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June 16, 2022

The Honorable Dianne Feinstein
Chair
The Honorable John Kennedy
Ranking Member
Committee on Appropriations
Energy and Water Development Subcommittee
United States Senate

The Honorable Marcy Kaptur
Chairwoman
The Honorable Mike K. Simpson
Ranking Member
Committee on Appropriations
Energy and Water Development, and Related Agencies Subcommittee
House of Representatives




Coastal Navigation: Authorized Purposes of Jetties, Breakwaters, and Other Structures Can Impact Corps' Maintenance and Repair

The movement of commerce and the presence of water recreation involve the ability of the U.S. Army Corps of Engineers (Corps) to provide safe, reliable, efficient, and environmentally sustainable waterborne transportation systems.¹ As part of the Corps' primary missions, the agency is tasked with maintaining and repairing coastal navigation structures that are part of harbors and ports (see fig. 1).²

¹The Corps has both a military and a Civil Works program. The military program provides, among other things, engineering and construction services to other U.S. government agencies and foreign governments, while the Civil Works program is responsible for investigating, developing, and maintaining water resources development projects. This report discusses only the Civil Works program.

²The Corps' three primary mission areas are (1) restoration, protection, and management of aquatic ecosystems; (2) support of commercial navigation; and (3) flood risk management. See U.S. Army Corps of Engineers, *Sustainable Solutions to America's Water Resource Needs: Civil Works Strategic Plan 2014-2018*, EP 1165-2-503 (Washington, D.C.: Dec. 31, 2014).

Figure 1: Most Common U.S. Army Corps of Engineers' Coastal Navigation Structures

Structure	Description
<p data-bbox="199 306 248 331">Jetty</p> 	<ul data-bbox="620 348 1125 464" style="list-style-type: none"> • Shelters harbor basins and entrances from waves and currents by securing a consistent and safe navigation channel from the ocean to inland waters. • Composed of large stones on the outside protecting smaller core stone on the inside.
<p data-bbox="199 600 305 625">Breakwater</p> 	<ul data-bbox="620 642 1084 737" style="list-style-type: none"> • Shelters harbor basins and entrances from waves and currents, to improve navigation safety. • Dissipates and reflects wave energy. • Usually made of rock or concrete.
<p data-bbox="199 894 298 919">Revetment</p> 	<ul data-bbox="620 936 1125 1031" style="list-style-type: none"> • Protects shorelines against erosion from water-level changes and small, low-energy waves by reinforcing a part of the beach profile. • Usually made of rock or concrete.

Sources: U.S. Army Corps of Engineers, Portland District (jetty photo); U.S. Army Corps of Engineers, Buffalo District (breakwater photo); and J.C. Allan, Oregon Department of Geology and Mineral Industries, O-16-07 report (October 2013) (revetment photo). | GAO-22-104304

The Corps' activities, including the type and scope of coastal navigation structures that the Corps may construct and maintain, are authorized by Congress. Corps officials said the authorization usually refers to the document or report recommending the project to Congress, which Congress then references in the legislation—typically a Rivers and Harbors Act or Water Resources Development Act—authorizing the project. These reports can include specific dimensions for the projects, according to the officials. The Corps is permitted to build or improve a structure, consistent with its authorization.

Moreover, a number of the coastal navigation structures maintained by the Corps were built over a century ago and may no longer be sufficient to meet current conditions and changes in the climate, such as sea level rise, according to Corps officials. For example, increased wave and storm intensity in coastal areas threaten the integrity of coastal navigation structures, such as jetties and breakwaters. This potentially jeopardizes lives and communities, disrupts commercial navigation traffic, and increases the frequency and cost of needed repairs. (In four enclosures to this report, we provide details of how specific communities may be impacted.)

A report accompanying the 2020 Energy and Water Development and Related Agencies Appropriations Bill includes a provision for us to review how to increase the Corps' capacity to

repair and maintain existing projects before they deteriorate to the point of failure.³ This report describes what factors, if any, affect the Corps' ability to consider impacts not directly related to navigation when determining which existing coastal navigation structures to maintain and repair.

To address this objective, we selected examples, reviewed documents, and interviewed officials.

Selected examples. We selected coastal navigation structures at four projects for use as illustrative examples based on input from Corps officials about the roles of these structures in their communities (see encs.). Specifically, we selected structures that we believe serve navigation functions while also demonstrating potential impacts to communities if the Corps' ability to maintain and repair the structures is restricted. Our observations from these structures may not be generalizable to all of the Corps' coastal navigation structures.

