COAST GUARD AND PORT INFRASTRUCTURE: BUILT TO LAST?

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HEARING

BEFORE THE

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COAST GUARD AND MARITIME TRANSPORTATION

OF THE

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TRANSPORTATION AND
INFRASTRUCTURE
HOUSE OF REPRESENTATIVES

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COAST GUARD AND PORT INFRASTRUCTURE: BUILT TO LAST?

WEDNESDAY, SEPTEMBER 25, 2019

HOUSE OF REPRESENTATIVES,
SUBCOMMITTEE ON COAST GUARD AND MARITIME TRANSPORTATION,
COMMITTEE ON TRANSPORTATION AND INFRASTRUCTURE,
Washington, DC.

The subcommittee met, pursuant to call, at 2 p.m., in room 2253, Rayburn House Office Building, Hon. Sean Patrick Maloney (Chairman of the subcommittee) presiding.

Mr. MALONEY. The committee will come to order. Thank you all for being here. To start, I would ask unanimous consent that the chair be authorized to declare a recess during today's hearing, if needed.

Without objection, so ordered.

Well, good afternoon and welcome to this afternoon's hearing to take stock of the conditions of the Coast Guard's shoreside infrastructure and the risks facing ports and maritime operators in this new era of climate uncertainty.

When Hurricanes Irma and Maria struck the Caribbean and Southeast United States in 2017, it was, of course, the Coast Guard who worked tirelessly and relentlessly to conduct search and rescue, reopen ports, remove debris, and bring lifesaving relief to hurricane-stricken areas.

At the same time, however, it is worth remembering that the Coast Guard's own shoreside infrastructure, which is vulnerable and located directly along the coastline, suffered over $800 million in damages. Offices lost roofs, communications went dark, and piers suffered extreme damage from flying debris.

In Puerto Rico, while servicemembers worked to save lives across the island, their own families were forced to relocate from shoreside facilities rendered inoperable and inhospitable. To date, many of the servicemembers working in Sector San Juan still work out of trailers while their base remains under repair.

This circumstance was not solely an issue of extreme storms in freak events. Rather, these events provide a painful snapshot of the very tenuous operating conditions Coast Guard servicemembers work through, caused by the Service's longstanding mismanagement of the maintenance and repair of its shoreside infrastructure and housing.

Few people realize it, but the Coast Guard owns or leases more than 20,000 shore facilities, far and away more real estate than all other properties under the control of the agencies within the De-

partment of Homeland Security, yet the Service's outdated, uncoordinated, and underresourced infrastructure management policies and practices have resulted in a $2.6 billion backlog in deferred maintenance, repairs, and reconstruction.

That servicemembers have been reported to conduct repair work while off duty is not only a slight to those members, but a condemnation of the Coast Guard's collective leadership in this area that would allow such mismanagement to persist at the expense of a workforce already strained and stretched thin. And that is simply unacceptable.

Furthermore, the deterioration of the Coast Guard's shoreside infrastructure will only be exacerbated by climate change. We spend billions on new assets, cutters and aircraft, that are critical, indeed, to execute the Coast Guard's 11 statutory missions, while at the same time the basics—piers, boathouses, barracks, airstrips—slowly crumble away. That is not semper paratus.

You know, the Commandant of the Coast Guard, Admiral Karl Schultz, has stated that it is his objective to ensure that the Coast Guard is ready, relevant, and responsive. And we need to add resilient to that list of the three R's.

As sea levels rise, extreme storms become more powerful, and coastal lands subside or erode away, the Coast Guard needs a rigorous new strategy to identify, design, budget and build its shore infrastructure. It is up to this committee, of course, and this Congress to provide the Coast Guard with the resources necessary to address its infrastructure backlog and, even more importantly, to build infrastructure that will be more durable and less costly to maintain over its lifetime.

If we are apportioning blame, we should look in the mirror as well. We must additionally take stock of our commercial ports and maritime terminal investments in the coastal zones. Each year, more than 1.2 billion metric tons of foreign commerce comes through American ports.

If the United States wants to remain globally competitive and avoid future dislocation of the maritime supply chain at vital ports, such as the Port of New York and New Jersey, right down the river from my district, we need a rigorous assessment of our critical port infrastructure and its vulnerability to coastal hazards, especially sea-level rise. To date, no such assessment exists, and I will be interested to hear our second panel's thoughts on this idea.

Whether you believe climate change is a hoax, and I certainly hope you do not, the reality is that Government agencies, local communities, maritime stakeholders and others are dealing with the physical, observable impacts caused by climate change, and those impacts are happening right in front of us. They are happening now.

So let's talk about how we can adapt to and mitigate these impacts. This hearing brings together an exemplary panel of experts from coastal engineering, adaptation planning, and risk management, to illustrate how agencies like the Coast Guard might better adapt to increasing coastal hazards.

In closing, today's extreme flood is tomorrow's daily high tide. To successfully navigate a changing climate will demand strategic de-

sign, planning, and investment across the public and private sectors, and we need to do that in time to do us some good.

As a Government and economy deeply invested and dependent upon a global maritime supply chain, how we respond to this challenge today will have a direct bearing on whether we maintain our standard of living or not. This hearing will help us intelligently assess the vulnerability of the maritime transportation system and build back better as we move into an era of unprecedented risk.

[Mr. Maloney's prepared statement follows:]

Prepared Statement of Hon. Sean Patrick Maloney, a Representative in Congress from the State of New York, and Chairman, Subcommittee on Coast Guard and Maritime Transportation

Good afternoon, and welcome to this afternoon's hearing to take stock of the condition of the Coast Guard's shoreside infrastructure, and the risks facing ports and maritime operators in this new era of climate uncertainty.

When Hurricanes Irma and Maria struck the Caribbean and Southeast United States in 2017, it was the Coast Guard who worked tirelessly and relentlessly to conduct search and rescue, re-open ports, remove debris, and bring lifesaving relief to hurricane-stricken areas.

At the same time, however, the Coast Guard's own vulnerable shoreside infrastructure, much of it located directly along the coastline, suffered over $800 million in damages. Offices lost roofs, communications went dark, and piers suffered extreme damage from flying debris. On Puerto Rico, while service members worked to save lives across the island, their own families were forced to relocate from shoreside facilities rendered inoperable and inhospitable. To date, many of the service members working in Sector San Juan still work out of trailers while their base remains under repair.

This circumstance was not solely an issue of extreme storms and freak events. Rather, these events provide a painful snapshot of the very tenuous operating conditions Coast Guard service members work through caused by the Service's longstanding mismanagement of the maintenance and repair of its shoreside infrastructure and housing.

Few people realize it, but the Coast Guard owns or leases more than 20,000 shore facilities—far and away more real estate than all other properties under the control of agencies within the Department of Homeland Security. Yet, the Service's outdated, uncoordinated and under-resourced infrastructure management policies and practices have resulted in a $2.6 billion dollar backlog in deferred maintenance, repairs and reconstruction.

That service members have been reported to conduct repair work while off-duty is not only a slight to those members, but a condemnation of the Coast Guard's collective leadership that would allow such mismanagement to persist at the expense of a workforce already strained and stretched thin. This is simply unacceptable.

Furthermore, the deterioration of the Coast Guard's shoreside infrastructure will only be exacerbated by climate change. We spend billions on shiny new assets—cutters and aircraft that are critical to execute the Coast Guard's eleven statutory missions—while their piers, boathouses, barracks, and airstrips slowly crumble away. Semper Paratus, indeed.

You know, the Commandant of the Coast Guard, Admiral Karl Schultz, has stated that it is his objective to ensure that the Coast Guard is Ready, Relevant and Responsive. Well, I say we add "Resilient" to that list, too.

As sea levels rise, extreme storms become more powerful, and coastal lands subside or erode away, the Coast Guard needs a rigorous new strategy to identify, design, budget, and build its shore infrastructure.

It is up to this committee and this Congress to provide the Coast Guard with the resources necessary to address its infrastructure backlog, and even more importantly, to build infrastructure that will be more durable and less costly to maintain over its lifetime.

We must additionally take stock of our commercial ports and marine terminal investments in the coastal zone. Each year, more than 1.2 billion metric tons of foreign commerce comes through American ports.

If the United States wants to remain globally competitive and avoid future dislocation of the maritime supply chain at vital ports, such as the Port of New York/

New Jersey downriver from my district, we need a rigorous assessment of our critical port infrastructure and its vulnerability to coastal hazards, especially sea level rise. To date, no such assessment exists, and I will be interested to hear our second panel's thoughts on this idea.

Whether you believe climate change is a hoax, or not, the reality is that government agencies, local communities, maritime stakeholders and others are dealing with the physical, observable impacts caused by climate change that are happening right now. So, let's talk about how we can adapt to and mitigate these impacts.

This hearing brings together an exemplary panel of experts from coastal engineering, adaptation planning, and risk management to illustrate how agencies like the Coast Guard might better adapt to increasing coastal hazards.

In closing, today's extreme flood is tomorrow's daily high tide. To successfully navigate a changing climate will demand strategic design, planning, and investment across the public and private sectors. As a government and economy deeply invested in and dependent upon a global maritime supply chain, how we respond to this challenge today will have a direct bearing on whether we maintain our standard of living, or not. This hearing will help us intelligently assess the vulnerability of the marine transportation system and build back better as we move into an era of unprecedented risk.

Mr. MALONEY. I would now like to call on the ranking member for any remarks.

Mr. GIBBS. Thank you, Chairman Maloney.

As we all know, since 2000, the Coast Guard was faced with its cutters and aircraft operating more than 50 miles offshore becoming obsolete. Understandably, the Coast Guard has chosen to focus its extremely limited capital acquisition funds to the purchase of those assets, and there is good news on that front. The Coast Guard just announced the home port for its 42nd Fast Response Cutter, and the Coast Guard has awarded a contract for construction of the 10th and the 11th National Security Cutter. The Coast Guard has also acquired new medium-range patrol aircraft and is recapitalizing its long-range patrol aircraft. Unfortunately, the single largest recapitalization contract for the Offshore Patrol Cutter is not executable, and we await the Coast Guard's solution to that problem.

However, while the Coast Guard has made those important and significant investments, it has developed a large and growing shoreside construction and maintenance backlog, and its IT systems have aged to the point that the Coast Guard operations are constrained. Investments in those areas are becoming crucial if we expect the Service to continue to carry out its missions.

The Coast Guard estimates its construction and deferred maintenance backlog is $2.6 billion, but this is a one-for-one replacement of assets and does not reflect a strategy for carrying out Coast Guard missions in an efficient manner.

Given the specific needs of the Coast Guard for coastal facilities, the Service is particularly vulnerable to the impacts of coastal storms, yet GAO has found that the Coast Guard does not follow the Department of Homeland Security's risk management framework. In addition, the GAO found that the Coast Guard has not identified all the shoreside assets that are vulnerable to potential storm damage, such as piers and runways.

I am also interested in whether the Coast Guard has followed through on its modernization effort. It has established the Shoreside Infrastructure Logistics Center, but it seems to continue to operate a highly decentralized infrastructure repair and maintenance operation out of its six civil engineering units.

I look forward to hearing from Rear Admiral Moore how the Coast Guard is centralizing its review and prioritization of shoreside infrastructure. I am also interested to know more about how the Coast Guard is preparing facilities for its new cutters and aircraft. The new assets are larger and more sophisticated than the old assets and require improved shoreside support. I am hopeful that the planning process for those assets and their support infrastructure is being well-coordinated.

Fortunately, my district does not suffer direct impacts by coastal storms, but I sympathize for my coastal colleagues. I know subcommittee member Congressman Graves of Louisiana has had major flood events in his district, and Congressman Weber has floods going on right now in Jefferson County, Texas. In addition, Puerto Rico and the Virgin Islands were visited by Hurricane Karen yesterday. Therefore, I look forward to hearing the suggestions of witnesses on panel 2 for the construction of more resilient port facilities to better withstand such coastal storms and flooding.

[Mr. Gibbs' prepared statement follows:]

Prepared Statement of Hon. Bob Gibbs, a Representative in Congress from the State of Ohio, and Ranking Member, Subcommittee on Coast Guard and Maritime Transportation

As we all know, as far back as 2000, the Coast Guard was faced with its cutters and aircraft operating more than 50 miles offshore becoming obsolete. Understandably, the Coast Guard has chosen to focus its extremely limited capital acquisition funds to the purchase of those assets.

And there is good news on that front. The Coast Guard just announced the homeport for its 42nd Fast Response Cutter, and the Coast Guard has awarded a contract for construction of the 10th and 11th National Security Cutters. The Coast Guard has also acquired new medium range patrol aircraft and is recapitalizing its long-range patrol aircraft.

Unfortunately, the single largest recapitalization contract for the Offshore Patrol Cutter is not executable, and we await the Coast Guard's solution to that problem.

However, while the Coast Guard has made those important and significant investments, it has developed a large and growing shoreside construction and maintenance backlog, and its IT systems have aged to the point that Coast Guard operations are constrained.

If we expect the Service to continue to effectively carry out its missions in the future, investments in these areas are crucial.

he Coast Guard estimates its construction and deferred maintenance backlog at $2.6 billion, but this is a one-for-one replacement of assets and does not reflect a strategy for carrying out Coast Guard missions in the most efficient manner.

Given the specific needs of the Coast Guard for coastal facilities, the Service is particularly vulnerable to the impacts of coastal storms. Yet GAO has found that the Coast Guard does not follow the Department of Homeland Security's Risk Management Framework. In addition, GAO found that the Coast Guard has not identified all shoreside assets that are vulnerable to potential storm damage such as piers and runways.

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I look forward to hearing from Rear Admiral Moore about how the Coast Guard is centralizing its review and prioritization of shoreside infrastructure.

I am also interested to know more about how the Coast Guard is preparing facilities for its new cutters and aircraft. These new assets are larger and more sophisticated than old assets and require improved shoreside support. I'm hopeful the planning process for those assets and their support infrastructure is well coordinated.

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floods going on right now in Jefferson County, Texas. In addition, Puerto Rico and the Virgin Islands were hit by Tropical Storm Karen yesterday.

Therefore, I look forward to hearing the suggestions of witnesses on Panel II for the construction of more resilient port facilities to better withstand such coastal storms and flooding.

Mr. GIBBS. Mr. Chairman, thanks for holding the hearing today, and I yield back.

Mr. MALONEY. I thank the gentleman.

I would now like to recognize Chairman DeFazio for any remarks.

Mr. DEFAZIO. I thank the chairman. I wish that I could stay. I, unfortunately, have to be in a briefing on the 737 MAX very shortly. So I just want to first recognize a member of the second panel, Dr. Daniel Cox—and I know how hard it is to get here from Oregon; I appreciate him traveling—a professor at the College of Engineering, Oregon State University, and has tremendous experience in dealing with coastal engineering resilience. And hopefully, his testimony will give us some direction.

The Coast Guard has been mentioned. There is a $2.6 billion backlog. I think the Coast Guard has for many years done an excellent job with not enough resources. I have been to many stations where the Coasties themselves are doing the work. We are maintaining some very unique older boats in the Northwest and the facilities are beautiful, but we need to better partner with the Coast Guard and better invest. The Coast Guard is the only uniformed service that has not done extensive studies on the impacts of climate change, sea-level rise, and more violent weather events. It is critical before we invest some of this $2.6 billion in areas that will be more at risk, that we will take into account what we should do to better protect these facilities in the not too distant future or—heck, you know, given what has been going on this year—next year.

So I hope to hear from the Coast Guard on that. We did put a provision in the Coast Guard authorization, which passed out of the House quite some time ago. And the, Senate as usual, is dithering around. But we did put a provision in there to require that the Coast Guard do such an assessment, and I think it will be experts like Dr. Cox who can help you work your way through this.

So we don't want to have to rebuild it twice, and that goes to all of our infrastructure. Surface infrastructure, 47,000 bridges need substantial repair or replacement; 40 percent of the National Highway System deteriorated to the point where you have to rebuild it; and transit. And we have to make those investments in a way that anticipates the continued detrimental effects of climate change, and the Coast Guard should do likewise.

So I am fully supportive of any initiatives the Coast Guard takes in this area. I am supportive of getting them more resources to deal with these problems.

[Mr. DeFazio's prepared statement follows:]

Prepared Statement of Hon. Peter A. DeFazio, a Representative in Congress from the State of Oregon, and Chairman, Committee on Transportation and Infrastructure

Mr. Chairman, thank you for scheduling this afternoon's hearing to assess the Coast Guard's substantial backlog in deferred maintenance and repair for its infrastructure, and examine policies to ensure that our Nation's port infrastructure is built to withstand the impacts of climate change.

I want to take a moment first, to acknowledge Dr. Daniel Cox, an esteemed professor in the College of Engineering at Oregon State University (OSU) and an expert on coastal engineering and thank him for traveling from Corvallis to testify on today's second panel.

OSU for decades has been a leader in ocean and coastal engineering research. I look forward to hearing more from Dr. Cox about OSU's ongoing initiatives to improve building codes to better withstand river flooding and coastal storm surge.

According to a study released earlier this year by the Government Accountability Office, the Coast Guard has a deferred maintenance and repair backlog of $2.6 billion for its shore side infrastructure, housing, and support facilities. And this total only reflects those needs for which the Coast Guard has affixed a cost estimate—the backlog is likely much, much higher.

It is no reach to conclude that while the Coast Guard's active duty force may be Semper Paratus, or Always Ready, the vital infrastructure that every service member relies on to perform their demanding work falls far short from meeting that motto.

Consequently, unless we address the circumstances that have contributed to this backlog, the situation will get much worse, much faster.

If anything was made clear by the recent hurricanes over the past three summers that made landfall in the Southeast United States and the Caribbean, Coast Guard facilities and port infrastructure in general are exposed to increased risks wrought by more powerful, slower moving hurricanes, higher storm surges, torrential rains and more frequent flooding.

To address facilities damaged through these storms, Congress provided the Coast Guard with more than $1.4 billion in emergency supplemental appropriations to rebuild and recover from the devastation, and more importantly, to rebuild to more resilient construction standards. I expect Admiral Moore to provide an update on this rebuilding.

Clearly, this funding was necessary to get affected Coast Guard units back up and operational. But just as clear to me is that this is no way for the Congress or the Coast Guard to address a chronic liability impacting operational readiness and capability.

A long-term strategy must be developed to address the backlog in a systematic and dedicated manner. Moreover, such a strategy should be guided by new modeling and data management systems, paired with modern advances in coastal science and engineering.

We must completely re-think where we locate Coast Guard units, and how we build the facilities they depend on to meet mission needs. For if we do not, all we will accomplish is to continue to throw good money after bad and end up with a Coast Guard less able to meet the increasing risks of operating along our Nation's shores. We can, and ought to, do better.

Mr. DEFAZIO. And, again, I wish I could stay, and I can't. So thank you, Mr. Chairman.

Mr. MALONEY. Well, I thank the gentleman.

I should also point out I will also be required on the House floor at some point during the course of today's hearing, so I may also have to depart for a period of time, depending on the floor schedule. So I apologize in advance that I miss some of the testimony today.

But I would like to thank our first two witnesses: Rear Admiral Nathan Moore, Assistant Commandant for Engineering and Logistics; and Mr. Nathan Anderson, Director of Homeland Security and Justice for the Government Accountability Office.

Gentlemen, we thank you both for being here.

Without objection, your full statements will be included in the record. And since your written testimony has been made part of the record, the subcommittee requests that you limit your oral testimony to 5 minutes.

With that, Admiral Moore, you may proceed.

TESTIMONY OF REAR ADMIRAL NATHAN A. MOORE, ASSISTANT COMMANDANT FOR ENGINEERING AND LOGISTICS, U.S. COAST GUARD; AND NATHAN ANDERSON, DIRECTOR, HOMELAND SECURITY AND JUSTICE, U.S. GOVERNMENT ACCOUNTABILITY OFFICE

Admiral MOORE. Chair Maloney, Ranking Member Gibbs, members of the subcommittee, good afternoon and thank you for the opportunity to speak about Coast Guard infrastructure today, and thank you for entering my written testimony into the record, as you have stated.

As the Assistant Commandant for Engineering and Logistics, I am honored to lead the 5,000 men and women of the Coast Guard dedicated to maintaining our diverse portfolio of operational assets and shore-based infrastructure. As I speak to you today, our engineering and logistics workforce is providing critical support to Coast Guard operations around the clock and across the globe. Every Coast Guard mission begins and ends at a shore facility. Not only is our shore infrastructure relevant to operations, it is essential to our readiness.

The Coast Guard is all about readiness. Admiral Schultz has outlined in the Coast Guard strategic plan that a resilient shore infrastructure is directly connected to operational readiness and successful mission execution. While my engineers take pride in our efforts to support operations, we face challenges related to the maintenance and recapitalization of our infrastructure. As the largest shore asset portfolio in the Department of Homeland Security, much of the Coast Guard's infrastructure is aging faster than we can maintain or replace it.

With the growing depot-level maintenance and recapitalization backlogs totaling more than $2.7 billion, our installations are geographically dispersed and range from large operational or industrial facilities in urban areas to small tactical units in remote areas. As many of our facilities are located on or very near the coast, they experience the daily corrosive effects of saltwater and wind and are vulnerable to flooding and increasingly severe weather. The devastation that we have seen from recent hurricanes underscores that risk.

Despite these challenges, we have observed the benefits of modern resilient infrastructure at locations where we have made investments. Thanks to support from both the administration and Congress, we have constructed new facilities to resilient standards, with high return on investment. We are working expeditiously to execute nearly $1.2 billion in supplemental procurement, construction, and improvement appropriations for the 2017 and 2018 hurricanes. We make our infrastructure more resilient by modernizing design specifications and construction technologies at every opportunity.

We aim to maximize our limited resources to invest in resilient infrastructure that directly enhances the Coast Guard's operational readiness. For example, our new infrastructure at Sector Houston-Galveston has proved critical to Hurricane Harvey response operations, during which the Coast Guard rescued 11,000 people. We have recapitalized the 100-year-old facilities in Massachusetts and recently finished facilities for new aircraft and cutters in Alaska, California, Hawaii, North Carolina, and New Jersey, with others under construction in Guam and Texas.

Despite this progress, the Coast Guard has made and continues to make difficult decisions within a constrained budget environment to balance the recapitalization of our operational assets with investments in our shore infrastructure.

We thank the Congress for the opportunity to further communicate our infrastructure needs through the annual Unfunded Priority List. Our fiscal year 2020 UPL includes over $570 million to address our most critical shore infrastructure priorities. At the same time, we continue to align our property with our mission needs. Since receiving direct sale authority in 2010, we have divested more than 205 real property assets and deposited more than $26 million in proceeds into the Coast Guard housing fund, which supports the recapitalization of housing for our servicemembers and their families.

While we highlight our progress, we recognize that we can do even better. With the benefit of insightful reviews from the Government Accountability Office, we are already improving our shore infrastructure management practices and incorporating them into our strategic planning.

Moving forward, we will employ a holistic approach that includes establishing performance goals and measures to track the effectiveness of our investments, aligning our shore infrastructure portfolio with mission needs, to include pursuing divestitures, establishing more detailed guidance for planning boards, and employing modeling to optimize our investments.

In closing, as one of the Nation's five Armed Forces, the Coast Guard's ability to remain semper paratus, always ready, to answer the Nation's call, fundamentally depends on reliable and resilient shore infrastructure. With the support of Congress and the administration and informed by GAO's recommendations, we will continue to overcome our infrastructure challenges and successfully execute our missions in service to the Nation. I appreciate the opportunity to testify today, and I look forward to your questions.

[Admiral Moore's prepared statement follows:]

Prepared Statement of Rear Admiral Nathan A. Moore, Assistant Commandant for Engineering and Logistics, U.S. Coast Guard

Good afternoon Chairman Maloney, Ranking Member Gibbs, and distinguished members of the subcommittee. I appreciate the opportunity to testify today and thank you for your continued support of the United States Coast Guard.

As a global maritime Service, the Coast Guard provides operational capabilities essential to a wide range of national security needs. With a variety of unique authorities, in addition to our organic missions, the Coast Guard operates daily in partnership with other Federal agencies to carry out law enforcement, regulatory, and emergency response missions. As a member of the Intelligence Community, the

Coast Guard helps to secure the seas by combating transnational criminal organizations and ensuring the safety of commercial activities on America's waters and abroad. As a member of the Armed Forces, the Coast Guard supports Department of Defense operations by providing Joint Force capabilities.

The Coast Guard excels at safeguarding American security and economic prosperity because of our distinct set of capabilities and authorities. Thanks to your unwavering support, the Coast Guard consistently succeeds in providing these critical services to the Nation.

All Coast Guard missions begin and end at shore facilities. The Coast Guard's Directorate of Engineering and Logistics, which contains the Office of Civil Engineering, is a professional, specialized, and innovative organization that manages a diverse portfolio of shore facilities nationwide. These facilities enable our operations, support our workforce, and strengthen our ability to remain Ready, Relevant, and Responsive. Our facilities are geographically distributed along America's coasts and inland waterways, allowing the Coast Guard to maintain presence throughout the Nation's Marine Transportation System, Exclusive Economic Zone, and strategically important areas of the high seas. In all these areas, the Coast Guard's presence ensures that our national interests are protected.

The Coast Guard's Civil Engineering Program executes construction and sustainment of shore infrastructure in support of Coast Guard personnel and their families, enabling mission resilience in the face of natural and man-made threats. Our goal is to maximize the lifecycle of Coast Guard shore infrastructure—from docks and hangars to housing and childcare facilities—managing assets using globally recognized standards, such as the International Organization for Standardization 55000, and benchmarking to industry and other agency best practices.

By holding ourselves to these standards, we deliver mission-ready facilities, which support Coast Guard operations around the world. We continuously adapt and improve our processes to maintain our current portfolio of facilities and pave the way to meet our shore infrastructure demands of the future.

The Coast Guard invests wisely, using strategic and risk-based decision-making to improve shore asset performance. Nevertheless, we want to do even better. The Civil Engineering Program manages the largest shore asset portfolio in the Department of Homeland Security, with over 41,000 assets, valued at $20 billion.

As the shore plant inventory ages, funding challenges affect our ability to maintain our facilities. Infrastructure scoring methodologies derived from the American Society of Civil Engineers give our portfolio an overall grade of C minus. Our deferred maintenance backlog continues to grow and at present exceeds $900 million. Our shore infrastructure recapitalization backlog is now more than $1.7 billion, with over 100 projects currently identified and estimated.

These projects address deficiencies in facilities that play a direct support role in front line Coast Guard operations and personnel support. They include operational facilities like bases, sectors, small boat stations and aviation facilities, as well as family housing and support facilities. The highest priority projects from the backlog are included in the Coast Guard's Fiscal Year (FY) 2020 Unfunded Priority List (UPL). These projects comprise $62 million in critical facility improvements to support our new cutters, $79 million in housing, family support and training facility needs, $391 million for improvements and recapitalization of operational facilities, and $6.7 million to recapitalize aids to navigation. Additionally, the FY 2020 UPL includes $35.7 million for critical shore depot-level maintenance.

To improve, the Coast Guard must shift from corrective to preventative facilities maintenance, establish enterprise-level strategic management for the appropriate facility inventory, and implement modern information technology (IT) systems to aid in decision-making for infrastructure investments. Implementing modernized IT systems is especially important because of the decentralized nature of the Coast Guard's shore infrastructure portfolio. The dynamic balance of these elements is the framework that will allow us to define affordable solutions for the Coast Guard's long-term shore facilities requirements and improve the resiliency and energy efficiency of our infrastructure.

Your support makes a palpable impact. In 2018 and 2019, the Coast Guard completed $152 million in shore infrastructure recapitalization, improving the physical condition and resilience of facilities in Massachusetts, New York, New Jersey, North Carolina, California, Oregon, and Hawaii. We awarded contracts for another $73 million of construction in Maine, Virginia, South Carolina, Texas, California, Alaska, and Guam.

We further appreciate Congress taking action to support the Coast Guard in the wake of recent natural disasters. Following the devastating hurricane seasons of 2017 and 2018, you provided nearly $1.2 billion in disaster supplemental funding to reconstitute damaged Coast Guard infrastructure with a focus on improving resil-

iency. We are working diligently to execute repair and reconstruction projects, and restore the full capability of our shore plant as quickly as possible.

While we are proud of these achievements, we appreciate the review of external agencies like the Government Accountability Office (GAO). We view these external agency reviews as opportunities to assess our internal processes, identify capability gaps, and develop plans of action to better manage our shore infrastructure program.

In its February 2019 report on Coast Guard Shore Infrastructure, GAO found that the Coast Guard met, fully or partially, six of nine leading practices for managing shore infrastructure. It provided six recommendations to improve our program. The Coast Guard concurred with these recommendations and is in the process of implementing several actions for improvement. One such action includes the recent implementation of a process guide for facility condition assessments which streamlines, standardizes, and improves our ability to identify and prioritize deficiencies across the shore infrastructure portfolio. The Coast Guard is also working to develop clear performance goals and baselines to track the effectiveness of maintenance and repair investments as well as a framework by which we can validate the alignment of our shore infrastructure assets with mission needs. To better manage our vast, decentralized shore portfolio, the Coast Guard is working to modernize its IT applications to improve investment scenario modeling, analyze trade-offs, and optimize decisions among competing investments. All of these initiatives will help us make capital investments in a smarter and more effective manner.

GAO further recommended a new assessment focused on how the Coast Guard manages risk in order to improve the resilience of shore facilities. Based on the nature of our missions, Coast Guard facilities are in areas prone to hurricanes, flooding, earthquakes, and other natural disasters. The Nation trusts that the Coast Guard will continue to act as a first responder after theses disasters, which underscores the importance of our facilities remaining ready for operations. To proactively address risk management for shore infrastructure, the Coast Guard is completing a study to assess risk from natural disasters across our infrastructure portfolio. To us, it's not just simply maintenance, repairs, and construction—it's about building a robust and resilient shore plant that will enable the Coast Guard to fulfill its many responsibilities in the maritime domain, support our national interests, and protect the nation for decades to come.

Coast Guard shore infrastructure readiness is a critical component of the Service's ability to carry out its missions. Your stalwart support, and that of the Administration, ensures the Coast Guard will continue to be *Semper Paratus*, Always Ready, to answer the Nation's call.

Thank you for the opportunity to testify before you today and for all that you do for the men and women of the United States Coast Guard. I look forward to your questions.

Mr. MALONEY. I thank the gentleman.

Mr. Anderson.

Mr. ANDERSON. Chairman Maloney, Ranking Member Gibbs, and members of the subcommittee, good afternoon. My testimony today discusses our findings and recommendations from three recent reports on Coast Guard's management of its shore infrastructure. I will discuss the condition of the Coast Guard's shore infrastructure, actions it has taken to improve its management of shore infrastructure, and key actions the Coast Guard needs to take to better manage these assets, which may help us save money and reduce risks.

