























**Ecostone by Akerstone**

Tightly spaced concrete joints flow with a  
weathered rock and luxury gold mosaic.

**Base**

2" compacted sand stone permeable fabric liner  
2" compacted gravel stone

Permeable Paving Pilot Program





Checkbook by Hastings

Permeable Paving Pilot Program









Decomposed Granite  
Permeable Paving Pilot Program

































STATION 3

# Stormwater Ponds, Swales & Wet Meadows



For more information, contact  
The Huron River Watershed Council (HRWC)  
1100 N. Main St., Suite 210  
Ann Arbor, MI 48104  
734 768 5123



The Huron Watershed is a natural resource and immediate  
habitat for many species of animals. It is important  
to protect and restore the natural resources of the  
watershed and to provide the quality of water, air, and  
land resources to the Huron Watershed. ALTARUM  
is a non-profit organization that provides  
education and information on environmental issues.

The stormwater ponds you see around you capture the runoff from the nearby buildings, driveways and parking lots and then release it slowly downstream. This decreases surging storm flows and helps to protect downstream areas from flooding. As one component of "Best Management Practices" (BMPs), the ponds work together with the swales and wet meadows around the site to improve the overall health and stability of the Millers Creek Watershed.

Swales — topographic depressions flowing across the site — convey the runoff water overland, rather than through pipes, and help slow it down before it enters the river system. The swales seen around the Plymouth-Green Innovation Community help to remove toxics such as motor oil, antifreeze, fertilizers and pet waste.

Low areas landscaped with water-loving plants, called wet meadows, are more effective than the swales, trapping the water and filtering it through plants and the soil. Water gardens are smaller versions of wet meadows.



### What Can I Do?

- ◆ Hold rain water in your rain barrel
- ♻️ Replace some of your turf lawn with Michigan-native plants
- ♻️ Properly dispose of household waste
- 📞 Contact HRWC for guidance on these actions



Oslund Basin



Pflizer Forebay



Swale Unvegetated



Wet Meadow



An Alder (*Alnus rugosa*) Bog



**Stormwater Ponds, Swales & Wet Meadows**

Stormwater ponds, swales, and wet meadows are natural or semi-natural areas that capture and store stormwater runoff from impervious surfaces such as roofs, parking lots, and streets. These areas help to reduce the volume of stormwater runoff, filter out pollutants, and recharge groundwater. They also provide habitat for wildlife and improve the aesthetic quality of the landscape.

Stormwater ponds are designed to store stormwater for a period of time, allowing it to infiltrate the ground and recharge aquifers. They also help to filter out pollutants and sediment from the runoff. Swales are shallow, vegetated channels that capture and store stormwater runoff. They help to reduce the volume of runoff and filter out pollutants. Wet meadows are areas of land that are periodically flooded with stormwater runoff. They help to reduce the volume of runoff and filter out pollutants. They also provide habitat for wildlife and improve the aesthetic quality of the landscape.

Stormwater ponds, swales, and wet meadows are important components of a sustainable stormwater management system. They help to reduce the volume of stormwater runoff, filter out pollutants, and recharge groundwater. They also provide habitat for wildlife and improve the aesthetic quality of the landscape.

**Benefits:**

- Reduces the volume of stormwater runoff
- Filters out pollutants and sediment
- Recharges groundwater
- Provides habitat for wildlife
- Improves the aesthetic quality of the landscape

**Types:**

- Stormwater ponds
- Swales
- Wet meadows

**Design Considerations:**

- Site location and topography
- Soil type and infiltration capacity
- Vegetation selection
- Structural design
- Construction and maintenance

**References:**

- U.S. Environmental Protection Agency (EPA)
- International Stormwater Conference
- Stormwater Management Handbook











STATION 2

# Native Environment

One of the strategies in restoring Millers Creek is the use of Michigan-native plants. Trees, shrubs, wildflowers and grasses indigenous to the area form low-maintenance landscaping that provides habitat for many birds, butterflies, and other animal life. Their deep root systems hold rain and survive drought much better than non-native plants and turf grass.

To strengthen the native plants and to help control invasive species, each year (usually in the springtime), a prescribed ecological burn is done. As practiced by our Native American ancestors, the controlled burn discourages the growth of exotic species (cool-season grasses such as Smooth Brome and Kentucky bluegrass), suppresses the establishment of woody plants, and stimulates the growth and regeneration of native plants and seed.

