2.6 SUSTAINABLE DESIGN STRATEGIES

A Guiding Principle for the project is to put the shoreline and innovative, sustainable design at the forefront. The goals are to bring people to the water’s edge to experience the water and ecology of Elliott Bay, to improve shoreline ecology while preserving and enhancing maritime activities, and to reflect Seattle’s commitment to sustainability and innovation.

The Central Waterfront is at the heart of some of the oldest communities of Seattle. It is easily accessible to pedestrians and bicyclists as well as by several types of public transportation, such as ferries, trains, light rail, buses and street cars. Creating a public open space in the heart of Seattle will serve the global environment because it will encourage residences in urban neighborhoods and by so doing reduce pressure on undeveloped land outside the city. This will contribute to reducing pollution and development impacts, support the local economy and improve human health.

The waterfront is particularly interesting from a local environmental perspective. It is located within a region of transition between two ecological communities, the aquatic communities of Elliott Bay and the upland communities in the urban neighborhoods abutting the waterfront. Both ecosystems have suffered decades of pollution and degradation, and are in great need of some repair.

The waterfront project has assembled a multidisciplinary team of professionals experienced in sustainable practices to collaborate in the design process and draft an integrated sustainable design and implementation strategy.

Opportunities for improving the environment on the waterfront are discussed below. These opportunities will continue to be explored, and they will inform design, construction, operation and maintenance decisions throughout the life of the project. Construction and maintenance guidelines will be established to ensure that every effort is made to maintain and improve the waterfront towards sustainability in the long term. Site users and other stakeholders will continue to be engaged in meaningful participation to identify needs and to supplement professional expertise with local knowledge.
SUSTAINABLE DESIGN STRATEGIES

HABITAT AROUND THE BAY RING

An integral part of this project is to adopt strategies for improving the functions of natural ecosystems along the central waterfront. The waterfront is located within an “ecotone”, or region of transition between two ecological communities - riparian and intertidal. Those are framed by upland and aquatic ecological communities. Thus the Bay Ring can be described as having four habitat zones: upland, riparian, intertidal, and aquatic. This framework plan focuses on identifying opportunities for enhancing each one of these ecological communities on the waterfront and improving the connections between them.
**HABITAT AROUND THE BAY RING**

**UPLAND HABITAT**

A primary component of the urban upland habitat is the urban forest. It helps mitigate air and water pollution and improve the urban environment for humans and wildlife alike. The City of Seattle Urban Forest Management Plan (2007) is taking steps to preserve and enhance Seattle’s urban forest which “has significantly declined over the last few decades.” This new commitment to reestablish the urban forest will serve three primary purposes:

- Create a more connected urban habitat system that pulls the natural realm into the city;
- Establish new and authentic parks, promenades and waterways; and
- Contribute toward a financial investment in mitigating the environmental impacts associated with urbanization, dramatically decreasing the long-term costs.

Seattle’s publicly managed parkland totals approximately 6,200 acres. This expanse of open space is dispersed throughout the city and takes on a wide variety of forms, ranging from Interstate Highway Lid parks (Freeway Park + I-90 Lid Parks), to reclaimed military bases (Discovery Park and Manguson Park), to old growth forests (Seward Park). These parks and open spaces range in size from less than an acre to the 534 acres that comprise Discovery Park in Magnolia. Many of the existing parks found throughout Seattle are disconnected from each other, preventing wildlife from moving freely and safely from one area to the other. By strategically inserting vegetal connections between pockets of upland habitat, potential for more biodiversity is increased. The establishment of strategic upland habitat corridors, stretching from the aquatic regions to the upland and connecting existing and proposed habitats, will ensure the integration of the Central Waterfront with the existing urban open space network and its contribution to the creation of a more sustainable upland urban ecosystem. Strategic partnerships can prevent overlap and redundancy, encourage knowledge sharing and ensure a coherent effort to establish beneficial plant communities that will be interconnected to form a larger and healthier environment.

**PATCH - CORRIDORS - MOSAIC**

Source: Richard Forman, Land Mosaics, 2003
PATCHES, CORRIDORS + MOSAICS ON THE CENTRAL WATERFRONT

This diagram shows existing green open spaces on and around the central waterfront. They form patches of urban habitat but remain disconnected from each other. Upland corridors which have potential for strengthening the connections between the patches are identified.

