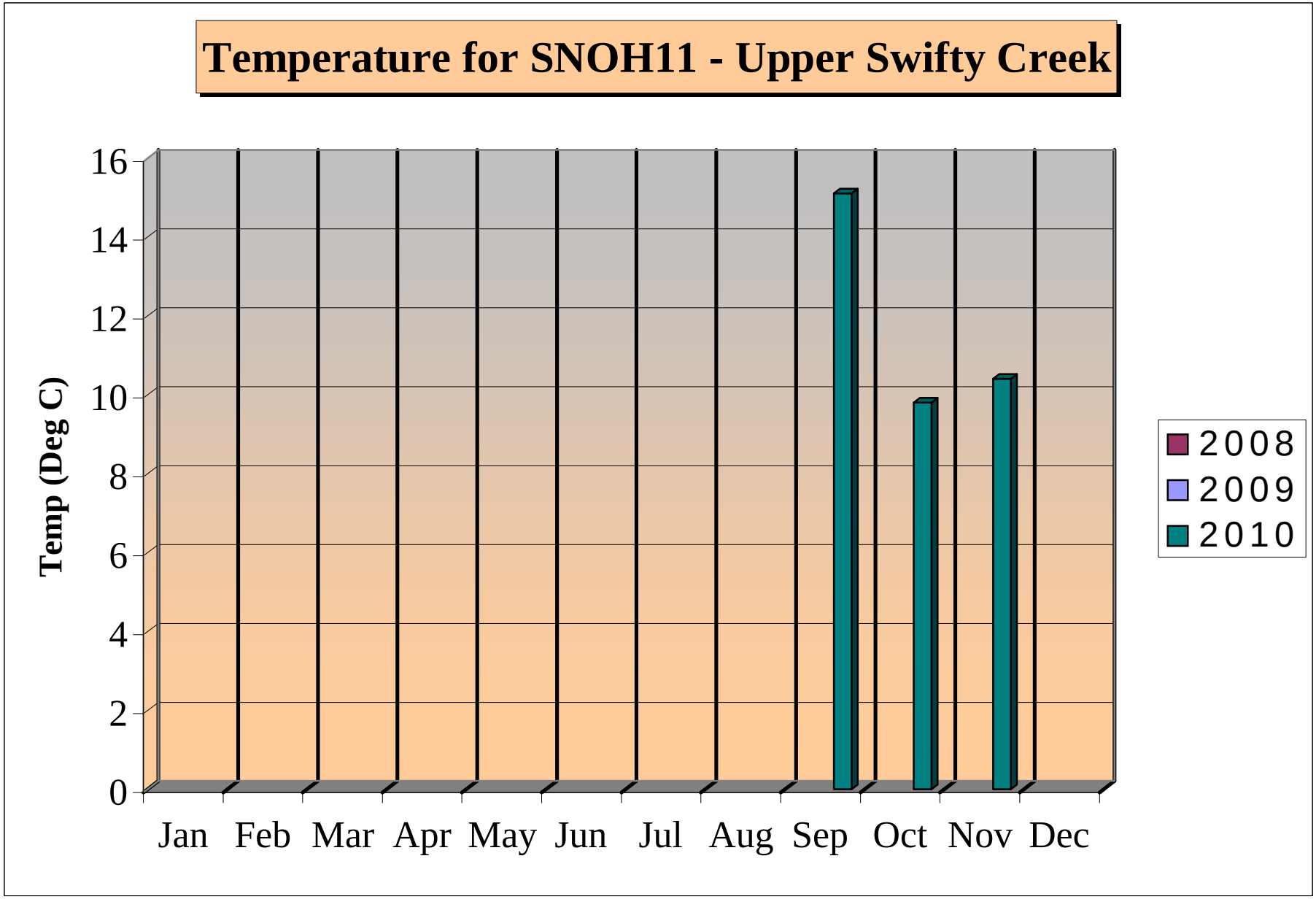

Temperature for SNOH6 - 13th St.
Temp (Deg C)
0
2
4
6
8
10
12
14
16
18
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
2008
2009
2010

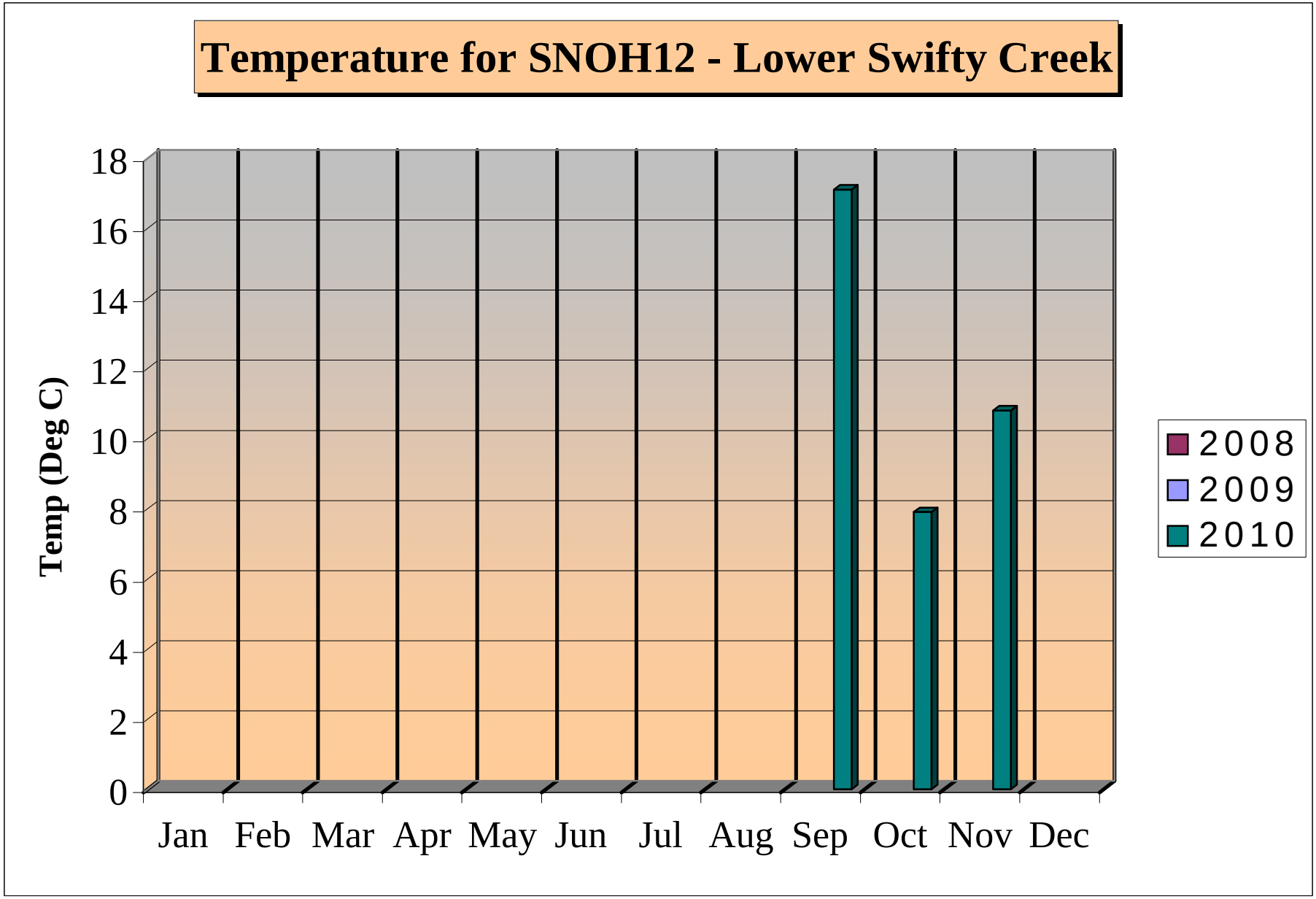

Temperature for SNOH7 - East of Ave. A
Temp (Deg C)
0
2
4
6
8
10
12
14
16
18
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
2008
2009
2010


Temperature for SNOH8 - Cady Park
Temp (Deg C)
16
14
12
10
8
6
4
2
0
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
2008
2009
2010

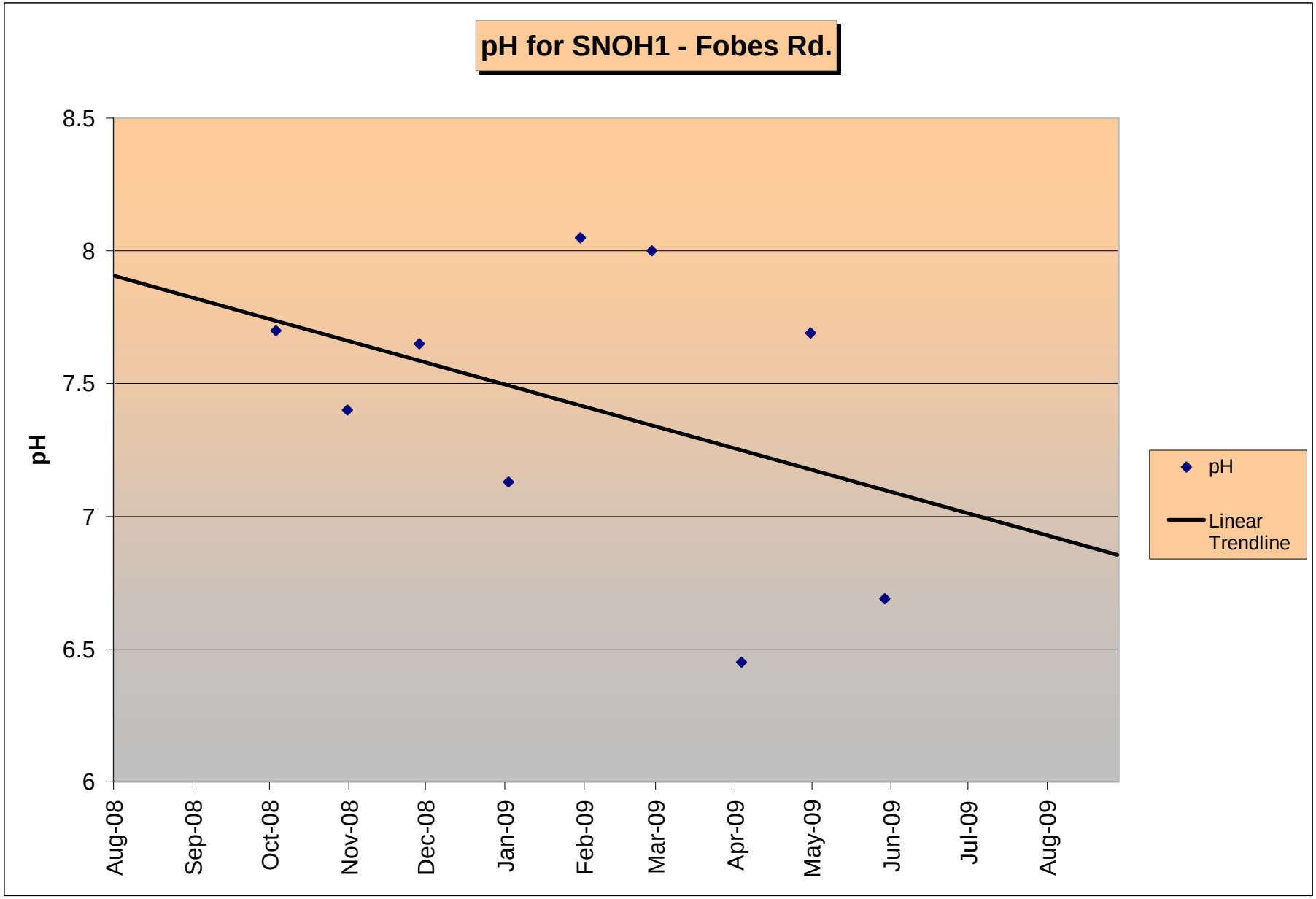

Temperature for SNOH9 - North of Riverview
Temp (Deg C)
0
2
4
6
8
10
12
14
16
18
20
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
2008
2009
2010

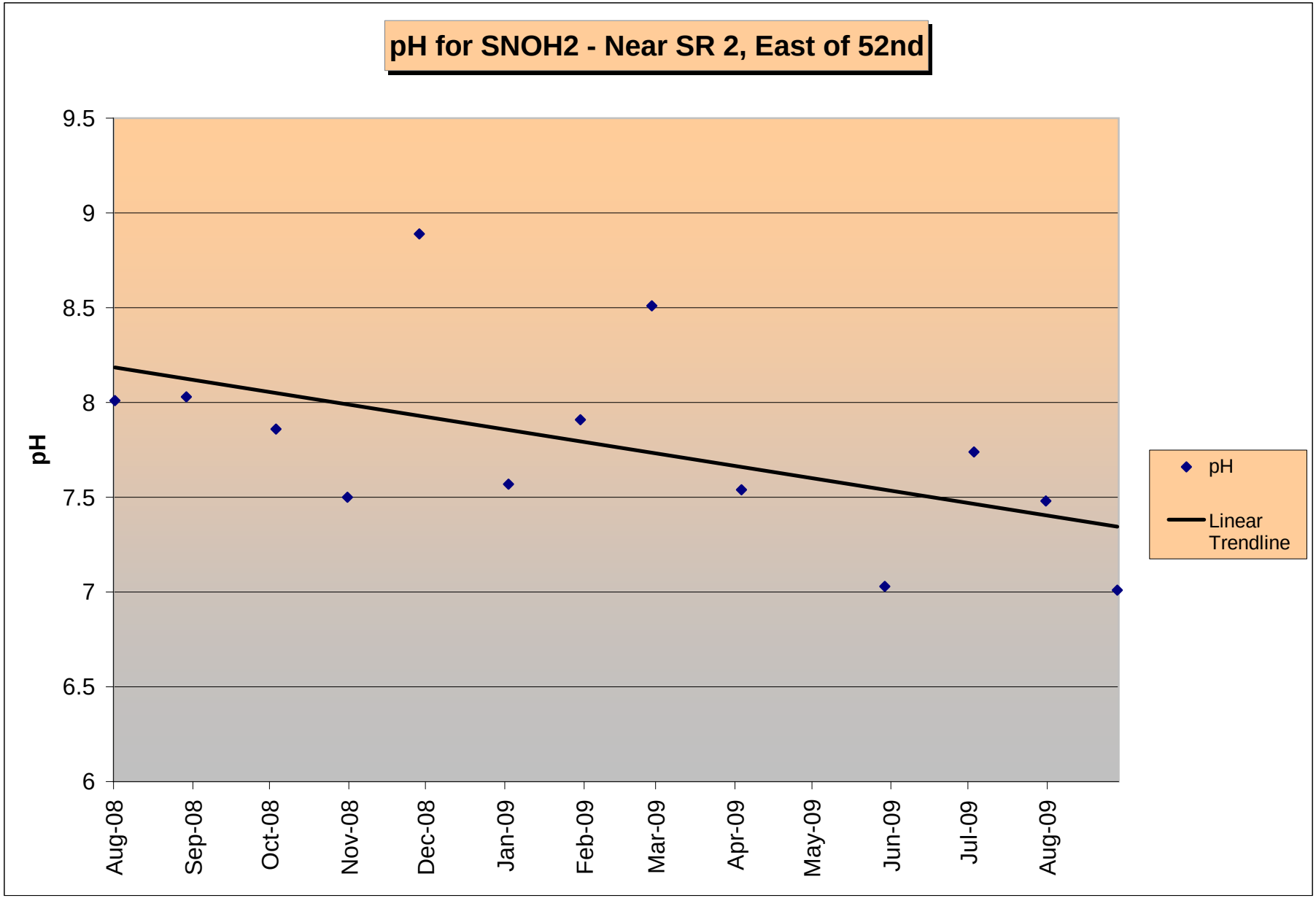

Temperature for SNOH10
South End of Lakecrest Dr.
Temp (Deg C)
16
14
12
10
8
6
4
2
0
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
2008
2009
2010

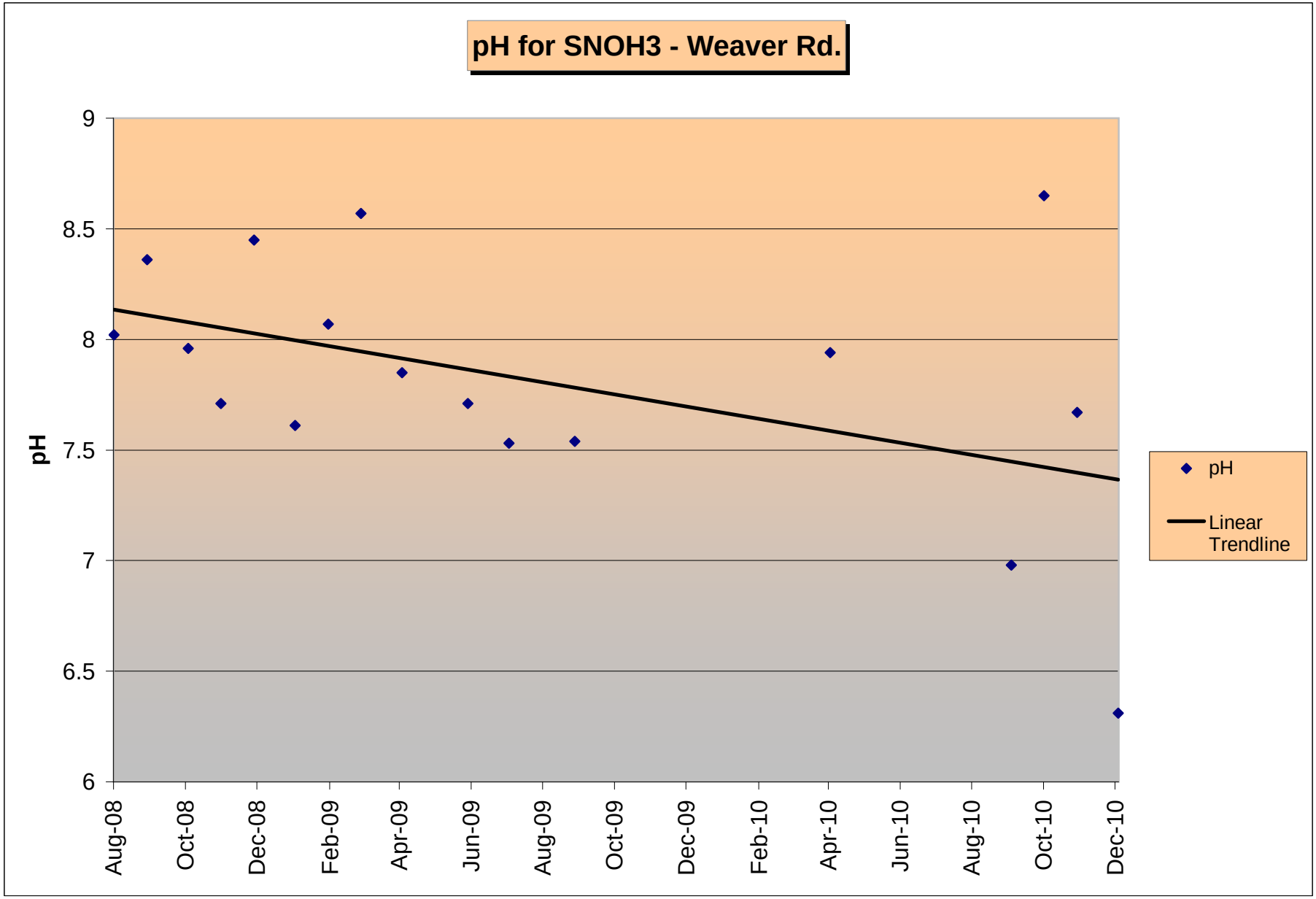

Temperature for SNOH11 - Upper Swifty Creek
Temp (Deg C)
16
14
12
10
8
6
4
2
0
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
2008
2009
2010

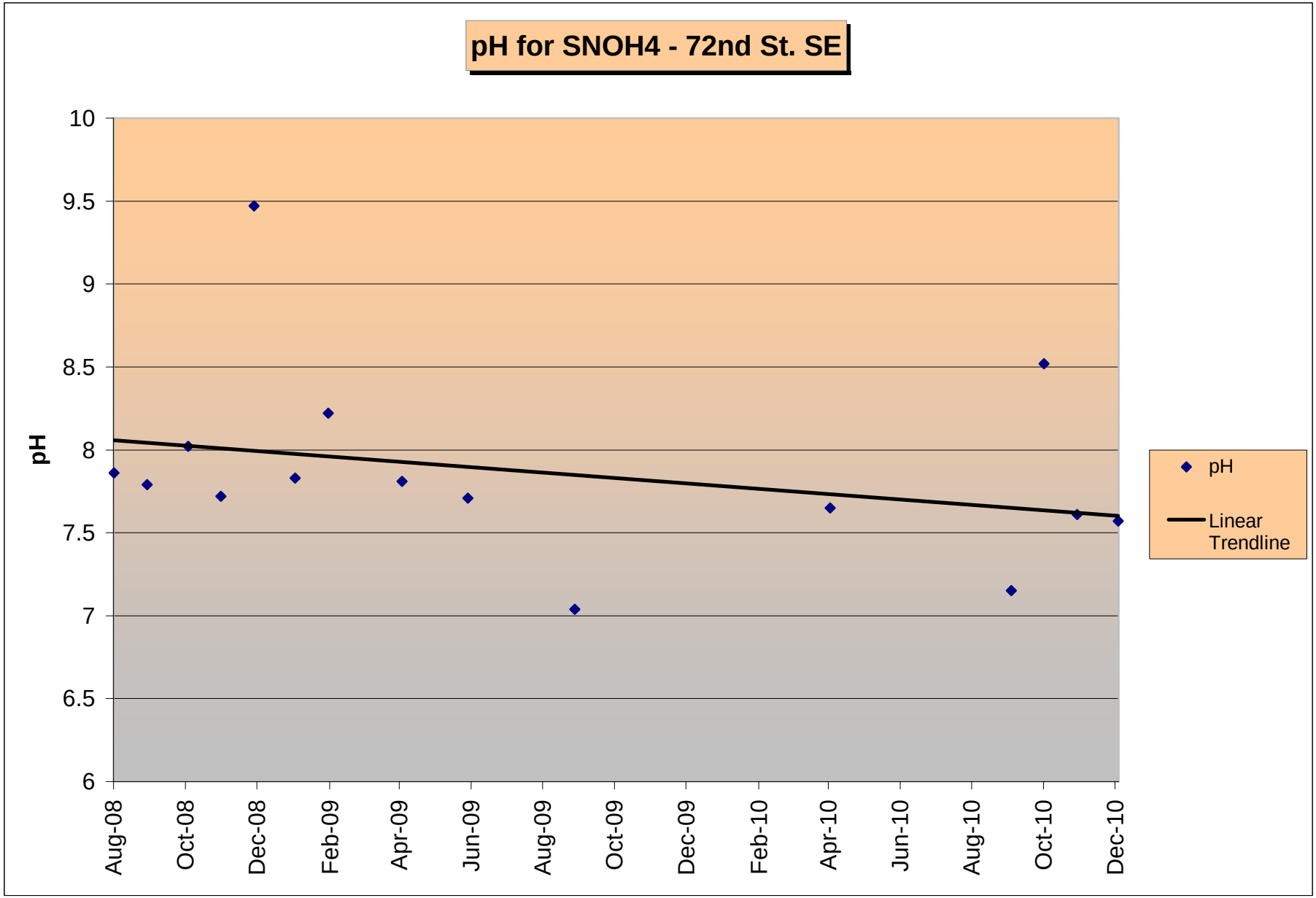

Temperature for SNOH12 - Lower Swifty Creek
Temp (Deg C)
18
16
14
12
10
8
6
4
2
0
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
2008
2009
2010

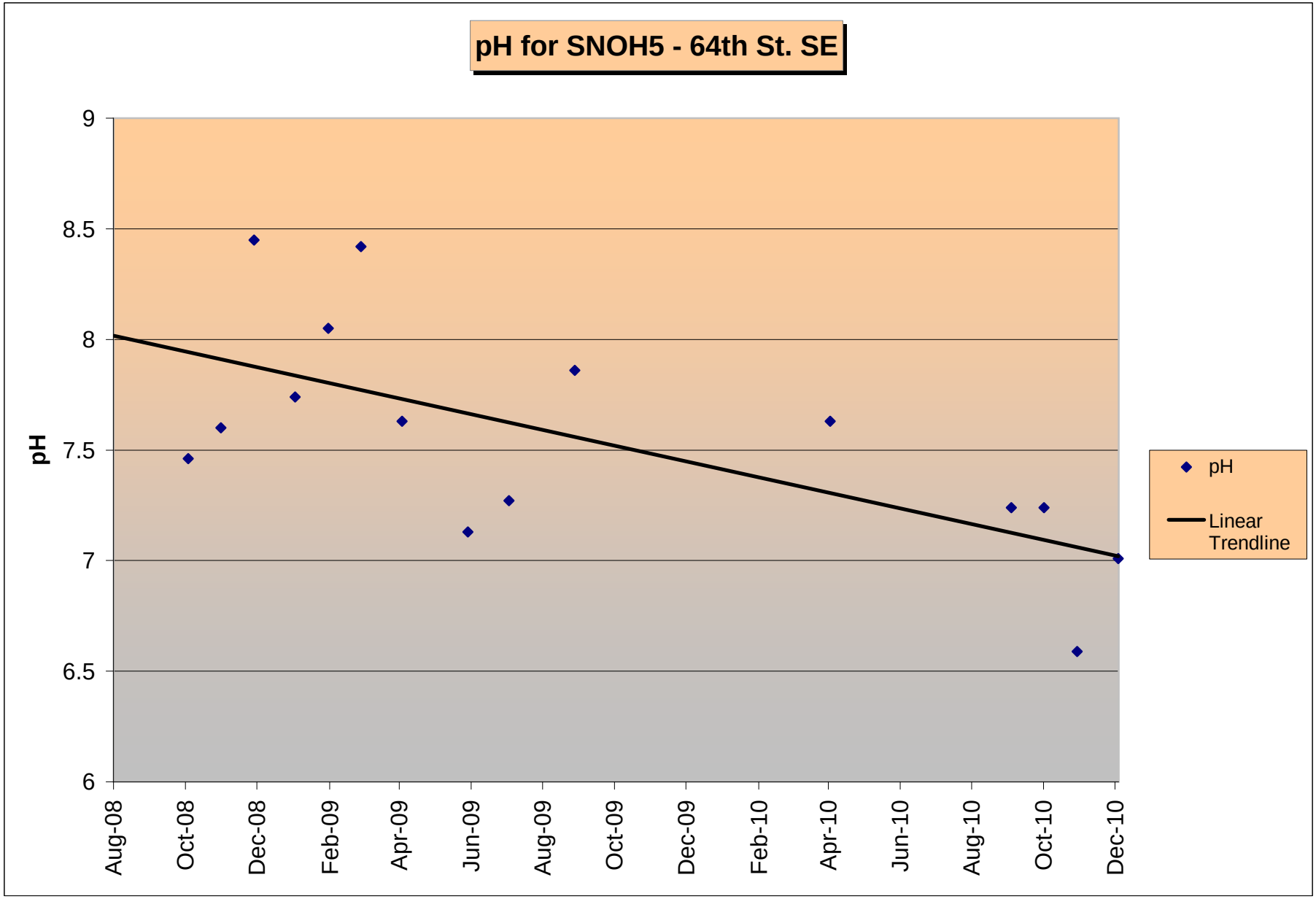
pH
Graphs
(2008-2010)

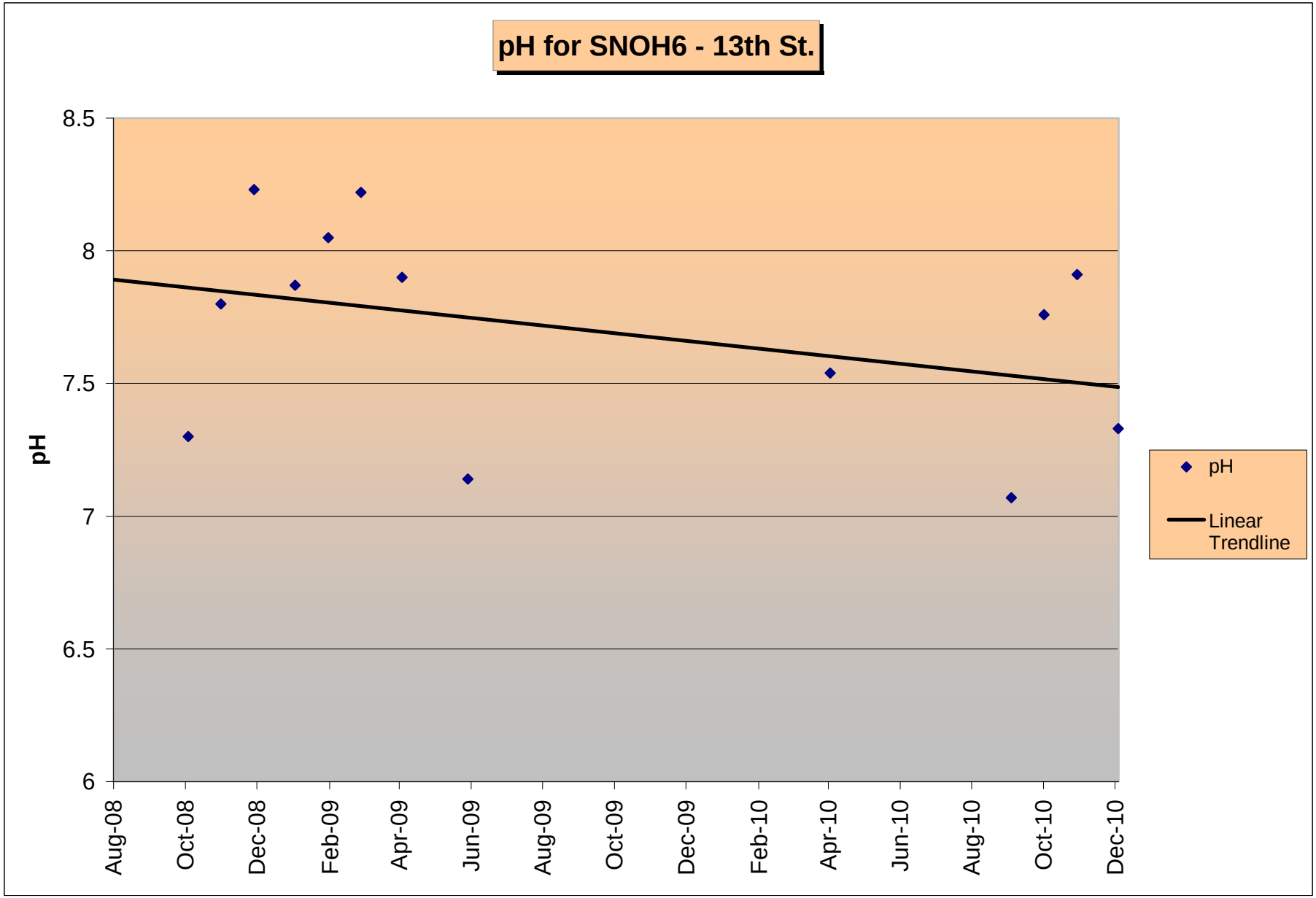

pH for SNOH1 - Fobes Rd.
pH
8.5
8
7.5
7
6.5
6
Aug-08
Sep-08
Oct-08
Nov-08
Dec-08
Jan-09
Feb-09
Mar-09
Apr-09
May-09
Jun-09
Jul-09
Aug-09
pH
Linear Trendline

