



Project Report

Coastal Flood Risk Building Adaptation Guide for the Pine Point Neighborhood

Scarborough, Maine

Submitted to:
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1. Introduction and Steps Towards Adaptation

This guide is designed to help homeowners in the Pine Point neighborhood of Scarborough, Maine, understand the steps involved in adapting their homes to reduce coastal flood risk. It focuses primarily on home elevation—a common and effective strategy to protect properties from sea level rise, storm surge, and erosion.

The guide was one piece of a larger project looking at flood vulnerability and adaptation for the Town of Scarborough. For more information on the greater project, please visit the Town's Vulnerability Assessment website which includes a background on the overall project, links to an interactive StoryMap, and report projects, (Town of Scarborough, 2025a).

Home elevation may be required if you are undertaking a substantial renovation or building in high-risk zones, but some homeowners may choose to elevate proactively even when not required. This guide explains when elevation is necessary based on local, state, and federal regulations, and outlines the general process and options available.

While elevation is a central focus, this guide also offers other flood risk reduction strategies and resources for going beyond the minimum standards.

This document is a starting point. Before beginning any project, homeowners should consult with the Scarborough Planning and Code Enforcement Office and/or a licensed contractor, engineer, or permitting specialist to understand the applicable requirements, potential exemptions, and best practices for your specific property.

We have outlined six steps to follow for adapting your Pine Point home to flood risk:

- **Step 1:** Understand Your Property's Flood Risk and Zones
- **Step 2:** Understand What These Zones Mean for Adaptation
- **Step 3:** Choose Your Adaptation Path
- **Step 5:** Contact the Scarborough Planning and Code Enforcement Office
- **Step 6:** Hire a contractor to coordinate the design, permitting, and adaptation of the property.

The following sections detail each of these steps.

2. Understand Your Property's Flood Risk and Zones

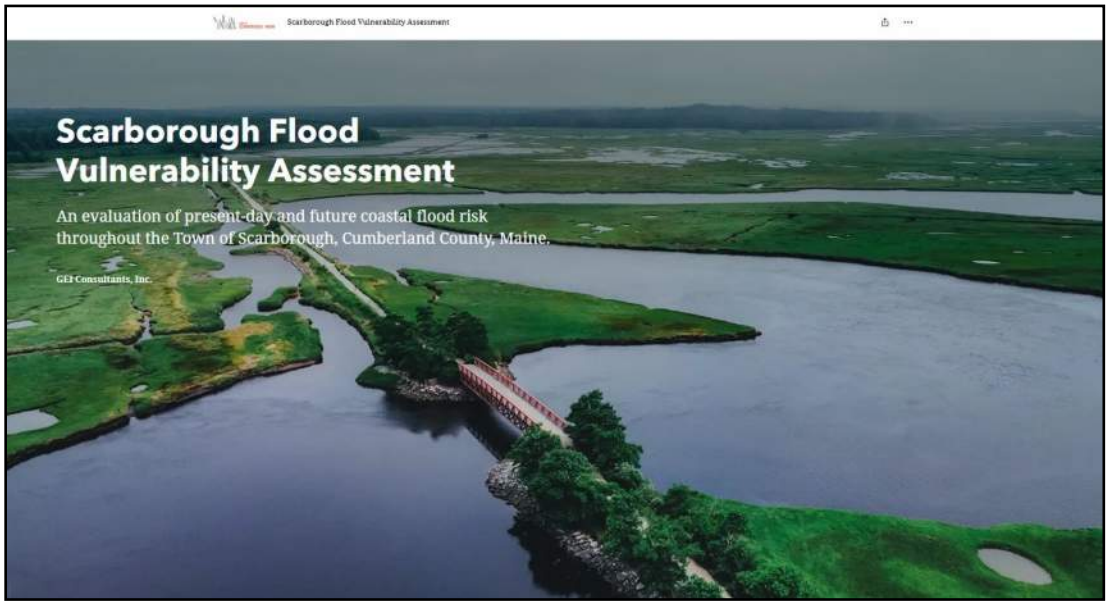
The first step to adaptation of a property is to understand the present-day and future flood risk due to coastal storm surge and sea level rise. Once the flood risk is understood, it is important to review Coastal Sand Dune Zones and the Shoreland Zoning Overlay to understand which rules and regulations an adaptation design would likely need to abide by. We have outlined the following steps for this process.

2.1. Review the Flood Vulnerability Assessment StoryMap

Review the online StoryMap to understand changing coastal flood risk over time due to storm surge and sea level rise. We recommend using your web browser to review the StoryMap inundation boundaries, but we have also provided inundation extents for Scenarios 2, 5, and 6 in Appendix A. Understand that these maps do not show areas subject to additional flooding due to waves. Use this reference to understand short and long-term flood risk of your property and if/when your property may be subject to high tide flooding (daily and/or monthly flooding due to high tide events). In particular, review the following flood boundaries:

- **Scenario 2** to see if the property would likely experience high tide flooding by 2050 (1.5 feet of sea level rise) during astronomically high tidal events.
- **Scenario 5** to see if the property would likely experience flooding during "100-yr" coastal storm events by 2050 (1.5 feet of sea level rise). Note that this does not show areas subject to wave action along the coast. A "100-yr" coastal storm event is typically characterized by having a 1% chance of occurring in any given year.
- **Scenario 6** to see if the property would likely experience high tide flooding by 2100 (4.0 feet of sea level rise) during astronomically high tidal events.

Figure 2-1. Scarborough Flood Vulnerability Assessment StoryMap Preview



Source: Town of Scarborough (2025b). Access StoryMap here: https://tinyurl.com/FVA-StoryMap

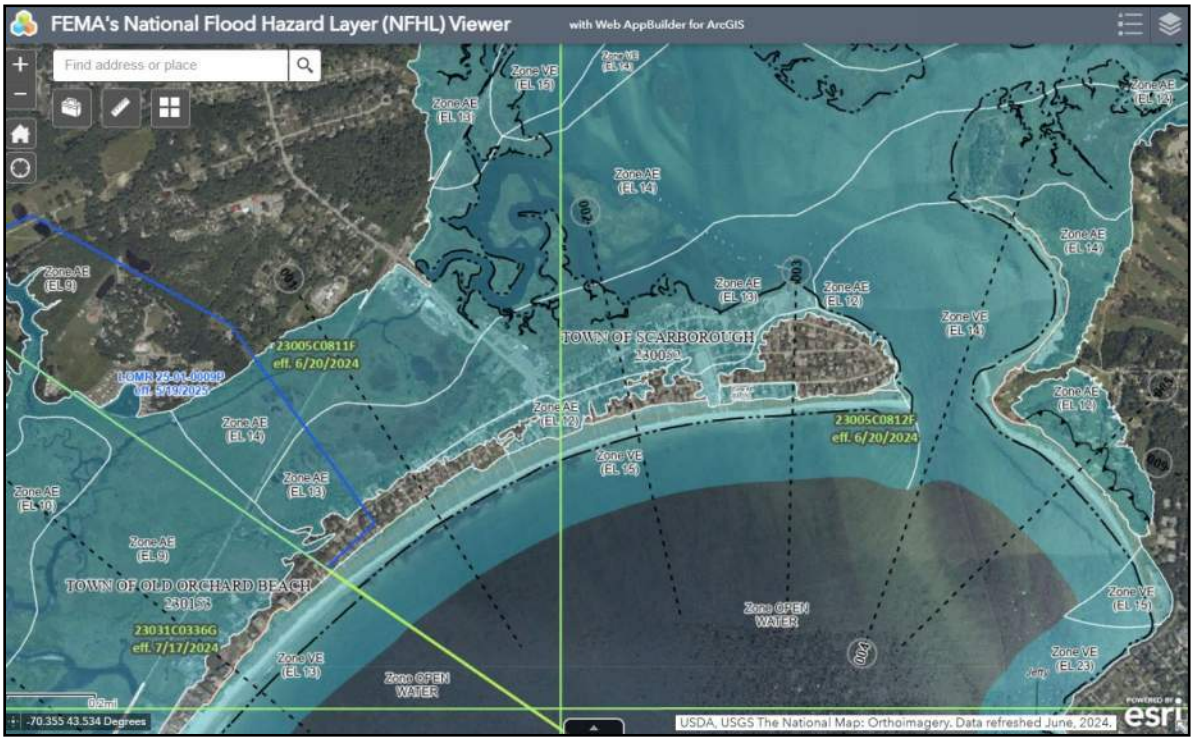
2.2. Check the FEMA Flood Zones at Your Property

Check the Federal Emergency Management Agency (FEMA) flood zones at the property and make note of if the property is in an "AE" or "VE" zone and the elevation associated with it (e.g., "ZONE VE [EL 15]"). "VE" stands for a "Velocity" zone and represents areas subject to wave action of 3 feet or greater. "AE" zones represent areas subject to wave action of less than 3 feet. The elevation associated with the flood zone is referred to as the "Base Flood Elevation" (BFE) and represents the elevation that floodwater during a 100-yr coastal storm event (i.e., a 1% annual chance coastal storm) would likely reach to.

The FEMA maps differ from the Flood Vulnerability Assessment StoryMap because they show flood risk due to 100-yr coastal storm events for present-day sea levels only. However, they also include wave action zones that are not present in the StoryMap. We have indicated three ways to view the FEMA flood zones for your property:

1. For web browser friendly maps with the ability to zoom in and pan around, visit FEMA's National Flood Hazard Layer Viewer website (FEMA, 2025). A preview of FEMA's web browser is provided in Figure 2-2.
2. Review the maps provided in Appendix B for FEMA maps specific to Pine Point.
3. Visit the Town of Scarborough Planning and Code Enforcement Office to view the maps in person.

