LIFELINES COUNCIL
Meeting 43: September 18, 2024

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Agenda

1. Call to Order	Douglas Legg, *Deputy City Administrator, City Administrator's Office* Chris Barkley, *AECOM*	5 minutes
2. Introductions and Agenda Review	Brian Strong, *Director, Office of Resilience and Capital Planning*	*5 minutes*
3. Hazards and Climate Resilience Plan	Melissa Higbee, *Office of Resilience and Capital Planning*	*30 minutes*
4. Workshop: Updating the Lifelines Restoration Performance Improvement Plan		*50 minutes*

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Hazards and Climate Resilience Plan

Melissa Higbee, Resilience Program Manager, Office of Resilience and Capital Planning

City Administrator's Office

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2025 Hazards and Climate Resilience Plan Report Back to the Lifelines Council

Melissa Higbee, Resilience Program Manager
Office of Resilience and Capital Planning
September 18th, 2024

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Background and Purpose

What it is:

- Citywide action plan to improve resilience to natural hazards and climate change impacts. Includes priority actions (projects, plans, programs) for strategic funding.

Why do we have it:

- Fed: Eligibility for FEMA grants. *2020 Plan needs to be updated and adopted by July 2025.*
- State: Compliance with SB 379 climate adaptation planning
- Local: Companion to Climate Action Plan; Safety & Resilience Element; ResilientSF

2025 Draft available for public comment @OneSanFrancisco.org

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HAZARDS

The HCR characterizes 13 natural hazards that impact San Francisco. The hazards are grouped into four different types: geological, weather-related, fire-related, and biological & toxic. This chapter also includes an overview of climate change science and how climate change influences hazards in San Francisco.

GEOLOGICAL

EARTHQUAKE

TSUNAMI

LANDSLIDE

DAM OR RESERVOIR FAILURE

WEATHER-RELATED

FLOODING

HIGH WIND

EXTREME HEAT

DROUGHT

FIRE-RELATED

LARGE URBAN FIRE

WILDFIRE

POOR AIR QUALITY

BIOLOGICAL & TOXIC

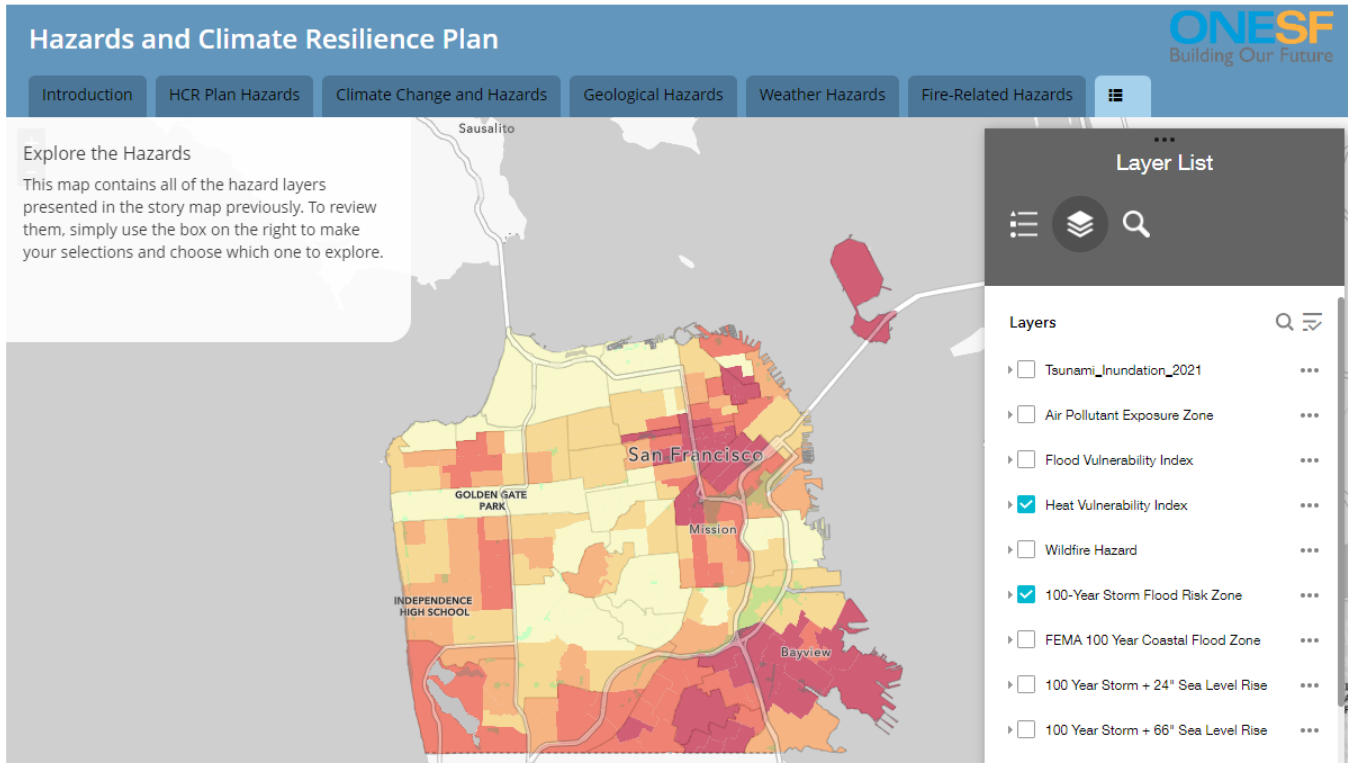
PANDEMIC

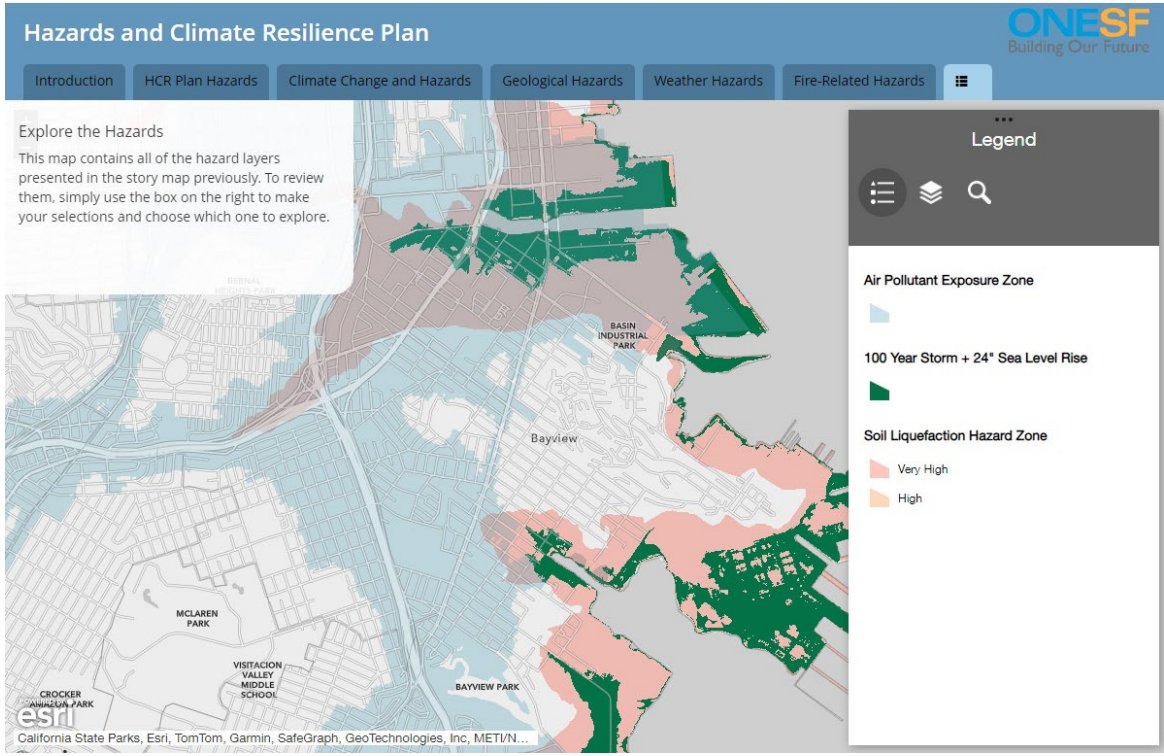
HAZARDOUS MATERIALS

Makes Hazard Data More Accessible

OneSanFrancisco.org/hazards

Hazards and Climate Resilience Storymap





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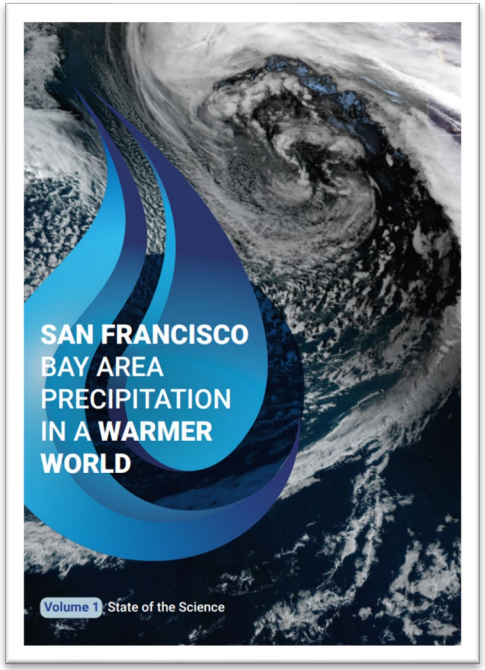
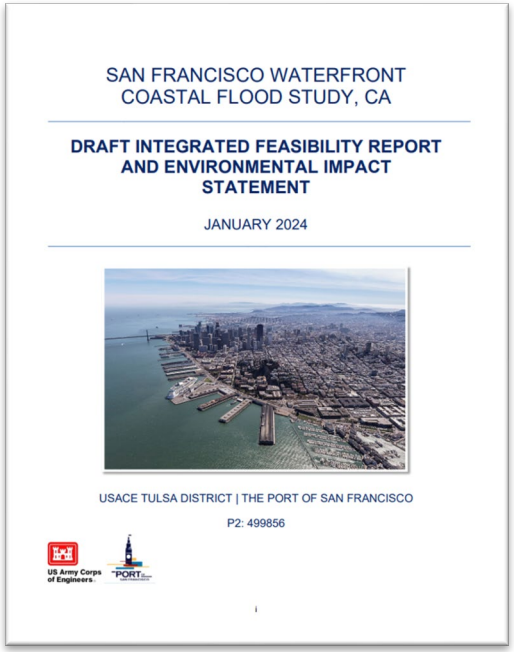
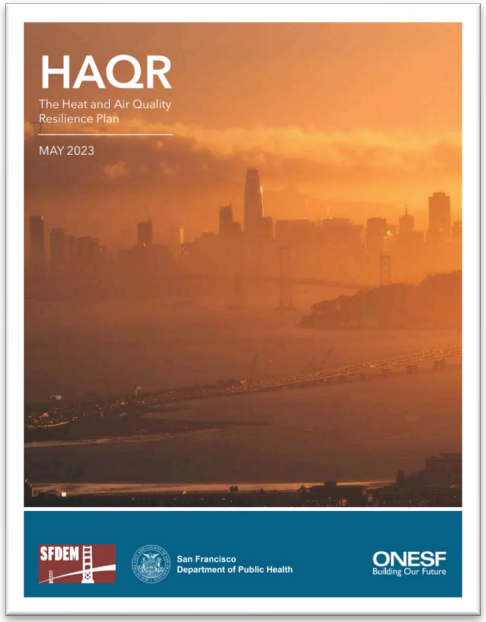
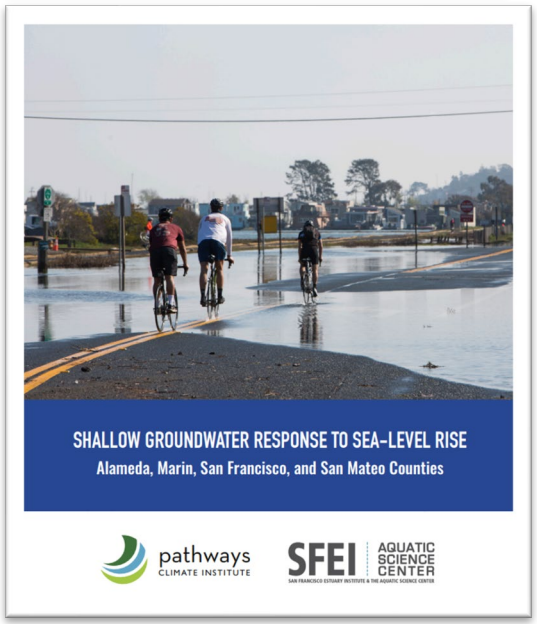
2025 Update Approach

