Comprehensive Land Use Plan Update

Pre-Process Informational Session

LAND USE PLANNING COMMISSION
DEPARTMENT OF AGRICULTURE, CONSERVATION & FORESTRY

FLOOD HAZARDS AND RESILIENCE:

ISSUES, TRENDS, AND PANEL SUMMARIES

Topics for Discussion:

- Precipitation trends – current and future
- Coastal and inland hazards *(for example, flooding, storm surge, sea level rise, storm damage)*
- Vulnerability of roads and infrastructure
- Recovery from recent storm events – issues and implications
- Building flood resilience into the LUPC regulatory framework

Session Information:

- ***When:*** Wednesday, **November 12**, 2025, at 10:00 am
- ***Where:*** Jeff's Catering, 15 Event Center Way, Brewer
- ***What:*** This is the second in a series of informational sessions planned to allow the Commission to learn more about specific topic areas before updating the Comprehensive Land Use Plan (CLUP). These sessions will take place during the Commission's regular business meetings and will include presentations by topic experts and/or roundtable discussions, with a question-and-answer portion to allow Commissioners to learn more from subject matter experts.
- ***A Key Note***: These informational sessions are not intended to be public hearings, and the public will not be invited to comment. There will be *many* opportunities for the public to provide input and comment during the remainder of the pre-process, including through a public survey and community workshop meetings. People are also welcome to submit comments on the topic in writing to the LUPC by mail to Stacy Benjamin, LUPC, 22 State House Station, Augusta, ME 04333, or email to stacy.benjamin@maine.gov.

Panelists:

- **Pete Slovinsky**, Marine Geologist (coastal focus), Maine Geological Survey
- **Ryan Gordon**, State Geologist (inland focus), Maine Geological Survey
- **Alex Zipparo**, Economic and Community Development Planner; Lincoln County Regional Planning Commission
- **Charles Hebson**, Hydrology and Stormwater Manager, Department of Transportation
- **George Buswell,** Director of UT Administration, Penobscot County

Flood Hazard and Resilience Related Information and Issues – What We've Heard So Far

Comments from Initial Outreach Interviews

Public Services. There is concern about the state of current infrastructure and potential impacts to transportation and emergency response. Remote communities, such as coastal communities, are particularly vulnerable.

Climate Change. Potential increases in storm intensity and frequency could impact current infrastructure and development. Flash flooding and resulting washouts have occurred throughout the service area.

LUPC Process and Administration. Long permit processing times could hinder efforts to quickly address damage to development and infrastructure.

Informational Session Summary

Presentation #1: Sea Level Rise, Storm Surge and Coastal Hazards – Pete Slovinsky, Marine Geologist, Maine Geologic Survey

Overview of Sea Level Rise (shortened to SLR)

- Maine has 3 long-term tide gauge stations (1929-2025). The Eastport gauge station data show annual SLR doubling from the 20th to the 21st centuries.
- Maine's Plan for SLR: Maine Won't Wait (Maine's Climate Action Plan - 2020 and 2024) addresses intermediate SLR for the state. This plan adopted both the "Commit to Manage" and "Prepare to Manage" scenarios, which utilizes new data to estimate potential future SLR scenarios for the coast of Maine. The "Commit to Manage" plans for a 1.5-foot SLR.

Weather and Tides

- Storm surge: an abnormal rise of water generated by a storm, over and above predicted astronomical tides
- Storm tide: the water level rise due to the combination of storm surge and astronomical tide
- Nuisance/king tide: the highest astronomical tides
    - Flooding from these tides have increased along the Maine coastline. Sea level rise will increase the duration and frequency of nuisance flooding.
    - Maine there is only a 1ft difference between the "king tide" and a 10-yr event, and less than a foot difference between the 10-yr and 100-yr storm event. As the sea level rises, the impact of larger storms will be greater.

What areas are at risk?

- About 50% of Maine's coastline is rocky cliff, very common in LUPC service area. There are few hazards here, though there is concern for erosion and flooding.
- Erosion and flooding are hazards for coastal sand dunes, coastal bluffs, and adjacent habitats. Coastal bluffs only erode in one direction and will not be reformed in our lifetimes. A single coastline can be at different stages of erosion, which is a natural process and important for supplying sediment to nearby habitats (intertidal zones, mudflats, wetlands, dunes, and beaches).
- The MGS maps and categorizes coastal bluff stability. MGS currently has gaps in its coastal bluffs mapping data, which are located within the LUPC service area. There is a plan for a 5-year update process, slated for completion by 2028/2029.
- Coastal dunes are a very dynamic coastal shoreline type and are also common in the LUPC service area (e.g., perched sand dunes and pocket sand/gravel/cobble dunes). MGS has some coastal sand dunes mapped and is updating its data in the service area. Currently, there are 96 dunes areas mapped.

