



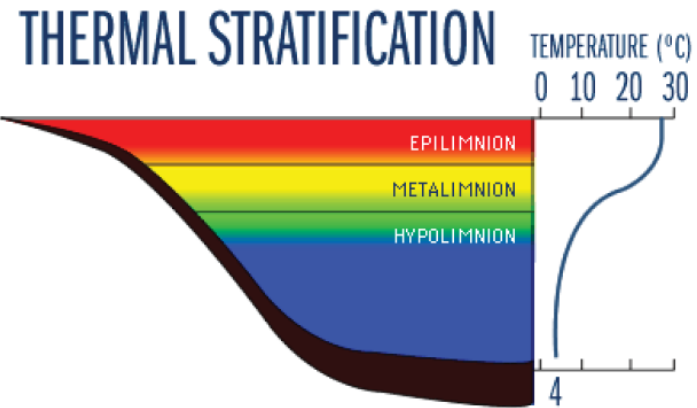
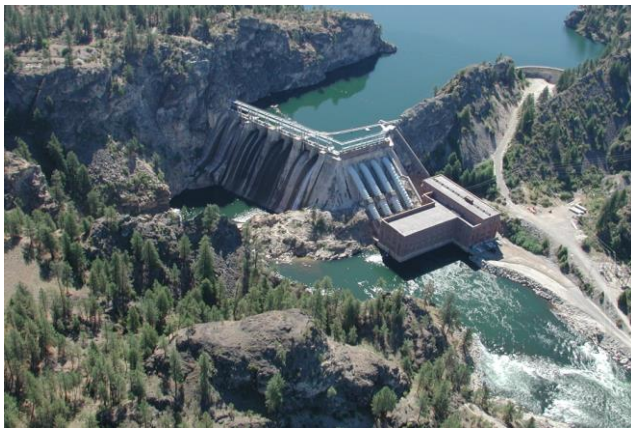
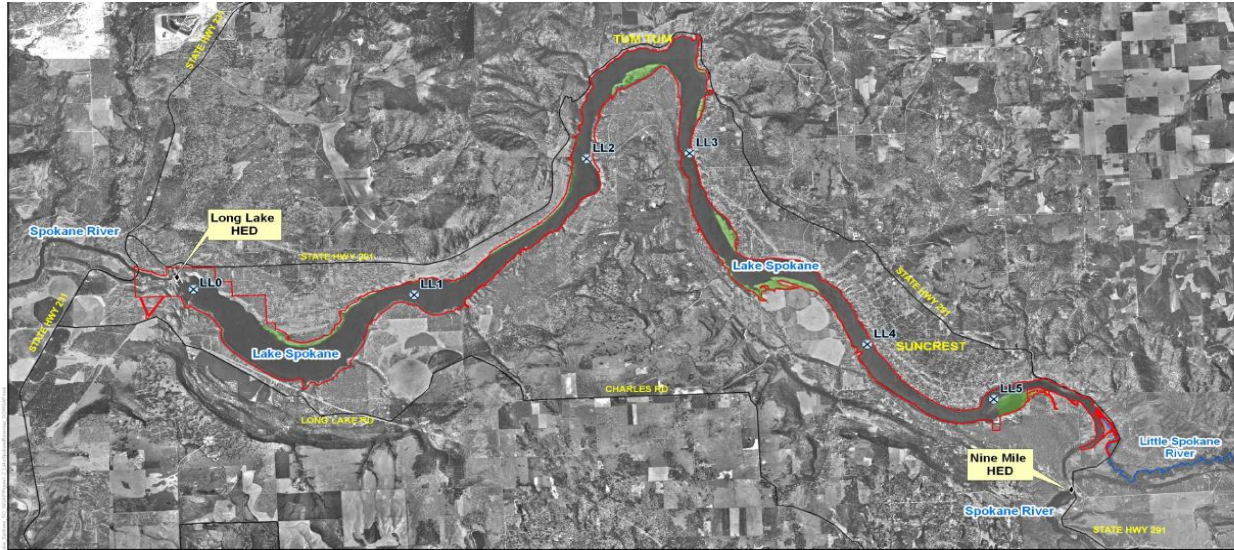
Spokane River and Lake Spokane
DO TMDL Advisory Committee Meeting

July 17, 2018

Lake Spokane DO Water Quality Attainment Plan

Meghan Lunney and Chris Moan

Vertical Structure



Discrete Depth Sampling Stations 2017

Lake Spokane Sampling Station and Discrete Depth						
	LL0	LL1	LL2	LL3	LL4	LL5
Depths	0.5	0.5	0.5	0.5	0.5	0.5
	5	5	5	5	4	B-1
	15	20	15	10	B-1	
	30	B-1	B-1	B-1		
	B-1					

