



PACIFIC COUNTY – NORTH WILLAPA SHORELINE EROSION MITIGATION MASTER PLAN

Cover Photo: Lighthouse Undermined circa 1940 (courtesy of Westport Maritime Museum)

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ACKNOWLEDGEMENTS

- Federal Emergency Management Administration
- Friends of North Cove
- Pacific Conservation District
- Pacific County
- Pacific County Drainage District #1
- Shoalwater Bay Indian Tribe
- U.S. Army Corps of Engineers Seattle District
- Washington Sea Grant
- Washington State Department of Ecology
- Washington State Department of Fish and Wildlife
- Washington State Department of Natural Resources
- Washington State Department of Transportation
- Washington State Historic Preservation Office
- Washington State Parks and Recreation Commission
- Westport Maritime Museum
- Willapa Erosion Control Action Now (WECAN) Community Forum

PRODUCED BY



moffatt & nichol

PRODUCED FOR AND FUNDED BY



PROJECT PARTNER: FEMA THROUGH COOPERATIVE TECHNICAL PARTNERS (CTP)



FEMA

IN COLLABORATION WITH



This document is respectfully dedicated to the memory of David Cottrell, the quiet giant in the North Cove community. He was a North Cove local from Day 1, a long-time cranberry farmer, and Pacific County Drainage District #1 Commissioner. He was a keen observer of coastal dynamics. David was instrumental in starting the North Cove dynamic revetment, which has slowed a century-long trend of shoreline retreat and saved the remaining North Cove community in the process. He will be dearly missed.
(Photograph courtesy of George Kaminsky)



"We all need to work together to save what we have and bring back some of what was there before. I think the master plan is a very important project and I will encourage others to look at the beach near them that is being washed away and say 'no more'."

Charlene Nelson, the Shoalwater Bay Indian Tribe Chairwoman, June 2023

The Shoalwater Dune protects coastal wetlands and tribal land on the Tokeland Peninsula
(Photograph courtesy of Larissa Pflieger)



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GLOSSARY

Terminology	Definition
Base Flood Elevation	The Base Flood Elevations (BFE) are measured from a reference point called NAVD88, which is approximately equal to sea level, and vary widely across geographies.
Coastal Erosion	Coastal erosion is the process by which local sea level rise, strong wave action, and coastal flooding wear down or carry away rocks, soils, and/or sands along the coast.
Coastal Flooding	See Inundation. Coastal floods come from sources such as the Atlantic and Pacific Oceans, the Gulf of Mexico and large lakes (such as the Great Lakes), bays, and tidal rivers that are big enough to have large waves or that can be affected by storm surge. Coastal floods can be very dangerous when high waters are combined with the destructive forces of waves. In low-lying coastal areas, storm surge and flooding can reach many miles from the shoreline, flowing up rivers and across flat land.
Community Lifeline	A lifeline enables the continuous operation of critical government and business functions and is essential to human health and safety or economic security. Lifelines are the most fundamental services in the community that, when stabilized, enable all other aspects of society to function.
Dynamic Revetment	Natural materials such as cobbles and wood are placed along a chronically eroding shore to absorb wave energy. Wave energy redistributes these materials across the beach, which helps rebuild the beach and dune system. Dynamic Revetment is an example of Nature-Based Solutions and Engineering with Nature®.
Engineering with Nature®	Engineering With Nature® is the intentional alignment of natural and engineering processes to efficiently and sustainably deliver economic, environmental, and social benefits through collaboration. An equivalent terminology for Engineering with Nature®, widely by USACE, is Nature-Based Solutions, preferred by FEMA.
FEMA	Federal Emergency Management Administration
Hazard	Hazard means an event or physical condition that has the potential to cause fatalities, injuries, property damage, infrastructure damage, agricultural loss, damage to the environment, interruption of business, or other types of harm or loss.
Hazard Mitigation	Hazard mitigation is the effort to reduce loss of life and property by lessening the impact of disasters. It is most effective when implemented under a comprehensive, long-term mitigation plan.
Inundation	Flooding; in other words, water covering normally dry land.
Nature-Based Solution	Nature-based solutions are sustainable planning, design, environmental management and engineering practices that weave natural features or processes into the built environment to promote adaptation and resilience. These solutions use natural features and processes to combat climate change and reduce flood risk. See 'Engineering with Nature®' for a similar concept.
Risk	The likelihood that a threat will harm an asset with some severity of consequences
RSM	Regional Sediment Management
SR 105	State Route 105
USACE	U.S. Army Corps of Engineers
WSDOT	Washington Department of Transportation



Shoalwater Dune restored in 2019 was eroded and breached in winter of 2020
(Photograph courtesy of Larissa Pfeleger)

1 EXECUTIVE SUMMARY

HISTORY

Rising and falling water levels, breaking waves, and shifting sands are common to life along the coast. These normal coastal features become hazardous when they strengthen in intensity — usually during a storm event — and pose an immediate threat to the lives and livelihoods of coastal populations.

Stretches of coastline along the southwest coast of Washington at the north side of entrance to Willapa Harbor have been receding at about 100 feet per year, the fastest-eroding shoreline on the U.S. Pacific Coast. The historic coastal erosion has led to the loss of several private properties, the Willapa Lighthouse, a Coast Guard station, the severing of State Route (SR) 105 and replacement of a local pioneer cemetery. Climate change is bringing major challenges to coastal protection and highlights the need for having an over-arching plan for mitigation of coastal erosion.

WHAT IS AT RISK IF EROSION CONTINUES?

COMMUNITY LIFELINES

The following Community Lifeline components will be at risk of disruption/loss if erosion continues.

TRANSPORTATION

Approximately 0.9 miles of SR 105 are along the shoreline and at high risk to erosion and debris buildup. If the remaining defense of SR 105 is damaged to the point that it becomes disconnected, a trickle effect will occur.

SAFETY AND SECURITY

Law enforcement/security, fire services, search and rescue, and government service teams will not be able to easily access the communities resulting in lessened community safety.

HEALTH AND MEDICAL

Medical care, patient movement, public health, fatality management, and the medical supply chain will become more expensive and difficult to receive therefore, harming the community's wellbeing.

ENERGY (POWER AND FUEL)

Utility lines, power grids, and fuel lines will be jeopardized threatening modern living practices.

COMMUNITY BUILT AND NATURAL ASSETS

TRIBAL/CULTURAL ASSETS

If erosion continues, the Shoalwater Bay Tribe properties, including tribal community and cultural lands, as well as ecologically significant wetlands could experience more frequent/intensive flooding. Storms in recent years have damaged the berm, resulting in flooding of nearby Shoalwater Bay tribal lands. The Shoalwater Bay dune is located at the mouth of Willapa Bay near Tokeland.

PRIVATE PROPERTIES

Pacific County Private Properties will be exposed to risk of shoreline erosion and deterioration/loss of property.

AGRICULTURAL LANDS

Tide gates, protecting cranberry bogs, could be impaired leading to further inland flooding and the cranberry bogs will be susceptible to long-term crop failure (local economy loss of \$3 to \$5 million per year).

WETLANDS AND MARSHES

Valuable marsh and wetlands vulnerable to inundation could experience deterioration.

ENDANGERED SPECIES

Dunes provide habitat for snowy plover and larks, and can be eroded if not maintained.

MASTER PLAN

The complex issues facing North Willapa are addressed through nine Focus Areas, each of which is described in some detail later in the document. In summary, they are as follows:

LEAD COORDINATOR

Summary of Findings

There is a need to designate a local government body as the lead community coordinator. Funding should be secured for a coordinator position to assist with organization, facilitation and execution of the community and multi-jurisdictional led erosion mitigation programs and projects.

Implementation Strategy

Identify a lead agency and corresponding staff person to be a designated coordinator. Lead agency to pursue funding, with support from community collaborative, for the coordinator position. Lead agency having cross cutting project area jurisdiction and governmental interest for community and infrastructure. Pacific County is a potential good first candidate.

STUDY AREA HOLISTIC SOLUTIONS

Summary of Findings

Coastal processes and sediment movement are inter-related through the entire study area. Erosion protection measures need to be implemented with the entire study area geomorphologic processes in mind to ensure nature-based solutions are implemented in a synergetic manner.

Implementation Strategy

Within the Corps, RSM originated with the idea of coordinating dredging and other activities in the coastal zone, such as beach nourishment or ecosystem restoration, to retain sand in the littoral

system, support natural system processes and reduce project costs.

INTERGOVERNMENTAL COLLABORATION

Summary of Findings

There has been strong openness to sharing information and collaboration among stakeholder agencies. A memorandum of Mutual Understanding (MOU) further helps show broad governmental and community support for grant applications and federal and legislative community project funding requests.

Implementation Strategy

An MOU between tribal, federal, state and local governments, agencies and public districts to coordinate long-term working relationships and applications for funding sources.

PACIFIC COUNTY HAZARD MITIGATION PLAN (HMP)

Summary of Findings

County's HMP needs to document latest information available Project Site relative to hazards, exposure, vulnerabilities and potential mitigation measures outlined in the master plan. An updated HMP is required by FEMA when pursuing non-emergency disaster assistance.

Implementation Strategy

County should take advantage of ongoing/planned erosion mitigation plans to update the HMP. If a holistic solution is established, that can further inform the hazard mitigation plan. Update the erosion risks outlined at the project areas to represent without shoreline stabilization condition, further enhance discussion of assets that are vulnerable to the multi-hazards (erosion, flooding and storm surge), update the range of mitigation options to include soft shore stabilization and nature-based systems.

PACIFIC COUNTY BUILDING MORATORIUM

Summary of Findings

A moratorium on development has been put into place for the North Cove wash-away stretches of coastline. This moratorium was established for a zone with the highest rates of erosion. Pacific County plans to reevaluate this line every five years based on the best available data regarding erosion estimates but regular updates might be challenging.

Implementation Strategy

Delineating the erosion hazard zone based on a constant offset from the current position of shoreline may be more programmatic to enable regular (five-year) updates.

GRANT FUNDING OPPORTUNITIES TO SUPPORT EROSION MITIGATION

Summary of Findings

The coastal communities and governments including Pacific County and Shoalwater Bay Indian Tribe are often constrained by inadequate staff capacity to pursue and manage grant funding opportunities. Additional support is needed to pursue and administer needed grant funds to address the erosion hazard.

Implementation Strategy

Tapping grant funding opportunities that require small/no match, such as the RCO WCCRI grant funding, could be beneficial.

Leverage existing relationship/collaboration with Pacific Conservation District for providing the local match.

EXISTING SHORELINE PROTECTION SYSTEMS MAINTENANCE

Summary of Findings

Dedicated funding program needed to perform maintenance of existing shore protection systems installed by WSDOT, USACE and Diking District when monitoring indicates a need. These existing facilities include a rock dike, rock jetty, rock revetment, sand berm, and dynamic revetment structures.

Implementation Strategy

Develop a range of revenue sources to provide funding for monitoring and maintenance activities.

SHORELINE MONITORING PROGRAM

Summary of Findings

Regular and long-term shoreline monitoring is critical to success of a long-term erosion hazard mitigation program. Having reliable, annual shoreline monitoring data can assist with adaptive management to inform/refine erosion mitigation plans and save cost for project stakeholders.

Implementation Strategy

Leveraging community and state-wide resources for conducting shoreline monitoring can be beneficial for Pacific County given their current staff capacity challenges.

STREAMLINING REGULATORY PERMITTING PROCESSES FOR SHORELINE MAINTENANCE

Summary of Findings

Multi-year permits for maintenance of nature based solutions and traditional erosion protections is needed to be able to quickly respond to dynamic conditions at the site and improve success of adaptive management for erosion mitigation.

Implementation Strategy

Pursue permits for maintenance of nature-based systems in advance of the need. Address the need for maintenance permits in the permitting for the initial construction. Investigate potential feasibility for USACE programmatic permits for shoreline maintenance which are designed to avoid duplication meant for projects that take longer than five years and are a good fit for phased approaches/long-term maintenance needs.

MASTER PLAN: A LIVING DOCUMENT

Summary of Findings

The master plan needs to be periodically updated to capture the most recent conditions of the coastal hazards, document lessons learned from recent erosion mitigation efforts and identify research needs.

Implementation Strategy

A lead coordinator with cross cutting area jurisdiction and governmental interest for community and infrastructure could pursue funding for frequent (every three years at a minimum) update of the master plan.



(Photograph courtesy of Larissa Prieegen)

COMMUNITY PRIORITIES

Grayland Beach State Park

Midway Beach Rd

Seashore Conservation Area State Park

Warrenton Cannery Rd

Seamobile Rd

Smith Anderson Rd

Shoalwater Bay Reservation

Tokeland Rd

Tokeland Peninsula

SR 105

Reach Name	Warrenton Cannery	Seamobile	Smith Anderson	SR 105 Groin	Graveyard Spit	Shoalwater Bay Tribe Empire Spit Dune	Tokeland
Urgency of Mitigation Actions	Low (Accretional Pattern)	Medium (Dynamic revetment)	High	High	High	Medium (Recent erosion mitigation action constructed)	Low (Armored)
Risk if Erosion Continues?	Reduction in Sediment Source	Loss of Private Properties	Threat to Agricultural Lands	Loss of/Disruption of SR 105		Loss of Aquatic Habitat and Threat to Tribal Lands	N/A
Short-Term Needs	Monitoring	Funding for M/M ¹ Program	Ability to Secure Permits ²	Design of a Sustainable Solution Resilient Against Climate Change		M/M ¹ Program	Monitoring
Long-Term Needs	Develop a Sustainable Long-Term Solution for the Entire Study Area						

Notes: 1=Monitoring/Maintenance; 2=Ability to Secure Permits for Maintenance Repair in a Timely Manner plus Funding for Design of a Sustainable Solution



2022 Shoalwater Berm Construction by USACE
(Photograph courtesy of Larissa Pflieger)

2 INTRODUCTION

Constructed sand dune fronted by cobble berm to protect interior wetland
(Photograph courtesy of Larissa Pfeleger)

OVERVIEW



COASTAL EROSION IN NORTH WILLAPA

Stretches of coastline along the southwest coast of Washington at the north side of entrance to Willapa Harbor have been receding at about 100 feet per year. The erosion started sometime between 1890 and 1910 and this stretch of coastline holds the record for having the highest rate of long-term erosion observed along the Pacific Coast of the United States.

Just a few years ago, this was the fastest-eroding shoreline on the U.S. Pacific Coast; locals here in North Cove, Washington, dubbed it “Washaway Beach.”

The historic coastal erosion has led to the loss of several private properties, the Willapa Lighthouse, a Coast Guard station, the severing of State Route (SR) 105 and replacement of a local pioneer cemetery.



WHAT IS AT RISK IF EROSION CONTINUES?

Ongoing erosion of coastline puts at risk community lifelines, as well as cultural, natural, and built assets. Some of these community lifelines and assets are as follows:

- State Route (SR) 105 is a community (transportation) lifeline. Undermining of this road will be loss of accessibility to schools, law enforcement/emergency response services, health clinics, medical supplies, and patient movement.
- Residential neighborhoods and the cultural/historical lands of the Shoalwater Bay Tribe will be flooded.
- Agricultural lands: cranberry bogs are susceptible to long-term crop failure (local economy loss of \$3 to \$5 million per year).



NATURAL VS. MANAGED HARBOR ENTRANCE

Willapa Bay is the largest estuary on the west coast with a natural inlet (entrance). The entrance of the Bay is a very dynamic region with the mouth configuration changing over time.

Native Indian Tribes have been living with change along the coast and estuaries as a constant for hundreds of years.

This entrance is unlike neighboring estuaries of Grays Harbor and the mouth of the Columbia River, which are protected by rubble mound jetties that are miles long.

Construction of jetties improves navigation by stabilizing the position of the channel, focusing the tidal flow to scour sediment from the channel, and protecting vessels from waves as they transit through the surf zone.



COASTAL EROSION AT THE NATIONAL SCALE

In the United States, coastal erosion is responsible for roughly \$500 million per year in coastal property loss, including damage to structures and loss of land. To mitigate coastal erosion, the federal government spends an average of \$150 million every year on beach nourishment and other shoreline erosion control measures.

In addition to beach erosion, more than 80,000 acres of coastal wetlands are lost annually—the equivalent of seven football fields disappearing every hour of every day. The aggregate result is that the United States lost an area of wetlands larger than the state of Rhode Island between 1998 and 2009.

Climate change is bringing major challenges to coastal protection.



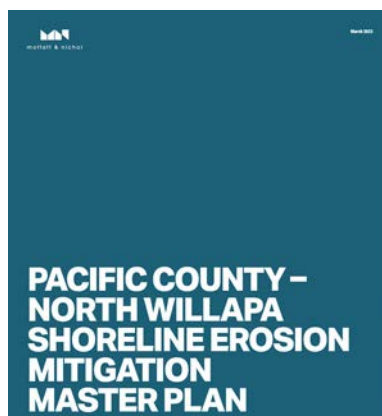
EROSION MITIGATION EFFORTS

Past erosion mitigation efforts include measures constructed by various entities to protect specific stretches of shoreline almost in a fragmented manner, see page 38 for a detailed mapping of previous/planned efforts.

In 1997, the first systemic erosion mitigation effort was an emergency stabilization of SR 105 and construction of the groin led by WSDOT.

In 2018, a long berm created from rocks and cobblestones was placed along Washaway Beach by the Drainage District to mimic natural gravel/cobble beaches in attenuating wave energy. It dramatically reduced the erosion rate of the shoreline.

Erosion mitigation efforts are needed today more than ever but the community acknowledges that there needs to be a holistic solution for the entire system.



MASTER PLAN

In 2021, Pacific County received a grant through FEMA Cooperative Technical Partners (CTP) Program to develop a master plan for erosion mitigation of coastline. Moffatt & Nichol is leading development of this master plan (project). The goal of this project is as follows:

- Establish a long-term vision (broadly supported by stakeholders) for mitigation of shoreline erosion along North Willapa shoreline and protection of built and natural assets against coastal hazards.
- The plan would be adaptable against climate change and would include specific actions in terms of monitoring, maintenance, strategy for pursuit of funding and permit applications.

Willapa Bay Lighthouse, circa 1900



Willapa Bay Lighthouse, lost to shoreline erosion in 1940



A BRIEF HISTORY

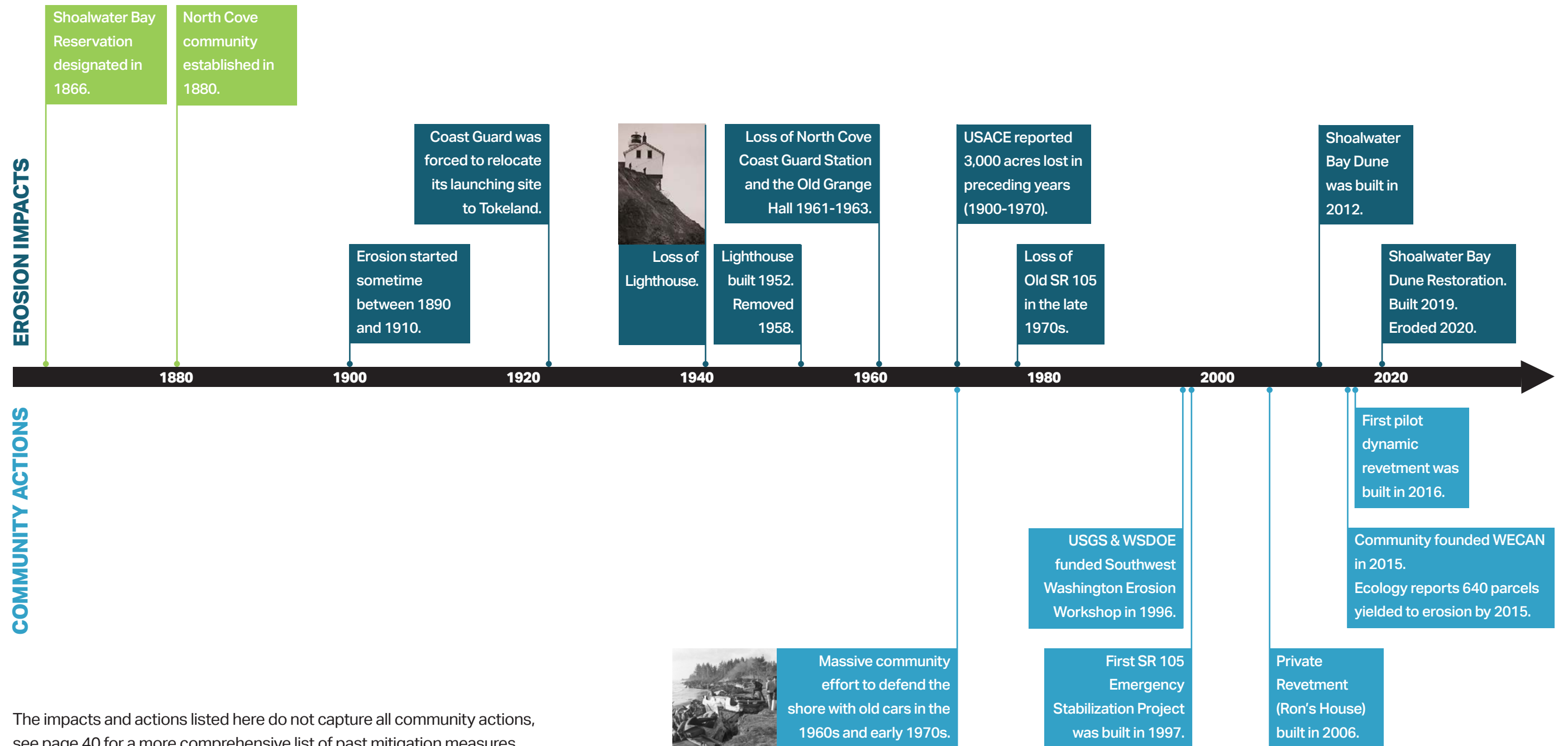
Beaches along the southwest coast of Washington have been evolving for thousands of years. North Cove, once known as Cape Shoalwater and since then renamed, holds the record for having the highest rate of long-term coastal erosion observed along the Pacific Coast of the United States exceeding 100 feet per year and has earned the nickname of “Washaway Beach”.

Native Indian Tribes have been living with change along the coast and estuaries as a constant for hundreds of years. Shoalwater Bay on the northern shore of the Willapa Bay was originally the wintering place of both the Lower Chinook and Lower Chehalis people. Today, the Shoalwater Bay tribe lives along the northern shores of Willapa Bay on the 2.693 km² Shoalwater Bay Indian Reservation with approximately 70 inhabitants (2000 census). The Shoalwater Bay Reservation was designated by President Andrew Johnson in 1866.

In 1884, the community of North Cove was established between the towns of Grayland and Tokeland in Southwest Washington. The erosion in this region started sometime between 1890 and 1910, and accelerated rates of erosion between the 1940s and 1960s resulted in deterioration and demolition of the original Willapa Bay Lighthouse, damage to the public highway, loss of numerous residential developments, and threatened the surrounding agricultural industry. By 1962, North Cove consisted of approximately 766 private parcels located in two different subdivisions, with an additional 340 parcels being added across three subdivisions in the years following. However, much of this development occurred as a looming threat began to grow, one that would put the entire community at risk (Cowardrey 2020).

In 2015, the community came together to create the Willapa Erosion Control Action Now (WECAN) coalition which was created to coordinate actions that address the ongoing erosion issue seen in Pacific County.

TIMELINE OF EVENTS



The impacts and actions listed here do not capture all community actions, see page 40 for a more comprehensive list of past mitigation measures.



Constructed dune offshore of Tokeland peninsula provides protection from waves
(Photograph courtesy of Larissa Pflieger)

3 MASTER PLAN PROJECT



Rock revetment along SR 106 near drainage ditch outlet
(Photograph courtesy of Shane Phillips)

PROJECT TEAM AND PARTNERS

PROJECT SPONSOR



PROJECT TEAM



moffatt & nichol

IN COLLABORATION WITH



PROJECT PARTNERS

Shoalwater Bay Indian Tribe
 Pacific County Drainage District #1
 U.S. Army Corps of Engineers Seattle District
 Pacific Conservation District
 Washington Sea Grant
 WA State Department of Ecology
 WA State Department of Fish and Wildlife
 WA State Department of Transportation

PROJECT PARTNER

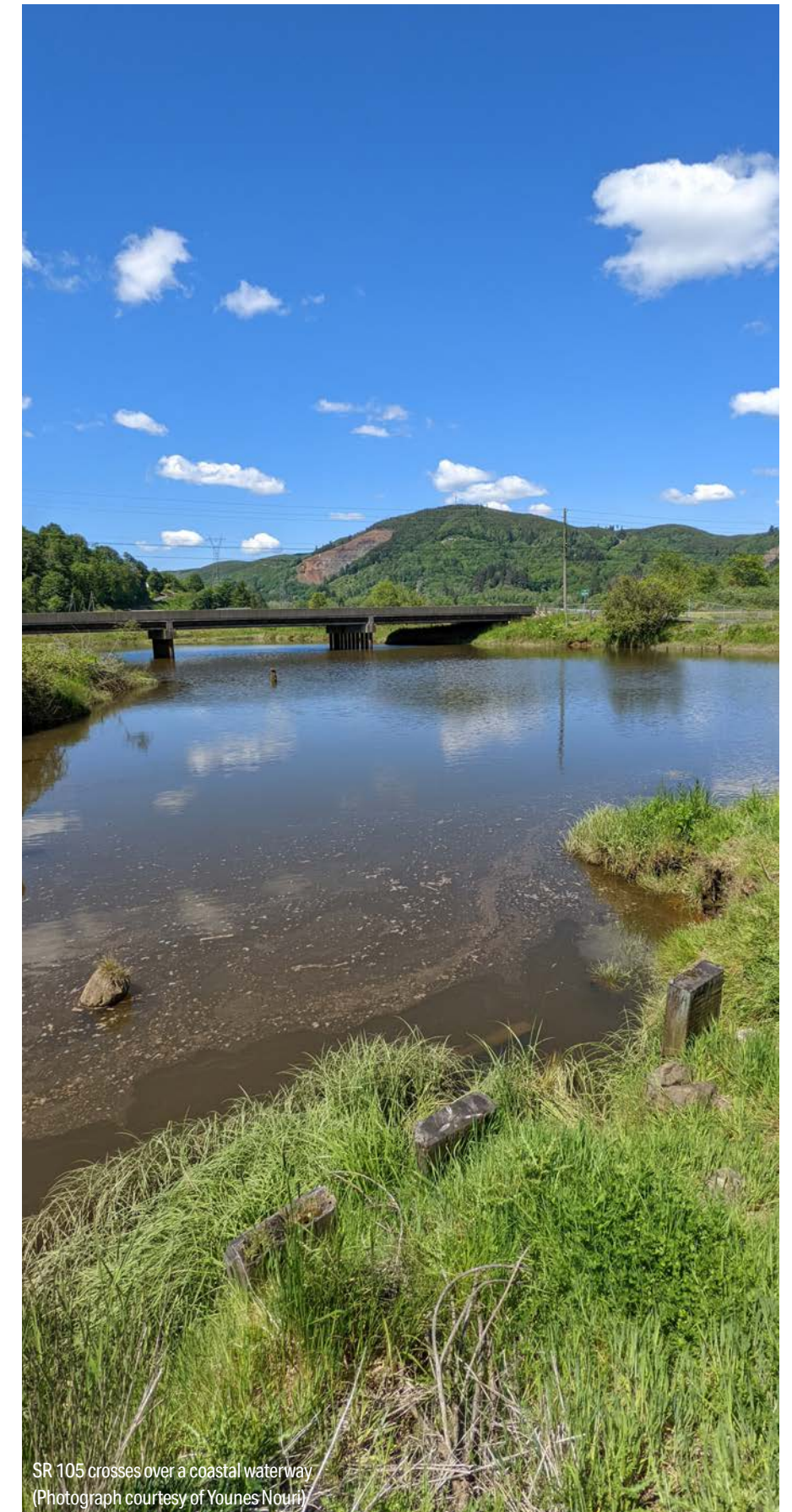


FEMA

Cooperative Technical Partners (CTP)
 Program

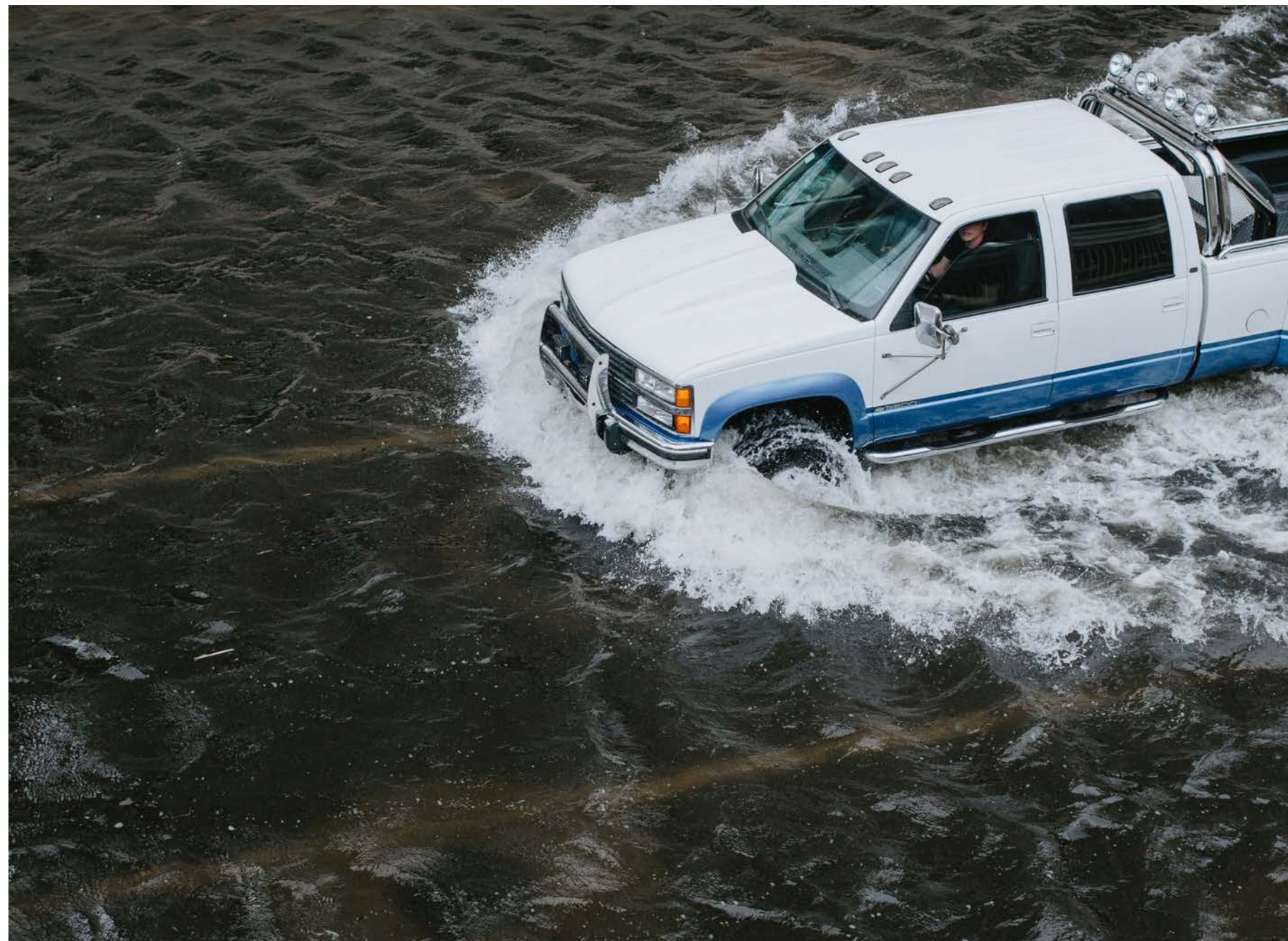
STAKEHOLDER COMMITTEE

Charlene Nelson, Earl Davis, Larissa Pfleeger; Shoalwater Bay Indian Tribe
 Chris Behrens, David Michalsen, Aurora Deangelis Caban, Janet C Curran; U.S. Army Corps of Engineers
 David Cottrell; Pacific County Drainage District and Cranberry Growers
 Kelly Rupp and Connie Allen; WECAN and Pacific County Planning Commission
 Chelsey Martin, Garrett Jackson, and Chad Hancock; WA Department of Transportation
 George Kaminsky, Henry Bell, and Bobbak Talebi; WA Department of Ecology
 Mike Nordin; Pacific Conservation District
 Jackson Blalock; WA Sea Grant
 Rebecca Chaffee; Community Member
 Lauren Bauernschmidt; WA Department of Fish and Wildlife



SR 105 crosses over a coastal waterway
 (Photograph courtesy of Younes Nouri)

A driver navigates a flooded roadway
(Photograph from Unsplash
picture library)



PURPOSE AND NEED

Coastal erosion is a natural hazard that poses a serious risk to Pacific County residents (the North Cove community in particular), the Indian Bay Shoalwater Tribe, and the Pacific County Drainage District.

