Apr 5th, 2:30 PM - 2:45 PM

The Clarks Creek TMDL dispute resolution agreement plan: advancing the use of model based analysis to demonstrate reasonable assurance in WA State

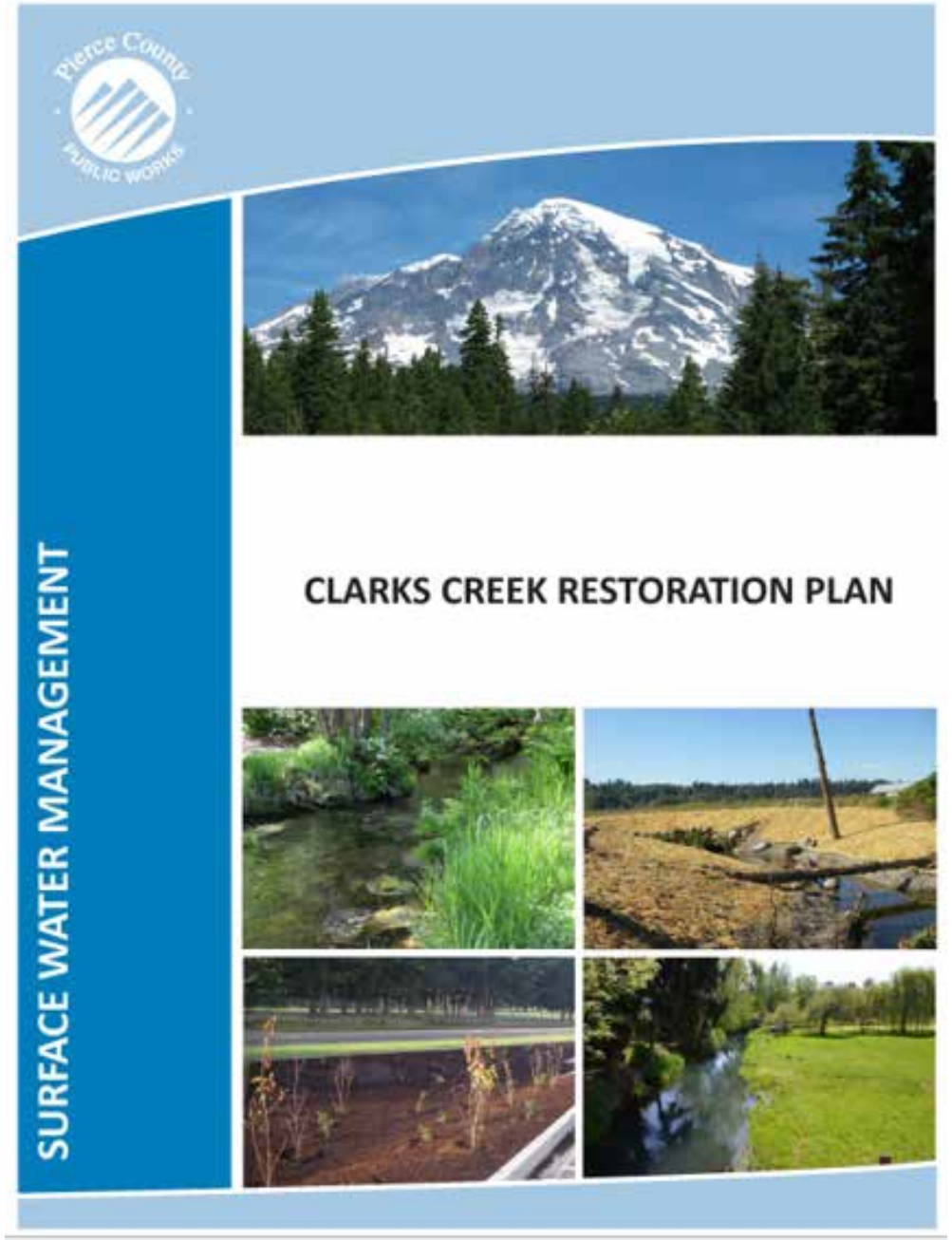
Timothy Hagan
Pierce County Planning and Public Works, United States, thagan@co.pierce.wa.us