Some of the native species that can be seen here at Station 2 around the retention basins are: Little Bluestem Grass, Butterfly Milkweed, Switchgrass, New-England Aster, Wild Bergamot, Yellow Coneflower, Black-Eyed Susan and Showy Goldenrod.



For more information, contact:  
The Huron River Watershed Council (HRWC)  
1102 N. Main St., Suite 210  
Ann Arbor, MI 48104  
734.769.8123



The Altarum website is a valuable resource for environmental education and more than 20 years of experience in sustainability, marketing, and online advertising. Our expertise allows us to provide the sustainable reporting of energy, water and other resources, and commercial customers in the retail, security, healthcare, and energy industries and transportation sectors.



### What Can I Do?

- Replace some of your turf lawn with Michigan-native plants
- ◆ Hold rain water in your rain barrel
- ⊗ Minimize fertilizer and pesticide use
- ☎ Contact HRWC for guidance on these actions



Little Bluestem Grass



Butterfly Milkweed



Switchgrass



New England Aster



Wild Bergamot



Yellow Coneflower



Black-Eyed Susan



Showy Goldenrod









STATION 1

# Runoff & Development

Rain water normally soaks into the soil to be taken up by plants or become groundwater.

Human development covers much of the ground with impervious surfaces (such as roofs, streets and parking lots), which prevents the rain water from soaking into the ground. The water, called runoff, travels directly to the streams, unfiltered, carrying with it pollutants like litter and sediments (dirt!) that can affect the health of our rivers and streams. The volume of runoff creates a forceful flow that erodes the creek, creating the steep, bare banks that you can see near Huron Parkway.

At this station, we see how the water from this parking lot is conveyed into a "retention basin" designed to slow the flow of the runoff and to allow it to soak into the ground and to filter out some of the pollutants and contaminants from the parking lot that would normally flow directly to the Huron River. The roots of the plants in this basin will break down these contaminants and cleanse the water.



### What Can I Do?

- ☒ Replace some of your turf lawn with Michigan-native plants
- ◆ Hold rain water in your rain barrel
- ⊗ Minimize fertilizer and pesticide use
- Ⓜ Contact HRWC for guidance on these actions



For more information, contact:  
The Huron River Watershed Council (HRWC)  
1102 N. Main St., Suite 215  
Ann Arbor, MI 48104  
734.769.5123



The Huron Wildlife is a nonprofit research and education organization that works to protect and restore the Huron River watershed. We provide information, education, and technical support to help landowners, businesses, and the general public understand the importance of the Huron River watershed and the need for responsible stewardship.



