

# Reducing the Storm Water Footprint of GVSU through BMP's

*Ottawa County  
Eighth Annual Water  
Quality Forum*

*West Olive, MI  
November 25, 2013*



Dr. Peter J. Wampler

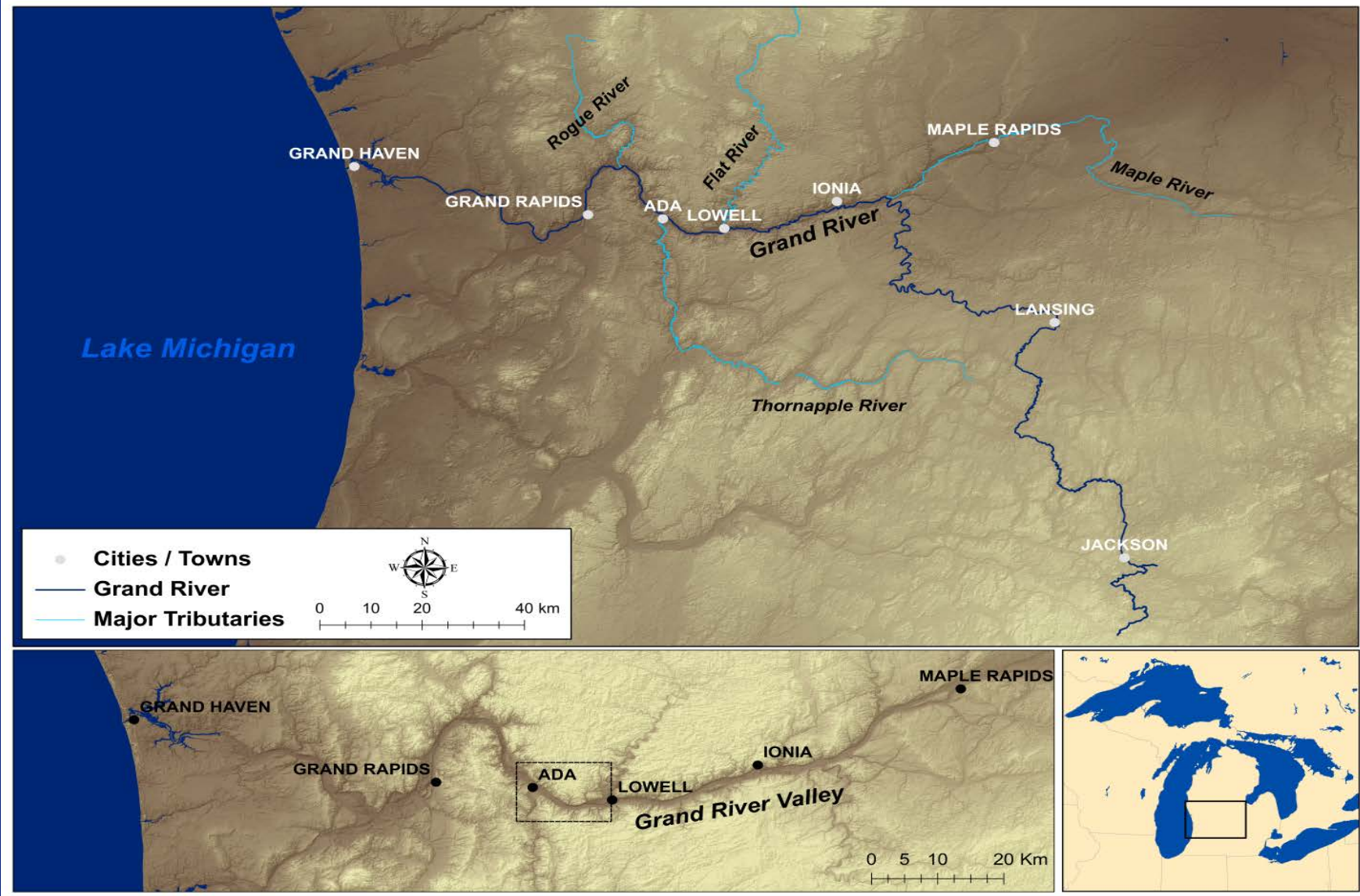


**GRAND VALLEY  
STATE UNIVERSITY**  
GEOLOGY DEPARTMENT

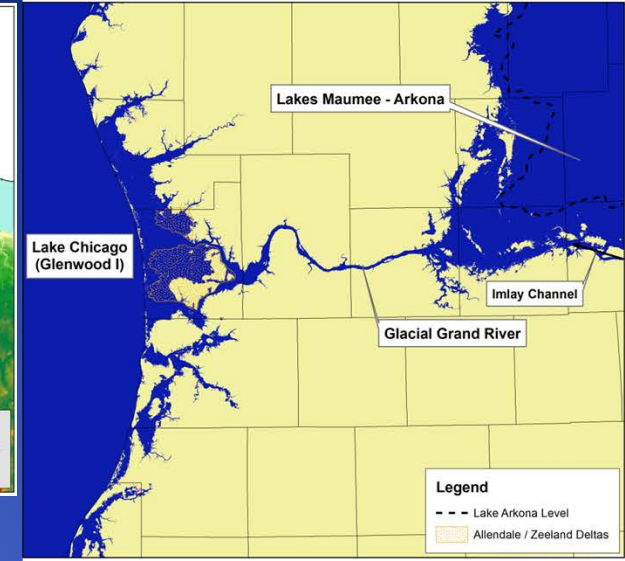
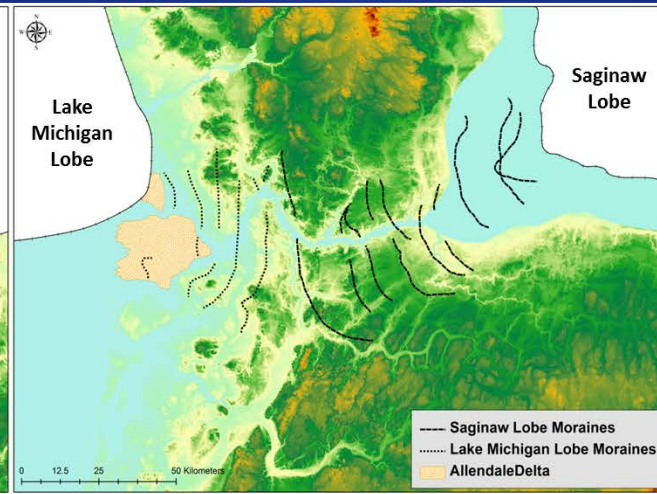
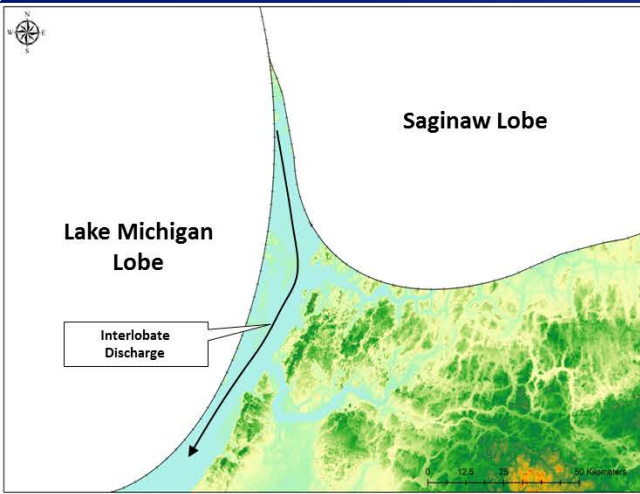
# Talk Road Map

- Brief Geomorphic History of the Grand River and Grand River Ravines
- Historic storm water and Land Use practices at GVSU
- Storm water runoff monitoring and research
- Best Management Practices at GVSU
- The future of BMP's and storm water at GVSU

# The Grand River and Grand River Valley



Churches and Wampler (2013)

