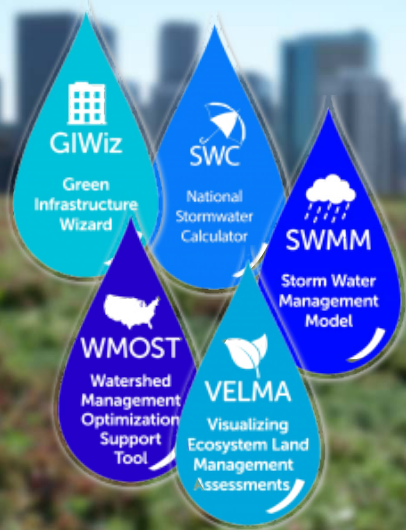




Office of Research and Development

Monthly Water Research Webinar Series

SAFE AND SUSTAINABLE WATER RESOURCES RESEARCH PROGRAM



October 26, 2016

TODAY'S TOPIC:

Toolkit of Available EPA Green Infrastructure Modeling Software

Watch as you wait

Watch the Toolkit video:

<https://www.epa.gov/water-research/green-infrastructure-modeling-toolkit>

Webinar Support Phone Number: 1-800-263-6317

Audio Controls: Your audio is muted by the organizer

To Ask a Question: Type in the "Questions" box in the lower section of your screen

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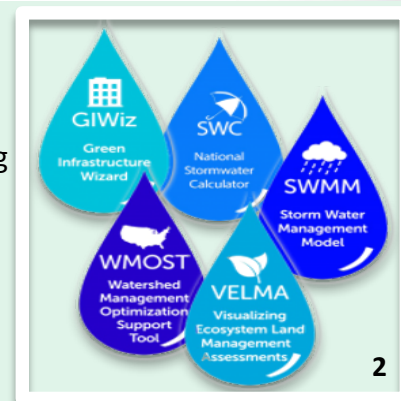
Need for Water Runoff Control: Stormwater discharges continue to cause impairment of our Nation's waterbodies. Conventional stormwater infrastructure, or gray infrastructure, is largely designed to move stormwater away from urban areas through pipes and conduit. Runoff from these surfaces can overwhelm sewer systems and end up contaminating local waterways. When stormwater runs off impervious streets, parking lots, sidewalks, and rooftops, it carries pollutants, such as motor oil, lawn chemicals, sediments, and pet waste to streams, rivers, and lakes. Runoff flows can also cause erosion and flooding that can damage property, infrastructure, and wildlife habitat. In addition to runoff problems, impervious surfaces also prevent water from penetrating the soil and recharging groundwater supplies.



Green Infrastructure: Green infrastructure, such as rain gardens, green roofs, porous pavement, cisterns, and constructed wetlands, is becoming an increasingly attractive way to recharge aquifers and reduce the amount of stormwater runoff that flows into wastewater treatment plants or into waterbodies untreated. It provides many environmental, social, and economic benefits that promote urban livability, such as improved surface water quality, water conservation, and improved aesthetics and property values. Green infrastructure is also incorporated into municipal separate storm sewer system (MS4) and National Pollutant Discharge Elimination System (NPDES) stormwater permits for retention requirements for various states across the Nation.

Green Infrastructure Modeling Toolkit: Researchers in EPA's Office of Research and Development (ORD) have been studying green infrastructure practices and developing models and tools to help communities manage their stormwater runoff and address nutrient impairment. This webinar will present a toolkit consisting of five EPA green infrastructure models and tools, along with communication material, that can be used as a teaching tool and as a quick reference resource for use by planners and developers when making green infrastructure implementation decisions, and can also be used for low impact development design competitions. The models and tools included in the toolkit will be presented during this webinar.

The toolkit is available on EPA's website: epa.gov/water-research/green-infrastructure-modeling-toolkit





Disclaimer

The views expressed in this presentation are those of the author and do not necessarily reflect the views of the U.S. Environmental Protection Agency. Any mention of trade names or commercial products does not constitute Agency endorsement or recommendation for use.



Green Infrastructure Wizard (GIWiz): GIWiz is an interactive web application that provides users with customized reports containing the EPA tools and resources they select, direct links, and overview information about each.



Dr. Marilyn ten Brink

Dr. Marilyn ten Brink is a Special Assistant to the Director of the Atlantic Ecology Division (AED) of EPA's National Health and Environmental Effects Research Laboratory (NHEERL) in Narragansett, Rhode Island. She received her Ph.D. in Environmental Geochemistry from Columbia University, New York, and has over 35 years of research experience on pollutant distribution, impacts, and management for aquatic systems. Marilyn is currently leading an interdisciplinary group of scientists to develop tools, including GiWIZ, that enable communities to better utilize Green Infrastructure approaches and improve sustainability.

Contact: tenbrink.marilyn@epa.gov



What is GIWiz?

A database of EPA's Green Infrastructure Tools and Resources

An interactive web application that connects communities with these Tools and Resources

A wizard that provides customized links and exploration, based on your objectives and specifications

A decision support tool for green infrastructure implementation

A simple means to generate a report about tools and resources of interest

EPA US Environmental Protection Agency

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Search EPA.gov

Related Topics: Sustainability

Green Infrastructure Wizard

Green infrastructure uses natural landscapes to manage water and provide environmental and community benefits. EPA's [Green Infrastructure Wizard](#), or **GIWiz**, provides access to tools and resources that can support and promote water management and community planning decisions.

What is GIWiz?

GIWiz is an interactive web application that connects communities to EPA Green Infrastructure tools & resources.

Users can produce customized reports.

[Visit GIWiz today](#)

Features include:

- Quick Links** – Customized access to thousands of green infrastructure tools & resources, according to one of four objectives.
- Explore** – Access to an interactive database of green infrastructure tools & resources, based on your individualized specifications.
- Connect** – For application related questions, send an email to GIWIZ@epa.gov.

[Contact Us](#) to ask a question, provide feedback, or report a problem.

Resources

- [Fact Sheet](#)

Key Links

- [Green Infrastructure Home](#)
- [National Exposure Research Laboratory](#)
- [Office of Policy](#)

<https://cfpub.epa.gov/giwiz/>

<https://www.epa.gov/sustainability/green-infrastructure-wizard>



Why GIWiz?



Green Infrastructure Workshop & Fair in MA

Problem formulation

GI?

*Connecting
the Dots Between
Supply and Demand
of Information*

Tools & Resources:

- What is already available to meet community and stakeholder needs?
- Where are the gaps in research, tools, and information?

*DEVELOPING
DECISION CASES*

NEEDS:

What do communities, practitioners, and stakeholders need to make good decisions and improve compliance and sustainability outcomes?

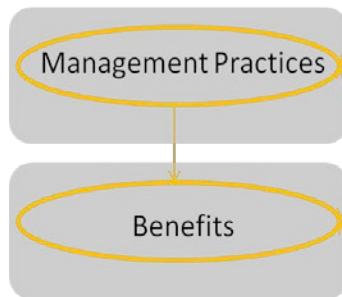
*LEARNING FROM
COMMUNITIES*

EPA has a vast array of *Green Infrastructure* tools, information resources, and case studies; however, this information can be difficult for users to navigate .

Attributes tagged for each Tool/Resource entry

User objectives associated with a suite of attributes

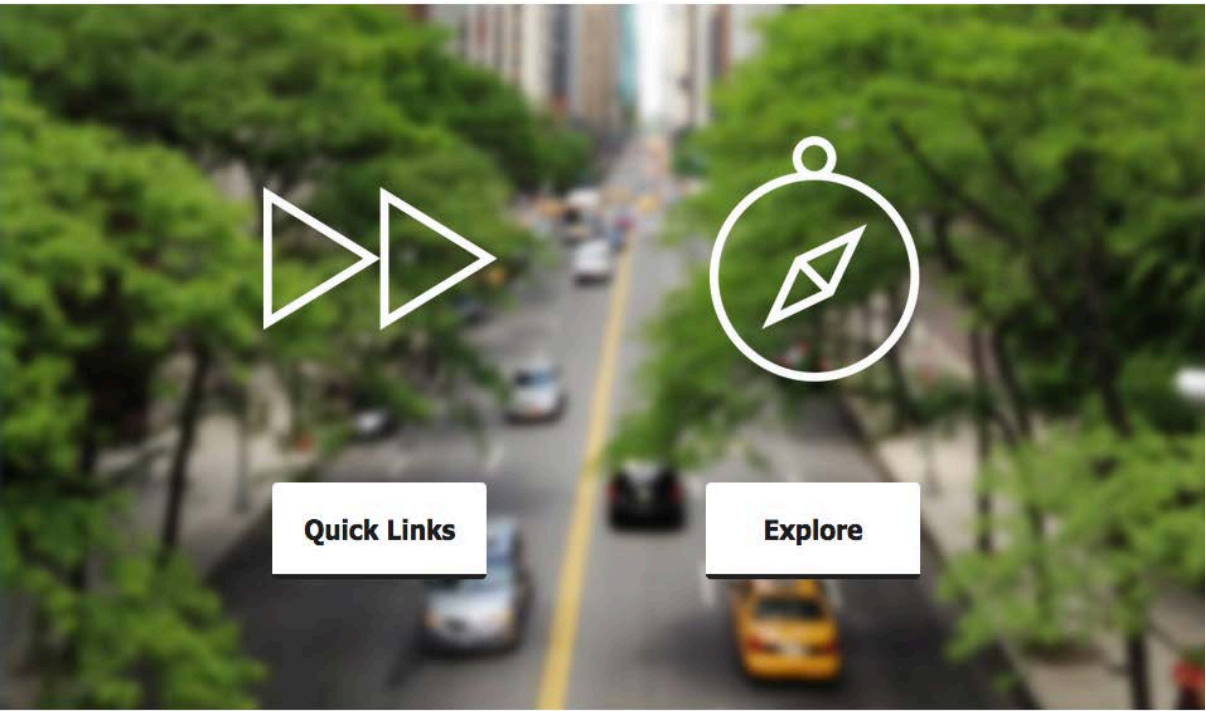
Practitioners often don't know where to start or how to find what they need.



Different types of users have differing needs specific to their context, objectives, and constraints.



What does GIWiz provide?



Quick, direct access to EPA's Green Infrastructure tools and resources

GIWiz offers you access to a repository of EPA-sourced Green Infrastructure tools and resources designed to support and promote sustainable water management and community planning decisions. The tools and resources available through GIWiz will help you analyze problems, understand management options, calculate design parameters, analyze costs and benefits, evaluate tradeoffs, engage stakeholders, and/or develop education and outreach campaigns. GIWiz is made possible through a cross-agency collaboration involving EPA's Office of Research and Development, Office of Policy, Office of Water, and Regional staff.



Faster, Easier Access to Information

Searching for: [EPA, Green Infrastructure, Regulator, Compliance] can yield an overwhelming array of results:



More than 7,000 users have visited GIWiz since the October 2015 launch.

First-level 'clicks'

- Learn
- Research
- Design
- Assess

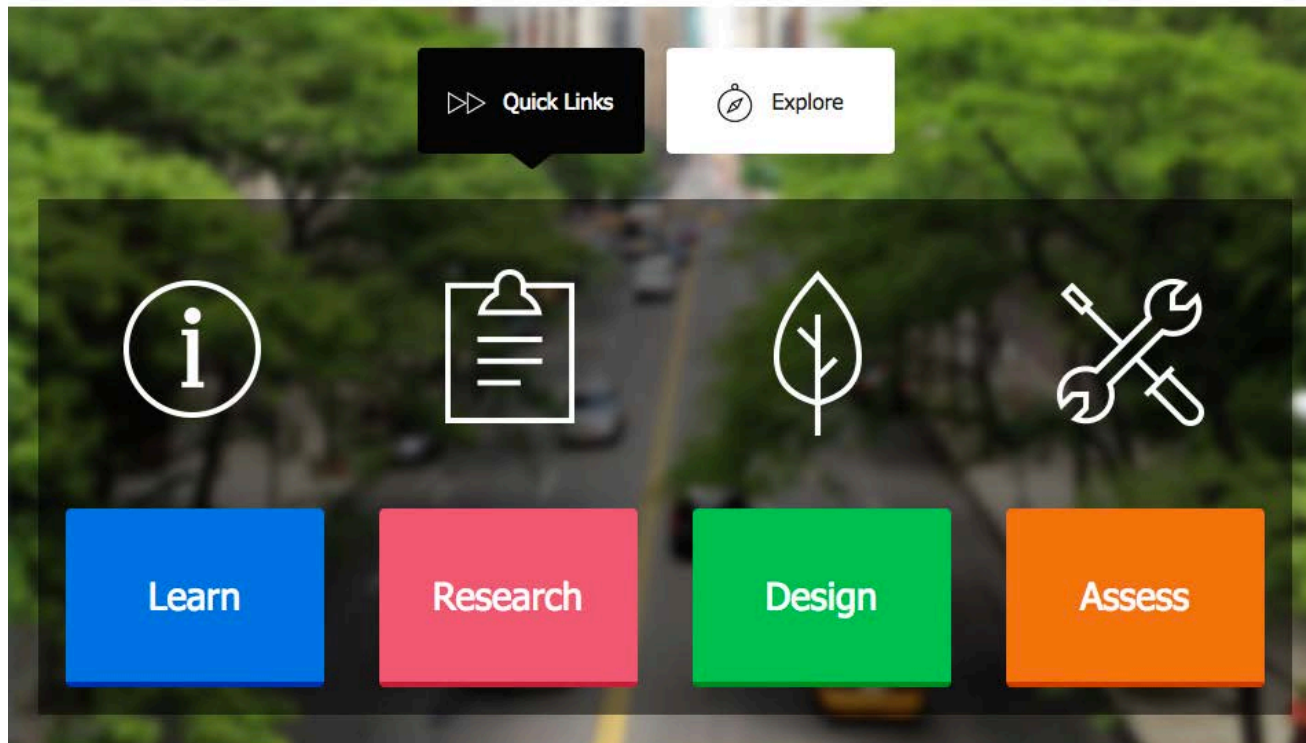
Quick Links

Explore

- Who are you?
- What would you like to do?
- Use the keyword search

- What resources are you interested in?
- What are your objectives?
- What benefits interest you?
- Are these skills applicable to you?
- Which management practices best fit your needs?

GIWiz offers you access to a repository of EPA-sourced Green Infrastructure tools and resources designed to help you analyze problems, understand management options, calculate design parameters, and promote sustainable water management and community planning decisions. The tools and resources available through GIWiz will help you analyze problems, understand management options, calculate design parameters, estimate costs and benefits, evaluate tradeoffs, engage stakeholders, and/or develop education and outreach campaigns. GIWiz is made possible through a cross-agency collaboration involving EPA's Office of Research and Development, Office of Policy, Office of Water, and Regional staff.



Use the Quick Links feature to access green infrastructure tools and resources, customized to a specific objective. Click the button that best matches your needs, and select the corresponding objective to view a tailored list of tools and resources.



QUICK LINKS to Tools and Resources



Learn



- I have general questions about green infrastructure
- I want to understand what other communities are doing
- I am interested in outreach and education
- I want to understand how green infrastructure can benefit my community



Design



- I want to use green infrastructure to manage stormwater and improve water quality
- I am interested in fostering climate resilience and preparing for extreme weather events
- I am focused on revitalizing my community and enhancing land use
- I want to manage, restore, and conserve my watersheds



Research



- I want to learn how green infrastructure can help me address regulatory compliance and meet permitting requirements
- I want to find out how to improve my community through Best Management Practices that target green infrastructure
- I need to find ways to pay for green infrastructure



Assess



- I am seeking tools to help me with site design, BMP performance, and maintenance
- I need help in developing strategies, plans, policies, and incentives
- I want to calculate, model, or manage data
- I am curious about mapping and geospatial analysis

Find the 'who, when, where, why and how' of Green Infrastructure Implementation

- Quick Link Organized by categories
- Include number of returns
- 'More info' and 'Resource Type'
- Downloadable
- Have links to each tool/ resource
- "Feedback" function

Example (Quick Links: *Research*)

1



I need to find ways to pay for green infrastructure

Total count: 66

 PDF Download

Green Infrastructure Resources

More Info

Resource Type

Like ?

Economic benefits and incentive mechanisms

+

Financial strategy, cost comparison, and cost-benefit analysis

+

Funding sources

+

Other

+

2



GIWiz Navigation for Your Needs



I need to find ways to pay for green infrastructure

Total count: 66

PDF Download

Green Infrastructure Resources

More Info

Resource Type

Like ?

Economic benefits and incentive mechanisms

Financial strategy, cost comparison, and cost-benefit analysis

Financing Alternatives Comparison Tool (FACT)



Fundamentals of Asset Management Step 10. Build Asset Management Plan A Hands-On Approach



Fundamentals of Asset Management Step 8. Optimize Capital Investment: A Hands-On Approach



Fundamentals of Asset Management Step 9. Determine Funding Strategy A Hands-On Approach



Green Infrastructure Approaches to Managing Wet Weather with Clean Water State Revolving Funds



Viewing the Resources

Linked url

5

Financing Alternatives Comparison Tool

The Financing Alternatives Comparison Tool (FACT) is a financial analysis tool that helps municipalities, utilities, and environmental organizations identify the most cost-effective method to fund a wastewater or drinking water management project. FACT produces a comprehensive analysis that compares financing options for these projects by incorporating financing, regulatory, and other important costs.

FACT creates several reports showing the results of the analysis. A summary report compares various financing options using key financial figures. Graphical presentations compare annual and total costs of financing options over time.

FACT version 3.1 includes a streamlined analysis option called FACT-Lite. FACT-Lite reduces the amount of information users must enter to compare financing options.

FACT User Guide

A comprehensive user guide is automatically available as part of the installation of FACT. Once FACT is installed, the user guide is accessed by selecting the Help and Definitions button in the top right corner of the homepage.

Alternatively, you can download the user guide separately, [FACT User Guide](#).

