Assessment of Existing Tools and Resouces for WatershedNJ
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Kate Douthat, Vanessa Tropiano

Task 1c: Rutgers will inventory and evaluate existing tools/data/platforms that can contribute to development of the application.

The purpose of this task was to inventory and evaluate existing tools and data for watershed planning. There are many web-based tools now available, and it is important to identify data and functionalities to leverage and/or incorporate into NJWRAP (and avoid unnecessary duplication) as New Jersey develops its own web-based tool. This process can also assist in scoping by identifying tools and data that are beyond the current goals for NJWRAP. These tools may not become part of NJWRAP, but can be shared with users for specific needs. This memo reviews types of data and tools and important data sources and tool features. Wetland function data and tools have been reviewed in a separate report.

Web tools often integrate multiple types and sources of information, so we first identified existing types of data and data sources. Parsing out the underlying data from the tool itself is important to understand which data will be useful to NJWRAP and how tools are constructed. We found three general levels of data and information in watershed-related tools: primary data, indicators and integrated information, and management recommendations that turn information into action.

Primary data are unprocessed or minimally processed information about the physical watershed or spatial distribution of a phenomenon in the watershed. Primary data are versatile and can be used to feed many types of analyses. Primary data includes monitoring and measurement, geographic information, and spatial distribution of watershed management actions.

Indicators and Integrated Information interpret primary data to apply standards or draw conclusions. Classifying waters for use and safety according to measured contamination levels is one important application of primary data to create integrated data. Landscape indicators and indexes are another type of integrated information that correlates landscape characteristics with watershed outcomes. Other models can have many levels of complexity, but all integrate primary data to create estimates, future scenarios, and other types of practical information.

Management Recommendations are how we describe "action" information for the purposes of this memo. Management Recommendations take in primary and integrated information to produce planning recommendations for watershed management. This includes recommendations for structural and non-structural best management practices (BMPs) such as infiltration basins and model ordinances.

Primary data are the most reliable and versatile, but indicators and integrated information help us understand primary data and turn it into action. Indicators and integrated information and management recommendations are both based on primary data, so it is important to parse out the basic data sources that provide the foundation for watershed planning. Data types are listed below with examples:

Types of Data

Primary data: monitoring, measurements and maps

- Monitoring and measurement

    - Current conditions
    - Continuous monitoring – stream gage
    - Chemical
    - Biological integrity
    - Climate and Precipitation
- Geographic information
    - Public access locations
    - Boundaries
    - Landscape classification (Land Use/Land Cover)
    - Geographic (elevation, streams)
    - Hydrologic models (flow direction and flow accumulation)
- Spatial Distribution of Watershed Management Actions
    - Regulatory (e.g., status of compliance with regulation or permit)
    - Voluntary (e.g., acres of green infrastructure, stormwater ordinance)

Indicators and Integrated Information: turning data into information

- Waterbody condition
    - Clean Water Act designated uses and impairments
    - Water quality advisories (e.g. HABs, beach closing/advisory)
- Landscape indicators
    - Broad-scale factors correlated with water quality outcomes (e.g. % impervious cover)
- Future estimates (e.g. climate, precipitation, flow, buildout)
- Ecosystem service models (e.g., issues of concern, wetland function)

Management Recommendations: turning information into action

- Impact of improvements model (Hypothesizing and communicating impact of action)
- Prioritization model (e.g. overburdened communities, conservation, restoration, water quality, etc.)
- Watershed Management Guidance
    - Structural and non-structural BMP selection
    - Assessment of current practices

Data Sources

Primary data sources: There are four datasets that provide much of the basic data for watershed analyses and tools (Table 1, Table 2). These are the EPA Water Quality Portal and USGS Water Quality Data in the National Water Information System (NWIS) that focus on water quality/quantity data. For physical geography, stream network and terrain information, the EPA/USGS National Hydrography Dataset (NHD) and the USGS digital elevation model and related flow direction and flow accumulation grids, based on the New Jersey LiDAR data, are the best sources. In addition to the data that the State contributes to the above national databases, there are a number of water quality datasets available through the Division of Water Monitoring and Standards (e.g., beach advisories, algal blooms, shellfish harvesting) found on different webpages throughout the DEP website. Public Access Locations are available in an interactive

map for coastal and some tidal areas. Freshwater access opportunities are not mapped, though there are lists of swimming and fishing locations that could go on a map.

