GREEN PARKING SOLUTIONS

HUXLEY
COLLEGE OF THE ENVIRONMENT

WESTERN
WASHINGTON UNIVERSITY

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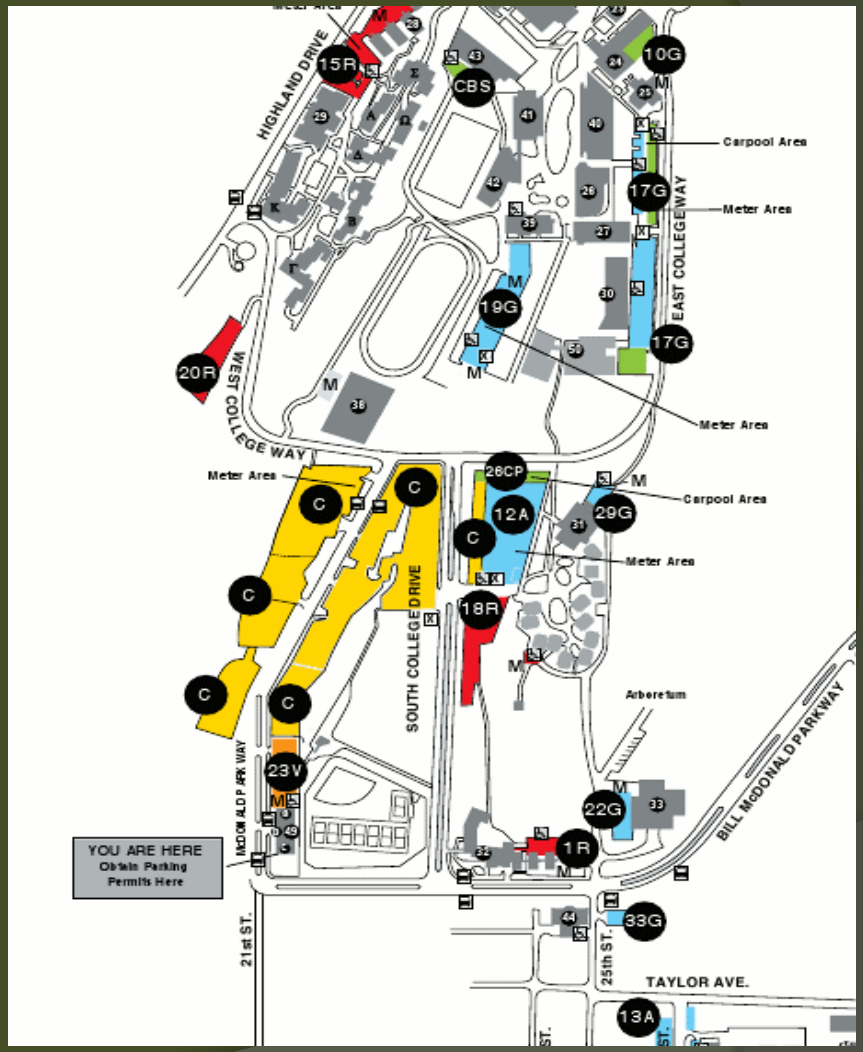
Green Parking Solutions

