Climate Adaptation and Vulnerability Assessment

Order Instituting Rulemaking to Consider Strategies and Guidance for Climate Change Adaptation (R.18-04-019)

May 15, 2025

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List of Abbreviations and Acronyms

AR	Assessment Report
AR6	Sixth Assessment Report
BIA	Bureau of Indian Affairs
CalEnviroScreen	California Communities Environmental Health Screening Tool
CAVA	Climate Adaptation and Vulnerability Assessment
CBO	Community-Based Organizations
CDD	Cooling-Degree Day
CEP	Community Engagement Plan
CERT	Community Emergency Response Team
Cm	Centimeter
CMIP	Coupled Model Intercomparison Project
CMIP5	Coupled Model Intercomparison Project Phase 5
CMIP6	Coupled Model Intercomparison Project Phase 6
CoSMoS	Coastal Storm Modeling System
CPUC	California Public Utilities Commission
DACAG	Disadvantaged Communities Advisory Group
DVC	Disadvantaged Vulnerable Communities
DWR	Department of Water Resources
EOC	Emergency Operations Center
ESJ	Environmental and Social Justice
GCM	General Circulation Model
GIS	Geographic Information System
HDD	Heating-Degree Day
HP	High-Pressure
ICS	Incident Command System
IOU	Investor-Owned Utility
IPCC	Intergovernmental Panel on Climate Change
Km	Kilometer
LOCA	Localized Constructed Analogs
LOCA2 CA	California-Specific LOCA2 Projections Developed by Scripps
LoRE	Likelihood of Risk Event
MP	Medium-Pressure
OIR	Order Instituting Rulemaking
OPC	Ocean Protection Council
Plan	Environmental and Social Justice Action Plan
RAB	Regional Advisory Board
RAMP	Risk Assessment Mitigation Phase
RCP	Representative Climate Pathway
SDG&E	San Diego Gas & Electric
SLR	Sea Level Rise
SME	Subject Matter Expert
SoCalGas	Southern California Gas Company
SSP	Shared Socioeconomic Pathways
USGS	U.S. Geological Survey
WUI	Wildland Urban Interface

EXECUTIVE SUMMARY

ES 1 Introduction and Context

Southern California Gas Company's (SoCalGas) Climate Adaptation and Vulnerability Assessment (CAVA) evaluates the risks of current and future climate hazards to the company's gas infrastructure, operations, and services, and recommends strategies to address these risks.

The changing climate requires an energy ecosystem that is resilient to extreme weather, wildfires, and drought, while delivering reliable, affordable energy. Increased awareness of the significance of climate events amongst utilities has been growing, as these climate-driven events can have severe impacts on energy resource infrastructure. Extreme temperatures, extreme weather conditions, and sea level rise are some climate hazards that will have short- and long-term ramifications in the Southern California region. SoCalGas recognizes the need to adapt to these climate hazards to promote safety and reliability of services to its customers and mitigate the increasing risk through innovative and community-centric approaches.

The CAVA is intended to fulfill the requirements of decisions from the California Public Utilities Commission (CPUC or Commission) issued in the Order Instituting Rulemaking (OIR) (R.18-04-019) to Consider Strategies and Guidance for Climate Change Adaptation (Climate Change Adaptation OIR).[1] These decisions define disadvantaged vulnerable communities (DVCs) in a climate adaptation context as those communities most vulnerable to climate change[2] and emphasize the importance of integrating DVCs into the adaptation process and promoting equity in addressing climate risks, particularly through promoting reliable service to all customers, including DVC members. SoCalGas's Community Engagement Plan (CEP), linked in Appendix A, outlines the strategies and initiatives taken to engage DVCs and to help achieve equity in climate resilience and adaptation.

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[1] *See* CPUC, Climate Adaptation, *available at: https://www.cpuc.ca.gov/industries-and-topics/electrical-energy/climate-change*.

[2] *See* CPUC D.20-08-046 at 3 (DVCs include the "25% highest scoring census tracts according to the California Communities Environmental Health Screening Tool (CalEnviroScreen); all California tribal lands; census tracts with median household incomes less than 60% of state median income; and census tracts that score in the highest 5% of Pollution Burden within CalEnviroScreen but do not receive an overall CalEnviroScreen score due to unreliable public health and socioeconomic data.").

As part of the CAVA development, SoCalGas sought to leverage the best available climate science and projections for California, ground analyses in data and observations, and incorporate subject matter expert (SME) input. The CAVA sought to understand the following:

- What changes in weather and climate can we expect?
- How will these changes affect SoCalGas?
- In turn, how will these changes impact communities?
- What actions should SoCalGas take to address these issues?

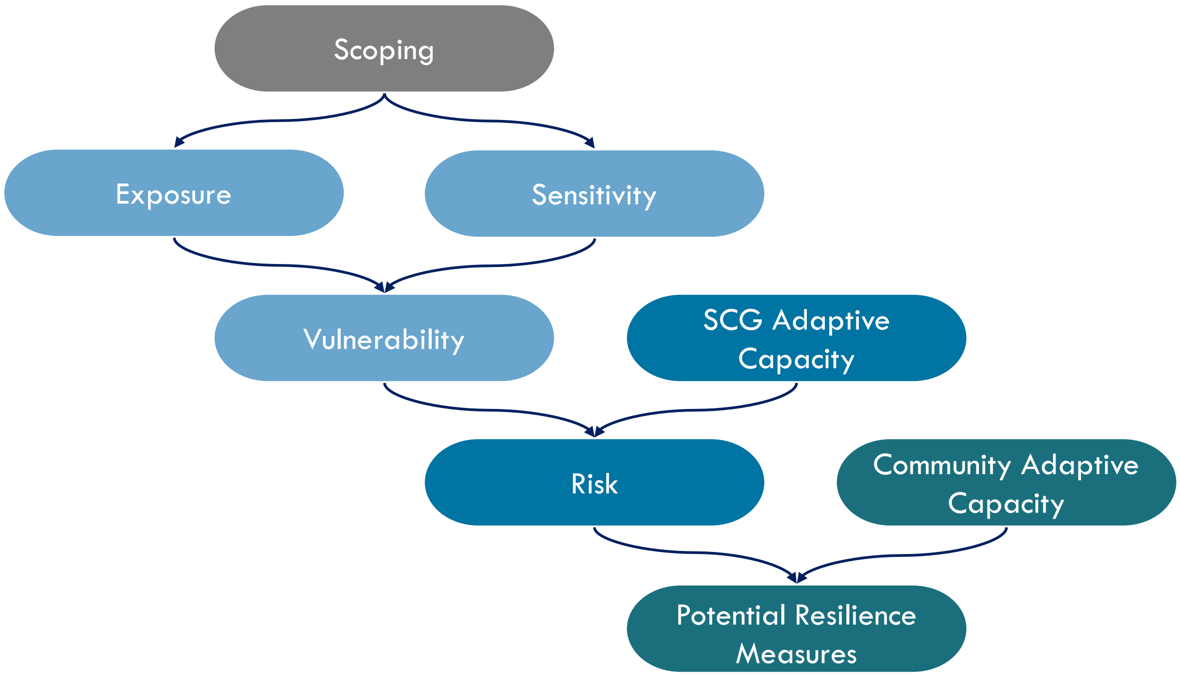
ES 2 Methodology

The CAVA methodology is designed to produce useful information for SoCalGas to consider in prioritizing its response to climate-related hazards as conditions change over time. Figure ES-1 shows the basic components and processes of the CAVA framework. First, scoping defines the hazards, timeframes, assets, climate models, and other analysis parameters. Next, the exposure and sensitivity of different assets to different hazards are assessed. These are combined to characterize the vulnerability of these assets. Then information on SoCalGas adaptive capacity (*i.e.*, asset adaptive capacity) is incorporated into vulnerability results to assess risk. Finally, information on community adaptive capacity is incorporated into risk results to develop potential resilience measures.[3]

[3] Adaptive capacity is "the ability of systems, institutions, humans, and other organisms to adjust to potential damage, to take advantage of opportunities, or to respond to consequences."

IPCC, *Climate Change 2014: Impacts, Adaptation, and Vulnerability* (2014), Annex II, Glossary at 1758, *available at: https://www.ipcc.ch/site/assets/uploads/2018/02/WGIIAR5-AnnexII_FINAL.pdf*.

Figure ES-1: SoCalGas CAVA Framework



Future climate projections help identify and mitigate local hazards by linking climate variables to specific risks. The Coupled Model Intercomparison Project Phase 6 (CMIP6) represents the latest advancement in the global effort to enhance climate modeling and improve the scientific understanding of future climate scenarios.[4] CMIP6 is an international collaboration involving climate modeling centers from around the world, producing simulations that project global climate changes under various shared socioeconomic pathways (SSPs). These SSPs reflect potential future projections shaped by various levels of greenhouse gas (GHG) emissions, population growth, and economic development.[5]

Per the CPUC requirements, the SoCalGas CAVA focuses primarily on SSP3-7.0, which represents a "regional rivalry" pathway characterized by high challenges to both mitigation and adaptation efforts. It assumes a fragmented world where national security and regional issues take precedence over

[4] Eyring, V., Bony, S., Meehl, G. A., Senior, C. A., Stevens, B., Stouffer, R. J., and Taylor, K. E.: Overview of the Coupled Model Intercomparison Project Phase 6 (CMIP6) experimental design and organization, Geosci. Model Dev., 9, 1937-1958, doi:10.5194/gmd-9-1937-2016, 2016.

[5] Science Direct, *The Shared Socioeconomic Pathways and their energy, land use, and greenhouse gas emissions implications: An overview* (January 2017), *available at:* *https://www.sciencedirect.com/science/article/pii/S0959378016300681*.

global cooperation. This results in high emissions, delayed climate action, and significant climate impacts such as extreme heat, shifts in precipitation patterns, and rising sea levels. For the CAVA, SoCalGas primarily used the CMIP6 projections downscaled for California by the Scripps Institution of Oceanography.[6]

As part of the CAVA, a few different analyses were performed. These included an asset vulnerability scoring process and several supplemental analyses. These approaches were tailored to help understand the extent of the risks and prioritize where resilience measures may be needed. The analysis included over 5.9 million SoCalGas assets across several different asset classes, spanning SoCalGas's territory. Thus, the analysis approach needed to account for this large number of assets spanning a diverse and large geographic area.

For the asset vulnerability scoring, scores were assigned to each asset within an asset class based on a series of metrics. There are two main groups of metrics—exposure and sensitivity metrics. Exposure metrics capture information about the likelihood that hazards will occur at an asset location now or in the future. Sensitivity metrics capture information about how susceptible an asset is to the hazards and the consequences to the overall system. (Susceptibility is the likelihood an asset will be damaged when exposed to a hazard.)

This approach helps prioritize the assets with the highest relative vulnerability so that they can be assessed in detail and, if necessary, adapted.

The five climate-related hazard types used in the scoring were:

1. Riverine and localized flooding (referred to together as inland flooding in this CAVA), including associated erosion and debris flow, driven by heavy precipitation and sometimes following a wildfire or snowmelt.
2. Wildfire, driven by changing precipitation patterns.
3. Landslide, particularly deeper-seated slope failures, as opposed to shallower failures; driven by longer-term precipitation patterns.
4. Coastal flooding, exacerbated by sea level rise (SLR).
5. Coastal erosion, including beach erosion and cliff retreat, exacerbated by SLR.

[6] LOCA (Localized Constructed Analogs), *LOCA statistical downscaling*, *available at:* https://loca.ucsd.edu/.

While gas infrastructure is not particularly sensitive to high temperatures, warmer conditions do affect other aspects of operations. These impacts were addressed in several of the supplemental analyses.

Vulnerability scores were assigned at individual asset levels for each hazard and year (the CAVA focused on the analysis of years 2023, 2030, 2050, and 2070). For summary purposes, these individual scores are classified into five categories: low, moderate-low, moderate, moderate-high, and high. Asset adaptive capacity was assessed qualitatively at the asset class level during workshops with several groups of SMEs. In addition to the individual asset results, each overall asset class was also assigned a vulnerability category for each hazard based on its 2050 vulnerability scores. Risk categories were also assigned at the asset class level and were based on vulnerability scores and adaptive capacity scores.

ES 3 Results

Table ES-1 shows the risk results for each pairing of hazard and asset class. The risk categories are a combination of the 2050 asset vulnerability scores and asset adaptive capacity results.

Table ES-1: Asset Risk Results by Asset Class and Hazard

	Coastal Erosion	Coastal Flood	Inland Flood	Landslide	Wildfire
High-Pressure Pipelines	Lower Risk	Lower Risk	Moderate Risk	Moderate Risk	Lower Risk
Medium-Pressure Pipelines	Lower Risk	Lower Risk	Lower Risk	Lower Risk	Lower Risk
Facilities	Lower Risk	Lower Risk	Moderate Risk	Moderate Risk	Moderate Risk
Regulators, Compressors, Valves	Lower Risk	Lower Risk	Lower Risk	Moderate Risk	Moderate Risk
Storage Fields	Higher Risk	Moderate Risk	Moderate Risk	Moderate Risk	Moderate Risk

Color	Label
Red	Higher Risk
Orange	Moderate Risk
Green	Lower Risk

High-pressure pipelines were categorized as moderate risk for both inland flooding and landslides, and lower risk for the other three hazards. Medium-pressure pipelines were categorized as lower risk for each of the five hazards. Facilities were at moderate risk for inland flooding, landslide, and wildfire, and lower for the other two hazards. Regulator stations, compressor stations, and valves (including controllable and non-controllable) were grouped together and considered moderate risk for landslide and wildfire hazards, and lower risk for the other three hazards. Storage fields were categorized as higher risk for coastal erosion (the only higher risk classification) and moderate risk for the other four hazards. In the analysis, each storage field was treated as a single asset. To be conservative, a storage field's exposure score for a particular hazard was assigned by taking the maximum exposure score across the entire storage field area for that hazard, including aboveground and underground assets. This does not imply that all parts of the storage field had that level of exposure or the resulting level of vulnerability (e.g., underground assets). Furthermore, the risk categories presented in Table ES-1 are assigned at the asset class rather than the asset level. An asset class being designated as high risk does not imply that all assets within that asset class are high risk.

Landslides were considered moderate risk for four of the five asset types, followed by inland flooding and wildfire (three each), and then coastal erosion and coastal flood (one each).

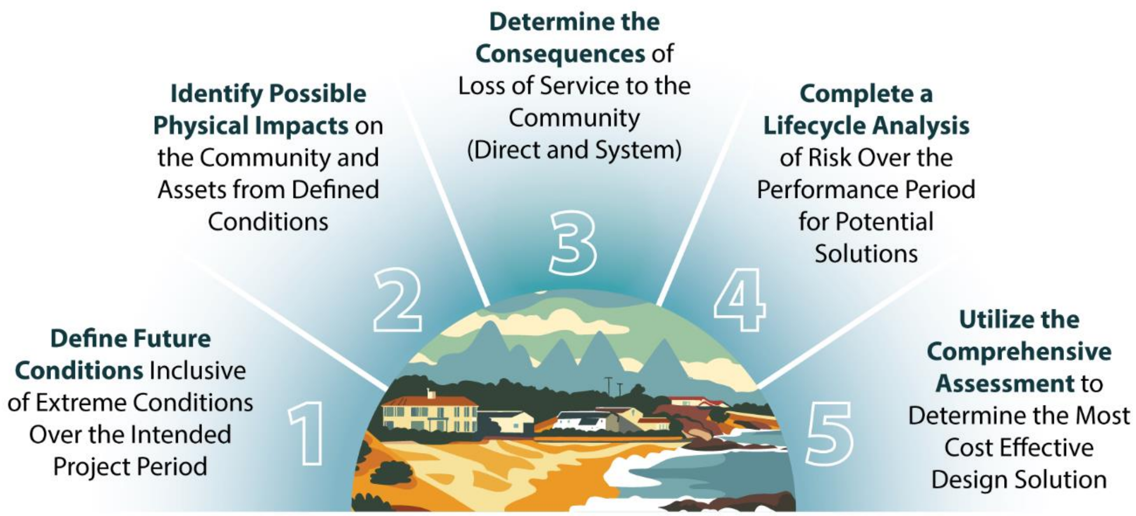
Chapter 4 discusses these results in greater detail and for specific assets. The scoring is intended to prioritize what assets require site-specific analysis.

Additionally, various supplemental analyses were performed. For example, a sensitivity analysis was done to understand the relationship between recent historical temperatures and gas consumption, and how expected changes in temperatures could affect gas consumption in the future. One notable finding was that warmer conditions during winter months could reduce natural gas consumption used for space heating. That said, gas consumption is driven by multiple factors such as population, technology, policy, and the economy.

ES 4 Resilience Measures and Next Steps

SoCalGas assets identified in the CAVA are likely to be the most vulnerable to climate change and, therefore, candidates for operational or capital improvements that enhance their resilience. The CAVA is a system-scale analysis conducted across a large geographic area covering multiple hazards and millions of assets. First and foremost, the CAVA scores are intended to help SoCalGas determine which assets should undergo project-level (*i.e.*, site-specific, asset-level, and facility-level) adaptation assessments to address climate risks. Figure ES-2 shows the basic steps of a project-level analysis.

Figure ES-2: Project-Level Climate Risk Analysis



Chapter 5 identifies specific locations — storage fields, facilities, high-pressure pipelines, gas valves, and regulator stations that may warrant a closer look. That chapter also discusses adaptation strategies currently used or under consideration by SoCalGas.

Next steps include continued dialogue with SoCalGas's Climate Advisory Group, various departments including engineering, operating groups, gas control and emergency management so that cross-functional and interdisciplinary teams remain engaged in implementing resilience measures. The findings will also be used to inform future regulatory proceedings such as SoCalGas's General Rate Case (GRC). SoCalGas acknowledges the importance of continuously updating this assessment as weather, system infrastructure and operations, and regulations change. SoCalGas will continue to update its analysis to reflect CPUC guidance changes on climate science and projections. Furthermore, SoCalGas will continue to engage and build on the relationships with DVCs and community leaders created during the development of the CAVA.

Climate Adaptation and Vulnerability Assessment

1 INTRODUCTION

1.1 Purpose and Context

SoCalGas serves over 21 million customers, and its service territory covers 24,000 miles of diverse terrain throughout Central and Southern California, from Visalia to the Mexican Border. SoCalGas's CAVA evaluates the risks of current and future climate hazards to the company's gas infrastructure, operations, and services and recommends strategies to address these risks.

In 2018, the Commission issued the Climate Change Adaptation OIR. Two subsequent Decisions (D.)19-10-054 and D.20-08-046 specify how investor-owned gas and electric utilities (IOUs) in California should assess their vulnerabilities to climate risks. SoCalGas's CAVA is intended to fulfill the requirements of D.19-10-054 and D.20-08-046 and to further integrate consideration of climate change into SoCalGas practices. The CAVA uses the CPUC definition of climate change adaptation from D.19-10-054:

> *Climate change adaptation is adjustment in natural and human systems to a new or changing environment. Adaptation to climate change for energy utilities…refers to adjustment in utility systems using strategic and data-driven consideration of actual or expected climatic impacts and stimuli or their effects on utility planning, facilities maintenance and construction, and communications, to maintain safe, reliable, affordable and resilient operations.*[7]

D. 19-10-054 defines climate change adaptation in the context of energy utilities, identifies proper data sources for climate projections, and sets planning standards related to climate scenarios. D. 20-08-046 defines disadvantaged and vulnerable communities (DVCs) in a climate adaptation context and emphasizes the importance of integrating DVCs into the adaptation process and promoting equity in addressing climate risks, particularly through

[7] D. 19-10-054 at 21 and Ordering Paragraph (OP) 1 at 56.

promoting reliable service to all customers, including DVC members. In addition, D. 20-08-046 sets requirements for filing a CEP and a vulnerability assessment.[8]

1.2 Guiding Principles and Process

In developing the CAVA methodology, performing the analysis, and presenting the results, SoCalGas aimed to adhere to the following guiding principles:

- Align with Commission decisions and guidance. The decisions provide specific orders to the IOUs that guide this CAVA's structure.
- Leverage the best available climate science in California. California is at the forefront of climate science research nationally and has invested heavily in creating research, data, and tools to understand how the climate is likely to change and how its communities will be affected. California's Fourth Climate Change Assessment, completed in 2018, and Fifth Climate Change Assessment, currently underway, provide much of this research and inform the CAVA.[9]
- Engage communities, with particular emphasis on DVCs. Through the CAVA's CEP, SoCalGas engaged community members and organizations throughout its service territory to understand how they would be affected by damage to gas infrastructure or disruption to gas service resulting from climate impacts.
- Incorporate SME input. In developing the methodology and refining results, practitioners throughout many disciplines of SoCalGas gave input and feedback.
- Ground analyses in data and observation. Information on past events and impacts on the SoCalGas system was used to help calibrate SoCalGas's understanding of current and potential future climate risks.
- Be explicit about limitations. In this report, SoCalGas aims to be clear about what the analysis is intended to do and what conclusions can and cannot be drawn from it.

While Chapter 3 offers more detail on the approach, Figure 1-1 shows the general line of inquiry taken by the CAVA to help assess climate risk and inform adaptation.

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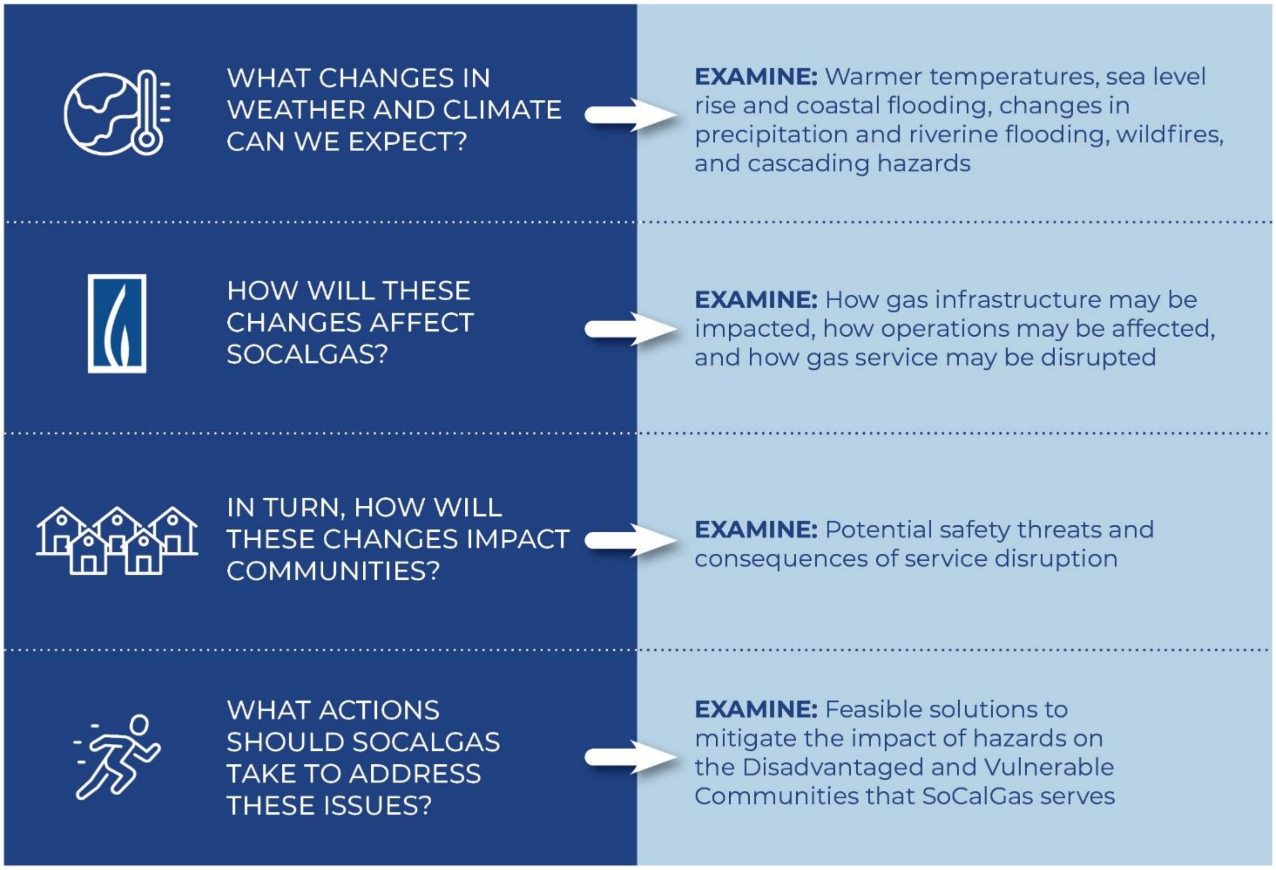
[8] D. 20-08-046 at 120-128 (OP 5-9).

[9] State of California – Climate Assessment, *California's Fourth Climate Change Assessment* (August 27, 2018), *available at:* *https://www.climateassessment.ca.gov/*.

Figure 1-1: Climate Adaptation and Vulnerability Assessment General Process



1.3 Organization of the CAVA

The CAVA is organized as follows.

- Chapter 1 Introduction.
- Chapter 2 Climate Change and Community Engagement. This chapter documents the CAVA's CEP and its implementation, discussing both the process and findings.
- Chapter 3 Vulnerability Assessment Methodology. This chapter provides a detailed overview of the technical methodology used in the CAVA.
- Chapter 4 Vulnerability Assessment Findings. This chapter discusses the results of the vulnerability assessment.
- Chapter 5 Adaptation and Resilience: Potential Measures and Next Steps. This chapter discusses adaptation analysis and strategies as well as next steps.

2 CLIMATE CHANGE AND COMMUNITY ENGAGEMENT

2.1 Introduction

This chapter summarizes SoCalGas's community engagement efforts and the implementation of the CEP. The CEP, which was filed last year in 2024, outlines the strategies and initiatives undertaken by SoCalGas in alignment with the Climate Change Adaptation OIR to help promote equity in climate resilience and adaptation for all community members in SoCalGas's service territory. It highlights how SoCalGas has and will continue to partner with community leaders in underserved and climate-vulnerable communities to understand and address their concerns about climate change and understand the unique challenges facing these communities. The CEP is a guide for equitable, collaborative, transparent, and culturally accurate engagement with the communities that SoCalGas serves and highlights partnerships with Tribal Nations, community-based organizations (CBOs), small businesses, and local governments.

To gather feedback and input from the community, SoCalGas organized four Regional Advisory Boards (RABs) throughout the service territory comprised of 27 CBOs that represent their communities and elevate their voices. The CBOs that participated in this unique climate adaptation opportunity provided direct services to DVCs and represented their interests and concerns as outreach experts in these communities.

SoCalGas is grateful to these community leaders for their collaboration throughout this process. This work would not be possible without their partnership, hard work, and commitment to creating a more climate-resilient system and communities. SoCalGas's CEP is linked in Appendix A. It includes a list of partners and provides additional details on SoCalGas's extensive outreach and engagement efforts, the role of the RABs, and community feedback.

2.1.1 Communities SoCalGas Serves

SoCalGas serves over 21 million customers and its service territory covers 24,000 miles of diverse terrain throughout Central and Southern California, from Visalia to the Mexican Border (see Figure 2-1 for the service territory map).

To meet the CPUC's requirements and understand the communities served, SoCalGas developed an interactive map platform that highlights DVC communities within the service area. According to the California Communities Environmental Health Screening Tool

(CalEnviroScreen) criteria on income and pollution burden, over 60 percent of the service area consists of DVCs and is vulnerable to climate change.

Figure 2-1: Southern California Gas Company Map of Service Territories and Disadvantaged Vulnerable Communities

2.1.2 Outreach Overview

The CAVA engagement efforts included Regional Advisory Board (RAB) workshops, Tribal talking circles, community events, surveys, and online comment forms. In this process, SoCalGas has and will continue to be committed to gaining DVC insight into SoCalGas's CAVA and the community's unique experiences with climate change and its impacts.

SoCalGas's strategies took a regional approach and were community-centered, focusing on each community's unique needs, history, experiences, and culture within the service territory. SoCalGas's process also prioritized the needs of DVCs within its service territory. These communities are often disproportionately affected by the impacts of climate change, are less resourced, and/or have lower adaptive capacity to counter such impacts; and frequently have less reliable access to information about climate change. At SoCalGas, we understand communities have different circumstances, different resources, and unique opportunities to overcome barriers. As such, DVCs require unique levels of support and attention as SoCalGas focuses on making changes or upgrades to its assets, utility infrastructure, operations, and services.[10] SoCalGas will continue to provide a forum for DVCs and others to comment on all aspects of the CAVA process, included suggestions for data sources, review of and contributions to vulnerability assessments, and commenting on the vulnerability assessments.

2.2 Assessing the Adaptive Capacity of Communities

Adaptive capacity assessments are critical to understanding the climate change vulnerability of communities. Adaptive capacity is “the ability of systems, institutions, humans, and other organisms to adjust to potential damage, to take advantage of opportunities, or to respond to consequences.”[11] In other words, adaptive capacity refers to a community’s ability to adjust and respond effectively to changing circumstances, particularly in the face of climate change impacts. Almost all communities in California are exposed to one or more climate-driven natural hazards, however, adaptive capacity can vary greatly between communities, leading to better or worse outcomes for those communities impacted by a climate hazard.

As directed by the CPUC, the development and implementation of the CEP includes an assessment of the adaptive capacity of DVCs.[12] SoCalGas discussed the topic of adaptive capacity and identified the CBO partners that could help measure the adaptive capacity of DVCs. To learn more about SoCalGas’s approach to assessing adaptive capacity, please refer to Appendix A, SoCalGas’s CEP. SoCalGas also assisted with promoting local government adaptive capacity through the development and implementation of the SoCalGas Climate Adaptation and Resiliency Planning Grant Program. The initiative provided $50,000 grants to municipalities working to prepare their communities for the impacts of climate change. Since 2018, 19 grants have been awarded ranging from Adaptive Capacity Assessments and Vulnerability Assessments to Local Hazard Mitigation Plans and Climate Adaptation Plans. The program enabled local governments to perform additional analysis, conduct more community outreach, and increase planning and capacity at the local government level for the benefit of DVCs.

[10] D.20-08-046 at 109 (Conclusion of Law (COL) 7).

[11] IPCC, *Climate Change 2014: Impacts, Adaptation, and Vulnerability* (2014), Annex II, Glossary at 1758, *available at: https://www.ipcc.ch/site/assets/uploads/2018/02/WGIIAR5-AnnexII_FINAL.pdf*.

[12] D. 20-08-046 at 109 (COL 8).

2.3 The Impacts of Climate Change on Communities

During the four rounds of RAB workshops, SoCalGas asked their CBO partners to discuss the climate change impacts that affect their communities and the impacts that they are most worried about. This also led to conversations surrounding the adaptive capacity of communities in different regions of the service territory and about which DVCs are the most vulnerable to different types of climate impacts.

ADAPTIVE CAPACITY BUILDING FOR LOCAL GOVERNMENTS

As part of its Climate Adaptation and Resiliency Planning Grant Program, SoCalGas awarded the Los Angeles County Department of Regional Planning with a grant to develop LA County's Adaptive Capacity Assessment. These assessments are a collaborative, community-led effort with energy utilities acting as stakeholders in the governmental process.

Since 2018, SoCalGas has awarded a total of 18 local government agencies with Climate Adaptation and Resiliency Planning grants:

City of Artesia, City of Redlands, Los Angeles County, City of Malibu, City of Loma Linda, City of Compton, City of Palmdale, City of Anaheim, City of Maywood, City of San Fernando, City of Pico Rivera, City of McFarland, City of La Puente, City of Costa Mesa, Soboba Band of Luiseno Indians, City of Santa Ana, City of Calipatria, City of Carson.

2.3.1 Northern Region

At workshop discussions, Northern RAB members highlighted wildfires, drought, extreme heat, and cascading events as their primary concerns regarding climate change impacts.

In connection with these climate change impacts, the group also expressed concerns about emergency response resources and access to rural communities during a natural disaster. The group noted that more rural areas in the region have lower adaptive capacity as they have less access to resources and emergency centers during a climate disaster.

2.3.2 Los Angeles Region

The Los Angeles RAB members' primary climate concerns were impacts associated with extreme temperature changes, extreme heat, wildfires, and drought. The group stressed the importance of communication during climate-related emergencies to help raise the adaptive capacity of communities in the Los Angeles region during climate disasters. Further, the Los Angeles RAB advocated for accessible information, translations, and multiple traditional and digital distribution methods.

2.3.3 Orange Coast Region

This group's main climate change concerns were impacts associated with extreme heat, extreme temperature changes, wildfires, and drought. They also expressed concerns about the aging population's resource access during disruptions as this group has low adaptive capacity and is particularly vulnerable to climate disasters.

2.3.4 South Inland Region

The South Inland RAB voiced concerns regarding extreme heat, wildfires, and temperature change in the region. They mentioned that climate impacts (*e.g.*, flooding and extreme heat) have effects on the community that we may not consider, such as agriculture and food security. RAB members recommended alternative solutions such as distributed energy resources (*e.g.*, generators) to increase adaptive capacity developed through community partnerships with SoCalGas and other utilities. This group also noted challenges faced by community members with disabilities, individuals with mental health issues, and poor air quality during wildfires. During these workshops, RAB members discussed that individuals with disabilities have particularly low adaptive capacity as these individuals may not be able to evacuate during a climate related emergency.

2.4 Community Recommendations for Building Adaptive Capacity

During the RAB workshops, SoCalGas discussed regional recommendations for building a community's adaptive capacity with their CBO partners. One of the key themes that the RABs explored was the important role that social cohesion plays in adaptive capacity. Each group highlighted that having a neighborhood-level emergency preparedness plan is essential during a disaster, especially for more vulnerable community members.

Additional recommendations for enhancing adaptive capacity varied across regions. The key themes for all four regions are outlined in the following subsections.

2.4.1 Northern Region

The Northern RAB members discussed SoCalGas providing emergency kits for families or providing a workshop and information on how to prepare an emergency kit. The group highlighted the importance of encouraging residents to develop neighborhood ties and neighborhood preparedness plans to enhance the overall community's adaptive capacity, especially for older adults and individuals with disabilities who otherwise may not be able to evacuate during an emergency. The group also discussed the adaptive capacity of agriculture workers in the region who are exposed to the impacts of climate change every day.

The RAB members talked about the idea of SoCalGas hosting neighborhood emergency preparedness events in collaboration with the local fire department.

Additionally, the group discussed the importance of educating younger generations on emergency preparedness and encouraged SoCalGas to develop a program for elementary and middle school students, who could bring this information home to share with their parents.

2.4.2 Los Angeles Region

The Los Angeles RAB echoed the significance of social cohesion in building a community's adaptive capacity through localized outreach strategies and collaborating with CBOs. Some of the outreach tactics discussed include partnering with local fire departments to host emergency preparedness events that could be hosted at CBO locations. The group mentioned that CBOs are trusted and therefore, community members would be more likely to attend an event hosted by a CBO.

The RAB members also suggested that SoCalGas should share emergency preparedness information at existing community events and should attend Community Emergency Response Team (CERT) events.

2.4.3 Orange Coast Region

The Orange Coast RAB suggested that SoCalGas should host an event in different regions of the service territory where community members are encouraged to talk to each other, such as a "Social Cohesion Day" or an "Emergency Preparedness Day" in collaboration with local fire departments. The group also mentioned sharing emergency preparedness information on the Nextdoor app or starting a neighborhood text chain to provide a communication platform during an emergency. The RAB members also discussed conducting additional emergency preparedness outreach in collaboration with fire departments and other first responders in the community to enhance adaptive capacity.

2.4.4 South Inland Region

The South Inland RAB members shared similar recommendations, sharing that during the recent Highland fires, neighbors were out in the street watching the fire and talking to their neighbors about what was happening. The group mentioned that this would have been a great opportunity for emergency preparedness outreach following this event. SoCalGas could visit communities following a climate event and talk about emergency preparedness, especially the critical issues that need to be addressed in the community.

Additionally, RAB members mentioned that after an emergency, SoCalGas should distribute flyers advertising emergency preparedness events to better communicate best practices. Community members are more likely to attend events like this following a climate disaster. At these events, SoCalGas should provide emergency supplies and an emergency checklist, especially for DVCs.

2.5 Summary of Key Recommendations

SoCalGas solicited feedback from a broad range of stakeholders, all representing disadvantaged and vulnerable communities in different capacities. Below is a summary of recommendations collected and synthesized from key themes heard from CBO, tribal, and local government partners:

- Center equity in all decision-making processes, investments, and programs.
- Provide financial support for the development and operation of community resilience centers.
- Improve emergency communications and public education on hazards and resources.
- Invest in and expand existing workforce development programs.
- Maximize enrollment and longevity of existing SoCalGas customer programs in disadvantaged and vulnerable communities.
- Invest in upgrading our current infrastructure serving disadvantaged and vulnerable communities.
- Continue to focus engagement on the most vulnerable communities, increased outreach and education programs.
- Co-design outreach and engagement programs with community organizations.
- Prioritize access and functional need customers and medical baseline customers.
- Encourage and empower tribal communities to share knowledge and best practices.
- Expand distributed energy resource offerings to most vulnerable communities.

2.6 Elevating Community Perspective and Feedback in the CAVA

Throughout the CAVA process, SoCalGas received feedback on investments and engagement practices directly from DVCs through public surveys and from community leaders during the RAB workshops. This feedback is crucial for SoCalGas to consider when prioritizing investments that make energy infrastructure and communities more climate resilient.

2.6.1 Regional Advisory Board Workshops

Acting on Community Recommendations for Investments

During the RAB workshops, SoCalGas asked CBOs about prioritization of investments moving forward. SoCalGas's CBO partners recommended investments in education and outreach to improve the adaptive capacity of DVCs in addition to traditional investments involving operations and maintenance of infrastructure.

A few recommendations included continuing compensated partnerships with CBOs, developing neighborhood educational training, hosting emergency preparedness events, and distributing emergency supplies to DVCs among other community engagement-focused investments.

Subject to the Commission's feedback, SoCalGas plans to further its engagement efforts by continuing to implement these recommendations in the next round of the CAVA process.

Use Feedback to Improve Engagement Practices

Building on the investment recommendations from community partners, SoCalGas will use this feedback to expand on current engagement best practices and begin planning the next round of engagement following the filing of the CAVA in 2025. These efforts will focus on equity and education around emergency preparedness. SoCalGas plans to collaborate with local first responders and CBOs to host community preparedness events in DVCs to raise adaptive capacity and encourage social cohesion.

Connecting Technical Climate Analysis and the Community

Just as SoCalGas shared these Vulnerability Assessment findings with their RAB partners and DVCs, SoCalGas will continue to keep the community informed about regional climate risks, what actions can be taken to lower risks, and how SoCalGas is improving the climate resilience of DVCs in the service area. SoCalGas plans to return to the community with updated climate adaptation information to promote transparency and continue elevating adaptive capacity.

2.6.2 Continued Engagement and Capacity Building

SoCalGas is committed to strengthening partnerships with community stakeholders and their customers. SoCalGas plans to continue carrying out the recommendations of their CBO partners to build DVC adaptive capacity through hosting emergency preparedness events, partnering with local first responders, attending existing community events, and distributing resources to DVCs to encourage emergency preparedness.

SoCalGas's engagement effort goals are outlined in the CEP and include the following:

- Understand communities' climate change concerns and their perceived adaptive capacities.
- Increase public knowledge of SoCalGas's climate adaptation efforts.
- Prioritize investments that make SoCalGas's energy infrastructure more climate resilient to reduce climate change impacts on communities.
- Foster trust with the communities SoCalGas serves through equitable and transparent engagement in collaboration with trusted community leaders.
- Integrate community feedback and perceptions into the CAVA and future outreach for the Climate Adaptation Program.
- Prioritize the voices of SoCalGas's service territory members (DVCs, California Tribal Nations, CBO partners, and local governments) and integrate them into the development and success of the Climate Adaptation Program.

For this CAVA, SoCalGas accomplished these goals through collaboration with CBO partners, Tribal Nation leaders, and DVC community members.

Subject to the Commission's feedback, SoCalGas will continue to compensate their partners for their expertise and participation in SoCalGas's Climate Adaptation Program. SoCalGas also plans to support community leaders and partners by keeping the lines of communication and feedback open to new ideas, suggestions, and recommendations for engaging with DVCs and creating more resilient communities. While the current CAVA process ends with filing the Vulnerability Assessment in 2025, this does not mark the end of the engagement and community partnerships. Efforts will be ongoing in preparation for the next round of engagement and 2028 CAVA filing. As such, SoCalGas plans to request additional funding for critical outreach and engagement with DVCs.

SoCalGas extends its heartfelt gratitude to the community partners for their trust, collaboration, valuable feedback, and for sharing their community insights throughout this process. Their efforts have been instrumental in achieving these accomplishments.

3 VULNERABILITY ASSESSMENT METHODOLOGY

3.1 Introduction and Overview

The CAVA methodology is designed to produce useful information for SoCalGas to prioritize how it responds to climate-related hazards as conditions change over time, allowing SoCalGas to fulfill the requirements of the Climate Change Adaptation OIR.

The CAVA focuses on the climate risk to infrastructure, operations, and services. In this filing, SoCalGas infrastructure, operations, and services are sometimes referred to as the SoCalGas system or the system. The CAVA leverages the Intergovernmental Panel on Climate Change (IPCC) core definition of risk in its Sixth Assessment as "the potential for adverse consequences."[13] Therefore, a risk has two components: a consequence to a human or ecological system and some likelihood of that consequence occurring.

The Climate Change Adaptation OIR provides that the Vulnerability Assessment shall "[u]se DWR's [Department of Water Resources'] two-step vulnerability assessment methodology that (1) combines exposure and sensitivity to determine risk, and (2) combines risk and adaptive capacity to determine vulnerability."[14] It also says that utilities "should use the DWR's two-step vulnerability assessment methodology modified to conform with the established IPCC definitions of risk terminology."[15]

Accordingly, this assessment uses the IPCC definition of risk as quoted above. The CAVA also applies a modified version of the DWR approach by assessing what parts of the system are exposed to different climate hazards and how sensitive they are when exposed to determine risk. This aligns with the IPCC definition in that it includes both likelihood and consequence components of risk. The term "adaptive capacity" is often used in different ways; this assessment evaluates SoCalGas's capacity to handle disruption to its system (*i.e.*, SoCalGas adaptive capacity or asset adaptive capacity) and DVC's capacity to adapt to the disruptions

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[13] IPCC, *The concept of risk in the IPCC Sixth Assessment Report: a summary of cross-Working Group discussion* (September 4, 2020), *available at: https://www.ipcc.ch/site/assets/uploads/2021/02/Risk-guidance-FINAL_15Feb2021.pdf*.

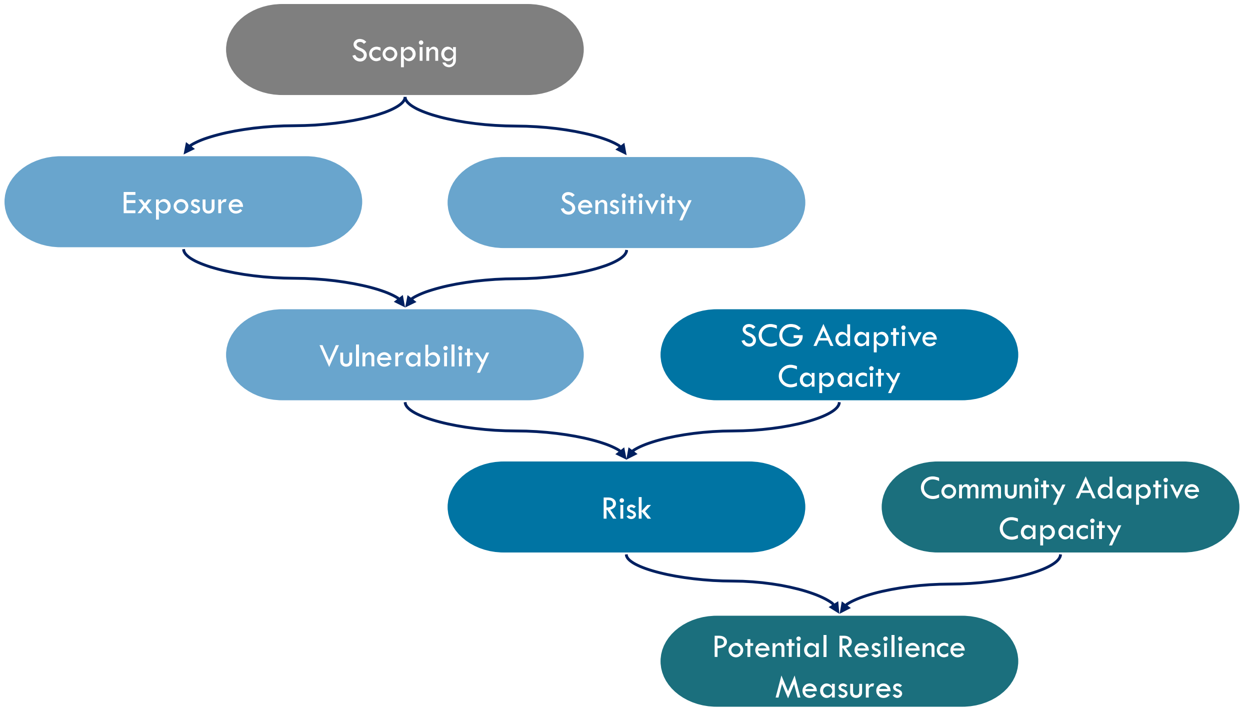
[14] D.20-08-046 at 126 (OP 9(9)).

[15] *Id.* at 106 (Finding of Fact (FOF) 29).

(*i.e.*, community adaptive capacity, which is what is defined in D. 20-08-046). Chapter 5 discusses adaptation analysis and strategies, as well as potential next steps.

Figure 3-1 shows the basic components and processes of the CAVA framework. First, scoping defines the hazards, timeframes, assets, and other analysis parameters. Next, the exposure and sensitivity of different assets to different hazards are assessed. These are combined to characterize the vulnerability of these assets. Then information on SoCalGas adaptive capacity (*i.e.*, asset adaptive capacity) is incorporated into vulnerability results to assess risk. Finally, information on community adaptive capacity is incorporated into risk results to develop potential resilience measures. The details of this process vary depending on the type of analysis undertaken.

Figure 3-1: Climate Adaptation and Vulnerability Assessment Framework



3.2 Climate Science and Projections

Future climate projections are crucial in identifying and mitigating local hazards by linking climate variables to specific risks. These projections help utilities and other organizations anticipate climate-related disruptions and guide investments in adaptive measures to protect critical infrastructure. This section provides background on key research and climate modeling in the CAVA.

The IPCC is a United Nations body for assessing the science related to climate change.[16] The IPCC creates assessment reports (ARs) about the latest scientific, technical, and socioeconomic information regarding climate change. The most recent, the Sixth Assessment Report (AR6), was finalized and released in 2023.

Global climate models or general circulation models (GCMs) simulate processes and interactions between different parts of the climate system. The Coupled Model Intercomparison Project (CMIP) coordinates these modeling efforts and enables comparisons between them to understand which results are consistent across models.[17] The Coupled Model Intercomparison Project Phase 6 (CMIP6) represents the latest advancement in the global effort to enhance climate modeling and improve the scientific understanding of future climate scenarios.[18] CMIP6 is an international collaboration involving climate modeling centers from around the world (see Table 3-1), producing simulations that project global climate changes under various shared socioeconomic pathways (SSPs) (see Figure 3-2). CMIP6 models were used in AR6.