There are a number of tools based on the primary datasets (Table 1, Table 2). The EPA Water Quality Portal (WQP) integrates data from many sources and can be accessed directly via the home page. Due its importance and complexity, the WQP has spawned a range of indicators and integrated information and tools. The ATTAINS (Assessment, Total Maximum Daily Load (TMDL) Tracking and Implementation System) database provides information about the conditions in the Nation's surface waters relative to Clean Water Act water quality standards. The primary data for this purpose comes from the WQP. The New Jersey State *Integrated Water Quality Assessment Report* integrates WQP and ATTAINS information. *How's My Waterway* also integrates ATTAINS and WQP data but in a simple format for the general public that provides a map of the selected HUC and a factsheet with the status of each designated use and impairments. Additionally, there are some tools available for download to run in Microsoft Excel or R, a free software for statistical computing and graphics.

Like the WQP, the USGS Water Quality database can be accessed directly through a web interface. The USGS Water Quality data has a few different web map interfaces to access streamflow information, including the NWIS Mapper with all gages and two platforms geared more toward current conditions: WaterWatch and National Water Dashboard. USGS StreamStats also has gage information, but also incorporates a flow direction and flow accumulation model to allow users to delineate small catchment areas or waterbodies of interest and generate streamflow scenarios. Model My Watershed, by Stroud Water Research Center, also allows users to delineate small catchments based on the NHD and to generate summary information for the catchment of interest.

Data regarding the spatial distribution of watershed management actions are more diffuse and in development. A few non-profit organizations map actions. Sustainable Jersey has a database of municipalities that engage in voluntary actions. Jersey WaterCheck, part of NJ Future, has a library of water-related goals and achievement by municipality, though the database is incomplete. WaterCheck also maps water and sanitary provider areas. This type of data is lacking, but is in development, especially related to updated MS4 permit rules.

Indicator and Integrated Information sources: Some of the more general watershed information comes from metrics/indicators/indexes that correlate land use/land cover features with water quality or watershed health (Table 1, Table 2). The EPA Watershed Index Online (WSIO) is a library of hundreds of indicators with definitions and results calculated at the HUC 12 level. The WSIO has an Excel-based tool to compare HUCs based on user-selected indicators. The associated Recovery Potential Screening (RPS) tool is also Excel-based, with a smaller number of indicators from the WSIO that relate to watershed restorability. Within the RPS tool, indicators are categorized as *ecological*, *stressor*, or *social*. Selected indicators are averaged to produce an integrated index for each HUC 12 (or HUC 14) to represent the relative ease of watershed restoration.

The Environmental Justice Mapping, Assessment and Protection Tool (EJMAP) identifies Overburdened Communities (OBC) by census block according to the model created by the state Environmental Justice Law. EJMAP also provides a stressor summary by county and census block of OBC criteria. The Coastal Ecological Restoration and Adaptation Plan (CERAP) models priority coastal ecosystem services and disservices, called "issues of concern", and stakeholder-suggested restoration project areas. Both EJMAP and CERAP are presented in an

interactive web map tool format that collects relevant existing spatial layers in addition to the modeled information. Other relevant models for water quality are climate models. The New Jersey Extreme Precipitation Projection Tool and NJ Adapt each model different aspects of future climate scenarios related to precipitation and water levels. The tools are presented as web maps but have additional functionality including user-selected geography and scenarios.

Table 1. Data by category and related tools. Data sources and tools are hyperlinked.