Downloading FACT

You can install FACT v.3.1 onto your computer by downloading the compressed (.zip) file below. See EPA's page on [Free Viewers and Readers to Read and Print EPA Information](#) to learn more about compressed files.

You will need Microsoft Access 2000 or higher to install and use FACT v.3.1.

If you have Microsoft Access 2000 or higher on your computer:

1. Install FACT by clicking on [FACT v.3.1](#) (1 pg, 36 MB) (ZIP)
2. Choose to run the file to install FACT v.3.1 on your computer.

If you do not have Microsoft Access 2000 or higher on your computer:

1. Install Access Runtime by clicking on [AccessRuntime](#) (1 pg, 36 MB) (EXE)
2. Install FACT by clicking on [FACT v.3.1](#) (1 pg, 10 MB) (ZIP)
3. Choose to run the file to install FACT v.3.1 on your computer.

After installing FACT, an icon named FACT will appear on your desktop that you can click to run the program.

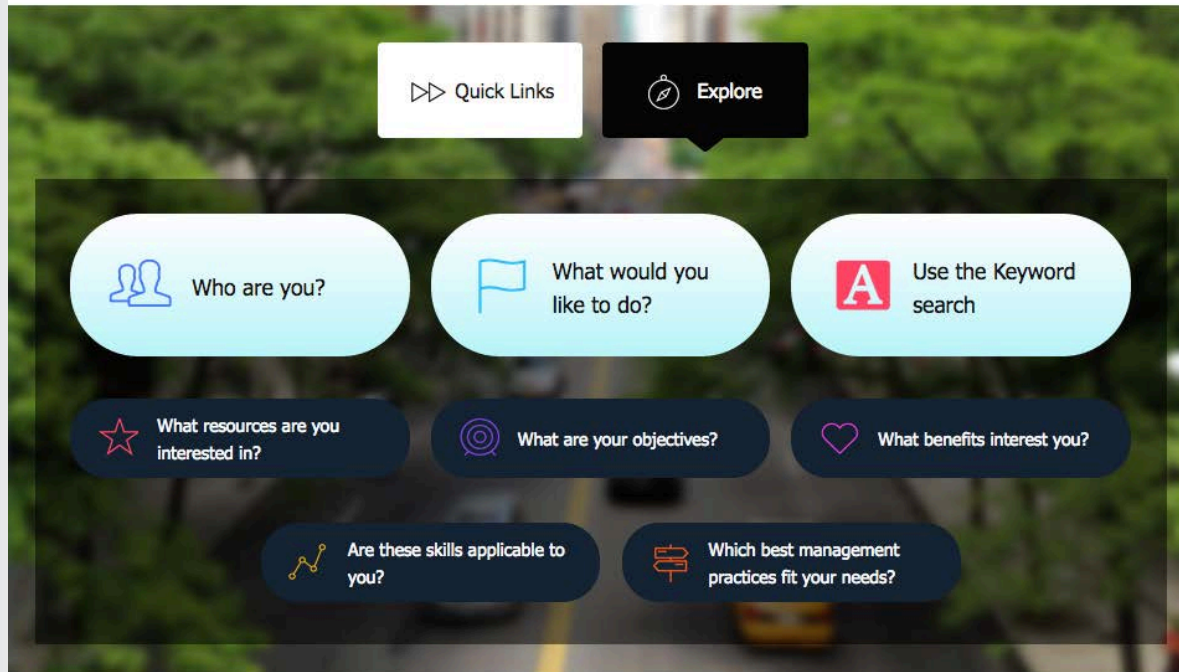
[Contact Us](#) to ask a question, provide feedback, or report a problem.

More info

4

Financing Alternatives Comparison Tool (FACT)

URL	https://www.epa.gov/cwswf/financing-alternatives-comparison-tool
Purpose	Drafting Standards and Codes, Economic Analysis/Assessment
Intended User	Community/Environmental Group Representative, Engineer/Developer, Natural Resource Manager/Planner, Regulatory Official
Objective	Address Zoning/Codes, Find Financing Options, Leverage Transportation Funding, Use Roadway Beautification Dollars
Benefits	Cost Savings, Regulatory
Cost	Free
Skills	
Resource Type	Data and Analytic Tools, Financial and Funding Support



Access GI tools and resources. Get a highly targeted report customized to your specifications....

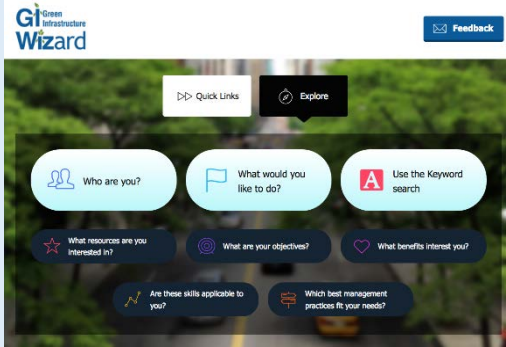
For example:

*"I am a **city planner** in a medium sized-city trying to do a **green streets program**. I want to **find design manuals** for various **tree planting scenarios** and for **stormwater management** within a business district.*

Use the Explore feature to access green infrastructure tools and resources, customized to your specifications. Answer any or all of the questions above by selecting one or more of the corresponding topics that interest you. At any point, click the "Show Results" button to view your customized list of results. Select as many, or as few, questions and corresponding topics as you would like. Click the "Clear Results" button to remove all previous selections and start over.

Using EXPLORE

Explore



Answer any or all of the questions and click **'show results'** to view your customized list of tools and resources

'Clear Results' to start a new search

1

2

Select as many or few as you wish

Who are you?

What would you like to do?

Use the Keyword search

What resources are you interested in?

What are your objectives?

What benefits interest you?

Are these skills applicable to you?

Which best management practices fit your needs?

- Address Zoning/Codes
- Carbon Sequestration
- Create a Model
- Develop a GI or LID Manual
- Examine Performance Rates
- Find Financing Options
- Leverage Transportation Funding
- Manage Extreme Rain Events
- Maximize Groundwater Quality
- Nutrient Removal
- Outreach/Education
- Project Monitoring/Evaluation
- Sediment Capture/Removal
- Select Trees/Plantings
- Use Roadway Beautification Dollars

Show results Clear results

Or **SEARCH** the database using keyword

Who are you?

What would you like to do?

Use the Keyword search

What resources are you interested in?

What are your objectives?

What benefits interest you?

Are these skills applicable to you?

Which best management practices fit your needs?

Keyword Search

Clear results

Wizard matches Tools and Resources to all user-selected criteria

What benefits interest you?

- Aesthetics/Livability
- Civic/Community Involvement
- Cost Savings
- Economic Development
- Ecosystem Health
- Grey Infrastructure Footprint
- Hydrological Improvements
- Pollution/Climate Change Mitigation
- Property Value Increases
- Public Health/Safety
- Recreational
- Regulatory
- Resource Protection/Improvement
- Right-of-Way Enhancements
- Runoff Nutrient Loading

Are these skills applicable to you?

- Concept Mapping
- Content Management
- Cost Estimation
- Data and Analysis
- Engineering
- Environmental / Program Management
- Geospatial Analysis
- Scientific Knowledge
- Statistics
- Teaching

What would you like to do?

- Compliance
- Data and Modeling
- Decision-Making and Planning
- Drafting Standards and Codes
- Economic Analysis/Assessment
- Engagement/Outreach
- Environmental Footprint Analysis
- Mapping and Visualization
- Other Environmental Analysis
- Other Environmental Assessment
- Performance Analysis
- Project Management and Reporting
- Sustainability Impact Analysis

Which best management practices fit your needs?



- Conservation/Restoration
- Construction
- Education and Outreach
- Environmental Management
- Municipal Management
- Stormwater/Flood Management
- Transportation
- Wastewater Management



GIWiz Database

Connecting the dots between Supply and demand for GI information

Database content is expanding

- V1 Sept 2015: 270 Tools and Resources
- V2 Sept 2016: **395 Tools and Resources**

What resources are you interested in?

- Case Studies
- Data and Analytic Tools
- Fact Sheets
- Financial and Funding Support
- Informational Websites
- Mapping Tools
- Outreach Materials and How-Tos
- Popular Press/Media
- Publications and Reports
- Videos, Webcasts, and Webinars

Green Infrastructure Wizard

Showing 395 Green Infrastructure Resources

Green Infrastructure Resources

A Triple Bottom Line Assessment of Traditional and Green Infrastructure Options for Controlling CSO Events in Philadelphia's Watersheds

Purpose: Data and Modeling, Decision-Making and Planning, Economic Analysis/Assessment, Environmental Footprint Analysis
Intended User: Community/Environmental Group Representative, Engineer/Developer
Objective: Carbon Sequestration, Create a Model, Maximize Groundwater Quality, Project Monitoring/Evaluation
Benefits: Aesthetics/Livability, Cost Savings, Ecosystem Health, Pollution/Climate Change Mitigation, Property Value Increases, Public Health/Safety, Recreational
Cost:
Skills:
Resource Type: Case Studies, Publications and Reports

Achieving Water Quality Through Integrated Municipal Stormwater and Wastewater Plans

Purpose:
Intended User: Regulatory Official
Objective:
Benefits:
Cost:
Skills:
Resource Type: Publications and Reports

Adaptive Management for Urban Watersheds: The Slavic Village Pilot Project

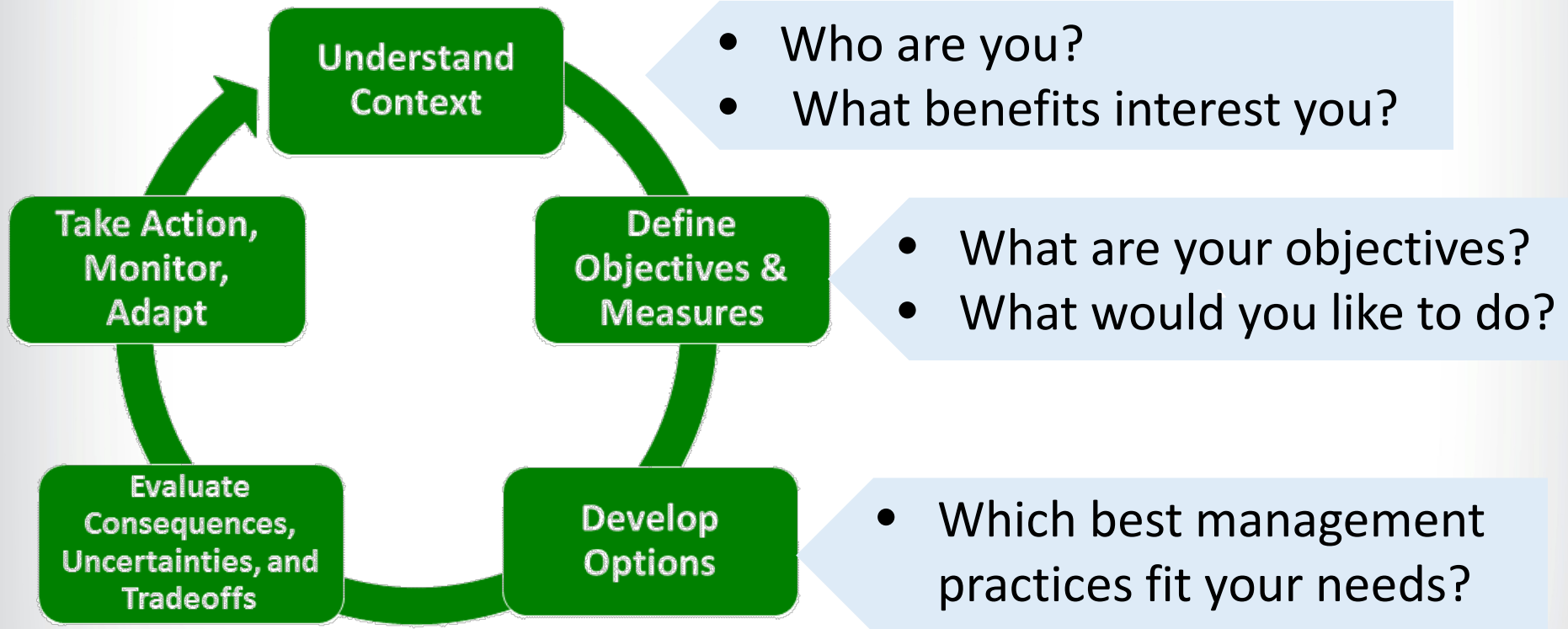
To create a report of the full GIWiz content, Select all in 'EXPLORE/ What Resources are you interested in?'



Decision Support with EXPLORE

Community/Environmental Group Representative
Engineer// Developer
Natural Resource Manager/ Planner
Landowner/Homeowner
Scientist/ Academic
Regulatory Official

ROLES & STAKEHOLDERS



Green Infrastructure Implementation
in DASEES Decision Analysis Framework

1
Example of report from user-customized criteria in EXPLORE pathway

Who are you?
What would you like to do?
Use the Keyword search
What resources are you interested in?
What are your objectives?
What benefits interest you?
Are these skills applicable to you?
Which best management practices fit your needs?

- Community/Environmental Group Representative
- Engineer/Developer
- Landowner/Homeowner
- Natural Resource Manager/Planner
- Regulatory Official
- Scientist/Academic

Show results Clear results

Total count: 201
Show 10 entries

results

PDF Download

Green Infrastructure Resources	More Info	Resource Type	Like
A Triple Bottom Line Assessment of Traditional and Green Infrastructure Options for Controlling CSO Events in Philadelphia's Watersheds			
Adaptive Management for Urban Watersheds: The Slavic Village Pilot Project			



Knowledge Base through Collaboration

This is a collaborative project aimed at bridging the gap between the expert knowledge contained within our Green Infrastructure Tools and Resources, and the institutional and user knowledge about where they are located and what they are for.



www.epa.gov/giwiz

GIWiz

- **Helps people considering Green Infrastructure**
- **to find the tools and resources they need**
- **to make sound decisions and advance Green Infrastructure implementation**



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GIWIZ

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- **to make sound decisions and advance Green Infrastructure implementation**

EPA Office of Research and Development (ORD)
Safe and Sustainable Waters Research (SSWR)
and Sustainable and Healthy Communities
Research (SHC), Office of Policy, Office of Water,
Office of Environmental Information, Regions 1, 2
and 3 and Community partners.

Marilyn Buchholtz ten Brink, Ph.D.
(ORD/NHEERL) RI

Michael Nye, Ph.D. (ORD/NERL) CO
Robert Sachs (AA/Office of Policy) DC
Ingrid Heilke, MCP (ORISE Fellow) RI



Watershed Management Optimization Support Tool (WMOST): WMOST is a software application designed to facilitate integrated water resources management across wet and dry climate regions. It allows water resources managers and planners to screen a wide range of practices across their watershed or jurisdiction for cost-effectiveness and environmental and economic sustainability. WMOST allows users to select up to fifteen stormwater management practices, including traditional grey infrastructure, green infrastructure, and other low impact development practices.



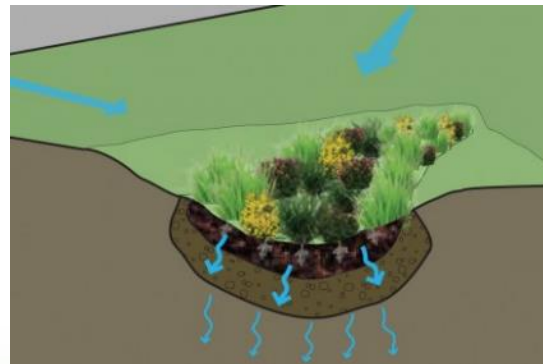
Dr. Naomi Detenbeck

Dr. Naomi Detenbeck is an ecologist in NHEERL AED in Narragansett, RI, with an adjunct faculty appointment in Natural Resources Science at the University of Rhode Island. Her current research is focused on the watershed-scale effects of natural and constructed green infrastructure, development of decision-support tools for integrated water resources management, such as WMOST, and development of EPA's Estuary Data Mapper. Naomi's past research has included work on biogeochemistry, wetlands, landscape ecology, nutrient criteria development, and watershed classification. She earned her M.S. and Ph.D. in Ecology from the University of Minnesota.

Contact: detenbeck.naomi@epa.gov

Decision-support tool for integrated water management at the small watershed/community scale

- Optimizes cost (given targets for base flows, peak flows, water storage, water quality*)
- Evaluates management options in multiple programs
 - Stormwater, including green infrastructure (GI)
 - Wastewater
 - Drinking water
 - Land conservation



* Water quality module available for beta testing in fall 2016



Who and What is WMOST Designed For?

- Community decision-makers:
 - Municipal, regional, or watershed planners
 - Utility managers
 - Community consultants
- Planning level assessments within the following:
 - Watershed Implementation Plans
 - Applications for Grants, State Revolving Fund loans, FEMA Community Rating System credits,...
 - Long-range strategies (utility 20-year horizons, smart growth, climate resilience)
 - Integrated management plans (e.g. wastewater + stormwater)



Example Applications

- **Ipswich River, MA**

What is the most cost-effective suite of management actions to meet target baseflows in the Ipswich River?

- **Monponsett Ponds watershed, Halifax, MA**

What are the tradeoffs among flood control, recreational use, downstream aquatic life use, and sustainable water supply?

- **Subwatersheds of Taunton River, MA (multiple communities)**

What is the value of natural and constructed green infrastructure in reducing flooding and water quality impairments under different development and climate change scenarios?

- **Subwatersheds of Montgomery County, MD**

What are the most cost effective management practices and tradeoffs involved in meeting both local sediment TMDLs and N/P/SS targets for the Chesapeake Bay TMDL?

- **Subwatersheds of Middle Kansas River, KS**

What are the most cost-effective management practices to both reduce water quality impairments and manage for resilience in the face of climate change?

