

SOUTH WATERFRONT DESIGN GUIDELINES & SOUTH WATERFRONT GREENWAY DESIGN GUIDELINES



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Planning and Sustainability
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SOUTH WATERFRONT DESIGN GUIDELINES 2002

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Introduction

Section I

Design Guidelines in South Waterfront

Compliance with the design guidelines in this document can take many different forms for different proposals—discussion of proposed designs among the applicant(s), design review staff, and the Portland Design Commission is encouraged. Design guidelines are intended to state broad design objectives and to provide guidance; they should not be construed as prescriptive standards.

CENTRAL CITY FUNDAMENTAL DESIGN GUIDELINES

Because South Waterfront is a subdistrict of Portland's Central City Plan District, the *Central City Fundamental Design Guidelines* apply throughout the South Waterfront plan area. The fundamentals serve as the base set of design guidelines for all subdistricts of the Central City and address basic issues about the design of buildings in an urban environment. The Introduction of the *Central City Fundamental Design Guidelines* contains a detailed description of the Central City's design guideline system and design review process.

SOUTH WATERFRONT DESIGN GUIDELINES

The *South Waterfront Design Guidelines*, contained within Section II of this document, supplement the *Central City Fundamental Design Guidelines*. These guidelines add layers of specificity to the fundamentals, addressing design issues unique to South Waterfront.

The *South Waterfront Design Guidelines* apply to all development proposals in South Waterfront within the design overlay zone, identified on zoning maps with the lowercase letter "d" (indicated by the hatched area in Map 1 on page 7). These guidelines primarily focus on the design characteristics of buildings in the area, including those along Macadam Avenue, at the western edge, to those facing the greenway and river.

SOUTH WATERFRONT GREENWAY DESIGN GUIDELINES

The greenway overlay zone of South Waterfront, identified on zoning maps with a lowercase letter "g" (indicated by the hatched area in Map 2 on page 7), focuses on the area roughly between the facades of buildings facing the river and the water's edge. All development within the "g" overlay will be required to meet the *South Waterfront Greenway Design Guidelines* (Section III of this document). These design guidelines serve as a supplement to the *Central City Fundamental Design Guidelines* and the *South Waterfront Design Guidelines*, addressing design issues unique to the South Waterfront greenway.

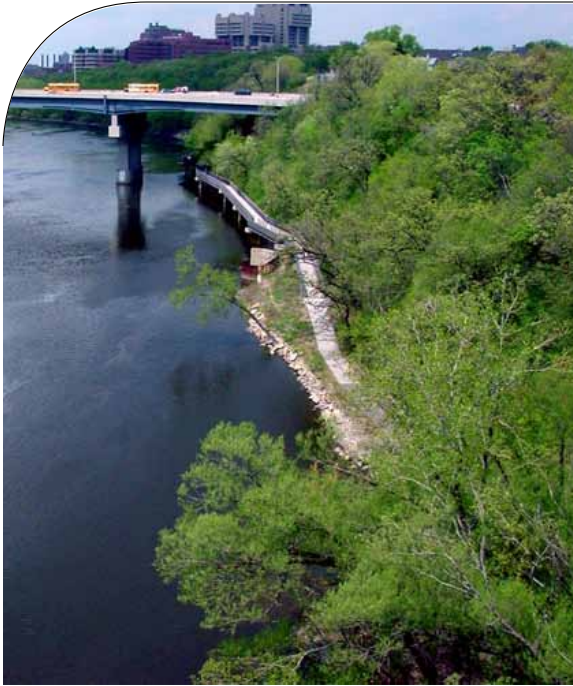


Copies of the *Central City Fundamental Design Guidelines* are available at the Bureau of Planning and Sustainability.

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Copies of the document can also be obtained from the City's Development Services Center, at 503-823-7526.



Introduction

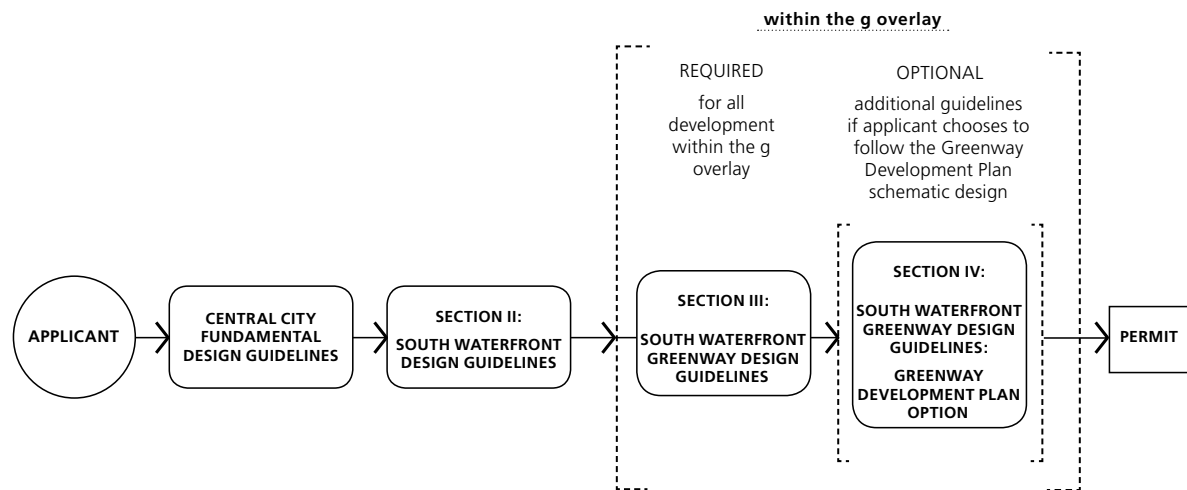
GREENWAY DEVELOPMENT PLAN OPTION

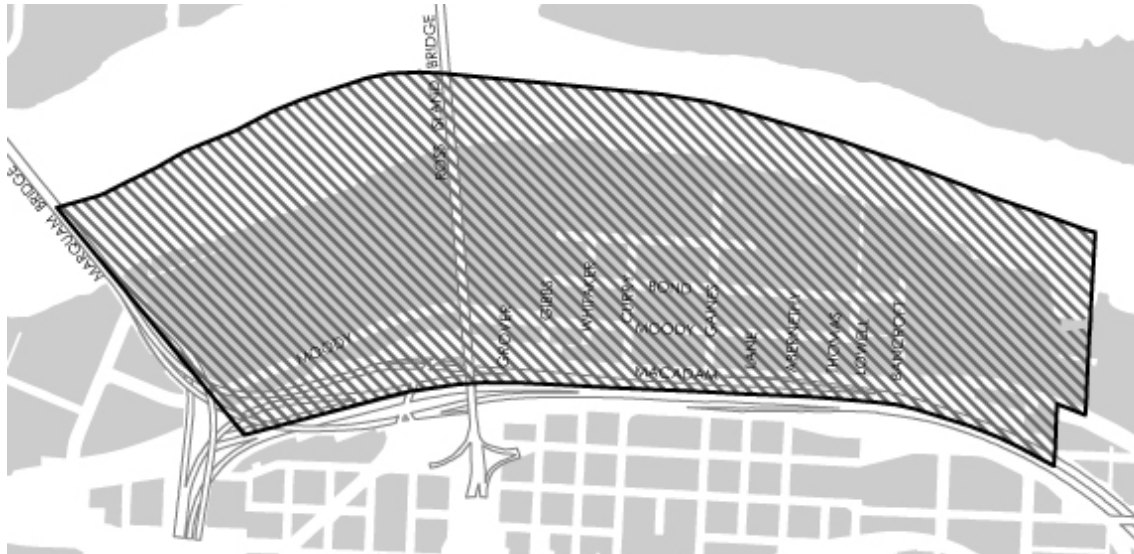
The Greenway Development Plan (GDP), accepted by Portland City Council in 2004, was designed to achieve a holistic and integrated approach toward the greenway for South Waterfront through a multi-stakeholder public process. A copy of this plan is provided in the Appendix. The GDP aimed to provide visual and physical continuity throughout the 1.2 mile corridor, through consideration of existing conditions, proposed private development, habitat creation, and setbacks. The *Greenway Development Plan Option* builds on the GDP's holistic approach.

Should the applicant choose to develop the greenway according to the GDP, the development will also be required to meet the guidelines within Section IV of this document, *Greenway Development Plan Option*, in addition to the guidelines within Section III.

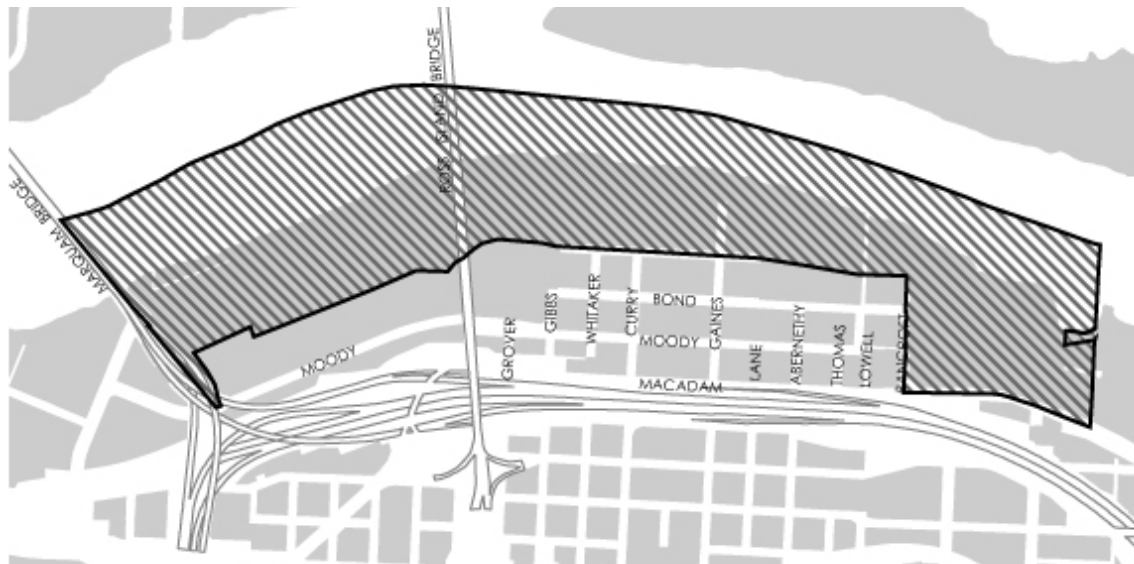
Because site conditions may present challenges to the specific placement of habitat types, structures, or activity areas, their explicit locations outlined in the GDP and the *Greenway Development Plan Option* are to be used as a guide for development. Alterations to the concepts offered in the GDP should carefully consider subsequent impacts on the integrity of the complete greenway vision and should meet the intent of the guidelines.

For applicants who choose to use the *Greenway Development Plan Option*, there is potential to take advantage of unique funding partnerships and long-term maintenance agreements described in Title 33 of Portland's Zoning Code.





Map 1 Design Overlay Zone ("d")



Map 2 Greenway Overlay Zone ("g")

Relevant Documents

Documents which provide useful information and insight to the applicant are listed below. These documents are a resource only and will not be used as approval criteria:

- **Greenway Development Plan, 2004**
a copy of this plan is provided in the Appendix of this document
- **South Waterfront Universal Streets and Accessway Study, 2004**
- **South Waterfront Plan, 2002**
- **Art Master Plan, 2004**
www.bustersimpson.net/portlandgreenway/portlandgreenway.08.23.04.pdf

Copies of these documents are available at the Bureau of Planning and Sustainability, unless otherwise noted.

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Introduction

How to use this document: Section II South Waterfront Design Guidelines

Each guideline addresses a single issue and has the same structural components:

Where a South Waterfront Design Guideline has not been identified, the Fundamental Design guideline will serve as the approval criteria.

The Central City Fundamental Design Guideline states the broad objective.

The South Waterfront Guideline builds on the fundamental guideline.

Guideline may be accomplished by:
Examples of some of the possible methods that can be used to address the guideline.

Heading identifies the specific guideline within the page

C4-1 DEVELOP COMPLEMENTARY STRUCTURED PARKING

III BRIDGE PEDESTRIAN OBSTACLES
B4 PROVIDE STOPPING AND VIEWING PLACES
B5 MAKE PLAZAS, PARKS, AND OPEN SPACES SUCCESSFUL
B6 DEVELOP WEATHER PROTECTION
B7 INTEGRATE BARRIER-FREE DESIGN

C PROJECT DESIGN
C1 ENHANCE VIEW OPPORTUNITIES
C2 PROMOTE QUALITY AND PERMANENCE IN DEVELOPMENT
C3 RESPECT ARCHITECTURAL INTEGRITY
C4 COMPLEMENT THE CONTEXT OF EXISTING BUILDINGS
C4-1 DEVELOP COMPLEMENTARY STRUCTURED PARKING

Background
 Parking structures provide parking for residential, commercial and other uses in South Waterfront. Their design should complement the design context of the area as expressed in the scale, proportion and materials of nearby buildings. Exterior facades of parking structures that expose or expose sloping floors are discouraged. The exterior walls of parking structures should incorporate materials, colors and articulation to visually complement adjacent buildings.

A strategic approach to the location of parking access points minimizes the potential for pedestrian/vehicle conflicts. Placing and screening structured parking to avoid views of parked cars from the greensway or accessways strengthens the character of these areas by reinforcing their emphasis on pedestrian and bicycle movement. Residential, commercial and institutional uses, public art and dense vegetation are examples of screening uses and/or devices.

Guideline
 Develop, orient and screen structured parking to complement adjacent buildings, reduce automobile/pedestrian conflicts and support the pedestrian environment.

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Background: The background statement describes the design problem or issue necessitating the design guideline.

Images which support the background statement

Guideline: The design guideline language serves as the approval criteria. It is the only part of the design guideline that is adopted by ordinance.

DEVELOP COMPLEMENTARY STRUCTURED PARKING C4-1

Guideline C4-1 may be accomplished by:

- Developing parking facilities to serve multiple buildings
- Integrating structured parking with the building's overall design

Guideline C4-1 may be accomplished by:

1. Developing parking facilities to serve multiple buildings

2. Integrating structured parking with the building's overall design

SOUTH WATERFRONT DESIGN GUIDELINES | DRAFT 2009

Graphic and written descriptions of the examples. The images provided are intended to illustrate a possible solution for each example, but should not be seen as the *only* solution.

Introduction

How to Use this Document: Section III and Section IV

Because these guidelines address issues specific to the South Waterfront Greenway, they do not nest easily within the framework of the Central City Fundamental Design Guidelines. These guidelines have the same structural components as the *South Waterfront Design Guidelines*, including the background statement, guideline language and examples, as shown on the preceding page. They are simply numbered either 1 through 6 (*South Waterfront Greenway Design Guidelines*) or 7 through 8 (*Greenway Development Plan Option*).

The Design Guideline Heading states the broad objective.

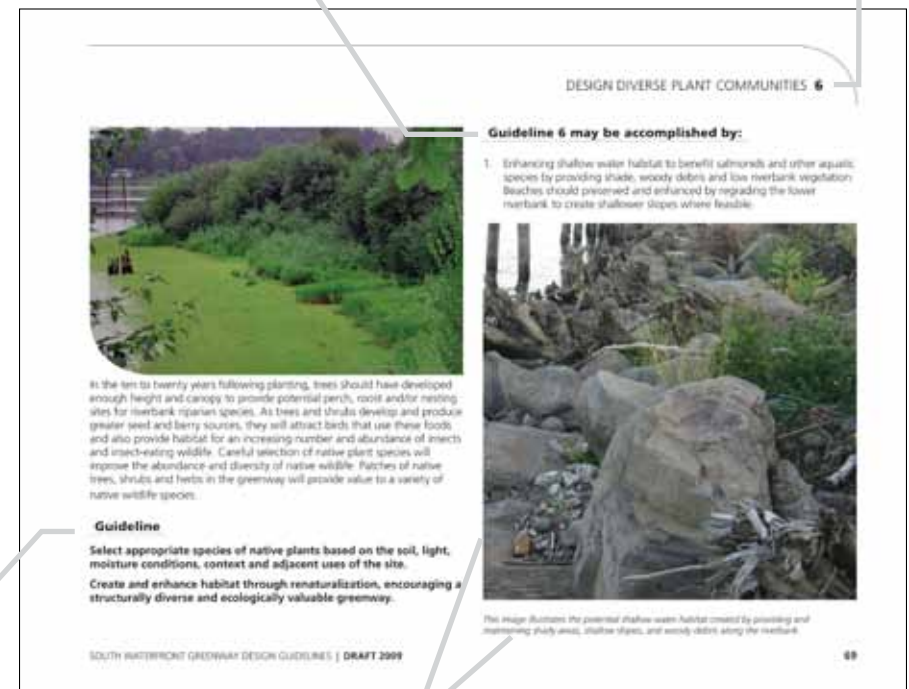
Guideline may be accomplished by: Examples of some of the possible methods that can be used to address the guideline.

Heading identifies the specific guideline within the page.



Background: The background statement describes the design problem or issue necessitating the design guideline.

Images which support the background statement



Guideline: The design guideline language serves as the approval criteria. It is the only part of the design guideline that is adopted by ordinance.

Graphic and written descriptions of the examples. The images provided are intended to illustrate a possible solution for each example, but should not be seen as the *only* solution.

Section II



South Waterfront Design Guidelines

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A PORTLAND PERSONALITY**A1 INTEGRATE THE RIVER****A1-1 DEVELOP RIVER EDGE VARIETY****Background**

Completing the Willamette River Greenway through South Waterfront will link RiverPlace and John's Landing areas. Many different qualities and opportunities exist along South Waterfront's extensive shoreline. Developing river edge variety within new development will make it one of the most lively and enjoyable segments of the entire Willamette River Greenway system.

Building mass and/or edges facing the river and adjacent to the greenway should express a diversity of building forms to avoid the creation of a "wall" along the greenway. Variation in the horizontal planes of buildings, as well as the vertical facades facing the river, help to transition from South Waterfront's interior of formal, urban buildings in an enclosed setting to the diverse character of the greenway. Buildings should be programmed with ground floor active uses that contribute to the public realm along the greenway and accessways.

Active ground floor uses will contribute to the diversity and variety of the river's edge, strengthening the livelihood of the greenway. Articulation of these building façades with human-scale elements will help to complement the greenway and add to the overall diversity of South Waterfront's built edge. Building elements, such as bay windows, balconies, roof terraces, awnings or large windows with locations for plants (such as in window boxes or on window sills), are encouraged to create a human scale at the lower levels of buildings.

Guideline

Vary the footprint and façade plane of buildings that face the Willamette River to create a diversity of building forms and urban spaces adjacent to the greenway.

Program uses on the ground level of buildings adjacent to the greenway and to accessways linking the greenway with the interior of the district that activate and expand the public realm.

Design the lower stories of buildings within the greenway interface to include elements that activate uses and add variety and interest to the building facades.



A1-1 DEVELOP RIVER EDGE VARIETY

Guideline A1-1 may be accomplished by:

1. Configuring the building's mass to be perpendicular to the river.



This is the end of one wing of the Tanner Place Condominiums in the River District. Narrower sections of the building face the pedestrian accessway to the north, reducing the overall mass of the building facing the pedestrian and bicycle-only environment. This plan layout would produce a dynamic set of building facades facing the greenway and would also create opportunities for semi-public outdoor spaces, such as the entry courtyard to the right.

Guideline A1-1 may be accomplished by:

2. Articulating the façade plane to step down to the greenway.



This apartment building on the South Park Blocks steps its façade in several increments down to meet the open space of SW Park Avenue and the Park Blocks themselves. This more aggressive strategy for stepping the building façade results in a richly textural set of heavily-glazed projecting bays.

Guideline A1-1 may be accomplished by:

3. Articulating building facades that face the Willamette River with human scale elements and activity.



These buildings in Vancouver, BC, have incorporated human-scaled elements including large expanses of window glazing, terraces oriented to the street, and large canopies to offer weather protection to pedestrians. Elements like these and others help to bring the scale of large buildings down to the scale of the people that live, work or visit in them.

Guideline A1-1 may be accomplished by:

4. Breaking up the building's mass to develop a variety of volumes.



This housing project in Vancouver, BC, has developed a three-story podium of rowhouses at its base. The building has also incorporated a taller tower component that has been pushed to one side of the podium, creating a varied building footprint and the perception of a smaller overall building mass.

A1-1 DEVELOP RIVER EDGE VARIETY

Guideline A1-1 may be accomplished by:

5. Using divisions inherent to the building type to break up potentially monolithic building forms with horizontal plane and façade shifts.



The designers of this residential development in Vancouver, BC, have used projecting bays to accentuate the divisions between individual dwelling units as well as a series of planters and seating ledges. The cumulative effect of this technique results in an undulating façade plane, offering lots of visual texture.

Guideline A1-1 may be accomplished by:

6. Programming the ground floor of buildings along the greenway with active uses.



Active ground floor uses, such as those along the accessway facing the Elizabeth Courtyard in the Pearl District, strengthen the sense of public ownership and activity of the public realm.

Guideline A1-1 may be accomplished by:

7. Providing stoops, windows, balconies and decks facing the greenway.



This image shows an “eyes on the street” approach toward the public right-of-way. Windows, balconies, and stoops are all oriented toward the street.

A1-2 INCORPORATE ACTIVE USES ALONG THE RIVER

Background



Orienting active uses toward the greenway and river provide visibility and security and encourage continuous use and public “ownership” of the greenway. A variety of uses such as restaurants, cafes, and retail will enliven the area, offering more reasons to populate the greenway and add to its vitality. Active retail should be located on corners where primary streets terminate at the greenway, such as Gibbs,

Curry, and Gaines. Other desirable locations include the intersections of the greenway and accessways.

Active retail uses should strengthen and build upon the special location along the greenway and river, by providing bicycle and pedestrian amenities or boat rentals or encouraging the use of walking, biking and boating. They should maintain an open and inviting public environment, avoiding walls, fences or other dividers between seating and the greenway. Restaurant or café seating should spill out directly onto the greenway. They should include building elements, such as patios, balconies, and stoops, which contribute to the expansion of the public realm. Access from these uses should be open, visually evident, and inviting.

