Lower Willamette Agricultural Water Quality Management Area Water Quality Status and Trends Report

Oregon DEQ's Water Quality Status and Trends Report for the Oregon Department of Agriculture's Biennial Review of the Agricultural Area Rules and Plans

August 2018

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1 Executive Summary

1.1 Purpose

This report presents data and analysis that will help DEQ fulfill its roles in the biennial review process described in the Memorandum of Agreement between ODA and DEQ. Water quality status and trends reports are created to inform discussions between DEQ Basin Coordinators and ODA Agriculture Water Quality Specialists prior to the Local Advisory Committee meeting. The discussions between DEQ and ODA prior to the LAC meeting could include: water quality and what's working and not working, source(s) and solutions, data needs and future monitoring to answer these questions. This report presents an analysis of water quality data readily accessible from public databases and available in sufficient quantity to indicate status and trends. Dependent on data availability, DEQ will use the available water quality data to answer the first three questions below. For the fourth bullet, the report is expected to inform DEQ Basin Coordinator analysis, interpretation, and discussion with ODA and the LAC about possible or potential sources:

- What is the status of water quality?
- What is the trend in water quality?
- When applicable, are TMDL load allocations for total phosphorus and total suspended solids being met?
- Can water quality status and trends be attributed to a pollution source or sources?

1.2 Analysis

Analysts retrieved data from DEQ (volunteer monitoring database was not included, however some volunteer data is queried from the Water Quality Portal), EPA and USGS databases. Many organizations provided data that was queried and evaluated for use in this report (see Appendix). The time period for the query was from 2000-01-01 to 2018-06-01. Parameters included in the query were temperature, pH, dissolved oxygen, total suspended solids, total phosphorus, and bacteria. Monitoring stations which had at least two years of recent data and/or at least 8 years of data fit the criteria to assess status and trends (see flow chart in full report).

1.3 Data Sources

The data returned were evaluated for data quality. DEQ data included A, A+, B, C data determined following the DEQ's Laboratory Quality Manual. EPA and USGS data were included unless result comments indicated problems with the data. Recent data (after June 2014) from the USGS was marked as provisional data and included in this analysis. Data was evaluated against the applicable Oregon water quality criterion.

1.4 Land Use

Each monitoring station that fit the criteria to assess water quality status and/or trends was included in the land use analysis. The Stream-Catchment (StreamCat) developed by EPA was used to summarize the cumulative upstream catchment of each station for primary land use characteristics, based on the National Hydrography Dataset Plus Version 2 geospatial framework. The land use summaries represent the entire upstream watershed area for the NHD catchment within which the station is located and is not limited to the Ag Water Quality Management Area in question.

Table 1: Cumulative land use and land cover for all upstream catchments of each station used in this analysis. Stations which fit the decision criteria are included. Source: 2011 NAIP

Station ID	Station Description	Watershed Area (km^2)	% Urban	% Forest	% Ag	% Range	% Other
USGS-14211400	JOHNSON CREEK AT REGNER ROAD, AT GRESHAM, OR	48	42	21	33	3	2
USGS-14211499	KELLEY CREEK AT SE 159TH DRIVE AT PORTLAND, OR	13	40	27	28	4	1
USGS-14211500	JOHNSON CREEK AT SYCAMORE, OR	73	45	23	27	3	2
10611	Willamette River at Hawthorne Bridge	28922	8	52	20	17	3
10801	Swan Island Channel Midpoint	28922	8	52	20	17	3
USGS-14211720	WILLAMETTE RIVER AT PORTLAND, OR	28922	8	52	20	17	3
10332	Willamette River at SP&S RR Bridge (Portland)	28950	8	52	20	17	3
33613	Willamette River at Cathedral Park Dock	28950	8	52	20	17	3
11321	Johnson Creek at SE 17th Avenue (Portland)	136	67	15	15	2	1
USGS-14211550	JOHNSON CREEK AT MILWAUKIE, OR	136	67	15	15	2	1
28712	Blue Lake Site 2 (west)	579133	2	37	11	47	3
11201	Columbia Slough at Landfill Road	119	93	1	2	1	3
USGS-14211542	CRYSTAL SPRINGS CREEK AT BYBEE ST, PORTLAND, OR	4	93	4	0	1	3
USGS-14211546	CRYSTAL SPRINGS CREEK AT MOUTH AT PORTLAND, OR	7	95	3	0	0	2

1.5 Results Summary

Table 2: Summary of stations with suffcient data for status or trend analysis

Analyte	Number of stations w/ sufficent data for status analysis	Number of stations w/ sufficent data for trend analysis
Ecoli	5	5
Enterococcus	0	0
Dissolved Oxygen	6	7
pH	6	8
Temperature	5	7
Total Phosphorus	6	7
TSS	5	5

14 monitoring stations contained sufficient data to assess status and/or trends out of 418 total monitoring stations within the Lower Willamette AgWQ Management Area.

Table 3: Summary of Monitoring Stations Status and Trend, where 'exceed' represents a single exceedance of the water quality standard within the last three years of available data. Note: DO = dissolved oxygen

Station ID	Station Description	Ecoli Status	Ecoli Trend	DO Status	DO Trend	pH Status	pH Trend	Temp Status	Temp Trend	TP Status	TP Trend	TSS Status	TSS Trend
10332	Willamette River at SP&S RR Bridge (Portland)	Meets	Improving	Meets	Improving	Meets	Degrading	–	–	–	Improving	–	No Sig Trend
10611	Willamette River at Hawthorne Bridge	Meets	Improving	Meets	Improving	Meets	Degrading	–	–	–	Improving	–	No Sig Trend
10801	Swan Island Channel Midpoint	Meets	Improving	Meets	Improving	Exceeds	Degrading	–	–	–	Steady	–	No Sig Trend
11201	Columbia Slough at Landfill Road	Meets	No Sig Trend	Meets	No Sig Trend	Exceeds	No Sig Trend	–	–	–	Improving	–	Degrading
11321	Johnson Creek at SE 17th Avenue (Portland)	Exceeds	Improving	Exceeds	No Sig Trend	Meets	No Sig Trend	–	–	–	Improving	–	No Sig Trend
28712	Blue Lake Site 2 (west)	–	–	–	–	–	Degrading	–	–	–	No Sig Trend	–	–
33613	Willamette River at Cathedral Park Dock	–	–	–	Improving	–	Degrading	–	–	–	–	–	–
USGS-14211400	JOHNSON CREEK AT REGNER ROAD, AT GRESHAM, OR	–	–	–	–	–	–	Exceeds	Degrading	–	–	–	–
USGS-14211499	KELLEY CREEK AT SE 159TH DRIVE AT	–	–	–	–	–	–	Exceeds	Degrading	–	–	–	–

Station ID	Station Description	Ecoli Status	Ecoli Trend	DO Status	DO Trend	pH Status	pH Trend	Temp Status	Temp Trend	TP Status	TP Trend	TSS Status	TSS Trend
	PORTLAND, OR												
USGS-14211500	JOHNSON CREEK AT SYCAMORE, OR	–	–	–	–	–	–	Exceeds	Degrading	–	–	–	–
USGS-14211542	CRYSTAL SPRINGS CREEK AT BYBEE ST, PORTLAND, OR	–	–	–	–	–	–	–	No Sig Trend	–	–	–	–
USGS-14211546	CRYSTAL SPRINGS CREEK AT MOUTH AT PORTLAND, OR	–	–	–	–	–	–	–	Improving	–	–	–	–
USGS-14211550	JOHNSON CREEK AT MILWAUKIE, OR	–	–	–	–	–	–	Exceeds	No Sig Trend	–	–	–	–
USGS-14211720	WILLAMETTE RIVER AT PORTLAND, OR	–	–	Exceeds	Degrading	Exceeds	Improving	Exceeds	No Sig Trend	–	Improving	–	–

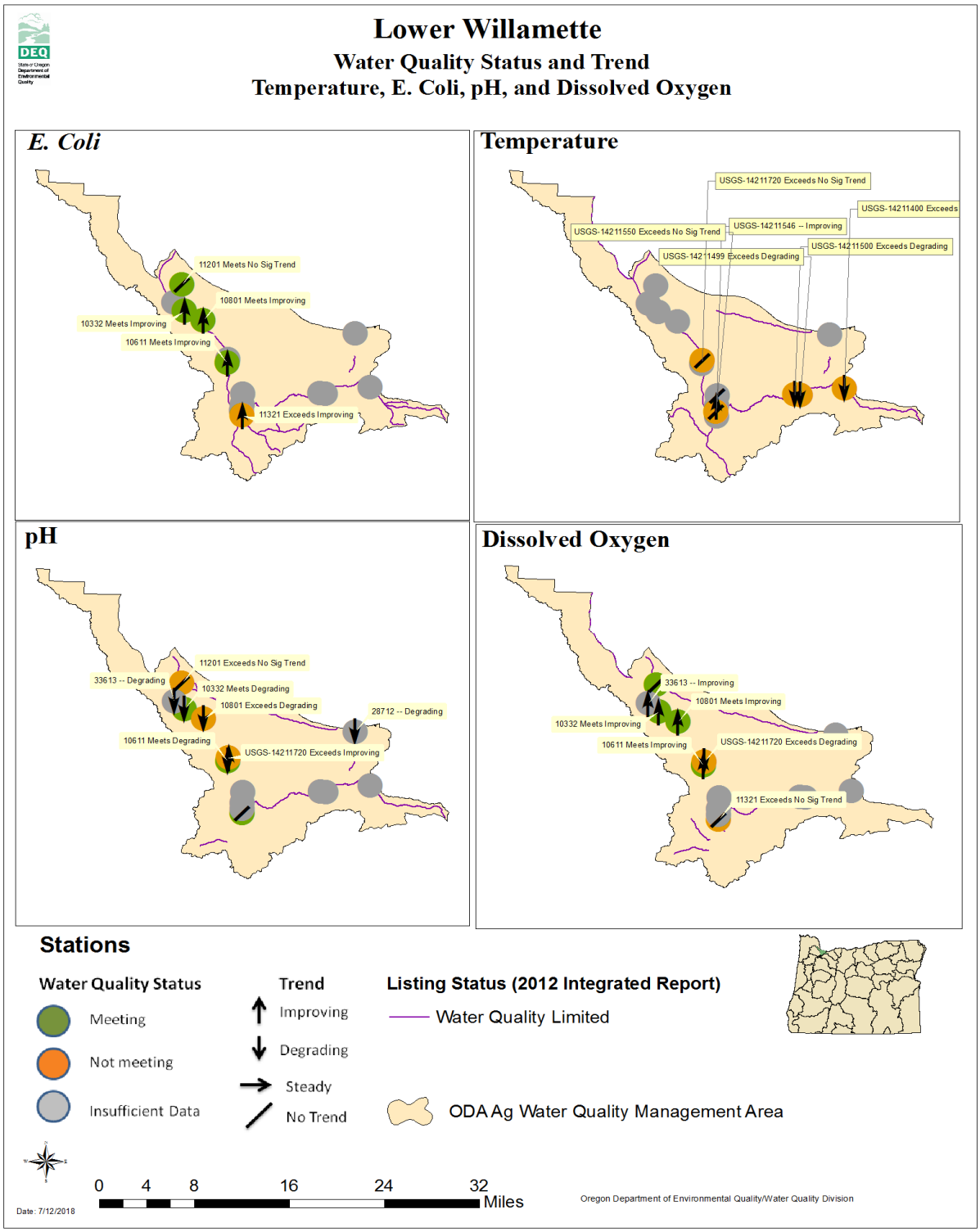

Figure 1: Summary of stations that fit the criteria for status and trend analysis. One or more exceedances within the last three years of available data defined whether a station was Meeting or Not Meeting. Trend was determined by significant trends associated with long-term datasets.

2 Conclusions

What are the overall status or trends?

- *Dissolved Oxygen*: There are seven stations that have sufficient data to assess status and/or trends for Dissolved oxygen. Stations 11201, 10332, 10611, and 10801 showed no exceedances in the last two years while stations 11321 and USGS-14211720 had at least one. Stations10332, 10611, 10801, and 33613 showed a significant improving trend in DO while USGS-14211720 had a degrading trend. No significant DO trend was determined in the available data for stations 11321 and 11201.
- *E. coli*: There was sufficient E. Coli data available to assess status and/or trends for five stations in the Lower Willamette Ag Water Quality Management Area. Stations 11201, 10332, 10611, and 10801 had no exceedances within the data available. Station 11321 had at least one exceedance. An improving trend in E. Coli data was found at stations 10332, 10611, 10801, and 11321 where no significant trend could be determined at station 11201.
- *Enterococcus*:
- *pH*: Eight stations had enough data available to assess status and/or trends for pH. Stations 10332, 10611, and 11321 had no exceedances within the last two years while 11201, 10801, and USGS-14211720 had at least one exceedance. Stations 10332, 10611, 10801, 33613, and 28712 all showed a decreasing pH trend. The only station with an increasing trend was USGS-14211720 and stations 11321 and 11201 showed no significant trend for pH.
- *Temperature*: Status and/or trend was able to be determined at seven stations within the Lower Willamette Ag Water Quality Management Area. Stations USGS-14211720, USGS-14211400, USGS-14211499, USGS-14211500, and USGS-14211550 all exceeded the water quality standard for temperature in the last two years. USGS-14211546 was the only station that showed a significant improving trend. USGS-14211400, USGS-14211499, and USGS-14211500 all had degrading trends. No other significant temperature trends were able to be determined.
- *Total Phosphorus*: Trends in total phosphorus were determined at six stations within the Lower Willamette Ag Water Quality Management Area. Significant improving trends were determined at stations 11321, 11201, 10332, 10611, and USGS-14211720 while station 10801’ s trend was steady.
- *Total Suspended Solids*: Only station 11201 showed a significant degrading trend for total suspended solids. No other significant trends were able to be determined.

Additional Conclusions:

- Toxics:
    - Dieldrin and Aldrin: Data provided by the City of Gresham represents Dieldrin concentrations from 2008 through 2016 at two locations along Johnson Creek (JCI1 and JCI2). Aldrin data exists at station JCI2. All results for Dieldrin and Aldrin were below the freshwater criteria for Dieldrin (0.056 ug/l) and Aldrin (3 ug/L).
    - Mercury: Four stations contain data to assess trends of mercury from 2004 to 2016. Station KI1 had no exceedances of the chronic freshwater mercury criteria, while JCI1 and KI2 had one exceedance and JCI2 had two.
    - DDT, DDD, DDE: Data was available to assess trends from 2008-2016 of DDT, DDE, and DDD at two sites in Johnson Creek (JCI1 and JCI2). At station JCI1, there were three exceedances of the freshwater criterion for DDT (0.001 ug/l). At station JCI2, all detectable DDT results (6 samples) were in exceedance of the freshwater criterion.
    - Total Suspended Solids (TSS): TSS is used as a surrogate measure for DDT in the Lower Willamette TMDL with values greater than 15 mg/l identified as exceeding the TMDL load

allocation. Two sites contain data to assess TSS trends from 2000 to 2016 (JCI1 and JCI2) and two sites have data from 2006 to 2016 (KI1 and KI2). Each of the four stations have many exceedances of the TMDL allocation.

3 Introduction

3.1 Purpose

Area rules and plans have been adopted by the Oregon Department of Agriculture (ODA) for the Lower Willamette agricultural water quality management area (603-095-3700-3760). Oregon statute and administrative rules require ODA to consult with the Department of Environmental Quality (DEQ) during the biennial review of Agricultural Water Quality Management Area Rules and Plans (ORS 568.930). DEQ Total Maximum Daily Load (TMDL) and Nonpoint Source (NPS) program staff conduct these reviews based on ODA's biennial review schedule of their area rules and plans. ODA's Agriculture Water Quality Program is outcome based, explicitly describing prohibited conditions, similar to DEQ's TMDL and NPS programs which explicitly define water quality targets and goals. The analysis of landscape conditions and water quality data is used for implementing these programs as well as identifying data gaps.

This report presents data and analysis that will help DEQ fulfill its roles in the biennial review process described in the Memorandum of Agreement between ODA and DEQ. Water quality status and trends reports are created to inform discussions between DEQ Basin Coordinators and ODA Agriculture Water Quality Specialists prior to the Local Advisory Committee meeting. The discussions between DEQ and ODA prior to the LAC meeting could include: water quality and what's working and not working, source(s) and solutions, data needs and future monitoring to answer these questions. This report presents an analysis of water quality data readily accessible from public databases and available in sufficient quantity to indicate status and trends. Dependent on data availability, DEQ will use the available water quality data to answer the first three questions below. For the fourth bullet, the report is expected to inform DEQ Basin Coordinator analysis, interpretation, and discussion with ODA and the LAC about possible or potential sources:

- What is the status of water quality?
- What is the trend in water quality?
- When applicable, are TMDL load allocations for total phosphorus and total suspended solids being met?
- Can water quality status and trends be attributed to a pollution source or sources?

DEQ basin coordinators review pertinent information including this report as part of ODA's biennial review. DEQ basin coordinators recommend changes and additional data and resources necessary to achieve water quality criterion and meet TMDL load allocations through ODA's survey.

3.2 Basin Contact

Table 3: Oregon DEQ and ODA basin contacts

AgWQ Management Area	DEQ Basin Coordinator	ODA AgWQ Specialist
Lower Willamette	Andrea Matzke; matzke.andrea@deq.state.or.us	Brenda Sanchez; bsanchez@oda.state.or.us

3.3 Background Information

Both the Willamette/Lower Willamette and Columbia Slough TMDLs apply to the Lower Willamette Agricultural Water Quality Management Area. Pollutants addressed in the TMDLs include: chlorophyll *a*, dissolved oxygen, phosphorus, bacteria, DDE/DDT, PCBs, lead, mercury, temperature, Dieldrin, and 2, 3, 7, 8 TCDD. Load allocations written in these TMDLs are as follows:

Toxics

- DDT (Johnson Creek):
  - Load allocations are expressed as a TSS target of 15 mg/l or a DDT reduction of 94%
  - The applicable chronic freshwater DDT target is listed in Table 4
  - Separate allocations for DDT and DDE apply to the Columbia Slough TMDL
- Dieldrin (Johnson Creek):
  - ODEQ believes that achieving DDT criteria will also result in the attainment of Dieldrin criteria
  - The freshwater chronic criteria for Dieldrin is 0.056 ug/l
  - Separate allocations for Dieldrin apply to the Columbia Slough TMDL

Lead

- In the Columbia Slough TMDL, DEQ developed specific allocations for lead from several sources that took into account four different flow rates.

PCBs

- To address PCB and dioxin impairments in the Columbia Slough, DEQ established specific TMDL allocations for PCB and dioxin for several sources in the Columbia Slough.

Mercury

- Mercury has an aquatic life acute criterion of 2.4 ug/L and a chronic criteria of 0.012 ug/l per the Lower Willamette TMDL
- The interim loading capacity of 94.6 kg/yr represents the total annual load of mercury (as calculated at the mouth of the Willamette River) associated with the water column guidance value concentration deemed to be protective of the beneficial use of fish consumption. For the mainstem Willamette River, Wasteload Allocations (WLA) for Point Sources total 3.7 kg/yr and Load Allocations (LA) for Nonpoint Sources total 90.1 kg/yr.

Nutrients and pH Criteria

- Chlorophyll a action level is 15 µg/L based on a three month average with a minimum of three samples. The Total Phosphorus interim target for the TMDLs in Columbia Slough and Fairview

Creek is 0.1 mg/L, ortho-phosphate interim target is 0.02 mg/L based on EPA guidelines and DEQ best professional judgment. Measurements for pH must fall between 6.5 and 8.5.The total phosphate TMDL allocation addresses pH and chlorophyll a impairments. The presence of too much phosphorus in waterbodies can increase plant and algal production, which can cause pH levels to be too high or too low. The TMDL for phosphate applies April through October.

Table 4- DDD, DDE, and DDT criteria

Chemical	Human Health Criteria		Aquatic Life Criteria (freshwater)		Aquatic Life Criteria (Saltwater)	
	Water + Org (ug/l)	Org only (ug/l)	Acute (ug/l)	Chronic (ug/l)	Acute (ug/l)	Chronic (ug/l)
DDD, -4,4’	0.000031	0.000031	---	---	---	---
DDE, -4,4’	0.000022	0.000022	---	---	---	---
DDT, -4, 4’	0.000022	0.000022	1.1	0.001	0.13	0.001
Mercury (Total)	---	---	2.4	0.012	2.1	0.025
Dieldrin	0.0000053	0.0000054	---	---	---	---
PCBs	---	---	2	0.014	10	0.03

4 Methods

4.1 Data Sources

Analysts retrieved data from DEQ (LASAR and ELEMENT), EPA (Storet) USGS (NWIS, Water Quality Portal) databases. Many other organizations provided data that were queried and evaluated for use in this report (see Appendix). Data collected between 2000-01-01 to 2018-06-01 were included in this report. Parameters included in the query were temperature, pH, dissolved oxygen, total suspended solids, total phosphorus, and bacteria. Note that there are TMDLs in the Lower Willamette for temperature, bacteria, total phosphorus, dieldrin/DDT (TSS as surrogate), mercury, PCBs, and lead.

Monitoring stations that had at least two years of recent data and/or at least 8 years of data fit the criteria to assess status and trends (see flow chart in full report). Stations that did not meet either of these criteria were not assessed for status or trends, but these stations were included in this report.

The data returned were evaluated for data quality. DEQ data included A, A+, B, C data that were rated under the DEQ’s Laboratory Quality Manual guidelines. EPA and USGS data were included unless result comments indicated problems with the data. Recent provisional data (after June 2014) from the USGS were included in this analysis.

4.2 Decision Criteria

Status and long-term water quality trends were compared to water quality criteria or TMDL allocations. The decision criterion shown below was created for selecting stations that had greater than eight years of data and/or data to address water quality status. Monitoring data collected in tribal lands were not included in this analysis. Dominant upstream land use characteristics were calculated for each station, but were not used to decide what stations to include in this report.

5 Analysis

DEQ compared pH results from both grab and continuous sample data to the water quality criterion. The bacteria standard is based on the presence of E. coli compared to a single sample maximum and a geometric mean of five or more samples in a 90 day period. The temperature standard is based on the calculation of the seven day average of the daily maximum stream temperatures. When applicable, total suspended solids and total phosphorus were compared to the TMDL load allocation. If no allocation was present, total suspended solid and total phosphorus result values were plotted over time. Trends for pH, E. coli, total phosphorus, and total suspended solids were assessed using Seasonal Kendall Analysis, which removes the influence of season-to-season fluctuations. The Seasonal Kendall Analysis also indicates the statistical significance and slope of the trend Hirsch et al. 1982.

Dissolved oxygen (DO) was assessed by comparing the concentration to the water quality criterion. If the DO concentration exceeded the water quality criterion, but met the criteria for percent saturation at the same time, it was considered to be in compliance with the water quality criterion. These points were noted in the plots using a different color. Fish use and spawning maps and the DO criteria flow chart were used to determine the applicable temperature and DO standards for the spawning and non-spawning time periods.

For temperature trend analysis, analysts used data only from stations with eight years of continuous hourly temperature data in each month during the query period. Data were not used if observations were missing for more than one day each month or if fewer than 22 hourly measurements were recorded during the day. These criteria resulted in no more than 10% missing data across each of the temporal periods of interest. Trends in the data were tested using a Mann Kendall test (Mann 1945). Trends were evaluated on the following metrics:

- Average Monthly 7-day average daily maximum
- Average Monthly daily degree hours > the applicable temperature standard.

Trends are more detectable with the average monthly daily degree hours that exceed the applicable temperature standard because the metric incorporates both magnitude and duration of temperatures; the 7-day average daily maximum only incorporates the magnitude of exceedance. Fish use and spawning maps were used to determine the applicable temperature standards for the spawning and non-spawning time periods. The results of this report include graphs for stations with data that exceeded a water quality criterion more than once and/or showed a positive or negative trend. When data were insufficient, that was noted in the graphs.

6 Results

Fourteen monitoring stations contained sufficient data to assess status and/or trends out of 418 total monitoring stations within the Lower Willamette AgWQ Management Area.

Table 5: Summary of stations with sufficient data for status or trend analysis

Analyte	Number of stations w/ sufficient data for status analysis	Number of stations w/ sufficient data for trend analysis
E.Coli	5	5
Dissolved Oxygen	6	7
pH	6	8
Temperature	5	7
Total Phosphorus	6	7
TSS	5	5

6.1 Station Locations

Within the Lower Willamette AgWQ Management Area, 14 out of 418 monitoring stations fit the criteria to assess water quality status and trends. The following maps show monitoring stations that fit the criteria within the watershed, all stations that were queried, land ownership, and landscape attributes.

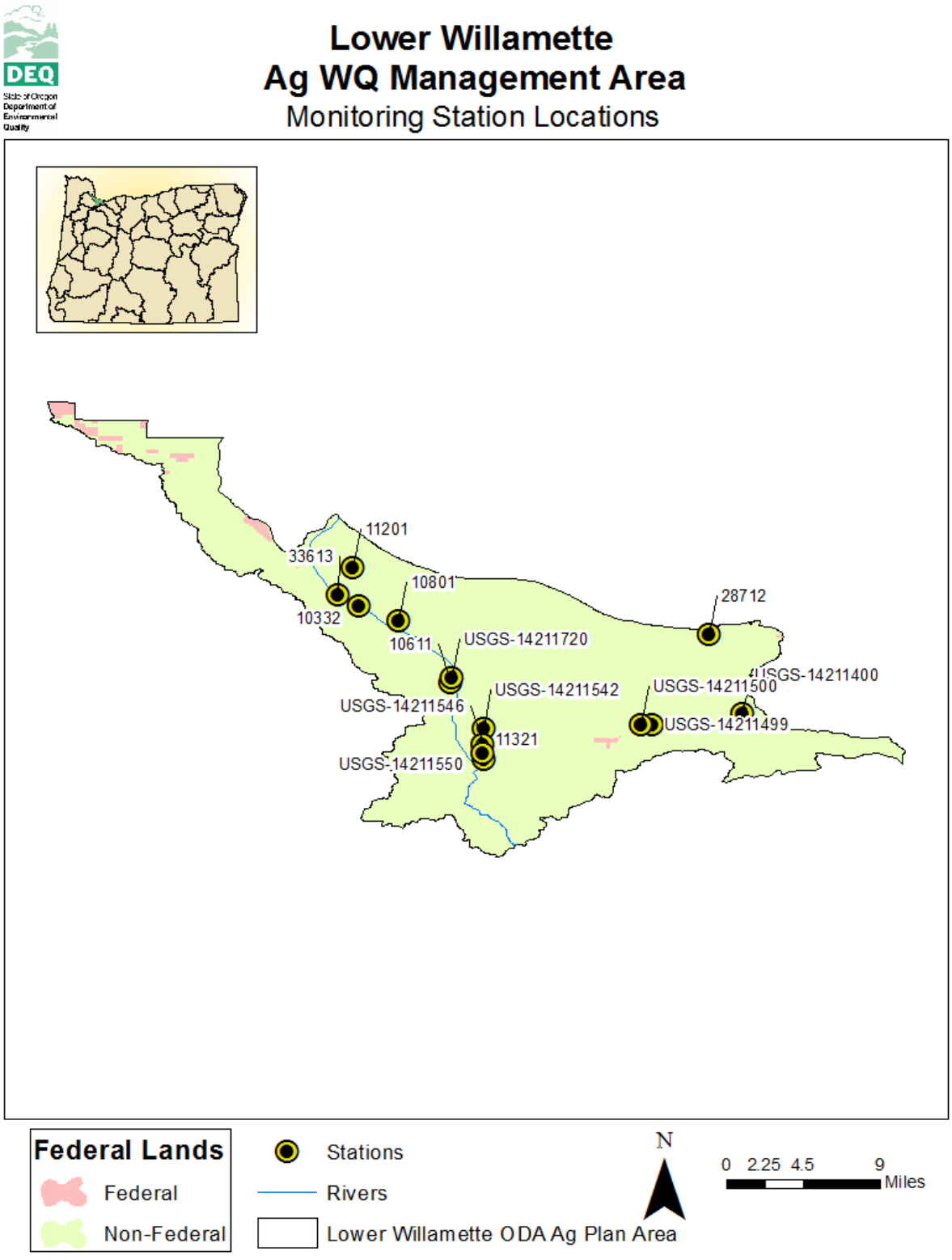

Figure 2: Monitoring station locations within the Lower Willamette AgWQ Management Area

6.2 Land Use

A land use analysis for catchments above all monitoring stations that fit the criteria to assess water quality status and/or trends was generated. Specifically, the Stream-Catchment (StreamCat) dataset developed by EPA (based on the National Hydrography Dataset Plus Version 2 geospatial framework) was used to categorize land uses in the catchment upstream of each station. An informative representation of land use and land cover (NLCD 2011) is shown in the station locations map below.

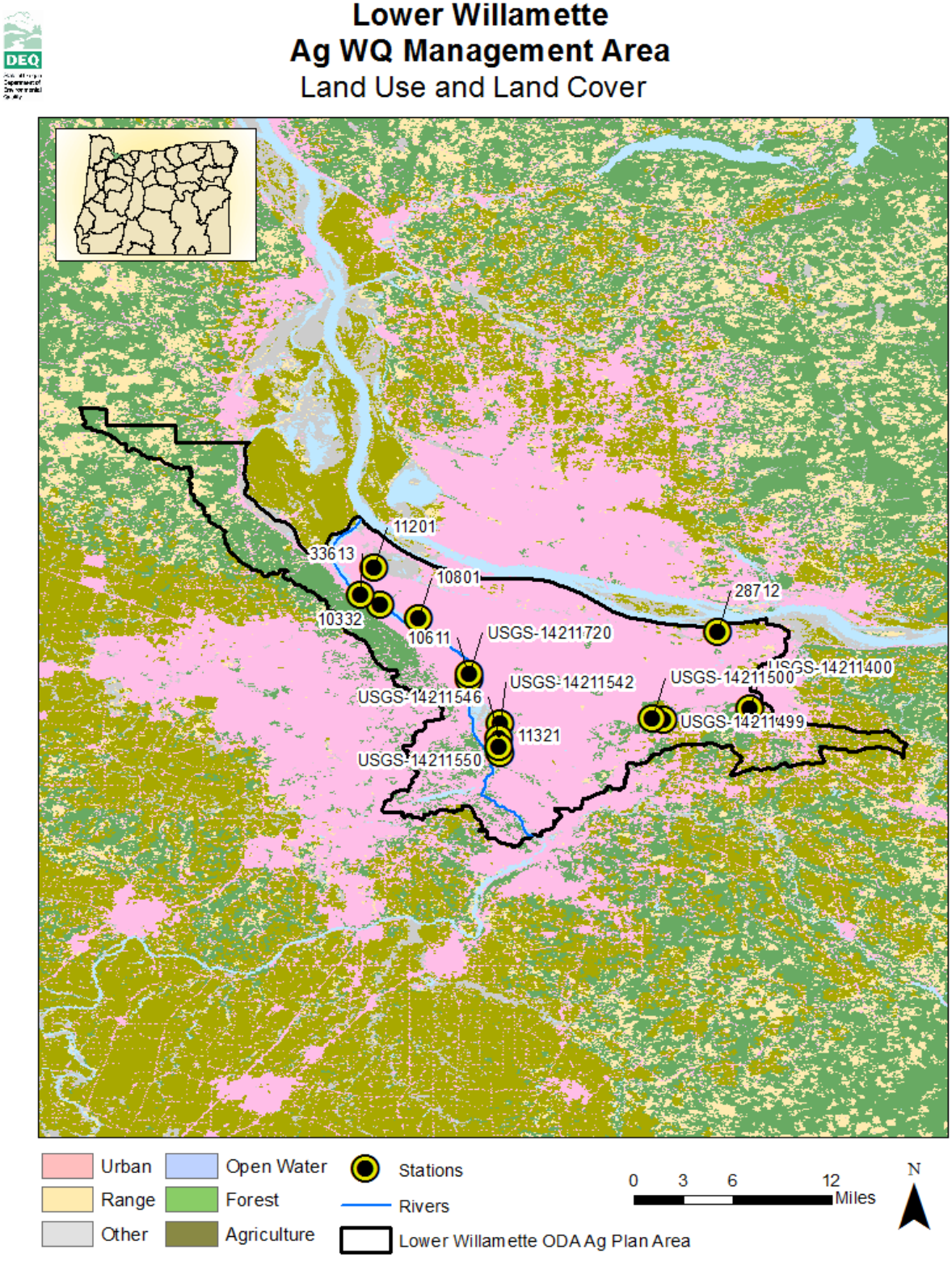

Figure 3: Land use and land cover within the Lower Willamette AgWQ Management Area

Below is a summary table of watershed land use by station. The stations included had at least 8 years of yearly data (between 2000 and 2018) and/or were used to evaluate last known status. The land use summaries represent the entire upstream watershed area for the NHD catchment within which the station is located and is not limited to the Ag Water Quality Management Area in question. Source: 2011 NAIP

Table 6: Summary table of watershed land use for stations with a status or trend result.