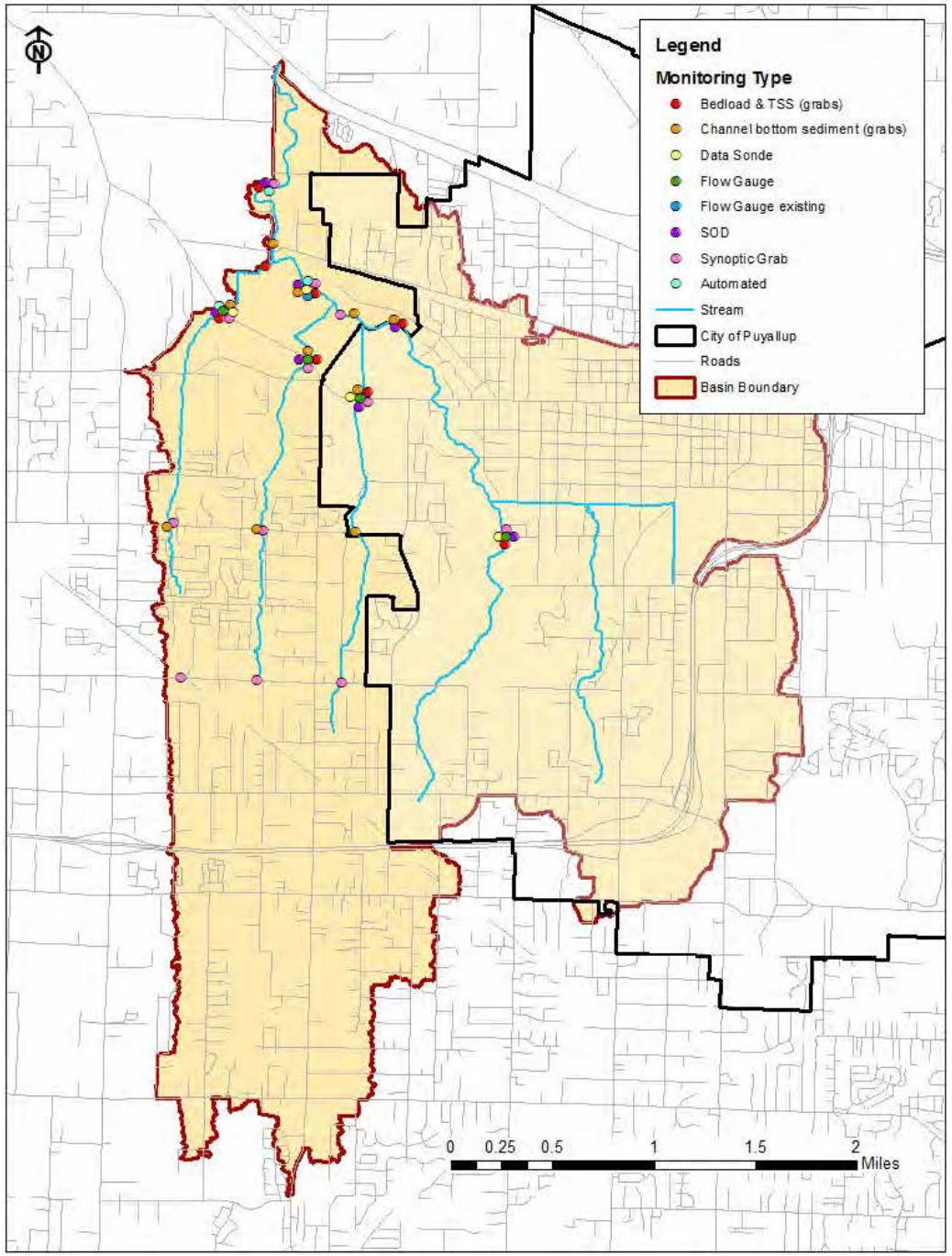
Pierce County Surface Water Management

The Clarks Creek Dispute Resolution Agreement Plan:

Advancing the use of model based analysis to demonstrate reasonable assurance in WA State

April 5th, 2018





Clarks Creek Watershed

Designated Beneficial Uses

- Core Salmon Habitat (7 species)
- Primary Contact
- Domestic Water Supply

Shared Jurisdiction

- Pierce County, City of Puyallup, WSDOT

State Water Quality Assessment

- Category 5 - 303d List as Impaired
- TMDL for:
  - Dissolved Oxygen (DO) Deficiency
  - Excessive Sediment Loading

WLA + LA + NL + (MOS + RC) = WRC + PAC

WLA = Waste Load Allocation: Point Sources

LA = Load Allocation: Nonpoint Sources

NL = Natural Load: Undeveloped Condition

RC = Reserve Capacity: Future Development

MOS = Margin of Safety: Captures Uncertainty

WRC = Watershed's Pollutant Retention Capacity

PAC = Pollutant Assimilating Capacity

Clarks Creek TMDL Implementation Targets

Waste Load Allocations

- **Dissolved Oxygen**

  Reduce 50% of Stormwater Runoff Volume

  or

  Treat 50% of Untreated Stormwater Volume

  Based on the October 21, 2003 Storm Event

- **Sediment**

  Reduce Average Annual Sediment Load by 66%

  Based on a Reference Condition Comparison

Load Allocations

- Permanently Reduce Elodea by 75%
- Increase Effective Riparian Shade by 85%
- Reduce Non-Point Sediment Load by 26 tons/year