Regarding the condition of the Coast Guard's shore infrastructure, the Coast Guard's inventory is vast, aging, and vulnerable to damage from extreme weather. The Coast Guard houses more than 20,000 shore facilities with a replacement value of over $18 billion, and nearly half are beyond their service lives. The Coast Guard data show that it will cost at least $2.6 billion to address current and deferred maintenance and recapitalization backlogs.

Now, recent funding levels and with existing business practices, it will take the Coast Guard nearly 400 years to address the projects currently on their backlogs. This brings me to my next point. The Coast Guard has taken some steps to manage its aging

infrastructure. Specifically, the Coast Guard classifies its infrastructure under a tier system that differentiates mission critical assets from mission support assets. Additionally, Coast Guard guidance prioritizes investments in infrastructure for frontline operations, such as piers or runways, over assets like administrative buildings. The Coast Guard has also initiated an assessment of vulnerabilities that its shore infrastructure faces. From 2015 to 2018, the Coast Guard analyzed occupied buildings for vulnerabilities to natural disasters, such as hurricanes and earthquakes.

However, significant work remains if the Coast Guard is going to make headway on reducing its backlog and to ensure wise use of limited resources. And this brings me to my final point about key actions the Coast Guard needs to take. First, the Coast Guard should employ models to optimize infrastructure investments. Earlier this year, we found the Coast Guard used a model to optimize its investment in aviation pavement for the repair of assets such as runways. This model showed that changing when and where such repairs take place could save nearly $14 million. Despite having this model, the agency has not yet implemented the model's results. The Coast Guard should use the results of this model and should employ such models to its entire portfolio of shore infrastructure, which may enable it to achieve cost savings across its 12 other asset lines.

Second, the Coast Guard should standardize facility assessments. In February 2019, we found that different units responsible for assessing the condition of infrastructure did not always follow consistent processes, and inconsistent processes raise questions as to whether the Coast Guard has the information it needs to set risk-based priorities for shore infrastructure and subsequent project selection decisions.

Third, the Coast Guard needs to fully implement DHS's risk management framework to improve shore infrastructure resilience. In a report we issued today, we found that the Coast Guard has not fully aligned its processes for improving shore infrastructure resilience with DHS's five key steps for critical infrastructure risk management.

Since 2005, Congress has appropriated more than $2 billion in supplemental funding to rebuild and repair Coast Guard infrastructure after severe storms. Data show it is often far cheaper to enhance the resilience of infrastructure before extreme weather strikes rather than to fix it after it is damaged. Nevertheless, while the Coast Guard selects projects to fund every year from its backlogs, officials were unable to verify that they consistently select projects with resilience in mind, that is, projects that will protect infrastructure before it is damaged and cost pennies on the dollar compared to rebuilding after extreme weather. Aligning its processes with DHS steps would provide greater assurance that the Coast Guard is investing resources to minimize potential damage and expenses caused by future extreme weather events.

In closing, while the Coast Guard faces significant expenses and time to repair, recapitalize, and make more resilient its shore infrastructure, it can augment its business practices in such a way that

more efficiently allocates its resources and better positions the agency to respond to risks from extreme weather.

Mr. Chairman, Ranking Member Gibbs, members of the subcommittee, this concludes my statement. I will be happy to take any questions you may have.

[Mr. Anderson's prepared statement follows:]

Prepared Statement of Nathan Anderson, Director, Homeland Security and Justice, U.S. Government Accountability Office

Chairman Mahoney, Ranking Member Gibbs, and Members of the Subcommittee:

I am pleased to be here today to discuss our recent work, including a report that is being released today, on the condition of the U.S. Coast Guard's (Coast Guard) shore infrastructure and recommendations we have made to improve it. The Coast Guard, within the Department of Homeland Security (DHS), is the principal federal agency charged with enforcing laws intended to prevent death, injury, and property loss in the maritime environment. All Coast Guard missions begin and end at the shore.[1] To help carry out its missions, the Coast Guard owns or leases more than 20,000 facilities—such as piers, boat stations, air stations, runways, and housing units—at more than 2,700 locations. Such infrastructure are often positioned along the nation's coastlines where facilities can be vulnerable to damage from extreme weather. We have reported that some Coast Guard facilities have required repair and recapitalization after being damaged by superstorm Sandy, and hurricanes Harvey, Irma, Maria, and Matthew.[2] The costs for some of those recovery efforts, combined, were about $1 billion.[3]

In my testimony today, will discuss (1) the condition of the Coast Guard's shore infrastructure, (2) actions the Coast Guard has taken to improve its management of shore infrastructure, and (3) key actions needed for the Coast Guard to better align its management of shore infrastructure with leading practices and key risk management steps.

This statement is based on three reports we issued from October 2017 to September 2019 on Coast Guard shore infrastructure, including management of its boat stations, overall shore infrastructure, and shore infrastructure resilience, as well as selected updates we conducted in September 2019 on Coast Guard efforts to address our previous recommendations.[4] To perform our work for the previous reports, we analyzed relevant Coast Guard documents, management processes, as well as applicable laws, regulations, and data for managing Coast Guard shore infrastructure. We also interviewed Coast Guard officials responsible for managing shore infrastructure. Further details on the scope and methodology for these reports are available within each of the published products. In addition, to conduct our selected up-

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[1] Under 6 U.S.C. § 468(a), the Coast Guard's 11 statutory missions are divided between "non-homeland security missions" and "homeland security missions." Non-homeland security missions include (1) marine safety, (2) search and rescue, (3) aids to navigation, (4) living marine resources (fisheries law enforcement), (5) marine environmental protection, and (6) ice operations. Homeland security missions include (1) ports, waterways, and coastal security; (2) drug interdiction; (3) migrant interdiction; (4) defense readiness; and (5) other law enforcement.

[2] In general, recapitalization refers to major renovation or reconstruction activities (including facility replacements) needed to keep existing facilities modern and relevant in an environment of changing standards and missions. Recapitalization extends the service life of facilities or restores lost service life. See, among other reports, GAO, *Coast Guard Shore Infrastructure: Applying Leading Practices Could Help Better Manage Project Backlogs of at Least $2.6 Billion*, GAO–19–82 [https://www.gao.gov/products/GAO-19-82], (Washington, D.C.: Feb. 21, 2019).

[3] The Disaster Relief Appropriations Act, 2013, Pub. L. No. 113–2, 127 Stat. 4, 28 (2013) appropriated around $274 million to the Coast Guard for Acquisition, Construction, and Improvements for necessary expenses related to the consequences of Hurricane Sandy. Bipartisan Budget Act, 2018, Pub. L. No. 115–123, 132 Stat. 64, 82–83 (2018) appropriated around $719 million to the Coast Guard for Acquisition, Construction, and Improvements for necessary expenses related to the consequences of Hurricanes Harvey, Irma, Maria, and Matthew.

[4] GAO, *Coast Guard: Actions Needed to Close Stations Identified as Overlapping and Unnecessarily Duplicative*, GAO–18–9 [https://www.gao.gov/products/GAO-18-9] (Washington, D.C.: Oct. 17, 2017); *Coast Guard Shore Infrastructure: Applying Leading Practices Could Help Better Manage Project Backlogs of at Least $2.6 Billion*, GAO–19–82 [https://www.gao.gov/products/GAO-19-82], (Washington, D.C.: Feb. 21, 2019); and *Coast Guard Shore Infrastructure: Processes for Improving Resilience Should Fully Align with DHS Risk Management Framework*, GAO–19–675 [https://www.gao.gov/products/GAO-19-675] (Washington, D.C., Sept. 25, 2019).

dates, we reviewed Coast Guard information about actions taken to address recommendations we had made in our previous reports.

We conducted the work on which this statement is based in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

BACKGROUND

The Coast Guard owns or leases more than 20,000 facilities consisting of various types of buildings and structures.[5] The Coast Guard's shore infrastructure is organized into five product lines and 13 asset types, known as asset lines.[6] For example, within its shore operations asset line, the Coast Guard maintains over 200 stations along U.S. coasts and inland waterways to carry out its search and rescue operations, as well as other missions such as maritime security.

Much of the Coast Guard's infrastructure is vulnerable to the effects of extreme weather and can be costly to repair or replace after major storms. From December 2005 through June 2019, the Coast Guard received about $2 billion in supplemental appropriation funds to, among other things, rebuild or relocate 15 facilities damaged by hurricanes. During this time, the Coast Guard relocated facilities further inland or to higher ground, upgraded facilities to be more resilient, and designed new facilities with features to protect them from natural disasters. For example, after being damaged by Hurricane Ike in 2008, the Coast Guard relocated a regional facility in Houston, Texas further inland to help protect the new facility from extreme weather. The facility was also designed to withstand wind speeds of up to 115 miles per hour. In February 2017, the Coast Guard's Civil Engineering program also issued guidance intended to increase the likelihood that new or recapitalized buildings would be designed to withstand natural disasters, and to enable the Coast Guard to better manage risks to its operations and personnel, among other things.[7]

ALMOST HALF OF THE COAST GUARD'S SHORE INFRASTRUCTURE IS BEYOND ITS SERVICE LIFE, AND PROJECT BACKLOGS WILL COST AT LEAST $2.6 BILLION TO ADDRESS

We found in February 2019 that the condition of the Coast Guard's shore infrastructure was deteriorating and almost half of it was past its service life[8]—resulting in (1) recapitalization and new construction and (2) deferred maintenance backlogs of at least $2.6 billion as of 2018.[9] In 2018, the Coast Guard graded[10] its overall shore infrastructure condition as a C minus[11] based on criteria it derived from standards developed by the American Society of Civil Engineers. Table 1 shows in-

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[5] According to Coast Guard guidance, a building is generally defined as a fully enclosed structure that is affixed to the ground, in which personnel work or live or where equipment is stored. Buildings include regional operations centers, aircraft hangars, and houses. A structure is generally defined as any other construction affixed to the ground that does not meet the definition of a building. Structures include helicopter landing pads, docks, and aircraft runways.

[6] Coast Guard's five product lines and the 13 asset lines within them are: (1) Tactical Operations—Aviation, Waterfront, Shore Operations; (2) Mission Support—Civil Works, Base Services, Industrial; (3) Mission Readiness—Housing, Community Services, Training; (4) Strategic Operations—Sector/District, Technology; and (5) Waterways Operations—Fixed and Floating Aids to Navigation (ATON), Marine Environmental Response and Signal Equipment.

[7] U.S. Coast Guard, *Shore Facilities Planning Factors Job Aid* (Norfolk, VA: Feb. 23, 2017). The Coast Guard guidance establishes building elevation requirements to account for storm surge, sea level rise, or periodic flooding, and utility and communication system placement to ensure operational continuity and safety, among other things.

[8] According to the Coast Guard its overall shore inventory has a 65 year service life, and its asset service life ranges from 6 to 75-years, depending on the type of asset.

[9] GAO–19–82 [https://www.gao.gov/products/GAO-19-82].

[10] The Coast Guard assigned each asset line a letter grade to provide a snapshot of what the Coast Guard considered the condition of its shore infrastructure to be for that year. Adapted from standards used by the American Society of Civil Engineers, the Coast Guard considered the following eight attributes: Capacity, Funding, Operations and Maintenance, Resilience, Condition, Future Need, Public Safety, and Innovation. As noted by the Coast Guard's fiscal year 2018 shore infrastructure reports, these infrastructure grades provide a broad basis for performance analysis and consider how well the Coast Guard is able to achieve mission objectives in relation to its dependencies on shore infrastructure.

[11] According to the American Society of Civil Engineers, an "A" is generally excellent condition, a "B" is in good to excellent condition, a "C" is in mediocre/fair to good condition but showing signs of deterioration and increasingly vulnerable to risk, a "D" is in poor to fair condition and mostly below standard, and an "F" is failing/critical, unfit for purpose, and in an unacceptable condition with widespread advanced signs of deterioration.

formation about the number of assets, replacement value, service life of, and condition grades assigned by the Coast Guard for each of its asset lines for fiscal year 2018.

Table 1: Asset Numbers and Replacement Values, Percent of Assets Operating Past Service Life, and Condition Grades of Select Assets, for Fiscal Year 2018 as Determined by the U.S. Coast Guard

Asset line	Number of assets	Replacement Value ($ in millions)	Percent of assets past service life†	Percent of assets operating more than 5 years past service life†	2018 condition grade‡
Aviation	334	2,570	63	35	D
Base services	4,180	880	50	33	C–
Civil works	6,665	1,872	55	33	C
Community services	1,135	1,394	68	37	D+
Housing	2,901	2,923	28	26	B–
Industrial	52	467	57	38	D–
Sector/District	459	2,029	27	16	C
Shore operations	1,056	1,951	38	19	B
Technology	1,910	835	24	15	D+
Training facilities	174	421	35	25	C+
Waterfront	1,577	2,494	55	26	C–
Total	**20,433**	**17,835**	**46**	**29**	**C–**

Source: GAO analysis of U.S. Coast Guard documents. GAO–19–711T

Note: Table excludes two asset lines—fixed and floating aids to navigation and signal equipment—which are used to mark federal waterways to safeguard maritime safety and commerce, among other things. We have ongoing work related to Coast Guard's fixed and floating aids to navigation.

† The Coast Guard does not have complete service life data on all of its assets. For example, the Coast Guard does not have data on the remaining service life for 16 percent of its aviation assets.

‡ According to the American Society of Civil Engineers, upon which Coast Guard based its grades, an ''A'' is generally in excellent condition; a ''B'' is in good to excellent condition; a ''C'' is in mediocre/fair to good condition but showing signs of deterioration and increasingly vulnerable to risk; a ''D'' is in poor to fair condition and mostly below standard; and an ''F'' is failing/critical, unfit for purpose, and in an unacceptable condition with widespread advanced signs of deterioration. The formula the Coast Guard uses to assign grades is based on a number of factors, including the results of its facility inspections, and the percent of assets past service life is independent of the grade calculation. According to Coast Guard officials, in 2018 some of its data on shore infrastructure may not be complete if field inspectors did not identify and record problems at facilities they inspected. As a result, condition grades could be overly positive.

The aging and deteriorating condition of the Coast Guard's shore infrastructure has led to at least $2.6 billion in deferred construction projects and maintenance backlogs. With almost half of its infrastructure past its service life, and given recent Coast Guard funding requests for its shore infrastructure, it will take many years for the agency to address these backlogs. For example, in 2018 the Coast Guard estimated that it would take almost 400 years [12] to address just the $1.774 billion recapitalization and new construction backlog—assuming an overall 65-year service life and that funding would continue at the fiscal year 2017 appropriations level. This time frame estimate excludes the Coast Guard's $900 million deferred depot-level maintenance backlog.[13] Table 2 provides information on the Coast Guard's two shore infrastructure backlogs as of August 2018.

[12] The number of years it would take to address the backlog is dependent on appropriated amounts, which have varied considerably.

[13] This estimate is as of August 2018. Deferred depot-level maintenance consists of major maintenance tasks that are beyond the capability of an individual unit, such as replacing exterior doors and windows.

Table 2: U.S. Coast Guard's Estimated Shore Infrastructure Backlogs, as of August 2018

Account	Backlog Total ($ in millions)	Description
Procurement, Construction, and Improvements	1,774	The backlog for which the Coast Guard had prepared cost estimates included 125 recapitalization and new construction projects. In 2017, the Coast Guard removed 132 projects from the backlog that it determined were no longer a priority.†
Deferred Depot-Level Maintenance	900	The backlog had increased by $300 million since fiscal year 2012 and includes more than 5,600 deferred maintenance projects.
Total	**2,674**	—

Legend: "—" = not applicable.
Source: GAO analysis of U.S. Coast Guard data. GAO–19–711T
† According to Coast Guard officials, in 2017 the Coast Guard reviewed all projects on the recapitalization backlog to determine if each project was needed and valid based on input from area leadership, Civil Engineering Units, and facility engineers, and removed projects that it determined were no longer necessary based on mission change, alternative solutions, or the need being met through another project. The Coast Guard was not able to identify the estimated total cost for the 132 projects it removed.

Nevertheless, the size and estimated costs of the Coast Guard's backlogs may be understated. We found in February 2019 that the Coast Guard's estimated costs did not include hundreds—or the majority—of the projects on the recapitalization and new construction backlog. For example, we reported that there were 205 projects on the backlog without cost estimates.[14] Officials explained that they had not prepared cost estimates for these projects because they were in the preliminary stages of development.[15]

Coast Guard Has Taken Initial Steps toward Improving Its Management of Its Shore Infrastructure

Our previous reports have identified various steps the Coast Guard has taken to begin to improve how it manages its shore infrastructure. Some of the steps the Coast Guard has taken align with leading practices for managing public sector backlogs and key practices for managing risks to critical infrastructure, including identifying risks posed by the lack of timely investment, identifying mission-critical facilities,[16] disposing of unneeded assets,[17] and beginning an assessment of shore infrastructure vulnerabilities.[18] Specifically, the Coast Guard has:

- *Identified risks posed by lack of timely investment.* In February 2019, we found that the Coast Guard had a process to identify, document, and report risks to its shore infrastructure in its annual shore infrastructure reports for fiscal years 2015 through 2018.[19] These reports identified the types of risks the Coast Guard faces in not investing in its facilities, including financial risk, capability risk, and operational readiness risk. The Coast Guard met this leading practice to identify risk in general terms—for example, in terms of increased lifecycle costs, or risk to operations.
- *Identified mission-critical and mission-supportive shore infrastructure.* In February 2019, we found that since at least 2012, the Coast Guard had documented its process to classify all of its real property under a tier system and established minimum investment targets by tier as part of its central depot level maintenance expenditure decisions.[20] These tiers—which range from mission-critical to

[14] In 2017, the Coast Guard removed 132 projects that it determined were no longer necessary based on mission change, alternative solutions, or the need being met through another project. We did not assess the process the Coast Guard applied to remove projects from its list. The Coast Guard was not able to identify the estimated total cost for projects it removed.
[15] In 2018, the Coast Guard's projected costs for individual shore projects with cost estimates ranged from $2 million to about $95 million per project. We did not evaluate the Coast Guard's cost estimating practices.
[16] GAO–19–82 [https://www.gao.gov/products/GAO-19-82].
[17] GAO–18–9 [https://www.gao.gov/products/GAO-18-9].
[18] GAO–19–675 [https://www.gao.gov/products/GAO-19-675].
[19] According to leading practices, agencies should identify the types of risks posed by not investing in deteriorating facilities, systems, and components because this is important for providing more transparency in the decision making process, and for communicating with staff at all organizational levels. See GAO, *Federal Real Property: Improved Transparency Could Help Efforts to Manage Agencies' Maintenance and Repair Backlogs*, GAO–14–188 [https://www.gao.gov/products/GAO-14-188] (Washington, D.C., January 23, 2014).
[20] Leading practices state that agencies should identify buildings as mission-critical and mission-supportive to help establish where maintenance and repair investments should be targeted, to ensure that funds are being used effectively. See GAO–14–188 [https://www.gao.gov/products/GAO-14-188].

mission-supportive assets—were incorporated into guidance that Coast Guard decision makers are to follow in their deliberations about project funding, and to help them determine how to target funding more effectively. For example, Coast Guard guidance for fiscal years 2019 through 2023 prioritized expenditures on shore infrastructure supporting front line operations, such as piers or runways, over shore infrastructure providing indirect support to front line operations, such as administrative buildings.

- *Assessed selected buildings for vulnerabilities.* We issued a report today that discusses the Coast Guard Civil Engineering program's efforts to conduct a vulnerability assessment of its owned and occupied buildings,[21] which the Coast Guard initiated in 2015 and aims to complete in 2025.[22] The Coast Guard calls this infrastructure review the Shore Infrastructure Vulnerability Assessment. The focus of Phase I of this assessment, completed in 2019, was to determine the vulnerability of certain occupied buildings to 10 natural disasters.[23] Further, the assessment results are intended to assist with contingency planning by identifying which Coast Guard facilities are likely to remain operational after a natural disaster.

  During Phase I of this assessment, completed in 2019, the Coast Guard analyzed 3,214 buildings, almost 16 percent of its infrastructure, for vulnerabilities to disasters such as floods, earthquakes, and hurricanes. The analysis identified Coast Guard-wide infrastructure vulnerabilities to coastal risks such as shoreline loss, coastal erosion and earthquakes, as well as tsunami risks on the West Coast of the United States, Alaska, Guam, and Hawaii, and immediate and serious flood risks in Puerto Rico and the Gulf and East Coasts. The Phase I report recommended that Coast Guard units and contingency planners consider these vulnerabilities when preparing contingency plans or making capital investments. The Coast Guard has also initiated a follow up effort involving structural analyses for buildings it believes to be more susceptible to damage from earthquakes and wind. Officials involved said their aim is to complete this effort in 2025.

COAST GUARD HAS NOT FULLY APPLIED LEADING PRACTICES AND KEY RISK MANAGEMENT STEPS IN MANAGING ITS SHORE INFRASTRUCTURE

The Coast Guard has taken actions to begin to improve its shore infrastructure management. However, as we previously reported, the Coast Guard has not fully applied leading practices and key risk management steps to improve its shore infrastructure management. Specifically, we found, among other things, that the following actions could help improve the Coast Guard's shore infrastructure management efforts:

- *Employ models for predicting the outcome of investments and analyzing trade-offs*. In February 2019, we found that a 2017 Coast Guard Aviation Pavement Study employed a model that found that the Coast Guard could more efficiently prioritize investment in aviation pavement.[24] A subsequent Coast Guard aviation pavement plan recommended actions to use the study results and potentially save $13.8 million. However, we found that the Coast Guard had not fully implemented its own recommended actions to achieve the cost savings.

  Additionally, we found that while a similar analytical approach to efficiently prioritizing investments in aviation pavement could be applied to all of the

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[21] According to DHS's Risk Management Framework, it is important to identify assets that are both nationally significant and those that may not be significant on a national level but are, nonetheless, important to state, local, or regional critical infrastructure security and resilience and national preparedness efforts.

[22] See GAO, *Coast Guard Shore Infrastructure: Processes for Improving Resilience Should Fully Align with DHS Risk Management Framework*, GAO–19–675 [https://www.gao.gov/products/GAO-19-675] (Washington, D.C., September 25, 2019).

[23] Specifically, the Shore Infrastructure Vulnerability Assessment analyzed all Coast Guard owned and occupied buildings over 1,000 gross square feet for vulnerabilities to natural disasters. The 10 natural disaster vulnerabilities assessed were: seismic/ earthquake, flood, tsunami, sea level rise, coastal vulnerability index (CVI), hurricane/typhoon wind, wildfire, volcano, tornado/wind, and drought. CVI quantifies the likelihood that physical changes may occur in the coastal zone based on analysis of the location's tidal range, ice cover, wave height, coastal slope, historical shoreline change rate, geomorphology, and sea level rise. The Coast Guard's CVI analysis was based on the U.S. Geological Survey National Assessment of Coastal Vulnerability to Sea-Level Rise.

[24] To ensure that investment decisions are aligned with agency missions and goals, agencies should employ models to predict the future condition and performance of its facilities as a portfolio, according to leading practices. GAO–19–82 [https://www.gao.gov/products/GAO-19-82].

shore infrastructure asset lines, the Coast Guard had not applied the approach to other asset lines. By not employing similar models across its asset lines for predicting the outcome of investments, analyzing tradeoffs, and optimizing decisions among competing investments, the Coast Guard is missing opportunities to potentially identify and achieve cost savings across other asset lines. We recommended that the Coast Guard employ models for its asset lines that would predict the investment outcomes, analyze tradeoffs, and optimize decisions among competing investments. The Coast Guard agreed with our recommendation but as of August 2019 had not addressed it. The Coast Guard stated that it plans to assess the use of modeling tools used by the Department of Defense as well as other alternatives to enhance its real property asset management capability. We will continue to monitor its actions.

- *Dispose of unneeded assets*. In October 2017, we found that disposing of unneeded assets, such as closing unnecessarily duplicative boat stations,[25] based on a sound analytical process, could potentially generate $290 million in cost savings over 20 years.[26] Specifically, the Coast Guard identified 18 unnecessarily duplicative boat stations with overlapping coverage that could be permanently closed without negatively affecting the Coast Guard's ability to meet its mission requirements, including its 2-hour search and rescue response standard.[27] In 2017, the Coast Guard affirmed that its leadership believes the study remains valid, but as of September 2019 it has not closed any stations. Figure 1 depicts the extent of the Coast Guard's overlapping boat and air station search and rescue coverage, as identified by the Coast Guard, some of which the Coast Guard determined to be unnecessarily duplicative.

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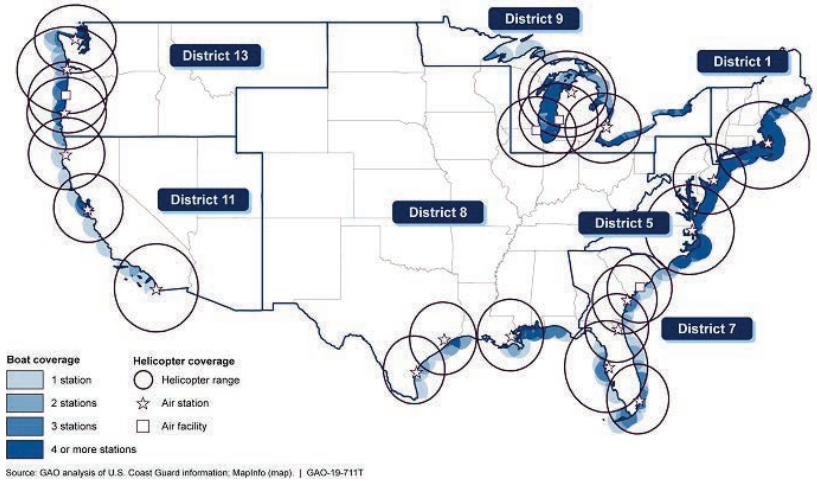
[25] In 2010, federal law required that within departments and government-wide we identify programs, agencies, offices, and initiatives with duplicative goals and activities and report annually. Pub. L. No. 111–139, § 21, 124 Stat. 29 (2010), 31 U.S.C. § 712 Note. See GAO's Duplication and Cost Savings web page for links to the 2011 to 2017 annual reports: http://www.gao.gov/duplication/overview. Overlap occurs when multiple agencies or programs have similar goals, engage in similar activities or strategies to achieve them, or target similar beneficiaries. Duplication occurs when two or more agencies or programs are engaged in the same activities or provide the same services to the same beneficiaries.

[26] GAO–18–9 [https://www.gao.gov/products/GAO-18-9]. In February 2019 we reported that leading practices state that agencies should efficiently employ available resources, limit construction of new facilities, and that facilities that are not needed to support an agency's mission should be disposed of whenever it is cost effective to do so. GAO–19–82 [https://www.gao.gov/products/GAO-19-82].

[27] Coast Guard guidance calls for its stations to plan to arrive to the scene of the search and rescue distress cases within their area of responsibility within 2 hours. The analytical process the Coast Guard used to identify unnecessarily duplicative stations was designed to ensure the Coast Guard was able to meet or exceed requirements to maintain search and rescue coverage, and to account for such factors as boat downtime and surge capacity to respond to incidents. Further, the boat station analysis did not include consideration of potential search and rescue responses by the Coast Guard's air stations and facilities, which can provide additional overlapping coverage. U.S. Coast Guard, *U.S. Coast Guard Addendum to the United States National Search and Rescue Supplement to the International Aeronautical and Maritime Search and Rescue Manual*, COMDTINST M16130.2F (Washington, D.C.: January 2013).

Figure 1: Overlap of U.S. Coast Guard Search and Rescue Coverage Provided by Boat Stations, Air Stations, and Air Facilities, May 2017



In February 2019, we found that 5 of the 18 boat stations recommended for closure had projects listed on the Coast Guard's current project backlog.[28] For example, Station Shark River, in New Jersey, was recommended for recapitalization in fiscal year 2017, despite Coast Guard recommendations to close the station in 1988, 1996, 2007, and 2013.[29] Notably, the Coast Guard has made multiple attempts in previous years to close such stations but was unable to due to congressional intervention, and subsequent legislation prohibiting closures.[30]

In October 2017, we recommended that the Coast Guard establish and implement a plan with target dates and milestones for closing boat stations that it has determined provide overlapping search and rescue coverage and are unnecessarily duplicative. In February 2019, we further recommended disposing of unneeded assets to more efficiently manage resources and better position the Coast Guard and Congress to address shore infrastructure challenges. The Coast Guard agreed with our recommendations. As of September 2019, the Coast Guard reported that it was considering changes in the operational status of several stations, such as closing the stations during the winter months when they conduct few, if any, search and rescue cases. The Coast Guard estimated

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[28] Leading practices state that agencies should efficiently employ available resources, limit construction of new facilities, adapt existing buildings to new uses, and transfer ownership of unneeded buildings to other public or private organizations to align real property with mission needs. In addition, facilities that are functionally obsolete, not needed to support an agency's mission, not historically significant, or not suitable for transfer or adaptive reuse should be demolished whenever it is cost effective to do so, under this leading practice.

[29] Projects added to the recapitalization and new construction backlog in 2017 involving stations previously recommended for closure included Station Oxford in Maryland, Station Ocracoke in North Carolina, Station Fortescue in New Jersey, and Station Kenosha in Wisconsin.

[30] Department of Transportation and Related Agencies Appropriations Act, 1989, Pub. L. No. 100–457, 102 Stat. 2125, 2126 (1988). Id. at § 350, 102 Stat. 2156. See also, 14 U.S.C. § 910 (formerly cited as 14 U.S.C. § 675). See Howard Coble Coast Guard and Maritime Transportation Act, 2014, Pub. L. No. 113–281, § 225(b), 128 Stat. 3022, 3039 (2014). See also, 14 U.S.C. § 912 (formerly cited as 14 U.S.C. § 676a). In 1990, we reported that the Department of Transportation Inspector General recommended that the Coast Guard close 21 stations, and the Coast Guard recommended additional closures. See GAO/RCED–90–98 [https://www.gao.gov/products/GAO/RCED-90-98]. We have reported on the Coast Guard's efforts to close stations over many years. In 1994, we reported that the Coast Guard had created a new process for determining the need for boat station changes. We also found that the new process included detailed criteria to evaluate the appropriate need for stations, such as boating and economic trends and the availability of alternative search and rescue resources. The Coast Guard then unsuccessfully attempted to close stations in 1995 using this process, and again in 2008. GAO, *Coast Guard: Improved Process Exists to Evaluate Changes to Small Boat Stations*, GAO/RCED–94–147 [https://www.gao.gov/products/GAO/RCED-94-147] (Washington, D.C.: Apr. 1, 1994); See also, GAO–18–9 [https://www.gao.gov/products/GAO-18-9].

that it will continue to consider changes until March 2020. These are positive steps, but we continue to believe that it is important for the Coast Guard to dispose of unneeded assets. Given the Coast Guard's competing acquisition, operational, and maintenance needs, and its existing $1.774 billion project backlog of recapitalization and new construction projects, these actions may help to mitigate some of its resource challenges. We will continue to monitor the Coast Guard's efforts to implement these recommendations.