Reviewed documents. We reviewed legislation, such as the Rivers and Harbors Acts, and Corps documents, such as the Chief of Engineer's reports and guidance documents, to verify officials' statements about the Corps' oversight of the structures and the agency's policies and procedures, as appropriate. In some instances, we were not able to verify officials' statements about particular structures, such as a project's authorized purpose, and attributed such comments to the officials. We also reviewed documents from nonfederal organizations, such as documents about the four illustrative examples.

Interviewed officials. We also interviewed officials from Corps headquarters, all eight Corps divisions based in the United States, and at least one district from each division (16 districts in total). We selected these districts to achieve geographic coverage and based on input from Corps officials in headquarters and the divisions. We also interviewed nonfederal partners, such as officials from state and local government agencies, organizations representing the navigation industry, and representatives of citizens' groups with knowledge about the structures highlighted as illustrative examples.

We focused our review only on the Corps' navigation mission area, specifically the agency's coastal structures, so the findings may not be applicable beyond this scope. We did not review the Corps' maintenance and repair processes for navigation; instead, we identified factors that may impact the Corps' processes and its ability to maintain and repair coastal navigation structures. Within the Corps' navigation mission area, we reviewed only coastal structures and did not assess the Corps' efforts to maintain and repair inland structures.⁴ We also did not include dredging within our review.⁵

We conducted our work from April 2020 to June 2022 in accordance with all sections of GAO's Quality Assurance Framework that are relevant to our objectives. The framework requires that we plan and perform the engagement to obtain sufficient and appropriate evidence to meet our stated objectives and to discuss any limitations in our work. We believe that the information and

³House Report 116-83, accompanying H.R. 2960 (116th Cong.).

⁴For past GAO work looking at the Corps' inland navigation efforts, see, for example, GAO, *Inland Waterways: Actions Needed to Increase Budget Transparency and Contracting Efficiency*, [GAO-19-20](#) (Washington, D.C.: Nov. 7, 2018).

⁵For past GAO work looking at the Corps' dredging efforts, see, for example, GAO, *Inland Harbors: The Corps of Engineers Should Assess Existing Capabilities to Better Inform Dredging Decisions*, [GAO-17-635](#) (Washington, D.C.: July 26, 2017).

data obtained, and the analysis conducted, provide a reasonable basis for any findings and conclusions in this product.

Authorized Purpose of Coastal Navigation Structures Can Impact the Corps' Maintenance and Repair Decisions

Coastal navigation structures' authorized purpose can impact the Corps' decisions to maintain and repair the structures. According to Corps officials in headquarters, divisions, and selected districts, the authorizing language for coastal navigation structures in some instances (1) designates navigation as the structures' authorized purpose and (2) can restrict flexibility or adaptive management.

Authorizing Language Designates Navigation as Structure's Purpose

Corps officials told us that because there is not enough funding to cover all the maintenance and repair needs for the agency's coastal navigation structures in a given year, the agency prioritizes structures at projects for maintenance and repair.⁶ Headquarters officials also said that the agency is limited in considering supplementary (i.e., nonnavigation) benefits for prioritizing structures for maintenance and repair as part of the Corps' budgeting process. Specifically, the authorizing language designates navigation as a coastal navigation structure's purpose and directs the Corps to consider navigation benefits and impacts when making repair decisions, according to the officials. Funding prioritization is tied to the business line and the authorized purpose, but the Corps can evaluate benefits that are incidental to the primary purpose of navigation, according to the officials. Among the factors the Corps considers when making maintenance and repair decisions for coastal navigation structures are navigation-focused criteria, primarily commercial tonnage categorized by high, moderate, or low use.⁷ As a result, Corps officials in some divisions and districts told us that projects for high or moderate use, such as at the Port of Los Angeles, are prioritized over structures at low-use projects, such as Lac La Belle Harbor in the Detroit District.

Yet, as both Corps division and district officials and nonfederal partners told us, some structures provide economic value, even though they may not have the highest commercial tonnage. Moreover, Corps officials told us that they cannot incorporate nonnavigation (supplementary) benefits, such as protection of coastal areas the structures may provide, when making maintenance and repair decisions, absent a change to the authorizing language or an additional authorization.

Corps headquarters officials said that recent additional funding, such as from changes to the Harbor Maintenance Trust Fund and the Infrastructure Investment and Jobs Act, have made

⁶As we previously reported, the Corps allocates funds for operations and maintenance projects based on economic benefit and risk. The Corps ranks maintenance projects identified during the budget process based on the value or level of service the project is expected to provide, as well as how critical they are. The Corps funds as many of the priority projects as possible, given available funding, and the rest are deferred. ([GAO-19-20](#)).