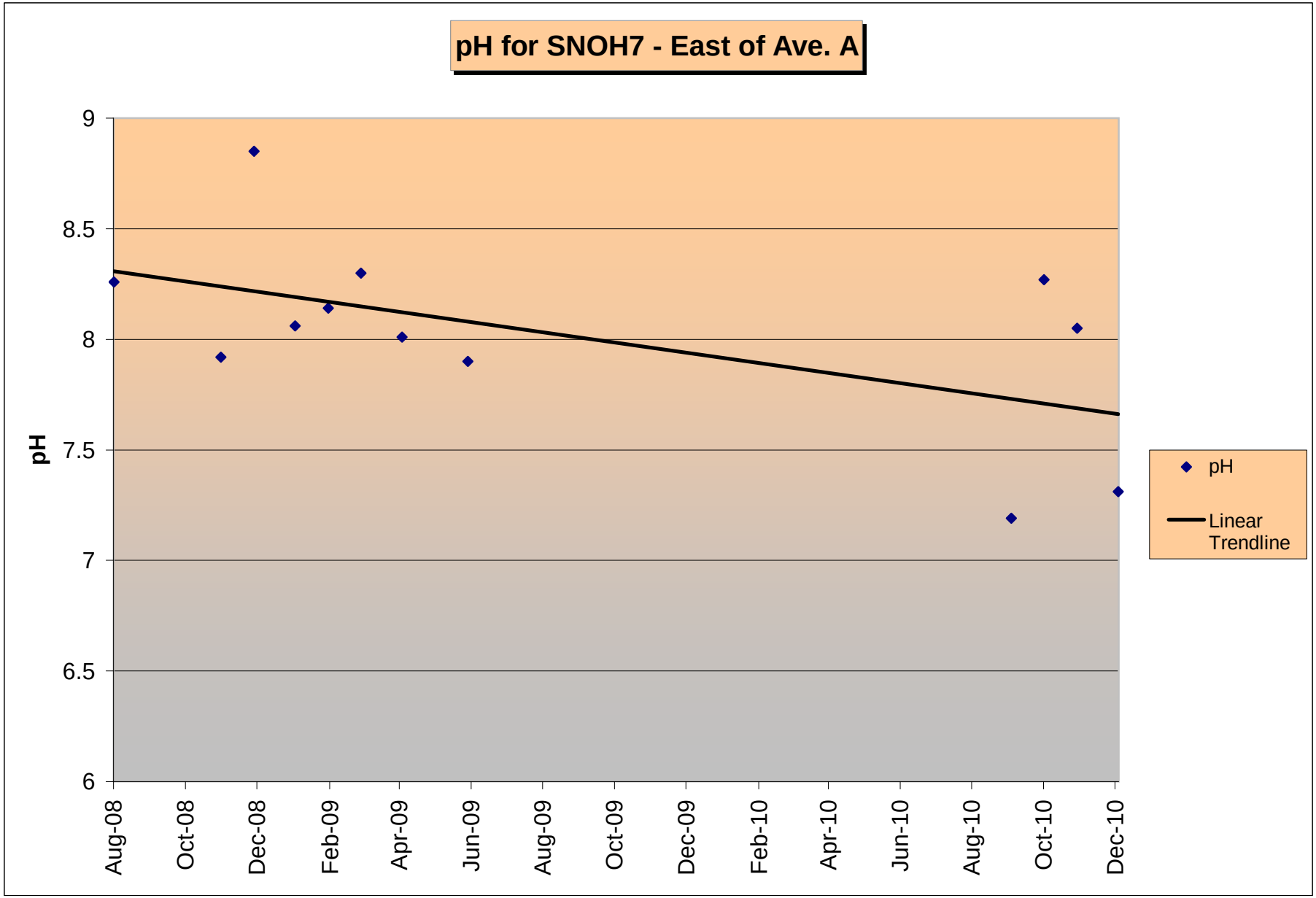

pH for SNOH2 - Near SR 2, East of 52nd
pH
9.5
9
8.5
8
7.5
7
6.5
6
Aug-08
Sep-08
Oct-08
Nov-08
Dec-08
Jan-09
Feb-09
Mar-09
Apr-09
May-09
Jun-09
Jul-09
Aug-09
pH
Linear Trendline

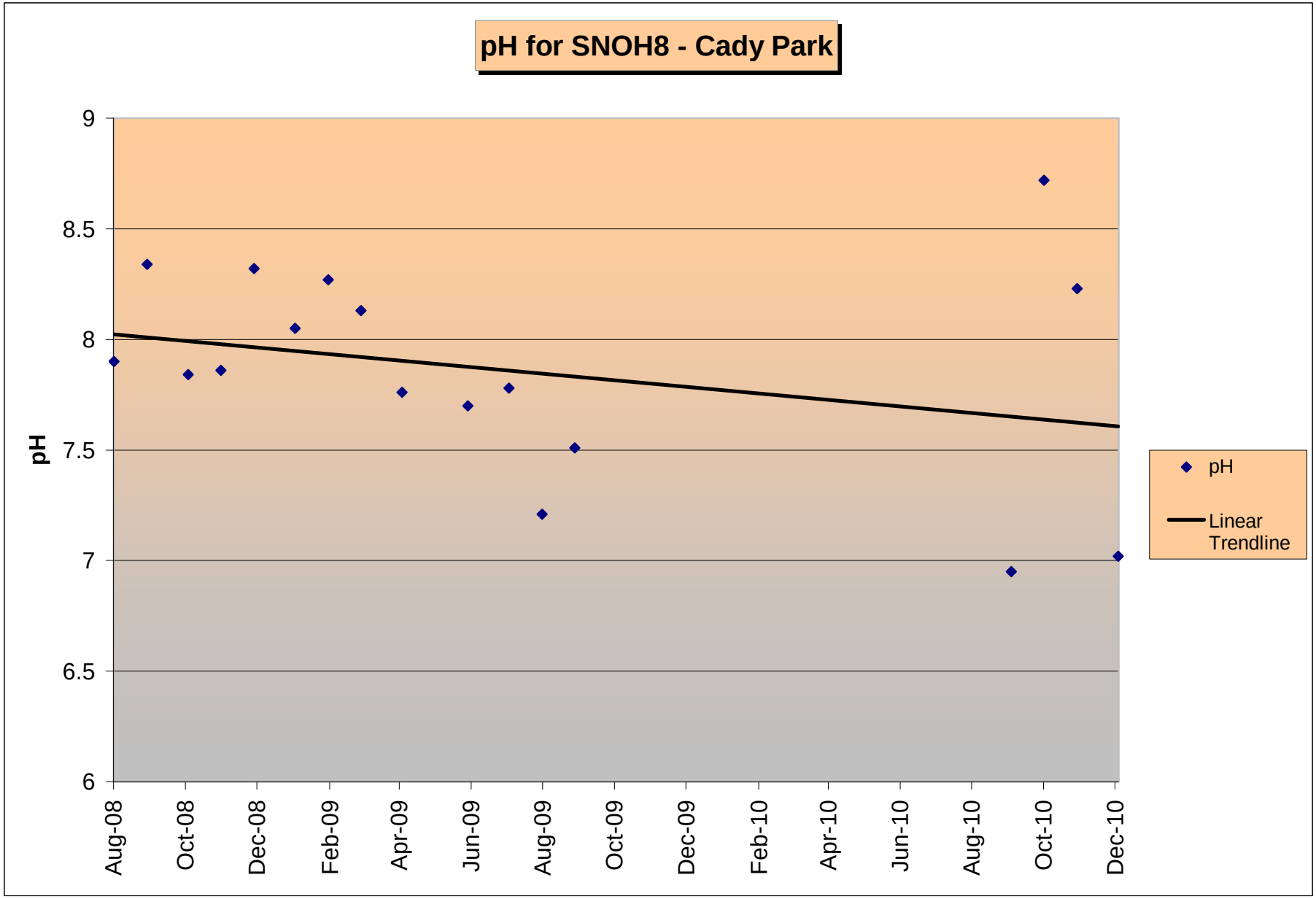

pH for SNOH3 - Weaver Rd.
pH
9
8.5
8
7.5
7
6.5
6
Aug-08
Oct-08
Dec-08
Feb-09
Apr-09
Jun-09
Aug-09
Oct-09
Dec-09
Feb-10
Apr-10
Jun-10
Aug-10
Oct-10
Dec-10
pH
Linear Trendline

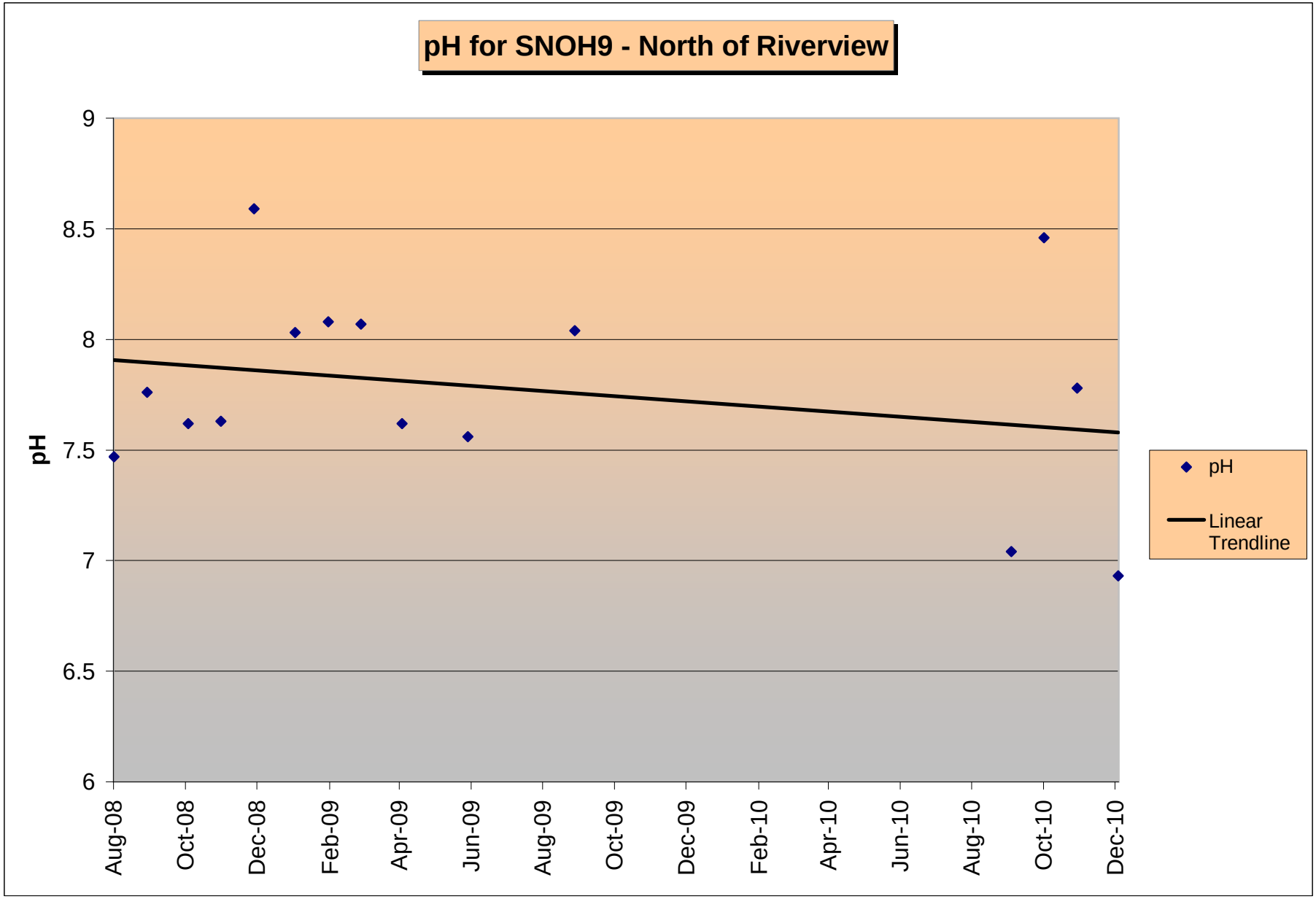

pH for SNOH4 - 72nd St. SE
pH
10
9.5
9
8.5
8
7.5
7
6.5
6
Aug-08
Oct-08
Dec-08
Feb-09
Apr-09
Jun-09
Aug-09
Oct-09
Dec-09
Feb-10
Apr-10
Jun-10
Aug-10
Oct-10
Dec-10
pH
Linear Trendline

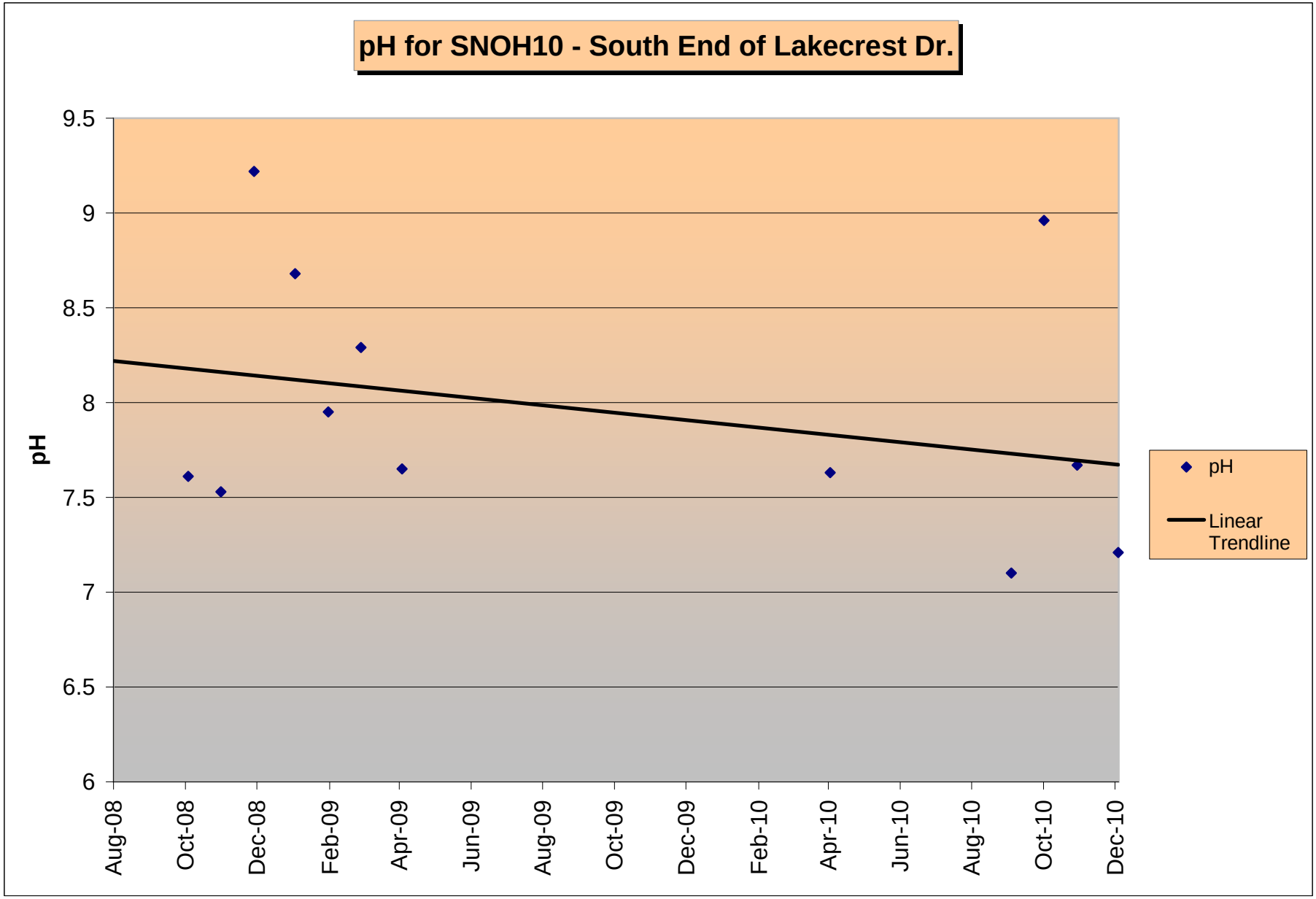

pH for SNOH5 - 64th St. SE
pH
9
8.5
8
7.5
7
6.5
6
Aug-08
Oct-08
Dec-08
Feb-09
Apr-09
Jun-09
Aug-09
Oct-09
Dec-09
Feb-10
Apr-10
Jun-10
Aug-10
Oct-10
Dec-10
pH
Linear Trendline

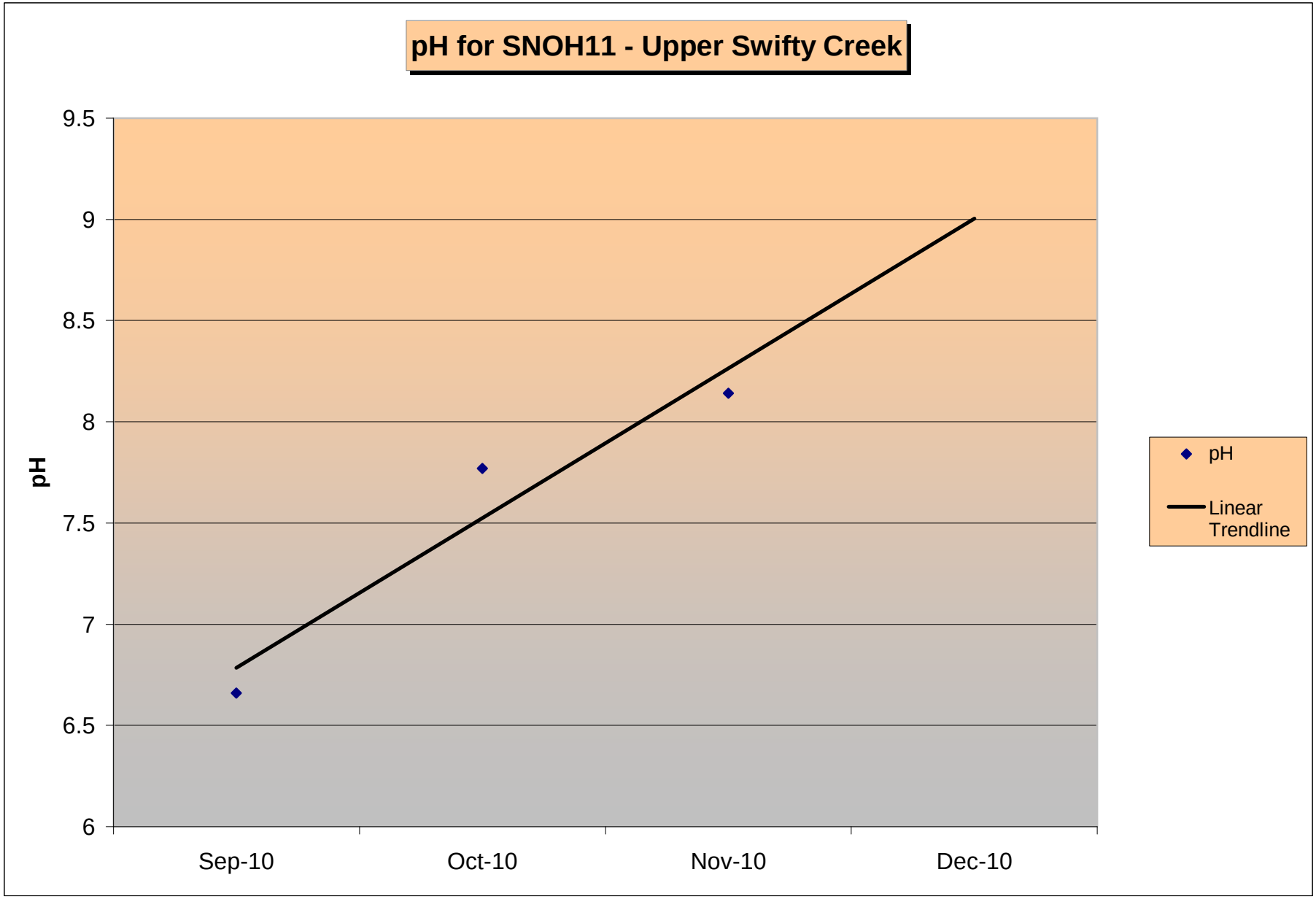

pH for SNOH6 - 13th St.
8.5
8
7.5
7
6.5
6
pH
Aug-08
Oct-08
Dec-08
Feb-09
Apr-09
Jun-09
Aug-09
Oct-09
Dec-09
Feb-10
Apr-10
Jun-10
Aug-10
Oct-10
Dec-10
pH
Linear Trendline

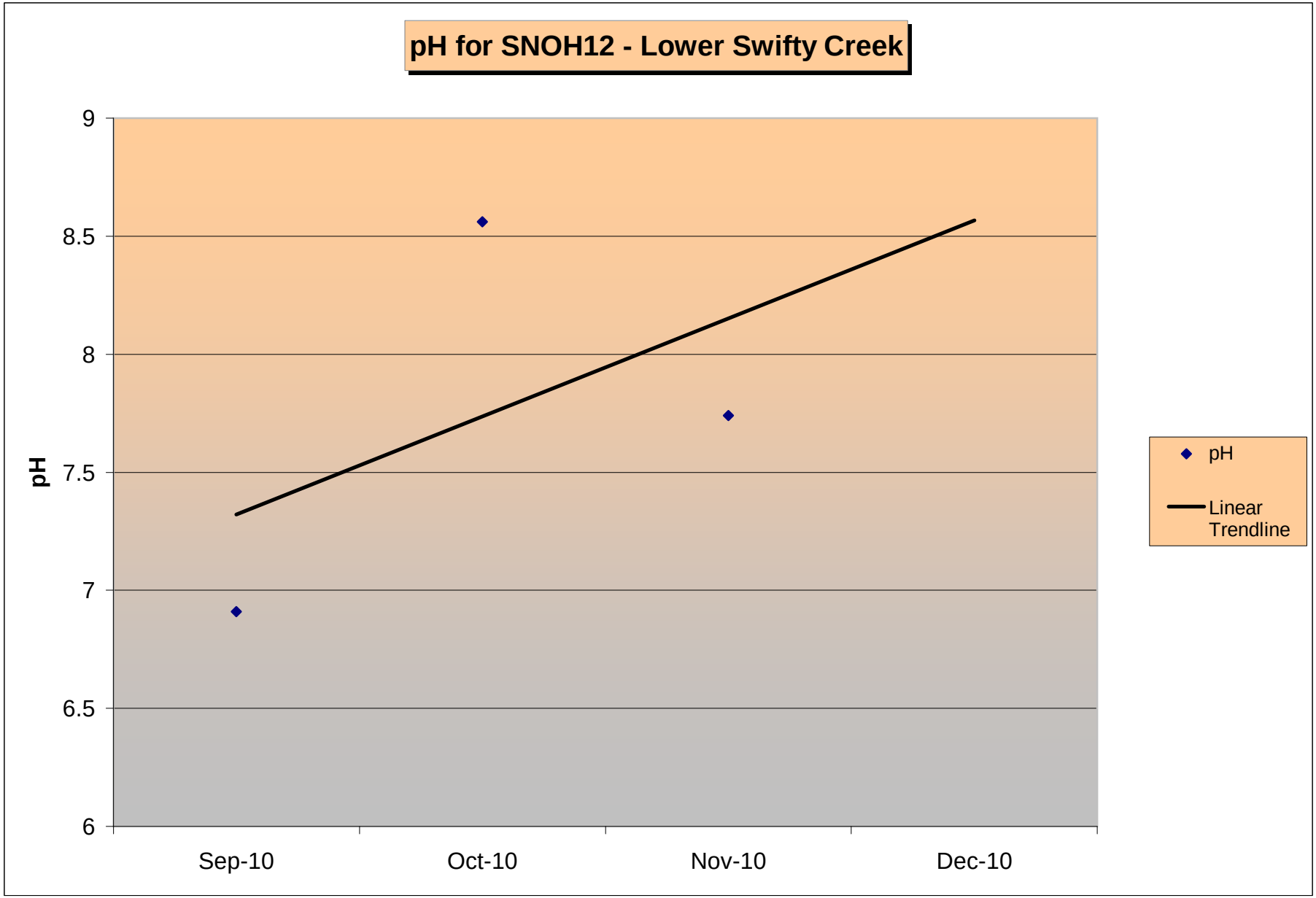

pH for SNOH7 - East of Ave. A
pH
9
8.5
8
7.5
7
6.5
6
Aug-08
Oct-08
Dec-08
Feb-09
Apr-09
Jun-09
Aug-09
Oct-09
Dec-09
Feb-10
Apr-10
Jun-10
Aug-10
Oct-10
Dec-10
pH
Linear Trendline


pH for SNOH8 - Cady Park
pH
9
8.5
8
7.5
7
6.5
6
Aug-08
Oct-08
Dec-08
Feb-09
Apr-09
Jun-09
Aug-09
Oct-09
Dec-09
Feb-10
Apr-10
Jun-10
Aug-10
Oct-10
Dec-10
pH
Linear Trendline

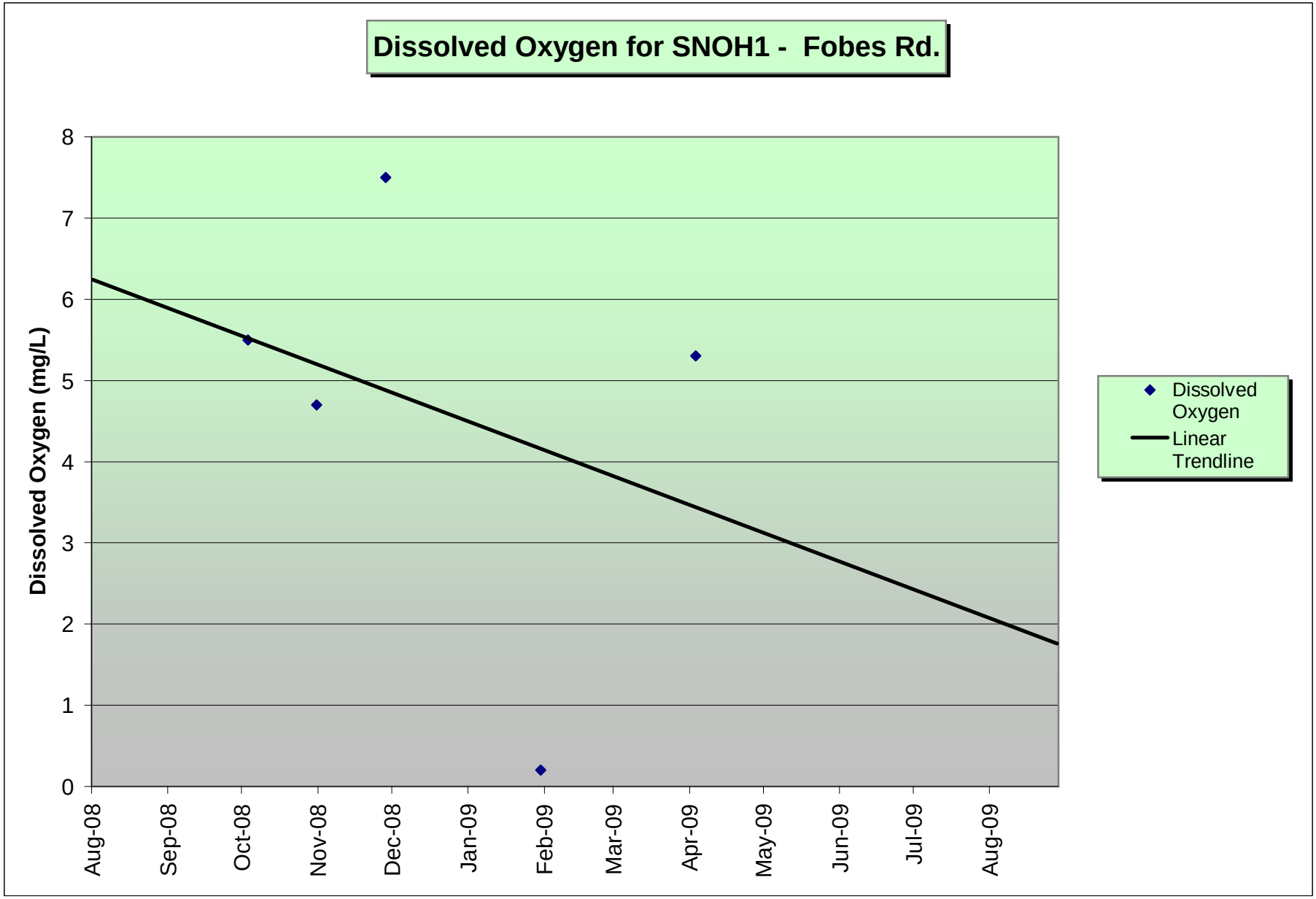

pH for SNOH9 - North of Riverview
pH
9
8.5
8
7.5
7
6.5
6
Aug-08
Oct-08
Dec-08
Feb-09
Apr-09
Jun-09
Aug-09
Oct-09
Dec-09
Feb-10
Apr-10
Jun-10
Aug-10
Oct-10
Dec-10
pH
Linear Trendline