Station ID	Station Description	Watershed Area (km^2)	% Urban	% Forest	% Ag	% Range	% Other
USGS-14211400	JOHNSON CREEK AT REGNER ROAD, AT GRESHAM, OR	48	42	21	33	3	2
USGS-14211499	KELLEY CREEK AT SE 159TH DRIVE AT PORTLAND, OR	13	40	27	28	4	1
USGS-14211500	JOHNSON CREEK AT SYCAMORE, OR	73	45	23	27	3	2
10611	Willamette River at Hawthorne Bridge	28922	8	52	20	17	3
10801	Swan Island Channel Midpoint	28922	8	52	20	17	3
USGS-14211720	WILLAMETTE RIVER AT PORTLAND, OR	28922	8	52	20	17	3
10332	Willamette River at SP&S RR Bridge (Portland)	28950	8	52	20	17	3
33613	Willamette River at Cathedral Park Dock	28950	8	52	20	17	3
11321	Johnson Creek at SE 17th Avenue (Portland)	136	67	15	15	2	1
USGS-14211550	JOHNSON CREEK AT MILWAUKIE, OR	136	67	15	15	2	1
28712	Blue Lake Site 2 (west)	579133	2	37	11	47	3
11201	Columbia Slough at Landfill Road	119	93	1	2	1	3
USGS-14211542	CRYSTAL SPRINGS CREEK AT BYBEE ST, PORTLAND, OR	4	93	4	0	1	3
USGS-14211546	CRYSTAL SPRINGS CREEK AT MOUTH AT PORTLAND, OR	7	95	3	0	0	2

6.3 Water Quality Limited Stream Segments

Summary of Oregon's 2012 Integrated Report Assessment database and 303(d) list for parameters included in this report. Table based on the 2012 Integrated Report Listings by the EPA. Note that pH exceedances are values higher or lower than the given range.

Table 7: Summary of Integrated Report listings for parameters included in this report. Table based on the approved (and partially disapproved) 2012 Integrated Report Listings by the EPA

Waterbody	Miles	Pollutant	Season	Year Assessed	Criteria	Listing Status
Willamette River	0 to 24.8	Aldrin	Year Round	2002	See below	Cat 5
Johnson Creek	0 to 23.7	Aldrin	Year Round	2004	Table 20 Toxic Substances	Cat 3
Kelly Creek	0 to 3.6	Aldrin	Year Round	2004	Table 20 Toxic Substances	Cat 3
Johnson Creek	0 to 23.7	DDD 4,4	Year Round	1998	Table 20 Toxic Substances	Cat 2
Johnson Creek	0 to 23.7	DDD 4,4	Year Round	2012	Table 40	Cat 3B
Willamette River	0 to 24.8	DDD 4,4	Year Round	1998	See below	Cat 3B
Columbia Slough	0 to 8.5	DDE 4,4	Year Round	2002	See below	Cat 4A
Willamette River	0 to 24.8	DDE 4,4	Year Round	2002	See below	Cat 5
Johnson Creek	0 to 23.7	DDE 4,4	Year Round	2012	Table 40	Cat 5
Willamette River	0 to 186.4	DDE 4,4	Year Round	2012	Table 40	Cat 3
Willamette River	0 to 24.8	DDE 4,4	Year Round	1998	See below	Cat 3B
Willamette River	0 to 24.8	DDT 4,4	Year Round	2002	See below	Cat 5
Kelly Creek	0 to 3.6	DDT 4,4	Year Round	2004	Table 20 Toxic Substances	Cat 3
Willamette River	0 to 24.8	DDT 4,4	Year Round	2002	Table 20 Toxic Substances	Cat 5
Johnson Creek	0 to 23.7	DDT 4,4	Year Round	2012	Table 40	Cat 4A
Willamette River	0 to 24.8	DDT 4,4	Year Round	1998	See below	Cat 3B
Willamette River	0 to 24.8	Dieldrin	Year Round	2002	See below	Cat 5

Waterbody	Miles	Pollutant	Season	Year Assessed	Criteria	Listing Status
Kelly Creek	0 to 3.6	Dieldrin	Year Round	2004	Table 20 Toxic Substances	Cat 3B
Johnson Creek	0 to 23.7	Dieldrin	Year Round	2012	Table 40	Cat 4A
Willamette River	0 to 186.4	E. Coli	FallWinterSpring	2010	30-day log mean of 126 E. coli organisms per 100 ml; no single sample > 406 organisms per 100 ml	Cat 4A
Willamette River	0 to 50.6	Temperature	Year Round (Non-spawning)	2010	Salmon and steelhead migration corridors: 20.0 degrees Celsius 7-day-average maximum	Cat 4A
Unnamed Stream/Smith Lake	1.7 to 3	pH	Summer	1998	pH 6.5 to 8.5	Cat 5
Unnamed Stream/Bybee Lake	0.5 to 1.7	pH	Summer	1998	pH 6.5 to 8.5	Cat 5
Unnamed Stream	0 to 3.1	E. Coli	FallWinterSpring	2012	30-day log mean of 126 E. coli organisms per 100 ml; no single sample > 406 organisms per 100 ml	Cat 4A
Tryon Creek	0 to 2.5	Dissolved Oxygen	October 15 - May 15	2012	Spawning: Not less than 11.0 mg/L or 95% of saturation	Cat 5
Tryon Creek	0 to 5	Temperature	Summer	2010	Rearing: 17.8 C	Cat 4A
Spring Brook Creek	0 to 2.3	Fecal Coliform	FallWinterSpring	2010	Fecal coliform log mean of 200 organisms per 100 ml; no more than 10% > 400 per 100 ml	Cat 4A
Spring Brook Creek	0 to 2.3	Phosphorus	May 1 - October 31	1998	Biocriteria: Waters of the state must be of sufficient quality to support aquatic species without detrimental changes in the resident biological communities.	Cat 4A
Spring Brook Creek	0 to 2.3	Fecal Coliform	Summer	2010	Fecal coliform log mean of 200 organisms per 100 ml; no more than 10% > 400 per 100 ml	Cat 4A
Phillips Creek	0 to 1.2	E. Coli	FallWinterSpring	2010	30-day log mean of 126 E. coli organisms per	Cat 4A

Waterbody	Miles	Pollutant	Season	Year Assessed	Criteria	Listing Status
					100 ml; no single sample > 406 organisms per 100 ml	
Phillips Creek	0 to 1.2	E. Coli	Summer	2010	30-day log mean of 126 E. coli organisms per 100 ml; no single sample > 406 organisms per 100 ml	Cat 4A
Oswego Creek/Lake Oswego	0.5 to 3	pH	May 1 - October 31	1998	pH 6.5 to 8.5	Cat 4A
Oswego Creek/Lake Oswego	0 to 3	Dissolved Oxygen	January 1 - May 15	2012	Spawning: Not less than 11.0 mg/L or 95% of saturation	Cat 5
Oswego Creek/Lake Oswego	0.5 to 3	Phosphorus	Spring/Summer/Fall	1998	Biocriteria: Waters of the state must be of sufficient quality to support aquatic species without detrimental changes in the resident biological communities.	Cat 4A
Osburn Creek/Fairview Lake	2 to 2.8	pH	FallWinterSpring	2004	pH 6.5 to 8.5	Cat 4A
North Fork Johnson Creek	0 to 2.1	E. Coli	FallWinterSpring	2012	30-day log mean of 126 E. coli organisms per 100 ml; no single sample > 406 organisms per 100 ml	Cat 4A
Multnomah Channel	0 to 21.7	Dissolved Oxygen	January 1 - May 15	2012	Spawning: Not less than 11.0 mg/L or 95% of saturation	Cat 5
Multnomah Channel	0 to 21.7	Temperature	Year Round (Non-spawning)	2010	Salmon and trout rearing and migration: 18.0 degrees Celsius 7-day-average maximum	Cat 4A
Mount Scott Creek	0 to 6.1	E. Coli	Summer	2010	30-day log mean of 126 E. coli organisms per 100 ml; no single sample > 406 organisms per 100 ml	Cat 4A
Mount Scott Creek	0 to 6.1	E. Coli	FallWinterSpring	2010	30-day log mean of 126 E. coli organisms per 100 ml; no single sample > 406 organisms per 100 ml	Cat 4A
Kellogg Creek	0 to 5	E. Coli	FallWinterSpring	2010	30-day log mean of 126 E. coli organisms per	Cat 4A

Waterbody	Miles	Pollutant	Season	Year Assessed	Criteria	Listing Status
					100 ml; no single sample > 406 organisms per 100 ml	
Kellogg Creek	0 to 1	Dissolved Oxygen	January 1 - May 15	2012	Spawning: Not less than 11.0 mg/L or 95% of saturation	Cat 5
Johnson Creek	0 to 10.5	Dissolved Oxygen	October 15 - May 15	2012	Spawning: Not less than 11.0 mg/L or 95% of saturation	Cat 5
Johnson Creek	0 to 23.7	E. Coli	FallWinterSpring	2010	30-day log mean of 126 E. coli organisms per 100 ml; no single sample > 406 organisms per 100 ml	Cat 4A
Johnson Creek	0 to 23.7	pH	FallWinterSpring	2010	pH 6.5 to 8.5	Cat 5
Johnson Creek	0 to 23.7	E. Coli	Summer	2010	30-day log mean of 126 E. coli organisms per 100 ml; no single sample > 406 organisms per 100 ml	Cat 4A
Johnson Creek	0.2 to 10.5	Temperature	October 15 - May 15	2010	Salmon and steelhead spawning: 13.0 degrees Celsius 7-day-average maximum	Cat 4A
Johnson Creek	0 to 23.7	Temperature	Year Round (Non-spawning)	2010	Salmon and trout rearing and migration: 18.0 degrees Celsius 7-day-average maximum	Cat 4A
Fairview Creek	0 to 1.7	E. Coli	Year Round	2010	30-day log mean of 126 E. coli organisms per 100 ml; no single sample > 406 organisms per 100 ml	Cat 4A
Fairview Creek	0 to 1.7	Temperature	Summer	2010	Rearing: 17.8 C	Cat 4A
Fairview Creek	0 to 1.7	pH	Spring/Summer	2004	pH 6.5 to 8.5	Cat 4A
Columbia Slough	0 to 9.8	pH	Summer	2004	pH 6.5 to 8.5	Cat 4A
Columbia Slough	0 to 9.8	Dissolved Oxygen	January 1 - May 15	2012	Spawning: Not less than 11.0 mg/L or 95% of saturation	Cat 5
Columbia Slough	0 to 8.5	Temperature	Spring/Summer/Fall	2010	Rearing: 17.8 C	Cat 4A
Columbia Slough	0 to 8.5	Fecal Coliform	Summer	2002	NA	Cat 4A

Waterbody	Miles	Pollutant	Season	Year Assessed	Criteria	Listing Status
Columbia Slough	0 to 8.5	Phosphorus	Spring/Summer/Fall	2002	Biocriteria: Waters of the state must be of sufficient quality to support aquatic species without detrimental changes in the resident biological communities.	Cat 4A
Columbia Slough	0 to 8.5	Dissolved Oxygen	Year Round (Non-spawning)	2002	Cool water: Not less than 6.5 mg/l	Cat 4A
Columbia Slough	0 to 8.5	Fecal Coliform	FallWinterSpring	2002	Fecal coliform log mean of 200 organisms per 100 ml; no more than 10% > 400 per 100 ml	Cat 4A
Columbia Slough	0 to 8.5	pH	Spring/Summer/Fall	2002	pH 6.5 to 8.5	Cat 4A
Arata Creek/Blue Lake	0 to 0.9	pH	Summer	2012	pH 6.5 to 8.5	Cat 5
Arata Creek/Blue Lake	0 to 0.9	pH	FallWinterSpring	2010	pH 6.5 to 8.5	Cat 5
Arata Creek/Blue Lake	0 to 0.9	Dissolved Oxygen	Year Round (Non-spawning)	2012	Cool water: Not less than 6.5 mg/l	Cat 5

E.coli: 30-day log mean of 126 E coli organisms per 100ml OR no single sample >406 organisms per 100 ml

pH: Exceedances are values high or lower than the given range

DDD, DDE, DDT, Dieldrin, Aldrin: Toxic substances may not be introduced above natural background levels in the waters of the State in amounts, concentrations, or combinations that may be harmful, may chemically change to harmful forms in the environment, or may accumulate in sediment. Where no published EPA criteria exist for a toxic substance, public health advisories and other published scientific literature may be considered and used, if appropriate, to set guidance values.

Assessment Categories:

- Cat 2: Attaining some criteria/uses
- Cat 3: Insufficient Data
- Cat 3b: Insufficeint Data, potential concern
- Cat 4A: Water quality limited, TMDL approved
- Cat 5: Water quality limited, 303(d) list, TMDL needed

6.4 Seasonal Kendall Trend Analysis

For all monitoring stations with sufficient data (8 years or more), trending was performed using Seasonal Kendall trend analysis. Results are summarized in the table below. (If no table is visible, there were no monitoring station that contained sufficient data to assess trends.)

Table 8: Output for the Seasonal Kendall analysis, which was performed on stations with at least 8 years of data between 2000 and 2018. Only stations used in this analysis are included in this table. The values in the N column represent the number of results for each analyte at each monitoring station and includes duplicate values; the slope refers to the slope of the trend line; the p-value represents the statistical significance of the trend (p<0.8 is significant and is defined in the 'significant' column); median represents the median value of all assessed results for each station at each monitoring station.

Station ID	Analyte	Slope	p value	Median	N	Significance Result
10332	Dissolved Oxygen	1.737500e-02	1.985626e-01	10.8	139	80% Significance Level
10611	Dissolved Oxygen	6.625000e-02	1.500000e-05	11	180	99% Significance Level
10801	Dissolved Oxygen	6.666670e-02	6.535600e-02	11.1	129	90% Significance Level
11201	Dissolved Oxygen	6.868690e-02	2.696745e-01	12.35	136	Not Significant
11321	Dissolved Oxygen	0.000000e+00	5.829273e-01	10.65	122	Not Significant
33613	Dissolved Oxygen	1.018333e-01	5.231430e-02	10.46	58	90% Significance Level
USGS-14211720	Dissolved Oxygen	-5.071430e-02	3.605440e-02	11.5	160924	95% Significance Level
10332	E. Coli	-7.196429e-01	3.080000e-05	20	172	99% Significance Level
10611	E. Coli	-3.435497e-01	1.371732e-01	18	230	80% Significance Level
10801	E. Coli	-5.142857e-01	7.791610e-02	18.5	176	90% Significance Level
11201	E. Coli	4.708333e-01	6.319411e-01	31	170	Not Significant
11321	E. Coli	-1.372565e+01	2.396100e-03	345	165	99% Significance Level
10332	pH	8.333300e-03	1.201430e-02	7.6	169	95% Significance Level
10611	pH	2.025000e-02	1.000000e-07	7.5	210	99% Significance Level
10801	pH	6.250000e-03	1.253490e-02	7.6	161	95% Significance Level
11201	pH	2.000000e-03	8.130797e-01	7.8	167	Not Significant

Station ID	Analyte	Slope	p value	Median	N	Significance Result
11321	pH	0.000000e+00	6.977233e-01	7.7	153	Not Significant
28712	pH	8.493450e-02	3.700890e-02	8.1	230	95% Significance Level
33613	pH	5.050000e-02	1.647700e-02	7.46	56	95% Significance Level
USGS-14211720	pH	-1.041700e-03	4.976700e-03	7.3	160284	99% Significance Level
USGS-14211400	Temperature	8.598480e-02	1.180000e-05	17.9	2703	99% Significance Level
USGS-14211499	Temperature	7.785710e-02	5.720000e-04	16.6	2518	99% Significance Level
USGS-14211500	Temperature	1.268333e-01	1.000000e-07	18.6	2745	99% Significance Level
USGS-14211542	Temperature	-3.125000e-02	2.641154e-01	18.3	2126	Not Significant
USGS-14211546	Temperature	-3.812500e-02	1.262084e-01	20.1	1575	80% Significance Level
USGS-14211550	Temperature	4.945000e-04	8.751844e-01	19.4	2717	Not Significant
USGS-14211720	Temperature	-1.767860e-02	8.333516e-01	19.9	1900	Not Significant
10332	Total Phosphorus	-1.250000e-03	5.600000e-06	0.07	134	99% Significance Level
10611	Total Phosphorus	-1.083300e-03	0.000000e+00	0.07	172	99% Significance Level
10801	Total Phosphorus	0.000000e+00	4.128500e-02	0.07	130	95% Significance Level
11201	Total Phosphorus	-3.333000e-04	1.853850e-02	0.15	136	95% Significance Level
11321	Total Phosphorus	-4.545000e-04	6.958600e-03	0.09	120	99% Significance Level
28712	Total Phosphorus	-5.000000e-05	6.596937e-01	0.03	192	Not Significant
USGS-14211720	Total Phosphorus	-1.250000e-03	0.000000e+00	0.06	302	99% Significance Level
10332	Total Suspended Solids	-8.333300e-03	9.704909e-01	5	132	Not Significant
10611	Total Suspended Solids	1.785710e-02	8.732891e-01	5	173	Not Significant

Station ID	Analyte	Slope	p value	Median	N	Significance Result
10801	Total Suspended Solids	0.000000e+00	4.802844e-01	5	127	Not Significant
11201	Total Suspended Solids	5.000000e-02	1.460554e-01	24	132	80% Significance Level
11321	Total Suspended Solids	0.000000e+00	8.171167e-01	7	122	Not Significant