2017 Sample Dates:

- May 15-16
- June 5-6
- June 20-21
- July 11-12
- July 25-26
- August 8-9
- August 22-23
- Sept. 12-13
- Sept. 26-27
- October 18-19

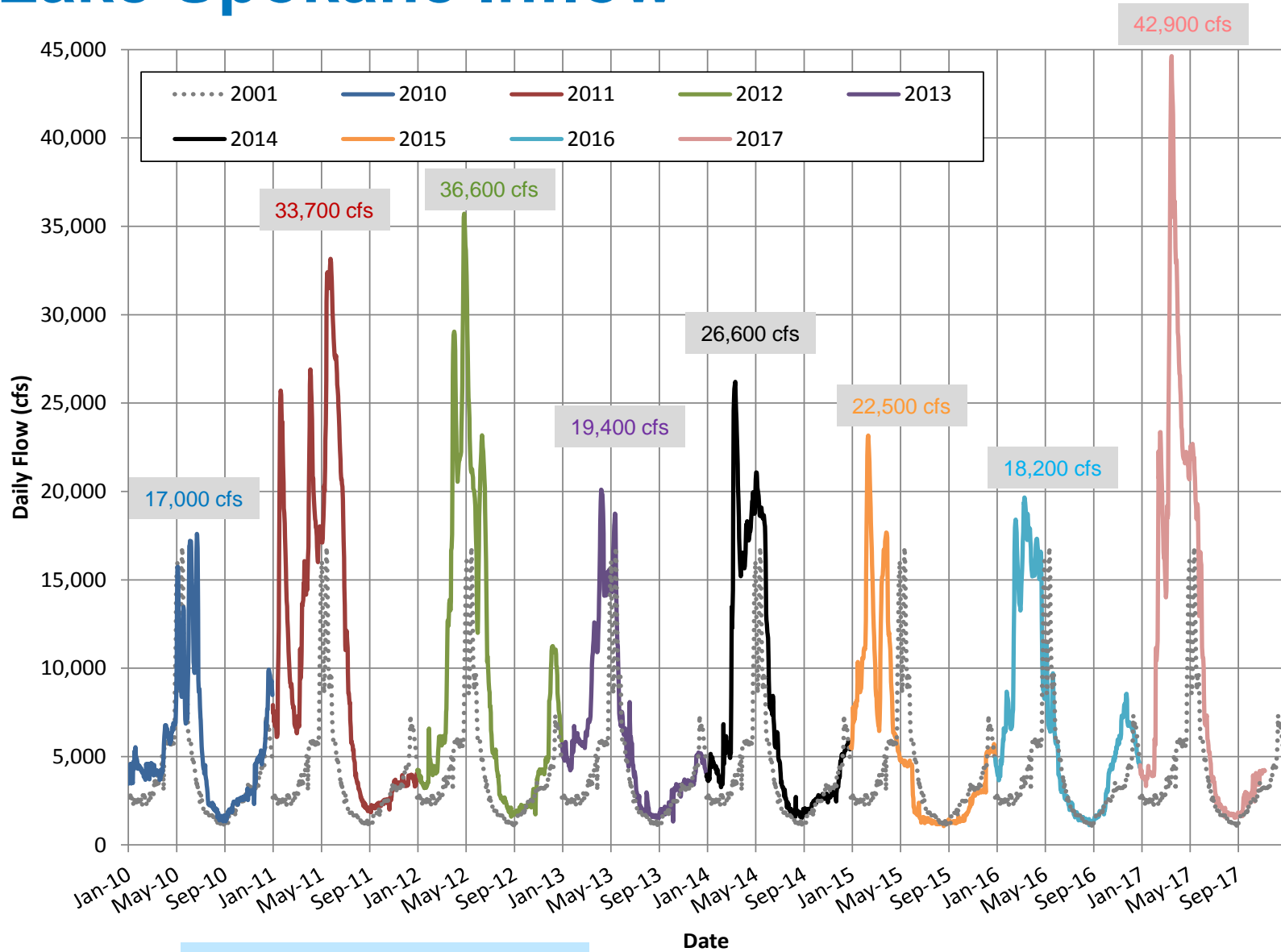
Lab Analyses

- Nitrate plus nitrite
- Total persulfate nitrogen (TN)
- Soluble reactive phosphorus (SRP)
- Total phosphorus (TP)
- Chlorophyll *a* (chl)
- Phytoplankton
- Zooplankton

