

SAN DIEGO REGION

**Military
Installation
Resilience**

FINAL

**Military Installation Resilience Transportation
Corridor Report**

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This study was prepared under contract with the San Diego Association of Governments (SANDAG), with financial support from the Office of Local Defense Community Cooperation, Department of Defense. The content reflects the views of SANDAG and does not necessarily reflect the views of the Office of Local Defense Community Cooperation.

Executive Summary

The purpose of the **Military Installation Resilience Transportation Corridor Report** (MIR Report) is to provide guidance to SANDAG, the U.S. Navy (Navy), and local and regional agencies on how to better integrate climate considerations into their processes, and safeguard long-term transportation solutions, regional resilience, and continued collaboration with the Navy to ensure naval bases remain operational in response to climate change. The resilience of Navy facilities and surrounding areas to the impacts of climate change is critical to maintaining Navy mission readiness.

Military Installation Resilience

The capability of a military installation to minimize, avoid, or adapt to and recover from the impacts of climate change.

San Diego is the Navy's most strategic port and the location for many operational and administrative headquarters. As the home port for about 20% of Navy vessels and 17% of active-duty personnel, San Diego has the second largest naval personnel concentration of any region in the country. According to the [San Diego Military Economic Impact Study \(2019\)](#), the Navy provides 354,000 military-connected jobs, including over 23,000 jobs for civilian personnel, accounting for 22% of all jobs in the San Diego region. The importance of the Navy's presence in San Diego cannot be overstated. The Military Installation Resilience report is a guideline to help local agencies and jurisdictions incorporate resilience planning and data needs of the Navy into their planning strategies.

In alignment with the 2021 Regional Plan, the Comprehensive Multimodal Corridor Plans (CMCP) are data-driven plans to reduce congestion and generate transportation choices while preserving community character and creating opportunities for enhancement projects. CMCPs promote a planning process that applies a holistic and multimodal approach and strives to achieve a balanced transportation system. Corridor Plans evaluate all travel modes and transportation facilities in each corridor to optimize system operations. Additionally, CMCPs must be complete to be eligible for certain state, local, and federal funding.

The study area for this project is shown in **Figure ES.1** on the following page. Within this study area are two CMCPs: Central Mobility Hub and Connections (CMH) and a portion of South Bay to Sorrento (SB2S). This report focuses on transportation facilities within this study area and that are key to Navy mission readiness and how they interrelate to the CMCPs in development.

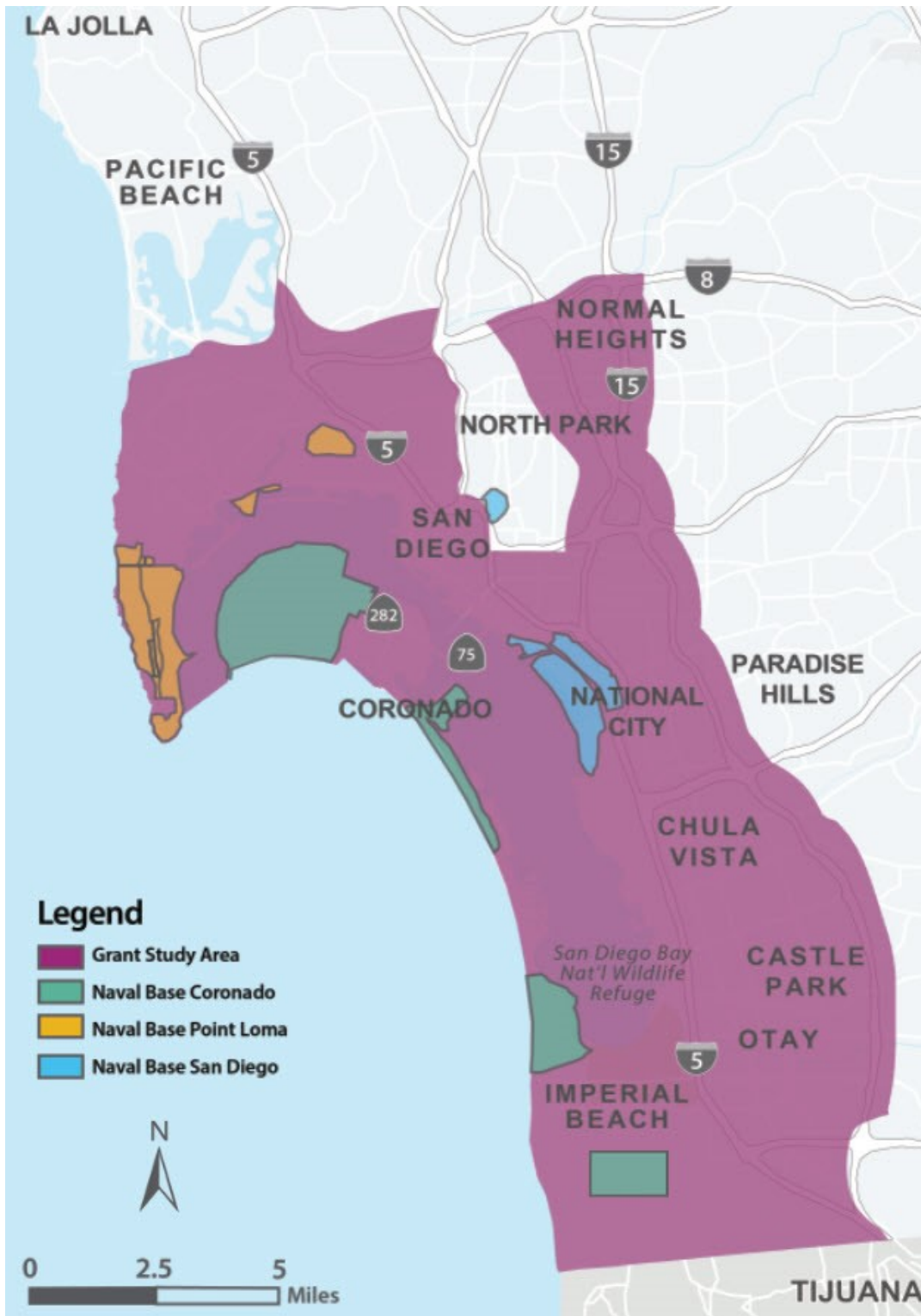


Figure ES.1 Project Study Area

In June 2020, San Diego Association of Governments (SANDAG) was awarded a grant from the Office of Local Defense Community Cooperation (OLDCC) through the Department of Defense. The grant aims to enhance the existing partnerships and collaborative efforts between SANDAG and the Navy by developing climate resilience recommendations and data sharing guidelines to encourage effective long-term transportation planning and minimize anticipated climate change impacts on Navy operations. In accordance with the grant requirements, outreach was conducted to enhance Navy participation in SANDAG forums and assess the concerns of Navy installations and surrounding communities.

This report is divided into three sections with each section consists of technical documents prepared to document the process undertaken through this grant to identify, evaluate, and develop potential climate adaptation considerations for integration into transportation facility planning. **Table ES.1** lists deliverables and the report sections where they can be found. They are described in context and development herein and make up the body of the Military Installation Resilience Transportation Corridor Report.

Table ES.1 Overview of Grant Deliverables

Section	Deliverable
Section 1: Climate Resilience, Vulnerability Assessment, and Adaption Strategies	<ol style="list-style-type: none"> 1. Climate Resilience Assessment 2. Vulnerability Assessment 3. Adaption Planning and Design Considerations
Section 2: Data Sharing and Collaboration with Military Stakeholders	<ol style="list-style-type: none"> 4. Data Sharing and Collaboration with Military Stakeholders
Section 3: Stakeholder Engagement and Communications Strategy with Evaluation and Summary	<ol style="list-style-type: none"> 5. Stakeholder Engagement and Communications Strategy with Evaluation and Summary

Section 1 combines the first three deliverables and summarizes the analysis of climate stressors on key transportation facilities as well as potential adaptation strategies to help mitigate potential impacts. Section 2 outlines the proposed data sharing framework between SANDAG and the Navy to ensure both agencies use the most current datasets in their respective analyses. Section 3 summarizes the outreach and surveys conducted with Navy personnel, families and surrounding communities that will aid in communication efforts with key stakeholders in future iterations of this Grant.

Methodology

Temperatures are expected to increase, sea levels are expected to rise, wildfire risk will likely increase as the climate warms, and precipitation changes will include wetter winters and more frequent and severe droughts. Potential impacts increase risk and may adversely affect military installations, transportation facilities, and neighboring communities. As SANDAG and other regional jurisdictions develop climate change adaptation plans and strategies, it is important to consider how these plans and developments interact and potentially affect mission readiness for the naval bases in our region. This report outlines how to identify climate stressors and key transportation facilities within CMCPs which are vital to Navy mission readiness.

Collaboration is essential to developing a cohesive and inclusive climate adaptation strategy. To identify the risks, gaps, and challenges to protecting Navy mission readiness an existing document review was conducted. This was key to identifying where there was opportunity to develop plans to protect access to Naval bases. Additionally, existing documentation review identified the data sets and models’ other jurisdictions have used to analyze the effects of climate change. (See Section 1.1 for a complete list of

models and data sets used in this report.) Collaboration between SANDAG, the Navy, and HNTB developed a list of climate stressor of most immediate concern and transportation facilities key Navy mission readiness, see **Table ES.2** and **Table ES.3** for the complete lists.

Identifying the correct data sets and models as the best available science is key to making sure the analysis of the effects of climate change is accurate and relevant. A Peer Review Process (PRP) was conducted to verify the data sets and models were current. Utilizing a joint review process, which included multiple jurisdictions and partner agencies, confirmed that relevant data and timelines would be analyzed and would be consistent with other studies in the region. The PRP confirmed the best available science was being used and an analysis of climate stressors on the selected transportation network was conducted using ArcGIS Online (AGOL) and ArcGIS Pro. Through the analysis of the climate stressors on the key transportation facilities vulnerability profiles were developed which identified the most vulnerable transportation facilities that could potentially affect Navy mission readiness, see **Table ES.4** for a summary of key facility

Once vulnerability profiles were defined, adaptation strategies were developed using the three types of adaptation responses: protection, retreat, and accommodation. Three respective matrices were developed to identify strategies that could work for each vulnerable transportation facility. The matrices include the jurisdictions that should be included in collaborative efforts. The intent being the matrices will assist with the collaboration necessary to work with not only SANDAG and the Navy but partner agencies and jurisdictions to coordinate plans and solutions to protect the transportation network supporting access to the Naval bases. In addition to identifying potential funding opportunities, the MIR Report also offers a guide to developing an adaptation process, see **Figure ES.5** for an example of an adaptation process.

As has been demonstrated, the importance of current and relevant data cannot be overstated. Sharing current and relevant data between SANDAG and the Navy is central to effective analysis and the role the Navy personnel and their families play in our region. Currently there is not a system in place for consistent sharing of this information and data resulting in potentially incomplete analysis of transportation needs of the Navy. The MIR Report identifies a framework for regular and continuous data sharing between the two agencies, including a standardized data request form and establishing primary points of contact for each agency. Establishing a data sharing framework for annual and semi-annual exchange of data will aid in refining regional transportation forecasts and housing and population estimates.

Continuous public outreach was conducted throughout the development of the MIR Report to communicate the importance of this project to Navy personnel, the communities surrounding the Navy, and key stakeholders. These communities were engaged through a variety of methods, including standing community planning group meeting participation, CMCP meeting participation, and Military Working Group agency briefings. The Strategic Communications plan establishes a process, including for communicating with stakeholders and communities with transparent and consistent messaging throughout the development the planning process.

Recommendations

Future funding options are going to be dependent on the development of CMCPs. As SANDAG and other regional agencies begin developing resilience and adaptation strategies to incorporate into CMCPs, it is essential they consider the needs of the Navy and how their corridor plans interact with and affect access to the naval bases. The intent of the MIR Report, as well as any future phases of this report, is to use this report as a reference to aid the regional governing agencies to assessing the needs of the Navy while developing climate adaptation solutions as part of the CMCP process. This report should be referenced early in the development of a CMCP, to assess whether there are opportunities to address the needs of the Navy as well as the needs of the corridor. The MIR Report identifies areas key to Navy mission readiness most at risk of climate disasters, the vulnerability profiles and interactive story map on the SANDAG AGOL website are tools SANDAG and Navy planners have access to aid in the collaborative process.

Early and continuous collaboration is the key to ensuring the Navy remains mission ready as the region develops resilience and adaptation plans to combat climate change. The MIR Report should be used as a guide to initiating conversations and alliance between SANDAG, the Navy, and partner agencies. Maintaining open lines of communication between SANDAG and the Navy is key to making sure all parties have the information they need to make informed, and data driven decisions.

Section Summaries

Section 1. Climate Resilience, Vulnerability Assessment, and Adaptation Strategies

The San Diego Military Installation Resilience Project developed a process to analyze how top climate impacts may affect key transportation facilities and how these impacts are considered in the SANDAG planning and design processes for regional efforts to enhance regional resilience. **Figure ES.2** illustrates the process that was followed to compile the Military Resilience Transportation Corridor Report.

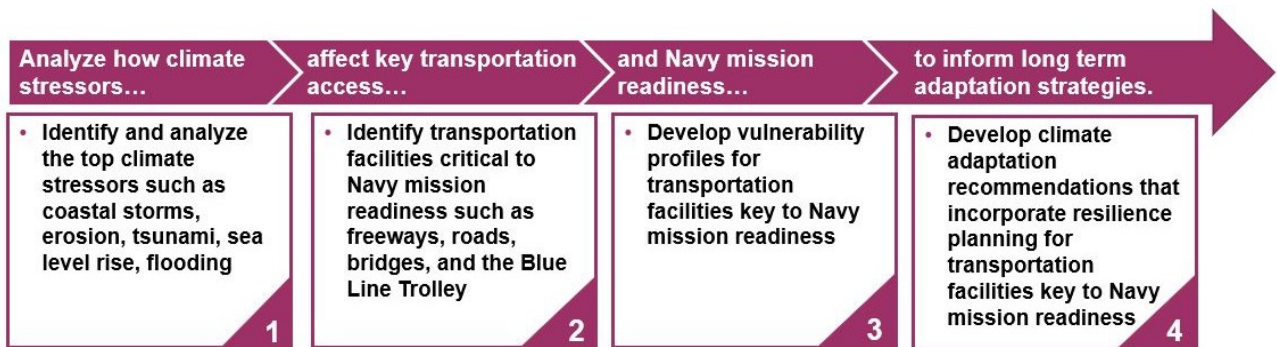


Figure ES.2 Military Resilience Assessment Process

Each step of the Military Resilience Assessment Process is further described in the three subsections of Section 1 as follows:

Section 1.1: Steps 1 and 2 – Climate Resilience Assessment memo

- Describes the collaboration between SANDAG, the Navy, and HNTB.
- Identifies climate stressors that may present the greatest threats to base access.
- Identifies the key transportation facilities the bases rely on to stay mission ready.

Section 1.2: Step 3 – Vulnerability Assessment memo

- Summarizes and compiles the analyses of potential impacts the top climate stressors may have on key transportation facilities.

Section 1.3: Step 4 – Adaptation Planning and Design Considerations memo

- Identifies potential adaptation strategies for the San Diego Region.
- Summarizes and discusses potential strategies as they apply to the key transportation facilities and the bases they serve.

1.1 Climate Resilience Assessment

The Climate Resilience Assessment memo summarizes the review of existing documentation, reports, and analyses of resilience efforts in the San Diego Bay region. This review identifies the strengths, opportunities, challenges, gaps, and risks in the existing resilience planning efforts related to potential impacts to Navy operations and mission readiness, Navy personnel and families, and surrounding communities. On the following page, **Table ES.2** lists the top five climate stressors, and **Table ES.3** lists the key transportation facilities serving each of the bases, which were identified in collaboration between SANDAG, the Navy, and HNTB.

Table ES.2. Top Climate Stressors

	Coastal Storms/ Storm Surge
	Erosion
	Tsunami
	Flooding
	Sea Level Rise

Table ES.3 Key Transportation Facilities Critical to Navy Mission Readiness

Naval Base San Diego	<ul style="list-style-type: none"> • I-5 • CA-15 • Harbor Drive • Pacific Highway • 32nd Street • Main Street 	<ul style="list-style-type: none"> • 8th Street • 28th Street • Harbor Drive bridges <ul style="list-style-type: none"> ○ Chollas Creek ○ Paleta Creek • Blue and Green Line Trolleys
Naval Base Coronado	<ul style="list-style-type: none"> • I-5 • SR 75/Coronado Bay Bridge • SR 282 (3rd Street) 	<ul style="list-style-type: none"> • 3rd Street • Ocean Boulevard • 13th Street • Palm Avenue
Naval Base Point Loma	<ul style="list-style-type: none"> • I-5 • I-8 • Pacific Highway (OTC area) • Catalina Boulevard 	<ul style="list-style-type: none"> • Rosecrans Street • Nimitz Boulevard • N. Harbor Drive

Additionally, the Climate Resilience Assessment recommends models and datasets for analyzing impacts of the climate stressors listed in **Table ES.2** on the transportation facilities listed in **Table ES.3**. The Climate Resilience Assessment uses the following data sources, which are consistent with other resilience studies in the San Diego Region:

- The Coastal Storm Modeling System (CoSMos) v.3.0 for Southern California/San Diego County
- State of California Sea Level Rise Guidance (Ocean Protection Council 2018)
- Caltrans D-11 Climate Change Vulnerability Assessment Map
- Cal-Adapt
- Federal Emergency Management Agency (FEMA)
- San Diego County Tsunami Inundation Maps
- SANDAG Regional Shoreline Monitoring Program

1.2 Vulnerability Assessment

The Vulnerability Assessment memo profiles transportation facilities key to Navy mission readiness that are vulnerable to climate change impacts. ArcGIS Pro and ArcGIS Online (AGOL) were used to map and analyze potential impacts to the transportation network supporting Naval bases in San Diego, Coronado, and Point Loma; Navy personnel and families; and surrounding communities. The maps and analyses highlight locations in the transportation network most vulnerable to the top climate stressors: coastal storms and storm surge, erosion, sea level rise, flooding, and tsunamis.

A Peer Review Process (PRP) was held to review the models, tools, and datasets identified in the Climate Resilience Assessment memo. The intent of the PRP process was to ensure the best available science and current datasets were being used to analyze the selected climate stressors. The PRP meeting included representatives from SANDAG, the Navy, Caltrans, the Port of San Diego, the San Diego County Regional Airport Authority, and the cities of San Diego, Imperial Beach, and Coronado.

This memo develops vulnerability profiles for each base and the key transportation facilities serving each base. The profiles identify potential impacts from coastal storms and storm surge, erosion, sea level rise, flooding, and tsunamis. **Table ES.4** lists the key transportation facilities critical to maintaining Navy mission readiness and identifies the top climate stressors that may impact them. Vulnerability profiles also include potential adaptation strategies, described in greater detail in Section 1.3: Adaptation Planning and Design.

Table ES.4. Summary of Key Transportation Facilities Potentially Affected by Climate Stressors

Climate Stressor	Key Transportation Facilities																				
	I-5	I-8	CA-15	SR 75/Coronado Bay Bridge	SR 282 (3rd Street)	8th Street	13th Street	28th Street	32nd Street	Catalina Boulevard	Harbor Drive	Main Street	Nimitz Boulevard	N. Harbor Drive	Ocean Boulevard	Pacific Highway	Rosecrans Street	Blue Line Trolley	Chollas Creek Bridge	Paleta Creek Bridge	
Coastal Storm/ Storm Surge	•	•		•	No Impacts	•	No Impacts	•	•	No Impacts	•		•	•	•	•	•	•	•	•	•
Erosion				•												•					
Sea Level Rise	•	•		•	No Impacts	•	No Impacts	•	•	No Impacts	•		•	•	•	•	•	•	•	•	•
Flood	•	•		•										•	•		•				•
Tsunami			•	•							•			•	•			•	•	•	•

Interactive and stagnant maps were developed using ArcGIS Pro and AGOL. The maps and analyses show the extent to which each stressor affects each key transportation facility. For each base, the vulnerability analysis used the following data sets to develop each profile and map:

- 100-year storm or 1% storm (CoSMoS)
- Erosion without shoreline mitigation (CoSMoS)
- Year 2050, sea level rise projections of 75 cm or 2.5 feet (CoSMoS)
- Year 2100, sea level rise projections of 200 cm or 6.6 feet (CoSMoS)
- FEMA Flood Hazard Layer 100-year/500-year flood
- Tsunami data from University of Southern California Tsunami Research Center

Figure ES.3 is an example of the type of analysis conducted showing the impacts of sea level rise in conjunction with a 100-year storm event, a worst-case scenario. The 2050- and 2100-year time horizons were used to show the greatest extent of flood.

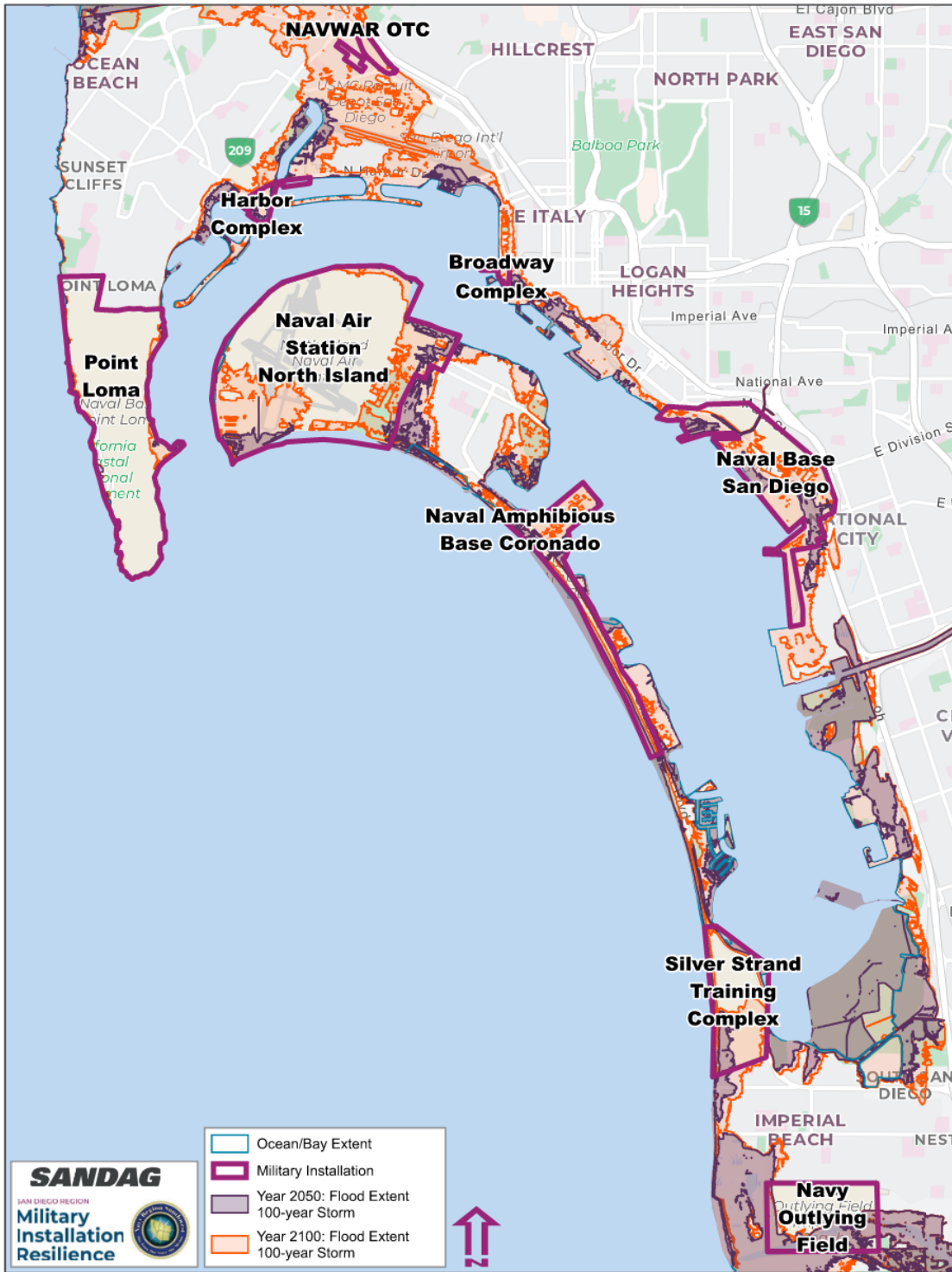


Figure ES.3 Year 2050 and 2100 Flood Extent During a 100-Year Storm Event

1.3 Adaptation Planning and Design Considerations

The Adaptation Planning and Design memo summarizes potential climate change adaptation strategies (policies, programs, and projects), planning considerations, and best practices for long-range resilience planning. Potential strategies focus on protection of key transportation facilities critical to Navy mission readiness within the SB2S and CMH CMCP planning areas. This memo looks at three different types of adaptation responses: **accommodate**, **protect**, and **retreat** (see **Figure ES.4** below); and outlines regional, general, and facility-specific strategies, describing how each could be applied to help protect the identified key transportation facilities.

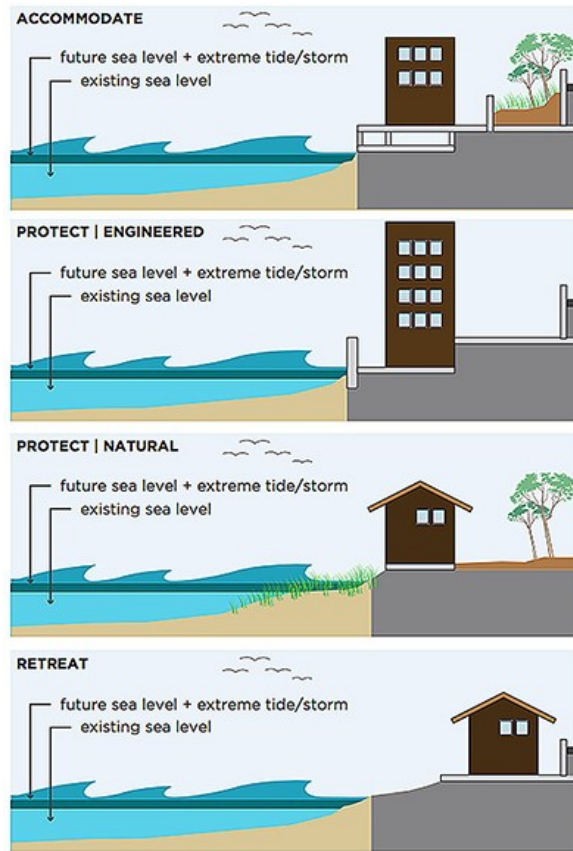


Figure ES.4 Adaptation Responses
(Source: *SF Planning*)

Matrices for each strategy have been developed to highlight adaptation strategies are already being implemented in the San Diego region. These matrices identify which jurisdictions and bases would benefit from the adaptation strategy identified.

With more than 10 different agencies and jurisdictions as well as with three bases in the SB2S and CMH CMCPs, ongoing collaboration is necessary to maintain an inclusive and considerate approach to the needs and priorities for each agency, jurisdiction, and base. The Adaptation Planning and Design Considerations memo outlines potential resilience planning implementation considerations, constraints, opportunities, and funding opportunities to facilitate collaboration between agencies. The memo is intended to serve as a guiding tool to initiate future discussions when considering cross-jurisdictional long-range transportation planning needs and incorporating the needs of the Navy.

The following are a few guiding principles:

- Long-term resilience planning and implementation of adaptation strategies for key transportation facilities in the San Diego region are critical to maintaining **Navy mission readiness**.
- Adaptation planning and strategies should prioritize **social equity, environmental justice**, and the **needs of vulnerable communities**.
- Adaptation strategies should prioritize **protection of coastal habitats** and **public access**.
- Adaptation strategies should consider the **unique characteristics, constraints**, and **values** of existing water-dependent infrastructure, ports, and public-trust users.
- Allowances for **phased implementation** of realignment and relocation projects must be given to make incremental changes in transportation networks so that access to and along the coast can be maintained while coastal hazards are addressed over the long term.
- Transportation networks must be designed to function even if the highest projected sea-level rise amounts occur, which requires retrofitting existing transportation infrastructure (as needed) and **building redundancy into the transportation system**.
- An **adaptive management approach** must be applied to maintain flexibility and to adjust strategies in the face of uncertain conditions and ever-changing climate stressors.
- An **informed and iterative approach to adaptation** founded on the best available science, and data monitoring in the San Diego region must be used to reduce risks from key climate stressors.
- A process to select the **best adaptation strategies in collaboration with partner agencies** based on criteria and a step-by-step approach to decision-making should be adopted, as illustrated in **Figure ES.5** below.



Figure ES.5. Adaptation Process Guideline

Lastly, this memo provides an overview of partner agency roles and responsibilities, guiding principles, and planning goals to help foster consensus between regional agencies and the Navy. As the region continues to develop, consideration and integration of the Navy mission readiness into the region’s transportation and resilience planning efforts is imperative.

Section 2. Data Sharing and Collaboration with Military Stakeholders

SANDAG uses a variety of data sources to create a regional and subregional growth forecast, yearly population, housing estimates, and periodic employment estimates for San Diego County and its subregional areas. These data are also used in research products and publications to inform decision making in the region. An important component of these datasets is from the local Naval installations and

pertains to the active-duty Navy and civilian/contractor population in the county and their household. It is important to consider and understand the Navy's critical resilience efforts and minimize impacts to military operations; therefore, SANDAG has partnered with the Navy to establish a framework to guide and enhance collaboration between the two agencies.

Currently, SANDAG compiles and integrates military-centric data into regional planning efforts. These data come from a variety of publicly available data sources as well as from Naval representatives through periodic outreach. However, data gathered through ad-hoc data requests and from multiple sources can lead to inconsistencies that could impede accurate development of regional recommendations to support Navy operations and minimize impacts to mission readiness. The current process is time consuming and staff turnover at either SANDAG, or the Navy can also make the process difficult.

The proposed framework will streamline this process and make data deliveries to SANDAG more regular and uniform for Naval installations in the region. This will allow the Navy and SANDAG to improve collaboration on data products, research, and prioritize transportation improvements that support Navy installations to maintain operations while also supporting neighboring communities.

Section 3. Stakeholder Engagement and Communications Strategy with Evaluation and Summary

During the planning stage of engagement activities, a Strategic Communications Plan (Plan) was developed to present and outline the approach to stakeholder outreach and public engagement for the OLDCC Grant for the project. This Plan served as a road map for stakeholder education and engagement, outlined the outreach approach and implementation plan, and defined the diverse outreach tools and materials used to facilitate engagement. In addition, outreach methods were established based on the best and most effective way of reaching stakeholder groups in the study area. These outreach methods included the development of project collateral materials, hosting of a Partner Agency Workshop, participation in CMCP meetings, and development of community planning group and agency briefings. The main objectives of this outreach strategy were to:

- Effectively communicate and present engaging information about the Grant's objectives and expected outcome to its diverse audience.
- Develop and administer programming to collect and analyze stakeholder input on climate resilience solutions focusing on impacts to Navy operations and mission readiness.
- Analyze and summarize stakeholder input.

Stakeholder groups received project collateral materials, which were designed to educate them about the Grant and to also provide the project team's contact information as another outlet for collecting public input. All messaging was developed in close coordination with SANDAG and the Navy, keeping in mind sensitive community issues and active projects. These materials included talking points, a Fact Sheet, and presentations.

The series of meetings outlined in the Plan were held in collaboration with the Navy. This coordination began prior to introducing the project to the public. The internal meetings consisted of a Partner Agency Workshop, a military group focus discussion, and a Peer Review Process meeting — in addition to resilience planning and potential adaption strategies discussions. Meeting objectives included discussing key information about the Grant, receiving valuable input and direction for the Grant, and establishing open communication and constant collaboration with all parties. The outcome of this collaboration allowed the project team to refine the Grant's focus including the definition of target areas and development key messaging for all outreach activities.

As a result of these meetings, the project team was able to identify:

- Key climate stressors that may affect the community and focused Navy assets

- Critical modes of access and transportation to three major Naval Bases
- Expected outcomes of climate resilience work
- Perceived challenges
- Potential obstacles of resilience planning, best practices, and challenges perceived with data sharing
- Best community outreach approach

The identification of climate stressors (coastal storms and storm surge, erosion, sea level rise, flooding, and tsunamis) and critical modes of access and transportation (freeways, roads, bridges, and Blue Line Trolley) were key to refine the Grant's focus. This process allowed the project team to focus specifically on developing vulnerability profiles for transportation facilities key to Navy mission readiness and designing climate adaptation recommendations that incorporated resilience planning for these transportation facilities.

During the public outreach phase, key stakeholders were engaged through a variety of methods, including standing community planning group meeting participation, CMCP meeting participation, and Military Working Group agency briefings. During these outreach activities, stakeholders were provided information about Grant objectives, top climate stressors being analyzed, Navy facilities critical to the study, data sharing goals, and the Grant's next steps. Stakeholders provided valuable input that will be key for the implementation of the next phase of the Grant. During the participation in community planning group meetings, the outreach team coordinated with six groups to share an informational item with the group and hold a live discussion with all the attendees. Stakeholders were able to ask questions about the project and receive live answers. A total of 126 stakeholders were engaged during this outreach effort.

Next Steps – OLDCC Grant: Phase II

In Phase II of SANDAG's Military Installation Resilience project, we will continue coordination with the Navy and the Department of Defense in implementing strategies to improve climate resilience and safeguard mission readiness at San Diego-area military installations. In addition to our collaboration with the military, SANDAG will also work with a consultant to advise and prepare on best approaches to addressing resilience planning relating to military bases. To ensure consistency across the region's major jurisdictions, SANDAG will also continue its collaboration on the project with the City of San Diego and Caltrans District 11 in its transportation infrastructure improvement projects under this umbrella.

SANDAG will first select an appropriate consultant for this project, and will identify stakeholders from local jurisdictions, public agencies, and parallel project efforts that could be leveraged to support San Diego Military Installation Resilience efforts. Working alongside the consultant, the City of San Diego, Caltrans, and appropriate stakeholders, SANDAG will leverage existing Military Working Group meetings to provide project updates, encourage regional collaboration, and to solicit feedback on project activities and deliverables, while also engaging other working groups when necessary. To successfully complete resilience planning for military installations, SANDAG will collect data on various aspects of current efforts at military installations as well as adjacent data (for example, climate, land use, and transportation planning) while incorporating these data into SANDAG's regional models for travel behavior, corridor congestion, and facility inventory. As part of this data collection, SANDAG will work with its partners in the Navy to organize a framework for long-term ongoing data sharing through SANDAG's anticipated Open Data Portal.

Once relevant data are compiled, SANDAG will review existing and newly collected data to form mitigation and adaptation plans. Planning for mitigation will consist primarily of transit demand management strategies in existing and potential new corridors. SANDAG will identify such corridors and plan for outreach, funding, and implementation. Adaptation planning will include a vulnerability profile review of high-risk corridors, including Pacific Highway, N. Harbor Drive, and SR-75/SR282. SANDAG will develop a list of appropriate solutions and corridor improvements while taking into consideration engineering project standards, funding, and overall resilience design. Once complete, SANDAG, along with the selected consultant, will draft, publish, and present a Consolidated Project Corridor Climate Adaptation Solutions Report for use and review by local jurisdictions, stakeholders, and SANDAG working groups and committees.

Table of Contents

Executive Summary	i
Methodology	iii
Recommendations	iv
Section Summaries	v
Next Steps – OLDCC Grant: Phase II	xiii
Section 1	1
1.1 OLDCC Climate Resilience Assessment Memo	3
Purpose	3
Background	3
Existing Document Review	4
Naval Base San Diego (NBSD)	6
Naval Base Coronado (NBC)	8
Naval Base Point Loma (NBPL)	9
Resilience Planning	10
Recommendations	13
Attachments	16
Vulnerability Assessment Technical Memo	18
Executive Summary	18
Purpose	19
Data and Tools for Climate Resilience Planning	19
Naval Base Descriptions	22
Vulnerability Profiles	28
Attachments	61
Adaptation Planning and Design Considerations Technical Memo	82
Executive Summary	82
Purpose	83
Climate Change Adaptation Strategies	83
Protection Strategies	84
Accommodation Strategies	88
Retreat Strategies	91
Resilience Planning Implementation Considerations	92
Best Practices for Conflict Resolution, Collaboration, and Consensus Building	95
Attachments	97
Section 2	112

Data Sharing Framework	114
Executive Summary	114
Introduction.....	115
Purpose and Need	115
Data Sharing Framework and Timeline.....	117
Future Considerations	119
Attachments.....	121
Section 3	127
3. Stakeholder Engagement and Communications Strategy with Evaluation, and Summary (Task 2) ..	129
3.1 - Subtask 2.5: Strategic Communications Plan.....	129
3.2 - Subtask 2.1: Coordination and Support from Caltrans and Local Jurisdictions.....	131
3.3 - Subtask 2.2: Comprehensive Multimodal Corridor Plan (CMCP) Meetings	131
3.4 - Subtask 2.3: Regional Resilience Stakeholder Engagement	131
3.5 - Subtask 2.4: Strategic Communications Workshop.....	133
3.6 - Subtask 2.6 Agency Briefings	137
Attachments.....	138

Section 1

Climate Resilience, Vulnerability Analysis, and Adaptation Strategies

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To: Sarah Pierce, SANDAG Associate Regional Planner
From: Tami Podesta, HNTB Senior Project Manager
Date: February 24, 2021
Re: Climate Resilience Assessment Memo

1.1 OLDCC Climate Resilience Assessment Memo

Purpose

The purpose of this memo is to summarize the review of existing documentation, reports, and analysis of resilience efforts in the San Diego Bay area and identify the strengths, opportunities, challenges, gaps, and risks related to impacts to Navy operations and mission readiness, Navy personnel and families and surrounding communities. Collaboration between San Diego Association of Government (SANDAG), the Navy, and HNTB has determined the key climate stressors which present the greatest, most immediate risks to Naval Operations in San Diego, as well as critical transportation assets key to maintaining mission readiness.

Background

In July 2020, SANDAG was awarded a grant from the Office of Local Defense Community Cooperation (OLDCC) [formerly the Office of Economic Adjustment (OEA)] to incorporate climate resilience considerations into the Central Mobility Hub (CMH) and Connections Comprehensive Multimodal Corridor Plan (CMCP) planning effort. The grant aims to enhance the existing partnerships and collaborative efforts between SANDAG and the Navy by developing climate resilience recommendations and data-sharing guidelines to encourage effective long-term transportation planning and minimize potential future impacts on Navy operations. **Figure 1** includes a breakdown of the OLDCC grant goals and how they align with SANDAG's CMCP efforts. The grant requires extensive outreach to enhance Navy participation in SANDAG forums—such as the San Diego Regional Military Working Group—to address the concerns of Navy installations and their surrounding communities.

The resilience of Navy facilities and surrounding areas to the impacts of climate change is critically important to ensuring that the Navy remains mission ready. The San Diego Region Report, prepared as part of California's Fourth Climate Change Assessment, notes that temperatures are expected to increase, sea levels are expected to rise, wildfire risk will likely increase as the climate warms, and precipitation changes will include wetter winters and more frequent, severe droughts. The OLDCC grant will ensure these climate change impacts are considered in the SANDAG planning and design process for the CMCP efforts currently under way to ensure that long-term transportation solutions enhance regional resilience and maintain Navy mission readiness.

Office of Local Defense Community Cooperation Grant Goals
<ul style="list-style-type: none"> • Add a strong resilience component on key transportation corridors in the San Diego region, supporting the SANDAG Comprehensive Multimodal Corridor Plan (CMCP) efforts
<ul style="list-style-type: none"> • Develop business processes and protocols for data and information sharing between SANDAG and Navy Region Southwest
<ul style="list-style-type: none"> • Support sustaining the Navy’s mission readiness and resilience towards implementing the National Defense Strategy

Figure 1. OLDCC Grant Goals

United States Navy

San Diego is the Navy’s most strategic port and the location for numerous operational and administrative headquarters, including Naval Special Warfare Command (oversight and training of Sea, Air and Land Forces (SEALS)), the Navy’s Third Fleet (operational control of all ships and aircraft), Naval Surface Forces (oversight of all surface ships in the Navy), Naval Air Forces (oversight of all aircraft and aircraft carriers in the Navy), Navy Region Southwest (administrative responsibility for all bases in six states), Naval Information Warfare Command (headquarters for the design and production of all Navy command and control systems), Naval Medical Forces Pacific (all western hospitals, clinics, and laboratories), and Naval Surface and Mine Warfare Development Command (training and doctrine headquarters). San Diego is also the operational home to numerous Carrier Strike Group headquarters and Expeditionary Strike Group, each led by an Admiral. As the home port for about 20% of Navy vessels and 17% of active-duty personnel, San Diego has the second largest naval personnel concentration in the country.

Military Installation Resilience

The term “military installation resilience” means the capability of a military installation to avoid, prepare for, minimize the effect of, adapt to, and recover from extreme weather events, or from anticipated or unanticipated changes in environmental conditions, that do, or have the potential to, adversely affect the military installation or essential transportation, logistical, or other necessary resources outside of the military installation that are necessary in order to maintain, improve, or rapidly reestablish installation mission assurance and mission-essential functions.