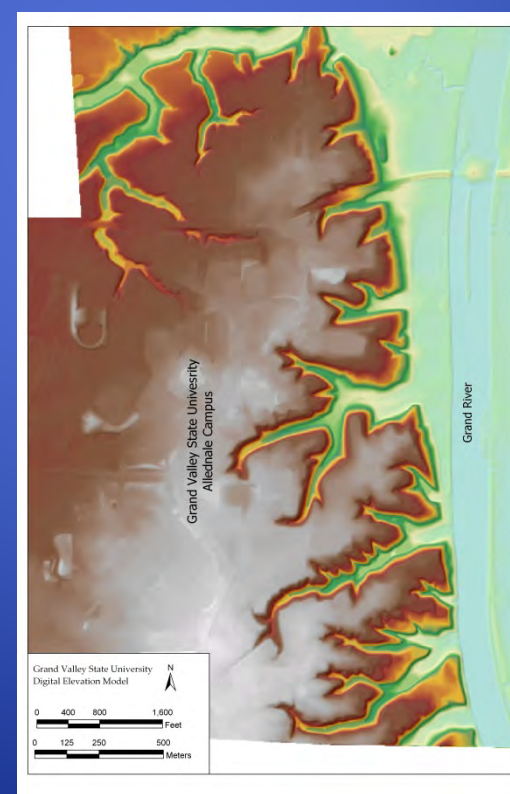


Churches and Wampler (2013)  
 ~ 15,000 years ago

~ 14,000 years ago

~ 13,000 years ago

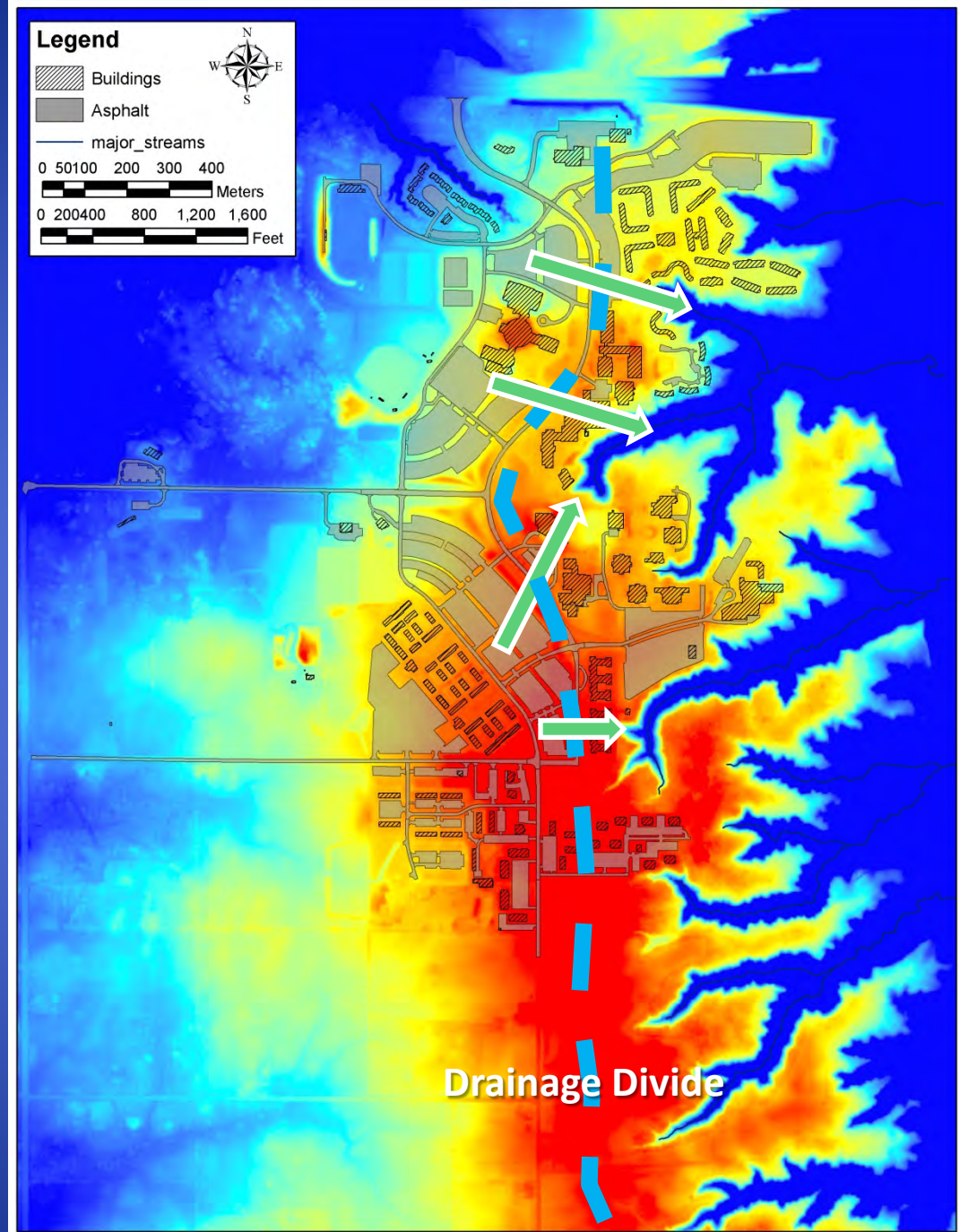
The Grand River  
 Ravines are  
 unique



Womble and Wampler (2006)

# Runoff direction toward ravines

- Drainage divide bisects campus.
- Historically water was directed east into the ravines from parking lots and buildings



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1958  
Aerial  
Photo  
of the  
GVSU  
site



