Natural Hazard Risk Assessment Guidance for Marine Oil Terminals

December 2024

Petroleum Management Division
Bureau of Remediation and Waste Management

Sprague, Searsport

MAINE DEPARTMENT OF ENVIRONMENTAL PROTECTION
17 State House Station | Augusta, Maine 04333-0017
www.maine.gov/dep

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Paul Aronian	FPL Wyman Terminal
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Julie Rosenbach	City of South Portland
Terry Sullivan	Sunoco Mid Stream, LLC
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Bruce Yates	Global Terminal
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Contents

I. What is the Purpose of this Guidance?

This guidance is intended to assist marine oil terminal owners and operators in the implementation of rule changes contained in Chapter 600 the Oil Discharge Prevention and Pollution Control Rules for Marine Oil Terminals, Transportation Pipelines and Vessels. The 2023 amendments to Chapter 600 incorporate new siting, design, operation, and planning for climate change including a Natural Hazard Risk Assessment (NHRA) requirement with several new flooding standards. The NHRA requires facilities to assess the risk of flooding events and projected sea level rise and to identify actions for infrastructure resilience. Use of this guidance is voluntary. A terminal may utilize different approaches provided the result meets the requirements of the rule.

A working group was tasked to create this guidance for the development of a NHRA. A significant focus of the NHRA is to inform facilities adaptions to withstand natural hazard impacts that could result in the release of oil and other contaminants such as lead and fuel additives, but this is not the only consideration. Other examples of considerations are to assess if damage to infrastructure could affect operations, result in movement of structures to other properties causing third-party damages, or damage to a facility's SCADA (Supervisory Control and Data Acquisition) system which controls and monitors tank valves, pumping, and other operational tasks.

The best practices incorporated in this document are designed to facilitate addressing the risk of a 100-year (1% annual chance) flood for present-day sea level and sea level 30 years in the future under both Intermediate and High Sea Level Rise scenarios into infrastructure resilience planning. This approach is consistent with the 2020 and 2024 Maine Climate Council (MCC) recommendation to manage for future flood risk using localized sea level rise scenarios consistent with the U.S. Interagency Sea Level Rise Task Force (Sweet et al. 2022), with the choice of scenario depending on the risk associated with flooding of the asset under consideration (MCC Scientific and Technical Subcommittee (STS). 2024).[1] The sea level rise scenarios represent an amount of sea level rise estimated for a specified time in the future. Based on these reports and as requested by the Legislature, the Maine Department of Environmental Protection (Department) adopted this approach for Chapter 600.

A NHRA will be submitted with each new or renewal oil terminal license application filed by a marine oil terminal facility to the Department. Chapter 600 is applicable to all marine oil terminals in the State of Maine, which are currently sited in South Portland, Yarmouth, Bucksport, and Searsport. The authority for Chapter 600 is found in 38 M.R.S. § 546(4).

[1] The Legislatively established Scientific and Technical Subcommittee of the Maine Climate Council prepared the report *Scientific Assessment of Climate Change and Its Effects in Maine*, which included science-based sea level rise projections that were subsequently adopted by the Maine Climate Council in its 2020 Climate Action Plan *Maine Won't Wait*.

Sprague, South Portland

Explanation of Information in Gray Boxed Areas within this Guidance

This guidance identifies required components of a NHRA. However, the user of this guidance may choose to include additional sources of information or use more cautious assessment tools, maps, or methods to assess for more severe risks than those required by Chapter 600.

Information in this document that is contained within gray boxed areas indicates information that is not required to be used for meeting Chapter 600 standards, but the reader might find useful for a more robust assessment and identification of adaptation actions. The information reflects NHRA workgroup discussion and suggests additional reference sources, examples addressing aspects of how a NHRA might be structured and implemented, and other possible approaches. The gray boxed areas can be found directly following the required sources of information.

II. What is Required for the Natural Hazard Risk Assessment?

A Natural Hazard Risk Assessment is the process of evaluating vulnerabilities of individual assets based on observed and foreseeable natural hazards using the best available scientific evidence and local knowledge.[2] In the context of Chapter 600 a NHRA is a method to examine a state of conditions at a marine oil terminal for the likelihood of an undesirable outcome, and the severity of that outcome. This is completed to support decision making and future planning for climate change.

Goals of this Natural Hazard Risk Assessment Guidance for Chapter 600 are to:

- Strengthen the Natural Hazard Risk Assessment process and outcomes;
- Ensure facilities receive helpful guidance from the Department;
- Reduce the level of effort for all parties involved with the Natural Hazard Risk Assessments;
- Provide consistent guidance to facility operators; and
- Allow for flexibility in how regulatory requirements are met to best address risk management at diverse facilities.

Objectives for the Chapter 600 Natural Hazard Risk Assessment are to:

- Define and characterize the critical system operations and the infrastructure assets supporting them;
- Analyze infrastructure and determine vulnerable and critical infrastructure, including critical assets that are dependent upon the operation of another asset to function;
- Understand the impacts of disruptive events on the facility and the facility's impacts on adjacent areas;
- Develop and evaluate alternatives that would improve resiliency to natural hazard events; and
- Develop a report that summarizes the findings, provides support for the findings, and is clear on the impacts, adaptations and timelines that are recommended.

In addition to the primary goals and objectives, facility risk assessment processes have demonstrated the ability to achieve **additional benefits** including improved understanding between stakeholders and partners, a holistic understanding of vulnerability, and buy-in from leadership to support dedicating resources to identified improvements.

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[2] Goals, objectives, and additional benefits for the Ch. 600 NHRA guidance have been informed by the NHRA work group and the *Marine Transportation System Resilience Assessment Guide*, February 2023 developed by US Department of Homeland Security (USDHS) Cybersecurity and Infrastructure Security Agency and US Army Corps of Engineers (USACE) Engineer Research and Development Center.

Requirements of the NHRA required for Chapter 600 are current and future flood risks associated with 100-year (1% annual chance) flood scenarios and the Intermediate and High Sea Level Rise (SLR) scenarios. The 100-year precipitation or 100-year flood event has a 1% chance of occurring every year over a 100-year period. Another way to think of this probability is over a 30-year period the 1% annual chance event has a 26% chance of occurring. The NHRA evaluates likelihoods, possible impacts, and resulting consequences of these natural hazards.

Below is the regulatory language for the Facility Drainage Systems and the Natural Hazard Risk Assessment sections of Chapter 600 (as adopted 6/6/23) that this document addresses. For a more complete list of sections that relate to climate change and other related topics, see Appendix B.

Chapter 600, Section 7 (E) Facility Drainage Systems

(1) Design. The water collection, drainage, discharge, and oil/water separator system must be designed and signed and sealed by a Maine licensed professional engineer or an engineer otherwise working in compliance with Maine's professional regulation statutes. The design and operation collectively must provide for operational stresses likely to be encountered in Maine, such as frost action, a 24-hour storm, 100-year precipitation event and other site specific factors. All buried or partially buried oil/water separators must be of a design and construction (approved by the Department) that will prevent releases due to corrosion or structural failure for the operating life of the system.

(a) The oil/water separator systems must be constructed or lined with material that is compatible with the expected contents of the system.

(b) Underground or inground oil/water separator system must be:

(i) Cathodically protected against corrosion;

(ii) Constructed of non-corrodible material;

(iii) Steel clad with non-corrodible material;

(iv) Designed in a manner to prevent the release or threatened release of any stored substance due to corrosion; or

(v) Installed at a site that is determined by a NACE certified corrosion expert to be unlikely to have a release due to corrosion during its operating life. Owners and operators shall maintain records that demonstrate compliance with the requirements of this provision for the remaining life of the tank.

(2) Oil/Water Separators. Oil/water separators must be designed, licensed, operated, and maintained according to *Pollution Control,* 38 M.R.S. §413 (Waste Discharge Licenses) if the effluent is discharged directly into the waters of the State. If the effluent will be discharged to a POTW, the oil/water separator must also be designed, licensed, operated, and maintained according to the requirements of the POTW (in order to meet their state and local license requirements). If the oil/water separator is required to be registered in accordance with *Rules for Underground Oil Storage Facilities,* 06-096 C.M.R. ch. 691, it must be installed by a Maine Certified Underground Oil Storage Tank Installer.

(3) Drain Valves. Drain valves must be easily accessible for closing in an emergency under all conditions of operations. Flapper valves are not acceptable.

(4) Dike Drainage.

(a) Control of drain water from inside a diked area must be by a valve outside the diked area, locked in the closed position except at times of drainage operations under supervision by personnel trained in the proper operation of drains and separators. Drainage control valves may be located inside the diked area at existing facilities where #6 oil or asphalt is the only oil being stored in the diked area, provided that these drainage valves are locked in the closed position except during drainage operations under supervision by trained personnel, and that the dike valves are exercised monthly.

(b) All drainage through the oil/water treatment system from a containment dike must be locked out from discharge except at times of supervised drainage. All drainage must flow through an oil/water separator

(5) Oil Storage and Handling Area. Facilities must be graded to collect surface run-off and discharge it through an oil/water separator to a location approved by the Department. Such separators must be designed, installed, operated, and maintained to collectively handle a 24-hour storm, 100-year precipitation event.

The below two examples of an oil/water separator are not part of Chapter 600 but are provided in this location as an illustration of the components of such a system.

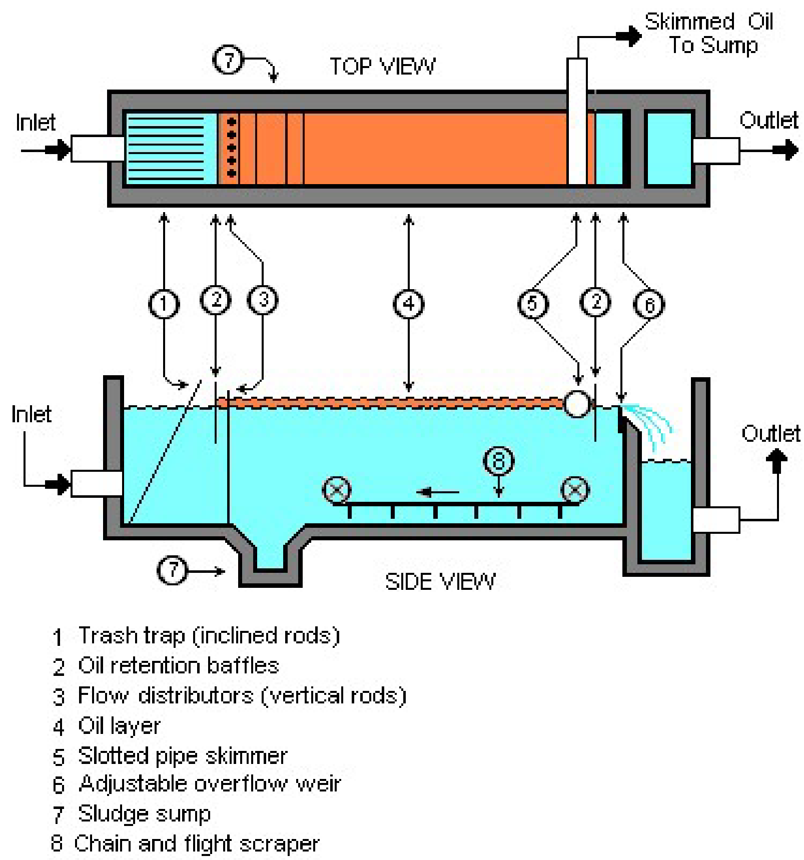


Figure 2.1: Design Example of a Gravimetric Oil/Water Separator by Milton Beychok

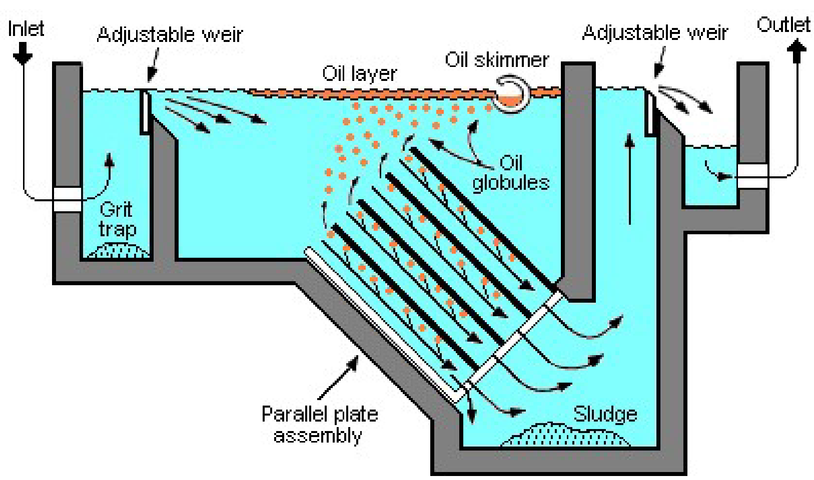


Figure 2.2: Design Example of a Parallel Plate Oil/Water Separator by Milton Beychok

Chapter 600, Section 7 (K). Natural Hazard Risk Assessment

All facility infrastructure must be assessed for current flood risk and for future flood risk. Potential impacts on adjacent properties must be identified including the possibility for damage to existing infrastructure and movement of product or contamination to adjacent areas.