- Interdepartmental Planning Team started meeting in July 2023
- Targeted update considering comprehensive update in 2020
- Incorporated new science, risk assessments, and plans
- Action prioritization
  - Planning Team survey
  - Workshop with Lifelines Council in December 2023
  - Community engagement









Engagement Approach and Themes

- Focus on Environmental Justice Communities
- Meeting community groups where they already are

Engagement Themes and Priorities

Energy Resilience	• Energy access and electrification support for low-income residents • Grid improvements to avoid power outages • Battery back up power and microgrids
Earthquake Resilience	• Neighborhood scale planning and preparedness • Retrofitting vulnerable buildings • Fire-following earthquake and water supplies
Waterfront Resilience	• Addressing contaminated sites and sea level rise • Protecting and adapting bridges and other key routes • Using nature-based solutions where feasible
Transportation	• Maintaining state-of-good repair, including sidewalks and streets • Reliable transit service
Neighborhood Capacity Building	• Importance of neighborhood-based organizations and network • Supporting the elderly

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2025 Draft Resilience Pillars and Objectives

(B) BUILDINGS	
B-1	Increase the resilience of existing seismically vulnerable buildings.
B-2	Increase climate and multi-hazard resilience of existing buildings.
B-3	Design and construct new buildings for high resilience performance for current and future hazards.

(C) COMMUNITIES	
C-1	Limit exposure and protect public health against hazards related to environmental health.
C-2	Support the growth of community resilience networks to empower all people.
C-3	Increase the City's capacity to improve resilience through collaboration among peer agencies, the private sector, and community-based organizations
C-4	Support robust emergency response planning in partnership with communities most adversely impacted by hazards.
C-5	Prepare small businesses and workers to bounce back faster after a hazard.
C-6	Make housing more affordable to increase community adaptive capacity.

(IN) INFRASTRUCTURE	
IN-1	Increase the resilience of electric power systems and increase access to resilient backup power.
IN-2	Increase the resilience of critical communications systems.
IN-3	Support sustainable and resilient multi-modal mobility.
IN-4	Promote, design, and use nature-based solutions to mitigate current and future hazards.
IN-5	Protect waterfront assets and communities from near-term flooding and seismic hazards.
IN-6	Adapt the city's bay and ocean shorelines to current and future climate flood hazards.
IN-7	Increase the resilience of local water and wastewater systems to natural hazards and climate change.
IN-8	Increase resilience of the regional water system to natural hazards and climate change.

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2025 Draft Actions -Water and Wastewater

Code	Action Title	Lead(s)	
IN-7	Increase the resilience of local water and wastewater systems to natural hazards and climate change.		
IN-7.1	Implement the Pipe Replacement Prioritization Program.	SFPUC	
IN-7.2	Support the completion and handover of new power, water, wastewater distribution infrastructure at Treasure Island and discontinue the use of the legacy navy systems.	TIDA, SFPUC	★
IN-7.3	Complete construction of the Treasure Island Water Resource Recovery Facility to improve water treatment, increase water security, and to connect recycled water to San Francisco's first neighborhood with a complete green infrastructure system.	SFPUC	★
IN-7.4	Complete studies and capital projects to improve and expand the Emergency Firefighting Water System (EFWS).	SFPUC	★
IN-7.5	Improve the capacity of the Portable Water Supply System to fight fires following earthquakes and other large urban fires.	SFFD	
IN-7.6	Pursue data-driven implementation of Green (GI) Infrastructure projects to be able to manage 1 billion gallons of stormwater per year using GI by 2050.	SFPUC	★
IN-8	Increase resilience of the regional water system to natural hazards and climate change.		
IN-8.1	Improve Resilience and Sustainability for regional dams and ancillary facilities from flood and earthquake events.	SFPUC	
IN-8.2	Mitigate wildfire hazards in SFPUC owned-watersheds to protect source water quality and minimize risk to SFPUC water and power infrastructure.	SFPUC	
IN-8.3	Diversify water supply options year-round by improving the use of new water sources and drought management.	SFPUC	
IN-8.4	Continue climate adaptation planning for the Hetch Hetchy Regional Water System.	SFPUC	

2025 Draft Actions -Transportation

Code	Action Title	Lead(s)	
IN-3	Support sustainable and resilient multi-modal mobility		
IN-3.1	Incorporate opportunities for hazard mitigation into the planning and design of all SFMTA facility improvements and property re-development.	SFMTA	★
IN-3.2	Study, plan, design, and implement improvements to the multimodal transportation system that are vulnerable to coastal flooding.	SFMTA	
IN-3.3	Improve the public right-of-way state-of-good-repair, including retrofitting bridges and other key structures.	ORCP, DPW	
IN-3.4	Decrease the geographic vulnerability inherent to the island communities on Treasure Island and Yerba Buena Islands by increasing low-emission, connectivity to San Francisco.	TIMMA	★
IN-3.5	Implement the SFO Infrastructure Resilience Framework to improve resilience of critical facilities, assets, operations, and lifeline utility systems.	SFO	

2025 Draft Actions – Power and Comms

Code	Action Title	Lead(s)	
IN-1	Increase the resilience of electric power systems and increase access to resilient backup power.		
IN-1.1	Enhance energy resilience at critical facilities.	SFPUC, DPW	★
IN-1.2	Improve and expand power distribution infrastructure and advanced energy systems to support new development and increase resiliency.	SFPUC	★
IN-1.3	Complete the Electrical Capacity Upgrade Project to ensure redundant electrical power capacity and distribution across SFO	SFO	
IN-1.4	Develop a roadmap for disaster resilient EV charging infrastructure	Fleet, ORCP	★
IN-2	Increase the resilience of critical communications systems		
IN-2.1	Increase the Resilience of the Municipal Fiber Optic Network	DT	
IN-2.2	Increase the Resilience of the 911 Radio System	DT	★
IN-8.3	Increase climate and multi-hazard resilience of existing buildings.		
B-2.5	Support increased building electrification (fuel switching), mechanical upgrade, and weatherization.	SFE, SFPUC	★

Draft 2025 Actions – Capacity and Collaboration

Code	Action Title	Lead(s)
(C) COMMUNITIES		
C-3	Increase the City's capacity to improve resilience through collaboration among peer agencies, the private sector, and community-based organizations	
C-3.1	Coordinate resilience engagement across departments and projects through ClimateSF	ORCP
C-3.2	Track progress and update the Lifelines Restoration Performance Project recommendations	ORCP
C-3.3	Develop and improve systems for hazard and climate resilience data.	ORCP
C-3.4	Improve San Francisco's climate health research capacity.	DPH
C-3.5	Develop citywide policy and proposed governance structure for flood resilience.	SFPUC

Example action

IN-1.4	Develop a roadmap for disaster resilient EV charging infrastructure	
NEEDS KEY PLANNING ISSUES: Communications and Power Transportation	VULNERABILITY ADDRESSED: The transition to zero emission vehicle (ZEV) fleets relies on power sources that are unreliable or not yet available. This could cause significant challenges for utilizing City vehicles during emergency operations, and more detailed planning is needed.	
LEAD: Fleet, ORCP PARTNERS:	ACTION SUMMARY: Create a roadmap for resilient ZEV power infrastructure that prioritizes life safety and disaster-response operations, acknowledges the need for redundancy, and identifies potential solutions for electric and hydrogen power needs. Wherever resources allow, invest in contracts, infrastructure, and equipment that will help the City meet its expected fuel and power needs.	
COST: Medium	SF GOVERNMENT ACTIVITY: Research, Planning, and Guidance	STATUS: New
POTENTIAL FUNDING SOURCES: General Fund, Special Funds	PRIORITY LEVEL: Medium	TIMELINE: By 2029
		

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Next steps

- **August & September:** Draft Plan available for public comment; Commission presentations; Board of Supervisors briefings
- **October:** Final Draft Plan submitted to CalOES/FEMA
- **April 2025:** Submit to Board of Supervisors

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Discussion

- Any lifeline restoration and recovery priorities missing?
- Any actions that the Council would like more information about or would like to stay engaged on?

Workshop: Planning to update the Lifelines Restoration Performance Improvement Plan

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Lifelines Restoration Performance Project

- How would we like lifelines to perform in an earthquake?
- How would lifelines perform if an earthquake happened today?
- What actions are needed to close the gap?

Report available at: onesanfrancisco.org/lifelines-program

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Report Update

- The Report calls for an update in 2025.
- We would like to use today's meeting to plan for how to make this update useful and relevant to the work of the Lifelines Council members.