The Pioneer Square neighborhood and the Belltown Bluff both present opportunities for enhancing the local urban mosaic of upland habitat and linking it to riparian and aquatic habitat on the waterfront.
SUSTAINABLE DESIGN STRATEGIES
HABITAT AROUND THE BAY RING

RIPARIAN AND INTERTIDAL HABITAT
The intertidal region is an important part of the waterfront ecosystem. The rocky, wave-swept shore, native to the Puget Sound region, is a highly diverse and productive habitat. These shores are also inviting to people, making it easy for the public to interact with water and experience its diverse habitats (algae beds, seaweed, salt marshes) and species (barnacles, sea urchins, crabs, starfish, heron, salmon and varieties of sedges). While providing a wealth of educational opportunities, the intertidal region also plays an important role in the food web, by connecting the upland zone with the aquatic zone.

The central waterfront riparian and intertidal zone has been replaced by the Elliott Bay Seawall. This has reduced the functions of the riparian and intertidal ecosystems in this part of the Puget Sound and has made it hard for people to interact with the Elliott Bay. Riparian areas decrease the flow rate of storm water, trap sediments, and reduce the amount of harmful pollutants discharged in water bodies while significantly increasing biodiversity. The introduction of a beach, water terraces, storm water collection devices and “get-downs” can simulate some of the functions of those ecosystems while helping to restore some habitat along the water’s edge.
AQUATIC HABITAT
Efforts to restore aquatic habitat along the waterfront are a critical aspect of the scope of the Elliott Bay Seawall Replacement Project. The Elliott Bay Seawall runs along a natural salmon migration route. Salmon prefers light and shallow water which can no longer be found along the central waterfront, where dredging and over-water coverage have created deep and dark waters. Research conducted by the Elliott Bay Seawall Team has identified three primary existing conditions along the central waterfront:

- Near-shore conditions tend to have shallower water and natural light which the salmon favor. They swim along the edge where they are protected.
- The areas between the piers tend to have deeper water and more natural light.
- The areas beneath the piers have relatively shallow water, but very little natural light.

One of the seawall project's goals is to create a continuous Salmon migration corridor and increase near-shore ecosystem productivity. Working with the Seawall Team, the Waterfront Design will incorporate habitat restoration elements such as a light penetrating surface (LPS) in the promenade, which will provide light to the salmon corridor below and an intertidal habitat bench at the base of the seawall to provide shallow water structure for the establishment of aquatic vegetation.
SUSTAINABLE DESIGN STRATEGIES

HABITAT AROUND THE BAY RING

SPECIES INTER-RELATIONSHIPS
Each plant and animal species is dependent on a wide array of other species for survival. The diagram to the right illustrates this concept with an example of inter-related species typical to the Puget Sound’s native habitat. Ospreys hunt marine fish and juvenile salmon that swim in shallow intertidal waters and feed on the nearby aquatic plants and invertebrates. Further uphill, squirrels feed on nuts, which fall from the mature trees rooted in the steep upland slopes. These trees provide shelter and habitat for the osprey, and thus the cycle completes itself.

Interspecies relationships are critical for the establishment of healthy and robust ecosystems. The central waterfront design will consider those relationships while coordinating with the seawall design for key relationships with marine and inter-tidal habitat. The central waterfront design will also coordinate with SDOT and Seattle Parks and Recreation to identify key upland connections and relationships.

The process of enhancing and connecting habitats around the bay will help plants and animals find opportunities to establish themselves along the waterfront. The integration, maintenance and support of these relationships are critical to the health of natural ecosystems on the waterfront. Partnerships with local and national environmental initiatives will be necessary to augment and strengthen these relationships.

The diagram on the opposite page applies those principles to the central waterfront. However, it is important to understand that those principles remain hypothetical at this time. This diagram illustrates how species might be distributed in the context of the Central Seattle Waterfront and how they could fit into the urban form. During Schematic Design and Design Development, both the seawall project and the waterfront project will have an opportunity to develop the first steps of an integrated approach to habitat development on the waterfront.
POTENTIAL HABITAT DISTRIBUTION
ON THE CENTRAL WATERFRONT
SUSTAINABLE DESIGN STRATEGIES