(1) The assessment must identify the infrastructure evaluated. Future flood risk evaluation must consider a timespan of 30 years from the date of the evaluation.

(2) The assessment must review previous flood information and any costs resulting from flood damage; evaluate current flood risks from a 100-year flood event; and evaluate future flood risks using storm surge and waves from a 100-year flood event added to both the projected intermediate and high sea level rise scenarios. The assessment must consider impacts including but not limited to erosion, collision, scouring, flooding, and flotation, including the buoyancy of any empty or partially empty tanks and pipelines.

(3) The assessment must consider how to meet the Facility Drainage System 24-hour, 100-year precipitation event requirements of Section (7)(E)(1) and (5) and the portion of Section (8)(K) that relates to these two Sections. The assessment must determine how stormwater management measures can accomplish this requirement and must include a timeframe for implementation of any measures needed to comply with these Sections. The implementation schedule must be completed within 5 years following the submittal of the Natural Hazard Risk Assessment report in Section (7)(K)(6).

*Referencing 8(K) is a typo in the rule, Section 7(K) is meant to be referenced above.

(4) The worst case scenarios of hazards to vulnerable infrastructure must be considered in the assessment. Evaluation of potential impacts to critical infrastructure and operations including their consequences; identification of short- and long-term adaptation practices; prioritization of adaptive actions; costs of recommended adaptations; and presentation of recommendations that build resilience into the critical infrastructure must be included.

(5) An explanation of the data sources used in the assessment must be included in the final assessment document.

(6) A report detailing the results of the assessment must be included in the initial license application and any renewal applications. The report must clearly specify what adaptive measures, if any, are incorporated into the facility design based on the evaluation and must include an implementation schedule for these measures.

III. Where Do We Acquire the Data to Complete a Natural Hazard Risk Assessment?

This Section covers sources of information and procedures to assist with due diligence for natural hazard and climate change rule requirements when conducting a NHRA pursuant to Chapter 600. The Department maintains a data folder containing NHRA information for all marine oil terminal locations to access in order to ease the risk assessment process.

Data Sources and Methods for Completing the Natural Hazard Risk Assessment

Completing the Natural Hazard Risk Assessment requires reviewing historic information and information on future climate conditions. Effective risk assessment processes combine natural hazard data, facility information, and local knowledge. Reports, data, and maps should be reviewed for the project location to inform the NHRA and a license application or renewal. Current and past employees or others who are knowledgeable about what has already occurred at the site during natural hazard events are also excellent sources of information.

HIGHLIGHTED RESOURCE

Scientific Assessment of Climate Change and its Effects in Maine – 2024 Update

Prepared by the MCC STS, this report includes detailed information on climate, hydrology, sea level rise and storm surge, and other relevant information for risk assessment and climate change planning. This report, as well as a directory of other natural hazard risk assessment information, can be found on the Maine Climate Hub.

Sea Level Rise Projections

The MCC STS provides updates to the recommended sea level rise scenarios for management decisions in Maine every 4 years. The most recent report was released in 2024, and another update will be released in 2028 that may alter sea level rise projections.

As of the 2024 MCC STS report, the state's "commit to manage" targets are consistent with the Sweet et al. (2022) Intermediate scenario (1.5 feet by 2050 and 4 feet by 2100, relative to 2000 mean sea level), which remain unchanged from the 2020 STS report. The "prepare to manage" targets are consistent with the High scenario (3 feet by 2050 and 8.8 feet by 2100) and were recommended in the 2024 STS report to be shifted (from the 2020 STS report) to two decades later.

A. Precipitation

Precipitation Data Source for Ch. 600 NHRA and 24-hour, 100-year (1% annual chance) Stormwater Design

The Department's Stormwater Management program and associated rule, Chapter 500, utilizes specific sources for precipitation data in their Stormwater Licenses. Since the marine oil terminal facilities need to account for precipitation in both the stormwater program and Chapter 600, marine oil terminals should use the rainfall data source in Chapter 500 for consistency when completing their NHRA's and in designing stormwater infrastructure at their facilities (i.e. drainage systems, oil/water treatment systems, containment dikes).

As of October 2024, the Department's Chapter 500 for Stormwater Management 24-hour duration rainfalls for various return periods (e.g. 25-year/4% annual chance, 50-year/2% annual chance, 100-year/1% annual chance) are derived from the Northeast Regional Climate Center's website, Extreme Precipitation Tables, which is based on June 2014 data from the National Oceanic and Atmospheric Administration's Regional Climate Center Program.

The Northeast Regional Climate Center hosts an interactive web tool and data portal to retrieve site specific precipitation tables, distribution curves, and intensity duration and frequency graphs to look at associated rainfall totals for the 24-hour, 100-year (1% annual chance) precipitation event.

Example for South Portland using the Northeast Regional Climate Center's interactive web tool

- 24-hour, 25-year / 4% annual chance = 5.94 (5.35-6.53)
- 24-hour, 100-year / 1% annual chance = 8.42 (7.30-9.54)

Precipitation Frequency Estimates (90% lower and upper confidence intervals). Data retrieved September 24, 2024.

Potential Change of Precipitation Data Source to National Oceanic Atmospheric Administration (NOAA) Atlas 14 & 15

NOAA Atlas 14 is an interactive web tool delivering precipitation frequency estimates and associated information.

Example for South Portland using NOAA Atlas 14:

24-hour, 25-year = 6.19 (4.97-7.74)
24-hour, 100-year = 7.94 (5.99-10.6) *

Precipitation frequency estimates (90% lower and upper confidence intervals). Data retrieved September 24, 2024.

*24-hour, 100-year with 18% multiplier = 9.37 (7.07-12.51). Adding a multiplier to the 24-hour, 100-year precipitation event is becoming an adopted practice across New England States to account for projected increases in total rainfall in the future due to climate change.

A stakeholder process informing revisions for Chapter 500 is currently underway in 2024. The Department anticipates the stakeholder process will be followed by a rulemaking process in 2025, which could incorporate using NOAA Atlas 14 (or 15 once updated).[3]

[3] NOAA Atlas 14 is in the process of being updated across the nation. This update is a step in the development of NOAA Atlas 15. In 2022 NOAA received first-ever direct Federal funding to (1) update the NOAA Atlas 14 precipitation frequency standard while accounting for climate change, and (2) develop precipitation frequency estimates for the entire U.S. and its territories. NOAA Atlas 15 will incorporate nonstationary approaches and be derived from climate model outputs to project precipitation frequency estimates into the future.

B. Coastal Flooding

Overview of Coastal Flood Risk Assessment Approach

This coastal flood risk assessment uses the 1% annual chance flood for present-day sea level and sea level 30 years in the future under an Intermediate and High Sea Level Rise scenario.

This list outlines the steps required for completing the NHRA. Each step is described in detail in the following sections.

STEP 1:	Use the most recent Federal Emergency Management Administration (FEMA) Flood Insurance Study (FIS) to determine the 1% annual chance Stillwater elevation (SWEL) at the coastal transect(s) nearest to the site.
STEP 2:	Adjust the 1% annual chance SWEL to present-day sea level (e.g. the year in which the risk assessment is being conducted) using the 1993-2023 measured rate of relative sea level rise at the Portland tide gauge.
STEP 3:	Determine the 1% annual chance SWEL for 30 years in the future by adding sea level rise, using median values of localized Intermediate and High scenarios.
STEP 4:	Determine site elevations, including flood protection and mitigation features.
STEP 5:	Map present and future 1% annual chance SWELs onto site elevations to assess inundation risk.
STEP 6: ***If the site is within or adjacent to a FEMA VE or Coastal A zone***	If the site is within a FEMA VE (Velocity) or Coastal A zone (indicating that there is the potential for damaging waves during the 1% annual chance event), assets in these areas must be identified as vulnerable to these natural hazards and a coastal engineering analysis that evaluates wave runup, wave overtopping, and wave loads on structures (where applicable) on top of present-day and future 1% SWELs must be included in the implementation schedule for these assets. A coastal engineering analysis is not required to be completed with the NHRA. Use the FEMA 1% annual chance significant wave height and wave period at the coastal transect(s) nearest to the site. Note: In VE and Coastal A zones, mapped FEMA floodplains and BFEs (peak total 1% annual chance water surface elevations), show the maximum inland extent and elevation of wave runup and overtopping; however, additional analysis is required to determine wave impacts to structures and assets at the site level.
STEP 7: ***Encouraged***	Consider adding freeboard, or additional elevation above the 1% annual chance water levels, as a margin of safety that accounts for statistical uncertainty and interannual variability in sea level, tides, and river flow.

Understanding Coastal Flooding in Maine

Multiple physical processes contribute to extreme flooding along Maine's tidally influenced coast (**Figures 3.1-3.2**). This NHRA method evaluates risks from 1) the 1% annual chance SWEL, which causes sustained inundation over minutes to hours and represents the combined impact of sea level, astronomical tides, storm surge, wave setup, and river flow (in estuarine areas); and 2) wave runup and overtopping that occur on top of the SWEL, caused by waves meeting the shoreline and breaking.

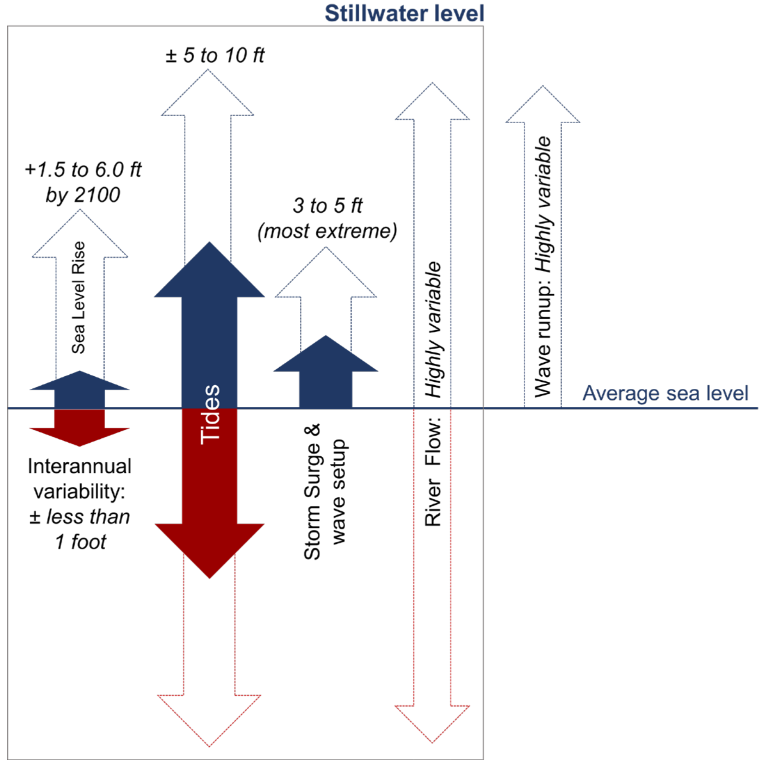


Figure 3.1. Physical processes that contribute to flooding along Maine's tidally-influenced coast. Average sea level varies by less than a foot on seasonal-to-annual timescales, and long-term sea level rise caused by anthropogenic warming will increase sea level 1.5 to 6 feet by 2100. Astronomical tides raise and lower water level twice per day by approximately 5 to 10 feet, depending on location. The most extreme storm surge and wave setup in Maine is 3 to 5 feet, and therefore generally smaller than the high tide. In estuarine locations, river flow may also raise or lower water level during coastal flood events. The combination of sea level, tides, storm surge, wave setup, and river flow represent the total SWEL that drives sustained inundation over minutes to hours. Wave runup, caused by waves meeting the shoreline and breaking, can lead to an additional uprush of water onshore. *Modified from Figure G1 of the 2024 STS report.*