Hubbard Higherflow



Runoff Cuts a Rivulet



Fallen Trees

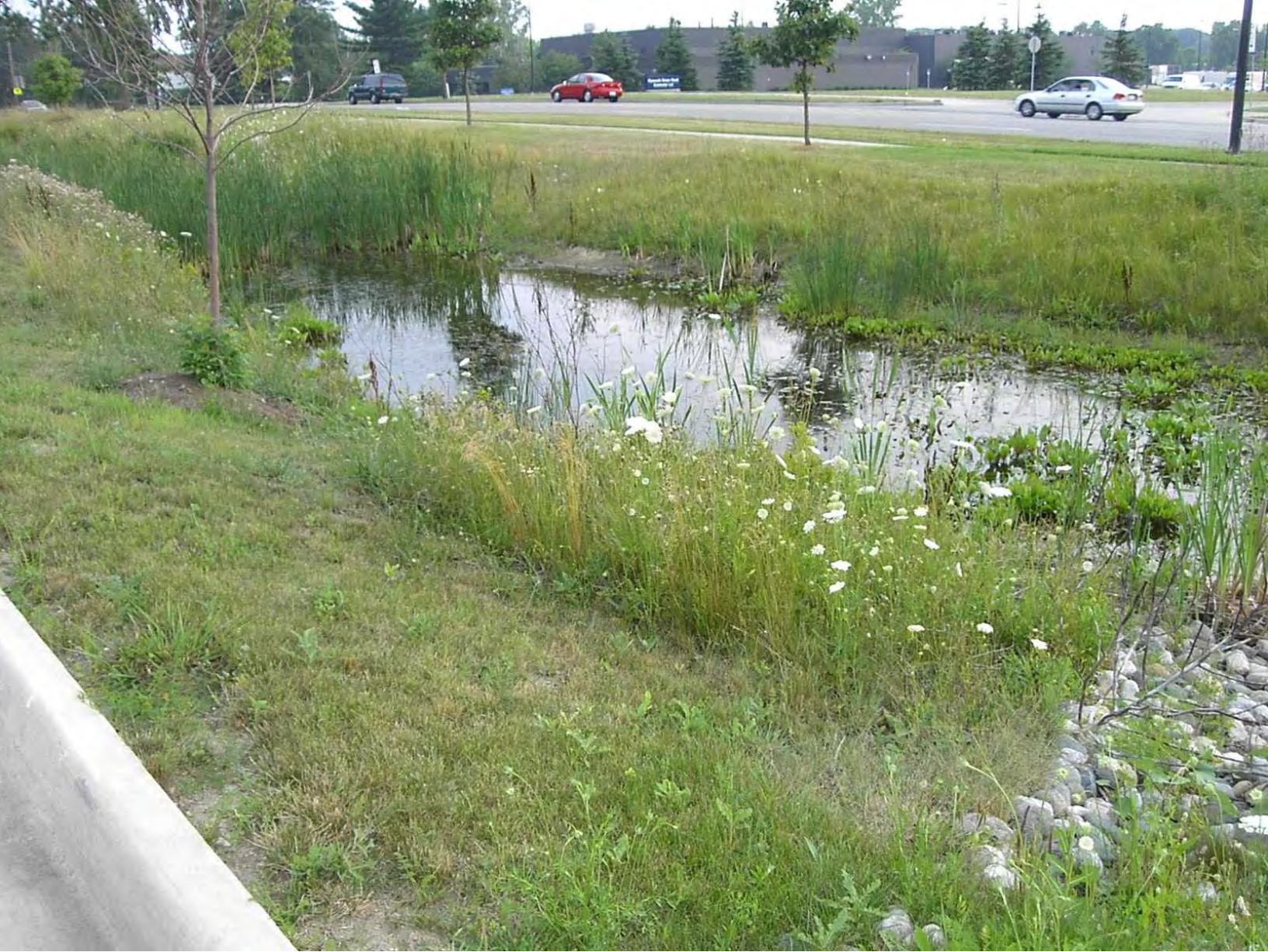


Eroded Stream Banks along Huron Parkway





















































# Appendix G

Stormwater Management Facility Photos

September 2002 Stormwater  
Management Manual

# Parking Lot Examples

## Site Location

## Page/ Slide

PCC Annex (SE Water Ave.)

3

OMSI, 1992 (1945 SE Water Ave.)

4 & 5

Troutdale Arata Creek School Site

6-8

SW Community Center (6820 SW 45th Ave.)

9

Buckman Heights Apartments (430 NE 16th Ave.)

10



PCC Annex (SE Water Ave.)



OMSI, 1992 (1945 SE Water Ave.)



OMSI, 2001 (1945 SE Water Ave.)



Troutdale Arata Creek School Site



Troutdale Arata Creek School Site



Troutdale Arata Creek School Site





SW Community Center (6820 SW 45th Ave.)



**Buckman Heights Apartments (430 NE 16th Ave.)**

# Street Examples

Site Location

Page/ Slide

Seattle Street Edge Alternative Project

12

SW Lodi Lane Subdivision (SW Lodi Lane & Shattuck)

13

# Seattle's Street Edge Alternatives Program



After Completion - January 2001



SW Lodi Lane Subdivision (SW Lodi Lane & Shattuck)

# Eco-Roofs and Roof Gardens

## Site Location

## Page/ Slide

SW 2nd Ave. & Market St.

15 & 16

Hamilton Apartments (1212 SW Clay St.)