Because of climate change, coastal erosion is likely to become more frequent and more severe. Reducing the impacts these hazards have on lives, properties, and the economy is a top priority for this community.

This community has recognized that there is a need to establish a long-term vision (broadly supported by stakeholders as opposed to fragmented efforts) for mitigation of coastline erosion along North Willapa and protection of built and natural assets against coastal hazards.

In 2021, Pacific County funded a master plan for erosion mitigation of coastline and retained Moffatt & Nichol (M&N) to develop the master plan. FEMA Cooperative Technical Partners (CTP) Program was a project partner throughout the duration of the master plan development.

GOALS

Establish a long-term vision (broadly supported by stakeholders) for mitigation of shoreline erosion along the North Willapa shoreline and protection of built and natural assets against coastal hazards.

The plan would be adaptable against climate change and would include specific actions in terms of monitoring, maintenance, strategy for pursuit of funding and permit applications.

DESIRED SMART* OUTCOMES

- Compile and document previous/ongoing erosion mitigation efforts.
- Identify underlying cause of shoreline erosion.
- Document lessons learned from previous efforts.
- Increasing public awareness about risks associated with shoreline erosion.
- Identify reliable sources of funding and details of funding programs.
- Identify next steps/action plan (includes monitoring) for the Master Plan implementation.

ASPIRATIONS

- Build consensus among stakeholders on a system-wide and coordinated plan of action.
- Align local and state resources, needs, and interests as much as possible to gain efficiencies.

*Specific, Measurable, Achievable, Relevant, and Timebound

Panoramic view of North Cove shoreline
(Photograph courtesy of Shane Phillips)



PROJECT SETTING

The Project Study Area includes coastal communities located on the outer coast of Washington State near the mouth of Willapa Bay, along SR 105.

Willapa Bay is the largest estuary on the west coast with a natural inlet (entrance). The entrance of the Bay is a very dynamic region with the mouth configuration changing over time.

This entrance is unlike neighboring estuaries of Grays Harbor and the mouth of the Columbia River, which are protected by rubble mound jetties that are miles long.

Construction of jetties improves navigation by stabilizing the position of the channel, focusing the tidal flow to scour sediment from the channel, and protecting vessels from waves as they transit through the surf zone.

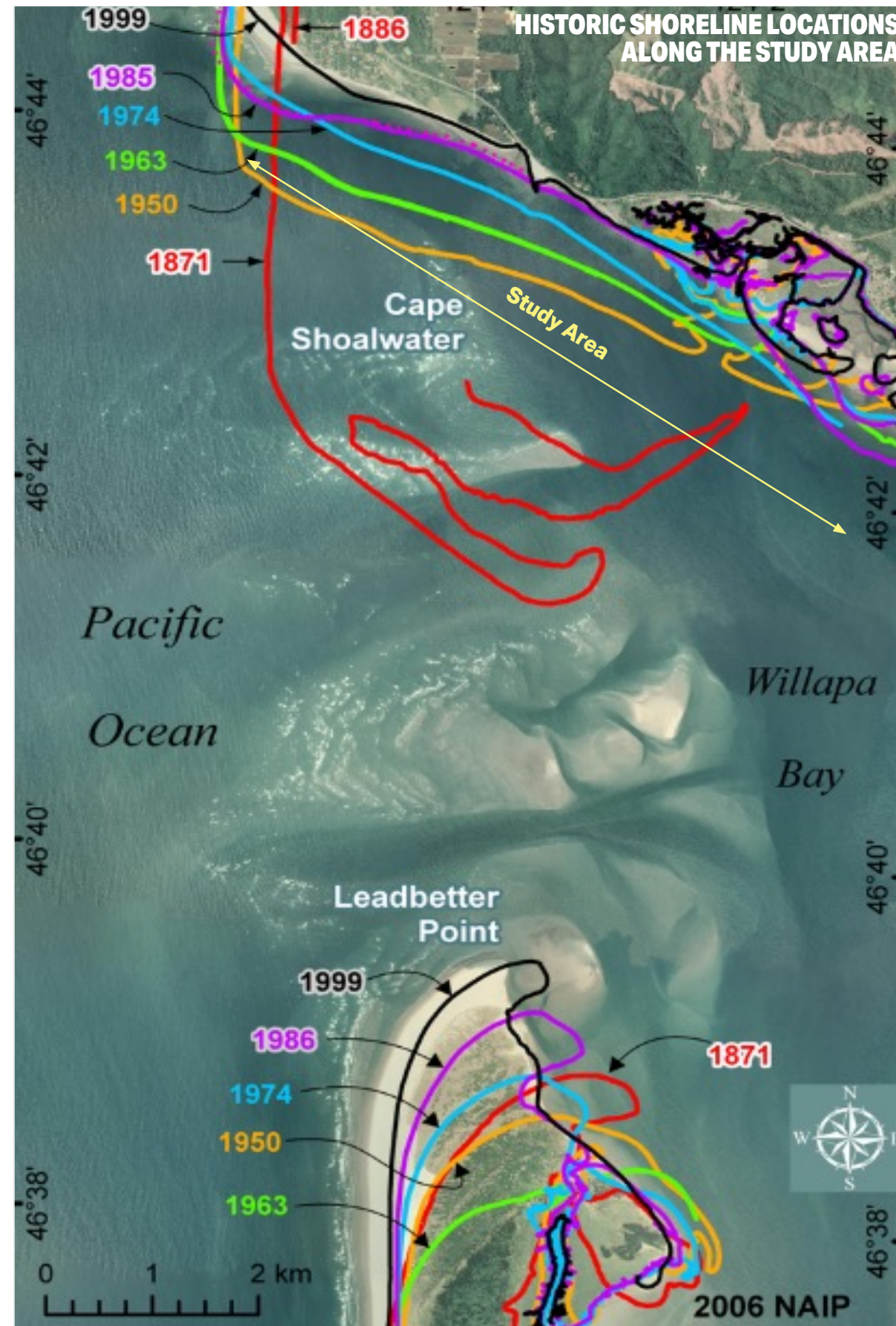


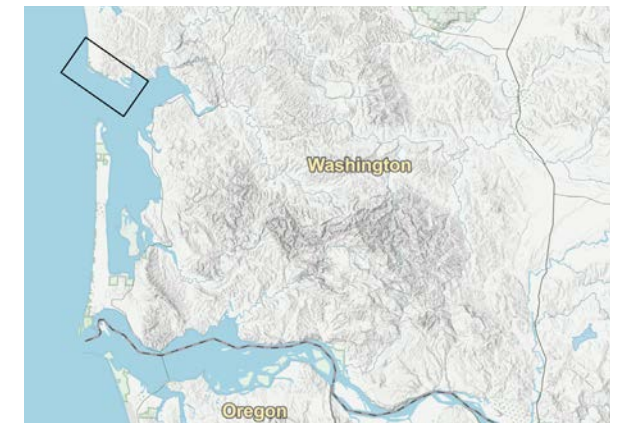
Figure (left) modified after Kaminsky, et al., 2010, Historical evolution of the Columbia River littoral cell, Marine Geology, <https://doi.org/10.1016/j.margeo.2010.02.006>.



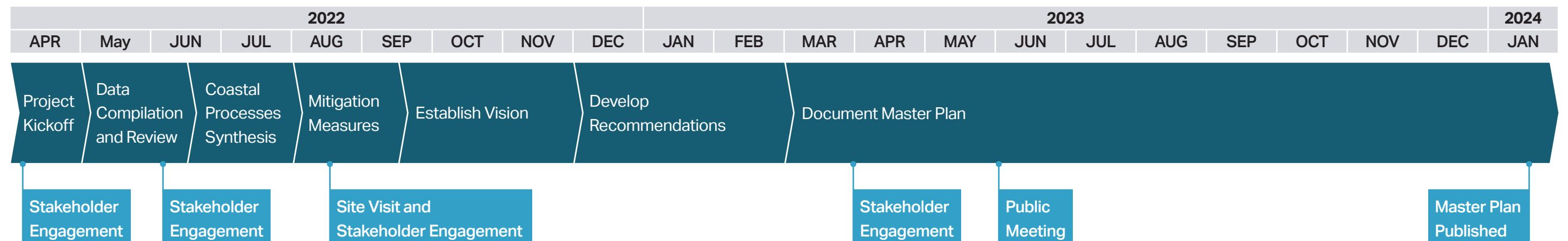


PROJECT STUDY AREA

The Project Study Area was defined in coordination with the stakeholder committee and extends from Toke Point to Intersection of the Shoreline with Midway Beach Road. Furthermore, the study area was broken into seven smaller reaches (from northwest to southeast): Warrenton Cannery, Seamobile, Smith Anderson, SR 105, Graveyard Spit, Shoalwater Bay Tribe Empire Spit Dune, and Tokeland.



PROJECT PLANNING PROCESS



DATA COMPILATION AND REVIEW

OBJECTIVE
To develop a catalog of existing information building on the library compiled during Pacific County’s Demonstration Project.

APPROACH
A detailed Request for Information (RFI) was sent to all project partners and the team compiled the information to be shared with public through a website.

COASTAL PROCESSES SYNTHESIS

OBJECTIVE
To compile existing characterization of coastal processes and potential causes of erosion and to identify data gaps/ unanswered questions.

APPROACH
This task was conducted by review of technical literature as well as discussions with subject matter experts with USACE, ECY, and WSDOT.

MITIGATION MEASURES

OBJECTIVE
To compile previously used mitigation measures, documenting performance and lessons learned to inform new mitigation approaches.

APPROACH
Develop a matrix of erosion mitigation options including cost estimates, maintenance requirements, and contingency measures to assess shoreline impacts. Review mitigation measures with stakeholders.

ESTABLISH VISION

OBJECTIVE
To define the overall vision for the study area to enable a coordinated, system-wide mitigation approach.

APPROACH
To define the overall vision for the coastline and surrounding areas to enable a coordinated, system-wide mitigation approach.

DEVELOP RECOMMENDATIONS

OBJECTIVE
To develop targeted, focused recommendations for further research that are applicable to potential mitigation measures.

APPROACH
Document common needs, desires, and data gaps with regard to erosion mitigation solutions. Provide initial recommendations for stakeholder review and outline funding pathways to fill research gaps.

DOCUMENT MASTER PLAN

OBJECTIVE
To produce a formal Master Plan document that encompasses findings from all previous steps in the project process to inform future activities.

APPROACH
Compile findings to summarize project needs, coastal setting, public outreach efforts, master plan recommendations, implementation strategies, and cost estimates in a single document.

PUBLIC OUTREACH AND ENGAGEMENT TRANSLATING COMMUNITY DESIRE

An integral part of the master plan has been working collaboratively with key stakeholders to understand various priorities and perspectives, translating the community’s desires into actionable projects.

STAKEHOLDER COMMITTEE ENGAGEMENT

- 20 representatives from key stakeholder groups were continuously engaged/updated throughout the process.

STAKEHOLDER INTERVIEWS

- One-on-one interviews were conducted with representatives of Drainage District, County, Tribe, WSDOT, USACE, and WSDOT.

TECHNICAL ADVISOR DISCUSSIONS

- Discussions were held with technical experts with USACE and WDOE.

SITE VISIT

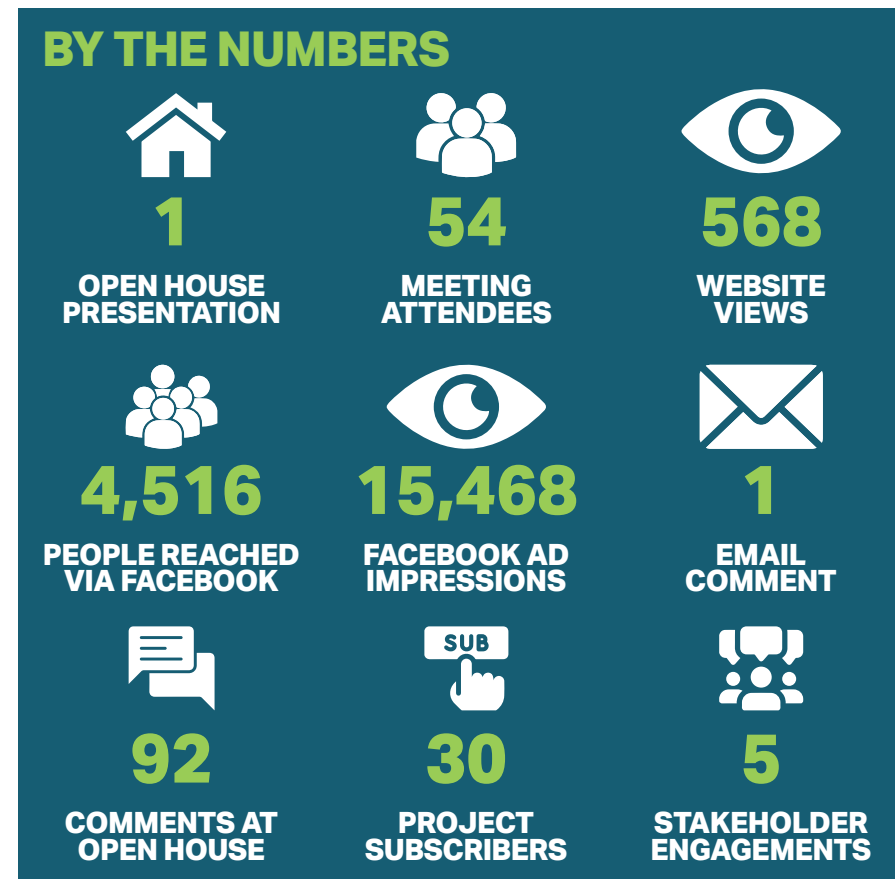
- A site visit was conducted with stakeholder committee members on August 17, 2022.

PUBLIC MEETING

- A public open house was held in early June of 2023 to seek input from the general public on the draft of the master plan.

This combination of meetings and online input yielded favorable results, both in terms of participation and clear community direction for the future of North Willapa Shoreline Erosion Mitigation.

Feedback from these various meetings with the stakeholders was able to be used and translated into clear community desires.



Consultant team and stakeholder committee members visited the site in summer of 2021 (Photograph courtesy of Henry Bell with Department of Ecology)



“ Identify unknown information (i.e., causes of erosion) ”

“ Identify internal organizational needs for long-term cohesion ”

“ Tell the story to the public ”

“ Align the need to mitigate risks with funding options ”

“ Importance of nature based systems for a long term solution ”

“ Working together is critical for community success to mitigate the erosion risks ”

“ Avoid maintenance (debris buildup) of SR 105 ”

“ Find a Holistic Solution ”

COMMUNITY DESIRES

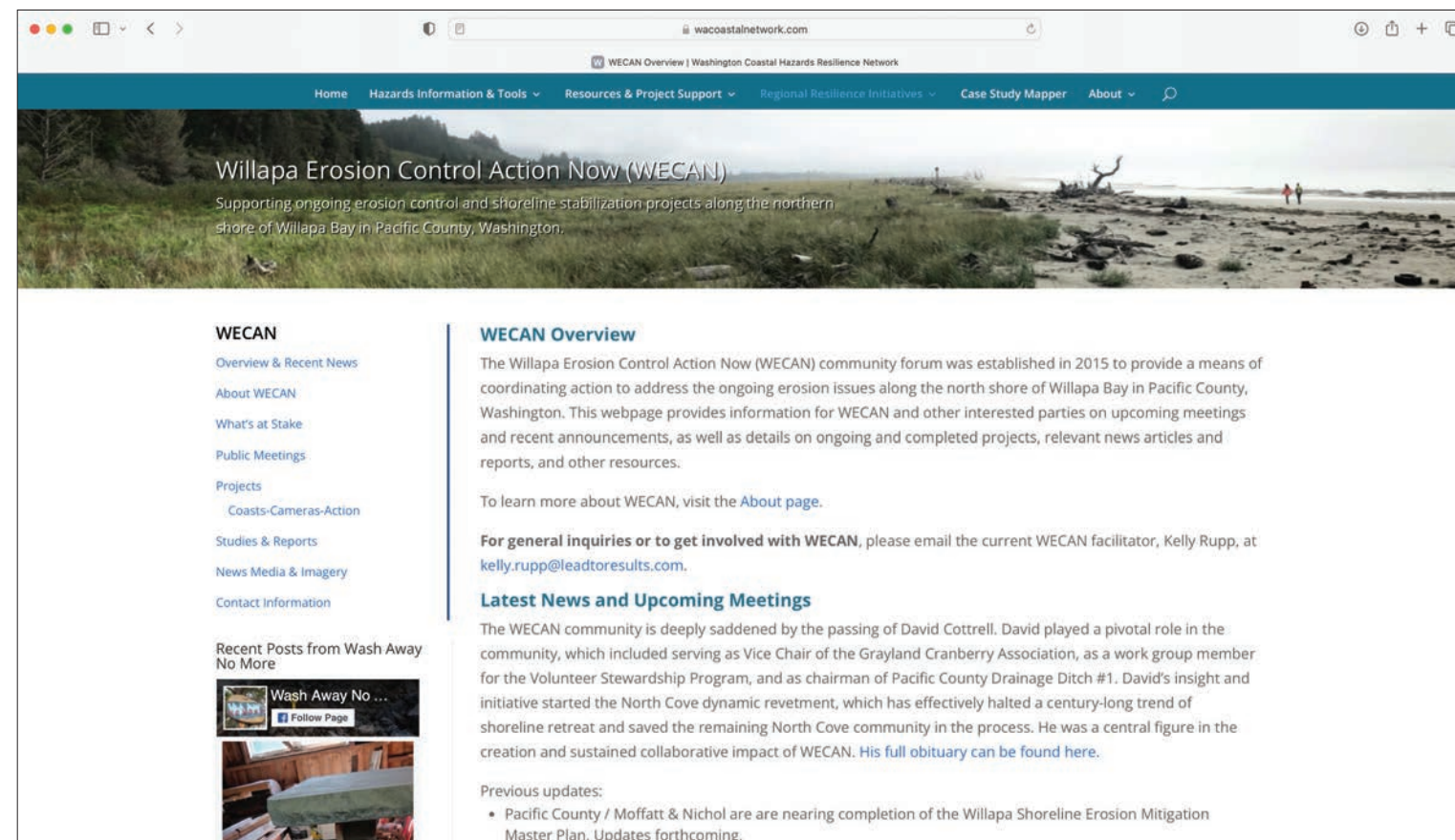
The Project Team sought input from the stakeholder committee about their desired long-term outcomes and overarching desires of the master plan. In working together, the stakeholders identified the needs that would best represent themselves and the surrounding community.

COMMUNITY ENGAGEMENT – WECAN

The Willapa Erosion Control Action Now (WECAN) community forum was established in 2015 to provide a means of coordinating action to address the ongoing erosion issues along the north shore of Willapa Bay in Pacific County, Washington. This webpage provides information for WECAN and other interested parties on upcoming meetings and recent announcements, as well as details on ongoing and completed projects, relevant news articles and reports, and other resources.

HOW WECAN COULD IMPROVE

- Can partner together on gathering support letters for community project legislative and federal community funding requests as well as grants.
- Could create a more formalized group through an MOU to help secure funding and more formally coordinate agency work.
- Collaborate on building project 1-pagers.
- Problem arose when the U.S. Army Corps returned materials that could have been used for a WSDOT project – need alignment within agencies to better collaborate with outside stakeholders.



WECAN website (<https://wacoastalnetwork.com/local-projects/wecan/>)

WECAN IS HELPFUL TO...



**BRING TOGETHER
DIVERSE
COMMUNITY
INTERESTS**



**HOLD REGULAR
MEETINGS WITH
STAKEHOLDERS**

**WEBSITE IS
A CENTRAL
REPOSITORY FOR
INFORMATION
AND UPDATES**



(Photograph courtesy of Shane Phillips)

4 HAZARDS, ASSETS AT RISK, AND IMPACTS

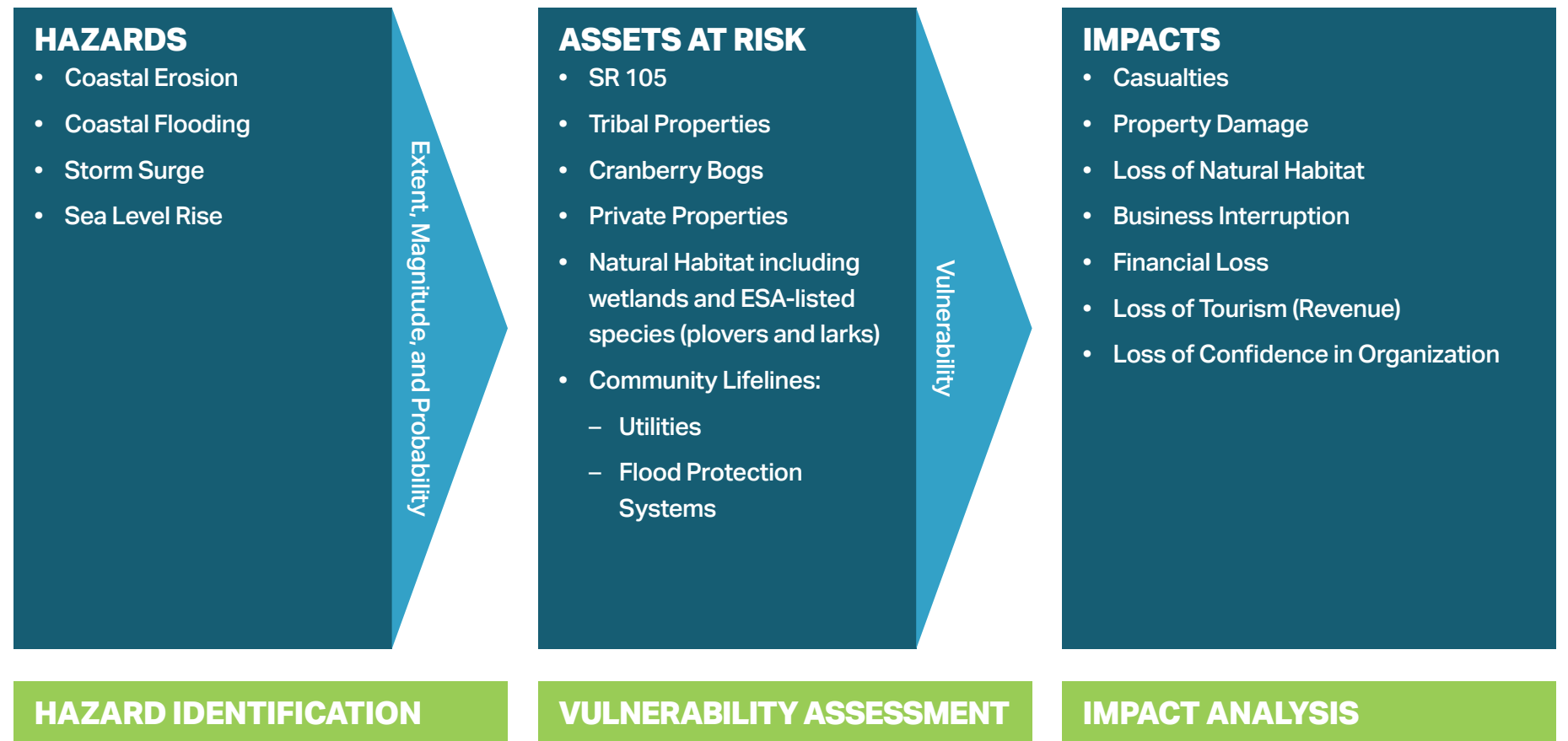


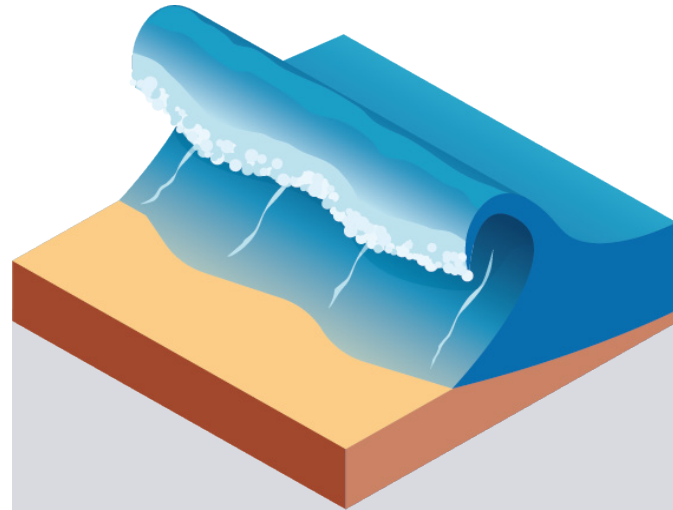
Waves send water and cobble onto SR 105

HAZARDS, ASSETS AT RISK, AND IMPACTS

Disasters occur when natural hazard events impact people, property, and the environment. We are unable to predict exactly when natural hazards will occur, or the extent to which they will affect communities. However, with careful planning and collaboration, it is possible to identify and implement actions that will reduce loss when the next disaster strikes. Implementing mitigation actions can also reduce the length of time that essential services are unavailable after a disaster, protect critical facilities, reduce economic hardship, speed recovery, and lower construction costs.

The following pages will provide details of the natural hazards that pose a threat to community lifelines and assets. Details of Natural Hazards include location, extent, prior occurrences, and future likelihoods. Details of Community Lifelines and Assets include location, sensitivity, and adaptive capacity.

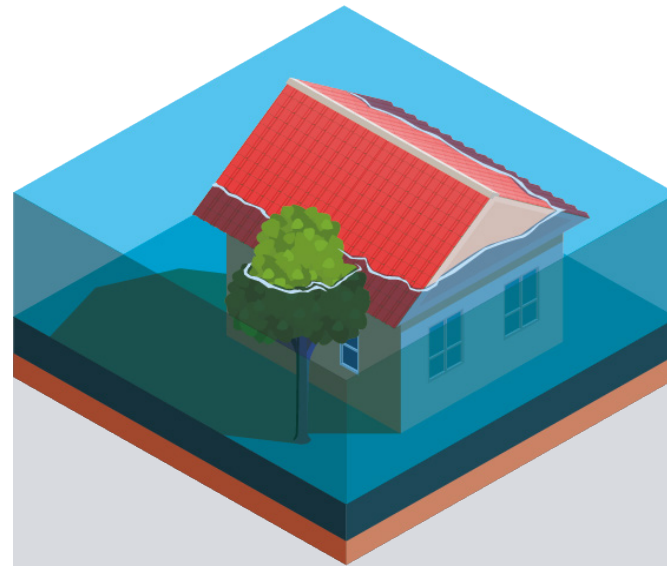




COASTAL EROSION

On coasts, erosion refers to the wearing away of beaches, dunes, or bluffs by the forces of waves, flowing water, and/or winds.

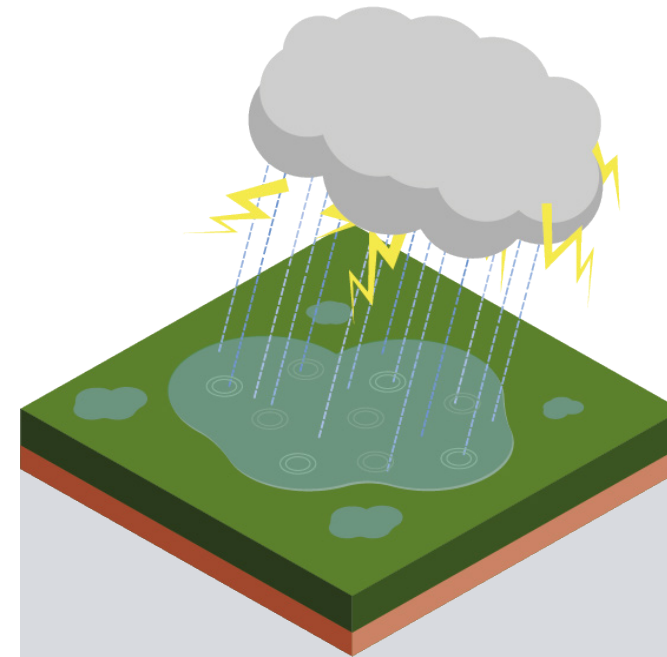
During storm events, a lot of erosion can happen in a short time, causing stark changes to the coastline. Erosion cuts into dunes and bluffs, causing roads and buildings built upon them to collapse. Smaller dunes may be completely washed away, allowing water and waves to flow inland and flood the areas behind them.