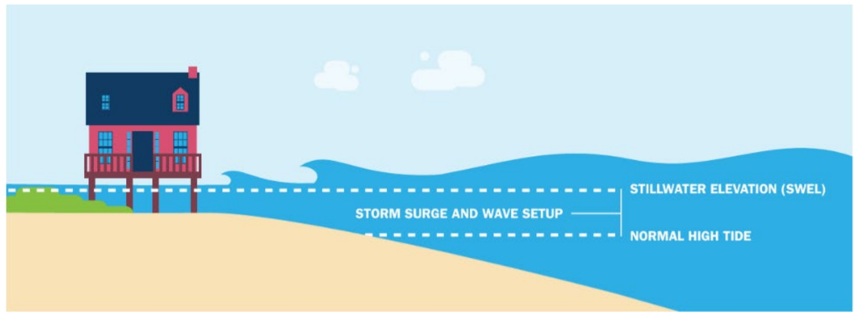
Understanding FEMA Flood Maps and Insurance Studies

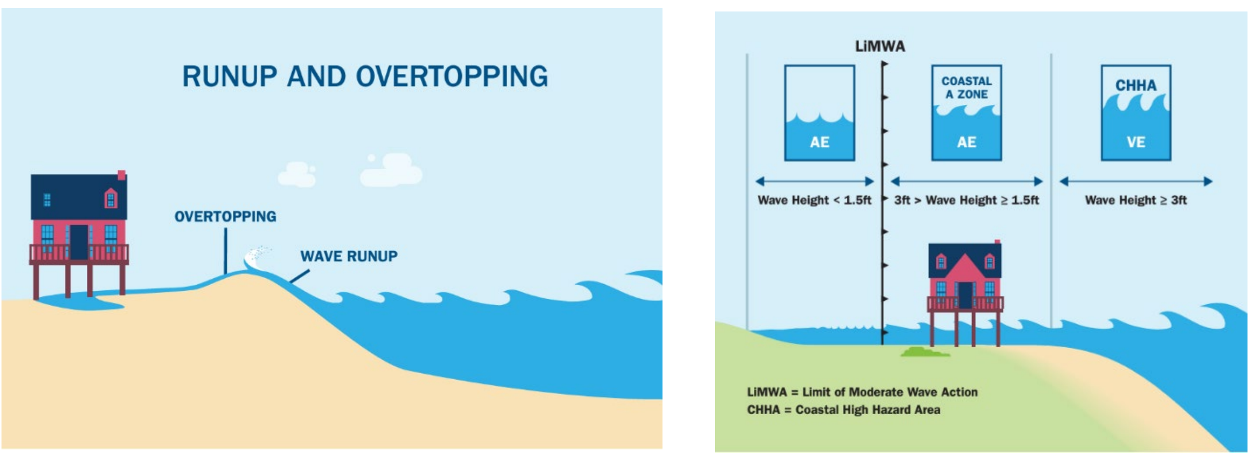
The Federal Emergency Management Agency (FEMA) has mapped floodplains for all of Maine's coastal counties as a part of their participation in the National Flood Insurance Program. This section provides an overview of the information provided on Flood Insurance Rate Maps (FIRMs) and in Flood Insurance Studies (FISs), as both will be used in a NHRA.

FIRMs show areas that will be flooded by the 1% annual chance flood event, which includes the combined impacts of tides, storm surge, wave setup, and wave runup and overtopping. FIRMs assume a certain baseline sea level year. The assumed year depends on when the maps were developed and the methodology used to develop them; therefore, FIRMs represent flood hazard for a specific time period and do not provide information about time-evolving flood risk due to sea level rise.

FIRMs also provide base flood elevations (BFE) and flood zone designations (**Figure 3.2**). BFE is the peak total water surface elevation (including wave impacts) reached by the 1% annual chance flood. It is rounded to the nearest foot and referenced to the NAVD88 vertical datum. FIRMs are accompanied by FISs that provide the 1% annual chance SWEL component of BFE (e.g. the peak 1% annual chance water level excluding wave runup and overtopping) along shore-perpendicular transects used for wave analyses. Note that wave-sheltered areas where BFE is the same as the 1%, the SWEL are not included in the FIS coastal transect tables.

Figure 3.2. Illustrations from *[FEMA Coastal Hazards and Flooding: A Visual Guide]* showing SWEL (upper right), wave runup and overtopping (lower left), and FEMA Coastal Special Flood Hazard Areas (lower right).





Coastal areas flooded by the 1% annual chance event are designated as VE or AE (also BFE) zones (**Figure 3.2**). Wave heights are greater than or equal to 3.0 feet in VE zones and less than 3.0 feet in AE zones. AE zones are sometimes separated into Coastal A zones and A zones by a line called the Limit of Moderate Wave Action (LiMWA). Wave heights are between 1.5 and 3 feet on Coastal A-Zones (seaward of the LiMWA) and less than 1.5 feet in A Zones (landward of the LiMWA). FEMA developed the LiMWA because waves greater than 1.5 feet can cause damage to infrastructure.

- **FEMA National Flood Hazard Layer & Flood Insurance Studies**
  https://www.fema.gov/flood-maps/national-flood-hazard-layer
- **Maine Flood Hazard Maps**
  https://www.maine.gov/dacf/flood/mapping.shtml

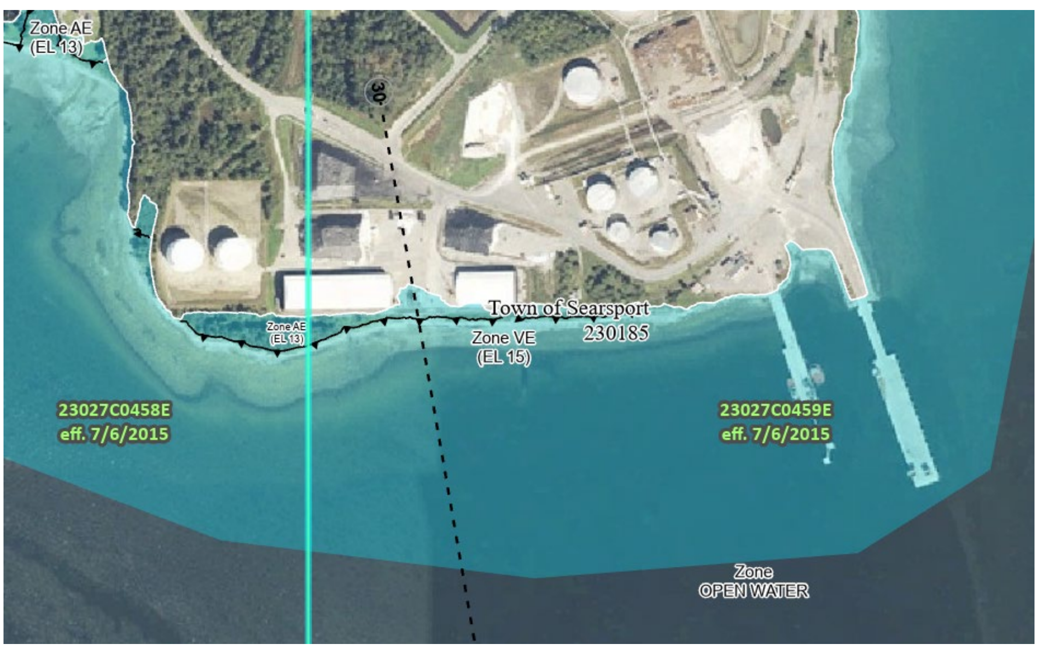
Detailed NHRA Methods

Note: For all calculations, water surface elevations can be rounded to the nearest **hundredth of a foot (0.01 feet)**.

STEP 1:	Use the most recent FEMA FIS to determine the 1% annual chance SWEL at the coastal transect(s) nearest to the site.

Determine the 1% Annual Chance Stillwater Elevation and FEMA Flood Zone Designation

Table 3.1 provides the FEMA flood zone designation, 1% annual chance SWELs, baseline sea level year of the FEMA coastal analysis, and nearest coastal transect for each marine oil terminal facility. Flood zone designations are determined from the effective (most recent) FIRM. Note that some facilities span multiple zones. For AE zones that are in wave-sheltered AE zones, the 1% SWELs is the same as the BFE (note that BFEs are rounded to the nearest foot, whereas SWELs are rounded to the nearest tenth of a foot). For AE zones that include a LiMWA designation or transition to VE zones in the seaward direction, sea level rise will cause damaging wave hazards to extend farther inland. The "AE zone wave hazard description" column of Table 3.1 provides an interpretation of the present-day wave hazard within AE zones indicated by the FIRM at each terminal location. In VE zones, 1% SWELs are found in a table called "Coastal Transect Parameters" or "Transect Data" in the effective FIS for each coastal county with a facility. Current effective FIRMs and FISs for all marine oil terminal locations are available in the Department's NHRA data folder.



FEMA National Flood Hazard Layer Viewer showing Sprague and Irving terminals in Searsport

Table 3.1. FEMA BFEs, flood zone designations, SWELs, baseline sea level years, and transect and FIS information for marine oil terminal facilities. This information is up-to-date as of September 2024; however, this data should be verified at the time of completing an NHRA.

LOCATIONS	Nearest Flood Zone Designation(s), BFE(s) (ft NAVD88)[1]	1% SWEL (ft NAVD88)	Sea level year used in flood hazard assessment	Transect Number; FIS County and Year	Wave Hazard Description
Portland Pipe Line Pier, 43°39'11.0"N 70°13'50.4"W, Cushing Ct, South Portland	VE, 14 ft AE, 9 ft	8.9 ft	2017	Transect 38-1; Tab. 16 of 2024 Cumberland County FIS	Landward boundary between VE and AE zones delineates present-day inland extent of damaging waves
Sunoco Mid Stream, 175 Front St, South Portland	VE, 13 ft	8.9 ft	2017	Transect 40; Tab. 16 of 2024 Cumberland County FIS	No damaging wave hazard
CITGO, 102 Mechanic St, South Portland	AE, 9 ft		2017	2024 Cumberland County FIS	No damaging wave hazard
Portland Pipe Line, 30 Hill St, South Portland	AE, 9 ft		2017	2024 Cumberland County FIS	No damaging wave hazard
Global, 1 Clark Rd, South Portland	AE, 9 ft		2017	2024 Cumberland County FIS	No damaging wave hazard
Sprague, 59 Main St, South Portland	AE, 9 ft		2017	2024 Cumberland County FIS	No damaging wave hazard
South Portland Terminal, 170 Lincoln St, South Portland	AE, 9 ft		2017	2024 Cumberland County FIS	No damaging wave hazard
FPL Energy Wyman,	AE/VE, 12 ft	9.1 ft	2017	Transect 102; Tab. 16 of 2024	Landward boundary between VE and AE zones delineates

LOCATIONS	Nearest Flood Zone Designation(s), BFE(s) (ft NAVD88)[1]	1% SWEL (ft NAVD88)	Sea level year used in flood hazard assessment	Transect Number; FIS County and Year	Wave Hazard Description
Cousins Island, Yarmouth				Cumberland County FIS	present-day inland extent of damaging waves
Irving Oil, 52 Station Ave, Searsport	VE, 15 ft AE, 13 ft	11.4 ft	1992	Transect 30; Tab. 9 of 2015 Waldo County FIS[2]	LiMWA or landward boundary of the VE zone delineates present-day inland extent of damaging waves, depending on specific location at the site
Sprague, Mack Point, Searsport	VE, 15 ft AE, 13 ft	11.4 ft	1992	Transect 30; Tab. 9 of 2015 Waldo County FIS[2]	LiMWA or landward boundary of the VE zone delineates present-day inland extent of damaging waves, depending on specific location at the site
Penobscot Bay Terminal, 9 River Road, Bucksport	VE, 12 ft	10.3 ft	1992	Transect HC-001; Tab. 17 of 2016 Hancock County FIS	N/A (in VE zone)

[1] This is the flood zone designation and BFE **nearest** to the site and does NOT necessarily indicate that the property is currently in a flood zone. Refer to the FIRM to view the extent of the flood zone.

