55TH AVE. SOUTH AND KUBOTA GARDEN - STORMWATER MASTER PLAN

JUNE 2021

KUBOTA GARDEN FOUNDATION

Seattle Parks & Recreation

King County
Department of
Natural Resources and Parks
Wastewater Treatment Division

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PROJECT SUMMARY

Kubota Garden is located in the Rainier Beach neighborhood of South Seattle and makes up about 21.3 acres within the upper Mapes Creek basin (68.2 acres total). Mapes Creek flows directly through Kubota Garden and discharges north into Lake Washington at Be'er Sheva Park.

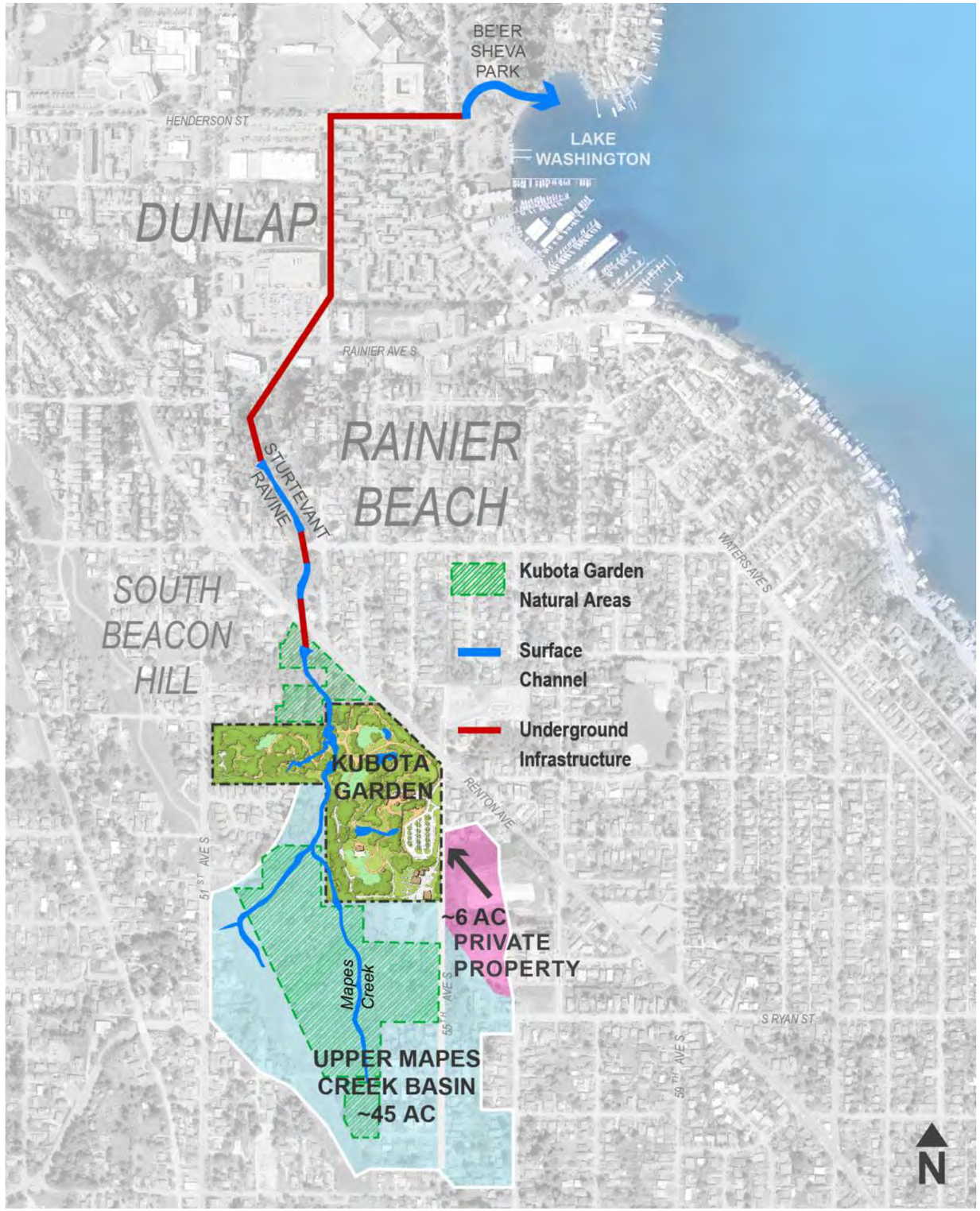
Inside the Garden, creek diversions create a "necklace" of ponds for visitors to enjoy. Garden visitors and maintenance staff have observed that the ponds can be "cloudy" – which is the result of stormwater carrying sediment into the ponds. This sediment buildup requires extra maintenance to clear and degrades the overall water quality in the ponds and the Mapes Creek watershed.

