# Stormwater Best Management Practices and Cost Analysis Options

### Colorado DPA Guide for Developing 208 Plans

## Overview

Designated Planning Agencies (DPAs) that want to include an evaluation of stormwater best management practice effectiveness and associated costs should use the Community-enabled Lifecycle Analysis of Stormwater Infrastructure Costs (CLASIC) tool. This tool uses a lifecycle cost framework to support stormwater infrastructure decisions regarding extent and combinations of green, hybrid green-gray and gray stormwater infrastructure Best Management Practices (BMPs). Users can identify specific priorities by developing scenarios to better understand associated benefits and costs for constructing and maintaining stormwater infrastructure. In addition, hydrologic performance (e.g., volume reduction, peak runoff, nutrient and other pollutant load reductions) of different stormwater management systems and their associated co-benefits (e.g., social, ecologic, and economic considerations) can be analyzed and quantitatively compared across user-specified scenarios.

### Additional Resources

Colorado State University (CSU), in collaboration with state and federal agencies, developed resources to assist in statewide planning and decision making. Access the tools and additional resources developed by CSU using the weblinks below:

- CLASIC Resources: https://erams.com/catena/tools/urban-planning/clasic/
  - Technical documentation, webtool access, video tutorials, overview information
  - How-to videos link: https://www.youtube.com/playlist?list=PL3OyYQXPKnXZnSKAl8LSW-bM9hrsDdbYu
  - Case Studies & Examples (scroll to bottom of page): https://clasic.erams.com/
- Additional DPA Resources: https://erams.com/catena/tools/colorado-collaborative/co-dpa-resources/
  - Access the suite of customized resources developed for DPAs

## QUICK START GUIDE

The CLASIC tool provides an extensive variety of features for planning and assessment of stormwater infrastructure costs and BMPs. The CLASIC tool is intended for planning purposes and decision making, the tool does not perform site design analyses for placement of stormwater infrastructure; rather it helps users better understand associated costs related to construction and maintenance of different systems and quantify co-benefits.

Deciding which features to use will depend on how the data will be incorporated into 208 plan development. The following information can be analyzed using the CLASIC tool:

- What are the costs associated with constructing and maintaining different Stormwater Control Measures (SCM) and treatment technologies in my region? Technology options in CLASIC include:
    - Rain gardens, sand filters, infiltration trench, collection basin, wet pond, stormwater harvesting, storage vaults, permeable pavement, disconnection, green roof
- What are effective SCMs and BMPs for treating stormwater and removing pollutants in runoff?
    - Cost comparisons can be conducted to inform decision making.
- What are additional benefits of different SCMs and BMPs beyond water quality?
    - Social, Environmental, and Economic ratings.

This complex tool is intended for more advanced users, especially since each step of the procedure must be performed correctly to ensure an accurate model output. This document briefly describes each step; however, we do not recommend using the CLASIC tool without consulting the following materials:

- CLASIC Technical User Manual: https://erams.com/catena/tools/urban-planning/clasic/
- CLASIC Video Tutorials: https://www.youtube.com/playlist?list=PL3OyYQXPKnXZnSKAl8LSW-bM9hrsDdbYu

## Procedure

1. Login to CLASIC Tool
2. Define Area of Interest
3. Select Climate Data
4. Define Model Defaults
5. Build Scenarios
    a. Baseline Scenario
    b. Example User Scenarios
    c. Co-Benefits
    d. Targets
6. Review Results

## Step 1 – Login to CLASIC

https://www.youtube.com/watch?v=MQ0Elqthq9A&t=70s

The CLASIC tool requires registering a free user account which can be accessed here: https://clasic.erams.com/login/register/.

