



## Project Report

# City of Bath Pilot Project: Adaptation of Washington Street and Harward Street

Bath, Maine

**Submitted to:**  
City of Bath  
55 Front Street  
Bath, ME 04530

**Submitted by:**  
GEI Consultants, Inc.  
5 Milk Street  
Portland, ME 04102  
207.797.8901

December 2024  
Project No.2204496

This report was prepared for the City of Bath under award CZM NA22NOS4190151 to the Maine Coastal Program from the National Oceanic and Atmospheric Administration, U.S. Department of Commerce. The statements, findings, conclusions, and recommendations are those of the authors and do not necessarily reflect the views of the National Oceanic and Atmospheric Administration of the Department of Commerce.



---

Leila A. Pike, P.E.  
Sr. Civil Engineer, Project Manager

---

Brian M. McDevitt, P.E.  
Senior Professional

# Table of Contents

---

<b>1.</b>	<b>Introduction</b>	<b>1</b>
<b>2.</b>	<b>Project Area Description</b>	<b>2</b>
<b>3.</b>	<b>Environmental Considerations</b>	<b>4</b>
3.1.	Wetlands	4
3.2.	Site Geology	4
3.3.	Endangered Species and Critical Habitats	4
<b>4.</b>	<b>Flood Exposure</b>	<b>6</b>
4.1.	Flood Vulnerability Study	6
4.2.	Summary of Tidal and Flood Elevations	6
<b>5.</b>	<b>Adaptation Design Alternatives</b>	<b>8</b>
5.1.	Elevate Washington and Harward Streets	8
5.1.1.	Flood Risk	8
5.1.2.	Design Considerations and Challenges	9
5.2.	Construct a New Road	9
5.2.1.	Flood Risk	9
5.2.2.	Design Considerations and Challenges	9
5.3.	Do-Nothing	10
<b>6.</b>	<b>Permitting Considerations</b>	<b>11</b>
6.1.	Federal Permits	11
6.2.	State Permits	11
6.3.	Local Permits	12
<b>7.</b>	<b>Cost Estimate</b>	<b>13</b>
<b>8.</b>	<b>Next Steps</b>	<b>14</b>
<b>9.</b>	<b>Limitations</b>	<b>15</b>
<b>10.</b>	<b>References</b>	<b>16</b>

## List of Tables

Table 4-1. Tidal and Flood Elevations	7
---------------------------------------	---

## List of Figures

Figure 2-1. Intersection of Washington Street and Harward Street	2
Figure 2-2. Flood Inundation along Washington Street facing South	3
Figure 2-3. Flood Inundation along Washington Street facing North	3

## Figures

Figure 1. Pilot Project Site Location

## Appendices

- Appendix A National Wetlands Inventory
- Appendix B Surficial Geology
- Appendix C Beginning With Habitat
- Appendix D IPaC Resources List
- Appendix E Project Drawings

LAP/BMM:bdp  
\\geiconsultants.com\data\Data\_Storage\Working\BATH, CITY OF MAINE\2204496 Bath Vulnerability Study\PilotProject\Report\City of Bath Pilot Project  
Report\_2024-12-27.docx

# 1. Introduction

---

GEI Consultants, Inc. (GEI) has undertaken a planning-level alternatives analysis for a flood adaptation project along Washington Street and Harward Street in the City of Bath (the “City”), Sagadahoc County, Maine (Figure 1). We have evaluated alternatives for the reconstruction of the existing Washington and Harward Streets with the goal of reducing the impacts of coastal flooding, rising sea levels, and extreme riverine events which may include damage and loss of transportation assets and/or impacts to vehicular access to and through the City of Bath.

The report provides an overview of the flood risk, introduces adaptation design alternatives and provides information on design feasibility, relative costs, permitting constraints, and next steps for design implementation. The findings of the alternatives analysis will serve to inform ongoing applications for state, federal, and nongovernment funding for continued engineering and design of the selected adaptation design alternative.

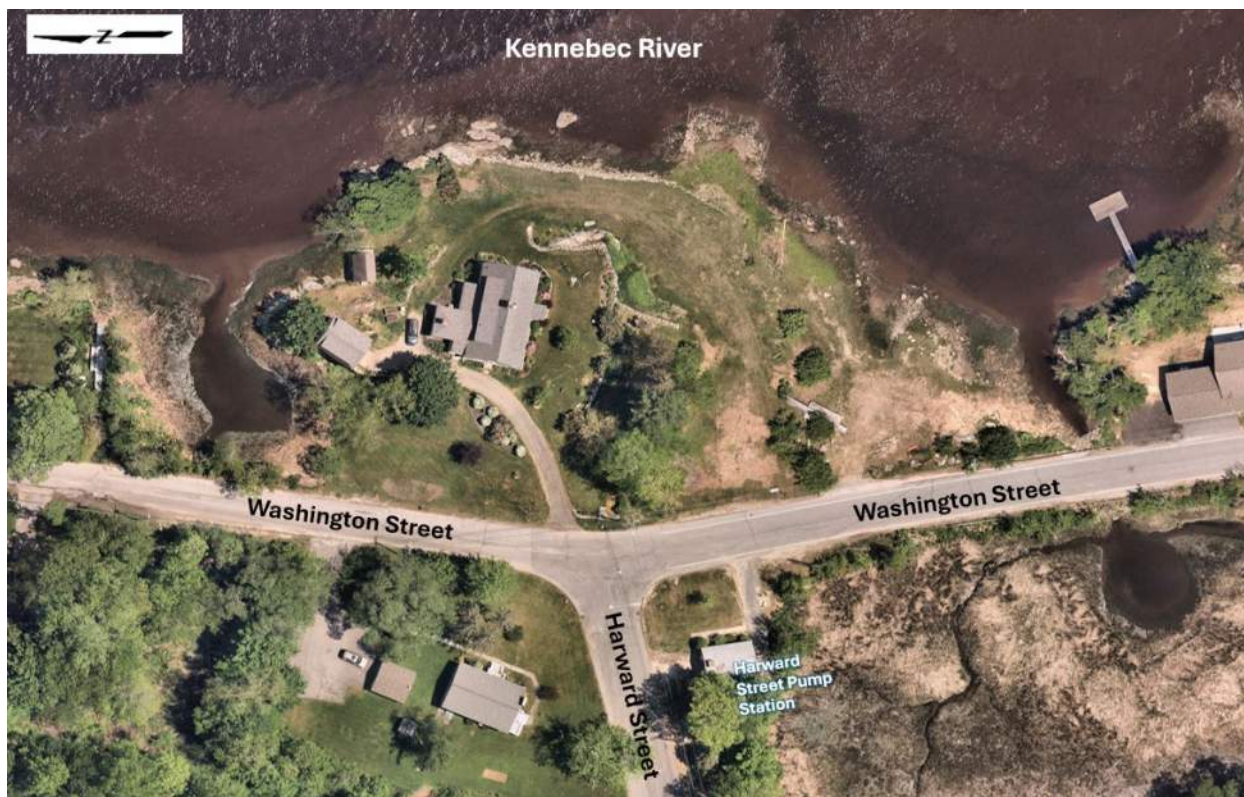
The North American Vertical datum of 1988 (NAVD88) was the reference datum for elevations in this report.

## 2. Project Area Description

---

Washington and Harward Streets are in the City of Bath, Sagadahoc County, Maine. Washington Street is a local road that runs along the eastern side of the City of Bath for approximately 4.5 miles alongside the Kennebec River. Harward Street intersects with Washington Street approximately 1.0 mile before its northern terminus. Based on readily available topographical information obtained by LiDAR survey (USGS, 2020), Washington Street near its intersection with Harward Street has a low point elevation of approximately El. 5.4 ft. Harward Street has a low point elevation of approximately 7.7 ft. There appear to be wetlands located upland of Washington Street both north and south of the Harward Street intersection, on both the east and west sides of Washington Street connected by culverts. The wetlands outlet to the Kennebec River via culverts that travel underneath Washington Street. The Harward Street Pump Station, a municipal sanitary sewer pump station, is located at the southwest corner of the intersection and is undergoing a separate flood adaptation project. Figure 2-1 shows an image of the roadway in the project area.

**Figure 2-1. Intersection of Washington Street and Harward Street**



There are approximately 60 buildings located along the 1.0-mile stretch of Washington Street north of the Harward Street intersection, which are only vehicularly accessible via Washington Street. The Average Annual Daily Traffic (AADT) along Washington Street, approximately 500 ft north of the Harward Street intersection, was measured over a 24-hour period between April 11<sup>th</sup> and April 12<sup>th</sup>, 2022. The vehicle count during that collection period was recorded as 314 (MaineDOT, 2022).

The road has experienced flood inundation during recent coastal storm events between 2022 and 2024. During these events, floodwaters have overtopped Washington Street, blocking vehicular passage to community lifelines for the approximately 60 buildings located along Washington Street north of the Harward Street intersection. Figures 2-2 and 2-3 show flood conditions at these roads during recent storm events.

**Figure 2-2. Flood Inundation along Washington Street facing South**



**Figure 2-3. Flood Inundation along Washington Street facing North**



## **3. Environmental Considerations**

---

### **3.1. Wetlands**

According to the U.S. Fish and Wildlife Service (USFWS) National Wetlands Inventory, there is an Estuarine and Marine wetland identified southwest of the Washington and Harward Street intersection. This wetland is fed by a Riverine system and includes an Estuarine and Marine Deepwater wetland that outlets to the Kennebec River, which is also classified as an Estuarine and Marine Deepwater wetland (USFWS, 2024a). A figure of these mapped wetlands is provided in Appendix A.

The National Wetlands Inventory can be useful in understanding the general area or presence of wetlands for initial project planning. However, a wetland scientist should confirm the type and boundaries of wetlands present in the project area for detailed design and permitting efforts. A wetland delineation by a wetland scientist would likely be required by regulatory agencies as part of the permitting process depending on the adaptation alternative selected.

### **3.2. Site Geology**

The Surficial Geology of the Bath Quadrangle, Maine, prepared by the Maine Geological Survey (MGS) in 2002, indicates the surficial material in the area of Washington and Harward Streets as thin-drift, with less than 10 feet of drift covering bedrock. Till would likely be present along hillslopes, and Presumpscot Formation silty clays would likely be present in depressions (MGS, 2002). The mapped surficial geology in the area is provided in Appendix B. Actual conditions should be verified using a geotechnical investigation. The scope of geotechnical investigation required for final design and construction of an adaptation alternative will depend on the design alternative selected but may consist of shallow test pits, drilled borings, and rock cores along with sampling and laboratory testing of recovered sediment and rock samples.

### **3.3. Endangered Species and Critical Habitats**

The Maine Department of Inland Fisheries & Wildlife (Maine DIFW) Beginning with Habitat (BwH) tool indicates the presence of riparian connector at the culvert location south of the intersection (Maine DIFW, 2024). Additionally, the USFWS Information for Planning and Consultation (IPaC) tool has identified four species identified as proposed endangered, endangered, or candidates for an endangered status; one critical habitat; the presence of bald and golden eagles; and seventeen other types of migratory birds that may be present in the area (USFWS, 2024b). The endangered species include Tricolored Bats (proposed), Roseate Terns (endangered), Atlantic Salmon (endangered), and Monarch Butterflies (candidate). The area is identified as a critical habitat for Atlantic Salmon. The seventeen other types of migratory birds include the Bay-breasted Warbler, Black-billed Cuckoo, Bobolink, Canada Warbler, Cape May Warbler, Chimney Swift, Eastern Whip-poor-will, Evening Grosbeak, Hudsonian Godwit, Lesser Yellowlegs, Olive-sided Flycatcher, Prairie Warbler, Rose-breasted Grosbeak, Semipalmated Sandpiper, Veery, Willet, and the Wood Thrush.

