Nature in Neighborhoods

Background Information

Twelve Award-Winning

Stormwater Management Facilities

== **1996** and **1997** ==

Gail B. Boyd
Independent Consultant

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Site #1

Mentor Graphics Campus

SW Boeckman Road, Wilsonville

Design Objectives	• Protect/enhance existing woodlands and wetlands. • Control flooding to protect downstream properties. • Control pollutants from lawns and parking areas.
Winning Features	Swales, constructed wetlands, and ponds that receive, convey, detain, and treat stormwater from the 90-acre watershed.

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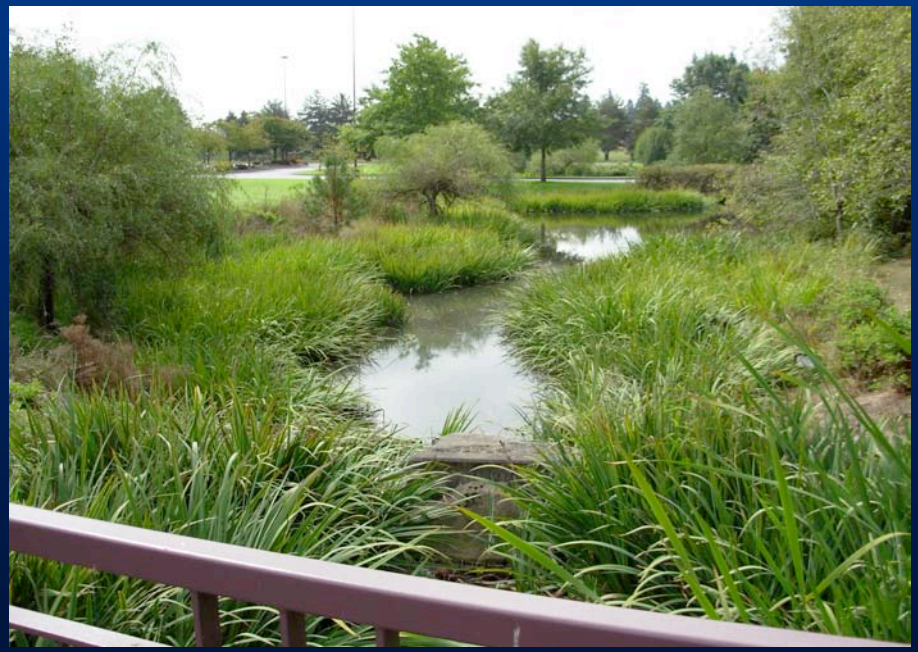

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Mentor Graphics Campus

Subjective Impressions	• The campus facilities and grounds are aesthetic and well maintained. • Standing water in the ponds looked fairly clear. • Submerged and emergent aquatic vegetation are abundant and dense, yet not out of control. • The facilities probably do satisfy the design objectives during most storm events. • No basis for judging their performance during large storms.

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Site #2

Butternut Creek Water Quality and Detention Facilities

SW Bany Road, Aloha

Design Objectives	• Control flooding (detention/retention). • Improve water quality (sedimentation, filtration, bioaccumulation). • Enhance habitat. • Minimize aesthetic impacts. • Provide public access and educational opportunities.
Winning Features	A 3-acre pond with wetland margins that receives and temporarily stores runoff from a 107-acre neighborhood of single-family homes.

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Butternut Creek Water Quality and Detention Facilities

Subjective Impressions	• Planted vegetation and invasive plants have grown to be very dense and presently preclude access to the pond. • The SW facilities probably do control flooding from most storms. • The facilities probably do remove settleable solids and associated pollutants during most storms. • No basis for judging performance during large storms.

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Site #3:

Portland BES Water Pollution Control Laboratory

N Burlington Avenue, Portland

Design Objectives	• Reduce peak flow rates (detention and infiltration). • Remove pollutants contributed by the buildings and parking areas (sedimentation and uptake by the soil matrix and by vegetation).
Winning Features	• A formally-designed flume structure and a 2-cell water garden. • Several bioswales in parking lots and elsewhere on the site.

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Portland BES Water Pollution Control Laboratory

Subjective Impressions

- The facilities have captured large amounts of sediment and have fostered the growth of both planted vegetation and invasive plants.
- Maintenance efforts have not kept pace with sediment loads or the growth of vegetation.
- Recent efforts to clear flume and re-arrange stones to alter flow patterns should help control sediment deposition problems.

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Site #4:

Heritage Planned Unit Development

Fisher's Landing, Vancouver

Design Objectives	• Collect, convey, temporarily store, and infiltrate the runoff from rainfall events that exceed the 10-year design storm. • Remove sediment and sediment-borne pollutants.
Winning Features	A 5-acre complex of ephemeral drainage courses, natural swales, biofiltration swales, ephemeral storage pond, and infiltration zones that are fully-integrated into the landscaping of a 90-acre, mixed-density residential development.

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Heritage Planned Unit Development

Subjective Impressions	• The homes, park and common-space areas, and other landscaping are visually attractive and well maintained. • No basis for judging hydraulic performance. • No basis for judging performance regarding pollutant control.

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Site #5:

107th Avenue Water Quality Facility

107th near Fourth Plain Blvd., Vancouver

Design Objectives	• Treat stormwater from adjacent retail site to remove pollutants (sedimentation, filtration, and adsorption). • Foster recharge of groundwater (infiltration). • Supplement habitat afforded by an adjacent forested wetland. • Demonstrate a "workable green solution for stormwater treatment in an urban setting".
Winning Features	• Sediment trap provides pretreatment. • The cells of the half-acre constructed wetland provide additional sedimentation, plus filtration, absorption, and infiltration.

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107th Avenue Water Quality Facility

Subjective Impressions	• Planted vegetation (primarily local native species) and invasive plants have grown to be very dense and now constrain access to or views of the wetland areas. • The facilities probably do satisfy the design objectives. • No basis for judging the performance of specific processes (e.g., sedimentation, filtration, absorption, filtration).

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Site #6:

Kaiser Permanente Salmon Creek Medical Office

NE 20th Avenue, Vancouver

Design Objectives	• Receive and infiltrate runoff from the adjacent medical center's roofs and parking areas. • Reduce peak runoff flow rates (via detention and infiltration). • Remove sediments and associated pollutants (via sedimentation). • Present the outward appearance of a natural wetland.
Winning Features	An 18,000-sq ft, 10-ft deep pond that was designed to resemble a "natural" ("not-engineered") wetland and to enhance the landscaping around the medical office complex.

