

Baker Bay and Grays Bay: 2024 Sea Level Rise Resilience Strategy

Created through the “Bay to Bay: Community-Based Hazards and Habitat Resilience Planning in the Columbia River Estuary” project



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The project was an effort between the Lower Columbia Estuary Partnership, Pacific Conservation District, and Washington Sea Grant. The project relied on the support and in-kind participation of many collaborators and partners, as listed on the following pages.

Acknowledgements

Cover image: King tide flooding at Port of Ilwaco Marina, by Guy Glenn Jr.

Project Team

- Lower Columbia Estuary Partnership
- Pacific Conservation District
- Washington Sea Grant
- Wolf Water Resources, Inc.

The following organizations and individuals participated in this project in various ways.⁴ Their ideas, insights, and other input shaped the project's results.

- Chinook Hatchery
- Chinook Indian Nation
- Chinook Observer
- Chinook Water Company
- City of Ilwaco
- City of Ilwaco Planning Commission
- City of Long Beach
- Cowlitz Indian Tribe
- Cowlitz-Wahkiakum Council of Governments
- Columbia Land Trust
- Columbia Pacific Heritage Museum
- Columbia River Crab Fishermen's Association
- Columbia River Estuary Study Taskforce
- Columbia River Inter-Tribal Fish Commission
- Democrats of Pacific County
- Dylan Jude Harrell Community Center
- Grays River Flood Control District (formerly Grays River Habitat Enhancement District)
- Ilwaco Revitalization Committee
- Lower Columbia Fish Recovery Board
- Naselle
- Mithun
- Office of Representative Marie Gluesenkamp Perez
- Office of Senator Cantwell
- Office of Senator Murphy
- Oregon Department of Land Conservation and Development
- Pacific Conservation District
- Pacific County
- Pacific County Emergency Management Agency
- Pacific County Marine Resource Committee
- Pacific Northwest National Laboratory
- Pearl Inn

⁴ This list of organizations is based on the sign-in sheets at workshops and also includes organizations who were consulted outside of workshops.

- Real Property Rights Advisory Board of Wahkiakum County
- Residents and landowners of Pacific County
- Residents and landowners of Wahkiakum County
- Sea Resources, Inc.
- The Nature Conservancy
- Town of Cathlamet
- United States Army Corps of Engineers
- Wahkiakum County
- Wahkiakum Eagle
- Wahkiakum Port #2
- Wash Away No More
- Wahkiakum West Communications
- 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 University Extension
- Whiting Environmental, Inc.

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Baker Bay and Grays Bay: 2024 Sea Level Rise Resilience Strategy

Executive Summary



image: Rosburg Hall by Mark Letham

Collaborations to support community assets and habitats

The “*Bay to Bay: Community-Based Hazards and Habitat Resilience Planning in the Columbia River Estuary*” project ran from 2021-2024.⁵ The project team conducted outreach and hosted eight public workshops⁶ to identify activities that can build resilience to long-term water level change⁷ while also addressing today’s priorities, and helped local project proponents to take next steps. Some activities were already active, while other opportunities had not yet been identified.

Bay to Bay advanced conversations across community members and city, county, state, federal, and Tribal governments. Workshop participants shared ideas and information, developed actionable and fundable steps for complex issues, and built relationships between interested parties. The project team provided technical assistance such as project scoping, engineering support, grant-writing, and meeting facilitation.



This *Sea Level Rise Resilience Strategy* documents this process, shares participant’s insights, suggests next steps for locally-prioritized activities to assist competitive funding proposals, and identifies cross-cutting recommendations to build resilience across organizations. This template can support locally-driven coastal resilience activities elsewhere and was preceded by 2019-21’s *Resilience Action Demonstration Project*.⁸



Debris-filled waves crash over the US 101 seawall in Chinook (Natalie St. John, Chinook Observer)

⁵ Funded by the National Fish and Wildlife Foundation’s National Coastal Resilience Fund; see wacoastalnetwork.com

⁶ Four workshops each for Baker Bay (at the Historic Chinook School Gym) and Grays Bay (at Rosburg Hall, pictured above)

⁷ Such as sea level rise and precipitation change

⁸ Led by Washington Sea Grant and Washington State Department of Ecology; see wacoastalnetwork.com

Outcomes: Resilience projects and suggested next steps

Workshop participants identified the following projects, which were refined through the project team's direct support and engagement with local project proponents. By moving forward with this network of interrelated proactive measures, we can build local capacity to safeguard critical infrastructure, ecosystems, and communities against the impacts of climate change. Projects that resulted in funding requests or other tangible next steps are marked with a star (★).

Activity	Suggested next steps
Baker Bay	
1. <u>Ilwaco shoreline flood protection</u>	Identify a competitive funding strategy to assess alternatives, incorporate public input, and design and implement this project.
2. <u>Ilwaco distributed stormwater management</u> ★	Secure funds to analyze existing conditions, assess alternatives in coordination with community members, and develop resulting projects, plans, and incentives.
3. <u>Lower Willacut River water management and flood adaptation</u>	Secure funds to analyze existing conditions, assess alternatives in coordination with community members, design relevant synergistic project components, and implement preferred project components.
4. <u>Chinook Hatchery and Houchen Street flood impacts reduction</u>	Secure funds to coordinate with adjacent landowners and regulators, analyze hydrology and habitats, assess alternatives, and develop project design(s).
5. <u>Chinook shoreline erosion reduction and habitat enhancement</u> ★	Secure funds to analyze existing conditions, coordinate with community members and landowners to identify goals and concerns, assess potential alternatives, and develop initial design to inform permitting discussions
6. <u>Ilwaco and Chinook (Pacific County) upland housing planning and development</u>	Develop a working group to - among other tasks - conduct local, state, and federal outreach; identify potential pathways to acquiring and developing uplands for housing; and create a work plan and feasibility assessment with a dedicated lead.
Grays Bay	
1. <u>Grays River dredging to reduce flood impacts</u> ★	Work with US Army Corps and others to conduct relevant studies and economic assessments to determine feasibility of dredging
2. <u>Grays River: coordinated flood impacts reduction projects across watershed</u> ★	Convene active parties to better understand local watershed processes and how other communities have dealt with similar issues (see Wahkiakum County Marine Resource Committee's coastal resilience outreach activities).
3. <u>Grays River gages</u> ★	Prioritize gages/locations and identify funding. Continue ongoing conversations and update interested parties about gage-related developments/needs.
4. <u>Grays River modeling</u> ★	Continue PNNL's modeling with multiple opportunities for community input.
5. <u>Deep River navigation channel dredging</u> ★	Work with US Army Corps and others to conduct relevant studies and economic assessments to determine feasibility of dredging
6. <u>Deep River: coordinated flood impacts reduction projects across watershed</u>	Continue collaboration with CREST and others to reduce flood impacts while improving habitat (see Wahkiakum County Marine Resource Committee's coastal resilience outreach activities).



Introduction

1. Project approach and goals

The 2021-2024 “Bay to Bay: Community-Based Hazards and Habitat Resilience Planning in the Columbia River Estuary” (Bay to Bay) sought to identify and assist locally-led efforts to reduce changing water levels’ impacts on people and habitats of Baker and Grays Bays (Figure 1). This project focused on the shorelines of Baker and Grays Bays on the Washington side of the lower Columbia River estuary, looking at potential sea level rise impacts, how those impacts relate to existing issues, and how we can respond to address present and future issues simultaneously in accordance with community visions and scientific information, in order to build a resilient system.

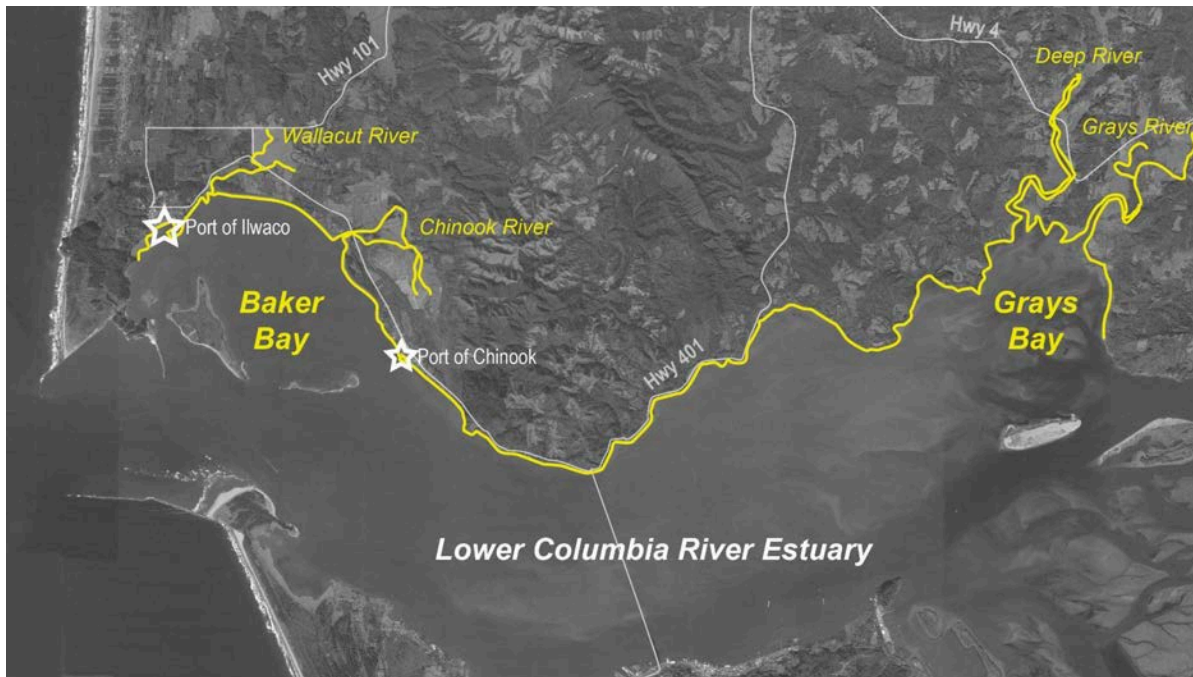


Figure 1. Bay to Bay project area encompassing Baker and Grays Bays, associated tidal streams, and associated floodplains.

In both Baker and Grays Bays, the project team conducted outreach to better understand local priorities, historical context, and other issues; hosted public workshops to co-produce potential resilience actions and build community awareness of potential solutions; and assisted local organizations to scope resilience projects and apply for funds to take next steps (Figure 2). This work is described in more detail in the following sections of this document. The project team members are key partners in development of the multiple coastal hazards resilience projects described further in this report.

The project team sought to advance conversations about near-term and future resilience across Baker and Grays Bays. The project team intends for this report and website⁹ to help tell the story of the communities and ecosystems of Baker and Grays Bay in service of developing fundable hazards resilience projects.

⁹ See wacoastalnetwork.com

Bay to Bay was funded by the National Fish and Wildlife Foundation's National Coastal Resilience Fund,¹⁰ and was led by the Lower Columbia Estuary Partnership (LCEP)¹¹ in partnership with Pacific Conservation District (PCD)¹² and Washington Sea Grant (WSG).¹³