6.5 E.coli

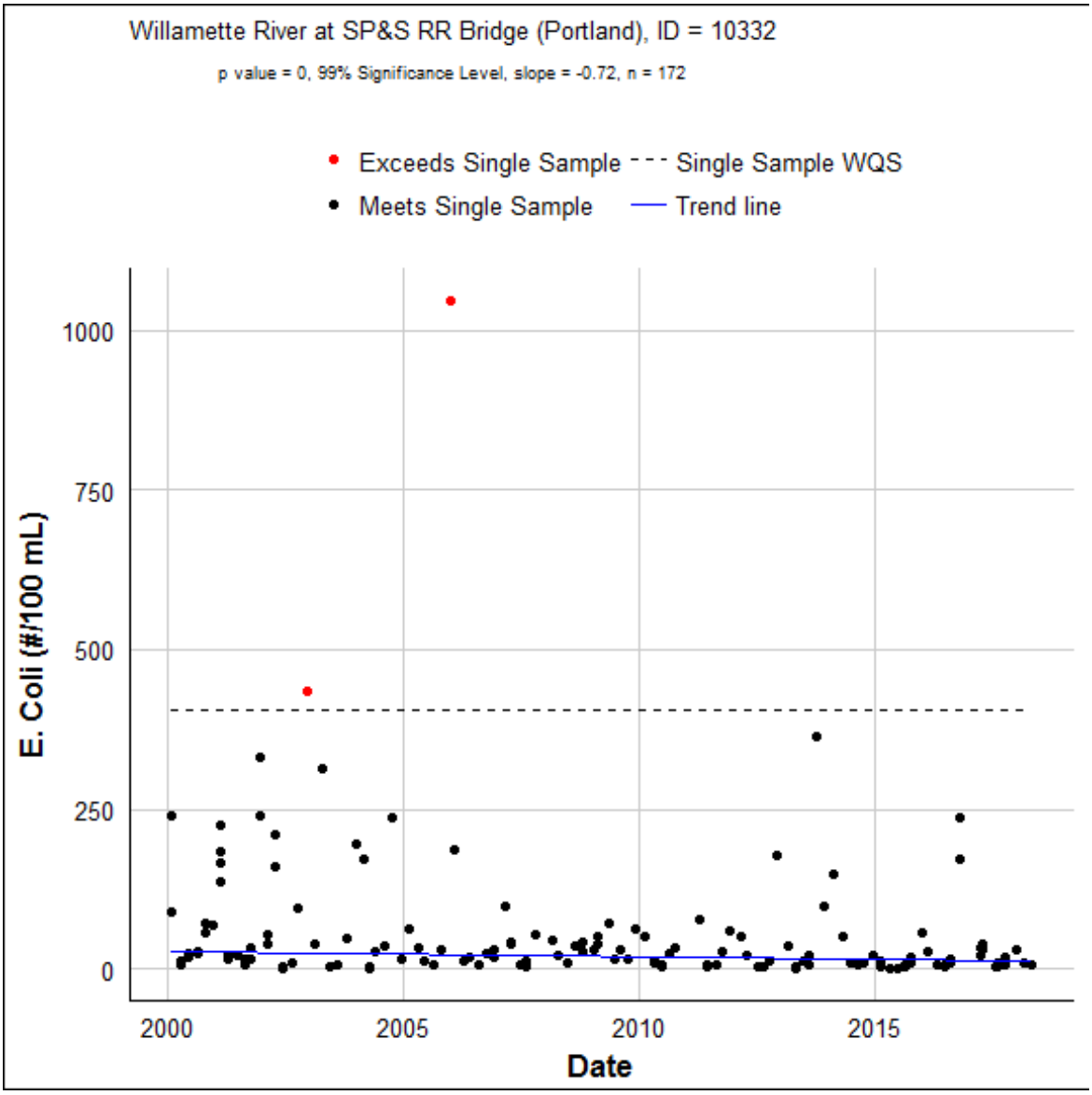

Figure 4: Station 10332 *E. Coli* water quality status and/or trends

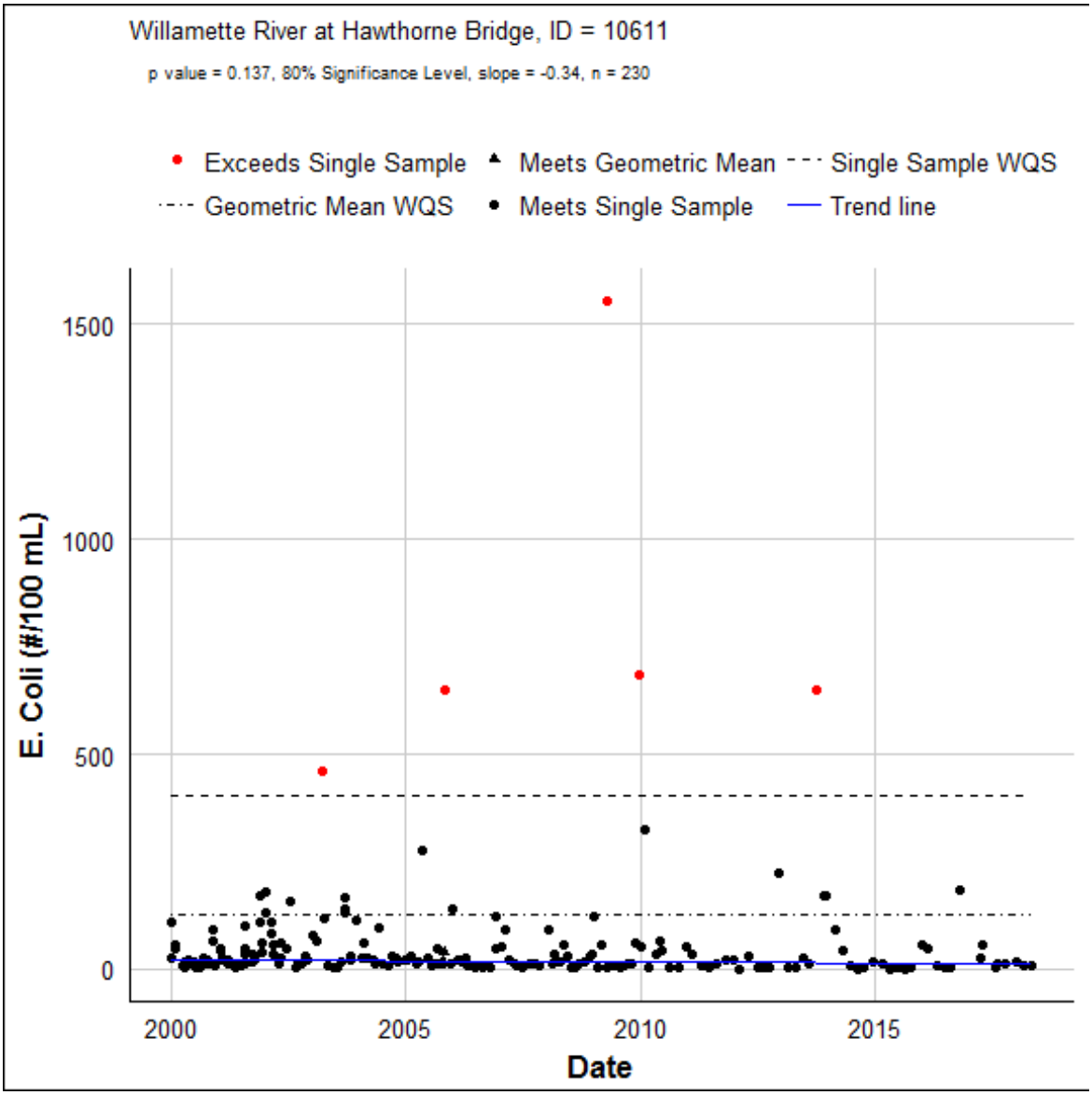

Figure 5: Station 10611 *E. Coli* water quality status and/or trends

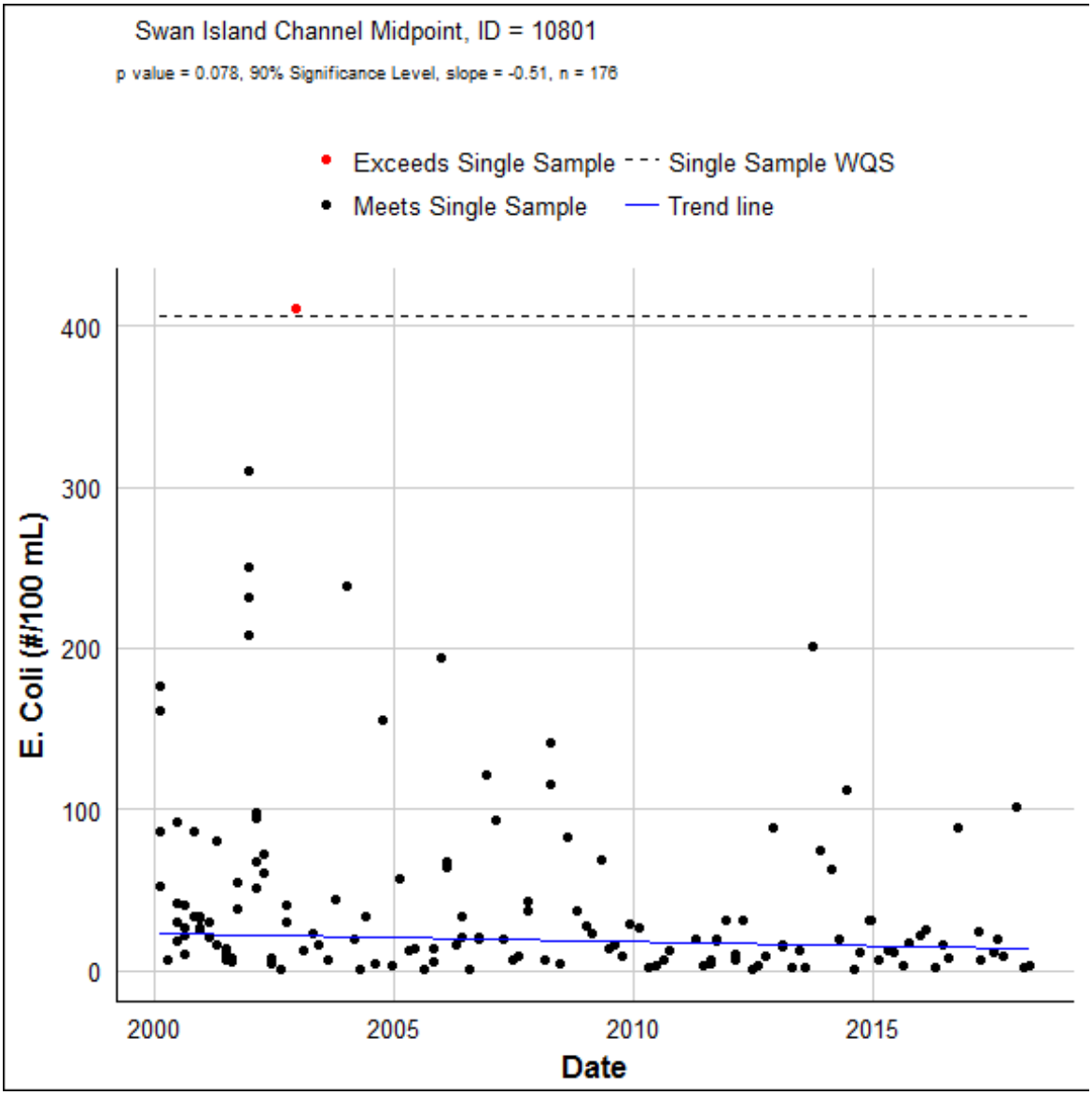

Figure 6: Station 10801 *E. Coli* water quality status and/or trends

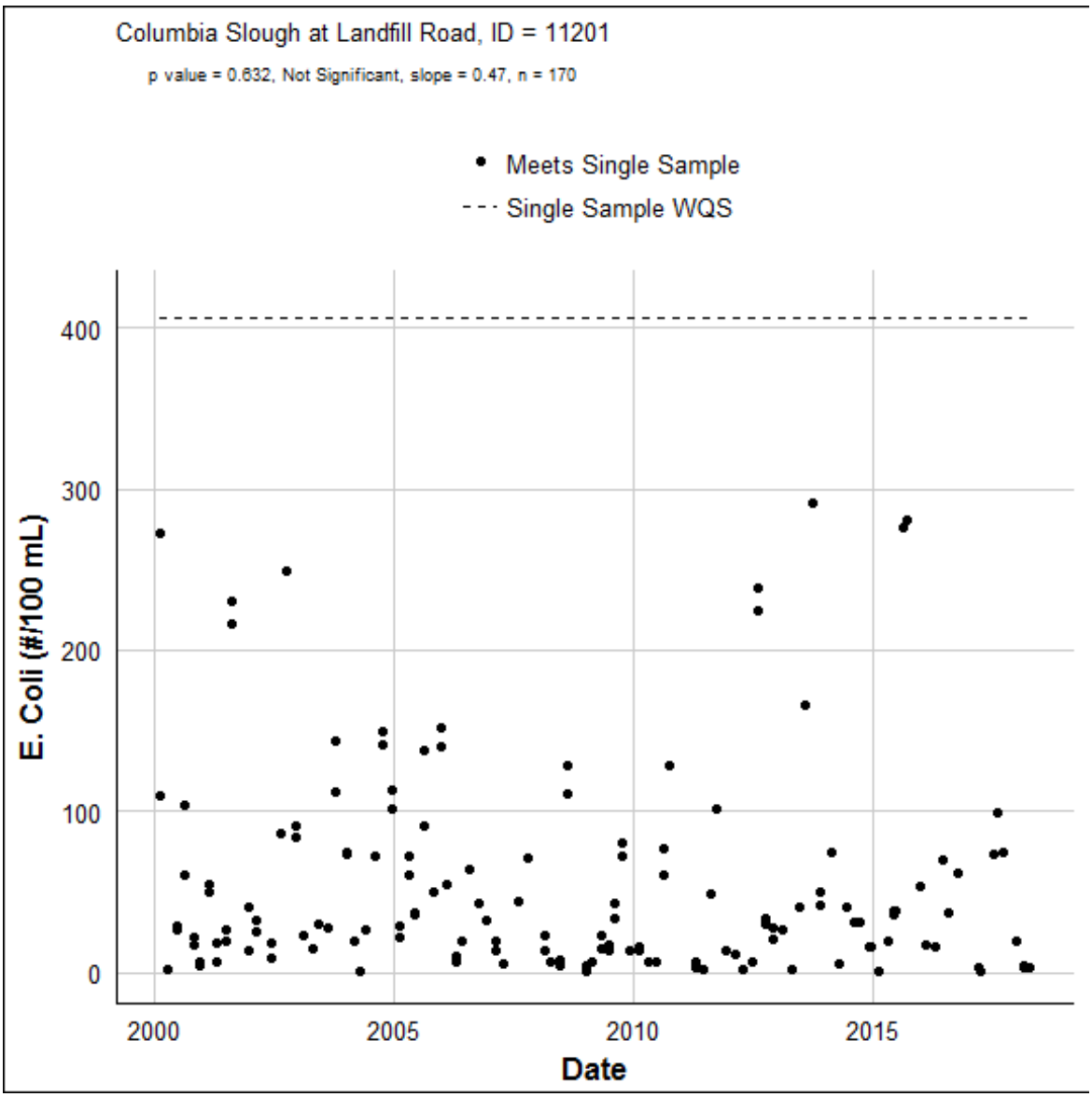

Figure 7: Station 11201 *E. Coli* water quality status and/or trends

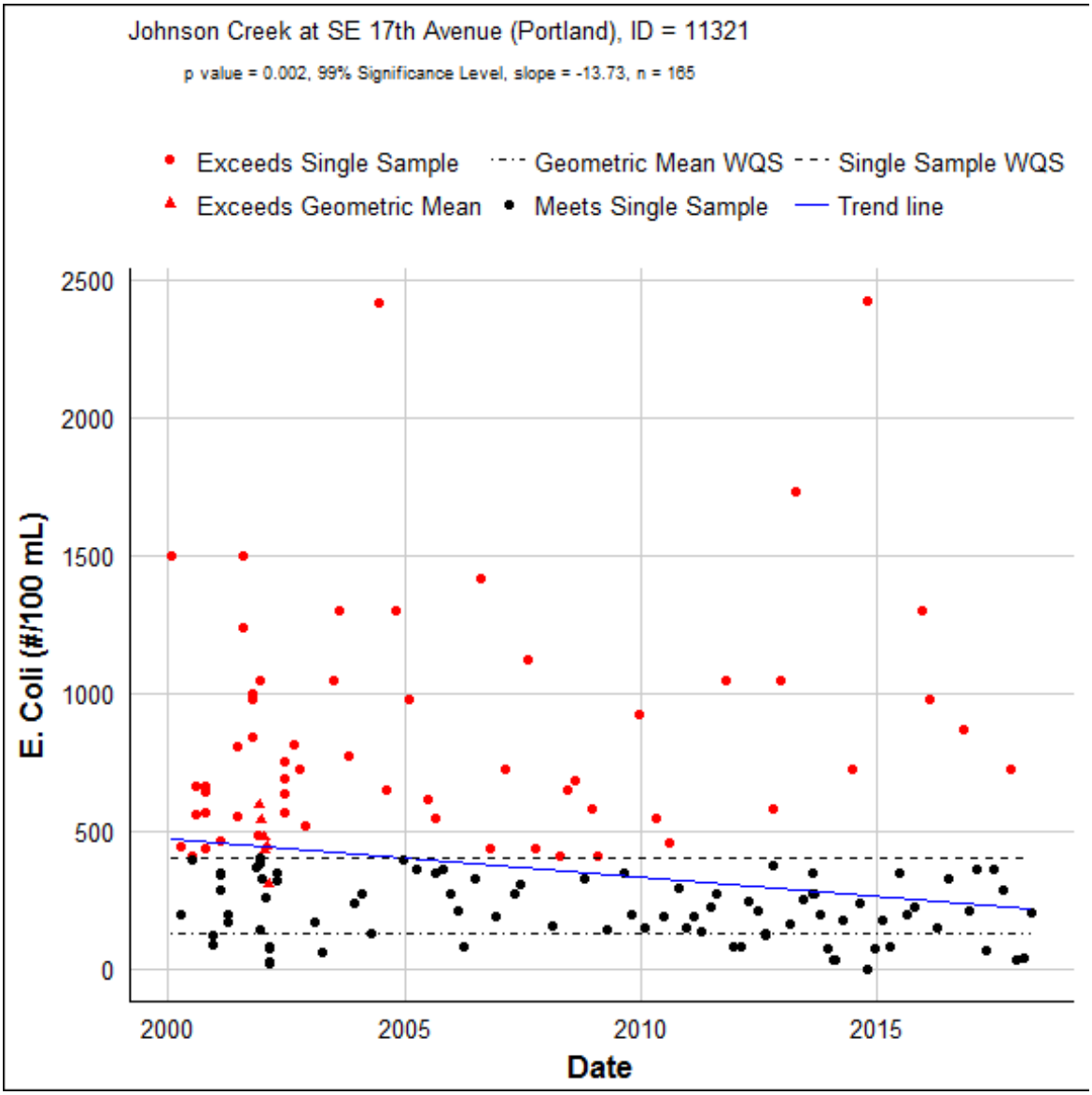

Figure 8: Station 11321 *E. Coli* water quality status and/or trends

Table 9: E. Coli status. If sufficient data exists to calculate the geometric mean, it is included in the table.

Station_ID	Station_Description	Sample	Obs	Exceedances	Percent_Exceedance
10332	Willamette River at SP&S RR Bridge (Portland)	Single sample	106	2	1.9
10332	Willamette River at SP&S RR Bridge (Portland)	Geomean	0	0	NaN
10611	Willamette River at Hawthorne Bridge	Single sample	172	5	2.9
10611	Willamette River at Hawthorne Bridge	Geomean	2	0	0.0

Station_ID	Station_Description	Sample	Obs	Exceedances	Percent_Exceedance
10801	Swan Island Channel Midpoint	Single sample	106	1	0.9
10801	Swan Island Channel Midpoint	Geomean	0	0	NaN
11201	Columbia Slough at Landfill Road	Single sample	102	0	0.0
11201	Columbia Slough at Landfill Road	Geomean	0	0	NaN
11321	Johnson Creek at SE 17th Avenue (Portland)	Single sample	113	47	41.6
11321	Johnson Creek at SE 17th Avenue (Portland)	Geomean	6	6	100.0

6.6 Total Phosphorus

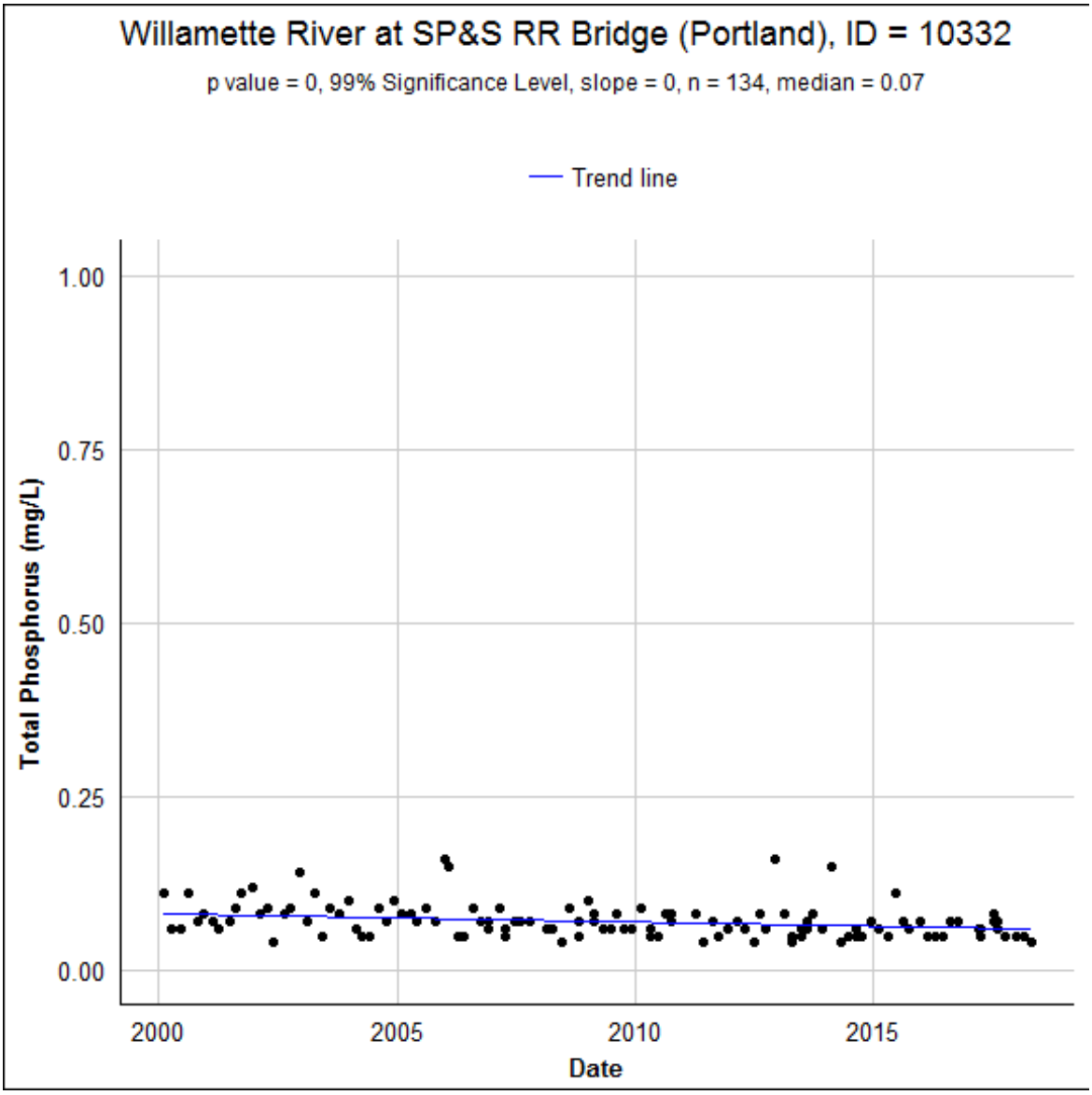

Figure 9: Station 10332 *Total Phosphorus* water quality status and trends

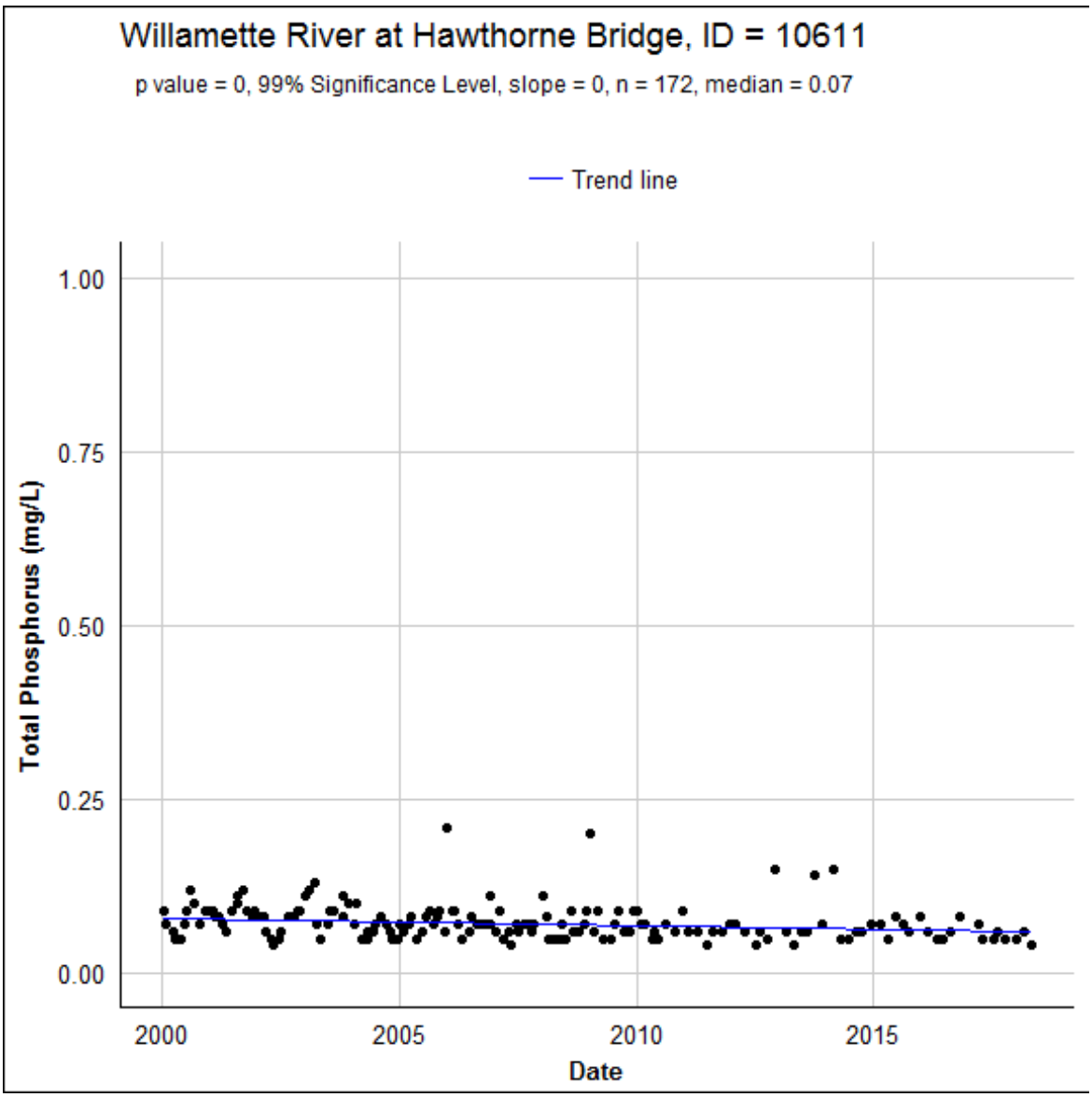

Figure 10: Station 10611 *Total Phosphorus* water quality status and trends

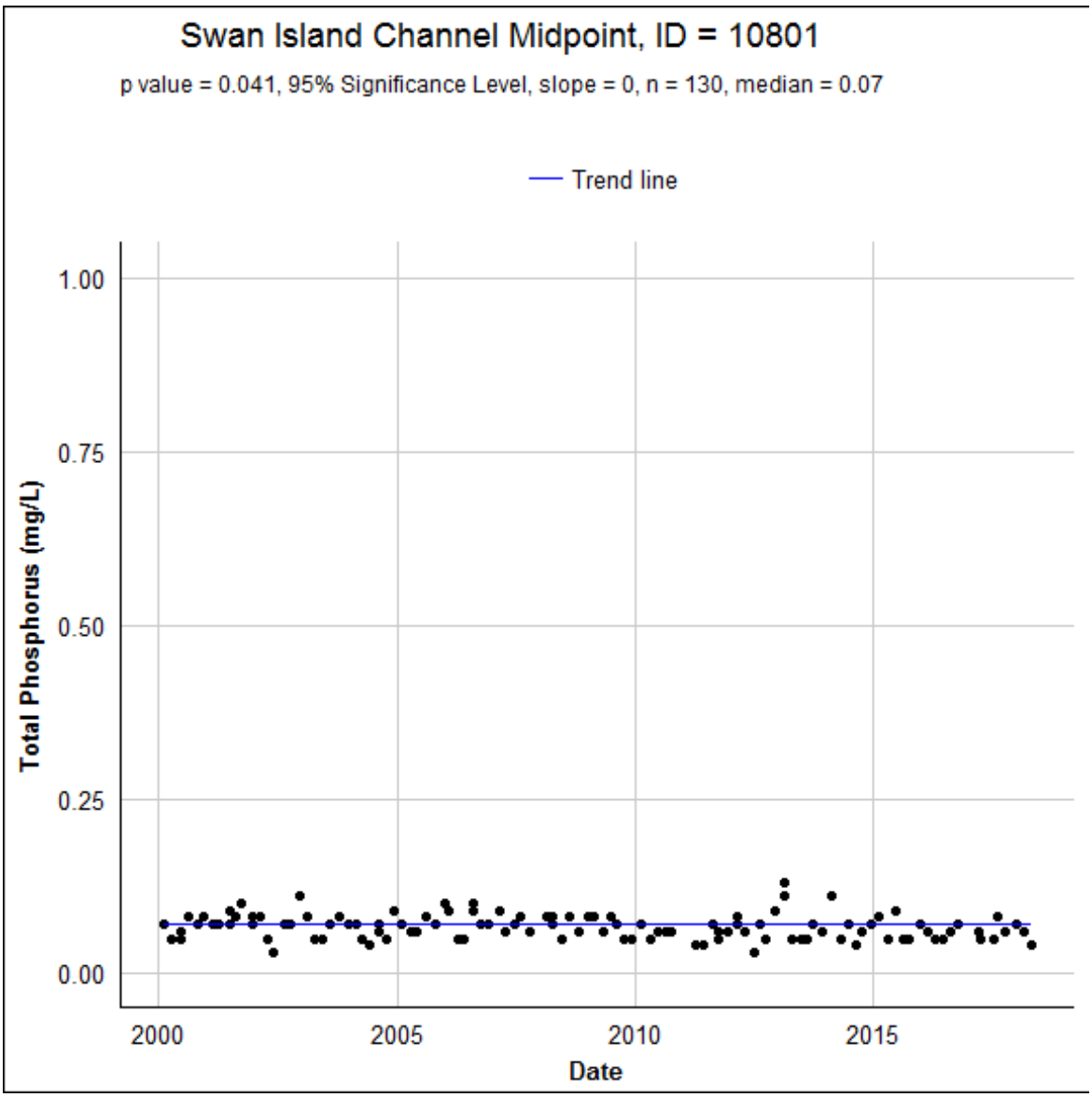

Figure 11: Station 10801 *Total Phosphorus* water quality status and trends

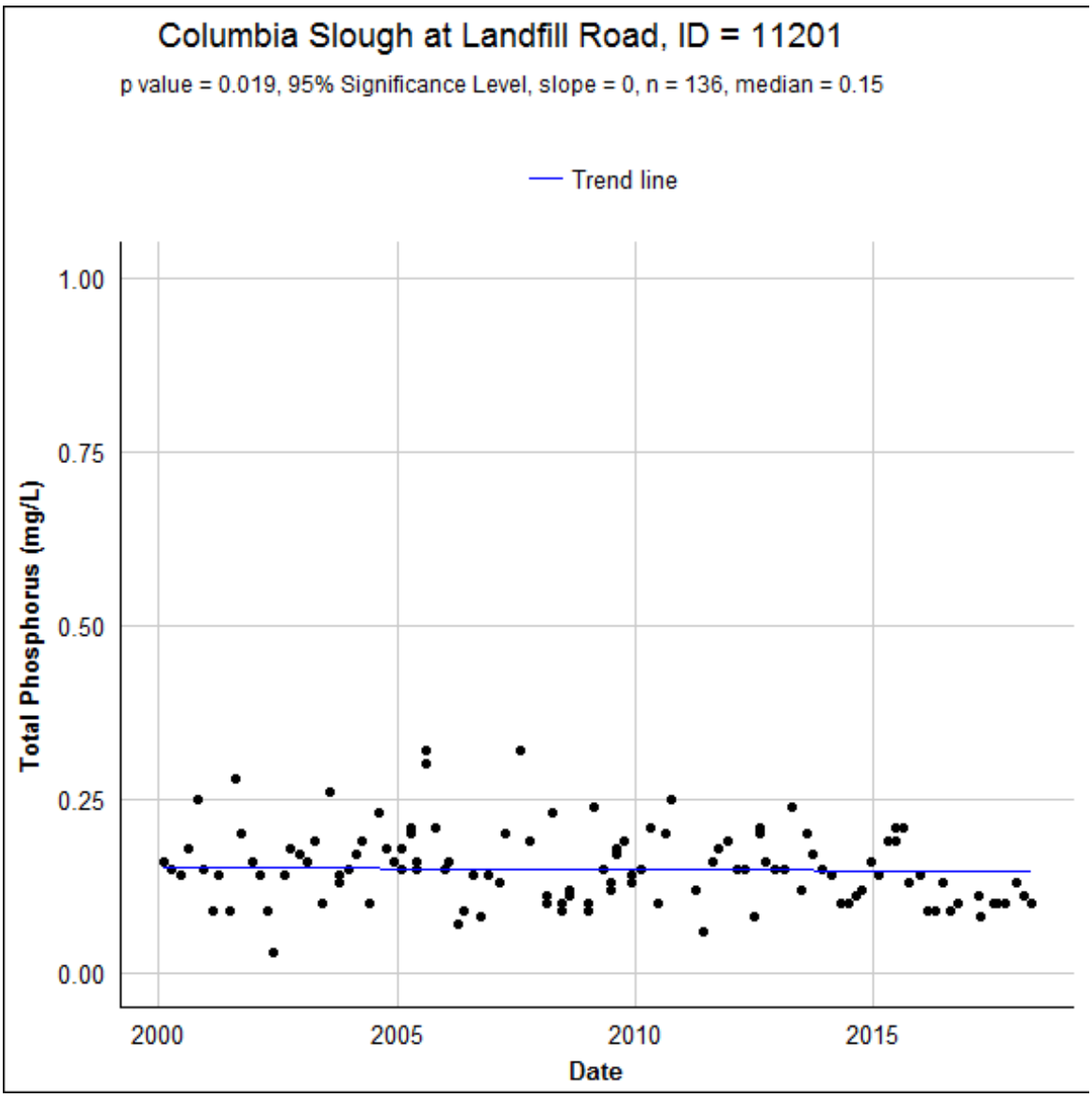

Figure 12: Station 11201 *Total Phosphorus* water quality status and trends

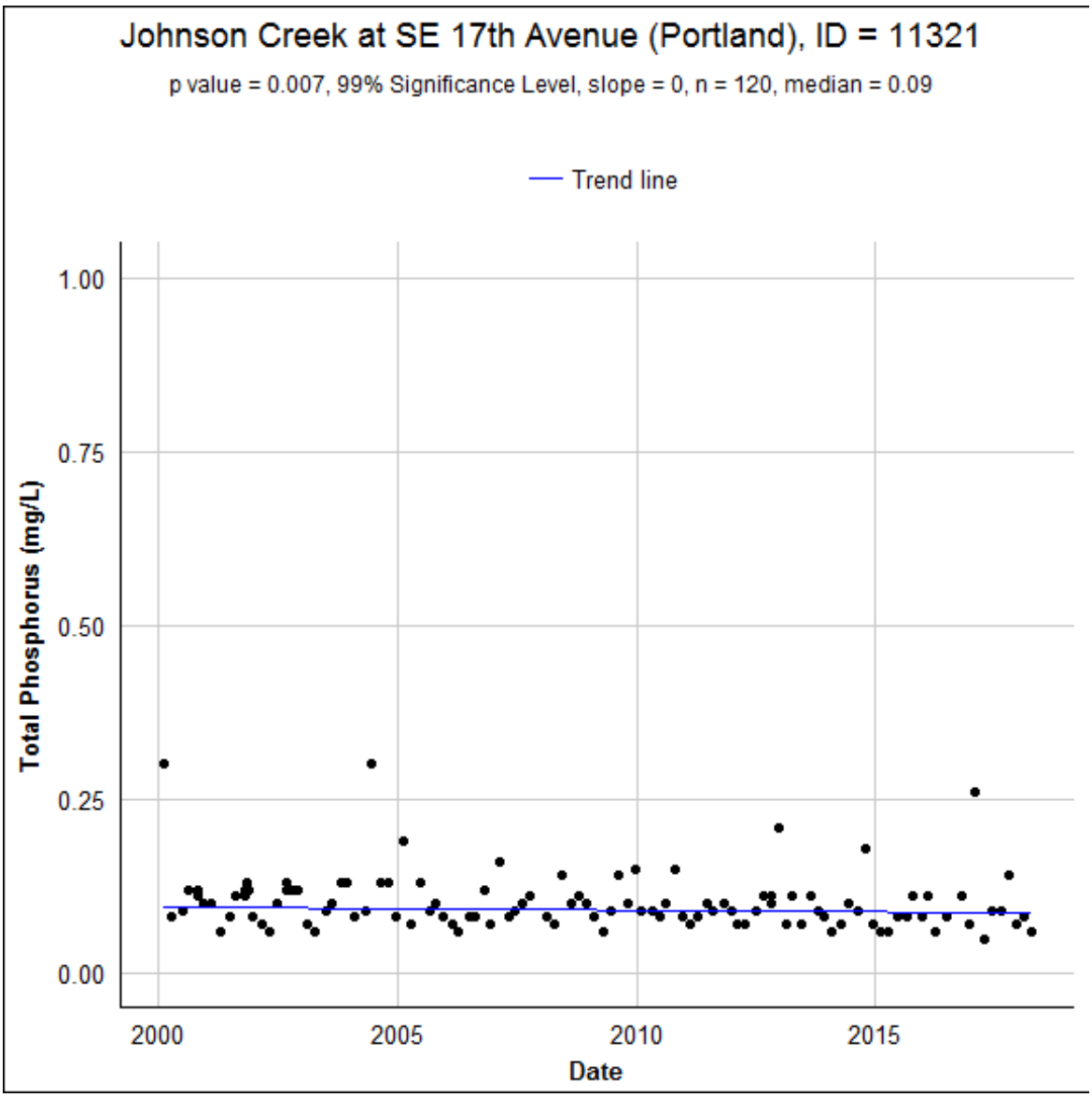

Figure 13: Station 11321 *Total Phosphorus* water quality status and trends

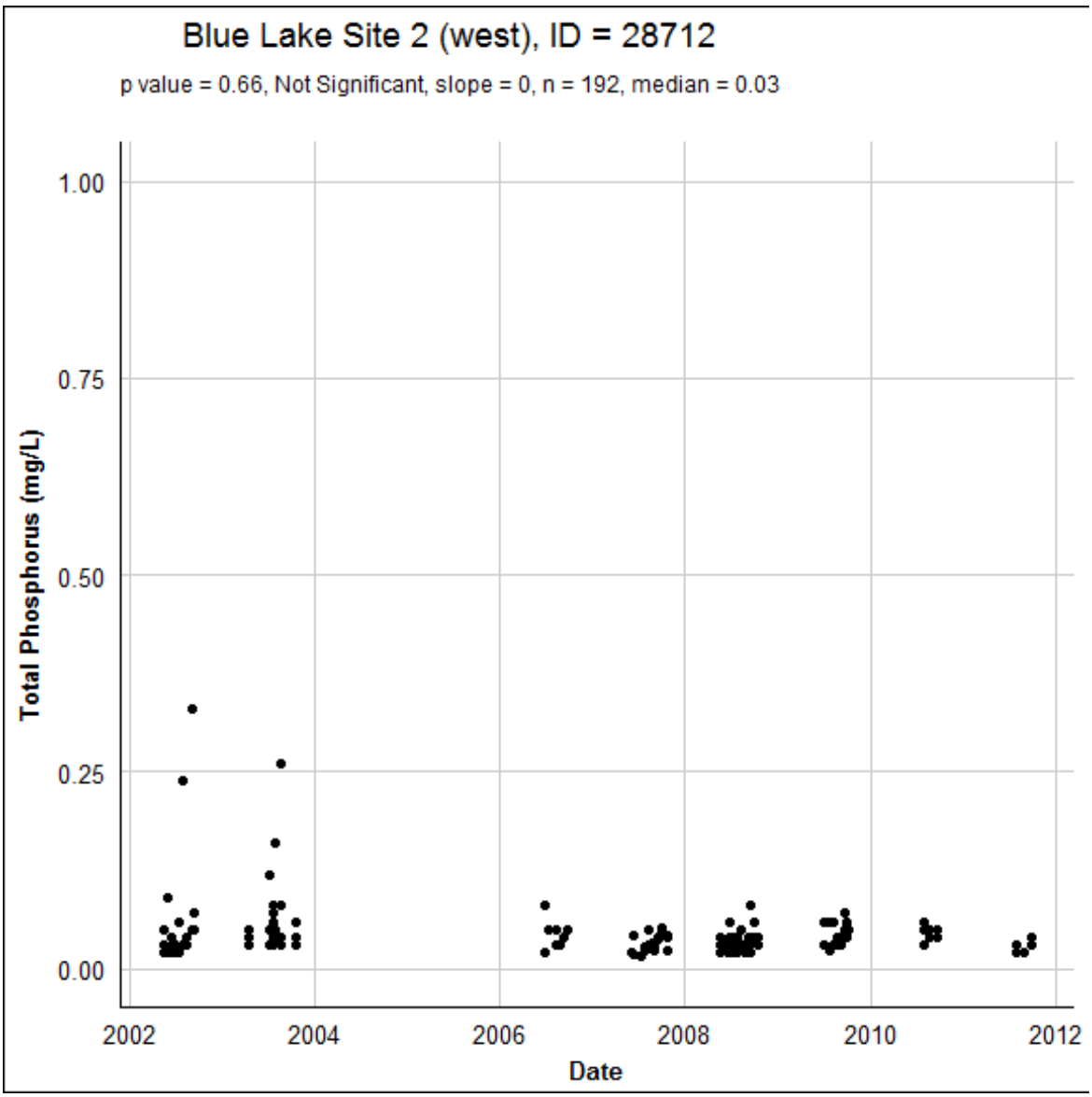

Figure 14: Station 28712 *Total Phosphorus* water quality status and trends

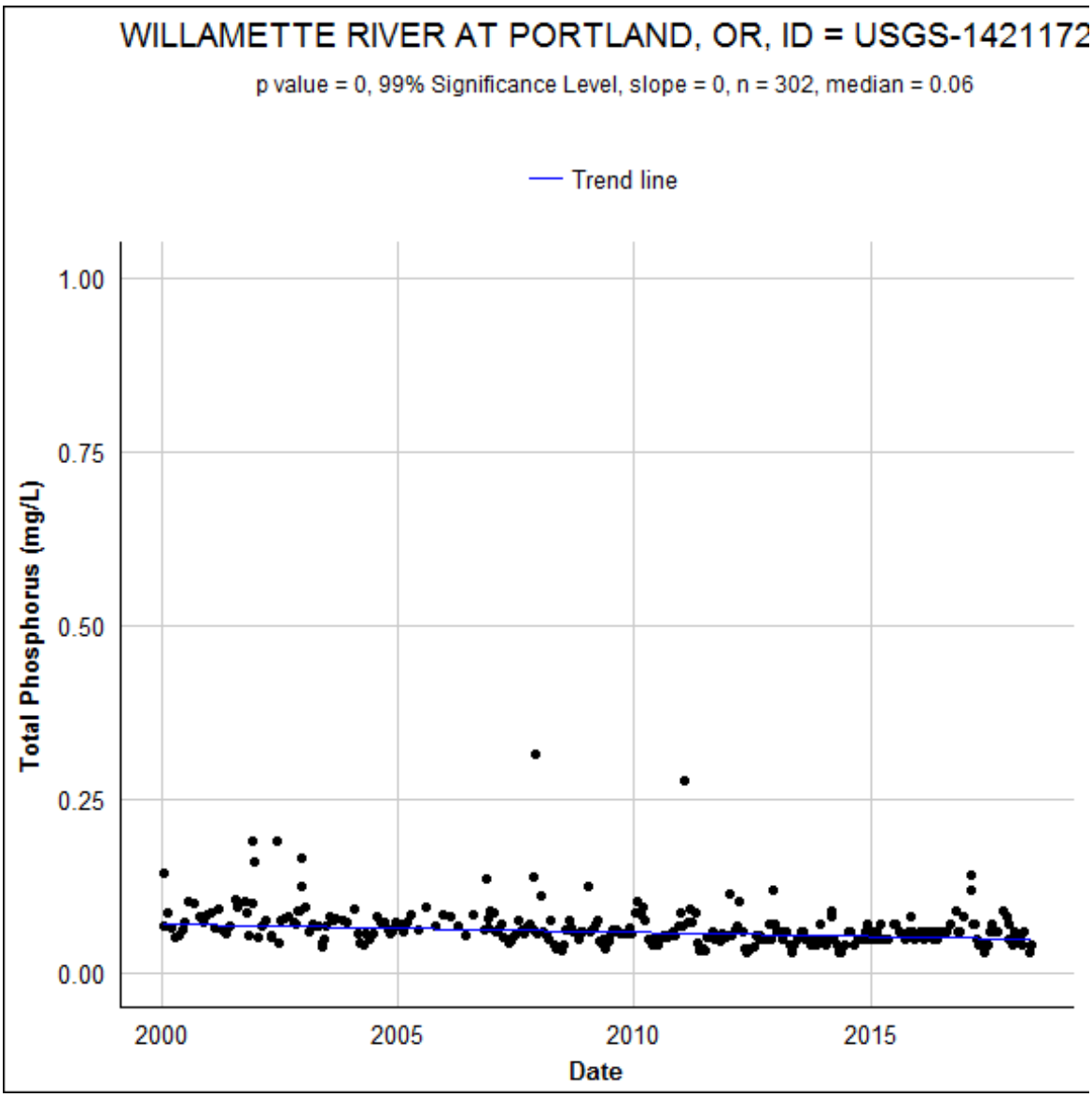

Figure 15: Station USGS-14211720 *Total Phosphorus* water quality status and trends