During an extensive stormwater study conducted in the winter of 2021, stormwater flows in the Garden were monitored to determine where sediment is coming from, where it ends up, and what to do about it. The goal is to make stormwater improvements that maximize ecological benefit, reduce garden maintenance, and enhance the garden experience. Not only will these improvements reduce stormwater impacts, they will also benefit pedestrian circulation, support educational opportunities, and promote the Kubota Garden's unique sense of place.

This Stormwater Master Plan, and the stormwater improvement projects that follow, will build off of the *2019 Kubota Garden Master Plan Update*. As part of this project effort, the Kubota Garden parking lot will be redesigned to accommodate visitor growth while strategizing safe pedestrian and bicycle connections from 55th Ave. S into the Garden. This Stormwater Master Plan will be used to inform concept design options for the Kubota Garden parking lot and other stormwater improvements.

PROJECT GOALS

- Improve water quality to create healthy ecological conditions in the Garden and Mapes Creek
- Improve visual quality of the water / garden experience
- Improve maintenance regimes in ponds and associated stormwater features
- Design stormwater features that have educational benefit
- Create a safe and accessible entry experience and circulation whether driving, walking, or bicycling to the Garden
- Provide more off-street parking and improve passenger loading, drop-off, and ride-share accommodations for current visitors and future growth
- Mitigate impacts of new parking lot and other new developments



STORMWATER IMPACTS: THE PROBLEM

Kubota Garden receives drainage from over 68 acres of land, including offsite flows from 55th Ave. S, the residential area east of 55th Ave. S, the nearby Catholic school property, and the largely forested upper Mapes Creek basin. During a 100-year storm event (a large storm that has a 1% chance of happening in a given year), it has been estimated that roughly 12.5 CFS (cubic feet per second) of stormwater is traveling through the Garden and into its Mapes Creek pond system. During the initial stormwater study for this project, a multitude of factors were considered as potentially affecting the water quality of the Mapes Creek pond system within Kubota Garden:

- Sediment-dense stormwater runoff that flows down the non-stabilized shoulder along the west side of 55th Ave. S and enters the small gravel parking lot
- Sediment from the parking lot and maintenance areas that flows into catch basins during rain events
- Stormwater runoff from the Garden's gravel paths
- Mapes Creek erosion upstream of Kubota Garden bringing sediment into the ponds

The water quality monitoring strategy was to assess the sources of sediment to the Garden ponds and establish priority areas for improvement. The study included analysis of total suspended solids (TSS) in receiving waters, sediment capture in catch basin inserts, and visual observations. Results of the water quality monitoring showed:

- Spring Pond is receiving the bulk of the transported sediment. Specific sources include west side of 55th Ave. S, the east side of maintenance yard, the parking lot, and the west side of maintenance yard and access road.
- Catch basins on the maintenance access road experienced elevated sediment and gravel issues
- On-site paths are contributing to sediment issues in the ponds, but more monitoring would need to be done to conclusively determine which paths and to what degree
- Erosion within Mapes Creek and the east side of 55th Ave. S were not significant contributors of sediment

Based on the monitoring results, the four key areas contributing sediment to the pond system have been ranked for their relative impact:

#1 - 55th Ave. S
#2 - Maintenance Yard
#3 - Parking Lot
#4 - On-Site Paths

STORMWATER IMPROVEMENTS: POTENTIAL SOLUTIONS

The stormwater impacts to the Kubota Garden have been found to be largely the result of degraded surfacing and exposed / loose material, both within and outside of the Garden, and drainage patterns that transport this sediment from the identified areas into the Garden ponds.

There are numerous potential solutions that can be implemented to mitigate these stormwater impacts by both addressing conditions at the surface (where sediment is introduced) and drainage patterns (how sediment is transported). Stormwater solutions will be a combined effort of improving surface conditions to limit the sources of sediment and introducing new green stormwater infrastructure that captures stormwater runoff containing sediment before it makes way into the Garden ponds.

The improvements proposed in this master plan range from simple, low-cost solutions that could be implemented relatively quickly, to more significant, higher-cost developments that would take more time to complete. All site improvements need to support the overarching project goals (page 1) to promote multifunctional benefits to the Kubota Garden. Essential considerations include:

- Limits of disturbance
- Associated maintenance regime
- Cost - both construction cost and long-term operations and maintenance cost
- Aesthetic look and feel - need to promote Kubota Garden context