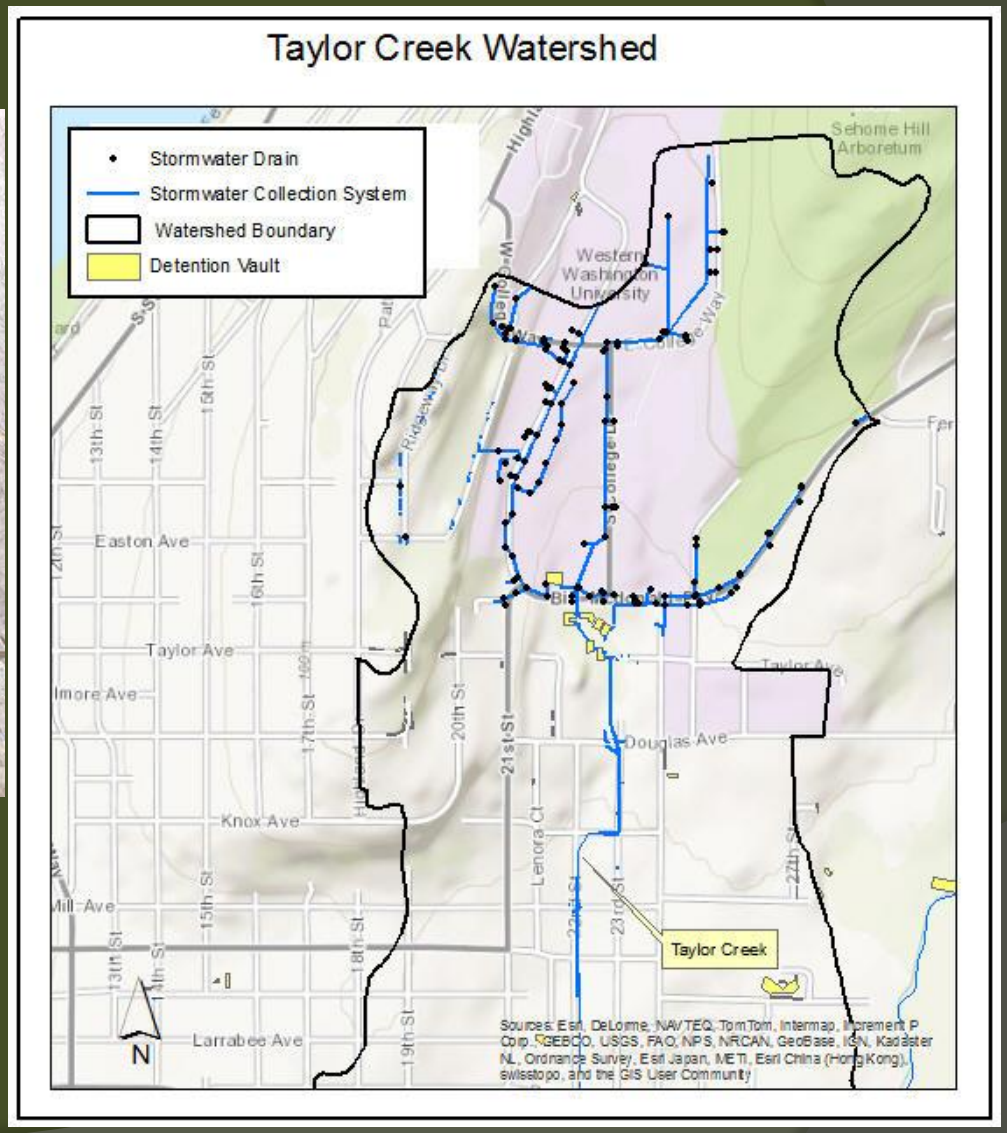
- Background/Context
- Issue
- Solution
- Pros and Cons of the Solution
- Budget/cost
- Discussion

Background

- Pollution
- Maintenance Costs; Parking Lots and Stormwater System
- Unpleasant, Muddy



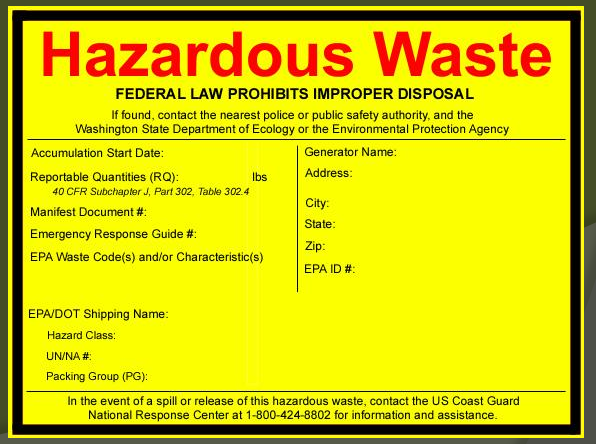
Issues: Water Quality



Issues; Stormwater System Maintenance

- Maintenance of the existing remediation systems is expensive and time/ resource consuming.
- Requires the supervision of multiple departments
- Material removed is hazardous waste

www.swmaintainence.com



Issue; Surface Condition and Maintenance Cost

- Unpleasant experience for pedestrians and motorists
- Expensive and costly to maintain.
- Band aid for the problems, any repair is temporary and causes other problems.