In Situ

- Water temperature
- Dissolved oxygen
- pH
- Conductivity
- Secchi Disc Depth

Lake Spokane Inflow



2001 Peak Streamflow = 16,800 cfs

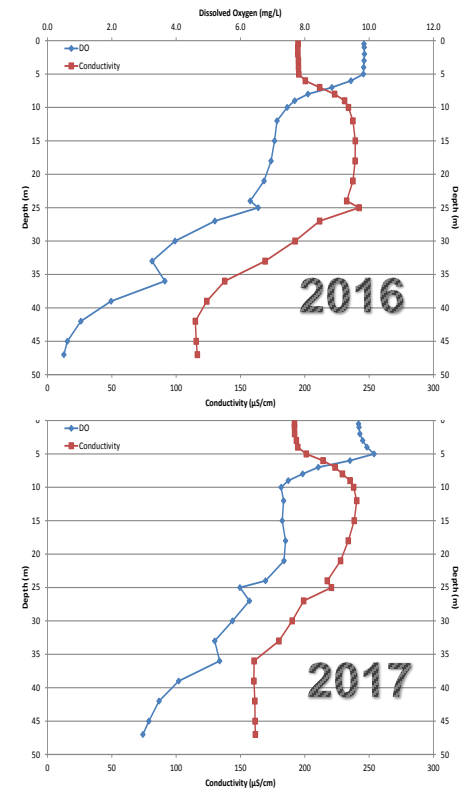
*2001, 2010-2017 Peak Streamflows from USGS, Spokane River @ Spokane Gage

2017 Weather Observations

- March was second wettest month on record
- Drought-like conditions June into September
- Air temperature reached 90°F or higher 14 days in July and high August temperatures resulted in 15 consecutive days of 90°F or higher

2017 Lake Spokane Monitoring

- Dissolved Oxygen
 - Max conc. ~11.8 to 12.6 mg/L
 - Ave conc. 8.4 to 10.1 mg/L
 - Min conc. 0 mg/L
 - July – Sept. volume weighted hypolimnetic ave. ranged from 6.4 to 8.1 mg/L
- Total Phosphorus
 - Ranged from 3 to 109 $\mu\text{g/L}$
 - Volume weighted water column TP conc. <25 $\mu\text{g/L}$
- Soluble Reactive Phosphorus
 - Ranged from non-detect (1.0 $\mu\text{g/L}$) to 94 $\mu\text{g/L}$



Ave. DO & Conductivity for LL0, LL1, LL2 (late July – Sept.)

2017 Lake Spokane Monitoring

- Nitrogen
 - Ranged from 270 to 2,720 $\mu\text{g/L}$
 - Most of the TN consisted of nitrate + nitrite
- Chlorophyll-a
 - Ranged from 0.4 to 26.7 $\mu\text{g/L}$
 - Often highest at ~16 ft depth
- Transparency
 - Ranged from 6.2 to 33.8 ft depth
- Phytoplankton
 - diatoms and green algae greatest biovolume
 - algal clumps/scums were observed in August and Sept. at LL5