Dispute Resolution Agreement Benefits

Clear Depiction of the County's Responsibilities
(Increased Certainty)

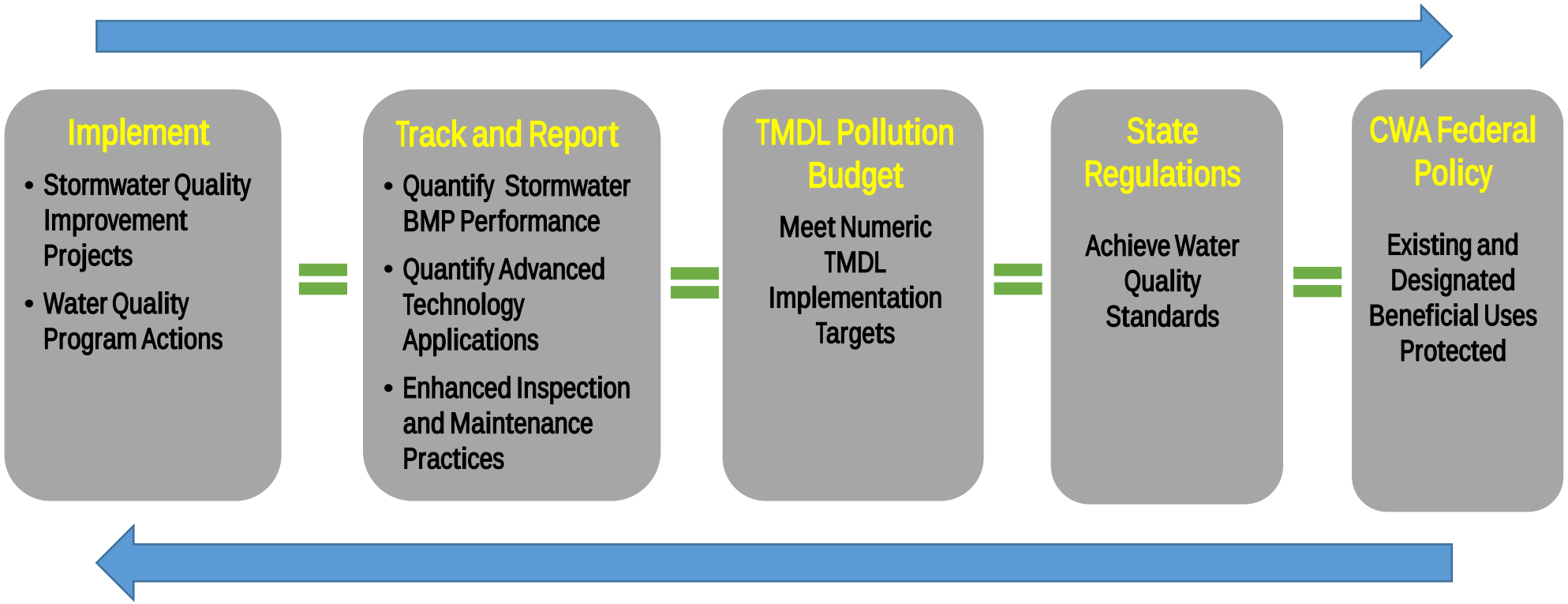
Specific, Quantifiable Measures to Track Progress of Investments
(Increased Reasonable Assurance)

Introduces a BMP Crediting Approach for WQIPs, Advanced Street Sweeping Program, and Instream Improvement Projects

