Improving Stormwater Management in Oshkosh through Green Infrastructure

Environmental Studies Senior Seminar
University of Wisconsin Oshkosh

7 May 2018

Overall Introduction

- UW-Oshkosh Environmental Studies Senior Seminar Class
- Stormwater management issues
- 4 groups
  - Landscaping
  - Shorelines
  - Permeable Pavement
  - Parking Lot Design
- What is sustainability?

Outline

1. Background
2. Recommendation
3. Stakeholders
4. Case Studies
5. Barriers
6. Cost/ Benefit
7. Sustainability
8. Summary

Landscaping Group

Benjamin Slusser, Grant Zwieg, Lexie Uffenbeck,
Caitlyn Uhlenbrauck, Hannah Holzschuh

Background

- Runoff problems in Oshkosh
- Soil types of Oshkosh
- Landscaping solutions

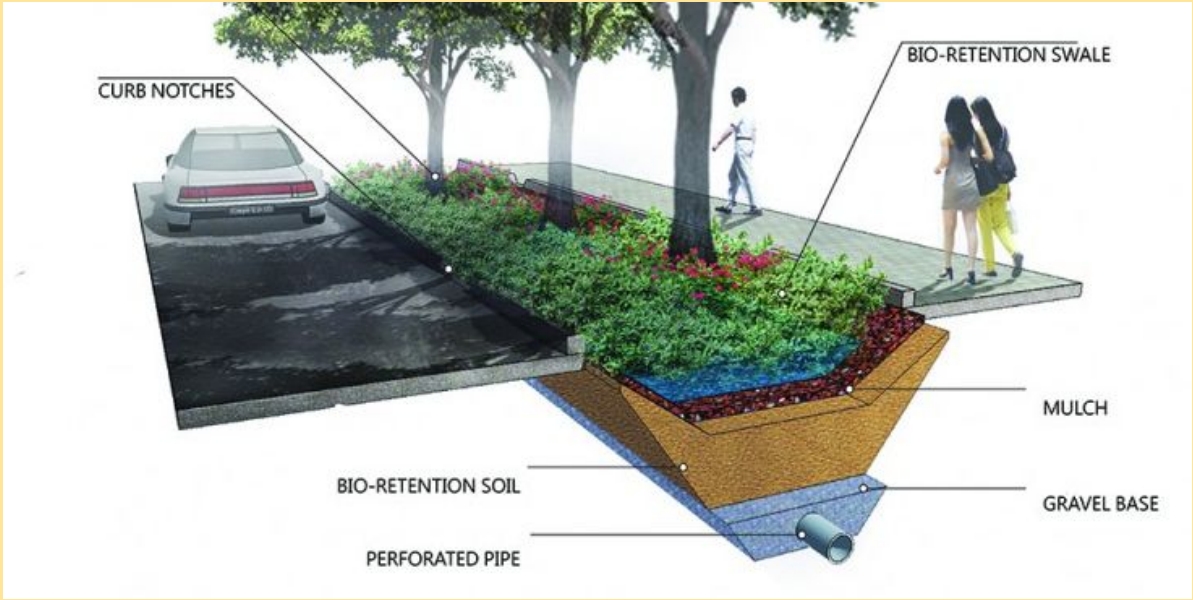
Background

Point System: Article IX, section 30 Landscaping Requirements

- Required number of points on public and commercial land
- Points awarded per landscaping technique

Background

- Landscaping techniques to manage stormwater runoff
  - Bioswales
  - Rain gardens
  - Native plants



http://lmgfl.com/whats-a-bioswale/

Recommendation

- Requirement for new construction only
  - Encouraged for existing structures
  - Private land excluded but encouraged

Recommendation

- Article IX section 30-253
  - Item (2) paved areas
  - Current plan: 40% of shrubbery requirements
  - Recommendation: 40% native shrubs only

Recommendation

- Article IX section 30-255
  - Item (3) street frontages
  - Current plan: minimum of 50% of all points are devoted to medium trees
  - Recommendation: 30% native trees and minimum 30% must be deep rooted native grasses

Recommendation

- Article IX section 30-255
  - Item (2) requirements part (A)
  - Current plan: bioswales and rain gardens get 20 points per 20 sq. ft area and cannot exceed 100 points.
  - Recommendation: 30 points per 20 sq. ft area and with no point limit

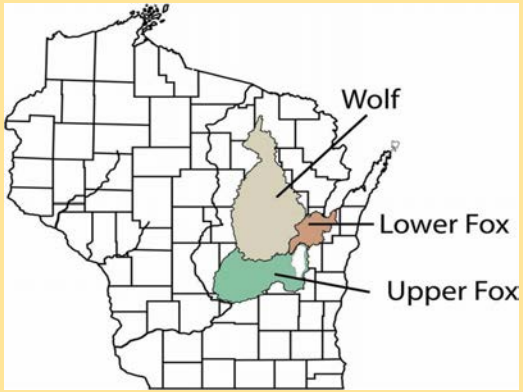
Stakeholders

- Northeast Wisconsin Water
- Bruce Bartel, District Director
  - Adaptive management
  - Interconnected watershed network