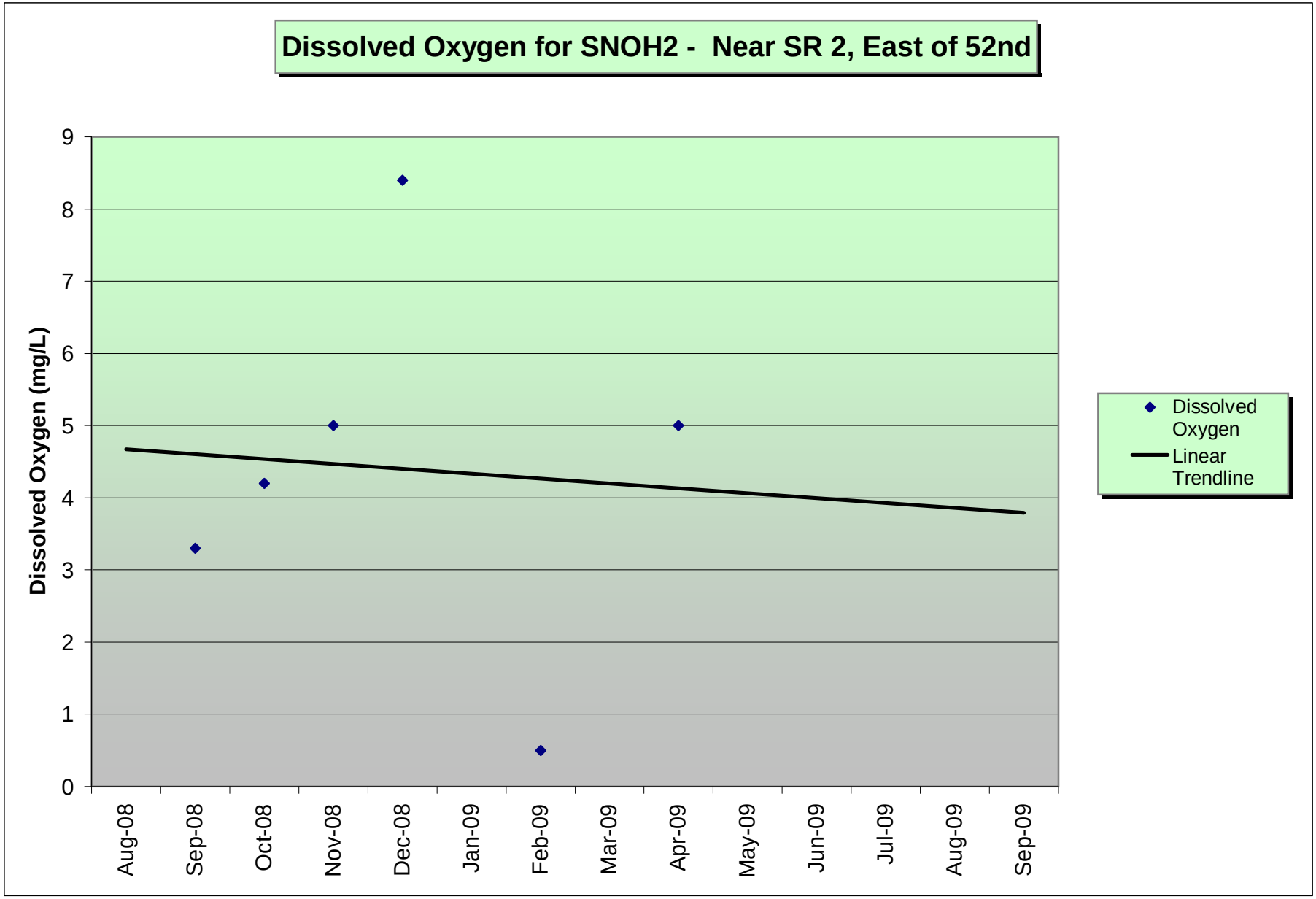

pH for SNOH10 - South End of Lakecrest Dr.
pH
9.5
9
8.5
8
7.5
7
6.5
6
Aug-08
Oct-08
Dec-08
Feb-09
Apr-09
Jun-09
Aug-09
Oct-09
Dec-09
Feb-10
Apr-10
Jun-10
Aug-10
Oct-10
Dec-10
pH
Linear Trendline

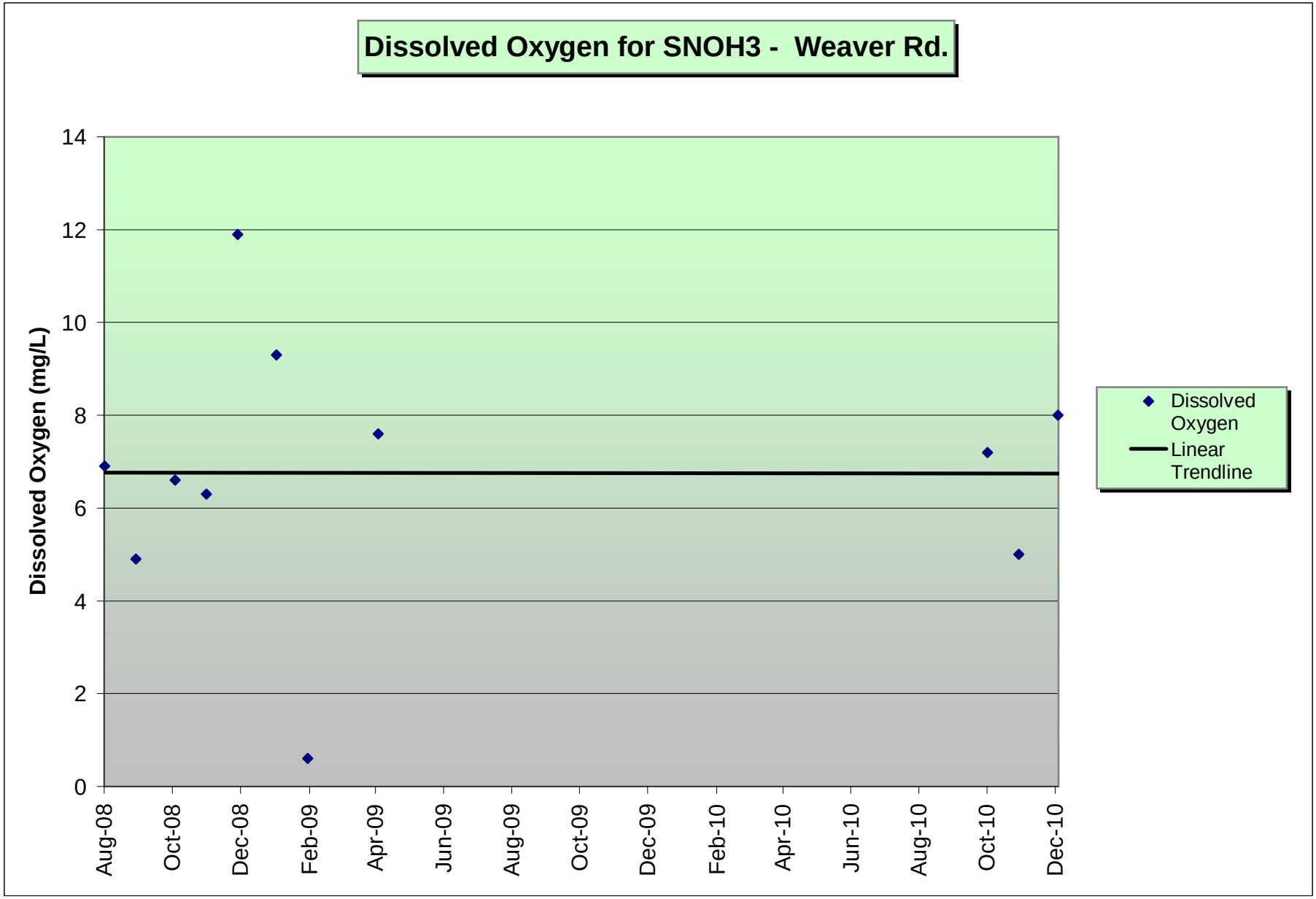

pH for SNOH11 - Upper Swifty Creek
9.5
9
8.5
8
7.5
7
6.5
6
pH
Sep-10
Oct-10
Nov-10
Dec-10
pH
Linear Trendline

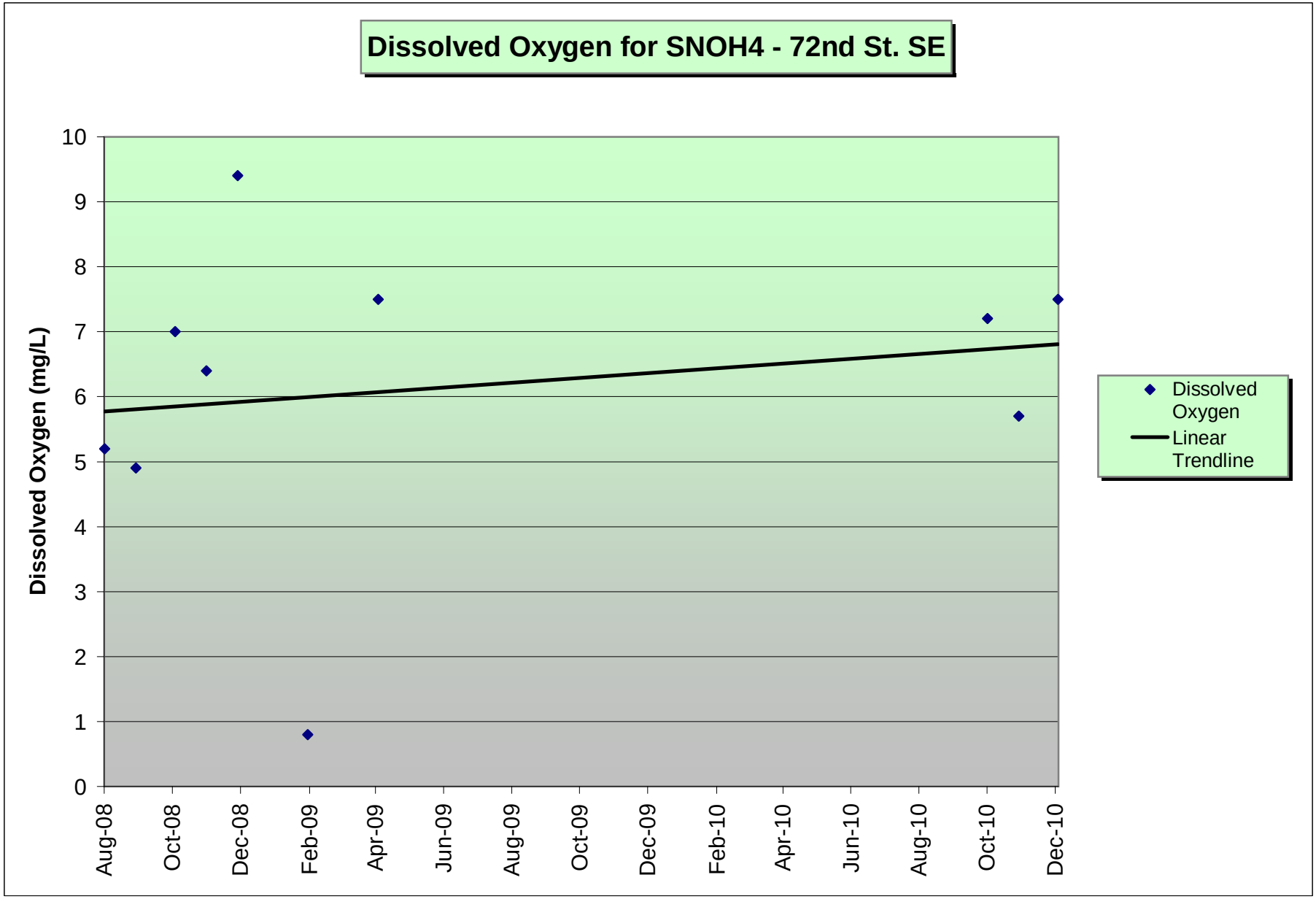

pH for SNOH12 - Lower Swifty Creek
9
8.5
8
7.5
7
6.5
6
pH
Sep-10
Oct-10
Nov-10
Dec-10
pH
Linear Trendline

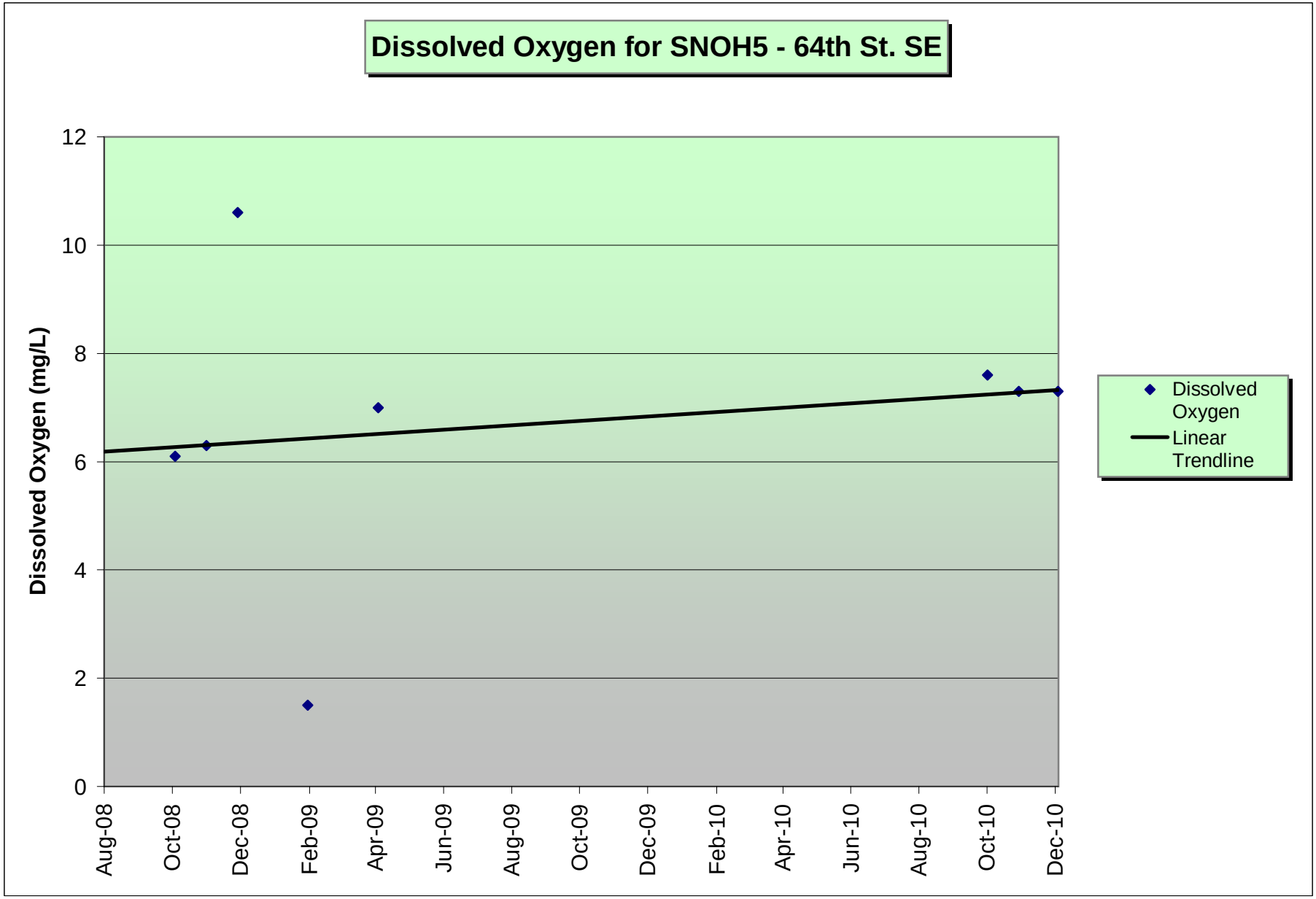
Dissolved Oxygen Graphs (2008-2010)

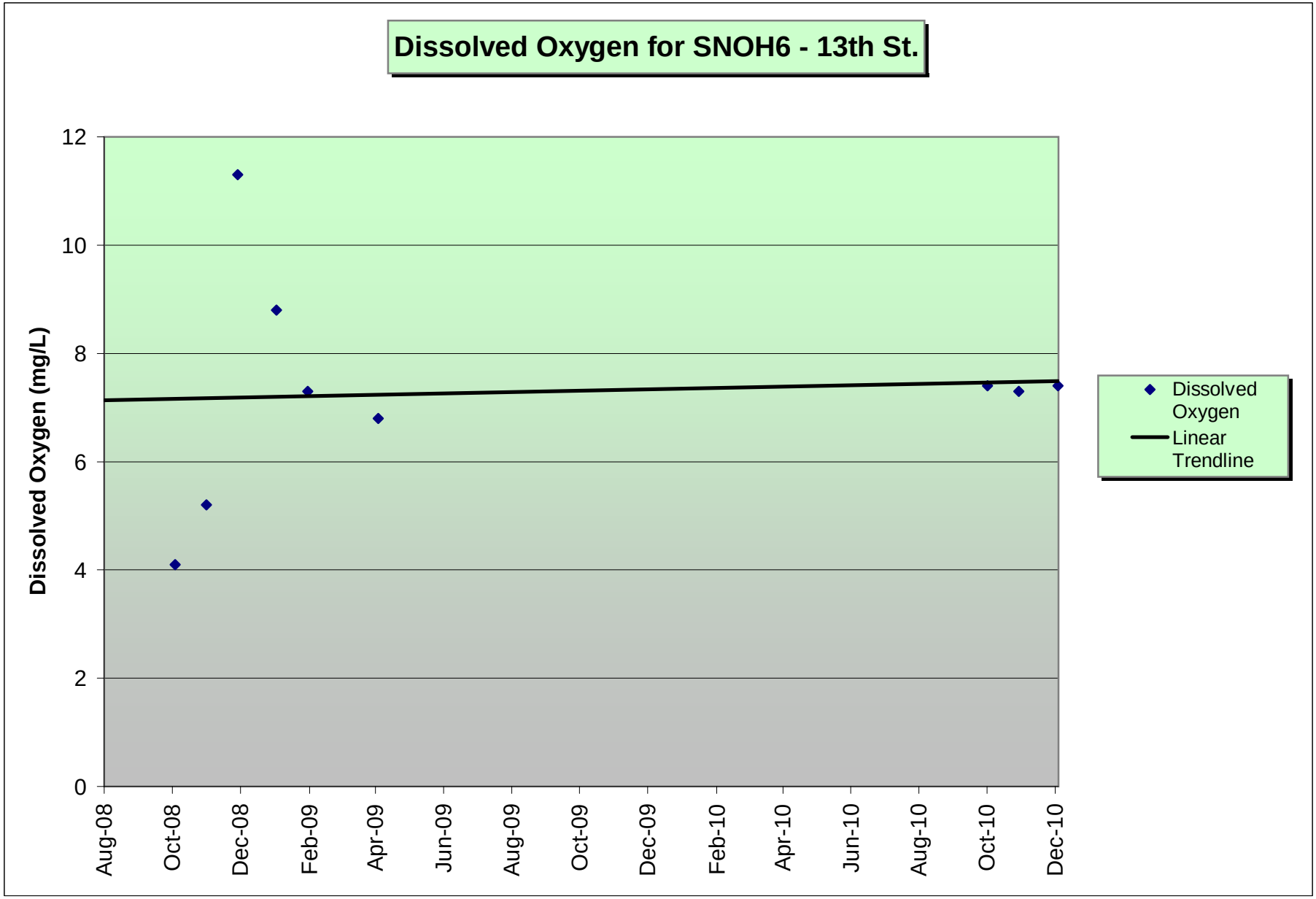

Dissolved Oxygen for SNOH1 - Fobes Rd.
Dissolved Oxygen (mg/L)
0
1
2
3
4
5
6
7
8
Aug-08
Sep-08
Oct-08
Nov-08
Dec-08
Jan-09
Feb-09
Mar-09
Apr-09
May-09
Jun-09
Jul-09
Aug-09
Dissolved Oxygen
Linear Trendline

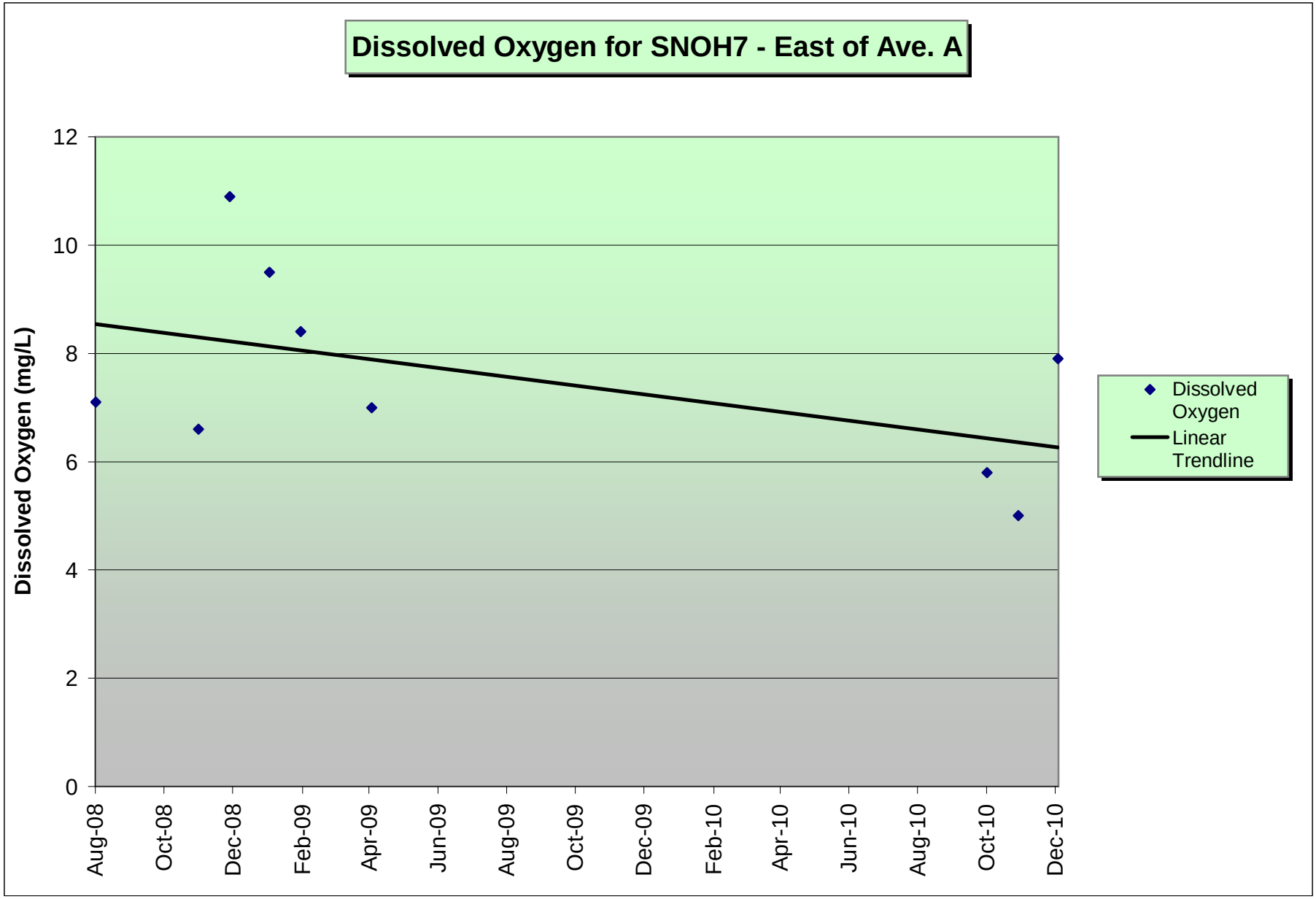

Dissolved Oxygen for SNOH2 - Near SR 2, East of 52nd
Dissolved Oxygen (mg/L)
0
1
2
3
4
5
6
7
8
9
Aug-08
Sep-08
Oct-08
Nov-08
Dec-08
Jan-09
Feb-09
Mar-09
Apr-09
May-09
Jun-09
Jul-09
Aug-09
Sep-09
Dissolved Oxygen
Linear Trendline

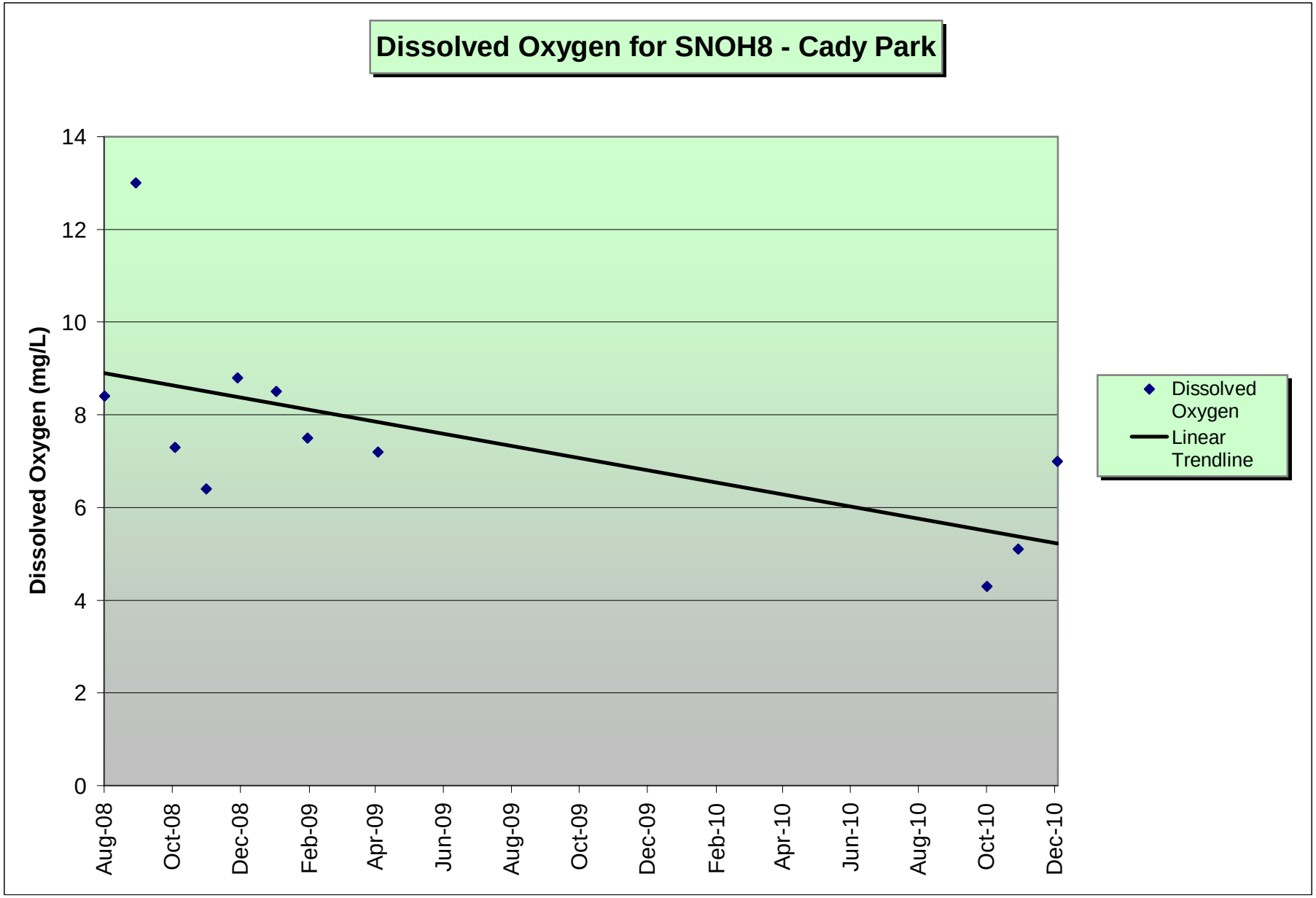

Dissolved Oxygen for SNOH3 - Weaver Rd.
Dissolved Oxygen (mg/L)
14
12
10
8
6
4
2
0
Aug-08
Oct-08
Dec-08
Feb-09
Apr-09
Jun-09
Aug-09
Oct-09
Dec-09
Feb-10
Apr-10
Jun-10
Aug-10
Oct-10
Dec-10
Dissolved Oxygen
Linear Trendline

