Seahurst Park Master Plan

APPENDIX D
STEWARDSHIP AND MONITORING PLAN

Prepared for

City of Burien

Prepared by

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August 2002

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1 INTRODUCTION

In 2002, the City of Burien developed a Master Plan for Seahurst Park using funding provided by the Salmon Recovery Funding Board. The Master Plan encompasses all areas of the park including nearshore, riparian, and upland habitats. As the City of Burien looks towards implementing Master Plan components, it recognizes the need for baseline and long-term data collection. This Monitoring and Stewardship Plan is intended to provide an overview of the types of monitoring activities that can be useful for evaluating the effectiveness of the design implementation as they relate to salmonid recovery, and the stewardship opportunities for promoting the success of restoration activities. This document is the first step in developing a monitoring and stewardship plan that will direct future activities, but will need to become more focused and detailed to reflect the goals and priorities of the City of Burien and any future, permit related, monitoring obligations.

This Plan presents two levels of monitoring and stewardship opportunities that require different degrees of expertise and expense. The first level of activities is volunteer-based and can provide general information on park conditions and be conducted at little or minimal cost. Assistance by volunteers would be integral to the first level of monitoring. The main objective of these activities is to characterize current conditions in general and screen for potential future concerns. Expert supervision by an organization such as People for Puget Sound is recommended to coordinate the volunteer activities and ensure standardized methods of data collection.

The second level of investigation would use professional scientists to conduct more intensive monitoring studies. This level of monitoring is intended to improve our understanding of how specific Master Plan components affect salmonid habitat conditions and utilization and how well the restoration of park features are sustained with time. Studies designed by experts or under expert supervision would also increase the ability to analyze potential trends in habitat recovery. The collection of baseline and post-construction data for several of these monitoring components is likely to be required during the permitting process for the restoration activities.

This monitoring plan is focused on shoreline restoration that improves the habitat conditions important for salmon, specifically, Chinook salmon. All anadromous salmonids use nearshore habitats, such as those found along Seahurst Park, during adult spawning migrations and for

juvenile migration and rearing, but chinook, chum, pink, and cutthroat use these habitats more than other species (Williams et al. 2001). Salmonids use nearshore habitats for foraging, refuge, protection from predators, osmoregulation, juvenile migration, and adult migration (Williams et al. 2001). For example, returning adult salmon use nearshore habitats as foraging areas, feeding on forage fish. Surf smelt and sand lance are two important forage fish that are known to spawn in the upper intertidal areas of the Seahurst Park shoreline. Surf smelt and sand lance lay their eggs in the upper intertidal areas in sand and gravel substrates (Williams et al. 2001). By improving conditions important for surf smelt and sand lance spawning, important salmonid prey populations will be maintained.

The monitoring and stewardship activities presented in the remainder of this document are summarized in Table 1. For each monitoring component, an overview of the rationale and general procedures are provided, as well as a cost estimate, equipment needs, and potential project partners.

Table 1
Summary of Potential Monitoring and Stewardship Activities

	Nearshore	Riparian Corridor and Streams
Monitoring	**Volunteer** • Shoreline inventory • Eelgrass surveys • Clam surveys **Expert** • Hydroacoustic bathymetry surveys • Grain size analysis • Forage fish surveys • Eelgrass surveys • Fish usage-beach seining • Epibenthic and benthic resources surveys	**Volunteer** • Riparian vegetation assessments • Substrate assessments • Invertebrate sampling • Water quality assessments • Salmon spawning surveys • Hatchery release documentation • Bank Slope surveys • Channel configuration surveys **Expert** • Statistical analyses of collected habitat data • Riparian vegetation assessments
Stewardship	• Marine debris and park clean-up • Removal of non-native vegetation • Restoration of native vegetation	• Park clean-up • Maintenance of north stream acclimation pond • Water quality improvement

2 GENERAL MONITORING RECOMMENDATIONS

The monitoring activities at Seahurst Park are likely to be a combination of professionally-conducted study components required for permitting restoration activities and opportunistic sampling efforts based on funding/volunteer availability. There are several general recommendations related to the timing, repeat sampling, background stations, and potential project partners that should be considered during the planning of monitoring activities.

The timing of monitoring activities is dependent upon the availability of funding and the seasonal or annual nature of the data being collected. It is imperative to collect quality baseline data on the physical and biological conditions of the park prior to restoration activities for comparison purposes post-restoration. Although a high-intensity monitoring program that includes seasonal baseline sampling is ideal, a moderate level of baseline sampling is beneficial to improving our understanding of how the restoration activities may contribute to salmonid utilization of the park shoreline and creeks. Post-construction sampling activities should occur at least annually during the first two years after construction. After that time, sampling at regular intervals (for example every three years) would provide an invaluable long-term dataset that could be used to track park changes and the sustainability of restoration activities. If seasonal monitoring is impractical, activities such as the volunteer shoreline inventory, eelgrass studies, and clam surveys should be conducted in the summer. Epibenthic/benthic prey resources and fish utilization studies should be conducted in spring or early summer. Other monitoring components, such as slope and substrate assessments should be conducted at the same time of the year, each time the monitoring is conducted. Additionally, spawner surveys for salmon in the creek and forage fish spawning surveys should occur during expected spawning run periods.

Monitoring efforts should collect data in a standardized, documented procedure that can be repeated during subsequent sampling events. This includes recording information on sample site location that allows the same location to be re-visited. Depending on the data being collected, locating features may require a global positioning system (GPS) or differential GPS (DGPS). An organization such as People for Puget Sound can significantly contribute expertise and/or equipment to ensure volunteer data are collected using a standardized and repeatable procedure.

