Menlo Park SAFER Bay Project
Mitigating Risk to One or More Lifelines

Primary Community Lifeline: Energy

Primary Sub-Community Lifeline: Power Grid

The Ravenswood Substation is a transmission-level substation that powers the communities of Menlo Park, East Palo Alto, Palo Alto, Redwood City, San Carlos, Belmont, Atherton, and North Fair Oaks. Figure 1 shows the area that would lose power if the substation experienced an outage.

An analysis of the substation's service area is shown in Tables 1 and 2. In addition to providing power to nearly 300,000 people in 104,000 households and powering an area that provides employment for 213,000 people, the substation is a primary power source for 17 police and fire stations, 98 schools, 10 hospitals, 140 water/wastewater facilities, and 34 major transportation facilities.

The substation is sited at the margin of San Francisco Bay, and is at risk of tidal flooding and sea level rise (Figures 2a and 2b). When flooded, the substation must be de-energized until flood waters recede, and repair and maintenance activities must be completed before re-powering the substation. The Menlo Park SAFER Bay Project will mitigate the risk of substation flooding by constructing flood control levees on three sides of the substation, and a floodwall on the fourth side.

Floodgates in the floodwall will allow access to the facility and can be closed during flood events to protect the substation infrastructure and allow continued operation. The levees and floodwall will be designed to account for the 100-year storm event, plus 3.5 feet of sea level rise and FEMA's specified freeboard. These project features will create resilience for the primary power supply lifeline to a very large community.

Secondary Community Lifeline: Safety and Security

Secondary Sub-Community Lifeline: Community Safety

The Ravenswood Substation provides electric power over a wide geographic area. A loss of service from the Ravenswood Substation will impact 17 police/fire stations, 10 hospitals, and 140 water/wastewater facilities that provide the backbone of community safety and security services that support the population within the impact area. While it is acknowledged that these facilities are likely to have backup emergency generator systems for such scenarios, it is also likely that the generators will only provide support for the minimum number of critical systems, thus resulting in an inability to perform the full range of duties and responsibilities that would normally be

expected. Under the current conditions, the Ravenswood Substation can be expected to be offline for five days or longer in the most frequent flood scenario (10-year return interval), and for over two weeks in all other flood scenarios (Table 3). It can be reasonably assumed that most backup emergency generator systems are not equipped to run for more than 24 hours before they exhaust fuel reserves, which can create an operational hurdle that may be difficult to address in the midst of an on-going local emergency condition.

Major hospitals in the area include the Lucille Packard Children's Hospital (364 beds); Stanford Hospital (605 beds), Redwood City Medical Center (149 beds); Sequoia Hospital (208 beds). Hospitals are required to have emergency backup generation and fuel stored on site for at least 72 hours, though such backup generation may not satisfy all hospital needs (such as indoor air conditioning).

A large number of other life safety facilities are located within the Ravenswood Substation service area. Just one example is California's Urban Search and Rescue Task Force 3 is stationed in the Ravenswood Substation service area at 2470 Pulgas Avenue in East Palo Alto. This is a state and federal Emergency Response Facility that has tremendous asset and operational value and is classified as a critical infrastructure site due to its level of operational response capabilities from a local, state, and federal position.

Additionally, three county jails are in the Ravenswood Substation service areas. This includes the Maguire Correctional Facility, the Maple Street Correctional Center, and one women's facility.

By mitigating the risk of the Ravenswood Substation flooding through construction of levees and floodwalls, the project will maintain the function of these facilities, and others in the area, that are critical to the safety of local communities.