Data Source	Tool
EPA Water Quality Portal	Water Quality Portal Data Discovery Tool
	EPA ATTAINS
	NJDEP Integrated Report Story Map
	EPA How's My Waterway
USGS Continuous Monitoring, Water-Quality Data	National Water Dashboard
	WaterWatch
National Hydrography Dataset	EPA WATERS
	Stroud Water Research Center Model My Watershed
NJ/USGS 10’ DEM and flow Direction/flow Accumulation model	USGS StreamStats
NJDEP DWM&S Continuous Data Monitoring Program	
NJDEP Cooperative Coastal Monitoring Program Beach Closures	
NJDEP Algal Bloom Sampling Status	
Shellfish Harvesting Conditions: National Shellfish Sanitation Program (NSSP)	
NJ Public Access Locations	
Swimming and Fishing Locations	
Jersey WaterCheck	
EPA Watershed Index Online (WSIO)	EPA Recovery Potential Screening Tool
	EPA Preliminary Healthy Watersheds Assessment (PHWA)
Coastal Ecological Restoration and Adaptation Plan (CERAP)	
Environmental Justice Mapping, Assessment and Protection Tool (EJAMP)	
	New Jersey Extreme Precipitation Projection Tool
	NJFloodmapper
Conservation Blueprint	
Water Resource Registries (WRR)	
GEMS Ecosystem Service Logic Models	
NJAES Water Resources Program	
	NJ Future Toolkits

	Sustainable Jersey Municipal Certification and Actions
	EPA Water Quality Scorecard
	Center for Watershed Protection Code and Ordinance Worksheet

Management Recommendation sources: This information incorporates many data sources by definition and is typically aimed at a specific focus or goal, so straddles the categories of data and tool. Action-oriented information is diffuse, spread throughout state, academic, and non-profits (Table 1, Table 2).

The following sources all contribute a spatial layer that represents a model of a focal issue. The New Jersey Conservation Blueprint and Water Resource Registry provide prioritization models for conservation and restoration. The Conservation Blueprint models priority parcels for ecological, agricultural, water quality, and social conservation. The ecological model includes four primary components: water, rare species and natural communities, climate change resilience, and habitat connectivity. The water model prioritizes headwaters, floodplains, groundwater recharge, wetlands, and low impervious surface. Beyond the integrated prioritization model, some of the component layers, such as headwaters and the Active River Area (similar to riparian area), may be valuable to review or incorporate in NJWRAP. Rowan University hosts the Conservation Blueprint, and they have some other models in development that are potentially of interest, including stormwater management, watersheds, and municipal buildout. The New Jersey Water Resource Registry, a collaboration between NJDEP, EPA, and USACE, does not currently have any models available there are plans to model priority landscapes for restoration and conservation for watershed health.

The following sources offer recommendations on a range of structural and non-structural best management practices. NJ Future has a number of green infrastructure resources for developers and municipalities. Sustainable Jersey outlines actions for municipalities, though few are focused on water specifically. The Center for Watershed Protection offers a comprehensive Code and Ordinance worksheet for improving local development regulations. The Rutgers Cooperative Extension Water Resources Program offers fact sheets and e-learning tools for a range of watershed management topics including stormwater management, green infrastructure, and impervious cover assessment.

One general resource in this area comes from the Duke Nicholas Institute for Energy, Environment, and Sustainability. They provide a series of Ecosystem Service Logic Models, general representations of the connections between elements of the ecosystem, human actions, and socioeconomic outcomes. Ecosystem services logic models illustrate and communicate the impacts of projects, showing how each type of action leads to different social and economic outcomes. These models can be edited and customized for different applications.

Tool Types and Features

All the data and information are useful, but how useful depends largely on user expertise or the tools that are readily available to process the data. Across tool types, there are certain features that lead to better user experiences. Web-based tools are generally the most user-friendly as downloads can cause problems. Some federal tools are Microsoft Excel-based and license, add-ons, macros, etc. can be difficult to manage. The Water Quality Portal and USGS Water Quality data can be difficult to navigate, so separating out specific elements and summaries of the data can improve accessibility for most users. For example, the National Water Dashboard displays current streamflow status relative to average rates. This is just one small portion of the data available from NWIS, but it has been extracted and presented in a usable form. Many data sources are spread over many separate web pages that can be confusing to navigate and manage, so it is best to keep information in as few separate pages or tabs as possible.