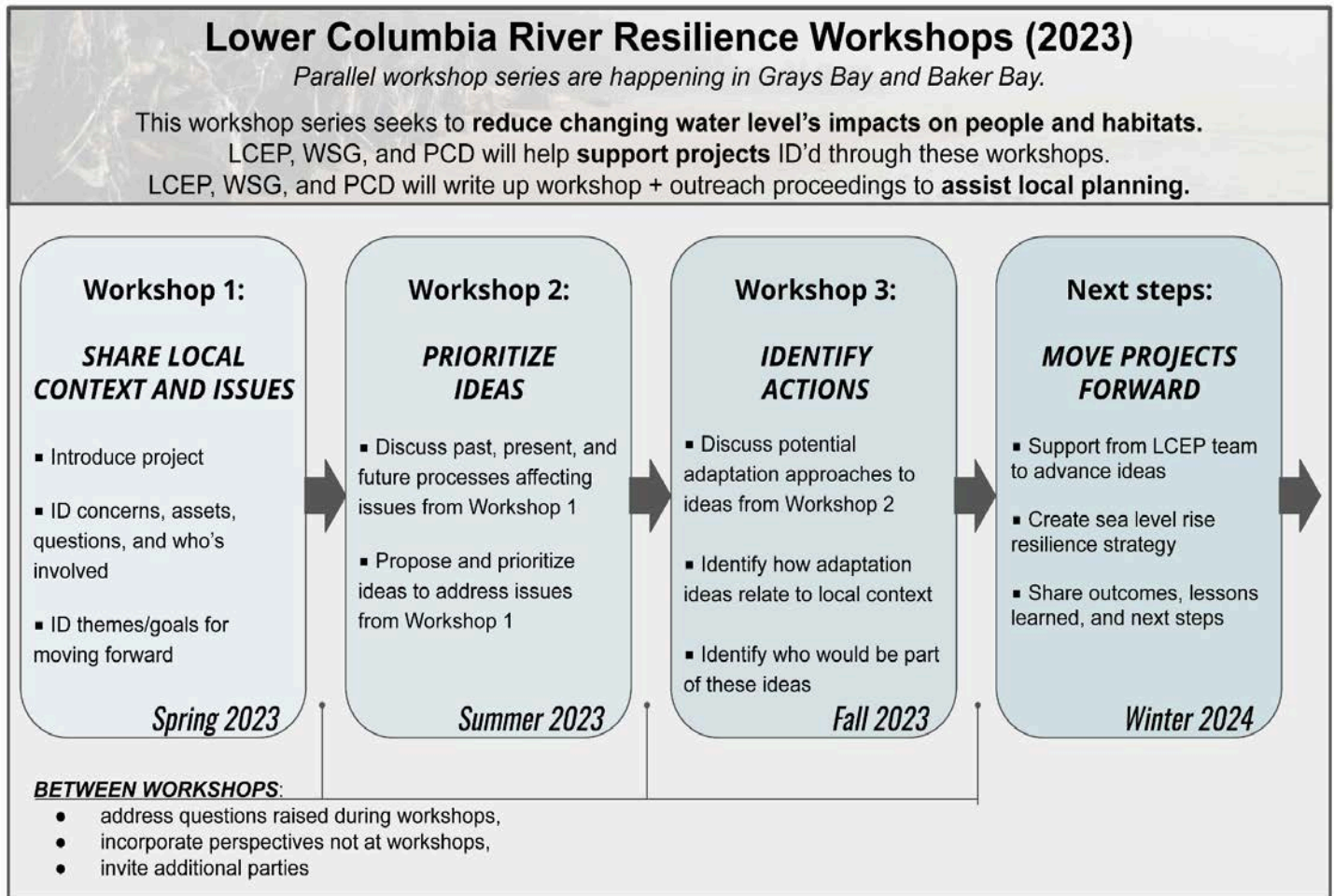


Figure 2. Outline of workshop series, preceded by community outreach. A fourth workshop occurred for both bays, during which project results were shared for final feedback (not shown).

¹⁰ <https://www.nfwf.org/programs/national-coastal-resilience-fund>

¹¹ <https://www.estuarypartnership.org/>

¹² <https://pacificcd.org/>

¹³ <https://wsg.washington.edu/>

2. Project team, origins, and theory of change

The Bay to Bay project came out of parallel processes involving the Lower Columbia Estuary Partnership (LCEP), Pacific Conservation District (PCD), and Washington Sea Grant (WSG).

Lower Columbia Estuary Partnership

LCEP is one of 28 National Estuary Programs (NEP) administered by the US Environmental Protection Agency (USEPA) to act as a coordinating body for regional entities to restore and protect “estuaries of national significance.” The lower Columbia River was designated an “estuary of national significance” in 1995 due to the loss of approximately 50% of its native historic habitat to urban or industrial development and agriculture since the late 1800’s,¹⁴ and because of its economic importance to the region and nation.

To reduce the potential for rising sea levels to further reduce habitat and harm regional partners’ significant investments in restoring and protecting native habitats, LCEP estimated future loss of habitat with sea level rise in 2018, with funding from US EPA. LCEP developed a GIS model to quantify possible impacts to wetlands from three sea level rise scenarios: 0.5, 1.0 and 1.5 meters. LCEP found that rising sea levels are likely to overtop portions of the widespread network of existing protective features, particularly in the furthest downriver areas of the lower Columbia River. LCEP evaluated a range of potential impacts for these areas, based on the magnitude of overtopping observed in the model. Results suggest that for areas of existing tidal wetland where no levees are present, the lower Columbia could lose 5% of existing wetlands with 0.5 meters of sea level rise, 13% with 1.0 meters of rise, and 25% with 1.5 meters of rise. When levees are factored in, the range of uncertainty increases. For the 1.0 meter scenario, for example, the lower Columbia could see anywhere from an 8% loss to a 21% gain of wetlands, depending on how leveed areas respond to flooding. More research on this is needed to improve these estimates. See the report for more information.¹⁵

LCEP advocated for continued follow up to this preliminary analysis and to provide regional partners more detailed analyses for anticipatory planning purposes, including reducing community flood risk from sea level rise. To that end, LCEP and WSG partnered on this project to work with two coastal communities to identify areas at risk for increased flooding and opportunities to design nature-based solutions (e.g., habitat buffers, living shorelines) to reduce these risks. LCEP hopes to continue supporting further efforts within these two communities and expanding these efforts to other communities at risk for increased flooding.

Washington Sea Grant and Pacific Conservation District

In 2018, WA Sea Grant (WSG) led the development of sea level rise projections for Washington State¹⁶ alongside outreach to ensure that sea level rise data could be integrated into projects, planning, and other use-cases across the state’s shorelines. These projections were used in LCEP’s sea level rise maps, as well as in locally-driven projects such as funding proposals to raise the Port of Ilwaco Marina’s shoreline. Port staff also assisted development of sea level rise communications materials, which were used throughout the Washington Coastal Hazards Resilience Network’s website.¹⁷

¹⁴ Marcoe, K., Pilson, S. Habitat change in the lower Columbia River estuary, 1870–2009. *J Coast Conserv* 21, 505–525 (2017). <https://doi.org/10.1007/s11852-017-0523-7>

¹⁵ https://www.estuarypartnership.org/sites/default/files/resource_files/LCEP_SLR_impacts_summary_for_web.pdf

¹⁶ Miller, I.M., Morgan, H., Mauger, G., Newton, T., Weldon, R., Schmidt, D., Welch, M., Grossman, E. 2018. Projected Sea Level Rise for Washington State – A 2018 Assessment. A collaboration of Washington Sea Grant, University of Washington Climate Impacts Group, University of Oregon, University of Washington, and US Geological Survey. Prepared for the Washington Coastal Resilience Project. updated 07/2019

¹⁷ www.wacoastalnetwork.com

Building from this work, WSG and the Washington State Department of Ecology partnered on the Resilience Action Demonstration project (RAD) to identify local hazards resilience needs across the state's Pacific Coast and to assist locally-led work.¹⁸ The RAD's resulting theory of change informs the Bay to Bay project:¹⁹

- Local peoples' traditional and local knowledge is necessary to equitably and effectively address changing coastal ecosystems and societies ("coastal resilience").
- Communities of rural coastal Washington's are geographically isolated, often with limited capacity and other resources required to advance locally-driven coastal resilience projects. Locally-driven coastal resilience work is more likely to happen through collaborations with technical service providers (e.g. state agencies, university extension programs, and county special districts), who can help fill needed roles such as writing grants or scoping projects in ways that provide multiple benefits, engage with ecological processes, and are competitive for public funds.
- Preparing for future conditions (such as climate change impacts) while addressing today's priorities can lead to effective and fundable coastal resilience projects that community members support.

During and after the RAD project, WSG and Ecology regularly collaborated with Pacific Conservation District (PCD) staff, leading to PCD's involvement as key local partner on multiple projects. PCD became further involved after their creation of an in-house Marine + Estuarine Resilience Program in 2023.

Discussions with community members, special districts, and jurisdictions in Pacific and Wahkiakum Counties highlighted multiple unmet needs for addressing hazards impacts across these counties' Columbia River shorelines and watersheds - specifically flooding, erosion and deposition, habitat change, and salinity intrusion. These issues are all connected to sea level rise. As such, adaptation to future conditions (such as sea level rise and increased precipitation) may be initiated by addressing today's priorities. The resulting Bay to Bay project's theory of change builds from the RAD:

- There are multiple community-identified issues related to changing water levels across Baker and Grays Bays.
- Many of these issues have similarities and span property/jurisdiction lines, and can be more effectively addressed through collaboration across multiple landowners, managers, and/or other parties.
- Those same issues may be addressed in a resilient manner that supports local social cohesion by focusing on locally-defined resilience principles²⁰ alongside regionally-relevant resilience principles²¹
- Facilitated processes (such as a workshop series) can help advance coastal resilience projects. In doing so, technical service providers can increase local capacity by helping participants gain additional insights, build relationships with potential collaborators and regulators, and be part of the solution(s) to local issues.
- Technical service providers can use their insights from these community-engaged facilitated processes to identify practical and achievable next steps which address near-term priorities alongside long-term hazards and climate change impacts, based on community perceptions and other relevant context.

¹⁸ <https://wacoastalnetwork.com/resilience-action-demonstration-project/>

¹⁹ See the Resilience Action Demonstration project's Resilience Principles For Coastal Hazards Projects for more : <https://apps.ecology.wa.gov/publications/parts/2206003part4.pdf>

²⁰ See local resilience principles for Baker and Grays Bays, in Appendices E and H, respectively

²¹ See the footnote 7, above

3. Sea level rise and associated hazards along the lower Columbia River

Figure 3 illustrates the primary threats associated with sea level rise that coastal communities typically face. Of these, Coastal Flooding, Habitat Loss, and Erosion and Deposition were regularly mentioned across the Baker Bay and Grays Bay project areas. Appendix A provides a detailed description of these impacts as they relate to the project areas. A summary of the impacts is provided below, along with a description of land use change which can compound these impacts.

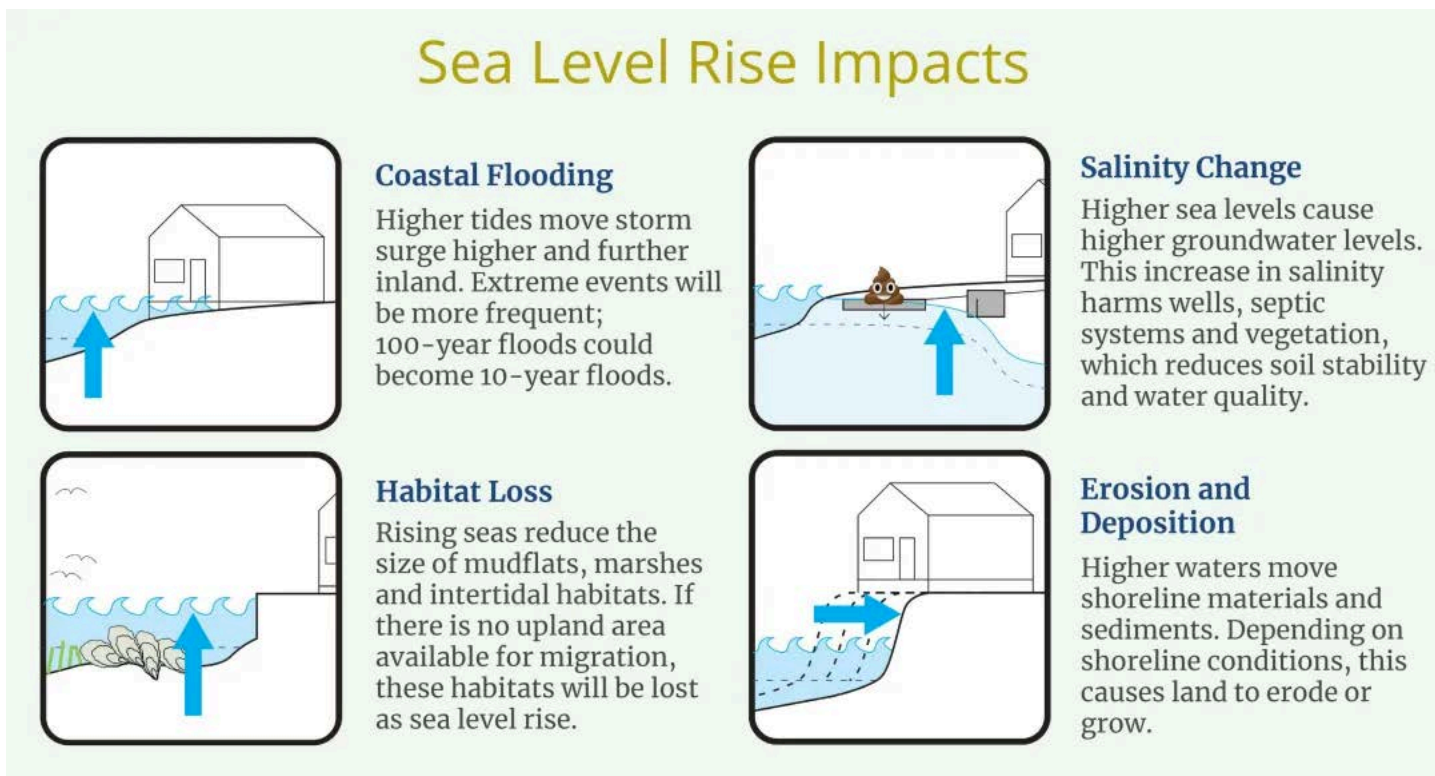


Figure 3. Sea level rise impacts, which parallel existing issues along Baker and Grays Bays.