Reserved Appeal Rights

5-Year Reassessment Project to Guide Future TMDL Implementation

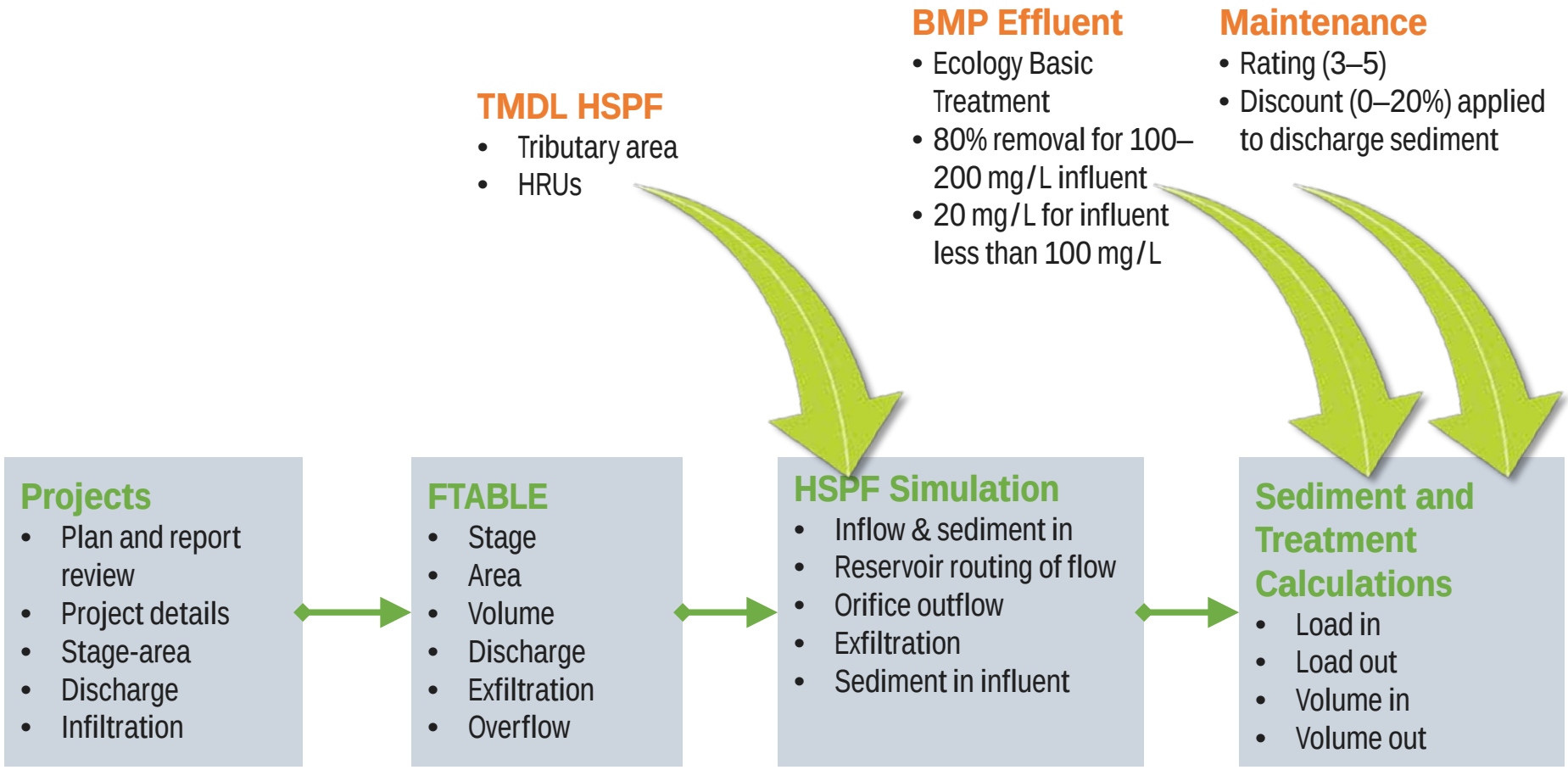
Clarks Creek Restoration Plan Strategy



Water Quality Standards Compliance Demonstration

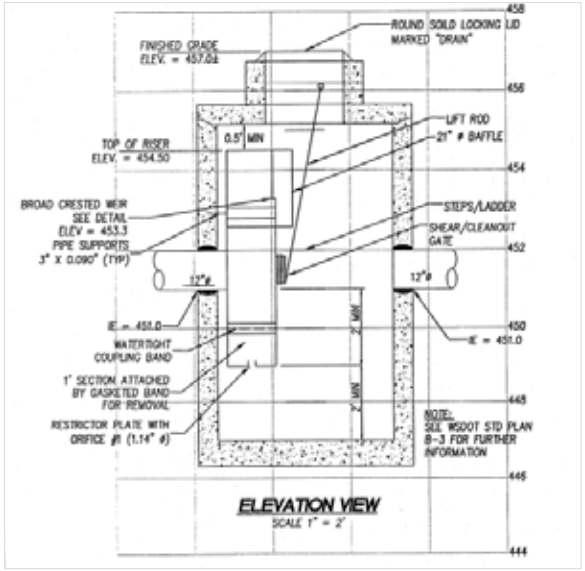
A Plan that attempts to create program alignment and policy accountability through a limited application of Reasonable Assurance Analysis

