



Coastal Vulnerability Assessment

20 Points

IMPORTANT ANNOUNCEMENT: In February, 2021 a new law went into effect in New Jersey that now requires the development of a climate change-related hazard vulnerability assessment in municipal master plans. These assessments will need to include an analysis of current and future threats associated with climate change related natural hazards, including increased temperatures, drought, flooding, hurricanes, and sea-level rise.

Due to the change in the Municipal Land Use Law, this action will be retired on **December 31, 2022**. Municipalities are advised not to undertake this action at this time. Municipalities that have already completed the action can potentially earn points in the 2022 certification cycle only. If your municipality is currently working on this, please contact Anne Heasley, Program Manager for Policy and Planning at Sustainable Jersey at 609-771-7835 or email heasleya@tcnj.edu.

Sustainable Jersey is in the process of preparing new guidance to assist municipalities in complying with the municipal land use law changes and making their communities climate ready.

The Municipal Coastal Vulnerability Assessment (CVA) is a tool for evaluating the degree to which a community's assets (e.g. public services, infrastructure, economic centers, neighborhoods and natural areas) will be impacted by projected sea level rise and tidal and storm-related coastal flooding, as well as the consequences those vulnerabilities pose to the community. With this information, a municipality can begin to identify and prioritize adaptation strategies to protect its assets.

The CVA goes beyond mapping the extent and duration of flooding by also examining how flooding will affect the functional capacity of the community's assets, including its buildings, infrastructure, ecological systems, and residences.

This action is related to other Sustainable Jersey actions focused on climate change, including [Climate Adaption: Flood Risk](#), [Heat Island Assessment](#), [Extreme Temperature Event Plan](#), and [Vulnerable Populations Identification for Emergencies](#).

For certified communities, this action can count toward a Gold Star in Health. See the Gold Star Standard section of this action for more information.

Why is it important?

Sea level rise, extreme storms and increasingly heavy precipitation events are all contributing to the likelihood of extreme flooding and storm damage in New Jersey's coastal and tidal communities. Sea level rise has been increasing in New Jersey for the past century, but the rate of increase is now accelerating and will continue to increase until significant reductions are made in greenhouse gas emissions. Sea level rise projections for New Jersey include a "central estimate" that the sea level will meet or exceed current levels by 0.8 feet in 2030, 1.4 feet in 2050 and 2.3-3.4 feet in 2100, depending the progress in reducing emissions¹. The rise in sea level will, in turn, cause higher levels of flooding from storm events. For example, the water level for an annual flood in 2050 is estimated at 4 feet, and a 1% flood event in that same year could be as high as 8 feet. This doesn't account for the potential increased intensity in storms due to global warming.

Understanding the various scenarios and climate assumptions associated with future flood risks is complex. Fortunately, climate scientists in New Jersey and throughout the country are studying these scenarios closely and have already provided useful data for government officials and practitioners to begin assessing the vulnerability of communities to future flood risks and to begin taking the necessary actions to reducing those risks.

Who should lead and be involved with this action?

The CVA process requires the participation of individuals and professionals with varying roles, perspectives and expertise. The CVA committee should be municipally appointed and include members with extensive local knowledge in flooding issues, land use, flood mitigation measures, local ecology. By convening a diverse and engaged CVA committee, the municipality will benefit from nuanced and well-rounded responses to the vulnerability and rating exercises.

Suggested members of a local CVA committee include, but are not limited to:

- GIS specialist
- Municipal Planner
- Emergency Manager
- Public Safety Official

- Municipal Engineer
- Public Works Official
- Floodplain Manager
- Ecologists and other experts in coastal management and habitat conservation
- Experts in climate science and sea level rise
- Local officials familiar with past damage from coastal storms, as well as current or pending flood mitigation measures within the community`

Timeframe

The CVA process typically requires 1-3 meetings of a municipally appointed committee of professionals and experts with the appropriate skills. Additional time and resources should be allotted to 1) compile and review background material; 2) schedule meetings; 3) identify and list community assets by block/lot; 4) map projected flood hazards and community assets; and, 5) prepare the final report. This action can be completed within 2-4 months.