- *Report shore infrastructure project backlogs accurately*. In February 2019, we found areas in which the Coast Guard could increase budget transparency for shore infrastructure by accurately reporting project backlogs and costs in Congressionally-required plans.[31] Specifically, we found that the Coast Guard had not provided accurate information to Congress necessary to inform decision-makers of the risks posed by untimely investments in maintenance and repair backlogs.[32] For example, the Coast Guard had not provided complete information to Congress in its Unfunded Priorities Lists of shore infrastructure projects, including information about tradeoffs among competing project alternatives, as well as the impacts on missions conducted from shore facilities in disrepair.[33] We also found that Coast Guard budget requests related to shore infrastructure for fiscal years 2012 through 2019 generally did not identify funding to address any backlogs of deferred maintenance or recapitalization, except for one fiscal year—2012—when the Coast Guard requested $93 million to recapitalize deteriorated/obsolete facilities.

  We also found that the Coast Guard had not provided accurate information about its requirements-based budget targets for shore infrastructure in its budget requests. According to Coast Guard officials, a requirements-based budget is an estimate of the cost to operate and sustain its shore infrastructure portfolio of assets over the lifecycle of the asset, from initial construction or capital investment through divestiture or demolition.[34] Further, we found that Coast Guard recapitalization targets showed a far greater need than was reflected in the appropriations it requested from fiscal years 2012 through 2019. Specifically, Coast Guard targets for recapitalization of shore assets indicated the Coast Guard needs $290 to $390 million annually for its recapitalization efforts. However, its budget requests for fiscal years 2012 through 2018 have ranged from about $5 million to about $99 million annually.

  We recommended that the Coast Guard include supporting details about competing project alternatives and report tradeoffs in Congressional budget requests and related reports. Without such information about the Coast Guard's budgetary requirements, the Congress will lack critical information that could help to prioritize funding to address the Coast Guard's shore infrastructure backlogs. While the Coast Guard agreed with our recommendation, in August 2019 officials reported that they will continue to develop budgets as the agency has done but will include additional information in future required reports to Congress. We will continue to monitor these actions.

- *Fully implement DHS's Critical Infrastructure Risk Management Framework*. In September 2019, we found that the Coast Guard has taken some steps to improve the resilience of its shore infrastructure by rebuilding storm-damaged facilities and initiating a vulnerability assessment, but its processes to improve

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[31] According to leading practices, agencies should structure maintenance and repair budgets to differentiate between funding allotted for routine maintenance and repairs, and funding allotted to addressing maintenance and repair backlogs, among other things. GAO–19–82 [https://www.gao.gov/products/GAO-19-82].

[32] Coast Guard and Maritime Transportation Act, 2012, Pub. L. No. 112–213, § 213, 126 Stat. 1540, 1552–53 (codified as amended at 14 U.S.C. § 5102, formerly cited as 14 U.S.C. § 2902). The Coast Guard was statutorily required to annually provide a list of each unfunded priority, including unfunded shore infrastructure priorities, to certain committees of Congress to support the President's budget, and its 5-year Capital Investment Plan. 14 U.S.C. § 2902 (2018). See 14 U.S.C. § 5108.

[33] The term 'unfunded priority' means a program or mission requirement that (1) has not been selected for funding in the applicable proposed budget; (2) is necessary to fulfill a requirement associated with an operational need; and (3) the Commandant would have recommended for inclusion in the applicable proposed budget had additional resources been available, or had the requirement emerged before the budget was submitted. 14 U.S.C. § 2902(c) (2018). See 14 U.S.C. § 5108.

[34] According to the Coast Guard, its requirements-based budget planning is based on industry standards and that it aligns with the National Academy of Sciences benchmarks for sustainable facility and infrastructure management. National Research Council of the National Academy of Sciences, *Stewardship of Federal Facilities: A Proactive Strategy for Managing the Nation's Public Assets* (Washington, D.C.: National Academies Press: 1998).

shore infrastructure resilience are not fully aligned with the five steps DHS has identified for critical infrastructure risk management (DHS Critical Infrastructure Risk Management Framework).[35] The five steps include: (1) setting goals and objectives, (2) identifying critical infrastructure, (3) assessing and analyzing risks and costs, (4) implementing risk management activities, and (5) measuring the effectiveness of actions taken.[36]

We found that the Coast Guard is not positioned to provide decision makers with complete details of which infrastructure facilities are critical, and the type of information the DHS Critical Infrastructure Risk Management Framework recommends for making cost effective risk management decisions. The Coast Guard identified occupied buildings that may be important to operations and assessed their vulnerability through its Shore Infrastructure Vulnerability Assessment process, but this process did not identify all shore infrastructure assets that are critical to its missions—such as aircraft runways—or screen them for all vulnerabilities, such as flooding. Similarly, we found that while the Coast Guard identified almost 800 buildings that may be vulnerable to tornadoes and another 1,000 buildings vulnerable to hurricanes, it has not analyzed the potential consequences, such as economic losses, costs for rebuilding, and impact on mission, should this infrastructure suffer damage from those vulnerabilities.

Without a complete understanding of both the vulnerabilities of its infrastructure and the consequences to its mission operations if its infrastructure is damaged, the Coast Guard risks questionable recapitalization investments for improving resilience when selecting projects to fund. Such an understanding is especially important given its existing project backlogs of at least $2.6 billion. The five steps of the DHS Critical Infrastructure Risk Management Framework are intended to guide decision making and prioritize actions to more effectively achieve desired outcomes. Therefore, in September 2019 we recommended that the Coast Guard implement risk management processes that more fully align with the five key steps outlined in DHS's Critical Infrastructure Risk Management Framework to better guide its shore infrastructure investment decisions. The Coast Guard agreed with our recommendation. It stated that it plans to make progress towards implementing the recommendation while developing and implementing its Component Resilience Plan, in accordance with the recently mandated DHS Resilience Framework.[37] It intends to complete these efforts by the end of 2021. The Coast Guard also intends to develop, by July 2020, goals and objectives for measuring the effectiveness of actions taken to identify resilience readiness gaps and resource needs. We will continue to monitor these efforts.

Chairman Maloney, Ranking Member Gibbs, and Members of the Subcommittee, this completes my prepared statement. I would be happy to respond to any questions you may have at this time.

Mr. MALONEY. I thank the gentleman.

We will now proceed to Members' questions under the 5-minute rule. I will begin by alternating between the majority and the minority. I will begin by recognizing myself for 5 minutes.

Admiral Moore, there were some eye-popping parts of Mr. Anderson's testimony. Would you like to respond to any of that? I mean, I can ask you about each one or I can just let you go.

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[35] See GAO, *Coast Guard Shore Infrastructure: Processes for Improving Resilience Should Fully Align with DHS Risk Management Framework*, GAO–19–675 [https://www.gao.gov/products/GAO-19-675] (Washington, D.C., September 25, 2019).

[36] In 2013, DHS updated its National Infrastructure Protection Plan guidance for critical infrastructure owners and operators to emphasize security and resilience as the primary aim of homeland security planning efforts for critical infrastructure. As part of this effort, DHS established a five step risk management framework for assessing critical infrastructure (DHS Risk Management Framework) and recommended that owners and operators of critical infrastructure whether private or public use the framework to identify priorities, articulate clear goals, mitigate risk, measure progress, and adapt based on feedback and the changing environment. See, Department of Homeland Security, *2013 National Infrastructure Protection Plan, Partnering for Critical Infrastructure Security and Resilience* (Washington, D.C.: December 2013).

[37] In 2018, DHS required all operational components to participate in the development of the DHS Resilience Framework, including developing individual component resilience plans, to guide DHS's approach to resilience planning. According to the Coast Guard officials, their plan was submitted to DHS in August 2019.

Admiral MOORE. Well, I think I can say, sir, just as an opening statement, that we are certainly appreciative of GAO's recommendations. And I think for me, as the chief engineer of the Coast Guard, as we work through our plan and how we get after this issue when we see the readiness that is impacted in the field, we really appreciate the outside look that an organization like GAO gives us.

They have created in this report six specific recommendations, and we concur with all six of those. In fact, we have already taken action on a couple of them, most recently some of this standardized facilities condition assessments. I actually control that out of my office and signed that out about a month ago, and we are doing that now Coast Guard-wide.

So I think, you know, as an overall statement, I would certainly say we appreciate the outside look, and we are taking action to address those recommendations.

Mr. MALONEY. Anything in the report you disagree with?

Admiral MOORE. Not as a functional, you know, set of comments. I mean, no, sir. I mean——

Mr. MALONEY. So we can expect progress on all those recommendations?

Admiral MOORE. Yes, sir. I have got my folks working towards each one of those six recommendations, and we have detailed timelines on how to get there.

Mr. MALONEY. Let me try and understand the scope of the problem. So I am told that 46 percent of the shore infrastructure is beyond its service life, that the project backlog will cost at least $2.6 billion. But, as I understand it, the majority of projects don't have cost estimates. And of the projects that do, they represent less than half of the total number of projects. The average cost for the ones that do have cost estimates is about $17 million. And if you are doing the math, you get to a notional number that would be far in excess of the $2.6 billion total cost.

So how do we, in the absence of cost estimates for the majority of the projects, have any idea what the true size of the backlog is, or can you shed some light on that?

Admiral MOORE. Yes. Thank you, sir. We do have cost estimates and different fidelity. What I would say about that backlog is everything on the backlog is not equal. There are certainly projects on that list that are more critical to our operations and to our support of our personnel, in terms of housing, et cetera. So we focus our effort and the limited funding that we do have for shore infrastructure on those projects that are executable.

So, while the backlog itself is large, we certainly focus our efforts on things that we believe are executable and projects that we are going to actually undertake to increase our readiness.

Mr. MALONEY. Admiral, could you also say a word about the risk management framework that DHS has, and could you expand on that? Is that the same process you are talking about implementing, or are you talking about something else?

Admiral MOORE. Sir, that risk management framework is something a little bit different. Underneath the Department of Homeland Security's guidelines, we have submitted our first component

plan for resilience. My office just signed that out a couple months ago.

That is our first effort into a plan for resiliency, and included in that are several specific steps that we are taking. One is a complete shore infrastructure vulnerability analysis that we have undertaken for all of our facilities. We have started with a phase 1 report, which we have completed already, which analyzes all of our facilities against natural threats, such as hurricanes, tornadoes, earthquakes, tsunamis, wildfires, that kind of thing. Phase 2 will be to look at our buildings, based on seismic and wind vulnerabilities. And then phase 3 is what are we going to do about it. Phase 3 is the actual plan for how we tackle that. So that is all underneath the component plan for resilience that we submitted to DHS.

Mr. MALONEY. Can I ask you for a little preview of coming attractions on that? I have only got about a minute. But do you have any visibility into that phase 1 assessment? I mean, common sense would tell you they are all on the water, aren't they? I mean, are all of them vulnerable to sea rise? How sweeping is that finding going to be?

Admiral MOORE. I think, at some level, all of our infrastructure is vulnerable. It is all on or near the water and accessible to that air, salt air in particular, and water. Different levels of vulnerability, though.

The initial assessments that I have seen will show us that there are some locations where you are in an elevated location. Some locations are newer than others, so built to modern standards.

Mr. MALONEY. Is it fair to say that common sense or an early glimpse at the survey would suggest that you are going to have a sweeping set of concerns, that the scope of this issue could be massive? Is that fair to say?

Admiral MOORE. It is going to be a significant backlog of work in addition to what we already know, but I think we already know most of it, sir. I think that is where—you know, we have been doing this for years, and we know that these assets that we place on the water are vulnerable to these natural threats. So it will be a significant report, but I don't think there will be that much new information that we didn't already know.

Mr. MALONEY. All right. I thank the gentleman.

I yield to Mr. Gibbs.

Mr. GIBBS. Thanks.

Thanks, Admiral, and thanks, Mr. Anderson, for being here.

Admiral, in your testimony, you talk about how the shore facilities are directly connected to all operations, which is obvious, I think. And then Mr. Anderson testified about 400 years to fix the backlog, which is staggering. So, obviously, a lot of planning and prioritization is going to have to occur with funding, of course.

Admiral, is the shoreside infrastructure planning initiative separate from the planning, design, and acquisition process for the new assets?

Admiral MOORE. Sir, there is some overlap there. We use our same people, our same set of resources to attack both those problems. We have what is called a Major Acquisition Systems Infrastructure budgetary line item, MASI we call that. The MASI ac-

count is specifically programmed to us for the arrival of new assets, so new ships, aircraft, C4IT, basically to prepare the shore infrastructure for arrival of those new assets.

So what we do is we fold together that MASI funding for new assets with our current depot shore infrastructure money that we use for existing assets because there is obvious overlap there as we roll assets into our operating bases today.

Mr. GIBBS. Yes, it is important to have that coordination, you know, is what you are saying. OK. The GAO found that the piers and airstrips are not necessarily included in the $2.6 billion maintenance and repair backlog. What actions need to be taken to review those assets so we have a more complete Coast Guard capital assets backlog?

Admiral MOORE. Sir, we do include piers and runways and all those facilities, including housing, into that backlog. So, again, everything on the backlog is not equal. There are some things that are deemed more essential. We look at anything supporting that operational readiness. We look at our housing program, any of those things that directly affect our members as most important.

Again, we have a very detailed prioritization process that we use on 6-month intervals to analyze all of those projects and prioritize which ones are going to be funded.

Mr. GIBBS. What would be the long-term impacts of operation of the Coast Guard personnel of carrying such a large backlog?

Admiral MOORE. Sir, thank you for asking that question. We know there are impacts to our people on this. I mean, we talk a lot about boats and aircraft and cutters that get underway, but in particular on the housing side, there are significant impacts to our people as we face backlogs there.

Our people do tremendous things, and we have seen the recent response to Hurricane Dorian and the Coast Guard being on scene there quickly. And, from my perspective, we realize that all of that response a couple weeks ago to the Bahamas, all that response came from shore facilities and assets where we are struggling on the shore infrastructure side. So the impacts to our people are real, both operationally and from the housing front.

Mr. GIBBS. Recently, Ranking Member Sam Graves toured the Barbers Point in Hawaii, the hangar there, which has an unfunded mandate listed for a $100.5 million project that would include housing, the C–130Js and the MH–65s.

What is the likelihood this funding will be included in the administration's fiscal year 2020 budget request? Are you guys recommending for that to be in there?

Admiral MOORE. Sir, we continue to make tough choices as we look at our funding constraints on where we place new assets and what gets put into the budget for acquisition. I can tell you from the shore infrastructure side, a new hangar facility is needed in Hawaii, and that is why you see that on the Unfunded Priority List.

We greatly appreciate the ability to provide that list to you and to demonstrate our highest priority needs, and that Air Station Barbers Point hangar is certainly one of them.

Mr. GIBBS. OK. I appreciate that. When we talk about modernization, we saw with Hurricane Katrina and the restructuring

called modernization. Does the Coast Guard intend to implement a national process of reviewing and rating individual projects? I guess that is where we get into the prioritization. How are we doing that and reviewing each individual project?

Admiral MOORE. We have a very detailed process. I mentioned these every 6-month reviews. We centrally review projects for prioritization, and then we regionally review them as well, and that way we get a field operator's perspective and also a centralized view for the larger recapitalization projects. That process is very time-tested and well-worn for us. It gives us a good opportunity to provide those highest prioritized projects.

Mr. GIBBS. I have just got one last question before I run out of time. Of the 10 recommendations in the last 3 GAO shoreside infrastructure reports, how many have been fully implemented, partially implemented, or received no action?

Admiral MOORE. Sir, I would have to refer to the record to give you a detailed breakdown from all 10 of those reports, but we have taken action on a significant number of GAO's recommendations, including this most recent report. As I mentioned, we are in agreement with all six of those recommendations.

Mr. GIBBS. Thank you. I yield back.

Mr. MALONEY. The gentleman, Mr. Brown.

Mr. BROWN. Thank you, Mr. Chairman.

Good afternoon, gentlemen.

Admiral Moore, can you kind of give us a little bit of color in terms of with this deferred maintenance and the repair backlog, about the impact on the mission? Give us some examples. You know, how is it impacting the mission? How is it impacting your members' families? Just kind of tell us a story or two.

Sometimes we get lost in these numbers, or at least I do, and I like to—I haven't yet been out to visit a Coast Guard facility. It is on my list. I am new to this committee. But tell us about the impact.

Admiral MOORE. Yes, sir. We would be happy to host you at any facility any time to show you. I can think of lots of impacts, I mean, and specific examples. If we think on the maintenance side in my world, we have infrastructure at our Coast Guard yard in Baltimore where we have cranes for doing that heavy work in the drydocks and docksides. And on the shore infrastructure budget, we have been unable to fund repair of those cranes, and that ends up meaning that we deliver ships a little later. The work has to be done harder, sometimes in a more expensive, more manual way.

If you look at operational units, places where we have piers, where we have temporary shore tie facilities set up because the electrical system may not be as robust as we need it to be. We have places in housing where we badly need to do renovations and remodeling. We have office space that often has, you know, sort of substandard ventilation equipment and things that need to be upgraded.

So all that puts a stress on our people. And when we ask them to go out and do these hard missions and do the Nation's business, it makes it much more difficult for them.

Mr. BROWN. Thank you.

And for Mr. Anderson, you gave us a time period in which it would take for the Coast Guard to get well, in terms of the backlog and the maintenance. What was that time period again? Was that 40 years?

Mr. ANDERSON. 400.

Mr. BROWN. 400 years. Tell me a little bit about the assumptions you make, and is that a flat sort of steady level of investment? Is that a declining investment in maintenance and repairs? What are some of the assumptions that you made to reach that?

Mr. ANDERSON. Unfortunately, the news doesn't get better. That is a 400-year estimate, based on projects that are on the backlog right now and does not consider any projects that will come on in future years. And that is clearly going to happen. That is just a reality.

So the assumptions that we used were what is being spent right now on the backlogs, what is being requested from Congress, and what is being appropriated for the purposes of trying to buy that down.

Mr. BROWN. And just so I understand sort of like the magnitude of this $2.6 billion in backlog, could either of you tell us, what is the current year's appropriation and spend for maintenance and repair of infrastructure?

Admiral MOORE. Sir, I am happy to take that one. For fiscal year 2019, we had $195 million enacted, in our enacted budget for us. We are looking at about the same level with the President's budget for fiscal year 2020, about $200 million. That is in our depot-level shore maintenance funding.

We also have a significant chunk of money for the new acquisitions that come online. So most of that is also shore infrastructure. In terms of depot maintenance, it is around $200 million a year, sir.

Mr. BROWN. Got it. I think this will probably be my final question. Admiral, you mentioned that the Coast Guard has divested itself of how many properties you mentioned?

Admiral MOORE. It is just over 200 in the past——

Mr. BROWN. And that is real property? OK.

Could you just tell a little bit about your process, the criteria that you use to divest of certain properties, and does that list of criteria include your ability to maintain it?

Admiral MOORE. Yes, sir. We do look at—we are really constantly looking at our shore infrastructure portfolio for opportunities to divest. As we bring new assets online, there is a constant balance of what the shore footprint needs to look like to support those assets and operate them.

Housing is also a significant portion of that. We have over 3,000 housing units, both owned and leased, around the world. So we do go through a rigorous process of determining where we can divest certain properties, and we follow the standard Federal procedure for doing that, including providing a real property report to the Congress every year of our progress.

Mr. BROWN. Thank you.

I will yield back the balance of my time, Mr. Chairman.

Mr. MALONEY. I thank the gentleman.

Mr. Weber.

Mr. WEBER. Thank you, Mr. Chairman.

Admiral, you say there are 5,000 Coasties. Was that what I understood you to say?

Admiral MOORE. In my organization, shore——

Mr. WEBER. In your organization.

Admiral MOORE [continuing]. Maintainers. Yes, sir.

Mr. WEBER. OK. Can you break those out by State? Do you know how many are in each State? I mean, not here, but——

Admiral MOORE. I can take that for the record, sir. We can provide that.

Mr. WEBER. You can get that for me. And one of the questions I had is, in the shoreside infrastructure planning initiative, is it separate from the planning, design, and acquisition of new assets?

Admiral MOORE. They are linked. To answer your question, yes, they are separate, but they are linked through that MASI account. So the idea of that is we bring new infrastructure on. We know that we are going to be—we want to make sure that new infrastructure that comes with new assets is a complement to what we already have.

Mr. WEBER. As more and more disasters happen—and Ranking Member Gibbs alluded to it—you know, we are the first three coastal counties of Texas from Louisiana, that other foreign country, coming down the gulf coast. And both Hurricane Harvey inundated us and then Imelda inundated us just a week ago.

And the Coast Guard has been great, you know, being Johnny on the spot and just doing everything needed. But as more and more disasters happen, is it pushing that planning process back for acquisition of new assets?

Admiral MOORE. No, sir, it really isn't. You know, in my world, in the maintenance world and in rebuilding the shore infrastructure, we have been very fortunate and very appreciative of the hurricane supplementals that we receive from Congress. That supplemental funding has provided us the ability to repair projects from the damage that we received in the storms.

Our shore infrastructure that happens around the country elsewhere is, you know, is largely a—you know, those are separate projects, obviously, that go on around that.

I would say specifically for, in your district, sir, and in other coastal areas, we have made great strides in resiliency of those facilities. And I think about Sector Galveston and Sabine Pass there that were destroyed by Hurricane Ike back in 2008.

Mr. WEBER. I have been to both.

Admiral MOORE. Yes, sir. And you likely know that the day after Hurricane Harvey came through, we were operating out of those facilities.

Mr. WEBER. Absolutely.

Admiral MOORE. What that shows me is, if we make a wise investment and recapitalize at new resilient standards, we won't have to come back and do this again.

Mr. WEBER. So 400 years that he is talking about, we won't have to worry about this.

Admiral MOORE. Yes, sir. That is exactly right.

Mr. WEBER. Yeah, I got you. You said there are 200 properties that you all have divested of. How many properties would you say are on our ledger sheet?

Admiral MOORE. Estimating, I think we have got around 10,000 properties of different size. Some are very small; some are large. But it is around 10,000.

Mr. WEBER. And you said you had divested some of the properties around the world? You had housing units, I think 3,000 housing units in the world?

Admiral MOORE. Yes, sir, including places like Guam and obviously the outer-continental locations in Alaska and everywhere. So——

Mr. WEBER. Are we divesting ourselves of those?

Admiral MOORE. The ones that are no longer needed. I mean, we are constantly looking at where we need more housing, where we no longer need housing, based on changes in our footprint, changes in the local economies, ability to support our members, et cetera.

Mr. WEBER. Are you divesting of those properties, obviously, in the various 50 States?

Admiral MOORE. We are. It isn't restricted by any particular geography. We look at it holistically.

Mr. WEBER. And is there a list of those who may be on the, quote/unquote, "chopping block"?

Admiral MOORE. Yes, sir. That real property report that we provide every year details the assets that we are in the process of divesting.

Mr. WEBER. OK. Does it take into account the length of waterways that move a lot of commerce, like Mississippi or the Sabine-Neches Waterway? Does it take that into account?

Admiral MOORE. Yes, sir. I mean, before we make any decision to pursue divestiture, all those factors are included.

Mr. WEBER. So you do an analysis on the amount of freight or trade or the military personnel, as you may know, Beaumont, Port of Beaumont in my district moves more military personnel and equipment than any other port in the other lesser 49 States.

And so you all take that into account as you are looking at those divestitures, and you have a list of those that you might be considering that is every year?

Admiral MOORE. Yes, sir. I mean, that real property report tells us exactly where we are at, which ones have been divested, and how we are moving forward in the process.

Mr. WEBER. I would like to get that list, if I could, Admiral, if you could get that to my office. I am basically out of time. I am going to yield back.

Thank you, Mr. Chairman.

Mr. MALONEY. I thank the gentleman.

Ms. Plaskett.

Ms. PLASKETT. Thank you very much, Mr. Chairman.

Good afternoon, gentlemen. I always have to bring up that the Coast Guard has been exemplary in the Virgin Islands, and we could not do many of the things that we do to protect ourselves without their support. And so I am grateful for that.

Acting Director Anderson, the Coast Guard received over $700 million in supplemental appropriations to restore facilities dam-

aged by Hurricanes Harvey, Irma, Maria and then Matthew. How has disaster funding been applied by the Coast Guard to rebuild island facilities to date?

Mr. ANDERSON. Portions of that question I may have to get back to you on. We do have some indepth analysis about where the funding went, which stations were hardened as a result of some of that.

But what I can say is the Coast Guard does deserve credit in this space for using the supplemental appropriations to rebuild and repair to higher building standards. There have been several instances where doing so has actually saved money down the road when extreme weather has struck those same areas again. Sector Houston-Galveston was an example of that.

Ms. PLASKETT. You're discussing in Texas?

Mr. ANDERSON. Exactly. It was a role model effort there, where it was hardened; the infrastructure was hardened. When extreme weather struck, they were able to use that as a central command post and do a lot of their emergency operations out of that.

Ms. PLASKETT. OK. Do you see mechanisms in place for creating strategies to do improvement in this?

Mr. ANDERSON. Our central point of our report that was issued today is really that the Coast Guard has an opportunity to be a little bit more forward-looking in this space. And what I mean by that is getting supplemental appropriations after the fact and hardening that infrastructure after the fact is good, but there are some statistics out there by the National Institute of Building Sciences that says for every dollar invested in resilience, you save $3 to $12 down the road. So doing it on the front end helps.

And what we haven't seen is that integration of vulnerable facilities, vulnerable infrastructure, kind of integrating that into the project selection when you are trying to buy down the backlog. So that is an opportunity the Coast Guard has.

Ms. PLASKETT. OK. So not just using those that are damaged, but recognizing those that need hardening so that they will be able to withstand?

Mr. ANDERSON. Exactly. And that comes from having a firm and comprehensive understanding of where the vulnerabilities are. Our report that we issued today found that the Coast Guard has information on 16 percent of its infrastructure.

Ms. PLASKETT. What can we do to support them in being able to do that?

Mr. ANDERSON. Well, I think it is important to note that when making resource allocation decisions, not having 100 percent certainty of what vulnerabilities exist, more information is needed.

And my understanding of the shore infrastructure vulnerability assessment, which is the main process that the Coast Guard follows, it won't be complete until 2025. So from now until 2025, you are operating with 16 percent visibility as to what the vulnerabilities are.

Ms. PLASKETT. Admiral Moore, did you want to add anything to that?

Admiral MOORE. I thought first I could mention, in terms of the work on the islands there and the idea of the hurricane reconstitution funding, we have provided detailed expenditure plans to Congress for both those supplementals for 2018 and 2019, and those

details, you know, specifically by project what we are working on there throughout the whole effort. So that information is available to be provided so you understand exactly what work is being done.

As far as the resiliency, I completely agree. I think, first of all, we are making an effort to make sure that anything we build to monitor resiliency standards withstands future storms and we don't have to come back and spend that money twice.

We do very much appreciate the recommendation to include that resiliency analysis into our construction decisions, and we are going to take that forward for action.

Ms. PLASKETT. Thank you. You know, I look at Sector San Juan, which is responsible for all of the Coast Guard throughout my district, and they suffered an estimated $156 million in infrastructure damages due to Maria 2 years ago. And I am just thinking about the particular vulnerabilities that those of your sectors that are in what may be considered far-flung areas may face with respect to that.

And then, you know, how do you need support from us? I am concerned about supplementals and those which kind of segregate the Territories, which then puts you in a more vulnerable state, in terms of doing your infrastructure bills. But is there any other thing you would like to add?

Admiral MOORE. Thank you, ma'am, for the opportunity. There is one particular area that would be very helpful for us within the housing portfolio. We have talked about housing a little bit here today, but we have a backlog that is significant there, and it is included in that larger backlog. And many of our homes where we need maintenance, we don't have the funding within our budgetary constraints to get there either.

We do have a housing fund that, as we divest properties, we have been able to put money into that fund. We have got about $26 million in there currently. However, we can't access that fund without an appropriation. So, if we could have the authority to access our housing fund without a direct appropriation, that would give me the funding and really the flexibility to be able to attack our most critical housing issues.

Mr. MALONEY. Thank you.

Mr. Gallagher.

Mr. GALLAGHER. Thank you.

Rear Admiral Moore, the GAO found that the documented $2.6 billion Coast Guard shoreside maintenance backlog does not necessarily include piers and docks. And I understand that the Coast Guard Great Lakes icebreaker home ports are in desperate need of major repairs.

And I am told that the Coast Guard pier at Sault Ste. Marie, Michigan, which is a major logistics location, particularly during ice season—we have a lot of ice on the Great Lakes in winter if some of you who live in warmer climates haven't been there. You are always welcome to come from Texas. But those logistics locations are crumbling. They are unable to accommodate fuel trucks, and the Coast Guard pier in Detroit has a failing electrical shore tie to provide electrical power to cutters moored there. We just visited; my whole team went to the Coast Guard facility in Sturgeon Bay in my district, and they are in a building that is a century old.

They are doing great work, by the way, and they didn't complain about it, but that is a concern for me.

Is there a cost estimate for doing the work at Sault Ste. Marie or for Detroit that you know of?

Admiral MOORE. Yes, sir. Thank you for the question. There are cost estimates for those two projects, both Sault Ste. Marie and Detroit. I am aware of those two. That is part of our shore depot maintenance fund, so you won't see a specific line item for that, because those are repairs to existing facilities, not hurricane damaged but, you know, just repairs that need to be done.

So we do have cost estimates. Those are competing through our process for funding, and I am aware of exactly what you are talking about.

Mr. GALLAGHER. So I guess, just to clarify, my understanding, were any funds requested for Sault Ste. Marie in the fiscal year 2019 Coast Guard budget request? Would they be subsumed within that broader pot you mentioned?

Admiral MOORE. They are within that pot of AFC–43 depot-level maintenance, and we have prioritized those projects for funding in the future.

The other thing I could point out is on our Unfunded Priority List, the UPL also has an item for this depot maintenance facility money. So projects like what needs to be done at Sault Ste. Marie and in Detroit, those would both fall under that account. So there is actually opportunity there on the UPL as well.

Mr. GALLAGHER. So we will see them on the Unfunded Priority List, both Detroit and Sault Ste. Marie?

Admiral MOORE. What you will see is the line item that says AFC–43 depot-level maintenance. That includes all of our repair work at our own facilities, so it is a broader pot of money that we can use for those facilities. But what I am telling you is those two projects are prioritized within that pot.

Mr. GALLAGHER. Well, then what I would ask—and, obviously, this is something you can take back—if there are cost estimates, if we can work with you to sort of see those cost estimates and a timeline for dock repairs. I think we all want the same thing here, and so I would just love to work with the Coast Guard on that issue if you can take that back. Let the record show he is nodding.

Admiral MOORE. Yes, sir, I can do that.