- Accepts inputs from commonly used hydrology models, e.g.,
 - HSPF, SWAT (HAWQS*), SWMM, GWLF, PRMS
 - National USGS Monthly Water Balance Model (Bock et al. 2016)
- Allows automated import of time series from existing calibrated models or addition of user-supplied datasets
- Links with EPA SUSTAIN/SWMM to automate calculation of gray and green infrastructure BMP runoff (v1-2) and load reductions (v3)**
- Accepts flood-cost curves derived using FEMA HAZUS tool with publically available data from Flood Insurance Studies

- *beta version tests underway

- **Beta version available for testing Fall 2016



MS-Excel interface

WMOSTv2_042415_LWD.xlsm - Excel

FILE HOME INSERT PAGE LAYOUT FORMULAS DATA REVIEW VIEW

Clipboard Font Alignment Number Styles Cells Editing

E22 : fx Summary table of management decisions and costs

Watershed Management Optimization Support Tool (WMOST) v2

Compatible with Microsoft Excel 2010 © Please refer to the documentation before using the model to understand its uses and limitations.
Original model was created in 2007 (Zoltay et al. 2010). WMOST development is sponsored by EPA. Contact for questions: Viktoria Zoltay, Abt Associates, Inc. 617-520-2721, viktoria_zoltay@abtassoc.com
Please report software errors to Naomi Detenbeck, detenbeck.naomi@epa.gov, with the subject "WMOST bug". To register for notices of updates and new releases, email detenbeck.naomi@epa.gov with the subject "WMOST register".

ENTER INPUT DATA

Proceed to The input data tab summarizes all input data necessary. Specific input tables and fields are accessed from this sheet.

RUN OPTIMIZATION

Optimize This button initiates the optimization program and processes the output for viewing.

EVALUATE RESULTS

Results Table Summary table of management decisions and costs for meeting user-specified goals (e.g., demand, in-stream flow targets)

Compare to Measured Flow Graph comparing modeled streamflow to measured streamflow

Compare to Target Flow Graph comparing modeled streamflow to target streamflow

Intro Input Runoff Recharge Surface Water Results Results_Raw Flow Chart Tables

READY 100%



Management options in WMOST

- Land conservation
- Water conservation
- Changes in drinking water infrastructure
- Changes in wastewater infrastructure
- Water reuse facility and aquifer storage/recharge
- Interbasin transfer
- Best Management Practices (BMPs), including green infrastructure (GI)

- Existing
 - Detention (dry) ponds (gray infrastructure)
 - Bioretention (GI)
 - Infiltration trench (GI)
- In progress
 - Forested riparian buffers
 - Biofiltration with internal storage reservoir (denitrification)
 - Grass swale
 - Gravel wetland
 - Infiltration basin
 - Infiltration chambers
 - Porous pavement
 - Sand filter
 - Wet pond

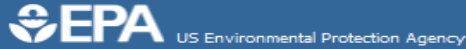


Ongoing WMOST Activities

- Water quality module – beta version available for testing Fall 2016
- Reduced Sewer Overflows module (Winter 2016)
- More input time series
 - New England loading time series (Fall 2016)
 - New England HSPF models: climate change scenarios
 - EPA 20 watershed study sites (historic and future climate change scenarios)
 - HAWQS (nationwide SWAT; undergoing testing now)
 - USGS Monthly water balance model (nationwide)
- Climate change/robust decision making modules (Fall 2016 - 2017)
- Co-benefit estimation (2017-2018)
 - Ecosystem benefits
 - Human health
 - Energy savings
- Training/tech transfer (workshops, support for 4 ongoing case studies)
- Optimize results across multiple objectives (2018)
- Strategies for scaling up and linking watersheds (2018)



WMOST Download Site



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Exposure Assessment Models

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Surface Water Models

Food Chain Models

You are here: EPA Home » Exposure Assessment Models » WMOST 2.0 Download Page

WMOST 2.0 Download Page

Watershed Management Optimization Support Tool (WMOST) v2.0 Specifications

Software Specifications

Tools & Data

Information Sources

Development Status	General Release
Development Information	Release notes - changes and known deficiencies
Operating System	Windows
Development Language	Excel 2010 with Macros, Excel 2013 with Macros

Download Files

Documents

Document	Description
Readme (1 pg, 2 K)	Installation notes, Text, 3KB
WMOST Theoretical Documentation	PDF, 80pp, 6185KB
WMOST User Guide	PDF, 109pp, 11,590KB
Managing Watersheds Presentation	PDF, 55pp, 18678KB

Files

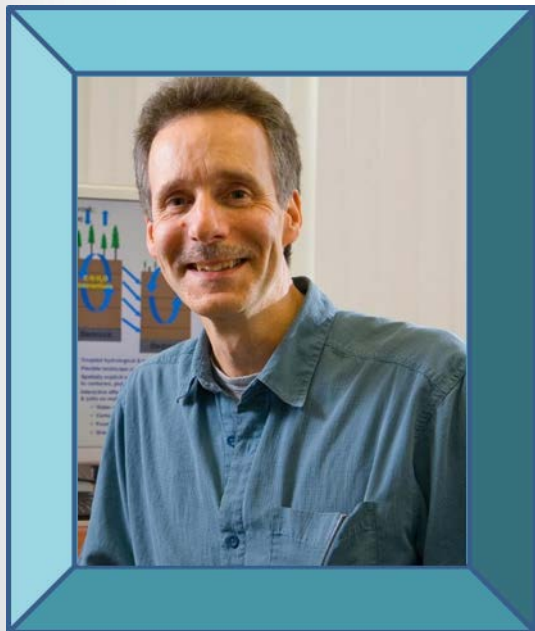
File Name / Size / Format	File Description
WMOST v2.0 Install files (2 pp, 22 MB) Excel 2010	WMOST 2.0 tool with blank input and output tables
WMOST Support Files (21 pp, 93 MB) Excel 2010, PDF	WMOST 2.0 Supportfiles subdirectory
WMOST 2.0 Casestudy 100215 (1 pg, 25 MB) Excel 2010	Casestudy 100215 Halifax, MA setting up a validation run

http://www2.epa.gov/exposure-assessment-models/wmost-20-download-page



Visualizing Ecosystems for Land Management Assessment (VELMA) Model:

VELMA is a computer software model that regional planners and land managers can use to quantify the effectiveness of natural and engineered green infrastructure management practices for reducing nonpoint sources of nutrients and contaminants in streams, estuaries, and groundwater. These practices include riparian buffers, cover crops, and constructed wetlands.



Dr. Bob McKane

Dr. Bob McKane is a Research Ecologist with NHEERL's Western Ecology Division in Corvallis, Oregon. He received his Ph.D. in Soil Science from the University of Minnesota, and has over 25 years of experience in the use of simulation models for analyzing effects of climate, soils, and land use on biogeochemical and hydrological processes. Bob is currently leading an interdisciplinary group of scientists to develop and apply the VELMA ecohydrology model, which is currently being used by EPA's ORD and Regions 7 and 10, tribes, and community groups to evaluate the effectiveness of alternative green infrastructure scenarios for improving water quality and ecosystem service co-benefits.

Contact: mckane.bob@epa.gov

Purpose: Identify green infrastructure (GI) best management practices for enhancing water quality & ecosystem service co-benefits.

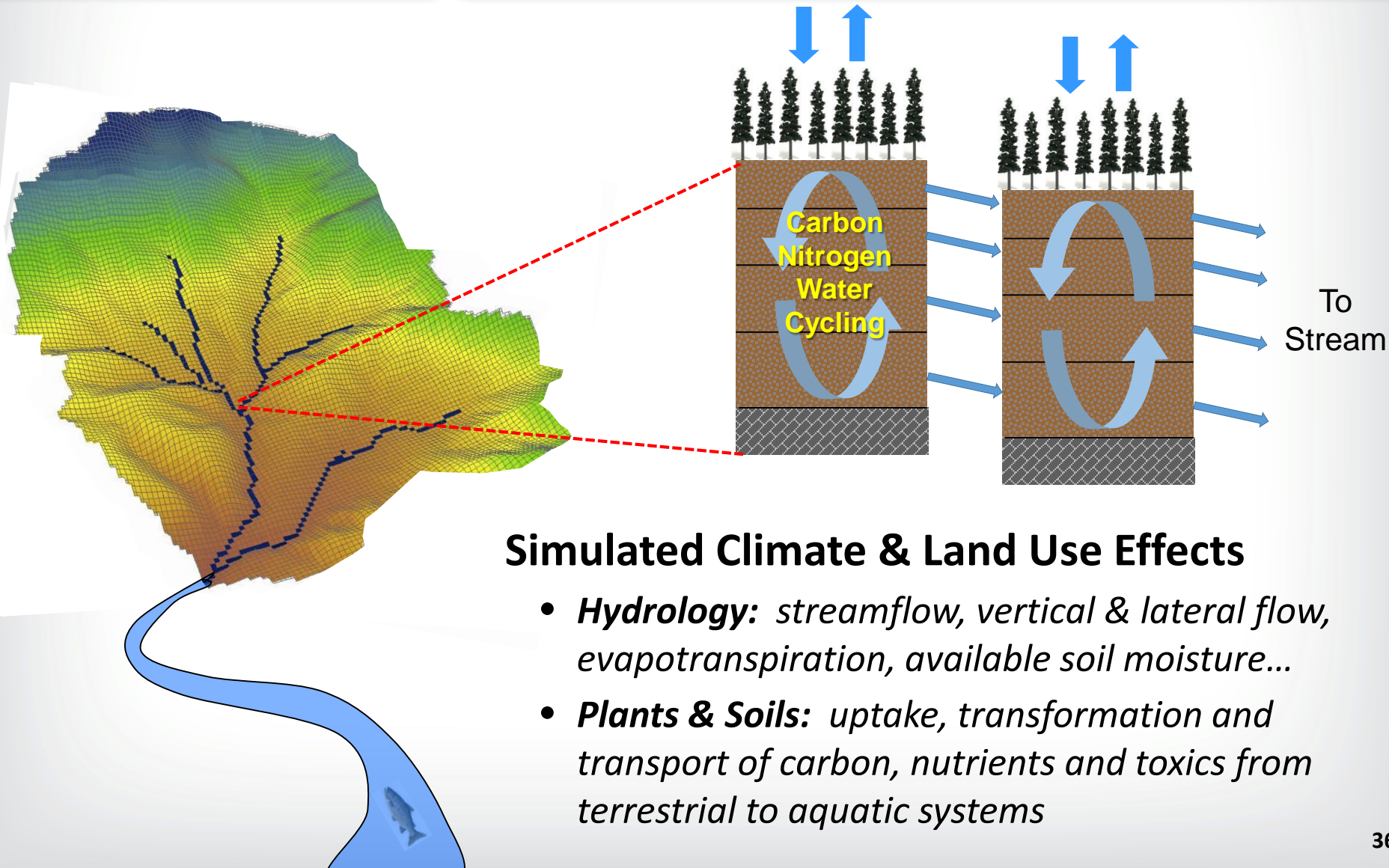
Results: Modeled effects of riparian buffers and other GI on water quality and quantity are well validated for ag, forest & rangeland systems

Applications: Users include communities, tribes, land managers, and EPA regions and scientists in Pacific Northwest, Central Plains, Midwest and East Coast



Fate & Transport of Water & Nutrients

plots → watersheds, days → centuries

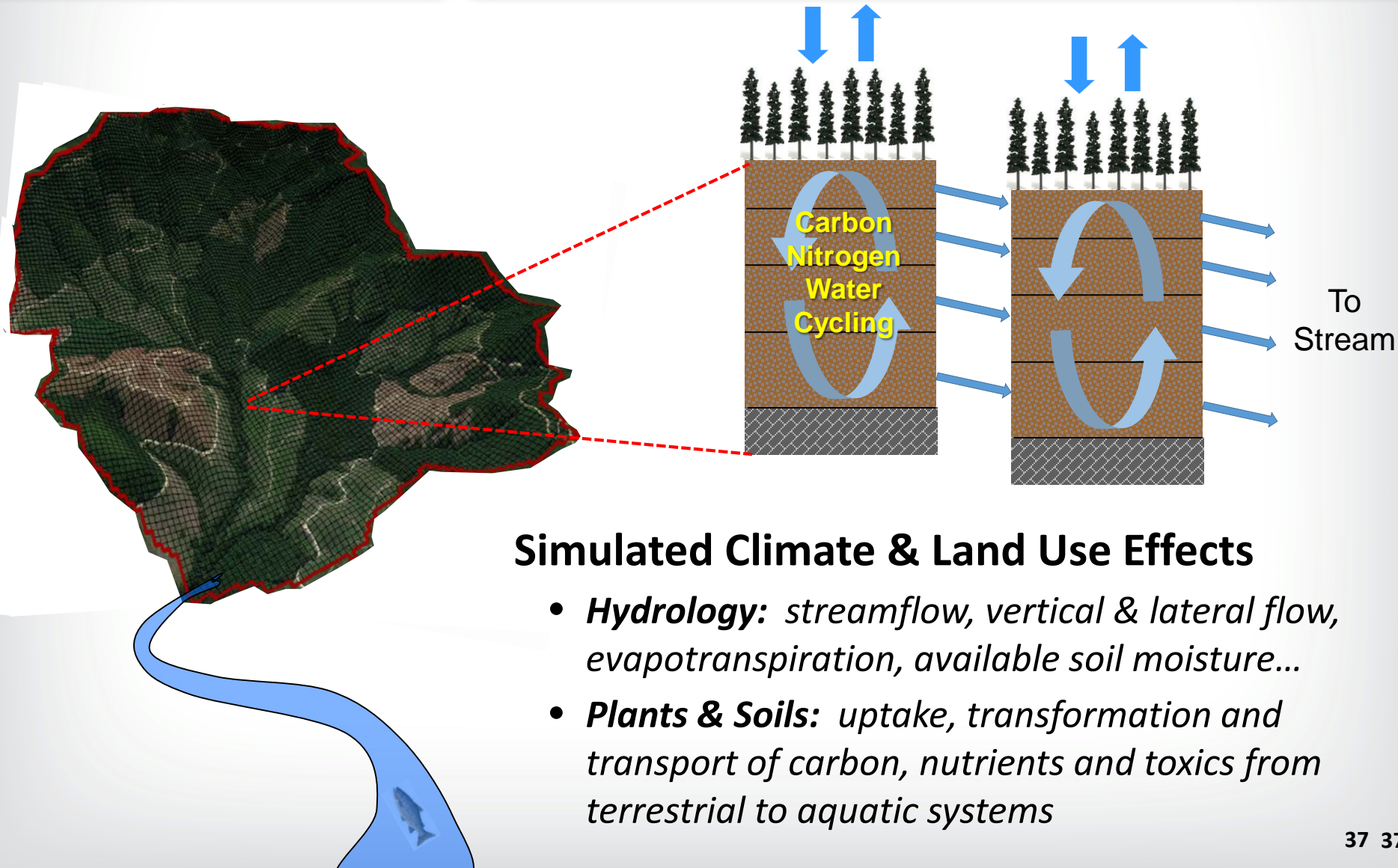


Simulated Climate & Land Use Effects

- **Hydrology:** streamflow, vertical & lateral flow, evapotranspiration, available soil moisture...
- **Plants & Soils:** uptake, transformation and transport of carbon, nutrients and toxics from terrestrial to aquatic systems

Fate & Transport of Water & Nutrients

plots → watersheds, days → centuries

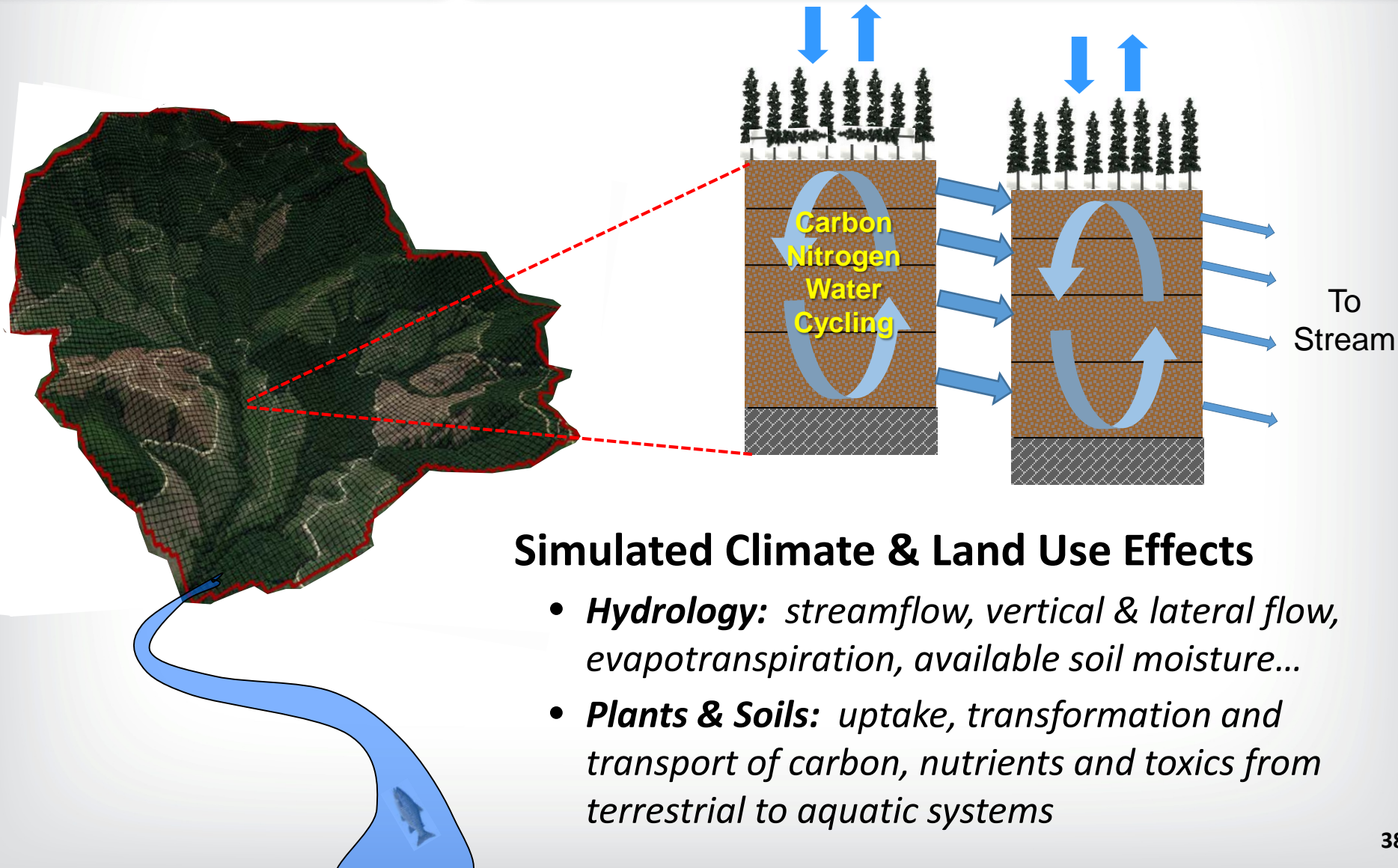


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Fate & Transport of Water & Nutrients