Background study areas can provide important information for evaluating conditions at study locations in the park. For datasets such as epibenthic and benthic productivity and fish utilization, background area and study site data can be used for comparisons and evaluations to monitor the recovery process at Seahurst Park. A natural beach, known as the Branson Property, located one-half mile south of Seahurst Park was recently acquired by the City of Burien, and would serve as a suitable background area for these investigations. Additional monitoring activities that would benefit from comparison to a background area are identified throughout this document (Section 3).

Several organizations may be interested in providing assistance or conducting the volunteer-based monitoring and stewardship activities discussed in this Plan. Professional scientists working for state and local agencies, private consultants, or Universities could conduct the monitoring components requiring expert assistance. One or more of these organizations has experience conducting various monitoring assessments and surveys in Puget Sound; therefore, the group is identified as a potential monitoring partner. For example, the Washington Department of Fish and Wildlife (WDFW) conducts forage fish spawning surveys in many areas of the state's shoreline and would be a logical monitoring partner for these surveys at Seahurst Park. Volunteer participants from the community may be recruited from a variety of groups to conduct monitoring and stewardship activities, including:

- Community volunteers
- Volunteers coordinated through People for Puget Sound
- Marine Technology Center students
- Highline Community College students
- South Seattle Community College students
- Environmental Science Center students

3 NEARSHORE MONITORING ACTIVITIES

A major component of this shoreline restoration project is to remove a bulkhead and rock revetment along a large portion of shoreline and to return it to a more natural condition. The removal of the bulkhead and rock revetment is expected to have impacts on the slope of the existing shoreline as well as the substrate. In turn, these changes will have impacts on the biological communities established in and using Seahurst Park. This monitoring plan offers suggestions for ways the City of Burien could evaluate these changes in the physical and biological condition of the beach at Seahurst Park resulting from restoration activities.

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3.1 Volunteer Monitoring

3.1.1 Shoreline Inventory

Rationale and General Procedures

A volunteer-conducted shoreline inventory can provide a detailed overview of nearshore habitat conditions. General habitat features that can be documented by volunteers, such as substrate composition, beach slope and width, presence of eelgrass, presence of driftwood, and presence of overhanging vegetation can be used to assess the condition of nearshore habitats based on their ability to support juvenile salmonids and their prey. In addition, habitat information is useful for evaluating whether nearshore configurations created through the restoration activities are being sustained or are being significantly altered by subsequent natural processes.

Volunteers can collect many types of useful physical and biological data for assessing nearshore habitat conditions. People for Puget Sound has developed a Rapid Shoreline Inventory (RSI) Protocol that guides volunteer stewards to collect shoreline data at 150-foot intervals (PPS 2001). People for Puget Sound would be an ideal participant to coordinate and train volunteers to collect shoreline data. Using their RSI Protocol, data can be collected along the entire Seahurst Park shoreline in approximately one day. People for Puget Sound can provide the required training and expert supervision to collect the following information:

- Characteristics of intertidal zone (including width, aquatic vegetation cover, substrate characterization, presence of driftwood (large woody debris), and beach slope)

- Characteristics of backshore zone (including width, substrate characterization, vegetation coverage, and overhanging vegetation)
- Bluff/bank characteristics
- Invasive species distribution
- Adjacent land use
- Streams, outfalls, and other freshwater discharges
- Artificial shoreline structures inventory
- Wildlife presence

Ideally, this survey should be conducted each year in the summer for the first few years after restoration activities occur, and frequency could drop off to once every two or three years after that initial time period.

Cost: $4,000 - $6,000. These costs are for People for Puget Sound expenses, assuming 3 training days and 1 day of field work with 10 volunteers. This cost would be incurred each time a survey was conducted, unless the same group of volunteers could be used each time.

Equipment: All equipment would be provided by People for Puget Sound.

Potential Project Partner: People for Puget Sound is an ideal organization to work with on the shoreline inventory monitoring. They have developed a protocol for volunteer-based data collection and experience in coordinating and training volunteers for the collection of quality data.

3.1.2 Eelgrass Surveys

Rationale and General Procedures

Eelgrass is an important habitat component for juvenile salmonid rearing, refuge, and feeding (Williams et al. 2001). Eelgrass is also an important area for refuge and feeding for other marine fish species, invertebrates, and birds. Volunteer monitoring of the growth and extent of eelgrass coverage at Seahurst Park can provide useful information for evaluating eelgrass beds along the shoreline, as well as long-term changes that may be associated with the implementation of Master Plan components.

The U.S. Environmental Protection Agency's Volunteer Estuary Monitoring Report outlines protocols for conducting intertidal eelgrass sampling using volunteers (EPA 2001). Surveys are conducted along transects and information is collected on percent cover and eelgrass shoot density using a one-meter square quadrat. A researcher familiar with eelgrass could teach volunteers how to distinguish between eelgrass shoots and blades. This survey should be conducted at least once a year in the summer or early fall for the first few years after restoration activities occur. After the first few years post-construction, the surveys could be scaled back to once every two or three years.

Cost: $400 - $600 for equipment and volunteer training by eelgrass expert for one day (This could be combined with the People for Puget Sound RSI.) This cost would be incurred each time a survey was conducted.

Equipment: one-meter square quadrat, tape measure, stakes.

Potential Project Partner: The eelgrass survey could be incorporated into the People for Puget Sound RSI described above.

3.1.3 Clam Surveys

Rationale and General Procedures

Clam and other shellfish are important members of the nearshore biological community and can be good indicators of the area's biological productivity. Clam surveys can provide useful information on the stability of nearshore substrates and can indicate whether shellfish harvest guidelines are being followed. Clam surveys conducted by King County Department of Natural Resources (KC-DNR) trained volunteers in 1996-1997 identified a scarce occurrence of clams at Seahurst Park and attributed the scarcity to overharvesting.