COASTAL FLOODING

Coastal floods come from sources such as the Atlantic and Pacific Oceans, the Gulf of Mexico and large lakes (such as the Great Lakes), bays, and tidal rivers that are big enough to have large waves or that can be affected by storm surge.

Coastal floods can be very dangerous when high waters are combined with the destructive forces of waves. In low-lying coastal areas, storm surge and flooding can reach many miles from the shoreline, flowing up rivers and across flat land.



STORM SURGE

When a storm approaches the coast, strong winds push water towards land and cause a rise in the water level. This is called storm surge.

Storm surge can cause major coastal and inland flooding. The amount of storm surge in an area depends on many things, including the size and strength of the approaching storm, where it is going and how fast it is moving, and the shape of the coastline. Because of this, the same storm can cause different levels of storm surge along the same coastline. Storm surge can be incredibly dangerous because water levels may rise very fast, even before a storm makes landfall.



SEA LEVEL RISE

An increase in sea level caused by a change in the volume of the world's oceans and changes in local ground elevations.

Sea level rise leads to increased frequency and depth of flooding in coastal areas.

COASTAL HAZARDS – MULTIPLE HAZARDS

North Willapa coastline is exposed to multiple hazards including coastal erosion, coastal flooding, storm surge, and sea level rise. Sea level rise and storm surge exacerbates impacts of coastal erosion and coastal flooding.

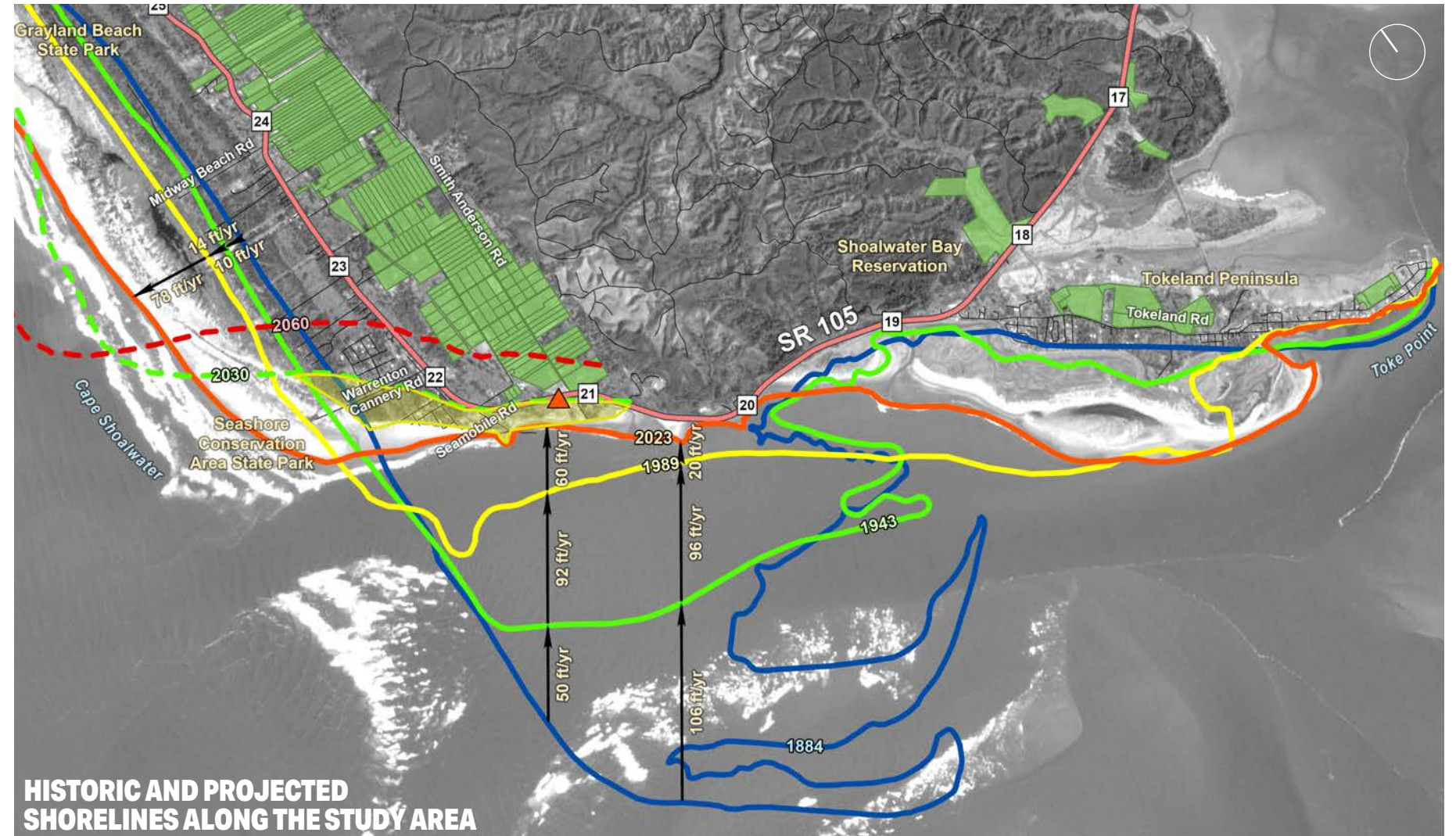


PROJECT SITE COASTAL/ESTUARINE PROCESSES

- River Flow and Main Entrance Channel:
 - Historical northward migration of the channel seems to have slowed/stabilized recently.
- Wave Climate:
 - Offshore climate most severe during La Nina and strong El Nino cycles increasing frequency of storms tracking from south-southwest.
 - Largest offshore waves from southwest during winter storms.

DATA/RESEARCH NEEDS

- The migration of main channel of Willapa Bay needs to be monitored on an annual basis.
- Nearshore wave characteristics along the study area need to be characterized using field data measurements to capture seasonal and annual patterns.
- The evolution of the flood and ebb shoals needs to be studied.
- Littoral sediment transport along the study area needs to be studied and quantified using field measurements supplemented with numerical modeling.
- Northwest offshore waves during summer are smaller.
- Ebb shoals shelter stretches of the shoreline from waves.



COASTAL EROSION AT NORTH WILLAPA

Beach erosion at Cape Shoalwater has been a chronic problem since the turn of the 20th century. The 1880 navigation charts show the entrance as only 3 miles wide. Between 1887 and 1971, Cape Shoalwater receded 11,700 feet northward. By 1971, shoreline erosion had destroyed 3,000 acres of public and private lands including over 30 homes, businesses, a grange hall, a public schoolhouse, a US Coast Guard Station, and twice forced the relocation of the Coast Guard Lighthouse. Washington SR 105 was relocated landward shortly after

1970 and the prior alignment was lost to erosion by 1978 (USACE 1970; 1978).

Comparing historical and new nautical charts indicates that over 4,000 acres of public and private land has been lost from 1890 to present with annual rates of erosion exceeding 100 ft/yr in some periods.

- Coastal Erosion at North Willapa is most likely driven by a complex combination of coastal processes:
 - Northward migration of Willapa Bay Entrance Channel.

- Increasingly severe wave climate.
- Loss of sand supply from Graveyard and Empire Spits.
- Loss of windblown sand from beaches to the north.

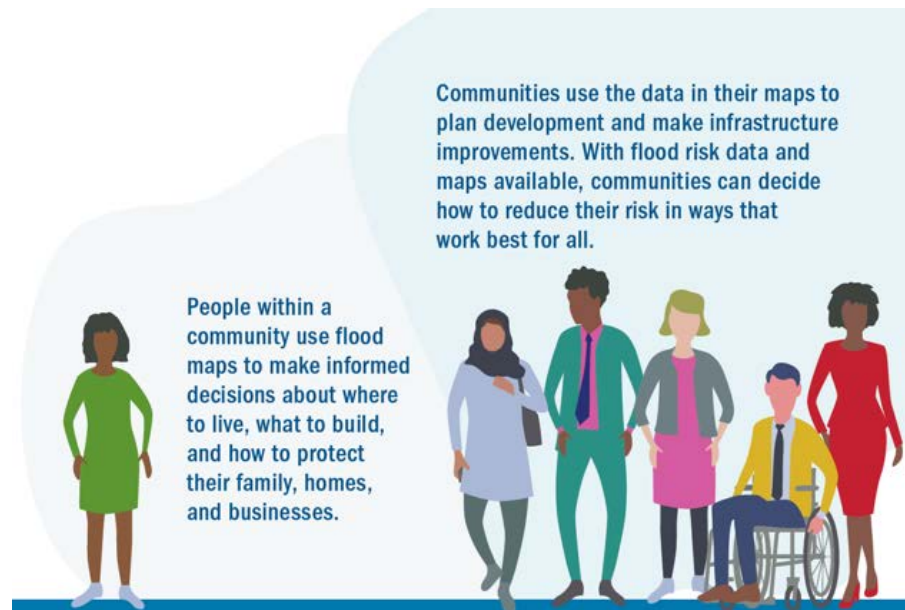
Future position of shoreline for 2060 was predicted by WA Department of Ecology. However, there are inherent uncertainties and assumptions embedded in any future projections of shoreline change.

Continued unabated shoreline erosion will result in loss of SR105 and direct exposure of tribal and agricultural lands to ocean flooding.



It is recommended for the County to follow up with FEMA to request updating effective flood maps for the North Willapa Harbor to support the community with their planning efforts.

Image from <https://www.fema.gov/flood-maps>



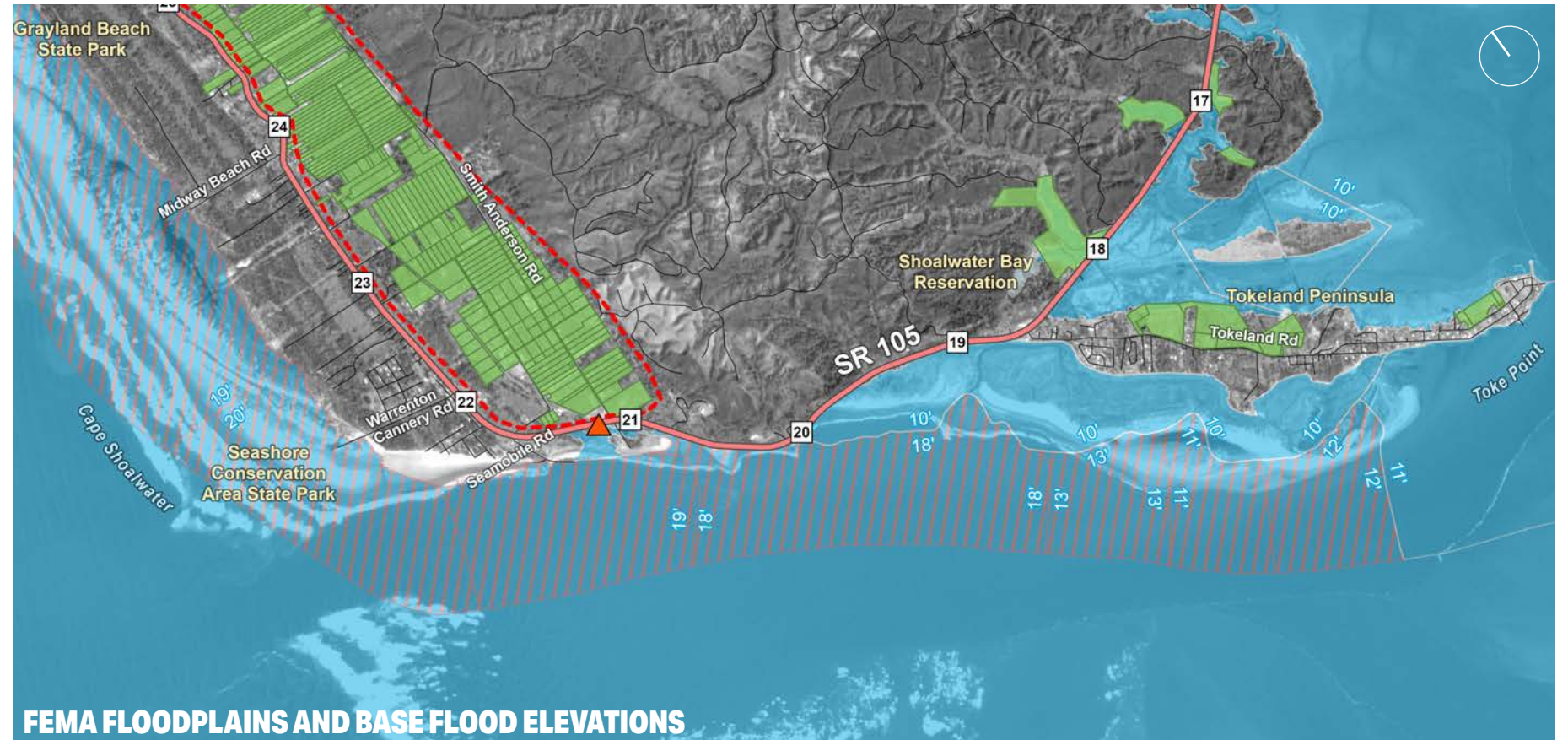
COASTAL FLOODING AT NORTH WILLAPA

FEMA

FEMA provides flood maps for coastal communities. Flood maps are one tool that communities use to know which areas have the highest risk of flooding. Any place with a 1% or higher chance of experiencing a flood each year is considered to have a high risk. Those areas have at least a one-in-four chance of flooding during a 30-year mortgage.

FEMA is required to review a community's flood maps every 5 years. The agency must then decide whether to update or change the maps.

- Tide Gate
- FEMA Floodplains
 - VE
 - A, AO, AE
 - 500-Yr (X)
 - Agricultural
- Roadways**
 - Major Roads
 - Minor Roads
 - Other Roads
 - SR 105
 - Future Flood Hazard Area



Note1: Potential Flood Inundation area will extend into agricultural lands if SR 105 and Drainage Ditch Culvert Tide Gate are not protected from erosion

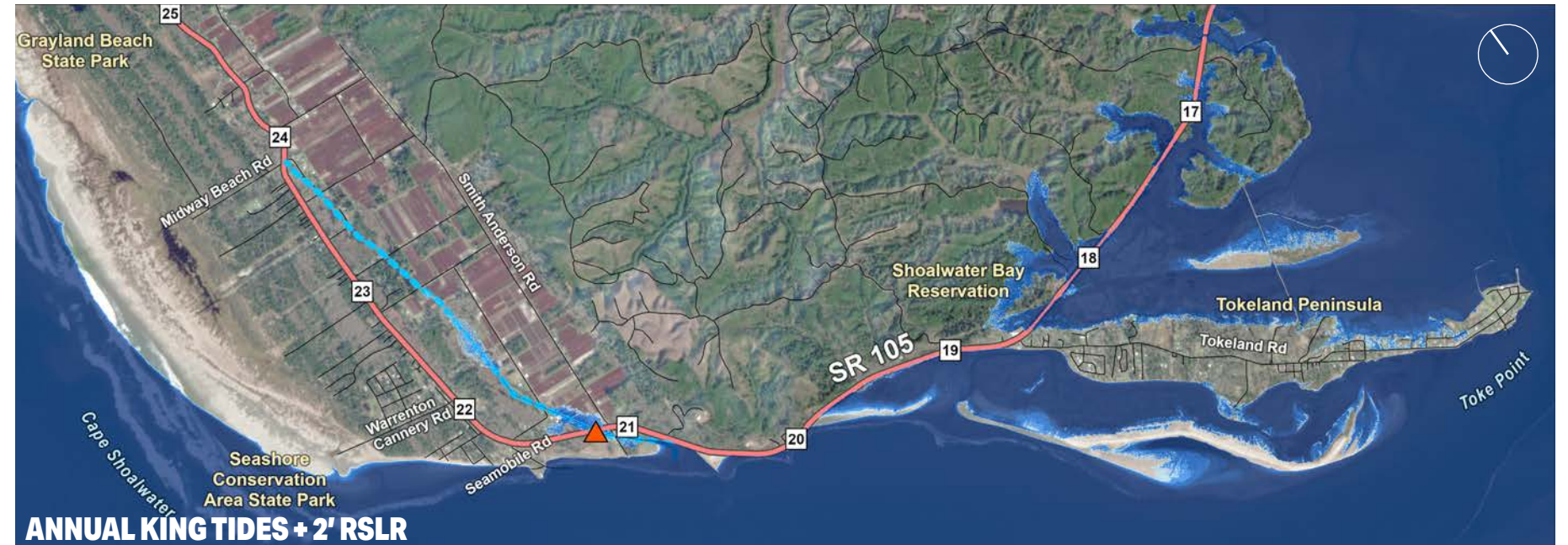
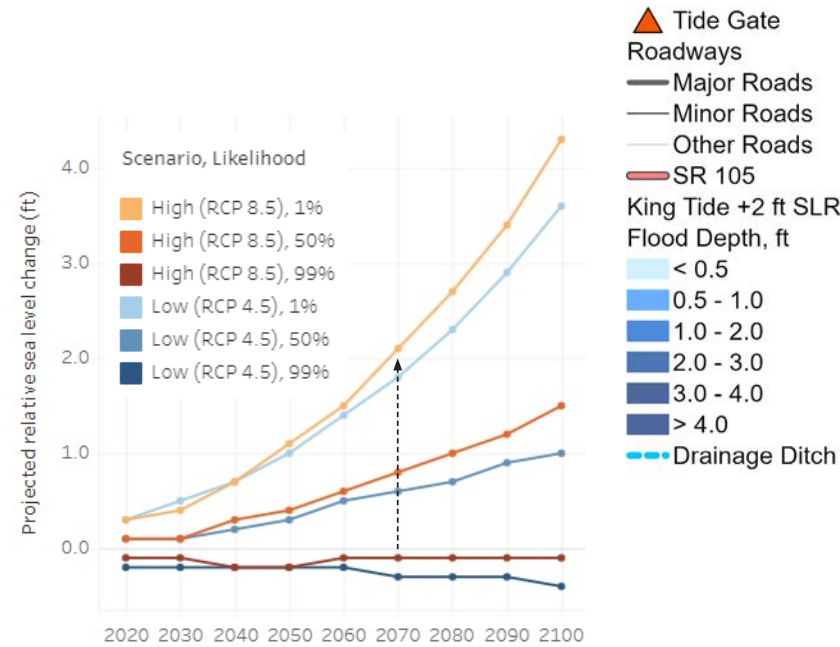
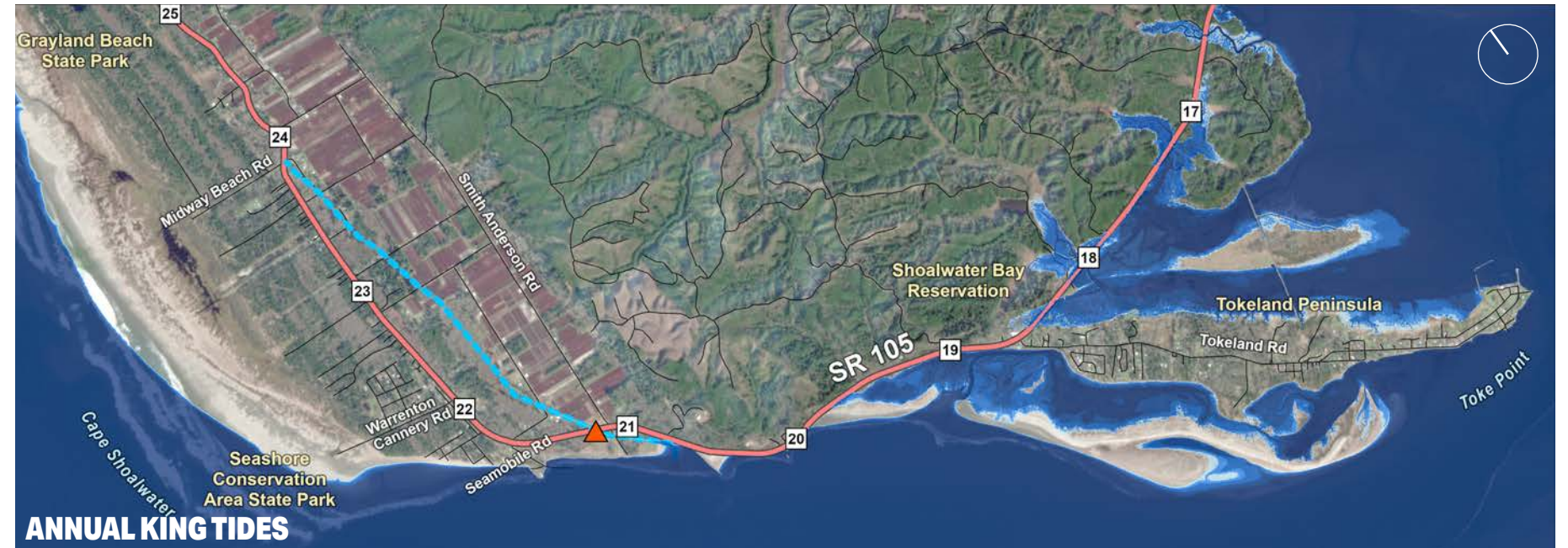
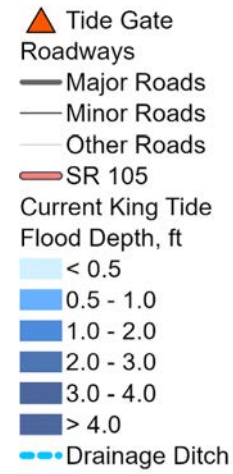
FEMA's effective flood maps for the Project and Pacific County are dated May 18, 2015. These maps are based on a study conducted in 2013. Given rapid rates of erosion along the Project coastline, it is essential to update flood maps at least on a 5-year cycle to reflect changes in the coastline.

MULTI-HAZARD INFRASTRUCTURE RISKS

Flood damage in tidal and coastal areas is a result of high stillwater

levels and wave action. The stillwater level is a result of astronomical tide (caused by gravitational effects of the sun and moon), and storm surge, rise in water levels due to wind stress and low atmospheric pressure.

Wave runup and over-topping is a current hazard at multiple locations in the project area between Milepost 21.5 and 19. Continued erosion of the shoreline will result in a significant increase in the hazard with risks to SR105, drainage ditch and tide gate that protects existing agricultural areas north of SR105 and the Shoalwater Reservation.



CLIMATE CHANGE AT NORTH WILLAPA

As future conditions lead to more intense storms and rising sea levels, coastal flooding is becoming more frequent and storm surges are becoming more severe. Additionally, higher sea levels will raise groundwater levels, exacerbating coastal flooding and erosion. There is typically more focus on sea level rise, storm surges, and impacts of raised groundwater levels are less commonly factored in vulnerability assessments against coastal hazards.

The projected relative sea level rise (RSLR) for the project in 2060

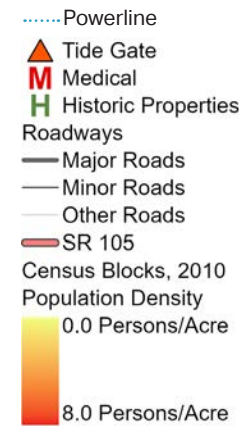
and 2100 was determined to be 0.6 and 1.5 feet corresponding to a RSLR with 50% probability of occurrence using a high emissions scenario based on Miller et al. (2018) as the best available science on local projections of RSLR.

SR105 is inundated with ponded water at multiple locations in Grayland near MP 25 to 23 during winter periods of high groundwater, precipitation and storm surge. Additionally, the areas of MP 20 to 19 are subject to debris on the road from storms.

MUTLI-HAZARD RISKS TO INRASTRUCTURE

The combination of climate change induced higher intensity precipitation, sea level rise, increasing storm surge, and potential for corresponding groundwater levels, resulting in greater flooding of interior areas should be expected. If the existing drainage ditch tide gate becomes inoperable due to erosional loss of protective land barrier, flooding of the agricultural lands will be significantly increased during high tide and storm surge events.

SR105 is a critical transportation link for providing access to emergency services (Fire, EMT and shortest route to hospitals) and power to the Tokeland area. The loss of the highway would cause a substantial impact to the community lifelines.



COMMUNITY LIFELINES AT RISK

Additional erosion and flood protection is crucial for the longevity of the community's lifeline components and assets.

TRANSPORTATION CORRIDOR

Approximately 0.9 miles of SR105 is located within the project area that is highly vulnerable to shoreline erosion, flooding and debris buildup. If the remaining buffer of land and shoreline protection systems are lost or damaged, SR105 could be damaged or result in loss of use. A loss of use for SR105 will create a disconnection of community lifelines and a corresponding cascading effect for hazards to the community will occur.

SCHOOLS

The North Cove and Tokeland area is served by the Ocosta School District located in Westport. SR105 represents a critical transportation route for school access for the Tokeland and North Cove Communities.

SAFETY AND SECURITY

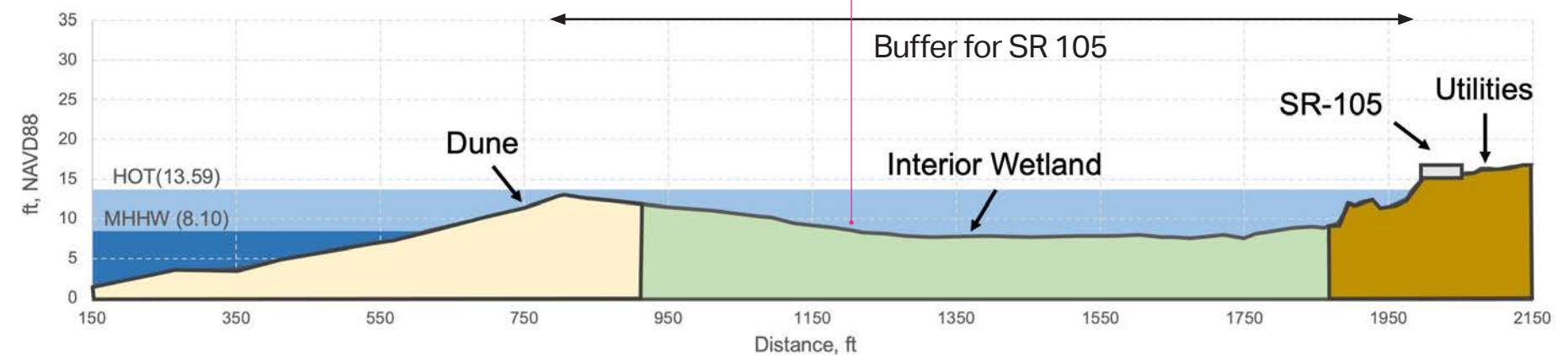
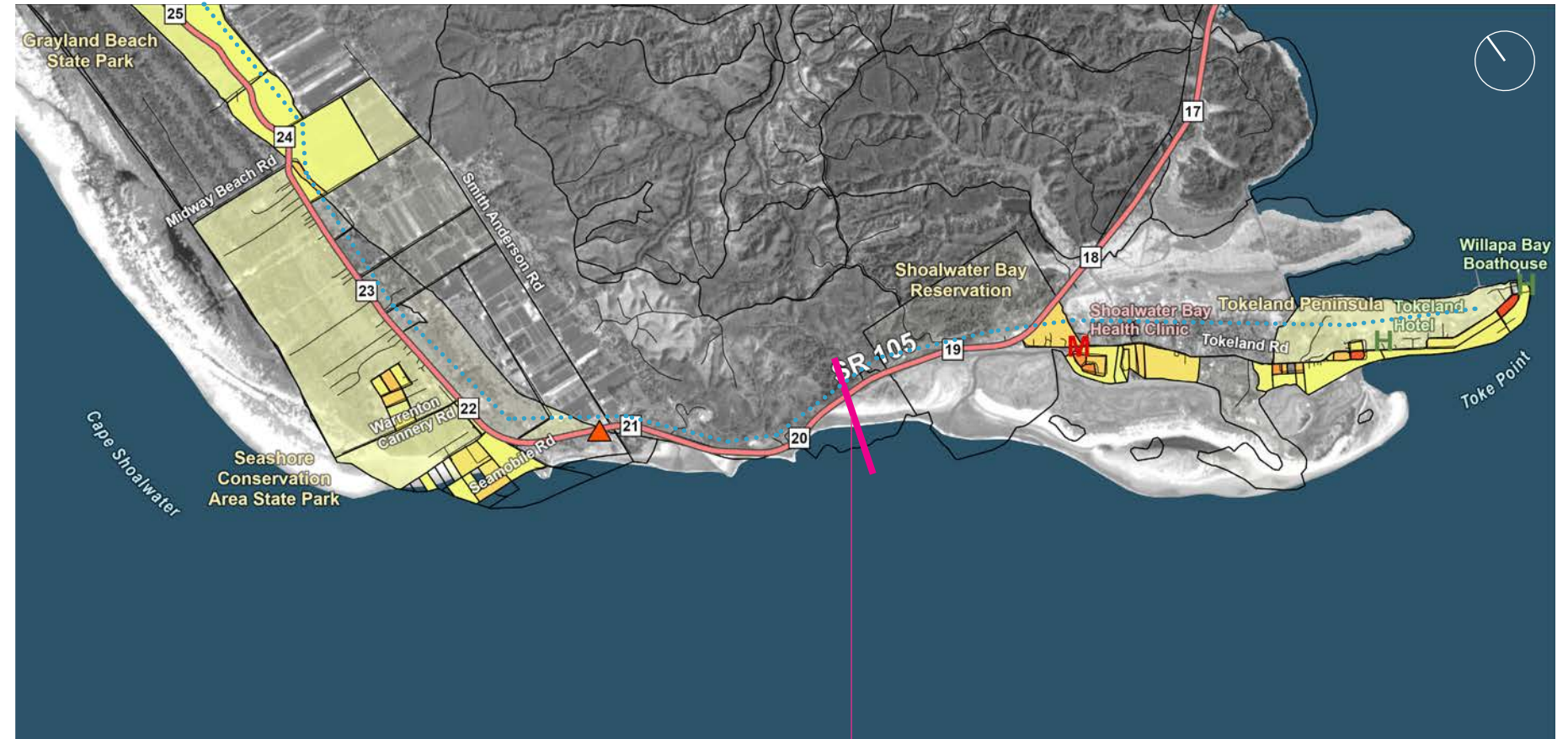
Law enforcement/security, fire services, search and rescue, and government service teams will not be able to easily access the communities resulting in lessened community safety.