Figure 2-2. FEMA National Flood Hazard Layer Viewer



Source: FEMA (2025). Access web viewer here: https://tinyurl.com/FEMA-NFHL

2.3. Check the Coastal Sand Dune Zones

Review the Maine Geological Survey (MGS) Coastal Sand Dune Zone web maps for the property and make note of if the property is in a Frontal Dune ("D1" or yellow) or Back Dune ("D2" or red) and if it is also within an Erosion Hazard Area ("EHA" or hashed area) (MGS, 2024). See Figure 2-3 for a preview of the MGS web map interface. Areas mapped within a coastal sand dune may be subject to the Maine Department of Environmental Protection (DEP) Natural Resources Protection Act, Coastal Sand Dune Rules.

Frontal dunes are the most seaward portion of a sand dune, back dunes are landward of frontal dunes, and erosion hazard areas represent areas "that can reasonably be expected to become part of a coastal wetland in the next 100 years" primarily due to historical or predicted erosion patterns.

The coastal sand dune zone that your property/building is in will determine regulatory stipulations that an adaptation project would likely be subject to. These maps can be viewed and downloaded online using the link above.

Maps of the coastal sand dune zones for Pine Point are also provided in Appendix C.

Figure 2-3. Maine Geological Survey Maine Coast Sand Dune Geology Viewer

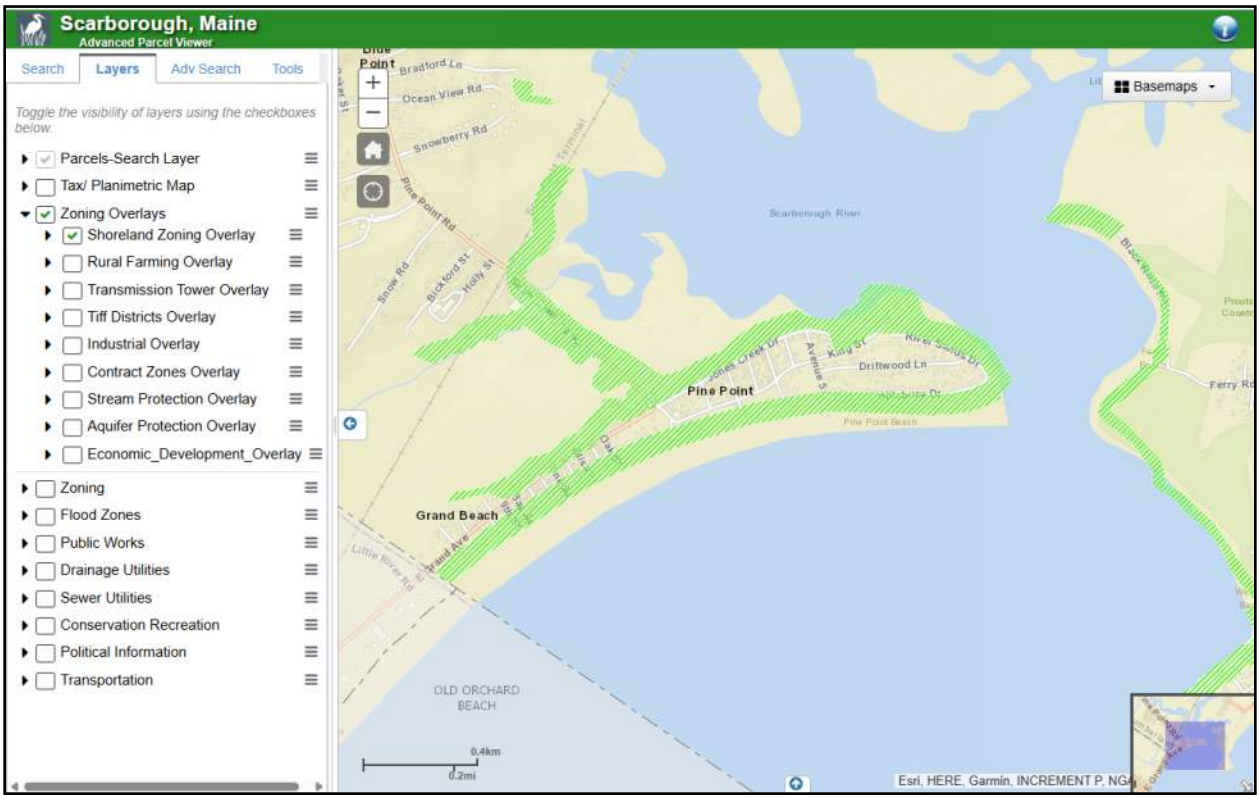


Source: MGS (2024). Access web viewer here: https://www.maine.gov/dacf/mgs/pubs/digital/dunes.htm

2.4. Review the Town of Scarborough Shoreland Zoning Overlay

Check if the property is within 250 feet of the highest astronomical tide (HAT) line by accessing the online Town of Scarborough Advanced GIS Viewer, zooming into the property, and turning on the layer for "Shoreland Zoning Overlay" under the "Zoning Overlays" category. The Town of Scarborough Code Enforcement Office can also assist in reviewing the zoning boundaries for a property. See Figure 2-4 for a preview of the Scarborough GIS Viewer Shoreland Zoning Overlay layer.

Figure 2-4. Scarborough GIS Viewer Shoreland Zoning Overlay Preview



Source: Town of Scarborough (2025c). Access GIS map here: https://webapps2.cgis-solutions.com/scarboroughAdvanced/

3. Understand What These Zones Mean for Adaptation

When elevating a residential structure, either due to significant renovation, proactive adaptation, or new construction, the amount the building must be elevated and the type of elevation (fill vs. pilings) will be stipulated based on the FEMA zone and coastal sand dune zone that the building is mapped in. We have provided a table below as a reference for elevation requirements and other restrictions based on the zone combination (Table 3-1).

Table 3-1. Residential Structure Elevation Requirements

Zone Combination	Restrictions and Elevation Guidance
FEMA VE Zone + Frontal Sand Dune	1) Cannot develop on undeveloped lots under current Maine DEP Coastal Sand Dune rules. 2) For developed lots, elevate on open pilings to at least 2 feet above the BFE or the highest natural elevation measured 5 feet from the corners of existing building foundation (whichever is higher).
FEMA AE Zone + Frontal Sand Dune Or FEMA AE or VE Zone + Back Sand Dune + Erosion Hazard Area	Elevate on open pilings: 1) For undeveloped lots, elevate to at least 2 feet above the BFE or 3 feet above existing elevation within the building's footprint (whichever is higher). Additional limitations apply to lots that include VE zones[1]. 2) For developed lots, elevate to at least 2 feet above the BFE or the highest natural elevation measured 5 feet from the corners of existing building foundation (whichever is higher)
FEMA AE or VE Zone + Back Sand Dune (non-Erosion Hazard Area) Or FEMA AE or VE Zone (outside Coastal Sand Dune Zone)	Elevate on open pilings to at least 2 feet above the BFE. Additional limitations apply to lots that include VE zones[1].
Frontal Sand Dune (outside FEMA zone) Or Back Sand Dune + Erosion Hazard Area (outside FEMA Zone)	Elevate on open pilings: 1) For undeveloped lots, elevate at least 3 feet above existing elevation within the building's footprint 2) For developed lots, elevate to the highest natural elevation measured 5 feet from the corners of existing building foundation
Back Sand Dune (outside FEMA Zone)	No elevation requirements

Notes:

1. Refer to Section 6(C) of the Maine Department of Environmental Protection (DEP) Natural Resources Protection Act (NRPA) Chapter 355: Coastal Sand Dune Rules for more details about building restrictions in a coastal sand dune and VE zone (MDEP, . 2024).

In addition to the general regulations identified in the table above, if a building is within a Shoreland Zoning Overlay, there are limits to the expansion height and footprint of a project and additional setback requirements. The Town of Scarborough Planning and Code Enforcement Office can help you understand these additional requirements.

Table 3-1 is a starting point for understanding regulations around residential building elevation and in particular, does not address lot size restrictions that may come into play. For an understanding of lot size restrictions, contact the Town of Scarborough Planning and Code Enforcement Office.

Additionally, there are DEP regulations around buildings that have been previously severely damaged by wave action for an ocean storm. In this circumstance, please work with a consultant or code enforcement officer to understand your options.

4. Contact the Planning and Code Enforcement Office

For help understanding regulations for a residential adaptation and/or building elevation project, contact the Town of Scarborough Planning and Code Enforcement Office. Town staff can assist in confirming the location of your property in relation to FEMA flood zones, coastal sand dune zones, and the Shoreland Zoning Overlay. They can review applicable regulations for a project, and answer questions that you may have.

The contact information for the Town of Scarborough Planning and Code Enforcement Office is provided below:

Scarborough Municipal Building
Lower Level, Room 125
259 U.S. Route 1
P.O. Box 360
Scarborough, ME 04070-0360
Phone: (207) 730-4040
Fax: (207) 730-4046

https://www.scarboroughmaine.org/departments/planning-codes

5. Hire a Contractor

The Town of Scarborough Planning and Code Enforcement Office can provide information on local contractors who have experience with flood adaptation projects in the area. Additionally, for projects located in the Shoreland Zone, the DEP requires the use of contractors certified in erosion and sediment control practices. A regularly updated list of certified contractors is available on the Maine DEP website (Maine DEP, 2025).

A qualified contractor can help coordinate the design, permitting, and construction of your adaptation project. They may also bring in additional professionals—such as engineers, permitting specialists, and subcontractors—to support different phases of the work.