A1-2 INCORPORATE ACTIVE USES ALONG THE RIVER

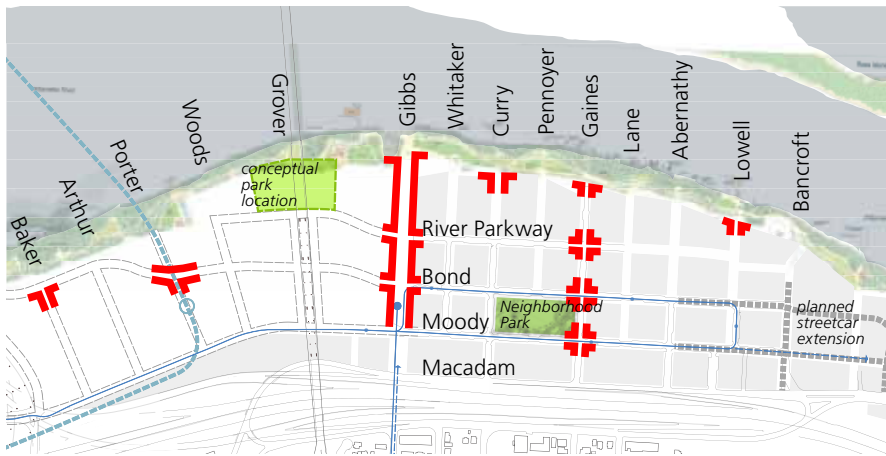
Active uses on the greenway should provide day and night, year-round activity and attract a wide range of people to the District, providing ‘eyes on the greenway’ and the sense that the greenway is a public amenity.

Guideline

Integrate active uses along the greenway to encourage continuous use and public “ownership” of the greenway.

Program active uses to face and connect with the greenway, expand the public realm, and enhance the experience for greenway users.

Develop active ground floor uses at the intersections of the greenway with accessways to the interior of the district to create stronger connections to and activity along the greenway.



Preferred Retail Use Focus Areas

Guideline A1-2 may be accomplished by:

1. Programming active uses, such as cafes, restaurants, and retail establishments along the greenway interface.



The image above shows retail, including a restaurant with outdoor seating along the water. Active uses along the greenway will provide visibility and continuous activity while directing attention and focus to the river itself.

INCORPORATE ACTIVE USES ALONG THE RIVER **A1-2**

Guideline A1-2 may be accomplished by:

2. Providing a variety of active uses, creating activity year-round for both daytime and night-time use.



Uses that are viable during the day and night will provide the area with a wide range of people and activity, enlivening the greenway's edge and the district as a whole.

Guideline A1-2 may be accomplished by:

3. Using building elements, such as open courtyards, balconies, outdoor seating, and front stoops, to orient active uses toward the river.



Windows, courtyards, and outdoor seating such as this example can build upon the area's unique location by orienting and focussing on the greenway and river.

A1-2 INCORPORATE ACTIVE USES ALONG THE RIVER

Guideline A1-2 may be accomplished by:

4. Providing amenities and access that encourage walking, biking, and boating.



Every effort should be made to provide amenities to pedestrians and bicyclists, such as signage, places to rest, and appropriate places to access the water. Direct connections to restaurants and other uses along the greenway will encourage walking, biking, and boating while expanding the public realm.

Guideline A1-2 may be accomplished by:

5. Allowing restaurant or café seating to spill out directly onto the greenway and accessways.



Uses that extend seamlessly into the public realm such as this image from Copenhagen will contribute to the sense of public ownership of the greenway by creating and open an inviting atmosphere.

A2 EMPHASIZE PORTLAND THEMES

A3 RESPECT THE PORTLAND BLOCK STRUCTURES

A4 USE UNIFYING ELEMENTS

A4-1 INTEGRATE ECOLOGICAL CONCEPTS IN SITE AND DEVELOPMENT DESIGN

Background



South Waterfront offers a rare opportunity to integrate and enhance the district's urban and natural contexts. As the designs of the district's future buildings will be highly urban and contemporary, a contextual and ecological approach to the development and site designs will strengthen connections to adjacent neighborhoods and ecological assets. It is important for the district's urban development to

build strong relationships with surrounding neighborhoods and the ecological landscape. The landscape context of South Waterfront will reflect its transitional nature as a highly urbanized area, lying between the forested West Hills, the Willamette River, and Ross Island.

In South Waterfront, site designs that build upon the inherent contrasts between intensely urban and ecologically-sensitive areas will be the defining quality of the district. Creating landscapes that integrate ecologically-sensitive plantings in the spaces between buildings will add to the area's diversity while helping to unify its overall development. Taking advantage of opportunities to plant native and native-like trees typical of riparian and upland areas, in concentrations with other indigenous plants, will

establish ecologically-diverse plant communities as counterpoints juxtaposed with urban landscape elements. Plazas (or plaza-like gathering places), unobstructed stopping and viewing locations, or other more intensive human-activity areas incorporated into building site designs strengthen South Waterfront's urban character and add to the area's diversity.

New development in South Waterfront can also benefit from the integration of ecological concepts, implemented on the exterior of buildings with sustainable building principles executed throughout the rest of the structure. "Green" or "high-performance" buildings can complement the landscapes created in the spaces between them by integrating ecological landscape elements with the building forms and technologies. Examples of ecological concepts for new development include the creation of multipurpose sunspaces, passive heating and cooling systems, shading and trellis systems, among many others. The City's Bureau of Planning and Sustainability, or the United States Green Buildings Council (USGBC) has more information on green building strategies.

Guideline

Incorporate ecological concepts as integral components of urban site and development designs.

A4-1 INTEGRATE ECOLOGICAL CONCEPTS IN SITE AND DEVELOPMENT DESIGN

Guideline A4-1 may be accomplished by:

1. Juxtaposing ecologically-sensitive site designs with intensely urban buildings and site elements.



This is a picture of one of the office buildings at the Daimler-Chrysler headquarters complex in Berlin, Germany. In the foreground is an artificial pond that has been lushly planted with wetland species of reeds and other plantings. The scale and design of the building and its site play off each other to emphasize the special qualities of both.

Guideline A4-1 may be accomplished by:

2. Integrating ecological landscape elements in site designs.



This is an image of a vegetated water feature at the Daimler-Chrysler headquarters complex in Berlin, Germany. Part of the intensely urban complex can be seen in the water's reflection. The combination of native and native-like plantings, irregularly-placed blocks of stone and seemingly-naturally occurring sandbanks work together to offer a serene alternative to the development's urban character.

Guideline A4-1 may be accomplished by:

3. Developing special landscape environments.



The Water Pollution Control Lab in Cathedral Park has an integrated system of water and wetland gardens. South Waterfront has a similar relationship to the river and new development could emphasize renewed ties to the river and its ecology by recreating wetland gardens. These heavily landscaped spaces offer serene settings for contemplative pursuits, as well as rare opportunities for the incorporation of wetland vegetation.

Guideline A4-1 may be accomplished by:

4. Creating interior spaces within buildings that celebrate and take advantage of exterior environments.



This is an interior view of the sunspace at the Prisma Building in Nuremberg, Germany. This multifunctional space provides a solar heated gathering space for the various tenants of the mixed-use building. It implements passive cooling strategies through plantings and by using water collected outside the building and bringing it inside. These features also strengthen the connections between the exterior and interior environments.

A4-2 INTEGRATE STORMWATER MANAGEMENT SYSTEMS IN DEVELOPMENT

Guideline A4-1 may be accomplished by:

5. Incorporating sustainable building practices or techniques into development designs.



This is a view looking south from the roof terrace on the Ecotrust Building in the River District. The development and design team of this building made sustainability a high priority. A significant amount of construction materials were recycled, an eco-roof has been incorporated (on other sections of the building's roof), an aggressive day-lighting strategy was employed and some spaces in the building have reused discarded materials, such as old industrial doors. These examples are only a few of the many sustainable strategies implemented by the building.

A4-2 INTEGRATE STORMWATER MANAGEMENT SYSTEMS IN DEVELOPMENT

Background

Stormwater management is a critical component of development everywhere. Integrating solutions within development retains, redirects or otherwise prevents stormwater from entering city systems and the river. On-site retention and management of stormwater greatly reduces impacts on adjacent collection areas, ecosystems and treatment facilities. South Waterfront provides exceptional opportunities for the implementation and integration of new stormwater management systems.

There are many different types of stormwater management systems. They range from eco-roofs or the incorporation of pervious surfaces, such as sand-set brick paving, to more comprehensive systems that reuse stormwater to irrigate landscape plantings.

Rooftop retention systems require enhanced structural components of the building, and need to be factored into the early stages of the design process for their successful integration. Water features that incorporate stormwater management capabilities with their aesthetic functions provide multiple benefits. Water features providing stormwater management capabilities often require early consideration for an integrated overall site and building design.

Guideline

Integrate innovative stormwater management systems with the overall site and development designs.

INTEGRATE STORMWATER MANAGEMENT SYSTEMS IN DEVELOPMENT **A4-2**

Guideline A4-2 may be accomplished by:

1. Developing multifunctional stormwater management systems.



This is a view of the courtyard at the Buckman Terrace Apartment complex. The courtyard's planted areas have been designed to function as stormwater retention facilities. In addition, (and typical of most courtyards) the courtyard offers visual and physical relief for the residents of the building.

Guideline A4-2 may be accomplished by:

2. Celebrating the stormwater functions of typical building elements.

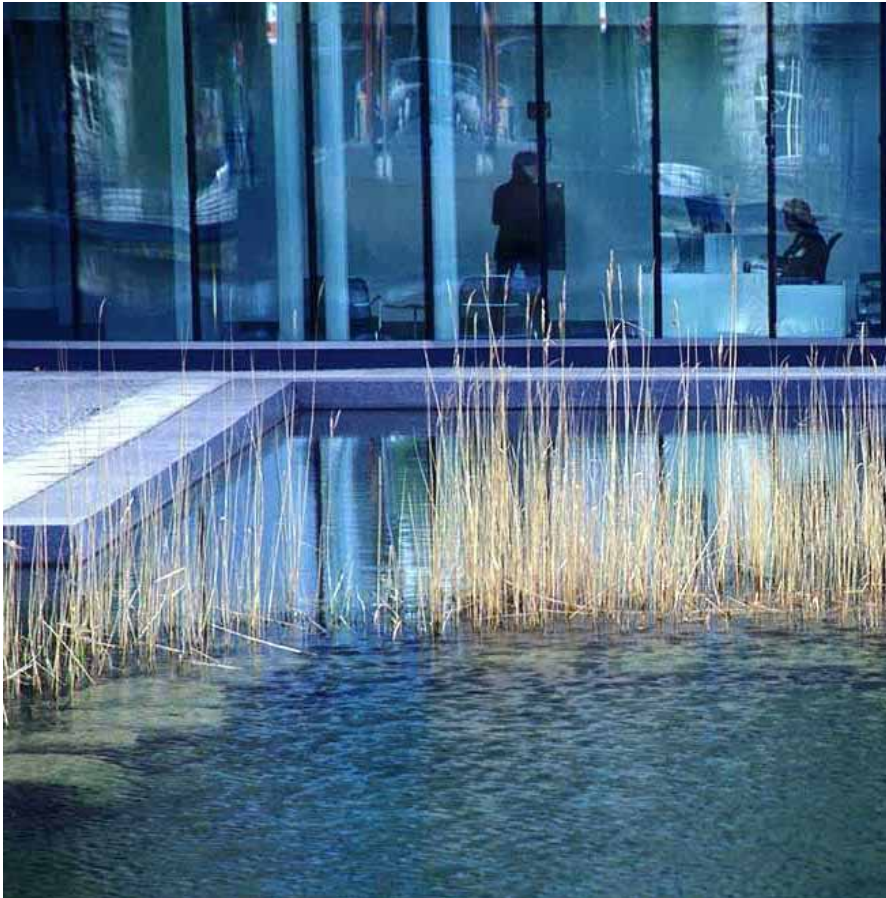


These scuppers at the Water Pollution Control Laboratory have been developed to cascade water from the building's roof into the wetland garden at the northern end of the site. This is a rather poetic and celebratory solution to a typical building element that could otherwise function unnoticed.

A4-2 INTEGRATE STORMWATER MANAGEMENT SYSTEMS IN DEVELOPMENT

Guideline A4-2 may be accomplished by:

3. Considering the potential aesthetic functions of stormwater management systems.



This image shows a view into an office environment across a stormwater retention pond. Locating the pond with this relationship to the adjacent uses allows the pond to provide visual relief to the workers from the office spaces within the building.

Guideline A4-2 may be accomplished by:

4. Integrating recreational rooftop facilities.



The 200 Market building in the South Auditorium District has developed a series of grass roofs for the lower portions of the building. This portion is being used by the building's workers for one of the regularly-scheduled bocce ball tournaments.

Guideline A4-2 may be accomplished by:

5. Creating comprehensive systems that advertise and celebrate the building's stormwater.



These channels incorporated into the building's columnar structure are actually displaying stormwater collected off the building's roof in open channels. This display of typically hidden building elements works in conjunction with other components of the system to successfully and comprehensively integrate stormwater into the building's systems.

Guideline A4-2 may be accomplished by:

6. Incorporating eco-roofs.



An eco-roof is a vegetated roofing system that can retain the majority of a building's stormwater on the roof. In addition, they contribute to a building's energy efficiency. Mature plantings on eco-roofs in urban areas also provide aesthetic functions by creating green oases that enhance views from nearby tall buildings.

A5-1 CONSIDER SOUTH WATERFRONT'S HISTORY AND SPECIAL QUALITIES

A5 ENHANCE, EMBELLISH AND IDENTIFY AREAS

A5-1 CONSIDER SOUTH WATERFRONT'S HISTORY AND SPECIAL QUALITIES

Background



The Willamette River serves as an important natural highway to and through the Willamette Valley. Throughout history, the Willamette River and its riverbanks have provided numerous functions. The river itself creates a huge amount of open space that brings sunlight and air down to the lowest understories of the riparian zones. The gently sloping banks have provided easy access to the river, which allowed

for basic needs of food and water to be met. Native Americans and the early pioneers in the area took advantage of South Waterfront's riverbank as an ideal campsite location.

The maritime industrial character of South Waterfront dates back to the early 1900s. The natural floodplain forming the bank of the Willamette River furnished the correct slope for the gravity-slide methods to access the river used by the early shipbuilding industry and the Willamette River's channel is deep enough in this section to accommodate deep-draft ships. In the early 1900s, the area became the site of several shipbuilding, scrap metal and steel fabrication operations. The shipbuilding industry was reversed in more recent times when World War II Liberty ships and other war vessels were brought upstream and docked for dismantling and the salvage of scrap steel.

The majority of the heavy maritime industrial activity in South Waterfront was located in the northern part of the district, roughly between the Marquam Bridge and SW Gibbs Street, just south of the Ross Island Bridge. South of Gibbs, the recent history of South Waterfront is more diverse. This area has gone through several phases of development and re-development during the previous century. The area has seen uses that have included industrial, light-industrial, commercial and even residential types. In 1988, the area (then named the North Macadam subdistrict) was rezoned as part of the Central City Plan from an industrial designation to a commercial zone as the area was no longer being used as a major industrial location.

Adaptively reusing artifacts or materials present in existing structures as elements of, or structural systems for, interpretive signs, benches, kiosks, lighting fixtures, public art, facilities serving water transportation, water features, and/or paving materials are potential methods for emphasizing the area's history.

New expressions, such as public art or water features that create new or highlight existing qualities of South Waterfront, are encouraged. These could "showcase" industrial artifacts from South Waterfront's past, such as ships, port/gantry cranes or wharves. The integration of these elements with site and development designs is important to achieve the area's urban design goals.

These types of elements should be sized and placed on or in the project to be visible from adjacent areas intended to accommodate public pedestrian movement and/or gathering. Additionally, functional building elements, such as awnings, windows, doors, and exterior lighting, can be creatively designed as identifying features to strengthen the character of South Waterfront.

Guideline

Consider emphasizing and integrating aspects of South Waterfront's diverse history in new development proposals.

When included in the development proposal, integrate works of art and/or water features with site and development designs.

CONSIDER SOUTH WATERFRONT'S HISTORY AND SPECIAL QUALITIES **A5-1**

Guideline A5-1 may be accomplished by:

1. Reusing or recycling elements of South Waterfront's past in new designs.



New York City's High Line reincorporates rail tracks within paving patterns and planting areas. These industrial remnants reinforce the character and history of its former use, while also giving the High Line a clear identity.

Guideline A5-1 may be accomplished by:

2. Combining works of art, stormwater management systems, and water features.



This image shows an approach that combines stormwater management and works of art. Their successful integration draws attention to both. The sculpture's placement adds to the visual relief offered by the water feature and provides different views from different locations around this office complex in Germany.

A5-1 CONSIDER SOUTH WATERFRONT'S HISTORY AND SPECIAL QUALITIES

Guideline A5-1 may be accomplished by:

3. Developing projects to integrate and enhance historic features.



The Ross Island Bridge is one of the district's most prominent historic features. New development adjacent to the bridge has special opportunities to create strong relationships with the bridge's graceful (upper image) and rhythmic (lower image) structural systems.

Guideline A5-1 may be accomplished by:

4. Using district elements and/or artifacts as inspiration for new works of art.



These cranes at the Zidell Marine barge-building facility (upper image) are indicative of the scale of heavy industrial manufacturing equipment. From a certain point of view, the cranes might have served as a contributing inspiration for the over-scaled spider sculptures in the lower image.

- A6 REUSE / REHABILITATE / RESTORE BUILDINGS
- A7 ESTABLISH AND MAINTAIN A SENSE OF URBAN ENCLOSURE
- A8 CONTRIBUTE TO A VIBRANT STREETScape
- A9 STRENGTHEN GATEWAYS
- B PEDESTRIAN EMPHASIS
- B1 REINFORCE AND ENHANCE THE PEDESTRIAN SYSTEM
- B1-1 FACILITATE TRANSIT CONNECTIONS**

Background

Building on the historic Jefferson Street trolley line, the transportation system in South Waterfront is anchored by the Moody-Bond spine that extends the length of the district. This corridor will serve as the primary vehicular mobility route, offer bus service, and help to extend streetcar service potentially to Lake Oswego.

The alignment for these transit services is within walking distance to the greenway and river transportation, and is consistent with the patterns of development densities in the district. In order to minimize the real or perceived distances between development in the area east of the Moody-Bond corridor and transit services, it is important to have convenient and direct pedestrian connections. Design decisions, such as orienting main building entrances to streets served by transit, can significantly enhance the accessibility of those facilities and potentially increase ridership.

Guideline

Orient the main entrances of buildings at streets served by public transit to conveniently and directly connect pedestrians with transit services.

Guideline B1-1 may be accomplished by:

1. Orienting main building entries or primary access locations to transit facilities.



These two images show examples of buildings in downtown Portland that have oriented main entries or primary access locations to transit facilities. The upper image is of the Nordstrom's department store and the MAX alignment on SW Morrison Street, and the lower image is of the Hilton Hotel expansion building and the transit mall on SW 6th Avenue.

B1-2 ENHANCE ACCESSWAY TRANSITIONS

Guideline B1-1 may be accomplished by:

2. Creating direct access connections from development to transit facilities.



This image shows an office building in the Lloyd District (in the background), and a planted accessway (in the foreground, and identified by the gabled portico) offering a direct connection from the building to the MAX alignment on NE Holladay Street. This heavily-planted accessway not only provides an effective transit connection, but also relief from the built environment around it.

B1-2 ENHANCE ACCESSWAY TRANSITIONS

Background



The accessways that lead to the greenway offer a special opportunity to enhance and unify the urban and natural contexts of South Waterfront.

Accessways connect the internal street network of South Waterfront to the greenway. The South Waterfront Street Plan identifies all accessway connections and their classifications. The term “accessway” specifically refers to the actual

transportation path that is used to connect one area or use to another. The transportation component is augmented by building setback areas that create a space defined on either side by building frontages. Many of the accessways provide east-west transitions from the urban interior of South Waterfront to the greenway and the river.

Some of the accessways should provide active ground level uses that transition into movement and activity along the greenway. Gibbs, Curry and Gaines, specifically should be programmed with active uses, such as cafes, restaurants, and retail to create an interactive experience into the greenway. Building faces should include patios, balconies, and entries which contribute to the to the bustle of the public realm.

Landscape designs in accessway setback areas should support pedestrian and bicycle movement. Arrangements of plantings can be incorporated within the accessway or building setback area to offer stormwater collection and/or dispersal functions, such as swales or stormwater planters.

Development adjacent to accessway paths intersecting with the greenway should blend species of vegetation used in the interior parts of the district with those used in the greenway. One way to accomplish this is through landscape designs and treatments that incorporate indigenous plants that are linked with the greenway's more intensive ecological landscape treatments. Plant species in accessway setback areas are encouraged to be native or native-like and coordinated with the greenway's treatment. Surface materials that provide some permeability to stormwater yet provide a hard, smooth surface for biking and walking are encouraged where these types of movements are intended.

Guideline

Program uses along accessways and at the intersections of accessways and public streets linking the greenway with the interior of the district that activate and expand the public realm.

Incorporate private building elements, such as entries, patios, balconies, and stoops, along accessways to expand the public realm from building face to building face.

Integrate landscape elements within accessway setback areas with accessway transportation components to enhance transitions from South Waterfront's interior to the greenway.

Guideline B1-2 may be accomplished by:

1. Programming active uses along accessways and at the intersections of public streets and accessways.



Active uses, such as this Vancouver restaurant's outdoor seating area and interactive fountain will help to establish important accessways into the greenway. The activity generated by these uses will transition and contribute to the movement and livelihood of the greenway itself.

B1-2 ENHANCE ACCESSWAY TRANSITIONS

Guideline B1-2 may be accomplished by:

2. Incorporating balconies, patios, and front doors along accessways.



Balconies, front doors, and patios facing the accessway, such as the one shown here in the Pearl District, will help create a sense of openness and “eyes on the street”. By treating the accessways with building elements that support transparency and fluidity, the sense of entry into the greenway should transition to the heart of the district.

