COLORADO
Water Quality Control Division
Department of Public Health & Environment

Planning for Regional Wastewater Treatment

Colorado DPA Guide for Developing 208 Plans

Overview

Designated Planning Agencies (DPAs) play a critical role in planning for infrastructure construction to meet regional wastewater treatment needs. The Watershed Rapid Assessment Program tool (WRAP tool) is available to help DPAs better understand regional water quality and information about regional wastewater treatment facilities in order to support wastewater infrastructure planning and the Nonpoint Source Priority Dashboard (NPSPD) can be used to forecast future conditions and evaluate watersheds relative to each other, both of which can assist with decisions regarding regional wastewater treatment.

Available 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:

- WRAP Tool Resources: https://erams.com/catena/tools/colorado-collaborative/watershed-assessment/
  - o Technical documentation, webtool access, video tutorials, overview information
  - o How-to video: https://youtu.be/nDUMODaBiWM
- NPSPD Resources: https://erams.com/catena/tools/colorado-collaborative/watershed-prioritization
  - o Technical documentation, webtool access, video tutorials, overview information
  - o How-to video: https://www.youtube.com/watch?v=nDUMODaBiWM&t=618s
- Additional DPA Resources: https://erams.com/catena/tools/colorado-collaborative/co-dpa-resources/
  - o Access the suite of customized resources developed for DPAs

QUICK START GUIDE

Two primary resources can be accessed to better understand regional water quality and information about wastewater treatment facilities: the WRAP tool and the NPSPD. Each of these resources provides different options for evaluating wastewater treatment planning and watershed prioritization activities. Deciding which approach to choose will depend on how the data will be used for 208 plan development.

The WRAP tool can be used to:

- Locate permitted wastewater treatment facilities (WWTFs) and review currently available data about these facilities
- Explore ambient water quality data and stream monitoring locations to identify areas with water quality protection and/or restoration needs

The NPSPD can be used to:

- Forecast future climate conditions
- Review water quality trends
- Prioritize watersheds for WWTF construction

WRAP Tool

The WRAP tool extracts, organizes, and analyzes data and information at various watershed scales, including HUC 12, HUC 10, and HUC 8 levels. These data extracts can be used to characterize existing conditions in watersheds. The WRAP tool can also use the extracted data to calculate a number of watershed health indicators. These can be used to inform value-based decisions relevant to DPAs and other watershed planning groups.

Procedure

A detailed discussion and summary of all data available in the WRAP tool can be found in the technical user guide available here: https://erams.com/catena/tools/colorado-collaborative/watershed-assessment/. The technical user guide also provides detailed step-by-step instructions for all WRAP features, this document is limited to features particularly helpful in developing sections of 208 plans.