I. Coastal Flooding

Flooding is currently a major concern in both the Baker and Grays Bay focus areas and is expected to increase in frequency and magnitude as a result of climate change. Both regions currently experience damage from flooding events during most years. Here, flooding is primarily driven by a combination of fluvial influence from local watersheds that can interact with tides in the Columbia River, and is also influenced by several interrelated anthropogenic factors. Columbia River fluvial effects are not a significant factor at these locations in the lower estuary, where ocean tides are the dominant forcing factor and most flood energy has been dissipated further upstream.

Flooding processes differ somewhat between the two project areas. Grays Bay is a larger and generally steeper watershed, with its major tributary (Grays River) unimpeded by flow structures. Flooding typically results during late fall and winter during periods of heavy precipitation when large flood flows overtop the banks of the Grays River. Extensive timber harvesting operations in the upper watersheds may be intensifying these runoff events and contributing to increased flooding.

Baker Bay subwatersheds are considerably smaller than the Grays River watershed, resulting in less overall runoff from precipitation events. Another major difference is that both primary waterways in

Baker Bay - the Chinook and Wallacut Rivers - have tidegates installed at or near their confluences with the Columbia River whereas the Grays River tributaries do not. As a result, tidegate management in Baker Bay is a critical factor that determines flooding. For example, flooding here can be a problem when high tides coincide with significant rain events. During these times, tidegates which are kept closed to prevent flooding from tides prevent rainfall runoff from draining out, leading to flooding. In addition to tributary flooding, localized flooding in the city of Ilwaco due to rainfall runoff is presently a concern. Stormwater projects at the Port of Ilwaco are currently underway to alleviate some of these problems. Solutions for other locations were discussed with stakeholders during the project workshops.

In general, whereas bank overtopping due to excess precipitation from a large drainage contributes to major flooding events in Grays Bay, flood issues along Baker Bay tributaries can largely be attributed to blockage of mainstem tributaries by flow control structures. These locations were identified and discussed at the project workshops. Many are located at major road crossings, which presents an additional safety concern when flooding prevents access along these emergency evacuation routes.

Flooding is expected to increase as a result of climate change due to two factors - changes in precipitation and sea level rise. Climate projections from the University of Washington Climate Impacts Group suggest that extreme precipitation events will become more common, and produce even higher precipitation totals.²² Averages of available projections, which vary widely, suggest that rain events with return intervals ranging from 2 to 100 years will produce 6–9 % more precipitation by the 2040's (CFHMP, 2023) and as a result lead to increased flooding and flood damage. In general, projections suggest that sea level will continue to rise by some amount due to warming climate, even under conservative greenhouse gas emissions scenarios. Most likely estimates of sea level rise above current sea level range from 0.4'/0.5' of rise by 2050 under low/high respective emissions scenarios, and 0.7'/1.6' of rise by 2100 under low/high respective emissions scenarios.²³ Because the floodplains within both focus areas are influenced by tides in the Columbia River, sea level rise will contribute to additional flood risk.

II. Erosion

In the Baker Bay focus area, concerns related to erosion focused on localized shoreline erosion along the Baker Bay coastline, primarily in the vicinity of the Port of Chinook and Chinook County Park (Figure A12). While not specifically called out in Pacific County's Comprehensive Plan or Hazard Mitigation Plan ("*The Ports of Chinook, Ilwaco, Peninsula, and Willapa Harbor are not currently at risk to coastal erosion,*" page 85, *Pacific County 2021 Hazard Mitigation Plan*), these areas were identified as concerns by multiple stakeholders during project workshops. Combined effects of rising sea levels and possible increased wave action due to more intense and frequent winter storms are almost certain to increase erosional impacts along the Baker Bay shoreline.

The primary erosion concern in the Grays Bay focus area is streambank erosion along the Grays River and the resulting lateral channel migration and/or risk to adjacent infrastructure. Streambank erosion in the Grays River is described in the Wahkiakum County Comprehensive Flood Hazard Mitigation Plan (CREST 2023), and several interrelated causes are identified. Streambank erosion in the Grays River is closely tied to other problems including flooding and sediment accretion, all of which have worsened with increasing human activity.

²² <https://cig.uw.edu/projects/heavy-precipitation-projections-for-use-in-stormwater-planning/>

²³ <https://wacoastalnetwork.com/research-and-tools/slr-projections/>

III. Sedimentation

Accretion of sediment is closely tied to erosion and flooding. All three are considered a major concern in both of the project focus areas, particularly in the bays themselves. Sedimentation in both bays has occurred largely as a result of major modifications to the Columbia and Willamette river systems over the past century, although in the case of Grays Bay excess sediment being delivered from the local watershed may also be a contributing factor. Columbia and Willamette river dam construction has altered the timing and magnitude of Columbia River discharge, reducing high flows that historically would have re-configured drainage patterns at tributary mouths in the estuary. Pile dikes, dredging, dredge material deposits, and other related Columbia River Federal Navigation Channel activities have further modified flow patterns in the estuary. Together these upstream and local actions have contributed to the accumulation of sediment in Grays and Baker bays (CREST, 2023).

IV. Habitat Loss

Columbia River floodplains and low-lying tributary floodplains comprise a large percentage of both the Baker Bay and Grays Bay project areas. Thus, potential for the loss of intact floodplain habitat resulting from sea level rise is significant. Furthermore, most of these floodplain areas transition steeply to higher elevation uplands, limiting the potential for wetland habitats to migrate upslope as currently-functioning wetlands become inundated. Overall, a net loss of wetland habitat is expected to occur in both project areas as a result of sea level rise. Actual quantities are difficult to estimate, due to the extensive network of dikes, levees, and tidegates in both areas, which complicate inundation patterns.

It should be noted that any additional habitat loss due to climate change impacts would come on top of extensive loss of tidal wetland habitats that has occurred since the late 1800's due to human activity including diking, and conversion of land to agricultural and other uses. Estimates of as much as 68-75% of loss for the entire lower Columbia River floodplain are consistent with what has occurred in the project areas.

V. Land Use Changes

Timber harvest practices on privately-owned lands have caused increased erosion on those lands and sedimentation within the downstream depositional reaches of streams and rivers.²⁴ This sedimentation results in decreased capacity of those waterbodies to absorb river flows - both tributary and Columbia River, which in turn increases flooding to nearby areas. Historically, high river flows would have deposited sediment onto the floodplains, when the river overtopped its banks - allowing the valley bottoms to naturally accrete sediment. However, levees and dikes built to protect infrastructure, farms, and local communities have cut off these sedimentation processes. Ironically, lands located behind levees and dikes are frequently subsiding from the lack of sediment supply, which in turn exacerbates local flooding problems. Meanwhile, sediment settles out within low gradient, slow velocity sections of the streams, rivers, and bays, building up over time and reducing the capacity of the waterbody (e.g. lower Grays River) to convey water downstream.

Without resolving the issue of eroding lands in the upland areas of the watersheds, this cycle is bound to continue and intensify, becoming more problematic as storm events become more intense and frequent and Columbia River tides increase with rising sea levels.

²⁴ Wahkiakum County, 2023. Draft Wahkiakum County Comprehensive Flood Hazard Mitigation Plan. *Baker Bay and Grays Bay: 2024 Sea Level Rise Resilience Strategy*

Baker Bay takeaways

1. Focus areas and priorities

Community-identified assets and flooding priorities were gathered during Workshops 1 and 2 for Baker Bay, as well as through ongoing project outreach. Key assets and locations of interest from Workshop 1 are shown in Figure 4 as red (priorities) and green (assets) diamonds centered around five key locations in Baker Bay. These five focus areas were used as the basis of small group discussions in Workshop 2 and 3, and resulting project development.

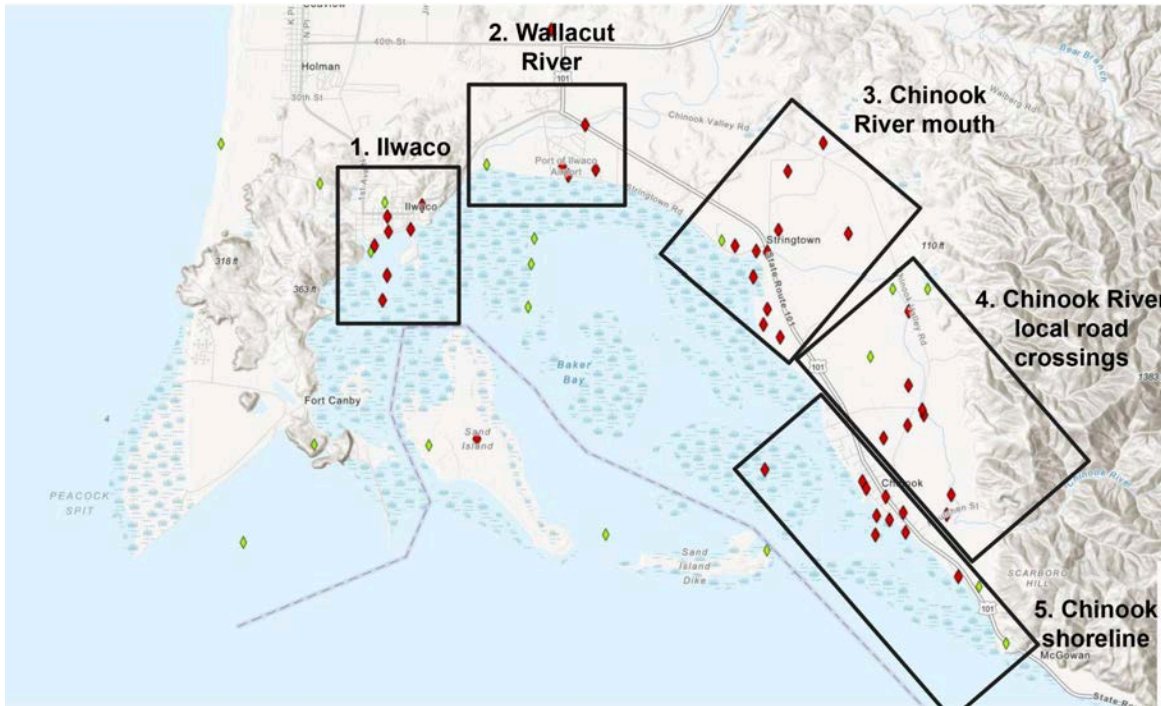


Figure 4. Locations of 5 key areas of interest in Baker Bay based on community-identified assets (green diamonds) and priorities (red diamonds) in the area.

These assets and priorities were summarized into local resilience principles, which fit into 7 key categories (Figure 5). These local resilience principles guided the project team as they scoped resilience project concepts shared during Workshop 3, and also assisted the project team to support specific projects. These methods are described in more detail in Appendix B. Results of the proposed project concepts are outlined in the next section and described in detail in Appendix E.

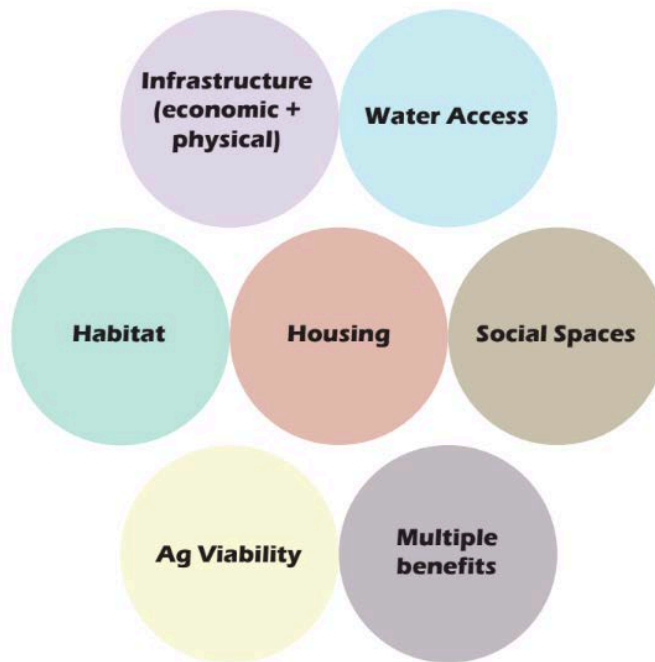


Figure 5. Local resilience principles identified in workshops 1 and 2 for Baker Bay.

2. Suggested resilience projects and next steps

Workshops 2 and 3 focused on scoping potential resilience projects, including who should be involved, potential hurdles, and potential opportunities. Project concepts were also informed by ongoing community engagement. Resulting Baker Bay resilience projects are described further in Appendices E and H. They are:

1. Ilwaco shoreline flood protection (Figure 6)
2. Ilwaco stormwater management (Figure 7)
3. Lower Wallacut River water management and flood adaptation (Figure 8)
4. Chinook Hatchery and Houchen Street flood impacts reduction (Figure 9)
5. Chinook shoreline erosion reduction and habitat enhancement (Figure 10)
6. Ilwaco and Chinook (Pacific County) upland housing development (Figure 11)

The project team helped the City of Ilwaco to write a grant proposal to Washington State Department of Commerce’s 2024 Salmon Recovery Through Local Planning program, in order to take next steps on project #2, Ilwaco stormwater management.