(http://newwater.us/about/)

FOX-WOLF WATERSHED ALLIANCE

(https://goo.gl/images/hnnhUS)



(https://goo.gl/images/ern Wo)

NEW Water
The brand of the Green Bay Metropolitan Sewerage District

(https://greatergreenbay.yourfuturewisconsin.com)

Stakeholders (cont.)

https://imgur.com/gallery/X61ca

- Steven Wiley
  - Assistant planner for City of Oshkosh
  - Insight of community reaction
    - Example: Miller's Bay shoreline restoration
    - Suggested: Pioneer site for future restoration
  - Oshkosh is:
    - Green Tier Community
    - Tree City
    - Has high-flyer status through Bird City

Case Study: Prairie Crossing, IL

- Stormwater Treatment Train system
- 200 acres restored wetland and prairie
- Lake
  - Buffers serve as detention and biological treatment
- Use of native plants
- Education

http://greenstreetltd.com/projects-places/prairie-crossing/

http://libertyprairie.org/contact-us/

Case Study: New York City, NY

Bioswale capture rates

Rainfall (in.)	**Mean**
Below 1.00	73%
1.00-2.00	25%
Above 2.00	14%
Total	59%

Barriers

- Lack of legislative mandate
- Lack of funding and effective market incentives
- Resistance to change

Solutions

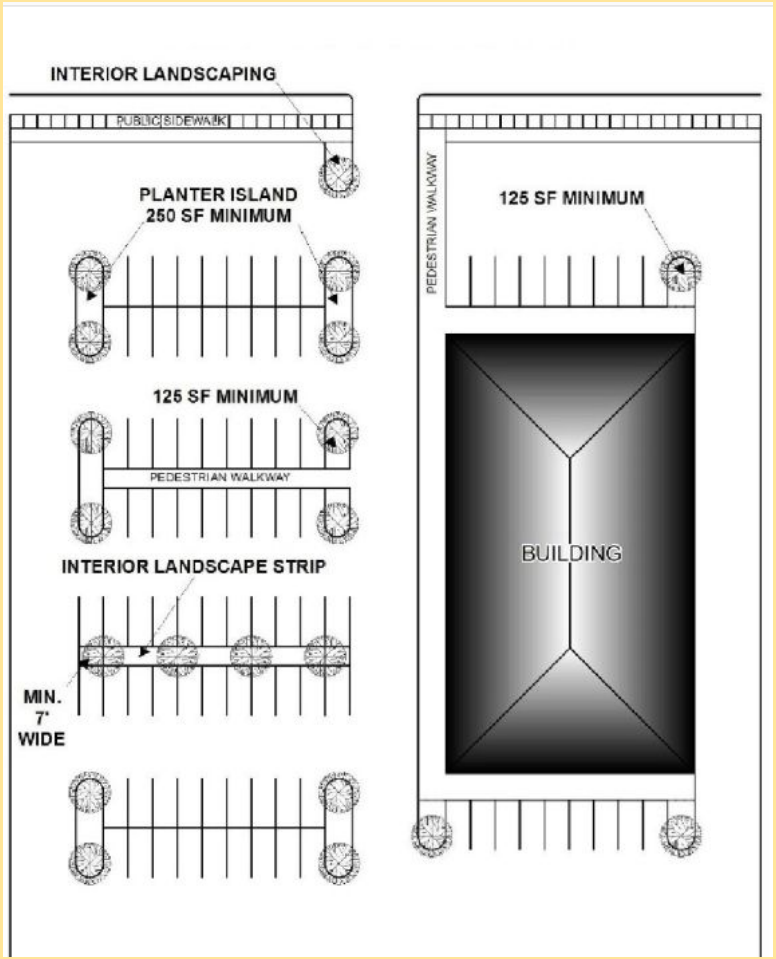
- Grassroot efforts
- Provide funding mechanisms
- Community engagement

Cost/ Benefit

- Cost
  - Green infrastructure
    - Bioretention (rain gardens/bioswales)
      - “Do-it-yourself” = $1-$5 per sq. ft. average
      - Professional = $10-$40 per sq. ft. average
        - (Rain garden alliance, 2018)

Cost/ Benefit

- Professional Pricing
- 250 SF planter island
  - $2,500 for minimum
  - $10,000 for maximum
- 125 SF planter island
  - $1,250 for minimum
  - $5,000 for maximum



(Article IX, City of Oshkosh, planning)

Cost/ Benefit (cont.)

