



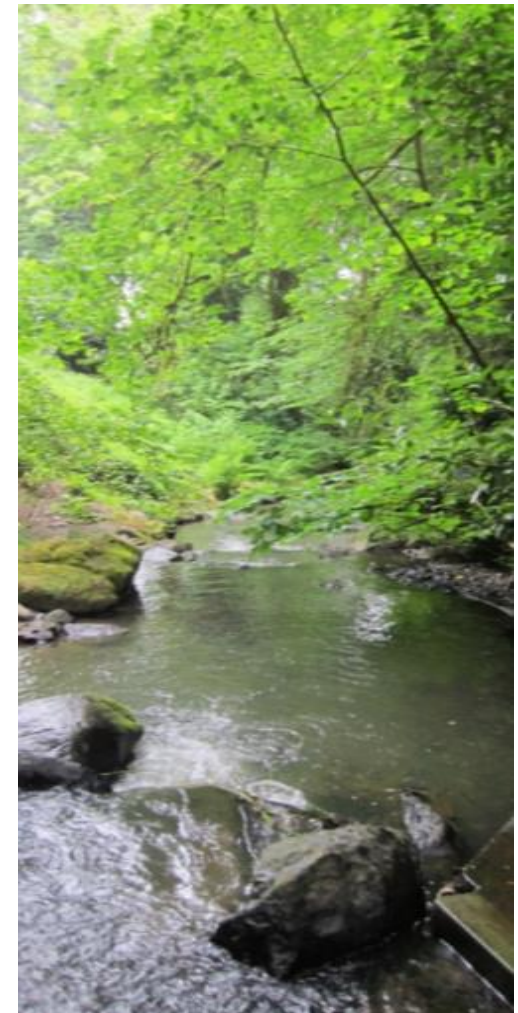


Summary of Instream Trends

Table 2. Legend for Summary of Trends	
No rain	< 0.1 inch of rainfall in the 24 hours prior to sampling
Rain	>= 0.1 inch of rainfall in the 24 hours prior to sampling
↑	Significant upward trend ($p \leq 0.05$)
↓	Significant downward trend ($p \leq 0.05$)
⇧	Somewhat significant upward trend ($0.05 < p \leq 0.1$)
⇩	Somewhat significant downward trend ($0.05 < p \leq 0.1$)
	Improvement in water quality indicator parameter
	Deterioration in water quality indicator parameter
	Not enough data for analysis
NA	Not enough uncensored values for analysis (<10)
	No trend was detected



Agenda

- Regulatory Framework
- Monitoring and Trends Analyses
- Oregon Trends Results
- Comparisons from Washington State
- Summary

Credits

- Torrey Lindbo and Keri Handaly (*City of Gresham*)
- Therese Walch and Tom Mendez (*City of Eugene*)
- Patrice Mango and Frank Wildensee (*City of Portland*)
- Anita Panko and Keith Bondaug (*City of Salem*)
- Geosyntec, Susan Aha and Danelle Peterson (*Port of Portland*)
- Steve Anderson (*Clean Water Services*)
- Clackamas Phase I Co-permittees
- King County
- Kitsap County
- City of Tacoma

MS4 NPDES Phase I Permit Requirements

- Program Monitoring
- Environmental Monitoring
 - To evaluate status and long-term trends in receiving waters
 - To evaluate the effectiveness of BMPs
 - To characterize stormwater
 - To identify pollutant sources
 - To assess progress towards meeting benchmarks
 - To assess the chemical, biological and physical effects of MS4 discharges
- Year 4 of the permit term – evaluate trends.



Instream Trends Analyses

- Goal
 - Analyze instream monitoring results to evaluate trends and pollutant concentrations in receiving streams.
- Methods
 - ACWA guidance
 - Separate data into wet and dry data
 - Non-parametric Mann Kendall or seasonal Kendall
 - Minimum of 30 data points over a 5-year period
 - Try to include data prior to or at the start up of our programs

Instream Trends Analyses

- Challenges in reviewing trends data and drawing conclusions
 - Wet versus dry season
 - Rain versus no rain
 - Upstream vs. downstream
 - Long list of parameters (varied by jurisdiction)
 - Varying watersheds with upstream sources
 - Varying periods of record
 - Varying storm events
 - Changing monitoring locations
 - Changing method detection levels
 - Changing frequency of sample collection
 - Relationship to water quality standards
 - Relationship to pollutant concentrations

Portland/Port of Portland

- 1996 – 2013 (varied by station)
- Range of 15 – 185 data points per pollutant
- Five watersheds
 - Columbia Slough (US and DS)
 - Fanno Creek (main stem)
 - Johnson Creek (US and DS)
 - Tryon Creek (DS only)
 - Willamette River
- Seven fixed monitoring locations
- Results for 7 sites \times 16 parameters at each site \times 2 conditions (wet and dry conditions) = 224 trends analyses

Portland/Port of Portland

Metals, Nutrients, Sediments, Bacteria, Dissolved Oxygen (DO)

	Dry weather (112 trends analyses)		Wet weather (112 trends analyses)
Decreasing	38%		27%
Increasing	5%	dissolved zinc, ammonia, nitrate, TP	2% dissolved zinc, OP
No trend	46%		62%
Not enough data	9%		9%

