Landscape Stormwater Strategies – A Practical Design Workshop

Designing, Building and Operating for Success

Planning, Design and Permitting for Natural Drainage Systems,
and
Integrated Landscape Design for Stormwater

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Our Region's Natural Drainage Systems Programs

Washington State Dept. of Ecology, Counties and Cities

The challenge is to try to make this…

develop like this, and …

……function like this

What makes natural drainage strategies different?

- Collaboration is a necessity
  - Owner, design team, AHJ
  - Contractor involvement
  - Maintenance involvement (if known)
- Think differently
  - Get stormwater "out of jail"
  - Let it disperse/go back in
  - Re use (pros/cons)
- Site design
  - Layout
  - Space needs
  - Dual function
  - Use of open space
  - Trade offs (pro underground still exists)
- Cost shift
- Expectations
- Maintenance

Selling the project- How and to whom?

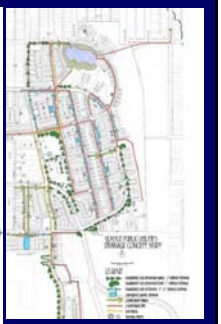
Words mean different things to engineers, landscape architects, planners, architects, regulatory staff, contractors, owners, developers, builders and real estate agents.

AND **Concepts read** differently - are you a hiker, hunter, fisher, farmer, shopper, and/or gardener???

wet integration disperse **porous** filtration convey perforated swale gravel trench **discharge** **absorb**

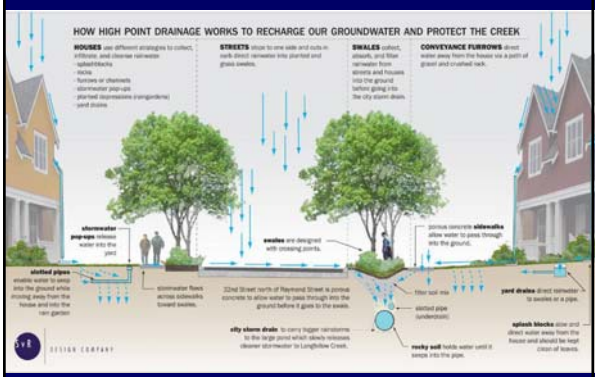
- Semantics cause iterative discussions on **what these terms actually mean**
- Understanding terminology affects construction bid prices, property values, expectations, and maintenance
- These are not minor considerations!

Case Study: High Point Redevelopment, Seattle, WA

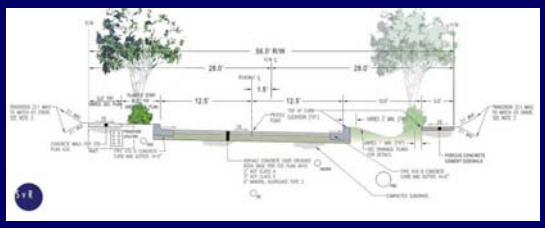


15,000 lineal feet of swales

120 acres; 1,600 housing units, neighborhood center, library, and mixed-use
Density ranges from 16 units/acre to 25 units/acre of ground-related housing

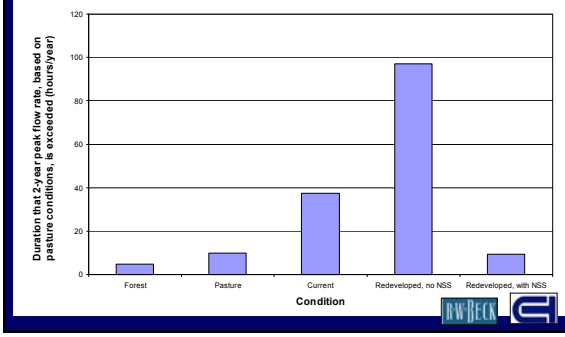


Developing Cross Section & Swale Length



- The cross sections for the NDS swales were developed through discussions with various City of Seattle departments (decisions by inches)
- Street widths: 25 feet/56 right of way; 28 feet/56 ft rw; 32 feet/60 ft rw
- Curb height, swale width, street tree locations, berm locations, side slopes, bottom width, etc. were established
- Porous sidewalks on the swale side

Case Study: High Point Redevelopment, Seattle, WA Comparison of Flow Duration



High Point Drainage Criteria

- Water quality treatment: 6 month storm
- NDS combined with the stormwater pond detain and match duration up to the 2 year, 24-hour storm assuming pasture conditions
- Piped conveyance sizing for 25-year storm
- Site drainage distributed at the block scale
- Peak flow control for 100 year storm (0.5 cfs per acre)
- Conveyance of dam safety flows downstream of storm water pond
- Note: Seattle tends to get drizzle versus the high intensity storm event. Ex. 100 year storm event is 3.84 inches/24 hour

Permitting the Project : Who approves what and when?

