

# Tualatin River Watershed & Forest Grove Natural Treatment System

Association of Clean Water Administrators  
Nutrient Permitting Workshop  
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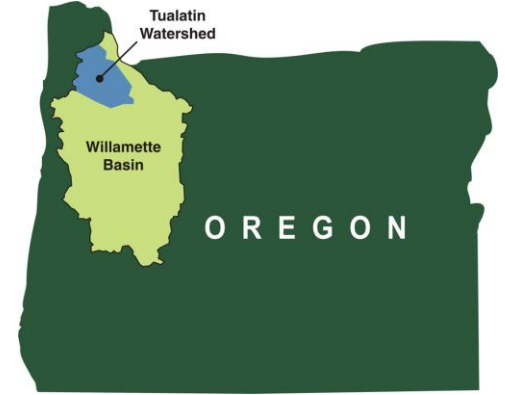


# Topics

- Tualatin River watershed/Clean Water Services
- Watershed-based NPDES Permit
- Forest Grove WWTF & NTS
- Operations/Performance
- Permitting challenges & recommendations

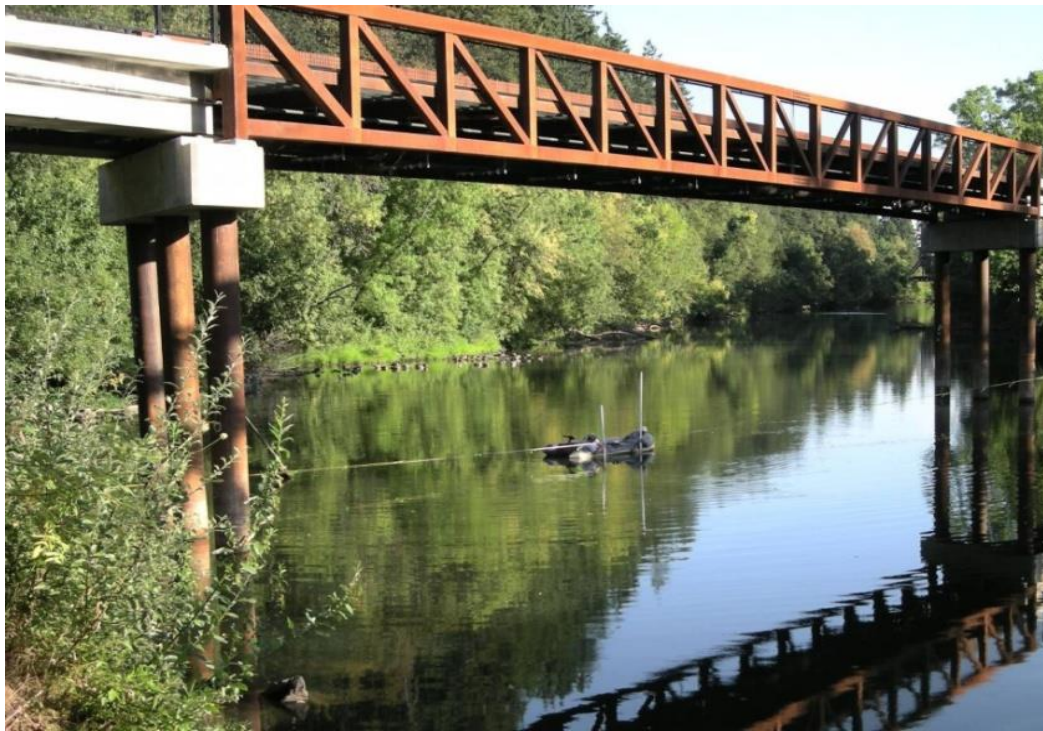


# Tualatin River Watershed





# Lower Tualatin River





# Clean Water Services

- Special service district
- Service population: ~600,000
- Operate 4 WWTFs
- Municipal stormwater program (MS4) in urban Wash. Co.
- Watershed enhancement activities
- Implement programs cooperatively
  - 12 member cities
  - Washington County