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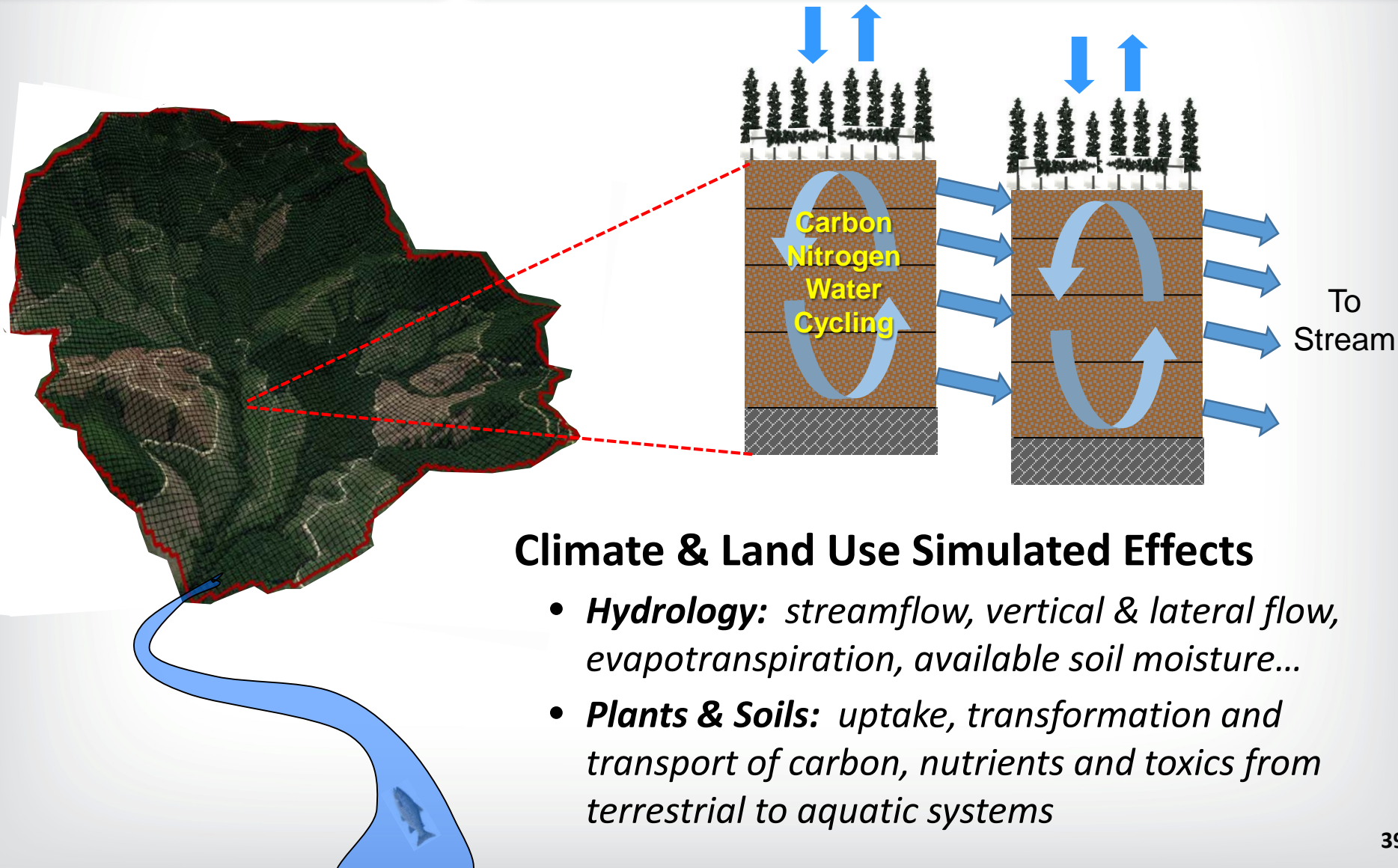


Simulated Climate & Land Use Effects

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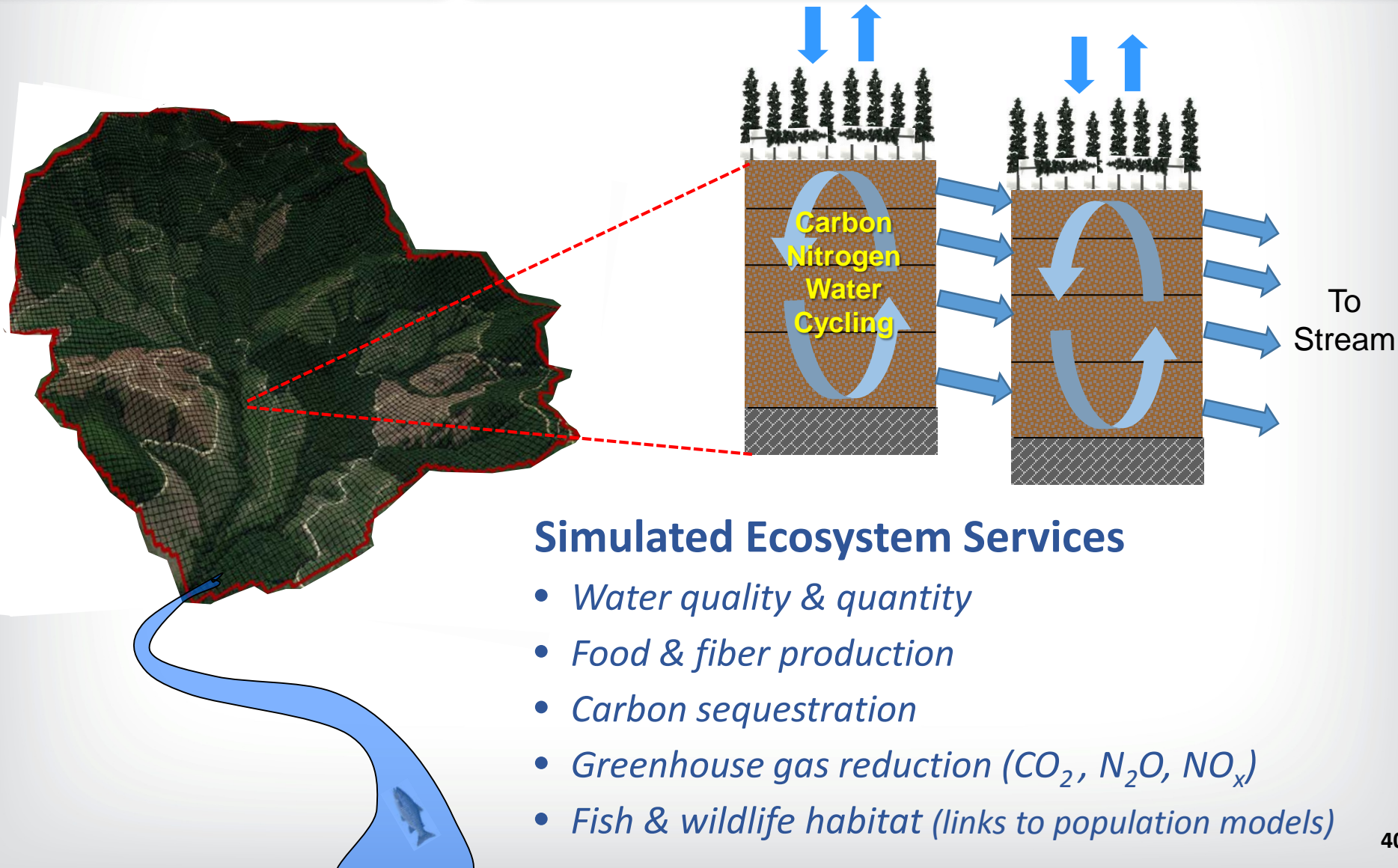
Climate & Land Use Simulated Effects

- **Hydrology:** streamflow, vertical & lateral flow, evapotranspiration, available soil moisture...
- **Plants & Soils:** uptake, transformation and transport of carbon, nutrients and toxics from terrestrial to aquatic systems



Fate & Transport of Water & Nutrients

plots → watersheds, days → centuries



Simulated Ecosystem Services

- *Water quality & quantity*
- *Food & fiber production*
- *Carbon sequestration*
- *Greenhouse gas reduction (CO_2 , N_2O , NO_x)*
- *Fish & wildlife habitat (links to population models)*



Broad Applicability



Salmon Recovery Planning
Puget Sound, WA



Urban GI Effectiveness
Seattle, Duluth, Mobile Bay



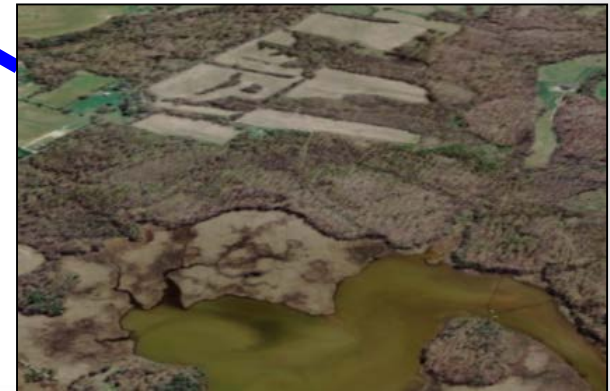
Constructed Wetland Effectiveness
Agricultural Watershed, OH



Estuarine Water Quality
Tillamook Bay Estuary, OR



Smoke Management Planning
Central Plains Rangelands, KS



Forest Buffer Effectiveness
Chesapeake Bay Agriculture, MD



Broad Applicability



Salmon Recovery Planning
Puget Sound, WA



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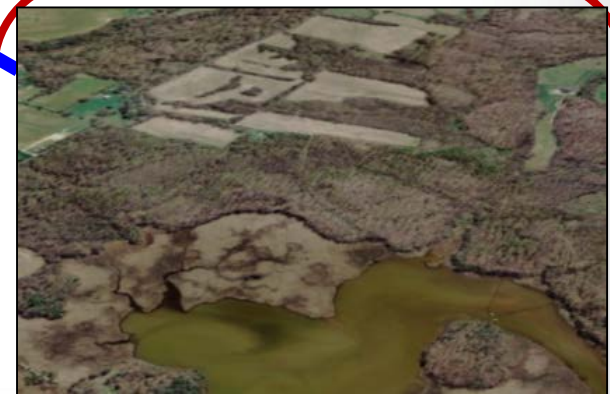
Constructed Wetland Effectiveness
Agricultural Watershed, OH



Estuarine Water Quality
Tillamook Bay Estuary, OR



Smoke Management Planning
Central Plains Rangelands, KS



Forest Buffer Effectiveness
Chesapeake Bay Agriculture, MD



Chesapeake Ag Water Quality Effectiveness of Riparian Forest Buffers

Product: Validated VELMA model for informing green infrastructure planning for Chesapeake ag systems

Goal: Transfer VELMA to *Smithsonian Environmental Research Center and EPA Region 3*



Chesapeake Ag Water Quality

Effectiveness of Riparian Forest Buffers

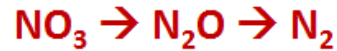
Product: Validated VELMA model for informing green infrastructure planning for Chesapeake ag systems

Goal: Transfer VELMA to *Smithsonian Environmental Research Center and EPA Region 3*

To what extent can riparian buffers and other GI reduce non-point sources of nitrogen to Chesapeake Bay?

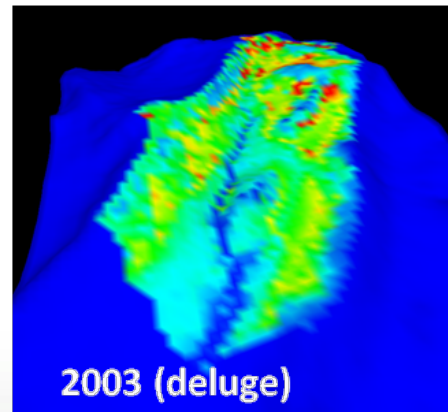
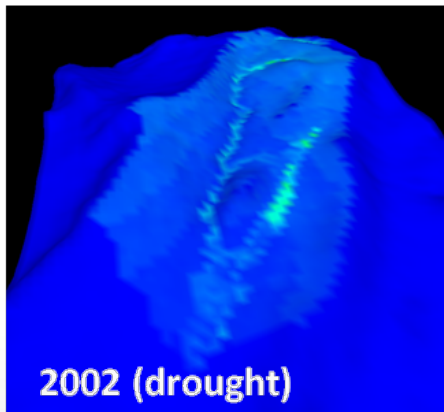
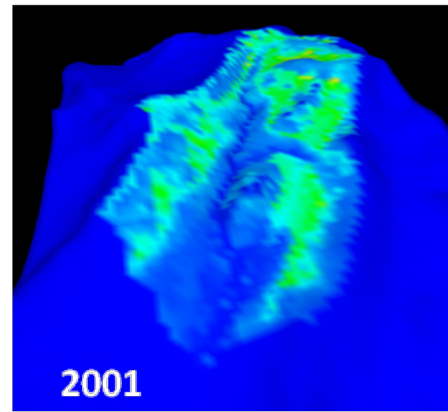
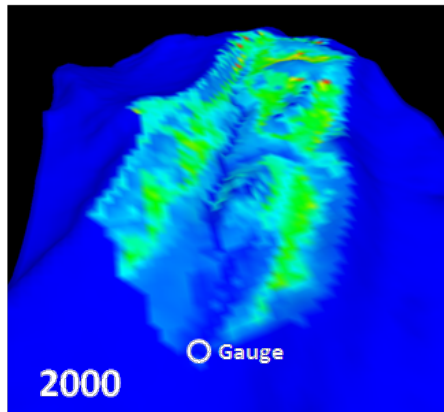


Rhode River Watershed #109



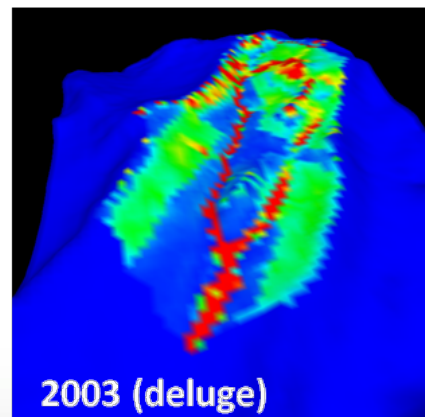
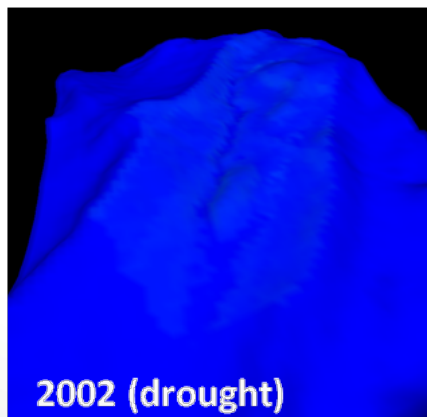
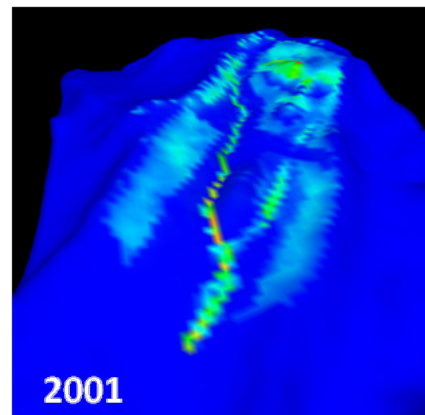
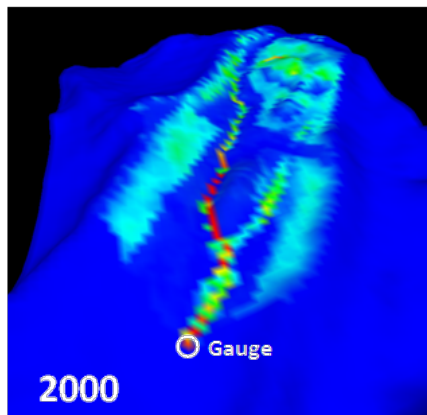
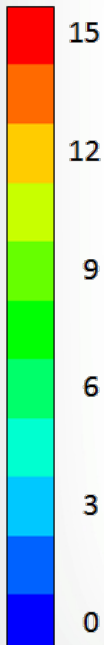
Simulated Annual Denitrification