The above summary of site environmental conditions is based on planning-level resource mapping. This data is useful for initial screening for site conditions and environmental resources, but site-specific information should be verified on site by qualified professionals. Upon selection of a preferred design alternative and determination of the scope and scale of construction, site investigations should be planned to verify site-specific and project-specific data in sufficient detail to undertake the regulatory permitting process.

The figure summarizing the BwH tool results is provided in Appendix C. The IPaC resource list is provided in Appendix D.



## 4. Flood Exposure

---

Washington and Harward Streets are currently at risk for flood inundation during combined coastal storms events and extreme riverine events. Under a separate project funded through a Community Resilience Partnership (CRP) grant, GEI performed a flood vulnerability assessment to evaluate current and future flood risk due to coastal storm surge, sea level rise, and extreme riverine events. Details of the flood vulnerability assessment are provided in Bath Flood Vulnerability Assessment Report (GEI, 2024). A summary of flood risk along Washington and Harward Streets is provided below.

### 4.1. Flood Vulnerability Study

The flood vulnerability study suggests that for present-day sea levels, approximately 725 ft of Washington Street and 103 ft of Harward Street, near the intersection of the two, would be at risk of inundation during a combined 100-yr coastal and riverine storm event. The peak water surface elevation for the storm event is estimated to be approximately 8.9 ft, which would inundate Washington Street and Harward Street with depths of up to 3.5 ft and 1.2 ft, respectively. Washington Street would likely be inundated between 6 and 7 hours during the peak of the storm, with additional periods of inundation likely during high tides on either end of the peak of the storm. The end of Harward Street near the intersection of Washington Street would likely be inundated between 3 and 4 hours during the peak of the storm, with additional periods of inundation likely during high tides on either end of the peak of the storm.

By 2050, approximately 620 ft of Washington Street and 40 ft of Harward Street, near the intersection of the two, would be likely to be inundated during high tides for the “prepare to manage” sea level rise scenario. This scenario is based on typical daily tides and riverine flows (i.e., no storm event). Washington Street would likely be inundated by depths up to 2.2 ft for durations between 5 and 6 hours during peak high tide. Details including depth, duration, and length inundated for the other flood scenarios near this location are available in the Bath Vulnerability Assessment Report (GEI, 2024).

As described previously, there are approximately 60 buildings located along Washington Street north of Harward Street, which are only vehicularly accessible via Washington Street. This includes buildings located along Mast Landing and Mariner’s Way. If this eastern end of Harward Street and the section of Washington Street north of the Harward Street intersection becomes impassible, these buildings would become inaccessible to emergency vehicles and building occupants would not be able to evacuate or access emergency services. There are no alternate routes available.

### 4.2. Summary of Tidal and Flood Elevations

Table 4-1 below summarizes pertinent elevations of Washington and Harward Street near their intersection, referenced to NAVD88. The table includes the peak water elevation during a 1% annual chance coastal storm for present-day sea levels and for sea levels in 2050 and 2100 for 1.5 ft and 4.0 ft of sea level rise, respectively.

The table also includes the minimum roadway elevations and elevations of various stages of the tide for present-day sea levels. For additional flood elevations, scenarios, and riverine flows, refer to the Bath Flood Vulnerability Assessment Report (GEI, 2024).

**Table 4-1. Tidal and Flood Elevations**

Elevation Reference	Elevation (ft NAVD88)	Source of Data
2100 1% annual chance coastal storm peak water elevation (4.0 ft SLR)	12.3	GEI (2024)
Proposed Washington St and Harward St raised crest elevation (as described in Section 5.1)	10.2	
2050 1% annual chance coastal storm peak water elevation (1.5 ft SLR)	9.8	GEI (2024)
Present-Day 1% annual chance coastal storm peak water elevation	8.3	FEMA FIS (FEMA, 2015b)
Existing FEMA Base Flood Elevation (BFE)	8.0	FEMA FIS (FEMA, 2015a)
Minimum existing Harward crest elevation	7.7	LiDAR Data (USGS, 2020)
Minimum existing Washington St crest elevation, north of intersection	6.2	LiDAR Data (USGS, 2020)
Minimum existing Washington St crest elevation, south of intersection	5.4	LiDAR Data (USGS, 2020)
Highest Astronomical Tide (HAT)	4.8	MGS (2024)
Mean-Higher-High-Water (MHHW)	4.6	NOAA VDATUM (2024)
Mean-High-Water (MHW)	5.0	NOAA VDATUM (2024)
Mean-Tide-Level (MTL)	-0.5	NOAA VDATUM (2024)
Mean-Low-Water (MLW)	-4.1	NOAA VDATUM (2024)
Mean-Lower-Low-Water (MLW)	-4.4	NOAA VDATUM (2024)

## 5. Adaptation Design Alternatives

---

The City of Bath requested an analysis of flood adaptation alternatives to address the flood risk along Washington Street and Harward Street near the intersection of the two. Three options were evaluated:

1. Elevate Washington and Harward Streets,
2. Construct a new road to connect Washington Street to High Street north of Harward Street.
3. Do-nothing.

### 5.1. Elevate Washington and Harward Streets

Elevating Washington Street and Harward Street would allow for increased vehicle access during coastal storm surge and extreme riverine flow events. Based on GEI's initial desktop-level analysis, the roads could likely be raised to El. 10.2 ft before topographic and boundary constraints limiting further raising would be encountered. This alternative could be achieved by elevating Washington Street north of Harward Street and the east end of Harward Street to a minimum elevation of 10.2 ft at the roads' centerlines. The section of Washington Street south of the Harward Street intersection would be tied back into existing grade and the area near the culvert to the south of the intersection would likely still experience flooding during coastal storm surge and extreme riverine events. Elevating the roadway would require sloped, armored embankments and/or vertical retaining walls to support an elevated roadway.

This option would increase the vertical road profile of Washington Street by up to 4.0 ft and Harward Street by up to 2.5 ft. The length of roadway to be elevated would be approximately 600 ft along Washington Street and 150 ft along Harward Street.

Appendix E provides figures showing a conceptual street plan and typical cross sections for proposed road profiles for both Washington and Harward Streets. It should be noted that these plans and profiles are conceptual in nature, and that the actual plan and profiles may be influenced by site conditions such as topographic survey, property boundaries, existing utility infrastructure, and environmental considerations.

#### 5.1.1. Flood Risk

Raising the road to El. 10.2 ft would likely prevent flood inundation during combined 1% annual chance storms and 1% annual chance riverine flows for present-day sea levels.

Raising the road to El. 10.2 ft would also likely prevent flood inundation during 1% annual chance storms by 2050, considering 1.5 ft of sea level rise. However, the road would likely be overtopped by approximately 5 inches of water during a combined 1% annual chance coastal event and 1% annual chance riverine event considering 1.5 ft of sea level rise by 2050.

By 2100, considering 4.0 ft of sea level rise, a roadway raised to El. 10.2 ft would likely experience flood inundation of up to 2.1 ft during 1% annual chance coastal storm events.

### **5.1.2. Design Considerations and Challenges**

We have compiled a list for the City to consider when evaluating this alternative:

- Elevating the roadway in its existing alignment would increase the footprint of the roadway and drainage requirements and may require right of way acquisition or easements.
- This alternative could have upstream impacts to private property. An elevated roadway will alter the existing drainage flow patterns. Additional drainage cross culverts may need to be installed north and south of the intersection to alleviate flooding due to rainfall.
- There are overhead utility lines along both sides of Washington Street and the south side of Harward Street. Coordination with the utility owners will be required for accommodation of construction impacts to these utilities. Relocation and/or bracing of the power poles may be required.
- This alternative would be subject to local, state, and federal permitting regulations. The project would occur in an area adjacent to mapped estuarine and marine wetland according to the National Wetland Inventory and a coastal wetland under the Maine DEP Natural Resources Protection Act (NRPA) and as such may be subject to federal regulations under Section 10 of the Rivers and Harbors Act and/or Section 404 of the Clean Water Act and state regulations under the NRPA. It is likely that the wetland would limit the embankment extents of the adjacent roadway. Permit considerations are discussed in Section 6.

## **5.2. Construct a New Road**

In this alternative, the existing elevations and configurations of Washington and Harward Streets would remain as they are, and an alternate access route would be constructed to connect Washington Street with High Street north of the Harward Street intersection. This alternative would require right of way access and/or easements for land to create a new road.

### **5.2.1. Flood Risk**

A newly constructed road would not likely be at risk of flood inundation under the scenarios included in this study due to the upland location. However, Washington and Harward Streets near the intersection of the two would still be subject to flood risk for present-day and future coastal storm events. During periods of flood inundation, the new road could be used as an alternative route to access the north end of Washington Street.

### **5.2.2. Design Considerations and Challenges**

We have compiled a list of factors for the City to consider when evaluating a new roadway:

- This alternative would likely require right of way through privately owned property. The City would need to go through a right of way process with landowners for easements or acquisition of the land.

- This alternative would be subject to several local, state, and federal permitting regulations. Permit considerations are discussed in Section 6.
- The steep terrain between Washington Street and High Street north of the Harward Street intersection would make construction of a roadway here difficult.

This alternative was not brought forward to concept development due to feasibility and cost concerns.

### **5.3. Do-Nothing**

For the Do-Nothing alternative, the existing roadway alignments and elevations of Washington Street and Harward Street would be maintained. Continued flood inundation due to coastal storm events and extreme riverine events would likely occur. Flood inundation events would likely increase in frequency and floodwaters would likely get deeper and extend further inland as seas rise. After storm damage, the City would need to repair and/or reconstruct damaged infrastructure to maintain vehicular access along the north end of Washington Street. Vehicles and residents could be stranded during periods of roadway damage. The cost of repeated roadway reconstruction, maintenance, and repair over time would likely exceed the cost of proactively adapting the roadway. The National Institute of Building Sciences reported that every \$1 invested in pre-disaster risk reduction results in \$6 of avoided disaster damage (MCC, 2020).

## 6. Permitting Considerations

---

We have outlined federal, state, and local permits that would likely be required for raising these roadways (Adaptation Alternative #1) considering the following features of the site location:

- The existing alignment of Washington Street is located adjacent to a coastal wetland under Maine DEP regulations and waters of the United States under the U.S. Army Corps of Engineers (USACE) regulations.
- The site is mapped in a FEMA AE-Zone (FEMA, 2015a).
- It is anticipated that the work will require a permit from Maine DEP under the Natural Resource Protection Act and from the USACE under the Maine General Permit.

The specific regulatory constraints and required permits would vary depending on the final adaptation design and the associated quantity and type of impacts to regulated resources. In addition to the permits described below, the City will need to demonstrate that they have sufficient title, right, or interest (TRI) in the project area in order to advance roadway adaptation. TRI can be anticipated to currently exist if the alternative could be constructed fully within City-owned right-of-way.

### 6.1. Federal Permits

The USACE regulates waters of the US under Section 404 of the Clean Water Act and navigable waters of the US under Section 10 of the Rivers and Harbors Act. The limit of USACE jurisdiction for tidal waters is the High Tide Line. USACE jurisdiction also includes freshwater wetlands, tributaries to navigable waters, intermittent streams, vernal pools and other waters. Design plans would need to be developed further along with wetland delineation of the site by a wetland scientist to understand if a USACE permit would be required and whether the project will qualify for a Self-Verification Notification Form (SVNF) or a Pre-Construction Notification (PCN) for elevating Washington Street and Harward Street near the intersection of the two.

### 6.2. State Permits

The Highest Annual Tide line is the defining boundary line that determines the landward extent of the coastal wetland. Additionally, there is wetland identified southwest of the Washington Street and Harward Street intersection that appears to be tidally influenced and, therefore, classified as a coastal wetland. Under the NRPA, the MDEP jurisdiction extends from the coastal wetland to 75-foot landward of the HAT.

Activities that require a permit under the NRPA include dredging, bulldozing, removing or displacing soil, sand, vegetation, or other materials, draining or otherwise dewatering, filling, including adding sand or other material to a sand dune, or and construction, repair, or alteration of any permanent structure.