Clackamas Co-permittees

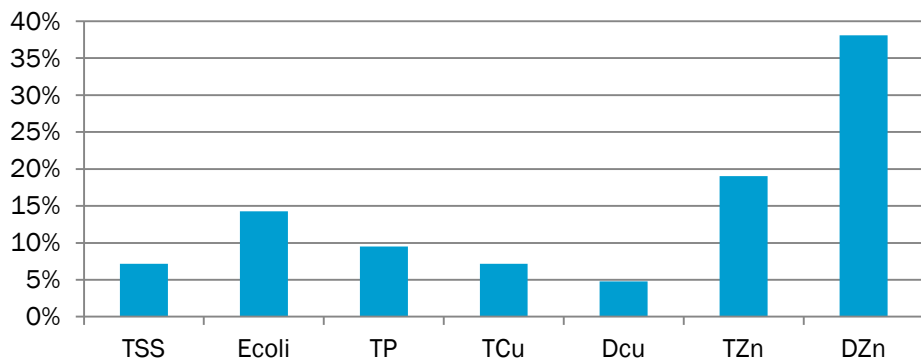
- 1994 – 2015 (varied by station)
- Ranged from 3-22 years of data
- Range of 1 – 194 data points per pollutant
- 8 Jurisdictions
 - Gladstone Oregon City
 - Lake Oswego West Linn
 - Milwaukie Wilsonville
 - Oak Lodge WES
- 33 fixed monitoring locations
- Results for 33 sites x 7 parameters at each site x 2 conditions (wet and dry) = 462 trends analyses

Clackamas Co-permittees

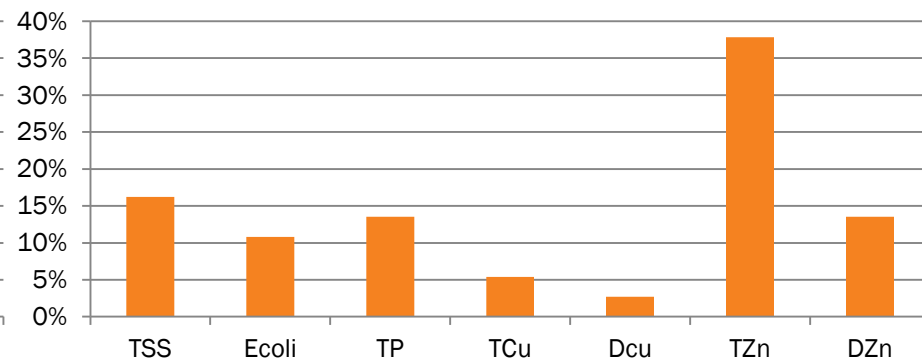
Metals, Total Phosphorus, TSS, Bacteria

	Dry weather/ season (231 trends analyses)		Wet weather/ season (231 trends analyses)	
Decreasing	15%		15%	
Increasing	16%	(52% T&D Zn)	18%	(57% T&D Zn)
No trend	44%		46%	
Not enough data	25%		21%	

Wet Season
% of Total Increasing Trends
(i.e., degrading)



Dry Season
% of Total Increasing Trends
(i.e., degrading)



Salem

- 2001 – 2014
- Range of 29 – 119 data points per pollutant
- 21 fixed monitoring locations
- 11 streams (10 streams have paired US and DS sampling sites).
- 5 parameters (DO, bacteria, nutrients, turbidity)
- Results for 21 sites x 5 parameters x 2 conditions (wet and dry conditions) = 210 trends analyses

Gresham

- 1999-2014
- Six fixed monitoring locations
- Three Creek systems (US and DS)
 - Fairview Creek
 - Johnson Creek
 - Kelly Creek
- 16 parameters (including DO, bacteria, nutrients, TSS/turbidity, metals)
- Results for 6 sites x 16 parameters x 2 conditions (wet and dry conditions) = 192 trends analyses.

Eugene

- 1997-2014
- Number of data points and years covered varied by station
- 12 fixed monitoring locations
- Creek systems
 - Willamette River (4)
 - Delta Ponds (1)
 - Spring Creek (1)
 - Amazon Creek (3)
 - Willow Creek (1)
 - A3 Channel (1)
 - Amazon Diversion Channel (1)
- Results for 12 sites x 40 parameters = 480 trends analyses

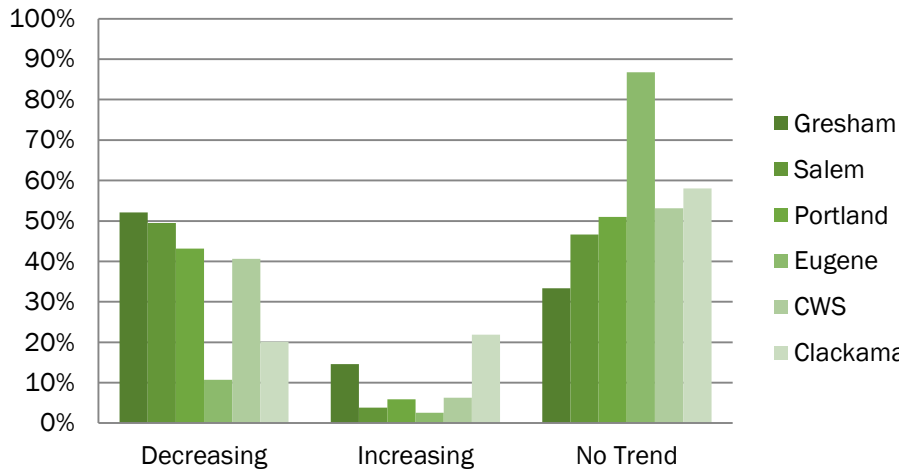
Clean Water Services

- 2004-2013
- Voluntarily provided trends in annual report
- Eight fixed monitoring locations
 - Three Tualatin River Sites
 - Five Tributary Sites
- 4 parameters (TSS, TP, OP, *E.coli*)
- Results for 8 sites x 4 parameters x 2 conditions (wet season and dry season) = 64 trends analyses