Table 3-1: Modeling Centers and Their Respective CMIP6 Models used in the CAVA[19]

Modeling Center	Country	CMIP6 Models
ARCCSS - Australian Research Council Centre of Excellence for Climate System Science (ARCCSS)	Australia	ACCESS-CM2, ACCESS-ESM1-5
BCC - Beijing Climate Centre, CMA - China Meteorological Administration (BCC CMA)	China	BCC-CSM2-MR
CCCma - Canadian Centre for Climate Modelling and Analysis (CCCma)	Canada	CanESM5
CAS - Chinese Academy of Sciences (CAS)	China	FGOALS-g3
DWD - Deutscher Wetterdienst (DWD)	Germany	MPI-ESM1-2-LR, MPI-ESM1-2-HR
DKRZ - Deutsches Klimarechenzentrum (DKRZ)	Germany	MPI-ESM1-2-LR, MPI-ESM1-2-HR
EC-Earth-Consortium (EC)	Sweden	EC-Earth3-Veg, EC-Earth3
IPSL - Institute Pierre Simon Laplace (IPSL)	France	IPSL-CM6A-LR
JAMSTEC - Japan Agency for Marine-Earth Science and Technology (JAMSTEC)	Japan	MIROC6
MPI-M - Max-Planck-Institut für Meteorologie (MPI-M)	Germany	MPI-ESM1-2-HR, MPI-ESM1-2-LR

[16] IPCC, *The Intergovernmental Panel on Climate Change, available at: https://www.ipcc.ch/*.

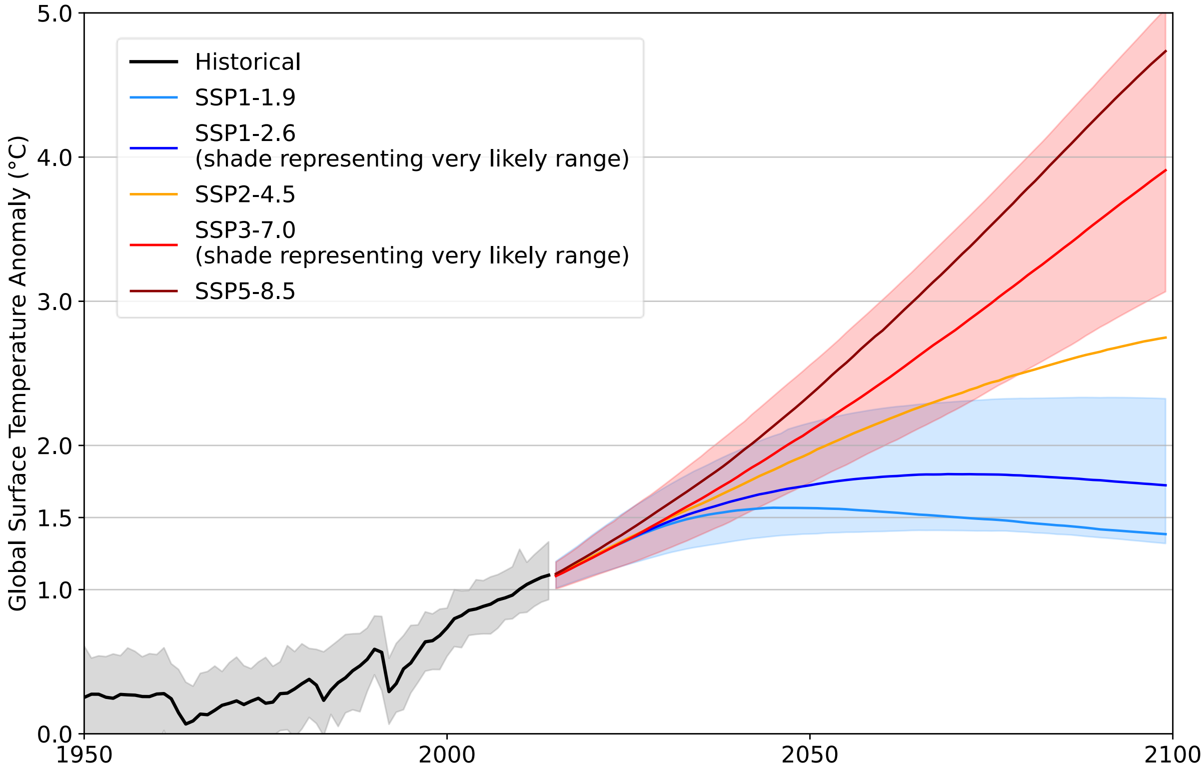
[17] World Climate Search Programme (WCRP) – CMIP, *CMIP Overview, available at: https://wcrp-cmip.org/cmip-overview/*.

[18] Eyring, V., Bony, S., Meehl, G. A., Senior, C. A., Stevens, B., Stouffer, R. J., and Taylor, K. E.: Overview of the Coupled Model Intercomparison Project Phase 6 (CMIP6) experimental design and organization, Geosci. Model Dev., 9, 1937-1958, doi:10.5194/gmd-9-1937-2016, 2016.

[19] WCRP – CMIP, *CMIP Modelling Centres and ESGF Nodes, available at: https://wcrp-cmip.org/map/*.

Modeling Center	Country	CMIP6 Models
MET Norway - MET Norway	Norway	NorESM2-LM, NorESM2-MM
MRI - Meteorological Research Institute (MRI)	Japan	MRI-ESM2-0
MOHC/ UK Met Office - The UK Meteorological Office	UK	HadGEM3-GC31-MM, HadGEM3-GC31-LL
CNRM - National Center for Meteorological Research, Météo-France (CNRM)	France	CNRM-CM6-1, CNRM-CM6-1-HR, CNRM-ESM2-1
NCAR - National Centre for Atmospheric Research (NCAR)	USA	CESM2
NOAA-GFDL - National Oceanic and Atmospheric Administration OAA Geophysical Fluid Dynamics Laboratory (NOAA-GFDL)	USA	GFDL-CM4, GFDL-ESM4
NIMS - Korea Meteorological Administration	Republic of Korea	KACE-1-0-G
AS-RCEC - Research Center for Environmental Changes : Academia Sinica (AS-RCEC)	Taiwan	TaiESM1
INM - Russian Academy of Science (INM)	Russia	INM-CM4-8, INM-CM5-0

Figure 3-2: Projected Changes in Global Surface Temperature Through 2100 Relative to the Period 1850-1900 Under Various Shared Socioeconomic Pathway Scenarios



Source: Reproduced from IPCC Sixth Assessment Report

These SSPs reflect potential future scenarios shaped by various levels of GHG emissions, population growth, and economic development.[20] For example, SSP3-7.0 represents a "regional rivalry" pathway characterized by high challenges to both mitigation and adaptation efforts. It assumes a fragmented world where national security and regional issues take precedence over global cooperation. This results in high emissions, delayed climate action, and significant climate impacts such as extreme heat, shifts in precipitation patterns, and rising sea levels. SSP2-4.5 represents a "middle-of-the-road" pathway where trends broadly follow historical patterns, with moderate population growth, technological development, and emissions. SSP5-8.5 is a "fossil-fueled development" pathway driven by rapid economic growth, energy-intensive lifestyles, and high dependence on fossil fuels, leading to relatively high levels of GHG emissions. CMIP6 models are essential for assessing large-scale climate trends, such as

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[20] Science Direct, *The Shared Socioeconomic Pathways and their energy, land use, and greenhouse gas emissions implications: An overview* (January 2017), *available at:* *https://www.sciencedirect.com/science/article/pii/S0959378016300681*.

temperature and precipitation pattern shifts, and form the foundation for numerous downscaled regional climate projections. Their outputs are critical for global and regional climate assessments, policy development, and infrastructure planning in the face of climate change. For the CAVA, SoCalGas primarily used the CMIP6 projections downscaled for California by the Scripps Institution of Oceanography using the Localized Constructed Analogs (LOCA) technique (LOCA2 CA).[21, 22] LOCA 2 CA and other climate projections used in the CAVA are peer reviewed. For LOCA2 CA, Scripps used a hybrid approach, combining statistical and dynamical downscaling methods,[23] and provided projections with a spatial resolution of 3 km by 3 km. This high resolution helps capture complex topographical and microclimate features unique to California, enabling more accurate identification of region-specific climate risks and vulnerabilities. LOCA2 CA thus serves as a valuable tool for understanding and addressing California's unique climate challenges.

California has selected a subset of 15 GCMs from CMIP6 based on their ability to accurately reflect the region's climate variability and historical weather patterns: ACCESS-CM2, CESM2-LENS, CNRM-ESM2-1, EC-Earth3, EC-Earth3-Veg, FGOALS-g3, GFDL-ESM4, HadGEM3-GC31-LL, INM-CM5-0, IPSL-CM6A-LR, KACE-1-0-G, MIROC6, MPI-ESM1-2-HR, MRI-ESM2-0, TaiESM1.[24] Projections from 1950 to 2100 from these models under SSP2-4.5, SSP3-7.0, and SSP5-8.5 scenarios are downscaled using the LOCA2 technique to provide localized projections tailored for California's diverse landscapes and climatic conditions. The resulting data sets, hosted on platforms including the Cal-Adapt Analytics Engine,[25] offer insights into key weather variables such as precipitation, temperature, humidity, and solar radiation.

Table 3-2 shows the combinations of SSPs and climate models included in the LOCA2 CA projections.

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[21] LOCA, *LOCA statistical downscaling, available at:* *https://loca.ucsd.edu/*.

[22] LOCA, *LOCA2-Hybrid for California (ca. May 2023), available at: https://loca.ucsd.edu/loca-version-2-for-california-ca-may-2023/*.

[23] LOCA, *LOCA version 2 (California) vs. LOCA version 2 (North America), available at: https://loca.ucsd.edu/loca-version-2-california-vs-loca-version-2-north-america/*.

[24] California Energy Commission (CEC), *Memorandum on Evaluating Global Climate Models for Studying Regional Climate Change in California* (November 29, 2021), *available at: https://www.energy.ca.gov/sites/default/files/2022-09/20220907_CDAWG_MemoEvaluating_GCMs_EPC-20-006_Nov2021-ADA.pdf*.

[25] Eagle Rock Analytics – Analytics Engine, *Cal-Adapt Analytics Engine*, *available at: https://analytics.cal-adapt.org/*.

Table 3-2: Availability of CMIP6 Models by Shared Socioeconomic Pathways in California-Specific LOCA2 Projections Hosted on Cal-Adapt Analytics Engine

CMIP6 Model	Shared Socioeconomic Pathways		
	SSP2-4.5	SSP3-7.0	SSP5-8.5
ACCESS-CM2	x	x	x
CESM2-LENS		x	
CNRM-ESM2-1	x	x	x
EC-Earth3	x	x	x
EC-Earth3-Veg	x	x	x
FGOALS-g3	x	x	x
GFDL-ESM4	x	x	x
HadGEM3-GC31-LL	x		x
INM-CM5-0	x	x	x
IPSL-CM6A-LR	x	x	x
KACE-1-0-G	x	x	x
MIROC6	x	x	x
MPI-ESM1-2-HR	x	x	x
MRI-ESM2-0		x	x
TaiESM1	x	x	

California conducts assessments of how climate changes and associated events could impact the people, economy, and environment of the state and inform policy. California's Fourth Climate Change Assessment, which wrapped up in 2018, is the state's most recent completed assessment.[26] California's Fifth Climate Change Assessment has been underway for several years and is expected to be completed in 2026.[27]

In D. 19-10-054, the CPUC ordered the utilities to:

> adhere to at least the same climate scenarios and projections used in the most recent California Statewide Climate Change Assessment when analyzing climate impacts, climate risk, and climate vulnerability of utility systems, operations, and customers…The Fourth Assessment uses 10 Global Climate Models and two Representative Climate Pathways [RCPs – GHG emissions scenarios] to simulate California's historical and projected temperatures, [precipitation], and other climate outcomes such as relative humidity and soil moisture. If the Fifth Assessment or future assessment updates these climate

[26] State of California – Climate Assessment, *California's Fourth Climate Change Assessment* (August 27, 2018), *available at:* https://www.climateassessment.ca.gov/.

[27] CA Governor's Office of Land Use and Climate Innovation, *Climate Assessment, Science, and Research – California's Fifth Climate Change Assessment, research priorities, and tools*, *available at:* https://lci.ca.gov/climate/icarp/climate-assessment/.

> scenarios and projections, the energy utilities shall align their analyses with the newly adopted scenarios and projections.[28]

SoCalGas began the assessment by leveraging the CMIP Phase 5 (CMIP5) data used for the Fourth Assessment, including the RCPs and GCMs specified by the CPUC. In 2024, the CPUC issued D. 24-08-005 and ordered utilities to use SSP 3-7.0 as a reference emissions scenario rather than RCP 8.5. As described earlier in this subsection, SSP 3-7.0 is one of the emissions scenarios used in the CMIP6 modeling. Both AR6 and California's Fifth Climate Change Assessment use the SSPs and CMIP6 models. To align with D. 24-08-005 and the most recent climate science, SoCalGas updated its CAVA analysis to use the LOCA2 downscaled CMIP6 models, with emphasis on SSP 3-7.0. The LOCA2 projections were used for precipitation, temperature, humidity, runoff, and other variables.

For the CAVA, these climate projections were used to calculate metrics relevant to local hazards and assess the vulnerability of SoCalGas infrastructure, operations, and services to these hazards now and in the future. For example:

- The maximum annual 60-day precipitation depth was used, as this is a proxy for slope saturation. More heavily saturated slopes are more prone to landslides.
- The change in peak annual streamflow, which is calculated using locally generated runoff and baseflow within different watersheds, was used as an indicator of inland flooding.
- Annual heating and cooling-degree days were calculated, as these are used to help understand potential impacts on gas demand. When temperatures are colder, there is generally more demand for natural gas for heating.
- Heat and humidity projections were used to calculate heat index values. Heat index is helpful for assessing health impacts on workers who work outside or in other exposed areas.

By using high-resolution downscaled climate projections, decision-makers can anticipate and adapt to these localized hazards, promoting more robust and forward-looking strategies for community and infrastructure resilience.

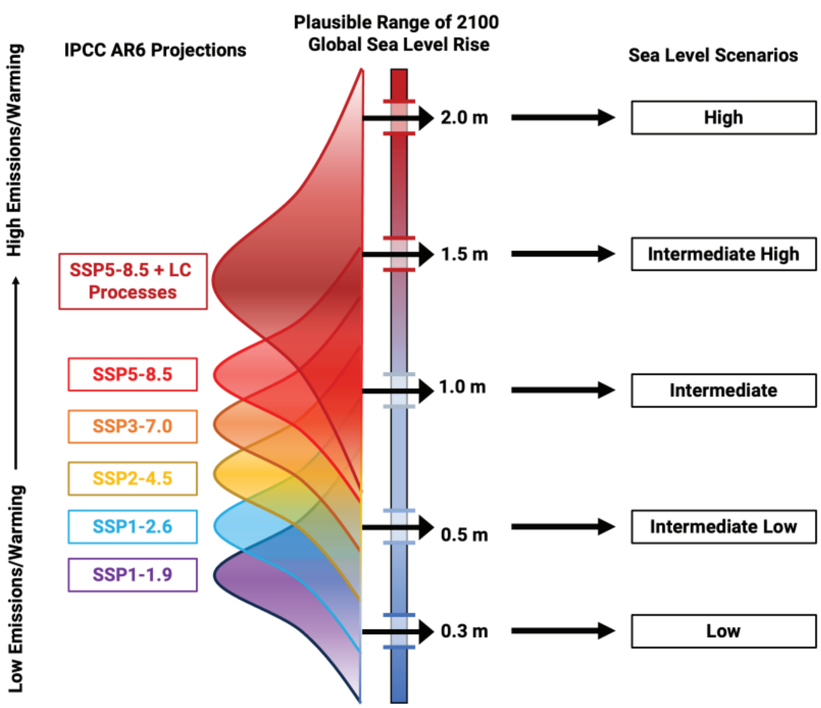
The California wildfire projections currently under development as part of the California Fifth Climate Change Assessment using LOCA2 downscaled CMIP6 climate models were not yet available when this CAVA analysis was performed. Therefore, the CAVA team used University of

[28] D. 19-10-054 at 56-57 (OP 3(a)-(b)).

California Merced Wildfire Simulations for California's Fourth Climate Change Assessment.[29] This modeling used LOCA downscaled projections from CMIP5. The wildfire modeling was performed for RCPs 4.5 and 8.5 for four GCMs: CanESM2, CNRM-CM5, HadGEM2-ES, and MIROC5. Wildfire projections were used from these eight climate scenarios (four GCMs times two RCPs).

For sea level rise (SLR), the CAVA leverages the state's most recent SLR projections from the Ocean Protection Council (OPC).[30] These projections were developed for five different scenarios that draw on CMIP6 projections across the different SSPs (Figure 3-3). The analysis focused on Intermediate, Intermediate-High, and High scenarios, as recommended by the state for informing SLR planning and project decisions.

Figure 3-3: Developing Sea Level Rise Scenarios from CMIP6 SSPs



Source: CA OPC, 2024 State of CA SLR Guidance[31]

[29] CEC, *Wildfire Simulations for California's Fourth Climate Change Assessment: Projecting Changes in Extreme Wildfire Events with a Warming Climate* (August 2018), *available at: https://www.energy.ca.gov/sites/default/files/2019-11/Projections_CCCA4-CEC-2018-014_ADA.pdf*.

[30] OPC, *State of California Sea Level Rise Guidance* (2024), *available at: https://opc.ca.gov/wp-content/uploads/2024/05/California-Sea-Level-Rise-Guidance-2024-508.pdf*.

[31] *Id.*

The projections are provided for 14 tide gauges along California's coast. Increments from the Los Angeles tidal gauge were emphasized in the CAVA, given the gauge's middling location along the coastal study area.

Table 3-3 shows feet of SLR compared to the year 2000 baseline used by the OPC for different scenarios and horizon years at the Los Angeles tide gauge.

Table 3-3: Selected California Ocean Protection Council Projections for Los Angeles Tidal Gauge (feet of change compared to the year 2000 baseline)

Year	Low	Intermediate-Low	Intermediate	Intermediate-High	High
2020	0.1	0.2	0.2	0.2	0.2
2030	0.2	0.3	0.3	0.4	0.4
2040	0.3	0.4	0.5	0.6	0.7
2050	0.4	0.5	0.7	0.9	1.1
2060	0.4	0.6	0.9	1.4	1.8
2070	0.5	0.8	1.2	2.1	2.7

Note: Projections are feet of change compared to the year 2000 baseline.

For future coastal flooding depth and wave height and future coastal erosion, the CAVA used the U.S. Geological Survey (USGS) Coastal Storm Modeling System (CoSMoS)[32] projections associated with different SLR increments. CoSMoS uses rounded SLR increments that do not correspond exactly to the CA OPC projections shown in Table 3-3. Table 3-4 shows the CoSMoS increments that captured most of the variation in SLR from 2000 to 2070 and the coastal flooding events for which flood depths and wave heights were available at SLR increments.

Table 3-4: SLR Increments and Coastal Flooding Events from CoSMoS

SLR Increment (centimeters)	SLR Increment Equivalent in feet	Coastal Flooding Events Considered
0	0	No surge, average annual maximum surge, 20-year surge, 100-year surge
25	0.82	
50	1.64	
75	2.46	

Key: SLR = sea level rise

[32] USGS, *Coastal Storm Modeling System (CoSMoS)* (November 21, 2021), *available at:* *https://www.usgs.gov/centers/pcmsc/science/coastal-storm-modeling-system-cosmos*.

3.3 Analysis Structure

As part of the CAVA, a few different analyses were performed. These included an asset vulnerability scoring process and several supplemental analyses. These approaches were tailored to help understand the extent of the risks and enable comparison between different system components. The methodology was vetted through several rounds of internal review and collaboration with SMEs.

For the asset vulnerability scoring, metrics were combined into vulnerability ratings for each asset within an asset class. While these scores do not estimate a dollar value of risk for each asset, they do characterize risk for many different assets in a manner that enables comparison. This approach helps prioritize the assets with the highest relative vulnerability so that they can be assessed in detail and, if necessary, adapted.

The supplemental analyses were conducted to understand different types of climate risks and account for limitations in indicator-based asset vulnerability scoring. Details of the supplemental analyses are described in Section 3.5.

3.4 Asset Vulnerability Scoring Method Details

The asset vulnerability scoring is a major component of CAVA analysis. The main purpose is to prioritize assets for project-level analysis and potential adaptation.

Identifying and selecting hazard types included in the scoring was informed by conversations with SMEs about the sensitivity of gas infrastructure to various hazards. The five main climate-related hazard types identified were:

1. Riverine and localized flooding (referred to together as inland flooding in this CAVA), including associated erosion and debris flow, driven by heavy precipitation and sometimes following a wildfire or snowmelt.
2. Wildfire, driven by changing precipitation patterns.
3. Landslide, particularly deeper-seated slope failures, as opposed to shallower failures; driven by longer-term precipitation patterns.
4. Coastal flooding, exacerbated by SLR.
5. Coastal erosion, including beach erosion and cliff retreat, is exacerbated by SLR.

Some of these hazards can overlap or interact with one another. For instance, a flood event can be driven by multiple sources, such as rivers and oceans. Also, cascading events can occur, for example, a wildfire followed by heavy rains may cause debris flow. These particular overlaps, interactions, and cascading events should be assessed in project-level analysis. For the vulnerability scoring, these five categories were chosen to organize the analysis.

Other notable hazards discussed included the following:

- High ambient temperatures: according to conversations with SMEs, the majority of the gas infrastructure is not particularly sensitive to high temperatures. Therefore, high ambient temperature was not factored into the asset vulnerability scoring. However, high temperatures were factored in several of the supplemental analyses described in Section 3.5. Humidity was also considered for the supplemental analysis associated with worker health.
- Subsidence: Subsidence can be caused by different factors and is not necessarily climate related. Common causes in California include groundwater pumping, peat loss, and oil extraction. Larger areas of potential subsidence caused by groundwater pumping in the SoCalGas territory include San Joaquin Valley (the largest area affected), Los Angeles/Santa Ana Basin, Antelope Valley, Yucaipa Valley, Coachella Valley, and Oxnard Plain.[33] Based on conversations with SMEs, subsidence was not determined to be a significant risk to the system to warrant inclusion in the asset vulnerability scoring. That said, subsidence can affect small portions of the system and therefore was considered in SME workshops on adaptive capacity along with the other identified hazards.

Several types of asset classes were included in the vulnerability scoring (see Table 3-5). The vulnerability scoring was predominantly a spatial analysis, examining the locations of hazards relative to assets. Therefore, geographic information system (GIS) asset data was used. Almost all the asset classes used in the analysis coincide with those in SoCalGas's GIS system. The units in the vulnerability assessment were the individual features in that GIS system. One exception was 13 compressor stations that were georeferenced using coordinates. The total of assets was more than 5.9 million, spanning Southern California Gas Company's territory. Thus, the analysis approach needed to account for this large number of assets spanning a diverse and large

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[33] USGS Areas of Land Subsidence in California, *available at* *https://ca.water.usgs.gov/land_subsidence/california-subsidence-areas.html*.

geography. In developing the CAVA, SoCalGas aimed to conduct the analyses at the finest spatial resolution feasible.

Table 3-5: Asset Classes Included in Vulnerability Scoring Along with Data Source and Update Information

Asset Class	Data Source	Count (or Mileage)
Facilities (i.e., SoCalGas-owned buildings)	SoCalGas GIS	144 count
High-Pressure Pipes	SoCalGas GIS	6,788 miles
High-Pressure Service Pipes	SoCalGas GIS	254 miles
Medium-Pressure Pipes	SoCalGas GIS	48,418 miles
Medium-Pressure Service Pipes	SoCalGas GIS	43,183 miles
Storage Fields	SoCalGas GIS	4 count
Compressor Stations	SoCalGas spreadsheet with coordinates	13 count
Regulators	SoCalGas GIS	10,917 count
Controllable Gas Valves	SoCalGas GIS	54,133 count
Non-Controllable Gas Valves	SoCalGas GIS	2,820 count

Key: Source datasets updated daily. However, GIS data used in the CAVA was extracted for analysis in 2022.

The asset vulnerability analysis was performed on gas infrastructure assets for both SoCalGas and San Diego Gas and Electric (SDG&E). The SoCalGas CAVA presents the analysis for the SoCalGas gas system. The SDG&E CAVA incorporates and reports on the results of this analysis for the SDG&E gas system.

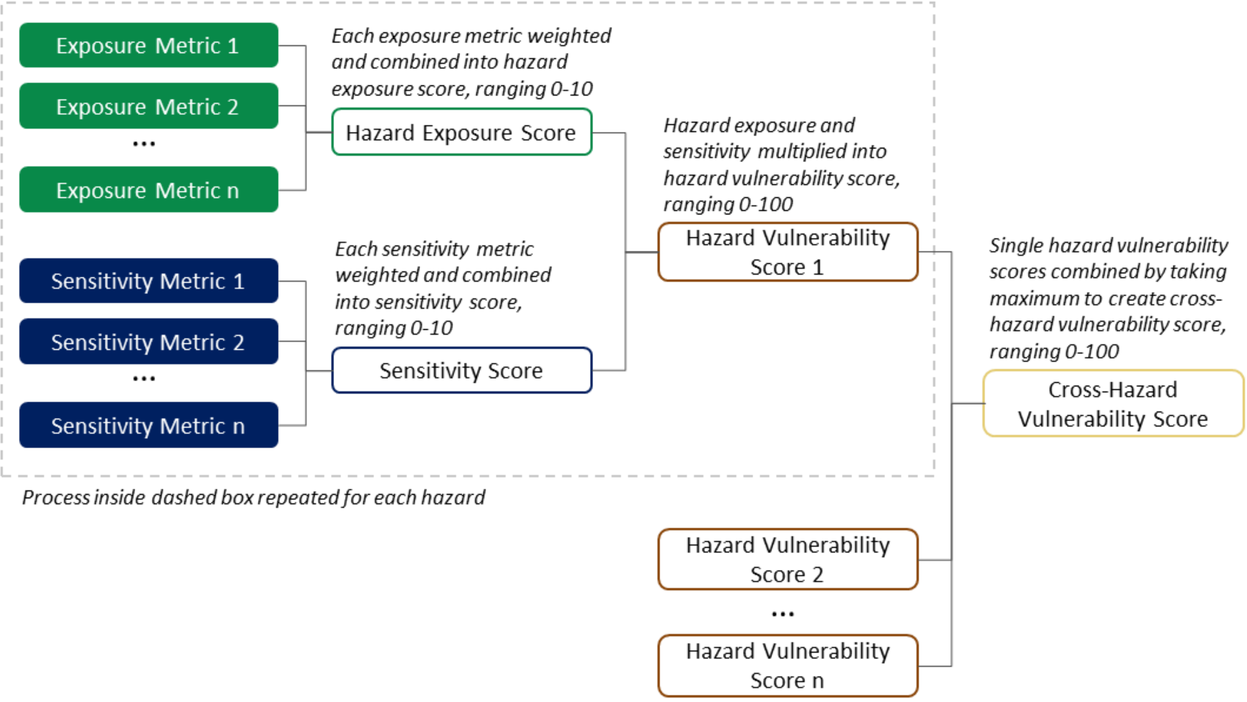
Distinct vulnerability scores were calculated for different years. The CAVA focused on year 2023, and projected years 2030, 2050, and 2070.

For each projected year, a 30-year window is considered. The window is centered on the target projected year (2030, 2050, 2070). For example, for the year 2050, the 30-year window spans from 2035 to 2065. The year 2023 is roughly analogous to the current timeframe (it was the year when most of the climate-related metrics were first calculated). Years 2030, 2050, and 2070 corresponded to roughly 10, 30-, and 50-year planning horizons after the CAVA commenced. The CAVA's results focus primarily on the 2050 analysis year, per the direction in D.20-08-046 to "address the key time frame to be considered by the vulnerability assessment of the next 20–30 years".

The structure of the scoring for each asset is shown in Figure 3-4. Scores are assigned to each asset ranging from 0 (relatively low vulnerability) to 100 (relatively high vulnerability). The scores consist of metrics — data that convey information about the assets or the hazards at or near the assets. There are two main groups of metrics that correspond to exposure and sensitivity:

- Exposure metrics capture information about the likelihood that hazards will occur at an asset location.
- Sensitivity metrics capture information about how susceptible an asset is to the hazards and the consequences to the overall system. (Susceptibility is the likelihood an asset will be damaged when exposed to a hazard.)

Figure 3-4: Asset Vulnerability Scoring Process for Each Asset



Each metric was converted to a common scale (0 to 10) with higher numbers corresponding to higher vulnerability. This process is often referred to as normalization or scaling. Then, the scaled exposure metrics are weighted based on their relative importance to overall exposure. This created a hazard exposure score ranging from 0 to 10. The same process was done for the sensitivity metrics creating a sensitivity score ranging from 0 to 10. The exposure and sensitivity scores were multiplied to create a set of vulnerability scores ranging from 0 to 100. The scale and weight of metrics are structured so comparisons are feasible across asset classes.

Each of the five hazard categories was scored separately for each of the four analysis years. Chapter 4 focuses on vulnerability scores for each individual hazard. Cross-hazard vulnerability scores were also calculated for each asset. These cross-hazard scores were created using the maximum single hazard vulnerability score for each asset.

Sections 3.4.1 and 3.4.2 provide more details on the exposure and sensitivity metrics used in the scoring process.

3.4.1 Exposure Metrics

Exposure metrics were selected based on professional judgment, SME input, similar climate vulnerability analyses of infrastructure, and available data. These metrics were further vetted during multiple rounds of internal workshops and, for most hazards, through a calibration process with past incident data.

Table 3-6 shows the hazard datasets that were used for the exposure metrics. They include both datasets with information on projected future hazards and datasets with information on current or recent historical hazards.

Table 3-6 Hazard Dataset Sources and Metrics

Source	Metric	Number of Variations Used in Scoring
Scripps LOCA 2 CA	Projected percent change in locally generated streamflow	16 (combinations of 50th and 90th percentile models from SSP3-7.0; 2- and 100-year return periods; 2023, 2030, 2050, and 2070 analysis years)
Scripps LOCA 2 CA	Project 60-day precipitation depth (inches)	16 (combinations of 50th and 90th percentile models from SSP3-7.0; 2- and 100-year return periods; 2023, 2030, 2050, and 2070 analysis years)
University of California Merced Westerling Wildfire Modeling	Projected 30-year cumulative burn percent	8 (combinations of 50th and 90th percentile models across RCPs 4.5 and 8.5; 2023, 2030, 2050, and 2070 analysis years)
USGS CoSMoS/2024 CA OPC SLR Projections	Shoreline change by SLR increment	8 (closest CoSMoS match to OPC Intermediate and High SLR projections; 2023, 2030, 2050, and 2070 analysis years)
USGS CoSMoS/2024 California OPC SLR Projections	Flood depth, 100-year event by SLR increment	8 (closest CoSMoS match to OPC Intermediate and High SLR projections; 2023, 2030, 2050, and 2070 analysis years)
Cal Fire	Fire Hazard Severity Zone ratings	1
CPUC	High-Fire Threat District ratings	1
Cal Fire	Historical burn areas	1
FEMA	Flood Hazard Zone rating	1
CGS	Deep landslide susceptibility rating	1
CGS	Tsunami zone rating	1
Natural Resources Conservation Service Soil Survey Geographic Database	Flood frequency class, dominant condition	1

Key: Cal Fire = California Department of Forestry and Fire Protection; CGS = California Geological Survey; CoSMoS = Coastal Storm Modeling System; CPUC = California Public Utilities Commission; FEMA = Federal Emergency Management Agency; OPC = Ocean Protection Council; SLR = sea level rise; USGS = U.S. Geological Survey

GIS analysis was performed to query hazard data at asset locations. The specific query approach depended on the formats of the hazard data (whether it was polygon, high-resolution raster, or low-resolution raster) and the asset data (whether it was point, line, or polygon).

The approach for scaling the metrics from 0 to 10 varied based on the nature of the hazard data. For continuous variables, this was typically done using truncated normalization, which preserves most of the distribution of the raw (*i.e.*, unscaled) data but prevents outliers from dominating the scoring. For categorical variables, professional judgment was used to map raw categories onto a 0 to 10 score.

Exposure metric weighting was typically performed through a calibration exercise analyzing past event locations and 2023 exposure scores. The calibration involved adjusting weights so that assets associated with past events of a given hazard type had relatively high exposure scores. Years 2030, 2050, and 2070 exposure scores were then scaled from 2023 exposure scores based on the proportional change in climate projection metrics (those that show change over time) from 2023 to each of those years. For instance, if the metrics increased by 15% from 2023 to 2050, the 2023 exposure score was correspondingly increased by 15% to obtain the 2050 exposure score. This process was performed for landslide, wildfire, and inland flooding exposure scores.

For coastal floods, there was minimal past event data. Therefore, weights were calibrated based on cost projections of potential damage to certain assets as part of one of the supplemental analyses described later in this chapter. As there was only one type of hazard metric for coastal erosion, the weighting calibration was unnecessary.

For metrics using climate projections that change over time, moderate and high-end projections (*e.g.*, 50th and 90th percentiles) were typically used to account for the uncertainty of future conditions. The middle or moderate projection was used to help account for relatively likely conditions, and the high-end projection was used to be relatively conservative or risk averse.

Table 3-7 presents the inland flooding exposure metrics and 2023 weights as percentages. The rightmost column indicates whether the metric changes over time (*i.e.*, based on climate projections). Table 3-8 provides the landslide exposure metrics and 2023 weights, while Table 3-9 provides the wildfire exposure metrics and 2023 weights. Table 3-10 and Table 3-11 list the coastal flooding exposure metrics and weights and the coastal erosion exposure metrics and weights, respectively.

Table 3-7: Inland Flooding Exposure Metrics and 2023 Weights

Hazard	Metric	Weight (%)	Changes over Time?
Inland Flooding	Percent change local streamflow - 2-year, 50th percentile SSP3-7.0	2.5	Yes
	Percent change local streamflow - 100-year, 50th percentile SSP3-7.0	2.5	Yes
	Percent change local streamflow - 2-year, 90th percentile SSP3-7.0	2.5	Yes
	Percent change local streamflow - 100-year, 90th percentile SSP3-7.0	2.5	Yes
	Current fire code*	45	No
	Current flood code**	45	No
	Total	**100%**	

Notes:

*Calculated by taking the maximum scaled California Department of Forestry and Fire Protection Fire Hazard Severity Zone rating and California Public Utilities Commission High Fire-Threat District rating.

**Calculated by taking the maximum scaled Federal Emergency Management Area Flood Hazard Zone rating and Soil Survey Geographic Database Flood Frequency rating.

Table 3-8: Landslide Exposure Metrics and 2023 Weights

Hazard	Metric	Weight (%)	Changes over Time?
Landslide	Projected 60-day precip. - 2-year, 50th percentile SSP3-7.0	2.5	Yes
	Projected 60-day precip. - 100-year, 50th percentile SSP3-7.0	2.5	Yes
	Projected 60-day precip. - 2-year, 90th percentile SSP3-7.0	2.5	Yes
	Projected 60-day precip. - 100-year, 90th percentile SSP3-7.0	2.5	Yes
	Deep Landslide Susceptibility Rating	90	No
	Total	**100%**	

Table 3-9: Wildfire Exposure Metrics and 2023 Weights

Hazard	Metric	Weight (%)	Changes over Time?
Wildfire	Projected burn frequency - 50th percentile across RCPs 4.5 and 8.5	5	Yes
	Projected burn frequency - 90th percentile across RCPs 4.5 and 8.5	5	Yes
	Current fire code*	45	No
	Overlap with historical burn area	45	No
	Total	**100%**	

Note:

*Calculated by taking the maximum of scaled California Department of Forestry and Fire Protection Fire Hazard Severity Zone rating and California Public Utilities Commission High Fire-Threat District rating.

Table 3-10: Coastal Flooding Exposure Metrics and Weights

Hazard	Metric	Weight (%)	Changes over Time?
Coastal Flooding	Flood depth - 100-year surge, Intermediate SLR	33.3	Yes
	Flood depth - 100-year surge, High SLR	33.3	Yes
	Tsunami Hazard Area	33.3	No
	Total	**100%**	

Key: SLR = sea level rise

Table 3-11: Coastal Erosion Exposure Metrics and Weights

Hazard	Metric	Weight (%)	Changes over Time?
Coastal Erosion	Eroded Area - Intermediate SLR	50	Yes
	Eroded Area - High SLR	50	Yes
	Total	**100%**	

Key: SLR = sea level rise

3.4.2 Sensitivity Metrics

Sensitivity metrics were selected based on professional judgment, SME input, similar past analyses, and available data. The metrics were vetted during multiple rounds of internal feedback, including a series of SME workshops devoted to SME metrics and their relative importance.

Sensitivity metrics include information about both the susceptibility of an asset to damage and the criticality of an asset to the system (Figure 3-5). Susceptibility is the likelihood an asset will be damaged when exposed to a hazard. Criticality reflects an asset's importance to the overall system and communities it serves and indicates the level of impact when the asset is damaged.

Figure 3-5: Susceptibility and Criticality

Sensitivity metrics were assigned based on the asset class. They were either included as attributes in the GIS data, included as assets in other tabular data sets, joined to GIS data, or created in GIS as part of the CAVA.

Similar to the exposure metrics, the approach for scaling the metrics from 0 to 10 varied based on the nature of the sensitivity data. This was typically done using truncated normalization for continuous variables. For categorical variables, professional judgment was used to map raw categories onto a score of 0 to 10.

Sensitivity metrics weights were developed through workshops with SoCalGas and SDG&E SMEs.

Each sensitivity score is made up of two components, which are weighted equally (*i.e.*, 50 percent):

- Asset-Specific Metrics, which are either continuous or categorical variables that capture information on criticality and susceptibility, vary by asset.
- Asset Class Relative Consequence Scores, which are categorical scores of "High," "Medium," or "Low" assigned to an asset class based on its (1) relative susceptibility to that hazard and (2) consequence of it failing for the overall system.

For the asset-specific metrics, the 50 percent was allocated among the metrics in proportion to their levels of importance, as assessed by SMEs. To do this, SMEs assigned ratings to each metric ranging from 3 (most important) to 0 (least important).

As a hypothetical example, take an asset class and asset-specific metrics assigned by SMEs on level of importance:

- Metric A received a 3 SME rating
- Metric B received a 2.5 SME rating
- Metric C received a 1 SME rating

Weightings for these metrics were established by:

- Tallying SME ratings to obtain the denominator: 3 + 2.5 + 1 = 6.5
- For each metric, divide the SME rating by this denominator and then multiply by 0.5
  - Metric A weighting: 3/6.5 * 50% = ~23% (0.23)
  - Metric B weighting: 2.5/6.5 * 50% = ~19% (0.19)
  - Metric C weighting: 1/6.5 * 50% = ~8% (0.08)

Note that a metric's weight reflects both SME ratings and the total number of metrics used for that asset class.

Asset class relative consequences make up the remaining 50 percent of the weight. The full set of weights for each sensitivity metric and asset class are presented in Table 3-12.

Asset class relative consequence ratings for each combination of asset class and hazard, along with the rationale for the ratings are presented in Table 3-13.

For example, here is how a wildfire sensitivity score would be developed for a hypothetical storage field:

- Located within HCA: storage field is not located in HCA so receives a scaled score of 0/10; multiplied by that metric's weight is 0 * 0.2 = 0
- Critical storage field flag: storage field is flagged as critical to the system so receives a scaled score of 10/10; multiplied by that metric's weight is 10 * 0.3 = 3
- Asset class relative consequence rating: storage field relative consequence for wildfire is high, receiving a scaled score of 10/10; multiplied by that metric's weight is 10 * 0.5 = 5
- Sensitivity score: a calculation of the sum of the weighted scaled metrics: 0 + 3 + 5 = 8. The asset receives a score of 8 out of a possible 10.

Table 3-12: Sensitivity Metric Weights by Asset Class

Metric	Facility (%)	Storage Field (%)	Compress. Stations (%)	Regulator stations (%)	Control. Gas Valve (%)	Non- Control. Gas Valve (%)	HP Pipe (%)	HP Service Pipe (%)	MP Pipe (%)	MP Service Pipe (%)
Facility Type Criticality	15									
Mission Critical	15									
Employee Number	10									
Vehicle Fleet	10									
Located Within HCA or Business District (MP)		20	12.5	16.66	22.22	22.22	13.23	18.52	10.53	10.53
Critical Storage Field Flag		30								
Located in a Low-Redundancy Area			18.75	16.66			14.29			
Critical Compressor Station Flag			18.75							
Reg. Station Age				8.33						
Operated by Transmission				8.33	16.66	16.66				
Valve Critical Indicator					11.11	11.11				
Above, Shallow, or Underground							13.23	18.52	13.16	13.16
Pipe MAOP							9.26	12.96		
Nominal Size									13.16	13.16
NSOTA Flag									13.16	13.16
Asset Class Relative Consequence	50	50	50	50	50	50	50	50	50	50
Total	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

Key: HCA = high consequence area; HP = high-pressure; MAOP = maximum average operating pressure; MP = medium-pressure; NSOTA = non-state-of-the-art

Table 3-13: Asset Class Relative Consequence Ratings

Asset Class	Wildfire	Inland Flooding	Landslide	Coastal Flooding	Coastal Erosion
Facilities	High (critical to system; sensitive to hazard)	High (critical to system; sensitive to hazard)	High (critical to system; sensitive to hazard)	High (critical to system; sensitive to hazard)	High (critical to system; sensitive to hazard)
Storage Fields	High (critical to system; sensitive to hazard)	High (critical to system; sensitive to hazard)	High (critical to system; sensitive to hazard)	High (critical to system; sensitive to hazard)	High (critical to system; sensitive to hazard)
Compressor Stations	High (critical to system; sensitive to hazard)	High (critical to system; sensitive to hazard)	High (critical to system; sensitive to hazard)	High (critical to system; sensitive to hazard)	High (critical to system; sensitive to hazard)
Regulator Stations	High (critical to system; sensitive to hazard)	High (critical to system; sensitive to hazard)	High (critical to system; sensitive to hazard)	High (critical to system; sensitive to hazard)	High (critical to system; sensitive to hazard)
Controllable Gas Valves	High (critical to system; sensitive to hazard)	High (critical to system; sensitive to hazard)	High (critical to system; sensitive to hazard)	High (critical to system; sensitive to hazard)	High (critical to system; sensitive to hazard)
Non-Controllable Gas Valves	Low (important to system but not critical; low sensitivity)	Low (important to system but not critical; low sensitivity)	Medium (important to system but not critical; sensitive to hazard)	Low (important to system but not critical; low sensitivity)	Low (important to system but not critical; low sensitivity)
HP Pipes	Low (critical to system; low sensitivity)	Medium (critical to system; moderate sensitivity)	High (critical to system; sensitive to hazard)	Medium (critical to system; moderate sensitivity)	High (critical to system; sensitive to hazard)
HP Service Pipes	Low (important to system but not critical; low sensitivity)	Low (important to system but not critical; moderate sensitivity)	Medium (important to system but not critical; high sensitivity)	Low (important to system but not critical; moderate sensitivity)	Medium (important to system but not critical; high sensitivity)
MP Pipes	Low (important to system but not critical; low sensitivity)	Low (important to system but not critical; moderate sensitivity)	Medium (important to system but not critical; high sensitivity)	Low (important to system but not critical; moderate sensitivity)	Medium (important to system but not critical; high sensitivity)
MP Service Pipes	Low (less important to system than other hazards; low sensitivity)	Low (less important to system than other hazards; moderate sensitivity)	Low (less important to system than other hazards; high sensitivity)	Low (less important to system than other hazards; moderate sensitivity)	Low (less important to system than other hazards; high sensitivity)

Key: HP = high-pressure; MP = medium-pressure.

3.4.3 Asset Adaptive Capacity

For adaptive capacity, the CAVA used the following definition, which is very similar to the definition used in Pacific Gas & Electric Company's (PG&E) CAVA: "current capabilities that SoCalGas and our communities rely on to manage environmental hazards." For SoCalGas's CAVA, asset adaptive capacity, or SoCalGas adaptive capacity was distinguished from community adaptive capacity. This chapter discusses asset adaptive capacity, whereas Chapter 2 discusses community adaptive capacity.

Asset adaptive capacity was assessed qualitatively at the asset class level during workshops with several groups of SoCalGas and SDG&E SMEs. During the workshops, SMEs provided input on the following topics for each hazard and asset group:

- Current planning and engineering design strategies for managing the vulnerability
- Current operational strategies for managing the vulnerability
- Categorize adaptive capacity as high, moderate, or low

Note that some asset classes were grouped together given their similarities. These included valves (both controllable gas valves and non-controllable gas valves), high-pressure pipes (both high-pressure pipes, and high-pressure service pipes), and medium-pressure pipelines (both medium-pressure pipes, and medium-pressure service pipes).

The adaptive capacity scores were then reviewed and converted to numeric scores ranging from 1 (high) to 3 (low), with "high" representing greater adaptive capacity (and thus lower risk) and "low" representing less adaptive capacity (and thus higher risk). Average scores were taken for each asset group. Some asset groups were further aggregated for summarization purposes (specifically, valves, regulator stations, and compressor stations were grouped together). Numeric scores were averaged across each asset class aggregated. These scores were rounded to the nearest whole number and converted back to high, moderate, or low.

3.4.4 Summarizing Vulnerability Scoring and Risk Scoring

As described earlier in this section, vulnerability scores are assigned at individual asset levels ranging from 0 (relatively low vulnerability) to 100 (relatively high vulnerability) for each hazard and year.

For summary purposes, these individual scores are classified into five equal-width categories (see Figure 3-6). Many of the asset-level results in Chapter 4 refer to these categories.

Figure 3-6: Vulnerability Score Categories

Color	Label	Score Range
	High	80 – 100
	Moderate-High	60 – 80
	Moderate	40 – 60
	Moderate-Low	20 – 40
	Low	0 - 20

In addition to the individual asset results, each overall asset class was also assigned a vulnerability category for each hazard based on its 2050 vulnerability scores. An asset class was assigned a category based on the 95th percentile asset category for that hazard. For example, if the 95th percentile score for a certain asset class and hazard was 63, it would be categorized as moderate-high, and the overall asset class would also be categorized and assigned a moderate-high vulnerability for that hazard.

Risk categories were also assigned at the simplified asset class level and were based on vulnerability scores and adaptive capacity scores. Risk was assigned qualitatively as one of three classes (higher risk, moderate risk, lower risk) and Table 3-14 shows the logic that was applied.

