

The background features a dark blue gradient with faint, light blue circular patterns and a scale. The scale is a semi-circular arc on the left side, with numerical markings from 150 to 260 in increments of 10. There are also several concentric circles and dashed lines scattered across the background, some with arrows indicating direction.

# CITY OF LONGVIEW

**COWLITZ RIVER COLLECTOR WELL  
ADDITIONAL EXPLORATORY WELL INVESTIGATION RESULTS  
&  
INTERIM MEASURES UPDATE**

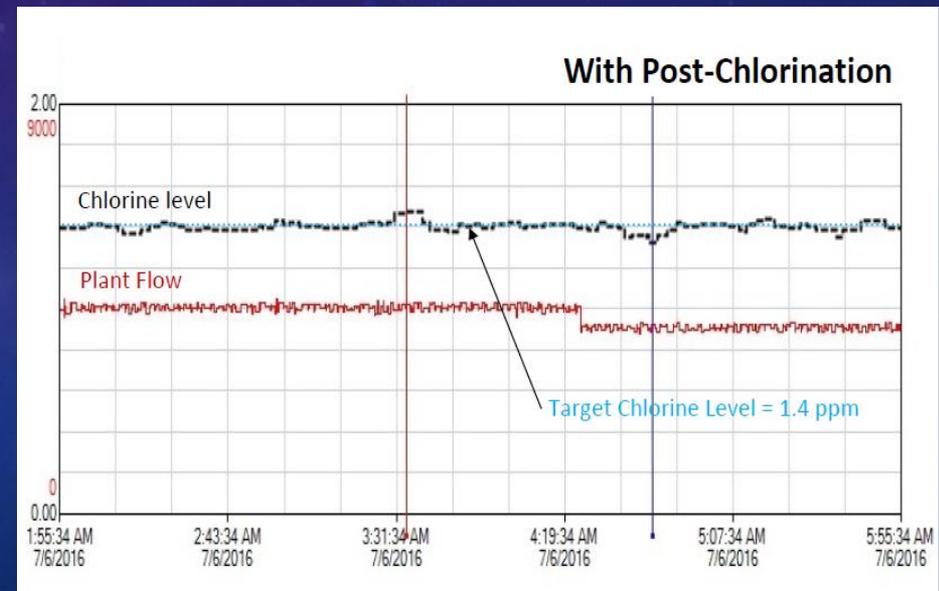
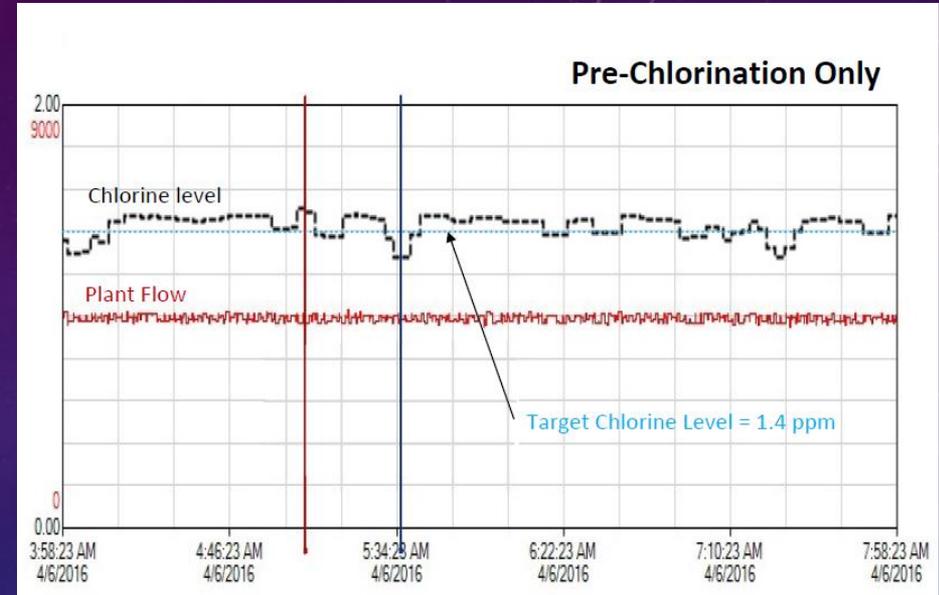
CITY COUNCIL/BHWSD COMMISSIONER JOINT SPECIAL MEETING

JULY 28, 2016

# INTERIM MEASURES

## POST CHLORINATION

- Certified Complete July-2016
- Provides trim dose after filtration
- Dampens fluctuating CL2 levels
- Improves control and flexibility
- Additional operating redundancy



# INTERIM MEASURES

## PREMISE AERATION DISSOLVED OXYGEN TRIAL

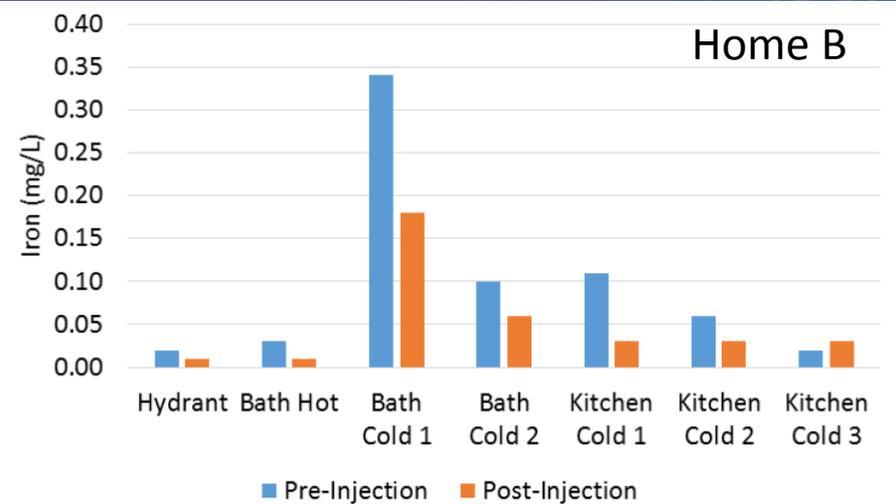
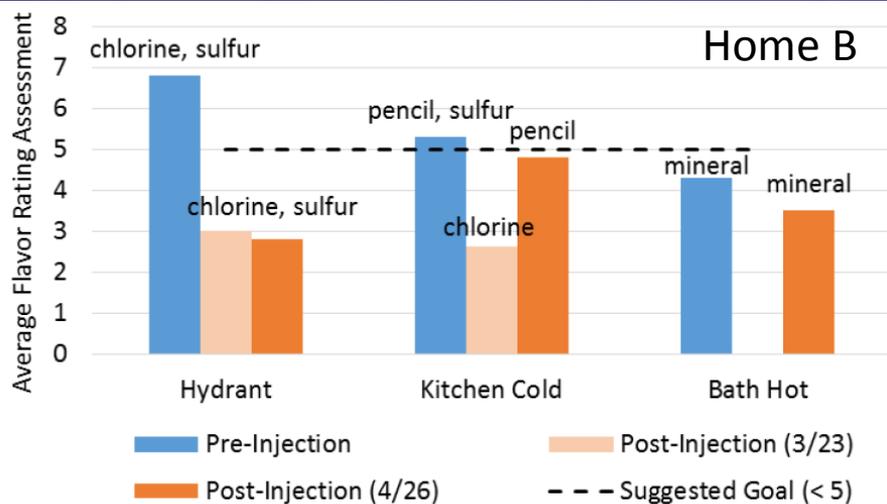
- Evaluate effect of DO on water quality in home plumbing
- Used commercially available equipment to aerate water
- 3-mo trial in two homes (City and BHWSD service areas)
- Target DO range of 4 to 8 mg/L
- Collected pre- and post- samples from kitchen, bath (hot/cold) and hydrant
- Collected weekly samples from exterior hose bib and hydrant
- Conducted Flavor Rating Assessment (FRA) to identify tastes and odors