- Bioretention (Benefits)
  - Reduced infrastructure cost
  - Lower maintenance
  - Chemical pollution reduction
  - Protection from flooding
  - Wildlife Habitat
  - Cost-effective stormwater management

(https://goo.gl/images/KRNjmG)

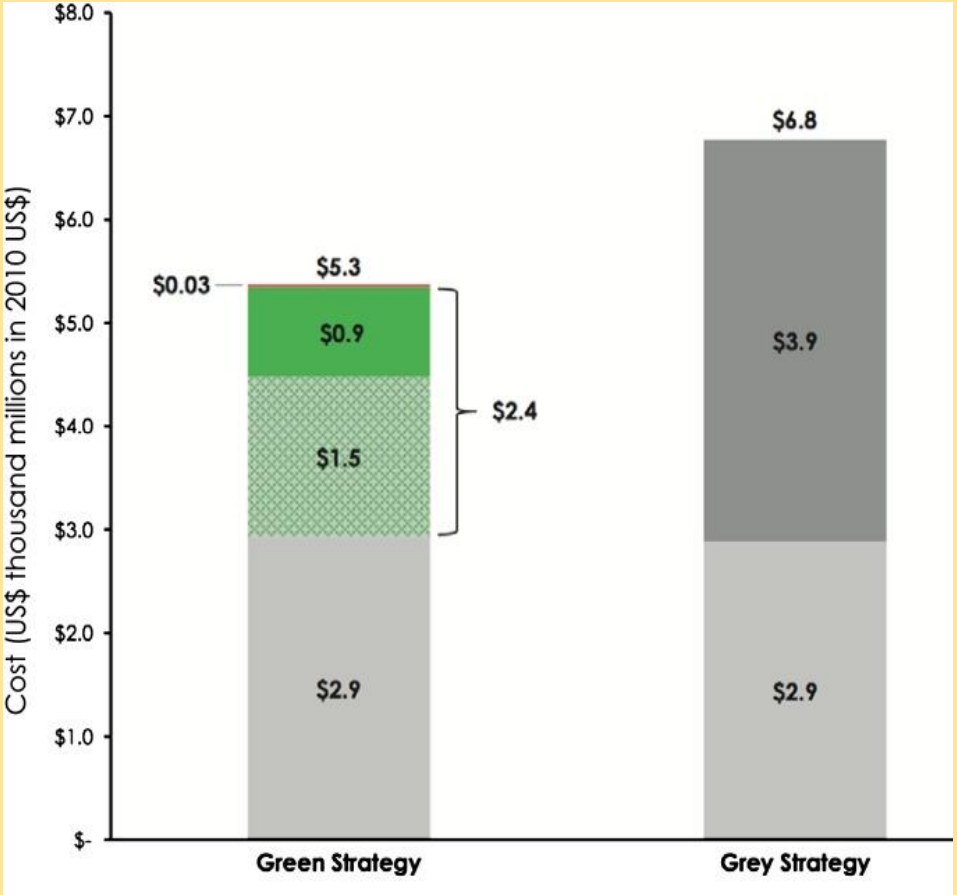
Sustainability

- Social
  - Increase human well-being and health
  - Improve appearance of the city
  - Produce cohesiveness and inclusion

https://www.researchgate.net/figure/The-three-pillars-of-sustainability-Based-on-sustainable-development-from_fig1_280935357

Sustainability

- Economic
  - Save Money
    - Green infrastructure is less expensive than gray infrastructure
  - Make Money
    - Brings in new residents and businesses



(Berkooz, 2011)

Sustainability

- Environmental
  - Deep rooted plants encourage soil health
  - Biodiversity improves ecosystem health
  - More vegetation leads to cleaner urban and natural environment

http://doorlandscape.com/native-plant-nursery/

Summary

- Stakeholder value
- Legislative mandate, resistance to change, lack of funding
- **Recommendation**
  - Change to the point system in the landscaping requirements ordinance
    - Street frontages
    - Paved areas
    - Bioswales and rain gardens
      - Relation to parking and parking lot design

Shorelines

Natalie Kostman, Kenzie Knox,
Amanda Peterson, Courtney Craighead

Background

- Shoreline vegetative buffer zones
  - Natural strip of vegetation
  - In and out of the water
- Development disrupts natural shoreline vegetation
  - Decreased water quality
  - Loss of habitat
  - Lower property value

Kenzie Knox
http://www.lakeshoreguys.com/natural-shorelines-and-buffer-zones/

Background continued

- Vegetative buffer zones are not required by the city of Oshkosh
  - Riverfront mixed use is mentioned in landscape point system
- Parks department has been working on some projects
  - Miller's Bay and South Park

Recommendation

- Meet countywide buffer requirement of 35' depth for city land
- 25' depth for private property
- Begin an incentive program to encourage people who are grandfathered in
- Give and Take Program