Denitrification
 $\text{g N m}^{-2} \text{ yr}^{-1}$



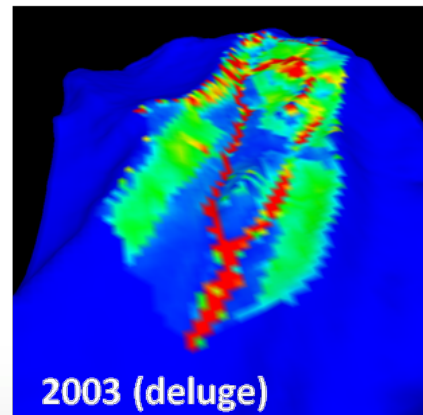
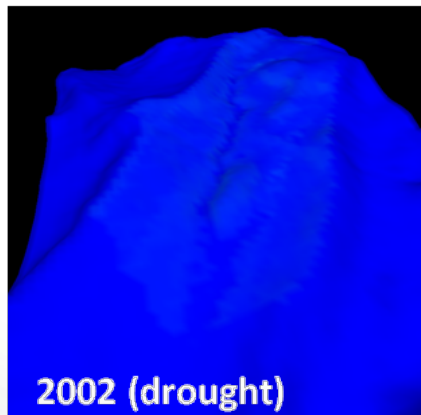
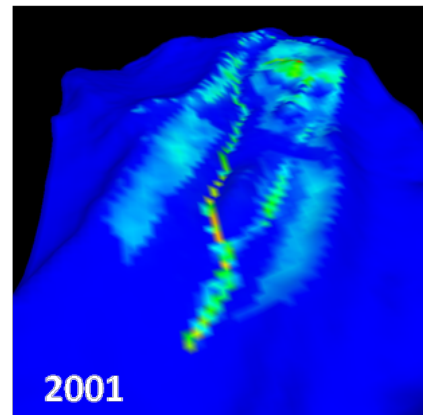
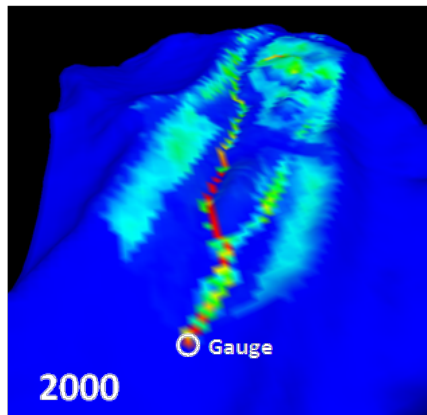
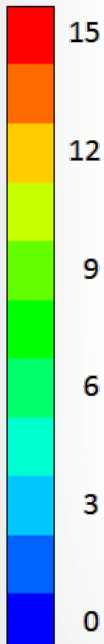
Simulated Nitrate PPM in Groundwater Flow

Annual mean
Nitrate-N PPM



Simulated Nitrate PPM in Groundwater Flow

Annual mean
Nitrate-N PPM



Summary

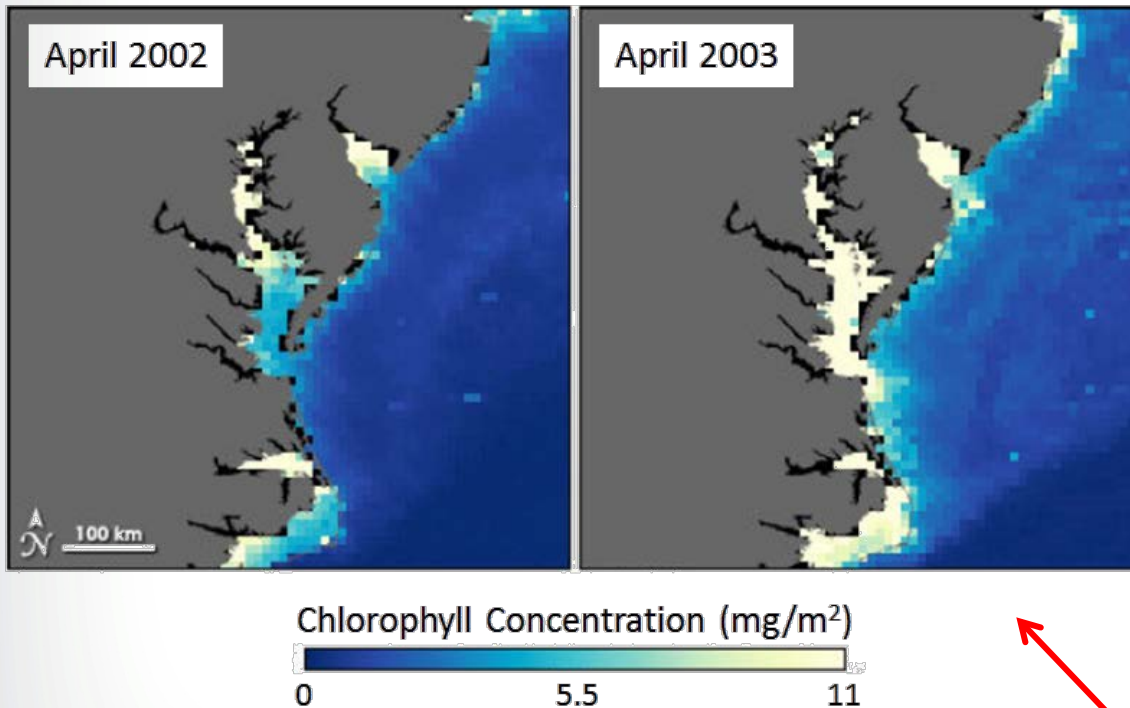
- Riparian forest buffers 20-30 meters wide can decrease ag nitrate stream loads by >90%
- 10m buffers = +50% load
- Buffers can be overwhelmed by extreme climatic events, such as a very dry year (2002) followed by a very wet year (2003)
- Model results are consistent with the observed sharp decrease in Chesapeake Bay water quality in 2003

Chesapeake Ag Water Quality

Effectiveness of Riparian Forest Buffers

Source: James Acker

earthobservatory.nasa.gov/Features/ChesapeakeBay/chesapeake_bay3.php



Summary

- Riparian forest buffers 20-30 meters wide can decrease ag nitrate stream loads by >90%
- 10m buffers = +50% load
- Buffers can be overwhelmed by extreme climatic events, such as a very dry year (2002) followed by a very wet year (2003)
- Model results are consistent with the observed sharp decrease in Chesapeake Bay water quality in 2003, **about 2x 2002 chlorophyll**



Puget Sound, WA

Salmon Recovery Planning



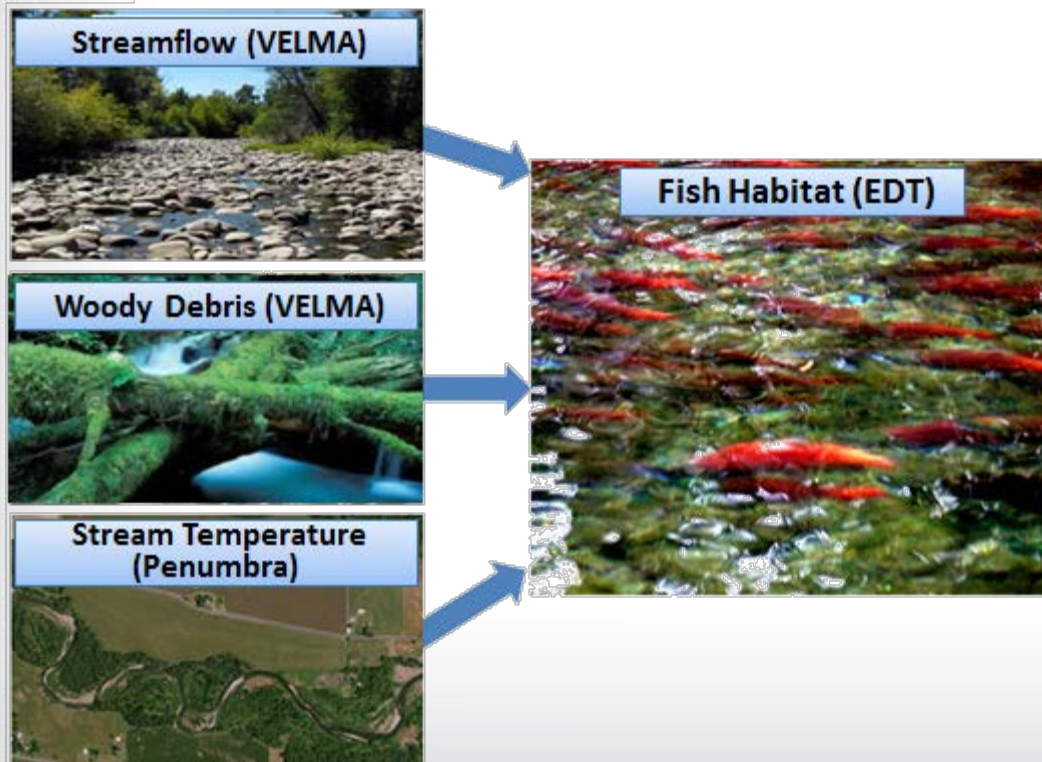
Puget Sound salmon populations have decreased by about 90% during the last 30 years. Tribes, communities and others have mobilized to develop salmon recovery plans. 49



Puget Sound, WA Salmon Recovery Planning

Product: Integrated modeling framework for informing community-based salmon recovery planning in Puget Sound

Goal: Transfer VELMA-Penumbra-EDT to *tribes, communities, state agencies and EPA Region 10*



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Puget Sound, WA

Salmon Recovery Planning

Product: Integrated modeling framework for informing community-based salmon recovery planning in Puget Sound

Goal: Transfer VELMA-Penumbra-EDT to *tribes, communities, state agencies and EPA Region 10*



Results:

- ✓ VELMA is now being used by Nisqually Community Forest managers for land acquisition & salmon recovery planning in 80 mi² Mashel River Watershed.
- ✓ VELMA predicts that increasing current forest harvest intervals from 40-50 yr to >80 yr would double streamflow during the summer dry season, a critical time for salmon migration & spawning.

VELMA-EDT Training Workshop for Nisqually Community Forest manager and collaborating EPA & ICF scientists

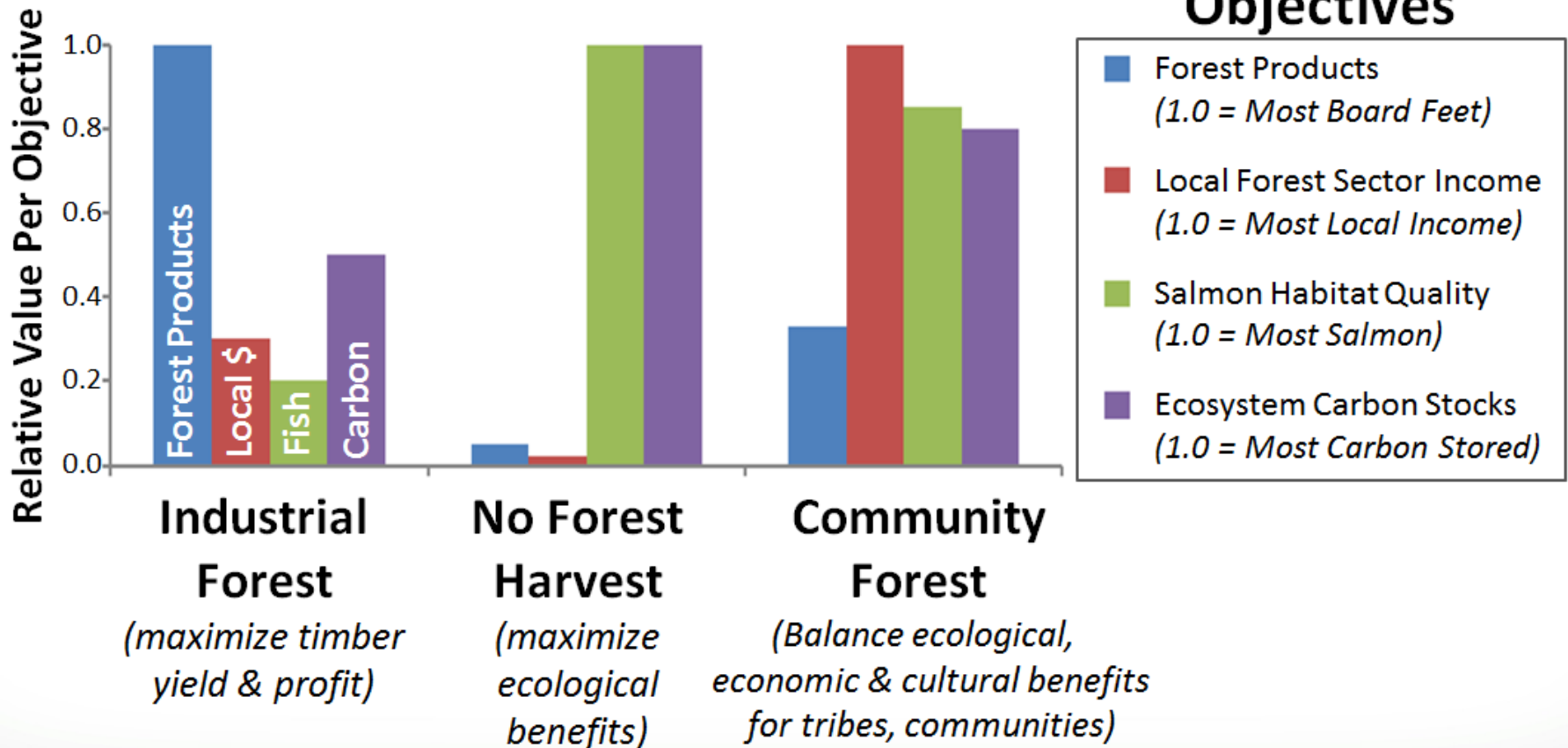




Puget Sound, WA Salmon Recovery Planning

Tradeoffs for Alternative Forest Management Scenarios

Hypothetical Example





VELMA Team

Bob McKane (mckane.bob@epa.gov)

Allen Brookes, Kevin Djang, Brad Barnhart
Jonathan Halama, Paul Pettus, Don Phillips
Marc Stieglitz, Feifei Pan, Alex Abdelnour



Storm Water Management Model (SWMM): SWMM is a software application that is used widely throughout the world for large-scale planning, analysis, and design related to stormwater runoff, combined and sanitary sewers, and other drainage systems in urban areas – although there are many applications for drainage systems in non-urban areas as well. It allows users to represent combinations of green infrastructure practices to determine their effectiveness in managing runoff. SWMM was developed to help support local, state, and national stormwater management objectives to reduce runoff through infiltration and retention.



Dr. Michael Tryby

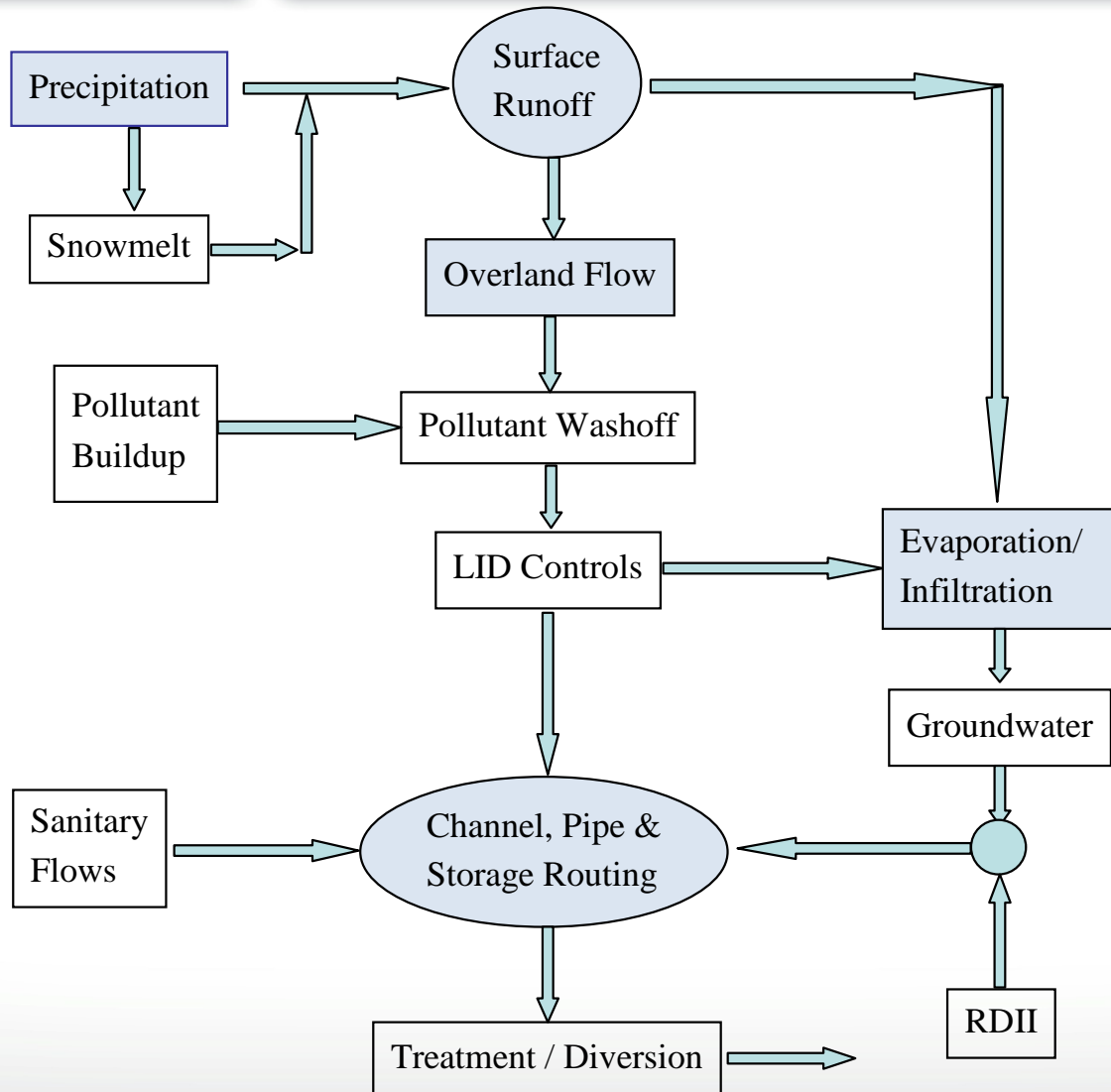
Dr. Michael Tryby joined the Water Supply and Water Resources Division in EPA's National Risk Management Research Laboratory located in Cincinnati, Ohio in September 2011. He holds a B.S. in Civil Engineering and an M.S. in Environmental Engineering from the University of Cincinnati, where he worked on drinking water treatment for disinfection byproduct control and systems analysis of water distribution system disinfection practices. Michael received his Ph.D. in Civil Engineering from North Carolina State University while working in commercial software development as a water distribution modeling domain expert. His immediate responsibilities include work on modeling green infrastructure and low impact development best management practices using EPA's SWMM 5.0.