INTEGRATING NATIVE SPECIES INTO THE URBAN ENVIRONMENT

HABITAT ZONE

AQUATIC ZONE

INTERTIDAL ZONE

UPLAND ZONE

BIOTYPE

Kelp Forest

Kelp Bed

Cobble Reef

Prairie

Shrub Forest

Pine Forest

Maple/Alder Woods

Hemlock/Fern Forest

VEGETATION

bull kelp

nerceocystis

don-float keip

laminaria, costaria

algae

hydrorids

sponges

golden indian paintbrush

castieja laesetsa

white-topped aster

aster curtus

torrey’s peavine

bathyurus torreyi

small-flowered trillium

trillium parviflorum

red huckleberry

vaccinium

parvifolum

pseudotsuga

menziesii

western hemlock

tsuga heterophylla

douglas fir

pseudotsuga

menziesii

western red cedar

thuja plicata

pacific madrone

arbutus menziesii

golden indian paintbrush

castleja laesetsa

white-topped aster

aster curtus

torrey’s peavine

bathyurus torreyi

small-flowered trillium

trillium parviflorum

red huckleberry

vaccinium

parvifolum

pseudotsuga

menziesii

western hemlock

tsuga heterophylla

douglas fir

pseudotsuga

menziesii

western red cedar

thuja plicata

pacific madrone

arbutus menziesii

brant / peregrine falcon / short-eared owl / great blue heron

dunlin / red-breasted merganser / canvas back

native bees / lacuna snail / pacific tree frog / vagrant shrew / snakes / townsend’s vole

WILDLIFE

zeoankton

sea cucumber

staked jellyfish

sea urchin

snail + snail eggs

staghorn sculpin

zeoankton

sea cucumber

staked jellyfish

sea urchin

snail + snail eggs

staghorn sculpin

small pebbles / gravel / rocks

gravel

boulders

shallow, rocky soils

over bedrock

often steep slopes

various

(fresh) outcrops, glacial gravelly outwash, deep grassland soils, and seasonally flooded riparian

gravelly

sand

rocky

gravelly

SOIL/ SUBSTRATE/ TOPOGRAPHY

small pebbles / gravel / rocks

gravel

boulders

various

(fresh) outcrops, glacial gravelly outwash, deep grassland soils, and seasonally flooded riparian

gravelly

sand

rocky

gravelly

INTERTIDAL ZONE

UPLAND ZONE
SUSTAINABLE DESIGN STRATEGIES

WATER

The waterfront is separated from Elliott Bay by the Seawall. Due to a long history of industry and development, the environment in marine waters along the central waterfront has been degraded by pollution, combined sewer discharge, dredging, dumping and large surfaces of over-water coverage. The quality of marine water environments along the central waterfront depends on many factors which are beyond the scope of this project, but every effort will be made to coordinate with and encourage initiatives to improve the quality of water in the marine environment.
The design and maintenance of all water features created in the public realm will consider minimal or no make-up water from potable sources or other natural surface or subsurface water resources. The swimming pool proposed at Pier 62/63 will be designed as a salt water pool to prevent the use of chlorine and its potential impact on marine environments.
SUSTAINABLE DESIGN STRATEGIES

WATER

Storm water
Managing the quality and quantity of storm water runoff is essential to the improvement of urban ecosystems along the waterfront. Stormwater drainage on Seattle’s waterfront involves a complicated system, built over many years. It includes a local, separated stormwater system on Alaskan Way draining directly into Elliott Bay and a combined sewer system that serves a much bigger part of the downtown Seattle. The stormwater system will be addressed directly through the waterfront design. The waterfront design will also be closely coordinated with changes to the combined sewer system that are being made to reduce annual overflows into the bay.

Some of the natural functions of the shoreline, drainages and wetland can be restored in part through innovative storm water management techniques. Drainage control facilities can be engineered to use infiltration, evapotranspiration, and stormwater reuse, to more closely mimic natural hydrology within this urban setting. Well designed drainage control facilities can help prevent or minimize the generation, mobilization and transport of common storm water pollutants and watershed-specific pollutants through combined sewers or storm water systems to receiving waters, including marine environments, surface water and groundwater.

The design team conducted a preliminary site storm water analysis which can be found in the Appendix. It maps existing drainage patterns and infrastructure, identifies existing drainage basins and system types (drainage, combined sewer, etc.), and catalogues proposed surface treatments, slopes and uses throughout the project area.

