RMAT's Climate Resilience Design Standards Tool

Overview

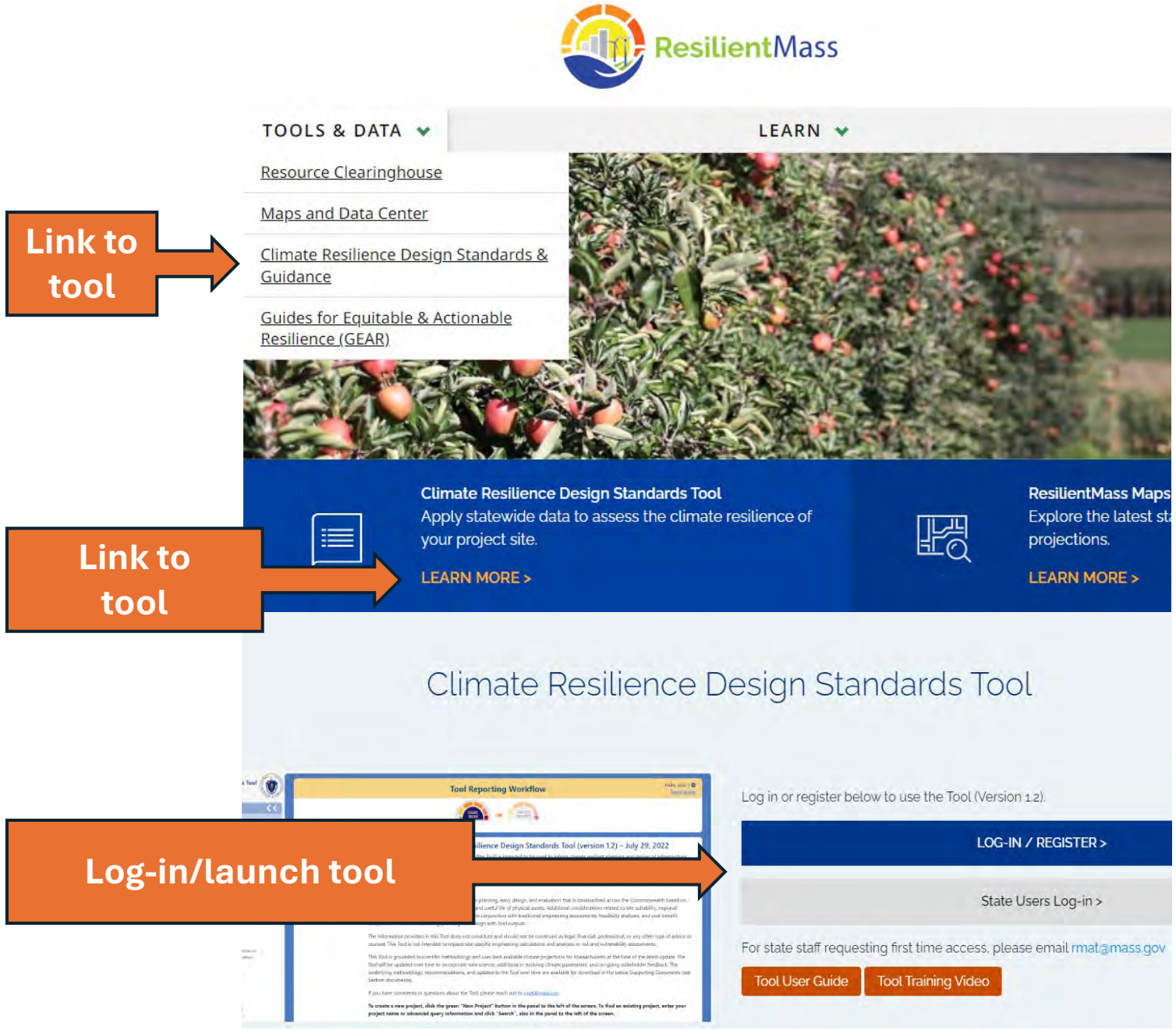
June 2024

Executive Office of Energy and Environmental Affairs

ResilientMass
Climate Adaption Clearinghouse for the Commonwealth

Tool Goals:

- Make preliminary climate resilience analysis **more broadly accessible**
- Inform **"climate smart"** capital planning, project design and procurement
- Provide recommendations based on **consistent use** of state's climate data
- Provide a unified planning and design **support tool** that state agencies can use to administer grant programs
- Provide **consistent information to municipalities** hosted on **resilient.mass.gov**