⁷Commercial tonnage is categorized by high, moderate, or low use. For coastal navigation, high commercial use is defined as coastal projects with at least 10 million tons of cargo annually. Moderate commercial use is defined as coastal projects with at least 1 million tons, but less than 10 million tons of cargo annually. Low commercial use is defined as coastal projects with less than 1 million tons of commerce annually. Headquarters officials told us that consideration is also given to minimum legal responsibilities for operation, safety, and environmental compliance. In addition to commercial tonnage, other factors the Corps considers include risk reduction, critical harbor of refuge, harbor safety issues, presence of a U.S. Coast Guard station, national security, subsistence harbor, public transportation, commercial fishing, and tribal access to usual and accustomed fishing grounds.

more funding available to address navigation projects and maintenance and repair backlogs.⁸ In addition, the Corps focuses a specific amount of funding for low-use projects, especially for those that are remote, subsistence, or harbors of refuge, according to agency officials. However, these projects represent the largest portion of the navigation portfolio, making it difficult to address every low-use project while ensuring that the high- and moderate-use projects are maintained.

The following examples illustrate the impact of authorizing language designating navigation as a structure's purpose.

Chicago. Officials in the Chicago District told us that the Chicago Harbor, which protects portions of the third-largest city in the nation, has a significant recreational boating and tourism industry, but the breakwaters in the harbor do not compete well for funding because there is minimal commercial traffic in the harbor.⁹ The officials said that the supplementary recreational benefits of the structures are not captured in the funding prioritization process.

Gulf of Mexico. Officials in the Corps' New Orleans District told us that certain ports and waterways provide critical service and supply capabilities for off-shore oil and gas activities in the Gulf of Mexico but do not rank highly in terms of the commercial tonnage metric. Corps officials and nonfederal partners also told us that many of the structures at low-use projects around the nation have valuable supplementary benefits, such as protection of agricultural lands used for rice production and recreation.

Seattle. At Grays Harbor in the Corps' Seattle District, the North Jetty was authorized for navigation, but the structure also provides erosion and flood protection benefits for the adjacent city of Ocean Shores, according to officials in the Corps' Seattle District. The jetty continues to function for its authorized navigation purpose, but the community has raised concerns about increased flooding and coastal storm damage as a result of the jetty eroding. Specifically, a 2017 report found that 20 percent of the city of Ocean Shores' property value is in jeopardy—\$200 million of the city's \$1 billion monetary worth. Moreover, municipal infrastructure—including the city's \$24.8 million wastewater plant, plus drinking water and road systems—are all vulnerable to inundation from continued decline of the jetty. (See enc. 2 for more about Grays Harbor.)

Officials told us that it could be beneficial for the Corps to be able to take a "systems approach" by including supplementary, nonnavigation benefits to other mission areas when prioritizing coastal navigation structures for maintenance and repair. However, they added that quantifying such benefits and determining how to divide the costs of the repairs among the mission areas could be difficult for the Corps. Officials also told us that adding purposes to a structure's

⁸Congress appropriates funds to the Corps for maintenance and repair of coastal navigation structures through certain Corps appropriation accounts, which are usually reimbursed from the Harbor Maintenance Trust Fund. The Water Resources and Development Act of 2020 increased the amount of receipts that could be appropriated from the fund to the Corps for its maintenance and repair responsibilities in a given fiscal year. Other sources of additional funding that the Corps cited include the Infrastructure Investment and Jobs Act, Pub. L. No. 117-58, Div. J, tit. III, 135 Stat. 429, 1359–63 (2021), and the Disaster Relief Supplemental Appropriations Act, Pub. L. No. 117-43, Div. B, tit. IV, 135 Stat. 344, 363 (2021).

⁹According to Corps officials, funding targets established in the Water Resources and Development Act of 2020 make more funds available to Great Lakes and Emerging Harbors, including Chicago Harbor.

authorization may also be beneficial, but this process is long and requires congressional approval.

Authorizing Language Can Restrict the Corps' Ability to Adapt Structures to Current Conditions

The authorizing language can include or reference structure specifications—specific length, height, or location—that do not allow the Corps to make updates to the structures that could better address current conditions, according to Corps officials. The officials told us that although the authorizing language for structures varies in terms of the levels of specificity, when the authorizing language is restrictive, it may require officials to use original design specifications that can date back decades or more when repairing damaged structures. The Corps views repairs that do not adhere to the original specifications as unauthorized, according to officials. However, these specifications may not reflect current design standards or changes in the conditions affecting the structures since the structures were built. For example, the structures' designs may not be able to address more frequent severe storms and wave action, sea level rise, and increased flooding because of changes in the climate.