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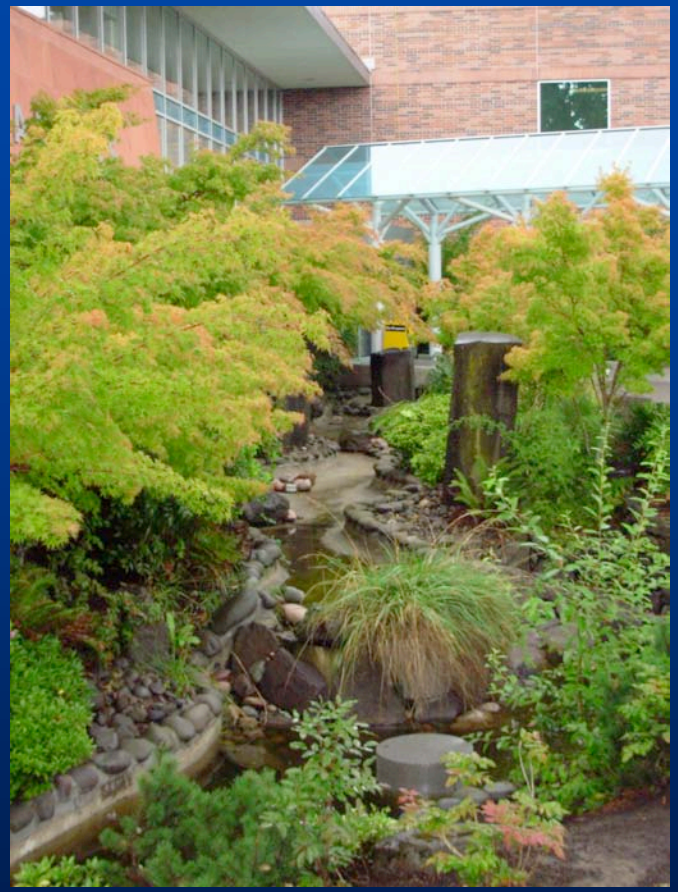

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Kaiser Permanente Salmon Creek Medical Office

Subjective Impressions

- All of the above-ground features of the stormwater facility were intact and appeared to be well maintained.
- The facilities probably do satisfy the design objectives.
- No basis for judging the performance of specific processes (e.g., detention, sedimentation, infiltration).

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Site #7:

CleanWater Services Water Quality Laboratory

SW Hillsboro Highway,Hillsboro

Design Objectives	• Provide a regional facility that demonstrates different approaches to integrating stormwater detention and pollutant control functions into an aesthetic site design. • Provide opportunities and information to support environmental education efforts that emphasize themes such as natural resource protection, enhancement, and restoration.
Winning Features	A contemporary building complex that is aesthetically pleasing and functional, and also contains full-scale examples of innovative stormwater management facilities (e.g., roadway drains, bioswales, trench drain, cistern, sedimentation basin, constructed wetland).

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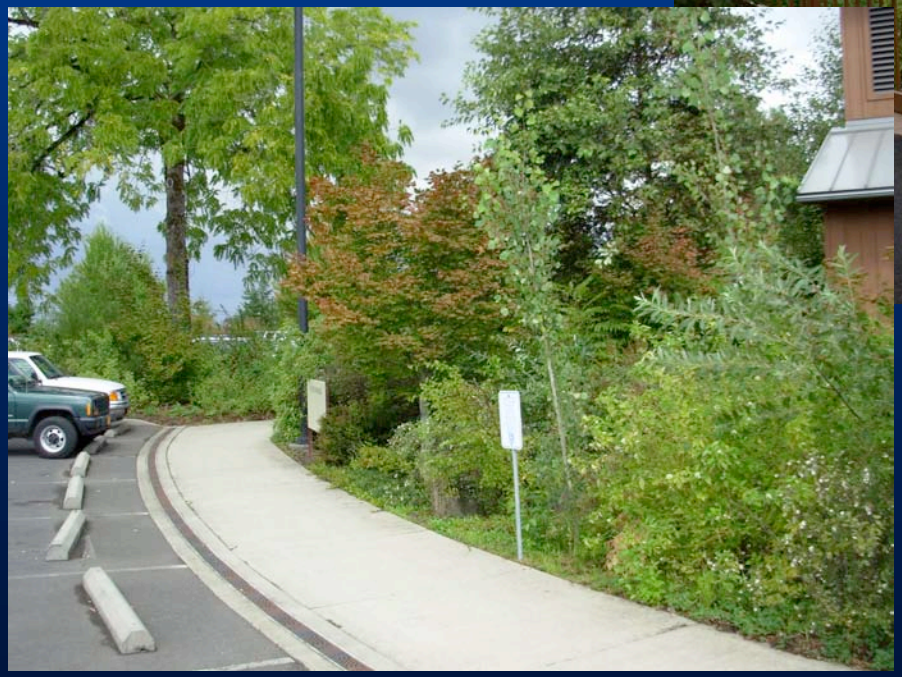

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CleanWater Services Water Quality Laboratory

Subjective Impressions	• The facilities provide good examples of diverse approaches to managing stormwater. • The facilities do not provide a basis for judging the operational performance of specific processes (e.g., detention, sedimentation, infiltration), but the design objectives did not include doing so.

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Site #8:

OHKA Light Industrial Development

NW Schute Road, Hillsboro

Design Objectives	**Demonstrate how landscape and stormwater management goals and features can be integrated into industrial development.**
Winning Features	**A 400-ft long, grass-lined swale that conveys runoff from a 16-acre industrial site to a 10,000-sq ft detention pond.** **The pond is surrounded by dense stands of native vegetation (e.g., wetlands plants, shrubs, trees).**

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OHKA Light Industrial Development

Subjective Impressions

- The facilities provide tangible, full-scale examples of several types of facilities for managing stormwater.
- The facilities probably satisfy the design objectives.
- The facilities do not provide a basis for judging the operational performance of specific processes (e.g., detention, sedimentation, infiltration), but the design objectives did not include doing so.

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Site #9:

Oregon Museum of Science and Industry

SE Water Avenue, Portland

Design Objectives	• Collect, convey, and infiltrate parking lot runoff. • Control oil, litter, sediment, and other pollutants. • Demonstrate the performance and practicality of innovative stormwater BMPs that could be applied in many locations. • Support BES's and OMSI's efforts to educate the public about its roles and responsibilities re: environmental problems.
Winning Features	Biofiltration swales within the parking lots function as small-scale linear wetlands. Runoff-borne pollutants are removed through a combination of processes (e.g., sedimentation, adsorption, plant uptake, filtration, and soil uptake).

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Oregon Museum of Science and Industry

Subjective Impressions

- The wetlands vegetation looked a bit ragged.
- Sediments appear to be clogging surface gravels.
- It is likely that the facilities still do satisfy the original design objectives.

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Site #10:

Heritage House Residence

NW Mc Kenna Drive, Portland

Design Objectives	• Achieve a degree of on-site management of stormwater that complies with municipal code requirements. • Avoid the problems of infiltration that commonly occur in steep terrain.
Winning Features	• Below-ground stormwater collection tank (500 gal). • Above-ground stormwater storage tank (2,500 gal). • Interconnecting piping, pump, and irrigation system. • Percolation tiles that foster infiltration.

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Heritage House Residence

Subjective Impressions

- The innovative stormwater management system made it possible to develop a large home on a very difficult site.
- No basis for judging if the storage volumes are adequate to manage all stormwater from typical storms.
- No basis for judging if the amounts of stored water constitute a significant fraction of the irrigation demand.

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Site #11:

Melrose Street Roadside Improvements

Melrose Street, Lake Oswego

Design Objectives	• Address problems of widening a street that was street bounded by a roadside ditch in poor condition. • Re-align and stabilize the stream channel to control bed and bank erosion. • Enhance open space and habitat values. • Improve water quality. • Enlarge and enhance adjacent wetland area.
Winning Features	A "new" stream that looks fairly natural, supports desired riparian and wetland functions, supports diverse wildlife, and reliably conveys stormwater.