Tools often incorporate several elements, but existing watershed tools can be generally sorted into the following categories:

Types of tools

- Static-"as is"
    - Map
    - List
    - Report
- Database filtering/retrieval
- Geographic comparison (HUC, municipality)
- Fact sheet/summary statistics
- Geographic/parameter selection
- Scenario generation
    - User generated models
    - Climate
    - Outcome of actions
- Self-assessment worksheet
- Decision support
    - Benefit-cost analysis
    - Landscape prioritization
    - Worksheet

Tools should allow users to gain insight or custom information that is beyond the basic data. For this reason, one of the more common data platforms, the web map, is not the most powerful tool format. Web maps are very useful for gathering relevant data and for some basic visual analysis; however they have limited functionality. Tools with more powerful functions allow users to do some of the following:

- Evaluate real-time risk
- Summarize action/inaction in an area
- Locate and filter public access opportunities
- See trends in water quality
- Delineate custom areas/basins of interest
- Trace upstream/downstream connections
- See visual models of systems/processes to understand importance of various actions
- Model potential outcome of restoration or improvement action
- Produce custom summaries and reports

Some existing tools and sources have excellent functions that NJWRAP may want to leverage or replicate (Table 2). The integrated report is a natural starting point for the watershed health assessment. Working with that document and the methodology used to assemble it will leap frog us forward in designing the Watershed Health Assessment. Though not specific to water quality, The Highlands Region Interactive Environmental Resource Inventory provides an example that NJWRAP might use for targeting specific use cases. In the Highlands tool, formatted reports and

maps on selected topics can be automatically generated and exported for use in the environmental resource inventory; NJWRAP could include reports for selected applications, such as MS4 permits. There are a range of coastal tools that can serve as models for NJWRAP modules, especially OceanReports by BOEM/NOAA and Marsh Explorer/Living Shorelines in The Nature Conservancy Coastal Resilience maps. The Chesapeake Assessment Scenario Tool (CAST), is the preeminent example of a webtool that allows users to find data, view monitoring locations, get information on best management practices and costs, and develop a watershed plan. Their platform may be the aspiration that NJWRAP can become, one "Lego piece" at a time.

NJWRAP can improve on existing data and tool availability in a number of ways. There is an opportunity to extract more information from the WQP and USGS Water Quality databases for the public and basic users, as the advanced tools are the most effective ones at the moment. Due to the complexity of the data stored in these databases, one of the most effective ways to extract information is through R, a software for statistical computing, that requires very specific knowledge to use. NJWRAP can either create summaries behind the scenes to populate factsheets, or a tool can be configured to allow users to retrieve specific types of information. Additionally, there will be clear benefits in consolidating the range of New Jersey state maps and interactive maps that are housed throughout many different DEP web pages. The action information needs to be brought together and curated, and tools for evaluating actions are lacking. We may want to explore more existing tools and models for watershed improvement for application to the Water Quality Improvement Opportunity portion of NJWRAP.

Table 2. Watershed planning tool evaluation.

Tool	Description	Pros	Cons	Application to Vision Document Deliverable I	Application to Vision Document Deliverable II	Application to Vision Document Deliverable III
EPA Water Quality Portal Database	Comprehensive database of chemical and biological measurements by various stakeholders. The WQP integrates publicly available water quality data from the USGS National Water Information System (NWIS) the EPA Water Quality Exchange (WQX) Data Warehouse, and the USDA Agricultural Research Database System (STEWARDS).	Incorporates many chemical and biological parameters from many data sources. The authoritative source for this type of data.	Complex dataset with many parameters, sources, and sampling programs.	Extract water quality trends, most recent conditions, identify gaps in monitoring	Identify areas in need of improvement actions and specific pollutants to remediate	Identify waterbodies with high pollutant levels and identify additional monitoring needs
WQP Dashboard	Excel based tool originally developed to help owners and WQX coordinators determine inventory of data submissions within the last 5 year period. The tool pulls data directly from the Water Quality Portal and can be used by any organization to determine types of data available for download and displaying inventory to bar charted maps.	Users can sort recent data by organization, parameter, geography, and more.	Only recent years of data are available, requires Excel and macros, and user must have Excel skills to extract useful information.			Model of an interface that advanced users may use to identify parameters of interest