The project team worked with the Ports of Chinook and Ilwaco to write grant proposals to the National Fish and Wildlife Foundation’s 2024 National Coastal Resilience Fund and to the US Army Corps of Engineers’ 2023 Section 165(a) Pilot Program for Small or Disadvantaged Communities, in order to take next steps on project #5, Chinook shoreline erosion reduction and habitat enhancement.

The project team also helped the Columbia River Estuary Study Taskforce (CREST) and the Columbia River Inter-Tribal Fish Commission (CRITFC) to write grants to NOAA. These grants would continue sea level rise modeling, local resilience project support, and related outreach across Baker and Grays Bays.

At the time of publication, these five proposals were still under review.

1. Ilwaco shoreline flood protection



Adaptive capacity

Motivation for adaptation:

Past interest from Port of Ilwaco; economic benefits

High

Access to resources:

Past grant unsuccessful due to low benefit-cost ratio

Low

Authority to implement adaptation decisions:

Port owns majority of project footprint; no in-water work expected

High

Ability to learn and innovate:

Collaborative design for public space; ongoing City sea level rise study

High

This project supports these local priorities:



Suggested next steps

Project lead (likely **Port of Ilwaco or City of Ilwaco**) should:

- Decide if/when to address this issue.
- Solicit technical assistance as needed from consultant(s), the Washington State COHORT, and/or others.
- Identify a competitive funding strategy to assess alternatives, incorporate public input, design, and implement this project, potentially combined with stormwater management in downtown Ilwaco [see separate project description].
- Submit funding proposal(s) and continue toward implementation.

Port of Ilwaco tenants and shoreline property owners should:

- Document previous and ongoing flooding issues and impacts, and share this information with the Port, the City, and/or Pacific Conservation District for use with funding proposals.

City of Ilwaco (and consultants) should:

- Use their ongoing sea level rise vulnerability assessment to better characterize and map expected flooding and sea level rise impacts to the marina and downtown areas, and how this relates to groundwater levels and precipitation/stormwater.

Figure 6. Ilwaco shoreline flood protection: concept, adaptive capacity, and suggested next steps

2. Ilwaco stormwater management



Adaptive capacity

Motivation for adaptation:

Relies on willingness of landowners; Port already implementing GSI

Medium

Access to resources:

Multiple applicable funding sources; grant currently in development

Medium

Authority to implement adaptation decisions:

Private landowners, City, and Port can each lead distributed projects

High

Ability to learn and innovate:

Small distributed projects can be modified with new learnings

High

This project supports these local priorities:



Suggested next steps

Project lead (likely **City of Ilwaco**) should:

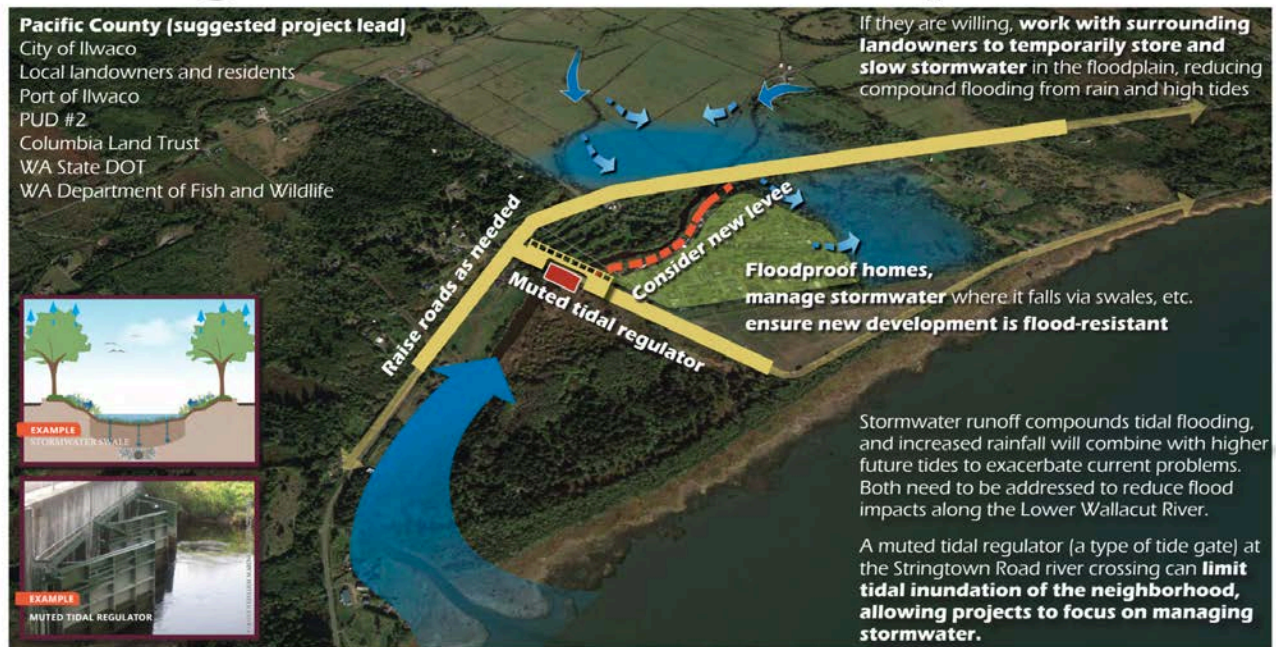
- Use the City's ongoing sea level rise vulnerability assessment to better characterize and map expected flooding and sea level rise impacts to the marina and downtown areas, and how this relates to groundwater levels and precipitation/stormwater.
- Submit funding proposal(s) and continue toward implementation.
- Once funds are secured, analyze existing conditions, assess alternatives in coordination with community members, design relevant distributed stormwater management, and implement stormwater management through projects, planning, or otherwise.

City of Ilwaco residents and property owners should:

- Document previous and ongoing flooding issues and impacts, and share this information with the Port, the City, and/or Pacific Conservation District for use with funding proposals.
- Attend City of Ilwaco's TBD public workshops and educational activities to inform stormwater design and planning, if grant funds are secured.

Figure 7. Ilwaco stormwater management: concept, adaptive capacity, and suggested next steps

3. Lower Wallacut River water management and flood adaptation



Adaptive capacity

Motivation for adaptation:

Existing issues impact many parties; complex approach requires coordination and planning

Medium

Access to resources:

High cost but likely competitive for grants; limited capacity at County

Medium

Authority to implement adaptation decisions:

Relies on support of multiple landowners

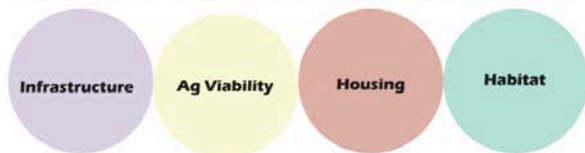
Medium

Ability to learn and innovate:

Multiple sub-projects can inform each other iteratively

High

This project supports these local priorities:



Suggested next steps

Project lead (likely **Pacific County or City of Ilwaco**) should:

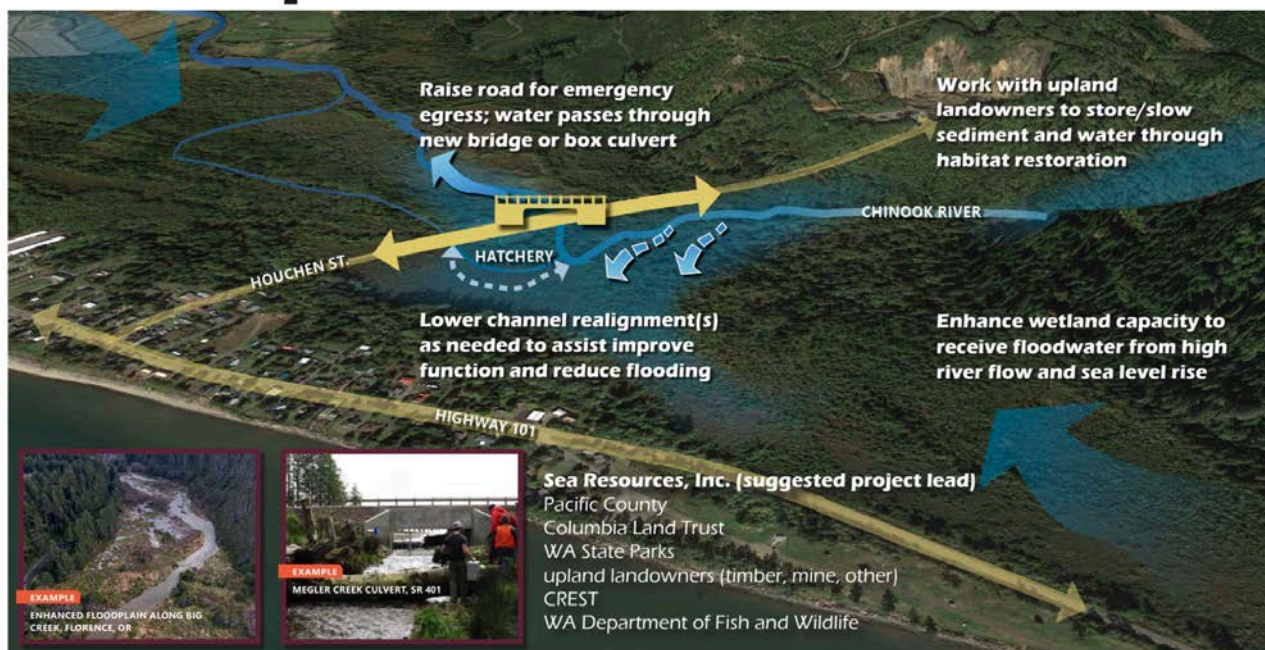
- Use the City's ongoing sea level rise vulnerability assessment to better characterize and map expected flooding and sea level rise impacts to the marina and downtown areas, and how this relates to groundwater levels and precipitation/stormwater.
- Decide if/when to address this issue.
- Solicit technical assistance as needed from consultant(s), the Washington State COHORT, and/or others.
- Identify a competitive funding strategy and submit funding proposal(s) to analyze existing conditions, assess alternatives in coordination with community members, design relevant synergistic project components.
- Implement preferred project design, preferably in a phased approach that starts with muted tidal regulator and adds stormwater management as needed.

Lower Wallacut River residents and landowners should:

- Port of Ilwaco tenants and shoreline property owners should document previous and ongoing flooding issues and impacts, and share this information with the Port, the City, and/or Pacific Conservation District for use with funding proposals.

Figure 8. Lower Wallacut River water management and flood adaptation: concept, adaptive capacity, and suggested next steps

4. Chinook Hatchery and Houchen St. flood impacts reduction



Adaptive capacity

Motivation for adaptation:

Sea Resources actively looking for solution(s); historic community asset

High

Access to resources:

Small volunteer-based organization; likely competitive for grants

Medium

Authority to implement adaptation decisions:

Relies on multiple large landowners; collaborative solution possible

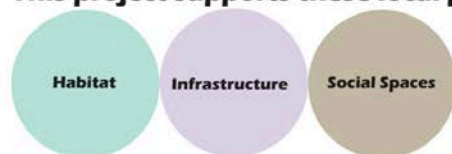
Medium

Ability to learn and innovate:

Hydrological/ecological assessments needed; group can learn together

High

This project supports these local priorities:



Suggested next steps

Project lead (likely **Sea Resources, Inc.**) should:

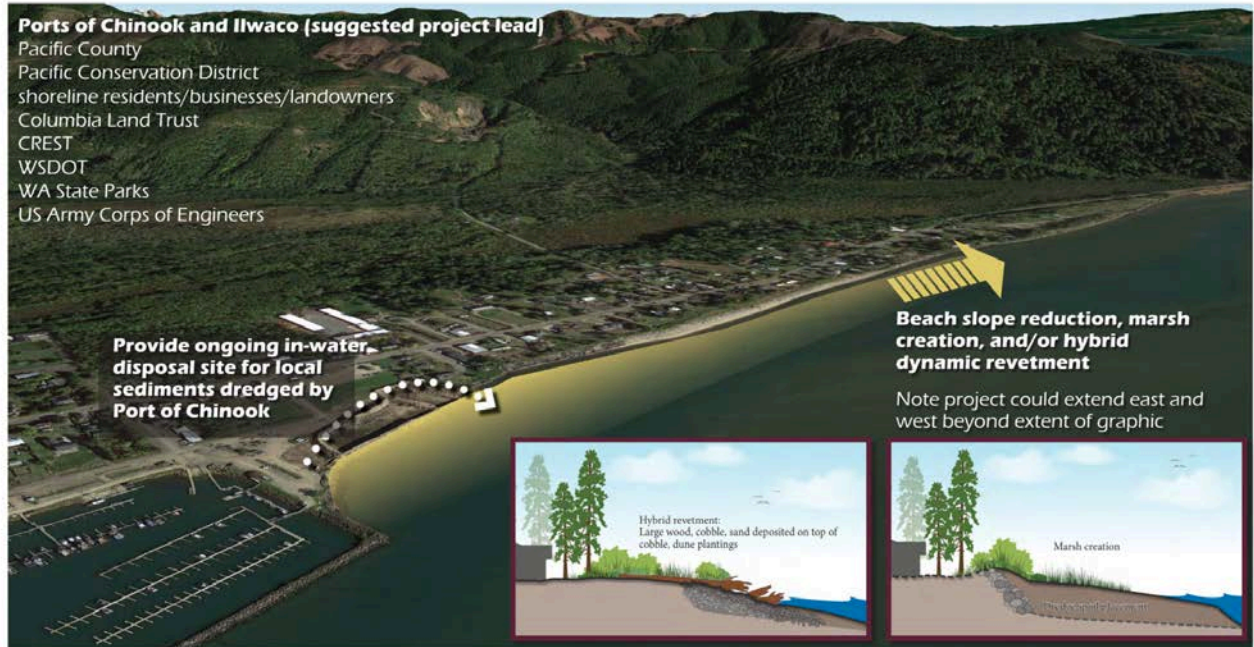
- Use the County's ongoing sea level rise vulnerability assessment to better characterize and map expected flooding and sea level rise impacts to the area, and how this relates to groundwater levels and precipitation/stormwater.
- Coordinate with adjacent landowners and technical assistance provider(s) to identify a competitive funding strategy
- Submit funding proposal(s) to analyze existing conditions, assess alternatives in coordination with adjacent landowners and regulators, and develop a project design.
- Implement preferred project design.