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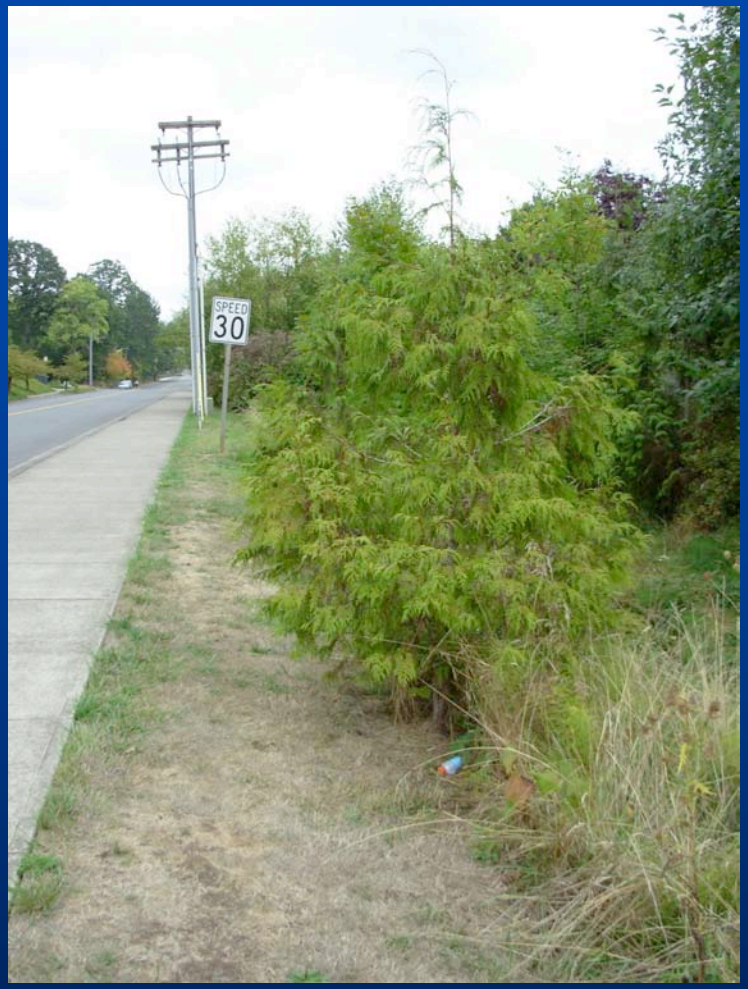

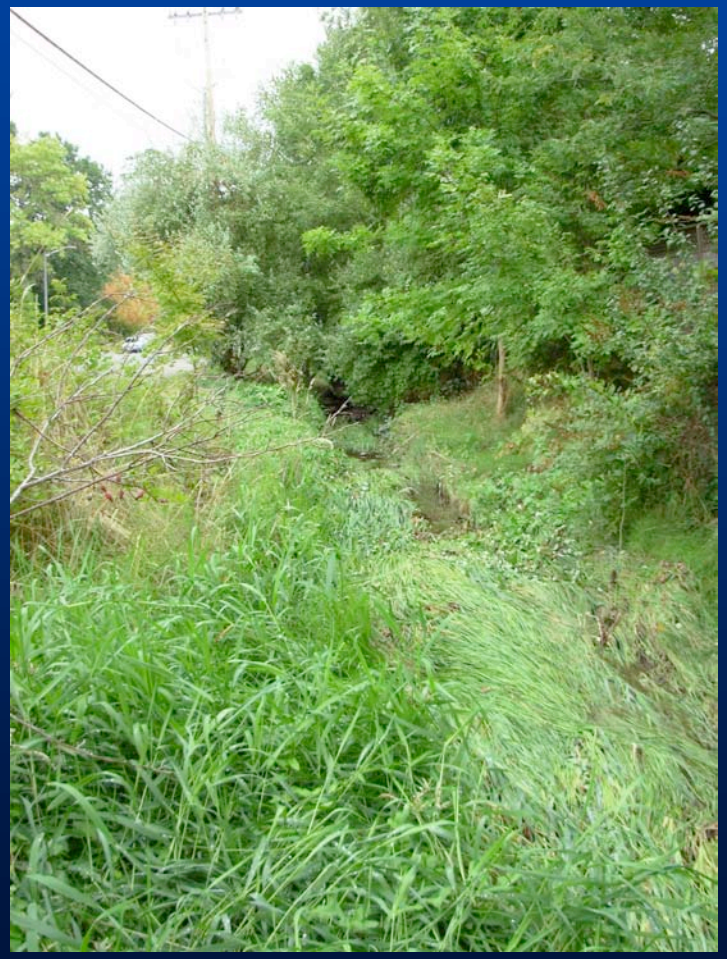

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Melrose Street Roadside Improvements

Subjective Impressions

- The project facilities are clearly improvements over the degraded street and roadside ditch.
- All of the in-channel and streamside improvements look natural enough to make them un-noticeable.
- The 1200-ft long stream receives a significant year-round baseflow that is contributed by numerous springs in the up-hill neighborhoods. The water from the springs supports dense stands of vegetation and keeps the stream clean and cool.

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Site #12:

Metro Solid Waste Transfer Station

South Station, Washington Street, Oregon City

Design Objective	**Protect a downstream pond from pollutants that are contributed by stormwater runoff that drains from the transfer station site.**
Winning Features	**A sedimentation chamber and an innovative stormwater filter that employs a granular filter media that is made from composted leaves. Such systems have been found effective in removing fine debris, fine sediments, some heavy metals, and some petroleum derivatives.**

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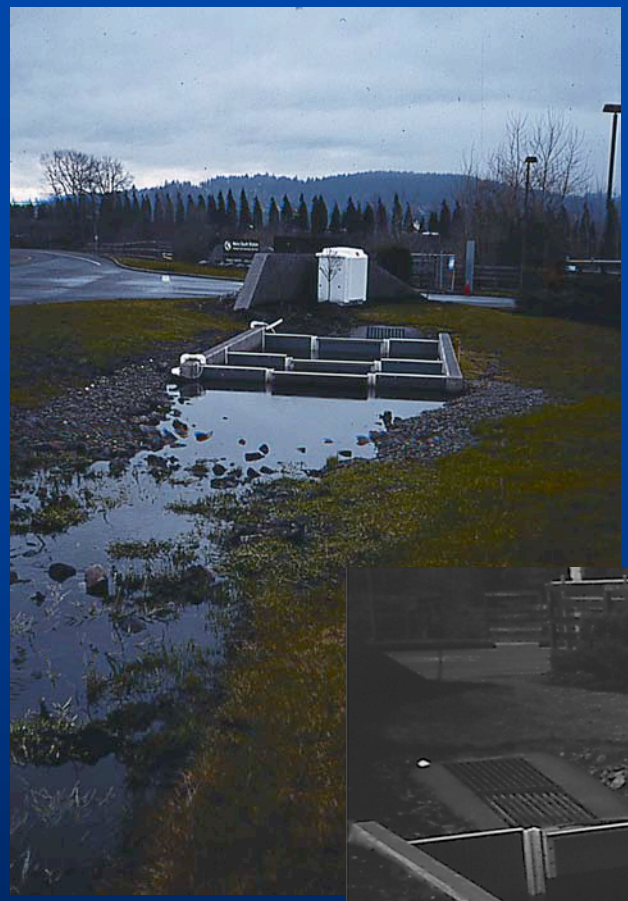