[2] This value is from the “Total Water Level 1-Percent Annual-Chance” Column of Tab. 9 to include wave setup.

STEP 2:	Adjust the 1% annual chance SWEL to present-day sea level (e.g. the year in which the risk assessment is being conducted) using 1993-2023 measured rate of relative sea level rise at the Portland tide gauge.

Adjust Stillwater Elevations to Present and Future Sea Level

An offset must be **added** to the FEMA 1% SWEL to account for sea level rise between the year of the FEMA assessment and the year the NHRA is being conducted. This offset should be calculated using the average rate of sea level rise measured at the Portland tide gauge over the 30-year time period of 1993-2023, which is **0.012 feet per year** (MCC STS. 2024). **Table 3.2** provides sea level offsets that should be added to the FEMA flood surface elevations (by location), depending on the year the NHRA is conducted. An example calculation is also provided after Step 3 of this Section III (B).

Consider local knowledge of site impacts

If there is documentation of historical extreme flooding event(s) at marine oil terminal sites where wave impacts or the depth/extent of inundation were **more severe** than indicated by FEMA FISs, or additional engineering analysis conducted as a part of or otherwise supporting the NHRA, the historical event may be used to define the present-day 1% annual chance flood event.

In the Gulf of Maine, extreme water levels do not increase significantly with increasing recurrence interval (or decreasing annual percent chance of occurrence). For example, in Portland, the 200-year (0.5% annual chance) coastal SWEL is only 0.2 feet higher than the 100-year (1% annual chance) coastal SWEL (MCC STS. 2024). This is because winter-season extratropical cyclones are the primary cause of flooding, and their maximum wind speeds are less than half of tropical cyclone (hurricane) wind speeds. Therefore, if historically observed flood levels exceed flood levels modeled by FEMA, terminal owners are encouraged (but not required) to consider those historical levels as representative of present-day flood risk. If the historical impacts are used for this risk assessment, an explanation of the data sources used must be included in the final assessment document (Chapter 600, Section 7(K)(5).

STEP 3:	Determine the 1% annual chance SWEL for 30 years in the future by adding sea level rise, using median values of localized Intermediate and High scenarios.

Determine Future 1% Annual Chance Stillwater Elevation

Chapter 600 requires that the NHRA evaluate future flood risk 30 years from the date of the evaluation under the 2022 U.S. Interagency Task Force Intermediate and High Sea Level Rise scenarios (Sweet et al. 2022). **Table 3.3** provides localized median (50^{th} quantile) Intermediate and High Sea Level Rise scenario amounts for South Portland, Yarmouth, Searsport, and Bucksport consistent with guidance from the MCC STS on applying sea level rise scenarios for planning applications at specific locations (MCC STS. 2024). **Table 3.3** provides sea level rise at decadal intervals, so linear interpolation may be required (see example calculation below).

The US Interagency Task Force provides sea level rise scenarios relative to a year-2000 baseline; in other words, the amount of sea level rise above 2000 sea level (see **Table 3.3**). Therefore, the amount of sea level rise that occurred between 2000 and the year the NHRA is being conducted must be **subtracted** from the values in **Table 3.3** to avoid double-counting sea level rise from 2000 to the present year. This offset should also be calculated using the average rate of sea level rise measured at the Portland tide gauge over the 30-year time period of 1993-2023, which is **0.012 feet per year** (MCC STS. 2024). **Table 3.2** provides sea level offsets that should be subtracted from sea level rise values in **Table 3.3**, depending on the year the NHRA is conducted. An example calculation is also provided at the bottom of this section.

Table 3.2. Sea level offsets (in feet) to be added to FEMA 1% SWELs (**Table 3.1**) and subtracted from sea level rise values (**Table 3.3**), depending on the year the NHRA is conducted.

NHRA Year	**Offsets for FEMA 1% SWELs** (feet) *Positive sign indicates these should be **added***		**Offsets for sea level rise values** referenced to 2000 sea level (feet) at 0.012 feet/year *Negative sign indicates these should be **subtracted***
	Searsport and Bucksport (referenced to 1992 sea level)	South Portland and Yarmouth (referenced to 2017 sea level)	
2024	+0.38	+0.08	-0.29
2025	+0.40	+0.10	-0.30
2026	+0.41	+0.11	-0.31
2027	+0.42	+0.12	-0.32
2028	+0.43	+0.13	-0.34
2029	+0.44	+0.14	-0.35
2030	+0.46	+0.16	-0.36
2031	+0.47	+0.17	-0.37
2032	+0.48	+0.18	-0.38
2033	+0.49	+0.19	-0.40

Table 3.3. Localized 50th quantile (median) sea level rise for the 2022 U.S. Interagency Task Force Intermediate and High Scenarios (Sweet et al. 2022).

Year	Sea level rise (feet above 2000 mean sea level)					
	South Portland[1]		Yarmouth[2]		Searsport & Bucksport[3]	
	Intermediate	High	Intermediate	High	Intermediate	High
2030	0.57	0.60	0.58	0.61	0.61	0.64
2040	0.83	0.95	0.85	0.97	0.88	1.00
2050	1.12	1.39	1.13	1.42	1.18	1.47
2060	1.45	2.04	1.46	2.06	1.52	2.11
2070	1.84	2.86	1.84	2.88	1.90	2.92
2080	2.29	3.81	2.30	3.84	2.38	3.87
2090	2.85	4.87	2.87	4.93	2.95	4.93
2100	3.49	5.93	3.49	5.98	3.58	6.03
2110	4.18	7.06	4.21	7.18	4.31	7.19
2120	4.83	8.20	4.86	8.22	4.97	8.25
2130	5.44	9.21	5.45	9.29	5.59	9.34
2140	5.98	10.00	5.95	10.10	6.11	10.14
2150	6.49	10.70	6.51	10.82	6.65	10.85

[1] Portland tide gauge projections (MCC STS. 2024; Table 3, p. 95)
[2] Kittery to Freeport gridded projections (MCC STS. 2024; Table E1, pp. 226-227)
[3] Lincolnville to Gouldsboro gridded projections (MCC STS. 2024; Table E1, pp. 226-227)

Searsport example calculation for an NHRA conducted in the year 2025:

Present-day 1% Stillwater elevation

STEP 1: Use the most recent FEMA FIS to determine the 1% annual chance SWEL at the coastal transect(s) nearest to the site.

FEMA 1% SWEL = **11.40 feet NAVD88**, referenced to 1992 sea level (**Table 3.1**)

STEP 2: Adjust the 1% annual chance SWEL to present-day sea level (e.g. the year in which the risk assessment is being conducted) using 1993-2023 measured rate of relative sea level rise at the Portland tide gauge.

Adjust to 2025 by adding 2017 to 2025 sea level rise (**Table 3.2** Offset Added, rate = 0.012 feet/year):

11.40 + [(2025 – 1992) * 0.012] = **11.40 ft + 0.40 ft = 11.80 ft NAVD88**

Present-day 1% Stillwater elevation = 11.80 ft NAVD88

Future 1% Stillwater elevation (2055)

STEP 3: Determine the 1% annual chance SWEL for 30 years in the future by adding sea level rise, using median values of localized Intermediate and High scenarios.

2025 + 30 years = 2055 (target year for future flood risk assessment)

<u>Determine 2055 sea level rise</u> by linearly interpolating between 2050 and 2060 sea level rise (**Table 3.3**):

Intermediate scenario: 1.18 + [(5/10) * (1.52 – 1.18)] = **1.35 ft above** 2000 sea level

High scenario: 1.47 + [(5/10) * (2.11 – 1.47)] = **1.79 ft above** 2000 sea level

<u>Adjust sea level rise from 2000 to 2025 baseline</u> using rate of 0.012 feet/year (**Table 3.2** Offset Subtracted):

Intermediate scenario: 1.35 – [(2025 – 2000) * 0.012] = **1.05 ft above** 2025 sea level

High scenario: 1.79 – [(2025 – 2000) * 0.012] = **1.49 ft above** 2025 sea level

<u>Add sea level rise to the present-day 1% SWEL</u>:

Intermediate scenario: 11.80 + 1.05 = **12.85 ft** NAVD88

High scenario: 11.80 + 1.49 = **13.29 ft** NAVD88

Future 1% Stillwater elevation (2055) =

12.85 ft NAVD88 (Intermediate scenario)
13.29 ft NAVD88 (High scenario)

STEP 4:	Determine site elevations, including flood protection and mitigation features.

Determine Site Elevations

Elevation of assets, especially within areas of the site that are shown to be at-risk from coastal flooding, and elevations of any flood protection and mitigation features are needed to complete the NHRA. A survey for elevation of assets may be needed if that information does not already exist. In some cases, the most recent lidar-derived elevation data can be used to determine site elevations. As of July 2024, available lidar-derived elevation data for terminal locations are:

South Portland and Yarmouth – 2020 USGS Lidar: South Coastal Maine (QL2)

Searsport and Bucksport – 2021-2022 USGS Lidar

NOAA collected new coastal topographic and bathymetric lidar data between 2022 and 2023 that will be made available through NOAA's Digital Coast in late 2024 or early 2025.

Lidar points, contours, and digital elevation models (DEMs) for user-defined areas can be downloaded from the NOAA Digital Coast Data Access Viewer. Prebuilt DEMs typically represent bare-earth elevations and often omit features that rise above the ground (e.g. trees, buildings) or cross water (e.g., piers, wharves, bridges). These features are retained in the full lidar point cloud.

Datum conversions:

Lidar-derived land surface elevations and FEMA water surface elevations are referenced to the NAVD88 vertical datum. If other elevation data source being used (site plans, for example) are referenced to a different vertical datum (NGVD29, for example), the online National Geodetic Survey Coordinate Conversion and Transformation Tool can be used to convert to NAVD88.

New Datum

NAVD88 will be replaced with a new datum, the North American-Pacific Geopotential Datum of 2022 (NAPGD2022, NSRS 2025), and tools will be made available to assist with datum transformations.

STEP 5:	Map present and future 1% annual chance SWELs onto site elevations to assess inundation risk.

See Section IV for how current flood and future flood risk information will be used to analyze impacts to vulnerable infrastructure.

Consider Routine Flooding from Sea Level Rise

Consider assessing the risk of higher tides over time due to sea level rise. Higher daily tide cycles cause ongoing erosion of shorelines that can manifest as a release of soil and contaminants into the marine environment and could damage infrastructure.

FEMA FIRM showing Global and CITGO terminals in South Portland

STEP 6: ***If the site is within or adjacent to a FEMA VE or Coastal A zone***	If the site is within a FEMA VE or Coastal A zone (indicating that there is the potential for damaging waves during the 1% annual chance event), assets in these areas must be identified as vulnerable to these natural hazards and a coastal engineering analysis that evaluates wave runup, wave overtopping, and wave loads on structures (where applicable) on top of present-day and future 1% SWELs must be included in the implementation schedule for these assets. A coastal engineering analysis is not required to be completed with the NHRA. Use the FEMA 1% annual chance significant wave height and wave period at the coastal transect(s) nearest to the site. Note: In VE and Coastal A zones, mapped FEMA floodplains and BFEs (peak total 1% annual chance water surface elevations) show the maximum inland extent and elevation of wave runup and overtopping; however, additional analysis is required to determine wave impacts to structures and assets at the site level.

Coastal Engineering Analysis of Wave Impacts

A site-specific coastal engineering analysis that considers wave runup, wave overtopping, and wave loads on structures (for example, the wave force exerted on a sea wall) should be included in the implementation schedule for terminal locations that are within or adjacent to a FEMA VE or Coastal A zone (e.g. an AE zone with a LiMWA designation). A coastal engineering analysis is not required to be completed with the NHRA. The results of the analysis will inform recommend design and construction practices that will be more resilient in these coastal areas where wave and flood conditions are known to cause significant damage. In these zones, damaging waves with heights exceeding 1.5 feet can occur during the 1% annual chance event. Sea level rise will also cause damaging wave hazards to extend farther inland in wave exposed areas; therefore, even if the LiMWA or AE/VE zone boundary is seaward of critical infrastructure or assets on the effective FIRM, it is important to evaluate whether this changes with higher sea level.