As officials in one division told us, something built 60 years ago will be unlikely to perform exactly the same way in today's dynamic environment. According to these officials, the original design from decades ago is based on how these projects were authorized but with changes in the climate may now be outdated.

The following examples illustrate how authorizing language that restricts the Corps' ability to adapt coastal navigation structures may affect communities.

Mouth of Columbia River, Pacific Northwest. The mouth of the Columbia River is one of the toughest passes to cross. Therefore, if the Corps does not maintain its structures—three jetties constructed between 1885 and 1939—ships can be delayed or put at risk. The mouth of the Columbia River is a high-use project, so its structures generally get funded for maintenance and repair. Yet, the jetties are regularly pounded by Pacific Ocean waves between 10 and 20 feet high, with winter storms bringing extreme waves in excess of 30 feet. As a result, the jetties have deteriorated from when they were first built. With prescriptive authorizing language, the division must mitigate a structure's original design rather than do what may be necessary to fortify a structure in light of current environmental conditions, according to officials in the Northwest Division. Therefore, less prescriptive language that still allows a structure to serve its intended function no matter the changing conditions would be beneficial, according to these officials.

Narragansett, Rhode Island. The Corps completed construction of the Main Breakwater in Narragansett's Point Judith Harbor in 1914. Officials from the New England District said the breakwater is significantly damaged, potentially threatening navigation interests in the area. According to these officials, rebuilding the breakwater to its original design would not be sufficient to protect these interests against sea level rise, increased storm intensity, and other events linked to climate change. The officials said they would need the flexibility to modify the structure in ways that may not currently be permitted by the authorizing language.

Communities, including Narragansett, have developed along beaches in the harbor protected by the breakwater and have seen the breakwater overtopped by waves that threaten these communities, according to Corps officials. The officials said that it would be more cost effective over the long term to allow the Corps to make repairs that the agency determines would be needed to address these current and likely near-term future conditions, rather than to the original specifications in the authorizing language. These repairs include increasing the

breakwater's elevation, changing slopes and width, or increasing the size of its protective stones. According to Corps officials, such adaptive management would also have the potential to reduce the frequency and scope of necessary repairs in the future. (See enc. 4 for more about Point Judith.)

Changing conditions, such as sea level rise, also point to Corps engineers' and scientists' need for flexibility when making decisions on how to maintain and repair structures, according to Corps officials. These officials said that a better approach could be if the project authorization focused on the intended function of a structure, as opposed to detailing the structure's length, height, or other dimension, while giving the Corps the flexibility to adapt the structure to changing conditions.

Although the Corps could request reauthorization to allow for such changes to the coastal navigation structures, officials said that this can be a long process, requiring congressional approval. Allowing the Chief of Engineers more authority to modify the design of the structure without requiring reauthorization by Congress may help to speed up the process of altering the projects to respond to climate change, according to the officials.

Agency Comments

We provided a draft of this report to the Department of Defense for review and comment. The Department of Defense informed us it had no comments on the draft report. Officials provided an alternative photo for fig. 1, which we incorporated.

We are sending copies of this report to the appropriate congressional committees, the Secretary of Defense, the Assistant Secretary of the Army for Civil Works, the Chief of Engineers and Commanding General of the U.S. Army Corps of Engineers, and other interested parties. In addition, the report is available at no charge on the GAO website at <https://www.gao.gov>.

If you or your staff have any questions about this report, please contact me at (202) 512-3841 or JohnsonCD1@gao.gov. Contact points for our Offices of Congressional Relations and Public Affairs may be found on the last page of this report. GAO staff who made key contributions to this report are Vondalee R. Hunt (Assistant Director); Lisa Vojta (Analyst-in-Charge); Danny Baez; William Gerard; and Donna Morgan. Amy Abramowitz; Ryan D'Amore; Edward J. Rice, PhD; Amelia Bates Shachoy; Rachel Stoiko; Sara Sullivan; and Joe Thompson also contributed to the report.



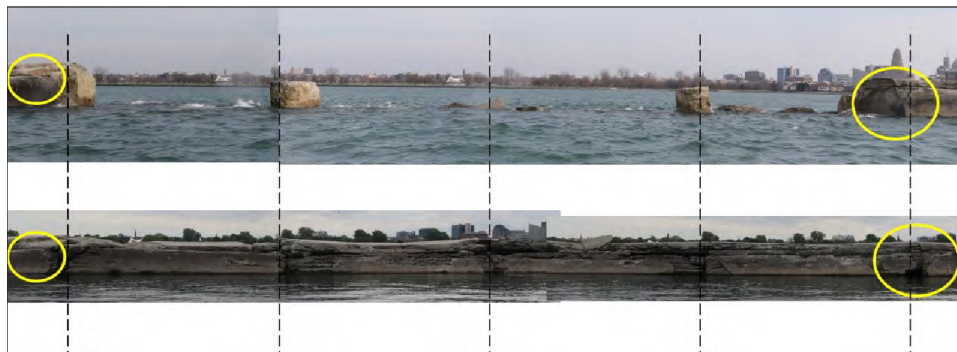
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Enclosures – 4