To login to CLASIC tool, click the login button from the upper left corner of the webtool homepage (https://clasic.erams.com/). The icons on the left panel will guide users through the required steps of the CLASIC tool.
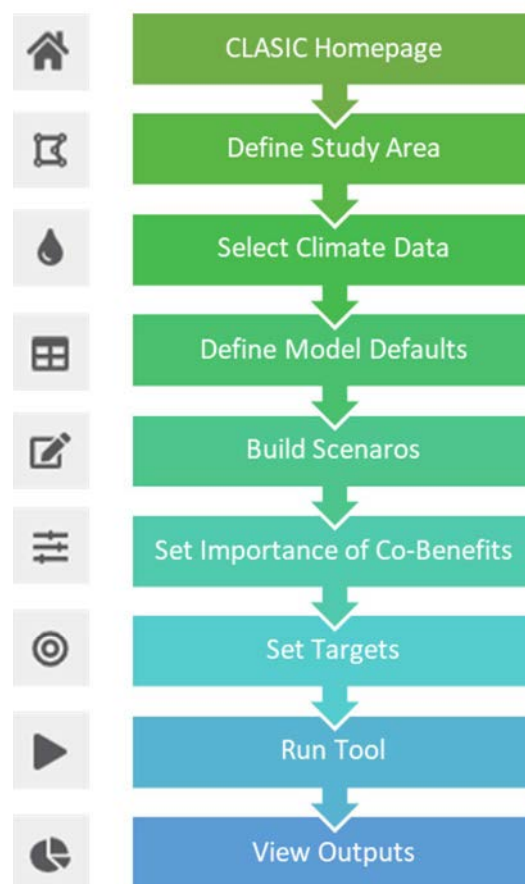


*Figure 1 CLASIC tool procedures.*

## Step 2 - Select Area
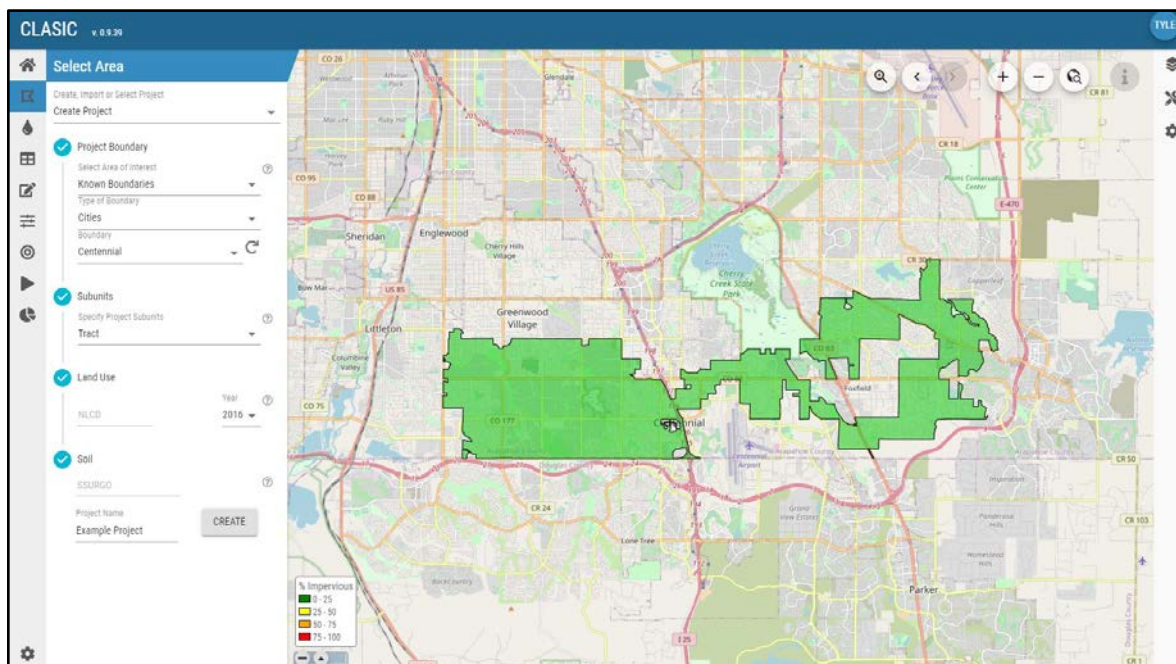https://www.youtube.com/watch?v=MQ0Elqthq9A&t=130s



*Figure 2 Define area of interest.*

The CLASIC tool requires users to first define the study area using one of the following methods: creating a new project using the default project creator, using a shapefile to create a new project, cloning a previously existing project, or loading a project you have previously created. For more details see **page 8** of the CLASIC technical user manual.