Project costs and resource needs

The cost and resources needed for this action depend on who facilitates and prepares the report. The report could be done in-house if a municipality has full-time staff. Some organizations may offer to facilitate and complete the report for free. If a consultant is hired for the entire process and report, the cost for completing this action could range from \$2,500 to \$5,000, or more for larger municipalities, i.e. more assets to evaluate. There may be grant funding available from Sustainable Jersey's Small Grants programs or other funding sources.

What to do, and how to do it ("How to")

This section provides guidance and recommendations for implementing the action. A municipality does not need to follow this guidance exactly as long as it meets the requirements for earning points for this action.

The steps for completing this action are listed below:

1. Convene a CVA committee

Convene a committee of local officials (and other stakeholders) to participate in the development of the municipal coastal vulnerability assessment. Participants should include the municipal engineer, planner, GIS specialist, emergency manager, a governing body representative, the public works director, and other officials and/or stakeholders that are familiar with the community's assets, past flood events and the status of coastal and tidal wetland/marshes. The committee should meet at least twice: the first meeting is to review past flooding issues; review and discuss predicted water levels and storm events for the region; select the flood scenarios and identify community assets; and begin assessing the vulnerability of the assets (or assign it to a consultant). The second meeting is to complete the vulnerability assessment or review and comment on the assessment if it was prepared by a consultant. A third meeting can be held if further review is needed.

2. Community Data

The CVA should begin with a brief introduction to your municipality (size, location, etc), followed by a review of recent storms and flooding, and any measures that are planned or have been implemented to minimize future flooding (e.g. a living shorelines, elevated homes, etc.)

Reviewing the impact of past flood events – such as physical damage, fiscal and economic impacts, and social consequences – can help set the stage for understanding the future. Before beginning the CVA process, the committee should review available data on the following: past storms and flooding – including any maps, reports and anecdotal information; the locations of severe repetitive loss (SRL) properties; and, any hazard mitigation projects and adaptive measures that have been recently implemented. (Note that the release of SRL data may raise confidentiality concerns; therefore, if SLR properties are mapped or described, they should refer to a general area, rather than be site specific.)

Examples of other plans and reports that may help inform the CVA process include the hazard mitigation plan, stormwater management plan, and the Getting to Resiliency (GTR) report, if it exists. The latter is an emergency preparedness and resiliency assessment <http://www.prepareyourcommunitynj.org/> which is also part of the Sustainable Jersey Flood Risk action.

Finally, review the predicted sea level trends for your area and insert the appropriate chart into the CVA report using these instructions: Go to the NOAA webpage for sea level trends at <https://tidesandcurrents.noaa.gov/sltrends/sltrends.html>. Select East Coast and expand the map so that New Jersey is clearly visible. Click on the arrow of the tidal gauge that is closest to your municipality. Then click on "linear trend" to create a chart. Copy the chart ("save image") and insert it into the CVA report.

3a. Identify and Map Flood Scenarios

Map at least two future flood scenarios that will be used to assess your community's vulnerability. The maps should include, at a minimum, one each from A and B below.

A. Permanent/Frequent Flood Scenarios* 2050 sea level rise (SLR)

B. Episodic Flood Scenarios* 2050 Hurricane Category 1

C. Additional flood scenarios (optional) 2050 sea level rise and 1% flood event.
 (Data source: National Climate Assessment <https://coast.noaa.gov/arcgis/rest/services/NCAMapping/2050/MapServer>)

Mapping sources for A and B: Future sea level rise and storm surge maps are available on web-based platforms such as NJ Adapt and Climate Central. However, these platforms do not offer GIS maps, which will make it difficult to gauge the depth of water and plot community assets, both of which are subsequent steps in this process. Until other maps become available, GIS maps developed by NJDEP can be downloaded from the Sustainable Jersey website using the links below. The maps include 2030 Category 1 and 2 hurricanes with SLR, and 2050 Category 1 and 2 hurricanes with SLR. The links are organized by hurricane category (C1 and C2), and the year.

