

Stanford
Doerr
School of
Sustainability



**APRIL
2023**

DEPARTMENT OF THE NAVY CLIMATE CHANGE TABLETOP EXERCISE II

AFTER ACTION REPORT

INTRODUCTION



April 27-28, 2023, the U.S. Department of the Navy (DON) held its second Navy Climate Change Tabletop Exercise in Monterey, California. The Assistant Secretary of the Navy (Energy, Installations, and Environment), Naval Postgraduate School (NPS), and Stanford Doerr School of Sustainability planned and hosted the exercise. Participants from the Department of Navy, other federal agencies, academia, industry, non-profits, non-governmental organizations, think tanks, and California state agencies came together to collaborate and identify innovative climate resiliency solutions. This after action report provides an overview of the scenarios, proposed solutions, and key takeaways.

BACKGROUND



The DON Climate Change Tabletop Exercise II is the first outcome of the formal Education Partnership Agreement (EPA) between NPS and the Stanford Doerr School of Sustainability. The two institutions entered into the EPA in December of 2022 to collaboratively address the common complex challenges of climate change and its impacts. Together, these leading educational institutions will deliver solutions at greater speed and scale, enabling climate-informed, data-driven decision-making by naval and national leaders.

Assistant Secretary of the Navy (Energy, Installations, and Environment) and Chief Sustainability Officer Honorable Meredith Berger, NPS President Vice Adm. (ret.) Ann E. Rondeau and Dr. Arun Majumdar, inaugural Dean of the Doerr School of Sustainability, signed a letter of intent in advance of the Climate Change Tabletop Exercise to provide guidance and desired outcomes for the exercise.

LETTER OF INTENT

April 25, 2023

Dear Colleagues,

On behalf of the Assistant Secretary of the Navy (Energy, Installations, & Environment), the Naval Postgraduate School, and the Stanford Doerr School of Sustainability, we are pleased that you are joining us for the Department of the Navy's Climate Change Tabletop Exercise II.

This tabletop exercise (TTX) is a unique opportunity for academics and subject matter experts, Navy and Marine Corps leaders, and government and private sector executives to collaborate and identify innovative climate resiliency solutions. These solutions will inform the Department of the Navy's analytic agenda on climate and sustainability. Approximately 60 subject matter experts and 20 senior leaders will participate in this event.

There are many aspects to this complex challenge where your contributions will have an impact. This event will specifically focus on improving Energy Security, Water Security, and Coastal Resilience at Navy and Marine Corps installations and communities in the Western United States. TTX facilitators will help teams craft innovative solutions for resilience and sustainability that can be shared broadly and advance Department of the Navy climate priorities.

On Thursday, Day One, teams of experts will use scenarios to consider solutions-based opportunities, potential challenges, and means to overcome them. The teams will create goals, identify actions that incorporate mission assurance and support for the community, and focus on sustainability and greenhouse gas reductions. They will incorporate data to improve decision making and seek innovative ideas in technology, policy, and financing. We encourage the teams to think beyond resource constraints.

On Friday, Day Two, the teams will present their ideas to a cohort of senior leaders. Those executives will then identify solution-driven research programs. The executive committee's effort will build off ideas created by the teams and add potential resources and timelines for execution. The meeting will result in a plan for focused collaboration among NPS, Stanford, and the Department of the Navy toward climate goals.

We greatly appreciate you investing your time and expertise this week, and your commitment to continued action that addresses a defining issue of this century.

Sincerely,



The Honorable Meredith Berger



President Ann Rondeau



Dean Arun Majumdar

EXERCISE OVERVIEW

Themes

The tabletop exercise discussion focused on three main themes: energy security, water security, and coastal resilience. Within each theme there exists strong interdependencies, especially for energy and water (often referred to as the energy-water nexus). While these issues are global, the exercise centered on the Western United States where most participants have subject matter expertise. Additionally, practitioners can scale and apply ideas and results from a Western United States perspective to similarly suited geographies and challenges.