EMERGENCY RESPONSE

The North Cove and Tokeland communities are served by the North Cove Fire Station 3-2 located in Grayland WA. SR105 represents a critical lifeline link for emergency response for those communities.

HEALTH AND MEDICAL

Medical care, patient movement, public health, hospital, fatality management, and the medical supply chain will become more



expensive and difficult to receive therefore, harming the community's wellbeing.

Response time for emergency services is substantially longer if SR105 is lost as the quickest route for the Tribal areas and Tokeland is west/north on SR105 through Grayland.

ENERGY (POWER AND FUEL)

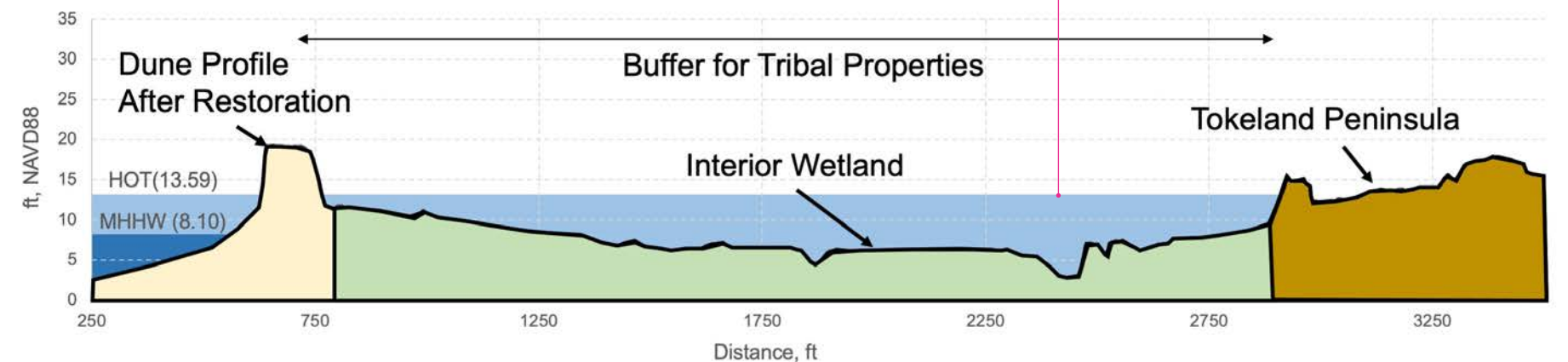
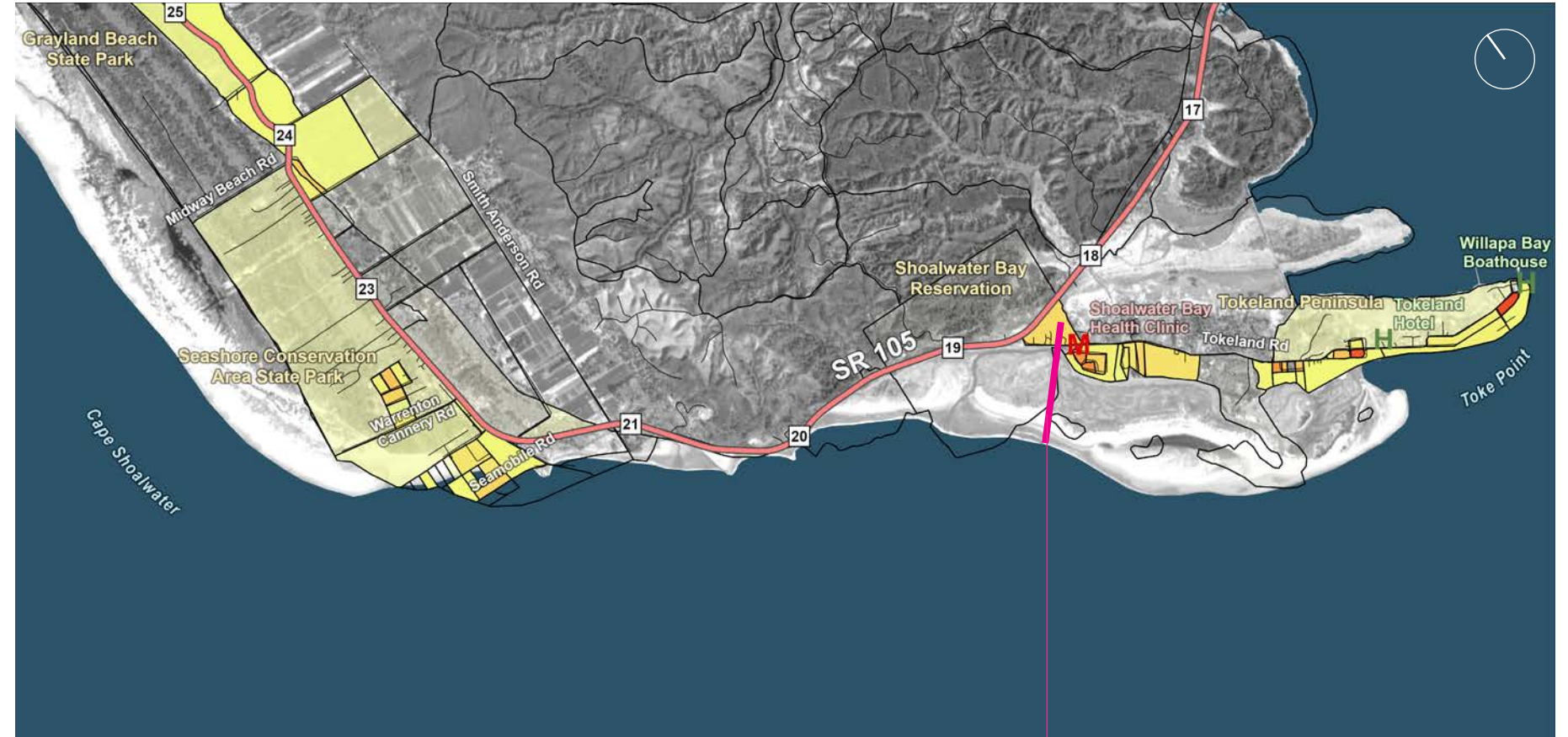
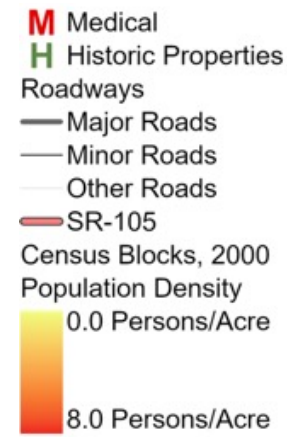
Utility lines, power grid, and fuel delivery corridor will be jeopardized

threatening modern living practices.

Power is provided by Grays Harbor PUD No. 1 from a substation in Grayland and routed for electrical service to customers located in North Cove and Tokeland. The power distribution line is located within the SR 150 corridor that is exposed to flooding and erosion hazards and at risk of being lost if not protected.



Snowy plovers are frequently sited on Graveyard Spit and Shoalwater Dune (Photograph from Unsplash picture library)



COMMUNITY ASSETS AT RISK (1 OF 2)

If erosion continues, the Shoalwater Bay Tribe properties, including tribal community and cultural lands, as well as ecologically significant wetlands could experience more frequent/intensive flooding. Storms in recent years have damaged the berm, resulting in flooding of nearby Shoalwater Bay tribal lands. The Shoalwater Bay dune is located at the mouth of Willapa Bay near Tokeland.

- Pacific County Private Properties will be exposed to risk of shoreline erosion and deterioration/loss of property.

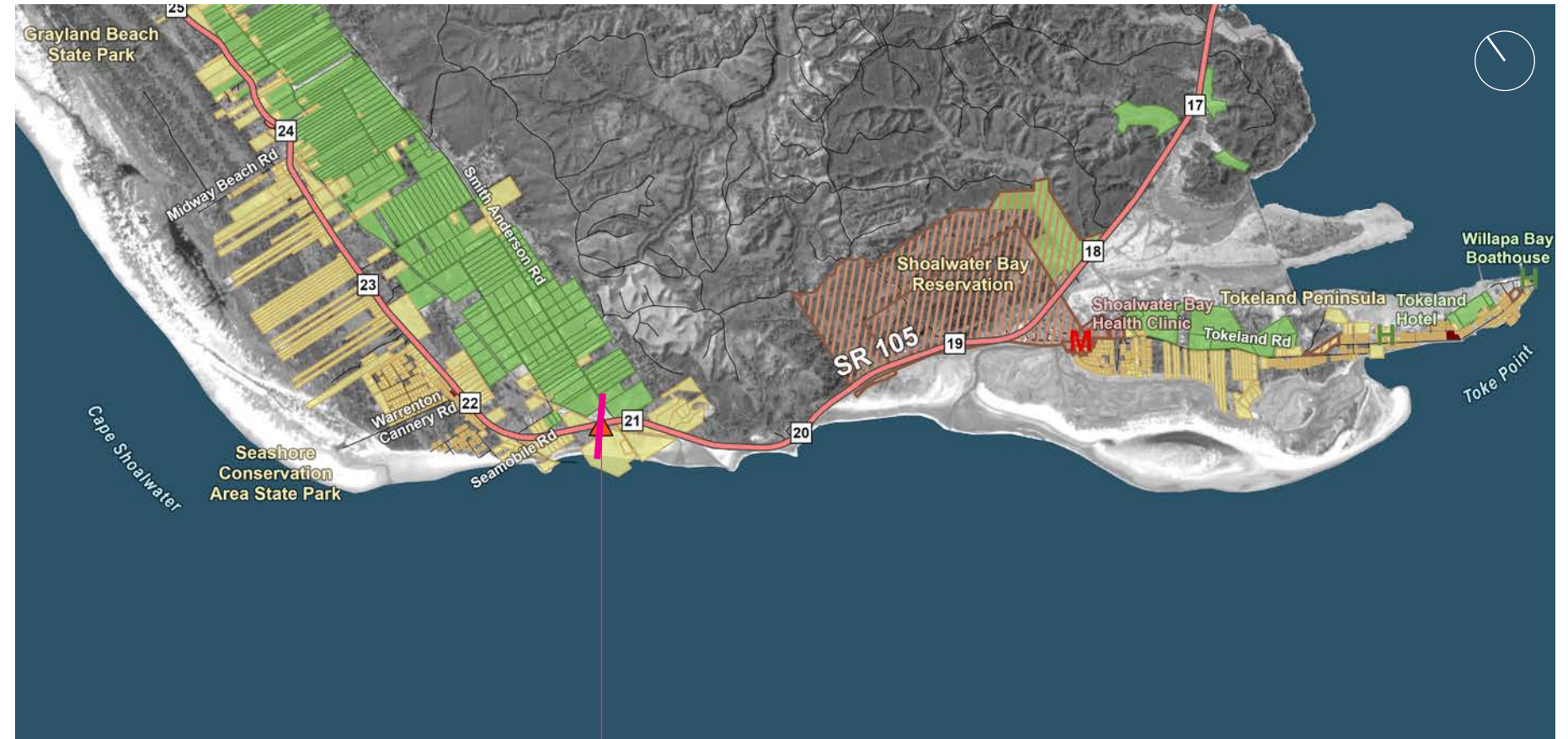
- Natural Assets: Valuable marsh and wetlands vulnerable to inundation could experience deterioration.

ENDANGERED SPECIES PROTECTION

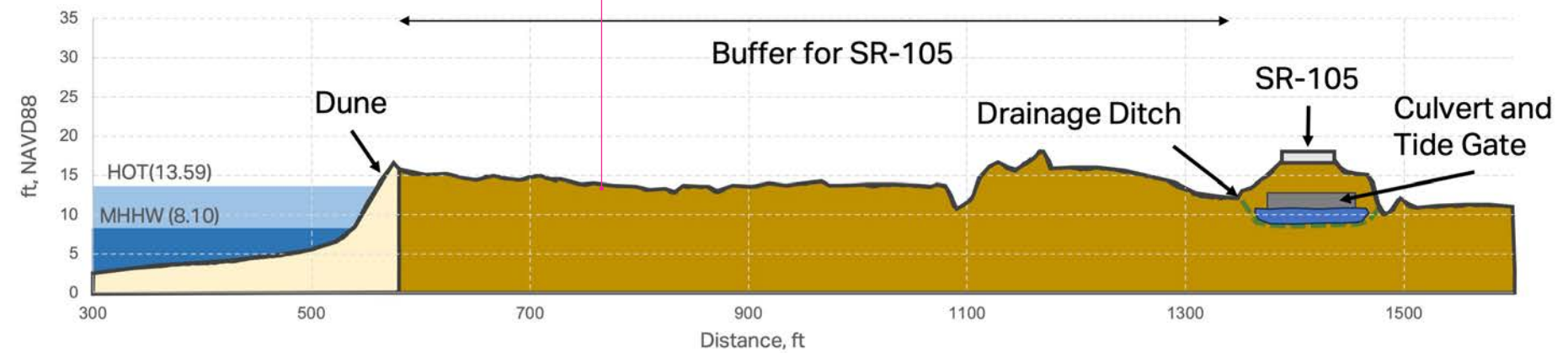
Existing dunes provide critical habitat for snowy plover (listed as a federal endangered species) and larks. If the dune system constructed by the US Army Corps of Engineers is not maintained, these sensitive habitats and coastal wetland will be lost to erosion.



- ▲ Tide Gate
- Agricultural
- Residential
- Commercial
- ▨ Tribal Lands
- M Medical
- H Historic Properties
- Roadways
- Major Roads
- Minor Roads
- Other Roads
- SR 105



Saltwater intrusion from a tide gate failure would permanently render these farm unusable for the cranberry farming for the next decade. Once the salt had leached out and they became farmable it would take > \$ 50 million to renovate, replant and restore them to their present farm value.



Cranberry Farm
(Photograph courtesy of George Kaminsky)

COMMUNITY ASSETS AT RISK (2 OF 2)

Tide gates, protecting cranberry bogs, could be impaired leading to further inland flooding and saltwater inundation resulting in the cranberry bogs being susceptible to long-term crop failure (local economy loss of \$3 to \$5 million per year).

SHORT- AND LONG-TERM NEEDS

Need to protect the current bay shoreline at current position to maintain the buffer of land to protect the tide gate. This is critical as the area is low lying and subject to overtopping.

- Monitoring and Maintenance – need to have a designated funding and assigned entity to track and take action.

- Need ability to do maintenance on the ditch to protect the function of the tide gate.
- Need ability to modify the outlet, such as with such as an engineered LWD structure type groin, to reduce risks to the ditch.



It is recommended for the County to revise the area with severe erosion hazards to be based on a uniform offset from OHWM. It is also recommended that the County changes the review period to eight years instead of every five years to coincide with SMP updates.

PACIFIC COUNTY BUILDING MORATORIUM

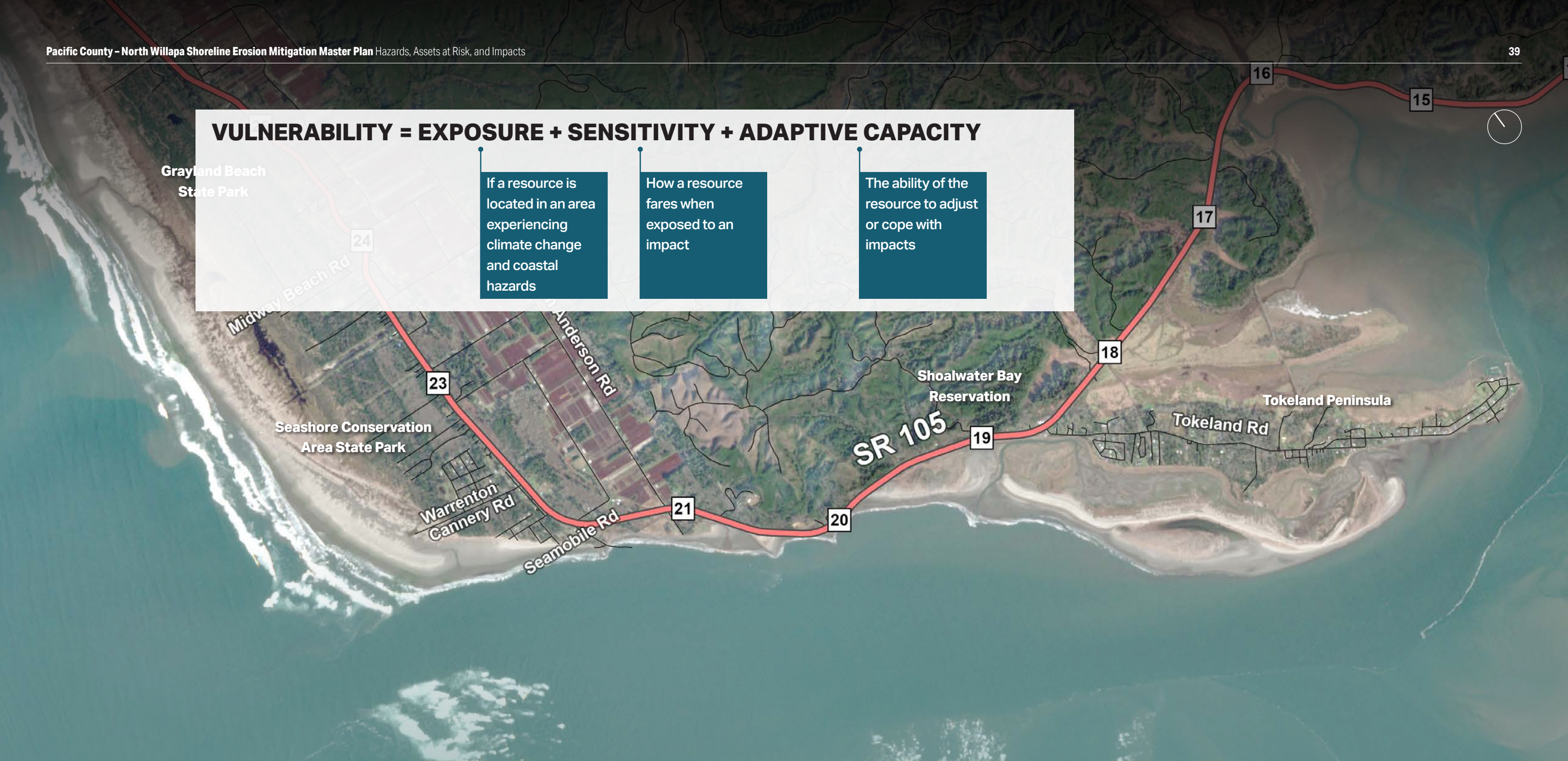
According to Pacific County's Comprehensive Plan 2020-2040 and Critical Areas and Resource Lands (CARL) Ordinance, a moratorium on new or expanded development has been put into place for the North Cove "Wash-Away" Beach stretches of coastline. This moratorium was established for a zone with highest rates of erosion. This zone was established in 2017 and extends landward from the Ordinary High Water Mark (OHWM) of the Pacific Ocean at that time, to the predicted position of shoreline in 2030. This prediction was performed by the Washington State Department of Ecology Coastal Monitoring and Analysis Program. Pacific County will review this line every five (5) years based on the best available data regarding erosion estimates. Pacific County Critical Areas Ordinance states that areas within the North Cove "Wash-Away" Beach Erosion Hazard Area, defined as that area within a distance from the ordinary high water mark that is less than or equal to the amount of land that is expected to erode within the next thirty (30) years, as determined by the Administrator (see map). The landward boundary of this area shall be reviewed by the County every five (5) years and revised as necessary. To remove or revise the existing building moratorium within the established North Cove "Wash-Away" Beach Erosion Hazard Area, the County would need to amend the current language contained within the Critical Area and Resource Lands (CARL) Ordinance (Pacific County Ordinance No. 180). To initiate this amendment, documentation would need to be provided to the County to demonstrate that the delineated Erosion Hazard Area (or a specific portion of the area) would not be at risk within the established thirty (30) year timeframe. Such a proposed amendment could be addressed in the periodic update of the CARL Ordinance as required by the Growth Management Act (GMA) every ten (10) years pursuant to RCW 36.70A.130. The County may consider amending the Ordinance outside of the periodic review timeline at their discretion. The proposed CARL amendment could also include a revision to the



current regulations described in the Geologically Hazardous Areas Section to allow for a site-specific evaluation of erosion hazard risks, or may include an updated Exhibit A, Erosion Hazard Area Map, based on best available science following the implementation of the Willapa Shoreline Erosion Mitigation Master Plan.

VULNERABILITY = EXPOSURE + SENSITIVITY + ADAPTIVE CAPACITY

- If a resource is located in an area experiencing climate change and coastal hazards
- How a resource fares when exposed to an impact
- The ability of the resource to adjust or cope with impacts



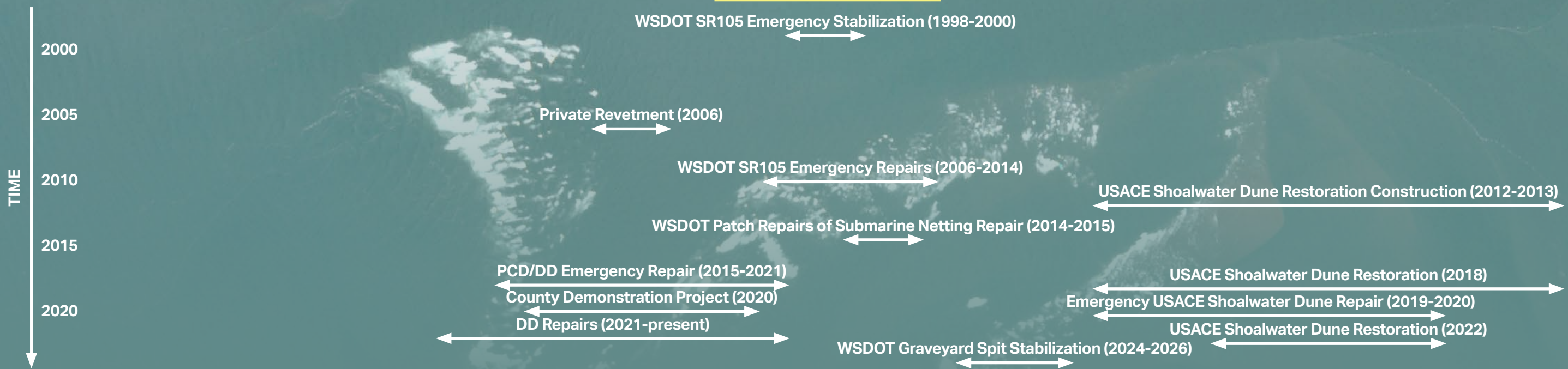
Exposure to Erosion	Low	Medium	High	Medium	High	Low
Exposure to Flooding	High				Medium	
Sensitivity	Low	Medium	High		Medium	
Lack of Adaptive Capacity	Low		High		Medium	
Vulnerability	Low	Medium	High		Medium	Low

5 EROSION MITIGATION EFFORTS

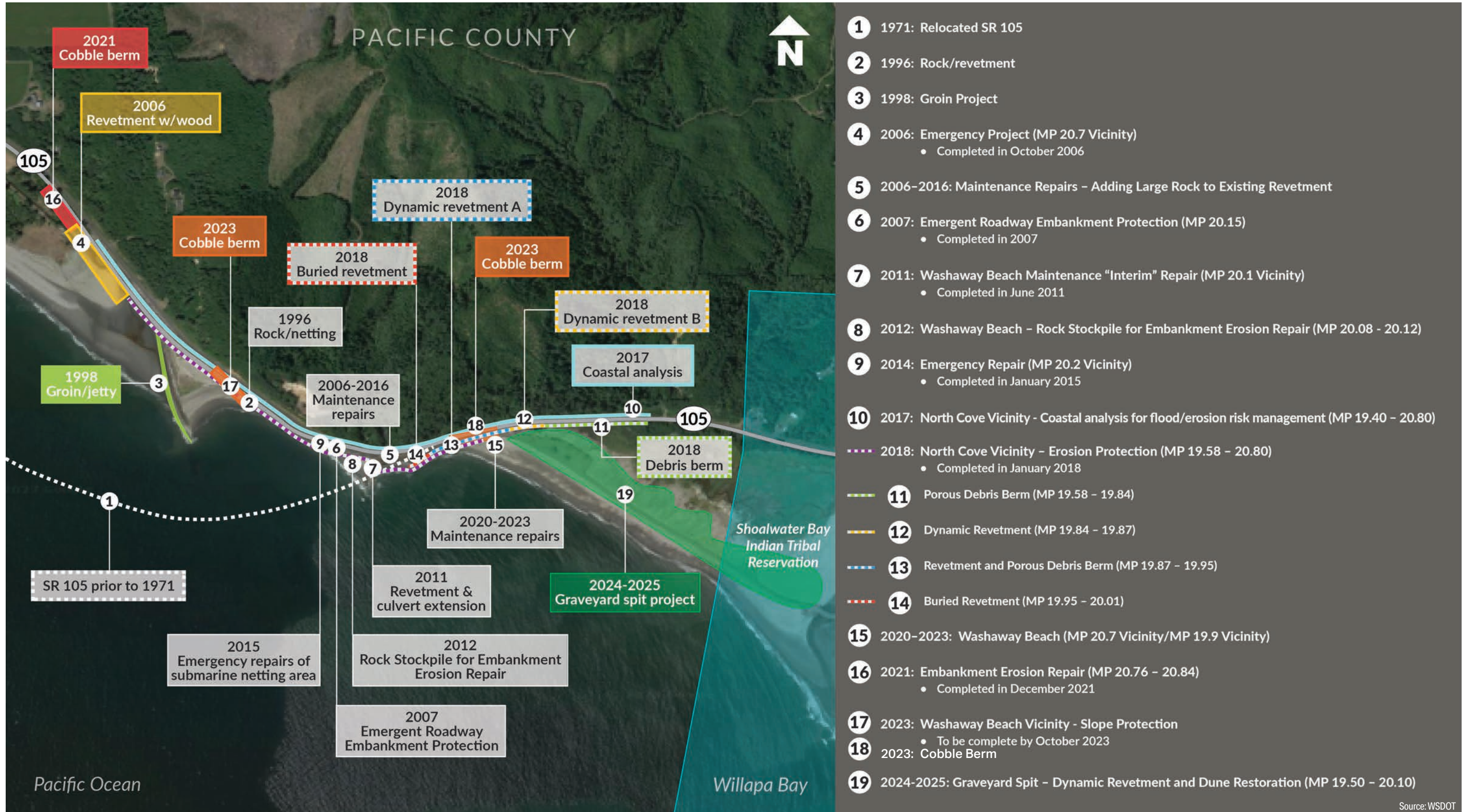


Historic photograph of coastal erosion damage in the study area

PAST MITIGATION EFFORTS

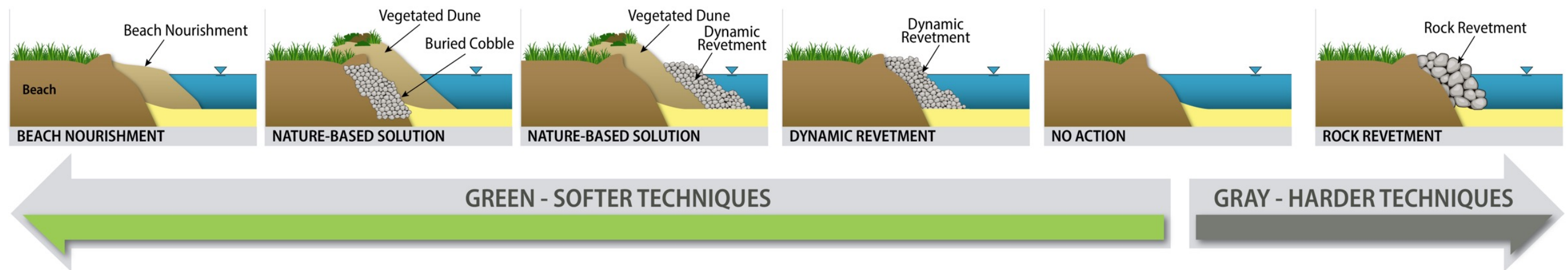


WSDOT EROSION MITIGATION EFFORTS



Selection of Green – Softer Techniques requires acknowledgment that more frequent monitoring/maintenance is likely to be needed.

EROSION MITIGATION MEASURES: MENU OF OPTIONS



A menu of options in terms of mitigation measures have been presented below ranging from green – softer techniques on the left to the gray – harder techniques on the right. Selection of most appropriate erosion mitigation measure for a specific stretch of shoreline/project site requires evaluation of various factors including the following:

- Likelihood and impact of risk (failure of mitigation measure).
- Vulnerability against sea level rise.
- Maintenance requirements.
- Adverse impact on natural environment.
- Probable opinion of construction cost.
- Mitigation requirements to secure regulatory permits.
- Applicable environmental and regulatory constraints.

To mitigate erosion along the entire study area, the optimal erosion mitigation measure for each reach may vary based on the respective levels of vulnerability (see page 39 for assessment of vulnerability along the study area). Generally, lower vulnerability against coastal hazards allows for implementation of green - softer techniques. Low vulnerability against coastal hazards is often associated with a larger than typical buffer between infrastructure at risk and the shoreline that can absorb the seasonal variability of shoreline change. Implementation of green – softer techniques requires a funded monitoring/maintenance program.

While FEMA uses the term “nature-based solutions,” other organizations use related terms, such as green infrastructure, natural infrastructure, natural and nature-based features, or Engineering with Nature®, a program of the U.S. Army Corps of Engineers.



NATURE-BASED SOLUTIONS

Dunes are coastal features made of blown sand and are an example of nature-based solutions. Healthy dunes often have dune grasses or other vegetation to keep their shape. Dunes can serve as a barrier between the water’s edge and inland areas, buffering waves as a first line of defense.

CHALLENGES

Current regulatory and environmental permit environment does not encourage use of nature-based solutions.

WHAT ARE NATURE-BASED SOLUTIONS?