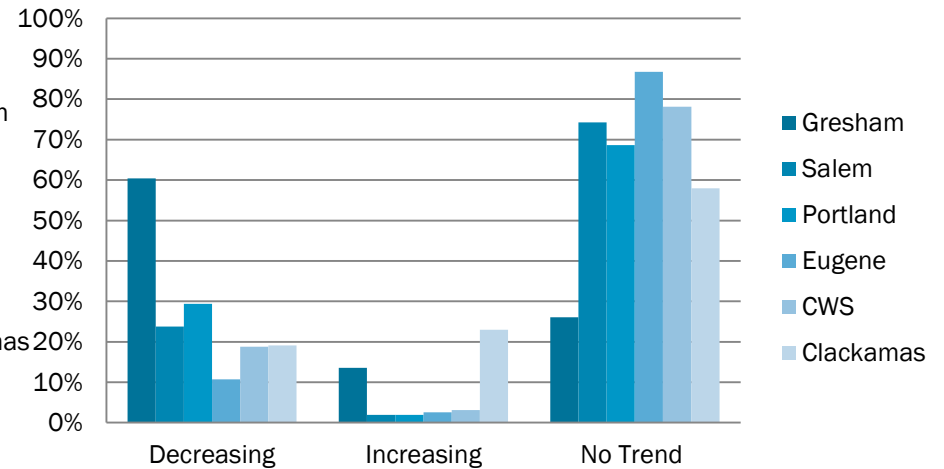
Summary

Based on 1457 Trends Analyses

Dry Weather/Dry Season

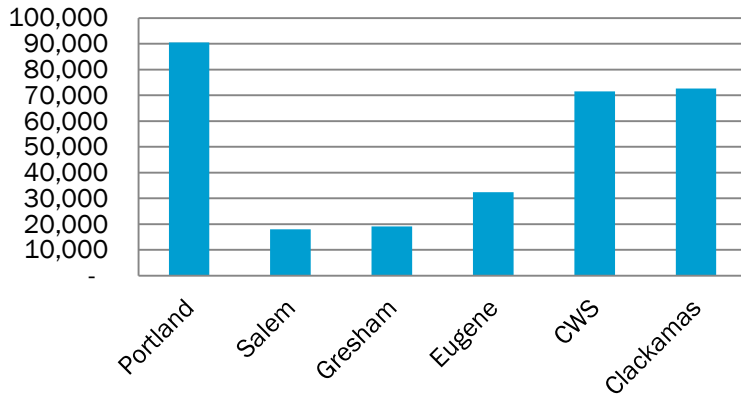


Wet Weather/Wet Season

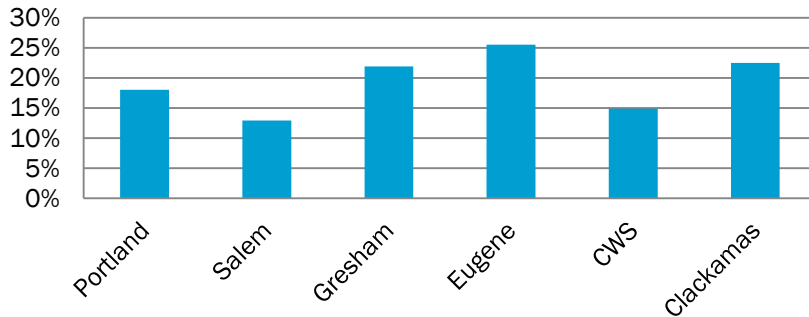


Population Growth

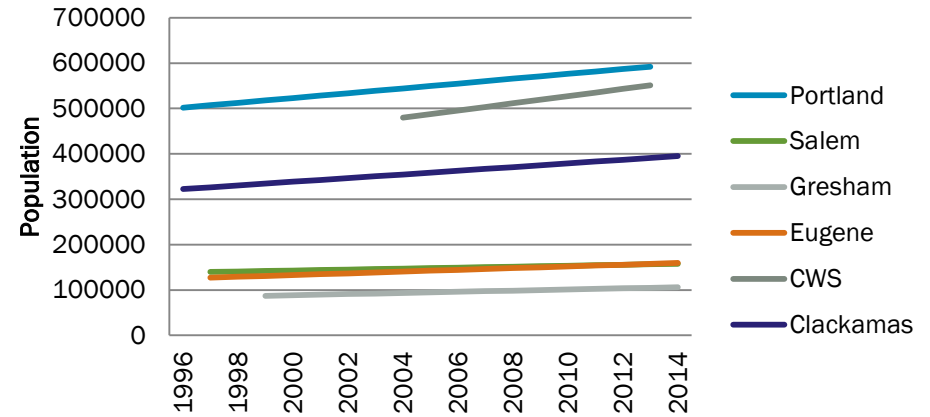
Population Increase During Monitoring Period