P. Fosmire & R. Malmo

Importance of Sustainability

- *Why is it important to WWU?*

http://www.dot.gov/mission/sustainability/our-sustainability-efforts-0

Western Sustainability

http://www.wwu.edu/sustain/

Solution

Use pervious concrete to resurface the gravel parking lots on Westerns campus. Pervious concrete is a highly effective and a sustainable material that has equal or superior performance compared to traditional materials.

http://www.forbes.com/sites/mikemyatt/2012/05/31/the-simple-solution-for-improved-performance/

Objectives

Identify the benefits of using pervious concrete over impervious materials.

Physical:

- Improve water quality by eliminating pollutants from entering the ecosystem,
- Provide a an easy to maintain surface

Economic:

- Potential Cost Benefits of using pervious concrete; Installation and Maintenance

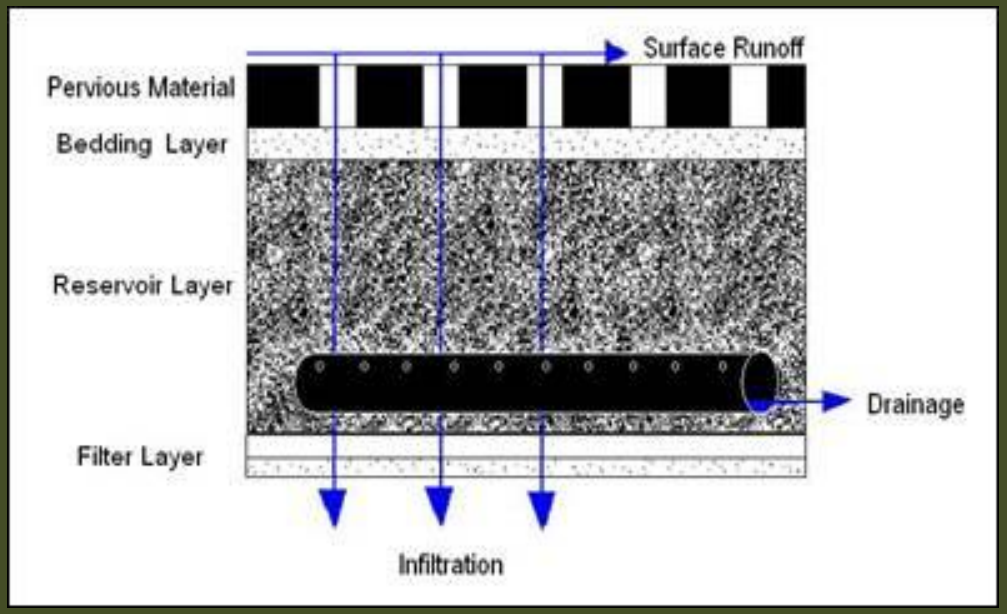
Cultural:

- This project can serve as a model for implementing the technology in different locations that share similar characteristics.
- This project has the potential to demonstrate WWU's commitment to sustainability

What is pervious pavement and how does it work

http://www.creativeconcrete4you.com/Pages/PerviousConcrete.aspx

Cross Section of Typical Permeable Pavement



(Hunt & Collins, 2008)