Enclosure 1. Buffalo Harbor North Breakwater (Buffalo, New York)

Figure 2: Storms Collapsed Buffalo Harbor’s North Breakwater’s Concrete Cap, Breaching the Structure, New York

Storms in 2019 collapsed 200 feet of the concrete cap, washed out the core stone, then breached the breakwater.



After (top) and before (bottom) 2019 storm events.

Source: U.S. Army Corps of Engineers, Buffalo District. | GAO-22-104304

Background. Construction of Buffalo Harbor’s North Breakwater was completed in 1901. The breakwater allows for safe navigation between Buffalo Harbor and Lake Erie and protects the entrance to the Black Rock Canal.¹ In addition to its authorized navigation function, the breakwater provides coastal, flood, and waterfront protection, as well as ecosystem benefits for the city of Buffalo, U.S. Army Corps of Engineers (Corps) officials in the Buffalo District said. These supplementary benefits play a key role in the protection of Buffalo’s waterfront. Annually, the North Breakwater, as part of the larger Buffalo Harbor, also enables the transportation of about 791,000 tons of cargo, directly supports 150 U.S. jobs, and helps generate \$34.6 million in U.S. business revenue, according to Corps officials.

Current condition. The breakwater has remained relatively unscathed, aside from damage that occurred during severe weather events in 1900, 1982, and 2019—which the Corps repaired. However, Corps officials told us that recent inspections have found the structure to be generally in poor condition and at risk of failure. Officials from the Corps’ Buffalo District stated that climate change effects, such as higher-intensity storms, are impacting its structures. Changes in Great Lakes water levels can also impact coastal structures, but Corps officials said that they do not have guidance on how to design for changing water levels on the Great Lakes, although guidance for incorporation of sea level change exists for oceanic coastlines.²

Risks to stakeholders. The risks to regional infrastructure are significant, should this structure fail. Specifically, navigational safety and coastal resiliency—with respect to the entrance to the Black Rock Canal channel and lock, as well as infrastructure along the nearby Lake Erie shoreline—may be compromised. Additionally, investments made in the western New York

¹The breakwater was authorized for construction under the River and Harbor Act of 1899 and was completed in 1901, according to Corps documents.

²The Great Lakes region in which the district is located does not have sea level rise, but climate change does affect weather patterns and lake levels. Additionally, during 2022, the Corps is scheduled to conduct the Great Lakes Coastal Study, which will address climate change issues in the region (see <https://www.lrc.usace.army.mil/Missions/GLCRS/>). According to the Corps, the study would recommend measures to bolster the coastlines’ ability to withstand, recover from, and adapt to future lake-level conditions and increased storm severity.

waterfront would also face significant risks, if needed repairs and maintenance are not conducted, according to the Corps.

Authorizing language limitations. The breakwater’s authorizing language that designates navigation as the structure’s only purpose and its low-use commercial tonnage traffic results in the structure not being highly prioritized for maintenance and repair funding, according to Corps officials.³ District officials told us that, during 2019, they knew the North Breakwater was at significant risk of failure but could not make preventative repairs because there was no funding available to do so. As a result, the district could not take action until there were breaches in the structure, which resulted in over \$20 million in damage. In addition, district officials said that in some instances they may need to adjust a structure’s dimensions, such as its width, to have the structure better withstand changing environmental conditions. However, they cannot do so without additional authorization, because the structure was authorized for a specific length or width, and the district does not have the flexibility to stray from the authorized dimensions. Designing repairs to fit within the structure’s authorized dimensions, which may have been established to withstand environmental conditions from decades ago, may limit the Corps’ repair options—possibly resulting in more expensive or less effective repairs.

Buffalo District officials stated that permitting the Corps to consider supplementary benefits when prioritizing budgets for coastal navigation structures could be beneficial. The district’s structures provide benefits beyond their authorized navigation purpose that may help better demonstrate their usefulness and the need to maintain these structures. District officials also said that having additional flexibility is needed to allow the Corps to maintain and repair the structures more effectively to better adapt to changing environmental conditions. Specifically, officials said that incorporating flexibility into the authorizing language or through some other means to allow the Corps to use its engineering expertise to lengthen, realign, or make other modifications that the officials determine are necessary would help the agency.

