Puget Sound Regional Council

Planning Stormwater Parks

Lessons learned from existing parks and guidance for future parks

December 2022

Guidance on Planning Stormwater Parks

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Acronyms

ADA: Americans with Disabilities Act

BMP: Best Management Practice

CERB: Community Economic Revitalization Board

CSO: Combined Sewer Overflow

CWSRF: Clean Water State Revolving Fund

DBH: Diameter at Breast Height

LID: Low Impact Development

NPDES: National Pollutant Discharge Elimination System

O&M: Operations and Maintenance

OSG: Overflow and Stormwater Reuse Municipal Grants Program

PRISM: Performance and Registration Information Systems Management

PSRC: Puget Sound Regional Council

RCO: Washington State Recreation and Conservation Office

SAW: Secure Access Washington Account

SFAP: Stormwater Financial Assistance Program

SFH: Single-Family Home

SSO: Sanitary Sewer Overflow

What are Stormwater Parks?

Stormwater parks are community facilities that both treat stormwater from a larger area (regional stormwater facility) and provide recreational opportunities (parks, trails, open space, community gardens, etc.). The purpose of this document is to describe the many benefits of stormwater parks, share information and lessons learned from already-built stormwater parks, and provide guidance for the planning of future stormwater parks.

Puget Sound Recovery Solutions

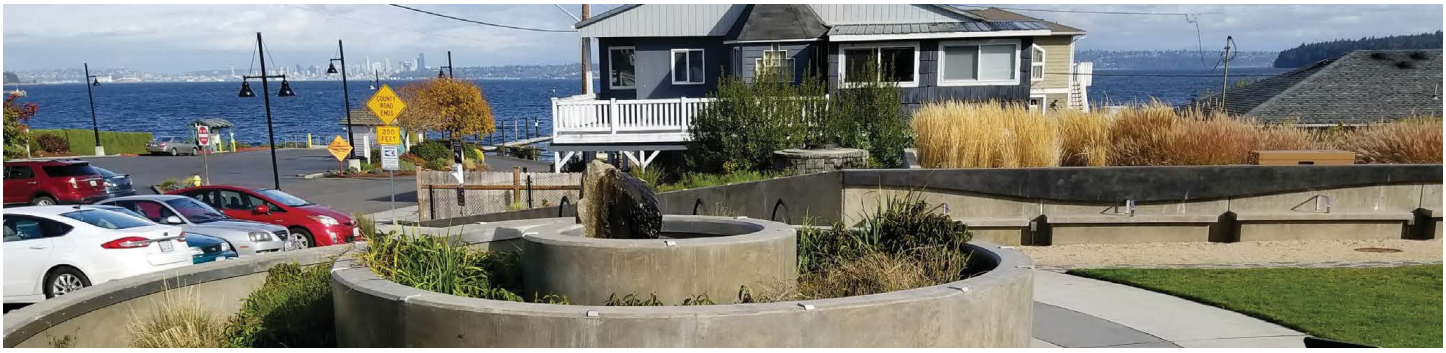
Though beautiful from a distance, Puget Sound is facing serious challenges. Human actions over the past few centuries have damaged Puget Sound and surrounding water bodies by degrading water quality and wildlife habitats and increasing stormwater runoff in the region.

While recovering the health of Puget Sound is challenging, many partners are working to address these issues under the umbrella of the Puget Sound Partnership. The Puget Sound Action Agenda charts the course for Puget Sound recovery as the community's shared plan for advancing protection and restoration efforts across the region. Stormwater is one of the main contributors to water quality degradation and is one of three strategic initiatives in Puget Sound recovery.

Puget Sound recovery is a goal of VISION 2050, the growth management, transportation, economic development, and environmental strategy for the central Puget Sound region. VISION 2050's Regional Growth Strategy focuses future population and employment growth in urban growth areas, and more specifically in centers and transit station areas. The many multicounty planning policies and actions in VISION 2050 address improving water quality, protecting habitat, enhancing tree canopy, providing equitable access to open space, reducing climate impacts, and many other issues related to Puget Sound recovery.

6PPD-Quinone Found Lethal to Puget Sound's Coho Salmon

When it rains, stormwater flushes many pollutants on roads, including bits of aging vehicle tires, into neighboring streams. Researchers have recently found that 6PPD-quinone, related to a tire chemical that keeps them from breaking down too quickly, is lethal to coho and other species. In some Puget Sound streams, most of the coho salmon die before they can spawn. One solution is to change the composition of the tires to make them less toxic. Another is to treat stormwater before it reaches water bodies. Green stormwater infrastructure can improve water quality and promote salmon survival, addressing the effects of 6PPD-quinone and thousands of other pollutants found in stormwater. The science and related regulation will continue to evolve.



Multiple Benefit Community Facilities

Stormwater parks have many benefits for the community and environment. A moderate sized stormwater park can treat stormwater from an entire basin, which could be hundreds of acres. Regional stormwater treatment facilities can be more cost effective for reducing pollutants in stormwater than distributed facilities like rain gardens or bioretention facilities.[1]

Cost effectiveness aside, research has shown that regional stormwater treatment can be challenging due to dilution by large quantities of stormwater. The Stormwater Management Manual for Western Washington (SMMWW) [2] notes that it is generally more cost-effective to use Source Control BMPs to prevent pollutants from entering runoff than to use Runoff Treatment BMPs to remove pollutants. However, since Source Control BMPs cannot prevent all impacts, some combination of measures will always be needed.

A facility that can provide multiple public benefits is especially useful in places where land is at a premium. Some of the benefits that stormwater parks can provide communities are listed below. These benefits have been documented in the fact sheets in Appendix A.

- Stormwater parks can help address equity when built in communities without access to open space and recreational opportunities.
- Park renovation can provide the opportunity to turn a portion of a park into a stormwater park. In addition to stormwater management, the stormwater facility can be designed to provide green space and wildlife habitat.
- Stormwater facility renovation can provide the opportunity to add recreational amenities. Trails, benches, art, and wildlife viewing areas are common amenities added to renovated stormwater facilities.
- Stormwater parks can provide educational opportunities on protecting water quality, habitat, and other environmental issues.
- By helping to improve water quality and fish habitat, stormwater parks support Tribal treaty rights.
- Stormwater parks can build resilience to climate change by increasing green space and stormwater management.
- Because they provide multiple services, stormwater parks can be funded by multiple sources, including grants from many agencies.

Cromwell Park, City of Shoreline

The area downstream of Cromwell Park had water quality and flooding issues, so a regional stormwater retrofit facility was proposed for Cromwell Park during a major renovation of the park. The stormwater facility type chosen was a constructed wetland, which cleans stormwater with plants and soils and adds an additional natural feature with native plants to the park. Visitors enjoy birdwatching and the walking trails that were added around and through the wetland.

[1] *Paradigm Environmental. 2022. Water Quality Benefits Evaluation – Phase 2 SUSTAIN Model Development (821-TM1). Prepared for King County Wastewater Treatment Division by Herrera Environmental Consultants. [Draft Report]*

[2] *Washington State Department of Ecology. 2019. Stormwater Management Manual for Western Washington. Volume 1, Chapter 1, Page 57.*

Each stormwater park will have a unique set of benefits and could include benefits other than those listed above. The concept of stormwater parks can be broadened to other types of multiple benefit infrastructure such as floodplain parks, stormwater trails, and resilience parks, which are parks that can help address and mitigate the effects of climate change.

Madison Valley Stormwater Improvements, City of Seattle

The Madison Valley stormwater improvement project has two locations in Seattle's Madison Valley. Together, the two sites greatly reduced potential for sewer backups and stormwater flooding while creating new open space for the community. These areas serve as attractive open spaces for the community with native plants and trees, walking paths, play areas, and art.

Promoting Development of New Stormwater Parks

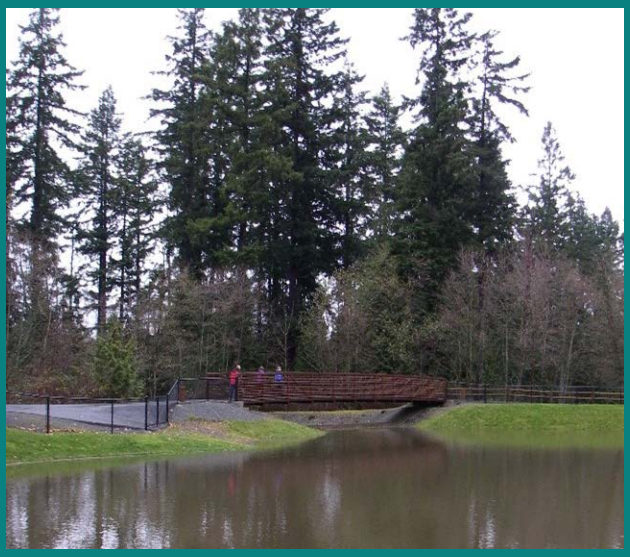
As can be seen in some of the examples presented throughout this document, multi-benefit facilities like stormwater parks are not a new idea. Although they have precedence and are cost-effective, stormwater parks are not yet a common design solution to providing stormwater treatment/attenuation and public open space. If stormwater parks became a widespread approach for providing stormwater management and recreation, the benefits described above will accrue at a large scale.

PSRC was awarded a Puget Sound National Estuary Program grant to provide guidance related to the siting and design of new stormwater parks. The following are the main objectives of the Stormwater Parks project:

- Share lessons learned from already-built stormwater parks
- Identify opportunities for stormwater parks regionwide and provide technical assistance for the planning of six new stormwater parks
- Develop a guidance document on planning stormwater parks

Lakemont Community Park, City of Bellevue

One of the oldest stormwater parks in the area, the Lakemont facility was built by the developer as part of the agreement to develop the Lakemont community in the 1990s. The park is 16 acres and features a play area, two picnic shelters, a basketball court, two tennis courts, a skate bowl, trails, restrooms, and a softball field. The stormwater management system reduces flooding and helps protect Lewis Creek and Lake Sammamish from pollution.



Existing Stormwater Parks in the Central Puget Sound Region

The region already has several excellent examples of stormwater parks. These stormwater parks were developed as a response to problems communities were experiencing, such as flooding, degraded water quality, and failing or inadequate infrastructure. To document information and learn lessons from already-built stormwater parks, PSRC, in consultation with jurisdiction staff, developed the following 7 fact sheets:

- Arlington Stormwater Wetland Park
- Bellevue Lakemont Community Park
- Kitsap County Manchester Stormwater Park
- Poulsbo Mountain Aire Stormwater Pond and Trails
- Seattle Madison Valley Stormwater Improvements
- Shoreline Cromwell Park
- Tacoma Point Defiance Stormwater Treatment Facility

Jurisdiction staff were asked about challenges and lessons learned from building their stormwater parks. These lessons were incorporated throughout this guidance document. They are also summarized in Appendix D and documented in the Summary of Stormwater Park Fact Sheets in Appendix A.

The region's stormwater parks vary considerably in size, design, cost, and function. This suggests that stormwater parks can be sited in many locations. Key attributes of the stormwater parks reveal opportunities, constraints, and the balancing of stormwater and recreational project objectives.

Land availability can represent a substantial portion of stormwater park project costs. Project costs can be minimized when a facility is sited on jurisdiction-owned land. Notwithstanding this, land acquisition may provide additional opportunities to find sites that are ideally situated within a drainage basin and enhance the equitable distribution of park space across a jurisdiction. With the right design, a stormwater park can be built on a variety of sites. As shown in Table 1, sites can range from a few hundred square feet to 10 acres or more.

Table 1. Key Attributes for Central Puget Sound Stormwater Parks

	Arlington	Bellevue Lakemount	Kitsap Co Manchester	Poulsbo Mountain Aire	Seattle Madison Valley	Shoreline Cromwell	Tacoma Point Defiance
Treatment	✓	✓	✓	✓		✓	✓
Flow/Flood Control	✓	✓	✓	✓	✓	✓	
Added to Existing Park					Lake WA Park facility	✓	✓
Type of Recreation	Trails, water access, wildlife viewing, dog park	Trails, play area, courts, skate bowl, baseball	Community gathering space/lawn	Trails	Trails, gathering spaces, play areas	Trails, wildlife viewing	Walking paths, education, visual interest
Stormwater Facility Size	9 acres	5 acres	0.5 acre	2 acres	0.84 acre	1.33 acres	0.13 acre
Drainage Basin Area	280 acres	215 acres	100 acres	39 acres	Not Available[3]	109 acres	754 acres
Ratio Facility to Basin Size	0.032	0.023	0.005	0.051	Not Available[3]	0.012	0.0002
Cost (Million $)[1]	$1.33	Not Available[2]	$2.30	Not Available[2]	$34.50	$1.60	$2.46
Cost per Acre Treated	$4,732	Not Available[2]	$23,000	Not Available[2]	Not Available[3]	$14,678	$3,269

[1] Does not include land costs, except Seattle facilities.

[2] The Bellevue and Poulsbo stormwater facilities were funded by the developers.

[3] Madison Valley treats 4 million gallons per day. The drainage basin area managed is not available.

In many cases, smaller sites will require increased engineering design and construction to provide meaningful stormwater management. Where there is more land available for a regional facility, a less engineered, and typically less expensive design, is possible, as evidenced by the 9-acre Arlington Stormwater Wetland Park.

Many jurisdictions do not have ample land to dedicate to a large regional facility. In that case a more engineered solution may be needed, which can be highly effective, but may be more costly to design and build. The 0.13-acre Tacoma Point Defiance Stormwater Treatment Facility is a good example of a smaller and cost-effective facility. While the Arlington Stormwater Wetland Park had a lower total construction cost, the Point Defiance Stormwater Treatment Facility treats stormwater at a lower cost per acre. The Bellevue and Poulsbo facilities were funded by developers, so the cities incurred no direct design and construction costs. When planning and permitting subdivisions, jurisdictions may be able to take advantage of similar opportunities.

While important to understand, direct costs should not be the only factor taken into consideration. The facility's potential benefits to the community and environment should also be taken in account, particularly communities that lack recreational amenities. Inclusive public engagement in the planning and design process is critical and can further increase the value of the stormwater park to the community.

Point Defiance Stormwater Treatment Facility, City of Tacoma

This facility (5,500 square feet), on a steep slope at the northeast entrance of Point Defiance Park, treats stormwater from the basin uphill (754 acres) before dispersing it into Puget Sound. It consists of a series of cascade pools, troughs, and treatment cells and an underdrain system. The facility discharges treated water into a bioswale and then Puget Sound. The facility is a six-pool waterfall that provides visual interest to the entrance of the park.

Planning Stormwater Parks

This section describes suggested steps for planning stormwater parks. While the planning and development of many stormwater parks may not be strictly linear, these steps provide helpful considerations. It does not include detailed instructions for feasibility assessment and design, nor is it a comprehensive guide to planning stormwater parks. Professionals, whether in-house staff or consultants, are needed to complete this work. An early step could be to look at existing facilities to see if they are stormwater parks. Lessons learned from planning and maintaining those facilities could inform the planning of new stormwater parks.

Step 1: Assemble Interdisciplinary Project Team

Stormwater parks provide multiple types of services and infrastructure on the same site, thus an interdisciplinary approach to planning them works best. Staff from the following departments are often involved in planning stormwater parks:

- **Public works/stormwater/maintenance** staff are crucial for siting, assessing feasibility, determining long-term maintenance needs, and designing the stormwater park.
- **Parks and recreation** staff are needed to plan the recreational components. This is particularly true if the stormwater park is to be built on parkland. Park staff will likely have a good idea of what types of recreation the community wants.
- **Natural resources** staff can help identify ecosystem functions, needs, and solutions.
- **Short and long-range planning** staff are needed to help with identifying opportunities for stormwater park sites, verifying that a stormwater park is an allowed use in the zoning code (and addressing that barrier if needed), permitting, working with developers, and integrating policies and projects into plans.
- **Transportation planners and engineers** can help to identify transportation facilities lacking up-to-date stormwater management and opportunities for adding stormwater retrofits to transportation projects. Given that the transportation system is one of the largest contributors to water and habitat impacts by blocking fish passage and polluting and diverting water, involving transportation staff in developing solutions is key to addressing Puget Sound recovery.
- **Community engagement specialists** can often be found in multiple departments. As discussed in Step 4, community engagement is crucial in creating a stormwater park that meets the needs of the community.

One Water

One Water is the emphasis that all water has value, encouraging an interdisciplinary approach to working together to prevent and solve water challenges.

Other departments such as the executive, city/county council, human services, and neighborhoods can also be helpful. In some cases, it may be appropriate to bring in outside partners such as Tribes, staff from a jurisdiction or school in the watershed, or agencies with facilities in the watershed, such as the Washington State Department of Transportation. A Community Benefit Public Private Partnership (CBP3) is an innovative approach that can help with staff capacity issues and be applied to stormwater parks and green stormwater infrastucture.

If capacity to plan for a stormwater park does not exist in-house, a jurisdiction may want to hire a consultant to help with community engagement, siting, feasibility assessment, design, or other work. See Step 6 for funding options to help with early planning and Appendix F for a sample request for proposals scope of work for stormwater park planning and design consultant services. Integrating proposed stormwater park projects into functional, comprehensive, and capital facilities plans can help to secure funding.

Step 2: Integrate Equity

Advancing racial and social equity is an important goal for central Puget Sound jurisdictions and is reflected throughout VISION 2050. PSRC has many resources in planning for equity. Equity and inclusive community engagement should be integrated into all stages of planning, constructing, programming, and maintaining stormwater parks. See Step 4 for strategies specific to community engagement. Greenprint Partners' Equity Guide for Green Stormwater Infrastructure Practitioners is a comprehensive guide to help incorporate equity into green infrastructure projects and programs. Adding art that reflects the community's cultural diversity can be included in stormwater park plans.