City Stakeholders

- City Park Employees (Bill Sturm & Ray Maurer)
  - South Park
    - Under construction
    - Stormwater management
  - Miller's Bay
    - Started in 2010
    - Implemented native grasses

Shoreline Landowner Stakeholders

- Kevin Crawford
  - Green infrastructure
  - Achievable?
- Anonymous Landowner
  - Against shoreline restoration projects
  - Assumptions
  - Willing to learn more

Case Studies

- Northern Highland Lake District, Northern Wisconsin, U.S.A.
  - Vegetation cover important - regulates temperatures
- Shihmen Reservoir, Taiwan
  - Larger buffer zones are more effective
    - Pollutant reduction and economic effectiveness
  - All areas are recommended to do their own cost- benefit analysis to determine suitable buffer zone length

Barriers

- Public acceptance
  - Costs
    - Taxes
    - Maintenance
  - Blocking waterfront view
- Education may help with a majority of these barriers

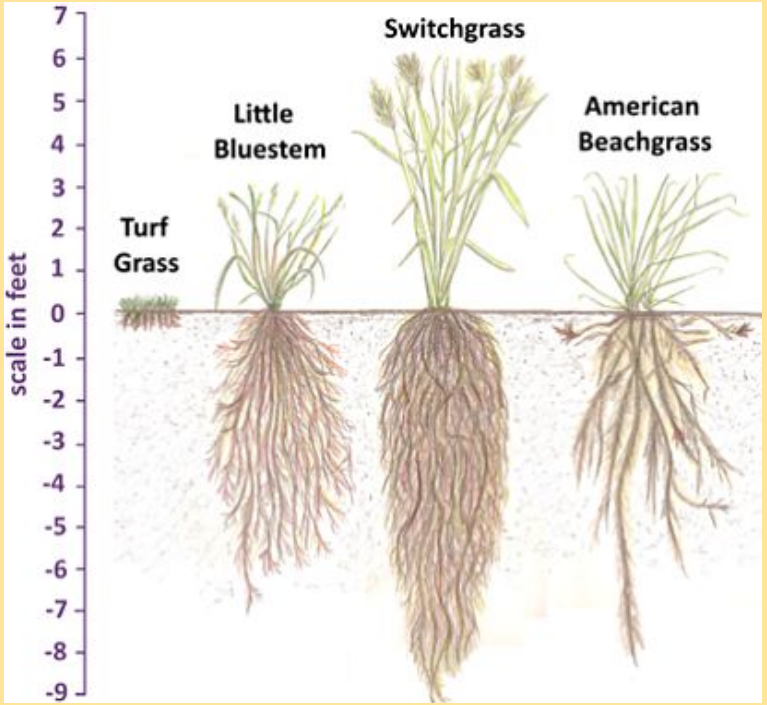
Costs

- $218-$729 per acre
- Miller's Bay
  - Approximately $6,000
- DNR Grants

http://www.greenlakeassociation.com/glaw/index.php/event/hammers-trail-shoreline-planting/

Significance for Sustainability

- Environment
  - Improve water quality
  - Make for healthier ecosystems
  - Control erosion



https://mgnv.org/2018/03/13/grasses-vs-sedges/

Significance for Sustainability

- Environment
  - Improve water quality
  - Make for healthier ecosystems
  - Control erosion
- Economy
  - Increase property value

http://goodoak.com/shoreline.html

Significance for Sustainability

- Environment
  - Improve water quality
  - Make for healthier ecosystems
  - Control erosion
- Economy
  - Increase property value
- Society
  - Improve community health

https://www.ci.buffalo.mn.us/engineering/lake_buffer/

Summary

- Stakeholders on board
- Other locations have had success
- Barriers can be overcome through education
- Sustainable
- Parking lot significance
- **Recommendation**
  - 35' buffer for city property
  - 25' buffer for private property
  - Incentive program