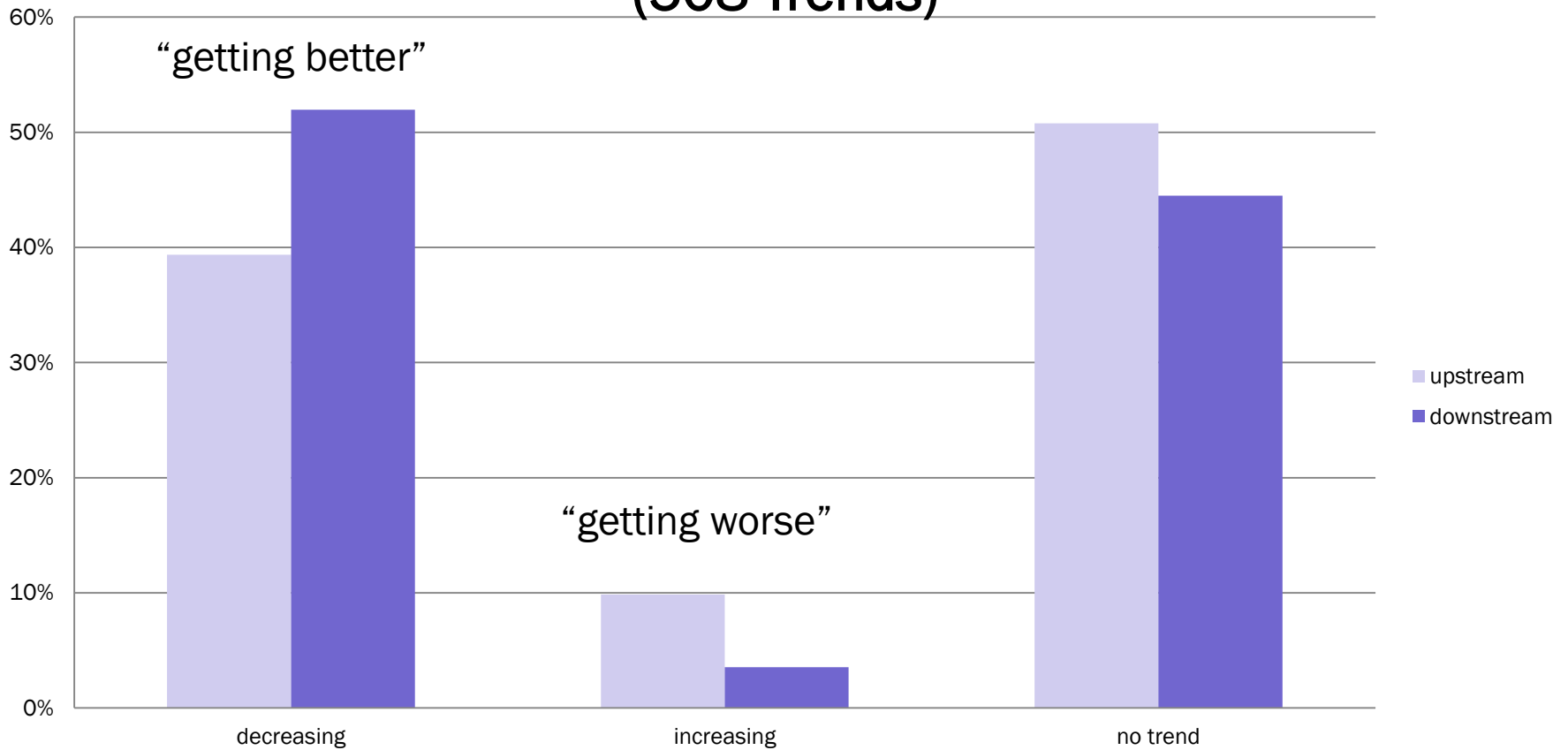
% Increase in Population During Monitoring Period



Population Growth During Monitoring Period



Upstream vs. Downstream Trends (508 Trends)



What do trends look like in Washington?

- King County
- Kitsap County
- City of Tacoma (Stormwater)
- Puget Sound Toxic Chemicals 2007-2011
- Water Quality Index Reports (e.g., Shoreline)
- Pierce County 2015 Report Card

King County Instream Monitoring

- 57 Instream Sites
- 1970 – 2007
- 12 parameters

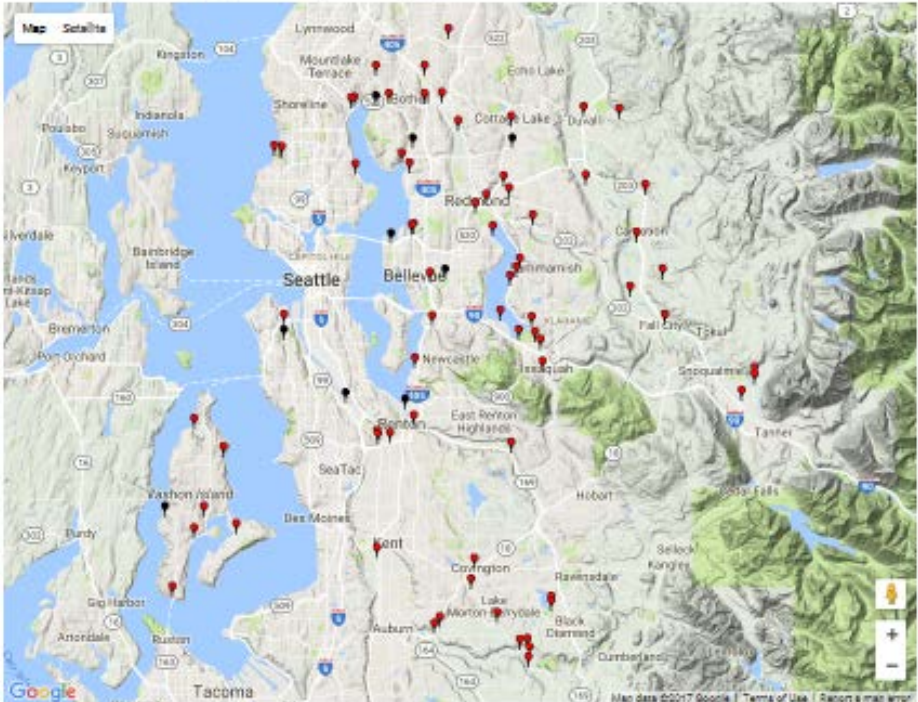
Watersheds and rivers

- Streams Data
 - Program History
 - Water Quality Trends
 - Monitoring Data By Map**
 - Monitoring Data By List
 - Stream Information
 - Data Download
 - Metals Download
 - Water Quality Index Score
 - Continuous Monitoring
 - Sediment Monitoring
 - Benthos Monitoring
 - SeaTac Precipitation
 - Science Section Document Database: Streams
 - Glossary
 - Technical References

Home > Services > Environment > Watersheds and rivers > Streams Data > Monitoring Data By Map

Streams Water Quality Monitoring Data

The King County Streams Monitoring Program provides two methods to find and display information for each stream. You can browse this map and click on the dot to access our database. (A black dot indicates there is historical data but the site is not currently monitored.) Or you can find your stream here.