Table 10: Total Phosphorus observations

Station ID	Station Description	Min Date	Max Date	Obs
10332	Willamette River at SP&S RR Bridge (Portland)	2000	2018	106
10611	Willamette River at Hawthorne Bridge	2000	2018	170
10801	Swan Island Channel Midpoint	2000	2018	106
11201	Columbia Slough at Landfill Road	2000	2018	104
11321	Johnson Creek at SE 17th Avenue (Portland)	2000	2018	110
28712	Blue Lake Site 2 (west)	2002	2011	66
USGS-14211720	WILLAMETTE RIVER AT PORTLAND, OR	2000	2018	302

6.7 Total Suspended Solids

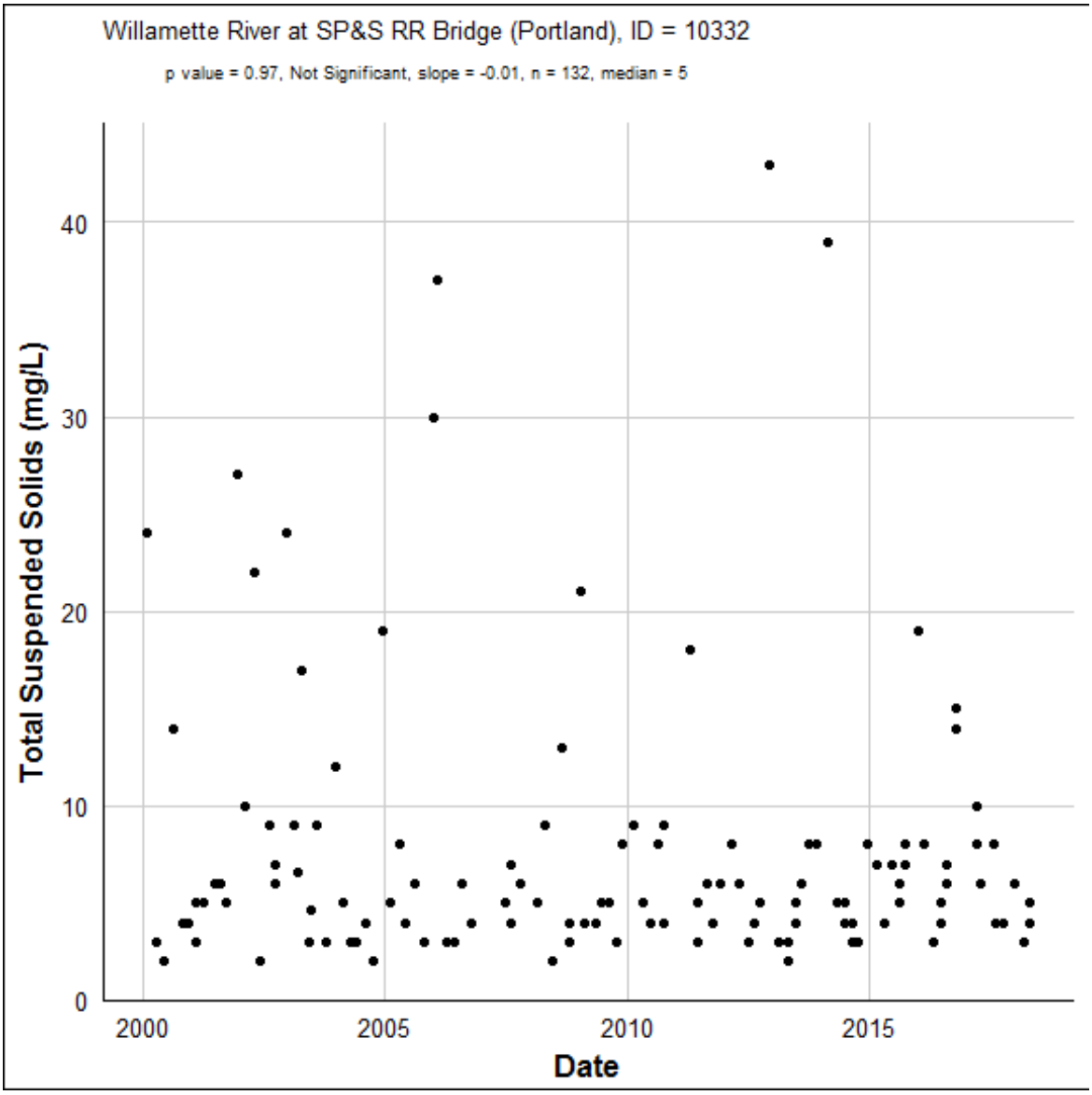

Figure 16: Station 10332 *Total Suspended Solids* water quality trends. Note that TSS (15 mg/L) is used as a surrogate for meeting the DDT/dieldrin TMDL in Johnson Creek

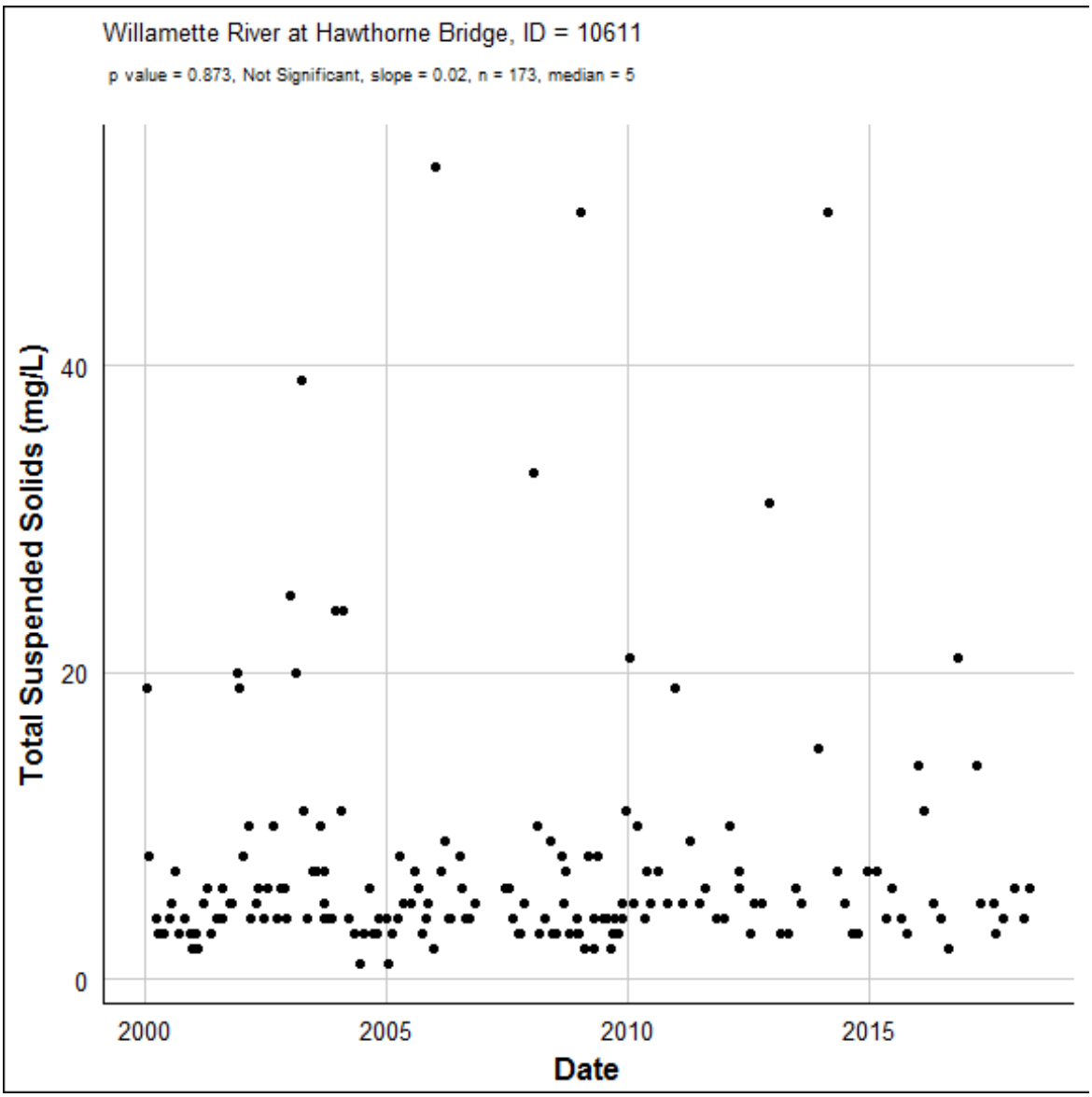

Figure 17: Station 10611 *Total Suspended Solids* water quality trends. Note that TSS (15 mg/L) is used as a surrogate for meeting the DDT/dieldrin TMDL in Johnson Creek

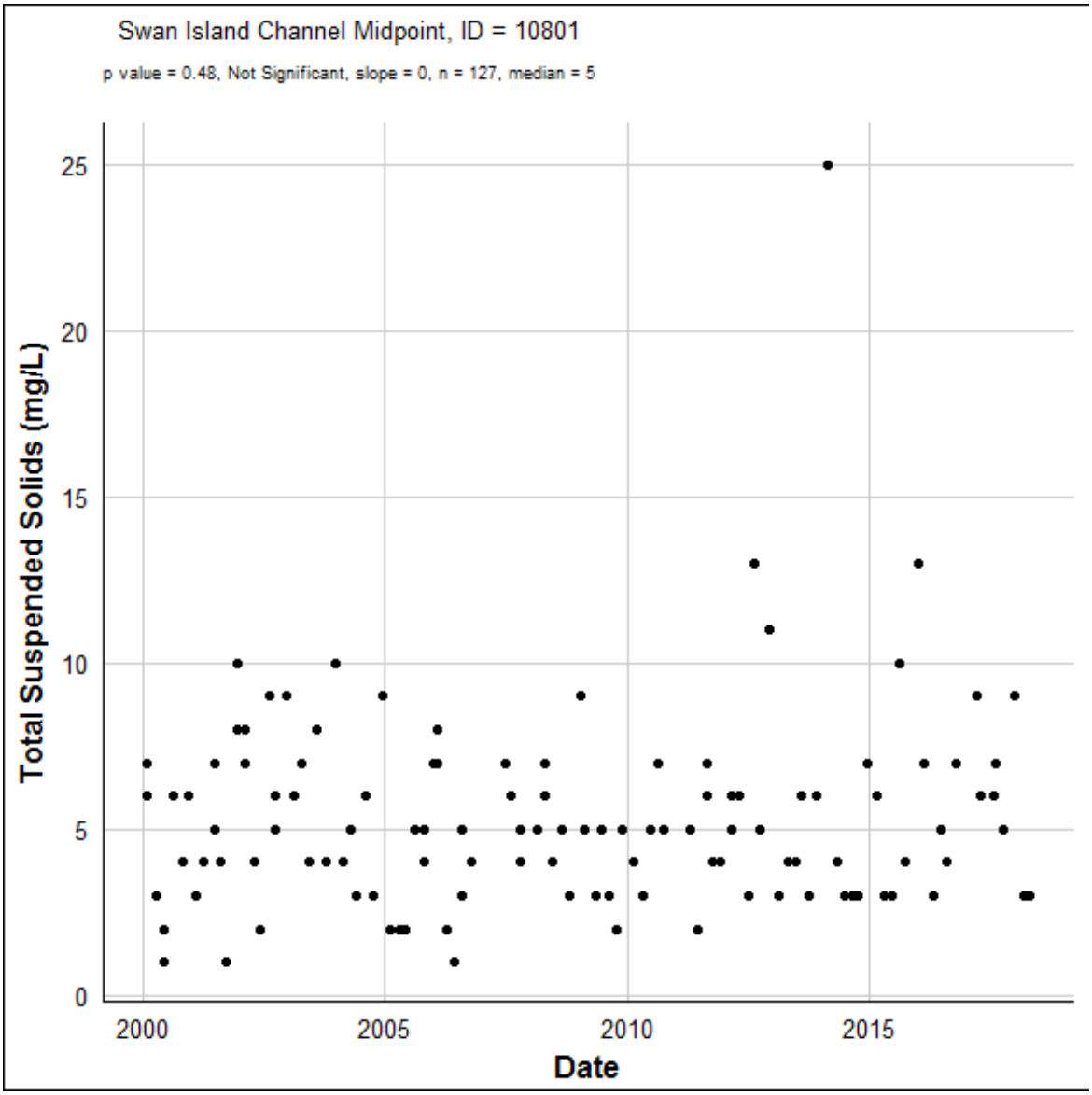

Figure 18: Station 10801 *Total Suspended Solids* water quality trends. Note that TSS (15 mg/L) is used as a surrogate for meeting the DDT/dieldrin TMDL in Johnson Creek

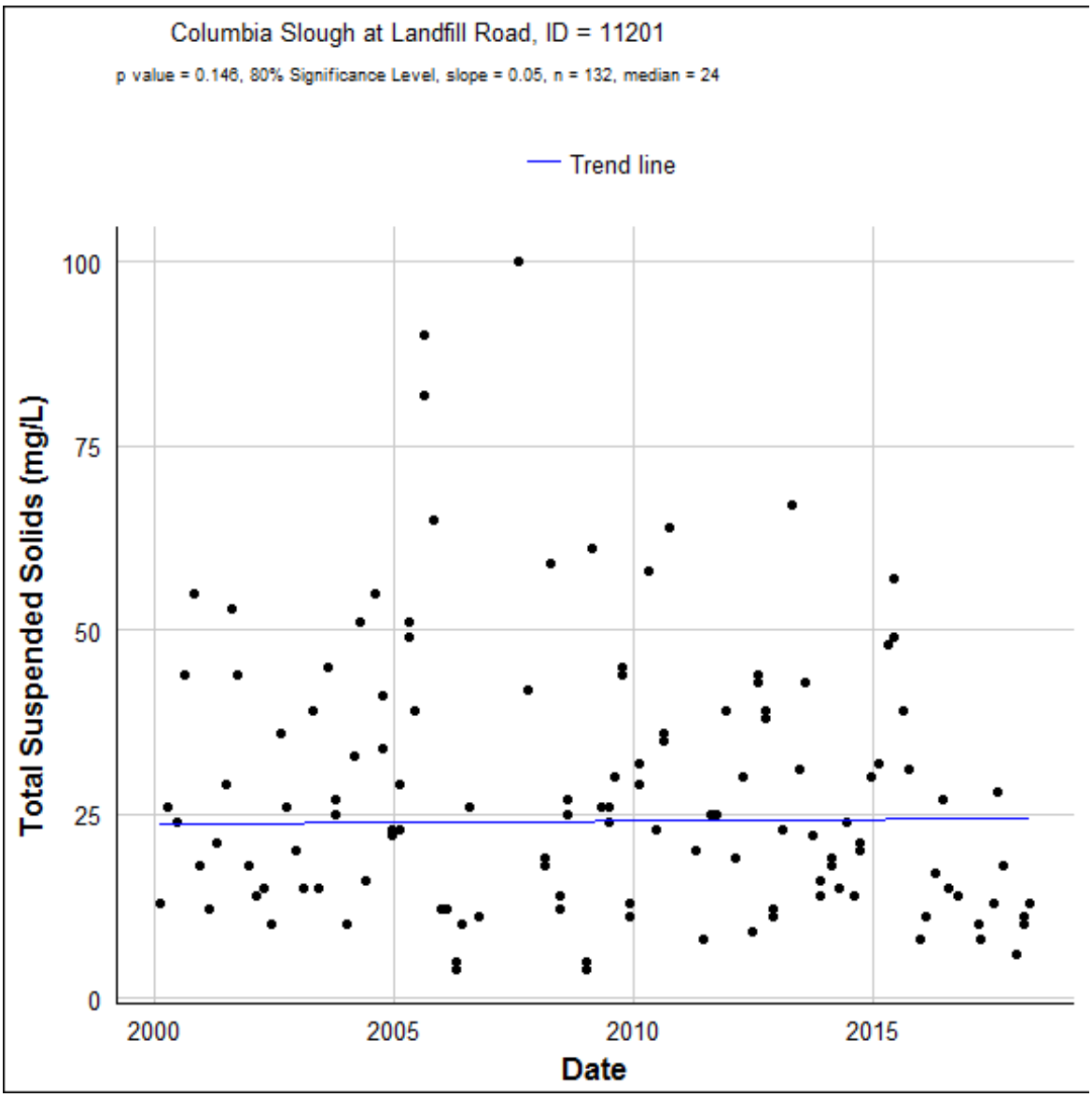

Figure 19: Station 11201 *Total Suspended Solids* water quality trends. Note that TSS (15 mg/L) is used as a surrogate for meeting the DDT/dieldrin TMDL in Johnson Creek

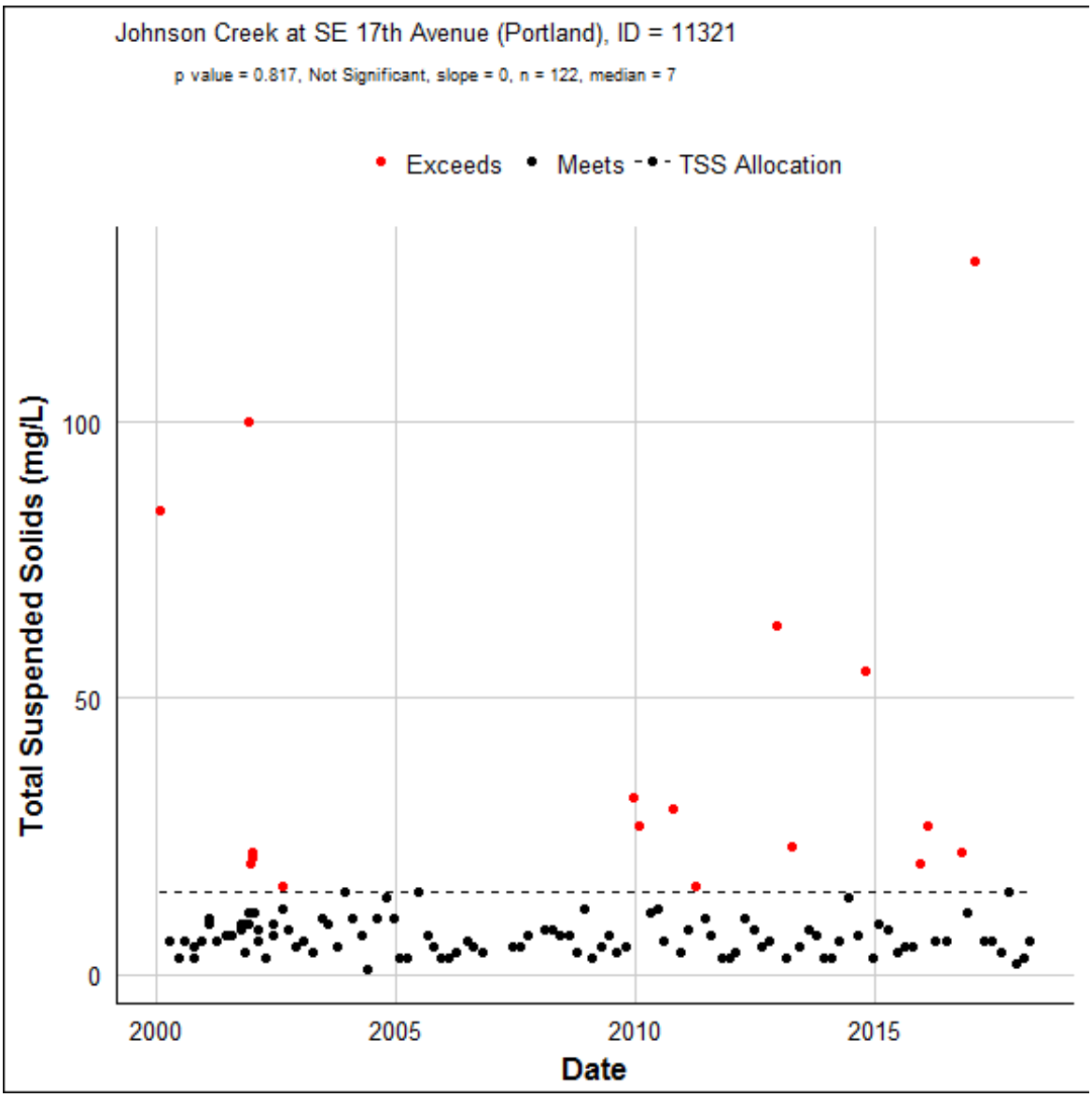

Figure 20: Station 11321 *Total Suspended Solids* water quality trends. Note that TSS (15 mg/L) is used as a surrogate for meeting the DDT/dieldrin TMDL in Johnson Creek

Table 11: Total Suspended Solids observations

Station ID	Station Description	Min Date	Max Date	Obs	Exceedances	% Exceedance
10332	Willamette River at SP&S RR Bridge (Portland)	2000	2018	106	0	0
10611	Willamette River at Hawthorne Bridge	2000	2018	169	0	0
10801	Swan Island Channel Midpoint	2000	2018	103	0	0
11201	Columbia Slough at Landfill Road	2000	2018	101	0	0

Station ID	Station Description	Min Date	Max Date	Obs	Exceedances	% Exceedance
11321	Johnson Creek at SE 17th Avenue (Portland)	2000	2018	111	0	0