Mr. GALLAGHER. And I know it is outside your responsibility, but let everyone at the Coast Guard know we are keenly interested in another icebreaker on the Great Lakes. I am hearing from my constituents in northeast Wisconsin that there was not enough icebreaking on the Great Lakes this past winter. Some ships weren't even able to head out on the first day that the locks opened because they were afraid of ice damage. And I think it is imperative we get another icebreaker of the *Mackinaw* size on the Great Lakes.

So take that for what it is worth. And, again, for my colleagues from warm climates, the cold builds character. So I would be happy to host you in my district.

Mr. WEBER. Yes, but the warm climate builds tourism.

Mr. BROWN [presiding]. Mr. Lowenthal.

Mr. LOWENTHAL. I don't want to deal with climate changes with just adding to tourism.

Admiral Moore, thank you for being here. I apologize for coming a little late. I was in another hearing. I want to ask you about the critical issue of how the Coast Guard manages its assets and how you mitigate some of the risks that are posed by sea-level rise and other aspects of climate change. What are the models?

I am primarily interested in the standards or what do you use or the anticipated levels of sea-level rise or flood risk and vulnerability do you use, does the Coast Guard use when designing new facilities. What do you see as the standard or when you are trying to assess critical infrastructure risks? Can you give us more about what level of—you know, how you predict the future, or what you are using as your model?

Admiral MOORE. Yes, sir, I will be happy to do that. Any of the new shore infrastructure that we are building, any of the hurricane supplemental work that we are doing to reconstitute those facilities, that is all done to modern resiliency standards.

So we employ modern building codes. We do things like relocate facilities upland so you are not—you know, you may have a lot of older facilities that are low-lying, even stilted in some areas. We are able to move those inland a little bit and upland. And so what we end up doing is building 2 feet above the FEMA 100-year flood plain that is a requirement now.

Mr. LOWENTHAL. Two feet above?

Admiral MOORE. Two feet above the 100-year flood plain level that FEMA has set.

So, again, the idea is as we spend this money, the precious money that we get for shore infrastructure, we don't want to have to spend it twice.

Mr. LOWENTHAL. Do you anticipate in your thinking the level of sea-level rise, what you see in terms of specifically in terms of how that will impact your infrastructure, and what sea-level rise you anticipate in the next 20 to 30 years?

Admiral MOORE. Sir, for me, you know, on the engineering side, civil engineering side, we are working to the modern standards. We basically follow the guidelines for what modern construction standards and resiliency metrics would mean. That is probably the best answer I can give you.

Mr. LOWENTHAL. All right. I want to also talk about, you know, the subcommittee has supported the Coast Guard's important mission in the Arctic. We have sought to increase resources dedicated to this region as we open it up to commercial and to recreational kinds of activities.

And so you must maintain a presence, it is required in the Arctic to execute your statutory mission. But so far, as I understand, you have done little to maintain the Arctic shore infrastructure that you have.

Can you speak to the Arctic shore infrastructure needs and what the Coast Guard is using to address climate impacts like thawing permafrost on the existing and future sites?

Admiral MOORE. Yes. In the Arctic, what we do every year is a typical exercise called Arctic Shield. That is seasonally based, pri-

marily around the summer, but it is a scalable, expeditionary style of operations.

So that gives us the opportunity to adjust to weather conditions or population moves or ship traffic or that sort of thing. That idea of having sort of a scalable mobile expeditionary style response helps us in the Arctic.

To answer your question about shore infrastructure, we are putting significant investment into Kodiak, sir. That is where we know we are going to be home porting major ships. That will be our hub for Coast Guard housing in the future, and we have housing listed on our Unfunded Priority List at Kodiak. We have shore facilities that we are using that acquisition infrastructure funding for to be ready for those new ships in Kodiak. That is where our focus is today.

Mr. LOWENTHAL. Thank you. And, finally, I want to express my concern about DHS's July section 503 notification that it is going to reprogram, I think it is $24.4 million from the Coast Guard, to fund additional ICE detention beds and transportation resources.

You know, members on this committee have fought to make important progress to grant the Coast Guard the resources it needs to capitalize first the first response cutter, the National Security Cutter programs after cuts were mandated by sequestration. I am disappointed that DHS has diverted these funds, and what is the impact of the diversion of these funds going to be?

Admiral MOORE. Sir, from my perspective, in the maintenance organization, none of that funding is coming out of my organization in maintenance. I would have to refer to DHS for questions about that.

Mr. LOWENTHAL. So you are not—Mr. Anderson, do you have any response to that?

Mr. ANDERSON. No, I don't. I would also have to say that is a better question for either a DHS witness or a Coast Guard witness.

Mr. LOWENTHAL. I mean, I don't know why we are giving money, and then it is being taken from one purpose and used for another outside of—you know, the Coast Guard has come and said that they really need these resources, and now they have been diverted to ICE for detention beds. And I am just telling you I am very disappointed.

Thank you, and I yield back.

Mr. BROWN. Thank you, Mr. Lowenthal.

My understanding is that there are no further questions by members of the subcommittee, so I would like to thank our first witnesses for your testimony. Your contribution to today's discussion has been very informative and helpful.

And since there are no further questions, I will now call up panel 2. I would like to welcome as they are coming forward our next panel of witnesses: Rear Admiral Ann C. Phillips, special assistant to the Governor for coastal adaptation and protection, Office of the Governor, for the Commonwealth of Virginia; Dr. Daniel Cox, CH2M-Hill professor of civil engineering at Oregon State University; and Mr. Sean Hecht, co-executive director for the Emmett Institute on Climate Change and the Environment at the University of California at Los Angeles School of Law.

I thank you for being here today, and I look forward to your testimony.

Without objection, our witnesses' full statements will be included in the record.

I also ask unanimous consent to include in the record a letter from the Commonwealth of Virginia's secretary of natural resources that Admiral Phillips references in her testimony.

Without objection, so ordered.

[The information is on pages 63–65.]

Mr. BROWN. As with the previous panel, since your written testimony has been made a part of the record, the subcommittee requests that you limit your oral testimony to 5 minutes.

Admiral Phillips, you may proceed.

TESTIMONY OF REAR ADMIRAL ANN C. PHILLIPS, U.S. NAVY (RET.), SPECIAL ASSISTANT TO THE GOVERNOR FOR COASTAL ADAPTATION AND PROTECTION, OFFICE OF THE GOVERNOR, COMMONWEALTH OF VIRGINIA; DANIEL COX, PH.D., CH2M-HILL PROFESSOR IN CIVIL ENGINEERING, OREGON STATE UNIVERSITY; AND SEAN B. HECHT, CO-EXECUTIVE DIRECTOR, EMMETT INSTITUTE ON CLIMATE CHANGE AND THE ENVIRONMENT, UNIVERSITY OF CALIFORNIA AT LOS ANGELES SCHOOL OF LAW

Admiral PHILLIPS. Thank you, Acting Chairman Brown and Ranking Member Gibbs and members of the subcommittee. It is an honor to have an opportunity to testify before you all today on this very important topic.

I am Ann Phillips. I am the special assistant to the Governor of Virginia for coastal adaptation and protection. I am a retired surface warfare officer who drove and commanded ships for the Navy for 31 years. I have served abroad in Guam and Lisbon and operated extensively with NATO in partnership with peace nations. I retired in 2014 as a rear admiral and commander of Expeditionary Strike Group 2 and since then have been involved in multiple efforts to highlight the impacts of climate change as a national security issue. Now I work for the State of Virginia where climate change has a significant impact on our coastal communities and Federal infrastructure today. There is an urgent need for coordinated Federal efforts to deal with the impacts.

This subcommittee can help by recognizing climate resilience and disaster preparedness as one of the country's greatest and most immediate needs and taking action to address that need now. In Virginia, we have experienced over 18 inches of relative sea-level rise in 100 years. We expect to see another 18 inches by midcentury. The duration, severity, and impacts of flooding have all increased substantially, and coastal storms are magnified as a result.

We are not simply preparing; we are already living with water. We have a water-based economy, all at risk. Our keystone is our Federal presence, arguably the largest concentration in the Nation, including our largest naval base, Naval Station Norfolk, as well as the only shipyard where we build aircraft carriers and one of only two places where we build nuclear-powered submarines. We also host the Coast Guard's Atlantic Area Command, Fifth District, and Force Readiness Command. We are home to the Port of Virginia,

the sixth largest container port by traffic volume in the country. We have a tremendous beach and water-related tourism industry along with aqua culture and fisheries industries. And, finally, our waterfront property and housing stock are a key source of property tax income for our localities.

To coordinate across Federal, State, and local partners, Virginia has focused on collaborative opportunities, including the Hampton Roads Intergovernmental Pilot Project, or IPP; joint land use studies conducted through the Department of Defense, Office of Economic Adjustment; and Army Corps of Engineers' feasibility studies under the 3x3x3 process authorized in the 2014 Water Resources Reform and Development Act.

The intergovernmental pilot project I speak of, which was conducted from 2014 to 2016, was initiated through the National Security Council and convened by Old Dominion University. It brought together over 200 Federal, State, and regional professionals to develop a whole-of-Government and community set of solutions and processes to prepare for sea-level rise and recurrent flooding in the Hampton Roads region.

This work is the subject of a recently completed dissertation by Dr. Hannah Teicher, who studied local and Federal alliances at both Hampton Roads and San Diego, California. Dr. Teicher found that the shared risks between installations and the communities that surround them bring great potential for joint adaptation planning and, in fact, drive a need for it. She also determined two key enabling mechanisms as critical to initiating and reinforcing alliances between Federal, State, and local partners: recognizing independence and constructing credibility.

As a direct outcome of this regional collaboration conducted by the IPP, intergovernmental pilot project, Hampton Roads embarked on a series of joint land use studies funded by the Office of Economic Adjustment. These included the cities of Newport News and Hampton, Norfolk, and Virginia Beach, and a third study just underway in Chesapeake and Portsmouth. These studies help us understand compatible use of infrastructure by Federal, in particular DoD, and local partners and how climate and recurring flooding impacts and outcomes affect their environmental resilience.

Virginia localities in the Commonwealth were also partnered with the Army Corps on two coastal storm risk management studies to further define the needs of communities dealing with rising waters and storm surge. Our local governments are in the need, and Virginia has laid groundwork to prepare elsewhere.

We struggle with our general assembly who has been reluctant to take funded action on climate change and sea-level rise. Under Governor Northam, however, we are taking bold and substantive action to address this threat. Governor Northam signed Executive Order 24, increasing Virginia's resilience to sea-level rise and natural hazards, in November of 2018. This directs the Commonwealth to determine the vulnerability of and set standards for State-owned infrastructure; develop a coastal protection master plan for the State of Virginia; and to coordinate, collaborate, and communicate across and with Federal and local governments to ensure aligned objectives.

Even with strong State action, we cannot do this alone. The actions of the subcommittee are vitally important to protecting people and property. And, again, I ask that you recognize climate resilience and disaster preparedness as one of the country's greatest and most immediate needs to protect American infrastructure and our economy.

We also ask that the subcommittee help States organize and prioritize flood control projects, including those underway with the Army Corps of Engineers; deliver timely Army Corps and Office of Economic Adjustment studies, and consider third-party analysis and study; and also include strong environmental review.

In Virginia, we are committed to building capacity for our coastal communities and to collaborating with our Federal and local partners, and we know we have no time to waste. Time and tide wait for no man.

Mr. BROWN. Admiral, can you close out your statement?

Admiral PHILLIPS. Thank you. Yes, sir. Thank you again for the opportunity to offer this testimony. I look forward to your questions.

[Admiral Phillips' prepared statement follows:]

Prepared Statement of Rear Admiral Ann C. Phillips, U.S. Navy (Ret.), Special Assistant to the Governor for Coastal Adaptation and Protection, Office of the Governor, Commonwealth of Virginia

Chairman Maloney, Ranking Member Gibbs, and distinguished Members of the Subcommittee, thank you for the opportunity to testify to you today. It is a privilege to be before you at this hearing to discuss this very important topic.

My name is Ann Phillips, and I currently have the honor to serve as the Special Assistant to the Governor of Virginia for Coastal Adaptation and Protection. I am a retired Surface Warfare Officer—I drove and commanded ships for the United States Navy for 31 years, served abroad in Guam and Lisbon, Portugal, and operated extensively with NATO and Partnership for Peace nations. I retired in 2014 as a Rear Admiral and Commander, Expeditionary Strike Group TWO. My experience in coastal adaptation and protection, along with climate and national security, stems from my work as Chair of the Surface Force Working Group for the Navy's Task Force Climate Change while still on active duty, and from my work since retiring, chairing the Infrastructure Working Group for the Hampton Roads Intergovernmental Sea Level Rise Pilot Planning Project from 2014 to 2016, and as a member of the Advisory Board of the Center for Climate and Security, and on the Board of Directors for the Council on Strategic Risks.

I've been asked to address the need for collaboration across and between Federal facilities and the maritime related businesses and communities that surround them, in the context of the current and long term risk to infrastructure, the economy, and social fabric of Virginia's coastal communities as viewed from my position as Special Assistant to the Governor. I would like to first set the stage in Coastal Virginia today, then describe what is at risk, and how Virginia's unique coastline intensifies that risk. I will then describe Virginia's efforts and intent to prepare, adapt and protect our Coast, and the actions that we as a Commonwealth and that our coastal communities are taking to align our actions with those of our Federal partners. Finally, I will touch on what Congress can do to help as we prepare for our collective climate-changed futures.

SETTING THE STAGE

Climate change has a significant and intensifying impact on our coastal communities in Virginia today. Rising sea levels lead to recurrent nuisance flooding, caused by high tides, accompanied by wind, and/or increased intensity and frequency of rainfall, or any combination of the three. These circumstances intensify the impact of coastal storms and hurricanes and the accompanying flooding and storm surges. *Coastal Virginia deals with water where we did not plan for it to be, and that im-*

pedes the expected pattern of life, in some form, nearly every day. This is our "new normal"—it affects every aspect of our lives in ways that we do not yet understand, or even realize. My current position works at the local, regional, state and national level to foster action across the whole of government, community and society to address and build resilience to this existential threat and to protect and adapt Coastal Virginia.

VIRGINIA'S UNIQUE RISK

We have a water-based economy in Coastal Virginia. The cornerstones of that economy are:

- *Our Federal presence, arguably the largest concentration in the nation*—in particular Department of Defense with Navy as the largest service represented, and including the substantial commercial industry surrounding military and commercial shipbuilding, maintenance and repair. We are also home to the Coast Guard's Atlantic Area Command, US Coast Guard Fifth District, (Both in Portsmouth) USCG Force Readiness Command (Norfolk), Coast Guard Sector Hampton Roads, Coast Guard Base Support Unit Portsmouth, and one of the Coast Guard's largest Training facilities, Coast Guard Training Facility Yorktown.
- *The Port of Virginia*—large and expanding capacity with multi-modal access reaching from the East Coast to west of the Mississippi River
- *Beach and Water-related Tourism*
- *Water-adjacent and dependent agriculture, aquaculture, fisheries, commercial property, and housing stock*

All of this is supported by critical public and private utility and transportation infrastructure, as well as a substantial medical/hospital presence, and the universities, schools, and public infrastructure sustaining cities, counties and towns, along our coast.

Virginia's large military and Coast Guard concentration is bound to the water by the very nature of its mission, and at risk from the threat of sea level rise and climate change impacts. In their 2016 report, "The Military on the Front Lines of Rising Seas," the Union of Concerned Scientists found that a 3-foot increase in sea level rise would threaten 128 coastal DOD installations [including US Coast Guard Facilities] in the United States, 43% of which are Navy facilities valued at roughly $100 billion.[1] In its own 2019 "Report on Effects of a Changing Climate to the Department of Defense," the Department found that 53 of its mission-critical facilities are currently vulnerable to recurrent flooding, with 60 such facilities vulnerable within the next 20 years. When other hazards from climate change are considered (wildfire, drought, desertification), 79 total DOD facilities are vulnerable at present. *In Virginia, five Hampton Roads area facilities are on the US Navy and US Air Force list of most vulnerable infrastructure released in June 2019, including Naval Air Station Norfolk, Naval Air Station Oceana, Naval Support Activity Hampton Roads, Naval Support Activity Hampton Roads-Northwest Annex, and Joint Base Langley-Eustis*.[2] US Coast Guard facilities are also vulnerable, and the Coast Guard Authorization Act of 2019 addresses this, at least in part, by including direction similar to that to DOD included in the 2018 NDAA. Specifically, that the Coast Guard identify its top 10 most vulnerable facilities, and address adaptation and mitigation needs and costs related to impact on its missions and facilities.[3] A 2008 study by the Organization for Co-operation and Economic Development, ranked the Hampton Roads metropolitan area as the 10th most vulnerable in the world related to the value of assets at risk from sea level rise.[4]

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[1] "The US Military on the Front Lines of Rising Seas," Executive Summary (Union of Concerned Scientists, 2016), https://www.ucsusa.org/sites/default/files/attach/2016/07/front-lines-of-rising-seas-key-executive-summary.pdf.

[2] United States Department of Defense, "Report on Effects of a Changing Climate to the Department of Defense," January 2019, https://media.defense.gov/2019/Jan/29/2002084200/-1/-1/1/CLIMATE-CHANGE-REPORT-2019.PDF.

[3] Rep. DeFazio, Peter A., "Coast Guard Authorization Act of 2019," Pub. L. No. H.R. 3049, § 407 (2019), https://www.congress.gov/bill/116th-congress/house-bill/3409/text.

[4] RJ Nicholls et al., "Ranking Port Cities with High Exposure to Climate Extremes—Exposure Estimates," Environment Working Papers (Organization for Economic Co-operation and Development. 2008.), http://www.oecd.org/officialdocuments/publicdisplaydocumentpdf/?cote=ENV/WKP(2007)1&doclanguage=en.

The Department of Defense and our federal partners are the largest employers in the state [5] and Virginia's percentage of gross domestic product derived from the federal presence in the state is 8.9% (the highest percentage of any state).[6] Virginia also has the highest rate of defense personnel spending of any state, and is second only to California in defense contract spending and defense-related contract spending. The Hampton Roads region hosts federal facilities that are unique and not easily replicable in other locations, including our largest Naval Base, Naval Station Norfolk, as well as the only shipyard where we build aircraft carriers and one of only two places where we build nuclear-powered submarines—Newport News Shipbuilding, owned by Huntington Ingalls Industries. The City of Portsmouth is home to Norfolk Naval Shipyard, one of only four Navy-owned and operated nuclear repair shipyards in the United States, and very vulnerable to flooding. Portsmouth also hosts US Coast Guard Atlantic Area Command, US Coast Guard Fifth District, Coast Guard Sector Hampton Roads, and Coast Guard Base Support Unit Portsmouth, all in flood-vulnerable areas.[7] Joint Base Langley-Eustis, with Fort Eustis in the City of Newport News and Langley Air Force Base in the City of Hampton are also vulnerable. Langley AFB, which deals with rising water as a matter of routine, and has done considerable work to make its facilities resilient, has taken up much of the overflow from the impact to aviation training for the F–22 Strike Fighter from Tyndall Air Force Base after Hurricane Michael's impact on that facility last year.[8]

The Eastern Shore of Virginia hosts NASA's Flight Facility at Wallops Island, which includes the Virginia Space and Mid Atlantic Regional Spaceport, NASA flight test facility, National Oceanographic and Atmospheric Administration and Federal Aviation Administration facilities, and the Navy's Surface Combat Systems Center Range. These facilities are unique. For example, the Navy Surface Combat Systems Center Range, the only such test range on the East Coast of the United States, supports the majority of new construction combat systems training for the Fleet.

We also are home to the Port of Virginia, the third largest container port on the East Coast and sixth busiest port by container traffic volume in the United States. A multi-modal port with facilities located in Hampton Roads in the cities of Norfolk, Portsmouth, and Newport News, and with barge service to the Port of Richmond and an Inland Port intermodal transfer facility in Front Royal, Virginia,[9] the Port of Virginia is the only East Coast port with federal authorization to dredge to a 55 foot channel depth, and generates a total of $60 billion in economic activity for the Commonwealth.[10] With a focus on sustainability, the Port of Virginia works to build resilience, aligned with the surrounding communities. Much like the regions' federal facilities, however, its future resilience is inextricably linked to that of the surrounding cities and other localities that support and provide its critical utilities, transportation, logistics, and supply chain infrastructure.

Coastal Virginia's substantial tourism industry generates direct travel-related expenditures exceeding $5.2 billion in our Coastal region [11]. Virginia boasts wide beaches, access to a myriad of water sports and recreational activities, as well as natural tidal marshlands, unique barrier island structures, and we are a critical stopover on the North Atlantic migratory bird flyway, all incredible facilities and natural amenities, and all at extreme risk.

Our substantial aquaculture and wild fishing industries generate over $1.4 billion in annual sales,[12] *including oysters, crabs, and the largest clam industry on the East*

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[5] "Virginia Statewide Community Profile" (Virginia Employment Commission, 2019). https://virginiawlmi.com/Portals/200/Local%20Area%20Profiles/5101000000.pdf

[6] "Defense Spending by State, FY 2017" (US Department of Defense, Office of Economic Adjustment, March 2019).

[7] "FEMA Flood Map Service Center / Search By Address," accessed September 16, 2019, https://msc.fema.gov/portal/search?AddressQuery=USCG%20Portsmouth%2C%20Virginia#searchresultsanchor.

[8] "Tyndall AFB Personnel, F–22s Temporarily Relocate to Hawaii and Alaska," U.S. Indo-Pacific Command, accessed July 17, 2019, ttps://www.pacom.mil/Media/News/News-Article-View/Article/1682655/tyndall-afb-personnel-f-22s-temporarily-relocate-to-hawaii-and-alaska-bases/.

[9] "NAFTA Region Container Traffic—2017 Port Rankings by TEU's" (American Association of Port Authorities, 2017).

[10] "About the Port of Virginia," accessed July 18, 2019, http://www.portofvirginia.com/about/.

[11] "The Economic Impact of Domestic Travel on Virginia Counties 2017: A Study Prepared for Virginia Tourism Authority" (U.S. Travel Association, August 2018), https://www.vatc.org/wp-content/uploads/2018/08/2017-Economic-Impact-of-Domestic-Travel-on-Virginia-and-Localities.pdf.

[12] "Fisheries Economics of the United States 2016" (U.S. Department of Commerce, NOAA National Marine Fisheries Service, 2018), https://www.fisheries.noaa.gov/content/fisheries-economics-united-states-2016.

Coast of the United States.[13] These industries are vulnerable to both sea level rise and ocean acidification and warming. The infrastructure necessary for their success ties them to low-lying areas near the water—vulnerable to flooding—and accessibility to workplaces and docks is becoming a challenge during the more frequent high tide flooding that impacts road access, as well as activities on the waterfront. Ocean acidification and warming will affect the ability of some species to survive and reproduce in Coastal Virginia waters—in particular shellfish, endangering the wild-caught and grown seafood industry treasured by the Chesapeake Bay region.[14] For Virginia, this may be only a matter of time as such impacts have already been observed in the Pacific Northwest region of the United States, costing that region over $110 million dollars and putting 3,200 jobs at risk.[15]

Finally, our waterfront property and housing stock is a challenge we share with many other coastal states. Within the next 30 years—the lifespan of a typical mortgage—as many as 311,000 coastal homes in the lower 48 states with a collective market value of about $117.5 billion in today's dollars will be at risk of chronic flooding (more than 26 times a year or about every other week). By the end of the century, 2.4 million homes and 107,000 commercial properties currently worth more than $1 trillion altogether could be at risk, with Virginia's coastal real estate significantly exposed. The expected Virginia homes at risk in 2045 currently contribute about $23 million in annual property tax revenue. The homes at risk by 2100 currently contribute roughly $342 million collectively in annual property tax revenue.[16] In an ongoing Comprehensive Sea Level Rise and Recurrent Flooding Study conducted by the City of Virginia Beach and Dewberry, the annualized losses today in that City alone result in residential damages of $26 million annually due to coastal flooding events. If no action is taken, with 1.5 feet of additional sea level rise, expected within 20–30 years, that number increases to $77 million annually, and with 3 feet of additional sea level rise, forecast within 60–70 years, to $329 million annually, a 12-fold + increase.[17]

COLLABORATIVE OPPORTUNITIES: THE HAMPTON ROADS SEA LEVEL RISE AND RESILIENCE INTERGOVERNMENTAL PILOT PROJECT

Virginia has a longstanding and vital relationship with our Federal partners, in particular the Department of Defense and Coast Guard, for reasons already stated. In 2014, the Hampton Roads region in particular had an opportunity to become part of a strategic partnership project effort to address and create practices by which Federal, State and Local partners could come together to identify and address climate impacts, and develop a codified process for achieving collaborative solutions. This project, initiated through the National Security Council, was the Hampton Roads Sea Level Rise and Resilience Intergovernmental Planning Pilot Project (Intergovernmental Pilot Project or IPP). Convened by Old Dominion University, the IPP was one of four federal and three Department of Defense climate preparedness and resilience planning pilots.[18] In correspondence as the then Acting Deputy Undersecretary of Defense for Installations and the Environment, Mr. John C. Conger designated the Navy as lead service supporting the Hampton Roads Pilot Project.[19] The intent of this pilot as stated by then Deputy Secretary Conger, was to leverage the Department of Defense's existing relationships and resources, develop additional partnerships and develop a process by which regional preparedness and planning

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[13] Thomas J. Murray and Karen Hudson, "Economic Activity Associated with Shellfish Aquaculture in Virginia 2012,", https://www.vims.edu/research/units/centerspartners/map/aquaculture/docs__aqua/MRR2013__4.pdf.

[14] "Virginia Is Highly Vulnerable to Ocean Acidification" (Natural Resources Defense Council adopted from Ekstrom et al., 2015, February 2015), https://www.nrdc.org/sites/default/files/state-vulnerability-VA.pdf.

[15] "New Study: Rapid Ocean Acidification Threatens Coastal Economies in 15 States," 2015. NRDC Press Release https://www.nrdc.org/media/2015/150223.

[16] "Underwater: Rising Seas, Chronic Floods, and the Implications for US Coastal Real Estate" (Union of Concerned Scientists, June 2018), https://www.ucsusa.org/global-warming/global-warming-impacts/sea-level-rise-chronic-floods-and-us-coastal-real-estate-implications.

[17] CJ Bodnar, "Comprehensive Sea Level Rise and Recurrent Flood Study" (Dewberry and City of Virginia Beach, May 2019), https://www.vbgov.com/government/departments/public-works/comp-sea-level-rise/Documents/slr-update-ccouncil-5-7-19.pdf.

[18] "June 27, 2016 IPP SC Consensus Resolution" (The Steering Committee of the Hampton Roads Sea Level Rise Preparedness and Resilience Intergovernmental Planning Pilot Project, June 27, 2016), https://www.floodingresiliency.org/wp-content/uploads/2016/11/IPP-Consensus-Resolution-All-Signatures.pdf.

[19] John Conger, "Memoradum for Assistant Secretaries of the Army, Navy and Air Force: DoD Climate Preparedness and Resilience Planning Pilots" (Office of the Under Secretary of Defense for Installations and Environment, October 29, 2014).

processes that supported both the Department of Defense mission and surrounding communities could be developed.[20]

The Intergovernmental Pilot Project (IPP) in Hampton Roads ran for two years from June 2014 to June 2016, and brought together more than 200 federal, state and regional professionals over the two-year period. Focused on collective holistic understanding of shared challenges and developing solutions to prepare for sea level rise and recurrent flooding impacts in the Hampton Roads Region, the IPP developed a series of final reports, and included five key priorities for action.[21]

- First: Set standards—including but not limited to sea level rise scenario planning, first finished floor elevation, and building code, and ensure that those standards are common across regions and localities with similar anticipated impacts from climate change and extreme weather to facilitate aligned planning and resilience efforts.
- Second: Ensure the support of a consortium of universities, to guarantee the best possible science and engineering technology is available to decision-makers.
- Third: Collect, analyze, process and share data. Shared data enables common regional understanding and analysis of outcomes, essential to the success of any collaborative planning effort.
- Fourth: Develop an understanding of what is critical and what is vulnerable from the context of shared infrastructure dependencies and interdependencies. Without a full and agreed-upon understanding of the nature of critical infrastructure affected by rising waters, it will be very difficult to develop a regional holistic plan.
- Fifth and finally, develop a plan and a set of strategies to achieve desired outcomes and then a process to fund the work necessary to achieve those outcomes. The financial instruments that we will use to pay for these challenges have not yet been developed, and federal support and collaborative alignment across communities is essential to address shared impacts.[22]

At the conclusion of the IPP, the steering committee and advisory and working group committee chairs signed a resolution recommending paths forward that the region might consider.[23] While the resolution was not ultimately adopted at a regional level, many of the recommendations have been taken up and implemented by cities, localities, and the Hampton Roads Planning District Commission, and many more are under consideration today. Those adopted include: setting standards, establishing a consortium of universities, and collecting and sharing data at a regional level. At the state level, Virginia is developing an analysis of critical and vulnerable infrastructure. Our challenge, like that of our Federal partners and fellow coastal and riverine states remains: how will we pay for this?[24]

The Intergovernmental Pilot Project was also one of two regional collaborative efforts analyzed in a recently completed doctoral dissertation by Dr. Hannah M. Teicher for her PhD in Architecture for the Massachusetts Institute of Technology, Department of Urban Studies and Planning, in June 2019.[25]

Her dissertation addresses the critical essential elements of this committee hearing, and can provide extensive value to Congress and the Federal Government as it works to address collaborative planning across and between Federal, State and local partners.

I have included Dr. Teicher's Dissertation "*Climate Allies: How Urban/Military Interdependence Enables Adaptation*," as an attachment to this testimony, available at the link cited below.

Dr. Teicher identifies key points and outcomes highlighting the value of such partnerships and alignments between communities and regional entities, and their Department of Defense and other Federal partners.[26]

In particular, she states "*the shared risks between installations and the communities that surround them bring great potential for joint adaptation planning and in*

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[20] John Conger.

[21] Emily E. Steinhilber et al., "Hampton Roads Sea Level Rise Preparedness and Resilience Intergovernmental Pilot Project. Phase 2 Report: Recommendations, Accomplishments and Lessons Learned" (Old Dominion University, October 2016), https://digitalcommons.odu.edu/hripp_reports/2/.

[22] Steinhilber et al.

[23] "June 27, 2016 IPP SC Consensus Resolution."

[24] Steinhilber et al., "Hampton Roads Sea Level Rise Preparedness and Resilience Intergovernmental Pilot Project. Phase 2 Report: Recommendations, Accomplishments and Lessons Learned."

[25] Hannah M Teicher, "Climate Allies: How Urban/Military Interdependence Enables Adaptation" (Doctoral Dissertation, Massachusetts Institute of Technology; Department of Urban Studies and Planning, 2019), https://dspace.mit.edu/handle/1721.1/122193.