Any potential improvements to the road within 75 feet of the wetland and/or potential impacts to delineated wetlands, significant vernal pools, streams, brooks, or rivers may require a permit under the NRPA.

### **6.3. Local Permits**

The project site is within the City of Bath Waterfront High Density Residential Districts and within a FEMA AE-zone. A permit will be required under the Floodplain Management Ordinance and a building permit from the Code Enforcement Officer may also be required. Review standards are outlined in Article 15 of the Bath Code of Ordinances.

## 7. Cost Estimate

---

We have provided an order of magnitude cost estimate for Adaptation Alternative 1 – raising Washington and Harward Streets. We estimate it could cost approximately \$1.2 million dollars to raise the roads to a minimum elevation of 10.2. ft to facilitate increased vehicular access to Washington Street north of the intersection, as described in Section 5.1.

This estimate is based on recent published information on unit prices of materials and similar projects constructed in Maine. The costs include a general mark-up for permit preparation, construction oversight, and easement acquisition. The cost estimates below do not include costs for regulatory permit fees. This estimate may vary significantly from true project costs due to the high-level nature of this study and based on final design considerations (i.e., vertical retaining wall or sloped embankments, size of culverts selected, property acquisition requirements, geotechnical considerations, etc.).

This estimate should be used for general planning purposes. Actual costs may vary over time depending on when construction takes place and the actual quantity of materials used, among other factors. Costs should be refined as the design alternative is developed.



## 8. Next Steps

---

The report presents conceptual options for adapting Washington Street and Harward Street in the City of Bath, Maine. The options are based on available online background information of the wetlands, geology, and endangered species and critical habitats present at the site. Additionally, the adaptation alternatives took into consideration site specific flood risk due to present-day and future high tides, coastal storms, and extreme riverine events. This adaptation alternatives analysis provides a high-level summary of options.

We have provided a summary of recommended next steps in order for the City to advance the adaptation of Washington and Harward Streets through raising the roadways in their existing horizontal alignment, which was selected as the preferred alternative by the City and residents of the upper Washington Street neighborhood. Next steps for this project could include:

- **Pursue relevant funding options.** Adapting Washington Street and Harward Street by raising the roads in elevation would likely require support from multiple grants, over multiple funding cycles, to complete. The City should continue to explore grant opportunities focused on implementation of flood adaptation measures. Some possible grant options include the Maine Infrastructure Adaptation Fund, further Coastal Community Grant opportunities, the U.S. DOT Federal Highway Administration PROTECT grant program, among others.
- **Contract with a consultant to develop preliminary and final designs, procure the necessary permits, and oversee construction.** Once funding has been secured, we recommend contracting with one or more consultants to develop preliminary and final designs of the alternative. The consultant(s) should be responsible for several tasks. These tasks could be part of separate contracts, funded through various grant programs, and take several years to complete. The tasks that the consultant(s) could be responsible for include:
  - **Conducting field investigations.** This would include scope items such as coordinating topographical and parcel boundary surveys of the area, performing wetland delineation, and carrying out a geotechnical investigation, as applicable.
  - **Develop preliminary and final designs.** The selected alternative would need to be advanced through preliminary and final phases of design development.
  - **Procure permits.** The consultant would help prepare and submit regulatory permits required for the selected design.
  - **Continue with a robust community engagement process.** As designs are developed, the community engagement process should be maintained to keep the public informed of the project.
  - **Prepare construction bid documents and oversee the bid process.** The consultant could help prepare construction plans and bid documents and assist in the selection of a contractor for the construction of the project.
  - **Oversee construction.** The consultant could oversee the construction of the project.

## 9. Limitations

---

This report summarizes GEI’s work for the City of Bath regarding the Adaptation of Washington Street and Harward Street. The project did not include field data collection and relied on readily available online information, published references, and our professional judgement. Actual storms, sea level rise rates, and flood conditions will vary from what has been presented in this report. The purpose of this alternatives analysis was to provide high-level conceptual options for adapting Washington Street and Harward Street. Estimates included in this report represent a rough order of magnitude of the probable cost of project implementation. The estimates may be useful for budgeting and pursuit of grant funding, but actual construction costs may vary based on the alternative selected, final design approaches, costs for right of way and regulatory compliance, and escalation that occurs in the time until implementation takes place.

Elevations of the roads are based on ground-surface LiDAR data. We recommend site survey and site-specific design be completed for any infrastructure project the City pursues. This study does not include an evaluation of the structural integrity of the roadway. 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 purposes, in part or in whole, is at the sole risk of the user.

## 10. References

---

FEMA (2015a). Flood Insurance Rate Map. Sagadahoc County, Maine, July.

FEMA (2015b). Flood Insurance Study. Sagadahoc County, Maine, July.

GEI (2024). Flood Vulnerability Assessment Report, Bath, Maine. Revised March.

Maine Climate Council (MCC) (2020). Scientific Assessment of Climate Change and Its Effects in Maine, August.

Maine Department of Inland Fisheries & Wildlife (DIFW) (2024). Beginning with Habitat. Interactive Web Viewer. Accessed November 1, 2024 from: <https://webapps2.cgis-solutions.com/beginningwithhabitat/mapviewer/>.

Maine DOT (2022). Yearly Traffic Counts. Station Name: Bath 09501. Description WASHINGTON ST N/O HARWOOD ST. Accessed on October 18, 2024 from: <https://mainedottrafficdata.drakewell.com/publicmultinodemap.asp>.

Maine Geological Survey (MGS) (2024). Highest Astronomical Tide Line. Accessed October 18, 2024 from: [https://www.maine.gov/dacf/mgs/hazards/highest\\_tide\\_line/index.shtml](https://www.maine.gov/dacf/mgs/hazards/highest_tide_line/index.shtml)

Maine Geological Survey (MGS) (2002). Surficial Geology. Bath Quadrangle, Maine.

NOAA (2024). Vertical Datum Transformation (VDATUM) Online Tool. Accessed September 2024 from: <https://vdatum.noaa.gov/vdatumweb/vdatumweb?a=114202120230727>.

U.S. Fish and Wildlife Services (USFWS) (2024a). National Wetlands Inventory. Accessed on October 18, 2024 from: <https://fwsprimary.wim.usgs.gov/wetlands/apps/wetlands-mapper/>.

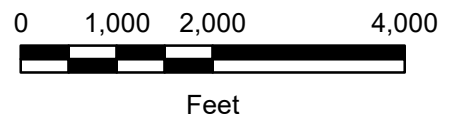
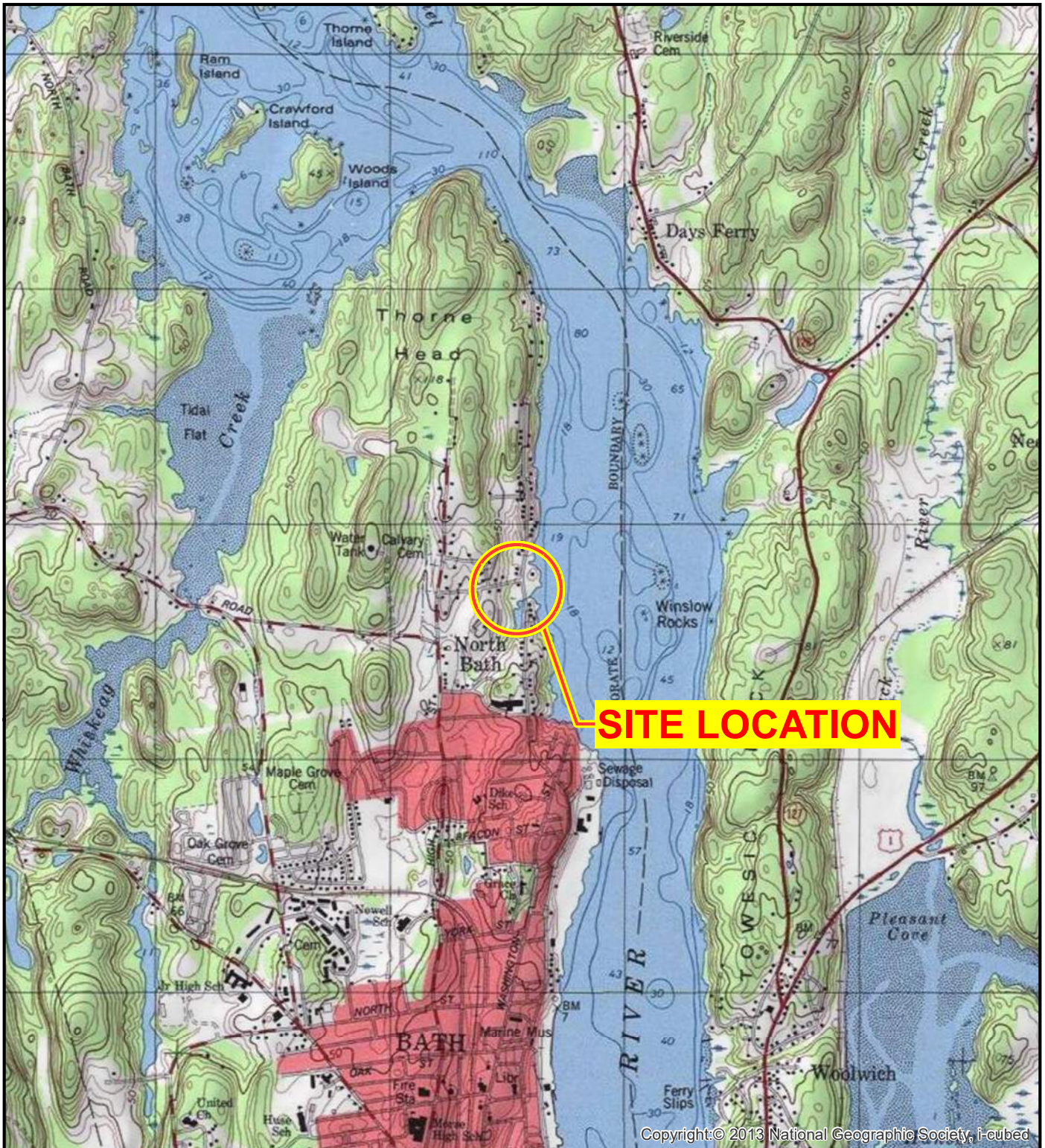
U.S. Fish and Wildlife Services (USFWS) (2024b). IPaC Resource List. Washington Street, Bath, Maine. Accessed October 18, 2024 from: <https://ipac.ecosphere.fws.gov/location/index>.


USGS (2020). 2020 USGS Lidar: South Coastal Maine (QL2), October.