6. Alternative Adaptation Measures and Additional Resources

While elevating a home can be an effective long-term strategy for reducing flood damage, there are many other practical and cost-effective adaptation measures that homeowners can take—some of which do not require major construction or permits or are eligible for expedited permit review. These include:

- **Floodproofing:**
  - Installing flood vents or flood-resistant materials
  - Sealing basements and crawlspaces
  - Elevating utilities like HVAC systems, water heaters, and electrical panels
- **Dune Restoration and Vegetation:**
  - Planting native dune grass or installing fencing to stabilize dunes
  - Maintaining or restoring natural buffers to absorb wave energy and erosion
- **Temporary Flood Barriers:**
  - Using sandbags, water-filled barriers, or inflatable flood shields during storm events
- **Flood Insurance**
  - Maintaining a National Flood Insurance Program (NFIP) policy is critical—even outside of mapped flood zones—to recover more quickly after a flood event

There are several publicly available resources that provide guidance on these measures. We have included a list below with additional information provided in links or the attached Appendices.

- **Maine Coastal Property Owner's Guide to Erosion, Flooding, and Other Hazards, 2nd Edition.** This guide was created by MGS (2021) to help educate coastal homeowners on specific hazards and identify mitigation and adaptation strategies. In particular, this resource is useful for understanding some of the adaptation options for homeowners with coastal dunes on their property. The guide can be accessed here: https://tinyurl.com/MGS-Guide.
- **Common Questions and General Guidelines for Repair or Rebuilding in the Coastal Sand Dune System (Maine DEP, n.d.).** This is a document provided by Maine DEP which outlines activities in the dune system and whether they would require a permit. Rules are subject to change. The guide is provided in Appendix D.
- **Protect Your Home from Flooding. Low-Cost Projects You Can Do Yourself.** This guide focuses on home mitigation and adaptation projects that would be easier to implement in terms of costs and permits (FEMA, 2020). The guide is provided in Appendix E.
- **Flood Fighting: How to Use Sandbags.** This reference is provided by the U.S. Army Corps of Engineers (USACE) (2018) and outlines how to fill and place sandbags to use in reducing flood water damage. The reference is provided in Appendix F.

7. Limitations

This guidance document summarizes residential home adaptation strategies, specifically for the Pine Point neighborhood in Scarborough, Maine. The purpose of this work was to provide a high-level overview of the steps required to understand flood risk and the regulations and zones pertinent for a residential home adaptation project. The guidance relies on readily available online information, published references, and regulations in place as of the date of this report.

This document does not provide an in-depth review of flood risk for a particular property and does not provide all the regulations that an adaptation project would be subject to. Actual flood risk, including storm surge elevations and rates of sea level rise, will vary from what has been presented in this report.

We recommend site survey and site-specific design be completed for any infrastructure project that a homeowner pursues. Because the methods, procedures, and assumptions used to develop the analysis are approximate, the results should be used only as guidance.

Reuse of this report for any purpose, in part or in whole, is at the sole risk of the user.

8. References

FEMA (2025). National Flood Hazard Layer Viewer. Accessed via web at: https://www.arcgis.com/apps/webappviewer/index.html?id=8b0adb51996444d4879338b5529aa9cd.

FEMA (2020). Protect Your Home from Flooding. Low-Cost Projects You Can Do Yourself.

Maine DEP (2025). Individuals Certified in Erosion Control Practices. Accessed via web at: https://www.maine.gov/dep/land/training/ccec.html.

Maine DEP (2024). Chapter 355: Coastal Sand Dune Rules. Accessed via web at https://www.maine.gov/sos/rulemaking/agency-rules/department-environmental-protection-rules.

Maine DEP (n.d.). Common Questions and General Guidelines for Repair or Rebuilding in the Coastal Sand Dune System.

MGS (2024). Coastal Sand Dune Geology 1:4,800-scale Maps Digital Data. Accessed August 1 2025 via: https://www.maine.gov/dacf/mgs/pubs/digital/dunes.htm.

MGS (2021). Maine Coastal Property Owner's Guide to Erosion, Flooding, and Other Hazards, 2nd edition. February.

Town of Scarborough (2025a). Vulnerability Assessment website. https://www.scarboroughmaine.org/stay-connected/municipal-projects/vulnerability-assessment.

Town of Scarborough (2025b). Scarborough Flood Vulnerability Assessment ArcGIS StoryMap. Accessed via web at: https://storymaps.arcgis.com/stories/69b7ac686fe447f6b824e9d7b6180368.

Town of Scarborough (2025c). Advanced Parcel Viewer. Accessed via web at: https://webapps2.cgis-solutions.com/scarboroughAdvanced/.

USACE (2018). Flood Fighting: How to Use Sandbags. November.