Table 3-14: Risk Categories Based on Vulnerability and Adaptive Capacity

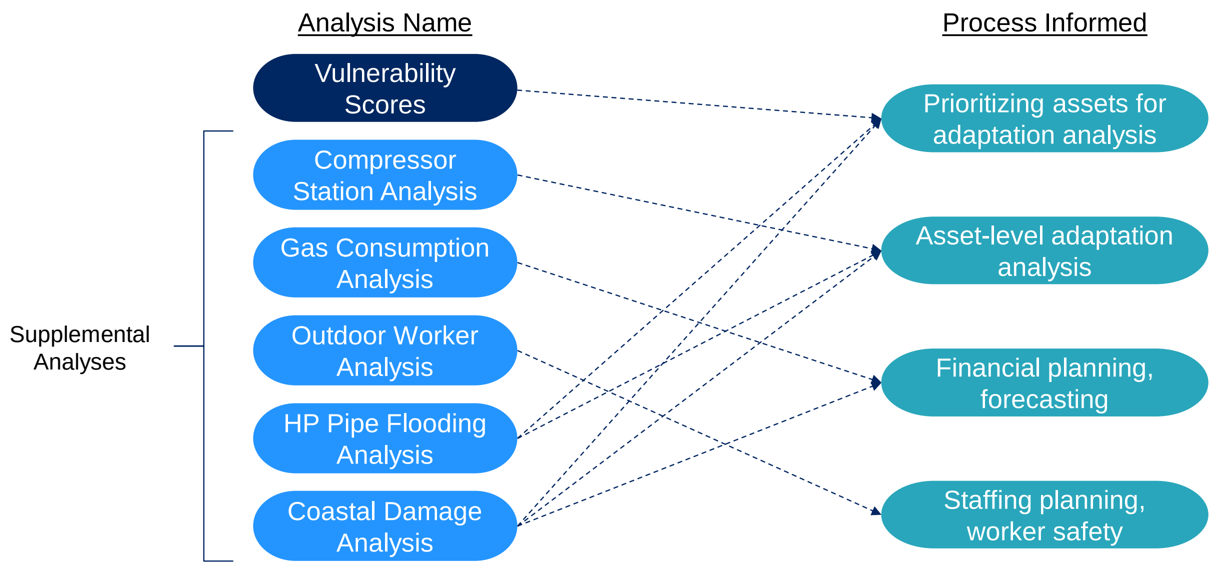
Vulnerability Level	Adaptive Capacity	Risk Class
Low/Moderate-Low	Moderate/High	Lower
Low/Moderate-Low	Low	Moderate
Moderate	High	Lower
Moderate	Low/Moderate	Moderate
Moderate-High/High	Low	Higher
Moderate-High/High	Moderate/High	Moderate

The asset class level risk, vulnerability, and adaptive capacity scores are used to summarize the results of the scoring process.

3.5 Supplemental Analyses

Several supplemental analyses were conducted to make CAVA more useful and to account for limitations in indicator-based asset vulnerability scoring. Figure 3-7 shows the supplemental analyses and the main analysis – the asset vulnerability scoring – along with the different processes each one informs. The vulnerability scoring serves to prioritize assets for adaptation analysis. The high-pressure pipe flooding analysis and the coastal damage analysis provide more granular information to inform this prioritization for certain asset-hazard combinations where better data is available. The compressor station ambient temperature analysis, the high-pressure pipe flooding analysis, and the coastal analysis can also inform or support asset-level adaptation analysis. The gas consumption analysis and coastal damage analysis can be useful for demand forecasting or other types of financial planning. The outdoor worker temperature analysis can inform staffing planning and safety measures. The subsections below describe these in more detail.

Figure 3-7: Supplemental Analyses



3.5.1 Compressor Station Analysis

Based on guidance from SMEs, a set of temperature climate projections was developed for each compressor station location. Increases in ambient air temperatures could increase the energy needed to cool compressor stations. It was helpful for SMEs to understand the distribution of expected daily maximum and minimum temperatures when designing compressor stations and equipment. Therefore, histograms of projected daily maximum and minimum temperatures were analyzed for 10-year periods from the 2020s through 2080s, using the LOCA2 projections from different SSP-GCM combinations. Historical baseline histograms were also developed for comparison. Additional details are provided in Section 4.

3.5.2 Gas Consumption Analysis

A sensitivity analysis was performed to understand the relationship between recent historical temperature and gas consumption and how expected changes in temperatures could affect gas consumption in the future.

Monthly zip code level gas consumption data was used in the analysis. Observed historical temperature data was obtained for the same period across the service territory. This data was then summarized by monthly heating- and cooling-degree days (HDDs and CDDs) by zip code.

A regression analysis of how HDD, CDD, and other variables affect consumption was performed. The regression model results were applied to projected climate conditions to estimate how consumption over the same period might have varied if the climate was akin to what is projected for future time periods under different emissions scenarios and climate models.

3.5.3 Outdoor Worker Analysis

Per the National Weather Service, “the heat index, also known as the apparent temperature, is what the temperature feels like to the human body when relative humidity is combined with the air temperature.”[34] The National Weather Service has four heat index classifications—Caution, Extreme Caution, Danger, Extreme Danger.[35] Heat and humidity are important considerations for workers outdoors or in other uncooled spaces.

A set of heat index projections was developed for each SoCalGas District. For different combinations of emissions scenarios, climate models, and future years, the CAVA team

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[34] NOAA (National Oceanic and Atmospheric Administration) – National Weather Service, *What is the heat index?*, *available at:* https://www.weather.gov/ama/heatindex.

[35] For definitions of the heat index classifications, *see id*. For the equations used for calculating the heat index, refer to: NOAA – National Weather Service – Weather Prediction Center, *The Heat Index Equation, available at:* https://www.wpc.ncep.noaa.gov/html/heatindex_equation.shtml.

developed estimates of the average annual number of days when each heat index classification is reached.

3.5.4 High-Pressure Pipe Flooding Analysis

Previous SoCalGas analyses have included a detailed examination of flood risk for high-pressure pipelines. Some of the subsequent analyses included hydraulic modeling of selected pipeline locations susceptible to flood-related damages using the software program HEC-RAS. For this supplemental analysis, the CAVA team leveraged the previous modeling to perform a sensitivity analysis using future climate projections. This analysis involved estimating how projected changes in climate change in both normal and post-wildfire conditions could affect the hydraulics previously modeled. This included assessing whether projected flood events would result in water surface elevations that exceeded the pipeline span elevations and thus could be damaged. This information can be used both for prioritization (locations where water surface elevations exceed asset elevations can be prioritized for adaptation analysis) and to inform adaptation analysis itself (e.g., determining new span elevations to withstand future events). The analysis was performed for four utility creek crossing locations of SoCalGas pipelines.

3.5.5 Coastal Damage Analysis

To help establish quantitative measures of the overall risk of coastal flooding and coastal erosion damage to the SoCalGas system, a high-level, do-nothing cost analysis across a selection of SoCalGas infrastructure assets was performed. The analysis incorporated information on SLR projections and associated shoreline change and flood depths, asset data, and standardized damage assumptions to calculate present discounted do-nothing costs from a 2023 base year through 2070. Assets with higher do-nothing costs can be prioritized for adaptation analysis, and the hazard data and analysis structure (including the calculation of do-nothing costs) can be used for adaptation analysis itself.

The analysis leveraged SLR projections from the California OPC and shoreline change and flood depth for the closest corresponding SLR increments from the USGS CoSMoS. The following asset classes were included in the analysis:

- Facilities (coastal flooding and erosion)
- Regulator stations (coastal flooding and erosion)
- Compressor stations (coastal flooding and erosion)
- High-pressure pipelines (coastal erosion only)

Replacement costs and damage functions from published sources such as the Federal Emergency Management Agency HAZUS model were used in the analysis. Present discounted do-nothing costs were calculated from 2023 to 2070. A discount rate of 2 percent was used in the analysis, consistent with recent guidance from the U.S. Office of Management and Budget.[36]

[36] The White House, *Default Social Rate Of Time Preference Estimates* (November 9, 2023), *available at: https://www.whitehouse.gov/wp-content/uploads/2023/11/CircularA-4Appendix.pdf*.

4 VULNERABILITY ASSESSMENT FINDINGS

This chapter presents the vulnerability assessment results. Section 4.1 focuses primarily on infrastructure and assets, though that analysis accounts for how asset damage and disruption can affect operations and services. Section 4.2 briefly discusses operations and services more directly with a focus on emergency management in particular. Section 4.3 briefly touches on third-party contracts.

4.1 Infrastructure and Assets

This section first provides a brief overview of the asset class vulnerability results. It then provides details on the asset vulnerability scoring and supplemental analysis results.

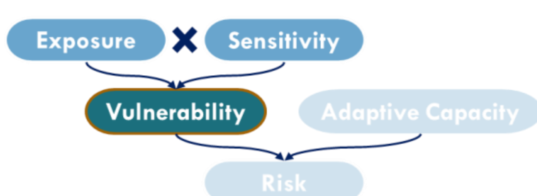
4.1.1 Asset Class Vulnerability and Risk Results Overview

Table 4-1 summarizes the asset vulnerability score categories for each pairing of hazard and simplified asset class (these simplified asset classes are described at the end of section 3.4.3). The categories are based on each 95th percentile asset vulnerability score for 2050 for each combination of asset class and hazard.

Table 4-1: Asset Vulnerability Scores Summary

	Coastal Erosion	Coastal Flood	Inland Flood	Landslide	Wildfire
High-Pressure Pipelines					
Medium-Pressure Pipelines					
Facilities					
Regulators, Compressors, Valves					
Storage Fields					

Color	Label
	High Vulnerability
	Moderate-High Vulnerability
	Moderate Vulnerability
	Moderate-Low Vulnerability
	Low Vulnerability



Storage fields were classified as high vulnerability for all five hazard types. Facilities were at moderate vulnerability to wildfire, landslide, and inland flooding. Regulator stations, compressor stations, and valves were at moderate vulnerability to inland flooding, landslide, and wildfire. High-pressure pipelines were at moderate-high vulnerability to landslide and moderate vulnerability to inland flooding.

Table 4-2 summarizes asset adaptive capacity, which was assessed qualitatively at the asset class level in a series of SME workshops. The definitions used were:

- High: "Sufficient or excellent capabilities to manage the climate hazard now and in the future" (or no exposure or very low sensitivity)
- Medium: "Some or many existing capabilities; however, there are opportunities to strengthen these"
- Low: "No or very few current capabilities"

Table 4-2: Asset Adaptive Capacity Summary

	Coastal Erosion	Coastal Flood	Inland Flood	Landslide	Wildfire
High-Pressure Pipelines					
Medium-Pressure Pipelines					
Facilities					
Regulators, Compressors, Valves					
Storage Fields					

Color	Label
	Low Adaptive Capacity
	Moderate Adaptive Capacity
	High Adaptive Capacity

Most simplified asset classes and hazards were categorized as having moderate adaptive capacity. Exceptions included the following:

- Storage fields were considered low adaptive capacity for coastal erosion.
- Regulator stations, compressor stations, and valves were considered high adaptive capacity for coastal and inland flooding.

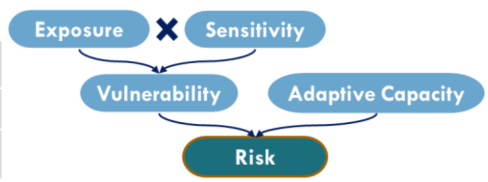
- Facilities were not exposed to either coastal erosion or coastal flooding, therefore, they were considered to have high adaptive capacity for those hazards.

Table 4-3 shows the risk results for each pairing of hazard and simplified asset class. The risk classes are a combination of the 2050 asset vulnerability scores and asset adaptive capacity results, both of which are summarized in Table 4-1 and Table 4-2.

Table 4-3: Asset Risk Results by Asset Class and Hazard

	Coastal Erosion	Coastal Flood	Inland Flood	Landslide	Wildfire
High-Pressure Pipelines					
Medium-Pressure Pipelines					
Facilities					
Regulators, Compressors, Valves					
Storage Fields					

Color	Label
	Higher Risk
	Moderate Risk
	Lower Risk



High-pressure pipelines, including high-pressure service pipelines, were categorized as moderate risk for both inland flooding and landslides, and lower risk for the other three hazards. Medium-pressure pipelines, including medium-pressure service pipelines, were categorized as lower risk for all of the hazards. Facilities were at moderate risk for inland flooding, landslide, and wildfire, and lower for the other two hazards. Regulator stations, compressor stations, and valves (including controllable and non-controllable) were grouped together and considered moderate risk for landslide and wildfire, and lower risk for the other three hazards. Storage fields were categorized as higher risk for coastal erosion (the only higher risk classification) and moderate risk for the other four hazards.

Landslides were considered moderate risk for four of the five simplified asset types, followed by inland flooding and wildfire (three each), and then coastal erosion and coastal flood (one each).

As discussed in Chapter 3, these results are intended to compare assets in relative terms rather than estimate monetized risk. The purpose is to prioritize what assets need a closer, site-specific analysis, which could occur in the next CAVA phase.

4.1.2 Asset Vulnerability Score Results

This section documents the detailed results of the asset vulnerability scoring in the form of tables, charts, maps, and narrative text.

Asset Class Vulnerability Score Results

Table 4-4 provides the vulnerability score results for each asset class and hazard combination. It shows the percentage of assets in each of the five asset classes: with low scores from zero up to 20; moderate-low scores from 20 up to 40; moderate scores from 40 up to 60; moderate-high scores from 60 up to 80; and high scores from 80 to 100. The percentages summarize the length for linear assets (*i.e.*, pipelines) and counts for other asset types. The scores are for 2050, the main horizon year used in the analysis.

Table 4-4: 2050 Vulnerability Scores by Asset Class, Hazard, and Scoring Category

Asset Class	Vulnerability Class	Coastal Erosion (%)	Coastal Flooding (%)	Inland Flooding (%)	Landslide (%)	Wildfire (%)
Facilities	Low	100.00%	100.00%	56.94%	84.72%	85.42%
Facilities	Moderate Low	0.00%	0.00%	27.78%	2.08%	4.17%
Facilities	Moderate	0.00%	0.00%	11.81%	9.72%	6.25%
Facilities	Moderate-High	0.00%	0.00%	2.78%	3.47%	3.47%
Facilities	High	0.00%	0.00%	0.69%	0.00%	0.69%
Compressor Stations	Low	100.00%	100.00%	38.46%	76.92%	69.23%
Compressor Stations	Moderate-Low	0.00%	0.00%	53.85%	7.69%	15.38%
Compressor Stations	Moderate	0.00%	0.00%	7.69%	15.38%	15.38%
Compressor Stations	Moderate-High	0.00%	0.00%	0.00%	0.00%	0.00%
Compressor Stations	High	0.00%	0.00%	0.00%	0.00%	0.00%
Controllable Valves	Low	100.00%	99.41%	59.94%	84.37%	83.20%
Controllable Valves	Moderate-Low	0.00%	0.53%	31.94%	8.04%	10.02%
Controllable Valves	Moderate	0.00%	0.04%	6.10%	5.72%	4.31%
Controllable Valves	Moderate-High	0.00%	0.01%	1.71%	1.54%	1.44%
Controllable Valves	High	0.00%	0.00%	0.31%	0.33%	1.04%
HP Pipes	Low	99.97%	99.62%	57.07%	66.35%	85.37%
HP Pipes	Moderate-Low	0.00%	0.23%	33.17%	5.17%	12.60%
HP Pipes	Moderate	0.00%	0.14%	9.45%	18.57%	2.03%
HP Pipes	Moderate-High	0.02%	0.01%	0.31%	9.78%	0.00%
HP Pipes	High	0.00%	0.00%	0.00%	0.13%	0.00%
HP Service Pipes	Low	99.91%	99.92%	88.40%	82.48%	93.35%
HP Service Pipes	Moderate-Low	0.08%	0.02%	10.23%	13.20%	5.28%
HP Service Pipes	Moderate	0.01%	0.06%	1.36%	4.32%	1.37%
HP Service Pipes	Moderate-High	0.00%	0.00%	0.00%	0.00%	0.00%

Asset Class	Vulnerability Class	Coastal Erosion (%)	Coastal Flooding (%)	Inland Flooding (%)	Landslide (%)	Wildfire (%)
HP Service Pipes	High	0.00%	0.00%	0.00%	0.00%	0.00%
MP Pipes	Low	99.99%	99.95%	94.06%	71.11%	94.56%
MP Pipes	Moderate-Low	0.00%	0.05%	5.84%	24.25%	5.39%
MP Pipes	Moderate	0.01%	0.00%	0.10%	4.58%	0.05%
MP Pipes	Moderate-High	0.00%	0.00%	0.00%	0.06%	0.00%
MP Pipes	High	0.00%	0.00%	0.00%	0.00%	0.00%
MP Service Pipes	Low	99.99%	99.96%	96.96%	93.05%	95.04%
MP Service Pipes	Moderate-Low	0.01%	0.04%	3.00%	6.89%	4.93%
MP Service Pipes	Moderate	0.00%	0.00%	0.04%	0.06%	0.03%
MP Service Pipes	Moderate-High	0.00%	0.00%	0.00%	0.00%	0.00%
MP Service Pipes	High	0.00%	0.00%	0.00%	0.00%	0.00%
Non-Controllable Valves	Low	100.00%	99.54%	72.06%	84.75%	83.44%
Non-Controllable Valves	Moderate-Low	0.00%	0.46%	21.21%	7.20%	6.88%
Non-Controllable Valves	Moderate	0.00%	0.00%	6.74%	6.13%	9.68%
Non-Controllable Valves	Moderate-High	0.00%	0.00%	0.00%	1.91%	0.00%
Non-Controllable Valves	High	0.00%	0.00%	0.00%	0.00%	0.00%
Regulator Stations	Low	99.94%	96.35%	50.83%	84.72%	78.67%
Regulator Stations	Moderate-Low	0.00%	3.61%	36.54%	3.87%	12.21%
Regulator Stations	Moderate	0.00%	0.04%	8.10%	10.14%	6.38%
Regulator Stations	Moderate-High	0.06%	0.00%	4.45%	1.21%	2.68%
Regulator Stations	High	0.00%	0.00%	0.08%	0.06%	0.06%
Storage Fields	Low	75.00%	50.00%	0.00%	0.00%	25.00%
Storage Fields	Moderate-Low	0.00%	0.00%	0.00%	0.00%	0.00%
Storage Fields	Moderate	0.00%	0.00%	0.00%	0.00%	25.00%
Storage Fields	Moderate-High	0.00%	0.00%	50.00%	0.00%	0.00%
Storage Fields	High	25.00%	50.00%	50.00%	100.00%	50.00%
Key: HP = high-pressure; MP = medium-pressure						

The next several paragraphs summarize the 2050 scores listed in Table 4-4 by asset type.

In terms of facilities, for each of the five hazards, most assets had low vulnerability scores. All facilities received low scores for coastal flooding and coastal erosion. The only high scores were for inland flooding (0.69 percent) and wildfire (0.69 percent). About 3 percent had moderate-high scores for wildfire (3.47 percent); about 3 percent for inland flooding (2.78 percent); and about 3 percent for landslide (3.47 percent).

For coastal flooding, coastal erosion, landslide, and wildfire, most compressor stations received low scores. All compressor stations had low scores for coastal flooding and coastal erosion. For inland flooding, most compressor stations received moderate-low scores (53.85 percent). No compressor stations received moderate-high or high scores for any of the hazards.

For each of the five hazards, most of the controllable gas valves had low vulnerability scores. All controllable gas valves received low scores for coastal erosion. About 1 percent of these assets received high scores for wildfire (1.04 percent), and a little more than 1 percent received moderate-high scores (1.44 percent). For both inland flooding and landslides, less than half a percent of controllable gas valves had high scores (0.31 percent and 0.38 percent), and less than 2 percent had moderate-high scores (1.71 percent and 1.54 percent).

In terms of high-pressure pipelines, most of the mileage had low vulnerability scores for each of the five hazards. Less than half a percent of the high-pressure pipeline length received high landslide scores (0.13 percent), with about 10 percent receiving moderate-high landslide scores (9.78 percent). Less than half a percent received moderate-high scores for inland flooding (0.31 percent); the same is true for coastal erosion (0.02 percent) and coastal flooding (0.01 percent).

For all five hazards, most of high-pressure service pipe mileage had low scores. None of these assets received moderate-high or high scores for any hazards.

For all five hazards, most of the medium-pressure pipeline mileage received low scores. Less than 1 percent of the mileage had moderate-high scores for landslides (0.06 percent).

Regarding medium-pressure service pipes, most of the mileage had low scores for all five hazards. None of these assets received moderate-high or high scores for any of the hazards.

For each of the five hazards, most non-controllable gas valves had low scores. A little less than 2 percent received moderate-high scores for landslides (1.91 percent).

In terms of regulator stations, for each hazard type, most assets received low scores. For inland flooding, less than half a percent of assets had high scores (0.08 percent) and approximately 4 percent of assets had moderate-high scores (4.45 percent). For wildfire, less than half a percent of assets had high scores (0.06 percent) and approximately 3 percent had moderate-high scores (2.68 percent). For landslide, less than half a percent of assets had high scores (0.06 percent) and approximately 1 percent had moderate-high scores (1.21 percent).

In terms of storage fields, all received high landslide scores (100.00 percent). For inland flooding, half of the storage fields had high scores (50.00 percent), and half had moderate-high scores (50.00 percent). For wildfire, half received high scores (50.00 percent). For coastal flooding, half received high scores (50.00 percent). For coastal erosion, one quarter (*i.e*., one storage field) received a high score (25.00 percent). In general, storage fields received relatively high scores because of their locations compared to existing and projected future hazards and because they are critical to the overall system. Also, each storage field was treated as a single asset. To be conservative, a storage field's exposure score for a particular hazard was assigned by taking the maximum exposure score across the entire storage field area for that hazard, including aboveground and underground assets. This does not imply that all parts of the storage field had that level of exposure or the resulting level of vulnerability (e.g., underground assets).

Figure 4-1 through Figure 4-20 show the vulnerability of scores for each asset class, hazard, and analysis year. Whereas most of the other vulnerability score results in this chapter are for the 2050 analysis year, the histograms (*e.g.*, Figure 4-1, Figure 4-3, and Figure 4-19) show the distributions for each of the four analysis years, which can be helpful for understanding how vulnerability changes over time. Each column corresponds to a different hazard. Each row corresponds to a different analysis year, starting with 2023 at the top and ending with 2070 at the bottom. The x-axes are all linear, fixed from 0 (lowest possible score) to 100 (highest possible score). Many of the y-axes are log-scale and show the counts of assets within each bin. Because for many asset types and hazards, most scores are at or near zero, the log scale makes it easier to see the shape of the distribution for scores higher than this. The dashed orange vertical lines show the median values, and the dashed black vertical lines show the mean values. In cases where these are not visible, this is because they are at or very close to zero. Following each histogram, a corresponding mean vulnerability score plot (*e.g.*, Figure 4-2, Figure 4-4, and Figure 4-20) illustrates how the average vulnerability score changes over time for the same asset type. These plots show the mean vulnerability scores for each hazard type from 2023 to 2070, providing a high-level summary of trends. For linear asset types (HP Pipe, HP Service Pipe, MP Pipe, and MP Service Pipe), the mean vulnerability scores were weighted by the length of each asset (i.e., distance-weighted mean equals the sum of each asset's vulnerability score times its length, divided by the sum of each asset's length). Table 4-5 through Table 4-14 present the numerical mean scores for each year and hazard type, aligning with the trends shown on the figures.

Figure 4-1: High-Pressure Pipeline Vulnerability Score Histograms by Hazard and Year

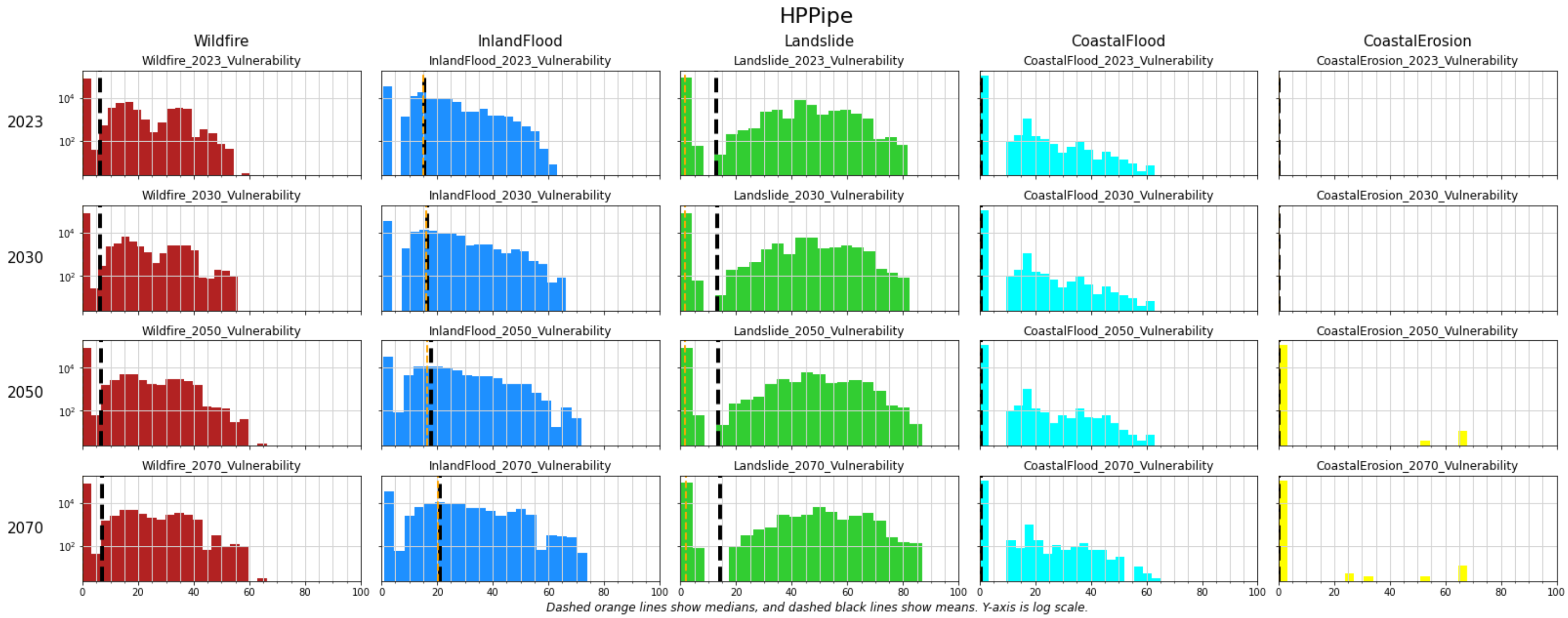


Table 4-5: High-Pressure Pipeline Distance-Weighted Mean Vulnerability Score by Hazard and Year

Year	Wildfire	Inland Flood	Landslide	Coastal Flood	Coastal Erosion
2023	6.188	16.236	17.142	0.243	0.000
2030	6.456	17.636	17.609	0.243	0.000
2050	6.669	19.104	18.231	0.255	0.017
2070	6.821	22.299	19.120	0.265	0.020

Figure 4-2: High-Pressure Pipeline Distance-Weighted Mean Vulnerability Score by Hazard and Year

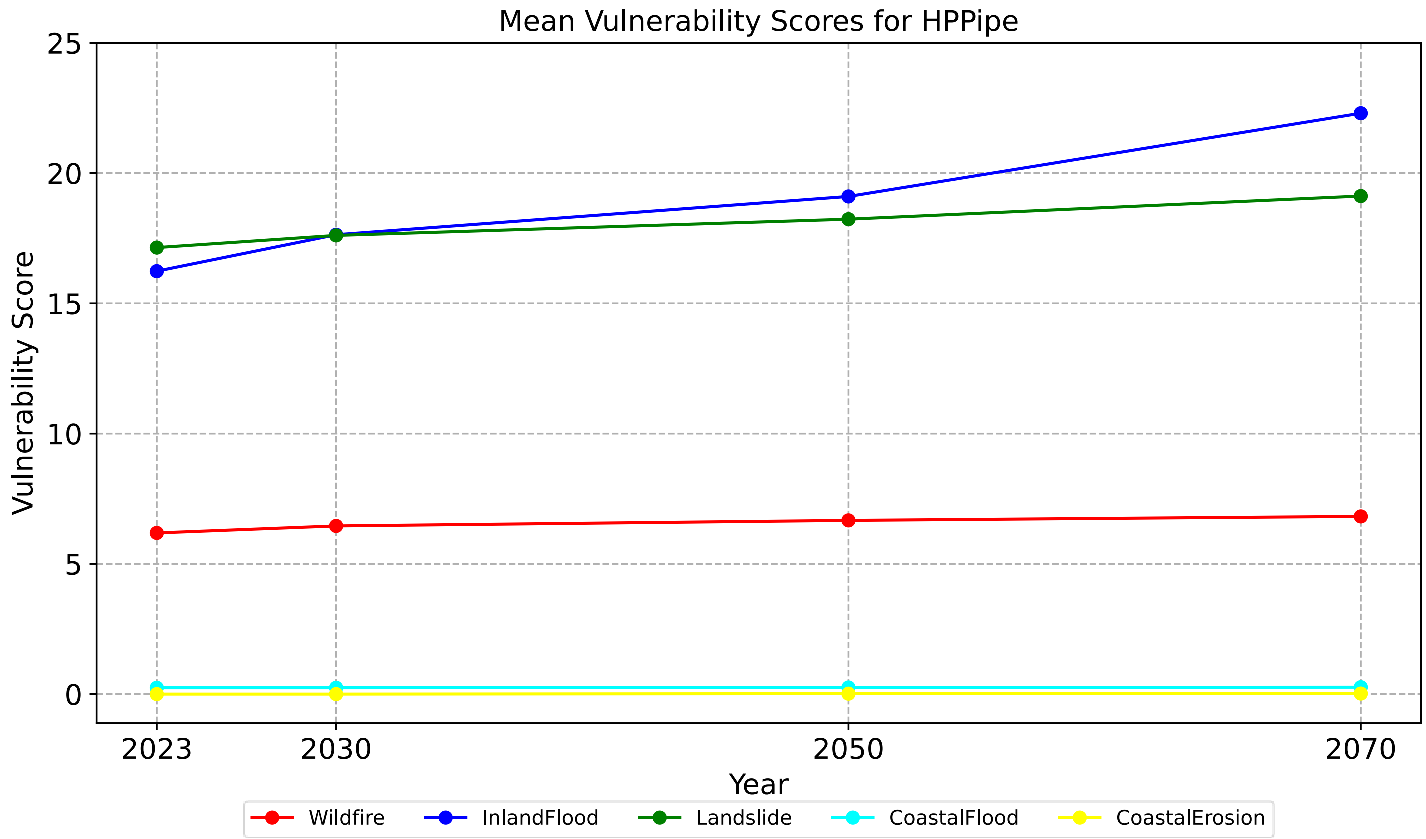


Figure 4-3: High-Pressure Service Pipeline Vulnerability Score Histograms by Hazard and Year

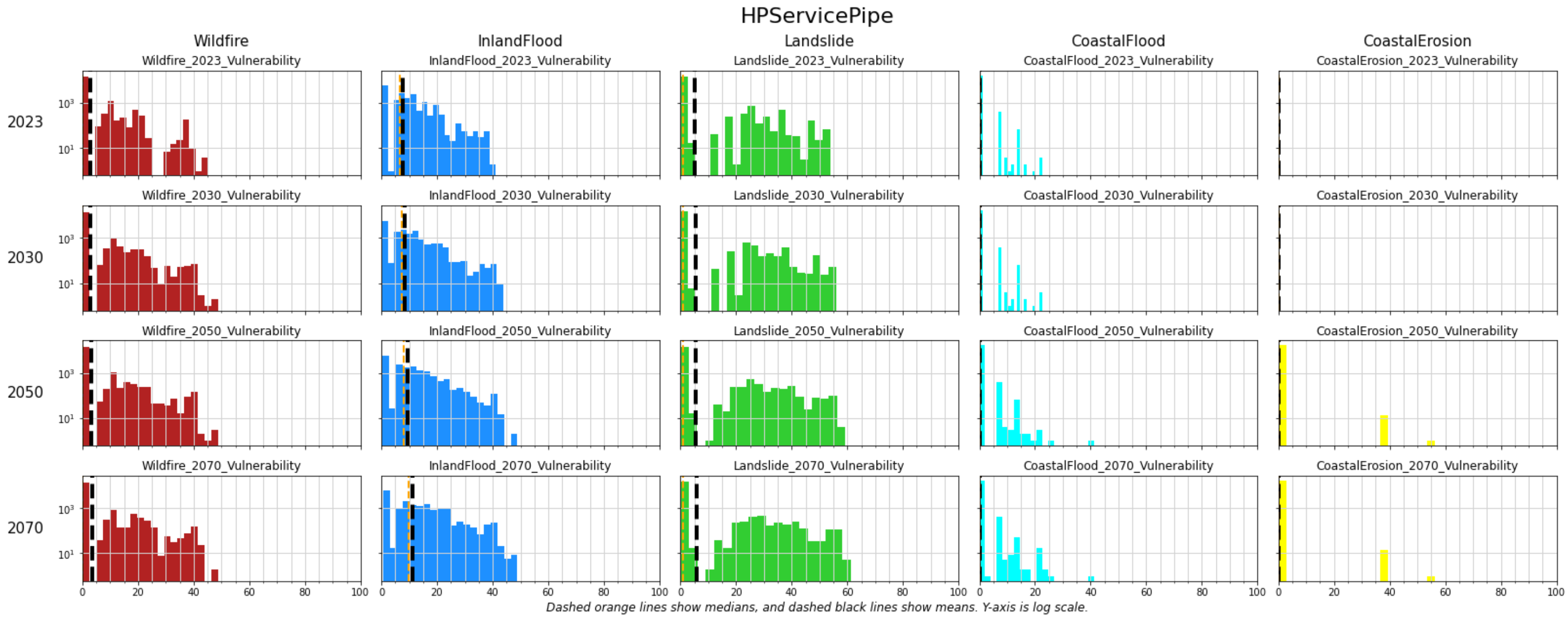


Table 4-6: High-Pressure Service Pipeline Distance-Weighted Mean Vulnerability Score by Hazard and Year

Year	Wildfire	Inland Flood	Landslide	Coastal Flood	Coastal Erosion
2023	3.195	8.031	6.818	0.158	0.000
2030	3.334	8.743	7.029	0.158	0.000
2050	3.659	9.713	7.258	0.173	0.034
2070	3.749	11.344	7.619	0.178	0.034

Figure 4-4: High-Pressure Service Pipeline Distance-Weighted Mean Vulnerability Score by Hazard and Year

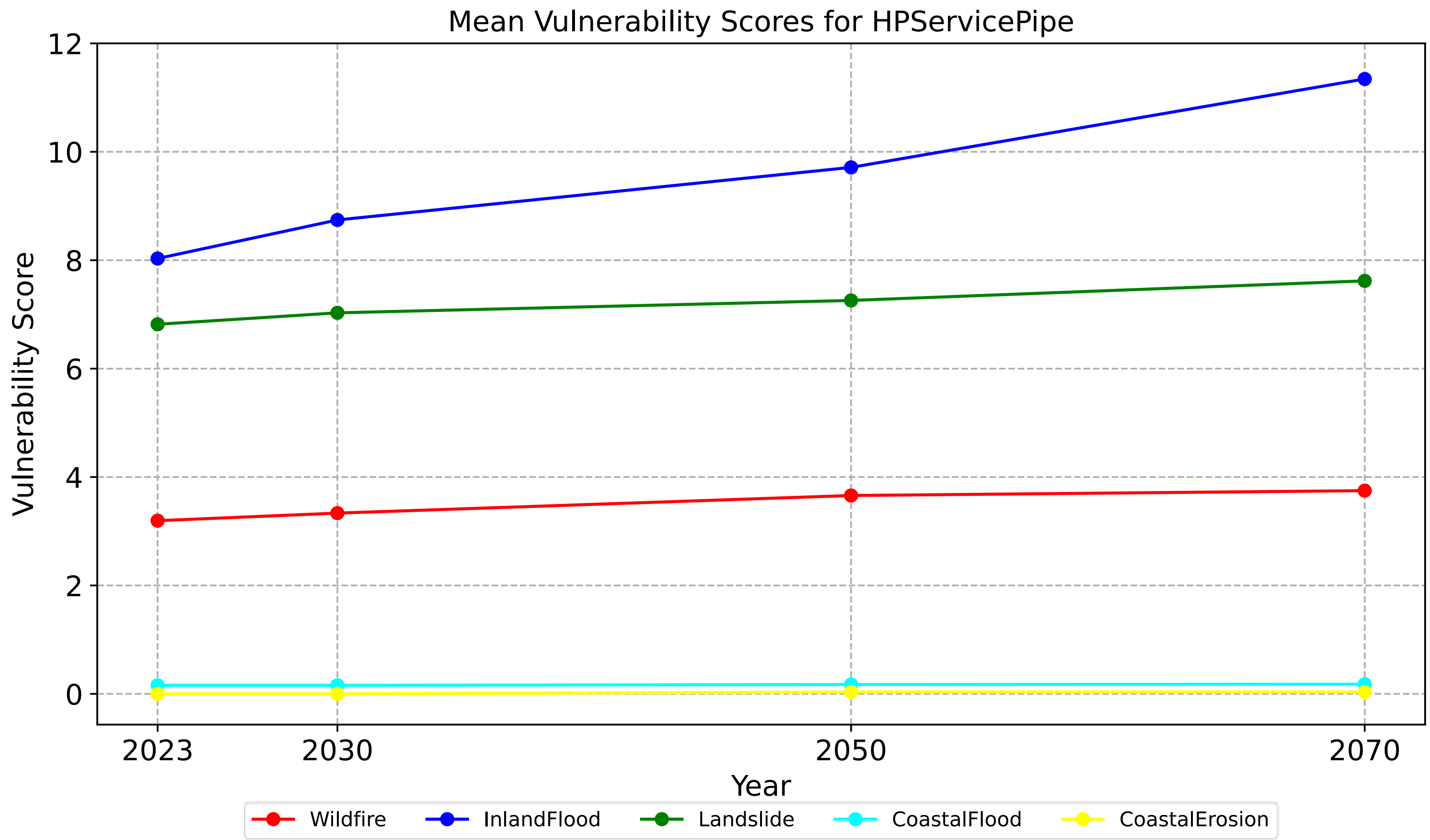


Figure 4-5: Medium-Pressure Pipeline Vulnerability Score Histograms by Hazard and Year

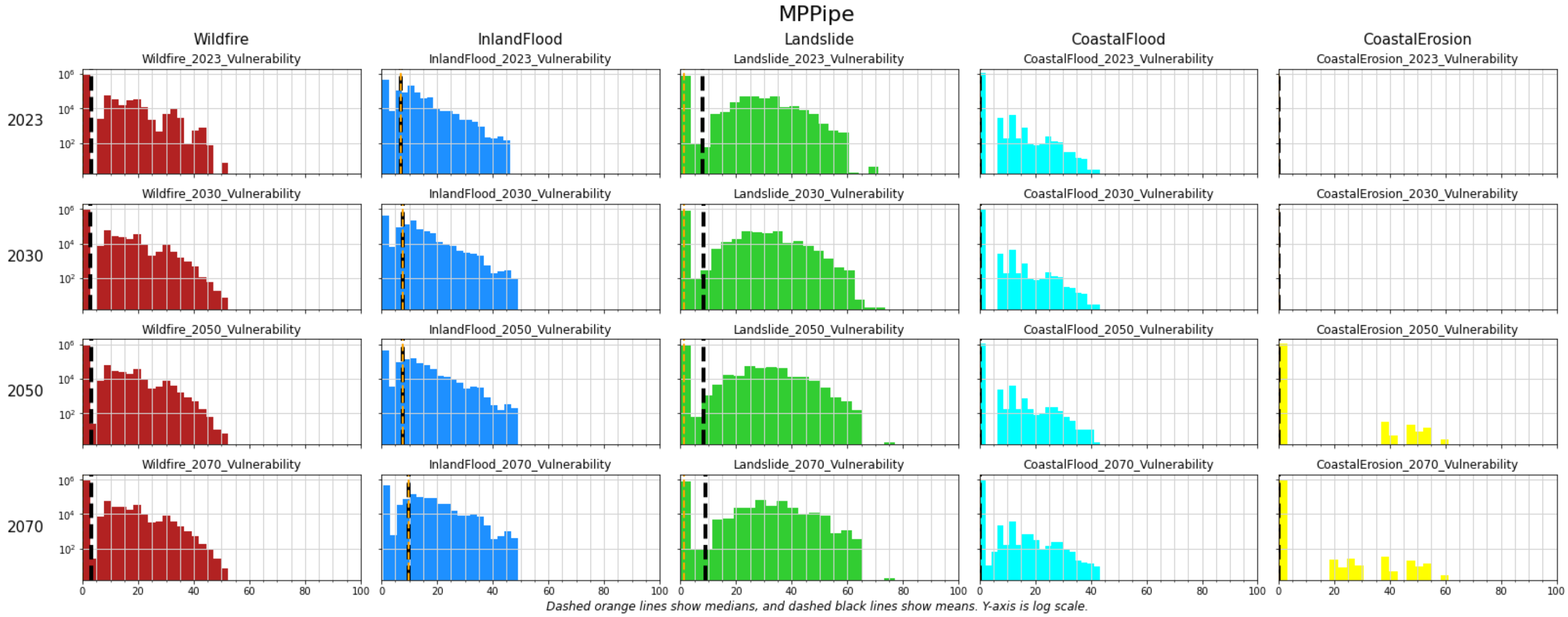


Table 4-7: Medium-Pressure Pipeline Distance-Weighted Mean Vulnerability Score by Hazard and Year

Year	Wildfire	Inland Flood	Landslide	Coastal Flood	Coastal Erosion
2023	3.808	7.330	10.298	0.075	0.000
2030	3.628	7.836	10.535	0.075	0.000
2050	3.660	8.065	10.855	0.078	0.006
2070	3.681	10.043	11.540	0.087	0.008

Figure 4-6: Medium-Pressure Pipeline Distance-Weighted Mean Vulnerability Score by Hazard and Year

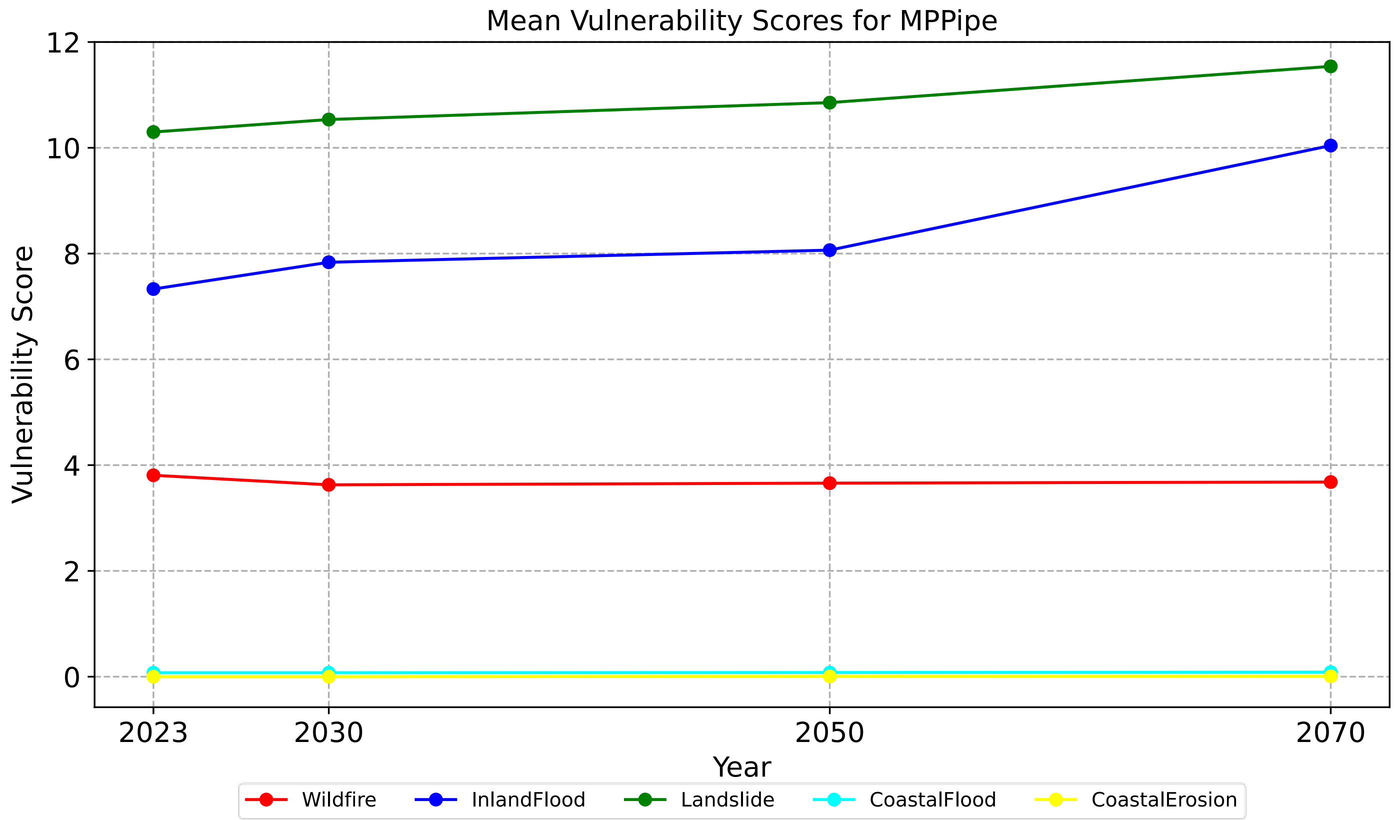


Figure 4-7: Medium-Pressure Service Pipeline Vulnerability Score Histograms by Hazard and Year

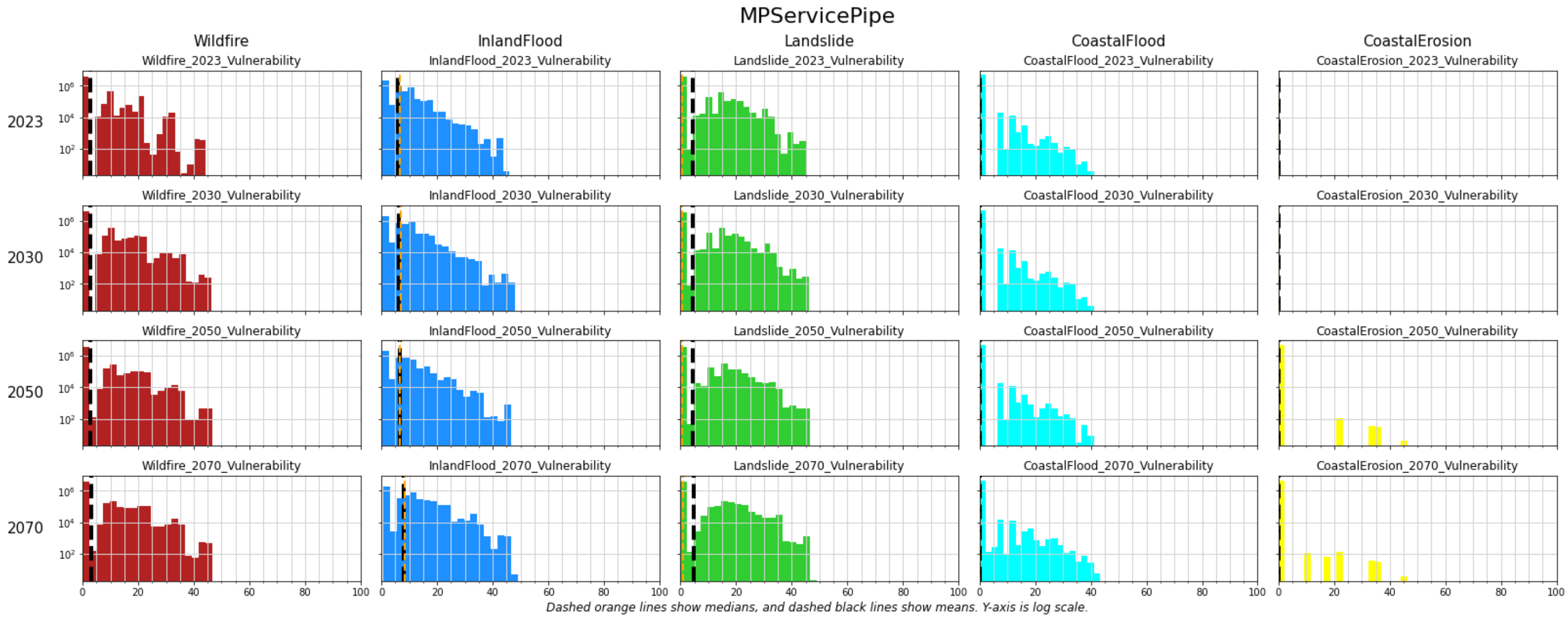


Table 4-8: Medium-Pressure Service Distance-Weighted Mean Pipeline Vulnerability Score by Hazard and Year