One Example: High Point Basis of Drainage

Master Use Permit
- Concept Approval by City

Plat
- Recorded Lot level requirements (subdivision)County

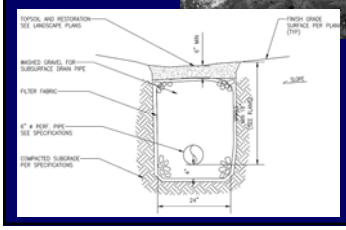
Building Permits
- by City for each separate Parent Lot development a plan identifying approach to meet the plat drainage thresholds.

Drainage thresholds for each lot in the plat.
- 60% impervious average for subdivision (15% to 70%)
- Downspout dispersal minimum requirements (0% to 100%)
- Designated NDS discharge points (to the swales)
- Soil amendment
- Multiple strategies to meet requirements

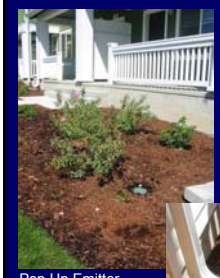
Drainage Covenant defined the regulatory and plat requirements
Site Drainage Technical Standards for permitting private development and long term site conditions
Maintenance Association of natural drainage landscape, open space and rights of way. City shares cost. **Maintenance Guide**
Memorandum of Agreement between the City and the Association

Natural Drainage Strategies - Block-level Design

- Porous pavement
- Swales and Conveyance furrows
- Dispersal trench
- Rain garden
- Pop-up emitter



High Point Natural Drainage Strategies
Housing: Block-level Design



Pop Up Emitter

Gravel Pave

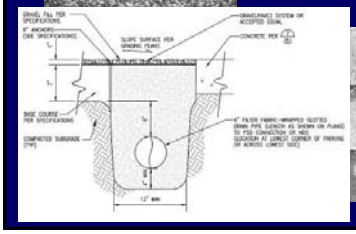
Splash Blocks

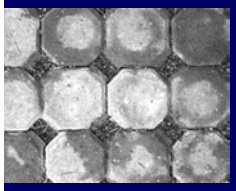
Swales – Use in Natural Drainage Systems
What are they? A non- technical view

Swale	Flat Bottom Depression
Ditch	Deep- cut steep side slopes
Conveyance Swale	Purpose to move water (temp vs permanent)
Bioswale	Engineered vegetated swale: cleans water
Bioretention Swale	Vegetated: infiltrates & cleans water
Natural Drainage Swales	Engineered system with amended subsurface soil layer
Raingarden	Organic shaped depression with amended soils and plants to soak up and retain water. Typically has overflow.
Stormwater planter	More structural to complement building- functions as retention to reduce stormwater discharge. Planted
Furrow	Small conveyance swale
Dispersal or Infiltration Trench	Underground washed rock or gravel to spread out flows

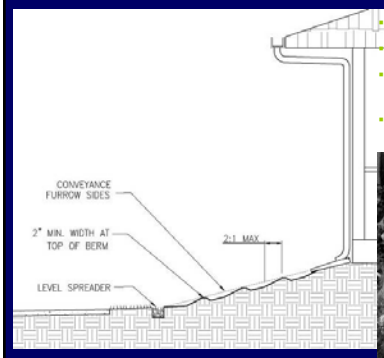
Natural Drainage Strategies – Porous Pavement

- Porous pavement materials - multiple choices
- Drainage through surface material
- Porous sub-base
- Perforated pipe to NDS or PS
- Full credit as pervious area



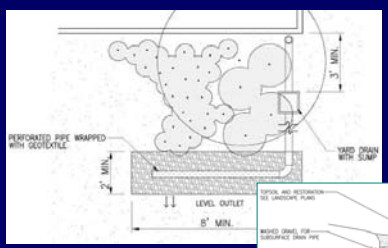


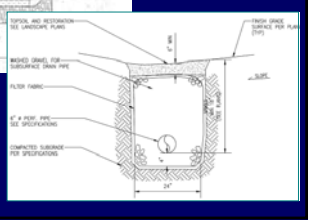
Natural Drainage Strategies – Conveyance Furrows



- Downspout dispersal
- Directs flow to NDS
- Berms and check dams to reduce velocity
- Level spreader reduces concentration at walks