Tool	Description	Pros	Cons	Application to Vision Document Deliverable I	Application to Vision Document Deliverable II	Application to Vision Document Deliverable III
R tools: Water Quality Portal Data Discovery Tool, dataRetrieval package	Search, QC, process, and display data from the WQP. The tool uses open source R, a statistical programming language, to visualize the data selected from the portal and to assist users in data analysis.	R software is free and open source, thus available to everyone. R is a powerful tool that allows a knowledgeable user to do a lot.	Requires R software and some programming ability to access data.	Create trend summaries by selected geographies	Identify specific impairments by geography or waterbody to match them with improvement actions.	Identify impairment types and severity.
EPA ATTAINS	The Clean Water Act requires states to assess water pollution. The Assessment, Total Maximum Daily Load (TMDL) Tracking and Implementation System (ATTAINS) is an online system for accessing information about the conditions in the Nation's surface waters relative to water quality standards.	Translates monitoring information into practical information regarding risks for waterbody use.	Many areas with insufficient data. Specifically linked to Clean Water Act designated uses so may exclude some uses or impairments.	Summarize status of waterbody risks and impairments by geography.	Identify geographies or waterbodies in need of improvement and impairments to target.	Identify impairment types and severity, identify monitoring gaps.
NJDEP Integrated Report Story Map	Web map of designated uses and levels of attainment statewide at a HUC 14 (?) level. Includes summary figures of designated uses and major parameters.	Practical information regarding risks for waterbody use presented in a visual format. Curated for the state of N with concise summaries.	Many areas with insufficient data. Information cannot be combined with other sources in this tool.	Similar summaries could be created for other geographies	Identify geographies or waterbodies in need of improvement and impairments to target.	Identify impairment types and severity, identify monitoring gaps.

Tool	Description	Pros	Cons	Application to Vision Document Deliverable I	Application to Vision Document Deliverable II	Application to Vision Document Deliverable III
EPA How's My Waterway	The tool was designed to provide the general public with information about the condition of their local waters. Information includes the status of designated uses; restoration and protection efforts; permitted discharger information, and identified Issues.	Simple to use and clearly demonstrates the connection between water quality and uses. Provides a brief overview and link to more detailed report.	The map shows watersheds but not waterways/waterbodies or upstream/downstream relationships to indicate how watersheds are connected and related.	Clear, simple maps and waterbody condition report for HUC 12.	Highlights HUC 12/HUC 14 with impaired uses or missing data.	Highlights parameters of concern in HUC 12s/HUC 14s
USGS Continuous Monitoring, Water-Quality Database	The U.S. Geological Survey's (USGS) National Water Information System (NWIS) supports the acquisition, processing, and long-term storage of water data. The USGS collects and analyzes chemical, physical, and biological properties of water in historical, discrete samples.	Historical data, statistics by day, month, or year, and current conditions are all available. Great customization available for a range of user needs.	Data not available at all locations. Many options can be complex to navigate.	Summarize trends in stream flow and water quality parameters over time.	Identify waterbodies with poor water quality trends.	Identify parameters of concern over time as well as nearly real-time concerns via current conditions.
National Water Dashboard	Map to view USGS real-time stream, lake, precipitation, water quality stations with current weather and hazard conditions.	Very user-friendly, gives up-to-the minute results. Beautiful interface	Data only available at a limited number of locations.	Communicating current watershed conditions.	Visualize areas in need of improvement.	Visualize areas of immediate concern.