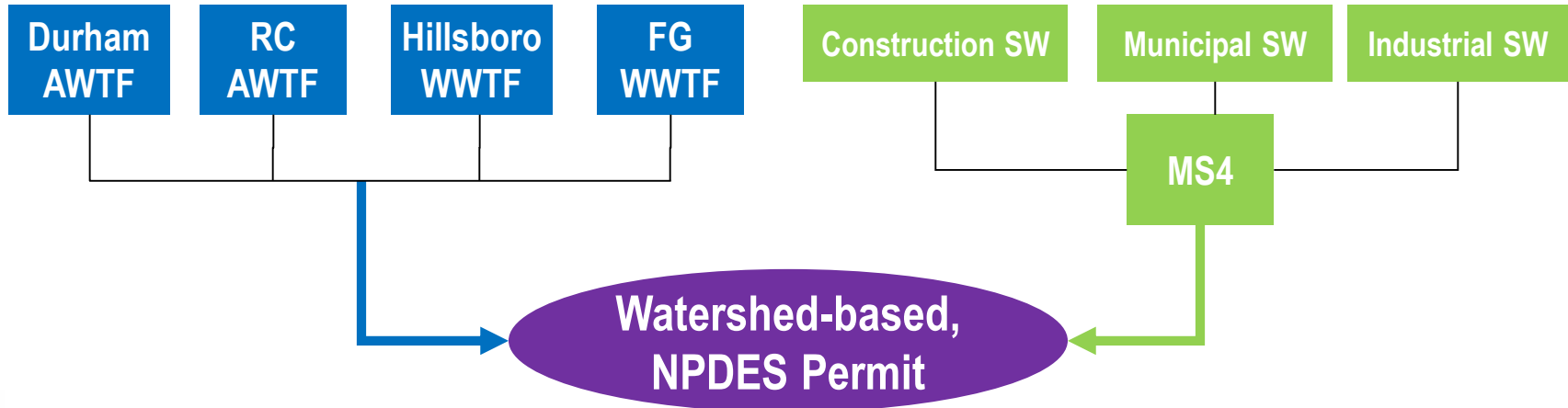
# CWS Activities in the Tualatin Basin

- Wastewater Collection & Treatment
  - Design/construct/maintain sanitary sewer collection system (w/cities)
  - Operate wastewater treatment facilities
- Stormwater (SW) Management
  - Design/construct/maintain SW infrastructure (w/cities)
  - Focus areas: construction sw, industrial sw, illicit discharges, pollution prevention, cleaning/maintenance, education/outreach
- Watershed activities
  - Flow enhancement
  - Riparian planting/stream and wetland restoration



# Watershed-based NPDES Permit

- Integrated permits for 4 WWTFs, and municipal stormwater program
- Shared loads for TSS, ammonia and phosphorus among WWTFs
- Includes water quality trading for temperature





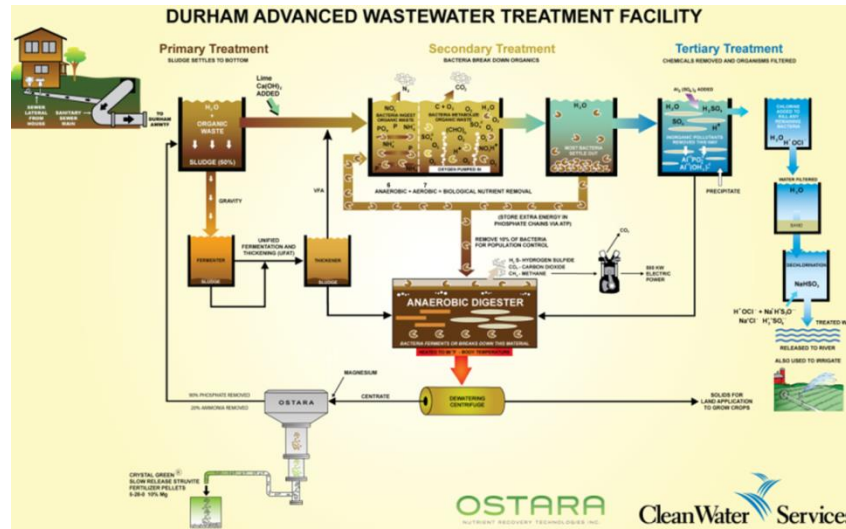
# Wastewater Treatment





# Rock Creek and Durham AWWTFs

- RC: 46.4 mgd; DM: 25.7 mgd
- Tertiary treatment facilities
- Resource recovery
- Effluent Limits (dry season)
  - CBOD/TSS: <5 mg/L
  - Ammonia: 0.5 mg/L
  - Phosphorus: 0.1 mg/L
- Effluent Quality (dry season)
  - TSS: <2 mg/L; CBOD: 2 – 4 mg/L
  - Ammonia: <0.1 mg/L
  - Phosphorus: <0.1 mg/L



# Forest Grove WWTF/NTS and Hillsboro WWTF

## Hillsboro WWTF:

- Secondary treatment facility
- Operates only during wet season
- Flows routed to either Rock Creek or Forest Grove during dry season



## Forest Grove WWTF/NTS:

- Secondary treatment facility followed by a natural treatment system (NTS)
- NTS became operational in 2017