1. Define Area of Interest: select desired geospatial boundary
2. Identify wastewater treatment facilities (WWTF) and other permitted dischargers and their associated metadata (location, name, permit ID, etc.)
   a. The WRAP tool summarizes current permitted discharge location(s) for WWTFs based on locations reported through Colorado Regulation 85 monitoring (WWTF) and the EPA National Pollution Discharge Elimination System (NPDES) permit system (WWTF and other permitted dischargers).
3. Explore ambient water quality data and stream monitoring locations
   a. The WRAP tool provides a summary of USGS National Water Information Systems (NWIS) and EPA Water Quality Portal monitoring data and sampling locations.
   b. The WRAP tool provides information about designated uses, attainment status, impairment listings.
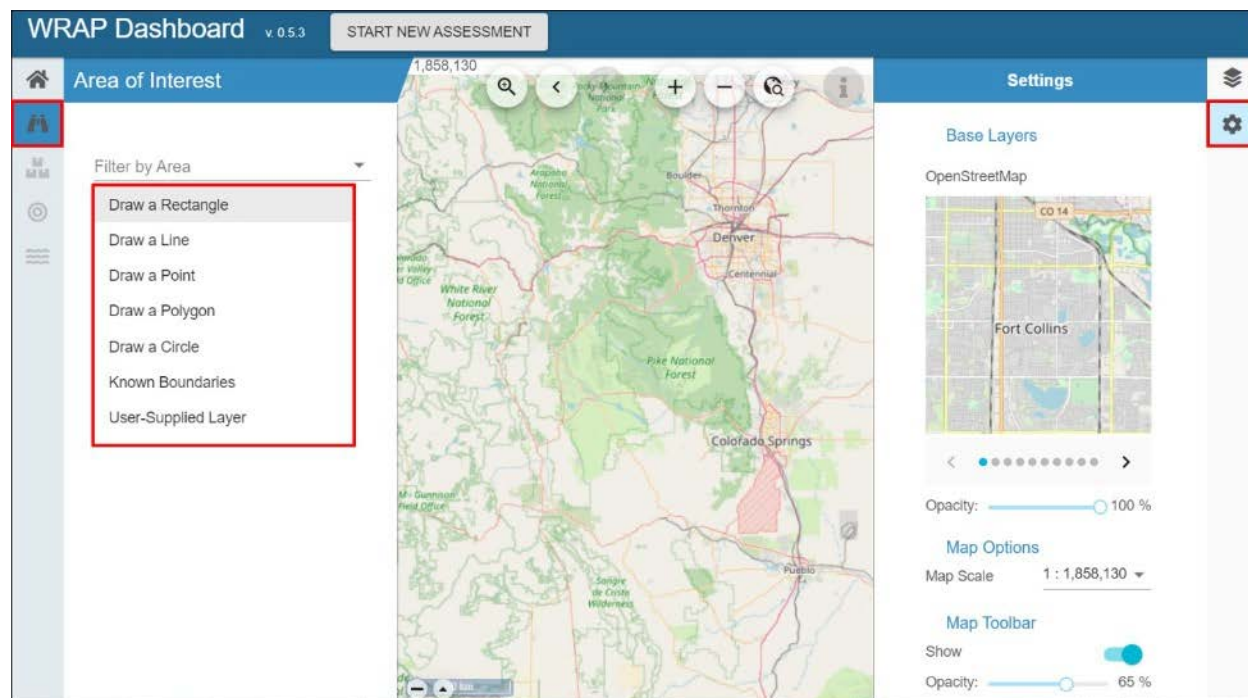
COLORADO
Water Quality Control Division
Department of Public Health & Environment

Define Area of Interest

https://www.youtube.com/watch?v=nDUMODaBiWM&t=100s

Figure 1 Define area of interest and modify base map (optional).

From the WRAP tool homepage (https://cdphe-wrap.erams.com/), click the "Select Area of Interest" (binoculars icon) section from the left dashboard. Define your watershed boundary by using one of the following methods.

- Known boundary list includes states, counties, cities, HUC 8, 10 or 12
- Upload boundary (user-supplied geospatial layer)

Detailed step-by-step instructions for defining the boundary, including uploading user layers, are located on **pages 7-9** of the technical user guide available here: https://erams.com/catena/tools/colorado-collaborative/watershed-assessment/