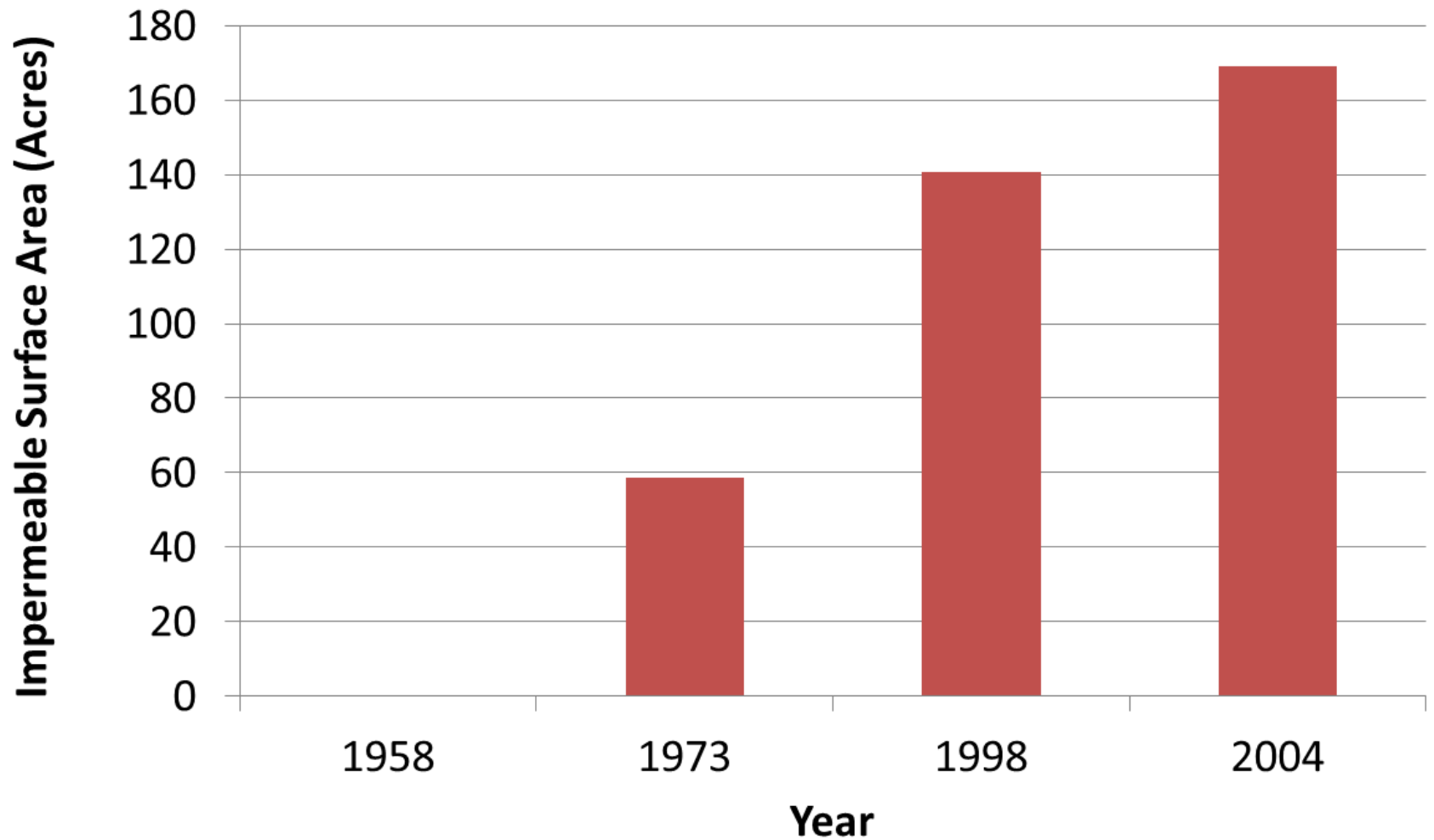
2004  
Aerial  
Photo  
of the  
GVSU  
site





2011  
Aerial  
Photo  
of the  
GVSU  
site

# Changes in Impermeable Surface Area



Womble and Wampler (2006)