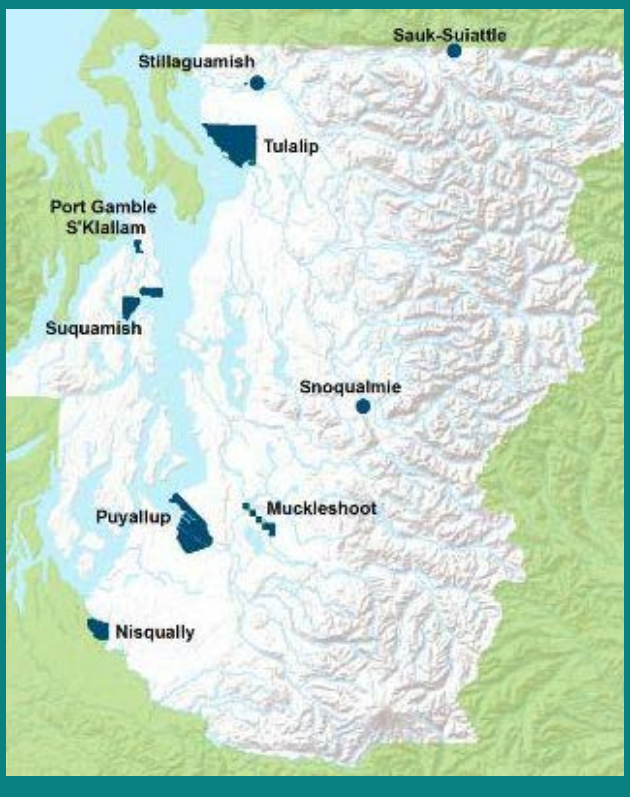
One important strategy for advancing racial and social equity is to ensure that all communities have easy access to parks and open space. Stormwater parks present an opportunity for jurisdictions to address discrepancies in access to parks and open space by siting new stormwater parks in areas of the community that are currently underserved. Gaps in access to parks and open space should be identified in a jurisdiction's comprehensive plan and parks, recreation and open space plan. Other resources for identifying park gaps include:

- PSRC's Regional Open Space Conservation Plan (Chapter 5 and Appendix E)
- The Trust for Public Land's ParkScore mapper

Tribal Treaty Rights

Tribes are important partners in Puget Sound recovery. Under treaties signed with the United States in the 1850s, many Tribes in the region ceded, frequently under duress, most of the land in Puget Sound region and state of Washington. In exchange Tribes reserved fishing and hunting rights including off-reservation rights to fish in all usual and accustomed fishing grounds and the right to hunt and gather on open and unclaimed lands. Federal courts have interpreted the nature and extent of those retained rights and have ruled that sovereign Tribes, along with the state of Washington, have co-management responsibility and authority over fish and wildlife resources. Protecting and improving water quality with facilities such as stormwater parks helps to uphold tribal treaty rights.

Central Puget Sound Coast Salish Tribes



Stormwater parks also present an opportunity to support Coast Salish Tribes and their treaty rights. By protecting and improving water quality and hydrology, stormwater parks contribute to better conditions for salmon, a crucial cultural, economic, and food resource for Tribes.

Park development and renovation has the potential to displace nearby residents if the project results in increased rents and property values. Demand for housing near parks is one reason why all communities should have walkable access to high-quality parks and open space. The risk of displacement is not a reason to abandon a park project as measures can be taken to prevent displacement. PSRC's displacement risk mapping tool identifies areas where residents and businesses are at greater risk of displacement. PolicyLink and Great Communities Collaborative also have lists of tools to help prevent displacement.

Step 3: Select Site

Several criteria should be considered when selecting a site for a stormwater park. These include:

- NPDES stormwater planning
- Pollutant loading
- Salmon presence
- Parcel, drainage basin, and existing conveyance infrastructure
- Equitable park access
- Community engagement and support
- Land ownership
- Opportunity for multiple benefits

The above is not a comprehensive list as there may be other criteria that can be used to further specific local goals and respond to current conditions. Each criterion is expressed in greater detail below. A siting study template developed by The Nature Conservancy can also help with site selection.

NPDES Stormwater Planning: Jurisdictions have, or are in the process of, identifying priority basins for stormwater retrofits. This planning is a requirement of NPDES permits. A park site or other public land in the right area of a drainage basin can be an ideal resource to be included in basin-wide stormwater planning objectives while constructing physical park improvements.

Pollutant Loading: To ensure stormwater infrastructure is being added to areas in need, new stormwater parks can be located to address basins with a medium to high level of pollutant loading. Ecology's Water Quality Atlas and The Nature Conservancy's Stormwater Heatmap can provide this information. The stormwater heatmap incorporates data such as land use, land cover, and age of development to assess hydrology and water quality.

Salmon Presence: To support Puget Sound recovery and tribal treaty rights, new stormwater parks can be located in basins that drains to salmon bearing water bodies and designed to remove pollutants that harm salmon. The Washington Department of Fish and Wildlife's SalmonScape mapping tool, which provides fish distribution data for all salmon species, can be used as a data source for this. Ecology's 6PPD in Road Runoff report provides information on salmon, transportation facilities, and 6PPD. Maps that highlight hot spots for 6PPD may be available soon.

Parcel, Drainage Basin, and Existing Conveyance Infrastructure: To optimize stormwater management, the following information is needed:

- The size of the drainage basin
- The location of the parcel within the drainage basin
- Characteristics of the parcel (i.e., size and presence of critical areas, soils and infiltration potential)
- Existing conveyance infrastructure
- History of flooding

Basins that are too small may not be cost effective for regional facilities. A threshold of 20 acres is sometimes used as a minimum basin size. Smaller areas may be addressed with other strategies, such as smaller scale green stormwater infrastructure. Additionally, a stormwater park should be located low in the basin, near the discharge point. This information could come from the ArcGIS hydrology toolset or the Washington State Department of Ecology's Watershed Characterization tool. Note that if stormwater can't be adequately managed lower in the basin, facilities added higher in the basin can help to protect some of the downstream area.

Equitable Park Access: Stormwater parks can help advance equity when they provide park space, open space, or trail access in an underserved community. See Step 2 for resources to identify gaps in park and recreational access. More information on park gaps can also be found in PSRC's Regional Open Space Conservation Plan.

Community Engagement and Support: Early and continuous community engagement can help gain community support for a stormwater park, as well as ensure that the park meets the community's needs and wants. In order to ensure an equitable approach, the project team should identify impacted communities and develop a strategy to engage with these groups. If the community has an incompatible vision for the area, it may not be the best place for a stormwater park.

Land Ownership: Unless there is a partnership with a private landowner or another public landowner, the jurisdiction may need to own the land for a stormwater park. Existing park land can be a good option for siting new stormwater parks, though it is necessary to coordinate with the Parks Department early in the process. If land has not yet been acquired, these criteria can be used to prioritize land for acquisition. In this case, parcel acquisition will need to be added to the capital facilities plan so that it is competitive with other needs of the jurisdiction. Land owned by the Washington State Department of Transportation, schools, or other public entities may be made available if partnerships are developed.

Private Property

Private property owners can participate in Puget Sound recovery when they include a regional stormwater facility on their property. These public private partnerships can be incentivized by jurisdictions. Building Green Cities provides guidance on how to develop a program to incentivize developers to build more green stormwater infrastructure in their development. While stormwater parks on private land may not be public parks, the public can be given access to the facility. This provides the greatest community benefit and addresses potential equity concerns.

Opportunity for Multiple Benefits: Stormwater parks present an opportunity to accelerate the design and construction of projects that provide multiple benefits to a community. Puyallup's Wildwood Park is an example of the use of park space to facilitate improvements to adjacent streets and the park. The project would provide stormwater treatment for a previously untreated adjacent road through the use of bioretention facilities as well as master planning for the park, which would include parking lot and pedestrian improvements.

Other Issues to consider include climate resilience, flooding (FEMA funds), fish passage barriers, and transportation project opportunities (WSDOT funds). PSRC conducted a site suitability analysis for stormwater parks regionwide. While jurisdictions may have better local data to conduct this type of analysis, PSRC can share the results of the regional analysis with jurisdictions.

Step 4: Engage community

Community engagement is critical in ensuring that a stormwater park is a valuable asset to the community. PSRC has guidance on equitable engagement that is relevant to planning stormwater parks. If adequate capacity to conduct community engagement is not available in-house, a consultant can help with many aspects of community engagement, from developing a community engagement plan to organizing community meetings.

Pre-project Engagement

Conducting early and ongoing engagement allows a jurisdiction to bring in a community's preferences from earlier meetings and outreach efforts. If this has not yet happened, building relationships and trust with the community is a step that should happen before project specifics are discussed.

Project Scoping

Community engagement should continue during project scoping, when the community's interests in types of recreation, ecosystem services, general park characteristics, and aesthetics are discussed and confirmed. Stormwater parks present an opportunity to include educational components about stormwater, water quality, and ecosystem health. Ideas that the community has for these educational components, as well as park design, programming, and art can also be discussed.

Engagement Techniques

A few ways to engage the community throughout the process include:

- Community meetings
- Online meetings
- Surveys
- Onsite kiosk with information
- Onsite public tour or information table
- Project website
- Social media

Manchester Stormwater Park, Kitsap County

The park treats stormwater from roads, parking lots, and residential and commercial properties in the small Kitsap County community of Manchester. Treatment cells around the perimeter of the park process stormwater through engineered filter media and plants. A spiral rain garden intercepts flows from groundwater and runoff and treats it through a bioretention soil mix and plants in the rain garden. The raingarden extends the life of the more expensive engineered treatment media in the treatment cells. Treated water is discharged to Puget Sound. The stormwater park provides a community gathering space for farmers' markets, celebrations, relaxation, and education. Public engagement was key to the success of this project and helped shape the design of the park. The community wanted a gathering space and interpretive signage on environmental solutions.

Reviewing Alternatives and Impacts

Once information on community interests, site constraints, etc. are compiled, alternatives for different park concepts can be developed. These concepts should be shared with the community, and, in turn, their input should be considered during alternative selection and design refinement. Letting the community know how their input was taken into consideration at each step helps to build trust. Potential impacts during construction or operation of the stormwater park should also be discussed, followed by options for mitigating any impacts.

Construction, Operation, Maintenance, and Programming

Additional engagement to discuss construction, operation, and maintenance should occur. If not already discussed, ideas for activating the park through programming can be generated by the community. Additionally, community groups may want to help with the maintenance of the stormwater park, as occurs in the Arlington Stormwater Wetland Park.

Kitsap County Bucklin/Tracyton Regional Stormwater Facility

Kitsap County is studying the feasibility of a new 0.8-acre stormwater park in the Silverdale community to provide treatment for 72.5 acres of urban development. In addition to stormwater treatment, the park may include recreational components, such as walking paths, benches, shelters, or enhanced landscaping. The project team developed a survey for community members to share their ideas for the park, as well as hosted a virtual open house to share potential park concepts. See below for an example of a meeting invitation flyer. Visit the project website to learn more.

Stormwater Wetland Park, City of Arlington

Arlington's Stormwater Wetland Park contains a constructed wetland that not only treats stormwater from Old Town Arlington, but cleans backwash water from the city's water treatment plant and reclaimed water from the city's water reclamation facility before infiltrating or discharging it into the Stillaguamish River. Public recreation features on the site include shoreline access, wildlife viewing areas, water features, a 4,200-foot trail network, dog park, and picnic tables. Monitoring is provided by a combination of city staff and volunteers.

Step 5: Develop Alternatives and Designs

The development of alternatives and designs for stormwater parks depends on many factors, such as the size of the site, the site's hydrology, and any critical areas located within or adjacent to the site. Understanding these important factors can help in selecting a design that meets the stormwater and recreational goals of the project, while still functioning within the constraints of a particular site. A feasibility assessment is a critical tool in understanding these factors.

The Stormwater Parks Planning Checklist is a helpful tool to inform the development of alternatives and designs (see Appendix C). Completing the checklist will provide in depth information about a potential site, including drainage area, existing stormwater management, the proposed retrofit, and site constraints.

Information to Collect

Necessary information to gather during this step includes:

- Site survey
- GIS data (topography, utilities, critical areas, soils, impervious coverage, zoning)
- Drainage area size
- Existing stormwater infrastructure
- Site drawings
- Site constraints
- Summary of community engagement efforts
- Geotechnical exploration

While developing alternatives and designs, it is also important to consider the maintenance needs of the new facility. Partnering with maintenance staff early in this process is important to inform the design and avoid or minimize any potential maintenance issues. Maintenance agreements can aid in relieving issues and uncertainty by clearly delineating roles and responsibilities.

As mentioned earlier in the document, outreach with the community about interests in types of recreation, ecosystem services, general park aesthetics, and education is an important part of the process. Also, important to consider is the cultural relationship between the project and the site and how a project can address and honor tribal, historical, or cultural connections.

Design solutions can help to address the potential that unhoused people may attempt to reside in the stormwater park. Designs should include interpretive signage that inform visitors and unhoused persons of the important role that the stormwater structure has in treating stormwater within the basin. Unhoused persons should be treated with respect, but also made aware that it is unacceptable to live within a stormwater BMP. Failure to keep people out of stormwater BMPs will result in diminished effectiveness and the potential need to reconstruct the facilities.

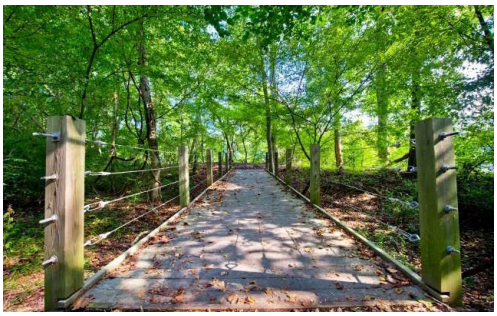
Establishing a process for how the community input will be reviewed and incorporated by the project team is important to building trust with the community and ensuring that a new stormwater park is consistent with the desires of the community. Community planners or other project team members with outreach experience can help work with engineers to incorporate expressed community preferences into the design.

The tables that follow present different options for recreation, stormwater control, and art/education displays that could be incorporated in the design of a new stormwater park. General space and maintenance requirements, as well as cost for each element are provided expressed in terms of low, medium, and high. These tables are not intended to provide exact figures for space, maintenance, and cost, but rather to provide comparison across the different options. Professionals are needed to provide exact space needs, maintenance requirements, and cost for a particular stormwater park.

Most stormwater parks can successfully integrate recreation, public education, and stormwater management into a cohesive design. Some stormwater BMPs provide enhanced water quality treatment while others BMPs provide flow control functions. Designs generally will include a combination of both flow control and treatment BMPs.

6ppd-quinone is an industrial chemical that is used as an antioxidant in rubber tires. Research is ongoing as to the stormwater BMPs that will provide treatment for this pollutant and our understanding continues to evolve. Research is suggesting that bioretention facilities will be a source for 6ppd-quinone treatment. After additional research and testing, other proprietary systems may be recognized as providing 6ppd-quinone treatment as well.

Table 2. Recreation Options

Type/Photo	Space Needs	Maintenance Considerations	Cost Level	Other Considerations
Trails 	Medium	Medium	$$	Can be linked to existing community trail networks.
Playground 	Medium	Medium	$$	Provide a variety of equipment to meet a variety of user needs.

Type/Photo	Space Needs	Maintenance Considerations	Cost Level	Other Considerations
Nature Play 	Low	Medium	$$	Can present barriers to accessibility.
Athletic Fields 	High	Medium	$$$	Multiple use benefits.
Picnic Tables/Shelter 	Low	Low	$	Could include art/ educational elements.
Wildlife Viewing 	Low	Low	$	Can combine with interpretive signage.
Pickleball Court 	Medium (standard dimensions are 20' x 44')	Medium	$$	Could use pervious pavement. Make sure that the court is free of ponding water.

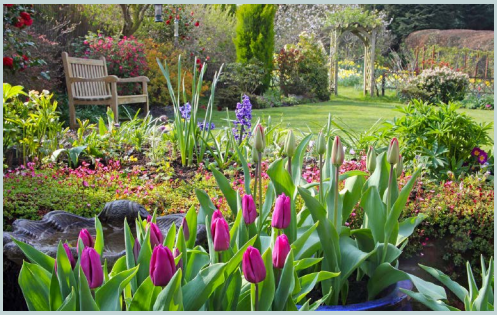
Type/Photo	Space Needs	Maintenance Considerations	Cost Level	Other Considerations
Bike Playground 	Medium	Medium	$$	
Community Gardens 	Medium	Low	$	Garden maintenance can be performed by gardeners.
Pollinator Gardens 	Low	Low	$	Garden maintenance can be performed by volunteers/park stewards.

Table 3. Stormwater Solutions

Type/Photo	Space Needs	Maintenance Considerations	Cost Level (Construction)	Stormwater Benefits	Description / Other Considerations
Constructed Wetlands 	High	Low	$	Enhanced water quality treatment Flow control (optional)	Wetlands which are artificially constructed to treat stormwater through natural filtration functions.

[6] *Photograph represents a conceptual design for Kitsap County Bucklin Hill/Tracyton Stormwater Park.*

Type/Photo	Space Needs	Maintenance Considerations	Cost Level (Construction)	Stormwater Benefits	Description / Other Considerations
Modular Wetlands 	Low	High	$$	Enhanced water quality treatment	Series of underground chambers designed to treat and ultimately discharge stormwater. Landscaping is present on the surface. Proprietary system.
Biopods 	Low	Medium	$$	Enhanced water quality treatment Phosphorus treatment	Units designed to capture and treat stormwater through a media and ultimately discharged. A variety of landscaping options can be present on the surface. Proprietary system.
Bioretention Cells 	Medium	Medium	$$	Enhanced water quality treatment Phosphorus treatment	Landscaped cells that are designed to capture and treat stormwater runoff.
Vaults 	High	Low	$$$	Flow control Basic water quality (optional)	Underground structures that are designed for stormwater detention and retention, often used in sites where there is not enough surface space on the site to cost-effectively construct stormwater controls.

Type/Photo	Space Needs	Maintenance Considerations	Cost Level (Construction)	Stormwater Benefits	Description / Other Considerations
Chambers 	High	Low	$$	Flow control	Underground structures that are designed for stormwater detention and retention, often used in sites where there is not enough surface space on the site to cost-effectively construct stormwater controls.
Trees 	Medium	Low	$	Flow control (limited)	Trees can provide stormwater control by capturing rainwater in their leaves (to be evaporated) and their roots (to be infiltrated by soil), all reducing the amount of runoff
Pervious Concrete 	Low	Medium	$$$	Flow control	A form of rigid paving that allows water to flow through it into a subsurface gallery and ultimately the soil, thereby reducing stormwater runoff.
Rainwater Cisterns 	High (No Pumps) High (Rainwater Harvesting, Pumps)	Low (No Pumps) High (Rainwater Harvesting, Pumps)	$$$ (No Pumps) $$$ (Rainwater Harvesting, Pumps)	Flow control	Structures that are designed to capture and hold stormwater falling on the roof structure for reuse.