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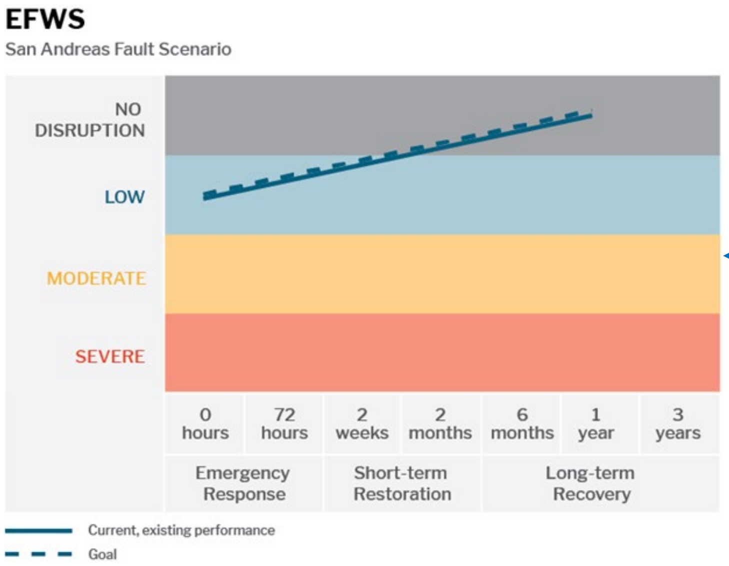
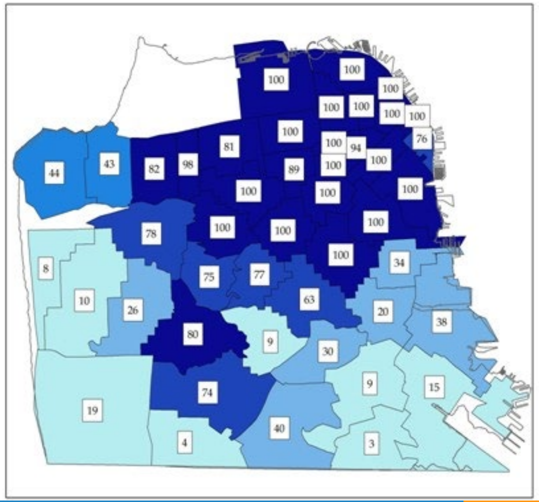
Tiered Assessment Process



Cross Sector Workshop

Sector modeling



Sector interviews

Expected Service Disruptions to Your System (Nature and Extent)						
M7.9 San Andreas Fault						
0 hours	72 hours	2 weeks	2 months	6 months	1 year	3 years
☐ No loss ☐ Slight disruption ☐ Moderate disruption ☐ Severe disruption Description:	☐ No loss ☐ Slight disruption ☐ Moderate disruption ☐ Severe disruption Description:	☐ No loss ☐ Slight disruption ☐ Moderate disruption ☐ Severe disruption Description:	☐ No loss ☐ Slight disruption ☐ Moderate disruption ☐ Severe disruption Description:	☐ No loss ☐ Slight disruption ☐ Moderate disruption ☐ Severe disruption Description:	☐ No loss ☐ Slight disruption ☐ Moderate disruption ☐ Severe disruption Description:	☐ No loss ☐ Slight disruption ☐ Moderate disruption ☐ Severe disruption Description:

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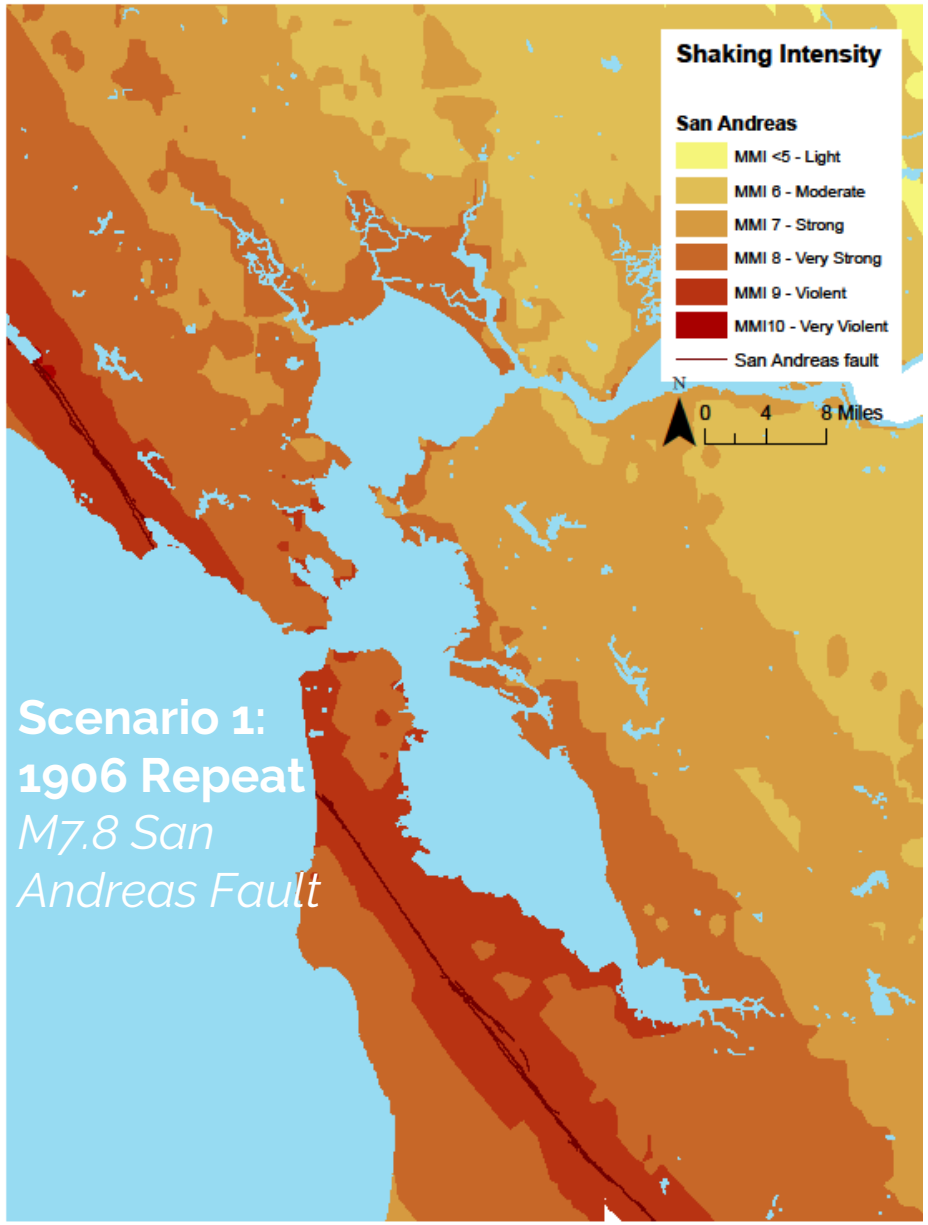

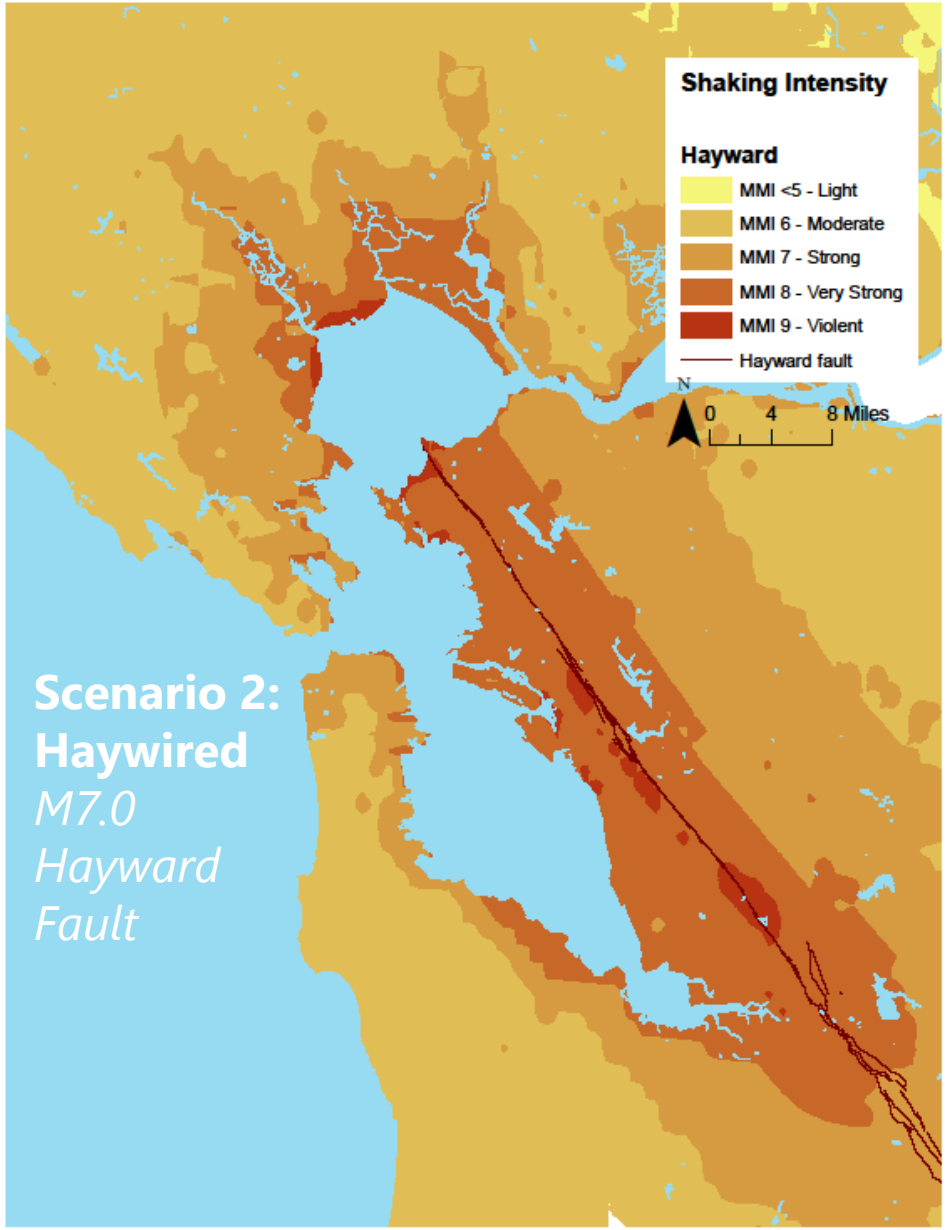

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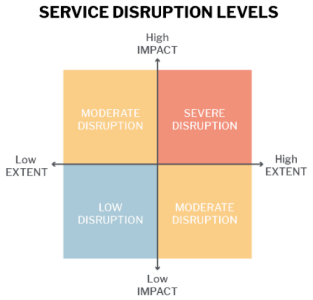
Common restoration picture across all lifeline systems

Sector	Organization	Emergency Response		Short-term Restoration		Long-term Recovery		
		0 hours	72 hours	2 weeks	2 months	6 months	1 year	3 years
Electric Power	PG&E							
	SFPUC							
Fuel	Kinder Morgan[1,2]							
Communications	AT&T Wireless							
	Comcast							
	Verizon Wireless							
	SF Dept of Technology							
Highways & Local Roads	Caltrans[2]							
	Golden Gate Bridge							
	Public Works							
Potable Water	SFPUC							
Transit	MUNI							
	BART[2]							
Natural Gas	PG&E							
Wastewater	SFPUC							
Solid Waste	Recology							
Port	Port of San Francisco							
Airport	SFO							
Firefighting Water (EFWS)[3]	SFPUC							

[1]Kinder Morgan has not provided expcted restoration performance. Kinder Morgan has many unknown and externalities that make estimating restoration of fuel delivery challenging.
[2]Wost case scenario is Hayward Fault
[3]Goal of EFWS is low disruption immediately after an earthquake. After post-earthquake fire fighting needs are met, SFPUC will focus efforts on restoring potable water first and then return to complete needed repairs to the EFWS system.