Tool	Description	Pros	Cons	Application to Vision Document Deliverable I	Application to Vision Document Deliverable II	Application to Vision Document Deliverable III
WaterWatch	Map of current and historical streamflow, drought, and flood conditions	User-friendly, clear summaries.	Interface looks unprofessional. Only includes streamflow data, not other parameters that may be available.	Communicating current watershed conditions.	Visualize areas in need of improvement.	Visualize areas of immediate concern.
NJDEP DWM&S Continuous Data Monitoring Program	Short and long term data loggers throughout NJ in both fresh and marine waters. Data logger deployments may range from several days to many months andin some cases, the data loggers transmit real-time parameter values every 15 minutes.	Provides a manageable set of tools for viewing realtime data, downloading, and graphing.	Difficult to understand what data is available as loggers are not deployed longterm.	Summarize trends in stream flow and water quality parameters over time.	Identify waterbodies with poor water quality trends.	Identify parameters of concern over time as well as nearly real-time concerns via current conditions.
USGS StreamStats	The map-based user interface can be used to delineate small drainage areas, determine basin characteristics, and estimate flow statistics, including instantaneous flood discharge, monthly flow-duration, and monthly low-flow frequency statistics for ungaged streams.	Very fine scale. The underlying data, based on NJ LiDAR data, includes raster digital datasets for a 10-foot digital elevation model, a flow direction grid, and a flow accumulation grid. Reports on stream or waterbody of	Results are uneven depending on the area of interest. Delineation doesn't seem to work well in areas with many tributaries.		Identify contributing watershed in need of improvement actions to improve focal waterbody	Identifying contributing area for waterbodies of interest. Tracing upstream/downstream connections for waterbodies and runoff

Tool	Description	Pros	Cons	Application to Vision Document Deliverable I	Application to Vision Document Deliverable II	Application to Vision Document Deliverable III
		interest and future flow estimates.				
Stroud Water Research Center Model My Watershed	Explore map layers and select your area of interest. Analyze land cover, hydrologic soil groups, permitted point source discharges and other natural and human influenced features. Models to compare impacts of different conservation and development scenarios on water quality.	Can delineate by some presets including HUCS and administrative. It provides an overview of land use/land cover and water quality, and the ability to do simple models of stormwater runoff for the area of interest. Works well for larger bodies such as lakes and river. You can download	Not all data sources are the available at all resolutions. Model output is very general, and the more detailed BMP worksheet is complicated.	Summary statistics in the watershed	Compare BMP options	Identifying contributing area for waterbodies of interest

Tool	Description	Pros	Cons	Application to Vision Document Deliverable I	Application to Vision Document Deliverable II	Application to Vision Document Deliverable III
NJDEP Cooperative Coastal Monitoring Program Beach Closures	Current beach status from May to September. Database includes water quality sample results, reports of beach advisories and beach closings, and historical results can be queried.	Timely information, simple interface.	Only coastal locations	Summary of historical beach advisories/closures	Target areas with frequent beach advisories for improvements	Target areas with frequent beach advisories to track down impairment sources
NJDEP Algal Bloom Sampling Status	Map of sampling results for suspected or confirmed HAB events reported to DEP. Samples for "current" status and all other sample dat	Timely information, simple interface.	Sampling does not cover all waterbodies, sample dates sporadic	Summary of historical HAB advisories	Target areas with frequent HABs for improvements	Target areas with frequent HABs to track down impairment sources
Shellfish Harvesting Conditions: National Shellfish Sanitation Program (NSSP)	Displays classification of shellfish growing waters according to FDA regulatory guidelines and links to reappraisal and sanitary survey reports	Timely information, simple interface.	Only coastal locations	Summary of shellfish harvesting status	Target areas with harvest limitations due to water quality	Target areas with harvest limitations to track down impairment sources
Chlorophyll Remote Sensing	Map of remotely sensed chlorophyll levels in NJ's coastal waters to detect algal blooms. Data back to 2007 is available for download.	Timely information, simple interface.	Regular flights do not cover freshwater locations	Summary of historical algal bloom status	Target areas with frequent algal blooms for improvements	Target areas with frequent algal blooms to track down impairment sources