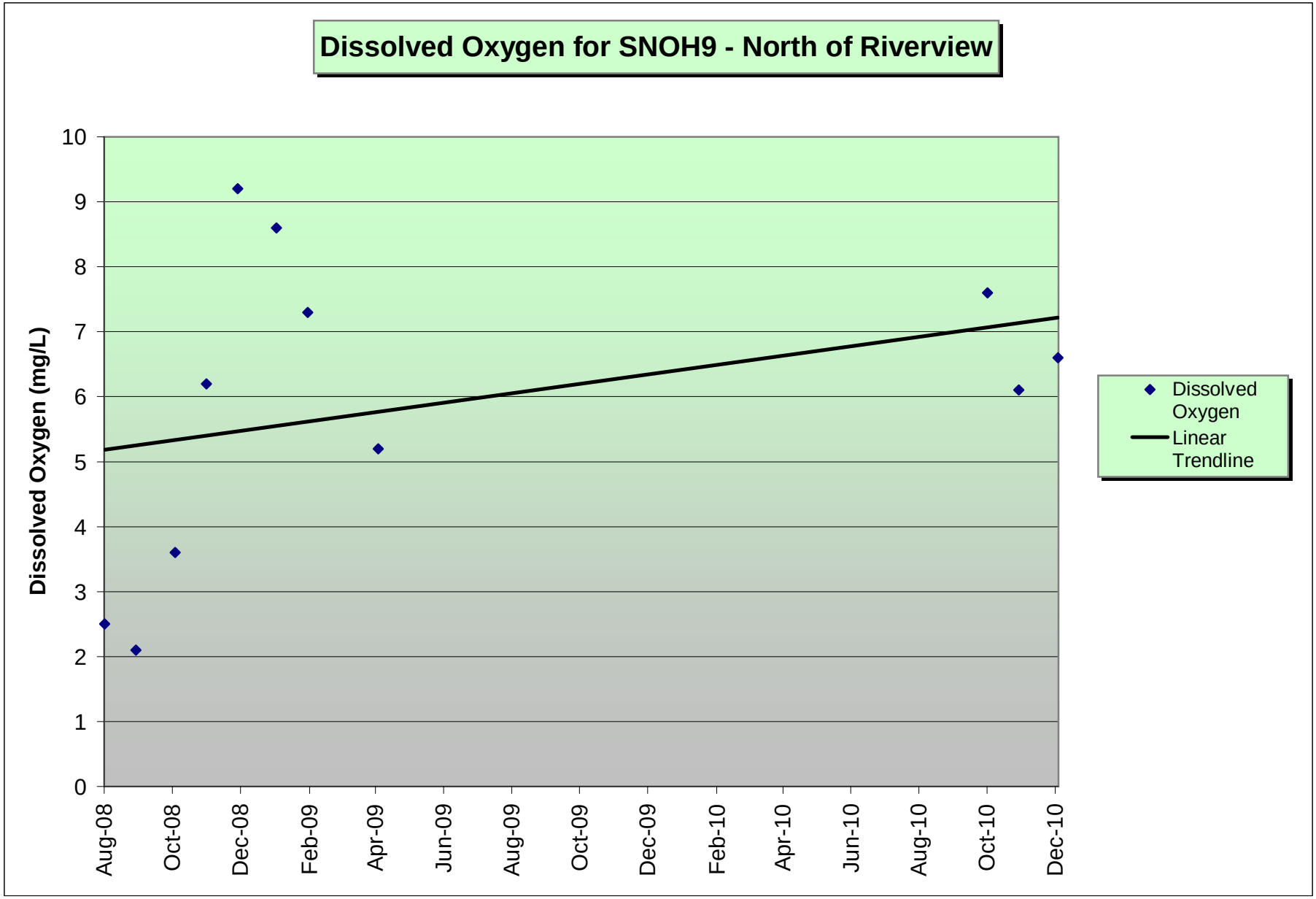

Dissolved Oxygen for SNOH4 - 72nd St. SE
Dissolved Oxygen (mg/L)
10
9
8
7
6
5
4
3
2
1
0
Aug-08
Oct-08
Dec-08
Feb-09
Apr-09
Jun-09
Aug-09
Oct-09
Dec-09
Feb-10
Apr-10
Jun-10
Aug-10
Oct-10
Dec-10
Dissolved Oxygen
Linear Trendline

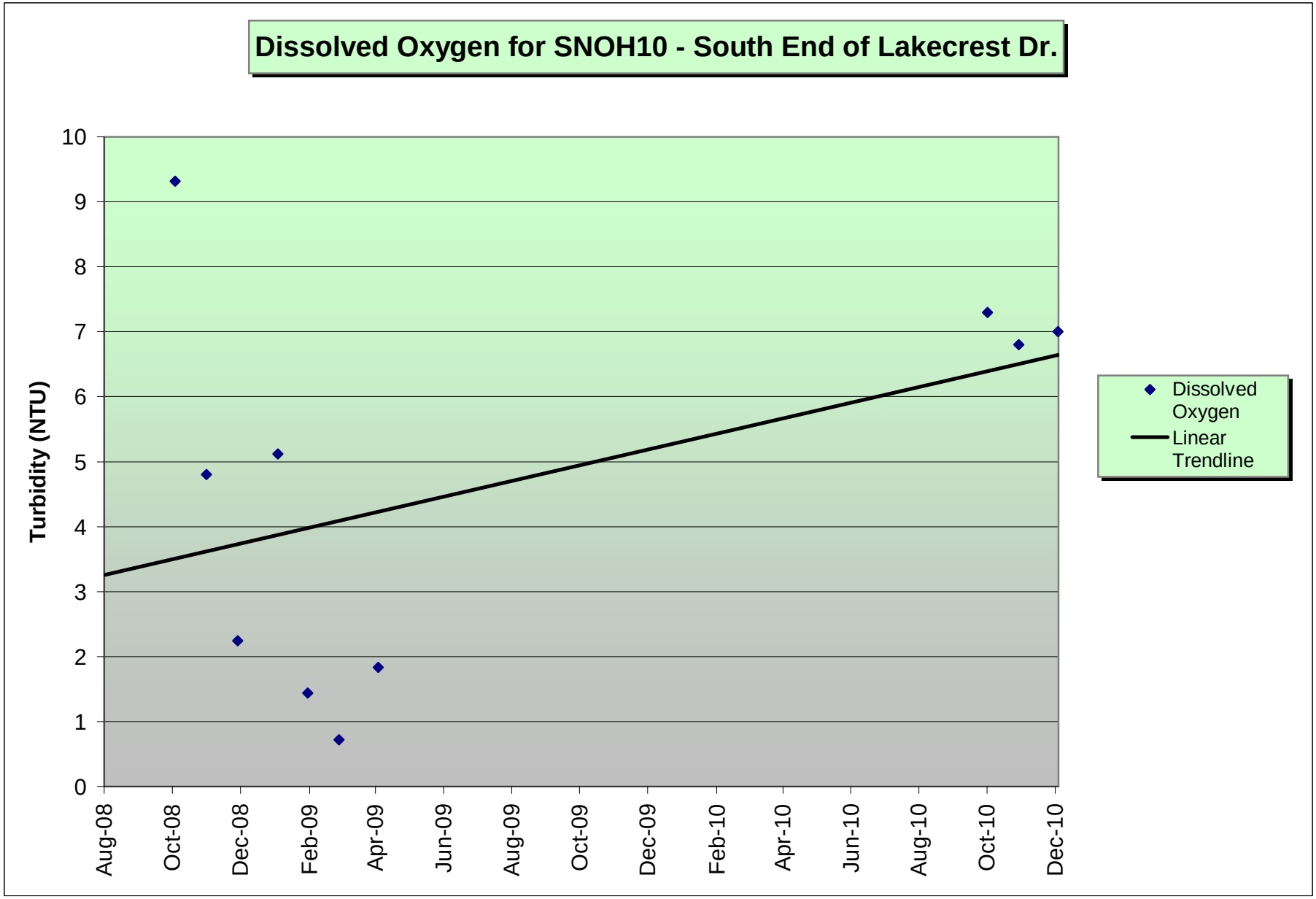

Dissolved Oxygen for SNOH5 - 64th St. SE
Dissolved Oxygen (mg/L)
12
10
8
6
4
2
0
Aug-08
Oct-08
Dec-08
Feb-09
Apr-09
Jun-09
Aug-09
Oct-09
Dec-09
Feb-10
Apr-10
Jun-10
Aug-10
Oct-10
Dec-10
Dissolved Oxygen
Linear Trendline

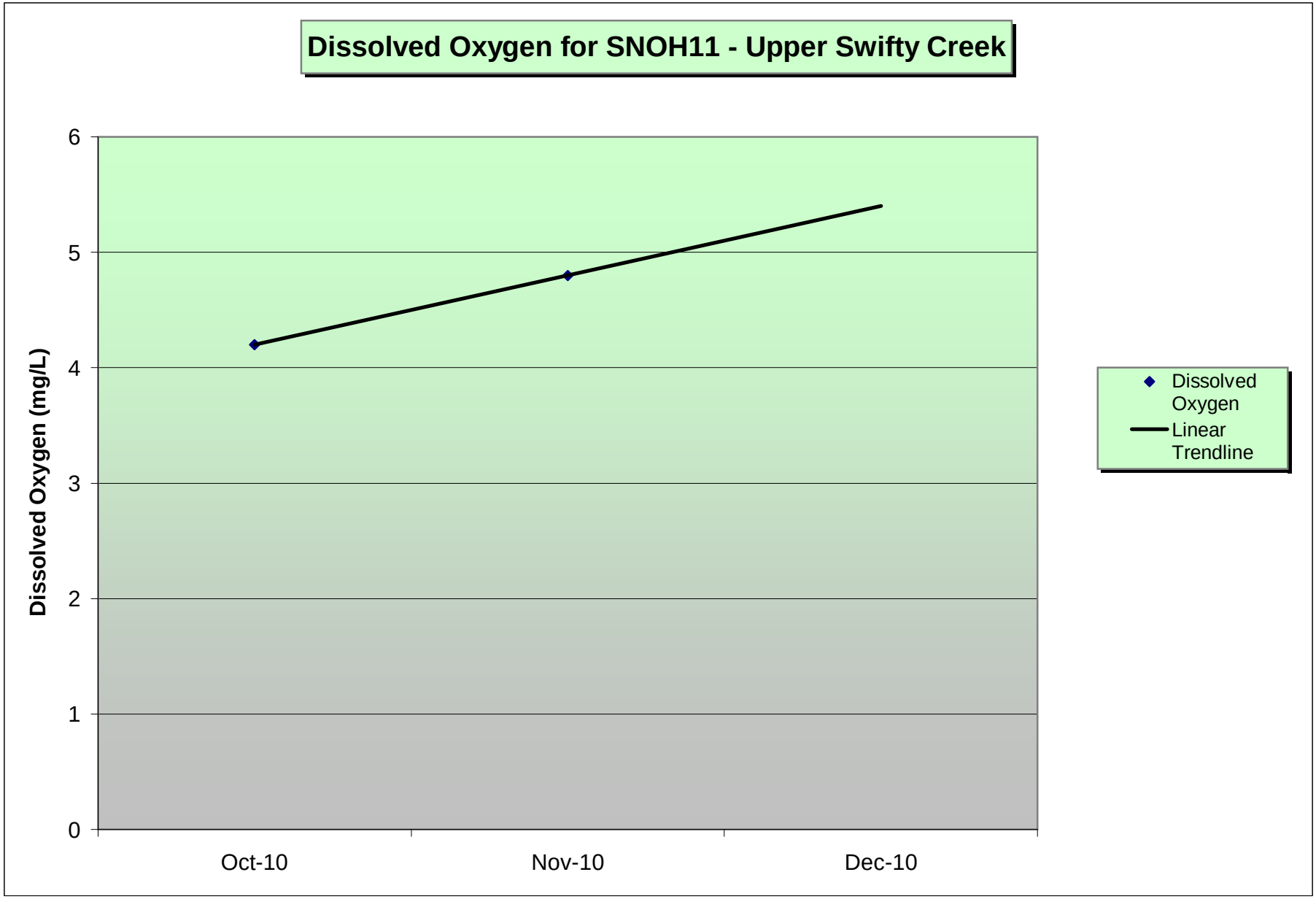

Dissolved Oxygen for SNOH6 - 13th St.
Dissolved Oxygen (mg/L)
0
2
4
6
8
10
12
Aug-08
Oct-08
Dec-08
Feb-09
Apr-09
Jun-09
Aug-09
Oct-09
Dec-09
Feb-10
Apr-10
Jun-10
Aug-10
Oct-10
Dec-10
Dissolved Oxygen
Linear Trendline

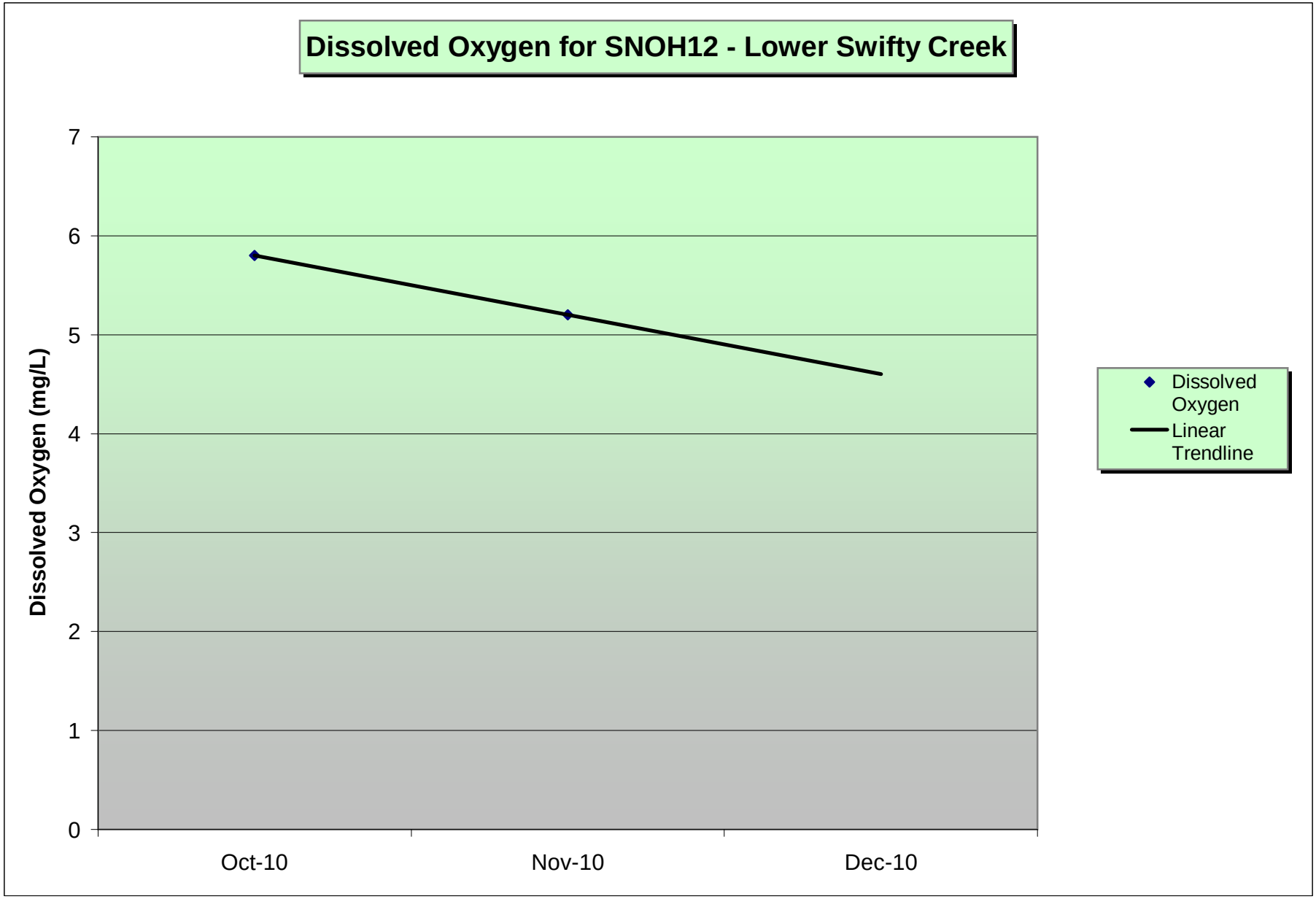

Dissolved Oxygen for SNOH7 - East of Ave. A
Dissolved Oxygen (mg/L)
12
10
8
6
4
2
0
Aug-08
Oct-08
Dec-08
Feb-09
Apr-09
Jun-09
Aug-09
Oct-09
Dec-09
Feb-10
Apr-10
Jun-10
Aug-10
Oct-10
Dec-10
Dissolved Oxygen
Linear Trendline


Dissolved Oxygen for SNOH8 - Cady Park
Dissolved Oxygen (mg/L)
14
12
10
8
6
4
2
0
Aug-08
Oct-08
Dec-08
Feb-09
Apr-09
Jun-09
Aug-09
Oct-09
Dec-09
Feb-10
Apr-10
Jun-10
Aug-10
Oct-10
Dec-10
Dissolved Oxygen
Linear Trendline

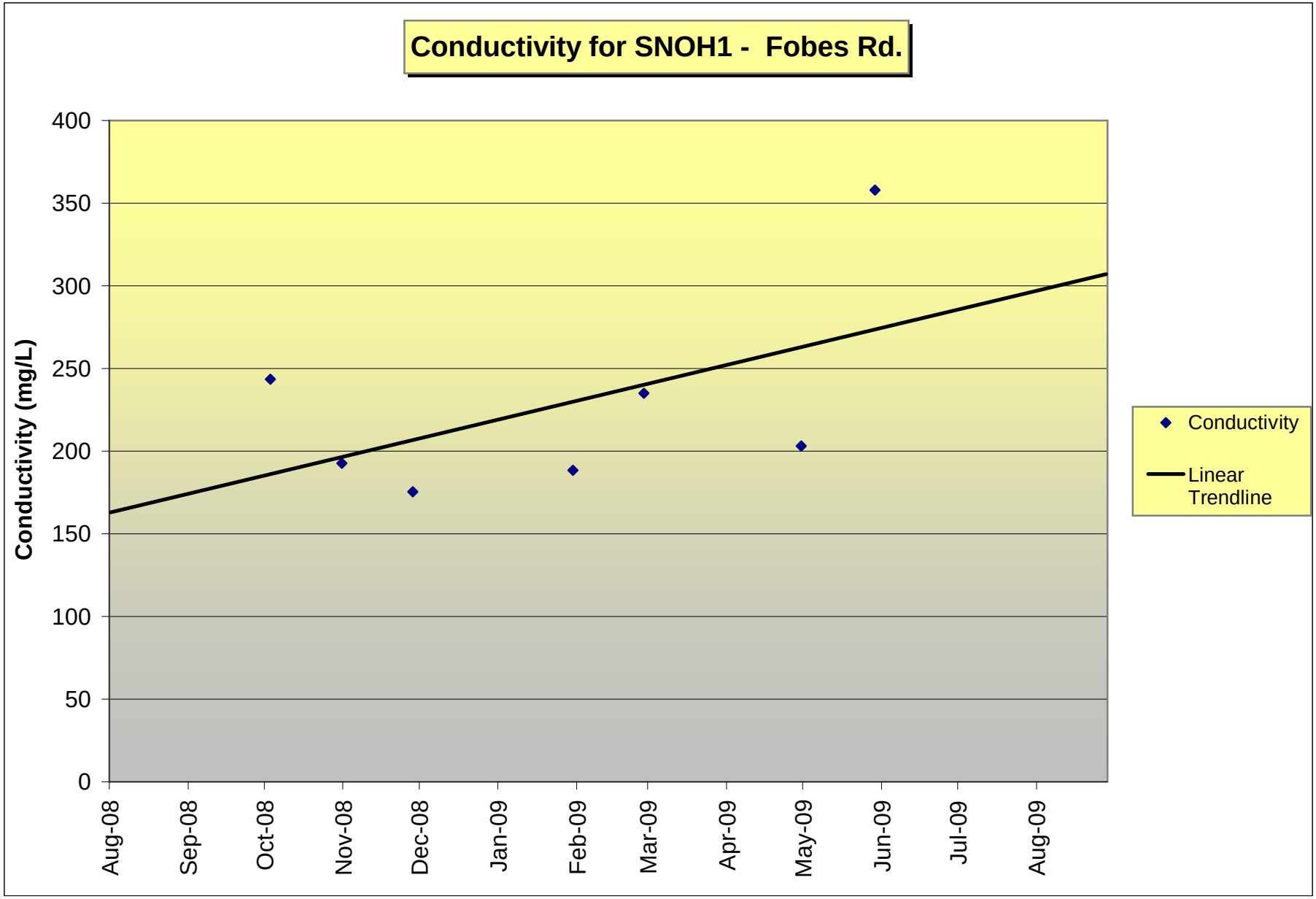

Dissolved Oxygen for SNOH9 - North of Riverview
Dissolved Oxygen (mg/L)
10
9
8
7
6
5
4
3
2
1
0
Aug-08
Oct-08
Dec-08
Feb-09
Apr-09
Jun-09
Aug-09
Oct-09
Dec-09
Feb-10
Apr-10
Jun-10
Aug-10
Oct-10
Dec-10
Dissolved Oxygen
Linear Trendline

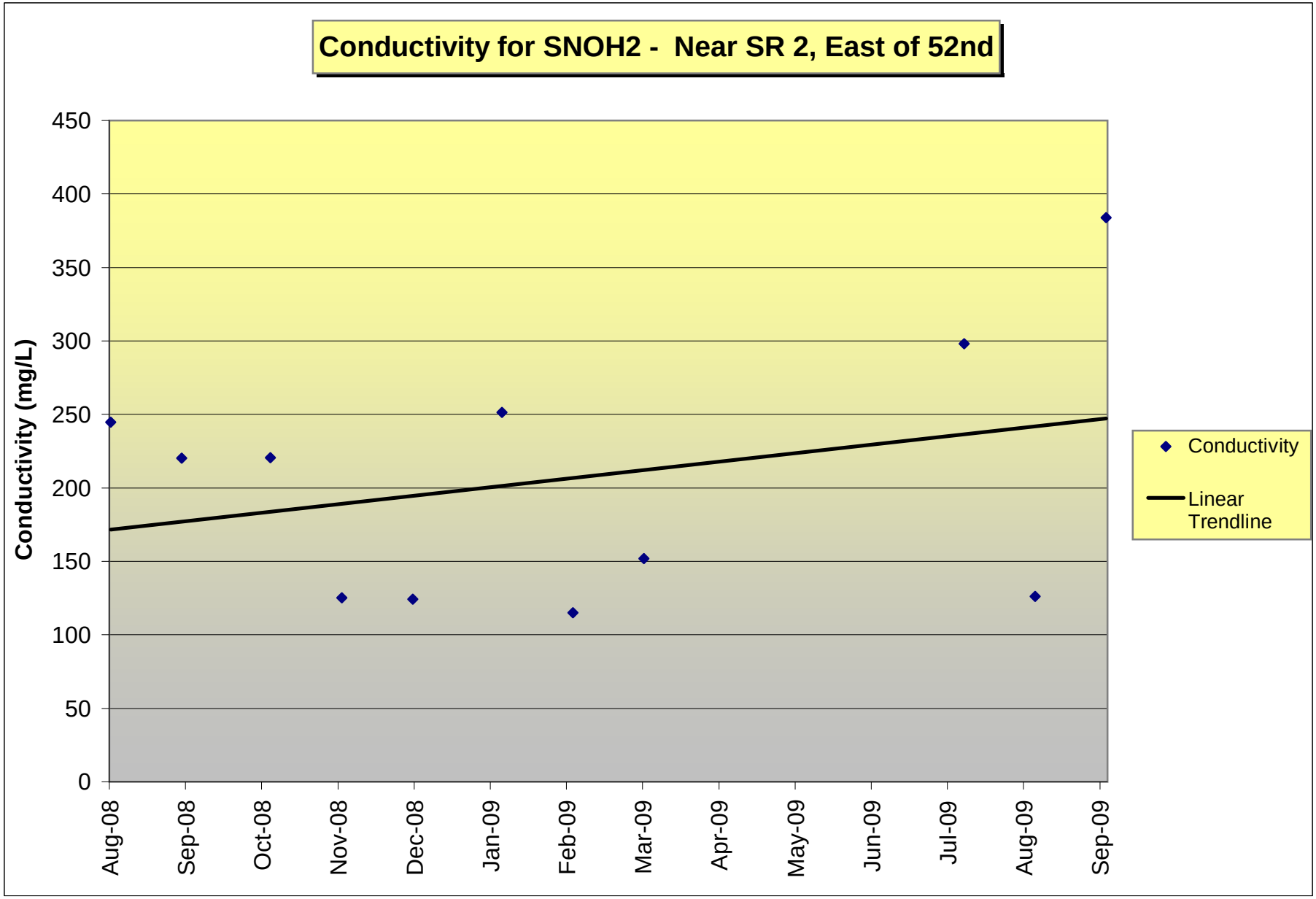

Dissolved Oxygen for SNOH10 - South End of Lakecrest Dr.
Turbidity (NTU)
10
9
8
7
6
5
4
3
2
1
0
Aug-08
Oct-08
Dec-08
Feb-09
Apr-09
Jun-09
Aug-09
Oct-09
Dec-09
Feb-10
Apr-10
Jun-10
Aug-10
Oct-10
Dec-10
Dissolved Oxygen
Linear Trendline

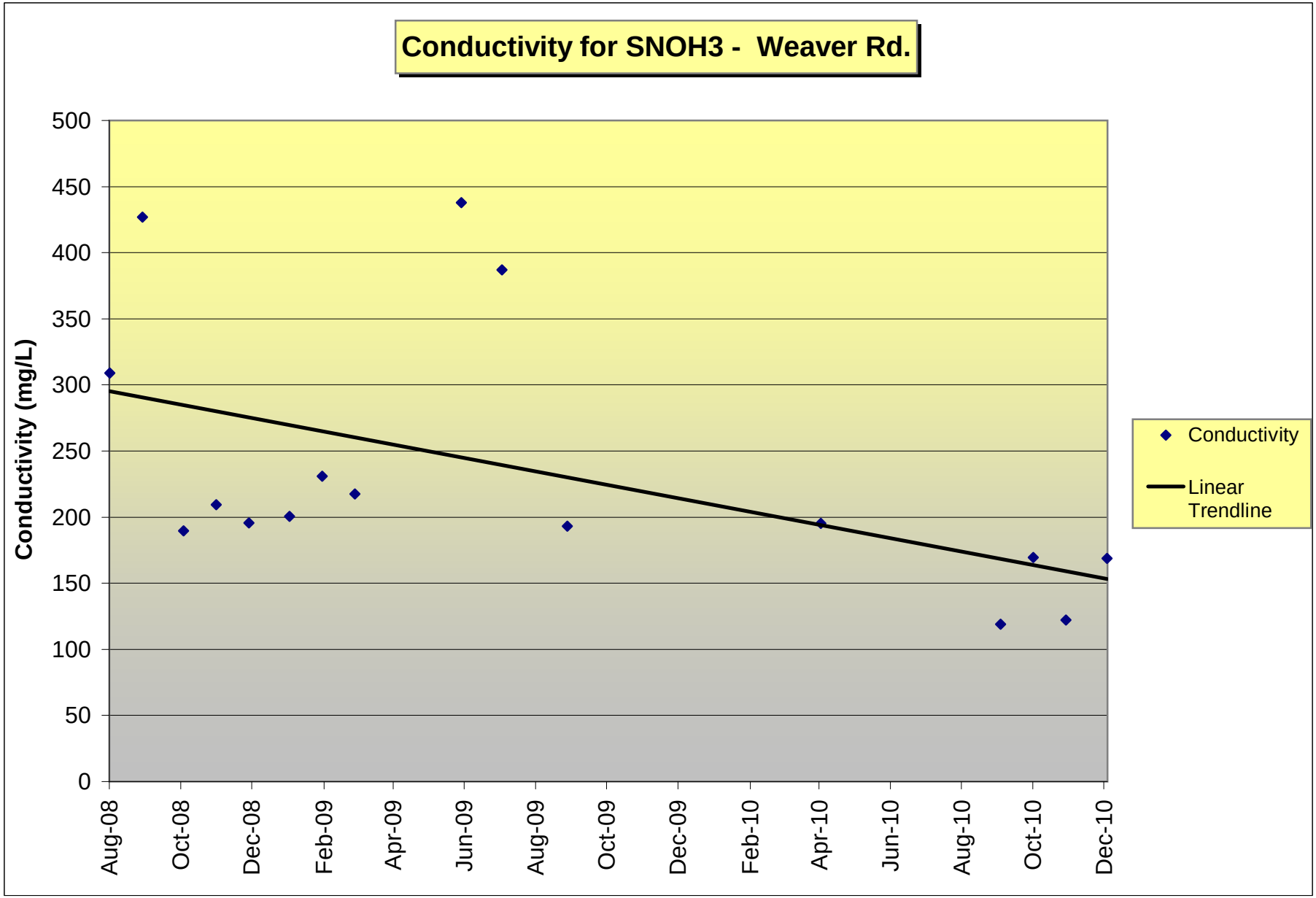

Dissolved Oxygen for SNOH11 - Upper Swifty Creek
Dissolved Oxygen (mg/L)
6
5
4
3
2
1
0
Oct-10
Nov-10
Dec-10
Dissolved Oxygen
Linear Trendline