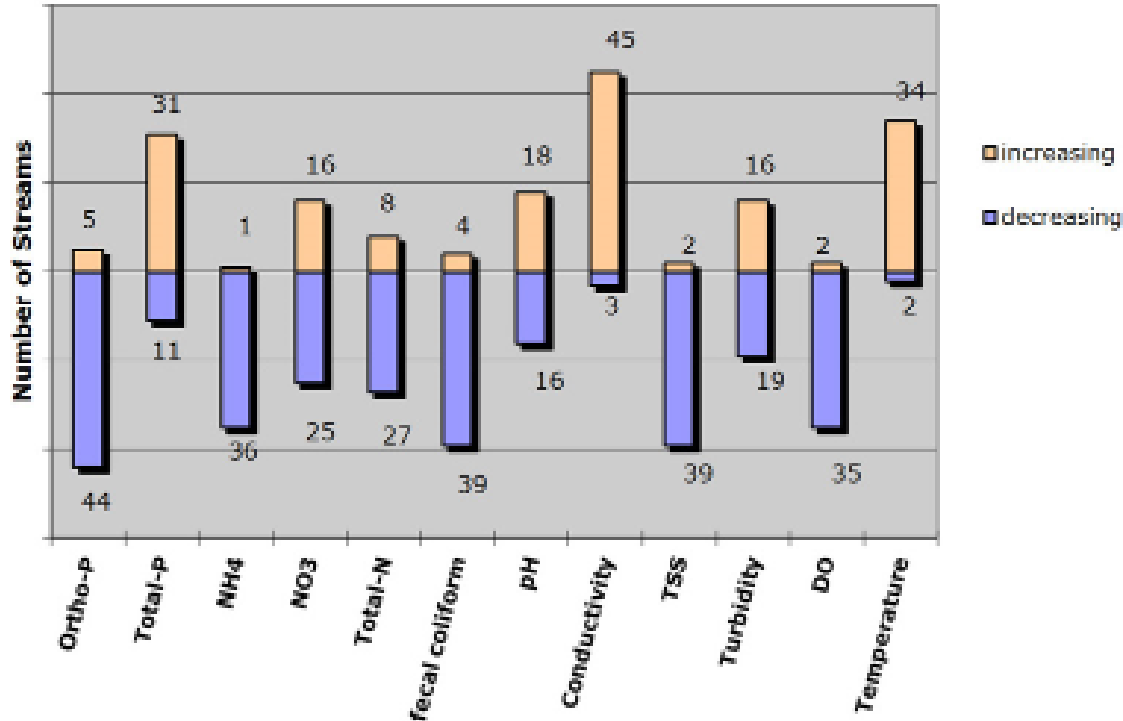
Map Legend: ● active site ● inactive site

King County Results

2007

Increasing or Decreasing Trends in King County Streams 1971 - 2007 Long-term Trend Analysis

Note: There were 57 stream stations in this analysis. See Table 1. for details.

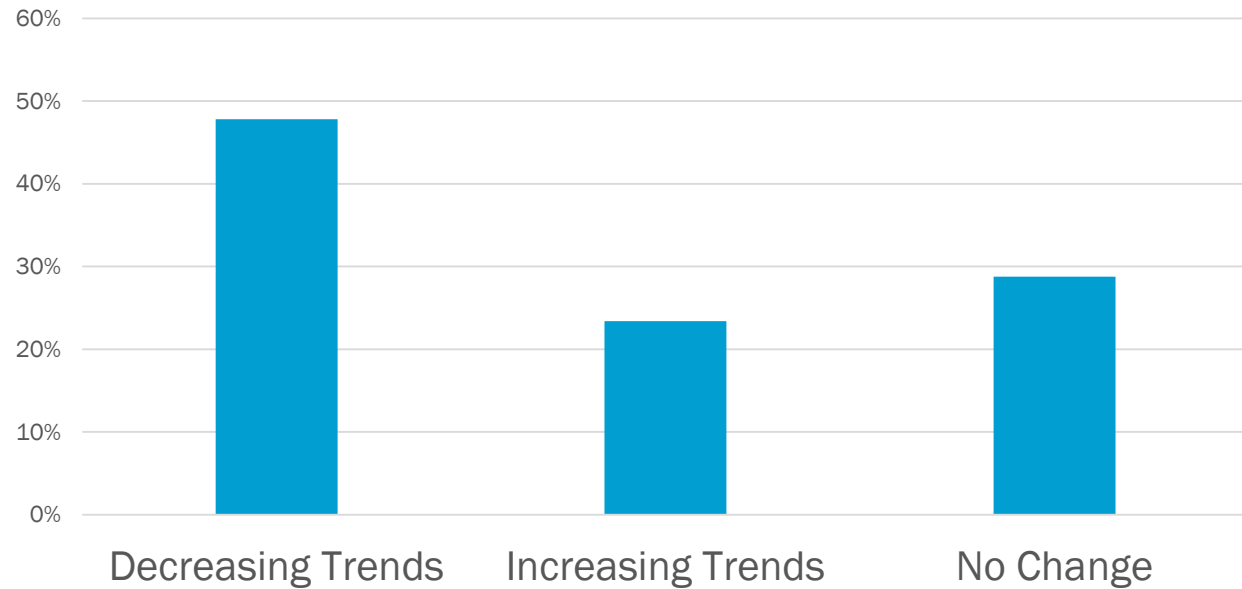


Results of the Long-term Trend Analysis for sites in the Ambient Stream Monitoring Program are available as an Adobe Acrobat pdf. You will need Adobe Acrobat to view the document. If you do not have this software, you can download a free copy of [Adobe® Acrobat® Reader](#).