Concerns: Factors influencing bluff stability

- Bluff hydrology (groundwater/surface runoff), upland land management (development, landscaping – tree and vegetation management), and freeze/thaw cycles. Presenter PowerPoint slides provide an photographic example of erosion in a residential area, highlighting the effects of surface runoff and/or groundwater influence, an extensive lawn, and tree removal.

Commissioner Questions for Panelist:

Q: If sea level continues to rise and the vegetation along the bluffs is not salt-tolerant, will the vegetation that is there die? Will this cause faster erosion?

A: Yes, vegetation that is not salt-tolerant will die with increasing salt content in groundwater and from sea level rise. There are many species of salt-tolerant vegetation that do well on coastal bluffs, but there are also species that are invasive or less tolerant of increasing saltwater. The Coastal Bluff Planting Guide, from the Cumberland County Soil and Water District, reviews native vegetation and ranks species' salt tolerance.

Q: How can the Commission educate landowners about caring for their shorelines and planting salt-tolerant vegetation?

A: The Maine Department of Environmental Protection (DEP) is currently running a workshop series called: O.U.R. S.H.O.R.E., which provides homeowners, municipalities, and land managers with best management practices for stabilizing shorelines with nature-based strategies, like living shorelines, hybrid structures, and rockwork. The LUPC staff have attended these workshops and look to incorporate O.U.R. S.H.O.R.E. information into LUPC rules, informational materials and

practices to be consistent with the DEP and the Natural Resources Protection Act's rules regarding shoreline stabilization.

Presentation #2: Inland Flooding and Climate Variability – Ryan Gordon, State Geologist, Maine Geologic Survey (MGS)

Hydrologic cycle, types of flooding, climate change and variability in Maine

- Though there is spatial variability across the state, Maine averages 45 inches of water per year from both rain and snow. There are two types of flooding in Maine: fluvial (river) and pluvial (overland), and both can be erosive floods. Examples of flood types in Hallowell, Phillips, and woodland damage are shown in slides.
- Climate change effects on the water cycle: increasing precipitation and greater variability over time; increasing temperatures will bring changes to the hydrologic cycle. Future changes depend on several factors (emission levels increasing or decreasing) but it's likely that Maine will see continued precipitation increase, especially in northern and western Maine.

Recent years in review:

- 2023: Dec. 18-19 (rain and snowmelt flooding): "Exceptional" atmospheric river event, and flash snowmelt "This was an extreme melt event of rare magnitude" (NWS). 3rd highest flood on major rivers since 1900. This storm caused MGS to start snow surveys in Dec. when there is snowpack, before this storm it did not start until Jan. 1.
- 2024: Jan. 10 and 13 (coastal storms and high tides), fall-winter (flash drought followed by continued dryness).
- 2025: spring (wet weekends), summer-fall (severe drought).
- Drought: Serious drought this year (2025), particularly in southern Maine. There have been periods of drought recently: 2000-2003, 2016, 2020-2022, 2024-2025. However, Maine is getting wetter (See Gordon's slides on the CLUP website for graphic).

Drinking water (subsurface water)

- There is a coastal transition zone of underground salt and fresh water, and it is sensitive to changes. Processes that affect the saltwater interface:
    - Pumping (drawing water to the surface) or drought can lower fresh groundwater table and shift the saltwater interface inland.
    - Sea-level rise can also shift the saltwater interface inland, raise the fresh groundwater table, flood the near-shore, and erode the near-shore
- Threats to drinking water and infrastructure from SLR:
    - Seawater intrusion into aquifers: salt contamination of drinking water supplies, and corrosion of pipes/foundations/other subsurface infrastructure.

- Fresh water-table rise: flooding and failure of septic systems and sewers, saturation and failure of roadbeds, foundations, etc., and saturation and remobilization of soil contamination.
- Land inundation: salt contamination of drinking water supplies

Commissioner Questions for Panelist:

Q: Will Maine's initiative to remove dams affect the number and severity of flooding events in the future?