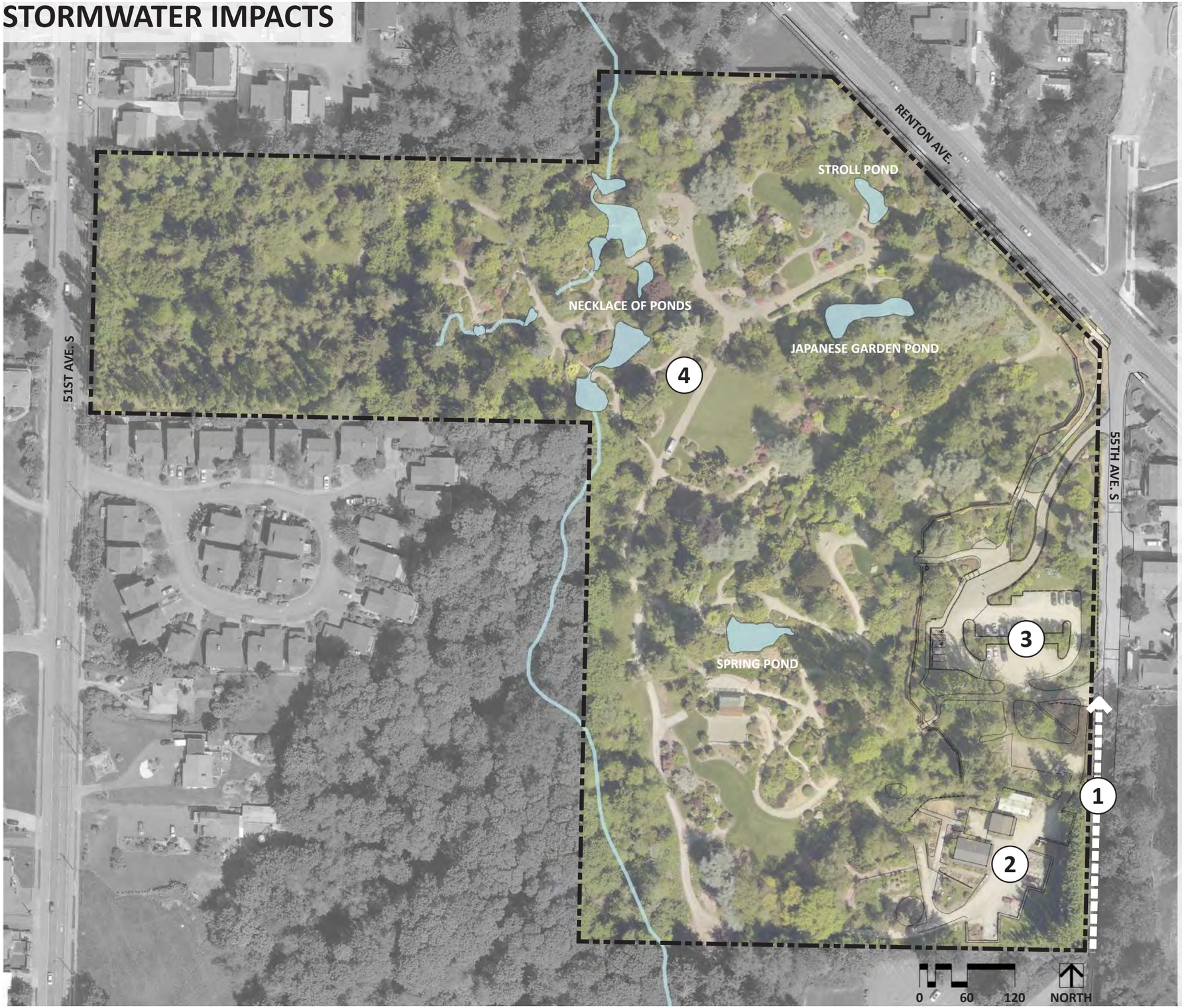
Moving forward, it is important to recognize the impact climate change is having on producing larger storm events and the need for the proposed stormwater solutions to respond to these changes for long-term resiliency. Another challenge that this site will need to respond to is the projected low-infiltration rates of the local soil. The concept design options for the Kubota Garden parking lot and other stormwater improvements will integrate solutions to both of these issues.

STORMWATER FACILITY DESIGN AND THE GARDEN AESTHETIC

Kubota Garden is a significant cultural and historic resource for citizens of the Seattle area and visitors from around the globe. The Core Garden, a 4.5 acre portion of the site containing the majority of the initial designed gardens created by Fujitaro Kubota, was designated as a historic landmark by the City of Seattle in 1981. To this day, the Garden reflects the original design intent of Fujitaro Kubota - melding the landscape traditions of Japan with the environmental character of the Pacific Northwest. The original Garden design embraced the use of readily available local materials, including boulders and native plants, and combined them with traditional Japanese garden elements to create a truly unique design style.

It is essential that any new stormwater improvements that are developed and visible within the Garden ensure that the design aesthetic established by Fujitaro Kubota is respected. Stormwater improvements that will be reviewed through this design lens may include paving upgrades, drainage systems, and green stormwater infrastructure (GSI). GSI, such as bioswales and bioretention facilities, have the opportunity to support the Kubota Garden's distinct design through strategic selection of plant species, planting composition, sculpting of landscape depressions for stormwater capture, and thoughtful integration of boulders.