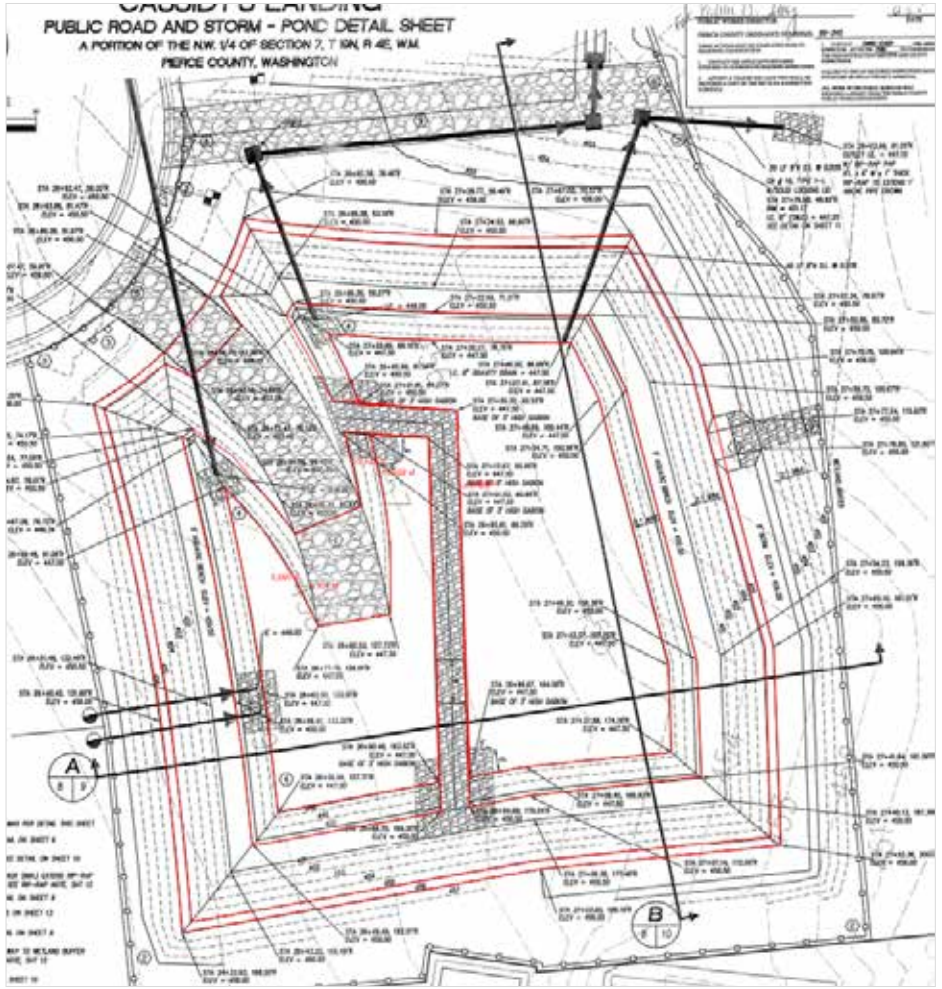
Volume and Load Reduction Estimation:
Stormwater Facilities



BMP Facility F-TABLE Development

- Reviewed plan, section, outlet structure, overflow
- Developed stage-area table





Stage Storage Discharge

Regional Facility

Detention Pond

Subbasin: SF575

Rchres 510

Routing Time Step, Δt (hr)	1.00
Base Elevation (ft)	447.50
Depth Increment (ft)	0.05
Gravitational Acceleration, g (ft	32.2

ASSUMPTIONS:

Pond has 5 outlet levels

Gate valve at 447.50, diameter 8" (not modeled, assumed closed except for maintenance)
Flow restrictor plate, I.E. 451, diameter 1.14"
Rectangular weir in riser, I.E. 453.3, width 1.4"
Riser rim, R.E. 454.5, diameter 15"
Baffle at riser rim, R.E. 454.5, diameter 21"
Overflow spillway elevation 455.5, width 6'

Discharge modeled as low outlet = gravity drain + flow restrictor plate; mid level outlet = rectangular weir + drop inlet at riser rim (baffle considered negligible); and high outlet = spillway.

Riser modeled as rectangular weir from invert to top of riser, then rectangular weir plus drop inlet for portion of riser not cut out.

Rectangular weir equation Q= C*b*h^1.5

Facility Dimensions	
Total Depth, D_{tot} (ft)	8.5
Permanent Pool Depth, D_{perm}	3.5
Live Storage Depth, D_{live} (ft)	5.0
Depth at overflow, h_{over} (ft)	8.0
Freeboard, D_{fb} (ft)	0.5

Calibrate Measuring Tool!