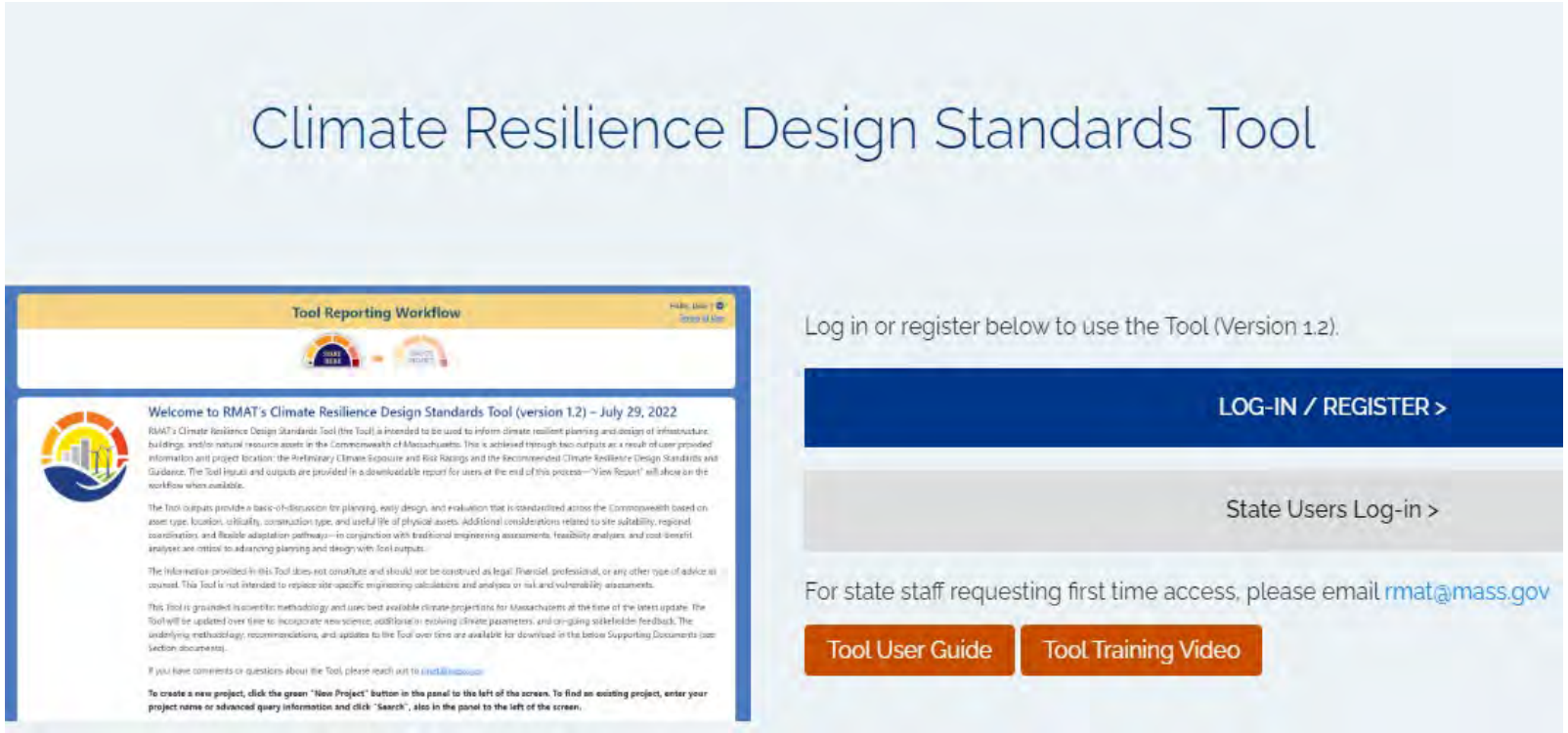


https://resilient.mass.gov/

When to use this tool:

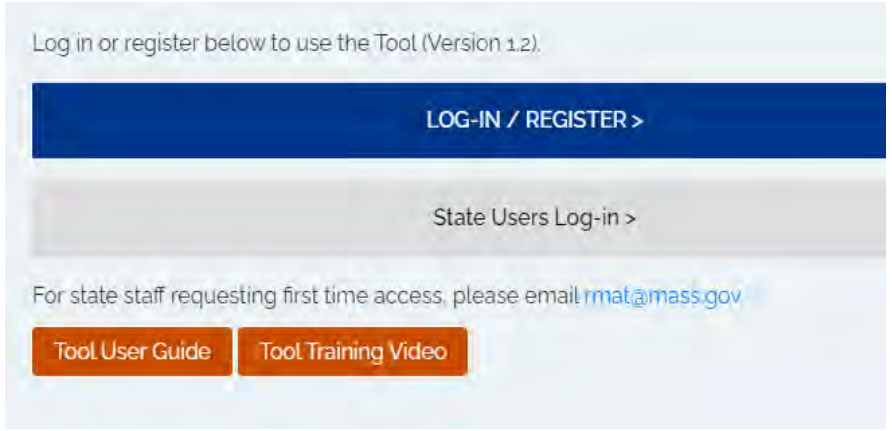
The Tool outputs provides a basis-of-discussion for planning, early design, and evaluation that is standardized across the Commonwealth based on asset type, location, criticality, construction type, and useful life of physical assets.

- **Project planning, design and procurement**
- Project siting
- Improving a state grant application



https://resilient.mass.gov/rmat_home/designstandards/

Key available resources:



User guide

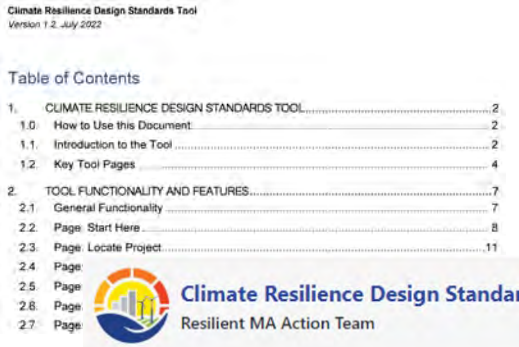
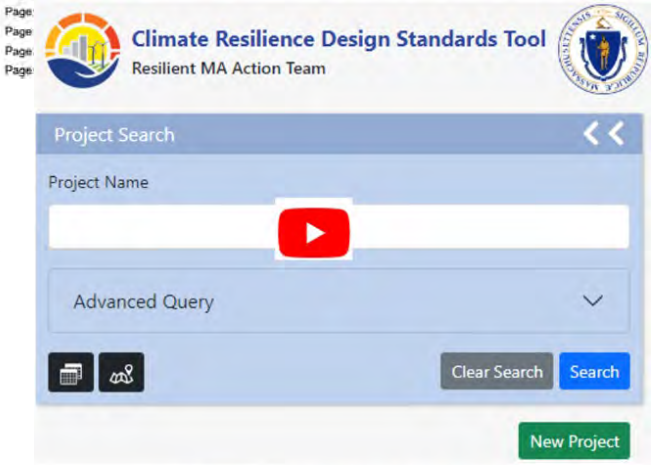

Climate Resilience Design Standards Tool
Version 1.2, July 2022

Table of Contents

1. CLIMATE RESILIENCE DESIGN STANDARDS TOOL 2
1.0 How to Use this Document 2
1.1. Introduction to the Tool 2
1.2. Key Tool Pages 4
2. TOOL FUNCTIONALITY AND FEATURES 7
2.1 General Functionality 7
2.2. Page: Start Here 8
2.3. Page: Locate Project 11
2.4 Page:
2.5. Page:
2.6. Page:
2.7 Page:

Training video



Tool (V1.2) Training Video - February, 2023

Guidance and Best Practices

The Climate Resilience Design Guidance provides general design guidance to consider while implementing resilience principles that are not specific to project type or climate hazards, and are illustrated through exam the Guidance considerations and document decision making throughout the planning process.

Guidance and Best Practices PDF

Additional forms include:

- Site Suitability
- Regional Coordination
- Flexible Adaptation Pathways

Climate resilience design guidance and best practices

Table 1.1. Climate Resilience Design Guidance Best Practices

Considerations	Best Practice
Site Suitability (SS)	1. Reduce exposure to climate hazards 2. Mitigate adverse climate impacts and provide benefits 3. Protect, conserve, and restore critical natural resources on-site and off-site
Regional Coordination (RC)	1. Assess regional context of vulnerability 2. Evaluate impacts beyond site-specific design 3. Optimize capital investment opportunities 4. Prioritize services and assets that serve vulnerable populations
Flexible Adaptation Pathways (AP)	1. Embed future capacity and design for uncertainty 2. Design for incremental change 3. Encourage climate mitigation and other co-benefits 4. Prioritize nature-based solutions 5. Prepare for current and future operational and maintenance needs

Documentation and training for technical data inputs:

