Conspicuous Hydrology: The un-tapped potentials of urban stormwater

Courtney DuChene
Freshwater only represents 1% of the total water supply on Earth and is an essential entity for life to exist. Urban development has led to pollution and degradation of this essential resource. Due to the existing urban development and lack of stormwater management facilities, water cannot be used for its natural process throughout the city (infiltration). Since urban development has implemented impervious surfaces, 70 percent of water pollution in our country comes from non-point sources such as urban runoff.

Stormwater Management

Questions:

How to implement a stormwater management system into an already existing city?

How to get society to understand stormwater as an entertainment entity rather than a utility?
Conveyance, curbing, piping, swale, filtration, green roof, constructed wetland, grass swale.

Quality, activity, Quantity, Context for learning, visibility, signage, gathering.

Portland, Oregon, Zurich, Switzerland, Los Angeles, California, Sydney, Australia.

Aesthetics, visual, line, plane, rhythm and repetition, tactile, texture, wetness.

Amenity, auditory, volume.

Recreation, view, pass by, pause, rest, play, explore.

Research Elements.
Historically and currently, the Port of Tacoma is greatly used, being the seventh-largest container port in the United States. The port is located between Mount Rainier and Commencement Bay; therefore, the residents tolerate high amounts of annual average rainfall.

Due to high amounts of infrastructure and lack of current water management in downtown, the city has began looking into more sustainable solutions to bring vegetative life back to the city.

### Annual Average Rainfall

<table>
<thead>
<tr>
<th>Location</th>
<th>Rainfall</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tacoma, WA</td>
<td>45.28&quot;</td>
</tr>
<tr>
<td>Portland, OR</td>
<td>39.02&quot;</td>
</tr>
<tr>
<td>New York, NY</td>
<td>51.59&quot;</td>
</tr>
<tr>
<td>Fargo, ND</td>
<td>39.16&quot;</td>
</tr>
</tbody>
</table>

**Why Tacoma?**
Seattle to Tacoma
Distance: 34.4 miles [30 min drive]

Site: Downtown Tacoma
Population: 200,678

Washington State
Population: 6,823,267

Northwestern USA
Central Puget Lowlands

Land was first to be logged, used for agriculture and welcomed urban forms. Biodiversity was lost due to urbanization that presented degradation to wetlands, streams and outlying landscapes.

Eastern Puget Riverine Lowlands

Point Defiance Park
Commencement Bay

Thea Foss Waterway

This watershed is the second largest covering 5,751 acres of Tacoma. It is mostly comprised of drainage basins located in south-central Tacoma and is dominantly residential and commercial infrastructure.

Western Slopes

Leach Creek [2,090 ac]
North Tacoma [4,766 ac]
Joes Creek [157 ac]

Lower Puyallup [2,971 ac]
Tideflats [2,112 ac]

North Puyallup [2,971 ac]
Northeast Tacoma [2,641 ac]

Central Puget Lowlands

Tacoma Narrows Park
Dash Point State Park

Expansive
Thea Foss Waterway / Commencement Bay

Drain larger sewer system

- 220' Tacoma Ave
- 205' Court E
- 180' S Fawcett Ave
- 160' Court D
- 135' Market St
- 120' Court C
- 90' Broadway
- 65' Commerce St
- 50' Pacific Ave

Site with Topography
'Green' Way: 3 acres

Connection through the U of W - Tacoma

Train barrier

Old RR ties

'Green' Way: 3 acres
Design Vision

This design intervention of Tacoma, WA will use the stormwater collected to create an ambiance, functioning both with high and low amounts of rainfall. This design proposal will not only implement functional stormwater management as a utility, but also add aesthetic value for the surrounding environment. Educational values will come from the viewer's mind through passive and active interaction within the site.
Program Elements

Rest: seating
Rhythm & Repetition
Pass by: trail systems
Pause
Texture
Swales
Activity
Constructed wetland
Wetness
Explore
Visibility
Plane
Line
Volume
Gather:
View:
Character:

Quality

- curbing [conveyance]: vegetated strips of gently sloping ground designed to drain water evenly from impermeable areas and filter out silt and other particulates
- piping [conveyance]: conduits and their accessories as conveyance measures or storage. Water quality can be targeted using sedimentation and filter media
- swale [conveyance & filtration]: broad, shallow channels covered by grass or other suitable vegetation. They are designed to convey, or store, runoff, and can infiltrate the water into the ground

- visibility [education]: create treatment systems that are visible and legible. Create visual interest by varying the appearance of different parts of the stormwater treatment system
- activity [education]: create designs that encourage people to explore and play near or in the treatment system