Facilitation

On the first day of the exercise, participants were split into groups of ten resulting in six exercise teams – two per theme. The teams worked to explore the impacts of climate change on the Navy and Marine Corps forces' mission, readiness, and warfighting capacity as well as on local communities outside the fenceline. Participants identified the status quo and known problems and challenges, mapped the solution state, and then refined likely solutions.

There was a facilitator assigned to each team who shared a scenario, provided additional context on the challenge, and injected relevant exacerbating factors. The exercise instructions directed teams to look for opportunities for collaboration across the public and private sector and suggest innovative concepts that might address the challenges through policy, data, technology, or business models. At the end of the tabletop exercise, each team presented their findings and solutions to senior leaders.



SCENARIOS: ENERGY

The effects of climate change threaten the electric power and energy infrastructure that serve Navy and USMC bases in southern California. As energy security impacts many other related infrastructure systems, including water, sewer, communications, and transportation, coordination and communication with other entities is paramount; the energy-water nexus is a key concern, particularly in the U.S. Southwest.

Facilitators worked through the following tasks in order to reach the exercise objectives.

- Establish a collective understanding of energy security and energy resilience definitions;
- Discuss results of the Energy Resilience Exercise performed in San Diego on 24-26 April 2023;
- Share summary of existing Installation Energy Plan Summaries and energy independence efforts at existing bases;
- Discuss opportunities to improve energy security and the barriers to achieving; and,
- Discuss new innovative approaches being developed commercially and potential ways to leverage recent USG investment and funding opportunities.



SCENARIOS: ENERGY

Primary Energy Scenario

Significant portions of Southern California have lost electric power. Approximately 2.5 million customers are affected, including Navy Region Southwest facilities in the San Diego area. Industry experts and government officials have determined that the wide-area outage is not the result of a deliberate attack, characterizing it as a blackout (or Black Sky) event. It was caused by a bulk power system cascading collapse due to a combination of factors, including wind damage, a series of operational and system failures and errors, and considerable damage to large power transformers. Initial assessments suggest that the outage will last for approximately two additional weeks. Restoring power under “black start” conditions will require carefully calibrated pacing and sequencing to avoid further system damage. Installations will also require time to perform assessments prior to re-energizing facilities.

Exacerbating Factor – Communications

The high winds have damaged numerous local area cell towers, so only on-base calling and limited satellite communications and battery-powered emergency radios are available. It has been reported that cell tower repairs are underway, but it may be a week or more before any stationary cell towers are fully operational. Emergency operations rely heavily on cell phone communications to meet demand response, including coordination with Mission Essential Personnel who reside in a large area of southern California not limited to San Diego. Communications must be restored.

Exacerbating Factor – Transportation Corridors

Forty-eight hours following the outage, major traffic corridors remain clogged throughout Southern California. Traffic is not diminished due to malfunctioning traffic lights, car abandonment on roadways, panic supply runs, and residents attempting to evacuate the area. Local authorities are imploring residents to stay off roadways, but the area is gridlocked. Moving fuel, food, materials, and personnel to support emergency actions is challenging. Many installations are already reporting depleted food, water, and fuel supplies.

SCENARIOS: WATER

Climate change is endangering water security by reducing the availability of water and making this life preserving resource more variable and unpredictable. These effects are especially pronounced in the Southwest (i.e., California, Nevada, and Arizona), where climate change is expected to exacerbate drought, extreme heat, flash flooding, and related natural disasters. These risks threaten the ability for military installations to remain mission capable and the livelihood of civilian communities that rely on the same water sources.

Facilitators worked through the following tasks in order to reach the exercise objectives.

- Establish a collective understanding of water security and water resilience definitions;
- Develop a better understanding of previously identified problem areas and gaps;
- Share existing water security and water resilience efforts at installations and in communities; and,
- Discuss opportunities to improve water security and their barriers.



SCENARIOS: WATER

Primary Water Scenario

The US Southwest is experiencing extreme drought that has persisted for 5+ years. Regional water resources, including external and locally derived sources, are well-below historical records. Rationing limited water supplies has been common practice for months. Several communities and military installations have lost access to primary groundwater aquifers due to over extraction and are forced to procure water from other sources, including secondary aquifers that have reduced water quantity and quality and emergency sources including bottled water. Some communities are experiencing a loss of primary water resources for more than 5 days.