## Step 3 - Select Climate Data
https://youtu.be/g-lZoKEHVHg

Climate station data from EPA's Better Assessment Science Integrating Point and Nonpoint Sources (BASINS) model are used in the CLASIC tool (USEPA, 2019). Select precipitation and evaporation data stations and define the analysis period of interest. For more details, see **page 10** of the CLASIC technical user manual.

## Step 4 – Default Parameters
https://youtu.be/YzRuTz_6STg

Default parameters used to generate CLASIC outputs can be modified. Reasonable outputs are provided without modification of default parameters, and there is no requirement to modify default parameters. However, the default parameters can be modified to provide more flexibility. If the user prefers, default parameters may be modified for subunit characteristics (e.g., impervious area and land use type), water quality parameters, overland flow, Horton infiltration equation coefficients, technology effluent quality, and characteristics for computing lifecycle cost. For more details see **page 12** of the CLASIC technical user manual.

## Step 5 – Develop Scenarios

**https://youtu.be/wKRl5fw8d4Q** (**DPAs are strongly advised to review the video tutorial for developing scenarios**).
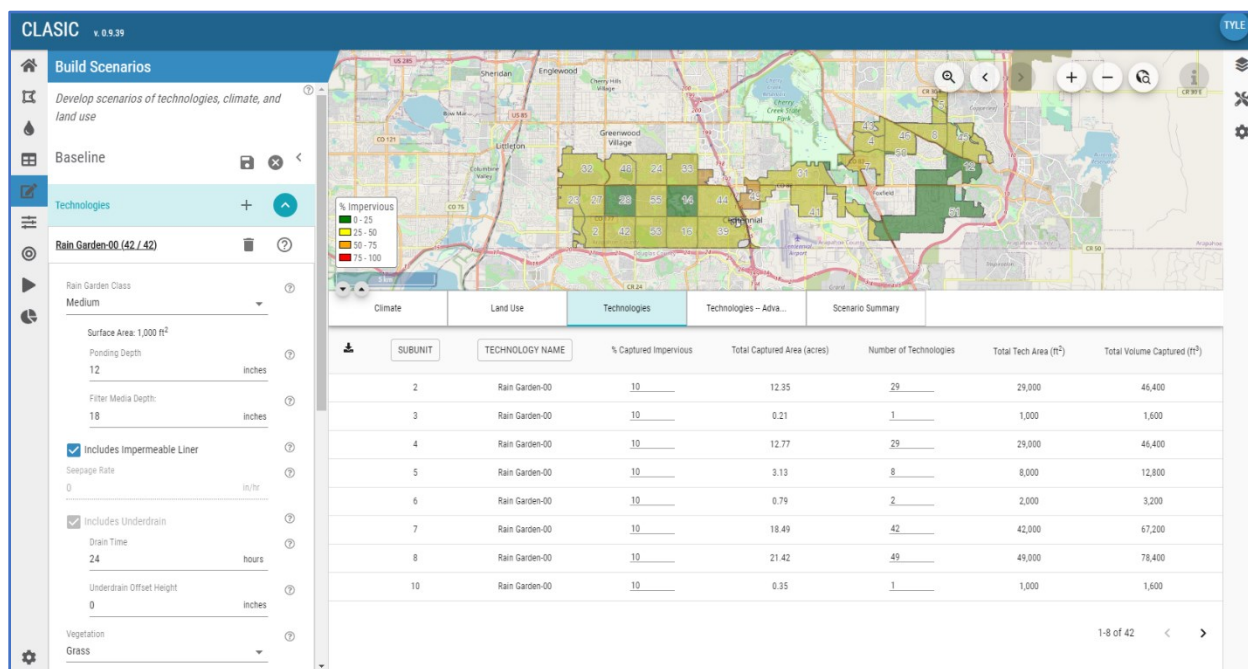


*Figure 3 Develop scenarios in CLASIC tool.*

At this step, a baseline scenario is developed and new scenarios of added technologies, climate change, and land use can be added. For more details see **page 14** of the CLASIC technical user manual.