Adjacent landowners and land managers (e.g. **Columbia Land Trust, WA State Parks, Pacific County Public Works**) should:

- Consider their long-term goals for land/water management, what habitat restoration and flood reduction projects they would support, and how this relates to collaborative land management across multiple properties.

Figure 9. Chinook Hatchery and Houchen Street flood impacts reduction: concept, adaptive capacity, and suggested next steps

5. Chinook shoreline erosion reduction and habitat enhancement



Adaptive capacity

Motivation for adaptation:
 Ongoing issues; previous project success; multi-organizational interest

High

Access to resources:
 Limited local capacity for coordination; two grant proposals in review

Medium

Authority to implement adaptation decisions:
 Requires landowner support ; significant permitting hurdles

Low

Ability to learn and innovate:
 Existing project = prototype to learn from; adaptive management likely

High

This project supports these local priorities:



Suggested next steps

Project lead (likely **Port of Chinook**) should:

- Submit funding proposal(s) [COMPLETE]
- Once funding is secured, analyze existing conditions, coordinate with community members and landowners to identify goals and concerns, assess potential alternatives, and develop initial design to inform permitting discussions.
- Conduct engineering and modeling to understand long-term costs, effectiveness, and maintenance requirements.
- Identify which sources of dredged material are clean enough for in-water or shoreline placement.
- Continue regular coordination with shoreline stakeholders throughout project design, implementation, and lifecycle.

Chinook shoreline residents and property owners should:

- Document previous and ongoing erosion and/or accretion, impacts, and various species' presence along the shoreline (such as shorebirds, fish, or otherwise).
- Share this information with the Ports and/or Pacific Conservation District for use with funding proposals.

Figure 10. Chinook shoreline erosion reduction and habitat enhancement: concept, adaptive capacity, and suggested next steps

6. Ilwaco and Chinook (Pacific County) upland housing development



Adaptive capacity

Motivation for adaptation:

Widespread interest; low expectations; supports tsunami safety

Medium

Access to resources:

Limited capacity for leadership; significant cost barrier to implement

Low

Authority to implement adaptation decisions:

Success depends on private landowners and real estate market

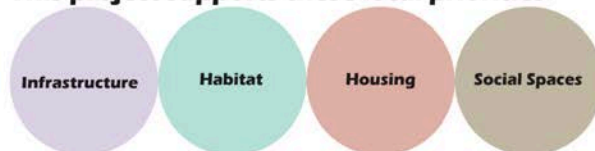
Low

Ability to learn and innovate:

Can learn from coastal Tribes moving upland and share with others

High

This project supports these local priorities:



Suggested next steps

Pacific County and/or City of Ilwaco should:

- Build upon University of Washington's recent housing studies for Pacific County, with focus on development safe from coastal hazards
- Develop a working group to - among other tasks - conduct local, state, and federal outreach to gauge public interest and potential pathways to acquiring and developing uplands for housing. This could inform a work plan and feasibility assessment so the City and/or County can better understand opportunities and constraints for this work. This could also identify a dedicated lead organization.
- In the near term, develop codes and incentives for increased density in non-hazard prone areas, low-impact development (LIDs), and upland development, with a focus on affordable or workforce housing.
- In the near-term, focus on small-scale pilot projects to acquire uplands for housing that is affordable/accessible and resilient. Relevant updates to codes and planning documents can assist this. Pilot projects could focus on potentially relocating Chinook Hatchery facilities upstream and/or providing upland housing for City of Ilwaco.

Private developers, landowners, or investors should:

- Consider if they are interested in this project, contact the City/County.

Local newspapers and interested organizations should:

- Include ongoing inquiries into this topic, to raise awareness, gauge public interest, and inform multi-benefit approaches. This could start by sharing results of this workshop series.

Figure 11. Ilwaco and Chinook (Pacific County) upland housing development: concept, adaptive capacity, and suggested next steps

3. Cross-cutting recommendations for Baker Bay sea level rise resilience

When these six Baker Bay sea level resilience projects' adaptive capacities are viewed side-by-side, and when we look at the number of times that each organization was suggested as a key project participant for Baker Bay projects (Figure 12), we see that **landowners, residents, City of Ilwaco, Pacific County, Port of Ilwaco, and Columbia Land Trust** are all part of the majority of resilience projects identified through workshops.

Resulting recommendations include:

- a. Regular communication regarding hazards, habitat changes, and land use across Baker Bay could build relationships between residents and landowners (including private upland and lowland landowners, Columbia Land Trust, WA State Parks, WA Department of Fish and Wildlife), and support multi-benefit resilience project development. Relationships across these organizations is likely to lead to increased motivation for action, access to resources, and authority to implement resilience actions.
- b. Local jurisdictions and special districts (City of Ilwaco, Pacific County, and Port of Ilwaco) should make sure to engage with Columbia Land Trust during long-range planning or other large-scale activities. Columbia Land Trust should ensure their activities accommodate local needs and priorities, also.
- c. Collaborative approaches and large funding is necessary for all of these projects. Lessons learned from emerging projects should be shared across project partners, perhaps through a continued resilience forum.²⁵ Washington State agencies can provide assistance, and should be involved at an early stage.



Figure 12. Groups or organizations arranged according to the amount of times they were listed as a Baker Bay project partner. Groups with suggested involvement in five projects are at the top, descending to groups with suggested involvement in one project at the bottom. This does not include regulatory roles, technical service providers, or other interested parties.

²⁵ Washington's Coastal Hazards Resilience Network's (CHRN) Annual Meeting is one such forum, though it currently has low involvement from community members and may not meet needs for local engagement. See www.wacoastalnetwork.com

Grays Bay takeaways

1. Focus areas and priorities

Community-identified assets and flooding priorities were gathered during Workshops 1 and 2 for Grays Bay, as well as through ongoing project outreach. Key assets and locations of interest from Workshop 1 are shown in Figure 6 as yellow (priorities) and green (assets) diamonds centered around five key locations in Grays Bay. These five focus areas were used as the basis of small group discussions in Workshop 2 and 3, and resulting project development.

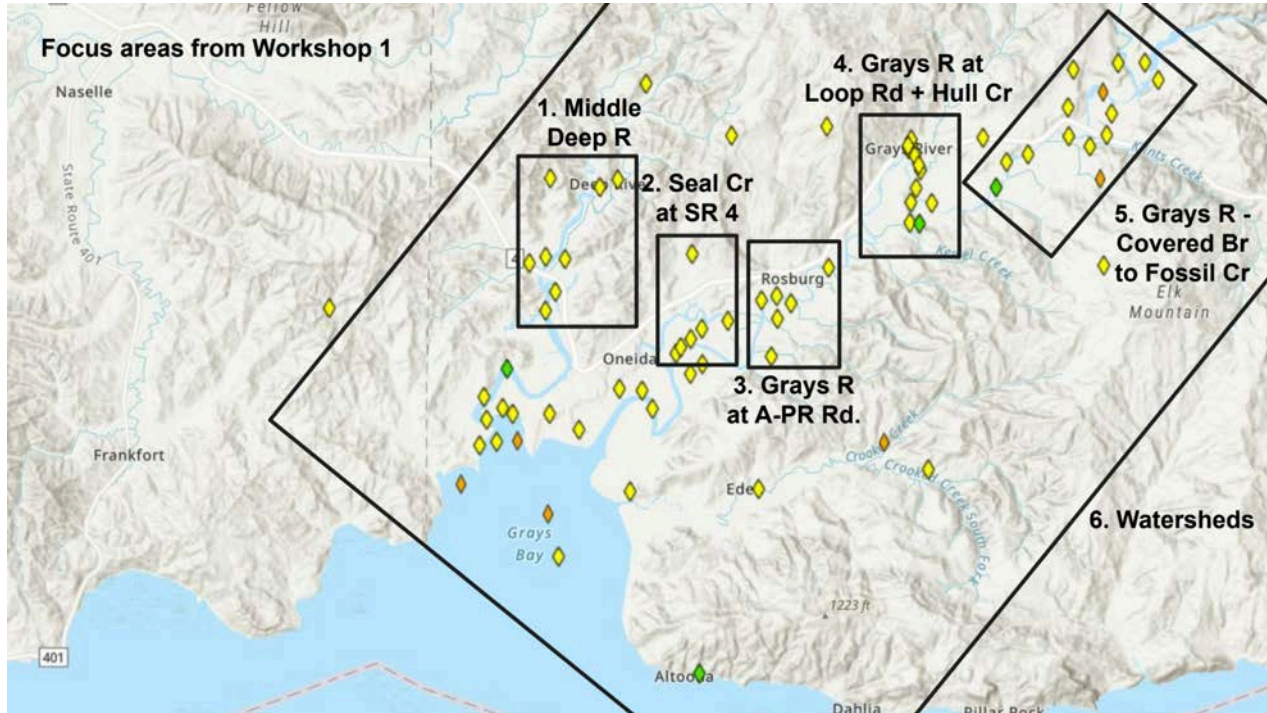


Figure 13. Locations of 6 key areas of interest in Grays Bay based on community-identified assets (green diamonds) and priorities (red diamonds) in the area.

These assets and priorities were summarized into local resilience principles, which fit into 6 key categories, as depicted in Fig. 7. These local resilience principles guided the project team as they scoped resilience project concepts shared during Workshop 3, and also assisted the project team to support specific projects. These methods are described in more detail in Appendix B. Results of the proposed project concepts are outlined in the next section and described in detail in Appendix H.

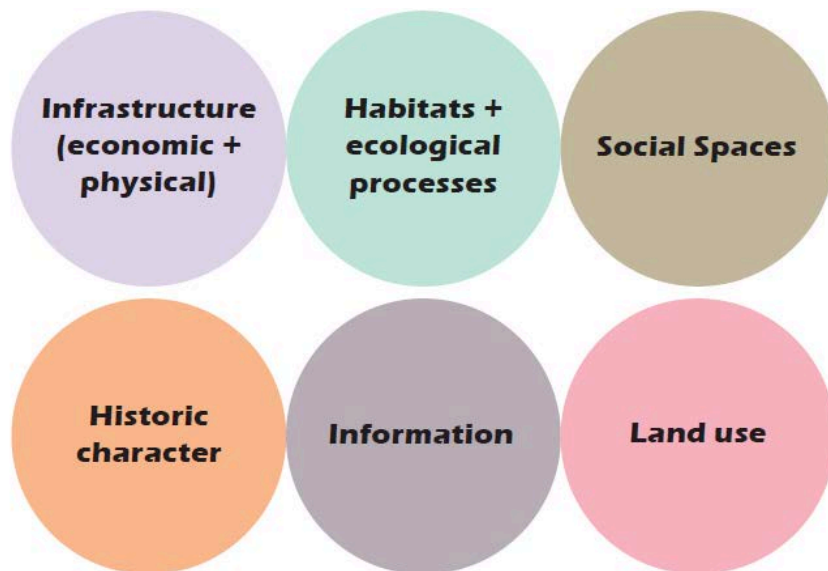


Figure 14. Local resilience principles identified in workshops 1 and 2 for Grays Bay.

2. Suggested resilience projects and next steps

Workshops 2 and 3 focused on scoping potential resilience projects, including who should be involved, potential hurdles, and potential opportunities. Project concepts were also informed by ongoing community engagement. Resulting Grays Bay resilience projects are described further in Appendices E and H. They are:

1. Grays River dredging to reduce flood impacts (Figure 15)
2. Grays River watershed-wide coordination (Figure 16)
3. Grays River monitoring via stream gages (Figure 17)
4. Grays River modeling (Figure 18)
5. Deep River dredging for navigation (Figure 19)
6. Deep River watershed-wide coordination (Figure 20)

The project team helped Wahkiakum County Commissioners to write two proposals to the US Army Corps of Engineers' Section 165(a) Pilot Program for Small or Disadvantaged Communities, in order to take next steps on project #1, Grays River dredging to reduce flood impacts, and project #5, Deep River dredging for navigation.

