EPA United States Environmental Protection Agency

U.S. EPA National Stormwater Calculator

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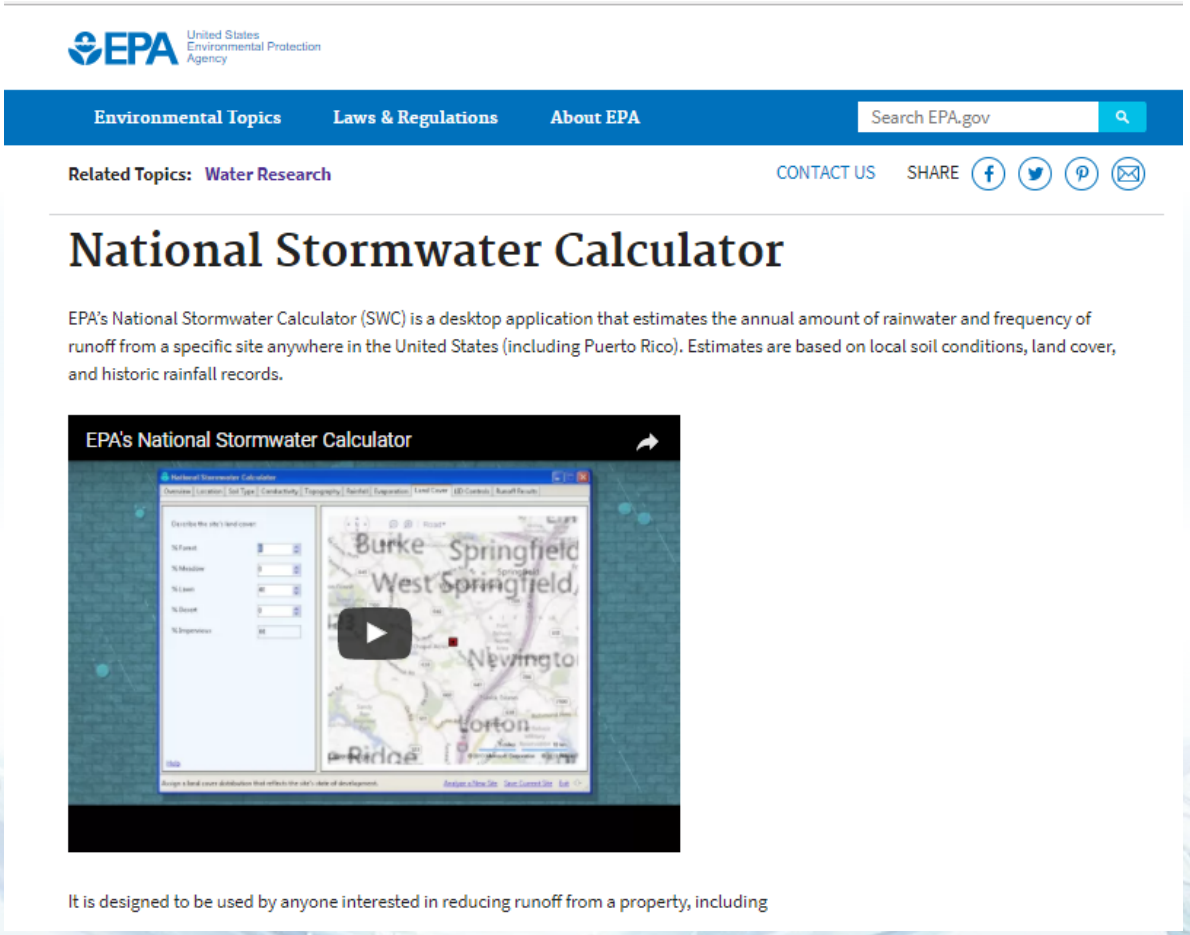
U.S. EPA's Office of Research and Development

Outline

U.S. EPA National Stormwater Calculator

- Stormwater Calculator Background Information
- LID Cost Estimation Module
- Development of Mobile Web Application
- Example Application: Northport, MI
- Interpreting Results
- Next Steps
- Discussion & Questions

National Stormwater Calculator Website

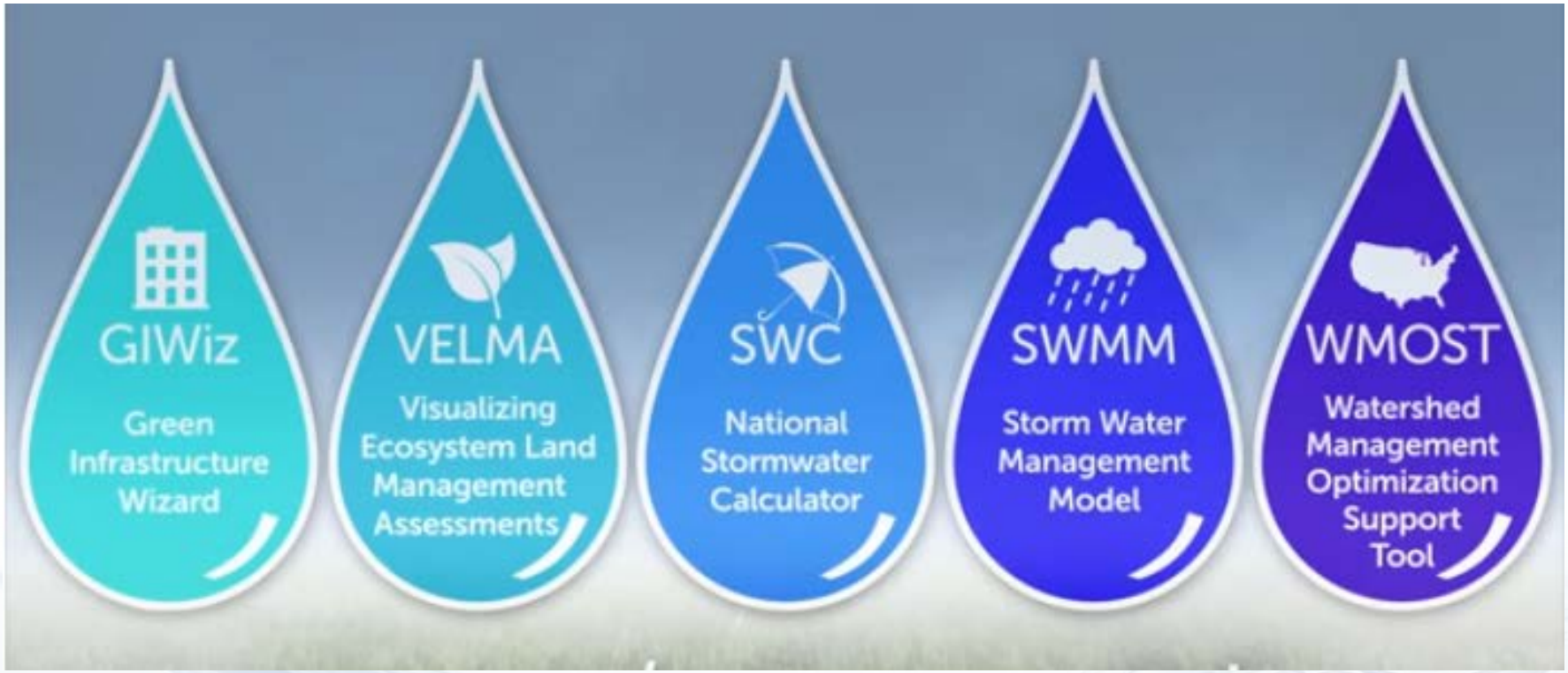


http://www2.epa.gov/water-research/national-stormwater-calculator

What Have We Created and Why?

- **A Stormwater Management (Green Infrastructure/Low Impact Development (LID)) Design and Planning Tool**
  - —To model post-construction urban stormwater runoff discharges
  - —Screening-level stormwater runoff reduction and cost analyses of various green infrastructure/low impact development (LID) practices, including:
    - Green roofs, rain gardens, cisterns, etc. throughout the U.S.
  - —Allow non-technical professionals to conduct screening level stormwater runoff for small to medium sized (less than 1 - 12 acres) sites

Green Infrastructure Modeling Toolkit



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

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 (U.S. Green Building Council) and Sustainable Sites Initiative stormwater credits
- Climate Resiliency Planning: Rockefeller Foundation's 100 Resilient Cities
- LID/Green Infrastructure Design Competitions: Campus RainWorks Challenge, DC Water Green Infrastructure Challenge, etc.

Examples of Urban Stormwater Management Projects: Great Lakes Region

- **Wisconsin:**
  - Manitowoc: rain garden along Blue Rail Marina Beach
  - Oak Creek: porous pavement parking area and bioretention along lakeside bluff

- **Michigan:**
  - Northport: pervious pavement, rain gardens, and tree box filters for Grand Traverse Bay

- **Indiana:**
  - Michigan City: green infrastructure streetscape (rain gardens & bioswales)

Communities using the SWC

- Northeastern Regional Ohio Sewer District (Cleveland, OH):

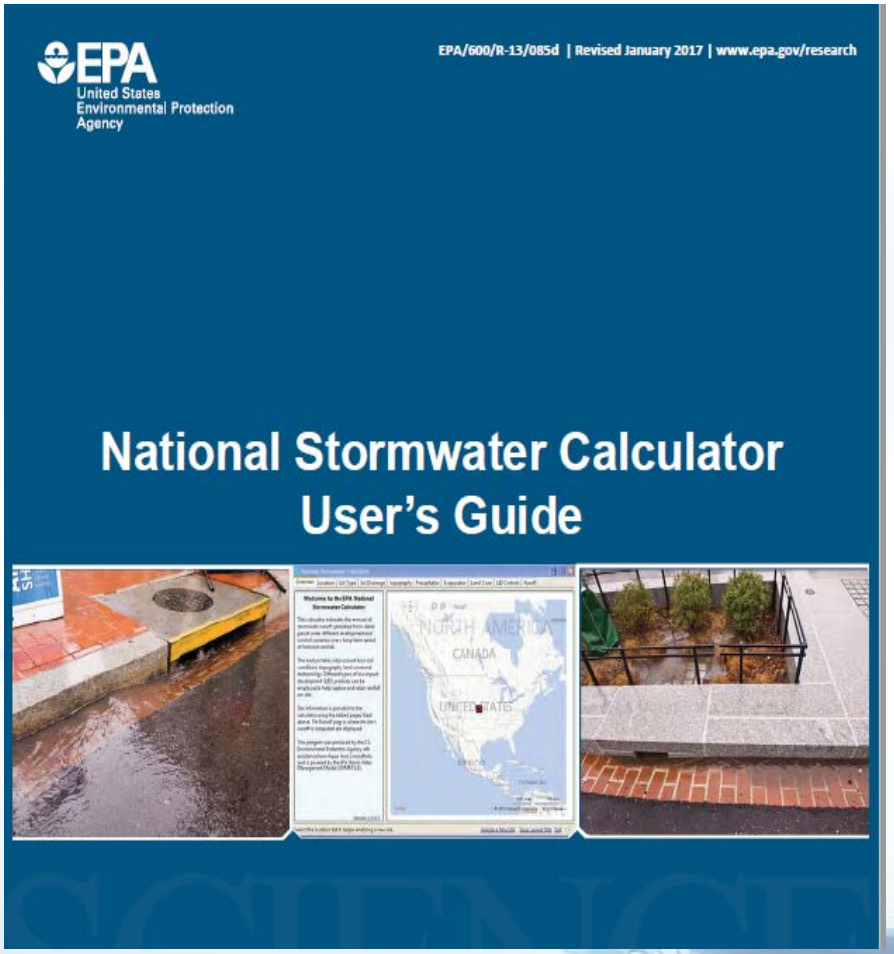
https://www.neorsd.org/stormwater-2/green-infrastructure-grant-program