Appendix A Flood Vulnerability Assessment Maps

A.1. Pine Point Flood Scenario 2

A.2. Pine Point Flood Scenario 5

A.3. Pine Point Flood Scenario 6

A.1. Pine Point Flood Scenario 2



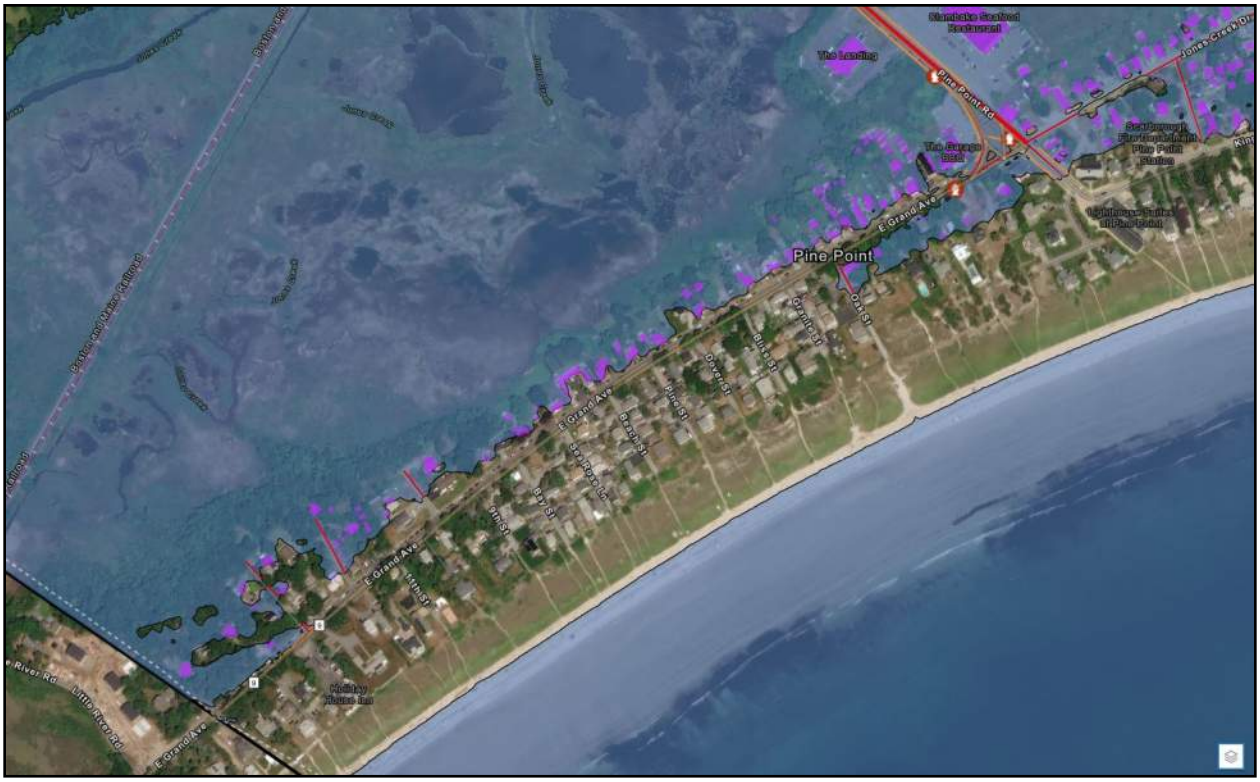


A.2. Pine Point Flood Scenario 5



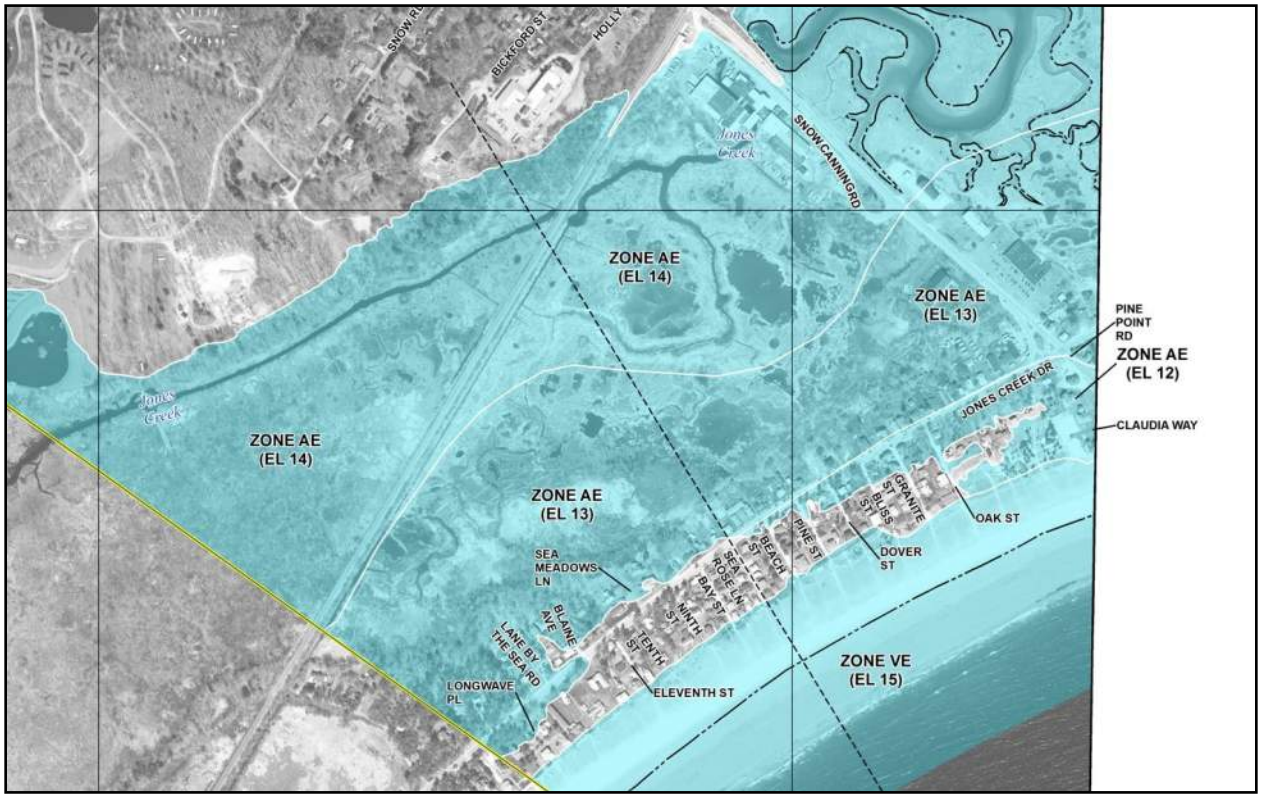


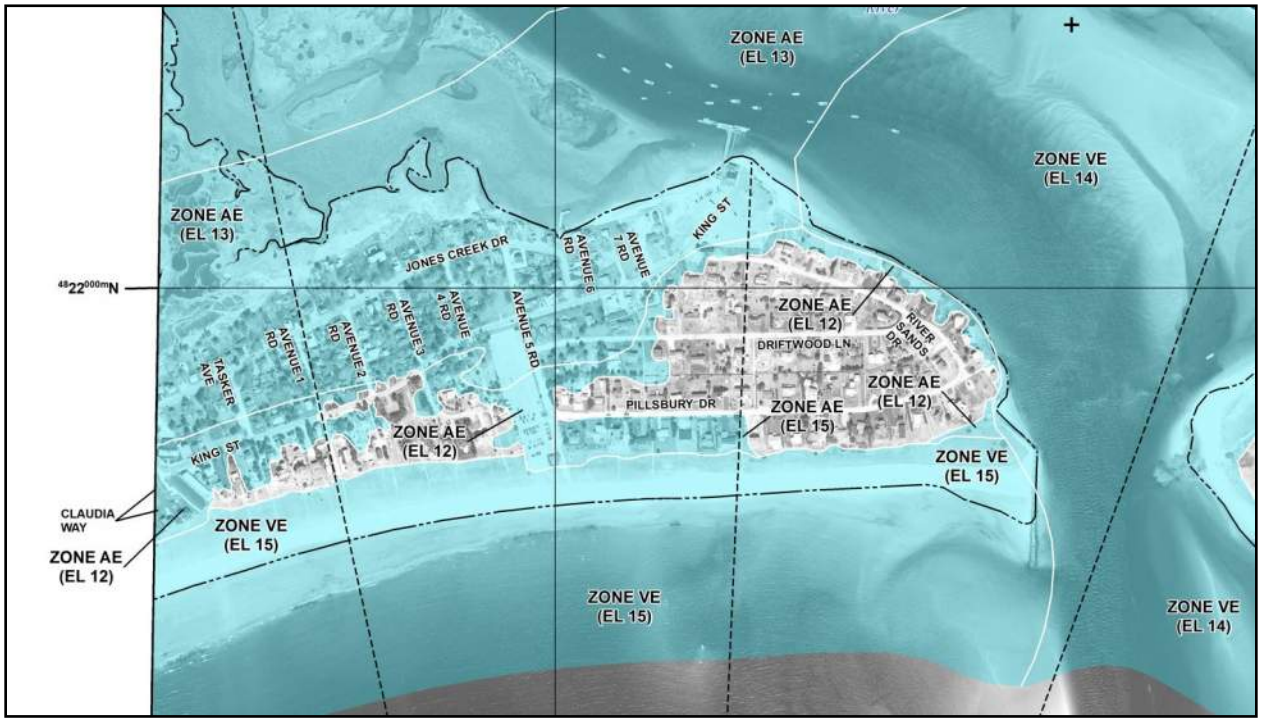
A.3. Pine Point Flood Scenario 6



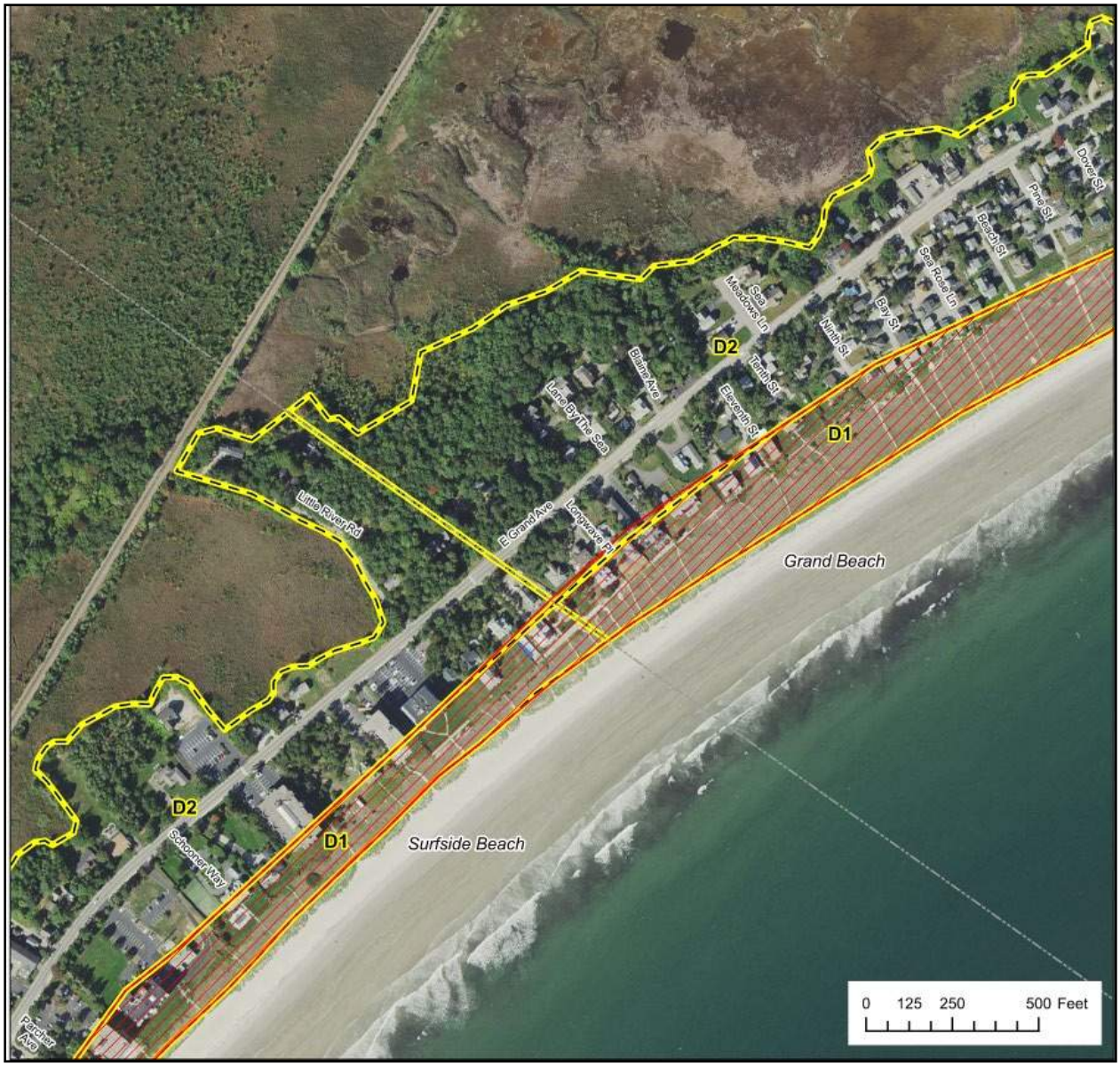


Appendix B Pine Point FEMA Maps

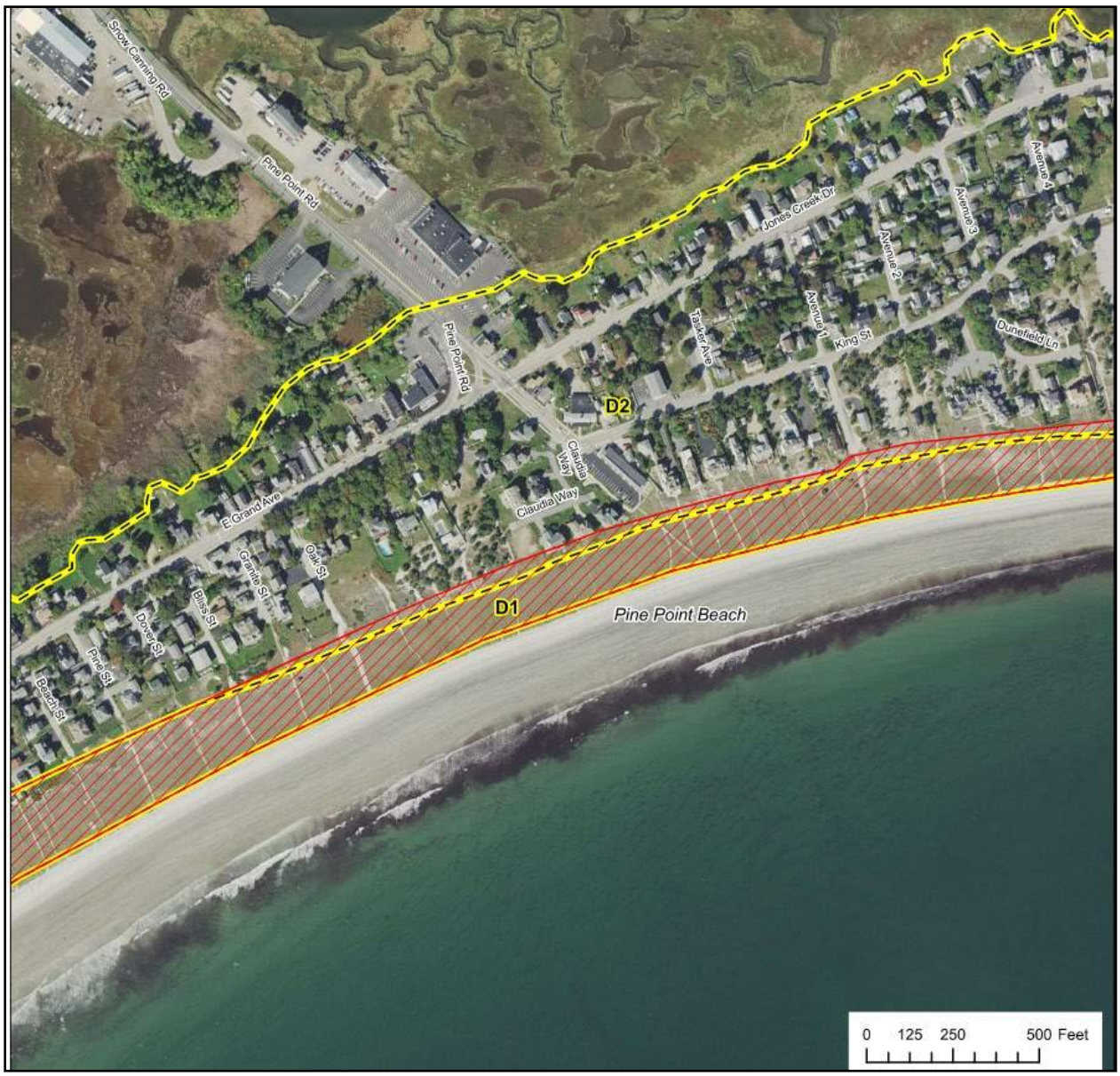




Appendix C Pine Point Sand Dune Maps



Note: D1 stands for Frontal Dune, D2 stands for Back Dune, and red hashing indicates an Erosion Hazard Area.



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Appendix D Common Questions and General Guidelines for Repair or Rebuilding in the Coastal Sand Dune System

Common Questions and General Guidelines for Repair or Rebuilding in the Coastal Sand Dune System

Contact: Southern Maine Regional Office, Land Division
207-822-6300 or 1-888-769-1036

Coastal sand dune systems are fragile and dynamic ecosystems that act as natural barriers protecting the shoreline from ocean storms. Many activities in coastal sand dunes require permits prior to the start of these activities. However, there are several activities that may be necessary after a severe coastal storm that do not require approval from the Department. Below are common questions about these activities:

1. **Can I move sand and debris away from my house/lawn/developed area on my property?**
   Yes. This is "de minimis" (a permit is not required) provided debris is removed and sand/cobble/seaweed is placed properly back into the sand dune system. Debris is defined in rule as "non-mineral material" so would not include sand, cobble or seaweed, but does include, and in this case, allows the removal of, driftwood, pieces of structure, and most other man-made material, including garbage or trash. If garbage or trash is removed, it must be disposed of at an approved solid waste disposal facility. See "de minimis" section for more information.
2. **Can I move cobbles away from my house/lawn/developed area on my property?**
   Yes, but with limitations. Limited amounts of cobble can be removed by hand but need to be placed immediately seaward of a frontal dune or seawall on your property. However, any clearing of significant amounts of cobble or removal using large equipment may require a permit. Please contact the Department to discuss permitting requirements.
3. **Can I move sand/debris/cobble from the Town owned beach in front of my house?**
   No. If the beach is owned by the Town, permission must first be granted by the Town. Cobble removal may require permits from the Department (See #1 and #2 above). Check with your local Code Enforcement Officer, Town Engineer, or Public Works Director.
4. **What do I do with garbage and other waste found within the natural cobble/sand/debris?**
   See #1 above.
5. **Can I shore up my seawall with riprap?**
   Yes, but with limitations. For a seawall damaged during a storm, or in imminent danger of being damaged, certain exemptions apply. There are provisions in the statute that allow the placement of riprap to shore up a seawall; however, the riprap would eventually have to be removed and the seawall repair would need to be permitted. Permanently protecting a seawall using riprap is not allowed. See repair and maintenance and seawall repair sections below for more information.

6. **Can I increase the height of my seawall to prevent over wash in the future?**
   No. According to the rules, "No new seawall or similar structure may be constructed. No existing seawall or similar structure may be altered or replaced, and as allowed under Chapter 305, Permit by Rule and 38 M.R.S.A. §480-W". Existing seawalls cannot be expanded. See repair and maintenance section below for more information.
7. **Is seaweed considered waste and should it be removed?**
   No. Seaweed is not considered waste and should be treated differently from "debris" i.e. not removed from the dune system. It can be moved as a "de minimis" activity provided it is not removed from the sand dune system and its placement does not disturb dune vegetation.
8. **Can I stockpile the sand recovered from my lawn into a protective berm?**
   No. The "de minimis" provisions require sand to be spread out not to exceed 3 inches in depth. If a property owner would like to use the sand to create a protective dune, there is an abbreviated permitting process (i.e. Permit by Rule) that can be obtained.
9. **Can I build a new footpath to the beach if the existing one was damaged or destroyed?**