Nature-based solutions are sustainable planning, design, environmental management and engineering practices that weave natural features or processes into the built environment to promote adaptation and resilience. These solutions use natural features and processes to improve resilience against natural hazards.

THE BUSINESS CASE

In response to natural hazards and to proactively address climate related risks, many communities are looking for ways to build resilience that yield the most benefit for the least cost. Nature-based solutions can help reduce the loss of life and property resulting from some of our nation’s most common natural hazards.

PLANNING AND POLICY MAKING PHASE

IMPLEMENTATION PHASE

FEDERAL FUNDING OPPORTUNITIES

RESOURCES

- Nature-Based Solutions Resource Guide, The White House, Nov 2022.
- Engineering with Nature® An Atlas, Volumes I and II, US Army Corps of Engineers, 2018 and 2021.
- Building Community Resilience with Nature-Based Solutions, A Guide for Local Communities, Federal Emergency Management Administration (FEMA), June 2021.

Right: Winter view
Far right: Summer view



Right: Newport Beach, OR
Far right: Rialto Beach, WA



DYNAMIC REVETMENT: GLOBAL AND REGIONAL EXPERIENCE

A dynamic revetment is an example of nature-based solutions meant to mirror the function of a cobble berm or rubble beach in resisting erosion.

In contrast to a riprap or seawall that absorbs the brunt of a waves energy and redirects it either down or outward, the smaller cobble is able to absorb and dissipate wave energy, thereby greatly reducing the impact to the shoreline.

From a practical standpoint, dynamic revetments are cheaper to build and maintain compared to seawalls, as the rock supply required to construct dynamic revetments is easier to source locally and transport.

Seamobile – Winter view,
January 2021



Seamobile – Summer view,
August 2021



DYNAMIC REVETMENT AT NORTH COVE

After years of watching the Pacific Ocean claim neighbors' properties, move closer to SR 105 and the multi-million dollar cranberry farms on the other side, and threaten to wipe out the community they call home, the residents of North Cove decided to take matters into their own hands.

Inspired by research conducted by the Oregon Department of Geology and Mineral Industries in the early 2000s, members of the community began pushing for the construction of a "dynamic revetment," a form of adaptive shoreline protection. Among them was David Cottrell, a cranberry farmer and Pacific County Drainage District No. 1 Commissioner, Connie Allen, Cottrell's partner and creator of the "Wash Away No More" fundraising campaign, and Charlene Nelson, chairwoman of the Shoalwater Bay Tribe (which is confronting its own erosion woes). Together they founded the Willapa Erosion Control Alliance Now (WECAN) and began seeking funding for their project.

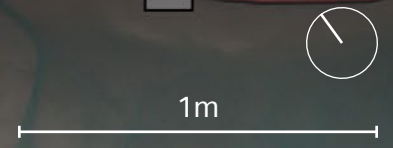
The initial efforts of WECAN paid off, and they were able to obtain grants from the Pacific County Conservation District, the Pacific County Drainage District No. 1, and the Pacific County to build a pilot revetment in 2016 and 2017. The preliminary results were promising, and when work conducted by CMAP (including the above report) and a renowned engineering firm Mott MacDonald corroborated that a dynamic revetment was the clear choice in terms of cost and effectiveness, the state granted \$600,000 for the construction of the project. A 2km stretch of dynamic revetment was constructed in December 2018, representing a significant and long-awaited victory to the community of North Cove.



Blue Pacific Drive Roadend, shows dune re-growth and vegetation following cobble placement (June 2023)

Between 2016 and 2018, small-scale (~1-5 CY/LF) emergency quarry spill placements were implemented within the Project Area. With funding from the Pacific Conservation District, cobble berms were placed and nourished between 2018 and 2020. By 2021, the efforts succeeded in halting shoreline retreat (that had averaged 61ft/yr in the decade prior to the 2018) and the area experienced significant beach growth, accumulation of large wood, and natural dune rebuilding with native vegetation. Observations of enhanced habitat include increased prevalence of snowy plovers, eagles, razor clams, and crabs. Unfortunately, limited funding prohibited construction to the required design elevation. As a result, segments of the placed material suffered significant damage during overtopping events that occurred during 2022-2023 king tides and energetic winter storms, causing further retreat of the North Cove shoreline and inland flooding. A large-scale, engineered dynamic revetment is needed to provide the critical threshold of material needed to perform as a robust and resilient beach (see picture above).

EROSION MITIGATION MEASURES



Pacific Ocean

Warrenton Cannery Seamobile Smith Anderson SR 105 Groin Graveyard Spit Shoalwater Bay Tribe Empire Spit Dune Tokeland

Master Plan Project Study Area

Willipa Bay

Erosion Mitigation Measures:

Monitoring
Identify Mitigation Measure as Needed

Dynamic Revetment
(see 2020 Demonstration Project)

Maintain Groin
Shoreline Protection TBD
Further Evaluation Needed

Dynamic Revetment
(see WSDOT Graveyard Spit)

USACE Berm Construction and Maintenance

Monitoring
Shoreline Protection TBD

6

MONITORING AND MAINTENANCE



Areas of erosion along constructed dune
(Photograph courtesy of Larissa Pfeleger)

MONITORING, MAINTENANCE, AND ADAPTIVE MANAGEMENT

As mentioned earlier, with selection of nature-based mitigation measures, we must acknowledge that more frequent monitoring/maintenance to inform adaptive management will be needed.

Developing a long-term maintenance/monitoring program requires continuity of funding, and highlights the need for having system-wide regular monitoring to support the coastal communities with protection of built and natural assets.

ECOLOGY'S CMAP

To better understand physical changes along Washington's beaches, bluffs, and nearshore zones, the Coastal Monitoring & Analysis Program (CMAP) conducts research by mapping and monitoring Washington's marine coastline.

The 2023 Washington State Legislature provided funds to expand the CMAP to improve capacity for data collection and analysis to assess vulnerabilities to coastal hazards and climate change.

As a result, Ecology's Shorelands and Environmental Assistance Program (SEA) created a new Applied Coastal Research and Engineering Section (ACRE) inclusive of CMAP and expanded to include a Shoreline Mapping Unit and a Coastal Engineering Team.

Detailed recommendations for conducting coastline monitoring are provided in the Appendix.

SHOALWATER INDIAN TRIBE

Members of the Tribe have been conducting habitat monitoring during and after construction of past/ongoing restoration of Shoalwater Bay Dune.

COMMUNITY COASTLINE MONITORING

MYCOAST WASHINGTON

MyCoast Washington is a Washington Department of Natural Resources collaboration with other project partners, including US Geological Survey, Washington Sea Grant, the Snohomish County Marine Resource Committee, and the Northwest Straits Initiative. Information collected through this site is used to characterize beach change and the impact of nearshore hazards in order to enhance awareness among decision-makers and stakeholders.

Over 1,000 community-provided photos for North Cove Old SR 105 and North Cove Seamobile are provided at MyCoast: Washington's website (<https://mycoast.org/wa>). New awards from UW EarthLab and WA Sea Grant are supporting a research partnership between scientists at the Applied Physics Laboratory and School of Public Health at UW, Wash Away No More, WECAN, and WA Ecology. The project will modify the existing North Cove photo stations, add new photo stations (where needed and permitted), and include initial RTK-GPS site surveys for calibration (courtesy of WA Ecology), to enable quantitative measurements of beach width from the community-submitted photos.

MyCoast will continue to serve as the image repository for these sites and will provide for QR code-based image submissions, making participation even easier. MyCoast will also host results, such that users can see up-to-date timelapse videos and plots of beach width variability and trends. The main added value of these efforts is to vastly increase the temporal frequency of beach width and shoreline data to fill in the gaps between the much higher spatial resolution, but only seasonal WA Ecology surveys.

DRONE IMAGERY

Members of the community have been recording photos/videos of the shoreline using unmanned drones. These efforts to collect aerial imagery collected by drones will help document seasonal changes as well as shoreline response to storms.

One notable examples of these efforts for shoreline monitoring is drone imagery collected and shared on the YouTube platform by Doug Davis: <https://www.youtube.com/@crabydoug>



Shoreline monitoring within the study area
(All pictures courtesy of George Kaminsky)

7 FUNDING EROSION MITIGATION

Sand built up along the North Cove shoreline
(Photograph courtesy of Younes Nouri)

HOW DO WE PAY FOR COASTAL EROSION MITIGATION?

Beach erosion is a major problem in the United States. At the same time, coastal resource protection is becoming increasingly expensive as state and federal funding become less available to local governments.

The sand on our beaches is a valuable resource, both for recreational purposes and as a buffer to prevent storms from causing severe property damage. Local governments can use their existing powers to obtain funding for beach stabilization projects.

The natural coastal processes, local regulations, and public trust concepts are the foundation of a rationale for a variety of methods for funding beach erosion control including taxes, fees, special assessments, and public trust funds. Local government can derive revenues from its taxing power, its police power, and income from its properties. All of these sources can be used to fund beach erosion control projects.

FEDERAL FUNDING

Federal investment in coastal restoration is critical to supplement local funding efforts. Maintaining federal funding at current annual levels, at a minimum, is crucial for coastal restoration, resilience, and research. There are ongoing efforts by various entities including American Shore & Beach Preservation Association (ASBPA) working with Congress to support policy for long-term coastal funding connected with coastal development and offshore energy production (both renewable and fossil fuel).

The best advocates for federal funding in coastal restoration are the communities and people who are managing projects on a day-to-day basis.



Historic photographs of coastal erosion damage to roadways and residences
(Photographs courtesy of Westport Historical Society)

GRANT FUNDING – CHALLENGES AND CONSIDERATIONS



STAFF CAPACITY

Small/disadvantaged communities and governments are often constrained by inadequate staff capacity to even manage grant funding opportunities.



LOCAL MATCH REQUIREMENTS

Grant funding opportunities often require a local match that can typically vary from 5% to 50% of the total funding. For small governments, providing even a small local match is challenging.



TIMING FOR SUBMISSION

Grant funding opportunities have specific timelines for submission of the request. Meeting these timelines can be challenging for small governments due to inadequate staffing and the deadline for submission coinciding with other commitments.



FUNDING TYPE (MAINTENANCE VS. CAPITAL CONSTRUCTION)

Most funding opportunities are streamlined to support capital construction as opposed to monitoring and maintenance. And there are fewer opportunities to support adaptive post-construction activities that are essential for long-term mitigation of erosion.



CONTINUITY OF FUNDING

Aside from gray structure/hard armoring of a shoreline, other mitigation measures (see page 35) will require some level of monitoring and maintenance. If monitoring and maintenance after construction is not implemented, long-term efficacy of the mitigation measure can be jeopardized.



COMPLICATED PROCESS

Submitting a funding request application can be complex and time consuming. Small governments often require capacity support applying for grant opportunities.



ELIGIBILITY

Purpose and need for a project needs to align with funding purpose and there are often eligibility criteria to be reviewed.

Mitigating coastal erosion can be costly. Local, state, and federal grant funding opportunities are often tapped into funding erosion mitigation projects. However, there are challenges and considerations in use of grant funding opportunities as described below.

NEED FOR DEDICATED STAFF CAPACITY

PURPOSE AND NEED

- There is a need for a dedicated staff capacity at the County level to coordinate efforts and continue/build on momentum from ongoing efforts.

FUNCTIONS AND RESPONSIBILITIES

- Coordinate work with stakeholders, governments, agencies and the Shoalwater Bay Tribe.
- Lead grant applications.
- Lead congressional and legislative direct community project funding requests.
- Coordinate support letters for grants and direct funding requests.
- Coordinate, track and manage funding for capital, maintenance and monitoring systems.

POTENTIAL FUNDING SOURCES FOR STAFF CAPACITY

- Use a combination of sources to pull together funding for a staff position
- Pacific County could establish a local taxing district to address coastal erosion
- Grants typically provide a small percentage for administrative costs
- Federal Grant, Deadline September 30, 2022
- Coastal Habitat Restoration and Resilience Grants for Underserved Communities
- One funding category is proposal development for future funding opportunities

GRANT FUNDING – OPPORTUNITIES



INTERGOVERNMENTAL COLLABORATION

Intergovernmental collaboration is already well established in the area. Pacific County, WA Department of Ecology, WA Department of Transportation, and the U.S. Army Corps of Engineers are all involved in an ongoing collaborative process to address hazard mitigation needs. This synergy across multiple agencies and levels of government can be utilized to both cast a wide net in terms of securing grant funding and strengthening individual applications.



COLLABORATION WITH ACADEMIA

Collaboration with local or regional academic institutions can strengthen grant applications as findings can be used to inform future projects in the region, increasing the chance of successful, cost effective efforts. Major research institutions such as the University of Washington and Oregon State University have initiated research on topics such as the dynamics of Willapa Bay Inlet as well as dynamic revetments, providing a strong opportunity for future collaboration.



PUBLIC SUPPORT

Strong public support is often a key driver in securing grant funding to move projects forward. Shoreline erosion is a highly visible hazard among local communities, who have been experiencing impacts for decades, and thus the public is well aware of the importance of effective erosion hazard mitigation. This public support has been demonstrated across multiple outreach efforts to date.



LEVERAGE LOCAL/STATE \$\$ TO SECURE FEDERAL GRANTS

Federal grant opportunities, which can provide the largest funding source for potential projects, often require some degree of local or state funding match.

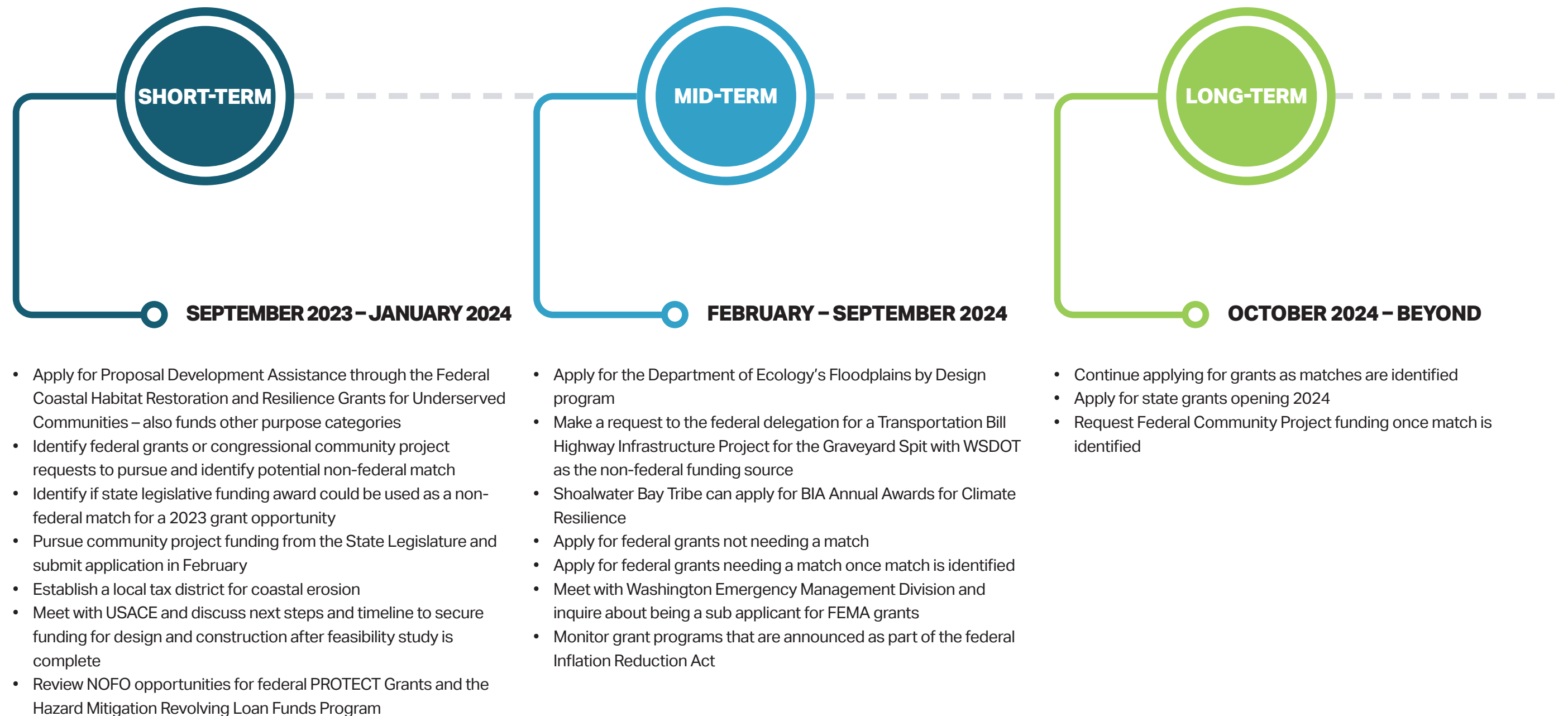
Using additional local or state grant funding to help meet this match requirement can significantly reduce the potential financial burden of meeting the federal match requirement. Existing collaboration among local and state agencies means projects will be well positioned to fully leverage any state or local grant funds into additional federal funding.

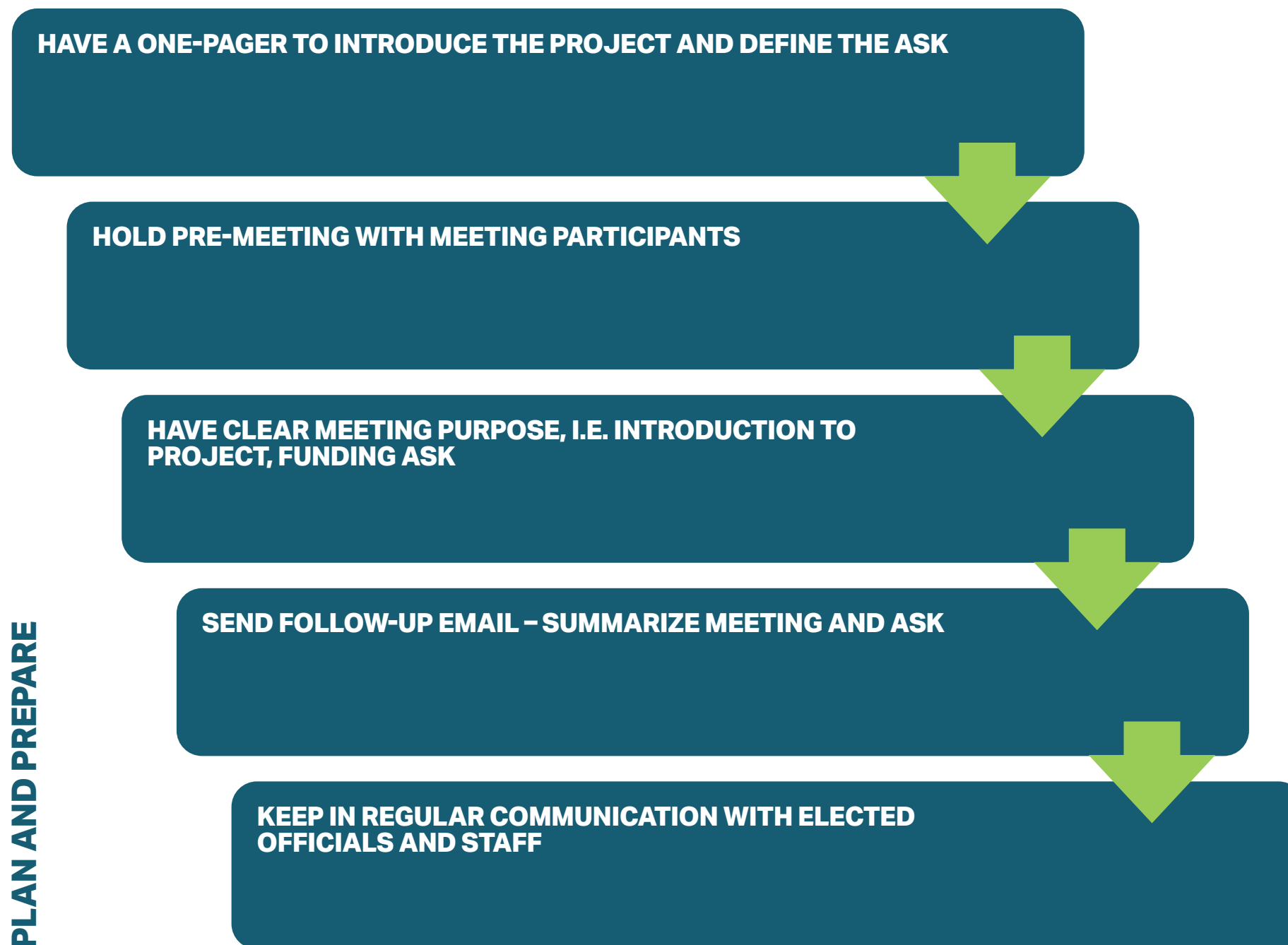
Despite challenges and considerations in use of grant funding opportunities presented on the previous page, there are opportunities and synergies for the North Willapa community. Some of these synergies are described below (also see Appendix E).

ACTION ITEMS

- Maintain a Central Library of Applicable Grants.
- Maintain a 'Funding Application Primer' tailored to North Willapa.
- Designate an agency and individual to track and review grant opportunities for the consideration by the community to pursue for funding planning, construction, monitoring and maintenance needs.
- Establish a Memorandum of Understanding (MOU) between key stakeholders

GRANT FUNDING OPPORTUNITIES – RECOMMENDATIONS FOR NEXT STEPS



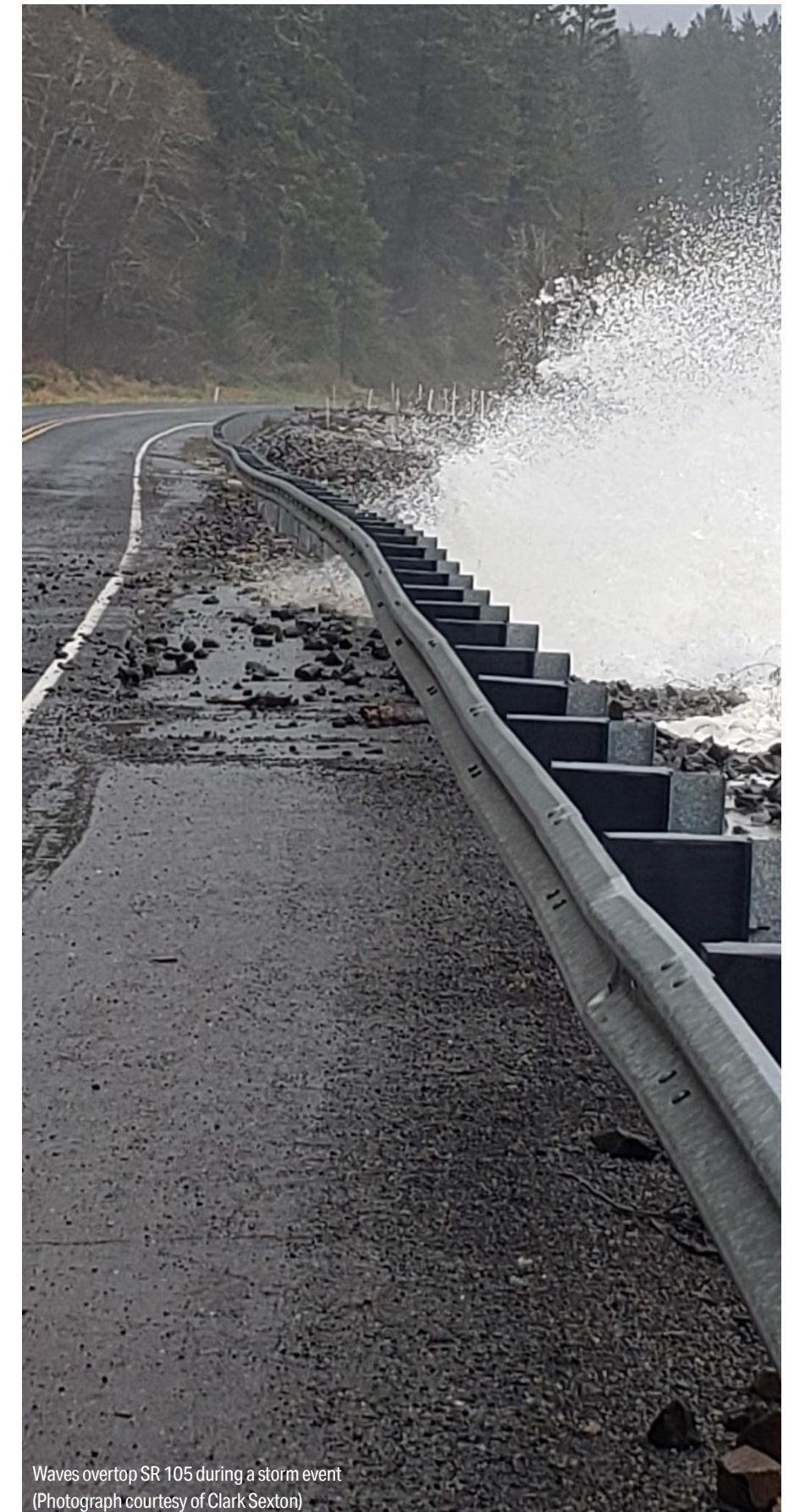


LEGISLATIVE OUTREACH

Legislative outreach is key for securing certain grants. Having an effective meeting with legislative representatives requires planning and preparation. But first, the community needs to establish concurrence on the priorities for the request (see Appendix E for a prime on legislative outreach).

RECOMMENDATIONS FOR NEXT STEPS:

- Develop a two-pager for each project – Need input on going forward and strategy (see examples of two-pager for project reaches in Appendix F).
- Follow the diagram shown here to plan and prepare for an effective meeting.
- Consider developing a MOU.



Waves overtop SR 105 during a storm event
(Photograph courtesy of Clark Sexton)



Rock revetment protects SR 105 from coastal erosion.



INTERGOVERNMENTAL COLLABORATION – OPPORTUNITIES

- Memorandum of Understanding (MOU).
- MOU between tribal, federal, state and local governments, agencies and public districts to coordinate long-term working relationships and applications for funding sources.
- Further helps show broad governmental and community support for grant applications, and federal and legislative community project funding requests.

8 THE PLAN



Aerial view of the study area shoreline

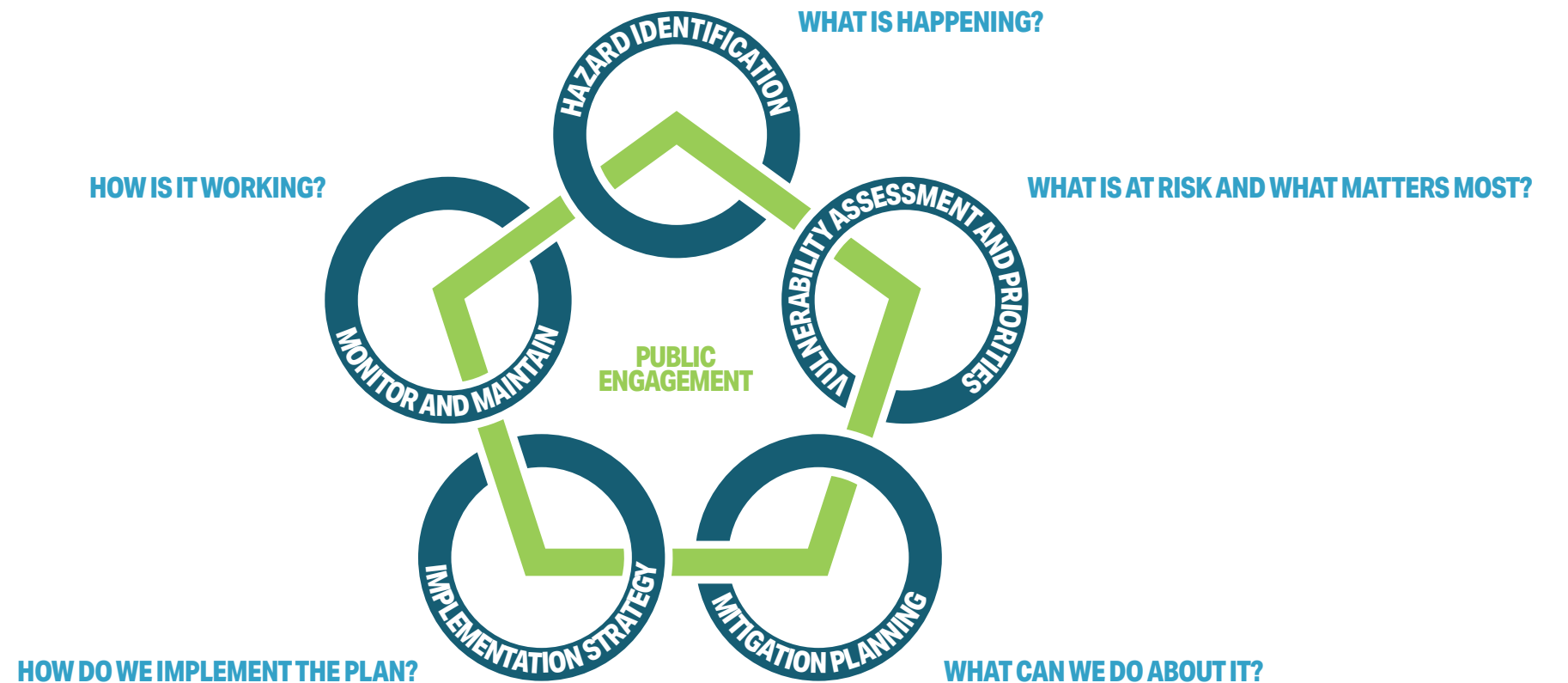
THE PLAN

Mitigation plans are key to breaking the cycle of disaster damage and reconstruction. Hazard mitigation planning reduces loss of life and property by minimizing the impact of disasters. It begins with state, tribal and local governments identifying natural disaster risks and vulnerabilities that are common in their area.

After identifying these risks, they develop long-term strategies for protecting people and property from similar events. A hazard mitigation plan is required by FEMA when requiring non-emergency disaster assistance.

Developing a hazard mitigation plan helps County, the Shoalwater Bay Indian Tribe, Drainage District, and state and federal agencies to:

- Increase education and awareness on natural hazards and community vulnerabilities.
- Build partnerships with the government, organizations, businesses and the public to reduce risk.
- Identify long-term strategies for risk reduction with input from stakeholders and the public.
- Identify cost-effective mitigation actions that focus resources on the greatest risks areas.
- Integrate planning efforts and risk reduction with other community planning efforts.
- Align risk reduction with other state, tribal, or community objectives.
- Communicate priorities to potential funders.