STORMWATER IMPACTS



1 55TH AVE. S

Stormwater runoff is directed north and down the hill of 55th Ave. S towards Renton Ave. and the Kubota Garden parking lot. Runoff flows along the unpaved, non-stabilized shoulder on the west side of the road and picks up significant sediment. Sediment travels downhill, reaches the southern edge of the parking lot exit, enters a catch basin, and is transported to the Garden ponds.

2 MAINTENANCE YARD

The maintenance yard surfacing is loose gravel, resulting in widespread sediment migration during storm events. Along the eastern edge of the yard's gravel road, a small channel transports gravel and sediment from the upper yard to a catch basin at the southern edge of the parking lot exit and ultimately to the ponds. The west side of the yard also drains sediment into the ponds through an alternate route. Uncovered material stockpiles as well as exposed slopes contribute additional material from this area.

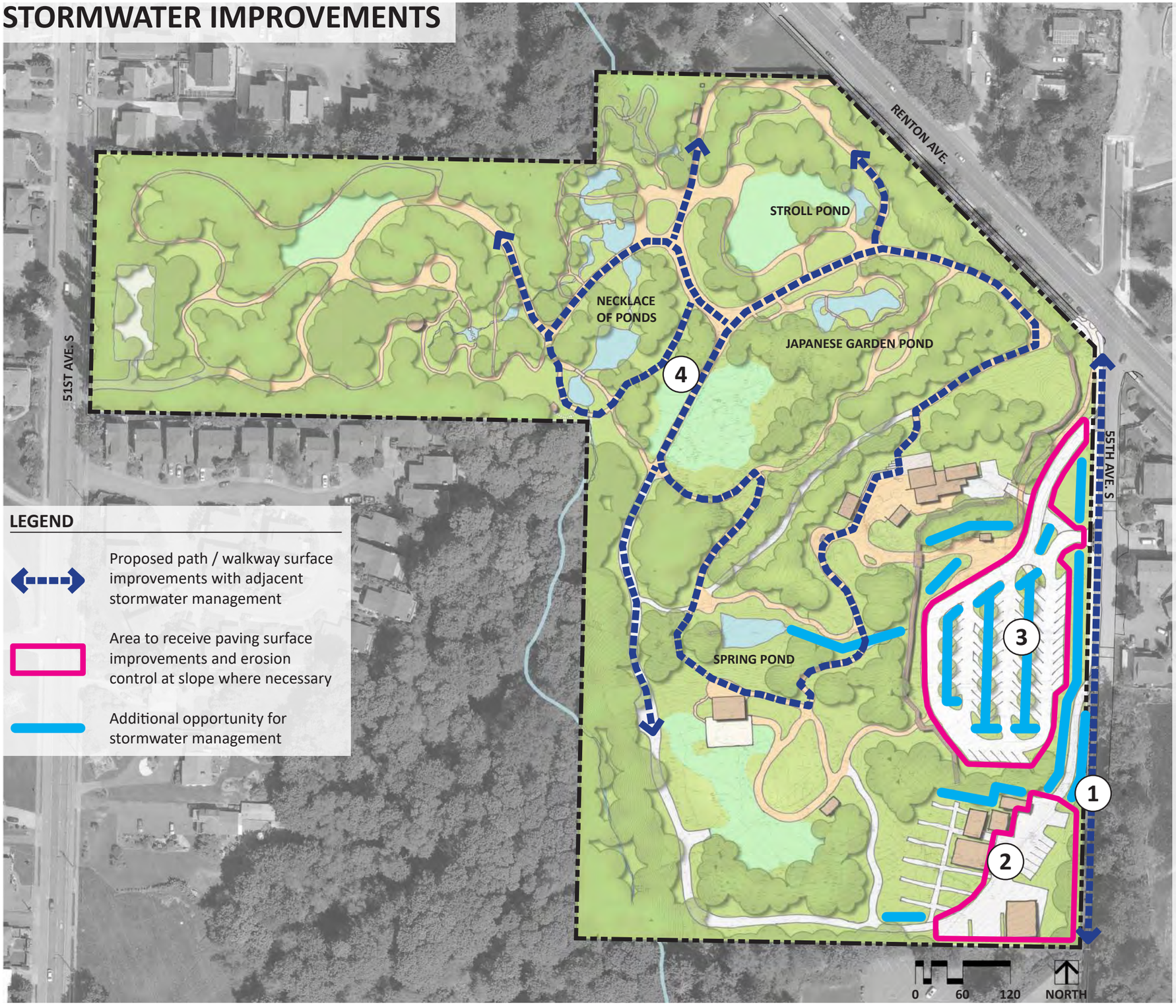
3 PARKING LOT

The parking area at Kubota Garden is a loose gravel lot with a central vegetated island. Sediment and other materials from the unstable surfacing are directed to several catch basins through stormwater flows. The runoff and associated sediment is then discharged into a landscaped swale before being released into the ponds.