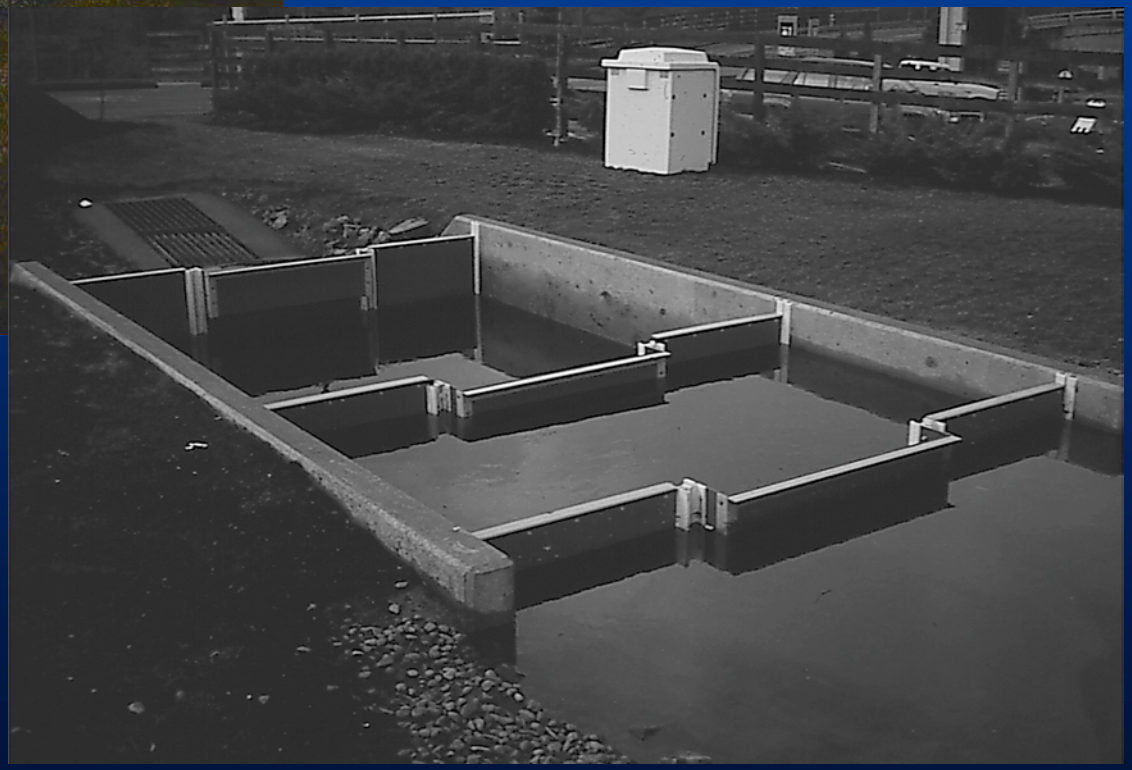

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Site #12:

Metro Solid Waste Transfer Station

Subjective Impressions	**The sedimentation cell and the filter cell both contained significant amounts of sandy silt and weeds, presumably indicating the need for maintenance. Routine maintenance of such units involves removing the sediment and replacing the pelletized filter media.**

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Questions Raised by Visits to Twelve Sites

Sustainability?	**How long will the SW facilities function as intended?**
Life-cycle costs?	**What will be the cost of keeping them functional?**
Overall practicality?	**What would the designers/owners do differently?**
Apply Adaptive management?	**How might one implement a program of regular inspection, testing, maintenance, repair, and refinement?**

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Take - home Lessons:

- We have done pretty well, to-date, considering how little we knew in the 1990s and how little guidance was available.
- We need to get clear about the difference between what we know and what we think.
- We need to develop the insights and tools that will lead to stormwater BMPs that will function as intended for decades.

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Now We Need to Move Forward

- **Clearly define the linkages between BMP <u>design</u> and actual <u>performance</u>** (re: explicit objectives).
- **Explicitly consider the relationships between BMP <u>performance</u> and <u>life-cycle costs</u>.**
- **Explicitly consider the relationships between BMP <u>performance</u> and adverse <u>side effects</u>.**
- **Build BMPs that will function as intended for decades** (i.e., by supporting necessary maintenance, repair, inspection, testing, and refinement activities).

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Steve Fancher

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Stormwater Facility Ownership

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- Ownership" = O&M Responsibility
- Public vs. Private, Homeowner vs. HA
- Criteria Varies Between Jurisdictions
- Cost of Public vs. Private Ownership
- Paradigm Shift to LID = More Private Ownership
- Public Awareness/Education
- Enforcement of Private O&M

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Hawthorne Ridge Subdivision Swales- Public O&M

Mill Pond, Forest Heights Subdivision- Private Homeowner's Assoc.

BES Water Pollution Control Lab (6543 N. Burlington)

Glencoe Elementary School (825 SE 51st)- Public

Glencoe Elementary School Parking Lot (825 SE 51st)- Private

Portland State University Planters- Private

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Flow-through planter test in New Zealand

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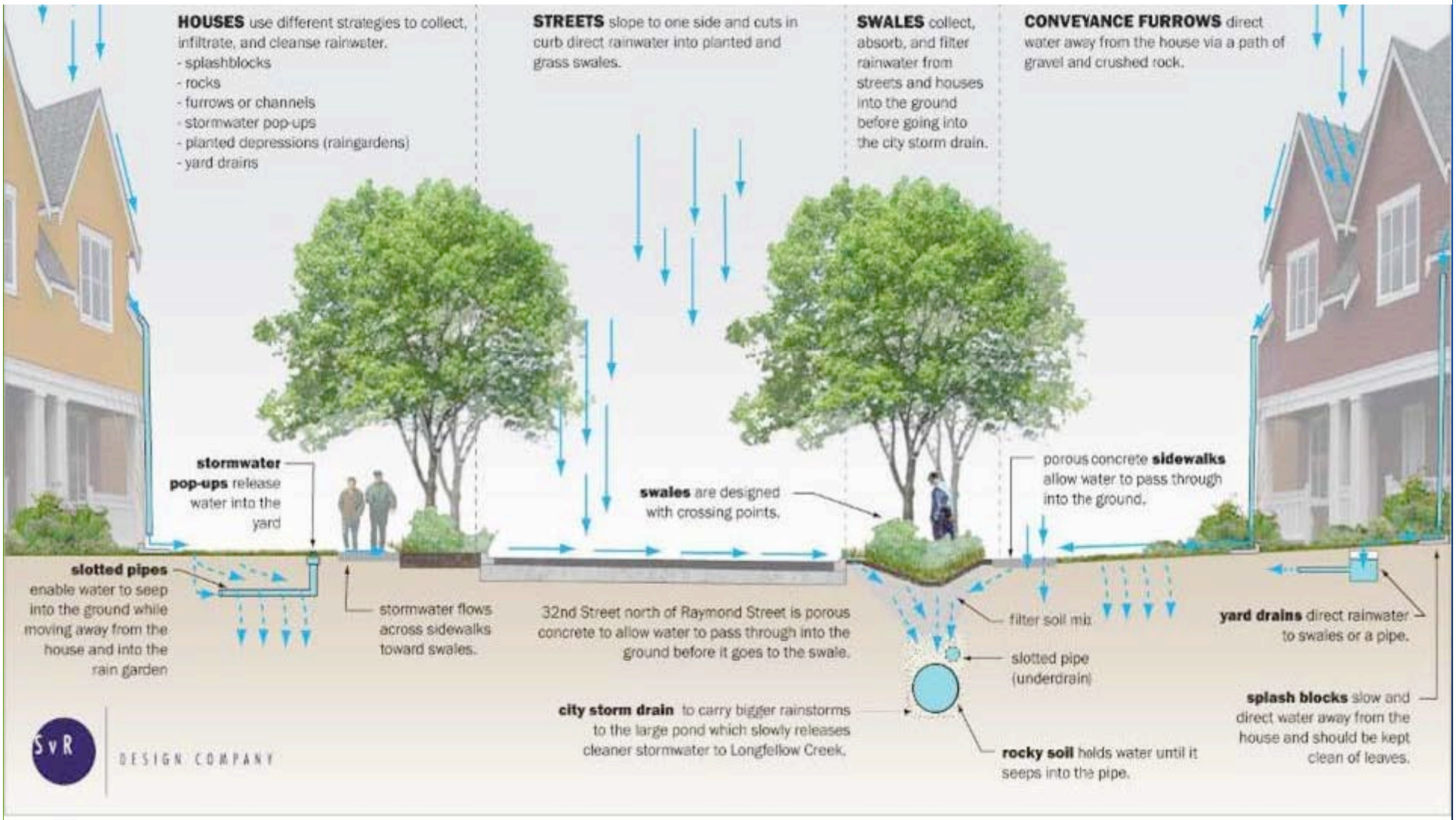
Buckman Heights infiltration basins (430 NE 16th Ave.)- Private