- Massachusetts Coast Flood Risk Model (MC-FRM) FAQ (April 6, 2022)
- Massachusetts Coast Flood Riks Model (MC-FRM) Online Trainings (April-May 2023)
- EEA's Climate and Hydrologic Risk Project - Weather Generator Technical Document (April, 2022)
- EEA's Climate and Hydrologic Risk Project - IDF Curves Technical Document (December, 2021)

https://resilient.mass.gov/rmat_home/designstandards/

Getting Started

Log-in at:
https://resilient.mass.gov/rmat_home/designstandards/

External users must follow register wizard for first time access

State users should request first time access at rmat@mass.gov

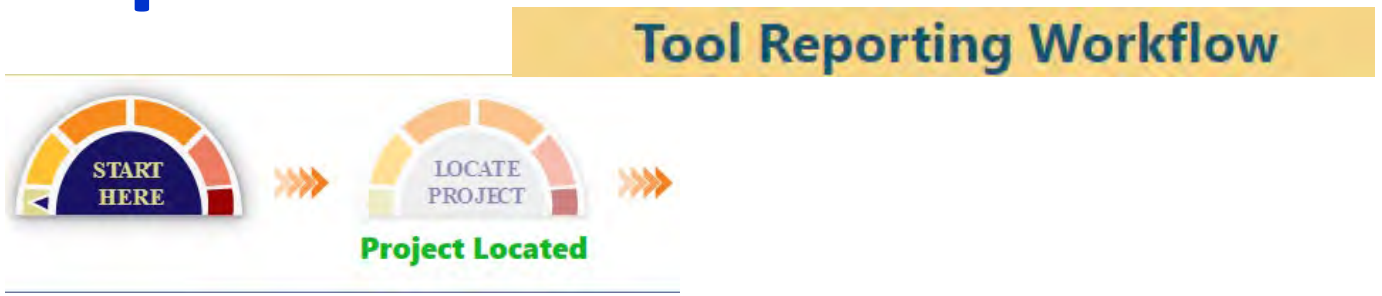
*Extra lead time needed for new tool accounts with **@dot.state.ma.us** email addresses

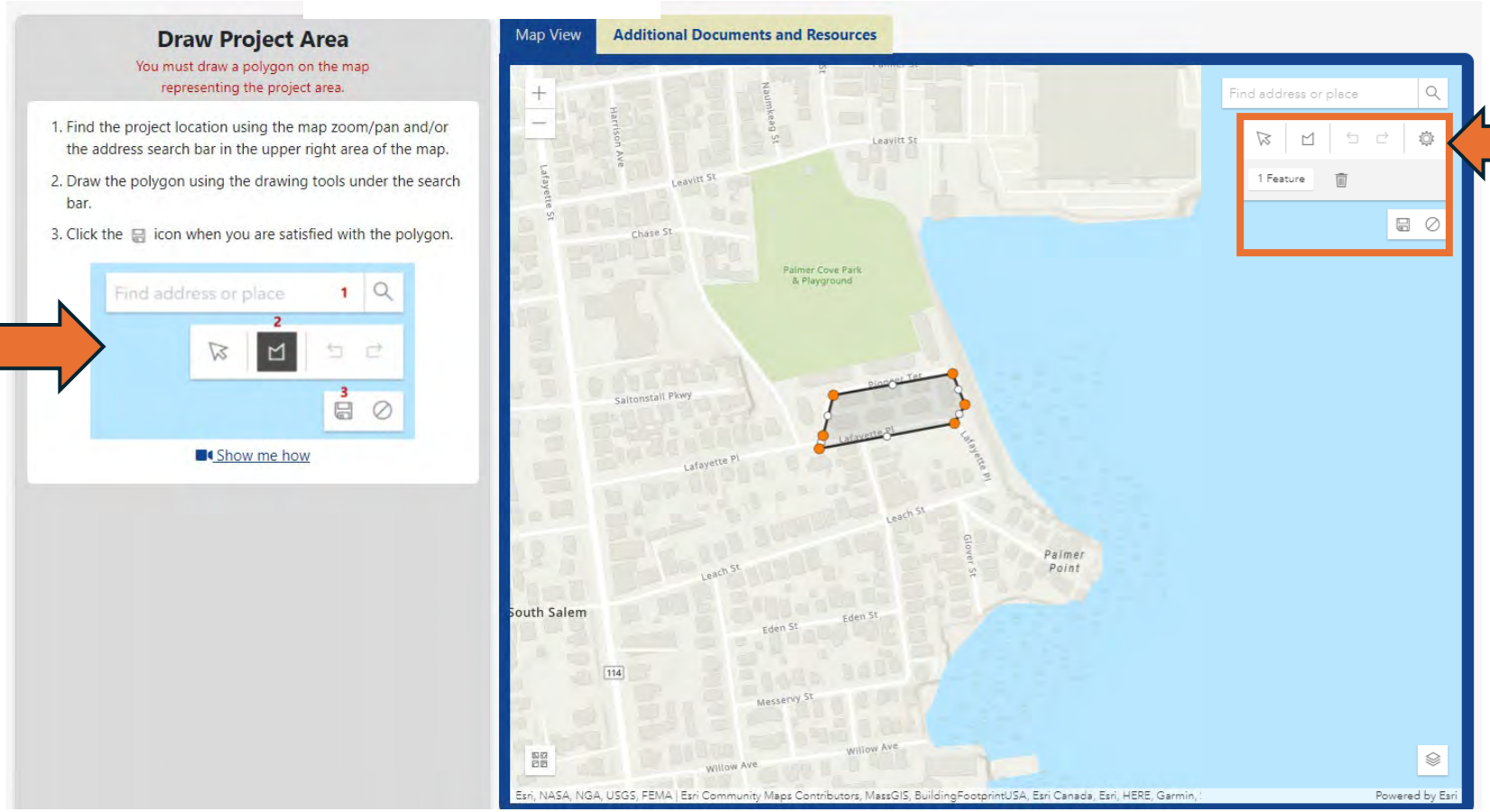
Search for existing projects,

OR

Click on **“New Project”** to start

Project Inputs

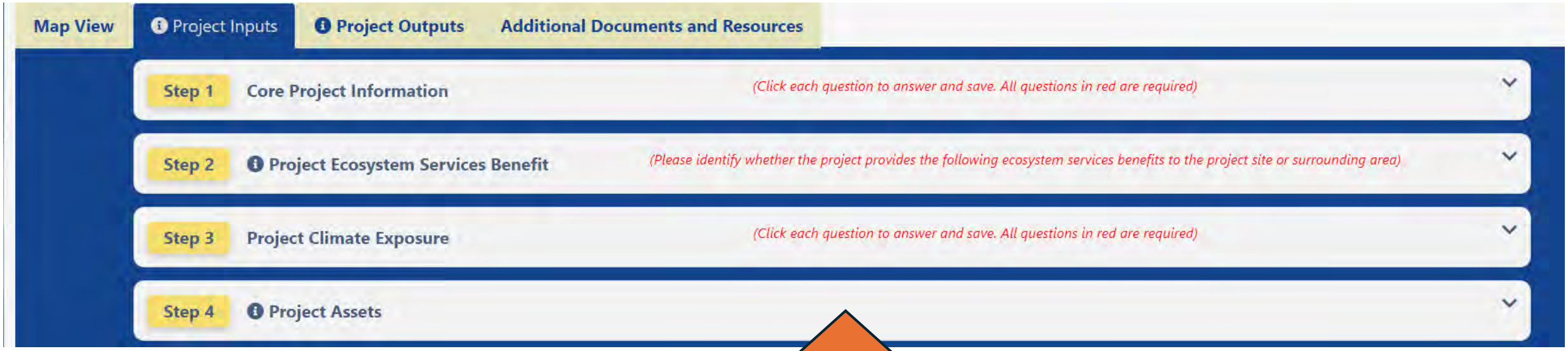




Draw project footprint

Drawing tools

Project Inputs



Answer input questions for four steps:

1. **Contextual Information**
2. **Environmental benefits from project**
3. **History of hazard exposure**
4. **Asset specific information**