[26] Hannah M Teicher.

fact drive a need for it". Her research found that, by using the circumstances and processes already in existence in these two unique communities of practice, "*Hampton Roads, Virginia and San Diego, California employed the most readily available joint planning mechanisms*" to elevate their broader adaptation agenda. In Hampton Roads, the IPP led to Joint Land Use Studies to further expand resilience planning, and in San Diego, the Integrated Natural Resource Management Plan (INRMP) process became the foundation for a Memorandum of Understanding between the Navy and the Port of San Diego to expand joint adaptation planning.[27]

Finally, Dr. Teicher points out two main enabling mechanisms in her dissertation: those of "*recognizing independence and constructing credibility*," as key to not only initiating such alliances, but to reinforcing and expanding them.[28]

- Teicher points out the "benefits of such collaboration -[include] *expanded regional cooperation across a range of jurisdictions and sectors, and enhanced technical capacity and increased access to federal funding*." [29]
- And the "*emerging risks* [to such collaboration, including] *prioritizing high-value assets over vulnerable populations, emphasizing adaptation at the expense of mitigation—addressing immediate impact rather than cumulative human causes—and prioritizing sensational risks, such as sea level rise rather than more pervasive risks, like heat stress*" or recurrent flooding.[30]

Certainly the IPP process in and of itself brought hundreds of stakeholders together, built lasting and ongoing relationships, and produced many workable recommendations for the region, accomplished by a variety of partnerships. The key deliverables—a whole of government mitigation and adaptation planning process, and a recommended integrated regional strategy to move forward, can both serve as a template for other regions.[31] Some of this work may be specific only to a unique circumstance or area, but when taken as a whole, it brings substantive change in the context of local, regional and federal collaboration. Finally, the IPP built on previous efforts accomplished by other leaders in the Hampton Roads region, and continues to leverage those outcomes to accelerate regional adaptation.[32]

Taking Advantage of Existing Federal Programs

As a direct outcome from the IPP, and as recommended by Commander Navy Region Mid-Atlantic, the Navy's Executive Agent for the IPP, the Department of Defense, Office of Economic Adjustment (OEA) undertook a series of Joint Land Use Studies (JLUS) within the Hampton Roads Region. The context of these studies, understanding compatible use of infrastructure by federal and local partners, focused on how infrastructure external to federal DOD facilities would be impacted by the encroachment of recurrent flooding, storm surge, sea level rise, and other coastal hazards, and how those impacts and outcomes would affect the environmental resilience of the federal facilities in the region. The first of the studies, completed in June 2018, built upon an existing JLUS with the City of Hampton in 2010, expanded to include compatible use aspects, and included the city of Newport News, James City and York Counties, and Joint Base Langley-Eustis, with a focus on the FT Eustis facility.[33]

JLUS Study objectives typically include four focus areas:

- Provide meaningful input by the public.
- Identify areas where land use conflict occurs.
- Identify strategies to reduce encroachment and promote land use compatibility including considerations for regional roadway congestion, sea level rise and recurrent flooding, waterway and access management, and safety and security for the installation.
- Create an implementation plan and narrative report with recommendations and strategies.

Key recommendations from the Newport News/Hampton JLUS study also support IPP outcomes. In particular, establishing a formal communications process and de-

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[27] Hannah M Teicher.
[28] Hannah M Teicher.
[29] Hannah M Teicher.
[30] Hannah M Teicher.
[31] Steinhilber et al., "Hampton Roads Sea Level Rise Preparedness and Resilience Intergovernmental Pilot Project. Phase 2 Report: Recommendations, Accomplishments and Lessons Learned."
[32] Commonwealth of Virginia, "EO 24; Increasing Virginia's Resilience to Sea Level Rise and Natural Hazards.," November 2,2018, https://www.governor.virginia.gov/executive-actions/.
[33] "Joint Base Langley Eustis (Fort Eustis) Joint Land Use Study" (City of Newport News, March 2018), https://docs.wixstatic.com/ugd/3a99a7__58423e7847ce4078af32aceafeb6489f.pdf.

veloping a series of memoranda of understanding to ensure standardized processes for future collaboration between the localities and the federal facilities on a host of topics, including GIS, land use compatibility, communication, sea level rise and recurrent flooding, traffic, waterway access, energy and natural resources.[34]

The IPP led directly to two additional new JLUS study efforts. The Norfolk/Virginia Beach JLUS, including Naval Station Norfolk, Joint Expeditionary Base Little Creek/Fort Story and Naval Air Station Oceana, and the Portsmouth/Chesapeake JLUS, including Norfolk Naval Shipyard in Portsmouth, outlying Fentress Field in Chesapeake, and the Portsmouth Naval Medical Center. The Norfolk/Virginia Beach Study has just been completed and just finished its final public comment—the Portsmouth/Chesapeake study has just started.[35] These studies are a great value to the region and to the Commonwealth of Virginia, as not only do we now have a better understanding of how shared infrastructure interdependencies will be negatively impacted by climate change effects over time, but we also have a prioritized process from which to work with our federal partners begin to adapt across the region in ways that provide mutual support.

Through the assistance of the Department of Defense Office of Economic Adjustment, we have the opportunity to apply for additional planning grants to allow us to take steps collaboratively with our federal partners to begin to plan for some of the IPP/JLUS recommended outcomes. This program provides critical planning funding to communities adjacent to DOD/Federal facilities that offers direct assistance to those facilities for resilience work, and should be fully funded and expanded.

The Commonwealth of Virginia also works closely with the US Army Corps of Engineers across a number of programs, most specifically the Feasibility Study 3x3x3 process and Continuing Authorities programs.[36] Both processes allow Army Corps districts to work with local governments to study the needs of communities dealing with rising waters and storm surge. Related to recommendations from the 2015 North Atlantic Coast Comprehensive Survey, completed by USACE North Atlantic Division, the City of Norfolk and USACE Norfolk District completed a 3x3x3 in February of 2019 and have proceeded to the preliminary engineering design phase.[37] The second recommended study area, Potomac River shoreline in Northern Virginia, has just started a Coastal Storm Risk Management Study (July 15, 2019) under the auspices of the Baltimore District, USACE, with the Metropolitan Washington Council of Governments as the non-federal sponsor, and the Commonwealth of Virginia as one of several cost share partners.[38] The 2018 Water Resources Development Act authorized a full coastal study for Coastal Virginia, to include flood risk management, ecosystem restoration and navigation, which gives the Commonwealth the flexibility to include more than one city or municipality in the study area, critical to a region such as Hampton Roads, where multiple cities, localities, and federal facilities exist in close proximity.[39]

The challenge, though, is that such studies do not include Federal property, as dictated by restrictions to funding appropriations sources, and so require additional coordination between USACE, DOD, State and local participants to align appropriated funding. As an example, the Norfolk CSRM study only includes the City of Norfolk, and did not include a similar level of effort or the impacts to or outcomes of storm surge and flooding for Naval Station Norfolk or Naval Support Activity Hampton Roads. While USACE can work for DoD, they must be funded with DOD appropriations for such work, which does not often happen because of a lack of coordination.

Further, the Naval Facilities and Engineering Command released an excellent Climate Change Planning Handbook: Installation Adaptation and Resilience planning guide in January 2017, but with little follow-up on how and when facilities

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[34] "Joint Base Langley Eustis (Fort Eustis) Joint Land Use Study."

[35] "Joint Land Use Studies/Hampton Roads Planning District Commission," accessed September 16, 2019, https://www.hrpdcva.gov/departments/joint-land-use-studies/.

[36] "The Corps Feasibility Study—Finding a Balanced Solution," Headquarters, accessed September 16, 2019, https://www.usace.army.mil/Media/News-Archive/Story-Article-View/Article/643197/the-corps-feasibility-study-finding-a-balanced-solution/.

[37] "North Atlantic Coast Comprehensive Study: Resilient Adaptation to Increasing Risk," Study (United States Army Corps of Engineers, 2015), https://www.nad.usace.army.mil/CompStudy/.

[38] "Northern Virginia Coastal Study," accessed September 16, 2019, https://www.nab.usace.army.mil/DC_Coastal_Study/.

[39] "Water Resources Development Act of 2018," Pub. L. No. H.R. 8, § 201 (9) (2018), https://www.congress.gov/bill/115th-congress/house-bill/8/text.

should use it. This document should be a key tool in federal facility resilience planning.[40]

Finally, language in the draft 2020 NDAA directs DOD to fund US Army Engineering Research and Development Center (ERDC) to undertake a national study of water related risks and vulnerabilities to military installation resilience, along with an assessment of ongoing or planned projects by the Corps of Engineers that may adapt such risks. This will help mitigate this challenge, but meanwhile, the gap in federal resilience planning alignment with the USACE 3x3x3 process continues, placing communities and military facilities at risk.

VIRGINIA IS TAKING ACTION

This is our challenge. In Virginia, we have over 10,000 miles of tidally-influenced shoreline.[41] Virginia has the eighth longest tidally-influenced coastline in the country, ranked just behind the state of Texas.[42] [43] We have experienced over 18 inches of sea level rise in 100 years, as indicated by NOAA Sewell's Point tide gauge at Pier Six, Naval Station Norfolk. With an average of 4.66 mm of sea level rise per year, Virginia has one of the highest rates of relative sea level rise change of any state on the East Coast of the United States, including the Gulf of Mexico.[44] We are also experiencing land subsidence—most evident in areas where there is heavy use of water from our aquifers. Land subsidence varies across Coastal Virginia, and can range from as much as 40% to as little as 0% of the observed relative sea level rise.[45] Since the late 1990s, the duration, severity, and impacts of flooding have all increased substantially.[46] Current scientific projections, as documented by the Virginia Institute of Marine Science Sea Level Report Card, show that our sea levels will continue to rise and the rate of rise will accelerate, such that we expect an additional 18 inches of relative sea level rise by mid-century.

Under Governor Ralph Northam, Virginia is taking bold and substantive action to identify and fill the gaps. He intends to build capacity for Virginia as we set standards and define how we as a coastal state will approach this existential threat. During the 2019 General Assembly Session, Governor Northam proposed legislation to begin to do just that, the Virginia Coastal Protection Fund Act, which would have modified and funded the Virginia Shoreline Resilience Fund, recast as the Virginia Shoreline Protection Fund, and provided a continuing source of income—estimated to be at least $50 million annually—generated by the sale of carbon dioxide emissions allowances received from Virginia joining the Regional Greenhouse Gas Initiative. Funds so generated would support implementing hazard-mitigation projects to both mitigate and prevent further flood damage. This legislation failed in Committee. And the General Assembly went further, preventing Virginia from participating in RGGI under any circumstance by blocking the use of agency funds for RGGI participation, even though it has already been approved by the Virginia State Air Pollution Control Board.[47]

Despite these efforts, Governor Northam remains committed to coastal resilience. His priorities are to identify critical infrastructure that is vulnerable to rising waters and recurrent flooding; to determine the best and most practical, innovative and cost effective solutions to adapt and protect that infrastructure; to use creative and less costly green or green-gray infrastructure approaches to protect more dis-

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[40] "Climate Change Planning Handbook Installation Adaptation and Resilience," Final Report (Naval Facilities Engineering Command Headquarters, January 2017), https://ww.fedcenter.gov/Documents/index.cfm?id=31041.

[41] MR Berman et al., "Virginia—Shoreline Inventory Report: Methods and Guidelines, SRAMSOE No. 450." (Comprehensive Coastal Inventory Program, Virginia Institute of Marine Science, 2016).

[42] NOAA Office for Coastal Management, "Shoreline Mileage of the United States," 1975.

[43] Berman et al., "Virginia—Shoreline Inventory Report: Methods and Guidelines, SRAMSOE No. 450."

[44] "Sea Level Trends—NOAA Tides & Currents. Sewell's Point VA Station," 2019, https://tidesandcurrents.noaa.gov/sltrends/sltrends_station.shtml?id=8638610.

[45] D. P. S. Bekaert et al., "Spaceborne Synthetic Aperture Radar Survey of Subsidence in Hampton Roads, Virginia (USA)," *Scientific Reports* 7, no. 1 (2017): 14752, https://doi.org/10.1038/s41598-017-15309-5.

[46] T Ezer and L Atkinson, "Sea Level Rise in Virginia—Causes, Effects and Response," *Virginia Journal of Science* 66, no. 3 (2015): 355–59.

[47] Lewis et al., "A BILL to Amend and Reenact § 10.1–603.25 of the Code of Virginia, Relating to the Virginia Coastal Protection Fund; Establishment of a Carbon Dioxide Cap and Trade Program; Authorization to Establish an Auction Allowance Program Consistent with the Regional Greenhouse Gas Initiative Memorandum of Understanding; Deposit and Distribution of Proceeds of Allowance Auctions; Virginia Coastal Protection Act.," Pub. L. No. SB1666 (2019), 10.1–603.25 (2019), https://lis.virginia.gov/cgi-bin/legp604.exe?191+ful+SB1666.

persed assets and communities; and to leverage federal, state and local funds to help make coastal Virginia more resilient to climate change.

To do this, *Governor Northam has established a series of executive actions, through Executive Order 24, Increasing Virginia's Resilience to Sea Level Rise and Natural Hazards*, signed on November 2, 2018. With this Order, Virginia is directed to determine the vulnerability of and set standards for future built infrastructure throughout the Commonwealth, to make Commonwealth holdings more resilient. We have established and will implement a series of sea level rise scenario planning curves, which we will use to ensure the resilience of state-owned infrastructure and as recommendations for local governments and regions to use in planning and preparations for the future. We have also established a series of recommendations for first finished floor elevation for future constructed state-owned buildings that may be located in floodplains.

Executive Order 24 also directs development of a Virginia Coastal Protection Master Plan to adapt and protect our coastal region. This plan will build on and align those actions, which our localities and regions have already taken to prepare themselves for their future, and will lay out a series of recommended actions and strategies for our state to develop and prioritize how it will adapt and protect our valuable and vulnerable coastline. In this context we view it as essential to work with our federal partners as we move forward to better prepare our state, regions, localities, and communities, to build trust, and demonstrate value. Finally, Executive Order 24 will serve to coordinate, collaborate, and communicate across state entities, across and with federal entities, and across our Coastal regions, communities, and localities to ensure coordinated objectives, and the best use of scarce funding dollars.

Virginia has identified four key areas of focus. First, the use of natural and nature-based features as a way to buy time—as the first line of defense—as we build our strategy and understanding of what infrastructure is critical and vulnerable, and what the best plans and processes will be over time to adapt that infrastructure. Second, we are focused on collaborative efforts at every level, working with and across localities to expand the capacity of their dollars, of state dollars, and where possible, of federal dollars. Third, we are committed to ensure environmental justice, as underserved communities often bear the most substantial brunt of flooding challenges, and yet have the least capacity to plan, apply for grant dollars, determine or meet federal and state match requirements, and to sort out solutions to fund and implement actions to keep their communities and their histories viable into the future. Finally, we will facilitate the adoption of resilience practices across state agencies and processes.

Executive Order 24 builds on actions already underway across Coastal Virginia. At the federal level, the Department of Defense, Office of Economic Adjustment has initiated a series of "compatible use" Joint Land Use Studies (JLUS) in Coastal Virginia. The Joint Base Langley-Eustis Study with the Cities of Hampton and Newport News was completed in 2018, and the Norfolk-Virginia Beach JLUS just entered its public comment period in June, and is nearly complete. The third JLUS study, including the cities of Chesapeake and Portsmouth, has just begun and should be complete in FY 2020. These studies help Coastal Communities understand the impacts of rising waters and flooding on infrastructure in and around their shared federal facilities, and give the communities and their federal partners a better understanding of how to prepare and prioritize project outcomes of benefit to both to ensure operational and community readiness.

As described earlier, the US Army Corps of Engineers North Atlantic Coast Comprehensive Survey (2015), a post-Hurricane Sandy report, recommended seven additional Coastal Storm Risk Management Studies, two specific in Virginia. The first, the Norfolk Coastal Storm Risk Management Study conducted by the USACE Norfolk District, received its signed Chief's Report in February 2019. The second, Northern Virginia/Potomac River Shoreline, executed by the USACE Baltimore District, officially started July 15th, 2019.

To give you a sense of the enormous costs of making our coast more resilient, the City of Norfolk USACE Coastal Storm Risk Management Study outlines $1.57B in proposed projects to reduce the impact of storm surge and risk on the city.[48] Though this is valuable work, critical to the city's future, it does little to address nearer term recurrent flooding across the city, and again, such studies do not, by law, in-

[48] "Final Integrated City of Norfolk Coastal Storm Risk Management Feasibility Study Report/Environmental Impact Statement," Feasibility Study (Norfolk, VA: US Army Corps of Engineers, Norfolk District, September 2018), https://usace.contentdm.oclc.org/digital/collection/p16021coll7/id/5490/.

clude Department of Defense infrastructure in considering impacts and design outcomes.

And the City of Virginia Beach is completing a series of studies, including a full watershed analysis, and a sea level rise and recurrent flooding study that has estimated $2.4B in anticipated costs to reduce flooding and surge impacts across the city. Virginia Beach has raised taxes and storm-water fees, and committed to $1.3B in spending over a 15-year period to begin to prepare for these impacts, and yet realizes that much of what it must do will require the cooperation of nearby cities to achieve the full set of desired resilience outcomes.

Many other cities are staring down costs on a similar scale, and rural localities with more dispersed populations and limited tax bases have a wholly different set of needs that must be addressed through more creative solutions.

WHAT CONGRESS CAN DO TO HELP

First, I would like to thank both the House and the Senate for the addition of climate-related amendments in the 2018, 2019, National Defense Authorization Act language and the 2020 NDAA mark-up language, and for the language contained in the 2019 Coast Guard Continuity Act. These efforts help coastal communities in Virginia with substantial federal presence improve coordination at the federal, state, and local level and improve resilience for our federal and defense facilities along with that of the surrounding communities, without which they would not be able to ensure our forces are prepared to deploy. I would also like to thank the House and the Senate for their work on the 2018 Disaster Recovery Reform Act and its many innovative solutions to focus on pre-disaster hazard mitigation, which will also give options and opportunities for coastal communities to better prepare themselves in advance of increased hazardous weather and storm activity. Further, in February, 2019, Virginia Secretary of Natural Resources, Matthew J. Strickler, submitted testimony for the record with specific recommendations as to how Transportation and Infrastructure Committee could assist Virginia and other states in mitigating and adapting to the impact of sea level rise and extreme weather events.[49] Several of his recommendations are particularly germane to this Subcommittee testimony, and include:

- *Helping States organize and prioritize flood control projects with USACE*,
- *Delivering timely USACE studies, and considering third party analysis and study, and*
- *Delivering strong environmental review*

I have included Secretary Strickler's letter of February 22, 2019 as an attachment for the record.[50]

As sea levels rise and extreme weather events, like the extreme rain and flash flooding event of July 8th 2019 here in Washington, DC, and the events leading up to and post Hurricane DORIAN, become more and more common, the United States is under stress. Since 1980 there have been have been 219 disasters costing over $1 billion each, for a cumulative cost of $1.57 trillion.[51]

Because of this, since 1980 the federal government has appropriated over $73 billion for disaster preparedness and recovery. In response to disasters, Congress has provided an additional $254.6 billion in supplemental and contingency funds, nearly three times more than had been provided in the annual budget.[52] This is a fiscal and budgeting problem as well as a resilience and disaster preparedness problem. We know every dollar spent on disaster mitigation saves $6, which should be full justification for Congress to take action to increase the amount of money spent on resilience and pre-disaster mitigation. The funding is needed, whether it is money for the Army Corps of Engineers to study and construct flood control projects, or for DOD and Coast Guard to study, understand, and prepare their facilities for current and future risk, or for FEMA to improve predictive floodplain mapping and help communities move out of floodplains, or money for USGS or NOAA to better monitor, analyze and understand flooding and storm surges. Increased spending

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[49] Matthew J Strickler, "Letter to Submit for the Record of the February 27, 2019 Transportation & Infrastructure Committee Hearing Titled 'Examining How Federal Infrastructure Policy Could Help Mitigate and Adapt to Climate Change.,'" February 22, 2019.

[50] Matthew J Strickler.

[51] Adam Smith, "2017 U.S. Billion-Dollar Weather and Climate Disasters: A Historic Year in Context." (NOAA Climate.gov, January 2018), https://www.climate.gov/news-features/blogs/beyond-data/2017-us-billion-dollar-weather-and-climate-disasters-historic-year.

[52] William Painter, "The Disaster Relief Fund: Overview and Issues" (Congressional Research Service, February 2019).

now will better protect people, property and the fiscal strength of the United States for tomorrow, and save precious dollars over time.

Further, this Committee and Subcommittee must recognize climate resilience and disaster preparedness as one of the country's greatest and most immediate needs. Without significant funding for and coordination across the federal agencies that provide resilience and pre-disaster mitigation, Congress will fail to meet its charge of protecting the communities of the United States. In addition, Congress should encourage greater alignment of these programs to eliminate redundancies and ensure the most expedient and effective use of funds to protect people and property and reduce repetitive disaster spending.

In addition to resilience, pre-disaster mitigation, and infrastructure and flood plain actions, the U.S. Army Corps of Engineers (USACE) has a $96 billion backlog of authorized but unconstructed projects, while annual appropriations for the USACE Construction account under Energy and Water Development appropriations bills have averaged $2 billion in recent years. Congress has also limited the number of new studies and construction projects initiated with annual discretionary appropriations, with a limit of five new construction starts using FY2019 appropriations.[53] Since only a few construction projects are typically started each fiscal year, numerous projects that have been authorized by previous Congresses remain unfunded and backlogged. This problem has worsened in recent decades as Congress has authorized construction of new projects at a rate that exceeds USACE's annual construction appropriations. This drives competition for funds among authorized activities during the budget development and appropriations process, and only a few projects make it into the President's budget each year. Non-federal entities involved in USACE projects are frustrated with the extreme effort it takes to fund the projects their localities need, and again, those processes do not include federal bases that are within or adjacent to community boundaries.

Finally, additional topic areas of need include:

- Substantive and timely, publically-available scientific data
- Expanded USACE Project Development, and alignment with DOD/USCG resilience needs
- Support for Department of Defense Office of Economic Adjustment
- Aligned and Expanded Federal Block Grant Programs
- State resilience incentivized with Federal Matching Funds

CONCLUSION

In summary, as viewed from the state and community level, there is an urgent need for a coordinated federal effort, and for codified Federal/community aligned planning processes to deal with the impacts of climate and rising waters on Coastal Communities. Rising waters and recurrent flooding know no political boundaries; they know no boundaries of wealth or race; they know no boundaries of society. Coastal communities and their Federal partners across Virginia and around the country are being impacted today.

This Committee can help by recognizing climate resilience and disaster preparedness as one of the country's greatest and most immediate needs.

Virginia is committed to building capacity for our coastal communities to prepare for and build resilience to this threat, and as one of many impacted coastal and riverine states, we need the support of a coordinated nationwide federal response to make this happen.

We have no time to waste because "*Time and Tide wait for no man*." (The words of Geoffrey Chaucer)

Thank you again for the opportunity to offer this testimony, and I look forward to your questions.

Mr. BROWN. Thank you.

Dr. Cox, you may proceed.

Mr. COX. Thank you, Chairman Brown, Ranking Member Gibbs, and members of the subcommittee, for the opportunity to testify today. My name is Dan Cox. I am a professor in civil engineering at Oregon State University with experience in climate engineering and community resilience. I am pleased to provide testimony on the

[53] "Army Corps of Engineers Annual and Supplemental Appropriations: Issues for Congress" (Congressional Research Service, October 2018), https://crsreports.congress.gov/product/pdf/R/R45326.

role that university-based research can play in providing the Coast Guard with tools to protect, rehabilitate, and mandate resilience and adaptive port infrastructure.

I will focus on science-based, risk-informed decision support tools to further promote resilient port infrastructure, including adaptive planning, and adaptation of advanced materials and natural and nature-based features.

Mr. BROWN. Can you turn on your microphone, please?

Mr. COX. Sorry about that. I won't go through the entire list again, if that is OK, but I would like to add one more point. I would also like to talk a little bit about the importance of the graduate education and maintaining a strong workforce for the Coast Guard, but, first, I will talk a little bit about the risk-informed decision support tools.

We have already talked today about the importance of the mission to be able to absorb and recover quickly after these extreme events. The modern risk-informed decision support tools that have been developed can be used to predict what the consequences of extreme coastal events would be and allows people to focus on optimized solutions, so trying to buy down the risk where it is the highest. It captures the uncertainties with the hazard as well as the response of how—you know, what is going to happen to the infrastructure once these storms come ashore.

So I will give you a couple of examples. NIST, the National Institute of Standards and Technology, has funded a risk-based center that is producing these open-source modeling tools that help with this mitigation strategy.DHS, for example, has funded a coastal resilience center and is also creating better tools for hazard prediction and looking at the related damage. Tools such as HAZUS–MH can be used to look at this type of risk. Also, the American Society of Civil Engineers are updating their standards for critical facilities to withstand floods, hurricanes, surge, and waves. These can all be used in some capacity to help make port facilities more resilient.

We have already heard testimony today about the U.S. Naval Station in Virginia that has been using these risk-based tools. I think the Coast Guard would also benefit from this type of study, trying to look at where the risk is the highest for their assets.

In concert with developing these strategies for the extreme events, the Coast Guard also has to consider the chronic conditions related to sea-level rise and how you are going to adapt to these changing conditions in sea level and storminess. For example, the U.S. ports, Navy ports on the Pacific coast have already looked at things that would affect operational days per year in some of their infrastructure and how far into the future do they have to plan in order to keep from exceeding these thresholds. So is it a 10-year problem, a 20-year problem, or a 50-year problem that helps them make better decisions on how to rehabilitate their infrastructure.

Another big issue with ports is a hostile environment for infrastructure. Corrosion is a big issue, and one of the big problems facing existing ports is maintenance, rehabilitation, and repair, and I think the use of some new technologies, higher strike concrete composites, these can help be used to extend the service life of a lot of our infrastructure.

There is also an issue with permitting. So you might have a great idea, but if you want to get it permitted, you have to think about these things, and natural and nature-based features are other ways in which we can think about how to adapt, make ports adaptive to future climate change.

Finally, the Coast Guard and other areas of Federal Government need a workforce that is trained in understanding these issues of port adaptation, resilience. Some of these training programs are already in place. Oregon State University, Texas A&M University, and the University of Rhode Island trains at the graduate level U.S. Coast Guard officers to be able to implement some of these solutions. These programs exist. Hope they stay in place, and even if they could be enhanced, I think that would be great for the U.S. Coast Guard.

So, in closing, I would just like to thank the subcommittee for all of the efforts, and I would be pleased to answer any questions.

[Mr. Cox's prepared statement follows:]

Prepared Statement of Daniel Cox, Ph.D., CH2M-Hill Professor in Civil Engineering, Oregon State University

Chairman DeFazio, Chairman Maloney, and Ranking Member Gibbs, thank you for the opportunity to testify today on the importance of port infrastructure resilience within the United States Coast Guard. I am pleased to provide testimony today on the role university-based research can play in providing the Coast Guard with tools to build and maintain resilient and adaptive port infrastructure to fulfill its mission.

I am a professor in the College of Engineering at Oregon State University and have been conducting research in coastal engineering for more than 30 years, including the impacts of extreme coastal storms and tsunami on critical infrastructure. Since 2014, I have served as an associate director of the Center for Risk-Based Community Resilience, headquartered at Colorado State University and supported through the National Institute for Standards and Technology. This center has supported me and other researchers to investigate coastal impacts on infrastructure, including critical facilities and lifelines such as electric power networks, water, communication, and transportation network that are essential for immediate response and recovery. Our work combines engineering, social science, economics and computer science to create metrics to assess community resilience and to develop open-source computation tools for risk-informed decision-making to enable better strategies for hazard mitigation. I am also a member of the Center Resilience Center, headquartered at the University of North Carolina, and funded through the Department of Homeland Security. Through the National Science Foundation's Natural Hazards Engineering Research Infrastructure program, I am supported as the principle investigator of the O.H. Hinsdale Wave Research Laboratory at Oregon State University, which serves as the Nation's shared-used experimental facility for coastal engineering research. I am a member of several committees of the American Society of Civil Engineers, including the chair of ASCE 7–22 Chapter 5 Flood Load subcommittee. Our subcommittee provides improvements to building codes to ensures the safe design of structures subjected to riverine flooding and to coastal surge and waves.

OVERVIEW

This testimony provides perspective on the importance of and opportunity for the Coast Guard to access and utilize science-based, risk-informed decision-support tools to further promote resilient port infrastructure, including adaptive planning for port infrastructure, advanced materials and health monitoring, natural and nature-based features (NNBF), as well as the importance of graduate educational programs for workforce development.

Risk-informed Decision-support Tools for Resilient Port Infrastructure

Resilience is the ability to absorb and recover quickly from a sudden stress. During extreme threats posed by coastal hurricanes and tsunami, it is essential that Coast Guard port facilities be able to absorb and recover quickly because these facilities are essential for emergency response, search and rescue, and for the early stages of recovery. Modern, risk-informed decision support tools have been developed that can be used to predict the consequences of extreme coastal events on port infrastructure and can be used to develop optimized solution strategies. Probabilistic tools, rather than scenario-based planning tools, can capture the uncertainties in both the hazard and system response, and can be used to identify highest-risk conditions for developing effective mitigation strategies.

These tools should be considered for resilient port infrastructure design, maintenance and operation. The US Naval Station at Norfolk VA, for example, has been studied extensively using risk-based approaches to determine which types of loading (wind, wave, and surge) were threats to the various assets; identify the most likely infrastructure failure modes; and generate the probability of damage based on the capacity and demand. These studies can also be conducted relevant to the Coast Guard or other critical port infrastructure to inform performance-based design of critical port infrastructure and improve risk communication and urgency for port infrastructure improvements. Additionally, work by the NIST-funded Center for Risk-Based Community Resilience is producing open-source modeling tools to enable better strategies for hazard mitigation. Further, the DHS-funded Coastal Resilience Center is creating better hazard prediction tools and related damage functions to predict infrastructure damage due to hurricane surge and waves, and can be used in conjunction with for decision-support tool such as HAZUS–MH. Work by the American Society of Civil Engineers is updating design standards for critical facilities to withstand floods, hurricane wave and surge, and tsunamis and can be used to make port facilities more resilient to these extreme events. These examples underscore the increasing access to and utility of decision-support tools and building design standards that are available to planners that can effectively promote enhanced resiliency of our critical federal and coastal infrastructure.

Adaptive Planning for Port Infrastructure

In concert with developing effective mitigation strategies for extreme events, the Coast Guard must consider port infrastructure under the chronic conditions related to sea level rise and changing storm in patterns. Nuisance flooding and other hazards associate with chronic coastal conditions can impact the Coast Guard's mission, impacting readiness and operation. The Coast Guard should consider adaptive planning to improve port infrastructure and account for future sea level uncertainties and associated short- and long-term vulnerabilities. For example, studies conducted on US Naval ports along the Pacific Coast, quantify the number of days per year when operational thresholds will be exceeded for critical infrastructure such as bridges and other lifeline networks due to combinations of future sea level rise, El Nino events, and changes in weather patterns. Investing in studies and analyses to make these future projections would allow port planners to compare elevation, relocation, and other adaptive mitigation strategies.