Surveys similar to the ones conducted in 1996-1997 by KC-DNR could be conducted again at Seahurst Park for this project following the same guidelines. Volunteers would be trained by an expert according to protocols outlined in WDFW's Population Assessment Procedures Guide (1995 -- as referenced in KC-DNR 1998). This survey should be conducted each year in the summer for the first few years after restoration

activities occur. Survey frequency could decrease to once every two or three years after that initial time period.

Cost: $400 - $600 for expert training and equipment for one day. This cost would be incurred each time a survey is conducted.

Equipment: Sieves, quadrat, tape measure.

Potential Project Partner: KC-DNR would be an appropriate agency to team with since they conducted clam surveys in the late 1990s at Seahurst Park. Alternatively, the clam surveys could be incorporated into the People for Puget Sound RSI.

3.2 Professional Monitoring

3.2.1 Beach Profile Survey

Rationale and General Procedures

A two-staged approach could be used to conduct beach profiles (cross sections) survey for monitoring purposes. Stage one would consist of a land-based cross-sectional survey at ten locations from the backshore down to 0 feet Mean Lower Low Water (MLLW). This type of land-based survey has already been conducted at four profile locations at Seahurst Park. The four detailed profiles were used to characterize the slope of the beach. A photogrammetric map was prepared in 2002 (using aerial photographs) down to +1 MLLW at two foot contour intervals. The six additional profile locations would span the length of the park shore to adequately characterize future changes along the entire shore, with one profile (of the ten) located south of the park and one located north of the north end of the concrete seawall. The ten profiles could be resurveyed quarterly throughout the year (ideally in March, July, September and December). This would allow for quantitative monitoring of beach slope changes and accretion/erosion trends in the baseline period and then occurring as a result of the shoreline restoration. Sediment samples (two) should also be collected from each profile during surveying. Processing could be carried out at a later date when adequate funding was secured.

Additional topography measurements should be made between profile locations during the spring (March) and fall (September) periods to capture the beach surface in plan form. This would allow for beach volume changes to be accurately calculated in specific

areas of the park shore. Existing survey control monuments would be sufficient for setting up several new monuments and completing a topography map of sufficient detail. Without this level of data collection, accurate beach volume changes would not be possible, and the baseline data collection period would have been missed.

Stage two of the data collection would consist of a hydroacoustic bathymetric survey conducted between 0 feet MLLW and –30 feet MLLW. This deeper survey would provide beach slope information for the subtidal area and could also be used to survey aquatic vegetation (e.g., eelgrass). A key component of this two-staged approach would be to integrate the land-based survey and hydroacoustic survey into one dataset. These survey types would need to be conducted by professionals.

An accurate measurement of beach slope and width is crucial to determine if the removal of the bulkhead and rock revetment and associated shoreline restoration activities are having the anticipated and desired effects. Comparing the bathymetry of the restored beach area with that of pre-restoration beach and possibly unaltered beach areas with a similar coastal setting (e.g., orientation, fetch) would be useful in gauging the beach's recovery. Beach slope surveys should ideally be conducted every year for the first few years after restoration activities. After the initial few years, survey frequency could scaled back to every two or three years.

Cost: $7,000 - $10,000 for a boat with all necessary equipment and operators for one day of hydroacoustic surveying. The cost of a land-based survey would be $3,000 - $4,500 for the ten profile survey, which includes basic data processing. The initial beach survey period would also involve establishing several new monuments that would involve a one-time cost on the order of less than $1,000. Note that land-based surveying alone would not be useful for mapping the extent of eelgrass beds or other aquatic vegetation.

Equipment: provided by professionals

Potential Project Partners: The US Army Corps of Engineers would have certain monitoring responsibilities associated with their participation in shoreline restoration.

3.2.2 Grain Size Analysis

Rationale and General Procedures

Monitoring data on substrate grain size can provide useful information on the quality of habitat for juvenile salmonids and their prey. Substrate grain size is important to monitor because it is expected to change as shoreline restoration activities occur, specifically removing the bulkhead and rock revetment. For example, substrate grain size is important for forage fish spawning that is known to have occurred all along the beach at Seahurst Park. In addition, grain size data can indicate whether the intended nearshore configuration created by restoration activities exist and are sustainable.

Substrate grain size samples can be collected from several (six to eight) intertidal locations throughout the park. Samples are collected as shallow cores of a known diameter and are analyzed using a "sieve stack" that sorts substrate into sizes ranging from cobbles to fine sand. The percentages of each substrate size class provide useful information on the physical processes shaping the site and the types of biological activities beneficial for salmon (e.g., forage fish spawning) that may occur at the site. Grain size analysis should coincide with the frequency and timing of the slope surveys.

Cost: $1000 - $1500 for all equipment and an expert for one day. This cost would be incurred each time an analysis is conducted.

Equipment: provided by professional

Potential Project Partners: Private consultant

3.2.3 Forage Fish Spawning Ground Surveys

Rationale and General Procedures

The shoreline restoration activities are intended to improve spawning habitat conditions for forage fish through changes in substrate size, upper intertidal accessibility, and amount of overhanging vegetation. Therefore, monitoring forage fish spawning

activities is important to determine if the shoreline restoration activities are functioning as anticipated.

Forage fish spawning surveys along the shoreline should be conducted using WDFW protocols for determining the presence of surf smelt and sand lance eggs on beaches. Sampling must be conducted by a WDFW-trained expert and consists of obtaining a sample of mixed sand and gravel from the upper intertidal region of the target beach, condensing the sample to a manageable volume, and examining the sample under a dissecting microscope to determine the presence or absence of eggs (Penttila and Moulton 2001). Forage fish spawning surveys should be conducted on an annual basis during the expected forage fish spawning seasons during the first few years after restoration activities occur. After that time, surveys could be conducted every two or three years. At Seahurst Park, surf smelt spawning would be expected from April through August; herring spawning would be expected from May through January; and sand lance spawning would be expected from March through October.