Project Inputs

Tool Reporting Workflow

Workflow expands once inputs have been completed

STEP 2:
Environmental benefits from project

Step 2 | **Project Ecosystem Services Benefit**

Provides flood protection through green infrastructure or nature-based solutions	No
Provides storm damage mitigation	No
Provides groundwater recharge	No
Protects public water supply	No
Filters stormwater	No
Improves water quality	No
Promotes decarbonization	Yes
Enables carbon sequestration	Yes
Provides oxygen production	No
Improves air quality	No
Prevents pollution	Yes
Remediates existing sources of pollution	No
Protects fisheries, wildlife, and plant habitat	No
Protects land containing shellfish	No
Provides pollination	No
Provides recreation	No

Guidance (i)

STEP 3:
History of hazard exposure

Step 3 | **Project Climate Exposure**

Does the project site have a history of coastal flooding?	Yes
Does the project site have a history of flooding during extreme precipitation events (unrelated to water/sewer damages)?	No
Does the project result in a net increase in impervious area of the site?	No
Does the project site have a history of riverine flooding?	No
Are existing trees being removed as part of the proposed project?	No

STEP 4:
Asset specific information

Step 4 | **Project Assets**

Building/Facility — Add

UserGuide Building

Infrastructure — Add

N/A

Natural Resources — Add

N/A

Selected Asset:	UserGuide Building
Asset Type:	Typically Occupied
Asset Sub-Type:	Residential building - Public Housing
Construction Type:	Maintenance (critical repair)
Construction Year:	2025
Useful Life:	15

Identify the length of time the asset can be inaccessible/inoperable without significant consequences.	Building must be accessible/operable at all times, even during natural hazard event
Identify the geographic area directly affected by permanent loss or significant inoperability of the building/facility.	Impacts would be limited to local area and/or municipality
Identify the population directly served that would be affected by the permanent loss of use or inoperability of	Less than 1,000 people

Outputs: Project Level Scores

Outputs: Project Level Scores

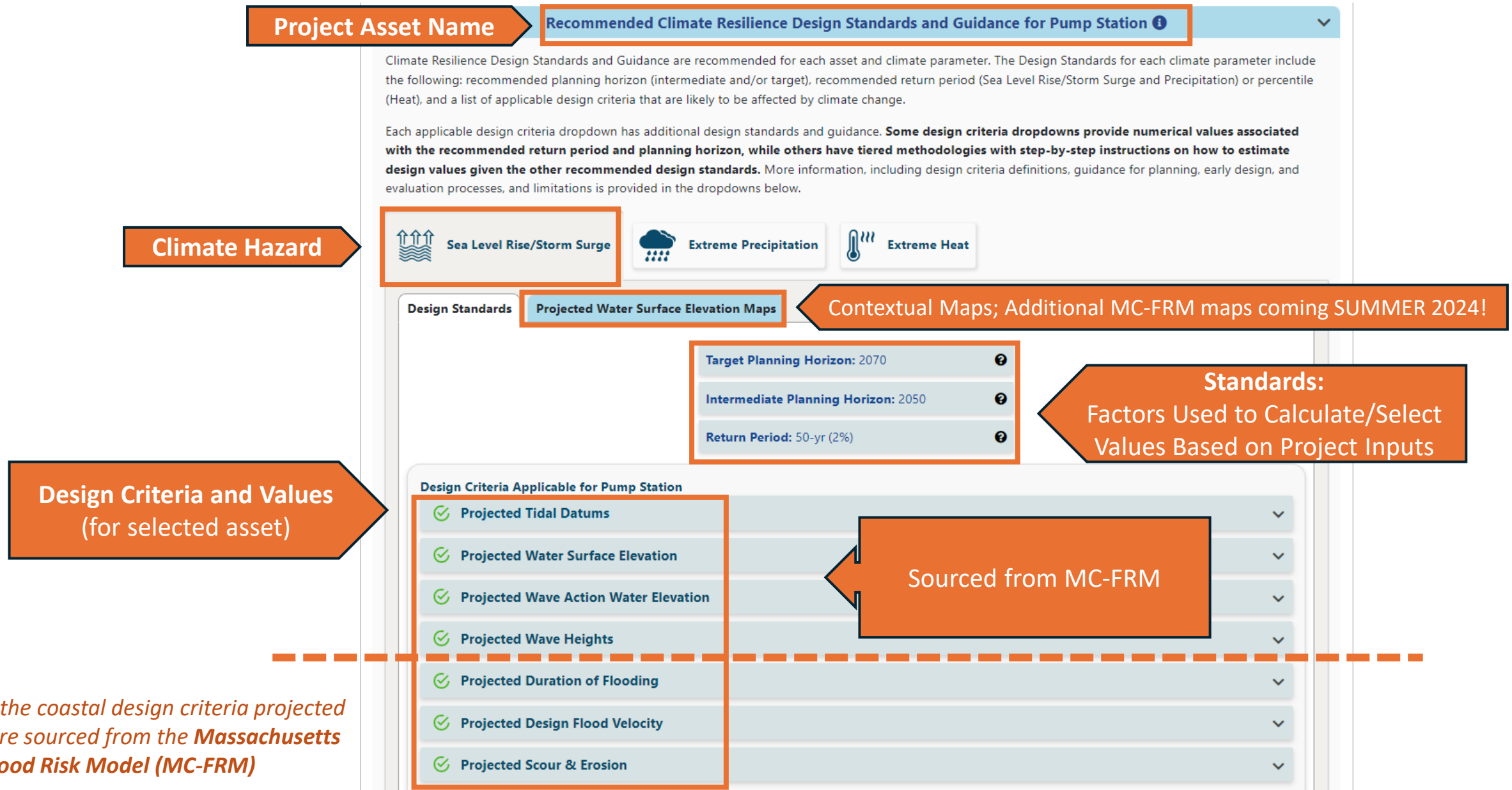
Outputs: Asset Climate Risk Rating

Tool projects can accommodate multiple assets

*Will receive **climate risk** rating for **each asset** entered*

NOTE: While it is possible to get a "no exposure" **project** score for "Sea Level Rise/Storm Surge" or "Extreme Precipitation – Riverine Flooding" because geographically dependent, the tool will still give an **asset risk score** (low).

Outputs: Standards/Design Criteria (Coastal Flooding)



*Most of the coastal design criteria projected values are sourced from the **Massachusetts Coast Flood Risk Model (MC-FRM)***

Outputs: Design Value Guidance (Coastal Flooding)

Design Criteria Applicable for Pump Station

Projected Tidal Datums

Projected Water Surface Elevation

Name of Design Standard/Value

Definition

Projected Water Surface Elevation is the projected elevation for a specific future flood event, considering storm surge, tides, and wave setup. Wave setup, as included in water surface elevation, is defined by FEMA as "an increase in the total stillwater elevation against a barrier (dunes, bluffs, or structures) caused by breaking waves." (https://www.fema.gov/sites/default/files/2020-02/Coastal_Wave_Setup_Guidance_Nov_2015.pdf).

Projected Water Surface Elevation Values:

Explanation of value

The projected modeled elevations may vary across large sites due to variations in the site's physi
presented as a maximum, minimum, and area weighted average values in the table below. The a
value corresponding to the projected Water Surface Elevation of the project site.