The FEMA 1% annual chance significant wave height and peak wave period from the nearest coastal transect should be used as forcing parameters for the analysis. These values are in the coastal transect tables of the county FIS and are provided for each terminal in **Table 3.4**. The engineering analysis should then be conducted for: 1) the present-day 1% annual chance SWEL; 2) the 1% SWEL 30 years in the future under the Intermediate Sea Level Rise scenario; and 3) the 1% SWEL 30 years in the future under the High Sea Level Rise scenario.

The US Army Corps of Coastal Engineering Manual (EM 1110-2-1100) should be consulted for the analysis, particularly Part VI, Chapter 5 (Fundamentals of Design). Section VI-5-2 (Structure Hydraulic Response) provides detailed guidance on estimating wave runup and overtopping.

Table 3.4. FEMA 1% annual chance wave parameters along coastal transects nearest to marine oil terminal facilities. This information is up-to-date as of September 2024; however, this data should be verified at the time of completing an NHRA.

LOCATIONS	1% Annual Chance Significant Wave Height H_s (ft)	1% Annual Chance Peak Wave Period T_P (seconds)	Transect Number; FIS County and Year
Portland Pipe Line Pier (South Portland)	1.2	4.5	Transect 38-1; Tab. 16 of 2024 Cumberland County FIS
Sunoco Mid Stream, (South Portland)	3.3	4.4	Transect 40; Tab. 16 of 2024 Cumberland County FIS
CITGO, Portland Pipe Line, Global, Sprague, South Portland Terminal	Not within or adjacent to a VE or Coastal A zone		
FPL Energy Wyman (Yarmouth)	2.0	7.7	Transect 102; Tab. 16 of 2024 Cumberland County FIS
Irving Oil, Sprague (Searsport)			Transect 30; Tab. 9 of 2015 Waldo County FIS[2]
Penobscot Bay Terminal (Bucksport)	1.0	3.4	Transect HC-001; Tab. 17 of 2016 Hancock County FIS

STEP 7: ***Encouraged***	Consider adding freeboard, or additional elevation above the 1% annual chance water levels, as a margin of safety that accounts for statistical uncertainty and interannual variability in sea level, tides, and river flow.

Freeboard and Local Information

Freeboard is additional elevation above the 1% annual chance water levels that could be added to design heights as a margin of safety. The addition of freeboard accounts for statistical uncertainty in SWELs and wave parameters; interannual variability in sea level, tides, and river flow; and uncertainty if a coastal engineering analysis is conducted.

Penobscot Bay Terminal Pier, Bucksport

Local Regulatory Requirements

The Chapter 1000 Guidelines for Municipal Shoreland Zoning Ordinances (Guidelines) are standards that the Department uses as a guide when reviewing municipal ordinances. Municipalities enact, administer, and enforce their local shoreland ordinance. Maine Shoreland Zoning minimum guidelines requires municipalities to adopt one foot of freeboard above BFE. Additionally, a municipality may wish to adopt a more stringent ordinance, and some Maine communities do require a freeboard of two or more feet. The freeboard standard applies to new structures as well as to existing structures if they are expanded from what was previously there. Structures can often be repaired and maintained, without a permit, provided no expansion occurs. The Municipal Shoreland Zoning Ordinances should be reviewed for the municipality where the facility is located before construction. And terminals should work with the municipality where they are located, often with the local code enforcement officer, about whether their actions require permits.[4]

[4] Municipal Shoreland Zoning Ordinances were reviewed September 2024 for the currently adopted freeboard amount. South Portland (1 foot of freeboard), Yarmouth (1 foot of freeboard), Bucksport (1 foot of freeboard), Searsport (1 foot of freeboard).

Elevation Implications of the Federal Flood Risk Management Standard

The Federal Flood Risk Management Standard (FFRMS) was established to encourage federal agencies to consider and manage current and future flood risks in order to build a more resilient nation. The FFRMS is applied to federal funding and must be met by entities receiving federal funding. The FFRMS gives flexibility and requires agencies to select one of the three approaches for establishing the flood elevation ("how high") and corresponding flood hazard area ("how wide") used for project siting, design, and construction.

The FFRMS approaches are:

Climate Informed Science Approach (CISA): The elevation and flood hazard area that result from using the best-available, actionable hydrologic and hydraulic data and methods that integrate current and future changes in flooding based on climate science;

Freeboard Value Approach (FVA): The elevation and flood hazard area that result from adding an additional 2 feet to the base flood elevation (e.g. the 1% annual chance event) for non-critical actions and by adding an additional 3 feet to the base flood elevation for critical actions; or

500-year floodplain: The area subject to flooding by the 0.2% annual-chance flood.

The FFRMS standard itself was revoked but was reinstated through Executive Order 14030, Climate-Related Financial Risk, clarifying that the FFRMS as well as the guidelines for floodplain management under Executive Order 11988 should remain in effect.

Coastal Flooding Data in Development

The National Tidal Datum Epoch (NTDE) will be updated from 1983-2001 to 2002-2020 in the year 2026.

Maine Coastal Flood Risk Model is a dynamic inundation map for the entire coast of Maine that will illustrate the combined impacts of sea level rise, tides, storm surge, wave setup, wave runup and overtopping, and river discharge. The initial model may be available as early as fall 2025 and may vary by location.

Additional Data on Shoreline Change and Natural Resources for NHRA

Coastal Sand Dune Geology Maps (Maine Geological Survey)

Coastal Bluff Maps (Maine Geological Survey)

Beginning with Habitat (Maine Department of Inland Fisheries and Wildlife)

Section III B References[5]

[5] Sweet, W.V., B.D. Hamlington, R.E. Kopp, C.P. Weaver, P.L. Barnard, D. Bekaert, W. Brooks, M. Craghan, G. Dusek, T. Frederikse,
G. Garner, A.S. Genz, J.P. Krasting, E. Larour, D. Marcy, J.J. Marra, J. Obeysekera, M. Osler, M. Pendleton, D. Roman, L. Schmied, W. Veatch, K.D. White, and C. Zuzak, 2022: Global and Regional Sea Level Rise Scenarios for the United States: Updated Mean Projections and Extreme Water Level Probabilities Along U.S. Coastlines. NOAA Technical Report NOS 01. National Oceanic and Atmospheric Administration, National Ocean Service, Silver Spring, MD, 111 pp. https://sealevel.globalchange.gov/internal_resources/756/noaa-nos-techrpt01-global-regional-SLR-scenarios-US.pdf

MCC STS. 2024. Scientific Assessment of Climate Change and Its Effects in Maine – 2024 Update. A Report by the Scientific and Technical Subcommittee (STS) of the Maine Climate Council (MCC). August, Maine. https://www.maine.gov/future/sites/maine.gov.future/files/inline-files/STS_2024_digital.pdf

United States Army Corps of Engineers Coastal Engineering Manual (EM 1110-2-1100). https://www.publications.usace.army.mil/USACE-Publications/Engineer-Manuals/u43544q/636F617374616C20656E67696E656572696E67206D616E75616C/

C. Facility Infrastructure Location and Condition

Asset Management

To determine vulnerability and risk of a facility, it is important to have the elevation, location, age, and condition of assets available. Additional surveying is not required for Ch. 600; however, terminals may decide they want this level of detail and conduct a site-specific flood survey. See Section III B. for more information on elevation of assets.

Example dependencies outside facility ownership that should be evaluated with the NHRA:

- Electrical grid
- Road access

Sources of Additional Information

Facilities may gather additional information about infrastructure that is adjacent to their terminal or that is identified to be important or critical to their ability to reduce their risks to natural hazards. The Maine Risk Assessment Map includes information on natural hazard locations and overlays with identified basic critical infrastructure and community asset data.

The Maine Department of Transportation (DOT) has jurisdiction over many state roads, culverts, and bridges that may be important to emergency response actions for marine terminals and has a risk assessment process. The Maine DOT has assessed many state-owned culverts, bridges, and roads as they relate to flooding and other climate impacts. The Maine Municipal Planning Infrastructure Toolbox also includes assessment of road crossings.

The State received funding to conduct a vulnerability assessment of state-owned infrastructure; however, results are not available yet. Information about this is provided in the 2024 Lead by Example Report from the Governor's Office of Policy Innovation and the Future (GOPIF)

D. Company Information for Past Flood Damage

There are many resources that a facility might utilize to obtain information on past flood damage. Long term employees or former employees can be a great source of information. In addition, the below individuals or locations may be useful in obtaining information.

- Terminal Manager, Emergency Response Coordinator
- Weekly safety meetings/logs
- Engineering Department
- Annual Inspection Reports
- Stormwater Inspection Reports
- Storm Preparedness Plans
- Debriefing and lessons learned meetings following storm events
- Tabletop exercises and/or facility training exercises with emergency response/preparedness groups (police, fire, emergency management, DEP)
- Infrastructure damage – marine contractor, insurance records
- Rainfall tracking/gauging (typically already monitored for stormwater management)
- U.S. Coast Guard and/or U.S. Environmental Protection Agency Facility Response Plan (FRP) – written procedures that may already be in place

Use of Existing Information

Emergency planning procedures are already in place at terminals and could be applicable to many aspects of natural hazard planning and response. Terminals could look first to their local operations/management for these records or information, then to their safety program directors and finally local/county/state/federal agencies. Damage and cost information would likely come from insurance records or corporate level management.

Facility Response Plan

The FRP rule includes a broad focus that is beyond habitat. It includes a list of resources that every terminal must evaluate, such as: water intakes (drinking, cooling or other), schools, medical facilities, residential areas, businesses, wetlands and other sensitive environments, Fish and wildlife resources, lakes and streams, endangered flora and fauna, recreational areas, transportation routes (air, land, and water), utilities, and other applicable areas of economic importance.

Case Study
https://pubs.usgs.gov/wri/1997/4189/report.pdf
Record setting rain event for New England in 1996. "Up to 19.19 inches of rain were recorded in southern Maine from October 20-22, 1996. This rainfall caused severe flooding that resulted in one death, damage to more than 2,100 homes and businesses, and the destruction of bridges and dams in 8 communities. Peak flows, with estimated recurrence intervals of greater than 500 years, were recorded on 3 streams. The peak flow on the Presumpscot River in Westbrook, Maine was 68 percent larger than any other flow at that location in the last 102 years."

IV. What Must Be Evaluated in the Analysis Portion of the Assessment?

A. Overview of Process

All infrastructure at the facility must be assessed for its critical role at the terminal and its current flood risk and for future flood risk. Identifying which assets are critical and those that are most vulnerable and then evaluating the extent of the risks (consequences) to those assets are the most important steps that will inform developing strategies to make infrastructure more resilient. These consequences are the impacts at or from the facility that are caused by natural hazards. The impacts of importance in the assessment are those that would result in a petroleum or petroleum related substance release, damage to the operations of the facility, or impacts from the movement of structures or contamination such that they cause collateral damage onsite or offsite.