Contact: tryby.michael@epa.gov

SWMM: What is it?

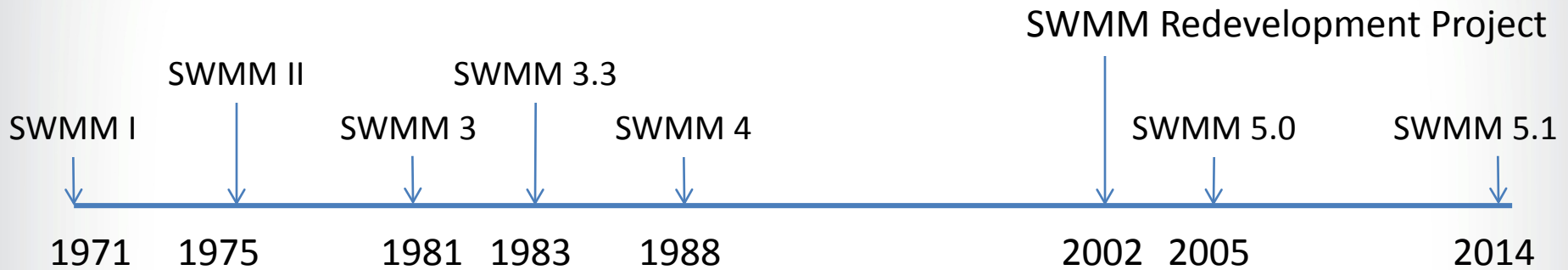


SWMM is a public domain, distributed, dynamic hydrologic - hydraulic - water quality model used for continuous simulation of runoff quantity and quality from primarily urban areas.





SWMM's History



A screenshot of the EPA Risk Management Water Research website. The page title is "Storm Water Management Model (SWMM)". It features a navigation menu on the left with links like "Water Research Home", "Basic Information", "Research Areas", "Drinking Water", "Aging Water", "Infrastructure", "Source Water", "Protection", "Ground Water", "Water Quality", "A to Z Subject Index", "Facilities", "Publications", and "Risk Management Research Home". The main content area includes a search bar, a breadcrumb trail, and a list of links for "Version 5.0.022 with Low Impact Development (LID) Controls": Description, Capabilities, Applications, Support, Downloads, Links, and Contact. Below this is a "Description" section and a small map titled "SWMM 5 GUI. Larger View".

- SWMM is a professional tool used by Civil / Environmental Engineers
- SWMM is used at the municipal level to design and manage stormwater and sanitary sewer infrastructure
- Many large cities across the US and around the world rely on SWMM



Design and sizing of drainage system components including detention facilities.



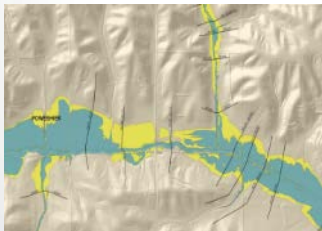
Control of combined and sanitary sewer overflows.

Modeling I&I in sanitary sewer systems.



Generating non-point source pollutant loadings for waste load allocation studies.

Evaluating BMPs and LIDs for sustainability goals.



Flood plain mapping of natural channel systems.

Source Control BMPs



Disconnection



Infiltration Basin



Rain Garden



Cistern



Infiltration Trench



Green Roof



Permeable Pavement

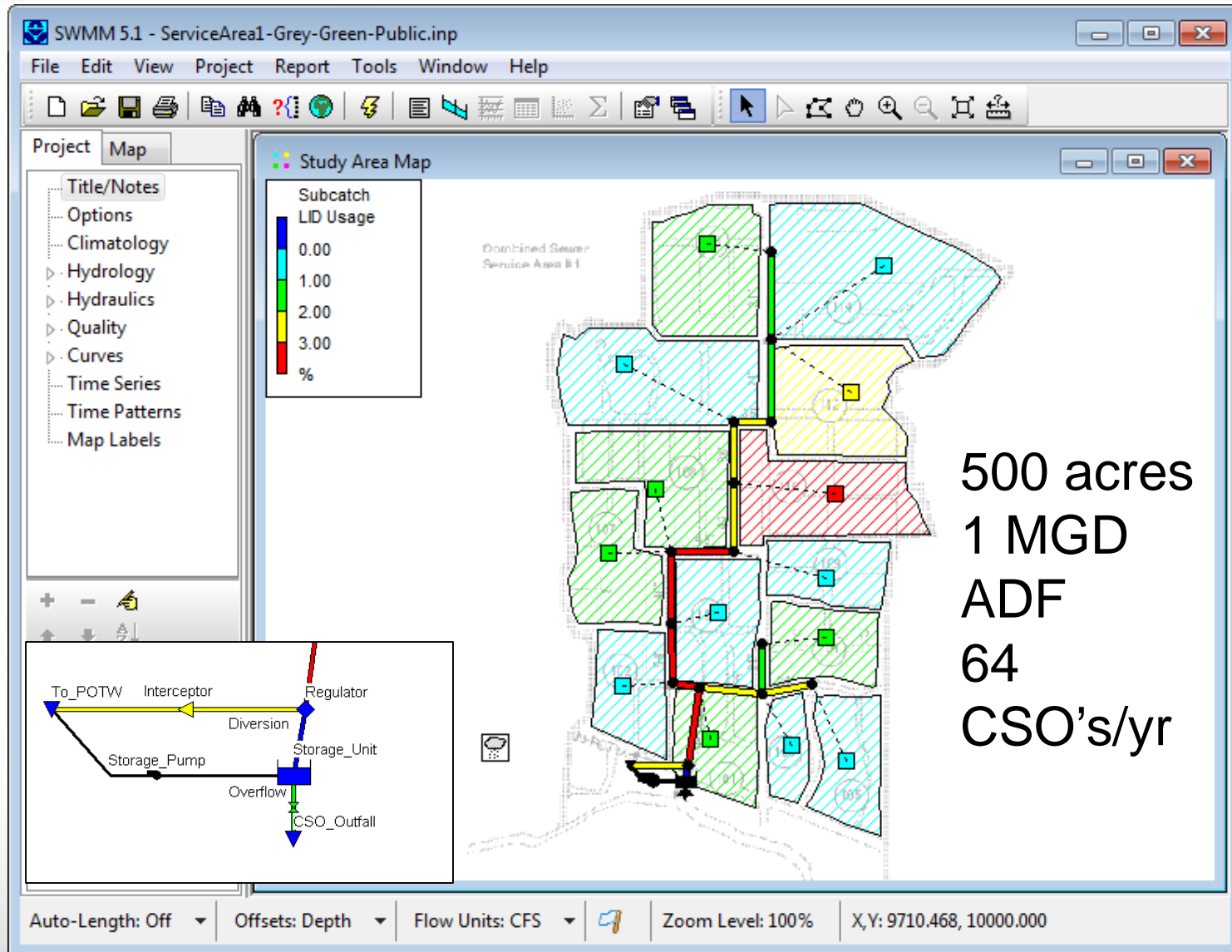


Vegetative Swale



Street Planter

SWMM CSO Example



SWMM 5.1 - ServiceArea1-Grey-Green-Public.inp

File Edit View Project Report Tools Window Help

Project Map

- Title/Notes
- Options
- Climatology
- Hydrology
- Hydraulics
- Quality
- Curves
- Time Series
- Time Patterns
- Map Labels

Study Area Map

Subcatchment LID Usage

0.00
1.00
2.00
3.00
%

Combined Sewer Service Area B1

```

    graph TD
      Regulator --> Interceptor
      Interceptor --> To_POTW
      Regulator --> Diversion
      Diversion --> Storage_Unit
      Storage_Unit --> Storage_Pump
      Storage_Pump --> To_POTW
      Storage_Unit --> Overflow
      Overflow --> CSO_Outfall
  
```

Auto-Length: Off Offsets: Depth Flow Units: CFS Zoom Level: 100% X,Y: 9710.468, 10000.000

SWMM 5.1 - ServiceArea1-Grey-Green-Public.inp

File Edit View Project Report Tools Window Help

Study Area Map

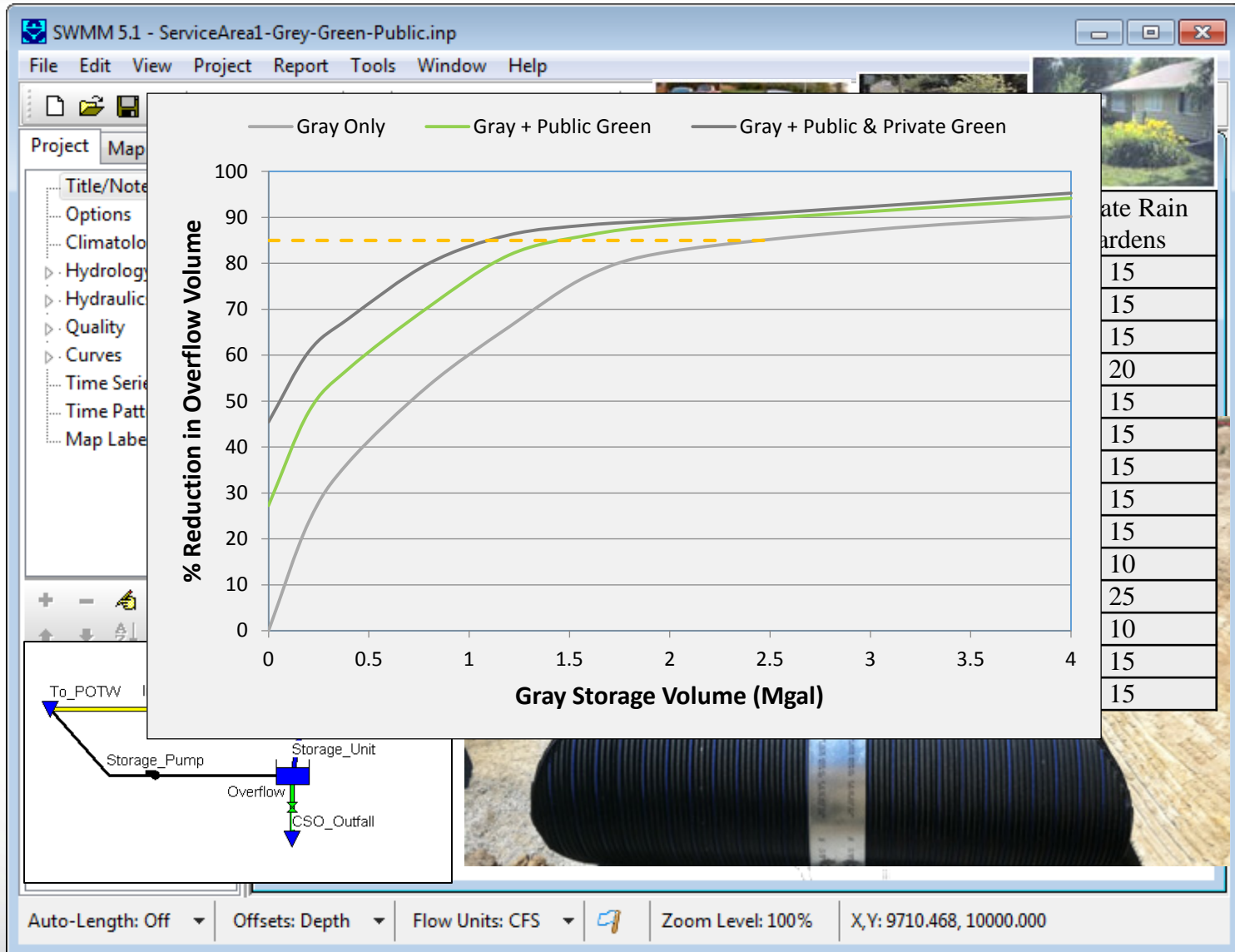
Sub-Area	Percent Impervious	Public Porous Pavement	Public Street Planters	Private Rain Gardens
101	55	10	10	15
102	35	10	5	15
103	28	10	5	15
104	55	10	10	20
105	22	10	5	15
106	31	10	5	15
107	46	10	10	15
108	38	10	5	15
109	35	10	5	15
110	75	20	20	10
111	17	0	5	25
112	59	15	10	10
113	39	10	5	15
114	29	10	5	15

Project Map

- Title/Notes
- Options
- Climatology
- Hydrology
- Hydraulics
- Quality
- Curves
- Time Series
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- Map Labels

Diagram Labels: To_POTW, Interceptor, Diversion, Storage_Pump, Storage_Unit, Overflow, CSO_Outfall

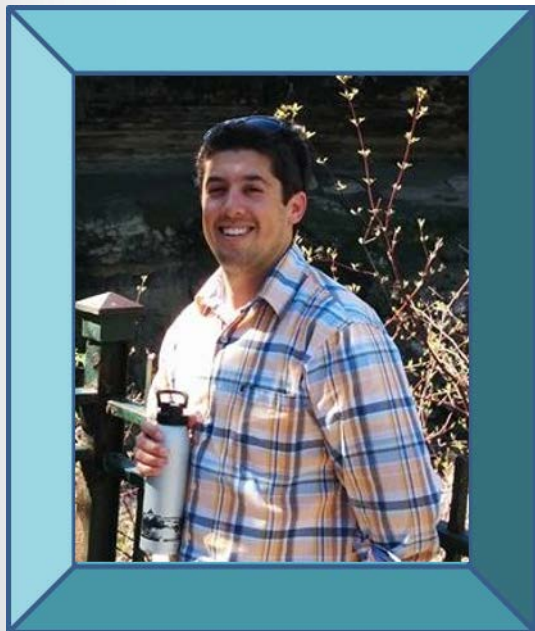
Auto-Length: Off | Offsets: Depth | Flow Units: CFS | Zoom Level: 100% | X,Y: 9710.468, 10000.000



- SWMM is widely used to evaluate gray infrastructure stormwater control strategies
- SWMM now offers a useful complement of LID stormwater controls
- SWMM is a useful tool for creating cost effective green / gray hybrid stormwater control solutions



National Stormwater Calculator (SWC): SWC is a desktop application that estimates the annual amount of stormwater runoff from a specific location in the United States (including Puerto Rico), based on local soil conditions, land cover, and historic rainfall records. It is used to inform site developers on how well they can meet a desired stormwater retention target with and without the use of green infrastructure. It also allows users to consider how runoff may vary based both on historical weather and potential future climate. SWC was mentioned in President Obama's Climate Action Plan and is now a resource for LEED Project Credit 16 (Rainwater Management) certification by the U.S. Green Building Council for projects that are designed to reduce runoff volume and improve water quality of a site.



Jason Berner

Jason Berner is trained as a landscape architect and has been with EPA for over nine years. He has worked in EPA's Region 2 and Office of Water, and is currently working as a biologist in ORD. His research focuses on the application of green infrastructure planning tools, urban planning and design, community capacity building with municipalities and utilities, and supporting innovative water technologies. Jason has a Master of Landscape Architecture and a B.S. in Environmental Sciences from the University of Illinois at Urbana-Champaign.

Contact: berner.jason@epa.gov

U.S. EPA National Stormwater Calculator

- **What, Why, and Who?**
- **Stormwater Calculator & Stormwater Management Model (SWMM)**
 - Green Infrastructure/Low Impact Development (LID) practices
- **Using the Calculator**
- **Potential Applications:** Post Construction Stormwater Standards, LEED, Sustainable Sites, Stormwater Concept Designs, LID Design Competitions
- **Example Applications:**
 - **Redevelopment Plan for Spartanburg, SC: Green Street Design**
(EPA Green Infrastructure 2013 Technical Assistance Project)
 - **U.S. Climate Resilience Toolkit**
- **Development of Cost Estimation Module and Mobile Web App**



What Have We Created and Why?

Stormwater Management (Green Infrastructure/Low Impact Development) Design and Planning Tool

- **Model pre- and post-construction stormwater runoff discharges**
- **Allow for screening-level analysis of various green infrastructure practices (green roofs, rain gardens, cisterns, etc.) throughout the U.S.**
- **Allow non-modelers to conduct screening level stormwater runoff analyses for small to medium sized (less than 1 acre to 1 dozen of acres) urban development sites**



Who We Created the Calculator for...

- **Urban & municipal planners**
- **Land developers**
- **Landscape architects**
- **Homeowners, etc.**

...to meet stormwater design goals or requirements.


- ✓ **What kind of user are you?**
- ✓ **How do you perform conceptual planning or design for stormwater management?**



Website

The screenshot shows the EPA website's 'Water Research' section. At the top, there is a navigation bar with the EPA logo and the text 'United States Environmental Protection Agency'. To the right of the logo are language options: Español, 中文: 繁體版, 中文: 简体版, Tiếng Việt, and 한국어. Below the navigation bar are four menu items: 'Learn the Issues', 'Science & Technology', 'Laws & Regulations', and 'About EPA'. A search bar labeled 'Search EPA.gov' is located to the right of these menu items. The main content area is titled 'Water Research' and includes a 'Contact Us' and 'Share' link. The primary heading is 'National Stormwater Calculator'. The text below the heading describes the calculator as a desktop application that estimates annual rainwater and runoff frequency based on local soil conditions, land cover, and historic rainfall records. It states the calculator is designed for use by site developers, landscape architects, urban planners, and homeowners. A list of seven green infrastructure practices is provided: 1. Disconnection, 2. Rain harvesting, 3. Rain gardens, 4. Green roofs, 5. Street planters, 6. Infiltration basins, and 7. Porous pavement.