Cost: $3000 - $4000 for WDFW experts to survey beaches at Seahurst Park. This cost would be incurred each time a set of surveys was conducted for one spawning year.

Equipment: provided by professional

Potential Project Partner: WDFW conducts forage fish spawning surveys in many locations throughout the state and has developed the accepted protocols to be used.

3.2.4 Eelgrass Surveys

Rationale and General Procedures

As discussed in the volunteer monitoring section, eelgrass is an important habitat component for juvenile salmonids. The nearshore restoration activities may improve intertidal conditions to allow expanded eelgrass coverage. Detailed investigations of eelgrass extent and density can provide valuable information for documenting the short and long-term effects of nearshore restoration on eelgrass beds.

WDFW has developed Eelgrass/Macroalgae Habitat Survey Guidelines that should be implemented to determine the extent and density of eelgrass. The guidelines require a diver biologist to conduct the survey along transects throughout the study area. An alternative approach for mapping eelgrass beds is through the hydroacoustic survey discussed in Section 3.2.1. Hydroacoustic survey outputs could also be interpreted to determine the extent and density of eelgrass beds. Ideally, extensive eelgrass surveys should occur each year for the first few years post-construction. After that time, surveys could be conducted once every two or three years.

Cost: $20,000 - $30,000 This cost would be incurred each time a dive survey of the eelgrass bed located offshore of Seahurst Park was conducted. As an alternative, the hydroacoustic survey could be used to determine the extent of the eelgrass bed offshore of Seahurst Park. The hydroacoustic survey costs are detailed in the costs listed in Section 3.2.1.

Equipment: provided by Private consultant

Potential Project Partners: Private consultant

3.2.5 Fish Usage—Beach Seining

Rationale and General Procedures

An important aspect of determining whether restoration activities are beneficial to salmonids is to monitor juvenile salmonid utilization of the nearshore areas. Removal of the bulkhead and rock revetment should allow for the re-establishment of natural beach slope conditions, which would increase habitat area and quality for juvenile salmonids. An additional component of this monitoring could be a dietary analysis to identify their prey items. A food habits study linked to an epibenthic/benthic productivity study (Section 3.2.6) can demonstrate the link between what the fish are eating and what prey items are available. As discussed above, this monitoring component should incorporate investigations at a background area, such as the City of Burien shoreline section approximately 0.5 miles south of the park. A comparison of results from Seahurst Park and the background area would be useful to evaluate whether the shoreline restoration increased fish utilization.

Juvenile fish sampling procedures should be consistent with those used in other Puget Sound areas. The King County Department of Natural Resources (KC-DNR) uses a 30-meter beach seine in fish surveys conducted throughout the area. These surveys have included Seahurst Park. Several sampling locations in the park should be established for the investigation. Continued baseline and post-construction sampling would be useful to determine whether fish use increases as shoreline restoration activities occur. Beach seines should be conducted on an annual basis in the spring or early summer (during juvenile outmigration period) for the first few years post construction. After this time period, the beach seines could be conducted every two or three years.

Cost: $2,000 to $5,000. This cost depends on the availability of existing scientific collection permits. Permits are required from WDFW, National Marine Fisheries Service, and U.S. Fish and Wildlife Service. In addition to adding costs to the project, permit review may require several months. This cost would be incurred each year beach seines are conducted.

Equipment: provided by professional

Potential Project Partner: KC-DNR has an ongoing nearshore fish sampling program. Their participation would be beneficial due to the ability to collect data in a consistent manner with their broader studies and because separate scientific collection permits would not be needed.

3.2.6 Epibenthic and Benthic Resources

Rationale and General Procedures

The monitoring of epibenthic and benthic resources provides an indication of the productivity of the nearshore habitats and availability of prey resources for juvenile salmonids. This monitoring component can be conducted in coordination with a fish diet study (Section 3.2.5) to provide information on what the fish are eating compared to what prey items are available.

Epibenthic samples can be collected using an epibenthic suction pump designed for such sampling. Benthic samples can be collected using a sediment grab, such as a petite

ponar grab. Multiple stations (four to six) should be established along the park shoreline. A minimum of three replicate samples at each station is recommended for the epibenthic monitoring component. Samples are preserved, processed, and identified using a microscope. Epibenthic sampling should occur in the spring or early summer on an annual basis for the first few years after restoration activities occur. After this time period, sampling could be reduced to once every two or three years.

Cost: $8,000 to $10,000 for equipment and technical expertise for completing survey on beaches at Seahurst Park. This cost would be incurred each year sampling was conducted.

Equipment: provided by professional

Potential Project Partner: Washington Department of Natural Resources and/or the University of Washington School of Fisheries Wetland Ecosystem Team (WETeam) are promising project partners, although the WETeam would be unlikely to provide funding for the work. The WDNR Nearshore Habitat Program has ongoing studies to investigate benthic communities in Puget Sound. The WETeam conducts many similar investigations throughout the area and has the sampling equipment necessary to conduct the work. The US Army Corps of Engineers will be embarking on the Puget Sound Nearshore Restoration Project soon. If Epibenthic and benthic monitoring become a part of this effort Seahurst could be used as a sampling location for that project.

4 RIPARIAN CORRIDOR AND STREAM MONITORING ACTIVITIES

There are two streams located at the north and south areas of the shoreline at Seahurst Park that would be affected by the shoreline restoration projects in the Master Plan. Activities that will affect the streams include the following:

- Stream channel and wetland restoration in the south stream where the section of upper parking lot would be removed
- Restoration of the lower reach of the north stream and construction of a new off-channel acclimation pond
- Exotic vegetation removal and native plantings in the lower and upper corridors of both streams.

Activities occurring in the upper corridors have an impact on conditions in the lower corridor, therefore, the monitoring and stewardship programs for riparian corridors and streams are relevant to the entire length of the streams.