Advanced Materials and Health Monitoring for Port Infrastructure Rehabilitation

Changes in water levels will also affect, and in some cases accelerate, the deterioration of port infrastructure. This deterioration can be reduced by improving the corrosion resistance of steel in reinforced concrete, potentially improving the service life of the infrastructure, and allowing adaptive strategies to be enacted. Service life models can be used to better document what remaining life a facility may have and improve decision-making on infrastructure rehabilitation. Improved models relating exposure conditions from extreme surge and waves on long term performance can be used to provide better service life prediction, and advances in high performance concrete can be use improve new construction.

Natural and Nature-Based Features (NNBF) for Port Infrastructure

Natural and nature-based features can be used to protect port infrastructure and to provide ecological benefits to adjacent areas. Research has demonstrated that NNBF can reduce wave and surge conditions acting on exposed port infrastructure, and biocementation can be used to mitigate effects of erosion and scour under extreme storm conditions. Specifically, research relying on field observations after

major storms combined with laboratory testing and numerical modeling confirms the role that NNBF can play in reducing the hazards associated with coastal storms on the built environment. At Oregon State University, through support of the National Science Foundation and the Natural Hazards Engineering Research Infrastructure program, and in collaboration with 5 other universities, we recently conducted one of the first comprehensive studies of the role of NNBF for coastal protection against hurricane wave and surge. This new research allows engineers to quantify the benefits of NNBF in the design of coastal infrastructure and to use NNBF in conjunction with traditional structures. This not only lowers the overall cost of infrastructure projects: it can also improve the permitting process by providing co-benefits for marine habitat and recreation. The US Army Corp of Engineers was also a partner on this project and has accelerated research and practical application of NNBF to mitigate coastal hazards. Similarly, the Coast Guard should consider the role of natural and nature-based features in the rehabilitation of existing infrastructure and future projects, including ways in which NNBF can supplement and integrate with more traditional infrastructure for better meeting objectives for adaptation and resilient planning.

GRADUATE EDUCATIONAL PROGRAMS FOR WORKFORCE DEVELOPMENT

The Coast Guard and other areas of the federal government need a workforce trained in understanding issues of port infrastructure adaptation and resilience. Some of these training programs are already in place. At Oregon State University, for example, we are engaging with Coast Guard and Navy students at the graduate education level. We provide a rigorous academic program combined with hands-on research projects tailored to the missions of these agencies. We encourage the Coast Guard to continue and enhance their workforce training at the graduate level in the area of coastal engineering to build and maintain resilient and adaptive port infrastructure.

SUMMARY

In closing, I thank the Subcommittee for your efforts to consider the role of university-based research and education can play in providing the Coast Guard with tools to build and maintain resilient and adaptive port infrastructure to fulfill its mission. I would be pleased to answer any questions.

Mr. BROWN. Thank you, Dr. Cox.

Mr. Hecht, you may proceed.

Mr. HECHT. Thank you, Chairman Brown, Ranking Member Gibbs, and members of the subcommittee. I appreciate the opportunity to appear before you today, and I am pleased to discuss some of the challenges facing the Coast Guard, our ports, and other public agencies as they try to make sure our coastal infrastructure is resilient to emerging risks relating to coastal change.

For over 10 years, I have studied the way that coastal managers and the insurance industry address climate change-related risks. Managers of coastal properties and infrastructure have to make strategic choices about where and how to invest. Federal management investment decisions influence downstream infrastructure investments in the public and private sector. With that in mind, the challenges that are faced by global risk managers, like insurers, hold lessons for the Federal Government.

We built our infrastructure around an historical range of conditions, knowing there may be extreme conditions at times, but it is clear that the past is no longer a reliable indicator of the future, and the conditions that we view as extreme today will become more ordinary. Moreover, we don't know the magnitude or pace of the change precisely since that depends on complex physical systems and on how much we reduce greenhouse gas emissions.

Federal agencies have a responsibility to ensure resilience to coastal change in the management of Federal assets, and vulner-

ability assessment and adaptation planning are essential for agencies to understand and evaluate the risks under a range of future scenarios and to strategically invest in resilience.

I want to note that coastal adaptation planning is increasingly common at the State and local level. So, for example, California's Coastal Commission, which administers the Coastal Zone Management Act in California, has been very forward thinking. And the Port of Los Angeles in Representative Lowenthal's district recently developed a sea-level rise adaptation plan that evaluates physical assets exposure, sensitivity to change, and adaptive capacity. Their plan reviewed multiple scenarios to account for uncertainty from about 2 feet of sea-level rise all the way up to 6 feet of sea-level rise, which is within the range of predictions that we have.

The private sector is focusing on adaptation more and more, and I want to focus on that for a while. Corporations are taking steps to assess and address vulnerabilities in their assets, and significantly, the insurance sector, which holds the most financial risk across the world economy, is increasingly concerned with climate-related risks. The type and level of disruption and uncertainty climate change will cause makes it challenging to plan for the future and increases the likelihood of chaotic outcomes.

Climate change increases the uncertainty of risks, and this is a challenge for insurers. Insurers can't insure where they can't predict risks over time, so the major insurers are investing heavily in better understanding climate risk as they sound the alarm. For example, officials at Lloyd's of London and Munich Re noted after Hurricane Sandy the likely connections between climate change and future increases in storm damage, and we see a lot of investment by especially the largest global insurers in understanding climate better.

The most recent annual survey of emerging risks by the professionals whose job it is to evaluate financial risk for the private sector actuaries named climate change as both the top emerging risk and the top current risk last year. The most sobering assessments within the insurance sector focus on the uncertainty that climate change injects into insurers' business models and the strategic challenges that uncertainty creates for risk management.

Within U.S. insurance markets, flood insurance has long been a special case among weather-related risks, even independent of and long before we recognized climate change risk. Private insurers largely pulled out of the flood insurance market in the middle 20th century as a result of massive correlated losses from hurricanes that made many insurers view flood risk as uninsurable.

One might suspect that availability of private coastal flood insurance will only get worse under emerging conditions, but recent research instead provides reason for optimism. Private flood insurance availability is improving as insurers develop more and better information about coastal risk through research, modeling, and data analysis and as planners work to address those risks. Insurers have made clear that more robust information and analysis about emerging risks and evidence of community scale risk mitigation planning are crucial to their ability to manage risks. The value of anticipating the need for elevation of structures or maintaining a

wetland that protects structures from king tides or storm surges can be quantified and considered, and this is of value to insurers.

So what does this mean for the Coast Guard and for port infrastructure? Federal planers can draw lessons. First, more information and analysis to clarify risk is crucial. Risk is inevitable, but understanding risks enables us to plan for them.

Second, planning for resilience will reduce uncertainty and facilitate better investment and prioritization by Federal agencies. Just as insurance underwriters are willing to address even very difficult risks where loss prevention measures are in place, Federal agencies can decrease their vulnerability through sound planning.

And the most crucial action is to integrate resilience planning governance into Federal actions at every step to consider that climate changes are considered in planning and decisionmaking about how and where we build and rebuild. Planning informs asset investment by agencies like the Coast Guard and also can inform grant making under, for example, the Port Infrastructure Development Grant and port security grant programs. Investing early to reduce and protect assets in light of real science will pay off. Thank you for your consideration, and I look forward to your questions.

[Mr. Hecht's prepared statement follows:]

Prepared Statement of Sean B. Hecht, Co-Executive Director, Emmett Institute on Climate Change and the Environment, University of California at Los Angeles School of Law

Chairman Maloney, Ranking Member Gibbs, and Members of the Subcommittee:

Thank you for the opportunity to appear before you today. I am pleased to be here to discuss some of the challenges facing the Coast Guard, our ports, and other public agencies as they try to make sure our coastal infrastructure is resilient to emerging risks relating to coastal change. The views I express in this testimony are my own, and not the views of UCLA School of Law.

For over ten years, I have studied the ways private and public institutions address emerging climate-change related risks to infrastructure and communities. I have followed closely the ways local, state, and federal coastal managers address climate change in their planning. I have also analyzed climate change's interactions with the insurance sector, which holds much of the world's weather- and climate-related financial risk.

Managers of coastal properties and infrastructure, including federal agencies, have to make strategic choices about where and how to invest. Federal management and investment decisions also influence downstream infrastructure investments in the public and private sector. These decisions necessarily involve consideration of all relevant risks. With that in mind, the challenges faced by global risk managers like reinsurers hold lessons for the federal government.

Coastlines, by their nature, undergo constant changes as well as occasional serious disruptions. The stability of our coastal infrastructure has always required careful attention to the physical conditions and the risks these conditions pose. But the evidence is clear: sea-level rise and increased storm-related coastal risk present new challenges that our infrastructure isn't designed for. Scientists have measured sea-level rise over the past century at an average of 6–8 inches already, with evidence the rate of rise is accelerating. A combination of factors, including changes in storm dynamics and the impact of rising seas on king tides along with increased urbanization and infrastructure on our coastlines, will result in more rapid coastal change and more vulnerability than we've seen in the past.

This will affect communities throughout the U.S. The National Oceanic and Atmospheric Administration (NOAA) found in a 2018 report that "While the rate and overall amount of [relative sea-level] rise over this century (and beyond) is uncertain, as it is linked to future amounts of emissions and global temperature rise, it is nearly certain that high tide flooding will become increasingly chronic within

coastal communities over the next several decades simply under current rates of local [relative sea-level] rise." [1]

Future chronic high-tide flooding in previously safe communities illustrates a key point. We built our infrastructure around a historical range of conditions—knowing that there may be extreme conditions at times. But it's clear the past is no longer a reliable indicator of the future, and the conditions we view as extreme today may become more ordinary, or at least more frequent. Moreover, we do not know what the magnitude or pace of the change will be, since that depends on complex physical systems as well as on how much we reduce greenhouse gas emissions. It is increasingly challenging to plan effectively for the future in a literal climate of uncertainty.

Federal agencies have a responsibility to ensure resilience to coastal change in the management of federal assets. In light of the foreseeable direction and probable magnitude of change, planning and investment will reduce the economic and social costs of sea-level rise, storm surge, and other impacts, compared with reacting when the hazard materializes. Vulnerability assessments and adaptation planning help agencies to understand and evaluate the risks under a range of future scenarios, and then to strategically invest in resilience accordingly.

I want to note here that adaptation planning is increasingly common at the state and local level, in addition to federal efforts. California's Coastal Commission, which administers California's Coastal Zone Management Act program, has been particularly forward-thinking in planning for coastal resilience. Other agencies have also had to address coastal change in the context of asset management. For example, the Port of Los Angeles, in Rep. Lowenthal's district, recently developed a Sea Level Rise Adaptation Plan. That plan evaluates physical assets' exposure, sensitivity to change, and adaptive capacity, as well as potential economic, social, and environmental vulnerabilities. It projects serious consequences if the Port fails to adapt.

The private sector is also focusing on adaptation more and more. Corporations are taking steps to assess and address vulnerabilities in their assets. Significantly, insurance executives, underwriters, and actuaries, who drive decisionmaking by the companies that hold the most financial risk across the world economy, are increasingly concerned with climate-related risks.

The Department of Defense has called climate change a "threat multiplier" to national security, and for good reason. The type and level of disruption and uncertainty that climate change will cause makes it challenging to plan, and increases the likelihood of chaotic outcomes. Similarly, because climate change increases the uncertainty of risks, it is a threat to risk managers and their clients.[2] Insurers cannot insure where they can't predict risks over time. The major international insurers, which hold the most risk, are particularly concerned, and are investing heavily in better understanding climate risk—as they sound the alarm within their industry and more generally. Officials at both Lloyd's of London and Munich Re noted, after Hurricane Sandy, the likely connections between climate change and future increases in storm damage.[3] The projected rise in sea level will further increase the risk of storm surge.

The most recent annual survey of emerging risks by three major actuarial societies—the professionals whose job it is to evaluate financial risks for the private sector—named climate change as both the top emerging risk and the top current risk.[4] The most sobering assessments within the sector focus on the uncertainty that climate change has injected into insurers' business model, and the strategic challenges it creates for risk management. The International Association of Insurance Supervisors recently noted "the potential for physical climate risks may change in non-linear ways, such as a coincidence of previous un-correlated events, resulting in unexpectedly high claims burdens," and concluded that "[a]t the macro-economic level, uninsured losses from physical risks may affect resource availability and economic

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[1] William V. Sweet et al., Patterns and Projections of High Tide Flooding Along the U.S. Coastline Using a Common Impact Threshold (NOAA Technical Report NOS CO-OPS 086 2018) (citation omitted), *available at* https://tidesandcurrents.noaa.gov/publications/techrpt86_PaP_of_HTFlooding.pdf.

[2] See Sean B. Hecht, Climate Change and the Transformation of Risk: Insurance Matters, 55 UCLA L. Rev. 1559 (2008), for a more comprehensive discussion of the strategic risks climate change poses for the insurance sector. *Available at* https://www.uclalawreview.org/pdf/55-6-3.pdf.

[3] Munich Re, Natural catastrophe statistics for 2012 dominated by weather extremes in the USA (January 3, 2013), https://www.munichre.com/en/media-relations/publications/press-releases/2013/2013-01-03-press-release/index.html.

[4] Max J. Rudolph, 12th Annual Survey of Emerging Risks: Key Findings (Casualty Actuarial Society et al. 2019), *available at* https://www.soa.org/globalassets/assets/files/resources/research-report/2019/12th-emerging-risk-survey.pdf.

productivity across sectors, the profitability of firms and individual assets, pose supply chain disruptions, and ultimately impact insurance market demand."[5]

Within U.S. insurance markets, flood insurance has long been a special case among weather-related risks, independent of climate change risk. Private insurers largely pulled out of the flood insurance market in the mid-20th century. This was the result of massive, correlated losses from hurricanes that made insurers view flood risk as uninsurable. Most insurable risks are spread over a large area, and occur more or less randomly across a large number of insureds. Think about auto insurance: not every drive will have an accident the same day. Instead, they are well-dispersed, enabling insurers to price the risks and to maintain sufficient capital to pay claims. Storm-related losses, and flood-related losses generally, are different. Insurers can't spread these risks effectively. The National Flood Insurance Program fills the gap in private flood insurance. Of course, that program has its own challenges that are out of the scope of this hearing.

One might suspect that availability of private coastal flood insurance will only get worse under emerging conditions. But recent research instead provides reason for optimism. Private flood insurance availability is improving as insurers develop more and better information about coastal risks through research, modeling, and data analysis, and as planners and infrastructure managers work actively to address those risks.[6] Insurers have made clear that more robust information and analysis about emerging risks, and evidence of community-scale risk mitigation planning, are crucial. The value of anticipating the need for elevation of structures across an entire area, or maintaining a wetland that protects structures from king tides or storm surges[7], can be quantified and considered. And over time, insurers' decisions may also signal practices that make assets so vulnerable that new investment should be avoided.

What does this mean for the Coast Guard, and for Port infrastructure?

Federal planners can draw lessons from the insurance sector. First, more information and analysis to clarify and assess site-specific and programmatic risks is crucial. Risk is inevitable. But where agencies understand risks, they can plan for them. Developing and using tools to assess the vulnerability of their infrastructure and personnel can help federal agencies to reduce risk, and to anticipate practices for adapting even to catastrophic events by managing risk more effectively. And agencies don't need to reinvent the wheel. Other agencies, academic researchers, and insurers have developed tools that can assist with modeling of physical conditions, assessment of economic and social vulnerability, and analysis of other parameters.

Second, planning for resilience will reduce uncertainty and facilitate better investment and prioritization by federal agencies. Just as insurance underwriters are willing to address even very difficult risks where loss prevention measures are in place, federal agencies can decrease vulnerability through sound planning. New infrastructure should avoid the most vulnerable areas, and agencies should evaluate the adaptability of what they've already built. A range of strategies will be necessary, including retrofitting existing structures, rebuilding smarter after disasters, using natural infrastructure to mitigate risks, and avoiding building in the most vulnerable places.

The most crucial action is to integrate resilience planning and governance into federal actions at every step, to ensure that climate change's impacts are considered in decisionmaking about how and where we build and rebuild, and that agencies understand the reasonable range of possible futures. This process will enable agencies to plan effectively for a range of scenarios. This type of planning can inform asset investment by agencies like the Coast Guard, and also may inform other programs, like grantmaking under the Port Infrastructure Development Grant and Port Security Grant programs. Investing early to reduce risk and protect assets will pay off.

Thank you for your consideration and I look forward to your questions.

Mr. BROWN. Thank you, Mr. Hecht.

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[5] International Association of Insurance Supervisors, Issues Paper on Climate Change Risks to the Insurance Sector (July 2018), *available at* https://www.insurancejournal.com/research/research/success/climate-change-risks-to-the-insurance-sector/.

[6] Carolyn Kousky et al., The Emerging Private Residential Flood Insurance Market in the United States (Wharton 2018), *available at* https://riskcenter.wharton.upenn.edu/wp-content/uploads/2018/07/Emerging-Flood-Insurance-Market-Report.pdf.

[7] Lloyd's of London, Coastal Wetlands Save Hundreds of Millions of Dollars in Flood Damages During US Hurricanes (October 25, 2016), https://www.lloyds.com/news-and-risk-insight/press-releases/2016/10/coastal-wetlands-save-hundreds-of-millions-of-dollars-in-flood-damages-during-us-hurricanes.

We will now move on to Member questions. Each Member will be recognized for 5 minutes, and I will start by recognizing myself.

Admiral Phillips, you mentioned the intergovernmental pilot project down at Hampton Roads. What were some of the resources that were crucial to that project that any coastal city with Federal facilities would need to conduct their own integrated adaptation plan.

Admiral PHILLIPS. Yes, sir. Thank you for your question.

The intergovernmental pilot project was one of four Federal and three Department of Defense pilot projects. It did not come with Federal resources or really any resources. It was a total voluntary effort. It was approved through the Office of the Secretary of Defense, and Navy was designated as lead service, so it was totally voluntary throughout.

What it did have, though, that facilitated action was Old Dominion University serving as a convener to provide a neutral entity upon which to base actions and activities. It had at its start a completed charter and suggestions for working groups. There were six working groups and four advisory committees that were already formed plus a steering committee and recommendations for who should serve on those committees and working groups and how the process should move forward. So it started with a charter in place. It was authorized by the Department of Defense, and the lead service was designated who was authorized to participate. And I would also add that we had considerable participation from the Coast Guard, Department of Homeland Security, Department of Energy, Department of Transportation, all facilitated through a letter Senator Kaine wrote requesting that the National Security Council include all of the agencies in this pilot project effort specifically in the State of Virginia.

So, with that kind of written support, we had a foundation upon which to move forward. Then it was a matter of getting the cities and localities involved and engaged, and what kept them there was Federal, State, and local participation, which many of them said they had not seen before. Thank you.

Mr. BROWN. Thank you.

Dr. Cox, in your testimony, you discuss the potential applications of risk-informed decision support tools, and what do you see are potential barriers to utilizing a tool like that?

Mr. COX. I think for the ports in particular, a lot of these——

Mr. BROWN. And is your mic on? I haven't been asking people.

Mr. COX. I think so.

But I think the Coast Guard in particular, the barriers, I think, one, is having the training, people that can operate these tools that are just not off the shelf, you know. You need somebody who really knows what they are doing and can interpret the results.

I think a second thing is a lot of the consequence, like how much damage could occur, it could be specific to the type of asset that the Coast Guard has. And if those relations aren't developed yet, then somebody has to, either through expert opinion or computer modeling or experiments, come up with what those damage functions would be.

So, depending on what they are trying to look at, if it is a building, that is kind of—you could say that is done already. But if it

is a particular port asset, there might have to be some work behind the scenes to get the right damage function.

Mr. BROWN. Thank you.

I will now recognize each Member for an additional 5 minutes of questions, and we will begin with Mrs. Miller.

Mrs. MILLER. Thank you, Chairman Brown and Ranking Member Gibbs. I appreciate that.

And thank you all for being here today.

Rear Admiral Phillips, how can Congress better collaborate with our State and local leaders when it comes to disaster preparedness?

Admiral PHILLIPS. Thank you for your question, ma'am.

The challenge for State and local leaders is that there are a number of Federal programs that work disaster preparedness predisaster, FEMA, HUD, NOAA, NFWF, just to name a few. They are not coordinated amongst themselves, and this is a part of our challenge.

There are also programs being developed within the Department of Defense, the Defense Community Infrastructure Program, which was created under the 2019 National Defense Authorization Act but not funded, not appropriated, and also Defense Access Roads Program, which comes out of MILCON dollars, which are always scarce across the services, are also options and opportunities for localities and the State perhaps to collaborate with Federal entities.

But the real challenge and the real need is for a coordinated effort across Federal agencies that focuses on this issue, that aligns grants and funding, and that is understandable and accessible by not only States but also localities.

Mrs. MILLER. Thank you. I have found that same issue in West Virginia in dealing with things.

Dr. Cox, what are the key factors that lead to Coast Guard infrastructure resiliency so that the Service can quickly recover from extreme weather events and transition to emergency response and search/rescue operations?

Mr. COX. Could you please repeat just the first part of the question?

Mrs. MILLER. What are the key factors that lead to Coast Guard infrastructure resiliency?

Mr. COX. Yeah. I think one of the keys is implementing the findings of these studies. So, if they are looking at here is where the greatest risk is, they know what the greatest risk is, OK, well, there needs to be a way to implement those findings.

Mrs. MILLER. OK. Thank you.

Mr. Hecht, what can commercial and residential areas do to protect themselves and mitigate damage from flooding such as the devastation that struck West Virginia earlier this year?

Mr. HECHT. Thank you for the question.

The best thing that local governments can do in communities is to do the proper kind of planning. And often what we see is that scenario planning, looking at various different possible futures because of the uncertainty, is essential to being able to plan properly.

So we might look at one scenario which has a relatively small amount of coastal change and another area with a different set of assumptions. And vulnerability assessment is the practice of doing that and also looking at the social vulnerability, not just the phys-

ical vulnerability, but the social and economic vulnerability that go along with that.

So we see many examples of local governments that are doing that kind of adaptation planning. One of the biggest challenges that they face in that planning is funding to do the planning and then, of course, the implementation, which sometimes creates not only funding challenges but also challenges of political will because governments have to make hard choices sometimes that affect residents in challenging ways.

Mrs. MILLER. Thank you very much.

I yield back my time. Thank you.

Mr. BROWN. Thank you.

Mr. Lowenthal.

Mr. LOWENTHAL. Thank you, Mr. Chair.

My first question is for Mr. Cox. In your testimony, you discussed—and this is both the written, especially—you discussed how natural and nature-based features can be used to protect port infrastructure. Can you elaborate on how expanded uses of natural and nature-based features are beneficial to private industry, and how can they be used on the large scale, such as at some of our Nation's busiest ports, which I represent?

Mr. COX. Yeah. Thank you for the question.

So the role of natural, nature-based features, one thing is it could be used to mitigate the intensity of the storm. So it can reduce surge, wave action, the stuff that is going to impact the structure. The other thing it can help to do is to change patterns of sedimentation. So one of the big issues with ports is keeping them open——

Mr. LOWENTHAL. Open.

Mr. COX [continuing]. For shipping. And so, if you are using a natural system to trap the sediments, basically you can improve the navigability of the ports.

Mr. LOWENTHAL. What kinds of natural——

Mr. COX. In Florida, for example, mangroves. So after Hurricane Irma, Maria, they saw that areas with mangroves suffered a lot less damage. With climate change there is a potential there is going to be more mangroves along the Texas coast and further north. That is just one example.

One of the other ones is called biocementation, so this is a process where you are accelerating the rate at which sediments can adhere to each other.

Mr. LOWENTHAL. Yes.

Mr. COX. Basically, you could eventually turn it into sandstone, if you wanted to. But trying to come up with an engineering way to apply that after a big storm, you know, instead of using sandbags or geotubes or something like that.

Mr. LOWENTHAL. Thank you.

Mr. Hecht, in your testimony, you talked about my part of the country when you were talking about the Port of Los Angeles, which is just adjacent to my district. I am the Port of Long Beach, but they are really one combined port. And its sea-level rise adaptation plan might be an example for the rest of the country. Can you elaborate on how the port actually designed and implemented

this plan, and what can we learn from adaptation projects on this magnitude?

Mr. HECHT. Yes. Thank you for the question, Representative Lowenthal. And I apologize for mischaracterizing the boundaries of your district.

Mr. LOWENTHAL. I will take the port of—I represented the Port of L.A. and Long Beach, as well, while I was in the State legislature, so I accept some ownership.

Mr. HECHT. So the port's planning process was detailed in a paper that they published recently just in the last few months. I haven't dug into the details of the adaptation plan, and my understanding is that it came out recently enough that there hasn't yet been implementation.

Mr. LOWENTHAL. OK.

Mr. HECHT. But what seems innovative about it to me and important is the fact that they are doing scenario planning, that they are looking at different possible futures, some futures with less sea-level rise, some with more, some with a certain amount of storm surge, and doing that and basing their determinations on that modeling.

The other really important feature of any sound adaptation planning, which appears to be in the port's plan, is that they are integrating plans for resilience in their planning process. It is not just a matter of let's build this thing here and let's remove that thing there. It is a matter of integrating this type of planning whenever they are making decisions about their infrastructure so that they understand what the vulnerabilities are of that infrastructure under different scenarios.

And so they explicitly have put into their planning and governance taking into account the latest projections of sea-level rise and related risks over time as they plan new infrastructure as they think about what they are doing going forward. So those seem to me to be the most important features, and they are the features of any really worthwhile adaptation planning process.

Mr. LOWENTHAL. I also kind of am looking at and want, Mr. Hecht, maybe a greater understanding of how potentially some of our interventions—the very intervention may cause some problems. I raise that in terms of as we invest in resilient shore infrastructure, I think it is important to keep in mind the environmental impacts of these very upgrades and what they might have. Not only should we be concerned about adapting to the impact of climate change, but we have to look at how we can mitigate the environmental impact of the new infrastructure itself. And so can you talk about how investing in resilient shoreside infrastructure can be an important way of reducing our overall environmental footprint?

Mr. HECHT. I would be happy to.

Mr. Chairman, I see my time is up, but may I respond?

Mr. BROWN. Well, since we are on short final, why don't you go ahead and answer the question, please?

Mr. HECHT. Thank you.

So that is a really important point. And so the California Coastal Commission is a good example of an agency that is really taking those——

Mr. LOWENTHAL. Yes.

Mr. HECHT [continuing]. Considerations into account. So, in their planning processes, they are looking very closely at shoreline armoring like seawalls and the spillover impacts that those might have and encouraging the use of other types of solutions, some of which include the types of natural infrastructure solutions that Dr. Cox was talking about.

In some cases, it is going to be difficult or impossible to do that, to protect particular kinds of assets that are fixed in place with very long, useful lives. But where possible, that is a key aspect of planning is to try to take that into account. It is not just about destroying nature and ecosystems; it is also about spillover impacts on other users of the coastline and beach loss and other impacts like that. So that question was very—it really does get at the heart of an important point.

Mr. LOWENTHAL. Thank you.

And I yield back. And I thank the chair for letting me have that extra minute.

Mr. BROWN. Thank you for that very important question and rounded out your 5 minutes brilliantly, yes.

Mr. Gibbs.

Mr. GIBBS. Thank you, Chairman.

Of the GAO's 10 recommendations for the Coast Guard management of shoreside infrastructure, which do you see, if any, of those recommendations apply to local ports and the maritime transportation system? Whoever wants to answer it.

Mr. HECHT. So I am not deeply familiar with all the recommendations in the GAO report. I looked at the report, but I don't have it in front of me now. I don't know if my copanelists can, but I am happy to talk about particular ideas.

Mr. GIBBS. That is fine. I will go on. I will move on.

I guess, Mr. Hecht, I guess you got my attention when you talked about out in California, the California Coastal Commission figures either the variation of a 2-foot to a 6-foot rise in sea level, which is, I think, a pretty good variation.

I guess my first thought is, what is the sea-level rise at the port of L.A., for example? I was out there a few years ago. I know it was all built in dredge material. I was fascinated by that port out there. But what are we seeing, if any, rise in the last 20, 30 years, or what is going on? Just give me an idea.

Mr. HECHT. So, over the last century, we have seen an average over the country of 6 to 8 inches. I think that the rise is slightly less in southern California so far. There is evidence from research that the rate of rise is accelerating.

And you are correct that that is a highly variable range. That is based on estimates not just from the Coastal Commission but also from NOAA, which is really the—you know, NOAA has done incredible work to really try to define the parameters of sea-level rise. And its most recent report—I believe it is the most recent report from 2018—provides a lot of insight into it. It is hugely challenging to have that type of a range, and, again, that is part of why——

Mr. GIBBS. That goes—well, you mentioned about the insurance actuaries.

Mr. HECHT. Yeah.

Mr. GIBBS. But how do you—we are building resilient infrastructure. How do you figure—you know, when you start looking at cost-benefit analysis and, you know, try to be reasonable, practical——

Mr. HECHT. Right. So you look at robustness over a range of scenarios. You can't look at just one scenario. You look at the range of scenarios, and you can't always plan for the worst case, but you can plan for infrastructure to be resilient over a range of the most probable outcomes.

And you can have different plans for different scenarios that are adaptable in 10 or 20 or 30 years when we see different levels of change. You create infrastructure that is adaptable enough that we can build that resilience in and change it if we need to. So creating something that might more easily be elevated, for example, if you are building something new rather than something that is so fixed in place that it is immovable would be an example of that.

Mr. GIBBS. Yeah, if you start new construction, it would be more cost effective probably.

Mr. HECHT. Yes.

Mr. GIBBS. OK. I don't know if this is a pertinent question to this panel. I think maybe. We will see. The Great Lakes. I don't know—you are from Oregon, and you are from California, and you are from Virginia, so maybe——

Mr. HECHT. I went to law school at the University of Michigan, so——

Mr. GIBBS. OK, well——

Mr. HECHT. I lived in Michigan for a while.

Mr. GIBBS. We are looking at, you know, resilience planning in the Great Lakes. You know, should the Great Lakes be just as concerned as our coastal—because we don't have hurricanes. We kind of do sometimes have nor'easters, but we don't have tropical storms. You know, what is the risk on the Great Lakes?

Mr. COX. I think the planning tools are there, and if they are used, they can basically——

Mr. GIBBS. Microphone, I think.

Mr. COX. Sorry. Maybe I will talk a little closer. I think the Great Lakes benefit as well from the resilience planning. So it is really just about the ability to absorb and recover quickly, and it is up to the Great Lakes to say this is how quickly we would need to recover, this is how much we can absorb. But I think the tools are there and useful for the Great Lakes as well.

Mr. GIBBS. Of course, with the freeze and the thawing of the ice, that might be a different consideration that you don't have in L.A., obviously. Because if you had that problem in L.A., then we have got a different issue, right?

Mr. HECHT. Yeah. We are not headed that way.