4 ON-SITE PATHS

Many of the Kubota Garden paths, as well as the maintenance yard access road, are eroding and collecting sediment and gravel throughout the site. It is likely that this loose material on the paths is transported into drainage structures that drain directly into the ponds during storm events. The stormwater study monitoring results indicate that the site paths may be contributing sediment to the Garden's ponds, but further monitoring would need to be completed in order to conclusively determine which paths are contributing to the problem and to what degree.

STORMWATER IMPROVEMENTS



LEGEND

- Proposed path / walkway surface improvements with adjacent stormwater management
- Area to receive paving surface improvements and erosion control at slope where necessary
- Additional opportunity for stormwater management

1 55TH AVE. S

Improvements at 55th Ave. S will be focused on the west side of the road to address the associated stormwater impacts. Enhancement of pedestrian circulation is also desired here as there is currently no formal walkway along the street. Potential solutions will mostly be constructed in the public right-of-way (ROW) and could include a variety design strategies to achieve project goals (see page 5).

The design and development of street improvements should be coordinated with the Kubota Garden goals of constructing a sidewalk from Renton Ave. up to the Garden parking lot. All work in the ROW will require close collaboration with SDOT to determine the extent of improvements and the possibility of making 55th Ave. S a one-way road with on-street parking.

2 MAINTENANCE YARD

Proposed improvements at the maintenance yard will be focused on upgrading the surface of the lot, covering material stockpiles, and capturing stormwater sediment before it makes its way into the ponds (see pages 6-7). These improvements should address stormwater impacts while supporting operations and maintenance efforts.

3 PARKING LOT

The Kubota Garden parking lot is currently scoped to be redeveloped in the near future. The redesign effort has numerous goals, including increasing parking capacity, improving circulation and pedestrian experience, creating a beautiful arrival point for the Garden, and mitigating stormwater impacts. The parking lot design proposed in the *2019 Kubota Garden Master Plan Update* (as shown) provides the starting point for stormwater improvements and the concept design phase.

There are a variety of potential stormwater solutions for the parking lot focused on surface upgrades and stormwater capture (see pages 8-9). It will be critical for these improvements to support the general design goals for the Garden's primary point of arrival.

4 ON-SITE PATHS

While further study is needed to determine which paths are contributing sediment to the ponds, a broad approach to upgrading degraded site paths and strategically integrating stormwater solutions adjacent to paths is expected to help mitigate overall stormwater impacts (see page 10).

Note: Plan graphic shown in map is from the *2019 Kubota Garden Master Plan Update*.

55TH AVE. S (WEST SIDE) - STORMWATER IMPROVEMENTS

ASPHALT THICKENED EDGE

- Thickened edge keeps stormwater within roadway, thus reducing erosion and sediment transport along exposed dirt shoulder
- Does not address pedestrian circulation or stormwater treatment
- Low cost, low maintenance, low impact to street width
- Will require stormwater treatment in public ROW with proprietary treatment device or on private property with bioretention

SIDEWALK WITH CURB AND GUTTER

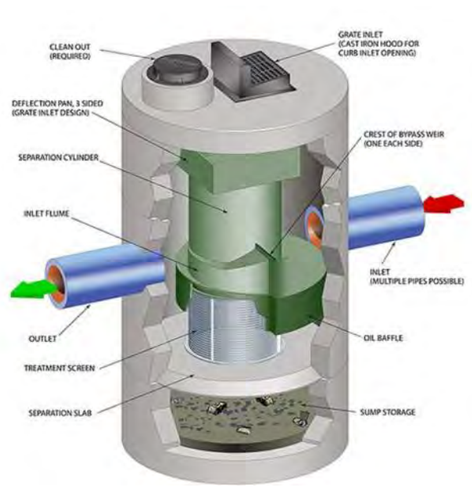
- Replaces loose material with hard paving but does not address stormwater treatment
- Optimum condition for accessible pedestrian walkway
- High cost, lowest maintenance, higher impact to street width
- Will require stormwater treatment in public ROW with proprietary treatment device or on private property with bioretention

BIOSWALE - GRASS

- Linear stormwater facility would capture and filter roadway runoff before releasing to the Garden drainage system in large storm events
- Provides horizontal separation between roadway and pedestrians
- Low cost, low maintenance, high impact to street width
- Would mitigate need for additional stormwater treatment of roadway runoff

BIOSWALE - PLANTING

- Linear stormwater facility would capture and filter roadway runoff before releasing to the Garden drainage system in large storm events
- Provides horizontal separation between roadway and pedestrians
- Higher cost, higher maintenance, better pedestrian environment, higher impact to street width
- Would mitigate need for additional stormwater treatment of roadway runoff