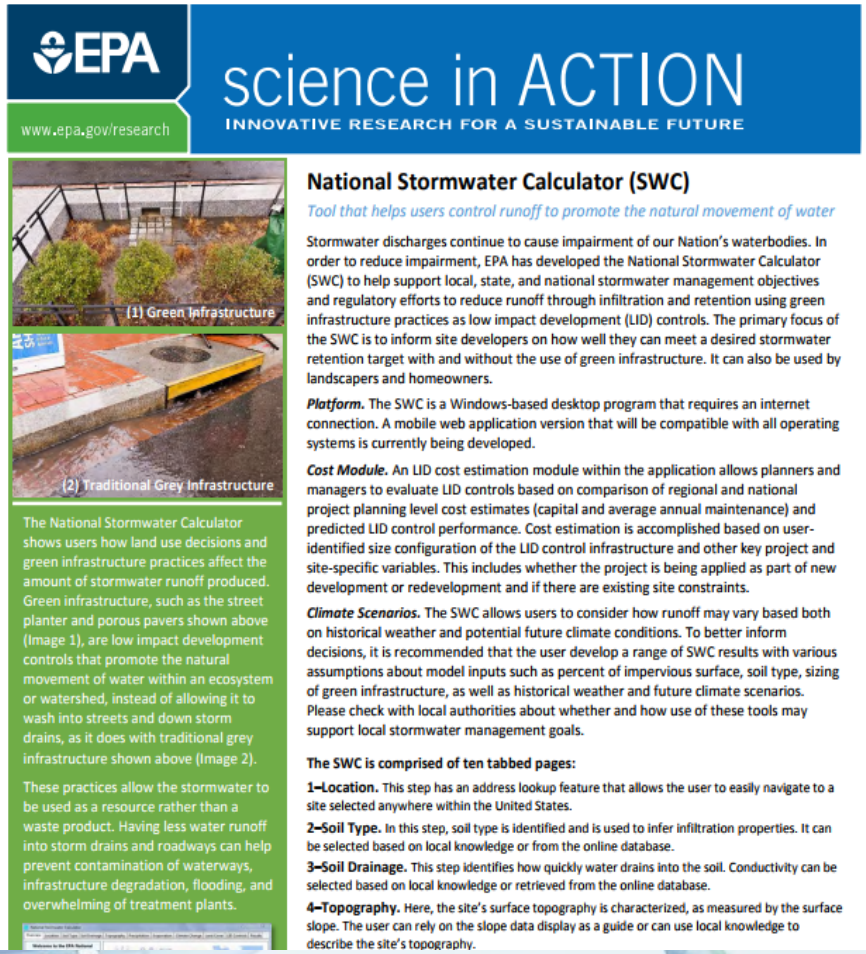
/

- EPA's Green & Complete Streets Building Blocks Program Recipients (2016- 2017):
  - Manatee County, FL
  - Baltimore, MD
  - Central Falls, RI

https://www.epa.gov/smartgrowth/building-blocks-sustainable-communities

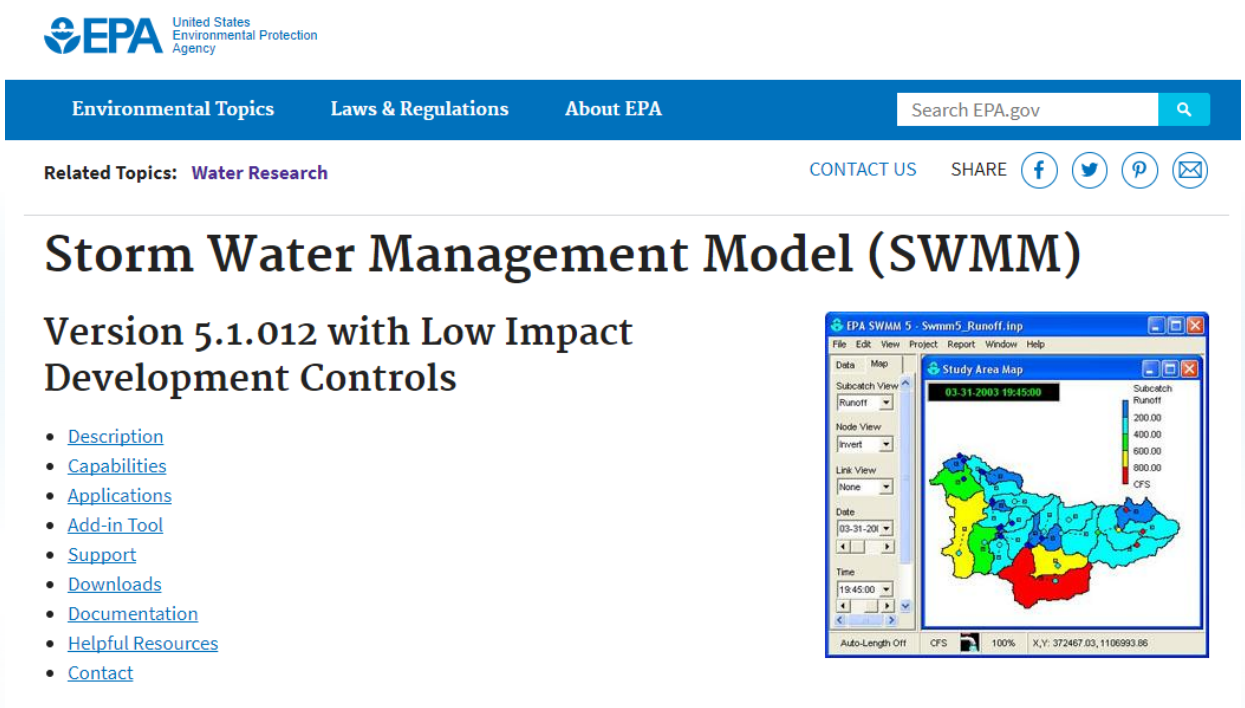
Training and Outreach Materials: User's Guide & Fact Sheet





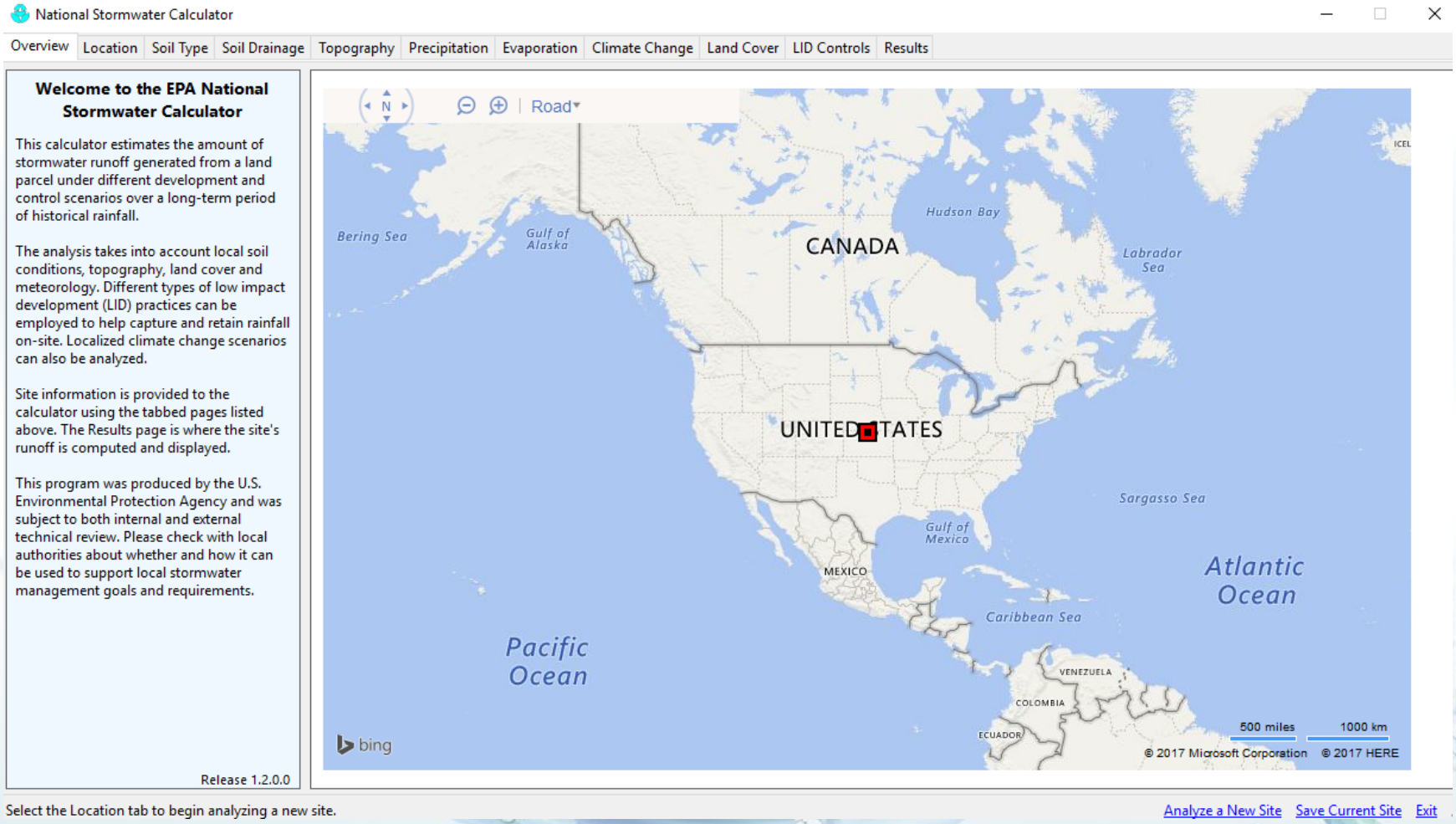
http://www2.epa.gov/water-research/national-stormwater-calculator

Storm Water Management Model (SWMM)

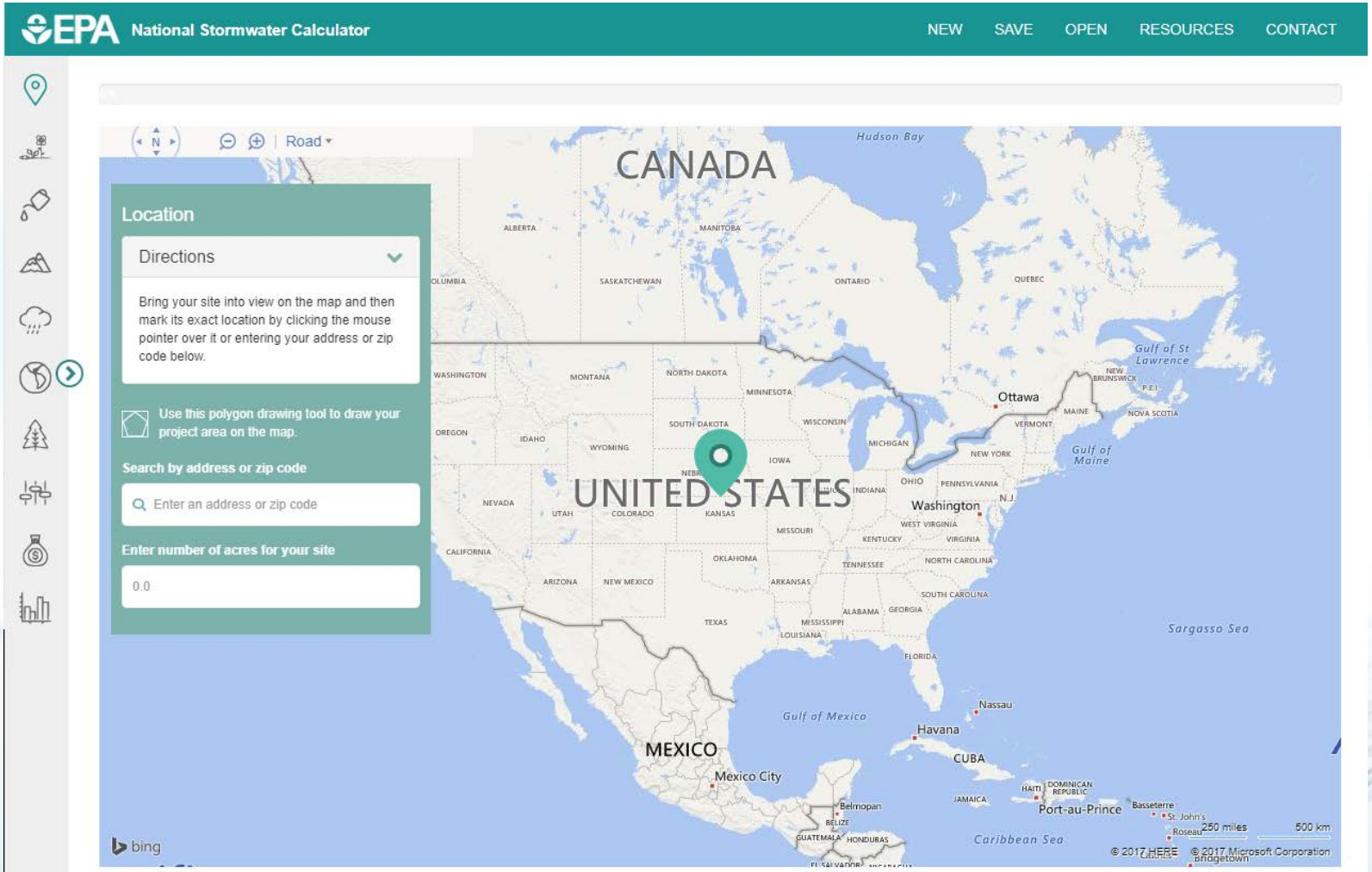


- Calculator is based on SWMM: Dynamic rainfall-runoff simulation model for long-term simulation of runoff quantity
- SWMM produces stormwater runoff estimates in the background of the Stormwater Calculator

National Stormwater Calculator (SWC) Desktop Application



SWC Mobile Web App



LID Cost Estimation Module (Released May 2017):

- **Intended Uses:**
  - Planning level cost estimates (magnitude of costs between planning scenarios)