<http://www2.epa.gov/water-research/national-stormwater-calculator>


United States Environmental Protection Agency

[Español](#) | [中文：繁體版](#) | [中文：简体版](#) | [Tiếng Việt](#) | [한국어](#)

[Learn the Issues](#)
[Science & Technology](#)
[Laws & Regulations](#)
[About EPA](#)

Water Research
Contact Us Share

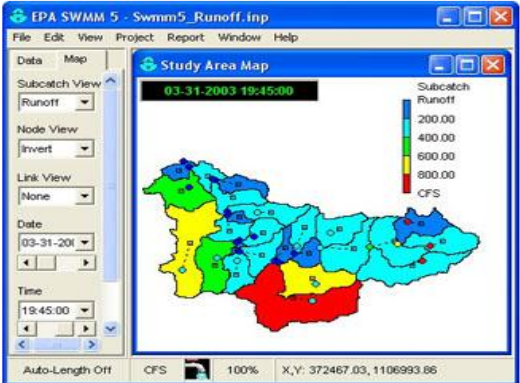
Storm Water Management Model (SWMM)

Version 5.1.006 with Low Impact Development (LID) Controls

- [Description](#)
- [Capabilities](#)
- [Applications](#)
- [Support](#)
- [Downloads](#)
- [Helpful Resources](#)
- [Contact](#)

Description

EPA's Storm Water Management Model (SWMM) is used throughout the world for planning, analysis and design related to stormwater runoff, combined and sanitary



- Calculator is based on SWMM: dynamic rainfall-runoff simulation model for long-term simulation of runoff quantity
- SWMM runs in background of Stormwater Calculator



Desktop Application

National Stormwater Calculator

Overview | Location | Soil Type | Soil Drainage | Topography | Precipitation | Evaporation | Climate Change | Land Cover | LID Controls | Results

Welcome to the EPA National Stormwater Calculator

This calculator estimates the amount of stormwater runoff generated from a land parcel under different development and control scenarios over a long-term period of historical rainfall.

The analysis takes into account local soil conditions, topography, land cover and meteorology. Different types of low impact development (LID) practices can be employed to help capture and retain rainfall on-site. Localized climate change scenarios can also be analyzed.

Site information is provided to the calculator using the tabbed pages listed above. The Results page is where the site's runoff is computed and displayed.

This program was produced by the U.S. Environmental Protection Agency and was subject to both internal and external technical review. Please check with local authorities about whether and how it can be used to support local stormwater management goals and requirements.

Release 1.1.0.0

Select the Location tab to begin analyzing a new site.

[Analyze a New Site](#) [Save Current Site](#) [Exit](#)

National Stormwater Calculator

Overview | Location | Soil Type | Soil Drainage | Topography | Precipitation | Evaporation | Climate Change | Land Cover | LID Controls | Results

Site Name (Optional)
Typical Singe Family Home

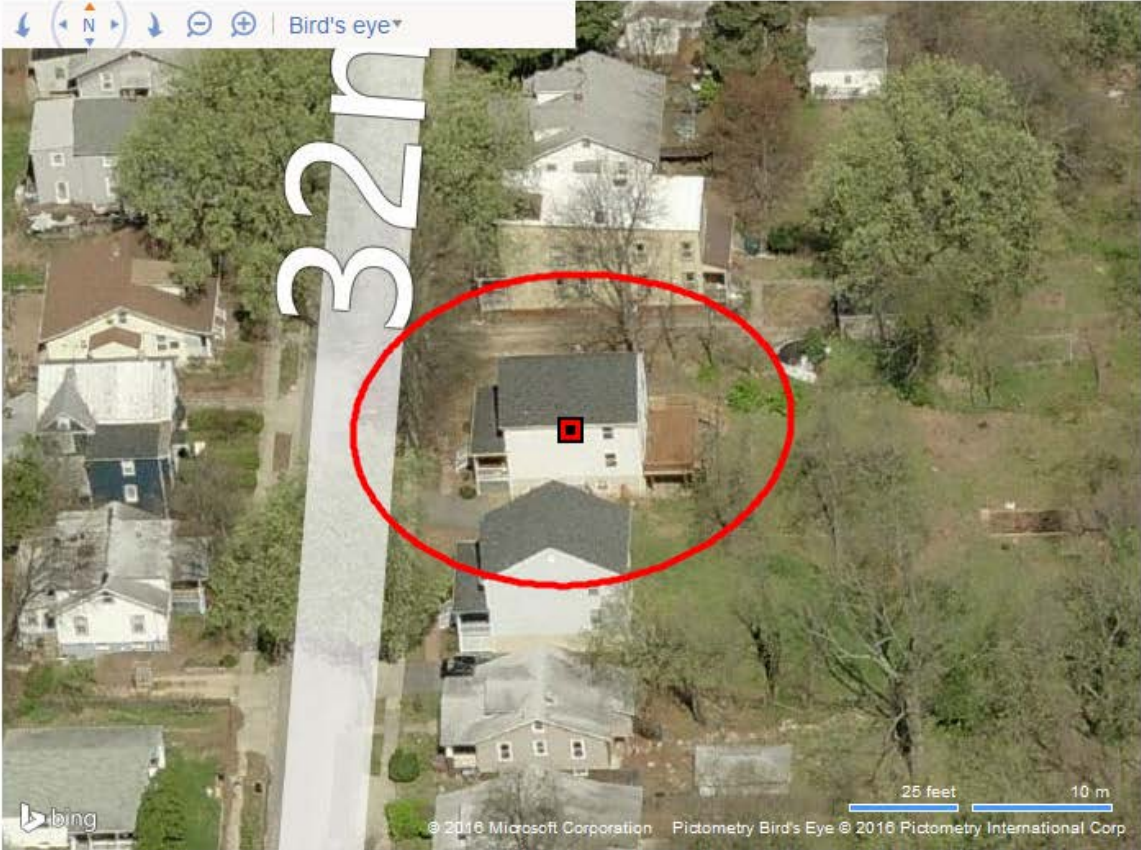
Search for an address or zip code:
mount rainer, md

Site Location (Latitude, Longitude)
38.94282161053263,-76.9632926223497

Site Area (acres - Optional)
0.2

[Open a previously saved site](#)

Bring your site into view on the map and then mark its exact location by clicking the mouse pointer over it.



bing

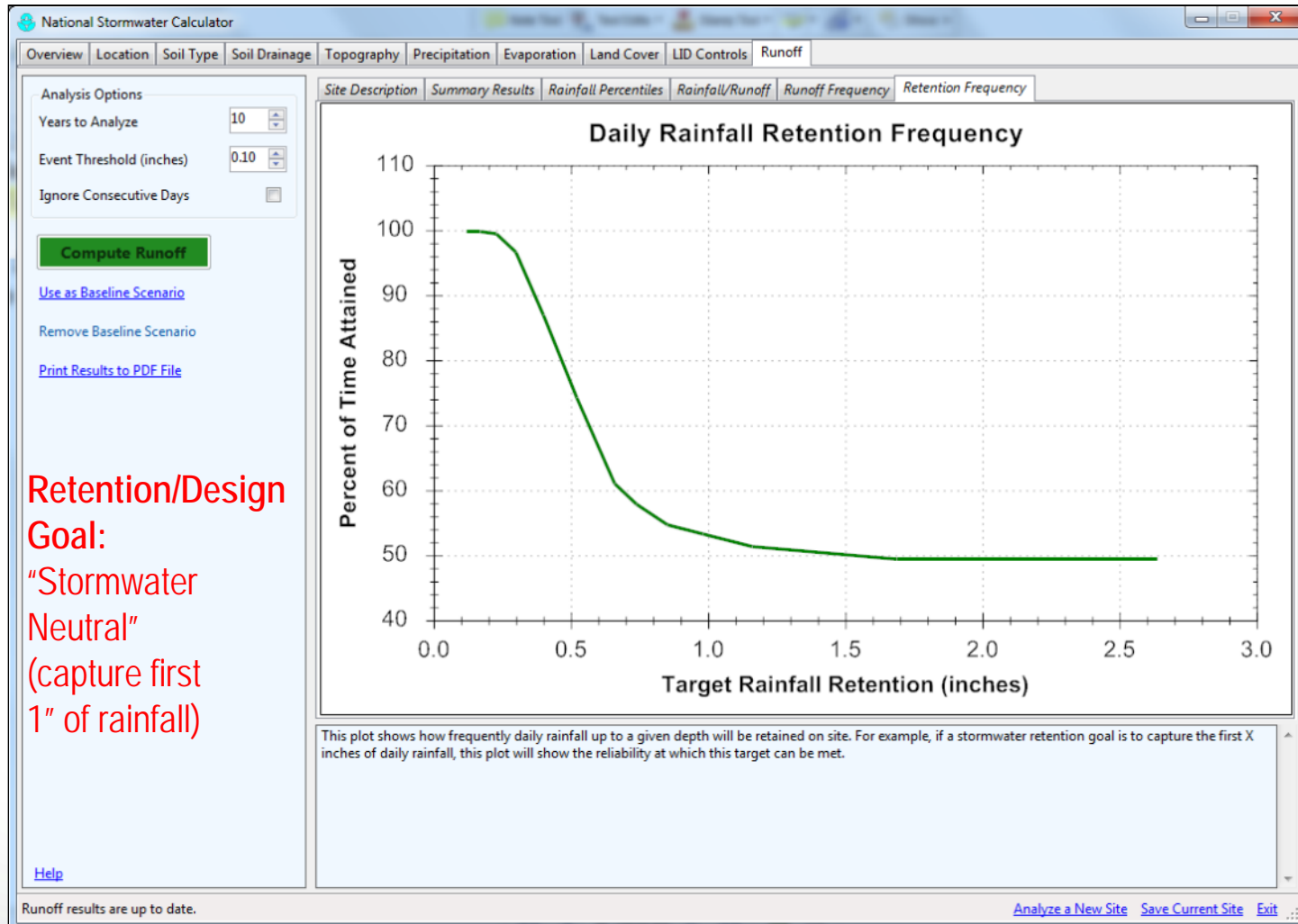
© 2016 Microsoft Corporation Pictometry Bird's Eye © 2016 Pictometry International Corp

Locate the site on the map.

[Analyze a New Site](#) [Save Current Site](#) [Exit](#)



Meeting Stormwater Runoff Design Goals



Retention/Design Goal:
"Stormwater Neutral"
(capture first 1" of rainfall)

National Stormwater Calculator

Overview | Location | Soil Type | Soil Drainage | Topography | Precipitation | Evaporation | Climate Change | Land Cover | **LID Controls** | Results

What % of your site's impervious area will be treated by the following LID practices?

Disconnection	45
Rain Harvesting	10
Rain Gardens	25
Green Roofs	0
Street Planters	0
Infiltration Basins	0
Permeable Pavement	0

Design Storm for Sizing (inches) (see Help) 0.00

Click a practice to customize its design.


Design Changes:

- *Downspout disconnection
- *Rain barrels
- *Rain gardens

[Help](#)

LID Design


Rain Garden



Rain Gardens are shallow depressions filled with an engineered soil mix that supports vegetative growth. They are usually used on individual home lots to capture roof runoff.

Typical soil depths range from 6 to 18 inches.

The Capture Ratio is the ratio of the rain garden's area to the impervious area that drains onto it.



[Learn more...](#)

Ponding Height (inches) 6

Soil Media Thickness (inches) 12

Soil Media Conductivity (in/hr) 10.00

% Capture Ratio 5

Size for Design Storm | Restore Defaults | Accept | Cancel

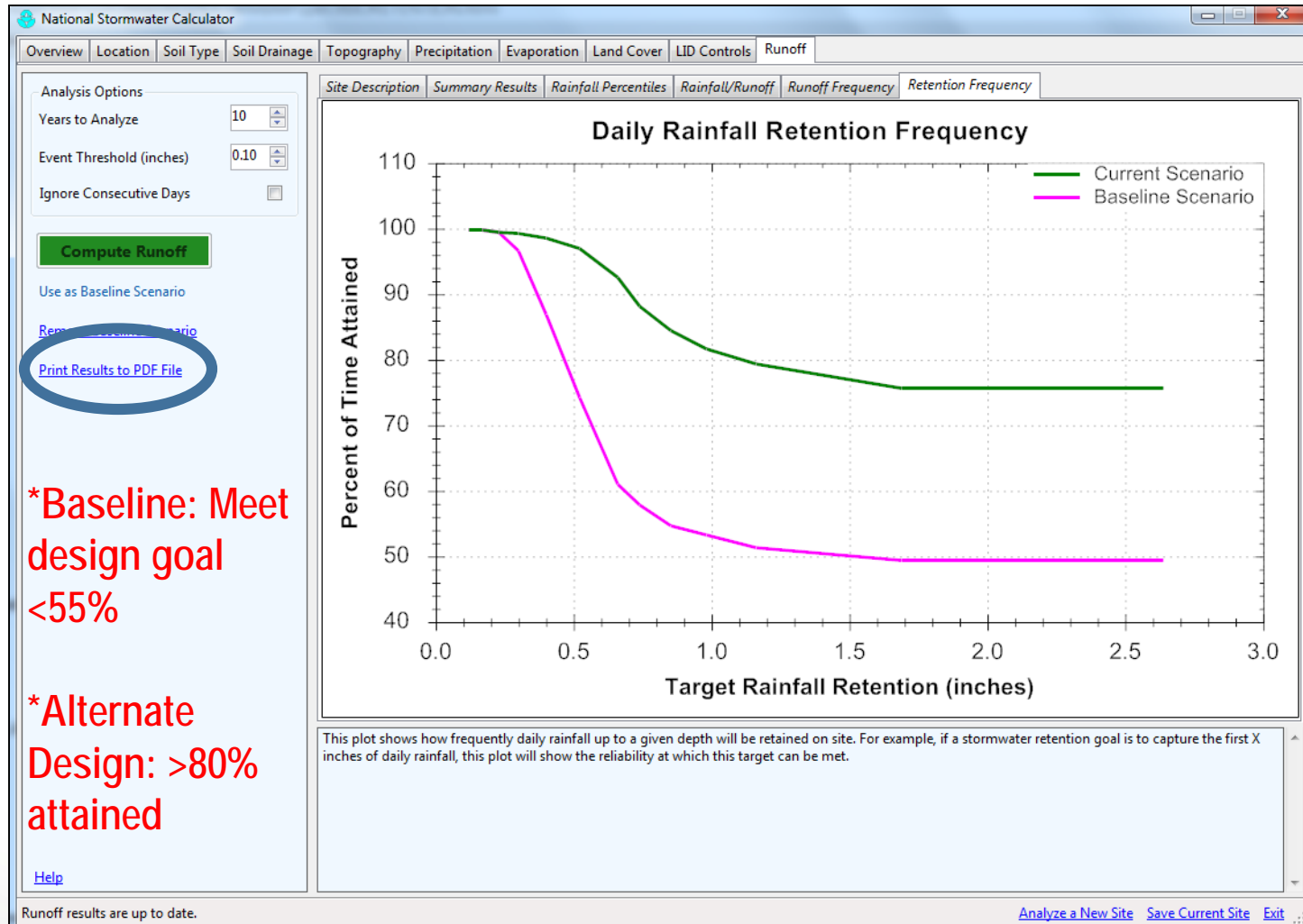
© 2016 Microsoft Corporation | Pictometry Bird's Eye © 2016 Pictometry International Corp

Assign LID practices to capture runoff from impervious areas.

[Analyze a New Site](#) | [Save Current Site](#) | [Exit](#)



Comparing Design Scenarios: Meeting Runoff Reduction Goals





Potential Applications

- State or MS4 (Municipal Separate Storm Sewer System) Post Construction Stormwater Design Standards
- Voluntary Stormwater Retrofits for private property owners
- Voluntary Programs: LEED (US Green Building Council) and Sustainable Sites Initiative stormwater credits, Rockefeller Foundation's 100 Resilient Cities
- Climate Resiliency Planning
- LID/Green Infrastructure Design Competitions: Campus RainWorks Challenge, DC Water Green Infrastructure Challenge, etc.



PUBLIC RELEASE: 22-APR-2016

UTA student team wins EPA Campus RainWorks Challenge for plan to reduce stormwater runoff

Sustainable environment

UNIVERSITY OF TEXAS AT ARLINGTON



PRINT E-MAIL

A University of Texas at Arlington student team's design to reduce stormwater runoff that could result from future campus construction projects has won a national Environmental Protection Agency's Office of Water award as part of the agency's 2015 Campus RainWorks Challenge.

The College of Architecture, Planning and Public Affairs team included landscape architecture graduate students Baishaki Biswas, Sherry Fabricant, Jacob Schwarz and Ahoura Zandiatashbar, a doctoral student in urban planning and public policy. Their winning entry in the Master Plan category was called "Eco-Flow: A Water-Sensitive Placemaking Response to Climate Change" and centered on water runoff rates at sites of potential UTA student living, dining, recreation and parking facilities.