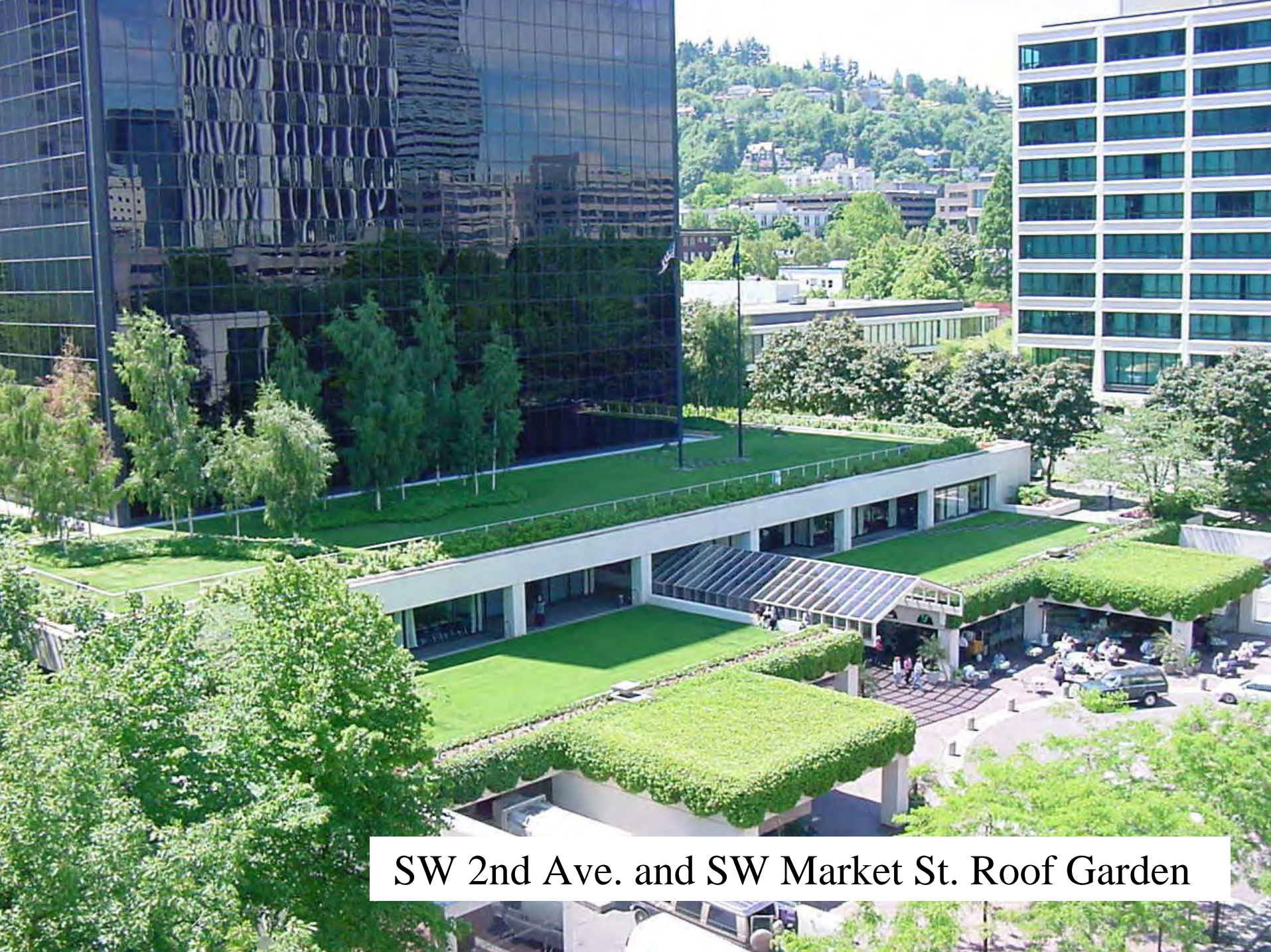
17-20

Buckman Terrace Apartments (303 NE 16th Ave.)