Hamilton Apartments Ecoroof (1212 SW Clay St.)- Private

Green Streets



NE 35th & Siskiyou Curb Extension Swales

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New Columbia Pocket Swales

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Westmoreland Porous Streets

SW 12th & Montgomery Street Planters

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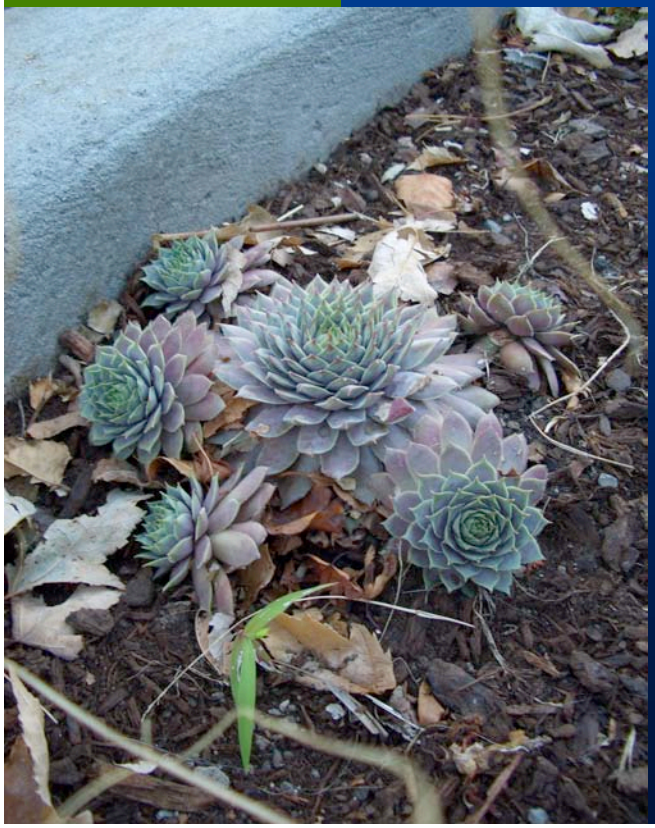

SE 21st & Tibbetts (Peoples Co-op)

Summer/Fall 2006

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Mike Faha

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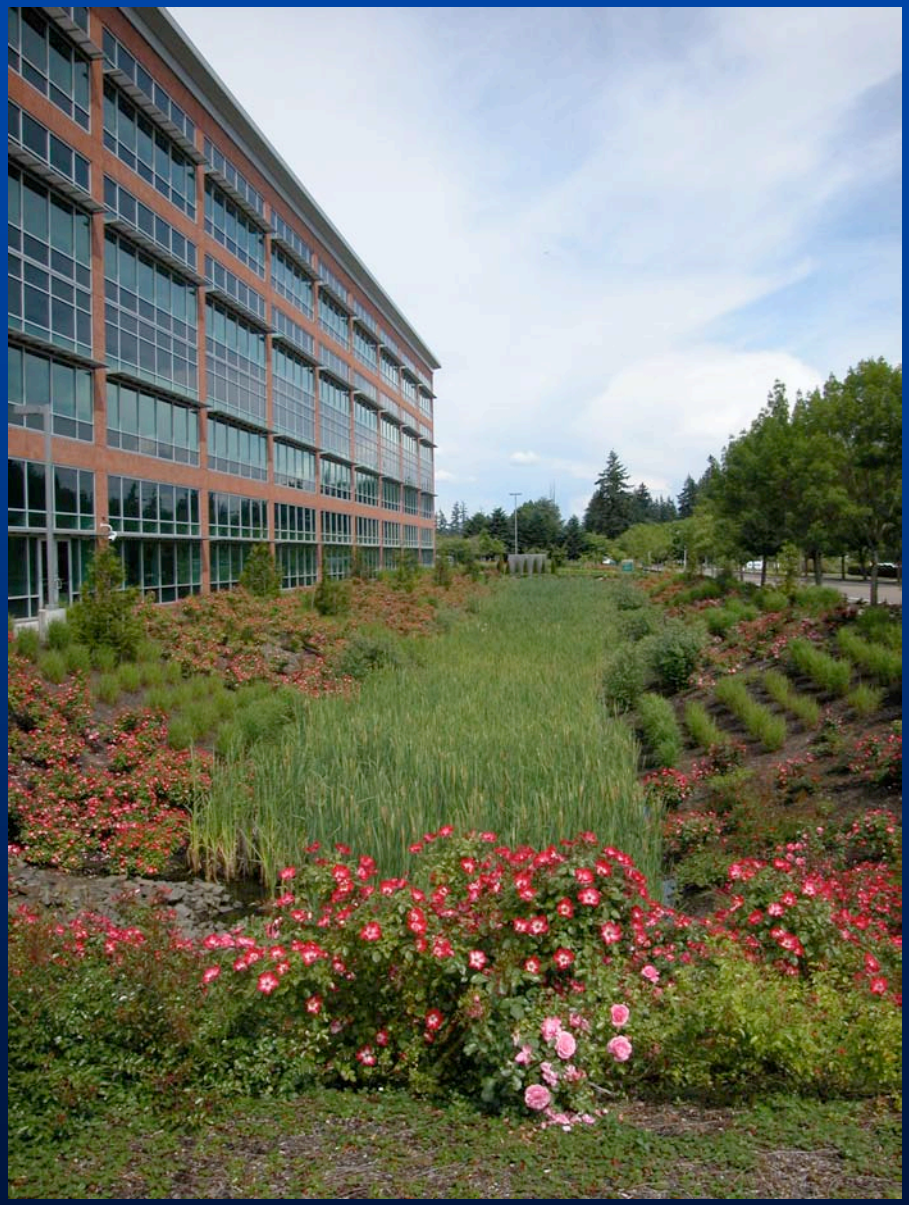
Suburban