6.8 pH

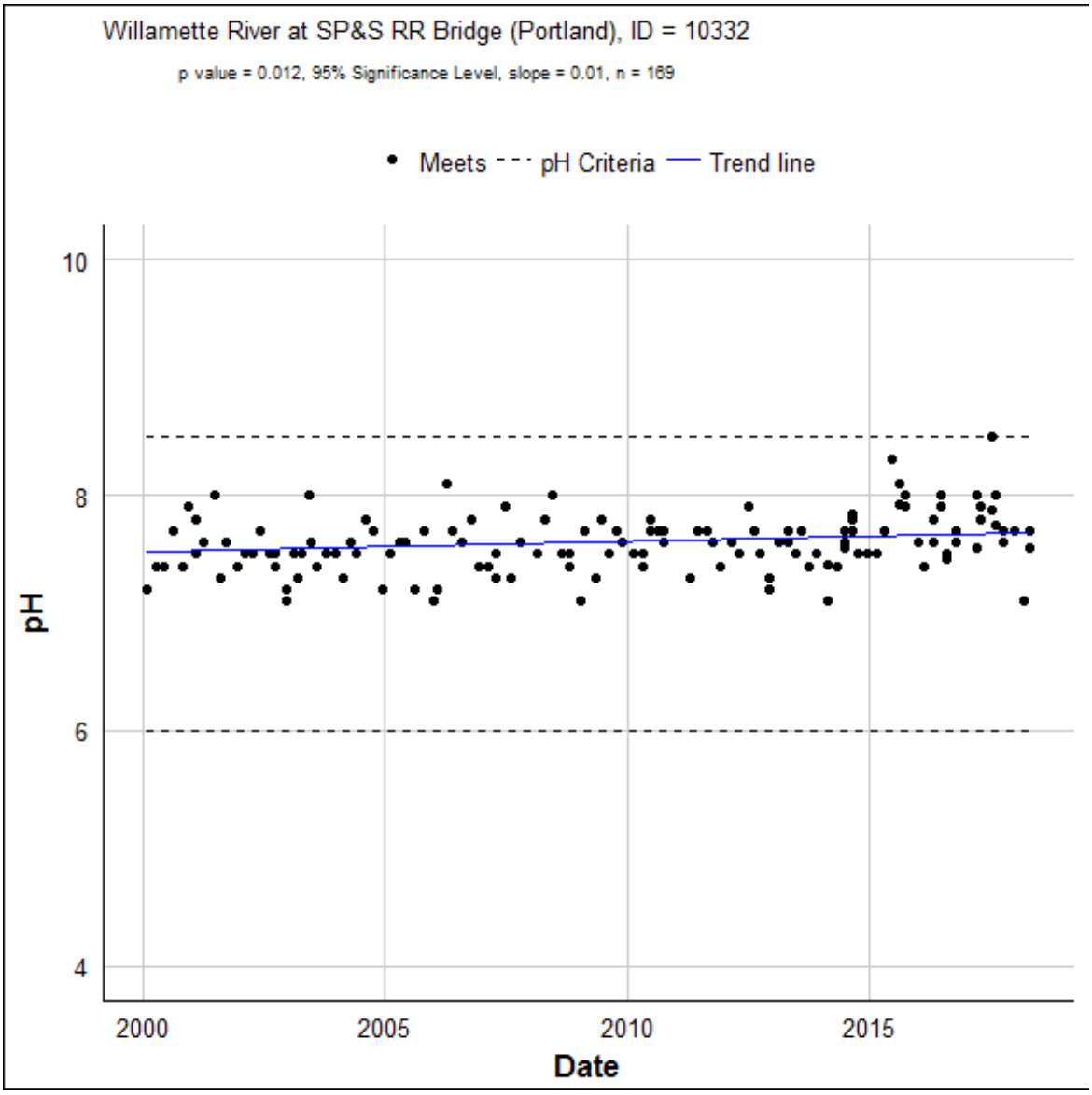

Figure 21: Station 10332 *pH* water quality status and trends

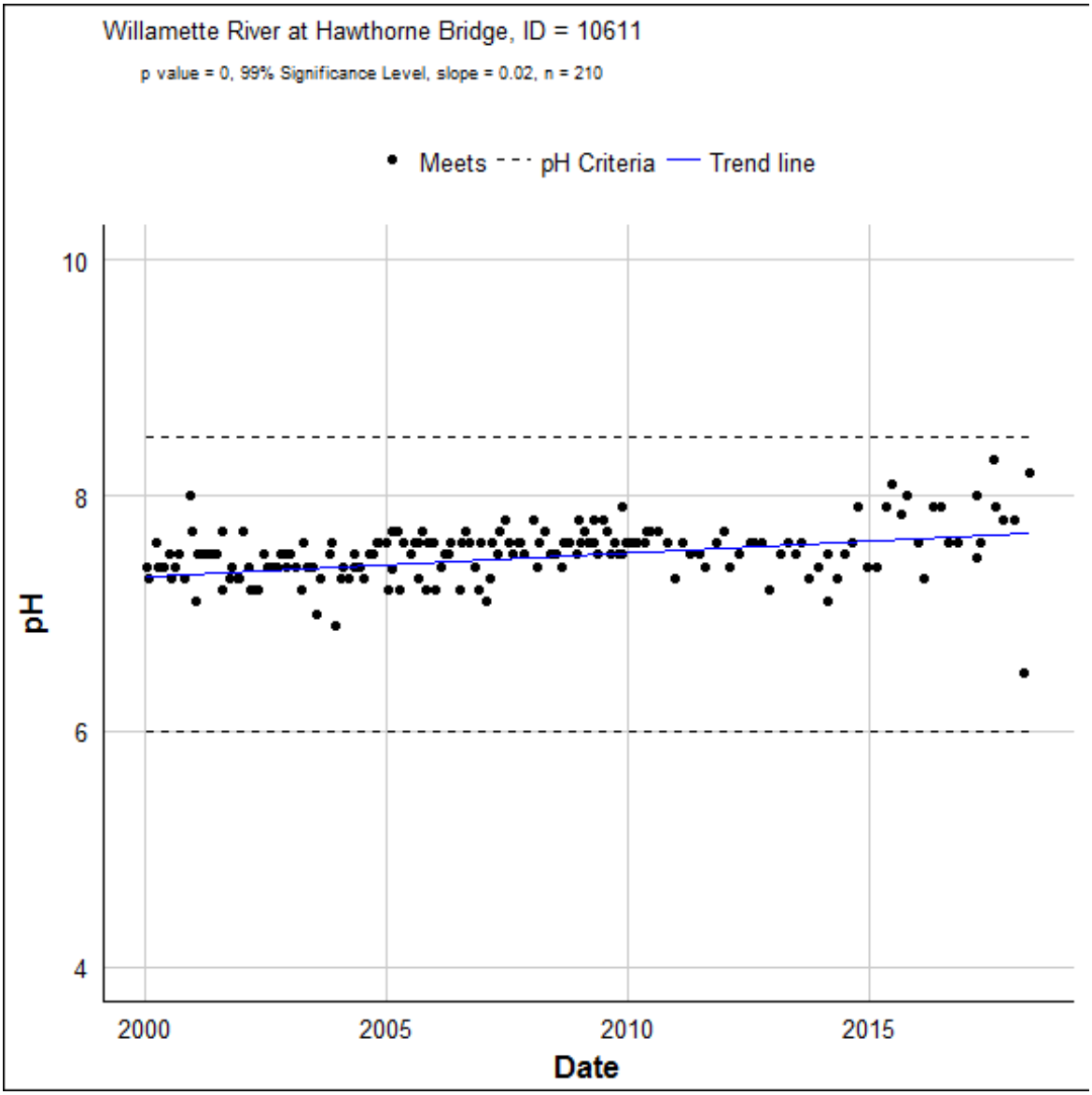

Figure 22: Station 10611 *pH* water quality status and trends

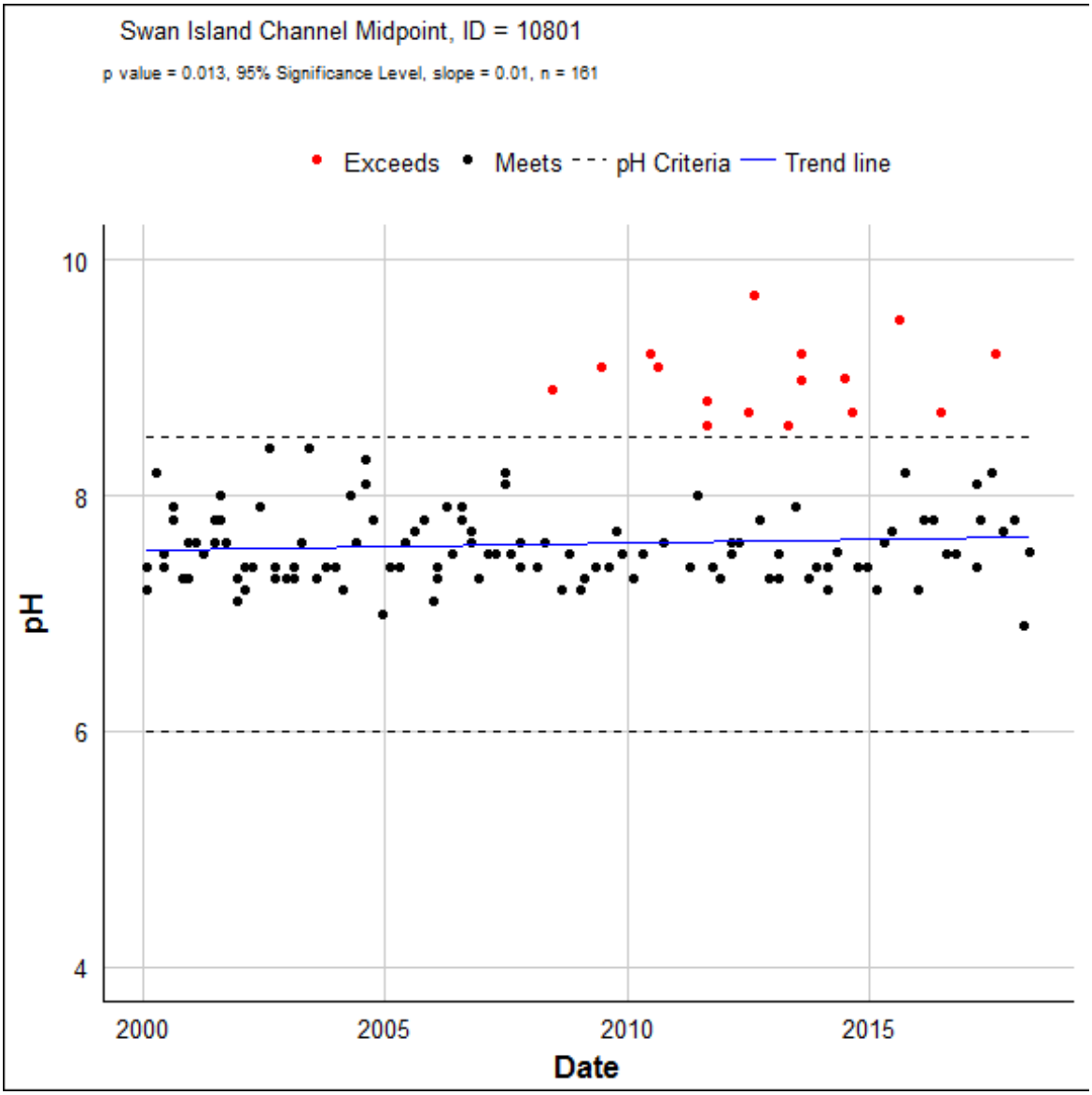

Figure 23: Station 10801 *pH* water quality status and trends

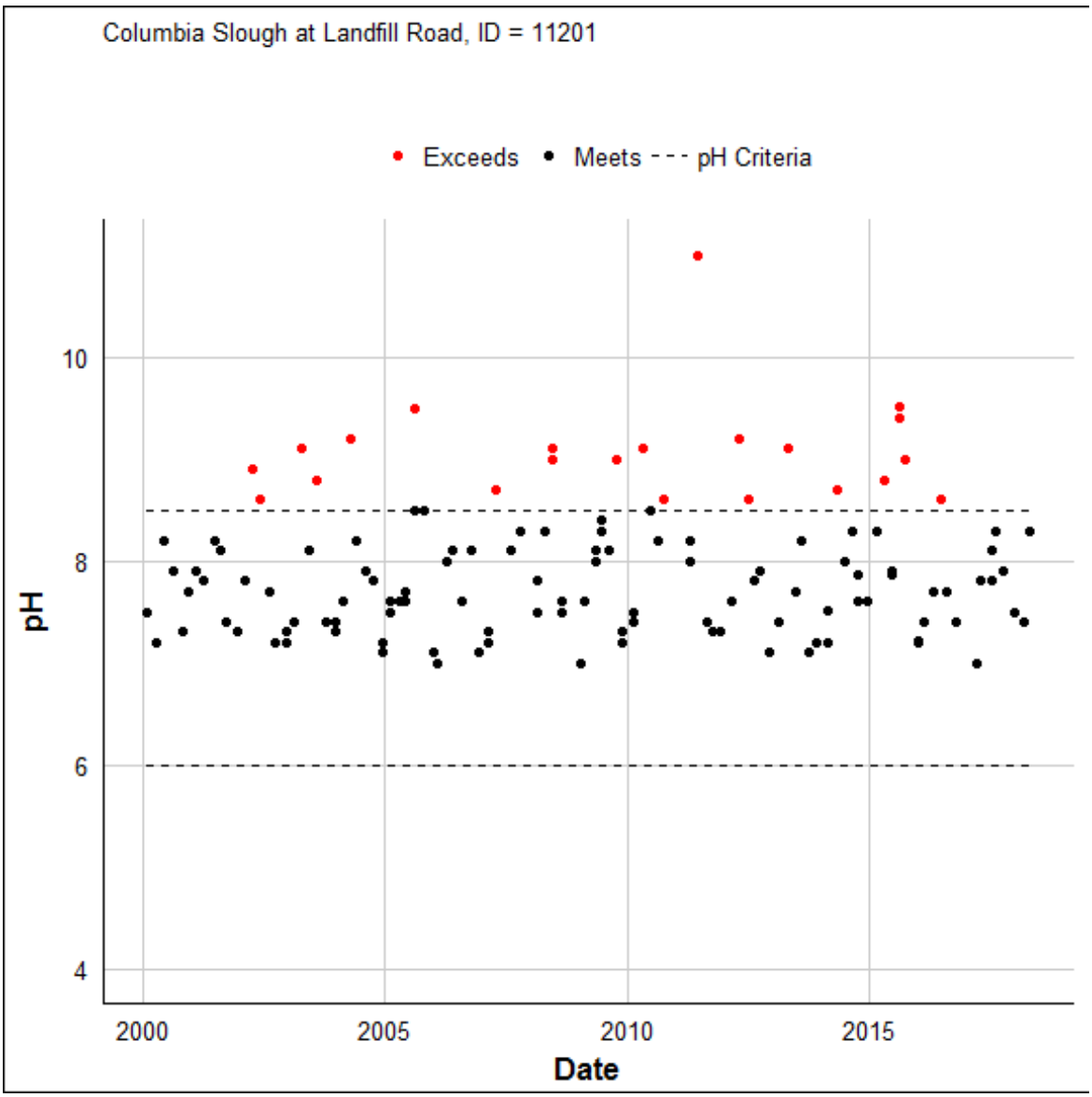

Figure 24: Station 11201 *pH* water quality status and trends

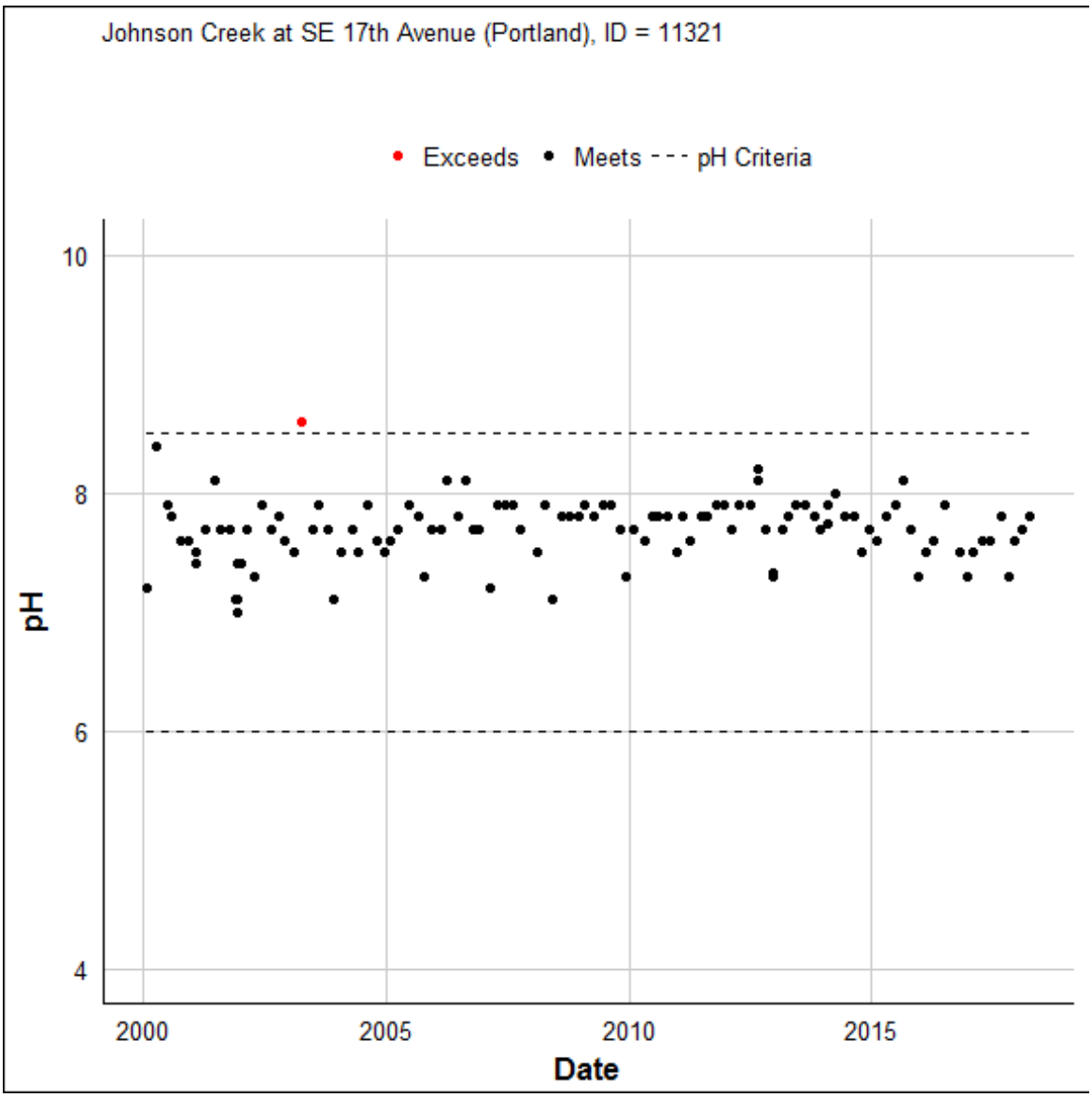

Figure 25: Station 11321 *pH* water quality status and trends

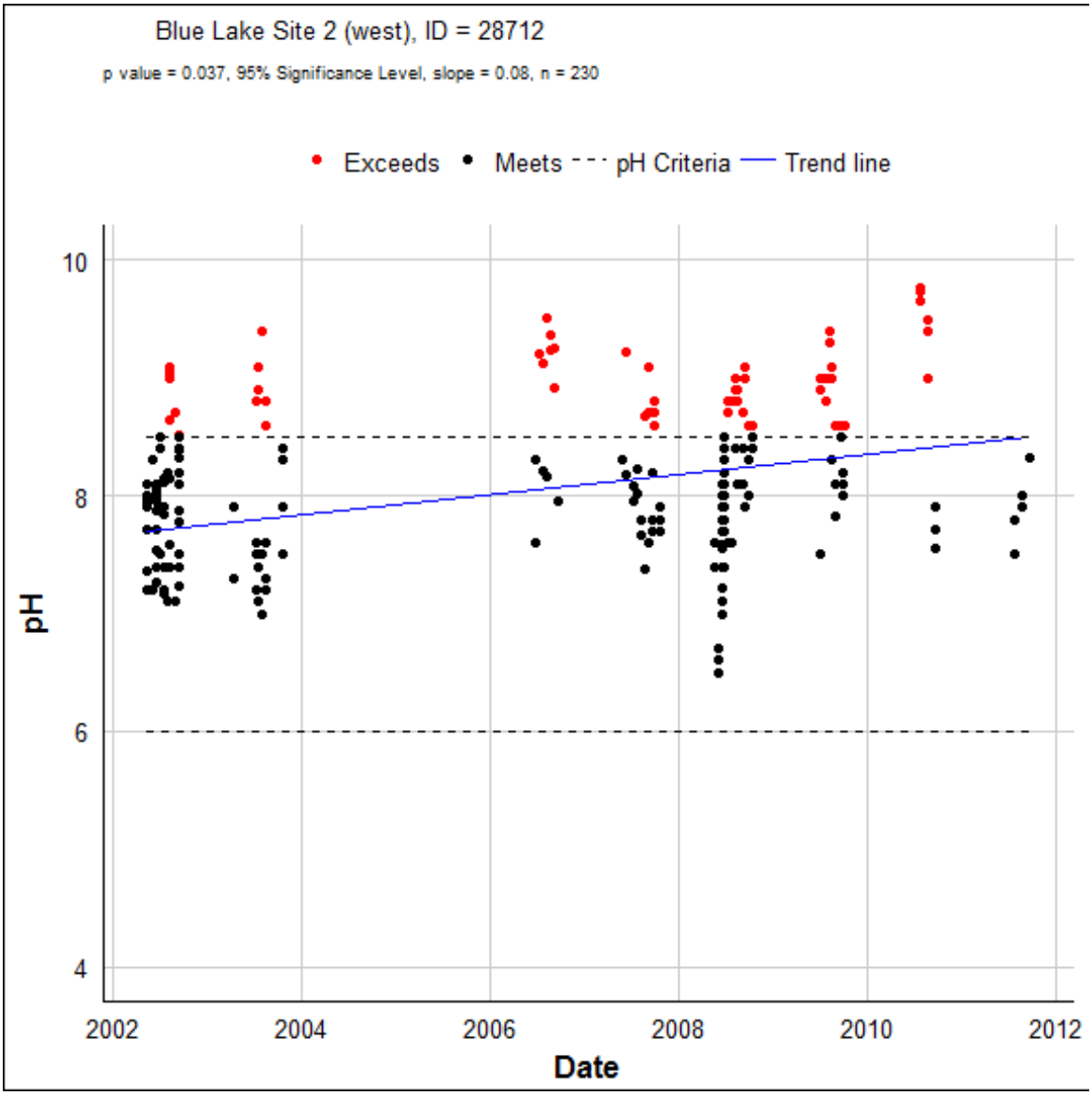

Figure 26: Station 28712 *pH* water quality status and trends

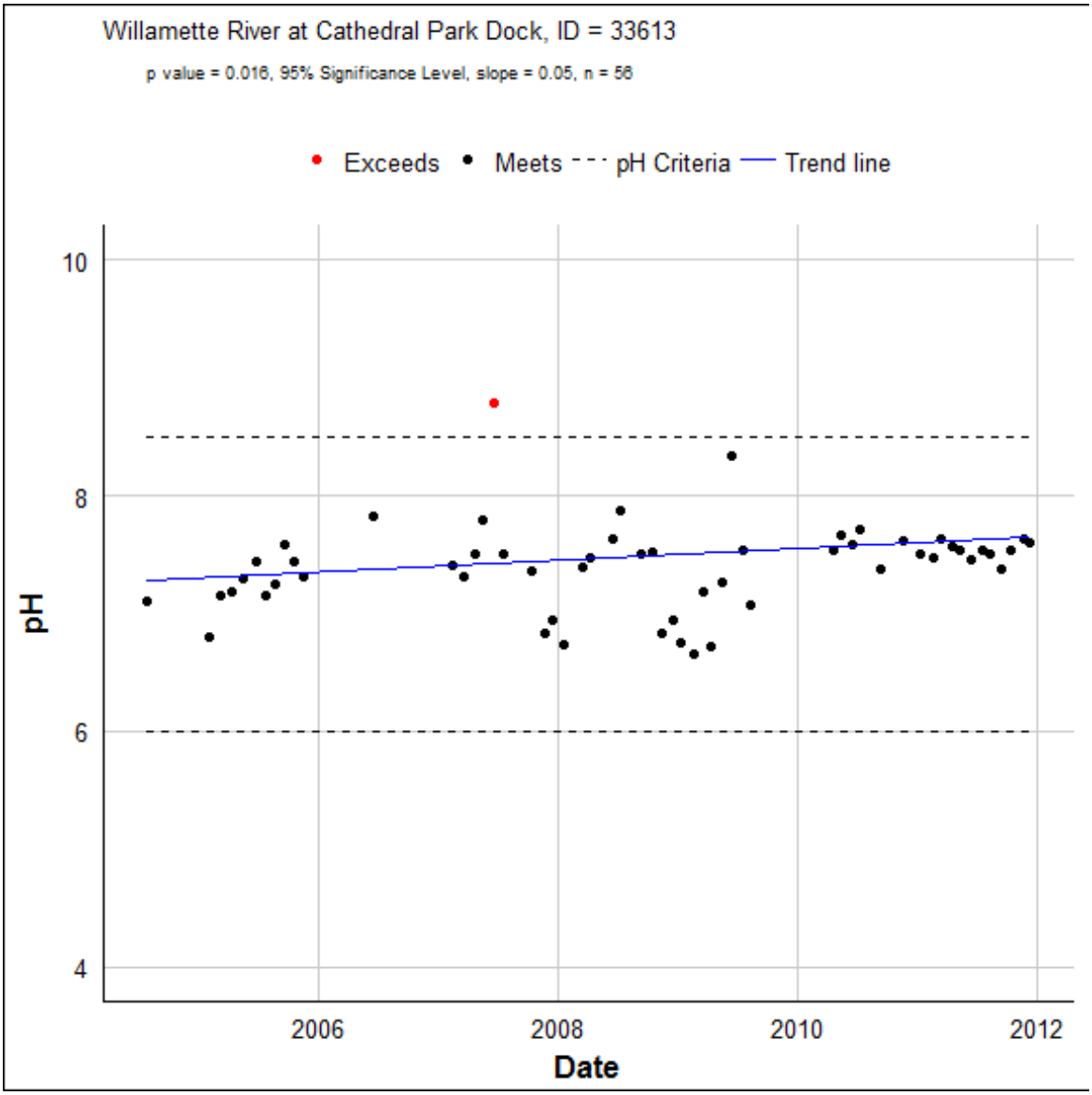

Figure 27: Station 33613 *pH* water quality status and trends

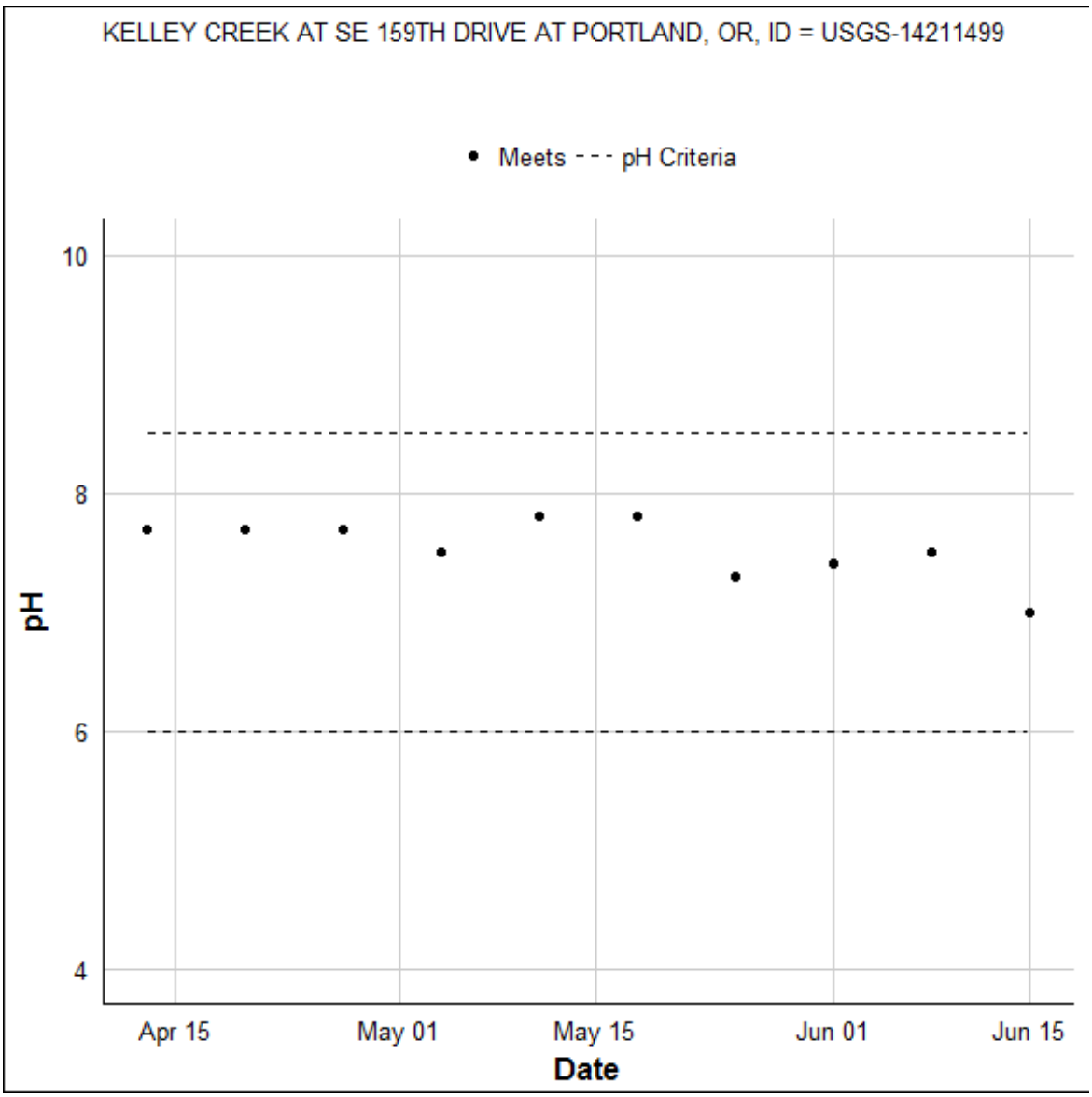

Figure 28: Station USGS-14211499 *pH* water quality status and trends

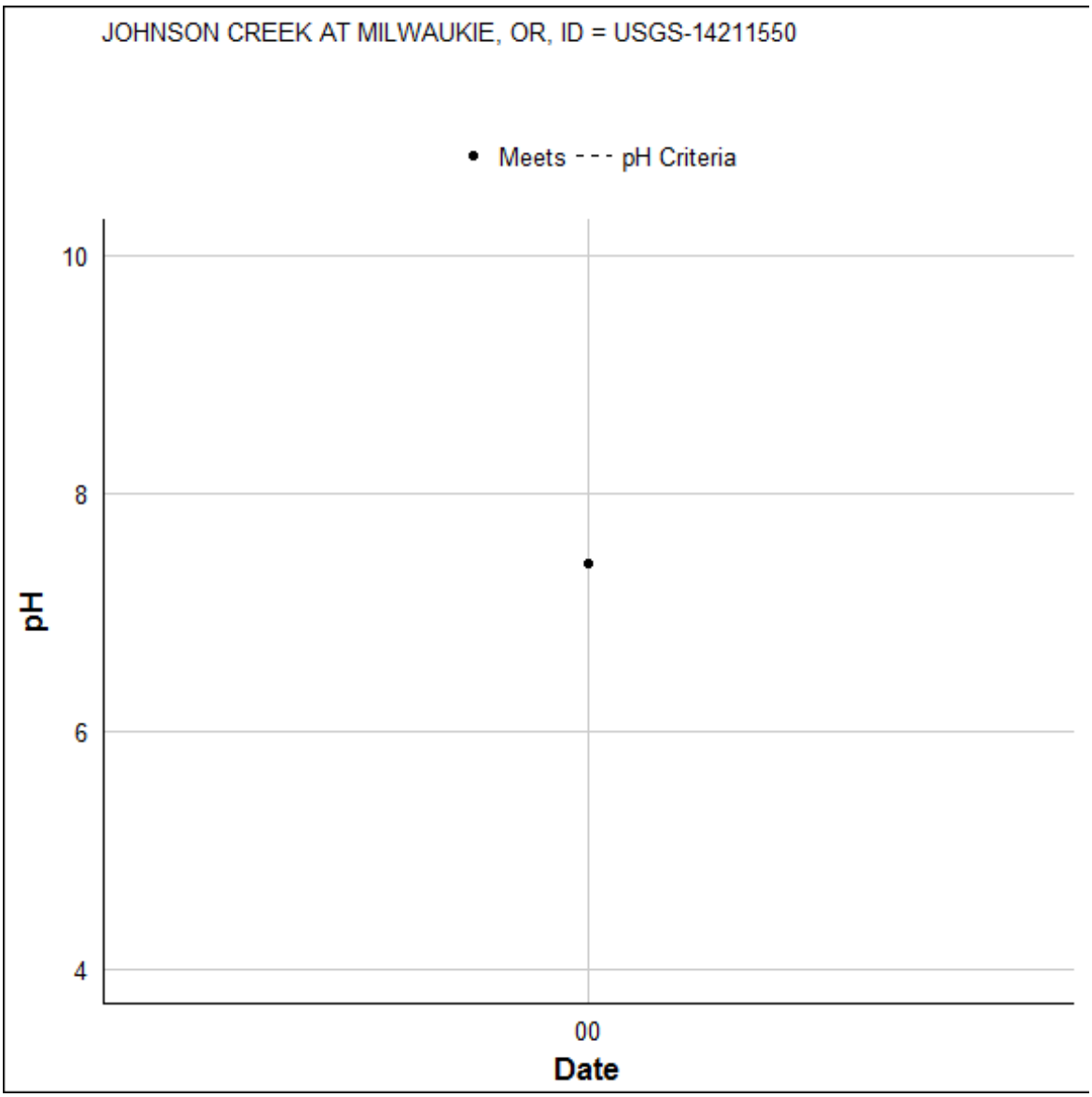

Figure 29: Station USGS-14211550 *pH* water quality status and trends

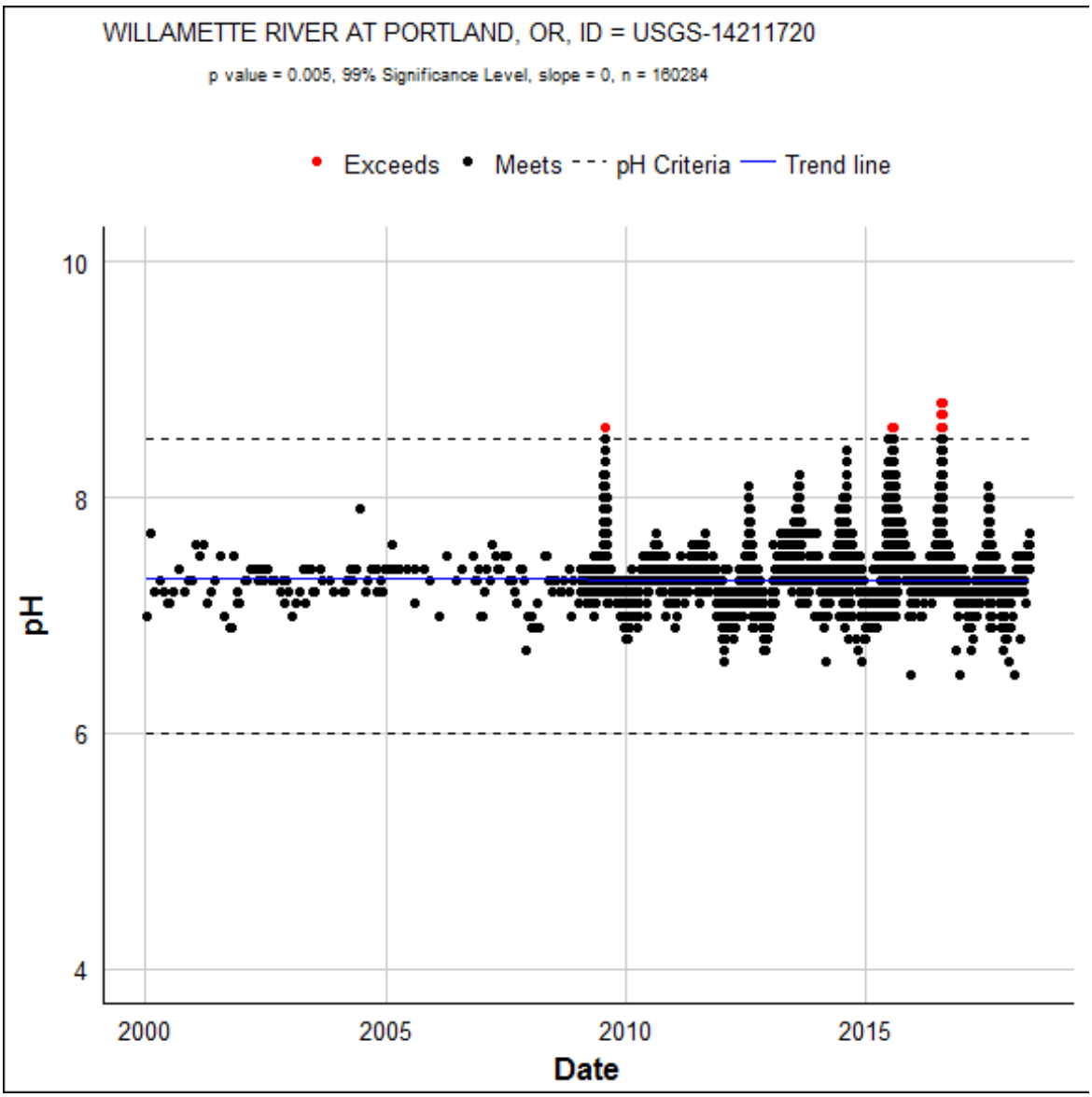

Figure 30: Station USGS-14211720 *pH* water quality status and trends

Table 12: pH status

Station ID	Station Description	Min Date	Max Date	# Obs	# Exceed	% Exceed
10332	Willamette River at SP&S RR Bridge (Portland)	2000-07-12	2018-07-12	110	0	0.0
10611	Willamette River at Hawthorne Bridge	2000-07-12	2018-07-12	177	0	0.0
10801	Swan Island Channel Midpoint	2000-07-12	2018-07-12	106	14	13.2
11201	Columbia Slough at Landfill Road	2000-07-12	2018-07-12	104	20	19.2

Station ID	Station Description	Min Date	Max Date	# Obs	# Exceed	% Exceed
11321	Johnson Creek at SE 17th Avenue (Portland)	2000-07-12	2018-07-12	111	1	0.9
28712	Blue Lake Site 2 (west)	2002-07-12	2011-07-12	67	33	49.3
33613	Willamette River at Cathedral Park Dock	2004-07-12	2011-07-12	56	1	1.8
USGS-14211499	KELLEY CREEK AT SE 159TH DRIVE AT PORTLAND, OR	2015-07-12	2015-07-12	10	0	0.0
USGS-14211550	JOHNSON CREEK AT MILWAUKIE, OR	2002-07-12	2002-07-12	1	0	0.0
USGS-14211720	WILLAMETTE RIVER AT PORTLAND, OR	2000-07-12	2018-07-12	3473	12	0.3