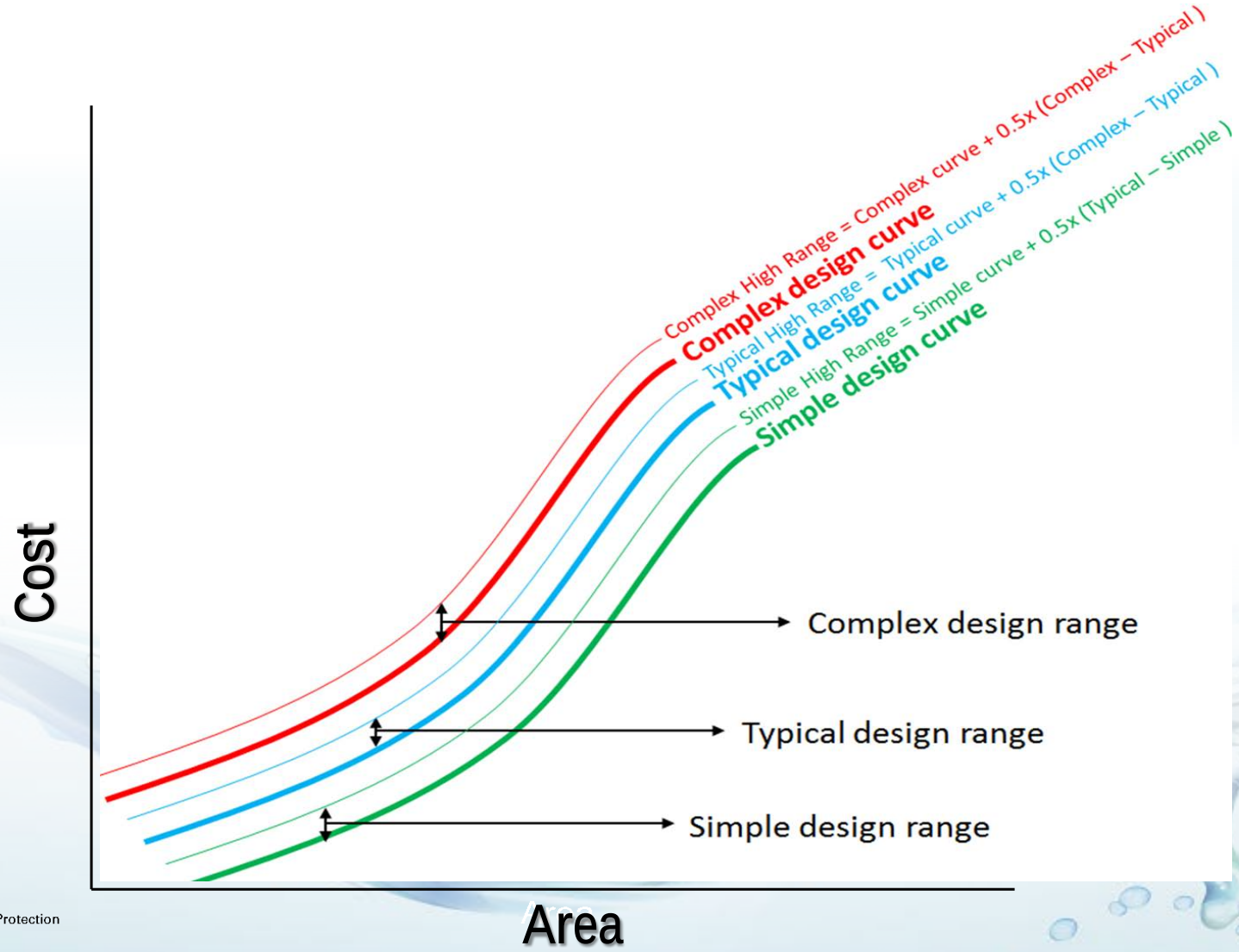
- **Limitations:**
  - Doesn't provide final construction/build costs
  - Doesn't provide lifecycle costs (gives annual operation and maintenance (O & M) costs, not replacement costs)
  - Regional costs not available for all areas of the US (many of the Western states)

LID Cost Estimation Module:
Site Complexity Effects on Costs of Stormwater Projects

Criteria	Degree of Complexity		
	Simple	Typical	Complex
New vs. existing development	New	Existing	Existing
(Pretreatment) Outflow and overflow discharge safety constraints	Safe & unconstrained	Slightly constrained & may require some grading or pipe infrastructure for safe discharge	Likely constrained & may require significant grading or pipe infrastructure for safe discharge
Equipment accessibility	Easy access	Fairly easy	Difficult access
Slope for LID control placement	Flat to moderately flat (0 – 4%)	Moderately flat (4 – 7%)	Steeper slope (greater than 7%)
Soil infiltration rate	High infiltration (HSG: A)	Moderate infiltration (HSG: B)	Low infiltration (HSG: C and D)

LID Cost Estimation Module:

Accounting for Uncertainty with Cost Estimates (Regression Cost Curves)



LID Cost Estimation Module:
Development of Regionalized LID/Green Infrastructure Costs

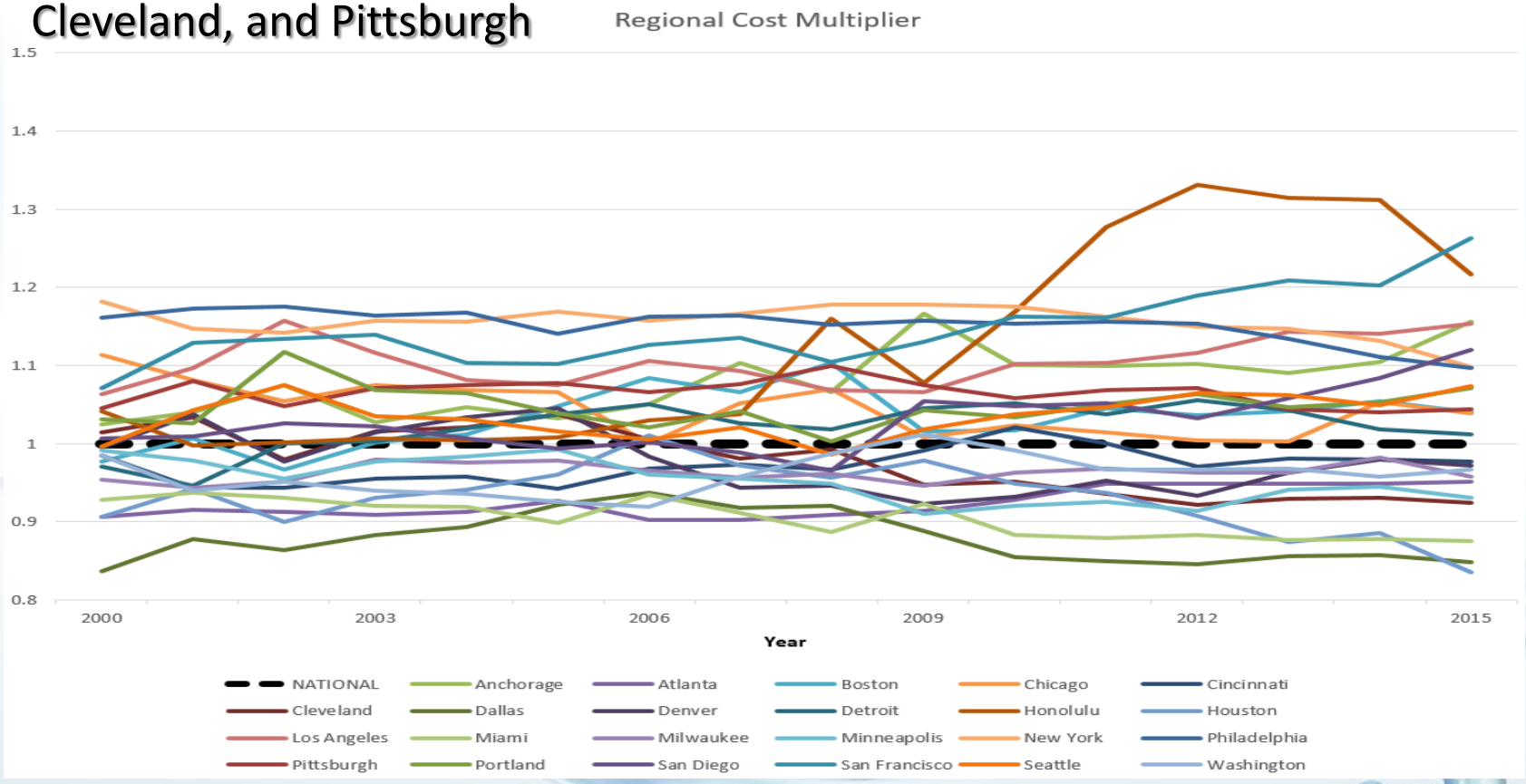
- **Utilization of Bureau of Labor Statistics (BLS) Data for regional costs**
  - *National Producer Price Index*: outputs of service, construction, utilities, and other goods producing entities
    - Examples include: concrete storm sewer pipe, construction sand and gravel, etc.
  - *Consumer Price Index*: regional/city data (23 major US cities)
    - Examples include: fuels and utilities, energy, and diesel fuel

- **Data easily updated and maintained annually by EPA**

- **Development of regional costs comparable to Engineering News Record (ENR) and RS Means**

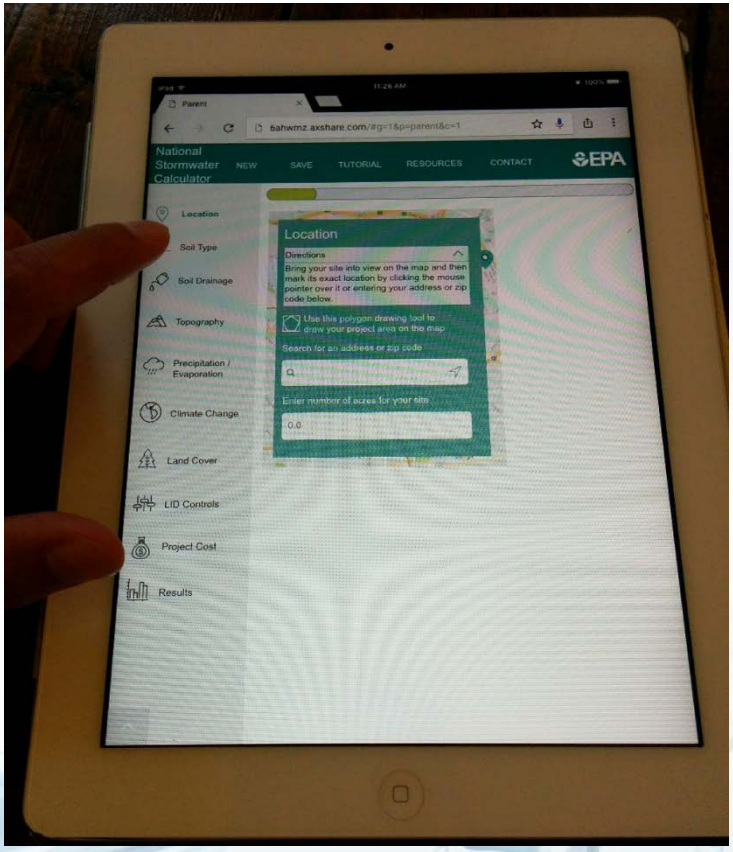
LID Cost Estimation Module:
Development of Regionalized LID/Green Infrastructure Costs

- Modeled regional cost multipliers (2000 - 2015)
- Great Lakes Cost Centers: Minneapolis, Milwaukee, Chicago, Detroit, Cleveland, and Pittsburgh



Mobile Web App Development: 2016 - 2017

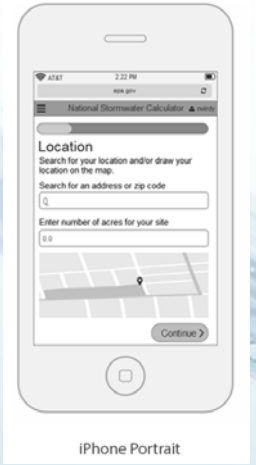
- **Ability to function on any web browser**
- **Mobile friendly design (tablets and smartphones)**
- **Platform neutral: functions on Windows, Apple, and Linux computers**
- **Not found in an "app store" (Google Play or Apple Store)**
  - **Save it as a "favorite" website**
- ***Requires a live Internet connection***

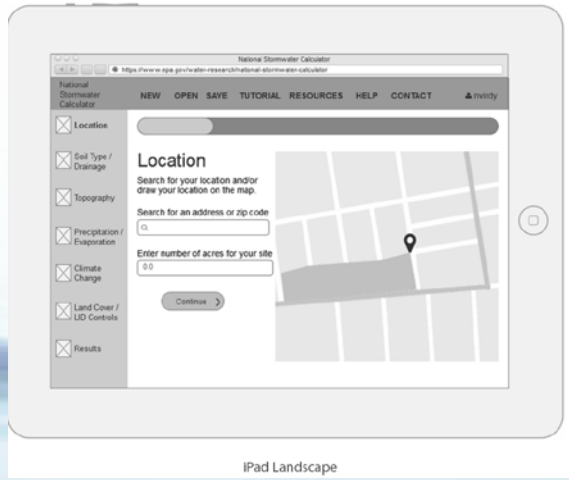


Mobile Web App Development: 2016 - 2017

- **Gathered user information on existing desktop application of the SWC (Spring 2016)**