Stage-Area from Plans		
Stage	Pond 1 Area	Pond 2 Area (or total)
447.50	1904	3518
450.5	3285	4799
450.6	0	10532
455	0	15429
456	0	16502

Outlet Dimensions	Low	Mid	High
Outlet Type	*Orifice*	*Rect Weir*	*Weir*
Facility Depth at Invert, h_{invert}	3.50	5.80	8.00
Discharge Coefficient, C_d	0.62	3.33	0.6
Discharge Coefficient, drop inlet		3.33	
Rect weir width at riser rim (ft)		0.12	
Riser rim height (ft)	NA	7.00	NA
Orifice or Riser Diameter (inches	1.14	15.00	0.00
Orifice Area, $A_{orifice}$ (sq ft)	0.007	NA	NA
Weir width, W_{weir} (ft)	NA	3.93	6.00
Maximum Discharge, Q_{max} (cf	0.079	NA	6.807

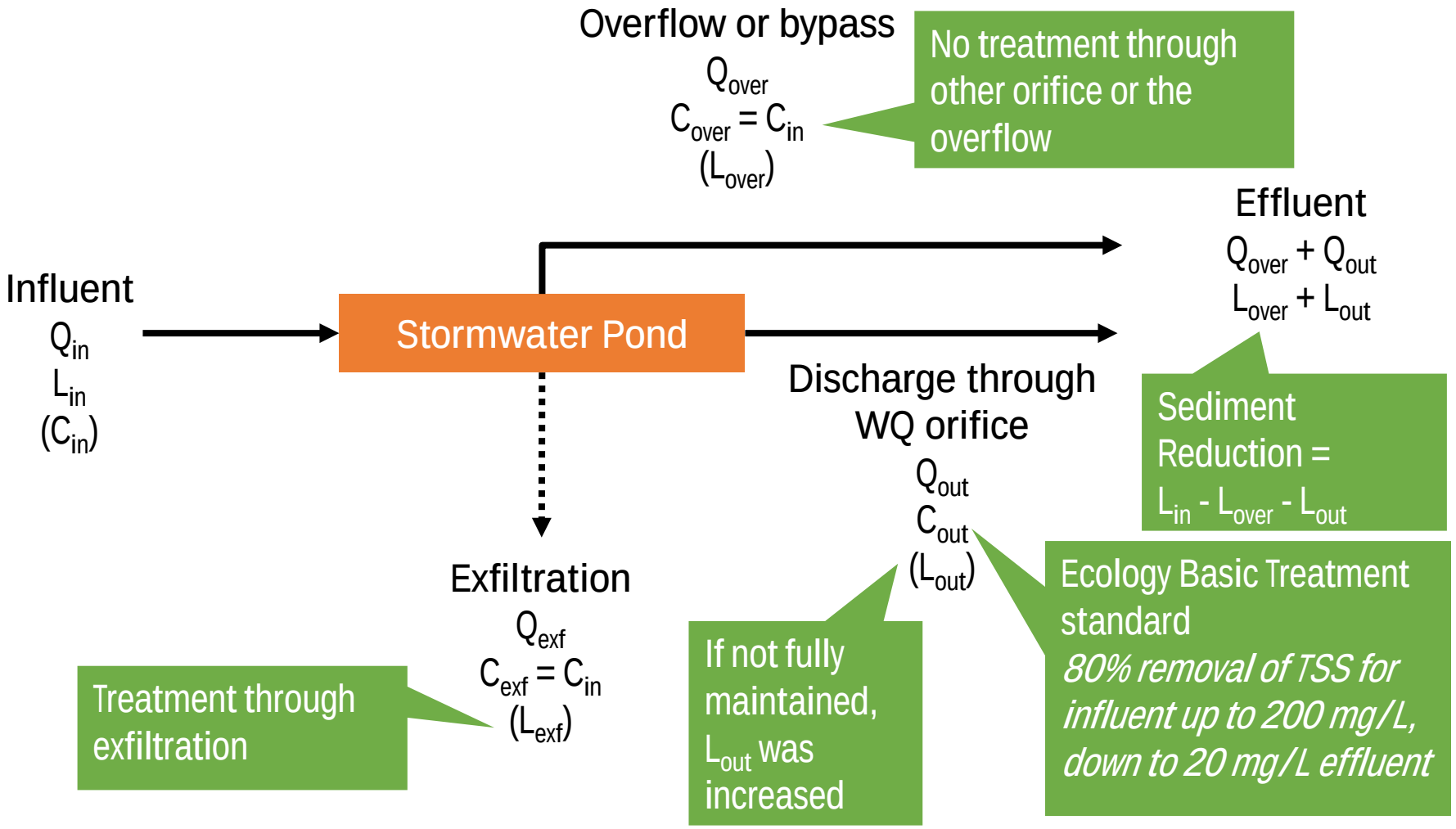
Exfiltration	
Exfiltration Rate, f_{exf} (in/hr)	0.00