### Baseline

Start by defining the baseline scenario. This scenario serves as the benchmark for comparing other created scenarios. In most cases, the user would consider the baseline scenario as the current system. The baseline scenario does not include technologies, unless added by the user.

### Example User Scenarios

Add new scenarios for analysis by clicking on the "+" icon next to Scenarios, or by duplicating a previously created scenario. Click on scenario name to modify characteristics for that scenario. Climate, land use, and technologies can be modified within scenarios. Consider what types of scenarios you are interested in. Some possible examples are:

- *Addition of stormwater technologies to meet regulatory requirements:* To assess how addition of technologies compare to the baseline scenario, the newly added scenarios should include addition of technologies of interest. CLASIC will provide outputs that enable comparison of cost, performance (i.e., nutrient pollutant load reductions), and co-benefits of these scenarios of technology addition.

- *Assess alternatives for a redevelopment area:* If stormwater control measures (SCMs) are in place in the existing development area, those need to be added to the baseline scenario. Then, the user can add scenarios with modified land use and additional technologies to assess how the

technologies' cost, performance, and co-benefits compare to the existing development (baseline scenario).

- *Assess alternative stormwater technologies for a new development area:* The baseline scenario could be the undeveloped area. New scenarios could be added where land use type is modified and stormwater technologies are added. Hydrologic performance of those scenarios could be compared to the pre-development condition, and added scenarios could be compared for cost and co-benefits.
- *Assess performance of technologies in alternative future conditions:* The baseline scenario can be developed to represent current land use and climatic conditions. New scenarios can be created using the same SCMs, but with modified climate and land use to represent alternative future conditions.
- *Assess life cycle cost trade-offs for SCMs:* Scenarios can be cloned and then using the advanced scenario options, the annual maintenance cost, years to first rehabilitation, or rehabilitation cost can be modified. Annual maintenance costs should be modified based on different maintenance activities and then various years to rehabilitation can be used to find when life cycle costs become smaller or equivalent.
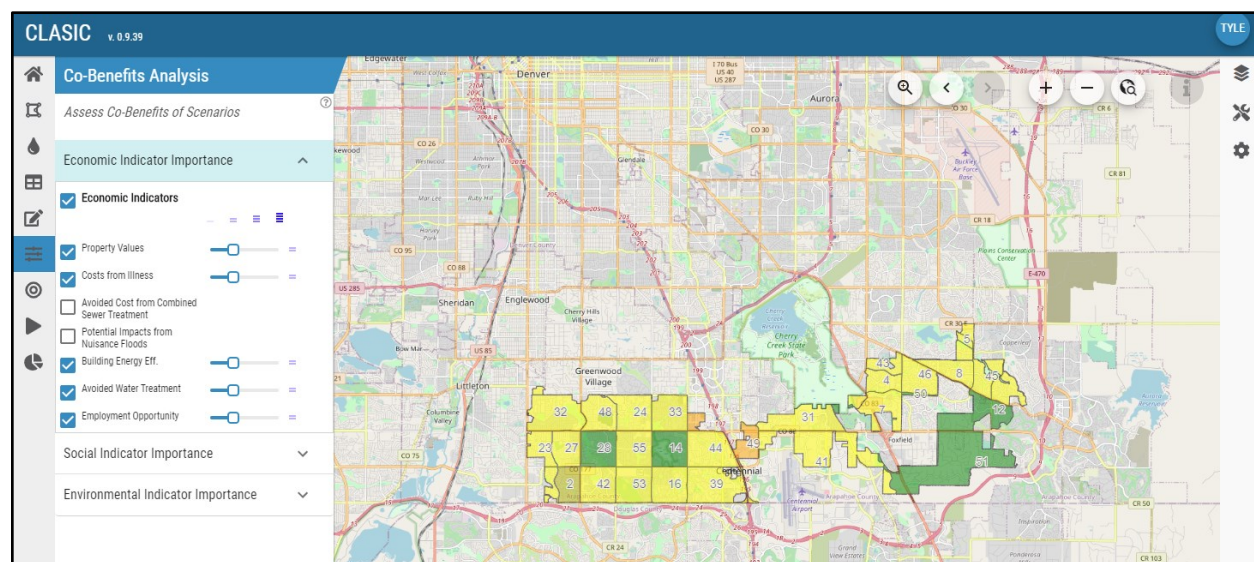
## Co-Benefits
https://youtu.be/zl1PZ4qg7yg