# Storm water directed to ravines



Original library under construction





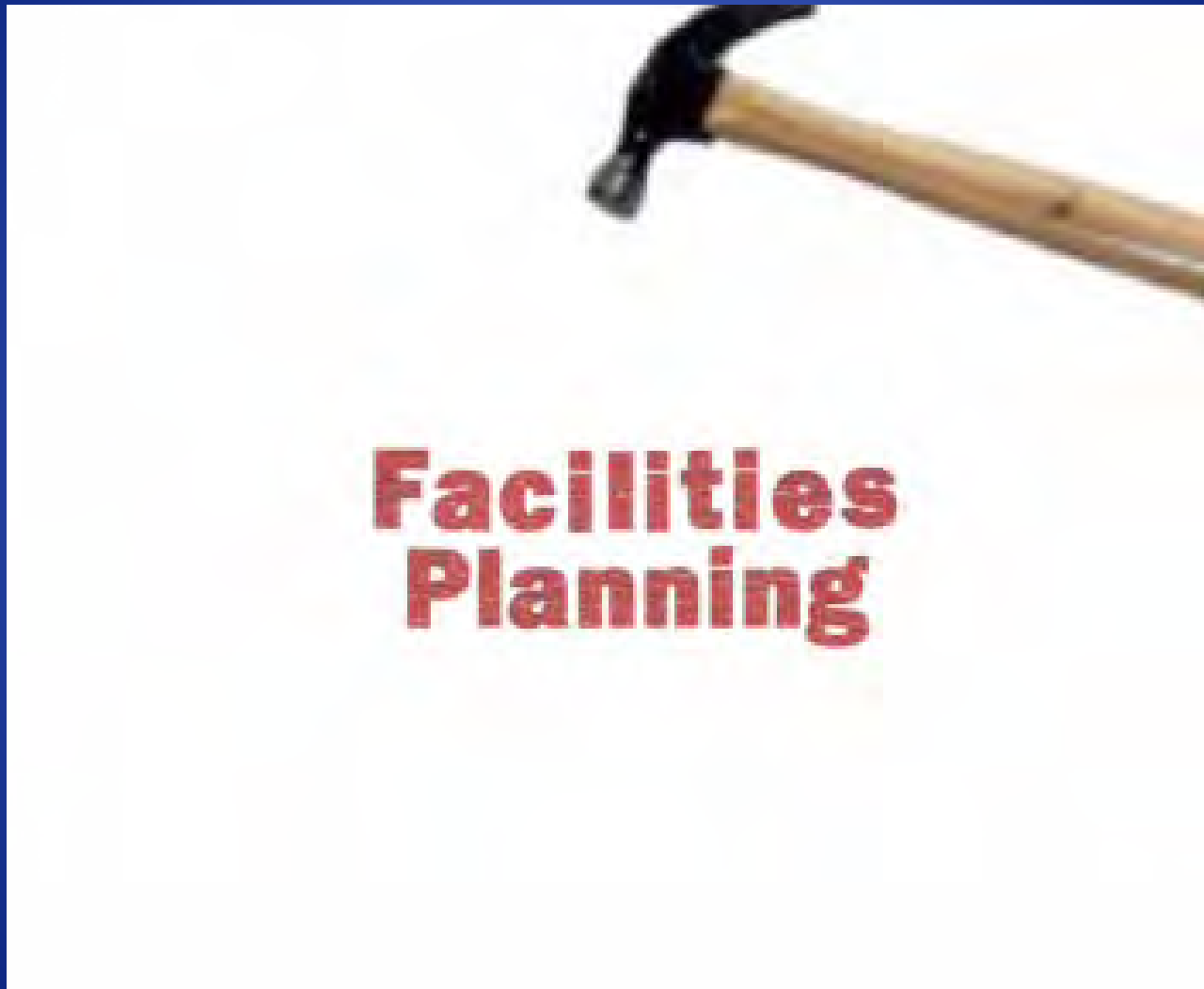
Drainage pipe into  
ravine behind  
Padnos



