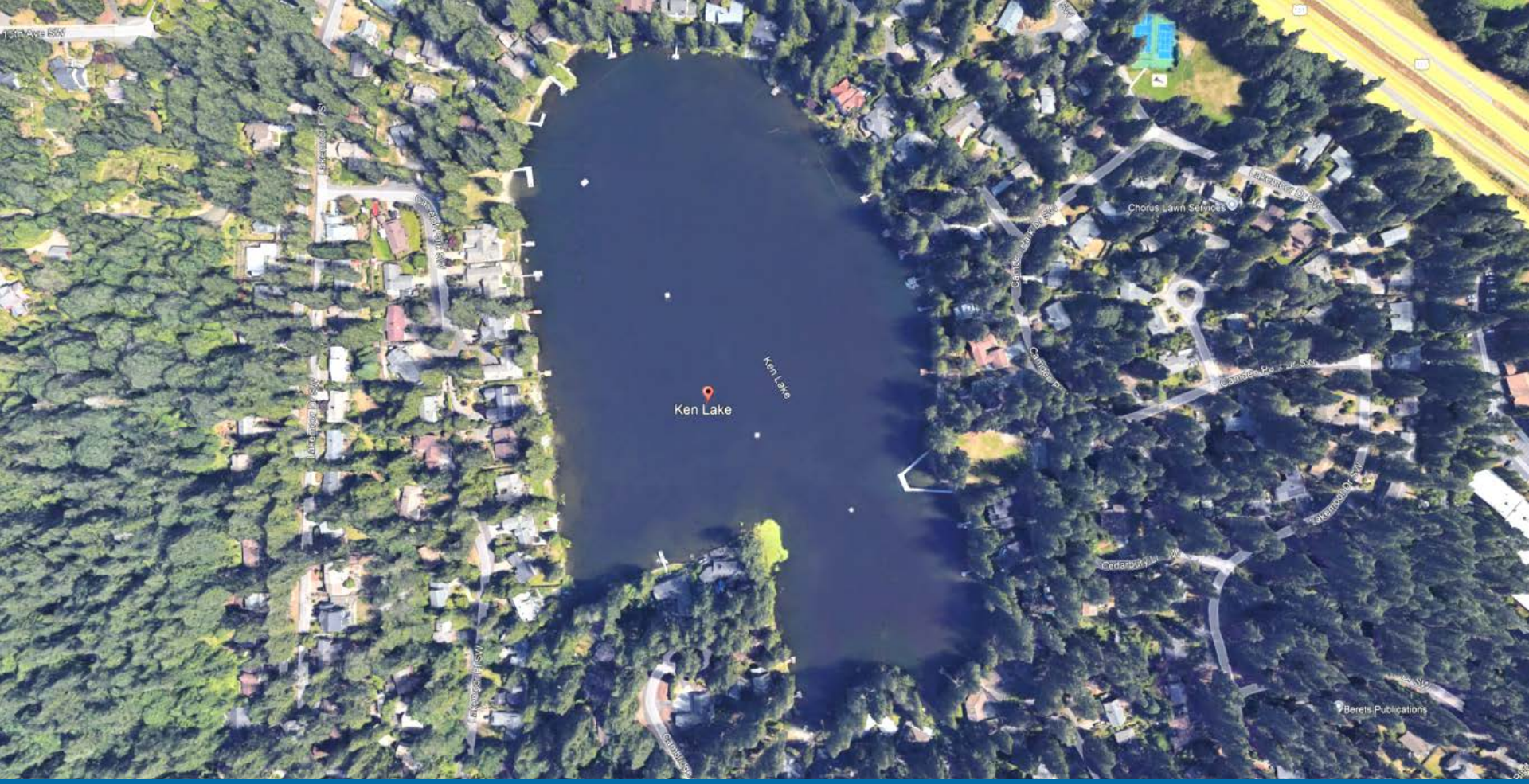


Ken Lake Stormwater Treatment Concepts

Lakemoor Community Club Town Hall Meeting, October 28, 2024

James Packman, PMP, Associate Scientist
Rachel Johnson, EIT, Environmental Engineer
Erynne van Zee, Environmental Engineer and Landscape Designer

HERRERA
Science + Planning + Design

Lake and Stormwater Concerns

Project Objectives & Goals

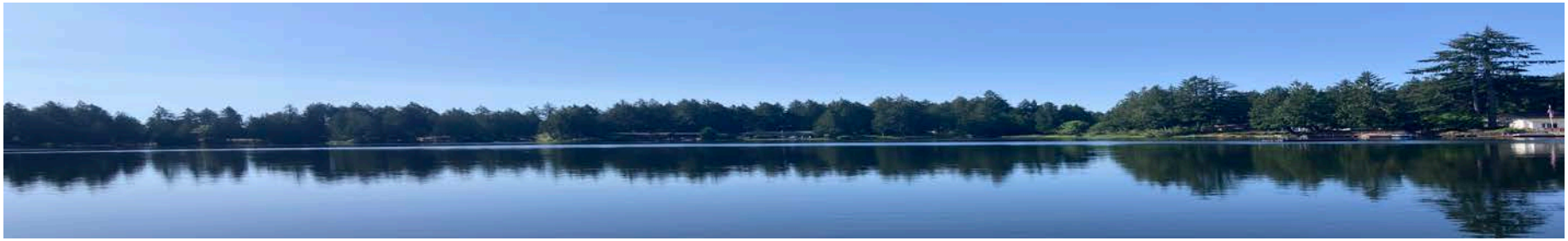
Lake Water Activities & Concerns

Water Quality
- No major issues known
- Monitoring by Stormwater committee quarterly

Lake Treatment
- Aquatic weed control May through October

Community Education
- Watercraft inspection and cleaning
- Noxious weed management

Concerns
- Muck in lake near some stormwater outfalls and in southern canals
- Aquatic plant and shoreline management
- Swimmer's itch in some areas (parasites)



Project Objectives & Goals

Project Goals

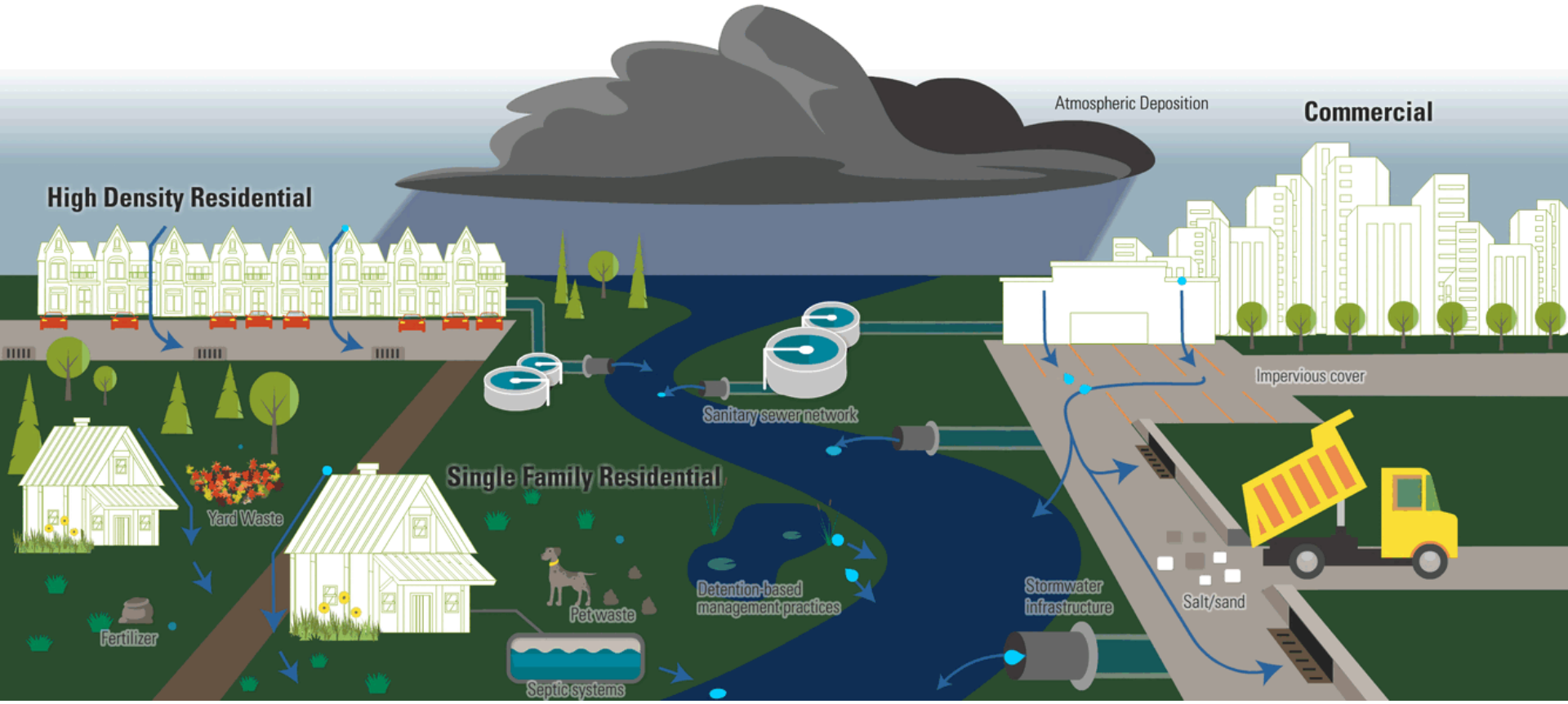
- Stormwater management planning
- Potential treatment of stormwater