   Yes, if you intend to rebuild the path in the same location, Call the Department's Portland office for guidance. However, dunes can lose their protective cover of vegetation along foot paths where people access the beach. Over time, these paths can act as conduits for floodwaters and waves. A path that curves or zig-zags near the seaward edge of the dune can slow erosion and flooding. Path rerouting will likely require a permit the Department since it may impact dune vegetation. To protect dunes from foot-traffic that can contribute to erosion, elevated walkways or bridges can be constructed perpendicular to the natural sand dune. For guidance on this and other issues related to activities in coastal sand dunes, Maine Sea Grant has published a helpful resource called the Maine Property Owners' Guide to Erosion, Flooding and Other Coastal Hazards: seagrant.umaine.edu/coastal-hazards-guide/beaches-and-dunes

"De minimis" activities that DO NOT require a permit:

- Removal of debris from a beach provided only limited amounts of cobble and no sand is removed;
- Addition of loam on existing lawn so that the total depth of loam does not exceed 3 inches;
- Removal of sand from lawns or other developed areas provided the sand is retained in the coastal sand dune system, does not disturb existing dune vegetation, and is spread on beach areas to a depth of no greater than three inches above the existing beach grade;
- Construction of open fences to keep pedestrian traffic off dune vegetation or away from designated essential wildlife habitat areas;
- Replacement of a foundation provided the new foundation is a post or piling foundation that meets the requirements of Chapter 355

5(D) and 6(G) and remains in the same footprint;

- Removal of seaweed from developed area (this does not apply to undeveloped frontal dunes) provided the seaweed remains in the coastal sand dune system and it does not impede the growth of dune vegetation.
- Construction of a walkway or path on an existing developed area.

PLEASE NOTE: *Removal of significant amounts of cobble and/or removal of cobble by large equipment requires permitting in the frontal dunes. Please contact the Department to discuss permitting requirements for your* property or contact the Town to discuss cobble removal from the beach in front of your property.

Maintenance and Repair Activities DO NOT require a permit provided that:

- They do not result in more than 50% of the structure being repaired or rehabilitated;
- They do not result in additional intrusion in the sand dune system;
- The repaired structure does not exceed the dimensions (height, width, and length) of the existing structure;
- The structure to be repaired is not an historic structure.
- Any resettlement of rocks or boulders in a riprap structure that were dislodged due to wave action, if the work is less than 50% of the riprap. If the repair is more than 50% of riprap structure, a NRPA permit by rule is required.

Note: Cost of the maintenance and repair activity may not equal or exceed 50% of a building's value prior to the start of the project. Once 50% of a building's value is equaled or exceeded, the project is no longer considered maintenance and repair and permits for reconstruction are necessary. Incremental improvements to a structure within a 5-year period are considered by the Department in determining whether the exemption applies. If reconstruction is necessary, please refer to the Standards for Building Reconstruction below and contact the Department for permitting requirements.

Seawall Repair:

No new seawalls or additions to existing seawalls are allowed in the coastal sand dune system. **A seawall may be reconstructed or repaired maintaining the same dimensions.** Repairs to more than 50% of a seawall are eligible for a permit by rule provided the same dimensions are maintained. An existing seawall may be reconstructed in a different location (more landward) and with different dimensions provided the new seawall is determined by the Department to be less damaging to the sand dune system, wildlife habitat and adjacent properties and would require an individual NRPA permit.

If deemed necessary by the local code enforcement officer, a state-licensed professional engineer, or a state-certified geologist, a seawall or similar structure located within the sand dune system that was destroyed or in danger of being destroyed may be reinforced with riprap or sandbags as an

emergency measure, provided the following steps are taken:

- Written notice must be provided to the Department within 5 days of when the emergency action was taken.
- Within 6 months following placement of the material, a permit application must be submitted to the Department to repair or replace the structure, and the reinforcement material must be removed within 18 months from the date a permit is issued.