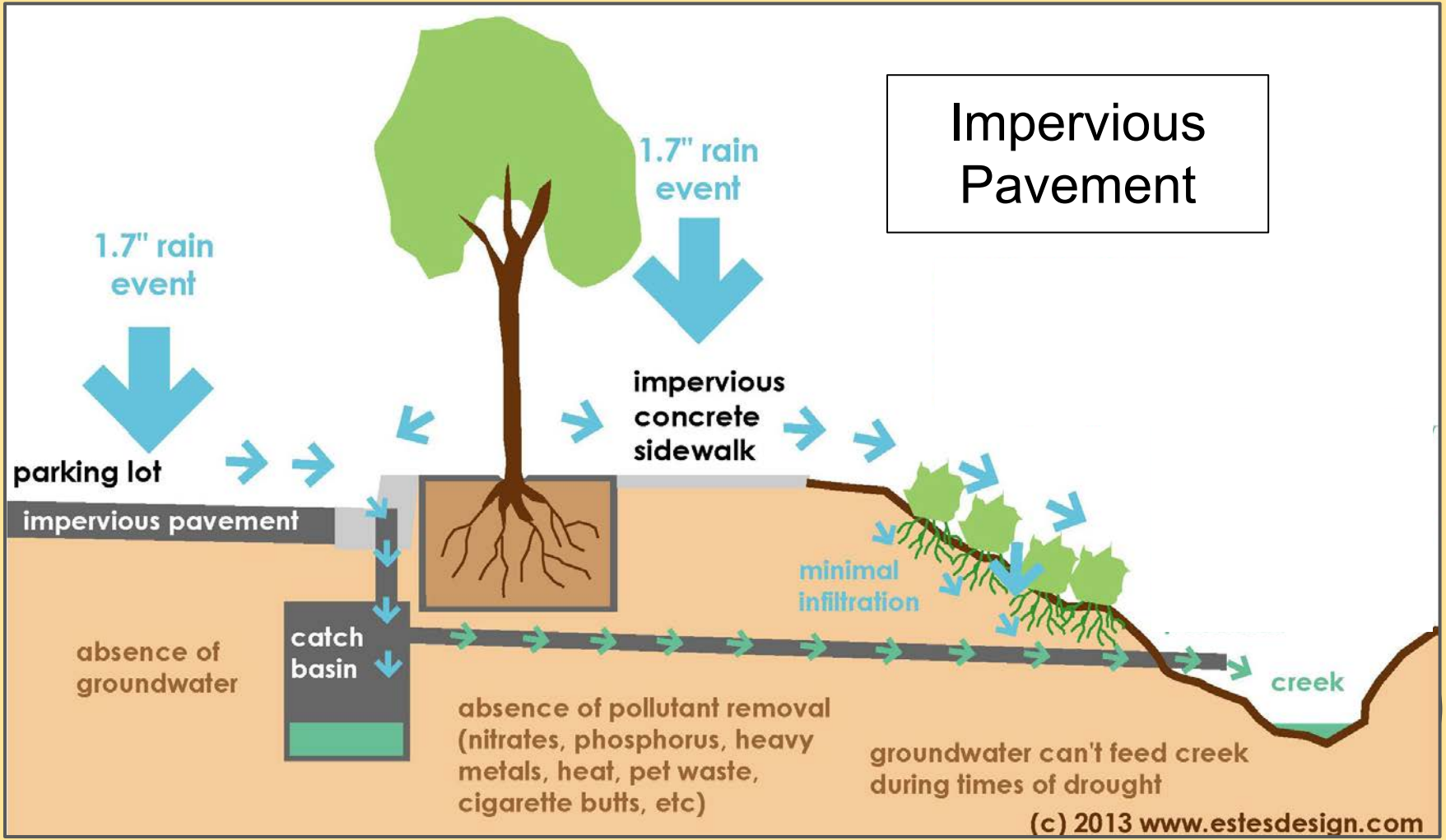
Permeable Pavement

Taylor Jansen, Wyatt Zahringer, Cody VanOss, Mitchell Furseth

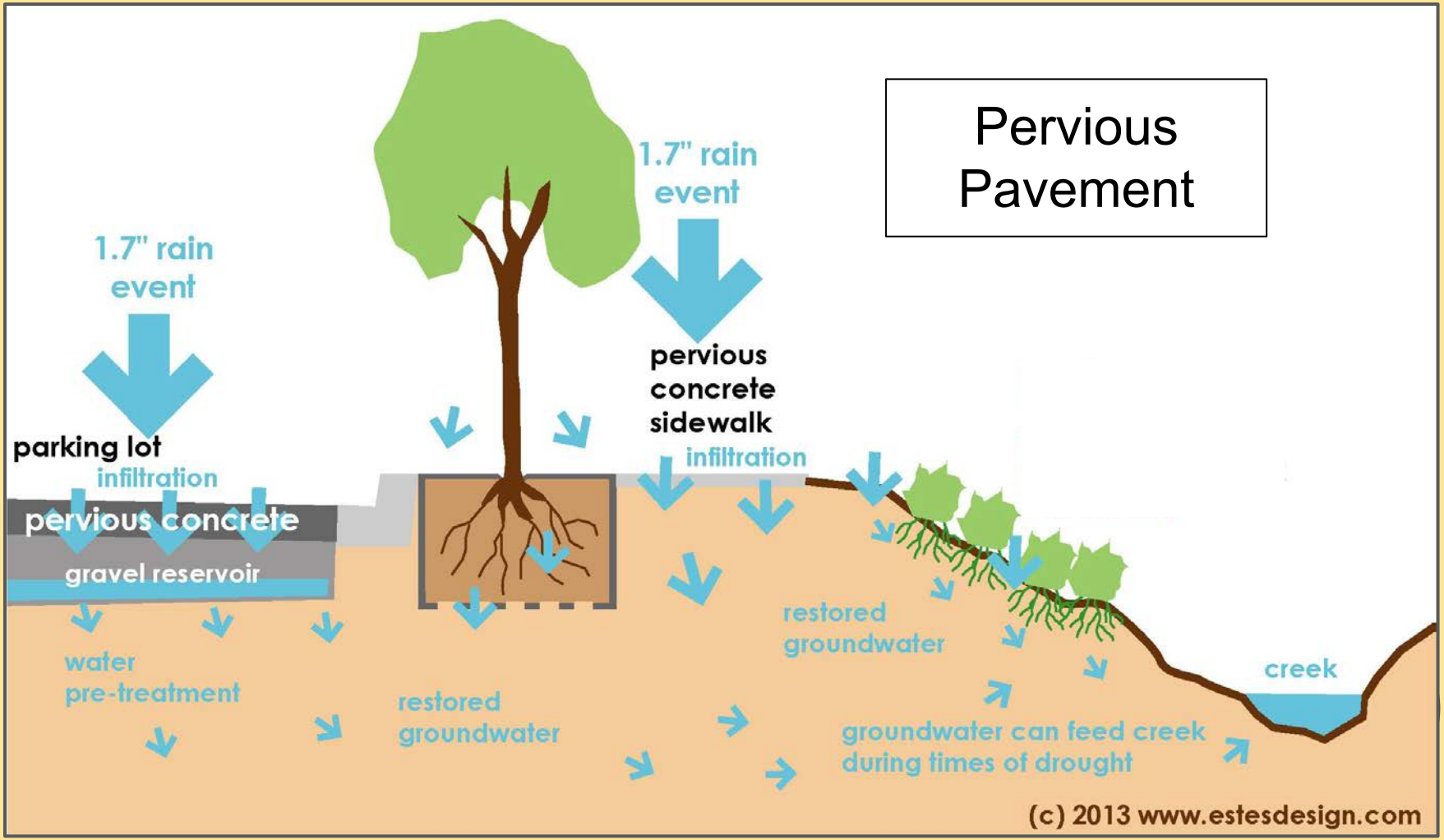
Background

- Impervious surfaces in cities has created issues.
  - Downstream flooding, high turbidity, bank erosion and habitat destruction
- Permeable pavements relieve pressure on sewer systems and home foundations while recharging groundwater at a natural rate

Impervious Pavement



Pervious Pavement



Recommended Ordinance

- Adding Article VII, titled Best Management Practices, in Chapter 14 of the Stormwater Management ordinance
  - Explicitly mentioning permeable pavement
- Will require at least 20% of parking lot surface to be permeable pavement in new construction
  - Off-street parking areas that accommodate five or more vehicles

Stakeholders

- James Rabe - Director of Public Works (Oshkosh)
  - Stormwater infiltration a major issue
  - Sewer system failures
- Doug Buch - President of PaveDrain
  - PaveDrain block systems
  - Implemented at four Oshkosh locations:
    - Downtown Oshkosh YMCA
    - Menominee Nation Arena
    - Oshkosh Senior Center
    - Oshkosh Fire Station #16

http://www.pavedrain.com/

Case Study: Burnsville, Minnesota

- Strategies to protect surface and groundwater resources
  - Strategy 1: Promote Infiltration and Water Quality Protection
    - Rain Gardens
    - Low Impact Development