PROPRIETARY STORMWATER TREATMENT IN ROW

- Singular piece of infrastructure used to intercept drainage and treat stormwater before it is released into the Garden drainage system and out to the ponds
- Multiple types of products are available (see pages 8-9)
- Use in conjunction with asphalt thickened edge or sidewalk with curb and gutter
- Low cost, low maintenance, low aesthetic value, no impact to street width

BIORETENTION ON ADJACENT PROPERTY

- Planted “rain garden” area adjacent to roadway but on Kubota Garden property would intercept roadway stormwater for treatment
- Leverages bioretention soil profile and vegetation to treat stormwater vertically and provide higher detention capacity than bioswales before directing stormwater to an underdrain
- Use in conjunction with asphalt thickened edge or sidewalk with curb and gutter
- Higher cost, higher maintenance, no impact to street width

MAINTENANCE YARD - STORMWATER IMPROVEMENTS

PAVEMENT SURFACE TREATMENT - CHIP SEAL

- Existing gravel driving area can receive application of a special protective wearing surface, thereby reducing sediment in stormwater
- Facilitates ease of operations and maintenance processes and allows striping
- Low cost, higher maintenance
- Will require additional stormwater facilities to capture runoff

PAVEMENT SURFACE TREATMENT - ASPHALT

- Replaces loose material with asphalt paving, thereby reducing sediment in stormwater
- Facilitates ease of operations and maintenance processes and allows striping
- High cost, low maintenance
- Will require additional stormwater facilities to capture runoff

COVER MATERIAL STOCKPILES - TARP

- Reduces sediment contribution from material stockpiles on site
- Tarps may make operations and maintenance processes more difficult
- Lowest cost, medium maintenance

COVER MATERIAL STOCKPILES - STRUCTURED COVER

- Reduces sediment contribution from material stockpiles on site
- Roof structures may make operations and maintenance processes easier
- Higher cost, low maintenance

PROTECT EXPOSED SLOPES - MULCH

- Temporary solution
- Arborist wood chip mulch would provide a quick and easy way to reduce erosion and sediment contribution in the short-term
- Low cost, higher maintenance, low aesthetic value

PROTECT EXPOSED SLOPES - PLANTING RESTORATION

- Restored planting will reduce erosion and sediment contribution over the long-term
- Higher cost, lower maintenance, high aesthetic value

MAINTENANCE YARD - STORMWATER IMPROVEMENTS

COMPOST FILTER SOCKS

- Temporary solution
- Compost filter socks would provide a quick and easy way to reduce erosion and sediment contribution in the short-term
- Versatile uses - can be installed on slopes, as check dams in swales, and around catch basins

CATCH BASIN PROTECTION - SAND OR GRAVEL BAGS

- Temporary solution
- Sand or gravel bags would provide a quick and easy way to capture sediment from maintenance yard stormwater runoff in the short-term
- Sand or gravel bags could be concentrated around catch basins out of sight of visitors
- Lowest cost, higher maintenance, lowest aesthetic value

SMALL SCALE SETTLING PONDS

- Landscape depressions would capture maintenance yard runoff and allow sediment to settle before releasing stormwater to the Garden drainage system
- Would perform best in conjunction with pavement surface improvement (chip seal or asphalt)
- Low cost, higher maintenance, lowest aesthetic value

BIOSWALE - GRASS

- Linear stormwater facility would capture and filter maintenance yard runoff before releasing to the Garden drainage system in large storm events
- Would perform best in conjunction with pavement surface improvement (chip seal or asphalt)
- Low cost, low maintenance

BIOSWALE - PLANTING

- Linear stormwater facility would capture and filter maintenance yard runoff before releasing to the Garden drainage system in large storm events
- Would perform best in conjunction with pavement surface improvement (chip seal or asphalt)
- Higher cost, higher maintenance, high aesthetic value

BIORETENTION FACILITY

- Planted “rain garden” area adjacent to maintenance yard would intercept stormwater runoff for treatment
- Would perform best in conjunction with pavement surface improvement (chip seal or asphalt)
- Higher cost, higher maintenance, high aesthetic value

PARKING LOT - STORMWATER IMPROVEMENTS

PAVEMENT SURFACE TREATMENT - ASPHALT

- Replaces loose material with asphalt paving, thereby reducing sediment in stormwater
- Facilitates ease of vehicle and pedestrian circulation and allows striping
- High cost, low maintenance
- Will require additional stormwater facilities to capture and treat runoff

PERMEABLE PAVEMENT / PAVERS

- Replaces loose material with hard paving
- Permeable surface would provide attenuation of stormwater runoff
- Can work well to differentiate areas - i.e. pavers in parking stalls, asphalt in drive aisle
- Higher cost, low maintenance, high aesthetic value

BIOSWALES - GRASS

- Linear stormwater facility in between parking aisles would capture and filter parking lot runoff through vegetation before releasing to the Garden drainage system in large storm events
- Would perform best in conjunction with asphalt paving surface improvement
- Low cost, low maintenance