Exacerbating Factor – Flooding

While drought persists, an atmospheric river the size and scale of the Great Flood of 1862 is impacting CA (45% of the overall rainfall for the season). The dry conditions followed by the storm are leading to extensive flooding and triggering massive mudslides. Regional dam and levee failures are expected, resulting in uncontrolled water flows. Enormous property damage and loss of life are expected. Unfortunately, the excessive rain will not break the drought as surface water flows are not likely to recharge groundwater aquifers to sufficient levels.

Exacerbating Factor – Competition

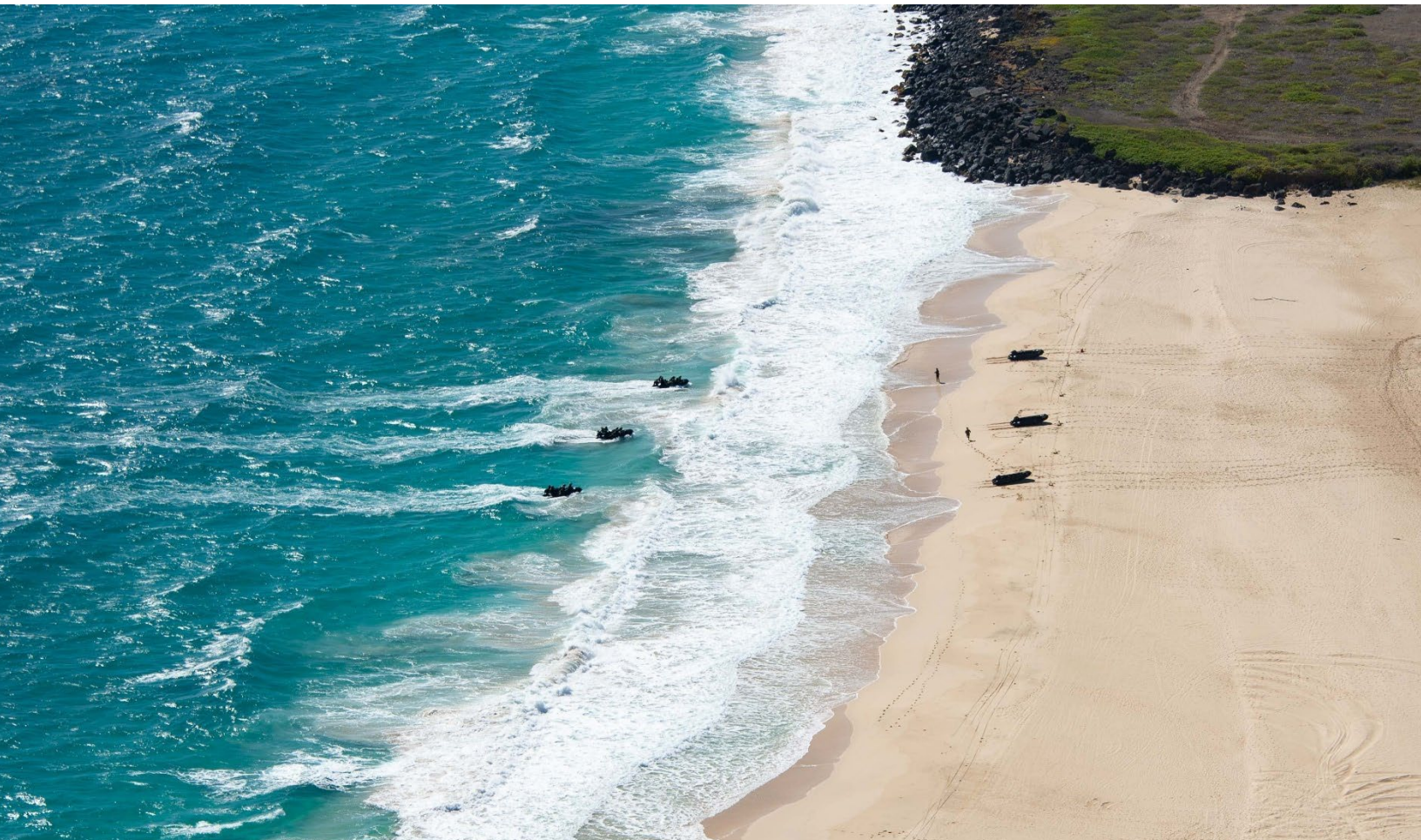
The drought has finally pushed some communities to the brink and is leading to competition for water. Tensions are building among diverse stakeholders across Southwestern states (Arizona, California, Colorado, and Nevada) due to limited water in the Colorado River basin. Similar issues are arising across central California and Arizona in communities that rely on a shared groundwater source. Stakeholders affected include but are not limited to military installations, communities, agriculture, and industrial facilities. Each stakeholder claims they need the water more than others. Some are making claims of overuse and overdrawing well past water rights provisions. Emergency rationing and management must be implemented and are expected to persist for an unknown time. The possibility of evacuation and/or strategic retreat is being discussed. The future use of this water resource is unknown.