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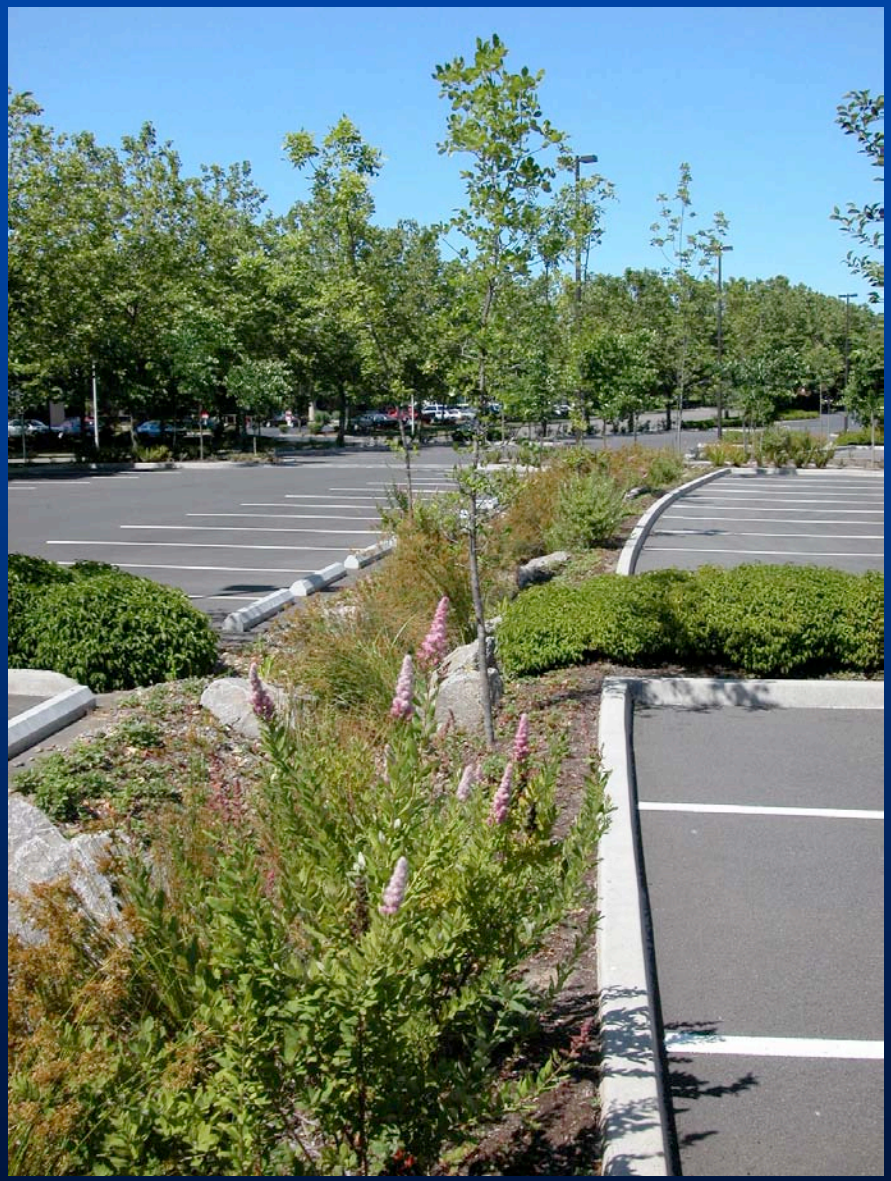
Suburban



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Infill

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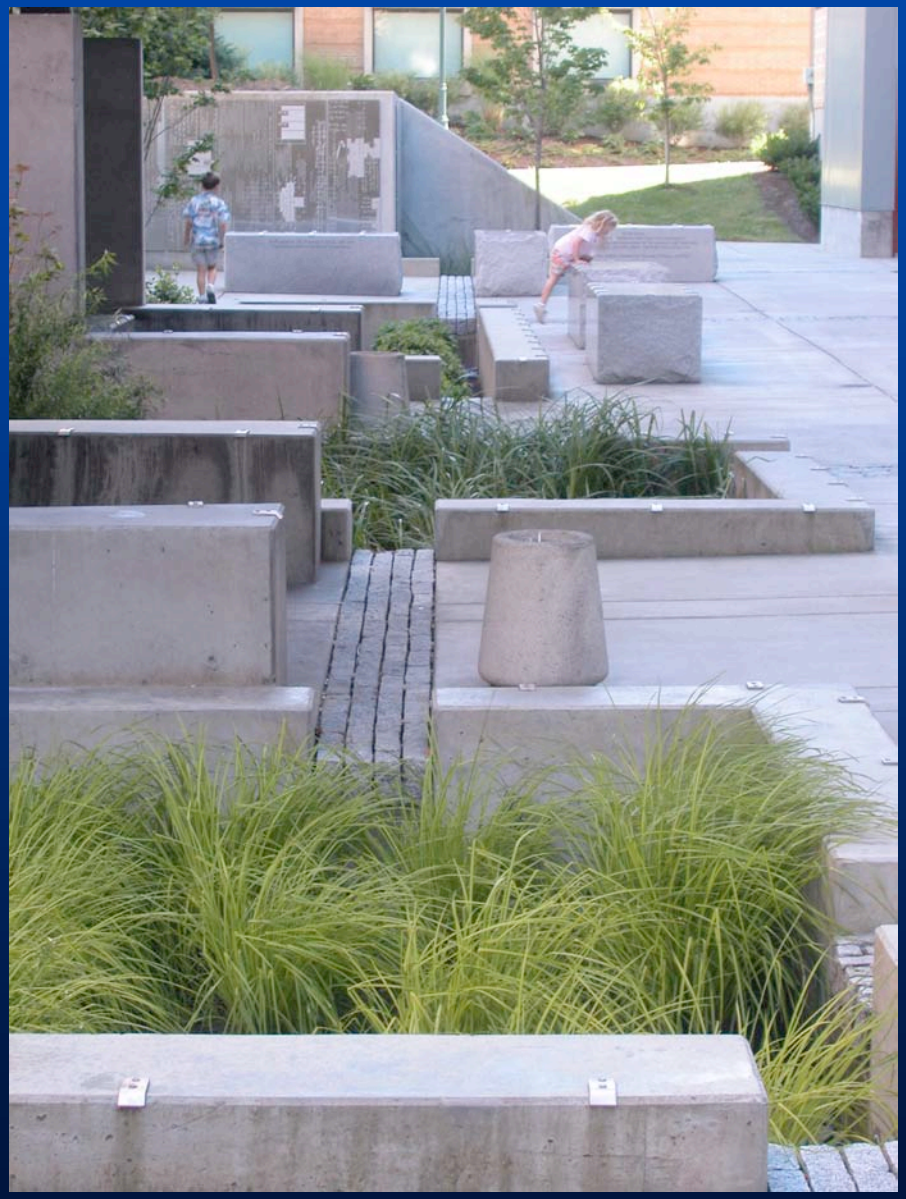