BIOSWALES - PLANTING

- Linear stormwater facility in between parking aisles would capture and filter parking lot runoff through vegetation before releasing to the Garden drainage system in large storm events
- Would perform best in conjunction with asphalt paving surface improvement
- Higher cost, higher maintenance, high aesthetic value

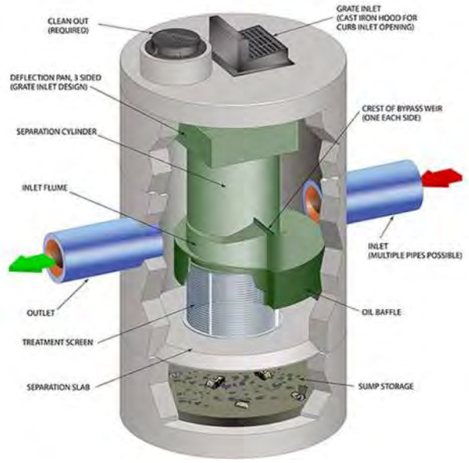
BIORETENTION FACILITIES

- Planted “rain garden” areas in between parking aisles would intercept parking lot stormwater runoff for treatment
- Leverages bioretention soil profile and vegetation to treat stormwater vertically and provide higher detention capacity than bioswales before directing stormwater to an underdrain
- Would perform best in conjunction with asphalt paving surface improvement
- Higher cost, higher maintenance, high aesthetic value

UNDERGROUND STORMWATER DETENTION VAULT

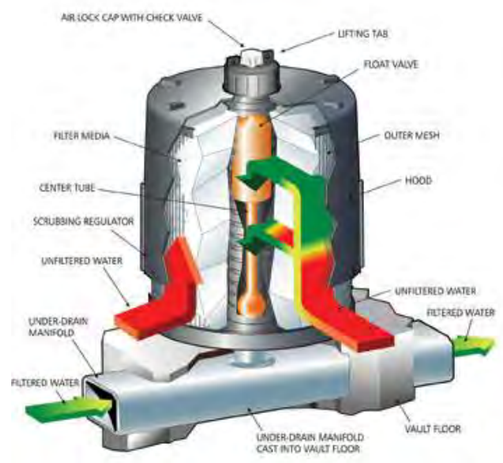
- Primary parking lot stormwater improvement proposed by the *2019 Kubota Garden Master Plan Update* supports flow control but not treatment
- Parking lot runoff would need to be pre-treated to remove sediment prior to conveyance to an underground vault for detention and slow release into the Garden drainage system
- Base aggregate underneath the pavement can also be leveraged for detention
- High cost, low maintenance, low aesthetic value

PARKING LOT - STORMWATER IMPROVEMENTS



PROPRIETARY TREATMENT - HYDRODYNAMIC SEPARATOR

- Hydrodynamic separators (HDS), also known as oil/grit separators (OGS), are widely deployed as stormwater treatment where a settling chamber function is needed
- HDS target the removal of high specific gravity suspended solids (such as sand, grit, and degraded asphalt), as well as free-floating oil and grease , trash, and debris
- Employ with current parking lot surface condition or with upgraded pavement surface
- Low cost, low maintenance, low aesthetic value



PROPRIETARY TREATMENT - STORMFILTER

- StormFilter is an underground stormwater treatment device comprised of one or more structures containing rechargeable, media-filled cartridges that trap particulates and adsorb pollutants from stormwater runoff such as total suspended solids, hydrocarbons, nutrients, metals, and other common pollutants
- Performance verified by the State of Washington Department of Ecology
- Employ with current parking lot surface condition or with upgraded pavement surface
- Low cost, low maintenance, low aesthetic value

PROPRIETARY TREATMENT - MODULAR WETLANDS

- Biofiltration system housed within singular structure utilizing patented horizontal flow, allowing for a smaller footprint, higher treatment capacity, and design versatility
- Provides pollutant removal for TSS, heavy metals, nutrients, hydrocarbons, and bacteria through a combination of physical, chemical, and biological processes
- Planting at surface works with underground system and helps reduce flow
- Employ with current parking lot surface condition or with upgraded pavement surface
- Low cost, higher maintenance, higher aesthetic value