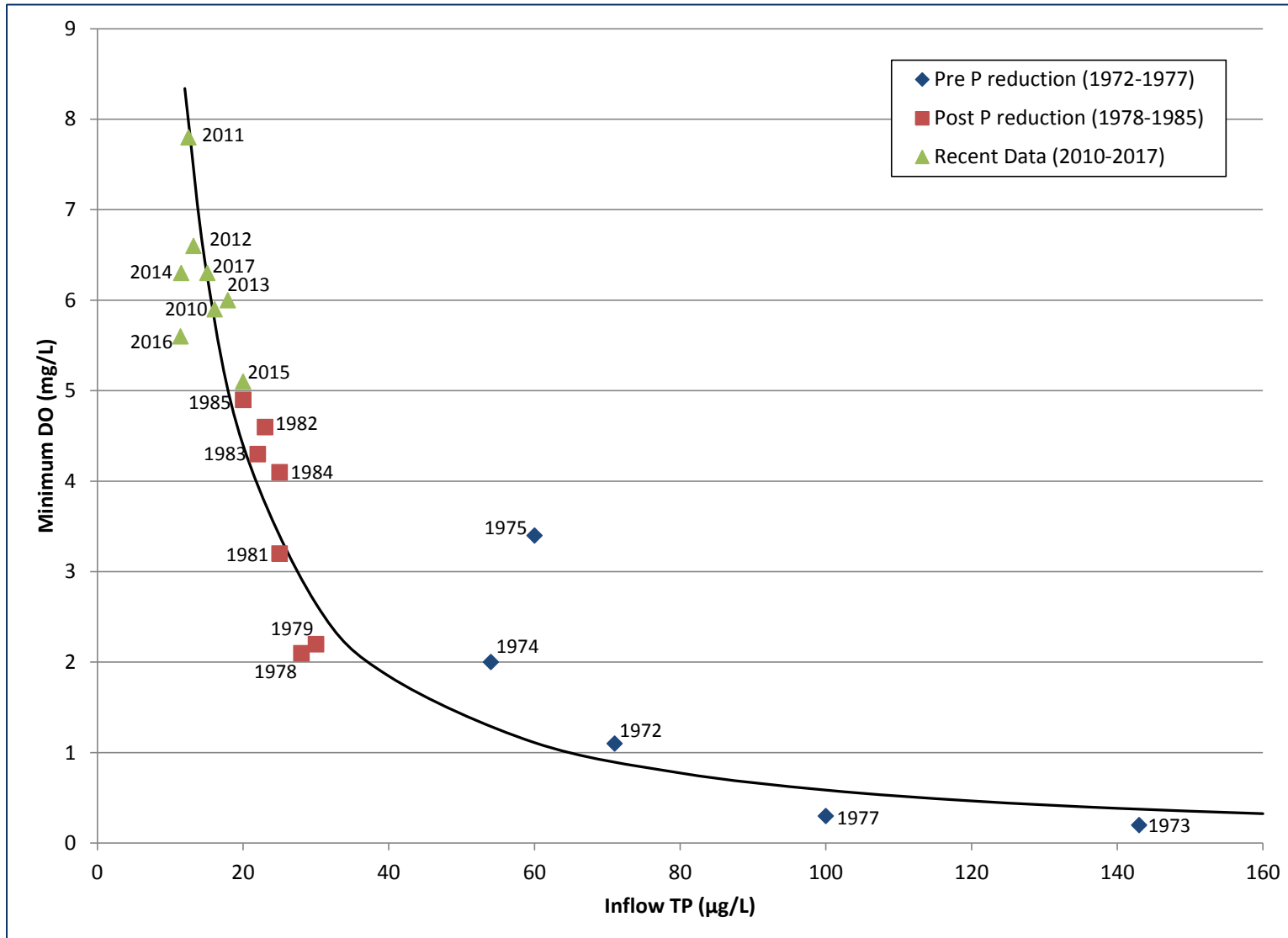
Cyanobacteria scum upstream LL3, late Sept



Cyanobacteria scum and plant debris near Tum Tum, late Sept.