Project Objectives

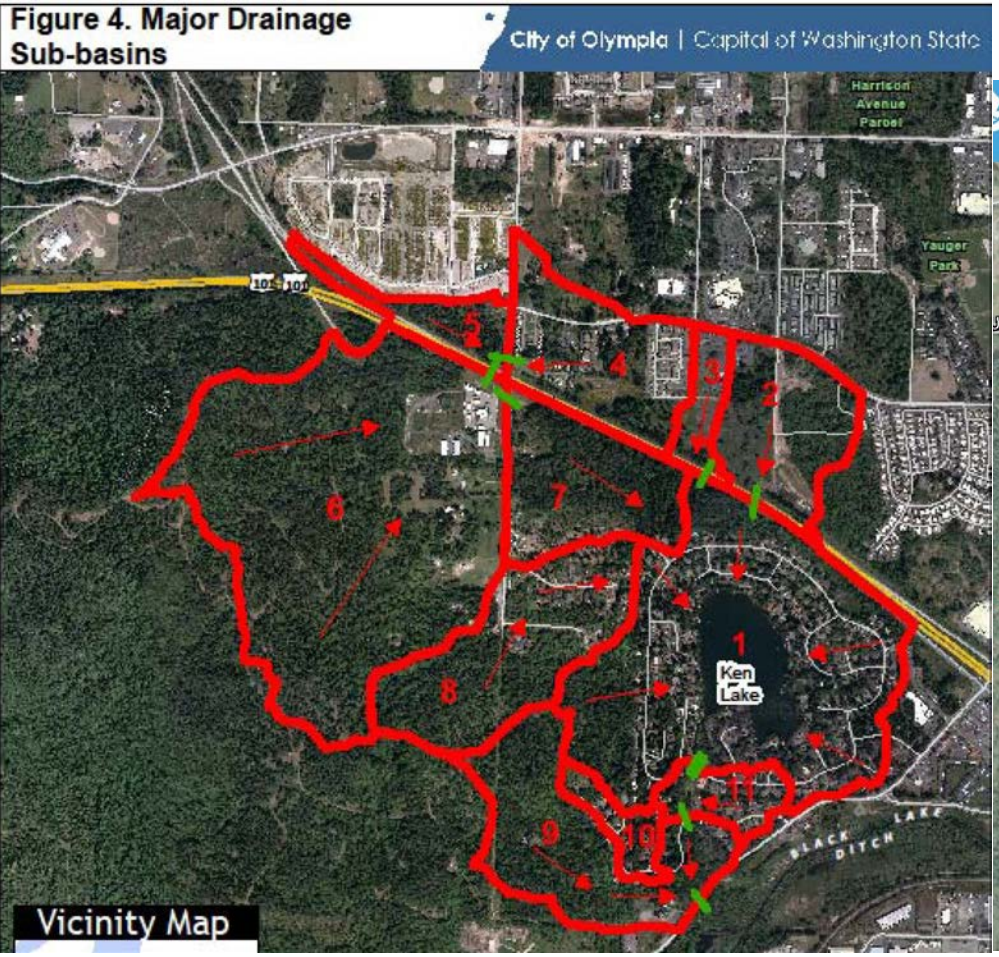
1. Review background documents and previous reports
2. Create spreadsheet database for lake water sample results
3. Site visit and reconnaissance of stormwater outfalls
4. Identify four priority drainage areas/basins
5. Identify stormwater treatment concepts, visualizations, and cost estimates

Four Priority Stormwater Areas

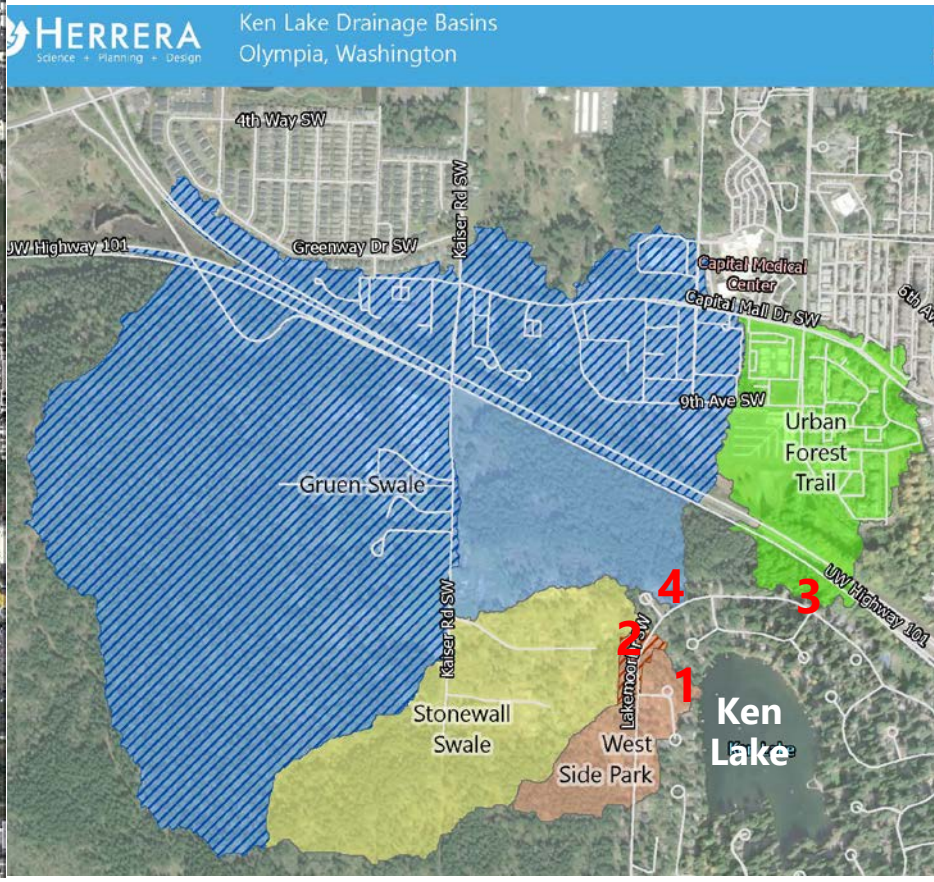
Stormwater Runoff in Urban Watersheds



Stormwater Drainage Basins



City of Olympia map of drainage subbasins, 2012



Herrera map of four priority subbasins, 2024

Modeling Stormwater Runoff, TP, and TSS

Annual Estimated Stormwater Runoff

Basin	Area (acres)	Percent Impervious	Annual Runoff (acre-feet)
1. West Side Park	21	18%	35
2. Stonewall Swale	73	9%	253
3. Urban Forest Trail Swale	55	50%	103
4. Gruen Swale	376	14%	17