The service disruption levels are defined as:

- Severe = disruptions with high spatial extent & high impact disruptions.
- Moderate = disruptions with low spatial extent & high impact, OR high spatial extent & low impact;
- Low = disruptions with low spatial extent and low impact;
- No disruption



Where,

- Extent = spatial reach of the disruption and proportion of people within the area that are affected.
- Impact = severity of consequences and the duration of the disruption. For example, complete loss of water supply is high impact (independent of how many people are affected), whereas a boil water advisory is low impact.

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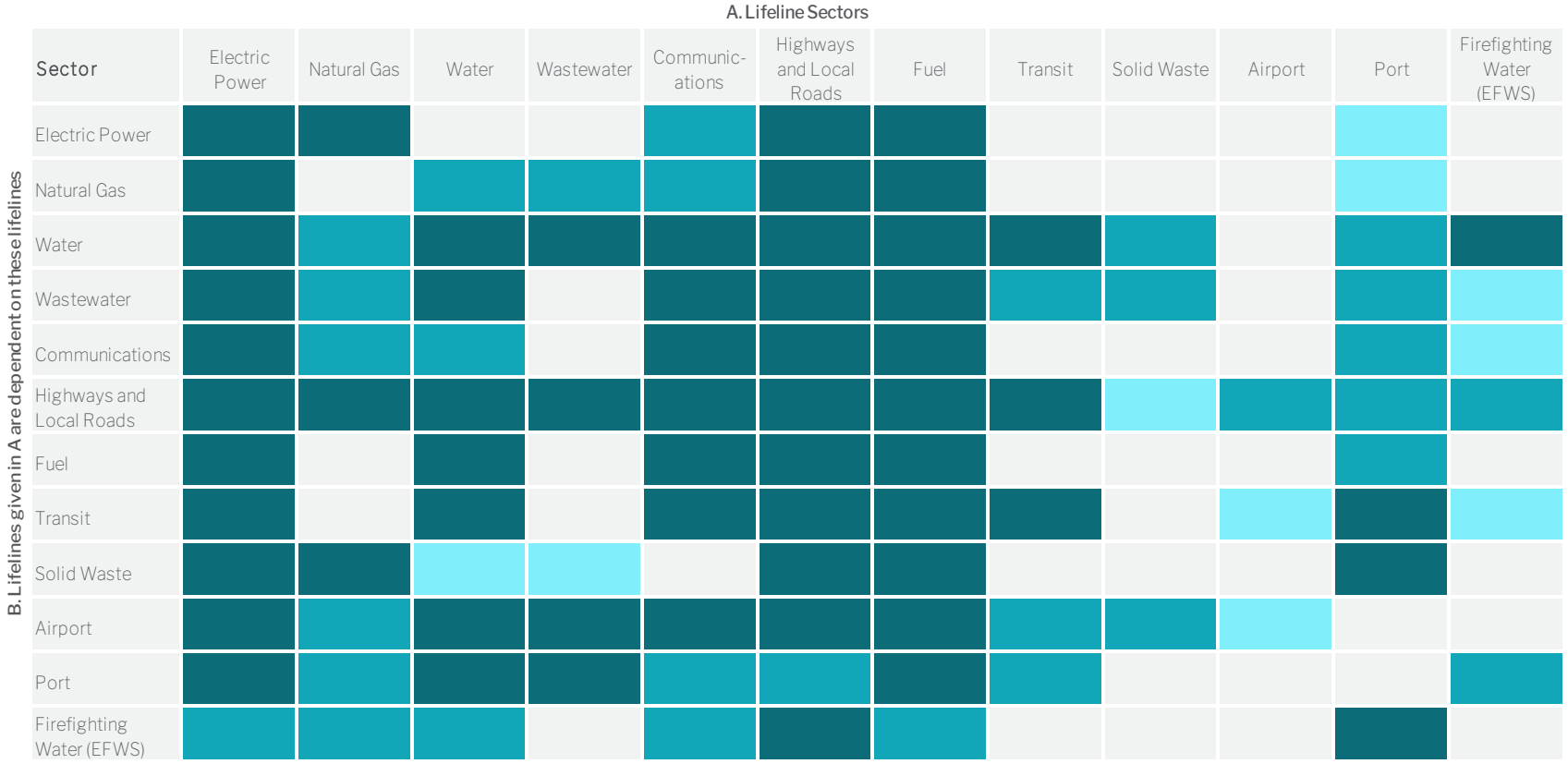
Lifeline Interdependencies



None	No reliance on sector
Low	Minimal reliance on sector
Moderate	Large reliance on sector with significant backup available, or moderate reliance on sector with no back up available
Significant	Large reliance on sector with limited backup available

Reading the matrix across each row shows which sectors a particular sector relies on. For example, electric power has a significant reliance on natural gas, but a low reliance on the Port.

Reading the matrix down each column shows which sectors rely on the designated sector. For example, all systems, except for EFWS have a significant dependence on electric power.

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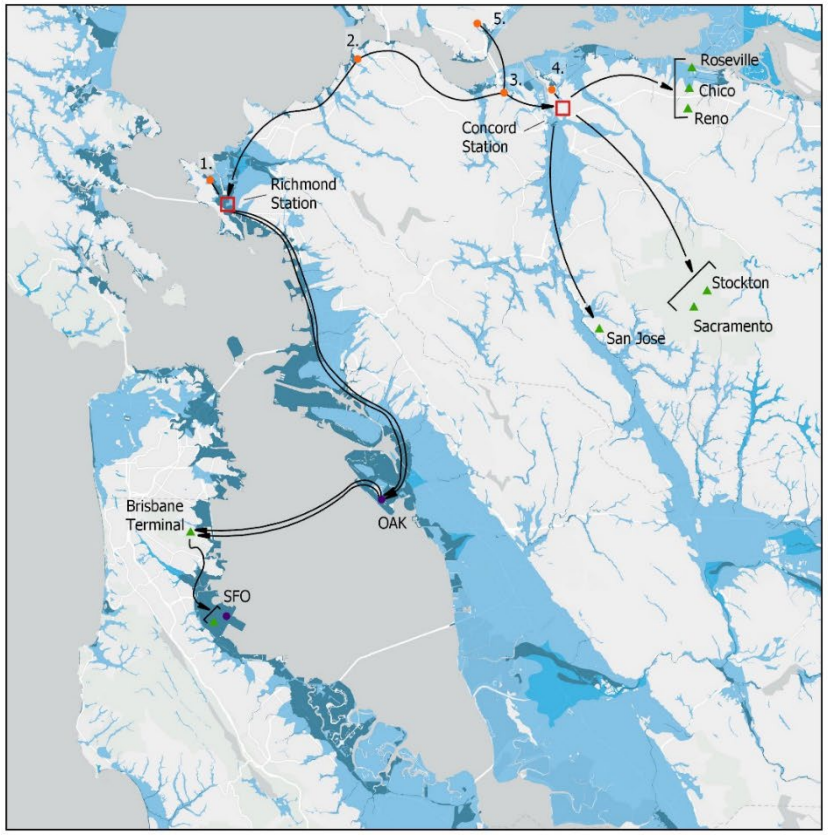
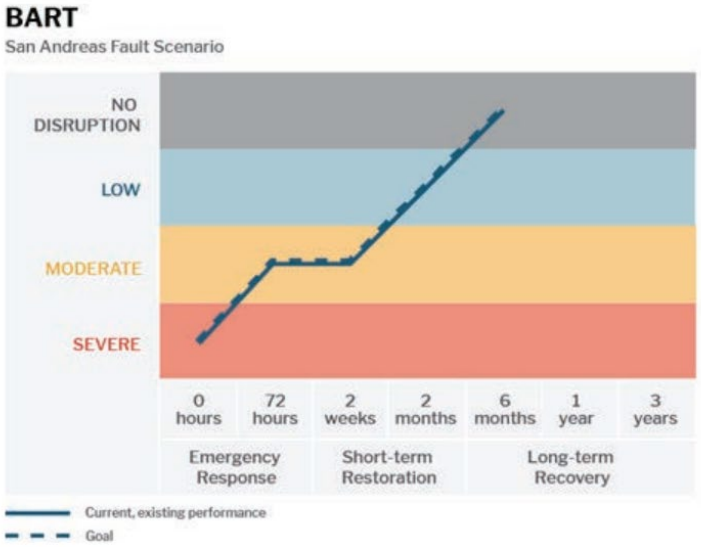
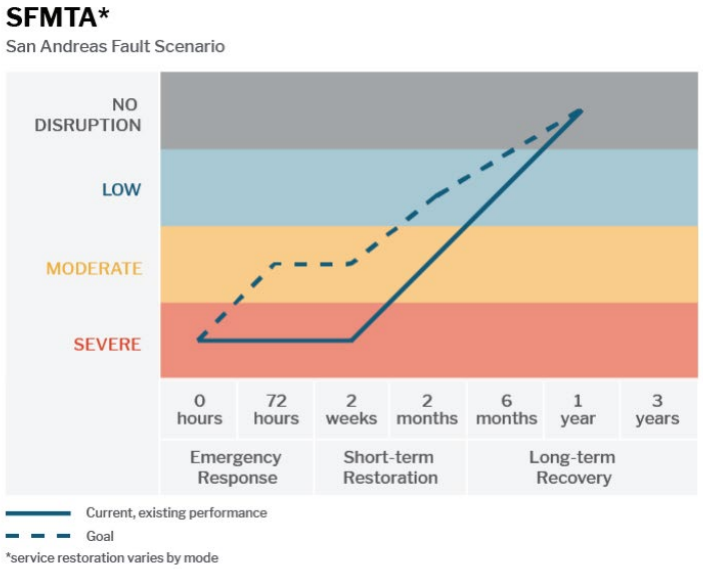
Lifeline system maps



Expected performance and goal performance timelines for each system





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Systemwide findings and recommendations (3 of 12 findings)

Findings	Recommendations
Disruption to some lifeline systems will significantly impact the long-term recovery of neighborhoods.	Lifeline distribution systems with long restoration timelines that are especially important to neighborhoods, including natural gas, water, sewer and local roads, should be evaluated and upgraded to help prevent the displacement of vulnerable residents.
Maintenance and repair workers needed for response and restoration increasingly live outside of San Francisco.	San Francisco should preserve and expand affordable and workforce housing options within the City to ensure that critical responders live in San Francisco and are available to respond to emergencies.
Many lifeline operators will need to bring additional crews, materials and equipment from outside the region to support system restoration.	• Develop a common and flexible identifier to help facilitate access on Bay crossings for those personnel who are not emergency responders but have critical post-disaster roles in performing damage assessment, inspections, and immediate repairs of critical assets within San Francisco. • Public Works and SFMTA should designate freight traffic routes as disaster recovery critical supply routes before an earthquake and develop mitigation plans to ensure they will be accessible immediately after an event.