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Retrofitting Parking Lots

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Artistic Elements

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Artistic Elements

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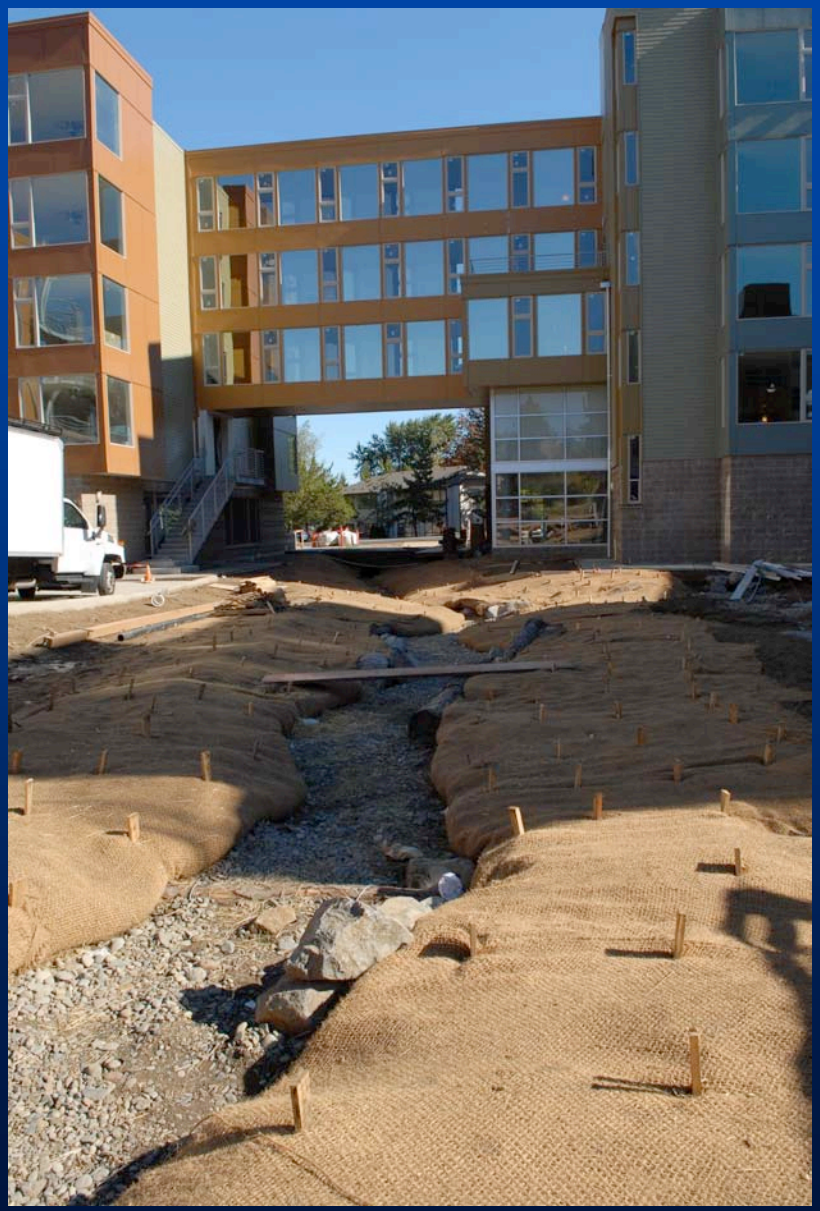
Multiple Objectives



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Green Street Solutions

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Difficult Conditions

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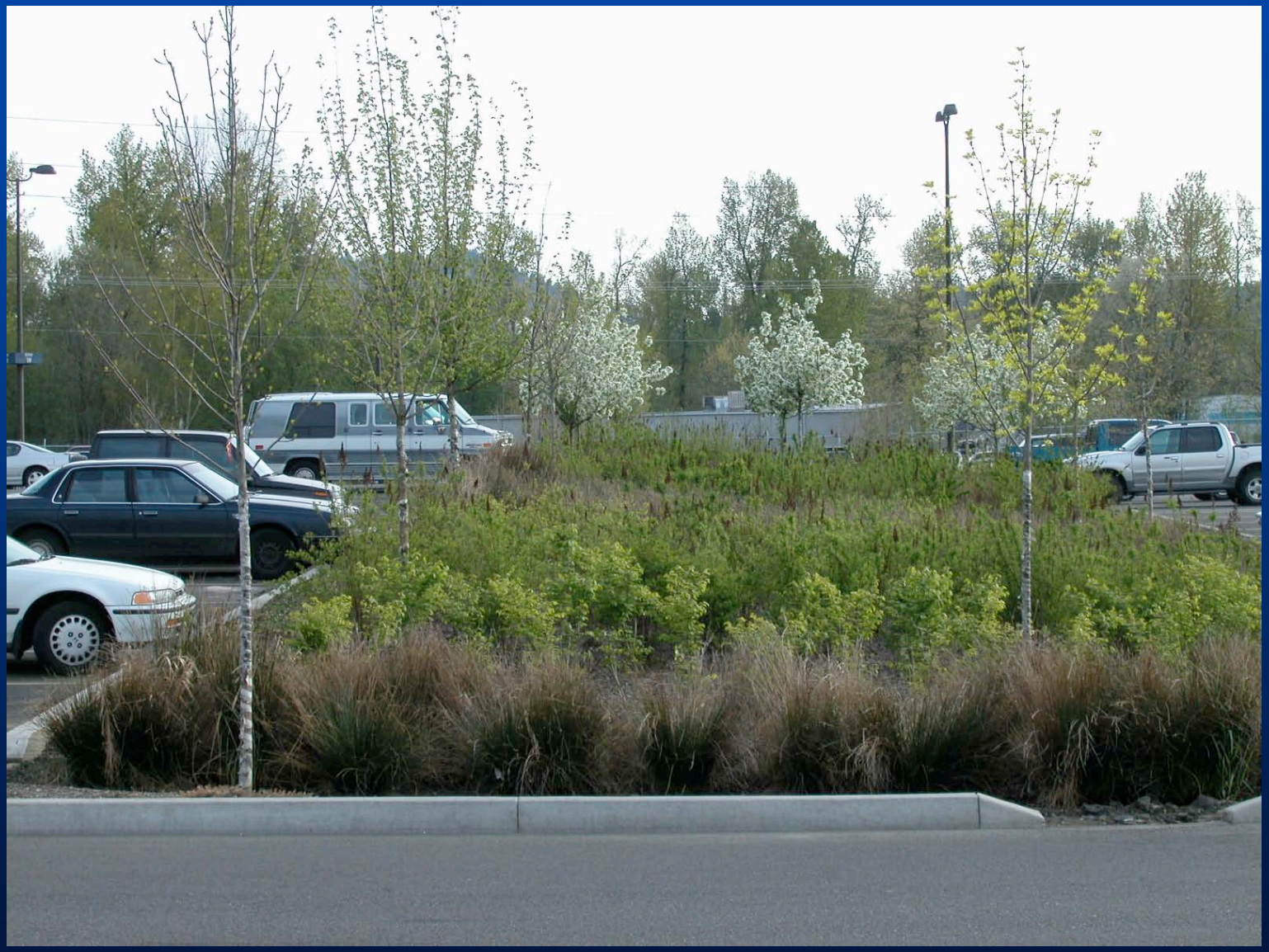