Value(s) for selected asset

Asset Name	Recommended Planning Horizon	Recommended Return Period	Max	Min	Area Weighted Average
			(ft - NAVD88)		
Pump Station	2050	2% (50-Year)	12.1	12.0	12.0
	2070		13.9	13.8	13.8

How Water Surface Elevation may inform Planning

How Water Surface Elevation may inform Early Design

How Water Surface Elevation may inform Project Evaluation

Guidance on how to use values during Planning, Early Design, and *Project Evaluation (e.g., MEPA)*

Limitations for Projected Water Surface Elevation Values, Standards, and Guidance

Outputs: Coastal Flooding Maps

Sea Level Rise/Storm Surge | Extreme Precipitation | Extreme Heat

Design Standards | Projected Water Surface Elevation Maps | Projected Wave Action Water Elevation Maps

Additional MC-FRM maps coming SUMMER 2024!

The following maps illustrate the Projected Wave Action Water Elevation for the 2030, 2050, and 2070 planning horizons corresponding to the lowest return period (largest design storm) recommended across the assets identified for this project in the Tool (see Recommended Design Standards Section below for projected values for individual assets). For projects that only have Natural Resource assets, the maps will show the Projected Wave Action Water Elevations corresponding to the 5% (20-year) return period. The maps include the project area as drawn by the user with a 0.1 mile minimum buffer, but do not reflect the location of specific assets on the site. Users can zoom into a parcel for more information.

Legend

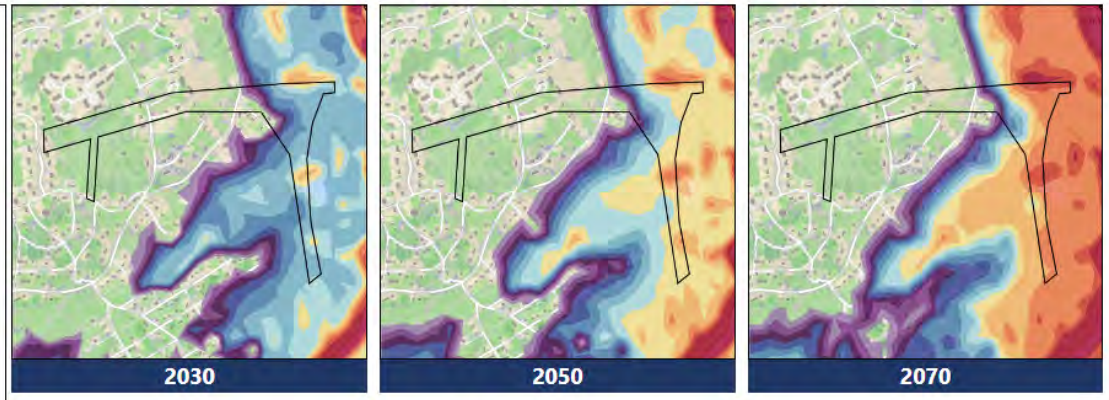
- Project Boundary
- Influenced by wave overtopping

Projected Wave Action Water Elevation (ft-NAVD88)

- ≤ 0.0
- 0.0 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.0
- 2.0 - 2.5
- 2.5 - 3.0
- 3.0 - 3.5
- 3.5 - 4.0
- 4.0 - 4.5
- 4.5 - 5.0
- 5.0 - 5.5
- 5.5 - 6.0
- ≥ 6.0

Climate Resilience Design Standards Tool:
Sea Level Rise/Storm Surge Design Criteria

Click to Expand Maps



0.25 0.5 1.0 Miles

N

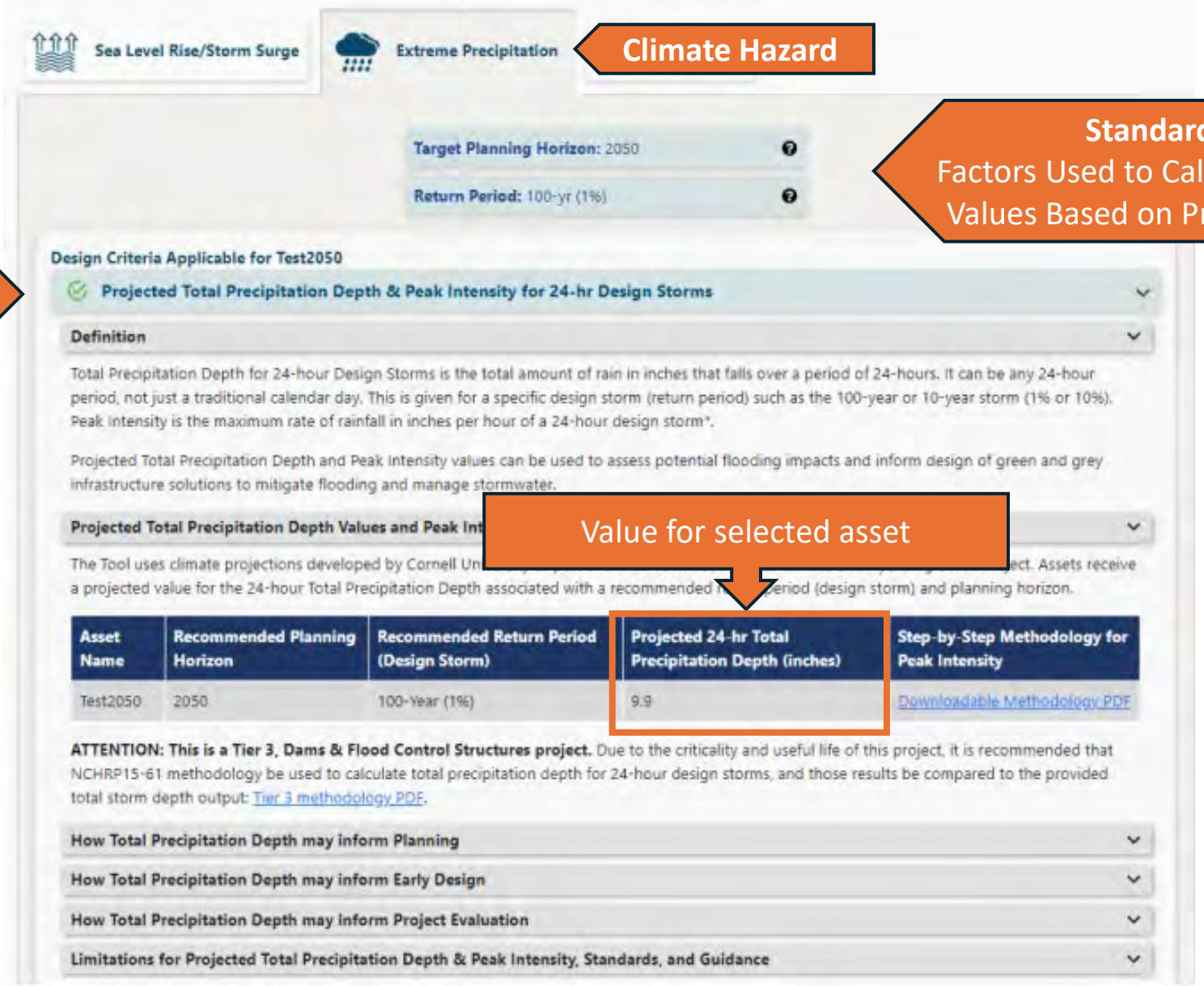
Projected Wave Action Water Elevation Map: 0.2% (500-yr)