# Figures

---

## Figure 1. Pilot Project Site Location



<p>City of Bath Pilot Project: Adaption of Washington Street and Harward Street Bath, Maine</p>	 <p>GEI Consultants</p>	<p>PILOT PROJECT SITE LOCATION</p>
<p>City of Bath Bath, Maine</p>	<p>Project 2204496</p>	<p>December 2024 <span style="float: right;">Fig. 1</span></p>

## **Appendix A National Wetlands Inventory**


---



U.S. Fish and Wildlife Service, National Standards and Support Team,  
wetlands\_team@fws.gov

December 6, 2024

### Wetlands

- |   |                                |   |                                   |   |          |
|---|--------------------------------|---|-----------------------------------|---|----------|
|  | Estuarine and Marine Deepwater |  | Freshwater Emergent Wetland       |  | Lake     |
|  | Estuarine and Marine Wetland   |  | Freshwater Forested/Shrub Wetland |  | Other    |
|  | Freshwater Pond                |  | Freshwater Pond                   |  | Riverine |

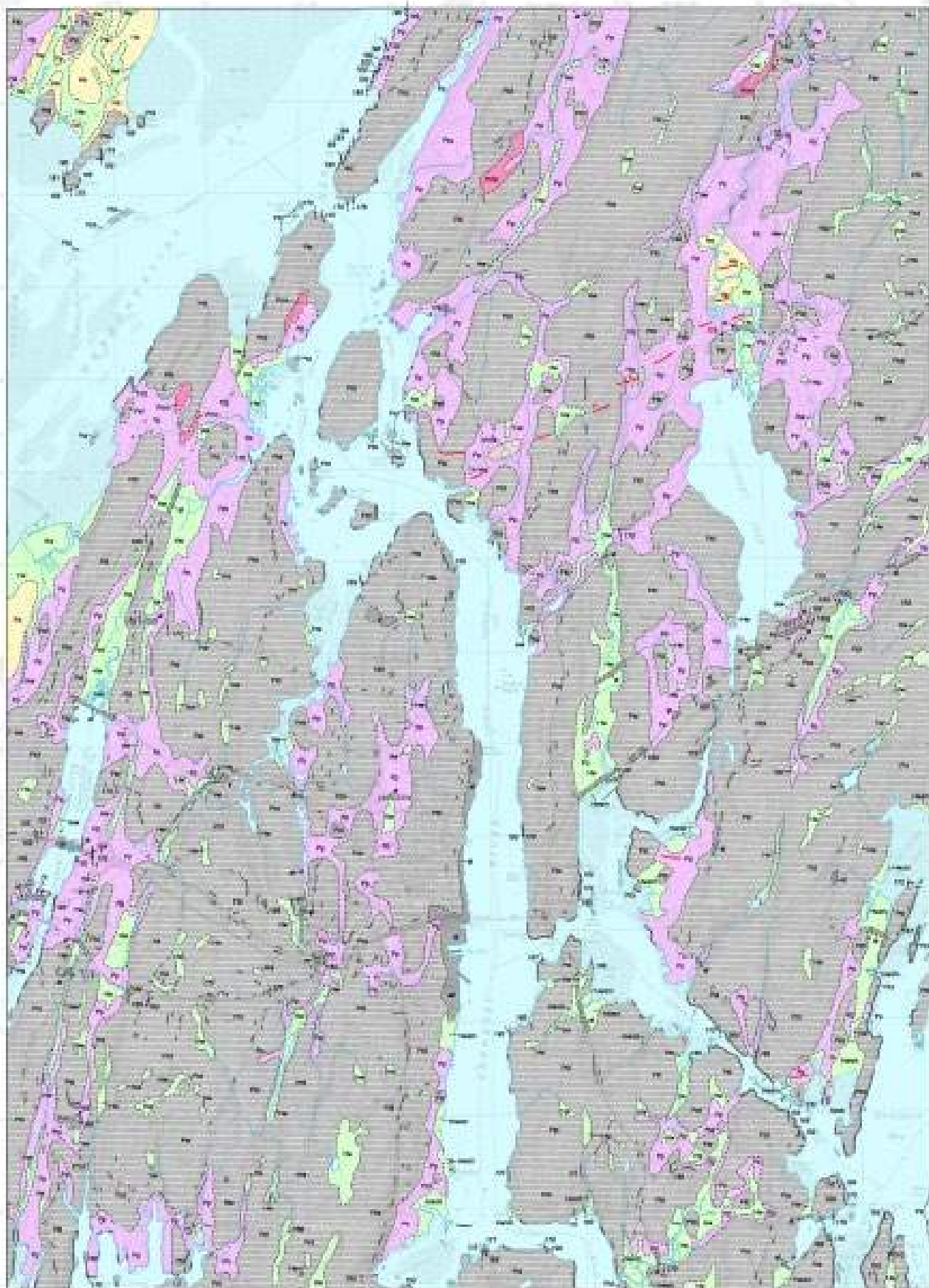
This map is for general reference only. The US Fish and Wildlife Service is not responsible for the accuracy or currentness of the base data shown on this map. All wetlands related data should be used in accordance with the layer metadata found on the Wetlands Mapper web site.

## **Appendix B Surficial Geology**

---



# Surficial Geology



### UNITS OF INTEREST

The symbols for units of interest are shown in this map in the legend. Symbols for units of interest are shown in this map in the legend.



### UNITS OF INTEREST

	Alluvial fill - Includes local alluvium and recent sediments, and other recent units. These units are mapped only when they are significant to the study. This unit includes alluvial sand, silt, and clay, and is mapped only when it is a primary depositional unit. It is mapped only when it is a primary depositional unit.		Recent stream alluvium - This unit is mapped only when it is a primary depositional unit. It is mapped only when it is a primary depositional unit.
	Stream alluvium - This unit is mapped only when it is a primary depositional unit. It is mapped only when it is a primary depositional unit.		Pleistocene deposits - These are the deposits that were deposited during the Pleistocene epoch. They are mapped only when they are significant to the study.
	Alluvial sand and gravel - This unit is mapped only when it is a primary depositional unit. It is mapped only when it is a primary depositional unit.		Recent stream alluvium - This unit is mapped only when it is a primary depositional unit. It is mapped only when it is a primary depositional unit.
	Stream alluvium - This unit is mapped only when it is a primary depositional unit. It is mapped only when it is a primary depositional unit.		Pleistocene deposits - These are the deposits that were deposited during the Pleistocene epoch. They are mapped only when they are significant to the study.
	Alluvial sand and gravel - This unit is mapped only when it is a primary depositional unit. It is mapped only when it is a primary depositional unit.		Recent stream alluvium - This unit is mapped only when it is a primary depositional unit. It is mapped only when it is a primary depositional unit.
	Stream alluvium - This unit is mapped only when it is a primary depositional unit. It is mapped only when it is a primary depositional unit.		Pleistocene deposits - These are the deposits that were deposited during the Pleistocene epoch. They are mapped only when they are significant to the study.
	Alluvial sand and gravel - This unit is mapped only when it is a primary depositional unit. It is mapped only when it is a primary depositional unit.		Recent stream alluvium - This unit is mapped only when it is a primary depositional unit. It is mapped only when it is a primary depositional unit.
	Stream alluvium - This unit is mapped only when it is a primary depositional unit. It is mapped only when it is a primary depositional unit.		Pleistocene deposits - These are the deposits that were deposited during the Pleistocene epoch. They are mapped only when they are significant to the study.
	Alluvial sand and gravel - This unit is mapped only when it is a primary depositional unit. It is mapped only when it is a primary depositional unit.		Recent stream alluvium - This unit is mapped only when it is a primary depositional unit. It is mapped only when it is a primary depositional unit.
	Stream alluvium - This unit is mapped only when it is a primary depositional unit. It is mapped only when it is a primary depositional unit.		Pleistocene deposits - These are the deposits that were deposited during the Pleistocene epoch. They are mapped only when they are significant to the study.

### THIS IS SURFICIAL GEOLOGY MAP

A surficial geology map shows the distribution of surficial deposits and features on the land surface. This map shows the distribution of surficial deposits and features on the land surface. This map shows the distribution of surficial deposits and features on the land surface.

### REFERENCES

1. Cook, D. B., and P. C. 1971. Surficial geology of the Bath quadrangle, Maine. Maine Geological Survey, Open-File Map 81.

2. ...

3. ...

4. ...

5. ...

## Bath Quadrangle, Maine

The Bath Quadrangle, Maine  
Robert A. Anderson

Field geologist  
Robert A. Anderson

Field geologist  
Robert G. Harrison

Geographic design and editing by  
Robert D. Tucker

Produced by the Department of Geology, Maine State College, as part of the U.S. Geological Survey  
SURFACE Geology, Cooperative Agreement No. 01434-00001.



### Maine Environmental Survey

Address: 20 State Street, Bangor, Maine 04401  
Telephone: (207) 947-5244  
E-mail: mesc@maine.gov  
Web page: http://www.mesc.gov

Open-File No. 02-145  
2002

### SURFICIAL GEOLOGY OF MAINE

The surficial geology of Maine is characterized by a wide variety of surficial deposits and features. These deposits and features are the result of a variety of geological processes, including erosion, deposition, and glaciation. The surficial geology of Maine is a complex and diverse system, and it is important to understand its distribution and characteristics for a variety of purposes, including land use planning, resource management, and environmental protection.

The surficial geology of Maine is characterized by a wide variety of surficial deposits and features. These deposits and features are the result of a variety of geological processes, including erosion, deposition, and glaciation. The surficial geology of Maine is a complex and diverse system, and it is important to understand its distribution and characteristics for a variety of purposes, including land use planning, resource management, and environmental protection.



Figure 1. The 'hollow' and valley floor in the Bath region. The river flows in the hollow, and the valley floor is the surrounding land.

Figure 2. A large boulder resting on the ground. This boulder is a remnant of glacial erosion.



Figure 3. A large boulder resting on the ground. This boulder is a remnant of glacial erosion.

Figure 4. A view of the valley floor in the Bath region. The river flows in the hollow, and the valley floor is the surrounding land.



Figure 5. A view of the valley floor in the Bath region. The river flows in the hollow, and the valley floor is the surrounding land.

Figure 6. A view of the valley floor in the Bath region. The river flows in the hollow, and the valley floor is the surrounding land.



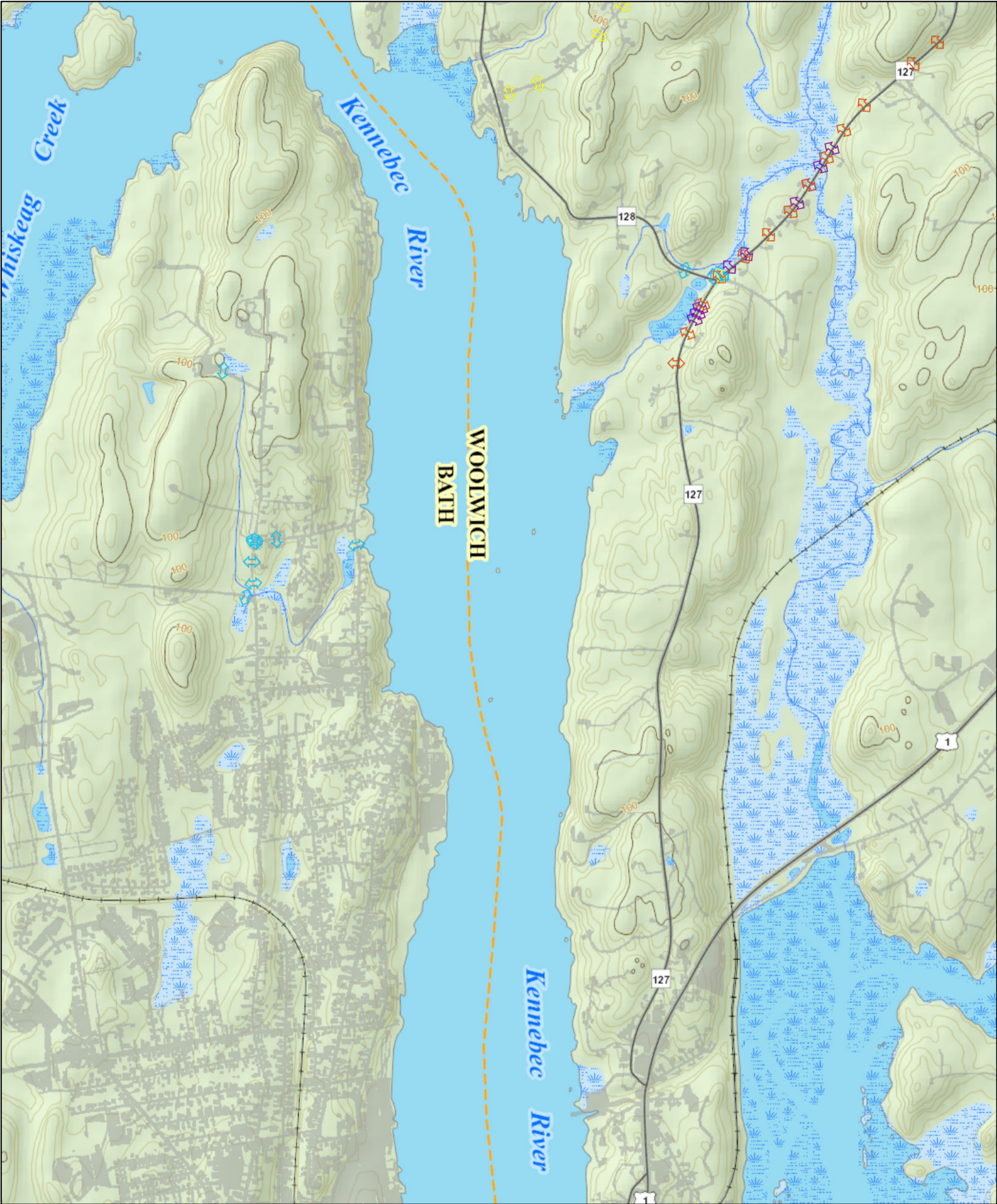
Figure 7. A view of the valley floor in the Bath region. The river flows in the hollow, and the valley floor is the surrounding land.