Guideline B1-2 may be accomplished by:

3. Developing transitional landscaping within accessway setback areas.



This accessway connection in the River District is oriented to pedestrian and bicycle transit, but can accommodate vehicle traffic to parking areas. The paving materials between the trees are pervious, offering some stormwater management capability.

Guideline B1-2 may be accomplished by:

4. Developing accessways that serve as extensions of the greenway.



This is a view looking south on SW 3rd Avenue in the South Auditorium District. The connected canopy of the trees overhead creates a feeling of enclosure by natural shadow, contrasting with the light of the open space that can be perceived in the distance. The rhythmic use of shadow and light can be used to guide people down the accessways from interior locations in South Waterfront.

Guideline B1-2 may be accomplished by:

3. Developing stormwater management facilities within the accessways and/or building setback areas.



This image is of a landscaped swale in the Buckman Terrace Apartment complex's courtyard. The swale and movement paths on either side give an indication of a stormwater design that could be developed within South Waterfront's accessways.

B1-2 ENHANCE ACCESSWAY TRANSITIONS

Guideline B1-2 may be accomplished by:

4. Enhancing connections to the greenway trail.



This image shows a view looking down a waterfront trail in Vancouver, BC. The woman with a dog in the lower right-hand corner of the image is accessing the trail system from an off-trail location. The connection is marked by a change in paving material and color, as well as a break in the landscaped median separating pedestrian from wheeled traffic.

Guideline B1-2 may be accomplished by:

5. Developing shelter opportunities along accessways.



A sheltering canopy such as the one shown can be used for small and large gathering, resting, or viewing activities on the greenway itself. These places serve as markers for recreationalists and visitors, providing shade and refuge along the trail.

Guideline B1-2 may be accomplished by:

6. Incorporating a mixture of plantings to create extensions of the greenway into the district.



Developing accessway connections with dense plantings (in a manner similar to this heavily planted path) will help to extend the greenway into the district. The mixture and density of the plantings creates a special, bucolic character, emphasizing a natural stronghold in a dense urban setting.

B2-1 INCORPORATE OUTDOOR LIGHTING THAT RESPONDS TO DIFFERENT USES

B2 PROTECT THE PEDESTRIAN

B2-1 INCORPORATE OUTDOOR LIGHTING THAT RESPONDS TO DIFFERENT USES

Background

Street level lighting of public areas is encouraged to provide a sense of community, activity and security. Effective night lighting promotes the use of pedestrian areas and ground level activity during the evening hours throughout the year. Specialty lighting should be applied where activity uses, such as along accessways or at the intersections with public streets are appropriate. Light fixtures should be placed to direct light at building walls and ground surfaces, where light is desirable, while shielding light from nearby residential windows, wildlife habitat areas and the sky, to avoid excess and/or vertical “spill” light.

Fixtures adjacent to ecological or habitat-enhancement areas should employ a hidden-source design, to avoid the creation of unwanted glare and/or light pollution into these areas. In addition, lighting should be carefully designed and directed to avoid impacts to birds, bats and fish.

Guideline

Place and direct exterior lighting to ensure that the ground level of the building and associated outdoor spaces are well lit at night.

Integrate exterior lighting so that it does not detract from the uses of adjacent areas.

When appropriate, integrate specialty lighting within activity nodes at the interfaces of accessways and the gateway.

Guideline B2-1 may be accomplished by:

1. Providing attached directional lighting along building facades.



These simple, directional lighting fixtures are attached to a mixed-use development in the RiverPlace community. The fixture's hood helps to shield the light from spreading and directs the light to the sidewalk.

INCORPORATE OUTDOOR LIGHTING THAT RESPONDS TO DIFFERENT USES **B2-1**

Guideline B2-1 may be accomplished by:

2. Developing light fixtures that offer direct and indirect light.



Light fixtures like this one on the Eastbank Esplanade offer focussed light from the directional piece onto the ground below. In addition, the hood component catches excess light from the fixture and spreads it indirectly over a slightly greater area, increasing efficiency of the fixture.

Guideline B2-1 may be accomplished by:

3. Applying specialty lighting to enhance activity areas and active uses.



Specialty lighting such as the hanging bulbs or round globes above, contribute to the nightlife and sense of activity that many areas will exhibit. These areas should explore specialty lighting that enhances the place and its use without detracting from other needs of the district.

C4-1 DEVELOP COMPLEMENTARY STRUCTURED PARKING

- B3 BRIDGE PEDESTRIAN OBSTACLES
- B4 PROVIDE STOPPING AND VIEWING PLACES
- B5 MAKE PLAZAS, PARKS, AND OPEN SPACES SUCCESSFUL
- B6 DEVELOP WEATHER PROTECTION
- B7 INTEGRATE BARRIER-FREE DESIGN



- C PROJECT DESIGN
 - C1 ENHANCE VIEW OPPORTUNITIES
 - C2 PROMOTE QUALITY AND PERMANENCE IN DEVELOPMENT
 - C3 RESPECT ARCHITECTURAL INTEGRITY
 - C4 COMPLEMENT THE CONTEXT OF EXISTING BUILDINGS
- C4-1 DEVELOP COMPLEMENTARY STRUCTURED PARKING**

Background

Parking structures provide parking for residential, commercial and other uses in South Waterfront. Their design should complement the design context of the area as expressed in the scale, proportion and materials of nearby buildings. Exterior facades of parking structures that expose or express sloping floors are discouraged. The exterior walls of parking structures should incorporate materials, colors and articulation to visually complement adjacent buildings.

A strategic approach to the location of parking access points minimizes the potential for pedestrian/vehicle conflicts. Placing and screening structured parking to avoid views of parked cars from the greenway or accessways strengthens the characters of these areas by reinforcing their emphasis on pedestrian and bicycle movement. Residential, commercial and institutional uses, public art and dense vegetation are examples of screening uses and/or devices.

Guideline

Develop, orient and screen structured parking to complement adjacent buildings, reduce automobile/pedestrian conflicts and support the pedestrian environment.

DEVELOP COMPLEMENTARY STRUCTURED PARKING **C4-1**

Guideline C4-1 may be accomplished by:

1. Developing parking facilities to serve multiple buildings.



Concentrating necessary parking for multiple buildings or uses in one facility significantly reduces or eliminates the need for incorporated parking in the other participating buildings. Levels 2 through 10 at the Hilton Hotel expansion on SW Taylor are used for parking. The parking developed in this building serves not only the hotel's patrons, but also several nearby uses.

Guideline C4-1 may be accomplished by:

2. Integrating structured parking with the building's overall design.



Incorporated structured parking at lower levels of the Gregory in the River District has been masked with decorative brick-work, applied in patterns consistent with the "neo-deco" styling theme used for the building.

C13-1 COORDINATE DISTRICT SIGNS

- C5 DESIGN FOR COHERENCY
- C6 DEVELOP TRANSITIONS BETWEEN BUILDINGS AND PUBLIC SPACES
- C7 DESIGN CORNERS THAT BUILD ACTIVE INTERSECTIONS
- C8 DIFFERENTIATE THE SIDEWALK-LEVEL OF BUILDINGS
- C9 DEVELOP FLEXIBLE SIDEWALK-LEVEL SPACES
- C10 INTEGRATE ENCROACHMENTS
- C11 INTEGRATE ROOFS AND USE ROOFTOPS
- C12 INTEGRATE EXTERIOR LIGHTING
- C13 INTEGRATE SIGNS

C13-1 COORDINATE DISTRICT SIGNS

Background

Signs exist in a shared environment that competes for the attention of viewers. Unlike most other communication devices, a sign is influenced by its location in relation to buildings, traffic arteries, other rights-of-way and by its proximity to other signs. Signs share with architecture an ability to characterize entire sections of a city as well as a single establishment. The street has become a gallery for the many forms of sign art.

Signs should be considered as integral components of any improvement/development project. To achieve compatibility in the design of signs for a building or a storefront, developers and their architects are encouraged to establish a master sign program for the signs. This program helps guide future improvements to a building's sign system over its life span. The master sign program will address design issues of the building's sign system, including sign size, character, materials, placement, and lighting. When supporting structures of signs are exposed, they should also be considered as elements in the master sign program.

For visual harmony, signs should be complementary and respectful to the architectural integrity of buildings. Inappropriate signs can defeat the purposes of other design considerations or even detract from the land uses within an area. On the other hand, signs that respect and enhance an area can be powerful tools in achieving the results intended by the land use and design process.

Guideline

Consider the development of a master sign program that integrates the sign system with the development's overall design.

Guideline C13-1 may be accomplished by:

1. Developing master sign programs that achieve integrated sign systems.

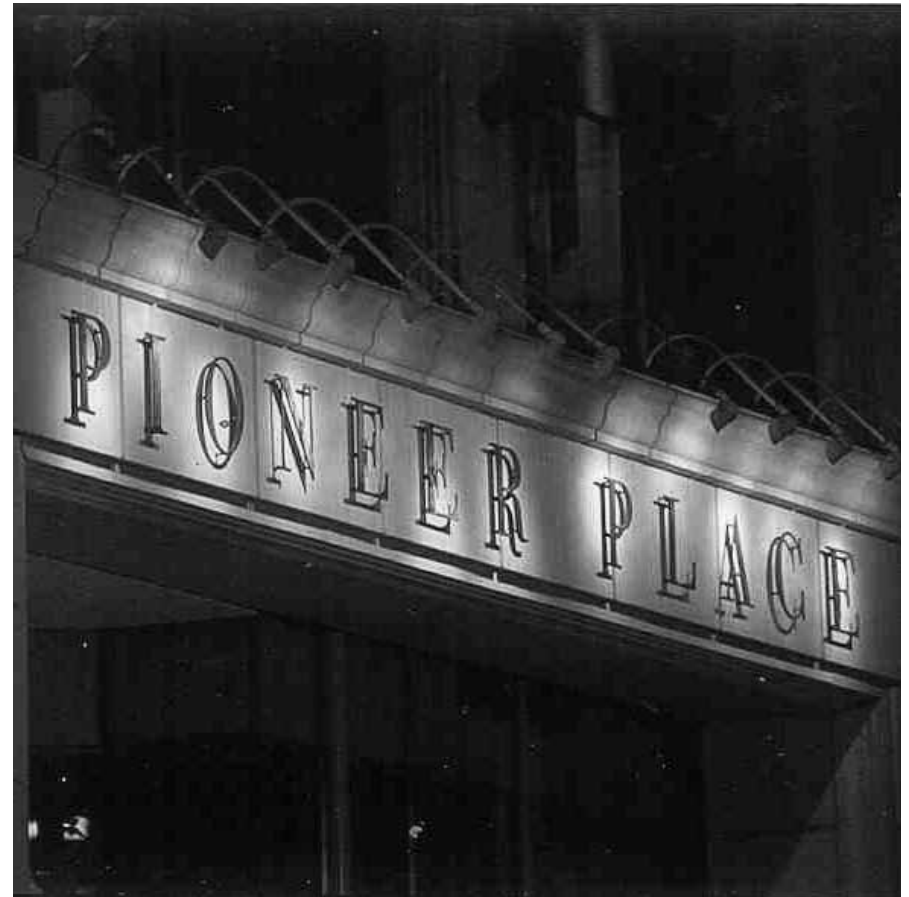


These examples of integrated sign systems are part of the overall design scheme for the respective buildings, Liberty Centre on the left, and PacWest Center on the right.



Guideline C13-1 may be accomplished by:

2. Using indirect lighting for building signs.



Pioneer Place II at SW 4th and Morrison uses raised metal letters for the sign and lighting that hides its source and illuminates the sign by silhouetting the letters.

Section III



South Waterfront Greenway Design Guidelines

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1. DESIGN A COHESIVE GREENWAY TRAIL SYSTEM

Background



The greenway serves both as a corridor for the South Waterfront District as well as an important link in a regional trail system. Implementation of the trail is critical to completing the district's transportation system and linking RiverPlace to John's Landing and beyond. Upon its completion, recreationalists and commuters will be able to enjoy an almost complete adjacency to the

Willamette River waterfront from downtown Portland to the Sellwood Bridge, on both banks of the river.

Dual Trail System. Heavy use of the trail requires separation of bicyclists and pedestrians along much of the greenway. The dual trail system consists of a pedestrian trail closest to the riverbank and a bicycle trail running roughly parallel to it. The two trails will intersect at several public plazas. At these busy locations, signage and tactile warnings advising cyclist caution will be needed. The dual trail should be aligned in a curvilinear manner, periodically moving toward and then away from the top of the bank. By providing many changing view angles and positions relative to the Willamette River, recreationalists will be less tempted to leave the trail and develop indiscriminate paths through habitat areas. By assuring protection of these resources, we can aspire a sense of stewardship, appreciation, and a greater level of support for similar efforts elsewhere along the Willamette.

Ensuring safe, engaging, convenient and direct public access to both trails from interior locations in the district will facilitate pedestrian and bicycle movement and help to encourage alternate modes of transportation.

Multiple points of public access will reinforce the idea that the greenway functions as a public amenity which serves both the district and the region.

Private development is encouraged to provide additional direct access points to the greenway trail from internal sections of the development to encourage increased use of the trail system.

North-South Continuity. The greenway will be implemented in an incremental fashion, closely tied to the development of private parcels adjacent to the corridor. As such, trail development will also proceed in incremental phases. Design of the greenway should strive to create a seamless and continuous greenway trail system. Consistency in site furnishings and transitions in paving materials will unify the dual trail system so that it does not seem disjointed from one development to the next. The evocative history of the greenway should be woven into these consistent elements, as well as forms inspired by historic structures. This is an important contributor to place-making and achieving a cohesive character in the district. While conceptual locations for both bicycle and pedestrian trails have been established, these locations may need to shift based on existing conditions. If variations are proposed to a trail alignment, revised routing should consider associated revisions to habitat areas and should align with existing and future segments to the north or south. [Also important is consideration of interim trail locations. If corridor users cannot connect along the riverbank, there should be a clear and safe detour route for them to access whatever stretches of trail exist.]



1 DESIGN A COHESIVE GREENWAY TRAIL SYSTEM

Trail Signage. Clear, simple signage should be provided to indicate shared use and basic rules for pedestrian and bicycle movement. This information can also be conveyed in subtle trail surface markings that warn of approaching intersections or heavy traffic areas. Mileage markers and street indicators, perhaps keyed to periodic district maps, are important wayfinding elements proposed for the greenway and could be incorporated in the trail surface.

Interpretive signage is also a potentially important contributor to the greenway's sense of place, describing the area's rich history to trail users in a clear, simple and educational manner that also indicates their particular position along the greenway and in history.



Guideline

Ensure that pedestrian and bicycle connections to the greenway trail from the adjacent accessways or urban spaces are safe, convenient and direct.

Align the trail to take advantage of the site's opportunities to enhance the diversity of trail experiences.

Create a continuous greenway trail system with consistency in design elements that celebrate the area's history and character.

Develop clear and simple signage for shared use, basic rules, wayfinding, and interpretive signage displays.

Guideline 1 may be accomplished by:

1. Developing additional access points to the trail.



Multiple access points to the trail encourage use and public ownership. The interior court of the Meriwether extends to the greenway trail, creating a network of open space.

Guideline 1 may be accomplished by:

2. Integrating the trail's design and development with adjacent streets.



Entry to this trail from the street is clearly demarcated with a curb cut and a concrete swath that cuts across the pedestrian and bicycle trails, leading to an open grassy area.

Guideline 1 may be accomplished by:

3. Aligning the trails in a curvilinear manner to maximize views and discourage users from leaving the designated trail and endangering habitat.



Curvilinear paths help frame views of and under the bridges as well as the river, while focusing the direction of movement for trail users.

1 DESIGN A COHESIVE GREENWAY TRAIL SYSTEM

Guideline 1 may be accomplished by:

4. Reusing existing materials or components to add to the diversity of trail experiences or using historically inspired forms and materials.



This sculpture just south of South Waterfront Park and RiverPlace integrates remnants of concrete piers and reinforcements from the old riverfront. Heavy steel reinforcement emerges from the old concrete forms, twisting at different angles. Native basalt and concrete cut at angles to expose the river rock aggregate are a nod to the evolving landscape of the river and its history.

Guideline 1 may be accomplished by:

5. Maintaining consistency in site furnishings and materials throughout the greenway, allowing transitions to occur where materials change.



Incremental development of the greenway will require careful transitions in material. Creative solutions may include using transitional bands of paving or introducing new materials gradually so that the change is not abrupt from one development to the next.

Guideline 1 may be accomplished by:

6. Advising caution with subtle trail surface markings and signage to indicate basic rules for pedestrian and bicycle movement and where trail intersections occur.



Signage can indicate both caution and direction for pedestrians and cyclists. Trail surface markings can be included where pedestrian/ cyclist intersections occur.

Guideline 1 may be accomplished by:

7. Developing a system of mile marker and street indicators.



Monumental markers along the trail, such as those along the Vera Katz Eastbank Esplanade, are useful for marking street locations west of the trail, as well as mile markers and points of interest.

2 ADDRESS GREENWAY EDGES

Guideline 1 may be accomplished by:

8. Describing the area's rich history in clear, simple, and educational signage indicating particular locations along the greenway.



Many opportunities exist along the greenway trail for interpretive or interactive signage. These examples include a map with a legend, photographs, and an explanation of historic or environmental significance of the site in clear and simple language.

2. ADDRESS GREENWAY EDGES

Background

The greenway will become a linear park and trail corridor positioned at the eastern end of the South Waterfront District. Among its challenges for continued success is the treatment and integration of its edges. The greenway will need to address the periodic adjacencies with streets and accessways, public open spaces, and existing and proposed bridge structures. The integration of the greenway with these elements will add vitality, enhance public safety, and instill the sense that the greenway is a public amenity shared by all.

Guideline

Address the edges of the greenway where it interfaces with streets and accessways, public open spaces, and bridge structures using the following Greenway Edge Guidelines (2-1 - 2-3).



2-1 ADDRESS STREETS AND ACCESSWAYS

Background



Public streets abutting the greenway should incorporate on-street parking and generous sidewalks to encourage public use and connections to the greenway. There should be a clear transition from the roadway edge into the greenway, avoiding steep grade changes or dense vegetation.

“Universal Accessways” are north-south connections

that may occur between the developed edge and greenway. To ensure the health of retail development such as restaurants and shops, accessways fronting the eastern edge of certain blocks are proposed. By providing 15' wide public/private corridors bracketing the greenway's western boundary, the accessways allow low-volume, limited access to the buildings' eastern frontages, hence encouraging mixed-uses such as retail, small offices, cafes with terraces and gathering spaces. This concept allows greenway-fronting plazas with light vehicular traffic, encouraging private development to create a more fluid edge to the greenway.

“Universal Streets”, or fingers of green, are east-west streets perpendicular to the river, extending approximately every 200' (based on the street grid) from the greenway into the South Waterfront District. The design of these streets is intended to be biased toward the pedestrian and bicyclist, and should incorporate stormwater planters and pervious surfaces, street furnishings, traffic calming, and visual permeability with adjacent development.



Clear connections to the greenway should be provided at the terminus of each street. Where the east-west streets do not link to north-south streets, their design should integrate with the greenway, incorporating turnarounds or cul-de-sacs that accommodate appropriate vehicle-restricting devices such as bollards. All terminus points should integrate generous views of the river and connections to activity areas, creating east-west pedestrian and bicycle entries into the greenway trail system. Signage should be incorporated to create clear entry points into the greenway.

Guideline

Provide clear connections to the greenway from streets and accessways.

2-1 ADDRESS STREETS AND ACCESSWAYS

Guideline 2-1 may be accomplished by:

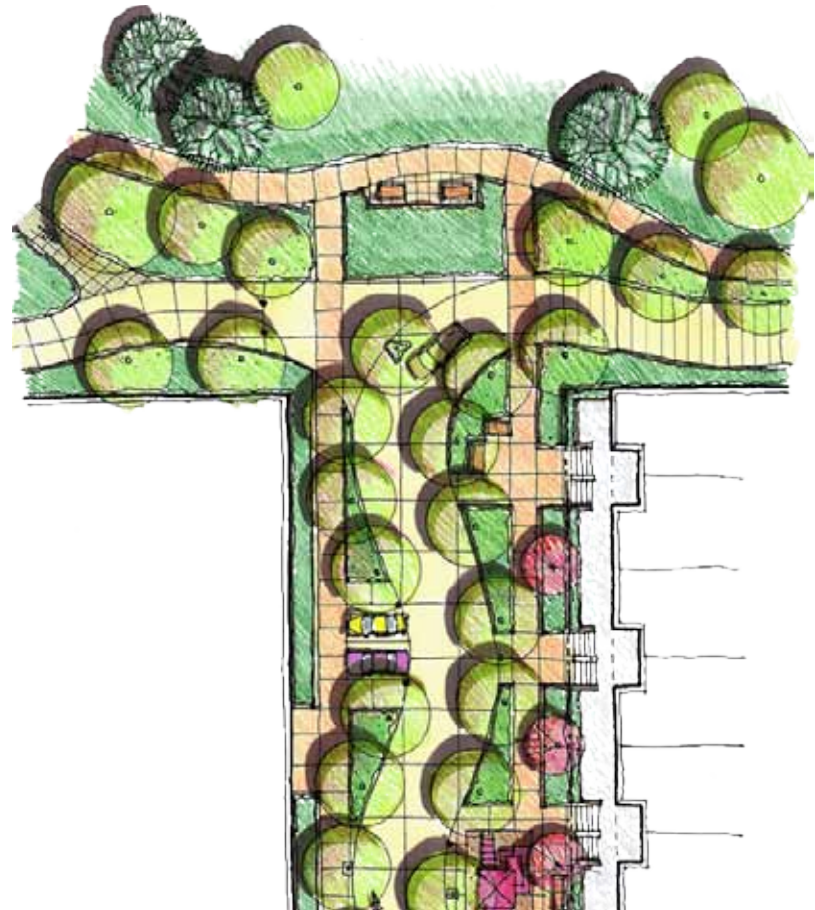
1. Incorporating on-street parking and wide sidewalks where public streets abut the greenway.



These two images show on-street parking and wide sidewalks adjacent to a street along the waterfront trail. The parking acts as a buffer between the street and trail and also encourages public use and connections through the generous sidewalk.