³Recently, repair and maintenance funding has been more robust, as the district has received \$13.5 million during fiscal year 2021 and \$15 million for fiscal year 2022. Specifically, fiscal year 2021 funding (\$13.5 million) was received and used to repair the breached section between Station 14+50 and 17+75. Repairs will resume, using fiscal year 2021 funding on Station 17+75 to 22+00 in 2022. Fiscal year 2022 funding (\$15 million) will be used for contracted repairs to the middle section (Station 11+25-12+00, and Station 13+00-14+50) and the south head (Station 0+00-1+75).

Enclosure 2. Grays Harbor North and South Jetties (Seattle, Washington)

Figure 3: Wave Action Caused Stone Displacement and Sediment Passing through Grays Harbor's North Jetty, Placing Nearby Infrastructure at Risk, Seattle, Washington

Wave action has displaced larger stones at the bottom of the jetty's slope, causing an avalanche effect, as the stones up above are no longer supported and roll down the slope (left). The jetty's low crest height and holes between stones allow sediment to pass through the structure, which places a nearby wastewater treatment facility at risk (right).



Source: U.S. Army Corp of Engineers. | GAO-22-104304

Background. Grays Harbor, a moderate-use harbor, has the North and South Jetties, which U.S. Army Corps of Engineers (Corps) officials in the Seattle District said were authorized in the late 1800s and early 1900s, respectively.¹ The jetties create channel depths suitable for reliable navigation by confining water current through a narrow inlet. In addition, both jetties provide shoreline and flood protection for private property and public infrastructure. The North Jetty protects the city of Ocean Shores, which contains a water treatment facility, and the Quinault Indian Nation. The South Jetty protects the city of Westport and its fishing industry, which produces approximately 120 million-150 million tons of seafood annually. Additionally, the South Jetty—in conjunction with the Point Chehalis Revetment, which reduces shoreline erosion and assists in keeping the entrance channel open—protects a wastewater treatment facility and the Westport Marina, at which a fishing fleet and a U.S. Coast Guard station are based.

Current condition. Although the North Jetty continues to function for its authorized navigation purpose, district officials said sea level change in the past 70 years may have led to increased wave overtopping and subsequent damage to the jetty—its last major repair was conducted in 2000.² Additionally, some evidence indicates that storm intensity may lead to more damage to the jetty, particularly those sections that have not been repaired recently and where the armor stone is undersized for current conditions.³ Evidence of stone displacement and sediment actively being transported through the jetty is present. The Corps has found similar issues with the South Jetty. In 2018, the Corps reported that the South Jetty carried out its authorized

¹The original project, authorized in 1896, provided for the construction of the South Jetty. The River and Harbor Act of 1907 authorized construction of the North Jetty.

²In January 2022, the Corps reported that about \$11 million from the Infrastructure Investment and Jobs Act will fund Grays Harbor North Jetty repairs.

³An armor stone is the large visible stone on the outside layer of the breakwaters. The stone dissipates wave energy as waves hit the exterior of the breakwaters and move through the gaps between the stones.

purpose of navigation but was “seriously degraded” structurally.⁴ Officials from the city of Westport agreed that the South Jetty continues to fulfill its navigation purpose but stated that they are concerned with waves overtopping the structure and frequently flooding the city.

Risks to stakeholders. With respect to the North Jetty, the city of Ocean Shores has reported wave overtopping, which causes flooding and shoreline erosion in the area adjacent to the jetty, damaging roads and city infrastructure, including the wastewater treatment facility. A fiscal year 2021 Corps inspection report found that if the North Jetty continues to degrade, a breach could develop through the jetty. Consequently, a significant amount of sand would be eroded, likely resulting in loss of private property and public infrastructure. Similarly with the South Jetty, shoreline erosion adjacent to the structure could adversely impact navigation, according to the Seattle District. Additionally, district officials said that wave overtopping of the Point Chehalis Revetment causes extensive flooding throughout the city of Westport multiple times a year—which greatly affects the commerce, safety, and functioning of the city, as well as commercial and tribal fisheries.

Authorizing language limitations. Officials in the Seattle District told us that the Corps cannot modify its structures to reduce flooding and erosion damage to the cities because the structures still carry out their authorized function (i.e., navigation), and they are not authorized for coastal storm damage or flood reduction purposes.⁵ Corps officials stated that flexibility, consideration of supplementary benefits, or additional authorities for the jetties by Congress could allow the Corps to make maintenance and repair decisions that may help protect the communities in the vicinity of the structures at Grays Harbor.