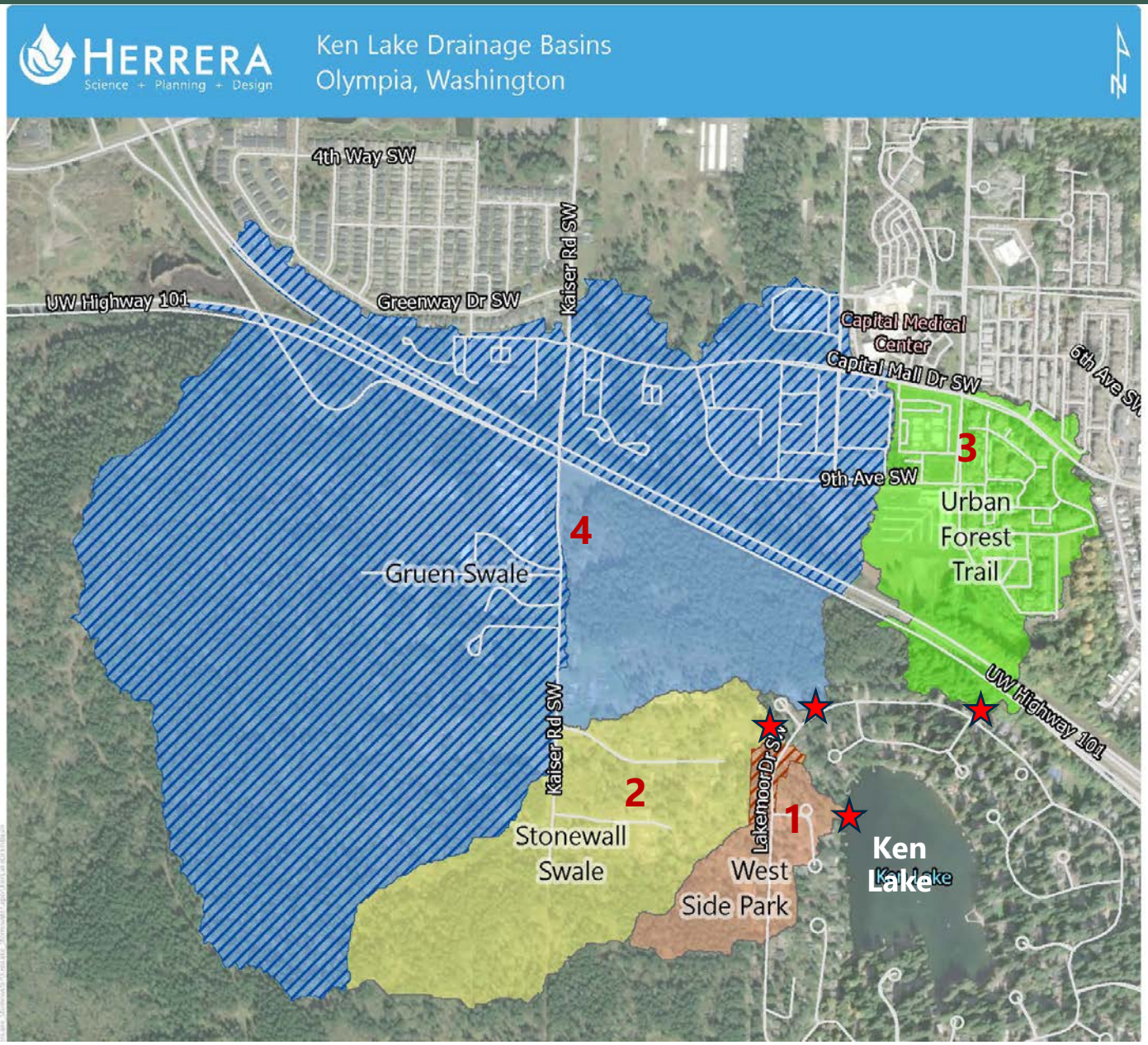
Annual Estimated Phosphorus and Total Suspended Solids Loading

Basin	Total Phosphorus (kg/yr)	Area-weighted TP (kg/ac)	Total Suspended Solids (kg/yr)	Area-weighted TSS (kg/ac)
1. West Side Park	3.7	0.11	2,600	73
2. Stonewall Swale	7.8	0.15	19,500	77
3. Urban Forest	24	0.44	7,800	75
4. Gruen Swale	58	0.17	1,200	73

Modeling assumptions:

- 50 inches annual rainfall
- Land-use based on zoning
- Average annual loading for TP and TSS *based on: Western Washington NPDES Final S8.D Data Characterization 2008-2013*, Dept of Ecology, publication 15-03-001, February 20215

Four Priority Sites

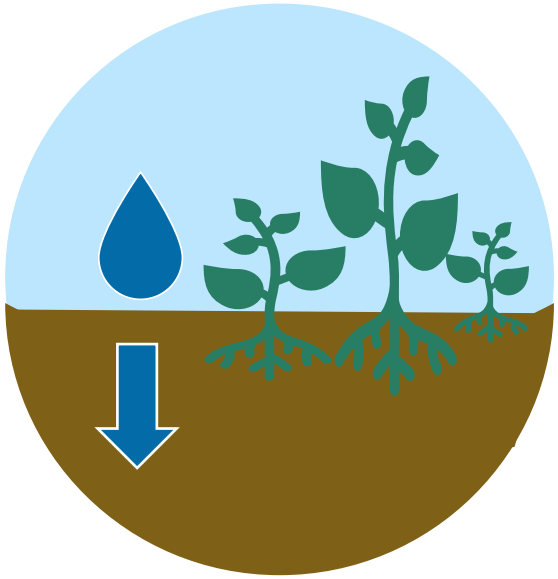


Four Priority Sites

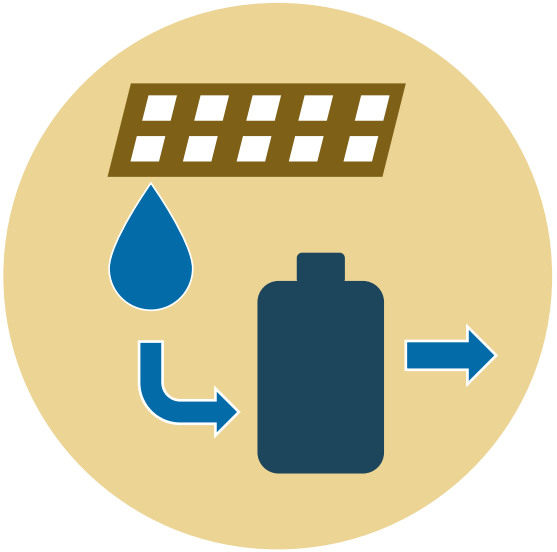
Four Priority Sites

Stormwater Treatment Concepts

Menu of Stormwater Treatment Options

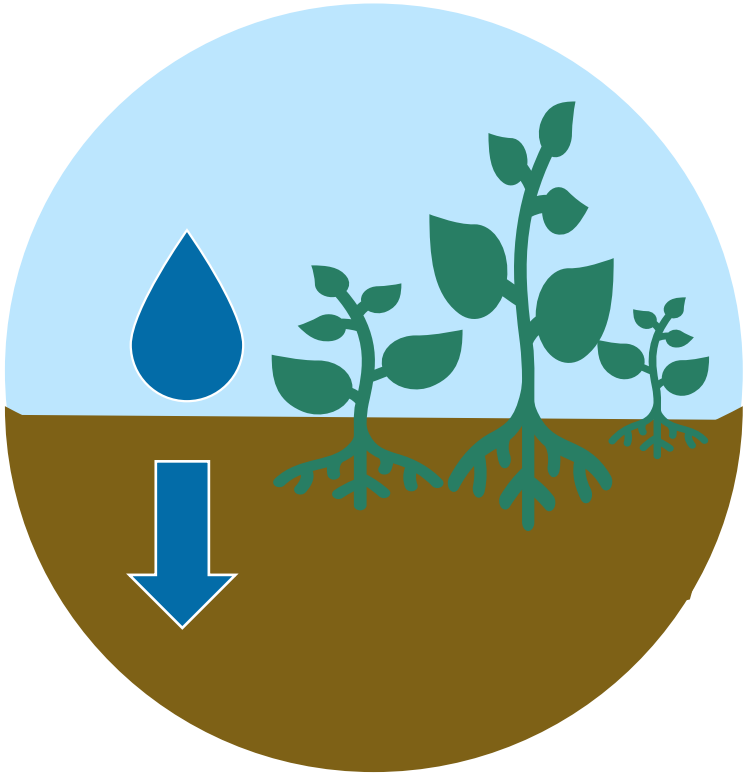


Bioretention Swales



Treatment Devices

Watershed Programs



Bioretention Swales

Bioretention Swales

What are they?

- Shallow, landscaped depressions for infiltrating water through surface soils
- Specially designed soil mix
- Well-adapted plants (native, non-invasive, etc.)

What are the benefits?