Guideline 2-1 may be accomplished by:

2. Creating east-west “Universal Streets” or fingers of green, extending into the greenway, and providing north-south “Universal Accessways” along the western boundary of development to allow low-volume, limited access and encourage mixed-uses.



This illustration of a Universal Street shows limited access to the greenway which could provide visitor parking, play areas, and semi-private courtyard or planting areas.

Guideline 2-1 may be accomplished by:

- Integrating views, connections to gathering places, and pedestrian and bicycle entries into the greenway from each street terminus.



The platform south of South Waterfront Park (top) is a good example of how providing regular overlooks cantilevered into the habitat can protect the river from excess human access. The diagonal path below the overlook provides an ADA-accessible route from the Greenway trail to the river's edge. Benches and signage (bottom) provided at the ends of streets can lead people to gather in appropriate places to view the water and its inhabitants.

Guideline 2-1 may be accomplished by:

- Providing signage at entry points into the greenway.



This entry point into the Brooklyn Heights Promenade visually links the neighborhood into the space with a prominent flag pole and signage that clearly indicates a point of access. The tree-lined pathway also reaches into the neighborhood, extending the trail and greenway back into the city.

2-2 ADDRESS ADJACENT OPEN SPACE

2-2 ADDRESS ADJACENT OPEN SPACE

Background

Open space directly adjacent to the greenway should be located to take advantage of greenway amenities such as plazas or overlooks. Plantings within the open space should complement the habitat renaturalization efforts of the adjacent greenway, and should also be of similar scale and density as the adjacent greenway. Open space should consider view corridors established on the greenway and ensure continued visual access from surrounding development.

If a street separates the open space and the greenway, there should be clear and safe connections across the street, including mid-block crossings, crosswalks and curb bulbs.

Guideline

Ensure continuity of design and movement between the greenway and adjacent open space.



Guideline 2-2 may be accomplished by:

1. Locating adjacent open spaces to take advantage of greenway gathering places and overlooks.



These two images illustrate overlooks which also function as gathering places. The examples range from a permeable grassy slope away from the river to a paved gathering spot that sits along the waterfront.

Guideline 2-2 may be accomplished by:

2. Reflecting the adjacent greenway's habitat character in scale, density, and plant palette to enhance habitat renaturalization.



This image of South Waterfront Park shows how the character and palette of plant materials extends from adjacent pathways, buffering the open space.

Guideline 2-2 may be accomplished by:

3. Creating clear and safe connections from the open space to the greenway, where there is a street separation in between.



This image illustrates a clear path that leads from the greenway trail to the street and plaza beyond. Using a change in paving materials as well as signage will create a safe connection to areas that streets bisect.

2-3 ADDRESS BRIDGES

2-3 ADDRESS BRIDGES

Background

The existing Marquam and Ross Island Bridges currently serve as wayfinding elements, visible from a distance along the waterfront and indicative of distances between reaches for trail users. Their impressive scale and structure becomes increasingly evident as one proceeds towards them along the riverbank. The bridges will therefore serve to frame the transition between reaches. As trail users proceed along the greenway, it should be clear that the trail continues under all bridges, unimpeded by bridge supports, and that detours are not needed. Due to the height of both bridges, there is ample daylighting underneath which will aid in the establishment of habitat and minimize any safety issues. Every bridge should be well-lit underneath with both daylighting and electrical light.



Each bridge also presents opportunities for public art. The broad columns of the Marquam Bridge could be painted in a way that marks a portal to and from the greenway (similar to the treatment of bridge columns at the east end of the Hawthorne Bridge). Art pieces could be suspended from the bridge or incorporated in plazas or overlooks beneath the bridge deck. There is an existing overlook plaza at the terminus of the South Waterfront Park under the Marquam Bridge, which will serve as a gateway gathering place for the greenway and the beginning of the dual trail system.

The height of the Ross Island Bridge prevents direct access to its deck for pedestrians and cyclists. It is a beautiful, historic bridge, with a unique prospect for innovative color, lighting and signage treatments. Greenway trails should be located to avoid the bridge's columns, and the passage should be evident to trail users approaching from both north and south. A viewing terrace or plaza underneath the Ross Island Bridge could serve as a place for signage interpreting the bridge's history, design and construction, while also serving as a gateway or a place to pause while transitioning from the North Greenway to the Central Greenway, from a quieter, more natural experience to the activity at the terminus of Gibbs Street. If provided in the future for pedestrians and cyclists, access to and from the Ross Island bridge deck should also be clear and simple, with broad ramps and stairs or safe elevators and good signage. Opportunities for art and other wayfinding or interpretive elements are also available underneath the new light rail bridge.

Plant selections should anticipate the shading cast by bridges with shade-tolerant species.

Guideline

Design the greenway to address the visual and physical presence of the bridges.

Guideline 2-3 may be accomplished by:

1. Taking advantage of views of the bridges along the greenway as wayfinding elements.



The greenway trail should frame views of the bridges from up close (top) and far away (bottom).

Guideline 2-3 may be accomplished by:

2. Providing clear and well-lit pathways under all bridges, so that pedestrians and cyclists are not deterred or impeded by bridge structures.



Areas under bridges should be clearly lit and unimpeded so that it is obvious where the greenway trail continues and where the trail users belong.

3 INCORPORATE A DIVERSE SET OF GATHERING PLACES

Guideline 2-3 may be accomplished by:

3. Enhancing the greenway under each bridge with public art, artistic lighting, interpretive signage, and wayfinding. .



Bridges offer unique opportunities to showcase their structural components with lighting, provide public art, or serve as wayfinding.

3 INCORPORATE A DIVERSE SET OF GATHERING PLACES

Background

The greenway should include a diverse set of gathering places to provide features for a range of visitors seeking visual and physical access to the Willamette River and its shoreline. The Greenway Development Plan should be used as a guide in the location of these special areas. In general, where the District's east-west streets meet the river, a series of plazas, overlooks and docks should be sited. These areas will accommodate special activities, many of which are oriented towards engagement with the Willamette River. These areas will also maintain an open view corridor through the greenway's habitat, while adding physical connections for pedestrians where they have the greatest benefit and least impact on habitat. Gathering places in the northern reaches of the greenway (north of the Ross Island Bridge) should feature steel as a predominant material, recognizing the former shipbuilding and breaking activities that once took place there. South of the Ross Island Bridge, areas should feature more wood elements in their design, echoing the sawmills once located in that stretch of the river.

Gathering places benefit from the incorporation of short-duration stop facilities that support stopping and viewing activities. Places to sit, interpretive kiosks, integrated water features and public art are examples of the types of facilities that can enhance these gathering places. These areas should be designed to be understood as extensions or supportive components of the greenway trail. They should provide enough space for groups of people to gather without conflicting with the movement portions of the trail system. Special arrangements of plants can be used to provide a sense of enclosure, and to develop a character that is distinct from the trail itself.

The following types of gathering places should respond to the character of their specific reach's historical context, urban setting, and particular habitat improvements:

INCORPORATE A DIVERSE SET OF GATHERING PLACES 3



Plazas. The greenway should incorporate numerous gathering places along the trail in a regular pattern associated typically with street ends, emphasizing the connections of these places with the larger district both visually and physically.

These spaces should be paved, landscaped, and furnished with higher-quality materials reflecting their visibility and heavier use. Between these plazas and terraces is an opportunity for many informal gathering places with seating, interpretive signage, structures or overlooks, and docks.



Play Areas. The greenway should anticipate its role as a regional attraction by providing spaces for all age groups. Play areas can serve to activate urban spaces during weekdays. The materials should reflect the materials selected for furnishings,

walls and structures within that specific reach. There should be provision for adult seating areas, as parents also serve to activate and supervise the vicinity.



Docks. Docks used to launch small water craft and access water taxis, should be carefully located and designed to provide easy and safe boating access while protecting habitat. Docks should be located away from the shoreline, accessed by

raised gangways with sufficient clearance to protect underlying habitat. The docks should be located over at least 20' of water at low water flows in the river if possible. Docks and associated accessways should use wood and steel, and consider nautical forms that reflect the area's history of shipbuilding and dismantling.



Overlooks. Overlooks should be located at the end of street rights-of-way, allowing pedestrians to gain access cantilevered over greenway habitat, experience river activities and enjoy unique vantage points of the river.

Overlooks should include public art pieces or interpretive signs as well as the adaptive reuse of building materials or elements from existing structures in the area.

Guideline

Accommodate a range of special activities oriented toward the Willamette River that offer large and small gatherings, play, watercraft launches, and unique viewpoints as extensions of the greenway trail.

Design gathering places to respond to the character of the specific reach's historical context, urban setting, and particular habitat improvements.

3 INCORPORATE A DIVERSE SET OF GATHERING PLACES

Guideline 3 may be accomplished by:

1. Developing gathering places as distinct areas that can be understood as extensions of the greenway trail, aligning with major east-west connections.



South Waterfront Park extends the city's block grid to the greenway and river's edge through walkways that lead to overlooks of the river, the city, and mountains.

Guideline 3 may be accomplished by:

2. Incorporating seating, high-quality materials, interpretive signage, docks, overlooks, and other major amenities.



Overlooks and other public gathering spaces should be constructed of high quality materials. Seating provided within this trail along the High Line in New York offers durable, regularly spaced places to sit and view the trail and beyond.

Guideline 3 may be accomplished by:

3. Taking advantage of historic remnants to mark overlooks and other gathering places.



Gantry Park uses large historic remnants where large overlooks or major gatherings occur.

Guideline 3 may be accomplished by:

4. Incorporating works of art and/or water features.



Along the greenway, there are many opportunities for major art pieces and water features. The Oregon Convention Center's rainwater garden (bottom) collects and treats water, while providing a peaceful place for convention-goers, walkers, and cyclists to enjoy.

3 INCORPORATE A DIVERSE SET OF GATHERING PLACES

Guideline 3 may be accomplished by:

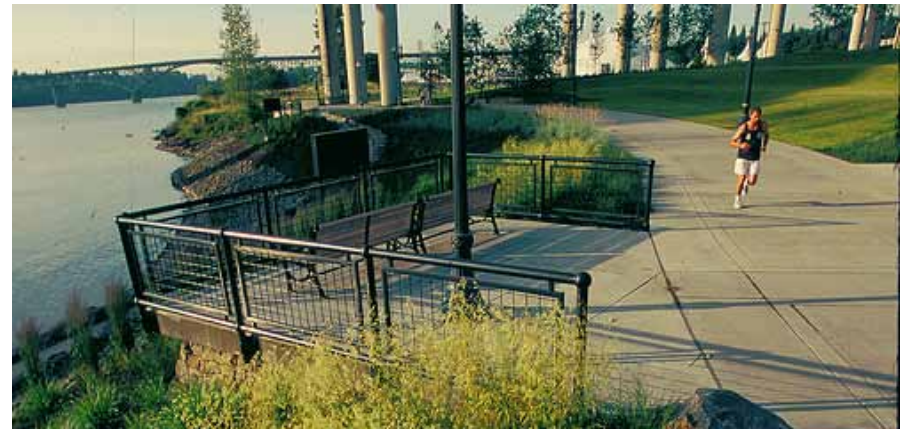
5. Providing spaces for all age groups, including children.



In the Pearl District, Jamison Square's interactive fountain (top) provides free play for all ages, activating the park and adjacent businesses during the day. The Greenway Development Plan (bottom) envisioned a grassy mound to provide free form play next to a designated toddler play area near Porter Street.

Guideline 3 may be accomplished by:

6. Integrating public access to the river at overlooks, located and designed to protect habitat.



Siting public overlooks above and separate from habitat areas allows the habitat to remain protected while onlookers can enjoy the lush environment that habitats provide.

4 INTEGRATE MATERIALS, STRUCTURES, AND ART

Background

South Waterfront's greenway offers significant opportunities for a range of new structures to define and strengthen gathering places and provide functional amenities for greenway users. The design of these structures should recognize creative responses to their context and should be high-quality, contemporary, and easy to maintain. The palette of structures and furnishings, including benches, trash cans, bike racks, bollards, and planters, should unify the greenway. Their design should be sensitive to surrounding habitat while complementing structure design within the district's private development and public rights-of-way. Attention should be taken in transitioning paving and maintaining consistency in materials and site furnishings where new greenway development abuts existing greenway.

Structures should be sensitive to their position within individual reaches. The rich variation and evolution of the greenway's history lends inspiration to the choices of materials for site furnishings and details. The robust steel remnants of shipyards, such as cranes and derelict hulls, inform material selections for northern reaches, while further south, the legacy of sawmills supports the selection of furnishings featuring wooden details. There may be interesting ways to combine the two materials in the Central Greenway, such as for railings, using stainless steel with a hardwood top. The combination of metal and wood elements suggests a subtle recognition of the site's past and lends an historical as well as physical continuity to the greenway.



Accessory Structures (Restrooms, Kiosks, Pavilions and other enclosed spaces).

These structures should be sited where streets meet the greenway or within special gathering places, recognizing the need for easy access and visibility

from the district. Restrooms and kiosks should be sized appropriately for their intended use. They should be in locations that are easily monitored, to deter loitering or vandalism. Storage is an important component of the kiosks, where small retail spaces should be included. Such retail spaces also provide an element of constant supervision by kiosk operators of activity along the greenway. Trellised pavilions will provide more open-air shelter from rain and sun, with an opportunity to accommodate some interpretive signage.



Lighting.

Well-integrated systems of night lighting will support the 24-hour character of South Waterfront. Night lighting along the greenway trail can provide a sense of security while remaining sensitive to adjacent habitat and residential areas.

A contemporary pole-mounted or pole-top light fixture is recommended for the South Waterfront Greenway, such as an unpainted or silver color die-cast aluminum. Lighting should be non-intrusive to habitat as well as residences fronting the greenway. Lighting should be directed downwards and away from greenway habitat so that only the trail and its supporting area are lit.



Paving. The selection of paving materials for public plazas and overlooks in the greenway should consider the immediate environment and context within the overall greenway. Generally, high-traffic and highly-visible pedestrian, residential, and gathering

4 INTEGRATE MATERIALS, STRUCTURES, AND ART

spaces should use a finer texture of paving, such as sand-set unit pavers or cut stone. Within the greenway, the bicycle trail should incorporate a continuously smooth travel surface, such as scored concrete or asphalt.



Walls. The design of greenway reaches will likely incorporate new walls to create gathering spaces and hold earth back from trail corridors or habitat areas. These walls should incorporate materials reflecting the historic and natural context of the corridor.

The greenway should offer a number of terraces on turf areas that hint at the history of the scrap metal industry through the use of metal, such as rusted steel plates facing on retaining walls supporting the terraces. Wood is not generally recommended as a substantial wall material but designers are encouraged to incorporate large logs or wood beams within walls if it is structurally feasible. Terraced water gardens along the greenway, notably at the terminus of Porter Street, were envisioned in the GDP to employ steel plate steps with steel grate walkways. In addition, there are opportunities to use native basalt stone as a wall material or within bioswales.



Public Art. There are numerous opportunities to locate highly-visible art pieces along the greenway. Special care should be taken to integrate art in subtle ways throughout one's experience of traveling within the corridor, respecting the site's

history in its use of evocative forms and materials, including the reuse of discarded, 'found objects'. These resources include ballast stone found on-site, as well as reclaimed metal scraps including entire ships' bows buried in the riverbank.

Art need not be traditional set pieces as in sculpture parks. Public art can be woven into planting design, structure design, treatment of rainwater, narrative texts, paving patterns and inlays and can serve as bold interpretive signage. Priority should be given to the installation of art where east-west streets meet the greenway in public plazas or terraces. The holistic view of introducing art into the greenway will add richness and vitality to the place, as well as act as a constant reminder of the site's past, present and role in the future.

Guideline

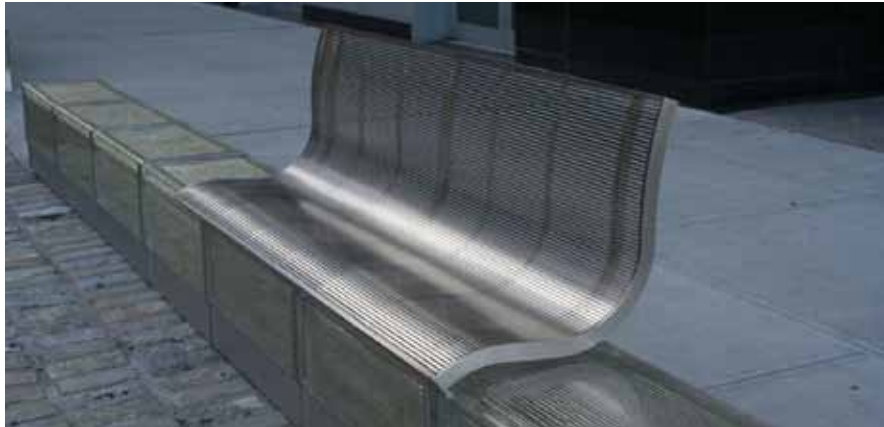
Integrate high quality, contemporary, visible, and easy-to maintain structures and materials which respond to context and need. Maintain consistency in structures and allow transition in paving materials where new greenway development abuts existing greenway.

Ensure that the greenway trail, its access connections, and the accessways are well lit at night to create a sense of activity and security. Place and shield lighting fixtures so that they do not detract from adjacent use areas.

Integrate art within the greenway through evocative forms and materials, including "found objects".

Guideline 4 may be accomplished by:

1. Drawing inspiration from the greenway's shipyard industry in the northern reaches and in the southern reach using wood and forms from the timber industry.



The images show examples of seating that would be appropriate in the northern reaches (top), where steel materials could draw upon the area's shipbuilding history. Chaise-like benches show a use of wood that would be appropriate in the southern reach.

Guideline 4 may be accomplished by:

2. Directing lighting to face downward and away from greenway habitat or using indirect lighting.



Downward or indirect lighting each provide a less intrusive environment for greenway habitat.

4 INTEGRATE MATERIALS, STRUCTURES, AND ART

Guideline 4 may be accomplished by:

3. Incorporating finer-textured paving for the pedestrian trail and gathering spaces and smoother travel surfaces for the bicycle trail.



This image illustrates a split trail where different materials suggest different users.

Guideline 4 may be accomplished by:

4. Integrating discarded, reclaimed historic remnants within the greenway.



This waterfront incorporates a crane into its trail, serving as a landmark and historic reminder of the area's industrial past.

Guideline 4 may be accomplished by:

5. Installing kiosks, restrooms, and art at street-end intersections or within gathering places.



Large art pieces should be used within gathering places and at street ends along the trail where they can serve as the defining icon and wayfinding element for the area.

Guideline 4 may be accomplished by:

6. Integrate art within the greenway into planting design, structure design, seating, treatment of rainwater, narrative texts, paving patterns, inlays, and interpretive signage.



Seating along the Greenway can be provided subtly within artwork, inviting personal interpretation of the art. The more recognizable chair forms in the lower image also serve as iconic art pieces and invite passersby to utilize this ramp space as an 'urban beach.'

5 ENHANCE THE RIVERBANK

5 ENHANCE THE RIVERBANK

Background

The South Waterfront Greenway can play an important role in providing increased habitat and enriching the ecological diversity of this portion of the Willamette River. Enhancements will need to address flood storage and protection, bank stabilization, safe public access to the water, and aesthetic qualities in a way that protects natural resources and public and private property.

Bank re-stabilization strategies that support ecological functions will enhance the overall value of the river's edge. Bio-engineered riverbank solutions are encouraged where they are compatible with the river's hydrology and other adjacent greenway functions. Over-steep banks can be stabilized by easing slopes to reduce the threat of erosion while providing a condition sufficiently stable to allow bioengineering structures to work effectively.

Where the adjacent river is shallow, redeveloping the riverbank with a shallower slope will enlarge shallow-water feeding and resting areas important to the juveniles of many native fish species and other wildlife. Excavated lowlands with willow/ash groves integrated with bank stabilization will flood frequently, adding to biodiversity potential and providing fish refuge during high water. It will also decrease the potential for flood damage by increasing flood storage capacity, and facilitate bank stability and erosion control.

To ensure the viability of riverbank renaturalization, human access to the river's edge should be restricted to street-end locations, docks, overlooks, and plazas generally identified in the Greenway Development Plan. River access should be provided in clearly identified, but limited locations, to provide human access to the river in a manner that will reduce indiscriminate intrusion into the riparian edge. Elevated overlooks above habitat areas will separate people from habitat and reduce the number of people who attempt to reach the river's edge. Docks should be designed in a way that minimizes impacts on riparian habitat, with gangways elevated above vegetation and descending clear to floating docks anchored by 'piles'.

Guideline

Utilize riverbank stabilization strategies that enhance the river and riverbank ecosystems.

Where appropriate, integrate public access to the water that is safe and supportive of adjacent riverbank areas.

Guideline 5 may be accomplished by:

1. Implementing bio-engineered riverbanks.



Reducing the slope and incorporating large wood or other natural structures, while using appropriate plant species in the design of the bank will help to effectively minimize the occurrence of erosion and support shallow water habitat.

Guideline 5 may be accomplished by:

2. Integrating riverbank design solutions with the different greenway areas and uses.



This photo shows a bank in Tacoma, Washington, where the viewpoint is cantilevered over the bank, minimizing impacts to a continuous habitat corridor below.

Guideline 5 may be accomplished by:

3. Providing clearly identified river access within appropriate locations, reducing riparian habitat intrusion.



The dock extending from the Eastbank Esplanade is clearly demarcated and raised to minimize habitat intrusion.

6 DESIGN DIVERSE PLANT COMMUNITIES

6 DESIGN DIVERSE PLANT COMMUNITIES

Background

The Greenway should provide habitat that will attract a diversity of wildlife and consider the context of the larger Willamette Watershed. This will be accomplished by creating areas of native habitat communities interspersed throughout the greenway. Plant species diversity and structure will be varied to maximize habitat attributes and promote wildlife diversity through enhancement activities that, where appropriate, restore in-water, riparian, and upland habitat.

General Habitat Enhancement and Renaturalization. A variety of clustered native plant species above and below ordinary high water on the riverbank will enhance ecological functions as well as in-water fish habitats. A combination of riverbank, riparian and upland habitat enhancement activities will restore a more diverse structure of habitat along the South Waterfront greenway and help to create a wildlife corridor as well as enhanced riverbank conditions for salmonids.