- **Wireframe Development of web app user interface (Spring – Summer 2016)**



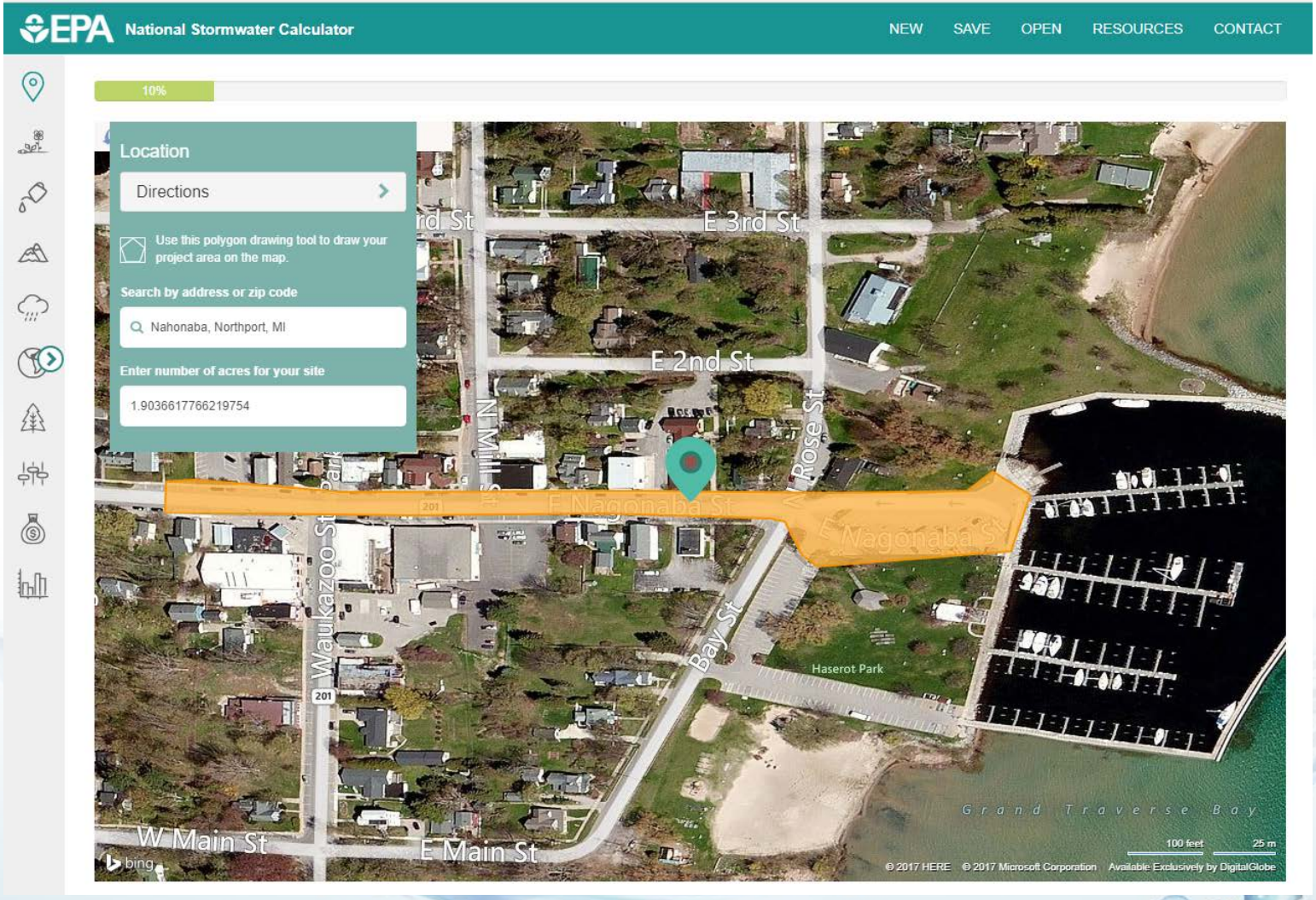


SWC:
Site Parameters and Embedded GIS Data-sets

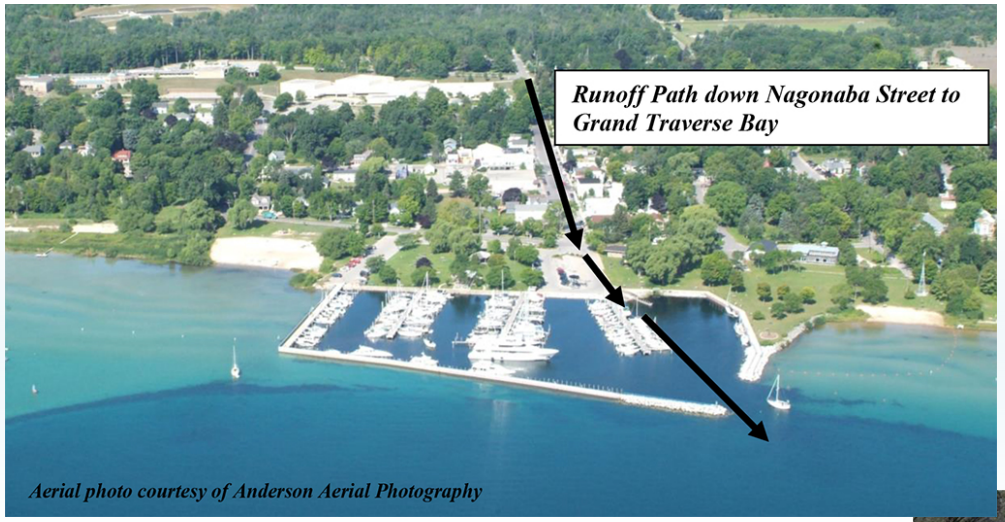
- **Location:** Bing Maps
- **Soils:** NRCS SSURGO *(web service)*
- **Slope:** NRCS SSURGO
- **Hydraulic Conductivity:** NRCS SSURGO
- **Precipitation and Temperature:** National Climate Center (NCDC)-NOAA *(EPA's BASINS Model)*
- **Evaporation:** Calculation based on meteorological data
- **Climate Change Future Scenarios:** Precipitation & evaporation *(EPA's CREAT 2.0)*
- **Land-Cover/Use:** User provided
- **LID Practices (*new costing module available*):** User provided

SWC Mobile Web App Application (Northport, MI)

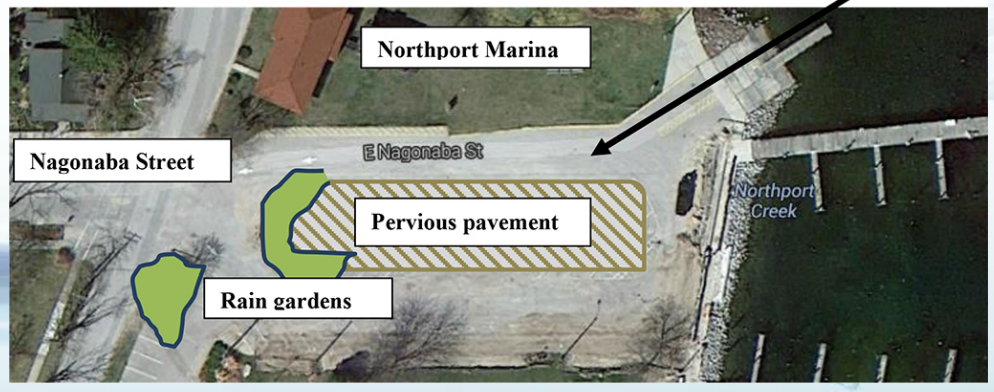
Location:



SWC Mobile Web App Application (Northport, MI)



The Watershed Center Grand Traverse Bay (2016)



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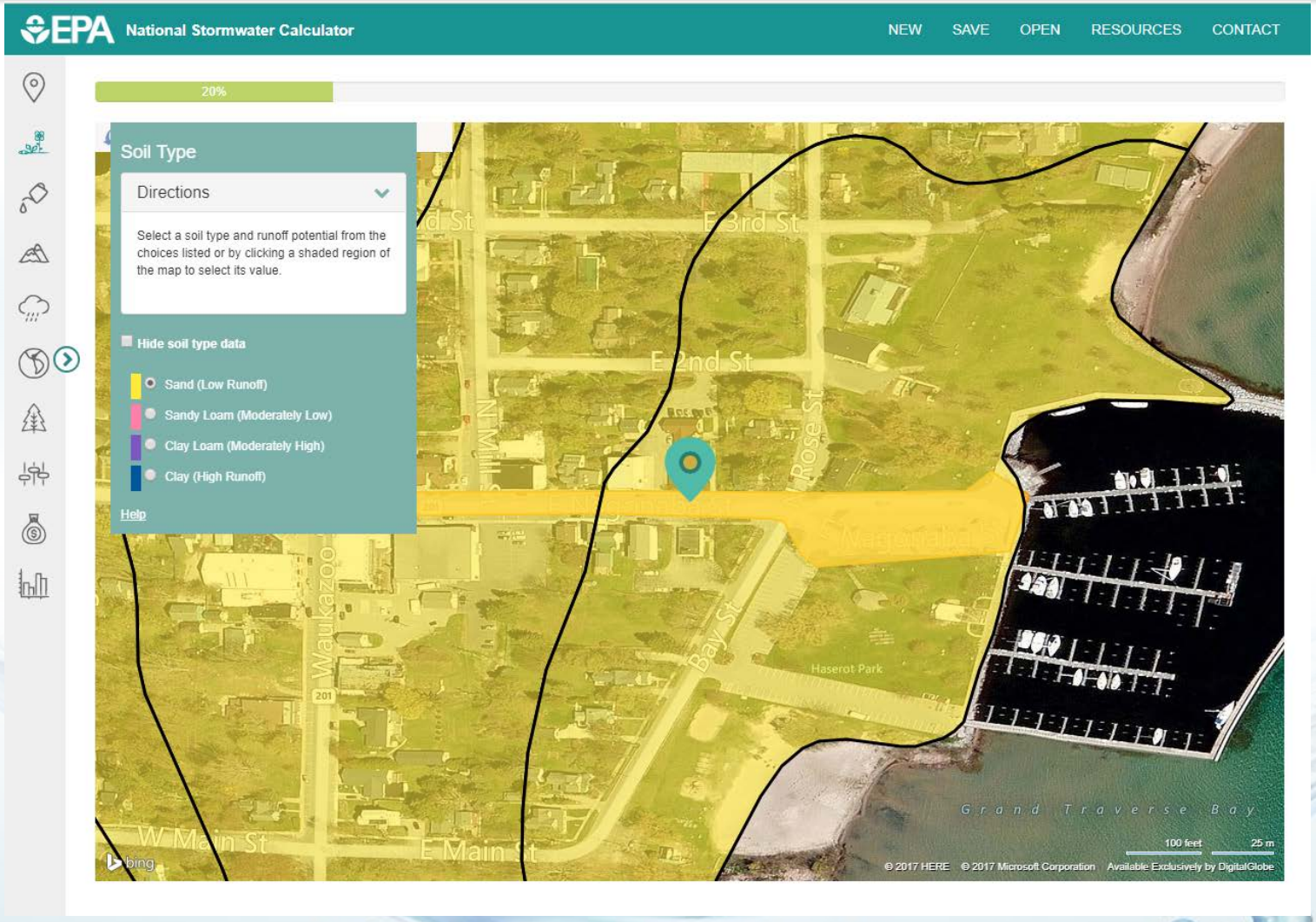
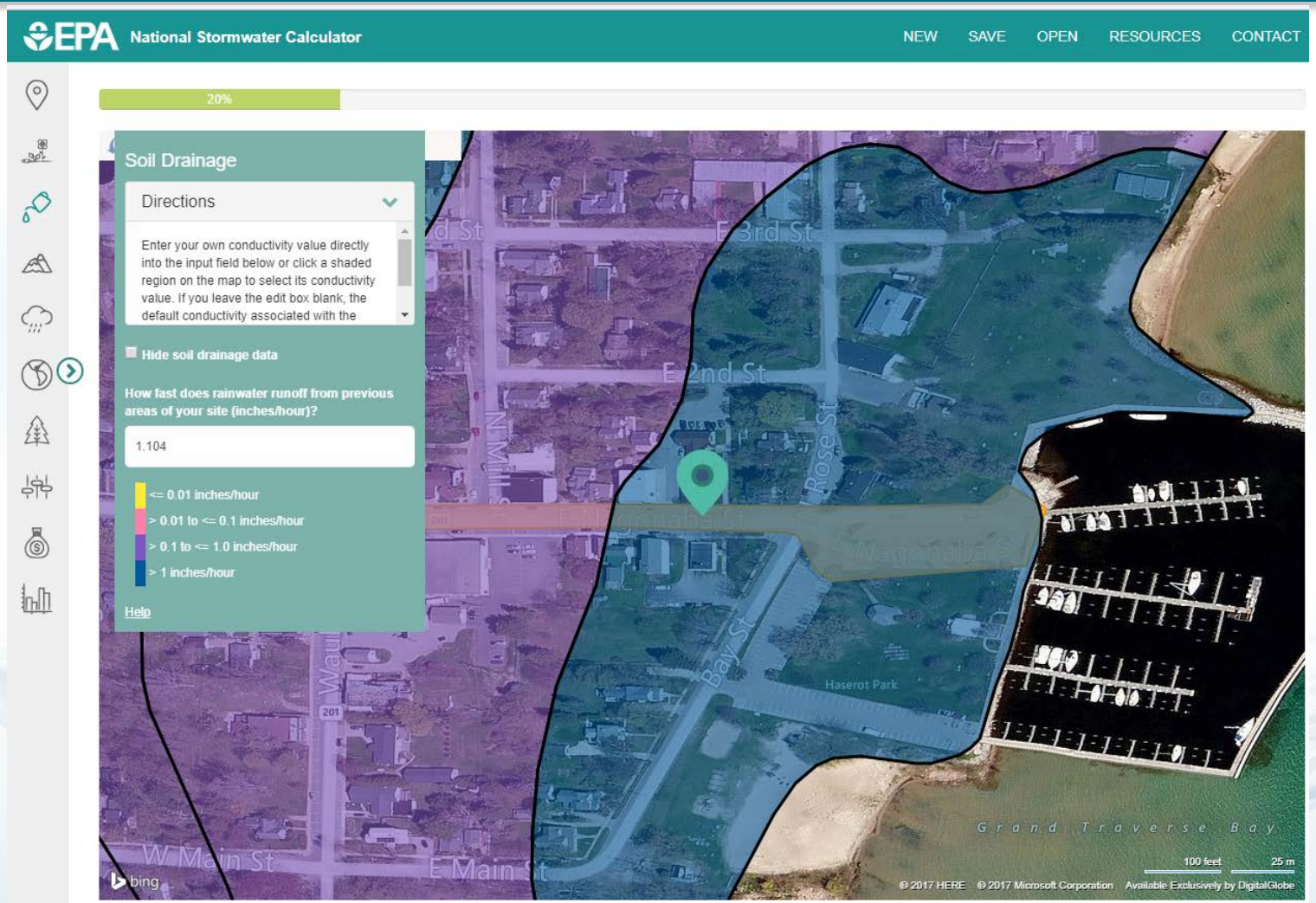
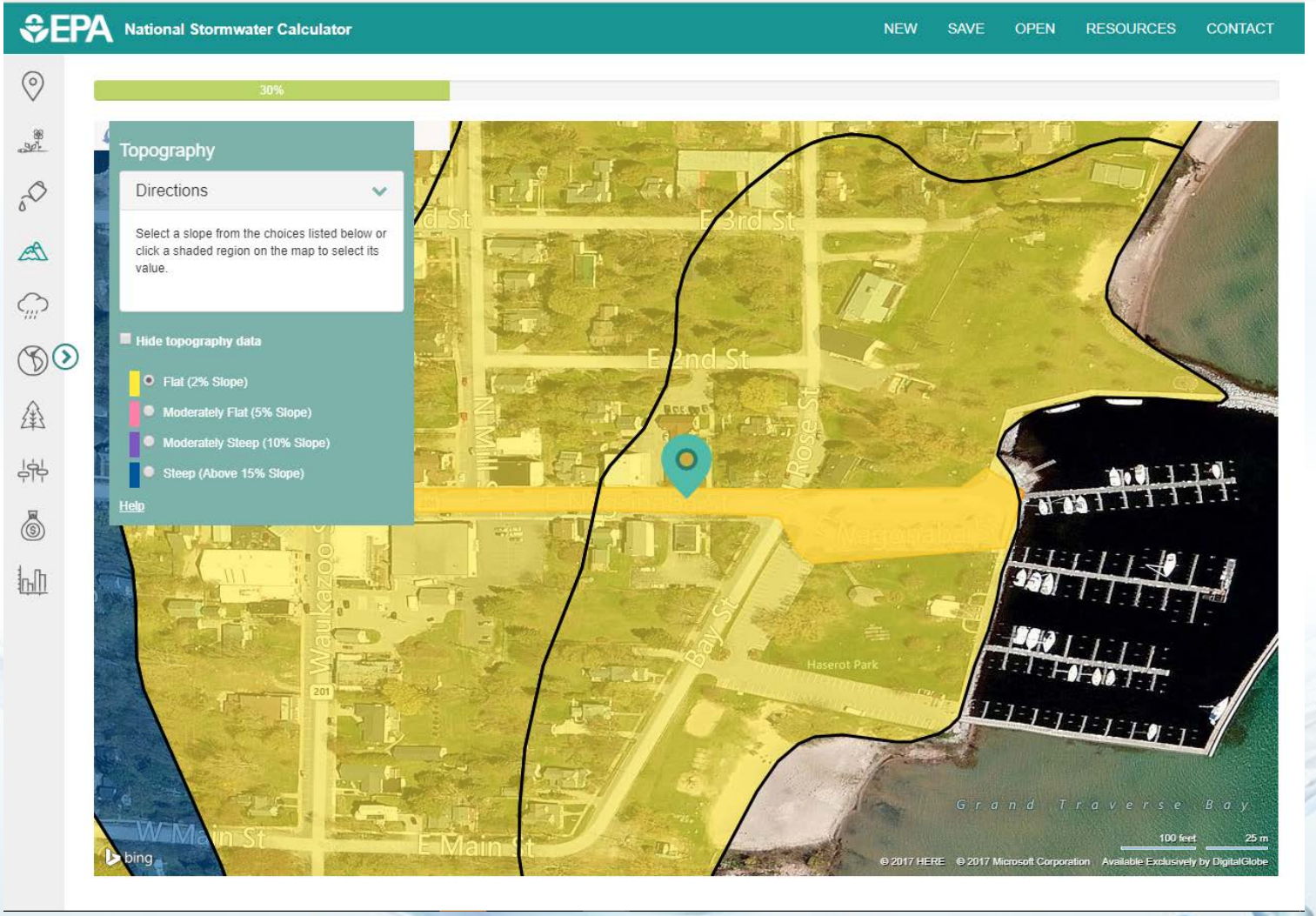
Soil Runoff Potential:



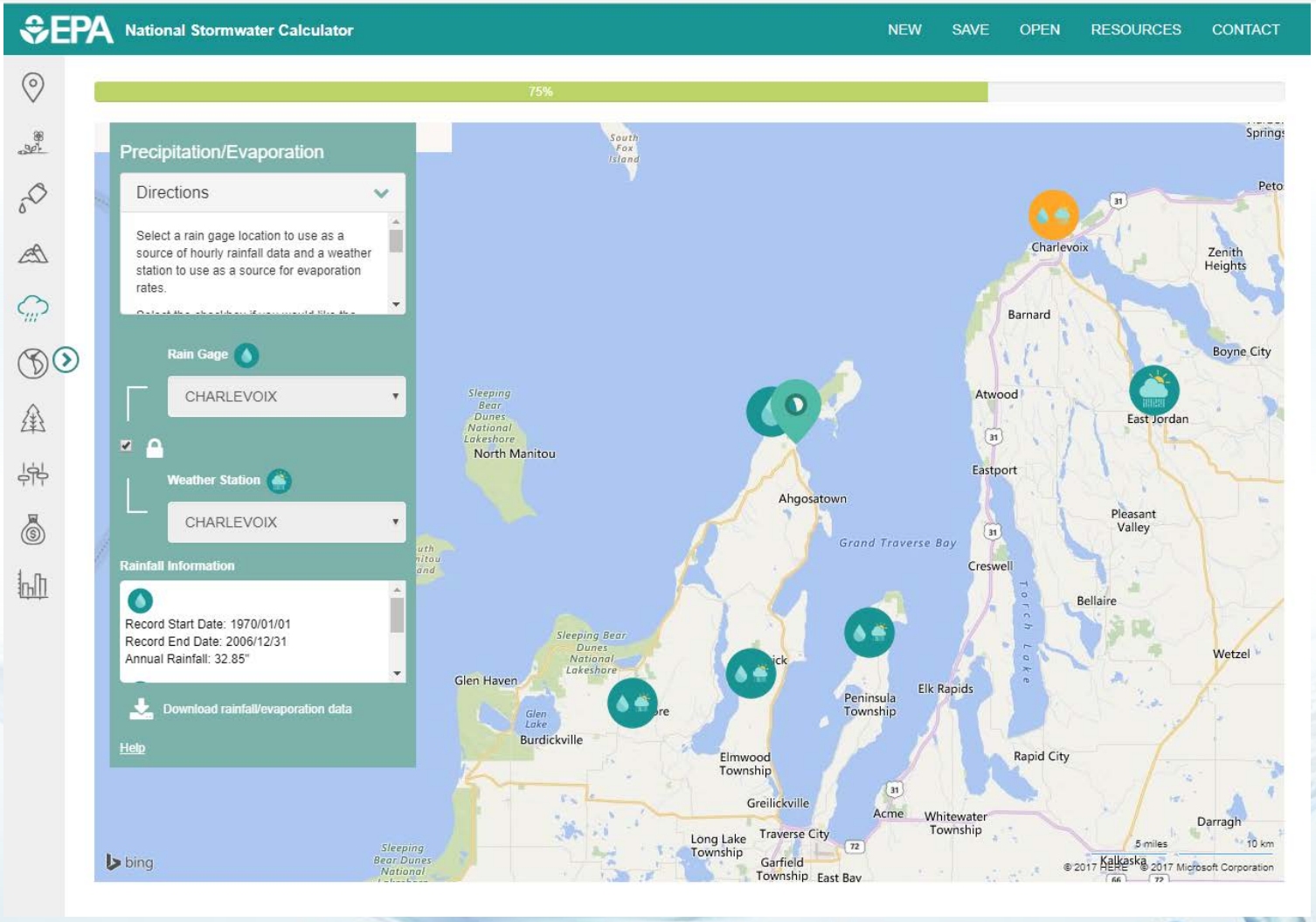
Soil Infiltration Capacity:



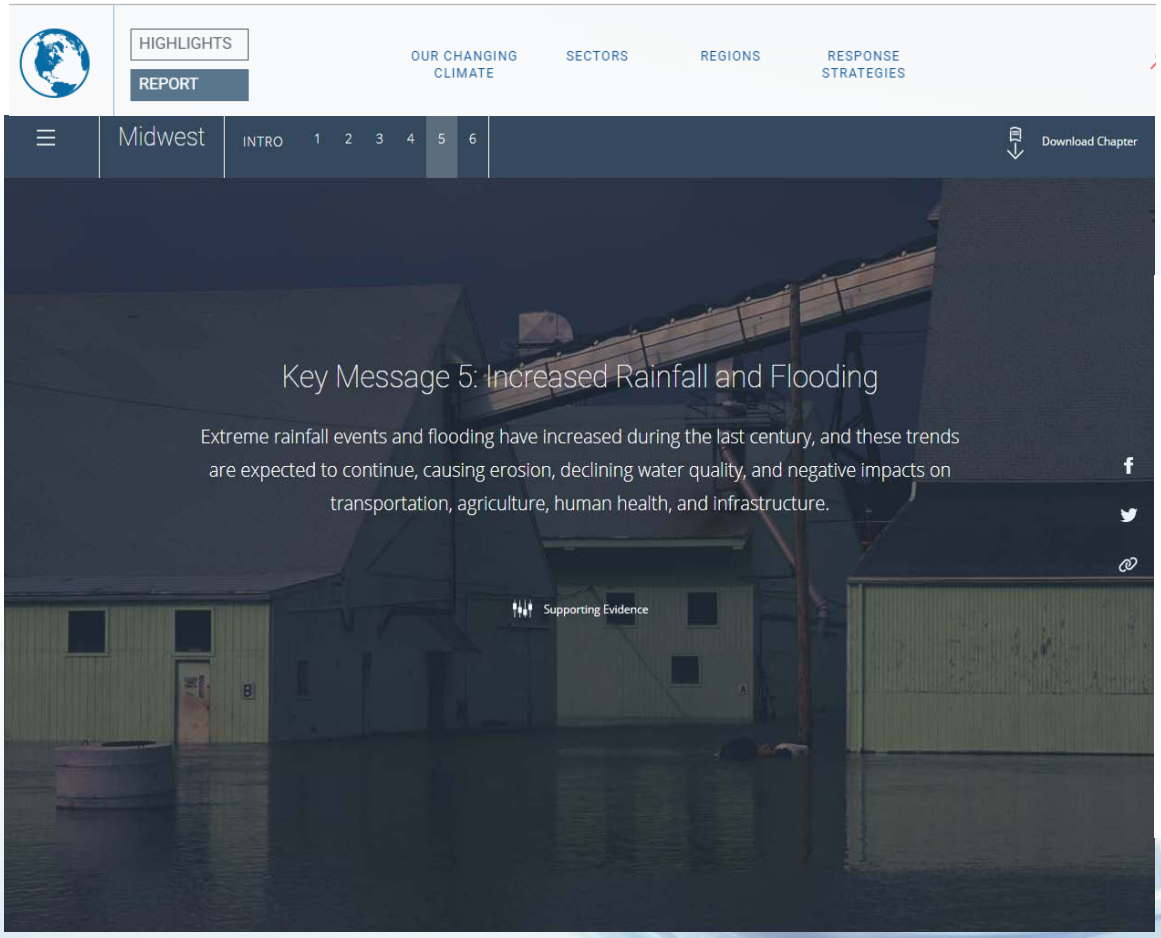
Topography/Slope:

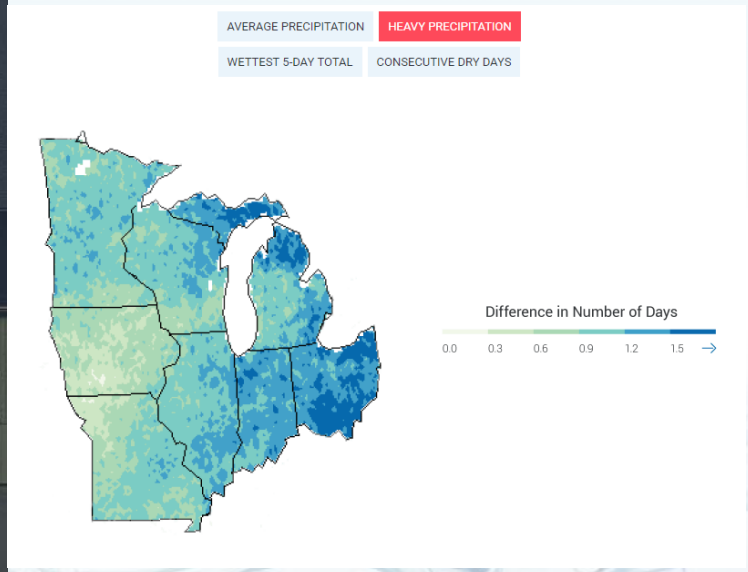


Historical Weather (precipitation & evaporation):