*Figure 4 Analyze economic, social, and environmental co-benefits.*

If you are interested in comparing co-benefits across scenarios, select importance factors to inform the co-benefits analysis that provides outputs for economic, social, and environmental performance. For more details see **page 21** of the CLASIC technical user manual.

## Set Targets
https://youtu.be/V-s7cIqLji8

If there are water quality, hydrologic, or cost targets that scenarios should meet, those should be entered here. If you would like to view results for all scenarios whether targets are met or not, no inputs are required here. Enter values for pollutants where targets are desired. For more details see **page 22** of the CLASIC technical user manual.

## Step 7 – Run CLASIC & Review Results
https://youtu.be/IKPfGK2iZpg

Click "Run" (triangle icon) from the left dashboard to review and run the CLASIC tool for any scenario that has been modified since the last time it was run.

***Note***: *A typical run may take 5 minutes. Run time can be shortened by decreasing the duration of weather data used or decreasing the number of subunits or technologies added.*

*Figure 5 Set targets in CLASIC tool.*

## Results
Users can view results for up to three scenarios at a time.

- The first tab includes a summary of life cycle cost, performance, and co-benefits (Figure 6). For more detailed outputs in any of these three categories, click on the tab for additional information.
- If you would like a summary of results for all scenarios run, click on the pdf button (Figure 6, top right) to generate a pdf report.
- If you would like to download data from any specific chart shown in the graphical outputs, click on the icon at the top right of the graphic to select the format.

Users can continue to build and view results for scenarios. If you would like to analyze more technology, climate, or land use options, build more scenarios as described in Step 5 and run the tool again.