⁴The Corps defined “seriously degraded” to mean that “an extensive portion of the structure has deteriorated to a condition that a need for repairs is indicated . . . a significant amount (20% to 40%) of materials composing the structure shows signs of deterioration, and a significant amount (20% to 40%) of any material composing the structure has been lost.” Additionally, a structure’s “structural condition” refers to its current physical characteristic within the environment, and the “functional condition” is the current ability of the structure to meet the authorized purpose. The Corps weighs functional condition ratings higher than structural ratings when evaluating the need for repair of a coastal navigation structure. Thus, a structure can be in poor structural condition but be functioning at an acceptable level. U.S. Army Corps of Engineers, *Report to Congress on Federal Breakwaters and Jetties, WRDA 2016, Section 1104* (Washington, D.C.: 2018).

⁵Corps officials also stated the importance of rethinking a structure’s Benefit-to-Cost Ratio when making major rehabilitation or new investment decisions. The Benefit-to-Cost Ratio does not preclude the Corps from operating and maintaining navigation projects and structures. For our past work on the Benefit-to-Cost Ratio, please see, for example, GAO, *Army Corps of Engineers: Budget Formulation Process Emphasizes Agencywide Priorities, but Transparency of Budget Presentation Could Be Improved*, [GAO-10-453](#) (Washington, D.C.: Apr. 2, 2010); and U.S. Army Corps of Engineers: *Information on Evaluations of Benefits and Costs for Water Resources Development Projects and OMB’s Review*, [GAO-20-113R](#) (Washington, D.C.: Dec. 18, 2019).

Enclosure 3. Laupahoehoe Harbor Breakwater and Boat Launch Ramp (Island of Hawaii)

Figure 4: Large Holes in Laupahoehoe Harbor’s Breakwater Allow Water to Pass through the Structure, Hawaii

Wave action and weather effects over time have caused the breakwater to sustain large holes between its concrete armor units (image on the right shows a close-up of this condition). These holes allow waves to pass directly through the structure, limiting the harbor’s usability.



Source: U.S. Army Corps of Engineers Honolulu District Office. | GAO-22-104304

Background. Two of Laupahoehoe Harbor’s key navigation structures are a breakwater, completed in 1988, and a boat launch ramp.¹ In addition to its authorized navigation function that protects the harbor in which the boat launch ramp resides, the breakwater, which is maintained and repaired by the U.S. Army Corps of Engineers (Corps), provides various supplementary benefits, such as shoreline protection. The boat launch ramp, which is not maintained by the Corps, provides recreation—primarily swimming and fishing—and emergency services.²

Current condition. Corps inspection reports found that the breakwater has a decreased level of functionality because of diffraction around the structure’s head and excessive wave transmission through its core.³ In addition, recent modeling conducted by the Corps found the harbor’s usability to be only 36 percent. The boat launch ramp has remained closed since 2009 stemming from unsafe conditions—including deteriorating concrete and exposed metal supports—which make it too dangerous to stage rescue operations.

Risks to stakeholders. Local community members and Corps officials stated that this project serves as a “lifeline” to several communities with distinct cultures. Specifically, Laupahoehoe Harbor is the only ocean access for boats on the Hamakua Coast, which is served by a single highway, raising the risk of isolation of the community from major population centers, medical services, and supplies should the highway be inaccessible. As a result, an operating boat launch ramp would provide another method to get resources to the community or to evacuate community members in the event of an emergency. Also, the local U.S. Coast Guard base is

¹This project was constructed under the authority of the Rivers and Harbors Act of 1960, Pub. L. No. 86-645, § 107, 74 Stat. 480, 486, and construction was completed during August 1988. In September 1989, a contract was awarded for additional work—specifically, for the removal of a rock shelf adjacent to the seaward edge of the turning basin and placement of revetment stone to improve navigation safety; construction was completed in June 1990.

²The Corps is responsible for maintenance and repair of the breakwater. Hawaii County, the county where Laupahoehoe Harbor resides, is responsible for the boat launch ramp.

³The Corps defined “diffraction” as the change in the wave direction as it approaches parallel to, and then wraps around, the breakwater and propagates toward the boat launch ramp.

limited to making departures from remote areas because the breakwater is not functioning effectively.

Authorizing language limitations. Honolulu Corps District Office officials said that a structure's authorizing language limits maintenance and repair activities to building back to the structure's original design footprint. In the case of the breakwater, the structure likely needs to be lengthened outside of its authorized footprint to meet its original design intent.⁴ Future changes in environmental conditions (e.g., sea level rise and increased storm intensities) will further exacerbate the harbor's limited functionality to meet the original design intent, according to the officials. Additionally, because the Corps prioritizes its maintenance and repair needs for coastal navigation structures based on commercial tonnage, modifications at lower-use projects would be challenged to meet the traditional National Economic Development benefits to justify a federal interest in modifying the existing project to lengthen the breakwater.⁵ In the case of Laupahoehoe Harbor, officials in the Honolulu District said the breakwater is too short, but because there are not significant economic benefits, the district would be challenged to justify extending the breakwater. Supplementary benefits, such as the harbor's importance to the surrounding community, may not be accounted for in the Corps' policy for modifying existing federal projects, according to district officials.