SCENARIOS: COASTAL

Climate change alters the DON's missions, capacities, capabilities, and infrastructure worldwide. Current environmental challenges in coastal resilience for the USN and USMC include sea level rise, coastal erosion, pervasive flooding from high tide or king tide events, storm surges, land subsidence, and saltwater intrusion. The primary Coastal Resilience scenario is below.

Facilitators worked through the following tasks in order to reach the exercise objectives.

- Establish a collective understanding of coastal resilience and associated definitions;
- Develop a better understanding of the previously identified problem areas and challenges;
- Share existing coastal resilience efforts at installations and in communities; and,
- Discuss opportunities to improve coastal resilience and its challenges.



SCENARIOS: COASTAL

Primary Coastal Scenario

With the current high greenhouse gas emissions, rapid ice sheet collapse, warming oceans, global water cycle fluctuations, and underground aquifer depletion, relative sea levels have risen faster than the current projections. In the U.S., sea levels are expected to increase by 2 feet (0.6 meters) from 2000 to 2100. However, in California, specifically in San Diego, the sea level projections are more significant than the national average. Based on the highest projects, sea levels in San Diego may rise by 1.1 feet by 2030, 2.8 feet by 2050, and 10.2 feet by 2100. Secondary consequences of relative sea level rise can further impact coastal infrastructure and ecosystems. Moreover, California coastal communities rely on coastal environments and services to support diverse uses. In 2023, along the 34,000 miles of the California Coast, an estimated 200,000 people live within 3 feet of current sea levels. That estimate is expected to double by 2050.

In 2050 in the Southwest U.S., sea levels have risen to just under 3 feet (0.9 meters). Along California's coast, homes and coastal infrastructure, marine flora and fauna, and people who depend on coastal resources face the impacts of rising relative sea levels.

Exacerbating Factor – Persistent Flooding

With the increase in sea levels of about 3 feet (0.9 meters), the Southwestern U.S. coastal communities must grapple with regular and persistent coastal flooding. Nuisance flooding from frequent high tide/king tide flooding regularly impacts homes and coastal infrastructure. Nuisance flooding is disrupting marine ecosystems, coastal economic activities, and disturbances of coastal infrastructure support services for the fleet, including maintenance of dry docks, fueling, sewer, and fresh water. Additionally, with reoccurring water flows on land, saltwater intrusion has become a common challenge for Southwestern coastal communities.