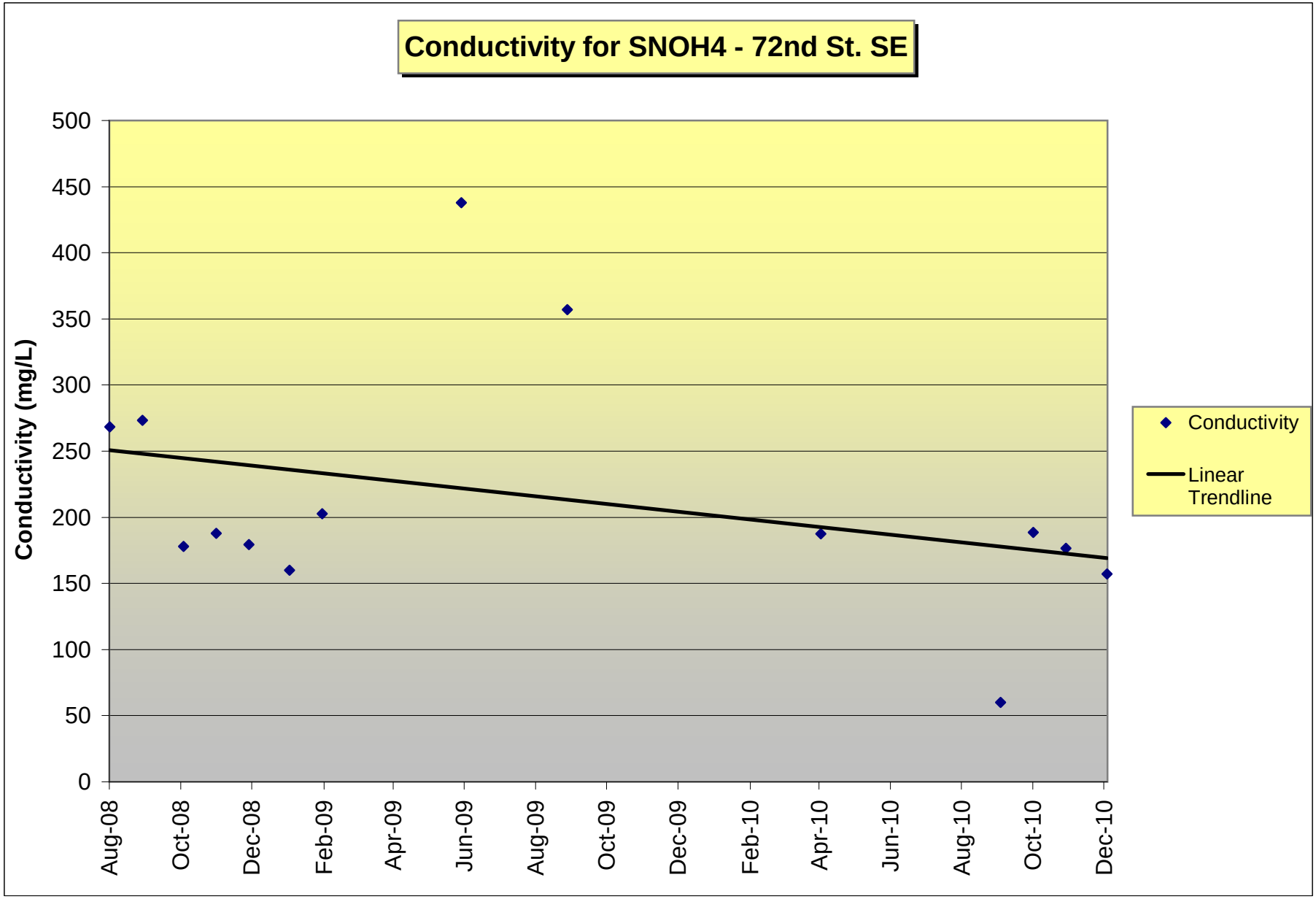

Dissolved Oxygen for SNOH12 - Lower Swifty Creek
Dissolved Oxygen (mg/L)
7
6
5
4
3
2
1
0
Oct-10
Nov-10
Dec-10
Dissolved Oxygen
Linear Trendline

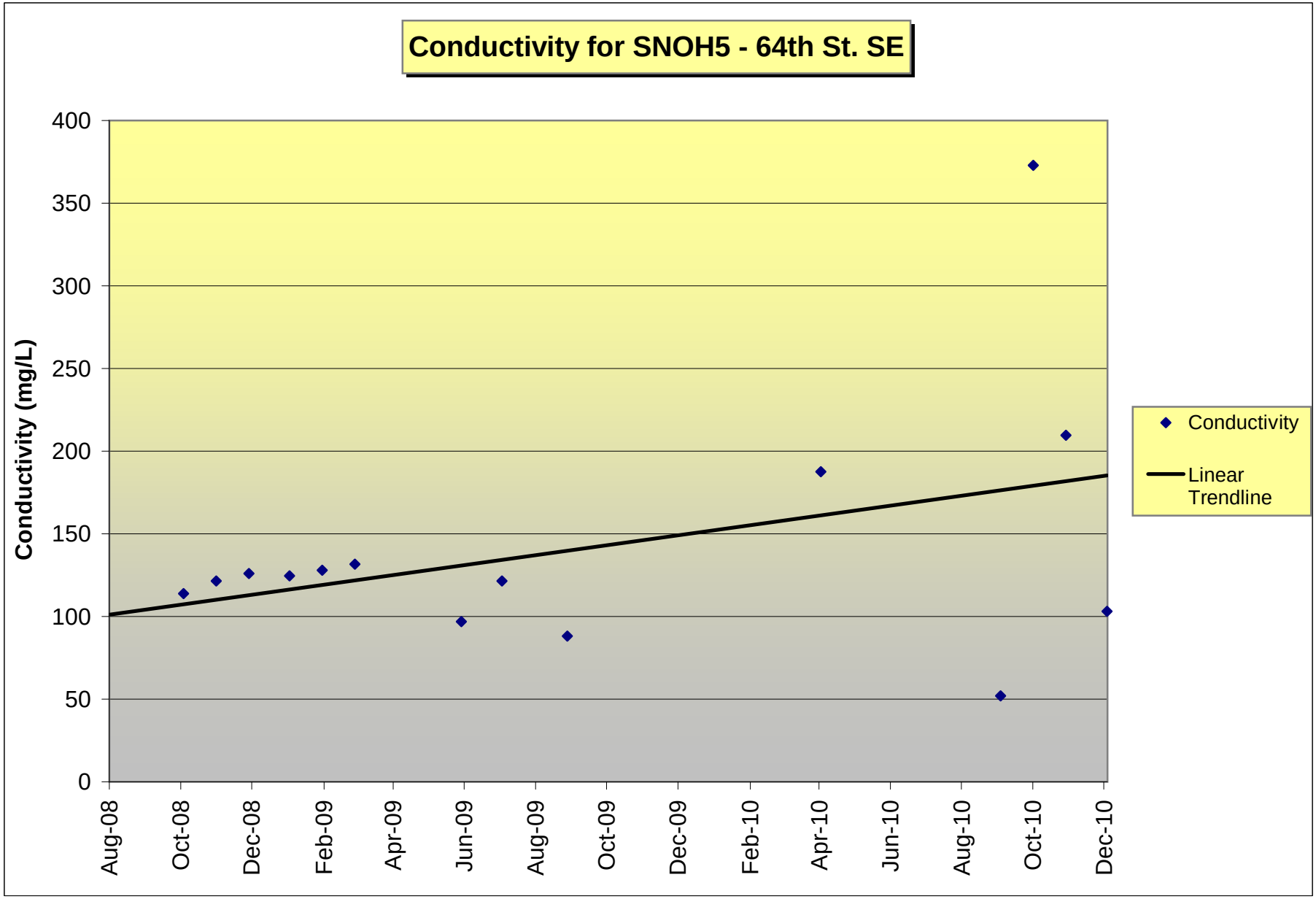
Conductivity Graphs (2008-2010)

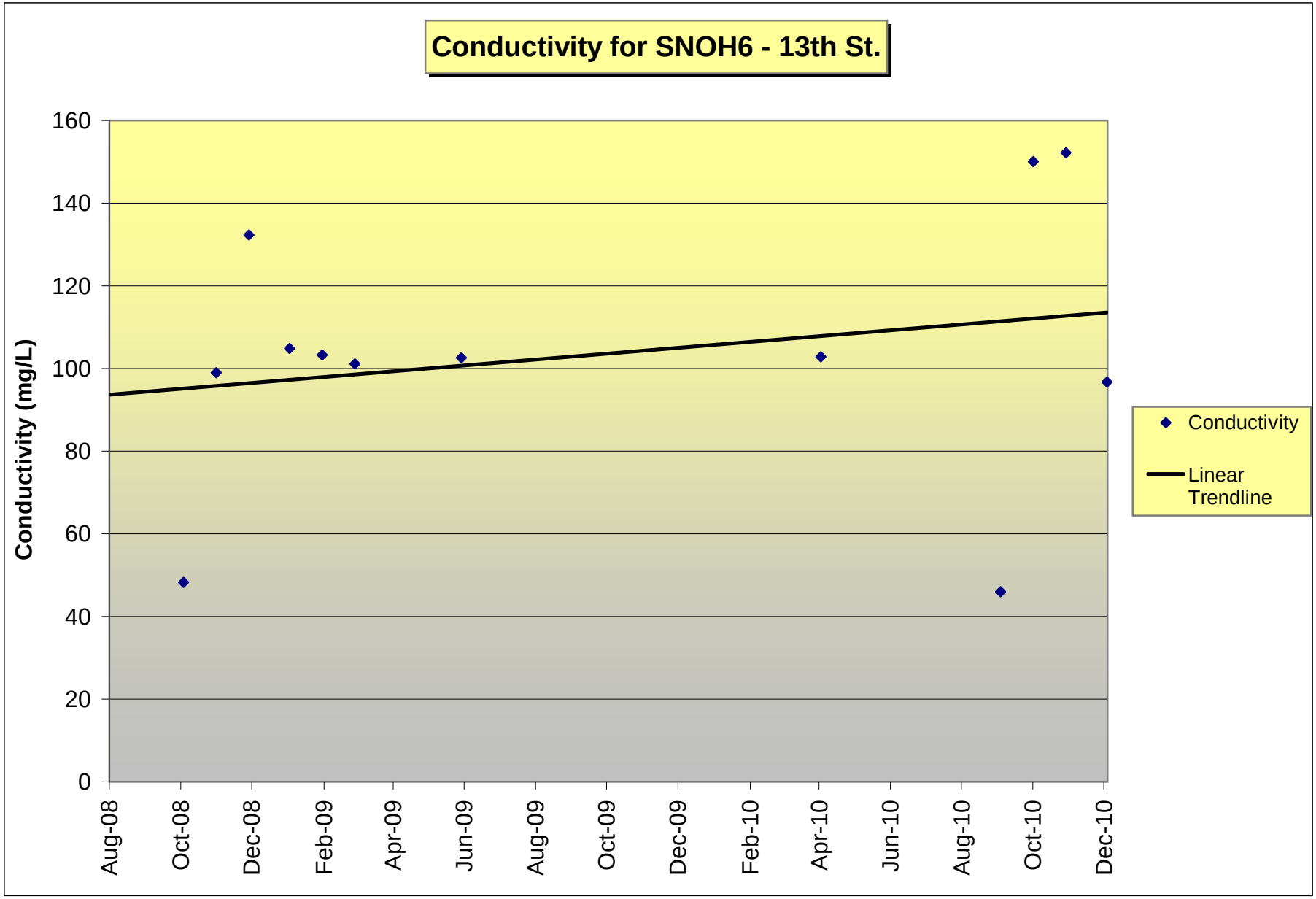

Conductivity for SNOH1 - Fobes Rd.
Conductivity (mg/L)
400
350
300
250
200
150
100
50
0
Aug-08
Sep-08
Oct-08
Nov-08
Dec-08
Jan-09
Feb-09
Mar-09
Apr-09
May-09
Jun-09
Jul-09
Aug-09
Conductivity
Linear Trendline

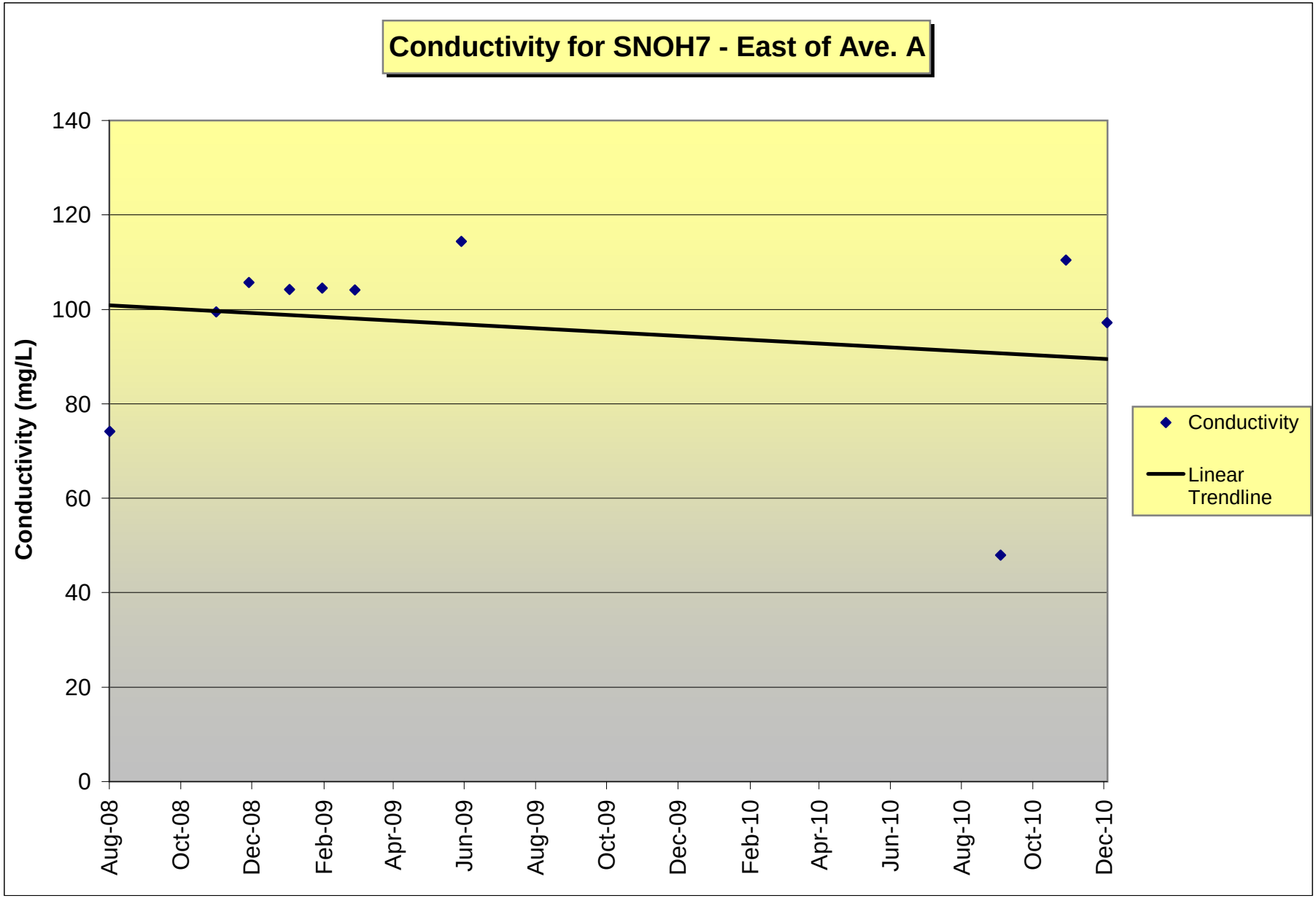

Conductivity for SNOH2 - Near SR 2, East of 52nd
Conductivity (mg/L)
450
400
350
300
250
200
150
100
50
0
Aug-08
Sep-08
Oct-08
Nov-08
Dec-08
Jan-09
Feb-09
Mar-09
Apr-09
May-09
Jun-09
Jul-09
Aug-09
Sep-09
Conductivity
Linear Trendline

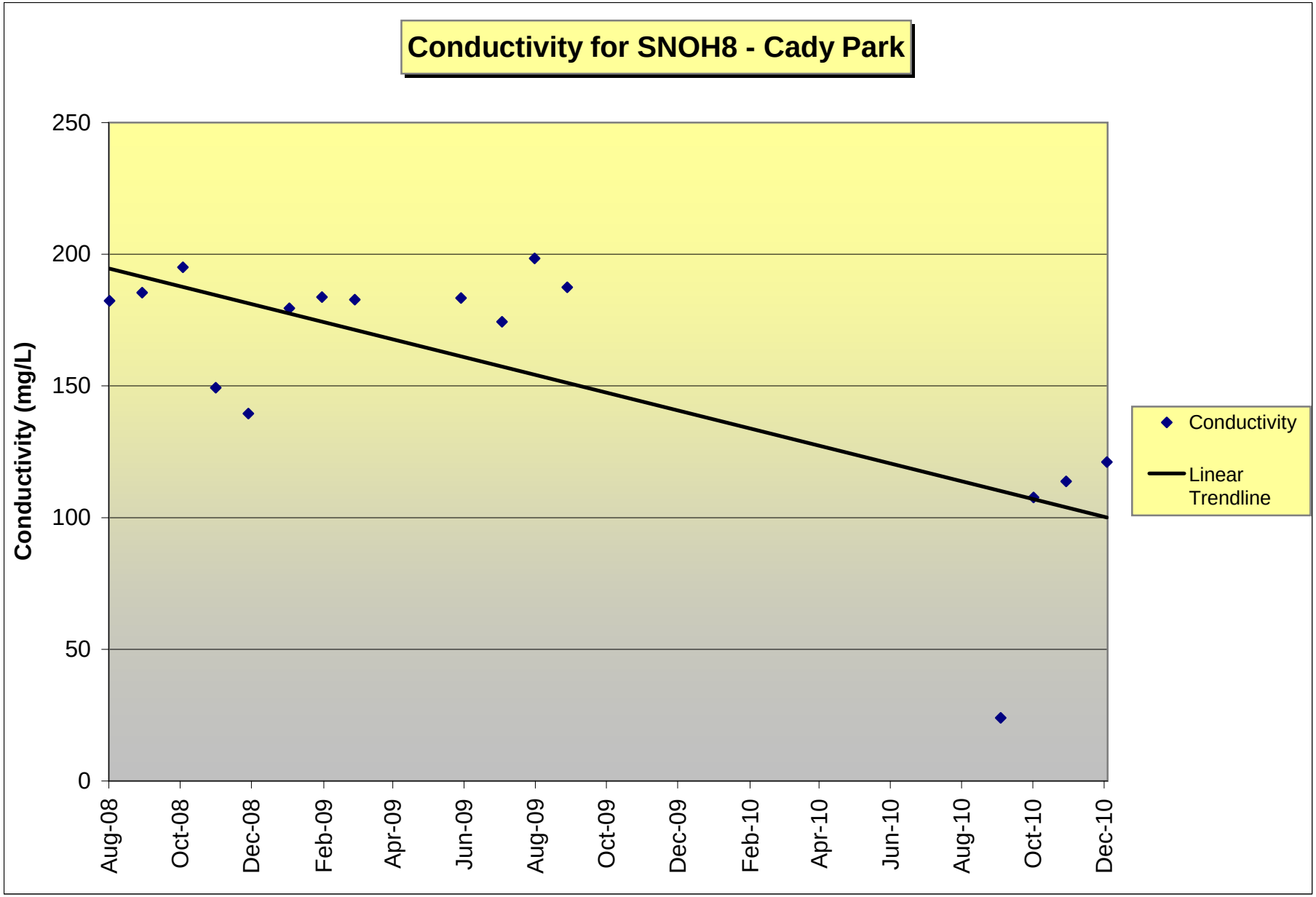

Conductivity for SNOH3 - Weaver Rd.
Conductivity (mg/L)
500
450
400
350
300
250
200
150
100
50
0
Aug-08
Oct-08
Dec-08
Feb-09
Apr-09
Jun-09
Aug-09
Oct-09
Dec-09
Feb-10
Apr-10
Jun-10
Aug-10
Oct-10
Dec-10
Conductivity
Linear Trendline

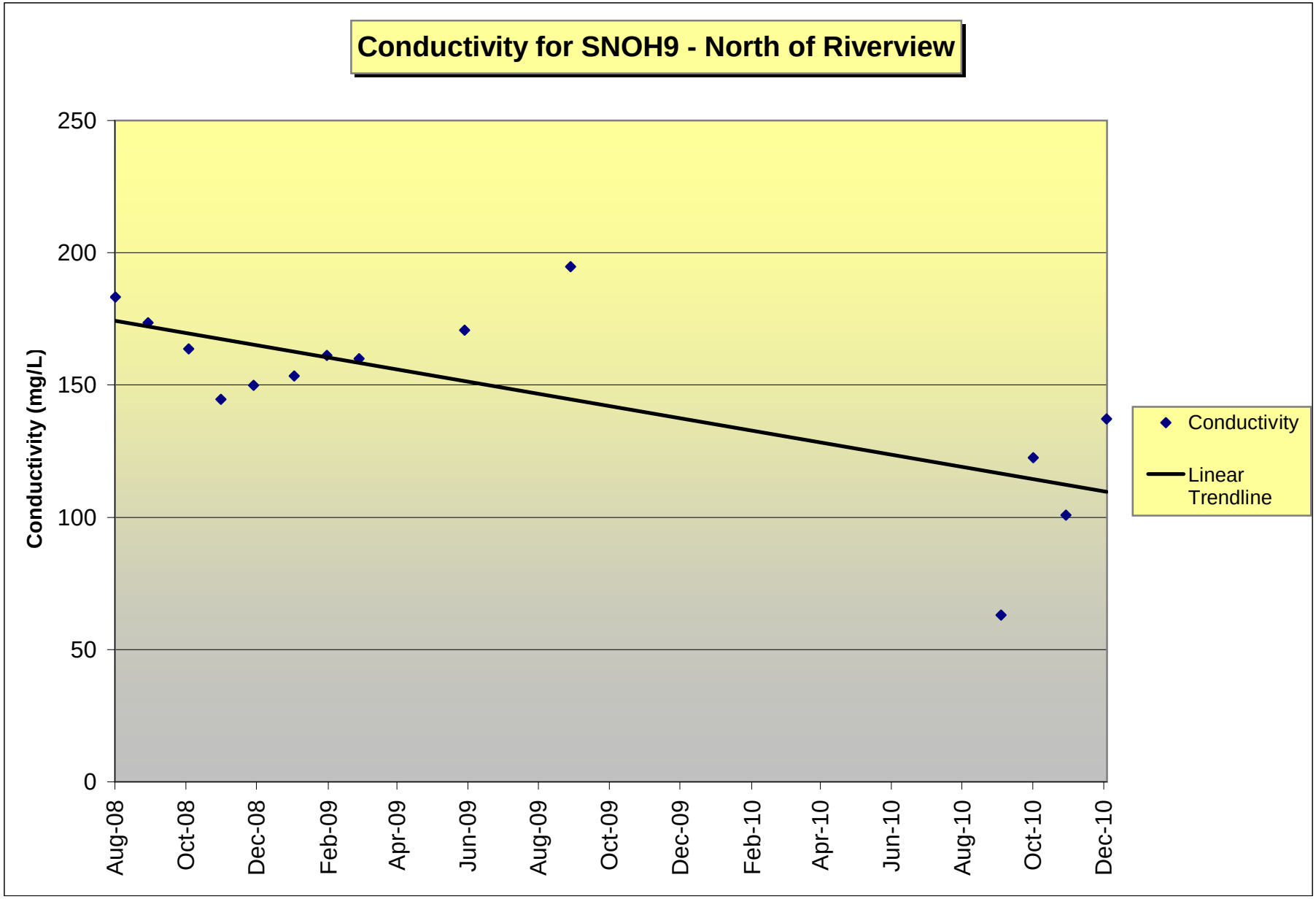

Conductivity for SNOH4 - 72nd St. SE
Conductivity (mg/L)
500
450
400
350
300
250
200
150
100
50
0
Aug-08
Oct-08
Dec-08
Feb-09
Apr-09
Jun-09
Aug-09
Oct-09
Dec-09
Feb-10
Apr-10
Jun-10
Aug-10
Oct-10
Dec-10
Conductivity
Linear Trendline

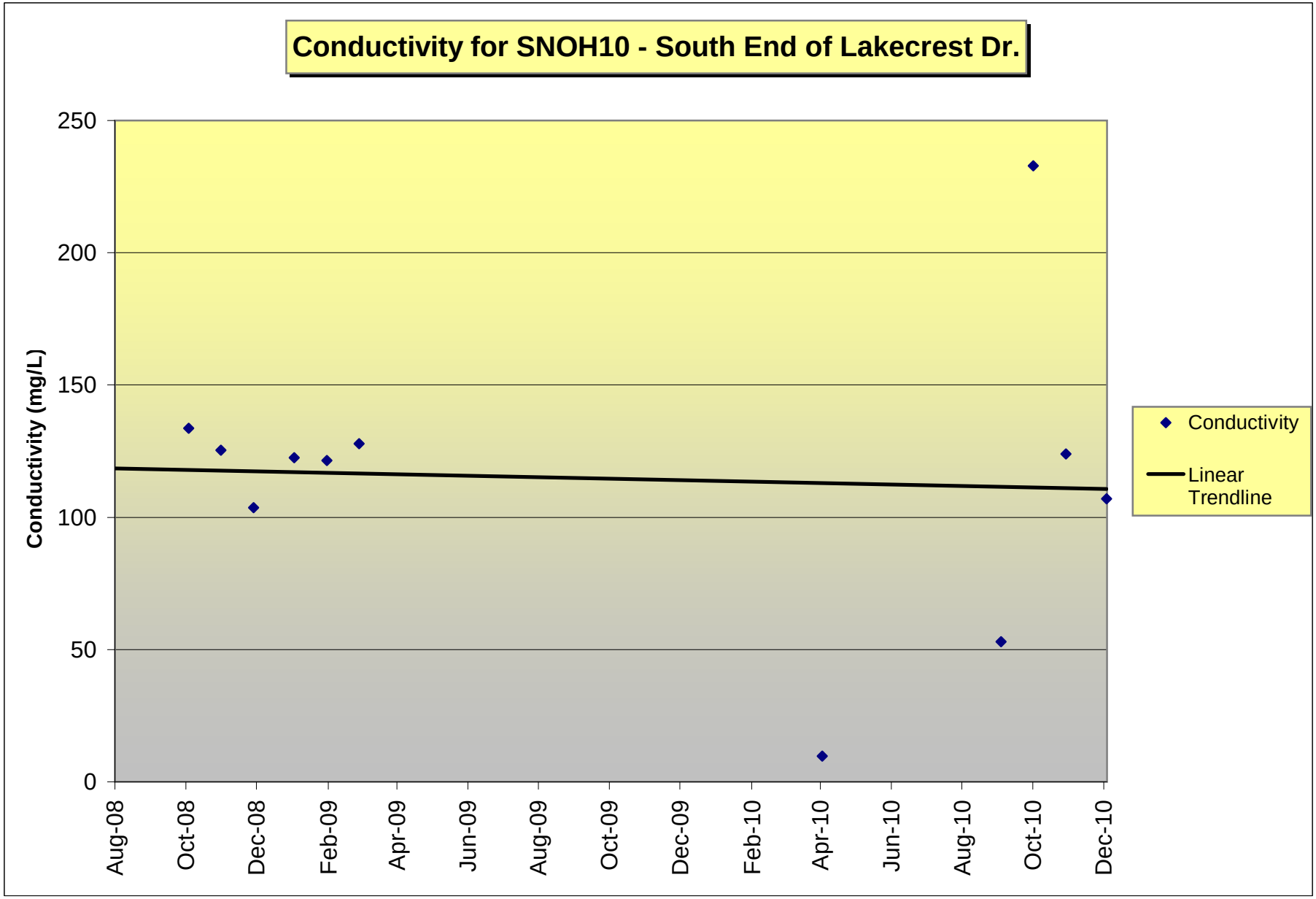

Conductivity for SNOH5 - 64th St. SE
Conductivity (mg/L)
400
350
300
250
200
150
100
50
0
Aug-08
Oct-08
Dec-08
Feb-09
Apr-09
Jun-09
Aug-09
Oct-09
Dec-09
Feb-10
Apr-10
Jun-10
Aug-10
Oct-10
Dec-10
Conductivity
Linear Trendline