# Forest Grove WWTF and NTS





# Forest Grove WWTF and NTS

- Historical operations (prior to construction of NTS)
  - Dry season: No discharge; influent pumped to Rock Creek for treatment/discharge
  - Wet season: secondary treatment/discharge
- Drivers:
  - Growth necessitates expansion of treatment capacity
  - Sustainable treatment processes
- 2016 watershed-based NPDES permit:
  - Permit authorized year-around discharge from Forest Grove WWTF and NTS
    - ❖ Conventional secondary treatment facility
    - ❖ 95-acre natural treatment system



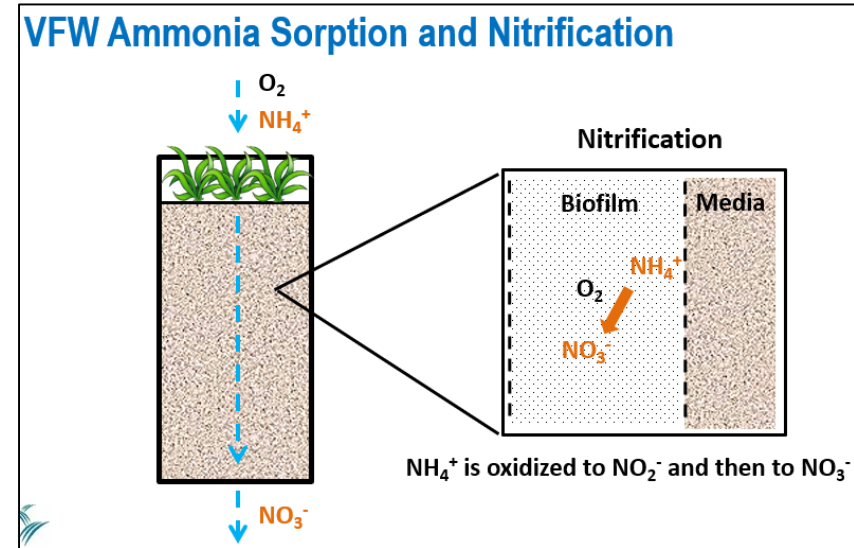
# Forest Grove NTS

- 95-acre natural treatment system
  - 5 acre engineered system for ammonia removal
  - 90 acre passive treatment system
- Construction began in 2012
- Initially began operating in 2017
- Operated intermittently in 2017-19; more consistently in 2020



# Forest Grove WWTF & NTS Design

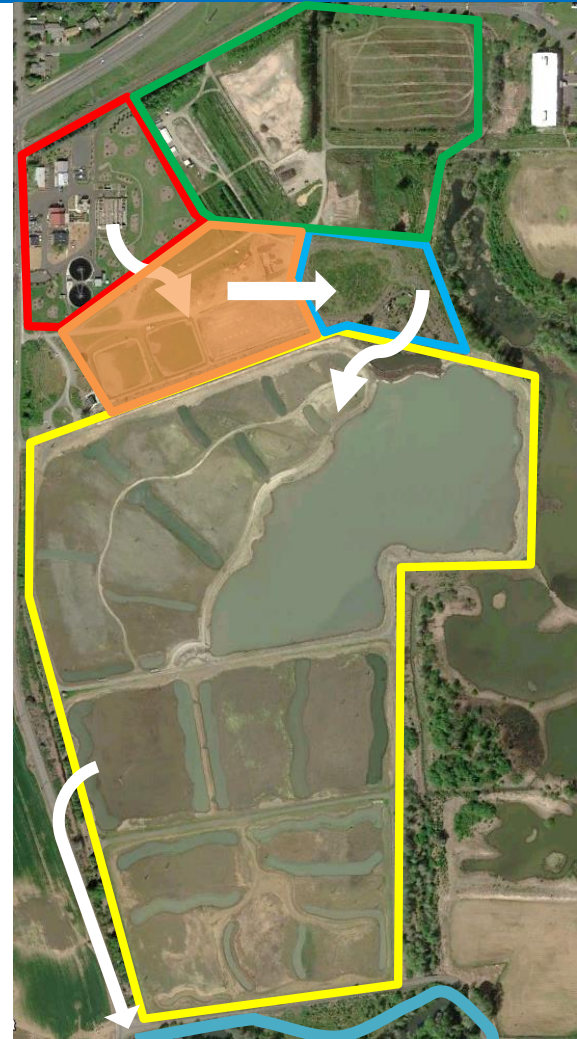
- Secondary treatment facility:
  - Focus on removal of conventional pollutants
  - Phosphorus (using biological processes)
  - Disinfection
- Natural Treatment System
  - Engineered system for ammonia removal (vertical flow wetland)
  - Passive system for nutrient removal, temperature reduction and effluent polishing