New vegetation or well-placed large woody debris (such as fallen timber) that overhangs or penetrates the water's edge, offers shaded protected areas desirable for native fish species. New, diverse communities of riverbank vegetation should be well integrated so that they are self sustaining and require little ongoing maintenance. Some of the riverbanks' existing conifers should be retained to provide raptor roosts, increased macro invertebrate diversity, shade, and needle and leaf mulch. Some may also be placed on the bank's slope to provide "full tree" large wood structures connected to the bank with roots intact.



Given its narrow width relative to the adjacent habitat areas, the South Waterfront Greenway's primary benefit will be at the water's edge where shade, woody debris, food, and refuge will be found for small salmon and steelhead starting their journey downstream to the sea, and shade and cool water for those returning to spawn. Shallow water areas will be home to a variety of aquatic species.

In areas where the greenway setback is widest, especially in the northern section of the greenway between the Marquam and Ross Island Bridges, opportunities to create clusters of upland habitat should be pursued. Here a diverse canopy of mixed broadleaf and conifer trees with an understory consisting of varied shrubs and herbs, may provide a source of habitat critical for a diversity of wildlife.



In the ten to twenty years following planting, trees should have developed enough height and canopy to provide potential perch, roost and/or nesting sites for riverbank riparian species. As trees and shrubs develop and produce greater seed and berry sources, they will attract birds that use these foods and also provide habitat for an increasing number and abundance of insects and insect-eating wildlife. Careful selection of native plant species will improve the abundance and diversity of native wildlife. Patches of native trees, shrubs and herbs in the greenway will provide value to a variety of native wildlife species.

Guideline

Select appropriate species of native plants based on the soil, light, moisture conditions, context and adjacent uses of the site.

Create and enhance habitat through renaturalization, encouraging a structurally diverse and ecologically valuable greenway.

Guideline 6 may be accomplished by:

1. Enhancing shallow water habitat to benefit salmonids and other aquatic species by providing shade, woody debris and low riverbank vegetation. Beaches should be preserved and enhanced by regrading the lower riverbank to create shallower slopes where feasible.



This image illustrates the potential shallow water habitat created by providing and maintaining shady areas, shallow slopes, and woody debris along the riverbank.

6 DESIGN DIVERSE PLANT COMMUNITIES

Guideline 6 may be accomplished by:

2. Developing and preserving wave attenuation features such as woody debris where possible. These traps can be constructed of wood or stone and are structured to retain flood-deposited wood and create diverse water velocity conditions to provide habitat for many species.



Large woody debris such as these driftwood tree trunks are critical elements in a healthy salmon habitat. The fish and other species use the shade created by the debris as a refuge from predators and are attracted to the cooler water that also results. The trap shown in the lower image is also a naturalistic way of reducing wave erosion on a riverbank.

Guideline 6 may be accomplished by:

3. Enhancing incised areas on the riverbank to provide protected micro environments and preserve remnant features of historic stream outlets. These cove areas should be cleaned of any hazardous materials, revegetated and used to route cleaned water into the river.



Small cove areas should be protected and enhanced to provide shallow water environments.

Guideline 6 may be accomplished by:

4. Enhancing riparian edges to include tree and shrub plantings, which will provide leaf and twig drop, insect drop, shade, a source of wood, food for wildlife, cover for wildlife movement, small animal habitat, and enhanced connectivity with Ross Island and Oaks Bottom habitats for birds and aquatic species.



This top view of a river bank edge shows multiple plantings of trees and shrubs along the bank to support a diverse habitat environment..

Guideline 6 may be accomplished by:

5. Developing upland tree “groves”, primarily in conjunction with key habitat areas, to create a multi-level canopy structure to encourage bird and mammal use.



A variety of trees should be planted upland to establish an enriched canopy habitat..

Section IV



South Waterfront Greenway Design Guidelines: Greenway Development Plan Option

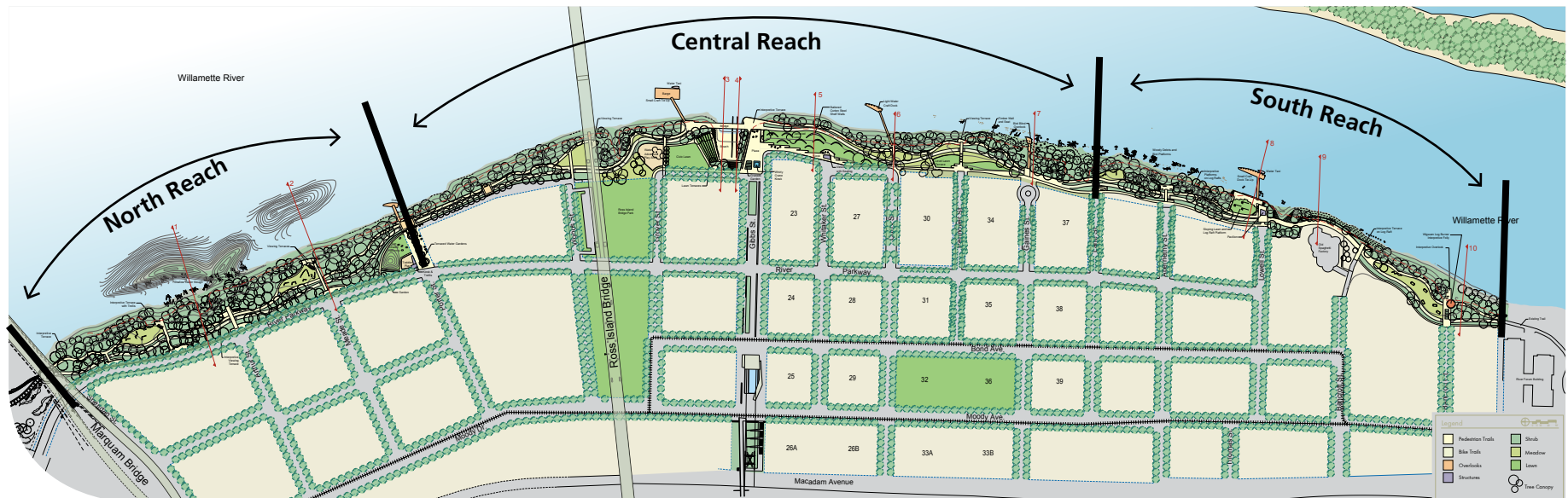
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7 DEFINE AND STRENGTHEN THE REACHES

Background

The South Waterfront Greenway Development Plan (GDP), adopted by the Portland City Council in 2004, was created to provide an integrated and balanced design approach that fuses the goal of creating a new high-density urban community with the desire to create habitat in the Willamette River. The adoption of the GDP was a critical step in the City's commitment to enhance the livability of South Waterfront District and to implement the City's commitment to the River Renaissance vision. The plan promotes a harmonious relationship between people and the river, with the vision to restore fish and wildlife habitat through an exemplary greenway design.

The GDP presents a vision for a large-scale approach to open space design and habitat creation. The scale of the space, over 1.2 miles of Willamette River shoreline, encompasses a range of historic habitats, geomorphological conditions and cultural influences, fronted by urban development with a range of land uses and intensities. *(Refer to the Appendix for Environmental History, Existing Conditions, and Historic Habitat.)*



7-1 DEFINE AND STRENGTHEN THE REACHES



The GDP consists of three primary geographic areas: the North, Central, and South reaches. Each reach is proposed to have its own unique character and each is intended to focus on different functions or aspects of the plan.

North Reach.

Extending from the Marquam Bridge to SW Porter Street, this reach presents some of the greatest opportunities to restore upland, riparian, and in-water habit in South Waterfront, and these activities are proposed to be a major focus of the greenway improvements in this reach. The GDP also proposes bicycle and pedestrian trails through this reach with a few places for people to stop and enjoy the greenway. An overlook and small play/plaza feature were also conceived by the GDP near Porter Street; however, as these features were in an area now within the proposed alignment of the Willamette Crossing light rail bridge, these features could also be pursued south of Porter within the Central Reach.



Central Reach.

This reach extends from SW Porter to SW Lane Street and is envisioned as the reach with the greatest emphasis on human interaction with the greenway and river. A large riverfront plaza was conceived for the end of SW Gibbs Street, a street that is envisioned to draw many people from the tram and Gibbs Street Pedestrian Bridge. This reach was also proposed to include active and passive recreation features, potentially including an urban beach, water play area, dock facility, lawn area, and a continuation of the split bicycle and pedestrian trail system that extends the length of the greenway. This reach is also envisioned to include the enhancement of habitat along the lower bank of the slope throughout the reach with a mix of in-water, riparian and upland habitat enhancement activities from SW Porter to a cove located south of the Ross Island Bridge.



South Reach.

This reach presents similar opportunities to restore various habitat conditions as are present in the North Reach. Extending from SW Lane Street to the River Forum Building at the southern end of the district, this reach is envisioned to include a mix of highly enhanced habitat areas while also providing opportunities for human interaction with the rivers edge though an overlook or perhaps light watercraft boat ramp. As with the other reaches, the bicycle and pedestrian trail network circulates though this reach and is supported with occasional places for people to sit and enjoy the greenway and river

As noted, the reaches are defined to some degree by subtle bends in the Willamette River that create different opportunities for habitat enhancements. The urban edge of the greenway, as defined by the adopted street network and interface with buildings outside of the greenway setback, is also a defining element of the greenway. The GDP provides a unique opportunity to showcase what can be accomplished to accommodate urban growth and, at the same time, develop a re-naturalized riverbank and river edge that provides fish and wildlife habitat. While it is not possible to turn back the clock to predevelopment conditions, it is possible to provide a diversity of habitat types within “niches” that will accommodate a wide variety of plants and animals.

Applicants choosing to use the GDP option will need to develop plans that implement the spirit and vision of the GDP. The guidelines specific to each reach are responsive to multiple needs of the district, which include restoring habitat along the Willamette River, providing both passive and active recreation, and creating an interface with the district’s urban edge. Proposals successfully striking this balance will draw people to the greenway, while allowing the natural aspects and character of the greenway to permeate into the district. It is envisioned that this combination of restored function and access will foster a greater sense of stewardship of the river for those living and visiting South Waterfront.

Guideline

Define and strengthen the identity and character of each reach using the following “Reach Guidelines” (7-1 – 7-3).

7-1 DEFINE AND STRENGTHEN THE NORTH GREENWAY REACH

Background



The North Greenway Reach, extending from the Marquam Bridge to SW Porter Street, presents the greatest opportunity for habitat enhancement in the South Waterfront District. It is here where upland, riparian, and in-water habitat enhancement are proposed to be a primary focus of greenway improvements. The river velocities are low along the bank, making it a good place for in-water

fish habitat development. Existing water depth conditions in the North Greenway Reach afford one of the best opportunities to restore near-shore and riparian habitat. Additionally, areas along the shoreline that have been previously used as storm sewer outfalls can be transformed into shallow coves providing shelter, shallow water, and lush vegetation for use by wildlife and fish.

Because this portion of the greenway is wider than most other portions of the greenway and the location of River Parkway results in most development being located further from the greenway than elsewhere in South Waterfront, there are opportunities to also establish upland habitat areas in this reach. Such enhancement activities would provide potential habitat for a diversity of wildlife and would enhance the ability of the South Waterfront greenway to serve as a wildlife corridor.

7-1 DEFINE AND STRENGTHEN THE NORTH GREENWAY REACH

Although habitat enhancement is a primary focus in this reach, bicycle and pedestrian trails, supported by occasional opportunities to sit and enjoy the greenway, will provide the ability for people to use this portion of the greenway. Greenway development that is designed for people and that utilizes art should take clues from the past history of ship construction and dismantling that characterized the last century of history in this reach.



The North Greenway Reach is paralleled by a public street for a portion of the reach and opportunities to provide on-street public parking and direct visual and physical greenway access should be pursued. The greenway's dual trail system will begin at the existing plaza under the Marquam Bridge and is then envisioned to meander through alternating open meadows and tree groves of upland habitat. As the northern entry point into the greenway, the North Greenway Reach should feature distinctive identifying elements at both the beginning of the dual trail and at the edges of the public street bordering the greenway to enhance the character of the greenway as a whole and to signal a sense of arrival to visitors. Lastly, the GDP also envisions the creation of one or two view corridors located at the terminus of SW Arthur and SW Meade Streets. These viewpoints could present an opportunity to include grassy terraces, overlooks, and opportunities for interpretive signage.



The design of the North Greenway Reach should recognize its proximity to the neighborhood and future OHSU Schnitzer Campus, by incorporating gathering places outside of sensitive habitat areas for people to enjoy and appreciate the greenway. The Porter Street Plaza was originally envisioned by the GDP to be a small park with open lawn, a small play area, and landscaping gardens. The GDP also envisioned an overlook as a place to view the Willamette River, Ross Island Bridge, and enhanced habitat areas along the riverbank.

DEFINE AND STRENGTHEN THE NORTH GREENWAY REACH **7-1**

Since the adoption of the GDP in 2004, the alignment of the proposed Willamette Crossing light rail bridge is now proposed to be located roughly where the Porter Street Plaza was to be located. Should this bridge be developed subsequent proposals implementing the GDP should consider if there are better suited locations for this plaza concept, such as inland of the greenway or south of SW Porter Street within the Central Reach.



Guideline

Define and strengthen the identity and character of the North Greenway Reach.

Guideline 7-1 may be accomplished by:

1. Developing offshore islands and coves which allow a variety of water depths and habitats.



Gravel bars provide important refuge for birds and help to form shallow areas on the river that are important habitats for avian and marine organisms. A combination of currents and riverbank composition has created a series of coves and small beaches along the Willamette, providing further refuge and habitat.

7-2 DEFINE AND STRENGTHEN THE NORTH GREENWAY REACH

Guideline 7-1 may be accomplished by:

2. Using steel and forms that evoke the ships that were built and dismantled in the North Greenway.



A metal shade pavilion (top), loosely resembles the structure of a ship. A curving metal bench (bottom) could offer multiple views and a form that relates to the area's shipbuilding history.

Guideline 7-1 may be accomplished by:

3. Developing distinctive identifying elements where the reach serves as an entry point into the South Waterfront Greenway.



Sculptural markers, similar to these columns, can be used to delineate major street intersections and gathering places. The vertical height and scale of the markers make them easily visible from a distance to facilitate wayfinding.

Guideline 7-1 may be accomplished by:

4. Creating a large activity area centered around Porter Street, as a neighborhood use park with an open lawn, a play area, gardens, a dock, and restrooms.



The terminus at Porter Street should include a large area for both formal and informal gathering. Visual access to the river should be incorporated.

Guideline 7-1 may be accomplished by:

5. Creating a central biofiltration basin that leads to an open plaza and river overlook.



A series of stepped terraces and ponds can be an effective way of designing the biofiltration function into a distinct landscape feature.

7-2 DEFINE AND STRENGTHEN THE CENTRAL GREENWAY REACH



7-2 DEFINE AND STRENGTHEN THE CENTRAL GREENWAY REACH

Background

The Central Greenway Reach will feature the contrast of urban development adjacent to new habitat within sight of the northern arm of Ross Island. Ross Island will likely be renaturalized as a wildlife area, providing quiet and direct connections to nature. In addition, there may be opportunities for small watercraft links to the island. Industrial activity, from postwar scrap metal recovery to the current Zidell Marine barge building operations, should be acknowledged in the Central Greenway Reach through its incorporation and interpretation of steel forms taken from the ships that were both built and dismantled here.

The GDP envisions multiple active spaces at Gibbs Street. Gibbs Street will unite the waterfront with the Portland Aerial Tram's lower terminus and the OHSU Center for Health and Healing. Gibbs Street should terminate into a large plaza, to be used for performances, gatherings, and daily use by residents, nearby workers, and visitors. The GDP includes a vending kiosk and a restroom within the plaza.

A remnant gantry crane will provide a significant visual reminder of the site's shipbuilding history and act as a beacon or landmark. A large, active "urban beach" centered on a reconfiguration of the existing Zidell Marine barge launch at Gibbs will allow people to access the river's edge. A set of terraces north of the 'beach' was envisioned in the GDP to provide seatwalls and lawn terraces for people to gather in the sun and watch nearby activity. A large civic lawn to the north of the urban beach could accommodate diverse activities, from public gatherings such as concerts, outdoor films and political events to informal recreation such as Frisbee and dog walking. An adjacent water adventure play area will bring additional activity and serve as a transition to the area underneath the Ross Island Bridge.

In the GDP, pedestrian and bicycle trails cross the urban beach together on a contemporary bridge which has the potential to become the iconic emblem of the district. South of the beach on a terraced lawn, overlooks resembling the bows of ships could be a reminder of the site's industrial history. Two docks are envisioned in this reach. One dock is intended to echo the Zidell

DEFINE AND STRENGTHEN THE CENTRAL GREENWAY REACH **7-2**

barge-building legacy, with a wide, barge-shaped form envisioned to be a landing for future water taxis and light water craft use.

South of the collection of urban spaces centered on Gibbs Street, Penoyer Street is a pedestrian-priority green street with bioswales. The street should terminate at a small plaza with a vending kiosk bordered by open lawns and views of the river beyond a sloping meadow. A special overlook, designed as a bird blind could offer views of Ross Island. Throughout the Central Greenway Reach, the riverbank should be re-contoured, establishing lowland areas and a variety of plant communities.

Guideline

Define and strengthen the identity and character of the Central Greenway Reach.

This illustration (bottom) shows a vision for the existing barge-launch area at the terminus of Gibbs Street. The launch should be reconfigured as a hardscaped "urban beach", on which people can gather to access the river's edge. A set of terraces north of the 'beach' could provide seating and viewing opportunities. The greenway's pedestrian and bicycle trails cross the urban beach together on a future iconic bridge. A large civic lawn to the north of the urban beach could accommodate large public gatherings or informal recreation.



7-2 DEFINE AND STRENGTHEN THE CENTRAL GREENWAY REACH

Guideline 7-2 may be accomplished by:

1. Taking cues in materials and forms or reusing pieces from the area's barge-building legacy.



The Greenway Master Plan envisions a series of terraced lawns formed by curved steel walls, evoking the hulls of ships historically dismantled in this reach.

Guideline 7-2 may be accomplished by:

2. Centering a collection of active urban spaces at Gibbs Street's terminus, including a large civic lawn, a water play area, and lawn terraces.



The terminus of Gibbs Street offers an opportunity for gathering places like the series of lawn terraces shown in this image (top). The rendering (bottom) illustrates the possibilities for the interface of city street grid and greenway at the terminus of Whitaker Street, just south of Gibbs. Small corner retail uses with moveable seating and tables front onto a universal accessway. Special paving extending across the accessway to the greenway's edge indicates to vehicles that pedestrians have priority in this streetscape.

DEFINE AND STRENGTHEN THE CENTRAL GREENWAY REACH **7-2**

Guideline 7-2 may be accomplished by:

3. Incorporating the Zidell barge launch as an “urban beach”.



The GDP envisioned an “urban beach” at the Zidell barge launch (top). These monumental hardwood steps (bottom) lead from an embankment promenade down to the water’s edge, serving as an urban beach, allowing the public to interact with the water. Large stones placed at water’s edge provide a more durable transition to the water, allowing people to immerse their feet. Large riprap boulders suggest that this is an artificial waterfront edge, with limited renaturalization potential.

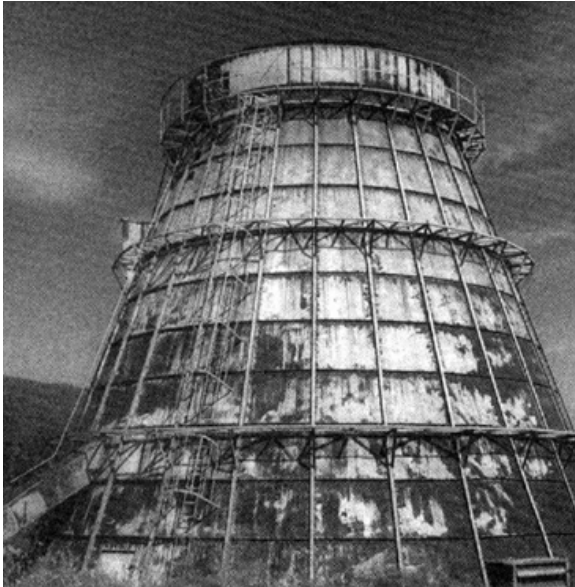
Guideline 7-2 may be accomplished by:

4. Designing a special overlook and pier to offer views of Ross Island.



Large expanses of public overlooks provide visual monitoring of activity on the waterfront, offering a unique position on the water (top). The GDP envisioned a wire mesh bird blind integrated with an overlook to Ross Island (bottom).

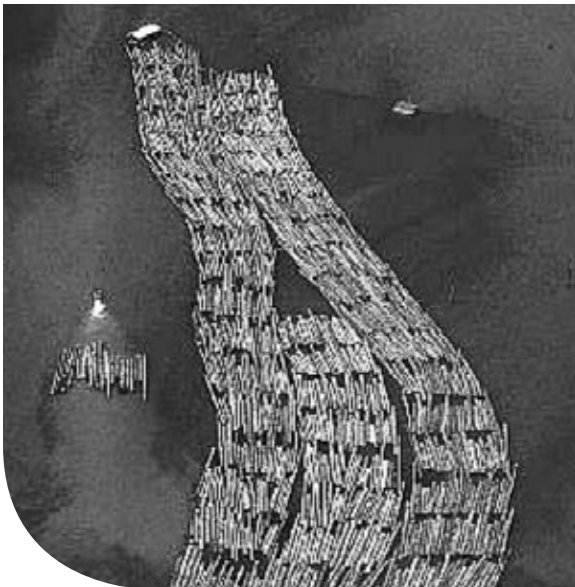
7-3 DEFINE AND STRENGTHEN THE SOUTH GREENWAY REACH



7-3 DEFINE AND STRENGTHEN THE SOUTH GREENWAY REACH

Background

The South Greenway Reach extends from SW Lane Street to the River Forum Building. Cottonwood trees on Ross Island's shore dominate the view from the riverbank. This portion of the greenway is intended to feature less active gathering spaces and cater to users moving through the greenway, as well as an anticipated high intensity of adjacent residential development. This area was once home to large sawmills that for decades processed raw timber which floated down the Willamette bundled together in distinctive rafts. Piles of lumber were stacked in geometric patterns behind the mill structures and waste sawdust was burned in unique conical 'wigwam' burners. Material choices and forms for future design details in this reach should reflect this history. The river's edge at Lowell will provide an opportunity for a variety of habitats including coves, tree groves and shallow water environments. The primary open space of the South Greenway Reach should be located at the terminus of SW Lowell Street. A lawn will offer quiet, passive recreation opportunities and views of Ross Island. This space is envisioned as a neighborhood use area including a play area and restroom. The GDP envisioned a series of historically evocative log raft platforms on this lawn and elsewhere in the South Greenway Reach.