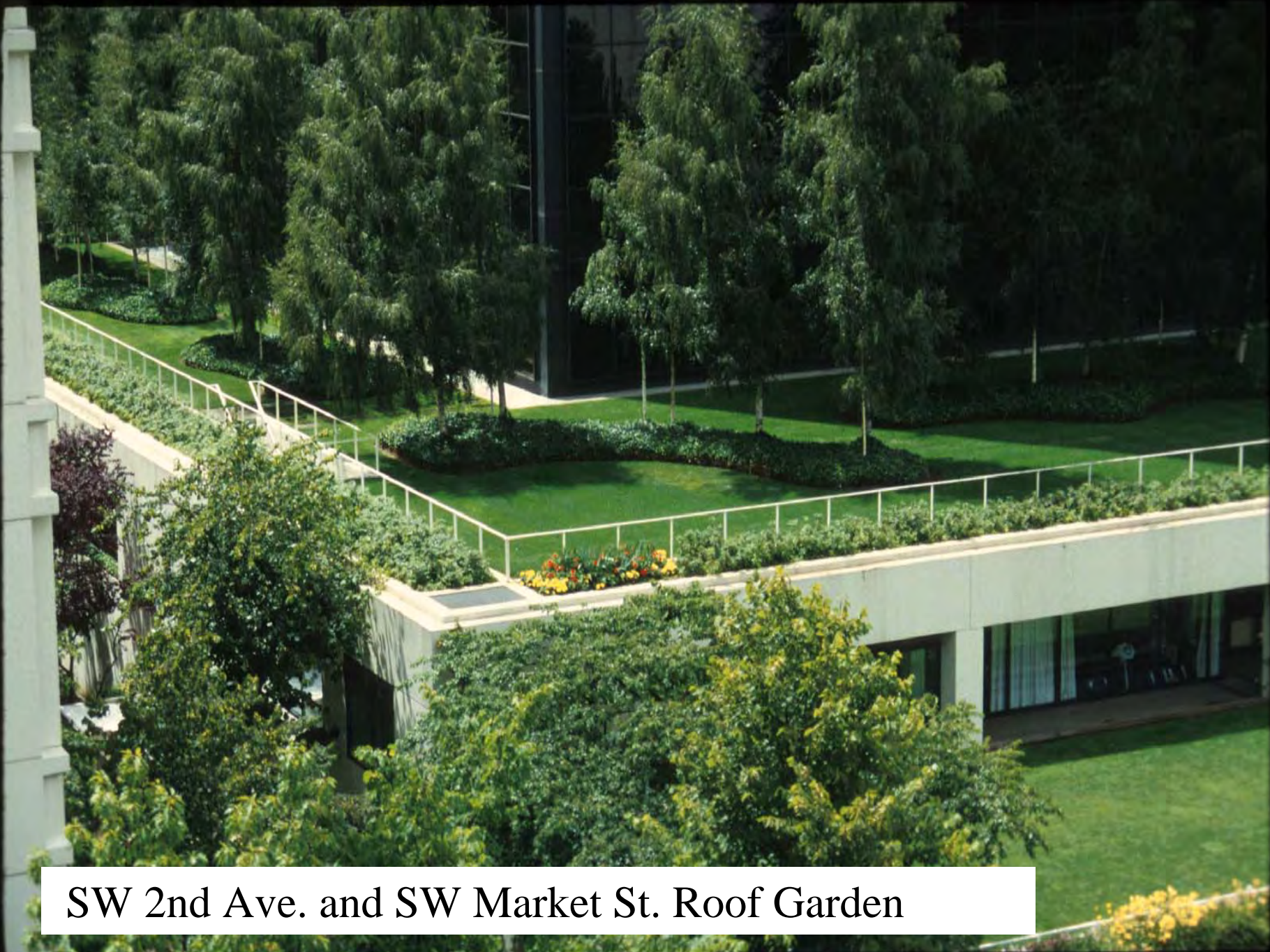
21 & 22

Eco-Roof in Philadelphia

23



SW 2nd Ave. and SW Market St. Roof Garden



SW 2nd Ave. and SW Market St. Roof Garden





**Hamilton Apartments Eco-Roof (1212 SW Clay St.)**



**Hamilton Apartments Eco-Roof (1212 SW Clay St.)**



**Hamilton Apartments Eco-Roof (1212 SW Clay St.)**





**Hamilton Apartments Eco-Roof (1212 SW Clay St.)**



**Buckman Terrace Eco-Roof (303 NE 16th Ave.)**



**Buckman Terrace Eco-Roof (303 NE 16th Ave.)**



Eco-Roof in Philadelphia

# Porous Pavement

Site Location

Page/ Slide

Unknown

25

Unknown

26-28











# Vegetated Swales

<u>Site Location</u>	<u>Page/ Slide</u>
Hawthorne Ridge Subdivision (SE 162 S. of Foster)	30, 31
OMSI (1945 SE Water Ave.)	32
BES Water Pollution Control Lab (6543 N. Burlington)	33, 34



Hawthorne Ridge Subdivision (SE 162nd, South of Foster)



Hawthorne Ridge Subdivision (SE 162nd, South of Foster)



**OMSI Vegetated Swale  
(1945 SE Water Ave.)**





**BES Water Pollution Control Lab (6543 N. Burlington)**



**BES Water Pollution Control Lab (6543 N. Burlington)**

# Grassy Swales

<u>Site Location</u>	<u>Page/ Slide</u>
Reed College (SE 28th Ave.)	36
Russell Pond Site (NE 88th Ave. & Freemont Dr.)	37
SW Scholls Ferry Road	38



Reed College (SE 28th Ave.)