Existing Document Review

Existing studies and analyses have been reviewed to identify potential climate threats to operations and mission readiness for the following Navy bases:

- Naval Base San Diego
- Naval Base Coronado
- Naval Base Point Loma

Climate Stressors

A review of existing studies and analysis determined the following climate stressors and potential hazards present potential risks to Navy mission readiness:

- Coastal storms/storm surge

- Erosion
- Tsunami
- Sea level rise
- Flooding
- Drought
- Earthquake/Liquefaction
- Landslide
- Terrorism
- Wildfire/structure fire
- Hazardous/nuclear materials release
- Dam failure

Through collaboration between SANDAG, the Navy, and HNTB, the climate stressors shown in **Figure 2** have been identified as the greatest and most immediate threats to Navy mission readiness. Recent climate events such as storms and hightides have affected existing transportation facilities limiting access to Naval bases and with growing threats due to climate change, the analysis of these stressors to the region is crucial to maintaining Navy mission readiness.

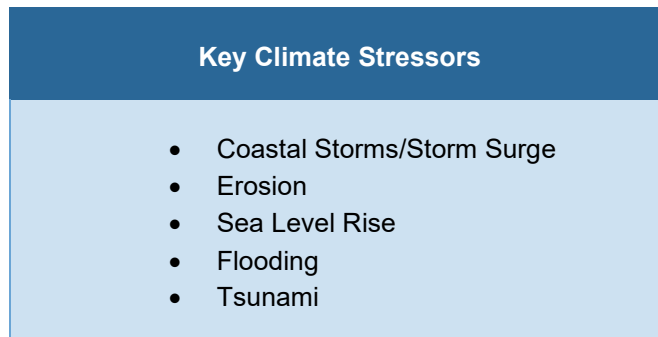


Figure 2. Key Climate Threats to Naval Operations and Mission Readiness

Critical Transportation Networks

Review of existing studies and analysis, specifically the Military Multimodal Access Strategy (2020), identified key transportation facilities to Naval operations. **Table 1** summarizes the highways, roadways, bridges, and transit facilities that are critical to maintaining mission readiness. Through a Partner Agency Workshop (January 21, 2021) and a focused discussion (February 5, 2021), SANDAG, the Navy, and HNTB identified the transportation facilities which will be analyzed as part of this grant. Detailed descriptions of the key naval facilities at each base and the critical transportation facilities that serve each base is provided in the following sections.

Table 1. Transportation Facilities Key to Navy Mission Readiness

Facility Type	Facility Name
Freeways:	I-8 I-5 SR 75 SR 282
Roadways:	N. Harbor Drive Harbor Drive 32 nd Street Pacific Highway (Broadway Complex) Pacific Highway (Old Town Complex) Rosecrans Street Nimitz Boulevard Catalina Boulevard
Bridges:	Chollas Creek (Harbor Drive) Paleta Creek (Harbor Drive) Coronado Bay Bridge (SR 75)
Transit:	Blue Line Trolley Green Line Trolley Ferry Terminals

Naval Base San Diego (NBSD)

Key Naval Facilities: 32nd Street Facility and Broadway Complex

The 32nd Street Facility is located between Main Street and the San Diego Bay, south of Downtown San Diego and the Barrio Logan community, and west of National City. NBSD has 12 piers and is the homeport to 61¹ Navy ships, which represents the largest concentration of Navy surface vessels on the west coast. The 32nd Street Facility also is home to seven ships of the Navy’s Military Sealift Command, two Coast Guard cutters, several research and auxiliary vessels, and over 200 individual commands. The base provides pier space and waterfront operational services. A major tenant command on base is Southwest Regional Maintenance Center (SWRMC), which makes NBSD the single point of contact for ship maintenance in the San Diego area. Harbor Drive and the freight and trolley lines split the base into two, the wet side and the dry side. The wet side is the area west of Harbor Drive and is comprised of piers, maintenance support, and supply operations. The dry side is the area east of Harbor Drive and includes base housing, professional education, training facilities, fitness/recreation centers, region headquarters of Navy Medicine West, the Navy Exchange, and Distribution Centers.

¹ CY 2021

The Navy Broadway Complex (Broadway Complex) is a bayside military facility of NBSD located in Downtown San Diego. It houses the primary offices of the Navy Region Southwest and is closely tied to regional US Coast Guard operations. The Broadway Complex is bordered by the San Diego Bay and Harbor Drive to the west, Broadway to the north, Pacific Highway to the east, and W. Harbor Drive to the south.

Critical Transportation Facilities

The Navy, in collaboration with SANDAG and HNTB, identified the following transportation facilities critical to naval operations and maintaining mission readiness at NBSD:

Interstate Access to NBSD

- I-5 (major north-south commuter route)
- I-15 (major north-south commuter route)

Strategic Highway Network (STRAHNET)² and Strategic Rail Corridor Network (STRACNET)

- Harbor Drive is a road deemed necessary for emergency mobilization and peacetime movement of heavy armor, fuel, ammunition, repair parts, food, and other commodities to support US Military Operations and a preferred truck route. The Burlington Northern Santa Fe (BNSF) Railway Company rail line runs adjacent to Harbor Drive and continues north and south of NBSD. Approximately eight BNSF trains pass-through the corridor every day. A rail spur north of Harbor Drive crossing provides direct access to the North American Steel and Shipbuilding Company shipyards for delivery of shipbuilding and ship repair materials.
- 8th Street is a STRAHNET connector for NBSD

Bridges

- 32nd Street over Chollas Creek
- Harbor Drive over Chollas Creek
- Harbor Drive over Paleta Creek

Street Access

- 32nd Street (dry and west side main gates)
- Harbor Drive (wet side gates)
- Main Street

Transit Access

- Blue Line Trolley (north-south light rail which parallels Harbor Drive and includes four stops <1 mile of base gates)

² Strategic Highway Network (STRAHNET) The National Highway System (NHS) includes STRAHNET a network of highways which are important to the United States' strategic defense policy and which provide defense access, continuity, and emergency capabilities for defense purposes.

Street Access to NBSD Broadway Complex

- Pacific Highway (provides sole access to NBSD Broadway Complex)

Naval Base Coronado (NBC)

Key Naval Facilities: Naval Air Station North Island (NASNI), Navy Amphibious Base (NAB), Silver Strand Training Complex (SSTC)

Naval Base Coronado (NBC) is a hub for U.S. naval activity and provides a shore-based platform for helicopters, aircraft carriers, SEAL Teams, and other ashore and afloat commands. NBC provides access to a comprehensive quantity of ground, sea, air, and undersea operational and training space and it is the only Naval amphibious base on the West Coast.

Naval Air Station North Island Coronado (NASNI) is a naval air station located on the northern end of Coronado Island. The installation is bordered by the Pacific Ocean and San Diego Bay. To the south, the installation borders the residential areas of the City of Coronado. NBC supports more than 30,000 military and civilian personnel who utilize three airfields, three ports, multiple training ranges, and more than 1,400 buildings. NBC accommodates 23 squadrons, two aircraft carriers, four SEAL teams, coastal riverine squadrons, and other air, surface, and subsurface commands.

Naval Amphibious Base (NAB) is in the City of Coronado, south of the main residential and commercial portions of the City. To the east and south, the installation is bordered by the San Diego Bay. To the west, the installation is bordered by the Pacific Ocean. The amphibious base includes approximately 3.1 miles of Pacific Ocean and bayside beachfront for training. NAB is approximately 1,000 acres in size and is composed of the Main Base, training beaches, California Least Tern preserve, enlisted family housing, and a portion of the Silver Strand State Beach. SR 75 separates NAB into oceanside and bayside areas.

Silver Strand Training Complex (SSTC) is located along the southern end of the City of Coronado, north of the City of Imperial Beach, and west of SR 75. The Pacific Ocean and the San Diego Bay border the facility on its west and east side, respectively. SSTC is over 500 acres in size and provides opportunities for the Navy, Marines, and the military’s special forces to train for waterborne approaches and critical urban warfare. The Navy has plans to expand its Special Warfare Command facilities at SSTC. The expansion, referred to as Naval Base Coronado Coastal Campus, includes over 20 projects and over one million square feet of building space. The project was environmentally cleared in 2015 and the expansion is expected to be complete by 2024. Over 3,000 military personnel from the Special Warfare Command at the current NAB location will be moved gradually to the Coastal Campus at SSTC.

Critical Transportation Facilities

The Navy, in collaboration with SANDAG and HNTB, identified the following transportation assets critical to naval operations and maintaining mission readiness at NBC:

Freeway Access to NBC

- I-5 (major north south commuter and goods movement route)
- SR 75 (the only road in and out of Coronado; provides access over the Coronado Bay Bridge and through Imperial Beach)

Strategic Highway Network (STRAHNET) Route

- SR 75 and SR 282 are part of a system of roads deemed necessary for emergency mobilization and peacetime movement of heavy armor, fuel, ammunition, repair parts, food, and other commodities to support US Military Operations
- Stockdale Boulevard/3rd Street is a STRAHNET connector

Bridge

- SR 75 Coronado Bay Bridge

Street Access to NBC

- 3rd Street
- Stockdale Boulevard (extension of 3rd Street provides main gate access)

Naval Base Point Loma (NBPL)

Key Naval Facilities: NBPL Submarine Base (Subbase), NBPL Harbor Drive Annex, Old Town Complex (NAVWAR)

NBPL Subbase is located at the south end of the Point Loma peninsula. It is bordered by the community of Point Loma to the north, the San Diego Bay to the east, the Pacific Ocean to the west, and Cabrillo National Monument to the south. The primary mission of NBPL is to sustain the fleet, enable the fighting forces. NBPL is home to over 70 tenant commands, including six submarines and a floating dry dock. Approximately 10,000 employees work at NBPL Subbase, and the number of commuting personnel can vary depending on the number of submarines docked and requiring maintenance.

NBPL Harbor Drive Annex is located on North Harbor Drive, southeast of Rosecrans Street. Harbor Drive is the location for the Fleet Anti-Submarine Warfare Training Center (Fleet ASW), Fleet Intelligence Training Center, Pacific (FITCPAC), Navy Talent Acquisition Group (NTAG), Defense Acquisition University, Navy Gateway Inns & Suites, and a conference center. Approximately 2,000 employees at the NBPL Harbor Drive Annex and there is only one gate entrance.

NBPL Old Town Complex (OTC) is located southwest of I-5 along Pacific Highway. OTC is home to Naval Information Warfare Systems Command (NAVWAR) Headquarters.

Critical Transportation Facilities

The Navy, in collaboration with SANDAG and HNTB, identified the following transportation facilities critical to naval operations and maintaining mission readiness at NBPL:

Interstate access to NBPL

- I-5 (major north south commuter route and goods movement)
- I-8 (major east west commuter route)

STRAHNET Route

- Rosecrans Street

Street Access to NBPL Subase

- Rosecrans Street (provides main gate access and connects NBPL Subase to NBPL Harbor Drive Annex)
- Catalina Boulevard (provides gate access)
- Nimitz Boulevard

Street access to NBPL Harbor Drive Annex

- Nimitz Boulevard
- N. Harbor Drive

Street Access to OTC (NAVWAR)

- Pacific Highway

Resilience Planning

Sea levels are projected to rise by 1 to 2 feet by 2050 and 3 to 7 feet, or more, by 2100 (relative to a 2000 baseline sea level) (OPC 2018) and are likely to impact Navy bases and all modes of transportation located near the San Diego coastline. The transportation networks critical to the Navy are located close to the coastline and may be vulnerable to sea level rise, erosion, flooding, and inundation. Potential impacts to segments of the interconnected transportation system can adversely affect Navy operations and mission readiness. Projections indicate that over the next several decades the most damaging events will involve temporary erosion and flooding caused by storm surge and wave run-up that coincide with peak high tides, particularly during El Niño winters, two opposing climate patterns that break normal conditions occurring every two to seven years. Rising sea levels will worsen these extreme events, causing larger, longer, and more damaging floods, eventually leading to daily inundation resulting in the closure of transportation facilities and loss of access if left unmitigated.

Opportunities

Resilience planning will align planning efforts for transportation routes critical to Navy operations and mission readiness and SANDAG's CMCP efforts. It will allow SANDAG and the Navy to work collaboratively with agencies such as Caltrans, the Port of San Diego, San Diego International Airport, and the Cities of San Diego, Chula Vista, National City, Coronado, and Imperial Beach to address potential vulnerabilities and impacts from sea level rise affecting transportation assets in the region. In addition, resilience planning will leverage information from recent studies conducted within the region to assess impacts to the transportation network from sea level rise, storm surge, coastal erosion, and flooding and build on preliminary adaptation concepts that will mitigate these impacts. This plan will also strengthen the SANDAG/Navy partnership through the Military Working Group and continued collaboration and achievement of common goals.

Strengths

The key studies listed below identify potential sea level rise, storm surge, and flooding impacts to routes identified as critical to Navy operations and mission readiness:

- Regional Transportation Infrastructure Sea Level Rise Assessment and Adaptation Guidance (SANDAG 2020)
 - Under modeled 2050 and 2100 conditions, SR 75 and the Blue Line Trolley are vulnerable to projected sea level rise and storm surge which will cause flooding and inundation of these facilities. Under a 2.5-foot sea level rise scenario

approximately 3.6 miles of SR 75 would be subject to flooding during a 100-year storm and under a 6.6-foot sea level rise scenario approximately 6.6 miles would be subject to both daily inundation (without a 100-year storm) and flooding (with a 100-year storm). The Blue Line Trolley will be exposed to flooding under a 2.5-foot sea level rise scenario during a 100-year storm and both daily inundation (without a 100-year storm) and flooding (with a 100-year storm).

- Caltrans District 11 Vulnerability Assessment (Caltrans 2019)
 - Under 2025, 2055, and 2085 conditions, SR 75 and portions of I-5 and I-8 are vulnerable to sea level rise, storm surge, and coastal erosion.
- Sea Level Rise Vulnerability Assessment & Coastal Resiliency Report (Port of San Diego 2019)
 - North Harbor Drive is vulnerable to storm surge (rare flooding) under 1.6 feet of sea level rise by 2050, and maximum high tide (recurring flooding) under 4.9 feet of sea level rise by 2100.
 - Burlington Northern Santa Fe (BNSF) freight railway projected to be inundated under 4.9 feet of projected sea level rise which would disrupt the supply chain and potentially disrupt Navy operations and mission readiness.
 - SR 75 exposure to projected sea level rise may occur by 2050 due to the route's low elevation. Potential inundation may be possible by 2100 with the low (2.5 feet) and high (4.9 feet) projected sea level rise scenarios.
- Climate Resilience Plan (San Diego International Airport 2019)
 - North Harbor Drive is exposed to flooding during heavy rain events under existing conditions. Overtopping is not expected to occur along the eastern side of the airport until 2050 with 1.6 feet of projected sea level rise during a 100-year storm surge event and up to 16 hours of flooding.
- Sea Level Rise Vulnerability Assessment Draft (City of San Diego 2019)
 - Sea Level Rise Projections for San Diego (under low, medium-high, and extreme risk scenarios)
 - 2030 0.25 meter
 - 2050 0.5-0.75 m
 - 2100 1.0-2.0m
 - Transportation and storm water assets include those managed by the City's Transportation and Storm Water department and Real Estate Assets department. The following assets are considered critical: City-operated airports, bridges, major arterials, drain pump stations, and storm water outfalls.
 - All transportation and storm water critical asset types, except airports, are highly vulnerable to sea level rise and have medium to high vulnerability to sea level rise with storm surge (100-year flood). Bridges, major arterials, and outfalls show vulnerability to coastal erosion. All erosion scenarios assume 2.0 meters of SLR.
- City of Imperial Beach Sea Level Rise Assessment (2016)
 - SR 75 is projected to be vulnerable to sea level rise in approximately 2046 (1.6 feet), 2069 (3.3 feet), and 2100 (6.6 feet). Potential impacts include inundation, flooding, and erosion.

Key Risks

Sea level rise, storm surge, flooding, and inundation may disrupt critical access routes to Navy Bases and adversely affect Navy operations and mission readiness.

- Disruptions to STRAHNET and STRACNET corridors (Rosecrans Street, Harbor Drive, SR 75)
- SR 75 provides the only land route into NBC over the Coronado Bay Bridge and through Imperial Beach.
 - SR 75 through Imperial Beach is the only route for transport of sensitive goods and materials to NBC.
- Pacific Highway provides sole access to the Broadway Complex at NBSD and provides the sole access to Old Town Campus at NBPL.

Gaps

Critical routes such as Rosecrans Street, Catalina Boulevard, Nimitz Boulevard, Pacific Highway, and the Harbor Drive bridges over Chollas and Paleta Creek were not addressed in the reports summarized under the “Strengths” section of this memo. Further analysis will be required.

Other gaps in information relevant to resilience planning:

- Lack of available information on condition of aging infrastructure, such as bridge inspection reports or drainage facilities (requires coordination with Caltrans and local jurisdictions).
- Lack of available information on the potential sea level rise effects on tsunami-induced flooding.

Anticipated reports and analysis:

- City of Coronado Sea Level Rise Vulnerability Assessment and Adaptation Plan is expected winter 2021.
- DOD Strategic Environmental Research and Development Program (SERDP) Project RC-2644 – Advancing Best Practices for the Analysis of the Vulnerability of Military Installations in the Pacific Basin to Coastal Flooding Under a Changing Climate, expected mid-2021 (includes Naval Base Coronado).

Challenges

Challenges to resilience planning include:

- Use of different methodologies and timelines to assess impacts and prioritize adaptation projects
- Coordination between local jurisdictions, agencies, and alignment of agency priorities
- Availability of funding to implement adaptation projects
- Lengthy or complex project development process for project approval, environmental clearance, and permitting
- Potential public opposition to proposed adaptation strategies and projects
- Right-of-way constraints
- Ongoing changes to climate science

Recommendations

Vulnerability profiles will be developed for each of the transportation facilities identified as critical to Navy operations and mission readiness addressing the potential effects of coastal storms/storm surge, erosion, tsunami, flooding, and sea level rise. The vulnerability profiles will adjust for climate science updates as feasible and leverage existing tools, studies, and maps developed by partner agencies.

Focus on High Priority Transportation Facilities

Resilience planning will prioritize transportation facilities key to keeping the Navy mission ready. Below are the recommended high priority facilities to be analyzed further.

Freeways

Freeways that provide access to Naval facilities:

- I-5
- I-8
- CA 15
- SR 75
- SR 282

Roads

Main roadways that provide access to Naval facilities and gates:

- Rosecrans Street
- Harbor Drive
- Pacific Highway
- Catalina Boulevard
- N. Harbor Drive
- Nimitz Boulevard
- 32nd Street
- Stockdale Boulevard/3rd Street

Bridges

Bridges that provide access to Naval facilities:

- Harbor Drive over Chollas Creek
- Harbor Drive over Paleta Creek
- Coronado Bay Bridge (SR 75)
- 32nd Street over Chollas Creek

Transit

Transit facilities that provide access to Naval facilities:

- Blue Line Trolley
- Green Line Trolley
- MTS Bus Services

- AMTRAK and Coaster Trains
- Coronado Ferry

Modeling, Data, and Mapping Tools

SANDAG, the Navy, and HNTB will use the following models and data sets to analyze the impact of climate stressors on the transportation facilities critical to Naval operations and mission readiness. The following is a list of data sources consistent with other resilience studies in the San Diego region.

[The Coastal Storm Modeling System \(CoSMoS\)v.3.0 for Southern California/San Diego County](#)

The Coastal Storm Modeling System (CoSMoS) makes detailed predictions (meter-scale) over large geographic scales (100s of kilometers) of storm-induced coastal flooding and erosion for both current and future sea level rise (SLR) scenarios.

- Storm Modeling
 - Annual
 - 20-year
 - 100-year
- Shoreline Position Layer
- Flood
 - CoSMoS 3.0 Phase 2 Flood Depth
 - CosMoS 3.0 Phase 2 Flood Hazard Projections
- Sea Level Rise
 - Projections: 2050 (2.5 feet)
 - Projections: 2100 (6.6 feet)
 - Medium-High Risk recommended for transportation infrastructure

The Ocean Protection Council's *State of California Sea-Level Rise Guidance* will be referenced to ensure the most applicable CoSMoS projections are utilized.

[State of California Sea-Level Rise Guidance \(Ocean Protection Council 2018\)](#)

State of California Sea-Level Rise Guidance (Guidance) reflects advances in sea level rise science and addresses the needs of state agencies *and* local governments as they incorporate sea level rise into their planning, permitting, and investment decisions. The Guidance provides: 1) a synthesis of the best available science on sea-level rise projections and rates for California; 2) a stepwise approach for state agencies and local governments to evaluate those projections and related hazard information in decision-making; and 3) preferred coastal adaptation approaches.

[Caltrans D-11 Climate Change Vulnerability Assessment Map](#)

The Caltrans D-11 Climate Change Vulnerability Assessment Map shows specific vulnerable locations along the State Highway System. Both the climate data and identified locations at-risk of impact are the foundation for further analysis of climate change vulnerabilities to the State's transportation infrastructure. The map included modeling and data from the State of California Sea Level Rise Guidance (OPC 2018) and CoSMoS Flood Hazard Projects and Depth.

- Percent Change in 100-year precipitation depth – 2055
- Percent Change in 100-year precipitation depth – 2085

[Cal-Adapt](#)

Cal-Adapt provides a view of how climate change might affect California. Cal-Adapt offers tools, data, and resources to conduct research, develop adaptation plans, and build applications.

[Federal Emergency Management Agency \(FEMA\)](#)

The National Flood Hazard Layer (NFHL) is a geospatial database that contains current effective flood hazard data.

- NFHL Flood Insurance Rate Maps
 - 100-year flood
 - 500-year flood

[San Diego County Tsunami Inundation Maps](#)

Detailed tsunami inundation maps for affected coastal cities and communities in San Diego County.

[SANDAG Regional Shoreline Monitoring Program](#)

Regional Shoreline Monitoring Program measures the changes in beach width and depth over time. This comprehensive approach to monitoring the shoreline provides data that provides important information to decision-makers when beach replenishment efforts are contemplated. The results of the Monitoring Program will help add to the discussion of the impacts erosion can have on the region's coastal communities.

Attachments

- A. Climate Resilience Assessment Memo Summary

Attachment A**Climate Resilience Assessment Memo Summary**

The Climate Resilience Memo summarizes the review of existing documentation, reports, and analysis of resilience efforts in the San Diego region to identify strengths, opportunities, challenges, gaps, and risks related to potential impacts to Navy operations and mission readiness. This project was completed in a state of constant collaboration. As this project developed, through ongoing conversation and deliberations, additional facilities and needs were discovered and added to the analysis. The purpose of the Military Installation Resilience Report is to highlight the vulnerabilities of the transportation network key to maintaining Navy mission readiness. The MIR Report is meant to be an introduction of the needs of the Navy and how those needs relate with the regional CMCPs. It is a broad sweeping discussion of solutions to aide in the inclusion of the Navy while developing regional corridor plans.

Review of Existing Documentation and Identification of:

- Grant Focus and Study Area
- Key base facilities at Naval Base San Diego, Coronado, and Point Loma
- Potential Climate Stressors and Hazards
- Focus area for the OLDCC Grant for Navy mission readiness and Military Resilience

Partner Agency Meeting:

A partner agency workshop was held to establish the project study area and to identify, by base:

- Key Base facilities
- Top Climate stressors
- Key Transportation facilities to maintain Navy mission readiness.

Vulnerability Assessment Technical Memo

Executive Summary

Purpose

The Vulnerability Assessment memo was used to develop vulnerability profiles for key transportation facilities by base. The vulnerability assessment identifies relevant data sets and potential climate-related impacts to key transportation facilities based upon the U.S. Geological Survey (USGS) Coastal Storm Modeling System (CoSMoS) Geographic Information System (GIS) based mapping program. CoSMoS was used to develop vulnerability mapping and data to identify potential climate-related impacts to key transportation facilities from coastal storms/storm surge, erosion, sea level rise, flooding, and/or tsunami. The vulnerability profiles build on the information contained in the Climate Resilience Assessment Memo (February 2021) and includes adaptation strategies discussed in Section 1.3 Adaptation Planning and Design Considerations Memo.

Data and Tools for Climate Resilience Planning Navy/SANDAG GIS collaboration

- Review of existing Climate Tools, Data Sets and Mapping for the San Diego region.
- Identification of potential data sets and time horizons to be used in the vulnerability analysis and mapping.

SANDAG Peer Review Process (PRP) and Partner Agency Meeting:

To determine the most appropriate datasets to analyze coastal storms/storm surge, erosion, sea level rise, flooding, and tsunami, SANDAG utilizes a PRP to share methodology and approach with local agencies. SANDAG and the Navy met with Caltrans, Port of San Diego, San Diego County Regional Airport Authority, and the Cities of San Diego, Imperial Beach, and Coronado, local agencies working on resilience planning in the region to discuss proposed climate tools and data sets. PRP participants provided input and concurred with the proposed approach, models, and datasets and discussed tools and data used for resilience planning as well as limitations and assumptions related to these tools.

Project Refinements

NBSD - Harbor Drive connections to Main Street, 8th Street, 28th Street and I-15 were added to the list of key transportation facilities for NBSD.

NBC - Ocean Boulevard and 13th Street were added to the list of key transportation facilities and Navy Outlying Field (NOLF IB) was included as a key NBC base facility.

Data and Tools for Resilience Planning and Vulnerability Profile Meeting Agendas, Minutes, and Power Point presentations are contained in the 3.0 Stakeholder Engagement.

Military Installation Resilience



To: Sarah Pierce, SANDAG Associate Regional Planner
From: Tami Podesta, HNTB Senior Project Manager
Date: May 24, 2021
Re: Vulnerability Assessment Technical Memo

Purpose

The purpose of this document is to profile transportation facilities critical to Navy mission readiness at risk of being vulnerable to climate change impacts. GIS was used to map and analyze impacts to the transportation network supporting Naval bases San Diego, Coronado, and Point Loma Navy personnel and families, and the communities surrounding the Naval bases. The document highlights the locations in the transportation network most vulnerable to coastal storms/storm surge, erosion, sea level rise, flooding, and tsunami. SANDAG, the Navy, and HNTB developed a list of key transportation facilities critical to maintaining Navy mission readiness. *The Climate Resilience Assessment Memo* (Task 4.1, February 2021) includes a comprehensive list of transportation facilities and data sets included in this analysis.

Data and Tools for Climate Resilience Planning

To determine the most appropriate datasets to analyze coastal storms/storm surge, erosion, sea level rise, flooding, and tsunami, the project team reviewed available models, tools, and datasets used throughout the region and input received during SANDAG's Peer Review Process (PRP). The PRP meeting included representatives from SANDAG, the Navy, Caltrans, Port of San Diego, San Diego County Regional Airport Authority, and the cities of San Diego, Imperial Beach, and Coronado. PRP participants provided input on the datasets proposed for this analysis and discussed the approach, models, and datasets used for their resilience work as well as any limitations and assumptions related to these tools. A detailed explanation of how the selected climate tools/models were applied to this analysis is included below.

Coastal Storms/Storm Surge

Since historic storms may not be an accurate predictor of storms under a changing climate, the Coastal Storm Monitoring System ([CoSMoS](#)) simulates future storms based on the latest global climate model projections of wind, air pressure, and sea surface temperature over the next century. Using this information, CoSMoS can model the oceanic conditions for future storms and then determine storm-driven water levels along the coast through 2100, including the effects of waves, storm surge, and seasonal water level anomalies. Based on these projections, storm return intervals are determined, and then the storms are fully simulated for a spring tidal cycle. The spring tidal cycle is important to include because it occurs all year long during full or new moons and twice a month when the earth, sun, and moon are nearly in alignment causing average tidal ranges to be slightly larger.

CoSMoS models storms on an annual, 20-year, and 100-year basis. A 100-year storm, or storm with a 1 percent chance of occurring in any given year, was included in this assessment to be consistent with the analysis in SANDAG's [Regional Transportation Infrastructure Sea Level Rise Assessment and Adaptation Guidance](#) (2020) and the Caltrans design standard used for transportation facilities such as the I-5, I-8, I-15, and SR 75 that are included in this analysis.

While precipitation information is not referenced explicitly in the vulnerability profiles included in this memo, it is important to note that future changes in precipitation patterns may worsen impacts shown in CoSMoS. Precipitation conditions in California are projected to change so that there are more frequent drought

periods, but heavier, intermittent rainfall. An analysis of future predicted precipitation data is insightful in analyzing the viability of existing and planned transportation infrastructure. Percent change in precipitation focuses on how heavy precipitation events may change and become more frequent over time. The predicted percent change in 100-year storm precipitation depth, also referenced in the [Caltrans Climate Change Vulnerability Assessments](#) (2019) San Diego Region, indicates there would be an increase of rainfall between 0.0 to 4.9 percent for 2055 and 5.0 to 9.9 percent in 2085 for the study area as shown in **Figure 3**. This is based on the RCP 8.5 model which is the high-end business as usual fossil fuel emission scenario, consistent with a future where there are few global efforts to limit or reduce emissions.

Some areas in the San Diego region already experience impacts under regularly occurring storms, precipitation events, and during high tides and these impacts will worsen under future conditions. For example, several storm water outlets that drain into the San Diego Bay and Tijuana Estuary cause flooding in Imperial Beach³. In addition, the community of Barrio Logan is under capacity in terms of storm drainage and the community has traditionally seen flooding during storms. Water from rainstorms can cause flooding throughout the alleys and many of the streets of Barrio Logan⁴.

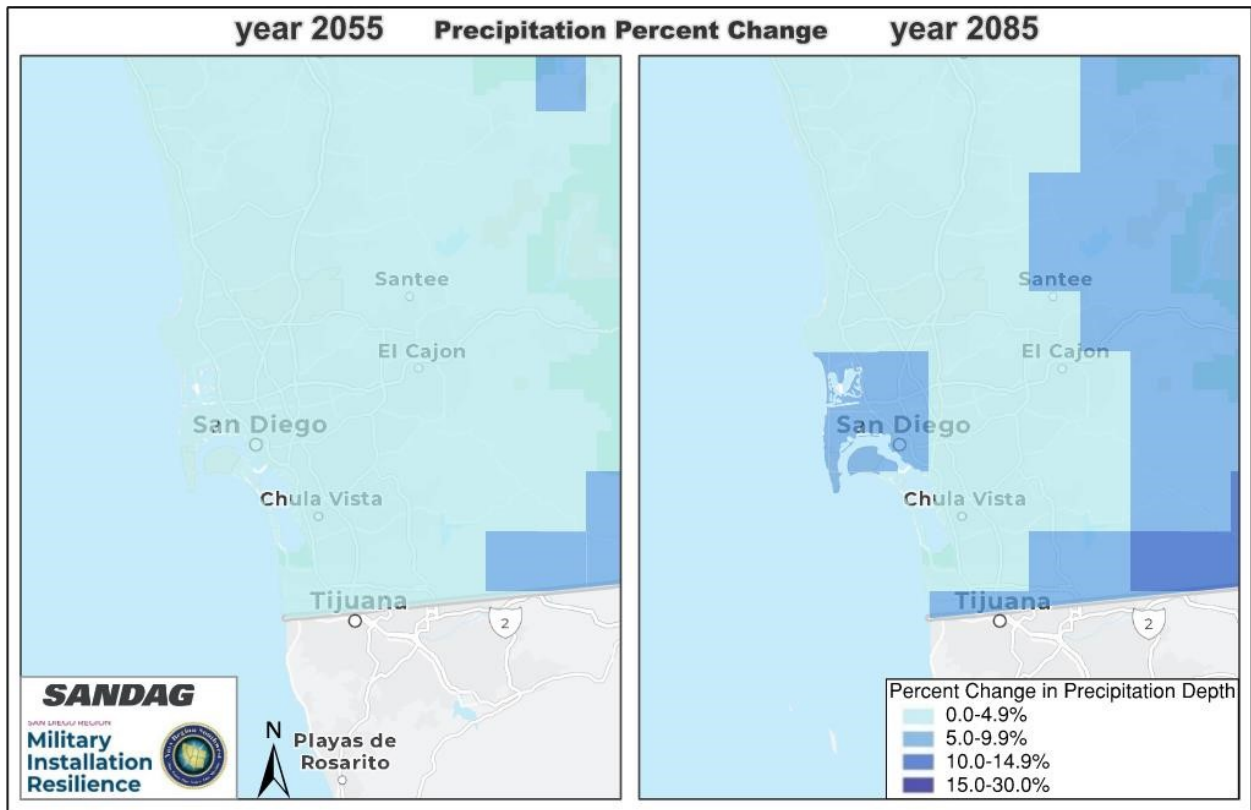


Figure 3. Percent Change in 100-year Storm Precipitation Depth Years 2055 and 2085

Erosion

The CoSMoS Shoreline Position Layer was reviewed to understand if erosion has the potential to affect the transportation facilities in 2050 and 2100. The Caltrans [Climate Change Vulnerability Assessment](#) included the do not hold the line scenario (no shoreline mitigation) to identify areas along the coastline that would

³ 2016 City of Imperial Beach Sea level Rise Assessment

⁴ Barrio Logan Community Plan Draft

be damaged if the shoreline is not managed. For consistency, the same scenario is included in this analysis. Erosion Maps for this assessment are in Attachment A.

Sea Level Rise

To remain consistent with [SANDAG's Regional Transportation Infrastructure Sea Level Rise Assessment and Adaptation Guidance](#) (2020) and vulnerability assessments completed by the [City of San Diego](#) (2019), the [Port of San Diego](#) (2019) and the [San Diego County Regional Airport Authority](#) (2019), the 2050- and 2100-time horizons were selected for analyzing sea level rise impacts in the study area. These time horizons allow for the ability to consider the average lifespan (20 to 50 years) of existing transportation facilities and planned mid-term transportation projects in the region. CoSMoS was used to model sea level rise:

- For the year 2050, sea levels are projected to increase 75 cm or 2.5 feet relative to a year 2000 baseline
- For the year 2100, sea levels are projected to increase 200 cm or 6.6 feet relative to a year 2000 baseline

Sea level rise projections are consistent with projections for a medium-high risk aversion (which assumes a 1 in 200 chance or 0.5 percent probability that sea level meets or exceeds predicted levels) as stated in the [State of California Sea Level Rise Guidance](#) (OPC 2018). [The CCC Sea Level Rise Policy Guidance 2018](#) recommends using the sea level rise projections from the 2018 OPC Sea Level Rise Guidance as the best available science to inform planning decisions and project design.

Flood

The Federal Emergency Management Agency (FEMA) Risk Mapping Assessment and Planning Program (Risk MAP) delivers quality data that increases public awareness and leads to action to reduce risk to life and property. Risk MAP is a nationwide program that works in collaboration with states, tribes, and local communities using the best available science, rigorously vetted standards, and expert analysis to identify risk and promote mitigation action, resulting in safer more resilient communities. The National Flood Hazard Layer (NFHL) is a geospatial database that contains current effective flood hazard data. FEMA provides the flood hazard data to support the National Flood Insurance Program. This information is used to better understand the level of flood risk and type of flooding. The FEMA National Flood Hazard Layer for 100-year and 500-year flood were used in the vulnerability analysis to identify areas where key transportation facilities are in FEMA flood hazard zones. Flood hazard areas identified on the Flood Maps are identified as a Special Flood Hazard Area (SFHA). SFHA are defined as the area that will be inundated by the flood event having a 1-percent chance of being equaled or exceeded in any given year. The 1-percent annual chance flood is also referred to as the base flood or 100-year flood. Moderate flood hazard areas, labeled Zone B or Zone X (shaded) are also shown on the map, and are the areas between the limits of the base flood and the 0.2-percent-annual-chance (or 500-year) flood. The areas of minimal flood hazard, which are the areas outside the SFHA and higher than the elevation of the 0.2-percent-annual-chance flood, are labeled Zone C or Zone X (unshaded). Flood Maps used for this assessment and definitions for FEMA Flood Zone Designations are in Attachment B.

Tsunami

An assessment of the transportation facility risk as it relates to tsunami is included in this vulnerability assessment. Tsunamis are rare events and there is a lack of known occurrences in the historical record. Tsunami data provided by the U.S. Department of Agriculture Natural Resource Conservation and the University of Southern California (USC) Tsunami Research Center was reviewed and used in this analysis. These data sources are primarily used by local jurisdictions for coastal evacuation planning. Tsunami Maps used for this assessment are in Attachment C.

Constraints

The digital elevation model used by CoSMoS is based primarily on the coastal LiDAR⁵ and multibeam data collected as part of state and federally funded projects from 2009-2011. For inclusion in CoSMoS, this digital elevation model was further refined in protected embayment's and harbors, where data coverage was often minimal or absent.

Considerations

Through the PRP it was understood that analyses completed by other local jurisdictions/agencies in the San Diego region may use "amended" CoSMoS data to account for land use changes/development not captured in the 2009-2011 lidar data. Therefore, mapping results included in other sea level rise assessments may be different from the direct outputs from CoSMoS. It should be noted that results included in this assessment rely on the CoSMoS model and did not include amended data. Continued monitoring of potentially impacted areas and coordination between local jurisdictions/agencies is recommended to develop solutions that are cost effective, have co-benefits, and can be implemented in a phased and timely manner depending on when impacts are expected.

Naval Base Descriptions

A description of each base and key base facilities is given below. Information regarding the bases was obtained from the Briefing Books for Naval Base [San Diego](#), [Coronado](#) and [Point Loma](#) (2020), the [Military Economic Impact Report](#) (2020), and employment and housing data received from the Navy. Impacts to the transportation network supporting access to Naval bases San Diego, Coronado, and Point Loma (see [Figure 4](#)) are summarized in the vulnerability profiles in the following sections. As noted in the [Error! Reference source not found.](#) (Task 4.1, February 2021), SANDAG, the Navy, and HNTB considered transportation facilities and routes used by Navy personnel to access each base, and STRAHNET⁶ routes to identify the key transportation facilities necessary to maintain Navy mission readiness.

⁵ LiDAR is method of determining ranges (variable distance) by targeting an object with a laser and measuring the time for the reflected light to return to the receiver.

⁶ Strategic Highway Network (STRAHNET) The National Highway System consists of roadways important to the nation's economy, defense, and mobility. The National Highway System (NHS) includes STRAHNET a network of highways which are important to the United States' strategic defense policy and which provide defense access, continuity, and emergency capabilities for defense purposes.

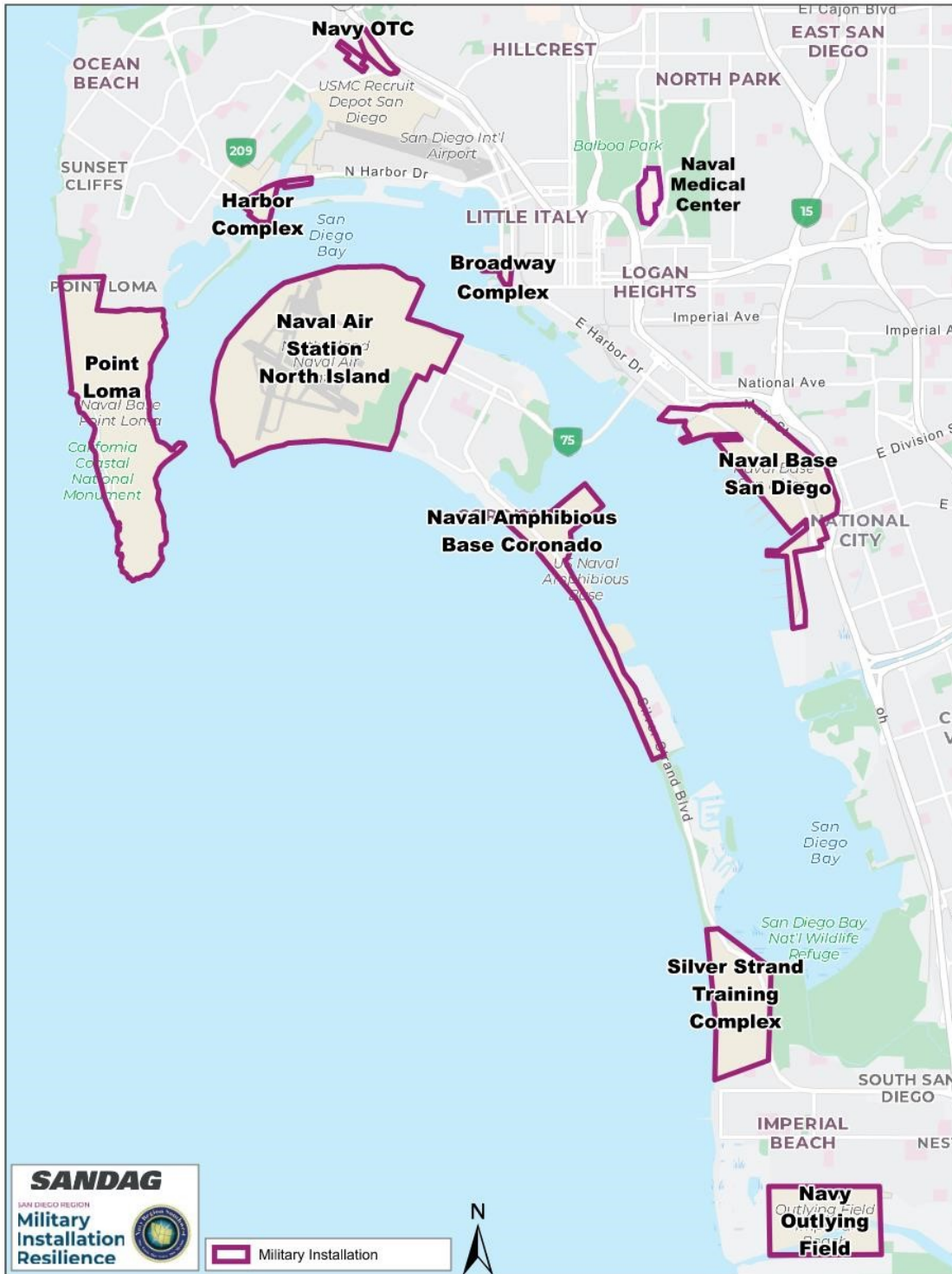


Figure 4. San Diego Bay Naval Bases and Key Navy Base Facilities

Naval Base San Diego (NBSD)



Figure 5. Transportation Facilities Identified as Key for Naval Base San Diego

Key base facilities at Naval Base San Diego (NBSD) include the **32nd Street Facility Naval Base**, the **Broadway Complex** in Downtown San Diego, and the **Naval Medical Center San Diego** complex located in Balboa Park. NBSD is the principal homeport for the United States Pacific Fleet. Along Harbor Drive, NBSD is divided by freight and trolley lines, creating a “Wet” and “Dry” side of the base, on the west and east sides of Harbor Drive, respectively. Most of the base’s employment is located on the base’s wet side. NBSD employs 25,610 soldiers and civilians and houses almost 5,000 service members, their families, and students.