Corps officials stated that because the breakwater is in a harbor with little commercial traffic, modifications may be difficult to justify, creating the potential for remote communities within the Honolulu District's area of responsibility to have their cultural, economic, and social lifelines severed. Officials said that greater flexibility in the remote and subsistence harbors authority could be useful in authorizing modifications to lengthen the breakwater without needing to meet the traditional National Economic Development benefits. Small-boat harbors on the U.S. mainland are generally for recreational use, but in Hawaii they are more for subsistence.

⁴District officials stated that lengthening the breakwater would likely increase the effect of wave diffraction around the breakwater and reduce wave heights in the entrance channel and turning basin.

⁵As we previously reported, National Economic Development benefits identify contributions to net national economic output of goods and services in monetary terms. For more on National Economic Development benefits, see GAO, *Army Corps of Engineers: Evaluations of Flood Risk Management Projects Could Benefit from Increased Transparency*, [GAO-20-43](#) (Washington, D.C.: Nov. 26, 2019).

Enclosure 4. Point Judith's Main Breakwater (Narragansett, Rhode Island)

Figure 5: Severe Storms Have Damaged Point Judith's Main Breakwater, Especially along Its East Arm, Rhode Island

Past storms have displaced some of the breakwater's stones, causing its size and shape to change since the breakwater was built—between 1891 and 1914—and may lead to the structure unraveling. Damage from Hurricane Sandy (2012) is shown here.



Source: U.S. Army Corps of Engineers New England District Office. | GAO-22-104304

Background. The Point Judith Pond and Harbor of Refuge Navigation project, located in Narragansett, Rhode Island, is composed of three large breakwaters—the East Shore Arm, Main Breakwater, and West Shore Arm (which also functions as the west jetty for the inlet that leads to Point Judith Pond). The U.S. Army Corps of Engineers (Corps) completed construction of the structures in 1914.¹ In addition to their authorized navigation function, the breakwaters provide shoreline protection for homes and commercial properties, as well as beaches and a state park, Corps officials in the New England District said. The breakwaters also provide recreational and commercial benefits, as Point Judith is Rhode Island's largest fishing port and the nation's 15th-largest fishing port.

Current condition. The most exposed and frequently damaged sections of the breakwaters are the East Shore Arm and the Main Breakwater (specifically, its east arm)—they were most recently repaired in 2015-2017, and 1961-1963, respectively. Significant storms over the past several decades have damaged the Main Breakwater, particularly at its head and along its eastern arm, where gaps can be seen at numerous locations. In contrast, the West Shore Arm rarely requires repairs because of its protected location.

¹The breakwaters were initially authorized by the River and Harbor Act of 1890 and later modified by the River and Harbor Acts of 1892, 1902, 1905, 1907, 1910, and 1919 and by the Chief of Engineers in 1961, according to Corps officials.

Risks to stakeholders. Shorefront property owners along the beach areas worry that continued deterioration of the breakwaters, coupled with sea level rise, will worsen erosion and eventually lead to property loss, according to Corps officials. In the future, there could also be impacts to navigation and the safety of port operations. Corps officials stated that, generally, it is difficult to keep structures in functioning condition without having a good understanding of the full range of future impacts of climate change on the structures. The officials said that they anticipate an increase in the frequency and strength of storms that the structures were not originally designed to withstand. As a result, the Corps is in a cycle of continuously repairing a given structure to fortify it against the increasing storms, according to the Corps officials.

Authorizing language limitations. As we described earlier in this report, Corps officials told us they cannot incorporate supplementary benefits when making maintenance and repair decisions, absent a change to the authorizing language or an additional authorization. New England District Office officials stated that the Point Judith community would benefit significantly if the breakwaters were repaired because doing so would prevent further erosion, and even a slight change in the amount of sand remaining on the surrounding beaches would have a huge impact. However, district officials said that the project's authorizing language does not permit such repairs for the purpose of shoreline protection. The officials said that they could more effectively manage the repair and maintenance of their coastal navigation structures if they had more flexibility to rebuild structures as the Corps determines is necessary to continue to meet the navigation function. This would also keep long-term costs down and help protect the local Point Judith community, according to district officials.

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