Table 4. Art/Education Options

Type/Photo	Space Needs	Maintenance Considerations	Cost Level	Description
Interpretive Signage 	Low	Low	$	Opportunity for community outreach and collaboration with local artists. Can include in multiple languages.
Sculptures 	Medium	Low	$$$	Opportunity for collaboration with local artists. Opportunity for stormwater art.
Decorative Pavement/Inlays 	Low	Low	$	Opportunity for collaboration with local artists. Opportunity for educational or stormwater related displays.
Shape of Landforms/Facilities[6] 	Medium	Medium	$$	Opportunity to use the land and/or park space as an educational tool.

Type/Photo	Space Needs	Maintenance Considerations	Cost Level	Description
Outdoor Learning Spaces 	Medium	Medium	$$	Variety of options available; can be designed to fit existing park space. Opportunity for partnerships with local schools, volunteer groups.
Partnered Programming 	Medium	Low	$	Can be incorporated into existing park space. Opportunity for educational events.

Step 6: Fund

A cost estimate should be developed for the stormwater park once the concept alternative has been selected and has been designed to at least 10%. Funding is an important element to the construction of a stormwater park. The purpose of a 10% or greater design is to allow funding entities to have a reasonable understanding for the cost of the park. While funding can be pursued in advance of a 10% design, there may need to be a large contingency added to a funding exploration to account for unknown site and project challenges. The project and estimated cost should be added to relevant functional plans, the comprehensive plan, the capital facilities plan, and other project lists as applicable. As previously discussed, stormwater parks are interdisciplinary in nature, therefore it is likely that a stormwater park may show up as a project for multiple departments in a jurisdiction and be funded by multiple sources. The potential for leveraging many sources of funding makes stormwater parks unique from other types of park or infrastructure projects. A phased approach to the project can help with project funding and implementation and allow for expanding function in future phases.

Some funding sources for stormwater parks are listed below. Less flexible funding sources may have constraints on what elements they are able to fund, so understanding those constraints early in the process and documenting costs for each component can help in assembling a funding package.

- **Jurisdiction General Funds** are flexible and may be used for priorities that don't have other funding sources.
- **Stormwater Utility Funds** must typically be used for the stormwater aspects of the stormwater park. Beyond construction and maintenance, they can often be used for community engagement, education, and planning.
- Some **county funding sources** may be used for stormwater parks. In King County and potentially other counties, Conservation Futures Taxes can help fund stormwater parks that use green stormwater infrastructure and features that function and look like natural systems.

- Many **Washington State Recreation and Conservation Office (RCO)** grant programs could help fund planning and development of stormwater parks. See Appendix G for more information on RCO funding opportunities. Programs include:
  - The Planning for Recreation Access grant program funds planning projects in communities that lack adequate access to outdoor recreation opportunities. Grants may be used to support planning, community engagement, and collaboration between local governments, community-based organizations, and residents to define outdoor recreation needs, prioritize investments to address those needs, and prepare projects for funding.
  - The Land and Water Conservation Fund provides funding to preserve and develop outdoor recreation resources, including parks and trails.
  - The Washington Wildlife and Recreation Program provides funding for a broad range of land protection and outdoor recreation, including local and state parks, trails, water access, conservation, and restoration.
  - The Youth Athletic Facilities program provides grants to buy land and develop or renovate outdoor athletic facilities such as ball fields, courts, swimming pools, mountain bike tracks, and skate parks that serve youth.

- The **Washington State Department of Ecology** Water Quality Combined Funding Program provides water quality funding opportunities by funding source, funding category, and project type. With a single application process and funding list, Ecology can create funding packages that meet the financial needs of project applicants. See Appendix G for more information on Ecology's funding opportunities.

- The **Washington State Department of Ecology** Stormwater Capacity Grants Program awards non competitive grants to Phase I and Phase II NPDES municipal permittees. These grants are to fund activities and equipment necessary for permit implementation. See Appendix G for more information on Ecology's funding opportunities.

- The **Washington State Department of Ecology** Stormwater Grants of Regional or Statewide Significance Program awards grants on a competitive basis to Phase I and Phase II NPDES municipal permittees. These grants are to fund projects that would provide benefits to more than one permittee. See Appendix G for more information on Ecology's funding opportunities.

- The **Washington State Department of Commerce** Community Economic Revitalization Board (CERB) provides funding to local governments and federally-recognized Tribes for public infrastructure which supports private business growth and expansion. Eligible projects include domestic and industrial water, stormwater, wastewater, public buildings, telecommunications, and port facilities.

- **Public Private Partnerships:** As described in Step 3, private property owners and developers can include a stormwater park on their project site. If a green/regional stormwater infrastructure incentive program is not already in place, the jurisdiction may need to negotiate with the developer or private property owner to allocate project costs and responsibilities. The private entity may provide the land and facility development in exchange for the right to develop and to meet their project stormwater requirements. Sometimes the facility is turned over to the jurisdiction to operate and maintain. This was the case with the Bellevue and Poulsbo stormwater park examples.
- The Environmental Protection Agency's **National Estuary Program** provides grant funding for projects that support the recovery of Puget Sound. A variety of stormwater projects have been funded, including research, green infrastructure, and pilot projects.

The Department of Commerce compiled funding sources in their Summary of Some Grant and Loan Programs for Drinking Water and Wastewater Projects document. This document identifies funding sources for planning, pre-construction, construction, design/construction, and emergency management for various water quality projects, including stormwater facilities.

Some private-sector organizations, such as Starbucks and the Sounders, help with park funding. Non-governmental organizations that help with park development and funding include Trust for Public Land and Seattle Parks Foundation. Stormwater parks located on school property may be eligible for funding sources that target schools and environmental education.

Mountain Aire Stormwater Pond and Trails, City of Poulsbo

This public private partnership developed out of the need to provide stormwater and sewer facilities for a new Quadrant Homes housing development, Mountain Aire. It also serves an additional development called Poulsbo Meadows. The development required mitigation for routing the sewer connection through part of a wetland and stream buffer. The city worked with the developer on a joint solution, resulting in a sewer connection and a stormwater pond that manages stormwater from the developments. Buffer enhancement and mitigation were also part of this project. The project was turned into a community amenity by adding trails and attractive vegetation around the pond and surrounding area.

Post Construction Operations and Maintenance

Quality operations and maintenance is important to extend the life of the new stormwater park to ensure it continues to provide high quality stormwater treatment and recreational opportunities for the community. The post-construction operations and maintenance requirements and cost are important considerations for a jurisdiction to take into account when planning a stormwater park. There are several operations and maintenance factors for a jurisdiction to consider, such as:

- **Maintenance Responsibility:** Which department will maintain the facility? Having a clear arrangement that defines maintenance roles and responsibilities will reduce confusion and ensure consistent maintenance is performed. It is also important to review the staffing requirements and training for long term operations and maintenance with a jurisdiction's current staffing availability. This will help jurisdictions decide whether a private contract for maintenance of the facility may be necessary.
- **Proprietary System:** Some stormwater solutions are proprietary, meaning that operations or maintenance is performed by the manufacturer. Some manufacturers may train jurisdiction staff to perform operations and maintenance. The role of the manufacturer is important for the jurisdiction to consider while considering an operations and maintenance plan.
- **Equipment Needed:** Different stormwater solutions may require different equipment for maintenance and operations. The equipment requirements of a particular system are important for a jurisdiction to understand to determine what equipment may need to be purchased or rented.

Specific maintenance information and requirements can also be found on the civil design for a particular project and on cut sheets provided by product manufacturers. Additionally, the Department of Ecology published a guidance document, Western Washington Low Impact Development (LID) Operation and Maintenance (O&M), which provides recommendations on LID operations and maintenance. More information regarding operations and maintenance recommendations for stormwater solutions mentioned in Table 3 can be found in Appendix H.

Conclusion

Bringing the building of stormwater parks to scale in the region can help meet the growing need for both stormwater management and recreation. To accomplish this, jurisdictions can think proactively about creating opportunities for new stormwater parks on public land, adding regional stormwater facilities to portions of existing parks, adding recreational components to stormwater facilities, and working with developers and private and public property owners to add stormwater parks to their sites. While many stormwater parks may be sited on park land, the principles covered in this document apply to stormwater parks on all locations. These cost-effective solutions will play a crucial role in improving the health of communities and Puget Sound.

Appendices

Appendix A. Existing Stormwater Park Fact Sheets

Central Puget Sound Stormwater Parks
January 2021

Puget Sound Regional Council

Stormwater Parks for Water Quality and Human Health

This report was prepared by the Puget Sound Regional Council.

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info@psrc.org | www.psrc.org

Puget Sound Regional Council

STORMWATER WETLAND PARK

City of Arlington

Facility type Constructed wetlands providing stormwater treatment and flow/flood control, wastewater treatment, trails, and other recreational opportunities

Construction date Construction completed in 2011

Facility size 21-acre park with a 9-acre wetland

Size of basin managed 280 acres (Old Town Arlington)

Facility Description

Arlington's Stormwater Wetland Park contains a constructed wetland that not only treats stormwater from Old Town Arlington, but clean backwash water from the City's water treatment plant, and reclaimed water from the City's Water Reclamation Facility before infiltrating or discharging into the Stillaguamish River. The wetlands consist of a series of wetland cells and weirs that improve water quality through infiltration, aeration, and vegetative uptake. Along with providing water treatment, the 9 acres of different wetlands types provide multiple habitat niches.

Public recreation features on the site include shoreline access, wildlife viewing areas, water features, a 4,200-foot trail network, dog park, and picnic tables. The facility also provides for educational opportunities to instruct the public on proper stormwater management and control practices, which helps meet NPDES permit requirements.

The opportunity to build the wetlands came in 2000, when the city obtained a 27-acre

parcel through purchase and donation. The parcel was on the site of an old farm with over 1,400 feet of Stillaguamish River frontage. City staff had identified many issues that could be addressed with the facility: stormwater treatment and flow/flood control, stormwater education, wastewater treatment (temperature, dissolved oxygen, emerging contaminants), waterfront access, wetland creation, and other recreational opportunities. The project was conceptual for years and evolved over time.

Departments involved Public Works, Natural Resources, Parks & Recreation, Community & Economic Development

Contractors Landau Associates, Reece Construction

Public engagement

Public meetings hosted by the City of Arlington helped shape the project. The public wanted park-like features. Concerns of neighboring landowners over water pollution led to the installation of groundwater monitoring wells that monitor urban runoff into the groundwater and floodplain. Farmers had some concerns about the loss of farmland.

Maintenance and monitoring

The facility is maintained by Public Works. After 10 years of operation, sediment must be removed from the first cell. The city contracted with Snohomish Conservation District to prepare a study to inform how best to remove the sediment while maintaining the habitat. A maintenance project is being planned. Monitoring is provided by a combination of city staff and volunteers/interns looking for community service or educational projects.

Challenges and lessons learned

- A facility can provide many functions when well sited and designed
- A single facility can replace parcel by parcel systems allowing for major cost savings
- Green infrastructure can provide cost savings over gray infrastructure
- A stormwater park needs to be an allowed use in the zoning code
- These types of projects require staff from multiple disciplines/departments to work together (stormwater, natural resources, planning, and parks staff)
- Early outreach to the public leads to greater public acceptance, volunteers can be helpful
- Consider irrigation needs and prepare for regular maintenance until vegetation is established. Once established, periodic maintenance is required – an excellent outdoor learning opportunity for students and community volunteer groups
- Practice due diligence in design and permitting to avoid setbacks

Cost $1,325,000 to treat 280 acres of historic downtown Arlington lacking modern treatment

Funding Sources Stormwater Utility, Sewer Utility, Washington Department of Ecology

For more information contact

James Kelly (jkelly@arlingtonwa.gov), City of Arlington Public Works Director and Bill Blake (bill@skagitcd.org), Executive Director, Skagit Conservation District

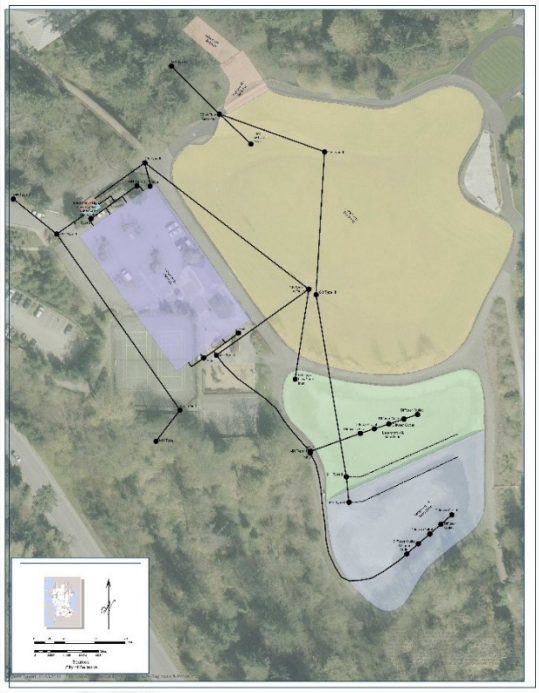
Additional information

- Project description: https://srp.rco.wa.gov/project/270/14667
- Drawings: https://www.arlingtonwa.gov/DocumentCenter/View/800/Stormwater-Wetland-PDF

Puget Sound Regional Council

LAKEMONT COMMUNITY PARK

City of Bellevue



Facility type Stormwater detention vault and sand filter treatment basins within a larger community park

Construction date 1990s

Facility size Approximately 5 acres in a 16-acre park

Drainage basin area 215 acres (Lakemont residential neighborhood)

Facility Description

One of the oldest stormwater parks in the area, the Lakemont facility was built by the developer as part of the agreement to develop the Lakemont community in the 1990s. The city was concerned about protecting Lewis Creek and Lake Sammamish from erosion, phosphorus, and other pollution.

Lakemont Community Park is 16 acres and features a play area, two picnic shelters, a basketball court, two tennis courts, a skate bowl, trails, restrooms, and a softball field. More than three miles of multiple-use trails cut through the Lakemont neighborhood, connecting Lakemont Park and Lewis Creek Park. Lakemont Park's distinguishing feature is a large stormwater management system.

This system reduces flooding and helps protect Lewis Creek and Lake Sammamish from pollution. From the park, soft surface trails lead down to Lewis Creek open space.

The stormwater system at Lakemont Community Park is a prominent feature consisting of a large detention vault below the parking lot that traps sediment and pollutants, two sand filter basins, and a high flow storage basin. Typically, water is directed into the vault then onto the sand filter basins before sending the treated water to Lewis Creek. During major storms, a flow control diverts overflow to the high flow storage area. Although a rare occurrence, if the water level reaches the top of the storage facility, it flows over the spillway into Lewis Creek.

Departments involved Parks, Utilities

Contractors No information available

Public engagement No information available (built by developer on undeveloped land)

Maintenance and monitoring

The Parks department maintains the amenities and landscaping within the Park. The Utilities Department maintains the infrastructure for the stormwater facility including the vault, sand filters and underground piping. The Stormwater facility is inspected annually with maintenance of the sand filters performed on average every 3 to 5 years and cleaning of the vault every 5 to 8 years. Two large valves operate the water distribution to the sand filters. To date, these have been replaced once over the life of the facility. Water quality monitoring of the facility was integrated into the construction of the facility but has since been deactivated after establishing that the facility was performing as designed.

Challenges and lessons learned

- This is an older facility that is working well with low maintenance needs. Bellevue has many regional stormwater facilities in its parks, such as vaults under tennis and basketball courts.
- The Utilities Department collaborates regularly with the Parks Department to manage the surface water drainage system. Much of the City's stream network is protected from development by incorporating them into the City's parks and open space network. Trails are also a part of this citywide network.
- The city is working on a citywide Watershed Management Plan, bringing together multiple departments to look for opportunities to improve the water quality of Bellevue.
- The city is looking at opportunities to include additional stormwater parks. Regional facilities are evaluated as opportunities arise but are difficult to site based on the topography of the city creating smaller drainage basins.

Cost Not available

Funding Sources Funded by the developer

For more information City of Bellevue Storm and Surface Water Utility (425-452-7840)

Additional information

- Park webpage: https://bellevuewa.gov/city-government/departments/parks/parks-and-trails/parks/lakemont-community-park

MOUNTAIN AIRE STORMWATER POND AND TRAILS

City of Poulsbo and Quadrant Homes

Contacts Charlie Roberts (croberts@cityofpoulsbo.com), Engineer, Poulsbo Public Works

Facility type Stormwater pond that provides flow control and treatment, surrounded by trails

Construction date Completed Fall 2015

Facility size The pond is about 2 acres. The wetland, trail, and storm pond together are 10 acres.

Size of basin managed 39 acres (190 residential lots)

Facility Description

This public private partnership developed out of the need to provide stormwater and sewer facilities for a new Quadrant Homes housing development, Mountain Aire. It also serves an additional development called Poulsbo Meadows.

The development required mitigation for routing the sewer connection through part of a wetland and stream buffer. The city worked with the developer on a joint solution, resulting in a sewer connection and a stormwater pond that manages stormwater from the developments. It also includes a dispersion trench that feeds the wetland. The wetland feeds Lemolo Creek. Buffer enhancement and mitigation were also part of this project. The project was turned into a community amenity by adding trails and attractive vegetation

around the pond and surrounding area. The stormwater pond trail is above the sewer line and connects to the adjacent community and other trails in the area. Part of the trail also doubles as a maintenance access road. Signage along the trail helps to educate visitors about how the area is protected to provide wildlife habitat and maintain critical area functions.

Departments involved Public works, Planning & Economic Development

Contractors Team 4 Engineering was hired to complete the design by Quadrant Homes (developer)

Public engagement

The Mountain Aire development went through the city's subdivision public process. The pond and trail system were included within the overall development process.

Maintenance and monitoring

The 10-acre parcel that includes the pond and trails/maintenance road was deeded to the city. The city maintains the pond and trails and charges stormwater connection and maintenance fees. Maintenance was considered early in the project design. Five years of wetland and wetland buffer monitoring has not raised any issues of concern. This monitoring was part of the enhancement and mitigation in the critical area.

Challenges and lessons learned

- Working closely with other departments and doing early coordination can help to identify opportunities for multi-benefit projects.
- Having political support is important, including having expectations that development will contribute funding and/or land to projects that protect water quality.
- Building maintenance needs into the project design helps make ongoing maintenance easier.
- Stormwater fee structures can provide incentivizes to help meet water quality goals, such as basing fees on quantity of impervious surface and discounting for adding green infrastructure.
- In planning for a stormwater park, identifying which portion of the land is for stormwater and which is for recreation can help in applying for grants.