Opportunities and constraints related to storm water management were identified as follows:

Opportunities
• Increase green spaces and plantings to provide environmental functions as well as an enhanced urban habitat;
• Improve the quality of stormwater runoff into Elliott Bay;
• Reduce the volume of runoff from the project area captured in the City’s combined sewer system;
• Provide education and highlight stewardship of the environment and ecology of Puget Sound;
• Restore dispersed, clean stormwater discharge to Elliott Bay to promote improved aquatic habitat along the seawall;
• Reduce water demand within the urban landscape through stormwater reuse;
• Reuse of stormwater by Seattle Steam.

Constraints
• Feasibility of infiltration is limited by underlying soils, shallow groundwater, and tidal influences;
• Drainage infrastructure needs to complement and integrate with many competing needs within the project area;
• Operations and maintenance considerations should be considered in selection and siting of practices;
• The subsurface of the project will require a stable substrate to support surface loads and ample space to avoid conflicts with subsurface utility infrastructure.
Bioretention planters are flat-bottomed, landscaped basins containing an amended soil mix and native plants within an impervious structure (preventing infiltration into surrounding, native soil). Bioretention planters are used to mimic pre-development conditions where the soils and plants work together to store and treat stormwater runoff.

Permeable pavement is a paving system that contains empty spaces which allow rainfall to percolate into underlying soil. There is a variety of permeable pavement surface options (asphalt, concrete, pavers, etc.). Permeable pavement systems can be designed to provide differing levels of flow control. Permeable pavement surfaces function as a permeable land surface, reducing the amount of runoff generated during a storm.

Biofiltration swales are open, gently sloped, vegetated channels designed to treat stormwater. Stormwater enters the head of the swale, percolates through the soil as it travels the swale’s length, and conveyed out of the system. Pollutant removal occurs by filtration as stormwater moves through the grass blades, which enhances sedimentation and trapping of pollutants to the grass.

Subsurface wetlands are basins (typically impervious) filled with a porous media (usually gravel or aggregate) that supports plant life. Subsurface wetlands are designed to allow stormwater runoff to flow below the ground surface through the root zone. The facility is designed so that the porous media stays submerged. Wetland plants are rooted in the media to allow for direct uptake of pollutants.

Rainwater harvesting is the capture and storage of roof runoff for reuse. The primary components of a rainwater harvesting system include the collection system (gutters and downspouts), storage (cisterns or rain barrels), and dispersion system (pipes or hoses). The stored rainwater is reused for non-potable uses such as irrigation. Rainwater harvesting is an effective form of green infrastructure where infiltration is not applicable.

Newly planted trees provide flow control in an urban environment by absorbing rain through their leaf system and roots, and allowing space for infiltration. Newly planted trees receive credits toward meeting flow control requirements.

Enhanced Tree Pits give trees roots more space allowing for large tree growth.
SUSTAINABLE DESIGN STRATEGIES

HUMAN HEALTH AND WELLBEING

ENGAGE THE COMMUNITY
An extensive public outreach process described in the Appendix was undertaken to involve the community in building the concept for the waterfront environment. Enthusiastic participation was encouraged via community workshops and outreach that engaged the public in thoughtful and interesting ways. Public input was wholly integrated in the design process. Active engagement of the public promotes a sense of ownership and helps in developing stewardship for the long term. Early implementation projects encourage early community participation, ongoing stewardship and showcase the larger ambition and commitment of Seattle to invest in habitat restoration. Potential initiatives could include: Community tree planting, urban agriculture and farmers markets, educational programs and activities, seed exchanges and various art projects related to ecology as described in the waterfront Art Plan.

PROTECT AND MAINTAIN EXISTING ASSETS
Cultural and historical assets as well as attributes and artifacts that enhance the waterfront’s sense of place and meaning will be protected. The character of different parts of the waterfront can be celebrated and together reveal the identity of the central waterfront. Cultural activities such as art events and displays can become an integral part of the culture of the waterfront. Artifacts, such as the Neon Signs owned by the Museum of History and Industry for example, could find a new home on the waterfront.

PROMOTE HEALTHY URBAN LIFESTYLES
The design provides on-site opportunities for outdoor physical activity that improve urban healthy living. Those include extensive pedestrian routes, a bike path, access to public transportation, access to water activities such as kayaking, swimming, and touching the water, roller skating, and play areas.