ONE WATER
SOLUTIONS INSTITUTE
COLORADO STATE UNIVERSITY

Wastewater Treatment Facility Data

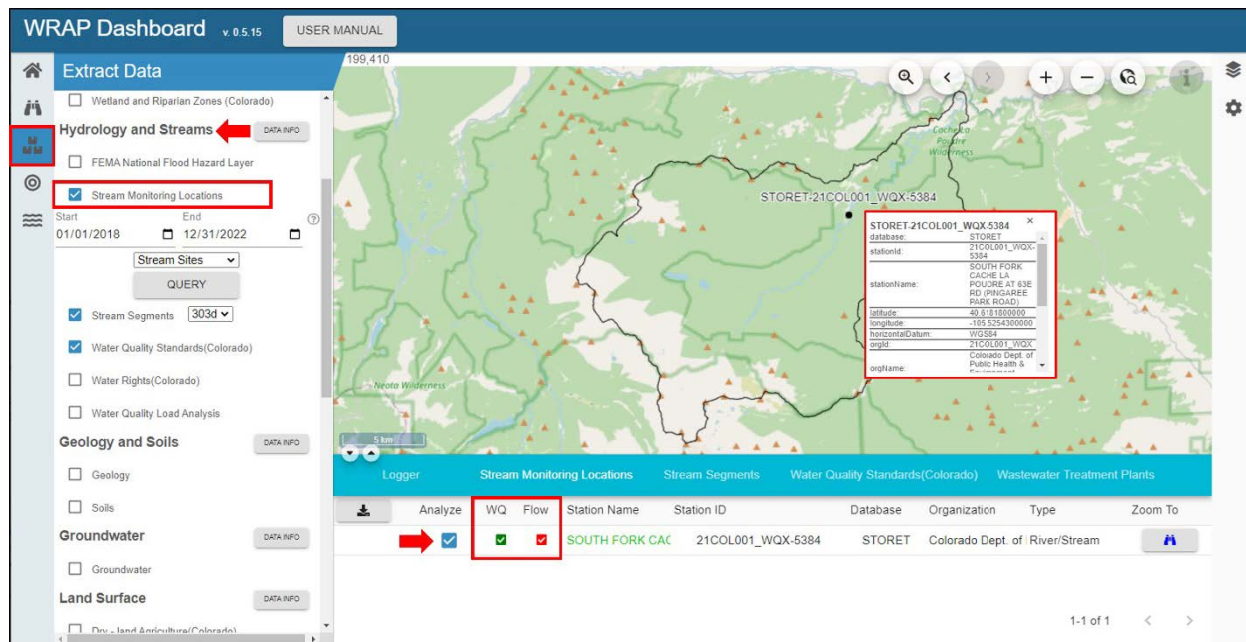https://www.youtube.com/watch?v=nDUMODaBiWM&t=148s

Figure 2 Select and extract desired data, help text available.

Once you have selected a boundary, use the WRAP tool to identify wastewater treatment facilities in your area of interest and access associated data. Regulation 85 monitoring locations can be used to confirm engagement with the right group of larger facility managers and forms the basis of a stakeholder group for this topic. Smaller facilities identified in the NPDES section also represent stakeholders that should be engaged in discussions on water quality along the stream segments of interest.

1. Select the "Extract Data" icon from the left dashboard (Figure 2)
2. Scroll down to "Other" and select "Wastewater Treatment Plants" from the prepopulated data options
   c. WRAP summarizes current permitted discharge location(s) for wastewater treatment facilities based on locations reported through Colorado Regulation 85 monitoring and the EPA National Pollution Discharge Elimination System (NPDES) permit system.
   a. WRAP will retrieve the most recent data available from the appropriate database (EPA-WQX for Reg. 85 sites, EPA NPDES for the other sites), therefore processing time may take longer depending on the size of the area analyzed.
3. Once data retrieval is complete, a summary table will appear below the map in the WRAP tool
   a. Click on the facility in the map to display a popout with facility information including the latitude/longitude, location, station ID, flow and system type if available.

COLORADO
Water Quality Control Division
Department of Public Health & Environment

Water Quality Data

https://www.youtube.com/watch?v=nDUMODaBiWM&t=270s

Figure 3 Analyze available water quality data in WRAP.

The WRAP tool summarizes water quality data available within the defined area of interest. This information can be used in conjunction with facility effluent monitoring data to compare and assess instream loads. This data is useful when reviewing utility plan permits with DPAs as well as planning for longer term trends in water quality for a DPA region. WWTF contribute to watershed nutrient loading and need to be accounted for in regional water quality planning and decision making.