4.1 Volunteer Monitoring

4.1.1 Riparian Vegetation Assessment

Rationale and General Procedures

Vegetation in riparian corridors encourages native invertebrate fauna and keeps water temperatures cool for fish and other water-dependent organisms. The restored portions of the north and south streams would require more intensive monitoring the first few years to ensure that they are functioning properly (e.g., native riparian vegetation has taken root, channel configuration is stable). Volunteers could monitor the efficacy of native vegetation plantings in the riparian corridors. Surveys of the planted areas could be conducted, including tracking the establishment and growth of the planted native vegetation and the colonization of the area by non-native plant species. This volunteer monitoring could indicate the need for non-native vegetation removal, as discussed below in the Stewardship Plan.

The U.S. Environmental Protection Agency (EPA) has developed protocols for volunteer stream monitoring using a Visual Assessment Method that incorporates vegetation monitoring as well as other important habitat features (U.S. EPA 1997). These protocols would be important to include in a monitoring plan for Seahurst Park. Additionally, a

densiometer could be used to measure the percentage of canopy shade (Washington Forest Practices 1997). This assessment should be conducted at a minimum of once a year during the first few years post-construction. After this time period, assessments should occur at regular intervals such as every two or three years.

Cost: $200 - $500 for equipment purchases and organization and training of volunteers; once volunteers are trained the costs would be minimal to compile the collected data. The equipment purchases would be a one-time cost. Costs to train volunteers would be incurred each time a new crew is assembled to conduct the assessments.

Equipment: Data sheets, tape measures, densiometers

Potential Project Partners: Community volunteers would only be necessary to follow the EPA protocols. Alternatively, the Mid-Sound Fisheries Enhancement Group is dedicated to enhancing and restoring salmonid habitat and resources in the region through community partnerships. The group is experienced with organizing volunteer-based stream restoration and monitoring work. King County also has an Adopt-A-Stream Program that coordinates volunteer monitoring groups for the county.

4.1.2 Substrate Assessment

Rationale and General Procedures

The existence of gravel substrate (0.5″ – 6.0″) is important to salmon spawning habitat. Surveys could be conducted in the lower reaches of the south stream to monitor substrate quality for spawning salmon. Additionally, the substrate in the newly restored sections of the north and south streams should be monitored to ensure that it is functioning properly. The EPA (1997) has established protocols and developed datasheets for volunteer monitoring of stream habitat including substrate characterization. These protocols would be useful to include in a volunteer monitoring plan for Seahurst Park. For the north stream, instream siltation may need to be monitored because a nearby acclimation pond associated with the hatchery frequently fills with silt.

This assessment should be conducted at a minimum of once a year during the first few years post-construction. After this time period, assessments should occur at regular intervals such as every two or three years.

Cost: $200 - $500 for equipment and organizing and training of volunteers; once volunteers are trained the costs would be minimal to conduct the surveys. Equipment purchases would be a one-time cost. Costs to train volunteers would be incurred each time a new crew is assembled to conduct the assessments.

Equipment: Data sheets, transect establishment markers, tape measures.

Potential Project Partners: This assessment could be conducted at the same time as the riparian vegetation assessment and would only require community volunteers.

4.1.3 Invertebrate Sampling

Rationale and General Procedures

The existence of native invertebrate communities can provide a measure of stream health. More intensive monitoring should be focused on the recreated areas of the north and south streams to determine if the restoration is progressing as expected and the invertebrates are establishing in these new areas. Invertebrates could be sampled and counted using protocols established by the EPA (1997) in the Volunteer Stream Monitoring Methods Manual. Volunteers could identify dominant invertebrate taxa and record information on data sheets, tracking general abundance and diversity of organisms. This sampling should be conducted at a minimum of once a year during the first few years post-construction. After this time period, assessments should occur at regular intervals such as every two or three years.

Cost: $300 - $500 for equipment, organization and training of volunteers; additional costs could be accrued depending upon level of invertebrate identification. Equipment purchases would be a one-time cost. Costs to train volunteers would be incurred each time a new crew is assembled to conduct the assessments.

Equipment: Data sheets, sample jars, labels, kick-net, dip net

Potential Project Partners: This assessment could be conducted at the same time as the riparian vegetation assessment and would only require community volunteers.

4.1.4 Water Quality Assessment

Rationale and General Procedures

Water quality in streams is integral to the health of resident and transient fish and invertebrates. To identify potential trends in water quality, parameters such as temperature, dissolved oxygen, pH, and nutrient levels could be monitored periodically. This assessment should be conducted at a minimum of once a year during the first few years post-construction. After this time period, assessments should occur at regular intervals such as every two or three years. It is also important to assess the water quality after a significant storm event.

Cost: $200 to $2,000 to cover equipment costs. Equipment purchases would be a one-time cost, but maintenance costs would be incurred over the life of the equipment used to sample water quality. The cost of water quality test kits would be incurred each time water is sampled.

Equipment: Data sheets, water quality test kits, and water quality meter.

Potential Project Partners: Community volunteers

4.1.5 Salmon Spawning Surveys

Rationale and General Procedures

One of the objectives of this project is to increase habitat quality for salmon. The south stream provides a short area near its mouth for potential salmonid spawning. Usage of the streams by spawning salmon would be an indicator that the habitat is functioning for this purpose. Species, numbers, redd locations, and dates of arrival for spawning salmon could be recorded by volunteers. These surveys should be conducted once or twice a month during the expected salmonid spawning seasons.

Cost: $100 - $300 to train volunteers to identify redds. This cost would be incurred on an annual basis, depending upon the number of return volunteers.

Equipment: Data sheets.