Erosion below one of the drainage pipes



# Runoff and Erosion Control



# 2012 flooding in the ravines after a ~ 1 inch rain in 30 min



PLOTWATCHER PRO

07/27/2012 03:03:55PM 57% 76F

# Runoff Impacts

- Erosion and sediment transport
- Slope stability
- Biological impacts
- Thermal impacts
- Water quality degradation





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# Storm water research 2006-2013

- 2006 – Runoff modeling and first discharge monitoring (Womble and Wampler 2006)
- 2007-2008 – Thermal impacts of runoff on the water quality in the ravines (Nagorsen et al. 2007)
- 2009 – Baseline biologic and hydrologic data collection (Snyder et al, 2009; Wampler, 2009)
- 2011 – Water quality analysis of ravine runoff (TSS, turbidity, conductivity, pH) and GIS-based watershed analysis to evaluate hydrologic impact of diversion of parking lots to newly constructed ponds. (Simonson et al., 2011)
- 2012 – Evaluation of water quality (nitrate; phosphate, turbidity, TSS) in the storm water pond system and the ravines. (Wampler and Kneeshaw, 2012)
- 2013 – Continued monitoring of water quality in Pond#1 of the pond system and Little Mac Ravine (in progress)

Research and Monitoring data can be found at [www.gvsu.edu/stormwater](http://www.gvsu.edu/stormwater)

# ISCO Sampler used for ravine Monitoring and sampling



Suction Head

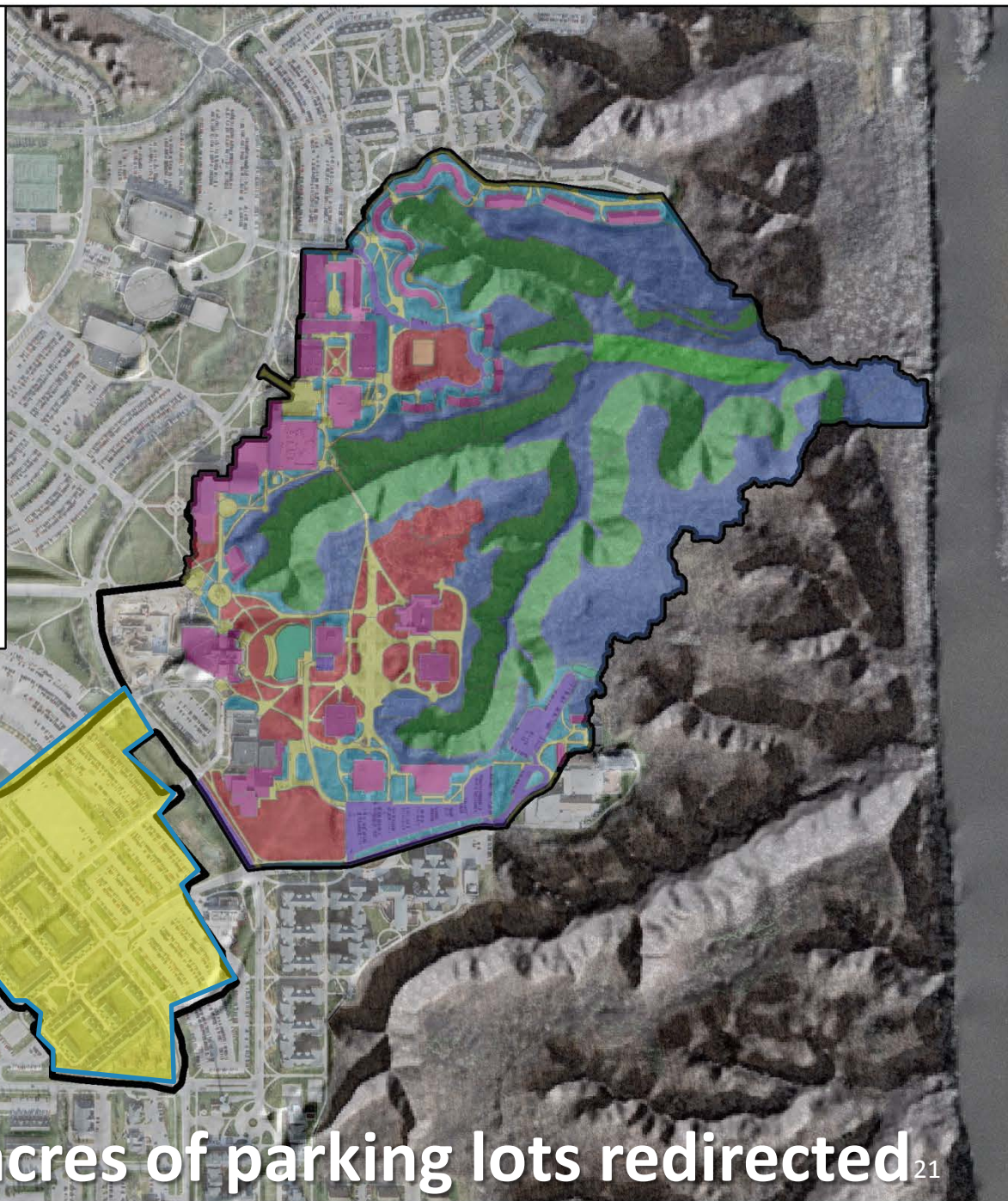
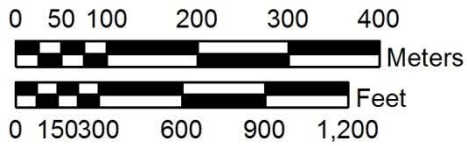
# Sediment samples from 5/23/11