Tool	Description	Pros	Cons	Application to Vision Document Deliverable I	Application to Vision Document Deliverable II	Application to Vision Document Deliverable III
NJ Public Access Locations	The interactive map shows over 3900 public access locations along New Jersey's tidal waters and provides filterable information about amenities at each location.	Valuable public information, can be filtered by user choices	Does not include freshwater locations	Summary of locations and uses	Combine with monitoring data to identify risk to public and priority areas for improvement	Identify potential sources of pollution
Swimming and Fishing Locations	Swimming lakes and beaches in state parks, forests and recreation areas as well as operating status. Fishing areas by county, stream, reach length, accessibility.	Lists locations for recreation opportunities.	Locations not on a map, just a list.	Summary of locations and uses	Combine with monitoring data to identify risk to public and priority areas for improvement	
Jersey WaterCheck *Shared Goals, Benchmark Hub, and System Finder*	The Benchmark Hub catalogs important factors for water infrastructure investment. data that we've gathered for every water and wastewater system in the state. System finder maps water supplier and wastewater treatment plant service areas statewide.	They have already identified some benchmarks for municipalities relative to green infrastructure and water supply.	Confusing interface, information incomplete	Summary of facilities and performance relative to benchmarks.	Locate facilities and improvements relative to benchmarks.	

Tool	Description	Pros	Cons	Application to Vision Document Deliverable I	Application to Vision Document Deliverable II	Application to Vision Document Deliverable III
EPA Watershed Index Online (WSIO)	This is a library of hundreds of landscape indices. They are correlative indicators of water quality or other aspects of watershed health based on landscape factors. These indicators can be combined to create custom indices for assessing and comparing watersheds in an Excel-based tool.	Many options, well-documented, customizable, fine scale	Overwhelming number of options, requires detailed knowledge to use effectively, data sources and survey date not the best available	We might pre-select most important indicators for the summary and/or create a map layer by HUC 12. The indicator definitions can be used to explain the meaning.	Can be used to identify general types of improvement opportunities such as impervious surface reduction.	Can be used to identify general stressors in the watershed
EPA Recovery Potential Screening Tool	Subset of indices from the WSIO in an Excel-based tool. Indicators are curated by three categories: Ecological, Stressor, Social. Selected indicators are averaged to produce an integrated index for each HUC 12 (or HUC 14) to represent relative restorability.	Many options, well-documented, customizable, fine scale	Overwhelming number of options, requires detailed knowledge to use effectively, data sources and survey date not the best available	We might pre-select most important indicators for the summary and/or create a map layer by HUC 12. The indicator definitions can be used to explain the meaning.	Can be used to identify general types of improvement opportunities such as impervious surface reduction. Could create custom indices for broad-scale restoration prioritization.	Can be used to identify general stressors in the watershed.

Tool	Description	Pros	Cons	Application to Vision Document Deliverable I	Application to Vision Document Deliverable II	Application to Vision Document Deliverable III
Coastal Ecological Restoration and Adaptation Plan (CERAP)	Platform with issue of concern data explorer for ecosystem services/disservices and composite scores. User-nominated restoration areas.	Stakeholder-driven process identified important issues of concern.	Only coastal/tidal areas.	Summary of areas of concern. Potential template for inland areas of concern	Suggested restoration sites. Issues of concern may require improvements	Issues of concern may signal water quality impairments
Environmental Justice Mapping, Assessment and Protection Tool (EJAMP)	Identifies Overburdened Communities (OBC) by census block according to the model created by the state Environmental Justice Law. Includes low-income, minority, and limited English communities.	Assembles relevant pollution/facilities layers.		Summary of overburdened communities and facilities related to water quality	Overburdened communities potentially priority areas for water quality improvements	
New Jersey Extreme Precipitation Projection Tool	This site provides an interactive tool for users to identify regional and local estimates of projected changes in extreme rainfall amounts for various return periods between current estimates and two future emission scenarios.	Clear user interface, user selected geography and scenarios, and downloadable reports	Not linked to waterbodies or streamflow	Summary of current and future precipitation	Sizing BMP improvements according to precipitation rates	
NJFloodmapper	An interactive mapping website to visualize exposure from coastal flooding hazards under different scenarios.	User selected scenarios, snapshot report	Only coastal/tidal areas.	Summary of coastal flooding	Identify coinciding areas of flooding and water quality	