6.9 Temperature

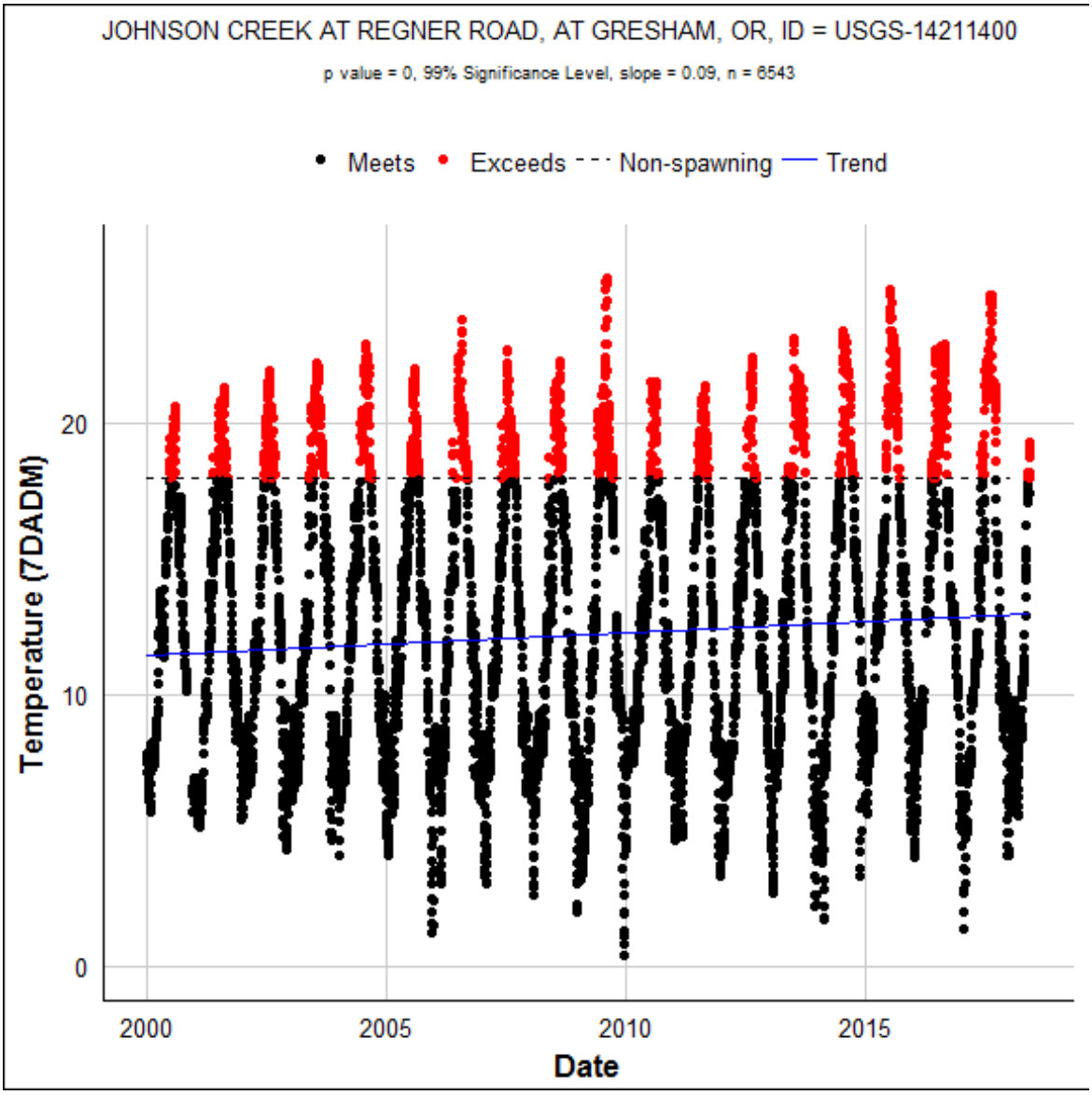

Figure 31: Station USGS-14211400 *Temperature* water quality status and trends

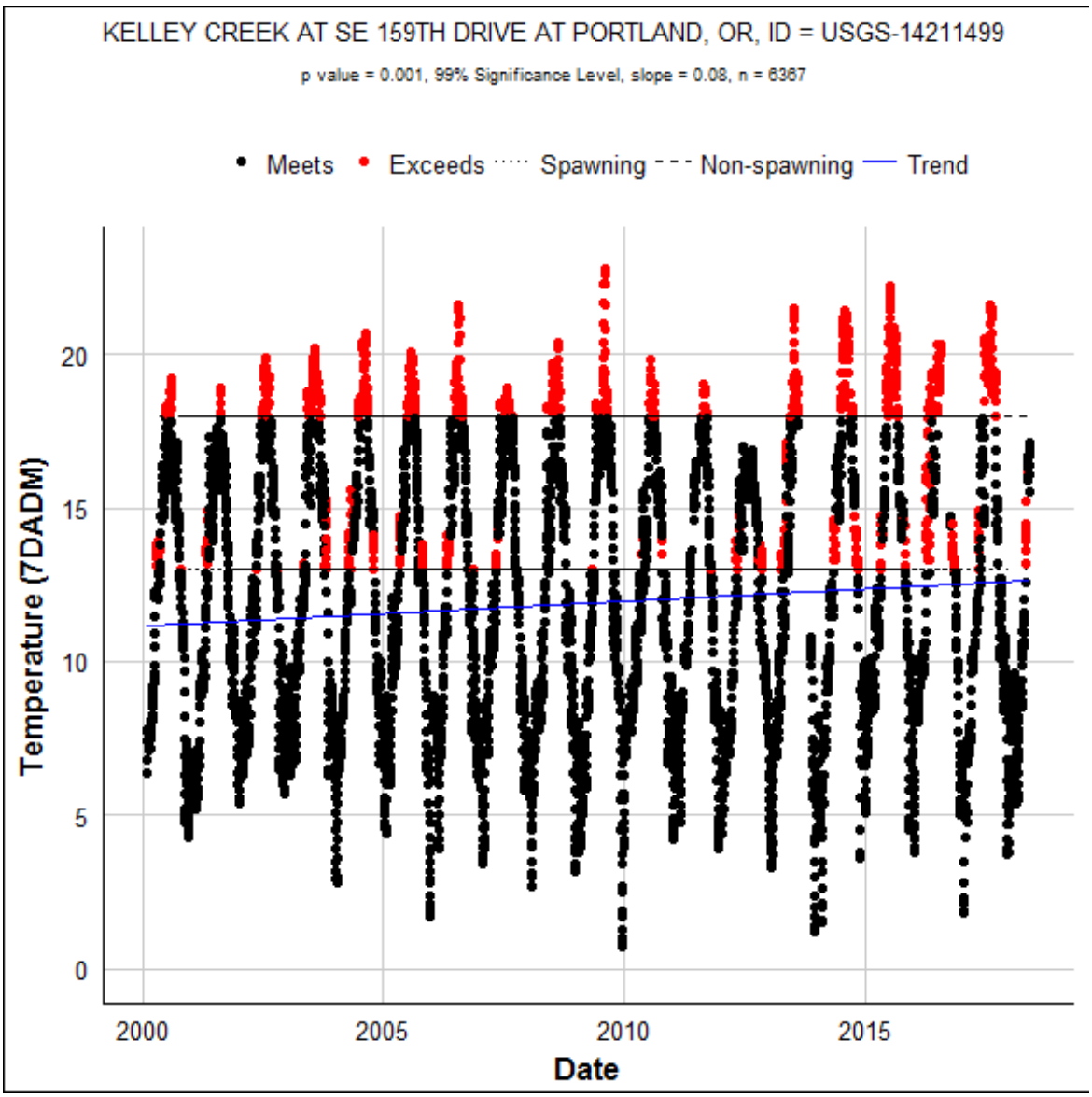

Figure 32: Station USGS-14211499 *Temperature* water quality status and trends

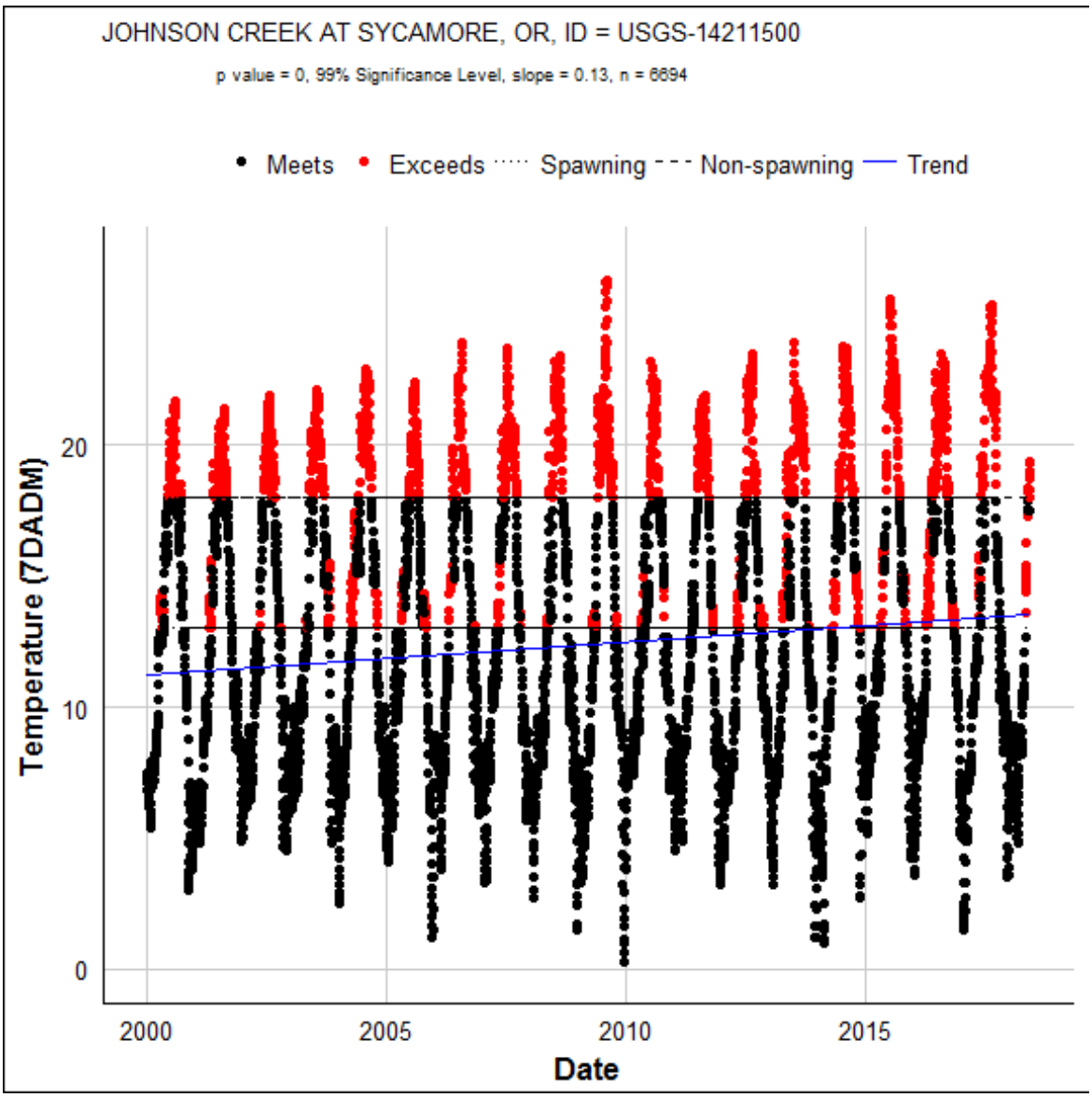

Figure 33: Station USGS-14211500 *Temperature* water quality status and trends

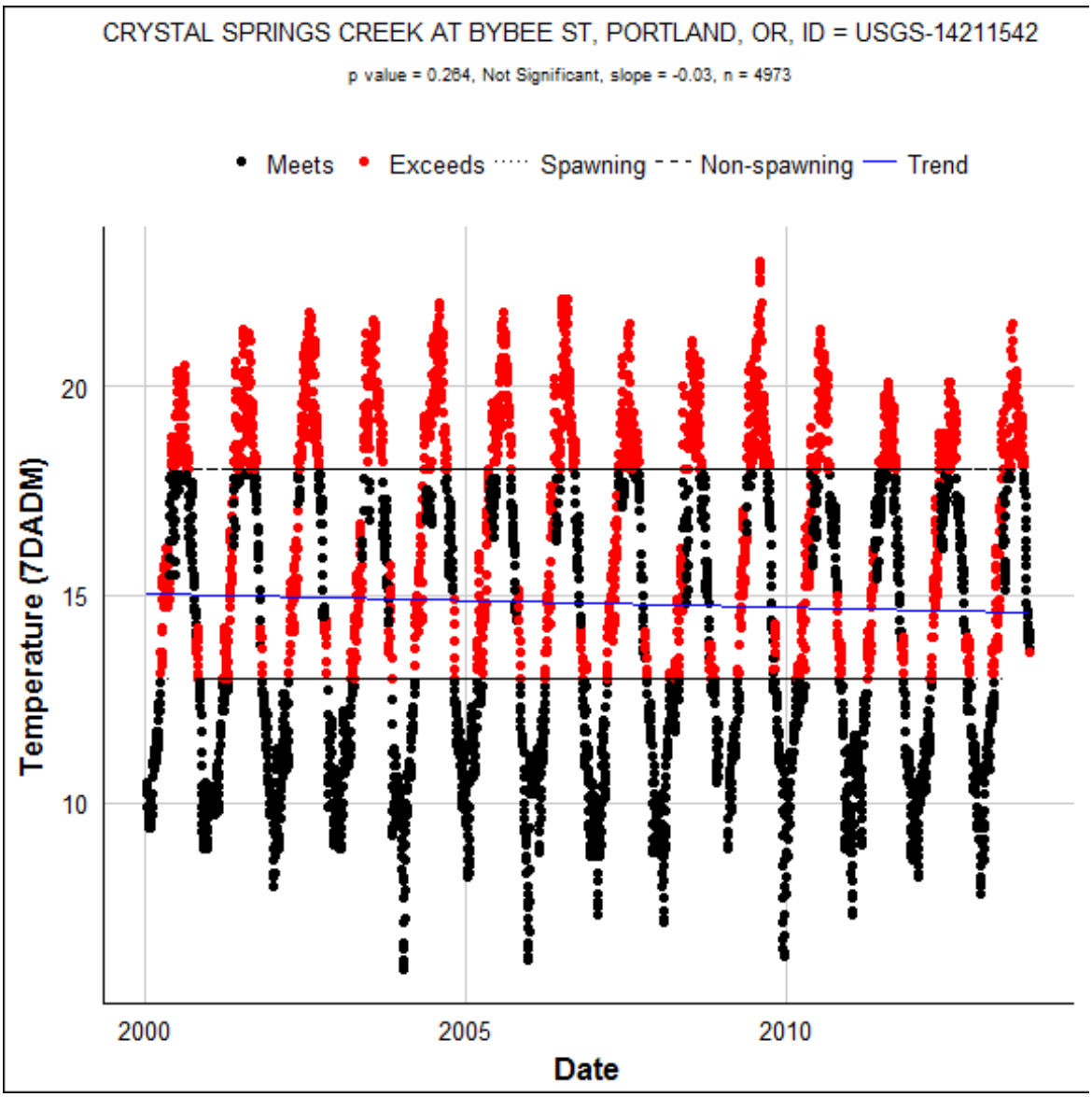

Figure 34: Station USGS-14211542 *Temperature* water quality status and trends

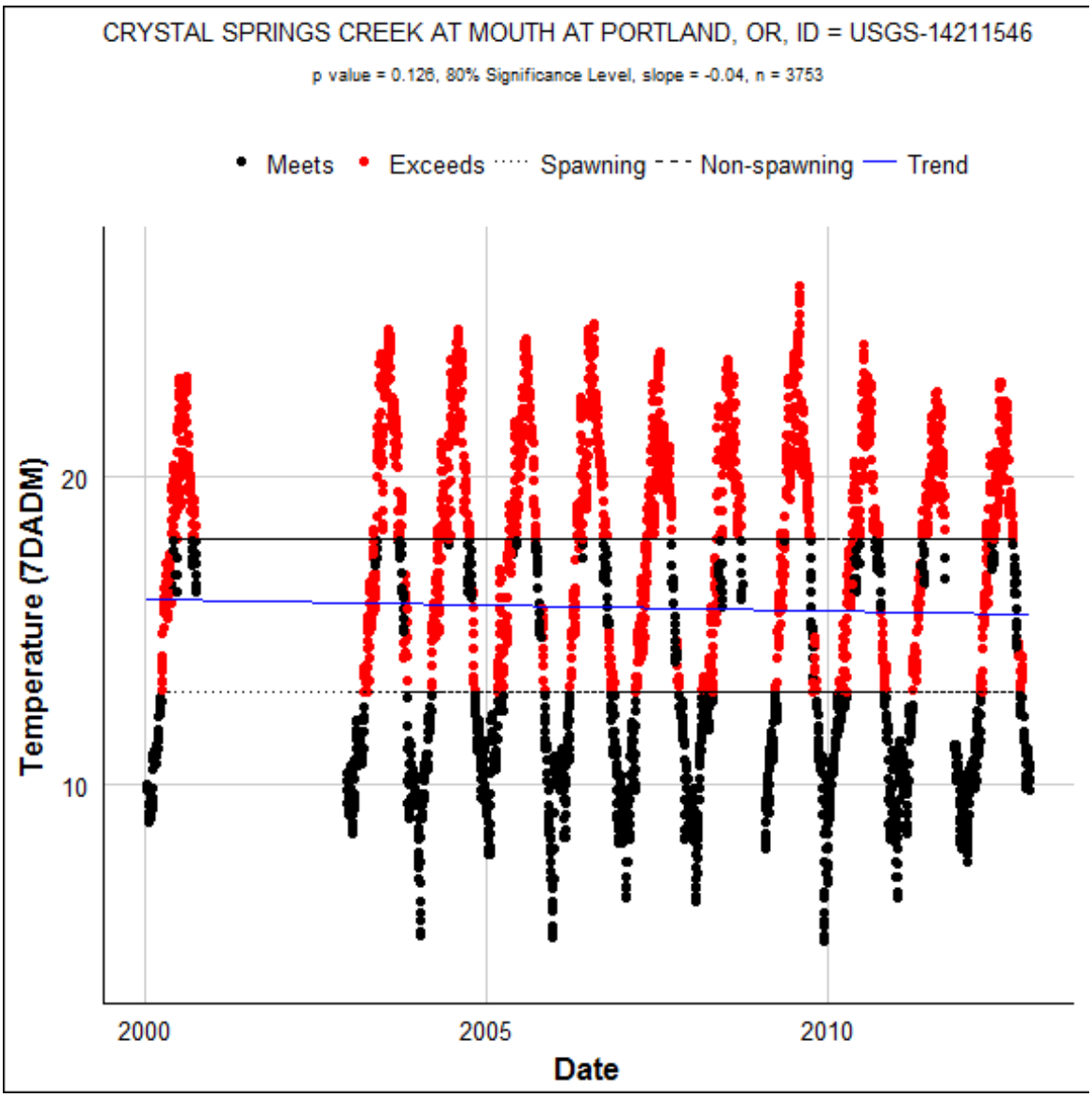

Figure 35: Station USGS-14211546 *Temperature* water quality status and trends

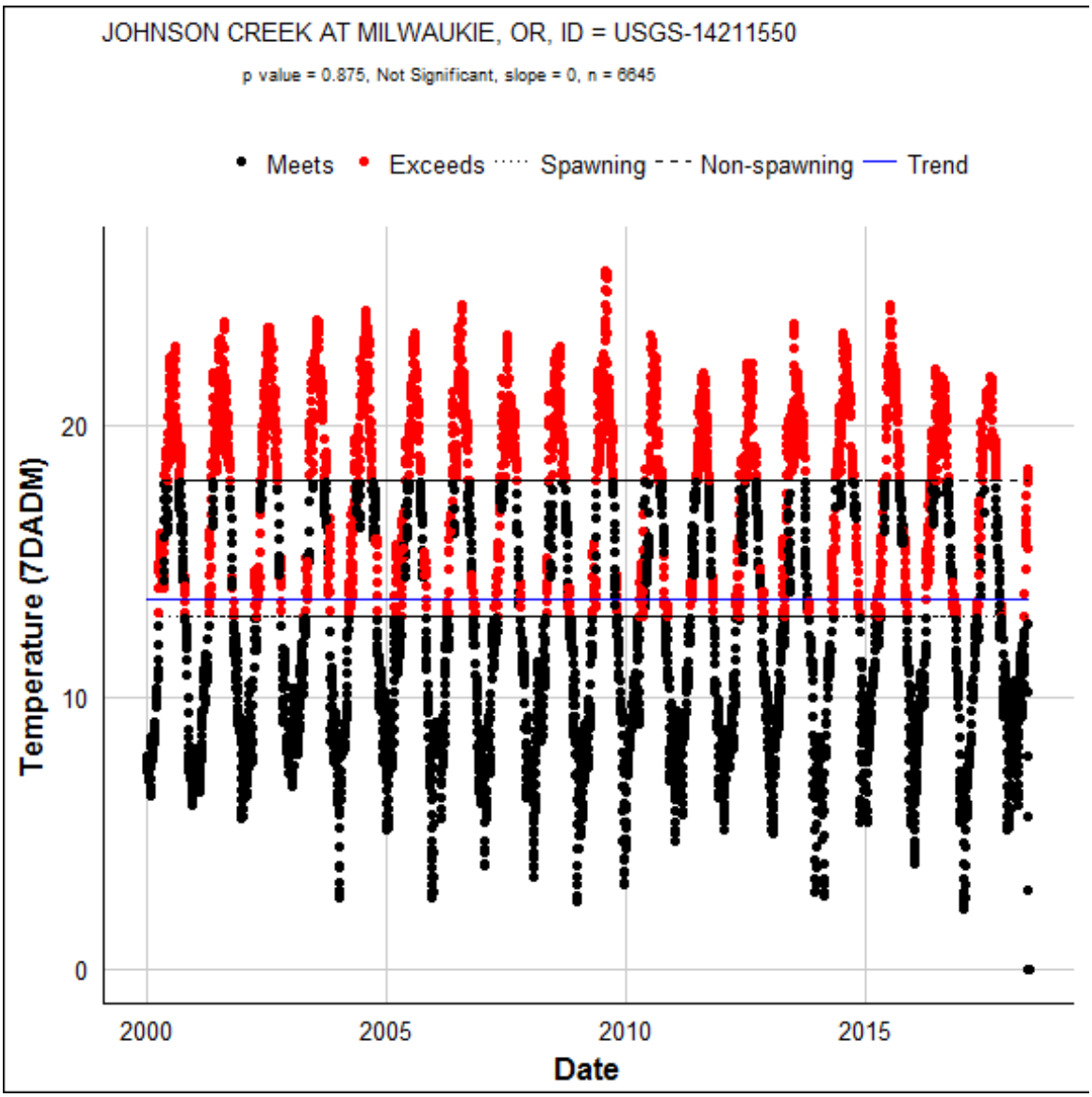

Figure 36: Station USGS-14211550 *Temperature* water quality status and trends

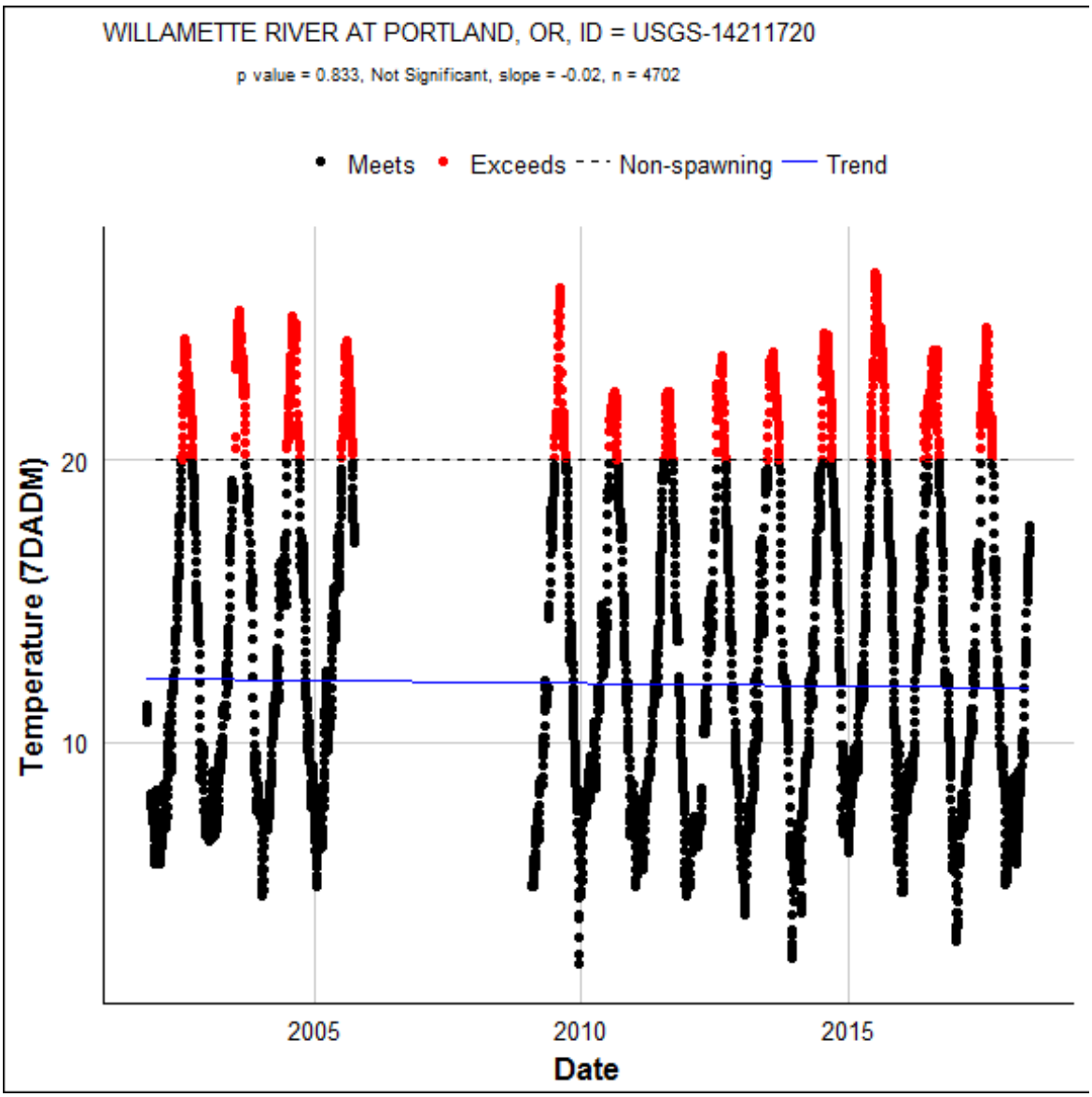

Figure 37: Station USGS-14211720 *Temperature* water quality status and trends

Table 13: Temperature status. Note: exceedances represent the number of seven day average daily max values above the temperature criteria within the associated time period.

Station_ID	Time_Period	Exceedances	Obs
USGS-14211400	Summer	1372	6543
USGS-14211400	Spawning	0	0
USGS-14211400	Total	1372	6543
USGS-14211499	Summer	736	2517
USGS-14211499	Spawning	375	3850
USGS-14211499	Total	1111	6367
USGS-14211500	Summer	1608	2744
USGS-14211500	Spawning	439	3950

Station_ID	Time_Period	Exceedances	Obs
USGS-14211500	Total	2047	6694
USGS-14211542	Summer	1271	2128
USGS-14211542	Spawning	951	2845
USGS-14211542	Total	2222	4973
USGS-14211546	Summer	1331	1618
USGS-14211546	Spawning	759	2135
USGS-14211546	Total	2090	3753
USGS-14211550	Summer	1916	2718
USGS-14211550	Spawning	863	3927
USGS-14211550	Total	2779	6645
USGS-14211720	Summer	937	4702
USGS-14211720	Spawning	0	0
USGS-14211720	Total	937	4702