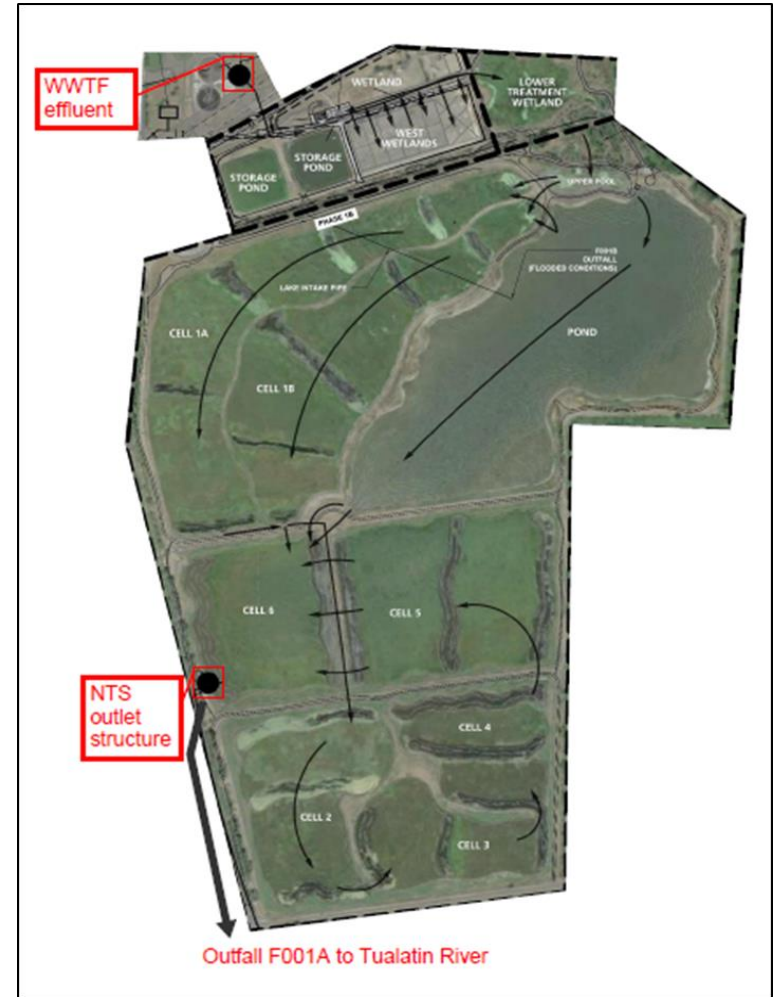
# Fernhill Natural Treatment System

-  Forest Grove WWTF
-  Vertical Flow Wetlands: Ammonia Reduction
-  Lower Treatment Wetland: Demonstration
-  South Wetlands: Temperature Reduction
-  Tualatin River: Outfall
-  Potential Future Expansion

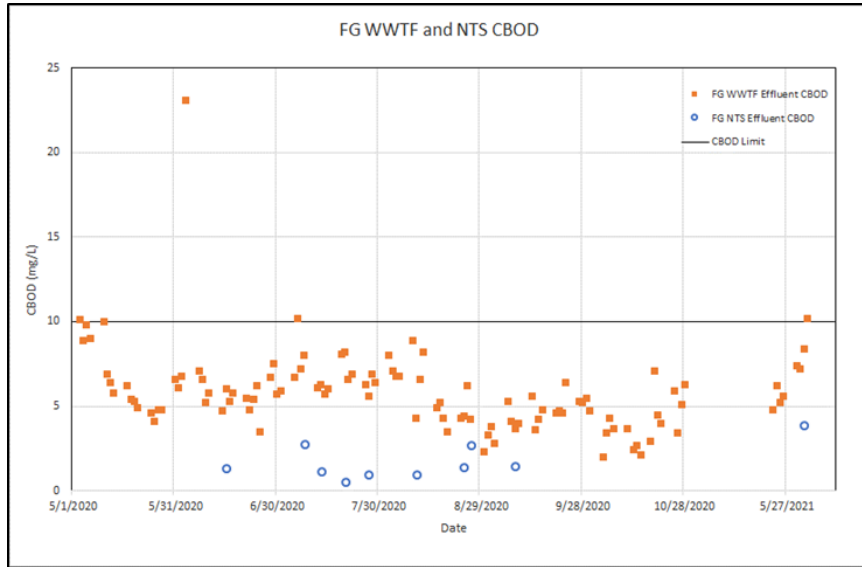


# FG WWTF and NTS: Monitoring and Compliance Locations

- Secondary WWTF monitoring: CBOD, TSS, bacteria, pH, nutrients, and metals
- NTS monitoring: temperature, dissolved oxygen, nutrients, metals
- Compliance points:
  - Secondary WWTF: CBOD, TSS, bacteria, pH, nutrients
  - NTS: ammonia (VFW effluent) temperature, dissolved oxygen