Russell Pond Site (NE 88th Ave. and Fremont Dr.)



SW Scholls Ferry Road

OCT 26 2000

# Vegetated Filters

Site Location

SW Community Center (6820 SW 45th Ave.)

Page/ Slide

40



**SW Community Center (6820 SW 45th Ave.)**



# Contained Planter Boxes

Site Location

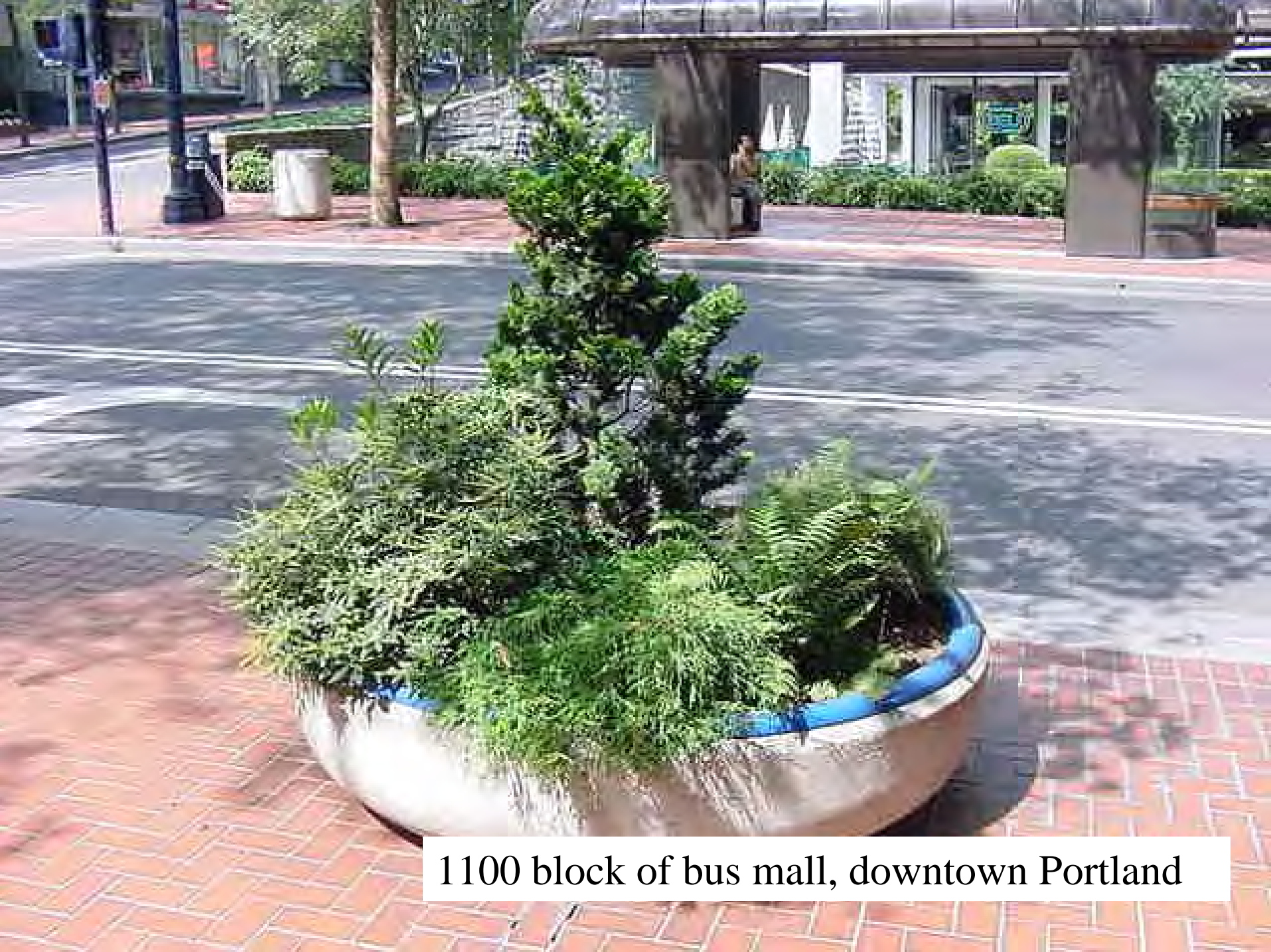
Page/ Slide

1100 block of bus mall, downtown Portland

42

Federal Building (1200 block of SW 3rd Ave.)