To access water quality data, follow the steps described below:

1. Select "Stream Monitoring Locations" located under the "Hydrology and Streams" section of the prepopulated data list available under the "Extract Data" feature (Figure 3)
   a. Include start and end dates, or use default values
   b. Indicate stream sites or lake sites from the drop-down list
   c. Click "QUERY" (the processing time may take a few minutes after you have selected the desired dataset(s) to complete the extraction)
2. Once processed, the WRAP tool will display a list of locations in the table below the map
   a. Select the "Analyze" box to enable additional data summary features
   b. If water quality data is available for the monitoring location(s) in your area a green check will be displayed in the "WQ" column in the table below the map (Figure 3)
3. The Water Quality Data feature (bullseye icon) on the left dashboard will be enabled if there is data available for the stream monitoring location(s) in your area (see Step 2a above). The following information will be summarized:

ONE WATER SOLUTIONS INSTITUTE
COLORADO STATE UNIVERSITY

a. Parameter Summary tab containing a count of available data by parameter and station as well as a download data option.

b. Station Summary tab will appear when a specific parameter is selected from the water quality data parameter drop-down menu. This summary provides a statistical overview of the station data for each monitoring location and the combined total dataset, including a box plot chart.

c. Station Timeseries tab contains a graphical summary of the raw data as well as a table of the available data for the selected parameter, its date-time stamp, any detection limits or other relevant water quality data flags, and units.

   i. The associated raw data for these stations is available under the "Water Quality Data" (bullseye) feature; simply click "DOWNLOAD TIME SERIES SUMMARY" to save the file.

Additional contextual datasets that may be useful in assessing and reviewing WWTF effluent (e.g., stream segments, water quality standards, and more) can be found along with step-by-step instructions on accessing and analyzing water quality data on pages **page 19-20** of the WRAP technical user guide available here: https://erams.com/catena/tools/colorado-collaborative/watershed-assessment/

NPSPD

The NPSPD was developed to prioritize watersheds for nonpoint source restoration and protection activities. The tool allows users to prioritize or rank watersheds or locations within them based using a range of user-selected criteria. The dashboard contains a number of datasets that are processed to calculate watershed indicators, many of which are based on the EPA Healthy Watershed framework (U.S. EPA, 2011).

This tool uses a Multi-Criteria Decision Analysis (MCDA) framework to prioritize multiple watersheds with various characteristics into subwatersheds within a DPA region or other user-specified area of interest. Specifically, climate conditions and trends, water quality conditions and trends, impaired stream and waterbodies, and wastewater treatment plant sections of the NPSPD can be used to help prioritize areas of interest within a DPA region for targeted water quality improvement projects in a 208 regional plan.

Procedure

A detailed discussion and summary of all data available in the NPSPD can be found in the technical user guide available here https://erams.com/catena/tools/colorado-collaborative/watershed-prioritization/. The technical user guide provides detailed step-by-step instructions for all features, this document is limited to those particularly helpful in developing sections of 208 plans.

1. Define Area of Interest: select desired geospatial boundary
2. Use the MCDA feature to conduct multiple analyses simultaneously and compare results:
    a. Develop climate change impact scenarios
    b. Examine water quality impacts to watersheds

COLORADO
Water Quality Control Division
Department of Public Health & Environment

c. [Prioritize decisions around density and location of WWTFs](#)