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Greenroofs

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Porous Pavement

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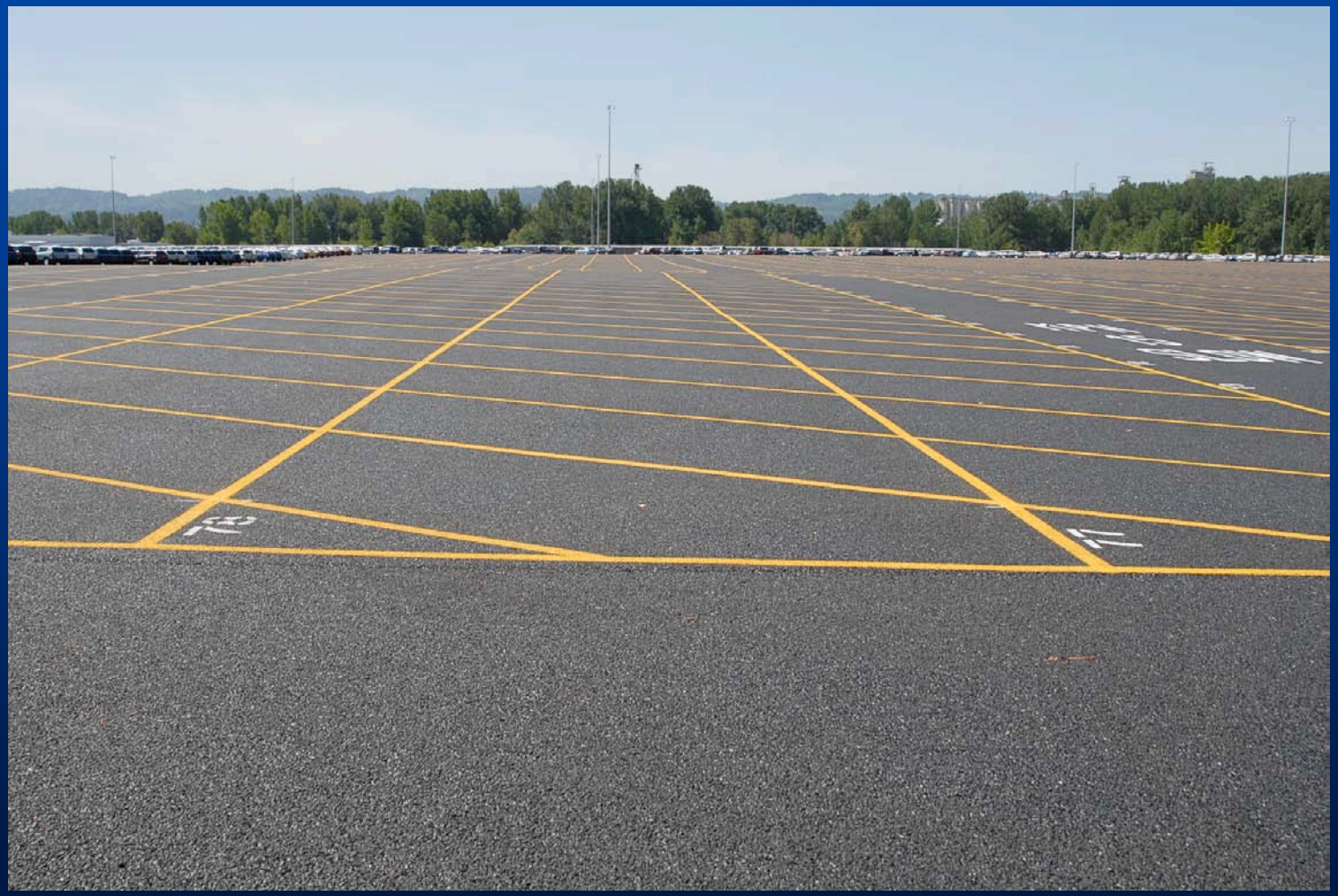

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Shared Facilities

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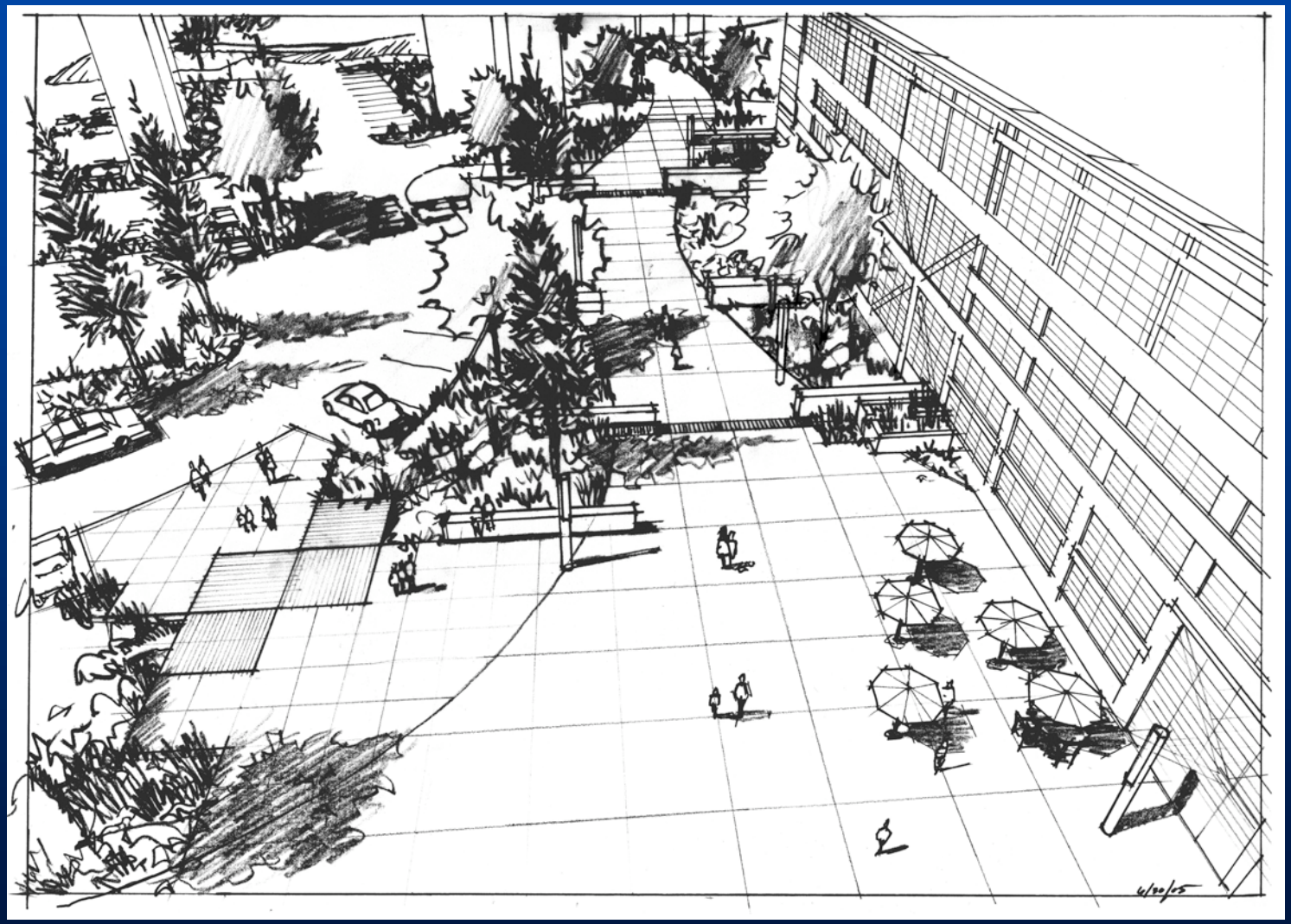

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Small Scale

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Neighborhood Scale

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Consistency, Complexity 2 key points:

- need to define "work" and need consistency between jurisdictions
- need to think more about complex natural systems and design projects to mimic that.

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Kendra Smith

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Nancy Kraushaar

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Dave Felstul

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Amanda Fritz

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Dennis Wilde

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