Cost

100% Developer funded improvement

Funding Sources Quadrant Homes, City of Poulsbo Stormwater Utility

Additional information

- The city is planning a stormwater park in the west waterfront area of Poulsbo

MADISON VALLEY STORMWATER IMPROVEMENTS

City of Seattle

Contacts Grace Manzano (grace.manzano@seattle.gov, main project contact) and Dave LaClergue (dave.laclergue@seattle.gov, Green Stormwater Infrastructure and planning), Seattle Public Utilities

Facility type Provides flow/flood control, it is part of the combined sewer system

Construction date Construction completed in 2013

Facility size The above ground storage facility at the 30th and John site is approximately 260 feet by 110 feet, or about 28,600 square feet and is part of a half-city block public amenity. The Washington Park tank (100 feet in diameter and 26 feet in height) creates a public plaza in a corner of the park. Earth berms around the lower lawn area allows for additional temporary stormwater storage during wet weather events.

Size of basin managed 4 million gallons total

Facility Description

The Madison Valley stormwater improvement project has two locations in Seattle's Madison Valley. Together, the two sites and underground infrastructure are capable of containing the stormwater of a 150-year event. The project greatly reduced potential for sewer backups and stormwater flooding while creating new open space for the community.

In heavy rains when underground pipelines become full, the above ground holding area on

30th Ave E is activated, storing water until the pipelines clear. At Washington Park, a 1.3-million-gallon storage tank was designed with an overlook on top to double its function as public infrastructure. Other parts of the site were transformed into a reforested park. Most of the time, these areas serve as attractive open spaces for the community with native plants and trees, walking paths, play areas, and art.

The project was catalyzed by a storm in 2004 that flooded the area and backed up sewers. The mayor and city council were supportive of the project, as was the community. The community was concerned about the construction impacts but also understood that the project was needed to increase the safety for their neighbors downhill. The community asked for park amenities. Seattle Public Utilities worked with the community and Seattle Parks and Recreation to design these community centered facilities. All of the properties were acquired from willing sellers.

Departments involved Seattle Public Utilities was the lead and partnered with Seattle Parks and Recreation to build both sites

Contractors RH2 Engineering (30th Ave E & E John St), Stantec (Washington Park)

Public engagement

Extensive community participation was an integral part of the design process. Public engagement was led by Seattle Public Utilities.

Maintenance and monitoring

The facility is maintained by Seattle Public Utilities. A valve was replaced in both locations. At Washington Park, a gate is being upgraded to utilize the tank more frequently during storm events. Water level monitoring equipment triggers warnings to Seattle Public Utilities staff if certain levels are reached during a wet weather event.

Challenges and lessons learned

- Creative and willing partners are important for these types of complex projects. Consultants can help with creative approaches.
- Political support was key. For identifying new opportunities, talk to other departments (utilities, transportation, parks, community development, etc.) about overlapping needs and interests. Keep these opportunities in mind in planning, permitting, and developing projects.

Cost $34.5 million (all phases and additional drainage improvements)

Funding Sources Seattle Public Utilities, King County Flood Control District

Additional information

- Presentation with drawings: http://www.seattle.gov/Documents/Departments/SPU//111412CDWACPresentationMadisonValley.pdf

Lake Washington Park

Puget Sound Regional Council

CROMWELL PARK

City of Shoreline

Facility type Constructed wetland added to an existing park during major renovation, provides treatment and flow/flood control

Design/construction 2007-2010

Facility size 1.33 acres in a 9-acre park

Drainage basin area 109-acre basin (residential neighborhood, can handle 435,000 gallons)

Facility Description

The city had identified areas with stormwater issues. The area downstream of Cromwell Park had water quality and flooding issues, so a regional stormwater retrofit facility was proposed for Cromwell Park during a major renovation of the park.

The stormwater facility type chosen was a constructed wetland, which added an additional natural feature with native plants to the park. The wetland attracts wildlife and has interpretive signs to provide education on habitat and stormwater. Walking trails were added around and through the wetland.

Retrofits such as this one that have been completed in Shoreline may have led to the City of Shoreline being the first Salmon Safe-certified city in Washington.

Departments involved Public Works, Parks Department

Contractors PACE Engineers

Public engagement
Led by the Parks department as part of the park's planned renovation.

Maintenance and monitoring
The Public Works department performs maintenance one to two times per year on the wetland. They check for and remove invasive plants. Maintenance has been minimal at Cromwell Park. Plant selection, monitoring, and maintenance are key to the facility's success.

Challenges and lessons learned
- The community had concerns about mosquitoes and odors but ended up being very happy with the wetland. The community now enjoys viewing the wildlife attracted to the wetland and the process of seeing the wetlands fill up with water after a rainstorm.
- Shoreline continues to evaluate possible stormwater facility improvement opportunities during park renovations projects. This is a good opportunity to incorporate stormwater management at a lower cost and less disruption for the community.
- Consider climate change and the greater need for stormwater infrastructure. This will affect the location and design of the facility.
- Shoreline is considering how to best use current detention pond space and may incorporate recreational features or even create new parks where stormwater facilities are renovated.

Cost	$1.6 million for park renovation and wetland
Funding Sources	Park Bond (two-thirds), Surface Water Utility Fund (one-third)
For more information	Dan Sinkovich (dsinkovich@shorelinewa.gov), City of Shoreline, Utility Operations Specialist

Sources and additional information
- Trust for Public Land case study: https://www.tpl.org/sites/default/files/Cromwell%20Park.pdf
- Salmon Safe city certification: https://salmonsafe.org/shoreline/

POINT DEFIANCE STORMWATER TREATMENT FACILITY

City of Tacoma/Metro Parks Tacoma

Contacts	Dana de Leon (ddeleon@cityoftacoma.org), Principal Engineer, City of Tacoma Environmental Services
Facility type	Provides stormwater treatment and visual interest in a park
Construction date	2015
Facility size	5,500 square feet
Size of basin managed	754 acres, 8 million gallons per day

Facility Description

This facility, on a steep slope at the northeast entrance of Point Defiance Park, treats stormwater from the basin uphill before dispersing it into Puget Sound. It consists of a series of cascade pools, troughs, and treatment cells with proprietary media and an underdrain system. The facility discharges treated water into a bioswale and then Puget Sound.

The facility is a six-pool waterfall that provides visual interest to the entrance of the park. It is not open to the public but can be seen from all sides.

The project started with Tacoma Parks talking to the city about the area's undersized outfalls. The two agencies partnered and brought in Tacoma Public Schools. The partners agreed on three main goals for the project: treat as much stormwater as possible, make it attractive, and provide a learning opportunity for students. The city upsized the outfall and

Tacoma Parks provided the land for the facility, which treats stormwater for the entire 754-acre basin. It is used as a lab for students to learn about stormwater.

Departments involved Tacoma Public Utilities, Metro Tacoma Parks, Tacoma Public Schools

Contractors Parametrix (Design Engineer), Site Workshop (Landscape Architect), Ceccanti Inc. (General Contractor), Oldcastle Precast (Precast Concrete), Contech Engineered Solutions (Manufacturer)

Public engagement

Tacoma Parks led the public outreach in coordination with other park improvements.

Maintenance and monitoring

Tacoma Public Works maintains the treatment facility and Tacoma Parks maintains the irrigation and landscaping.

Challenges and lessons learned

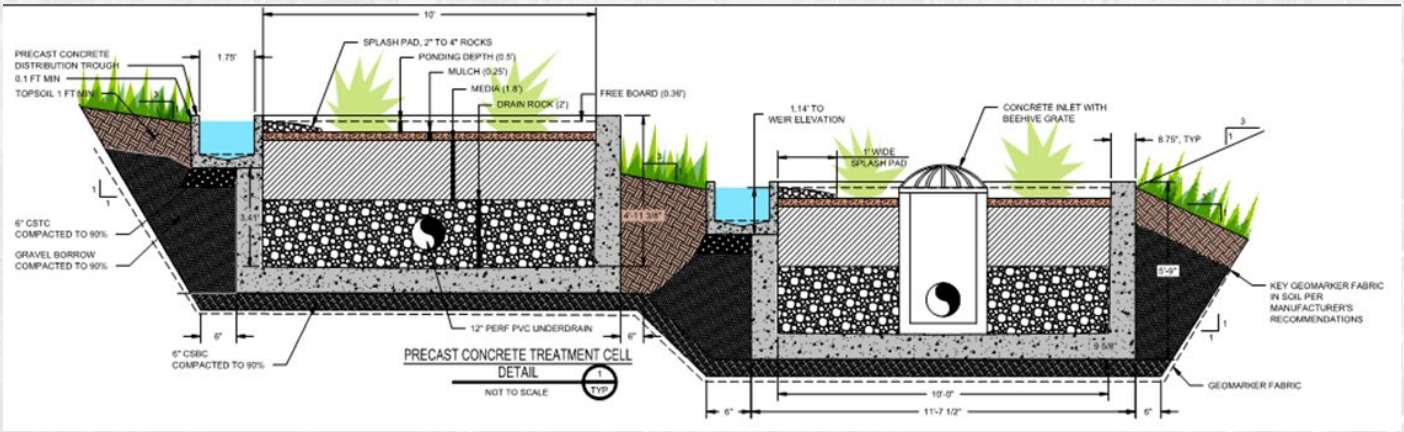
- ILAs can help address issues when multiple partners are involved, especially for maintenance.
- Having goals for the project can help guide it and keep it moving forward.
- Adding regional stormwater facilities to parks is a good way to provide large-scale stormwater treatment. Work with the parks department for opportunities to plan retrofits into future park renovation projects.
- A funding strategy for regional facilities is to charge development projects in the basin a fee in lieu of constructing onsite stormwater management.
- The parks board provided valuable insights on issues to address, such as safety and siting.
- Think about maintenance early, incorporating maintenance considerations into design can make ongoing maintenance easier.
- Having flexibility in the design can enable the facility to treat a larger area.

Cost $2,464,600

Funding Sources Tacoma Surface Water Management, Metro Parks Tacoma, Washington State Department of Ecology

Additional information

- City of Tacoma project description: https://www.cityoftacoma.org/government/city_departments/environmentalservices/surface_water/green_stormwater_infrastructure__gsi_/gsi_projects/point_defiance_regional_stormwater_treatment_facil
- Tacoma Parks description: https://www.metroparkstacoma.org/project/stormwater-treatment-facility/



Puget Sound Regional Council

MANCHESTER STORMWATER PARK

Kitsap County

Contacts	Tim Beachy (tbeachy@co.kitsap.wa.us), PE, Capital Improvements PM, Michelle Perdue (mperdue@co.kitsap.wa.us), Stormwater Monitoring and Outreach Manager, Kitsap County Public Works
Facility type	Small park with natural and engineered stormwater infrastructure that provides treatment and flood control
Construction date	2015
Facility size	0.5 acres
Size of basin managed	100 acres (community of Manchester)

Facility Description

Manchester Stormwater Park treats stormwater from roads, parking lots, and residential and commercial properties in the small Kitsap County community of Manchester. Treatment cells around the perimeter of the park process stormwater through engineered filter media and plants. A spiral rain garden intercepts flows from groundwater and light storms and treats it through a bioretention soil mix and plants in the rain garden. The rain garden extends the life of the more expensive engineered treatment media in the treatment cells. Treated water is discharged to Puget Sound.

The stormwater park provides a community gathering space for farmers' markets, celebrations, relaxation, and education.

Before the stormwater park was built, Manchester did not have any stormwater treatment structures and stormwater drained untreated through one pipe into Puget sound. The stormwater park was built on a vacant lot in Manchester that was once a gas station. The project was initially designed to replace an aging and undersized outfall. However, Kitsap County recognized the opportunity for multiple benefits: treating a larger drainage area, reducing flooding, and providing a community amenity.

It is estimated that more than 100,000 pounds of contaminated suspended solids will be cleansed from the upstream stormwater runoff in its first 10 to 20 years.

Departments involved Kitsap County Public Works

Contractors Parametrix, N.L. Olson & Associates, Northwest Cascade

Public engagement

Public engagement was key to the success of this project and helped shape the design of the park. The community wanted a gathering space and interpretive signage on environmental solutions.

Maintenance and monitoring

The Port of Manchester takes care of mowing and garbage collection, Kitsap County Public Works maintains the rest of the facility, and the University of Washington's Green Futures Lab provides water quality monitoring. Monitoring indicates that the stormwater park is effective in treating pollutants and is especially effective at treating bacteria and metals in the runoff.

Challenges and lessons learned

- Have goals for the project
- It helps to have a champion as there are many issues to work through with innovative projects
- Do public outreach early
- Formal agreements can help when multiple departments and agencies are involved, especially for maintenance
- Having a use agreement helps with liability concerns when a group wants to reserve the park

Cost

$4M (Phase I $2.3M: stormwater park and surrounding roadway/sidewalks, Phase II $0.4M: new outfall, roadway and sidewalk improvements, Phase III $1.2M: stormwater conveyance, roadway and sidewalks construction)

Funding Sources Kitsap County Public Works Stormwater and Roads Divisions, Washington State Department of Ecology grant

Additional information

- Monitoring information: http://greenfutures.washington.edu/2019/07/25/manchester-stormwater-park/
- Detailed project description: https://www.waterworld.com/home/article/14070125/manchesters-stormwater-park

Additional Stormwater Parks in Central Puget Sound and Beyond

Photo: Tanner Springs Park, GreenWorks

Atlanta, Georgia: Cook Park

Chattanooga, Tennessee: Miller Park

Kirkland, Washington: 132nd Square Park

Kitsap County, Washington: Whispering Firs Stormwater Park

Normal, Illinois: Uptown Circle Park

Olympia, Washington: Yeager Park

Qunli, China: Qunli Stormwater Park

Portland, Oregon: Tanner Springs Park

Renton, Washington: Sunset Neighborhood Park

Thurston County, Washington: Albany Street Stormwater Pond

Please contact PSRC to share additional stormwater parks

Appendix B. New Stormwater Park Fact Sheets

Puget Sound Regional Council

NORTH ROSE HILL STORMWATER PARK

City of Kirkland

Facility Type Small park with green stormwater infrastructure that would provide treatment and some flood control

Facility Size 1.09 acres

Drainage Basin Area 17.97 acres

Facility Description

The project site is adjacent to the Totem Lake Regional Growth Center. Although relatively small, this parcel is an ideal location for a stormwater park because it collects water from about 18 acres of upstream area and the 2015 Parks Recreation and Open Space (PROS) Plan has identified this area as needing a neighborhood park. Additionally, the site is owned by the City of Kirkland. The proposed design includes two bioretention cells to provide stormwater treatment to runoff from 17.97 acres. Park programming includes a paved trail that extends an existing trail south of the site, interpretive signage, benches, and plantings.

The area draining to the site is largely a single-family residential area and is unlikely to redevelop in way that will require stormwater controls. A stormwater park would provide water quality treatment for a drainage area that would not otherwise receive it via other means. This park drains to Forbes Creek, which has 303(d) listings for fecal coliform bacteria (now e coli), temperature, and dissolved oxygen.

Departments Involved

Kirkland Public Works, Parks, Planning and Community Development

Public Engagement

Staff have distributed information to and talked to neighbors. A more robust public engagement process will occur in the next stage of planning.

Advancing Equity

The parcel is adjacent to a rapidly increasing population at the Totem Lake Regional Growth Center. The area does not have a park.

Salmon Benefit

The area drains to Forbes Creek. Forbes Creek has Fall Chinook, Coho, Winter Steelhead, and Sockeye salmon and cutthroat trout.

Maintenance and Monitoring

Incorporating suggestions from maintenance staff in the design. Design includes replacement of a failing storm pipe, which will ease system maintenance.

Challenges and Lessons Learned

- Get soils and geotechnical info early. This affects possible designs.
- It is important to follow and adapt to Parks Department priorities. Develop potential stormwater uses and be ready to match these with Parks planning and capital projects.
- One issue for Parks is that small sites are seen as inefficient for parks maintenance, although there may not be opportunities for additional large parks.
- Design will need to consider constraints of the Seattle City Light powerlines and associated easement that run over the park.
- The Green Kirkland Partnership requested pollinator-friendly plants on the site. A good issue to be aware of for many stormwater parks.

Cost Estimate

Construction cost opinion at conceptual design phase: $1.1 million

Likely Funding Sources

Kirkland Public Works, Washington State Department of Ecology grant, Washington Recreation and Conservation Office grant

For More Information

Jenny Gaus (jgaus@kirklandwa.gov), Surface Water Strategic Advisor, Kirkland Public Works

Additional Information

- Webpage for 132nd Square Park Redevelopment and Stormwater Retrofit Project: https://www.kirklandwa.gov/Government/Departments/Public-Works-Department/Construction-Projects/132nd-Square-Park-Redevelopment-and-Stormwater-Retrofit
- 2022 Parks Recreation and Open Space Plan: https://www.kirklandwa.gov/Government/Departments/Parks-and-Community-Services/Park-Planning-and-Development/Parks-Recreation-and-Open-Space-Plan

Puget Sound Regional Council

BUCKLIN/TRACYTON STORMWATER PARK

Kitsap County

Facility Type Small park with green stormwater infrastructure that provides treatment and flood control

Facility Size 0.8 acres

Drainage Basin Area 75 acres in the community of Silverdale

Facility Description

This new 0.8-acre stormwater park in the community of Silverdale would treat stormwater using green stormwater infrastructure. Located on the corner of Bucklin Hill Road and Tracyton Boulevard in the Silverdale Regional Growth Center, this facility would provide treatment for approximately 75 acres of urban development that contributes a variety of pollutants to the stormwater system. Treated stormwater would discharge to an existing system and outfall to the Clear Creek estuary and Dyes Inlet. This proposed site could also provide the community with amenities such as a walking path, covered shelters, benches, wildflower gardens, interpretive signage, and green space that can be enjoyed year-round. The parcel is owned by Kitsap County Public Works and is currently vacant.

Departments Involved

Kitsap County Public Works

Public Engagement

Kitsap County engaged the community to help shape the design of the park. The project has a webpage with information and opportunities for providing input. A kiosk with information about the project was installed at the project site. In the spring and summer of 2022, Kitsap County provided opportunities to the public to share ideas for the park and review and comment on initial design concepts. This included a survey and public meeting. The community will have the opportunity to remain involved throughout the final design process.