King County Results

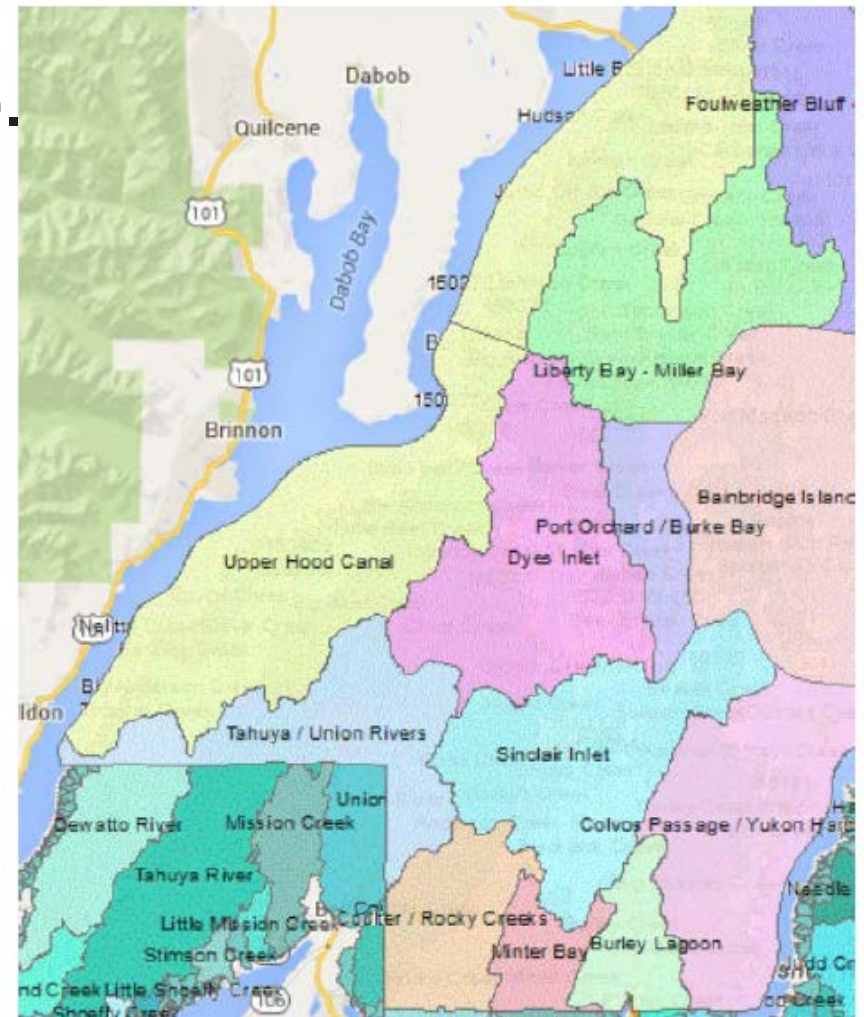
56% of increasing (degrading) trends were for TP and DO

Trends Results
(excluding pH, conductivity and temperature)