Amenity

- rhythm & repetition [recreation]: create unified design themes by using multiple bio-swales, basins, weirs, ponds, or rain gardens
- pause [recreation]: create overlooks with views of the stormwater system. Create destination points related to stormwater treatment systems
- rest [recreation]: provide seating, using walls, benches, or tables and chairs with views of the stormwater system

Aesthetics

- visual [aesthetic]: use downspouts, runnels, flumes, or bioswales to draw attention to the line of the stormwater trail, enhancing legibility as well as interest and curiosity
- line [aesthetic]: use of water-related plants such as rushes and grasses, and water-related hardscape such as river pebbles or driftwood to provide interesting surfaces
- volume [aesthetic]: create a variety of volumes by allowing stormwater to fall from various heights onto different materials such as stone or steel
- wetness [aesthetic]: allow people to touch stormwater in different forms such as flowing, falling, splashing, standing, and sheeting, or on damp surfaces where water can soak in or evaporate

- explore [recreation]: provide a variety of small and large places to play in or explore. Make areas that invite climbing and physical exploration while balancing perceptions of safety with adventure

Filtration

- green roof [filtration]: systems which cover a building's roof with vegetation. They are laid over a drainage layer, with other layers providing protection, waterproofing and insulation.
- constructed wetland [filtration]: shallow areas and wetland vegetation to improve pollutant removal and enhance wildlife habitat

Quantity

- gathering [education]: create a variety of spaces for groups to explore, gather, or sit near the stormwater management.
- plane [aesthetic]: stack horizontal and vertical planes such as pools and falls to exploit visual interest of stormwater flowing over surfaces, plunging down planes, through weirs, or over edges.
- texture [aesthetic]: use of water-related plants such as rushes and grasses, and water-related hardscape such as river pebbles or driftwood to provide interesting surfaces
- pass by [recreation]: provide paths in strategic locations that ensure encounter with the stormwater treatment system, connect on-site trails to off-site trail systems and destinations that ensure encounters with the stormwater treatment system

Context for learning

- visibility [education]: create treatment systems that are visible and legible. Create visual interest by varying the appearance of different parts of the stormwater treatment system
- activity [education]: create designs that encourage people to explore and play near or in the treatment system

Program Elements

- Portland, Oregon
- Zurich, Switzerland
- Los Angeles, California
- Sydney, Australia
Concept

Urban Filtration
Natural Interaction

Passive: Auditory
Passive: Visual
Active: Interactive

Existing
Breakdown

Existing Entrances

Visibility

Canopy

Vegetation: Filtering Visible Water

Hardscape

Stormwater Pipe System

Connections
Stage 1&2: Conveyance & Filtration

- Entrances
- Conveyance Grates
- Acoustic Walls
- Dining / Seating
- Food Kiosk
- Crosswalks
- Great Lawn
- Stage
- Stage Pergola
- Existing Sculpture Park
- Filtration Planting Beds
- Over Road Pergola
- East Entrance
- Boulevard Trees
- Boulevard View
- road
- southern
- eastern
- western
- northern
- 30 60 120
Stage 3: Natural

- Existing Pervious Parking Lot
- Existing Buildings
- Crosswalks
- Railroad Corridor: Boardwalk
- Existing Overhead Highway System
- Existing Crosswalks
- Pergola
- Stream
- Wall
- Ridge
- Stream
- Constructed Wetland
- Crosswalk to Railroad Corridor
- Railroad Corridor: Boardwalk
- Existing Overhead Highway System
Hydrology

Thea Foss Waterway / Commencement Bay

Drain

Larger sewer system

Drain

Pump

Existing 100 yr / 24 hour storm event
90,493 in/hr

Existing 2 yr / 24 hour storm event
35,139 in/hr

Implemented Design 100 yr / 24 hour storm event
65,008 in/hr

Implemented 2 yr / 24 hour storm event
25,243 in/hr

2'

3.37'

45'

40'

65,008 in/hr

90,493 in/hr

35,139 in/hr

25,243 in/hr

2'

3.37'

45'

40'

3.37'
Design Stages

Stage 1: Conveyance

Stage 1: Conveyance
Stage 2: Filtration

Stream to Wetland

12 ft Existing Wall
Stage 3: Natural

Emergent: Open Water
Dense Emergent: Shallow Water
Meadow / Lawn: Shallow Water

Wall Detail
Wetland Detail

10’
1’10”
2’10”
2’2”
Stage 4: Railroad Corridor
Questions?