The project team worked with the Wahkiakum County Marine Resources Committee and Wahkiakum County Port District #2 to write a successful grant proposal to the Washington State COHORT (Coastal Hazards Organizational Resilience Team, via Washington State legislative funding²⁶), in order to take next steps on project #2, Grays River watershed-wide coordination. Work is currently starting.

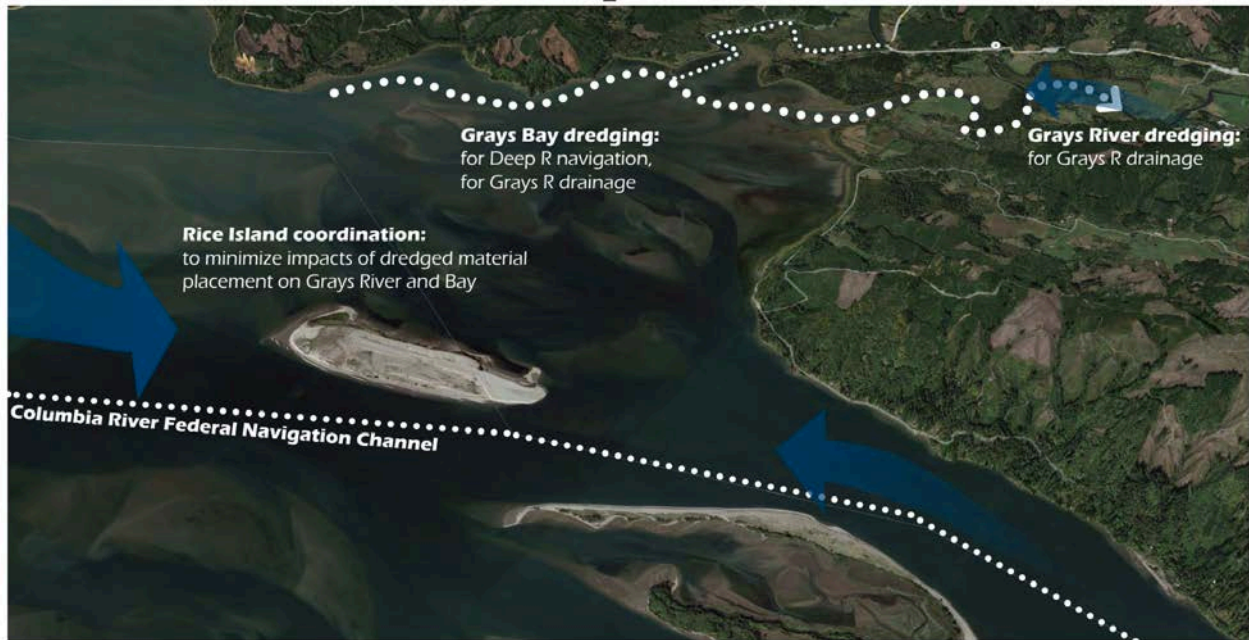
The project team also helped the Columbia River Estuary Study Taskforce (CREST) and the Columbia River Inter-Tribal Fish Commission (CRITFC) to write grants to NOAA. These grants would continue sea level rise modeling, local resilience project support, and related outreach across Baker and Grays Bays.

At the time of publication, proposals to the US Army Corps and NOAA were still under review.

²⁶ See <https://wacoastalnetwork.com/cohort/>

1. Grays River dredging to reduce flood impacts

Wahkiakum County (suggested project lead),
 Port District No. 2,
 WA Department of Fish and Wildlife,
 State of Washington,
 US Army Corps of Engineers



Adaptive capacity

Motivation for adaptation:

Strong community priority, with some objections

High

Access to resources:

Expensive; requires studies and likely maintenance; proposal to US Army Corps in review

Low

Authority to implement adaptation decisions:

Tough permitting; reliance on US Army Corps to conduct all work

Low

Ability to learn and innovate:

Necessary study of hydrology and habitats can inform other efforts

Medium

This project supports these local priorities:



Suggested next steps

Wahkiakum County should:

- Submit funding/assistance proposal to US Army Corps [COMPLETE]
- Work with US Army Corps and others to conduct relevant studies and economic assessments to determine feasibility of dredging
- Conduct State and Federal advocacy and fundraising for next steps
- Pursue additional approaches to reduce flood impacts and their underlying causes across Grays River watershed, in case dredging does not prove successful on its own.

WA Department of Fish and Wildlife should:

- Conduct studies about potential impacts to species/habitats of concern (or aggregate existing studies), and communicate results to interested parties.
- Communicate permitting requirements and concerns to interested parties.

US Army Corps of Engineers should:

- Lead a focused conversation with state agencies and elected officials from Wahkiakum County and Grays River Flood Control District. This would outline the steps required for dredging and relevant hurdles/opportunities.

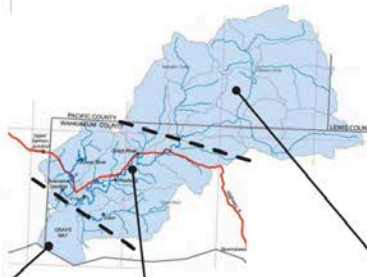
Figure 15. Grays River dredging to reduce flood impacts: concept, adaptive capacity, and suggested next steps

2. Grays River: watershed-wide coordination

Flood impacts reduction is tied to factors across the watershed. A regular action-oriented community forum can ensure that actions are synergistic with related efforts and communicated to interest parties (see Willapa Erosion Control Action Now - WECAN).

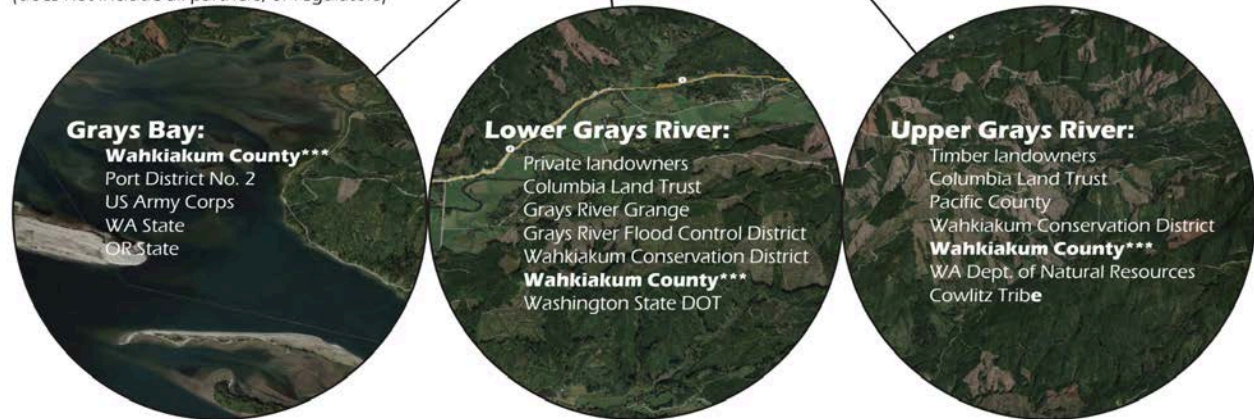
Studies, prototype projects, and information/insight-sharing will be critical to affecting large-scale change through smaller projects.

Key organizations by subregion:
(does not include all partners, or regulators)



All key organizations would be regularly involved in outreach, fundraising, project developments, and group coordination. Participation by agencies will ensure permissible work that builds relationships.

***As the only key organization in all subregions, Wahkiakum County is the logical lead coordinator. Subregion-specific leads may be different than the County.



Adaptive capacity

Motivation for adaptation:

Many efforts already occurring; addresses priority issues

High

Access to resources:

Costly but competitive for grants; leadership needed; studies exist

Medium

Authority to implement adaptation decisions:

TBD distributed projects can focus on interested landowners

Medium

Ability to learn and innovate:

Can learn from existing studies and examples elsewhere; potential for prototypes + revision

High

This project supports these local priorities:



Suggested next steps

Wahkiakum County should:

- Create a webpage with existing documents and project updates
- Conduct educational events to better understand watershed processes, and how other communities have dealt with similar issues. In the near-term, this could be supported by Wahkiakum County Marine Resource Committee's coastal resilience outreach activities.
- Designate a paid individual and/or department as a point of contact for Grays River flood-related issues. Host a regular action-oriented watershed-wide forum for project participants and interested parties to develop projects + learn together

Columbia Land Trust, WA Department of Natural Resources, Cowlitz Tribe, and Wahkiakum County could:

- Create project briefs about their planned and/or ongoing work in the upper watershed to include on the County's TBD webpage.
- Continue to attend local events and Flood Control District meetings.

Grays River Flood Control District should:

- Continue to address localized flood issues (e.g. tide gates, culverts).
- Consider multiple approaches to address flood issues at larger scales that involve coordination across multiple partners.

Figure 16. Grays River watershed-wide coordination: concept, adaptive capacity, and suggested next steps
Baker Bay and Grays Bay: 2024 Sea Level Rise Resilience Strategy

3. Grays River monitoring via stream gages



Adaptive capacity

Motivation for adaptation:

Supports local priorities; uncertain which gage(s) to prioritize

Medium

Access to resources:

Limited funding sources for ongoing operations/maintenance

Low

Authority to implement adaptation decisions:

Gage(s) installation, operations/maintenance, and website are possible

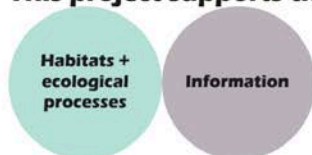
High

Ability to learn and innovate:

Assists emergency preparedness; informs watershed-wide coordination and modeling to reduce flood impacts

High

This project supports these local priorities:



Suggested next steps

Columbia Land Trust should:

- Update vertical elevation info for Covered Bridge gage [COMPLETE]
- Collaborate with Grays River Flood Control District on public outreach in support of emergency preparedness.
- Based on existing conversations, prioritize gages/locations within a phased funding strategy. Continue to lead conversation and update interested parties about funding opportunities and other gage-related developments/needs.
- Once funding is secured, collaborate with PNNL to develop new ratings for sediment and flow. Ensure gages are used for local benefit.

Grays River Flood Control District should:

- Conduct outreach to ensure that locals know how to access and read gage data (including 2024 recalibration of the Covered Bridge gage's elevation datum), in service of emergency preparedness and in collaboration with Columbia Land Trust.
- Communicate to the public how new gages can improve understandings of watershed processes and inform enduring flood impacts reduction projects.

WA Department of Ecology should:

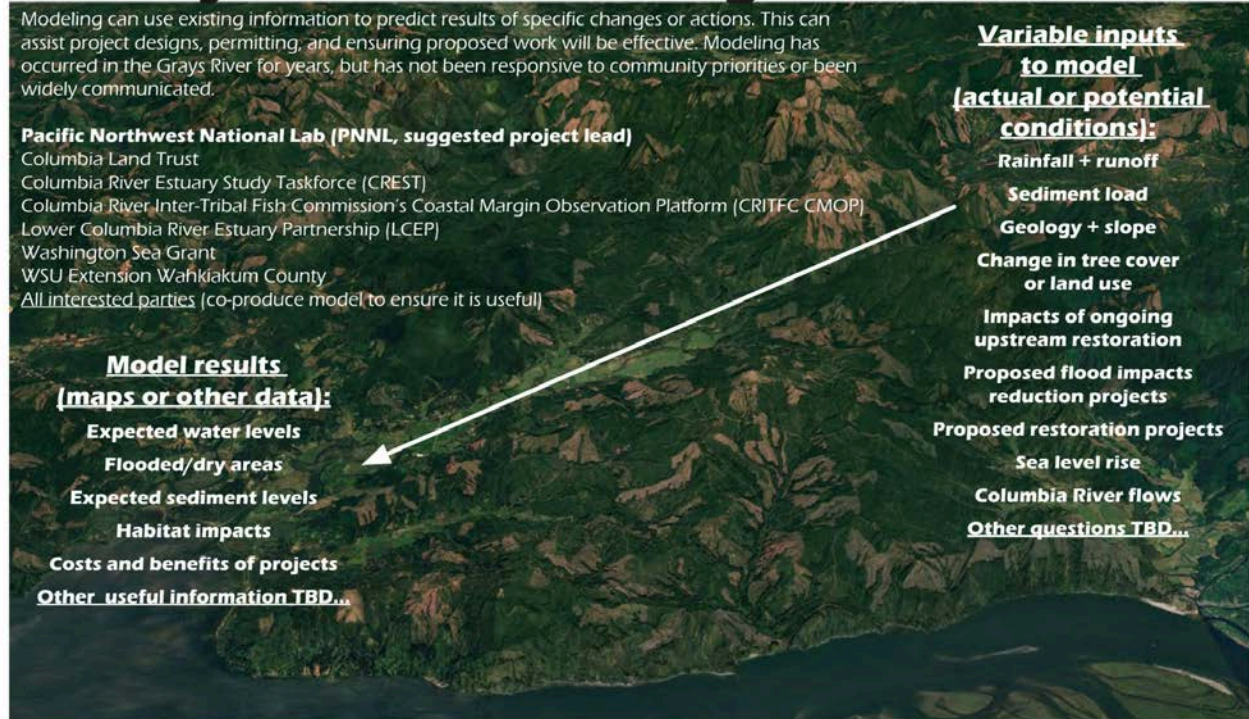
- Continue to host gage data online and advise on gage strategy

Wahkiakum County should:

- Continue to fund the Covered Bridge gage, and explore additional funding opportunities for expanding gaging to reduce flood impacts.