- Remove sediment, organic debris (muck), bacteria, and nutrients from stormwater
- Slow down water flow, reduce erosion
- Add native vegetation and habitat
- Small scale for residential application

Limitations/Considerations:

- Potentially limited infiltration
- Regular maintenance required

Bioretention Swales

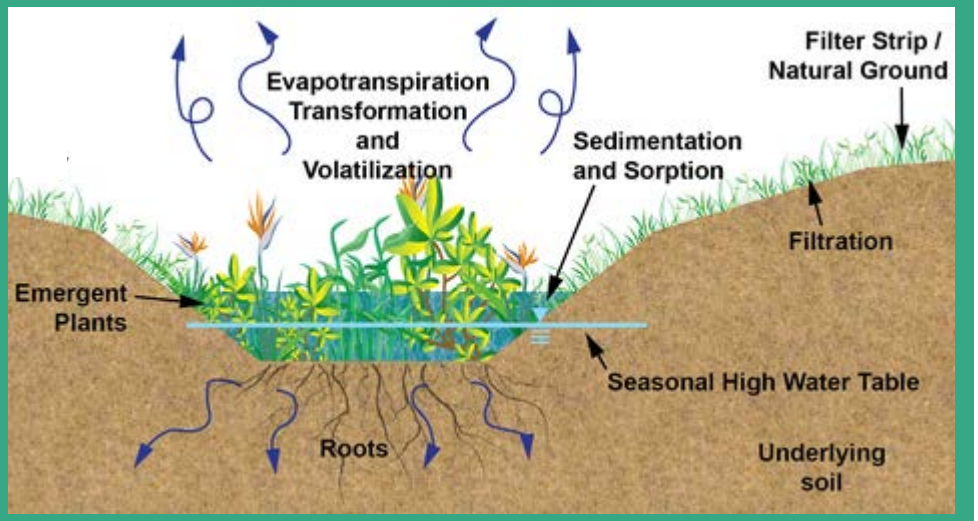
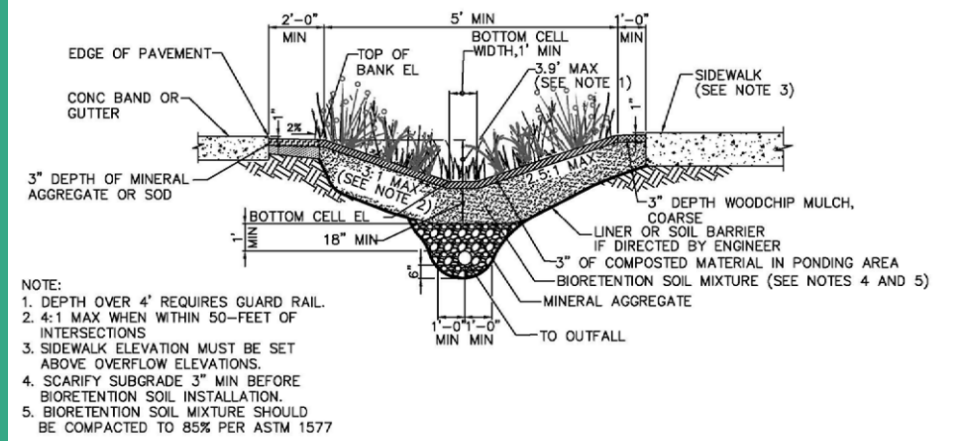


Figure 7.4.1 Example of a Bioretention Swale

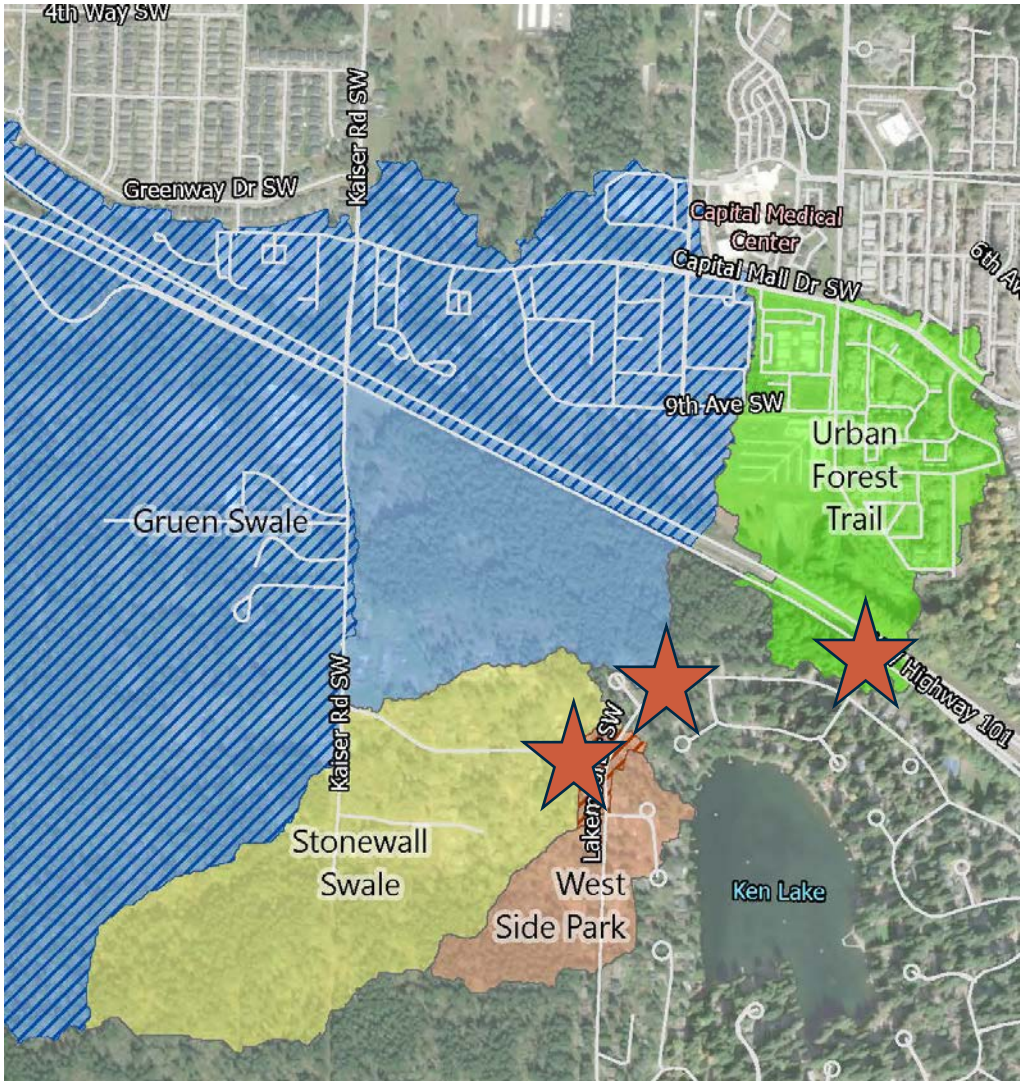


Modified from City of Seattle ROW Manual Figure 6-15

Design elements:

- Maximum ponding depth: 12 inches
- Drawdown time: 24 hours
- Soil depth: 18" +
- Overflow to storm sewer system
- Bioretention soil mix can be optimized for phosphorus removal