# INTERIM MEASURES

## PREMISE AERATION DISSOLVED OXYGEN TRIAL

- Hindered by recurring equipment sensitivity and fluctuation
- Full time monitoring needed in lieu of frequent onsite support
- DO somewhat higher in both homes as compared to distribution system
- Unable to maintain consistent DO levels in target range
- Results offer potential trends but don't support use of premise aeration
- Water quality improvements may be attributable to other factors



# INTERIM MEASURES

## PREMISE AERATION DISSOLVED OXYGEN TRIAL – CONCLUSIONS & RECOMMENDATIONS

- Taste and odor observations likely correspond to distribution system changes
- Lower chlorine levels in the home than in the distribution system
- Higher iron and turbidity levels in the home than in the distribution system
- Regular hot water tank maintenance recommended to minimize sulfur odors
- Aggressive whole-house flushing likely to improve in-home water quality
- Larger scale DO demonstration recommended at distribution system level
  - Pipe loop tests demonstrated improvement in unlined cast iron pipe
  - Documented benefit for reduced development of hydrogen sulfide

# INTERIM MEASURES

## ORGANIC NITROGEN REMOVAL

- Bench scale testing in October, 2015
- Inconsistent nitrogen levels and reactivity presented challenges during testing
- Coagulant addition not a viable option to reduce chloramines or nitrogen
- Hydrogen Peroxide Addition
  - Measureable reduction in total nitrogen (20%) and organic nitrogen (56%)
  - Ongoing monthly nitrogen sampling to monitor changing levels
  - Ongoing bi-weekly chlorine decay testing to monitor changing reactivity

## LITREE FILTER PILOT STUDY

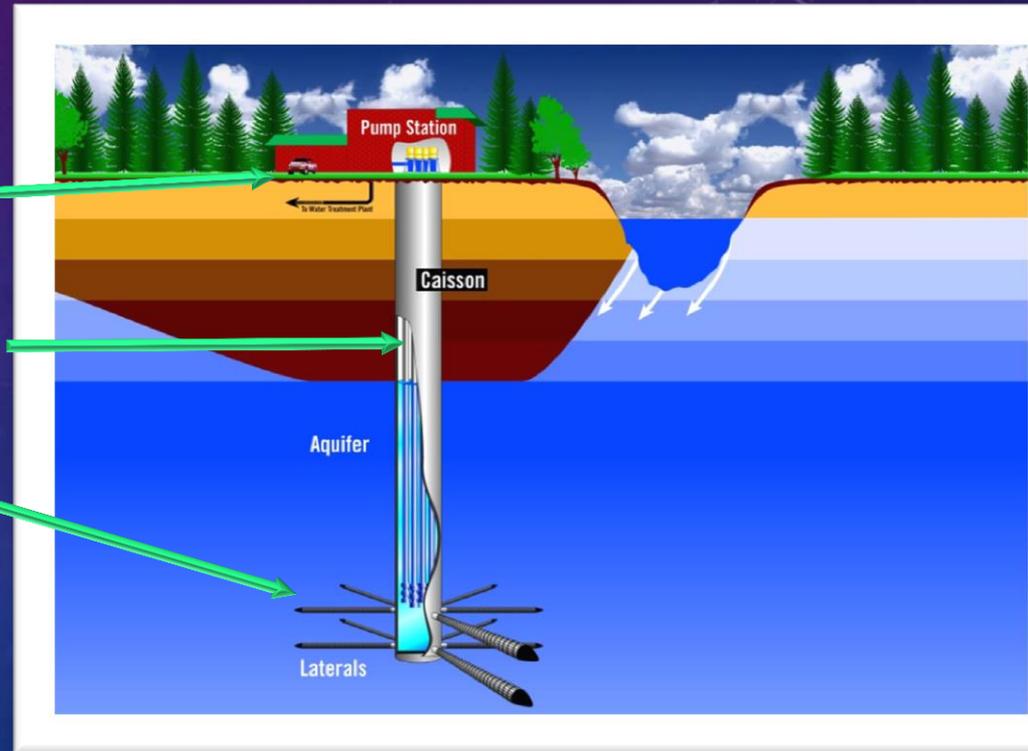
- 10-gallon water sample shipped to Minneapolis, MN for testing

# COLLECTOR WELL INVESTIGATION PROCESS

- **Phase I Drilling Investigation:**
  - A. Conduct Preliminary Drilling and Water Quality Screening at three potential sites along the Cowlitz River from Fishers Lane WTP to Riverside County Park.
  - B. Conduct Preliminary Drilling and Water Quality Screening at the Rocky Point site along the Cowlitz River, located East of the Westside Highway, South of Sparks Drive/Lexington Bridge
- **Determine Feasibility of Additional Testing**
  - Determine the best location for possible additional detailed aquifer test
- **Phase II Drilling Investigation:**
  - Continue detailed investigation with higher capacity and longer duration pumping at one site to further define aquifer characteristics and analyze water quality. Determine if Collector Well is fully suitable for site.

# TYPICAL COLLECTOR WELL PROFILE

- 💧 Pump Station
- 💧 Reinforced Concrete Caisson
- 💧 Horizontal Well Screens



# Phase I Drilling Investigation Purpose

An investigation to determine best potential collector well location

- Conduct Initial Capacity Analysis at four locations to determine feasibility of Collector Well to supply between 12 to 18 MGD (replacement of existing Mint Farm Capacity)
- Collect Water Quality Samples to screen and determine fatal flaw constraints