Mr. GIBBS. All right. I yield back. I think I am good. Thanks.

Mr. BROWN. Are there any further questions for members of the subcommittee?

Seeing none, I would like to thank each of the witnesses for your testimony today. Your contribution to today's discussion has been very informative and helpful.

I ask unanimous consent that the record of today's hearing remain open until such time as our witnesses have provided answers to any questions that may be submitted to them in writing and

unanimous consent that the record remain open for 15 days for any additional comments and information submitted by Members or witnesses to be included in the record of today's hearing.

Without objection, so ordered.

If no other Members have anything to add, this subcommittee stands adjourned.

[Whereupon, at 3:32 p.m., the subcommittee was adjourned.]

SUBMISSIONS FOR THE RECORD

Prepared Statement of Hon. Sam Graves, a Representative in Congress from the State of Missouri, and Ranking Member, Committee on Transportation and Infrastructure

As a farmer and a Member whose district is bounded by both the Missouri and Mississippi Rivers, I understand the power of water both as a necessity and as a sometimes destructive force. In the Midwest we must be prepared for river flooding, just like coastal areas must prepare for hurricanes and other large coastal storms. Therefore, I commend the Chair for holding this hearing on the importance of building Coast Guard and port facilities in a way that can withstand the ever-increasing forces of mother nature.

The Coast Guard has a $2.6 billion backlog of construction and maintenance projects. I share GAO's concern that this only represents a one-for-one replacement rather than a strategic assessment of the Coast Guard's long-term operating needs. The Coast Guard needs to undertake such an assessment.

I am particularly concerned that the Coast Guard does not understand the shoreside facility needs for its new operational assets. Recapitalizing Coast Guard aircraft and the fleet which operates more than 50 miles offshore has taken priority in Coast Guard budgets now for over 15 years. However, we must make sure that shoreside facilities keep pace with commissioning these new assets.

For example, a $100 million investment is needed to upgrade the hangars at Barbers Point in Hawaii to adequately protect the new C–130Js the Service is procuring. The service life of those aircraft will be reduced, and taxpayer dollars wasted, unless the appropriate hangar space is provided. Put simply, salty air and exposed planes don't mix. While I am glad the Coast Guard is getting the airplanes they need to do their jobs, I think we need to be smarter about how we protect these investments.

I look forward to hearing from the witnesses about how the Coast Guard can better plan for its future shoreside facility needs, and how U.S. ports can design more resilient facilities to withstand coastal storms and flooding.

Letter Referenced in Testimony of Rear Admiral Phillips, Dated February 22, 2019, from Matthew J. Strickler, Secretary of Natural Resources, Commonwealth of Virginia, Office of the Governor, Submitted for the Record by Hon. Anthony G. Brown

FEBRUARY 22, 2019.

Hon. PETER DEFAZIO,
Chairman,
House Transportation and Infrastructure Committee, Washington, DC.

Hon. SAM GRAVES,
Ranking Member,
House Transportation and Infrastructure Committee, Washington, DC.

DEAR CHAIRMAN DEFAZIO AND RANKING MEMBER GRAVES,

I am writing today to offer the Commonwealth of Virginia's perspective on ways the federal government can better assist Virginia and other states in mitigating and adapting to the impacts of sea level rise and extreme weather events. Please accept this testimony for the record of the February 27, 2019 Transportation and Infrastructure Committee hearing titled "Examining How Federal Infrastructure Policy Could Help Mitigate and Adapt to Climate Change."

Virginia has much at stake as Congress considers legislation to address our country's aging infrastructure. In addition to help repairing and modernizing roads,

bridges, and railways, the Commonwealth requires the assistance of the federal government to make coastal communities and critical assets more resilient to climate change and natural hazards.

Sea level rise and more frequent and intense weather events have combined with land subsidence to dramatically increase flooding and storm damage risk to coastal Virginia. We are not unique among coastal states in this regard, but with nearly 10,000 miles of tidal shoreline, the deepest and one of the busiest ports on the east coast, and numerous military installations including the largest naval base in the world, we are uniquely vulnerable.[1]

The recently published, Fourth National Climate Assessment report summary includes the following findings regarding infrastructure:

> Climate change and extreme weather events are expected to increasingly disrupt our Nation's energy and transportation systems, threatening more frequent and longer-lasting power outages, fuel shortages, and service disruptions, with cascading impacts on other critical sectors. The continued increase in the frequency and extent of high-tide flooding due to sea level rise threatens America's trillion-dollar coastal property market and public infrastructure, with cascading impacts to the larger economy … Expected increases in the severity and frequency of heavy precipitation events will affect inland infrastructure in every region, including access to roads, the viability of bridges, and the safety of pipelines. Flooding from heavy rainfall, storm surge, and rising high tides is expected to compound existing issues with aging infrastructure in the Northeast.[2]

In Virginia, these warnings are already ringing true. According to the National Oceanic and Atmospheric Administration's 2017 Sea Level Trends Map, all eight of the sea level monitoring stations in the Commonwealth show a relative sea level rise of one to two feet per century, among the highest rates of sea level rise on the east or west coasts.[3] The Hampton Roads Planning District Commission estimates the negative impacts on private property and public infrastructure from three feet of sea level rise in Southeastern Virginia, in the tens of billions of dollars.[4] As this trend continues, the costs and profound impacts of natural hazards associated with climate change will only increase the longer we wait to address them. Public health and safety, our environment and natural resources, and the economic wellbeing of the Commonwealth, including our ports, military installations, transportation infrastructure, tourism assets, farms, forests, and fisheries are all at risk.

We must act now to protect lives and property and reduce taxpayer exposure through fiscally responsible planning. It is important to understand that we must not only work to make our existing infrastructure more resilient to sea level rise and other natural hazards, but that we will need to build new infrastructure, both green and grey, for the express purpose of making our coastal communities more resilient.

Virginia is already doing its part. Last November, Governor Northam issued Executive Order (EO) 24: *Increasing Virginia's Resilience to Sea Level Rise and Natural Hazards*. This sweeping directive establishes a roadmap for making Virginia more resilient, including the creation of a Coastal Resilience Master Plan for the Commonwealth. A copy of E0-24 is attached for your reference.

Given the enormous scope of this problem and the significant cost required to better protect people and property from extreme weather and sea level rise, Virginia will require the assistance of the federal government to address this pressing issue and to implement our Master Plan. On behalf of the Commonwealth of Virginia, we respectfully urge the Committee and Congress to consider the following recommendations as you develop infrastructure legislation:

1. Provide robust funding to help states and localities address sea level rise and extreme weather events

As detailed in this letter, the cost of making the United States more resilient to extreme weather and sea level rise is enormous. Without consistent, dedicated funding, coordinated fully across federal agencies, states like Virginia will not be able to adequately protect their citizens and the built and natural infrastructure that underpins their economies. In particular, we urge Congress to make significant investments in pre-disaster mitigation and resilience funding, and U.S. Army Corps of Engineers (Corps) flood protection projects. To meet the challenge before us, we will need unprecedented investment from the federal government to better protect Amer-

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[1] https://www.vims.edu/bayinfo/faqs/shoreline__miles.php
[2] https://nca2018.globalchange.gov/
[3] https://tidesandcurrents.noaa.gov/sltrends/slrmap.html
[4] https://www.hrpdcva.gov/uploads/docs/HRPDC__ClimateChangeReport2012__Full__Reduced.pdf

ica's coasts. We urge the committee to prioritize flood control projects for those areas most at risk, and to also prioritize projects that are part of comprehensive regional or multi-state plans rather than free-standing projects that may be advanced by a particular locality or interest.

2. Encourage green infrastructure solutions where applicable

Science has shown us that natural defenses against flooding, storm surge, erosion, and other forces are often our most effective—and most cost effective—solutions for protecting vulnerable areas. By reducing storm water runoff and allowing floodplains to function, green infrastructure can help manage both localized and riverine floods. In areas impacted by localized flooding, green infrastructure practices absorb rainfall, preventing water from overwhelming pipe networks and pooling in streets or basements. In coastal areas, natural or nature-based buffers and living shorelines can reduce storm surge and absorb flood waters. In addition, green infrastructure provides an array of co-benefits including improved water quality and productive fish and wildlife habitat. To the maximum extent possible, the Corps should look first toward natural and nature based infrastructure solutions for coastal protection and flood risk reduction, reserving more costly gray infrastructure for situations where it is the only feasible option. In Virginia, we hope to anchor our Coastal Resilience Master Plan with a limited number of structural flood protection projects, while we fill in the gaps with an array of softer solutions including coastal barrier protection, land acquisition, property buyouts, buffers, living shorelines and more.

3. Help states organize and prioritize flood control proiects

For years, cities and towns have taken the lead on requesting Army Corps flood control studies and construction projects, which has led led to a long list of regional studies that either overlap or leave gaps in coverage along jurisdictional lines. To ensure that studies are providing the maximum benefit, the Corps should assist states in prioritizing and aggregating flood control projects. Furthermore, the Corps should prioritize new studies and new projects according to the greatest flood risk and the greatest economic needs, as well as giving priority to projects that are part of a regional comprehensive plan. In addition, the Corps should provide regional guidance for how to best address sea level rise and pre-disaster hazard mitigation.

4. Deliver timely Army Corps studies and consider third party analysis and study

In recent years, appropriations bills have limited the number of Corps flood control feasibility studies and project starts in any given year. We simply cannot afford the delay. Congress and the Corps must devise a way to expand capacity to complete such studies more quickly and begin detailed planning and project execution to reduce flooding and extreme weather risk.

In an effort to address the critical need for flood control and pre-disaster hazard mitigation, some cities or towns have engaged private engineering companies to undertake studies on how to best reduce flooding. For example, Virginia Beach has spent more than $4 million studying its vulnerabilities to flooding and sea level rise. Rather than begin a new feasibility study by the Corps, Congress should ensure that the Corps will accept and validate viable commercial and academic study work as the basis for, or in lieu of, a full feasibility study.

5. Ensure strong environmental review

While both the need and desire for coastal protection projects are urgent, we must resist the temptation to circumvent or weaken bedrock environmental laws. This goes for all infrastructure projects. Robust reviews under the National Environmental Policy Act will help ensure that projects with negative unintended consequences are not selected, and that the needs of impacted communities—particularly environmental justice communities—are taken into account. Similarly, thorough and effective consultation under the Endangered Species Act is necessary to protect vulnerable fish, wildlife, and plants that serve as proxies for the health of entire natural systems.

I understand and appreciate the challenging task that lies ahead of you in developing this infrastructure package, and I thank you for your consideration of these requests. Please do not hesitate to contact me if I can be of further assistance.

Sincerely,

Matthew J. Strickler.

Statement of the American Society of Civil Engineers, Submitted for the Record by Hon. Anthony G. Brown

The American Society of Civil Engineers (ASCE) appreciates the opportunity to submit our position on the importance of long-term, strategic investment in our nation's ports infrastructure. ASCE also thanks the U.S. House of Representatives Transportation and Infrastructure Subcommittee on Coast Guard and Maritime Transportation for holding a hearing on this critical issue.

OVERVIEW OF ASCE'S 2017 INFRASTRUCTURE REPORT CARD

Infrastructure is the foundation that connects the nation's businesses, communities, and people, serves as the backbone to the U.S. economy, and is vital to the nation's public health and welfare. Every four years, ASCE publishes the *Infrastructure Report Card*, which grades the nation's 16 major infrastructure categories using a simple A to F school report card format. The Report Card examines the current infrastructure needs and conditions, assigning grades and making recommendations to raise them.

ASCE's *2017 Infrastructure Report Card* rated the overall condition of the nation's infrastructure a cumulative grade of "D+" across sixteen categories, with an investment gap of $2 trillion. The Report Card gave our nation's ports infrastructure category a grade of "C+."

The economic consequences of our nation's infrastructure deficiencies also extend to families' disposable incomes, with each household in the U.S. losing $3,400 each year through 2025; if left unaddressed, the loss will grow to an average of $5,100 annually from 2026 to 2040. It is possible to close the infrastructure investment gap and avoid the economic consequences caused by this deficit, but it will require sustained and robust investment.

PORTS AND THE HARBOR MAINTENANCE TRUST FUND

Our nation's 926 ports support over 23.1 million jobs, provide $321.1 billion in tax revenue to federal state, and local governments, and are responsible for $4.6 trillion in economic activity, or roughly 26 percent of the nation's economy—making them essential to U.S. competitiveness. Our ports serve as the gateway through which 99 percent of America's overseas trade passes, and the top 10 U.S. ports accounted for 78 percent of U.S. foreign waterborne trade in 2015. However, the investment gap for inland waterways systems and ports is expected to be $1.5 billion by 2025.

According to ASCE's 2016 economic study, *Failure to Act: Closing the Infrastructure Investment Gap for America's Economic Future*, if America's current level of investment in its inland waterways and marine ports continues, the losses to the nation's economy will increase shipping costs, resulting in GDP losses of $95 billion in 2020 to over $255 billion by 2040. The cumulative loss in national GDP through 2040 will be over $4 trillion, resulting in over 738,000 fewer jobs in 2020 and growing to over 1.3 million job losses by 2040.

In a 2015 survey[1] of ports, a third indicated that congestion over the past ten years resulted in a 25 percent decrease in port productivity. Few of our nation's ports can accommodate the large ships that pass through the Panama Canal, so to remain competitive in the global market and to accommodate these larger vessels, ports have been investing in their facilities and plan to spend over $154 billion from 2016 to 2020 on expansion, modernization, and repair. Ports, however, are contending with larger container ships and do not always have adequate access to the user-fee funded Harbor Maintenance Trust Fund (HMTF), which would help these facilities prepare for larger vessels.

Enacted in the Water Resources Development Act of 1986, the Harbor Maintenance Tax (HMT) is a fee (0.125 percent of the value of cargo) collected from users of our nation's maritime transportation system that is then used by the U.S. Army Corps of Engineers (USACE) to dredge harbors. Despite the significant dredging needs at the majority of U.S. ports, the fund's revenues have frequently not been appropriated for its designated purposed, instead being used for federal deficit offsets. ASCE strongly supported the provision in the Water Resources Reform and Development Act (WRRDA) of 2014 that created a phased-in approach to reach full use of HMT revenues by FY2025 and that set incremental spending targets each year until full use.

The HMTF's balance currently sits at over $9 billion. Once fully funded, it will take five years of complete HMTF appropriations to dredge and restore channel

[1] American Association of Port Authorities, 2015 Port Surface Freight Infrastructure Survey, April 2015

depths and widths. ASCE urges the Subcommittee to continue implementing the WRRDA 2014 agreement by increasing expenditures accordingly and ensuring that HMT revenues are used only for its intended purpose, and we support the bipartisan Full Utilization of the Harbor Maintenance Trust Fund Act, H.R. 2440.

PORTS RESILIENCE

Ports are unique infrastructure systems in that they must efficiently move goods while also maintaining secure facilities. However, natural disasters not only create high cost damage to ports infrastructure, but they can result in the loss of long-term economic activity.

According to the National Oceanic and Atmospheric Administration (NOAA), natural disasters cost the country $91 billion in 2018—the fourth-highest total costs from natural disasters since NOAA started tracking this data in 1980. It also marked the eighth consecutive year with eight or more natural disasters that cost at least $1 billion each. According to the National Institute of Building Sciences, however, every dollar spent on pre-disaster mitigation and preparedness saves six dollars in rebuilding costs after a storm. Investment in disaster mitigation makes the recovery process shorter while saving taxpayer money.

ASCE believes that a critical component to raising our nation's infrastructure grade is careful preparation for the needs of the future. This includes the utilization of new approaches, materials, and technologies to ensure our infrastructure is both more resilient and sustainable—that is, the ability to quickly recover from significant weather and other hazard events while reducing impacts on local economies, quality of life, and the environment—as well as the need to support research and development into innovative materials and processes to modernize and extend the life of infrastructure, reduce life-cycle costs, expedite repairs or replacement, and promote cost savings.

The nation's economy relies on resilient ports infrastructure that can withstand future extreme weather events. As civil engineers, we think about building infrastructure that will last for 50 to 100 years or more. It shouldn't take a disaster to spur action. The opportunity to build strategically is upon us.

PORTS RECOMMENDATIONS FROM ASCE'S 2017 INFRASTRUCTURE REPORT CARD

- Increase overall investment into the freight program to ensure ports can effectively distribute and receive goods as ships continue to grow in size.
- Appropriate funds to the congressionally-authorized projects to ensure that projects crucial to freight movement are completed in a timely manner.
- Ensure that ports have a seat at the table as states create and execute freight plans.
- Adopt new technologies to reduce wait times at docks, boost efficiency, and increase security.
- Improve freight and landside connections to strengthen the entire freight system and reduce congestion that is costly to the economy when moving goods.

CONCLUSION

ASCE believes Congress must prioritize the investment needs—including building with a resilient eye to the future—of our ports infrastructure to protect our nation's economy and millions of jobs, and to ensure we remain internationally competitive. ASCE thanks the Subcommittee for holding this hearing and bringing attention to this critical matter. We look forward to working with you to find investment solutions to our nation's ports infrastructure.

APPENDIX

QUESTION FROM HON. SEAN PATRICK MALONEY FOR REAR ADMIRAL NATHAN A. MOORE, ASSISTANT COMMANDANT FOR ENGINEERING AND LOGISTICS, U.S. COAST GUARD

Question 1. In your testimony you describe that your shore infrastructure vulnerability assessment will not be completed until 2025. By that time, many of the Coast Guard's existing infrastructure issues will have compounded by increasingly severe natural hazards. What will it take to have that assessment completed by 2021?

ANSWER. The Government Accountability Office's (GAO) report entitled *Coast Guard Shore Infrastructure: Processes for Improving Resilience Should Fully Align with DHS Risk Management Framework* (GAO-19-675) notes that the Coast Guard's SIVA process is "not expected to be completed until at least 2025." In our communications with GAO during the development of this report, the Coast Guard emphasized that the completion of SIVA Phase II by 2025 is uncertain given funding limitations and that the actual completion date will depend on funding availability.

QUESTIONS FROM HON. RICK LARSEN FOR REAR ADMIRAL NATHAN A. MOORE, ASSISTANT COMMANDANT FOR ENGINEERING AND LOGISTICS, U.S. COAST GUARD

Question 1. The first Polar Security Cutters will be homeported in Seattle, which has been the home of the nation's icebreaking fleet since 1976. It is also my understanding the Coast Guard is considering homeporting future vessel acquisitions in Northwest Washington. What are the berth capacity needs in the Puget Sound region to accommodate these new vessels?

ANSWER. The ship's design for the Polar Security Cutter is not finalized, however, the anticipated berthing requirements are as follows:

Item	Polar Security Cutter Requirement
Depth at Mooring	40 feet.
Mooring Length	480 feet.
Ship's Beam	90 feet.
Fendering, mooring devices, and deck fittings	Fendering, mooring devices, and deck fittings shall comply with the Navy's Unified Facilities Criteria.
Pier lay down space	4,000 Square Feet area in addition to pier/wharf space for pre-staging supplies and equipment within ½ mile of the pier or wharf.
Vertical load	600 pounds per square feet live load.
Fueling	Capable of being fueled at pier either by truck (AASHTO HS20 Truck loading) or by installed fueling system.
Shore ties	Electric, potable water, sewage, telephone, local area network.

Question 1.a. Follow-up: Does the Coast Guard also have the necessary maintenance and shipyard capacity in the Pacific Northwest for new acquisitions?

ANSWER. The Coast Guard is currently in the process of establishing maintenance requirements for new surface asset acquisitions. The Coast Guard is forecasting nation-wide commercial and government industrial base challenges based on proposed U.S. Navy fleet expansion, and we are looking at all options to best support our new cutters.

Question 1.b. Follow-up: How are homeport sites being designed to a more resilient standard? What are the benefits?

ANSWER. All Coast Guard construction projects include resilient standards based on local building codes, likely risks, and operational requirements. The physical resilience of the building is usually addressed through siting considerations, structural criteria, and elevation controls. Operational resilience is addressed with emergency

utilities capability, logistics chain planning, and use of renewable energy sources where possible.

Resilient buildings are more likely to support contingency operations during emergency events and restore normal operations faster after those events have occurred. They also better protect occupants in cases where events happen without warning (e.g. earthquakes) and it is not possible to relocate personnel to a safer location prior to the event occurring. Where physical reconstitution of resilient buildings is required after an event, these efforts are less costly due to the improved building survivability.

Question 2. In my home state of Washington, the impact of climate change has resulted in rising temperatures, record-breaking wildfires and an acidifying ocean which harms coastal communities. When the Coast Guard is considering a new construction project, what are some of the climate risk considerations incorporated into planning?

ANSWER. As Coast Guard facilities and assets are planned for recapitalization, resiliency for natural disasters is factored into facility plans and designs. The Coast Guard considers 10 natural hazards based on a project's geographical location. Those hazards include earthquakes, flooding, tsunamis, sea level rise, coastal vulnerability, hurricanes, wildfires, volcanoes, tornadoes, and drought.

Question 2.a. Follow-up: How are carbon dioxide emissions levels built into these models?

ANSWER. The Coast Guard does not include carbon dioxide emissions in its construction considerations beyond efforts to meet the requirements of the *Executive Order Regarding Efficient Federal Operations* (EO 13834).

Question 2.b. Follow-up: To date, Sea Level Change is not incorporated into FEMA's 100-year floodplain models, which in your testimony you cite as the SILC's baseline standard for designing new facilities. What are some other predictive models the Coast Guard could apply that incorporate sea level change, storm surge, and the 100-year flood models? What agencies do you collaborate with for these data?

ANSWER. The Coast Guard primarily uses publicly available products from the National Oceanic and Atmospheric Administration (NOAA) and the National Aeronautic and Space Administration (NASA) to inform planning factors when considering infrastructure project siting. These include NOAA's Global and Regional Sea Level Rise Scenarios for the United States and NASA's AVISO Level 4 data sets.

QUESTIONS FROM HON. STACEY E. PLASKETT FOR REAR ADMIRAL NATHAN A. MOORE, ASSISTANT COMMANDANT FOR ENGINEERING AND LOGISTICS, U.S. COAST GUARD

Question 1. As a result of the Hurricanes, Sector San Juan (to include Rio Bayamon Housing) suffered an estimated $156 million in infrastructure damages. The entire PC&I portion of the FY18 hurricane supplemental appropriation was $719 million. How has disaster funding been applied by the coast guard to rebuild island facilities to date? What are the rebuilding standards used for these facilities, and how does the CG account for the specific vulnerabilities of island property?

ANSWER. Upon receipt of the Fiscal Year 2018 hurricane supplemental appropriation, the Coast Guard commenced repairs to damaged infrastructure and concurrently began planning and design efforts to rebuild affected facilities in Puerto Rico and St. Thomas to resilient standards. To date, the Coast Guard has obligated $42 million for repair and rebuild work in Puerto Rico and St. Thomas. Nearly all of the repairs will be completed by April 2020, and we anticipate awarding the first rebuild contract in October 2020.

The Coast Guard rebuilds facilities in accordance with applicable building codes. When more stringent design criteria are required, the Coast Guard exceeds building codes to ensure structures can survive likely natural events. The Coast Guard considers historical climate data and forecasts to influence design criteria for new construction projects and major renovations on the islands. Locations specifically affected by flooding and coastal vulnerabilities normally receive siting and elevation considerations based on Federal Emergency Management Agency (FEMA) flood maps and design criteria recommended by the American Society of Civil Engineers. For example, the Coast Guard implements a minimum finished floor elevation of the 100-year flood level + 3 feet, or the 500-year flood elevation + 1 foot, whichever is greater.

QUESTIONS FROM HON. BOB GIBBS FOR REAR ADMIRAL NATHAN A. MOORE, ASSISTANT COMMANDANT FOR ENGINEERING AND LOGISTICS, U.S. COAST GUARD

Question 1. After Hurricane Katrina, the Coast Guard undertook an internal restructuring called Modernization. Among other things, it used the Aviation Logistics Center as a model for new surface assets, IT, and shoreside infrastructure logistics center. The Aviation Logistics model imposed national standards for all Coast Guard aviation operations proved successful when the Coast Guard mounted its monumental response to the massive hurricane. Unfortunately, it appears the Shoreside Infrastructure Logistics Center (SILC) exists largely as a paper exercise, and that the six regional civil engineering units continue to make decisions without the benefit of national processes and standards. The one-for-one replacement of existing Coast Guard shoreside facilities is not the best way to assure the Coast Guard can carry out its missions in the future.

Question 1.a. When does the Coast Guard intend to implement a national process for reviewing and rating individual projects?

ANSWER. Review and prioritization of the Coast Guard's major repair and recapitalization projects have been part of a national process overseen by the Shore Infrastructure Logistics Command (SILC) since 2012. The Coast Guard is in the process of updating formal guidance to its national and regional shore infrastructure planning boards.

Question 1.b. When does the Coast Guard intend to review its assets nationwide and match those assets to its mission needs?

ANSWER. The Coast Guard provides a comprehensive Coast Guard Mission Needs Statement to Congress at least every four years with the first delivered in 2016. The latest version was delivered in 2018 (attached).† The Coast Guard Mission Needs Statement reviews the Coast Guard's statutory missions, threats, and opportunities and compares them to the service's ability to conduct effective operations resulting in the required mission needs of the service.

Question 1.c. Of the ten recommendations in the last three GAO shoreside infrastructure reports, how many have been fully implemented? Partially implemented? Received no action?

ANSWER. The Coast Guard is tracking seven recommendations from two recently completed GAO audits on Coast Guard shore infrastructure: six from GAO-19-82, *Coast Guard Shore Infrastructure: Applying Leading Practices Could Help Better Manage Project Backlogs of At Least $2.6 Billion*, and one from GAO-19-675, *Coast Guard Shore Infrastructure: Processes for Improving Resilience Should Fully Align with DHS Risk Management Framework*. Of these seven recommendations, one has been fully implemented and six have been partially implemented. In addition to these recommendations, the Coast Guard is tracking three recommendations from GAO-18-9, *Coast Guard Actions Needed to Close Stations Identified as Overlapping and Unnecessarily Duplicative*. These three recommendations have been partially implemented.

Question 1.d. Does the Coast Guard plan to impose a national standard for resilient construction and maintenance in areas subject coastal storms and flooding? What would be the costs of implementing such a policy? The savings?

ANSWER. Coast Guard operational resilience standards are applied based on the mission criticality of the specific building. Physical resilience standards are defined by applicable building codes. Locations specifically affected by flooding and coastal vulnerabilities normally receive siting and elevation considerations based on FEMA Flood Maps and design criteria recommended by the American Society of Civil Engineers. Where appropriate, the Coast Guard exceeds building codes to ensure structures can survive likely natural events.

The cost of building to resilient standards increases where we exceed building codes because baseline costs are based on building code requirements. Examples of design considerations that may exceed building codes include a sacrificial first floor, thicker walls, emergency power generation, and additional potable water storage and purification.

Following disasters, the Coast Guard's infrastructure reconstitution costs have been relatively low for facilities built to resilient standards. Recent examples include Coast Guard infrastructure at Sabine Pass, Texas, and Great Inagua, the Bahamas, which was rebuilt after Hurricane Ike and sustained no damage during more recent hurricanes.

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†Editor's note: The 126-page report entitled "Coast Guard Mission Needs Statement: Report to Congress—November 21, 2018," is retained in committee files.

QUESTIONS FROM HON. SEAN PATRICK MALONEY FOR NATHAN ANDERSON, DIRECTOR, HOMELAND SECURITY AND JUSTICE, U.S. GOVERNMENT ACCOUNTABILITY OFFICE

Question 1. The Coast Guard began assessing certain buildings for vulnerabilities to natural disasters in 2015 and aim to complete that process in 2025, but are only 15 percent finished. Taking into account the projects that the GAO does not consider necessary to cost, what resources would it take to complete that process by 2021?

ANSWER. It is unclear what resources it would take to complete the Coast Guard's vulnerability assessment process by 2021 because the Coast Guard's phase I analysis did not identify all shore infrastructure assets that are critical to its missions. Additionally, its ongoing phase II assessment, which involves more detailed structural analyses of 1,500 buildings, is limited in scope to earthquakes or tornado and hurricane winds, depending on the building. Moreover, the phase II assessment, which began in September 2018, included just one contract for about $700,000 to determine if 15 buildings at multiple Coast Guard sites are vulnerable to earthquakes. According to the contract, these 15 assessments are to be completed in October 2021. However, the Coast Guard did not have a charter that outlined a methodology for the broader development of phase II. A Coast Guard memo from March 2019 recommended that phase II assessment work be prioritized based on how critical a building is to Coast Guard operations, its occupant density, and its overall age and condition, and the Coast Guard has data it could use to accomplish this assessment. As a result, we recommended in September 2019 that the Coast Guard implement a risk-informed approach to better guide its shore infrastructure investment decisions.

Further, even if the assessment process could be completed by 2021, we cannot estimate the resources it would take because the Coast Guard would then have to identify projects needed to address assessment results. But, as we reported in February 2019, (1) the Coast Guard was unable to provide us with documentation showing whether and to what extent risk reduction methods were considered in its funding prioritization processes for shore infrastructure projects, and (2) it was unclear whether future Coast Guard prioritization decisions would focus on the most critical risks and consider resilience as a factor when choosing which projects to fund. As a result, we are unable to estimate resources needed to address the Coast Guard's shore infrastructure vulnerabilities.

Question 2. Should the Coast Guard conduct comprehensive adaptation planning for its facilities? To what extent does the Coast Guard coordinate with local planning bodies when identifying critical assets and planning shoreside infrastructure improvements?

ANSWER. GAO's High Risk work on *Limiting the Federal Government's Fiscal Exposure by Better Managing Climate Change Risks* [https://www.gao.gov/highrisk/limiting__federal__government__fiscal__exposure/why__did__study#t=2], states that the federal government needs a comprehensive approach to improve the resilience of the facilities it owns and operates and the land it manages.[1] This involves incorporating climate change resilience into agencies' infrastructure and facility planning processes.[2] It also involves accounting for climate change in National Environmental Policy Act (NEPA) analyses and working with relevant professional associations to incorporate climate change information into structural design standards. Specifically, in November 2016 we reported that standards-developing organizations—such as professional engineering societies—are the primary source of the standards, codes, and certifications that federal, state, local, and private-sector infrastructure planners follow.[3] In this report, we found that standards-developing organizations generally have not used forward-looking climate information in design standards, building codes, and voluntary certifications, but instead have relied on historical observations.

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[1] See GAO, https://www.gao.gov/highrisk/limiting__federal__government__fiscal__exposure/why__did__study#t=2.