Year	Wildfire	Inland Flood	Landslide	Coastal Flood	Coastal Erosion
2023	2.776	6.000	4.430	0.067	0.000
2030	2.846	6.413	4.529	0.067	0.000
2050	2.942	6.617	4.676	0.070	0.002
2070	3.006	8.333	4.982	0.079	0.003

Figure 4-8: Medium-Pressure Service Pipeline Distance-Weighted Mean Vulnerability Score by Hazard and Year

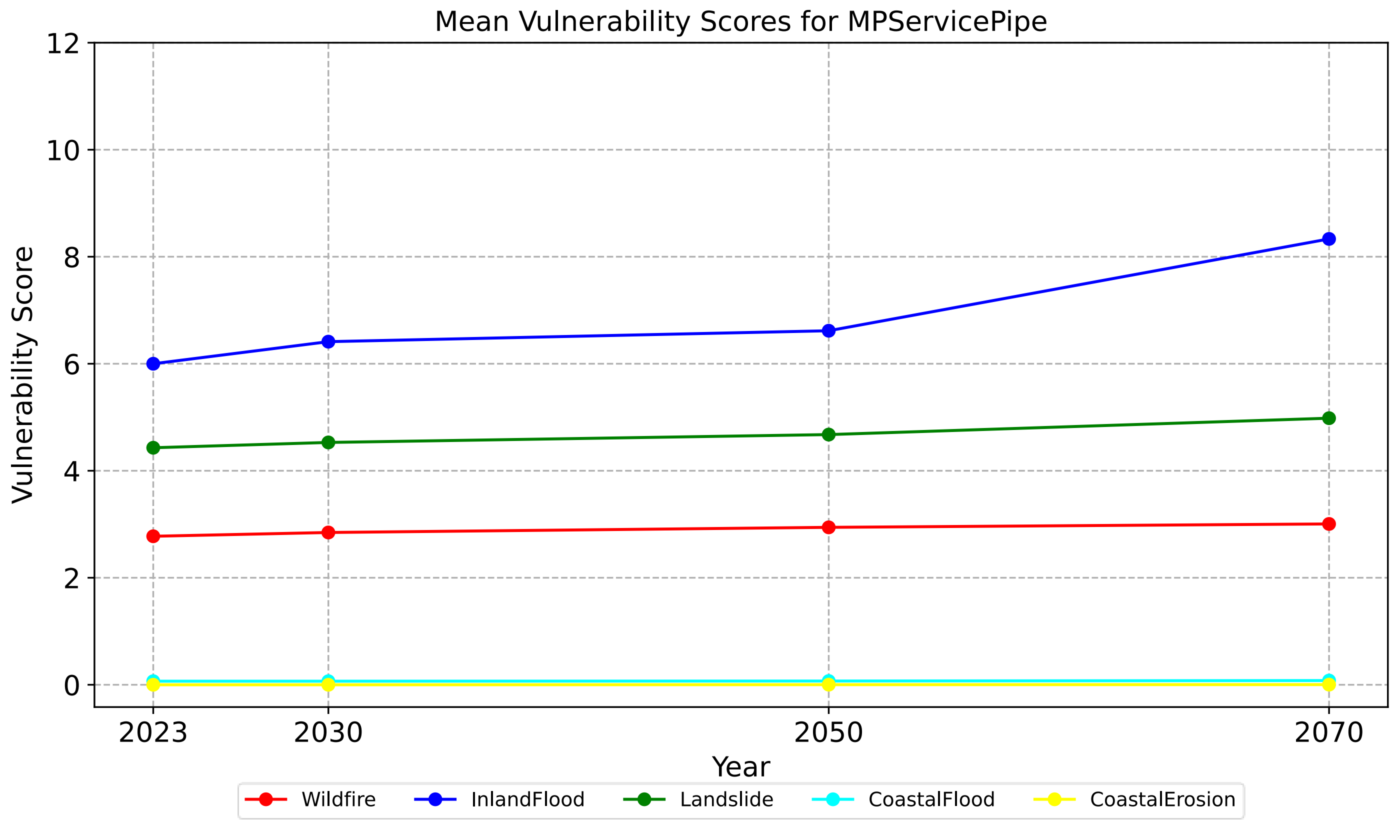


Figure 4-9: Controllable Gas Valve Vulnerability Score Histograms by Hazard and Year

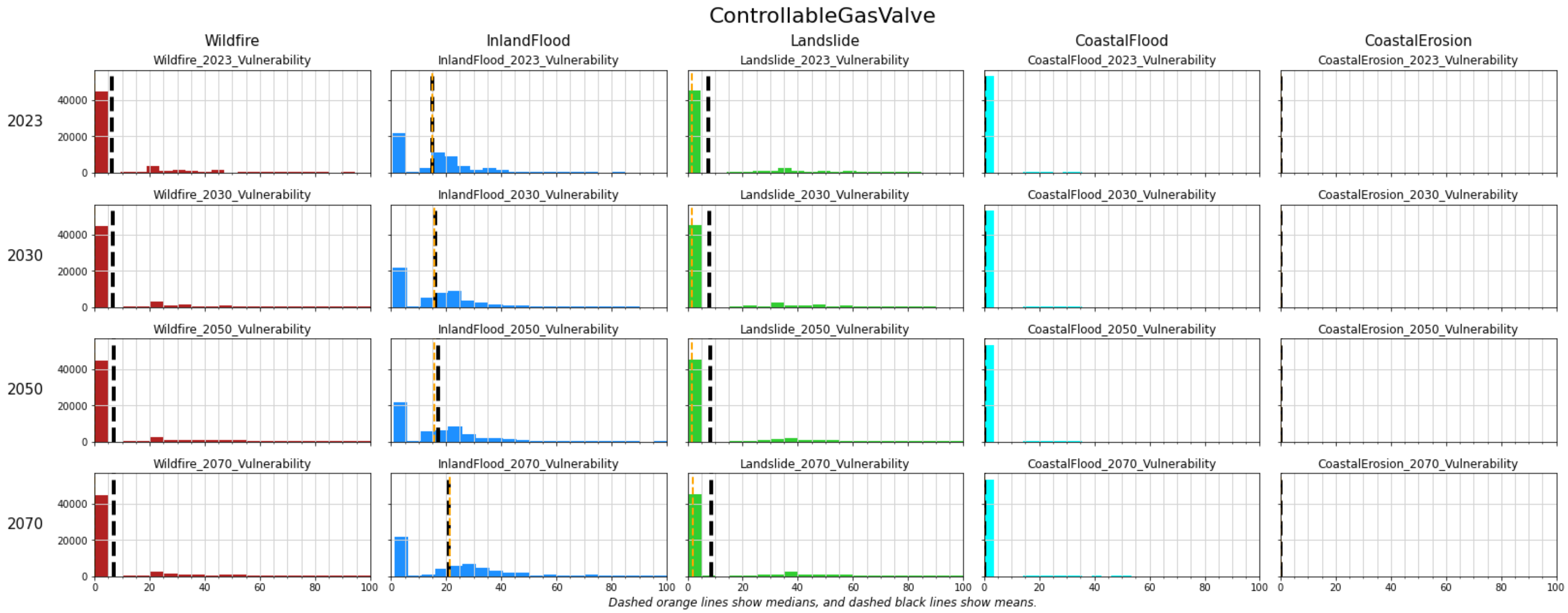


Table 4-9: Controllable Gas Valve Mean Vulnerability Score by Hazard and Year

Year	Wildfire	Inland Flood	Landslide	Coastal Flood	Coastal Erosion
2023	6.306	15.008	7.697	0.249	0.000
2030	6.594	15.997	7.897	0.249	0.000
2050	6.904	17.032	8.164	0.252	0.000
2070	7.049	20.823	8.628	0.267	0.000

Figure 4-10: Controllable Gas Valve Mean Vulnerability Score by Hazard and Year

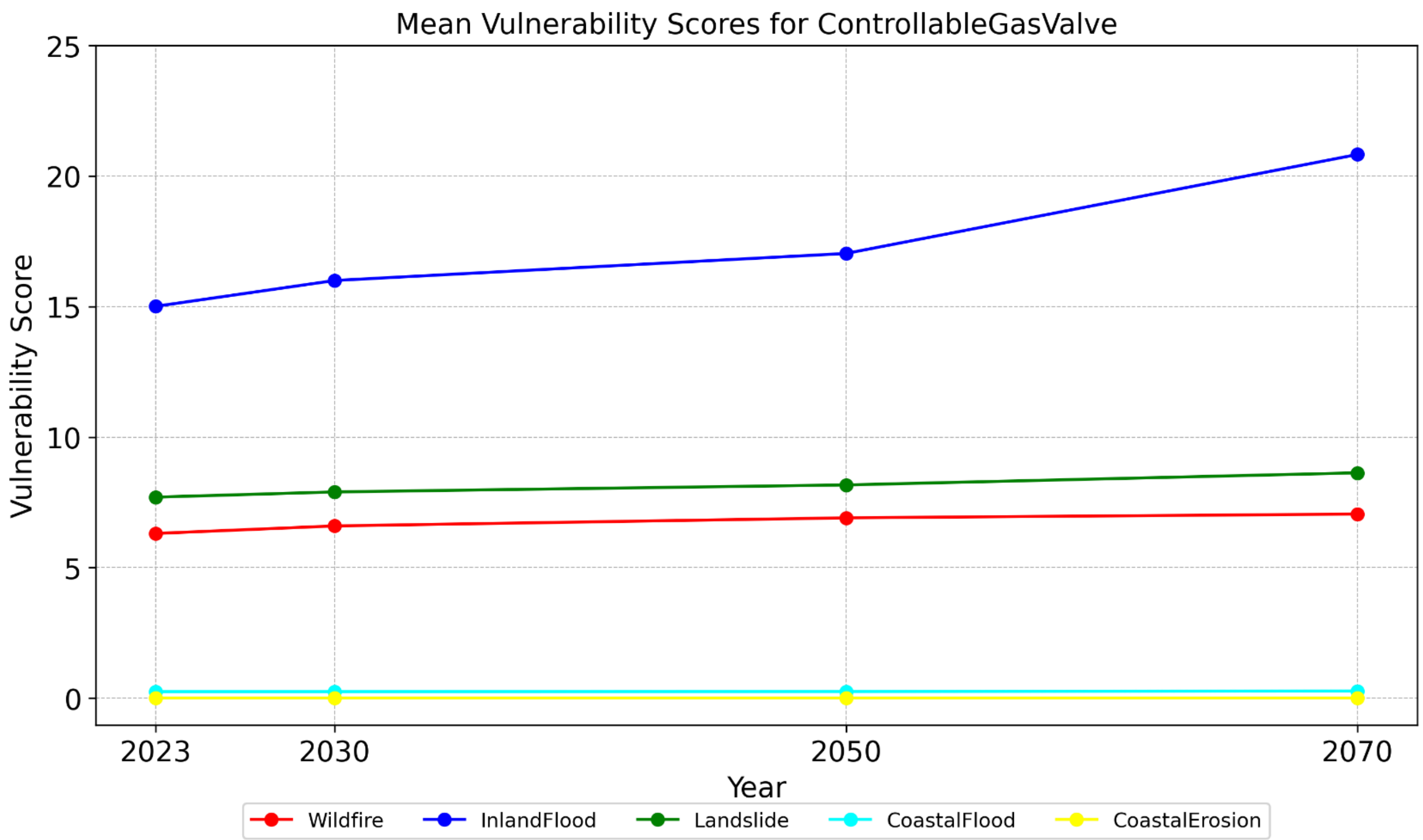


Figure 4-11: Non-Controllable Gas Valve Vulnerability Score Histograms by Hazard and Year

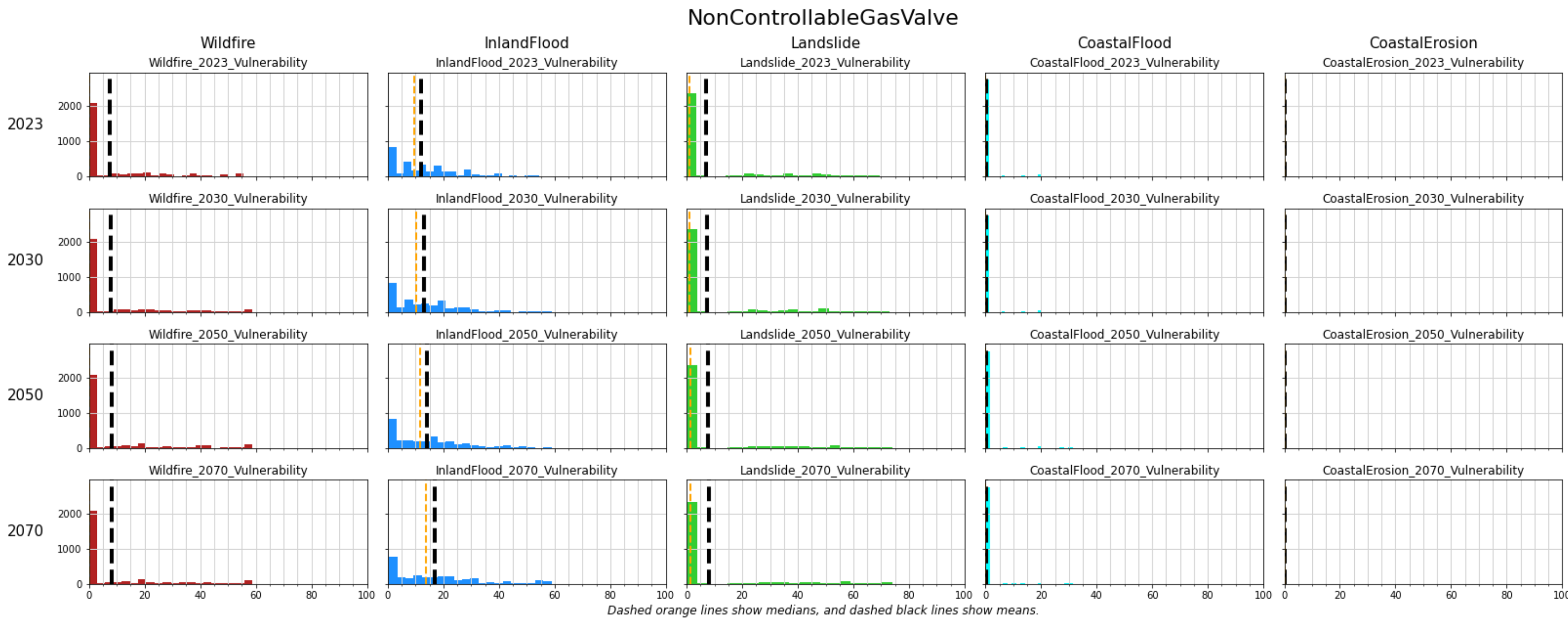


Table 4-10: Non-Controllable Gas Valve Mean Vulnerability Score by Hazard and Year

Year	Wildfire	Inland Flood	Landslide	Coastal Flood	Coastal Erosion
2023	7.364	12.048	7.148	0.352	0.000
2030	7.891	13.015	7.317	0.352	0.000
2050	8.204	14.239	7.591	0.360	0.000
2070	8.275	16.755	8.065	0.404	0.000

Figure 4-12: Non-Controllable Gas Valve Mean Vulnerability Score by Hazard and Year

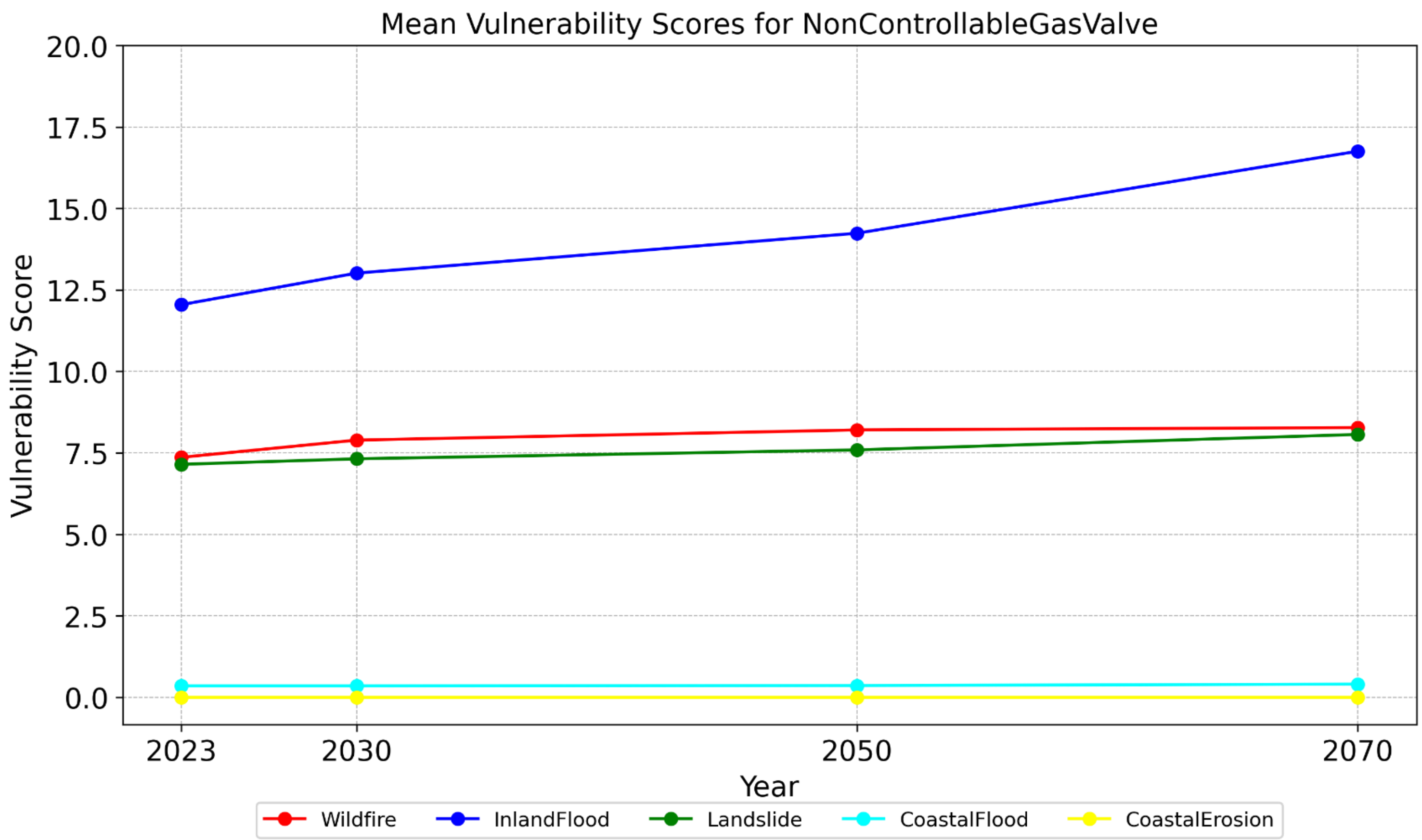


Figure 4-13: Regulator Vulnerability Score Histograms by Hazard and Year

Table 4-11: Regulator Vulnerability Score Histograms by Hazard and Year

Year	Wildfire	Inland Flood	Landslide	Coastal Flood	Coastal Erosion
2023	7.454	17.531	7.749	0.852	0.000
2030	7.978	19.032	7.924	0.852	0.000
2050	8.745	20.603	8.146	0.852	0.043
2070	9.401	24.489	8.549	0.865	0.043

Figure 4-14: Regulator Vulnerability Score Histograms by Hazard and Year

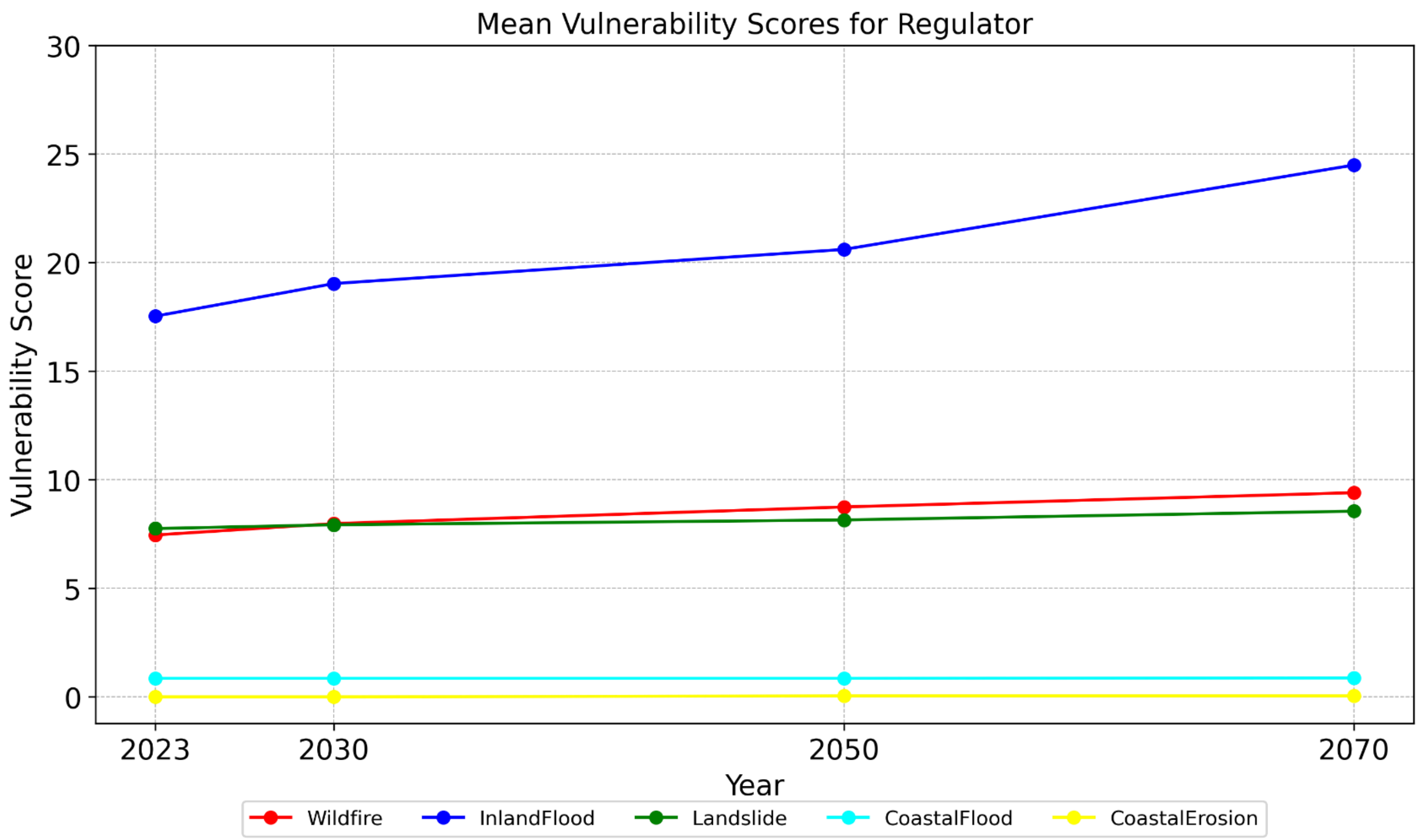


Figure 4-15: Facility Vulnerability Score Histograms by Hazard and Year

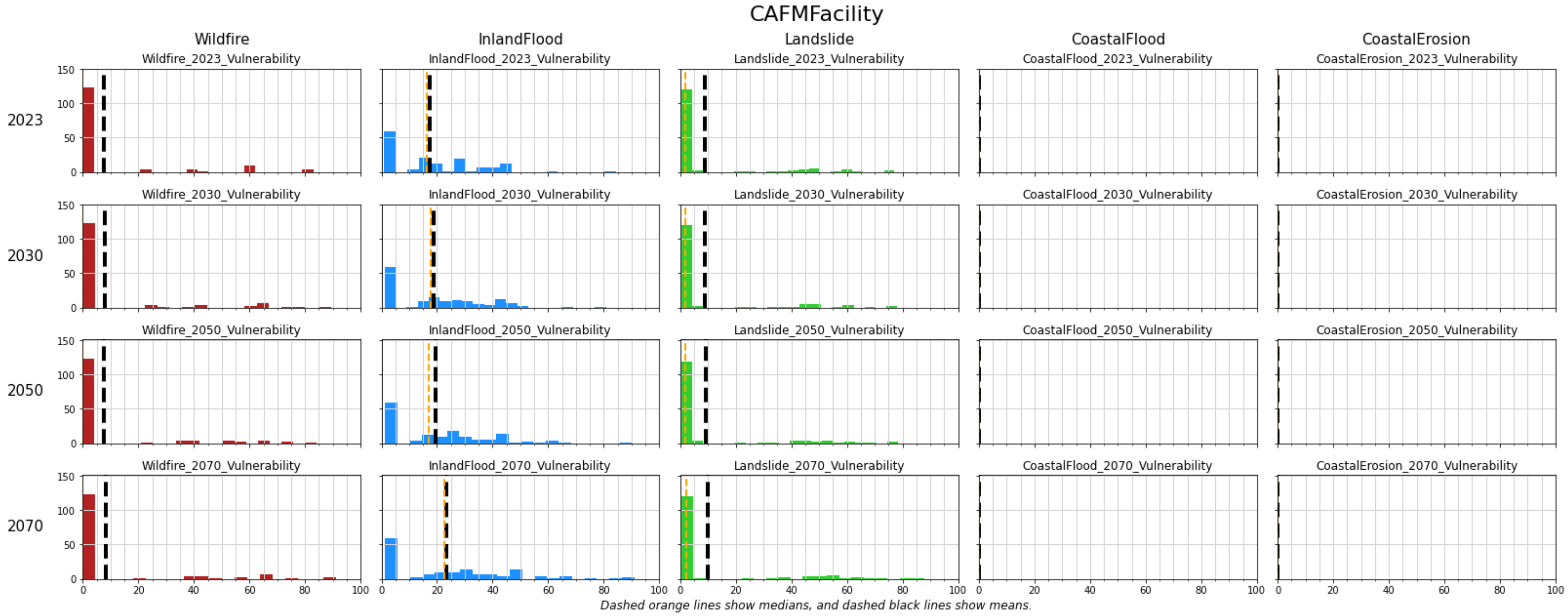


Table 4-12: Facility Mean Vulnerability Score by Hazard and Year

Year	Wildfire	Inland Flood	Landslide	Coastal Flood	Coastal Erosion
2023	7.555	17.442	8.866	0.000	0.000
2030	7.784	18.698	9.051	0.000	0.000
2050	7.606	19.359	9.298	0.000	0.000
2070	8.364	23.343	9.934	0.000	0.000

Figure 4-16: Facility Mean Vulnerability Score by Hazard and Year

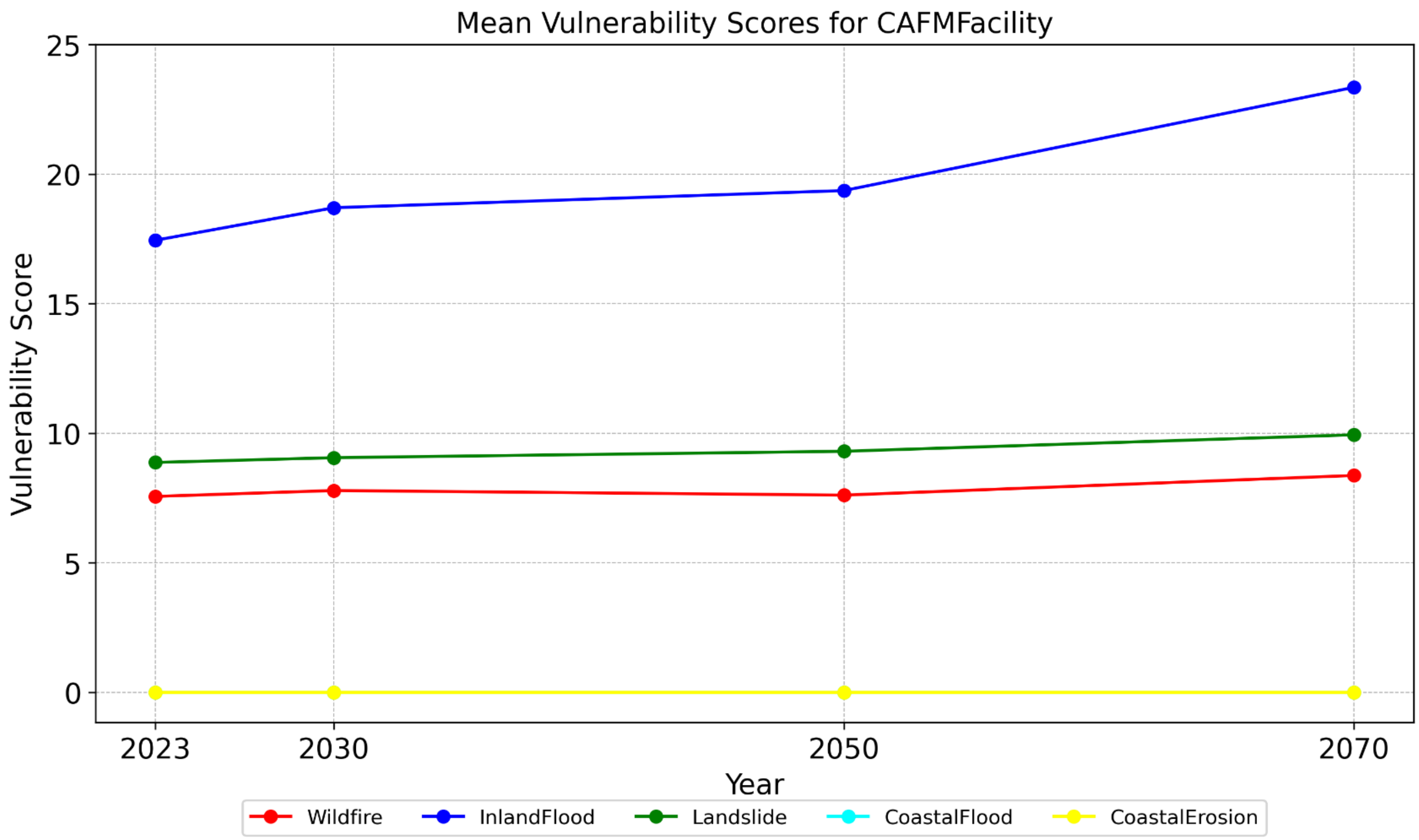


Figure 4-17: Compressor Station Vulnerability Score Histograms by Hazard and Year

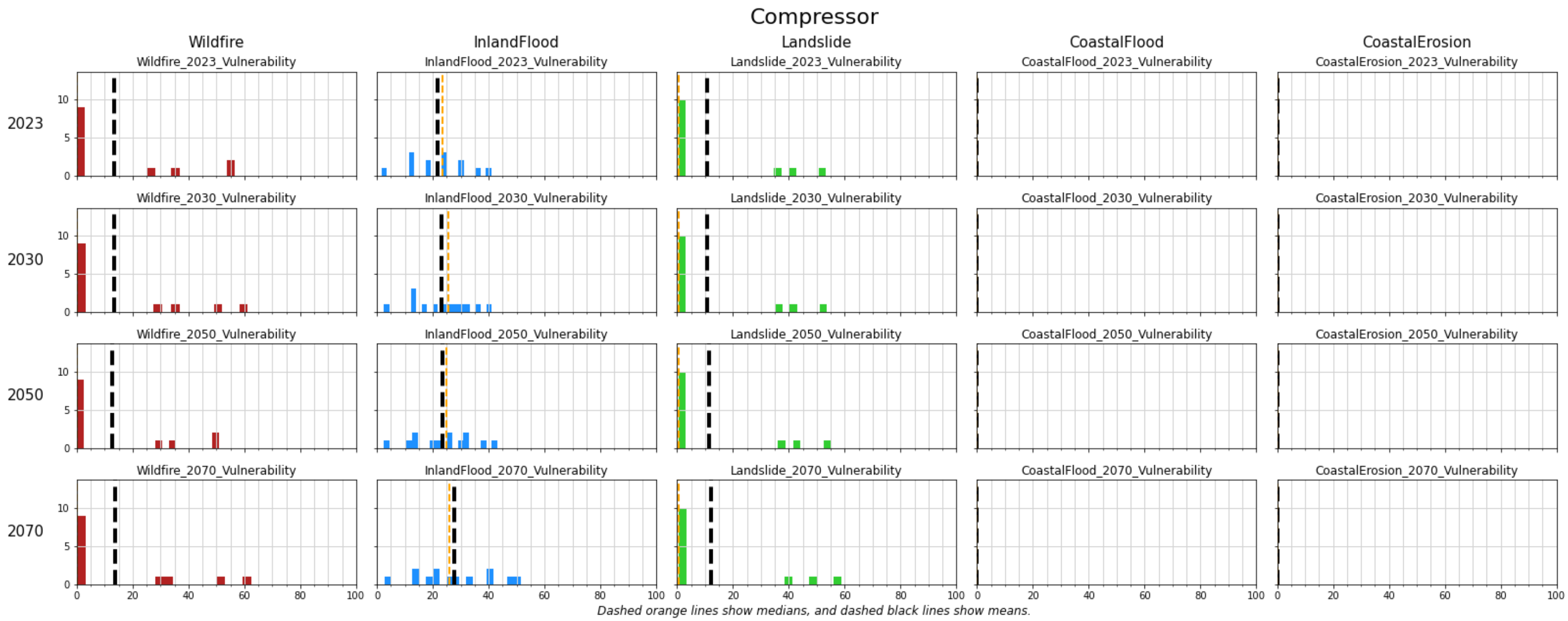


Table 4-13: Compressor Station Mean Vulnerability Score by Hazard and Year

Year	Wildfire	Inland Flood	Landslide	Coastal Flood	Coastal Erosion
2023	13.492	21.887	10.792	0.000	0.000
2030	13.437	23.180	10.892	0.000	0.000
2050	12.629	23.430	11.332	0.000	0.000
2070	13.544	27.649	12.272	0.000	0.000

Figure 4-18: Compressor Station Mean Vulnerability Score by Hazard and Year

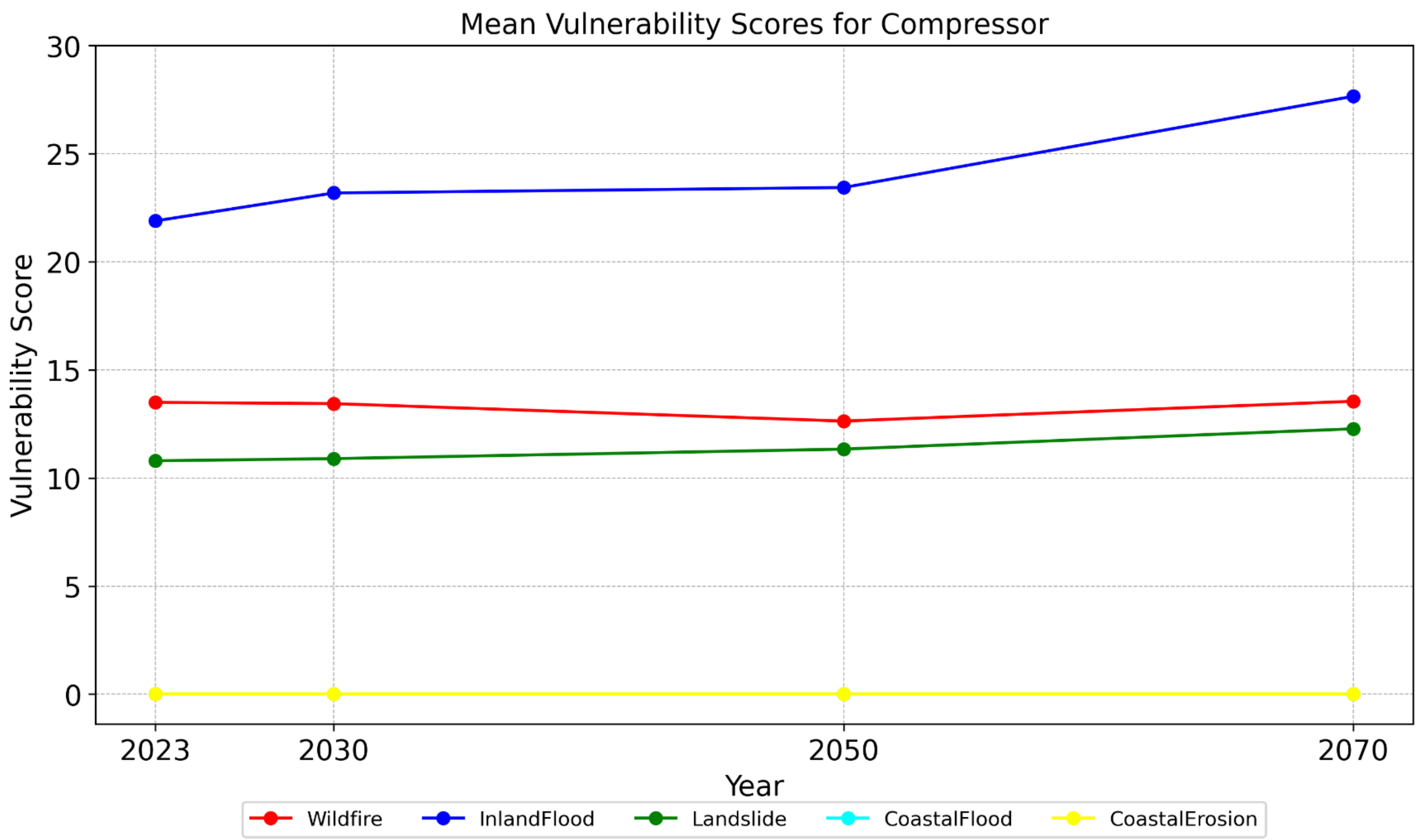


Figure 4-19: Storage Field Vulnerability Score Histograms by Hazard and Year

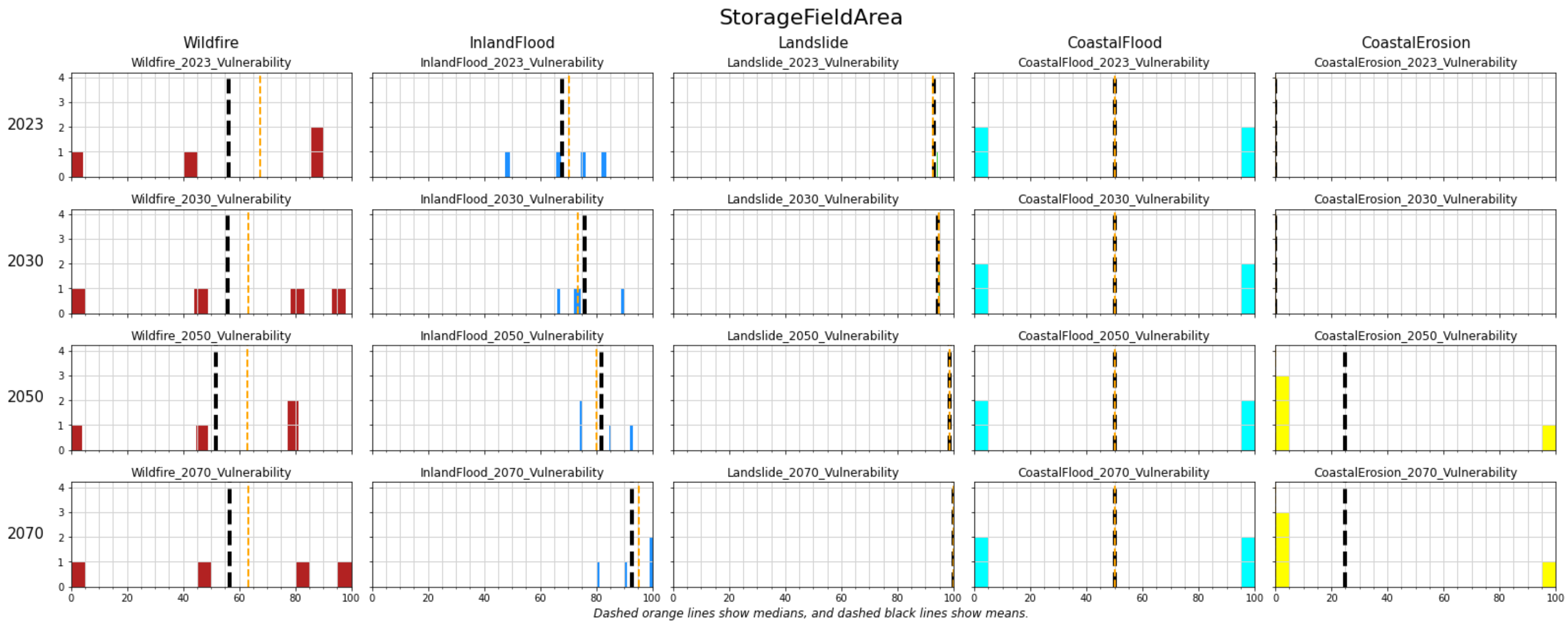
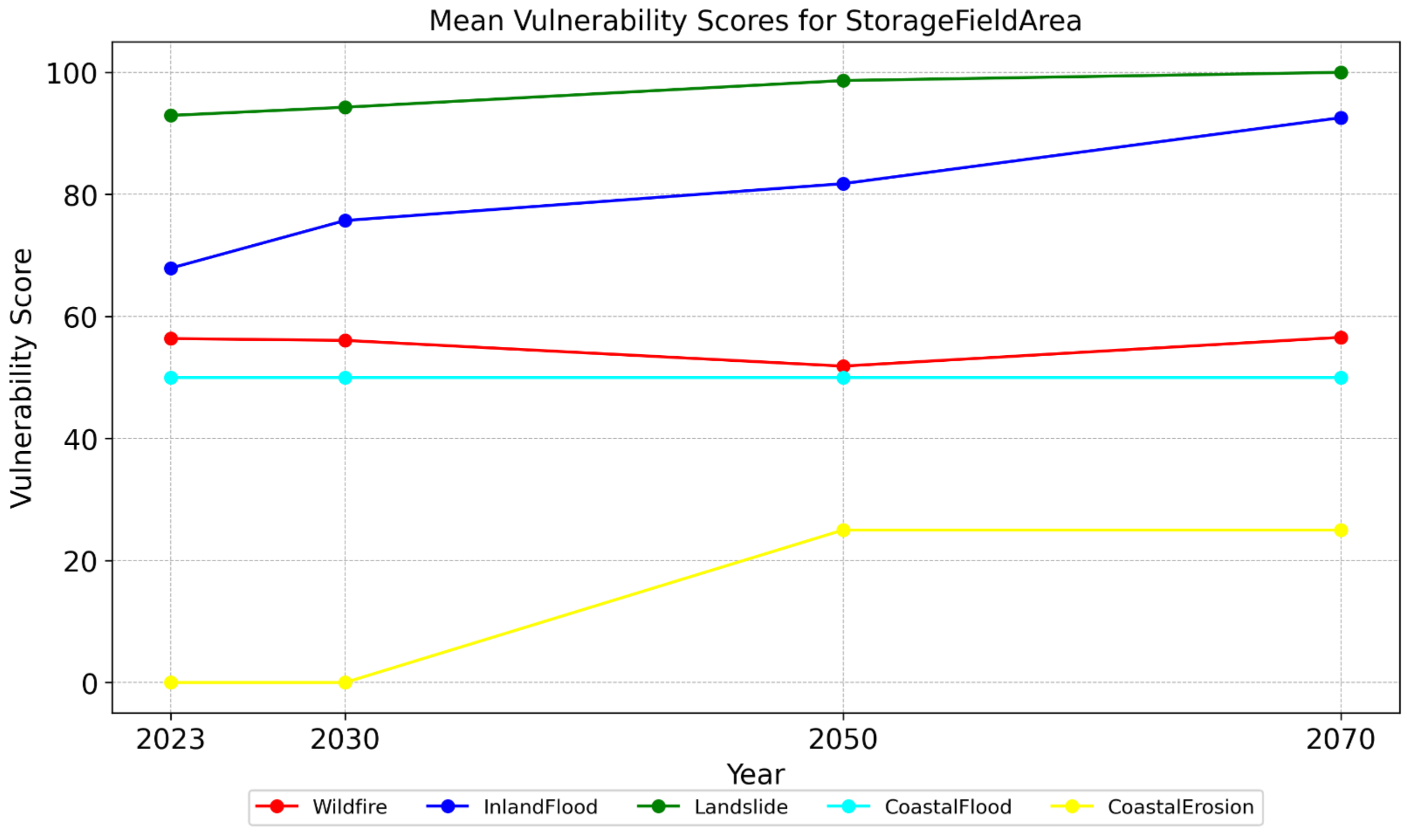


Table 4-14. Storage Field Mean Vulnerability Score by Hazard and Year

Year	Wildfire	Inland Flood	Landslide	Coastal Flood	Coastal Erosion
2023	56.368	67.907	92.935	50.000	0.000
2030	56.073	75.715	94.282	50.000	0.000
2050	51.856	81.757	98.653	50.000	25.000
2070	56.578	92.579	100.000	50.000	25.000

Figure 4-20: Storage Field Mean Vulnerability Score by Hazard and Year



Hazard Results by Asset Class

This section discusses the vulnerability scores organized by hazard and by asset class within each hazard. For each pairing of hazard and asset class, a table is provided to show the count (or length) and percent by vulnerability class for all assets and a breakout of assets in DVCs.

WILDFIRE

High-Pressure Pipelines

Of the almost 36 million linear feet of high-pressure pipelines, the majority received low (roughly 31 million), and roughly 5 million received moderate-low wildfire vulnerability scores in 2050 (see Table 4-15). About 730,000 feet received moderate scores, whereas a minimal amount received moderate-high scores, and none received high scores. Of the pipeline length receiving moderate scores, about 10,000 feet were located in DVCs.

Table 4-15: 2050 Vulnerability Scores: Wildfire, High-Pressure Pipelines

Vulnerability Class	Total Feet	Total %	DVC Feet	DVC %
Low	30,597,539	85.37%	17,270,095	96.39%
Moderate-Low	4,515,097	12.60%	637,225	3.56%
Moderate	727,655	2.03%	9,653	0.05%
Moderate-High	7	0.00%	0	0.00%
High	0	0.00%	0	0.00%

Several of the highest-scoring high-pressure pipelines are located in low-redundancy portions of the transmission networks, but are smaller branches rather than main lines. In the SoCalGas territory, some of the main lines or longer branches (over 30,000 feet) that received at least moderate wildfire vulnerability scores along some of their lengths include:

- Lines 1004 and 1005 in Santa Barbara and Ventura Counties parallel to the coast
- Line 1010 in western Santa Barbara County
- Line 1185 north of Cajon Junction
- Line 2025 between Santa Clarita and Kern River
- Line 235 West between Santa Clarita and Newberry Compressor Station
- Line 247 in Santa Barbara County parallel to the coast
- Line 325 between Oxnard and Santa Clarita
- Line 335 between Santa Clarita and Victorville
- Line 4000 between Anaheim and Newberry Compressor Station
- Lines 404 and 406 between Ventura and Encino
- Line 8109 between Oxnard and Cuyama

- Line SL-32-85 in the Acton Area
- Line SL-33-37 between Oak Park and Calabasas
- Lines SL-36-1032 and SL 36-9-04 in western Santa Barbara County
- Line SL-36-37 between Ventura and Oak Park
- Line SL 36-8-04 between Ventura and Ojai
- Line SL 42-54 in southern Orange County

Some notable segments of high-pressure pipelines that pass through DVCs and receive at least moderate wildfire vulnerability scores in 2050 include portions of Lines SL-41-16 and 4002 in Fontana; Line 214 in rural western Kings County; and Line 173 in rural western Kern County.

