THINKING OUTSIDE THE BOX CULVERT
UNDERSTANDING FLOOD MANAGEMENT
AND NATURAL FLOODPLAIN MITIGATION

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October 9th, 2012
The following presentation represent the views of the speaker and may not represent views of the Milwaukee Metropolitan Sewerage District, the ASFPM Board or Membership.

This Presentation is Focused on What I Think I know Best, Which is not Much.
Floodplain Managers Celebrating Job Security
If you lived here you would be flooded
A lake view was not in the Real Estate Brochure.

“If a community knows it can get a hundred percent aid to rebuild, there's no incentive for moving out.”
Background Basics for Flood Management

• Basics of Blame
• In any flood there is always a great search to find the culprit who caused the flood event “Take the Blame”
• Often Called SODDI-Some Other Dude Did It
• The SODDI for Flooding Damages and most natural disasters is:

Slide Courtesy of Ed Thomas
Mother Nature

Slide Courtesy of Ed Thomas
Does Nature Cause Disasters?

• Are Natural Disasters “Natural”?  
• Chinese Proverb: “Floods are Gifts of Heaven, Flooding is the Work of the Devil”  
• Dr. Gilbert Fowler White Stated The Facts: “Floods are Necessary Acts of Nature; But Flood Losses Are Largely Acts of Man”  

Cause of increased Flood Loss Is Changes in the Density and Cost/Type of Buildings in Flood Hazard Areas  

Slide Courtesy of Ed Thomas
Basic Flood Facts

- Flooding is #1 natural hazard in US and it is increasing
- More than 50% of properties in high-risk areas do not have flood insurance
- 25% flood insurance claims outside SFHA
- 26% chance of flood during 30-year mortgage (compared to 9% chance of fire)
- Studies show $4 savings on every $1 of mitigation
• $16 billion annually
• Four-fold increase from early 1900s
• Per capita damages increased by more than a factor of 2.5 in the previous century in real dollar terms
• And then there was Katrina, Irene, and the Mississippi Floods...
Current Floodplain Management Approach Influences Damage Trends

- Promotes construction in risk areas
- Ignores changing conditions
- Ignores adverse impacts to existing properties
- Undervalues natural floodplain functions
- Transfer of who pays for Risk
What is Flood Management?

Flooding is a natural process that becomes problematic if property and life are put in the path of disaster!

THEREFORE:

Floodplain management is a decision making process for wise use of the Existing Floodplain based on all costs and benefits
Functions and Values

Wetlands

- WILDLIFE AND WILDLIFE HABITAT
- FLOOD PROTECTION
- WATER QUALITY PROTECTION & IMPROVEMENT
- SURFACE WATER AND GROUNDWATER
- RECREATION AND AESTHETICS
- FOOD, JOBS, AND THE ECONOMY

Floodplains

- WATER RESOURCES VALUES
  - Natural Flood Storage and Conveyance.
  - Water Quality Maintenance
  - Groundwater Recharge
- LIVING RESOURCES AND HABITAT VALUES (wildlife)
- CULTURAL RESOURCES VALUES (historical significance, aesthetics, recreation)

Slide Courtesy of Jeanne Christie
Functions and Values

Wetland

- Dissipates stream energy
- Provides critical wildlife habitat
- Contaminants and sediment are filtered
- Cleaner water outflow
- Slow release of stored water
- Groundwater flow
- Bacteria break down contaminants

How wetlands work

Floodplains

- 100-Year Floodplain
- 100-Year Floodway
- No Development Allowed
- Regulatory Water Surface Elevation
- Maximum 1-ft Increase in Flow Depth
- Development Allowed in 100-Year Flood Fringe on Fill
- Main Channel

Slide Courtesy of Jeanne Christie
Funding and Programs Must Support Multi-Service Projects

- Flood Management + Wildlife + Water Pollution
- Aesthetics + Flood Management + Wildlife
- Recreation + Groundwater Recharge + Sediment Management
- Wildlife + Erosion Control + Recreation
- Water Quality + Water Quantity

Slide Courtesy of Jeanne Christie
Constraints to Incorporating Ecosystem Functions and Services Into Local Land Use Decisions

- Local governments and Development:
  - Tend to have a short-term focus
  - Strive to increase the local tax base
  - Need to accommodate an increasing population
  - Must navigate local politics and property rights issues
  - Need to satisfy state/federal regulators
  - May not be aware of guidance/data on ecosystem service benefits
Natural Floodplain Functioning

Slide Courtesy of John Mc Shane
Activities that could adversely impact flood damage to another property or community will be allowed only to the extent that the impacts are mitigated or have been accounted for within an adopted community-based plan.

NAI is a concept/policy/strategy that broadens one's focus from the built environment to include how changes to the built environment potentially impact other properties.

NAI broadens property rights by protecting the property rights of those that would be adversely impacted by the actions of others.
“Floods produce several direct and indirect effects most of which remain unpriced by the market [and] prevents the market price from sending the correct signals about the true economic value of the wetland.”

“...there is a need to consider other means to assess the true value of unpriced environmental resources taking into account implicit and explicit trade-offs between conservation and development.”

- Business as usual is not cost effective
- It is and will become increasingly difficult to get funds from federal government or state government
- Preserving (or Restoring) Natural Functions is cost effective (cheap)
Located in the Menomonee River Watershed SE Wisconsin.

Compared cost of building detention basin to provide flood water storage to preserving natural floodplain storage through the purchase of the land.