DEFINE AND STRENGTHEN THE SOUTH GREENWAY REACH **7-3**

The existing concrete block wall here should be retained and incorporated as a retaining wall for the overlook plaza and an associated pavilion building. The wall can also serve to support a gangway down to a floating dock. The existing piles in the river should be reused to establish nesting sites, and placed woody debris can enhance aquatic life here. The GDP included a dock here for both small water craft and water taxi use.



The narrow area fronting the Old Spaghetti Factory is planned for redevelopment by removing the existing asphalt slurry and terracing the bank to accommodate a bicycle and pedestrian trail and substantial new plant material. The GDP envisions an open meadow and interpretive 'folly' in the form of a reinterpreted wigwam burner to serve as wayfinding elements marking the southern terminus of the greenway. This will signal to northbound users the approaching change from the narrow single mixed use trail to the dual trail and to the experience that the South Waterfront Greenway offers.



This illustration demonstrates the idea of placing an interpretation of a traditional sawmill's sawdust burner, or 'wigwam', a round steel structure, to create visual interest within the park and serve as a beacon along the trail network. This landscape folly can also be used as a sheltered place for children to play and explore along the waterfront.

Guideline

Define and strengthen the identity and character of the South Greenway Reach.

7-3 DEFINE AND STRENGTHEN THE SOUTH GREENWAY REACH

Guideline 7-3 may be accomplished by:

1. Designing areas to offer quiet, passive recreation and views of Ross Island and the Willamette River.



Opportunities within the South Greenway Reach should be provided that allow quiet gathering and views of Ross Island.

Guideline 7-3 may be accomplished by:

2. Taking cues from the area's timber mill history in forms and material choices.



Inspired by the sawmilling heritage of the Greenway area, the Master Plan proposed unique furnishings and overlooks evoking the historic forms of log rafts. The contemporary benches (below, in NYC) are one example of an acceptable interpretation of these forms.

Guideline 7-3 may be accomplished by:

3. Incorporating existing remnants from the industrial past to enhance habitat.



New York's High Line incorporates train rails into planting beds as a nod to the area's industrial past. Similar features could be embedded in South Waterfront using elements from the area's timber industry to introduce the area's rich context.



Guideline 7-3 may be accomplished by:

4. Creating a neighborhood use area, including a play area and restroom.



This landscape feature creates a place for interaction among all age groups. The use of water as a play feature, attracts many visitors, especially children. A simple blend of stone and lawn materials is a durable option for heavily-used areas. Moveable chairs provide informal and ever-changing seating for adult supervision.

8 CREATE AND ENHANCE HABITAT

8 CREATE AND ENHANCE HABITAT

Background

Diverse Habitat Types. Ecological health of the greenway will depend on establishing and maintaining a diversity of life forms. Biodiversity within a given area relies on both the diversity within a specific habitat type as well as the variety of diverse habitat types across a geographic area. The habitats' ability to adapt and cope with change along the greenway will be strengthened by this biodiversity.

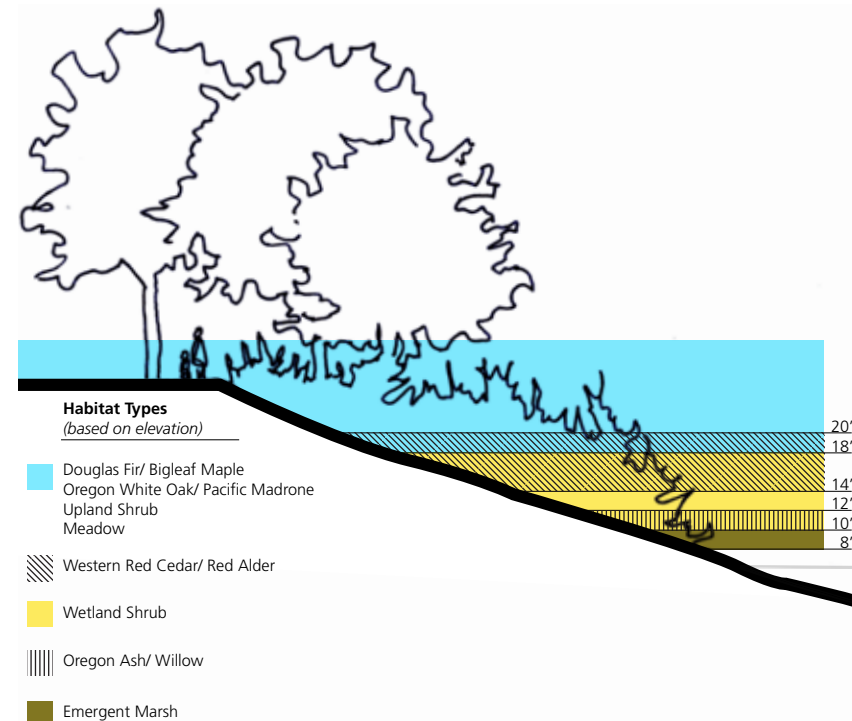
Based on the existing habitat conditions along the greenway and the Willamette River, eight diverse habitat types are proposed for new greenway development. These habitat types are generally located by elevation on the riverbank, according to annual changes in river height and the length of time that the area is inundated. The diagram on the left shows appropriate habitat types for a range of areas based on ordinary low water elevation. Specific Habitat Types are listed and described on pages 88-95. See *Suggested Plant List in Appendix G for plant selections.*

Guideline

Create and enhance habitat using the specific habitat types (pages 90-97) appropriate to each area.

Provide a diversity of plantings within each habitat type.

**Given current regulatory jurisdictions, the City of Portland cannot require redevelopment of the riverbank below the ordinary high water elevation of 18', the area of highest habitat benefit:*



Habitat Type	Elevation
Douglas Fir/ Bigleaf Maple	above 18'
Oregon White Oak/ Pacific Madrone	above 18'
Upland Shrub	above 18'
Meadow	above 18'
Western Red Cedar/ Red Alder	14 - 20'
Wetland Shrub	10 - 18'
Oregon Ash/ Willow	10 - 12'
Emergent Marsh	8 - 10'

Guideline 8 may be accomplished by:

1. Providing a variety of specific habitat types within each location.



Many locations along the greenway allow several different habitat options, depending on their elevation. Maintaining a diversity of habitats will ensure the ecological health of the greenway.

Guideline 8 may be accomplished by:

2. Providing a variety of species within each habitat type.



Creating a great amount of biodiversity within each habitat will strengthen its ability to adapt and thrive.

8 CREATE AND ENHANCE HABITAT



DOUGLAS FIR / BIGLEAF MAPLE

Location:

The Douglas fir / bigleaf maple community is the most extensive natural upland habitat in the Metro region. Along the South Waterfront Greenway, this habitat is proposed in areas where dense vegetation can be established based on upland uses and view corridors.

Elevation of Planting Area: Above 18' (City of Portland (COP) datum)

Habitat Function:

This coniferous / deciduous community provides year-round visual screening, shade, and wildlife habitat. The structural complexity of this habitat is a major factor in its species richness; more structurally complex areas (i.e. several vertical layers of vegetation) will have a greater diversity of wildlife species. The varied structure and plant diversity provides food (e.g. seeds, berries, insects), cover, and nesting opportunities for a variety of resident and migratory species throughout the year. Snags and large woody debris are important components of this habitat and provide potential nesting opportunities for cavity nesters (e.g. swallows) and refugia for small wildlife species such as chipmunks and squirrels. As the Douglas fir matures (~50 years) it will provide potential roosting and nesting habitat for osprey and bald eagle. A few examples of wildlife associated with the Douglas fir / bigleaf maple community include osprey, bald eagle, belted kingfisher, chickadees, bushtits, kinglets, spotted towhee, wrens, thrushes, song sparrow, hummingbirds, nuthatches, swallows, warblers, and raccoon.

Typical Plantings:

Common species proposed for these areas include Douglas fir, bigleaf maple, vine maple, Indian plum, Oregon grape, red flowering currant, snowberry, elderberry, sword fern, inside-out flower, Pacific waterleaf, fringecup, and trillium.

Canopy Structure:

The multi-layered canopy of trees, high shrubs, low shrubs, and ground cover provides structure and refuge for small wildlife species and nesting for diverse avian species.

OREGON WHITE OAK / PACIFIC MADRONE

Location:

Oregon white oak / Pacific madrone groves are scattered along the drier rocky bluffs and terraces above the Willamette River. In the South Waterfront Greenway this habitat is proposed to be planted in well-drained uplands.

Elevation of Planting Area: Above 18' (City of Portland (COP) datum)

Habitat Function:

The oak / madrone community provides year-round visual screening, shade, and wildlife habitat. As the oaks mature they will provide food and shelter for a variety of wildlife. Kinglets, bushtits, wrens, thrushes, and warblers will eat insects from the leaves, twigs, and branches. The long lived oak provides dead branches and cavities as it ages which provide safe places for wildlife such as squirrels, swallows, wrens, to nest and raise young. Acorns are important food sources for many species in the urban environment including jays, wood duck, deer, raccoon, and squirrels. A few examples of other wildlife associated with urban oak groves include nuthatches, brown creepers, flickers, and screech owls.

Typical Plantings:

Common species proposed for these areas include: Pacific madrone, Oregon white oak, western serviceberry, oceanspray, tall Oregon grape, common and trailing snowberry, and giant fawnlily.

Canopy Structure:

The proposed open canopy with 30% tree cover will allow sufficient light through to the understory.



8 CREATE AND ENHANCE HABITAT



UPLAND SHRUB

Location:

Upland shrub communities occur primarily as a successional stage between grassland and forest habitats. The upland shrub community will be planted on the upper riverbank.

Elevation of Planting Area: Above 18' (City of Portland (COP) datum)

Habitat Function:

Upland shrub areas provide a diverse layering of shrubs which provides cover, refugia, and nesting opportunities for wildlife. The wide variety of shrubs also provides food resources including seeds, berries, and insects. A few examples of wildlife associated with upland shrub habitat include song sparrow, cedar waxwing, and American robin.

Typical Plantings:

Common species proposed to be planted in these areas include: oceanspray, serviceberry, mock orange, red-flowering currant, elderberry, salal, Oregon grape, and snowberry.

Canopy Structure:

Minimal tree canopy is proposed in this habitat. Shrubs will be densely planted.



MEADOW

Location:

Meadow habitat is proposed for select pockets along the Greenway trail.

Elevation of Planting Area: Above 18' (City of Portland (COP) datum)

Habitat Function:

Meadow habitat provides food, cover, and nesting opportunities for a variety of wildlife. A few examples of wildlife that typically inhabit this community include voles, deer mice, snakes, sparrows, and butterflies. Other species such as robin and flicker nest in adjacent tree/shrub communities and forage in the meadow; raptors such as red-tailed hawk could hunt rodents in these meadows too.

Typical Plantings:

Common species proposed to be planted in the meadow community include native grasses such as California brome and blue wild rye, and wildflowers such as yarrow, onion, showy mildewed, aster, iris, and brodiaea. Meadow areas are to be planted with mixtures of grasses that are tolerant of more intensive human use and that thrive in low-maintenance conditions. Meadow grasses should be maintained at heights of 4"-12" and should be predominantly comprised of species requiring minimal supplemental water.

Canopy Structure:

None



8 CREATE AND ENHANCE HABITAT

WETLAND SHRUB

Location:

Wetland shrub habitat occurs in alluvial and riparian bottomlands along the Willamette River. On the greenway it is proposed to be planted on lower riverbanks and coves above the emergent marsh community.

Elevation of Planting Area: 10'-18' (City of Portland (COP) datum)

Habitat Function:

Interactions of tidal level, seasonal hydrology fluctuations, and fluvial processes result in a dynamic setting for this community. The plant species proposed for these areas tolerate frequent inundation and high shear stresses during flood stage. The plantings can also break up the hydraulic forces of wave action which can erode riverbanks.

Greater habitat diversity will benefit fish and wildlife:

- increased over-hanging vegetation at the water margin provides shading and cover for fish
- shrubs support many insects that in turn support abundant bird, fish and mammal populations.

Wetland shrub habitat will provide much needed forage, cover, and nesting habitat for a variety of species including beaver, waterfowl, belted kingfisher, golden-crowned kinglet, American goldfinch, song sparrow, warblers, and flycatchers.

Typical Plantings:

The plant community supported here is dependent on hydrology and substrate composition. The low wet areas of the riverbank and cove areas should be planted with shrub willows that are tolerant of wetter conditions such as Columbia River willow, Piper's willow, and Sitka willow. Higher wetland areas of the riverbank should be planted with other shrubs such as Pacific ninebark, red-osier dogwood, black hawthorn, and high bush cranberry.



Canopy Structure:

No tree canopy is proposed in this habitat but there should be a continuous dense shrub layer.

WESTERN RED CEDAR / RED ALDER**Location:**

Western red cedar / red alder communities occur along Willamette River tributaries and in seeps on hillslopes adjacent to the river. In the greenway this community is proposed to be planted in conjunction with cove areas.

Elevation of Planting Area: 14'-20' City of Portland (COP) datum)

Habitat Function:

The cedar/alder riparian community contributes to the quality of habitat by shading the stream and providing food, cover, and nesting opportunities. The groves do not need to be extensive in order to add to an area's habitat value.

The structural complexity of these habitats (i.e. several vertical layers of vegetation) adds to the diversity of wildlife species using the Greenway.

Typical wildlife species utilizing riparian habitat include swallows, song sparrow, thrushes, spotted towhee, squirrels, raccoons, deer mice, and chorus frog..

Typical Plantings:

Primary plantings in this community include western red cedar, red alder, vine maple, Oregon grape, sword fern, and Pacific waterleaf.

Canopy Structure:

The extent and density of the groves canopy and understory should be determined in balance with their value to the habitat and their location relative to upland uses. This habitat type would feature less canopy coverage than the Douglas fir / Bigleaf maple habitat type.



8 CREATE AND ENHANCE HABITAT

OREGON ASH / WILLOW

Location:

The Oregon ash / willow community occupies a distinct wetland niche on fine-textured soils where shallow winter and spring inundation (and perhaps summer moist soils) is provided by a high groundwater table or accumulation of surface water from precipitation due to topography and soil parameters. Along the South Waterfront Greenway, this habitat type is proposed in limited locations on the lower riverbank where shallow slopes exist or can be developed.

Elevation of Planting Area: 10'-12' (City of Portland (COP) datum)

Habitat Function:

Interactions of tidal level, seasonal hydrology fluctuations, and fluvial processes result in a dynamic setting for this community. The plant species proposed for these areas tolerate frequent inundation and high shear stresses during flood stage. The plantings can also break up the hydraulic forces of wave action which can erode riverbanks.

Oregon ash / willow habitat provides important shade, food, cover, and nesting opportunities. The canopy will provide increased over-hanging vegetation at the water margin that will improve shading and cover for fish and other aquatic species. Vegetation supports many insects that in turn support abundant bird, fish and mammal populations. This community will potentially support a variety of species including waterfowl, northern red-legged frog, Pacific treefrog, Townsend's big-eared bat, beaver, osprey, great blue heron, belted kingfisher, warblers, ruby-crowned kinglet, and common bushtit.

Typical Plantings:

Primary plant species proposed for this habitat include Oregon ash, willow, alder, Douglas spirea, Pacific ninebark, black hawthorn, red-osier dogwood, and slough sedge.



Canopy Structure:

The extent and density of the canopy and understory will be determined in balance with their value to the habitat and their location relative to upland uses. Typically, this habitat type will provide a roughly 50% canopy coverage.

EMERGENT MARSH

Location:

Emergent marshes or wetlands occur in seasonally flooded bottomlands in the Willamette River floodplain and in isolated wetland depressions. This habitat is proposed primarily in the northern portion of the greenway in existing shallow water areas and in cove areas developed at current stormwater outfalls.

Elevation of Planting Area: 8' to 10' (City of Portland (COP) datum)

Habitat Function:

Interactions of tidal level, seasonal and regulated hydrology, and fluvial processes result in a dynamic setting for numerous herbaceous plant species. The plant communities proposed for these areas tolerate frequent inundation and high shear stresses during flood stage. The plantings can also break up the hydraulic forces of wave action which can erode riverbanks.

Greater habitat diversity will offer increased opportunities for all fish including small Chinook salmon that tend to be associated with the shore. Habitat improvements beneficial to these fish include:

- increased in-water structural diversity (hiding and velocity refuge) through the use of vegetation
- more diverse and abundant food supply provided by vegetation and insects
- increased over-hanging vegetation at the water margin which provides visual complexity and terrestrial insects for food

Many insects are supported here that in turn support abundant bird, fish and mammal populations. This plant group will provide much needed forage, cover and nesting habitat for many species, including waterfowl, shorebirds, dragonflies and mayflies, reptiles (if other conditions permit), as well as the shading and cover for near-shore aquatic and fish species.



Typical Plantings:

Typically dominant herbaceous plant species include water-adapted plants such as rushes, Columbia sedge, bulrush, spikerush, wapato, knotgrass, bur-reed, and pondweed. Within cove areas and low wet areas of the riverbank, the shrub willows of the shallow water wetland community, notably Columbia River, Piper's and Sitka willows, should be used. Soil is typically saturated through June, so standing water is acceptable.

Canopy Structure:

No canopy is present at this elevation, and a dense understory shrub arrangement provides better wildlife habitat benefits than more sparse plant groupings.

NOTE: There are no 20-year coverage targets for this habitat type because it is always in flux; always intended to be emergent.

Appendices



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APPENDIX A: ORDINANCE NO. XXXXXX

APPENDIX A: ORDINANCE NO. XXXXXX

APPENDIX B: GREENWAY DEVELOPMENT PLAN

An illustration of the **Greenway Development Plan (GDP)** is provided on the following pages. Accepted by Portland City Council in 2004, the GDP was designed with the following set of goals outlined in 2003:

- Enhance livability of South Waterfront
- Provide a harmonious relationship between people and the natural functions of the river
- Restore the river's fish and wildlife habitat through an exemplary greenway design .

These goals were a reflection of the greater vision outlined in the River Renaissance, a citywide initiative to reclaim the Willamette River as Portland's centerpiece. The initiative promotes and celebrates the Willamette River as Portland's chief environmental, economic and urban asset.

The GDP aims to provide visual and physical continuity throughout the 1.2 mile corridor. The overall form is that of a linear park and trail corridor with a series of plazas, overlooks and activity nodes. The GDP offers solutions that provide active, safe, and accessible places for people to connect with the river.

When complete, the greenway will serve as a critical piece of the South Waterfront District's open space system, providing a key link in the regional trail system, reintegrating habitat for fish and wildlife into an urban setting, and aiding in the re-naturalization of the Willamette River. The greenway will also function as a green seam connecting the river and the neighborhood.



APPENDIX B: GREENWAY DEVELOPMENT PLAN



Walker Macy - Thomas Balsley Associates

Fishman Environmental Services, LLC
KPFF Consulting Engineers, Inc.
WaterCycle, Inc.

Geotechnical Resources, Inc.
PAE Consulting Engineers
Parsons Brinckerhoff, Inc.

APPENDIX B: GREENWAY DEVELOPMENT PLAN



Illustrative
Site Plan

August 16, 2004



SOUTH WATERFRONT GREENWAY

APPENDIX C: HABITAT AND VEGETATION PLAN



Walker Macy - Thomas Balsley Associates

Fishman Environmental Services, LLC
 KPFF Consulting Engineers, Inc.
 WaterCycle, Inc.

Geotechnical Resources, Inc.
 PAE Consulting Engineers
 Parsons Brinckerhoff, Inc.

APPENDIX C: HABITAT AND VEGETATION PLAN



APPENDIX D: PROPOSED PLANTING STRATEGY AND COVERAGE TARGETS



In order for the greenway's habitat to be self-sustaining, natural forces must be allowed to slowly adjust to the initial design in a manner that can be characterized as "dynamically stable." Such a landscape typically evolves in response to a range of natural forces, but shows relatively

modest changes in structure over time. An extreme event such as a flood may create a significant disturbance but over time the plant structure returns to a pre-disturbance condition. Human pressures such as vegetation conversion, chemical inputs, and grade alterations are also typically extreme events outside the range of natural conditions under which dynamically stable landscapes have evolved. The challenge for long-term greenway health is to understand the background rate of change and to protect the landscape from catastrophic events from which it cannot recover.

The following includes some of the forces influencing the greenway in the future:

- Property owners will develop individual parcels in response to market forces. It is likely that full development of the District could take 10-30 years. During development, there will be continuing change in the area and a continuing increase in the number of people who work and/or reside in the South Waterfront area and who correspondingly use the greenway.
- Microclimate changes will occur as tall buildings are constructed (wind pattern changes, shadow creation, urban heat island increases). Changes to sunlight penetration, shade patterns, and ground temperature will also occur as vegetation matures and tree canopies develop.

- Groundwater flows will be modified as each new building is constructed. In some situations, groundwater routing may change as foundations interrupt water movement. In other locations, groundwater pumping may be employed, leading to reduced groundwater flows, but increased surface/pipe flow.
- Soil changes will occur slowly over decades as topsoil is developed, fine-grained soils are deposited by high river events, and microbial changes occur under the influence of various vegetation types, and a maturing organic "duff" layer accumulates, a critical component of soils in healthy habitats.
- Periodic flooding of areas below the top of bank will cause erosion in some areas, soil deposition in others, change nutrient availability, and change vegetation patterns by depositing seed, and removing/uprooting/breaking existing vegetation. The result, over time, will be the evolution of a mosaic of plant communities of variable composition, age and structure.
- Animal communities supported by the greenway will change in response to changes in hydrology, soil characteristics, plant communities, plant age, sensitivity to urban populations, dog and cat pressures, and other factors.
- The shallow water zone adjacent to the northern portion of the District is an area where water velocities are typically low and accretion of silty sand soils can be expected during most years. However, when a large flood event occurs, some erosion of these soils can be expected.