COMMUNITY PRIORITIES











Reach Name	Warrenton Cannery	Seamobile	Smith Anderson	SR 105 Groin	Graveyard Spit	Shoalwater Bay Tribe Empire Spit Dune	Tokeland
Urgency of Mitigation Actions	Low (Accretional Pattern)	Medium (Dynamic revetment)	High	High	High	Medium (Recent erosion mitigation action constructed)	Low (Armored)
Risk if Erosion Continues?	Reduction in Sediment Source	Loss of Private Properties	Threat to Agricultural Lands	Loss of/Disruption of SR 105	Loss of Aquatic Habitat and Threat to Tribal Lands		N/A
Short-Term Needs	Monitoring	Funding for M/M ¹ Program	Ability to Secure Permits ²	Design of a Sustainable Solution Resilient Against Climate Change		M/M ¹ Program	Monitoring

Develop a Sustainable Long-Term Solution for the Entire Study Area

Notes: 1=Monitoring/Maintenance; 2=Ability to Secure Permits for Maintenance Repair in a Timely Manner plus Funding for Design of a Sustainable Solution

CHAMPION/LEAD COORDINATOR



Reach Name	Warrenton Cannery	Seamobile	Smith Anderson	SR 105 Groin	Graveyard Spit	Shoalwater Bay Tribe Empire Spit Dune	Tokeland
Urgency of Mitigation Actions	Low (Accretional Pattern)	Medium (Dynamic revetment)	High	High	High	Medium (Recent erosion mitigation action constructed)	Low (Armored)
Erosion Mitigation Champion/Lead Coordinator	 County	 Drainage District #1	 Drainage District #1	 WSDOT	 WSDOT	  Shoalwater Bay Tribe + U.S. Army Corps of Engineers	 County
Project Area Lead Agency	County or Conservation District? TBD						

IMPLEMENTATION STRATEGY – NEED FOR A CHAMPION



PURPOSE AND NEED

Successful coastal erosion mitigation is comprised of planning, construction, monitoring, and maintenance. There is a need for funding and regulatory permits to make erosion mitigation happen.



VISION

Sustainable mitigation of shoreline erosion along the study area would require a champion and continuous attention building on previous efforts.

Benefits of a designated position are as follows:

- Coordinating stakeholders and community.
- Organizing priorities for projects and pursuits of grant funding.
- Organizing and managing data collection and monitoring activities.
- Administering grant funds for construction, monitoring and maintenance.
- Coordination with County leadership.
- Pursuit of programmatic maintenance permits for projects.



IMPLEMENTATION STRATEGY

A designated position within Pacific County would be ideal for providing efficiency and continuity to the County as well as other stakeholders.

Another viable alternative would be a designated position within the Conservation District.



ACTIONS

Pacific County to explore establishing a designated position for shoreline erosion mitigation efforts.



(Photograph courtesy of Younes Nouri)

NEED FOR A HOLISTIC SOLUTION



PURPOSE AND NEED

Coastal processes and sediment movement are regional, and projects involving sediment can have effects beyond an immediate site and for extended periods of time.

There is a need for a systems approach using best management practices for more efficient and effective management, and use of sediments along the project area.



VISION

Sustainable long-term erosion mitigation along the study area would require a systems approach. A systems approach to sediment management involves:

- Understanding the ways sediment moves naturally, and how natural and man-made factors affect that movement.
- Valuing sediment as a resource, not a waste product.
- Carrying out actions that achieve multiple objectives with sediment.
- Working with many stakeholders so that all interests are considered.

Benefits of having a holistic solution are as follows

- Reduced lifecycle costs.
- Improved partnerships.
- Improved regional and project sediment management.
- Improved environmental stewardship.

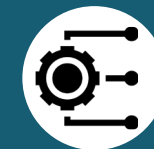


IMPLEMENTATION STRATEGY

A systems approach (similar to a Regional Sediment Management or RSM) is an overarching approach for managing projects involving sand and other sediments, and it is intended to advance the application of sustainability principles by:

- Valuing sand and other sediments as resources.
- Accommodating multiple objectives.
- Considering project effects beyond the immediate timeframe and location.
- Achieving cost efficiencies and program integration.

Within the Corps, RSM originated with the idea of coordinating dredging and other activities in the coastal zone, such as beach nourishment or ecosystem restoration, to retain sand in the littoral system, support natural system processes, and reduce project costs.



ACTIONS

Pacific County to discuss/explore request to USACE for establishing a RSM for Willapa Harbor.

THE PLAN

Grayland Beach State Park

Midway Beach Rd

Seashore Conservation Area State Park

Warrenton Cannery Rd

Smith Anderson Rd

Seamobile Rd

Shoalwater Bay Reservation

Tokeland Rd

Tokeland Peninsula

SR 105

Pacific Ocean

Warrenton Cannery

Seamobile

Smith Anderson

SR 105 Groin

Graveyard Spit

Shoalwater Bay Tribe Empire Spit Dune

Tokeland

Master Plan Project Study Area

Willipa Bay

The Plan:

MONITORING PROGRAM

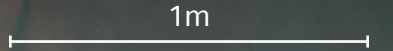
SECURE FUNDING FOR DYNAMIC REVETMENT
Permitting, Bid Documents and Construction; Monitoring Program

MONITORING PROGRAM, STUDY TO DETERMINE SHORE PROTECTION
Ditch outlet and adjacent to groin, maintenance for groin structure

DYNAMIC REVETMENT
Secure Construction funding for WSDOT dynamic revetment project

MONITORING AND MAINTENANCE
USACE Berm

MONITORING PROGRAM



9

SUMMARY OF FINDINGS AND RECOMMENDATIONS

SUMMARY OF FINDINGS AND RECOMMENDATIONS

Topic	Summary of Findings	Implementation Strategy	Actions
<p>Coastal Erosion Coordinator for Erosion Mitigation Planning, Funding and Monitoring Efforts</p>	<p>Lead Coordinator. There is a need to designate a local government body as the lead community coordinator. Funding should be secured for a coordinator position to assist with organization, facilitation and execution of the community and multi-jurisdictional led erosion mitigation programs and projects.</p> <p>Community Collaboration. The North Cove community has exceptional involvement, support and collaboration at citizen, local government and state government level. WECAN should continue to be a centerpiece for community collaboration and advocacy. A lead coordinator could assist in leveraging the good community support and activities into a larger program and not rely solely upon volunteerism to address a large-scale problem with significant risk to the community.</p> <p>Coordination of Ongoing Plans and Studies. A number of government agencies are engaged in planning, designing, implementing and monitoring coastal erosion measures in the study area. Coordination of these plans and projects will be essential to meeting the overall objective of reducing erosion and flooding hazards to the community.</p>	<p>Identify a lead agency and corresponding staff person to be a designated coordinator. Lead agency to pursue funding, with support from community collaborative, for the coordinator position. Lead agency having cross cutting project area jurisdiction and governmental interest for community and infrastructure. Pacific County is a potential good first candidate.</p> <p>Lead coordinator to assist Tribe and other community members with coordination and continuation of WECAN organization meetings and outreach with state and federal agencies.</p>	<p>Pacific County to explore establishing a designated position for shoreline erosion mitigation efforts.</p> <p>Engage local community to organize, formalize and implement community-based strategy for WECAN next steps and continuation of efforts to date to advocate for funding and implementation of projects.</p>
<p>North Cove Study Area Holistic Solutions</p>	<p>Study Area Wide Approach. Coastal processes and sediment movement are inter-related through the entire study area. Erosion protection measures need to be implemented with the entire study area geomorphologic processes in mind to ensure nature-based solutions are implemented in a synergetic manner .</p> <p>Systems Based Approach. There is a need for a systems approach using best management practices and adaptive management for more efficient and effective management and use of nature-based solutions along the study area. Requires an erosion coordinator and implementing a monitoring program to manage erosion hazard following a systems-based approach.</p>	<p>Within the Corps, RSM originated with the idea of coordinating dredging and other activities in the coastal zone, such as beach nourishment or ecosystem restoration, to retain sand in the littoral system, support natural system processes and reduce project costs.</p>	<p>Pacific County to discuss/explore request to USACE for establishing a RSM for Willapa Harbor.</p>

Topic	Summary of Findings	Implementation Strategy	Actions
Erosion Protection Needs	<p>Demonstration Project Performance. Current demonstration scale projects using Nature Based Solutions have proven to be effective on over 35% of the study area. Additional funding is needed to build those areas into long term, sustainable erosion protection systems.</p> <p>Areas of Critical Need. Over 75% of the study area shoreline is in immediate and critical need of funding for permitting and construction activities.</p> <p>Erosion Protection Systems. Over 75% of the study area shoreline is feasible to utilize Nature Based Solutions to address the erosion hazard. The remaining 25% will require a combination of traditional and yet to be determined approaches to mitigation the erosion hazard.</p>	Ranking of the project list is needed to help better prioritize funding pursuits by reaches of the project area.	
Assets at Risk	<p>Community Lifelines. Emergency services (Health and Medical), powerline (Energy) and SR 105 (Transportation) are at great risk to erosion and flooding hazards.</p> <p>Flood Protection of Agricultural Lands. XX acres of agricultural land is at risk of flooding from tide gate failure if erosion hazard is not mitigated.</p> <p>Public Roads. State Route 105 is at high risk of complete loss to erosion and flooding. Relocation of the highway is not feasible.</p> <p>Tribal Lands. Native people have lived on the Willapa Bay for over 2000 years. The Shoalwater Bay Indian Tribe ancestral lands have shrunk to the reservation that located in the study area which has continued to be lost to erosion and at greater risk of flooding.</p> <p>Estuary Habitat. High quality estuarine habitat located in the project area has seen continued loss due to erosion processes. Habitat critical to the local ecosystem and endangered species (snowy plover) is at risk of complete loss if a long term solution is not implemented.</p>	<p>For funding requests and outreach activities, describe the linkage between erosion risks to community lifelines.</p> <p>For funding requests and outreach activities, describe the linkage of multi-hazards present at the project area to significant risks to agricultural lands.</p>	<p>Funding requests and outreach should clearly outline the multi-hazards and assets at risk for the community. There is risks to a combination of inter-related community assets including lifelines, agricultural lands, public access roads, tribal lands and estuary habitat.</p> <p>Master plan documentation can be used to develop a narrative that captures the range of hazards and risks that can be used for a large range of funding sources. Sharing of language across various partners for use in pursuit of funding application documentation.</p>

Topic	Summary of Findings	Implementation Strategy	Actions
Intergovernmental Collaboration	<p>Multijurisdictional MOU. There has been strong openness to sharing information and collaboration among stakeholder agencies. A memorandum of Mutual Understanding (MOU) further helps show broad governmental and community support for grant applications and federal and legislative community project funding requests.</p> <p>Update Pacific County Hazard Mitigation Plan. County’s Hazard Mitigation plan needs to document latest information available Project Site relative to hazards, exposure, vulnerabilities and potential mitigation measures outlined in the master plan. An updated hazard mitigation plan is required by FEMA when pursuing non-emergency disaster assistance.</p>	<p>An MOU between tribal, federal, state and local governments, agencies and public districts to coordinate long-term working relationships and applications for funding sources.</p> <p>County should take advantage of ongoing/planned erosion mitigation plans to update the Hazard Mitigation Plan. If a holistic solution is established, that can further inform the hazard mitigation plan. Update the erosion risks outlined at the project areas to represent without shoreline stabilization condition, further enhance discussion of assets that are vulnerable to the multi-hazards (erosion, flooding and storm surge), update the range of mitigation options to include soft shore stabilization and nature-based systems. Align the HMP with the Ecology SMP updates for shoreline stabilization techniques.</p>	<p>Pacific County to hire a consultant to facilitate establishing an MOU.</p> <p>County to update hazard mitigation plan as it relates to erosion mitigation for the study area every five years. Engage the county erosion coordinator and WECA during the update to the HMP to bring up to date description of the risks by location.</p>
Pacific County Building Moratorium	<p>Building Moratorium Periodic Update. A moratorium on development has been put into place for the North Cove wash-away stretches of coastline. This moratorium was established for a zone with the highest rates of erosion. This zone extends landward from the Ordinary High Water Mark (OHWM) of the Pacific Ocean to a line of expected erosion over the next thirty (30) years. Pacific County plans to reevaluate this line every five years based on the best available data regarding erosion estimates but regular updates might be challenging. Some form of building moratorium should remain in place until a long term, funded solution is identified.</p>	<p>Delineating the erosion hazard zone based on a constant offset from the current position of shoreline may be more programmatic to enable regular (five-year) updates.</p>	<p>County to refine the zone of high erosion rate</p>
Grant Funding Opportunities to Support Erosion Mitigation	<p>Staffing Resources. The coastal communities and governments including Pacific County and Shoalwater Bay Indian Tribe are often constrained by inadequate staff capacity to pursue and manage grant funding opportunities. Additional support is needed to pursue and administer needed grant funds to address the erosion hazard.</p> <p>Matching Funds. Grant funding opportunities often require a local match that can typically vary from 5% to 50% of the total funding. For small governments, providing even a small local match is challenging. Identification of local funding mechanism to support grant funding match and support annual monitoring and data repository needs.</p> <p>Funding Strategy. Develop a strategic plan for leveraging a combination of local, state and federal dollars in pursuit of funding. Develop a coordinated plan to conduct legislative outreach at state level.</p>	<p>Tapping grant funding opportunities that require small/no match, such as the RCO WCCRI grant funding, could be beneficial.</p> <p>Leverage existing relationship/collaboration with Pacific Conservation District for providing the local match.</p> <p>Develop a range of revenue sources to provide funding for matching grants, to assist in funding a portion of a lead coordinator position and assist with funding monitoring and maintenance activities. A county wide SLR, Erosion and Climate Change mitigation fund could be developed that addresses these risks county wide but with an emphasis on highest needs in the north bay. Tie the need for funding to the County Hazard Mitigation Plan relative to erosion and flooding risk areas and funding opportunities. Matching funds can vary from 9 to 25% depending on the funding program.</p> <p>Funding strategy to outline needs for both capital construction, ongoing maintenance, and monitoring activities for long term resilience.</p>	<p>Maintain a Central Library of Applicable Grants.</p> <p>Maintain a ‘Funding Application Primer’ tailored to North Willapa.</p> <p>Investigate possible revenue sources through partners for raising funds to serve as matching funds. Potential sources could be use fees, taxes, or other revenue streams through county.</p>

Topic	Summary of Findings	Implementation Strategy	Actions
Existing Shoreline Protection Systems Maintenance	<p>Maintenance Funding. Dedicated funding program needed to perform maintenance of existing shore protection systems installed by WSDOT, USACE and Diking District when monitoring indicates a need. These existing facilities include a rock dike, rock jetty, rock revetment, sand berm, and dynamic revetment structures.</p>	Develop a range of revenue sources to provide funding for monitoring and maintenance activities.	Investigate possible revenue sources through partners such as use fees, taxes, or other revenue streams through county. Investigation O&M funding through WSDOT to serve as possible revenue for ongoing monitoring or maintenance activities.
Shoreline Monitoring Program	<p>Project Area Annual Monitoring. Regular and long-term shoreline monitoring is critical to success of a long-term erosion hazard mitigation program. Having reliable, annual shoreline monitoring data can assist with adaptive management to inform/refine erosion mitigation plans and save cost for project stakeholders.</p> <p>Funding and Resources. Funding and assigned responsibility for reproducible monitoring work is needed for the shoreline monitoring program that is needed to address the north cove erosion hazards.</p> <p>Data Repository. A single repository of historical and future monitoring data should be developed and housed with a government body to ensure continuity of information for future adaptive management project needs.</p>	Leveraging community and state-wide resources for conducting shoreline monitoring can be beneficial for Pacific County given their current staff capacity challenges.	<p>Stakeholders to support WA Dept of Ecology’s proposal for state-wide shoreline monitoring provided by CMAP group.</p> <p>Pacific County to start discussions with Sea Grant to further develop community-based capacity to monitor shoreline change.</p>
Streamlining Regulatory Permitting Processes for Shoreline Maintenance	<p>Maintenance Permits. Multi-year permits for maintenance of nature based solutions and traditional erosion protections is needed to be able to quickly respond to dynamic conditions at the site and improve success of adaptive management for erosion mitigation.</p> <p>Programmatic Permits. For reaches of shoreline with similar erosion protection techniques (nature-based solution), consider bundling projects across multi-agencies to increase efficiency and readiness for “shovel ready” funding programs for construction. Investigate Programmatic permits for that can provide permits for longer duration (greater than 5 years) to provide greater flexibility in pursuit of construction funding.</p>	<p>Pursue permits for maintenance of nature-based systems in advance of the need. Address the need for maintenance permits in the permitting for the initial construction.</p> <p>Investigate potential feasibility for USACE programmatic permits for shoreline maintenance which are designed to avoid duplication meant for projects that take longer than five years and are a good fit for phased approaches/long-term maintenance needs.</p>	Lead coordinators for each reach to start discussions with regulatory agencies to explore securing permits for maintenance.
Master Plan: A Living Document	The master plan needs to be periodically updated to capture the most recent conditions of the coastal hazards, document lessons learned from recent erosion mitigation efforts and identify research needs.	A lead coordinator with cross cutting area jurisdiction and governmental interest for community and infrastructure could pursue funding for frequent (every three years at a minimum) update of the master plan.	Pacific County to explore establishing a designated position for the lead coordinator. Lead coordinator to explore grant funding opportunities to hire consultants to update the master plan every three to five years. Pacific County to explore establishing a designated position for the lead coordinator. Lead coordinator to explore grant funding opportunities to hire consultants to update the master plan every three to five years.



Aerial view of Tokeland peninsula dune and wetland system
(Photograph courtesy of Larissa Pfleeger)

10 APPENDIX



Vegetation, rock revetment, and sandy beach along the study area
(Photograph courtesy of Younes Nouri)

APPENDIX A: COMMUNICATION PLAN

INTRODUCTION

The shoreline of North Willapa Bay has been subject to long-term and severe erosion dating back to available records in the late 1800s. This shoreline erosion has resulted in significant loss of public and private properties and poses a significant threat to not only private property within the North Cove community, but also significant risk to critical habitat and infrastructure including State Route 105, Shoalwater Nation Tribal properties, agricultural lands (cranberry bogs), cultural resources, and community emergency response services. The consequences of erosion are accelerating for the natural and built assets and services and increasing risk of damage and disruption to these assets and services. There have been several historical and recent efforts by multiple stakeholders to mitigate erosion along a few stretches of the North Willapa Bay shoreline using various mitigation measures. Recent efforts using nature-based measures, such as the dynamic revetment, have shown good short-term performance and promise as a long-term erosion mitigation measure. However, a documented long-term vision to mitigate shoreline erosion along the entire reach of the shoreline is absent.

A coordinated and broadly supported Master Plan for the entire reach of shoreline is needed to meet the communities’ goals of implementing a group of long-term, sustainable erosion mitigation projects. There is a need to formalize and document lessons learned from historical/recent erosion mitigation efforts and stakeholder communications to inform a unified vision for the shoreline erosion mitigation. The goal of this Master Plan is to establish a vision, to maintain momentum and cohesion among various stakeholders, develop a funding strategy, integrate emerging best management practices within agency work plans, and address emerging hurdles that threaten the longevity of past coastal protection efforts.

This Communications Plan outlines the steps Pacific County (County) will take, with support from the consultant team, to provide opportunities for public engagement, while coordinating directly with key stakeholders as part of the Master Plan project.

1.0 GOALS AND OBJECTIVES OF THIS COMMUNICATIONS PLAN

1.1 GOAL

- Ensure a coordinated effort to establish a Master Plan that is broadly supported across the community.

1.2 OBJECTIVES

- To provide opportunities to participate in the development of the Master Plan, including identifying what different projects are considered priority, by hosting two workshops for stakeholders at the beginning of

the development process, and prior to finalization of the Master Plan in December 2022.

- To ensure project partners are aligned with the approach proposed by the Master Plan through targeted outreach and by convening one meeting for steering committee (critical prioritized audience) members during 2022.
- To provide timely information on, and an understanding of the process of, the Master Plan development to the public by hosting a public information meeting in 2022.
- To develop a Master Plan document that increases public awareness about risks posed by shoreline erosion and articulates a resilient, efficient, and coordinated erosion mitigation program that aligns current efforts, identifies ongoing needs and provides a clear pathway for future project funding through grant acquisition, by December 2022.

2.0 MASTER PLAN TEAM ROLES AND RESPONSIBILITIES

Name	Organization	Role
Marshall Rivers	FEMA	Agency Providing the Funding
Paul Plakinger	Pacific County	Planning Director, County Project Manager
Nichol Duff	Pacific County	Accounting/Office Manager
Shane Phillips	Moffatt & Nichol	Consulting Team Principal-In-Charge Coastal Engineering
Younes Nouri	Moffatt & Nichol	Consulting Team Project Manager Coastal Engineering
Aaron Porter	Mott MacDonald	Consulting Team Member Existing Data Compilation and Cataloging
Dan Nickel	Watershed	Consulting Team Member Communications Lead
Sarah Round	Strategies 360	Consulting Team Member Funding Strategies

3.0 PRIORITIZED AUDIENCE

Prioritized audience for this master plan will likely include, at a minimum:

- Pacific County (County)
- Willapa Erosion Control Alliance Now (WECAN)
- Private Property Owners/Community Members
- U.S. Army Corps of Engineers (USACE)
- Washington State Department of Ecology (Ecology)
- Washington State Department of Transportation (WSDOT)

- Shoalwater Bay Tribe
- National Oceanographic and Atmospheric Administration Office for Coastal Management (NOAA)
- Federal Emergency Management Agency (FEMA)
- Washington State Department of Fish and Wildlife (WDFW)
- Washington State Parks and Recreation Commission (WSPRC)
- Washington Department of Natural Resources Aquatic Lands (WA DNR)
- University of Washington Sea Grant (Sea Grant)
- Pacific County Drainage District #1
- Pacific Conservation District (PCD)

WeCAN List:

Organization	Name	Title	Email
Cranberry/ Drainage District	David Cottrell		cranberrydavid@yahoo.com
EPA	Justine Barton		Barton.Justine@epa.gov
WSDOT	Garrett Jackson		JacksGa@wsdot.wa.gov
WSDOT	Chad Hancock		HancocC@wsdot.wa.gov
WSDOT	Chelsey Martin		MartinCh@wsdot.wa.gov
WSDOT	Oteberry Kedelty		KedeltO@wsdot.wa.gov
WSDOT	Scott Seroshek		SeroshS@wsdot.wa.gov
WSDOT	Pedro Reyes		reyesp@wsdot.wa.gov
WSDOT	Angie Haffie		HaffieA@wsdot.wa.gov
USFWS (WSDOT liaison)	DeeDee Jones		deean_jones@fws.gov
State Parks	Jay Carmony		Jay.Carmony@PARKS.WA.GOV
State Parks	Miles Wenzel		Miles.Wenzel@PARKS.WA.GOV
WDFW	Lauren Bauernschmidt		Lauren.Bauernschmidt@dfw.wa.gov
USACE	Juliana Houghton		juliana.houghton@usace.army.mil
USACE	David Michalsen		David.R.Michalsen@usace.army.mil
USACE	Sandra Manning		Sandra.L.Manning@usace.army.mil
USACE	Chris Behrens		christopher.behrens@usace.army.mil
USACE	Jennifer Lang		Jennifer.W.Lang@usace.army.mil
USACE	Laura Boerner		Laura.a.boerner@usace.army.mil
USACE	Daryl Downing		Daryl.S.Downing@usace.army.mil
Conservation District	Mike Nordin		plutroll@willapabay.org
Pacific County DCD	Shawn Humphreys		shumphreys@co.pacific.wa.us
Pacific County	Kathy Spoor		kspoor@co.pacific.wa.us

Organization	Name	Title	Email
Pacific County Marine Resource Committee	Doug Kess		kess-spack@wwest.net
Pacific County Commissioner	Mike Runyon		mrnyon@co.pacific.wa.us
Pacific County Commissioner	Lisa Olsen		lolsen@co.pacific.wa.us
Pacific County Commissioners office	Marie Guernsey		mguernsey@co.pacific.wa.us
Washington Sea Grant	Jackson Blalock		jackbla@uw.edu
Washington Sea Grant	Kevin Decker		kadecker@uw.edu
Washington Sea Grant	Sean Macduff		sean670@uw.edu
Shoalwater Bay Tribe	Jesse Downs		jdowns@shoalwaterbay-nsn.gov
Shoalwater Bay Tribe	Larissa Pfleeger		lpfleeger@shoalwaterbay-nsn.gov
Shoalwater Bay Tribe	Earl Davis		edavis@shoalwaterbay-nsn.gov
Shoalwater Bay Tribe	Kristine Torset		ktorset@shoalwaterbay-nsn.gov
Shoalwater Bay Tribe	Charlene Nelson		cnelson@shoalwaterbay-nsn.gov
Pacific County/ WECAN Facilitator	Kelly Rupp		kelly.rupp@leadtoresults.com
NOAA	Kris Wall		kris.wall@noaa.gov
WashAway No More & Pacific CO Planning Commission	Connie Allen		callen3@gmail.com
WashAway No More & Pacific CO Planning Commission			washawaynomore@yahoo.com
Westport Historical Society & Museum	John Shaw		johnshaw98520@gmail.com
Mott MacDonald	Aaron Porter		aaron.porter@mottmac.com
Coast Harbor Engineering	Vladimir Shepsis		vladimir@coastharboreng.com
Moffatt & Nichol	Shane Phillips		sphillips@moffattnichol.com

Organization	Name	Title	Email
Ecology	Bobbak Talebi		BTAL461@ECY.WA.GOV
Ecology - SW	Zach Meyer		zmey461@ecy.wa.gov
Ecology - CMAP	George Kaminsky		gkam461@ECY.WA.GOV
Ecology - WSDOT liaison	Penny Kelley		PKEL461@ECY.WA.GOV
Ecology	Henry Bell		hbel461@ecy.wa.gov
Legislators	Joel McEntire		joel.mcentire@leg.wa.gov
Legislators	Jeff Wilson		Jeff.Wilson@leg.wa.gov
Legislators	Jim Walsh		jim.walsh@leg.wa.gov
Legislators	Sarah Kohout		Sarah_Kohout@cantwell.senate.gov
Legislators	Anthony Pena		anthony_pena@murray.senate.gov
Legislators	Colin Swanson		Colin.swanson@mail.house.gov

Stakeholders will be individuals who represent the interests of particular groups, can effect change, have relevant knowledge or skills, and/or are working to address the issues of coastal flooding, storm surge, and erosion damage across the north Willapa Bay shoreline. Information to support the formation of a potential steering committee will build on the coordination efforts of the North Willapa Shoreline Protection Demonstration Project and the community initiatives by the WECAN and be referred to as the Critical Audience segment. The other two Audience segments are also vital to achieve the project goal and objectives and will be engaged through different degrees and methods. The Prioritized Audience list below is not static and may be refined and expanded as necessary.

Critical Audience will likely include, at a minimum:

Organization	Name	Title	Email
County	Paul Plakinger		pplakinger@co.pacific.wa.us
	Shawn Humphreys		shumphreys@co.pacific.wa.us
WECAN and/or County Planning Commission	Kelly Rupp	WECAN Facilitator	kelly.rupp@leadtoresults.com
WECAN/ Washaway	Connie Allen		washawaynomore@yahoo.com; callen3@gmail.com
Drainage District	Dave Cottrell		cranberrydavid@yahoo.com
USACE	David Michalsen	Hydraulic Engineer	David.R.Michalsen@nwp01.usace.army.mil
	Chris Behrens	Senior Planner	Christopher.Behrens@usace.army.mil
	Laura Boerger		laura.a.boerner@usace.army.mil
	Janet C. Curran	New PM for North Cove	janet.c.curran@usace.army.mil
	Aurora DeAngelis-Caban	Project Manager for Shaolwater Bay Dune Restoration Project	aurora.deangelis-caban@usace.army.mil

Organization	Name	Title	Email
WA Department of Ecology	George Kaminsky		gkam461@ecy.wa.gov
	Henry Bell		hbel461@ecy.wa.gov
	Bobbak Talebi		bobbak.talebi@ecy.wa.gov
WA Department of Transportation (WSDOT)	Chelsey Martin		martinch@wsdot.wa.gov
	Garrett Jackson		jacksga@wsdot.wa.gov
	Chad Hancock		hancocc@wsdot.wa.gov
Shoalwater Bay Tribe	Charlene Nelson	Chairperson for Tribal Council	cnelson@shoalwaterbay-nsn.gov
	Earl Davis	Commissioner Chairperson	edavis@shoalwaterbay-nsn.gov
	Larissa Pfleeger	Director of Natural Resources and Environmental Department	lpfleeger@shoalwaterbay-nsn.gov
Community Members	Rebecca Chaffee		rebecca.e.chaffee@gmail.com
Conservation District	Mike Nordin		plutroll@willapabay.org
Sea Grant	Jackson Blalock		jackbla@uw.edu
WA Department of Fish and Wildlife	Lauren Bauernschmidt		lauren.bauernschmidt@dfw.wa.gov

Important Audience will likely include, at a minimum:

Organization	Name	Title	Email
County	Scott McDougall		smcdougall@co.pacific.wa.us
NOAA	Kris Wall		kris.wall@noaa.gov
USFWFS	DeeDee Jones	WSDOT Liaison	deean_jones@fws.gov
Sea Grant	Kevin Decker		kadecker@uw.edu
	Sean Macduff		sean670@uw.edu
Shoalwater Bay Tribe	Jesse Downs		jdowns@shoalwaterbay-nsn.gov
	Kristine Torset		ktorset@shoalwaterbay-nsn.gov

Considered Audience will likely include, at a minimum:

Organization	Name	Title	Email
WSPRC	Jay Carmony		Jay.Carmony@parks.wa.gov
WSPRC	Miles Wenzel		Miles.Wenzel@PARKS.WA.GOV
WSDOT	Oteberry Kedelty		
WSDOT	Scott Seroshek		seroshs@wsdot.wa.gov

Organization	Name	Title	Email
WSDOT	Pedro Reyes		
WSDOT	Angie Haffie		Angie.Haffie@wsdot.wa.gov
Ecology	Zach Meyer		
Ecology	Penny Kelley		
Ecology	Tess Brandon		tess.brandon@ecy.wa.gov
EPA	Tess Brandon		tess.brandon@ecy.wa.gov
USACE	Juliana Houghton		juliana.houghton@usace.army.mil
USACE	Sandra Manning		
USACE	Chris Behrens		Christopher.Behrens@usace.army.mil
USACE	Jennifer Lang		Jennifer.W.Lang@usace.army.mil
USACE	Laura Boerner		laura.a.boerner@usace.army.mil
USACE	Daryl Downing		daryl.s.downing@usace.army.mil
Pacific County MRC	Doug Kess		
Pacific County Commissioners	Lisa Olsen		
Pacific County Commissioners	Mike Runyon		
Pacific County Commissioners	Frank Wolfe		
Pacific County Commissioners	Marie Guernsey		mguernsey@co.pacific.wa.us
Westport Historical Society & Museum	John Shaw		
Pacific County Emergency Management Agency	Scott McDougall		
WA DNR Aquatic Lands	Rick Schwartz		

Legislative Representatives (WA -19 for the State, WA-3 for federal) will likely include, at a minimum:

Organization	Name	Title	Email
Cantwell	Sarah Kohout		
Murray	Anthony Pena		
Rep. Jamie Herrera-Beutler	Colin Swanson		
WA State Rep	Joel McIntire		
WA State Rep	Jim Walsh		
WA State Senate	Jeff Wilson		

4.0 ENGAGEMENT AND OUTREACH STRATEGIES

The County is committed to providing multiple opportunities for the public and stakeholders to increase their awareness about risks posed by shoreline erosion and learn about the proposed Master Plan development that will address erosion mitigation strategies. The County will take advantage of various modes of communication to inform the public, which may include, but not limited to social media and/or other web presence and email distribution lists. The County also recognizes that we are in a period of time where opportunities for in-person public involvement are limited and subject to changing pandemic circumstances. Public engagement opportunities will follow current health and safety guidelines for Washington State, relying primarily on virtual and digital platforms. Engagement strategies include:

4.1 STAKEHOLDERS

Stakeholder workshops will be held to collectively gather existing information and provide specific feedback to aid in Master Plan development. The workshops will be held to seek feedback from the broader group, refine specific details, and finally to review the Master Plan in a draft form.