**Constructed Detention**  
315M gallons  
$100M+  
$0.31 per gallon

**“Greenseams” (Natural Storage)**  
1.325 B gallons  
$22.5 M  
$0.017 per gallon

SE Wisconsin has lost 150,000 acres of wetlands and riparian flood storage, and more than 30 billion gallons of flood storage since the early 70s.
Natural Floodway Preservation
Otter Creek Vermont

- Town of Middlebury delineated natural floodplain and floodway
- Middlebury worked to prevent development in floodway
- Middlebury preserved natural floodplain and flood fringe through land purchases, zoning restrictions, and restoration of wetlands
- First big test was Tropical Storm (Hurricane) Irene
- Town of Rutland (30 miles upstream of Middlebury) saw a rapid rise in flow 15-16,000 CFS, severe damage, limited protection of natural floodplain
- Downstream in the Town of Middlebury no rapid rise, reduction in peak flow to 8,000 CFS, nearly 50% reduction with minimal damage.
- No calls from Middlebury Residents for dredging or channelization of Otter Creek. Cost benefit did not include structural flood control solutions not needed
- Up to 40 additional Vermont communities are looking at this model to lower their vulnerability to floods

Mike Kline, River Program Manager, Vermont Department of Environmental Conservation
Lessons From Louisiana and Katrina

- Since the 1930s 1.2 million acres of Mississippi wetlands lost
- Levees and channels send billions of tons of sediment into the gulf
- Mississippi Delta Basin dams catch sand destined for barrier islands
- Wetlands can reduce the storm surge 1 foot for every 2.5 miles of wetlands
- There was reduced levee damage and flood damage where barrier islands, and wetlands were present in front of levee systems
- Levees damaged or breached where there was only open water
- The Mississippi River has the water, sediment and energy to rebuild the Delta
- Rebuilding the Delta will provide hurricane protection, increased fisheries, recreation, reduce “dead zone”, carbon sequestration, reduced flooding
- Costs to rebuild and restore the Delta are estimated at $15 Billion.
- Benefits are estimated at $12-$47 Billion/year.
- If treated as capital asset the value would be $330 billion to $1.3 trillion
- Rebuilt wetlands and barrier islands reconnected to the river system and delta will not degrade as constructed flood management facilities like levees

Bullet Points are from “What’s the Economy For Anyway?” John De Graaf and David Batker
Research from LSU Professors Paul Kemp, Hassan Mashriqui, and John Day
Menomonee River Watershed
Milwaukee, WI
Menomonee River
Watercourse Management Plan

Greenseams Program
Timmerman Field Basin
County Grounds Basin & Hart Park
Western Milwaukee
Valley Park Levee
Concrete Channel Removal
Green vs Grey Infrastructure
LAKE MICHIGAN
Rain Gardens
INITIATIVE

150,700 Plants Sold Since 2006
More than 20,000 Sold
Green Roofs

MMSD

Milwaukee County Zoo

Mequon

MillerCoors
County Grounds
Hart Park Flood Management
Rehabilitating Urban Streams

Old Ideas

New Ideas

Photos: Dr. Thomas M. Slawski
Men. River
Drop Structure
Dewatering Channel
12/20/99
Revitalize Menomonee River Channel

Slide Courtesy of Tom Sear
Green Streets and Sustainable Storm Water Management

**Before**

Curb extensions instead of bigger pipes for storm water flows

Green infrastructure can be used when its cost $\approx$ grey infrastructure.

**After**

Drainage: 9,300 sq. ft.

Removed: 590 sq. ft.
Trees hold rain to reduce storm water runoff.

Stormwater Trees
This needs lots of Explaining Lucy
Small Project Can Have a Huge Impact... in urban areas
Channel Restoration Improved Fishing and Water Quality

Photos: Dr. Thomas M. Siewski and SEWRPC
MMSD Water Quality Index Menomonee River

FIGURE BS-1: MMSD Water Quality Index Rating Menomonee River Monitoring Sites (Pre-tunnel 1980 - 1992)

Underwood Creek – Before Construction 2008
Existing Conditions & 1st Flood Event
Kinnickinnic River Project

Objectives:

• Reduce Flood Risk
• Improve Public Safety
• Stream Channel Rehabilitation
• Neighborhood Development
Kinnickinnic River Watershed
Was voted one of the top ten worst rivers in North America in 2007
Kinnickinnic River

Year 1836

Vs

Year 2009
(Increased Stream Channel Miles)

Lost Wetlands

Slide Courtesy of Tom Slawski
Kinnickinnic River
1930-1960

- Channel photos taken April 1960 in vicinity of S. 6th St Bridge
- Channel constructed by WPA in 1930’s
March 1960 Flood Event

Flooding in S. 12th St South of the KK River
Flood Risk Management
Improved Channel?
Concrete Channel Encouraged Development in Floodplain
KK River “100 year” Floodplain and Floodway
Current Project Background

- KK Watercourse Plan updated in October 2009
- Reduce flood risk for ~328 properties
- Improves public safety
- Includes acquiring 100 properties with 83 structures (Deconstruction Used)
- Neighborhood Plan (Catalytic Project)
KK River Channel Alternatives 6th-16th Street

Stone Channel & Vegetated Overbanks Without Walls

Low Flow Channel & Vegetated Overbanks With Walls
Potential Bioengineered Channel Conceptual Cross Sections
KK River Channel Alternatives 6th-16th Street

Stone Channel & Vegetated Overbanks Without Walls

Low Flow Channel & Vegetated Overbanks With Walls
• Existing concrete channel

KK River 6th Street to I-94 Upstream 2010
Concrete Channel Removal
Channel Construction Completed
Oh, crap! Was that today?
Questions?

Has a century of work in water resource management (flood management) resulted in an outcome that we would wish to continue into the future in its current form?

Should we be concerned about the extent and condition of our floodplain and coastal resources (our natural infrastructure)?

How can we adapt to a changing world (climate, population, economies...)?

Can we afford to continue on this pass?