Figure 8. A view of the valley floor in the Bath region. The river flows in the hollow, and the valley floor is the surrounding land.








## **Appendix C Beginning With Habitat**

---

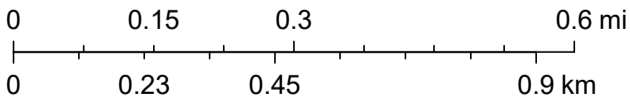
# Beginning With Habitat Bath Maine



December 6, 2024

-  Highway Bridge Connectors
-  Riparian Connectors
-  Less than 2000 Vehicles/Day
-  More than 2000 Vehicles/Day
-  Undeveloped Block Connectors
-  Less than 2000 Vehicles/Day
-  More than 2000 Vehicles/Day

1:18,056



## **Appendix D IPaC Resources List**

---

# IPaC resource list

This report is an automatically generated list of species and other resources such as critical habitat (collectively referred to as *trust resources*) under the U.S. Fish and Wildlife Service's (USFWS) jurisdiction that are known or expected to be on or near the project area referenced below. The list may also include trust resources that occur outside of the project area, but that could potentially be directly or indirectly affected by activities in the project area. However, determining the likelihood and extent of effects a project may have on trust resources typically requires gathering additional site-specific (e.g., vegetation/species surveys) and project-specific (e.g., magnitude and timing of proposed activities) information.

Below is a summary of the project information you provided and contact information for the USFWS office(s) with jurisdiction in the defined project area. Please read the introduction to each section that follows (Endangered Species, Migratory Birds, USFWS Facilities, and NWI Wetlands) for additional information applicable to the trust resources addressed in that section.

## Location

Sagadahoc County, Maine



## Local office

Maine Ecological Services Field Office

☎ (207) 469-7300

📅 (207) 902-1588

MAILING ADDRESS

P. O. Box A  
East Orland, ME 04431

PHYSICAL ADDRESS

306 Hatchery Road  
East Orland, ME 04431

NOT FOR CONSULTATION

# Endangered species

**This resource list is for informational purposes only and does not constitute an analysis of project level impacts.**

The primary information used to generate this list is the known or expected range of each species. Additional areas of influence (AOI) for species are also considered. An AOI includes areas outside of the species range if the species could be indirectly affected by activities in that area (e.g., placing a dam upstream of a fish population even if that fish does not occur at the dam site, may indirectly impact the species by reducing or eliminating water flow downstream). Because species can move, and site conditions can change, the species on this list are not guaranteed to be found on or near the project area. To fully determine any potential effects to species, additional site-specific and project-specific information is often required.

Section 7 of the Endangered Species Act **requires** Federal agencies to "request of the Secretary information whether any species which is listed or proposed to be listed may be present in the area of such proposed action" for any project that is conducted, permitted, funded, or licensed by any Federal agency. A letter from the local office and a species list which fulfills this requirement can **only** be obtained by requesting an official species list from either the Regulatory Review section in IPaC (see directions below) or from the local field office directly.

For project evaluations that require USFWS concurrence/review, please return to the IPaC website and request an official species list by doing the following:

1. Draw the project location and click CONTINUE.
2. Click DEFINE PROJECT.
3. Log in (if directed to do so).
4. Provide a name and description for your project.
5. Click REQUEST SPECIES LIST.

Listed species<sup>1</sup> and their critical habitats are managed by the [Ecological Services Program](#) of the U.S. Fish and Wildlife Service (USFWS) and the fisheries division of the National Oceanic and Atmospheric Administration (NOAA Fisheries<sup>2</sup>).

Species and critical habitats under the sole responsibility of NOAA Fisheries are **not** shown on this list. Please contact [NOAA Fisheries](#) for [species under their jurisdiction](#).

- 
1. Species listed under the [Endangered Species Act](#) are threatened or endangered; IPaC also shows species that are candidates, or proposed, for listing. See the [listing status page](#) for more information. IPaC only shows species that are regulated by USFWS (see FAQ).

2. [NOAA Fisheries](#), also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

The following species are potentially affected by activities in this location:

## Mammals

NAME	STATUS
Tricolored Bat <i>Perimyotis subflavus</i> Wherever found No critical habitat has been designated for this species. <a href="https://ecos.fws.gov/ecp/species/10515">https://ecos.fws.gov/ecp/species/10515</a>	Proposed Endangered

## Birds

NAME	STATUS
Roseate Tern <i>Sterna dougallii dougallii</i> No critical habitat has been designated for this species. <a href="https://ecos.fws.gov/ecp/species/2083">https://ecos.fws.gov/ecp/species/2083</a>	Endangered

## Fishes

NAME	STATUS
Atlantic Salmon <i>Salmo salar</i> There is <b>final</b> critical habitat for this species. Your location overlaps the critical habitat. <a href="https://ecos.fws.gov/ecp/species/2097">https://ecos.fws.gov/ecp/species/2097</a>	Endangered

## Insects

NAME	STATUS
Monarch Butterfly <i>Danaus plexippus</i> Wherever found No critical habitat has been designated for this species. <a href="https://ecos.fws.gov/ecp/species/9743">https://ecos.fws.gov/ecp/species/9743</a>	Candidate

## Critical habitats

Potential effects to critical habitat(s) in this location must be analyzed along with the endangered species themselves.

This location overlaps the critical habitat for the following species:



NAME	TYPE
------	------

Atlantic Salmon <i>Salmo salar</i> <a href="https://ecos.fws.gov/ecp/species/2097#crithab">https://ecos.fws.gov/ecp/species/2097#crithab</a>	Final
---	-------

## Bald & Golden Eagles

Bald and golden eagles are protected under the Bald and Golden Eagle Protection Act<sup>1</sup> and the Migratory Bird Treaty Act<sup>2</sup>.

Any person or organization who plans or conducts activities that may result in impacts to bald or golden eagles, or their habitats<sup>3</sup>, should follow appropriate regulations and consider implementing appropriate conservation measures, as described in the links below. Specifically, please review the "[Supplemental Information on Migratory Birds and Eagles](#)".

Additional information can be found using the following links:

- Eagle Management <https://www.fws.gov/program/eagle-management>
- Measures for avoiding and minimizing impacts to birds  
<https://www.fws.gov/library/collections/avoiding-and-minimizing-incident-take-migratory-birds>
- Nationwide conservation measures for birds  
<https://www.fws.gov/sites/default/files/documents/nationwide-standard-conservation-measures.pdf>
- Supplemental Information for Migratory Birds and Eagles in IPaC  
<https://www.fws.gov/media/supplemental-information-migratory-birds-and-bald-and-golden-eagles-may-occur-project-action>

There are likely bald eagles present in your project area. For additional information on bald eagles, refer to [Bald Eagle Nesting and Sensitivity to Human Activity](#)

For guidance on when to schedule activities or implement avoidance and minimization measures to reduce impacts to migratory birds on your list, see the PROBABILITY OF PRESENCE SUMMARY below to see when these birds are most likely to be present and breeding in your project area.

NAME	BREEDING SEASON
------	-----------------

**Bald Eagle** *Haliaeetus leucocephalus*

Breeds Dec 1 to Aug 31

This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.

<https://ecos.fws.gov/ecp/species/1626>

**Golden Eagle** *Aquila chrysaetos*

Breeds Jan 1 to Aug 31

This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.

<https://ecos.fws.gov/ecp/species/1680>

## Probability of Presence Summary

The graphs below provide our best understanding of when birds of concern are most likely to be present in your project area. This information can be used to tailor and schedule your project activities to avoid or minimize impacts to birds. Please make sure you read ["Supplemental Information on Migratory Birds and Eagles"](#), specifically the FAQ section titled "Proper Interpretation and Use of Your Migratory Bird Report" before using or attempting to interpret this report.

### Probability of Presence (■)

Each green bar represents the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during a particular week of the year. (A year is represented as 12 4-week months.) A taller bar indicates a higher probability of species presence. The survey effort (see below) can be used to establish a level of confidence in the presence score. One can have higher confidence in the presence score if the corresponding survey effort is also high.

How is the probability of presence score calculated? The calculation is done in three steps:

1. The probability of presence for each week is calculated as the number of survey events in the week where the species was detected divided by the total number of survey events for that week. For example, if in week 12 there were 20 survey events and the Spotted Towhee was found in 5 of them, the probability of presence of the Spotted Towhee in week 12 is 0.25.
2. To properly present the pattern of presence across the year, the relative probability of presence is calculated. This is the probability of presence divided by the maximum probability of presence across all weeks. For example, imagine the probability of presence in week 20 for the Spotted Towhee is 0.05, and that the probability of presence at week 12 (0.25) is the maximum of any week of the year. The relative probability of presence on week 12 is  $0.25/0.25 = 1$ ; at week 20 it is  $0.05/0.25 = 0.2$ .

3. The relative probability of presence calculated in the previous step undergoes a statistical conversion so that all possible values fall between 0 and 10, inclusive. This is the probability of presence score.

To see a bar's probability of presence score, simply hover your mouse cursor over the bar.

### Breeding Season (■)

Yellow bars denote a very liberal estimate of the time-frame inside which the bird breeds across its entire range. If there are no yellow bars shown for a bird, it does not breed in your project area.

### Survey Effort (|)

Vertical black lines superimposed on probability of presence bars indicate the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps. The number of surveys is expressed as a range, for example, 33 to 64 surveys.

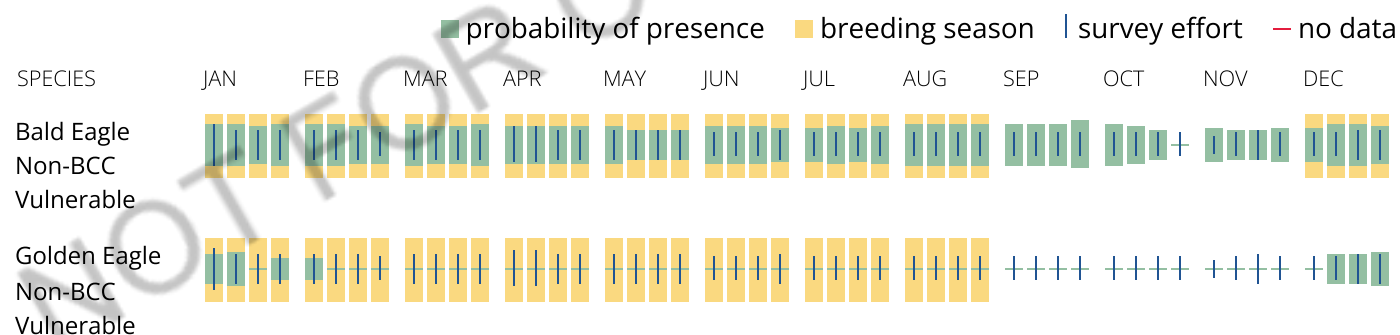
To see a bar's survey effort range, simply hover your mouse cursor over the bar.