Natural Drainage Strategies – Dispersal Trenches



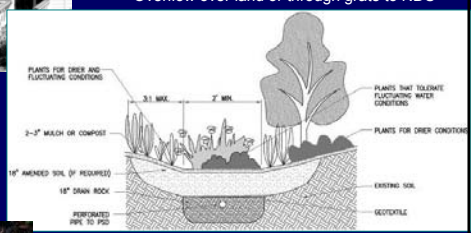


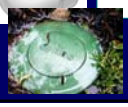
- Gravel or sod covered
- Spreads flow of large storms
- Infiltrates small storms
- May connect to PSD

Natural Drainage Strategies – Rain Gardens and Pop-up Emitters

Rain Gardens:

- Small storm detention
- Overflow over land or through grate to NDS





Pop-up:

- Releases flow away from building

Pop Up Emitters

- Placement for dispersal
- Initial protection required until landscape is installed

High Point Revitalization Project

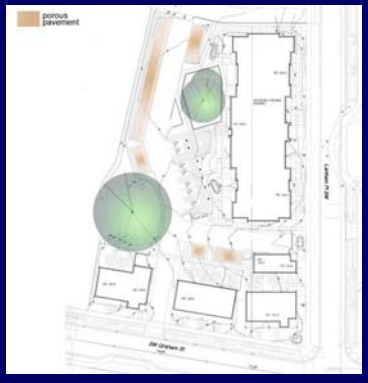
Phase I
under construction,
October 2005

Block-level Drainage Design

Block-level Drainage Design

Each block uses site-specific drainage strategies

Block-level Drainage Design

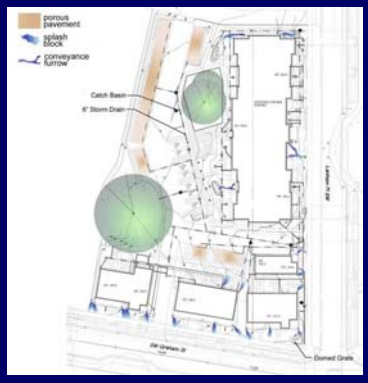


- Each block uses site-specific drainage strategies
- 62%- 70% allowable impervious
- 50% of roof area drainage dispersed
- Porous pavement

Block-level Drainage Design

- Each block uses site-specific drainage strategies
- Porous pavement
- Splash block
- Conveyance furrow

Block-level Drainage Design



- Each block uses site-specific drainage strategies
- Porous pavement
- Splash block
- Conveyance furrow
- Integrated utilities

Block-level Drainage Design

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- Dispersal trench
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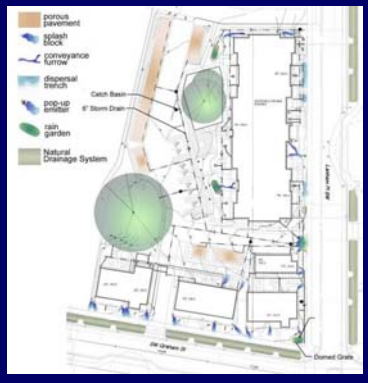
- Rain garden

Block-level Drainage Design



- Each block uses site-specific drainage strategies
- Porous pavement
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- Integrated utilities
- Dispersal trench
- Pop-up emitter
- Rain garden
- Adjacent NDS

Block-level Drainage Design

- Each block uses site-specific drainage strategies
- Porous pavement
- Splash block
- Conveyance furrow
- Integrated utilities
- Dispersal trench
- Pop-up emitter
- Rain garden
- Adjacent NDS
- Lot drainage to NDS

High Point: Frequently asked questions.

- **What would you change?** *Not a simple answer. Ideally you would reorient the site plan (grid) to follow topography however that orientation might not work best for blending with the neighborhood. It is not all about drainage.*
- **How do you deal with tight sites?** *High Point is a big project with lots of small projects. The housing sites are tight. It takes more strategies and attention to grading, drainage flow pattern, footpaths, watch for those "closed areas" that don't give the water a way to get out. You have to achieve amended soils or you will have soggy yard syndrome.*
- **How do you permit it?** *Short answer: lots of discussion with AHJ. Note: the codes are changing, it will get easier.*
- **The engineer we are working with won't do it?** *Keep talking to them.*
- **How do you keep the site dry?** *Expectations need to change, to allow the water to get back into our ground we need to let the ground get wet.*
- **Why do you still have a pond?** *The pond manages larger storms. The natural drainage approach at High Point manages small storms (2 year and less)*

High Point Natural Drainage Project Recognition:
Seattle Housing Authority
Seattle Public Utilities

Other agencies:
Washington State Department of Ecology
US Department of HUD
Seattle Department of Planning & Development
Seattle Department of Transportation
Seattle City Light