Asset Name	Planning Horizon	Return Period	Max	Min	Area Weighted Average
			(ft-NAVD88)		
Hartford Avenue	2050	0.2% (500-yr)	16.3	13.5	15.2

Project site with limited view context of projected coastal flooding

*Most of the coastal design criteria projected values are sourced from the **Massachusetts Coast Flood Risk Model (MC-FRM)***

Outputs: Standards/Design Criteria (Precipitation)

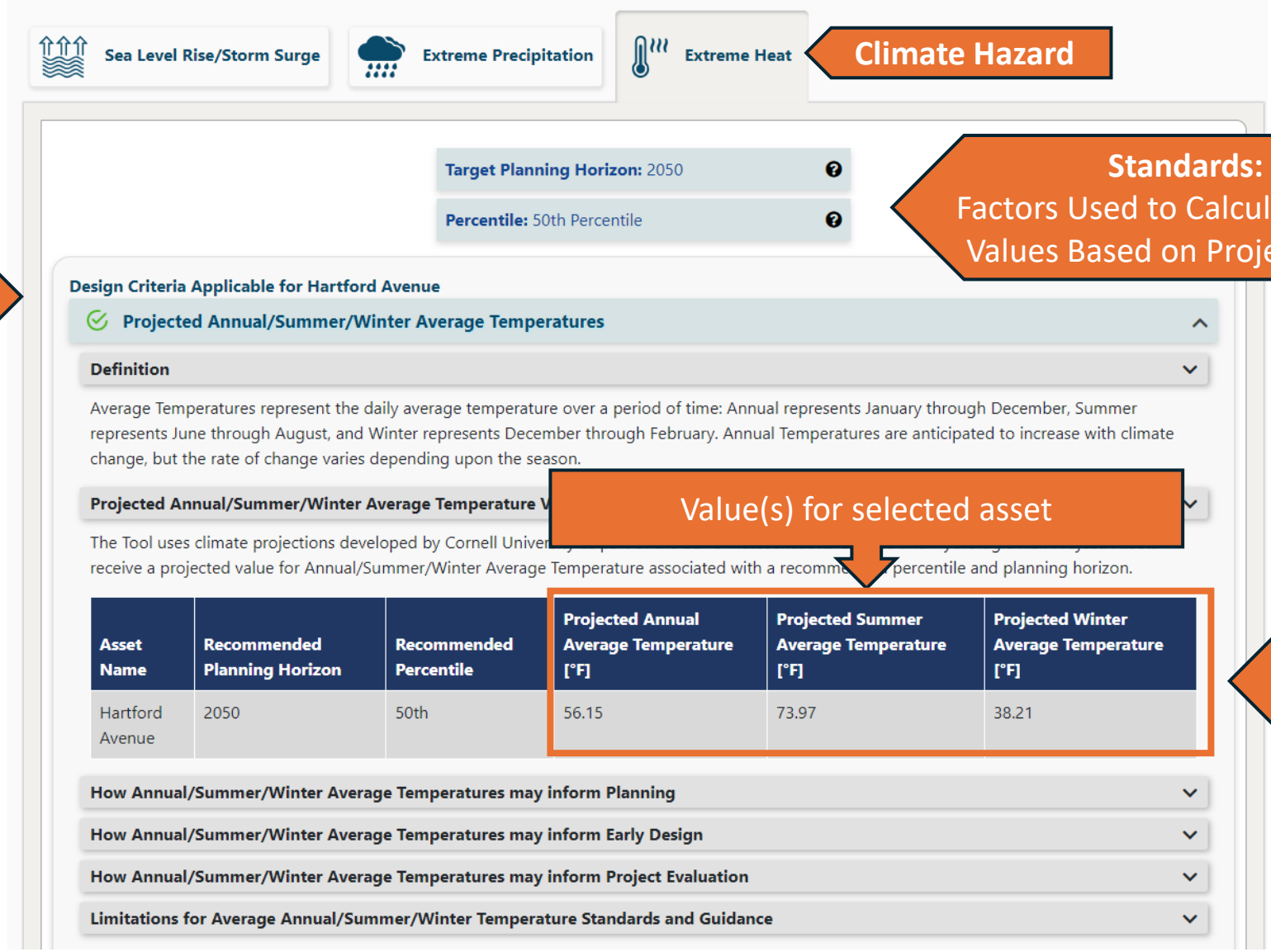


*Will receive recommended standards and design criteria for **each asset** entered*

*Explore **additional design storm precipitation values** on external dashboard:*

https://mass-eoeea.maps.arcgis.com/apps/dashboards/2e8534bc2a7849b0aa6f64d0f79a8937

Outputs: Standards/Design Criteria (Temperature)