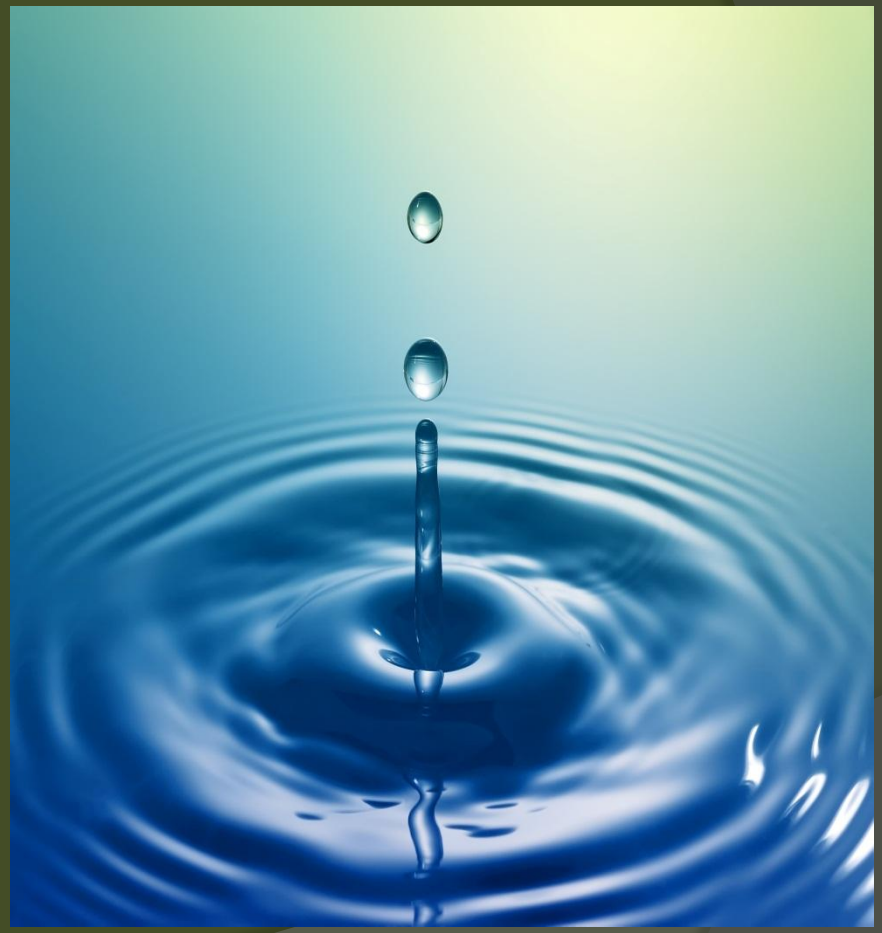
- Pervious Concrete 4 -8 inches thick depending on application.
- Open Graded Bedding Layer
- Open Graded Reservoir
- Drainage requirements as specified by engineer
- A optional geotextile if desired.
- Base un compacted soil.

Water Quality

Pervious concrete has the capacity to reduce the amount of pollutants in runoff through several methods.

- Velocity reduction increases sedimentation. (Ruston, 2001)

- Beneficial Bacteria in soils and on aggregates filter petroleum, metals and nutrients.(Pratt et al., 1999)



tchd.org

Infiltration and Storage

Superior infiltration and storage capabilities over impervious materials

Infiltration Video

http://www.smgov.net/uploadedImages/Departments/Public_Works/Civil_Engineering/Street_Maintenance/pervious-water-pic.JPG

Other Environmental Benefits

- Reduced Heat Island effect
- Increased Traction
- Less energy requirement for night time lighting
- Less pooling of water

Other Potential Benefits of Using Pervious Pavement

- Reduced Stormwater Fees City of Bellingham
- Use of porous concrete or porous asphalt will help to meet criteria that could qualify a project for a 50% reduction in the stormwater development charges.

Potential LEED Credits with Permeable Pavement

- Credit 5.1 Reduced Site Disturbance, Protect or Restore Open Space
- Credit 5.2 Reduced Site Disturbance, Development Footprint
- Credit 6.1 Stormwater Management, Rate or Quantity
- Credit 6.2 Stormwater Management, Treatment
- Credit 7.1 Landscape and Exterior Design to Reduce Heat Island, Non-Roof
- Credit 7.2 Landscape and Exterior Design to Reduce Heat Island, Roof
- Credit 3.1-2 Resource Reuse, 5% - 10%
- Credit 4.1-2 Recycled Content, 25% - 50%
- Credit 1.1 Innovation in Design

Durability/ Maintenance

- Long Term Durability at URI noted as ordinary after 5 years
- Infiltration Rates maintained
- Regular vacuum sweeping required

www.vactruck.com

Budget and Cost Considerations

- *Availability of Specialized Contractors*
  - Meet NRMCA requirements
- *Site Conditions*
  - Accessibility by construction equipment, slope, and existing buildings and uses
- *Subgrade*
  - Subgrade soils such as clay may result in additional base material needed
- *Stormwater Management Requirements*
  - The level of control required for the volume, rate, or quality of stormwater discharges will impact the volume of treatment needed
- *Project Size*
  - Larger pervious concrete areas tend to have lower per square foot costs due to construction efficiencies