Standards for Building Reconstruction:

Other standards apply to reconstruction of buildings severely damaged by wave action, including buildings that have already been reconstructed once – please refer to the Natural Resources Protection Act Chapter 355 rules.

- Reconstructed buildings must always be moved landward to the extent practicable. When reconstructing a building that will be moved landward, the shape of the building's footprint may be altered provided the overall area of the proposed building's footprint is not exceeded. If the building cannot be moved back, then the shape (area and dimensions) of the building's footprint must remain the same as the existing building.
- The height of the structure must not exceed the height of the existing structure, unless a vertical addition is proposed that meets Section 6(B)(4).
- **All buildings modified or reconstructed in the frontal dune must be supported on a post of piling foundation that allows the free movement of sand, with the lowest portion on structural members of the lowest floor elevated at least three feet above the highest natural elevation of the dune measured five feet from the corners of the existing building's foundation.** A flow-through foundation or one with breakaway panels does NOT meet this standard.
- Post or piling foundations should be designed by a structural engineer. An acceptable design frequently includes posts or piles supported by a continuous footing and/or spread footings below the frost line.
- The post or piling foundation can be enclosed with lattice or vertical boards. Lattice must have minimum openings of 4 inches by 4 inches and vertical boards must have openings that are twice the width of the boards, with a minimum opening size of 4 inches. Doors and garage doors under a post or piling foundation must also have these size openings. If the project design includes provisions to park a vehicle under the building, any doors used to enclose the parking area must have a three-foot opening measured from the existing ground elevation to the bottom of the garage doors. Large mesh hardware cloth may be attached to the lattice or vertical boards to keep rodents out of the foundation area. Detached garages are not subject to this requirement and may have solid walls and doors.
- Mitigation is required in some cases where practicable, and may include dune construction and/or enhancement of developed areas with native beach vegetation if there are areas on the lot not covered by buildings or parking areas.

Appendix E Protect Your Home from Flooding. Low-Cost Projects You Can Do Yourself



Protect Your Home from Flooding

LOW-COST PROJECTS YOU CAN DO YOURSELF

FEMA

RiskMAP
Increasing Resilience Together

FLOODING IS THE MOST COMMON AND COSTLY DISASTER IN THE UNITED STATES AND CAN HAPPEN ANYWHERE.

However, there are many ways to reduce your home's risk of flooding, and not all of them are difficult or expensive. This guide briefly describes some of the smaller, lower cost actions you can take yourself or with minor assistance from others. It also suggests places you can go to find more information about flood mitigation techniques, including some of these.

You have many flood mitigation options as a homeowner. As you begin to think about which might be the best for you and your home, consider following these **three key steps**:

1. **Know Your Risk.** Anywhere it can rain, it can flood–so we all live in a flood zone, and we all live with the risk of flood damage to our property. Learn more details about your home's level of flood risk, including the type of flood zone it is in and, if available, the potential flood elevation (referred to as the "base flood elevation" on a flood map). A good place to start is FEMA's online Flood Map Service Center at www.msc.fema.gov/portal/. You can also visit the officials in your community who maintain the FEMA flood maps and elevation certificates; they may work in the local planning and zoning office or in the building department. Talk to them, your neighbors, and others about any past flood events and how high the water has risen in the past at or near your home.

2. **Insure Your Property.** As a homeowner, it's important to insure your home and personal belongings. Even if your home is in a low- or moderate-risk flood zone, purchasing a flood insurance policy is highly recommended. It provides you with financial protection from a flood event. Flood damage isn't covered by standard homeowners insurance policies, and just a few inches of floodwater can end up costing thousands of dollars in repairs. More than 25 percent of flood insurance claims come from properties that are not in an identified high-risk zone, but most homeowners in these areas are eligible for coverage at a preferred rate. Preferred Risk Policy premiums are the lowest premiums available, offering building and contents coverage for one low price.

3. **Reduce Your Risk.** Decide how to prepare your family and protect your home from flooding. Consider which of the methods included in this guide are most appropriate and practical, based on your home's flood risk, and create a plan to mitigate the risk to your property. Even after a mitigation project, some risk will remain, so learn about more actions to prepare and protect your family, home, and belongings at www.ready.gov/make-a-plan.



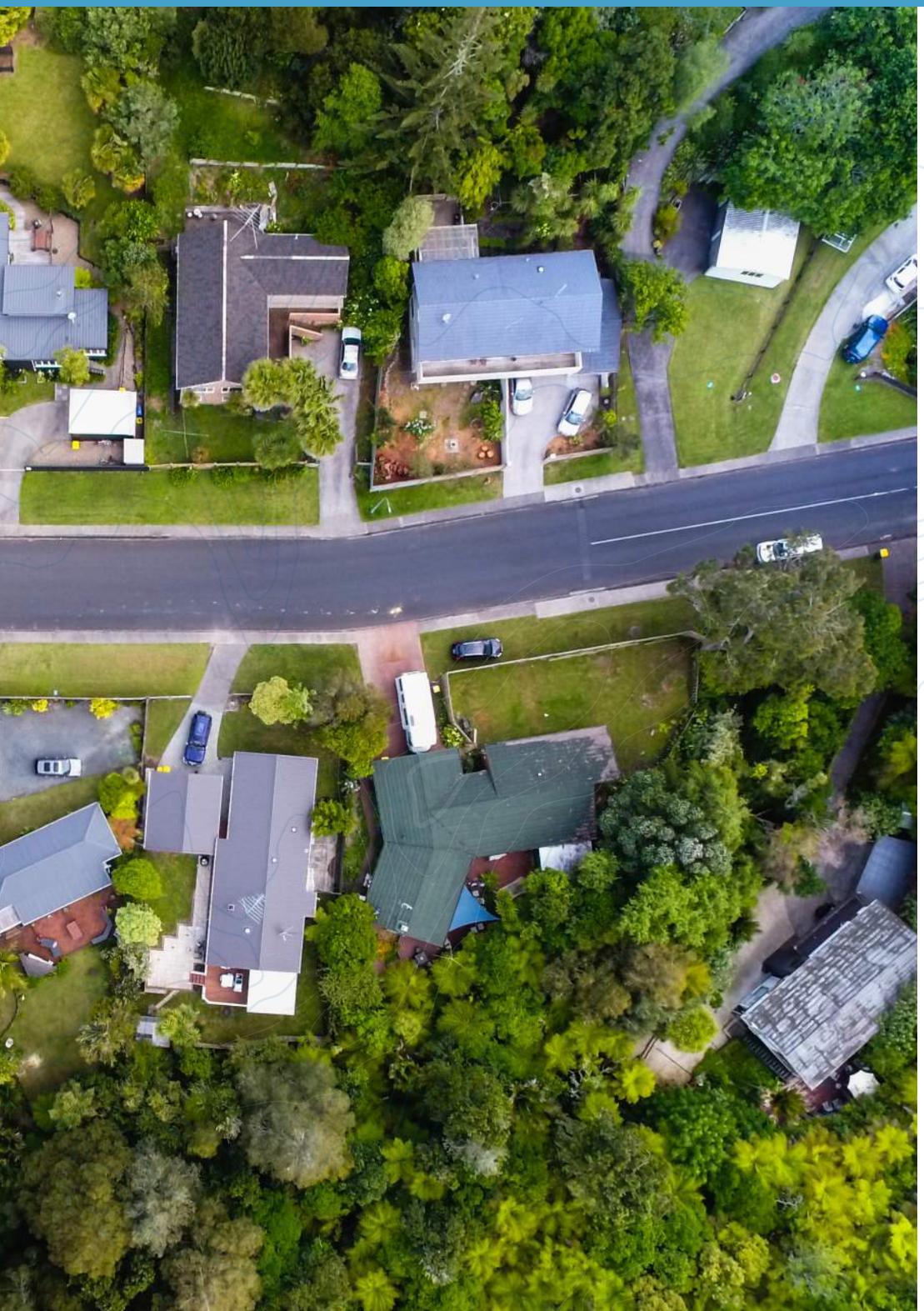


Please be aware that flood mitigation measures need to be tailored to the property in question. Depending on the project, you may need to consult local architects, engineers, contractors, landscapers, or other experts in design and construction. Also, changes to properties and buildings often require permits or other regulatory approvals. Your local planning and zoning office or building department is a good place to start for advice on how to best proceed. Lastly, please remember to be kind to your neighbors! Consulting adjacent property owners is very important when any actions on your property, such as extending downspouts or regrading areas between homes, could affect their property.