Figure 4-21 and Figure 4-22 show maps of wildfire vulnerability scores in 2023 and 2070; the bookends of the analysis period for high-pressure pipelines show the change in the spatial pattern of the vulnerability over time. Figure 4-23 and Figure 4-24 show the same results but only for the moderate, moderate-high, and high vulnerability assets.

High-Pressure Service Lines

Of the over 1.34 million linear feet of high-pressure service lines, the majority received low (roughly 1.25 million) wildfire vulnerability scores in 2050 (see Table 4-16). About 71,000 feet received moderate-low scores, and about 18,000 feet received moderate scores. None received moderate-high scores or high scores. Of the pipeline length receiving moderate scores, approximately 200 feet were located in DVCs. The spatial pattern of vulnerability scores for high-pressure service lines was similar to the spatial pattern for high-pressure pipelines.

Table 4-16: 2050 Vulnerability Scores: Wildfire, High-Pressure Service Lines

Vulnerability Class	Total Feet	Total %	DVC Feet	DVC %
Low	1,253,796	93.35%	783,799	99.17%
Moderate-Low	70,930	5.28%	6,350	0.80%
Moderate	18,429	1.37%	204	0.03%
Moderate-High	0	0.00%	0	0.00%
High	0	0.00%	0	0.00%

Medium-Pressure Pipelines

Of the almost 256 million linear feet of medium-pressure pipelines, the majority received low (roughly 242 million feet) wildfire vulnerability scores in 2050 (see Table 4-17). Roughly 14 million feet received moderate-low. About 125,000 feet received moderate scores, whereas none received moderate-high or high scores. Of the pipeline length receiving moderate scores, approximately 4,000 feet were located in DVCs.

Table 4-17: 2050 Vulnerability Scores: Wildfire, Medium-Pressure Pipelines

Vulnerability Class	Total Feet	Total %	DVC Feet	DVC %
Low	241,751,304	94.56%	73,618,479	99.27%
Moderate-Low	13,770,727	5.39%	537,735	0.73%
Moderate	124,895	0.05%	4,384	0.01%
Moderate-High	0	0.00%	0	0.00%
High	0	0.00%	0	0.00%

Notable clusters of moderate-scoring medium-pressure pipelines include the following:

- Many areas along the vegetated parts at the edges of Los Angeles Basin, where urbanized areas meet more mountainous wildlands (*i.e.*, Wildland Urban Interface)
- Some portions of the Ojai area
- Some portions of the Santa Clarita area
- Some portions of the Thousand Oaks and Agoura Hills area
- Some portions of the Simi Valley area
- Along the edges of the San Fernando Valley, such as in the Encino and Porter Ranch areas
- Along the communities at the southeastern edges of the Santa Monica Mountains, like Pacific Palisades and Beverly Glen
- Some portions of the Palos Verdes peninsula
- Anaheim Hills area and nearby communities
- Kinneloa Mesa area and nearby communities
- La Verne area and nearby communities
- Lake Arrowhead, Crestline, and nearby mountain communities
- Portions of Murrieta area

Medium-Pressure Service Lines

Of the approximately 228 million linear feet of medium-pressure service lines, the majority received low (roughly 217 million feet) wildfire vulnerability scores in 2050 (see Table 4-18). About 11 million feet received moderate-low scores, and about 72,000 feet received moderate scores. None received moderate-high scores or high scores. Of the pipeline length receiving moderate scores, approximately 3,000 feet were located in DVCs. The spatial pattern of vulnerability scores for medium-pressure service lines was similar to the spatial pattern for the medium-pressure pipelines.

Table 4-18: 2050 Vulnerability Scores: Wildfire, Medium-Pressure Service Lines

Vulnerability Class	Total Feet	Total %	DVC Feet	DVC %
Low	216,701,065	95.04%	69,720,535	99.45%
Moderate-Low	11,234,918	4.93%	380,379	0.54%
Moderate	72,161	0.03%	2,840	0.00%
Moderate-High	0	0.00%	0	0.00%
High	0	0.00%	0	0.00%

Controllable Gas Valves

Of the over 54,100 controllable gas valves, the majority received low (roughly 45,000) wildfire vulnerability scores in 2050 (see Table 4-19). About 5,400 received moderate-low scores, 2,300 received moderate scores, about 780 received moderate-high scores and about 560 received high scores. Of the controllable valves receiving moderate-high or high scores, approximately 130 were in DVCs.

Table 4-19: 2050 Vulnerability Scores: Wildfire, Controllable Gas Valves

Vulnerability Class	Total Count	Total %	DVC Count	DVC %
Low	45,038	83.20%	22,366	95.79%
Moderate-Low	5,424	10.02%	642	2.75%
Moderate	2,331	4.31%	210	0.90%
Moderate-High	778	1.44%	61	0.26%
High	562	1.04%	71	0.30%

Areas with notable clusters of moderate-high or high-scoring controllable gas valves in the SoCalGas territory included:

- Along the transmission lines that parallel the coast in Santa Barbara and Ventura Counties, such as Lines 1003 and 247
- In the mountains near the City of Ventura
- In the Santa Monica Mountains between Oxnard and San Fernando Valley
- Mountainous areas in and around Santa Clarita
- Along the transmission lines between Santa Clarita and the Central Valley, such as Lines 225 and 85 South
- Along the transmission lines between Santa Clarita and Palmdale, including Lines 235 West and 335
- Along the transmission lines through the Cajon Pass between Fontana and the Adelanto Compressor Station, including Lines 4000 and 4002

- Along the transmission lines in the San Jacinto Mountains and through the San Gorgonio Pass, including Lines 2000 and 5000(3)
- Along the transmission lines between Yorba Linda and Lake Elsinore, including Lines 2000 and SL-41-12
- Clusters of controllable gas valves with high 2050 wildfire scores in DVCs are located in both the Banning and Fontana areas

Non-Controllable Gas Valves

Of the approximately 2,800 non-controllable gas valves, the majority received low (roughly 2,400) wildfire vulnerability scores in 2050 (see Table 4-20). About 200 received moderate-low scores, and about 300 received moderate scores. None received moderate-high or high scores. Of the non-controllable valves receiving moderate scores, about 60 were in DVCs.

Table 4-20: 2050 Vulnerability Scores: Wildfire, Non-Controllable Gas Valves

Vulnerability Class	Total Count	Total %	DVC Count	DVC %
Low	2,353	83.44%	1,258	94.30%
Moderate-Low	194	6.88%	19	1.42%
Moderate	273	9.68%	57	4.27%
Moderate-High	0	0.00%	0	0.00%
High	0	0.00%	0	0.00%

Compressor Stations

Of the 13 compressor stations, most received low (nine) wildfire vulnerability scores in 2050 (see Table 4-21). Two received moderate-low scores.

Table 4-21: 2050 Vulnerability Scores: Wildfire, Compressor Stations

Vulnerability Class	Total Count	Total %	DVC Count	DVC %
Low	9	69.23%	6	100.00%
Moderate-Low	2	15.38%	0	0.00%
Moderate	2	15.38%	0	0.00%
Moderate-High	0	0.00%	0	0.00%
High	0	0.00%	0	0.00%

Two compressor stations received moderate scores: Honor Rancho and Aliso Canyon. Neither of these are located in DVCs.

No compressor stations received moderate-high or high scores for wildfire.

Regulator Stations

Of the over 10,900 regulator stations, the majority received either low (roughly 8,600) or moderate-low (roughly 1,300) wildfire vulnerability scores in 2050 (see Table 4-22). About 700 received moderate scores, about 300 received moderate-high scores, and seven received high scores. Of the regulator stations receiving moderate-high or high scores, 22 were in DVCs.

Table 4-22: 2050 Vulnerability Scores: Wildfire, Regulator Stations

Vulnerability Class	Total Count	Total %	DVC Count	DVC %
Low	8,588	78.67%	4,796	96.13%
Moderate-Low	1,333	12.21%	122	2.45%
Moderate	696	6.38%	49	0.98%
Moderate-High	293	2.68%	22	0.44%
High	7	0.06%	0	0.00%

Areas with notable clusters of moderate-high or high-scoring regulator stations in the SoCalGas territory included:

- Southern Santa Barbara County in the corridor between the coast and Santa Ynez Mountains, including some along Lines 247, 1005, 1003
- Along Line 324 in the mountains between Oxnard and Santa Clarita
- Mountainous areas in and around Santa Clarita
- In the mountainous areas along Lines SL 36-37 and SL 33-37 near Oak Park and Calabasas
- Along SL 37-04 parallel to the coast east of Malibu
- Along the transmission lines between Santa Clarita and Palmdale including Lines 235 West and 335, and SL 32-85
- Along the transmission lines between the Central Valley and Tehachapi, including Line SL 32-116-2
- Along and near Line SL 36-1032 in the Lompoc area
- In the Lake Arrowhead area
- In the Fontana and Cajon Canyon area, including along lines 4000 and 4002

Storage Fields

Two of the four storage fields received high wildfire vulnerability scores in 2050—Honor Rancho and Aliso Canyon (see Table 4-23). These high scores were driven by high exposure to current and projected future wildfire and the high consequence to the overall system when these assets are affected. Playa Del Rey received a moderate score and Goleta received a low score.

Even though Goleta is the only storage field physically in a DVC, all storage fields are crucial to the serviceability of gas to all DVCs.

Table 4-23: 2050 Vulnerability Scores: Wildfire, Storage Fields

Vulnerability Class	Total Count	Total %	DVC Count	DVC %
Low	1	25.00%	1	100.00%
Moderate-Low	0	0.00%	0	0.00%
Moderate	1	25.00%	0	0.00%
Moderate-High	0	0.00%	0	0.00%
High	2	50.00%	0	0.00%

Facilities

Of the over 140 facilities, the majority received low (roughly 120) wildfire vulnerability scores in 2050 (see Table 4-24), 6 received moderate-low scores, 9 received moderate scores, 5 received moderate-high scores and one received a high score. Of the facilities receiving moderate-high or high scores, none were in DVCs.

Table 4-24: 2050 Vulnerability Scores: Wildfire, Facilities

Vulnerability Class	Total Count	Total %	DVC Count	DVC %
Low	123	85.42%	74	98.67%
Moderate-Low	6	4.17%	0	0.00%
Moderate	9	6.25%	1	1.33%
Moderate-High	5	3.47%	0	0.00%
High	1	0.69%	0	0.00%

Areas with notable moderate-high or high-scoring facilities in the SoCalGas region included:

- Rim Forest Base Building 01 (the only facility with a high 2050 wildfire score)
- Aliso Canyon Building 01
- Honor Rancho Station
- Blue Ridge Communication Site
- Mount David Communication Site
- Sunset Ridge Communication Site

Figure 4-21: Wildfire Vulnerability Scores, 2023, High-Pressure Pipelines

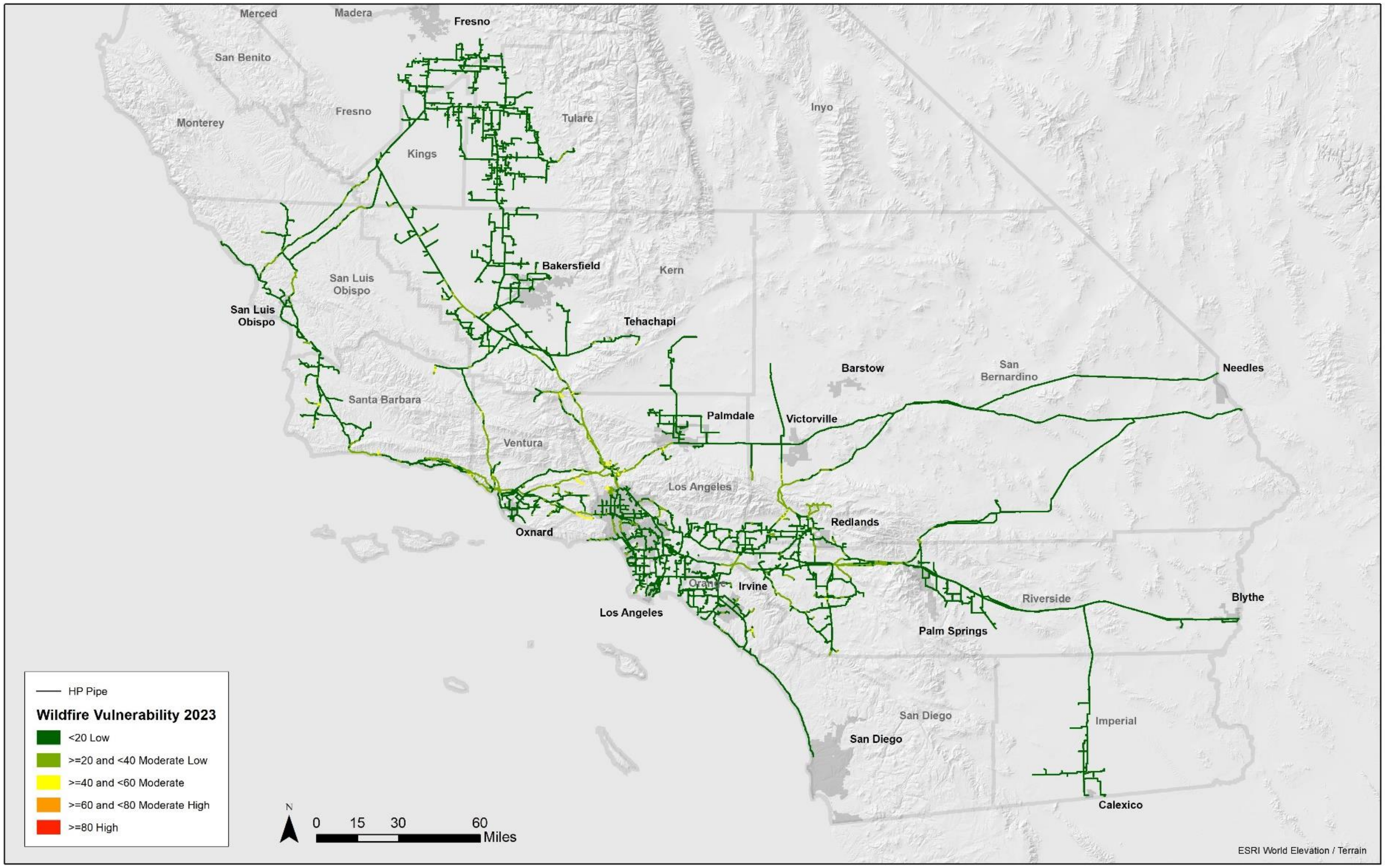


Figure 4-22: Wildfire Vulnerability Scores, 2070, High-Pressure Pipelines

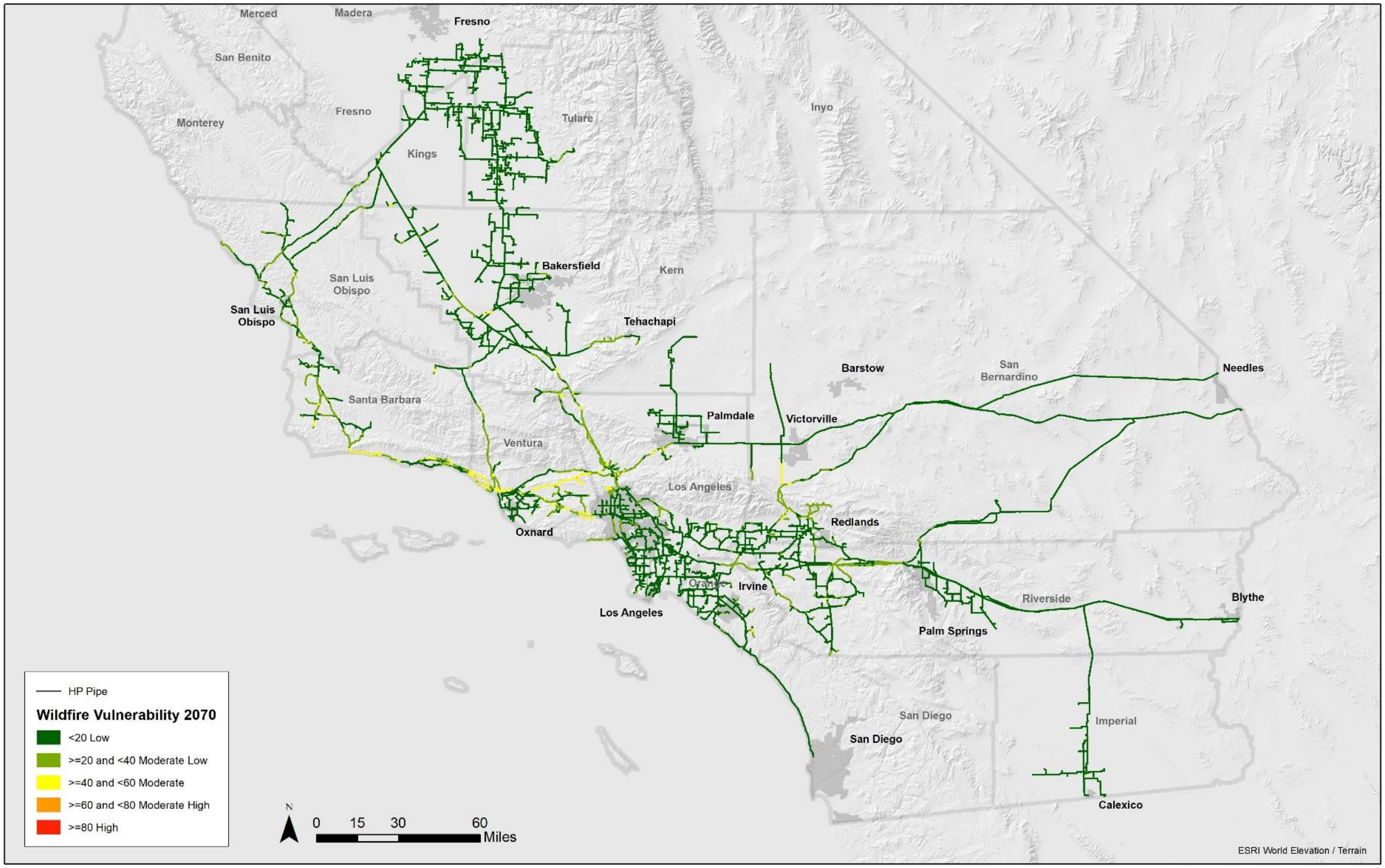


Figure 4-23: Wildfire Vulnerability Scores, 2023, High-Pressure Pipelines (Moderate, Moderate-High and High Vulnerability Assets)

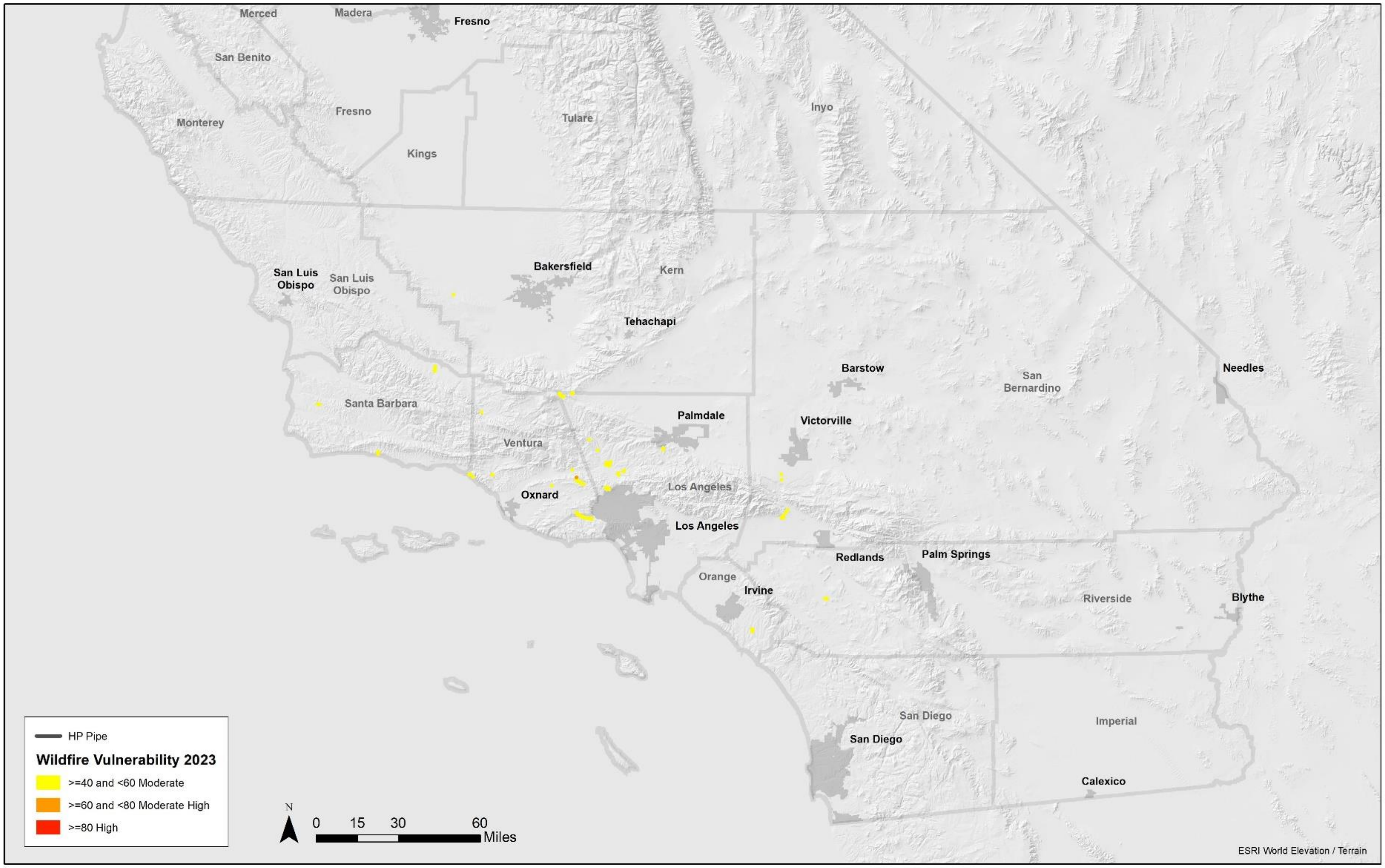
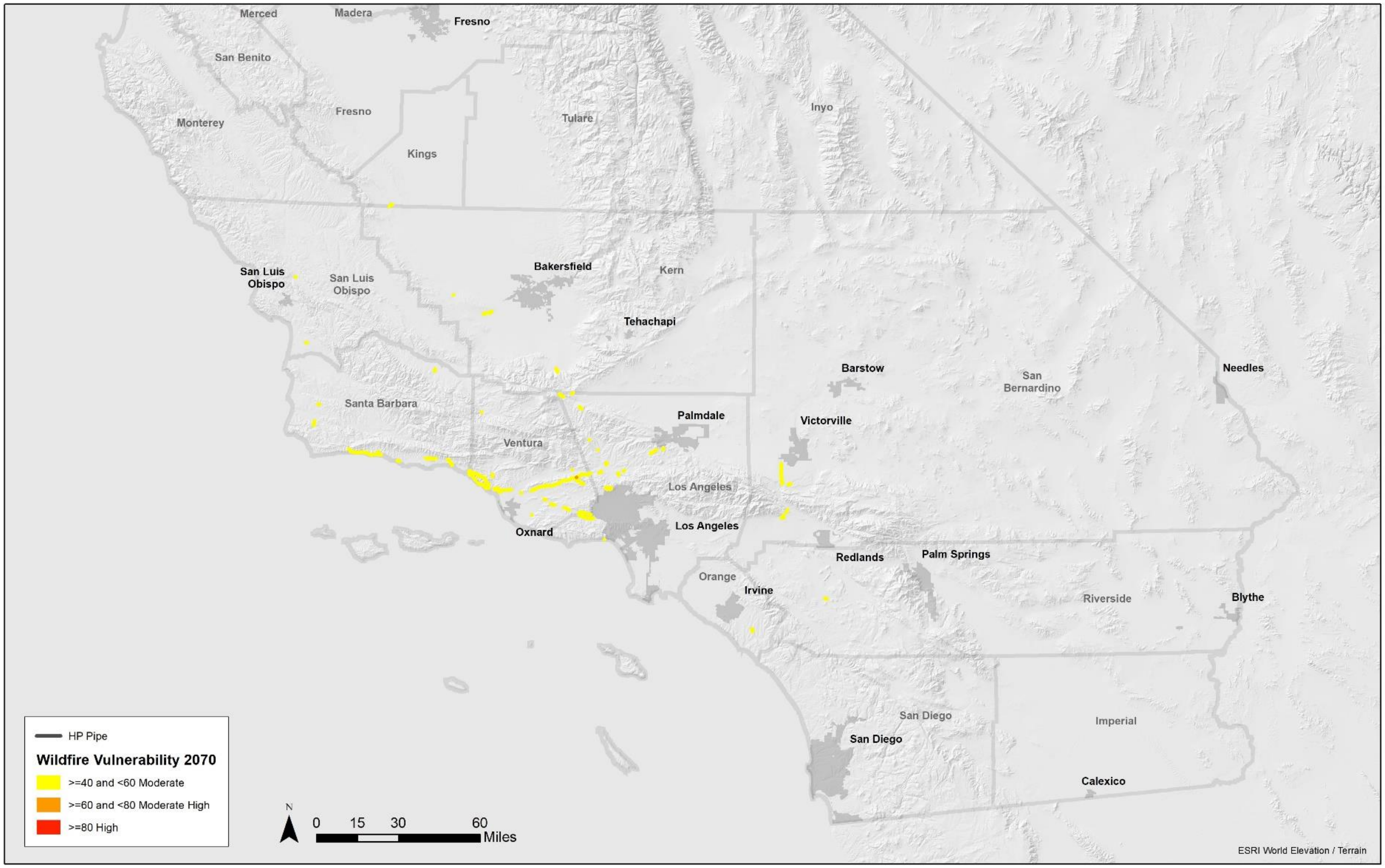


Figure 4-24: Wildfire Vulnerability Scores, 2070, High-Pressure Pipelines (Moderate, Moderate-High and High Vulnerability Assets)



INLAND FLOODING

High-Pressure Pipelines

Of the almost 36 million linear feet of high-pressure pipelines, the majority received either low (roughly 21 million feet) or moderate-low (roughly 12 million feet) inland flooding vulnerability scores in 2050 (see Table 4-25). Over 3 million feet received moderate scores, and about 100,000 feet received moderate-high scores. None received high scores. Of the pipeline length receiving moderate-high scores, approximately 40,000 feet were located in DVCs.

Table 4-25: 2050 Vulnerability Scores: Inland Flooding, High-Pressure Pipelines

Vulnerability Class	Total Feet	Total %	DVC Feet	DVC %
Low	20,454,430	57.07%	12,326,078	68.80%
Moderate-Low	11,887,084	33.17%	4,791,802	26.74%
Moderate	3,388,188	9.45%	755,823	4.22%
Moderate-High	110,597	0.31%	43,269	0.24%
High	0	0.00%	0	0.00%

Several of the highest-scoring high-pressure pipelines are located in low-redundancy portions of the transmission networks but are smaller branches rather than main lines. In the SoCalGas territory, some of the main lines or longer branches (over 30,000 feet) that received at least moderate-high inland flooding vulnerability scores along some of their lengths include:

- Line 8109 between Oxnard and Cuyama
- Line SL 32-116-2 and SL 38-116-1 between Wheeler Ridge and Tehachapi
- Lines SL 38-250, 7055, and 7056 branch from the southwestern portion of Central Valley extending into the nearby mountains; most of these are in DVCs
- Lines SL-36-1032, SL-36-9-18, and SL-36-9-04 in western Santa Barbara County
- Line SL 36-8-04 between Ventura and Ojai
- Line SL 38-174 near Frazier Park

Figure 4-25 and Figure 4-26 which appear further below show maps of inland flooding vulnerability scores in 2023 and 2070, the bookends of the analysis period, for high-pressure pipelines, and show the change in spatial pattern of the vulnerability over time. Figure 4-27 and Figure 4-28 show the same results but only the moderate, moderate-high, and high vulnerability assets.

High-Pressure Service Lines

Of the over 1.34 million linear feet of high-pressure service lines, the majority received low (roughly 1.19 million) inland flooding vulnerability scores in 2050 (see Table 4-26). Approximately 138,000 feet received moderate-low scores, and approximately 18,000 feet received moderate scores. None received moderate-high scores or high scores. Of the pipeline length receiving moderate scores, about 3,200 feet were located in DVCs. The spatial pattern of vulnerability scores for high-pressure service lines was similar to the spatial pattern for high-pressure pipelines.

Table 4-26: 2050 Vulnerability Scores: Inland Flooding, High-Pressure Service Lines

Vulnerability Class	Total Feet	Total %	DVC Feet	DVC %
Low	1,187,374	88.40%	748,157	94.66%
Moderate-Low	137,458	10.23%	39,037	4.94%
Moderate	18,324	1.36%	3,159	0.40%
Moderate-High	0	0.00%	0	0.00%
High	0	0.00%	0	0.00%

Medium-Pressure Pipelines

Of the almost 256 million linear feet of medium-pressure pipelines, the majority received low (roughly 240 million feet) inland flooding vulnerability scores in 2050 (see Table 4-27). About 15 million feet received moderate-low scores, and about 243,000 feet received moderate scores. None received moderate-high or high scores. Of the pipeline length receiving moderate scores, approximately 23,000 feet were located in DVCs.

Table 4-27: 2050 Vulnerability Scores: Inland Flooding, Medium-Pressure Pipelines

Vulnerability Class	Total Feet	Total %	DVC Feet	DVC %
Low	240,472,277	94.06%	71,925,871	96.99%
Moderate-Low	14,931,204	5.84%	2,211,945	2.98%
Moderate	243,446	0.10%	22,782	0.03%
Moderate-High	0	0.00%	0	0.00%
High	0	0.00%	0	0.00%

Notable clusters of moderate-scoring medium-pressure pipelines include the following:

- Some portions of the Central Coast region in western San Luis Obispo and Santa Barbara counties, such as in Atascadero, Arroyo Grande, and Lompoc
- Some portions of the greater Santa Barbara area

- Clusters of assets in the San Antonio Creek and Ventura River watersheds, including in Ojai, Mira Monte areas
- Some portions of Thousand Oaks and Casa Conejo
- Clusters of assets in the Simi Valley and Moorpark areas
- Clusters of assets in the greater Santa Clarita area
- Some portions along the northeastern edge of Los Angeles basin, such as in Sunland, Pasadena, Sierra Madre, and La Verne
- Some portions in San Bernardino County just south of Cajon Pass
- Some portions in the San Gorgonio area
- Some portions of Lake Elsinore, Murietta, and Temecula area
- Some portions in the Tehachapi area
- Some portions in the Frazier Park area

Medium-Pressure Service Lines

Of the approximately 228 million linear feet of medium-pressure service lines, the majority received low (roughly 221 million feet) inland flooding vulnerability scores in 2050 (see Table 4-28). About 7 million feet received moderate-low scores. About 80,000 feet received moderate scores, whereas none received moderate-high scores or high scores. Of the pipeline length receiving moderate scores, approximately 1,600 feet were located in DVCs. The spatial pattern of vulnerability scores for medium-pressure service lines was similar to the spatial pattern for the medium-pressure pipelines.

Table 4-28: 2050 Vulnerability Scores: Inland Flooding, Medium-Pressure Service Lines

Vulnerability Class	Total Feet	Total %	DVC Feet	DVC %
Low	221,072,498	96.96%	69,438,278	99.05%
Moderate-Low	6,850,890	3.00%	663,891	0.95%
Moderate	84,757	0.04%	1,586	0.00%
Moderate-High	0	0.00%	0	0.00%
High	0	0.00%	0	0.00%

Controllable Gas Valves

Of the over 54,100 controllable gas valves, the majority received either low (roughly 32,400) or moderate-low (roughly 17,300) inland flooding vulnerability scores in 2050 (see Table 4-29). Approximately 3,300 received moderate scores, approximately 900 received moderate-high scores, and approximately 200 received high scores. Of the controllable valves receiving moderate-high or high scores, approximately 130 were in DVCs.

Table 4-29: 2050 Vulnerability Scores: Inland Flooding, Controllable Gas Valves

Vulnerability Class	Total Count	Total %	DVC Count	DVC %
Low	32,447	59.94%	14,830	63.51%
Moderate-Low	17,289	31.94%	7,663	32.82%
Moderate	3,302	6.10%	726	3.11%
Moderate-High	925	1.71%	109	0.47%
High	170	0.31%	22	0.09%

Areas with notable clusters of moderate-high or high-scoring controllable gas valves in the SoCalGas territory included:

- Along the transmission lines that parallel the coast in Santa Barbara and Ventura Counties, such as Lines 1003 and 247
- In the mountains near the City of Ventura
- In the Santa Monica Mountains between Oxnard and San Fernando Valley
- Mountainous areas in and around Santa Clarita
- Along the transmission lines between Santa Clarita and the Central Valley, such as Lines 225 and 85 South
- Along the transmission lines between Santa Clarita and Palmdale, including Lines 235 West and 335
- South of, through, and north of the Cajon Pass area
- Along the transmission lines in the San Jacinto Mountains and through the San Gorgonio Pass, including Lines 2000 and 5000(3)
- Along the transmission lines between Morongo Valley and Joshua Tree, including Lines 6916 and SL 41-54
- Assets in various portions of Central Coast region in western San Luis Obispo and Santa Barbara counties
- Assets along the western and southern edge of the Central Valley

Non-Controllable Gas Valves

Of the approximately 2,800 non-controllable gas valves, the majority received either low (roughly 2,000) or moderate-low (roughly 600) inland flooding vulnerability scores in 2050 (see Table 4-30). About 200 received moderate scores, and none received moderate-high or high scores. Of the non-controllable valves receiving moderate scores, about 30 were in DVCs.

Table 4-30: 2050 Vulnerability Scores: Inland Flooding, Non-Controllable Gas Valves

Vulnerability Class	Total Count	Total %	DVC Count	DVC %
Low	2,032	72.06%	1,092	81.86%
Moderate-Low	598	21.21%	214	16.04%
Moderate	190	6.74%	28	2.10%
Moderate-High	0	0.00%	0	0.00%
High	0	0.00%	0	0.00%

Compressor Stations

Of the 13 compressor stations, most received low (five) or moderate-low (seven) inland flooding vulnerability scores in 2050. Aliso Canyon received a moderate score (see Table 4-31). Aliso Canyon is not located in a DVC.

Table 4-31: 2050 Vulnerability Scores: Inland Flooding, Compressor Stations

Vulnerability Class	Total Count	Total %	DVC Count	DVC %
Low	5	38.46%	4	66.67%
Moderate-Low	7	53.85%	2	33.33%
Moderate	1	7.69%	0	0.00%
Moderate-High	0	0.00%	0	0.00%
High	0	0.00%	0	0.00%

Regulator Stations

Of the over 10,900 regulator stations, the majority received either low (roughly 5,500) or moderate-low (roughly 4,-00) inland flooding vulnerability scores in 2050 (see Table 4-32). About 900 received moderate scores, about 500 received moderate-high scores and nine received high scores. Of the regulator stations receiving moderate-high or high scores, 35 were in DVCs.

Table 4-32: 2050 Vulnerability Scores: Inland Flooding, Regulator Stations

Vulnerability Class	Total Count	Total %	DVC Count	DVC %
Low	5,549	50.83%	2,817	56.46%
Moderate-Low	3,989	36.54%	1,908	38.24%
Moderate	884	8.10%	229	4.59%
Moderate-High	486	4.45%	34	0.68%
High	9	0.08%	1	0.02%

Areas with notable clusters of moderate-high or high-scoring regulator stations in the SoCalGas territory included:

- In rural western Santa Barbara County, such as along Lines 1010, SL 36-1032, and SL 36-9-22
- In northern Kings County near Lemoore
- Between Tehachapi and Wheeler Ridge
- At the southern end of the Central Valley in the Di Gorgio and Arvin areas
- In the Frazier Park area
- In the Santa Clarita area
- In the river valleys in southern Ventura County, such as Santa Clara River and the Arroyo Simi
- Many regulator stations along the coast between Malibu and Santa Monica along Line SL 37-04
- In the area at the southern end of Cajon Pass
- In the San Gorgonio Pass area

Storage Fields

All four of the storage fields received moderate-high or high inland flooding vulnerability scores in 2050. Playa Del Rey and Honor Rancho had high scores, and Aliso Canyon and Goleta had moderate-high scores (see Table 4-33). Even though Goleta is the only storage field physically in a DVC, all storage fields are crucial to the serviceability of gas to all DVCs.

Table 4-33: 2050 Vulnerability Scores: Inland Flooding, Storage Fields

Vulnerability Class	Total Count	Total %	DVC Count	DVC %
Low	0	0.00%	0	0.00%
Moderate-Low	0	0.00%	0	0.00%
Moderate	0	0.00%	0	0.00%
Moderate-High	2	50.00%	1	100.00%
High	2	50.00%	0	0.00%

Facilities

Of the over 140 facilities, the majority received either low (roughly 80) or moderate-low (40) inland flooding vulnerability scores in 2050 (see Table 4-34). About 20 received moderate scores. Four received moderate-high scores, and one received a high score. Of the facilities receiving moderate-high or high scores, one was in a DVC.

Table 4-34: 2050 Vulnerability Scores: Inland Flooding, Facilities

Vulnerability Class	Total Count	Total %	DVC Count	DVC %
Low	82	56.94%	47	62.67%
Moderate-Low	40	27.78%	25	33.33%
Moderate	17	11.81%	2	2.67%
Moderate-High	4	2.78%	1	1.33%
High	1	0.69%	0	0.00%

Facilities receiving moderate-high or high inland flooding vulnerability scores in the SoCalGas region included:

- Valencia Base Building 01 (this received a high score)
- Simi Valley Base Building 01
- Rim Forest Base Building 01
- La Habra Height Communication Site
- Yucca Valley Base Building 01 (this is located in a DVC)

Figure 4-25: Inland Flooding Vulnerability Scores, 2023, High-Pressure Pipelines

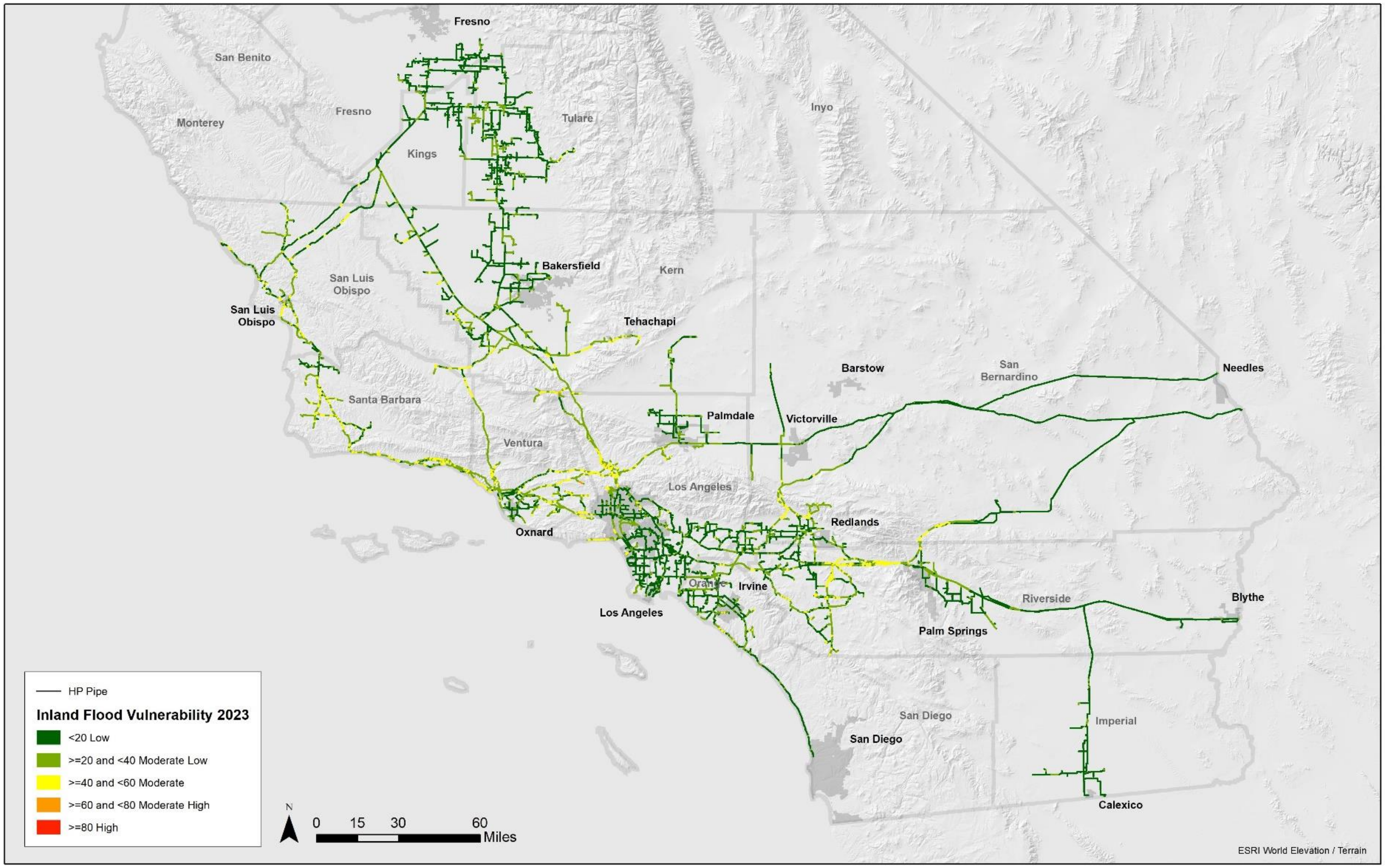


Figure 4-26: Inland Flooding Vulnerability Scores, 2070, High-Pressure Pipelines

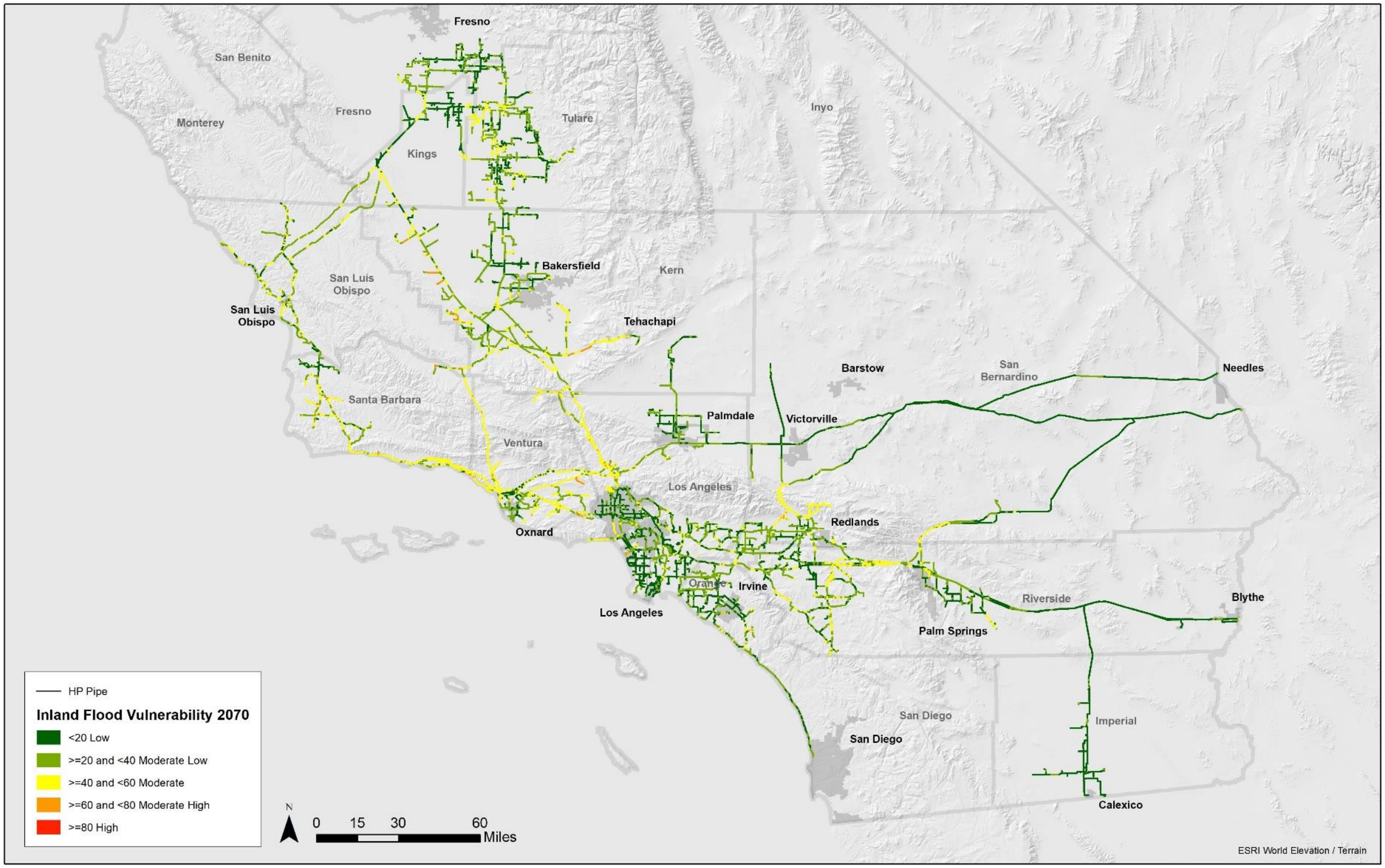


Figure 4-27: Inland Flooding Vulnerability Scores, 2023, High-Pressure Pipelines (Moderate, Moderate-High, and High Vulnerability Assets)

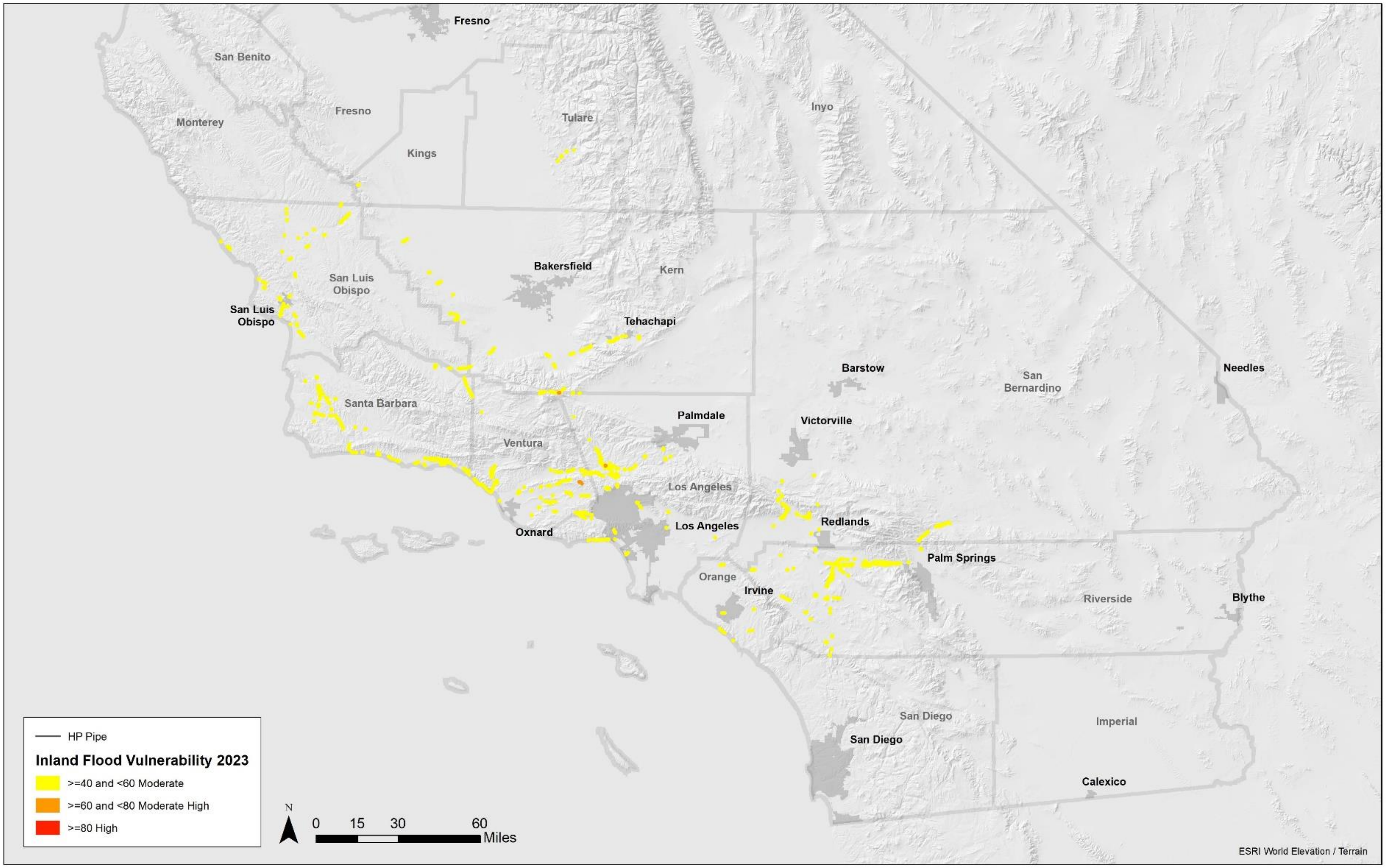
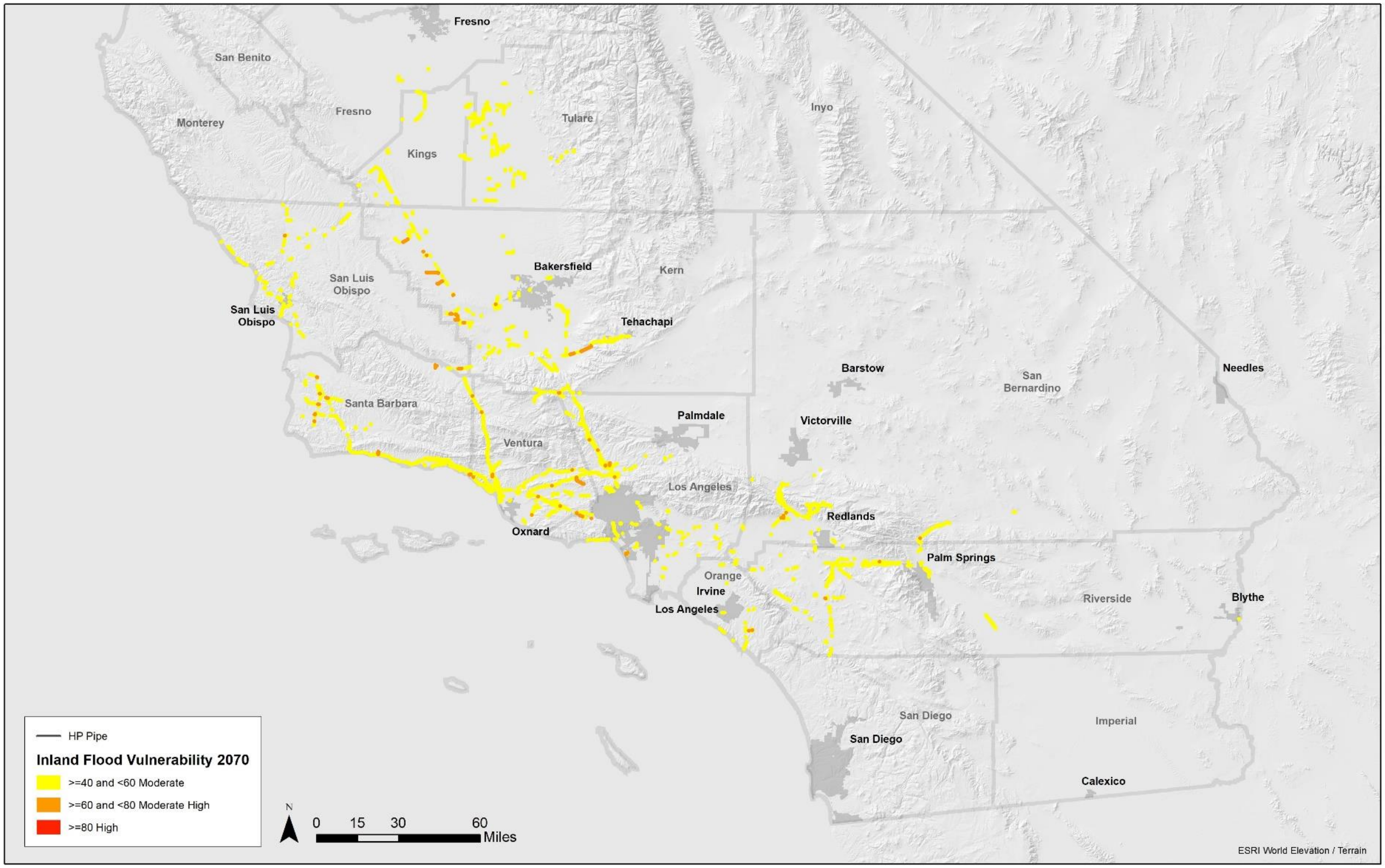


Figure 4-28: Inland Flooding Vulnerability Scores, 2070, High-Pressure Pipelines (Moderate, Moderate-High, and High Vulnerability Assets)



LANDSLIDE

High-Pressure Pipelines

Of the almost 36 million linear feet of high-pressure pipelines, the majority received low (roughly 24 million feet) landslide vulnerability scores in 2050 (see Table 4-35). About 2 million feet received moderate-low scores, about 7 million feet received moderate scores, and about 4 million feet received moderate-high scores. Approximately 45,000 feet received high scores. Of the pipeline length receiving moderate-high or high scores, about 615,000 feet were located in DVCs.