    - Short/Long Term solutions

Case Study: Burnsville, Minnesota

- Strategies to protect surface and groundwater resources
  - Strategy 1: Promote Infiltration and Water Quality Protection
  - Strategy 2: Education and Stewardship

EDUCATION FOR SUSTAINABILITY

http://blacklemag.com/living/changes-to-environmental-education-programs/

Type of pavement:	Applications:	Installation Cost (per/sq. ft):	Life Span (years):
Porous Asphalt	Low Weight Capacity	$1.11	17.5
Pervious Concrete	Small to Large Projects	$6.66	25
Permeable Pavers	Small to Large Projects	$11.10	25-30

Costs: ½ acre parking lot costs over 25 years

	Freq in 25 yrs	Permeable pavements	Freq in 25 yrs	Asphalt
Installation	1	$165,350	1	$109,000
Vacuum sweeping	25	$400	0	$0
Restore permeability	5	$1750	0	$0
Seal coating	0	$0	5	$20,000
Stripping	0	$0	1	$3,125
Replacing surface	0	$0	1	$32,000
Total		***306,707***		***371,356***

Barriers

- Initial Installation Cost
- Maintenance
  - Clogging
  - Snow removal
- Perceived Barriers
  - Climate

http://www.concretethinker.com/applications/Hardscape-Pavers.aspx

Significance for Sustainability

- 3 Pillars of Sustainability
  - Environment
    - Reduction of runoff and pollutants
  - Economy
    - Eliminates excess costs on other BMPs
  - Society
    - Reduced flooding

https://travelfoodguru.wordpress.com/2012/01/15/sustainability-101-towards-sustainable-cities-and-communities/