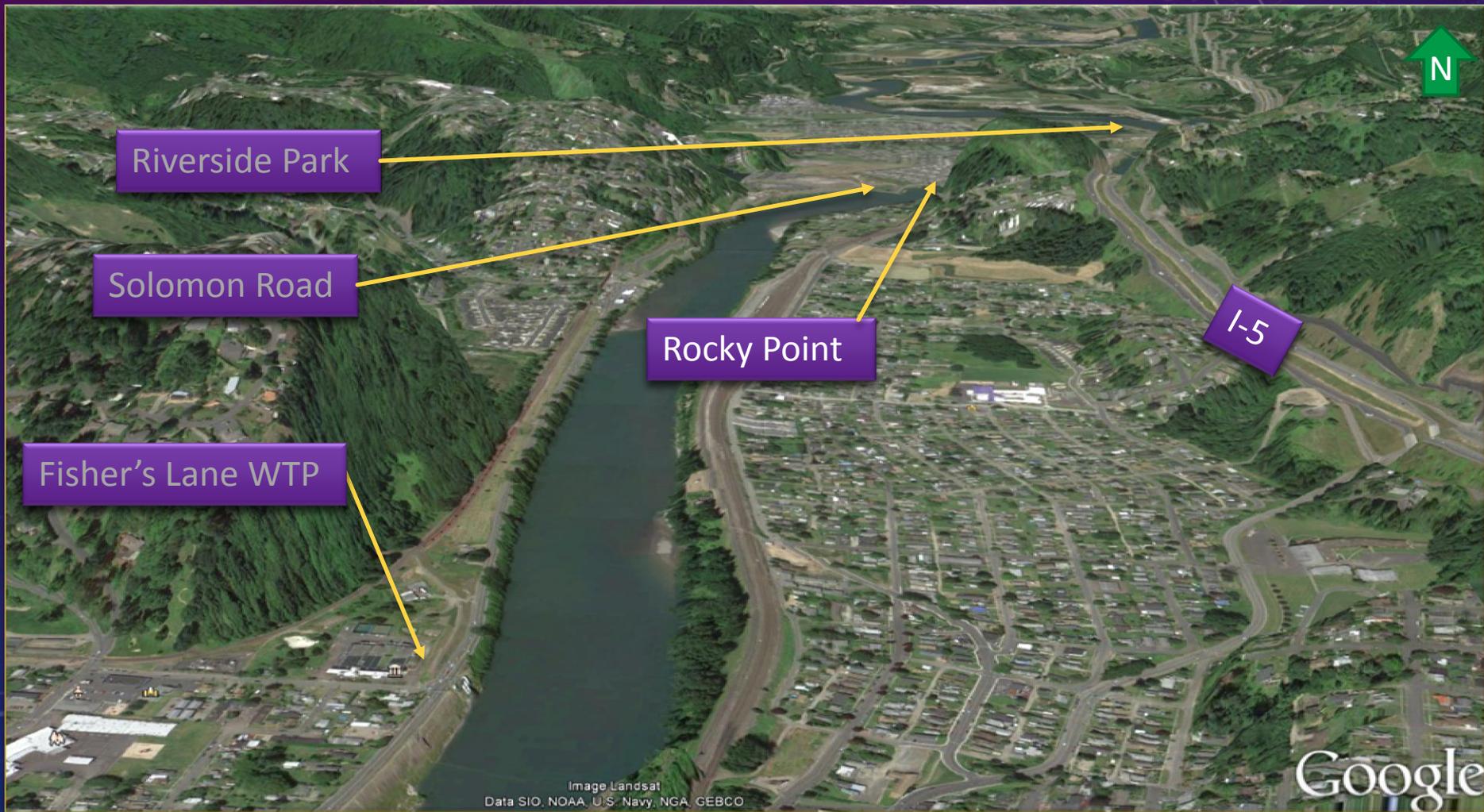
# PHASE I DRILLING ACTIVITIES: ADDED SITE

**Rocky Point OB-3 Drilling**

**Spring 2016**



# PHASE I DRILLING LOCATIONS FOUR SITES



# MAPPED DRILLING LOCATIONS 2016 & 1977

Fisher's Lane WTP

Solomon Road

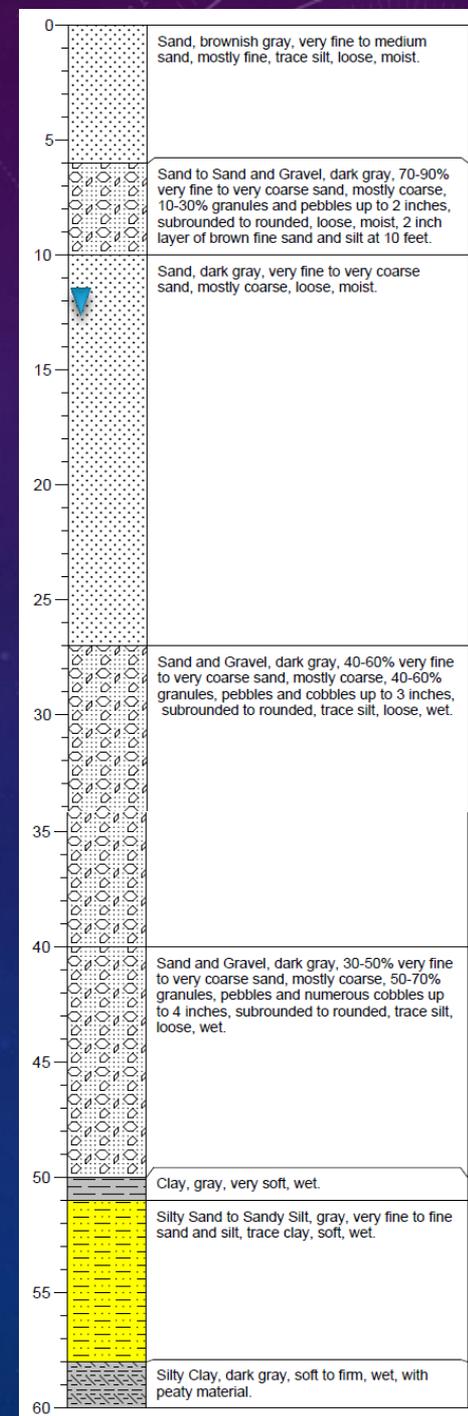
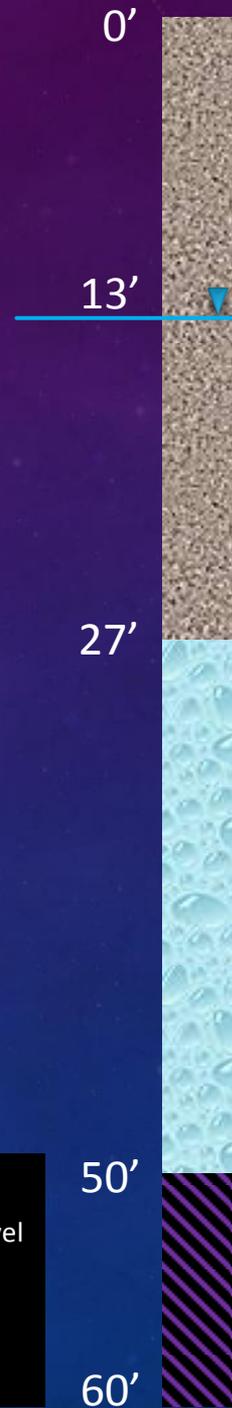
Riverside Park