Climate Change Scenarios & Extreme Storm Events:





Climate Change Scenarios & Extreme Storm Events:

EPA National Stormwater Calculator

NEW SAVE OPEN RESOURCES CONTACT

85%

Climate Change

Directions

Helpful Resources

Scenarios for Climate Assessment and Adaptation - Regions

GlobalChange.gov - Regions & Topics

US Environmental Protection Agency - Future of Climate Change

World Climate Research Programme

Select a future climate change scenario to apply:

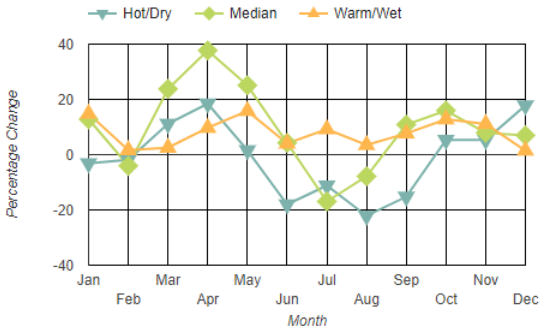
- No Change
- Hot/Dry
- Median Change
- Warm/Wet

Select the time period to which the climate change scenario applies:

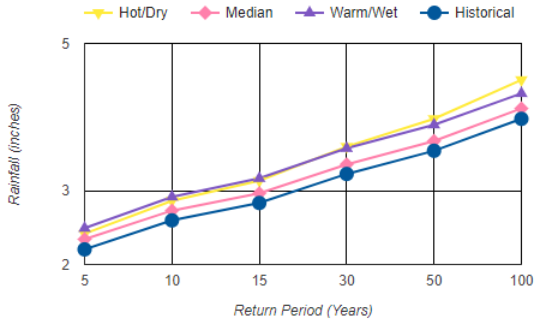
- Near Term (2020 - 2049)
- Far Term (2045 - 2074)

Save charts as PDF

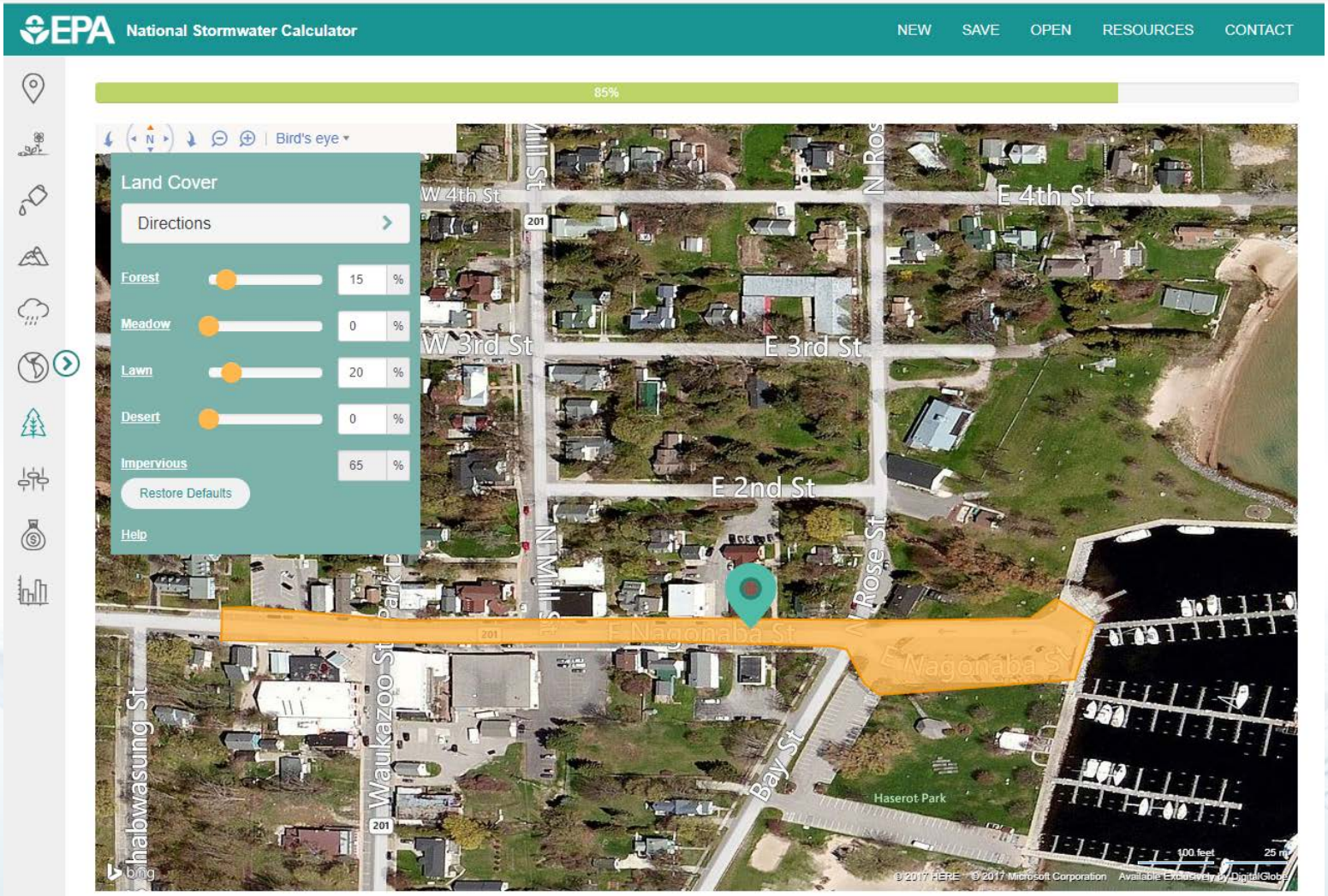
Percentage Change in Monthly Rainfall for Far Term Projections



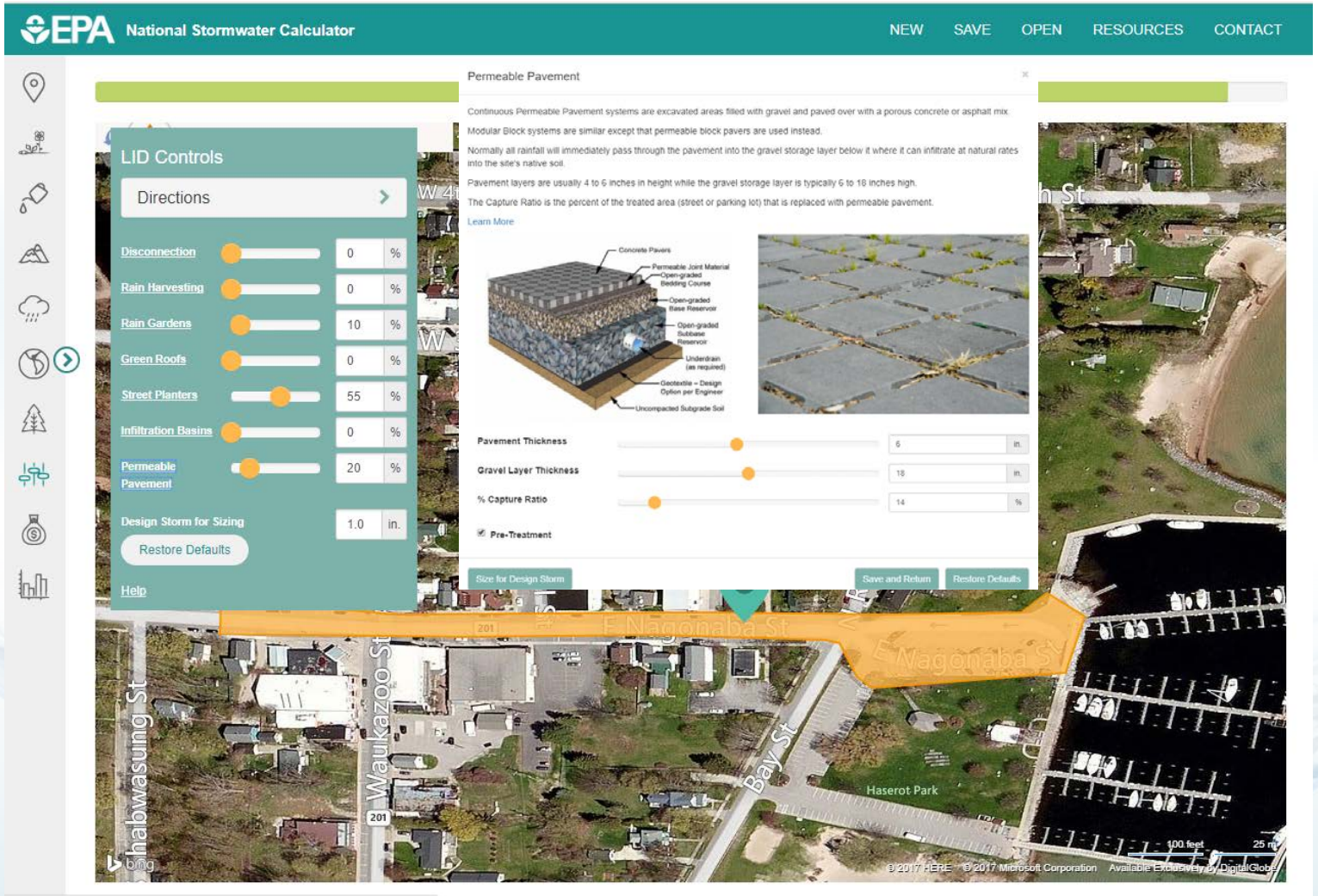
Annual Max. Day Rainfall (inches) for Far Term Projections



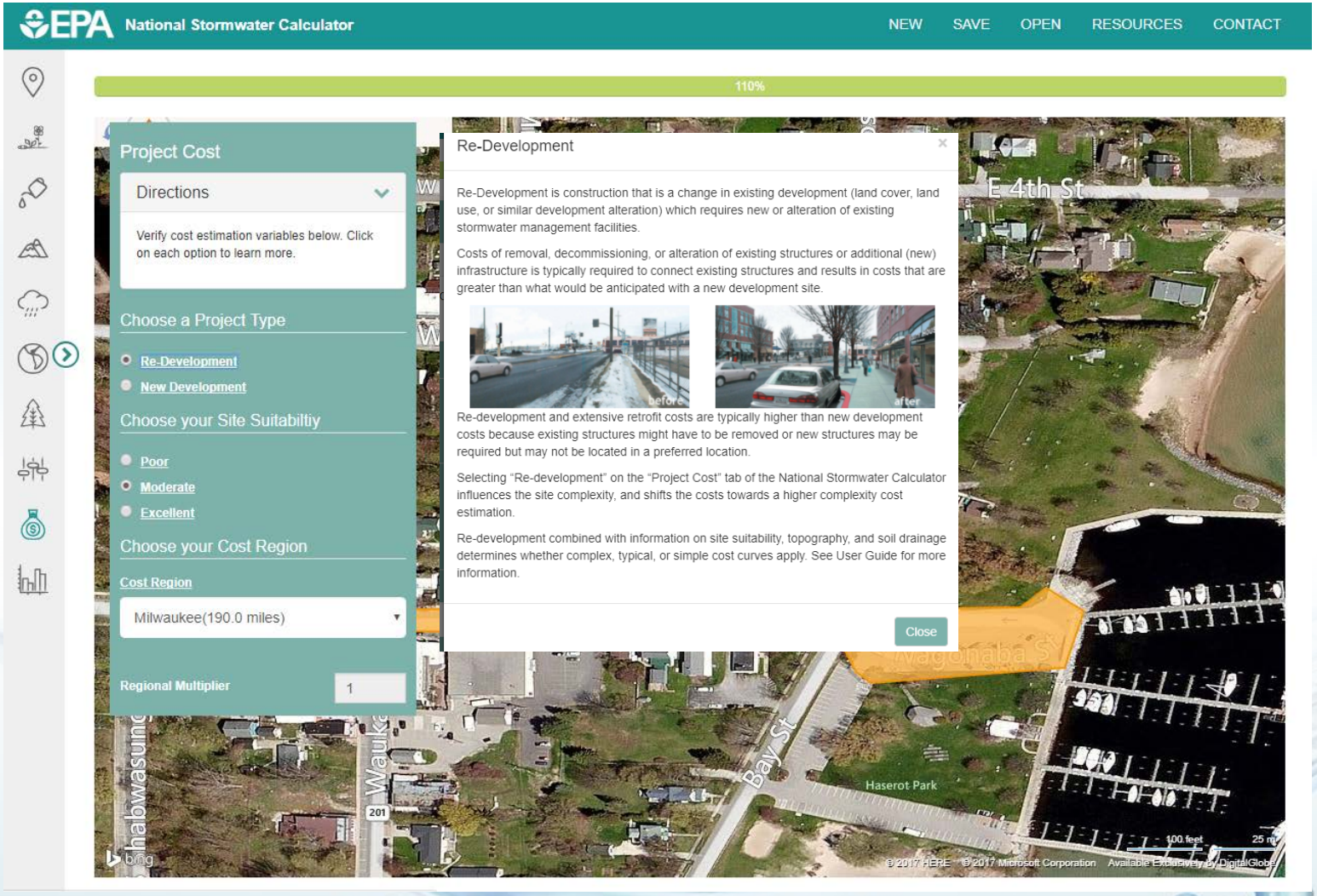
Land Cover:


EPA National Stormwater Calculator
NEW
SAVE
OPEN
RESOURCES
CONTACT
85%
Bird's eye
Land Cover
Directions
Forest 15 %
Meadow 0 %
Lawn 20 %
Desert 0 %
Impervious 65 %
Restore Defaults
Help
W 4th St
E 4th St
W 3rd St
E 3rd St
E 2nd St
E Nagonaba St
Nagonaba St
Waukazoo St
Bay St
Haserot Park
Shabwasung St
201
100 feet
25 m
© 2017 HERE © 2017 Microsoft Corporation Available Exclusively by DigitalGlobe

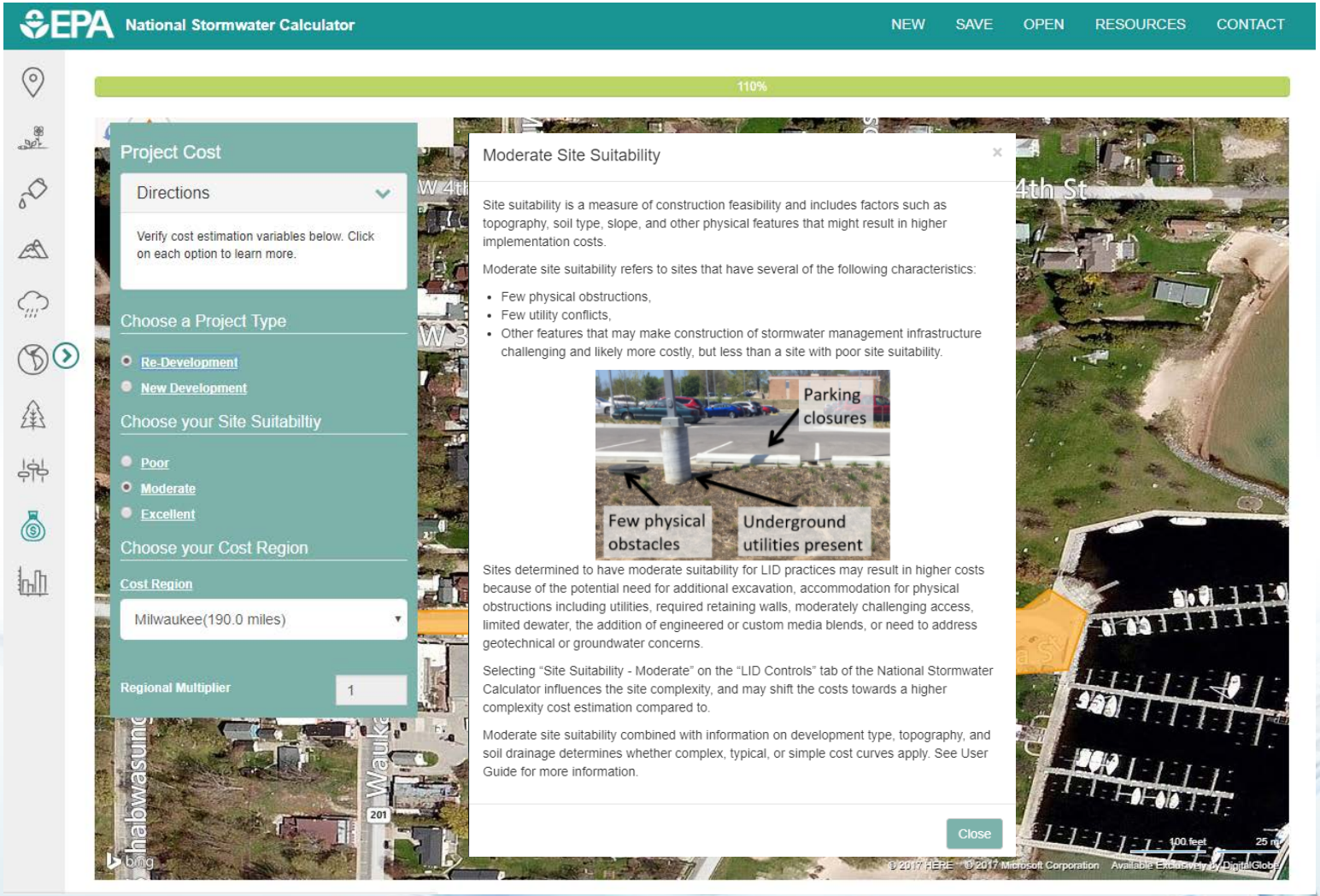
LID Controls:



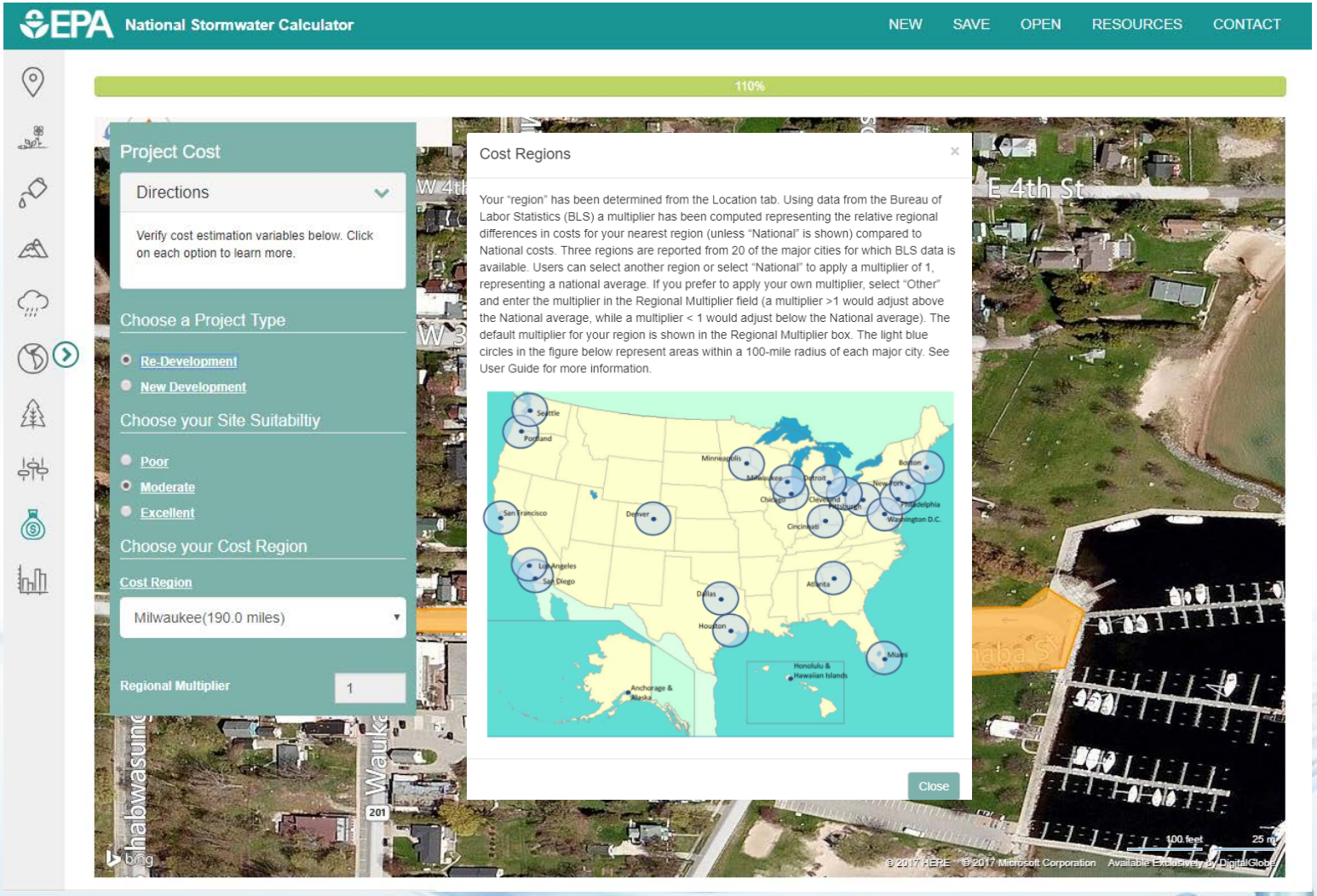
Project Cost (Development Type):



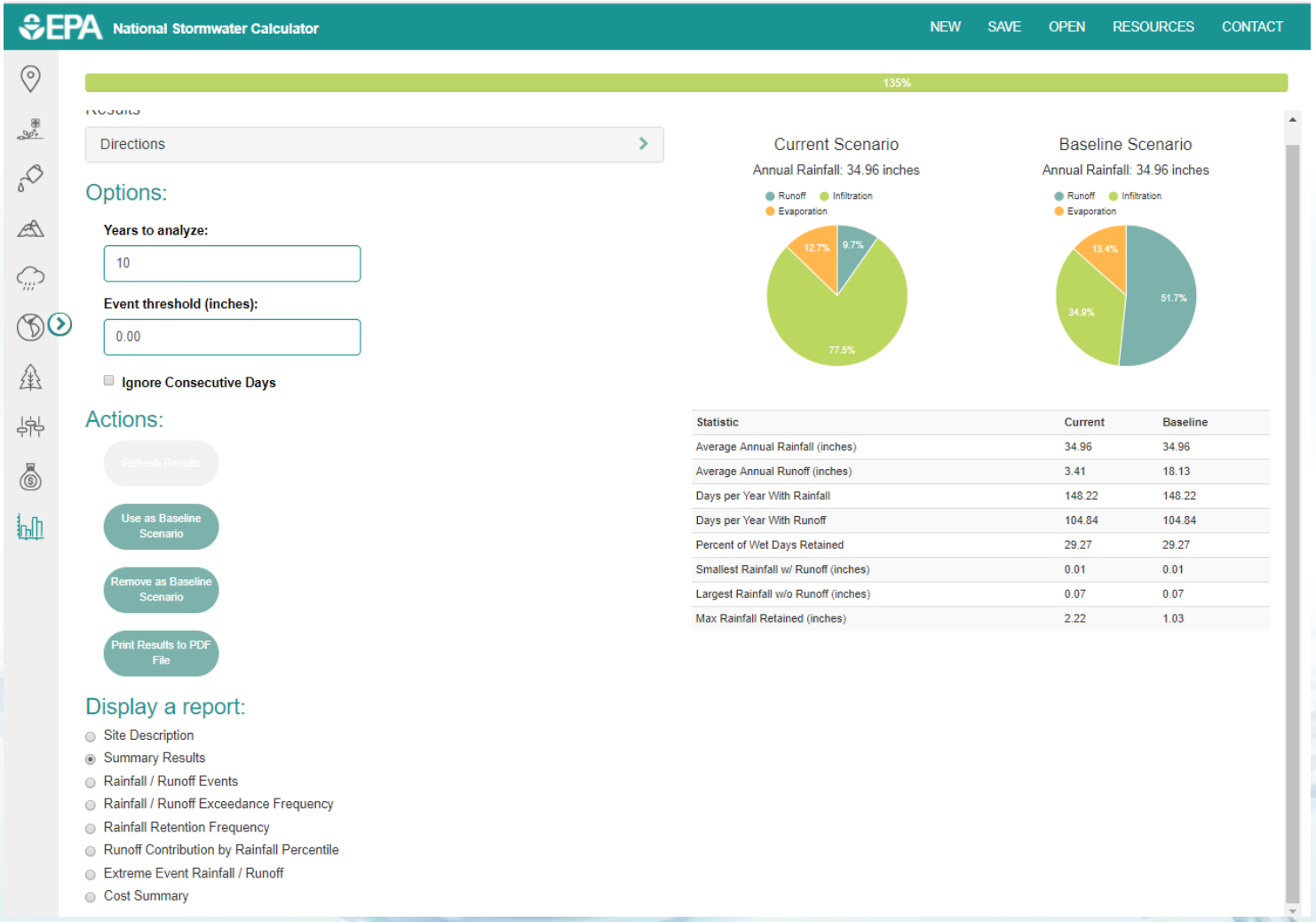
Project Cost (Site Suitability):



Project Cost (Bureau of Labor Statistics Cost Region):