A: Continuing to remove dams may cause moderate-sized floods to increase in the main stem of rivers, but the largest floods are unlikely to change in magnitude post-dam removal. As of now, most dams are open for major flooding events, and dam managers work with Maine DEP and the Weather Service to mitigate flood risk.

Presentation #3: Coastal Vulnerability Planning and Impact: Matinicus and Monhegan Plantations – Alex Zipparo, Economic and Community Development Planner, Lincoln County Regional Planning Commission

Discussion of two islands in LUPC service area

Monhegan Plantation	**Matinicus Plantation**
Similarities: each have a one-room school, no paved roads, and have year-round (and need more!) and seasonal residents	
Differences: Driven by tourism and commercial activity. It has only one passenger boat to visit the island. It is mostly undeveloped with 75% of the island protected as conservation land.	**Differences:** It has no stores and is heavily reliant on the fishing industry. It has both a car ferry and air travel to reach the island. Density is low and dispersed.

Matinicus Plantation

- Density of development is low and dispersed on the island. Harbor has a 451-foot federal breakwater, a steamboat wharf which today serves the Maine State Ferry Service, and a beach for barge access.
- 23 miles out to sea, 2.3 square miles, and 53 residents (2020 US Census), with a summer population of up to 300, and 38 businesses (mostly fishermen). Ferry service only comes 2-4 times a summer, and 1-2 times in the winter (weather dependent). The air taxi has limited flights and only flies in daylight. There is a closed-loop power system, recently upgraded to a new one this year.

- The Jan. 2024 storm damaged the Centennial Building, steam wharf, and Harbor Road. The Centennial Building held up the integrity of the Harbor Road, raising concerns for the stability of the road, which is very important to the island community. US Army Corps of Engineers and Maine Department of Transportation (Maine DOT) are involved with projects upgrading the breakwater and steamboat wharf.

Monhegan Planation

- Mostly undeveloped island, small village area with commercial uses and residences; 75% of the island is conserved. The breakwater in the harbor is much smaller than Matinicus' and is owned by the Plantation. The harbor infrastructure was not built for the velocity wave zone that it is in. Island drinking water comes from an aquifer in the bog – there are concerns with SLR and saltwater intruding into the freshwater aquifer.
- 12 miles out to sea, 1 sq. mile, 64 residents (45 in the winter), 1,000 summer residents, and thousands of visitors. Three private boat services to the island in the summer. Winter has one privately owned company operating for passengers only.
- There are fire concerns on the island due to 400 acres of conserved forest. Drought and low precipitation leave concerns for fire fuel.
- Jan. 2024 storm: Monhegan wharf and freight shed were affected. The shed was moved 8 feet by the water, and the storm caused an island-wide power outage for days. The shed has been relocated to its original position and elevated. It is a central spot on the island for foot traffic and boats, as well as an important location for island news (side of the shed is a noticeboard). Engineers are currently working on upgrading the wharf.

Commissioner Questions for Panelist:

Q: What is the future of these islands and their communities with sea level rise?

A: If the island entry points, wharves, breakwaters, and necessary infrastructure are raised, secured, and made more resilient, these islands should be able to sustain their communities. Keeping saltwater out of the freshwater for drinking will need to be addressed for both islands.

Presentation #4: Maine Department of Transportation Perspective – Charles Hebson, Hydrology and Stormwater Manager, Maine DOT

Planning perspective for hydrology and stormwater for inland flooding and resilience

- MaineDOT has a strong Design Standard for bridges and culverts
    - This means designing infrastructure for peak flows for 10-year, 50-year, 100-year storm events
    - Culverts (cross culverts and large culverts): MaineDOT designs for big flows, 50-year and 100-year events. This is conservative compared to other states.

  - Bridges (spans): a 50-year event has the water surface elevation 2-4 ft below the chord (found on truss bridges) of the bridge, a 100-year event is called a "flood of record" when the water surface elevation is 1 ft below the low point on the bridge, a 500-year event causes a scour. These are very conservative standards. Planning this way effectively takes care of climate change.
  - MaineDOT is an engineering organization. It is difficult for small towns to employ the same standards because engineers are expensive. Even without climate change, Mainers are living with risk every day.