Rocky Point

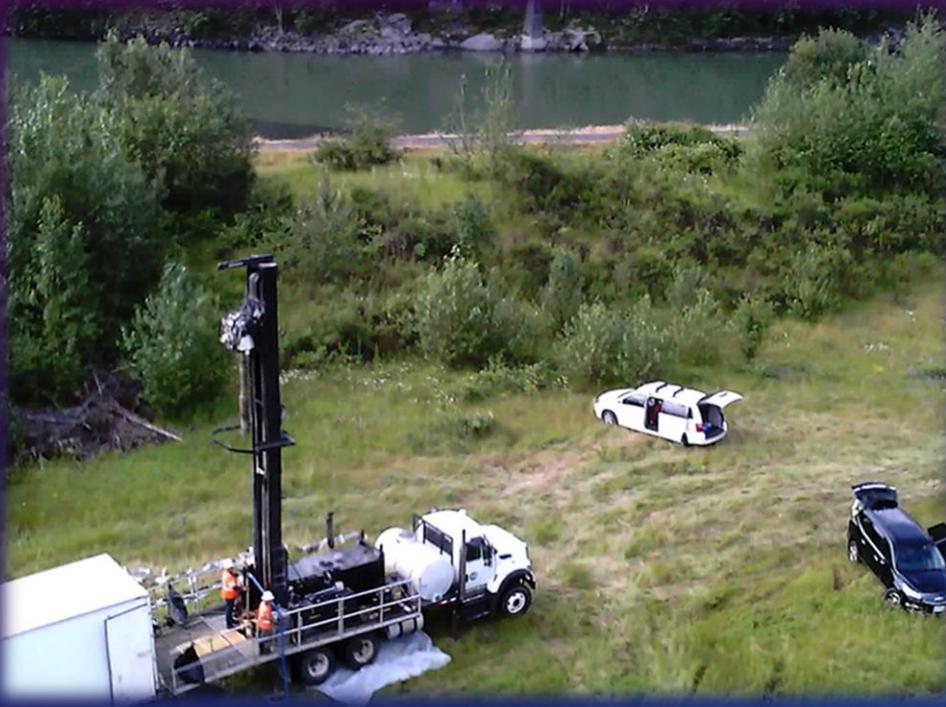
# DRILLING LOG

## TH-1: RIVERSIDE PARK



# DRILLING LOG

## OB-3: ROCKY POINT



0'

19'

41'

54'

55'

60'

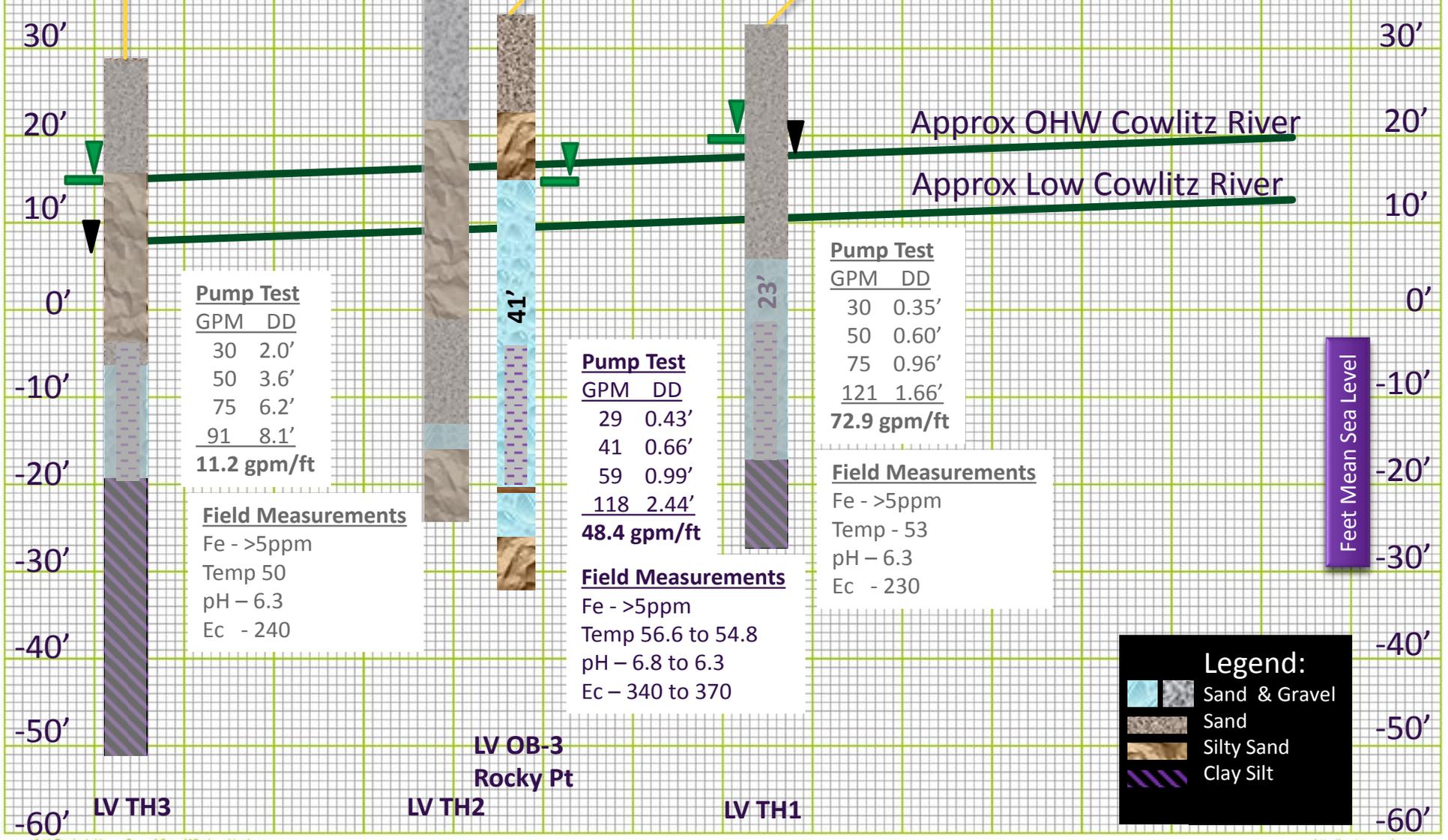
66'