### No Data (-)

A week is marked as having no data if there were no survey events for that week.

### Survey Timeframe

Surveys from only the last 10 years are used in order to ensure delivery of currently relevant information. The exception to this is areas off the Atlantic coast, where bird returns are based on all years of available data, since data in these areas is currently much more sparse.



### What does IPaC use to generate the potential presence of bald and golden eagles in my specified location?

The potential for eagle presence is derived from data provided by the [Avian Knowledge Network \(AKN\)](#). The AKN data is based on a growing collection of [survey, banding, and citizen science datasets](#) and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) which your project intersects, and that have been identified as warranting special attention because they are a BCC species in that area, an eagle ([Eagle Act](#) requirements may apply). To see a list of all birds potentially present in your project area, please visit the [Rapid Avian Information Locator \(RAIL\) Tool](#).

### What does IPaC use to generate the probability of presence graphs of bald and golden eagles in my specified location?

The Migratory Bird Resource List is comprised of USFWS [Birds of Conservation Concern \(BCC\)](#) and other species that may warrant special attention in your project location.

The migratory bird list generated for your project is derived from data provided by the [Avian Knowledge Network \(AKN\)](#). The AKN data is based on a growing collection of [survey, banding, and citizen science datasets](#) and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) which your project intersects, and that have been identified as warranting special attention because they are a BCC species in that area, an eagle ([Eagle Act](#) requirements may apply), or a species that has a particular vulnerability to offshore activities or development.

Again, the Migratory Bird Resource list includes only a subset of birds that may occur in your project area. It is not representative of all birds that may occur in your project area. To get a list of all birds potentially present in your project area, please visit the [Rapid Avian Information Locator \(RAIL\) Tool](#).

### What if I have eagles on my list?

If your project has the potential to disturb or kill eagles, you may need to obtain a permit to avoid violating the [Eagle Act](#) should such impacts occur. Please contact your local Fish and Wildlife Service Field Office if you have questions.

## Migratory birds

Certain birds are protected under the Migratory Bird Treaty Act<sup>1</sup> and the Bald and Golden Eagle Protection Act<sup>2</sup>.

Any person or organization who plans or conducts activities that may result in impacts to migratory birds, eagles, and their habitats<sup>3</sup> should follow appropriate regulations and consider implementing appropriate conservation measures, as described in the links below. Specifically, please review the "[Supplemental Information on Migratory Birds and Eagles](#)".

1. The [Migratory Birds Treaty Act](#) of 1918.
2. The [Bald and Golden Eagle Protection Act](#) of 1940.

Additional information can be found using the following links:

- Eagle Management <https://www.fws.gov/program/eagle-management>
- Measures for avoiding and minimizing impacts to birds <https://www.fws.gov/library/collections/avoiding-and-minimizing-incident-take-migratory-birds>
- Nationwide conservation measures for birds <https://www.fws.gov/sites/default/files/documents/nationwide-standard-conservation-measures.pdf>
- Supplemental Information for Migratory Birds and Eagles in IPaC <https://www.fws.gov/media/supplemental-information-migratory-birds-and-bald-and-golden-eagles-may-occur-project-action>

The birds listed below are birds of particular concern either because they occur on the [USFWS Birds of Conservation Concern \(BCC\) list](#) or warrant special attention in your project location. To learn more about the levels of concern for birds on your list and how this list is generated, see the FAQ [below](#). This is not a list of every bird you may find in this location, nor a guarantee that every bird on this list will be found in your project area. To see exact locations of where birders and the general public have sighted birds in and around your project area, visit the [E-bird data mapping tool](#) (Tip: enter your location, desired date range and a species on your list). For projects that occur off the Atlantic Coast, additional maps and models detailing the relative occurrence and abundance of bird species on your list are available. Links to additional information about Atlantic Coast birds, and other important information about your migratory bird list, including how to properly interpret and use your migratory bird report, can be found [below](#).

For guidance on when to schedule activities or implement avoidance and minimization measures to reduce impacts to migratory birds on your list, see the PROBABILITY OF PRESENCE SUMMARY below to see when these birds are most likely to be present and breeding in your project area.

NAME	BREEDING SEASON
<p><b>Bald Eagle</b> <i>Haliaeetus leucocephalus</i></p> <p>This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.</p> <p><a href="https://ecos.fws.gov/ecp/species/1626">https://ecos.fws.gov/ecp/species/1626</a></p>	Breeds Dec 1 to Aug 31
<p><b>Bay-breasted Warbler</b> <i>Setophaga castanea</i></p> <p>This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA</p>	Breeds May 25 to Aug 1
<p><b>Black-billed Cuckoo</b> <i>Coccyzus erythrophthalmus</i></p> <p>This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.</p> <p><a href="https://ecos.fws.gov/ecp/species/9399">https://ecos.fws.gov/ecp/species/9399</a></p>	Breeds May 15 to Oct 10
<p><b>Bobolink</b> <i>Dolichonyx oryzivorus</i></p> <p>This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.</p>	Breeds May 20 to Jul 31
<p><b>Canada Warbler</b> <i>Cardellina canadensis</i></p> <p>This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.</p>	Breeds May 20 to Aug 10

<b>Cape May Warbler</b> <i>Setophaga tigrina</i> This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA	Breeds Jun 1 to Jul 31
<b>Chimney Swift</b> <i>Chaetura pelagica</i> This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds Mar 15 to Aug 25
<b>Eastern Whip-poor-will</b> <i>Antrostomus vociferus</i> This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds May 1 to Aug 20
<b>Evening Grosbeak</b> <i>Coccothraustes vespertinus</i> This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds May 15 to Aug 10
<b>Golden Eagle</b> <i>Aquila chrysaetos</i> This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. <a href="https://ecos.fws.gov/ecp/species/1680">https://ecos.fws.gov/ecp/species/1680</a>	Breeds Jan 1 to Aug 31
<b>Hudsonian Godwit</b> <i>Limosa haemastica</i> This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds elsewhere
<b>Lesser Yellowlegs</b> <i>Tringa flavipes</i> This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. <a href="https://ecos.fws.gov/ecp/species/9679">https://ecos.fws.gov/ecp/species/9679</a>	Breeds elsewhere
<b>Olive-sided Flycatcher</b> <i>Contopus cooperi</i> This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. <a href="https://ecos.fws.gov/ecp/species/3914">https://ecos.fws.gov/ecp/species/3914</a>	Breeds May 20 to Aug 31
<b>Prairie Warbler</b> <i>Setophaga discolor</i> This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds May 1 to Jul 31

**Rose-breasted Grosbeak** *Pheucticus ludovicianus* Breeds May 15 to Jul 31  
 This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA

**Semipalmated Sandpiper** *Calidris pusilla* Breeds elsewhere  
 This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA

**Veery** *Catharus fuscescens fuscescens* Breeds May 15 to Jul 15  
 This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA

**Willet** *Tringa semipalmata* Breeds Apr 20 to Aug 5  
 This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.

**Wood Thrush** *Hyllocichla mustelina* Breeds May 10 to Aug 31  
 This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.

## Probability of Presence Summary

The graphs below provide our best understanding of when birds of concern are most likely to be present in your project area. This information can be used to tailor and schedule your project activities to avoid or minimize impacts to birds. Please make sure you read ["Supplemental Information on Migratory Birds and Eagles"](#), specifically the FAQ section titled "Proper Interpretation and Use of Your Migratory Bird Report" before using or attempting to interpret this report.

### Probability of Presence (■)

Each green bar represents the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during a particular week of the year. (A year is represented as 12 4-week months.) A taller bar indicates a higher probability of species presence. The survey effort (see below) can be used to establish a level of confidence in the presence score. One can have higher confidence in the presence score if the corresponding survey effort is also high.

How is the probability of presence score calculated? The calculation is done in three steps:

1. The probability of presence for each week is calculated as the number of survey events in the week where the species was detected divided by the total number of survey events for that week. For example, if in week 12 there were 20 survey events and the Spotted Towhee was found in 5 of them, the probability of presence of the Spotted Towhee in week 12 is 0.25.

- To properly present the pattern of presence across the year, the relative probability of presence is calculated. This is the probability of presence divided by the maximum probability of presence across all weeks. For example, imagine the probability of presence in week 20 for the Spotted Towhee is 0.05, and that the probability of presence at week 12 (0.25) is the maximum of any week of the year. The relative probability of presence on week 12 is  $0.25/0.25 = 1$ ; at week 20 it is  $0.05/0.25 = 0.2$ .
- The relative probability of presence calculated in the previous step undergoes a statistical conversion so that all possible values fall between 0 and 10, inclusive. This is the probability of presence score.

To see a bar's probability of presence score, simply hover your mouse cursor over the bar.

### Breeding Season (■)

Yellow bars denote a very liberal estimate of the time-frame inside which the bird breeds across its entire range. If there are no yellow bars shown for a bird, it does not breed in your project area.

### Survey Effort (|)

Vertical black lines superimposed on probability of presence bars indicate the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps. The number of surveys is expressed as a range, for example, 33 to 64 surveys.

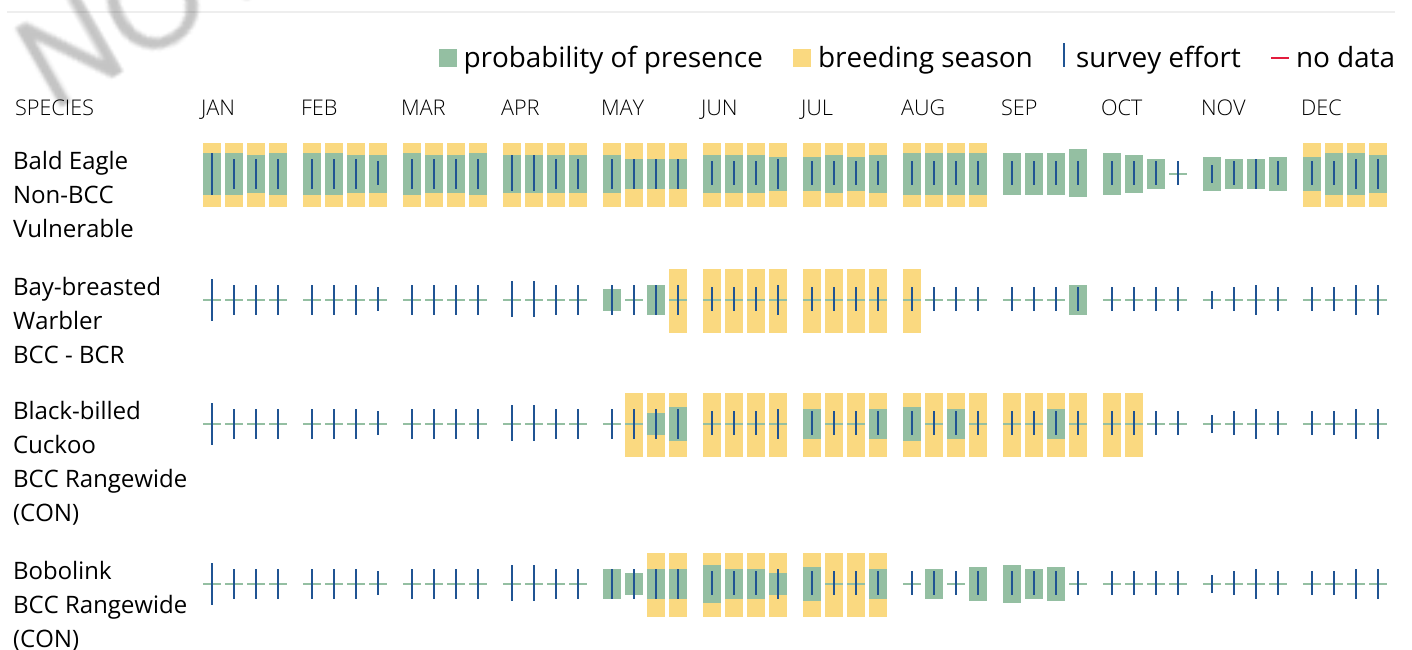
To see a bar's survey effort range, simply hover your mouse cursor over the bar.