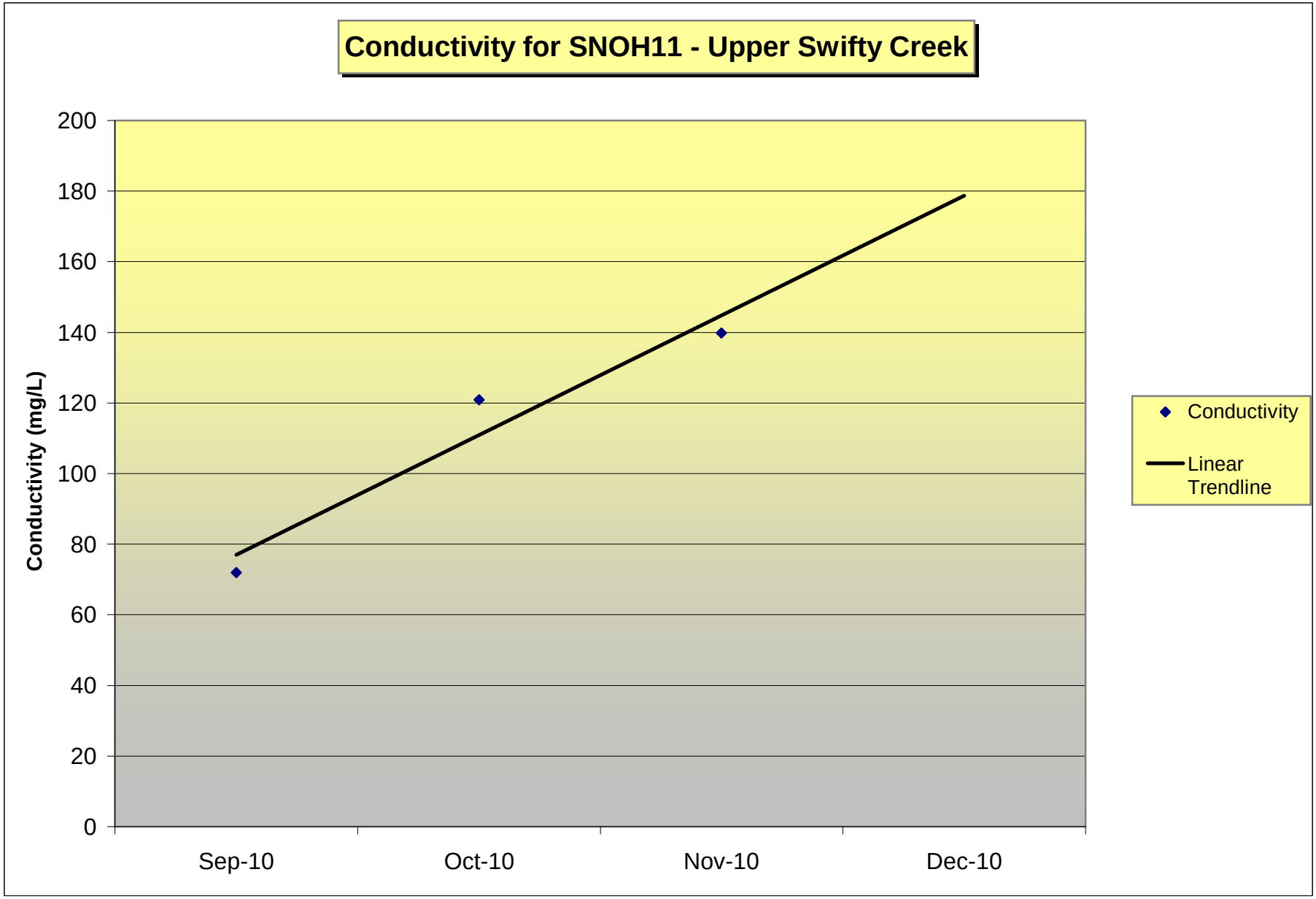

Conductivity for SNOH6 - 13th St.
Conductivity (mg/L)
160
140
120
100
80
60
40
20
0
Aug-08
Oct-08
Dec-08
Feb-09
Apr-09
Jun-09
Aug-09
Oct-09
Dec-09
Feb-10
Apr-10
Jun-10
Aug-10
Oct-10
Dec-10
Conductivity
Linear Trendline

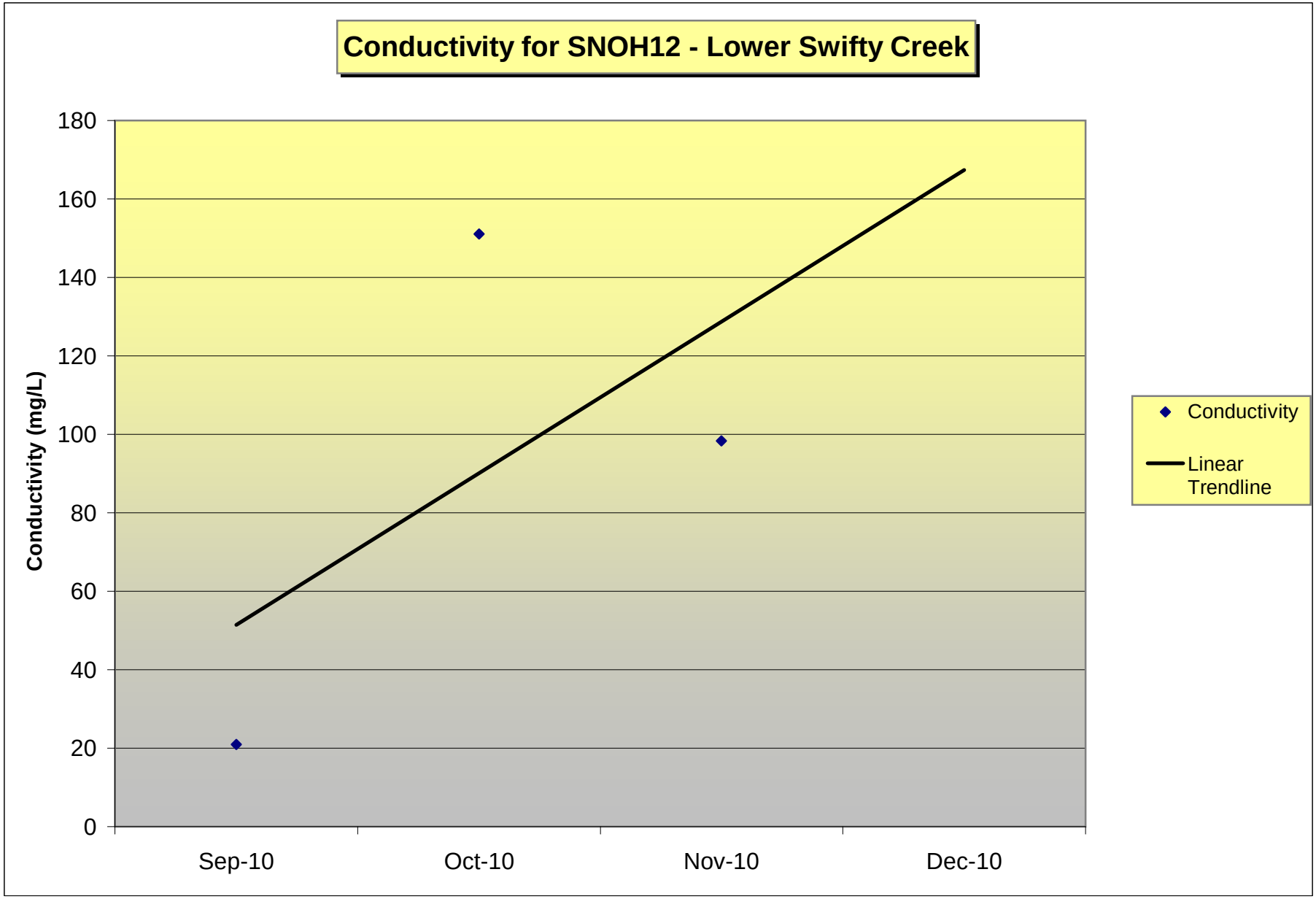

Conductivity for SNOH7 - East of Ave. A
Conductivity (mg/L)
140
120
100
80
60
40
20
0
Aug-08
Oct-08
Dec-08
Feb-09
Apr-09
Jun-09
Aug-09
Oct-09
Dec-09
Feb-10
Apr-10
Jun-10
Aug-10
Oct-10
Dec-10
Conductivity
Linear Trendline


Conductivity for SNOH8 - Cady Park
Conductivity (mg/L)
250
200
150
100
50
0
Aug-08
Oct-08
Dec-08
Feb-09
Apr-09
Jun-09
Aug-09
Oct-09
Dec-09
Feb-10
Apr-10
Jun-10
Aug-10
Oct-10
Dec-10
Conductivity
Linear Trendline

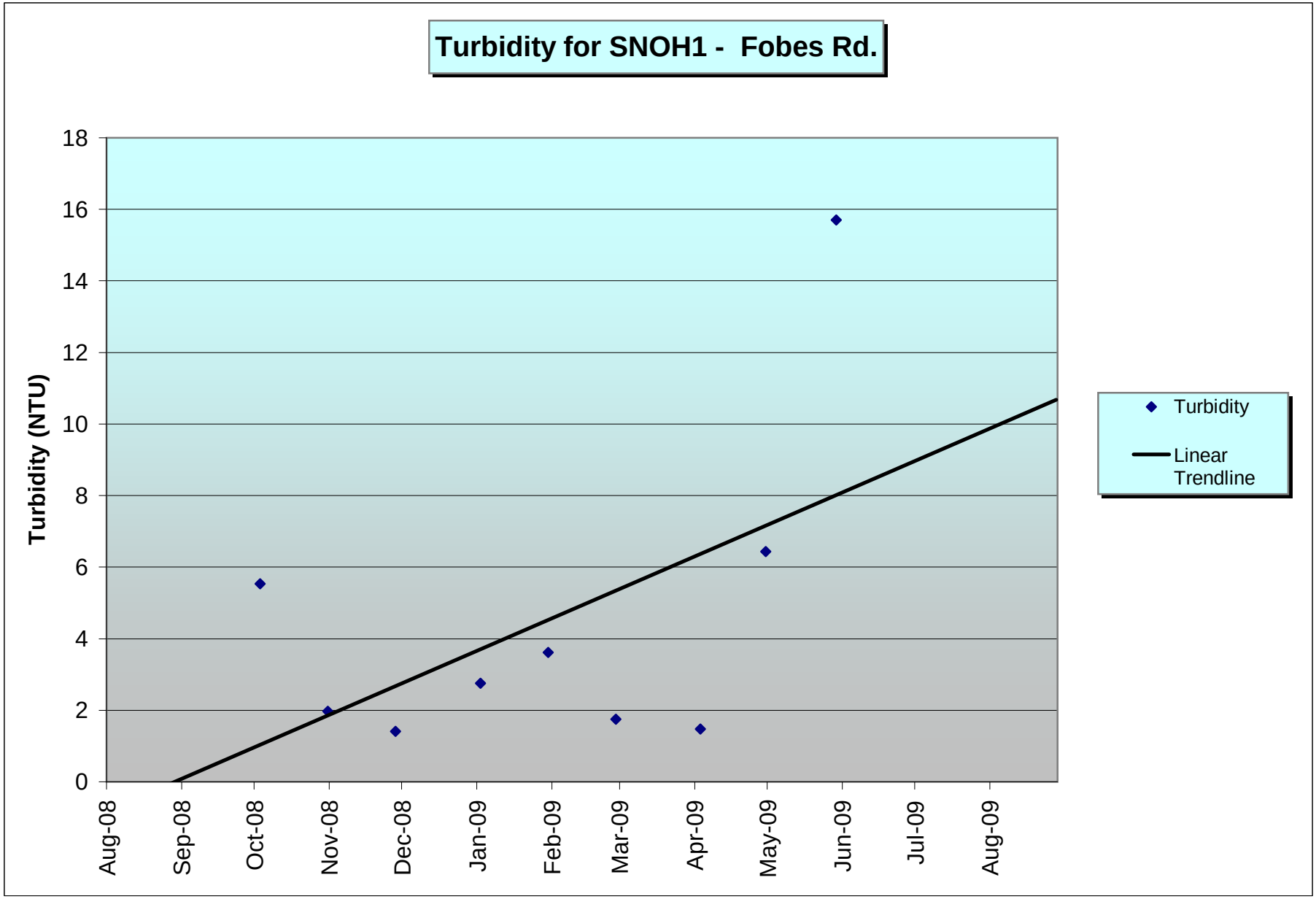

Conductivity for SNOH9 - North of Riverview
Conductivity (mg/L)
250
200
150
100
50
0
Aug-08
Oct-08
Dec-08
Feb-09
Apr-09
Jun-09
Aug-09
Oct-09
Dec-09
Feb-10
Apr-10
Jun-10
Aug-10
Oct-10
Dec-10
Conductivity
Linear Trendline

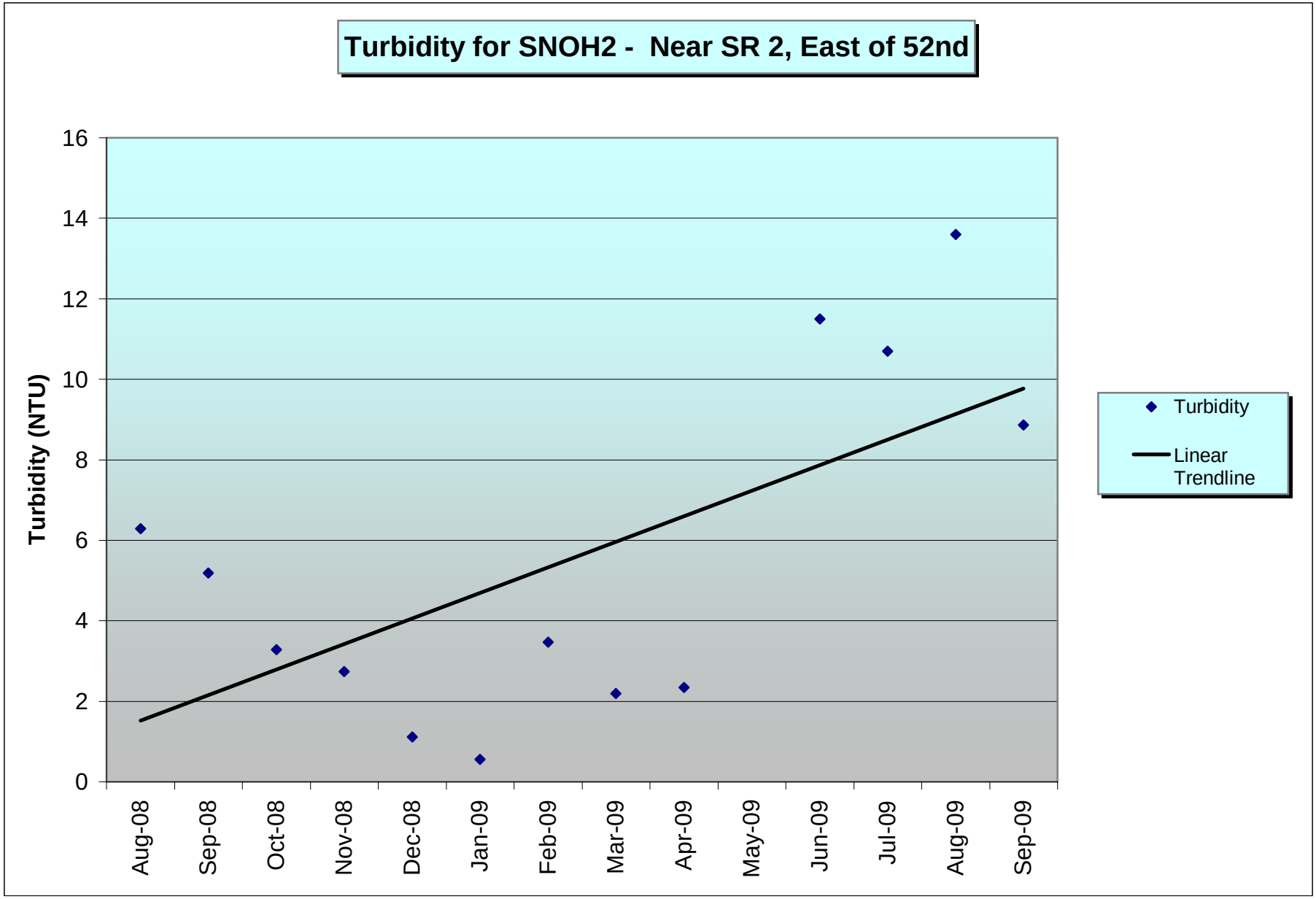

Conductivity for SNOH10 - South End of Lakecrest Dr.
Conductivity (mg/L)
250
200
150
100
50
0
Aug-08
Oct-08
Dec-08
Feb-09
Apr-09
Jun-09
Aug-09
Oct-09
Dec-09
Feb-10
Apr-10
Jun-10
Aug-10
Oct-10
Dec-10
Conductivity
Linear Trendline

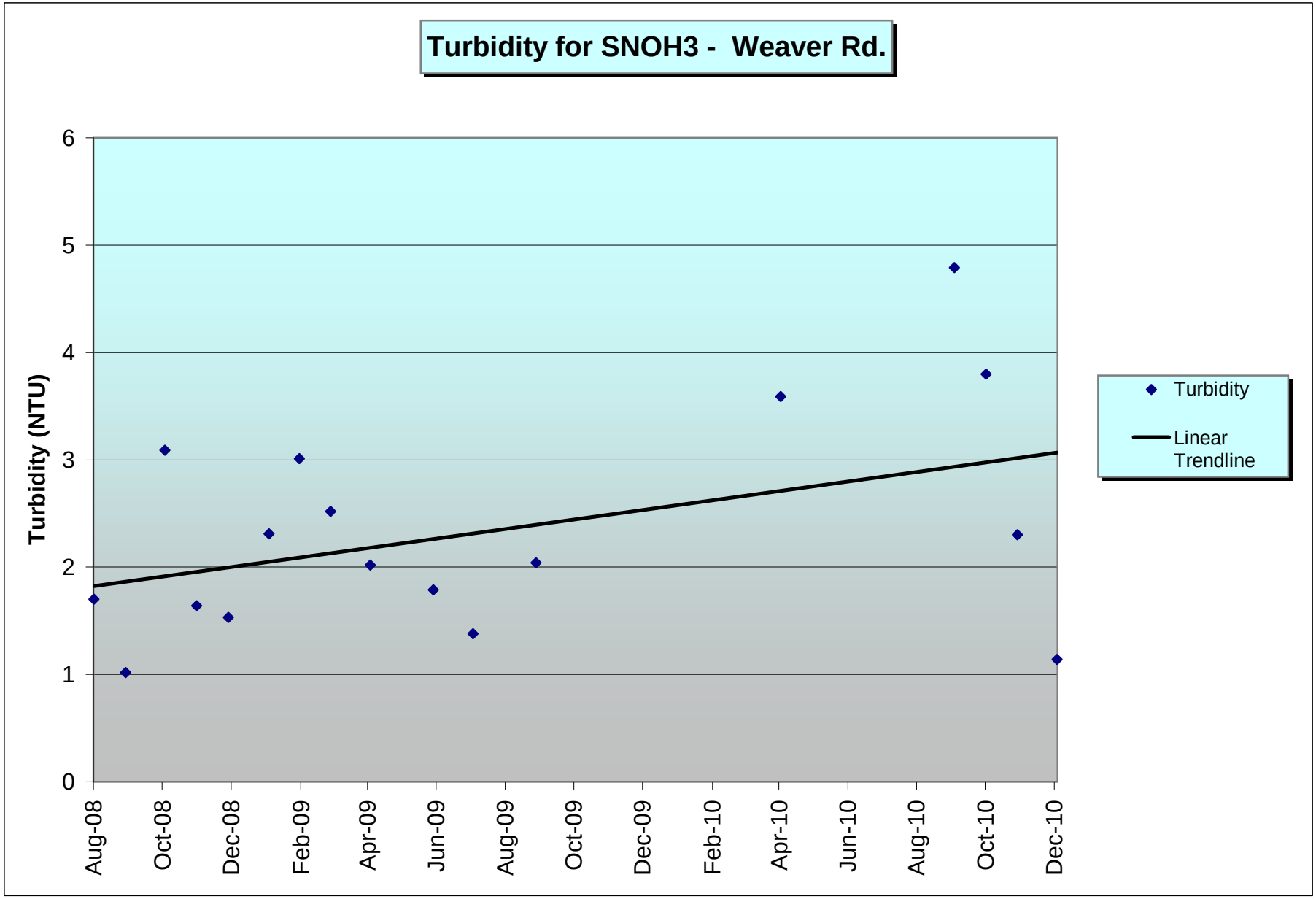

Conductivity for SNOH11 - Upper Swifty Creek
Conductivity (mg/L)
200
180
160
140
120
100
80
60
40
20
0
Sep-10
Oct-10
Nov-10
Dec-10
Conductivity
Linear Trendline

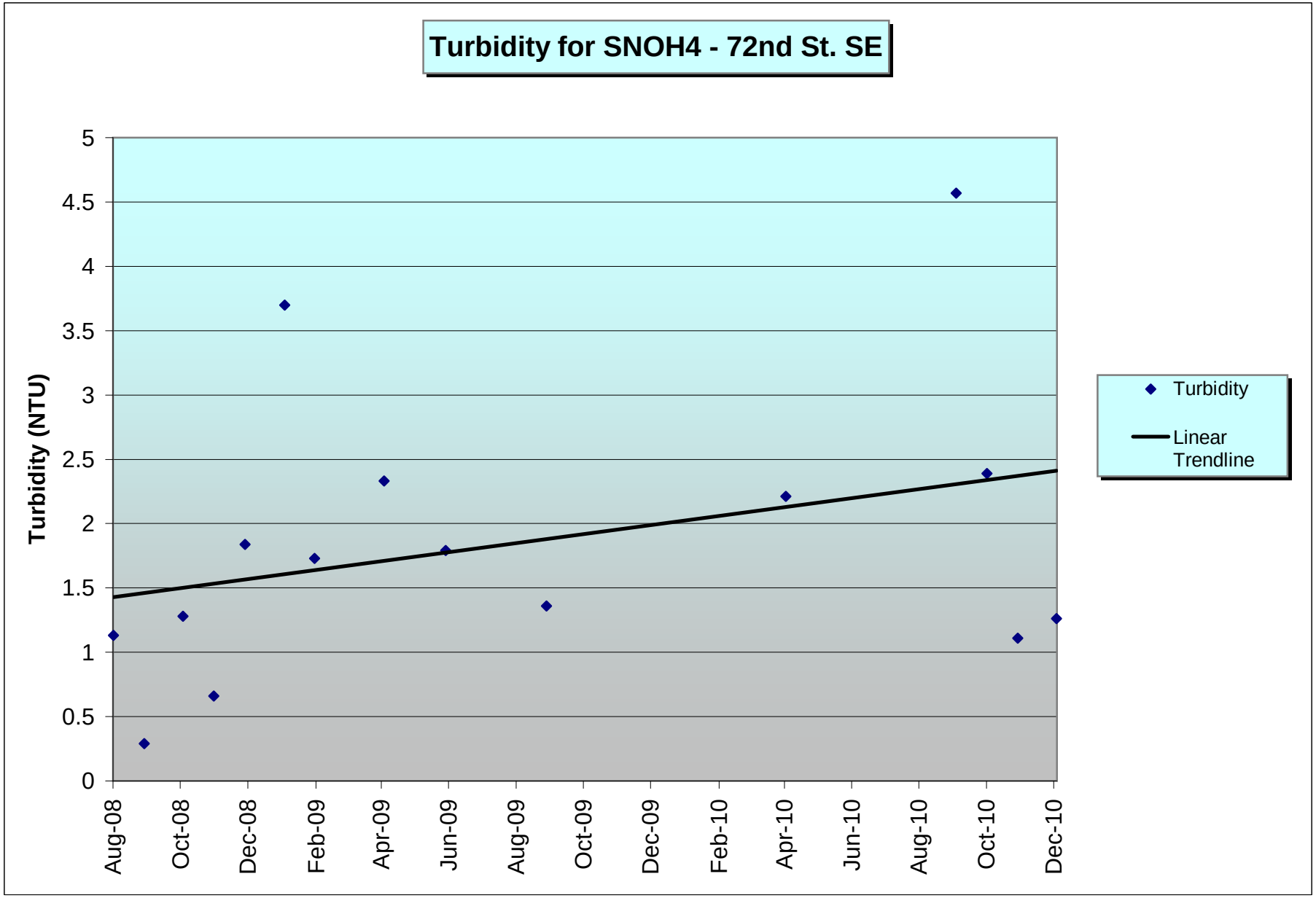

Conductivity for SNOH12 - Lower Swifty Creek
Conductivity (mg/L)
180
160
140
120
100
80
60
40
20
0
Sep-10
Oct-10
Nov-10
Dec-10
Conductivity
Linear Trendline

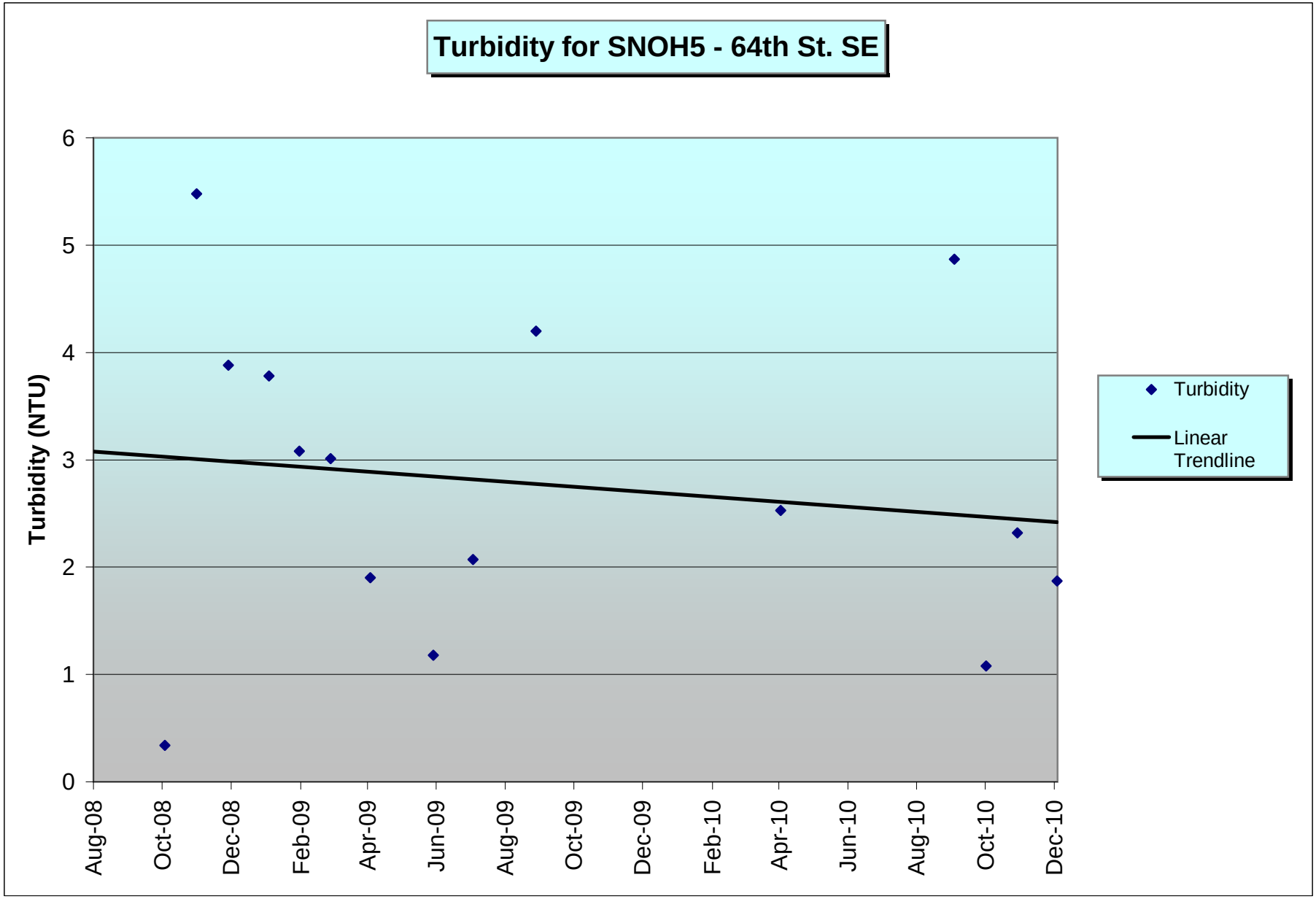
Turbidity Graphs (2008-2010)

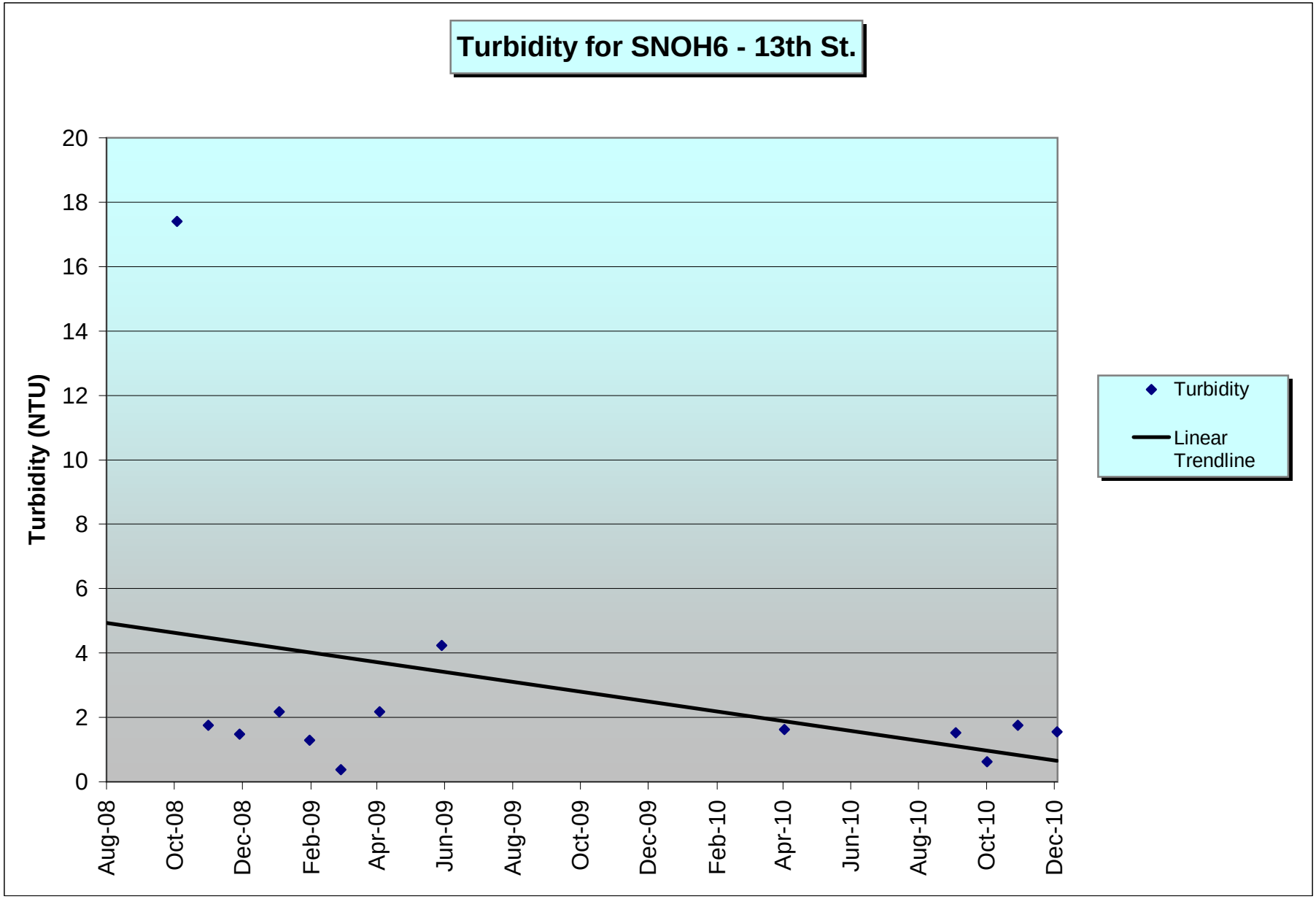

Turbidity for SNOH1 - Fobes Rd.
Turbidity (NTU)
0
2
4
6
8
10
12
14
16
18
Aug-08
Sep-08
Oct-08
Nov-08
Dec-08
Jan-09
Feb-09
Mar-09
Apr-09
May-09
Jun-09
Jul-09
Aug-09
Turbidity
Linear Trendline