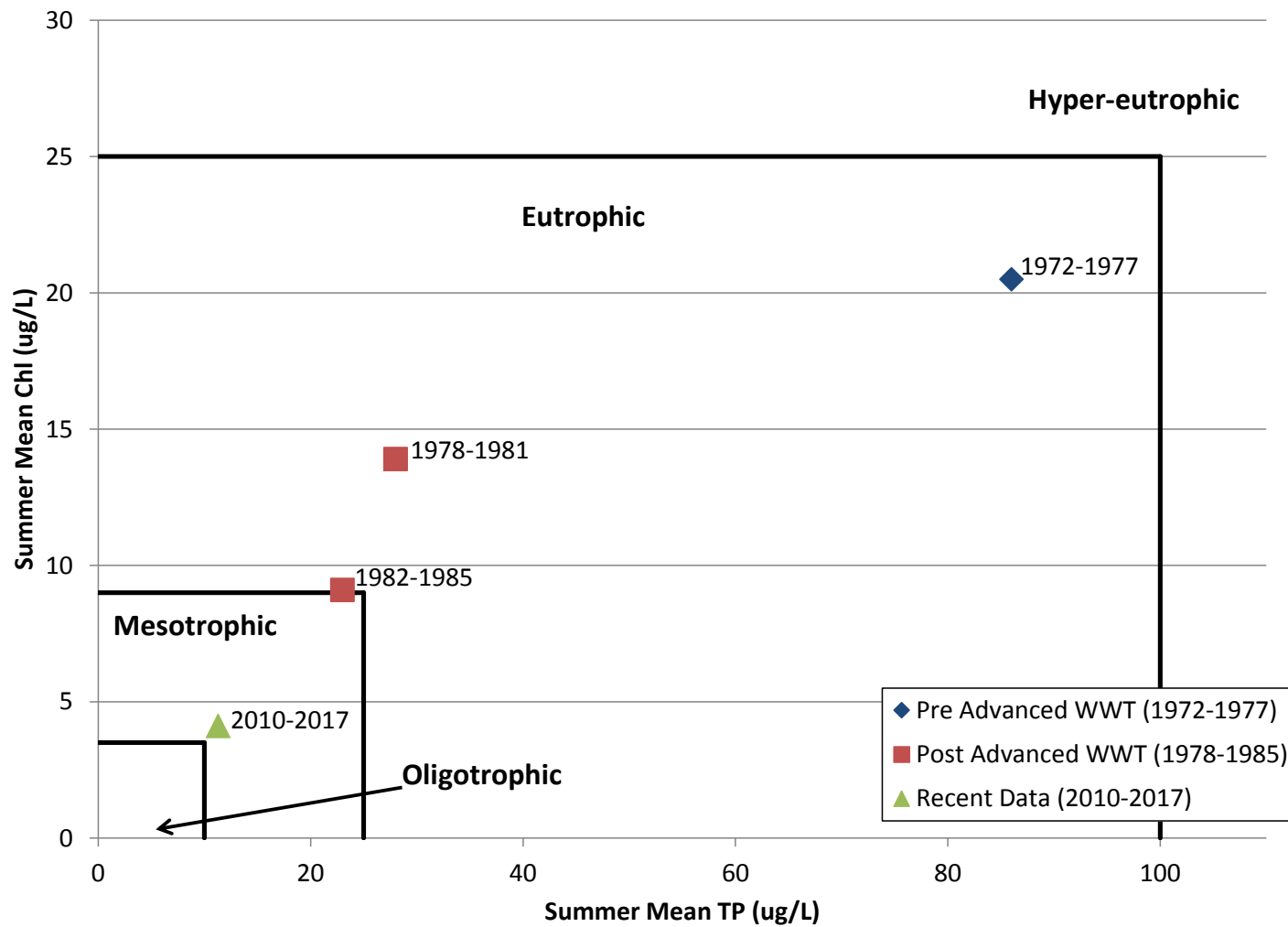
Photo Source: Lake Spokane Annual Summary, 2017 Baseline
Water Quality Monitoring Results (TetraTech 2018)

June – October Volume Weighted Mean Inflow TP Concentrations related to Volume Weighted Hypolimnetic DO Concentrations before and after advanced wastewater treatment.



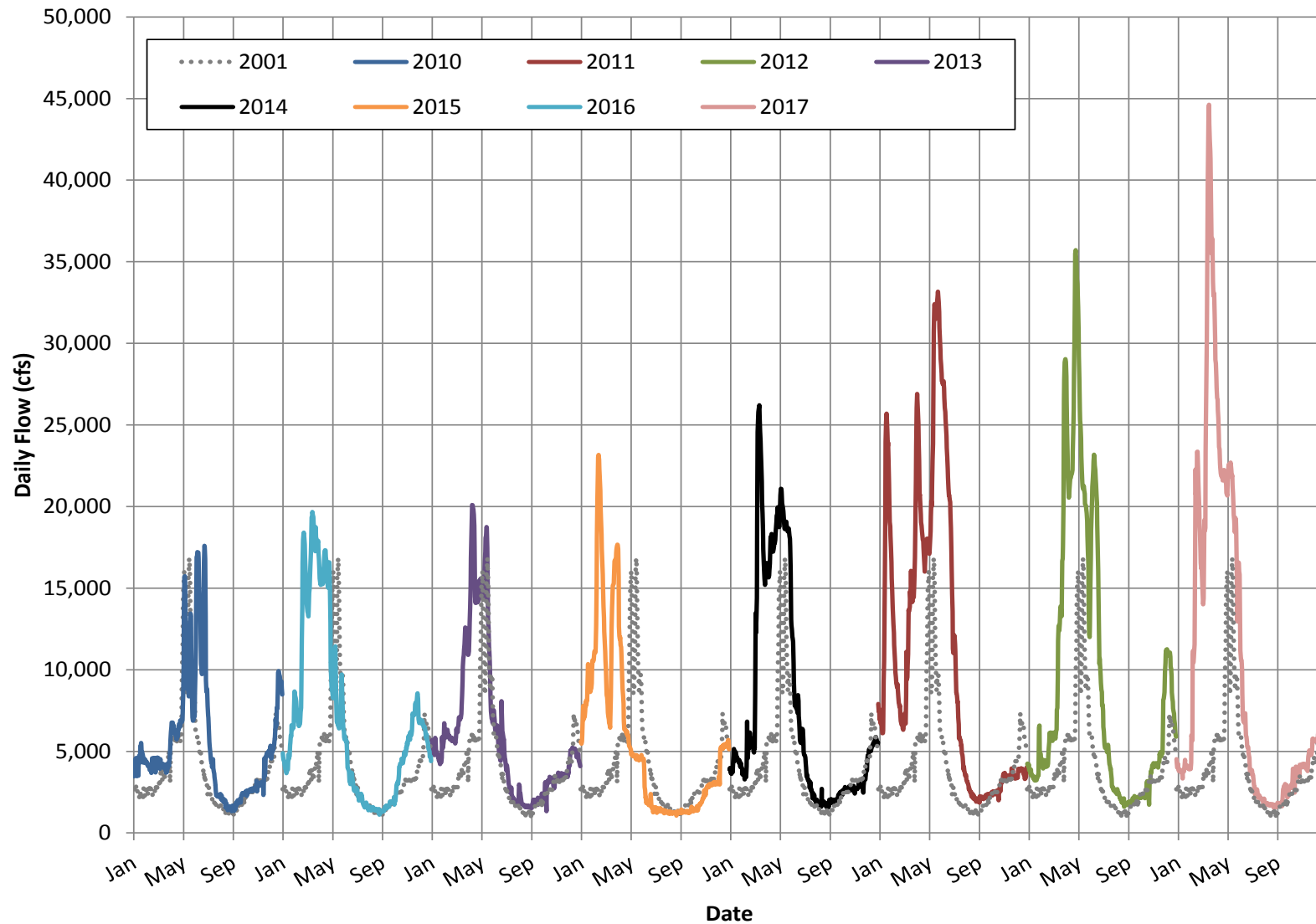
Source: Avista 2018 (Lake Spokane Dissolved Oxygen Water Quality Attainment Plan 2017 Annual Report)