Bioretention Swales



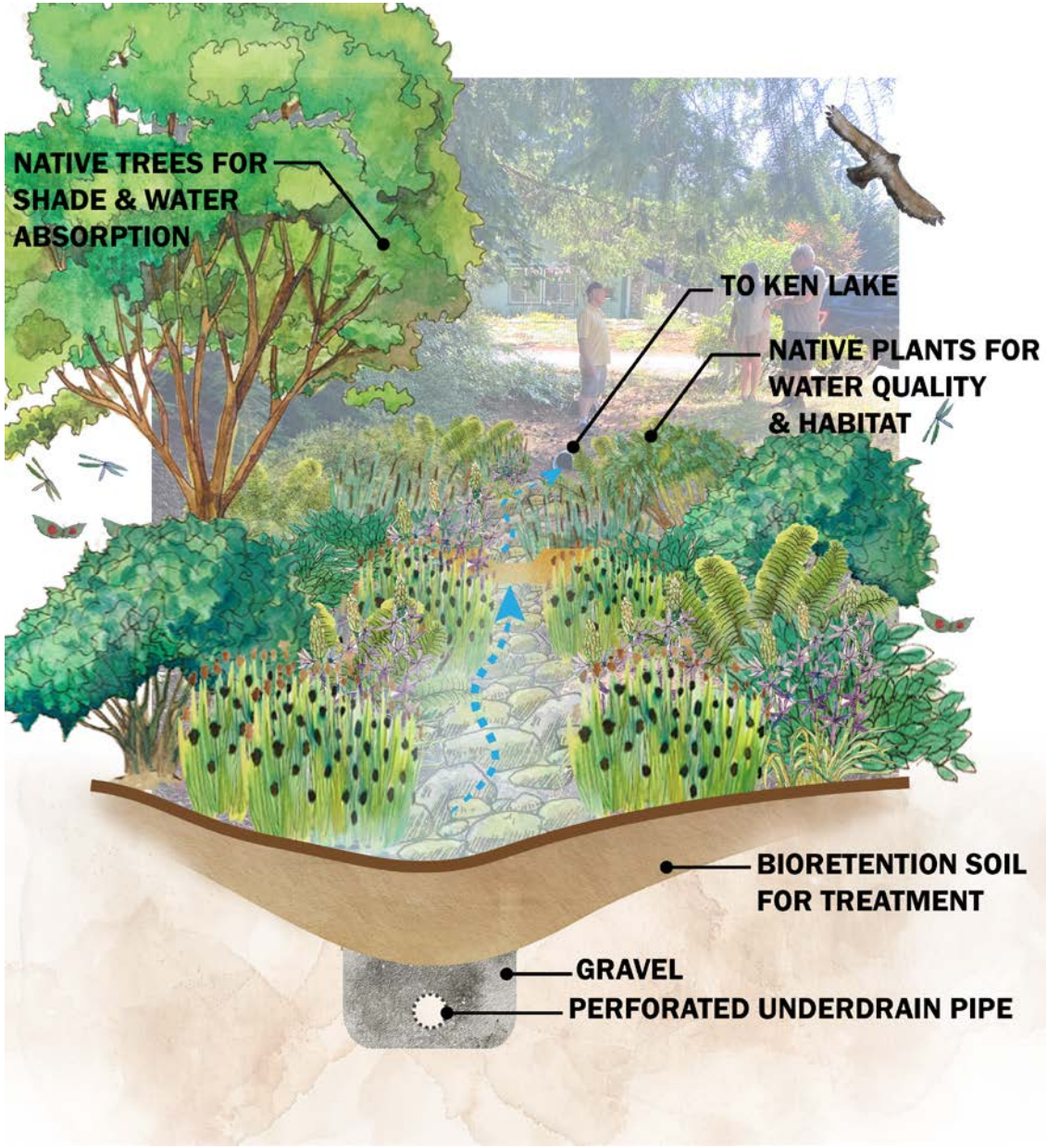
Locations: Upstream areas where have space; treat water coming into neighborhood

- Stonewall Swale
- Gruen Swale
- Urban Forest Trail Swale

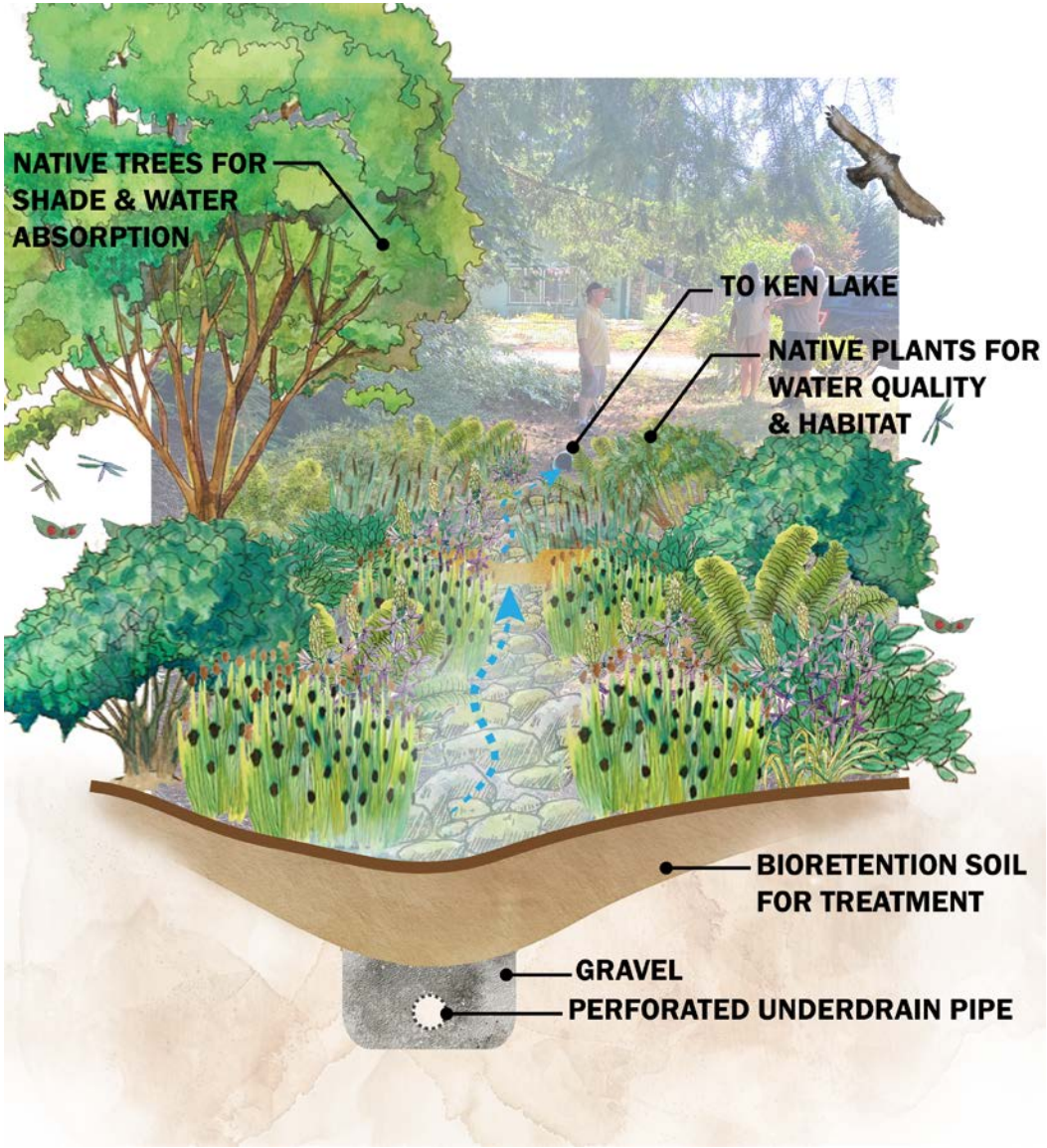
Maintenance Needs:

- Avoid compaction
- Water plants during establishment
- Weeding and pruning
- Mulching
- Plant replacement
- Erosion repair
- Sediment removal

Bioretention Swales



Bioretention Swales



High-level cost estimate:

- $5,000/ site for infiltration testing

Stonewall swale:

- Swale area: ~ 560 sq. ft.
- ~30% of impervious area
- Cost: ~ $135,000

Gruen swale:

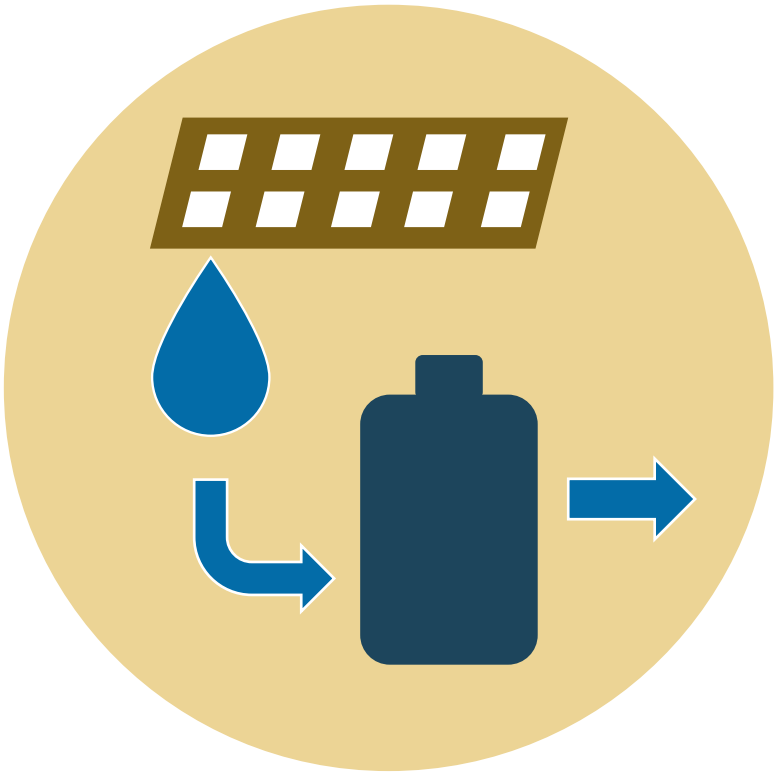
- Swale area ~1,900 sq. ft.
- ~12% of impervious area
- Cost: ~$280,000

Urban Forest Trail swale:

- Swale area ~ 450 sq. ft.
- ~5% of impervious area
- Cost: ~$130,000

Cost assumptions include:

- *Design, permitting, traffic control, erosion control, installation*
- *Underdrain*
- *Contingency*



Treatment Devices

Treatment Devices

What are they?