- <https://www.sustainablejersey.com/fileadmin/media/Zips/c1hslr2030.zip>
- <https://www.sustainablejersey.com/fileadmin/media/Zips/c1hslr2050.zip>
- <https://www.sustainablejersey.com/fileadmin/media/Zips/c2hslr2030.zip>
- <https://www.sustainablejersey.com/fileadmin/media/Zips/c2hslr2050.zip>

3b. Map Community Assets

Identify the community assets to be included in this vulnerability assessment, and map them on the GIS-based flood maps created in Step 3a. Community assets fall into four categories: Critical Facilities & Infrastructure, Community Resources & Amenities, Districts & Neighborhoods, and Natural Assets & Ecosystems. At a minimum, include all public buildings, critical infrastructure/facilities (e.g. fire, hospitals, sewer/water facilities), places with vulnerable populations (e.g. low-income neighborhoods, senior housing) and tidal wetlands/marshes (for their flood mitigation functions).

Create a spreadsheet and list the name of the assets in one column and the function of each asset in a separate column. (Additional columns will be added in subsequent steps.) For the “function” of each asset, describe the specific ways it contributes to the daily routine of community life, noting that it may serve multiple, and sometimes subtle but important, functions. Depending on the asset, it may also be worthwhile noting the level of activity in a typical week. For example, some buildings or facilities may only be open seasonally (such as tourist destinations), or used only during specific events (such as emergency shelters), while others may have a specific pattern of use (such as schools or churches).

To view an example of a completed spreadsheet layout for the City of Burlington, click [here](#).

4. Identify Exposure

“Exposure” refers to the extent of flooding that might occur if the asset is not otherwise protected. Using the GIS map created in Step 3a, determine the exposure, or approximate depth of water, for each asset. If using the NJDEP maps, the depth of water is revealed by “clicking” on the desired area (e.g. asset) on the map. Other maps display approximate depths of water using color gradients. Avoid using maps with too broad of a range of exposure, e.g. 0-3 feet, because the potential impacts within such a range can vary significantly. Indicate the exposure of each asset in a separate column on the spreadsheet.

Note: The water depths are estimates based upon a specific set of assumptions regarding future greenhouse gas emissions and climate change. Since these assumptions could change in the near and distant future, the estimates for water depth should only be used for planning purposes.

5. Describe and Rate Vulnerability

Describe and rate the vulnerability of each community asset given its exposure to future flooding. Vulnerability here refers to the degree that an asset’s physical condition and/or functional capacity would be impaired by the flooding. For example, is the water so deep at a fire station that a fire truck is unable to drive through the floodwaters? Or, will the flooding impact the power source and backup generator to the hospital or other critical infrastructure?

It is important to keep in mind that even off-site impacts that are located well outside of the path of expected flooding, can cause an asset to be vulnerable to the flood hazard. For example, a hospital built on a hill would not be fully functional if the road network leading to and from the facility is flooded. After describing the vulnerability of each asset, rate the vulnerability (low, moderate, or high) using the criteria listed below in **Table 1**. Insert the vulnerability description and rating in two new columns in the spreadsheet. Note: It is possible that an asset’s vulnerability could fall under multiple ratings. For example, if there is no anticipated physical or structural damage to an asset, but the flooding of evacuation routes would create a serious problem, the asset could fall under both insignificant and moderate vulnerability ratings. In situations like this, the CVA participants will need to make an informed decision based upon their knowledge of the asset and the type and extent of exposure and vulnerability.

Table 1: Vulnerability Rating Key

Level	Vulnerability Rating Given Hazard Exposure and Vulnerability
Insignificant	<p>Exposure to Flooding: This community asset is located out of harm’s way.</p> <p>Physical/Structural Damage: No physical/structural damages expected.</p> <p>Disruption/Impairment: No disruption in function, accessibility, or development and delivery of basic services and supplies. No apparent impacts to services provided by, typical operations, routine or daily life.</p> <p>Accessibility: Key staff able to access facilities or locations without interruption.</p>