43



1100 block of bus mall, downtown Portland



Federal Building (1200 block of SW 3rd Ave.)

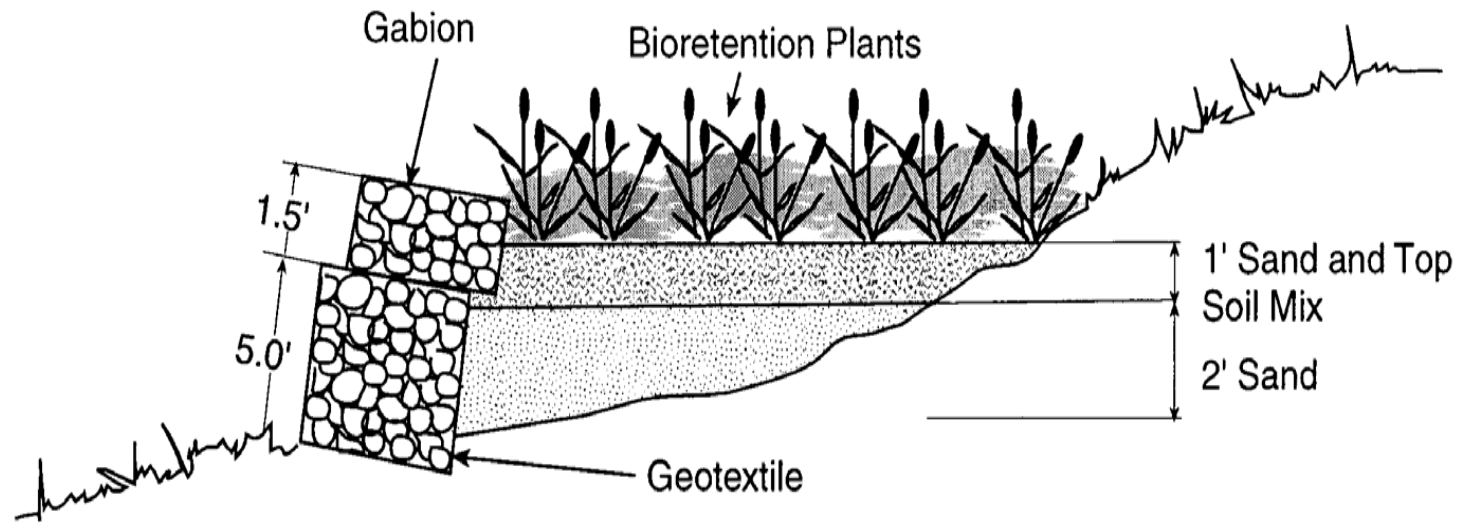
# Infiltration Planter Boxes

Site Location

Unknown

Page/ Slide

45



# Flow-Through Planter Boxes

## Site Location

## Page/ Slide

Buckman Terrace Apartments (303 NE 16th Ave.) 47-50

Ritzdorf Apartments (SE 12th Ave. & Belmont) 51



**Buckman Terrace Apartments (303 NE 16th Ave.)**



**Buckman Terrace Apartments (303 NE 16th Ave.)**





Buckman Terrace Apartments (303 NE 16th Ave.)



**Buckman Terrace Apartments (303 NE 16th Ave.)**



Ritzdorf Apartments (SE 12th Ave. & SE Belmont St.)

# Vegetated Infiltration Basins

Site Location

Page/ Slide

Buckman Heights Apartments (430 NE 16th Ave.) 53-55



**Buckman Heights courtyard infiltration basins (430 NE 16th Ave.)**



**Buckman Heights courtyard infiltration basin (430 NE 16th Ave.)**



**Buckman Heights  
courtyard  
planter overflow  
(430 NE 16th Ave.)**

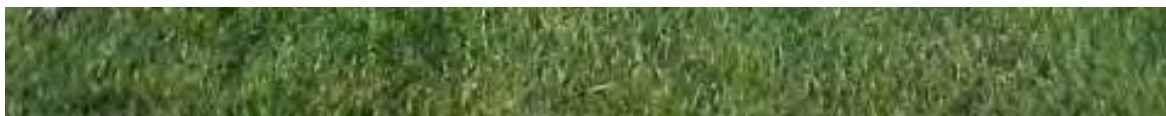
# Sand Filters

<u>Site Location</u>	<u>Page/ Slide</u>
Cascade Station (NE Airport Way & I-205)	57-60
Unknown	61