Pollutant Load Reduction Parameters			
BMP Effluent Irreduceable Conc.	20	Nonstructural discount	0

Facility Storage and Rating Table

fta	ftable x	Index	Stage (ft)	Total Depth (ft)	Pond 1 Ponding Depth (ft)	Area Interpolation Parameters: Low Stage	High Stage	Low Area	High Area	Pond 1 Surface Area (ft^2)	Pond 2 Ponding Depth (ft)	Low Area	High Area	Pond 2 Surface Area (ft^2)	Total Volume (ft^3)	Dead Storage (ft^3)	Li
	1	0	447.50	0.00	0.00	447.50	450.50	1904.00	3285.00	1904.00	0.00	3518.00	4799.00	3518.00	0	0.0	
	1	1	447.55	0.05	0.00	447.50	450.50	1904.00	3285.00	1927.02	0.00	3518.00	4799.00	3539.35	272.2	272.2	
	1	2	447.60	0.10	0.00	447.50	450.50	1904.00	3285.00	1950.03	0.00	3518.00	4799.00	3560.70	546.6	546.6	
	1	3	447.65	0.15	0.00	447.50	450.50	1904.00	3285.00	1973.05	0.00	3518.00	4799.00	3582.05	823.3	823.3	
	1	4	447.70	0.20	0.00	447.50	450.50	1904.00	3285.00	1996.07	0.00	3518.00	4799.00	3603.40	1102.1	1102.1	
	1	5	447.75	0.25	0.00	447.50	450.50	1904.00	3285.00	2019.08	0.00	3518.00	4799.00	3624.75	1383.2	1383.2	

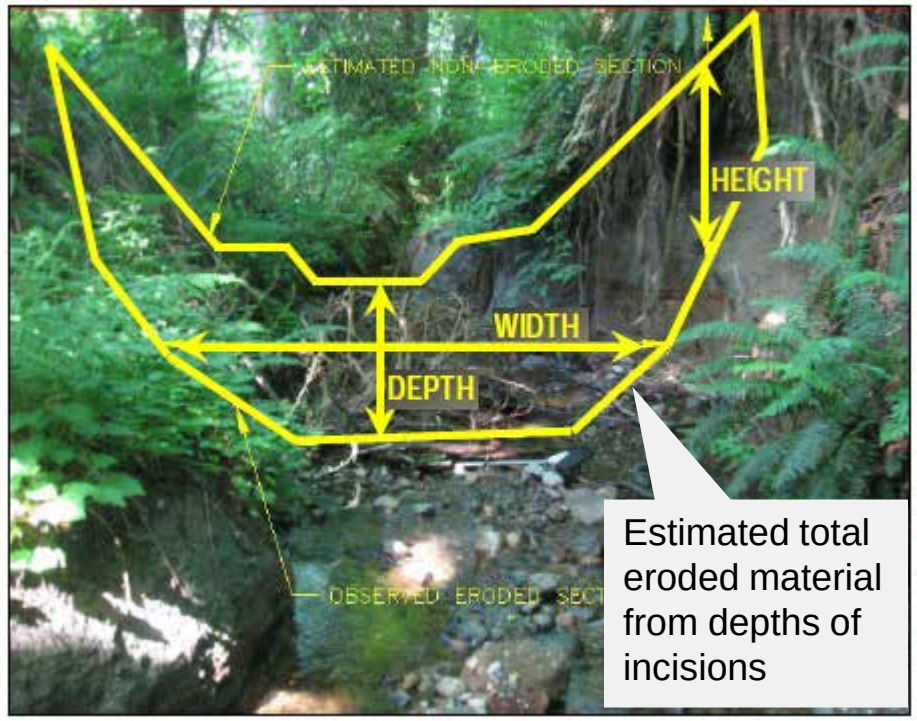
Sediment Reduction Calculation



Stream Stabilization Benefits

Clarks Creek Sediment Reduction Action Plan (CCSRAP)

- Estimated volume of past channel erosion (CCSRAP)
  - Estimated total eroded material from field measurements
  - Calculated average loss per lineal foot
  - Calculated average annual loss (assuming 95-year period [1916–2011])



Project

Annual Sediment Load Reduction = (average annual loss x % reduction) x project area length

Why Pursue Reasonable Assurance Analysis

- Focus on the Right Pollutants
- Design the Right Projects
- At the Right Scale
- In the Right Place
- For the Right Price
- Operationally Maintained

Increased Certainty of Outcome (Investment Insurance)

RAA methods provide a critical framework for comparing stormwater management alternatives, including different mixes of structural and non-structural practices and different options for distributing stormwater management practices and facilities throughout the program implementation area.