Define Area of Interest
https://www.youtube.com/watch?v=nDUMODaBiWM&t=618s

From the NPSPD homepage (https://npspd.erams.com/), click the "Select Analysis Scenario" (water drop icon) on the left dashboard to define the area of interest. Define your watershed boundary by selecting the desired method from the drop-down options and click "NEXT" to proceed. The user will then be prompted to indicate the boundary subregion type (Figure 3). Again, click "NEXT" to fetch related data.
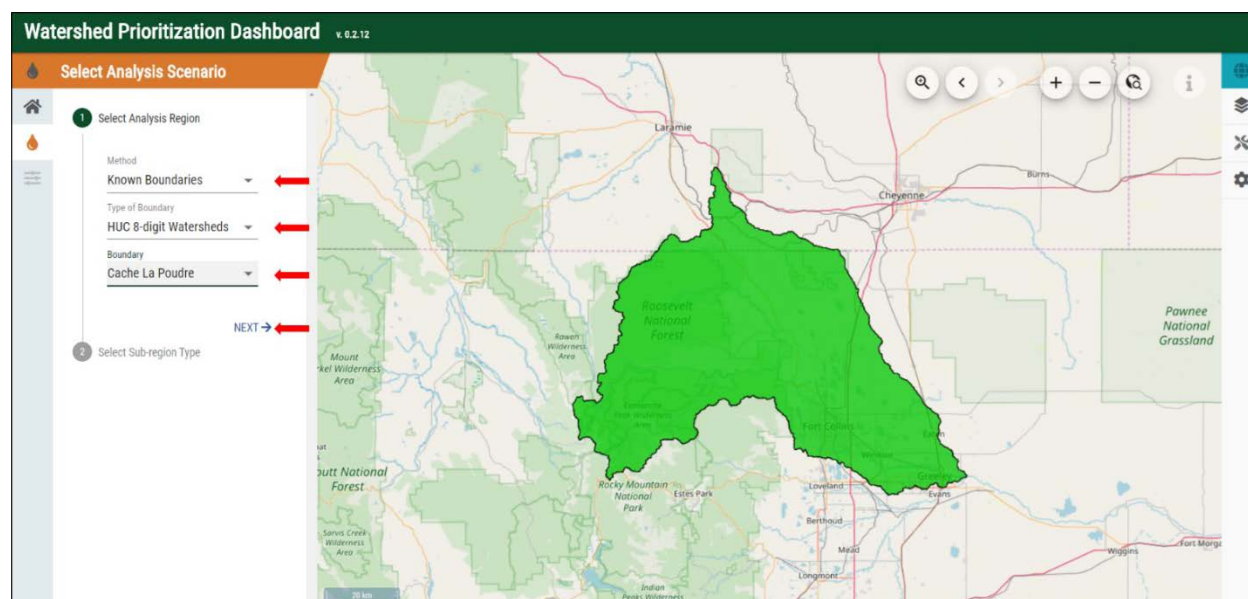

Figure 4 Define area of interest and boundary subregion(s).

Once processed, the map will display the extent of each subregion and a summary table will appear below the map. The map can be minimized by selecting the triangles in the lower left corner of the map to allow the data tabs to be maximized, making it easier to read and sort.

Additional information regarding the watershed data summary features, including instructions for downloading raw data, figures, and maps can be found in the technical user guide **pages 7 to 8**, available here: https://erams.com/catena/tools/colorado-collaborative/watershed-prioritization/

Develop Climate Scenarios
https://www.youtube.com/watch?v=nDUMODaBiWM&t=754s

DPAs can develop climate change trend assessments to target water quality and other concerns in the areas experiencing the greatest impacts.

1. Select the MCDA feature (triple line icon) and indicate the priority outcome:

ONE WATER
SOLUTIONS INSTITUTE
COLORADO STATE UNIVERSITY

COLORADO
Water Quality Control Division
Department of Public Health & Environment

a. By default the NPSPD has multiple defaults of how to prioritize a set of watersheds. These include the EPA Health Watershed, Protect, or Restore approaches.

   i. These are useful outside the context of this prioritization if you want to look at large scale watershed health assessments and prioritize your area of interest for which watersheds are the 'healthiest', need protection or need restoration (most impaired).

b. DPAs can start with any of those approaches and customize it to just the data topics described below. Specifically, to analyze climate and water quality trends and wastewater treatment facilities, you will need to turn off (check box) all the other data categories and indicators and only turn on the climate, water quality, and infrastructure categories with the indicators of interest (see below)

2. Scroll to the "Climate" section (current conditions) and indicate the relative level of importance using the following procedures (Figure 5):

   a. The horizontal dial directly under the Climate section allows the user to adjust the relative level of importance for the climate category compared to the other categories (Figure 5a)

   b. The horizontal slider next to each indicator can be used to customize the indicators relative level of importance among other indicators within the climate category (Figure 5b)

      i. Note user must click the box to the left of the criteria to modify it

   c. The up/down arrow will place the criteria/indicator into a relative ranking (Figure 5c)

      i. Use up to maximize priority
      ii. Use down to minimize priority

   d. Users can modify the following climate criteria/indicators:

      i. Snow to total precipitation ratio
      ii. Average annual precipitation
      iii. Average annual minimum temperature
      iv. Average annual maximum temperature
      v. Maximum 24-hour precipitation
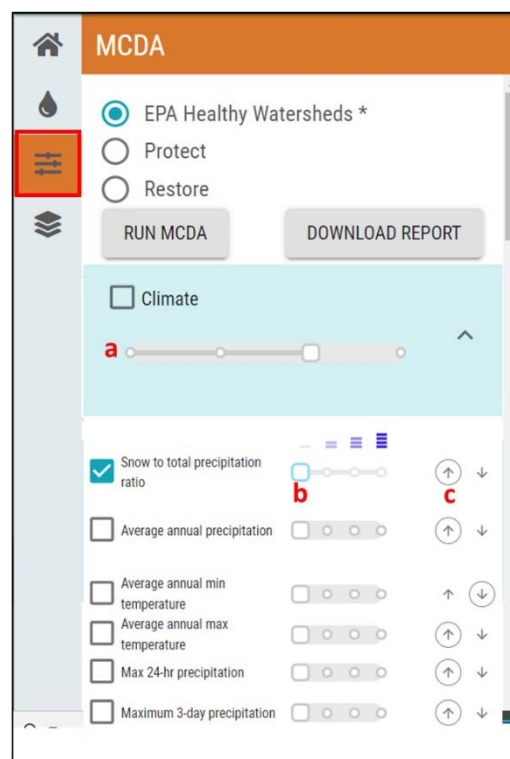   vi. Maximum 3-day precipitation

Figure 5 Climate conditions indicator adjustments.

3. Once preferences have been selected, click "RUN MCDA" to generate results which appear in the table below the map

   a. MCDA Results tab shows the watershed ranking, based on the user-specified importance.

      i. For example, if a user specifies annual precipitation is the most important factor the highest ranked watershed will be the one with the most annual rainfall.

COLORADO
Water Quality Control Division
Department of Public Health & Environment
CDPHE

b. MCDA Detailed Results tab shows subcategory ranks, i.e., scores for climate, land use, water quality trends, etc.
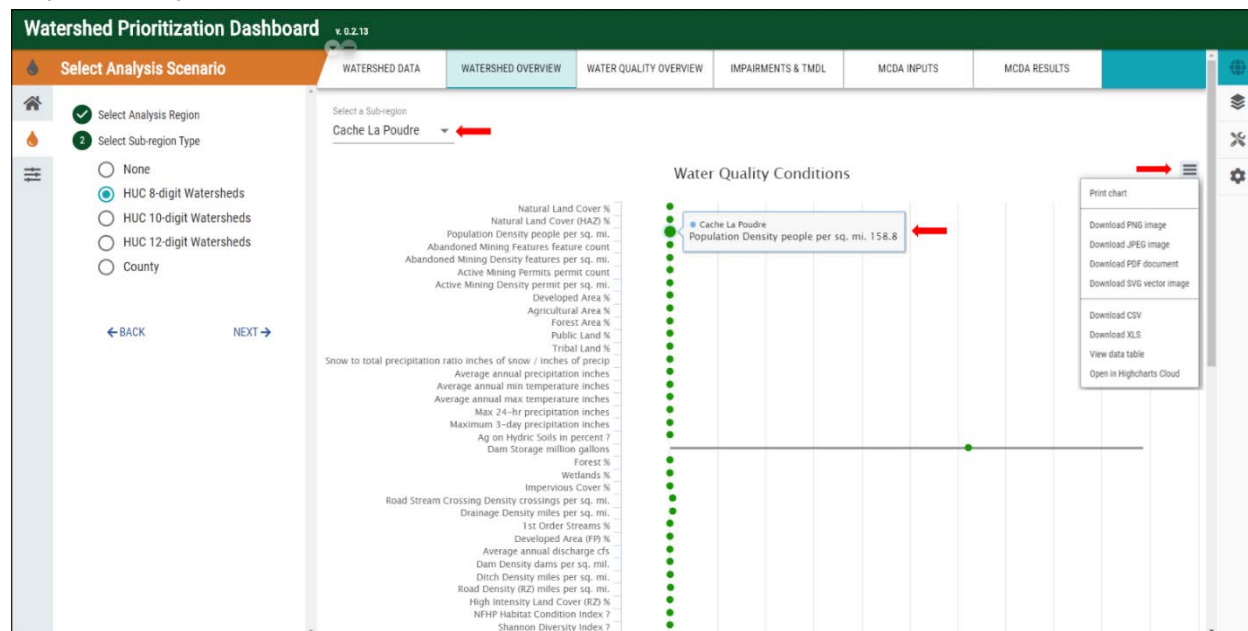
Examine Water Quality Impacts