Advancing Equity

The park site is located in the most diverse area of unincorporated Kitsap County. The nearest park is the Old Mill waterfront park, approximately 3,000 feet west of the site.

Salmon Benefit

The facility would discharge to the Clear Creek estuary and Dyes Inlet. Clear Creek is one of the most productive salmon streams in Kitsap County and supports multiple salmonid species including threatened chinook salmon and winter steelhead. Overall, the facility would be expected to provide significant salmon recovery benefits.

Maintenance and Monitoring

Kitsap County Public Works would maintain the facility.

Challenges and Lessons Learned

- Need high level support that values innovation and a leader with a vision for multi-benefit solutions.
- Challenge staff to think about the full span of community needs and potential opportunities.
- Find ways to coordinate with other plans and departments for expanded benefits.
- Engage with the community often and early.
- Consider operations and maintenance from the start.
- It is useful to have someone 'creative' on the team.
- Consider potential limitations such as space, funding, community desire, and technical needs.
- Look forward, beyond today – what challenges can you solve for the future?
- There's more than one way to do it. If you can't go huge, start small.

Cost Estimate

Construction cost opinion at conceptual design phase: $2.5 million

Likely Funding Sources

Kitsap County Public Works Stormwater and Roads Divisions, Washington State Department of Ecology grant, Washington Recreation and Conservation Office grant

For More Information

Michelle Perdue (mperdue@co.kitsap.wa.us), Stormwater Program Manager, Kitsap County Public Works

Additional Information

Project webpage: https://kitsap-county-projects-pages-kitcowa.hub.arcgis.com/pages/bucklintracyton-stormwater

Puget Sound Regional Council

MAPLE MINI STORMWATER PARK

Lynnwood

Facility Type Small park with green stormwater infrastructure that provides treatment and flood control

Facility Size .77 acres

Drainage Basin Area 20 acres

Facility Description

Maple Mini Park is near Lynnwood's Regional Growth Center. It is a stormwater detention facility with a small, aged play feature and is jointly managed by Parks and Public Works. The site holds standing water during the rainy season and it does not currently meet ADA standards, with a dozen documented barriers restricting access to the play features. The city must remove and replace the current play structure due to its current condition. These existing challenges provide the opportunity to improve both the recreational facilities and stormwater management at the park. The city is considering how to advance stormwater park facilities through private development and reconsidering the function of the city's other various stormwater properties that could be converted to parkland and open for public use.

The improved stormwater system provided for Maple Mini Park is comprised of underground chambers with a modular wetland. This system would treat runoff from 20 acres with 100% treatment efficiency and provide flow control from 6.87 acres with 34% treatment efficiency. The improved park programming provided would include a new playground, picnic shelter, benches, open lawn, enhanced plantings, paved trail connecting park entrances, and improved accessibility.

Departments Involved

Public Works, Parks, Recreation & Cultural Arts

Public Engagement

Neighbors will be engaged at the next phase of the project. The city wants input on the recreational components desired.

Advancing Equity

Located in an area experiencing growth and increasing density, this park's single recreation feature is not accessible during the rainy season of the year and lacks ADA access. It could be redeveloped to meet ADA standards and better provide equitable access year-round.

Salmon Benefit

The area drains to Scriber Creek.

Maintenance and Monitoring

Public Works will maintain the stormwater components and Parks will maintain the recreation components.

Challenges and Lessons Learned

- Clearly define roles and responsibilities between the Parks and Public Works Departments.
- Understand design parameters for amenity features.
- Understand maintenance and operations needs for clean-outs.
- Enhance outreach and education regarding stormwater solutions.
- Learn about grant opportunities and deadlines.

Cost Estimate

Construction cost opinion at conceptual design phase: $2 million

Likely Funding Sources

Public Works, Parks, Recreation & Cultural Arts, Washington State Department of Ecology grant, Washington Recreation and Conservation Office grant

For More Information

Sarah Olson (solson@lynnwoodwa.gov), Deputy Director, Lynnwood Parks, Recreation & Cultural Arts Department

Additional Information

Park Webpage: https://www.lynnwoodwa.gov/Community/Play-Lynnwood/Parks-Trails-and-Open-Space/Maple-Mini-Park

Puget Sound Regional Council

JENNINGS STORMWATER PARK

Marysville

Facility Type Park with green stormwater infrastructure that provides treatment

Facility Size 3,650 square feet

Drainage Basin Area 118 acres

Facility Description

Allen Creek runs through Jennings Park, with several stormwater outfalls within the park. The stormwater basins discharging here have little or no treatment, which presents opportunities for stormwater retrofits within the existing park. There are two potential stormwater retrofit projects on the east side of the park. One could be placed in an open field, utilizing the footprint of an existing stormwater pond. The other could be located in the parking lot. These stormwater retrofits would treat runoff from 118 acres by using biopods systems. Improved park programming could include interpretive signage, a decorative bridge, and enhanced landscaping.

The City has developed a watershed analysis and basin prioritization plan. The Middle Allen Creek basin, containing Jennings Park, was prioritized for stormwater retrofits. The implementation report or Stormwater Management Action Plan (SMAP) identified potential stormwater retrofits for the chosen basins. A full description of the retrofits in Jennings Park are included in the SMAP. As part of the process, the City solicited public input on the plan and retrofit designs.

This section of Allen Creek is undergoing restoration and buffer enhancements. The Snohomish Conservation District has completed an extensive wetland enhancement project that included planting native vegetation on 15 acres, along 2,500 feet of Allen Creek. The native vegetation provides shade and enhances the stream buffer within Jennings Park. Directly downstream of the park is the Qwuloolt Estuary Restoration Project, completed by Tulalip Tribes and their project partners. The project breached a levy in 2015 opening 400 acres to tidal inundation from Ebey Slough. Together stormwater treatment retrofits and stream restoration projects greatly improve habitat conditions.

Departments Involved
Public Works and Parks

Public Engagement
Public engagement occurred multiple times throughout the site identification and design process. The watershed analysis and basin prioritization plan and Stormwater Management Action Plan, which served as the predicate to this project are posted on the City Surface Water web page.
https://www.marysvillewa.gov/179/Surface-Water

Advancing Equity
The watershed analysis and basin prioritization plan included a review of environmental justice factors. In addition to other scoring criteria the environmental justice criteria was used to select basins. The selected basins will be a focus for stormwater retrofits and other programs.

Salmon Benefit
The area drains to Allen Creek which has 8 species: Pink, Coho, fall and summer Chinook, Chum, Cutthroat trout, steelhead, and bulltrout.

Maintenance and Monitoring
The city inspects publicly owned and operated stormwater facilities annually. Maintenance is completed based on the results of the inspections.

Challenges and Lessons Learned
- It is important to involve multiple departments early in the process and understand the goals, values, and priorities of each department.
- Use stormwater projects as catalysts to accelerate the design and construction of projects that provide community benefits, such as traffic calming, pedestrian safety, and park and trail improvements.
- Apply for funding – you'll never receive funding that you do not apply for!

Cost Estimate
Construction cost opinion at conceptual design phase: $2.5 million

Likely Funding Sources Marysville Public Works, Washington State Department of Ecology grant, Washington Recreation and Conservation Office grant

For More Information Brooke Ensor (bensor@marysvillewa.gov), NPDES Coordinator, Marysville Public Works

Additional Information
Park Webpage: https://www.marysvillewa.gov/Facilities/Facility/Details/Jennings-Memorial-Park-16

Puget Sound Regional Council

WILDWOOD STORMWATER PARK

Puyallup

Facility Type Park with bioretention swales along drive and down hillside in steps

Facility Size 0.19 acres

Drainage Basin Area Managed 9.35 acres

Facility Description

Wildwood Park is a heavily used park in Puyallup, about a half mile from the South Hill Regional Growth Center. The park is forested, and Wildwood Creek flows south to north through the park. The creek eventually discharges into the Puyallup River. The Puyallup River is assessed and listed as impaired under the Clean Water Act section 303(d) for multiple pollutants. The project would provide additional stormwater treatment beyond what is required for a road widening project on 23rd Avenue SE and a parking expansion project within the park. The stormwater system provided would treat runoff for 9.35 acres through a series of bioretention systems. Additionally, the improved stormwater system would provide a treatment swap for roadway improvements to the west of the site in addition to providing treatment for existing areas not being redeveloped. Park programming would include 57 new parking stalls and master planning for nature play areas. The project would create an educational opportunity for the need for such facilities to keep water cool and clean.

Departments Involved

Puyallup Public Works, Parks

Public Engagement

A robust public engagement process will occur in the next stage of planning.

Advancing Equity

The park is in an area experiencing growth. This regional park draws residents from across the city.

Salmon Benefit

The site drains to tributaries of the Puyallup River.

Maintenance and Monitoring

Maintenance would include ongoing maintenance of the proposed bioretention systems including removal of sediment and trash and maintenance of vegetation, mulch, bioretention soil media, aggregate, overflow structures, underdrains, curb inlets, curb and gutter, and the irrigation system if integrated.

Challenges and lessons learned

- All departments involved should discuss their goals for the project early
- Elected officials can help promote multidisciplinary projects
- Identifying coinciding high priorities of water quality deficiency with the need for park improvements can be difficult

Cost Estimate

Construction cost opinion at conceptual design phase: $3 million

Likely Funding Sources Puyallup Public Works, Washington State Department of Ecology grant, Washington Recreation and Conservation Office grant

For more information Hans Hunger (hhunger@puyallupwa.gov), City Engineer, Puyallup Public Works

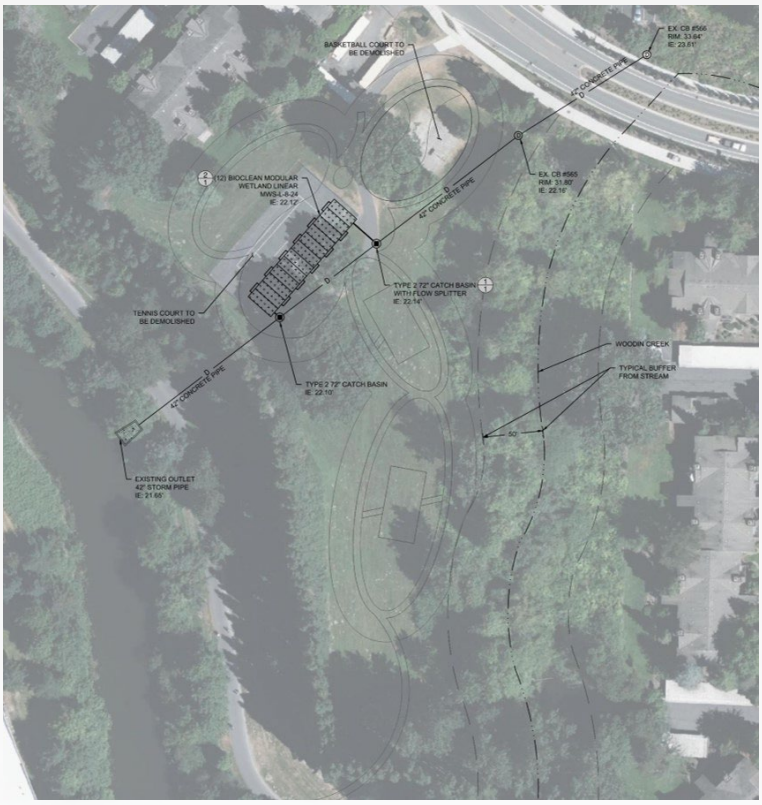
Additional information

Park Webpage: https://www.cityofpuyallup.org/Facilities/Facility/Details/Wildwood-Park-18

Puget Sound Regional Council

WOODIN CREEK PARK

Woodinville



Facility Type Park with modular wetlands that provides treatment and flood control

Facility Size 2,700 square feet

Drainage Basin Area 123 acres

Facility Description

Woodinville's high traffic downtown core currently discharges stormwater to the Sammamish River with no regional treatment facility. Woodin Creek Park has an outfall from the City's storm sewer system into the Sammamish River, which makes it a prime location for a regional facility to treat stormwater. Woodinville's 2021-2026 Capital Improvement Plan proposes the rehabilitation of Woodin Creek Park and possible installation of additional parking and other improvements, providing a good opportunity to develop the stormwater facility. Woodin Creek runs near the perimeter of the park boundary. This project could also address issues such as stream habitat and temperature in an impaired waterbody. The stormwater system would provide water quality treatment for 123 acres through 12 modular wetlands, which have lower maintenance requirements and allow for more active recreation opportunities and the possibility of broadening park accessibility. Park programming could include removal of the existing basketball and tennis courts, to be replaced with a bicycle playground, pickleball courts, open lawn, and enhanced trails that connect to the Sammamish River Trail, a popular multiuse path.

Departments Involved

Woodinville Public Works, Development Services

Public Engagement

Earlier community engagement helped to identify the recreational components that the neighborhood is interested in. Additional engagement will occur at the next stage of the project.

Advancing Equity

The proposed site is within one mile of affordable housing developments and would be one of the nearest walkable city-owned parks to these developments. This opportunity would improve access to natural areas near high density residential developments. Several of the nearby residences include group care facilities and retirement communities.

Salmon Benefit

The facility would drain to the Sammamish River. Coho, Chinook, Kokanee, and Sockeye salmon are present in the Sammamish River. Coho and Sockeye salmon are also present in Woodin Creek.

Maintenance and Monitoring

Modular wetlands were selected, in part, due to lower maintenance needs compared to other options.

Challenges and Lessons Learned

- Interdisciplinary team agreement can be difficult (maintenance vs. treatment efficiency vs. permitting)
- The city staff would have liked to have done more community engagement to understand what proposed active recreation components of the stormwater park would be the most utilized.

Cost Estimate

Construction cost opinion at conceptual design phase: $2.3 million

Likely Funding Sources Woodinville Public Works, Washington State Department of Ecology grant, Washington Recreation and Conservation Office grant

For More Information Leah Mikulsky (leahm@ci.woodinville.wa.us), Surface Water Program Coordinator, Woodinville Public Works

Additional Information

Park Webpage: https://www.ci.woodinville.wa.us/facilities/facility/details/woodincreekpark-7

Appendix C. Stormwater Parks Planning Checklist

Purpose of checklist:

- To help assemble the information necessary to begin conceptual design of a new stormwater park.
- Identify information that may be required after completing the checklist. This checklist may help jurisdictions develop RFPs for local projects.

Phase 1a. Site Suitability for Regional Stormwater Retrofit	
Potential deliverable (staff or consultant): summary of information below	
1. Site description	
• Name of site	
• Address and/or parcel no.	
• Zoning for parcel(s)	
• Ownership type (public, private, local, state, unknown, other)	
2. Drainage area to proposed retrofit	
• Watershed	
• Regulatory or planning considerations (303d list, etc.)	
• Water body flow control exempt?	
• Drainage area (acres) tributary to the facility	
• Imperviousness (percent and area) of tributary basin	
• Drainage area existing land uses within tributary area: (SFH > 1 acre lots, SFH < 1 acre lots, townhouses, multi-family, commercial, institutional, industrial, transport-related, park, undeveloped, other)	

• Expected growth in drainage basin area, if known	
• Age of development in drainage basin area (average or range)	
3. Existing stormwater management	
• Describe any existing stormwater facilities in tributary area	
o City to furnish drainage reports and record drawings for any constructed flow control facilities	
o Record drawings for conveyance system upstream and downstream of the retrofit site	
• Approximate existing head available	
• Existing treatment provided (detention, infiltration, water quality, none, unknown)	
• Year of construction, if known	
• Describe existing site conditions (existing site drainage, conveyance, visible problems, etc.)	
4. Proposed retrofit	
• Purpose of retrofit (water quality, infiltration, channel restoration, flow control, other)	
• Existing facility computations (storage)	
• Retrofit computations (storage)	
• Acceptable and preferred BMP options (detention, proprietary media filter, wet pond, infiltration, constructed wetland, swale, bioretention/BSM, other)	
• Level of treatment and pollutants that will be treated	
• Describe elements of proposed retrofit, including surface area, maximum depth of treatment, and conveyance	

5. Site constraints	
• Adjacent land uses (residential, commercial, institutional, industrial, transport-related, park, undeveloped, other)	
• Possible conflicts due to adjacent uses? (If yes, describe)	
• Access (Any constraints due to slope, utilities, structures, space, tree impacts, property ownership, other)	
• Conflicts with existing utilities (none, unknown, or possible due to sewer, water, gas, cable, electric, electric to streetlights, overhead wires, other)	
• Potential permitting factors (probable due to impacts to wetlands, impacts to a stream, floodplain fill, impacts to forests, impacts to specimen trees (how many, approximate DBH), dam safety permit needed, other factors)	
• Soils (prior geotechnical analysis, soil auger test holes, evidence of poor infiltration (clays, fines), evidence of shallow bedrock, evidence of high-water table (gleying, saturation), soil classification, comments)	
6. Sketch	
7. Design or delivery notes	
8. Follow-up needed to complete field concept	
• Confirm property ownership	
• Confirm drainage area	
• Confirm drainage area impervious cover	
• Obtain existing stormwater facility as-builts	
• Obtain site as-builts	
• Obtain detailed topography or use GIS	
• Obtain utility mapping	
• Confirm storm drain invert elevations	
9. Initial feasibility and construction considerations	

Phase 1b. Public engagement plan and list of (non-stormwater) considerations (concurrent with suitability phase)	
Potential deliverables (staff or consultant): community engagement plan and list of considerations Information to obtain:	
1. Project partners and roles	
2. What work has already been done and when? (link or attach)	
• Studies, planning, surveying, design	
• Wetlands, geotech	
• Community engagement	
3. Demographics and stakeholder mapping	
4. Preliminary list of park elements desired, what to leave as is (staff and community)	
5. What maintenance issues should be considered?	
6. Describe any compatibility/perception issues between different department (parks dept v stormwater department, etc.)	
7. What ILAs need to be developed?	