- Underground stormwater treatment devices
- Vault structures with rechargeable, media-filled cartridges
- Cartridges filter and trap particles and pollutants in media (proprietary mix)

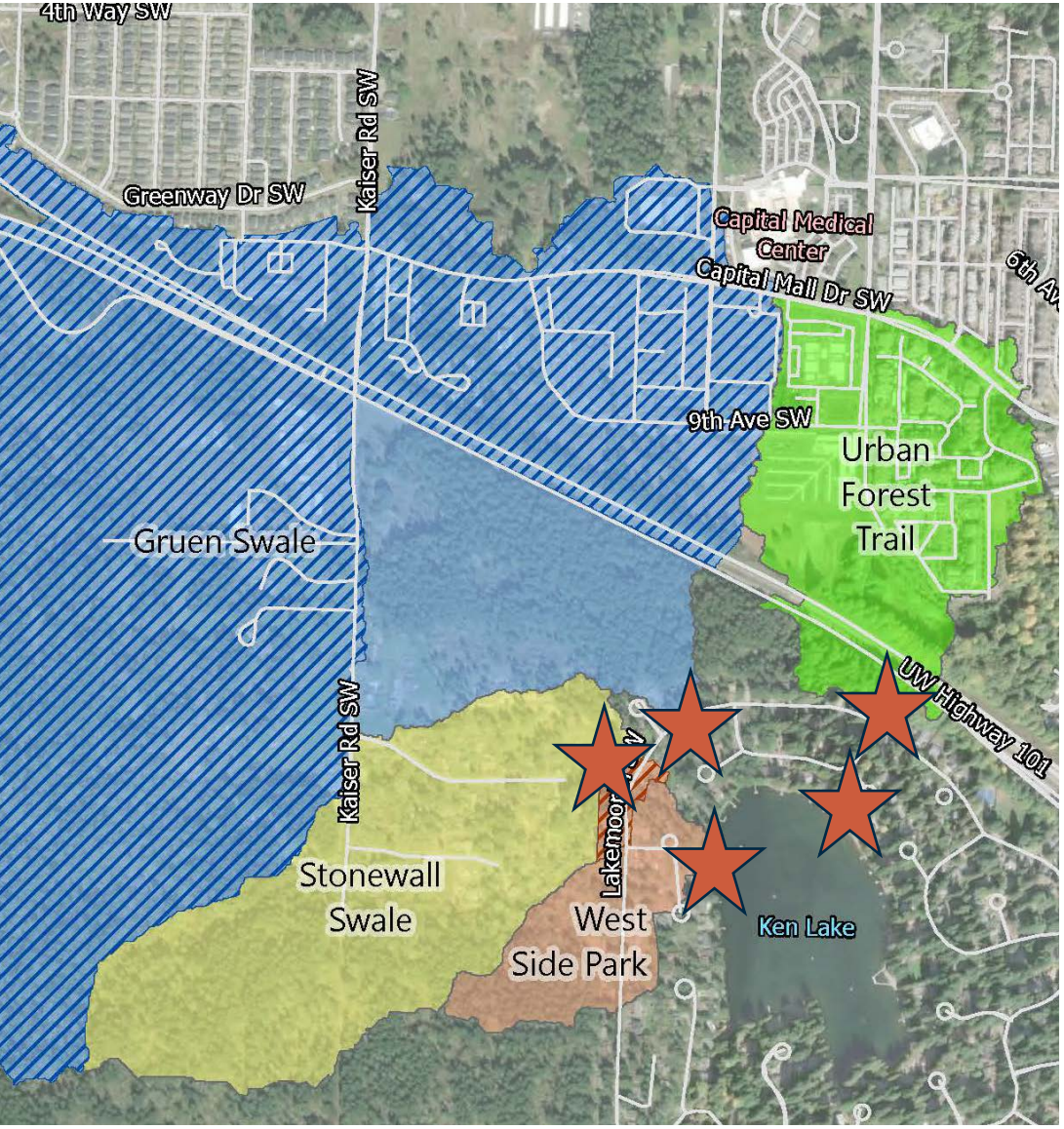
What are the benefits?

- Trap sediment and capture pollutants
- Installed in the street/right-of-way, small footprint
- Can be optimized for phosphorous removal

Limitations/Considerations:

- Underground area needs
- Elevation difference between inflow and outflow pipes
- Regular maintenance required
- Replacing media cartridges expensive

Treatment Devices



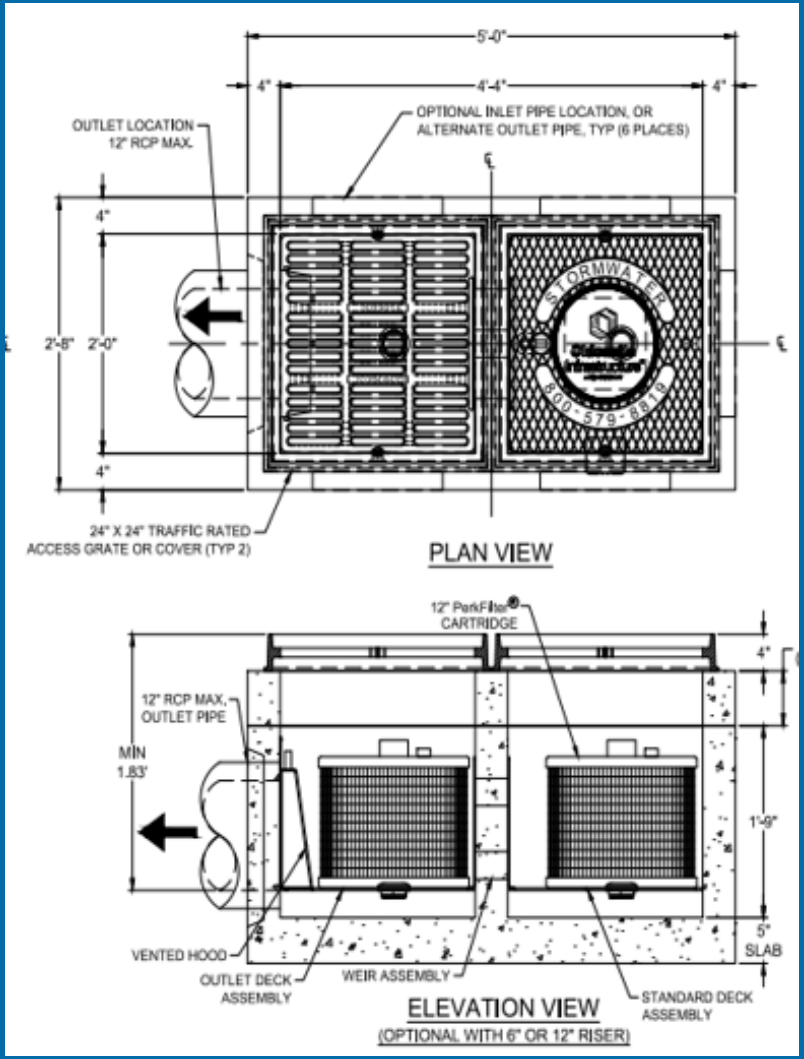
Locations: Downstream areas connected to stormwater catch basins; treat water before outfall to lake

- Downstream of bioretention swale
- Upstream of outfall

Maintenance Needs:

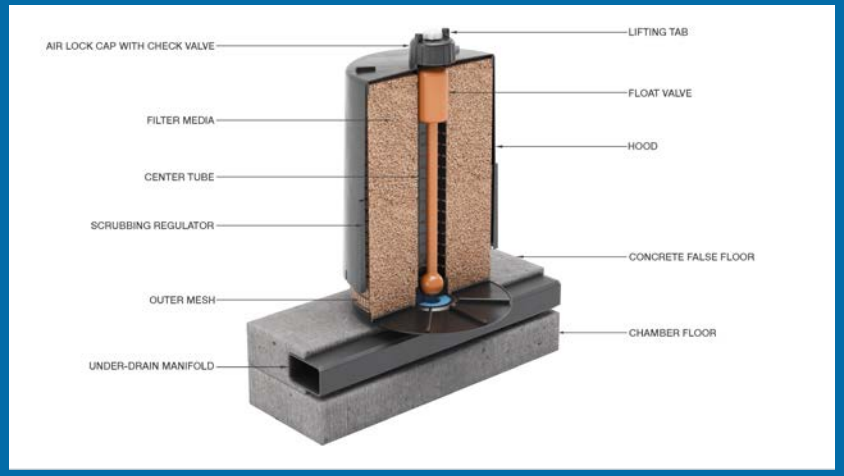
- Annual inspection of cartridges
- Regular removal of sediment and debris (vacuum truck)
- Cartridge replacement (every 1 – 3 years)

Treatment Devices

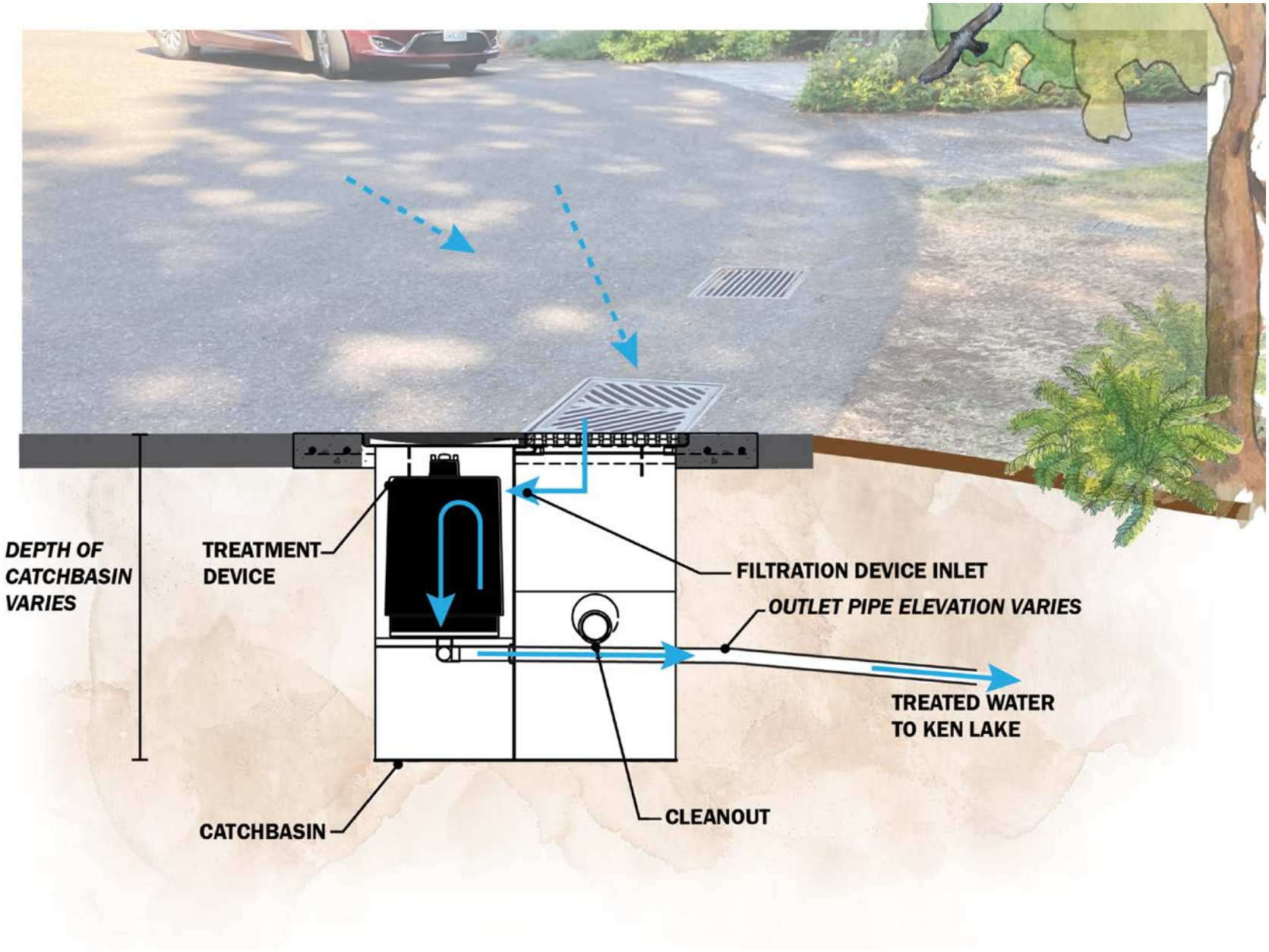


Design elements:

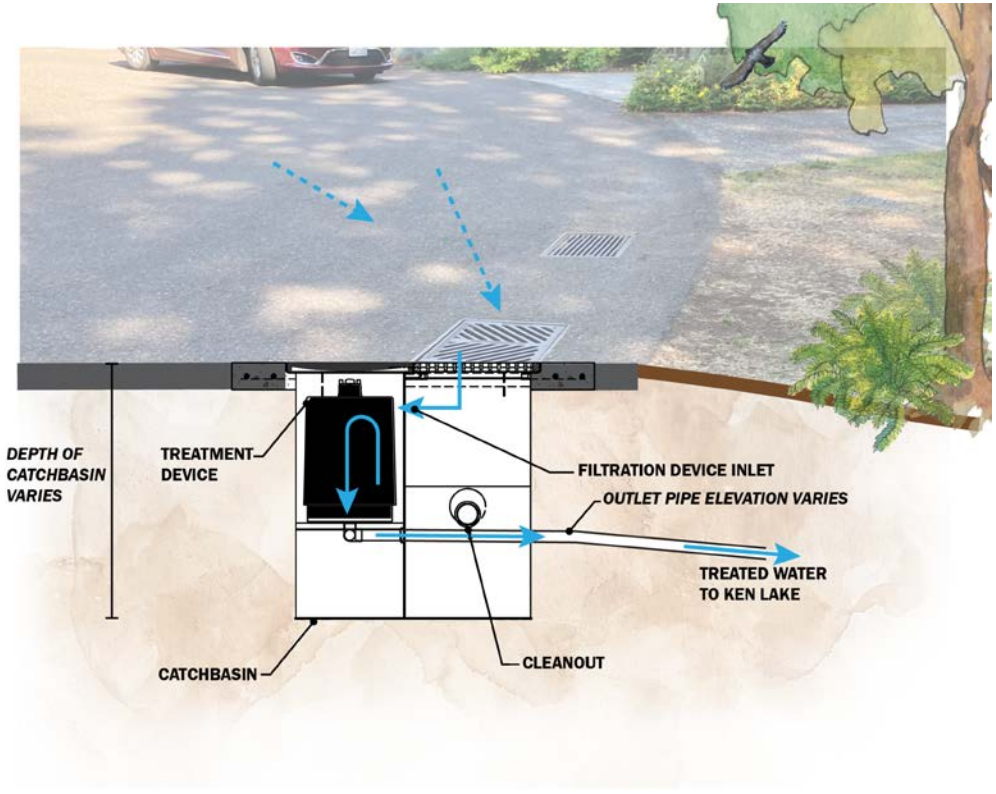
- Underground, connected to existing catch basin
- 1 – 2 cartridges
- Access to cleanout



Treatment Devices



Treatment Devices



For Example:

StormFilter Stormwater Treatment Device

https://www.conteches.com/stormwater-management/filtration/stormfilter/

High-level cost estimate:

Cost for 1 – 2 cartridges

- Cost: ~$60,000

Cost for a larger cartridge vault (eg 4 – 6 cartridges)

- Cost: ~$180,000

Maintenance costs:

- Replace every 1 – 3 years; $175/cartridge for materials
- Additional cost for maintenance team to replace
- Assume vactor truck provided by City of Olympia

Cost assumptions include:

- *Construction and materials*
- *Design and permitting*
- *Construction management*
- *Contingency*

Specific cartridges used would depend on:

- *Available space*
- *Depth: grate to outlet pipe*
- *Cost*

Watershed Education Programs

Watershed Education Programs

Add to existing LCC community education

Homeowners manage and treat stormwater from HOA areas

- **Management practices:**
  - Residential rain gardens
  - Catch basin socks
- **Community programs:**
  - Adopt-a-Drain program
  - Free pet waste stations
- **Programs for residents**
  - Natural yard care

Watershed Education Programs

Residential Rain Gardens

What are they?
- Shallow, landscaped depression
- Compost-amended native soils (not engineered)
- Temporarily ponds to store water and infiltrate

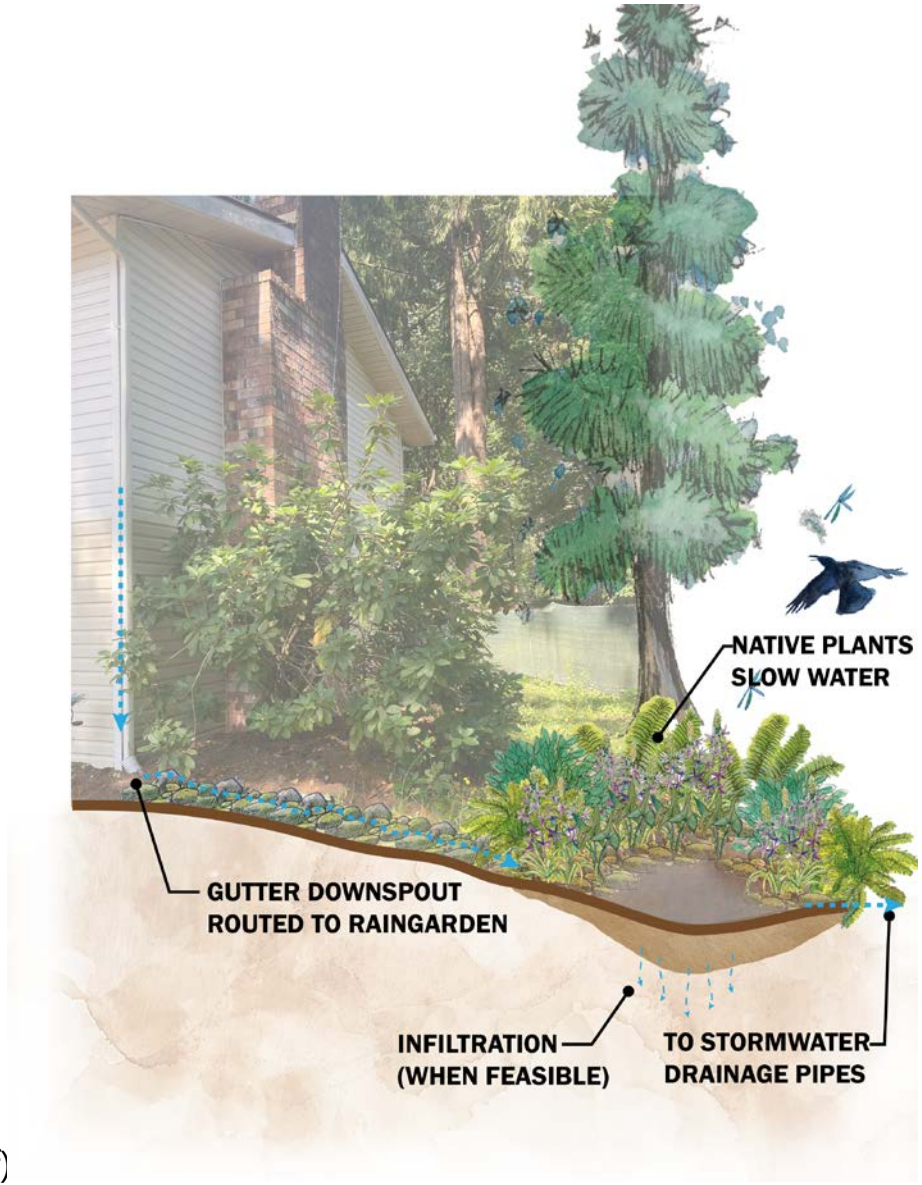
What are the benefits?
- Reduce volume of water into storm drain system
- Remove sediment, bacteria, and nutrients
- Native vegetation and habitat

Limitations/considerations:
- Manage water from one house roof/driveway

Locations:
- On private properties, to manage water from roof downspouts or driveways

Maintenance needs:
- Water plants during establishment
- Weeding, pruning, and mulching
- Plant replacement
- Erosion repair and sediment removal

Cost estimate:
~$6,000 - $8,000/ rain garden (to manage half of roof)



Catch Basin Filter

What are they?

- Also called filter socks
- Placed in drain – water must pass through

What are the benefits?

- Filters sediment from streets and neighborhood
- Easy to install and monitor

Limitations/considerations:

- Only treats street runoff (not flow already in sewer)

Locations:

- Target areas with most street sediment and yard debris

Maintenance needs:

- Monitor, replace as needed

Cost estimate: approx. $70/filter.

For Example. Frameless Storm Drain Filter, $74,
https://www.newpig.com/pig-frameless-storm-drain-filter-for-small-drains/p/FLT1000

RISK

Can cause flooding if not maintained

Watershed Education Programs

Adopt-a-Drain

What is it?

- Neighbors 'adopt' a nearby catch basin
- Keep it clear and free of trash, leaves, and debris to prevent year-round prevention

What are the benefits?

- Reduce localized flooding
- Improve water quality by removing sediments and pollutants
- Augments street sweeping

Maintenance needs:

- ~ 2x/month for 15 minutes time requirement
- Remove trash, leaves, other debris

Cost estimate:

Free; neighbors supply tools to keep clear

ADOPT A STORM DRAIN

Pet Waste Stations

What are they?
- Free supplies in public places to dispose properly of pet waste

What are the benefits?
- Reduce bacteria, nutrients, and sediment
- Water quality improvements

Locations:
West Side Park, Urban Forest Trail, other community locations

Maintenance needs:
- Empty garbage
- Replace bags
- Keep area around station clean

Cost estimate:
Free to install– City of Olympia program
- City has free station to install
- Allow City reps to inspect installation and maintenance
- Complete 6-month evaluation

Watershed Education Programs

Natural Yard Care

What is it?

- Method of maintaining yard with fewer inputs (water, pesticides, fertilizers, etc.)
- Support healthy, low-maintenance landscape
- Use native plants with deep roots and mulch to hold dirt in place

What are the benefits?

- Build healthy soil
- Reduce inputs and improve downstream water quality

Maintenance needs:

- Mowing, aerating, weeding, pruning, watering
- Planting

Cost estimate:

Free

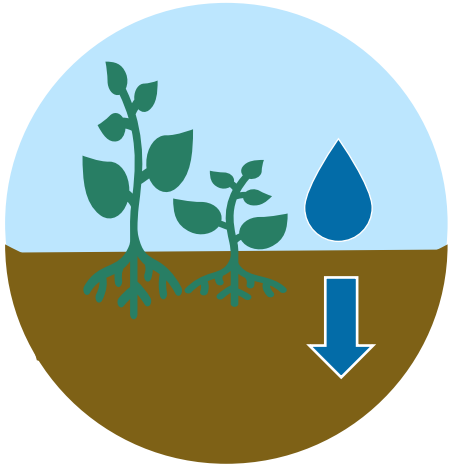

Aerating & Top Dressing

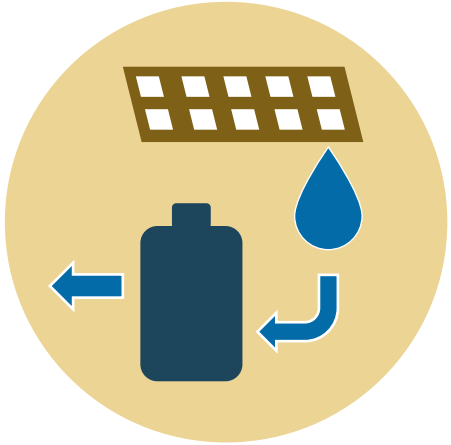

Mowing


Moles


Watering

Summary of Treatment Options





	Bioretention Swales	Treatment Devices	Watershed Programs
Location	Existing Swales	Underground	HOA/Private Property
Estimated cost ea.	$130K - $280K	$60K - $180K	Free - $8K
Best for	Surface flow from upstream areas	Piped flow from upstream and neighborhood	Neighborhood streets and yards

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