Summary

- Adding Article VII, titled Best Management Practices, in Chapter 14 of the Stormwater Management ordinance
- Require at least 20% of parking lot surface to be permeable pavement
  - Focus on parking lots currently yet to be being constructed
  - Only applies to off-street parking areas that accommodate five or more vehicles

Design

Brandon Flenz, Martha Hill, Eric Hoff, Joey Stammer

1. Background

- Implement other groups recommendations into parking lots
- Status quo:
  - Depending on the size of the lot, a certain number of points is required
  - 40 - 50 points per 10 stalls or 10,000 square feet
    - 30% - Tall Trees
    - 40% - Shrubs

Recommendation

- Replace planter islands
  - Bioswales or rain gardens
- Increase points per 10 stalls or 10,000 square feet
  - From 40 to 50 Urban Mixed Use
  - From 50 to 60 Central Mixed Use and Riverfront Mixed Use
- Have a minimum requirement for permeable pavements for parking lots with more than five spaces

Stakeholder

Businesses

- Daniel Schetter
  - Manager
  - Oshkosh Best Western
- Sarrah Larson
  - Owner
  - Wagner Market
- Ben Rennert
  - Owner
  - Winnebago Bicycle

Stakeholder

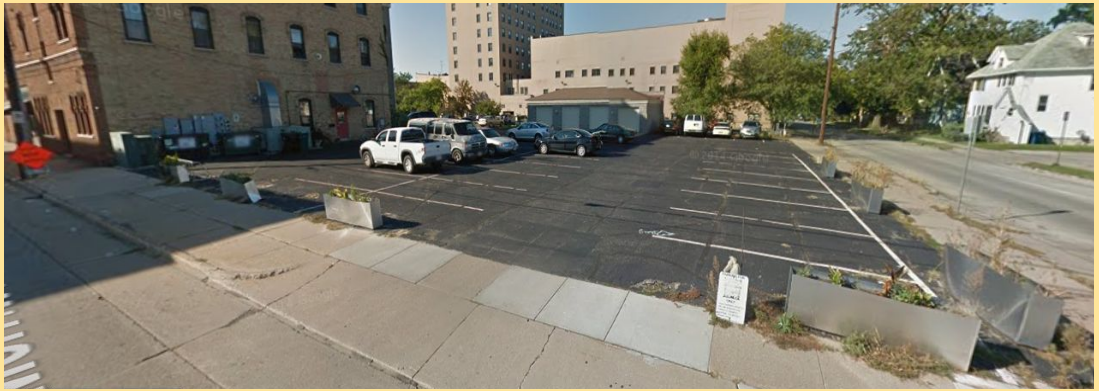
- Daniel Schetter - Best Western

- Comments
  - Obstruction of water
  - Native plants
  - Parking constraints
  - Permeable pavements

Stakeholder

- Sarrah Larson
  - Wagner Market
- Ben Rennert
  - Winnebago Bicycle

- Comments
  - Designated brown site
  - Sufficient parking
  - Native plants
  - Signs



Case Studies

- New York City, New York
  - Stormwater retention cells
  - Natural filters
- Minnetonka, Minnesota
  - Filter Vegetation and Porous Surfaces
- Olympia, Washington
  - Increase landscaping and pervious areas