6.10 Dissolved Oxygen

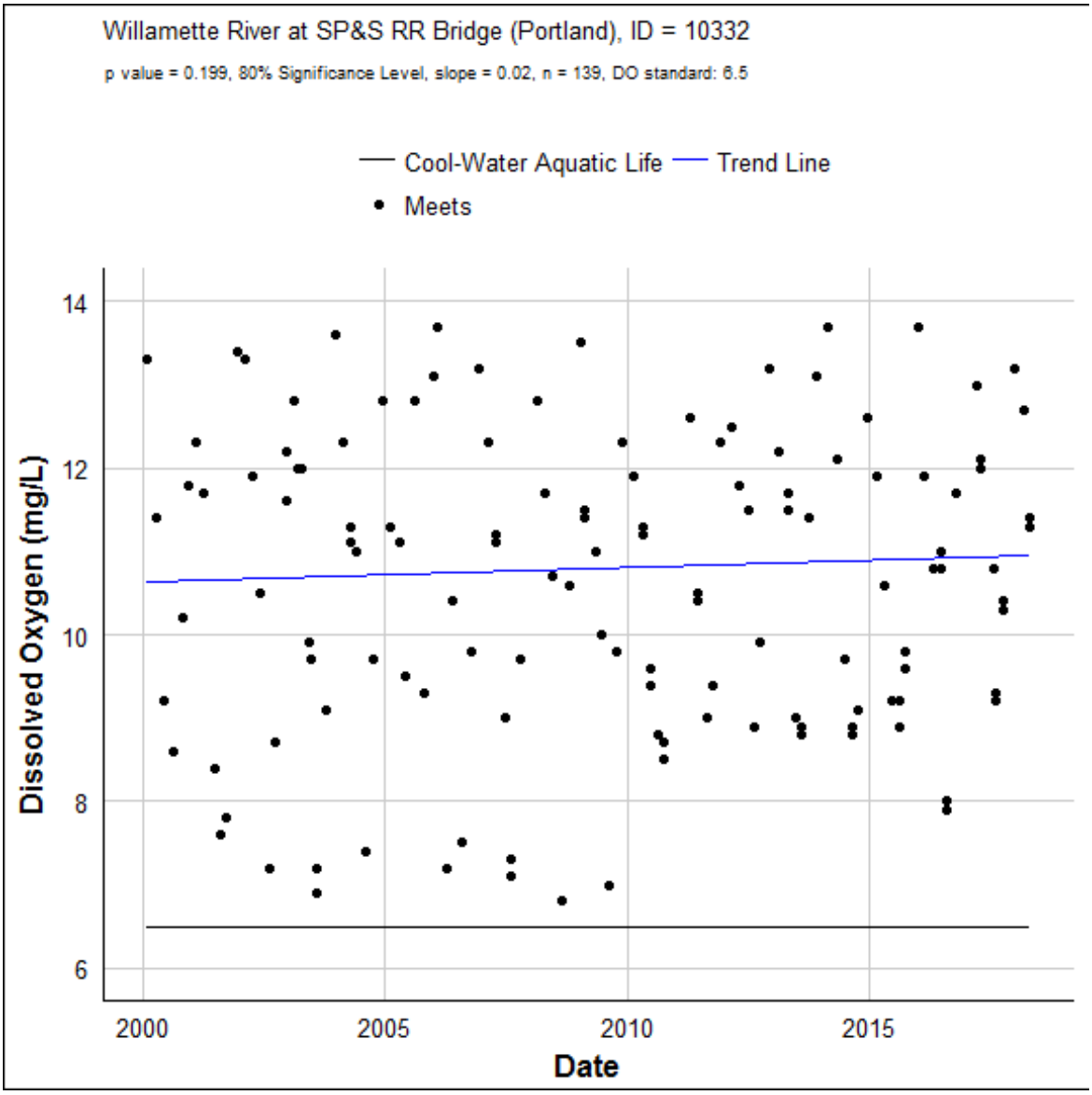

Figure 38: Station 10332 *Dissolved Oxygen* water quality status and trends

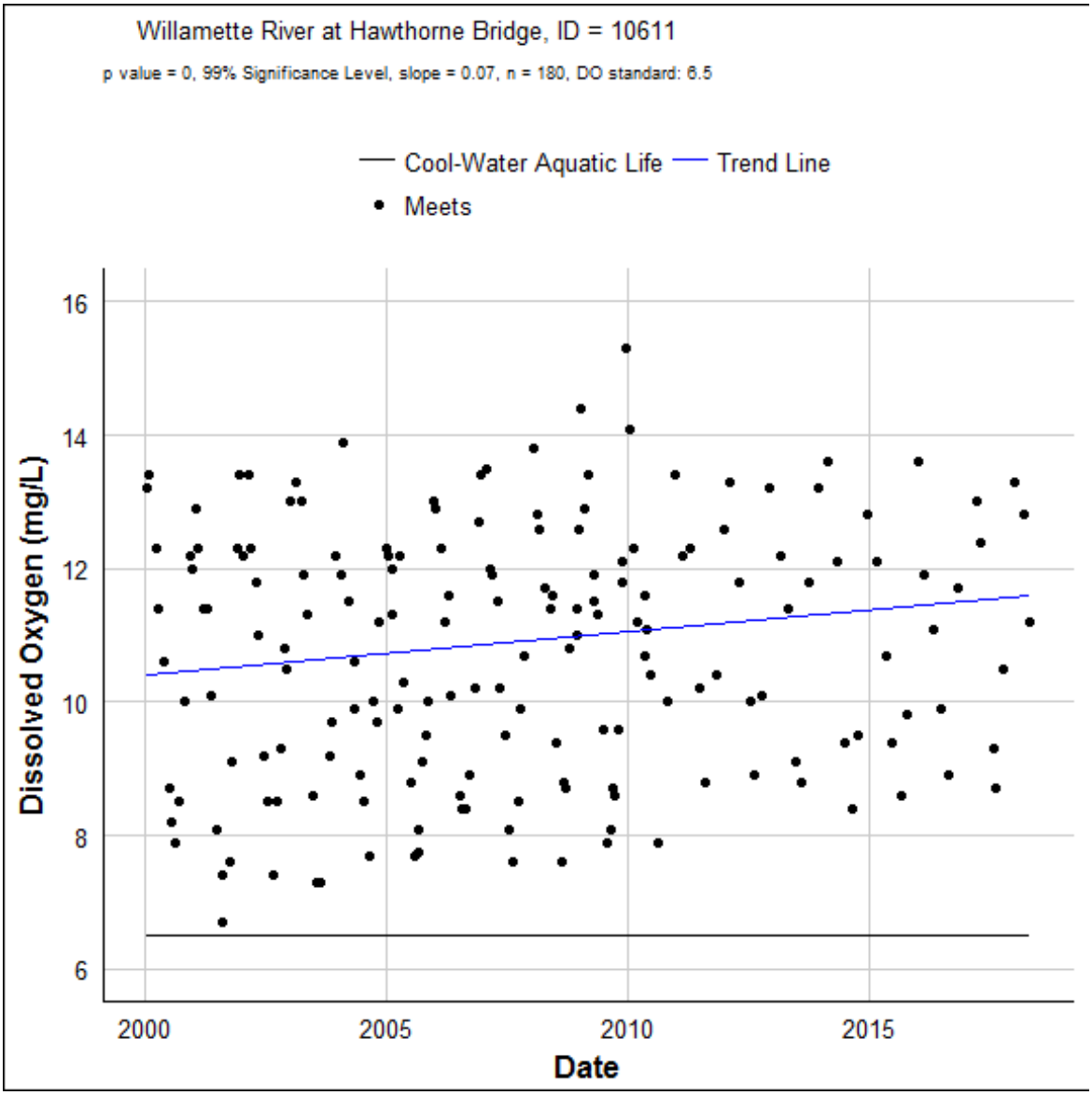

Figure 39: Station 10611 *Dissolved Oxygen* water quality status and trends

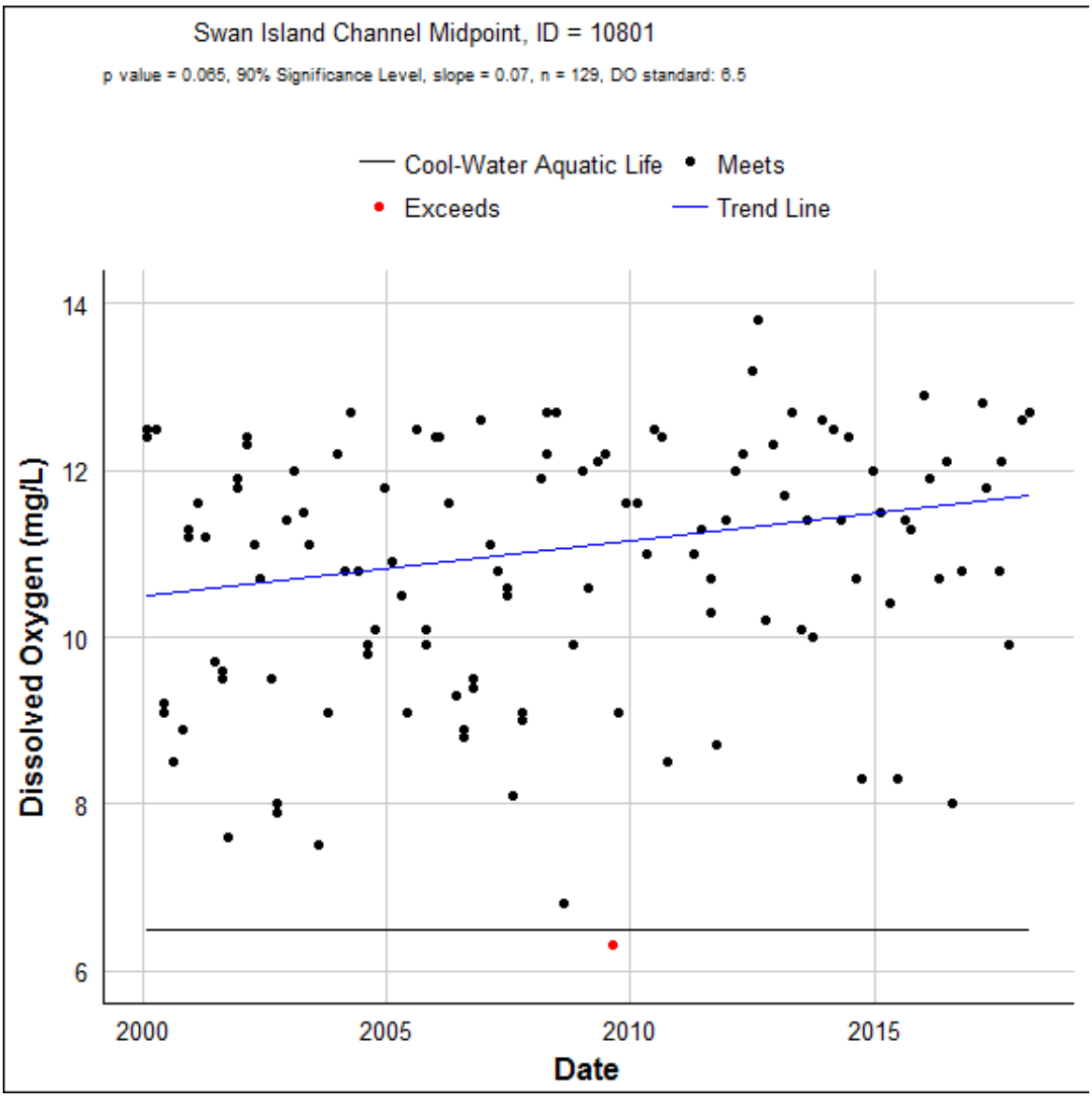

Figure 40: Station 10801 *Dissolved Oxygen* water quality status and trends

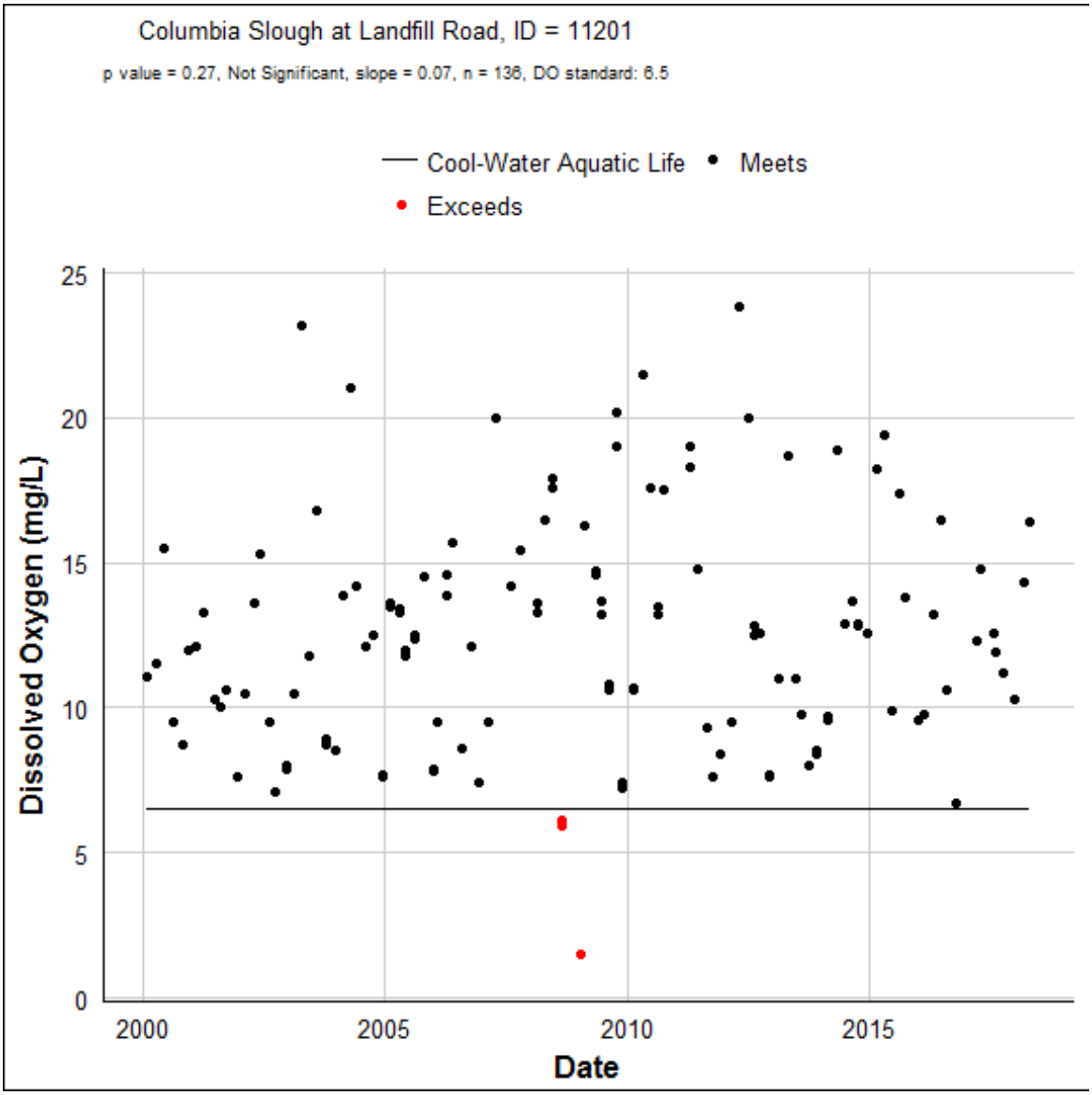

Figure 41: Station 11201 *Dissolved Oxygen* water quality status and trends

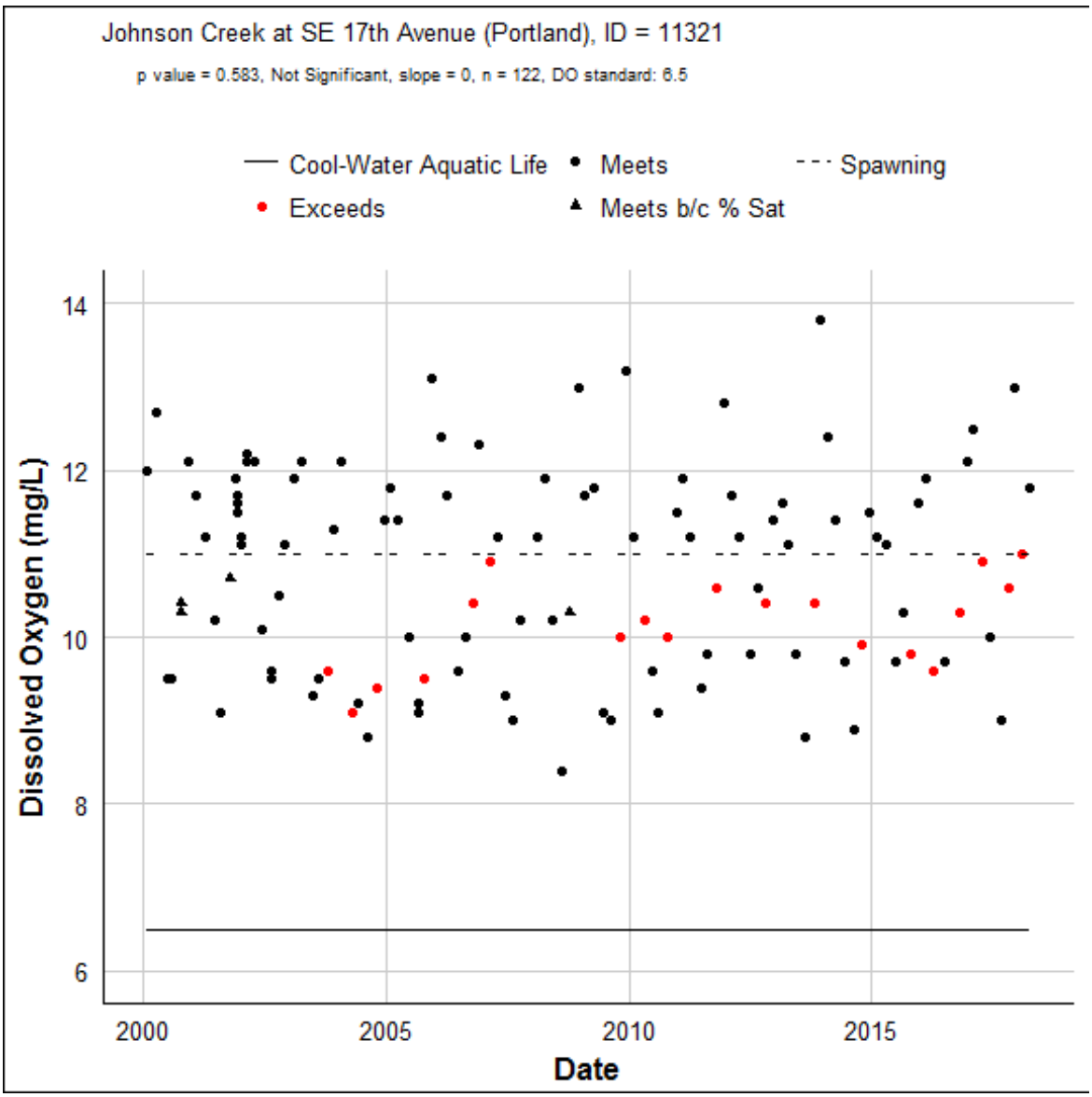

Figure 42: Station 11321 *Dissolved Oxygen* water quality status and trends

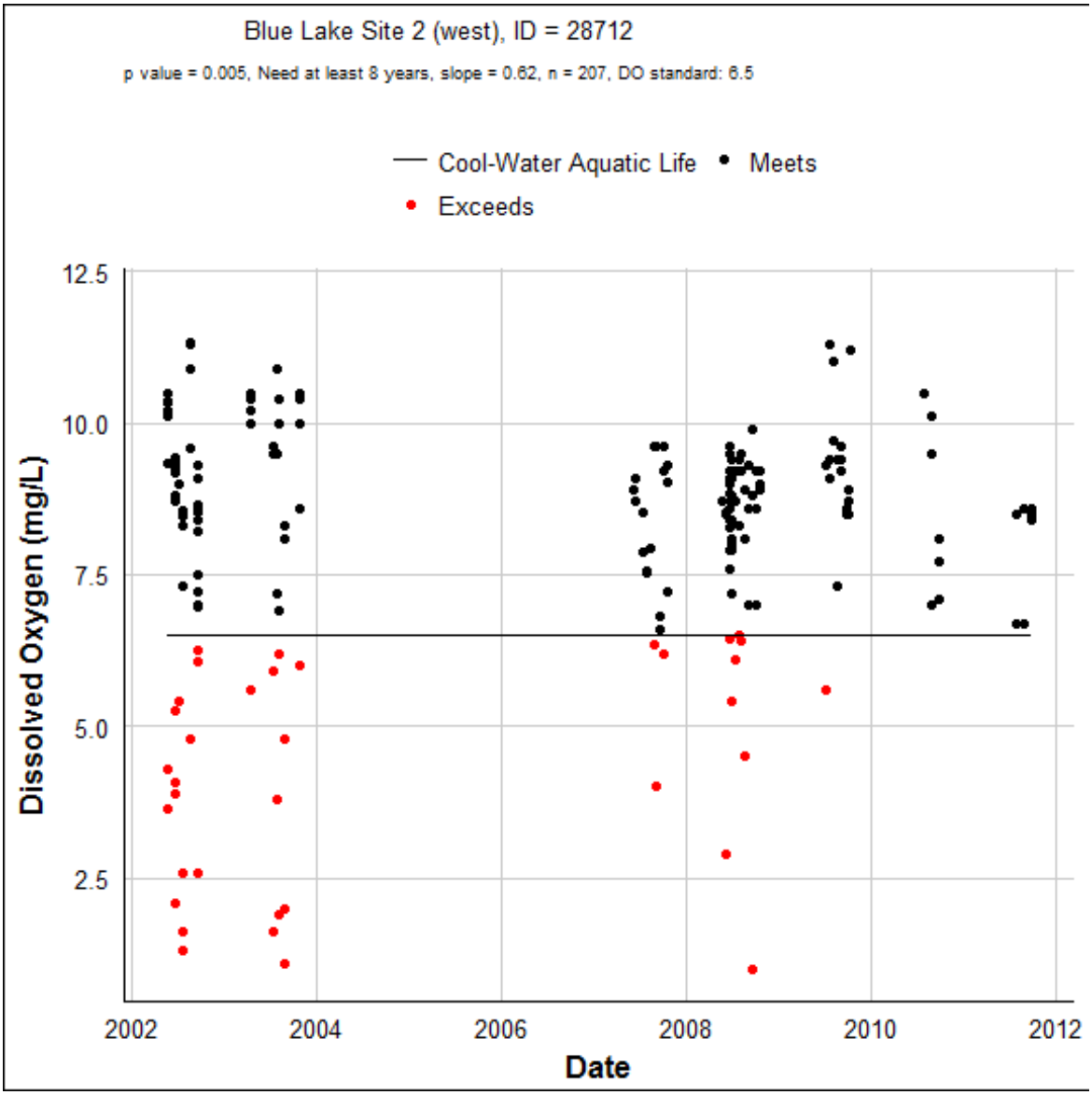

Figure 43: Station 28712 *Dissolved Oxygen* water quality status and trends

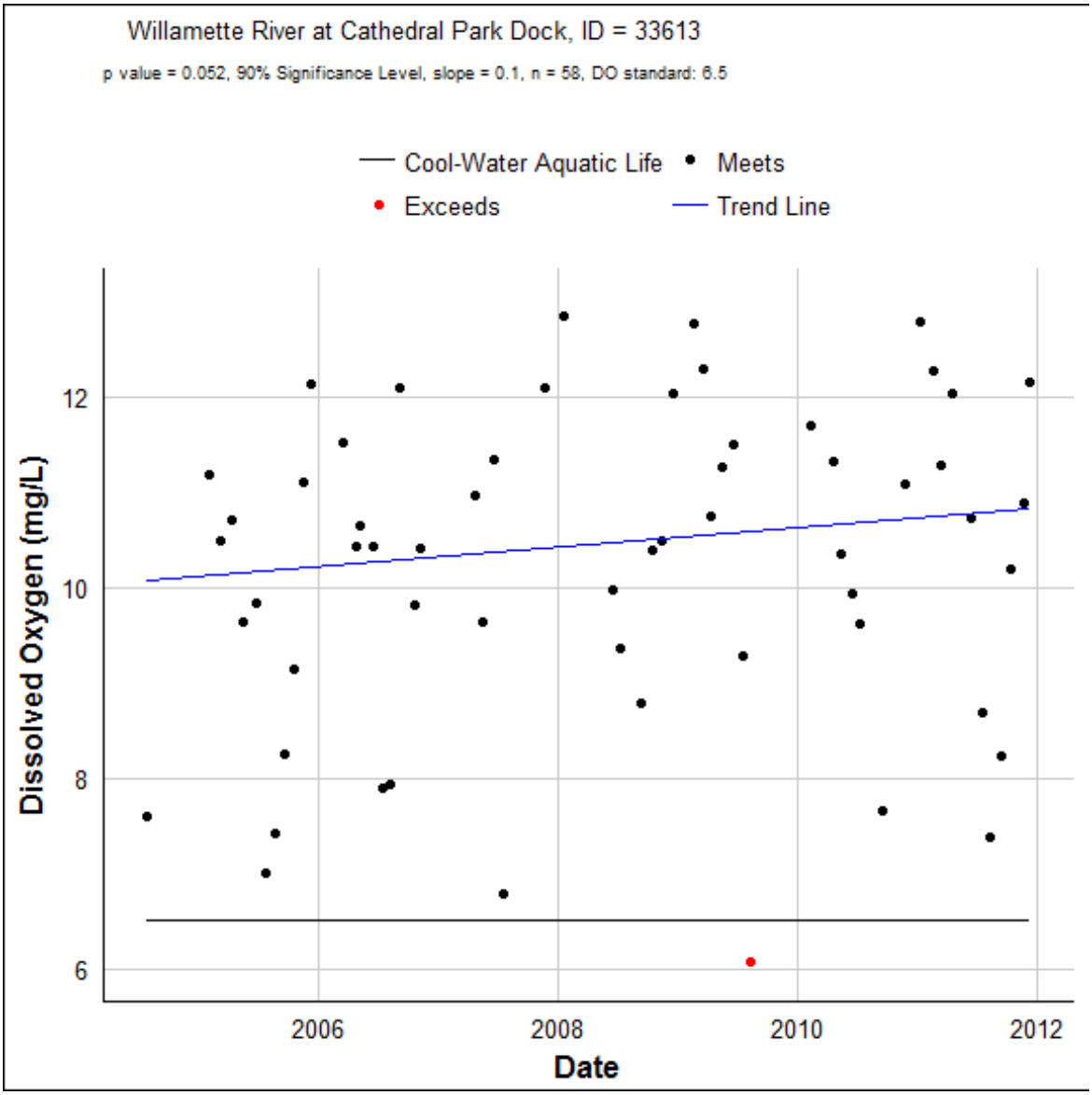

Figure 44: Station 33613 *Dissolved Oxygen* water quality status and trends

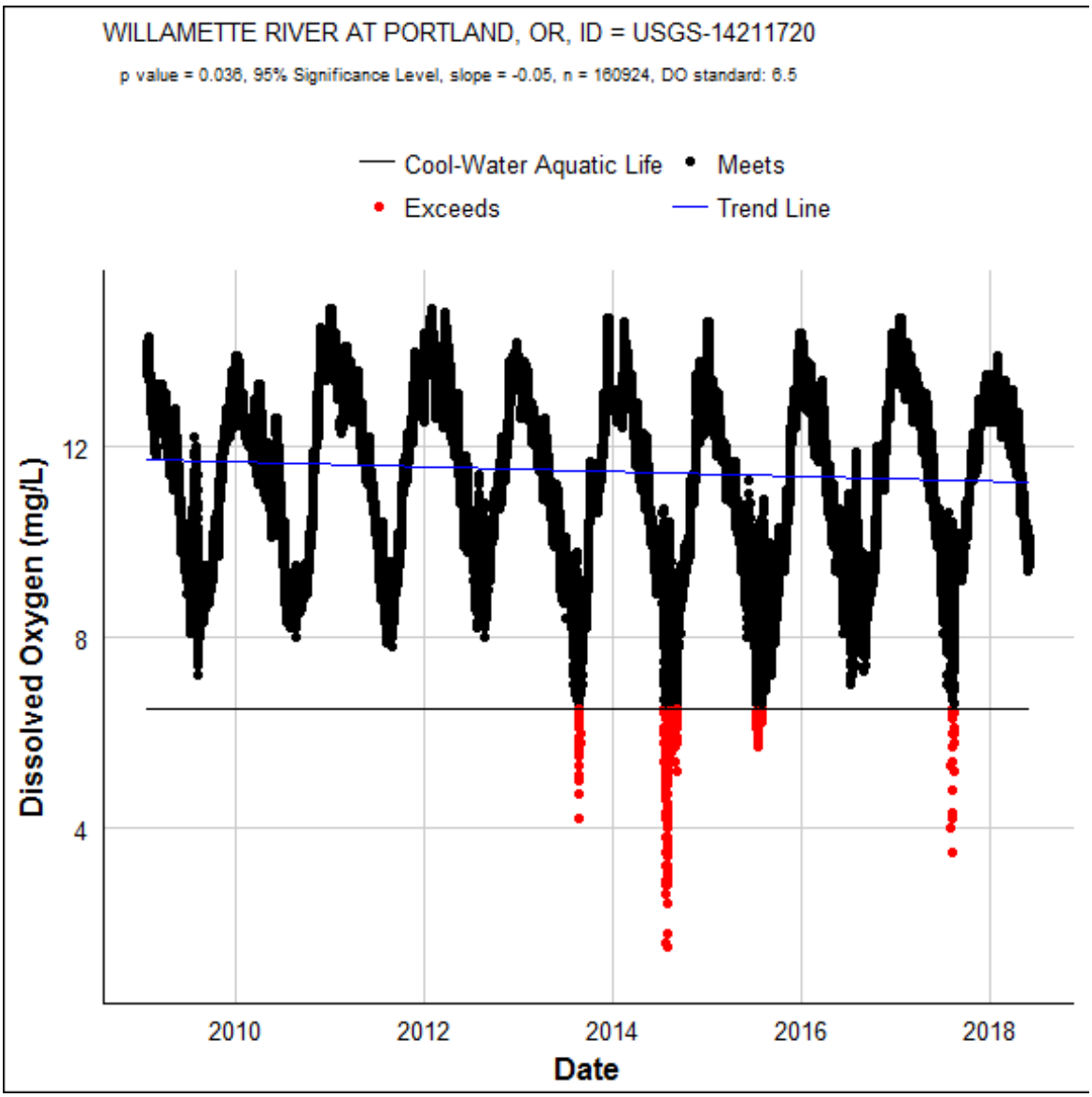

Figure 45: Station USGS-14211720 *Dissolved Oxygen* water quality status and trends

Table 14: Dissolved Oxygen status

Station ID	Station Description	Obs	Exceedances	Meets b/c %Sat	Min Date	Max Date
10332	Willamette River at SP&S RR Bridge (Portland)	110	0	0	2000	2018
10611	Willamette River at Hawthorne Bridge	178	0	0	2000	2018
10801	Swan Island Channel Midpoint	105	1	0	2000	2018
11201	Columbia Slough at Landfill Road	104	2	0	2000	2018
11321	Johnson Creek at SE 17th Avenue (Portland)	111	19	3	2000	2018

Station ID	Station Description	Obs	Exceedances	Meets b/c %Sat	Min Date	Max Date
28712	Blue Lake Site 2 (west)	57	24	0	2002	2011
33613	Willamette River at Cathedral Park Dock	58	1	0	2004	2011
USGS-14211720	WILLAMETTE RIVER AT PORTLAND, OR	3361	73	0	2009	2018

6.11 Additional Parameters included in the L. Willamette TMDL

Toxics data provided by the City of Gresham is summarized in throughout this section. Four sites in the Johnson Creek watershed were sampled for a variety of parameters over a two year period. Data that was less than the minimum reporting limit (<MRL) was marked as 'NA' and not included in the plots. Station descriptions are included in the following table. This data was reported in the 2017 Lower Willamette Status and no new data has been analyzed in this report.

Table 15: Station descriptions for City of Gresham provided data

Station ID	Station Description
JCI1	Johnson Creek at 174th Ave/Jenne Rd
JCI2	Johnson Creek at 252nd/Palmblad
KI1	Kelley Creek at Pleasant Valley Grange
KI2	Kelley Creek at Rodlun Road

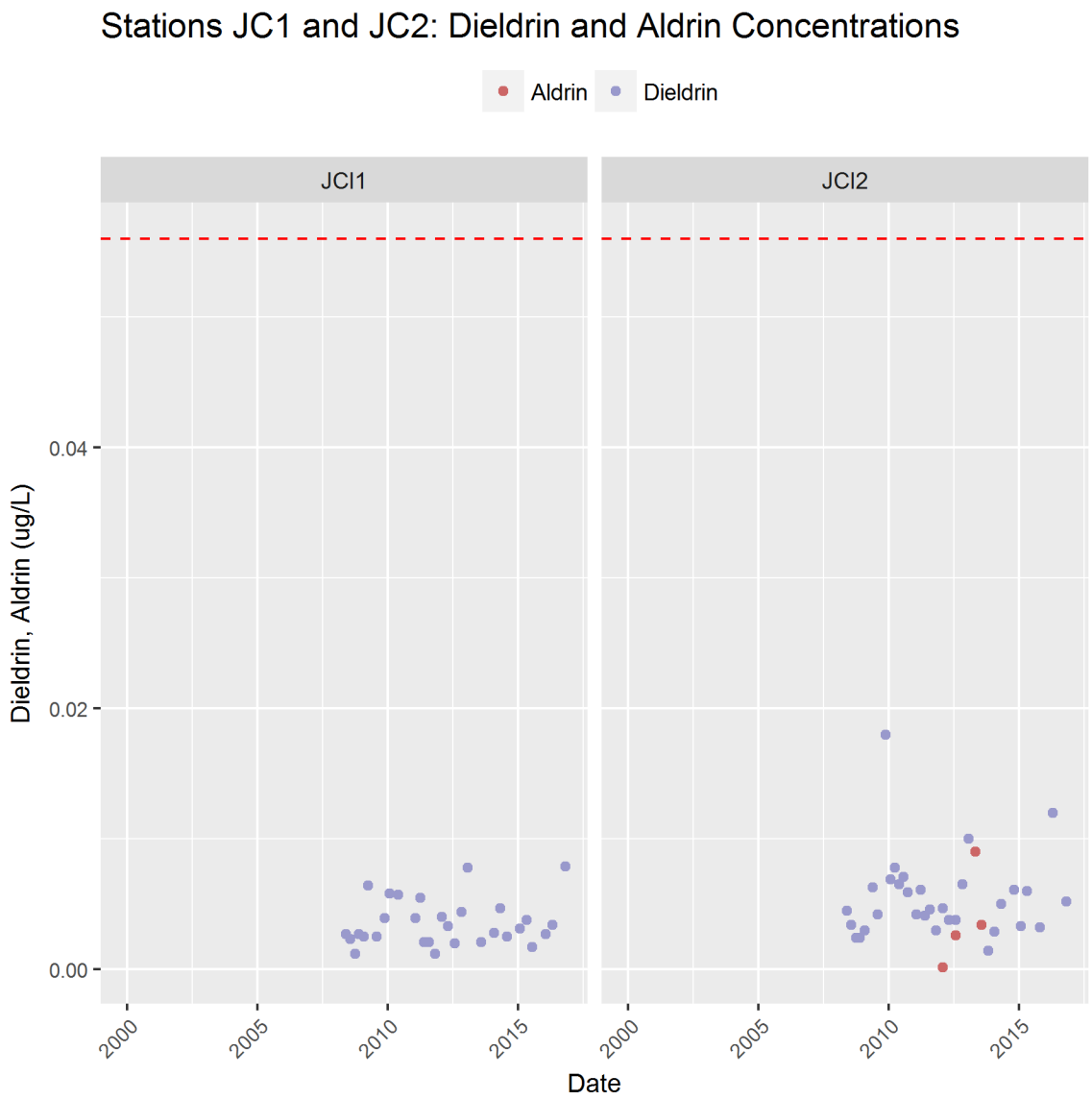

Figure 1- Dieldrin concentrations at two sites in the Johnson Creek watershed over an eight-year period, data provided by the City of Gresham. The dashed red line represents the aquatic life criterion of 0.056 ug/l, all values above 0.056 are considered exceedances. The aquatic life criterion for aldrin is 3 ug/L.