- Engineers design infrastructure for a "design flood", which is a term for a hypothetical flood event with a recurrence interval of years. This terminology can be confusing and leads to many misunderstandings. A 50-year flow is the probability of distribution of the maximum flow in a single year not that it occurs every 50 years.
- "Failure" and Expected Life Performance
  - MaineDOT has 4,000+ bridges, 1,900+ culverts, 38,000+ cross culverts and remarkably few failures. Most "real failures" of inland culverts are due to debris blockage or culvert condition, and low-lying, low-gradient watersheds where water simply cannot drain fast enough.
- Climate change – what about it?
  - Good rule of thumb: plan for 15%-20% increase in design storms by the end of the century. The anticipated NOAA Atlas 15 will be a great help in quantifying this.
- Coastal Resilience: well-established standards for bridges – but not so much for roads
  - Conceptually, simple: raise road or structure, but it is very expensive and we "can't always build our way out of the problem." We need to figure out how to live with it and manage the problem.
  - The Maine Coastal Flood Risk Model will be a huge help in quantifying risk and impacts and is undertaken with another state agency.

Commissioner Questions for Panelist:

Q: Are there situations where infrastructure (roads or bridges) should just be abandoned instead of being fixed?

A: Those decisions are not for the engineers to make. Engineers can design whatever they are asked, but the reality of funding limits what can be accomplished. Decisions on abandoning infrastructure must be made at the highest levels, not by the engineers.

Q: What are the consequences of infrastructure (roads and bridges) failing? When these things fail, local businesses and residents are affected. Are these consequences taken into consideration?

A: Unfortunately, 200-year+ storm events are bound to occur. Designing infrastructure for 500-year events with no disruption to service is possible, but it is very expensive. Consideration is given to residents and businesses and factored indirectly through the "level of risk" with a design. Critical infrastructure is looked at individually for risk, but as a general design standard, it is not practical to design everything for a 500-year storm event.

Q: Does the MaineDOT have a list of roads that are currently underwater during high tides?

A: MaineDOT created a list of roads with periodic issues with water and created preliminary designs for some of those locations. However, the funding for this initiative has gone away, but there are a few projects still moving forward. It should be noted that some roads on the coast were first built hundreds of years ago with local knowledge of tides, which are changing due to climate change. Moving or raising roads is not easy.

Q: Is there anything that the Commission should be thinking about regarding land use in the vicinity of bridges and culverts?

A: Consideration should be given when reviewing land use proposals for developments near big structures and numbered highways. A good design standard should be considered.

Q: There has been evidence of ditches and steep slopes filled with big rocks washing out after storm events. Is this a MaineDOT maintenance issue?

A: It is maintenance, but the ditches are not formally designed. Road ditches can "unzip" when they are filled with gravel or rocks and are not vegetated, and a storm event brings a lot of water into those spaces.

Presentation #5: Overview of Road/Bridge Maintenance in the Unorganized Territories of Penobscot County – George Buswell, Director of UT Administration, Penobscot County

<u>Road vulnerability and budget decisions by Penobscot County</u>

- Key point: budgetary constraints drive what can be maintained and planned
- Penobscot County UT has: 40 townships, 53.66 miles of year-round maintained roads, 130.14 miles of winter plowing. Overall, Penobscot County has the 5th lowest cost per capita out of the 9 counties involved with the UT (Municipal Cost Component Report, FY 26)
- Other services provided: additional law enforcement, animal control (15 towns, plus 3 UT townships), ambulance service, fire protection, cemetery maintenance, snow removal, and solid waste.

- Emergency response costs have been the biggest increase in the last 3 years. The UT need to pay their fair share in this, as organized towns are needed to help provide services. This is happening with the increased budget costs.
- Snow removal is the largest single line budget item ($1.2 million out of $2.6 million budget)

UT Road Vulnerabilities:

- Storm events:
  - Downed trees. We have contractors ready before storm events to go out and clean up afterwards, except for trees in powerlines. Rural areas are not so much of a priority when the power is out, compared to urban areas.
  - Ditches. Overflow from debris filling up road ditches and then flooding the edges out. It is very costly to fix during the winter.
  - Beavers. Will always be a problem. Beaver Deceivers have helped and sometimes work.
- Using what is available: Round rock is readily available in the Commission's service area but is not the best material for culverts. Round rock is used if other rock is not available.

Other practices:

- Slip-line culverts, example in Grand Falls.
- Increase culvert size to follow fish passage laws.
- Example of riverbank erosion and house damage.

Commissioner Questions for Panelist:

Q: Has Penobscot County ever formed partnerships with municipalities for snow removal?

A: Yes, Penobscot County has several plowing contracts with municipalities, as well as joint contracts with Hancock, Piscataquis, and Aroostook counties.

This informational panel session did not have additional Panelists for a Roundtable Discussion.