Potential Project Partners: King County Salmon Watcher Program involves volunteers watching streams fro spawning salmon in King and Snohomish Counties. This program would be a good starting point for developing spawner surveys in the south stream at Seahurst Park.

4.1.6 Hatchery Release Documentation

Rationale and General Procedures

Juvenile coho salmon have been noted using the streams at Seahurst Park. Documenting releases by the hatchery would help track the movements of these fish and add information to the database. Volunteers could help by compiling the dates and numbers of fish released from the nearby hatchery.

Cost: Minimal cost to coordinate with the Marine Technology Center.

Equipment: Data sheets.

Potential Project Partners: The Marine Technology Center keeps track of hatchery releases, therefore coordination with them would be beneficial.

4.1.7 Bank Slope Assessment

Rationale and General Procedures

Channel bank slope is an important factor in salmon habitat. Bank slope influences erosion and vegetative cover for fish, while change in the slope of a bank can indicate that erosive processes are occurring. Erosion may influence beach substrate in addition to ecological features of the stream. Volunteers could qualitatively monitor on a periodic basis the slope of banks affected by the shoreline work to ensure proper vegetative cover and no bank erosion. This assessment could be combined with the riparian vegetation assessment since similar features would be evaluated.

Cost: Minimal because it could be conducted along with the vegetation assessment and would require no additional equipment.

Equipment: Data sheets

Potential Project Partners: Community volunteers

4.1.8 Channel Configuration Monitoring

Rationale and General Procedures

Changes in channel configuration affect organisms using the stream, so the lower reaches of the south stream may need to be monitored for extreme changes in channel morphology. The lower reach of the south stream has meandered through the intertidal zone over the years. Volunteers could use a global positioning system (GPS) to document the location of main points of the stream on a periodic basis. Additionally, channel configuration of the newly restored areas in the north and south streams should be more closely monitored in the first few years to be sure that the changes are sustainable.

Cost: No or Minimal cost if GPS is available (not necessary).

Equipment: Data sheets, GPS (could also be done by sketching map).

Potential Project Partners: Community volunteers could do this monitoring

4.2 Professional Monitoring

4.2.1 Riparian Vegetation Assessment

Rationale and General Procedures

(See 4.1.1 above). If volunteer monitoring activities identify areas of concern, a more extensive evaluation could be professionally conducted to identify the source of the problem and offer recommendations to correct it. Seasonally, experts could estimate percent cover and map the extent of native vegetation plantings in riparian corridors with GPS tools. This assessment should occur at least once a year during the first few

years post-construction. After this time period, assessments could be conducted every two or three years.

Cost: $1,000 - $5,000 for an evaluation of a problem area depending on extent of area degraded. This cost would be incurred each time an assessment was conducted and would vary depending on the size of the area to be assessed.

Equipment: Provided by professional.

Potential Project Partners: Private consultant

4.2.2 Spawner Surveys and Juvenile Fish Utilization

Rationale and General Procedures

As with the nearshore monitoring, an important aspect of determining whether restoration activities are beneficial to juvenile and adult salmonids is to monitor their utilization of stream areas. More specific redd counts and identifications could be provided by a professional. Additionally, fish use could also be documented using net-capture techniques at known areas of habitat use. Spawner surveys should be conducted once or twice a month during the expected salmonid spawning seasons. Juvenile fish sampling should be conducted during the spring or early summer. Sampling should occur on an annual basis during the first few years post-construction and once every two or three years after that time period.

Cost: $2,000 - $4,000. This cost depends on the availability of existing scientific collection permits. Permits are required from WDFW, National Marine Fisheries Service, and U.S. Fish and Wildlife Service. In addition to adding costs to the project, permit review may require several months. These costs would be incurred each year sampling occurred.

Equipment: Provided by professional

Potential Project Partners: Private consultant

4.2.3 Bank Slope Assessment

Rationale and General Procedures

(See 4.1.7 above). If volunteer monitoring assessments target specific areas of concern, then more in depth professional assessments may be required to address bank erosion problems.

Cost: Depends on areas requiring further assessment, if any at all.

Equipment: Provided by professional

Potential Project Partners: Private consultant

5 PARK STEWARDSHIP

Stewardship opportunities in Seahurst Park provide an opportunity for the community to take an active role in promoting the park's beauty and ecological function for salmonids and other wildlife. Stewardship activities can address general needs of the park as well as those specifically geared to support the restoration activities. Possible partnerships for stewardship are listed along with each stewardship activity.

5.1 Marine and Upland Park Debris Clean-up

Rationale and General Procedures
Marine debris washed ashore by waves and litter left behind by park visitors on the beach and in the upland areas can degrade park aesthetics and habitat quality. Volunteers could remove these items from beach, creek corridor, and upland areas.

Cost: Minimal costs for equipment and the removal of the waste materials from the park.

Equipment: Garbage collection bags, gloves, disposal fees.

Potential Project Partners: Adopt-a-Beach is a Puget Sound organization that is in charge of programs for each adopted beach including marine debris collection.

5.2 Removal of Non-native Vegetation

Rationale and General Procedures
Restoration activities in the park may include removal of invasive plants and planting of native trees and shrubs. Volunteer stewardship activities to remove non-native vegetation can aid the natural establishment of native plant communities. Generally, removal of non-native vegetation should precede planting with native species. Areas where non-native vegetation is removed should be immediately replanted with native vegetation to prevent reestablishment by invasive species. The use of mulch and biodegradable landscape fabrics can also significantly increase new plant survival and suppress invasions on non-native plants.

Cost: Minimal costs for equipment and the removal of the non-native plant material from the park.

Equipment: shovels, picks and other hand tools.