Download Project Report

Preview report summary on **View Report** workflow page

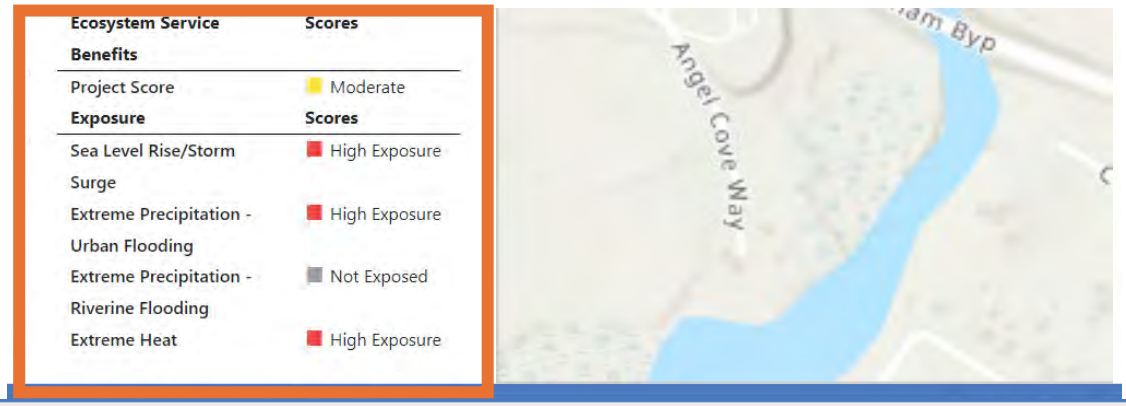
Download PDF of project report

Click **“Submit”** report

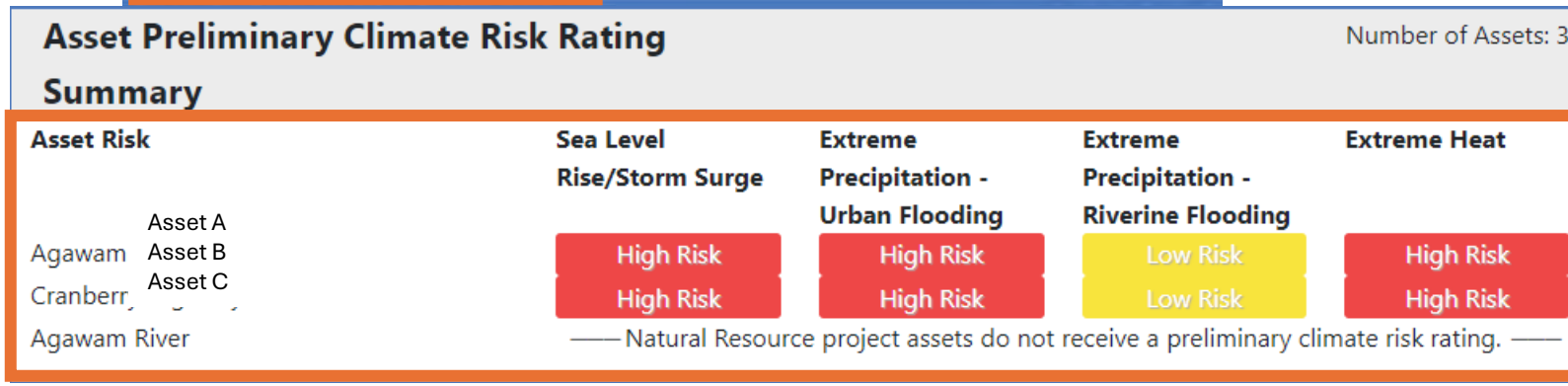
Upload/attach PDF to respective grant portal/MEPA filing

View Report page

Full project site exposure scores

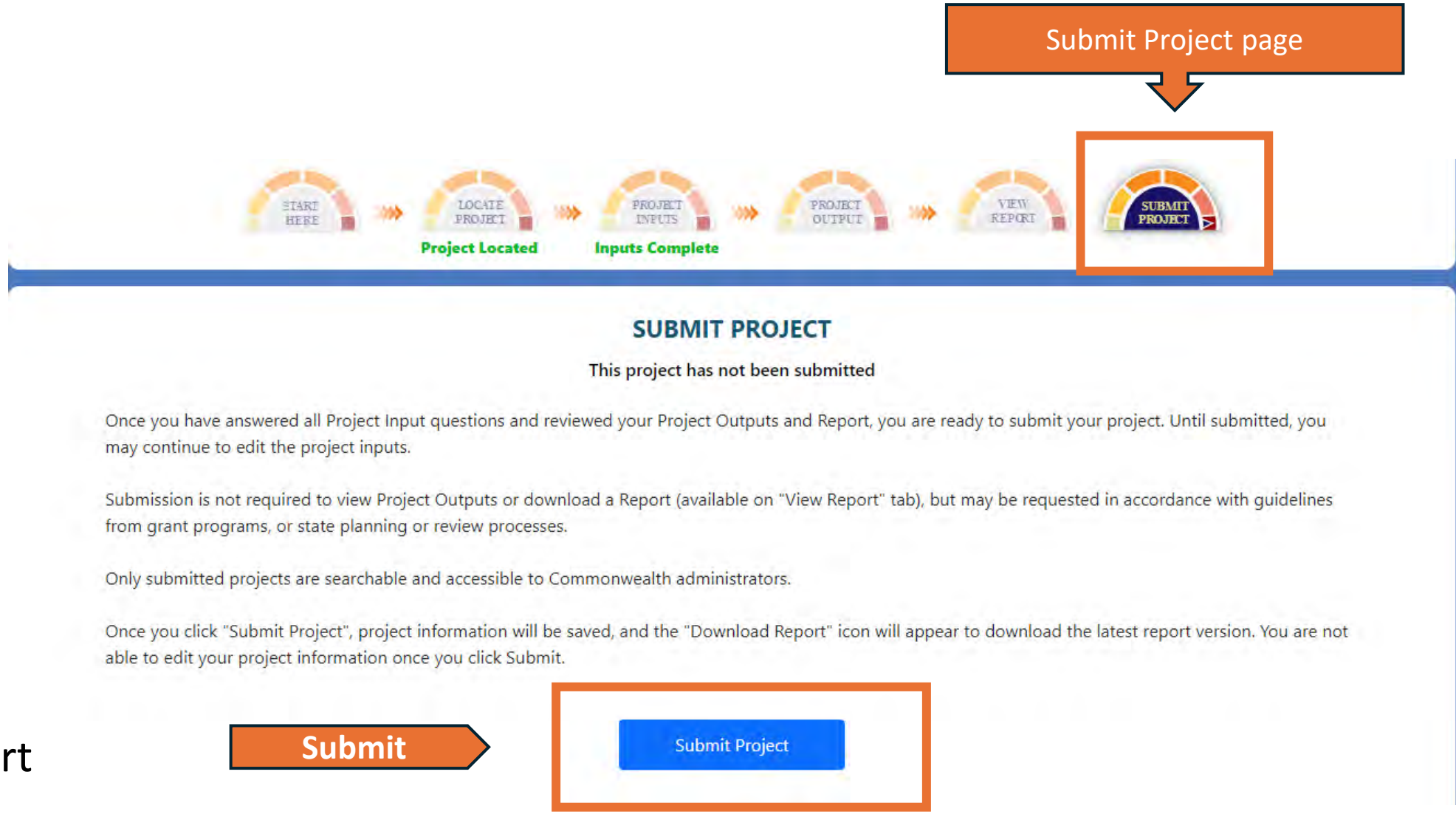


Asset Risk Ratings *(for each asset)*



Submit Project Report

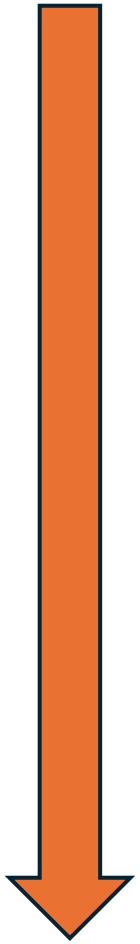
Submit Project page



Click **“Submit”** report

Submit

Tool Version history



Beta Tool (April 2021)

- MVP and Massworks requested Tool reports in grant applications

Version 1.0 (February 2022)

- Climate exposure updates
- Ecosystem service benefits updates
- Additional in-tool guidance

Version 1.1 (April 2022)

- **MC-FRM Level 2 outputs** (dynamic tables for applicable coastal design criteria)
- MA Climate Hydrologic Risk Project outputs (dynamic tables for applicable extreme precipitation design criteria)

Version 1.2 (July 2022)