How the Plan's Strategy Strives to Improve the TMDL Process

(A) Establish a Shared Definition of the Problem

(B) Develop Greater Networks of Inter-Organizational Trust

(C) Define Common Interests (e.g. Mutual Assurance Analysis)

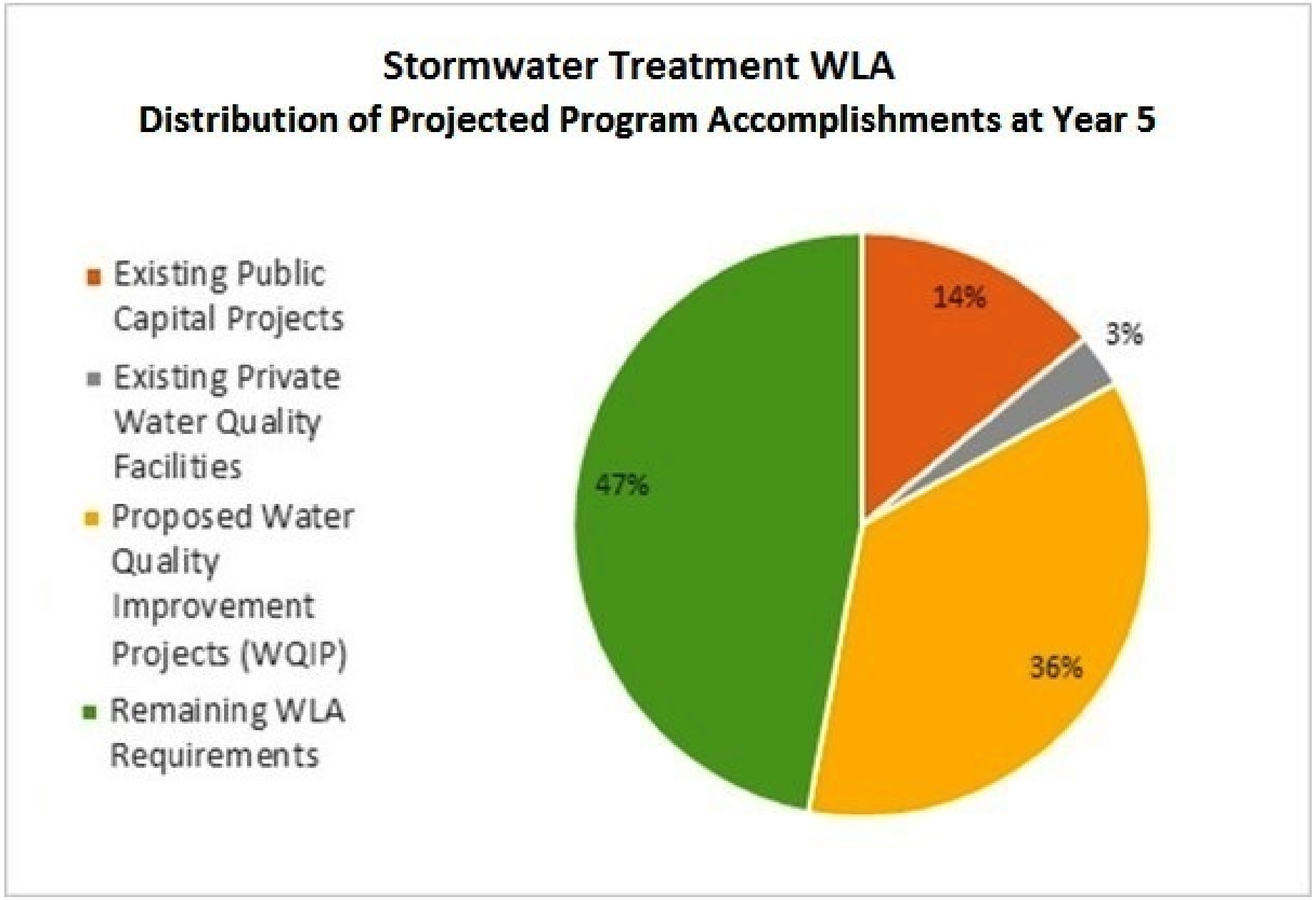
(D) Balance of Power Among Policy, Regulatory and Program Implementers

(E) Increase the Diversity of Policy Instruments

Thank you…

Questions?

The Results of the Plan's Initial Investment



The Results of the Plan's Initial Investment