Cascade Station (NE Airport Way & I-205)





Cascade Station (NE Airport Way & I-205)



Cascade Station (NE Airport Way & I-205)



Cascade Station (NE Airport Way & I-205)



3 01 17

Unknown Location

# Soakage Trenches

Site Location

7123 SE Powell

Page/ Slide

63 & 64



7123 SE  
Powell



7123 SE Powell



# Wet & Extended Wet Detention Ponds

<u>Site Location</u>	<u>Page/ Slide</u>
Mill Pond (NW Mill Pond Road, Forest Heights)	66
Troutdale School Site	67-69
BES Water Pollution Control Lab (6543 N. Burlington)	70-73
Hawthorne Ridge Subdivision (SE 162nd, S. of Foster)	74-76



Mill Pond (NW Mill Pond Rd., Forest Heights Subdivision)



Troutdale Arata Creek School Site



Troutdale Arata Creek School Site



Troutdale Arata Creek School Site



**BES Water Pollution Control Lab (6543 N. Burlington)**



AUG 21 2000

BES Water Pollution Control Lab (6543 N. Burlington)



BES Water Pollution Control Lab (6543 N. Burlington)





**BES Water Pollution Control Lab (6543 N. Burlington)**



MacGregor Heights Subdivision (SE 158th Ave. & Belmore)



Hawthorne Ridge Subdivision (SE 162nd, S. of Foster)



Hawthorne Ridge Subdivision (SE 162nd, S. of Foster)



# Constructed Treatment Wetlands

Site Location

Page/ Slide

Russell Pond Site (NE 88th & Freemont)

78 & 79



**Russell Pond Site (NE 88th Ave. and Fremont)**



**Russell Pond Site (NE 88th Ave. and Fremont)**

# Tree Credit Examples

Site Location

Page/ Slide

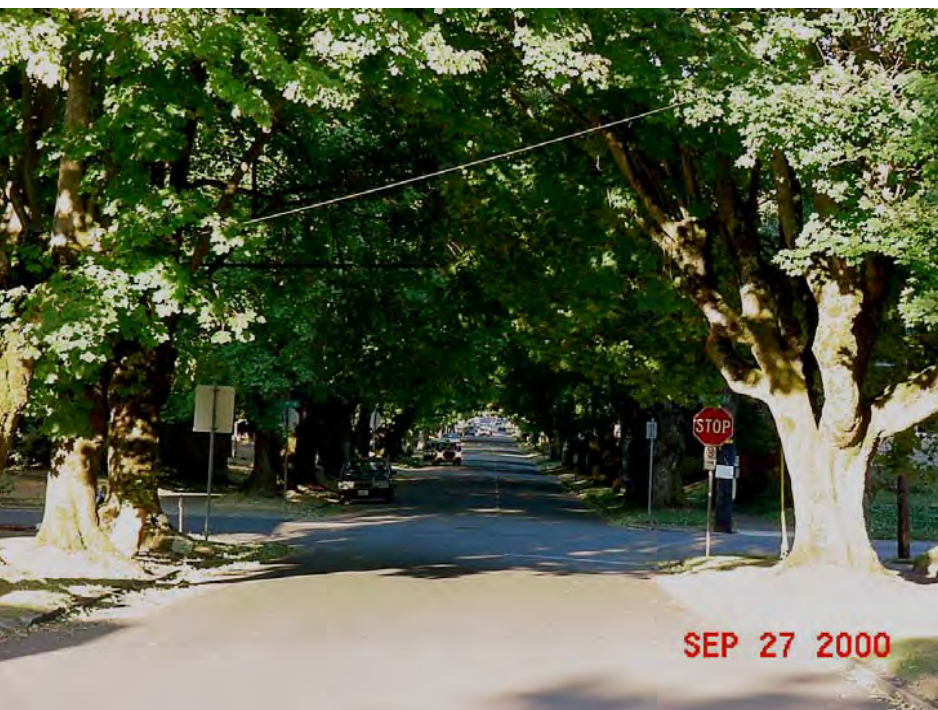
Miscellaneous

81

Buckman Terrace Apartments (303 NE 16th Ave.)

82







**Buckman Terrace tree preservation and at grade infiltration planter  
(303 NE 16th Ave.)**

# Stormwater Re-Use: Rain Barrels, Cisterns and Storage Tanks



# Portland Watersheds