Exacerbating Factor – Erosion and Deposition

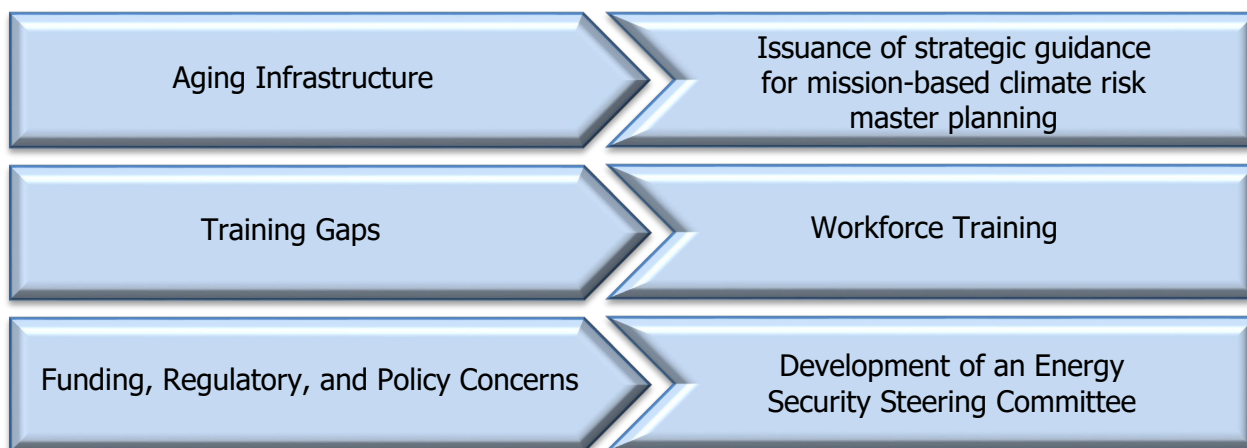
A rise in relative sea levels of about 3 feet (0.9 meters) would inundate over one-half of California's beaches and coastal areas. Damage to native marine ecosystems is a secondary impact that has resulted in subsequent consequences. Additional consequences include increased coastal erosion, which causes further damage and disruptions to coastal infrastructure and ecosystems. Accelerated coastal erosion has claimed thousands of oceanfront infrastructure and impacted the ability of ports and harbor facilities. Alternatively, sediment flows from one area to another have led to sediment deposits downstream, creating changes to water flows, infrastructure, maintenance, and dredging.

EVENT CONCLUSION

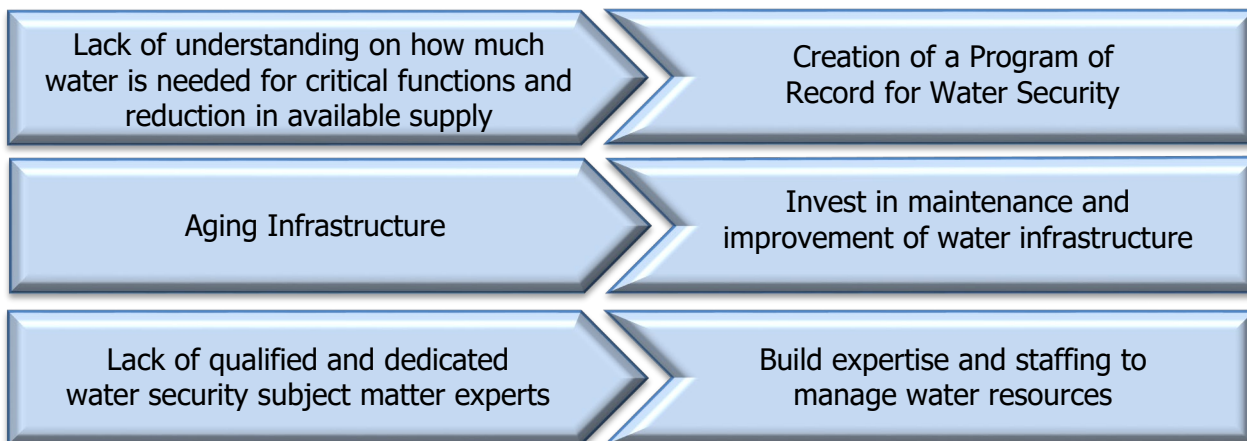
On the second day of the event each exercise team briefed their results to a group of senior leaders including Assistant Secretary Meredith Berger, NPS President Ann Rondeau and Dean of the Doerr School, Dr. Arun Majumdar.