The design also provides several large and quiet outdoor spaces for mental restoration and social interaction. Most of those outdoor spaces provide a variety of views of large natural and urban landscapes, sunsets as well as closer of views of vegetation, water, art and seasonal changes.
BE AN ECONOMIC CATALYST
The project is designed to provide economic and social benefits to the local community. In addition to the design of the public realm, the framework plan developed a robust development strategy for the Central Waterfront. The infusion of new residential areas, shops and restaurants, performance venues and entertainment will strengthen and diversify the waterfront’s commercial activity. Vibrant urban development, symbiotically paired with an inviting public realm, will generate private economic growth that could potentially spread to neighboring areas. In addition, the waterfront Art Plan is proposing to support and strengthen the cultural communities, venues and events which will add great sense of place and cultural identity on the waterfront.

SUPPORT LOW IMPACT MEANS OF TRANSPORTATION
The waterfront framework plan has developed an access and mobility strategy which encourages the use of public transit, creates strategic connections and linkages to existing transit routes, improves waterfront transit hubs and adds sustainable alternative modes of transportation such as a waterfront circulator and a bike path. Together these initiatives will make it easier to get to and through the waterfront without a private vehicle, thereby decreasing carbon emissions in the city.

INFORM THE PUBLIC
Both interpretive signage and public outreach will be developed to help promote the understanding of sustainability in ways that positively influence user behavior on site and beyond. The public will have access to information about on-site features and processes, the history of the site, its geography, its local ecosystems, its environmental context, and the benefits of physical activities and healthy living. The public will also be informed about opportunities for engaging in healthy living and activities that will improve their environment.
SUSTAINABLE DESIGN STRATEGIES

MATERIALS

The selection of materials for use in the project will take into consideration their impact on the environment as a whole as well as on the local ecosystem in order to support sustainable practices in materials manufacturing and nurseries. Wood products extracted from non-threatened tree species will be favored to minimize negative effects on other ecosystems. Salvaged materials, materials with recycled content, and materials with low VOC will be favored whenever possible to reduce the use of virgin materials and avoid sending useful materials to the landfill. Regional materials will be favored to reduce energy use for transportation, support the local economy and promote regional identity. Whenever possible, plants and materials will be purchased from providers who reduce resource consumption and waste.

ENERGY USE

Energy use will be investigated and options for both alternative sources of energy and sustainable energy consumption will be considered. Wherever possible, the use of energy from renewable sources, such as solar energy, steam, wind energy, wave power, and tidal power, will be explored. Technologies that are designed to improve energy efficiency, such as efficient light fixtures, or the Dark-Sky Association Guidelines, will also be examined.
SUSTAINABLE DESIGN STRATEGIES

MANAGEMENT

CONSTRUCTION MANAGEMENT
Construction can have significant environmental impacts if not undertaken with care, especially when located near a body of water. Construction can impact air quality, noise levels, water quality, soil erosion and habitat disruption. Construction also generates a very large amount of refuse. The project will prepare a construction management plan to minimize the discharge of construction site pollutants and materials and protect receiving waters, air quality and public safety. Construction and demolition materials will be diverted from landfill disposal whenever possible. For example, the removal of the viaduct, which will create vast amounts of materials bound for the landfill, including concrete, steel, and asphalt, can be considered for materials re-use. The materials generated by demolition could potentially be recycled and reused along the Waterfront for slope stabilization, revetments, riprap, pavement, and public art. In addition, rubble from the Viaduct could be used to fill the Battery Street Tunnel.

OPERATIONS AND MANAGEMENT
A site maintenance plan will outline long-term strategies and identify short term actions to achieve sustainable maintenance goals. For example, the storage and collection of recyclables will be provided. Organic matter generated during site operations and maintenance will be composted and used. Energy efficient outdoor fixtures and equipment will be selected to reduce energy consumption and costs associated with site use and operations.

MONITORING AND INNOVATION
Sustainable design practices can be monitored and documented to evaluate their performance over time and improve the body of knowledge on long term site sustainability. Innovative ideas will be taken into consideration and tested when deemed worth pursuing. Ideas such as an on-site nursery, planted as an early win, would help plants get acclimated to the waterfront and better survive the near shore conditions. Snags and habitat houses could be added to provide habitat for birds and other wildlife. In addition to English, other languages could be used in signage, such as, for example, native American languages.