The **32nd Street Facility** is located between Main Street and the San Diego Bay, south of Downtown San Diego and the Barrio Logan community, and west of National City. NBSD has 12 piers and is the homeport to 66 Navy ships, which represents the largest concentration of Navy surface vessels on the west coast. The 32nd Street Facility also is home to seven ships of the Navy’s Military Sealift Command, two Coast Guard cutters, several research, and auxiliary vessels, and over 200 individual commands. The base provides pier space and waterfront operational services. The wet side of the base includes piers, maintenance support, and supply operations. The dry side includes base housing, professional education, training facilities, fitness/recreation centers, region headquarters of Navy Medicine West, the Navy Exchange, and Distribution Centers.

The Navy **Broadway Complex** is a bayside military facility of NBSD located in Downtown San Diego. It houses the primary offices of the Navy Region Southwest and is closely tied to regional US Coast Guard

operations. The Broadway Complex is bordered by the San Diego Bay and Harbor Drive to the west, Broadway to the north, Pacific Highway to the east, and W. Harbor Drive to the south.

Naval Medical Center San Diego (NMCS) is a technologically advanced Navy medical treatment facility and serves as the largest teaching hospital in the Navy. NMCS has five medical mobilization teams including the hospital ship whose personnel are drawn from the hospital staff. These teams deploy to the Western Pacific at various times during the year. NMCS also is a major training facility and is affiliated with other medical facilities in the region such as Scripps Clinic and University of California, San Diego. NMCS is located within the grounds of Balboa Park, approximately 4 miles north of NBSD. The facility is bordered by Zoo Place to the north, Florida Drive to the east and I-5 to the south, and Park Boulevard to the west. NMCS employs 3,819 military personnel and civilians. *There are no anticipated impacts to the transportation facilities accessing Naval Medical Center San Diego.*

Naval Base Coronado (NBC)



Figure 6. Transportation Facilities Identified as Key for Naval Base Coronado

Naval Base Coronado (NBC) is a hub for U.S. naval activity and provides a shore-based platform for helicopters, aircraft carriers, SEAL Teams, and other ashore and afloat commands. NBC provides access to a comprehensive quantity of ground, sea, air, and undersea operational and training space and it is the only Naval amphibious base on the West Coast. NBC supports more than 30,000 military and civilian personnel who utilize three airfields, three ports, multiple training ranges, and more than 1,400 buildings. NBC accommodates 23 squadrons, two aircraft carriers, four SEAL teams, coastal riverine squadrons, and other air, surface, and subsurface commands.

Naval Air Station North Island Coronado (NASNI) is a naval air station located on the northern end of Coronado Island. The installation is bordered by the Pacific Ocean and San Diego Bay. To the south, the installation borders the residential areas of the City of Coronado. Over 15,000 military personnel and civilians work at NASNI.

Naval Amphibious Base (NAB) is in the City of Coronado, south of the main residential and commercial portions of the City. To the east and south, the installation is bordered by the San Diego Bay. To the west, the installation is bordered by the Pacific Ocean. The amphibious base includes approximately 3.1 miles of Pacific Ocean and bayside beachfront for training. NAB is approximately 1,000 acres in size and is composed of the Main Base, training beaches, the California Least Tern preserve and a portion of the Silver Strand State Beach. SR-75 separates NAB into oceanside and bayside areas. NAB employs 5,681 military personnel and civilians.

Silver Strand Training Complex (SSTC) is located along the southern end of the City of Coronado, north of the City of Imperial Beach, and west of SR-75. The Pacific Ocean and the San Diego Bay border the facility on its west and east side, respectively. SSTC is over 500 acres in size and provides opportunities for the Navy, Marines, and the military's special forces to train for waterborne approaches and critical urban warfare. The Navy has expanded its Special Warfare Command facilities at SSTC. The expansion, referred to as Naval Base Coronado Coastal Campus, includes over 20 projects and over one million square feet of building space. The project was environmentally cleared in 2015 and the expansion is expected to be complete by 2024. Over 3,000 military personnel from the Special Warfare Command at the current NAB location will move gradually to the Coastal Campus at SSTC.

Navy Outlying Landing Field (NOLF IB) is in Imperial Beach, near the U.S. Mexico border. NOLF is about 1204 acres with 270 acres leased for agricultural purposes and 284 acres for a wildlife refuge. The airfield provides training for the Pacific Fleet helicopter squadrons based at NASNI. Approximately 900 personnel work on the base and approximately 850 are civilian.

Naval Base Point Loma (NBPL)

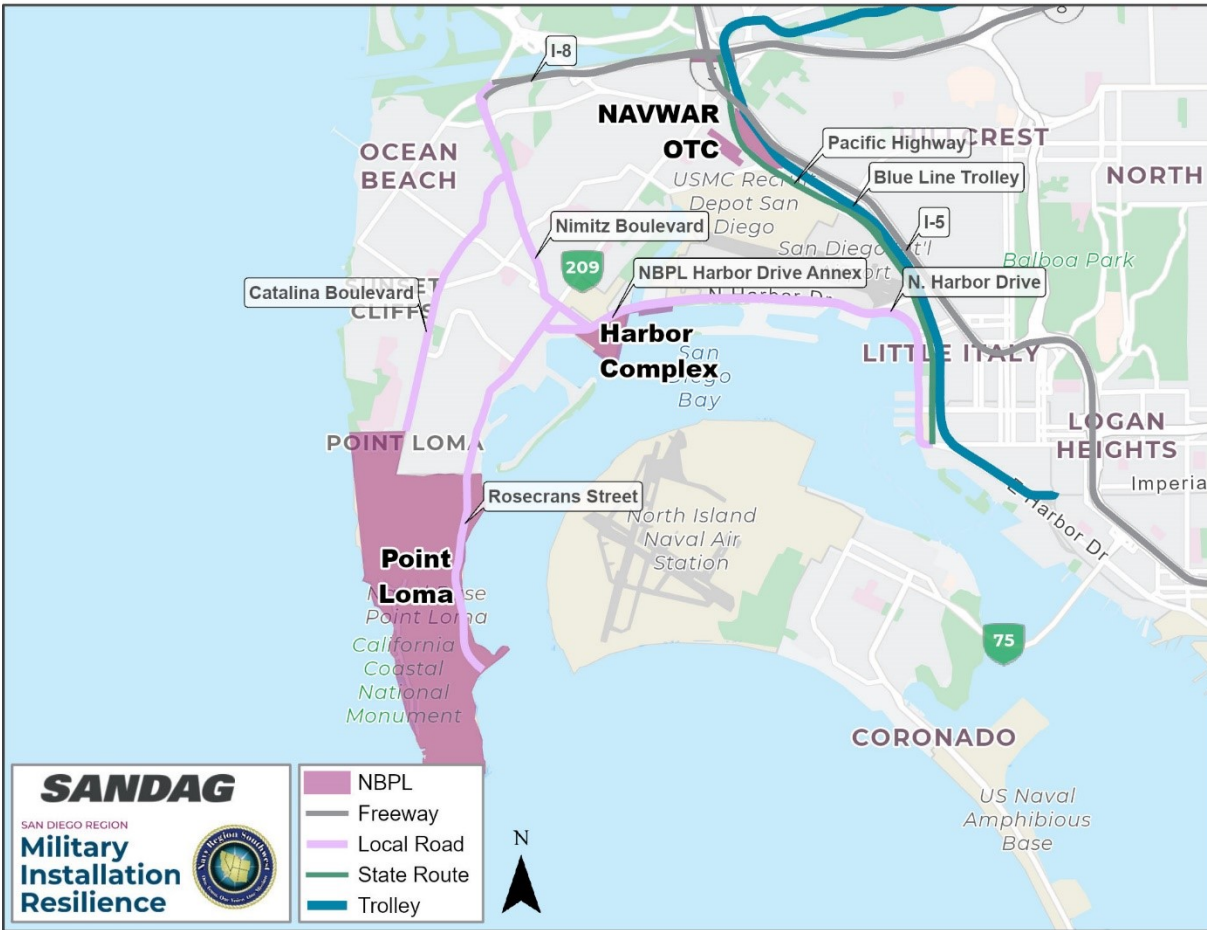


Figure 7. Transportation Facilities Identified as Key for Naval Base Point Loma

NBPL Subbase is located at the south end of the Point Loma peninsula. It is bordered by the community of Point Loma to the north, the San Diego Bay to the east, the Pacific Ocean to the west, and Cabrillo National Monument to the south. The primary mission of NBPL Subbase is to sustain the fleet and enable the fighting forces. NBPL Subbase is home to over 70 tenant commands, including six submarines and a floating dry dock. Approximately 18,000 employees work at NBPL Subbase, and the number of commuting personnel can vary depending on the number of submarines docked and requiring maintenance.

Harbor Drive Annex is located on North Harbor Drive, southeast of Rosecrans Street. Harbor Drive is the location for the Naval Mine and Anti-Submarine Warfare Complex (NMAWC), Fleet Intelligence Training Center Pacific (FITCPAC), U.S. Naval recruiting buildings, Navy Gateway Inns & Suites, and a conference center. The Harbor Drive Annex employs almost 600 sailors, students, and civilians.

Old Town Complex (OTC) is located southwest of I-5 along Pacific Highway. OTC is home to Naval Information Warfare Systems Command (NAVWAR) Headquarters.

Vulnerability Profiles

Potential impacts to the key transportation facilities supporting access to Naval bases San Diego, Coronado, and Point Loma (see Figure 2) are summarized in the vulnerability profiles below. As noted in the *Climate Resilience Assessment Memo* (Task 4.1, February 2021), SANDAG, the Navy, and HNTB considered transportation facilities and routes used by Navy personnel to access each base, and STRAHNET routes to identify the key transportation facilities necessary to sustain Navy mission readiness.

In the following vulnerability profiles, the transportation facilities supporting each base are identified by areas most affected by climate stressors. Some transportation facilities are used by multiple bases and are included in the vulnerability profile for multiple bases. Where a transportation facility is potentially impacted, the limits and extent of the impact are identified in the table and transportation facilities not impacted by any of the identified climate stressors are noted as “No Impact” in the table. Additionally, vulnerability maps for each base are included in the profiles and erosion, flood, tsunami, and all base maps for 2050 and 2100 projected sea level rise and 100-year storm are included in Attachment A, B, C and D respectively.

Naval Base San Diego – Vulnerability Profile

Key Transportation Facilities

The key transportation facilities for NBSD selected for inclusion in this analysis are:

- I-5
- I-15
- Harbor Drive
- Main Street
- 8th Street
- 28th Street
- 32nd Street
- Pacific Highway
- Blue Line Trolley
- Harbor Drive Bridges over Chollas and Paleta

Vulnerability Analysis

Potential impacts to key transportation facilities from coastal storms/storm surge, erosion, sea level rise, flooding, and tsunami (if applicable) for the 2050- and 2100-time horizons and for 100- and 500-year flood are identified in the table below.

The vulnerability analysis utilized the following data sets to develop each profile:

- 100-year storm or 1 percent storm (CoSMoS)
- Erosion without shoreline mitigation (CoSMoS)
- Year 2050, sea level rise projections of 75 cm or 2.5 feet (CoSMoS)
- Year 2100, sea level rise projections of 200 cm or 6.6 feet (CoSMoS)
- FEMA Flood Hazard Layer 100-year/500-year Flood
- Tsunami data from University of Southern California Tsunami Research Center

The results of the vulnerability profile are summarized in the table below. Additionally, maps depicting flood extent, depth, and duration follow the table. For maps showing transportation facilities at risk of 100- and 500-year flood and tsunami see Attachment B and C. There are no key transportation facilities that provide access to NBSD at risk of erosion.

Note: 2050/2100 sea level rise projections with 100-year storm conditions were used to show the greatest extent of flood, depth, and duration for each time horizon. Future changes in precipitation patterns may worsen erosion and flooding in vulnerable areas.

Key Facility	Year 2050	Year 2100	Flood Zone		Adaptation Strategies ¹
			100-Year	500-Year	
Freeways					
I-5 <i>STRAHNET</i>	<u>Location:</u> I-5 and Harbor Drive Sea Level Rise/Storm depth 1 foot or less (duration 5- 6 hours)	<u>Location:</u> I-5 and Harbor Drive Sea Level Rise/Storm: depth up to 5 feet (duration 20-25 hours)	Yes	Yes	Accommodation <ul style="list-style-type: none"> Adaptation of Asphalt Grades Ongoing Maintenance and Inspections
I-15	No Impacts	No Impacts	Yes	Yes	Accommodation <ul style="list-style-type: none"> Downsizing for Coastal Hazards Adaptation of Asphalt Grades Ongoing Maintenance and Inspections Retreat <ul style="list-style-type: none"> Transfer of Development Rights (TDR) Policy
Streets					
Harbor Drive <i>STRAHNET</i>	<u>Location 1:</u> Between Switzer to W. F Street Sea Level Rise/Storm: depth up to 7 feet (duration 10 hours)	<u>Location 1:</u> Between Sigsbee Street and the southern terminus of Harbor Drive Sea Level Rise/Storm: depth up to 12 feet (duration up to 25 hours)	Yes	Yes	Protection <ul style="list-style-type: none"> Regional Shoreline Monitoring Program Nature-based Adaptation Projects Building and Infrastructure Projects Living Breakwaters Protect Embarcadero and N. Harbor Drive <ul style="list-style-type: none"> Raised seawall/bulkhead or elevate bike paths Analyze Adaptation and Mitigation Strategies for N. Harbor Drive <ul style="list-style-type: none"> Raise shoreline Seawalls
	<u>Location 2:</u> Between Chollas and 28 th Street Sea Level Rise/Storm: depth up to 2 feet (duration up to 16 hours) Tsunami: risk on Harbor Drive and Chollas Creek	<u>Location 2:</u> Between 32 nd Street and 26 th Street Sea Level Rise/Storm: depth up to 6 feet (duration up to 25 hours). Tsunami: risk on Harbor Drive and Chollas Creek			

Key Facility	Year 2050	Year 2100	Flood Zone		Adaptation Strategies ¹
			100-Year	500-Year	
	<p><u>Location 3:</u> Between I-5 and Recreation Way</p> <p>Sea Level Rise/Storm: depth up to 6 feet (duration up to 8 hours)</p> <p>Tsunami: risk on Harbor Drive north of 8th Street</p>	<p><u>Location 3:</u> Between I-5 and Vesta Street</p> <p>Sea Level Rise/Storm: depth 10 feet (duration up to 25 hours)</p> <p>Tsunami: risk on Harbor Drive north of 8th Street</p>			<p>Accommodation</p> <ul style="list-style-type: none"> • Green Streets Program • Nature-based Adaptation Projects • Adaptation of Asphalt Grades • Bio-Enhancing Concrete • Ongoing Maintenance and Inspections • Analyze Options for Protecting Blue Line Trolley • Elevate Critical Roads • Potential Strategy for Imperial Beach <p>Retreat</p> <ul style="list-style-type: none"> • Protect Embarcadero and N. Harbor Drive <ul style="list-style-type: none"> ○ Relocate bike paths inland
Main Street	No Impacts	No Impacts	Yes	Yes	<p>Protection</p> <ul style="list-style-type: none"> • Nature-based Adaptation Projects • Building and Infrastructure Projects • Living Breakwaters • Protect Embarcadero and N. Harbor Drive <ul style="list-style-type: none"> ○ Raise seawall/bulkhead ○ Elevate bike paths • Analyze adaptation and mitigation strategies for N. Harbor Drive <ul style="list-style-type: none"> ○ Raise shoreline ○ Seawalls
8 th Street	<p><u>Location:</u> 8th Street and Harbor Drive</p> <p>Sea Level Rise/Storm: depth less than 1 foot (duration 8 hours)</p>	<p><u>Location:</u> 8th Street and Harbor Drive</p> <p>Sea Level Rise/Storm: depth less than 1 foot (duration 11-25 hours)</p>	Yes	Yes	
28 th Street	No Impacts	<p><u>Location:</u> 28th Street and Harbor Drive</p> <p>Sea Level Rise/Storm: depth 1-4 feet (duration 15-20 hours)</p>	Yes	Yes	

Key Facility	Year 2050	Year 2100	Flood Zone		Adaptation Strategies ¹
			100-Year	500-Year	
32 nd Street	<u>Location:</u> 32 nd Street and Chollas Creek Sea Level Rise/Storm: depth less than 6-inches	<u>Location:</u> 32 nd Street between Chollas Creek and Harbor Drive Sea Level Rise/Storm: depth up to 6 feet (duration 6-25 hours)	Yes	Yes	Accommodation <ul style="list-style-type: none"> • Green Streets Program • Policy-based Adaptation Strategies • Nature-based Adaptation Projects • Bio-Enhancing Concrete • Ongoing Maintenance and Inspections • Analyze Options for Protecting Blue Line Trolley
Pacific Highway	<u>Location:</u> Pacific Highway and Harbor Drive Sea Level Rise/Storm: depth up to 1 foot (duration less than 1 hour)	<u>Location:</u> Pacific Highway between Grape Street and Harbor Drive to southern terminus Sea Level Rise/Storm: depth 5 feet (duration 10-25 hours)	No	No	Protect <ul style="list-style-type: none"> • Living Breakwaters • Protect Embarcadero and N. Harbor Drive <ul style="list-style-type: none"> ◦ Raise seawall/bulkhead ◦ Elevate bike path • Analyze adaptation and mitigation strategies for N. Harbor Drive Accommodation <ul style="list-style-type: none"> • Green Street Program • Adaptation of Asphalt Grades • Bio-Enhancing Concrete • Ongoing Maintenance and Inspections • Analyze Options for Protecting Blue Line Trolley
Transit					
Blue Line Trolley	<u>Location:</u> Blue Line Trolley between Harbor Drive and the I-5 to Division Street and	<u>Location:</u> Blue Line Trolley between Harbor Drive and I-5	Yes	Yes	Protection <ul style="list-style-type: none"> • Nature-based Adaptation Projects

Key Facility	Year 2050	Year 2100	Flood Zone		Adaptation Strategies ¹
			100-Year	500-Year	
	between Park Boulevard to G Street Sea Level Rise/Storm: depth up to 3 feet (duration 8-16 hours near stations and Chollas Creek) Tsunami: 8 th Street Transit Center is in the risk area	to 28 th Street and between Sigsbee to Broadway Sea Level Rise/Storm: depth up to 8 feet (duration 8-25 hours along Blue Line Trolley line). Tsunami: 8 th Street Transit Center is in the risk area			<ul style="list-style-type: none"> • Building and Infrastructure Projects • Living Breakwaters • Protect Embarcadero and N. Harbor Drive <ul style="list-style-type: none"> ○ Raise seawall/bulkhead ○ Elevate bike paths • Analyze adaptation and mitigation strategies for N. Harbor Drive <ul style="list-style-type: none"> ○ Raise shoreline ○ Seawalls <p>Accommodation</p> <ul style="list-style-type: none"> • Policy-based Adaptation Strategies • Nature-based Adaptation Projects • Bio-Enhancing Concrete • Ongoing Maintenance and Inspections • Analyze Options for Protecting Blue Line Trolley
Bridges					
	<u>Location:</u> Harbor Drive Bridge over Chollas Creek Sea Level Rise/Storm: depth up to 2 feet (duration up to 16 hours) Tsunami: risk in Chollas Creek	<u>Location:</u> Harbor Drive Bridge over Chollas Creek Sea Level Rise/Storm: depth up to 6 feet (duration up to 25 hours) Tsunami: risk in Chollas Creek	Yes	Yes	<p>Protection</p> <ul style="list-style-type: none"> • Nature-based Adaptation Projects • Building and Infrastructure Projects • Living Breakwaters

Key Facility	Year 2050	Year 2100	Flood Zone		Adaptation Strategies ¹
			100-Year	500-Year	
	<p><u>Location:</u> Harbor Drive Bridge over Paletas Creek</p> <p>Sea Level Rise/Storm: depth up to 6 feet (duration up to 8 hours)</p> <p>Tsunami: risk around Paletas Creek</p>	<p><u>Location:</u> Harbor Drive Bridge over Paletas Creek</p> <p>Sea Level Rise/Storm: depth 10 feet (duration up to 25 hours)</p> <p>Tsunami: risk around Paletas Creek</p>	Yes	Yes	<ul style="list-style-type: none"> • Protect Embarcadero and N. Harbor Drive <ul style="list-style-type: none"> ○ Raise seawall/bulkhead ○ Elevate bike paths • Analyze adaptation and mitigation strategies for N. Harbor Drive <ul style="list-style-type: none"> ○ Raise shoreline ○ Seawalls <p>Accommodation</p> <ul style="list-style-type: none"> • Policy-based Adaptation Strategies • Nature-based Adaptation Projects • Bio-Enhancing Concrete • Ongoing Maintenance and Inspections • Analyze Options for Protecting Blue Line Trolley

Notes:

1. For descriptions of Adaptation Strategies, see Section 1.3 Adaptation Planning and Design Strategies.

NBSD Vulnerability Mapping

The following maps represent the 2050/2100 sea level rise projections with 100-year storm conditions. The 2050-year and 2100-year time horizons were used to show the greatest extent of flood, depth, and duration for each time horizon.

For maps identifying the locations of transportation facilities at risk from erosion, 100- and 500-year floods, and tsunami see Attachments A, B, and C respectively. See Attachment D for an overall map showing the 2050 and 2100 sea level rise scenarios with 100-year storm.

Flood Extent and Depth Maps

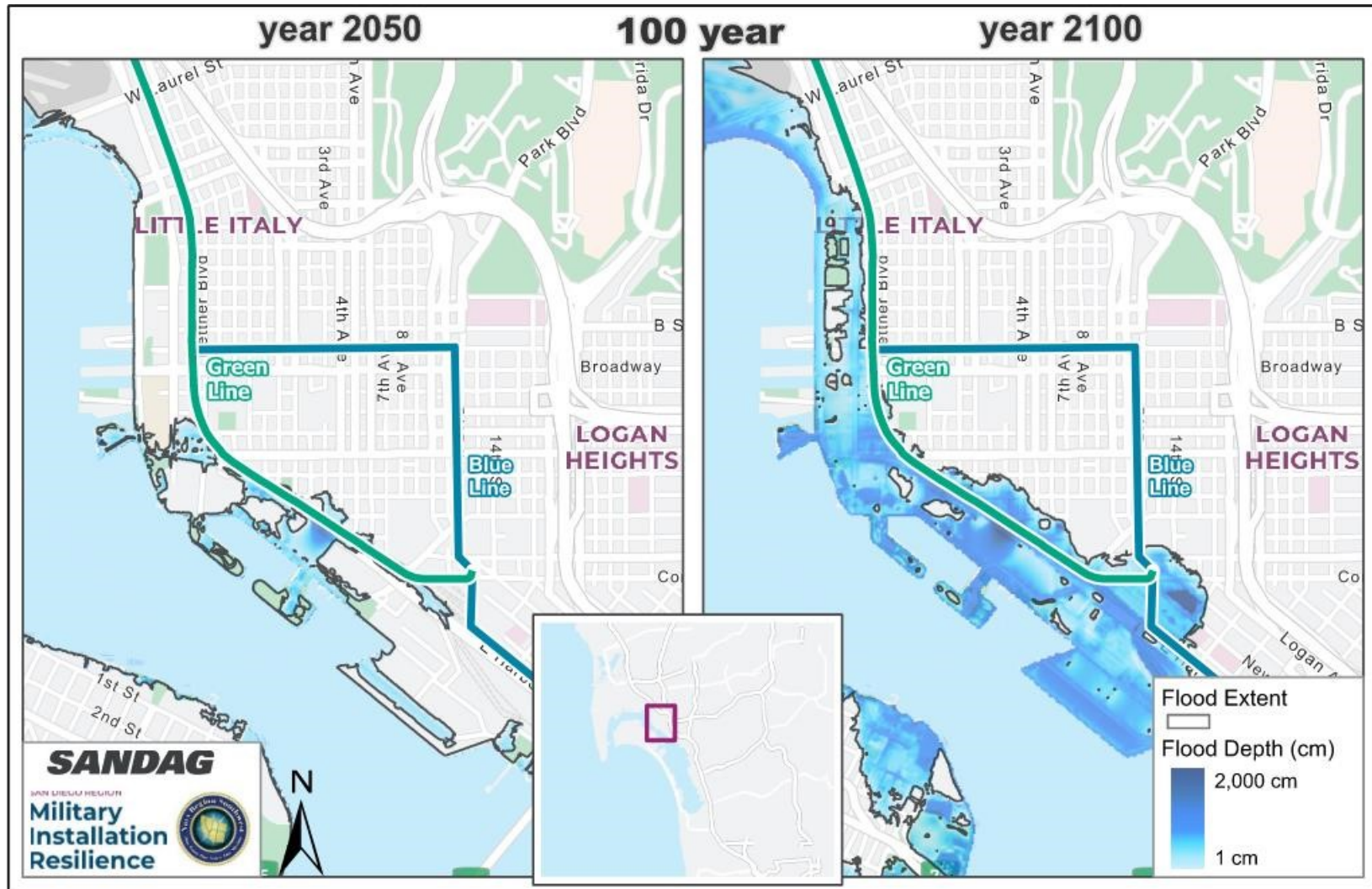


Figure 8 NBSD Broadway Complex: Pacific Highway, Harbord Drive, and Blue and Green Line Trolleys

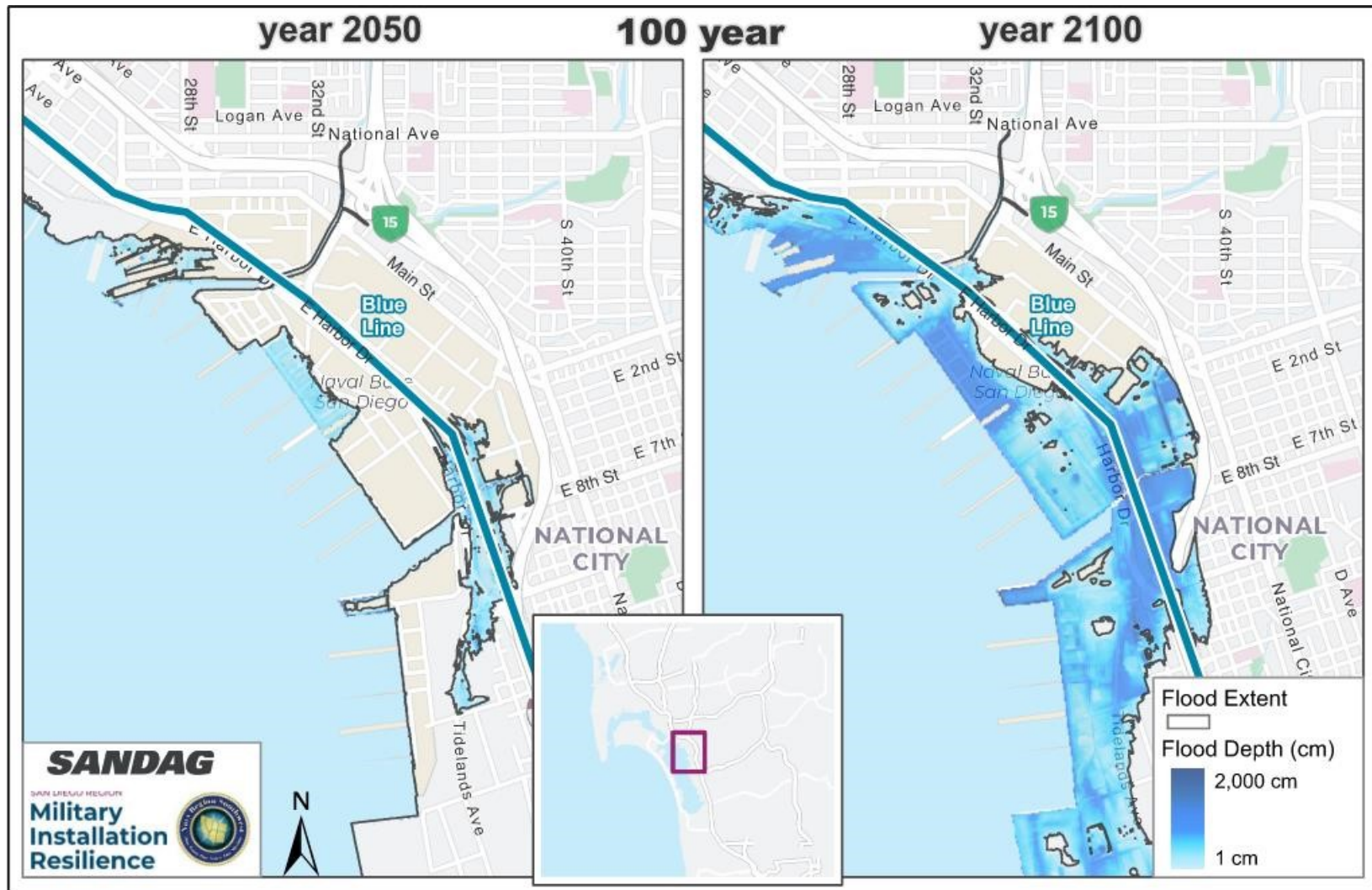


Figure 9. NBSD 32nd Street Facility: I-5, I-15, Harbor Drive (including bridges over Chollas and Paletas Creeks), 8th Street, 28th Street, 32nd Street, Main Street, and Blue Line Trolley

Flood Extent and Duration Maps

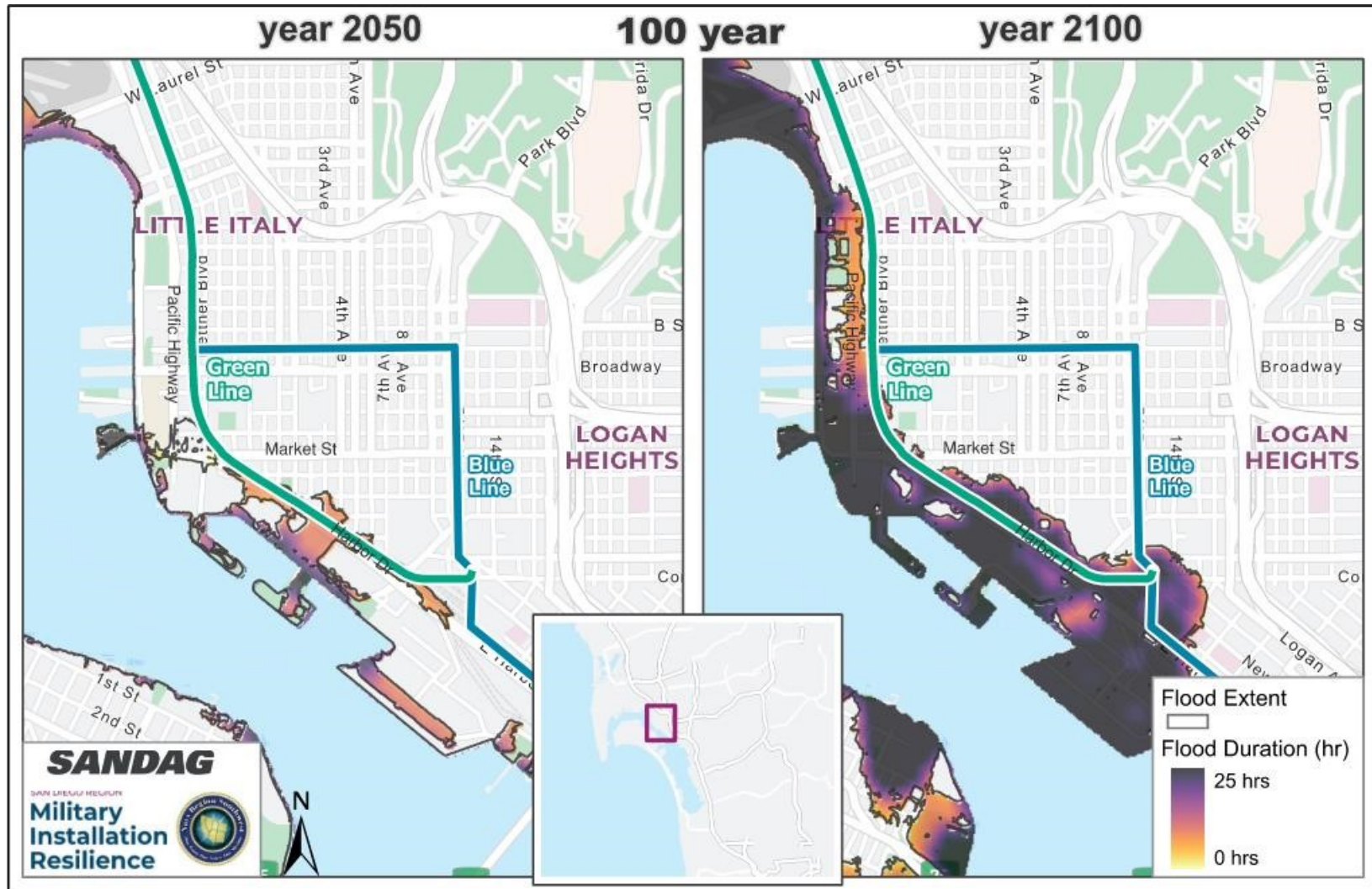


Figure 10. NBSD Broadway Complex: Pacific Highway, Harbor Drive, and Blue and Green Line Trolleys

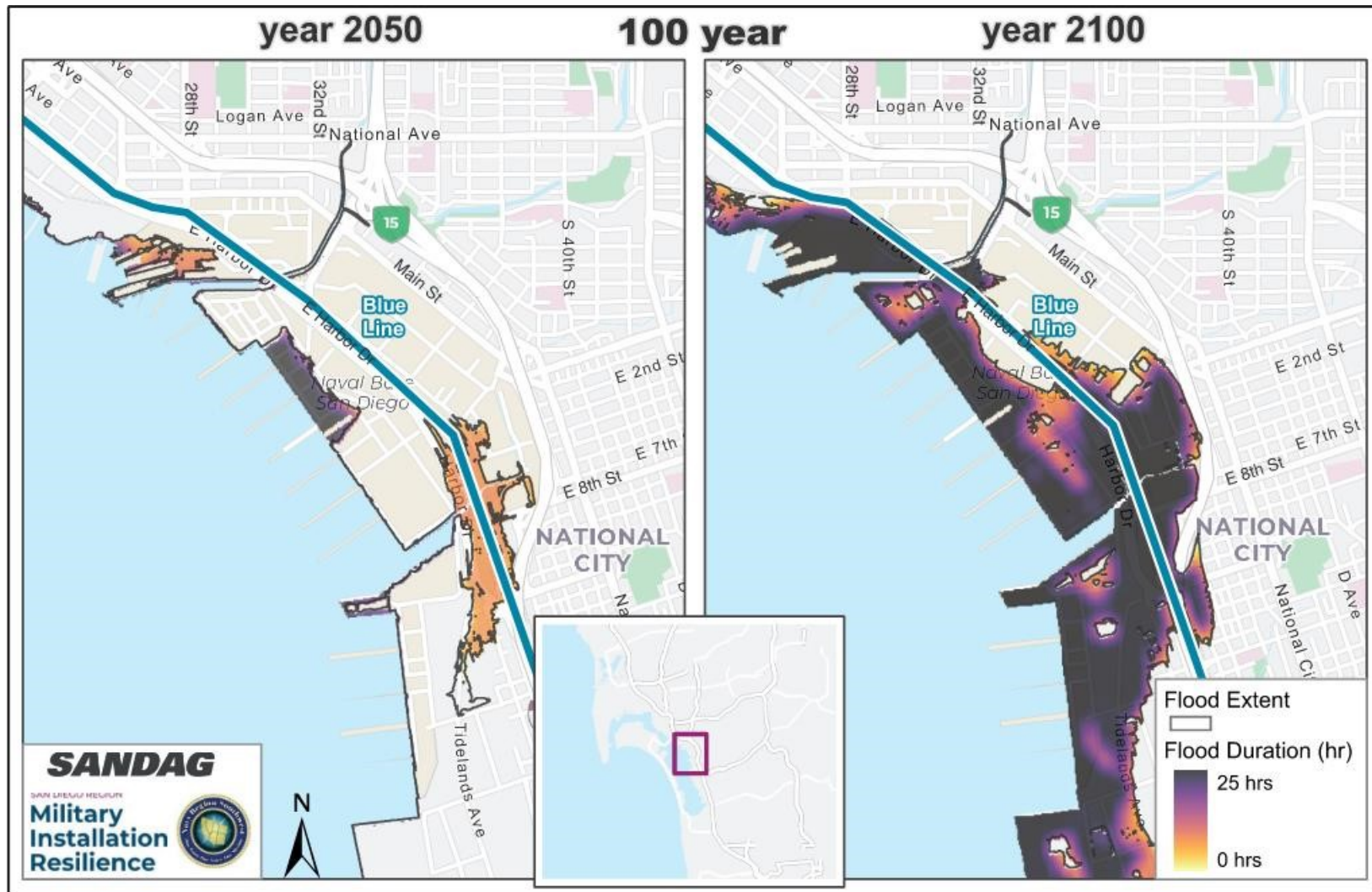


Figure 11. NBSD 32nd Street Facility: I-5, I-15, Harbor Drive (including bridges over Chollas and Paleta creeks), 8th Street, 28th Street, 32nd Street, Main Street, and Blue Line Trolley

Key Transportation Facilities

The key transportation facilities, within the limits of this study, serving NBSD are identified below.

Interstate 5 (I-5)

I-5 extends from the California-Mexico border to Canada for a total length of more than 1,350 miles. In San Diego County, I-5 extends 72.4 miles from the U.S./Mexico International Border to the Orange County line. I-5 is a heavily utilized commuter route providing direct access to the San Diego Central Business District in downtown San Diego as well as the Navy Bases and numerous other employment centers located within the corridor. I-5 is a major north-south corridor that connects to I-8, I-15 and SR 75 and local roads used by military personnel from Navy Base San Diego, Navy Base Coronado, and Navy Base Point Loma facilities to drive, carpool, and vanpool to and from the bases. There are several Park & Ride lots along I-5 where commuters can meet to carpool, vanpool, and access transit services. I-5 is part of the National Highway System and Strategic Highway Network (STRAHNET) a network of roadways important to the country's economy, defense, and mobility and it also provides truck access to San Diego's marine terminals, rail yards, and air freight terminals for the purpose of goods movement.

Interstate-15 (I-15)

I-15 is a major north-south state highway and Interstate Highway in California, connecting San Bernardino, Riverside, and San Diego Counties. South of its junction at I-8 in San Diego, the highway becomes SR 15, extending 6.13 miles to I-5, about 12 miles from the Mexican border.

Pacific Highway (Highway 101)

Known as the Pacific Coast Highway, California U.S. Route 101 (or 1 in some stretches) runs directly along the Pacific Ocean for 790 miles, from San Diego to the Oregon border. An old freeway section of U.S. Route 101 parallel to Interstate 5 near the San Diego International Airport is known as 'Pacific Highway' and is now locally maintained. Pacific Highway provides access to Navy Base San Diego Broadway Complex. Pacific Highway borders the Broadway Complex to the east and is a direct connector between NBSD and the Navy Base Point Loma Old Town Complex and NAVWAR in Point Loma.

Harbor Drive

Harbor Drive is a major north-south arterial that connects to I-15 in the city of San Diego. Harbor Drive is part of the STRAHNET and a preferred truck route. Harbor Drive provides access to NBSD 32nd Street facility and splits the base into two sections: the "wet side" and the "dry side." The wet side is the area west of Harbor Drive and is comprised of the piers, maintenance support, and supply operations. Harbor Drive provides access to all wet side gates except for one. Parking can be accessed from Harbor Drive and there is a drop off and pick up spot for Transportation Network Companies and taxis on the southside of Harbor Drive, west of the 32nd Street pedestrian bridge and gate access. There are two bridges on Harbor Drive that cross over Chollas and Paletas Creek, travel over the bridges may be required for access to the base. Harbor Drive also connects to Pacific Highway and provides a connection between the 32nd Street Facility and the Broadway Complex.