For more information:
pdf of High Point Site Drainage Technical Standards (design ideas for drainage strategies on housing sites)
www.svrdesign.com and
www.seattle.gov/util/naturalsystems

SVR DESIGN COMPANY

Consultants:
SvR Design Company-
Civil Engineering Natural Drainage
and Right of Way Landscape Architects
Mithun
Planning Lead and Team lead
Rental Architects and Landscape Architects
Nakano Associates Rental Housing Landscape Architects
Streeter Associates- Block 8/9 Architects

Resource consultants:
Greg McKinnon at Stoneway Concrete
Jim Powell at NW Chapter ACPA
Cedar Grove Compost
Shannon and Wilson

32nd Ave SW & NDS Contractors:
Gary Merlino Construction Company
T. Yorozu Gardening Co.
Subs to: Absher Construction Co.

Natural Systems

Finding a common language
(bring your discipline and
experience to the table.
"like a good pot luck")

Natural Systems

- Respect for other disciplines, their knowledge and experience.
- Design construction, maintenance.
- Ask questions
- Answer questions
- Trust (sometimes the answer is not what you wanted)

Some Example Projects

Broadview Green Grid

Kitsap County Administration Building

Drawing courtesy of Miller|Hull

Design Team: Miller/Hull, SvR, Site Workshop, Myers Biodynamics, Abacus

Kitsap County Administration Building

Concept 2003

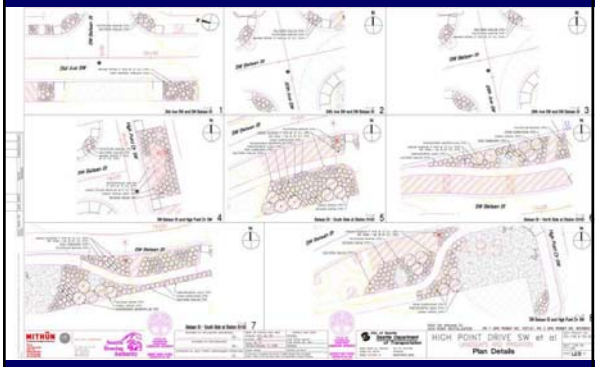
- Urban Redevelopment
- Green roofs for runoff control
- Cisterns
- Rainwater harvesting for landscape irrigation

Construction, Fall 2005

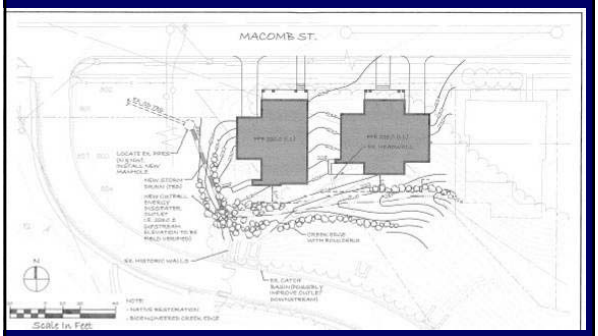
Drawings and Construction Documents

- Natural systems may require a rethinking of the order of drawings
- We may need more details
- Specifications –jeepers they need to be read
- Interdisciplinary- yet who stamps what ?? This is a real issue
- Who is in charge of construction?
- How do these issues apply to different projects?
  - Residential
  - Commercial
  - Parks
  - Public

Details, Details, Details: What not to forget!



Design Communication- Concept Development and Permitting



Design Communication- Concept Development and Permitting

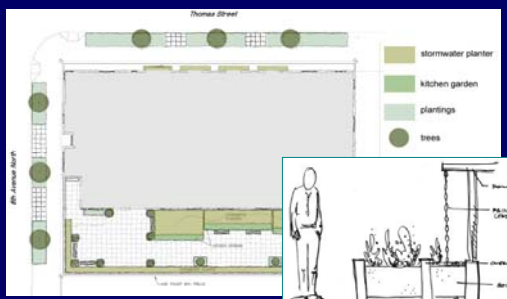
- This is the phase where ideas are discussed
- Concepts are developed
- Permit issues are evaluated and designs either
  - Modified to fit current requirements
  - Agency approached for alternative approval
  - Design Team decides to further study
- All site related disciplines should be involved in the design approach. Discussion should address design, permitting, construction and maintenance
- Why the reluctance to a more natural approach? Is it is the delivery, tone, discipline, fear or ??? We need to keep trying. The answer is not a specialized firm, the answer is getting more people to understand NDS as the way to do land design.

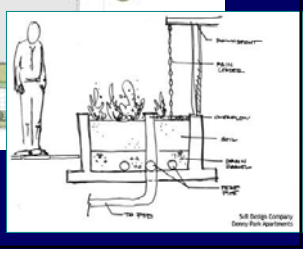
Natural Drainage and Concept Development

New homes on an historic hillside.