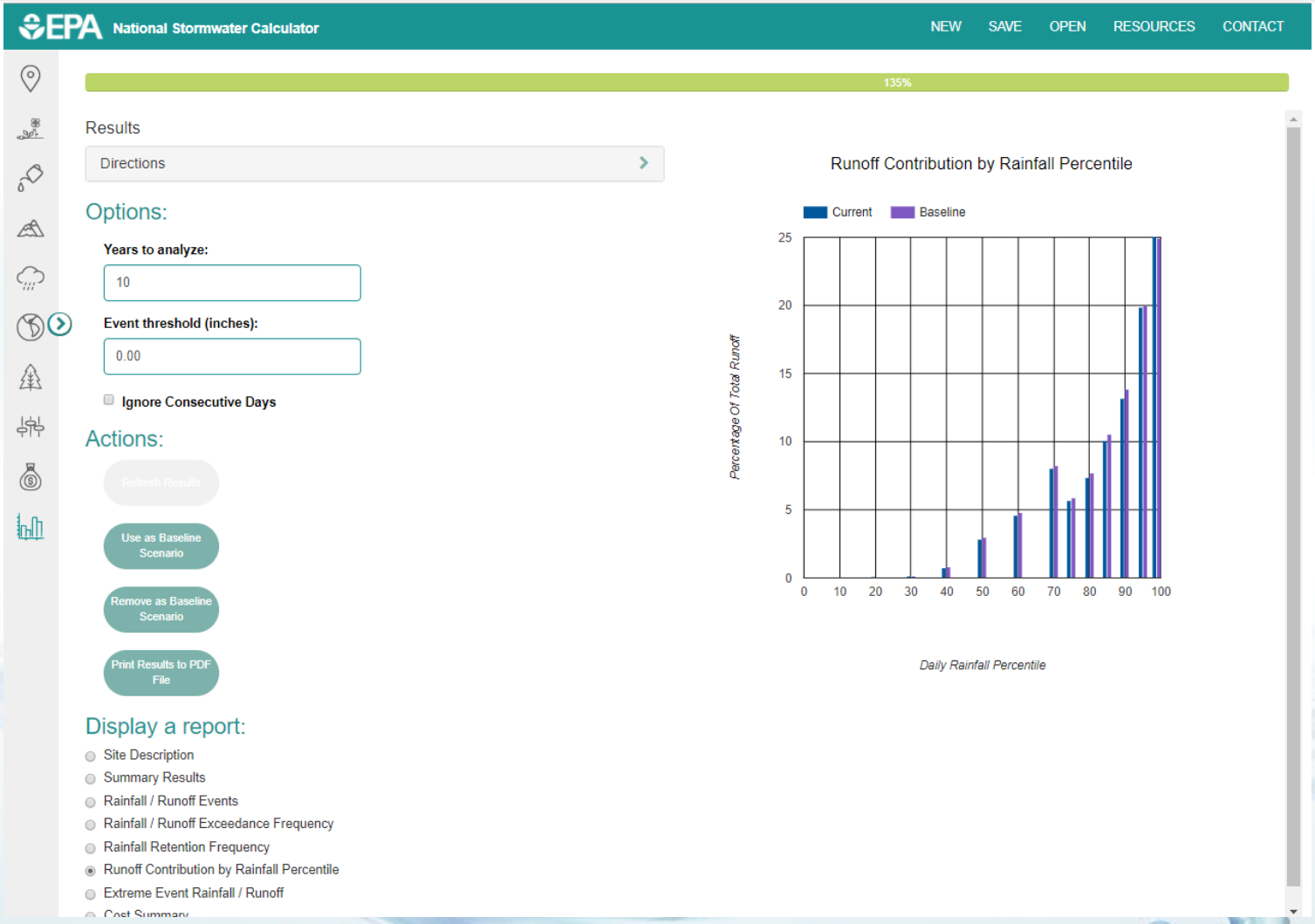


Results (Summary):

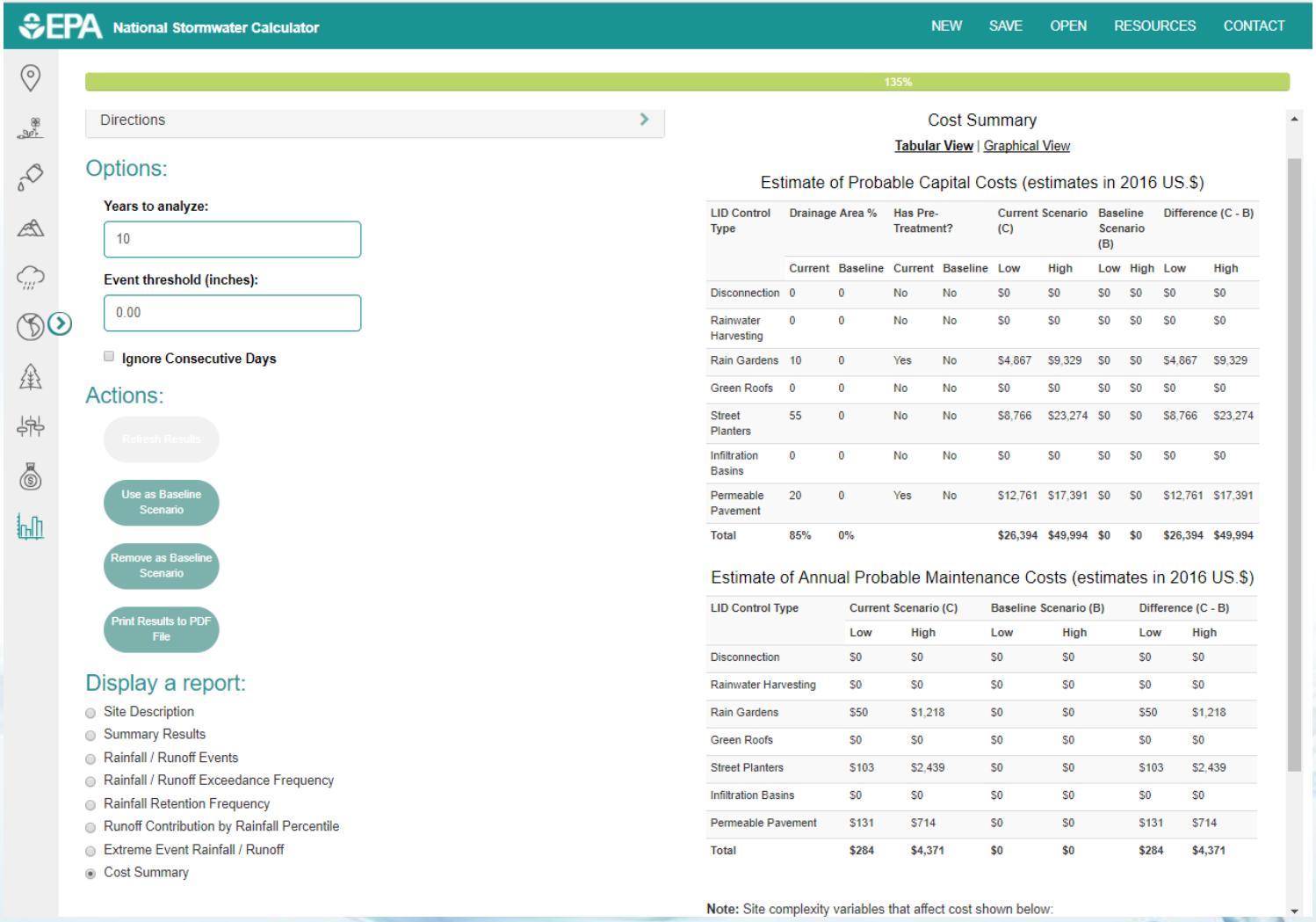


Statistic	Current	Baseline
Average Annual Rainfall (inches)	34.96	34.96
Average Annual Runoff (inches)	3.41	18.13
Days per Year With Rainfall	148.22	148.22
Days per Year With Runoff	104.84	104.84
Percent of Wet Days Retained	29.27	29.27
Smallest Rainfall w/ Runoff (inches)	0.01	0.01
Largest Rainfall w/o Runoff (inches)	0.07	0.07
Max Rainfall Retained (inches)	2.22	1.03

Results (Runoff Contribution by Rainfall Percentile):



Results (Cost Summary):



LID Control Type	Drainage Area %		Has Pre-Treatment?		Current Scenario (C)		Baseline Scenario (B)		Difference (C - B)	
	Current	Baseline	Current	Baseline	Low	High	Low	High	Low	High
Disconnection	0	0	No	No	$0	$0	$0	$0	$0	$0
Rainwater Harvesting	0	0	No	No	$0	$0	$0	$0	$0	$0
Rain Gardens	10	0	Yes	No	$4,867	$9,329	$0	$0	$4,867	$9,329
Green Roofs	0	0	No	No	$0	$0	$0	$0	$0	$0
Street Planters	55	0	No	No	$8,766	$23,274	$0	$0	$8,766	$23,274
Infiltration Basins	0	0	No	No	$0	$0	$0	$0	$0	$0
Permeable Pavement	20	0	Yes	No	$12,761	$17,391	$0	$0	$12,761	$17,391
Total	**85%**	**0%**			**$26,394**	**$49,994**	**$0**	**$0**	**$26,394**	**$49,994**

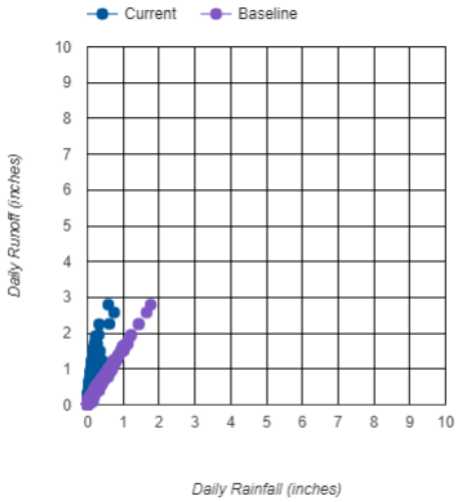
LID Control Type	Current Scenario (C)		Baseline Scenario (B)		Difference (C - B)	
	Low	High	Low	High	Low	High
Disconnection	$0	$0	$0	$0	$0	$0
Rainwater Harvesting	$0	$0	$0	$0	$0	$0
Rain Gardens	$50	$1,218	$0	$0	$50	$1,218
Green Roofs	$0	$0	$0	$0	$0	$0
Street Planters	$103	$2,439	$0	$0	$103	$2,439
Infiltration Basins	$0	$0	$0	$0	$0	$0
Permeable Pavement	$131	$714	$0	$0	$131	$714
Total	**$284**	**$4,371**	**$0**	**$0**	**$284**	**$4,371**

Results (PDF Report):

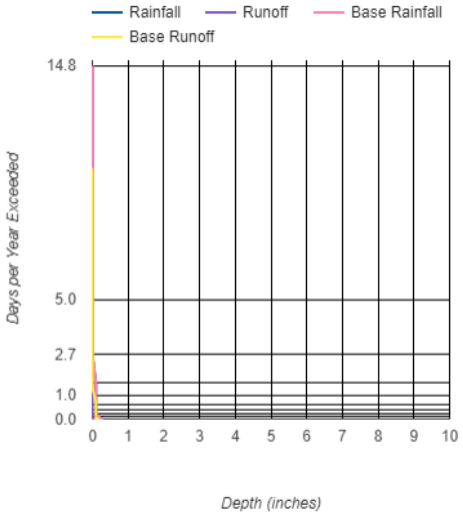
National Stormwater Calculator Report

Results

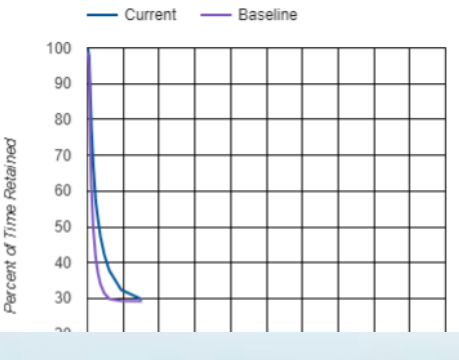
Rainfall / Runoff Events



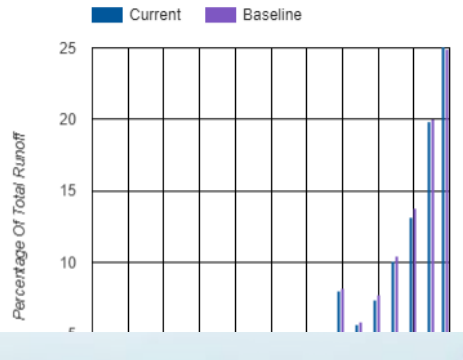
Rainfall / Runoff Exceedance Frequency



Rainfall Retention Frequency



Runoff Contribution by Rainfall Percentile



Interpreting the Results

- Informing next steps for finalizing costs of stormwater projects and construction plans/designs
- Comparing the relative magnitude of planning level costs for different stormwater management solutions
  - Finding least cost option(s) while meeting performance goals
- Comparisons may be made between national and regional cost estimates:
  - Using local knowledge in selection of regional BLS cost multipliers

SWC Analysis: Potential Next Steps

- Sharing planning results with decision-makers
- Applying for funding
- Developing construction plans/designs
- Final construction costs
- Construction

http://news.maryland.gov/dnr/2017/06/29/over-800000-announced-to-support-local-green-infrastructure-projects-to-improve-communities-and-provide-jobs/

SWC Next Steps

- Training on using the mobile web app
- Updating historical weather data (web services)
- Improving mobile web app based on user feedback
- Phasing out of the SWC desktop application

Fall 2017 Webinar

EPA United States Environmental Protection Agency

EPA's Office of Research and Development (ORD) invites you to a free webinar

Safe and Sustainable Water Resources Research Program

A monthly webinar series focused on EPA water research

National Stormwater Calculator for Managing Runoff Using Green Infrastructure

A certificate of attendance will be provided for attending this webinar

Wednesday, November 15, 2017 2:00 to 3:00 pm EDT

Registration: https://attendee.gotowebinar.com/register/5929804033268092674

Discussion and Questions

Thank You!

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National Stormwater Calculator Website:
https://www.epa.gov/water-research/national-stormwater-calculator
Contact: SWC@epa.gov