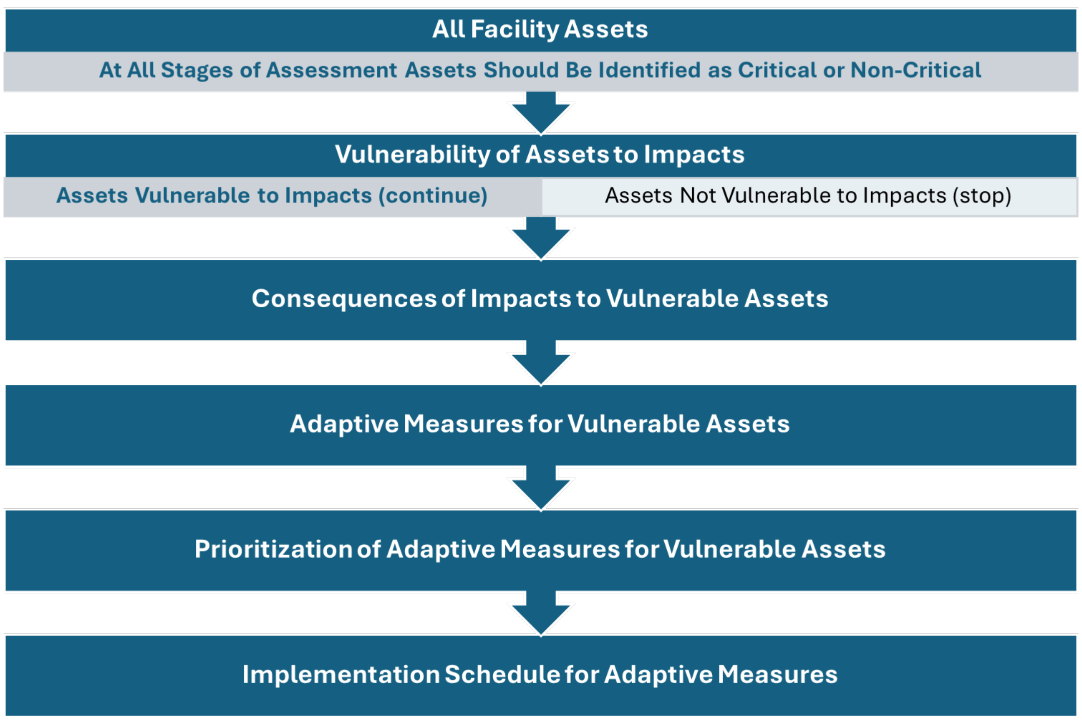


Figure 4.1. Flow diagram depicting the steps in the NHRA analysis.

Throughout this analysis, an evaluation needs to occur to understand whether infrastructure is critical or not as well as whether infrastructure is vulnerable to natural hazards or not. It is possible and likely that infrastructure may fall into one or both of these categories as these assets are reviewed against current risk and future flood risk. For example, a structure might not be critical but might be vulnerable and would need to be evaluated for the risk that it might cause to the oil terminal or offsite properties.

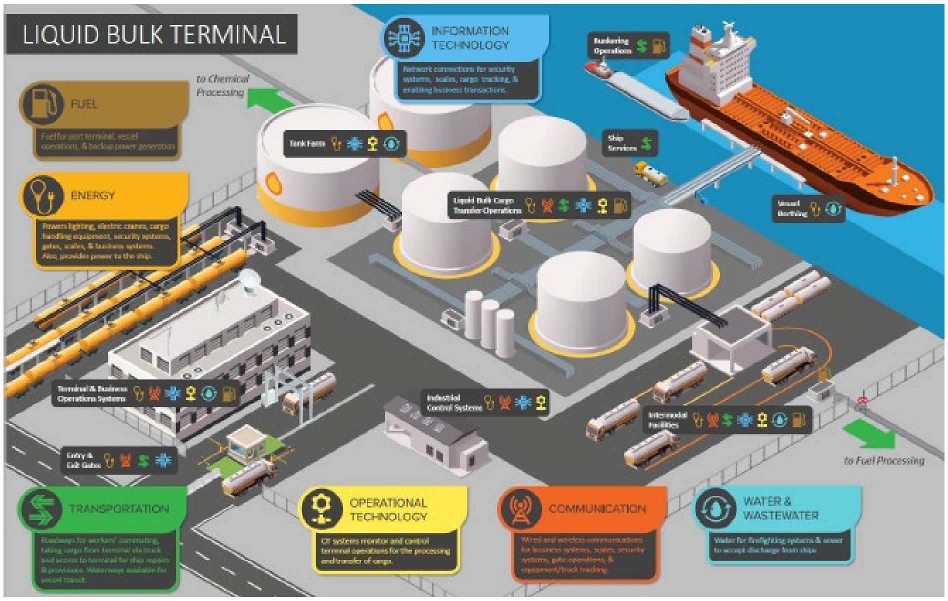


Figure 4.2. *Marine Transportation System Resilience Assessment Guide*, February 2023. USDHS Cybersecurity and Infrastructure Security Agency and USACE Engineer Research and Development Center. Figure B-4. Dependencies at Liquid Bulk Terminals. Page 66.

B. All Facility Infrastructure

List of All Asset Types

Assessing the risk to the facility infrastructure includes identifying all assets. Below is a list of assets that a marine oil terminal might contain. This list was created to ease getting started but is not exhaustive. Terminals may need to assess risk for additional facility specific assets. Each asset must be assessed to first determine if the asset is a critical infrastructure and/or whether it is an asset vulnerable to a natural hazard.

- Aboveground storage tanks
- Piping (above and below ground)
- Electrical systems
- Pumping infrastructure
- Transformers and utility infrastructure
- Dock structures and dock piping
- Loading racks
- Secondary containment systems
- Surface water and groundwater management infrastructure and drainage systems (oil water separators, drainage valves, settling ponds, etc.)

Sprague, South Portland

- Building infrastructures in the flooding zones
- Access to assets (e.g. roads)
- Fencing and site security
- Wastewater process systems
- Emergency response equipment assets (e.g. spill kits, trailers, boats, boom)


South Portland Terminal

At this step, all portions of the marine oil terminal should be evaluated. Some items will be screened out at this stage as being not critical to the facility, not in a vulnerable situation, and not posing a risk to the marine oil terminal operations and structures or adjacent properties. A paragraph or table would be needed that identifies assets that are not deemed critical and the reason why they would not be critical. For facilities that have a property that contains more than one activity, such as salt piles or scrap metal operations, if these activities are separate and do not share locations or structures with the marine oil terminal, they are not required to meet the NHRA standards. However, these activities will need to be evaluated at this stage to determine if they pose a risk to the marine oil terminal portion of the property in times of storms. For example, could the scrap metal operations damage tanks, piping or other critical structures if the metal became airborne or otherwise mobile. Since these activities occur on the terminal property, it would be within the ability of the facility owner/operator to evaluate and potentially make adaptations if the activities posed a risk to the marine oil terminal.

Identify Critical Infrastructure

> Chapter 600 defines Critical Infrastructure as, an asset, system, or network, whether physical or virtual, that is so vital to the operation of a facility that the incapacity or destruction of such items would have a debilitating impact on the facility, public health, safety, or the environment.

AN EXAMPLE OF CRITICAL INFRASTRUCTURE AT A MARINE OIL TERMINAL IS A PIER WITH ASSOCIATED PIPING. Without a working pier and piping, the terminal would be prevented from receiving shipments of petroleum.

Facilities must identify assets at the facility that are determined to be critical infrastructure. Using the list of potential assets above or a list developed for the specific facility, identify which assets by type and location are critical infrastructure.

When identifying whether infrastructure is critical, it is not dependent on the duration of the debilitating impact that would be caused by its incapacity or destruction, but rather whether that debilitating impact would occur or not. In other words, the infrastructure can be identified as critical if the identified infrastructure was not available or is functioning with a reduced capacity or capability, and the facility cannot operate normally. Infrastructure can also be identified as critical if there is an increased likelihood of negatively impacting the environment, neighboring properties, or causing damage to other facility infrastructure, if this infrastructure was not functioning or at reduced capacity or capability.

Include a map showing where the various infrastructure is located and that shows if it is critical and/or vulnerable to current and future flood risk.

Identify Vulnerable Infrastructure

Facilities must identify the assets at the facility that would be vulnerable infrastructure. Generally, vulnerable infrastructure is infrastructure that is identified to be at-risk to natural hazards. A vulnerable asset may pose a problem with the oil terminal or adjacent properties.

At this point in the analysis, there will be some interplay between infrastructure and the sea level rise, storm surge and floodplain determination information. Infrastructure will be compared to these water levels to determine what infrastructure is vulnerable to which types of flood risks and whether vulnerable assets may pose a risk to other structures or properties (see **Table 4.1**).

Table 4.1 is one example of an abbreviated version of how infrastructure might be depicted as critical, vulnerable, and at what point in the 30-year evaluation time of the assessment adaptations might be warranted.

Asset	Critical	SFHA (VE or Coastal A Zone)	Vulnerability				
			History of flooding	100-year precipitation [6] event	100-year floodplain	Sea level rise of 1.5 feet[7]	Sea level rise of 4 feet[8]
Pier and piping (Area 1)	Yes	VE Zone	No	Currently vulnerable	Currently vulnerable	Currently vulnerable	Currently vulnerable
Containment area around tank #10	Yes		No	By 2030	No	No	No
Access entrance and gate to facility	Yes		Flooded by precipitation event of 2023	Currently vulnerable	Currently vulnerable	Currently vulnerable	Currently vulnerable
Tanks #1-9	Yes		No	No	No	No	By 2100
Pumps in Area 2	Yes		No	No	No	By 2050	No
Visitor parking lot	No		Flooded by precipitation event of 2023	Currently vulnerable	Currently vulnerable	Currently vulnerable	Currently vulnerable

[6] With storm surge and waves
[7] From a 100-year storm with storm surge and waves
[8] From a 100-year storm with storm surge and waves

C. Impacts to be Evaluated

The assessment must evaluate impacts to infrastructure because of these natural hazard events:

- Current flood risk to those assets for a 100-year flood event
- Future flood risk to those assets considering risk from the date of the evaluation forward to 30 years
- Storm surge and wave impacts to those assets from a 100-year flood event under an Intermediate and High Sea Level Rise scenario

Risk reduction measures can be reevaluated cyclically using the Natural Hazard Risk Assessment process and by applying the latest sea level rise projections for Maine to inform when improvements should be made as well as at what point in time those improvements may no longer be able to provide adequate risk reduction. The Department requires a 30-year timeframe to adequately plan for hazards that are potentially coming, together with hazards that are imminent. It is important not only for a facility, but for the Department, host communities and nearby residents to be aware of current and future risks and the mitigation actions planned to reduce impacts from those risks.

Some examples of risk reduction measures could include raising piping, electrical equipment, and security systems to avoid flooding. Another measure might involve raising the height of berms surrounding oil storage tanks.

Citgo, South Portland

For the purposes of applying sea level rise to infrastructure, the best available data, model and datum information that is available 6 months before the NHRA is due to the Department should be utilized. If new data becomes available in the period 6 months before the NHRA is due to the Department, terminals can use that data as desired.

Consider evaluating and preparing for a series of storms in close timing to each other

The January 10 and 13, 2024 southeaster storm events created new total water level records in Portland and Bar Harbor, and within the top 5 in Eastport. The first storm weakened or damaged infrastructure and the second storm further damaged or destroyed infrastructure. The combined impact of the storms damaged roads and buildings and destroyed piers, wharves, and sea walls. $70.3 million in public infrastructure damage was reported from the storms. Additionally, looking to the future, the water levels were a combination of high tide and surge (storm tide) that are not historically unprecedented; however, the high sea level (from sea level rise) is what caused the events to break records. *MCC STS. 2024. Scientific Assessment of Climate Change and Its Effects in Maine – 2024 Update. A Report by the Scientific and Technical Subcommittee (STS) of the Maine Climate Council (MCC). Augusta, Maine. 268 pp.*

Things to include in the analysis are:

Impacts	Damages To Be Assessed
Potential impacts to adjacent properties	• Damage to existing infrastructure onsite • Damage to existing infrastructure offsite • Movement of product to adjacent areas • Movement of contamination (soil and groundwater) to adjacent areas • Movement of contamination to surface waters
Physical damages to facility	• Erosion and scouring • Collision • Flooding
Flotation and buoyancy	• Empty or partially empty tanks • Empty or partially empty pipelines
Worst case scenario of hazards	• Vulnerable infrastructure
Evaluate potential impacts	• Critical infrastructure • Operations

An assessment of past damages must be made and include a review of past flood information and the cost of any flood damage.

Cost of Damages

If known, the type of damage that resulted in the flood damage cost should be included in the assessment.

D. Facility Drainage 24-hour, 100-year Precipitation Event

The assessment must determine how the facility drainage system will be designed and operated to meet a 24-hour 100-year precipitation event. It is anticipated, this will be through infrastructure changes, procedural changes, or most likely a combination of the two. This assessment must lay out the steps to accomplish compliance along with an implementation plan with a schedule that gains full compliance within 5 years of the submittal of a facility's first NHRA.