4.2 STEERING COMMITTEE

A steering committee composed of critical prioritized audience stakeholders will be formed early in the Master Plan development. The steering committee will help guide decisions on a range of topics during the execution of the Master Plan.

4.3 TARGETED OUTREACH

Focused conversations with specific stakeholders will also help refine the understanding of the project's needs.

5.0 IMPLEMENTATION ACTIONS

5.1 WORKSHOPS AND MEETINGS

To achieve the objectives outlined in Section 1.2, a total of 4 meetings will be convened as follows:

- An initial workshop for stakeholders will be organized to introduce the Master Plan concept, purpose, components and timeline. Data needs and sources, as well as information distribution recommendations, will be identified.
- Two Steering Committee meetings will be convened between the workshop and the final stakeholder's meeting. These meetings will provide the Steering Committee with the ability to review and discuss the plan as development progresses.
- A final workshop for stakeholders will be organized to present the near-final draft of the Master Plan. This will provide the larger stakeholder group the opportunity to learn about the outcomes of the Master Planning process, next steps and any future phases that may be identified.

Stakeholder meetings will be 60-90 minutes long and held virtually. Steering Committee meetings will be 60 – 90 minutes long. It may be possible to hold at least one Steering Committee meeting in person, depending upon public health recommendations and member availability. Any in-person meeting will have a virtual attendance option available.

5.2 REQUEST FOR INFORMATION

Points of contact for stakeholders will be identified during the initial workshop. Within two weeks of the

initial workshop, a request for information will be communicated to points of contact using various mediums to gather as much available information as possible. This outreach will include a data request for state and federal agencies in addition to the County including WSDOT, USACE, Ecology, Tribe, and the Drainage District at the outset of the project to include all historical and ongoing efforts.

5.3 TARGETED OUTREACH

Outreach strategies will be dependent on the audience identified. Email and phone calls will be utilized for steering committee engagement. Email will be utilized for stakeholder engagement. The public will be notified of meetings and opportunities to engage through various modes of communication that may include notifications on social media platforms, webpages and appropriate email distribution lists. Recommendations and support for specific modes of online communication will be identified during the initial workshop.

Stakeholders will be encouraged to use social media, at their discretion, to reach their audiences. It will be encouraged to use any common messaging themes that may be developed or identified by the Steering Committee to ensure a unified vision and alignment of intent throughout the duration of the project.

5.4 DOCUMENTATION

Meeting notes will serve as documentation of participants, agreements and concerns, as well as the solutions identified and next steps that will lay the groundwork for future actions. Meeting notes will be captured and disseminated to the Steering Committee and Stakeholders present, within two weeks of the meeting, for review to ensure conversations and decisions are correctly represented. Presentation materials will be preserved and available upon request. Transparency in decision making and plan development is foundational to acceptance of the Master Plan by the broader community.

6.0 DELIVERABLES

To facilitate a transparent and well documented process, the following deliverables will be collected, submitted to FEMA and made available to the public in the most accessible and equitable manner as recommended by FEMA, the County and other prioritized audience stakeholders:

- Directory of Federal, State and local Agency Sponsors and stakeholders
- Directory of community and tribal stakeholders
- Published calendar of outreach meetings
- Catalogue of current and planned mitigation activities
- Meeting materials, including attendance lists, meeting notes, presentation materials
- Master Plan, including the Mitigation Plan Supplement

7.0 REVISITING THE COMMUNICATIONS PLAN

Throughout the project duration, this Communications Plan will be revisited to consider the effectiveness of outreach, thoroughness of stakeholder participation, and whether change in communication approach or planned events is warranted.

APPENDIX B: COASTAL PROCESSES AND MITIGATION MEASURES

INTRODUCTION

A majority of the North Willapa Bay shoreline within the Master Plan Study Area has been exposed to severe long-term erosion which has resulted in landward migration of the High Tide Line (HTL) toward public infrastructure, private property, and habitat. There have been numerous projects installed since 1998 intended to mitigate shoreline retreat (as shown below). In addition, multiple studies have been conducted by local, state, and federal agencies and organizations to assess the hazards and develop options for hazard mitigation. However, these projects and studies have been developed without a master plan. As a result of this there are gaps in both the physical location between the constructed projects, the potential lifespans, and how these projects may interact with each other from a coastal processes perspective. To document these gaps, a synthesis of coastal processes, as well as historic and on-going erosion mitigation projects, was developed as part of this study to form a basis for future planning efforts. This synthesis aided in identifying gaps in erosion protection projects, lessons learned and best management practices from previous projects, and development of recommendations for detailed monitoring and research. An executive summary is provided herein, additional details are provided in the attached slides and document library.



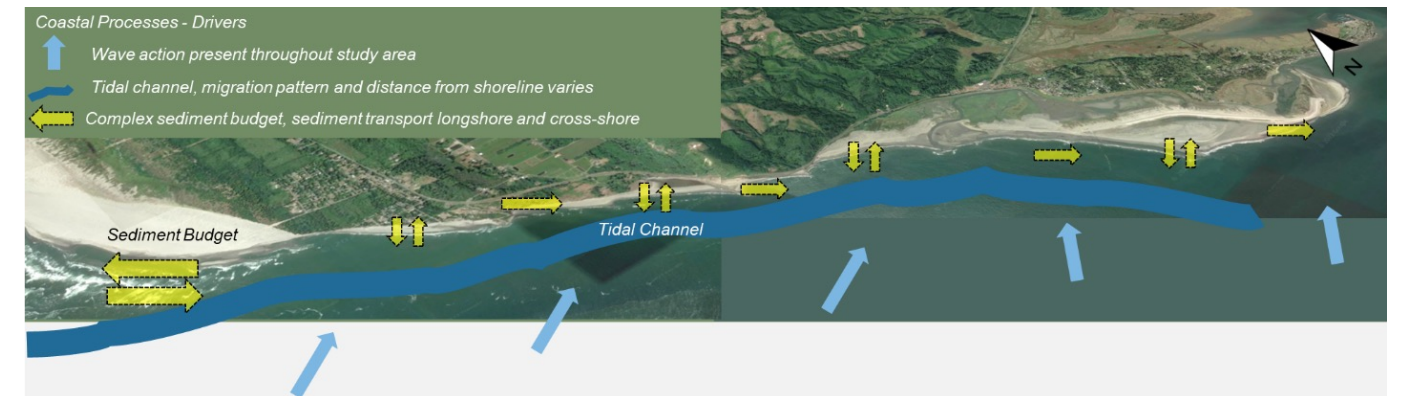
Constructed Erosion Mitigation Project Extents

COASTAL PROCESSES

Shoreline erosion in this area is highly complex, but primary factors that have affected erosion are (below):

- Tidal channel migration, and
- Wave induced erosion
- Changes (reduction) in available sand (sediment) sources and patterns

The following subsections contain a synthesis of these processes along the shoreline of North Willapa Bay, which affect existing and planned shoreline erosion mitigation projects in the study area.



Coastal Processes Synthesis

TIDAL CHANNEL

The tidal flow in and out of Willapa Bay is one of the largest in the world, similar in hourly flow volume to the Mississippi River. A system of tidal channels that allows for flow in and out of the bay has naturally developed and appears to constantly adjust and migrate.

- **Hazard:** While migrating shoreward, the North Tidal Channel (Main Entrance Channel) can undermine the beach, allowing high energy ocean waves to propagate closer to the shoreline, and cause large parts of the shoreline to erode into the deep tidal channel (USACE 2018). Outside this area (to the Northwest and Southeast), where the channel has not been stabilized by coastal infrastructure, variation in the North Tidal Channel appears to have reduced in recent years relative to variations in the late 1990s, though with localized migration. Should the channel begin to adjust shoreward outside the area in the vicinity of the SR105 groin the shoreline would be vulnerable to erosion and therefore additional analysis is likely required (DOE 2021).

- **Existing Hazard Mitigation:** The North Tidal Channel appears to have been largely stabilized in a localized region around the SR105 groin (constructed in 1998) (MM 2016), approximately 25% of the total study area.
- **Knowledge Gaps:** The long-term stability of the tidal channel position and depth has not been assessed. The tidal dynamics and long-term stability of the channel near Toke Point have not been assessed.

WAVES

The shoreline is subject to both ocean swell propagating into the bay (partially protected by ebb shoals), and to local wind-waves.

- **Hazard:** The wave climate varies seasonally with more energy (and therefore erosion) occurring in winter, and less energy in the summer (supporting accretion/widening of the beach). Wave energy hitting the shoreline increases (resulting in increased erosion) when deep portions of the tidal channel are close to shore since the shoreline has less capability to attenuate wave energy (MM 2016, MM 2020).
- **Existing Hazard Mitigation:** No breakwaters (wave energy mitigation) are constructed other than the portion of the shoreline sheltered by the SR105 groin. Mitigation for wave induced erosion is described below.
- **Knowledge Gaps:** There are limited (or no) measurements available in the study area. Understanding of the wave dynamics has relied on numerical models, in this area of very complex hydrodynamics.

SEDIMENT TRANSPORT & EROSION PATTERNS

For a majority of the study area the net sediment direction is from the Pacific Ocean side towards Empire Spit (Northwest to Southeast). The exception is the shoreline on the west side of the project area (facing the Pacific Ocean) where the shoreline has increased in width relative to 1985 (DOE 2017), this area may exhibit net sediment transport to the Northwest. Graveyard Spit and Empire Spit are at the eastern (downdrift) side of the study area and appear to be receiving less sediment relative to historical rates. Sediment lost offshore from North Willapa Bay may enter the greater Willapa Bay system, or be lost offshore in the Pacific Ocean depending on the tidal stage, freshwater flow, and sea state.

- **Hazard:** Graveyard Spit and Empire Spit appear to have a sediment deficit (more sediment leaving the area than coming in), contributing to erosion (USACE 2018).
- **Existing Hazard Mitigation:** Dynamic revetment (cobble berm), beach nourishment, and rock revetment projects have been constructed by various entities to mitigate erosion due to waves.
- **Knowledge Gaps:** Systemwide sediment budget and pathways are not fully documented or understood. No conclusive evidence of impact of groin/dike and WSDOT revetment on sediment transport. Interaction between the drainage ditch and groin/dike is not fully understood. The rate of sediment bypassing the groin and feeding Graveyard and Empire Spits is not well characterized.

HISTORIC AND ON-GOING MITIGATION MEASURES

Erosion mitigation projects in the study area date back to 1998 with the installation of the WSDOT Emergency Stabilization (SR105 groin). Since that time there have been various studies and projects undertaken in the study area by the Grayland Drainage District, Pacific County, private citizens, state agencies, and federal agencies to address hazards (Figure 3 1 provides a graphical summary). These projects have consisted of both green -softer techniques (including beach nourishment, dynamic revetments), as well as gray-harder techniques (rock revetments). The work conducted to date has been

complimentary and informative . The sponsors and leaders of these projects have coordinated as possible through technical committees and WECAN, but there has not been a formal process to coalesce around a master strategy for the shoreline as a whole, considering the different needs, and complex coastal processes and hazards in different segments of the shoreline. Lessons from these projects have been discussed during various technical committee meetings but are not well documented holistically.

A brief summary of these projects are listed below, as organized by shoreline stabilization type:

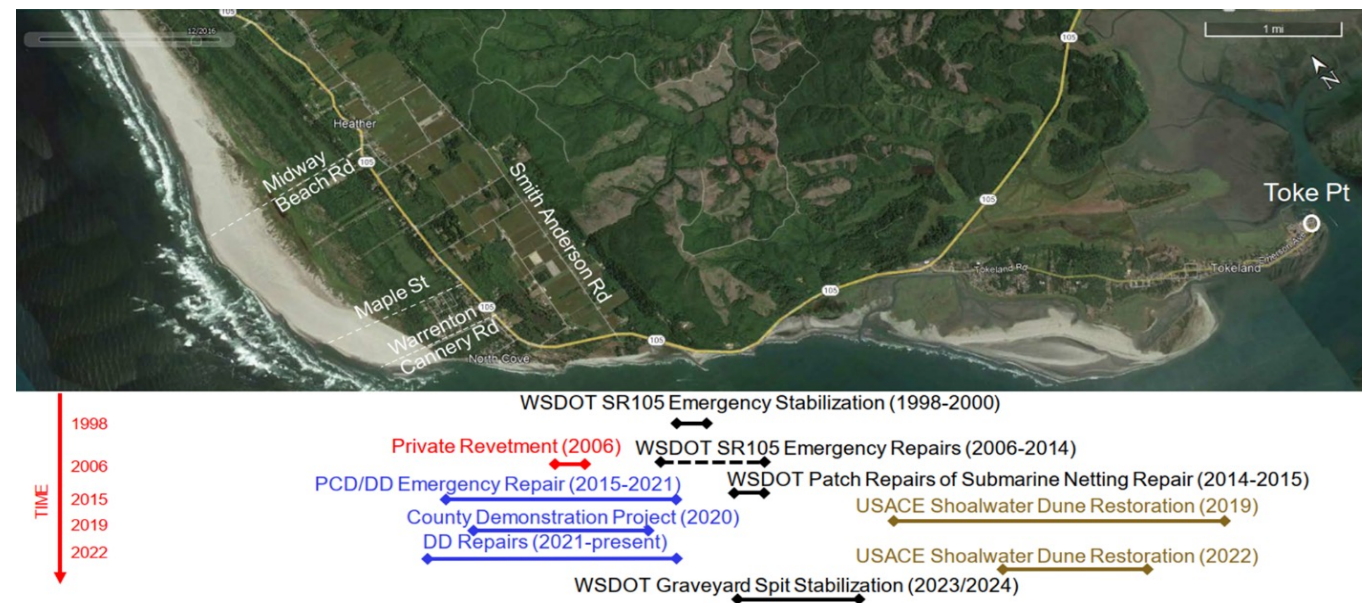
GREENER (SOFTER TECHNIQUES)

- Sand Dune/Beach Nourishment:
 - Locations: Empire Spit – Example project - Shoalwater Dune Restoration project. A 12,500ft. sand dune was constructed in 2012/2013. A repair was conducted in 2018, with additional emergency response in 2020 (USACE, 2021).
 - Purpose: Provide coastal (wave) storm damage reduction.
 - Performance Notes: Sand placed on the North Willapa Shoreline as dune or beach nourishment without a cobble feature have shown to have an increased maintenance cost relative to cobble berms, per liner foot of shoreline. The 2022 project incorporated a cobble toe as part of design.
- Dynamic revetments (cobble berms):
 - Locations:
 - Between the SR105 groin and approximately Warrenton Cannery Road: With maintenance of the dynamic revetment, the beach appears to have met the performance goal a dynamic equilibrium, supporting beach growth in the summer and improved protection in the winter when larger storm events typically occur. Angular rock performed well, and the area has seen natural dune vegetation become established.
 - WSDOT SR105 – East of SR105 Groin near Milepost 20: WSDOT constructed a dynamic revetment at the end of the existing WSDOT rock revetment near Graveyard Spit. Monitoring reports indicate the dynamic revetment generally performed as intended, dissipating wave energy during storm events. The rate of material loss required multiple cobble replacement projects and replacement of a portion of the dynamic revetment with a rock revetment in the most critical section.
 - Purpose: Dynamic revetments are not intended to directly mitigate for migration of the tidal channel but provide protection against the increased wave energy resulting from channel migration, and have shown to aid in recruiting sand in the summer months.
 - Performance Notes: Small large woody material groin features have shown to potentially reduce the volume of dynamic revetment material lost (reduced maintenance cost) due to longshore sediment transport.

GRAY (HARDER TECHNIQUES)

- Groin:
 - Location: SR-105 Groin – adjacent to Drainage Ditch #1, and directly seaward of SR-105.
 - Purpose: The tidal channel can be very dynamic, and the present SR 105 groin is a key feature in maintaining the shoreline along the shoreline adjacent to the structure.
 - Performance Notes: The groin has performed as intended, stabilizing the tidal channel in the area of the groin. As noted, the rate of sediment bypassing the groin and feeding Graveyard and Empire Spits is not well characterized.

- Rock Revetments:
 - Location(s):
 - WSDOT SR-105 Emergency Stabilization and Repairs adjacent to SR105 has been effective at protecting SR105 from erosion.
 - Private Revetment at Seamobile Road has been effective in localized shoreline erosion protection.
 - Purpose: Provide protection from wave-driven shoreline erosion
 - Performance Notes: This structure type reflects wave energy rather than absorbing, which does not support natural development of a beach. This feature likely results in less sediment recruitment on the shoreline in summer periods (relative to a cobble berm or natural beach), and may be affecting downdrift shoreline stability (e.g., towards Graveyard and Empire Spit). The private revetment structure at Seamobile Road has– though downdrift (to the east) the dynamic revetment has required a higher level of maintenance relative to other portions of the shoreline and been more vulnerable during storm events.



Historic and On-going Erosion Mitigation Efforts

REFERENCES

- Kaminsky, George. North Cove Beach Changes and Sediment Transport Observations. WECAN Meeting January 2021.
- Mott MacDonald (2020). Willapa North Shoreline Protection Demonstration Project Design Report. Pacific County.
- Mott MacDonald (2016). WECAN North Willapa Bay Shoreline Erosion Assessment.
- Talebi et al (2017). Assessment of Coastal Erosion and Future Projections for North Cove, Pacific County. Washington Department of Ecology.
- USACE (2018) Willapa Bay - WSDOT SR-105 Feasibility of longer-term shoreline stabilization alternatives between North Cove and Tokeland, WA.
- USACE (2021). SHOALWATER BAY DUNE REPAIR – FY2022. Semi-Annual Agency & Tribal Dredging Coordination Meeting. 4 November 2021

APPENDIX C: CATALOGUE OF EXISTING INFORMATION/STUDIES

Agency Providing Data	Year	Data Category	Type	Title	Author(s) - If Applicable	Notes
Diking District	1900	Literature	Dike Description	Pacific County Commissioners Records		
Diking District	1904	Imagery & Maps	Maps	Drainage District No. 1 Survey		
Diking District	1904	Literature	Contract	Swank Contract		
Diking District	1933	Imagery & Maps	Orthoimagery	Grays Harbor-Olympia Canal Project Aerial Map		
Diking District	1961	Literature	Report	Watershed Work Plan - Grayland Watershed - Grays Harbor & Pacific Counties		
Diking District	2011	Regulatory	Letter	WDFW Cranberry bogs and WDFW Regulatory Authority		
Diking District	2017	Regulatory	Shoreline Exemption	Shoreline Exemption #P1700545	Pacific County Drainage District	
Diking District	2017	Regulatory	HPA	North Cove Shoreline Defense HPA		
DOT	2000-2002	Elevation	Topography			
DOT	2012	Elevation	Topography	February 2012 Dike Topo Survey		
Hart Crowser	1997	Literature	Memorandum	Geotechnical Engineering Assessment - Rock Groin & Underwater Geotextile Tube Dikes	John Verduin & Garry Horvitz	
Mott MacDonald	2020	Literature	Master Plan Report	Willapa North Shoreline Protection Demonstration Project Design Report	Aaron Porter, Shane Phillips	
Mott MacDonald	2020	Costs	Cost Estimate	Dynamic Revetment Construction Cost Estimate		
Mott MacDonald	2020	Regulatory	Biological Assessment	Willapa Bay Demonstration Project BA		
Mott MacDonald	2020	Regulatory	JARPA	Willapa Bay Demonstration Project JARPA		
Mott MacDonald	2020	Regulatory	SEPA	Willapa Bay Demonstration Project SEPA		
Mott MacDonald	2020	Design	PS&E	North Shoreline Protection Demonstration Project PS&E		
Mott MacDonald	2020	Regulatory	Cultural Resource Survey	Cultural Resource Survey for the North Willapa Shoreline Protection Project	Archaeological Investigations Northwest, Inc.	
PIE	Unknown	Literature	Memorandum	SR105 Emergency Stabilization Project Beach Nourishment Maintenance Costs, Options, and Construction Scheduling		
PIE	Unknown	Literature	Memorandum	Channel Migration and Shoreline Erosion Rate Estimates Accuracy Analysis		

Agency Providing Data	Year	Data Category	Type	Title	Author(s) - If Applicable	Notes
PIE	1997	Literature	Technical Document	Groin maintenance & rehabilitation summary		
PIE	1997	Literature	Report	Past & Predicted Future Channel and Shoreline Migration Rates in Willapa Bay	PIE	
PIE	1999	Literature	Memorandum	Groin issues - SR105 Emergency Stabilization Project		
PIE	1997	Literature	Memorandum	Preliminary Analysis - Dike Configuration - Initial Design Determinations Based on Results of 2D Hydrodynamic Modeling		
PIE	1997	Literature	Letter	Willapa Bay Stabilization Study - Quarry Evaluations	Richard J. Bielefeld (CEG)	
PIE	2003, 2006	Elevation	Profiles	Topographic Profiles		
PIE	2000, 2006	Elevation	Profiles	Bathymetric Profiles		
Shannon & Wilson	2018	Geotech	Sloep Stability Analysis	Slope Stability Analysis - Submarine Rock Groin	Shannon & Wilson	
Shannon & Wilson	2019	Literature	Letter	Re: Geologic Review Summary North Willapa Bay Shoreline Protection Project	Stephanie Wanderer, LG	Includes geotech borings
TU Delft	2009	Literature	Thesis	An Approach to medium-term coastal morphological modelling	Giles Ransom Lesser	
USACE	2000	Literature	Report	Study of Navigation Channel Feasibility, Willapa Bay	Nicholas C. Kraus	
USACE	2001	Modeling	Model	CMS model files		
USACE	2002	Literature	Report	Study of Navigation Channel Feasibility, Willapa Bay; Report 2 Entrance Channel Monitoring and Study of Bay Center Entrance Channel	Nicholas C. Kraus, Hiram T. Arden, David P. Simpson	
USACE	2002	Literature	Paper	Channel Reliability Study, Willapa Bay	William C. Seabergh, et. al.	
USACE	2007	Literature	Report	Shoalwater Bay Shoreline Erosion, WA; Flood and Coastal Storm Damage Reduction; Appendix 1 Engineering Analysis and Design (Final Draft)		
USACE	2007	Modeling	Model	ADCIRC model		
USACE	2009	Literature	Report	Shoalwater Bay Shoreline Erosion, WA; Flood and Coastal Storm Damage Reduction; Appendix 1 Engineering Analysis and Design		
USACE	2009	Literature	Report	Shoalwater Bay Shoreline Erosion, WA; Flood and Coastal Storm Damage Reduction; Final Post-Authorization Decision Document and Final Environmental Assessment		
USACE	2009	Literature		Shoalwater Bay Decision Final		
USACE	2009	Literature	Report	Shoalwater Bay EA Final		
USACE	2010	Literature	Paper	Barrier Island Restoration for Storm Damage Reduction: Willapa Bay, WA	David R. Michalsen, et. Al.	
USACE	2011	Design	Drawings	Shoalwater Bay FY2011 Dune Restoration Plan		
USACE	2012	Literature	Presentations	May 2012 Workshop PPT Slides	Babcock, Morang, Gelfenbaum, Smith, Nelson, Mark	
USACE	2014	Elevation	Topobathy LiDAR	2014 USACE NCMP Topobathy Lidar DEM: Washington		
USACE	2016	Elevation	MBES, Transects			
USACE	2017	Literature	Paper	Framework geology of Cape Shoalwater and NW Willapa Bay	Heidi M. Wadman, et. al.	
USACE	2018	Elevation	MBES			

Agency Providing Data	Year	Data Category	Type	Title	Author(s) - If Applicable	Notes
USACE	2019	Literature	Report	Section 103 Federal Interest Determination - North Cove Shoreline Protection Project		
USACE	2008-2016	Imagery & Maps	Graphic	Thalweg Positions - 2008-2016		
USACE	2008-2016	GIS	Shapefiles	Thalweg Positions - 2008-2016		
USGS	2000-2001	Elevation	Topo & bathy transects	csw_050501_lineXXX_Y.xyz		
USGS	2002	Literature	Paper	Large-scale cycles of holocene deposition and erosion at Willapa Bay	Robert A. Morton, et. al.	Includes geotech borings
WDOE	1911-2003	GIS	Shapefiles	Historical Shoreline Positions		
WDOE	1997-1999	Geotech	Sieve Analysis	Sediment Data from CSW Profile (1997-1999)		
WDOE	2014-2016	Elevation	MBES, MLS, Topo	Shoalwater Bay Survey Campaign Data (2014-09; 2015-04; 2015-08; 2016-04)		
WDOE	2015-2018	Elevation	Transects	Ocean Shores Dynamic Revetment (Profiles 3.1-3.3 & X1North) from December 2015 through June 2018.		
WDOE	2017	Literature	Report	Shoalwater Bay Berm Monitoring: 2014-2016 Assessment of Coastal Morphology Change	Heather Weiner, et. al.	
WDOE	2017	Literature	Report	Assessment of Coastal Erosion and Future Projections For North Cove, Pacific County	Bobbak Talebi, et. al.	
WDOE	2017	Literature	Letter	Re: Response to WSDOT SR105 North Cove Vicinity-Washaway Beach Erosion Protection Project Comments		
WDOE	2017	Literature	Letter	Re: WSDOT SR 105 North Cove Vicinity - Washaway Beach Erosion Protection Project	Bobbak Talebi, George Kaminsky	
WDOE	2018-2019	Elevation	Scarp Toe Positions	June, September, December 2018 & January, February, March 2019.		
WDOE	2018	Geotech	Sieve Analysis	Sediment Data from Profiles 213 and 230		
WDOE	2018	Elevation	Profiles	September 2018 - Profiles 201-232		
WDOE	2018	Elevation	Profiles	December 2018 - Profiles 201-232		
WDOE	2018	Elevation	Topo & MBES	June 2018 Topographic & MBES Surveys		
WDOE	2019	Literature	Report	North Cove Dynamic Revetment Monitoring: Winter 2018-2019	Heather Weiner, et. al.	
WDOE	2019	Elevation	Topographic Survey	June 2019 Topographic Survey		
WDOE	2019	Elevation	Profiles	January 2019 - Profiles 201-232		
WDOE	2019	Elevation	Profiles	March 2019 - Profiles 201-232		
WSDOT	1955	Imagery & Maps	Aerials	1955 Aerial Photos		
WSDOT	1956	Geotech	Test Results	Undisturbed Samples Test Data - North River to North Cove (T-677 thru T-687)		
WSDOT	1957	Literature	Report	District Soils and Resurfacing Report		
WSDOT	1957	Geotech	Borings	North Cove to North River Ced River Borings & Field Notes (Job 1636)		
WSDOT	1957	Geotech	Borings	Soil Profile for H-XU-57 North Cove to North River (Job 1636)		