### No Data (-)

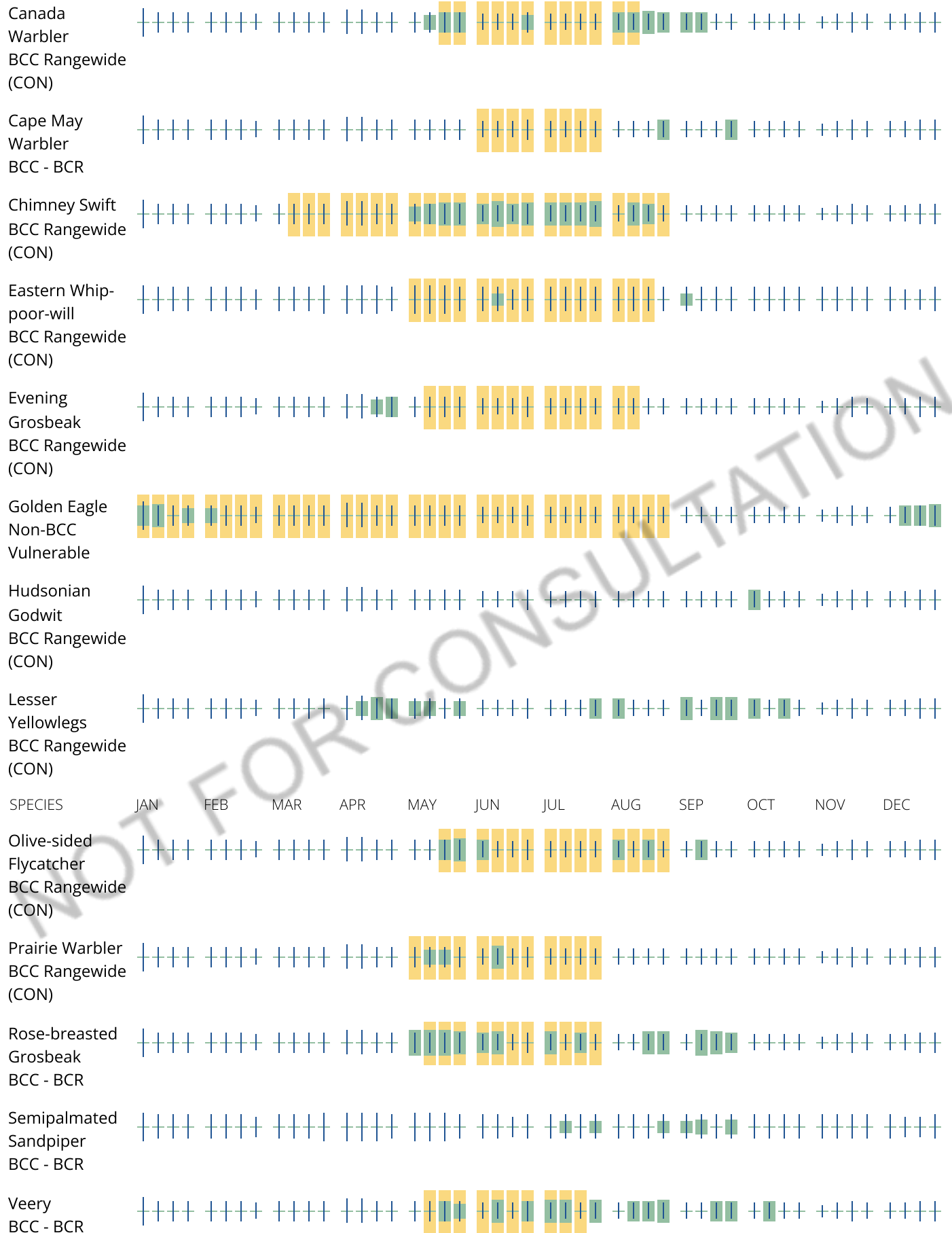
A week is marked as having no data if there were no survey events for that week.

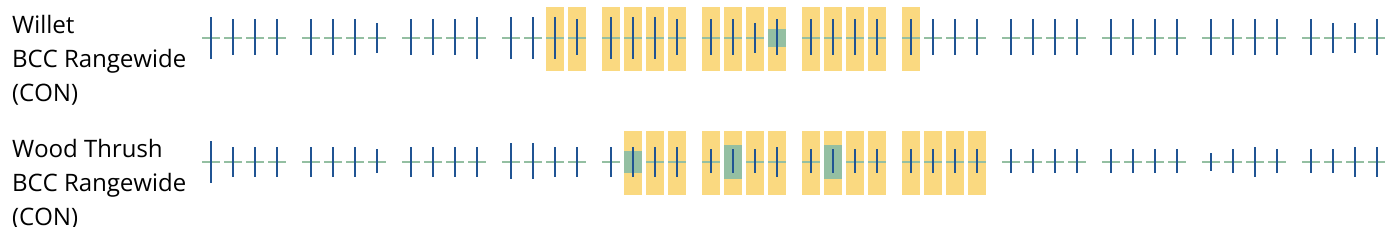
### Survey Timeframe

Surveys from only the last 10 years are used in order to ensure delivery of currently relevant information. The exception to this is areas off the Atlantic coast, where bird returns are based on all years of available data, since data in these areas is currently much more sparse.









## Tell me more about conservation measures I can implement to avoid or minimize impacts to migratory birds.

[Nationwide Conservation Measures](#) describes measures that can help avoid and minimize impacts to all birds at any location year round. Implementation of these measures is particularly important when birds are most likely to occur in the project area. When birds may be breeding in the area, identifying the locations of any active nests and avoiding their destruction is a very helpful impact minimization measure. To see when birds are most likely to occur and be breeding in your project area, view the Probability of Presence Summary. [Additional measures](#) or [permits](#) may be advisable depending on the type of activity you are conducting and the type of infrastructure or bird species present on your project site.

## What does IPaC use to generate the list of migratory birds that potentially occur in my specified location?

The Migratory Bird Resource List is comprised of USFWS [Birds of Conservation Concern \(BCC\)](#) and other species that may warrant special attention in your project location.

The migratory bird list generated for your project is derived from data provided by the [Avian Knowledge Network \(AKN\)](#). The AKN data is based on a growing collection of [survey, banding, and citizen science datasets](#) and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) which your project intersects, and that have been identified as warranting special attention because they are a BCC species in that area, an eagle ([Eagle Act](#) requirements may apply), or a species that has a particular vulnerability to offshore activities or development.

Again, the Migratory Bird Resource list includes only a subset of birds that may occur in your project area. It is not representative of all birds that may occur in your project area. To get a list of all birds potentially present in your project area, please visit the [Rapid Avian Information Locator \(RAIL\) Tool](#).

## What does IPaC use to generate the probability of presence graphs for the migratory birds potentially occurring in my specified location?

The probability of presence graphs associated with your migratory bird list are based on data provided by the [Avian Knowledge Network \(AKN\)](#). This data is derived from a growing collection of [survey, banding, and citizen science datasets](#).

Probability of presence data is continuously being updated as new and better information becomes available. To learn more about how the probability of presence graphs are produced and how to interpret them, go the Probability of Presence Summary and then click on the "Tell me about these graphs" link.

## How do I know if a bird is breeding, wintering or migrating in my area?

To see what part of a particular bird's range your project area falls within (i.e. breeding, wintering, migrating or year-round), you may query your location using the [RAIL Tool](#) and look at the range maps provided for birds in your area at the bottom of the profiles provided for each bird in your results. If a bird on your migratory bird species list has a breeding season associated with it, if that bird does occur in your project area, there may be nests present at some point within the timeframe specified. If "Breeds elsewhere" is indicated, then the bird likely does not breed in your project area.

### What are the levels of concern for migratory birds?

Migratory birds delivered through IPaC fall into the following distinct categories of concern:

1. "BCC Rangewide" birds are [Birds of Conservation Concern](#) (BCC) that are of concern throughout their range anywhere within the USA (including Hawaii, the Pacific Islands, Puerto Rico, and the Virgin Islands);
2. "BCC - BCR" birds are BCCs that are of concern only in particular Bird Conservation Regions (BCRs) in the continental USA; and
3. "Non-BCC - Vulnerable" birds are not BCC species in your project area, but appear on your list either because of the [Eagle Act](#) requirements (for eagles) or (for non-eagles) potential susceptibilities in offshore areas from certain types of development or activities (e.g. offshore energy development or longline fishing).

Although it is important to try to avoid and minimize impacts to all birds, efforts should be made, in particular, to avoid and minimize impacts to the birds on this list, especially eagles and BCC species of rangewide concern. For more information on conservation measures you can implement to help avoid and minimize migratory bird impacts and requirements for eagles, please see the FAQs for these topics.

### Details about birds that are potentially affected by offshore projects

For additional details about the relative occurrence and abundance of both individual bird species and groups of bird species within your project area off the Atlantic Coast, please visit the [Northeast Ocean Data Portal](#). The Portal also offers data and information about other taxa besides birds that may be helpful to you in your project review. Alternately, you may download the bird model results files underlying the portal maps through the [NOAA NCCOS Integrative Statistical Modeling and Predictive Mapping of Marine Bird Distributions and Abundance on the Atlantic Outer Continental Shelf](#) project webpage.

Bird tracking data can also provide additional details about occurrence and habitat use throughout the year, including migration. Models relying on survey data may not include this information. For additional information on marine bird tracking data, see the [Diving Bird Study](#) and the [nanotag studies](#) or contact [Caleb Spiegel](#) or [Pam Loring](#).

### What if I have eagles on my list?

If your project has the potential to disturb or kill eagles, you may need to [obtain a permit](#) to avoid violating the Eagle Act should such impacts occur.

### Proper Interpretation and Use of Your Migratory Bird Report

The migratory bird list generated is not a list of all birds in your project area, only a subset of birds of priority concern. To learn more about how your list is generated, and see options for identifying what other birds may be in your project area, please see the FAQ "What does IPaC use to generate the migratory birds potentially occurring in my specified location". Please be aware this report provides the "probability of

presence" of birds within the 10 km grid cell(s) that overlap your project; not your exact project footprint. On the graphs provided, please also look carefully at the survey effort (indicated by the black vertical bar) and for the existence of the "no data" indicator (a red horizontal bar). A high survey effort is the key component. If the survey effort is high, then the probability of presence score can be viewed as more dependable. In contrast, a low survey effort bar or no data bar means a lack of data and, therefore, a lack of certainty about presence of the species. This list is not perfect; it is simply a starting point for identifying what birds of concern have the potential to be in your project area, when they might be there, and if they might be breeding (which means nests might be present). The list helps you know what to look for to confirm presence, and helps guide you in knowing when to implement conservation measures to avoid or minimize potential impacts from your project activities, should presence be confirmed. To learn more about conservation measures, visit the FAQ "Tell me about conservation measures I can implement to avoid or minimize impacts to migratory birds" at the bottom of your migratory bird trust resources page.

## Facilities

### National Wildlife Refuge lands

Any activity proposed on lands managed by the [National Wildlife Refuge](#) system must undergo a 'Compatibility Determination' conducted by the Refuge. Please contact the individual Refuges to discuss any questions or concerns.

There are no refuge lands at this location.

### Fish hatcheries

There are no fish hatcheries at this location.

### Wetlands in the National Wetlands Inventory (NWI)

Impacts to [NWI wetlands](#) and other aquatic habitats may be subject to regulation under Section 404 of the Clean Water Act, or other State/Federal statutes.

For more information please contact the Regulatory Program of the local [U.S. Army Corps of Engineers District](#).

Please note that the NWI data being shown may be out of date. We are currently working to update our NWI data set. We recommend you verify these results with a site visit to determine the actual extent of wetlands on site.