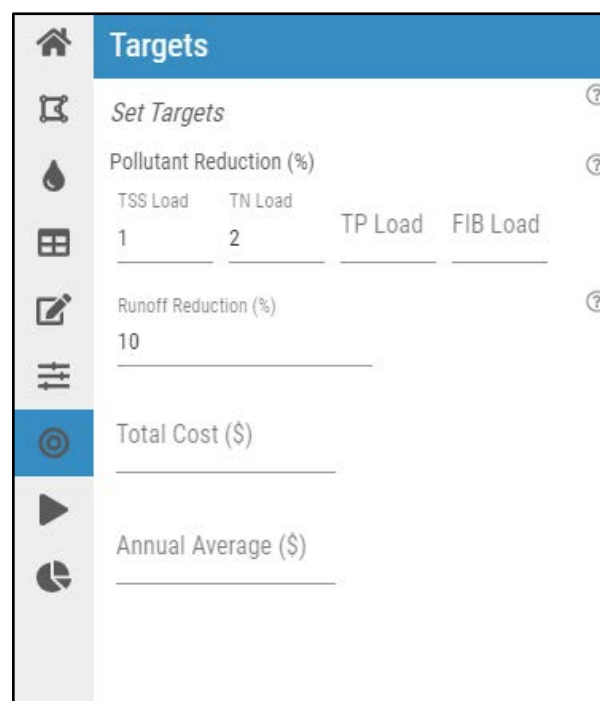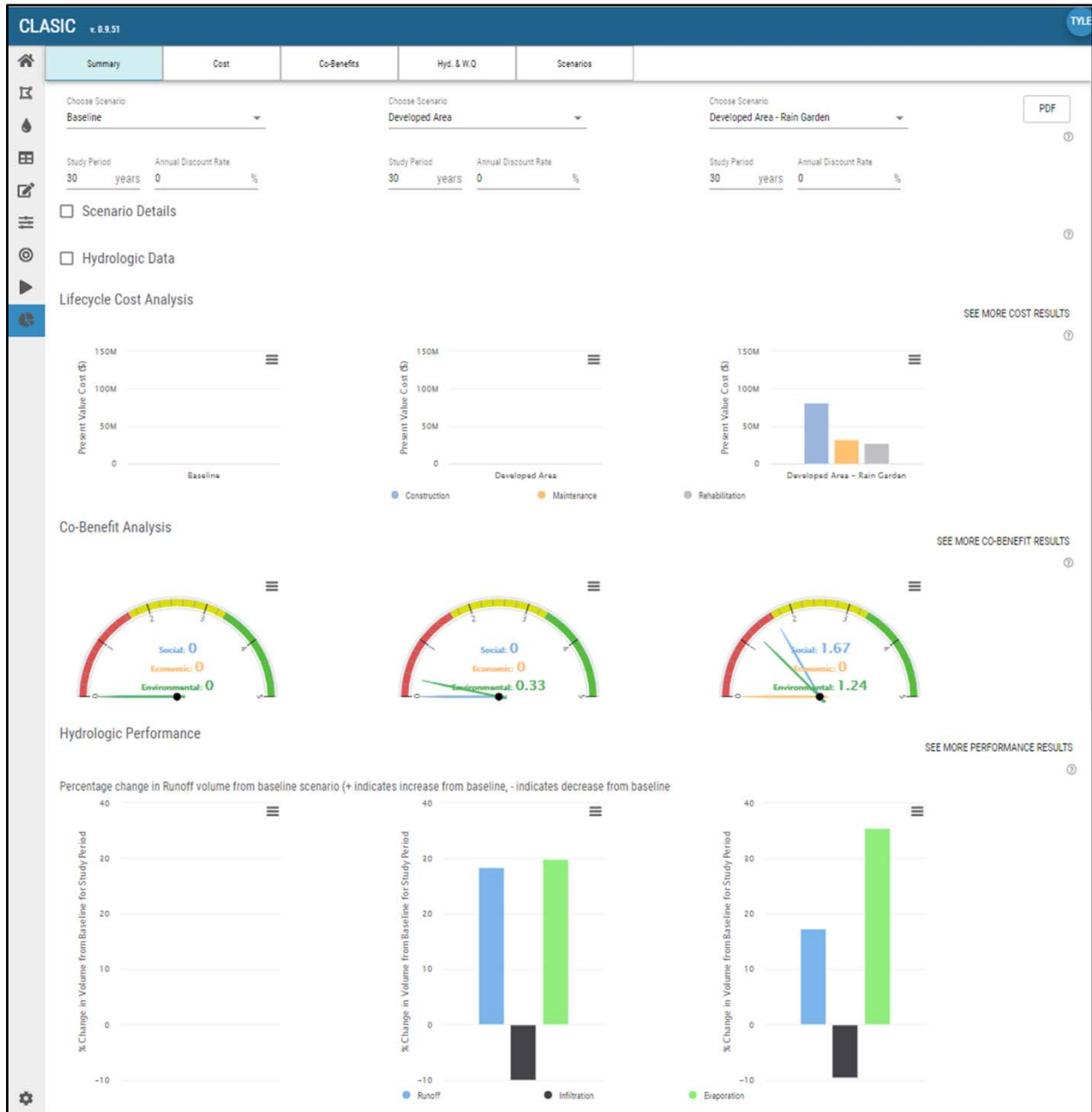For more details see **page 23** of the CLASIC technical user manual.