Table 4-35: 2050 Vulnerability Scores: Landslide, High-Pressure Pipelines

Vulnerability Class	Total Feet	Total %	DVC Feet	DVC %
Low	23,781,263	66.35%	14,310,570	79.87%
Moderate-Low	1,852,286	5.17%	625,474	3.49%
Moderate	6,656,510	18.57%	2,367,820	13.22%
Moderate-High	3,504,843	9.78%	607,836	3.39%
High	45,396	0.13%	5,273	0.03%

In the SoCalGas territory, some of the lines that received moderate-high or high landslide vulnerability scores along relatively long segments include:

- Lines 1003, 1004 and 1005 in Santa Barbara and Ventura Counties roughly parallel to the coast
- Lines 247 and SL 36-1002 in Santa Barbara County parallel to the coast
- Line 1010 in western Santa Barbara County
- Lines 44-307 and SL 44-1008 between Central Coast and Central Valley regions
- Line 8109 between Oxnard and Cuyama
- Lines 225 and 85 South between Santa Clarita and Lebec area
- Line 324 between Oxnard and Santa Clarita
- Portions of Lines 404 and 406 and other shorter lines between the Ventura area and the southern edge of San Fernando Valley
- Lines 3003, 407, and others in Santa Monica Mountains between Santa Monica and San Fernando Valley
- Lines 235 West and 335 between Santa Clarita and Palmdale
- Lines 2001 West, 2000, 4000, and 4002 crossing the Chino Hills
- Lines 4000 and 4002 crossing the Cajon Pass

Various segments of high-pressure pipelines that receive moderate-high or high 2050 landslide vulnerability scores pass through DVCs. These include areas in some of the hillier portions of Greater Los Angeles; areas in the foothills along the western and southern edges of the Central Valley; near San Gorgonio Pass; and in some of the steeper areas in the desert regions in the east of the SoCalGas territory, among others.

Figure 4-29 and Figure 4-30 show maps of landslide vulnerability scores in 2023 and 2070, the bookends of the analysis period for high-pressure pipelines, and show the change in the spatial pattern of the vulnerability over time. Figure 4-31 and Figure 4-32 show the same results but only the moderate, moderate-high, and high vulnerability assets.

High-Pressure Service Lines

Of the over 1.34 million linear feet of high-pressure service lines, the majority received low (roughly 1.11 million) landslide vulnerability scores in 2050 (see Table 4-36). About 180,000 feet received moderate-low scores, about 58,000 feet received moderate scores, and none received moderate-high scores or high scores. Of the pipeline length receiving moderate scores, about 10,000 feet were located in DVCs. The spatial pattern of vulnerability scores for high-pressure service lines was similar to the spatial pattern for high-pressure pipelines.

Table 4-36: 2050 Vulnerability Scores: Landslide, High-Pressure Service Lines

Vulnerability Class	Total Feet	Total %	DVC Feet	DVC %
Low	1,107,828	82.48%	727,140	92.00%
Moderate-Low	177,240	13.20%	52,800	6.68%
Moderate	58,087	4.32%	10,413	1.32%
Moderate-High	0	0.00%	0	0.00%
High	0	0.00%	0	0.00%

Medium-Pressure Pipelines

Of the over 255 million linear feet of medium-pressure pipelines, the majority received either low (roughly 182 million feet) or moderate-low (roughly 62 million feet) landslide vulnerability scores in 2050 (see Table 4-37). About 12 million feet received moderate scores, whereas roughly 145,000 received moderate-high scores. Of the pipeline length receiving moderate-high scores, about 9,000 feet were located in DVCs.

Table 4-37: 2050 Vulnerability Scores: Landslide, Medium-Pressure Pipelines

Vulnerability Class	Total Feet	Total %	DVC Feet	DVC %
Low	181,799,815	71.11%	67,377,891	90.85%
Moderate-Low	62,000,852	24.25%	5,918,267	7.98%
Moderate	11,699,769	4.58%	855,302	1.15%
Moderate-High	146,490	0.06%	9,138	0.01%
High	0	0.00%	0	0.00%

Notable clusters of moderate-high scoring medium-pressure pipelines include the following:

- Some portions of the greater Santa Barbara area
- Clusters of assets in the San Antonio Creek and Ventura River watersheds, including in Ojai, Mira Monte areas
- Some portions of Thousand Oaks and Casa Conejo
- Clusters of assets in the greater Santa Clarita area
- Some portions along the northeastern edge of the Los Angeles basin, such as in Pasadena, Sierra Madre, and Duarte
- Some portions of the eastern Santa Monica Mountains and also Monterey Heights north of downtown Los Angeles
- Some portions of the Covina Hills area
- Some portions of the Rancho Palos Verdes area
- Some portions of the Chino Hills area
- Clusters of assets in the southwestern Irvine/Turtle Rock/Newport Hills area
- Clusters of assets in the hillier portions of northern Mission Viejo
- Some portions of Murietta and Temecula area

Medium-Pressure Service Lines

Of the approximately 228 million linear feet of medium-pressure service lines, the majority received either low (roughly 212 million feet) or moderate-low (roughly 16 million feet) landslide vulnerability scores in 2050 (see Table 4-38). About 148,000 feet received moderate scores, whereas none received moderate-high scores or high scores. Of the pipeline length receiving moderate scores, about 8,100 feet were located in DVCs. The spatial pattern of vulnerability scores for medium-pressure service lines was similar to the spatial pattern for the medium-pressure pipelines.

Table 4-38: 2050 Vulnerability Scores: Landslide, Medium-Pressure Service Lines

Vulnerability Class	Total Feet	Total %	DVC Feet	DVC %
Low	212,153,801	93.05%	68,886,419	98.26%
Moderate-Low	15,706,582	6.89%	1,209,253	1.72%
Moderate	147,762	0.06%	8,082	0.01%
Moderate-High	0	0.00%	0	0.00%
High	0	0.00%	0	0.00%

Controllable Gas Valves

Of the over 54,100 controllable gas valves, the majority received either low (roughly 45,700) or moderate-low (roughly 4,300) landslide vulnerability scores in 2050 (see Table 4-39). About 3,100 received moderate scores, about 800 received moderate-high scores and about 200 received high scores. Of the controllable valves receiving moderate-high or high scores, over 200 were in DVCs.

Table 4-39: 2050 Vulnerability Scores: Landslide, Controllable Gas Valves

Vulnerability Class	Total Count	Total %	DVC Count	DVC %
Low	45,673	84.37%	21,818	93.44%
Moderate-Low	4,350	8.04%	756	3.24%
Moderate	3,096	5.72%	547	2.34%
Moderate-High	835	1.54%	222	0.95%
High	179	0.33%	7	0.03%

Areas with notable clusters of moderate-high or high-scoring controllable gas valves in the SoCalGas territory included:

- Along the transmission lines that parallel the coast in Santa Barbara and Ventura Counties, such as Lines 1003 and 247
- In the mountains near the city of Ventura
- In the mountains between Oxnard and San Fernando Valley, such as some portions of Thousand Oaks and Granada Hills
- Mountainous areas in and around Santa Clarita
- Along the transmission lines between Santa Clarita and the Central Valley, such as Lines 225 and 85 South
- Some portions of the eastern Santa Monica Mountains and Monterey Heights north of downtown Los Angeles
- Some portions of southern Orange County, such as Mission Viejo, Dana Point, and San Juan Capistrano

- Some portions of the Chino Hills area
- Some portions of the San Gorgonio Pass area

Non-Controllable Gas Valves

Of the approximately 2,800 non-controllable gas valves, the majority received low (roughly 2,400) landslide vulnerability scores in 2050 (see Table 4-40). About 200 received moderate-low scores, roughly 200 received moderate scores, and about 50 received moderate-high scores. Of the non-controllable valves receiving moderate-high scores, none were in DVCs.

Table 4-40: 2050 Vulnerability Scores: Landslide, Non-Controllable Gas Valves

Vulnerability Class	Total Count	Total %	DVC Count	DVC %
Low	2,390	84.75%	1,225	91.83%
Moderate-Low	203	7.20%	42	3.15%
Moderate	173	6.13%	67	5.02%
Moderate-High	54	1.91%	0	0.00%
High	0	0.00%	0	0.00%

Compressor Stations

Of the 13 compressor stations, most received low (10) landslide vulnerability scores in 2050 (see Table 4-41). Honor Rancho and Aliso Canyon received moderate scores, and Playa Del Rey received a moderate-low score, albeit on the high end of the moderate-low score range. None of these three compressor stations are located in DVCs.

Table 4-41: 2050 Vulnerability Scores: Landslide, Compressor Stations

Vulnerability Class	Total Count	Total %	DVC Count	DVC %
Low	10	76.92%	6	100.00%
Moderate-Low	1	7.69%	0	0.00%
Moderate	2	15.38%	0	0.00%
Moderate-High	0	0.00%	0	0.00%
High	0	0.00%	0	0.00%

Regulator Stations

Of the over 10,900 regulator stations, the majority received low (roughly 9,200) landslide vulnerability scores in 2050 (see Table 4-42). About 400 received moderate-low scores, about 1,100 received moderate scores, about 130 received moderate-high scores, and seven received high scores. Of the regulator stations with moderate-high or high scores, seven were in DVCs.

Table 4-42: 2050 Vulnerability Scores: Landslide, Regulator Stations

Vulnerability Class	Total Count	Total %	DVC Count	DVC %
Low	9,249	84.72%	4,738	94.97%
Moderate-Low	422	3.87%	112	2.24%
Moderate	1,107	10.14%	132	2.65%
Moderate-High	132	1.21%	7	0.14%
High	7	0.06%	0	0.00%

Areas with notable clusters of moderate-high or high-scoring regulator stations in the SoCalGas territory included:

- Central Coast region in western San Luis Obispo and Santa Barbara counties, such as portions of Atascadero, Arroyo Grande, and Lompoc areas
- Southern Santa Barbara County in the corridor between the coast and Santa Ynez Mountains, including some along Lines 247, 1005, and 1003
- Along SL 37-04 parallel to the coast east of Malibu
- Portions of the Rancho Palos Verdes area
- Hillier portions of southern Orange County

Storage Fields

All four of the storage fields received high landslide vulnerability scores in 2050: Honor Rancho, Aliso Canyon, Playa Del Rey, and Goleta. These high scores were driven by high exposure to current and projected future landslides and the high consequence to the overall system when these assets are affected. Even though Goleta is the only storage field physically in a DVC, all storage fields are crucial to the serviceability of gas to all DVCs (see Table 4-43).

Table 4-43: 2050 Vulnerability Scores: Landslide, Storage Fields

Vulnerability Class	Total Count	Total %	DVC Count	DVC %
Low	0	0.00%	0	0.00%
Moderate-Low	0	0.00%	0	0.00%
Moderate	0	0.00%	0	0.00%
Moderate-High	0	0.00%	0	0.00%
High	4	100.00%	1	100.00%

Facilities

Of the over 140 facilities, the majority received low (roughly 120) landslide vulnerability scores in 2050 (see Table 4-44). Three received moderate-low scores, and 14 received moderate scores.

Five received moderate-high scores, and none received high scores. Of the facilities receiving moderate-high scores, two were in DVCs.

Table 4-44: 2050 Vulnerability Scores: Landslide, Facilities

Vulnerability Class	Total Count	Total %	DVC Count	DVC %
Low	122	84.72%	70	93.33%
Moderate-Low	3	2.08%	1	1.33%
Moderate	14	9.72%	2	2.67%
Moderate-High	5	3.47%	2	2.67%
High	0	0.00%	0	0.00%

Facilities receiving moderate-high landslide vulnerability scores in the SoCalGas region included:

- Aliso Canyon Building 01
- Goleta Base Building 01
- Baldwin Hills Communication Site

Figure 4-29: Landslide Vulnerability Scores, 2023, High-Pressure Pipelines

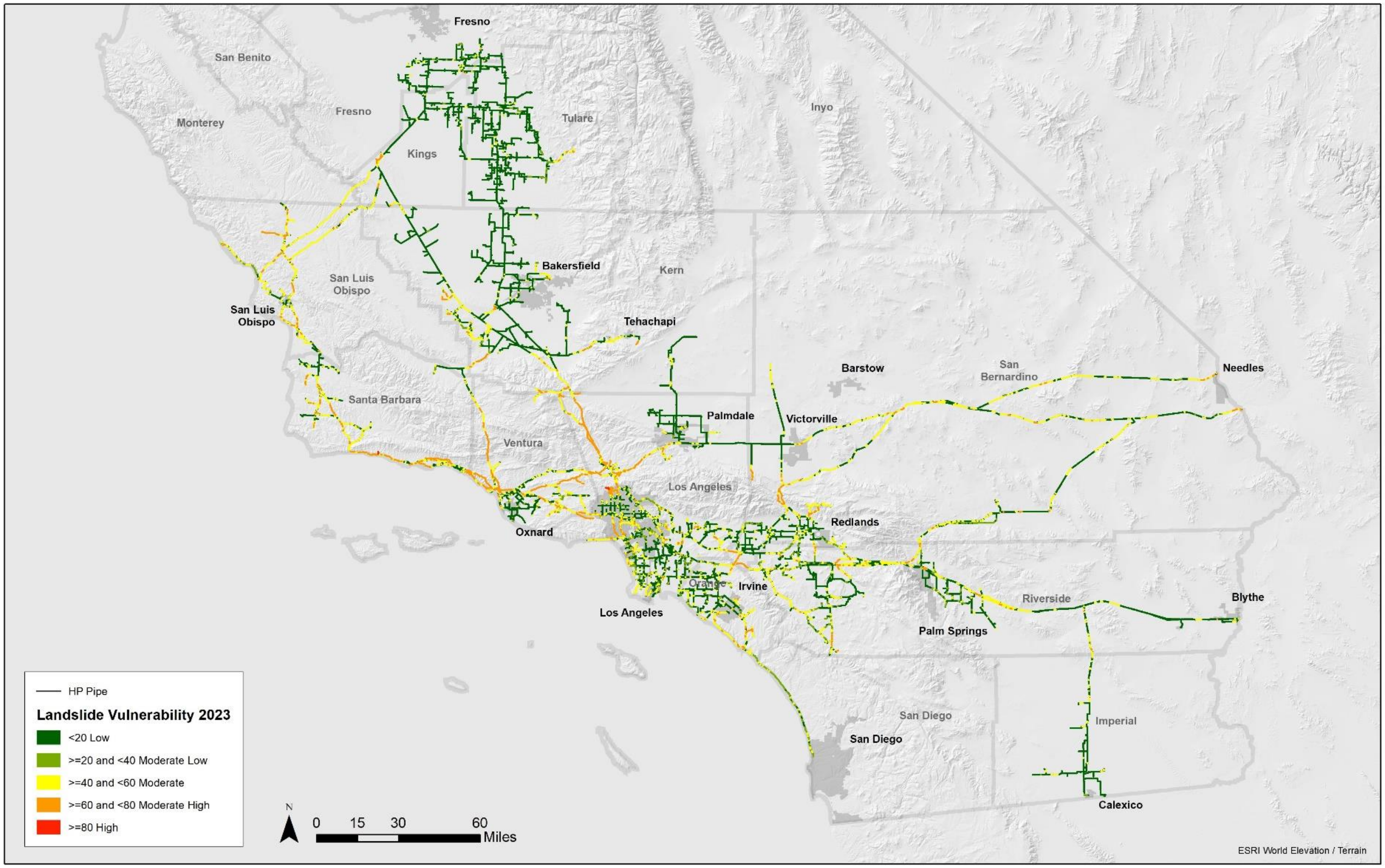


Figure 4-30: Landslide Vulnerability Scores, 2070, High-Pressure Pipelines

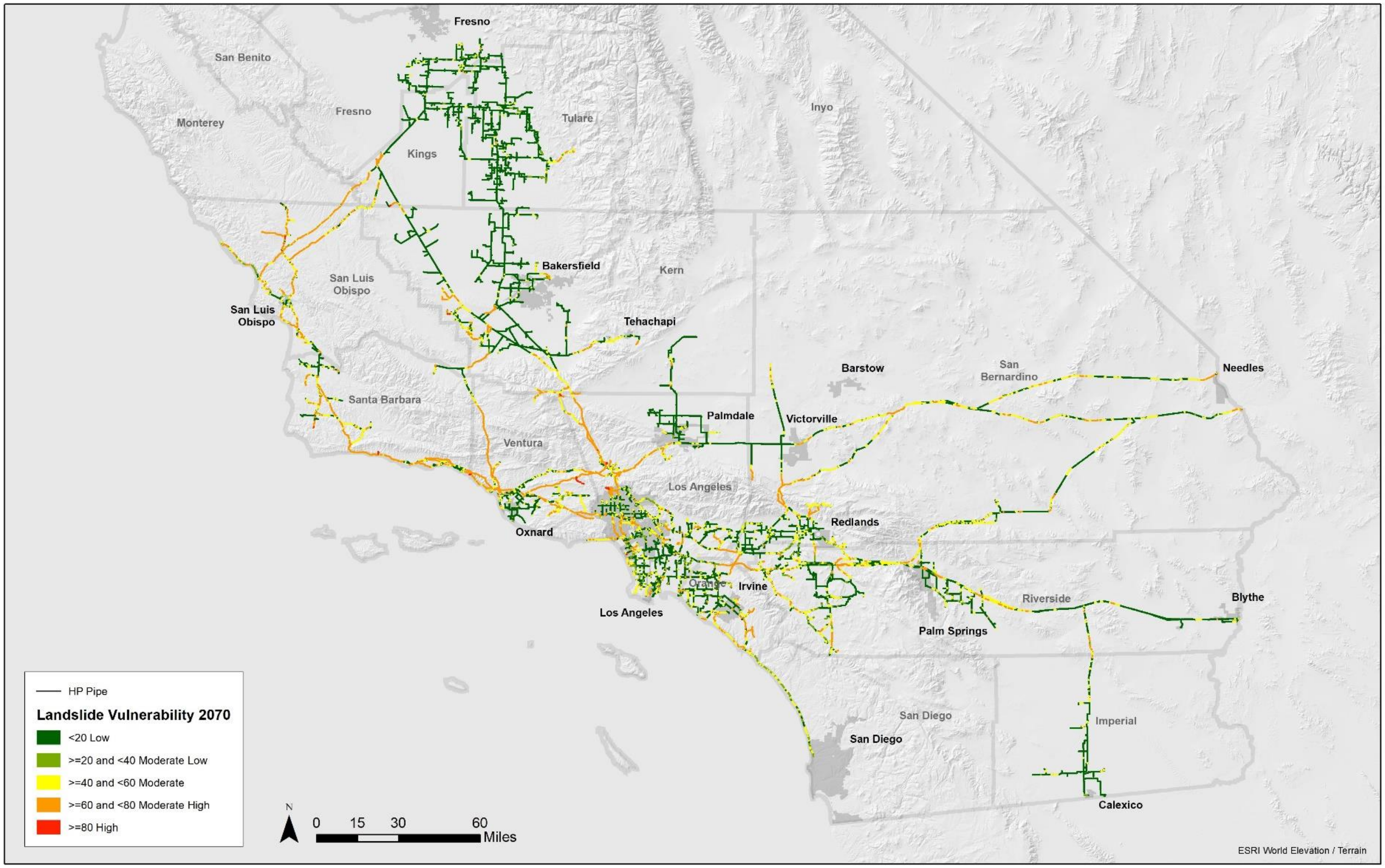


Figure 4-31: Landslide Vulnerability Scores, 2023, High-Pressure Pipelines (Moderate, Moderate-High, and High Vulnerability Assets)

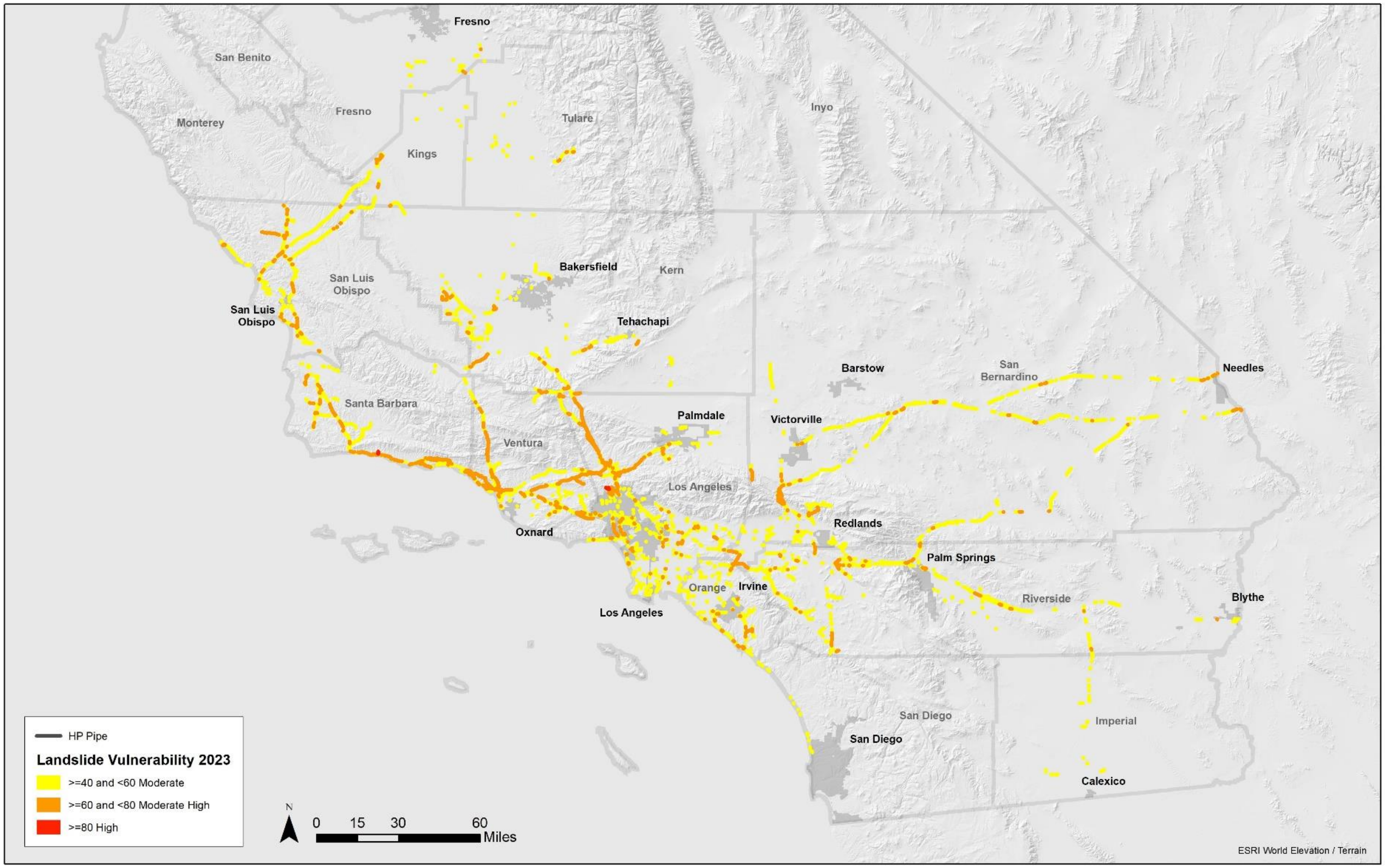
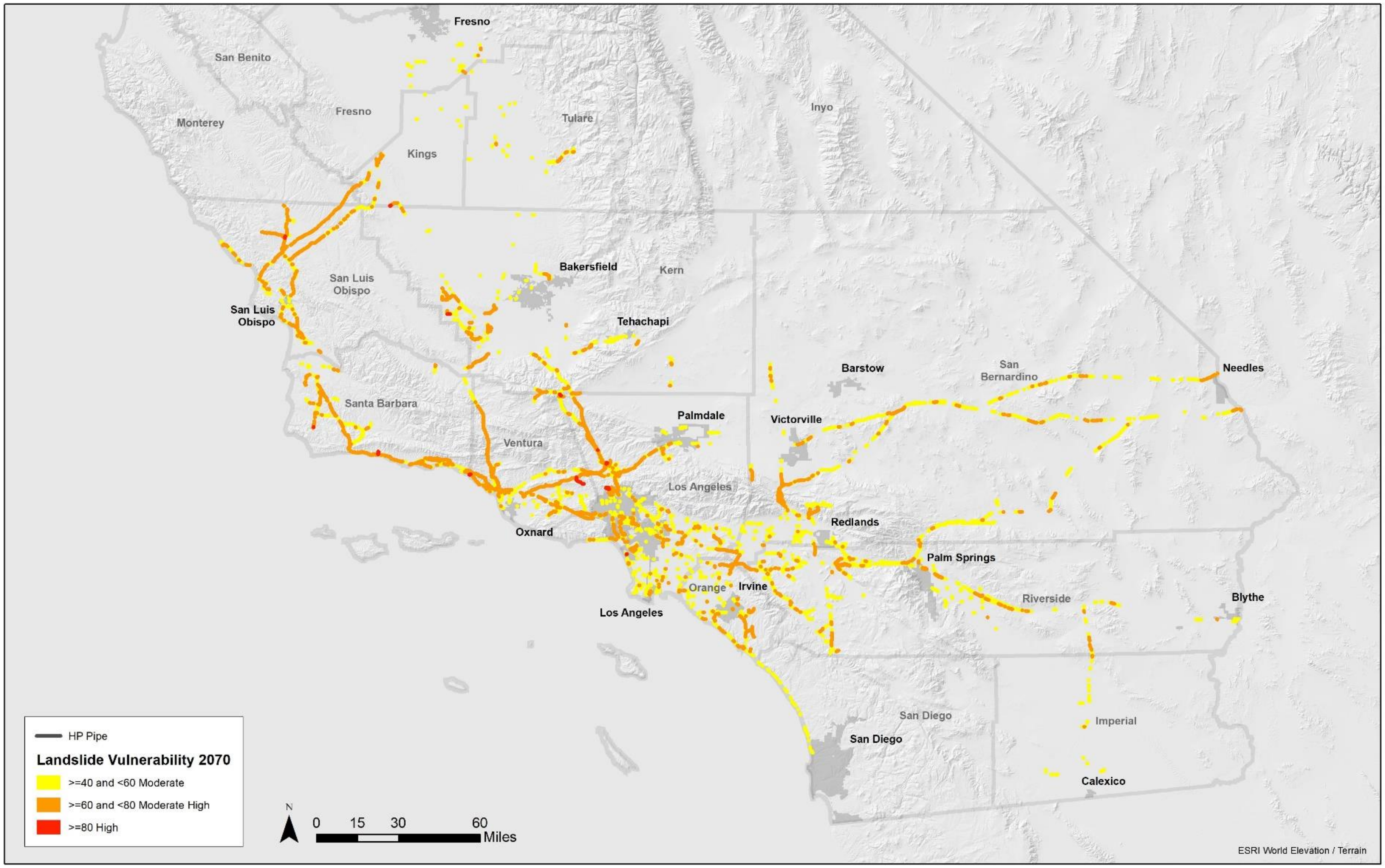


Figure 4-32: Landslide Vulnerability Scores, 2070, High-Pressure Pipelines (Moderate, Moderate-High, and High Vulnerability Assets)



COASTAL FLOODING

High-Pressure Pipelines

Of the almost 36 million linear feet of high-pressure pipelines, almost all received low coastal flooding vulnerability scores in 2050 (see Table 4-45). About 84,000 feet received moderate-low scores, 50,000 feet received moderate scores, and 2,000 feet received moderate-high scores. Of the pipeline lengths receiving moderate-high scores, none were located in DVCs.

Table 4-45: 2050 Vulnerability Scores: Coastal Flooding, High-Pressure Pipelines

Vulnerability Class	Total Feet	Total %	DVC Feet	DVC %
Low	35,705,047	99.62%	17,890,326	99.85%
Moderate-Low	83,890	0.23%	20,469	0.11%
Moderate	49,425	0.14%	6,178	0.03%
Moderate-High	1,936	0.01%	0	0.00%
High	0	0.00%	0	0.00%

Several of the highest-scoring high-pressure pipelines are located in low-redundancy portions of the transmission networks but are smaller branches rather than main lines. In the SoCalGas territory, some of the main lines or longer branches (over 30,000 feet) that received at least moderate coastal flooding vulnerability scores along some of their lengths include:

- Lines 247, 1003, and 1004 in coastal Santa Barbara and Ventura Counties; most exposed segments are in Goleta, Carpinteria, and Ventura River areas
- Line 1017 between Santa Ana and Huntington Beach; the most exposed segment is across Santa Ana River
- Line 1026 between Dana Point and Torrey Pines; most exposed segment is across San Juan Creek
- Line SL 36-9-10 between Cambria and Morro Bay; most exposed segments are across Toro Creek and Cayucos Creek
- Line SL 37-04 between Malibu and Santa Monica; the most exposed segment is across Malibu Creek

Figure 4-33 and Figure 4-34, which are further below, show maps of coastal flooding vulnerability scores in 2023 and 2070, the bookends of the analysis period for high-pressure pipelines, and help show the change in spatial pattern of the vulnerability over time. Figure 4-35 and Figure 4-36 show the same results but only the moderate, moderate-high, and high vulnerability assets.

High-Pressure Service Lines

Of the over 1.34 million linear feet of high-pressure service lines, almost all received low coastal flooding vulnerability scores in 2050 (see Table 4-46). About 300 feet received moderate-low scores and about 800 feet received moderate scores. One pipeline segment in Long Beach accounts for the entire length of moderate-scoring high-pressure service pipeline. It is located in a DVC.

Table 4-46: 2050 Vulnerability Scores: Coastal Flooding, High-Pressure Service Lines

Vulnerability Class	Total Feet	Total %	DVC Feet	DVC %
Low	1,342,093	99.92%	789,307	99.87%
Moderate-Low	298	0.02%	281	0.04%
Moderate	765	0.06%	765	0.10%
Moderate-High	0	0.00%	0	0.00%
High	0	0.00%	0	0.00%

Medium-Pressure Pipelines

Of the almost 256 million linear feet of medium-pressure pipelines, almost all received low coastal flooding vulnerability scores in 2050 (see Table 4-47). About 140,000 feet received moderate-low scores, and about 1,500 feet received moderate scores. Of the pipeline length receiving moderate scores, none are located in DVCs.

Table 4-47: 2050 Vulnerability Scores: Coastal Flooding, Medium-Pressure Pipelines

Vulnerability Class	Total Feet	Total %	DVC Feet	DVC %
Low	255,508,631	99.95%	74,151,878	99.99%
Moderate-Low	136,785	0.05%	8,719	0.01%
Moderate	1,510	0.00%	0	0.00%
Moderate-High	0	0.00%	0	0.00%
High	0	0.00%	0	0.00%

The segments of moderate-scoring medium-pressure pipelines are located in the Carpinteria, Sunset Beach, and Newport Beach areas.

Medium-Pressure Service Lines

Of the approximately 228 million linear feet of medium-pressure service lines, the vast majority received low coastal flooding vulnerability scores in 2050 (see Table 4-48). About 92,000 feet received moderate-low scores, and about 550 feet received moderate scores. Of the pipeline length receiving moderate scores, about 60 feet were located in DVCs. The spatial pattern of vulnerability scores for medium-pressure service lines was similar to the spatial pattern for the medium-pressure pipelines.

Table 4-48: 2050 Vulnerability Scores: Coastal Flooding, Medium-Pressure Service

Vulnerability Class	Total Feet	Total %	DVC Feet	DVC %
Low	227,915,654	99.96%	70,101,684	100.00%
Moderate-Low	91,941	0.04%	2,007	0.00%
Moderate	549	0.00%	63	0.00%
Moderate-High	0	0.00%	0	0.00%
High	0	0.00%	0	0.00%

Controllable Gas Valves

Of the over 54,100 controllable gas valves, the majority received low (roughly 53,800) coastal flooding vulnerability scores in 2050 (see Table 4-49). About 290 received moderate-low scores, 24 received moderate scores, and six received moderate-high scores. Of the controllable valves receiving moderate-high scores, four were in DVCs.

The moderate-high scoring valves were located in the Goleta and Long Beach areas.

Table 4-49: 2050 Vulnerability Scores: Coastal Flooding, Controllable Gas Valves

Vulnerability Class	Total Count	Total %	DVC Count	DVC %
Low	53,816	99.41%	23,243	99.54%
Moderate-Low	287	0.53%	87	0.37%
Moderate	24	0.04%	16	0.07%
Moderate-High	6	0.01%	4	0.02%
High	0	0.00%	0	0.00%

Non-Controllable Gas Valves

Of the approximately 2,800 non-controllable gas valves, all received either low (roughly 2,800) or moderate-low (13) coastal flooding vulnerability scores in 2050 (see Table 4-50).

Table 4-50: 2050 Vulnerability Scores: Coastal Flooding, Non-Controllable Gas Valves

Vulnerability Class	Total Count	Total %	DVC Count	DVC %
Low	2,807	99.54%	1,324	99.25%
Moderate-Low	13	0.46%	10	0.75%
Moderate	0	0.00%	0	0.00%
Moderate-High	0	0.00%	0	0.00%
High	0	0.00%	0	0.00%

Compressor Stations

All of the 13 compressor stations received low coastal flooding vulnerability scores in 2050 (see Table 4-51).

Table 4-51: 2050 Vulnerability Scores: Coastal Flooding, Compressor Stations

Vulnerability Class	Total Count	Total %	DVC Count	DVC %
Low	13	100.00%	6	100.00%
Moderate-Low	0	0.00%	0	0.00%
Moderate	0	0.00%	0	0.00%
Moderate-High	0	0.00%	0	0.00%
High	0	0.00%	0	0.00%

Regulator Stations

Of the over 10,900 regulator stations, the vast majority received either low (roughly 10,500) or moderate-low (roughly 400) coastal flooding vulnerability scores in 2050. Four received moderate scores; of these, none were in DVCs (see Table 4-52).

Table 4-52: 2050 Vulnerability Scores: Coastal Flooding, Regulator Stations

Vulnerability Class	Total Count	Total %	DVC Count	DVC %
Low	10,519	96.35%	4,946	99.14%
Moderate-Low	394	3.61%	43	0.86%
Moderate	4	0.04%	0	0.00%
Moderate-High	0	0.00%	0	0.00%
High	0	0.00%	0	0.00%

Storage Fields

Two of the four storage fields received high coastal flooding vulnerability scores in 2050: Playa Del Rey and Goleta (see Table 4-53). Even though Goleta is the only storage field physically in a DVC, all storage fields are crucial to the serviceability of all DVCs.

Table 4-53: 2050 Vulnerability Scores: Coastal Flooding, Storage Fields

Update Vulnerability Class	Total Count	Total %	DVC Count	DVC %
Low	2	50.00%	0	0.00%
Moderate-Low	0	0.00%	0	0.00%
Moderate	0	0.00%	0	0.00%
Moderate-High	0	0.00%	0	0.00%
High	2	50.00%	1	100.00%

Facilities

All of the over 140 facilities received low coastal flooding vulnerability scores in 2050 (see Table 4-54).