APPENDIX D: PROPOSED PLANTING STRATEGY AND COVERAGE TARGETS

PLANTING STRATEGY

The following is a suggested strategy for installing and maintaining Greenway vegetation.

Year 1: Initial Planting

- Prepare soils appropriately
- Establish irrigation
- Install trees to get canopy established
- Install sun-tolerant shrubs and groundcovers
- Plant or seed ground to minimize erosion and weed composition
- Maintain planting by watering and invasive plant removal

Years 2 - 5: Landscape Establishment

- Monitor plant health and growth
- Ongoing irrigation
- Remove invasive and unwanted plant material
- Replace dead/dying plants
- Reseed base ground areas for erosion control and weed management
- Mow meadows and lawns

Years 5 - 10: Secondary Planting

- Monitor plant health and growth
- Selectively thin dense plants
- Remove invasive and unwanted species
- Add shade-tolerant shrubs and groundcovers
- Replace dead/dying plants
- Reduce irrigation where feasible

Years 10 and Beyond: Landscape Management

- Monitor plant health and growth
- Ongoing mowing in meadows and lawns
- Reduced irrigation as necessary for plant survival
- Replace dead/dying plants
- Selectively prune for views and safety

PLANTING TYPES AND COVERAGE - 20 YEAR TARGETS

The following suggests coverage targets for canopies and understory:

Douglas Fir/Bigleaf Maple

Tree Coverage: 60%
Shrub Coverage: 40%
Herbaceous Coverage: 60%

Oregon Ash/ Willow

Tree Coverage: 50%
Shrub Coverage: 40%
Herbaceous Coverage: 60%

Oregon White Oak/ Pacific Madrone

Tree Coverage: 30%
Shrub Coverage: 10%
Herbaceous Coverage: 90%

Upland Shrub

Tree Coverage: 20%
Shrub Coverage: 80%
Herbaceous Coverage: 20%

Meadow

Tree Coverage: 10%
Shrub Coverage: 5%
Herbaceous Coverage: 95%

Wetland Shrub

Tree Coverage: 10%
Shrub Coverage: 80%
Herbaceous Coverage: 20%

Western Red Cedar/ Red Alder

Tree Coverage: 60%
Shrub Coverage: 40%
Herbaceous Coverage: 60%



APPENDIX E: HABITAT MANAGEMENT



Long-term management of habitat areas, as well as human spaces, is very important to the success of the South Waterfront Greenway as an ecological restoration effort. Because the greenway's vegetation will play a vital role in the renaturalization of the habitat, a detailed

strategy must be in place for ongoing maintenance and protection to diminish negative impacts on densely planted habitat areas.

Vegetation will need to be managed to ensure human safety, to benefit desired habitats, to remove invasive species, and to maintain desired views. In response to changing citizen desires, public safety requirements, property owner interests, and availability of maintenance/management funds, vegetation management will likely differ as time progresses.

Community places must also be managed well, so the greenway will be a pleasant and safe place for people, while corridors continue to provide open views of the river. Defined locations for open, filtered, and closed views were created to provide clarity for prospective buyers, for those interested in habitat development, and importantly, for those charged with maintaining the greenway. Maintenance of such views will be an important consideration that must be balanced with habitat growth in the years to come.

APPENDIX F: USE OF NON-NATIVE SPECIES

Given the potential intensity of public activity in the Greenway, there is a significant need to utilize plant material that can withstand human use and urban conditions and that do not require significant maintenance. The use of climate-adaptive plants is encouraged, if they meet height and growth patterns desired along the Greenway trail and adjacent to overlooks. These plants provide some habitat value while also providing aesthetic and easily-maintained attributes needed in these interface areas.



APPENDIX G: SUGGESTED PLANT LIST

Plants used on the upper banks of the greenway and especially in areas of public use should be selected based on their growth habit, maintenance needs, their visual cohesion with the native palette and their contribution to their habitat categories. "Friends of Natives" plants are proposed to be utilized adjacent to paths, overlooks and other urban interface areas where surveillance is important. Most are non-invasive and drought-tolerant once they become established and they can aesthetically blend in with the adjacent native plant assemblage. In addition, many of these plants naturally grow to lower heights which will allow visual connections to areas along the greenway.

Scientific Name	Common Name	(Comments)
Erosion Control		
<i>Note: This general category applies to work in all habitat types, whenever there is earthwork or soil disturbance. It is often an initial treatment of disturbed ground, after which the habitat plantings are typically installed.</i>		
<i>Bromus carinatus</i>	California Brome	
<i>Elymus glaucus</i>	Blue Wild Rye	
<i>Festuca rubra 'commutata'</i>	Chewings Red Fescue	
<i>Gilia capitata</i>	Common Gilia	
<i>Hordeum brachyantherum</i>	Meadow Barley	
<i>Lotus purshiana</i>	Spanish Clover	

Lawn		
<i>Note: Lawn should not be considered a habitat type. It is specified for active use areas along the greenway where habitat renaturalization is not intended or needed. Eight pounds per 1000 sf of the following mix:</i>		
<i>Festuca rubra commutata</i>	Chewings Fescue	
<i>Festuca diruscula</i>	Hard Fescue	

Doug Fir/Bigleaf Maple		
Trees:		
<i>Abies grandis</i>	Grand Fir	infrequent
<i>Acer circinatum</i>	Vine Maple	
<i>Acer macrophyllum</i>	Bigleaf Maple	
<i>Alnus rubra</i>	Red Alder	Does not tolerate compacted soils
<i>Pseudotsuga menziesii</i>	Douglas Fir	

APPENDIX G: SUGGESTED PLANT LIST

Scientific Name	Common Name	(Comments)
<i>Rhamnus purshiana</i>	Cascara	
<i>Tsuga heterophylla</i>	Western Hemlock	Does not tolerate compacted soils
Shrubs:		
<i>Amelanchier alnifolia</i>	Western Serviceberry	Some sun
<i>Gaultheria shallon</i>	Salal	After shade only
<i>Holodiscus discolor</i>	Oceanspray	
<i>Mahonia aquifolium</i>	Tall Oregon Grape	
<i>Mahonia nervosa</i>	Low Oregon Grape	After shade only
<i>Salix scouleriana</i>	Scouler Willow	
<i>Pachistima myrsinites</i>	Oregon Boxwood	This species is not native
<i>Philadelphus lewisii</i>	Mock Orange	Full sun
<i>Oemlaria cerasiformis</i>	Indian Plum	After shade only, Soil compaction an issue
<i>Ribes sanguineum</i>	Red-flowering Currant	
<i>Rosa gymnocarpa</i>	Baldhip Rose	After shade only
<i>Rubus parviflorus</i>	Thimbleberry	
<i>Rubus ursinus</i>	Trailing Blackberry	
<i>Sambucus mexicana (Caerulea)</i>	Blue Elderberry	Full sun
<i>Sambucus racemosa</i>	Red Elderberry	
<i>Symphoricarpos albus</i>	Common Snowberry	
<i>Symphoricarpos mollis</i>	Trailing Snowberry	
<i>Vaccinium ovatum</i>	Evergreen Huckleberry	Organic matter, no compaction

Herb Layer:

During the initial planting phase, the Erosion Control seed mix should be used. After tree canopy is established, the following plants can be added. This group of plants will require soil that has been amended with organic material.

<i>Achlys triphylla</i>	Vanilla Leaf	
<i>Adiantum pedatum</i>	Maidenhair Fern	
<i>Aquilegia formosa</i>	Red Columbine	
<i>Aruncus sylvestris</i>	Goatsbeard	

APPENDIX G: SUGGESTED PLANT LIST

Scientific Name	Common Name	(Comments)
<i>Asarum caudatum</i>	Wild Ginger	
<i>Blechnum spicant</i>	Deer Fern	
<i>Delphinium menziesii</i>	Menzies' Larkspur	
<i>Dicentra formosa</i>	Bleeding Heart	
<i>Disporum hookeri</i>	Fairy Bells	
<i>Fragaria vesca</i>	Wood Strawberry	
<i>Hydrophyllum tenuipes</i>	Pacific Waterleaf	
<i>Oxalis oregana</i>	Sorrel	
<i>Polystichum munitum</i>	Sword Fern	After shade only
<i>Sedum oregana</i>	Oregon Stonecrop	Open rocky areas
<i>Sedum spathulifolium</i>	Broadleaf Stonecrop	Open rocky areas
<i>Smilacina racemosa.</i>	False Solomon's Seal	
<i>Tellima grandiflora</i>	Fringecup	
<i>Thalictrum occidentale</i>	Meadow Rue	
<i>Tolmiea menziesii</i>	Youth-on-Age	
<i>Trillium ovatum</i>	Western Trillium	
<i>Vancouveria hexandra</i>	Inside-out-flower	
<i>Viola glabella</i>	Yellow Wood Violet	
<i>Viola sempervirens</i>	Trailing Yellow Violet	

Oregon White Oak/ Pacific Madrone

Trees:

<i>Acer macrophyllum</i>	Bigleaf Maple	
<i>Arbutus menziesii</i>	Pacific Madrone	
<i>Pinus ponderosa</i> 'Valley'	Valley Ponderosa Pine	Willamette Valley origin only, few
<i>Quercus garryana</i>	Oregon White Oak	

Shrubs:

APPENDIX G: SUGGESTED PLANT LIST

Scientific Name	Common Name	(Comments)
<i>Amelachier alnifolia</i>	Western Serviceberry	
<i>Ceanothus sanguineus</i>	Oregon Tea-tree	
<i>Ceanothus velutinus</i>	Snowbrush	
<i>Holodiscus discolor</i>	Ocean Spray	
<i>Mahonia aquifolium</i>	Tall Oregon Grape	
<i>Sambucus mexicana</i>	Blue Elderberry (Full sun)	
<i>Spiraea betulifolia</i>	Shiny-leaf Meadowsweet	
<i>Symphoricarpos albus</i>	Common Snowberry	
<i>Symphoricarpos mollis</i>	Trailing Snowberry	
<i>Viburnum ellipticum</i>	Western Blackhaw	
Ground Cover/Perennials:		
<i>Erythronium oregonum</i>	Giant fawnlily	
<i>Penstemon ovatus</i>	Penstemon	
<i>Penstemon richardsonii</i>	Penstemon	
Herb Layer: refer to Meadow list		

Upland Shrub

Note: Non-native plants will not be allowed east of the pedestrian path.

Willamette Valley Natives:

Trees:		
<i>Acer circinatum</i>	Vine Maple	
<i>Acer macrophyllum</i>	Bigleaf Maple	
<i>Arbutus menziesii</i>	Pacific Madrone	
<i>Pinus contorta</i> Shore Pine		
<i>Pinus ponderosa</i> 'Valley'	Valley Ponderosa Pine	Willamette Valley origin only, few
<i>Quercus garryana</i>	Oregon White Oak	
<i>Rhamnus purshiana</i>	Cascara	

Medium to Tall Shrubs (over 3', few)

APPENDIX G: SUGGESTED PLANT LIST

Scientific Name	Common Name	(Comments)
<i>Amelanchier alnifolia</i>	Western Serviceberry	
<i>Holodiscus discolor</i>	Ocean Spray	Needs full Sun
<i>Mahonia aquifolium</i>	Oregon Grape	
<i>Philadelphus lewisii</i>	Mock Orange	
<i>Ribes sanguineum</i>	Red-flowering Currant	
<i>Rosa gymnocarpa</i>	Baldhip Rose	After shade only
<i>Rosa pisocarpa</i>	Rose	
<i>Rubus parviflorus</i>	Thimbleberry	
<i>Sambucus caerulea</i>	Blue Elderberry	
<i>Sambucus mexicana</i>	Blue Elderberry	Full sun
<i>Viburnum ellipticum</i>	Western Viburnum	
Low Shrubs:		
<i>Gaultheria shallon</i>	Salal	Shade only
<i>Mahonia nervosa</i>	Low Oregon Grape	Shade only
<i>Pachistima myrsinites</i>	Oregon Boxwood	Not native
<i>Rubus ursinus</i>	Trailing Blackberry	
<i>Symphoricarpos albus</i>	Common Snowberry	
<i>Symphoricarpos mollis</i>	Trailing Snowberry	
Natives from the larger region:		
Trees:		
<i>Abies procera</i>	Noble Fir	
<i>Acer glabrum</i>	Douglas Maple	
<i>Aesculus californica</i>	California Buckeye.	
<i>Calocedrus decurrens</i>	California Incense Cedar	
<i>Castaopsis chrysophylla</i>	Chinquapin	
<i>Chamaecyparis nootkatensis</i>	Alaska Yellow Cedar	
<i>Chrysolepis chrysophylla</i>	Golden Chinquapin	

APPENDIX G: SUGGESTED PLANT LIST

Scientific Name	Common Name	(Comments)
<i>Garrya buxifolia</i>	Silktassel	
<i>Garrya x issaquahensis</i>		
<i>Juniperus occidentalis</i>	Western Juniper	
<i>Juniperus scopulorum</i>	Rocky Mountain Juniper	
<i>Lithocarpus densiflorus</i>	Tan Oak	
<i>Picea breweriana</i>	Brewers Weeping Spruce	
<i>Pinus monticola</i>	Western White Pine	
<i>Prunus virginiana</i>	Choke Cherry	
<i>Quercus kelloggii</i>		
<i>Quercus crysophylla</i>		
<i>Quercus douglasii</i>		
<i>Quercus wislizenii</i>		
<i>Sequoia sempervirens</i>	Coast Redwood	
<i>Sequoiadendron giganteum</i>	Giant Redwood	
Medium to Tall Shrubs (few) Over 3'		
<i>Arctostaphylos columbiana</i>	Hairy Manzanita	
<i>Arctostaphylos densiflora</i>	Vine Hill Manzanita	
<i>Arctostaphylos manzanita</i>	Common Manzanita	
<i>Ceanothus integerrimus</i>	Deer Brush	
<i>Ceanothus thyrsiflorus</i>	California Blueblossom	
<i>Cercis occidentalis</i>	Western Redbud	
<i>Juniperus communis</i>	Common Juniper	
<i>Myrica californica</i>	Pacific Waxmyrtle	
<i>Quercus sadleriana</i>	Deer Oak	
<i>Quercus vaccinifolia</i>	Huckleberry Oak	
<i>Rhododendron occidentale</i>	Western Azalea	May use selections and cultivars
<i>Rhus glabra</i>	Western Sumac	

APPENDIX G: SUGGESTED PLANT LIST

Scientific Name	Common Name	(Comments)
<i>Ribes aureum</i>	Golden Currant	
<i>Ribes divaricatum</i>	Wild Gooseberry	
<i>Shepherdia canadensis</i>	Buffaloberry	
Low Shrubs:		
<i>Arctostaphylos hookeri</i>	Monterey Manzanita	
<i>Baccharis pilularis</i>	Coyote Brush	
<i>Chrysolepsis sempervirens</i>	Bush Chinquapin	
<i>Leucothoe davisiae</i>	Western Leucothoe	
<i>Mahonia repens</i>	Creeping Oregon Grape	
<i>Ribes cereum</i>	Wax Currant	
<i>Ribes lacustre</i>	Black Gooseberry	
<i>Rosa woodsii</i>	Pearhip Rose	
<i>Spiraea densiflora</i>	Subalpine spiraea	
Groundcover/Perennials/Herb:		
<i>Arctostaphylos edmundsii</i>	Little Sur Manzanita	
<i>Arctostaphylos uva-ursi</i>	Kinnikinnick	
<i>Iris innominata</i>	Golden Grass Iris	
<i>Lilium occidentale</i>	Western Lily	
<i>Penstemon acuminatus</i>	Penstemon	
<i>Penstemon barretiae</i>	Barrett's Penstemon	
<i>Penstemon cardwellii</i>	Penstemon	
<i>Penstemon davidsonii</i>		
<i>Penstemon fruticosus</i>	Penstemon	
<i>Penstemon laetus</i>	Penstemon	
<i>Penstemon lyallii</i>	Penstemon	
<i>Penstemon richardsonii</i>	Penstemon	
<i>Penstemon rupicola</i>		

APPENDIX G: SUGGESTED PLANT LIST

Scientific Name	Common Name	(Comments)
<i>Penstemon speciosus</i>	Penstemon	
<i>Penstemon syaneus</i>	Penstemon	
<i>Penstemon venustus</i>	Penstemon	
<i>Polystichum munitum</i>	Sword Fern	Shade only
<i>Sisyrinchium bellum</i>	Blue-Eyed Grass	
<i>Sisyrinchium angustifolium</i>	Narrowleaf Blue-Eyed Grass	
<i>Zauschneria</i> spp.	California Fuchsia	
Non-Natives:		
Trees:		
<i>Abies pinsapo</i>	Spanish Fir	
<i>Acer saccharum</i>	Sugar Maple	Cultivars are acceptable
<i>Cedrus deodara</i>	Deodar Cedar	
<i>Cedrus libani</i>	Cedar of Lebanon	
<i>Cornus 'Eddies White Wonder'</i>	Eddie's White Wonder Dogwood	
<i>Cotinus coggygria</i>	Common Smoketree	Allow purple variety
<i>Cotinus x 'Grace' (coggygria x obovatus)</i>	'Grace' Smoketree	
<i>Crataegus lavalleyi</i>	Lavalle Hawthorn	
<i>Crataegus phaenopyrum</i>	Washington Hawthorn	
<i>Eleagnus</i> spp.		Could allow uninvasive, draught tolerant species and hybrids. Species 'angustifolia' is not acceptable.
<i>Fagus sylvatica</i>	European Beech	Cultivars are acceptable
<i>Hovenia dulcis</i>	Japanese raisin tree	
<i>Koelreuteria paniculata</i>	Goldenrain Tree	
<i>Laurus nobilis</i>	Greek Bay	
<i>Metasequoia glyptostroboides</i>	Dawn Redwood	
<i>Magnolia grandiflora</i>	Southern Magnolia	No cultivars
<i>Nyssa sylvatica</i>	Black Tupelo	

APPENDIX G: SUGGESTED PLANT LIST

Scientific Name	Common Name	(Comments)
<i>Parottia persica</i>	Persian Parottia, Ironwood	
<i>Picea omorika</i>	Serbian Spruce	
<i>Pinus koraiensis</i>	Korean Pine	
<i>Pinus pinaster</i>	Maritime Pine	
<i>Pisticia chinensis</i>	Chinese Pistache	
<i>Quercus muhlenbergii</i>	Chinquapin or Chestnut Oak	
<i>Styrax japonicus</i>	Japanese Snowbell	
<i>Tetradium daniellii</i> (<i>Evodia daniellii</i>)	Beebee Tree, Korean Evodia	
<i>Taxodium distichum</i>	Bald Cypress	
<i>Zelkova serrata</i>	Japanese Zelkova	Cultivars are acceptable
Shrubs:		
<i>Amelanchier laevis</i>	Allegheny Serviceberry	
<i>Arbutus unedo</i> 'Compacta'	Compact Strawberrytree Madrone	
<i>Arctostaphylos</i> 'Austin Hill'	Manzanita	
<i>Arctostaphylos bakeri</i> 'Louis Edmunds'		
<i>Arctostaphylos densiflora</i> 'Harmony'	Harmony Manzanita	
<i>Arctostaphylos</i> 'Sunset'	Manzanita	
<i>Artemesia abrotanum</i>	Old man or Southernwood	
<i>Artemesia caucasica</i>		needs good drainage
<i>Artemesia frigida</i>	Fringed Wormwood	
<i>Artemesia x Powis Castle</i>		
<i>Artemesia schmidtiana</i>	Angel's hair	
<i>Artemesia stellerana</i>	Beach Wormwood, Old Woman	
<i>Caryopteris</i>	Bluebeard	
<i>Ceanothus</i> 'Anchor Bay'		
<i>Ceanothus</i> 'Centennial'		
<i>Ceanothus gloriosus</i> 'Point Reyes'	Point Reyes Ceanothus	

APPENDIX G: SUGGESTED PLANT LIST

Scientific Name	Common Name	(Comments)
<i>Ceanothus griseus horizontalis</i>	Carmel Creeper	
<i>Ceanothus gloriosus</i> 'Point Reyes'	Point Reyes Ceanothus	
<i>Ceanothus griseus horizontalis</i>	Carmel Creeper	
<i>Ceanothus thyrsiflorus repens</i>		
<i>Choisya ternata</i>	Mexican Orange	
<i>Cistus</i> spp.	Rock Rose species and selections	
<i>Cornus sericea</i> 'Kelsey'	Dwarf Red-osier Dogwood	
<i>Genista lydia</i>	Broom	
<i>Genista pilosa</i>		
<i>Lavandula</i> spp.	Lavender	Ensure cold hardy selections
<i>Mahonia aquifolium</i> 'Compacta'	Compact Oregon Grape	
<i>Osmanthus burkwoodii</i>	Burkwood Osmanthus	
<i>Osmanthus delavayii</i>	Delavay Osmanthus	
<i>Osmanthus heterophyllus</i>	Holly-leaf Osmanthus	
<i>Philadelphus lewisii</i> selections	Selections of Wild Mock Orange	
<i>Physocarpus opulifolius</i> 'Dart's Gold' Golden Ninebark		
<i>Physocarpus opulifolius</i> 'Diablo'	Purple Ninebark	
<i>Potentilla</i> spp.	Cinquefoil	Shrubby species and selections
<i>Ribes sanguineum</i>	Flowering Currant selections	
<i>Rosa rugosa</i> .	Rugosa Rose	
<i>Rosemarinus officinalis</i>	Rosemary	Ensure cold hardy selection
<i>Salvia greggii</i>	Autumn Sage	
<i>Salvia leucophylla</i>	Purple Sage	
<i>Santolina chamaecyparissus</i>	Lavender Cotton	
<i>Spiraea pyramidata</i>		
<i>Symphoricarpos</i> spp.	Cultivated Snowberry	Selections of native species only

Groundcovers/Perennials/Herb:

APPENDIX G: SUGGESTED PLANT LIST

Scientific Name	Common Name	(Comments)
<i>Arctostaphylos media</i>	Tall Kinnikinnick	
<i>Artemesia abrotanum</i>	Old man or Southernwood	
<i>Artemesia caucasica</i>		needs good drainage
<i>Artemesia frigida</i>	Fringed Wormwood	
<i>Artemesia x Powis Castle</i>		
<i>Artemesia schmidtiana</i>	Angel's hair	
<i>Artemesia stellerana</i>	Beach Wormwood, Old Woman	
<i>Baptisia australis</i>	Wild Indigo	
<i>Echinacea spp.</i>	Coneflower	Not purple, may be meadow natives that will withstand drought
<i>Helianthus annuus</i>	Sunflower	
<i>Helianthus maximilianii</i>	Sunflower	
<i>Genista lydia</i>	Broom	
<i>Genista pilosa</i>		
<i>Helenium autumnale 'cv'</i>	Cultivated Sneezeweed	
<i>Hemerocallis spp.</i>	Daylily	Do not allow <i>Hemerocallis fulva</i>
<i>Heuchera sanguinea</i>	Coral Bells	Purple-leafed hybrids are not drought-tolerant
<i>Hypericum calycinum</i>	St. John's Wort	
<i>Juniperus conferta</i>	Shore Juniper	And cultivars, must be disease-resistant
<i>Juniperus horizontalis</i>	Creeping Juniper	And cultivars, must be disease-resistant
<i>Lavandula ssp.</i>	Lavenders	And cultivars, verify hardiness
<i>Penstemon procerus</i>	Penstemon	
<i>Penstemon globosus</i>		
<i>Penstemon venustus</i>		
<i>Rudbeckia hirta</i>	Black-eyed Susan	
<i>Salvia chamaedryoides</i>	Blue Chichuahuan Sage	
<i>Salvia 'Mainacht'</i>		

APPENDIX G: SUGGESTED PLANT LIST

Scientific Name	Common Name	(Comments)
<i>Salvia spathacea</i>	Hummingbird Sage	
<i>Santolina chamaecyparissus</i>	Lavender Cotton	
<i>Symphoricarpos 'cv'</i>	Cultivated Snowberry	Selections of native species only
<i>Wyethia amplexicaulis</i>	Mule's Ear	
<i>Narcissus</i>	Narcissus	
<i>Tulipa spp.</i>	Species Tulips	

Other bulbs that have summer dormancy period and will not excessively naturalize should be considered.