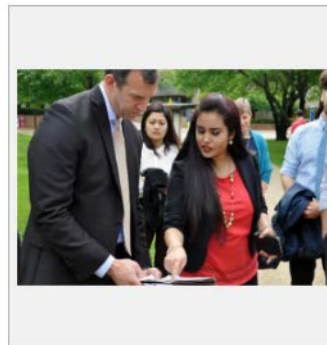
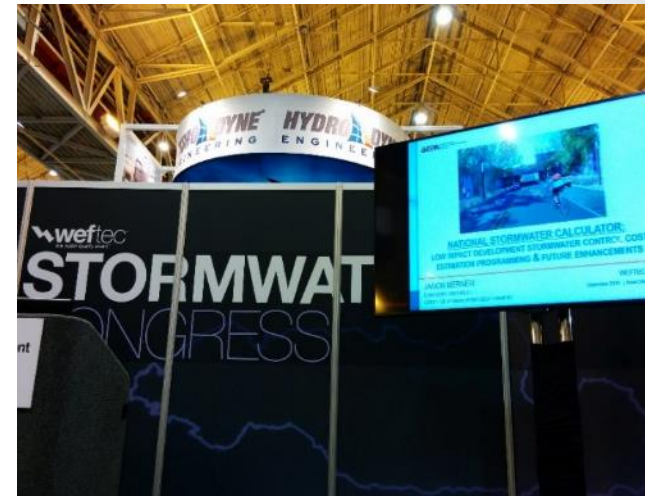


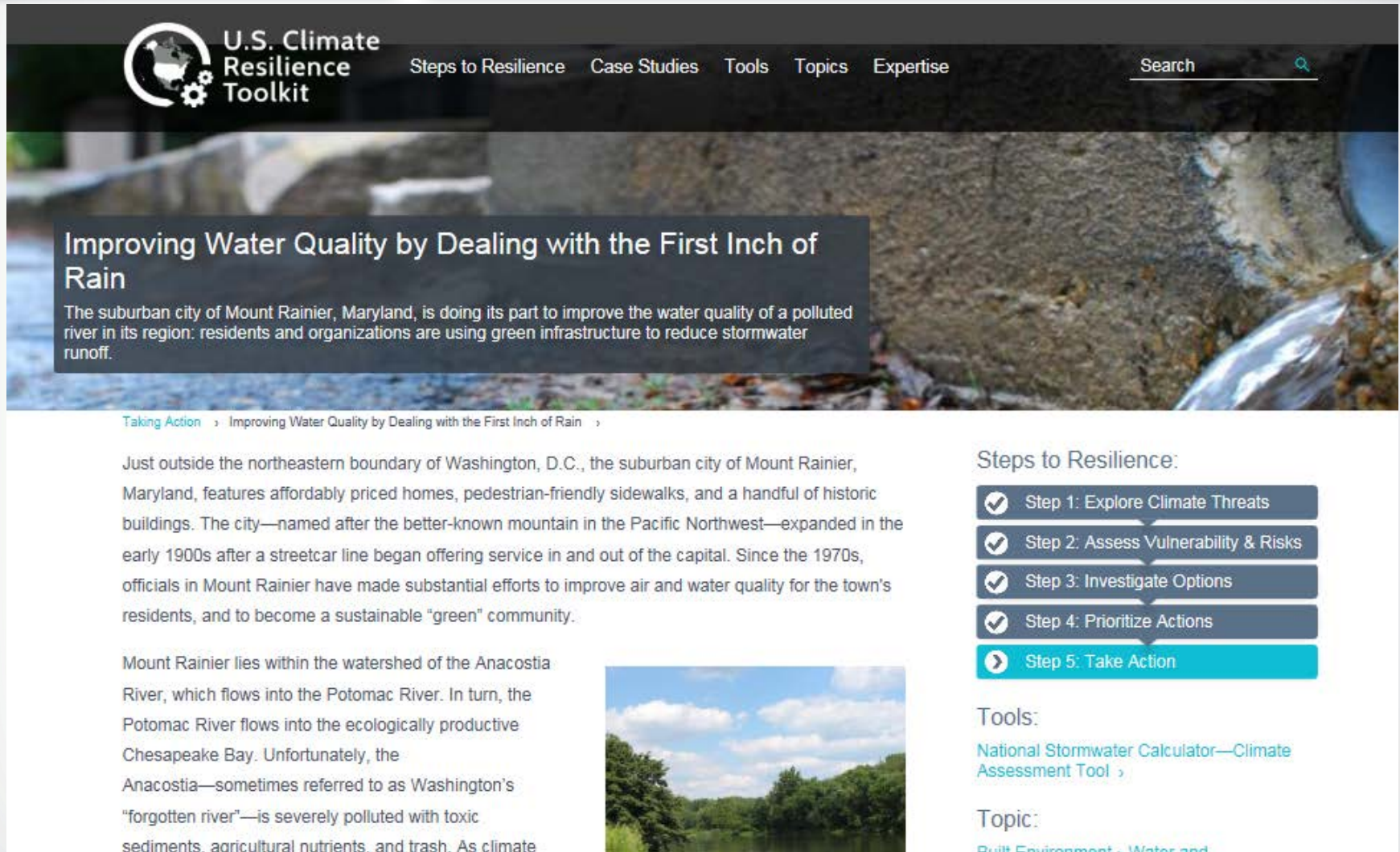
IMAGE: BAISHAKHI BISWAS, A UTA COLLEGE OF ARCHITECTURE, PLANNING AND PUBLIC AFFAIRS STUDENT, SHOWS STORMWATER-REDUCTION PLANS TO JOEL BEAUVAIS, EPA'S DEPUTY ASSISTANT ADMINISTRATOR IN THE OFFICE OF WATER. [view more >](#)

CREDIT: UT ARLINGTON



- Design competitions
- Tools demonstration workshops

Climate Resiliency Planning Application



U.S. Climate Resilience Toolkit

Steps to Resilience Case Studies Tools Topics Expertise Search


Improving Water Quality by Dealing with the First Inch of Rain

The suburban city of Mount Rainier, Maryland, is doing its part to improve the water quality of a polluted river in its region: residents and organizations are using green infrastructure to reduce stormwater runoff.

[Taking Action](#) > [Improving Water Quality by Dealing with the First Inch of Rain](#) >

Just outside the northeastern boundary of Washington, D.C., the suburban city of Mount Rainier, Maryland, features affordably priced homes, pedestrian-friendly sidewalks, and a handful of historic buildings. The city—named after the better-known mountain in the Pacific Northwest—expanded in the early 1900s after a streetcar line began offering service in and out of the capital. Since the 1970s, officials in Mount Rainier have made substantial efforts to improve air and water quality for the town’s residents, and to become a sustainable “green” community.

Mount Rainier lies within the watershed of the Anacostia River, which flows into the Potomac River. In turn, the Potomac River flows into the ecologically productive Chesapeake Bay. Unfortunately, the Anacostia—sometimes referred to as Washington’s “forgotten river”—is severely polluted with toxic sediments, agricultural nutrients, and trash. As climate



Steps to Resilience:

- ✓ Step 1: Explore Climate Threats
- ✓ Step 2: Assess Vulnerability & Risks
- ✓ Step 3: Investigate Options
- ✓ Step 4: Prioritize Actions
- ▶ Step 5: Take Action

Tools:

[National Stormwater Calculator—Climate Assessment Tool](#) >

Topic:

[Built Environment](#) > [Water and](#)



Conceptual Design of Green Streets: Spartanburg, SC

EPA Green Infrastructure Technical Assistance



<https://www.epa.gov/green-infrastructure/northside-neighborhood-green-infrastructure-master-plan-spartanburg-sc>



Spartanburg, SC Green Street Design

Stormwater runoff results from EPA Stormwater Calculator

Scenario	Runoff	Infiltration	Evapo- transpiration
Baseline	84%	5%	11%
Scenario 1 (Street Planters)	18%	67%	15%
Scenario 2 (Pervious Pavement)	17%	75%	8%

- Intended Uses:
 - Planning level capital and operations & maintenance cost estimates (magnitude of costs between planning scenarios)
 - Regionalized and national cost estimates



LID Controls: Cost Estimation Enhancements

National Stormwater Calculator
_ □ ×

Overview | Location | Soil Type | Soil Drainage | Topography | Precipitation | Evaporation | Climate Change | Land Cover | LID Controls | Results

What % of your site's impervious area will be treated by the following LID practices?

[Disconnection](#)

[Rain Harvesting](#)

[Rain Gardens](#)

[Green Roofs](#)

[Street Planters](#)

[Infiltration Basins](#)

[Permeable Pavement](#)

Design Storm for Sizing (inches) (see Help)

Click a practice to customize its design.

Verify cost-estimation variables below

Project is [Re-Development](#)

Project is [New Development](#)

Site Suitability - [Poor](#)

Site Suitability - [Moderate](#)

Site Suitability - [Excellent](#)

[Cost Region](#) Boston (100 miles) 1.04

Regional Multiplier

[Help](#)

LID Design ×

New Development

New development is construction that occurs on a greenfield (undeveloped) site or does not fit into the definition of redevelopment or retrofit.

New development allows site planners to more efficiently place infrastructure to balance costs of grading, protection of existing topography, and other natural features which can often reduce or avoid these costs and the costs more typical of redevelopment including removal, decommissioning and alteration of existing structures.

Pre-development

Post-development

Selecting "New Development" on the "LID Controls" tab of the National Stormwater Calculator influences the site complexity, and shifts the costs towards a lower complexity cost estimation.

New development combined with information on site suitability, topography, and soil drainage determines whether complex, typical, or simple cost curves apply. See User Guide for more information.

Assign LID practices to capture runoff from impervious areas. [Analyze a New Site](#) [Save Current Site](#) [Exit](#)



Capital and Maintenance Cost Estimates

National Stormwater Calculator

Overview | Location | Soil Type | Soil Drainage | Topography | Precipitation | Evaporation | Climate Change | Land Cover | LID Controls | Results

Options

Years to Analyze: 20

Event Threshold (inches): 0.10

Ignore Consecutive Days:

Actions

[Refresh Results](#)

[Use as Baseline Scenario](#)

[Remove Baseline Scenario](#)

[Print Results to PDF File](#)

Reports

- Site Description
- Summary Results
- Rainfall / Runoff Frequency
- Rainfall Retention Frequency
- Runoff By Rainfall Percentile
- Extreme Event Rainfall / Runoff
- Cost Summary

[Help](#)

Estimate of Probable Capital Costs (estimates in 2015 US.\$)

[Maintenance Costs](#) | [Graphical View](#)

Cost By LID Control Type	Drainage Area %	Has Pre-trt?	Current Scenario (C) Area Treated 11.00 ac		Baseline Scenario (B) Area Treated 11.00 ac		Difference (C - B) Area Treated 0.00 ac	
	Current / Baseline	Current / Baseline	Low	High	Low	High	Low	High
Disconnection	NA / NA	No / No	\$0	\$0	\$0	\$0	\$0	\$0
Rainwater Harvesting	NA / NA	No / No	\$0	\$0	\$0	\$0	\$0	\$0
Rain Gardens	60 / NA	No / No	\$4,289	\$15,386	\$0	\$0	\$4,289	\$15,386
Green Roofs	NA / NA	No / No	\$0	\$0	\$0	\$0	\$0	\$0
Street Planters	NA / NA	No / No	\$0	\$0	\$0	\$0	\$0	\$0
Infiltration Basins	12 / 12	No / No	\$4,325	\$5,340	\$4,325	\$5,340	\$0	\$0
Permeable Pavement	25 / NA	No / No	\$285,567	\$428,932	\$0	\$0	\$285,567	\$428,932

Note: site complexity variables that affect cost shown below:

<p style="text-align: center;">Current Scenario</p> <p>Dev. Type New Development</p> <p>Site Suitability Moderate</p> <p>Topography Steep (> 15% Slope)</p> <p>Soil Type A</p> <p>Cost Region Boston (100 miles) 1.04</p>	<p style="text-align: center;">Baseline Scenario</p> <p>New Development</p> <p>Moderate</p> <p>Steep (> 15% Slope)</p> <p>A</p> <p>Boston (100 miles) 1.04</p>
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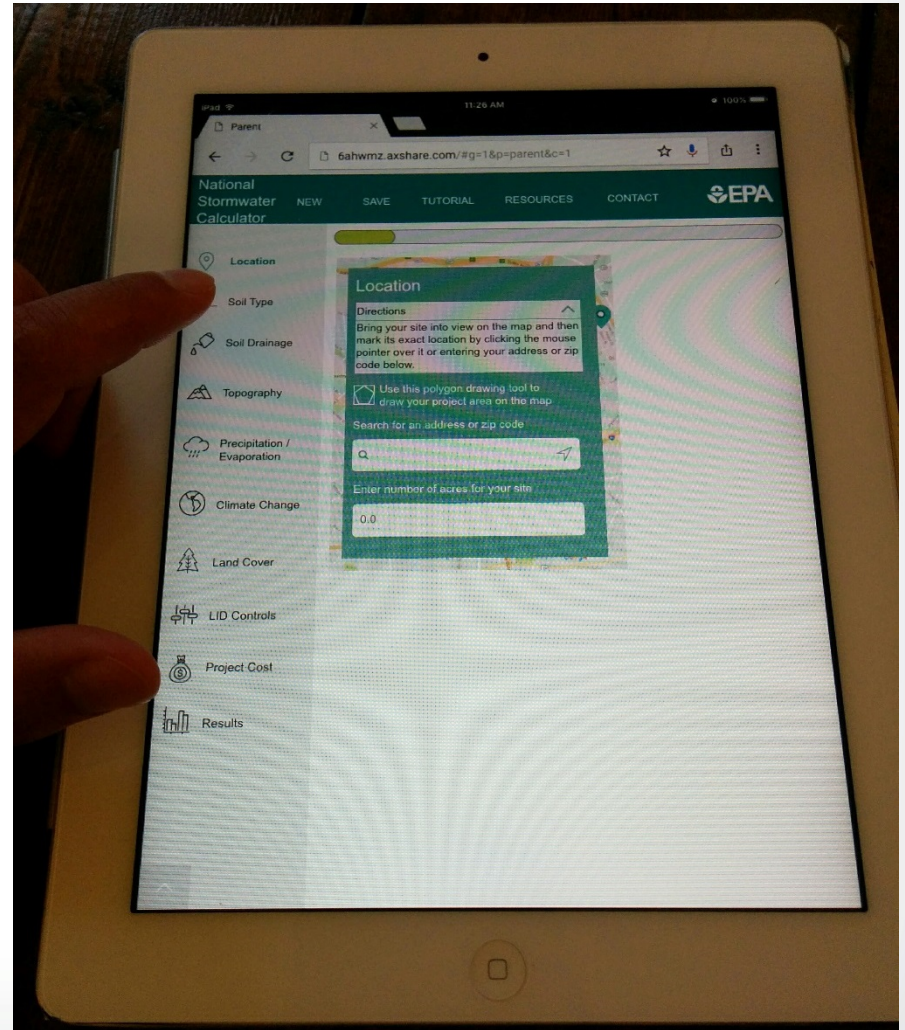
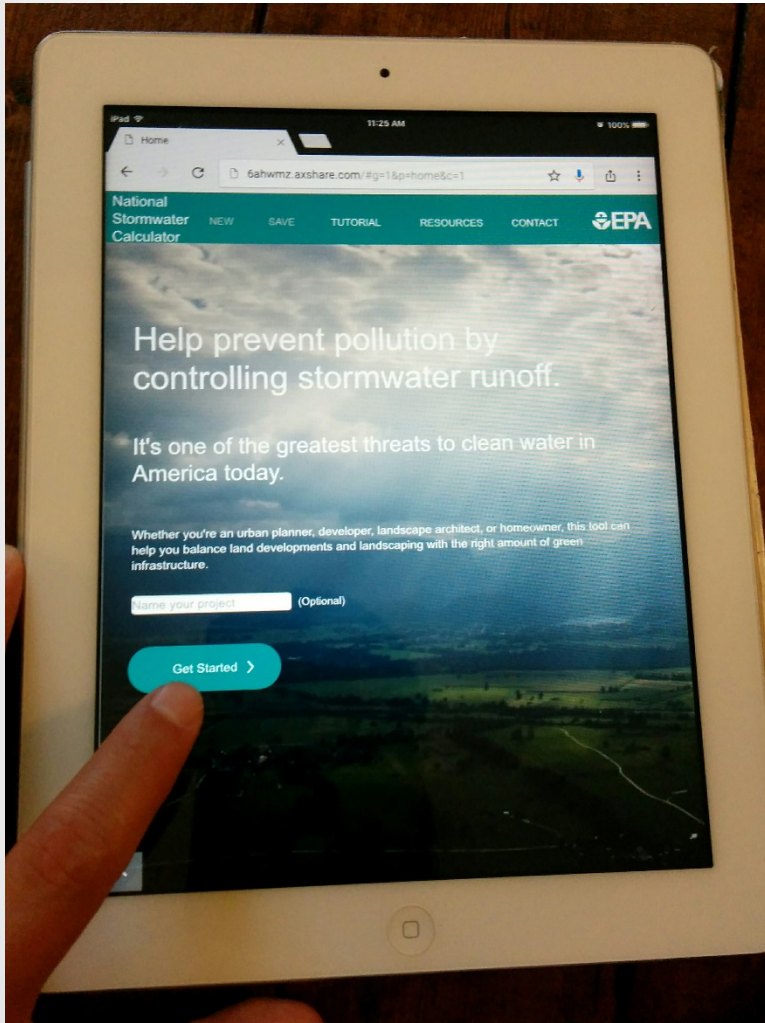
[Help](#)

Runoff results are up to date.

[Analyze a New Site](#) | [Save Current Site](#) | [Exit](#) ::



Mobile Web App Development



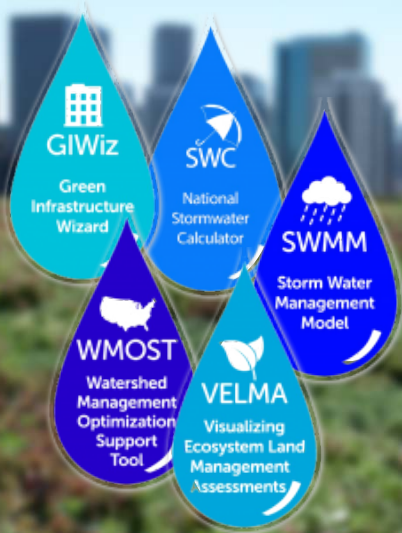


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National Stormwater Calculator Website:
epa.gov/water-research/national-stormwater-calculator

SAFE AND SUSTAINABLE WATER RESOURCES RESEARCH PROGRAM



Questions and Answers Session