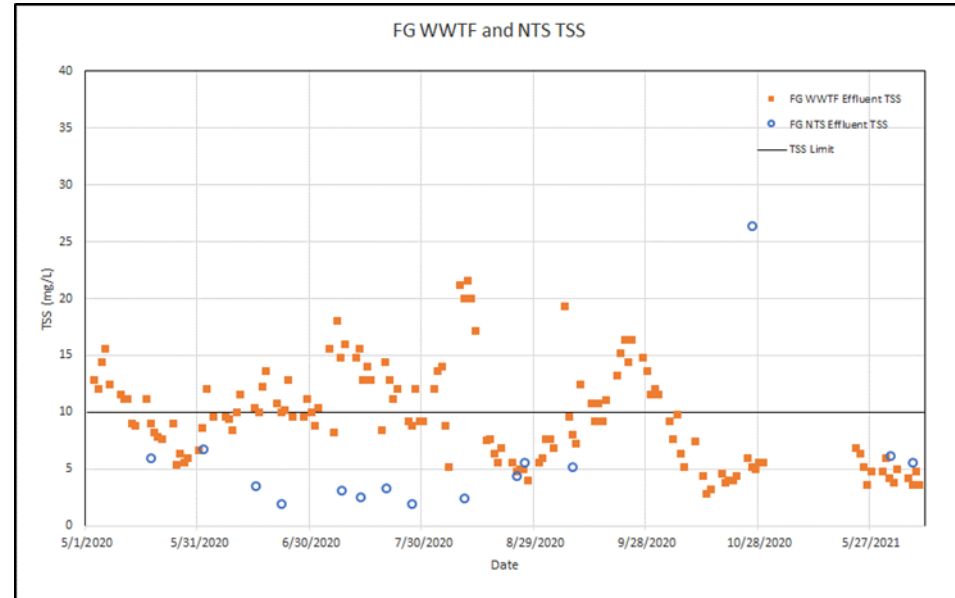
# Forest Grove WWTF & NTS Performance Data: CBOD & TSS



- CBOD
  - WWTF Effluent (influent to NTS): ~4 – 10 mg/L
  - NTS Effluent: 1 – 4 mg/L



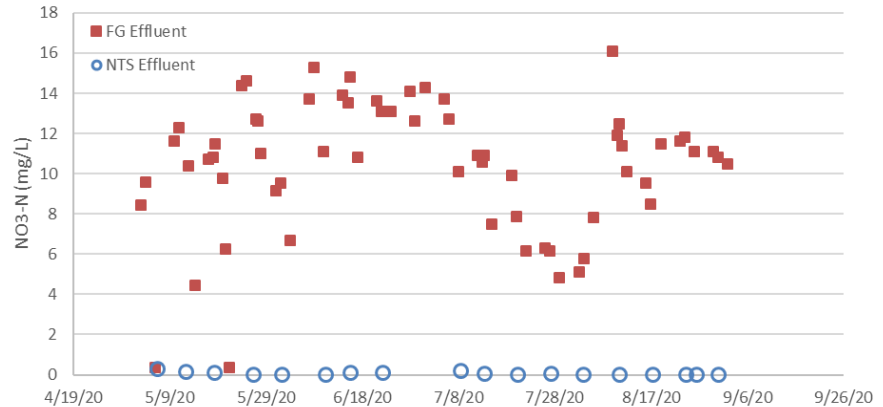
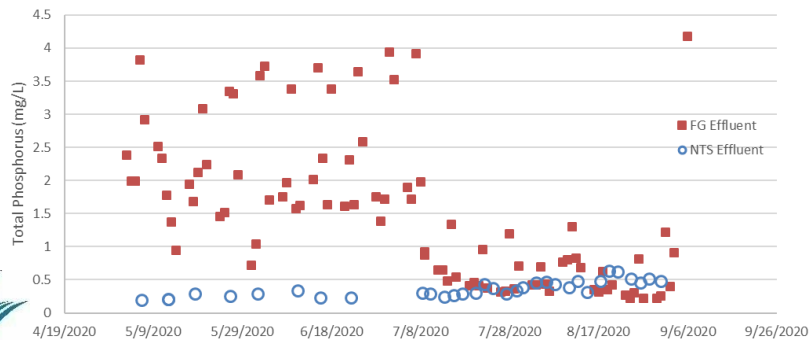
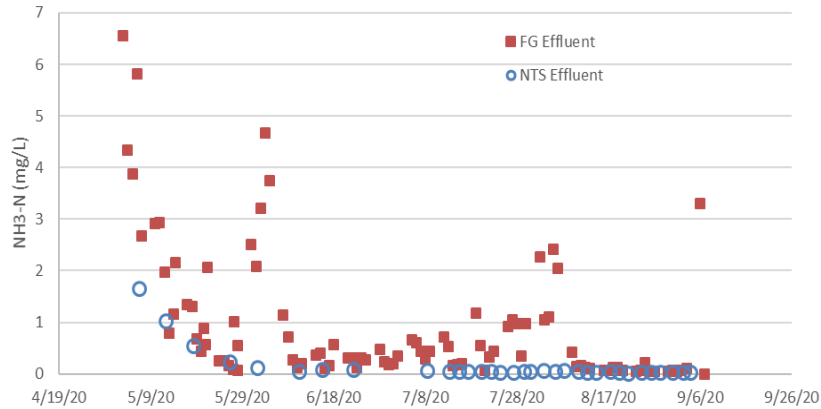
- TSS:
  - WWTF Effluent (influent to NTS): 5 – 20 mg/L
  - NTS Effluent: 2 – 7 mg/L