Budget: Construction and Material Cost Estimates

Estimated Installation Cost Impervious Concrete	
Location/Contractor	**Price (sq. ft)**
Chris Webb P.E.	$3-4
Puget Sound Partnership	$ 6-9
Blue Chip Construction	$4.93
City of Sammamish	$3.83- 6.29

Estimated Installation Cost Pervious Concrete May 2013	
Location/Contractor	**Price (sq. ft)**
Chris Webb P.E.	$4-5
Puget Sound Partnership	$ 6-9
Blue Chip Construction Sultan, WA	$3.19
City of Sammamish, WA	$5.05

Potential Limitations/ Additional Expenses

Requires more materials to be used in storage beds

Potential Benefits

Reduction in stormwater fees, and the amount of land required for remediation measures

Potential Limitations/Additional Expenses; Requires additional systems and space to mitigate stormwater runoff

Budget: Completed Project Costs

Completed Projects Construction Cost			
Location	**Paved Area (Acres)**	**Considerations**	**Total Installation Cost**
University of Rhode Island Kingston, RI (2007)	7.0	Demolition of existing structures, Installation of security infrastructure	3,033,700
Quil Ceda Casino Tulalip, WA (2010)	4.6	Expansion of existing lot	

UNIVERSITY OF Rhode Island

- The University of Rhode Island primary motivation for use of pervious materials was to protect water quality.
- The Tulalip tribe has a deep concern for the protection of the environment, but also recognizes the economic benefits of using pervious material.

http://www.washingtonconcrete.org/assets/Quil%20Ceda%20Creek%20Casino.JPG
http://www.best-masters.com/logo_ecole/625.jpg

Budget; Estimate for Construction WWU

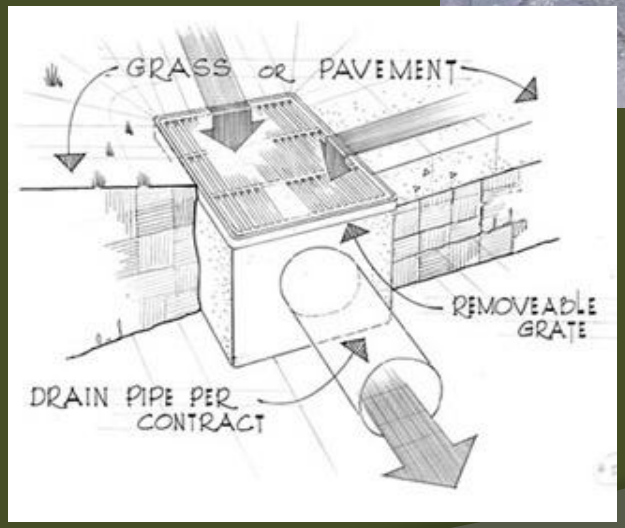
Estimated Construction Cost: WWU "C" lots				
Location	**Paved Area (Acres)**	**Considerations**	**Cost (sq. ft.)**	**Total Installation Cost**
Western Washington University Bellingham, WA	10.55	Unknown sub surface conditions.	$ 3.83-9.00	$ 1.75-2.15 Million

- Number of C lot parking spaces:1064 10.55ac

Potential Cost Savings

- Stormwater Management
- Catch basins
- Piping
- Detention
- Treatment

http://elitefinishes.com/services/catch basin_repair.html



http://trottercompany.com/services/catch-basins.jsp

Implications

- Time/Logistics
- Un foreseen obstacles to construction
- Existing infrastructure
- A combination of BMPs would most likely be the best solution

Discussion

In an effort to promote sustainable, environmentally-sound campus development, pervious concrete should be used for resurfacing the gravel parking lots on Westerns campus.

With this project, the College has the opportunity to reconsider and enhance its academic facilities and campus spaces, particularly with regards to environmental sustainability.

Acknowledgements

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