Low	<p>Exposure to Flooding: The majority of this community asset is located out of harm’s way.</p> <p>Physical/Structural Damage: Minor physical/structural damages expected.</p> <p>Disruption/Impairment: Limited disruption in function, accessibility, or development and delivery of basic services and supplies. Limited impacts to typical operations, routine or daily life, if any.</p> <p>Accessibility: Key staff able to access facilities or locations with minimal interruption.</p>
Moderate	<p>Exposure to Flooding: A significant portion of this community asset is located in harm’s way.</p> <p>Physical/Structural Damage: Moderate physical/structural damages sustained.</p> <p>Disruption/Impairment: Moderate level of disruption to accessibility or mobility of asset, amenity or population. Moderate level of interruptions to development and delivery of basic services and supplies. Typical operations, routine or daily life moderately affected by flood hazard scenario.</p> <p>Accessibility: Secondary evacuation and access routes available for use if/when primary systems fail.</p>
High	<p>Exposure to Flooding: The majority of this community asset is located in harm’s way.</p> <p>Physical/Structural Damage: Severe level of harm (destruction on property or degradation of function and/or injury) is expected, resulting in a high degree of loss. Asset, amenity or population is unable to withstand flood impacts.</p> <p>Disruption/Impairment: Severe, potentially irreparable challenges faced requiring significant changes to asset functioning, community’s daily life or "new normal." Production, provision of services or daily routine expected to sustain high degree of disruption. Significantly reduced operational capacity of community assets and amenities; long term or permanent relocation of asset, amenity or population.</p> <p>Accessibility: Severe disruptions to accessibility of asset, amenity or population or the disruption of this assets causes accessibility issues to other community assets. Key individuals, material supplies, core operating systems and functioning interrupted or unavailable.</p>

6. Evaluate and Rate Potential Consequences

While the vulnerability assessment (described in Step 5 above) attempts to understand what might happen to an individual asset if/when flooding occurs, Step 6 (this step) answers a follow-up question “What does the vulnerability of each asset mean to the community?” This step is critically important because it helps a municipality decide which assets should be targeted or prioritized for mitigation and adaptation strategies.

The consequences to the community of a damaged, impaired or lost asset will vary, depending on its relative importance and function. For example, losing a health clinic from flood inundation can create a serious public health problem, while the impact of losing a community baseball field may be limited to delays in the recreation calendar. Another example is when an asset helps to mitigate flooding. For example, marshes and other wetlands can help slow and absorb floodwaters, minimizing damage to nearby property.

For this step, evaluate the consequences of the vulnerability (potential impact of flooding) of each asset to the community, and rate the consequences using the criteria listed below in **Table 2**. This is the last of the information to be included on the spreadsheet. To view an example of a completed spreadsheet layout for the City of Burlington, click [here](#).

Note: Rating the consequences is the most difficult task in this assessment. Using “a best guess” approach is fine, as long as the participants all agree with the ratings.

Table 2: Consequences Ratings Key

Level	Given Vulnerability of Assets, Rate the Magnitude or Severity of Consequences to the Community
1. Insignificant	<p>Property Damages: Only minor property damage.</p> <p>Typical Operations/Daily Life: No impacts or disruptions to typical operations, routine or daily life.</p> <p>Environment: No lasting environmental degradation.</p> <p>Emergency Response: No adverse effects to emergency response.</p> <p>Hazardous Materials: No increase or change in community/ecosystem exposure to toxics or hazardous materials.</p> <p>Municipal Budget: Negligible operational costs.</p>
2. Minor	<p>Property Damages: Limited property in narrow affected area damaged or destroyed.</p> <p>Typical Operations/Daily Life: Limited disruption to typical operations, routine or daily life.</p> <p>Environment: Minor damage or loss to habitat and species or functioning of the systems as a component of “coastal green infrastructure” of the community. Small loss of natural resource</p>

	<p>base. Increased, but tolerable stress on ecosystem. Emergency Response: Slight decrease in emergency response times and effectiveness</p> <p>Hazardous Materials: Limited hazardous materials spill, manageable clean-up and remediation.</p> <p>Municipal Budget: Additional but tolerable operational costs.</p>
3. Moderate	<p>Property Damages: Substantial property in affected area damaged or destroyed.</p> <p>Population Displacement: Long-term population displacement over a broader segment of the population.</p> <p>Typical Operations/Daily Life: Daily life is affected such that only redundant systems can be used for an extended duration.</p> <p>Environment: Major damage or loss of habitat or functioning of the systems as a component of “coastal green infrastructure” of the community that may be permanent with adverse impacts.</p> <p>Emergency Response: Emergency response is strained resulting in significant degradation of response effectiveness and times.</p> <p>Hazardous Materials: Large hazardous material spill with significant risk to humans and ecosystems.</p> <p>Municipal Budget: High operational costs straining local budgets</p>
4. High	<p>Property Damages: Majority of property in affected area damaged or destroyed</p> <p>Population Displacement: Permanent and widespread population displacement.</p> <p>Delivery of Services: Long-term interruption of supply and services.</p> <p>Typical Operations/Daily Life: Majority of community operations, daily life patterns intensely impacted for an extended period.</p> <p>Environment: Permanent degradation of habitat or functioning of the systems as a component of “coastal green infrastructure” of the community.</p> <p>Emergency Response: Need for emergency services exceeds full capacity and/or services are degraded and not functioning.</p> <p>Hazardous Materials: Hazardous material spill that requires multi-year clean-up and poses significant health or ecosystem risk.</p>