OUTSIDE THE HOME

For the exterior areas of your property, consider taking the following actions:

- **Maintain proper water runoff and drainage.** Routinely clean and maintain gutters, downspouts, and splashpads so that rainwater from your roof flows easily away from your home. Also, make sure that any nearby drainage ditches or storm drains are clear of debris and functioning properly.
- **Improve lot grading.** Determine how water flows or accumulates around your home to identify potential trouble spots (often easy to see during an average rainstorm). Stormwater should always drain away from the building; if necessary, change your landscaping to improve runoff. This may include building up any sunken areas around the foundation, digging small depressions to properly channel water, and otherwise improving the yard so that it slopes away from your home.
- **Reduce impervious surfaces around your home.** Water runs off concrete and asphalt almost immediately and can exceed the capacity of storm sewers quickly during heavy rains. Retaining and creating natural green space around your home can help reduce sewer overflows by reducing stormwater runoff. Consider options such as rain gardens, vegetated swales, or pervious pavements, which allow more water to be absorbed by the ground.
- **Install a rain barrel.** A rain barrel is an alternative method for dealing with rainwater. Rain barrels are typically connected to gutter downspouts and collect the runoff from roofs. You can use this stored water for non-potable uses such as watering the lawn and gardens or washing your car.
- **Elevate utilities and service equipment.** Raise and anchor air conditioning condensers, heat pumps, water meters and other service equipment onto pedestals or platforms that are at least 1 foot above the potential flood elevation. For identified high-risk zones this means going to or above the regulatory flood elevation for the property as adopted by the local community. This inexpensive action can help prevent significant damage and disruption following a flood event.
- **Anchor outdoor fuel tanks.** Attach outdoor fuel tanks to a large concrete slab that weighs enough to resist the force of floodwaters, or install inexpensive ground anchors that are connected across the top of the tank with metal straps. Unanchored fuel tanks can be easily moved and ruptured by floodwaters and pose serious threats to people, property, and the environment. If located in an identified high-risk zone, fuel tanks should also be elevated to or above the regulatory flood elevation as adopted by the local community. If not feasible then all filling and ventilation tubes should be elevated so that floodwaters cannot enter the tank.



INSIDE THE HOME

For interior areas below the potential flood elevation, consider making the following alterations:

- **Protect your valuable possessions.** Move important documents and other valuable or sentimental items to a safer location, well above the potential flood elevation and/or inside watertight containers.
- **Seal your foundation and basement walls.** Close any foundation cracks with mortar and masonry caulk or hydraulic cement, which expands and fills gaps completely. Seal walls in your basements with waterproofing compounds to avoid seepage. Make sure any floor drains are clear of obstructions.
- **Install flood vents.** Flood vents are small permanent openings that allow floodwater to flow freely through an enclosure such as a crawlspace or garage. Properly positioned and installed flood vents protect homes during floods by preventing water pressure buildup that can destroy walls and foundations. Flood openings may be required for lower enclosures of homes being built in high-risk flood zones, but they can also be installed in existing homes. Once installed, make sure your flood vents are kept free of debris and will allow the free-flow of floodwater.
- **Install a sump pump.** Sump pumps, which pump groundwater away from your home, can be an excellent defense against basement seepage and flooding. They draw in the groundwater from around the house and direct it away from the structure through drainage pipes. Be sure to choose a device with battery-operated backup, in case of electrical power failure.
- **Prevent sewer backups.** Install drain plugs for all basement floor drains to prevent sewer backups. Another recommended option, regardless of the potential flood elevation, is to install sewer backflow valves for all pipes entering the building. These devices, which allow water to flow only one direction, prevent floodwater and wastewater from backing up into your home through toilets, sinks, and other drains. They are available in a variety of designs that range from simple to complex, but they should be installed by a qualified, licensed plumber.

- **Use flood-resistant building materials.**
  - — Replace wooden floorboards and carpets with ceramic tile, vinyl, rubber, or other flood-resistant materials. Use moveable rugs instead of fitted carpets.
  - — Replace internal walls and ceilings with flood-resistant material such as lime plaster, cement board, concrete, or pressure-treated and decay-resistant wood.
  - — Replace wooden doors and window frames with metal or other flood-resistant options.
- **Raise electrical system components.** Increase the height of electric service panels (fuse and circuit breaker boxes) and all outlets, switches, and wiring to at least 1 foot above the potential flood elevation. These modifications should be made by a licensed electrician.
- **Protect utilities and service equipment.** Move the main parts of your heating, ventilation, and air conditioning (HVAC) systems to a higher floor or the attic. Consider raising other major appliances, such as washers, dryers, and hot water heaters, above the ground floor. If relocation or elevation is not possible, you can protect service equipment in place using low floodwalls and shields. Alternative options such as replacing traditional hot water heaters with tankless units should also be considered.
- **Anchor indoor fuel tanks.** Anchor fuel tanks by attaching them to a large concrete slab that weighs enough to resist the force of floodwaters.
- **Install a flood alert system.** A variety of flood sensors and other early warning devices can alert you to the risk of imminent flooding so that you can take preventative or protective actions before extensive damage occurs (see “Flood Preparedness”).

FLOOD PREPAREDNESS

You may be able to take additional actions immediately before an expected flood event that will prevent or reduce flood damage to your home:

- Activate flood protection devices (turn on sump pumps, close backflow valves, etc.).
- Shut off electricity at the breaker panel.
- Safeguard important paperwork and move furniture, rugs, electronics, and other valuable belongings to upper floors, or at least off the floor of the ground level.
- Elevate major appliances onto concrete blocks.
- Clean gutters, downspouts, and splash pads, along with any nearby drainage ditches or storm drains; clear snow and ice away from foundations.
- Deploy temporary flood barriers, such as portable flood gates or shields, sandbags, inflatable floodwalls, and flood skirts.

WANT TO LEARN MORE?

Contact your local community officials. Start with the local planning and zoning office or building department, and ask to speak with the designated floodplain administrator.

Consult local contractors or design professionals with flood mitigation expertise.

Visit the following websites:

FEMA, Protect Your Property
www.fema.gov/protect-your-property

FloodSmart
www.floodsmart.gov

Read more detailed publications available from FEMA:

Homeowner's Guide to Retrofitting
www.fema.gov/media-library/assets/documents/480

Reducing Flood Risk to Residential Buildings That Cannot Be Elevated.
www.fema.gov/media-library/assets/documents/109669

Protecting Your Home and Property from Flood Damage.
www.fema.gov/media-library/assets/documents/21471

Protecting Building Utility Systems from Flood Damage.
www.fema.gov/media-library/assets/documents/3729

Protect Your Property from Flooding.
www.fema.gov/media-library/assets/documents/13261

Appendix F Flood Fighting: How to Use Sandbags

Flood Fighting: How To Use Sandbags

U.S. ARMY CORPS OF ENGINEERS **BUILDING STRONG®**

Sandbag Construction – The use of sandbags is a simple, but effective way to prevent or reduce flood water damage. Properly filled and placed sandbags can act as a barrier to divert moving water around, instead of through, buildings. Sandbag construction does not guarantee a water-tight seal, but is satisfactory for use in most situations. Sandbags are also used successfully to prevent overtopping of streams with levees, and for training current flows to specific areas.

Untied sandbags are recommended for most situations. Tied sandbags should be used only for special situations when pre-filling and stockpiling may be required, or for specific purposes such as filling holes, holding objects in position, or to form barriers backed by supportive planks. Tied sandbags are generally easier to handle and stockpile. However, sandbag filling operations can generally be best accomplished at or near the placement site, and tying of the bags might be a waste of valuable time and effort. If the bags are to be pre-filled at a distant location, due consideration must be given to transportation vehicles and placement site access.

Commercial plastic sandbags, made from polypropylene, are available from most bag suppliers and hardware stores. These will store for a long time with minimum care, and are not biodegradable. Thus, they have to be disposed of after use, or will remain around for a long time. Another option is untreated burlap sacks, often available at feed or hardware stores. Empty bags are biodegradable, and can be stockpiled for several years, if properly stored. Filled burlap bags of earth material will deteriorate quickly. In either case, rodent control is strongly recommended during storage.

Do not use garbage bags, as they are too slick to stack. Avoid the use of feed or seed sacks, as they are too large to handle when filled even half full. If they must be used, keep the weight of filled bags down to what can be handled by one or two people (no more than 60 pounds). Where possible, use bags about 14-18" wide, and 30-36" deep.

A heavy bodied or sandy soil is most desirable for filling sandbags, but any usable material at or near the site has definite advantages. Coarse sand could leak out through the weave in the bag. To prevent this, double bag the material. Gravelly or rocky soils are generally poor choices because of their permeability.

Sandbag barriers are best built by a group of people working as a team. Insure that the individuals have the physical capability to carry or drag a sandbag weighing approximately 30-50 pounds (depending on dampness and type of sand). They should wear work clothing and gloves.

How to Fill a Sandbag – Filling sandbags is usually a two-person operation. The use of safety goggles and gloves is recommended. One member of the team places the empty bag between or slightly in front of widespread feet with arms extended. The throat of the bag is folded to form a collar, and held with the hands in a position that will enable the other team member to empty a rounded shovel full of material into the open end. The person holding the sack stands with knees slightly flexed, and head and face as far away from the shovel as possible.



The shoveler carefully releases the rounded shovel full of soil into the throat of the bag. Haste in this operation can result in undue spillage and added work. Bags should be filled between one-third (1/3) to one-half (1/2) of their capacity. This keeps the bag from getting too heavy, and permits the bags to be stacked with a good seal.

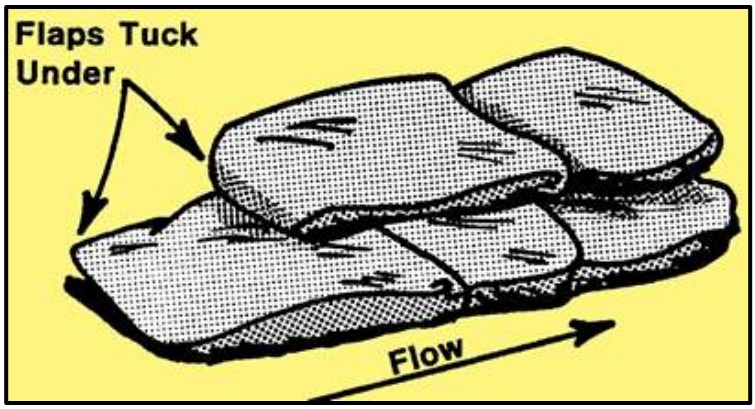
For large scale operations, filling sandbags can be expedited by using bag-holding racks, funnels, or power loading equipment. The special equipment required is not always available during an emergency, but can be fabricated using available materials, and should be identified in local flood response plans.