Figure 17. Grays River monitoring via stream gages: concept, adaptive capacity, and suggested next steps

4. Grays River modeling



Adaptive capacity

Motivation for adaptation:

Historical disconnection between modeling and local priorities/projects

Low

Access to resources:

Existing funds; 2 grants in review; competitive for funds if collaborative

High

Authority to implement adaptation decisions:

Occurs primarily on computers; interested parties can guide modeling

High

Ability to learn and innovate:

Provides better understanding of risks + project feasibility

High

This project supports these local priorities:



Suggested next steps

PNNL should:

- Continue existing modeling efforts with multiple opportunities for community input. Adjust expectations as needed to reflect community priorities.
- Produce an easily-digestible set of hydrodynamic maps showing flooding hotspots, for use in ongoing conversations.

Research partners with modeling and mapping capabilities (**CREST, CRITFC CMOP, LCEP, PNNL**) could:

- Continue existing modeling efforts in coordination with community input, reflecting community priorities.
- Ensure that existing and new modeling activities are coordinated with other research partners' efforts, have a robust outreach component, and will tangibly advance projects for local benefit.

Washington Sea Grant and/or WSU Extension Wahkiakum County should:

- Assist public communication about modeling efforts, while assisting modelers to incorporate community perspectives.

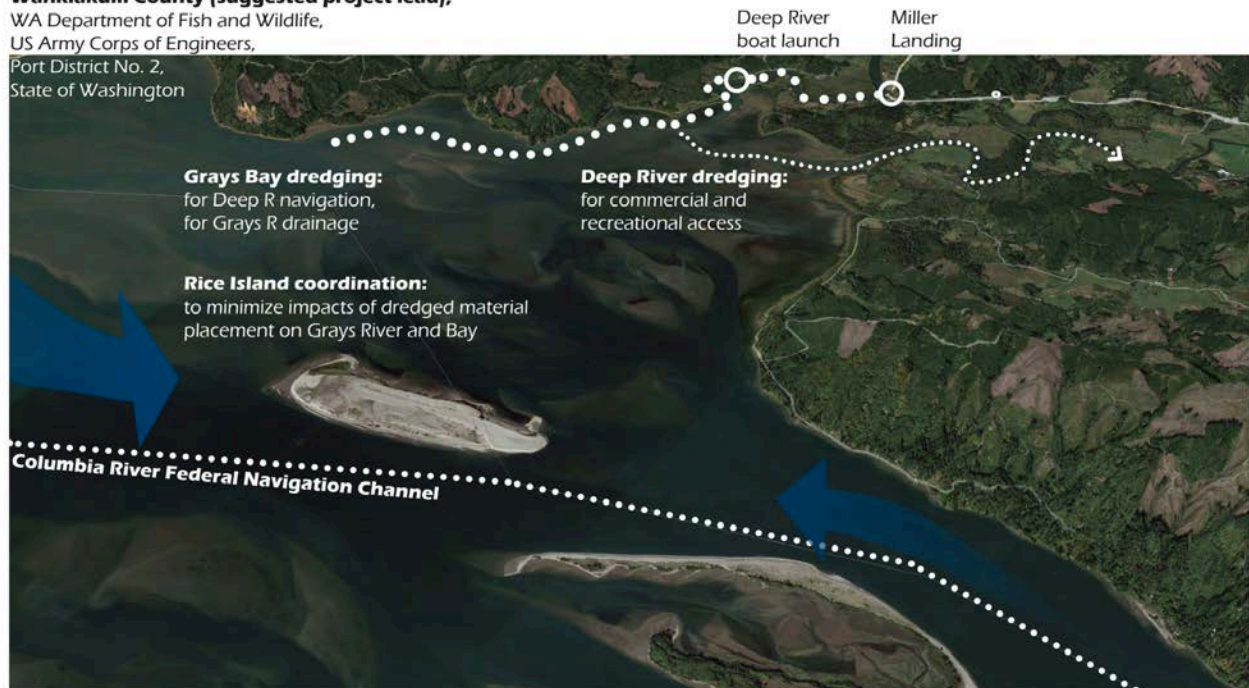
Local interested parties should:

- Continue to join conversations about modeling.
- Learn about ways that modeling has assisted flood impacts reduction projects elsewhere. Communicate your ideas to modelers who may be more focused on research than outreach.

Figure 18. Grays River modeling: concept, adaptive capacity, and suggested next steps

5. Deep River dredging for navigation

Wahkiakum County (suggested project lead),
 WA Department of Fish and Wildlife,
 US Army Corps of Engineers,
 Port District No. 2,
 State of Washington



Adaptive capacity

Motivation for adaptation:
 Strong community priority

High

Access to resources:
 Expensive; requires studies and likely maintenance; proposal to US Army Corps in review

Low

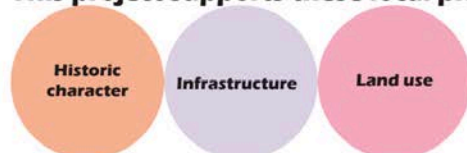
Authority to implement adaptation decisions:
 Tough permitting; reliance on US Army Corps to conduct all work; reliance on economic development at Miller Landing

Low

Ability to learn and innovate:
 Necessary study of hydrology and habitats can inform other efforts

Medium

This project supports these local priorities:



Suggested next steps

Wahkiakum County should:

- Submit funding/assistance proposal to US Army Corps [COMPLETE]
- Work with US Army Corps and others to conduct relevant studies and economic assessments to determine feasibility of dredging
- Conduct State and Federal advocacy and fundraising for next steps
- Ensure that economic development initiatives will be successful by addressing other needs for success
- Pursue additional approaches to reduce flood impacts and their underlying causes across Deep River watershed, in case dredging does not prove successful on its own.

WA Department of Fish and Wildlife should:

- Conduct studies about potential impacts to species/habitats of concern (or aggregate existing studies), and communicate results to interested parties.
- Communicate permitting requirements and concerns to interested parties.

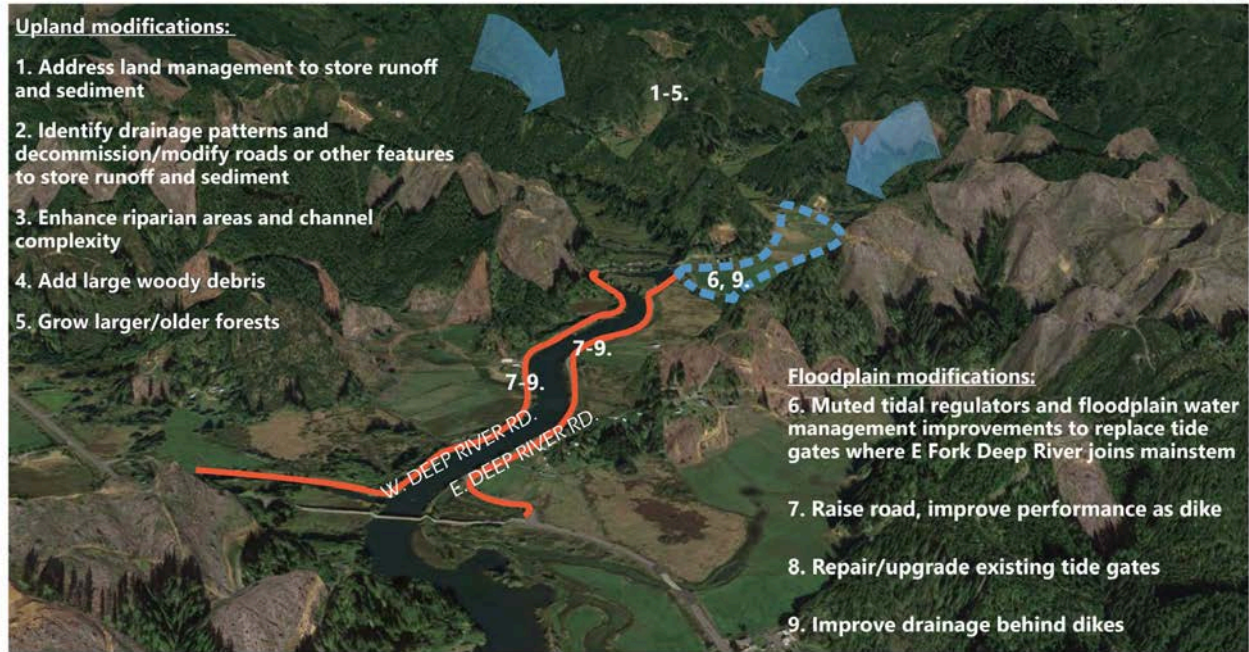
US Army Corps of Engineers should:

- Lead a focused conversation with state agencies and elected officials from Wahkiakum County. This would outline the steps required for dredging and relevant hurdles/opportunities.

Figure 19. Deep River dredging for navigation: concept, adaptive capacity, and suggested next steps

6. Deep River: watershed-wide coordination

CREST (suggested project lead), Timber landowners,
Private Landowners, Columbia Land Trust,
Wahkiakum County, Grays River Grange



Adaptive capacity

Motivation for adaptation:

Some efforts already occurring which may address bulk of flooding; addresses both underlying causes and small-scale projects

High

Access to resources:

Costly and private parcel projects may not be competitive for grants; leadership needed; limited studies exist

Low

Authority to implement adaptation decisions:

TBD distributed projects can focus on interested landowners

Medium

Ability to learn and innovate:

Can learn from existing studies and examples elsewhere; potential for prototypes + revision

High

This project supports these local priorities:



Suggested next steps

CREST should:

- Create project briefs about their planned and/or ongoing work at the East Deep River Road culverts to share at public meetings and on a project webpage.
- Identify a point of contact or project lead to assist with flood impacts reduction (especially upgrade/repair of tide gates and drainage improvements behind dikes. Continue to attend local events.

Wahkiakum County should:

- Assist CREST and landowners to hold regular conversations about Deep River flooding issues.
- Assist CREST and landowners to connect with timber landowners in order to address upland impacts on lowland flooding.

Local residents and landowners should:

- Continue to collaborate with CREST to address flood issues.
- Consider multiple approaches to address flood issues at larger scales that involve coordination across multiple partners.
- Consider whether formation of a Deep River Flood Control District would be a valuable and effective way to address flooding

Figure 20. Deep River watershed-wide coordination: concept, adaptive capacity, and suggested next steps

3. Cross-cutting recommendations for Grays Bay sea level rise resilience

When these six Grays Bay sea level resilience projects' adaptive capacities are viewed side-by-side, and when we look at the number of times that each organization was suggested as a key project participant for Grays Bay projects (Figure 21), we see that **Wahkiakum County, Columbia Land Trust, Port District #2, the State of Washington, and the US Army Corps of Engineers** are all part of the majority of resilience projects identified through workshops.

Resulting recommendations include:

- a. Regular communication regarding hazards, habitat changes, and land use across Baker Bay could build relationships between key entities: Wahkiakum County, Columbia Land Trust, and Port District #2. While private landowners (both residential and timber land owners) are key parts of ecological processes related to flooding in the Grays Bay area, coordination between the County, Land Trust, and Port offers an opportunity to engage these private groups and develop collaborative resilience projects. Relationships across these organizations and Washington State agencies is likely to lead to increased access to resources and authority to implement resilience actions.
- b. Local jurisdictions and special districts (Wahkiakum County, Port District #2, Grays River Flood Control District, and Wahkiakum Conservation District) should make sure to collaborate with Columbia Land Trust (CLT) on day-to-day activities as well as large-scale or long-range activities. CLT should ensure their activities accommodate local needs and priorities, also.
- c. Collaborative approaches and large funding is necessary for all of these projects. Lessons learned from emerging projects should be shared across project partners, perhaps through a continued resilience forum.²⁷ Washington State agencies can provide assistance, and should be involved at an early stage. This can also assist early-stage determinations of feasibility for projects that have much community support but limited likelihood of being permitted, in order to develop more feasible projects.
- d. State and federal elected officials are key to unlock funding for complex projects involving watershed-wide coordination and federal navigation channel operations. They are also likely to have an audience with the US Army Corps of Engineers. Local interested parties would benefit from understanding pathways to working with the US Army Corps, as well as the Corps' limitations.
- e. Due to the scale and complexity of several of these projects, they will continue to involve multiple generations. While ongoing research may be necessary, it is also necessary that local and regional education programming allows youth and today's interested parties to learn about hydrologic processes and floodplain functions; case studies and their lessons learned from projects of interest (including field visits); local activities, projects, and culture throughout local watersheds; and ever-changing socio-ecological dynamics.
- f. While potential projects and plans may abound, there are also realistic concerns about unexpected impacts from policy and land use change on surrounding residents. This could be addressed through legal/policy inquiry, education and outreach campaigns, robust and community-engaged design of physical projects, and/or demonstration projects to pilot ideas that are new to the area.²⁸

²⁷ Washington's Coastal Hazards Resilience Network's (CHRN) Annual Meeting is one such forum, though it currently has low involvement from community members and may not meet needs for local engagement. See www.wacoastalnetwork.com

²⁸ For example, there are questions regarding the application of RCW 90.58.580 across Grays Bay, concerning properties being newly-regulated by the County's Shoreline Master Program if restoration actions occur next door. Additional inquiry seems necessary to understand whether land that becomes within 200' of a shoreline due to new restoration or water management work is subject to shoreline regulations, and how this may limit use of property.