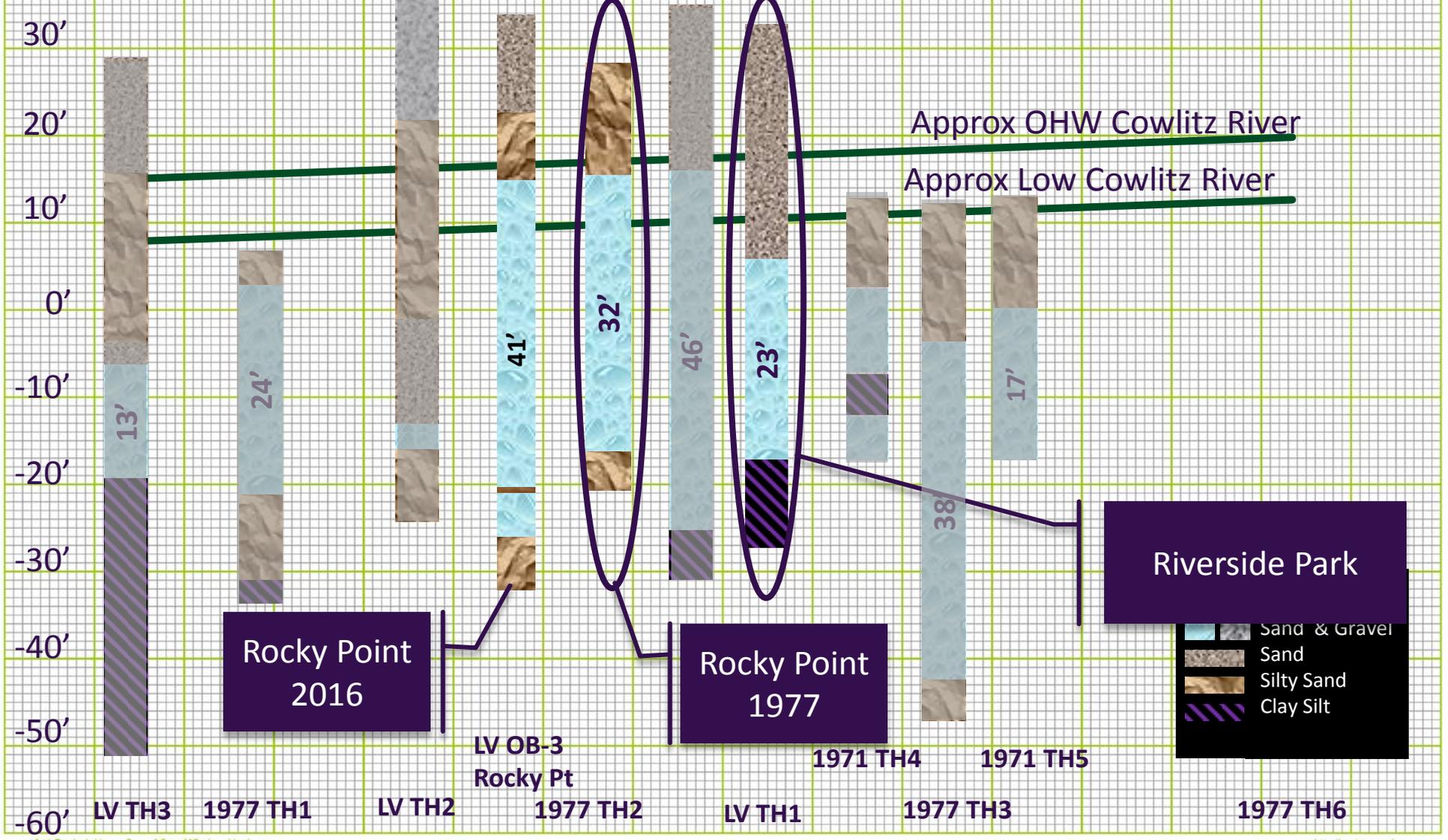
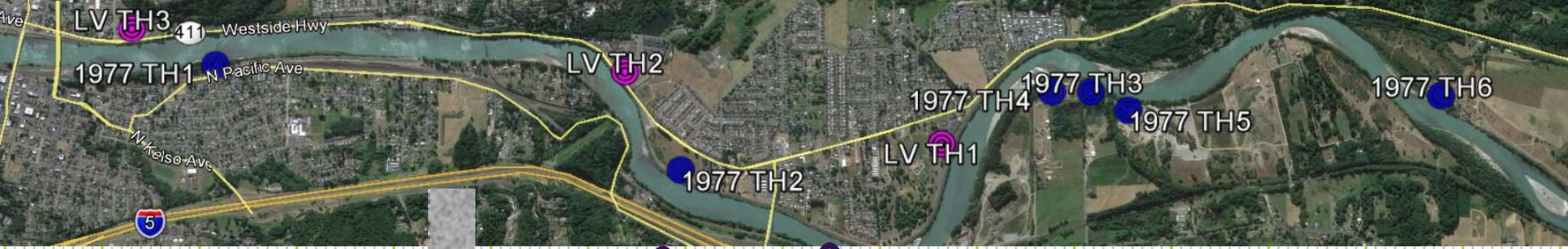
**Legend:**

-  Sand & Gravel
-  Sand
-  Silty Sand
-  Clay Silt
-  Organic Mat'l



0	5	10	15	20	25	30	35	40	45	50	55	60	65
Silty Sand, brown, mostly very fine to coarse sand, trace to 10% silt, trace clay, loose, dry to moist.													
Sand, brownish gray, very fine to very coarse sand, mostly medium, occasional granules, pebbles and cobbles, loose, dry.													
Sand, gray, very fine to very coarse, mostly coarse, trace granules and pebbles, loose, dry, clayey zone with wood fragments at about 10 feet													
Clayey Silt, brown mottled gray, mostly silt, trace clay, trace fine sand, slightly cohesive, moist.													
Silty Sand, brown, very fine to medium sand, mostly fine, trace to 10% silt, slightly cohesive, moist.													
Sand, brown, very fine to coarse, mostly medium, loose, dry to moist													
Silty Sand, brown to reddish brown, some gray layering, very fine to medium sand, mostly fine, trace to 10% silt, slightly cohesive, moist to wet.													
Sand and Gravel, gray grading to reddish brown at about 21 feet, 50-70% very fine to very coarse sand, mostly coarse, 30-50% granules and pebbles up to 2-1/2 inches, rounded to subrounded, loose, wet.													
Sand and Gravel, reddish brown, 70-90% very fine to very coarse sand, mostly coarse, 10-30% granules and pebbles up to 2 inches, rounded to subrounded, loose, wet.													
Sand and Gravel, dark gray, 50-70% very fine to very coarse sand, 30-50% granules and pebbles up to 1 inch, rounded to subrounded, loose, wet, numerous light gray pumice granules and small pebbles.													
Sand and Gravel, dark gray, 60-80% very fine to very coarse sand, mostly coarse, 20-40% granules and pebbles up to 1 inch, rounded to subrounded, loose, wet, several pieces of charred wood and pumice pebbles at 36 feet.													
Sand and Gravel, dark gray, 40-60% very fine to very coarse sand, mostly coarse, 40-60% granules, pebbles and numerous cobbles up to 4 inches, rounded to subrounded, trace silt, loose, wet.													
Partially decayed wood, dark brown, friable, wet.													
Sand, dark gray, very fine to very coarse, mostly coarse, trace granules and occasional pebbles, trace silt, loose, wet.													
Sand to Silty Sand, dark gray, very fine to very coarse sand, mostly medium, trace to 10% silt, loose, wet, layers with more silt at the bottom.													