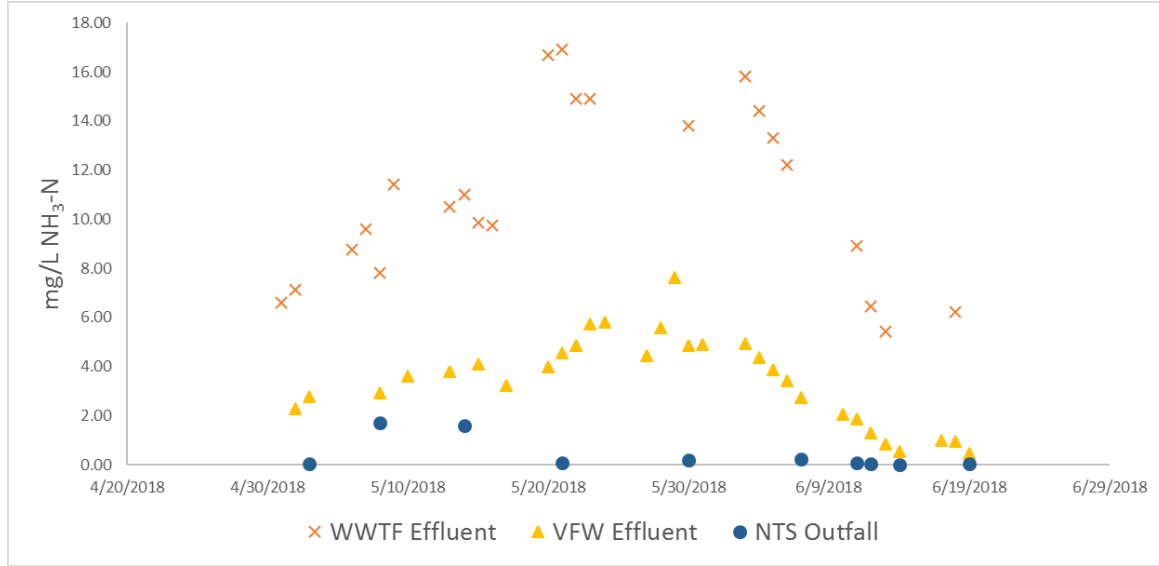


# Forest Grove WWTF & NTS Performance Data: Nutrients

- NTS is highly effective in reducing nutrients



# Ammonia Reduction



Ammonia



# Forest Grove Natural Treatment System Performance

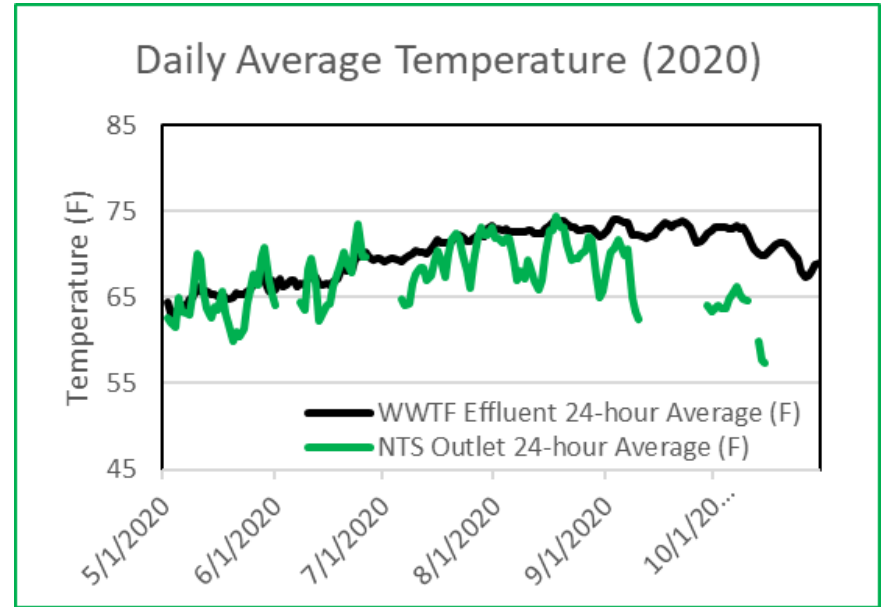
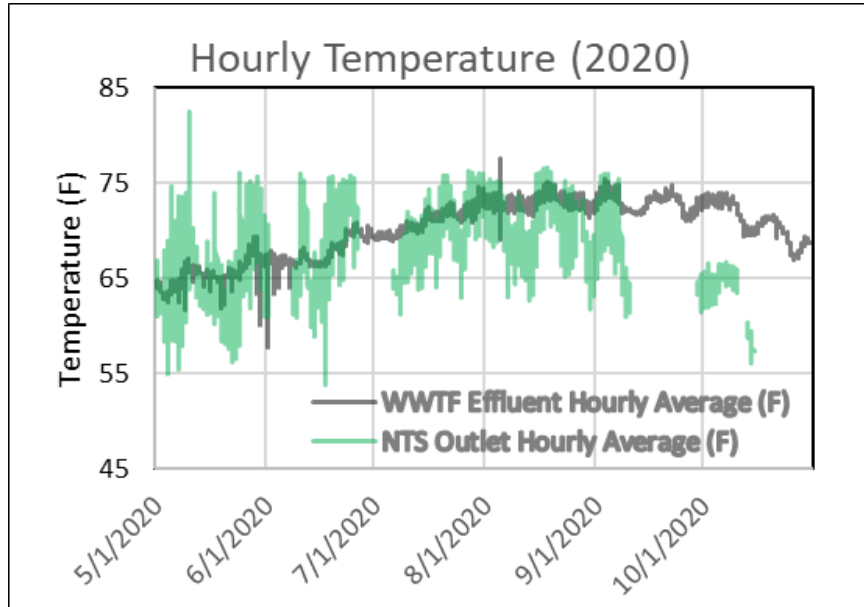
Parameter	FG WWTF Effluent to NTS	FG NTS Effluent to River	% Reduction
CBOD <sub>5</sub>	6.1 mg/L	1.5 mg/L	75%
TSS	10.5 mg/L	3.8 mg/L	64%
Ammonia	1.0 mg/L	0.14 mg/L	86%
Nitrates	10.4 mg/L	0.11 mg/L	99%
Total Phosphorus	1.5 mg/L	0.36 mg/L	76%
Copper*	9.3 µg/L	2.2 µg/L	76%
Zinc*	53.7 µg/L	3.9 µg/L	93%

\*2017-20 data





# Forest Grove WWTF and NTS: Temperature



# Effluent limits at NTS discharge

- Not an engineered system; no control on processes
- Unpredictable events in effluent quality due to natural processes
- Subject to diurnal variation, weather patterns and seasonal variation
- Substantial removal of CBOD & TSS but also contributions from natural processes (i.e. background loading from NTS)
- From EPA's Wastewater Technology Fact Sheet:
  - *Wetland systems are living ecosystems. The life and death cycles of the biota produce residuals which can be measured as BOD, TSS, nitrogen, phosphorus, and fecal coliforms. As a result, regardless of the size of the wetland or the characteristics of the influent, there will always be a residual background concentration of these materials in wetland systems.*
  - EPA estimates background loading of 1- 10 mg/L BOD & 1 – 6 mg/L TSS
  - EPA estimates that a lightly loaded surface flow wetland can be expected to have BOD and TSS of 15 mg/L



# Permitting Challenges

- Systems do not fit current regulatory structure
  - Compliance point
  - Averaging periods
  - Diurnal and seasonal considerations
  - Weather patterns
  - Limited operational controls
  - Vegetation maturity/cycling