7. Develop “Next Step” Recommendations

Discuss with the committee the steps that should follow the completion of the CVA, including those suggested below, and include those that are considered most important or practical in the final report. Remember, these suggestions are not to be done as part of this process, but are the recommended “next steps” for local officials to consider.

- Share the results of the Coastal Vulnerability Assessment with owners and managers of vulnerable and at risk properties and work together to develop mitigation and adaptation strategies.
- Coordinate a community outreach and education effort, sharing the results of the Coastal Vulnerability Assessment with the public.
- Incorporate the results of the Coastal Vulnerability Assessment into the municipal master plan and determine if any planning policies in the master plan should be revisited or revised.
- Cross reference the Coastal Vulnerability Assessment in relevant sections of the floodplain management plan, emergency operations plan, and local hazard mitigation plan.
- Develop a long-term process for identifying critical issues, potential partners, mitigation and funding options, and specific strategies for reducing the vulnerability of community assets.

8. Prepare CVA Report

Compile the data from the above steps into a CVA report, and include the required elements noted below:

Required Elements of the Municipal Coastal Vulnerability Assessment report:

- a. A summary of the process
- b. The participants involved in the process
- c. Brief description of the community and past flooding issues and mitigation measures
- d. Maps of at least two future flood scenarios with an overlay of community assets from the four categories
- e. A spreadsheet listing the name and block/lot (or address) of each asset, the function of that asset, the approximate depth of water, if any, for each flood scenario, a description of the vulnerability and rating, and a description and rating of community consequences (To view an example of a completed spreadsheet layout for the City of Burlington, click [here](#).)
- f. Recommendations for “Next Steps”

9. Share the Municipal Coastal Vulnerability Assessment report

Forward the completed CVA report to the planning board, governing body, environmental commission and green team for their review and consideration. (Confidential data related to homeland security or other issues may be redacted from the report prior to distribution.)

What to submit to earn points for this action

In order to earn points for this action, submit the following documentation to verify the action was completed to the above standards. (Login to the password protected web page where you submit your online application for certification to write in the text box and upload documents).

- In the text box, please provide a short narrative (300-word max) that summarizes what was accomplished and the general steps taken to accomplish it.
- Upload: The Municipal Coastal Vulnerability Assessment that includes the required components (below) along with verification that it was completed from within 5 years of the June submission deadline. The following is a list of the required elements of the Municipal Coastal Vulnerability Assessment
 - Summary of the process
 - The participants involved in the process
 - Brief description of the community and past flooding issues and mitigation measures.
 - Maps of at least two future flood scenarios with an overlay of community assets from the four categories.
 - A spreadsheet listing the name and block/lot (or address) of each asset, the function of that asset, the approximate depth of water, if any, for each flood scenario, a description of the vulnerability and rating, and a description and rating of community consequences (see Appendix C for a sample)
 - Recommendations for "Next Steps"
- Upload: Documentation showing that the CVA has been distributed to the governing body, planning board, environmental commission and green team (confidential data related to homeland security or other issues may be redacted from the report prior to distribution).

Approved Action Expiration Date

Approved actions will be set to expire five years from the date the CVA was completed OR if resubmitting for this action, the date of the reexamination report.