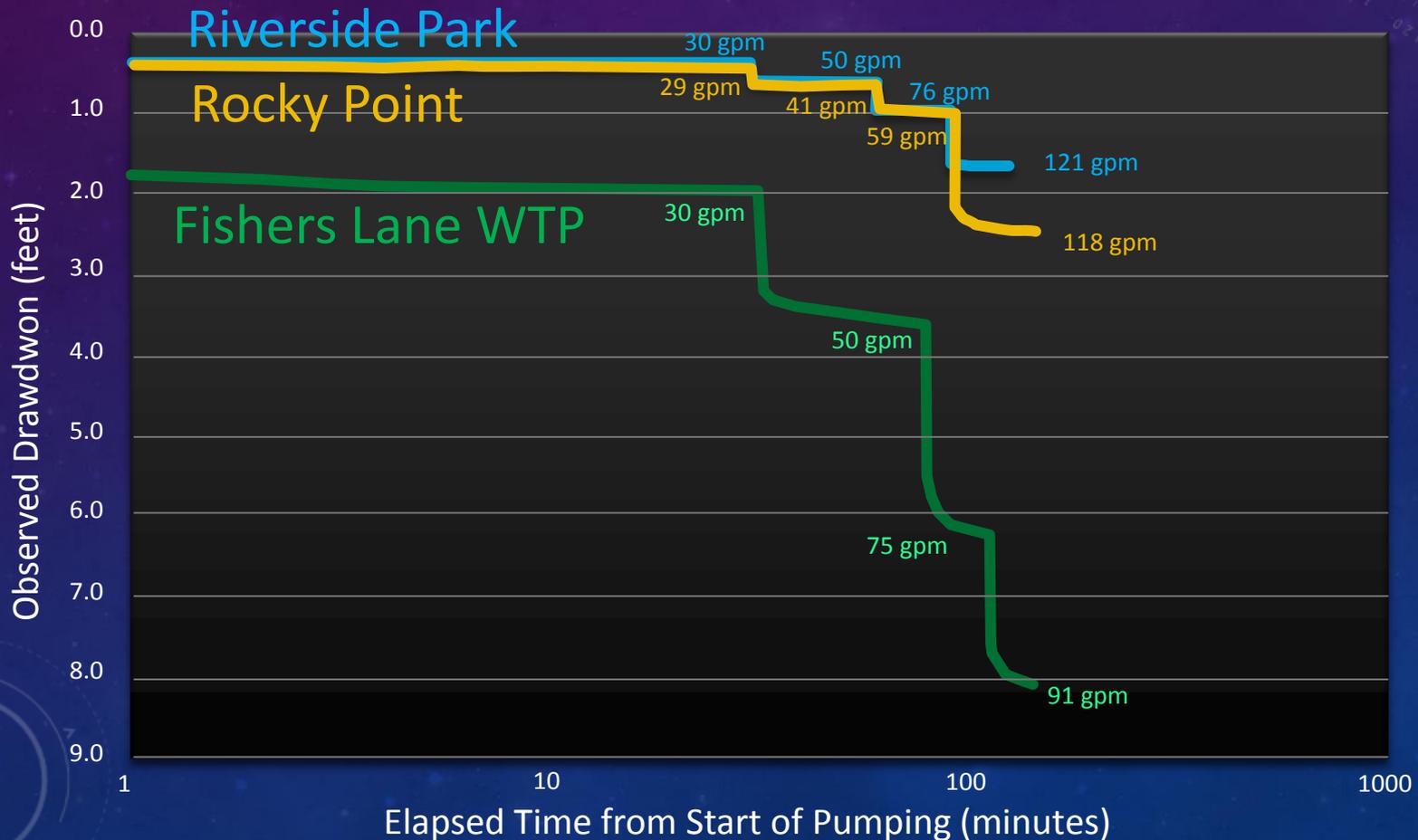




# COLLECTOR WELL CAPACITY ANALYSIS

## RESULTS FROM PHASE I TESTING

Hydraulic Interval Test Time versus Drawdown Plots

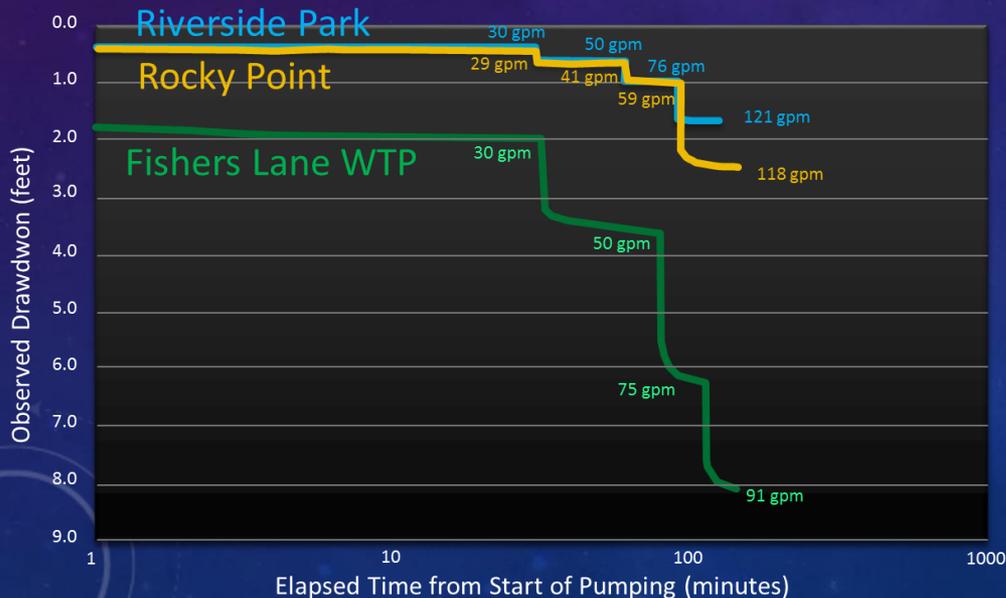


# COLLECTOR WELL CAPACITY ANALYSIS

## PHASE I ANALYSIS

- Fishers Lane WTP – Collector Well Capacity 1 to 3 MGD
- Riverside Park – Collector Well Capacity 5 to 9 MGD  
Potential for multiple wells
- Rocky Point – Collector Well Capacity 9 to 11 MGD

Hydraulic Interval Test Time versus Drawdown Plots



### Transmissivity Comparison (gpd/ft<sup>2</sup>)

Mint Farm Wells	1,030,000
Riverside Park	135,000 to 240,000
Fishers Lane	35,000
Rocky Point	200,000

Note: 12 MGD = 8,333 gpm

# WATER QUALITY ANALYSIS PHASE I TESTING

- Screening Level Water Quality Analysis Performed
- Water Quality represents localized groundwater
  - Short duration tests – low volume pump test
  - Little displacement of the native groundwater and no recharge from the river or other source

# WATER QUALITY ANALYSIS: PHASE I TESTS

## SUMMARY & COMPARISON

Analyte <sup>1</sup>	MCL or SMCL	Riverside Park PH I Test	Mint Farm	Cowlitz River	Kelso Collector Well	Rocky Point 2016
Aluminum	0.2	0.044	0.006	0.3		.120
Ammonia	----	0.37	0.3-0.4	----		0.263
Arsenic	0.01	ND	0.006	ND		.007
Hardness	----	81.4	98	24		125
Iron	0.3 <sup>2</sup>	11.1	1.1	0.43	3.7 <sup>4</sup>	28.8
Manganese	0.05 <sup>2</sup>	0.291	0.5	0.051	2.5 <sup>4</sup>	1.03
Silica	----	58	58	18	19.5 <sup>5</sup>	68.1
Dissolved Oxygen	----	1.09	<1.0	----		0