32nd Street

32nd Street connects to I-15 and Harbor Drive and provides access to NBSD and to a pedestrian bridge at the intersection of Harbor Drive and 32nd Street. The pedestrian bridge provides convenient access for transit riders using the Blue Line Trolley Pacific Fleet Trolley Station. There is a drop off and pick up spot for Transportation Network Companies and taxis on the eastside of 32nd Street in between the Pacific Fleet Trolley Station and access to the base.

Blue Line Trolley

The Blue Line Trolley is a north-south light rail service operated by San Diego Metropolitan Transit System (MTS) that runs from the U.S.-Mexico border at San Ysidro to Downtown San Diego. Adjacent to NBSD, the Blue Line Trolley runs parallel to Harbor Drive and has four stations within a mile of one or more of the base's access gates: Harborside Station, Pacific Fleet Station, 8th Street Transit Center, and 24th Street Transit Center. The Trolley crosses 28th Street and 32nd Street at-grade, causing additional queuing at the intersections of 28th Street and Harbor Drive, and 32nd Street and Harbor Drive when traffic volumes and congestion are at their peak.

Naval Base Coronado – Vulnerability Profile

Key Transportation Facilities

The key transportation facilities for NBC selected for inclusion in this analysis are:

- I-5
- SR 75 and the SR 75 Coronado Bay Bridge
- SR 282 (3rd Street/Stockdale Blvd)
- Ocean Boulevard
- 13th Street
- Palm Avenue

Vulnerability Analysis

Potential impacts to key transportation facilities from coastal storms/storm surge, erosion, sea level rise, flooding, and tsunami (if applicable) for the 2050- and 2100-time horizons and 100- and 500-year flood are identified in the table below.

The vulnerability analysis utilized the following data sets to develop each profile.

- 100-year storm or 1 percent storm (CoSMoS)
- Erosion without shoreline mitigation (CoSMoS)
- Year 2050, sea level rise projections of 75 cm or 2.5 feet (CoSMoS)
- Year 2100, sea level rise projections of 200 cm or 6.6 feet (CoSMoS)
- FEMA Flood Hazard Layer 100-year/500-year Flood
- Tsunami data from University of Southern California Tsunami Research Center

The results of the vulnerability profile are summarized in the table below. Additionally, maps depicting flood extent, depth, and duration follow the table. For maps showing transportation facilities at risk of erosion, 100- and 500-year flood zones, and tsunami see Attachment A, B and C, respectively.

Note: 2050/2100 sea level rise projections with 100-year storm conditions were used to show the greatest extent of flood, depth, and duration for each time horizon. Future changes in precipitation patterns may worsen erosion and flooding in vulnerable areas.

Key Facility	Year 2050	Year 2100	Flood		Adaptation Strategies ¹
			100-Year	500-Year	
Freeways/Streets/Bridge					
I-5 STRAHNET	<u>Location:</u> I-5 connection to SR 75 No Impacts	<u>Location:</u> I-5 connection to SR 75 No Impacts	Yes	Yes	Accommodation <ul style="list-style-type: none"> Adaptation of Asphalt Grades Ongoing Maintenance and Inspections
SR 75	<u>Location 1:</u> SR 75 Coronado Bay Bridge/entry into Coronado Sea Level Rise/Storm: depth 1 to 5 feet (duration 10 to 14 hours)	<u>Location 1:</u> SR 75 Coronado Bay Bridge/entry into Coronado Sea Level Rise/Storm: depth 1 to 9 feet (duration 12 to 16 hours)	Yes	Yes	Protection <ul style="list-style-type: none"> Regional Beach Sand Program Sand Retention Strategy Pilot Update Shoreline Preservation Strategy (SPS) Regional Shoreline Monitoring Program Nature-base Adaptation Projects Potential Strategies for Coronado <ul style="list-style-type: none"> Seawall Revetment Vegetated sand dunes Beach nourishment Analyze Strategies for Protecting SR 75 <ul style="list-style-type: none"> Armoring Imperial Beach Coastline Phase relocation/retreat Sand nourishment Hybrid dunes and cobble Groins with sand nourishment
	<u>Location 2:</u> SR 75 between Pamona Avenue to the Coronado Boathouse and Glorietta Bay Park Sea Level Rise/Storm: depth up to 2 feet (duration 10 to 20 hours) Erosion: along coastal areas of SR 75 Tsunami: risk along coastal areas of SR 75	<u>Location 2:</u> SR 75 between Leyte Road in Coronado to Palm Avenue in Imperial Beach, Sea Level Rise/Storm: depths up to just over 8 feet (duration of up to 24 hours) Erosion: along coastal areas of SR 75 Tsunami risk along coastal areas of SR 75 and bayside between NAB and SSTC			
	<u>Location 3:</u> SR 75 southwest of Glorietta Bay Park (oceanside) to Tulagi Road Sea Level Rise/Storm: depth up to 3 feet (duration 3 to 5 hours) Erosion: along coastal areas of SR 75 Tsunami: risk along coastal areas of SR 75				

Key Facility	Year 2050	Year 2100	Flood		Adaptation Strategies ¹
			100-Year	500-Year	
	<p><u>Location 4</u>: SR 75 between Tulagi Road and Leyte Road</p> <p>Sea Level Rise/Storm: depth under 2 feet (duration up to 23 hours)</p> <p>Erosion: along coastal areas of SR 75</p> <p>Tsunami: risk along coastal areas of SR 75</p>				<p>Accommodation</p> <ul style="list-style-type: none"> Downsizing or Coastal Hazards Nature-base Adaptation Projects Adaptation of Asphalt Grades Ongoing Maintenance and Inspections Elevate Critical Roads Potential Strategy for Imperial Beach <p>Retreat</p> <ul style="list-style-type: none"> TDR Policy Analyze Strategies for Protecting SR 75
SR 282 includes 3 rd Street and Stockdale	No Impacts	No Impacts	No	No	<p>Accommodation</p> <ul style="list-style-type: none"> Green Streets Program
Ocean Boulevard	<p><u>Location</u>: between Rogers Road and G Avenue</p> <p>Sea Level Rise/Storm: depth from 1-4 ft (duration 25 hours)</p> <p>Erosion: along coastal side of Ocean Boulevard</p> <p>Tsunami: risk on coastal side of Ocean Boulevard</p>	<p><u>Location</u>: Between Rogers Road and G Avenue</p> <p>Sea Level Rise/Storm: depth up to 6 ft (duration up to 25 hours)</p> <p>Erosion: along coastal side of Ocean Boulevard</p> <p>Tsunami: risk on coastal side of Ocean Boulevard</p>	Yes	Yes	<p>Protection</p> <ul style="list-style-type: none"> Regional Beach Sand Program Sand Retention Strategy Pilot Update Shoreline Preservation Strategy (SPS) <p>Accommodation</p> <ul style="list-style-type: none"> Downsizing or Coastal Hazards Adaptation of Asphalt Grades Ongoing Maintenance and Inspections Potential Strategy for Imperial Beach <p>Retreat</p> <ul style="list-style-type: none"> TDR Policy

Key Facility	Year 2050	Year 2100	Flood		Adaptation Strategies ¹
			100-Year	500-Year	
					<ul style="list-style-type: none"> Analyze Strategies for Protecting SR 75
13 th Street	No Impact	No Impact	No	No	Protection <ul style="list-style-type: none"> Imperial Beach Bayshore Bikeway

Notes:

1. For descriptions of Adaptation Strategies, see Section 1.3 Adaptation Planning and Design Strategies Memo.

NBC Vulnerability Mapping

The following maps represent the 2050/2100 sea level rise projections with 100-year storm conditions. The 2050-year and 2100-year time horizons were used to show the greatest extent of flood, depth, and duration for each time horizon.

For maps identifying the locations for transportation facilities at risk for erosion, 100- and 500-year floods, and tsunami see Attachments A, B, and C respectively. See Attachment D for an overall map showing the 2050 and 2100 sea level rise scenarios with 100-year storm.

Flood Extent and Depth Maps

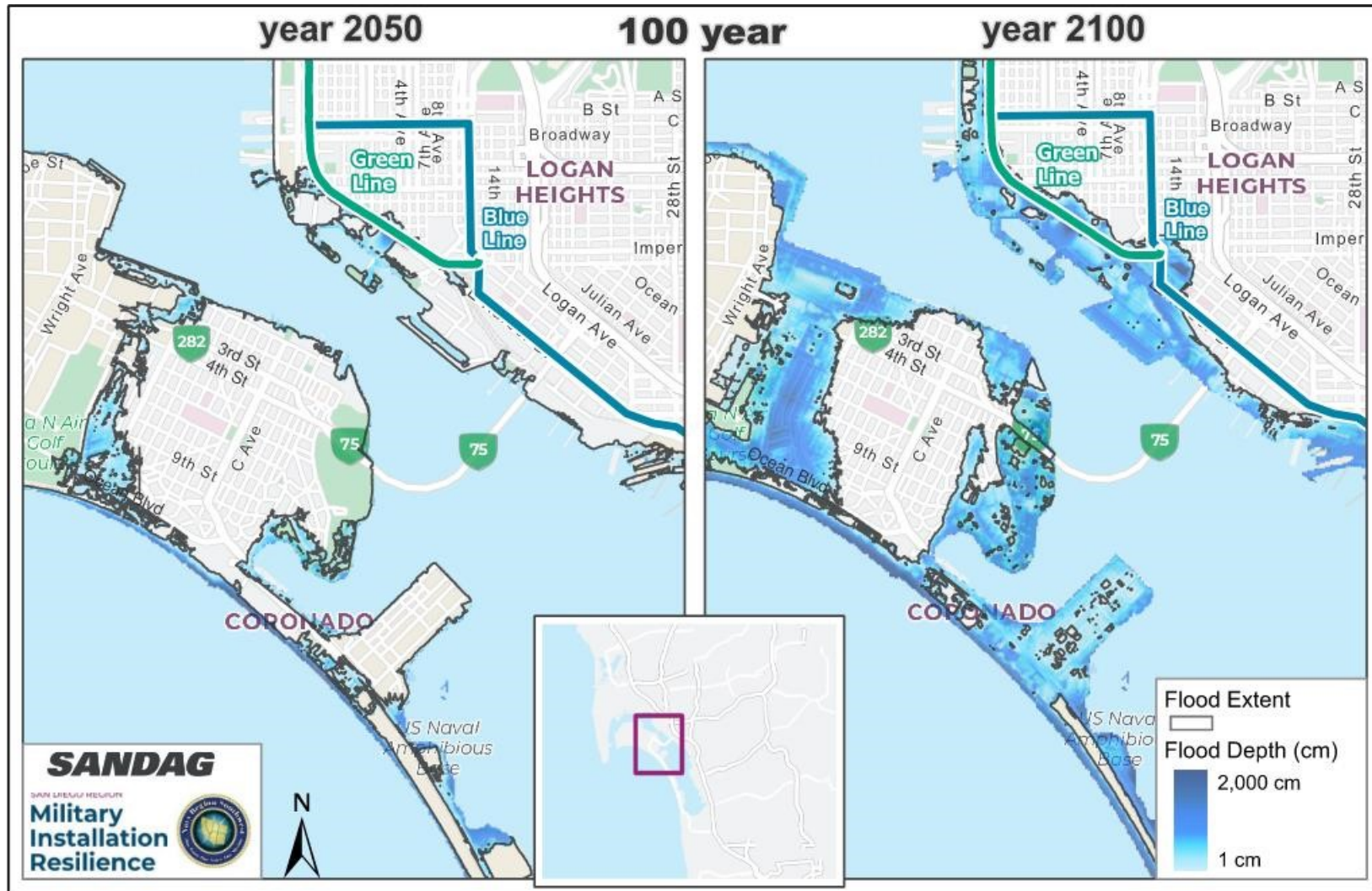


Figure 12. NBC NASNI and NAB: SR 75, SR 282 (3rd Street and Stockdale Boulevard), and Ocean Boulevard

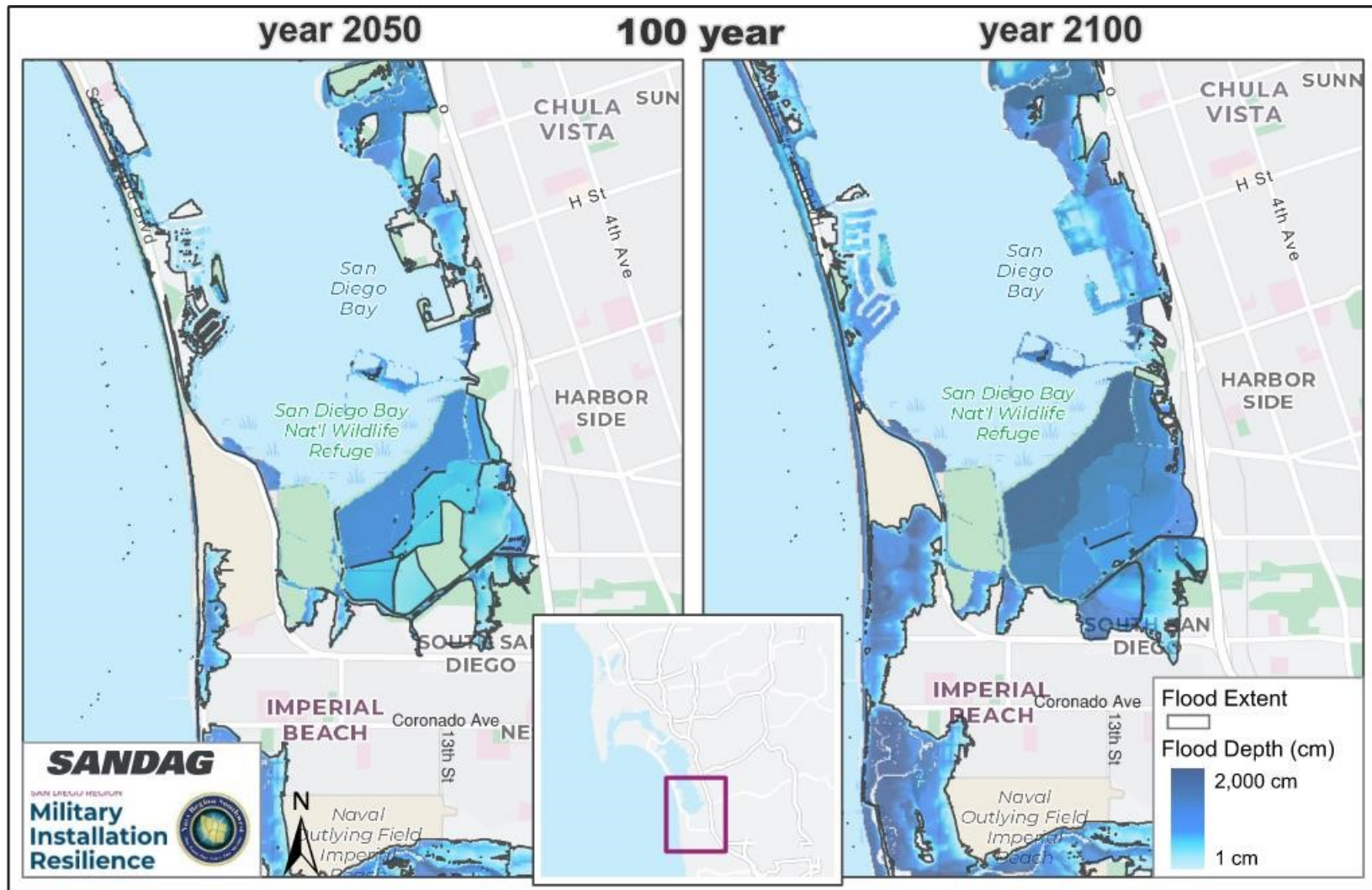


Figure 13. NBC Silver Stand Training Complex and NOLF: SR 75 and 13th Street

Flood Extent and Duration Maps

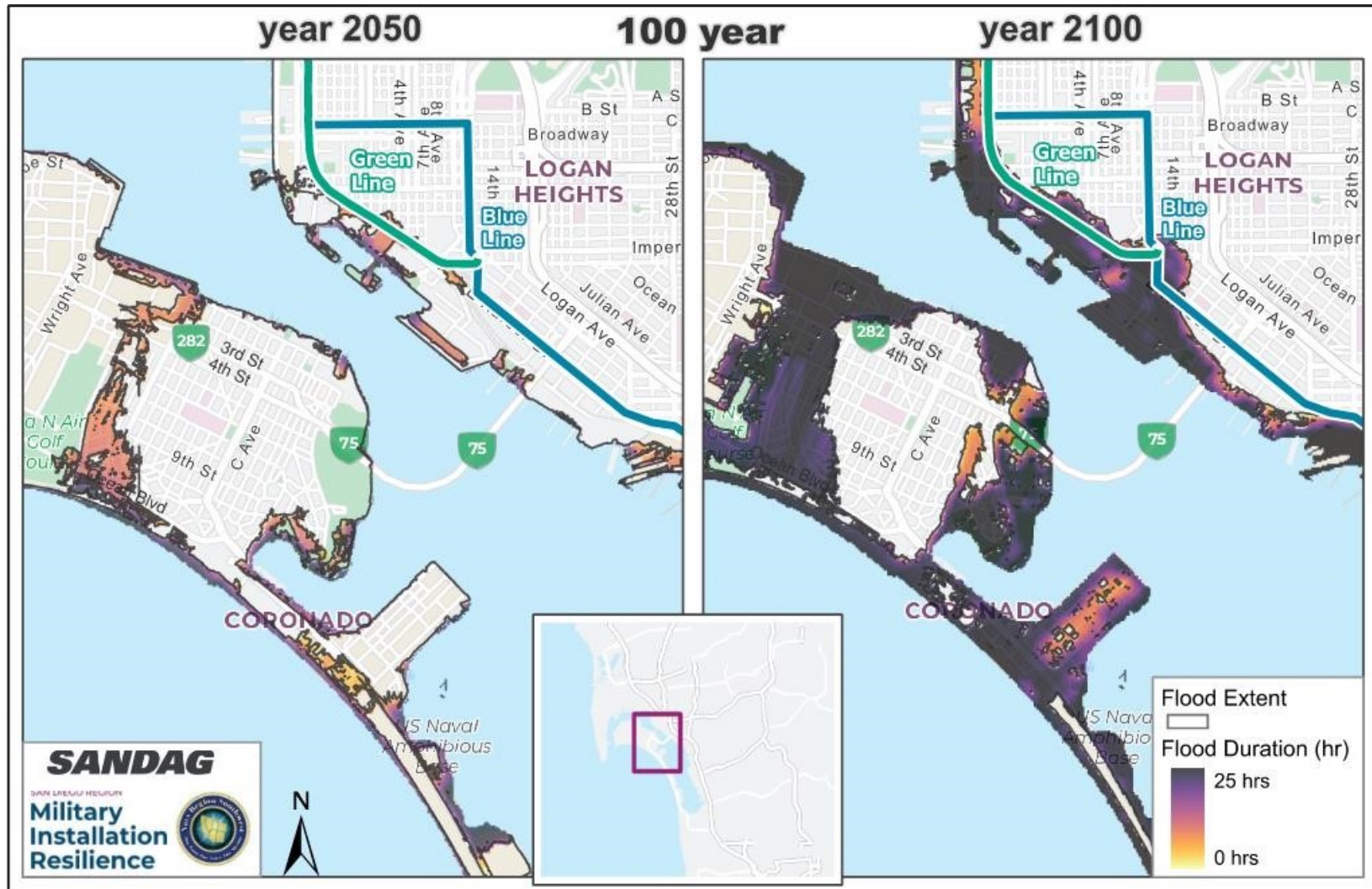


Figure 14. NBC NASNI and NAB: SR 75, SR 282 (3rd Street and Stockdale Boulevard), and Ocean Boulevard

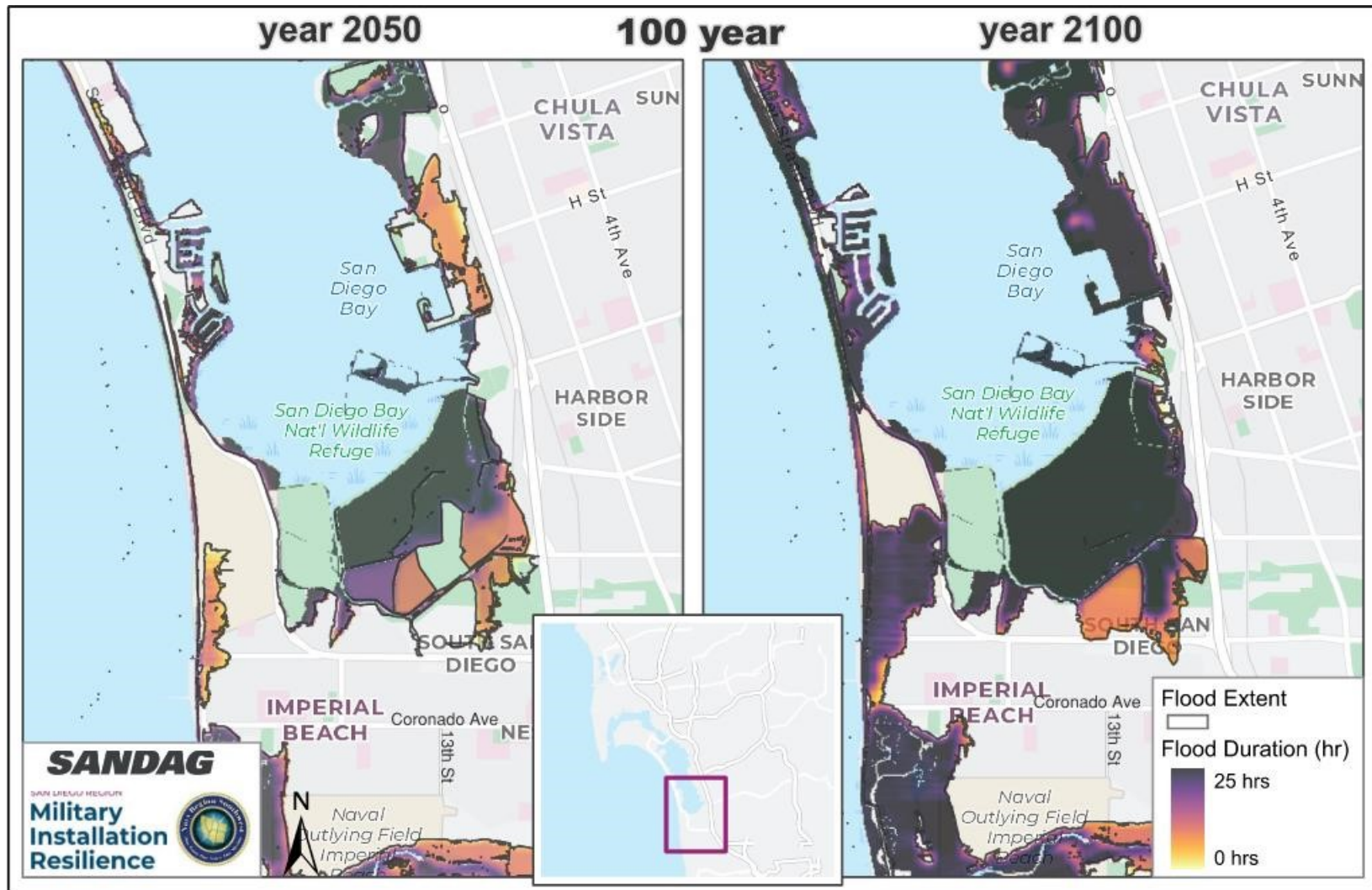


Figure 15. NBC Silver Stand Training Complex and NOLF: SR 75 and 13th Street

Key Transportation Facilities Key NBC

The key transportation facilities, within the limits of this study, serving NBC are identified below.

State Route 75 (SR 75)/Coronado Bay Bridge

SR 75 is STRAHNET Connector route. The route carries a high volume of civilian and military commuters to NASNI and the NAB on Coronado. SR 75 also serves local traffic and functions as a main arterial street through the cities of Imperial Beach and Coronado with significantly high bicycle and pedestrian volumes. With on-street parking and numerous driveways and access points, the route operates more like a city street rather than an interregional state highway. The Coronado Bridge will continue to be owned, operated, and maintained by Caltrans.

State Route 282 (SR 282)/3rd and 4th Streets

SR 282 is located entirely within the City of Coronado connecting the City of San Diego via the Coronado Bridge and SR 75 to residential neighborhoods and to NASNI. The route is a STRAHNET Connector and functions as a separated couplet operating along 3rd and 4th Streets. Extending roughly 0.69 miles, SR 282 has three travel lanes in each direction and has an Average Annual Daily Traffic (AADT) of approximately 18,000. The route serves both military and residential commuter trips and is entirely within the boundaries of the City of Coronado in San Diego County. SR 282 primarily serves local traffic and functions as a Main Street through the City of Coronado with moderately high pedestrian volumes. 3rd Street leads to the main vehicular entrance to NASNI, which is on the south side of the base. Inside the base, 3rd Street turns into Stockdale Boulevard, which continues through some of NASNI.

Ocean Boulevard

Ocean Boulevard is a local street that connects to SR 75 and provides access to NASNI.

13th Street

13th Street is a local street that runs north and south through Imperial Beach and provides access to NOLF via SR 75.

Navy Base Point Loma – Vulnerability Profile

Key Transportation Facilities

The key transportation facilities for NBPL selected for inclusion in this analysis are:

- I-5
- I-8
- Catalina Boulevard
- Rosecrans Street
- Nimitz Boulevard
- N. Harbor Drive
- Pacific Highway

Vulnerability Analysis

Potential impacts to key transportation facilities from coastal storms/storm surge, erosion, sea level rise, flooding, and tsunami (if applicable) for the 2050- and 2100-time horizons and 100- and 500-year flood are identified in the table below.

The vulnerability analysis utilized the following data sets to develop each profile.

- 100-year storm or 1 percent storm (CoSMoS)
- Erosion without shoreline mitigation (CoSMoS)
- Year 2050, sea level rise projections of 75 cm or 2.5 feet (CoSMoS)
- Year 2100, sea level rise projections of 200 cm or 6.6 feet (CoSMoS)
- FEMA Flood Hazard Layer 100-year/500-year Flood
- Tsunami data from University of Southern California Tsunami Research Center

The results of the vulnerability profile are summarized in the table below. Additionally, maps depicting flood extent, depth, and duration follow the table. For maps showing transportation facilities at risk of 100- and 500-year flood zones and tsunami see Attachment B and C. There are no key transportation facilities that provide access to NBPL at risk of erosion.

Note: 2050/2100 sea level rise projections with 100-year storm conditions were used to show the greatest extent of flood, depth, and duration for each time horizon. Future changes in precipitation patterns may worsen erosion and flooding in vulnerable areas.

Key Facility	Year 2050	Year 2100	Flood		Adaptation Strategies ¹
			100-Year	500-Year	
Freeways					
I-5 STRAHNET	<u>Location:</u> Just north of I-5 and I-8 interchange Sea Level Rise/Storm: depth of up to just over 8 feet (duration 14 to 25 hours)	<u>Location:</u> Just north of I-5 and I-8 interchange Sea Level Rise/Storm: depth of up to 10 feet (duration 25 hours)	Yes	Yes	Accommodation <ul style="list-style-type: none"> Adaptation of Asphalt Grades Ongoing Maintenance and Inspections
I-8	<u>Location:</u> I-8 and I-5 interchange Sea Level Rise/Storm: depth of up to just over 8 feet (duration 14 to 25 hours)	<u>Location:</u> I-8 and I-5 interchange extending west for approximately 1.75 miles Sea Level Rise/Storm: depth of just over 8 feet (duration of 2 to 15 hours)	Yes	Yes	Accommodation <ul style="list-style-type: none"> Adaptation of Asphalt Grades Ongoing Maintenance and Inspections
Streets					
Catalina Boulevard	No Impacts	No Impacts	No	No	N/A
Rosecrans Street STRAHNET	No Impacts	<u>Location1:</u> Between Jarvis Street and Emerson Street (intersection of Rosecrans Street and N. Harbor Drive) Sea Level Rise/Storm: depth of up to 9 feet (duration of 12 to 25 hours) <i>Flooding from sea level rise and storm surge are not expected to reach west of Rosecrans Street.</i>	No	No	Accommodation <ul style="list-style-type: none"> Green Streets Program Adaptation of Asphalt Grades Ongoing Maintenance and Inspections
	No Impacts	<u>Location 2:</u> Between Pacific Highway and Evergreen Street Sea Level Rise/Storm: depth of up to 8 feet (duration 25 hours)			

Key Facility	Year 2050	Year 2100	Flood		Adaptation Strategies ¹
			100-Year	500-Year	
Nimitz Boulevard	<p><u>Location</u>: Between Rosecrans Street and N. Harbor Drive</p> <p>Sea Level Rise/Storm: depth of up to 4 feet (duration of 3 to 15 hours)</p>	<p><u>Location</u>: Between Rosecrans Street and N. Harbor Drive</p> <p>Sea Level Rise/Storm: depth of up to 8 feet (duration of 12 to 25 hours)</p>	No	No	<p>Accommodation</p> <ul style="list-style-type: none"> • Green Streets Program • Adaptation of Asphalt Grades • Ongoing Maintenance and Inspections
N. Harbor Drive	<p><u>Location 1</u>: Between Rosecrans Street and Nimitz Boulevard</p> <p>Sea Level Rise/Storm: depth of up to 2-4 feet (duration up to 17 hours)</p>	<p><u>Location 1</u>: Between Rosecrans Street to West Laurel Street</p> <p>Sea Level Rise/Storm: depth of up to 11 feet for 3 miles along N. Harbor Drive (duration up to 24 hours)</p>	Yes	Yes	<p>Protection</p> <ul style="list-style-type: none"> • Regional Shoreline Monitoring Program • Raise shoreline to protect assets from sea level rise and storm surge <p>Accommodation</p> <ul style="list-style-type: none"> • Green Streets Program • Adaptation of Asphalt Grades • Ongoing Maintenance and Inspections • Elevate Critical Roads • Address downstream sedimentation and flooding at intersection of Pacific Highway and Laurel Street <p>Retreat</p> <ul style="list-style-type: none"> • Protect Embarcadero and N. Harbor Drive <ul style="list-style-type: none"> ○ Relocate bike paths
	<p><u>Location 2</u>: N. Harbor Drive Bridges over the San Diego Bay</p> <p>Sea Level Rise/Storm: depth of up to 6 feet (duration up to 17 hours)</p> <p>Tsunami: risk area near San Diego Bay</p>				
	<p><u>Location 3</u>: Between West Laurel Street and Liberator Way</p> <p>Sea Level Rise/Storm: depth of 2-4 feet (duration less than one hour)</p>				
Pacific Highway	No Impacts	<p><u>Location</u>: Between Barnett Avenue and Witherby Street</p> <p>Sea Level Rise/Storm: depth of 5 feet to 17 feet (duration 8 to 25 hours)</p>	No	No	<p>Accommodation</p> <ul style="list-style-type: none"> • Green Streets Program • Adaptation of Asphalt Grades • Ongoing Maintenance and Inspections

Key Facility	Year 2050	Year 2100	Flood		Adaptation Strategies ¹
			100-Year	500-Year	
					<ul style="list-style-type: none"> Address downstream sedimentation and flooding at intersection of Pacific Highway and Laurel Street

Notes:

- For descriptions of Adaptation Strategies, see Section 1.3 Adaptation Planning and Design Strategies.

NBPL Vulnerability Mapping

The following maps represent the 2050/2100 sea level rise projections with 100-year storm conditions. The 2050-year and 2100-year time horizons were used to show the greatest extent of flood, depth, and duration for each time horizon.

For maps identifying the locations for transportation facilities at risk for erosion, and 100- and 500-year floods, tsunamis, see Attachments A, B, and C respectively. See Attachment D for an overall map showing the 2050 and 2100 sea level rise scenarios with 100-year storm.

Flood Extent and Depth Maps

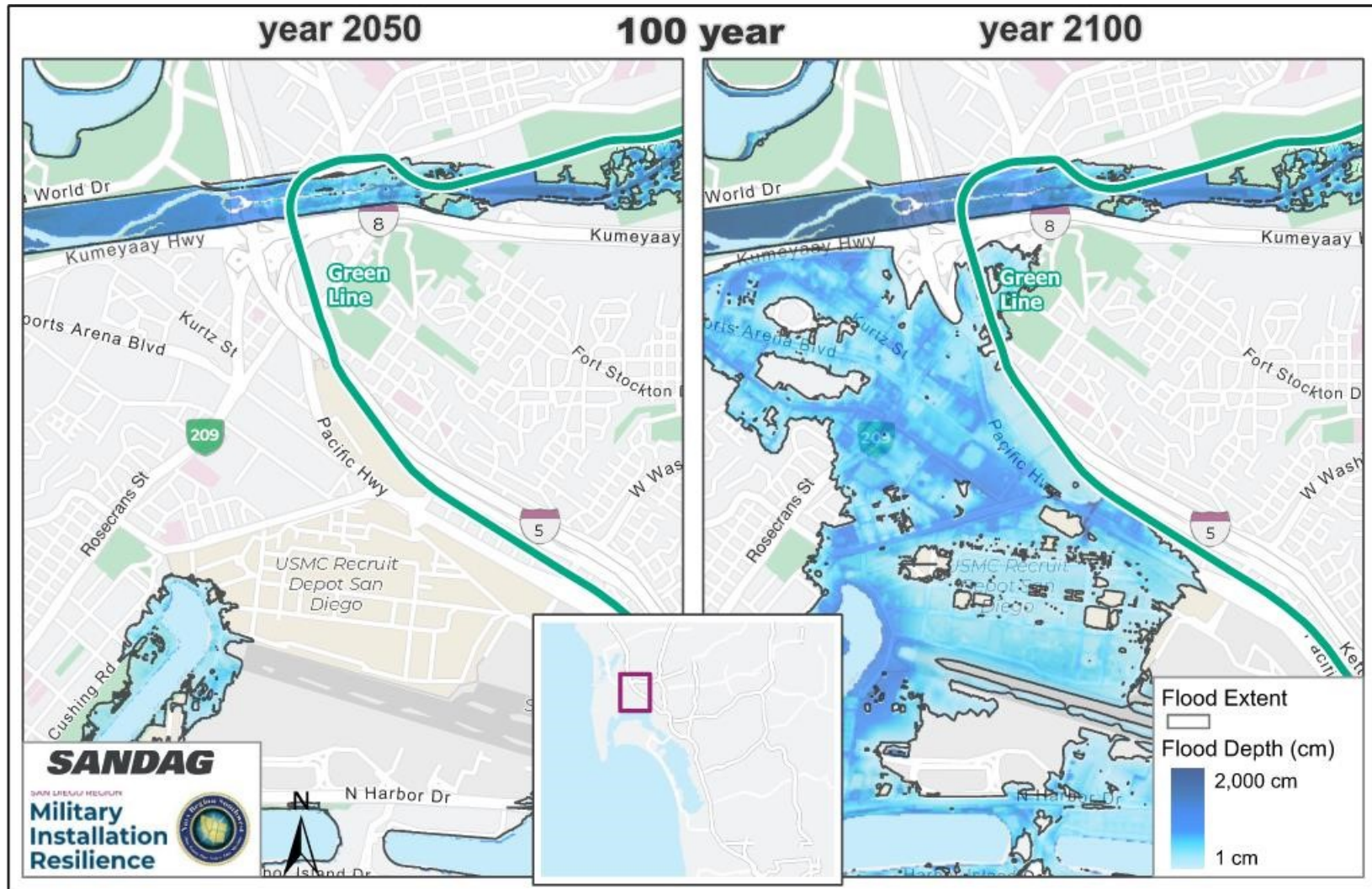


Figure 16. NBPL OTC Complex: I-5, I-8, Pacific Highway and Rosecrans Street

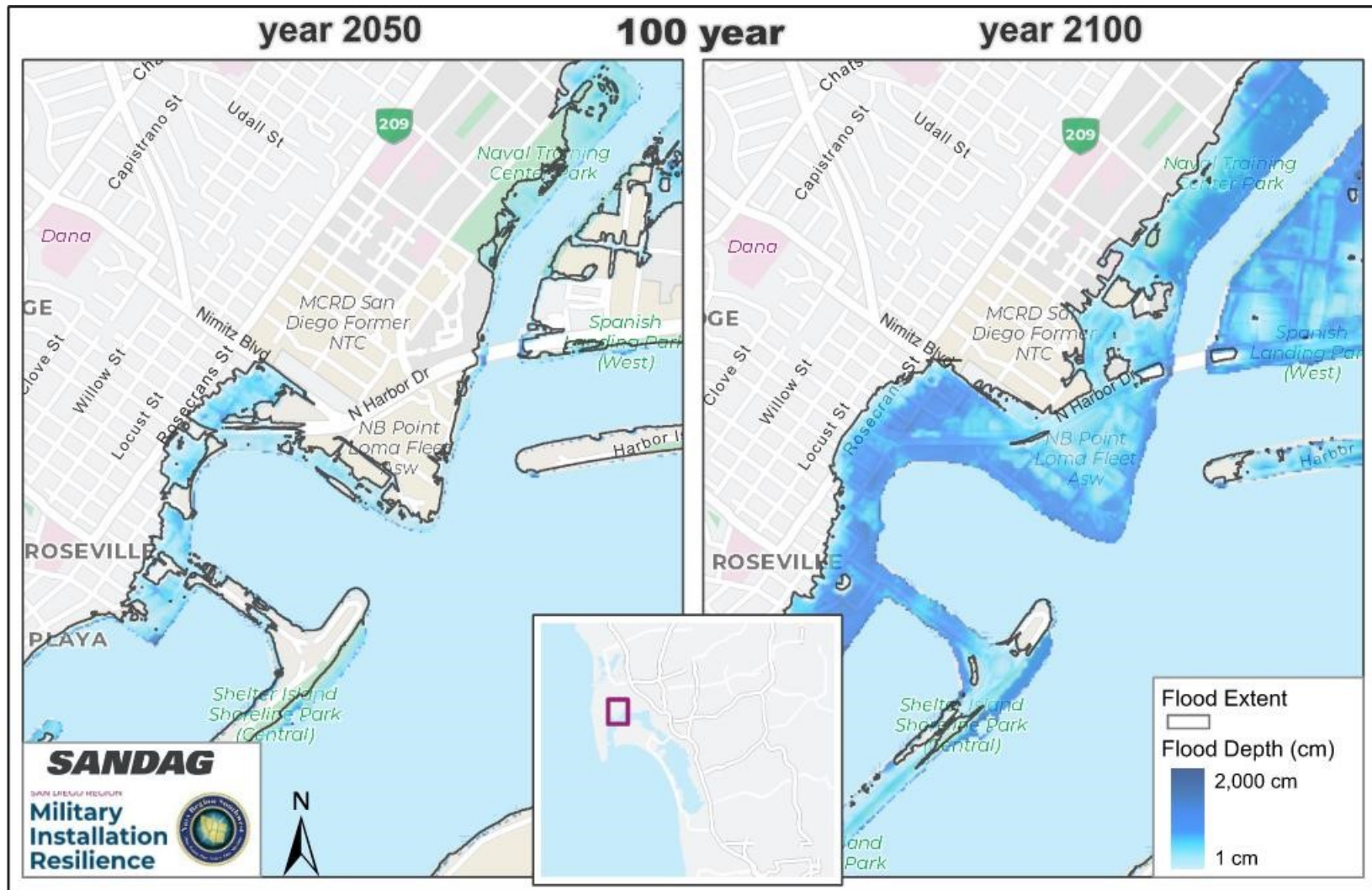


Figure 17. NBPL Harbor Drive Annex: Rosecrans Street, N. Harbor Drive, and Pacific Highway