The procedures to be used must be identified in the NHRA with a clear description of how they will meet the regulatory requirements. While other documents may be referenced, the NHRA must be able to fully document compliance with the requirements. In some cases, it may be advantageous to provide related documents, but compliance will be based upon the NHRA, and the overarching terminal application as implemented.

E. Identify and Evaluate Adaptation Measures

Identification of short- and long-term adaptation practices

The assessment must evaluate worst-case scenarios of hazards to vulnerable infrastructure. This evaluation must include potential impacts to critical infrastructure and operations as well as their consequences. The identification of short- (less than 5 years) and long-term (greater than 5 years) adaptation practices, the prioritization of the potential adaptive actions, and the cost of the recommended adaptations must be included. It is possible that some impacts that do not result in damage to the environment or other properties may be resolved through repair or replacement of the asset in lieu of building resiliency in this particular asset. This is most likely to happen with assets that are relatively inexpensive to repair or replace and where these actions are easily handled in a reasonable timeframe.

TWO EXAMPLES OF A CONSEQUENCE WOULD BE:

(1) Where damage occurs to a tank that causes the petroleum in the tank to drain into the secondary containment dike. In this case the consequence would be the release of petroleum as well as the damage to the tank.
(2) Where piping from the pier to the storage tanks is broken and washed onshore resulting in a need to repair the piping run but no release of petroleum occurred. In this case the consequence is the need to repair the piping run.

Example Adaptation Practice

Utilizing existing or developing additional onsite storage capacity may be an option for the controlled release of excess water from storm events through the oil/water separator. Extra capacity could be built by surrounding additional areas of the facility with containment walls or by creating a properly sized retention basin

Prioritization of Adaptive Actions

All adaptations should be included in the prioritization process and documentation. The prioritization process is intended to help winnow adaptation options down to those most appropriate to the situation.

A quantitative method of risk assessment is to assign ranks to the likelihood of an outcome and the severity of that outcome, then multiply these two ranks to generate a final risk score. By completing this process on a spectrum of related risks, the final risk scores can be compared alongside each other, and actions prioritized.

For example, for evaluating extreme weather where events are differentiated over longer timeframes. A scale such as below may be appropriate:

i. Rare (once per 500 years)
ii. Infrequent (once per 100 years)
iii. Occasional (once per 25 years)
iv. Frequent (once per 10 years)
v. Very frequent (annually)

The severity of an outcome also needs its own defined ranking. For this component the degree of damage, length of time to resume normal operations, or impact on the environment, to adjacent properties, people or property could be included along with a separate set of criteria for the financial impact of the damage. For example, the below two set of criteria could be included to address the severity of the outcome:

i. Negligible (Fully contained, remediation can be completed immediately with on-site resources)
ii. Minor (Fully contained, remediation requires contracted assistance)
iii. Significant (Not fully contained, product does not leave site boundaries, weeks or months anticipated to resume normal operations)
iv. Major (Not fully contained, release may spread to adjacent properties or the offsite environment such as the ocean, months to a year anticipated to resume normal operations)
v. Catastrophic (Not fully contained, release may spread widely in the environment and impact properties or property offsite, years anticipated to resume normal operations)

For the financial piece of the severity of an outcome a ranking such as below might work:

i. Negligible (less than $25,000 cost)
ii. Minor ($25,000 – $100,000 cost)
iii. Significant ($100,000 - $1,000,000 cost)
iv. Major ($1,000,000 - $50,000,000 cost)
v. Catastrophic (greater than $50,000,000 cost)

Once both likelihood and severity rankings are established, the values can be added to generate a risk score. See the below scoring system approach and a hypothetical scenario regarding outcomes from storms of varying magnitudes, where the outcome of the risk assessment will be used to determine what magnitude of storm should receive what level of priority for planning purposes when developing an implementation schedule of adaptive actions.

Not every situation will require an adaptive measure, in some cases the scoring will be low enough that an adaptation may be deemed unnecessary at a point in time. The amount of time anticipated to resume business operations because of damage should also be included in the outcome of the risk assessment. This information should explain that because of damage to X asset (singular or collective, e.g. SCADA system or pier), the terminal anticipates resuming business operations in Y time (e.g. days, weeks, months, years).

Risk Assessment Scoring for Storm Damage

Storm Frequency	Environmental Damage	Adjacent Property	Resume Operations	Financial Cost
Rare (1)	Negligible (1)	Negligible (1)	Negligible (1)	Negligible (1)
Infrequent (2)	Minor (2)	Minor (2)	Minor (2)	Minor (2)
Occasional (3)	Significant (3)	Significant (3)	Significant (3)	Significant (3)
Frequent (4)	Major (4)	Major (4)	Major (4)	Major (4)
Very Frequent (5)	Catastrophic (5)	Catastrophic (5)	Catastrophic (5)	Catastrophic (5)

Using the scoring above, for the below three examples would generate a risk score as below:

Hypothetical Risk Assessment for Storm Damage

Storm Frequency	Environmental Damage	Adjacent Property	Resume Operations	Financial Cost	Risk Score
Rare (1)	Catastrophic (5)	Catastrophic (5)	Catastrophic (5)	Catastrophic (5)	1 + 5 + 5 + 5 + 5 = 21
Occasional (3)	Significant (3)	Significant (3)	Significant (3)	Significant (3)	3 + 3 +3 + 3 + 3 = 15
Very Frequent (5)	Minor (2)	Negligible (1)	Negligible (1)	Minor (2)	4 + 2 + 1 + 1 + 2 = 10

Develop Costs of Recommended Adaptations

The evaluation stage for potential adaptations is a screening level of review. This is the level of review where a ballpark estimate can be formed but is not yet at the level of detail for design, bid, or construction. At this stage in the process, it is recommended that an order of magnitude type of costing method be used to evaluate the cost of potential adaptation actions. The report should contain a written description of the scope of the potential project and include at least the following items within the estimate: the cost of design engineering, materials, labor, and contingency.

Assumptions and limitations for calculations should also be included in the write-up to accurately frame the cost estimate.

Identify any recommendations that build resilience into the critical infrastructure

Following the evaluation stage of the assessment, recommendations should be developed for any vulnerable or critical infrastructure that is determined to need additional protection from storm events. For any recommendations, there needs to be a schedule for implementation of the measures, whether procedural, virtual, or physical actions (see **Table 4.2**).

Examples of Adaptations

Erosion of tank containment wall from storm.

Repairs to tank containment.

Old petroleum piping run, note location of pipes in relation to yellow railing to the right.

Petroleum piping run elevated as an adaptation for climate change. The old piping run was at the elevation of the middle yellow railing in this picture.

Offsite structures that can impact terminal property and operations. Terminals may want to assess damage that can be caused by adjacent properties and whether actions taken on the site of the terminal may minimize such damage.

Terminal property after clean-up of offsite structures that moved onto the property as a result of storm surge/wave action.

An example of an adaptation that elevated the fire suppression system above a level of concern.

Table 4.2 shows example mitigation and adaptation options identified for different assets together with the implementation schedule for selected adaptations.[9]

Asset	Impact	Consequence	Mitigation and Adaptation Options	Selected Adaptation & Implementation Schedule[10]
Pipe (emptied prior to storm)	Pipe breaks because of storm surge and wave action	Loss of operations until pipe is repaired	Emergency Response/Recovery: • Fix or replace pipe Adaptation: • Elevate pipe (add to Construction Implementation Plan)	Fix or replace pipe within 30 days Elevate Pipe within 5 years
Pipe (full of petroleum during storm)	Pipe breaks because of storm surge and wave action	Spill of product onto site (land), potentially into water/ocean as well Loss of operations until pipe is repaired	Emergency Response/Recovery**:** • Clean up • Fix or replace pipe Adaptation**:** • Drainpipe before storm (add to Storm Preparedness Plan) • Elevate pipe (add to Construction Implementation Plan)	Fix or replace pipe within 30 days Update Storm Preparedness Plan within 30 days Elevate pipe within 5 years
Pumps in tank containment	Pumps inundated with water	Loss of the ability to pump oil from the tank location	Emergency Response/Recovery**:** • Remove pumps for repair or replacement Adaptation: • Remove critical equipment including pumps prior to storm • Include in Storm Preparedness Plan: the location of higher ground for storage of equipment prior to storm and a post storm evaluation of what worked and what could be improved upon	Repair or replace pumps within 5 weeks Remove and relocate critical equipment 5 days before storm

[9] Storm Preparedness Plan would include those actions that could be taken before the storm strikes that could minimize damage to the facility, its operations, and improve resiliency. Such actions could include moving equipment and other structures to higher ground, cleaning out oil water separators, and adjust oil in tanks to prevent buoyancy.
[10] The implementation schedule considers the prioritization analysis.

Asset	Impact	Consequence	Mitigation and Adaptation Options	Selected Adaptation & Implementation Schedule[10]
Storage tank containment	Soil containment structure erodes from wave action	Loss of secondary containment for tank	Emergency Response: • Temporary fill and erosion control measures Adaptation: • Design and implement a more resistant containment system	Implement temporary repairs within 10 days Coastal Zone Engineering analysis conducted of structure within 1 year. Implement more resistant containment system within 5 years based upon results of Coastal Zone Engineering analysis.
Oil/water separator (cleaned of all oil prior to storm's arrival)	Oil/water separator is overwhelmed by heavy precipitation	Loss of capability to process facility runoff	Emergency Response: • Check facility for releases and clean up if found • Store water onsite and meter excess water through the system	Verify containment calculations and develop plan for onsite water storage within 30 days Develop additional water storage for storm events within 2 years Develop procedures for onsite storage of water from storms and for controlling release of water into oil/water separator system within 2 years
Storage tank located adjacent to shoreline	Tank located within vulnerable area of 100-year storm surge and wave action	Inundation of tank, containment structure, and piping run to tank	Adaptation: • Raise and strengthen containment structure to withstand 100-year storm surge and wave action. • Plan for relocation of storage tank to portion of facility outside of vulnerable location	Design changes to containment with schedule for implementation within one year Develop a relocation plan with an implementation schedule within 10 years
Petroleum waste sludge and contaminated soil	Shoreline retreat puts petroleum waste sludge and contaminated soil at risk for migration to other areas onsite or removal and transport offsite or into the sea	Migration of contamination from existing locations including to offsite locations	Adaptation: • Relocate contaminated sludge and soil to non-vulnerable location on property depending on characteristics of contamination and appropriate approvals • Remove contaminated sludge and soil to appropriately licensed disposal facility	Relocate contamination to non-vulnerable location within 2 years Remove vulnerable contamination to an appropriately licensed disposal facility within 10 years

V. What Must Be Included in an Assessment Report?

The assessment report must identify what was considered, how the analysis was conducted, and include a diagram identifying the facility infrastructure locations with an accompanying table that identifies the infrastructure, critical infrastructure, vulnerable infrastructure as compared to current flood risk and future flood risk.

A. Discussion of the Infrastructure Considered

The list of infrastructure, by category or location, at the facility must be included in the report. It is expected that all infrastructure will be evaluated in the initial phase of determining what is vulnerable and critical to the operations at the facility.

B. What Infrastructure is Vulnerable

The report must include the infrastructure that was determined to be vulnerable. Vulnerable infrastructure may or may not be critical to immediate operations but needs to still be identified and assessed for any adaptations that could protect this infrastructure.

C. What Infrastructure is Critical

The critical infrastructure must be identified. Critical infrastructure poses a particular risk to operations at the facility and should be given careful consideration as to means to protect these structures.

D. Details of Analysis and Results

The report needs to include how the analysis was conducted, who led the assessment as well as who was consulted, what alternatives were evaluated, and what the findings were for the analysis, identifying the infrastructure critical to operations and those that are vulnerable to both current and future flood risks. The report should logically flow from the analysis to what adaptations were identified to mitigate or remove risks and what adaptations, if any, are recommended in the report.

A map must be included showing where the various infrastructure is located and that shows if they are critical and/or vulnerable to current and future flood risk.

The report needs to include a discussion of how the facility drainage system will comply with the requirement to manage a 100-year precipitation event.

E. Implementation Schedule for All Recommended and Required Adaptations

The report must include an implementation schedule for all adaptations recommended or required in the report.

F. Data Sources Used in Assessment

All sources of data, reports, and other information used in the assessment must be referenced and a copy included where the references are not readily available.