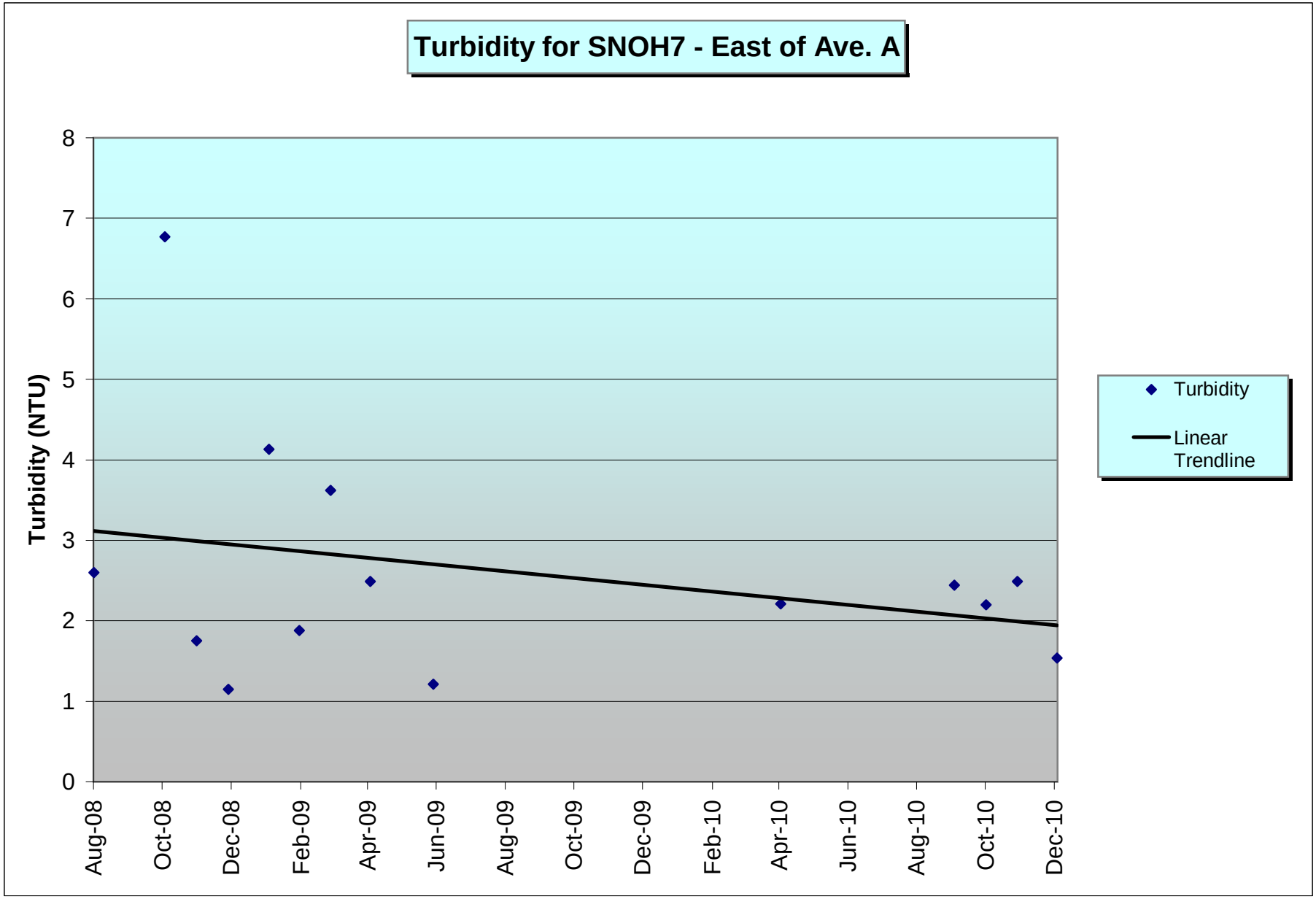

Turbidity for SNOH2 - Near SR 2, East of 52nd
Turbidity (NTU)
16
14
12
10
8
6
4
2
0
Aug-08
Sep-08
Oct-08
Nov-08
Dec-08
Jan-09
Feb-09
Mar-09
Apr-09
May-09
Jun-09
Jul-09
Aug-09
Sep-09
Turbidity
Linear Trendline

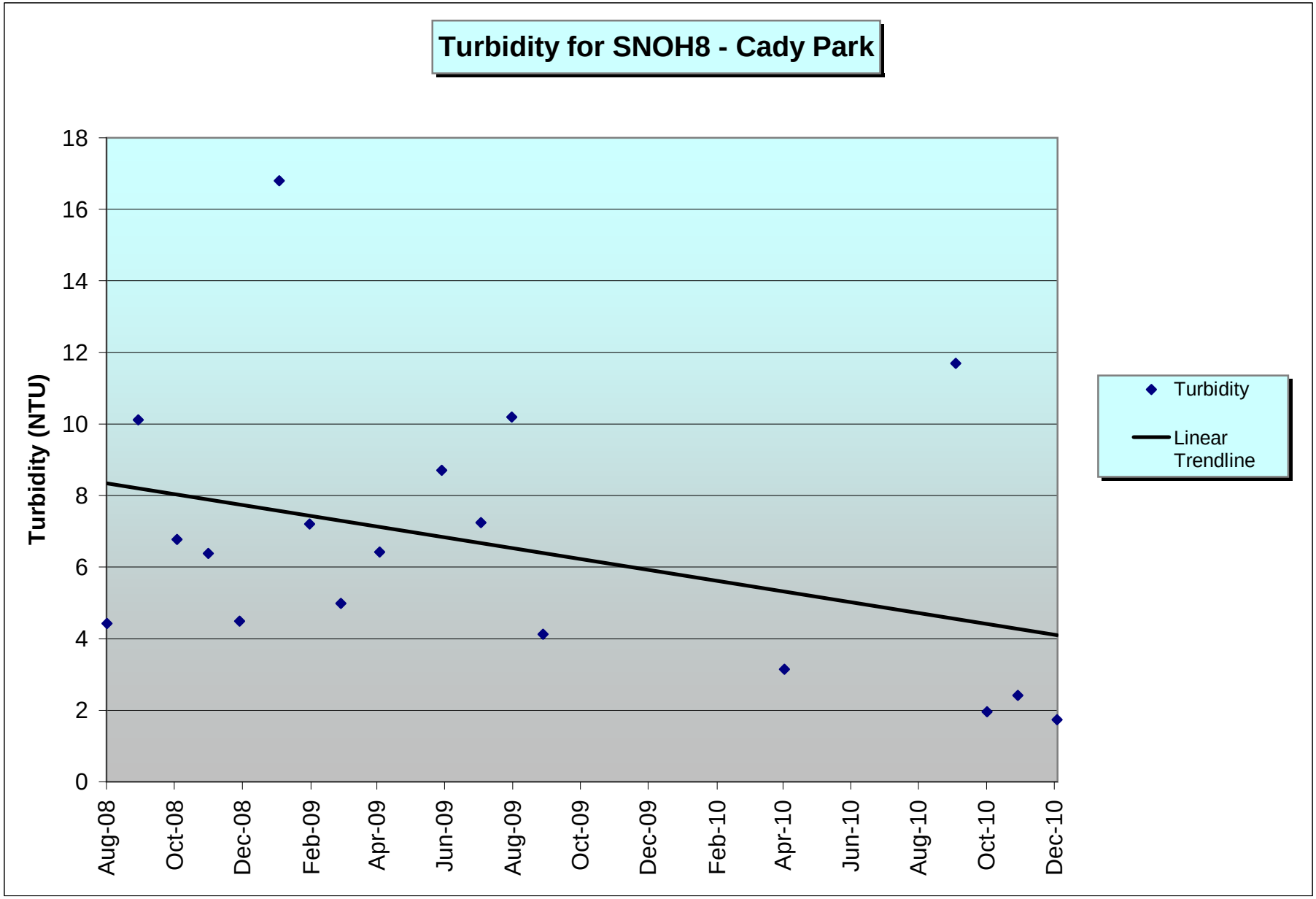

Turbidity for SNOH3 - Weaver Rd.
Turbidity (NTU)
0
1
2
3
4
5
6
Aug-08
Oct-08
Dec-08
Feb-09
Apr-09
Jun-09
Aug-09
Oct-09
Dec-09
Feb-10
Apr-10
Jun-10
Aug-10
Oct-10
Dec-10
Turbidity
Linear Trendline

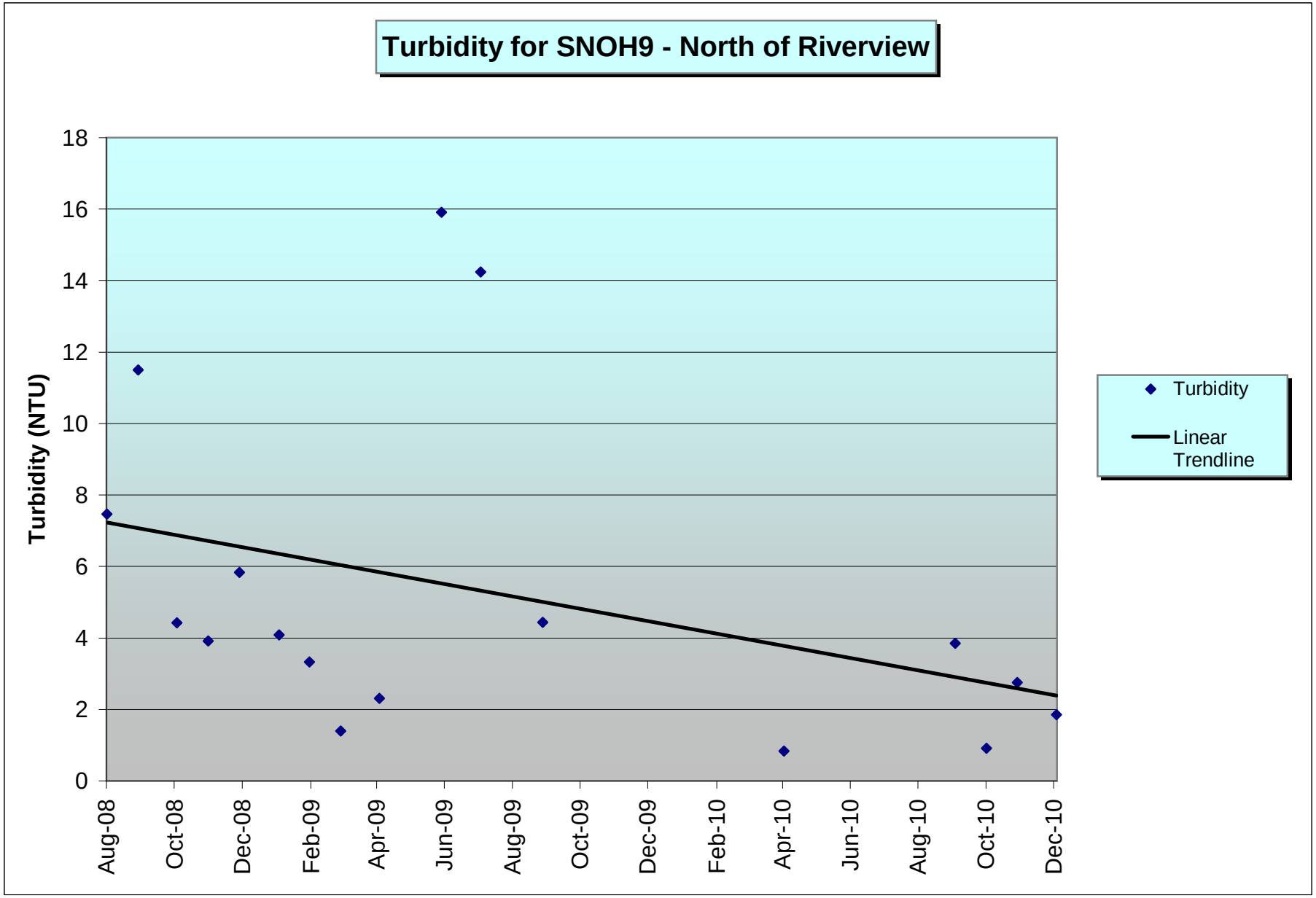

Turbidity for SNOH4 - 72nd St. SE
Turbidity (NTU)
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
Aug-08
Oct-08
Dec-08
Feb-09
Apr-09
Jun-09
Aug-09
Oct-09
Dec-09
Feb-10
Apr-10
Jun-10
Aug-10
Oct-10
Dec-10
Turbidity
Linear Trendline

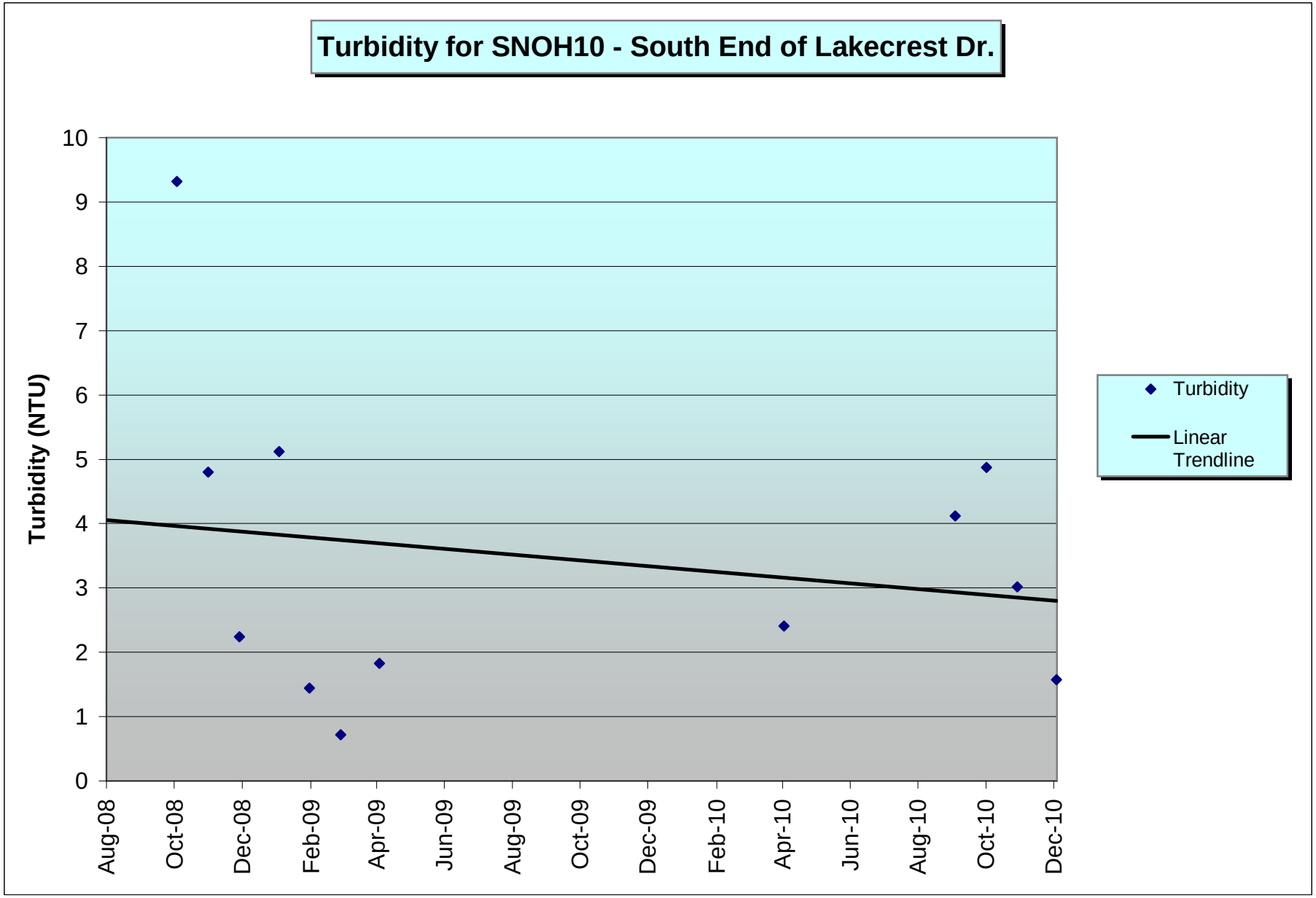

Turbidity for SNOH5 - 64th St. SE
Turbidity (NTU)
0
1
2
3
4
5
6
Aug-08
Oct-08
Dec-08
Feb-09
Apr-09
Jun-09
Aug-09
Oct-09
Dec-09
Feb-10
Apr-10
Jun-10
Aug-10
Oct-10
Dec-10
Turbidity
Linear Trendline

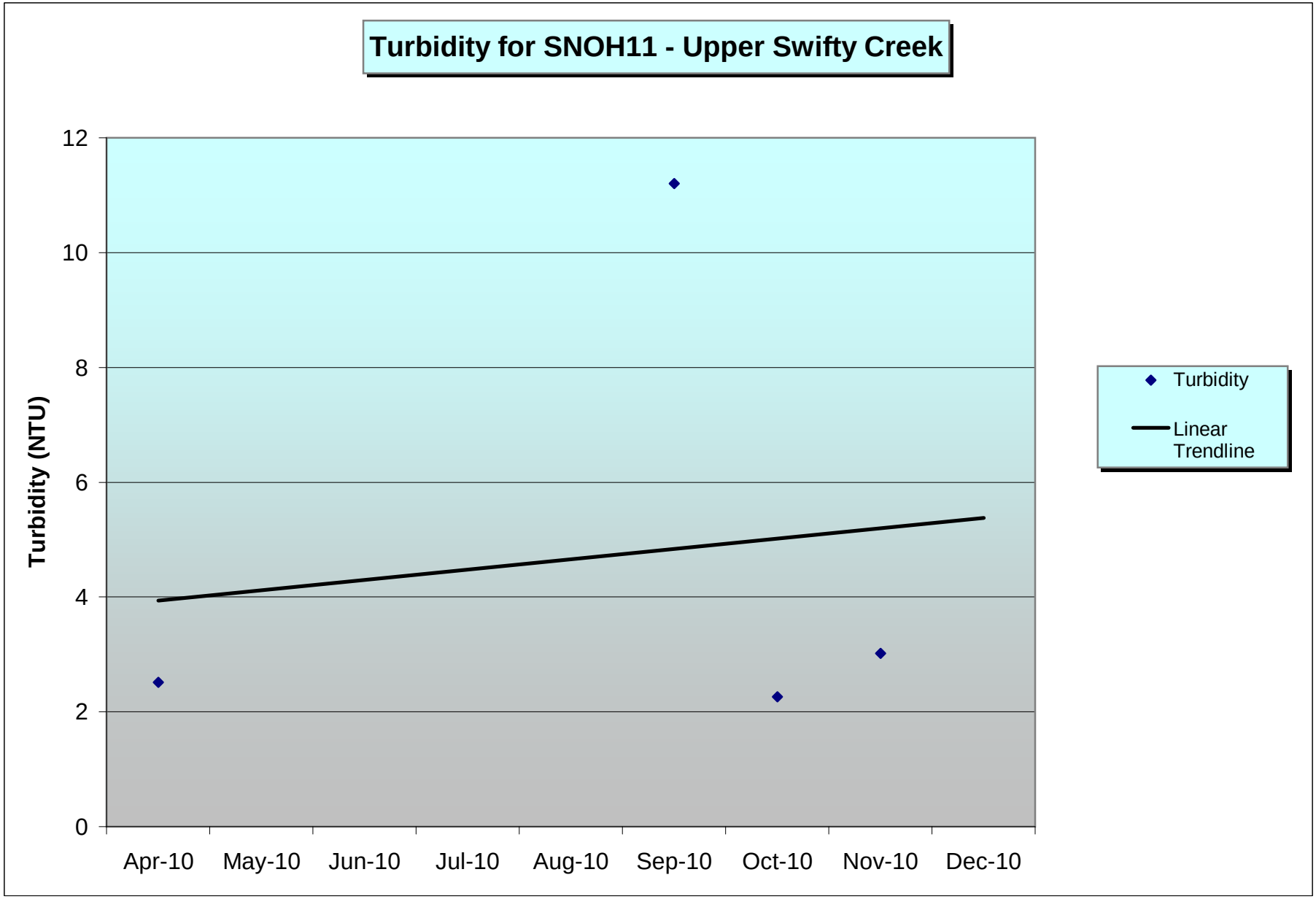

Turbidity for SNOH6 - 13th St.
Turbidity (NTU)
20
18
16
14
12
10
8
6
4
2
0
Aug-08
Oct-08
Dec-08
Feb-09
Apr-09
Jun-09
Aug-09
Oct-09
Dec-09
Feb-10
Apr-10
Jun-10
Aug-10
Oct-10
Dec-10
Turbidity
Linear Trendline

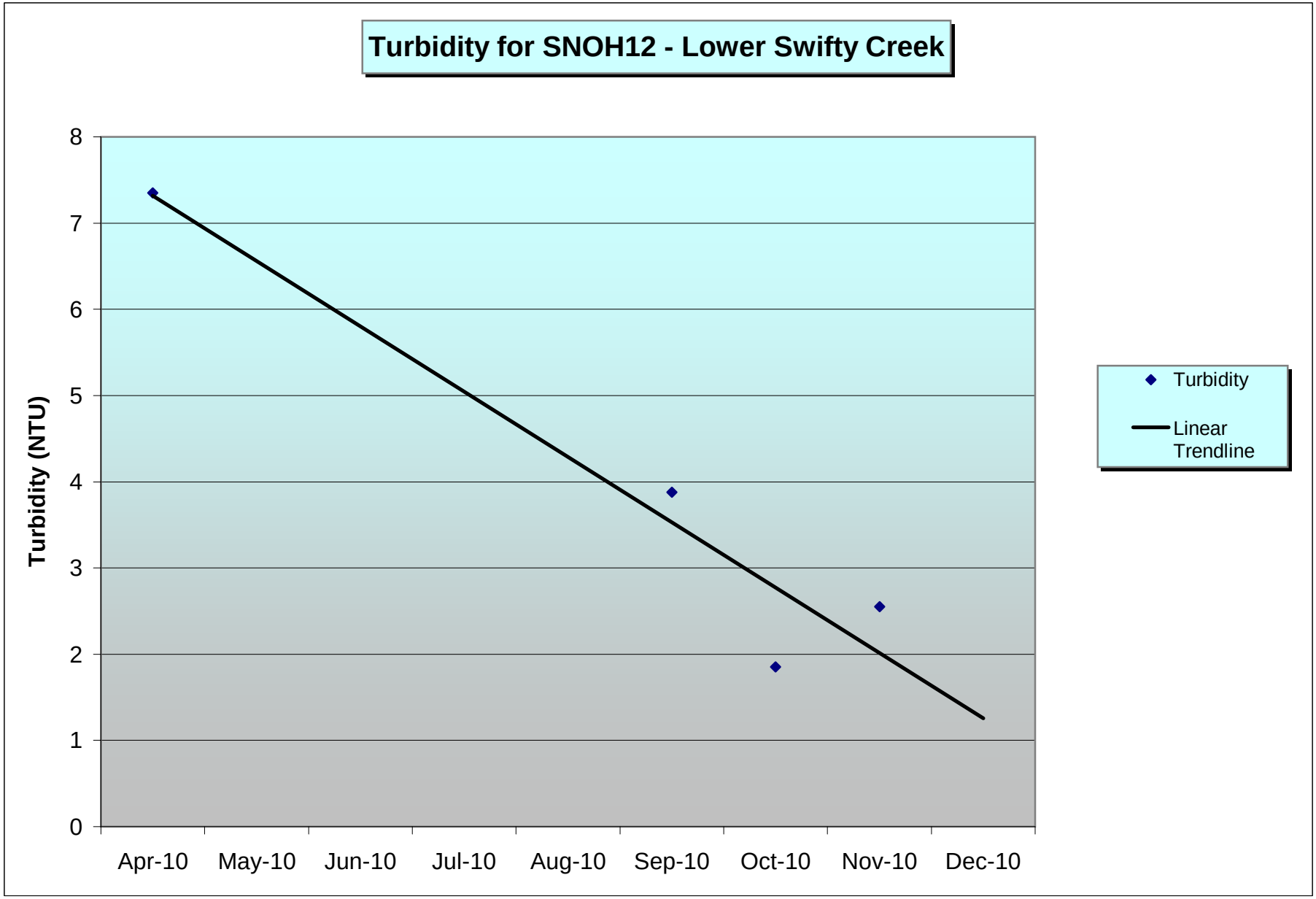

Turbidity for SNOH7 - East of Ave. A
Turbidity (NTU)
0
1
2
3
4
5
6
7
8
Aug-08
Oct-08
Dec-08
Feb-09
Apr-09
Jun-09
Aug-09
Oct-09
Dec-09
Feb-10
Apr-10
Jun-10
Aug-10
Oct-10
Dec-10
Turbidity
Linear Trendline


Turbidity for SNOH8 - Cady Park
Turbidity (NTU)
18
16
14
12
10
8
6
4
2
0
Aug-08
Oct-08
Dec-08
Feb-09
Apr-09
Jun-09
Aug-09
Oct-09
Dec-09
Feb-10
Apr-10
Jun-10
Aug-10
Oct-10
Dec-10
Turbidity
Linear Trendline


Turbidity for SNOH9 - North of Riverview
Turbidity (NTU)
18
16
14
12
10
8
6
4
2
0
Aug-08
Oct-08
Dec-08
Feb-09
Apr-09
Jun-09
Aug-09
Oct-09
Dec-09
Feb-10
Apr-10
Jun-10
Aug-10
Oct-10
Dec-10
Turbidity
Linear Trendline


Turbidity for SNOH10 - South End of Lakecrest Dr.
Turbidity (NTU)
10
9
8
7
6
5
4
3
2
1
0
Aug-08
Oct-08
Dec-08
Feb-09
Apr-09
Jun-09
Aug-09
Oct-09
Dec-09
Feb-10
Apr-10
Jun-10
Aug-10
Oct-10
Dec-10
Turbidity
Linear Trendline


Turbidity for SNOH11 - Upper Swifty Creek
Turbidity (NTU)
12
10
8
6
4
2
0
Apr-10
May-10
Jun-10
Jul-10
Aug-10
Sep-10
Oct-10
Nov-10
Dec-10
Turbidity
Linear Trendline


Turbidity for SNOH12 - Lower Swifty Creek
Turbidity (NTU)
8
7
6
5
4
3
2
1
0
Apr-10
May-10
Jun-10
Jul-10
Aug-10
Sep-10
Oct-10
Nov-10
Dec-10
Turbidity
Linear Trendline

Appendix B
Raw Data

City of Snohomish

Fecal Coliform Monitoring Results [1]

2008	SNOH 1	SNOH2	SNOH3	SNOH4	SNOH5	SNOH6	SNOH7	SNOH8[2]	SNOH9	SNOH10		
3/18/2008	26E	2E	18E	14E	6E	6E	380E	10E	40	24E		
4/15/2008	30E	10E	62	94	8E	14E	70	220	72E	6E		
5/202008	52	20E	58	110	52	TNTC	450E	TNTC	180	120		
6/26/2008	400E	12E	230	28E	30E	170	260E	490	380E	42		
7/24/2008	400E	42	220	24E	140	NS	NS	160	36E	NS		
8/19/2008	NS	23E	100E	110E	NS	NS	1100E	330	30E	NS		
9/16/2008	NS	5E	72E	12E	NS	NS	NS	190E	18E	NS		
10/21/2008	430E	100	103	66	10E	2200E	NS	100	14E	50		
11/18/2008	76	ND	28E	12E	16E	220	120	18E	26E	90		
12/16/2008	100	12E	270	88	2E	200	230	540	48E	38E		
Annual Avg Mean	189	25	116	56	33	1830	373	1206	84	53		
Geometric Mean	110	14	84	39	16	**202**	**266**	**201**	48	38		
State Geomean Standard	100	100	100	100	50	100	100	100	100	50	100	100
Meet State Geomean Std?	**No**	Yes	Yes	Yes	Yes	**No**	**No**	**No**	Yes	Yes		
10% sampled>State Std of 200 (or 100 in lake or	**Yes**	No	**Yes**	No	**Yes**	**Yes**	**Yes**	**Yes**	No	No		

1. Units are colonies/100mL; E = Estimated Count; NS = Not Sampled (dry, low flow, etc.); ND = Non Detect; TNTC = Too numerous to count; ( ) = Duplicate Sample

2. The SNOH8 site at Cady Park is sampled at the outfall of a pipe but 100 colonies/100mL is listed as the State Standard for this site due to its close proximity to the Snohomish River.