Figure 1: Outage Map for PG&E Ravenswood Substation

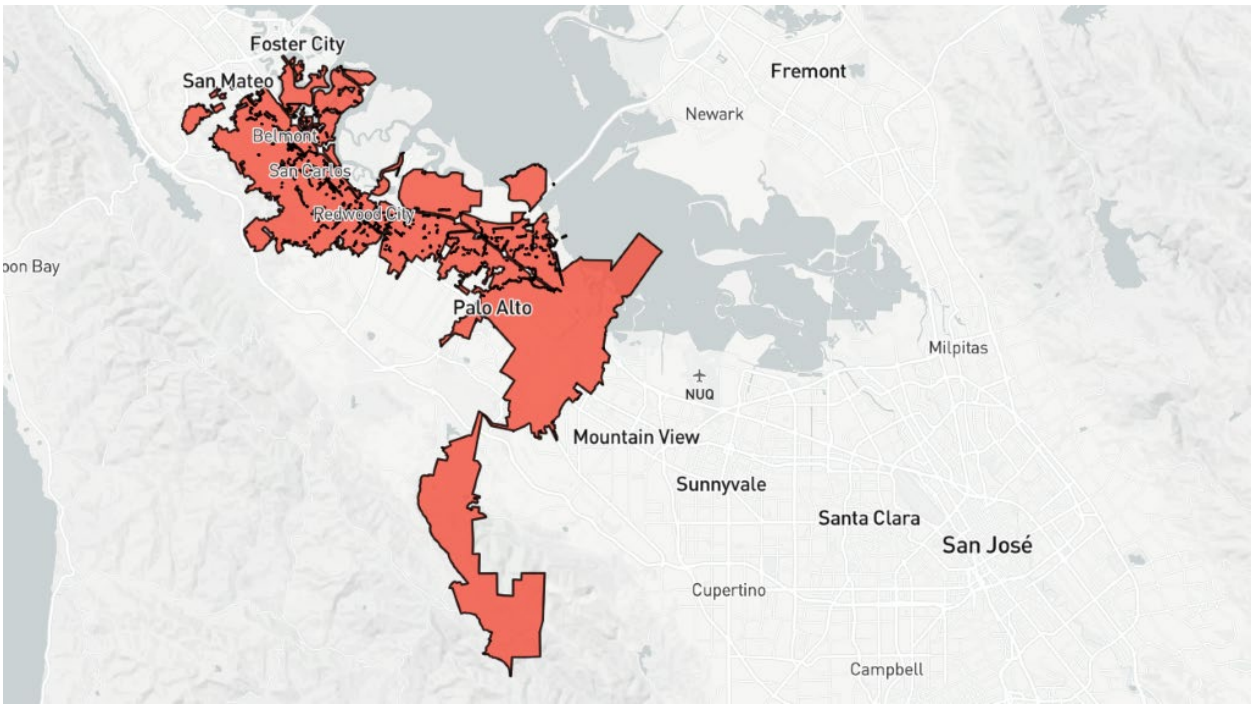

Figure 2a: Google Earth Aerial View of the Substation, showing the Proximity of the Tidal Environment

Figure 2b: Photos Taken at the Ravenswood Substation during High Tide on January 10, 2020

Table 1. PG&E Ravenswood Substation: Summary Statistics Report for FEMA BRIC Application

	Base Outage Scenario
Population	296,183
Dwelling Units	110,530
Households	104,862
Employment	213,371

Table 2. PG&E Ravenswood Substation: Customer Overview for FEMA BRIC Application

Emergency Services	17
Government - Schools	98
Government - Jails and Prisons	1
Healthcare - Hospitals	10
Healthcare - Other	50
Water and Wastewater	140
Communications	624
Major Transportation	34
Other	60
Medical Baseline (medical device in home - respirators, CPAP machines, etc.)	1,632
Total Customers	79,338

Table 3. Estimated Loss of Service at PG&E Ravenswood Substation Due to Tidal Flood Inundation with 3.5 feet of Sea Level rise

Event	Substation Inundation Depth (ft.)	Event Duration (days)	Drainage Duration (days)	Repair Time (days)	Total loss of Service Time (days)
10-year	2	1	5	7	13
50-year	2	2	5	7	14
100-year	2	3	5	7	15
200-year	2	3	5	7	15

Assumptions

1. Inundation depths are just for PG&E substation, with approximate elevation of 9 ft NAVD.
2. Event duration based off of January 1983, when three successive days had high water marks approaching the 100-year SWL
3. Maximum inundation depth is set by external levee crest elevation's capacity to hold water, so 100-year and 200-year have same inundation depth
4. Future conditions with 3.5 ft SLR assumes no change to the levee elevations that detain water after the event.
5. Repair time changes from minor (2 days) to major (7 days) for inundation depth greater than or equal to 1.5 ft