# Little Mac Watershed and GVSU Wetlands

## Legend

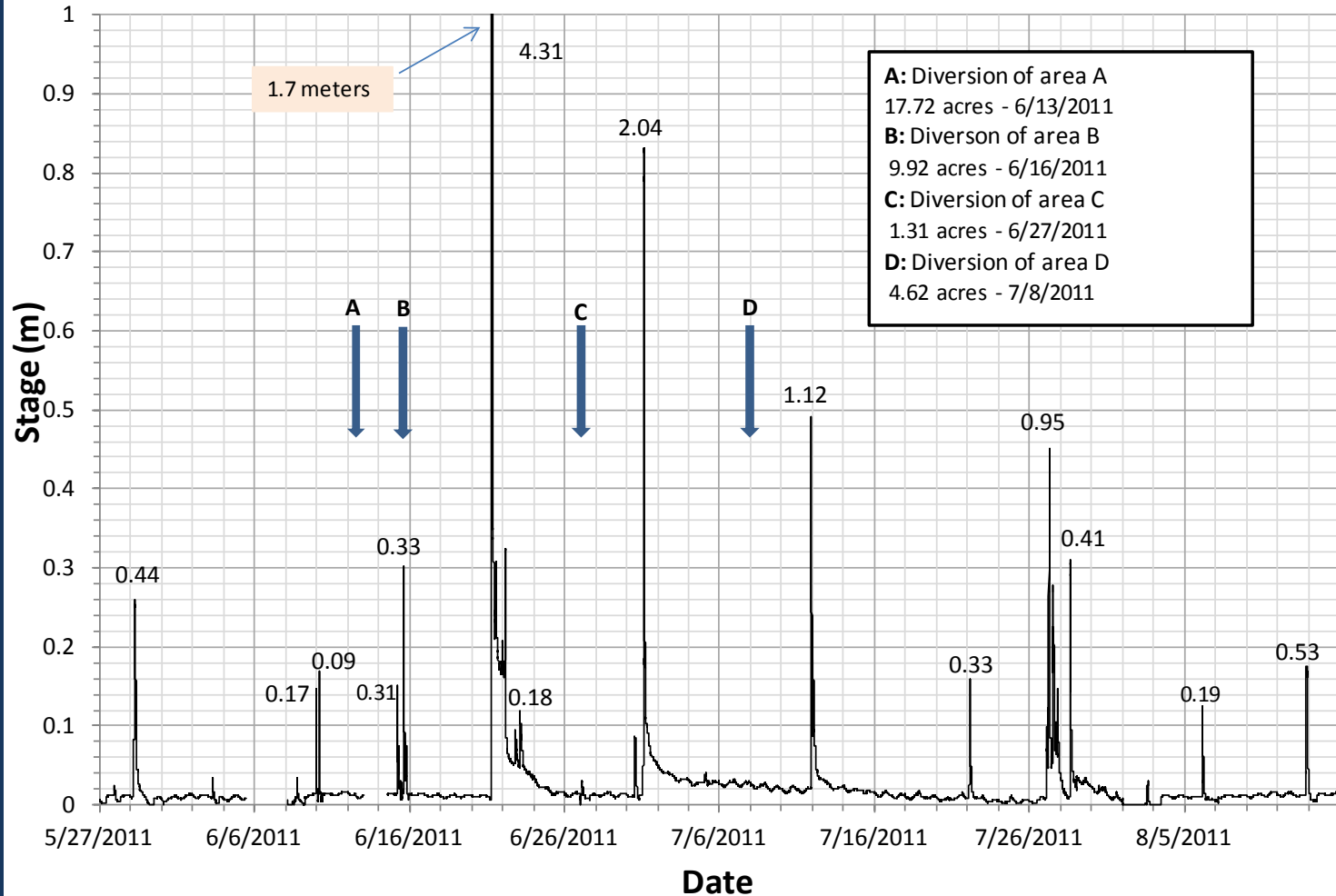
- |  |  |
|--|--|
|  Wetlands Ponds  |  Pond           |
|  Asphalt         |  Roofs          |
|  Concrete        |  Sand           |
|  Flat lawn       |  Woodland flat  |
|  Grass and shrub |  Woodland steep |
|  Meadow          |  |