Sector-Based Recommendations
Water and Wastewater (1 of 10 sectors)

Operator and System Description	Recommendations
SFPUC: Systems include the Hetch Hetchy system, which serves not only San Francisco, but nearly 2 million Bay Area customers outside the City; potable water treatment and distribution and wastewater collection and treatment systems within the City.	Potable Water: • SFPUC should analyze the seismic reliability and expected restoration time of the in-city water distribution system and develop an upgrade strategy. • SFPUC should identify key facilities that should be prioritized by PG&E for power restoration. • SFPUC should stockpile critical spare parts needed for emergencies. • SFPUC should work with lifeline sectors co-located in city streets to coordinate post-earthquake emergency response and restoration work. Wastewater: • SFPUC should develop service level agreements and MOUs to ensure adequate staffing for post-disaster evaluations and emergency repairs. • SFPUC should communicate power restoration needs of treatment plants and pumps to PG&E. • SFPUC should characterize its needs and impact to the pumps and treatment plants of lengthy power outages, and work with PG&E to prioritize restoration of power accordingly. • SFPUC should adopt and implement measures to achieve performance goals pertaining to restoration of the wastewater collection system. • SFPUC should develop a coordinated plan and public messaging for handling biological waste when toilets won't flush.

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Breakout session

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Discussion 1:

1. *Are you familiar with this report?*
2. *Were you involved in putting it together?*
3. *How has your organization used the Lifelines Restoration Performance Improvement Plan?*

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Discussion 2:

1. *What new information would you like to see from an update of this Plan?*
2. *How could this plan be more useful to you/your agency in planning for recovery from a large earthquake?*

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Discussion 3:

1. *Should we follow a similar methodology to last time (interviews + workshops) or take a different approach?*
2. *Where should we focus our energy and attention?*

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Report out

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Adjourn

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Extra slides

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Systemwide findings and recommendations

Findings	Recommendations
For the first time, we have a common understanding of expected restoration time across all lifeline systems in San Francisco.	
Decades of investment in infrastructure improvements will improve post-earthquake restoration performance	Lifeline operators should continue to invest in seismic improvements that speed system restoration.
While some organizations have adopted restoration performance goals, more are needed.	Lifeline operators that have not yet done so should adopt restoration performance targets and measure progress toward their goals.
Many organizations have undertaken robust emergency response planning that will speed their system restoration.	Lifeline operators that have not yet done so should perform a systemwide risk analysis to assess needed retrofits and capital improvement to speet post-earthquake restoration.
The type and extent of restoration each system may require varies significantly across systems.	Lifeline providers should anticipate the likely restoration approach needed for their system following an earthquake to inform pre-earthquake planning decisions.
Even lifeline systems that are not damaged may not be functional because they depend on other systems to operate.	The Lifelines Council should continue to advance and facilitate interagency efforts to understand and mitigate lifeline system interdependencies.

Systemwide findings and recommendations

Findings	Recommendations
Ensuring crews can access assets for damage assessment and repairs is critical to restoration of every system.	• Public Works should develop risk models that predict likely road closures before an earthquake and use shaking intensity-based triggers to initiate and prioritize inspections based on likely damage to utilities and buildings, as well as for roads that provide access to critical facilities like hospitals, police and fire, and PG&E and SFPUC assets. • As with accessing the bridges, identifying flexible, consistent ways for lifeline operators to identify their crews and contractors to CHP or San Francisco Police will facilitate their access to cordoned areas.
Loss of power will significantly impact every single lifeline system, as well as all buildings.	To the extent possible and feasible, recovery critical buildings and lifeline systems should utilize solar with battery storage to provide some level of continuous power. This strategy has the added benefit of reducing system disruption in future power shut-off events.
Reducing reliance on petroleum fuel will improve restoration of all systems.	• Municipal and private lifeline owners with critical fuel needs should develop policies to maintain adequate supply of fuel within vehicles and equipment, and store fuel locally in tanks that can be pumped without electricity. • Vehicle fleets should be electrified and powered with solar power to reduce reliance on fuel because the electric system will likely restore faster than the fuel system. • To the extent possible and feasible, solar with battery storage should be the primary power backup source rather than generators, because of fuel supply issues.

Electric Power

Operator and System Description

PG&E: Distribution to residential and commercial customers.

SFPUC: Uses the Hetch Hetchy system to generate hydropower to provide municipal power, including power for transit, streetlights, traffic lights, airports, municipal buildings, and Treasure Island.

Recommendations

- Building and lifelines owners with critical electricity needs should install a grid-independent solar battery storage system.
- The Lifelines Council and PG&E should evaluate the earthquake vulnerability of power generation sources in the Bay Area.
- PG&E should share its plans for establishing an above ground temporary electrical network with San Francisco.
- PG&E should develop a clear understanding of the reliance of other lifeline systems on power supply and the implications if these partners lose power.
- SFPUC should continue to assess the vulnerability of substations at SFO to damage in an earthquake and develop a plan to address deficiencies.
- SFPUC should understand the earthquake vulnerability of critical PG&E owned power components and develop a plan to address deficiencies.
- SFPUC should develop mutual aid agreements with individual utilities in another region and improve emergency purchasing processes.

Fuel

Operator and System Description

Kinder Morgan: Refineries process crude oil to make petroleum products. The Kinder Morgan fuel pipeline system delivers finished petroleum products (gasoline, diesel and aviation fuel) from refineries to fuel terminals where the product is picked up by fuel trucks for delivery to end users.

Recommendations

- Kinder Morgan should strive to better understand the vulnerability of its system components to damage due to earthquake.
- San Francisco should collaborate with industry stakeholders to accelerate deployment of electric and alternative fuel for light, medium and heavy-duty vehicles.
- Municipal and private owners with critical electricity needs should develop policies to ensure adequate supply of fuel within vehicles and equipment as a first priority and then store fuel locally in tanks that can be pumped without electricity.
- The Lifelines Council should work with key fuel users, regulators and fuel providers to evaluate the impact of an earthquake on Bay Area refineries and encourage them to upgrade vulnerable components as necessary.
- The Lifelines Council should request public reports focusing on post-earthquake operational issues of marine oil terminals to assist in better understanding moderate and long-term fuel supply impacts.
- The City of San Francisco Fire Department, SFPUC, and City of Brisbane should work with Kinder Morgan to determine the vulnerability of the Brisbane water main.

Communications

Operator and System Description

AT&T, Verizon and Comcast were private communications providers included in this Project. Systems include television, internet, cell phone, and voice communications.

City and County of San Francisco: The Department of Technology provides technology services to City departments and agencies throughout San Francisco, including radio, video, internet access, business systems, public warning sirens, emergency call boxes, traffic signals, and the Mayor's Emergency Telephone Systems (METS).

Recommendations

- San Francisco should prioritize fuel distribution to generators at City radio communication sites and data centers to maintain City vital information systems and communications.
- Communication providers should identify locations to add permanent generators at more cell sites and nodes and co-locate cell sites with building solar and battery systems.
- Communication providers should develop agreements to provide emergency mobile wireless to priority locations in the City within a specified time.
- Identify communications providers as disaster service workers to ensure access to cordoned areas when safe for service restoration activities.
- Identify staging locations for personnel supporting communications restoration.
- Identify ways to ensure communications providers and other lifeline operators coordinate restoration activities.

Highways and Local Roads

Operator and System Description	Recommendations
California Department of Transportation (Caltrans): Interstate and state highways and the San Francisco-Oakland Bay Bridge. **Golden Gate Bridge, Highway, and Transportation District:** Golden Gate Bridge **City and County of San Francisco:** The Department of Parking and Traffic is responsible for traffic engineering; Public Works is responsible for street repair.	• San Francisco should work with Caltrans and GGBHTD to identify protocols for granting access to bridges for repair crews. • SFMTA and Public Works should designate freight traffic routes as disaster recovery critical supply routes and protect them from damage in an earthquake. • Caltrans should delegate responsibility for clearing local priority state routes to local jurisdictions in an emergency.

Transit

Operator and System Description	Recommendations
SFMTA: Owns and operates bus, metro, and streetcar lines. BART: Heavy rail system connecting San Francisco and Oakland with urban and suburban areas in Alameda, Contra Costa and San Mateo Counties.	• BART and SFMTA should work with PG&E to better understand when power will be restored to components of the transit system. • BART should work with SFPUC and EBMUD to better understand when water will be restored to the BART system. • SFMTA should assess the feasibility of providing battery backup for critical traffic signals to ensure basic level of post-earthquake traffic flow. • SFMTA should study resilience issues related to the overhead catenary systems

Natural Gas

Operator and System Description	Recommendations
PG&E: Operates the distribution system within the City, including regulation, high- and low-pressure distribution lines, and service lines	• San Francisco Department of Building Inspection should require all new buildings to be fully electric. • San Francisco Department of Building Inspection should require electrification of existing buildings with gas shut-off valves as an interim measure.

Solid Waste

Operator and System Description	Recommendations
Recology: Collects, processes, and hauls waste, recycling and organics and operates recycling plants and San Francisco's Household Hazardous Waste Facility.	• Recology should increase its understanding of post-disaster fuel availability and the regional prioritization process to enable better planning for post-disaster fuel needs. • Port of San Francisco should complete a vulnerability study to determine the likelihood that Pier 96 will be operational after the scenario earthquake and determine alternate recycling collection and debris processing locations. • Recology should explore alternative methods for waste transfer, such as activation of the existing rail spur and connection to the rail line would reduce likelihood of surpassing Recology's waste storage capacity. • Large building owners should consider redundant power source for trash compactors for commercial buildings.

Port

Operator and System Description

Port of San Francisco: Manages 7.5 miles of waterfront infrastructure, including the Embarcadero roadway, open-space and parks, mooring and berthing facilities, a number of finger piers, and the Seawall. The Port property also supports lifeline infrastructure including critical utilities, transportation corridors, and emergency response areas.

The Water Emergency Transportation Authority (WETA) and Golden Gate Ferry administer all ferry service on the San Francisco Bay, serving San Francisco, Alameda, Oakland, South San Francisco, Vallejo, and Marin County. WETA and Golden Gate Ferry were not included in this project.

Recommendations

- The Port should evaluate potential seismic upgrades to Pier 1 and a plan to upgrade Pier 50 or relocate these operations to support the Port's role in waterfront restoration.
- The Port, the Department of Emergency Management and the ferry operators should evaluate the impact of a major earthquake on ferry operations and the expected timeline for restoration of service.
- The Port should identify additional resources, partnerships, projects, policies and actions necessary to continue to reduce the risk of seawall failure.
- The Port should perform a seismic vulnerability assessment of southern waterfront with a particular focus on piers that are important to the City's post-disaster response.
- The Port should develop Memoranda of Understanding (MOUs) with Resource agencies responsible for permitting along the shoreline to expedite post-disaster construction.

Airport

Operator and System Description	Recommendations
San Francisco International Airport (SFO): The airport is owned and operated by the City and County of San Francisco and served 57.8 million passengers in 2018.	• SFO should identify ways to improve the reliability of fuel delivery in the event of an emergency. • SFO should improve the reliability of priority utility systems in an earthquake.