[2] See GAO, *Climate Change Adaptation: DOD Can Improve Infrastructure Planning and Processes to Better Account for Potential Impacts*, GAO–14–446 [https://www.gao.gov/products/GAO-14-446] (Washington, D.C.: May 30, 2014); *Climate Change Adaptation: DOD Needs to Better Incorporate Adaptation into Planning and Collaboration at Overseas Installations*, GAO–18–206 [https://www.gao.gov/products/GAO-18-206] (Washington, D.C.: Nov 13, 2017); *Climate Resilience: DOD Needs to Assess Risk and Provide Guidance on Use of Climate Projections in Installation Master Plans and Facilities Designs* GAO–19–453 [https://www.gao.gov/products/GAO-19-453]: (Washington, D.C.: Jun 12, 2019).

[3] See GAO, *Climate Change: Improved Federal Coordination Could Facilitate the Use of Forward-Looking Climate Information in Design Standards, Building Codes, and Certifications*, GAO–17–3 [https://www.gao.gov/products/GAO-17-3] (Washington, D.C.: Nov 30, 2016).

QUESTIONS FROM HON. RICK LARSEN FOR NATHAN ANDERSON, DIRECTOR, HOMELAND SECURITY AND JUSTICE, U.S. GOVERNMENT ACCOUNTABILITY OFFICE

Question 1. What research has the GAO done into the use of nature-based infrastructure in climate mitigation projects beyond the more conventional mitigation approaches (e.g. structure elevation, flood-proofing, relocation, etc.)?

Question 1.a. Follow-up: Are there potential returns on investment with nature-based infrastructure?

Question 1.b. Follow-up: Should the Coast Guard consider other types of adaptation techniques?

ANSWER (1.a.–1.b.). In March 2019, we reported on how the Army Corps of Engineers (Corps) determines when to use natural infrastructure (e.g. wetlands and beaches), or hard infrastructure (e.g., seawalls) for coastal management projects.[4] For coastal storm and flood risk management projects, the Corps is supposed to choose the infrastructure type with the greatest net benefits. Reducing damages to existing structures, including homes and commercial buildings, is the primary benefit the Corps considers when identifying benefits for coastal storm risk management project alternatives, according to its planning guidance. Specifically, the guidance outlines general steps for estimating damage reduction benefits, which are to be calculated and included in each coastal storm and flood risk management alternative's economic analysis. We also found that the Corps is beginning to pursue the use of natural infrastructure in its planning, but that it can be difficult to calculate the net benefits of natural infrastructure. For example, it can be hard to put a dollar value on environmental benefits, such as providing habitat for fish and birds.

Further, our October 2019 *Disaster Resilience Framework: Principles for Analyzing Federal Efforts to Facilitate and Promote Resilience to Natural Disasters* states that, in addition to built-infrastructure assets, information about how natural ecosystems contribute to disaster resilience and overlap with the built environment can help provide additional insight into how to design better solutions that account for the condition and benefits of the whole system.[5] For example, as we have previously reported, coastal ecosystems—including wetlands, marshes, and mangroves—may shield communities from some of the impacts of climate change.[6]

- According to the *Fourth National Climate Assessment*, information on benefits of resilience efforts is lacking in many sectors, though some information exists on the benefits and costs of such efforts in certain sectors, such as resilience efforts in coastal areas, resilience efforts designed to protect against riverine flooding (i.e., flooding that occurs when river flows exceed the capacity of the river channel), and resilience efforts related to agriculture at the farm level.[7] According to this assessment, some of the actions in these sectors, at least in some locations, appear to have large benefit-cost ratios—both in addressing current variability and in preparing for future change. According to the National Oceanic and Atmospheric Administration's (NOAA) Office for Coastal Management, wetlands can protect coastal communities from powerful storm surge by buffering waves and absorbing additional water. NOAA estimates that coastal wetlands in the United States provide about $23 billion in storm protection services each year.[8]
- As a federal agency, the Coast Guard should pursue every feasible opportunity to limit federal fiscal exposure to climate change risks within its planning and construction processes. As GAO stated in its High Risk area *Limiting the Federal Government's Fiscal Exposure by Better Managing Climate Change Risks* [https://www.gao.gov/highrisk/limiting__federal__government__fiscal__exposure/why__did__study#t=2], the federal government needs a comprehensive approach

[4] See GAO, *Army Corps of Engineers: Consideration of Project Costs and Benefits in Using Natural Coastal Infrastructure and Associated Challenges*, GAO–19–319 [https://www.gao.gov/products/GAO-19-319] (Washington, D.C.: Mar 28, 2019).

[5] See GAO, *Disaster Resilience Framework: Principles for Analyzing Federal Efforts to Facilitate and Promote Resilience to Natural Disasters*, GAO–20–100SP [https://www.gao.gov/products/GAO-20-100SP] (Washington, D.C: Oct 23, 2019).

[6] See GAO, *Climate Change: Information on NOAA's Support for States' Marine Coastal Ecosystem Resilience Efforts*, GAO–16–834 [https://www.gao.gov/products/GAO-16-834] (Washington, D.C.: Sep 28, 2016).

[7] Jay, A.,D.R. Reidmiller, C.W. Avery, D. Barrie, B.J. DeAngelo, A. Dave, M. Dzaugis, M. Kolian, K.L.M. Lewis, K. Reeves, and D. Winner, 2018: Overview. In *Impacts, Risks, and Adaptation in the United States: Fourth National Climate Assessment, Volume II* [Reidmiller, D.R., C.W. Avery, D.R. Easterling, K.E. Kunkel, K.L.M. Lewis, T.K. Maycock, and B.C. Stewart (eds.)]. U.S. Global Change Research Program, Washington, D.C.

[8] See https://coast.noaa.gov/data/nationalfacts/pdf/hand-out-natural-infrastructure.pdf and National Research Council of the National Academies, America's Climate Choices: Panel on Adapting to the Impacts of Climate Change, *Adapting to Impacts*.

to improve the resilience of the facilities it owns and operates, and land it manages. This involves incorporating climate change resilience into agencies' infrastructure and facility planning processes, such as agency efforts to implement our prior recommendations.[9] It also involves accounting for climate change in NEPA analyses and working with relevant professional associations to incorporate climate change information into structural design standards.[10]

QUESTIONS FROM HON. SEAN PATRICK MALONEY FOR REAR ADMIRAL ANN C. PHILLIPS, U.S. NAVY (RET.), SPECIAL ASSISTANT TO THE GOVERNOR FOR COASTAL ADAPTATION AND PROTECTION, OFFICE OF THE GOVERNOR, COMMONWEALTH OF VIRGINIA

Question 1. Is there a comprehensive national report on port vulnerability available? What variables and concerns should such a report take in to account?

ANSWER. Congressman Maloney, Thank you for the opportunity to testify and to answer Questions for the Record. As related to a comprehensive national report on Port Security, the Department of Homeland Security, Cybersecurity and Infrastructure Security Agency, (DHS/CISA) is currently working in partnership with the U.S. Army Corps of Engineers (USACE) to develop a uniform set of guidance for assessing port resilience with three scope levels: single port, a regional system of ports, and an inland marine transportation system. This project draws from the Regional Resilience Assessment Program (RRAP) Methodology that DHS/CISA has developed and used for the past 10 years to conduct a large number of assessments of infrastructure resilience.[1] Many of these assessments have involved ports, but they have not been specific to the port of interest and focused on particular regions, and the resulting reports have generally been designated FOUO, which impacts public access. Working with USACE, DHS plans to augment this assessment methodology with quantitative and qualitative tools developed by USACE in addition to analytical approaches developed by National Laboratory partners supporting the Regional Resilience Assessment Program. DHS is in the process of drafting the guidance and conducting case studies using some of these analytical techniques. They intend to produce a general methodology supported by a suite of analytical tools that can be selected based on the resilience question being considered, and to ensure the results are released publicly when complete—they estimate at least a year to completion.

Question 2. While Congress provided for $292.7 million in discretionary grant funding through the Port Infrastructure Development Program as part of the Consolidated Appropriations Act of 2019, it is my understanding that the Department of Transportation has not issued a single grant nor did the President request further funding in his 2020 Budget Request. If the Port of Virginia were to be awarded a grant from that program, what sort of resilient infrastructure investments would you be able to make?

ANSWER. The Port of Virginia maintains a proactive stance on preparing for its future infrastructure needs across a range of circumstances, and over the past year, has been creating a comprehensive document that details the port's Design and Construction Standards and Preferences. This document (in draft form) borrows from established industry practices that take into account the latest technology and engineering solutions. The Port of Virginia's construction is governed by those standards and preferences—whether grant funded or not.

The Port of Virginia has applied for a Port Infrastructure Development grant for additional capacity and corresponding upgrades to rail operations at the Norfolk International Terminals. The following paragraph is excerpted from their grant application:

> "It is important to address project resiliency at the onset of design for all projects. The NIT CRY Optimization project has a projected service life of 30 years which necessitates adopting a Basis of Design that reflects industry accepted resilient design criteria. The Port of Virginia continues to lead regional discussions and sustainability action and is proud to have created a set of Resilient Design Criteria as part of its Design and Construction Standards and Preferences. These design criteria encourage all engineered projects to adopt future intensity-duration charts for rainfall projections, baseline flood elevations, and best practices for resilient design. The port

[9] See GAO, High-Risk Series: Substantial Efforts Needed to Achieve Greater Progress on High-Risk Areas GAO–19–157SP [https://www.gao.gov/products/GAO-19-157SP] (Washington, D.C.: Mar 6, 2019).

[10] GAO–19–157SP [https://www.gao.gov/products/GAO-19-157SP].

[1] "Regional Resiliency Assessment Program," U.S. Department of Homeland Security, February 5, 2010, https://www.dhs.gov/cisa/regional-resiliency-assessment-program.

views this project as an opportunity to further the resiliency of both terminal infrastructure and regional/national freight infrastructure."

The United States Maritime Administration (MARAD) administers the Port Infrastructure Development Grant process.[2] As stated in your question, to date, no awards have been made, but the Port of Virginia expects announcements around the start of the calendar year.

Finally, the Port of Virginia's annual Sustainability Report details those activities that illustrate its commitment to environmental stewardship, fiscal responsibility, the health and well-being of its colleagues, port partners and neighbors, and to building strong community relationships.[3]

QUESTIONS FROM HON. ANTHONY G. BROWN FOR REAR ADMIRAL ANN C. PHILLIPS, U.S. NAVY (RET.), SPECIAL ASSISTANT TO THE GOVERNOR FOR COASTAL ADAPTATION AND PROTECTION, OFFICE OF THE GOVERNOR, COMMONWEALTH OF VIRGINIA

Question 1. In the EPA's draft report, "Environmental Justice Primer for Ports" from 2016, the agency identified that near-port communities and tribes can face unique challenges due to sustained exposure to pollutants and toxins from ports, and that the disproportionate impacts experienced by these communities are often compounded when they do not receive the same level of benefits from port activities—such as jobs and economic growth—that are enjoyed regionally.

Question 1.a. As ports work to become more resilient and develop their infrastructure, how can they best do so in a way that encompasses principles of environmental justice?

ANSWER. Congressman Brown, Thank you for the opportunity to testify and to answer Questions for the Record. The Port of Virginia has a particular focus on sustainability to meet present needs without compromising future generations, communities, or the environment. With facilities in Norfolk, Portsmouth, Newport News, barge service to Richmond, and an Inland Port Intermodal transfer facility in Front Royal, Virginia—all localities with under-served populations—the Port of Virginia works to build resilience, as recommended in the EPA Draft Environmental Justice Primer for Ports, through a focus on community engagement, through building long-term relationships with near-port communities, working to ensure environmental regulatory compliance, responsible land use, and through integrating port needs and community goals.[4] In addition, they have focused on increasing capacity while reducing emissions, and have been awarded their 16th consecutive River Star Business Award for environmental excellence by the Elizabeth River Project. Much like the regions' federal facilities, the Port of Virginia understands its future resilience is inextricably linked to that of the surrounding cities and other localities that support and provide its critical utilities, transportation, logistics, and supply chain infrastructure. The Port of Virginia's annual Sustainability Report details those activities that illustrate its commitment to environmental stewardship, fiscal responsibility, the health and well-being of its colleagues, port partners and neighbors, and to building strong community relationships. Key to the success of their efforts is their focal point of community stewardship, partnership, and engagement.

Question 1.b. Were there any lessons learned from the Hampton Roads pilot project regarding the intersection of climate adaptation planning and environmental justice issues?

ANSWER. The Hampton Roads Pilot Project focused on whole of government and community solutions to prepare the Hampton Roads Region to adapt to sea level rise and recurrent flooding. Its particular focus was in the coordination among and between communities, localities, and Federal, State and local stakeholders. It did not specifically address environmental justice, and did not focus on environmental regulatory compliance, rather it worked to determine a series of regional priorities, to inform future actions, and to understand the need for and in some contexts to develop institutionalized processes that would facilitate continued formal stakeholder collaboration. Key deliverables included whole of government mitigation and adaptation planning processes and integrated regional recommendations, with the

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[2] US Maritime Administration, "About Port Infrastructure Development Grants: MARAD," accessed November 6, 2019, https://www.maritime.dot.gov/PIDPgrants.

[3] "Port of Virginia—Sustainability Report 2018," accessed November 6, 2019, http://www.portofvirginia.com/fy18-sustainability-report/.

[4] Office of Transportation and Air Quality, "Environmental Justice Primer for Ports: The Good Neighbor Guide to Building Partnerships and Social Equity with Communities" (United States Environmental Protection Agency, July 2016), https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P100OYGB.pdf.

intent that both could be adapted for use by other regions—a particular interest area of the National Security Council and Department of Defense.[5] [6]

Nevertheless, the Whole of Government and Community effort would not have been successful without the hundreds of stakeholders and volunteer leaders from across the full spectrum of government, academia, and the community, many of whom participated out of a sense of duty to their community and shared commitment to collaboration.[7] This in and of itself drives to the heart of ensuring environmental justice, cross community collaboration and inclusion, supported by "recognized interdependence and constructed credibility" between stakeholders.[8] This outcome is also reflected at the State level with Governor Northam's Executive Order 24, *Increasing Virginia's Resilience to Sea Level Rise and Natural Hazards, and Executive Order 29, Establishment of the Virginia Council on Environmental Justice*. Again, institutionalized processes, built on continued and ongoing relationships and partnerships between stakeholders were and continue to be the key to a successful effort, and to adaptive planning, across the full spectrum of community, the "whole of society."

Question 2. You recommended that we establish a coordinated Interagency Task Force for help agencies like FEMA, HUD, NOAA, NFWF, and others to coordinate amongst themselves. What are some lessons from the Hampton Roads pilot project that would be well applied to such a task force?

ANSWER. The Hampton Roads Pilot Project was fortunate to have the participation of and collaboration with a number of Federal partners. This was in large part facilitated at the request of Senator Kaine, who wrote letters requesting such participation to stakeholder Cabinet Secretaries at the Federal and State level, as well as other Deputy and Assistant Secretaries, Mayors, and Planning District Directors within the Hampton Roads Region—requesting their agencies' support and participation.[9] Ultimately, their participation was critical to the overall success of the effort, and many participants stated they stayed with the two-year process because it was the first time Federal, State and local participants sat at the table together to develop processes to determine solutions for the region.

One of the key recommendations of the Pilot Project was that such interoperability should be institutionalized, in particular at the regional level, such that the regional presence of federal agencies had an agreed-upon means to remain involved in the ongoing planning and needs to prepare the Region for sea level rise and recurrent flooding, as well as other efforts that would benefit from such a regional collaborative effort. This concept could mirror a similar approach with the establishment of an Interagency Task Force at the Federal level, which could coordinate across agencies, and develop and implement a national policy, standards and processes to address and prepare for climate impacts.

A similar construct was directed by President Obama's Presidential Memorandum on Climate Change and National Security, of September 21st, 2016. The Memorandum specifically focused on "establishing a framework to direct Federal Departments and Agencies to ensure climate-related impacts were fully considered in national security doctrine, policies and plans."[10] It built on existing Presidential directives and policies, including the Climate Action Plan of June 2013, and Executive Orders 13653 (Preparing the United States for the Impacts of Climate Change) of November 1, 2013 (revoked in 2017), 13677 (Climate-Resilient International Devel-

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[5] John Conger, Acting Under Secretary of Defense, "Memoradum for Assistant Secretaries of the Army, Navy and Air Force: DoD Climate Preparedness and Resilience Planning Pilots," October 29, 2014.

[6] Emily E. Steinhilber et al., "Hampton Roads Sea Level Rise Preparedness and Resilience Intergovernmental Pilot Project. Phase 2 Report: Recommendations, Accomplishments and Lessons Learned" (Old Dominion University, October 2016), https://digitalcommons.odu.edu/hripp__reports/2/.

[7] "June 27, 2016 IPP SC Consensus Resolution" (The Steering Committee of the Hampton Roads Sea Level Rise Preparedness and Resilience Intergovernmental Planning Pilot Project, June 27, 2016), https://www.floodingresiliency.org/wp-content/uploads/2016/11/IPP-Consensus-Resolution-All-Signatures.pdf.

[8] Hannah M Teicher, "Climate Allies: How Urban/Military Interdependence Enables Adaptation" (Doctoral Dissertation, Massachussets Institute of Technology; Department of Urban Studies and Planning, 2019), https://dspace.mit.edu/handle/1721.1/122193.

[9] Emily E. Steinhilber et al., "Hampton Roads Sea Level Rise Preparedness and Resilience Intergovernmental Pilot Project Phase 1 Report: Accomplishments and Lessons Learned" (Old Dominion University, November 2015), 1, http://www.mari-odu.org/news/IPP-Phase-1-Report-with-Appendices.pdf.

[10] Barack Obama, "Presidential Memorandum—Climate Change and National Security" (The White House Office of the Press Secretary, September 21, 2016), https://obamawhitehouse.archives.gov/the-press-office/2016/09/21/presidential-memorandum-climate-change-and-national-security.

opment) of September 23, 2014, and 13693 (Planning for Federal Sustainability for the Next Decade) of March 19, 2015.[11] [12] [13] [14] It further directed the establishment of a Climate and Security Working Group, chaired by members of the National Security Council, and including representation from stakeholder Federal departments and agencies. Unfortunately, this group never convened, but the need for an institutionalized national-level focus, process and strategy, one that could be replicated at the State and regional level to coordinate on Pre-disaster preparedness, planning and adaptation development was shown by the IPP to be of value.

In addition, the 2016 Water Resources Development Act directed the US Army Corps of Engineers to establish an Interagency Coordination process, to participate in any State level activities related to Federal property that would be impacted by local, regional, or State adaptation and protection efforts to prepare for coastal resilience. The 2016 WRDA/WIN Act §1183(b)[15] language, (shown below) could also be a template for an interagency coordination effort, though it is not clear how USACE has implemented this legislation.

(b) INTERAGENCY COORDINATION ON COASTAL RESILIENCE.—

(1) IN GENERAL.—The Secretary shall convene an inter-agency working group on resilience to extreme weather, which will coordinate research, data, and Federal investments related to sea level rise, resiliency, and vulnerability to extreme weather, including coastal resilience.

(2) CONSULTATION.—The interagency working group convened under paragraph (1) shall participate in any activity carried out by an organization authorized by a State to study and issue recommendations on how to address the impacts on Federal assets of recurrent flooding and sea level rise, including providing consultation regarding policies, programs, studies, plans, and best practices relating to recurrent flooding and sea level rise in areas with significant Federal assets.

QUESTIONS FROM HON. SEAN PATRICK MALONEY FOR DANIEL COX, PH.D., CH2M-HILL PROFESSOR IN CIVIL ENGINEERING, OREGON STATE UNIVERSITY

Question 1. In your testimony, you cite the importance of modern technology and data that should be considered for resilient port infrastructure design, maintenance, and operation. How should the Coast Guard best adopt those technologies given that they maintain 20,000 shore facilities?

ANSWER. A response was not received at the time of publication.

Question 2. In your testimony you discuss how natural and nature-based features can be used to protect port infrastructure. Can you elaborate on how expanded use of natural and nature-based features are beneficial to private industry and how they can be used on a larger scale at some of our nation's busiest ports?

ANSWER. A response was not received at the time of publication.

Question 3. Is there a comprehensive national report on port vulnerability available? What variables and concerns should such a report take in to account?

ANSWER. A response was not received at the time of publication.

Question 4. In your written testimony, you mentioned the potential for integrating advanced materials into infrastructure reinforcement projects for expanding service life, can you speak to what this entails and how the economics works for building with more advanced materials to extend service life may also reduce costs?

ANSWER. A response was not received at the time of publication.

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[11] Executive Office of the President, "The President's Climate Action Plan" (The White House, June 2013), https://obamawhitehouse.archives.gov/sites/default/files/image/president27sclimateactionplan.pdf.

[12] Barack Obama, "Executive Order 13653: Preparing the United States for the Impacts of Climate Change," November 6, 2013, https://www.federalregister.gov/documents/2013/11/06/2013-26785/preparing-the-united-states-for-the-impacts-of-climate-change.

[13] Barack Obama, "Executive Order 13677: Climate-Resilient International Development" (The White House Office of the Press Secretary, September 26, 2014), https://www.federalregister.gov/documents/2014/09/26/2014-23228/climate-resilient-international-development.

[14] Barack Obama, "Executive Order 13693: Planning for Federal Sustainability in the Next Decade" (The White House Office of the Press Secretary, March 25, 2015), https://www.federalregister.gov/documents/2015/03/25/2015-07016/planning-for-federal-sustainability-in-the-next-decade.

[15] "Water Infrastructure Improvements For The Nation Act," Pub. L. No. 114–322, § 1183(b) (2016), https://www.congress.gov/114/plaws/publ322/PLAW-114publ322.pdf.

QUESTIONS FROM HON. RICK LARSEN FOR DANIEL COX, PH.D., CH2M-HILL PROFESSOR IN CIVIL ENGINEERING, OREGON STATE UNIVERSITY

Question 1. States like Washington are working to address growing infrastructure needs and a transition to sustainable, energy-efficient efforts to mitigate the impacts of climate change. How can we ensure that technologies like port electrification, are designed to withstand sea level rise and other climate impacts?

ANSWER. A response was not received at the time of publication.

Question 2. In your testimony, you mentioned the potential for integrating natural and nature-based features into port infrastructure projects. Can you talk more about what that entails and whether there are cost benefits for reinforcing exposed port infrastructure?

ANSWER. A response was not received at the time of publication.

Question 3. Mr. Cox, in your experience with the National Institute for Standards and Technology (NIST), what further investments are needed to enhance infrastructure adaptation and mitigation?

ANSWER. A response was not received at the time of publication.

QUESTIONS FROM HON. SEAN PATRICK MALONEY FOR SEAN B. HECHT, CO-EXECUTIVE DIRECTOR, EMMETT INSTITUTE ON CLIMATE CHANGE AND THE ENVIRONMENT, UNIVERSITY OF CALIFORNIA AT LOS ANGELES SCHOOL OF LAW

Question 1. The Port Authority of New York New Jersey pays $200 million annually to insure $9 billion in assets. Are there other models for insuring coastal property or reducing perceived risk that we should consider? When and how should the government intervene in such an increasingly risky market?

ANSWER. Insurers will cover risks only under certain conditions. Risks that do not meet these conditions may be considered uninsurable, because the basic model of collecting premiums to pay for losses wouldn't work without them. Disaster risks, including many that relate to climate change, have many of the markers of uninsurability, as does incremental sea-level rise.

Here are factors that determine whether a risk is insurable:

- The largest possible loss should not affect the insurer's solvency (ability to have the capital to pay all claims).
- The average loss should be determinable and quantifiable (to allow insurers to plan for risk and set premiums rationally).
- Risks should be independent and well-distributed in time and space rather than correlated (so that the insurer can diversify risks effectively and avoid insolvency or other failures).
- The pool of insureds should not be skewed toward those with high risk, and the insurance contract should not motivate policyholders to fail to take self-protective measures (moral hazard).
- There must actually be a market in which supply and demand yield a price point for any given level of insurance against any given risk.

Insurers can take actions to try to make risks more insurable, especially engaging in research to understand risks as well as possible. But the financial dynamics of disasters are particularly challenging for risk management: not only are basic parameters of disasters themselves unpredictable (for example, how many hurricanes of what magnitude in what location make landfall), but a single year of extremely large covered losses may be high enough to render an insurer insolvent. Unlike, for example, automobile insurance, insurers can't spread disaster risks effectively. The widespread disruption in insurance markets after Hurricane Andrew's wind-related destruction in Florida illustrates this well.

The example of Hurricane Andrew demonstrates how some types of climate-related risk challenge core principles of insurability. A given level of overall risk from a particular kind of insured loss may be perfectly acceptable if losses are likely to be well-distributed and independent. But concentration or correlation of losses—as occurs in hurricanes, wildfires, and other major disasters—makes it more likely that an insurer may will suffer unsustainable losses within a single year. Uncertainty, or ambiguity of risk—the inability to assess and quantify probabilities of predicted losses with sufficient precision—makes insurers reluctant to insure risks, except at high cost. In extreme cases, uncertainty will render a risk uninsurable by rendering risks unquantifiable, concentrated, and unable to be priced at a level consumers or regulators will tolerate.

This recognition of uninsurability happened long ago with flood insurance in the United States. Private insurers largely pulled out of the flood insurance market in the mid-20th century. This was the result of massive, correlated flood-related losses

that made insurers view flood risk as uninsurable—or at least insurable only at very high cost through specialty insurance products. The federal government stepped in to insure homes at risk of flood damage through the National Flood Insurance Program, but that program relies, when there are significant correlated losses from events like hurricanes, on subsidies from general federal funds.

As climate change affects weather patterns, changing sea levels and storm surge as well as changing tropical storm and precipitation dynamics, it will become even harder for insurers to manage these already-difficult types of risks. Many of these risks may end up being insured through government-run risk pools—as is already the case with earthquake insurance in California, flood insurance nationally, and a significant amount of weather risk on the gulf coast. Insurers have been working in recent years to develop new financial instruments to try to address those risks by providing incentives for capital investment that can provide funding to address the risks when they materialize. These include catastrophe bonds and other types of insurance-linked securities, as well as other parametric products that provide capital when a triggering physical condition is reached.

For essential infrastructure, government agencies at all levels will have to make difficult choices about investment and risk management. Competent port managers are projecting future risks and making decisions that reflect those risks. Ultimately, while insurance and other financial risk-management tools will continue to play a role, I believe the federal government will have to view investment in resilience and rebuilding of infrastructure as a cost that must be borne by some combination of private actors (such as shipping companies) and the public, and will have to make choices with that in mind. I note, also, that hardening coastal infrastructure has its own environmental costs, including spillover effects, or externalities, that negatively impact other coastal resources; this should be considered, and the use of natural infrastructural features should be encouraged where possible.

Question 2. In your experience, what percent of ports are using risk-based approaches to determine resilient infrastructure designs?

ANSWER. I do not have data to answer this question. A survey of the ways that ports nationally or internationally are responding to sea-level rise is outside my experience or expertise. Anecdotally, I can say that over the past decade, port managers everywhere are beginning to look at design in light of sea-level rise risk. This article by researchers at RAND provides one model for this type of risk management, Robust Decision Making (RDM), with a case study focus on the Port of Los Angeles: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5802450/

Question 3. Is there a comprehensive national report on port vulnerability available? What variables and concerns should such a report take in to account if it does not yet exist?

ANSWER. I am not aware of a comprehensive national report on port vulnerability. One very recent publication, Climate Change Adaptation Planning for Ports and Inland Waterways, was published by *PIANC*, the World Association for Waterborne Transport Infrastructure. This guidance document provides detailed technical climate adaptation guidance for ports: https://navclimate.pianc.org/about/navclimate-news/climate-change-adaptation-planning-guidance-launched-by-pianc

Other resources are available, such as this book: https://www.researchgate.net/publication/281119163__Climate__Change__and__Adaptation__Planning__for__Ports.

There is also a literature on why adaptation planning in the context of ports and other infrastructure has lagged. For example, this article explores the concept of a "leadership void" with a port case study: https://www.frontiersin.org/articles/10.3389/feart.2019.00029/full

More generally, the federal government, local and state governments, and academic researchers have developed widely-used frameworks for climate adaptation. The federal toolkit is available here: https://toolkit.climate.gov/#steps

Question 4. As ports work to become more resilient and develop their infrastructure, how can they best do so in a way that encompasses principles of environmental justice?

ANSWER. Environmental injustice—the disproportionate impact of environmental and public health harms on low-income communities and communities of color—is a serious and well-documented problem in the United States and globally. Ports, while necessary for our economy, contribute to environmental injustice through emissions from freight movement. Ships, trucks, and short-haul equipment contribute significantly to pollution that disproportionately affects those who live near ports and freight corridors. Port-related infrastructure and industrial land uses also dominate the landscape of nearby communities in other ways. The report available

here, developed by the nonprofit Harbor Community Benefit Foundation when I was the board chair of that organization, documents some of those impacts relating to the Port of Los Angeles: https://hcbf.org/blog/hcbf-proudly-releases-harbor-community-off-port-land-use-study/

Addressing the impacts of port-related land use changes, air emissions, toxic substances, and flood and other infrastructure risk on local communities should be an essential component of any port's planning processes. Ensuring community participation and input into planning processes is, in turn, an essential piece of addressing those impacts.

Question 5. At what point do we disinvest from coastal property? Are there better ways to get a picture of what industrial or federal properties we should let fall into the water?

ANSWER. The process of climate change adaptation planning, including the tools of social, economic, and physical vulnerability assessment and the planning processes that follow that assessment, should inform all management of coastal infrastructure. There is no fixed answer to the question of under what conditions we need to disinvest, or "retreat"; ultimately, government agencies will have to make decisions based on weighing the probable social, economic, and physical consequences of different options. Unfortunately, this decisionmaking will inevitably have to happen under conditions of deep uncertainty.

QUESTION FROM HON. RICK LARSEN FOR SEAN B. HECHT, CO-EXECUTIVE DIRECTOR, EMMETT INSTITUTE ON CLIMATE CHANGE AND THE ENVIRONMENT, UNIVERSITY OF CALIFORNIA AT LOS ANGELES SCHOOL OF LAW

Question 1. Your testimony describes how more robust information and analysis about emerging risks and community-scale risk mitigation planning, can reduce port insurance costs in the near and long term. Yet, a recent study by the International Association of Ports and Harbors and the American Association of Port Authorities found that most ports are concerned about the impacts of sea-level rise, but not implementing adaptation strategies. What are some incentives to encourage ports to implement these strategies and remain competitive nationally and internationally?

ANSWER. I believe that competent managers who are looking at long-term consequences, and who have the resources to assess and implement adaptation strategies, will be motivated to take into account sea-level rise in their planning. The key is to make sure that managers and planners are incentivized to look at long-term rather than short-term planning. Providing funding, and stressing the dire necessity of a national mandate to understand and adapt to changing coastal conditions, are minimal conditions. Unfortunately, currently, many local and state governments and federal agencies are not providing adequate resources to address the problem, and the political mandate is not there in many jurisdictions or under the current federal administration. Government needs to acknowledge the scientific basis for concern, to foreground the research demonstrating the economic, social, and physical need for adaptation, and to provide funding mechanisms for both basic research and specific adaptation planning and implementation.

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