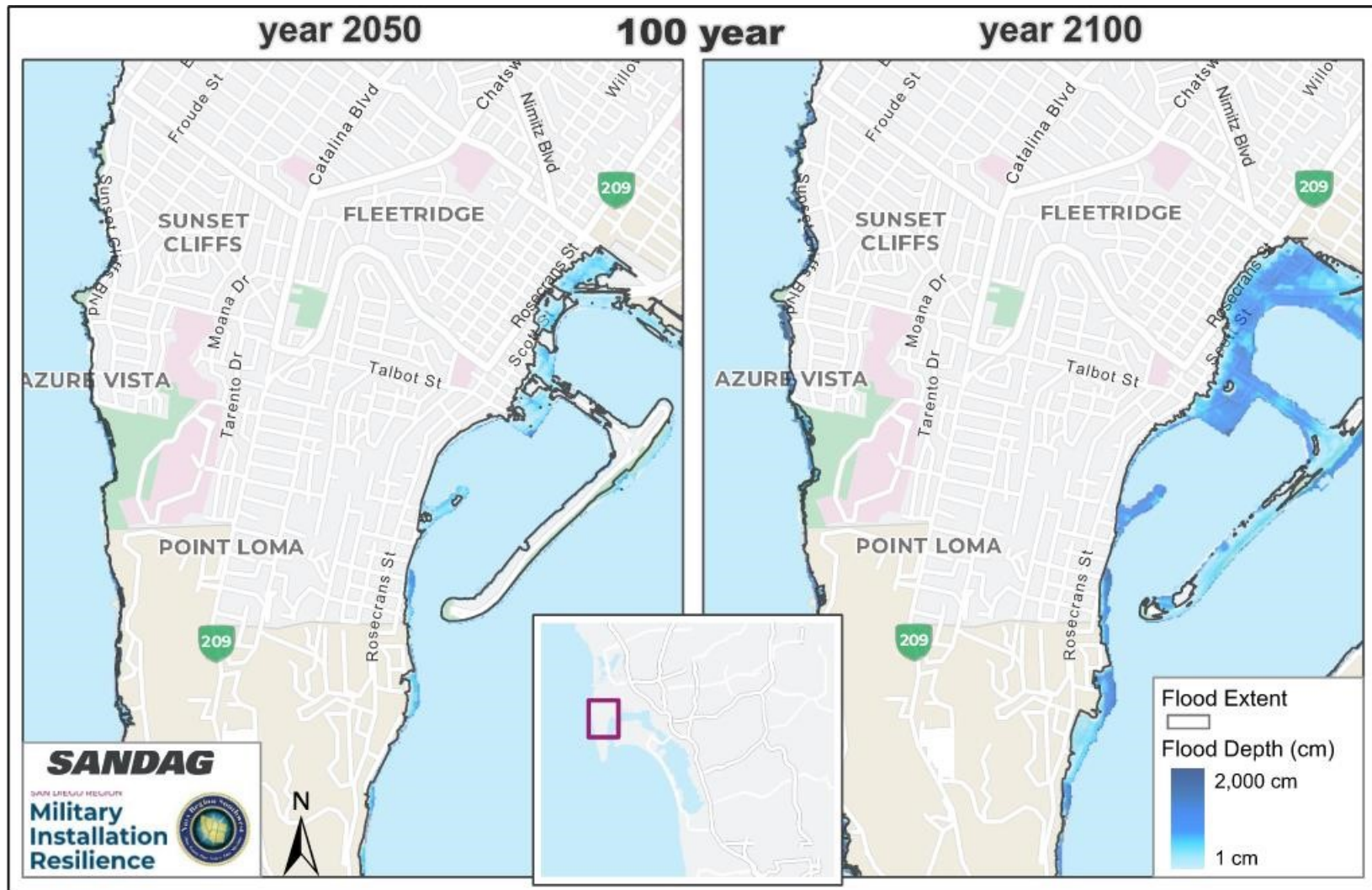


Figure 18. NBPL: Catalina Boulevard, Rosecrans Street, Nimitz Boulevard, and N. Harbor Drive

Flood Extent and Duration Maps

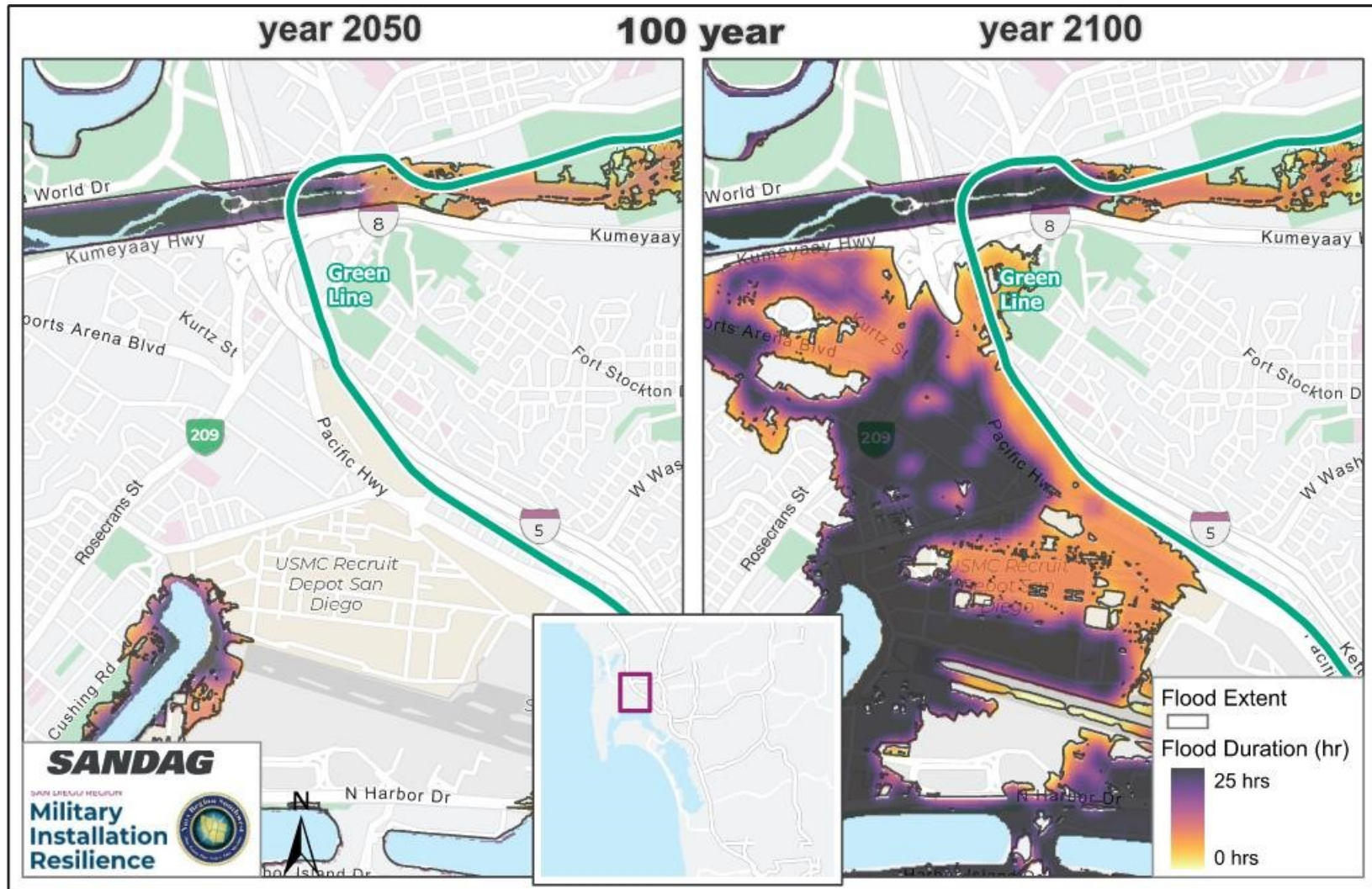


Figure 19. NBPL OTC Complex: I-5, I-8, Pacific Highway, Rosecrans Street, and Green Line Trolley

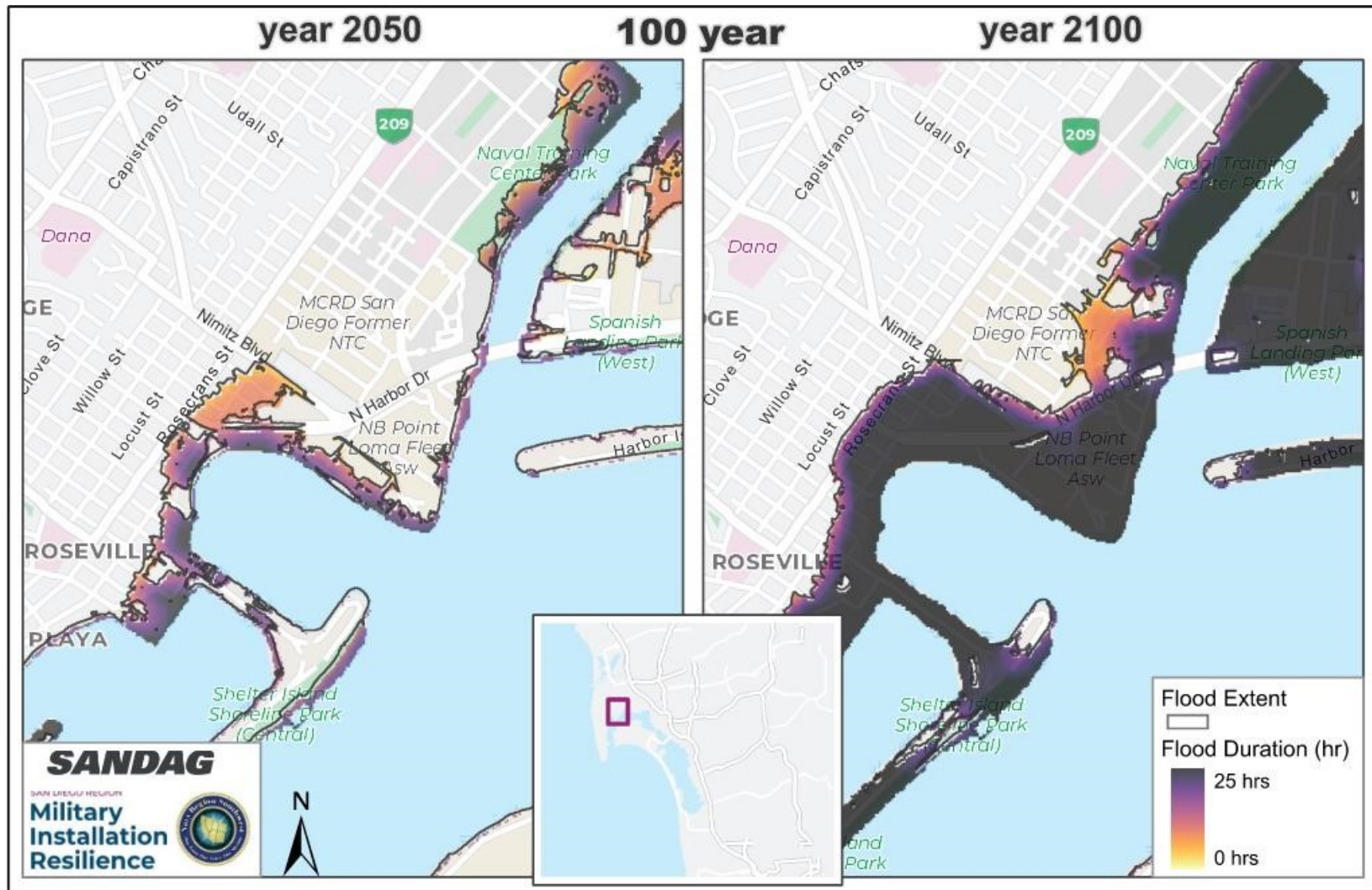


Figure 20. NBPL Harbor Drive Annex: Rosecrans Street, N Harbor Drive, and Pacific Highway

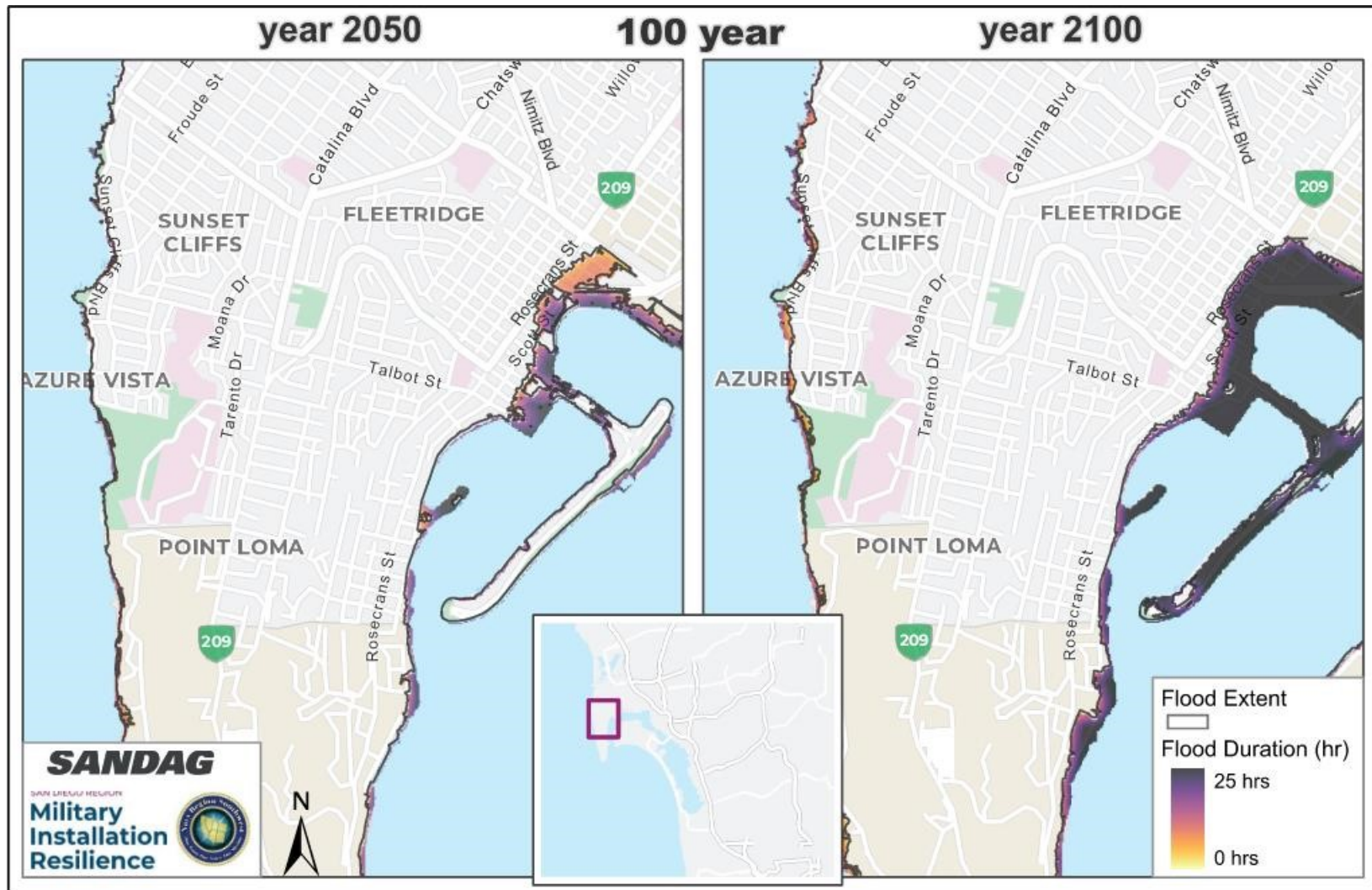


Figure 21. NBPL: Catalina Boulevard, Rosecrans Street, Nimitz Boulevard, and N. Harbor Drive,

Key Transportation Facilities NBPL

The key transportation facilities, within the limits of this study, serving NBPL are identified below.

North Harbor Drive

North Harbor Drive is the northern segment of Harbor Drive which is a major north-south arterial that connects to I-15 in the city of San Diego. Harbor Drive is part of the STRAHNET and a preferred truck route. North Harbor Drive provides access to NBPL Harbor Drive Annex and to Lindbergh Field and connects to NBPL through Rosecrans Street. North Harbor Drive also connects to NBSD through Harbor Drive.

Nimitz Boulevard

Nimitz Boulevard is a major road that provides access to NBPL through Catalina Boulevard and Rosecrans Street and to NBPL Harbor Drive Annex and to Lindbergh Field through N. Harbor Drive. Nimitz Boulevard also connects to the I-8. Nimitz Boulevard is a STRAHNET Connector route.

Rosecrans Street

Rosecrans Street is a major road in the Point Loma community that connects to the I-5 and I-8 and is used to provide access to NBPL Subbase. It also connects NBPL to NBPL Harbor Drive Annex and to the Old Town Campus NAVWAR facility through Pacific Highway. Rosecrans Street is a STRAHNET Connector route.

Catalina Boulevard

Catalina Boulevard connects to Nimitz Boulevard and I-8 and provides access to NBPL Subbase. Catalina Boulevard is a direct access route to NBPL Subbase from Nimitz Boulevard.

Pacific Highway

Pacific Highway connects to I-5 and Rosecrans Street and provides access to NBPL OTC.

Attachments

- A. Erosion Map
- B. FEMA Flood Zone Maps
- C. Tsunami Maps
- D. Coastal Storms/Storm Surge with Sea Level Rise

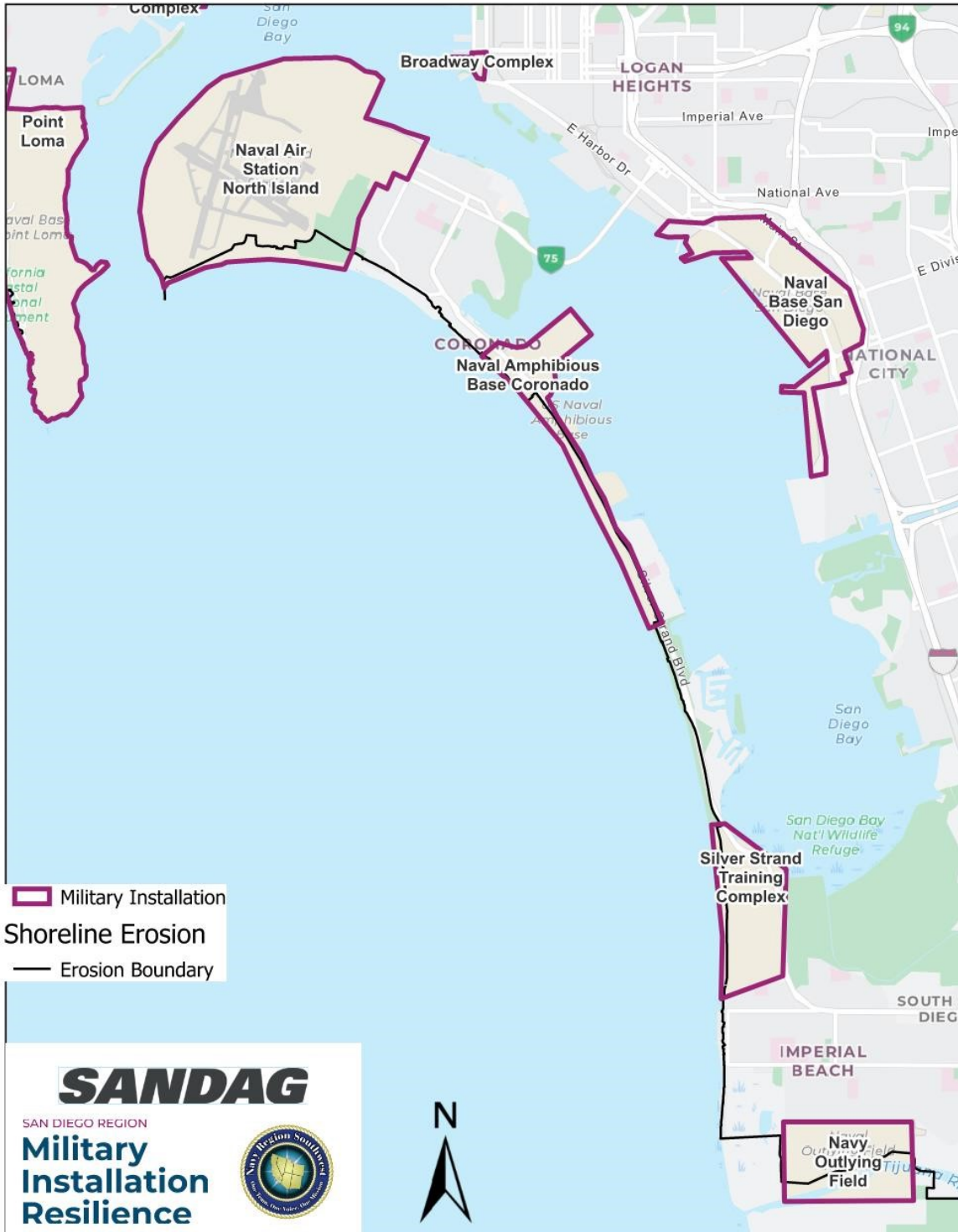
Attachment A

Erosion Maps

Source: CoSMoS Shoreline Projections

<https://www.sciencebase.gov/catalog/item/57f426b9e4b0bc0bec033fad>

Naval Base Coronado



Attachment B
Flood Zone Maps

Source: FEMA Map Service Center:

FEMA Flood Zone Designations

Definitions of FEMA Flood Zone Designations

Flood zones are geographic areas that the FEMA has defined according to varying levels of flood risk. These zones are depicted on a community's Flood Insurance Rate Map (FIRM) or Flood Hazard Boundary Map. Each zone reflects the severity or type of flooding in the area.

Moderate to Low Risk Areas

In communities that participate in the NFIP, flood insurance is available to all property owners and renters in these zones:

ZONE	DESCRIPTION
B and X (shaded)	Area of moderate flood hazard, usually the area between the limits of the 100-year and 500-year floods. B Zones are also used to designate base floodplains of lesser hazards, such as areas protected by levees from 100-year flood, or shallow flooding areas with average depths of less than one foot or drainage areas less than 1 square mile.
C and X (unshaded)	Area of minimal flood hazard, usually depicted on FIRMs as above the 500-year flood level. Zone C may have ponding and local drainage problems that don't warrant a detailed study or designation as base floodplain. Zone X is the area determined to be outside the 500-year flood and protected by levee from 100-year flood.

High Risk Areas

In communities that participate in the NFIP, mandatory flood insurance purchase requirements apply to all of these zones:

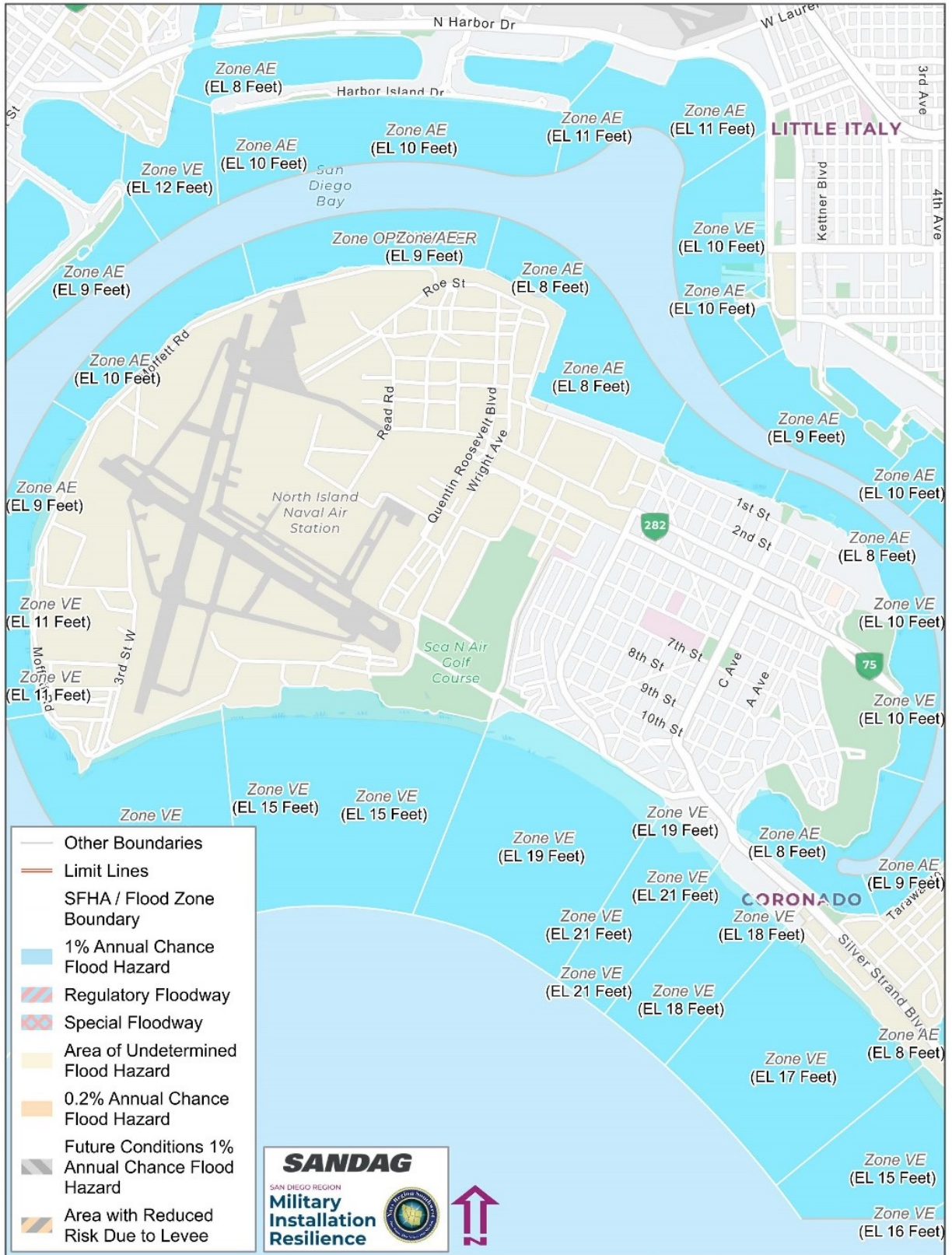
ZONE	DESCRIPTION
A	Areas with a 1% annual chance of flooding and a 26% chance of flooding over the life of a 30-year mortgage. Because detailed analyses are not performed for such areas; no depths or base flood elevations are shown within these zones.
AE	The base floodplain where base flood elevations are provided. AE Zones are now used on new format FIRMs instead of A1-A30 Zones.
A1-30	These are known as numbered A Zones (e.g., A7 or A14). This is the base floodplain where the FIRM shows a BFE (old format).
AH	Areas with a 1% annual chance of shallow flooding, usually in the form of a pond, with an average depth ranging from 1 to 3 feet. These areas have a 26% chance of flooding over the life of a 30-year mortgage. Base flood elevations derived from detailed analyses are shown at selected intervals within these zones.
AO	River or stream flood hazard areas, and areas with a 1% or greater chance of shallow flooding each year, usually in the form of sheet flow, with an average depth ranging from 1 to 3 feet. These areas have a 26% chance of flooding over the life of a 30-year mortgage. Average flood depths derived from detailed analyses are shown within these zones.
AR	Areas with a temporarily increased flood risk due to the building or restoration of a flood control system (such as a levee or a dam). Mandatory flood insurance purchase requirements will apply, but rates will not exceed the rates for unnumbered A zones if the structure is built or restored in compliance with Zone AR floodplain management regulations.
A99	Areas with a 1% annual chance of flooding that will be protected by a Federal flood control system where construction has reached specified legal requirements. No depths or base flood elevations are shown within these zones.

Naval Base San Diego

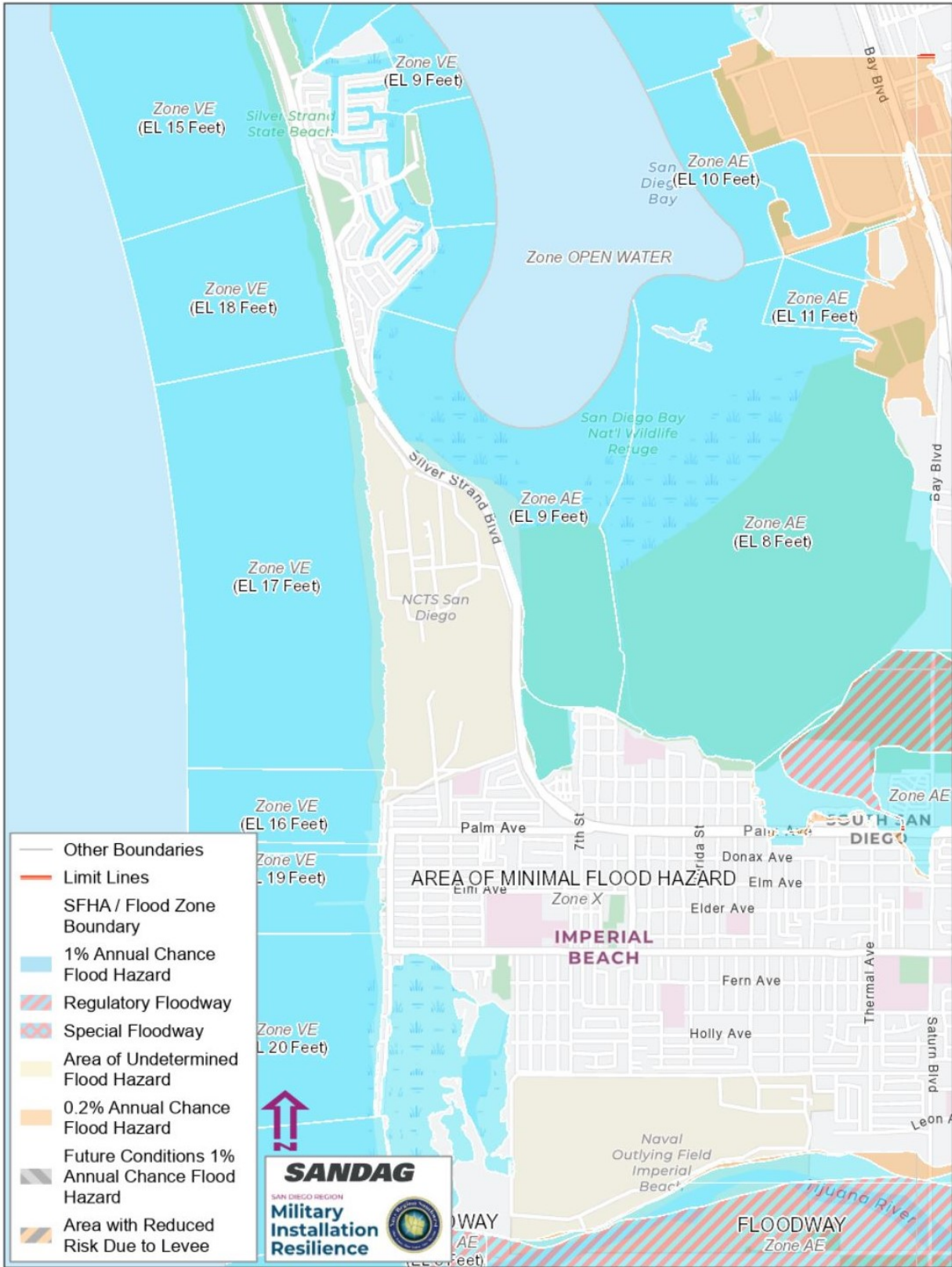




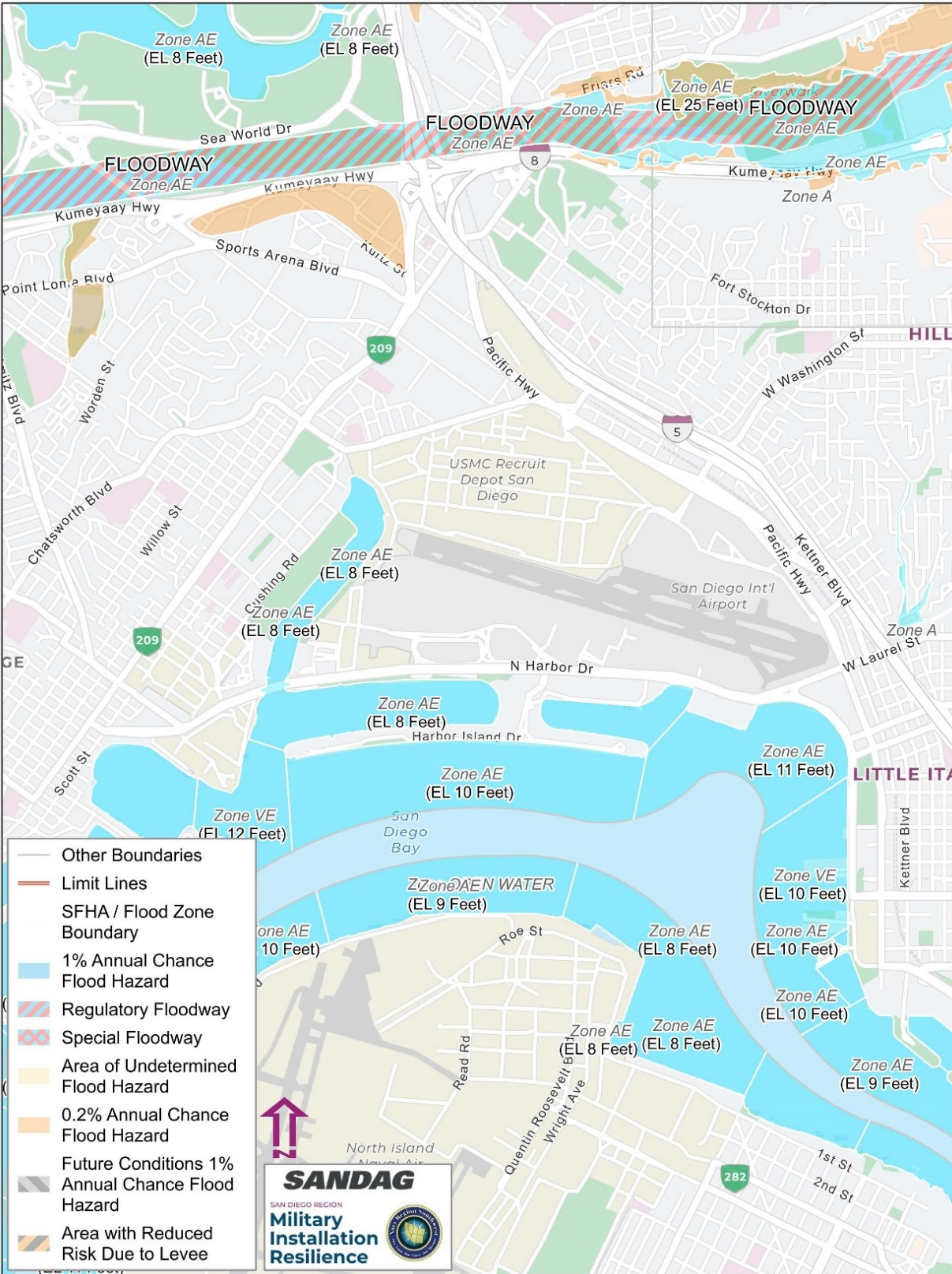
Naval Base Coronado



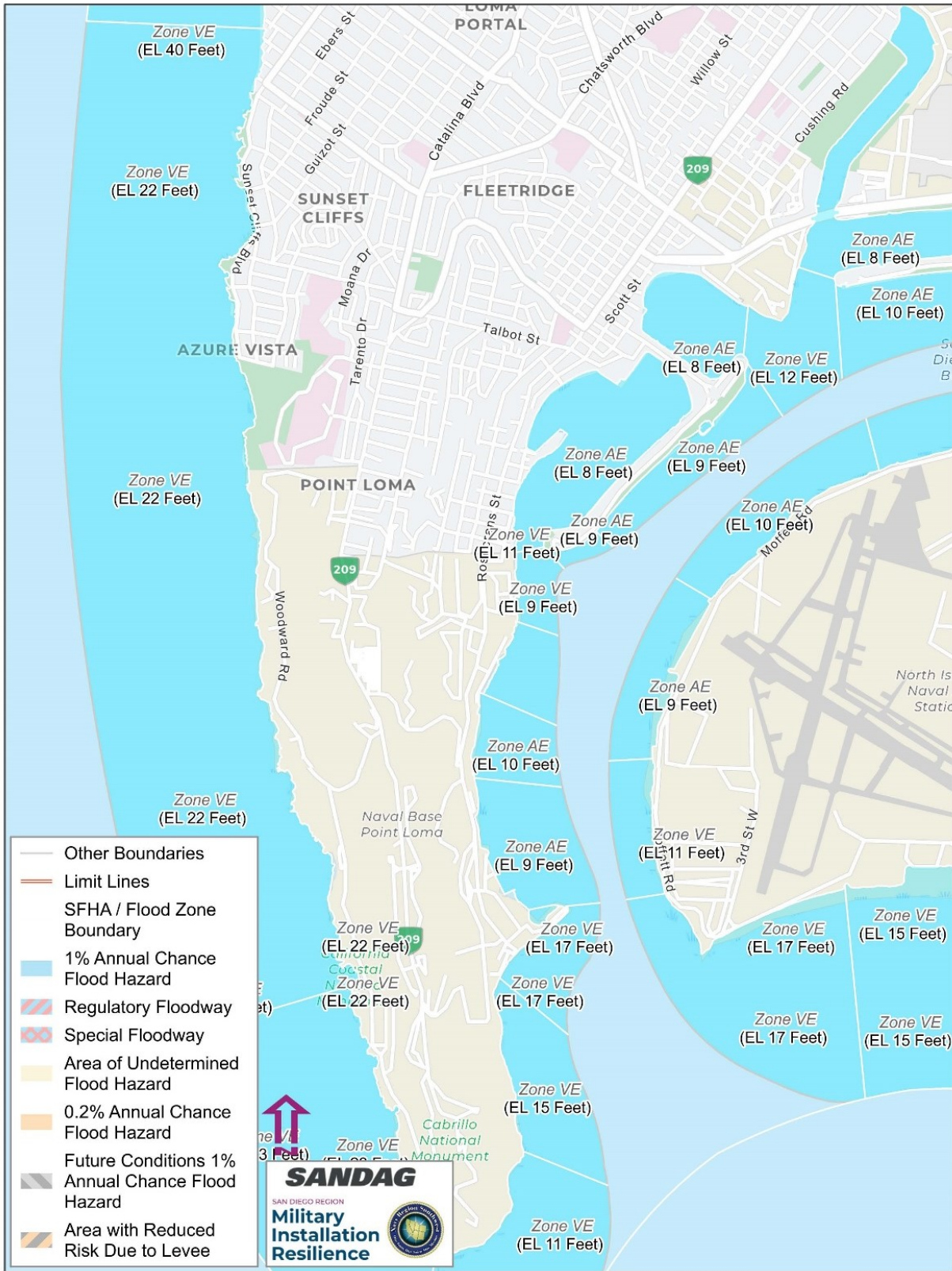




Naval Base Point Loma







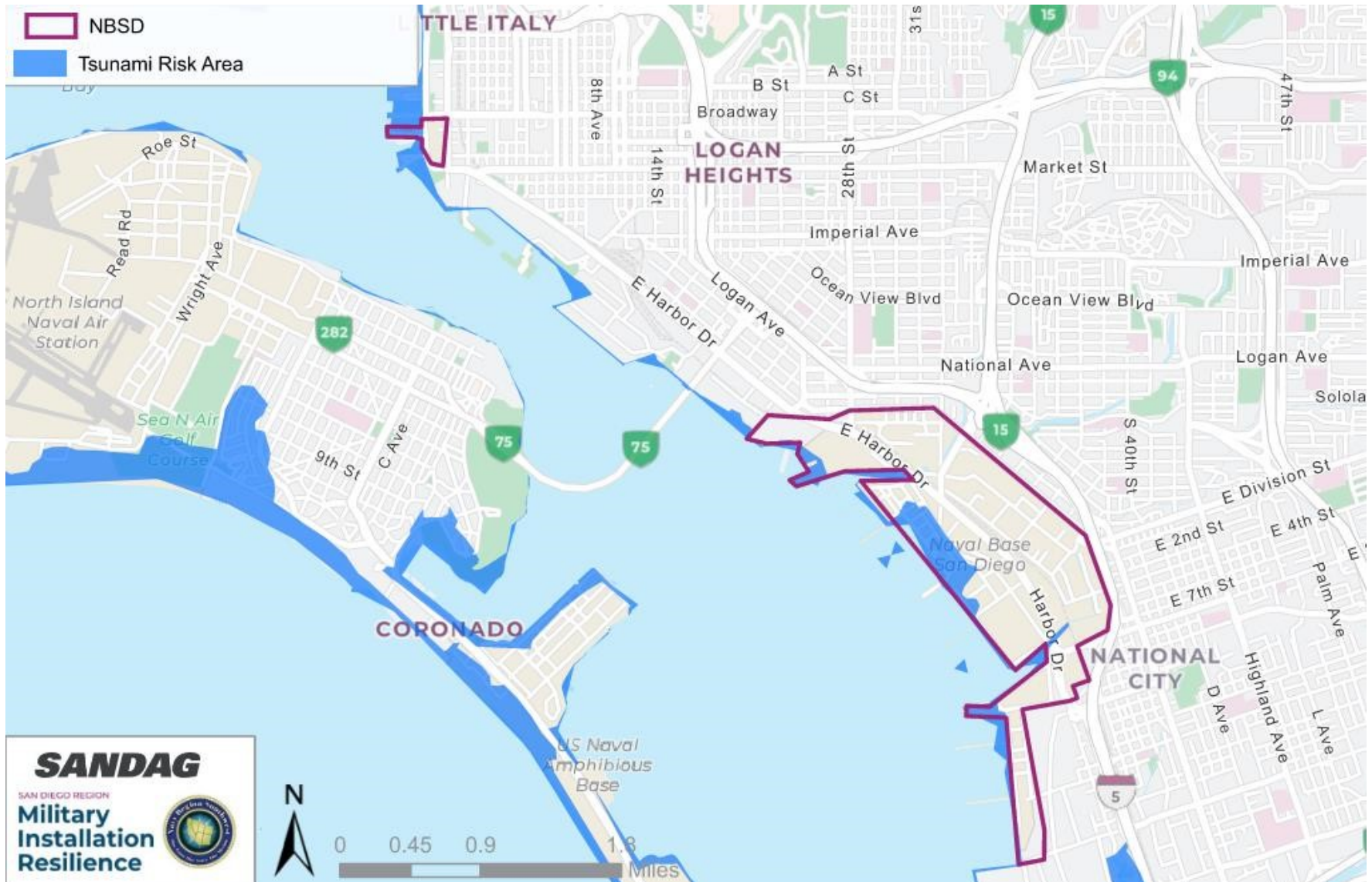
Attachment C

Tsunami Maps

Source: University of Southern California (USC) Tsunami Research Center, CGS, and Cal OES