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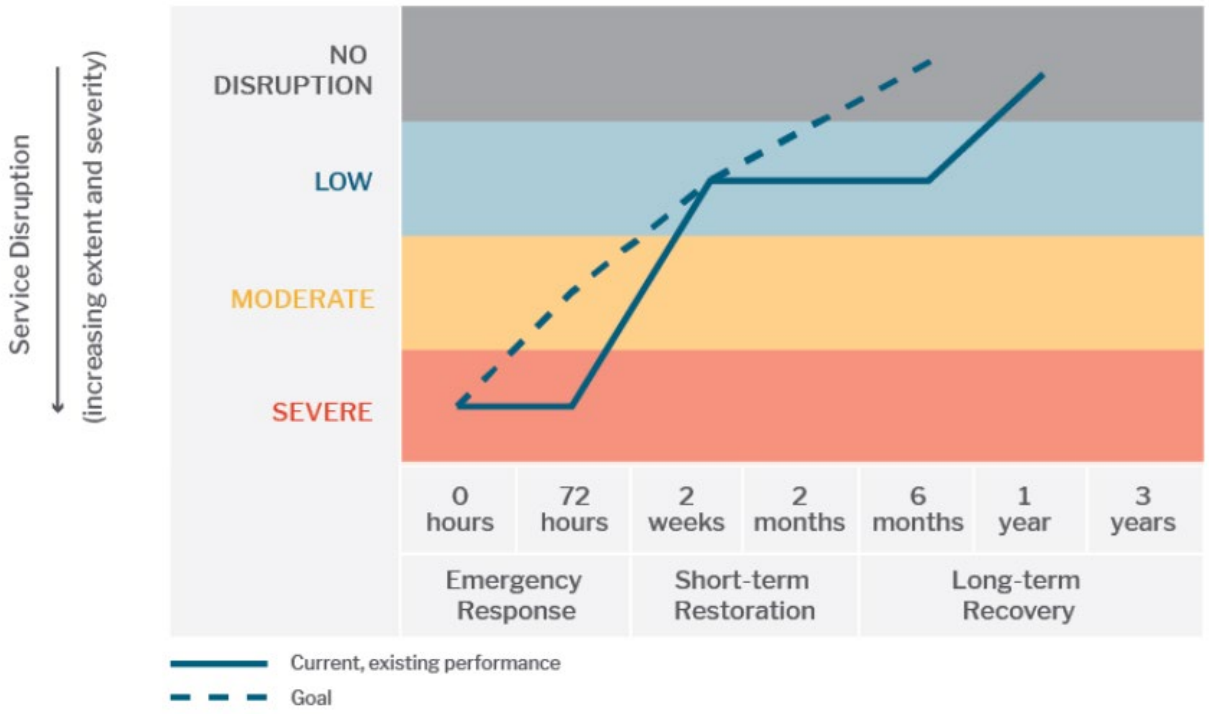
Firefighting Water

Operator and System Description	Recommendations
SFPUC: High-pressure water supply network for post-earthquake firefighting. System includes 5” hose tenders, EFWS salt-water inlet manifolds, water reservoirs, pump stations, cisterns, suction connections and fireboats	• SFPUC should complete studies and analysis, and implement capital projects to improve and expand the EFWS, emphasizing capital investments in areas of the City with limited access to the EFWS.

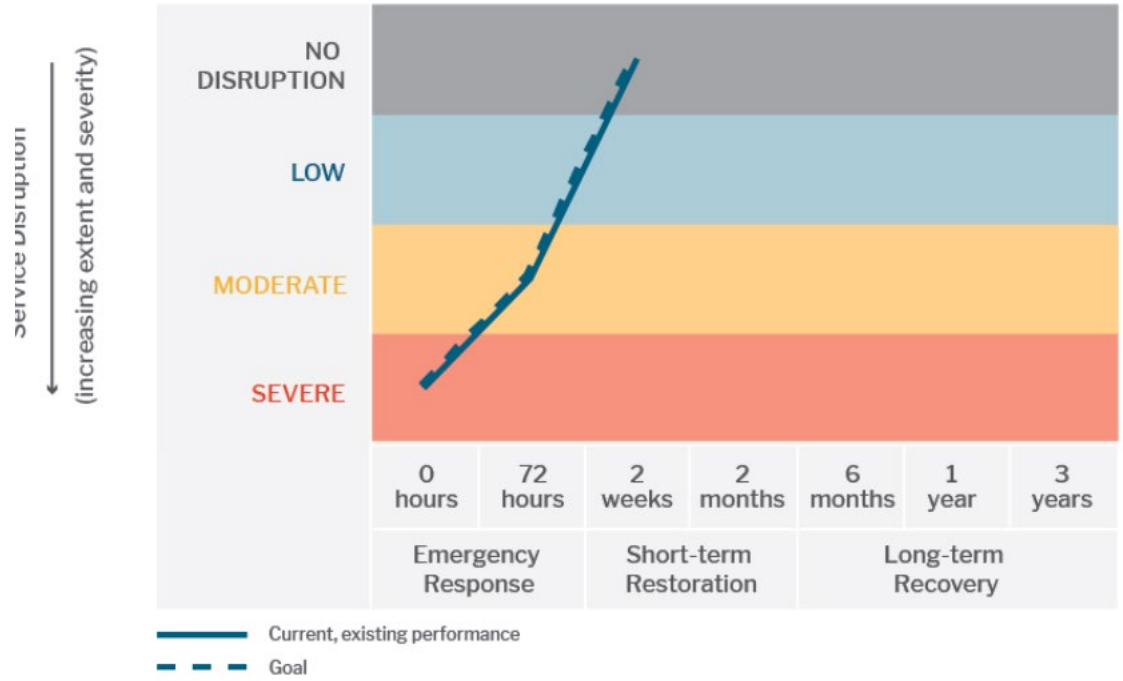
SFPUC

San Andreas Fault Scenario



PG&E

San Andreas Fault Scenario



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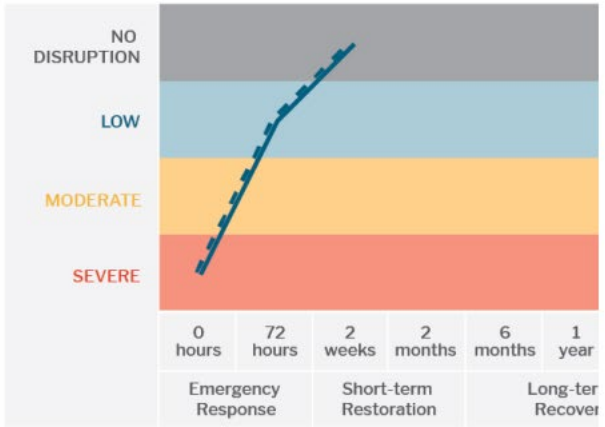
Building Our Future