Sandbag Placement – Remove any debris from the area where the bags are to be placed.

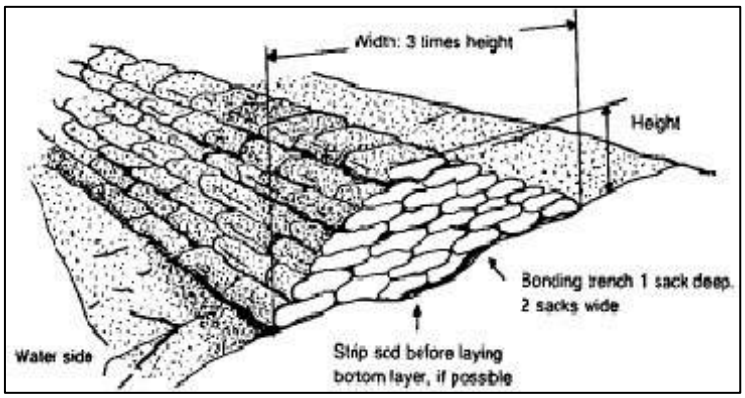
Fold the open end of the unfilled portion of the bag to form a triangle. If tied bags are used, flatten or flare the tied end.

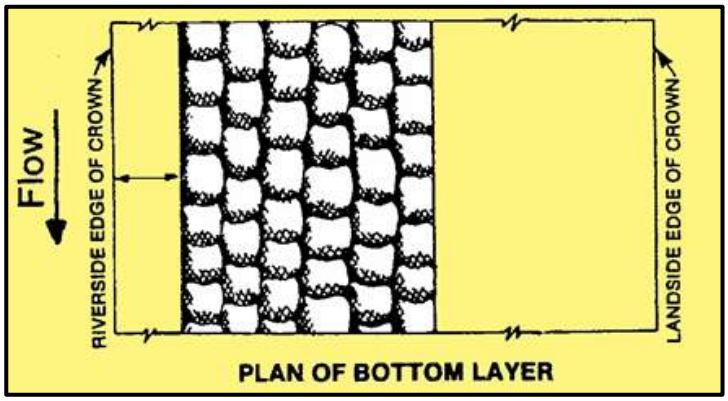
Place the partially filled bags lengthwise and parallel to the direction of flow, with the open end facing against the water flow. Tuck the flaps under, keeping the unfilled portion under the weight of the sack.

Place succeeding bags on top, offsetting by one-half (1/2) filled length of the previous bag, and stamp into place to eliminate voids, and form a tight seal.



Stagger the joint connections when multiple layers are necessary. For unsupported layers over three (3) courses high, use the pyramid placement method (below).





Pyramid Placement Method – The pyramid placement is used to increase the height of sandbag protection. Place the sandbags to form a pyramid by alternating header courses (bags placed crosswise) and stretcher courses (bags placed lengthwise). Stamp each bag in place, overlap sacks, maintain staggered joint placement, and tuck in any loose ends.

Estimating materials – Use the above table, and assume 40 pounds of sand per bag. A 3 foot levee, 500 feet long, requires (500/100) × 4500 = 22,500 bags. From that, (40 * 22,500) ÷ 2000 = 450 tons of sand. The weight of sand per bag will vary locally.

Number of Bags / 100 linear feet of sandbag levee					
Levee Height	# Bags	Levee Height	# Bags	Levee Height	# Bags
1 foot	800	3 feet	4,500	5 feet	9,750
2 feet	2,100	4 feet	7,800	6 feet	11,700

Ringing boils – A boil is a condition where water is flowing through or under an earth structure (such as a levee) that is retaining water. Free flowing water wants to move to lower elevations. If a levee is stopping floodwaters, the water may be able to find weak points to enter. This action is called "piping". If the water finds a large enough path, the flow will become visible, and is a serious threat to the integrity of the levee. Most boils occur in sand, silt, or some combination.

A boil is found on the landward side of the levee, or in the ground past the levee toe (the exact distance varies with local conditions). Possible boil sites can be identified by free standing or flowing water (other than culverts, pumps, etc). A boil can be found only by close inspection. A prime indicator is water bubbling (or "boiling"), much like a natural spring. Another is obvious water movement in what appears to be standing water.

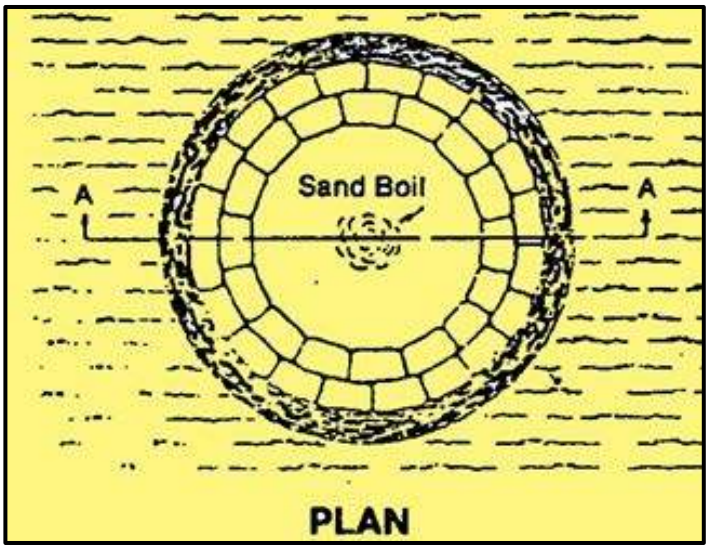
Carefully examine the water for movement. Boils will have an obvious exit (such as a rodent hole), but the water may be cloudy from siltation, or the hole very small. If there is any movement in the water, carefully approach the site, disturbing the water as little as possible. Let the water settle, and look at the suspected site. If you see the hole, examine it carefully. If the water flow is clear, there are no problems as yet. If there is no distinct hole, the water flow is not a threat. Monitor the site regularly for changes, and take no other actions.

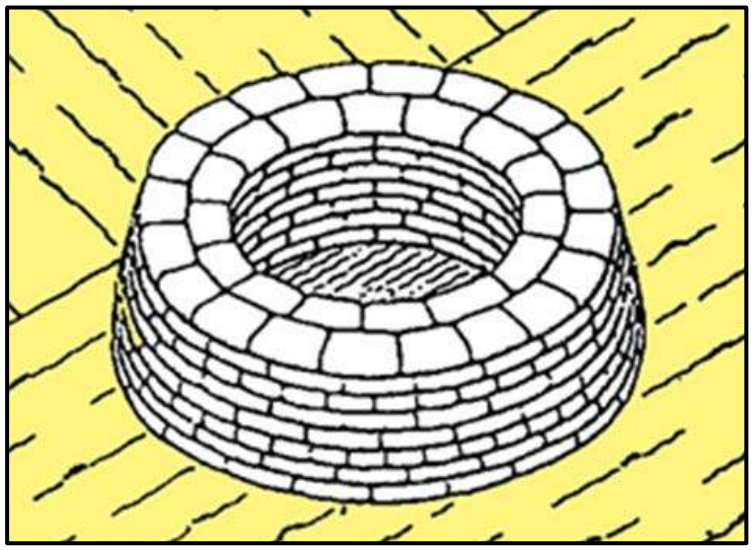
A dirty water flow indicates that the soil is being eroded by the water, and that could mean failure of the levee. A boil ring is the best solution. The idea is to reduce the water flow until the water is flowing clear, but not to stop the water flow. This

acts as a relief valve for the water pressure; the water continues to flow, but is not eroding the material. If the water flow is stopped, the pressure will remain, and another boil will form. Ring the boil with sandbags, with the first bags back 1-2 feet from the boil. More, if the soil is unstable.

Build the first layer in a circle, 2-4 bags across, and then build up, bringing each layer in. If possible, keep the interior face straight. Build the ring wall with the means for water to flow out, leaving a gap in the wall, or using pipes. Adjust the flows until the water slows, and becomes clear.

Monitor the ring wall constantly. Raise or lower the height of the wall as necessary, maintaining a slow, clear flow. The height should be only enough to slow flow such that no more material is displaced, and the water runs clear.





Notes:

Do not sack a boil which does not put out material.

The entire base should be cleared of debris and scarified.

Tie into the levee if the boil is near a toe.

Use loose earth between all of the sacks.

All joints must be staggered.

Be sure to clear the sand discharge.

Never attempt to completely stop the flow through a boil.

Corps of Engineers Sandbag Policy – Non-federal governments are responsible for maintaining a supply of sandbags adequate to cover anticipated immediate needs. At the discretion of the District Commander, a portion of the District's stockpile may be loaned to meet a specific local flood emergency. The Walla Walla District maintains a limited sandbag stockpile to augment local jurisdictions during actual flood emergencies, but can access a national contract for additional supplies. We will issue only to agencies or governments, through the designated emergency manager. Individual citizens requesting sandbags will be directed to their local government.

Unused stocks must be returned to Walla Walla District as soon as the emergency is over, unless otherwise released to the supported jurisdiction. Consumed stocks must be replaced in kind, or paid for by the local interests, unless the District Commander directs otherwise This applies only to those jurisdictions within the Walla Walla District's area of operation, the Snake River basin.

For Further Information – Refer to the Walla Walla District Flood Fight Handbook: Preparing For a Flood, available for download at the link below. Contact the District Readiness Office, as noted below, for a copy.

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READINESS OFFICE
201 North Third Avenue; Walla Walla, WA 99362-1876
509-527-7146 business hours
1-509-380-4538 emergencies (include 1-509- when calling)
cenww-eoc@usace.army.mil ¤ www.nww.usace.army.mil/Missions/Flood-Assistance/

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