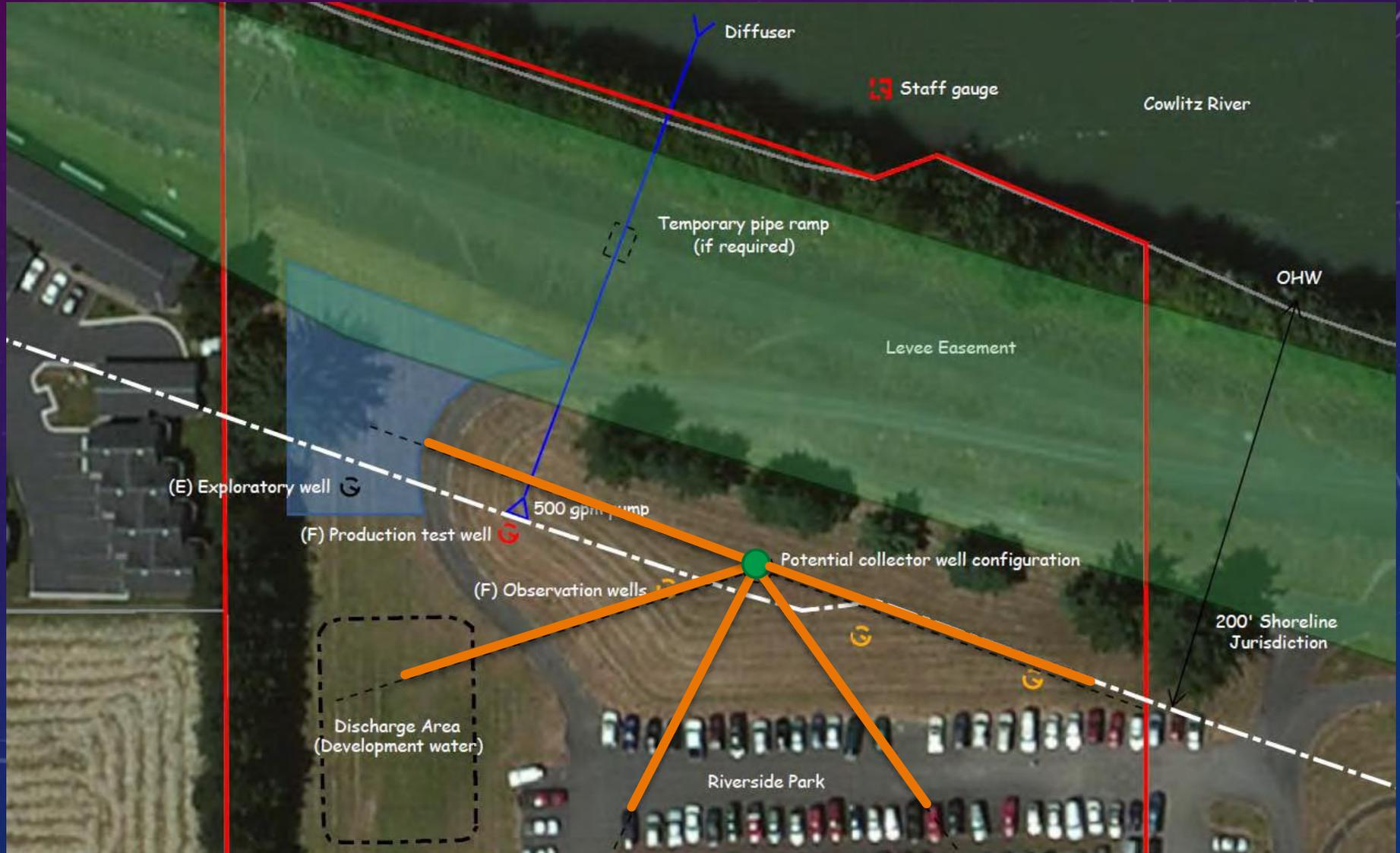
Notes:

1. Not all Analytes Tested are Shown, refer to report for full suite of test results
2. Indicates Secondary Maximum Contaminant Level (aesthetics)
3. Values shown are ppm (milligrams/litre)
4. From Kelso 2014 Annual Water Quality Report
5. Sample Conducted by City of Longview Sept 2014

# PHASE I TESTING SUMMARY

- ~~Three~~ Four Sites have been Explored
- ~~Two~~ Three Sites Analyzed for Capacity and Water Quality
  - Rocky Point: Highest yield potential at 9 to 11 MGD per Collector Well. Multiple collectors wells may be possible.
  - Riverside Park: Next highest yield potential at 5 to 9 MGD per Collector Well. Multiple collectors wells may be possible.
  - Screening Level Water Quality Tests indicate high iron, manganese and silica.
  - High iron at Rocky Point (2.5x Riverside Park, 26x Mint Farm, 96x SMCL)
  - Water quality may change as long term pumping displaces groundwater and influences the direction of subsurface flow
  - If water quality does not improve at Rocky Point during Phase II pump test, highest level of iron treatment is required.
  - Additional treatment will likely be needed to meet WDOH regulations.