<https://gis.conservation.ca.gov/server/rest/services/CGS/tsunami/MapServer>

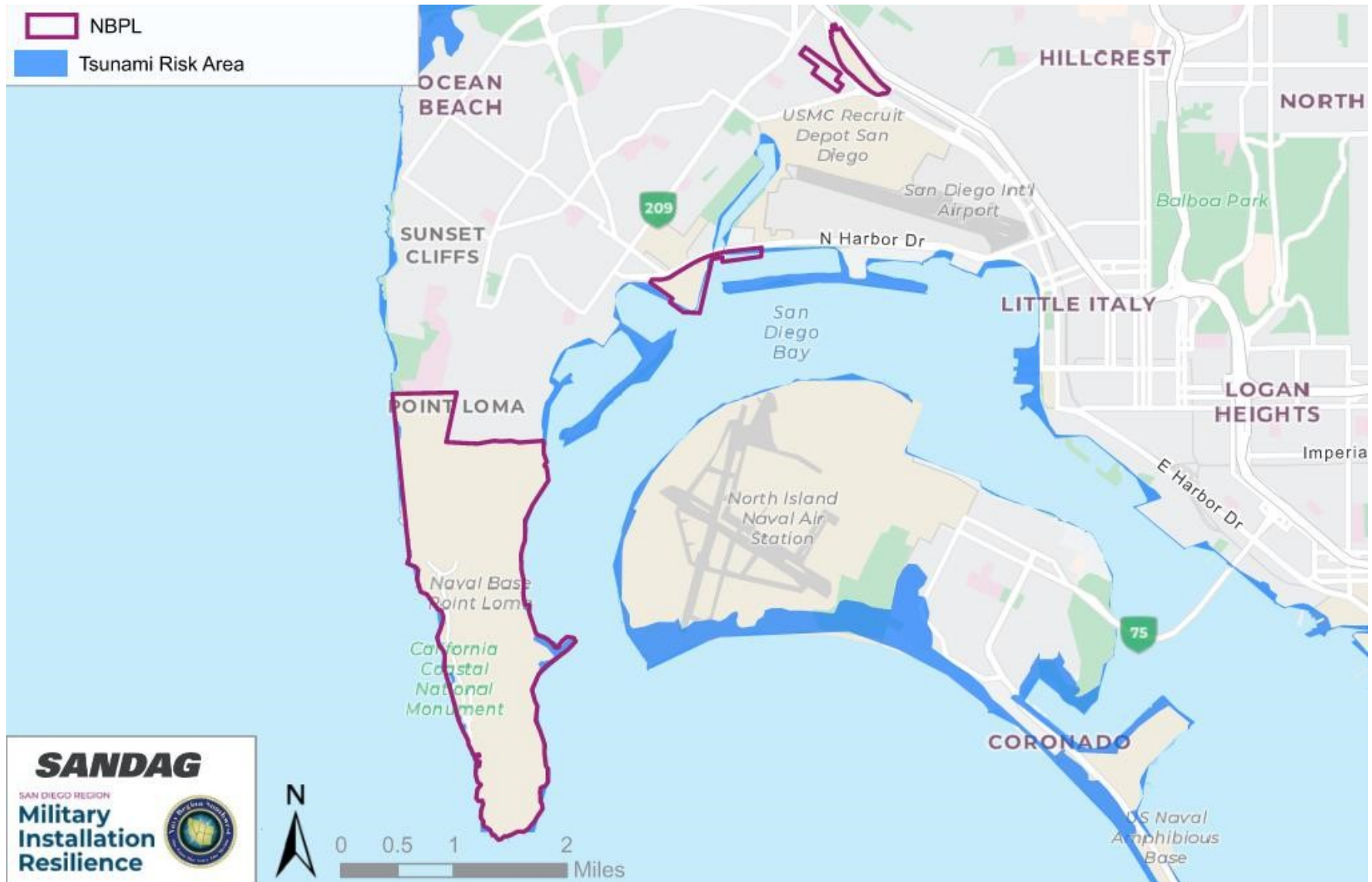
Naval Base San Diego



Naval Base Coronado



Naval Base Point Loma



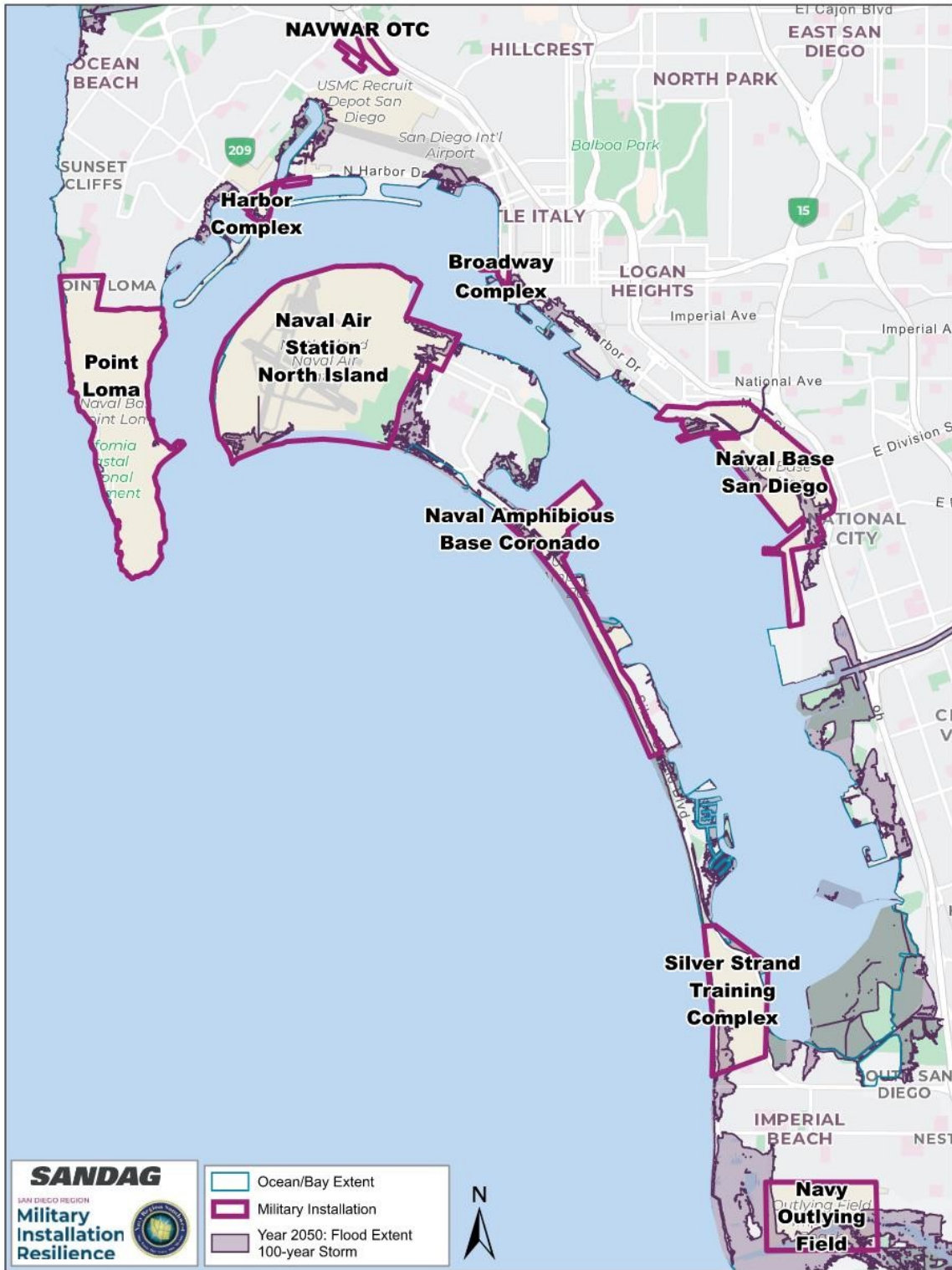
Attachment D

Coastal Storm/Storm Surge with Sea Level Rise

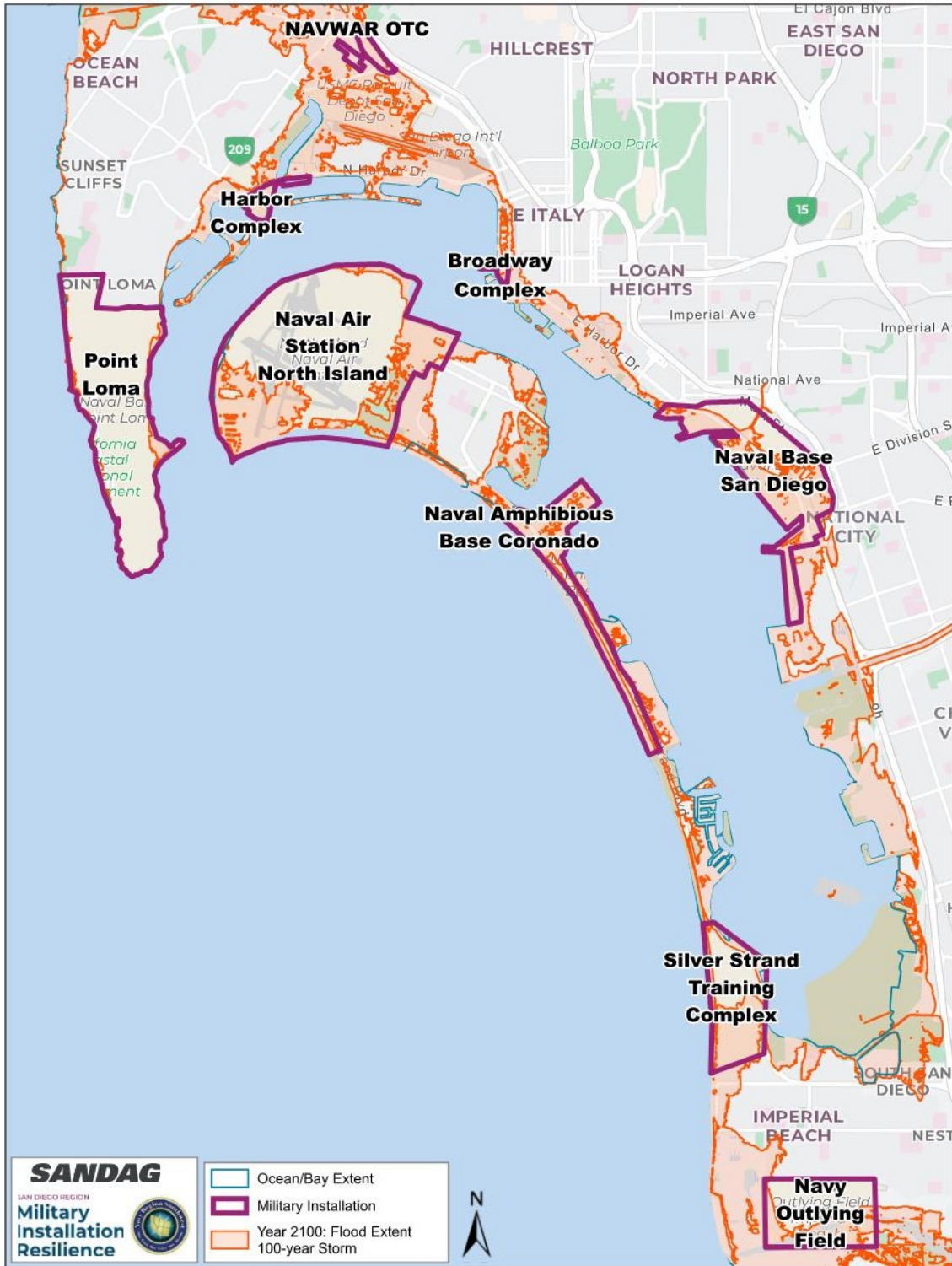
Source: USGC Coastal Storm Modeling System (CoSMos)

<https://www.sciencebase.gov/catalog/item/57f1d572e4b0bc0bebf144>

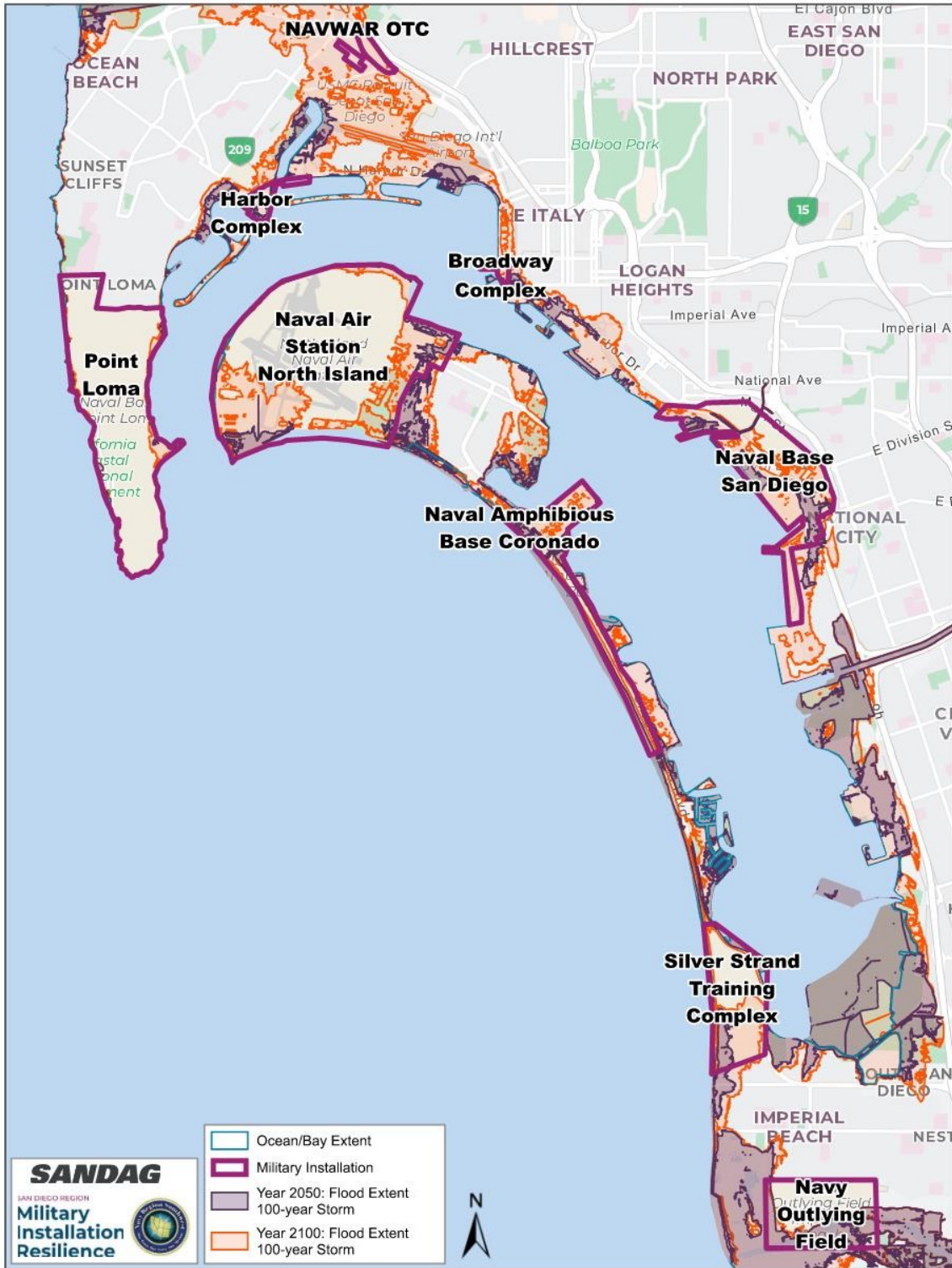
2050 Flood Extent with 100-Year Storm Event



2100 Flood Extent with 100-Year Storm Event



2050 and 2100 Flood Extent with 100-Year Storm Event



Adaptation Planning and Design Considerations Technical Memo

Executive Summary

The Adaptation Planning and Design Considerations memo outlines climate adaptation strategies recommended by base for key transportation facilities critical to maintain Navy mission readiness. The analysis includes review of existing adaptation strategies, resilience planning, and design considerations used throughout the region or recommended by the state to mitigate or adapt to such risks in the region. Recommended adaptation strategies include regionwide, general, and specific facility and address the potential climate related impacts to key transportation facilities identified in the Section 1.2 Vulnerability Assessment Memo (May 2021).

Partner Agency Collaboration: SANDAG and the Navy

- Review of adaptation strategies recommended for the San Diego region.
- Evaluation of Response Types: Protection, Accommodation and Retreat

Best Practices for Conflict Resolution, Collaboration, and Consensus Building

SANDAG and the Navy met with Regional Partner Agencies to discuss proposed region wide, general, and focused adaptation strategies, agency roles and responsibilities and points of contact, ways to communicate better and collaborate on multijurisdictional resilience planning by leveraging existing meetings for a more unified approach to resilience planning to protect key transportation facilities in the San Diego region and support Navy mission readiness. Two regional partner agency meetings were held with representatives from:

- SANDAG, Naval Base Coronado and the Cities of Coronado, Imperial Beach
- SANDAG, Naval Base San Diego and Navy Base Point Loma and the cities of San Diego, National City, the Port of San Diego, the San Diego International Airport Authority, Caltrans, and the Metropolitan Transit System.

Resilience Planning and Design Meeting Agendas, Minutes, and Power Point presentations are contained in Attachment C.

Military Installation Resilience

SANDAG

To: Sarah Pierce, SANDAG Associate Regional Planner
From: Audrey Edney, HNTB Transit Planner
Date: June 4, 2021
Re: Adaptation Planning and Design Considerations

Purpose

The purpose of this document is to summarize climate change adaptation strategies (policies, programs, and projects), planning considerations, and best practices for long-range planning for transportation facilities critical to Navy mission readiness within the South Bay to Sorrento and Central Mobility Hub and Connections CMCP planning areas. The document builds off the Vulnerability Assessment Technical Memo (Technical Memo) to ensure the resilience goals, summarized in **Figure 22**. The Technical Memo includes an analysis of the impacts coastal storms/storm surge, erosion, sea level rise, flooding, and tsunamis may have on the transportation network serving Naval Base San Diego (NBSD), Naval Base Coronado (NBC), and Naval Base Point Loma (NBPL).⁷

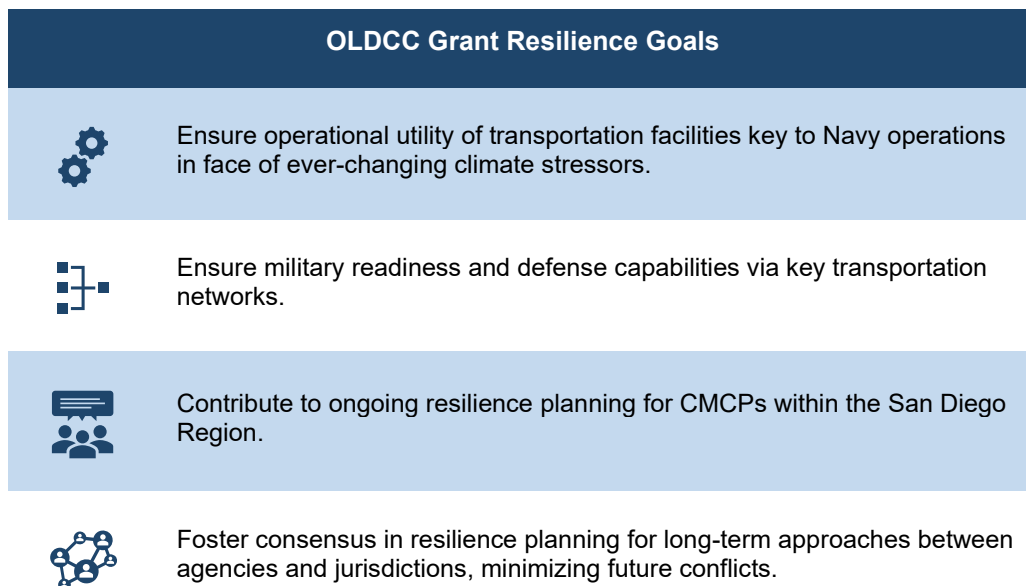


Figure 22. OLDCC Grant Resilience Goals

Climate Change Adaptation Strategies

There are several different types of adaptation strategies that may reduce the identified risks associated with climate change. For example, impacts from sea level rise may be mitigated by modifying land use plans, regulatory changes, project modifications, or permit conditions that focus on avoidance or

⁷ Reference the Vulnerability Assessment Memo for depth and duration of coastal/storm surge, flooding, sea level rise detail maps.

minimization of risks and the protection of coastal resources.⁸ Three main responses, **protection**, **accommodation**, and **retreat** (See **Figure 23**) in climate change resilience planning and design have been identified as overarching themes to addressing the key risks impacting Navy mission readiness in the San Diego region. Strategies are organized by response type in the discussion below.

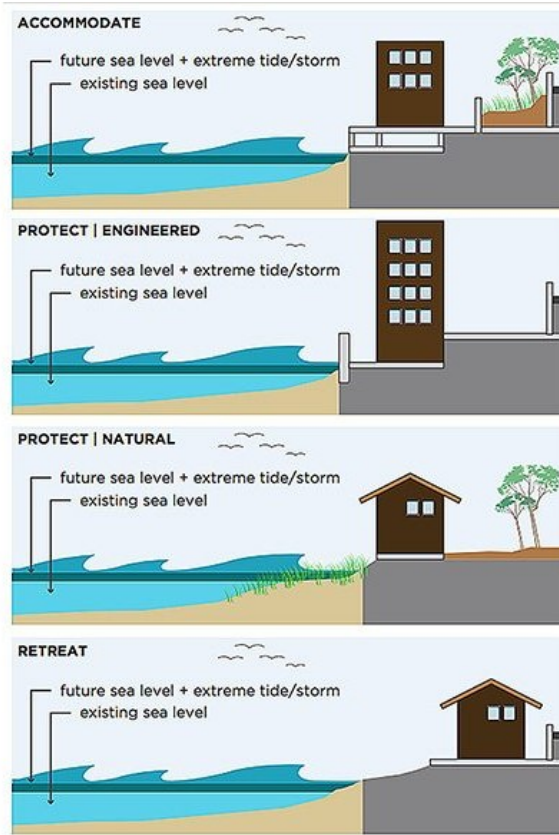


Figure 23. Adaptation Responses
 Source: SF Planning, <https://sfplanning.org/>

SANDAG, the Navy, and HNTB met with regional partner agencies and local jurisdictions to review adaptation strategies being considered for key transportation facilities that serve Navy Bases San Diego, Pont Loma, and Coronado. Integrating adaptation strategies into long-range transportation planning and continually considering how long-range planning efforts will affect Navy mission readiness were key outcomes from these meetings.

This report summarizes *potential* strategies that may be implemented in future long-range planning for the San Diego Region. It includes strategies from existing adaptation plans and should not be considered a comprehensive list of strategies. Maps with potential adaptation strategies are organized by base and are included in the Attachment B. It is meant to be a guiding tool for future transit and transportation planning efforts incorporating adaptation strategies with a focus on climate resilience and Navy mission readiness.

Protection Strategies

Protection strategies refer to projects, policies, or programs that defend large sections of transportation facilities from the effects of identified environmental risks. For example, this could include nature-based programs to restore and replenish the coastline to protect key transportation facilities from further erosion

⁸ See California Coastal Commission Sea Level Rise Policy Guidance (2018), Chapter 7: Adaptation Strategies, pp. 121

or engineered projects to implement coastal breakwaters, sea walls, or revetments to lessen the impacts of floods or sea level rise. Both “hard”, or engineered structures, and “soft”, or nature-based strategies, are considered for protection. While some protection strategies are applicable to specific transportation facilities, other strategies may be implemented on a region-wide scale to reduce the risks to multiple transportation facilities. For example, the Regional Beach Sand Project (RBSP) III would consider how beach nourishment can be used to protect transportation infrastructure from the impacts of erosion sea level rise. The Protection Strategy Matrix includes a list of identified strategies applicable to potentially vulnerable key transportation facilities critical to maintain Navy mission readiness.

Protection Strategy Matrix

Recommended protection strategies and key transportation facility areas in which they would apply are listed in **Table 2** below. The strategy matrix displays potential options to be considered in future resilience planning phases. Although strategies have been listed per at risk key transportation facilities, each scenario could utilize several strategy options to mitigate each risk present. See **Attachment A** for the source list.

Table 2. Protection Strategies

Strategy Name	Description	Partner Agency Coordination	Facilities/Area
Regional Strategies			
Regional Beach Sand Program	<p>Program that considers how beach nourishment can be used to protect regional transportation infrastructure as sea level rises, including the need for placing larger volumes of sand more frequently over time.</p> <p><i>Source: 10. SANDAG Regional Transportation Infrastructure Sea Level Rise Assessment and Adaptation Guidance</i> 1. California Coastal Commission (CCC) Sea Level Rise Guidance</p>	<p>Multi-jurisdictional</p> <ul style="list-style-type: none"> City of Coronado City of Imperial Beach All Navy Bases 	<ol style="list-style-type: none"> Region-wide NBC: Ocean Boulevard, SR 75
Sand Retention Strategy Pilot	<p>Pilot projects to determine effectiveness of select sand retention strategies to supplement and be coordinated with beach nourishment projects. Potential pilots include:</p> <ul style="list-style-type: none"> Reef at south end of Seacoast Drive (submerged) Offshore breakwater or reef by Hotel del Coronado <p><i>Source: 10. SANDAG Regional Transportation Infrastructure Sea Level Rise Assessment and Adaptation Guidance</i> 1. CCC Sea Level Rise Guidance</p>	<p>Multi-jurisdictional</p> <ul style="list-style-type: none"> City of Coronado City of Imperial Beach Port of San Diego 	<ol style="list-style-type: none"> Region-wide NBC: Ocean Boulevard, SR 75
Update Shoreline Preservation Strategy (SPS)	<p>SPS should be updated so that the amount of sand and frequency of beach nourishment can adapt as sea level rises and to reflect recent lessons learned from shoreline monitoring and new sand sources identified.</p> <p><i>Source: 10. SANDAG Regional Transportation Infrastructure Sea</i></p>	<p>Multi-jurisdictional</p> <ul style="list-style-type: none"> City of Coronado City of Imperial Beach 	<ol style="list-style-type: none"> Region-wide NBC: Ocean Boulevard, SR 75

Strategy Name	Description	Partner Agency Coordination	Facilities/Area
	<p><i>Level Rise Assessment and Adaptation Guidance and the 1. CCC Sea Level Rise Guidance</i></p>		
<p>Regional Shoreline Monitoring Program</p>	<p>Develop and implement a monitoring program for adaptation strategies in San Diego Bay.</p> <p><i>Source: 10. SANDAG Regional Transportation Infrastructure Sea Level Rise Assessment and Adaptation Guidance 1. CCC Sea Level Rise Guidance</i></p>	<p>Multi-jurisdictional</p> <ul style="list-style-type: none"> • SANDAG • Port of San Diego 	<ol style="list-style-type: none"> 1. Region-wide 2. NBC: SR 75 3. NBSD: Harbor Drive 4. NBPL: N. Harbor Drive
General Strategies			
<p>Nature-based Adaptation Projects</p>	<p>Evaluation and implementation of nature-based adaptation strategies for site-appropriate solutions.</p> <p>Protection strategies for existing hard-edged shorelines include living breakwaters and bio-enhancing concrete.</p> <p><i>Source: 9. San Diego Unified Port District Sea Level Rise Assessment and Coastal Resiliency Report 14. Bayshore Bikeway Resiliency Project</i></p>	<p>Multi-jurisdictional</p> <ul style="list-style-type: none"> • City of Coronado • City of Imperial Beach • City of San Diego • San Diego Metropolitan Transit System 	<ol style="list-style-type: none"> 1. Region-wide 2. NBSD: Harbor Drive and connections to Main Street, 32nd Street, 28th Street, 8th Street, Harbor Drive Bridges, and Blue Line Trolley. 3. NBC: SR 75, Bayshore Bikeway
<p>Building and Infrastructure Projects</p>	<p>Evaluation and implementation of projects that include:</p> <ul style="list-style-type: none"> • embankments • retractable barriers • aqua fence • elevating structures • floodable parks <p><i>Source: 9. San Diego Unified Port District Sea Level Rise Assessment and Coastal Resiliency Report</i></p>	<p>Multi-jurisdictional</p> <ul style="list-style-type: none"> • City of San Diego • San Diego Metropolitan Transit System 	<ol style="list-style-type: none"> 1. NBSD: Harbor Dr., 32nd St, Blue Line Trolley, and the Harbor Drive Chollas and Paleta Creek Bridges
<p>Living Breakwaters</p>	<p>Living breakwaters, sometimes known as artificial reefs, are offshore structures designed to limit wave attenuation by creating a barrier between open water and the shoreline. As opposed to traditional breakwaters made from concrete or other building materials, living breakwaters incorporate natural habitat and provide opportunities for settlement and colonization by oysters and other living species.</p> <p>Note: Living breakwaters should be considered in locations that do not</p>	<p>Multi-jurisdictional</p> <ul style="list-style-type: none"> • City of San Diego • Port of San Diego • City of Chula Vista • National City 	<ol style="list-style-type: none"> 1. NBSD: Harbor Dr., 32nd St, Blue Line Trolley, and the Harbor Drive Chollas and Paleta Creek Bridges 2. NBSD Broadway Complex: Harbor Drive, Blue Line Trolley, and Pacific Highway

Strategy Name	Description	Partner Agency Coordination	Facilities/Area
	<p>conflict with Navy fleet or shipping lanes.</p> <p><i>Source: 9. San Diego Unified Port District Sea Level Rise Assessment and Coastal Resiliency Report</i></p>		
Protect Embarcadero and N. Harbor Drive	<p>Potential strategies include raised seawall/bulkhead or elevating bike paths with fill.</p> <p><i>Source: 10. SANDAG Regional Transportation Infrastructure Sea Level Rise Assessment and Adaptation Guidance</i></p> <p>1. <i>California Coastal Commission Sea Level Rise Guidance</i></p>	<p>Multi-jurisdictional</p> <ul style="list-style-type: none"> • San Diego Metropolitan Transit System • City of San Diego • Port of San Diego • San Diego County Regional Airport Authority • National City 	<p>1. NBSD Broadway Complex: Harbor Drive, Blue Line Trolley, and Pacific Highway</p>
Raise shoreline to protect assets from sea level rise and storm surge	<p>Coordination between San Diego County Regional Airport Authority (SDCRAA) Port of San Diego and City of San Diego to elevate 1,250 linear feet pedestrian/bicycle path along the Embarcadero and build 1,100 linear feet of permanent barrier along the eastern side of the Coast Guard property,</p> <p><i>Source: 11. San Diego International Airport (SDIA) Climate Resilience Plan</i></p>	<p>Multi-jurisdictional</p> <ul style="list-style-type: none"> • San Diego County Regional Airport Authority • City of San Diego • Marine Corps Recruit Depot • Port of San Diego 	<p>1. NBPL: N. Harbor Drive</p>
Analyze adaptation and mitigation strategies for North Harbor Drive	<p>Project to protect critical roadway networks. Analyze protection strategies including raising the shoreline, seawalls, or nature-based adaptation projects.</p> <p><i>Source: 11. San Diego International Airport Climate Resilience Plan</i></p>	<p>Multi-jurisdictional</p> <ul style="list-style-type: none"> • Port of San Diego • City of San Diego • San Diego County Regional Airport Authority • National City 	<p>1. NBSD: Broadway Complex Harbor Drive, Blue Line Trolley, and Pacific Highway</p>
Potential Strategies for Coronado	<p>Seawall, revetment, vegetated sand dune, beach nourishment</p> <p><i>Source: 10. SANDAG Regional Transportation Infrastructure Sea Level Rise Assessment and Adaptation Guidance</i></p> <p>1. <i>California Coastal Commission Sea Level Rise Guidance</i></p>	<p>Multi-jurisdictional</p> <ul style="list-style-type: none"> • City of Coronado • City of Imperial Beach • Caltrans 	<p>1.NBC: SR 75 (coastal areas)</p>
Analyze strategies for protecting SR 75	<p>Projects include armoring the Imperial Beach coastline, phased relocation/retreat, sand nourishment, hybrid dune and cobble and/or five groins with sand nourishment.</p> <p><i>Source: 10. SANDAG Regional Transportation Infrastructure Sea Level Rise Assessment and Adaptation Guidance</i></p> <p>1. <i>California Coastal Commission Sea Level Rise Guidance</i></p>	<p>Multi-jurisdictional</p> <ul style="list-style-type: none"> • SANDAG • Caltrans • City of Imperial Beach • City of Coronado • City of San Diego 	<p>1. NBC: SR 75 (coastal areas and near the Silver Strand Training Complex)</p>

Accommodation Strategies

Per the California Coastal Commission’s Sea Level Rise Policy Guidance, “accommodation strategies refer to those strategies that employ methods that modify existing developments or design new developments to decrease hazard risks and thus increase the resilience of development to the impacts of sea level rise.” Accommodation strategies can range in scale, from individual projects to community-scale. Projects include actions such as elevating structures to accommodate for floods or sea level rise. A community-scale response may include strategies such as adjusting zoning ordinances. Regional responses include efforts such as the San Diego Port District Sea Level Rise Vulnerability and Coastal Resilience Plan, Policy-based Adaptation Strategies. The Accommodation Strategy Matrix includes a list of identified strategies applicable to potentially vulnerable key transportation facilities critical to maintain Navy mission readiness.

Accommodation Strategy Matrix

Recommended accommodation strategies and key transportation facility areas in which they would apply are listed in **Table 3** below. The strategy matrix displays potential options to be considered in future resilience planning phases. Although strategies have been listed per at-risk facility, each scenario could utilize several strategy options to mitigate each risk present. See Attachment A for the source list.

Table 3 Accommodation Strategies

Strategy Name	Description	Partner Agency Coordination	Facilities/Area
Regional Strategies			
Downzoning for Coastal Hazards	Downzoning so that Coastal Hazard Areas are rezoned to a usage that is less intense than previously. Coastal Hazard Areas are defined by FEMA as 100- and 500-year flood zone designated areas. <i>Source: 3. Imperial Beach Sea Level Rise Assessment Federal Emergency Management Agency (FEMA)</i>	City of Imperial Beach	1. NBC: 100-year flood zone along Ocean Boulevard between Alder Street and Loma Avenue, developments along SR 75 between 13th Street and the intersection of I-15 and Main Street
Policy-based Adaptation Strategies	Evaluation and implementation of policies including the following: <ul style="list-style-type: none"> • Protect coastal-dependent mission-driven uses such as the Port and tourism • Limit redevelopment in at-risk locations • Design standards to include minimum elevation requirements for structures/utilities • Provide adequate setbacks. <i>Source: 9. San Diego Unified Port District Sea Level Rise Vulnerability and Coastal Resilience Plan</i>	Multi-jurisdictional <ul style="list-style-type: none"> • City of San Diego • City of Imperial Beach • City of Coronado • Port of San Diego • San Diego Metropolitan Transit System • City of Chula Vista • National City 	1. Region-wide 2. NBSD: Harbor Drive Bridges, Blue Line Trolley
General Strategies			
Green Streets Program	Green Street features capture and treat stormwater and are integrated into street design. Features can include street trees, permeable pavements, bioretention, and swales.	Multi-jurisdictional <ul style="list-style-type: none"> • City of Imperial Beach • City of Coronado 	1. Region-wide 2. NBC: SR 282/3rd Street/Stockdale

Strategy Name	Description	Partner Agency Coordination	Facilities/Area
	<p>Incorporate features to capture and treat stormwater into street design. Features may include street trees, permeable pavements, bioretention, and swales. A wide corridor is not necessarily required, as a range of techniques and individual features for stormwater management can be installed and existing rights-of-way can be retrofitted</p> <p><i>Source: 12. California's 4th Climate Change Assessment - San Diego Region</i></p>	<ul style="list-style-type: none"> • City of San Diego • National City • City of Chula Vista 	<p>Boulevard (and environs)</p> <p>3. NBSD: Harbor Drive, 32nd Street, 28th Street, 8th Street, Main Street (and environs)</p> <p>4. NBPL: Rosecrans Street, Nimitz Boulevard, North Harbor Drive, Pacific Highway (and environs)</p>
<p>Nature-based Adaptation Projects</p>	<p>Evaluation and implementation of nature-based adaptation strategies for site-appropriate solutions. Protection strategies for existing hard-edged shorelines include living breakwaters and bio-enhancing concrete.</p> <p><i>Source: 9. San Diego Unified Port District Sea Level Rise Assessment and Coastal Resiliency Report</i></p>	<p>Multi-jurisdictional</p> <ul style="list-style-type: none"> • City of Coronado • City of Imperial Beach • City of San Diego • National City • City of Chula Vista 	<p>1. Region-wide</p> <p>2. NBSD: Harbor Drive and connections to Main Street, 32nd Street, 28th Street, 8th Street, Harbor Drive Bridges, and Blue Line Trolley.</p> <p>3. NBC: SR 75</p>
<p>Adaptation of Asphalt Grades</p>	<p>Early adaptation of asphalt grades based on anticipated warmer temperatures could significantly increase durability of roadways. Asphalt binder is highly sensitive to temperature and sunshine. Reviewing grade standards will be vital to decelerating pavement deterioration as temperatures rise. Pavement in need of repair would also be more susceptible to flooding and erosion.</p> <p><i>Source: 12. California's 4th Climate Change Assessment - San Diego Region</i></p>	<p>Multi-jurisdictional</p> <ul style="list-style-type: none"> • Caltrans • City of San Diego • National City • City of Coronado • San Diego County Regional Airport Authority • Port of San Diego • City of Imperial Beach 	<p>Region-wide</p> <p>Applies to all bases and all key transportation (roadway) facilities</p>

Strategy Name	Description	Partner Agency Coordination	Facilities/Area
Bio-enhancing concrete	<p>Bio-enhancing concrete is an environmentally sensitive concrete solution that enhances the biological and ecological value of urban, coastal, and marine infrastructure while increasing strength and durability. The use of bio-enhancing concrete at the piers/docks would mitigate the impacts of storm surge/coastal floods, sea level rise, and/or tsunamis.</p> <p><i>Source: 9. San Diego Unified Port District Sea Level Rise Assessment and Coastal Resiliency Report</i></p>	<p>Multi-jurisdictional</p> <ul style="list-style-type: none"> • City of San Diego • Port of San Diego • National City 	<p>1. NBSD Broadway Complex: Harbor Drive, Blue Line Trolley, and Pacific Highway</p>
Ongoing Maintenance and Inspections	<p>Ongoing maintenance and inspections of key transportation facilities before and after hazard events is critical to monitoring both large and incremental changes. This practice would aid in the identification of performance measures and targets and inform modifications to design and procurement criteria including the introduction of new materials.</p>	<p>Multi-jurisdictional</p> <ul style="list-style-type: none"> • Caltrans • City of San Diego • City of Imperial Beach • City of Coronado • San Diego Metropolitan Transit System • National City • San Diego County Regional Airport Authority • Port of San Diego 	<p>Region-wide Applies to all bases and all key transportation facilities</p>
Facility Specific Strategies			
Analyze Options for Protecting Blue Line Trolley	<p>Project to analyze adaptation for flooding for Blue Line Trolley.</p> <p><i>Source: 10. SANDAG Regional Transportation Infrastructure Sea Level Rise Assessment and Adaptation Guidance</i> <i>1. California Coastal Commission Sea Level Rise Guidance</i></p>	<p>Multi-jurisdictional</p> <ul style="list-style-type: none"> • City of San Diego • National City • San Diego Metropolitan Transit System 	<p>1. NBSD: Blue Line Trolley, Harbor Drive, Pacific Highway by Broadway Complex</p>
Elevate Critical Roads	<p>Elevate critical roads including Seacoast Drive, Palm Avenue, Imperial Beach Boulevard.</p> <p><i>Source: 3. Imperial Beach Sea Level Rise Assessment</i></p>	<p>Multi-jurisdictional</p> <ul style="list-style-type: none"> • City of Imperial Beach • City of Coronado • City of San Diego • Caltrans 	<p>1. NBSD: Harbor Drive and supporting key transportation facilities 2. NBC: SR 75 coastal areas and near Silver Strand Training Complex 3. NBPL North Harbor Drive</p>

Strategy Name	Description	Partner Agency Coordination	Facilities/Area
Potential Strategy for Imperial Beach	Elevate SR 75 <i>Source: 10. SANDAG Regional Transportation Infrastructure Sea Level Rise Assessment and Adaptation Guidance</i> 1. California Coastal Commission Sea Level Rise Guidance	Multi-jurisdictional <ul style="list-style-type: none"> City of Imperial Beach City of Coronado City of San Diego City of Chula Vista Caltrans 	1.NBSD: Harbor Drive 2.NBC: SR 75 coastal areas and near Silver Strand Training Complex NBPL North Harbor Drive
Address downstream sedimentation and flooding at intersection of Pacific Highway and Laurel Street	Support the City of San Diego and San Diego Canyonland's Maple Canyon restoration efforts to address downstream sedimentation and flooding issues at intersection of Pacific Highway and Laurel Street next to N Harbor Drive. <i>Source: 11. San Diego International Airport Climate Resilience Plan</i>	Multi-jurisdictional <ul style="list-style-type: none"> City of San Diego San Diego County Regional Airport Authority Port of San Diego 	1. NBPL: N. Harbor Drive, Pacific Highway

Retreat Strategies

In specific instances, retreat from climate stressors would be necessary. In such circumstances, the risk of damage is high and likely causing for a relocation of an asset. This can range in scale from relocating a bike path exposed to increased storm surge to a phased retreat of a series of streets due to coastal erosion. Retreat becomes a final resort when protection and accommodation strategies will not suffice in mitigating stressors. In the case of relocation for key transportation facilities with operations crossing multiple jurisdictions, greater coordination and early planning efforts would be necessary. The Retreat Strategy Matrix includes a list of identified strategies applicable to potentially vulnerable key transportation facilities critical to maintain Navy mission readiness.