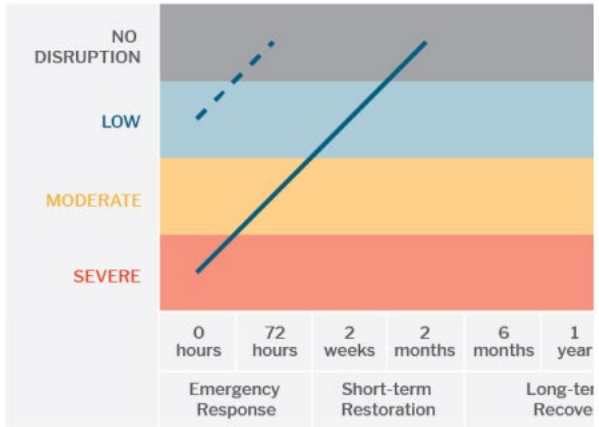
DEPT OF TECHNOLOGY

San Andreas Fault Scenario



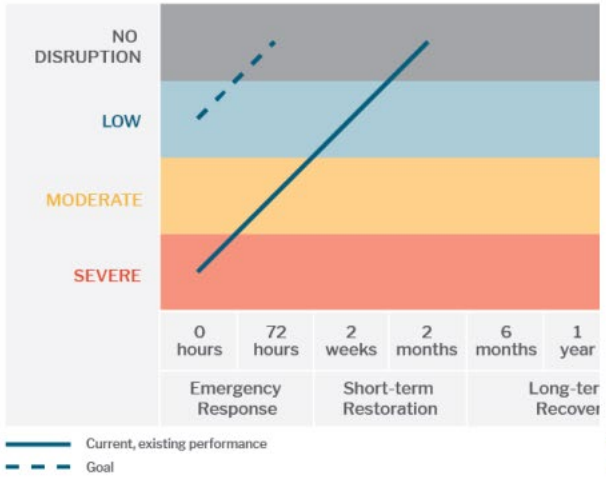
AT&T Wireless

San Andreas Fault Scenario



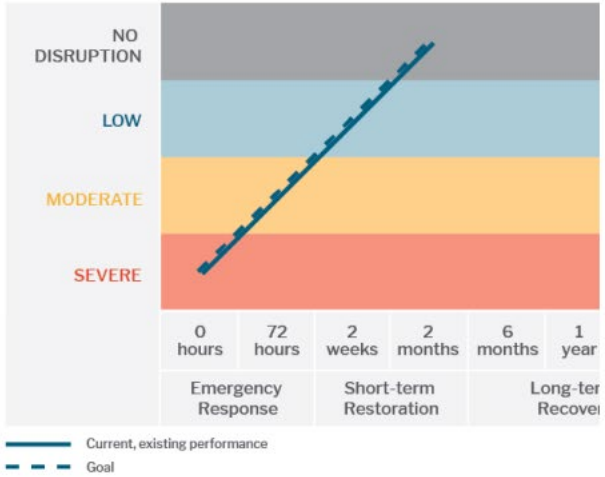
VERIZON

San Andreas Fault Scenario



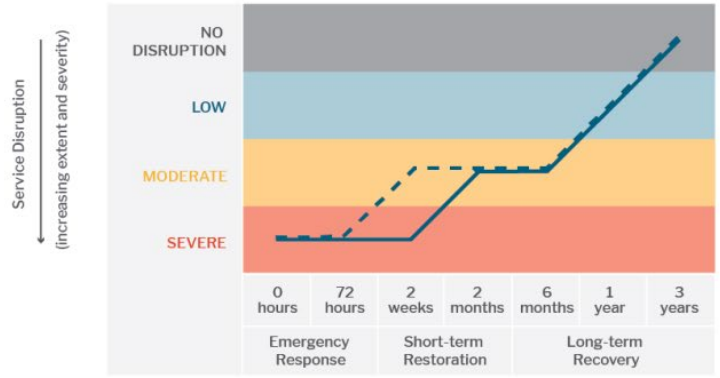
COMCAST

San Andreas Fault Scenario



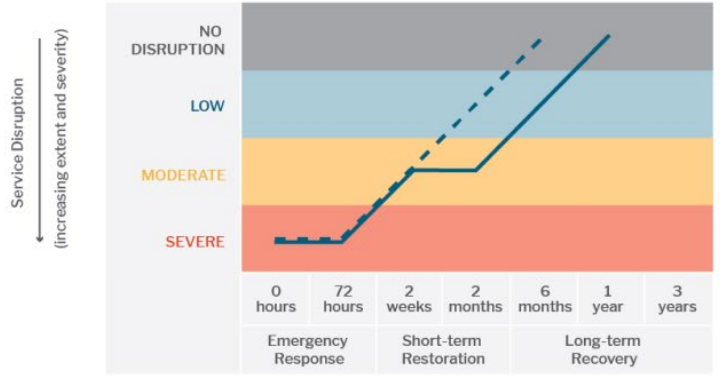
HIGHWAYS AND LOCAL ROADS - CALTRANS

San Andreas Fault Scenario



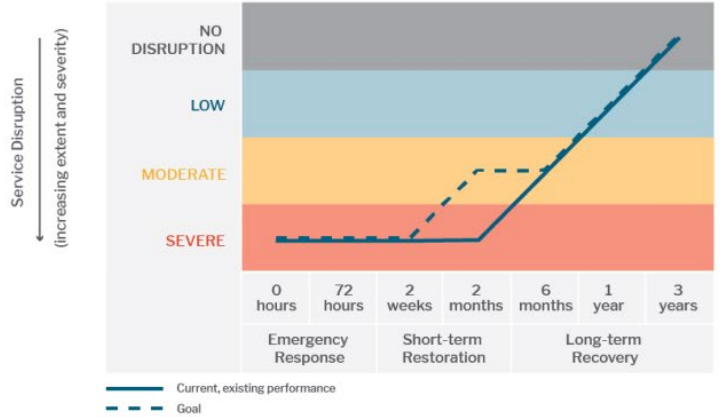
HIGHWAYS AND LOCAL ROADS - GOLDEN GATE BRIDGE

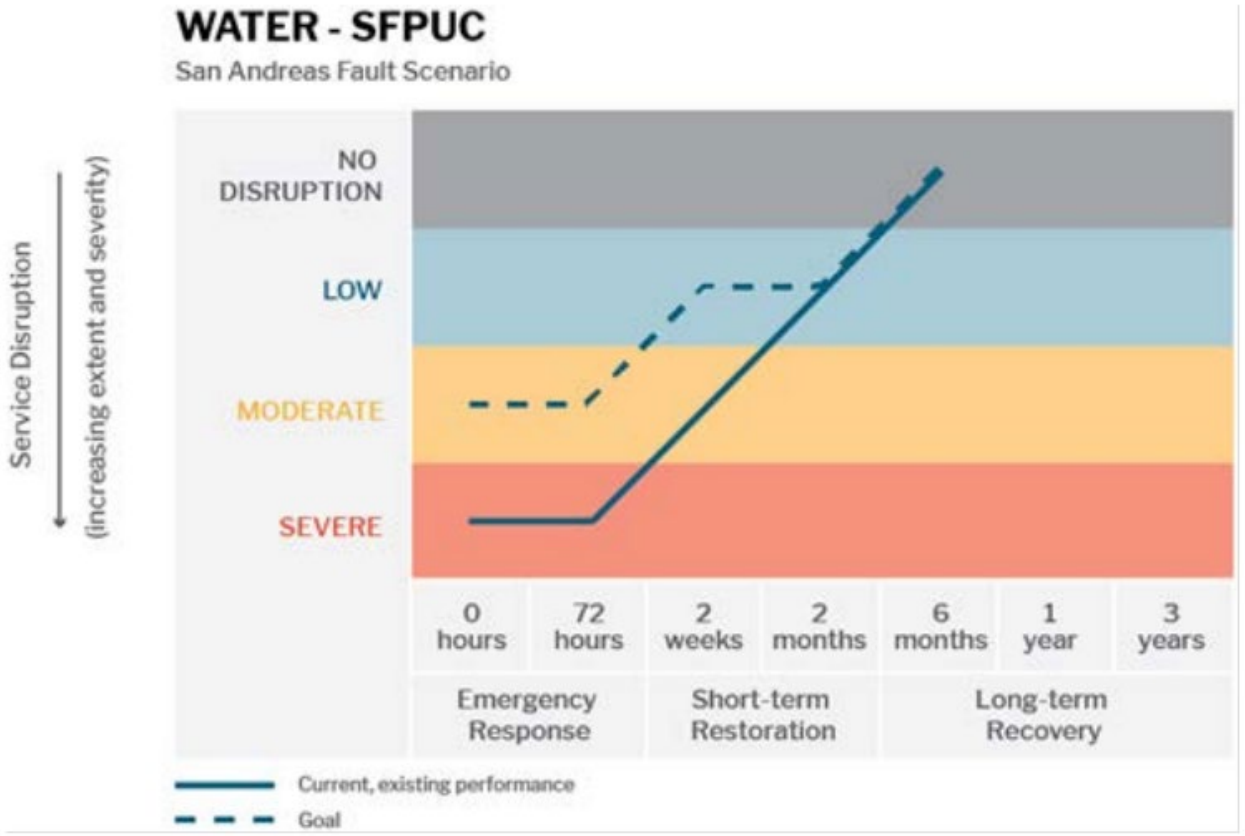
San Andreas Fault Scenario

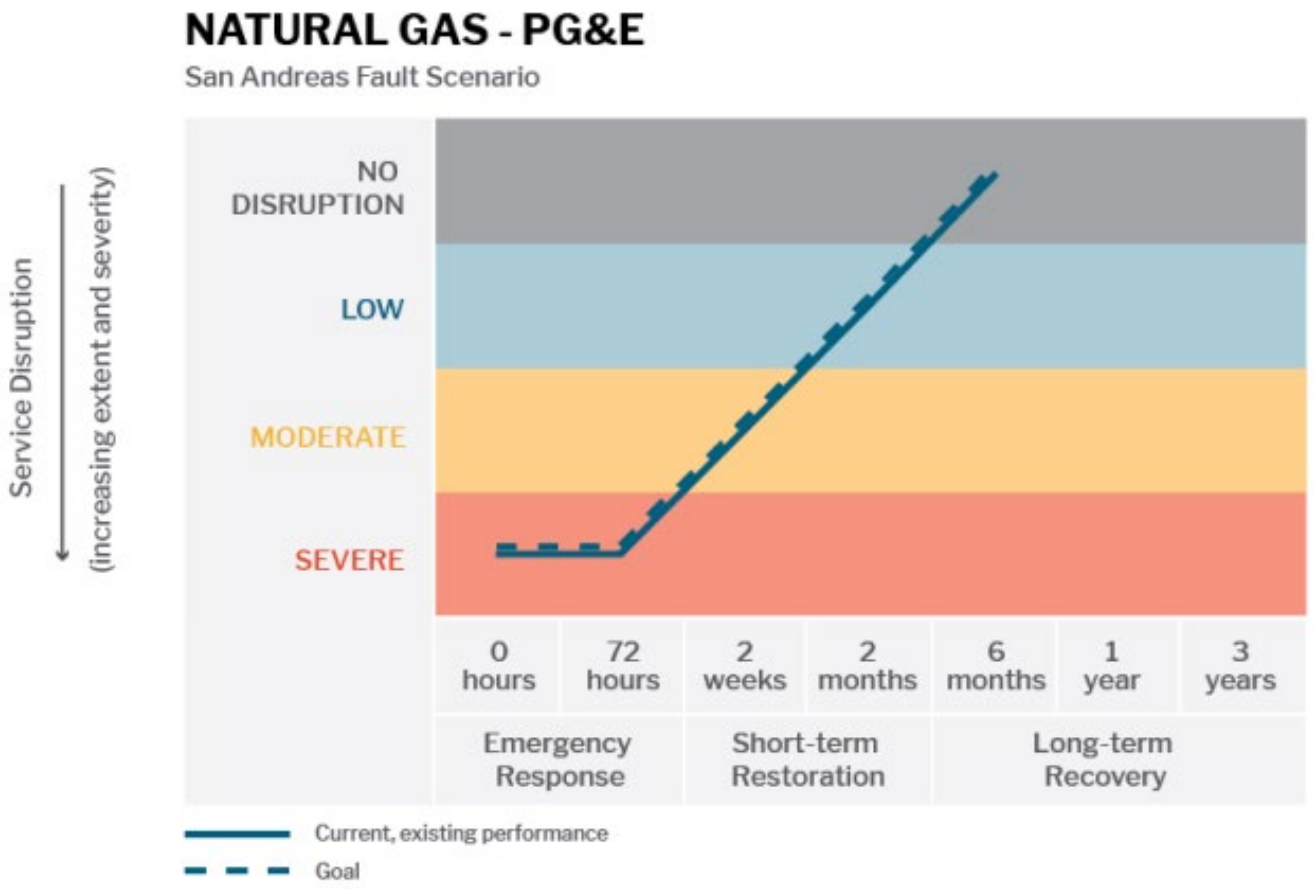


HIGHWAYS AND LOCAL ROADS - PUBLIC WORKS

San Andreas Fault Scenario

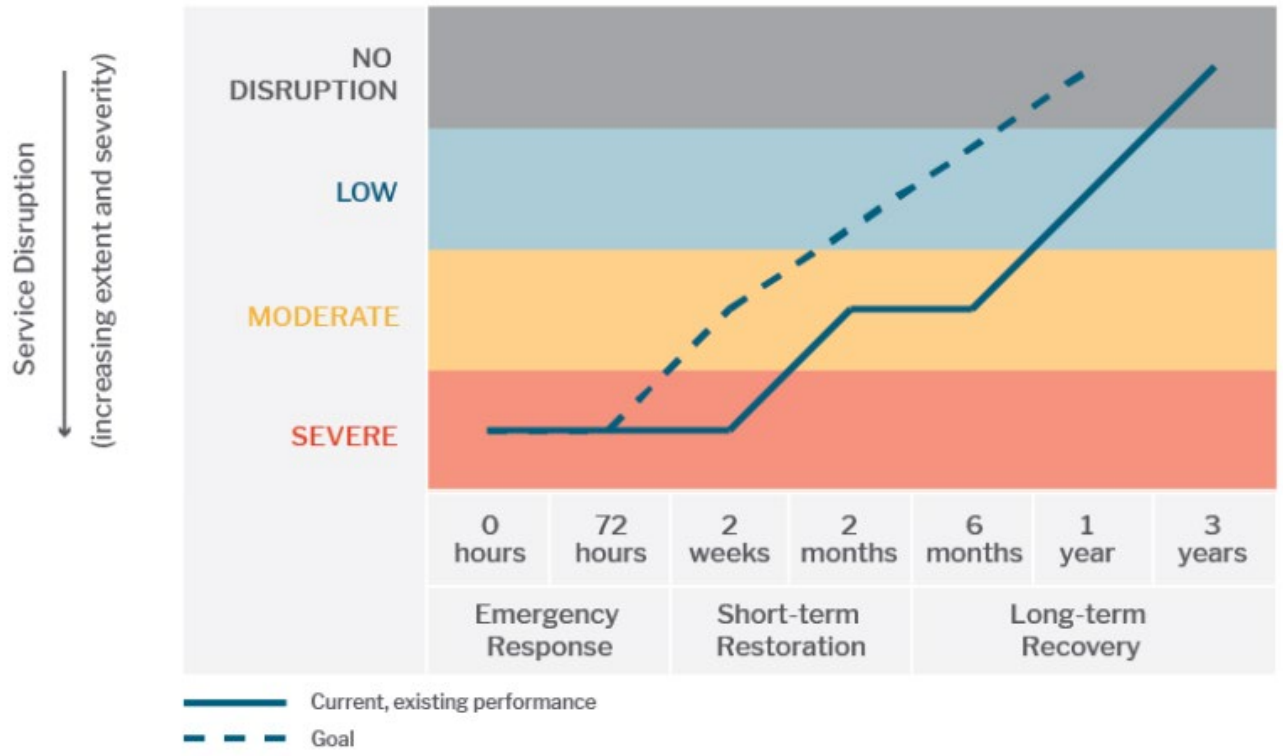



WATER - SFPUC
San Andreas Fault Scenario
Service Disruption
(increasing extent and severity)
NO DISRUPTION
LOW
MODERATE
SEVERE
0 hours
72 hours
2 weeks
2 months
6 months
1 year
3 years
Emergency Response
Short-term Restoration
Long-term Recovery
Current, existing performance
Goal