Tool	Description	Pros	Cons	Application to Vision Document Deliverable I	Application to Vision Document Deliverable II	Application to Vision Document Deliverable III
					impairments for green infrastructure projects	
Conservation Blueprint	Prioritization of the most important remaining natural and cultural land resources in New Jersey. Models and open space preservation data to evaluate the importance of 1) Community Green Space, 2) Agricultural Preservation (Fall 2020), 3) Ecosystems to Protect (Spring 2020), 4)Water Quality Protection. In addition to prioritization models, the tool compiles a number of important watershed layers.	Compiles a range of important watershed data layers. Provides ready-made prioritization maps for users who don't need to set their own criteria.	Layers and purpose of various layers are not defined. Does not include restoration priorities	Summary of conservation priorities.	Highlight high-impact areas for conservation to maintain water quality.	
NJDEP, EPA, USACE Water Resource Registries (WRR)	Consensus-based restoration and preservation analyses for use in resiliency and sustainability planning. The New Jersey WRR team plans to develop eight GIS-based analyses for preservation and restoration of aquatic and terrestrial resources. An interactive mapping application	May complement the Conservation Blueprint well by providing restoration priority locations.	This resource is not yet available.	Summary of restoration and conservation priorities. Example of reference layers to include	Identify priority locations for restoration.	

Tool	Description	Pros	Cons	Application to Vision Document Deliverable I	Application to Vision Document Deliverable II	Application to Vision Document Deliverable III
	(see link) shows basic environmental resource layers.					
GEMS Ecosystem Service Logic Models	Duke Nicholas Institute for Energy, Environment, and Sustainability. They provide a series of Ecosystem Service Logic Models, general representations of the connections between elements of the ecosystem, human actions, and socioeconomic outcomes.	Illustrate and communicate the impacts of different types of actions	Does not incorporate primary data		Inform selection of project type	
NJAES Water Resources Program	Webpage of the program dedicated to solving New Jersey's water resources issues. Fact sheets and e-learning tools for water quality improvement actions.	Practical information such as Impervious Cover Assessment/Reduction plan guides	A lot of the information is out of data and tool technology out of data and don't load		Supporting information for improvements	

Tool	Description	Pros	Cons	Application to Vision Document Deliverable I	Application to Vision Document Deliverable II	Application to Vision Document Deliverable III
NJ Future Toolkits *Developers Green Infrastructure Guide; Municipal Green Infrastructure Toolkit*	Guide to creating green infrastructure in municipalities and new developments. Provides an overview of the state rules and a workflow for implementation.	Full step-by-step guidance	Not self-contained-many separate web pages and external resources are difficult to navigate.		Recommended workflow can be incorporated	
Sustainable Jersey Municipal Certification and Actions	Complete guide to actions municipalities can take to increase sustainability. Includes structural and non-structural practices and a database of actions taken by municipalities.	Ready-to-go guidance, attractive incentives for municipalities	Few of the actions apply to water quality.			
EPA Water Quality Scorecard	The scorecard guides municipal staff through a review of relevant local codes and ordinances across multiple departments to ensure that these codes work together to support a green infrastructure approach.	Reliable guidance	Not specific to New Jersey rules		Assessment and recommended actions can be incorporated	

Tool	Description	Pros	Cons	Application to Vision Document Deliverable I	Application to Vision Document Deliverable II	Application to Vision Document Deliverable III
Center for Watershed Protection Code and Ordinance Worksheet	Municipalities can review their current rules relative to a complete set of water-quality related local codes and ordinances.	Comprehensive, reliable guidance	Not specific to New Jersey rules		Recommended actions can be incorporated	
Highlands Region Interactive Environmental Resource Inventory	Interactive Environmental Resource Inventory (ERI) is a map-based application designed to assist in the development of municipal ERIs. The application can be used to view and export maps and associated narratives describing a wide range of environmental and other resource data for the Highlands Region.	Export maps and reports of selected data formatted for use in ERI	Only includes the Highlands Region		Example of how NJWRAP could be formatted to export reports for targeted applications.	