Retreat Strategy Matrix

Recommended retreat strategies and key transportation facility areas in which they apply are listed in **Table 4** below. The strategy matrix displays potential options to be considered in future resilience planning phases. Although strategies have been listed for facility or area, each scenario could choose from several strategy options to mitigate each risk present. See **Attachment A** for the source list.

Table 4. Retreat Strategies

Strategy Name	Description	Coordination with Partner Agencies	Facilities/Area
Protect Embarcadero and N. Harbor Drive	Relocate bike paths inland. <i>Source: 10. SANDAG Regional Transportation Infrastructure Sea Level Rise Assessment and Adaptation Guidance</i> 1. California Coastal Commission Sea Level Rise Guidance	Multi-jurisdictional <ul style="list-style-type: none"> San Diego County Regional Airport Authority City of San Diego 	1. NBSD: Harbor Drive 2. NBPL: North Harbor Drive
Transfer of Development Rights (TDR) Policy	Policy (TDR) to encourage relocation of development away from at-risk locations such as areas in FEMA 100- and 500-year flood zones	Multi-jurisdictional <ul style="list-style-type: none"> City of Imperial Beach City of Coronado City of San Diego 	1. NBC: 100-year flood impact along Ocean Boulevard between Alder Street and Loma Avenue,

Strategy Name	Description	Coordination with Partner Agencies	Facilities/Area
	<i>Source: 3. Imperial Beach Sea Level Rise Assessment</i>		developments along SR 75 between 13th Street and intersection of I-15 and Main Street.
Analyze strategies for protecting SR 75	Analyze options for phased relocation/retreat of SR 75 <i>Source: 3. Imperial Beach Sea Level Rise Assessment</i> <i>10. SANDAG Regional Transportation Infrastructure SLR Assessment and Adaptation Guidance</i> <i>1. California Coastal Commission Sea Level Rise Guidance</i>	Multi-jurisdictional <ul style="list-style-type: none"> • Caltrans • City of Imperial Beach • City of Coronado 	1. NBC: SR 75 along the coast and near Silver Strand Training Complex as well as along Ocean Boulevard between Rogers Road and Isabella Avenue

Resilience Planning Implementation Considerations

There are more than 10 different agencies and jurisdictions in the South Bay to Sorrento (SB2S) and Central Mobility Hub (CMH) and Connections Comprehensive Multimodal Corridor Plans (CMCPs). NBSD, NBC, and NBPL are located within the planning areas for these CMCPs. On-going collaboration is necessary to be inclusive and considerate of all needs and priorities for each agency and jurisdiction. In this section overarching and analogous considerations, constraints, and opportunities that align with each agency, jurisdiction, and base are discussed and summarized.

Planning Considerations

The following is not meant to be an inclusive list of all planning considerations for the region, but a guiding tool to initiate future discussion when considering cross-jurisdictional long-range transportation planning needs.

- Long-term resilience planning and implementation of adaptation strategies for key transportation facilities in the San Diego region are critical to maintain **Navy mission readiness**
- Adaptation planning and strategies should **prioritize social equity, environmental justice, and the needs of vulnerable communities**.
- Adaptation strategies should prioritize **protection of coastal habitats and public access**.
- Adaptation strategies should **consider the unique characteristics, constraints, and values of existing water-dependent infrastructure**, ports, and public-trust users.
- Allow for **phased implementation** of realignment and relocation projects to make incremental changes in transportation networks so that access to and along the coast can be maintained while also addressing coastal hazards over the long term.
- Ensure that transportation networks are designed to function even if the highest projected sea level rise amounts occur by retrofitting existing transportation infrastructure as necessary and **building redundancy into the transportation system**.
- Utilize an **adaptive management approach** to remain flexible and to adjust strategies in the face of uncertain conditions and ever-changing climate stressor.
- Use an **informed and iterative approach to adaptation** founded on the best available science and monitoring data in the San Diego region to reduce risks from key climate stressors.
- **Adopt a process** to select the best adaptation strategies in collaboration with partner agencies based on criteria and by taking a step-by-step approach to decision-making, see Figure 2, below.



Figure 2. Example of an Adaptation Process Guideline

Constraints

Coordination and collaboration between agencies, jurisdictions, and the Navy is going to be extensive and necessary; staff time needed to have these conversations on top of existing workload and projects. The priorities of multiple jurisdictions and agencies will need to be considered. Leveraging existing committees and working groups will be essential to aligning the timing of projects and planning processes.

Opportunities

Cross-jurisdictional collaboration and joint projects allow for greater opportunity to get resilience projects built and funded possibly earlier than would be expected. It would benefit most, if not all, agencies, and jurisdictions to collaborate and work with the Navy when planning for resilience and adaptation for their long-range transit and transportation needs. Utilizing existing SANDAG working groups and committees to help facilitate these conversations and take some of this burden off staff.

An additional opportunity is funding. Climate resilient projects which also incorporate protecting Navy mission readiness, could offer an occasion to leverage funding for projects that may not otherwise qualify for other funding opportunities. Senate Bills requiring resilience planning in projects are on the rise, offering another opportunity to leverage alternative funding sources. Table 5, below, lists out some potential funding sources for future transportation planning efforts.

Table 5. Potential Funding Sources

Funding Source	Description	Level
FAA AIP	AIP provides grants to public agencies for the planning and development of public-use airports included in the NPIAS. This funding program could be used to help fund a project such as raising low areas of the shoreline near the San Diego International Airport.	Federal
TRB-ACRP	For research around innovation and progress in transportation. Potential collaboration opportunities with local universities and other jurisdictions.	Federal
USDOT Transportation Infrastructure Finance and Innovation Act (TIFIA) program	Provides credit assistance for qualified projects of regional and national significance. Many large-scale, surface transportation projects - highway, transit, railroad, intermodal freight, and port access - are eligible for assistance. Eligible applicants include state and local governments, transit agencies, railroad companies, special authorities, special districts, and private entities.	Federal

Funding Source	Description	Level
FEMA Hazard Mitigation Assistance Programs	FEMA offers Pre-Disaster Mitigation grants, which could be used to prepare for flooding by elevating/protecting low areas of shoreline. Applicants must be local governments that have completed a FEMA-approved hazard mitigation plan.	Federal
USDOT RAISE Discretionary Grants	Rebuilding American Infrastructure with Sustainability and Equity (RAISE) (formerly BUILD and TIGER): DOT will prioritize projects that can demonstrate improvements to racial equity, reduce impacts of climate change, and create good paying jobs.	Federal
USDOT FTA	Provides a variety of funds to improve public transportation systems, including adaptation co benefits such as greater accessibility for vulnerable populations.	Federal
DoD REPI	The REPI Program provides funds to protect military missions by helping remove or avoid land-use conflicts near installations and addressing regulatory restrictions that inhibit military activities and supports large landscape partnerships that advance cross-boundary solutions and link military readiness, conservation, and communities with federal and state partners through a common, collaborative framework	Federal
OLDCC DCIP	Offers grants to address deficiencies in community infrastructure, supportive of a military installation, to enhance military value, installation resilience, and military family quality of life.	Federal
National Oceanographic and Atmospheric Agency (NOAA) Coastal Resilience Grants	Provides funds for hazard mitigation planning and projects to reduce reliance on federal funding in future disasters.	Federal
USACE Continuing Authorities Program (CAP)	Provides funding for feasibility study and implementation of water and environmental projects related to flood control, aquatic ecosystem restoration, erosion control and prevention, and storm damage reduction.	Federal
USACE Planning Studies	To conduct planning studies to support floodplain management	Federal
California State Coastal Conservancy - Prop 1 Grants	The Coastal Conservancy provides Proposition 1 grant funding to implement multi-beneficial projects that enhance the shoreline, including preparing communities for impacts of climate change. They are currently seeking to fund projects in Southern California.	State
California State Coastal Conservancy - Climate Ready Program	Part of statewide program that invests in Cap-and-Trade revenues in projects addressing climate change. The program seeks to support multi-benefit projects that use natural systems to assist communities in adapting to the impacts of climate change. Government agencies are eligible.	State
California Infrastructure and Economic Development Bank	Infrastructure State Revolving Funds. These are low interest loans for investment in infrastructure.	State

Funding Source	Description	Level
California Coastal Conservancy Proposition 68 funds	To assist coastal communities with adaptation to climate change	State
Private Activity Bonds	Allow for private developers to access tax-exempt interest rates for certain qualified projects. State or local govts can issue private activity bonds on behalf of a private developer for transportation projects that receive Title 23 assistance	State, Local
Catastrophe Bonds	Optimal for low-probability, high impact events. Local governments sponsor these bonds to insure against natural disaster damages and recovery efforts	State, Local
Resilience Bonds	Provide rebates to the sponsor local government to make investments that reduce exposure and risk that is reflected in the reduced investment risk to investors and reduced premiums from the sponsor.	Local
Green Bonds	Bonds to fund projects with environmental or climate adaptation benefits. Includes Environmental Impact Bonds (EIBs) where investors receive a higher rate of return if a certain predetermined environmental objective is met.	Local
Capital Appreciation Bonds	Capital Appreciation Bonds may be appropriate for emergency adaptation investments where cash supplies are limited in a post-recovery setting.	Local
Taxes	Potential taxes include: General local taxes, sales tax, Transit Occupancy Tax, Parcel Tax, Documentary Transfer Tax, Special Assessment Districts, Property Tax Increment Financing, and Development Impact Fees	Local

Best Practices for Conflict Resolution, Collaboration, and Consensus Building

SANDAG, the Navy, and HNTB met with regional partner agencies being considered for key transportation facilities that serve Navy Bases San Diego, Pont Loma, and Coronado. The intent of these meetings was to foster a consensus on best practices, planning considerations, and ways to continue collaboration between local agencies and the Navy, including leveraging existing committees and working groups to assist in continuous and consistent communication between the governing bodies and the Navy. As the region continues to develop and plan for the impacts of climate change, Navy mission readiness should also be considered and integrated into the transportation planning efforts. See Attachment C for the meeting agendas, attendance lists, and notes.

Two partner agency meetings were held with NBSD, NBC, NBPL, SANDAG, the Port of San Diego, the San Diego International Airport Authority, Caltrans, the San Diego Metropolitan Transit System, and the Cities of Coronado, Imperial Beach, San Diego, and National City to discuss possible adaptation responses and strategies to protect key transportation facilities in the San Diego region supporting Navy mission readiness. To guide best practices for future collaboration and consensus building, agency roles and responsibilities, early guiding principles and resilience goals were discussed:

Partner Agencies Roles and Responsibilities

- Incorporate “Navy mission readiness” into guiding principles language.
- Potential to collaborate on public outreach efforts
- Incorporation of strategies into CMCP’s to leverage funding
- Leverage existing meetings to collaborate

- Collaborate at a regional level to assess risks and impacts holistically
- Cities/agencies work directly with CPLOs and incorporate communications through SANDAG MWG.
- NBPL- the City of SD is large can the city provide a list of contacts.

Guiding Principles

- Climate change considerations are an essential element of national security. Long-term resilience planning and implementation of adaptation strategies for key transportation facilities in the San Diego region are critical to maintain Navy mission readiness
- Adaptation planning and strategies should prioritize social equity, environmental justice, and the needs of vulnerable communities
- Adaptation strategies should prioritize protection of coastal habitats and public access.
- Adaptation strategies should consider unique characteristics, constraints and values of existing water-dependent infrastructure, ports, public-trust users.
- Allow for phased implementation of realignment and relocation projects to make incremental changes in transportation networks so that access to and along the coast can be maintained while also addressing coastal hazards over the long-term.
- Ensure transportation networks are designed to function even if the highest project sea level rise amounts occur by retrofitting existing transportation infrastructure as necessary and building in redundancy into the system.

Resilience Planning Goals

- Include adaptation strategies in future resilience planning.
- Foster existing partnerships and lines of communication between agencies and the Navy and leverage existing lines of communication, such as committees and working groups, such as the Military Working Group.
- Consider integration of Navy mission readiness in future resilience and adaptation planning for the transportation network in the San Diego Region.
- Use guiding principles and regular communication to foster consensus and to develop an integrated approach to resilience planning to maximize co-benefits, leverage funding opportunities and minimize future conflicts.

Attachments

- A. Source List
- B. Maps with Potential Adaptation Strategies by Base
- C. Partner Agency Meeting Agendas, Attendance Lists, and Minutes

Attachment A

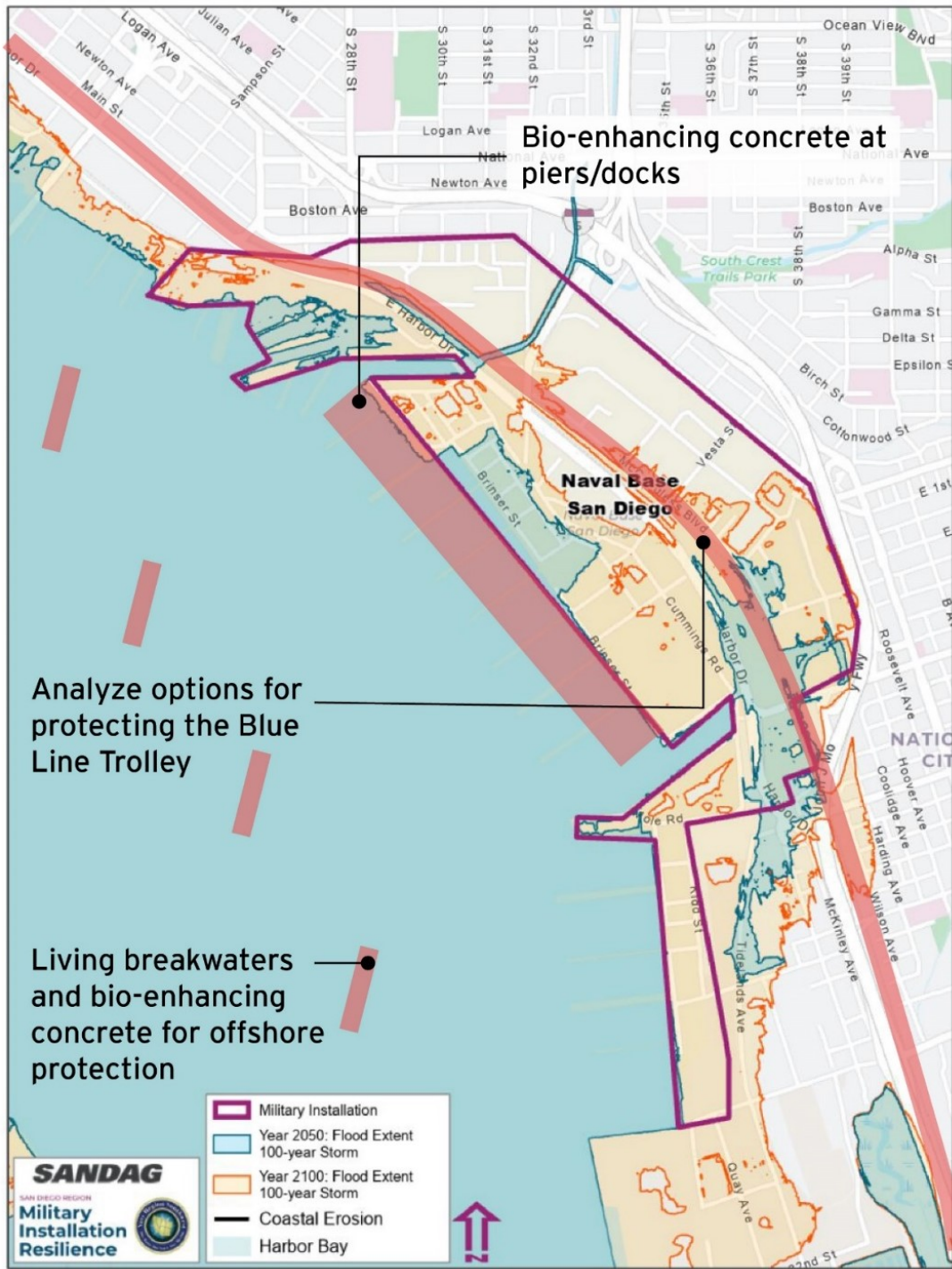
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11. San Diego International Airport. (June 2019) Climate Resilience Plan: A Roadmap to Maintain Business Continuity in a Changing Climate.
12. State of California. (2018). California's Fourth Climate Change Assessment: San Diego Region Report
13. State of California. (2018 Update). Sea-Level Rise Guidance
14. City of Imperial Beach (YYYY) Bayshore Bikeway Resiliency Project – Creation of a Coastal Resiliency Corridor

Attachment B

Maps with Potential Adaptation Strategies by Base

Naval Base San Diego

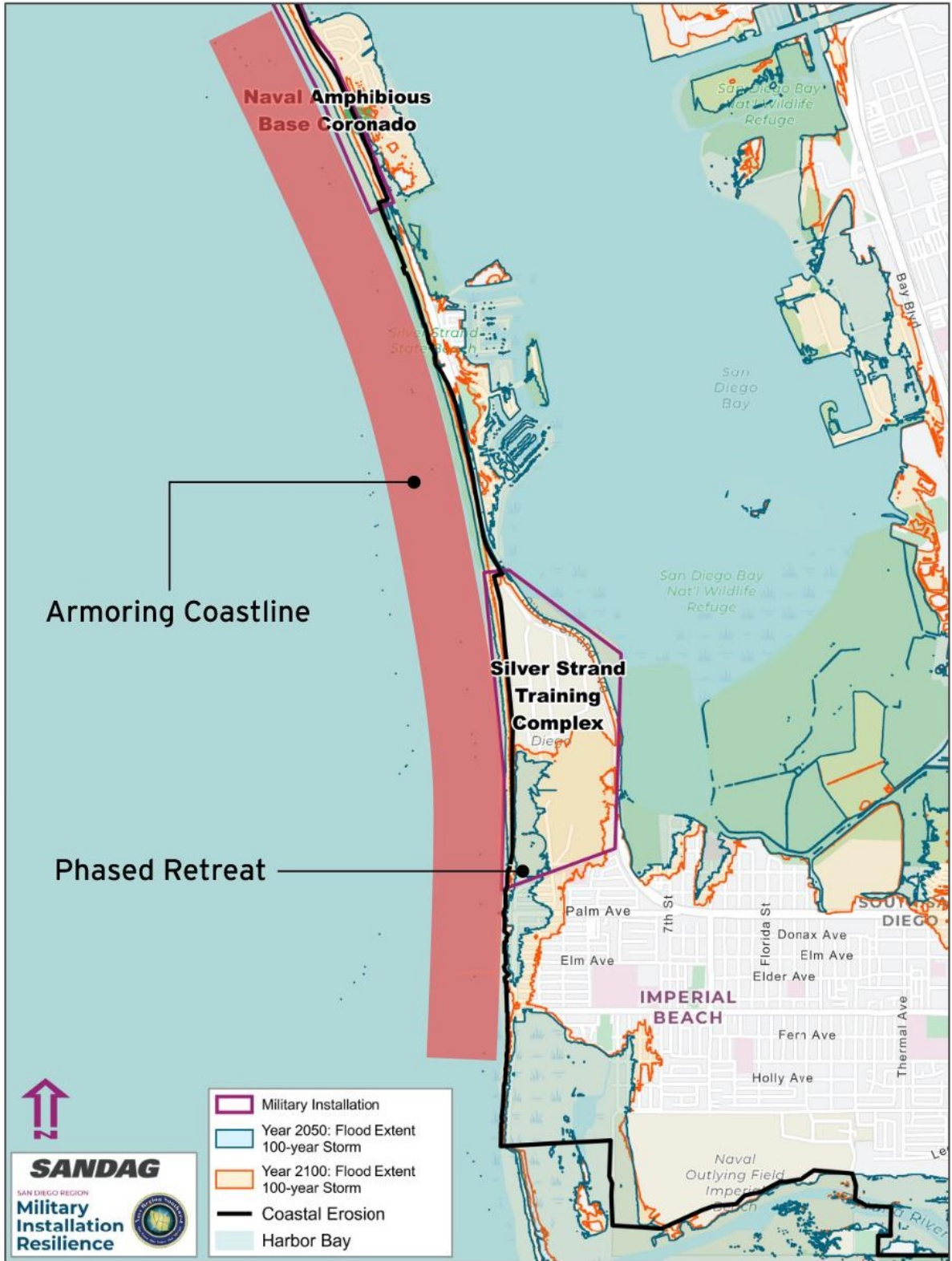


. Examples of Response Strategies for NBSD

Naval Base Coronado

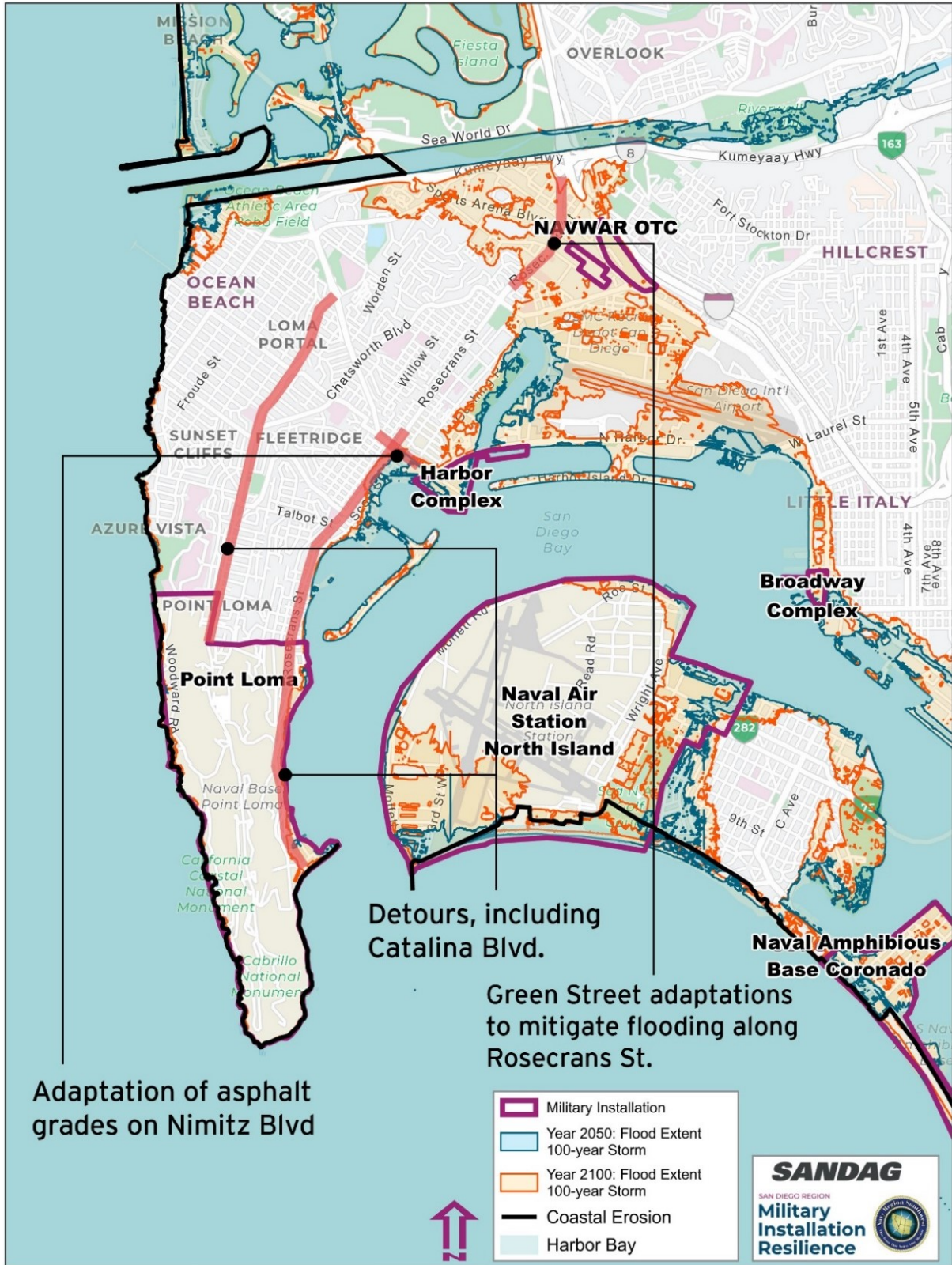


Examples of Response Strategies for NBC



Examples of Response Strategies for NBC

Naval Base Point Loma



Examples of Response Strategies for NBPL

Attachment C

Partner Agency Meeting Agendas, Attendance Lists, and Minutes



AGENDA

OLDCC Grant Coordination: Resilience Planning & Design Strategies and Coordination – Naval Base Coronado

April 29, 2021
9:00-10:30 AM

Microsoft Teams meeting
Join on your computer or mobile app

[Click here to join the meeting](#)

Or call in (audio only)

1 323-553-2644 United States, Los Angeles

Phone Conference ID: 702 569 575#

9:00-9:10 AM	Introductions <ul style="list-style-type: none">• Introduce new staff as needed
9:10-9:15 AM	Office of Local Defense Community Collaboration Grant Overview <ul style="list-style-type: none">• Grant goals• Background
9:15-9:25 AM	Overview of Strategies <ul style="list-style-type: none">• Accommodation• Protection• Retreat
9:25-9:45 AM	Adaptation Planning Strategies - NBC <ul style="list-style-type: none">• Regional Strategies
9:45-10:00 AM	Planning Considerations <ul style="list-style-type: none">• Guiding Principals
10:00-10:20 AM	Regional Agency Roles and Responsibilities <ul style="list-style-type: none">• Discussion Questions
10:20-10:30 AM	Next Steps & Action Items

Resilience Planning and Design Strategies Workshop Proposed Attendees:

	Sarah Pierce	SANDAG, OEA Grant Resilience Lead
	Gia Ballash	SANDAG, OEA Grant Communications Lead
	April DeJesus	SANDAG, OEA Project Manager
	Anna Lowe	SANDAG
	Sarah Hanna	SANDAG
	David Zajac	Navy Region Southwest
	Garth Nagel	Navy Region Southwest
	Anna Shepherd	Naval Base Coronado
	Megan Openshaw	City of Imperial Beach
	Michelle Blake	Caltrans
	Jane Thornton	City of Coronado
	Audrey Edney	HNTB
	Tami Podesta	HNTB
	Marcy Monroe	HNTB



AGENDA

OLDCC Grant Coordination: Resilience Planning & Design Strategies and Coordination – Naval Base San Diego & Point Loma

April 29, 2021
2:00-4:00 PM

Microsoft Teams meeting
Join on your computer or mobile app

[Click here to join the meeting](#)

Or call in (audio only)

1 323-553-2644 United States, Los Angeles
Phone Conference ID: 131 981 465#

2:00-2:10 PM	Introductions
2:10-2:15 PM	Office of Local Defense Community Collaboration Grant Overview <ul style="list-style-type: none">• Grant goals• Background
2:15-2:25 PM	Overview of Strategies <ul style="list-style-type: none">• Accommodation• Protection• Retreat
2:25-2:45 PM	Adaptation Planning Strategies - NBSD
2:45-3:05 PM	Adaptation Planning Strategies - NBPL
3:05-3:20 PM	Planning Considerations <ul style="list-style-type: none">• Guiding Principals
3:20-3:45 PM	Regional Agency Roles and Responsibilities <ul style="list-style-type: none">• Discussion Questions
3:45-4:00 PM	Next Steps & Action Items

Resilience Planning and Design Strategies Workshop Proposed Attendees:

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	Anna Lowe	SANDAG
	Sarah Hanna	SANDAG
	David Zajac	Navy Region Southwest
	Garth Nagel	Navy Region Southwest
	Ya-Chi Huang	Naval Base San Diego
	Muska Laiq	Naval Base Point Loma
	Julia Chase	City of San Diego
	Rodrigo Carrasco	MTS
	Lily Tsukayama	Port of San Diego
	Phil Gibbons	Port of San Diego
	Jose Lopez	City of National City
	Patrick Moneda	City of Chula Vista
	Audrey Edney	HNTB
	Tami Podesta	HNTB
	Leah Wener	HNTB



MINUTES

OLDCC Grant Coordination: Resilience Planning & Design Strategies and Coordination

April 29, 2021

Naval Base Coronado: 9 – 10:30 AM

Introductions were made and an overview of the purpose of this project was given to the participants.

An overview and background of the OLDCC Grant were given, as well as the process to determine which transportation facilities and climate stressors were analyzed for vulnerabilities. The following discussion is to review possible adaptation strategies to protect the key transportation facilities supporting Navy mission readiness.

Adaptation Planning Strategies

Accommodation

- Add green streets to IB wherever possible
 - Incorporate any way to retain water or places to direct it
 - Where can we live with water? Where can we put water during these high tide events/flooding events?
 - Bayshore Bikeway received grant funding and focuses on directing water to existing low lying areas.
 - IB looking at public parcels- owned by City, School District, and Wildlife Agencies.
 - Eco tide pools
- Eco-concrete/ Oyster reef being considered by the Port.
 - Where are these strategies being considered? Could they also be used on the Ocean-side rather than in the Bay?
 - *Can innovative concrete solutions work on the ocean side?*

Protection

- Strategy focused on dredging or reusing materials locally (repurposing soils) on beach.
 - Beneficial use of sediment- TJ estuary and SD Bay (reformatting permit process to not go into dump sites)
- **Preserving existing wetland habitats and other areas as adaptation strategy**
- IB presents huge opportunity for living coastline and natural solutions
 - Protection of the existing military pump that manages the flood waters.
- Coronado to have maps prepared in the next couple weeks (on SLR)
- Eco tide pools
- Eco-concrete/ Oyster reef being considered by the Port.
 - Where are these strategies being considered? Could they also be used on the Ocean-side rather than in the Bay?
 - *Can innovative concrete solutions work on the ocean side?*

- Increasing number of inspections and maintenance in vulnerable areas (to update on our slides/qualify in our language related to inspections and maintenance)
 - Change the language to say "increase" in maintenance and inspections rather than just ongoing.

Retreat

- Little to no opportunities for retreat adaptations in our region.

Other comments

- Michelle Blake (Caltrans) asked if there are strategies out there for dedicated escape routes just for Navy personnel during an event?
- Jane Thornton (Coronado) mentioned in coordination of planning processes for resilience, reference to the National Environmental Policy Act and guidance related to the military and naval readiness was emphasized.
- Detours just for military personnel during extreme events?

Regional Strategies

- Regional strategies- consider the littoral cell. In IB things move south to north. Strategy to be tailored to the cell. Maintaining and managing at the littoral cell scale.

Planning Considerations

- In implementing strategies, emphasize utilization of existing resources and avoid creating more committees for implementation.

Roles and Responsibilities

- Incorporate "Navy mission readiness" into guiding principles language.
- Jane Thornton suggested agencies work together to do public outreach collectively to demonstrate in public the coordination taking place.
 - Collaboration on fact sheets and public meetings between SANDAG/NAVY/local jurisdictions. Need to recognize impacts to staff workload.
- IB and Coronado contact and coordinate with Anna S. regularly
- Coronado- Naval complex meeting at Coronado council chambers. Could be leveraged to coordinate on adaptation strategies.
- MWG meeting at SANDAG could be leveraged.
- Incorporation into CMCP's to leverage funding
- SDRCC- leverage those meetings for coordination and collaboration. Leverage existing rather than setting up new committees and groups.
- Opportunity to collaborate at a regional level is helpful- assess risks and impacts holistically

Naval Base San Diego and Naval Base Point Loma: 2 – 4 PM

Introductions were made and an overview of the purpose of this project was given to the participants. An overview and background of the OLDCC Grant were given, as well as the process to determine which transportation facilities and climate stressors were analyzed for vulnerabilities. The following discussion is to review possible adaptation strategies to protect the key transportation facilities supporting Navy mission readiness.

Adaptation Planning Strategies

Accommodation

- Can asphalt grade improvements also be used to accommodate and divert storm water as needed? Bioswales may help.
- City of SD Barrio Logan Community Plan update- looking at green streets as an implementation strategy from flooding.
- National City also been doing green streets- maybe also could be implemented on cross streets.
- Consider restoration and/or nature-based solutions along creeks that run through bases to possibly mitigate impacts in these areas. Would need to be multijurisdictional in the sense that these creeks are both "on" and "off" base.

Protection

- Sarah to follow up with Lily (Port of SD) on N. Harbor Drive study and use of eco concrete and use of oyster reef and how shipping lanes have been considered.

Retreat

- Need more research about the strategies that can work or should be considered for Harbor Drive- lots of money going into planning improvements for this corridor.
 - Is anything being considered regarding resilience in current planning efforts?
 - *Relocation/retreat* should be considered a very last option for Harbor Drive.
 - Ralph Redman (Airport) was adamant that relocation was not an option for Harbor Drive because of the planning and money going into this corridor.

Other comments

- SD resilience plan – may not be exploring the how to phase these various approaches could be explored more on a regional level

Planning Considerations

- Need to connect and marry adaptation/and transportation planning. Integrate adaptation into transportation planning.

Roles and Responsibilities

- Cities/agencies work directly with CPLOs and communicate through SDANDAG MWG.
- NBPL- City of SD is large and there are multiple bases in their jurisdiction. Could maybe provide a list of people at Navy to make it easier for SD to reach out to.
- SD Bay focused group- task forces vs MWG. Don't want to be redundant.

Section 2

Data Sharing and Collaboration with Military Stakeholders

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Data Sharing Framework

Executive Summary

Purpose

In June 2020, the San Diego Association of Governments (SANDAG) was awarded a grant from the Office of Local Defense Community Cooperation (OLDCC) through the Department of Defense. Part of this grant concentrated on the data sharing between the Navy and SANDAG. Currently, SANDAG and the Navy do not have a data sharing framework and part of this grant is to develop such a framework to guide data sharing efforts between the Navy and SANDAG. The purpose of the data sharing framework is to streamline the data sharing process, making the data deliveries from the Navy to SANDAG more regular and uniform for all naval installations in the region.

Goals

Our goals are: (1) to streamline the data sharing process between the Navy and SANDAG for regular annual deliveries by (2) providing the framework, process, and templates needed for data sharing and collaboration on data products and research and to (3) support Navy mission readiness and SANDAG's Regional Transportation Plan.

Future Considerations

Availability and demands for datasets that could support military needs may change over time, and the process, points of contact and responses should be reviewed and revised, as needed. To ensure this effort is prioritized and updated, SANDAG will add an agenda item with the Military Working Group for an annual review of this framework. Enhanced collaboration with other local jurisdictions in this process will ensure that the region maximizes any opportunities for shared investment.

Introduction

The San Diego Association of Governments (SANDAG) uses a variety of data sources to create a regional and subregional growth forecast, yearly population and housing estimates, and periodic employment estimates for San Diego County and its subregional areas. These data are also used in research products and publications to inform decision-making in the region. An important component of these datasets is information from the local Naval installations: Naval Base San Diego, Naval Base Coronado, and Naval Base Point Loma. These installations share common planning areas defined by the boundaries of jurisdictions fronting San Diego Bay. It is imperative that local jurisdictions and stakeholders consider and understand the Navy's critical climate resilience efforts and minimize impacts to military operations; therefore, SANDAG has partnered with the Navy to establish a framework to guide and enhance collaboration between the two agencies.

The San Diego region has a long history of coordinating initiatives with the military through the San Diego Regional Military Working Group (MWG), which provides a collaborative forum for the various branches of military, local jurisdictions and SANDAG to address areas of mutual interest, including growth management, habitat preservation, transportation, regional growth, housing, water, energy, and other related topics that inform the Regional Plan. Effective data sharing with military partners maximizes future opportunities from State and Federal agencies to contribute to economic growth and improve the transportation network while supporting National Security and Mission Readiness.

Although SANDAG compiles and integrates military-centric data into regional planning efforts, the current process that is used to collect and compile these data can be improved. Having an efficient process will help accurately develop regional recommendations that support and minimize impacts to the Navy's mission readiness. This proposed framework will streamline this process and make data deliveries to SANDAG more regular and uniform for Naval installations in the region. This will allow the Navy and SANDAG to improve collaboration on data products, research, and prioritize transportation improvements that support Navy installations to maintain operations while also supporting neighboring communities.

Purpose and Need

SANDAG developed the vision for the 2021 Regional Plan based on careful and deliberate analysis of where people live and work, how they get around, what mobility options would make their lives easier, what transportation infrastructure exists, what is needed to serve future growth, and more. SANDAG used a wide range of data sources – including census data, survey data, employment data, operational data collected from roadways and anonymous cellular data – to identify travel patterns. Analysis of connections between where people live, and work allowed SANDAG to visualize the most significant commute patterns in the region.

SANDAG's new data driven approach to planning has created opportunities for additional products that have not been available in the past. As SANDAG further enhances its data-driven approach to regional planning, it is critical that SANDAG utilizes a replicable and consistent data sharing framework with the military to support this regional priority and ensure analysis and decisions consider any potential impacts to military operations to ensure sustainment of military readiness.

The mission of this data sharing framework is to maximize the availability and impact of data for public good. A partnership between SANDAG and the Navy will help develop an infrastructure that enables better sharing, usage, and learning from data. The approach of this framework is to blend the current data sharing needs and efforts with an anticipation of future needs for the region. Our vision is a collaboration between SANDAG and the Navy where we use data to build a more equitable region for all and support Navy mission readiness. We envision a future where data plays a key role in enabling evidence-based decision making to support the population of the region.

Existing Data Inventory and Collection Process

Currently, data measuring military personnel in the region are derived by SANDAG from several sources many of which are collected on an ad-hoc basis. These data are used to inform the Regional Plan and to support planning decisions throughout the region. The county and characteristics of the military personnel, civilian employees, private contractors, and veterans throughout the region can contribute to the understanding and needs of the military population. Also, understanding commute patterns of the region's military population is key to evaluating the existing regional travel demands. Commuting patterns are influenced by various factors including housing, available mobility options, cost, convenience, travel time, and parking.

There are several products that SANDAG creates on a regular basis that are used for a variety of research and planning processes. Every 3-4 years SANDAG creates a population, job, and housing unit forecast used for the Regional Plan, research, and other planning purposes. Every year, SANDAG creates population and housing estimates for the subregional areas in the county to be used for research and planning purposes and displayed on datasurfer.sandag.org. These estimates are also used in customized data requests by internal and external stakeholders. Periodically, SANDAG also creates subregional employment estimates for the region. These data are used for research and planning purposes and as the base-year employment data for the Regional Growth Forecast. In the latest planning cycle for the 2021 Regional Plan, SANDAG collected data from publicly available sources which simplified the collection process, but it did not allow military stakeholders to provide information directly to SANDAG.

The active-duty military personnel and their dependents are a unique population in the region, with travel behavior that can be different from the rest of the population. This means that the classic methods of collecting and compiling data on the region's population may not work for the military population. It is important to collect data that accurately reflects the military population to understand behavior and choices that impact this special population in the region.

Lost Opportunities without Consistent Data Sharing

SANDAG has established processes for collecting employment and housing data for the region and complements it with annual surveys to validate commute pattern assumptions; however, the data collected for military employment and housing have been inconsistent and coordinated surveys frequently result in insufficient sample sizes. Other data have been sourced from publicly available data sources that have made it difficult to assess its accuracy. Additionally, there are challenges with frequent turn-over which makes it difficult to maintain points of contact for data requests or establish standardized assumptions for military populations.

Unpredictability in data availability frequently results in confusion about the level of detail included and referenced in regional plans and databases. For example, SANDAG has developed employment center analyses highlighting origin-destination commute patterns. Unfortunately, the datasets needed to incorporate active-duty military employment were not publicly available, and data received was not sufficient for this effort. This inconsistency of referenced data has caused confusion in map references labeled "Employment Centers" within the region. Although this is only one example the consequences from lack of consistent data sharing, there may be additional cascading impacts affecting regional trends that result from inefficient incorporation of military data into regional planning processes. Additional data analysis is anticipated to be more common at SANDAG as we embark on the data that will be used in the 2025 Regional Plan and our future data-centric planning efforts.

Benefits of Data Sharing

Effective collaboration in data sharing allows data driven decisions that enhance the military value and security of regional Navy installations. This effort will promote understanding of data needs and information gaps to improve base access and mission readiness. Data sharing also enables new research and allows for the testing of innovative and alternative methods to address regional challenges and enhance access to and from Navy installations.

Reducing congestion and maintaining access to and from military bases supports the National Defense Strategy and collaboration on regional resilience initiatives to support the military throughout the San Diego region. As SANDAG prioritizes initiatives that reduce greenhouse gas emissions through investments that incentivize modal shifts in commuter behavior, these investments also support military access priority needs and regional resilience strategies. Regional decision-making is based on commute behavior data collected by SANDAG on an annual basis and developing a standardized process with military partners will ensure that decisions consider national security priorities and concerns. Congestion and traffic for military personnel accessing Navy installations could be improved with data on the commute origin of each installations' population and personnel. This information could facilitate planning and funding to areas in the region most impacted by congestion.⁹ Reducing traffic congestion equates to greater quality of life for military service members and their families, while also providing more time for mission readiness, training, and improving safety and security. Creating a framework to share data ensures data collection is collaborative and incorporates review from both SANDAG and the Navy.