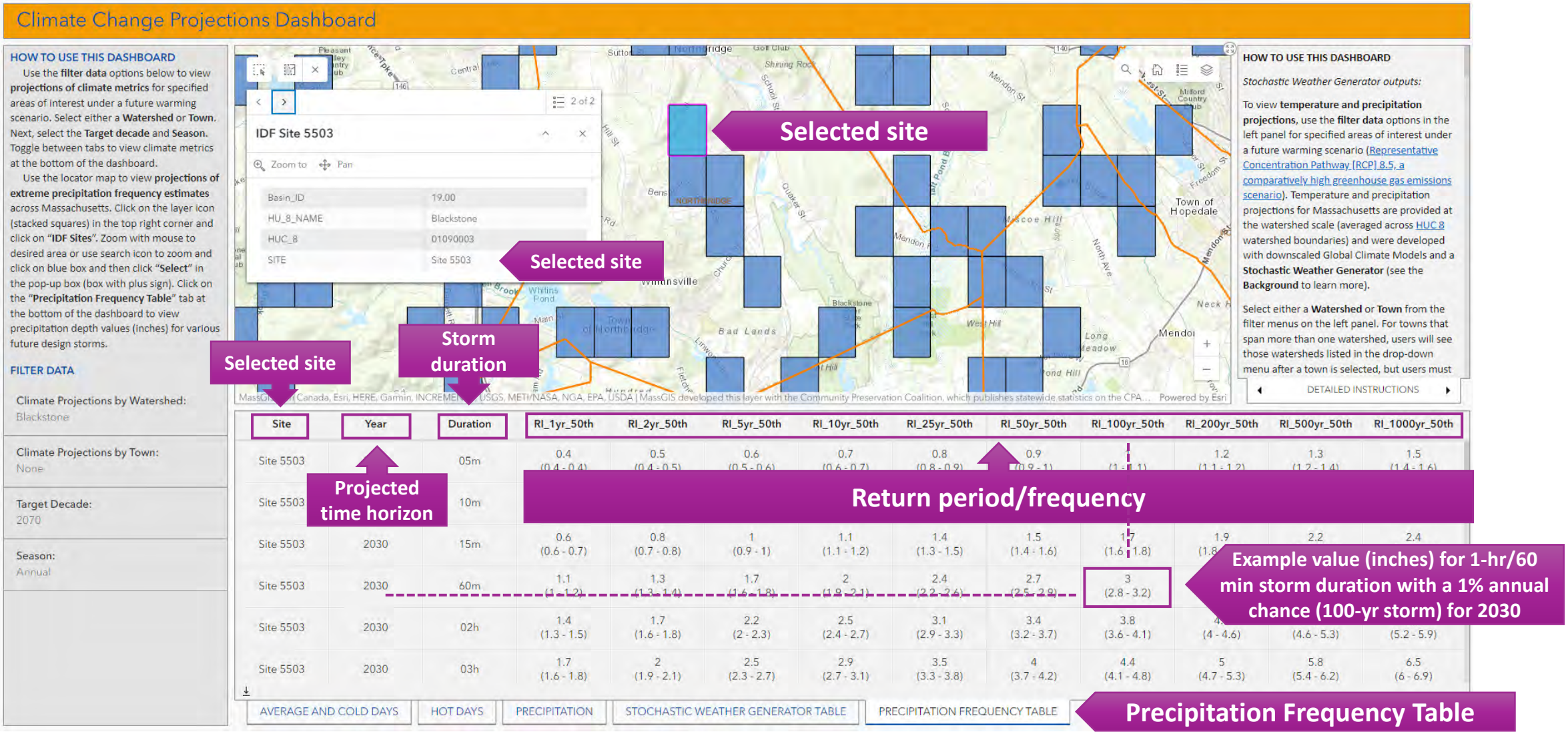
- **MC-FRM Projected Water Surface Elevation Maps** (interactive in-tool interface and printed maps in project report)

Version 1.3 (2024) – In progress

- Updates to temperature design standards (**adding** projected values into tool interface)
- Additional MC-FRM maps (**Projected Wave Action Water Elevation**)
- Bug fixes

Related resources:

Climate informed precipitation values (Intensity-Duration-Frequency)



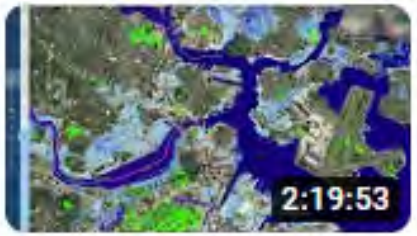
https://mass-eoeea.maps.arcgis.com/apps/dashboards/2e8534bc2a7849b0aa6f64d0f79a8937

Related resources: Massachusetts Coast Flood Risk Model (MC-FRM)

Training Videos

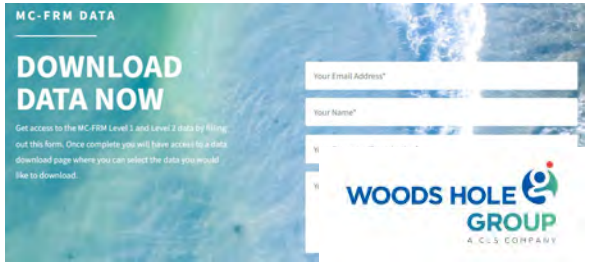
1

2

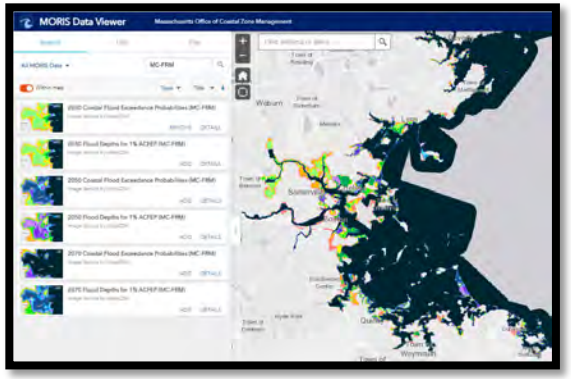


3

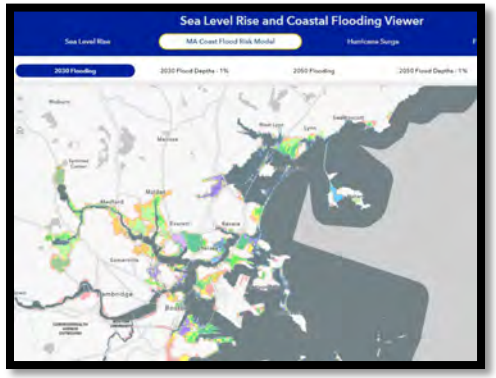
Data Download Page



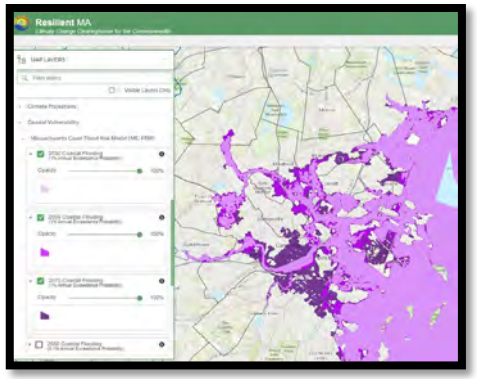
State Data Viewers



CZM's MORIS Data Viewer



CZM's Sea Level Rise and Coastal Flooding Viewer



ResilientMass Climate & Hazards Viewer

ResilientMass

Climate Adaption Clearinghouse for the Commonwealth

Reach out to rmat@mass.gov with any questions!

*NOTE: There is no full-time dedicated staff to support technical issues pertaining to the tool, so please allow at least three to five business days to resolve issues.