Sunoco, South Portland

VI. When Does the Assessment Report Get Submitted?

A. New facility

The Natural Hazard Risk Assessment must be included in the initial marine oil terminal license application.

B. Existing facility

The Natural Hazard Risk Assessment must be included in any license renewal application with a license expiration date after May 31, 2025.

As a part of the application process for new or renewal applications, the applicant must submit the application including the NHRA to the local community, send notification to all abutters, and provide public notice of the application in a newspaper widely circulated in the area of the facility. Applicants should have a system in place to respond to any comments received on the application and NHRA.

Public Meeting

Prior to filing the application with the Department, the applicant should consider holding a meeting with interested parties to go over what is contained in the NHRA as well as existing disaster and spill response plans for the facility.

i. Drainage Facility System

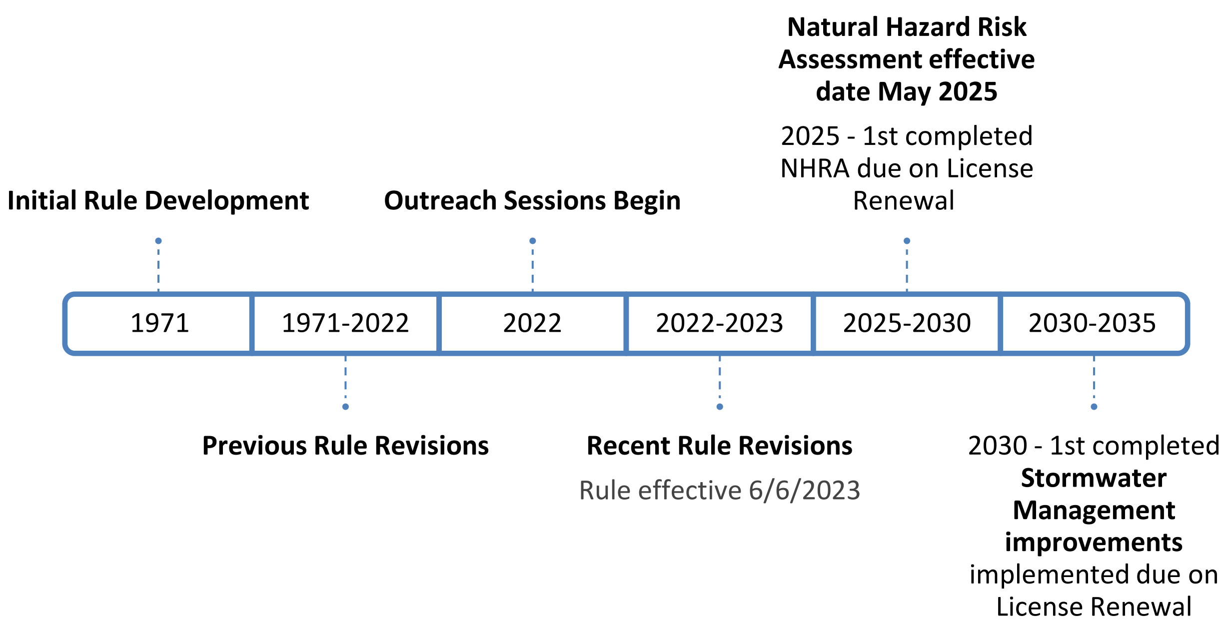
The facility drainage system 24-hour, 100-year (1% annual chance) precipitation event requirements for stormwater management must include a timeframe for implementation of any measures needed to comply. The implementation schedule must be completed within 5 years following the submittal of the initial Natural Hazard Risk Assessment.

ii. All Other Aspects of Facility

The Natural Hazard Risk Assessment must clearly specify what adaptive measures, if any, are incorporated into the facility design based on the evaluation and must include an implementation schedule for those measures.

Appendix A. Brief History of Revisions to Chapter 600 and NHRA Timeline

Chapter 600: Oil Discharge Prevention and Pollution Control Rules For Marine Oil Terminals, Transportation Pipelines And Vessels Rules



Appendix B. Summary of Natural Hazard Related Requirements in Chapter 600

Chapter 600 Section	Natural Hazard Related Requirements	Page
6. Siting Requirements	**A. New Land Based Oil Terminal Facilities.**	10–12
	(3) A new oil terminal facility located as set forth below is presumed to pose a serious threat to public health or welfare or to the environment such that a license for a facility may not be issued. The presumption applies if a facility is located:	
	(a)Within a 100-year floodplain, unless critical infrastructure is suitably elevated to four feet above the 100-year flood elevation to maintain continuity of operations, except for piers and piping from a pier to the terminal. Piers and piping from a pier to the terminal must be secured through an alternative means such as marine break away couplings;	
	(b)Within 1,000 feet of a freshwater wetland, great pond, river, stream or brook (as defined in *Natural Resources Protection Act,* 38 M.R.S. § 480-B) not used as a public drinking water supply, except for piers and piping from a pier to the terminal;	
	(c)Within an area that is less than four feet in elevation above the highest astronomical tide (HAT) line of coastal wetlands (as defined in 38 M.R.S. § 480-B) with a salt or brackish water regime (salinity equal to or greater than 0.5 parts per 1,000) that contain emergent vegetation tolerant of salt water occurring primarily in a salt water or estuarine habitat including, but not limited to, marshes and salt meadows; or	
	(d)Within 1,000 feet of an eel grass bed.	
	B. Existing Land Based Oil Terminal Facilities.	11-12
	(2) Non Operating Facilities. Existing facilities that have been abandoned, closed or that have been in disrepair for more than 10 years are prohibited from reuse unless the facility siting complies with Section (6)(A) of this Chapter.	
	C. Piping, Valves and Pumps.	12-14

Chapter 600 Section	Natural Hazard Related Requirements	Page
7. Minimum Design Standards, Construction Standards and Related Measures	(3) Aboveground Piping. Aboveground piping must be adequately supported and must be protected from physical damage including but not limited to damage caused by freezing, frost heaving, flooding, and vehicular traffic. Aboveground piping must be painted or coated according to nationally recognized industry standards to prevent corrosion.	
	(6) Valve Access. Tank shut-off valves must be accessible under all operating conditions including during a 24-hour storm, 100-year precipitation event.	
	E. Facility Drainage Systems.	
	Design. The water collection, drainage, discharge, and oil/water separator system must be designed and signed and sealed by a Maine licensed professional engineer or an engineer otherwise working in compliance with Maine's professional regulation statutes. The design and operation collectively must provide for operational stresses likely to be encountered in Maine, such as frost action, a 24-hour storm, 100-year precipitation event and other site specific factors. All buried or partially buried oil/water separators must be of a design and construction (approved by the Department) that will prevent releases due to corrosion or structural failure for the operating life of the system.	16-18
	(5) Oil Storage and Handling Area. Facilities must be graded to collect surface run-off and discharge it through an oil/water separator to a location approved by the Department. Such separators must be designed, installed, operated, and maintained to collectively handle a 24-hour storm, 100-year precipitation event.	
	F. Tank Truck and Tank Car Loading and Unloading.	18
	(5) Spill Containment. Tank truck and tank car loading, and unloading areas, except for facilities handling only asphalt, must be provided with impervious secondary containment, that is designed, constructed, and maintained to contain spills in amounts up to the volume of largest compartment of any vehicle loaded or unloaded at the facility. The secondary containment systems in loading and unloading areas must be designed and constructed to prevent collection of stormwater runoff and must be connected to either a holding tank for removal and disposal or to an oil/water separator.	21-22

Chapter 600 Section	Natural Hazard Related Requirements	Page
	K. Natural Hazard Risk Assessment.	
	All facility infrastructure must be assessed for current flood risk and for future flood risk. Potential impacts on adjacent properties must be identified including the possibility for damage to existing infrastructure and movement of product or contamination to adjacent areas.	
	(1) The assessment must identify the infrastructure evaluated. Future flood risk evaluation must consider a timespan of 30 years from the date of the evaluation.	
	(2) The assessment must review previous flood information and any costs resulting from flood damage; evaluate current flood risks from a 100-year flood event; and evaluate future flood risks using storm surge and waves from a 100-year flood event added to both the projected Intermediate and High Sea Level Rise scenarios. The assessment must consider impacts including but not limited to erosion, collision, scouring, flooding, and flotation, including the buoyancy of any empty or partially empty tanks and pipelines.	
	(3) The assessment must consider how to meet the Facility Drainage System 24-hour, 100-year precipitation event requirements of Section (7)(E)(1) and (5) and the portion of Section (8)(K) that relates to these two Sections. The assessment must determine how stormwater management measures can accomplish this requirement and must include a timeframe for implementation of any measures needed to comply with these Sections. The implementation schedule must be completed within 5 years following the submittal of the Natural Hazard Risk Assessment report in Section (7)(K)(6).	21-22
	(4) The worst case scenarios of hazards to vulnerable infrastructure must be considered in the assessment. Evaluation of potential impacts to critical infrastructure and operations including their consequences; identification of short- and long-term adaptation practices; prioritization of adaptive actions; costs of recommended adaptations; and presentation of recommendations that build resilience into the critical infrastructure must be included.	
	(5) An explanation of the data sources used in the assessment must be included in the final assessment document.	

Chapter 600 Section	Natural Hazard Related Requirements	Page
	(6) A report detailing the results of the assessment must be included in the initial permit application and any renewal applications. The report must clearly specify what adaptive measures, if any, are incorporated into the facility design based on the evaluation and must include an implementation schedule for these measures.	
8. Existing Land Based Oil Terminal Facility Minimum Design Standards, Construction Standards, and Related Measures	**D. Tank Secondary Containment.** (6) Valve Access. Tank shut-off valves must be accessible and operable during a 24-hour storm, 100-year precipitation event and all operating conditions.	25-26
	E. Leak Monitoring and Detection. (2) Existing monitoring wells must be checked for free phase product and depth to ground water annually or as directed by the Department as a licensing requirement of oil terminal facilities.	26
	F. Existing Tank Truck and Tank Car Loading and Unloading Spill Containment. (1) Except for facilities handling only asphalt, tank truck loading and unloading areas must be provided with impervious secondary containment that is designed, constructed, and maintained to contain spills in amounts up to the volume of the largest compartment of any tank truck loaded or unloaded at the facility. These secondary containment systems must be designed and constructed to prevent the collection of storm water runoff and must be connected to either a slop tank for removal and disposal or to an oil water separator.	26-27
	H. Other Requirements. All existing oil terminal facilities must meet the requirements of Sections (7)(E), (7)(F) (1)-(4), (7)(G), (7)(H), (7)(I) and (7)(K) of this Chapter.	27
12. Non-Operating	**B. Temporarily Out of Service.** Facility owners or operators must notify the Department of storage tanks or facilities that are planned to be or have been temporarily	40

Chapter 600 Section	Natural Hazard Related Requirements	Page
Tanks and Facilities	out of service for 12 or more months. The storage tanks or facility must be temporarily closed as follows: (2) Tanks must be protected from flotation in accordance with good engineering practices if in an area within four feet above the 100-year floodplain;	
Delay	AMENDED: June 6, 2023 – filing 2023-079, except that the effective dates for the following existing facility requirements must be May 31, 2025 for that portion of Section (8)(H) relating to other requirements for existing oil terminal facilities that concerns the submission of a Natural Hazard Risk Assessment referenced in Section (7)(K); December 31, 2025 for that portion of Section (9)(C)(2)(h)(i) relating to a 10 year internal inspection frequency; and Five years from the date of the first submittal of the Natural Hazard Risk Assessment for that part of Section (8)(H) that relates to managing 100-year precipitation events referenced in Sections (7)(E)(1) and (7)(E)(5).	45
Appendix C	Chapter 600: OIL DISCHARGE PREVENTION AND POLLUTION CONTROL RULES FOR MARINE OIL TERMINALS, TRANSPORTATION PIPELINES AND VESSELS	50-52
	Sea Level Rise scenarios. MCC STS. 2020. Scientific Assessment of Climate Change and Its Effects in Maine. A Report by the Scientific and Technical Subcommittee (STS) of the Maine Climate Council (MCC) Figure 6. Augusta, Maine. August 2020	50-52
Appendix D	NATURAL HAZARDS, CLIMATE CHANGE, AND FLOOD RISK REFERENCE MATERIAL	52-54