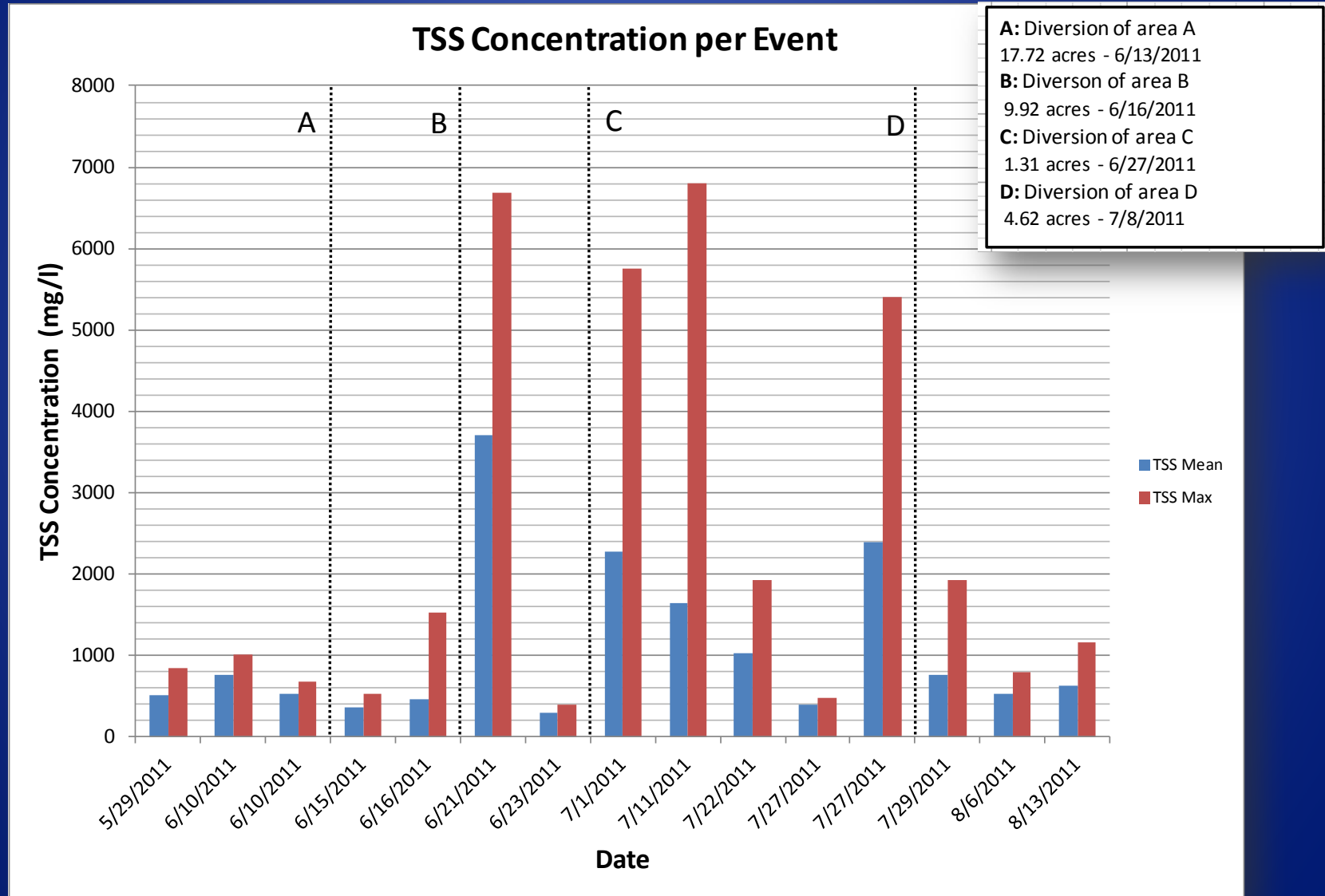
~ 33.6 acres of parking lots redirected <sup>21</sup>

# Summer 2011 Hydrograph

## Hydrograph - May 27th, 2011 to August 15th, 2011



# TSS Concentration in Little Mac Ravine



# GVSU Storm Water Management Complex



**GRAND VALLEY STATE UNIVERSITY.**

## Storm Water Management Complex at the Towers

This site has been developed for the purpose of managing storm water generated from campus buildings and parking facilities. The 80 acre site is the home to many species of wildlife.

This is an outdoor science lab for several academic programs. Please respect the plant and animal life by viewing this complex from the top of the mound at Laker Village. Access to the viewing area is provided by the established path.