Barriers

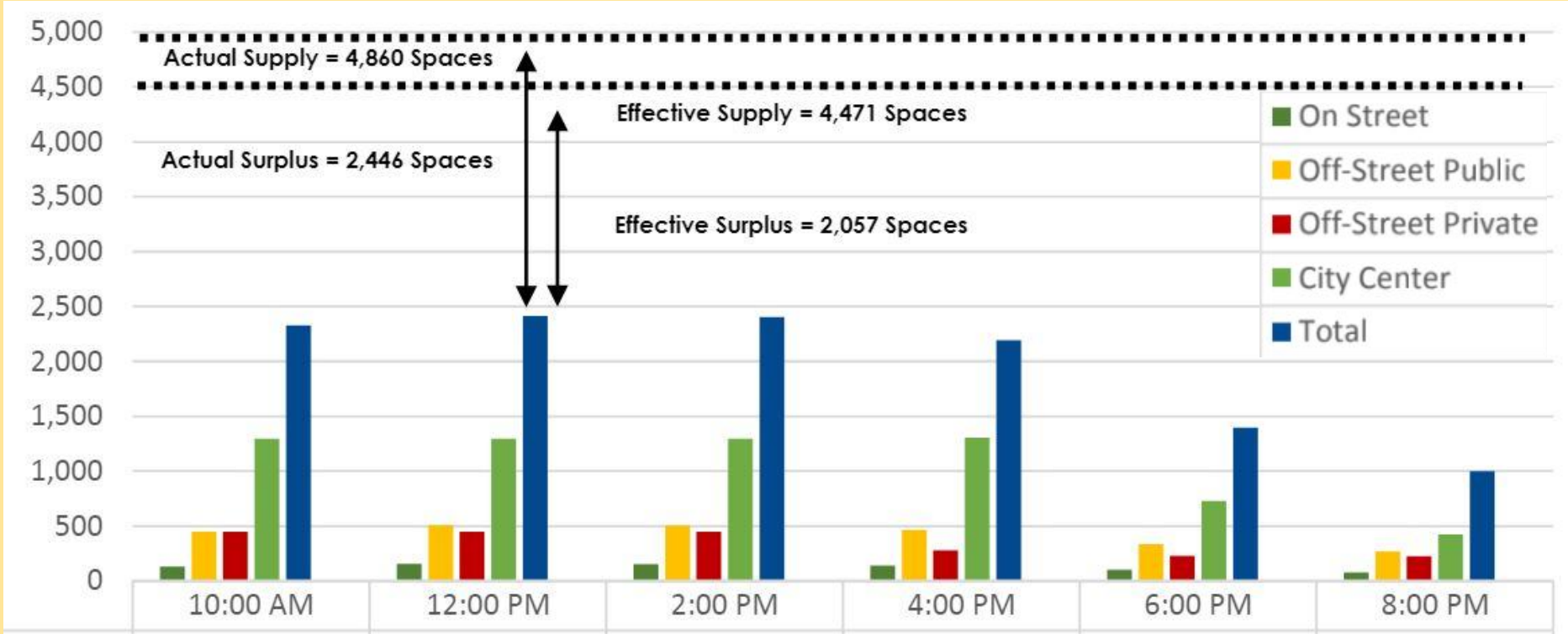
- Maintenance
- Perception
  - No community benefit
- Life style
  - Convenience
- Disturbance
- Initial Cost

https://www.ebhoward.com/barriers-to-applying-four-common-items-to-look-for-when-considering-funding/?v=7516fd43adaa

Costs

- Initial Costs
  - Cost of permeable surfaces
  - Construction
- Maintenance
- Reduced number of parking spaces

Oshkosh Parking Trends

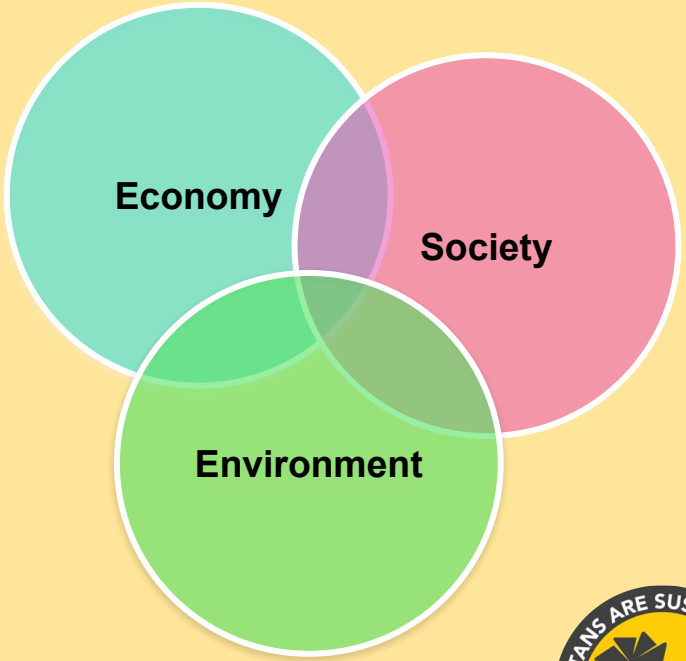


Benefit

- Reduces maintenance cost
  - Green infrastructure is cheaper in long run
- Limits chemical pollution
  - Oils and metals
- Reduces stormwater
  - Allows for runoff to reach the plants
- Improve habitat and increase biodiversity

Significance for Sustainability

- Environment
  - Create connected habitats
  - Filtration of metals and oils
- Economy
  - Increase consumers
- Society
  - Increase human health



Summary

- Higher minimums for landscaping requirements
  - More bioswales and rain gardens
- More emphasis on native plants
- Mandatory sites for natural filtration per number of spaces
- Have a minimum requirement for permeable pavements for parking lots with five or more spaces

Conclusion

Research topic	Recommendation
Landscaping	Increase point value and percentages of native plants.
Shorelines	35’- city property, 25’- private property Incentive program
Permeable Pavement	Add within Chapter 14, Stormwater Management, Article VII titled Best Management Practices, requiring 20% of parking lot surfaces to be permeable pavements
Design	Replace planter islands, increase landscaping points needed for urban and riverfront mixed use areas, and require permeable pavements.