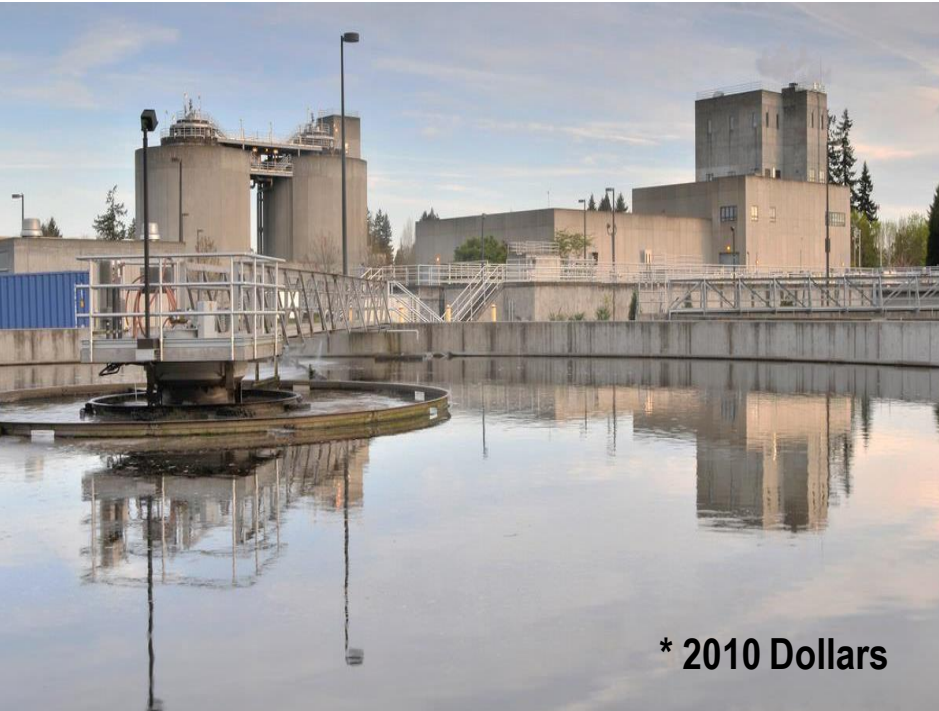
# Permitting Approaches

- Climate change adaptation strategy: focus on natural solutions
  - Compliance point: consider multiple compliance points
  - Averaging period: considering longer averaging periods to deal with diurnal variation, weather patterns
  - Limited operational controls: consider including an operational plan to optimize effluent quality
  - Allow for vegetation to mature (start-up period)
    - ❖ Minimum of 2 – 3 years
  - Adaptive management
    - ❖ Operational strategies
    - ❖ Vegetation management
    - ❖ Permitting framework



# Economic Benefits

Rock Creek Full Liquids Treatment Train = \$31M\*



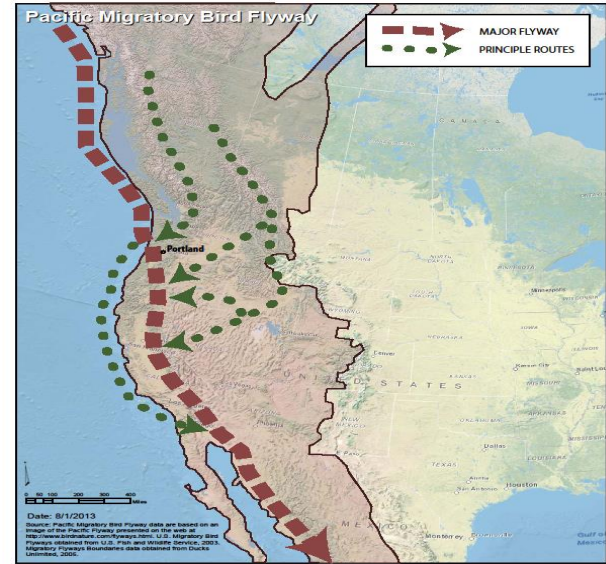
\* 2010 Dollars

Fernhill NTS Tertiary Treatment = \$18M



# Community/Social Benefits

- Community amenity
- Birdwatching and hiking
- >1,000 students studying water quality, native plants, wildlife & natural treatment systems
- 40+ volunteer stewards
- Bilingual guided walks





Questions?

A wide-angle photograph of a sunset over a large body of water. The sky is filled with horizontal bands of color, transitioning from deep blue at the top to vibrant orange and red near the horizon. The water in the foreground is dark and still, reflecting the colors of the sky. In the distance, a dark silhouette of a shoreline with trees and some buildings is visible. The word "Questions?" is written in a clean, white, sans-serif font in the upper center of the image.