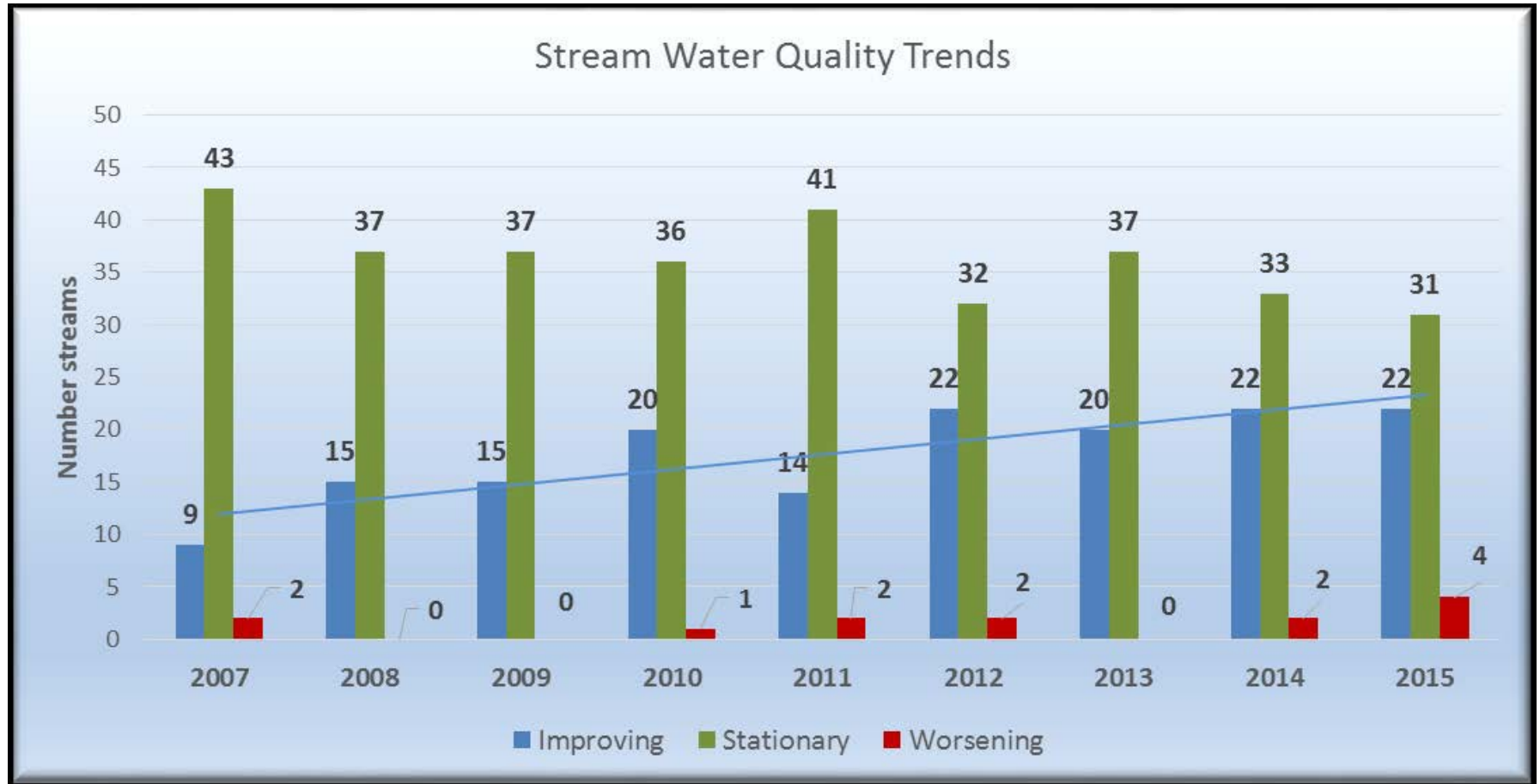


Kitsap County

- Streams sampled monthly for bacteria (fecal coliform).
- Samples collected from 1996 - 2007.
- 57 streams sampled.



Kitsap County Results



Kitsap County Results

Annual Water Quality Report 2015

- Trends are important but so are concentrations.
- Some trends that are “worsening” are meeting water quality standards.
- Some trends that are improving or stationary are exceeding water quality standards.

2015 KITSAP STREAM WATER QUALITY SUMMARY					
Watershed	Stream Name	Station	Range	FC GMV	Long Term Trend
BM	Burley	BL01	30-390	133	Stationary
BM	Bear	BR01	3-990	135	Stationary
BM	Huge	HG01	4-110	23	Stationary
BM	Minter	MND1	10-200	35	Stationary
BM	Purdy	PR01	4-370	33	Stationary
CCRC	Coulter	CU01	4-200	12	Worsening
CPYH	Olalla	OC02	10-470	58	Improving
CPYH	Salmonberry	SM01	4.0-150	11	Improving
CPYH	Wilson	WND1	4-210	32	Improving
CPYH	Curley	CY01	10-220	55	Stationary
CPYH	Fragaria	FG01	4-420	13	Stationary
DYES	Barker	BK01	4-300	72	Improving
DYES	Chico	CH01	4-100	27	Stationary
DYES	Clear	CC01	10-120	31	Improving
DYES	Kitsap Mall West	KWD1	4-240	26	Stationary
DYES	Masher	MS01	4-310	61	Stationary
DYES	Ostrich Bay	OB01	20-2001	248	Stationary
DYES	Pahrmann	PA01	10-100	31	Stationary
DYES	Phinney	PH01	4-2150	146	Improving
DYES	Strawberry	SR01	4-370	37	Improving
FBAC	Carpenter	CA02	4-960	18	Stationary
LBMB	Barrantes	BAR01	4-2001	100	Stationary
LBMB	Big Scandia	BS01	10-160	37	Stationary
LBMB	Bjorgen	BN01	10-1500	122	Stationary
LBMB	Cowling	CWD1	4-160	21	Improving
LBMB	Daniels	DC01	4-730	86	Improving
LBMB	Dogfish	DF01	4-160	38	Improving
LBMB	Grovers	GC01	4-510	28	Stationary
LBMB	Indianola	IN01	4-190	32	Improving
LBMB	Johnson	JC01	4-240	27	Improving
LBMB	Kitsap	KT01	4-680	51	Stationary
LBMB	Little Scandia	LS01	20-2001	98	Stationary
LBMB	South Dogfish	SF01	4-180	23	Improving
POBB	Enetai	DE01	10-90	38	Improving
POBB	Illahee	IC01	4-170	24	Stationary

Trends Summary for Oregon

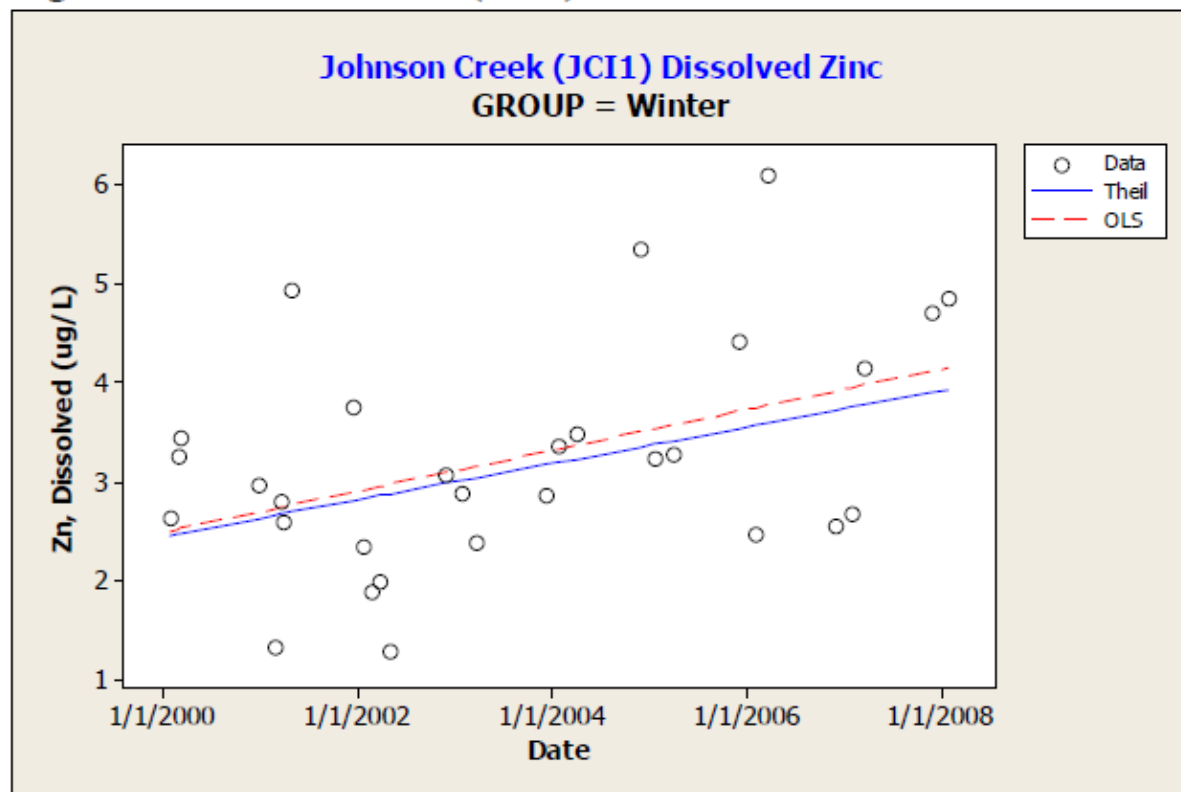
- Relatively consistent results from six Phase I monitoring programs.
- Overall combined wet and dry results:
 - Increasing trends 9% (water quality declining)
 - Decreasing trends 27% (water quality improving)
 - No statistically significant trend 64%
- Downstream sites had more “improving” trends than upstream sites.
- For the cities that provided data for zinc, 49% of the “increasing” trends (declining trends) were for zinc. Slightly more than half of those declining zinc trends were during dry weather.
- P value is important.