Lake Spokane Trophic Status



Source: Lake Spokane Annual Summary, 2017 Baseline Water Quality Monitoring Results (TetraTech 2018)

Lake Spokane Inflow



Sampling Stations 2018

Lake Spokane Sampling Station and Discrete Depth

	LL0	LL1	LL1a	LL2	LL2a	LL2b	LL3	LL3a	LL4	LL5
Depths	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
	B-1	B-1	B-1	B-1	B-1	B-1	B-1	B-1	B-1	B-1

2018 Sample Dates:

- May 16-17
- June 6-7
- June 19-20
- July 10-11
- July 23-24
- August 7-8
- August 28-29
- Sept. 12-13
- Sept. 25-26
- October 16-17

Lab Analyses

- Dissolved oxygen
- Zooplankton

In Situ

- Water temperature
- Dissolved oxygen
- pH
- Conductivity
- Secchi Disc Depth

DO WQAP Implementation

- Carp Removal
- Bulkhead Rmvl/Reducing lawn areas
- Grazing land lease
- Wetlands/Floating Treatment Wetland
- Planting trees
- Education
- Rainbow Trout Habitat Assessment



DO WQAP Implementation

- **Carp Removal**
- Bulkhead Rmvl/Reducing lawn areas
- Grazing land lease
- Wetlands/Floating Treatment Wetland
- Planting trees
- Education
- **Rainbow Trout Habitat Assessment**



2017 Carp Removal

	Winter Event	Spring Event**
Timeframe	1 Week	2 Weeks
Method	Gill Netting	Gill Netting & Electrofishing
Number Carp Removed	149	1,072
Total Weight of Carp Removed*	1,030	9,279
Max Weight *	13 lbs	22 lbs
Ave Weight*	7 lbs	8.6 lbs
Max Length*	29 in	34 in
Ave Length*	23 in	25 in

Note:

* = Measurements are approximate.

** = Estimate of TP removed during removal is ~87 lbs



Photo by: Rich Landers – Spokesman Review

2018 Carp Removal

	Spring Event
Timeframe	2 Weeks
Method	Gill Netting
Number Carp Removed	557
Total Weight of Carp Removed*	5,184
Max Weight *	20 lbs
Ave Weight*	9.3 lbs
Max Length*	34.2 in
Ave Length*	25.7 in

Note:

* = Measurements are approximate



DO WQAP Implementation

- Carp Removal
- Bulkhead Rmvl/Reducing lawn areas
- Grazing land lease
- Wetlands/Floating Treatment Wetland
- Planting trees
- Education
- **Rainbow Trout Habitat Assessment**