City of Snohomish

Fecal Coliform Monitoring Results [1]

2009	SNOH 1	SNOH2	SNOH3	SNOH4	SNOH5	SNOH6	SNOH7	SNOH8[2]	SNOH9	SNOH10		
1/20/2009	<2	<2	2 E	8 E	2 E	26 E	32	14 E	4E	42		
2/17/2009	12 E	<2	<2	18 E	<2	30 E	520 E	<2	30 E	16 E		
3/17/2009	75	3 E	20 E	78	13 E	15 E	110 E	28 E	20 E	270		
4/21/2009	56	26E	4E	22E	4E	12E	70	26E	60	40		
5/19/2009	1200E	46	350E	780E	380E	410E	800E	1100E	160	250E		
6/16/2009	35E	18E	570	50	35E	70	140	480	100	NS		
7/21/2009	NS	10E	98	NS	88	NS	NS	1860E	210	NS		
8/18/2009	NS	33E	NS	NS	NS	NS	NS	1000	30E	NS		
9/15/2009	NS	8E	68	95	5E	NS	NS	240	48E	NS		
10/20/2009	25E	8E	83	75	28E	190	550	200	13E	470		
11/24/2009	470	93	200	250	120	190	530	4200	160	130		
12/18/2009	470	3	360	1100	250	12	620	550	390	260		
Annual Avg Mean	260	21	160	248	84	106	375	808	102	185		
Geometric Mean	61	9	44	85	22	49	**240**	**179**	54	114		
State Geomean Standard	100	100	100	100	50	100	100	100	100	50	100	100
Meet State Geomean Std?	Yes	Yes	Yes	Yes	Yes	Yes	**No**	**No**	Yes	**No**		
10% sampled>State Std of 200 (or 100 in lake or above)?	**Yes**	No	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**		

1. Units are colonies/100mL; E = Estimated Count; NS = Not Sampled (dry, low flow, etc.); ND = Non Detect; TNTC = Too numerous to count; ( ) = Duplicate Sample

2. The SNOH8 site at Cady Park is sampled at the outfall of a pipe but 100 colonies/100mL is listed as the State Standard for this site due to its close proximity to the Snohomish River.

City of Snohomish

Fecal Coliform Monitoring Results [1]

2010	SNOH 1	SNOH2	SNOH3	SNOH4	SNOH5	SNOH6	SNOH7	SNOH8[2]	SNOH9	SNOH10	SNOH11	SNOH12
1/27/2010	18	23	3	18	8	35	130	190	93	30		
2/16/2010	250	18 E	68	100	45 E	63	150 E	720 E	48 E	38 E		
3/16/2010	20 E	6 E	28 E	50	8 E	4 E	30 E	60	24 E	300 E		
4/20/2010			34 E	110	18 E	62	84	78	62	20 E	70	<2
5/21/2010			3300 E	260 E	38 E	34 E	300 E	120	180	3100 E	410 E	270 E
6/15/2010			260	110	23 E	58	83	83	<3	83	80	10 E
7/20/2010			220	10 E	28 E	30 E	400	250	230		350	
8/17/2010			310 E	3000 E	2 E	120	308 E	220	32 E		12 E	280 E
9/21/2010			410	730 E	520	290	470	100 E	670 E	670 E	10 E	190
10/19/2010			23 E	25 E	8 E	25 E	190	300	23 E	18 E	3 E	340
11/23/2010			15 E	13 E	30 E	58	40 E	63	8 E	33 E	130	140
12/21/2010			28 E	35 E	5 E	5 E	15 E	13 E	8 E	3 E		
Annual Avg Mean	96	16	392	372	61	65	183	183	115	430	133	176
Geometric Mean	45	14	77	80	18	38	119	**120**	40	68	50	68
State Geomean Standard	100	100	100	100	50	100	100	100	100	50	100	100
Meet State Geomean Std?	Yes	Yes	Yes	Yes	Yes	Yes	**No**	**No**	Yes	**No**	Yes	Yes
10% sampled>State Std of 200 (or 100 in lake or above)?	**Yes**	No	**Yes**	**Yes**	**Yes**	No	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**

1. Units are colonies/100mL; E = Estimated Count; NS = Not Sampled (dry, low flow, etc.); ND = Non Detect; TNTC = Too numerous to count; ( ) = Duplicate Sample

2. The SNOH8 site at Cady Park is sampled at the outfall of a pipe but 100 colonies/100mL is listed as the State Standard for this site due to its close proximity to the Snohomish River.

City of Snohomish

Fecal Coliform Monitoring Results [1]

2011	SNOH 1	SNOH2	SNOH3	SNOH4	SNOH5	SNOH6	SNOH7	SNOH8[2]	SNOH9	SNOH10	SNOH11	SNOH12
1/27/2011			30E	15E	3E	98	60	30E	95	3E		
2/25/2011			15E	12E	160E	5E	10E	8E	18E	230		12E
3/1/20111												
4/1/20111												
5/1/2011												
6/21/2011			130	50	<2	90	53	110		8E		
7/19/2011			93	40E	63	240	140	18E		4E		
8/16/2011			85	40E	16E	55	110	8E		55E		
9/20/2011			370	78	470	120		4500E				
10/18/2011			24E	140	14E	8E		60				
11/21/2011			6E	28E	12E	140	730E	90		80		
12/1/2011												
Annual Avg Mean			94	50	105	95	184	603		63		
Geometric Mean			47	38	32	55	84	56		21		
State Geomean Std	100	100	100	100	50	100	100	100	100	50	100	100
Meet State Geomean Std?			Yes	Yes	Yes	Yes	Yes	Yes		Yes		
10% sampled>State Std of 200 (or 100 in lake or above)?			**Yes**	No	**Yes**	**Yes**	**Yes**	**Yes**		**Yes**		

1. Units are colonies/100mL; E = Estimated Count; NS = Not Sampled (dry, low flow, etc.); ND = Non Detect; TNTC = Too numerous to count; ( ) = Duplicate Sample
2. The SNOH8 site at Cady Park is sampled at the outfall of a pipe but 100 colonies/100mL is listed as the State Standard for this site due to its close proximity to the Snohomish River.

City of Snohomish

Fecal Coliform Monitoring Results [1]

2012	SNOH 1	SNOH2	SNOH3	SNOH4	SNOH5	SNOH6	SNOH7	SNOH8[2]	SNOH9	SNOH10	SNOH11	SNOH12
1/24/2012				12E	16E	60	80	70		8E		
2/22/2012			480	370		350	380			58		
3/20/2012			6E	16E	8E	8E	50E	38E		8E		
4/17/2012			130	38E	4E	14E	30E	42E		75		
5/15/2012			22E	8E	12E	30E	48E	12E		16E		
6/1/2012												
7/25/2012			63	78	2E	140	110	24E		24E		
8/1/2012								110				
9/27/2012			10E	100	2E							
10/17/2012			250	260	660E	280	490	480				
11/21/2011			60	68	14E	110	130	55		16E		
12/1/2011			75	40E	10E	110	170	28E		8E		
Annual Avg Mean			122	99	81	122	165	95		27		
Geometric Mean			56	51	11	69	111	52		18		
State Geomean Std	100	100	100	100	50	100	100	100	100	50	100	100
Meet State Geomean Std?			Yes	Yes	Yes	Yes	**No**	Yes		Yes		
10% sampled>State Std of 200 (or 100 in lake or above)?			**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**		No		

1. Units are colonies/100mL; E = Estimated Count; NS = Not Sampled (dry, low flow, etc.); ND = Non Detect; TNTC = Too numerous to count; ( ) = Duplicate Sample
2. The SNOH8 site at Cady Park is sampled at the outfall of a pipe but 100 colonies/100mL is listed as the State Standard for this site due to its close proximity to the Snohomish River.

City of Snohomish

Fecal Coliform Monitoring Results [1]

2013	SNOH 1	SNOH2	SNOH3	SNOH4	SNOH5	SNOH6	SNOH7	SNOH8[2]	SNOH9	SNOH10	SNOH11	SNOH12
2/19/2013			80	28E	8E	22E	55	6E		8E		
3/19/2013			10E	2E	130	30E	36E	58		4E		
4/16/2013			6E	12E	22E	4E	36E	14E		8E		
5/23/2013			88	250	350	2000E	85	660E		32E		
6/18/2013			58	52	<1	780E	58	180E		36E		
7/16/2013			100	120	150	150	98	46E				
9/4/2013				670E	570	360		230				
9/17/2013			120	140	550		760E	140				
10/16/2013			65	24E	6E	50	160	8E		16E		
12/17/2013			48E	22E	16E	34E	68	24E		4E		
Annual Avg Mean			64	132	180	381	151	137		15		
Geometric Mean			46	47	45	90	87	53		11		
State Geomean Standard	100	100	100	100	50	100	100	100	100	50	100	100
Meet State Geomean Std?			Yes	Yes	Yes	Yes	Yes	Yes		Yes		
10% sampled>State Std of 200 (or 100 in lake or above)?			No	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**		No		

1. Units are colonies/100mL; E = Estimated Count; NS = Not Sampled (dry, low flow, etc.); ND = Non Detect; TNTC = Too numerous to count; ( ) = Duplicate Sample
2. The SNOH8 site at Cady Park is sampled at the outfall of a pipe but 100 colonies/100mL is listed as the State Standard for this site due to its close proximity to the Snohomish River.

City of Snohomish

Fecal Coliform Monitoring Results [1]

2014	SNOH 1	SNOH2	SNOH3	SNOH4	SNOH5	SNOH6	SNOH7	SNOH8[2]	SNOH9	SNOH10	SNOH11	SNOH12
1/22/2014			2E	30E	2E	12E	24E	<2		<2		
2/19/2014			10E	12E	2E	14E	10E	12E		<2		
3/18/2014			6E	130	<2	12E	12E	58		<2		
4/15/2014			160	360	<2	88	34E	130		10E		
5/30/2014			24	130	6E	63	90	12E		14E		
7/29/2014			100	120		90		600				
8/22/2014			120	1200E		220		20E				
9/30/2014			120		130	690	640	390				
Annual Avg Mean			60	283	3	71	34	119		6		
Geometric Mean			25	118	2	42	24	31		4		
State Geomean Standard	100	100	100	100	50	100	100	100	100	50	100	100
Meet State Geomean Std?			Yes	Yes	Yes	Yes	Yes	Yes		Yes		
10% sampled>State Std of 200 (or 100 in lake or above)?			No	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**		**Yes**		

1. Units are colonies/100mL; E = Estimated Count; NS = Not Sampled (dry, low flow, etc.); ND = Non Detect; TNTC = Too numerous to count; ( ) = Duplicate Sample
2. The SNOH8 site at Cady Park is sampled at the outfall of a pipe but 100 colonies/100mL is listed as the State Standard for this site due to its close proximity to the Snohomish River.

City of Snohomish

Fecal Coliform Monitoring Results [1]

2015	SNOH 1	SNOH2	SNOH3	SNOH4	SNOH5	SNOH6	SNOH7	SNOH8[2]	SNOH9	SNOH10	SNOH11	SNOH12
1/20/2015			2	6	6	12	24	22				
2/24/2015			2	2	6	42	18	2				
3/19/2015			43	27	4	60	74	44				
4/29/2015			34	42	12	80	110	63				
5/19/2015			52	53	2	150	570	130				
6/16/2015			110	110	2	75		34				
7/23/2015			120		4	6		16				
8/20/2015			520		4	210		44				
9/24/2015			22	20	2	53		12				
10/29/2015			95	88	150	490	270	610				
11/30/2015			4	2	6	440	620	180				
12/16/2015			12	12	2	150	150	8				
Annual Avg Mean			85	36	17	147	230	97				
Geometric Mean			28	18	5	79	122	35				
State Std			100	100	50	100	100	100				
Meet State Std?			Yes	Yes	Yes	Yes	No	Yes		Yes		
10% sampled>State Std of 200 (or 100 in River)?			No	No	No	**Yes**	**Yes**	**Yes**		No		

1. Units are colonies/100mL; E = Estimated Count; NS = Not Sampled (dry, low flow, etc.); ND = Non Detect; TNTC = Too numerous to count; ( ) = Duplicate Sample

2. The SNOH8 site at Cady Park is sampled at the outfall of a pipe but 100 colonies/100mL is listed as the State Standard for this site due to its close proximity to the Snohomish River.

City of Snohomish

Fecal Coliform Monitoring Results[1]

2016	SNOH 1	SNOH2	SNOH3	SNOH4	SNOH5	SNOH6	SNOH7	SNOH8[2]	SNOH9	SNOH10	SNOH11	SNOH12
1/22/2016			70	68	20	65	48	105				
2/17/2016			12	28	18	110	80	NS				
3/16/2016			68	65	20	46	24	2				
4/20/2016												
5/18/2016			4	18	6	22	34	26				
6/1/2016												
7/20/2016			38	60	2	NS	NS	68				
8/22/2016			140	NS	4	63	NS	38				
9/26/2016												
10/17/2016			65	82	720	730	880	120				
11/14/2016			260	70	26	1100	390	270				
12/19/2016			42	26	12	480	490	2				
Annual Avg Mean			78	52	92	327	278	79				
Geometric Mean			46	46	16	143	127	31				
State Std			100	100	50	100	100	100				
Meet State Std?			Yes	Yes	Yes	**No**	**No**	Yes		Yes		
10% sampled>State Std of 200 (or 100 in River)?			No	No	No	**Yes**	**Yes**	No		No		

1. Units are colonies/100mL; E = Estimated Count; NS = Not Sampled (dry, low flow, etc.); ND = Non Detect; TNTC = Too numerous to count; ( ) = Duplicate Sample
2. The SNOH8 site at Cady Park is sampled at the outfall of a pipe but 100 colonies/100mL is listed as the State Standard for this site due to its close proximity to the Snohomish River.

City of Snohomish Expanded Parameters for Water Quality Monitoring

Sample Site	Date	Temp (°C)	pH	Conductivity(µ/cm)	DO (mg/L)	Turbidity (NTU)
SNOH1	8/19/2008					
SNOH2	8/19/2008	17.7	8.01	244.8		6.29
SNOH3	8/19/2008	16.1	8.02	309	6.9	1.7
SNOH4	8/19/2008	16	7.86	268.3	5.2	1.13
SNOH5	8/19/2008					
SNOH6	8/19/2008					
SNOH7	8/19/2008	17.5	8.26	74.2	7.1	2.6
SNOH8	8/19/2008	14.6	7.9	182.3	8.4	4.42
SNOH9	8/19/2008	18.8	7.47	183.3	2.5	7.47
SNOH10						
SNOH1	9/16/2008					
SNOH2	9/16/2008	12.8	8.03	220.1	3.3	5.19
SNOH3	9/16/2008	11.7	8.36	427	4.9	1.02
SNOH4	9/16/2008	12.5	7.79	273.4	4.9	0.29
SNOH5	9/16/2008					
SNOH6	9/16/2008					
SNOH7	9/16/2008					
SNOH8	9/16/2008	12.2	8.34	185.4	13	10.12
SNOH9	9/16/2008	13.2	7.76	173.6	2.1	11.5
SNOH10						
SNOH1	10/21/2008	8.1	7.7	243.5	5.5	5.54
SNOH2	10/21/2008	8.4	7.86	220.6	4.2	3.28
SNOH3	10/21/2008	7.5	7.96	189.7	6.6	3.09
SNOH4	10/21/2008	7.3	8.02	178.1	7	1.28
SNOH5	10/21/2008	9.4	7.46	113.8	6.1	0.34
SNOH6	10/21/2008	8.7	7.3	48.3	4.1	17.4
SNOH7	10/21/2008					6.77
SNOH8	10/21/2008	9.2	7.84	195.1	7.3	6.77
SNOH9	10/21/2008	9.1	7.62	163.7	3.6	4.42
SNOH10	10/21/2008	6.7	7.61	133.7	6.7	9.32
SNOH1	11/18/2008	10.6	7.4	192.7	4.7	1.97
SNOH2	11/18/2008	9	7.5	125.2	5	2.74
SNOH3	11/18/2008	9.6	7.71	209.5	6.3	1.64
SNOH4	11/18/2008	9.5	7.72	187.9	6.4	0.66
SNOH5	11/18/2008	9.5	7.6	121.4	6.3	5.48
SNOH6	11/18/2008	10.4	7.8	99	5.2	1.75
SNOH7	11/18/2008	10.4	7.92	99.5	6.6	1.75
SNOH8	11/18/2008	10.3	7.86	149.3	6.4	6.38
SNOH9	11/18/2008	9.5	7.63	144.6	6.2	3.91
SNOH10	11/18/2008	9.7	7.53	125.3	5.2	4.8
SNOH1	12/16/2008	2.8	7.65	175.5	7.5	1.41
SNOH2	12/16/2008	1.2	8.89	124.3	8.4	1.11
SNOH3	12/16/2008	1.7	8.45	195.6	11.9	1.53
SNOH4	12/16/2008	0.9	9.47	179.3	9.4	1.84
SNOH5	12/16/2008	1.3	8.45	126	10.6	3.88
SNOH6	12/16/2008	1.3	8.23	132.3	11.3	1.48
SNOH7	12/16/2008	3.4	8.85	105.7	10.9	1.15

City of Snohomish Expanded Parameters for Water Quality Monitoring

Sample Site	Date	Temp (°C)	pH	Conductivity(µ/cm)	DO (mg/L)	Turbidity (NTU)
SNOH8	12/16/2008	4.5	8.32	139.5	8.8	4.49
SNOH9	12/16/2008	0.6	8.59	149.9	9.2	5.84
SNOH10	12/16/2008	3.7	9.22	103.6	7.2	2.24
SNOH1	1/20/2009	5	7.13	1133		2.76
SNOH2	1/21/2009	1.8	7.57	251.3		0.56
SNOH3	1/22/2009	1.2	7.61	200.6	9.3	2.31
SNOH4	1/23/2009	2.6	7.83	159.9		3.7
SNOH5	1/24/2009	2.3	7.74	124.6		3.78
SNOH6	1/25/2009	2.6	7.87	104.9	8.8	2.17
SNOH7	1/26/2009	2.8	8.06	104.2	9.5	4.13
SNOH8	1/27/2009	6.4	8.05	179.5	8.5	16.8
SNOH9	1/28/2009	1.4	8.03	153.5	8.6	4.08
SNOH10	1/29/2009	2.8	8.68	122.5	8.6	5.12
SNOH1	2/17/2009	5.2	8.05	188.5	0.2	3.62
SNOH2	2/17/2009	4.5	7.91	115.1	0.5	3.47
SNOH3	2/17/2009	4.6	8.07	231.1	0.6	3.01
SNOH4	2/17/2009	4.2	8.22	202.6	0.8	1.73
SNOH5	2/17/2009	4.4	8.05	128.1	1.5	3.08
SNOH6	2/17/2009	5	8.05	103.3	7.3	1.29
SNOH7	2/17/2009	5	8.14	104.5	8.4	1.88
SNOH8	2/17/2009	8.4	8.27	183.7	7.5	7.2
SNOH9	2/17/2009	5.3	8.08	161.2	7.3	3.33
SNOH10	2/17/2009	5.1	7.95	121.4	7.8	1.44
SNOH1	3/17/2009	6	8	235.1		1.75
SNOH2	3/17/2009	4.7	8.51	151.8		2.19
SNOH3	3/17/2009	4.8	8.57	217.4		2.52
SNOH4	3/17/2009					
SNOH5	3/17/2009	4.4	8.42	131.5		3.01
SNOH6	3/17/2009	6	8.22	101.1		0.38
SNOH7	3/17/2009	5.9	8.3	104.1		3.62
SNOH8	3/17/2009	7.9	8.13	182.8		4.99
SNOH9	3/17/2009	6.1	8.07	159.9		1.4
SNOH10	3/17/2009	4.7	8.29	127.9		0.72
SNOH1	4/21/2009	11.7	6.45		5.3	1.47
SNOH2	4/21/2009	15.6	7.54		5	2.34
SNOH3	4/21/2009	10.6	7.85		7.6	2.02
SNOH4	4/21/2009	11.3	7.81		7.5	2.33
SNOH5	4/21/2009	12.4	7.63		7	1.9
SNOH6	4/21/2009	15.6	7.9		6.8	2.18
SNOH7	4/21/2009	15.1	8.01		7	2.49
SNOH8	4/21/2009	13.5	7.76		7.2	6.42
SNOH9	4/21/2009	14.9	7.62		5.2	2.31
SNOH10	4/21/2009	12.6	7.65		6.6	1.83
SNOH1	5/18/2009	11.2	7.69	203.2		6.44
SNOH2	5/18/2009					
SNOH3	5/18/2009					
SNOH4	5/18/2009					

City of Snohomish Expanded Parameters for Water Quality Monitoring

Sample Site	Date	Temp (°C)	pH	Conductivity(µ/cm)	DO (mg/L)	Turbidity (NTU)
SNOH5	5/18/2009					
SNOH6	5/18/2009					
SNOH7	5/18/2009					
SNOH8	5/18/2009					
SNOH9	5/18/2009					
SNOH10						
SNOH1	6/16/2009	13.4	6.69	358		15.7
SNOH2	6/16/2009	16.7	7.03	0.27		11.5
SNOH3	6/16/2009	13.6	7.71	438		1.79
SNOH4	6/16/2009	14.5	7.45	247.2		3.21
SNOH5	6/16/2009	15.1	7.13	96.8		1.18
SNOH6	6/16/2009	16.4	7.14	102.6		4.24
SNOH7	6/16/2009	16.2	7.9	114.4		1.21
SNOH8	6/16/2009	14.7	7.7	183.4		8.7
SNOH9	6/16/2009	18.8	7.56	170.8		15.91
SNOH10						
SNOH1	7/21/2009					
SNOH2	7/21/2009	18.4	7.74	298		10.7
SNOH3	7/21/2009	14.1	7.53	387		1.38
SNOH4	7/21/2009					
SNOH5	7/21/2009	15.7	7.27	121.4		2.07
SNOH6	7/21/2009					
SNOH7	7/21/2009					
SNOH8	7/21/2009	15.1	7.78	174.4		7.24
SNOH9	7/21/2009					14.24
SNOH10						
SNOH1	8/18/2009					
SNOH2	8/18/2009	17.4	7.48	126.3		13.6
SNOH3	8/18/2009					
SNOH4	8/18/2009					
SNOH5	8/18/2009					
SNOH6	8/18/2009					
SNOH7	8/18/2009					
SNOH8	8/18/2009	15.6	7.21	198.4		10.2
SNOH9	8/18/2009					
SNOH10						
SNOH1	9/15/2009					
SNOH2	9/15/2009	15.4	7.01	384		8.86
SNOH3	9/15/2009	13.1	7.54	193		2.04
SNOH4	9/15/2009	15	7.04	357		1.36
SNOH5	9/15/2009	15.9	7.86	88.1		4.2
SNOH6	9/15/2009					
SNOH7	9/15/2009					
SNOH8	9/15/2009	14.8	7.51	187.5		4.13
SNOH9	9/15/2009	17.5	8.04	194.8		4.44
SNOH10						
SNOH3	4/20/2010	12	7.94	195.4		3.59

City of Snohomish Expanded Parameters for Water Quality Monitoring

Sample Site	Date	Temp (°C)	pH	Conductivity(µ/cm)	DO (mg/L)	Turbidity (NTU)
SNOH4	4/20/2010	12.2	7.65	187.6		2.21
SNOH5	4/20/2010	12.1	7.63	111.3		2.53
SNOH6	4/20/2010	12.5	7.54	102.8		1.63
SNOH7	4/20/2010					2.21
SNOH8	4/20/2010					3.14
SNOH9	4/20/2010					0.83
SNOH10	4/20/2010	15.2	7.63	9.64		2.41
SNOH11	4/20/2010					2.51
SNOH12	4/20/2010					7.35
SNOH3	9/21/2010	13.6	6.98	119		4.79
SNOH4	9/21/2010	13.1	7.15	60		4.57
SNOH5	9/21/2010	13.4	7.24	52		4.87
SNOH6	9/21/2010	16.5	7.07	46		1.53
SNOH7	9/21/2010	15.9	7.19	48		2.44
SNOH8	9/21/2010	16.1	6.95	24		11.7
SNOH9	9/21/2010	15.2	7.04	63		3.85
SNOH10	9/21/2010	13.9	7.1	53		4.12
SNOH11	9/21/2010	15.1	6.66	72		11.2
SNOH12	9/21/2010	17.1	6.91	21		3.88
SNOH3	10/19/2010	10.4	8.65	169.6	7.2	3.8
SNOH4	10/19/2010	9.6	8.52	188.7	7.2	2.39
SNOH5	10/19/2010	7.9	7.24	373	7.6	1.08
SNOH6	10/19/2010	6.9	7.76	150.1	7.4	0.63
SNOH7	10/19/2010	8.1	8.27	475	5.8	2.2
SNOH8	10/19/2010	10.5	8.72	107.7	4.3	1.96
SNOH9	10/19/2010	9.7	8.46	122.5	7.6	0.92
SNOH10	10/19/2010	9.7	8.96	232.8	7.3	4.87
SNOH11	10/19/2010	9.8	7.77	120.9	4.2	2.26
SNOH12	10/19/2010	7.9	8.56	151.1	5.8	1.85
SNOH3	11/16/2010	10.9	7.67	122.1	5	2.3
SNOH4	11/16/2010	11.9	7.61	176.4	5.7	1.11
SNOH5	11/16/2010	10.8	6.59	209.5	7.3	2.32
SNOH6	11/16/2010	10.4	7.91	152.2	7.3	1.75
SNOH7	11/16/2010	10.1	8.05	110.4	5	2.49
SNOH8	11/16/2010	10.3	8.23	113.8	5.1	2.42
SNOH9	11/16/2010	10.7	7.78	100.8	6.1	2.75
SNOH10	11/16/2010	10.5	7.67	124	6.8	3.76
SNOH11	11/16/2010	10.4	8.14	139.8	4.8	3.02
SNOH12	11/16/2010	10.8	7.74	98.3	5.2	2.55
SNOH3	12/21/2010	6.2	6.31	168.9	8	1.14
SNOH4	12/21/2010	6.4	7.57	157.1	7.5	1.26
SNOH5	12/21/2010	6	7.01	103.2	7.3	1.87
SNOH6	12/21/2010	6.4	7.33	96.7	7.4	1.55
SNOH7	12/21/2010	6.7	7.31	97.2	7.9	1.54
SNOH8	12/21/2010	6.7	7.02	121.1	7	1.73
SNOH9	12/21/2010	6.6	6.93	137.1	6.6	1.85
SNOH10	12/21/2010	6.8	7.21	107	7	1.57

City of Snohomish Expanded Parameters for Water Quality Monitoring

Sample Site	Date	Temp (°C)	pH	Conductivity(µ/cm)	DO (mg/L)	Turbidity (NTU)
SNOH11	12/21/2010	[Flooded - did not sample]				
SNOH12	12/21/2010	[Flooded - did not sample]				

City of Snohomish
TMDL Status Report
NPDES Phase II Permit Year 2016
(January – December 2016)

- The list of animal handling facilities was prepared in June 2015. Inspections of appropriate BMP practices within these facilities was conducted on June 22 and June 26, 2015. All veterinary clinics at that time had implemented appropriate BMPs. Per the current permit, the City will revisit these facilities along with any new facilities by August 1, 2018.

- The City continues to implement and uphold the measures and ordinances referenced in its 2010 Bacterial Pollution Control Plan.

- Per Appendix 2 of the Phase II Permit, the City has Ordinance 2173 in place which prohibits animal wastes into stormwater systems. The City also has pet waste stations located at parks within the city limits.

- The City continued to monitor for fecal coliform in seven locations on a monthly basis throughout the year. These sites are listed in Table 1.

TABLE 1
Snohomish Fecal Coliform Monitoring Sites

Station name	Site Description	Latitude/Longitude
SNOH3	Weaver Rd. (CMP)	N 47º56.279/ W 122º06.626
SNOH4	72nd St. SE, Near SR 9 (Concrete Box Culvert)	N 47º55.879/ W 122º06.409
SNOH5	64th St. S.E. (Concrete Pipe under Road)	N 47º56.306/ W 122º05.759
SNOH6	13th St., Near Ave. A	N 47º55.640/ W 122º05.581
SNOH7	E. of Ave. A, Near 8th St. in Park (CMP)	N 47º55.292/ W 122º05.559
SNOH8	Cady Park (CMP)	N 47º54.593/ W 122º05.599

- In April 2015, a revised Quality Assurance Protection Plan (QAPP) was finalized (with Ecology's comments) reflecting the City's intention to continue monitoring for fecal coliform at sites SNOH3 through SNOH8 with a priority for investigative efforts related to sites SNOH6 and SNOH7 due to historically high data in this region.

- The City did an onsite inspection of Swifty Creek between sample sites SNOH6 and SNOH7 on December 16, 2015. The City was prepared an informational streamside mailer to the residents abutting Swifty Creek in that area.

- In January 2017, a Water Quality Monitoring Report was prepared to analyze the fecal coliform monitoring data collected by the City over the past year.