During the process of identifying the most relevant resilience data to use in the analysis, multiple multi-jurisdictional meetings were held to verify the data we were using was the “best available science.” Through this collaborative data review, the project team learned that some data sets were out of date, for example, the CoSMoS topographical data did not depict accurate and correct elevations of Coronado. A benefit of this collaboration was awareness of any shortcomings of the available data and any potential new data becoming available. Multi-jurisdictional collaboration for regional decision-making provided opportunities to leverage investments and maintain consistency across resilience plans and studies throughout the region. This effort provided additional datasets and products to inform the CMCP planning process and recommended strategies that highlight transportation infrastructure needs that support mission readiness, and continued collaboration could ensure consistency and accuracy of data assumptions as it relates to mitigation and adaptation planning recommendations.

Data Sharing Framework and Timeline

The data sharing framework supports data access, use, and sustainability. SANDAG should ensure it uses current standards for data sharing and allocates the time of the appropriate staff resources, and computer systems and has current software in place to support the project. When utilizing this data framework, a timeline should be developed to ensure data are received by SANDAG in time for the yearly production process of the population and housing estimates, and the periodic process of the regional growth forecast. Receiving data after agreed upon dates would preclude incorporating timely data in either of those products and the regional planning efforts for that cycle. This framework ensures consistency with data requests and responses, mitigates repetitive requests, and provides opportunity for streamlined communication with Navy partners to ensure the process and points of contact are updated.

Near-term Solutions

The Navy and SANDAG instituted several measures and tools to facilitate current data sharing and allow for better collaboration in the future. First, a standardized data request form was developed for SANDAG to enter in pertinent information when requesting yearly data from the Navy. A standardized template ensures all necessary information is provided when requesting data and that anyone requesting data is aware of the detailed facts needed before asking for information. Second, primary points of contact were established for both the Navy and SANDAG. Assigning one “person” to compile and send all data requests between agencies ensures that several people are not being contacted throughout the year. It also ensures that there is continuity in the case of staff turnover at either agency. Lastly, instituting a schedule will ensure that any data needed for regional planning purposes is received to be included in any upcoming products

⁹ The topic obtaining data of the origin-destination data for the military population in the region is covered in more detail in Attachment A Pilot Implementation of Data Sharing Framework to support Origin-Destination Data for the Military Population in the region

or modeling efforts. Adhering to an agreed upon schedule will ensure that the latest available data are being used in regional planning efforts.

Another key element that led to improvements in the near-term data sharing process is the creation of an inventory of current datasets and processes. This detailed information is used to understand the current use and acquisition of military-centric data in SANDAG planning and research projects. It allows both agencies and the public to understand how data are currently being used as well as serving as a method for determining gaps in data and places where improvements in the data sharing processes can be implemented.

After these processes have been developed and agreed to, SANDAG and the Navy will use this framework and the information derived from these specific near-term solutions to request, deliver, and use the data that are needed for the yearly and periodic regional planning projects and research.

As a part of this effort, SANDAG and the Navy have successfully shared data on installation-specific employment origins directly from the Navy (Attachment A: Pilot Implementation of Data Sharing Framework to support Origin-Destination Data for the Military Population). Previously, installation-specific employment was estimated from publicly available data sources (Attachment B: Data Definitions). This grant-awarded coordination effort supported the successful delivery of these data directly from the Navy to SANDAG as part of the development of this data sharing framework, and SANDAG hopes to replicate this process in future years.

This dataset is an improvement upon the previous process because it provided a process for receiving origin data from our Navy partners which had been very challenging in prior requests. This process would allow SANDAG to receive standardized data from all installations in one delivery and allow the Navy to review data for consistency and accuracy before it is used in SANDAG models and research.

Having origin-destination data for the active-duty military population in the region is an important component of planning work done by SANDAG. A large part of transportation planning for the region is accounting for work trips and improving the ability of workers to get to their jobs in a safe, fast, and efficient way. Having data on the origin of the active-duty military population who work on installations will allow SANDAG to incorporate more detailed and up-to-date information in the calibration and estimation of the commute patterns of this population. This information will improve the accuracy of the estimates and forecasts for the entire region. Future analysis with this dataset could include integration into SANDAG's regional GIS data viewer to inform estimation of travel assumptions and/or develop products to support visualization of assumed travel behaviors and impacts to transportation infrastructure facilities. These products will encourage regional prioritization of infrastructure improvements that are critical to mission readiness.

Other data sources that will be modeled as part of phase 2 based on this phase 1

- How is it all coming together?
- What have we received from DMDC? What we also must complement it?
- Employment Center Clarity
- Transit/Transportation corridors utilized by Military
- Drawing some conclusions that will set stage for phase 2
- Initial data set and limitations of zip data'
- Military civilian dataset, limits of DMDC data, cross walking datasets = write up is this is how the three different buckets are correlated and talk through the methodology.
- Future phase 2 build off this effort

Additionally, data identifying key climate threats have been compiled and integrated into SANDAG's data viewer to support regional planning decisions for future transportation infrastructure investments. Critical transportation facilities that support base access were identified, and protection strategies have been identified to be referenced in future multi-jurisdictional infrastructure investments. The data viewer and

vulnerability profiles of climate stressors will be referenced as a tool for other jurisdictions and is recommended for annual updates to ensure consistent data references and prioritized discussion of strategies that support base access.

Long-term Strategies

SANDAG has identified several datasets that would be beneficial in supporting regional planning analysis (outlined in Attachment C: Military Data Request Matrix); several of these data are currently available and data sharing recommendations are addressed as part of the near-term solutions. However, the remaining requests may need to be obtained using other methods depending on regional priority needs and available budgets. One strategy that could be implemented near-term would be to work in collaboration with Navy partners to develop high-level estimates when data are lacking or unavailable. These types of estimates serve as an informed alternative in the regional data analysis when exact data are not available.

Due to National Security concerns, it is understood that some data that is available for public consumption may not be consistent with data available from the military to ensure confidentiality and security of our armed forces. These references have been discussed with Navy partners and identified as confidential in internal records to avoid repetitive requests. Remaining data sets could be reviewed and considered by SANDAG and the Navy to determine if additional investments should be prioritized to fund alternative data collection efforts such as targeted surveys, field assessment or third-party procurements.

The climate stressors in this study prioritized data collection and analysis to the five threats that were most critical to the Navy's mission readiness, including coastal storms/storm surge, erosion, sea level rise, flooding, and tsunamis. Several maps and tools have been developed as part of this effort, and it is recommended that enhanced collaboration with other agencies to address other potential hazards and risks such as wildfire, drought and earthquakes can be assessed regionally to support concerns that impact key transportation facilities that impact mission readiness. As SANDAG hopes to be the clearinghouse for regional data sharing collaboration through an open data portal, these discussions and shared analysis will continue through future planning endeavors.

Future Considerations

SANDAG is becoming a data-driven organization and will have the opportunity to create unique and insightful data products in the future, but if we don't continue increasing efficiency in data sharing, military may consequentially be left off new products. In some cases, datasets may not be available due to security concerns, limited resources, and/or no potential sources that currently exist, and SANDAG and the Navy will continue working together and creatively develop opportunities that could still inform regional planning efforts. There is value in providing continuous analysis using the best available data: it offers a real-time ability to strategically look at infrastructure critical to mission readiness and align it with the regional priorities. Availability and demands for datasets that could support military needs may change over time, and the process, points of contact and responses should be reviewed and revised, as needed. To ensure this effort is prioritized and updated, SANDAG will add an agenda item to the Military Working Group meetings for an annual review of this framework. Enhanced collaboration with other local jurisdictions in this process will ensure that the region maximizes any opportunities for shared investment.

The San Diego Military Installation Resilience Project developed a process for data sharing to ensure that climate change impacts are considered in the SANDAG planning and design processes for regional efforts to enhance regional resilience. Through collaboration between SANDAG, the Navy and HNTB, climate stressors have been identified as the greatest and most immediate threats to base access, including storms and hightides that have affected existing transportation facilities resulting in limited access to Navy bases. The analysis of these stressors to the region is not only crucial to regional planning efforts and but also critical for national security concerns. Open lines of communication and systematic data sharing between agencies will help foster a consensus on best practices, decision-making processes, planning considerations, and ways to continue collaboration between local agencies and the Navy. Frequently updated data sets will help in to inform policy-based strategies that are reflective of consistent datasets across all agencies, which will aid in the development of transportation infrastructure projects that support

base access and informed an iterative approach to adaptation founded on the best available science and monitoring data in the San Diego region.

Attachments

- A. Pilot Implementation of Data Sharing Framework to support Origin-Destination Data for the Military Population
- B. Data Definitions
- C. Military Data Request Matrix

Attachment A: Pilot Implementation of Data Sharing Framework to support Origin-Destination Data for the Military Population

Background

Every four years, SANDAG creates a forecast of population, housing units, households, and employment that informs the transportation model, which is used in the region's transportation planning. A large part of developing these input data is identifying where the military population in the region lives and works and their household characteristics. This information can improve the accuracy of the estimates and forecasts of the military population and active-duty personnel in the region.

Challenge

Currently, SANDAG relies on data from a variety of publicly available sources to create estimates of the active-duty military and military dependent population in the region. While these data represent the best available data accessible to the public, there are many components' staff must estimate because either the data are not available, or the data available do not contain the needed level of detail.

One of these datasets not publicly available is information on the origin-destination of the military personnel in the region. Most active-duty personnel work on the military installations in the region but knowing where they commute from is important to the transportation planning efforts in the region. For the non-military personnel in the region, data from the U.S. Census Bureau shows the work location and home location of civilian employees. Not having analogous information for the active-duty military population means that some analyses that SANDAG conducts do not include the military population.

Solution

In June 2020, SANDAG was awarded a grant through the Office of Local Defense Community Cooperation (OLDCC) through the Department of Defense. Part of this grant concentrated on data sharing between the Navy and SANDAG. SANDAG and the Navy had several discussions during this grant period on how to request and provide data between the two agencies. Navy staff ultimately facilitated this request by contacting the Defense Manpower Data Center (DMDC) to obtain origin and destination data for the active-duty and civilian population working on naval installations in the region.

Facilitators to Data Sharing

Many factors facilitated the process of data sharing. The Navy personnel involved in the OLD CC grant led the effort to request origin-destination data from the DMDC. SANDAG staff involved in the grant also helped develop this framework and requirements for successful data sharing. SANDAG staff also used the Military Working Group to inform stakeholders in the region about the data sharing efforts.

Challenges to Data Sharing

Challenges faced included the DMDC no longer maintaining data in a format that links active-duty personnel to the installation where they work. This means that after the data are obtained, staff must work closely with the Navy to create an estimate from available sources of the origin-destination of military personnel in the region. Additionally, the DMDC does not include civilian or contractor data and will present a data gap, specifically for NBPL, which employs more civilians and contractors than active-duty members.

Outcomes

As a result of the collaboration of the Navy and SANDAG through the OLDCC grant, a partnership was formed to ensure all data requested and received are accurate, timely, and represent the best source available. The formation of this relationship will apply to more than just the origin-destination data described above. It will also apply to all data used by SANDAG for research and modeling purposes to support regional

planning. More information about data sharing can be found in Appendix A which outlines the process from the perspective of the Navy.

Attachment B: Data Definitions

Housing (Active Duty by Place of Residence)

The location of residences of the active-duty personnel in the region. A count of the households with active-duty military personnel and the count of the active-duty personnel living in group quarters units in the region.

Currently these data are derived from the tabulation in the ACS in Table B23001 which lists a person's occupation as "In the Armed Forces" as their employment. These data are available at the census tract-level and are used to classify population in the region as active-duty military personnel. These data are used to create the output data used by the Activity Based Model (ABM) which uses a person-based file for the region to model transportation behavior. One field in this file is a dichotomous table which indicates if a person is active-duty military or not.

ACS Public Use Microdata (PUMS) are also used to classify household members as "military dependents". Military dependents are non-military relatives (children ages 0-18 and/or spouses) in households in which a household head or a spouse (of a household head) is an active-duty military.

This information is used in the socioeconomic modeling to hold constant the military personnel and their household members. Although individual military personnel transition in and out of the region, overall, the distribution of the population in the military is relatively constant. Knowing the active-duty personnel in the region and their dependents allows the modeling to maintain a similar population structure of the active-duty military population and their dependents.

Employment (Active-Duty and Civilian Department of Defense Employees by Installation of Employment)

Active-duty population in the region is the count of the population currently employed full-time in the military, by the military installation where the individual works.

Currently these data are derived from a Defense Manpower Data Center report entitled "Demographics" that is published yearly (2019 version available here) which lists the installation, the service branch, the closest zip code to the installation and count of the active duty military and dependents for the given year. These counts by installation are allocated to MGRAs within the region or modeling purposes.

This information is used in the SANDAG Population and Housing estimates, estimates of employment and jobs in the region, the Regional Growth Forecast, and for research projects such as the employment centers. After these counts are allocated to MGRAs, the ABM uses information on the active-duty population in the region to measure travel patterns for regional planning purposes. For employment centers, information on the active-duty population is used to describe the sociodemographic makeup of a given area.

Origin-Destination (Active-Duty Population by Place of Residence and Place of Employment)

A count of the population by their place of residence and the installation on which they are employed by zip code for the region.

Additionally, the origin-destination data by zip code could be enhanced with information on the count of workers who live on the same installation where they work by installation and the count of workers who live outside of San Diego County by installation.

Information on the origin and destination of military personnel in the region will be used to create traffic flows of personnel accessing the installation for employment. This is like information that SANDAG uses on the civilian employees in the region which provides a count of employees by place of work and place of

residence by census block. These data will be used similarly and for possible research projects in the future.

Future Personnel and Installation-Specific Information

When creating the Regional Growth Forecast and its subregional allocation, SANDAG makes assumptions about the size and location of jobs, housing units, and population in the future. For this purpose, SANDAG could include information on plans for expansion for employment. Counts of expected increases to future employment and the timing of that expansion SANDAG could incorporate it into the forecast.

Additionally, the transportation modeling group could use information on transportation policies that may restrict access/egress now and in the future from installations in the region. This information could be used by transportation modeling staff to enhance ABM development and calibration.

Attachment C: Military Data Request Matrix

Number	Short Name	Dimensions
1)	Housing	Type of housing unit: i.e., Single-family, multi-family, military owned
		Household population
		Group Quarters population
		Characteristics of military personnel (race, ethnicity, age, sex)
		Count and characteristics of military dependents if applicable (race, ethnicity, age, sex)
2)	Employment	Rank and salary of the employees
		Characteristics of employees (race, ethnicity, age, sex)
		Characteristics of job (industry, occupation)
		Deployed personnel
3)	Origin-Destination of Employees	Zip code of origin
		Installation of employment by zip code
		Characteristics of worker (race, ethnicity, age, sex)
4)	Base Access Volumes	By purpose (work, shopping, visiting, returning to base (for those living on base). If delivery to base type of delivery (food, retail, etc.)
		By time of day (in 30 min increments)
		By mode (truck delivery, military vehicle, car, transit, walk, bike, TNC (uber, lyft, etc.), other), vanpool, include if more than one mode was taken
		Wait time at gate to access installation
5a)	Primary Mode of Transportation to Base	Drive alone, carpool, vanpool, walking, biking (option to specify)
5b)	For those who report using dockless micro mobility services:	Device types used (e.g., pedal bikes, electric-assist, adaptive)
		Walk access time to micromobility device
		Device unlock time
		Demographic information on personnel choosing to use micromobility
		Estimated trip cost
5c)	For those who report using TNC or Microtransit Services:	Micromobility parking restrictions on base
5c)	For those who report using TNC or Microtransit Services:	Walk access to Microtransit static or virtual stop
		Microtransit wait time
		Microtransit reservation made v. real-time hail
5d)	For those who report using carshare services:	Walk access to carshare vehicle
		Vehicle unlock time
		Vehicle rental time
		Carshare reservation made v. on-demand access
6)	Vehicle ownership and type	Mode replaced by using carshare option
6)	Vehicle ownership and type	Type of vehicle (ICE, EV, hybrid, motorcycle, moped, other)
7)	Future Personnel and Installation Specific Information	
8)	Electric Vehicle Charging	EV charger stations by installation site and charger type - L1, L2, DCFC, other.

Data Sources Legend	
	Currently Not Available
	Navy
	Estimates/Assumptions
	Other Sources

Section 3

Stakeholder Engagement and Communications Strategy with Evaluation and Summary

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3. Stakeholder Engagement and Communications Strategy with Evaluation, and Summary (Task 2)

3.1 - Subtask 2.5: Strategic Communications Plan

The purpose of the Plan was to provide a detailed description of the approach to stakeholder outreach and public engagement for the San Diego Region Military Installation Resilience project. The Plan outlined the approach, implementation and outreach tools and materials that would be used during stakeholder engagement. The intention of all outreach efforts was to provide stakeholders with a clear understanding of the Grant and its objectives.

Outreach efforts were led by MBI Media which served as a strategic communications advisor and meeting/workshop facilitator. All engagement activities were coordinated and implemented with SANDAG.

This Plan was created as a living document that was revisited throughout the study to review activities, assess effectiveness, and optimize community outreach outcomes.

The Plan objectives include the following:

- Effectively communicate and present engaging information about the Grant’s objectives and expected outcome to its diverse audiences
- Develop and administer programming to collect and analyze stakeholder input on climate resilience solutions focusing on impacts to Navy operations and mission readiness through a variety of methodologies
- Analyze and summarize stakeholder input to be used as content for the final report

In addition, the Plan outlined the outreach and communication protocol and the quality assurance and quality control process. These processes guaranteed the outreach strategy and materials followed SANDAG’s standards and the efficient use of resources across all efforts.

See Appendix A for the complete Strategic Communications Plan.

3.1.1 Project Collaterals

Project collateral materials were designed and developed to distribute to key stakeholder groups. The purpose of these materials was to educate stakeholders about the Grant while providing project team contact information as another outlet to collect public input. All messaging was developed in close coordination with SANDAG and the Navy Region Southwest, keeping in mind sensitive community issues and active projects.

Branding for the study was developed and included a set theme of fonts, colors, and treatments to apply as well as logos that were used throughout all materials developed. This established a sense of familiarity and recognition of the project and helped to distinguish it from other concurrent SANDAG outreach efforts. Prior to approval, all project collaterals followed the appropriate Quality Assurance and Quality Control process to ensure clear and consistent messaging.

The outreach team collaborated with SANDAG to develop the following materials:

- Talking Points
- Fact Sheet
- Presentations

3.1.2 Talking Points

Talking points were fundamentally a set of clear, easily remembered phrases that outline the Grant's proposals, initiatives, and ideas and were used to keep speakers on track when they were giving a presentation during stakeholder engagement activities. They consisted of the following key themes:

- Grant Overview
- Key Objectives
- Top Climate Stressors
- Critical Navy Facilities
- Data Sharing
- Outreach and Engagement Strategy
- Project Milestones

See Appendix B for the full version of the talking points.

3.1.3 Fact Sheet

The purpose of the Fact Sheet was to inform target audiences of the Grant's key messages. This collateral included a brief overview of the grant, key objectives, project milestones, study area map, and contact information. The outreach team provided Fact Sheets in English and Spanish.

See Appendix C for the Fact Sheet in English and Spanish.

3.1.4 Presentation

The outreach team developed PowerPoint presentations for all stakeholder engagement activities. The presentations were showcased in both English and Spanish and contained detailed information about the Grant:

- Grant Overview
- Key Objectives
- Top Climate Stressors
- Critical Navy Facilities
- Data Sharing
- Outreach and Engagement Strategy
- Project Milestones

Presentations were designed to visually portray the Grant's information, timeline, and milestones. The presentations were tailored to each outreach activity; the outreach team designed the presentation template to align with the study's branding. In addition, the outreach team worked with SANDAG to finalize all content and information.

See Appendix D for the PowerPoint presentation template.

3.2 - Subtask 2.1: Coordination and Support from Caltrans and Local Jurisdictions

3.2.1 Memorandum of Understanding (MOU) Partners

To support the development of specified CMCPs, cooperative agreements were signed to work collaboratively as MOU partners with SANDAG. MOU partners for the San Diego Region Military Installation Resilience project included:

- Caltrans (Appendix E)
- City of San Diego (Appendix F)

In compliance with these agreements, the project team held a meeting on March 5, 2021, to provide an update on the status of the Grant and upcoming milestones.

See Appendix G for the PowerPoint presentation used during the engagement.

3.3 - Subtask 2.2: Comprehensive Multimodal Corridor Plan (CMCP) Meetings

SANDAG and the outreach team attended and participated in the CMCP team meetings. Involvement in the CMCP team meetings was intended to update the team on the Grant's objectives, ensure that communication and outreach strategies are consistent among concurrent SANDAG initiatives and to help inform the CMCP studies to the maximum extent possible.

SANDAG participated in the first CMH - CMCP Project Study Team Briefing for the San Diego Region Military Installation Resilience project held on February 23, 2021.

The team presented a brief informational item with the purpose of providing key information about the Grant and establishing open communication and constant collaboration with all parties. The informational item included the following topics:

- Overview of the Grant
- Key Objectives
- Top Climate Threats
- Critical Navy Facilities
- Data Sharing
- Outreach and Engagement Strategy

A total of 39 attendees participated in the briefing which included teams from SANDAG, Navy Region Southwest, consultants, CALTRANS, City of San Diego, City of Imperial Beach, MTS, and Port of San Diego.

See Appendix H for the PowerPoint presentation used during the engagement.

After the meeting, the outreach team developed a summary report. See Appendix I for the complete summary report.

3.4 - Subtask 2.3: Regional Resilience Stakeholder Engagement

3.4.1 Community Planning Group Briefings

SANDAG and the outreach team participated in a series of Community Planning Group briefings. Groups were selected based on recommendations from the Navy CPLOs and historic data on previous groups

briefed by SANDAG. SANDAG and the outreach team coordinated with leaders of each group to establish briefing dates. Briefings were held during each group’s monthly meetings and were virtually through Zoom. Each briefing included a live question and answer segment. During the briefings, SANDAG shared key information about the Grant through a brief presentation. All presentations included the following information:

- Grant Overview
- Key Objectives
- Top Climate Stressors
- Critical Navy Facilities
- Data Sharing
- Next Steps

See Appendix J for the PowerPoint presentations used during the briefings.

All questions and comments shared during this effort are included in the briefing summary report. See Appendix K for the briefing summary reports.

Table 5. Community Planning Group Briefings

Community Planning Groups	Date
Old Town San Diego Community Planning Group	4/14/2021
Otay Mesa-Nestor Planning Group	4/14/2021
Peninsula Community Planning Board	4/15/2021
Midway-Pacific Highway Planning	4/21/2021
Barrio Logan Planning Group	5/19/2021
Barrio Logan Planning Group 2	6/16/2021

During these briefings, stakeholders had the opportunity to provide valuable input that will be key for the implementation of the next phase of the Grant. A total of 126 stakeholders were briefed during this effort. The following chart represents the number of individuals briefed during each engagement:

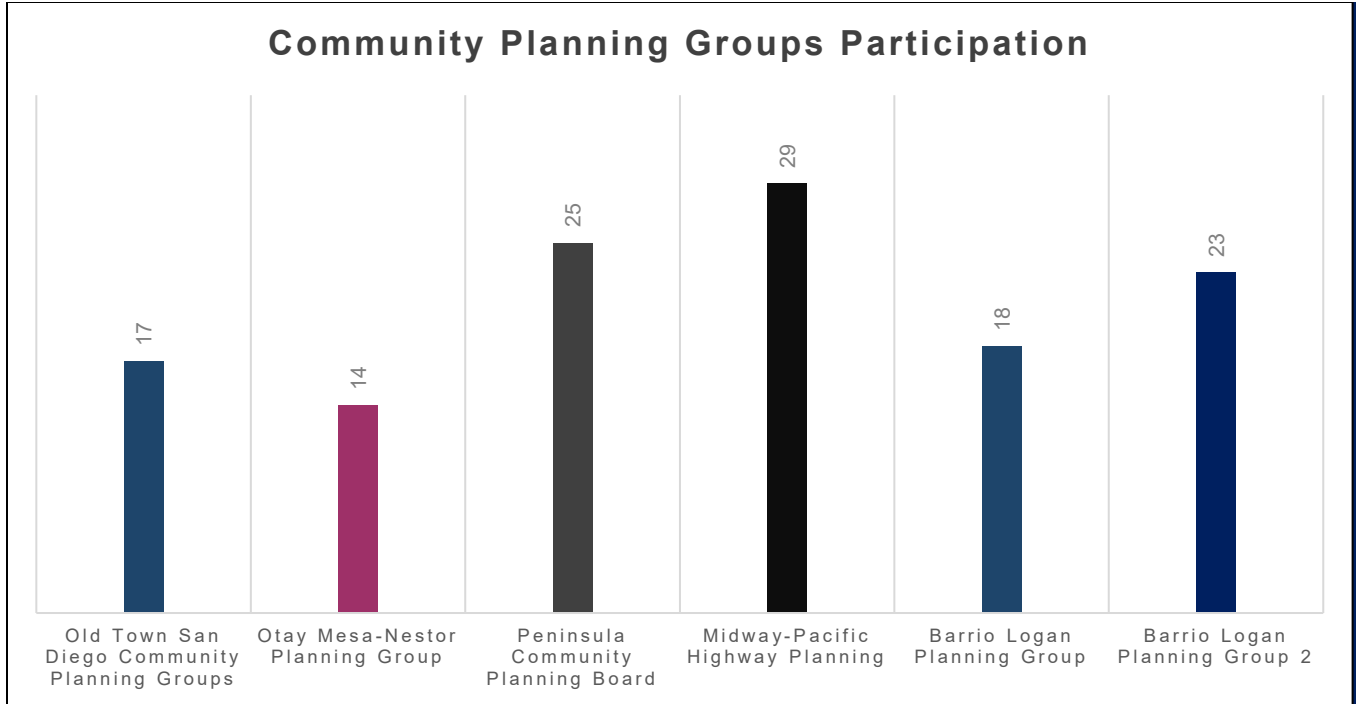


Figure 24. Community Planning Groups Participation

3.5 - Subtask 2.4: Strategic Communications Workshop

3.5.1 Partner Agency Workshop

SANDAG and the outreach team held a Partner Agency Workshop for the San Diego Region Military Installation Resilience project on January 22, 2021. The workshop allowed the team to provide key information that helped all parties understand the Grant, receive valuable input from all parties that provided direction for the Grant, and establish open communication and constant collaboration between all partners.

- The workshop was held virtually through Microsoft Teams and the presentation was divided into four (4) main topics:
- - **Topic 1** - Project Study Area
 - **Topic 2** - Identification of Tools and Outcomes for Climate Resilience Work
 - **Topic 3** - Long-Term Vision for Data Sharing
 - **Topic 4** - Communication and Outreach Needs

Each topic included the following interactive sections:

- Informational Presentation
- Live Polling Questions
- Open Discussion

Live polling questions were asked during the workshop by using Mentimeter. In addition, an open discussion was held after presenting each main topic and allowed the team to engage with the attendees throughout the workshop while collecting valuable input on each topic. Attendees were encouraged to participate by speaking or submitting their questions or comments through the chat box. A total of 28 attendees participated in the workshop, which included teams from SANDAG, Navy Region Southwest and consultants.

See Appendix L for the PowerPoint presentation used during the engagement.

Attendees of the workshop provided their input and identified important information key to establishing a clear direction for the project approach. The attendees were able to provide their input in key items that should be kept in consideration throughout the fulfillment of the Grant. These items included the identification of climate stressors that affect the community, the identification of critical modes of access and transportation, expected outcomes of climate resilience work, perceived challenges and potential obstacles of resilience planning, best practices and challenges perceived with data sharing, and the best community outreach approach. The results of each discussion can be seen below.

Classification of Climate Stressors

For classification of climate stressors, the question consisted of ranking climate stressors in order from “greatest threat” to “mission-ready” from items including coastal storms, erosion, and tsunami; sea level rise; floods, storm surge; dam failure; drought; earthquake/liquefaction; landslide; nuclear/hazardous materials release; and wildfire/structure fire. A total of 17 responses were received. According to the results, the top three (3) climate stressors were coastal storms, erosion and tsunami, sea level rise and floods/storm surge.

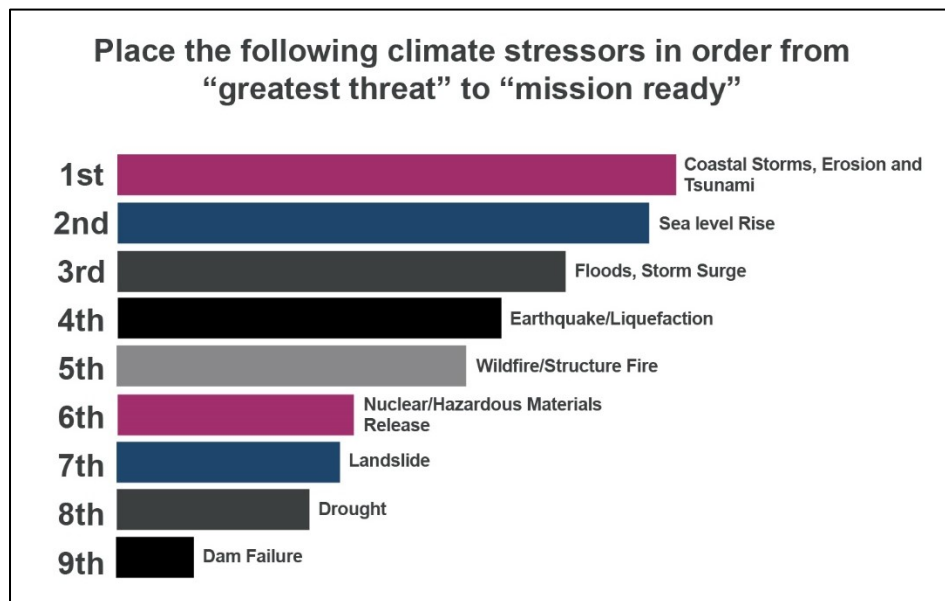


Figure 25. Classification of Climate Stressors

Climate Vulnerability

To address this climate vulnerability, the question consisted in consulting with the attendees how the listed climate change/extreme weather events affected the transportation network that serves local Navy bases, and families/personnel. A total of 13 results were submitted and the detailed answers are shown in the following word cloud.

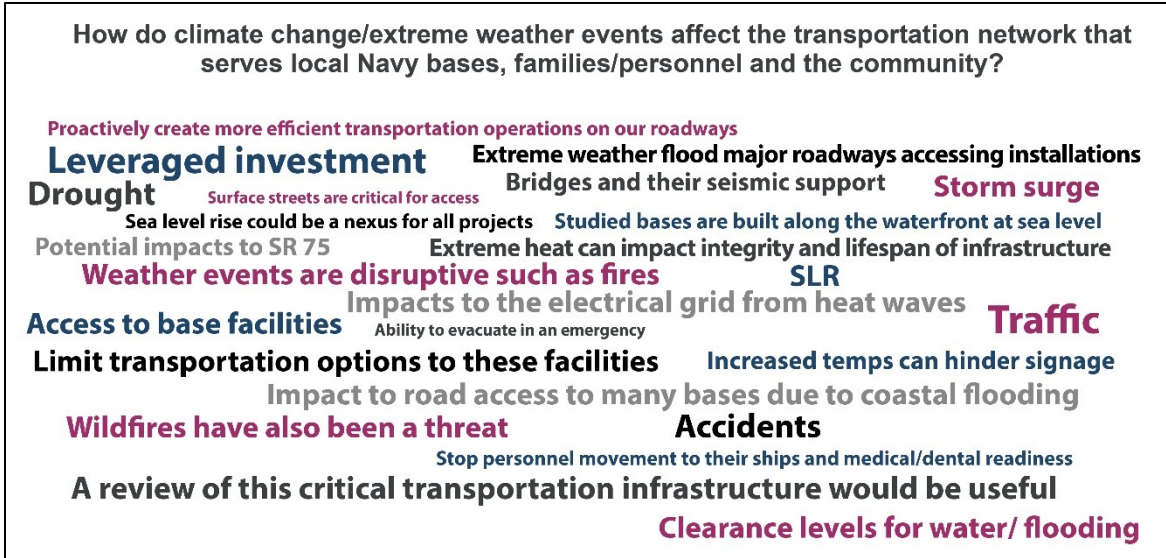


Figure 26. Climate Vulnerability

Identification of Critical Modes of Access and Transportation

To identify the critical modes of access and transportation for mission readiness, attendees were provided with the polling question of ranking the following climate sensors in order “Most Critical” to “Least Critical”. A total of 13 results were submitted. According to the results, it is shown that the most critical mode of transportation are roads/highways.

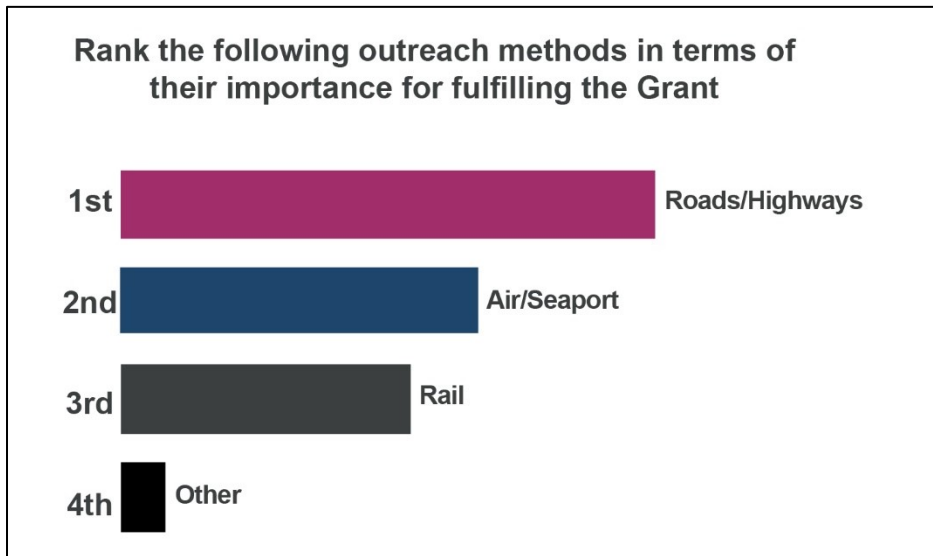


Figure 27. Identification of Critical Modes of Access and Transportation

Identification of Additional Key Stakeholders

For the identification of additional key stakeholders, the audience was presented with the question “Who are the key stakeholders that should be prioritized through this effort?”, attendees had the option of submitting their responses through an answer box. A total of eight (8) results were submitted and the detailed answers are shown in the following word cloud.

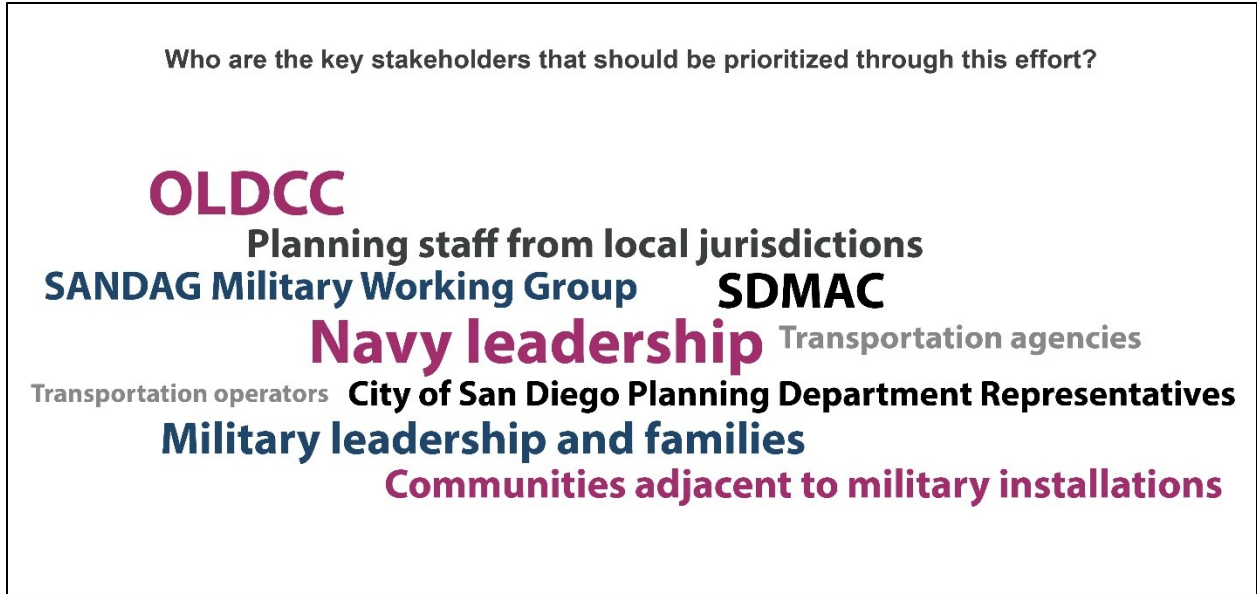


Figure 28. Identification of Additional Key Stakeholders

Identification of Best Outreach Methods

For the identification of best outreach methods, attendees had the option to rank each item from “Most Important” to “Least Important”. A total of 9 attendees participated. According to the results, key stakeholder focus groups were ranked as the most important outreach method to fulfill the Grant.

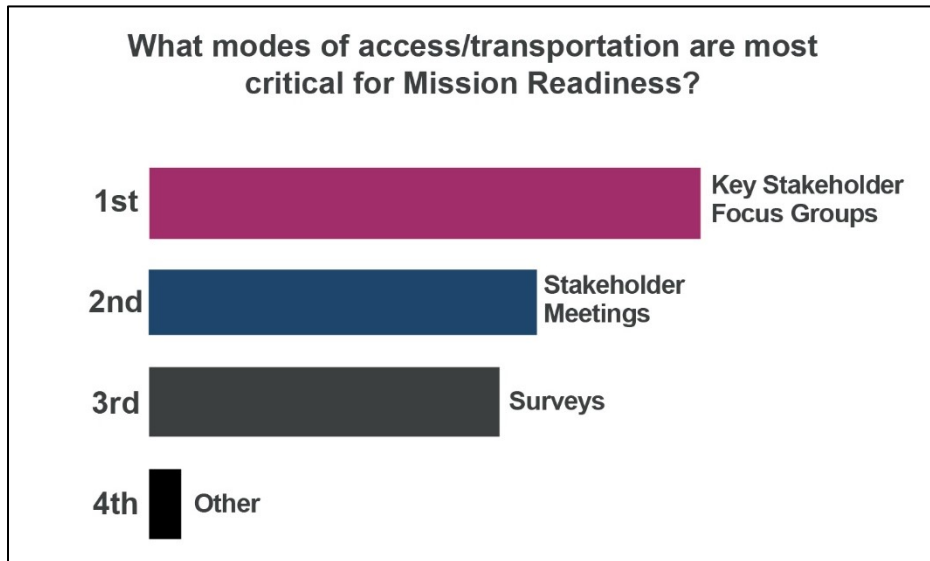


Figure 29. Identification of Best Outreach Methods

After the meeting, the outreach team developed a summary report. See Appendix M for the complete summary report.

3.5.2 Focus Meeting with Navy

As a result of the Partner Agency Workshop, SANDAG, the Navy, and the outreach team decided to hold a focus meeting to discuss and identify target areas to refine the Grant's focus. This discussion included the identification of:

- Areas of the transportation network that are critical for mission readiness
- Jurisdictions and agencies that have planned any improvements to those facilities and areas identified
- Climate impacts and hazards that are the largest threats to the identified areas
- Climate impacts and hazards that affect the identified areas
- Recommendations for climate adaptation are needed to make these facilities resilient to climate risks or other risks in the future to ensure mission readiness
- Strategies for data sharing and climate resilience work

The project team held the focus meeting on February 5, 2021. See Appendix N for the PowerPoint presentation used during the engagement.

3.6 - Subtask 2.6 Agency Briefings

3.6.1 Military Working Groups (MWG)

SANDAG participated in the Military Working Group (MWG) meetings on October 26, 2020 and April 12, 2021. SANDAG provided an informational update during the reporting section of the meeting. The presentation contained the following information about the Grant:

- Grant Overview
- Data Sharing Components
- Resilience Planning
- Top Climate Stressors
- Critical Transportation Facilities
- Communication and Outreach Needs
- Project Timeline

See Appendix O for the meeting agenda.

See Appendix P for the PowerPoint presentations used during this engagement.

Attachments

- A. Strategic Communications Plan
- B. Talking Points
- C. Fact Sheet
- D. PowerPoint Presentation Template
- E. MOU Agreement Caltrans
- F. MOU Agreement City of San Diego
- G. MOU PowerPoint Presentation
- H. CMCP Meeting PowerPoint Presentation
- I. CMH Meeting Summary Report
- J. CPG PowerPoint Presentation
- K. CPG Briefing Summary Reports
- L. Partner Agency Workshop PowerPoint Presentation
- M. Partner Agency Workshop Summary Report
- N. Focus Meeting with Navy PowerPoint Presentation
- O. MWG Agendas
- P. MWG PowerPoint Presentations