Lake Spokane Hatchery Rainbow Trout Habitat Assessment

- Gain understanding of trout summer habitat and the lakes ability to support healthy trout
- Multi-year rainbow trout population and habitat assessment
 1. Rainbow trout growth and natural mortality
 2. Identify rainbow trout habitat utilization



1. Growth and Natural Mortality

- Recapturing previously tagged fish
- Floy tagged 636 rainbow trout in 2017
 - Total length
 - Weight
- Angler surveys to recapture fish
 - Voluntary reporting in 2017
 - 13 -14 inches after one year



Important information Avista needs from you:

Report the individual tag ID number, the location where the fish was caught and, if possible, its length. Call Chris Moan at the phone number listed on the tag (509-495-4084) or email him at chris.moan@avistacorp.com

Avista is conducting research to evaluate the condition of hatchery rainbow trout stocked in Lake Spokane. Please report any trout you catch that are tagged with a **gray** floy tag near the dorsal fin.

1. Growth and Natural Mortality

- Floy tagged 882 rainbow trout in 2018
 - Total length
 - Weight
- Angler surveys to recapture fish
 - Voluntary reporting
 - Avista creel survey
- Tagging multiple year classes provides short and long term growth rates; compare relative weights

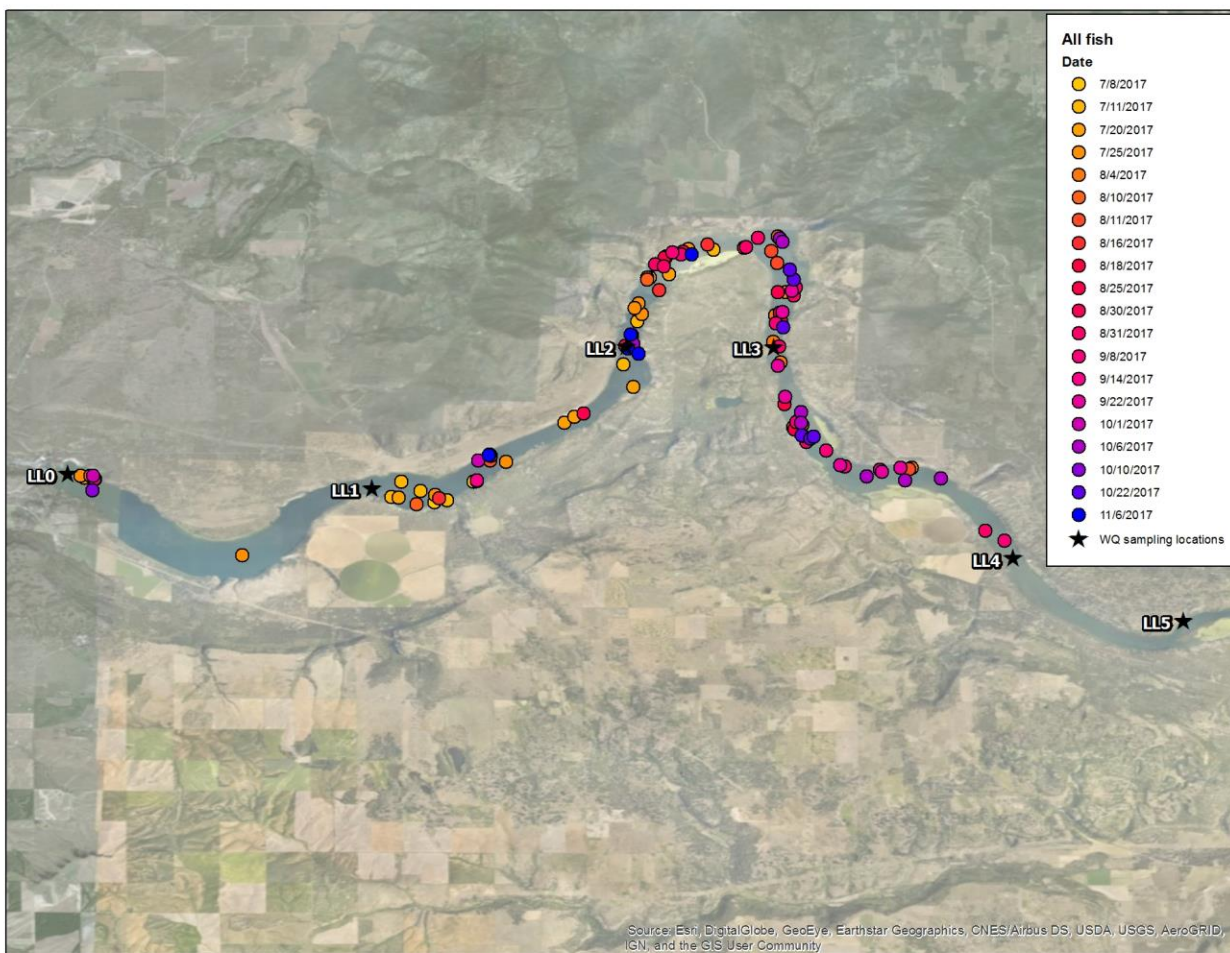


2. Habitat Utilization

- Partnered with Eastern Washington University
- Collected and tagged 20 adult hatchery rainbow trout: 14.5 – 17.5 inches; 1.12 – 1.76 lbs
 - Latitude and longitude
 - Depth
 - Temperature

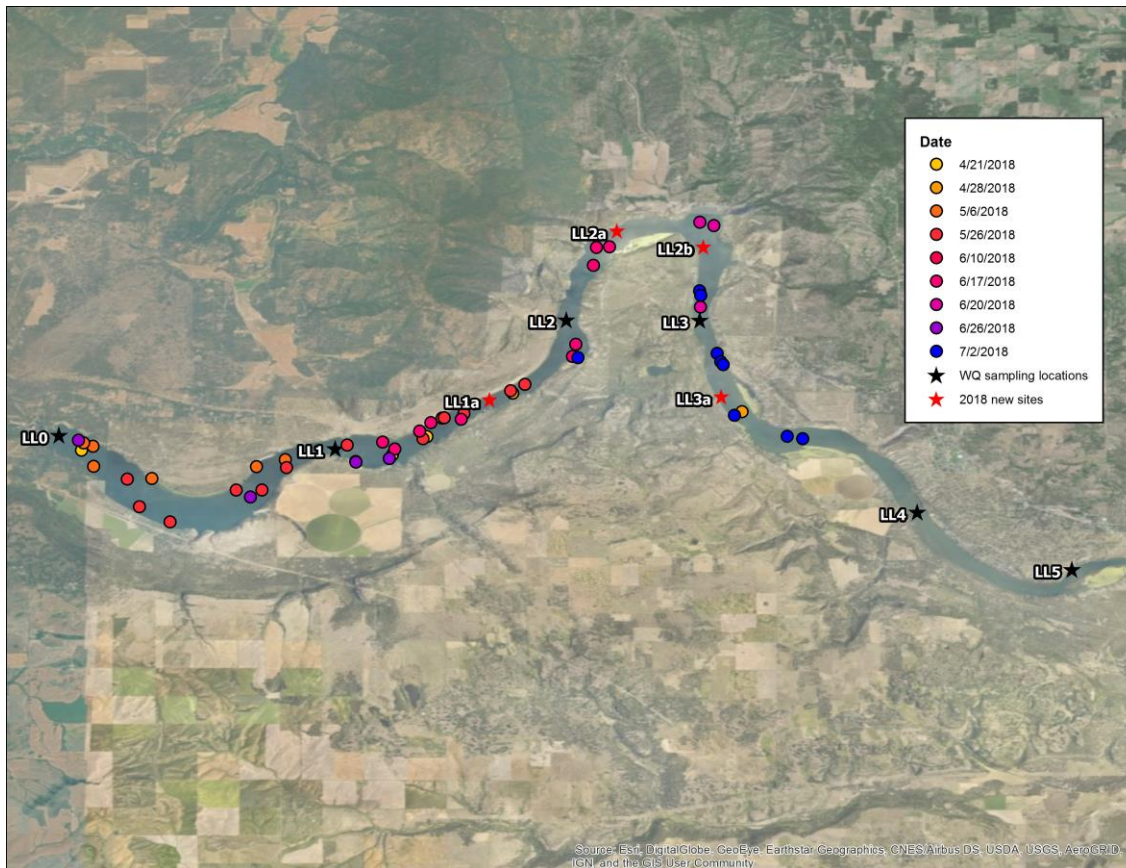


- Surveyed July through early November; Found 13 fish consistently
- Majority stayed between the DNR launch and Suncrest Park Launch
 - Depth ranged from 0 – 52 feet; Averaged slightly over 20 ft in depth in July, compared to average depths ranging from 6 – 10.5 ft in August through October.
 - Temperature ranged from 54 – 75 F, average of 65 F (18.3 C)



2018

- Tagged 25 new fish in 2018; 13.5 – 18.1 inches and 0.9 – 2.2 lbs.
 - Tagged a few fish in March and more in April and May
- Track weekly April - October
 - One 24 hour tracking



Questions?