https://www.youtube.com/watch?v=nDUMODaBiWM&t=852s

Figure 6 Review watershed data summaries, display individual data points, export data.

In addition to summarizing trends in annual water quality statistics, the NPSPD also summarizes existing conditions of watershed data for all subregions that fall within the area of interest. This tools calculates trends by fitting a regression to the annual statistic (i.e., annual median total nitrogen) and the slope of this regression is calculated using Sen's Slope Coefficient to quantify water quality trends (i.e., the change to water quality per year).

The geographic interface (map) displays the extent of each subregion. In addition, the raw watershed indicator data is also displayed in the corresponding analysis tabs. Hovering over any point on the interactive graph will display the corresponding data (Figure 6). The raw data can be exported as a .csv or excel file and the graph can be downloaded as an image or .pdf by selecting the horizontal bars in the upper right corner of the table.

A variety of watershed information is summarized in the overview tabs including water quality information, impairments and TMDL data, as well as the MCDA results and ranking for watershed prioritization. For more information about each summary please refer to **page 7** of technical user guide.

ONE WATER
SOLUTIONS INSTITUTE
COLORADO STATE UNIVERSITY

Prioritize Watershed(s) for WWTF Construction

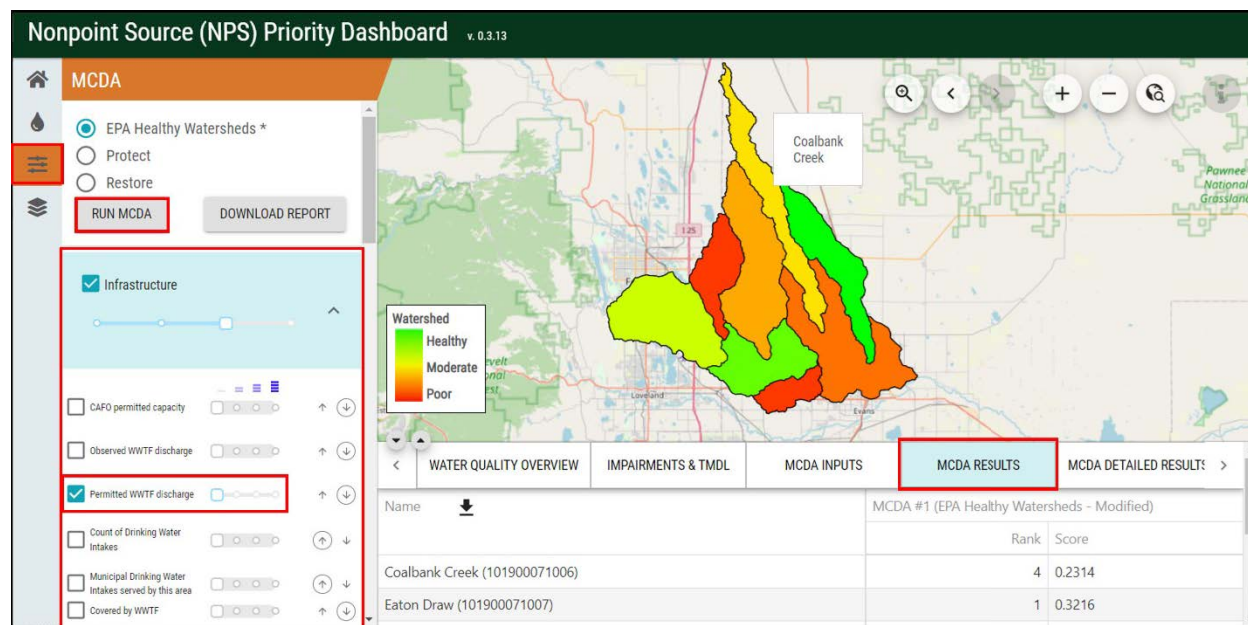https://www.youtube.com/watch?v=nDUMODaBiWM&t=1030s

Figure 7 Identify WWTF locations.

