Adapting to Rising Tides

Stormwater Management Vulnerability and Risk Profile

The stormwater management system includes storm drains and pipes that connect to flood control infrastructure such as creeks, channels, culverts, pump stations, and outfalls along the Bay. Stormwater and flood control infrastructure protect homes, transportation networks, and other infrastructure during flood events. Therefore, the adaptive capacity of stormwater and flood control infrastructure has direct implications for community adaptive capacity.

Key Issues

With the exception of the City of Alameda, which owns and operates its own stormwater management *and* flood control system, the cities in the ART project area own the stormwater management system, while the flood control infrastructure is owned and operated by Alameda County, creating challenges for watershed-wide stormwater management. In addition, critical information, such as outfall elevations and pipe capacity, is currently lacking, which hinders the evaluation of stormwater management vulnerability and the development of adaptation strategies.

Outfalls that are below the new high tide or storm water level and do not have check valves to prevent inflow could become backed up, resulting in flooding. Likewise, if pipe capacity is insufficient, upstream flooding will occur. Higher groundwater caused by rising sea level will reduce the capacity for stormwater infiltration and result in more runoff. Another component of the stormwater system, pump stations, rely on sensitive electronic equipment that cannot get wet and that may be corroded by saltwater. In addition, some pump stations may not have sufficient capacity to lift water above the new Bay water levels. GIS data was only available for Alameda County's pump stations, and exposure analysis was only conducted for these assets. A number of pump stations are exposed to one or more of the sea level rise scenarios evaluated, which could result in flooding in neighborhoods that rely on pumping.

Vulnerabilities

Timing

- Near-term: Stormwater infrastructure in some parts of the ART project area is already inadequate and flooding occurs when rain events coincide with high tides.
- Mid-century: Of the pump stations evaluated over half are exposed to one or more scenarios by mid-century, and all but one are exposed to a sea level rise scenario by end of century.

Consequences

Scale

- If a pump station or other element of the stormwater management system cannot function due to a climate impact, it could result in flooding at the site, adjoining properties, and in the neighborhoods served by the pump station.

Ecosystem Services

- Flooding due to pump station damage or backups in the conveyance system could redistribute contaminants, possibly harming sensitive habitats.

People

- Flooding due to backups or pump station failures could cause flooding in the neighborhoods they serve.

Economy

- If sea level rise diminishes the function of the stormwater system, resulting flooding could block access to employment centers and businesses, with associated impacts on the subregional economy.

Vulnerabilities

Physical and Functional Qualities

- Outfalls that are below the high tide or storm event water level and do not have check valves could experience encroachment from Bay water.
- Pipe capacity may be insufficient to store both stormwater and Bay water that could enter pipes if their outfalls are below water levels.
- Pump stations have electric or computerized components - often at grade or underground - that are sensitive to water.
- Saltwater may corrode and damage pump stations and other infrastructure.
- Pump stations require power to operate; if a flooding event also causes power outages, they will have to rely on backup power, which would require a sufficient fuel supply to last the duration of the flooding event.
- Pump stations are built to a certain design capacity - that is, the ability to lift water to a certain elevation at a certain rate - which may be exceeded with sea level rise.
- If pump stations are required to operate more frequently, or pump water to higher elevations, energy and maintenance costs will increase, and pumps may not last as long.
- Reduced infiltration capacity due to higher groundwater could stress the stormwater management system.

Information

- Information that is critical to evaluating vulnerability and developing adaptation strategies, such as outfall elevations and pipe capacity, is currently lacking.

Management Control

- Alameda County owns and operates the flood control channels and outfalls, and the cities own and operate the stormwater infrastructure (with the exception of the City of Alameda). Cities also have responsibility for zoning and other land use decisions that can affect the amount of stormwater runoff (e.g., the extent of development and impervious surfaces). Therefore, a high degree of coordination between the county and the cities is necessary to manage stormwater in an integrated manner - including LID approaches - to make the overall system more resilient to sea level rise.
- Cities and flood control districts have limited sources of funding and their ability to increase revenues to address SLR or other problems is constrained.