Table 4-54: 2050 Vulnerability Scores: Coastal Flooding, Facilities

Vulnerability Class	Total Count	Total %	DVC Count	DVC %
Low	144	100.00%	75	100.00%
Moderate-Low	0	0.00%	0	0.00%
Moderate	0	0.00%	0	0.00%
Moderate-High	0	0.00%	0	0.00%
High	0	0.00%	0	0.00%

Figure 4-33: Coastal Flooding Vulnerability Scores, 2023, High-Pressure Pipelines

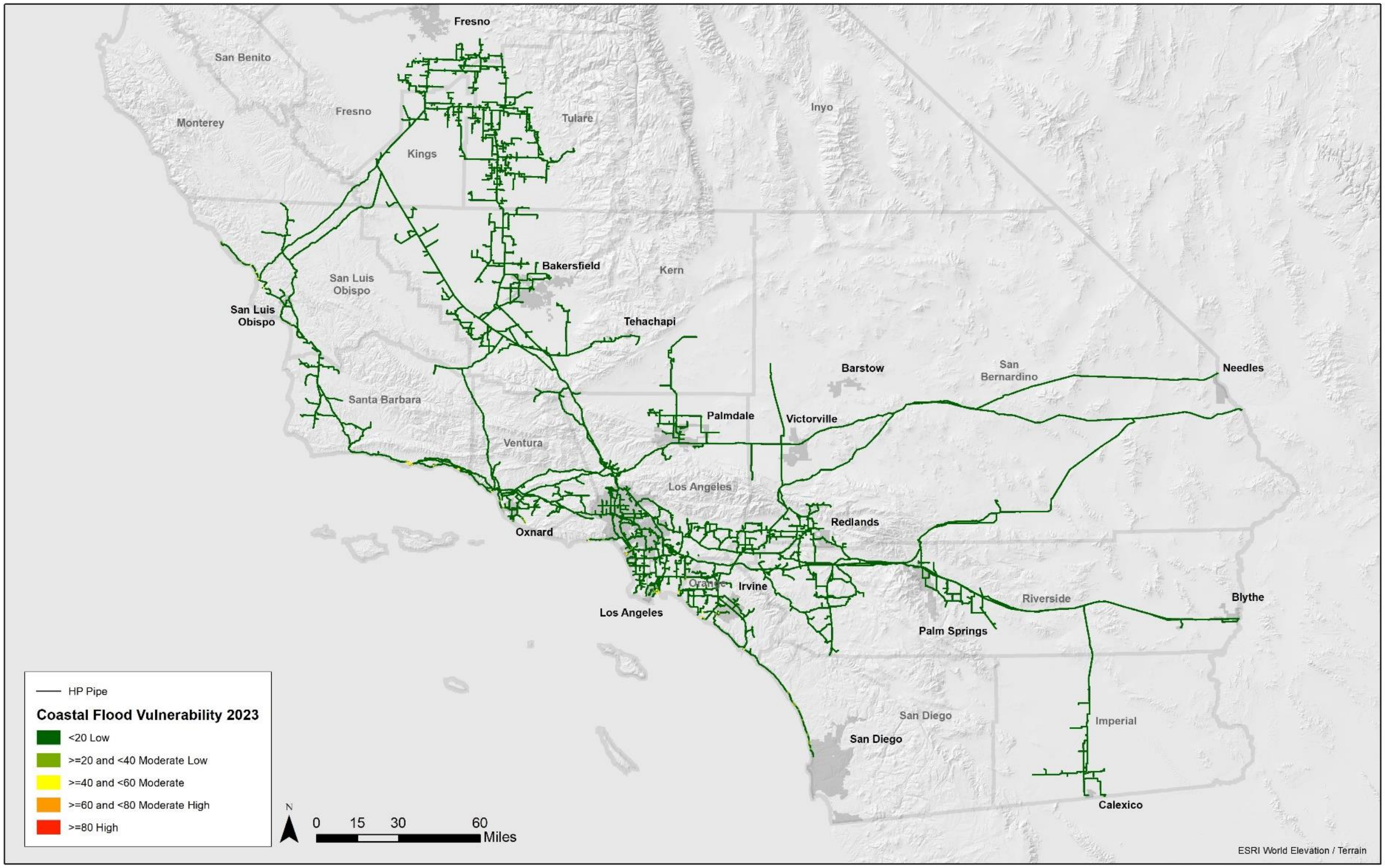


Figure 4-34: Coastal Flooding Vulnerability Scores, 2070, High-Pressure Pipelines

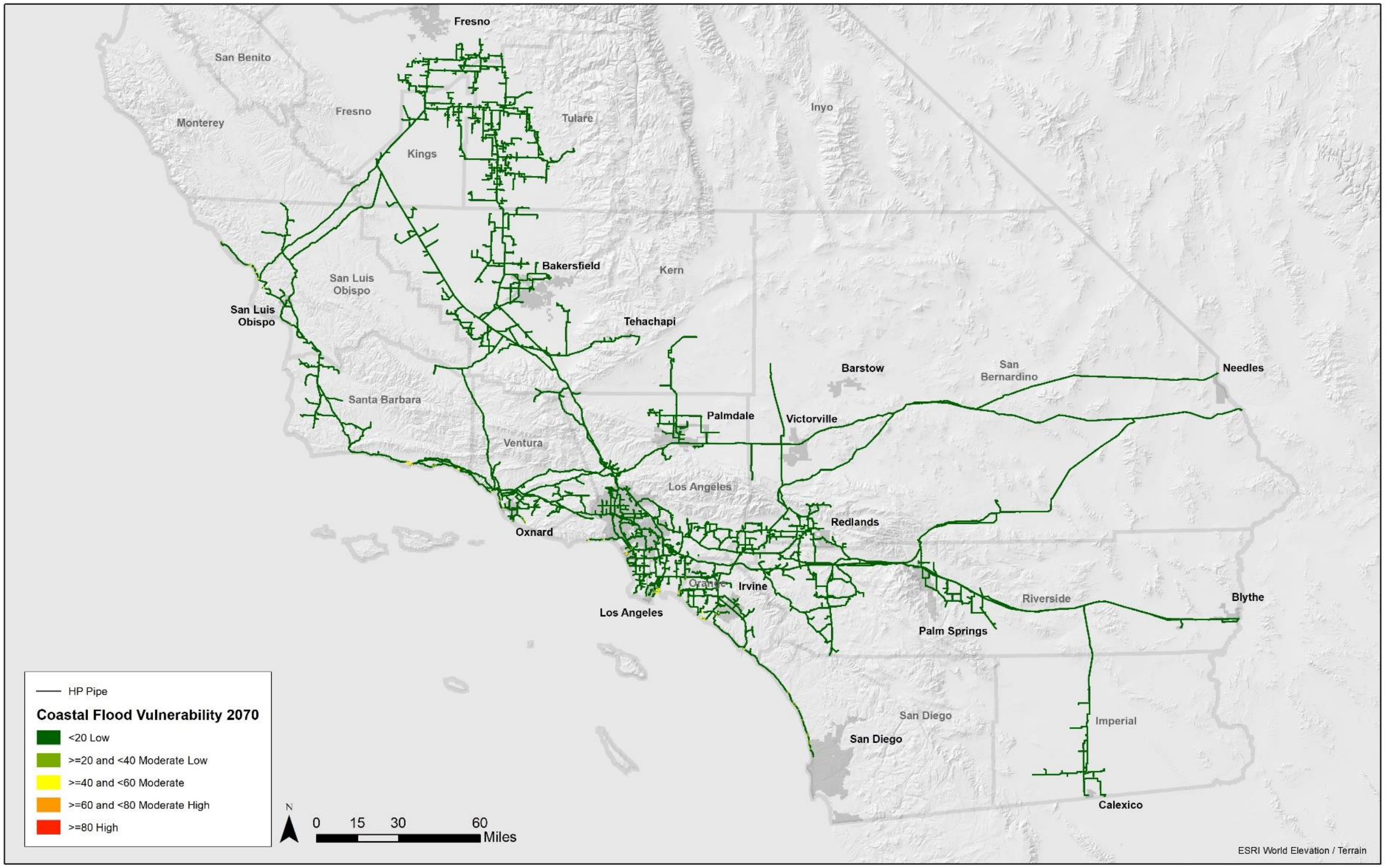


Figure 4-35: Coastal Flooding Vulnerability Scores, 2023, High-Pressure Pipelines (Moderate, Moderate-High and High Vulnerability Assets)

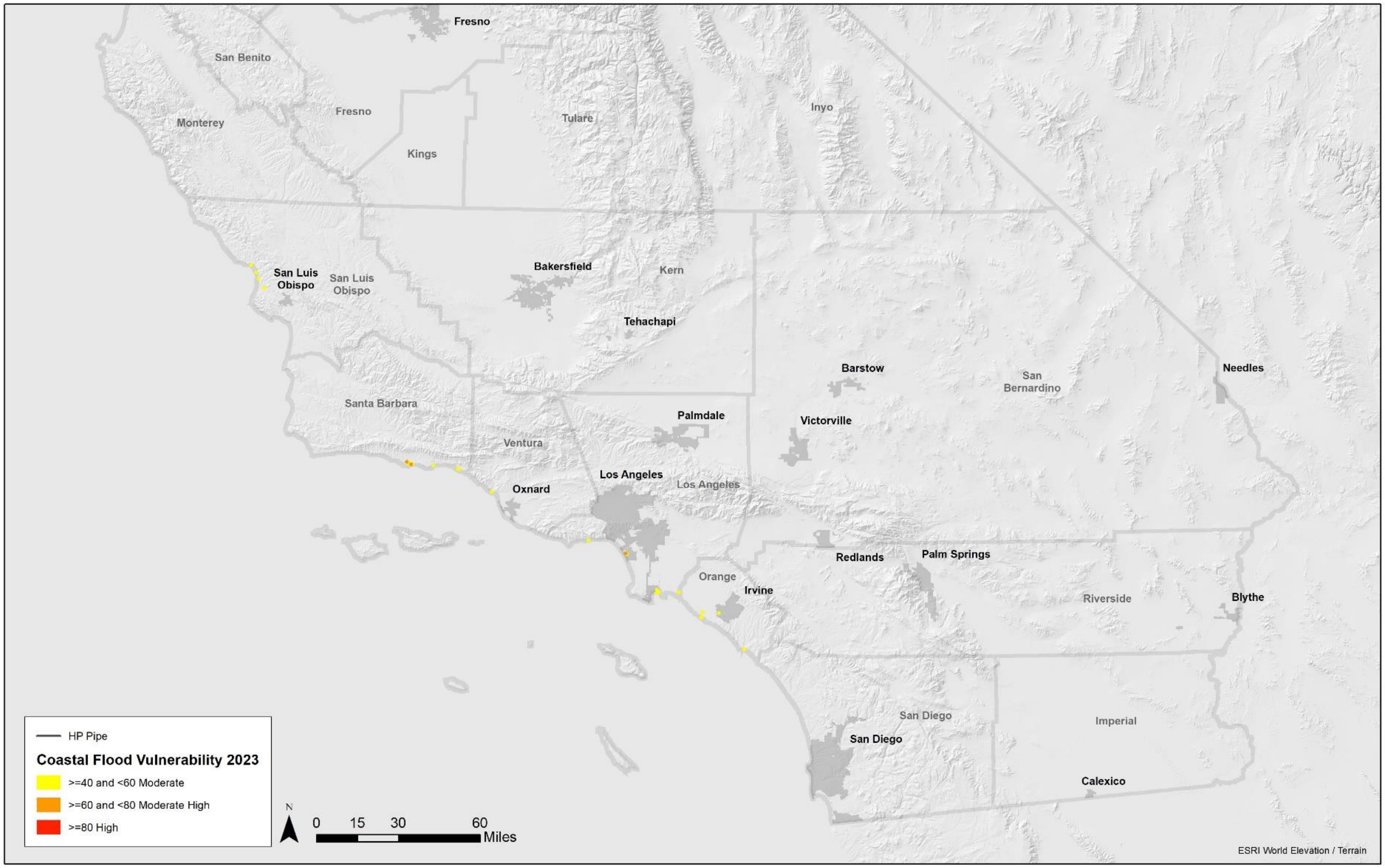
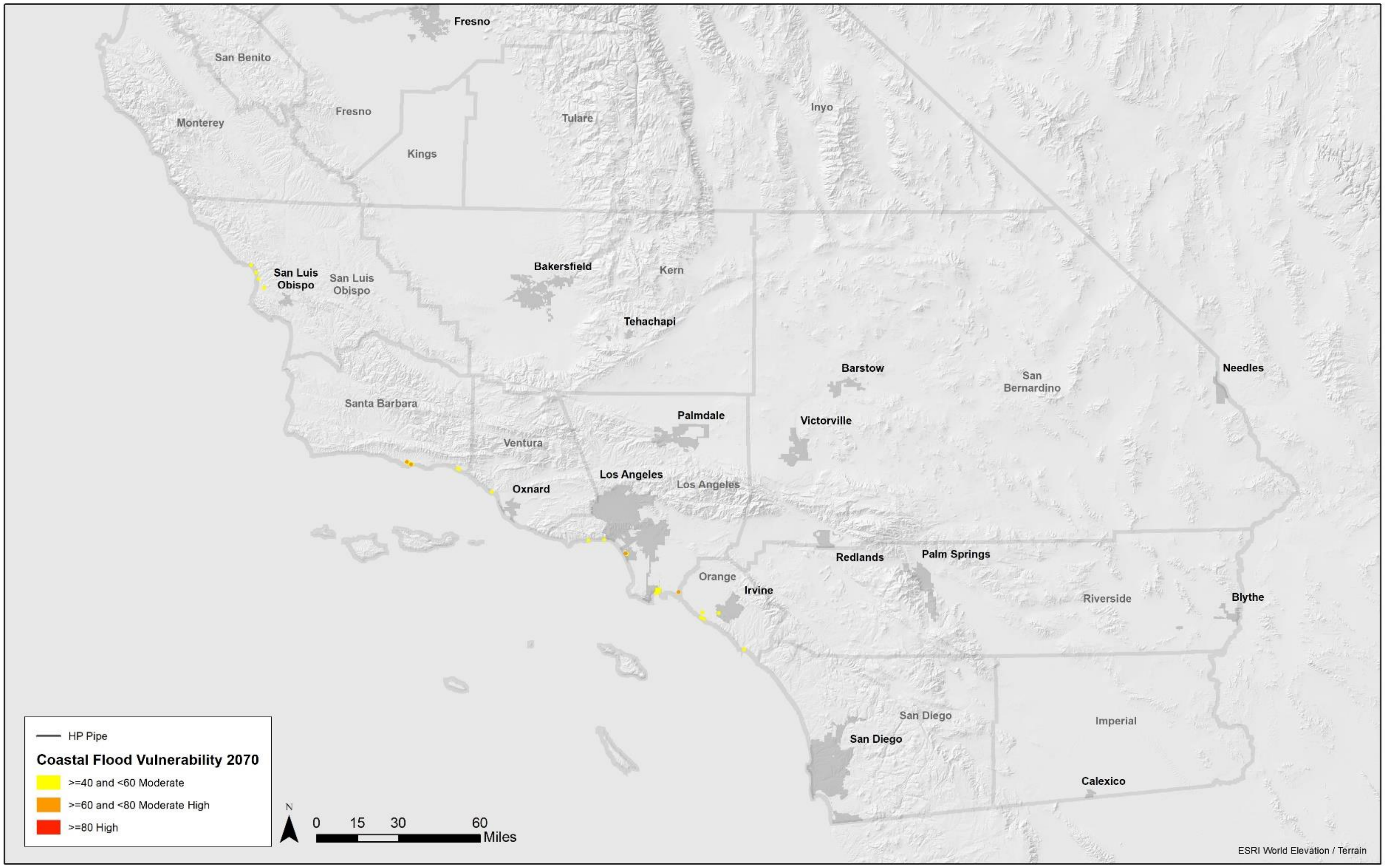


Figure 4-36: Coastal Flooding Vulnerability Scores, 2070, High-Pressure Pipelines (Moderate, Moderate-High and High Vulnerability Assets)



COASTAL EROSION

High-Pressure Pipelines

Of the almost 36 million linear feet of high-pressure pipelines, almost all received low coastal erosion vulnerability scores in 2050 (see Table 4-55). About 300 feet received moderate scores, and about 8,700 feet received moderate-high scores. Of the pipeline lengths receiving moderate-high scores, over 1,300 feet were located in DVCs.

Table 4-55: 2050 Vulnerability Scores: Coastal Erosion, High-Pressure Pipelines

Vulnerability Class	Total Feet	Total %	DVC Feet	DVC %
Low	35,831,224	99.97%	17,915,628	99.99%
Moderate-Low	0	0.00%	0	0.00%
Moderate	317	0.00%	0	0.00%
Moderate-High	8,757	0.02%	1,345	0.01%
High	0	0.00%	0	0.00%

In the SoCalGas territory, the lines that received moderate-high coastal erosion vulnerability scores along some of their length include:

- Line SL 35-20 between Dana Point and Costa Mesa; exposed portion is in Crystal Cove State Park
- Line SL 36-8-01-E in southern Oxnard; exposed portion is near Ormond Beach
- Line SL 36-8-01-H in west Oxnard; exposed portion is near Mandalay State Beach
- Line SL 36-9-10 between Cambria and Morro Bay; exposed portions are just west of Cayucos and just north of Morro Bay
- Line SL 37-04 between Malibu and Santa Monica; exposed portion is at Malibu Creek

Figure 4-37 and Figure 4-38 show maps of coastal erosion vulnerability scores in 2023 and 2070, the bookends of the analysis period, for high-pressure pipelines and help show the change in spatial pattern of the vulnerability over time. Figure 4-39 and Figure 4-40 show the same results but only the moderate, moderate-high, and high vulnerability assets.

High-Pressure Service Lines

Of the over 1.34 million linear feet of high-pressure service lines, the vast majority received low coastal erosion vulnerability scores in 2050 (see Table 4-56). About 1,000 feet received moderate-low scores, and over 100 feet received moderate scores. The moderate-scoring portion of the network was one service line segment located in Crystal Cove State Park near Laguna Beach. It is not in a DVC.

Table 4-56: 2050 Vulnerability Scores: Coastal Erosion, High-Pressure Service Lines

Vulnerability Class	Total Feet	Total %	DVC Feet	DVC %
Low	1,341,988	99.91%	789,997	99.95%
Moderate-Low	1,045	0.08%	356	0.05%
Moderate	123	0.01%	0	0.00%
Moderate-High	0	0.00%	0	0.00%
High	0	0.00%	0	0.00%

Medium-Pressure Pipelines

Of the almost 256 million linear feet of medium-pressure pipelines, the vast majority received low coastal erosion vulnerability scores in 2050 (see Table 4-57). About 9,100 feet received moderate-low scores, and about 22,900 received moderate scores. About 600 feet received moderate-high scores. Of the pipeline lengths receiving moderate or moderate-high scores, none are located in DVCs.

Table 4-57: 2050 Vulnerability Scores: Coastal Erosion, Medium-Pressure Pipelines

Vulnerability Class	Total Feet	Total %	DVC Feet	DVC %
Low	255,614,337	99.99%	74,160,598	100.00%
Moderate-Low	9,075	0.00%	0	0.00%
Moderate	22,914	0.01%	0	0.00%
Moderate-High	601	0.00%	0	0.00%
High	0	0.00%	0	0.00%

Areas with some moderate or moderate-high scoring medium-pressure pipelines include the following:

- In Hearst San Simeon State Park north of Cambria
- In Pismo Beach near Dinosaur Caves Park (this portion receives a moderate-high score)
- In Rincon
- In Mussel Shoals
- A few different portions of Malibu
- At Santa Monca Pier
- In the Playa Del Rey area
- In Palos Verdes Estates area near Bluff Cove (this portion receives a moderate-high score)
- In the Sunset Beach area
- In the Newport Beach area
- In the Laguna Beach area
- In the San Clemente area

Medium-Pressure Service Lines

Of the approximately 228 million linear feet of medium-pressure service lines, almost all received low coastal erosion vulnerability scores in 2050 (see Table 4-58). Approximately 15,400 received moderate-low scores, and approximately 450 received moderate scores.

Table 4-58: 2050 Vulnerability Scores: Coastal Erosion, Medium-Pressure Service Lines

Vulnerability Class	Total Feet	Total %	DVC Feet	DVC %
Low	227,992,261	99.99%	70,103,056	100.00%
Moderate-Low	15,434	0.01%	698	0.00%
Moderate	449	0.00%	0	0.00%
Moderate-High	0	0.00%	0	0.00%
High	0	0.00%	0	0.00%

Controllable Gas Valves

Of the over 54,100 controllable gas valves, all received low coastal erosion vulnerability scores in 2050 (see Table 4-59).

Table 4-59: 2050 Vulnerability Scores: Coastal Erosion, Controllable Gas Valves

Vulnerability Class	Total Count	Total %	DVC Count	DVC %
Low	54,133	100.00%	23,350	100.00%
Moderate-Low	0	0.00%	0	0.00%
Moderate	0	0.00%	0	0.00%
Moderate-High	0	0.00%	0	0.00%
High	0	0.00%	0	0.00%

Non-Controllable Gas Valves

Of the approximately 2,800 non-controllable gas valves, all received low coastal erosion vulnerability scores in 2050 (see Table 4-60).

Table 4-60: 2050 Vulnerability Scores: Coastal Erosion, Non-Controllable Gas Valves

Vulnerability Class	Total Count	Total %	DVC Count	DVC %
Low	2,820	100.00%	1,334	100.00%
Moderate-Low	0	0.00%	0	0.00%
Moderate	0	0.00%	0	0.00%
Moderate-High	0	0.00%	0	0.00%
High	0	0.00%	0	0.00%

Compressor Stations

All of the 13 compressor stations received low coastal erosion vulnerability scores in 2050 (see Table 4-61).

Table 4-61: 2050 Vulnerability Scores: Coastal Erosion, Compressor Stations

Vulnerability Class	Total Count	Total %	DVC Count	DVC %
Low	13	100.00%	6	100.00%
Moderate-Low	0	0.00%	0	0.00%
Moderate	0	0.00%	0	0.00%
Moderate-High	0	0.00%	0	0.00%
High	0	0.00%	0	0.00%

Regulator Stations

Almost all of the over 10,900 regulator stations received low coastal erosion vulnerability scores in 2050. Seven received moderate-high scores (see Table 4-62). Of the regulator stations receiving moderate-high scores, two were in DVCs.

Table 4-62: 2050 Vulnerability Scores: Coastal Erosion, Regulator Stations

Vulnerability Class	Total Count	Total %	DVC Count	DVC %
Low	10,910	99.94%	4,987	99.96%
Moderate-Low	0	0.00%	0	0.00%
Moderate	0	0.00%	0	0.00%
Moderate-High	7	0.06%	2	0.04%
High	0	0.00%	0	0.00%

Of the moderate-high scoring regulator stations in the SoCalGas territory:

- Two are in southern Oxnard near Ormand Beach (this is a DVC)
- Five are near or along SL 37-04 between Big Rock and Topanga Beach

Storage Fields

Goleta received a high coastal erosion vulnerability score in 2050 (see Table 4-63). It is also in a DVC.

Table 4-63: 2050 Vulnerability Scores: Coastal Erosion, Storage Fields

Vulnerability Class	Total Count	Total %	DVC Count	DVC %
Low	3	75.00%	0	0.00%
Moderate-Low	0	0.00%	0	0.00%
Moderate	0	0.00%	0	0.00%
Moderate-High	0	0.00%	0	0.00%
High	1	25.00%	1	100.00%

Facilities

All of the over 140 facilities received low coastal erosion vulnerability scores in 2050 (see Table 4-64).

Table 4-64: 2050 Vulnerability Scores: Coastal Erosion, Facilities

Vulnerability Class	Total Count	Total %	DVC Count	DVC %
Low	144	100.00%	75	100.00%
Moderate-Low	0	0.00%	0	0.00%
Moderate	0	0.00%	0	0.00%
Moderate-High	0	0.00%	0	0.00%
High	0	0.00%	0	0.00%

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Figure 4-37: Coastal Erosion Vulnerability Scores, 2023, High-Pressure Pipelines

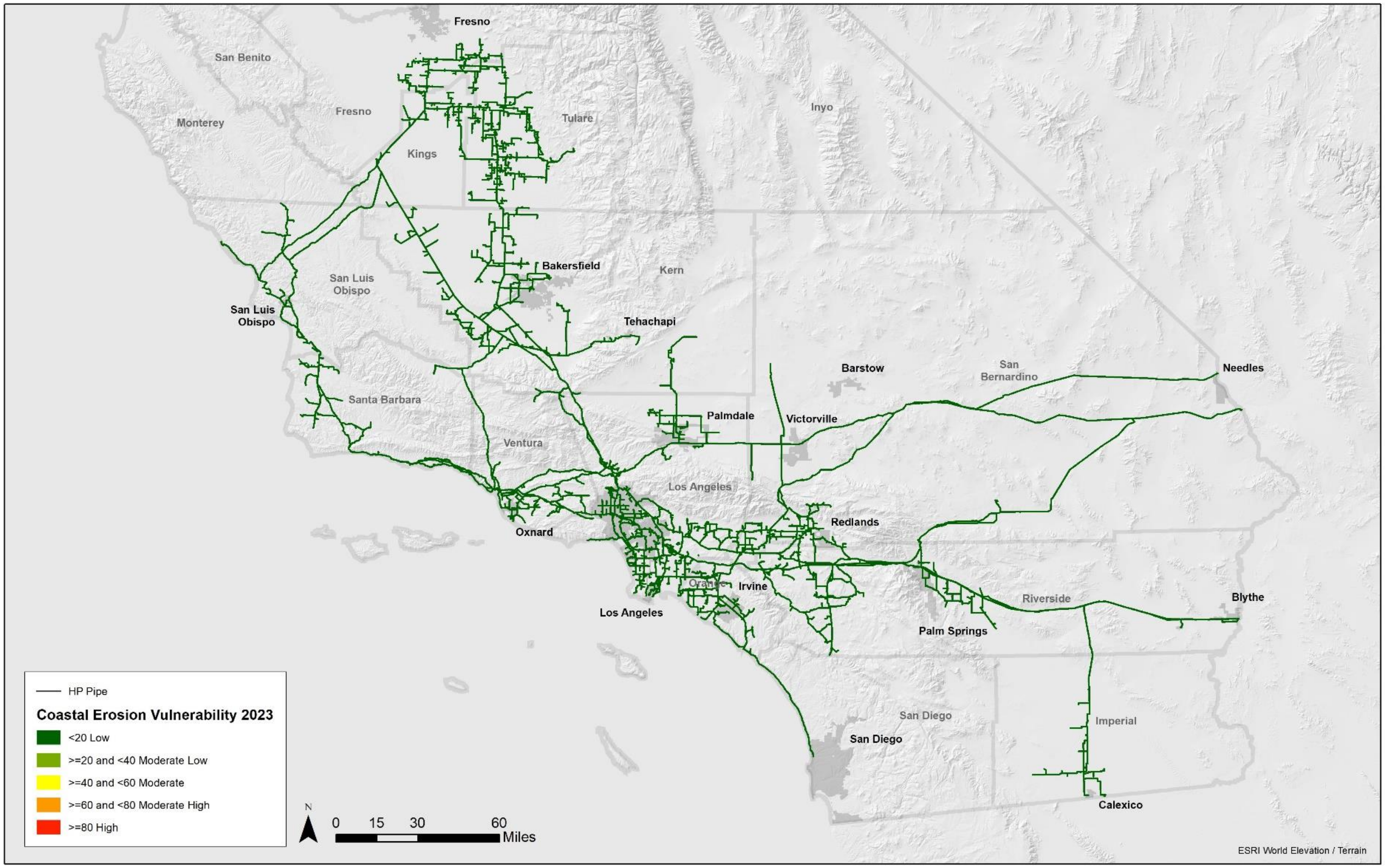


Figure 4-38: Coastal Erosion Vulnerability Scores, 2070, High-Pressure Pipelines

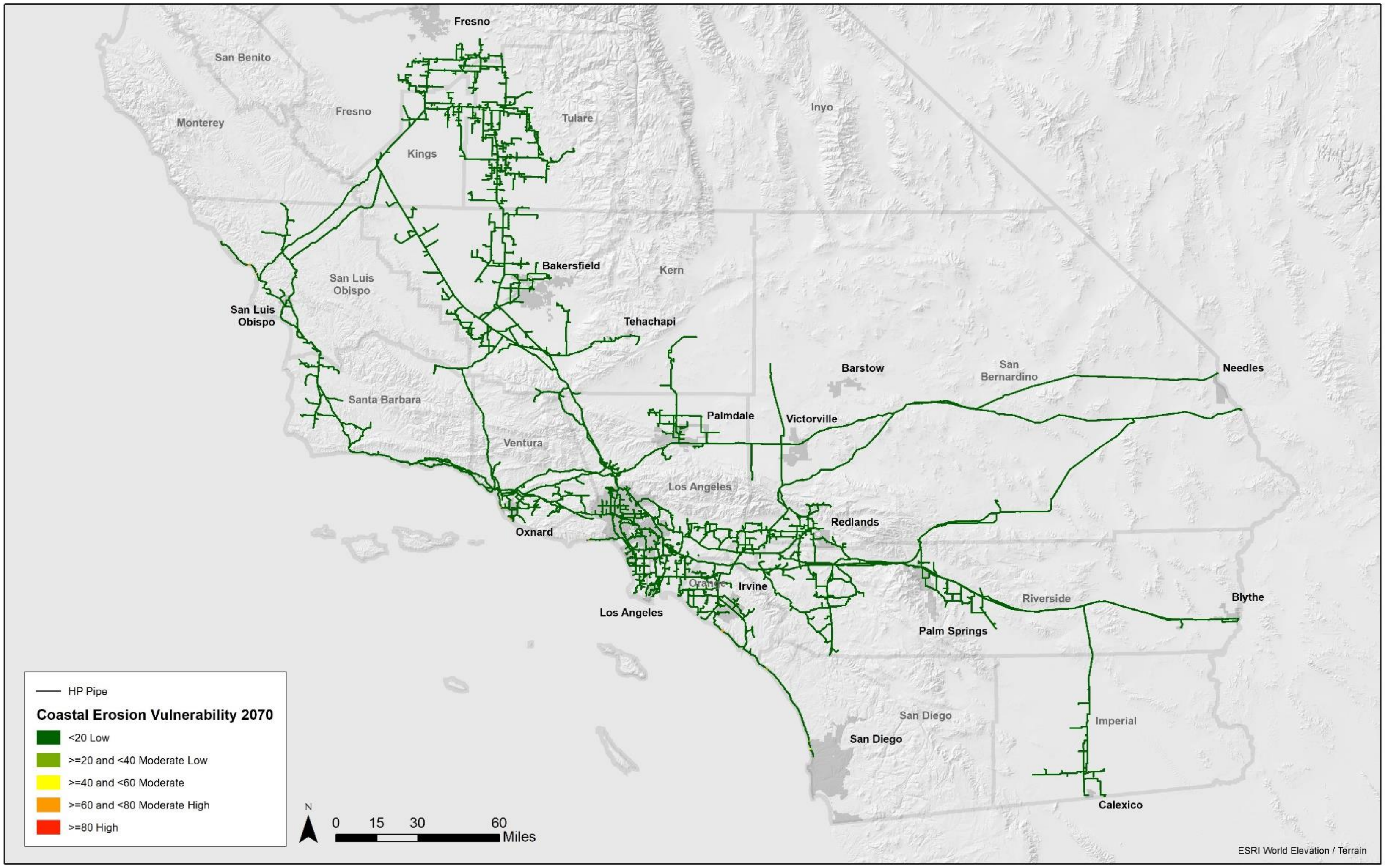


Figure 4-39: Coastal Erosion Vulnerability Scores, 2023, High-Pressure Pipelines (Moderate, Moderate-High and High Vulnerability Assets)

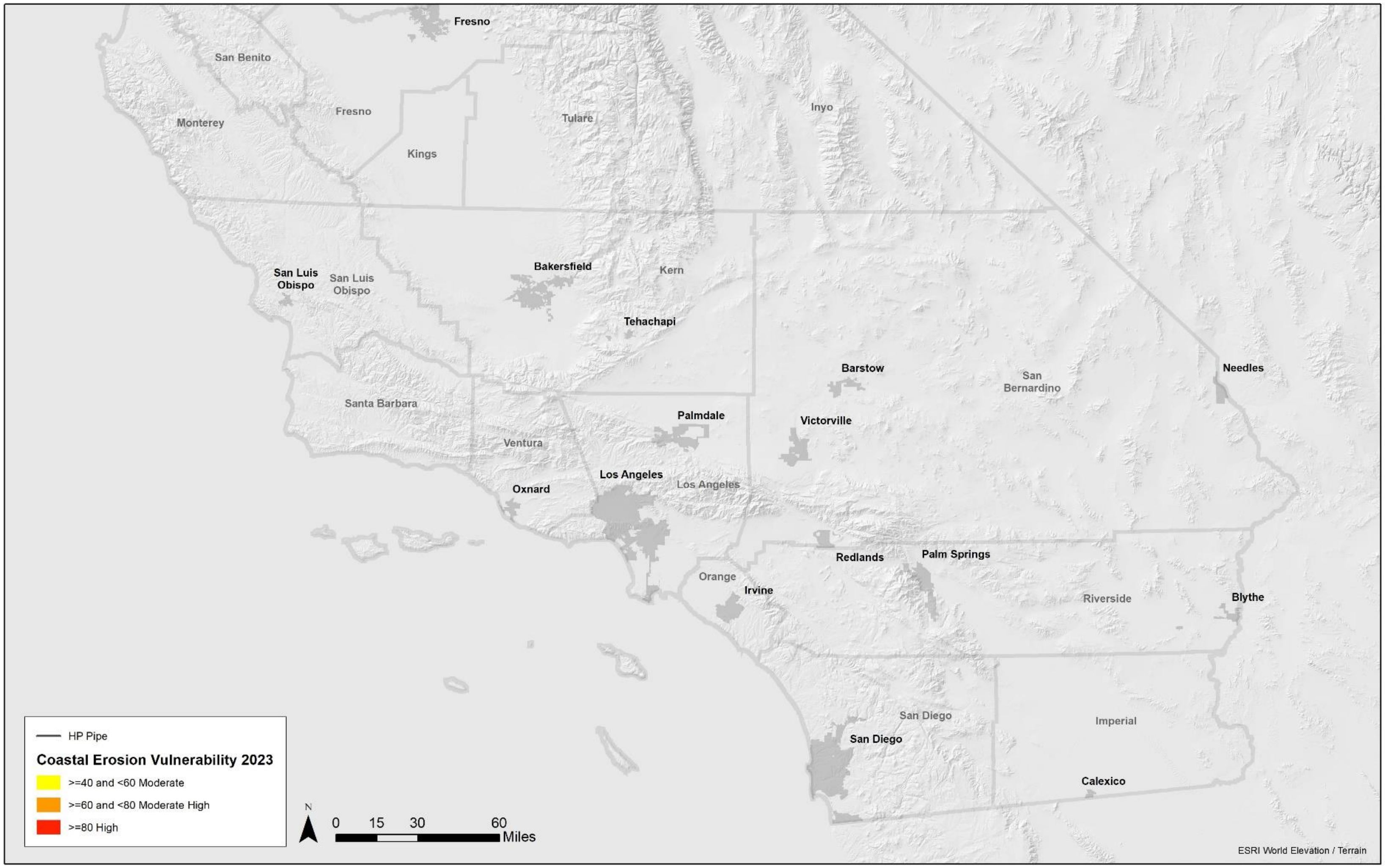
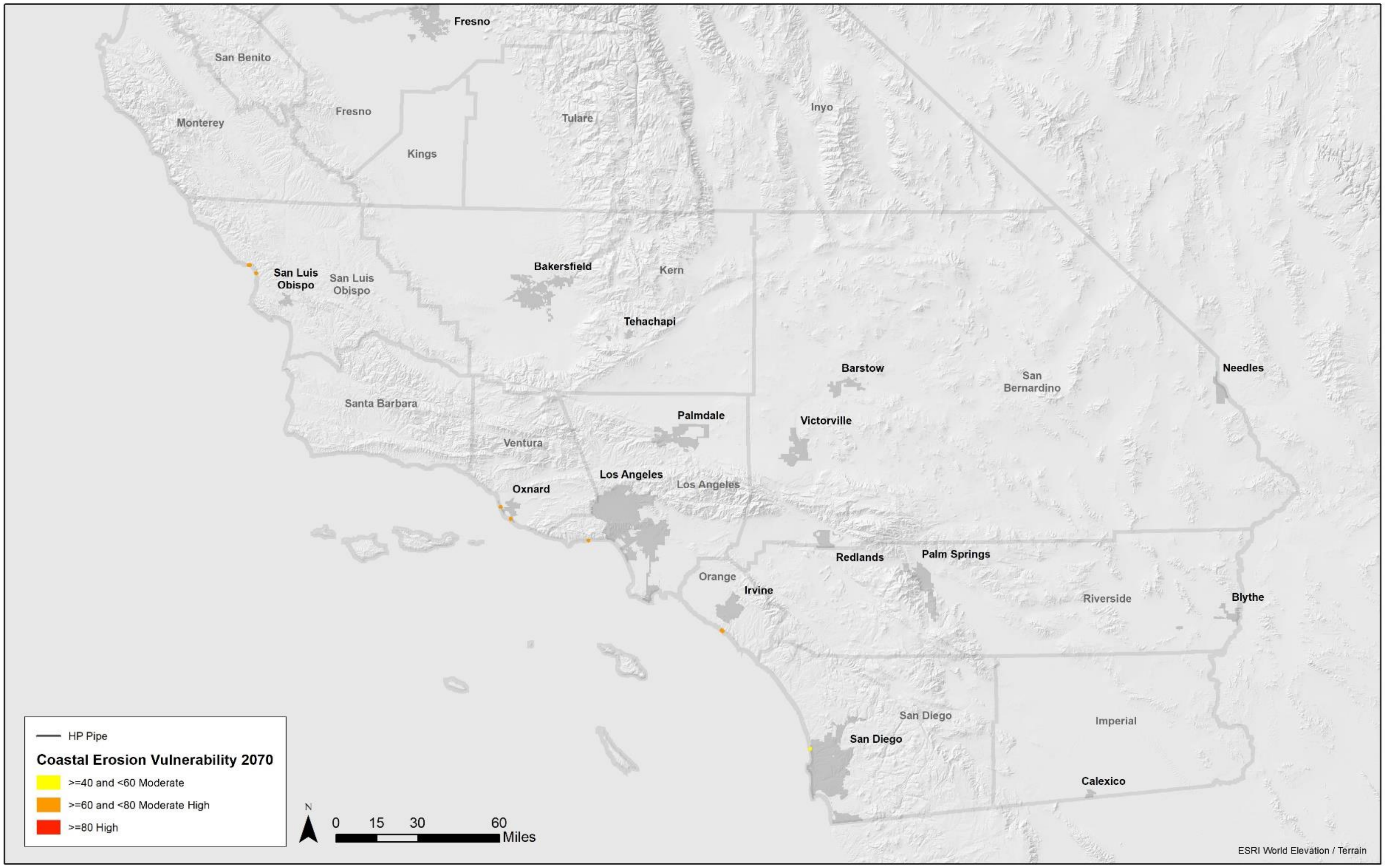


Figure 4-40: Coastal Erosion Vulnerability Scores, 2070, High-Pressure Pipelines (Moderate, Moderate-High and High Vulnerability Assets)



Asset Adaptive Capacity Results

This section briefly documents the results of the asset adaptive capacity qualitative analysis.

Table 4-65 summarizes the qualitative level of capacity from the SME workshops for each combination of asset type and hazard. As described in Chapter 3, SMEs were asked to characterize adaptive capacity as low, moderate, or high for each combination using the following definitions:

- High: “Sufficient or excellent capabilities to manage the climate hazard now and in the future”
- Medium: “Some or many existing capabilities; however, there are opportunities to strengthen these”
- Low: “No or very few current capabilities”

The categorical assignments were converted to numeric scores ranging from 1 (high) to 3 (low). In cases where multiple SMEs assigned scores, average scores were taken for each asset group. These scores were rounded to the nearest whole number and converted back to high, moderate, or low.

Table 4-65: Level of Adaptive Capacity by Asset Type and Hazard

	Wildfire	Inland Flooding	Landslide	Coastal Flooding	Coastal Erosion
Facilities	Moderate	Moderate	Moderate	No exposure	No exposure
Storage Fields	Moderate	Moderate	Moderate	Moderate	Low
Compressor Stations	High	High	Moderate	No exposure	No exposure
Regulator Stations	Moderate	High	Low	High	Low
Gas Valves	Moderate	High	Moderate	High	Moderate
High-Pressure Pipelines	Moderate	Moderate	Moderate	Moderate	Moderate
Medium-Pressure Pipelines	Moderate	Moderate	Moderate	Moderate	Moderate

Adaptive capacity was classified as moderate or high for all exposed asset classes for wildfire, inland flooding, and coastal flooding. Adaptive capacity was classified as low for regulator stations for both landslide and coastal erosion; and for storage fields for coastal erosion.

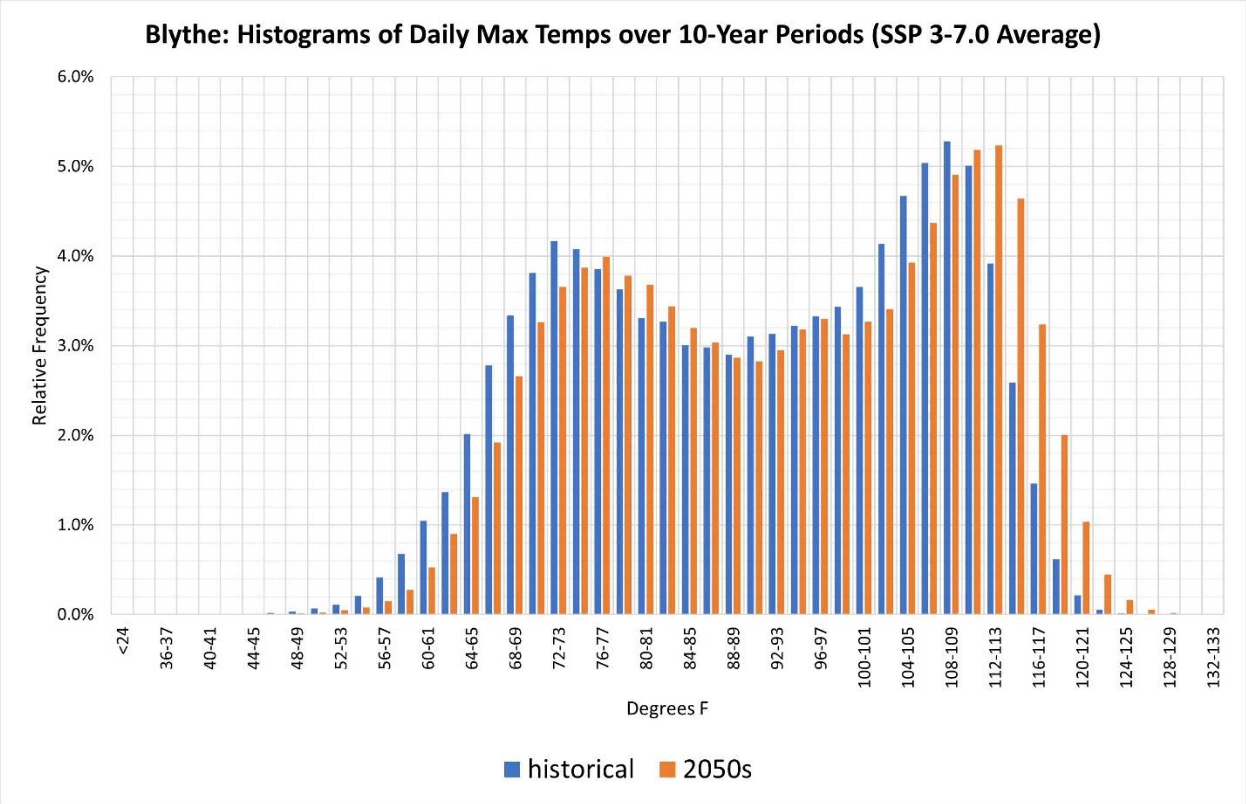
The specific planning and operational capacities mentioned by the SMEs are listed in Chapter 5.

4.1.3 Supplemental Analysis Results

Compressor Station Analysis

Summary charts of temperature distributions were produced for each station location, SSP, and decade, as described in section 3.5.1. Figure 4-41 is an example of one of these charts for Blythe compressor station for an average across SSP3-7.0 models. The blue bars show the distribution of daily maximum temperatures over the 10-year historical case period, and the orange bars show the distribution of daily maximum temperatures over a projected future 10-year period in the 2050s. The projected future temperatures tend to be higher than the historical based case temperatures.

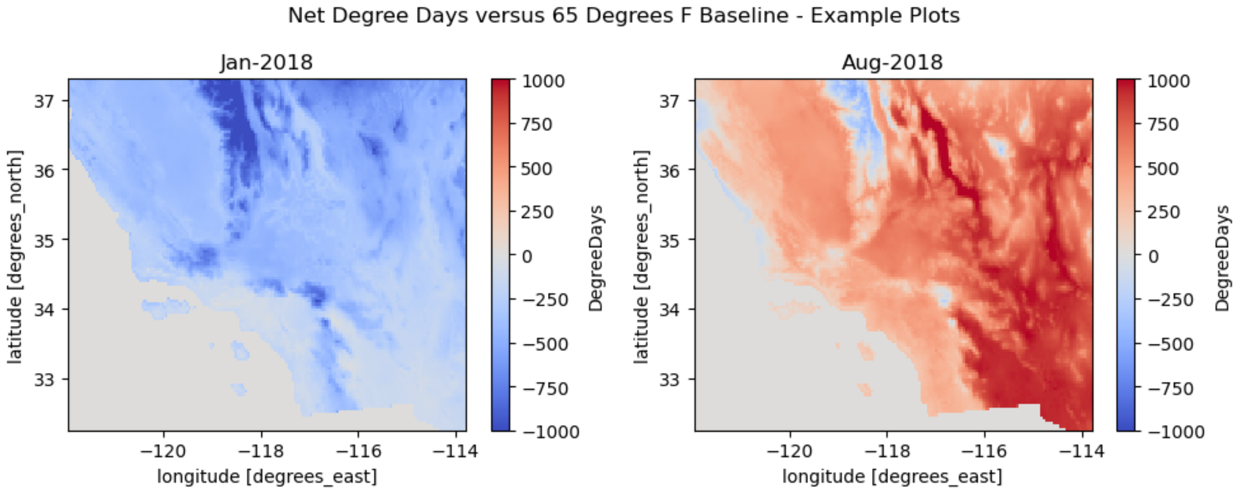
Figure 4-41: Example Histograms from Compressor Station Analysis



Gas Consumption Analysis

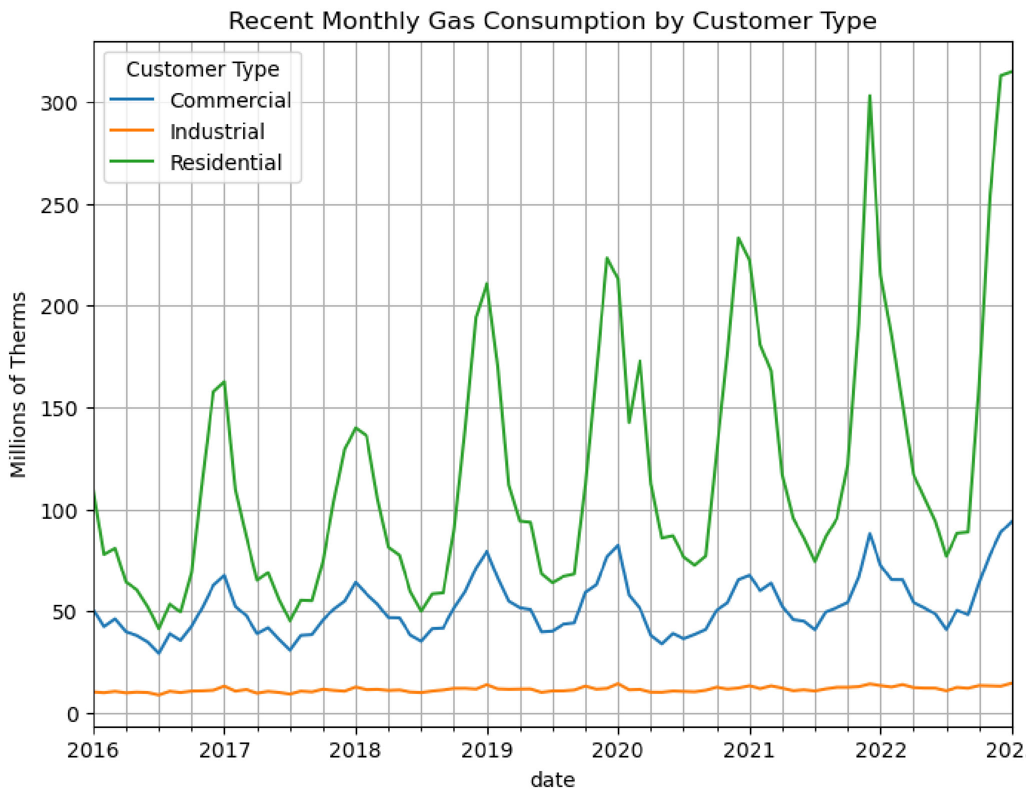
Over the historical period analyzed, consumption fluctuated heavily based on time of year. As expected, heating degree days (HDDs) were positively correlated with consumption and cooling degree days (CDDs) were negatively correlated with consumption. Figure 4-42 shows a plot of net degree days across the study area at different points in the same historical year. Figure 4-43 shows aggregate historical consumption by customer type of time, with heavy seasonal fluctuation, including higher consumption in winter months when there are more HDD.

Figure 4-42: Example Plots of Net Degree Days versus 65˚ F Baseline for a Winter Month and Summer Month



Note: Positive numbers show cooling-degree days dominate the net calculation and negative numbers show heating-degree days dominate the net calculation.

Figure 4-43: Aggregate Recent Monthly Gas Consumption by Customer Type

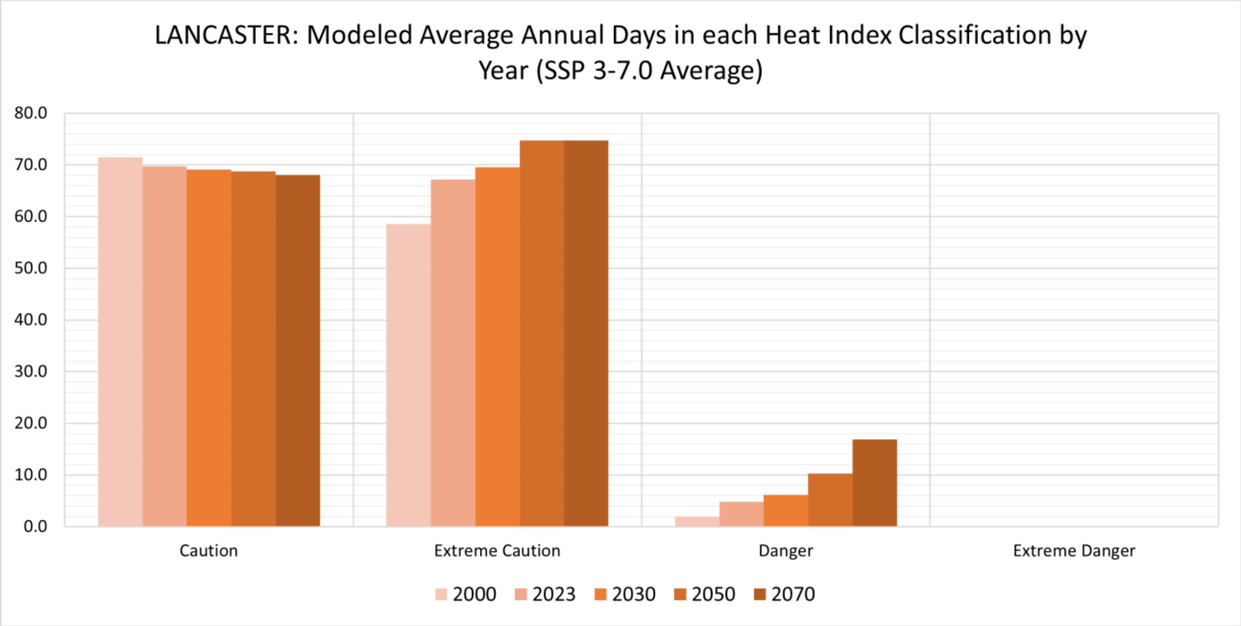


There are marked changes in expected CDDs and HDDs for the typical zip code across the projections used, with large increases in CDDs and large decreases in HDDs. The consumption analysis suggested that substantial decreases in HDDs will have a significant dampening impact on natural gas consumption in southern California. Therefore, consumption will likely be affected by many other variables including population changes, availability and prices of gas and other energy sources, policy changes, and technological development.

Outdoor Worker Analysis

Summary charts of heat index projections were produced for each district and SSP, as described in section 3.5.3. Figure 4-44 shows an example of one of these charts for the Lancaster district for an average across SSP3-7.0 models. The four clusters of bars show the average annual days under each of the four heat index classes (Caution, Extreme Caution, Danger, Extreme Danger). Each color corresponds with a different time period. The lightest set corresponds with a historical baseline period centered around the year 2000, whereas the darkest set corresponds with a projected future period centered around the year 2070. As time progresses and conditions get hotter, the projected number of days in the Caution classification decreases, but the projected number of days in the Extreme Caution and Danger classifications increases.