Agency Providing Data	Year	Data Category	Type	Title	Author(s) - If Applicable	Notes
WSDOT	1957-1958	Geotech	Borings	Soil Profiles (Job 1636)		
WSDOT	1967-1968	Geotech	Borings	North Cove Cape Shoalwater Boring Logs (B-X-67, Job L-3577)		
WSDOT	1968	Geotech	Test Results	Consolidation Test Data		
WSDOT	1968	Literature	Report	District Soils Report	L.J. Gadbois, PE & V. Lieutuvietis, PE	
WSDOT	1968	Geotech	Sample Transmittals	Job L-3577 Sample Transmittals		
WSDOT	1968	Literature	Letter	Review of Shannon & Wilson Soils Report	R.V. LeClerc, H.E. Sandahl	
WSDOT	1968	Literature	Report	Soils Investigation WA State Highway SSH 13-A Hill Line Relocation	Shannon & Wilson	
WSDOT	1968	Literature	Report	Supplemental District Soils Report		
WSDOT	1968	Geotech	Test Results	Triaxial Test Results		
WSDOT	1968	Geotech	Borings	H-X-68 (Job L-3577) Boring Logs - North Cove Vicinity		
WSDOT	1969	Literature	Report	Supplemental Soils Report	L.J. Gadbois, PE & V. Lieutuvietis, PE	
WSDOT	1977	Literature	Report	Marine Geophysical Investigation of SR105 North Cove Area	Golder Associates	Includes sidescan sonar, seismic reflection data
WSDOT	1977	Literature	Report	Geological study of the North Channel of Willapa Bay		
WSDOT	1984	Imagery & Maps	Maps	Coastal Area Maps		
WSDOT	1995	Literature	Email Correspondence	Embankment Erosion SR105 - Field Review	Steve Lowell	
WSDOT	1995 & 1998	Imagery & Maps	Photos	Washaway Beach Photos		
WSDOT	1996	Literature	Notes	Summary Review of DOE Water Well Report		
WSDOT	1997	Geotech	Borings	Willapa Bay Channel Restoration Project Boring Logs		
WSDOT	1997	Literature	Memorandum	Civil Design Section comments on "Environmental Assessment for the SR105 Emergency Stabilization Project"	Federal Highway Administration & WSDOT	
WSDOT	1997	Geotech	Borings	Washaway Beach (Job L-2431) B-X-97 Boring Logs		
WSDOT	1997	Literature	Report	Willapa Bay Emergency Stabilization Project Environmental Assessment		
WSDOT	1997	Literature	Field Notes	Field Trip Report (Jan 8, 1997) - SR105 Willapa Bay ER Project	C. Dunn	
WSDOT	1997	Literature	Email Correspondence	Geotechnical Observations - SR105 - North Cove	Martin Fisher	
WSDOT	1997	Literature	Memorandum	Sr105 Emergency Stabilization Project Geotechnical Container Design		
WSDOT	1997	Literature	Package	Willapa Bay Channel Restoration Project - Historical Shoreline Trends, Geological Maps, Channel Details, and Stabilization Plans		
WSDOT	1997	Geotech	Test Results	Sediment Gradation associated with H-X-97 Borings		
WSDOT	1997	Geotech	Drill Hole	Drill Hole Locations		
WSDOT	1997	Elevation	Cross Sections	Hydraulic Survey Results - East and West Dike Alignments in North Channel	Vladimir Shepsis (PIE)	

Agency Providing Data	Year	Data Category	Type	Title	Author(s) - If Applicable	Notes
WSDOT	1997	Seismic	Package	P-Wave Velocity Surveys, Erosion Rates, Channel Migration	Golder Associates	
WSDOT	1997	Literature	Letter	Questions for Technical Review of Hydraulic and Geologic Engineering	Gerald E Smith, PE	
WSDOT	1997	Seismic	Seismic Refraction Survey	Seismic Refraction Survey		
WSDOT	1997	Literature	Letter	Stabilization Project Concerns	Gerald E Smith, PE	
WSDOT	1997	Literature	Email Correspondence	SR105 Technical Questions	Martin Fisher	
WSDOT	1997	Literature	Package	Willapa Bay Channel Restoration Project Figures - Geologic Information, Cross Sections		
WSDOT	1997	Literature	Report	Geological Study of the North Channel of Willapa Bay - Vicinity of North Cove: Willapa Bay Channel Restoration Project	D. Jackson; T.M. Allen	
WSDOT	1998	Literature	Email Correspondence	SR105 Geotextile Container Dike - Design Summary Report Review	Tony M. Allen	
WSDOT	1998	Literature	Report	Technical Summary of Geotextile Container Dike Design	Shane Phillips (PIE)	
WSDOT	1998	Literature	Comments	PS&E Comments - North Cove Emergency Stabilization - Stage 3		
WSDOT	1999	Literature	Standards	Pacific County Road Standards		
WSDOT	2002	Literature	Report	Effects of shoreline hardening and shoreline protection features on fish utilization and behavior at Washaway Beach, WA (Report 2)		MC Miller, et. al.
WSDOT	2005	Literature	Report	SR105 Benefit-Cost Analysis	Northern Economics Inc.	
WSDOT	2005	Imagery & Maps	Photos	SR105 Embankment Failure Photos		
WSDOT	2005-2012	Elevation	Singlebeam Elevations	2005, 2008, 2010, 2012		
WSDOT	2006	Literature	Email Correspondence	Washaway Beach Geotextile - Review & Recommendations	Doug Anderson	
WSDOT	2006	Literature	Letter	SR105 Embankment Erosion ER and Short-Term Geotechnical Recommendations	T.M. Allen, D.A. Anderson	
WSDOT	2006	Imagery & Maps	Photos	SR105 Embankment Erosion Site Visit Photos		
WSDOT	2006	Literature	Report	SR105 MP20 Emergency Evaluation & Technical Recommendations Report	Jim Park	
WSDOT	2015	Literature	Report	Analysis of Options for Maintaining SR105 near Washaway Beach	Jim Park, Garret Jackson, Rob Schanz	
WSDOT	2016	Regulatory	JARPA	SR105 North Cove Vicinity Washaway Beach Erosion Protection Project JARPA		
WSDOT	2016	Literature	Memorandum	Re: 41051E - Washaway Scope Revision - Repair Concepts and Appropriate Quantities	Rob Schanz, Garrett Jackson	
WSDOT	2016	Imagery & Maps	UAV Orthomosaic	North Cove SR105 Orthomosaic Aerial & KML File		
WSDOT	2016	Elevation	DTM	September 2016 SR105 North Cove Survey		
WSDOT	2017	Costs	Bid Tabs	SR105 North Cove Vicinity Erosion Protection 2017 Bid Tabs (Contract 009130)		
WSDOT	2017	Literature	Report	Hydraulic Summary: SR105/North Cove Vicinity Erosion Protection 2017; MP 19.58 to MP20.58	Colin Newell, PE	
WSDOT	2017	Design	Drawings, Quantities	SR105 North Cove Vicinity Erosion Protection		

Agency Providing Data	Year	Data Category	Type	Title	Author(s) - If Applicable	Notes
WSDOT	2017	Design	Contract Documents	SR105 North Cove Vicinity Erosion Protection Contract Provisions & Plans		
WSDOT	2018	Literature	Report	SR 105 Feasibility of long-term shoreline stabilization alternatives between North Cove and Tokeland, WA	David R. Michalsen, PE	
WSDOT	1950s	Geotech	Test Results	Consolidation Test Results		
WSDOT	1950s	Geotech	Test Results	Triaxial Test Results		
WSDOT & PIE	1997	Design	Drawings	Geotextile Container Dike Site Plan - SR105 North Cove Vicinity Emergency Stabilization - Stage 2		
WSDOT & PIE	1997	Design	Drawings	Groin Plan & Sections - SR105 Emergency Stabilization Project Phase 1 Construction		
WSDOT & PIE	1999	Design	Drawings	SR105 North Cove Vicinity Monitoring Program		
WSDOT & PIE	2000	Design	Drawings	Island Location & Dike Detail		

APPENDIX D: RECOMMENDATIONS FOR SHORELINE MONITORING PROGRAM AND RESEARCH

Recommendations on monitoring and research have been developed based on the synthesis of coastal processes and historic/on-going projects. Because the shoreline processes within the study area are interconnected, it is important that the project area be both monitored and researched/analyzed as a whole. The intent of these recommendations is to provide a basis for risk-based decisions, and to support a cohesive approach to future hazard mitigation projects. Monitoring and research recommendations are based in part on the knowledge gaps and hazards included in this memo.

MONITORING

Preliminary recommendations to support a future monitoring program have been developed. A summary of recommended monitoring is provided in Table 1. Project stakeholders and monitoring teams should be consulted as part of the development of a more detailed monitoring program. This information should be included in a regular reporting interval (annual or other) and made available to stakeholders. On-going reports should be coordinated with the Drainage District, and others, who may be conducting maintenance or other project work in the study area, so that such activities are included in the report. As shown in the figure to the right, it is recommended that the monitoring be carried out for the entire master plan study area.

Future monitoring reports should include all collected data, comparative analyses, and recommendations for actions to consider. As part of development of the monitoring report, performance or risk criteria need to be established for the different reaches of the shoreline, to trigger actions. Due to the dynamic nature of the beaches, it is important to consider the following when creating a schedule for monitoring events:

- Seasonality: Beaches experience seasonal changes, which could result in an overestimate or underestimate of changes to the beach
- Tides: When taking photography, differences in water surface elevation can give incorrect representations of shoreline change for a period of time. Time of day for photos can also affect qualitative assessment.



Monitoring Recommendations

TABLE 1: PRELIMINARY MONITORING RECOMMENDATIONS

Parameter	Purpose(s)	Methodology
Topographic and Hydrographic Surveys	<p>Track changes in:</p> <ul style="list-style-type: none"> Beach volume, elevation and slope (above and below water line). North Tidal Channel thalweg location and trends. <p>Provide validation of morphological models which may be used to assess hazard mitigation alternatives.</p> <p>Aid in refinement of maintenance program costs.</p>	<p>Surveys should be conducted according to USACE standards, with multi-beam data preferred where available. Locations of transects should align with historical surveys (where possible), be collected during the same season, and be consistent on each survey. Each survey should be compared to previous surveys and would require data review and interpretation to answer questions such as:</p> <ul style="list-style-type: none"> Does the thalweg appear to be shifting? Is the nearshore beach slope changing? Which areas appear most vulnerable (according to specific vulnerability criteria).
Ground-Level Photography	<p>Ground level photography along the constructed and adjacent beaches is recommended to document ground level changes to the beaches. The photographs would be used to assess changes to beaches, public and private infrastructure, and monitor dune vegetation.</p>	<p>Ground level photography should be conducted annually and should be established along photography stations to maintain an accurate reference for comparison. Photography stations should be established at benchmarks. Photos should be compared to existing photos and a comparative qualitative analysis should be submitted annually.</p>
Aerial Photography	<p>Aerial photography would support the determination of shoreline changes and support the assessment of large-scale shoreline change that may be occurring in the area.</p>	<p>A qualitative and quantitative analysis of the aerial photographs would consist of documenting and measuring shoreline changes in the study area, and interpreting landforms changes that are not evident from the ground.</p>

RESEARCH

Due to the complexity of the system, there are coastal processes that are either not fully understood, or a consensus among stakeholders has not been established. Therefore, additional research is needed to support development, design, and construction of hazard mitigation features for the project area. Recommended research items are outlined in Table 2.

TABLE 2: RECOMMENDED RESEARCH ITEMS

Parameter	Assessment Recommendation
Shoreline Erosion	<p>Shoreline change projections for the entire study area should be updated.</p> <p>Updates should be consistent with work conducted by DOE in 2017 for the northern section of the project extents</p>
Coastal Morphology	<p>A nearshore coastal morphology study on longshore sediment transport and sediment bypass around SR105 groin and drainage ditch should be conducted.</p> <p>Tidal channel morphologic analysis should be conducted to aid in understanding of long-term channel migration and projections of future shoreline changes. This is critical to identify the need and solution for long-term shoreline erosion mitigation measures in response to the tidal channel.</p>
Wave Data	<p>A wave buoy located within Willapa Bay is needed to validate the numerical models used in the morphological studies. The buoy should be outfitted with a multitude of instruments to capture wave parameters, water levels, and current profiles.</p> <p>Depending on the length of deployment, it may also support the monitoring of change in beach slope with storm conditions (either directly or through validation of a hindcast model).</p>
Flooding	<p>Coastal flooding and inundation mapping for the project area relative to sea level rise, climate change, and storm surge, and potential tide gate failure scenarios should be conducted.</p>
Hazard Combinations	<p>Present and future combinations of hazards and need to be assessed to assist in development of cost-benefit analysis of mitigation measures, accounting for future maintenance needs.</p>
Nature-based Measures	<p>Shoreline protection measures implemented throughout the region should be monitored to evaluate their performance and changes under varying conditions. This data will help to better quantify maintenance estimates for nature-based solutions and help to inform the design and implementation of future shoreline protection measures in the project area.</p>

APPENDIX E: GRANT FUNDING OPPORTUNITIES

PACIFIC COUNTY NORTH WILLAPA EROSION STABILIZATION – FUNDING THEME OUTCOMES

AVAILABLE FUNDING SOURCES

- Federal Grants
- State Grants
- USACE Section 103 Projects
- Congressional and Legislative Community Project Funding Requests (earmarks)

TIMING – STATE AND FEDERAL FUNDING CYCLES

- Funding occurs on routine cycles and requires advance planning to prepare

STAFF CAPACITY

- Identify funding for community level staff person to manage funding and activities for erosion protection

PACIFIC COUNTY NORTH WILLAPA EROSION STABILIZATION SECURING FUNDING

OUTREACH AND EDUCATION OF PURPOSE AND NEED

- Match the purpose and need for funding - variety of purposes, i.e. construction, planning and design
- Identify potential match through congressional/legislative community project requests, state and federal funding sources
- For grants, funding awards are competitive on a larger scale with other projects

TYPE OF FUNDING

- Funding Purposes: Planning, Construction, Acquisition, Design, Flood Mapping, Relocation, Monitoring Outreach, Education and Partnerships
- Legislative appropriations works well for capital construction but aren't aligned with the need for ongoing monitoring and maintenance
- Department of Ecology is proposing to the Governor a monitoring and maintenance fund for the next biannual budget

FUNDING SOURCES PREVIOUSLY AWARDED TO PROJECT AREA

Grant Agency	Program Name	Purpose	Awardee
FEMA	Flood Mitigation Assistance Grants	2022-2023 Master Plan	Pacific County
FEMA	Pre-Disaster Mitigation Program (Replaced with BRIC)	2020-2025 Shoalwater Bay Tribe Hazard Mitigation Master Plan	Shoalwater Bay Tribe
IIJA	CAP Section 103 Program	Feasibility Study	Shoalwater Bay Tribe and Pacific County
Pacific Conservation District	Emergency Repair	2017-2018 Emergency Repair	Drainage District
Washington State Conservation Commission Shellfish Program	Demonstration Project	2018-2019 Demonstration Project	Pacific County

FUNDING SOURCES PREVIOUSLY AWARDED TO PROJECT AREA

Grant Agency	Grant Funding	Available Award Amount	Match	Purpose	Application Due																			
					J	F	M	A	M	J	J	A	S	O	N	D	J							
NOAA/NFWF	America the Beautiful Challenge	\$5,000,000	90% Federal/10% Non-Federal	Planning • Construction • Acquisition • Design								●												
FEMA	Cooperating Technical Partners Program	\$1,000,000	No match required	Flood Mapping								●												
FEMA	Flood Mitigation Assistance	\$30,000,000	75-90% Federal/25-10% Non-Federal	Planning • Construction • Acquisition • Design									●											
Pacific Conservation District	Building Resilient Infrastructure Communities	\$50,000,000	75-90% Federal/25-10% Non-Federal	Planning • Construction									●											
FEMA	Hazard Mitigation Grant Program	\$50,000,000	90% Federal/10% Non-Federal	Planning • Construction • Acquisition	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●

1 Hazard Mitigation Grant Funding awards are based on a percentage depending on estimated total or aggregate cost of disaster assistance. They are awarded after each Presidential Declaration of a major disaster
 2 Building Resilient Infrastructure Communities national competition cap is up to \$50 million per subapplication
 3 Flood Mitigation Assistance Grants and America the Beautiful Challenge Grants range per type of application and can be less than \$ 1 million for certain types of grants

GRANT FUNDING OPPORTUNITIES – MORE FEDERAL GRANTS

Grant Agency	Grant Funding	Available Award Amount	Match	Purpose	Application Due																		
					J	F	M	A	M	J	J	A	S	O	N	D	J						
U.S. DOT	Rural Surface Transportation Grant Program	\$25,000,000	80% Federal/20% Non-Federal	Planning • Construction • Acquisition • Design					●														
NOAA	Coastal Zone Management Program	\$6,000,000	No match required	Planning • Construction • Design													●						
NOAA	Coastal Habitat Restoration and Resilience Grants for Underserved Communities	\$1,000,000	No match required	Planning • Design • Permitting • Monitoring									●										
NOAA	Transformation Habitat Restoration and Coastal Resilience Grants	\$15,000,000	No match required	Planning • Design • Permitting • Monitoring										●									
NFWF	Five Star and Urban Waters Program	\$50,000	Meet or exceed 1:1	Construction • Outreach • Education	●																		
EPA	NEP Coastal Watersheds Program	\$250,000	Match must be an additional 33% of the requested amount	Construction • Assessment • Partnerships • Prevention					●														
NOAA	National Coastal Resilience Fund	\$10,000,000	No match required	Planning • Construction • Design					●														

1 State Coastal Zone Management Programs are the applicant for those grants, funding can go to subgrantees
 2 NOAA may choose to combine FY 22 & FY 23 grant opportunities for Coastal Habitat Restoration and Resilience Grants for Underserved Communities and the Transformation Habitat Restoration and Coastal Resilience Grants. If this is the case, the next time they will be available is 2024

GRANT FUNDING OPPORTUNITIES – STATE GRANTS

Grant Agency	Grant Funding	Available Award Amount	Match	Purpose	Application Due											
					J	F	M	A	M	J	J	A	S	O	N	D
Ecology	Flood Control Assistance Account Program	\$250,000	75-80% State/20-25% Non-State	Planning • Construction									●			
Ecology	Floodplains by Design	\$10,000,000	100% State (for economically disadvantaged communities)	Construction • Acquisition							●					
WA RCO	Aquatic Lands Enhancement Act	\$1,000,000	80% State/20% Non-State	Construction • Acquisition					●							
WA RCO	Washington Coast Resiliency and Restoration Initiative	\$2,000,000	No match required	Construction • Acquisition												●

¹ State grants are awarded on a biannual basis – all are 2024 except for the Flood Control Assistance Account program which is 2023

INFRASTRUCTURE INVESTMENT AND JOBS ACT – NOFO NOT RELEASED YET

Grant Agency	Program Name	Match	Purpose
U.S. DOT	Promoting Resilient Operations for Transformative, Efficient and Cost-Saving Transportation (PROTECT) Grants – Discretionary Grants	80-100% Federal/20-0% Non Federal	Planning • Construction
FEMA	Hazard Mitigation Revolving Loan Funds	Revolving Loan Program More will be known about additional purposes for funding when the NOFO is released	Construction

¹ PROTECT Formula Grants have been given to states and funding will be distributed for five years

INFLATION REDUCTION ACT – PENDING CONGRESSIONAL APPROVAL

Grant Agency	Program Name	Match	Purpose
NOAA	Investing in Coastal Communities and Climate Resilience	TBD	Funding available for conservation, restoration and protection of coastal and marine habitats and resources to enable coastal communities to prepare for extreme storms and other changing climate conditions More information will be released as legislation moves forward and agencies develop NOFOs

POTENTIAL APPROPRIATIONS REQUESTS

HOMELAND SECURITY APPROPRIATIONS BILL

- Pre-Disaster Mitigation Grants
 - Funding range \$150,000 and \$9,950,000
 - Only projects that meet the requirements in the most recent Notice of Funding Opportunity for the Building Resilient Infrastructure and Communities grant program will be considered for funding
 - Cost-share requirement 75% Federal/25% Non-Federal for Pacific County, 90% Federal/10% Non-Federal for the Shoalwater Bay Tribe

ENERGY AND WATER APPROPRIATIONS BILL

- U.S. Army Corps of Engineers
 - Investigations
 - Construction
 - Mississippi River and Tributaries
 - Operation and Maintenance
 - The Subcommittee may provide funding for a limited number of Continuing Authorities Program projects, if any, in the Construction account.
 - Project needs to be authorized, for example for in the Water Resources Development Act which is passed by Congress every two years
 - Cost share is 65% Federal/35% Non-Federal for CAP Section 103 Construction
 - CAP Section 103 Construction Federal share shall not exceed \$10 million

TRANSPORTATION, HOUSING AND URBAN DEVELOPMENT APPROPRIATIONS BILL

- Highway Infrastructure Projects
 - Eligible projects are in Section 133(b) of title 23 United States Code
 - Projects must be capital projects or project-specific planning/design for capital project
 - Supported by state or tribal government that would administer the project. Inclusion in a Statewide Transportation Improvement Plan
 - Administered by public entities or tribal entities
 - Cost share is 80% Federal/20% Non-Federal
 - Average award for FY 2022 was \$2.7 million. Committee may consider project amounts of up to \$7 million by FY 2023. Caps will be determined by the Chairman after reviewing the full universe of requests

APPENDIX F: PRIMER ON LEGISLATIVE OUTREACH

STEPS TO SECURE STATE LEGISLATIVE COMMUNITY PROJECT REQUEST

SEPTEMBER
Decide funding request and purpose

SEPTEMBER
Compile support letters, i.e. WE-CAN Members, Local Associations and Governments, Chambers of Commerce

SEPTEMBER/ OCTOBER
Meet with staff from the Governor’s Office of Financial Management responsible for the capital budget for the Department of Ecology

OCTOBER/ NOVEMBER
Meet with all three members of the 19th Legislative Delegation

JANUARY
Applications open from both the House and the Senate for legislative community project requests

FEBRUARY
Deadline to complete an application for both House and Senate

STEPS TO SECURE STATE LEGISLATIVE COMMUNITY PROJECT REQUEST

FUNDING IS USED FOR A FACILITY PROVIDING IMPORTANT PUBLIC BENEFITS.

THE FUNDING REQUESTED IS A SMALL PORTION OF THE TOTAL PROJECT FUNDING 25% OR LESS.

FUNDING WILL RESULT IN A COMPLETED PROJECT OR PHASE USABLE BY THE PUBLIC FOR THE INTENDED PURPOSE WHEN STATE FUNDS ARE EXPENDED.

FUNDING IS FOR A PROJECT THAT IS READY FOR CONSTRUCTION OR RENOVATION AND WILL BE COMPLETED IN THE BIENNIUM

APPROPRIATIONS COMMITTEE GUIDELINES FOR COMMUNITY PROJECT FUNDING MEMBER REQUEST PROCESS

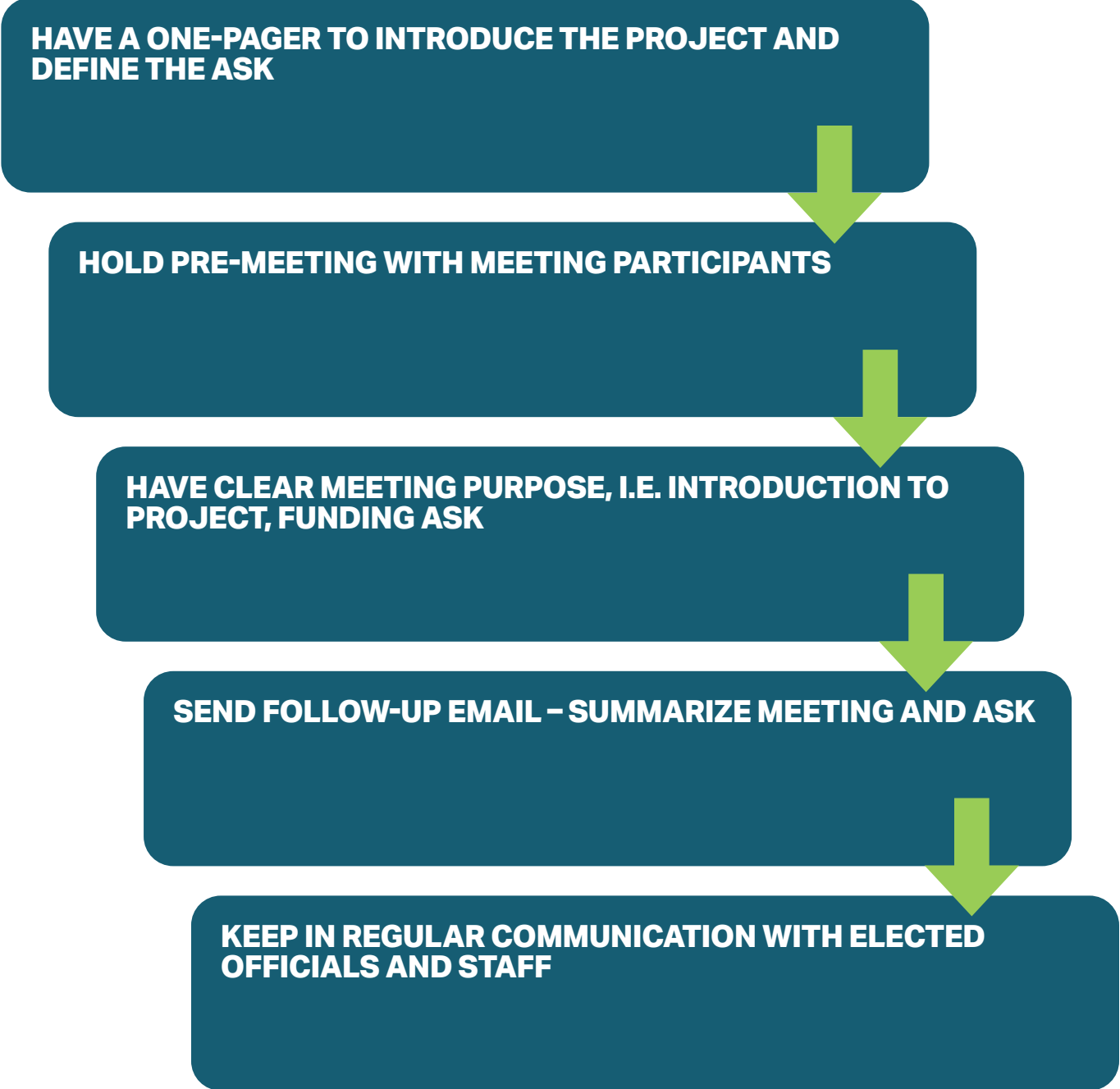
GENERALLY, PROJECT ELIGIBILITY REQUIREMENTS FOR FUNDING ARE THE SAME AS FOR COMPETITIVELY AWARDED PROJECTS THROUGH EXISTING FEDERAL GRANT PROGRAMS.

SEVERAL OF THE PROGRAMS ELIGIBLE FOR COMMUNITY PROJECT FUNDING REQUESTS REQUIRE A STATE OR LOCAL MATCH FOR PROJECTS EITHER BY STATUTE OR ACCORDING TO LONGSTANDING POLICY. THE COMMITTEE WILL NOT WAIVE THESE MATCHING REQUIREMENTS FOR COMMUNITY PROJECT FUNDING REQUESTS, SO IT IS IMPORTANT TO ENSURE THAT YOU CAN MEET THE MATCHING REQUIREMENTS BEFORE REQUESTING A PROJECT.

STEPS TO SECURE STATE LEGISLATIVE COMMUNITY PROJECT REQUEST

- Who can submit requests?
 - State, local and tribal governments and non-profits
- Submit requests to U.S. Senators and House of Representative member (In January contact the personal offices for their internal deadline, which is ahead of the April and May Committee deadlines)
- Need several community support letters
- Information Required for Requests:
 - Official Project Name
 - Project Purpose
 - Justification
 - Project Budget
 - Project Financing
 - Timeline to Completion

SUGGESTIONS FOR EFFECTIVE MEETINGS



APPENDIX G: EXAMPLE OF TWO-PAGERS – GRAVEYARD SPIT

SR 105 / Graveyard Spit Dynamic Revetment and Dune Restoration

On behalf of the local communities of North Cove, Tokeland, Pacific County, the Shoalwater Bay Tribe, and Willapa Erosion Control Action Now (WECAN), Washington State Department of Transportation (WSDOT), WA Department of Ecology, and USACE have finalized the design and permitting for the Graveyard Spit Restoration and Resilience Project (June 2022) and are seeking funding for construction of the design.

The long-term coastal erosion rates at Graveyard Spit are some of the highest of any coastline in the mainland U.S., with up to 107 feet of shoreline loss per year.

This rapid coastal erosion represents a significant hazard to State Route (SR) 105, the sole transportation route serving local communities of Tokeland and North Cove, and the Shoalwater Bay Tribal Reservation that provides access to medical facilities, residential areas, and agricultural lands.

The Graveyard Spit Project will advance community resilience goals to provide vital coastal hazard mitigation for State Route 105, ensuring the region's primary transportation, utility, and emergency access corridor remains functional.

Hazards

- › Coastal Erosion
- › Flooding
- › Sea Level Rise
- › Storm Surge

The Graveyard Spit Restoration and Resilience Project represents a collaborative solution to address ongoing coastal hazards and improve community and regional resilience. The project team has been working together through a collaborative locally led forum, Willapa Erosion Control Action Now (WECAN), to address severe erosion, flooding, and sea level rise since 2015.



Photo: WA Department of Transportation



Community Lifelines



SR 105 / Graveyard Spit Dynamic Revetment and Dune Restoration

Details

Project Owner
Washington State Department of Transportation

Type of Project
Nature-Based Shoreline Protection

Area of Impact
Graveyard Spit, WA and surrounding communities. SR 105 between mile posts 19.50 to 20.10.

Key Partnerships

This project is part of local communities' regional effort to find a holistic solution to address impacts to life, property, safety, economy, and the environment on the north shore of Willapa Bay.

Ecology and WSDOT have been leading the Graveyard Spit Project because the communities of the region lack the staff capacity and resources to seek funding for this project on their own. This a common challenge for communities within Pacific County, Wahkiakum County, and across Washington's Pacific Coast.

Benefits

Reduced physical damage to transportation infrastructure from erosion and flood events

Reduced loss of service to critical transportation infrastructure

Reduced loss of service to surrounding community from road closures

Critical habitat benefits including dune, wetland, and marsh restoration for ESA listed shorebirds

Cost

At a total cost of approximately \$30 million, this project was found to be the most comprehensive and cost-effective solution to address erosion and flooding risks in this area based upon a 2015 analysis of alternatives by WSDOT and a feasibility study by the US Army Corps of Engineers in 2018.

Construction Timeline and Funding

National Environmental Policy Act (NEPA) is anticipated to be complete Summer 2023 and construction is anticipated to begin in Summer 2024.

Through a combination of federal funding programs, the project has received approximately \$15 million in grant funding for Phase 1 construction, environmental monitoring, and maintenance rock. WSDOT is pursuing approximately \$15 million to complete Phase 2 of construction.

We have several policy improvements we would like to share with the D.C. Office based on our experiences working with local communities through efforts such as the Resilience Action Demonstration Project (RAD).

The RAD project piloted a coordinated agency assistance program to work directly with communities to support local capacity. The RAD Final Report includes a series of recommendations for improving coastal hazards resilience in Washington State, focusing on increasing local capacity and enhancing state assistance to coastal communities and Tribes.

Resources & References

- › [Willapa Erosion Control Action Now](#)
- › [Graveyard Spit Restoration and Resilience Project](#)
- › [2015 WSDOT Alternatives Analysis](#)
- › [2018 USACE Feasibility Study](#)
- › [Resilience Action Demonstration Project \(RAD\)](#)
- › [RAD Final Report](#)



(Photograph courtesy of Younes Nouri)



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