The solution briefings contained common themes relating to strengthening community relationships, measuring critical data for improved decision making, and enabling culture changes through workforce education. More broadly, a common outcome among all teams was a deeper resolve, more effective partnerships, and commitment to action and collaboration.

The Energy Security teams identified the following challenges and solutions

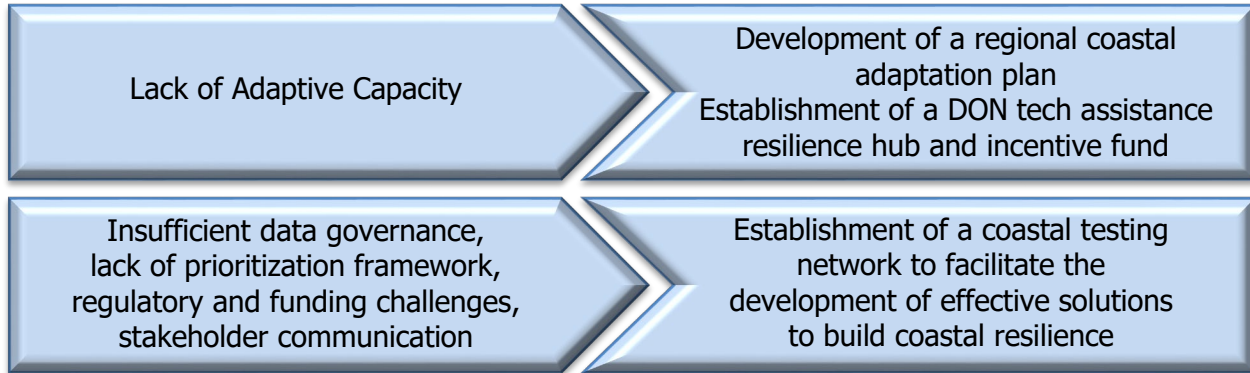


The Water Security teams identified the following challenges and solutions



EVENT CONCLUSION

The Coastal Resilience teams identified the following challenges and solutions



Following the solution briefings, various senior leaders came together for an executive summit. During this summit, leaders reviewed the challenges and solutions and workshopped multiple concepts. The group prioritized solutions and assessed how they could knock down barriers to enable innovative ideas to come to fruition. As a result of the summit, leaders walked away with a commitment to supporting relevant efforts and the applied research necessary to inform purposeful solution development.



KEY TAKEAWAYS

The following salient themes emerged from the event.

- **Climate change poses a significant threat to readiness.** Extreme climate events are increasing in frequency, are unlike anything we've experienced previously, and their impacts are long-lasting. These impacts intensify risk and expose vulnerabilities to DON installations and surrounding communities while simultaneously expanding mission set demands.
- **The DON must increase climate readiness, particularly in regions experiencing water and energy stress.** DON installations must accelerate efforts in water and energy security, as well as coastal resilience in response to these extreme events. Impacts from these topical areas are particularly acute in the U.S. Southwest.
- **Partnerships improve preparedness.** The DON should leverage its existing partnerships with academia and the private sector to better respond and prepare for upcoming climate challenges.
- **Community readiness is Navy readiness.** Working with the local communities outside the fence line is critical to developing holistic approaches that best meet the needs of the Navy and local stakeholders.
- **Addressing the climate threat requires a multi-pronged approach.** The DON needs to develop appropriate plans for climate event response, leverage empirical data on energy and water consumption across its installations, develop advisory bodies for key topical areas, and increase efforts in workforce education on the importance of conserving energy and water.



EVENT OUTCOMES

While the team will take action on many of the recommendations raised during the tabletop exercise; the DON will pursue three solutions immediately. Ninety days from the release of this After Action Report, the DON will complete coordination on a plan of action and milestones to accomplish the following solutions:

1. Establish a partnership agreement between the Department of the Navy and the Port of San Diego to add the sharing of data and testing to improve climate resilience using the Port's Blue Economy project;
2. Ensure installations have personnel identified to develop, manage, and advance their water policies with a focus on looking across the fenceline and viewing water as a shared resource; and,
3. Develop a master plan framework that directly connects climate risk with readiness and mission assurance.