*Figure 6 CLASIC tool results summary.*

## Additional Features & Information

### Map Features & Layers
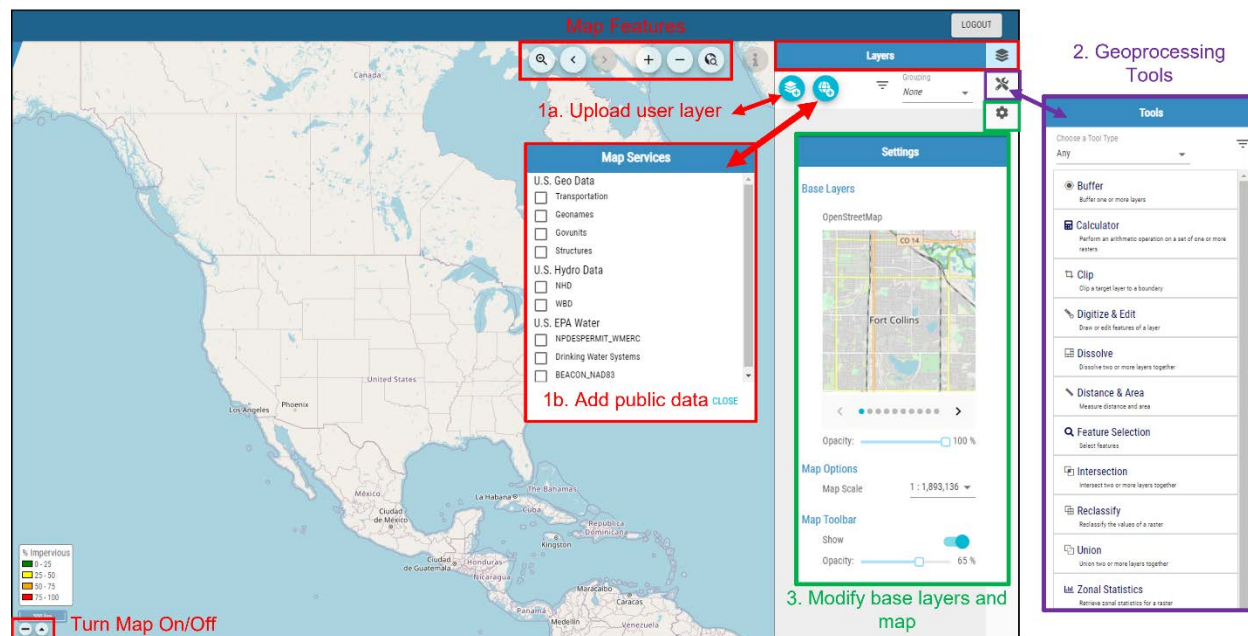
https://youtu.be/-3LoHpUeC0E



*Figure 7 Add user layers, import public data, and navigate map features and geoprocessing tools.*

Users can upload geospatial layers (Figure 7) and add their own information under the "layers" section located on the right dashboard (shown in red):

- Upload their own geospatial layers (shapefile, kmz, GeoJson)
- Import data from public sources such as U.S. Geo Data, U.S. Hydro Data and U.S. Environmental Protection Agency water data.

The dashboard also allows users to navigate basic mapping features from the toolbar located on top of the map canvas (search location, zoom in/out/to specific place, enter location, layer attributes). A suite of geoprocessing tools and services is also provided under the "tools" icon (shown in purple). The base map can also be modified under the "settings" icon (shown in green).

### Downloading Information

Each data category is summarized using interactive maps and graphs which are accessible from the results tab(s) that automatically populate under the map canvas. The results tabs can be maximized or minimized and the map canvas can be hidden by clicking the arrows at the bottom left corner of the map canvas.

The graphs (png, jpeg, pdf, svg) as well as the raw data including time series (xls, csv) and raster maps can be downloaded from the dashboard. These figures are interactive and hovering your mouse over any section will reveal additional information.