Potential Project Partners: People for Puget Sound is experienced in organizing groups to remove non-native vegetation identified in RSIs. The Mid-Puget Sound Fisheries Enhancement Group is experienced with non-native vegetation removal along stream corridors. Other areas that would require the use of equipment such as chainsaws and weed wrenches are better suited to conservation corps such as the World Conservation Corps and Earth Corps. These crews already have this equipment and are generally better suited to work on steep or relatively inaccessible terrain than volunteers.

5.3 Restoring Native Vegetation

Rationale and General Procedures

Much of the upland portion of Seahurst Park is well vegetated by native plants in a closed canopy forest. This closed canopy helps to maintain the natural understory of native shrubs and herbs at the park. Unfortunately, non-native species are a threat to the regeneration of these forests. In a natural state, Red Alders (*Alnus rubra*) and Maples (*Acer macrophyllum*) would be the first trees to colonize open areas. These trees would slowly be replaced, primarily by Hemlock (*Tsuga heterophylla*) and Cedar (*Thuja plicata*). Now alders and maples may be replaced by English holly (*Ilex aquifolium*) and English Laurel (*Prunus laurocerasus*) or by invasive shrubs such as Himalayan Blackberry (*Rubus discolor*) and even English Ivy (*Hedera helix*). Removing these and other invasive species and immediately replanting with appropriate native vegetation will help sustain the plant communities of the park over time.

Disturbances such as landslides often become opportunities for weeds to establish. Areas that are disturbed (naturally or unnaturally) should be closely monitored for invasive species. Trees that should be planted in open or disturbed areas include; Pacific Madrone (*Arbutus* menziesii) and Shore Pine (*Pinus* contorta) on drier sites, Grand Fir (*Abies* grandis), Bitter Cherry (*Prunus emarginata*), Douglas Fir (*Psuedotsuga menziesii*) Western Crabapple (*Pyrus fusca*), Cascara (*Rhamnus purshiana*), Red Alder (*Alnus rubra*)and Maple (*Acer macrophyllum*) can be planted in other more moderate sites, in the wettest areas Western Red Cedar (*Thuja plicata*), Shore Pines (*Pinus contorta*), Oregon Ash (*Fraxinus latifolia*) and Red Alder (*Alnus rubra*) are appropriate. Native shrubs that should be planted in these areas include Kinnikinnick (*Arctostaphylos uva-ursi*) and Thimbleberry (*Rubus parviflorus*)

along sunny unshaded edges and Vine Maple, (*Acer circinatum*), Salal (*Gaultheria shallon*), Indian Plum (*Oemelaria cerasiformis*), Red Flowering Current (*Ribes sanguineum*), Salmonberry (*Rubus spectabilis*), Red Elderberry (*Sambucus racemosa*), Snowberry (*Symphoricarpos alba*), and Red Huckleberry (*Vaccineum parviflorum*).

Planting conifers will help Seahurst evolve into a stable and mature seral forest community. Shade tolerant trees such as Western Red Cedar (*Thuja plicata*) and Western Hemlock (*Tsuga heterophylla*) and Sitka Spruce (*Picea sitchensis*) can be planted under a closed canopy. Shrubs that can be planted in shady forested areas include; Red-osier Dogwood (*Cornus sericea*), Black twinberry (*Lonicera involucrata*), Pacific Ninebark (*Physocarpus capitatus*), Pacific Rhododendron (*Rhododendron macrophyllum*) and Evergreen Huckleberry (*Vaccineum ovatum*).

Other native species may also be used in conjunction with those listed. Special care should be given to planting each species where the local conditions and microclimate are appropriate. It is equally important to protect newly planted specimens from desiccation and weeds during the first two to five years while they become established.

Table 2
Native Trees

TREES		Moisture Regime	Shade Tolerance	Wetland Indicator Status	Successional Stage	Nutrient Regime
Abies grandis	Grand Fir	D, M, F	Sun	FACU	S, C	
Acer macrophyllum	Bigleaf Maple	D, M	Sun	FACU	P, S	R
Alnus rubra	Red Alder	D, M, F, W	Sun/Shade	FAC	P, S	
Arbutus menziesii	Pacific Madrone	X, D	Sun	UPL	P, S,C	P
Fraxinus latifolia	Oregon Ash	F, W	Sun	FACW	P, S	R
Picea sitchensis	Sitka Spruce	M, F	Sun/Shade	FAC	S, C	R
Pinus contorta	Shore Pine	X, D---W	Sun	FAC	P, S	P
Populus trichocarpa	Black Cottonwood	D, M, F	Sun	FAC	P,S	M
Populus tremuloides	Quaking Aspen	M, F	Sun	FAC	P	M
Prunus emarginata	Bitter Cherry	D, M, F	Sun	FACU	P, S	R
Pseudotsuga menziesii	Douglas Fir	D, M	Sun	FACU	S, C	
Pyrus fusca	Western Crabapple	M, F	Sun			
Rhamnus purshiana	Cascara	M	Sun			
Thuja plicata	Western Red Cedar	M, F, W	Sun/Shade	FAC	S, C	R
Tsuga heterophylla	Western Hemlock	D, M, F	Shade	FACU	S, C	