NATURAL GAS - PG&E
San Andreas Fault Scenario
Service Disruption
(increasing extent and severity)
NO DISRUPTION
LOW
MODERATE
SEVERE
0 hours
72 hours
2 weeks
2 months
6 months
1 year
3 years
Emergency Response
Short-term Restoration
Long-term Recovery
Current, existing performance
Goal

WASTEWATER - SFPUC

San Andreas Fault Scenario



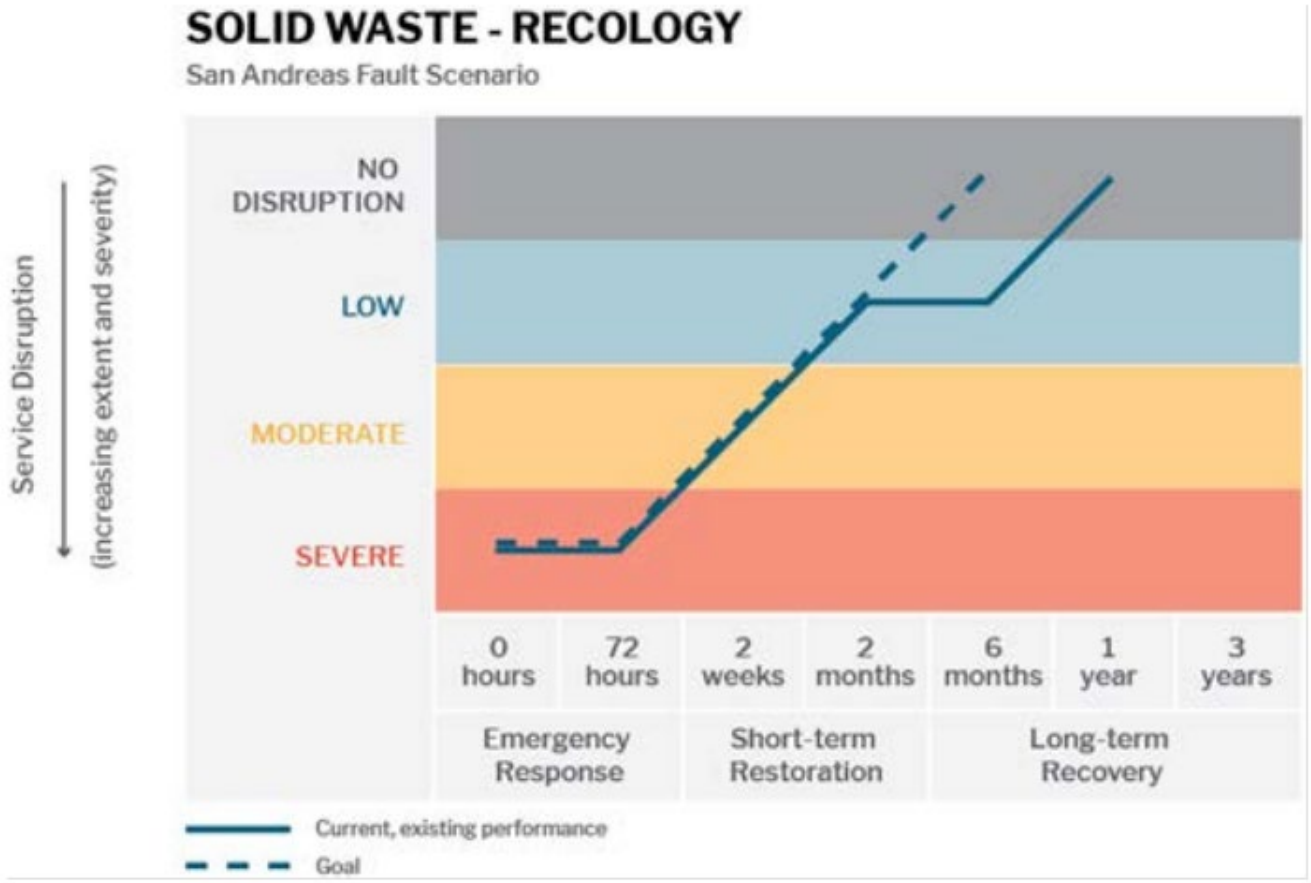
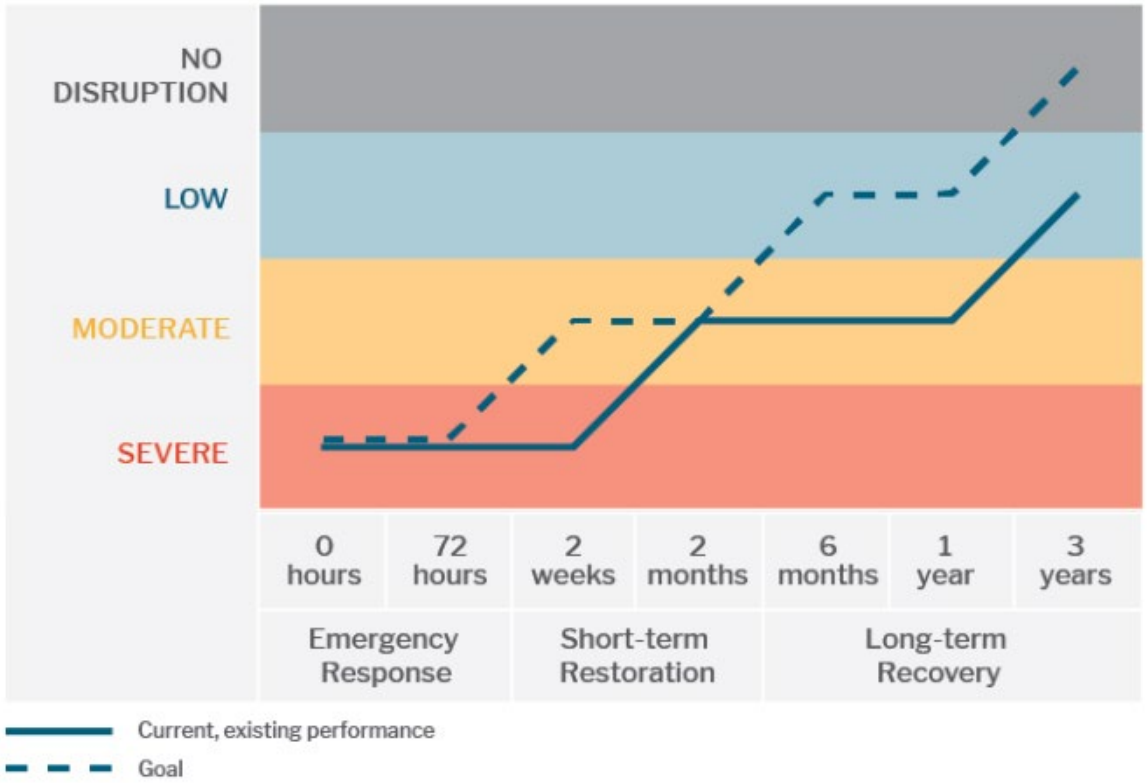

SOLID WASTE - RECOLOGY
San Andreas Fault Scenario
Service Disruption
(increasing extent and severity)
NO DISRUPTION
LOW
MODERATE
SEVERE
0 hours
72 hours
2 weeks
2 months
6 months
1 year
3 years
Emergency Response
Short-term Restoration
Long-term Recovery
Current, existing performance
Goal

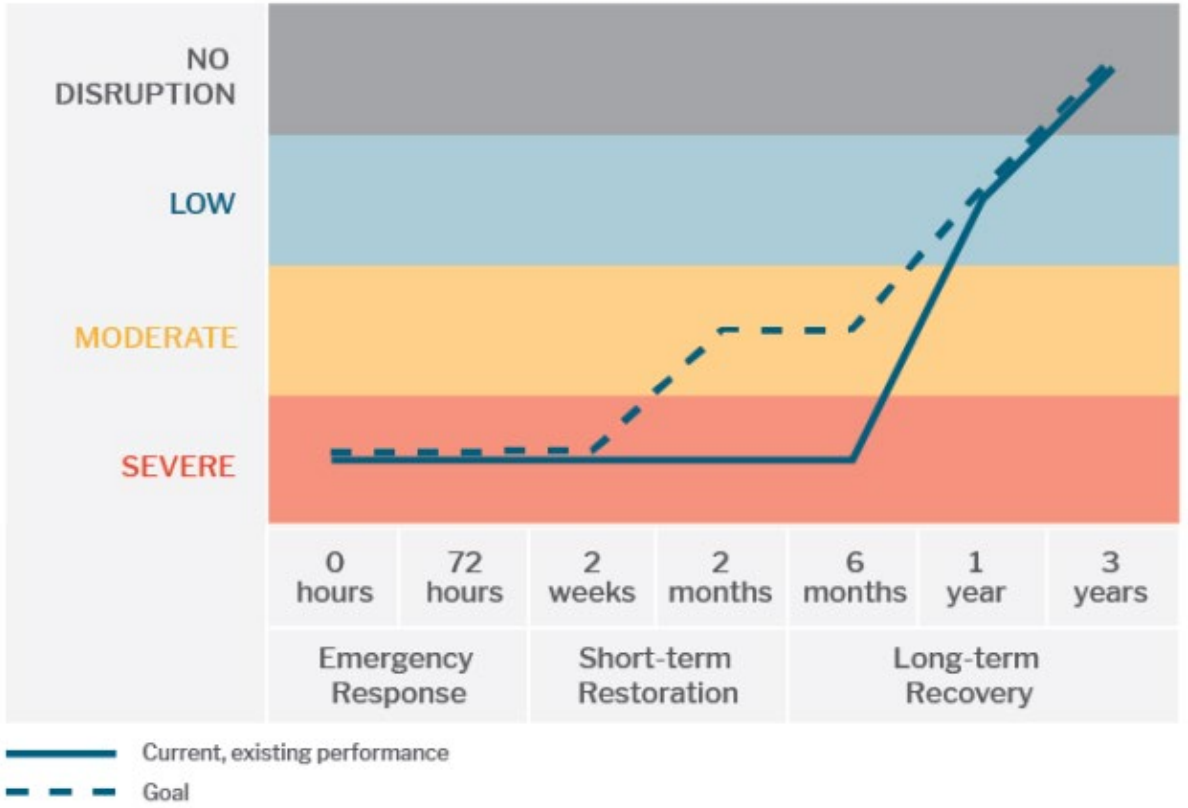
FIGURE 24: PORT RESTORATION TIMELINE

San Andreas Fault Scenario



AIRPORT - SFO

San Andreas Fault Scenario



EFWS

San Andreas Fault Scenario