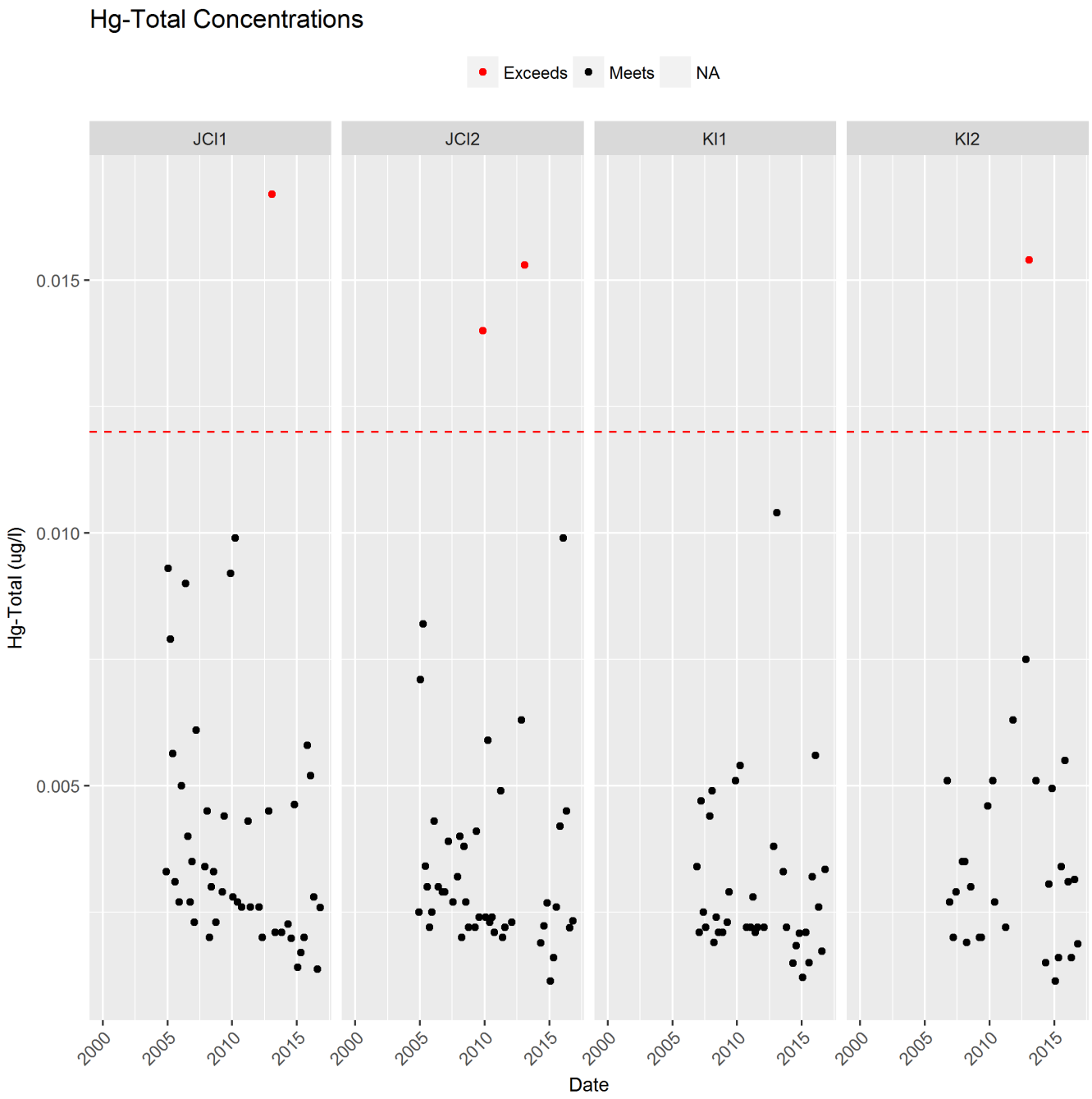

Figure 47- Mercury concentrations over an eight-year time period at four monitoring stations within the Johnson Creek watershed, provided by the City of Gresham. The dashed line represents the chronic mercury aquatic life criterion of 0.012 ug/l. Four results were above the criterion.

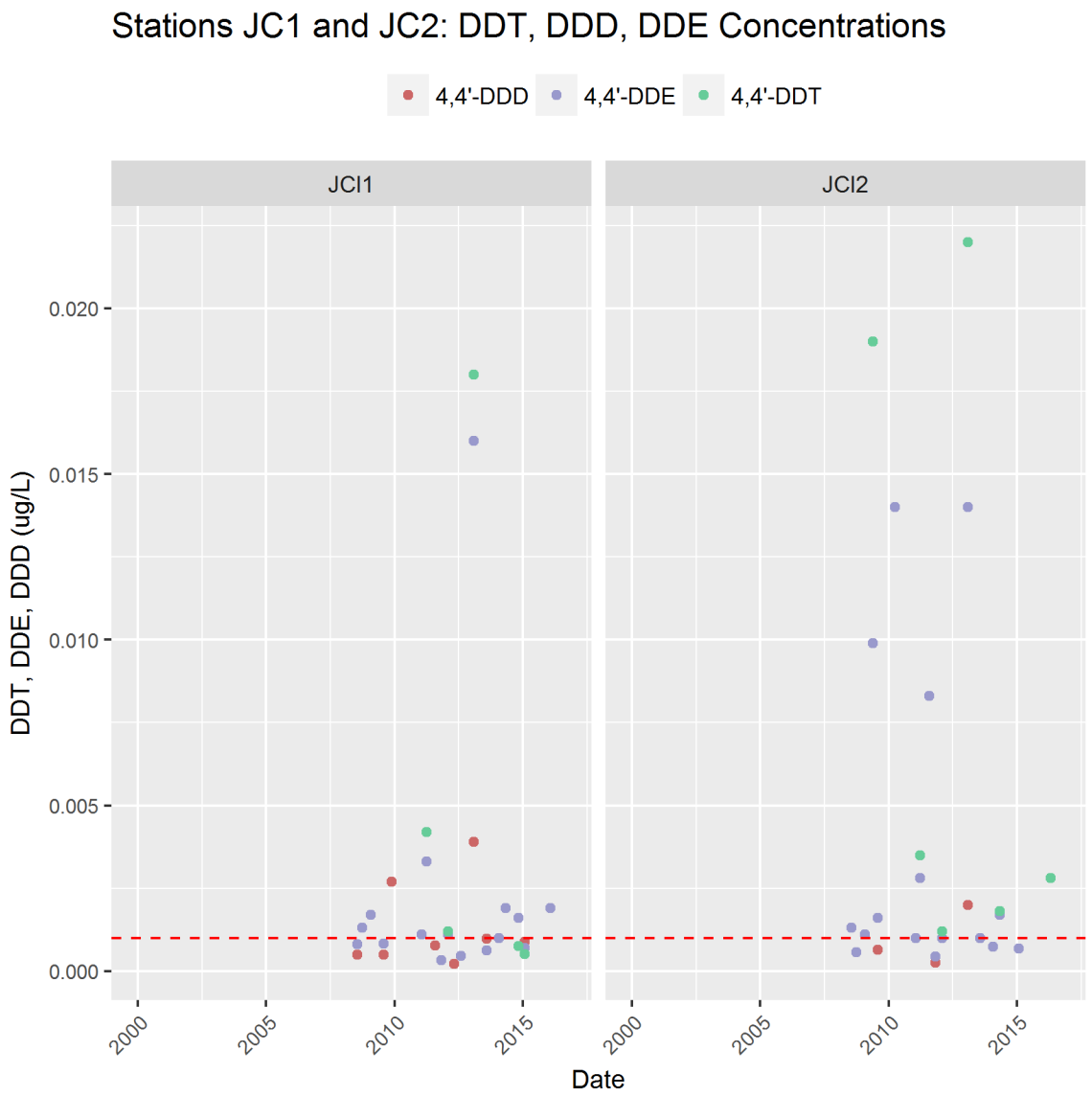

Figure 2- DDT, DDE, and DDD concentrations for samples with detections during an eight-year time period at two monitoring stations within the Lower Willamette Subbasin, provided by the City of Gresham. The chronic aquatic life criterion of 0.001 ug/l is represented by the dashed red line. Most of the samples collected (73%) are not shown because they were below MRLs, which were sometimes above 0.001 ug/l.

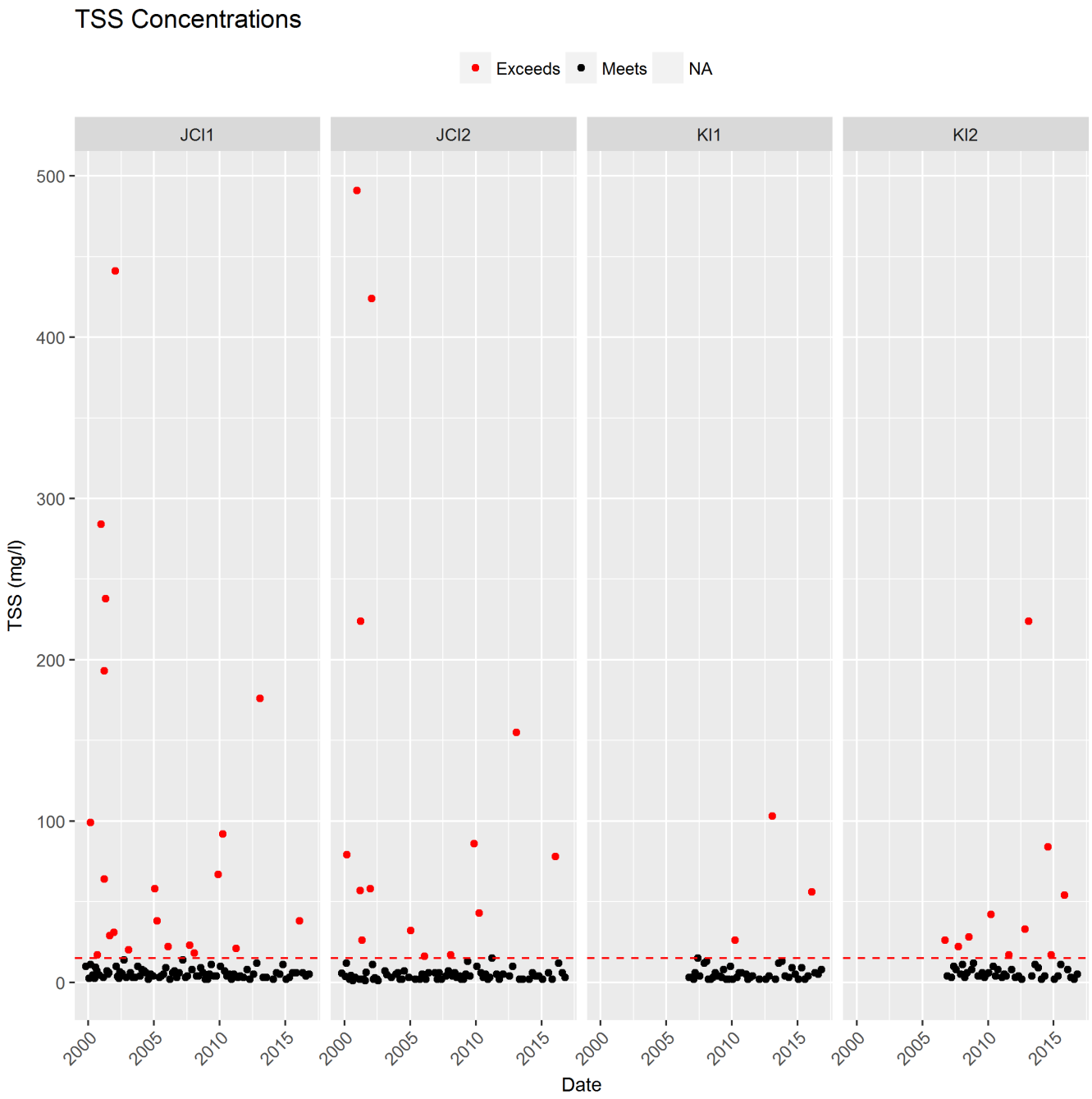

Figure 49- Total Suspended Solids (TSS) concentrations over an eight-year time period at four monitoring stations within the Johnson Creek watershed, provided by the City of Gresham. The dashed line represents the TMDL allocation for DDT and dieldrin when pollutant data is not available; exceedances are represented by data that is greater than 15 mg/l.

7 Summary

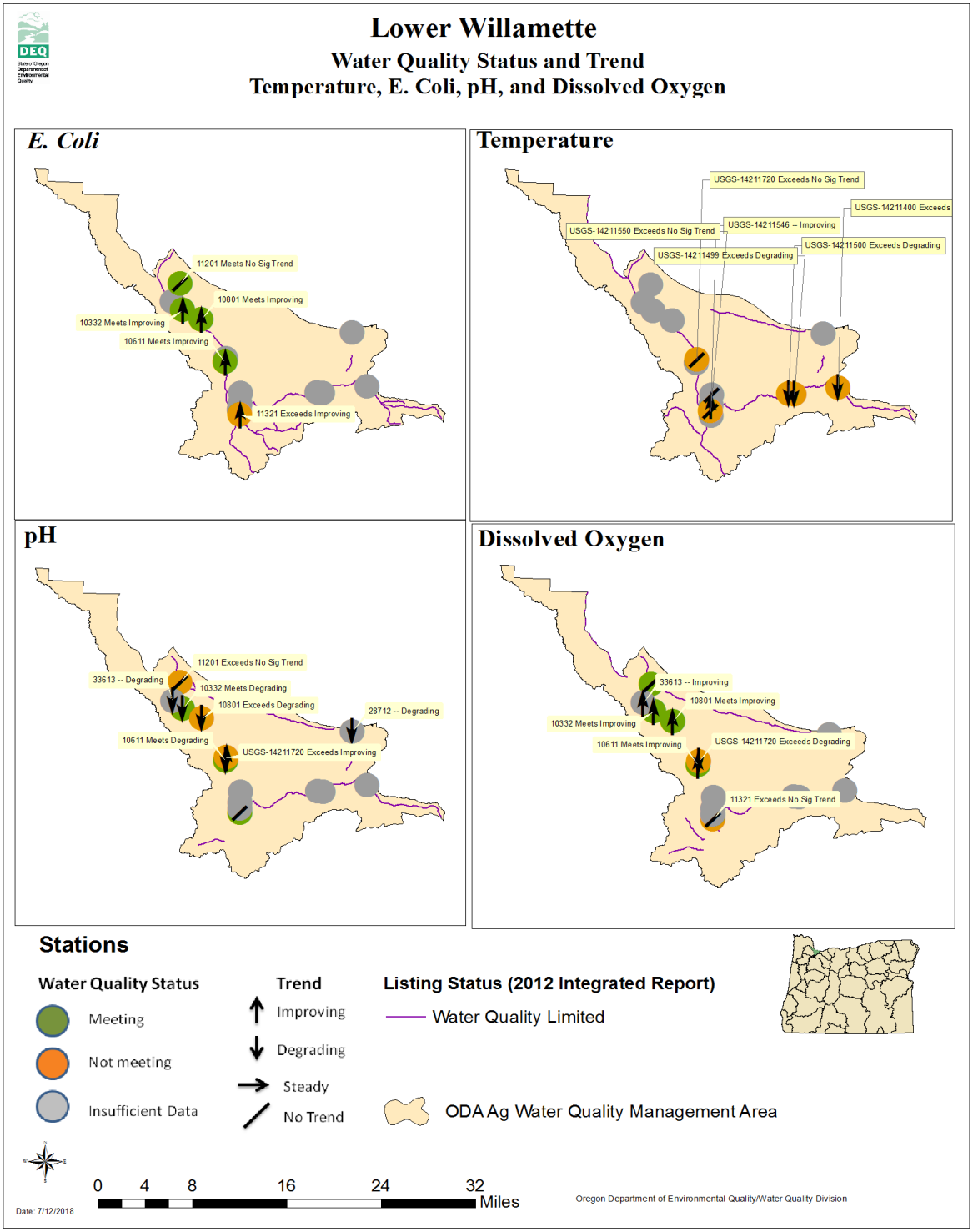

Figure 50: Summary of stations that fit the criteria for status and trend analysis. One or more exceedances within the last three years of available data defined whether a station was Meeting or Not Meeting. Trend was determined by significant trends associated with long-term datasets.

Table 16: Summary of Monitoring Stations Status and Trend, where 'exceed' represents a single exceedance of the water quality standard within the last three years of available data and "-" represents not enough data to make any determinations?. Note: DO = dissolved oxygen

Station ID	Station Description	E.coli Status	E.coli Trend	DO Status	DO Trend	pH Status	pH Trend	Temperature Status	Temperature Trend	TP Trend	TSS Trend
10332	Willamette River at SP&S RR Bridge (Portland)	Meets	Improving	Meets	Improving	Meets	Degrading	–	–	Improving	No Sig Trend
10611	Willamette River at Hawthorne Bridge	Meets	Improving	Meets	Improving	Meets	Degrading	–	–	Improving	No Sig Trend
10801	Swan Island Channel Midpoint	Meets	Improving	Meets	Improving	Exceeds	Degrading	–	–	Steady	No Sig Trend
11201	Columbia Slough at Landfill Road	Meets	No Sig Trend	Meets	No Sig Trend	Exceeds	No Sig Trend	–	–	Improving	Degrading
11321	Johnson Creek at SE 17th Avenue (Portland)	Exceeds	Improving	Exceeds	No Sig Trend	Meets	No Sig Trend	–	–	Improving	No Sig Trend
28712	Blue Lake Site 2 (west)	–	–	–	–	–	Degrading	–	–	No Sig Trend	–
33613	Willamette River at Cathedral Park Dock	–	–	–	Improving	–	Degrading	–	–	–	–
USGS-14211400	JOHNSON CREEK AT REGNER ROAD, AT GRESHAM, OR	–	–	–	–	–	–	Exceeds	Degrading	–	–
USGS-14211499	KELLEY CREEK AT SE 159TH DRIVE AT	–	–	–	–	–	–	Exceeds	Degrading	–	–

Station ID	Station Description	E.coli Status	E.coli Trend	DO Status	DO Trend	pH Status	pH Trend	Temperature Status	Temperature Trend	TP Trend	TSS Trend
	PORTLAND, OR										
USGS-14211500	JOHNSON CREEK AT SYCAMORE, OR	–	–	–	–	–	–	Exceeds	Degrading	–	–
USGS-14211542	CRYSTAL SPRINGS CREEK AT BYBEE ST, PORTLAND, OR	–	–	–	–	–	–	–	No Sig Trend	–	–
USGS-14211546	CRYSTAL SPRINGS CREEK AT MOUTH AT PORTLAND, OR	–	–	–	–	–	–	–	Improving	–	–
USGS-14211550	JOHNSON CREEK AT MILWAUKIE, OR	–	–	–	–	–	–	Exceeds	No Sig Trend	–	–
USGS-14211720	WILLAMETTE RIVER AT PORTLAND, OR	–	–	Exceeds	Degrading	Exceeds	Improving	Exceeds	No Sig Trend	Improving	–

8 Conclusions

What are the overall status or trends?

- *Dissolved Oxygen*: There are seven stations that have sufficient data to assess status and/or trends for Dissolved oxygen. Stations 11201, 10332, 10611, and 10801 showed no exceedances in the last two years while stations 11321 and USGS-14211720 had at least one. Stations10332, 10611, 10801, and 33613 showed a significant improving trend in DO while USGS-14211720 had a degrading trend. No significant DO trend was determined in the available data for stations 11321 and 11201.
- *E. coli*: There was sufficient E. Coli data available to assess status and/or trends for five stations in the Lower Willamette Ag Water Quality Management Area. Stations 11201, 10332, 10611, and 10801 had no exceedances within the data available. Station 11321 had at least one exceedance. An improving trend in E. Coli data was found at stations 10332, 10611, 10801, and 11321 where no significant trend could be determined at station 11201.
- *Enterococcus*:
- *pH*: Eight stations had enough data available to assess status and/or trends for pH. Stations 10332, 10611, and 11321 had no exceedances within the last two years while 11201, 10801, and USGS-14211720 had at least one exceedance. Stations 10332, 10611, 10801, 33613, and 28712 all showed a decreasing pH trend. The only station with an increasing trend was USGS-14211720 and stations 11321 and 11201 showed no significant trend for pH.
- *Temperature*: Status and/or trend was able to be determined at seven stations within the Lower Willamette Ag Water Quality Management Area. Stations USGS-14211720, USGS-14211400, USGS-14211499, USGS-14211500, and USGS-14211550 all exceeded the water quality standard for temperature in the last two years. USGS-14211546 was the only station that showed a significant improving trend. USGS-14211400, USGS-14211499, and USGS-14211500 all had degrading trends. No other significant temperature trends were able to be determined.
- *Total Phosphorus*: Trends in total phosphorus were determined at six stations within the Lower Willamette Ag Water Quality Management Area. Significant improving trends were determined at stations 11321, 11201, 10332, 10611, and USGS-14211720 while station 10801’ s trend was steady.
- *Total Suspended Solids*: Only station 11201 showed a significant degrading trend for total suspended solids. No other significant trends were able to be determined.

Additional Conclusions:

- Toxics:
  - Dieldrin and Aldrin: Data provided by the City of Gresham represents Dieldrin concentrations from 2008 through 2016 at two locations along Johnson Creek (JCI1 and JCI2). Aldrin data exists at station JCI2. All results for Dieldrin and Aldrin were below the freshwater criteria for Dieldrin (0.056 ug/l) and Aldrin (3 ug/L).
  - Mercury: Four stations contain data to assess trends of mercury from 2004 to 2016. Station KI1 had no exceedances of the chronic freshwater mercury criteria, while JCI1 and KI2 had one exceedance and JCI2 had two.
  - DDT, DDD, DDE: Data was available to assess trends from 2008-2016 of DDT, DDE, and DDD at two sites in Johnson Creek (JCI1 and JCI2). At station JCI1, there were three exceedances of the freshwater criterion for DDT (0.001 ug/l). At station JCI2, all detectable DDT results (6 samples) were in exceedance of the freshwater criterion.

– Total Suspended Solids (TSS): TSS is used as a surrogate measure for DDT in the Lower Willamette TMDL with values greater than 15 mg/l identified as exceeding the TMDL load allocation. Two sites contain data to assess TSS trends from 2000 to 2016 (JCI1 and JCI2) and two sites have data from 2006 to 2016 (KI1 and KI2). Each of the four stations have many exceedances of the TMDL allocation.

9 Appendix

Table 17: Summary table of all unique organizations that were queried; note that organizations included in this table may or may not have had data sufficient for status and/or trends analysis and therefore may not be included in this report

Organization	Observations	'Unique Stations'	'NA obs'	'Unique Comments'
USGS	360468	8	0	1
Oregon Department of Environmental Quality	9430	87	0	2
Willamette Riverkeeper	1183	30	0	1
Ambient Water Quality Monitoring - DEQ	916	6	0	0
Portland, Bureau Of Water Works	839	6	0	1
USGS Oregon Water Science Center	806	10	0	7
EPA Region 10 Superfund Portland Harbor Site	736	231	0	21
State of Oregon Dept. of Environmental Quality	350	79	0	7
TMDL - Northwest Region	73	69	0	0
Harmful Algal Bloom Response	27	3	0	0
US Geological Survey, Portland	19	4	0	1
Columbia Riverkeeper	15	3	0	1
Portland Metropolitan Service District	7	2	0	1
NA	0	1	0	1

Table 18: Monitoring stations that fit the criteria to assess status; note value represents the number of results for each monitoring station per year

Station_ID	2015	2016	2017	2018	Analyte
10332	9	8	10	4	Dissolved Oxygen
10611	6	5	5	3	Dissolved Oxygen
10801	6	5	5	2	Dissolved Oxygen
11201	7	5	5	4	Dissolved Oxygen

Station_ID	2015	2016	2017	2018	Analyte
11321	6	5	6	2	Dissolved Oxygen
USGS-14211720	17158	17513	17501	7275	Dissolved Oxygen
10332	13	12	10	6	E. Coli
10611	11	9	5	5	E. Coli
10801	11	9	5	5	E. Coli
11201	13	9	5	6	E. Coli
11321	9	8	8	3	E. Coli
10332	15	13	15	6	pH
10611	12	10	10	5	pH
10801	12	10	10	5	pH
11201	13	10	10	6	pH
11321	12	10	12	3	pH
USGS-14211720	17487	17296	17476	7245	pH
USGS-14211400	343	326	357	151	Temperature
USGS-14211499	365	250	346	151	Temperature
USGS-14211500	357	366	365	151	Temperature
USGS-14211550	365	366	346	151	Temperature
USGS-14211720	365	358	365	151	Temperature
10332	9	8	10	4	Total Phosphorus
10611	6	5	5	3	Total Phosphorus
10801	6	5	5	3	Total Phosphorus
11201	7	5	5	4	Total Phosphorus
11321	6	5	6	2	Total Phosphorus
USGS-14211720	17	18	19	8	Total Phosphorus
10332	9	8	10	4	Total Suspended Solids
10611	6	5	5	3	Total Suspended Solids
10801	6	5	5	3	Total Suspended Solids
11201	7	5	5	4	Total Suspended Solids
11321	6	5	6	2	Total Suspended Solids

Table 19: Monitoring stations that fit the criteria to assess trends; note value represents the number of results for each monitoring station per year

Station ID	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	Analyte
10332	6	7	8	9	7	6	7	7	6	8	8	6	6	9	8	9	8	10	4	Dissolved Oxygen
10611	12	12	12	11	12	14	12	11	14	15	10	6	8	6	6	6	5	5	3	Dissolved Oxygen
10801	10	9	9	7	7	7	10	7	6	7	5	7	7	7	6	6	5	5	2	Dissolved Oxygen
11201	6	6	7	8	8	11	7	5	7	13	7	6	9	7	8	7	5	5	4	Dissolved Oxygen
11321	7	11	11	6	6	7	6	5	6	6	6	6	8	6	6	6	5	6	2	Dissolved Oxygen
33613	NA	NA	NA	NA	1	11	9	5	7	7	7	11	NA	NA	NA	NA	NA	NA	NA	Dissolved Oxygen
USGS-14211720	NA	NA	NA	NA	NA	NA	NA	NA	NA	15925	16796	17228	17277	16738	17513	17158	17513	17501	7275	Dissolved Oxygen
10332	6	7	8	9	7	6	7	7	5	7	8	6	5	NA	NA	NA	NA	NA	NA	Dissolved oxygen saturation
10611	12	12	12	11	12	12	12	11	14	15	10	6	7	NA	NA	NA	NA	NA	NA	Dissolved oxygen saturation
10801	10	9	9	7	7	7	10	7	4	6	5	7	6	NA	NA	NA	NA	NA	NA	Dissolved oxygen saturation
11201	6	6	7	8	8	11	7	5	6	11	7	6	7	NA	NA	NA	NA	NA	NA	Dissolved oxygen saturation
11321	7	11	11	6	6	7	6	5	6	6	6	6	7	NA	NA	NA	NA	NA	NA	Dissolved oxygen saturation
10332	11	14	9	6	7	6	7	7	6	8	8	6	7	15	14	13	12	10	6	E. Coli
10611	24	24	18	14	12	13	12	11	12	12	9	6	9	12	12	11	9	5	5	E. Coli
10801	20	18	14	7	6	7	10	7	6	7	5	7	8	12	12	11	9	5	5	E. Coli

Station ID	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	Analyte
11201	12	10	8	8	8	11	7	5	7	13	7	6	10	12	13	13	9	5	6	E. Coli
11321	14	22	15	6	6	7	6	5	6	5	6	6	9	13	11	9	8	8	3	E. Coli
10332	6	7	8	8	7	6	7	7	6	8	8	6	7	15	14	15	13	15	6	pH
10611	12	12	12	11	12	14	12	11	14	14	10	6	9	12	12	12	10	10	5	pH
10801	10	9	9	7	7	7	10	7	6	7	5	7	8	13	12	12	10	10	5	pH
11201	6	6	7	8	8	11	7	5	7	13	7	6	10	13	14	13	10	10	6	pH
11321	7	11	11	6	6	7	6	5	6	6	6	6	9	12	12	12	10	12	3	pH
28712	NA	NA	68	30	NA	NA	12	23	60	22	9	6	NA	NA	NA	NA	NA	NA	NA	pH
33613	NA	NA	NA	NA	1	10	1	9	9	8	6	12	NA	NA	NA	NA	NA	NA	NA	pH
USGS-14211720	13	14	16	14	15	10	9	19	18	15975	16126	17180	17325	16543	17503	17487	17296	17476	7245	pH
USGS-14211400	318	365	365	365	358	365	365	357	366	357	365	365	342	365	348	343	326	357	151	Temperature
USGS-14211499	332	365	365	365	350	365	365	365	355	365	365	316	366	272	344	365	250	346	151	Temperature
USGS-14211500	360	365	365	365	366	365	365	365	366	365	365	365	366	365	347	357	366	365	151	Temperature
USGS-14211542	360	365	365	365	366	365	365	365	344	338	365	356	366	288	NA	NA	NA	NA	NA	Temperature
USGS-14211546	267	NA	19	365	366	365	365	365	272	338	365	314	352	NA	NA	NA	NA	NA	NA	Temperature
USGS-14211550	360	365	365	365	366	365	355	365	366	365	365	346	355	365	349	365	366	346	151	Temperature
USGS-14211720	NA	37	365	340	366	271	NA	NA	NA	322	365	349	326	357	365	365	358	365	151	Temperature

Station ID	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	Analyte
10332	6	7	6	6	7	6	7	7	6	8	8	6	6	9	8	9	8	10	4	Total Phosphorus
10611	12	12	12	11	12	12	12	11	12	12	9	6	8	6	6	6	5	5	3	Total Phosphorus
10801	10	9	9	7	7	7	10	7	6	7	5	7	7	7	6	6	5	5	3	Total Phosphorus
11201	6	6	7	8	8	11	7	5	7	13	7	6	9	7	8	7	5	5	4	Total Phosphorus
11321	7	11	9	6	6	7	6	5	6	6	6	6	8	6	6	6	5	6	2	Total Phosphorus
28712	NA	NA	25	30	NA	NA	10	27	62	22	9	7	NA	NA	NA	NA	NA	NA	NA	Total Phosphorus
USGS-14211720	13	14	16	14	15	9	9	19	18	20	19	19	19	18	18	17	18	19	8	Total Phosphorus
10332	6	7	7	8	7	6	5	4	6	8	8	6	6	9	8	9	8	10	4	Total Suspended Solids
10611	12	12	12	14	12	12	10	6	14	15	10	6	8	5	6	6	5	5	3	Total Suspended Solids
10801	10	9	9	7	7	7	9	5	6	7	5	7	7	7	6	6	5	5	3	Total Suspended Solids
11201	6	6	7	8	8	11	6	2	7	13	7	6	9	7	8	7	5	5	4	Total Suspended Solids
11321	7	13	12	6	6	7	5	3	6	6	6	6	8	6	6	6	5	6	2	Total Suspended Solids