Meadow

Native Grasses:

<i>Agrostis exarata</i>	Spike Bentgrass	
<i>Danthonia californica</i>	California Oatgrass	
<i>Deschampsia cespitosa</i>	Tufted Hairgrass	
<i>Deschampsia elongata</i>	Slender Hairgrass	
<i>Elymus glaucus</i>	Blue Wild Rye	
<i>Festuca idahoensis 'Roemerii'</i>	Roemer's Fescue	plugs only
<i>Fragaria virginiana</i>	Blueleaf Strawberry	
<i>Koeleria cristata (micrantha)</i>	June Grass	
<i>Lotus purshiana</i>	Spanish Clover	
<i>Poa secunda</i>	Pine Bluegrass	

Herbaceous Plants:

<i>Achillea millefolium</i>	Common Yarrow	
<i>Allium cernuum</i>	Nodding Onion	
<i>Allium acumintum</i>	Hooker's Onion	
<i>Anaphalis margaritacea</i>	Pearly Everlasting	
<i>Aquilegia formosa</i>	Columbine	
<i>Asclepias speciosa</i>	Showy Milkweed	

APPENDIX G: SUGGESTED PLANT LIST

Scientific Name	Common Name	(Comments)
<i>Aster chilensis</i>	Common California Aster	
<i>Aster subspicatus</i>	Douglas' Aster	
<i>Brodiaea spp.</i>	Brodiaea	
<i>Camassia leichtlinii</i>	Leichtlin's Camas	
<i>Castilleja levisecta</i>	Golden Indian Paintbrush	
<i>Collomia grandiflora</i>	Large-flowered Collomia	Will not tolerate compacted soils
<i>Epilobium angustifolium</i>	Fireweed	
<i>Eriophyllum lanatum</i>	Wooley Sunflower	
<i>Eschscholzia californica</i>	California Poppy	Be careful of seed source
<i>Festuca rubra commutata</i>	Chewings Fescue	
<i>Fragaria virginiana</i> var. <i>platypetala</i>	Blueleaf Strawberry	
<i>Geranium oreganum</i>	Western Geranium	
<i>Gilia capitata</i>	Bluefield Gilia	
<i>Iris douglasii</i>	Douglas Iris	
<i>Iris tenax</i>	Oregon Iris	
<i>Lupinus latifolia</i>	Broadleaf Lupine	
<i>Lupinus polyphyllus</i>	Bigleaf Lupine	
<i>Lupinus rivularis</i>	Stream Lupine	
<i>Penstemon ovatus</i>	Broad-leaved Penstemon	
<i>Potentilla glandulosa</i>	Sticky Cinquefoil	
<i>Prunella vulgaris</i> var. <i>lanceolata</i>	Heal-all	
<i>Pteridium aquilinum</i>	Bracken	
<i>Ranunculus occidentalis</i>	Western Buttercup	
<i>Sedum oregana</i>	Oregon Stonecrop	
<i>Sedum spathulifolium</i>	Broadleaf Stonecrop	
<i>Sidalcea campestris</i>	Meadow Sidalcea	
<i>Sisyrinchium idahoensis</i>	Idaho Blue-Eyed Grass	

APPENDIX G: SUGGESTED PLANT LIST

Scientific Name	Common Name	(Comments)
<i>Solidgo canadensis</i>	Canada Goldenrod	
Western Red Cedar/ Red Alder		
Trees:		
<i>Acer circinatum</i>	Vine Maple	
<i>Acer macrophyllum</i>	Bigleaf Maple	
<i>Alnus rubra</i>	Red Alder	
<i>Crataegus douglasii</i>	Black Hawthorn	
<i>Malus fusca</i>	Western Crabapple	
<i>Populus balsamifera</i> var. <i>trichoarpa</i>	Black Cottonwood	Avoid use where falling limbs could be a safety concern
<i>Prunus emarginata</i>	Bitter Cherry	
<i>Rhamnus purshiana</i>	Cascara	
<i>Thuja plicata</i>	Western Red Cedar	
Shrubs:		
<i>Cornus sericea</i>	Red-osier Dogwood	
<i>Mahonia nervosa</i>	Low Oregon Grape	After shade only
<i>Physocarpus capitatus</i>	Pacific Ninebark	
<i>Rosa pisocarpa</i>	Swamp Rose	
<i>Rubus spectabilis</i>	Salmonberry	
Occasional Willows:		
<i>Salix sessilifolia</i>	Soft-leaved Willow	Suitable for bioengineering
<i>Salix rigia</i> var. <i>macrogamma</i>	Rigid Willow	Suitable for bioengineering
<i>Salix lasiandra</i>	Pacific Willow	
<i>Salix sitchensis</i>	Sitka Willow	
<i>Spirea douglasii</i>	Douglas Spirea	
<i>Symphoricarpos albus</i>	Common Snowberry	
<i>Viburnum edule</i>	Squashberry	Note limited availability.

APPENDIX G: SUGGESTED PLANT LIST

Scientific Name	Common Name	(Comments)
Herb:		
Establishment:		
<i>Deschampsia cespitosa</i>	Tufted Hairgrass	
<i>Hordeum brachyantherum</i>	Meadow Barley	
<i>Juncus ensifolius</i>	Dagger-leaf Rush	Plugs only
<i>Scirpus microcarpus</i>	Small-fruited Bullrush	
For later planting:		
<i>Adiantum pedatum</i>	Maidenhair Fern	
<i>Carex obnupta</i>	Slough Sedge	Plugs only
<i>Geum macrophyllum</i> Avens		
<i>Hydrophyllum tenuipes</i>	Pacific Waterleaf	
<i>Lysichitum americanum</i>	Skunk Cabbage	
<i>Oenanthe sarmentosa</i>	Water Parsley	
<i>Polystichum munitum</i>	Sword Fern	After shade only
<i>Viola glabella</i>	Yellow Wood Violet	
<i>Viola sempervirens</i>	Trailing Yellow Violet	
Wetland Shrub		
Trees:		
<i>Fraxinus latifolia</i>	Oregon Ash	
<i>Salix lasiandra</i> (lucida var. lasiandra)	Pacific Willow	
Shrubs:		
<i>Cornus sericea</i>	Red-osier Dogwood	
<i>Crataegus douglasii</i>	Black Hawthorne	
<i>Physocarpus capitatus</i>	Pacific Ninebark	
<i>Rosa pisocarpa</i>	Clustered Rose	
<i>Salix piperi</i> (hookeriana)	Hooker's Willow	

APPENDIX G: SUGGESTED PLANT LIST

Scientific Name	Common Name	(Comments)
<i>Salix sitchensis</i>	Sitka Willow	
<i>Viburnum edule</i>	Viburnum	
Herb:		
<i>Carex obnupta</i>	Slough Sedge	
<i>Juncus ensifolius</i>	Dagger-leaf Rush	
Oregon Ash / Willow		
Trees:		
<i>Alnus rubra</i>	Red Alder	
<i>Fraxinus latifolia</i>	Oregon Ash	
<i>Populus balsamifera</i> var. <i>trichoarpa</i>	Black Cottonwood	Avoid use where falling limbs could be a safety concern
<i>Salix lasiandra</i> (<i>lucida</i> var. <i>lasiandra</i>) Pacific Willow		
Shrubs:		
<i>Cornus sericea</i>	Red-osier Dogwood	
<i>Crataegus douglasii</i>	Black Hawthorne	
<i>Physocarpus capitatus</i>	Pacific Ninebark	
<i>Salix piperi</i> (<i>hookeriana</i>)	Hooker's Willow	
<i>Salix sitchensis</i>	Sitka Willow	
<i>Spiraea douglasii</i>	Douglas Spiraea, Hardhack	
<i>Symphoricarpos albus</i>	Common Snowberry	
Herb:		
<i>Athyrium filix-femina</i>	Lady Fern	
<i>Carex obnupta</i>	Slough Sedge	
<i>Claytonia perfoliata</i>	Miner's Lettuce	
<i>Deschampsia cespitosa</i>	Tufted Hairgrass	
<i>Collinsia grandiflora</i>	Large-flowered Blue-eyed Mary	
<i>Glyceria</i> ssp.	Mannagrass	

APPENDIX G: SUGGESTED PLANT LIST

Scientific Name	Common Name	(Comments)
<i>Hordeum brachyantherum</i>	Meadow Barley	
<i>Juncus ssp.</i>	Rushes	

Gravel Bar Vegetation (Elevation 11' – 13')

Trees:

<i>Fraxinus latifolia</i>	Oregon Ash	
<i>Salix lasiandra (lucida var. lasiandra)</i>	Pacific Willow	

Shrubs:

<i>Cornus sericea</i>	Red-osier Dogwood	
<i>Crataegus douglasii</i>	Black Hawthorne	
<i>Salix fluviatilis</i>	Columbia River Willow	Suitable for Bioengineering
<i>Salix piperi (hookeriana)</i>	Hooker's Willow	
<i>Salix rigia var. macrogemma</i>	Rigid Willow	Suitable for bioengineering
<i>Salix sessilifolia</i>	Soft-leaved Willow	
<i>Salix sitchensis</i>	Sitka Willow	

Emergent Marsh

Herb:

<i>Aster subspicatus (douglasii)</i>	Douglas Aster	Use plugs to protect from predation
<i>Bidens ssp..</i>	Beggars Tick	
<i>Carex obnupta.</i>	Slough Sedge	
<i>Carex ssp..</i>	Other Sedges	
<i>Carex aperta</i>	Columbia Sedge	
<i>Deschampsia cespitosa</i>	Tufted Hairgrass	
<i>Eleocharis ssp..</i>	Spikerushes	
<i>Glyceria ssp.</i>	Mannagrass	
<i>Grindelia integrifolia</i>	Willamette Valley Gumweed	
<i>Helenium autumnale</i>	Sneezeweed	

APPENDIX G: SUGGESTED PLANT LIST

Scientific Name	Common Name	(Comments)
<i>Hordeum brachyantherum</i>	Meadow Barley	
<i>Juncus ensifolius</i>	Dagger-leaf Rush	
<i>Leersia oryzoides</i>	Rice Cutgrass	
<i>Lycopus americanus</i>	Bugleweed	
<i>Mimulus guttatus</i>	Yellow Monkey-flower	
<i>Paspalum distichum</i>	Knotgrass	
<i>Potamogeton nodosus</i>	Long-leaved Pondweed	
<i>Sagittaria latifolia</i>	Wapato	
<i>Scirpus ssp.</i>	Bulrushes	
<i>Scutellaria galericulata</i>	Marsh Skullcap	
<i>Solidago gigantea</i>	Giant Goldenrod	
<i>Solidago (Euthamia) occidentalis</i>	Grass-leaved Goldenrod	
<i>Veronica americana</i>	American Brooklime	

APPENDIX H: ENVIRONMENTAL HISTORY AND EXISTING CONDITIONS

An 1852 map identifies the entire South Waterfront area as primarily floodplain marsh, and shows most of what is now the South Waterfront area under farm cultivation, with two streams flowing from the West Hills into a small lake or inundated area and then continuing to the Willamette River. Floodwaters break out of the main channel and slow down when they flow onto the shallower floodplain marshes, where coarser sediments are deposited during flood stage.

Prior to filling, the area was probably subject to annual or biennial flooding. Flood storage capacity was quite large, probably on the order of 1,200 acre-feet of storage (assumes 80 acres of lowland, and an average flooded depth of 15 feet). Now that the site has been filled, the water storage capacity of the site is diminished—but still significant. Assuming an average water storage capacity range of 0.07 to 0.10 cubic feet of water per cubic foot of soil, and a groundwater fluctuation of 10 feet, the filled site probably holds 56 to 80 acre-feet of groundwater in the saturated zone which is slowly released into the river each summer and fall.

Today, the original floodplain marsh has been filled to a depth of some 20 feet (approximately to elevation +30 Mean Sea Level) leaving banks that are high, steep, and covered with dumped rock and demolition debris. The top of this bank roughly conforms to the regulatory (100-year) floodplain elevation and land west of the top of bank is considered upland, rather than riparian. The shallow shoreline zone, which is seasonally exposed during the low-water period, consists of a continuous strand of sand and mudflats of low relief interrupted by lines of old piles and occasional derelict harbor structures.

Fill materials are variable, ranging from silty materials to sands and gravels, to demolition debris. The fill is underlain by deposits of silt and sand that, in turn, are underlain by sand, gravel and basalt. The most recent fill has caused the site to be highly contaminated with materials toxic to both aquatic organisms and humans. Soil contamination issues are significant in the northern portion of the District (generally between the Marquam Bridge and Gibbs Street). South of Gibbs, soil and groundwater contamination is believed to be localized.

Within the District, groundwater flows from the southwest toward the northeast. The groundwater level beneath the District is expected to reflect the river level, rising to approximately 16 feet (COP datum) in the winter and

falling to approximately 6 feet (COP datum) in the late summer and early fall. The groundwater level rises significantly during high river and flood events and lags as high water levels subside.

The river itself has also been heavily manipulated through upstream damming, dramatic increases in urbanized runoff, elimination of meanders and side channels, and continual use for industrial and recreational purposes. Just offshore are the remains of groins, single piles and dolphins (collections of piles reinforcing one another) dating from this area's industrial past. These old wooden structures may still have polluting preservatives locked inside them, but could provide offshore habitat if left undamaged.

Willamette River bathymetry varies along the South Waterfront Greenway, with the upstream and downstream ends of the District having shallower water along shore, and the central part of the District having a deeper channel, or *thalweg*, close to shore. The near-shore area at the north end of the District, downstream of the Ross Island Bridge, is a shallow deposition zone that has relatively low current velocities.



APPENDIX I: HISTORIC HABITAT

In a map of Portland dated 1884, the following plant community types were graphically indicated within the complex habitat system that includes Ross Island, Oaks Bottom, Cottonwood Cove and associated vegetated riverbanks:

A. Shallow Water & Fringing Wetland

B. Floodplain Marsh

C. Floodplain Shrub

D. Tributary Riparian

E. Ash/ Willow Lowland

F. Mixed Coniferous/Deciduous Woodland

In the intervening century, our understanding of these habitats has been enhanced significantly and evolving habitat conditions have led to the defining of new categories. The following habitats are still found naturally occurring in the Willamette Valley, and have the potential to be enhanced or developed within or adjacent to the South Waterfront Greenway and were used as models and references for greenway Plan habitat development and design.



A. SHALLOW WATER & FRINGING WETLAND

- variable river margin creates an aquatic zone where water levels fluctuate throughout the seasons, but shallow water persists for most of the year
- substrate varies from clay-silt to sands, and small gravel, often a depositional zone where sediments and wood accumulate
- typically supports a herbaceous community, but the presence of these soft-stemmed plants depends on the hydraulic forces of water during flood stage, and these plants can be negatively affected by boat wave action during lower flow periods of the year
- provides important habitat for rearing of many species of freshwater aquatic animals, including salmonid juveniles, frogs, amphibians and aquatic insects
- at least 40 species of fish have been identified in the lower Willamette River, including 24 native species. Limited sampling along the District shoreline between the Ross Island and Marquam Bridges found large scale sucker to be most abundant. Juvenile Chinook, Coho salmon and steelhead were also identified.

B. FLOODPLAIN MARSH

- occurs at the margins of large river floodplains and on old oxbows (former river channels)
- properly functioning floodplain marsh is inundated by the river on an annual and regular basis
- diverse herbaceous plant community provides habitat for many mammals, birds, amphibians and reptiles, and insects including aquatic species; and seasonally for fish during high water periods
- composed of fine-textured soils, frequently saturated by groundwater for more than half the year

APPENDIX I: HISTORIC HABITAT

C. FLOODPLAIN SHRUB

- occurs at floodplain margins and around floodplain forest communities where fine soils mix with coarser sediments
- herbaceous plants yield to woody shrubs where well-drained soils are moist but not saturated, which provide more canopy and nesting cover for many birds and insects
- receives at least annual inundation by floods, receives normal rainfall, has frequent contact with groundwater, but withstands some summer drought

D. TRIBUTARY RIPARIAN

- occurs where a small stream meets a larger river
- In-channel sediments are generally composed of coarser materials, often forming a delta outwash with patches of fine materials. Banks can be of fine grained materials or sandy soils
- dominated by woody shrubs, including alder, cottonwood and coniferous trees with some herbaceous annuals and perennials

E. ASH/WILLOW LOWLAND

- occurs on a valley floor where groundwater is high for more than half the year and/or surface drainage results in persistent inundation
- composed of finer textured soils which support a distinct plant community with Oregon ash and willow as dominant trees
- important ecotype for forage, cover and nesting for many bird, insect and amphibian species

F. MIXED CONIFEROUS/DECIDUOUS WOODLAND

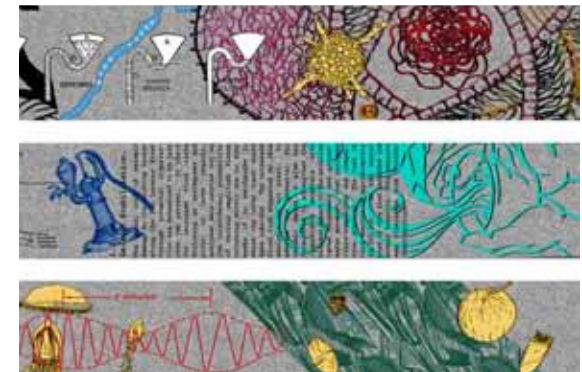
- diverse canopy of mixed broadleaf and conifer trees
- understory composed of varied shrubs and herbs, with differing plant heights beneath the canopy
- hydrology is mainly dependent on rainfall with subsurface flow contacts



APPENDIX J: ART PLAN (IMAGES)

For a copy of the entire Art Plan, go to:

www.bustersimpson.net/portlandgreenway/portlandgreenway.08.23.04.pdf



Anamorphic walkway studies



APPENDIX K: GLOSSARY

Biodiversity: The variety of distinct species within a given area as well as:

1. genetic diversity or variability within a given species population and
2. the variety of ecosystems across a geographic area

(*National Parks Conservation Association*)

Furnishing: A built, free-standing element within a public street right-of-way. Examples include benches, bike racks, trash cans and raised planters.

Habitat: The area or natural environment in which an organism or population normally lives. A habitat is made up of physical factors such as soil, moisture, range of temperature, and availability of light as well as biotic factors such as the availability of food and the presence of predators. (*The American Heritage Science Dictionary*)

Interpretive Signage: A display, typically public, of historical or natural information for educational purposes

Leaf Drop: The release of leaves triggered by weather changes, strong winds or disease

Ordinary High Water: The line to which high water normally reaches under natural conditions, but not including floods, storms, or severe meteorological conditions (*National Oceanic and Atmospheric Administration*)

Ordinary Low Water: The line to which low water normally reaches under natural conditions, but not including floods, storms, or severe meteorological conditions (*National Oceanic and Atmospheric Administration*)

Reach: The stretch of water visible between bends in a river or channel

Renaturalization: The process of creating ecological functions on disturbed or unnatural sites that typify elements of intact ecosystems that did not originally exist on the site but which are appropriate to the sites' ecological context

Riparian: Relating to or inhabiting the banks of a natural course of water. Riparian zones are ecologically diverse and contribute to the health of other aquatic ecosystems by filtering out pollutants and preventing erosion. (*The American Heritage Science Dictionary*)

Understory: An underlying layer of vegetation, especially the plants that grow beneath a forest's canopy. (*American Heritage Dictionary*)

Universal Accessway: A public or private street intended for use primarily by pedestrians and bicycles but still open for limited use by vehicles.

Wave Attenuation: Decreasing the energy of a wave with a structure or other device