DPAs may find it helpful to identify the watershed location of the wastewater treatment facilities already present in your area to assess potential and/or appropriate locations for constructing a new WWTF. To do so:

1. Select your area of interest, as described previously, using HUC12 as the subregion type.
2. Deselect all the other datasets (uncheck the check box next to each data category) *except* "Infrastructure" (Figure 7).
   a. Turn off all the indicators in that category *except* "Permitted WWTF discharge".
3. Scroll back to the top and select "Run the MCDA" to complete the analysis.
4. Reviewing these results either in tabular form or on the map will identify the watershed locations with the largest amounts of permitted discharges (shown in red) and those with the least permitted discharges (show in green).
   a. This information can assist in identifying a location with sufficient water flow but minimal permitted dischargers already located in that area.

ONE WATER
SOLUTIONS INSTITUTE
COLORADO STATE UNIVERSITY

Additional Features & Information

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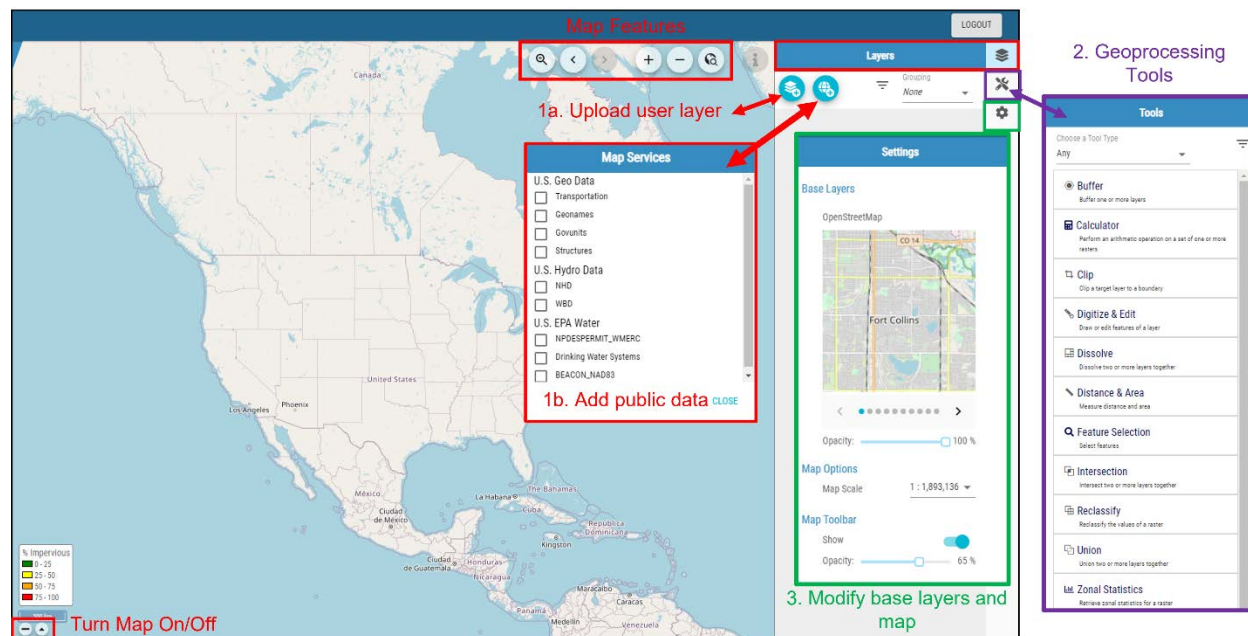
https://youtu.be/-3LoHpUeC0E

Figure 8 Add user layers, import public data, and navigate map features and geoprocessing tools.

Users can upload geospatial layers (Figure 8) 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.