Phase 2. Community outreach and conceptual design phase	
Potential deliverable (staff or consultant): graphics and information for community meetings, summary of community engagement efforts and community input. Information to develop for community engagement:	
1. Preliminary sizing of facility and effectiveness (quantify benefit, how much of Ecology standard can be met)	
2. Sketch and Fact Sheet for stormwater improvement	
3. Possible recreational opportunities for the site	
4. Recreational elements desired by community, prioritized if possible	

5. Equity (Would the recreational facilities meet the community's needs? Are there other ways to advance racial equity with this project?)	
6. Educational elements desired by community	

Phase 3. Design	
Potential deliverables:	
1. Survey	
2. 30% design drawings and hydrologic modeling	
3. Cost estimate	
4. Maintenance practices	
5. Drawings/renderings/graphics	
6. Recommended next steps	

Appendix D. Summary of Lessons Learned

Jurisdictions were asked about challenges and lessons learned from planning and building their stormwater parks. The following summarizes those lessons by topic area. Lessons learned are also included for each stormwater park in the fact sheets.

Multiple Benefits

- A facility can provide many functions when well sited and designed.
- Working closely with other departments and doing early coordination can help to identify opportunities for multi-benefit projects, which tend to be the proposals that score highest in competitive grant applications. Conversely, poor coordination can slow down decision making which slows down design and implementation.
- Use stormwater projects as catalysts to accelerate the design and construction of projects that provide multiple benefits to your community, such as traffic calming, pedestrian safety, and park and trail improvements.

Project Team and Coordination

- These types of projects require staff from multiple disciplines/departments to work together early in the process (stormwater, natural resources, planning, parks, etc.) Goals, priorities, and values of each department, as well as roles and responsibilities, need to be clearly defined. These teams can also identify new opportunities by discussing overlapping needs and interests. These opportunities can be kept in mind while planning, permitting, and developing projects.
- It is important to understand the Park Department's priorities. Choose sites that are in the parks, recreation, and open space plan to help align projects with the Parks Department.
- Find ways to coordinate with other plans and departments for expanded benefits.
- Need high level support that values and invites innovation and a leader with a vision for multi-benefit solutions. A project champion can help with the many issues to work through with innovative projects.
- Learn about grant opportunities and deadlines. Apply for funding – you'll never receive funding that you do not apply for!
- Interdisciplinary team agreement can be difficult (maintenance vs. treatment efficiency vs. permitting).
- A stormwater park needs to be an allowed use in the zoning code.
- Practice due diligence in design and permitting to avoid setbacks.
- Have goals for the project.
- Having political support is important, including having expectations that development will contribute funding and/or land to projects that protect water quality. Elected officials can help promote multidisciplinary projects.
- Creative and willing partners are important for these types of complex projects. It is useful to have someone 'creative' on the team.
- Consultants can help with creative approaches.

Public Engagement

- Early outreach to the public leads to greater public acceptance and volunteers, who can be helpful.
- Enhance outreach and education regarding stormwater solutions.

Maintenance and Operations

- Consider irrigation needs and prepare for regular maintenance until vegetation is established. Once established, periodic maintenance is required, which can be an excellent outdoor learning opportunity for students and community volunteer groups.
- Formal agreements can help when multiple departments and agencies are involved, especially for maintenance.
- Building maintenance needs into the project design helps make ongoing maintenance easier. Consider operations and maintenance from the start.
- Having a use agreement helps with liability concerns when a group wants to reserve the park.
- One issue for parks is that small sites are seen as inefficient for parks maintenance, although there may not be opportunities for additional large parks.
- Other organizations may be able to help with maintenance needs.
- Understand maintenance and operations needs for clean-outs.

Cost Savings and Funding

- A single facility can replace parcel-by-parcel stormwater systems, allowing for major cost savings.
- Green infrastructure can provide cost savings over gray infrastructure.
- Stormwater fee structures can provide incentivizes to help meet water quality goals, such as basing fees on quantity of impervious surface and discounting for adding green infrastructure.
- In planning a stormwater park, identifying which portion of the land is for stormwater and which is for recreation can help in applying for grants.

Design

- Get soils and geotechnical info early. This affects possible designs.
- Consider potential limitations – space, funding, community desire, technical needs.
- Look forward, beyond today – what challenges can you solve for the future?
- There's more than one way to do it. If you can't go huge, start small.
- Challenge staff to think about the full span of community needs and potential opportunities.
- Understand design parameters for amenity features.

Appendix E. Project Team

Jurisdiction Staff Interviewed for Completed Stormwater Parks:

Arlington
- James Kelly
- Bill Blake

Bellevue
- Don McQuilliams

Kitsap County
- Tim Beachy
- Chris May
- Michelle Perdue

Poulsbo
- Charlie Roberts

Seattle
- Dave LaClergue
- Grace Manzano

Shoreline
- Dan Sinkovich

Tacoma
- Dana de Leon
- Jessica Knickerbocker

PSRC Staff:
- Drew Hanson
- Erika Harris, AICP
- Paul Inghram, FAICP
- Choo Ling Khoo

Consultant Staff:
- Wayne Carlson, FAICP, AHBL
- Elizabeth Housley, AHBL
- Andrew Love, AHBL
- Craig Skipton, PLA, AHBL
- Carmen Smith, AHBL
- Helen Stanton, AHBL
- Bethany Steadman, PE, AHBL

Jurisdiction Staff Planning New Stormwater Parks:

Kirkland
- Jason Filan
- Jodie Galvan
- Mary Gardocki
- Jenny Gaus
- Jason Osborn
- Jordan Segal

Kitsap County
- Christine DeGeus
- Michelle Perdue
- Kym Brolin-Pleger

Lynnwood
- Sarah Olson
- Charlie Palmer
- Eric Peterson
- Monica Thompson

Marysville
- Adam Benton
- Brooke Ensor
- Matt Eyer
- Dave Hall
- Tara Mizell

Puyallup
- Sarah Harris
- Hans Hunger
- Paul Marrinan

Woodinville
- Leah Mikulsky

Appendix F. Sample Scope of Work for Consultant Request for Proposals

A. Purpose

The purpose of the project is to complete early planning, community engagement, and design stages for a new stormwater park. This planning will prepare the project for grant funding and inclusion in functional plans and the comprehensive plans.

B. Task Details

The following proposed scope of work represents current thinking. This draft scope of work will be refined after selection of the consultant as part of the contract negotiation process.

Task 1. Project Administration and Management.

- This task includes the overall administration and management to accomplish the tasks identified below. This includes coordinating with staff in multiple departments to complete the scope of work as defined and could include assisting with site selection.
    - Deliverable: Description of project management approach and schedule.

Task 2. Stormwater Park Planning.

Work will include:

- Initial meeting with staff to verify the location of the stormwater park and identify the scope of work to complete early planning. This could include feasibility work such as hydraulic or infrastructure analysis, concept planning, public engagement, alternatives evaluation, cost estimation, and/or other work agreed upon by the parties.
    - Deliverable: memo documenting the work to be performed.
- Visit the site and perform the work as agreed to in the memo in coordination with jurisdiction staff.
    - Deliverable: report documenting work performed, including any analysis, plans, sketches, or other information produced.

Content and Format of Response

The consultant should emphasize clarity and brevity in describing the understanding of the project approach to each task, schedule, and personnel experience. The responses should be prepared using a standard size 8.5” x 11” format using a 12-point type.

Respondents must submit one (1) electronic copy of their response by or before ____. Responses will not be reviewed and will be considered non-responsive if they arrive past the noted deadline or exceed a total of 25 pages in length for all required information. The 25-page limit shall include a transmittal letter, signed by the individual(s) from the consultant team able to commit the resources of the consultant, and shall identify the key person and phone number to contact regarding such response.

This 25-page limit does not include the front and back covers, if they are provided, nor the required forms.

Each submission must include the following information:

1. Knowledge and experience in the following areas:
    a. Working with municipal staff on complex, interdisciplinary projects.
    b. Working with clients to assess and agree on project needs and providing innovative, cost-effective services and solutions to meet those needs.
    c. Planning for and complying with stormwater, watershed planning, and municipal stormwater permit requirements.
    d. Planning for regional stormwater facilities, stormwater retrofits, recreational facilities, and multi-benefit projects.
    e. Planning and designing stormwater facilities with both green and gray components and that vary in size, cost, and complexity.
    f. Conducting feasibility studies for stormwater facilities in a variety of conditions and locations, including the examination of drainage areas.
    g. Conducting conceptual planning and developing and assessing alternatives for stormwater facilities.
    h. Developing community engagement and education strategies, with a focus on advancing racial equity.
    i. Developing documents that summarize findings in a clear and concise manner, including excellent visuals and graphics.
2. Outline and description of work required to complete the scope of work.
3. A schedule of deliverables, interim products, and reports within the necessary time frame.
4. Participation of principal, investigators, key support, and technical staff, including estimates of time for each key participant in the project. Identify and describe the qualifications of the individuals who would work on the project. It should estimate the time availability of each individual over the period of the project. It should list references who can verify the recent experience of each individual.
5. List of people, with telephone numbers and email addresses, who can be contacted for reference on relevant experience.
6. Required forms.

NOTE: Do not include fee or cost information in Statements of Qualifications.

SELECTION CRITERIA

The primary selection criterion will be the ability of the firm to understand the issues and accomplish the tasks described in this Request for Qualifications. Other selection criteria will include:

1. Quality of proposed technical approach to project.
2. Experience and qualifications of key personnel who would work on the project.
3. Recommendations of references.
4. Ability to work within deadlines and to develop mutually agreed dates for deliverables.

Appendix G. Funding Sources

*funding sources subject to change

Department of Ecology

The Department of Ecology awards grants and loans on a competitive basis for high priority water quality projects in Washington State. There are five funding programs that make up the Water Quality Combined Funding Program through an integrated annual funding cycle. The Water Quality Combined Funding Program is the annual single-application process to apply for funding from these multiple sources. Funding opportunities vary by funding source, funding category, and project type. With the single application and funding list, Ecology creates funding packages that meet the financial needs of project applicants.

Stormwater Facility projects are eligible for three out of the five funding programs: Washington State Water Pollution Control Revolving Fund; commonly referred to as the Clean Water State Revolving Fund (CWSRF), Stormwater Financial Assistance Program (SFAP), and Sewer Overflow and Stormwater Reuse Municipal Grants Program (OSG). Of these, most stormwater facility projects are funded through CWSRF and SFAP.

Clean Water State Revolving Fund (CWSRF)

The program provides loans for wastewater and stormwater projects and is funded through an annual EPA capitalization grant, state matching funds, and principal and interest payments on past program loans.

Application Deadline: Annual

Loan Amount: Varies. 75% of the total CWSRF is set aside for stormwater facility and wastewater facility construction projects. No more than 50% in this category may be awarded to a single applicant.

Loan Terms: Ecology issues loans for terms of 5, 20, or 30 years. The loan term cannot be longer than the useful life of the project being financed. Most interest rates for 5-year loans is 0.6%, 1.2% for 20 years, and 1.6% for 30 years.

Activities Eligible for Funding: Stormwater project planning and prioritization, design, construction, and small project design/construction.

Application Requirements (submitted as one Water Quality Combined Funding Program application):

- EAGL Form Responses (through online portal, must have/set up Secure Access Washington (SAW) account)
- Detailed Budget Spreadsheet
- Project Schedule
- Site Photos
- Site Maps
- Letters of Support

Application Link: https://ecology.wa.gov/About-us/Payments-contracts-grants/Grants-loans

Stormwater Financial Assistance Program (SFAP) (for retrofits only)

The Stormwater Financial Assistance Program is designed to fund stormwater projects and activities that have proven effective at reducing impacts from existing infrastructure and development and enhance existing stormwater programs. Stormwater facility projects must provide stormwater treatment and/or flow control for stormwater generated from existing hard surfaces. Projects that trigger new or re-development requirements in the appropriate Stormwater Management Manual for Eastern and Western Washington are not eligible for SFAP funding.

Application Cycle: Annual

Grant Amount: Varies. 100% of the fund is provided to cities, counties, and ports for planning and implementing stormwater-related projects. Maximum award is $10,000,000 per funding cycle per applicant.

Match: 15% cash match

Activities Eligible for Funding: Stormwater project planning and prioritization, design, construction, and small project design/construction.

Application Requirements: (submitted as one Water Quality Combined Funding Program application)

- EAGL Form Responses (through online portal, must have/set up SAW account)
- Detailed Budget Spreadsheet
- Project Schedule
- Site Photos
- Site Maps
- Letters of Support

Application Link: https://ecology.wa.gov/About-us/Payments-contracts-grants/Grants-loans

Sewer Overflow and Stormwater Reuse Municipal Grants Program (OSG)

This program awards grants to states, which will then provide sub-awards to eligible entities for projects that address infrastructure needs for combined sewer overflows (CSO), sanitary sewer overflows (SSO), and stormwater management. States are required to prioritize funding projects for communities that are financially distressed and have a long-term municipal CSO or SSO control plan. Projects funded by the OSG will follow the same requirements of the CWSRF.

Application Cycle: Annual

Grant Amount: Varies.

Activities Eligible for Funding: Stormwater project planning and prioritization, design, construction, and small project design/construction.

Application Requirements (submitted as one Water Quality Combined Funding Program application):

- EAGL Form Responses (through online portal, must have/set up SAW account)
- Detailed Budget Spreadsheet
- Project Schedule
- Site Photos
- Site Maps
- Letters of Support

Application Link: https://ecology.wa.gov/About-us/Payments-contracts-grants/Grants-loans

Stormwater Capacity Grants Program

This program awards non-competitive grants to Phase I and Phase II NPDES municipal permittees. These grants are to fund activities and equipment necessary for permit implementation.

Grant Amount: Varies. Set biennially based on approved state budget.

Match Amount: None.

Activities Eligible for Funding: Projects that benefit stormwater management programs and implementation of the NPDES stormwater permit. Examples include public education and outreach, illicit discharge detection and elimination program activities, activities to support programs to control runoff from new development, and source control for existing development. Capital construction projects are not eligible for funding through this program.

Funding Guidelines: 21-23 Capacity Grant Guidelines (wa.gov)

Stormwater Grants of Regional or Statewide Significance Program

This program awards grants on a competitive basis to Phase I and Phase II NPDES municipal permittees. These grants are to fund projects that would provide benefits to more than one permittee.

Grant Amount: $300,000 limit.

Match Amount: None.

Activities Eligible for Funding: Projects that support implementation of permit-required municipal stormwater programs and that demonstrate and sustain long-term benefits to multiple permittees across a region or statewide. Examples include public education and outreach, training programs, and technical tools.

Funding Guidelines: Municipal Stormwater Grants of Regional or State Significance

Recreation and Conservation Office

Washington's Recreation and Conservation Office awards grants through an open and competitive process for salmon recovery, parks, trails, conservation, boating, outdoor recreation, and shooting ranges. Two grants in particular, the Recreation Projects – Washington Wildlife and Recreation Program and the Land and Water Conservation Fund, award grants for acquisition and/or development and improvement of local parks.

Recreation Projects – Washington Wildlife and Recreation Program

This program provides funding for developing and improving local and state parks and trails and providing access to the waterfront. The local parks category provides grants to create or improve parks. Grants in this category provide for active or passive parks and may contain both upland and water-oriented elements.

Application Cycle: Occurs every two years

Grant Amount: Varies. Maximum for development projects is $500,000. Total funding is $45,000,000.

Match: Varies, typically 50%. Match may include labor, equipment, materials, appropriations, cash, bonds, donations of cash, land, labor, equipment and materials, and other grants.

Activities Eligible for Funding: Land acquisition and development of local and state parks. Must be outdoor recreational areas.

Application Requirements:

- Legal Opinion (for first time applicants only; to prove you are eligible to receive funding)
- Application Form (through online portal, must have/set up a PRISM and SAW account)
- Jurisdiction must have a Comprehensive Recreation or Conservation Plan to apply
- PowerPoint presentation to an advisory committee

Application Link: Apply for a Grant - Recreation and Conservation Office (wa.gov)

More Information: Manual 10a WWRP-ORA (wa.gov)

Notes: Land acquired or developed must be kept and maintained for public outdoor recreation use for at least 50 years. Long-term obligations for structures or facilities for outdoor recreation will be tied to a reasonable, agreed-upon service life for the structure or facility.

Land and Conservation Fund

This program provides funding for purchasing and improving parks, trails, wildlife lands, and other outdoor recreational resources. There are two programs: state and legacy. The State Program funds acquisition and development of public outdoor recreational areas, and all communities are eligible to apply.

The Legacy Program funds acquisition and development of land to create or reinvigorate public parks or other outdoor recreation spaces in urbanized areas (populations of at least 30,000). Priority is given to projects in economically disadvantaged areas that lack outdoor recreation opportunities. These applications are reviewed by a national review panel.

Application Cycle: Occurs every two years

Grant Amount: Varies. State varies between $200,000 to $2,000,000 and Legacy varies between $300,000 to $9,580,000. Total funding is $14,000,000.

Match: 50%. Match may include labor, equipment, materials, appropriations, cash, bonds, donations of cash, land, labor, equipment and materials, and other grants. For local agencies, at least 10 percent of the total project cost must come from a non-state, non-federal contribution.

Activities Eligible for Funding: Land acquisition and development or renovation of outdoor recreational areas.

Application Requirements:

- Legal Opinion (for first time applicants only; to prove you are eligible to receive funding)
- Application Form (through online portal, must have/set up a PRISM and SAW account)
- Jurisdiction must have a Comprehensive Recreation or Conservation Plan to apply
- PowerPoint presentation to an advisory committee

Application Link: Apply for a Grant - Recreation and Conservation Office (wa.gov)

More Information: Manual 12 Land and Water Conservation Fund

Notes: All property acquired or developed with these grants must be kept forever exclusively for public outdoor recreational use.

Planning for Recreation Access

This program provides funding for planning projects in communities that lack adequate access to outdoor recreation opportunities. This program specifically focuses on diverse urban neighborhoods, small rural communities, and those that are less experienced with RCO's grant process.

Application Cycle: TBD; first time grant

Grant Amount: $20,000 - $250,000

Match: None.

Activities Eligible for Funding: All phases of planning, pre-design, and technical assistance for public recreation facilities including comprehensive plans, construction drawings, environmental assessments, feasibility and pre-construction studies, route surveys, and site master plans.

Application Requirements:

- Legal Opinion (for first time applicants only; to prove you are eligible to receive funding)
- Application Form (through online portal, must have/set up a PRISM and SAW account)
- PowerPoint presentation to an advisory committee

Application Link: Apply for a Grant - Recreation and Conservation Office (wa.gov)

Appendix H. Operations and Maintenance Recommendations

Table 3. Maintenance Standards and Procedures for Bioretention Facilities.