Trends Summary for Oregon

- Trends analysis don't portray the whole picture and they lead to more questions:
 - Do we have data from prior to program implementation?
 - Are we meeting water quality standards?
 - How significant are the concentration values?
 - If we have an increasing trend, does it matter?
 - If we have a decreasing trend, is it good enough/will we get there?
 - What is the rate of decline?
 - What are trends in stormwater data?

Add comparison of zinc values to water quality standards.

Figure 2.6: Johnson Creek (JCI1) Dissolved Zinc



Water Quality
Criteria = 43 ug/L

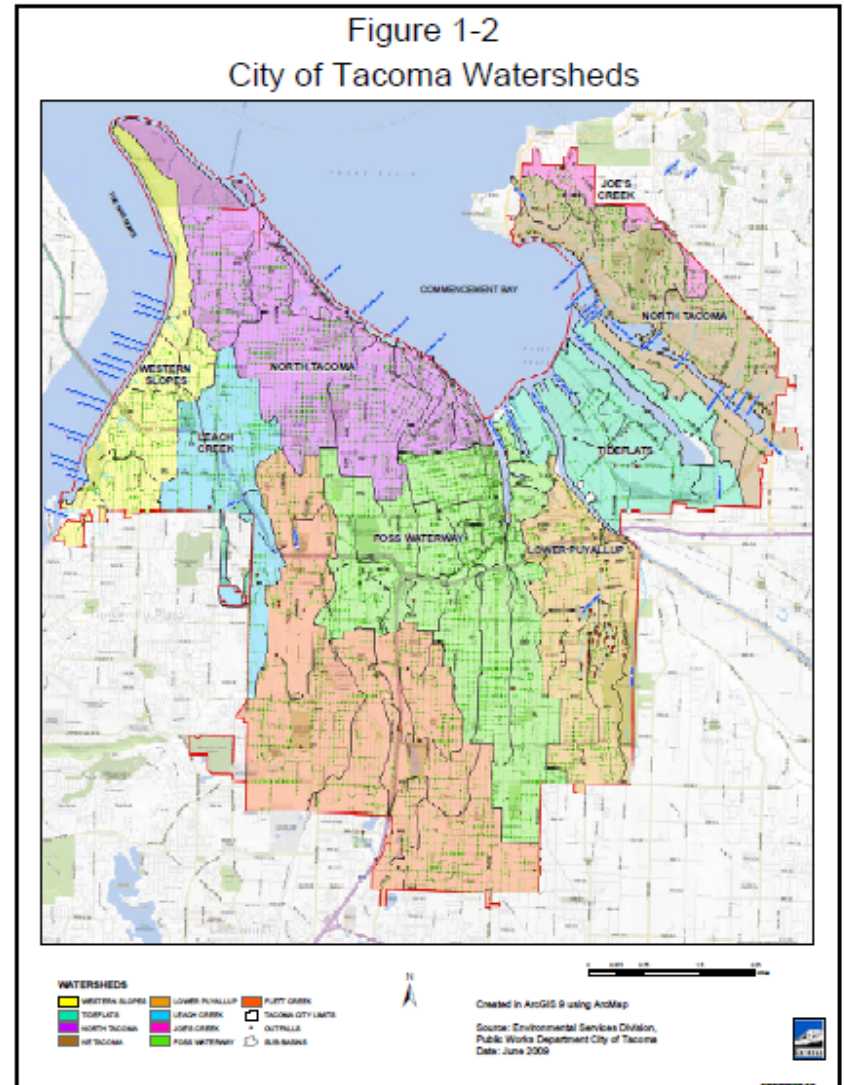
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 - What is the rate of decline?
 - What are trends in the stormwater data?

City of Tacoma Stormwater Results

- Stormwater sampling.
- Seven outfall locations.
- 2001 - 2015.
- 954 stormwater samples and 322 baseflow samples were collected.
- 47 out of 52 tests showed statistically significant time trends using linear regression.
- All statistically significant trends were decreasing.
- Parameters included TSS, Copper, Lead, Zinc, PAHs and Phthalates

Figure 1-2
City of Tacoma Watersheds



Conclusion

- Trends data have provided some indication of progress.
- Given population growth, most trends are favorable.
- Our stormwater management work is not done.
- More data mining is needed to enhance the value of the results.



Questions



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