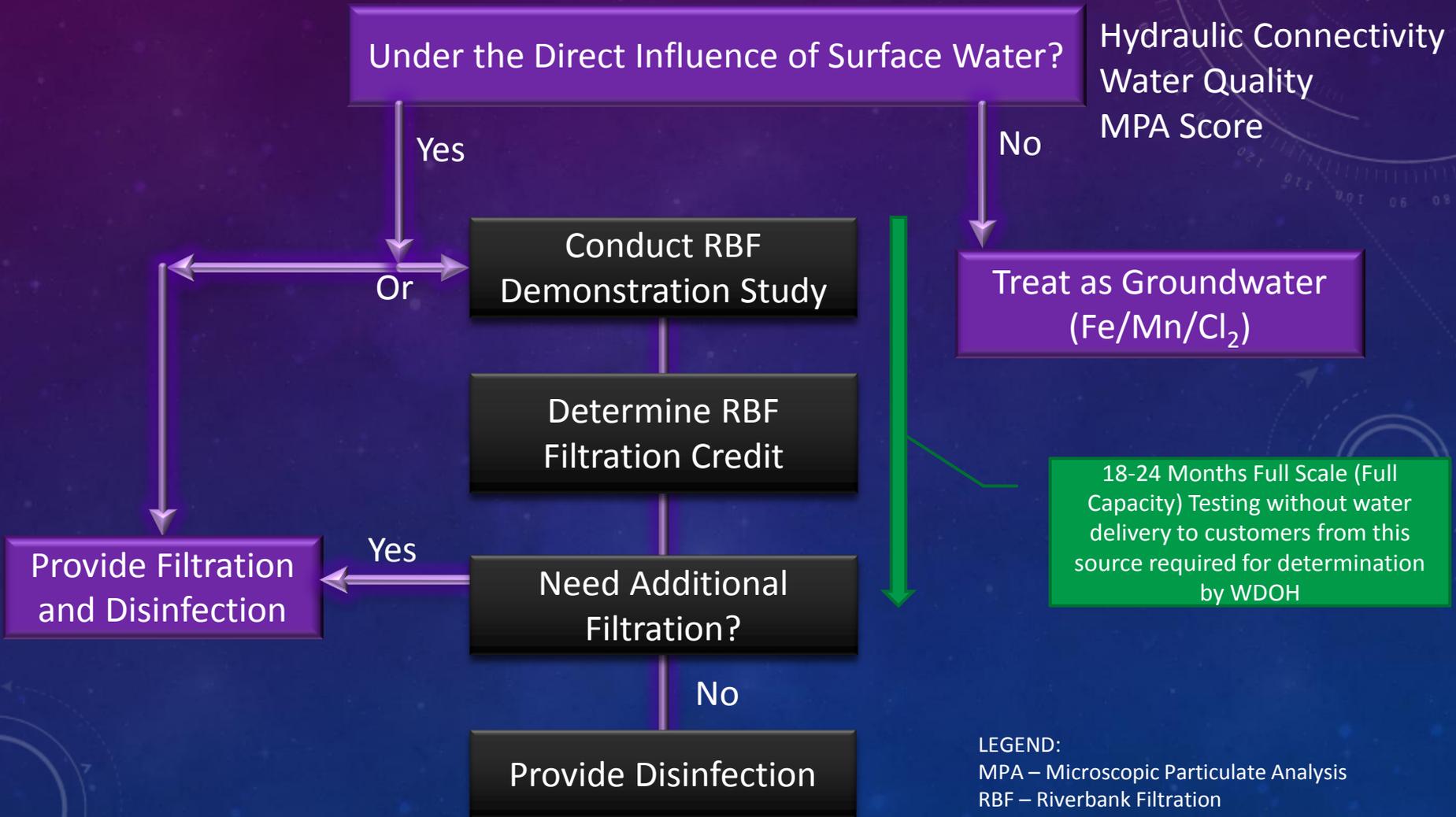
# RIVERSIDE PARK COLLECTOR WELL CONCEPT DESIGN



# ROCKY POINT COLLECTOR WELL CONCEPT DESIGN



# WATER TREATMENT DETERMINATION



Hydraulic Connectivity  
Water Quality  
MPA Score

18-24 Months Full Scale (Full Capacity) Testing without water delivery to customers from this source required for determination by WDOH

LEGEND:  
MPA – Microscopic Particulate Analysis  
RBF – Riverbank Filtration  
WDOH – Washington State Department of Health

# TREATMENT & PROJECT COSTS SCORECARD

Groundwater		Groundwater Under the Direct Influence of Surface Water (GUI)		
<u>Treatment 1</u>	<u>Treatment 2</u>	<u>Treatment 3</u>	<u>Treatment 4</u>	<u>Treatment 5</u>
Chlorination Only	Use Mint Farm Pressure Filters	Ultraviolet Disinfection and Chlorination Only	Coagulant Addition, Filtration, Disinfection	Coagulant Addition, Clarification, Filtration, Disinfection
Groundwater with No Iron or Manganese	Groundwater with Iron and Manganese	Allowed if Riverbank Filtration credit is granted	Allowed if water quality meets certain limits	Required if little water quality data is available, or if turbidity is above 5 NTU
\$29.5 million	\$40.4 million	\$33.2 million	\$48.9 million	\$55.1 million
High Iron – Requires Treatment	High Silica in Native Groundwater	\$6.44/ERU per month	\$11.38/ERU per month	\$13.16/ERU per month
		Requires 18-24 Months Full Scale Testing and positive results meeting requirement of WDOH		

Estimates Based on:

Two Collector Wells At Riverside Park, Transmission Mains and Treatment

# OPTIONS FOR MOVING FORWARD



# MINT FARM OPTIONS

## LONGVIEW DRINKING WATER IMPROVEMENT STUDY – OPTIONS EVALUATION & COSTS

Option	Customer Perception						Technical Feasibility							Costs			
	Spotting	Taste	Color	Smell	General Health	Purity, Cleanliness	Long Term Capacity	Reliability	Environmental Impact	Time to Implement	Regulatory Compliance	Transition Time	Governance Agmts	Operating Complexity	Capital Cost (Millions)	O&M Cost (Millions)	Impact to Monthly Bill
Optimize Existing			✓				✓	✓	✓	✓	✓	✓	✓	✓	-	-	-
Add Dissolved Oxygen		✓	✓	✓			✓	✓	✓	✓	✓	✓	✓	✓	\$2.0	\$0.0	\$0.7
Add Post Chlorination		✓	✓	✓			✓	✓	✓	✓	✓	✓	✓	✓	\$0.2	\$0.0	\$0.1
Add Softening		✓	✓	✓			✓	✓	✓		✓	✓	✓	✓	\$18	\$2.7	\$16
Add Silica Removal (RO)	✓	✓	✓	✓		✓	✓	✓	✓		✓	✓	✓		\$41	\$3.4	\$25
Add Silica Removal (Precip)	✓	✓	✓	✓		✓	✓	✓	✓		✓	✓	✓		\$18	\$2.8	\$16
Add Silica Removal (EC)	✓	✓	✓	✓		✓	✓	?	✓		✓	✓	✓		\$18	\$2.9	\$17
Well Optimization (Silica)	?	?	?	?	?	?	?	?	✓		✓	✓	✓	✓	\$0.6	\$0.0	\$0.2
Utilize Scavenger Wells	?	?	?	?	?	?	?	?	✓		✓	✓	✓	✓	\$2.0	\$1.0	\$1.0

# ESTIMATED COSTS FOR PHASE II TESTING

	Budget	Spent To Date	Phase II 72-hour pump test @500 gpm	Phase II 90-day pump test @1500 gpm
Exploratory Drilling (Phase I)	\$111,900	\$177,000	\$0	\$0
Well Drilling (Phase II)	\$65,000	\$0	\$65,000	\$165,000
Aquifer Testing (Phase II)	\$36,750	\$0	\$36,750	\$160,000
Engineering Analysis	\$45,250	\$10,000	\$37,250	\$60,000
Community Outreach	\$52,150	\$26,000	\$27,150	\$27,150
Project Management	\$16,500	\$11,000	\$10,500	\$20,000
Contingency	\$0	\$0	\$3,350	\$3,350
<b>Total</b>	<b>\$327,550</b>	<b>\$224,000</b>	<b>\$180,000</b>	<b>\$435,500</b>
Authorized Contract Amount	\$327,550			
Contract Balance Remaining	\$103,550			
Additional Funds Needed	\$0	\$0	(\$76,450)	(\$331,950)

# DIRECTION TO STAFF - OPTIONS

- Proceed with standard Phase II testing scope of work
  - Riverside Park
  - Rocky Point
  - Both Riverside Park and Rocky Point
- Proceed with enhanced Phase II testing scope of work
  - Riverside Park
  - Rocky Point
  - Both Riverside Park and Rocky Point
- Reconsider and pursue options to upgrade Mint Farm treatment
- No additional studies or treatment processes; optimize existing Mint Farm treatment processes