Re-Submission Requirements

Resubmission requirements include a) a reexamination of factors that may have changed since the CVA was completed, e.g. new assets, revised sea level rise projections, flood mitigation projects; b) the progress that has been made in response to the report's recommended next steps; and, c) any other steps that have been taken to mitigate and adapt to predicted flooding. No points will be issued for a re-submission that does not include progress in mitigating and/or adapting to the predicted flooding identified in the CVA.

IMPORTANT NOTES:

There is a limit of six uploaded documents per action and individual files must not exceed 30 MB. Excerpts of relevant information from large documents are recommended.

All action documentation is available for public viewing after an action is approved. Action submissions should not include any information or documents that are not intended to be viewed by the public.

Gold Star Standard

Successful completion of this action will meet the requirement of a High Impact action for earning a Gold Star in Health. For more information on earning a Gold Star in Health see the [Gold Star Standards](#) section of the website.

Spotlight: What NJ municipalities are doing

[Coastal Vulnerability Assessment for Moorestown, NJ](#)

[Coastal Vulnerability Assessment for Burlington Township](#)

Resources

The following resources may be helpful in understanding flood risk analysis and for completing this action.

New Jersey Maps, Data and Reports

Integrating Climate Science into Coastal Resilience Planning and Decision Making in New Jersey
<http://njadapt.rutgers.edu/docman-lister/conference-materials/169-stapssummaryfinal-october-2016/file>

New Jersey Adapt
<http://www.njadapt.org>

New Jersey and the Surging Sea, A Vulnerability Assessment with Projections for Sea Level Rise and Coastal Flood Risk

<https://riskfinder.climatecentral.org/api/reports/state/new-jersey.us/state-report>

New Jersey Coastal Flood Exposure Assessment

<http://njadapt.rutgers.edu/docman-lister/resource-pdfs/95-nj-coastal-flood-exposure-assessment-revised/file>

New Jersey Climate Adaptation Alliance

<http://njadapt.rutgers.edu>

NJ Sea Level Rise Reports

<http://njadapt.rutgers.edu/resources/nj-sea-level-rise-reports>

Other Reports and Resources

Association of State Floodplain Managers, Inc. December 2013. "Holistic Coasts: Adaptive Management of Changing Hazards, Risks, and Ecosystems." <https://tinyurl.com/yc67ezak>

Blintiff, Jacob. December 2011. "Adapting to Rising Coasts Staff Report: Assessing Climate Change Vulnerability & Risk." <http://www.adaptingtorisingtides.org/?s=bintliff-Assessing-Vulnerability+Risk>

Kopp, R. E., Horton, R. M., Little, C. M., Mitrovica, J. X., Oppenheimer, M., Rasmussen, D. J., ... Tebaldi, C. (2014). Probabilistic 21st and 22nd century sea-level projections at a global network of tide-gauge sites. *Earth's Future*, 2(8), 383-406. <http://onlinelibrary.wiley.com/doi/10.1002/2014EF000239/full>

Miller et al. December 2013. "A geological perspective on sea-level rise and its impacts along the U.S. mid-Atlantic coast." <http://onlinelibrary.wiley.com/doi/10.1002/2013EF000135/pdf>

Milone & MacBroom, Inc., The Nature Conservancy and Yale University. May 2014. "Town of Guilford Community Coastal Resilience Plan: Risk and Vulnerability Assessment Report."

<http://www.ci.guilford.ct.us/wp-content/uploads/coastal-resilience-plan-Risk-and-Vulnerability-Assessment-Report.pdf>

US Army Corps of Engineers. August 2014. "Procedures to Evaluate Sea Level Change: Impacts, Responses and Adaptation."

http://www.publications.usace.army.mil/Portals/76/Publications/EngineerTechnicalLetters/ETL_1100-2-1.pdf

USDOT's Literature Review: Climate Change Vulnerability Assessment, Risk Assessment, and Adaptation Approaches

https://www.fhwa.dot.gov/environment/sustainability/resilience/publications/vulnerability_assessment/index.cfm#Toc236233843

Endnotes

¹Kopp, R. E., Horton, R. M., Little, C. M., Mitrovica, J. X., Oppenheimer, M., Rasmussen, D. J., ... Tebaldi, C. (2014). Probabilistic 21st and 22nd century sea-level projections at a global network of tide-gauge sites. *Earth's Future*, 2(8), 383-406.