Table 3
Native Shrubs and Ferns

SHRUBS		Moisture Regime	Shade Tolerance	Wetland Indicator Status	Successional Stage	Nutrient Regime
Acer circinatum	Vine Maple	M, F	Sun/Shade	FAC	P, S, C	R
Amelanchier alnifolia	Serviceberry	D, M	Sun	UPL	S	R
Arctostaphylos-uva-ursi	Kinnikinnick	X, D, M	Sun	UPL	P, S	P
Cornus sericea (stolonifera)	Red-osier Dogwood	M, F	Sun/Shade	FACW	S, C	R
Corylus cornutus	Western Hazelnut	D, M	Sun	UPL	S, C	R
Cratageus douglasii	Black Hawthorn	M	Sun			
Gaultheria shallon	Salal	D, M	Sun/Shade	UPL	P, S, C	P
Holodiscus discolor	Oceanspray	D, M	Sun	UPL	S, C	M
Lonicera involucrata	Black Twinberry	M, F, W	Sun/Shade	FAC	S, C	R
Mahonia aquifolium	Tall Oregon Grape	D, M, F	Sun	UPL	S, C	M
Mahonia nervosa	Dwarf Oregon Grape	D, M	Sun	UPL	S, C	M
Oemleria cerasiformis	Indian Plum	D, M	Sun/Shade	FACU	P, S	R
Philadelphus lewisii	Mock Orange	M, F	Sun/Shade	UPL	S, C	M
Physocarpus capitatus	Pacific Ninebark	D, M	Sun/Shade	FAC	S	R
Rhododendron macrophyllum	Pacific Rhododendron	D, M	Sun/Shade	UPL	S, C	P
Ribes bracteosum	Stink Current	M, F	Sun/Shade	FAC	S, C	R
Ribes sanguineum	Red Flowering Current	D, M	Sun/Shade	UPL	P, S	M
Rosa nutkana	Nootka Rose	D, M, F	Sun	FAC	S, C	R
Rosa gymnocarpa	Baldhip Rose	D, M	Sun	FACU	S, C	M
Rubus parviflorus	Thimbleberry	X, D, M, F	Sun	FAC	P, S	R
Rubus spectabilis	Salmonberry	M, F	Sun/Shade	FAC	P, S	R
Sambucus racemosa	Red Elderberry	D, M	Sun/Shade	FACU	P, S	R
Symphoricarpos alba	Snowberry	D, M, F	Sun/Shade	FACU	P, S	R
Vaccineum ovatum	Evergreen Huckleberry	M	Sun/Shade	UPL	S, C	P
Vaccineum parviflorum	Red Huckleberry	D, M, F	Sun/Shade	UPL	P, S, C	P

SHRUBS		Moisture Regime	Shade Tolerance	Wetland Indicator Status	Successional Stage	Nutrient Regime
FERNS						
Athyrium filix-femina	Lady Fern	M, F	Sun/Shade	FAC	S, C	R
Blechnum spicant	Deer Fern	M, F	Shade	FAC	S, C	P
Polystichum munitum	Sword Fern	D, M	Sun/Shade	FACU	S, C	M-R
Pteridium aquilinum	Bracken Fern	X, D	Shade	FACU	P, S	
Dryopteris expansa	Spiny Wood Fern	M	Shade			

Key to Tables 2 and 3:
Moisture Regime: X=xeric, D=dry, M=moderate, F= facultative wet., W=wet.
Shade Tolerance: Sun=not shade tolerant, Sun/Shade=sun and shade tolerant, Shade=not Sun Tolerant.
Wetland Indicator Status: Based on the US Fish and Wildlife indicator status codes.
Successional Stage: P=pioneer, S=seral, C=climax
Nutrient Regime: R= rich, M= moderate, P= poor.

Cost: Varies greatly depending on type of crew used, and type and size of plant materials

Equipment: Plant material, soil amendment, mulch and/ or landscape fabric, shovels, chainsaws, weed wrenches, Maddox picks, irrigation equipment

Potential Project Partners: Some weeding and planting projects can be completed with volunteers in cooperation with groups such as Adopt-a-Park. The city of Burien already has an established partnership with this organization that will be used to plant bare root trees over the 2002-2003 winter season. This relationship could be used for some expanded planting and weeding projects outlined in the Master Plan Summary Document. Additionally, the King County Conservation District grows native plants for replanting purposes and provides volunteer stewardship opportunities, as does King County Department of Natural Resources and Parks.

5.4 Maintenance of North Stream Acclimation Pond

Rationale and General Procedures

The north stream in Seahurst Park has an acclimation pond for juvenile salmonids about to exit the Marine Technology Center's hatchery. Under the current configuration, the acclimation pond can become filled with silt from the upper watershed. After the new off-channel acclimation pond is constructed, volunteer stewardship activities could monitor the restored pond to be sure that it is functioning properly and that no silt is accumulating in it.

Cost: Minimal costs for equipment

Equipment: Shovel and wheel barrows

Potential Project Partners: Students associated with the Marine Technology Center could provide volunteer labor to monitor the acclimation pond on a periodic basis.

5.5 Water Quality Improvements

Rationale and General Procedures

Volunteer water quality monitoring on a regular basis can indicate degraded conditions for one or more parameters. If water quality is degraded, efforts could be focused to identify

sources of contamination or degradation and take corrective action. Corrective action could be focused at various locations throughout the watershed depending on how water quality is degraded. For example, if there are high levels of nutrients in the stream, then stormwater runoff inputs would need to be analyzed to see if the nutrients are coming from this source.

Cost: Moderate, dependent upon consulting costs.

Equipment: Depends on source of contamination.

Potential Project Partners: Private consultant

6 DATABASE MANAGEMENT

An important component of habitat restoration monitoring that is often neglected is how the data will be organized and managed so it may be used over time to detect trends resulting from restoration activities. To address this issue, a monitoring database could be created and managed by a single organization, in cooperation with other entities as necessary. People for Puget Sound has expressed an interest in participating in this capacity for the Seahurst Park restoration project. Monitoring data collected by volunteers, state and county agencies, University researchers and consultants could be compiled and included in the database for all components of the monitoring plan discussed in this document.

An additional component of database management would be evaluation of the collected data. Time series analyses could be most effectively displayed graphically to represent how conditions are changing through time. These evaluations may be important to the water quality and substrate datasets for trends detection, and to the invertebrate dataset for community composition information (percent composition, species richness, etc.).

The cost of database management and data evaluation is hard to determine without knowing what types of information will be included and the number of partners contributing data to the database. A common data format should be identified and would be necessary to facilitate combining data from a number of different sources.

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