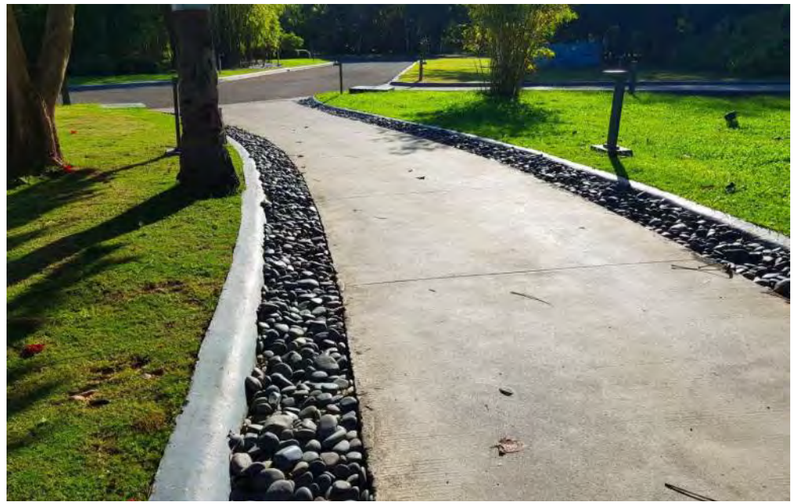
ON-SITE PATHS - STORMWATER IMPROVEMENTS

PAVEMENT SURFACE TREATMENT - PATH STABILIZER

- Replaces loose material with stabilized crushed rock, thereby reducing sediment in stormwater
- Facilitates ease of pedestrian circulation and promotes accessibility standards
- Maintains existing rough path surface texture and auditory experience
- Lower cost, higher maintenance

PAVEMENT SURFACE TREATMENT - CONCRETE

- Replaces loose material with concrete paving, thereby reducing sediment in stormwater
- Facilitates ease of pedestrian circulation and promotes accessibility standards
- Special finish can be applied to concrete to enhance Kubota Garden aesthetic
- High cost, low maintenance



FRENCH DRAIN

- Linear drainage system adjacent to paths would capture runoff and collect sediment prior to release to Garden ponds
- Low cost, low maintenance, potentially high aesthetic value

BIOSWALES

- Linear stormwater facilities adjacent to paths would capture and filter runoff prior to release to the Garden drainage system
- Facilities should be located in areas where paths drain directly into ponds via surface flows or piped conveyance
- Low cost, low maintenance

BIORETENTION FACILITY

- Planted “rain garden” area(s) nearby paths would capture runoff for treatment
- Leverages bioretention soil profile and vegetation to treat stormwater vertically and provide higher detention capacity than bioswales before directing stormwater to an underdrain
- Facilities should be located in areas where paths drain directly into ponds via surface flows or piped conveyance
- Higher cost, higher maintenance, high aesthetic value

UPPER MAPES CREEK BASIN - STORMWATER IMPROVEMENTS

WHAT ABOUT UPPER MAPES CREEK BASIN?

During the stormwater study portion of this project, erosion in the upper Mapes Creek basin was not found to be a significant contributing factor for sediment loading in the Kubota Garden ponds. While the sediment levels in the Creek were found to be relatively low, the flows directed to the ponds from this area are quite high. Therefore, additional stormwater improvement measures upstream of the Garden are presented here in order to assist with future long-term planning efforts and help further mitigate sediment transport after the preceding priority areas are addressed.

Factors to consider when planning for stormwater improvements in the upper Mapes Creek basin include the following:

- The sediment moving through upper Mapes Creek is diluted
- This lower total suspended solid (TSS) content results in a steep diminishing return in terms of degree of difficulty and benefit when trying to remove sediment - i.e. it's much harder to get the last 6 mg/L out than the first 220 mg/L
- Upper Mapes Creek runs through a forested basin that's semi-steep and this kind of slope naturally generates some sediment transport
- The typical solution for addressing the sediment is to settle it out, and at the scale of the basin, it's cost prohibitive
- The stormwater study found that sediment entering and exiting the Kubota Garden ponds is within a similar range of TSS and aren't out of the ordinary
- While the upper Mapes Creek basin was found to not currently have a significant stormwater impact on the Garden, areas with active erosion should receive targeted erosion control to maintain the low level of sediment transport

EROSION CONTROL - COMPOST FILTER SOCKS

- Temporary solution for exposed slopes - alternative to mulch
- Compost filter socks would provide a quick and easy way to reduce erosion and sediment contribution in the short-term
- Low cost, higher maintenance, lowest aesthetic value

EROSION CONTROL - MULCH

- Temporary solution for exposed slopes
- Arborist wood chip mulch would provide a quick and easy way to reduce erosion and sediment contribution in the short-term
- Low cost, higher maintenance, low aesthetic value

EROSION CONTROL - PLANTING RESTORATION

- Restored planting at exposed slopes will reduce erosion and sediment contribution over the long-term
- Evergreen trees and understory planting will maximize reduction in stormwater runoff
- Higher cost, lower maintenance, high aesthetic value

CREEK CHANNEL WORK

- After applying erosion control for areas draining into the Creek where needed, in-water work could potentially further help mitigate sediment transport into the Garden ponds
- Further analysis is required to determine if creek channel work is warranted
- Strategies could include armoring the Creek channel at erosion-prone areas, introducing large woody debris to slow flows, and constructing settling ponds for sediment capture
- Highest cost, low maintenance, high aesthetic value

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