This location overlaps the following wetlands:

ESTUARINE AND MARINE DEEPWATER

[E1UBL](#)

ESTUARINE AND MARINE WETLAND

[E2EM1P](#)

FRESHWATER EMERGENT WETLAND

[PEM1E](#)

RIVERINE

[R4SBC](#)

A full description for each wetland code can be found at the [National Wetlands Inventory website](#)

**NOTE:** This initial screening does **not** replace an on-site delineation to determine whether wetlands occur. Additional information on the NWI data is provided below.

#### Data limitations

The Service's objective of mapping wetlands and deepwater habitats is to produce reconnaissance level information on the location, type and size of these resources. The maps are prepared from the analysis of high altitude imagery. Wetlands are identified based on vegetation, visible hydrology and geography. A margin of error is inherent in the use of imagery; thus, detailed on-the-ground inspection of any particular site may result in revision of the wetland boundaries or classification established through image analysis.

The accuracy of image interpretation depends on the quality of the imagery, the experience of the image analysts, the amount and quality of the collateral data and the amount of ground truth verification work conducted. Metadata should be consulted to determine the date of the source imagery used and any mapping problems.

Wetlands or other mapped features may have changed since the date of the imagery or field work. There may be occasional differences in polygon boundaries or classifications between the information depicted on the map and the actual conditions on site.

#### Data exclusions

Certain wetland habitats are excluded from the National mapping program because of the limitations of aerial imagery as the primary data source used to detect wetlands. These habitats include seagrasses or submerged aquatic vegetation that are found in the intertidal and subtidal zones of estuaries and nearshore coastal waters. Some deepwater reef communities (coral or tubercid worm reefs) have also been excluded from the inventory. These habitats, because of their depth, go undetected by aerial imagery.

### Data precautions

Federal, state, and local regulatory agencies with jurisdiction over wetlands may define and describe wetlands in a different manner than that used in this inventory. There is no attempt, in either the design or products of this inventory, to define the limits of proprietary jurisdiction of any Federal, state, or local government or to establish the geographical scope of the regulatory programs of government agencies. Persons intending to engage in activities involving modifications within or adjacent to wetland areas should seek the advice of appropriate Federal, state, or local agencies concerning specified agency regulatory programs and proprietary jurisdictions that may affect such activities.

NOT FOR CONSULTATION

## **Appendix E Project Drawings**

---

D:\CASTELNUOVO, VINNIE B\Working\BATH, CITY OF BATH\Maine\Bath\Bath\_Vulnerability\_Study\00\_CAD\Design\Working\Bath Maine Conceptual Plans\_Option 1.dwg - 9/12/2024



Attention:  
 0 1"  
 If this scale bar does not measure 1" then drawing is not original scale.

**DRAFT**

Designed: AM  
 Drawn: AM  
 Checked: BM/LP  
 Approved: BM  
 P.E. No: PE#  
 GEI Project 2204496



CITY OF BATH MAINE  
 55 FRONT STREET  
 BATH, ME 04530

**COASTAL RESILIENCY  
 COMMUNITY AND  
 STAKEHOLDER  
 ENGAGEMENT**  
 CITY OF BATH  
 SAGADAHOC COUNTY MAINE, 04530

NO	DATE	ISSUE/REVISION	APP

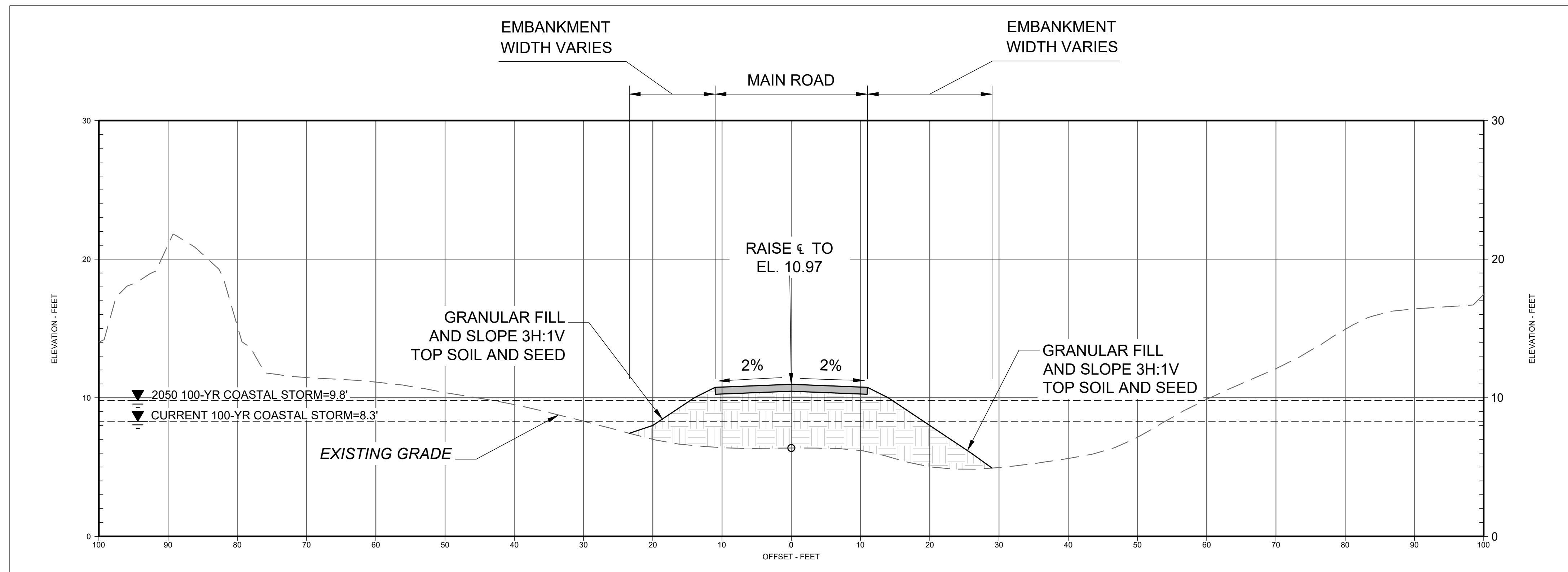
SHEET NAME  
**WASHINGTON STREET  
 AND HARWARD STREET  
 CONCEPTUAL PLAN**

SHEET NO.  
**1 OF 1**

© 2024 Microsoft Corporation © 2024 Maxar © CNES (2024) Distribution Airbus DS

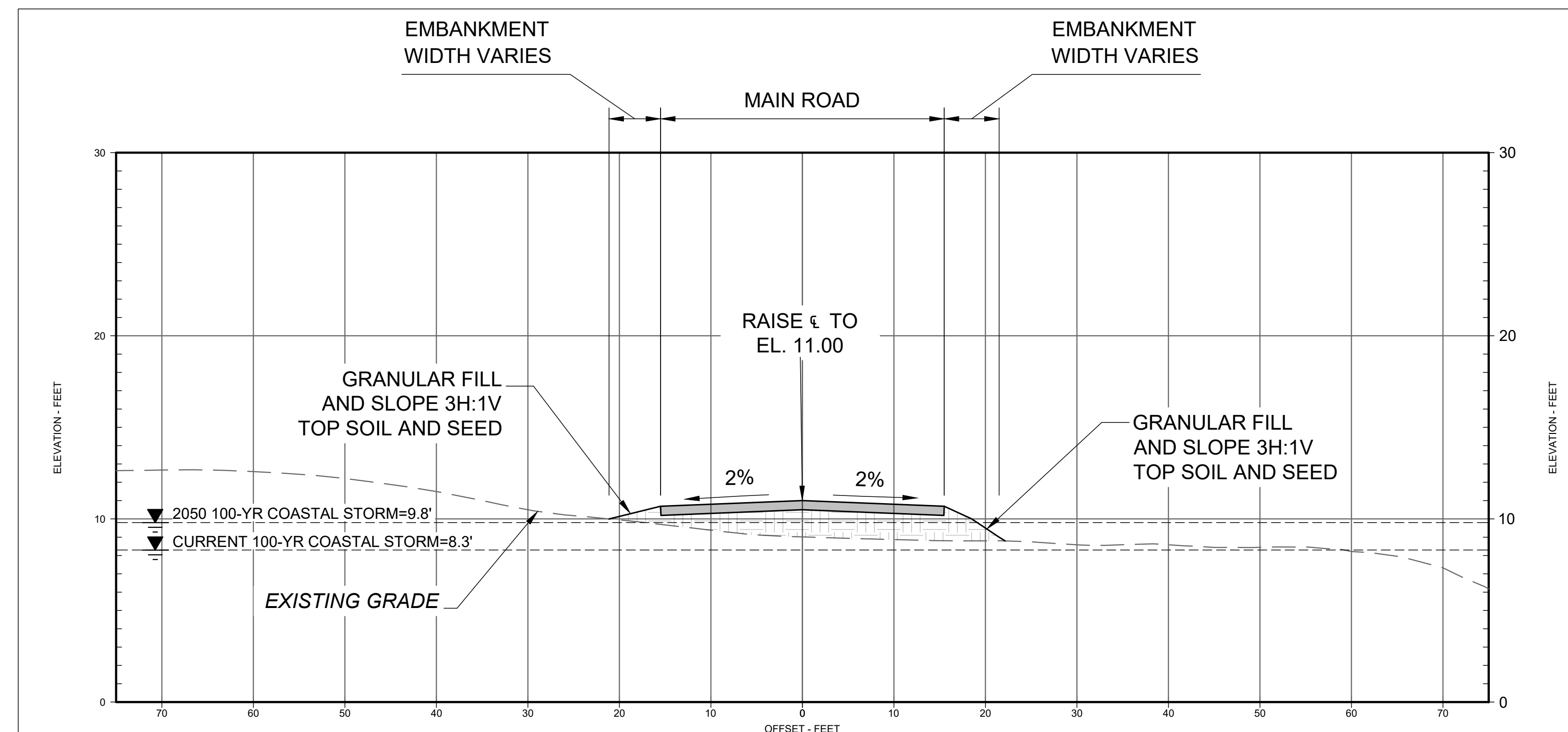


D:\CASTELNUOVO, VINNIE B\Working\BATH, CITY OF MAINE\2204496 Bath Vulnerability Study\00\_CADD\Design\Working\Bath Maine Conceptual Plans\_Option 1\VD Working.dwg - 9/13/2024



**WASHINGTON STREET TYPICAL SECTION**

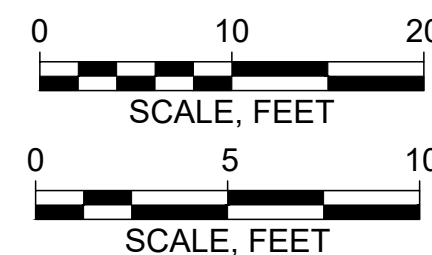
HORIZONTAL SCALE: 1" = 10'  
VERTICAL SCALE: 1" = 5'



**HARWARD STREET TYPICAL SECTION**

HORIZONTAL SCALE: 1" = 10'  
VERTICAL SCALE: 1" = 5'

**NOT FOR CONSTRUCTION**



Attention:  
0 1"  
If this scale bar does not measure 1" then drawing is not original scale.

**DRAFT**

Designed: VD  
Drawn: VD  
Checked: BM/LP  
Approved: BM  
P.E. No:  
GEI Project 2204496



CITY OF BATH, MAINE  
55 FRONT STREET  
BATH, ME 04530

**COASTAL RESILIENCY  
COMMUNITY AND  
STAKEHOLDER  
ENGAGEMENT**  
CITY OF BATH  
SAGadahoc County, Maine, 04530

NO	DATE	ISSUE/REVISION	APP

SHEET NAME  
**WASHINGTON STREET  
AND HARWARD STREET  
TYPICAL SECTIONS**

SHEET NO.  
1 OF 1