Figure 4-44: Example Heat Index Projections: Example Heat Index Projections



High-Pressure Pipe Flooding Analysis

The analysis showed how future precipitation and wildfire could affect water surface elevations at four different high-pressure pipeline spans in Ventura and Riverside County that had been flagged in previous analyses. For three of the four locations, water surface elevations for the projected future events were below the bottom elevations of the spans. For one of the four locations, some of the future events analyzed had water surface elevations that exceeded the bottom elevation of the span. This location should be prioritized for adaptation analysis. The projected future flood information can be used to inform selection and evaluation of potential adaptation options at this site.

Coastal Damage Analysis

Table 4-66 shows the projected potential damage costs summarized by asset class and SLR scenario for the asset classes included in the analysis. Across the 45 exposed SoCalGas assets, discounted[37] coastal damage was $4.0 million for the Intermediate scenario, $5.0 million for the Intermediate-High scenario, and $6.5 million for the High scenario. Regulators incurred the highest costs and accounted for most of the damage costs in each of the three scenarios. This was followed by high-pressure pipelines. Assets with higher damage costs should be prioritized for site-specific analysis and potential adaptation.

Table 4-66: Present Discounted Damage Costs by Sea Level Rise Scenario and Asset Type

Asset Class	Asset Count	Intermediate SLR Cost	Intermediate-High SLR Cost	High SLR Cost
SoCalGas HP Pipe	25	860,000	1,330,000	1,720,000
SoCalGas Regulator	20	3,180,000	3,710,000	4,820,000
Total	**25**	**4,040,000**	**5,040,000**	**6,550,000**
Key: HP = high-pressure; SLR = sea level rise; SoCalGas = Southern California Gas Company				

4.2 Operations and Services

The prior section describes potential climate change impacts on SoCalGas assets and the role of these assets in enabling SoCalGas safe and reliable operations and services. This section focuses on describing SoCalGas's emergency management practices and its role to enable resilient operations and services.

[37] Future costs were discounted to 2023 dollars.

SoCalGas has a structured and comprehensive emergency management framework designed to promote operational resilience and safety during emergency crisis situations and other related incidents that may disrupt operations. This framework integrates industry best practices, national standards, and internal protocols to effectively respond to and recover from incidents.

SoCalGas follows the Incident Command System (ICS), a standardized approach to emergency management recognized nationwide. The ICS framework facilitates coordinated decision-making, clear command structures, and efficient resource management. SoCalGas's Emergency Operations Center (EOC) serves as the central hub for emergency response, promoting a unified and rapid response to incidents. SoCalGas's emergency response operations are structured around four core mission areas: make safe, assess, respond, and restore. The EOC coordinates all aspects of emergency response, restoration, and recovery.

SoCalGas categorizes incidents into five levels of severity, from Type 5 (routine incidents) to Type 1 (catastrophic events such as major earthquakes). Depending on the severity, response efforts may involve local field personnel, regional response teams, or full-scale EOC activation.

- Routine and Elevated Incidents (Types 5 and 4): Managed by field supervisors or area managers with minimal impact on operations.
- Serious to Severe Incidents (Types 3 and 2): Require higher-level coordination and potential multi-agency involvement.
- Catastrophic Incidents (Type 1): Demand a companywide response and coordination with state and federal agencies.

SoCalGas's EOC operates under three activation levels that are aligned with the Federal Emergency Management Agency and State Office of Emergency Services:

- Level 3 – Monitoring: Emergency Management personnel actively monitor conditions and stand ready to escalate response efforts, if needed.
- Level 2 – Light Activation: Key response personnel are mobilized for in-person coordination.
- Level 1 – Full Activation: A fully staffed EOC responds to large-scale emergencies with all ICS roles engaged.

SoCalGas emphasizes situational awareness through continuous monitoring, structured incident complexity analysis, and collaboration with local, state, and federal emergency response agencies. Rapid assessment and communication protocols promote a proactive approach to potential threats. To maintain readiness, SoCalGas personnel undergo ICS training, annual refresher courses on emergency response, and regular drills and tabletop exercises to reinforce response strategies.

SoCalGas's emergency management framework is built to handle a range of crises, from localized service disruptions to large-scale natural disasters. By integrating robust planning, real-time situational awareness, and structured response mechanisms, SoCalGas promotes operational continuity while prioritizing public safety and infrastructure resilience.

4.3 Third-Party Contracts

SoCalGas does not have long-term contracts of 15 years or more for power, capacity, or reliability. Therefore, this section is not applicable to SoCalGas.

5 ADAPTATION AND RESILIENCE: POTENTIAL MEASURES AND NEXT STEPS

5.1 Introduction

The Commission in D.20-08-046, asks utilities to "describe possible solutions" and to highlight incremental steps that SoCalGas can evaluate in the future.[38] This chapter provides potential climate adaptation options for asset categories for which climate change risks are identified as moderate or high. The climate adaptation options presented in each asset family are targeted toward individual future climate hazards. These adaptation options are not fully developed projects and may or may not be developed into future funding requests.

This chapter describes how CAVA findings can enhance the resilience of SoCalGas infrastructure, operations, and customer services. This chapter focuses on how to use the CAVA results to conduct project-level adaptation analyses and to prioritize which assets and locations should undergo these project-level analyses. Potential adaptation strategies are listed along with a discussion of the broader integration of CAVA findings and processes into other SoCalGas programs and activities. This chapter also briefly summarizes ongoing community partnership, CEP work, and suggestions for future CAVA enhancements.

5.2 Using the Climate Adaptation and Vulnerability Assessment to Prioritize Project-Level Adaptation Analysis

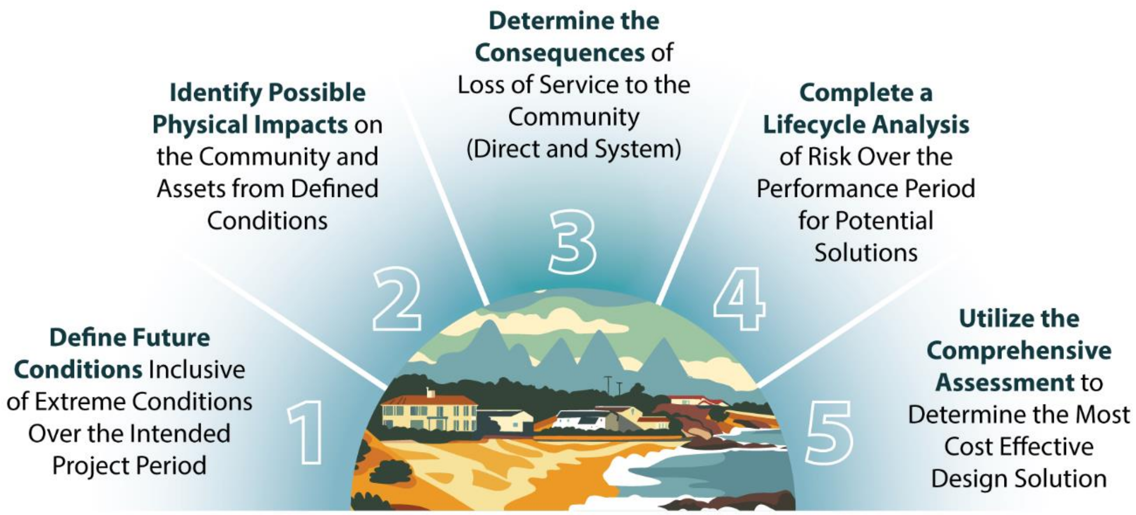
The adaptation options identified in the CAVA will be considered in the context of SoCalGas's existing risk-based planning processes.

The CAVA identifies SoCalGas assets that are likely to be most vulnerable to climate change and, therefore, candidates for operational or capital improvements that enhance their resilience. The CAVA is a system-scale analysis conducted across a large geographic area covering multiple hazards and millions of assets. First and foremost, the CAVA scores are intended to help SoCalGas determine which assets should undergo project-level (*i.e.*, site-specific, asset-level, and facility-level) adaptation assessments to address climate risks.

[38] D.20-08-046 at 117 (COL 56).

A project-level analysis evaluates different alternatives to address risks at a project location (see Figure 5-1). It can be conducted for an individual asset, such as a pipeline segment, or a group of assets, such as a storage field and all associated facilities. Typically, this assessment would include a no-action alternative and one or more action alternatives. The action alternatives could include capital improvement and mitigation projects, operational improvements, or both.

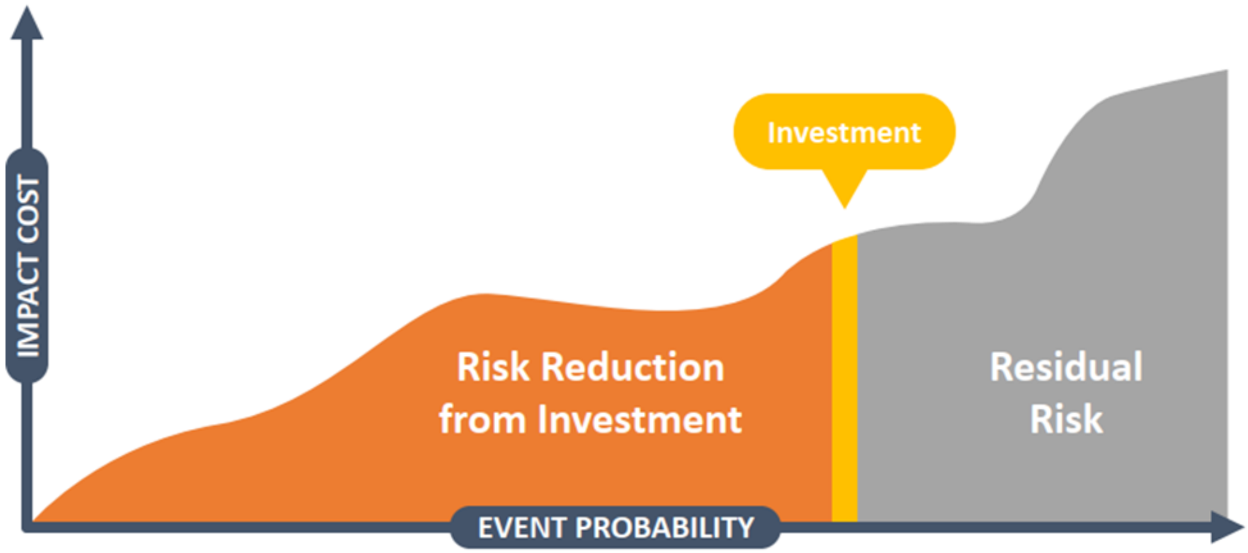
Figure 5-1: Project-Level Climate Risk Analysis



In some cases, particularly when mitigation or resilience solutions are lower cost, one project option may be an obvious choice without much additional analysis or design work needed. In other cases, conducting an economic analysis of potential options may be helpful.

This economic analysis typically includes assessing probabilities of different magnitude events (*e.g.*, 2-year, 25-year, and 100-year storm), assessing costs of different magnitude events, and calculating discounted costs (*e.g.*, capital costs, hazard-related costs, and regular operations and maintenance costs) to compare options (see Figure 5-2). For assets affected by climate change, the probabilities, magnitudes, or both, of these events may shift over time, so it is informative to incorporate these changes into the analysis. In this type of economic analysis, resilience benefits are hazard-related costs avoided compared with a no-action alternative. Ideally, the hazard costs should include both SoCalGas costs to repair the damage and user costs to customers who rely on the gas system. Assessing how these costs and benefits affect different populations, such as DVC members, may also be informative.

Figure 5-2: A project-level assessment with an economic analysis informs how much an alternative reduces risk, which is compared to the cost of implementing that alternative.



5.3 Priorities for Project-Level Adaptation Analysis

Based on the asset vulnerability scoring process across hazards and asset type results, the project team selected locations with assets with moderate-high or high scores for one or more hazards. Table 5-1 shows portions of the gas system that are good candidates for project-level assessments.

Table 5-1: Priorities for Project-Level Adaptation Analysis

Asset Type	Asset Name	Wildfire	Landslide	Inland Flooding	Coastal Flooding	Coastal Erosion
Storage Fields	Honor Rancho	☑	☑	☑		
	Aliso Canyon	☑	☑	☑		
	Playa Del Rey		☑	☑	☑	
	Goleta		☑	☑	☑	☑
Facilities (aside from those at storage fields)	Rim Forest Base Building 01	☑		☑		
	Blue Ridge Communication Site	☑				
	Mount David Communication Site	☑				
	Sunset Ridge Communication Site	☑				
	Valencia Base Building 01			☑		
	Simi Valley Base Building 01			☑		
	La Habra Height Communication Site			☑		
	Yucca Valley Base Building 01			☑		
	Baldwin Hills Communication Site		☑			
High-Pressure Pipelines	Lines 44-307 and SL 44-1008 between Central Coast and Central Valley regions		☑			
	Lines SL 38-250, 7055, 7056 from the southwestern portion of Central Valley extending in the nearby mountains			☑		
	Line SL 32-116-2, SL 38-116-1 1 between Wheeler Ridge and Tehachapi			☑		
	Line SL 36-9-10 just west of Cayucos and just north of Morro Bay					☑
	Lines SL-36-1032, SL-36-9-18, SL-36-9-04 in western Santa Barbara County			☑		
	Line 1010 in western Santa Barbara County		☑			
	Lines 247, SL 36-1002 parallel to coast in Santa Barbara County		☑			
	Lines 247 in Goleta					
	Lines 1003, 1004, 1005 in Santa Barbara and Ventura Counties roughly parallel to the coast		☑			
	Line SL 36-8-04 between Ventura and Ojai			☑		
	Line SL 38-174 near Frazier Park			☑		
	Line 8109 between Oxnard and Cuyama		☑	☑		
	Line 324 between Oxnard and Santa Clarita		☑			
	Line SL 36-8-01-E near Ormond Beach					☑
	Lines 225 and 85 South between Santa Clarita and Lebec		☑			

Asset Type	Asset Name	Wildfire	Landslide	Inland Flooding	Coastal Flooding	Coastal Erosion
	Portions of Lines 404 and 406 and other shorter lines between the Ventura area and the southern edge of San Fernando Valley		☑			
	Lines 3003, 407, and others in the Santa Monica Mountains between Santa Monica and San Fernando Valley		☑			
	Line SL 37-04 at Malibu Creek					☑
	Lines 235 West and 335 between Santa Clarita and Palmdale		☑			
	Lines 2001 West, 2000, 4000, and 4002 crossing the Chino Hills		☑			
	Lines 4000 and 4002 crossing the Cajon Pass		☑			
	Line SL 35-20 in Crystal Cove State Park					☑
Controllable Gas Valves	Along the transmission lines that parallel the coast in Santa Barbara and Ventura Counties, such as Lines 1003 and 247	☑	☑	☑		
	In the mountains near the City of Ventura	☑	☑	☑		
	In the Santa Monica Mountains between Oxnard and San Fernando Valley	☑	☑	☑		
	Mountainous areas in and around Santa Clarita	☑	☑	☑		
	Along the transmission lines between Santa Clarita and the Central Valley, such as Lines 225 and 85 South	☑	☑	☑		
	Along the transmission lines between Santa Clarita and Palmdale, including Lines 235 West and 335	☑		☑		
	Along the transmission lines through the Cajon Pass between Fontana and the Adelanto Compressor Station, including Lines 4000 and 4002	☑	☑	☑		
	Some portions of the eastern Santa Monica Mountains and Monterey Heights north of downtown Los Angeles	☑	☑			
	Some portions of southern Orange County, such as Mission Viejo, Dana Point, and San Juan Capistrano		☑			
	Some portions of the Chino Hills area		☑			
	Along the transmission lines between Morongo Valley and Joshua Tree, including Lines 6916 and SL 41-54			☑		
	Assets in various portions of Central Coast region in western San Luis Obispo and Santa Barbara counties			☑		
	Assets along the western and southern edge of the Central Valley			☑		

Asset Type	Asset Name	Wildfire	Landslide	Inland Flooding	Coastal Flooding	Coastal Erosion
	Along the transmission lines in the San Jacinto Mountains and through the San Gorgonio Pass, including Lines 2000 and 5000(3)	☑		☑		
	Along the transmission lines between Yorba Linda and Lake Elsinore, including Lines 2000 and SL-41-12	☑				
	Northern Kings County near Lemoore			☑		
	Between Tehachapi and Wheeler Ridge			☑		
Regulator Stations	Southern Central Valley in the Di Gorgio and Arvin areas			☑		
	Between the Central Valley and Tehachapi, including Line SL 32-116-2	☑		☑		
	Rural western Santa Barbara County, such as along Lines 1010, SL 36-9-22, and SL 36-1032		☑	☑		
	Southern Santa Barbara County in the corridor between the coast and Santa Ynez Mountains, including some along Lines 247, 1005, and 1003	☑	☑			
	In southern Oxnard near Ormand Beach					☑
	Line 324 in the mountains between Oxnard and Santa Clarita	☑				
	Santa Clarita area	☑		☑		
	Frazier Park area			☑		
	Lines SL 36-37 and SL 33-37 near Oak Park and Calabasas	☑				
	In the river valleys in southern Ventura County, such as Santa Clara River and the Arroyo Simi			☑		
	Along SL 37-04 parallel to the coast east of Malibu	☑	☑	☑		
	Along SL 37-04 between Big Rock and Topanga Beach					☑
	Along the transmission lines between Santa Clarita and Palmdale, including Lines 235 West and 335, and SL 32-85	☑				
	In the Lake Arrowhead area	☑				
	In the Fontana and Cajon Canyon area, including along lines 4000 and 4002	☑		☑		
	Central Coast region in western San Luis Obispo, such as portions of Atascadero and Arroyo Grande areas		☑			
	Portions of the Rancho Palos Verdes area		☑			
	Hillier portions of southern Orange County		☑			
	In northern Kings County near Lemoore			☑		
	West Newport Beach area				☑	
	In the San Gorgonio Pass area			☑		

5.4 Potential Adaptation Strategies

As part of the adaptive capacity of various asset types to different hazard evaluations, SMEs discussed measures either currently used or under consideration for mitigating climate-related risks. Table 5-2 shows potential adaptation measures for various hazard types.

Table 5-2: Potential Adaptation Strategies

Adaptation Strategy	Category (Planning/ Design or Operations/ Maintenance)	Hazard Type Wildfire	Landslide & Subsidence	Inland Flooding	Coastal Erosion & Flooding	Multiple Hazards
Incorporate future climate projections into climate-related design parameters used in design (e.g., ambient temperature, flood elevation, rainfall depth, scour depth, and wave runup elevation)	Planning/Design					☑
Identify locations where assets are close to the affected pipeline and isolate pipeline segments by identifying appropriate valves and turning them off when a hazard occurs	Operations/ Maintenance					☑
Consider remote-controlled valves for emergency access	Planning/Design					☑
Mitigate impacts with duplicate/redundant valves	Planning/Design					☑
Regularly patrol pipeline network after events	Operations/ Maintenance					☑
Use findings, such as climate projections, to inform preventive measures such as rupture-mitigation valves or similar technologies to identify pipeline ruptures when they occur and close valves to isolate the ruptured segment as soon as practicable	Operations/ Maintenance					☑
Use vegetation control (fencing, trimming)	Operations/ Maintenance	☑				
Inspect pipelines after wildfires	Operations/ Maintenance	☑				
Install fire systems and sprinklers in buildings	Planning/Design	☑				
Increase water supply in fire-prone areas	Planning/Design	☑				
Partner with the fire department to control the flow of gas at the service to the main connection or squeeze pipes in the distribution system when a wildfire burns down structures	Operations/ Maintenance	☑				
Follow architectural code for fire protection	Planning/Design	☑				
Enclose susceptible equipment	Operations/ Maintenance	☑				
Ensure Fire Marshals review plans for projects	Planning/Design	☑				
Replace plastic markers along pipelines after being destroyed by wildfire	Planning/Design	☑				
Install fiber optics to monitor slope integrity	Planning/Design		☑			
Conduct geohazard reviews and design adjustments	Planning/Design		☑			
Open the trench, visually inspect the pipe, and, if needed, cut the pipe to release the strain for pipelines affected by subsidence or slope movement	Operations/ Maintenance		☑			
Place rock or landscaping grid to stabilize a slope; add retaining walls where warranted as landslide mitigation options at buildings	Planning/Design		☑			

Adaptation Strategy	Category (Planning/ Design or Operations/ Maintenance)	Hazard Type: Wildfire	Hazard Type: Landslide & Subsidence	Hazard Type: Inland Flooding	Hazard Type: Coastal Erosion & Flooding	Hazard Type: Multiple Hazards
Add strain gauges to pipes	Planning/Design		☑			
Explore options including attaching piles to the underlying bedrock for buildings prone to slope movement or subsidence	Planning/Design		☑			
Retrofit facilities and compressor stations when subsidence occurs	Operations/ Maintenance		☑			
Consider design options (e.g., using extra support or redirecting water) in areas vulnerable to landslide; compare with operational solutions such as relying on valves upstream	Planning/Design		☑			
Develop a plan for how to shut down in the event of a rupture and how to maintain service for customers for areas particularly vulnerable to slope movement	Planning/Design		☑			
Stabilize slopes for infrastructures in landslide-prone areas	Planning/Design		☑			
Enhance stormwater drainage in geohazard-prone areas	Planning/Design		☑			
Use bend joints on landslide-prone pipelines	Planning/Design		☑			
Elevate infrastructure susceptible to flood inundation	Planning/Design			☑	☑	
Relocate infrastructure if flood risk is too high	Planning/Design			☑	☑	
Bury pipelines deeper in flood-prone areas	Planning/Design			☑		
Use sump pumps for flood-prone buildings	Operations/ Maintenance			☑		
Use information on depth of cover, area, slope, property of materials, catchment area, and precipitation levels to calculate flood height and scour depths when designing pipelines	Planning/Design			☑	☑	
Use flood protection design codes for flood-prone facilities	Planning/Design			☑	☑	
ensure designs account for these impacts for coastal areas prone to wave action	Planning/Design				☑	

SoCalGas will continue to consider potential remedies for vulnerable infrastructure. Enhancing resilience and sustainability in vulnerable infrastructure can sometimes be achieved by integrating sustainable business practices. These types of solutions can play a helpful role in strengthening infrastructure against hazards. For instance, vegetative stabilization, green buffers, and bioengineered slopes can help control erosion and reduce landslide risks in areas with unstable terrain. In flood-prone locations, permeable surfaces, constructed wetlands, and bioswales can be implemented to manage stormwater and reduce the impact of heavy rainfall on critical infrastructure. These approaches not only improve resilience but also provide ecological benefits by enhancing groundwater recharge and biodiversity.

Sustainable material selection and infrastructure design modifications are also considerations. Using corrosion-resistant and weather-resilient materials in construction, such as fiber-reinforced composites or recycled aggregates, can help extend the lifespan of infrastructure while reducing environmental impact.

As the Commission and regulated utilities consider strategies to integrate climate change adaptation planning to address the increasing frequency and intensity of climate impacts, it is important to preserve the long-term safety, reliability, and affordability of infrastructure and services provided by regulated utilities, while investing in decarbonization solutions that can further reduce climate impacts. Decarbonization investments can be pursued in a way that leverages the value and service from the gas system, such as the integration of lower carbon fuels, such as Renewable Natural Gas (RNG),[39] which is a drop in fuel replacement, and Hydrogen (H2) Blending.[40]

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[39] Prompted by SB1440, the CPUC has set a procurement target that the gas utilities should procure RNG equivalent to about 12% of their residential and small business 2020 load by 2030

[40] H2 blending has been identified in the California Air Resources Board's Scoping Plan as a key component of its efforts to achieve net-zero greenhouse gas emissions by 2045. In March 2024, as directed by the CPUC in D.22-12-057, SoCalGas and three other California gas utilities submitted an application requesting approval for a series of demonstration projects designed to inform a standard for blending clean, renewable hydrogen into the natural gas system.

5.5 Integration into Other SoCalGas Programs and Activities

There are several ways that the CAVA analysis and results could be incorporated into existing SoCalGas programs and activities.

SoCalGas has included a summary of the CAVA results in its 2025 RAMP filing.[41] SoCalGas recognizes the importance and benefit of integrating the climate hazard analysis from the CAVA into the Company's other risk management processes. The CAVA offers key considerations for areas of further study and development of additional risk mitigation efforts in the future.

Next steps include utilizing SoCalGas's governance structure, such that these findings continue to be elevated and discussed among SoCalGas's Climate Advisory Group and Chief Safety Office, so that cross-functional and interdisciplinary teams continue to be engaged in implementing resilience measures. The findings will also be used to inform upcoming proceedings such as SoCalGas's General Rate Case Application. SoCalGas acknowledges the importance of continuously updating this assessment as weather, the system infrastructure and operations, and regulation changes. For example, on August 1, 2024, the CPUC issued a decision, D.24-08-005, to adopt the Global Warming Level approach as the basis of future CAVA planning in lieu of the SSP approach used in this assessment. One of the next steps for SoCalGas will be to update this assessment in accordance with the D.24-08-005 to adopt the Global Warming Level approach.

SoCalGas is continuing to explore ways that the CAVA could be further integrated into RAMP. For this cycle SoCalGas's CAVA and 2025 RAMP Report are filed on the same day. In future cycles the CAVA will be filed a year before RAMP allowing more time for the CAVA analysis to be incorporated into RAMP as applicable.

More broadly, another potential action is to review the locations of existing projects in other SoCalGas programs alongside the CAVA vulnerability scores. Planned projects that coincide with or affect high-scoring assets could be strong candidates for resilience measures and implementation.

[41] For this cycle SoCalGas's CAVA and 2025 RAMP Report are filed on the same day. In future cycles the CAVA will be filed a year before RAMP allowing more time for the CAVA analysis to be incorporated into RAMP as applicable.

Another option would be to incorporate the CAVA vulnerability scores as a criterion for project prioritization processes amongst other factors.

A different aspect of the CAVA that could be utilized for other purposes is the input data developed to calculate the metrics for each asset. Potential uses could include a more targeted analysis of a certain hazard or group of hazards in a particular area, pulling together information for project specifications, or feeding into a broader prioritization process.

Aside from using the results of the asset-level vulnerability scoring process, SoCalGas can leverage the findings of the CAVA supplemental analyses in a few different ways:

- Supplement existing methodologies used to incorporate projections of how heating and cooling-degree days are likely to change over time when preparing long-term gas demand forecasts
- Incorporate projections of ambient temperature distribution into the design of cooling capacity for compressor stations
- Incorporate projections of heat index changes (*i.e.*, increases in days with heat index classifications of Caution, Extreme Caution, Danger, and Extreme Danger) into long-term staff planning for outdoor workers

5.6 Community Partnerships and Ongoing Community Engagement Plan Work

Subject to Commission's feedback, SoCalGas plans to continue engagement and building on the relationships with DVCs and community leaders that were developed throughout this process.

SoCalGas is committed to strengthening genuine partnerships with community stakeholders and its customers. SoCalGas plans to continue carrying out the recommendations of its CBO partners to build DVC adaptive capacity through hosting emergency preparedness events, partnering with local first responders, attending existing community events, and distributing resources to DVCs to encourage emergency preparedness.

SoCalGas will continue to compensate its partners for their participation in SoCalGas's Climate Adaptation Program and expertise. SoCalGas also plans to support community leaders and partners by keeping the lines of communication and feedback open to new ideas, suggestions, and recommendations for engaging with DVCs and creating more resilient communities.

5.7 Future Enhancements to the Climate Adaptation and Vulnerability Assessment

This CAVA is an important step in both evaluating how climate-related risks may affect SoCalGas infrastructure, operations, and services, including the communities SoCalGas serves and planning how SoCalGas can adapt to these risks. This section briefly discusses potential ways to enhance CAVA in the future.

In future assessments SoCalGas will consider the breadth and depth of the CAVA analysis. This CAVA cast a relatively wide net, assessing numerous potential hazards, millions of assets, and a large geography. Future assessments may conduct additional or supplemental quantitative analysis to incorporate probabilistic risk assessments on specific asset types or particular areas of potential threats. Additional quantitative analysis may help estimate pre-mitigation or "do-nothing" costs as well integrate with portions of the RAMP and GRC processes.

SoCalGas will also phase in the Global Warming Level approach to climate modeling and analysis for the next CAVA, according to the D.24-08-005.

SoCalGas will also explore how to integrate asset information from asset management systems into GIS data to study more consistent spatial information across the entire system.

SoCalGas may revisit the asset class taxonomy used in the analysis that was based on the GIS system's asset classes. In some cases, splitting or combining asset classes may be helpful (*e.g.*, splitting storage fields into multiple assets).

SoCalGas will also consider whether to assess additional climate hazards, such as extreme wind.

Another potential consideration would be incorporating hydraulic modeling of gas systems, where feasible or significant, to simulate how damage at individual locations could affect the overall system energy reliability.

SoCalGas may supplement existing methodologies to incorporate projections of how temperatures are likely to change over time when preparing long-term gas demand forecasts.

SoCalGas may also incorporate projections of ambient temperature distribution into the design of cooling capacity for compressor stations.

SoCalGas may incorporate projections of heat and humidity index changes into long-term staffing planning for outdoor workers.

The next SoCalGas CAVA filing will be in 2028, followed by every four years thereafter. SoCalGas looks forward to continuing to improve its CAVA to account for climate risks, and continue to provide safe, reliable, and affordable service to its customers.

Appendix A
Climate Adaptation Community Engagement Plan

Due to file size, the CEP and its appendices are linked below:

- **CEP:** *https://docs.cpuc.ca.gov/PublishedDocs/Efile/G000/M531/K638/531638892.PDF*
- **Attachment A:** *CalEnviroScreen 4.0*
- **Attachment B-H:** *2024-05-15 (R1804019) SoCalGas Community Engagement Plan (Append B-H).pdf*

Appendix B
Stakeholder Comments from February 13, 2025 CAVA Workshop

Background and Climate Education

Question: Regarding the wildfire methodology, does the wildfire threat include sources from high winds?

Response: Yes, the global climate models do consider wind.

Question: Are there sources for those models and can SCG share those sources with us?

Response: Yes, SCG will share these models.

Question: Given the recent fires and their impacts, should the models address civic mismanagement of resources?

Response: These are strictly climate models. Of course, there are uncertainties depending on the year.

Question: With potential increased rainfall, is the risk for landslides larger than what the model shows?

Response: The models take rainfall into consideration.

Question: Will the new administration change the requirements for climate adaptation work?

Response: The scope of this conversation and workshop is focused on the climate adaptation vulnerability assessment.

VA Methods & High-Level Results

Question: Do other utilities use the same scale for analyzing climate change vulnerability scores?

Response: Some utilities use a similar scale and some utilities only use quantitative data. It depends on the metrics and the extent of accuracy that is needed. There is no strict scale for this.

Question: Why are storage fields at a high-risk level?

Response: Because storage facilities are comprised of various types of infrastructure, there are various assets and locations. During the next round, SCG will look into this and which locations need further analysis.

Question: In terms of storage, it makes sense that storage would be more at risk because the infrastructure is above ground. What is the risk of loss of functionality vs. loss of containment?

Response: This could impact gas demand and service to customers.

Community/Tribal Outreach Results

Question: Can you discuss compensation for CBOs?

Response: Yes, all CBOs were compensated for their time and resources engaging in this project. SCG provided grants to each CBO, following the compensation recommendation from CPUC, but SCG is open to other compensation models for the next round.

Question: What was the scope for the CBOs?

Response: There was a general scope and SCG was flexible to tailoring the overall scope to the strengths and needs of each CBO.

Question: Were the CBO and tribal grants shareholder-funded?

Response: Yes, the grants were all shareholder-funded.

Question: What were the 19 municipalities able to accomplish with the $50,000 grants?

Response: All municipalities that received a grant had either a climate adaptation plan, climate action plan, or other plan to take to City Council and have the plan adopted.

Question: You mentioned SDG&E that customers did not attribute a high favorability to cooling centers. Did SCG receive similar feedback?

Response: SCG has referred to these as resiliency centers. We received positive feedback from the public on resiliency centers. Community members wanted maps of where these centers are located and how to get there.

Questions sent to the SoCalGas Climate Adaption Email

Email:

Dear Climate Adaptation Group:

I joined your CAVA workshop this morning, which was very informative and helpful. I found your community engagement to be quite comprehensive. I'm curious about any issues, and feedback, you discovered regarding small and diverse businesses, which often have unique challenges, such as limited human, technical, and financial resources. I'd be interested in how you are addressing those issues, and any other issues, identified by the CBOs and RABs.

Response:

Thank you so much for attending our workshop. We appreciate you taking time to listen in and are interested in our community workshops. We are in stage 1 of the OIR so we were asking our members for feedback on what they thought climate change would have on our infrastructure and the community at large. I would describe this as more of us in the listening and gathering information stage and as move into the next stage I think we will work on a plan to work with small business owners and the community at large on how we implement their ideas.

Our Regional Area Boards found that the impact on small businesses and their ability to stay open, employee's ability to get to a work location and financial impacts. We were fortunate to have the following groups included: The LA Chamber of Commerce, Greater Conejo Valley Chamber, The OC Hispanic Chamber, and the American Indian Chamber of Commerce. These groups were very active in giving us feedback on the impacts on small business.

These members had concerns that climate change could force a small business to close due to the impacts of climate on our infrastructure for example turning off the gas because of a weather event or the inability to get to the workplace because of the damage to roads or flooding. I think the weather events in our service territory have provided us insight to how these businesses survived (hopefully) and if they didn't what are we able to do to support them. We had a unique opportunity as there were a few major weather events while we were working with the RAB's and they gave us real time thoughts and ideas on next steps. For example, the drought caused a lack of crops growing which resulted in employees who work in the food industry to suffer from food insecurity because there wasn't any work for them. The trickle-down effect of climate change on the employees was something we hadn't thought of in relation to climate change.

Below are some more of thoughts they had:

- A big concern is commuting – Southern California is so spread out and many people commute long distances for work. Small business' employees could be impacted by down power lines, road closures etc. in one part of the area -say LA and getting to the OC for work could be challenging

- SoCalGas should include small businesses in our outreach because where individuals work vs where they live could impact their ability to continue.

- SoCalGas needs redundancies to cover vulnerable areas in our service territory

- Small business in our communities is a reliable source for information about resiliency centers…community members usually trust small businesses because they know the owners and employees.
- All the utilities should work together so efforts are not duplicated

I think we have much more to learn from our communities and we will continue to listen and share our findings.

Appendix C
Summary of How the CAVA Meets the Requirements of the Climate Change Adaptation OIR

The following table lists the relevant decisions from the Climate Change Adaptation OIR and how the CAVA addresses them.

Decision	Ordering Paragraph	Requirement	Addressed in CAVA
D.19-10-054	1	Provides the definition of climate change adaptation	The CAVA uses the CPUC definition. See Section 1.1 (Purpose and Context).
D.19-10-054	2	Guidance shall apply to climate vulnerability analyses by IOUS	The guidance was used to inform the CAVA. See Section 1.1 (Purpose and Context) and throughout.
D.19-10-054	3	Adhere to at least the same climate scenarios and projections used in the most recent California Statewide Climate Change Assessment	The CAVA uses the CMIP6 scenarios and projections used in California's Fifth Climate Change Assessment. See Section 3.2 (Climate Science and Projections).
D.19-10-054	4	Use business-as-usual Representative Concentration Pathways 8.5	This requirement was superseded by D.24-08-005, OP 1 and is no longer applicable.
D.19-10-054	5	For other climate variables and climate trend datasets and tools, prioritize peer-reviewed methodologies over non-peer-reviewed methodologies	Climate datasets used by CAVA were peer-reviewed. See Section 3.2 (Climate Science and Projections).
D.19-10-054	6	If the Fifth Assessment or a future assessment updates these models, representative concentration pathways, climate scenarios or projections, the energy utilities shall align their analyses with those updates by filing a Tier 3 Advice Letter with Energy Division within six months of the new assessment update.	The CAVA aligns with the updates provided in D.24-08-005. See Section 3.2 (Climate Science and Projections).
D.20-08-046	1	Refer to disadvantaged communities as “Disadvantaged Vulnerable Communities,” or “DVCs.” Definition of DVCs.	The CAVA uses the CPUC terminology and definition for DVCs. See Section 1.1 (Purpose and Context).
D.20-08-046	2	Place maps on website illustrating the service territory area covered by DVCs	The map is located on SoCalGas's website: https://www.socalgas.com/climate-adaptation-at-socalgas
D.20-08-046	3	Provides the definition of adaptive capacity	This definition is used in assessing community adaptive capacity. See Section 2.2 (Assessing the Adaptive Capacity of Communities).
D.20-08-046	4	Consult with and consider advice from DVCs in determining levels of adaptive capacity	SoCalGas incorporated DVC recommendations and advice regarding adaptive capacity. See Section 2.2 (Assessing the Adaptive Capacity of Communities), Section 2.3 (The Impacts of Climate Change on Communities), and Section 2.4 (Community Recommendations for Building Adaptive Capacity).

Decision	Ordering Paragraph	Requirement	Addressed in CAVA
D.20-08-046	5	File the Community Engagement Plan (CEP) every four years and one year prior to CAVA. Minimum requirements for CEP are also given.	SoCalGas's CEP was filed one year ago and meets the CPUC requirements. It is available here: https://www.socalgas.com/sites/default/files/2025-02/2024-05-15-R1804019-SoCalGas-Community-Engagement-Plan.pdf. It is also linked in Appendix A.
D.20-08-046	6	Meet with CBOs, DVCs, and other parties to develop CEP outline and disseminate a draft CEP.	These requirements were met as part of the CEP development. The CEP, at Appendix A, documents this process.
D.20-08-046	7	Survey DVCs and CBOs regarding effectiveness of engagement. Provides the minimum requirements for survey report.	DVCs and CBOs were surveyed regarding effectiveness of the engagement. The CEP, at Appendix A, documents this process. The survey report will be filed one year after the CAVA and will meet the requirements provided.
D.20-08-046	8	Lead the development of the vulnerability assessment	SoCalGas led the development of this CAVA.
D.20-08-046	9.1	Consider climate risks to IOU operations, services, and assets. Include an array of options for dealing with vulnerabilities.	Chapter 4 of the CAVA presents the findings of the assessment of climate risks to SCG assets, operations, and services. Chapter 5 discusses potential adaptation options and next steps.
D.20-08-046	9.2	Identify facilities with third-party contracts for power, capacity, or reliability. Communicate with the operators of these facilities and ask them to report exposure to climate risk. Document risks and contingency planning associated with these third parties.	This requirement was eliminated in D.24-08-005 at 48-49 and is no longer applicable.
D.20-08-046	9.3	Address the key time frame to be considered by the vulnerability assessment of the next 20 to 30 years. Also address the Intermediate time frame of the next 10 to 20 years and the long-term time frame of the next 30 to 50 years.	The CAVA uses horizon years of 2030, 2050, and 2070 to meet this requirement. 2050 was the main horizon year emphasized in the results. See Section 3.4 (Asset Vulnerability Scoring Method Details).
D.20-08-046	9.4	Consider and identify the green and sustainable remedies for the vulnerable infrastructure.	Section 5.4 discusses green and sustainable remedies.
D.20-08-046	9.5	Analyze how IOUs promote equity. Address extra funding and extra outreach requirements.	Chapter 2 discusses IOUS and the promotion of equity in DVCs. Chapter 2 also describes the need for additional, tailored outreach to build on CAVA results and focus in on investment prioritizations in DVCs.

Decision	Ordering Paragraph	Requirement	Addressed in CAVA
D.20-08-046	9.6	Include the plan for engaging DVCs and providing for community engagement work that allows for suggesting sources of data or other information to be used, reviewing and contributing to the text, and commenting on the vulnerability assessments.	Chapter 2 discusses engaging DVCs and allowing for suggestions on these aspects of the CAVA.
D.20-08-046	9.7	Include a summary of the IOU's community engagement with DVCs before, during, and after the process of completing the vulnerability assessment and attach the previously filed Community Engagement Plan.	Chapter 2 summarizes the community engagement to date. Appendix A links to the CEP.
D.20-08-046	9.8	Address actual or expected climatic impacts and stimuli or their effects on utility planning, facilities maintenance and construction, and communications, to maintain safe, reliable, affordable and resilient operations	Chapter 3 documents how these impacts are assessed in the CAVA, and Chapter 4 documents findings of the assessment.
D.20-08-046	9.9	Use DWR's two-step vulnerability assessment methodology.	Section 3.1 (Introduction and Overview) discusses how the DWR methodology is incorporated.
D.20-08-046	9.10	Include off-ramps for assets with low climate risk but also a mechanism to reassess assets as climate risks change.	Section 3.4 (Asset Vulnerability Scoring Method Details) discusses off-ramping. Chapter 5 discusses mechanism for reassessing off-ramped assets.
D.20-08-046	9.11.a	Assess temperature	Included in several supplemental analyses (Compressor Station Analysis, Gas Consumption Analysis, Outdoor Worker Analysis)
D.20-08-046	9.11.b	Assess sea level	SLR incorporated into exposure in Coastal Flooding and Coastal Erosion vulnerability scoring, and Coastal Damage supplemental analysis
D.20-08-046	9.11.c.i	Assess variations in precipitation - snowpack	Snowpack influence on flows incorporated into exposure in Inland Flooding vulnerability scoring
D.20-08-046	9.11.c.ii	Assess variations in precipitation - extreme precipitation events	Extreme precipitation events incorporated into exposure in Inland Flooding and Landslide vulnerability scoring, and High-Pressure Pipe Flooding supplemental analysis

Decision	Ordering Paragraph	Requirement	Addressed in CAVA
D.20-08-046	9.11.c.iii	Assess variations in precipitation - long-term precipitation trends	Precipitation trends influence exposure directly in Inland Flooding and Landslide vulnerability scoring, and indirectly in Wildfire vulnerability scoring
D.20-08-046	9.11.c.iv	Assess variations in precipitation - droughts	Drought indirectly influences exposure for Wildfire vulnerability scoring
D.20-08-046	9.11.c.v	Assess variations in precipitation - subsidence	Subsidence off-ramped from vulnerability scoring given limited impacts; included in asset adaptive capacity discussion
D.20-08-046	9.11.d	Assess wildfire	Wildfire incorporated into exposure for Wildfire vulnerability scoring
D.20-08-046	9.11.e	Assess cascading impacts	Considered in multiple places (e.g., wildfire projections and associated post-fire threats such as flooding and debris flows incorporated into Inland Flooding vulnerability scoring and High-Pressure Pipe supplemental analysis)
D.20-08-046	10	Establish a memorandum account, titled "Climate Adaptation Vulnerability Assessment Memorandum Account – CAVAMA" for the purpose of tracking costs directly related to the vulnerability assessments and any incremental costs related to the community engagement.	SoCalGas's CAVAMA was established via Advice Letter 5694G and approved by the Commission on September 25, 2020.
D.20-08-046	11	File CAVA every four years and one year before General Rate Case (GRC) filing as Tier 2 Advice Letters. Serve a copy on the corresponding service list for RAMP proceedings.	This CAVA was filed one year before SoCalGas's GRC filing and will be updated and refiled in accordance with the direction provided in D.24-08-005.
D.20-08-046	12	Include in GRCs the main takeaways from the vulnerability assessments as a separate section or chapter that contains, at a minimum: (1) a list of vulnerabilities, (2) proposals addressing those vulnerabilities (with options), and (3) long-term goals for adapting to climate risks.	The next GRC will include this information from the CAVA.

Decision	Ordering Paragraph	Requirement	Addressed in CAVA
D.20-08-046	13	Designate "climate change teams" across departments that report directly to an executive at a senior vice president level or above using existing climate change personnel or personnel newly appointed to this role.	The climate change team was formed in 2020 across departments that report directly to an executive to the chief infrastructure officer/senior vice president level.
D.20-08-046	14	Identify risks and obtain information from the facility operator when IOUs sign new contracts for power, capacity or reliability. Beginning in 2022 when an IOU enters a new long-term contract of 15 years or more for power, capacity, or reliability, the IOU shall seek to obtain an acknowledgment in the new contract that the operator has considered long-term climate risk and include, if available, a facility safety plan considering climate risks.	SoCalGas does not have any long-term contracts of 15 years or more for power, capacity, or reliability. See Section 4.3 (Third-Party Contracts).
D.24-08-005	1	Submit to the Commission's Energy Division as Tier 2 Advice Letters the CAVA two years before the filing date of their GRC applications. This requirement begins with Southern California Edison's next CAVA, which shall be submitted in 2025.	Starting with the next GRC cycle, SoCalGas will submit its CAVA two years prior to the subsequent GRC filing.
D.24-08-005	2	Use SSP 3-7.0 as the reference scenario	The CAVA used SSP 3-7.0 as its main emissions scenario. See Section 3.2 (Climate Science and Projections).
D.24-08-005	3	Integrate climate forecasts using SSP 3-7.0 into other proceedings	SoCalGas is actively working to refine methodologies and conduct critical analyses before integrating SSP 3-7.0 into other proceedings.

Decision	Ordering Paragraph	Requirement	Addressed in CAVA
D.24-08-005	4	Integrate climate forecasts using SSP 3-7.0 into Rulemaking (R.) 20-05-003 (Integrated Resource Planning proceeding), R.20-01-007 (Long-Term Natural Gas Planning proceeding), and future Long-Term Procurement Plan proceedings.	SoCalGas is actively working to refine methodologies and conduct critical analyses before integrating SSP 3-7.0 into other proceedings
D.24-08-005	5	Use Global Warming Level approach in CAVAs submitted in 2026 or later	SoCalGas will use this approach in its next CAVA filing.
D.24-08-005	7	Southern California Gas Company and San Diego Gas & Electric Company are encouraged but not required to use the Global Warming Level approach starting in 2025.	SoCalGas will begin using the approach in 2025 after this CAVA filing and then will incorporate this approach into its next filing.
D.24-08-005	8	Use the benchmark global warming levels of 1.5 and 2 degrees centigrade above pre-industrial levels	SoCalGas will use these global warming levels when it begins using this approach later in 2025.
D.24-08-005	9	Assess the plausible range of timing within projections at a benchmark level of warming and provide this information for, at minimum, the 50th percentile outcomes, and, to the extent possible, include a plausible range of results.	SoCalGas will use this guidance regarding global warming levels when it begins using this approach later in 2025.
D.24-08-005	10	Include comprehensive and clear source data summary tables; clearly name the infrastructure data set used and the last time it was updated; base CAVA on infrastructure data that is consistent with that used for related planning proceedings and for Wildfire Mitigation Plans; and shall generally strive to conduct analyses at the smallest spatial resolution feasible for any given set of IOU infrastructure.	Section 3.4 summarizes the infrastructure datasets used in the CAVA. SoCalGas does not have Wildfire Mitigation Plans.

Decision	Ordering Paragraph	Requirement	Addressed in CAVA
D.24-08-005	11	Convene a workshop presenting near-final CAVA findings and high-level methods no less than 90 days prior to the advice letter submittal due date for the CAVA, shall notice this workshop at least 20 days prior to the workshop and to serve workshop slides at least five days prior to the workshop to the service list of Rulemaking 18-04-019. Include in CAVA a short appendix summarizing stakeholder comments.	SoCalGas held its workshop on February 13, 2025, which is 90 days prior to its May 15, 2025, CAVA filing date. Appendix B documents stakeholder comments from this workshop.
D.24-08-005	13	Adhere to the CAVA Investment Proposal Guidelines when proposing climate adaptation investments based on their CAVA analyses	SoCalGas will adhere to the guidelines when proposing climate adaptation investments based on CAVA analyses.
D.24-08-005	14	IOUS shall jointly convene a lexicon working group and shall jointly serve and file a working group report no later than one year from issuance of this decision.	SoCalGas is not currently part of a lexicon working group, but can join this group in the future.