Component	Recommended Frequency [a]		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
Facility Footprint				
Earthen side slopes and berms	B, S		Erosion (gullies/ rills) greater than 2 inches deep around inlets, outlet, and alongside slopes	• Eliminate cause of erosion and stabilize damaged area (regrade, rock, vegetation, erosion control matting) • For deep channels or cuts (over 3 inches in ponding depth), temporary erosion control measures should be put in place until permanent repairs can be made. • Properly designed, constructed and established facilities with appropriate flow velocities should not have erosion problems except perhaps in extreme events. If erosion problems persist, the following should be reassessed: (1) flow volumes from contributing areas and bioretention facility sizing; (2) flow velocities and gradients within the facility; and (3) flow dissipation and erosion protection strategies at the facility inlet.
	A		Erosion of sides causes slope to become a hazard	Take actions to eliminate the hazard and stabilize slopes
	A, S		Settlement greater than 3 inches (relative to undisturbed sections of berm)	Restore to design height
	A, S		Downstream face of berm wet, seeps or leaks evident	Plug any holes and compact berm (may require consultation with engineer, particularly for larger berms)
	A		Any evidence of rodent holes or water piping in berm	• Eradicate rodents (see "Pest control") • Fill holes and compact (may require consultation with engineer, particularly for larger berms)
Concrete sidewalls	A		Cracks or failure of concrete sidewalls	• Repair/ seal cracks • Replace if repair is insufficient
Rockery sidewalls	A		Rockery side walls are insecure	Stabilize rockery sidewalls (may require consultation with engineer, particularly for walls 4 feet or greater in height)
Facility Area		All maintenance visits (at least biannually)	Trash and debris present	Clean out trash and debris
Facility bottom area	A, S		Accumulated sediment to extent that infiltration rate is reduced (see “Ponded water”) or surface storage capacity significantly impacted	• Remove excess sediment • Replace any vegetation damaged or destroyed by sediment accumulation and removal • Mulch newly planted vegetation • Identify and control the sediment source (if feasible) • If accumulated sediment is recurrent, consider adding presettlement or installing berms to create a forebay at the inlet
		During/after fall leaf drop	Accumulated leaves in facility	Remove leaves if there is a risk to clogging outlet structure or water flow is impeded
Low Permeability Check dams and weirs	A, S		Sediment, vegetation, or debris accumulated at or blocking (or having the potential to block) check dam, flow control weir or orifice	Clear the blockage
	A, S		Erosion and/or undercutting present	Repair and take preventative measures to prevent future erosion and/or undercutting
	A		Grade board or top of weir damaged or not level	Restore to level position

[a] Frequency: A = Annually; B = Biannually (twice per year); M = Monthly; W = At least one visit should occur during the wet season (for debris/clog related maintenance, this inspection/maintenance visit should occur in the early fall, after deciduous trees have lost their leaves); S = Perform inspections after major storm events (24-hour storm event with a 10-year or greater recurrence interval).

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Table 3 (continued). Maintenance Standards and Procedures for Bioretention Facilities.

Component	Recommended Frequency [a]		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
Facility Footprint (cont'd)				
Ponded water	B, S		Excessive ponding water: Water overflows during storms smaller than the design event or ponded water remains in the basin 48 hours or longer after the end of a storm.	Determine cause and resolve in the following order: 1) Confirm leaf or debris buildup in the bottom of the facility is not impeding infiltration. If necessary, remove leaf litter/debris. 2) Ensure that underdrain (if present) is not clogged. If necessary, clear underdrain. 3) Check for other water inputs (e.g., groundwater, illicit connections). 4) Verify that the facility is sized appropriately for the contributing area. Confirm that the contributing area has not increased. If steps #1-4 do not solve the problem, the bioretention soil is likely clogged by sediment accumulation at the surface or has become overly compacted. Dig a small hole to observe soil profile and identify compaction depth or clogging front to help determine the soil depth to be removed or otherwise rehabilitated (e.g., tilled). Consultation with an engineer is recommended.
Inlets/Outlets/Pipes				
Bioretention soil media	As needed		Bioretention soil media protection is needed when performing maintenance requiring entrance into the facility footprint	• Minimize all loading in the facility footprint (foot traffic and other loads) to the degree feasible in order to prevent compaction of bioretention soils. • Never drive equipment or apply heavy loads in facility footprint. • Because the risk of compaction is higher during saturated soil conditions, any type of loading in the cell (including foot traffic) should be minimized during wet conditions. • Consider measures to distribute loading if heavy foot traffic is required or equipment must be placed in facility. As an example, boards may be placed across soil to distribute loads and minimize compaction. • If compaction occurs, soil must be loosened or otherwise rehabilitated to original design state.
Splash block inlet	A		Water is not being directed properly to the facility and away from the inlet structure	Reconfigure/ repair blocks to direct water to facility and away from structure
Curb cut inlet/outlet	M during the wet season and before severe storm is forecasted	Weekly during fall leaf drop	Accumulated leaves at curb cuts	Clear leaves (particularly important for key inlets and low points along long, linear facilities)
Pipe inlet/outlet	A		Pipe is damaged	Repair/ replace
	W		Pipe is clogged	Remove roots or debris
	A, S		Sediment, debris, trash, or mulch reducing capacity of inlet/outlet	• Clear the blockage • Identify the source of the blockage and take actions to prevent future blockages
		Weekly during fall leaf drop	Accumulated leaves at inlets/outlets	Clear leaves (particularly important for key inlets and low points along long, linear facilities)
		A	Maintain access for inspections	• Clear vegetation (transplant vegetation when possible) within 1 foot of inlets and outlets, maintain access pathways • Consultation with a landscape architect is recommended for removal, transplant, or substitution of plants
Erosion control at inlet	A		Concentrated flows are causing erosion	Maintain a cover of rock or cobbles or other erosion protection measure (e.g., matting) to protect the ground where concentrated water enters the facility (e.g., a pipe, curb cut or swale)

[a] Frequency: A = Annually; B = Biannually (twice per year); M = Monthly; W = At least one visit should occur during the wet season (for debris/clog related maintenance, this inspection/maintenance visit should occur in the early fall, after deciduous trees have lost their leaves); S = Perform inspections after major storm events (24-hour storm event with a 10-year or greater recurrence interval).

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Table 3 (continued). Maintenance Standards and Procedures for Bioretention Facilities.

Component	Recommended Frequency [a]		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
Inlets/Outlets/Pipes (cont'd)				
Trash rack	S		Trash or other debris present on trash rack	Remove/dispose
	A		Bar screen damaged or missing	Repair/replace
Overflow	A, S		Capacity reduced by sediment or debris	Remove sediment or debris/dispose
Underdrain pipe	Clean pipe as needed	Clean orifice at least biannually (may need more frequent cleaning during wet season)	• Plant roots, sediment or debris reducing capacity of underdrain • Prolonged surface ponding (see "Ponded water")	• Jet clean or rotary cut debris/roots from underdrain(s) • If underdrains are equipped with a flow restrictor (e.g., orifice) to attenuate flows, the orifice must be cleaned regularly.
Vegetation				
Facility bottom area and upland slope vegetation	Fall and Spring		Vegetation survival rate falls below 75% within first two years of establishment (unless project O&M manual or record drawing stipulates more or less than 75% survival rate).	• Determine cause of poor vegetation growth and correct condition • Replant as necessary to obtain 75% survival rate or greater. Refer to original planting plan, or approved jurisdictional species list for appropriate plant replacements (See Appendix 3 - Bioretention Plant List, in the LID Technical Guidance Manual for Puget Sound). • Confirm that plant selection is appropriate for site growing conditions • Consultation with a landscape architect is recommended for removal, transplant, or substitution of plants
Vegetation (general)	As needed		Presence of diseased plants and plant material	• Remove any diseased plants or plant parts and dispose of in an approved location (e.g., commercial landfill) to avoid risk of spreading the disease to other plants • Disinfect gardening tools after pruning to prevent the spread of disease • See Pacific Northwest Plant Disease Management Handbook for information on disease recognition and for additional resources • Replant as necessary according to recommendations provided for "facility bottom area and upland slope vegetation".
Trees and shrubs		All pruning seasons (timing varies by species)	Pruning as needed	• Prune trees and shrubs in a manner appropriate for each species. Pruning should be performed by landscape professionals familiar with proper pruning techniques • All pruning of mature trees should be performed by or under the direct guidance of an ISA certified arborist
	A		Large trees and shrubs interfere with operation of the facility or access for maintenance	• Prune trees and shrubs using most current ANSI A300 standards and ISA BMPs. • Remove trees and shrubs, if necessary.
	Fall and Spring		Standing dead vegetation is present	• Remove standing dead vegetation • Replace dead vegetation within 30 days of reported dead and dying plants (as practical depending on weather/planting season) • If vegetation replacement is not feasible within 30 days, and absence of vegetation may result in erosion problems, temporary erosion control measures should be put in place immediately. • Determine cause of dead vegetation and address issue, if possible • If specific plants have a high mortality rate, assess the cause and replace with appropriate species. Consultation with a landscape architect is recommended.
	Fall and Spring		Planting beneath mature trees	• When working around and below mature trees, follow the most current ANSI A300 standards and ISA BMPs to the extent practicable (e.g., take care to minimize any damage to tree roots and avoid compaction of soil). • Planting of small shrubs or groundcovers beneath mature trees may be desirable in some cases; such plantings should use mainly plants that come as bulbs, bare root or in 4-inch pots; plants should be in no larger than 1-gallon containers.

[a] Frequency: A = Annually; B = Biannually (twice per year); M = Monthly; W = At least one visit should occur during the wet season (for debris/clog related maintenance, this inspection/maintenance visit should occur in the early fall, after deciduous trees have lost their leaves); S = Perform inspections after major storm events (24-hour storm event with a 10-year or greater recurrence interval).

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Table 3 (continued). Maintenance Standards and Procedures for Bioretention Facilities.

Component	Recommended Frequency [a]		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
Vegetation (cont'd)				
Trees and shrubs (cont'd)	Fall and Spring		Planting beneath mature trees	• When working around and below mature trees, follow the most current ANSI A300 standards and ISA BMPs to the extent practicable (e.g., take care to minimize any damage to tree roots and avoid compaction of soil). • Planting of small shrubs or groundcovers beneath mature trees may be desirable in some cases; such plantings should use mainly plants that come as bulbs, bare root or in 4-inch pots; plants should be in no larger than 1-gallon containers.
	Fall and Spring		Presence of or need for stakes and guys (tree growth, maturation, and support needs)	• Verify location of facility liners and underdrain (if any) prior to stake installation in order to prevent liner puncture or pipe damage • Monitor tree support systems: Repair and adjust as needed to provide support and prevent damage to tree. • Remove tree supports (stakes, guys, etc.) after one growing season or maximum of 1 year. • Backfill stake holes after removal.
Trees and shrubs adjacent to vehicle travel areas (or areas where visibility needs to be maintained)	A		Vegetation causes some visibility (line of sight) or driver safety issues	• Maintain appropriate height for sight clearance • When continued, regular pruning (more than one time/ growing season) is required to maintain visual sight lines for safety or clearance along a walk or drive, consider relocating the plant to a more appropriate location. • Remove or transplant if continual safety hazard • Consultation with a landscape architect is recommended for removal, transplant, or substitution of plants
Vegetation (cont'd)				
Flowering plants		A	Dead or spent flowers present	Remove spent flowers (deadhead)
Perennials		Fall	Spent plants	Cut back dying or dead and fallen foliage and stems
Emergent vegetation		Spring	Vegetation compromises conveyance	• Hand rake sedges and rushes with a small rake or fingers to remove dead foliage before new growth emerges in spring or earlier only if the foliage is blocking water flow (sedges and rushes do not respond well to pruning)
Ornamental grasses (perennial)		Winter and Spring	Dead material from previous year's growing cycle or dead collapsed foliage	• Leave dry foliage for winter interest • Hand rake with a small rake or fingers to remove dead foliage back to within several inches from the soil before new growth emerges in spring or earlier if the foliage collapses and is blocking water flow
Ornamental grasses (evergreen)		Fall and Spring	Dead growth present in spring	• Hand rake with a small rake or fingers to remove dead growth before new growth emerges in spring • Clean, rake, and comb grasses when they become too tall • Cut back to ground or thin every 2-3 years as needed
Noxious weeds		M (March - October)	Listed noxious vegetation is present (refer to current county noxious weed list)	• By law, class A & B noxious weeds must be removed, bagged and disposed as garbage immediately • Reasonable attempts must be made to remove and dispose of class C noxious weeds • It is strongly encouraged that herbicides and pesticides not be used in order to protect water quality; use of herbicides and pesticides may be prohibited in some jurisdictions • Apply mulch after weed removal (see "Mulch")

[a] Frequency: A = Annually; B = Biannually (twice per year); M = Monthly; W = At least one visit should occur during the wet season (for debris/clog related maintenance, this inspection/maintenance visit should occur in the early fall, after deciduous trees have lost their leaves); S = Perform inspections after major storm events (24-hour storm event with a 10-year or greater recurrence interval).

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Table 3 (continued). Maintenance Standards and Procedures for Bioretention Facilities.

Component	Recommended Frequency [a]		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
Vegetation (cont'd)				
Weeds		M (March – October, preceding seed dispersal)	Weeds are present	• Remove weeds with their roots manually with pincer-type weeding tools, flame weeders, or hot water weeders as appropriate • Follow IPM protocols for weed management (see "Additional Maintenance Resources" section for more information on IPM protocols)
Excessive vegetation		Once in early to mid- May and once in early- to mid-September	Low-lying vegetation growing beyond facility edge onto sidewalks, paths, or street edge poses pedestrian safety hazard or may clog adjacent permeable pavement surfaces due to associated leaf litter, mulch, and soil	• Edge or trim groundcovers and shrubs at facility edge • Avoid mechanical blade-type edger and do not use edger or trimmer within 2 feet of tree trunks • While some clippings can be left in the facility to replenish organic material in the soil, excessive leaf litter can cause surface soil clogging
Excessive vegetation (cont'd)	As needed		Excessive vegetation density inhibits stormwater flow beyond design ponding or becomes a hazard for pedestrian and vehicular circulation and safety	• Determine whether pruning or other routine maintenance is adequate to maintain proper plant density and aesthetics • Determine if planting type should be replaced to avoid ongoing maintenance issues (an aggressive grower under perfect growing conditions should be transplanted to a location where it will not impact flow) • Remove plants that are weak, broken or not true to form; replace in-kind • Thin grass or plants impacting facility function without leaving visual holes or bare soil areas • Consultation with a landscape architect is recommended for removal, transplant, or substitution of plants
	As needed		Vegetation blocking curb cuts, causing excessive sediment buildup and flow bypass	• Remove vegetation and sediment buildup
Mulch				
Mulch		Following weeding	Bare spots (without mulch cover) are present or mulch depth less than 2 inches	• Supplement mulch with hand tools to a depth of 2 to 3 inches • Replenish mulch per O&M manual. Often coarse compost is used in the bottom of the facility and arborist wood chips are used on side slopes and rim (above typical water levels) • Keep all mulch away from woody stems
Watering				
Irrigation system (if any)		Based on manufacturer's instructions	Irrigation system present	• Follow manufacturer's instructions for O&M
	A		Sprinklers or drip irrigation not directed/located to properly water plants	• Redirect sprinklers or move drip irrigation to desired areas

Summer watering (first year)		Once every 1-2 weeks or as needed during prolonged dry periods	Trees, shrubs and groundcovers in first year of establishment period	• 10 to 15 gallons per tree
				• 3 to 5 gallons per shrub
				• 2 gallons water per square foot for groundcover areas
				• Water deeply, but infrequently, so that the top 6 to 12 inches of the root zone is moist
				• Use soaker hoses or spot water with a shower type wand when irrigation system is not present
				  ○ Pulse water to enhance soil absorption, when feasible
				  ○ Pre-moisten soil to break surface tension of dry or hydrophobic soils/mulch, followed by several more passes. With this method , each pass increases soil absorption and allows more water to infiltrate prior to runoff
				• Add a tree bag or slow-release watering device (e.g., bucket with a perforated bottom) for watering newly installed trees when irrigation system is not present

[a] Frequency: A = Annually; B = Biannually (twice per year); M = Monthly; W = At least one visit should occur during the wet season (for debris/clog related maintenance, this inspection/maintenance visit should occur in the early fall, after deciduous trees have lost their leaves); S = Perform inspections after major storm events (24-hour storm event with a 10-year or greater recurrence interval).

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Table 3 (continued). Maintenance Standards and Procedures for Bioretention Facilities.

Component	Recommended Frequency [a]		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
Watering (cont'd)				

Summer watering (second and third years)		Once every 2-4 weeks or as needed during prolonged dry periods	Trees, shrubs and groundcovers in second or third year of establishment period	• 10 to 15 gallons per tree
				• 3 to 5 gallons per shrub
				• 2 gallons water per square foot for groundcover areas
				• Water deeply, but infrequently, so that the top 6 to 12 inches of the root zone is moist
				• Use soaker hoses or spot water with a shower type wand when irrigation system is not present
				  ○ Pulse water to enhance soil absorption, when feasible
				  ○ Pre-moisten soil to break surface tension of dry or hydrophobic soils/mulch, followed by several more passes. With this method , each pass increases soil absorption and allows more water to infiltrate prior to runoff

Summer watering (after establishment)		As needed	Established vegetation (after 3 years)	• Plants are typically selected to be drought tolerant and not require regular watering after establishment; however, trees may take up to 5 years of watering to become fully established • Identify trigger mechanisms for drought-stress (e.g., leaf wilt, leaf senescence, etc.) of different species and water immediately after initial signs of stress appear • Water during drought conditions or more often if necessary to maintain plant cover
Pest Control				
Mosquitoes	B, S		Standing water remains for more than 3 days after the end of a storm	• Identify the cause of the standing water and take appropriate actions to address the problem (see "Ponded water") • To facilitate maintenance, manually remove standing water and direct to the storm drainage system (if runoff is from non pollution-generating surfaces) or sanitary sewer system (if runoff is from pollution-generating surfaces) after getting approval from sanitary sewer authority. • Do not use pesticides or *Bacillus thuringiensis israelensis* (Bti)
Nuisance animals	As needed		Nuisance animals causing erosion, damaging plants, or depositing large volumes of feces	• Reduce site conditions that attract nuisance species where possible (e.g., plant shrubs and tall grasses to reduce open areas for geese, etc.) • Place predator decoys • Follow IPM protocols for specific nuisance animal issues (see "Additional Maintenance Resources" section for more information on IPM protocols) • Remove pet waste regularly • For public and right-of-way sites consider adding garbage cans with dog bags for picking up pet waste.
Insect pests	Every site visit associated with vegetation management		Signs of pests, such as wilting leaves, chewed leaves and bark, spotting or other indicators	• Reduce hiding places for pests by removing diseased and dead plants • For infestations, follow IPM protocols (see "Additional Maintenance Resources" section for more information on IPM protocols)

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Table 6. Maintenance Standards and Procedures for Rain Gardens.