Wahkiakum County

Columbia Land Trust

Port District No. 2 State of WA US Army Corps

CREST Grays River Grange Grays River Flood Control District

PNNL Private landowners timber/upland landowners

Wahkiakum Conservation District WA Department of Fish and Wildlife

CRITFC CMOP Cowlitz Tribe LCEP Pacific County

State of Oregon WA Department of Ecology WA Department of Natural Resources

WA Sea Grant WA State DOT WSU Extension - Wahkiakum County

Figure 21. Groups or organizations arranged according to the amount of times they were listed as a Grays Bay project partner. Groups with suggested involvement in five projects are at the top, descending to groups with suggested involvement in one project at the bottom. This does not include regulatory roles, technical service providers, or other interested parties.

Regional takeaways

Several interrelated and complex issues related to climate hazards and habitat resilience were repeatedly brought up at community workshops in both regions. These require significant additional coordinated effort to address:

- I. Upland forestry practices that promote increased flooding downstream;
- II. Limited affordable housing availability;
- III. Reduced access for emergency services when transportation infrastructure is flooded;
- IV. Earthquake and tsunami resilience;
- V. Limited local capacity to lead projects, advocacy, and other coastal resilience activities;
- VI. Economic trends affecting resilience capacity and quality of life

I. Upland forestry practices that promote increased flooding downstream

Throughout the project, community members mentioned land use and upland forestry practices as a major issue exacerbating flooding. Timber harvest practices on privately-owned lands have caused increased erosion of those lands and resulting sediments being deposited in downstream depositional reaches of streams and rivers.²⁹ This sedimentation results in decreased capacity of these waterbodies to absorb river flows - both tributary and Columbia River, while features (e.g., levees) built to protect infrastructure, farms, and local communities can frequently increase subsidence of lands behind these protective features, increasing flood risk. Without resolving the issue of eroding lands in the upland areas of the watersheds, this cycle is bound to continue and intensify, becoming more problematic as storm events increase in magnitude and frequency while sea levels rise. Timber companies were not directly engaged through this project's outreach and community workshops.

II. Limited affordable housing availability

Another widespread issue discussed was affordable housing, with a focus on low- or fixed-income and workforce housing. With limited housing availability, high cost of land for new housing, and the high cost of existing homes, low and moderate income residents face a difficult time finding affordable places to live within these regions and beyond. A concern amongst workshop participants is that there will be pressure for community leaders to address these issues by allowing developers to convert marginal, frequently flooded areas such as floodplain wetlands into housing developments for lower income residents. Unfortunately, if this were to occur, the residences would likely suffer frequent flooding, as would the larger surrounding areas without the former wetlands to buffer flooding events.

Participants recognized the need for both short-term and long-term strategies to provide housing, protect communities, and sustain ecosystems. Short-term approaches may involve designs to reduce flood impacts on existing developed areas, however many participants suggested that upland relocation is necessary for some areas. Participants highlighted that such large projects would be difficult to achieve due to funding and motivational constraints. As such there may be a need to provide incentives for people to live upland, including providing desirable transportation access, infrastructure, utilities, and permitting. Continuous community outreach and coordination between various entities will be necessary to reduce flooding hazards while balancing other long-term community priorities in service of housing availability. At the time of publication, Pacific County has initiated this work via a housing needs assessment and related research in partnership with the University of Washington's Livable City Year.³⁰

²⁹ Wahkiakum County, 2023. Draft Wahkiakum County Comprehensive Flood Hazard Mitigation Plan.

³⁰ <https://lcy.be.uw.edu/pacific-county-2022-2023/>

The two above discussions about land use also relate to agricultural land use, agricultural viability, and land use change mentioned throughout these workshops.

III. Reduced access for emergency services when transportation infrastructure is flooded

An often repeated issue is the ability of emergency services to access areas that are prone to flooding. During flood events that overtop roadways, some residents are unable to leave their homes to obtain medical care or other services. Likewise, emergency services are unable to reach them. Some residents of Grays Bay have obtained keys to gated logging roads, but this has not provided a wide-ranging or equitable solution to access issues. This issue will likely worsen with more intense and frequent storm events and higher tidal flows from the Columbia River.

IV. Earthquake and tsunami resilience

Workshop participants repeatedly mentioned impacts, emergency response, and proactive adaptation opportunities related to earthquakes and tsunamis. Adaptation opportunities to support local coastal resilience and other priorities, potentially alongside sea level rise resilience, should be explored further.

V. Limited local capacity to lead projects, advocacy, and other coastal resilience activities

Workshop participants regularly described the need for a local champion(s) and resiliency advocate(s). The issues described above are widespread, complex, and not limited to Baker and Grays Bays. They will require sustained efforts to address. These efforts may be most beneficial if led by a person or organization that is trusted within local communities, with the resources and capacity to dedicate time and attention to resiliency issues. As such, the region³¹ could greatly benefit from a local champion who consistently and effectively identifies and advocates for solutions to local resilience issues.³²

Resilience capacity needs are illustrated in Figure 22 via an adaptive capacity analysis for specific projects across both Baker and Grays Bays, as presented and discussed in the final workshop.³³ This analysis can inform efforts to build local resilience capacity. Key takeaways from this analysis include:

- Communities generally have motivation and opportunities to learn and innovate through this work, as long as expectations remain flexible. Rather than relying on *project*-focused processes alone (such as this workshop series),³⁴ collaborative *goals*-driven processes could assist while building trust alongside incremental gains.³⁵
- Motivation was closely related to projects that directly address present-day local priorities. Long-term planning, research, and modeling were not prioritized by workshop participants (Baker Bay project #6 and Grays Bay projects #5 and #6). Similarly, the other low-priority project was complex and had not been successfully addressed by attempts to-date (Baker Bay project

³¹ A regional approach could cover coastal Washington (Pacific Coast), southwest Washington, the lower Columbia River estuary, coastal Washington and Oregon, or otherwise.

³² While this role is often referred to as an individual, an organizational or multi-organizational approach involving multiple people will likely be most effective due to the complexity, scale, and duration of these issues.

³³ See Appendices E and H for more detail.

³⁴ These workshops focused on developing and advancing projects, rather than focusing on education or other topics necessary for collaborative coastal resilience work.

³⁵ Goals-driven processes may focus on underlying motives, desires, and needs for participants, rather than results. This may also involve greater understandings of events, patterns, structures, and mental models affecting resilience.

#3). This highlights the opportunity to pair long-term work with tangible and visible progress while engaging community members in modeling or other research.³⁶

- Funding this work is a consistent hurdle, but some projects may be competitive for relevant grants if 1) there is local capacity to write, manage, and participate in those grants and 2) they are able to show habitat and social benefits. State agencies can fill this role.
- Authority to implement many projects is limited by regulations, buy-in from landowners, and/or reliance on the US Army Corps to perform work. Across multiple projects there is need for information about project design alternatives, technical feasibility, and permitting requirements.

	<u>Motivation</u>	<u>Resources</u>	<u>Authority</u>	<u>Innovation</u>
<u>Baker Bay projects</u>				
1. Ilwaco shoreline flood protection	likely to happen	low likelihood or requires significant effort	likely to happen	likely to happen
2. Ilwaco distributed stormwater management	likely to happen	somewhat likely	likely to happen	likely to happen
3. Lower Wallacut River water management and flood adaptation	somewhat likely	somewhat likely	somewhat likely	likely to happen
4. Chinook Hatchery and Houchen Street flood impacts reduction	likely to happen	somewhat likely	somewhat likely	likely to happen
5. Chinook shoreline erosion reduction and habitat enhancement	likely to happen	somewhat likely	low likelihood or requires significant effort	likely to happen
6. Ilwaco and Chinook (Pacific County) upland housing planning and development	somewhat likely	low likelihood or requires significant effort	low likelihood or requires significant effort	likely to happen
<u>Grays Bay projects</u>				
1. Grays River dredging to reduce flood impacts	likely to happen	low likelihood or requires significant effort	low likelihood or requires significant effort	somewhat likely
2. Grays River: coordinated flood impacts reduction projects across watershed	likely to happen	somewhat likely	somewhat likely	likely to happen
3. Grays River gages	somewhat likely	low likelihood or requires significant effort	likely to happen	likely to happen
4. Grays River modeling	low likelihood or requires significant effort	likely to happen	likely to happen	likely to happen
5. Deep River navigation channel dredging	likely to happen	low likelihood or requires significant effort	low likelihood or requires significant effort	somewhat likely
6. Deep River: coordinated flood impacts reduction projects across watershed	likely to happen	low likelihood or requires significant effort	somewhat likely	likely to happen
<div style="display: flex; flex-direction: column; gap: 5px;"> <div style="background-color: #c8e6c9; width: 100px; height: 15px;"></div> <div style="background-color: #fff9c4; width: 100px; height: 15px;"></div> <div style="background-color: #ffcdd2; width: 100px; height: 15px;"></div> </div> <p>likely to happen somewhat likely low likelihood or requires significant effort</p>				

Figure 22. Adaptive capacity analysis for the projects across Baker Bay and Grays Bay

³⁶ For example, Grays Bay watershed-wide coordination efforts (Grays Bay project #2) could advance modeling and other understandings through community science. Related, small-scale pilot projects would provide more visibility to long-term and large-scale work - such as addressing sedimentation and optimizing public space at the Rosburg boat launch.

These findings reflect the 2019-21 RAD project’s findings and its ensuing recommendations to enhance local communities’ resilience along the Pacific coast of Washington State.³⁷ The RAD recommendations are focused on state and federal audiences, however locally-driven pathways to increasing staffing and community-driven resilience activities should be further explored, potentially alongside addressing foundational or systemic issues such as forestry practices, housing availability, and economic trends.³⁸ This also requires the ability to attract and/or retain residents interested in and capable of this work, alongside developing sustained funding and programs to advance these initiatives. The position could sustain itself through successful grants and collaborations with organizations involved in this work.³⁹

Figure 23 shows organizations identified during workshops as partners on specific resilience projects. This list provides a starting point for developing a regional resilience collaborative and/or staff positions. Notably, multiple participants identified the Chinook Indian Nation as a potentially interested party or partner in projects across the region, though their role(s) in individual projects were not communicated further. If the Chinook Indian Nation is further engaged or achieves federal recognition, this lack of specificity may change.⁴⁰ Additional engagement with the Chinook Indian Nation is necessary to better understand their interests. Additional engagement with private timber/upland landowners is also necessary for collaboratively managing this region’s natural resources and reducing flood impacts.



Figure 23. Groups or organizations arranged according to the amount of times they were listed as a Baker Bay or Grays Bay project partner. Groups with suggested involvement in eight projects are at the top, descending to groups with suggested involvement in one project at the bottom. No organizations were listed for 6 projects. This does not include regulatory roles, technical service providers, or other interested parties.

³⁷ <https://wacoastalnetwork.com/resilience-action-demonstration-project/>

³⁸ For example, communities or counties could pool resources to employ staff specifically dedicated to reducing flooding issues across these two regions. This reflects several recommendations in this report for specific resilience projects.

³⁹ See *Acknowledgements, Suggested resilience projects and next steps* sections of this report.

⁴⁰ The Chinook Indian Nation is actively involved in a campaign for federal recognition. For a description of potential community impacts from federal recognition which relate to the regional takeaways described in this report, see <https://chinookjustice.org/tribal-recognition/>

VI. Economic trends affecting resilience capacity and quality of life

Coastal resilience is directly affected by economic trends across Baker and Grays Bay's communities. Participants noted a need to coordinate with local, state, and regional organizations (including Clatsop County and others in Oregon) to support community viability on both sides of the Columbia River. By focusing on economic development alongside coastal resilience, communities of the lower Columbia River can support future generations and ecosystems in a place-based regenerative manner.