It Takes a Team: landscape architects, architects, engineers, historians, arborists, hydrologists, surveyors, owners, neighbors

Seattle: Denny Way Apartments: Concept 2003-04





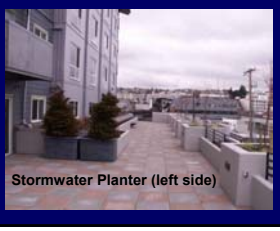
- Stormwater planter prototype for runoff control
- Amended soils to attenuate runoff

Seattle: Denny Park Apartments : January 2006



Planters have a double liner, an impermeable membrane and a vertical drain. Approximately 18 inches of soil overlays a gravel sub base.

Seattle: Denny Park Apartments : January 2006

Stormwater Planter (left side)

Stormwater Planter (north edge)

Note soil level / overflow drain height mistake

Seattle: Denny Park Apartments: January 2006


Engineered Soils

Review plant density – denser planting makes for quicker canopy closure and less trampling

The Challenge of Balance

We use our land for many activities. Natural Drainage is not always the driver of the design, so it is important to use a variety of strategies to achieve the desired goal.


Vine Maple
Autumn Brilliance Serviceberry


Hinoki Cypress
Calocedrus decurrens
Incense cedar
Thuja plicata
Western red cedar
Pinus contorta
Shore pine


Purple-
Leafed
Hazelnut
Diane Witchhazel


Strawberry Tree
Native Rhododendron


Mahonia
Evergreen Huckleberry


Red-Twig;
Yellow Twig
Dogwood

Red Currant

Daylily

Polystichum munitum

Lupine

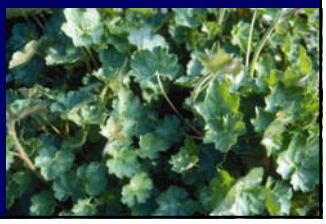
Douglasiana Iris

Ribes

Purple Place Heuchera

Frageria

Coral Bells



Helictrochitron

Tree Protection- A long term enforcement

Trees 234 & 237

High Point: Tree Protection

- Arborist evaluation
- Valuation posted
- Critical root zone fencing
- Contractor education/ incentive
- Utility boring

Lawson Cypress and Big Leaf Maple Trees 228 and 289

Tree Protection – Critical Root Zone

- Maintaining room for tree to grow
- Protected area can assist with TESC
- Maintaining natural drainage flow
- Restoration of area
- Discuss what is appropriate for planting in the CRZ

Tree#1 Sequoia

High Point: Tree Protection - The Exceptional Tree

This is a must save – leave curb; leave foundation under redevelopment

Red Oak- Tree #784

Franchise and Electrical Utilities

Right of Way is usually a busy place underground
(note this same issue applies to private property - **call before you "design"**

Ground covers preferred, but check in on maintenance

Before

After

- Change: was lawn now is ground cover – multiple benefits

Opportunities

- Look for conditions that allow stormwater to be collected and flow by gravity to a location that allows
  - Dispersal
  - Percolation
  - Filtration
  - Storage

Natural Drainage Strategies Lessons Learned

- Learning curve for both designers and permitting agencies
- Owner/Developer understanding of differing site constraints
- Broad tool kit necessary for site plan treatments
- Contractor information, discussion, ideas. (keep an ongoing dialog)
- Temporary sedimentation and control approach and sequencing
  - This takes collaborative discussion of all disciplines - not just civil.
- Fine grading for site contractors or under the landscape contractors
- Commissioning for sites
- Expect to answer questions- (Why are you doing this?)
- Expect to make adjustments

Why Natural Drainage?

- Demonstrated results
- Installed examples now common place
- Accepted practice with many jurisdictions
  - Accepted treatment by the public (if you explain it)
- Retrofit is an option
- Value added/practical

Where are we headed?

The northwest is a leader. Many states have changed their approach, and internationally this is becoming a standard. **Share your ideas** – it's a big country, and we all want to see our impact on the land change. Lessons learned can help us all - let's use the European model of an open discussion.

- Washington State DOE
- King, Snohomish and Pierce Counties
- City of Seattle
- City of Bellingham and Whatcom County

Other places to watch:

- Maryland
  - Prince Georges County
  - Center for Watershed Protection
- District of Columbia
- California Stormwater Quality Assoc.
- Milwaukee WI
- Chicago

- Puget Sound Action Team LID Technical Guidance Manual for Puget Sound:

http://www.psat.wa.gov/Publications/LID_tech_manual05/lid_index.htm