For more information visit [www.gvsu.edu/stormwater](http://www.gvsu.edu/stormwater).



Labels on the map include: Outflow Ditch, Lower Storm Water Management Cell, Middle Storm Water Management Cell, Upper Storm Water Management Cell, Storm Water Forebay, Storm Water Flow through North Storm Water Management Complex, Upper Storm Water Management Cell, Lower Storm Water Management Cell, Storm Water Forebay, and Storm Water Flow through South Storm Water Management Complex.





# GVSU Storm water Management Complex



# GVSU Storm Water Management Complex



Google earth

# 2012 Storm Water Ponds Research

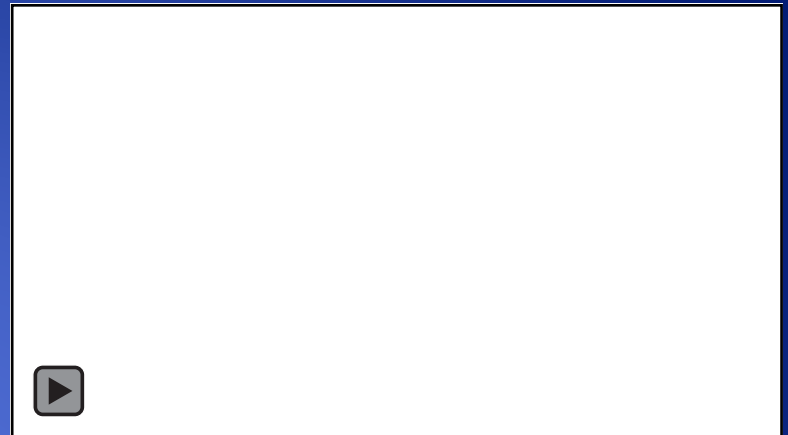
- Data from 936 samples and 9 precipitation events indicate that the system is efficient at removing suspended solids and contaminants.
- Many of the precipitation events in 2012 were hydrologically undetectable beyond the second pond, and the time required to pass through all the ponds during 2012 was on the order of 5 days
- Nutrient levels (nitrate and phosphate) were elevated (pond event average was 0.4 ppm and 0.1 ppm for nitrate and phosphate, respectively) above background levels during precipitation events; however, there is no clear indication that fertilizer-derived nutrients are adversely affecting water quality.

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# Storm Water BMPS at GVSU

- Bio swales
- Permeable Concrete and Asphalt
- Rain Gardens (Large and Small)
- Detention Ponds
- Green roofs
- Vegetated buffers (no mow zones)



Mackinac Bio Swale after light rain



Mackinac Bio Swale after heavy rain

# Other BMP examples



Permeable Concrete

Green Roof on Mackinac Hall



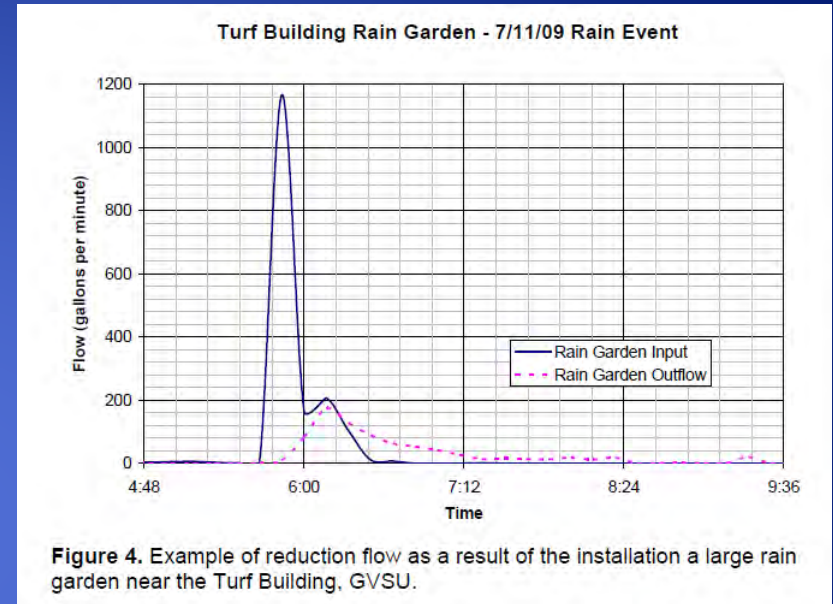
Bio swale with art



# BMP examples



Permeable Asphalt



Turf Building Rain Garden



# BMP Benefits



Introductory geology students at storm water ponds



Bald Eagle at the Pierce Storm Water Management Complex 2011



# Acknowledgements

- Dr. Eric Snyder, GVSU
- Dr. Tara Kneeshaw, GVSU
- Kerri Miller, FTCH
- James Moyer, GVSU facilities

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# GVSU's Storm Water Future

- Strategic Water Quality Initiative (SAW) grant to update GVSU storm water management plan
- Data collection and monitoring with students
- Faculty participation in planning process (SWAG)
- Collaboration with others implementing storm water solutions in West Michigan
- Storm water art



# Questions ?

<http://www.gvsu.edu/stormwater>

<http://faculty.gvsu.edu/wamplerp/>

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