Component	Recommended Frequency [a]		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
Rain Garden Footprint				
Earthen side slopes	B (during the wet season)		Persistent soil erosion on slopes	If erosion persists, water may be flowing into the garden too rapidly. In this case, the slope of the pipe or swale directing water to the garden, or the amount of water may need to be reduced (see "Erosion control at inlet")
Rockery sidewalls	A		Rockery side walls are insecure	Stabilize rockery sidewalls (may require consultation with engineer, particularly for walls 4 feet or greater in height)
Rain garden footprint		B	Trash and debris present	Clean out trash and debris
Rain garden bottom area	A		Visible sediment deposition in the rain garden that reduces drawdown time of water in the rain garden	• Remove sediment accumulation • If sediment is deposited from water entering the rain garden, determine the source and stabilize the area
		During/after fall leaf drop	Accumulated leaves in rain garden (may reduce infiltration capacity of rain garden or clog overflow)	Remove leaves
Ponded water	B, S		Excessive ponding water: Ponded water remains in the basin more than 3 days after the end of a storm	Confirm leaf, debris or sediment buildup in the bottom of the rain garden is not impeding infiltration. If necessary, remove leaf litter/debris/sediment. If this does not solve the problem, consultation with a professional with rain garden expertise is recommended to evaluate the following: • Check for other water inputs (e.g., groundwater, illicit connections) • Verify that the facility is sized appropriately for the contributing area. Confirm that the contributing area has not increased • Determine if the soil is clogged by sediment accumulation at the surface or if the soil has become overly compacted

[a] Frequency: A = Annually; B = Biannually (twice per year); S = Perform inspections after major storm events (24-hour storm event with a 10-year or greater recurrence interval).

Table 6 (continued). Maintenance Standards and Procedures for Rain Gardens.				
Component	Recommended Frequency [a]		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
Inlets/Outlets/Pipes				
Splash block inlet	A		Water is not being directed properly to the rain garden and away from the building	Reconfigure/ repair blocks to direct water to the rain garden and away from building
Pipe inlet/ outlet	A		Pipe capacity is reduced by sediment or debris (can cause backups and flooding)	Clear pipes of sediment and debris
Pipe inlet/outlet (cont'd)	A		Damaged/cracked drain pipes	• Repair/seal cracks • Replace when repair is insufficient
Erosion control at inlet	A		Rock or cobble is removed or missing and concentrated flows are contacting soil	Maintain a cover of rock or cobbles to protect the ground where concentrated water flows into the rain garden from a pipe or swale
Vegetation				
Vegetation		As needed	Dying, dead, or unhealthy plants	• Maintain a healthy cover of plants • Remove any diseased plants or plant parts and dispose of in commercial landfill to avoid risk of spreading the disease to other plants • Disinfect gardening tools after pruning to prevent the spread of disease • Re-stake trees if they need more support, but plan to remove stakes and ties after the first year • Cars can damage roots – protect root areas of trees and plants from vehicle traffic
		As needed	Vegetation inhibits sight distances and sidewalks	Keep sidewalks and sight distances on roadways clear
		As needed	Broken, dead, or sucker vegetation is present	Remove broken or dead branches and suckers
		As needed	Vegetation is crowding inlets and outlets	Keep water inlets and outlets in the rain garden clear of vegetation

[a] Frequency: A = Annually; B = Biannually (twice per year); S = Perform inspections after major storm events (24-hour storm event with a 10-year or greater recurrence interval).

Table 6 (continued). Maintenance Standards and Procedures for Rain Gardens.				
Component	Recommended Frequency [a]		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
Vegetation (cont'd)				
Vegetation (cont'd)		As needed	Broken, dead, or sucker vegetation is present	Remove broken or dead branches and suckers
		As needed	Vegetation is crowding inlets and outlets	Keep water inlets and outlets in the rain garden clear of vegetation
	One time March through June		• Yellowing: possible Nitrogen (N) deficiency • Poor growth: possible Phosphorous (P) deficiency • Poor flowering, spotting or curled leaves, or weak roots or stems: possible Potassium (K) deficiency	• Test soil to identify specific nutrient deficiencies • Consult with a professional knowledgeable in the area of natural amendments or refer to Natural Lawn and Garden Care resources and avoid synthetic fertilizers • Consider selecting different plants for soil conditions
Weeds		As needed, preceding seed dispersal	Problem weeds are present	• Remove weeds by hand, especially in spring when the soil is moist and the weeds are small • Dig or pull weeds out by the roots before they go to seed • Apply mulch after weeding (see "Mulch")
Mulch				
Mulch		Following weeding	Bare spots (without mulch cover) are present or mulch depth less than 2 inches	• Supplement mulch with hand tools to a depth of 2 to 3 inches • Use coarse compost in the bottom of the rain garden and arborist wood chips on side slopes and rim (above typical water levels) • Keep all mulch from being in contact with woody stems.

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Table 6 (continued). Maintenance Standards and Procedures for Rain Gardens.

Component	Recommended Frequency [a]		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
Watering				
Summer watering (first year)		Once every 1-2 weeks or as needed during prolonged dry periods	Tree, shrubs and groundcovers in first year of establishment period	• 10 to 15 gallons per tree • 3 to 5 gallons per shrub • 2 gallons water per square foot for groundcover areas • Water deeply, but infrequently, so that the top 6 to 12 inches of the root zone is moist • Use soaker hoses or spot water with a shower type wand when irrigation system is not present • Add a tree bag or slow-release watering device (e.g., bucket with a perforated bottom) for watering newly installed trees when irrigation system is not present
Summer watering (second and third years)		Once every 2-4 weeks or as needed during prolonged dry periods	Tree, shrubs and groundcovers in second or third year of establishment period	• 10 to 15 gallons per tree • 3 to 5 gallons per shrub • 2 gallons water per square foot for groundcover areas • Water deeply, but infrequently, so that the top 6 to 12 inches of the root zone is moist • Use soaker hoses or spot water with a shower type wand when irrigation system is not present
Summer watering (after establishment)		As needed	Established vegetation (after 3 years)	• Water during drought conditions or more often if necessary to maintain plant cover • Identify trigger mechanisms for drought-stress (e.g., leaf wilt, leaf senescence, etc.) of different rain garden species and water immediately after initial signs of stress appear

[a] Frequency: A = Annually; B = Biannually (twice per year); S = Perform inspections after major storm events (24-hour storm event with a 10-year or greater recurrence interval).

Table 6 (continued). Maintenance Standards and Procedures for Rain Gardens.				
Component	Recommended Frequency [a]		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
Pest Control				
Mosquitoes	B, S		Standing water remains for more than 3 days after the end of a storm	• Identify the cause of the standing water and take appropriate actions to address the problem (see "Ponded water") • Do not use pesticides or *Bacillus thuringiensis israelensis* (Bti)

[a] Frequency: A = Annually; B = Biannually (twice per year); S = Perform inspections after major storm events (24-hour storm event with a 10-year or greater recurrence interval).

Table 8. Maintenance Standards and Procedures for Permeable Pavement.

Component	Recommended Frequency [a]		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
Surface/Wearing Course				
Permeable Pavements, all	A, S		Runoff from adjacent pervious areas deposits soil, mulch or sediment on paving	• Clean deposited soil or other materials from permeable pavement or other adjacent surfacing • Check if surface elevation of planted area is too high, or slopes towards pavement, and can be regraded (prior to regrading, protect permeable pavement by covering with temporary plastic and secure covering in place) • Mulch and/or plant all exposed soils that may erode to pavement surface
Porous asphalt or pervious concrete		A or B	None (routine maintenance)	Clean surface debris from pavement surface using one or a combination of the following methods: • Remove sediment, debris, trash, vegetation, and other debris deposited onto pavement (rakes and leaf blowers can be used for removing leaves) • Vacuum/sweep permeable paving installation using: ○ Walk-behind vacuum (sidewalks) ○ High efficiency regenerative air or vacuum sweeper (roadways, parking lots) ○ ShopVac or brush brooms (small areas) • Hand held pressure washer or power washer with rotating brushes Follow equipment manufacturer guidelines for when equipment is most effective for cleaning permeable pavement. Dry weather is more effective for some equipment.
	A[b]		Surface is clogged: Ponding on surface or water flows off the permeable pavement surface during a rain event (does not infiltrate)	• Review the overall performance of the facility (note that small clogged areas may not reduce overall performance of facility) • Test the surface infiltration rate using ASTM C1701 as a corrective maintenance indicator. Perform one test per installation, but not less than 1 test per 2,500 square feet. • If the results indicate an infiltration rate of 10 inches per hour or less, then perform corrective maintenance to restore permeability. To clean clogged pavement surfaces, use one or combination of the following methods: • Combined pressure wash and vacuum system calibrated to not dislodge wearing course aggregate. • Hand held pressure washer or power washer with rotating brushes • Pure vacuum sweepers Note: If the annual/biannual routine maintenance standard to clean the pavement surface is conducted using equipment from the list above, corrective maintenance may not be needed.
	A		Sediment present at the surface of the pavement	• Assess the overall performance of the pavement system during a rain event. If water runs off the pavement and/or there is ponding then see above. • Determine source of sediment loading and evaluate whether or not the source can be reduced/eliminated. If the source cannot be addressed, consider increasing frequency of routine cleaning (e.g., twice per year instead of once per year).
	Summer		Moss growth inhibits infiltration or poses slip safety hazard	• Sidewalks: Use a stiff broom to remove moss in the summer when it is dry • Parking lots and roadways: Pressure wash, vacuum sweep, or use a combination of the two for cleaning moss from pavement surface. May require stiff broom or power brush in areas of heavy moss.
	A		Major cracks or trip hazards and concrete spalling and raveling	• Fill potholes or small cracks with patching mixes • Large cracks and settlement may require cutting and replacing the pavement section. Replace in-kind where feasible. Replacing porous asphalt with conventional asphalt is acceptable if it is a small percentage of the total facility area and does not impact the overall facility function. • Take appropriate precautions during pavement repair and replacement efforts to prevent clogging of adjacent porous materials

[a] Frequency: A= Annually; B= Biannually (twice per year); S = Perform inspections after major storm events (24-hour storm event with a 10-year or greater recurrence interval).
[b] Inspection should occur during storm event.

Table 8 (continued). Maintenance Standards and Procedures for Permeable Pavement.

Component	Recommended Frequency [a]		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
Surface/Wearing Course (con't)				
Interlocking concrete paver blocks and aggregate pavers		A or B	None (routine maintenance)	Clean pavement surface using one or a combination of the following methods: • Remove sediment, debris, trash, vegetation, and other debris deposited onto pavement (rakes and leaf blowers can be used for removing leaves) • Vacuum/sweep permeable paving installation using: o Walk-behind vacuum (sidewalks) o High efficiency regenerative air or vacuum sweeper (roadways, parking lots) o ShopVac or brush brooms (small areas) • Note: Vacuum settings may have to be adjusted to prevent excess uptake of aggregate from paver openings or joints. Vacuum surface openings in dry weather to remove dry, encrusted sediment.
	A [b]		Surface is clogged: Ponding on surface or water flows off the permeable pavement surface during a rain event (does not infiltrate)]	• Review the overall performance of the facility (note that small clogged areas may not reduce overall performance of facility) • Test the surface infiltration rate using ASTM C1701 as a corrective maintenance indicator. Perform one test per installation, but not less than one test per 2,500 square feet. • If the results indicate an infiltration rate of 10 inches per hour or less, then perform corrective maintenance to restore permeability. • Clogging is usually an issue in the upper 2 to 3 centimeters of aggregate. Remove the upper layer of encrusted sediment, and fines, and/or vegetation from openings and joints between the pavers by mechanical means and/or suction equipment (e.g., pure vacuum sweeper). • Replace aggregate in paver cells, joints, or openings per manufacturer's recommendations
	A		Sediment present at the surface of the pavement	• Assess the overall performance of the pavement system during a rain event. If water runs off the pavement and/or there is ponding, then see above. • Determine source of sediment loading and evaluate whether or not the source can be reduced/eliminated. If the source cannot be addressed, consider increasing frequency of routine cleaning (e.g., twice per year instead of once per year).
	Summer		Moss growth inhibits infiltration or poses slip safety hazard	• Sidewalks: Use a stiff broom to remove moss in the summer when it is dry • Parking lots and roadways: Vacuum sweep or stiff broom/power brush for cleaning moss from pavement surface
	A		Paver block missing or damaged	Remove individual damaged paver blocks by hand and replace or repair per manufacturer's recommendations
	A		Loss of aggregate material between paver blocks	Refill per manufacturer's recommendations for interlocking paver sections
	A		Settlement of surface	May require resetting
Open-celled paving grid with gravel		A or B	None (routine maintenance)	• Remove sediment, debris, trash, vegetation, and other debris deposited onto pavement (rakes and leaf blowers can be used for removing leaves) • Follow equipment manufacturer guidelines for cleaning surface.
	A [b]		Aggregate is clogged: Ponding on surface or water flows off the permeable pavement surface during a rain event (does not infiltrate)]	• Use vacuum truck to remove and replace top course aggregate • Replace aggregate in paving grid per manufacturer's recommendations
	A		Paving grid missing or damaged	• Remove pins, pry up grid segments, and replace gravel • Replace grid segments where three or more adjacent rings are broken or damaged • Follow manufacturer guidelines for repairing surface.
	A		Settlement of surface	May require resetting
	A		Loss of aggregate material in paving grid	Replenish aggregate material by spreading gravel with a rake (gravel level should be maintained at the same level as the plastic rings or no more than 1/4 inch above the top of rings). See manufacturer's recommendations.
		A	Weeds present	• Manually remove weeds • Presence of weeds may indicate that too many fines are present (refer to Actions Needed under "Aggregate is clogged" to address this issue)

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[b] Inspection should occur during storm event.

Table 8 (continued). Maintenance Standards and Procedures for Permeable Pavement.

Component	Recommended Frequency [a]		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
Surface/Wearing Course (con't)				
Open-celled paving grid with grass		A or B	None (routine maintenance)	• Remove sediment, debris, trash, vegetation, and other debris deposited onto pavement (rakes and leaf blowers can be used for removing leaves) • Follow equipment manufacturer guidelines for cleaning surface.
	A b		Aggregate is clogged: Ponding on surface or water flows off the permeable pavement surface during a rain event (does not infiltrate)]	• Rehabilitate per manufacturer's recommendations.
	A		Paving grid missing or damaged	• Remove pins, pry up grid segments, and replace grass • Replace grid segments where three or more adjacent rings are broken or damaged • Follow manufacturer guidelines for repairing surface.
	A		Settlement of surface	• May require resetting
	A		Poor grass coverage in paving grid	• Restore growing medium, reseed or plant, aerate, and/or amend vegetated area as needed • Traffic loading may be inhibiting grass growth; reconsider traffic loading if feasible
		As needed	None (routine maintenance)	• Use a mulch mower to mow grass
		A	None (routine maintenance)	• Sprinkle a thin layer of compost on top of grass surface (1/2" top dressing) and sweep it in • Do not use fertilizer
		A	Weeds present	• Manually remove weeds • Mow, torch, or inoculate and replace with preferred vegetation
Inlets/Outlets/Pipes				
Inlet/outlet pipe	A		Pipe is damaged	Repair/replace
	A		Pipe is clogged	Remove roots or debris
Underdrain pipe	Clean pipe as needed	Clean orifice at least biannually (may need more frequent cleaning during wet season)	Plant roots, sediment or debris reducing capacity of underdrain (may cause prolonged drawdown period)	• Jet clean or rotary cut debris/roots from underdrain(s) • If underdrains are equipped with a flow restrictor (e.g., orifice) to attenuate flows, the orifice must be cleaned regularly
Raised subsurface overflow pipe	Clean pipe as needed	Clean orifice at least biannually (may need more frequent cleaning during wet season)	Plant roots, sediment or debris reducing capacity of underdrain	• Jet clean or rotary cut debris/roots from under-drain(s) • If underdrains are equipped with a flow restrictor (e.g., orifice) to attenuate flows, the orifice must be cleaned regularly
Outlet structure	A, S		Sediment, vegetation, or debris reducing capacity of outlet structure	• Clear the blockage • Identify the source of the blockage and take actions to prevent future blockages

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[b] Inspection should occur during storm event.

Table 8 (continued). Maintenance Standards and Procedures for Permeable Pavement.

Component	Recommended Frequency [a]		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
Surface/Wearing Course (con't)				
Overflow	B		Native soil is exposed or other signs of erosion damage are present at discharge point	Repair erosion and stabilize surface
Aggregate Storage Reservoir				
Observation Port	A, S		Water remains in the storage aggregate longer than anticipated by design after the end of a storm	If immediate cause of extended ponding is not identified, schedule investigation of subsurface materials or other potential causes of system failure.
Vegetation				
Adjacent large shrubs or trees		As needed	Vegetation related fallout clogs or will potentially clog voids	• Sweep leaf litter and sediment to prevent surface clogging and ponding • Prevent large root systems from damaging subsurface structural components
		Once in May and Once in September	Vegetation growing beyond facility edge onto sidewalks, paths, and street edge	Edging and trimming of planted areas to control groundcovers and shrubs from overreaching the sidewalks, paths and street edge improves appearance and reduces clogging of permeable pavements by leaf litter, mulch and soil.
Leaves, needles, and organic debris		In fall (October to December) after leaf drop (1-3 times, depending on canopy cover)	Accumulation of organic debris and leaf litter	Use leaf blower or vacuum to blow or remove leaves, evergreen needles, and debris (i.e., flowers, blossoms) off of and away from permeable pavement

[a] Frequency: A= Annually; B= Biannually (twice per year); S = Perform inspections after major storm events (24-hour storm event with a 10-year or greater recurrence interval).
[b] Inspection should occur during storm event.