CHAPTER 7

San Dieguito River Flooding Adaptation

This chapter includes a range of adaptation measures to address vulnerabilities from flooding along the San Dieguito River, including the river valley, Del Mar Fairgrounds, and North Beach (north from 15th St to the San Dieguito river mouth). Permitting for some adaptation measures may be processed through the California Coastal Commission or through the City of Del Mar based on the Local Coastal Plan as summarized in Section 7.3.

The increased risk of San Dieguito River flooding is driven by changes in extreme precipitation and river discharge and increased deposition of sand in the River channel, which would raise the elevation of the channel bed and the flood level. Increased channel deposition could occur as sea level rises, with waves driving an increase in sand transport “up” into the channel. The increase in channel depth could also increase deposition due to tidal flows into the San Dieguito River Lagoon and the interaction of river and tidal flows in the estuary.

Vulnerability assessment:

- The Fairgrounds’ present low exposure to significant flooding will become highly exposed with 2 to 3 feet of channel deposition; however, the vulnerability of the Fairgrounds’ land uses to flooding may be less than for other public and private development due to the reduced consequences of the flooding.
- Roads and bridges, including Camino Del Mar, Jimmy Durante Blvd. and bridge, the east ends of North Beach District streets and San Dieguito Drive, will be highly vulnerable to flooding with 2 to 3 feet of deposition.
- Low-lying central portions of the North Beach District (blocks bounded by Camino Del Mar, 28th St, and Railroad; general vicinity of Coast Blvd. and Santa Fe between 17th St. and 23rd St.), which currently have low vulnerability to river flooding, would be highly vulnerable with 2 to 3 feet of deposition.
- The sewer lift station along San Dieguito Drive would be increasingly exposed to flooding and risk of failure.
- Other water and sewer infrastructure in these areas would also be exposed to both river and coastal flooding.

River flooding adaptation options:

- River channel dredging
- Reservoir management
- Levees with partial retreat
- Raise structures

River flooding adaptation monitoring:

- River channel deposition
- Chance of extreme flooding

7.1 Adaptation options

7.1.1 Adaptation option: river channel dredging

River channel dredging maintains the channel bed near its current elevation and maintains the river flood risk near the current risk level. This could be accomplished using marine-based floating dredges and barges and/or land-based equipment operated from the channel bank. Assuming the dredged material is primarily sand, the dredged material could be placed on the beach to provide nourishment as a beach adaptation measure. Material could also be placed to raise the elevation of wetlands as a wetland adaptation measure (e.g., using “spray” dredging), especially for finer-grained dredged material.

Southern California Edison has dredged the River channel as part of the San Dieguito Lagoon Wetland Restoration. Southern California Edison dredged approximately 40,000 cubic yards of sand from the channel in 2011 and 16,800 cubic yards in 2015 to maintain the tidal flow (tidal prism) required by mitigation permits. Southern California Edison is required to maintain a minimum tidal prism, which is achieved by maintaining a certain minimum channel cross-section; however, the permits and maintenance program do not account for future sea-level rise or require a certain channel bed elevation to be maintained. With sea-level rise, the tidal prism could be maintained for the restoration, while the channel bed elevation and flood risk increase. Modifying the channel dredging program to maintain the channel bed elevation as a River flood adaptation measure is therefore expected to be required.

As part of the Adaptation Plan, the City will review channel survey data and deposition monitoring from the San Dieguito Lagoon Restoration and coordinate with Southern California Edison on the channel dredging program.

7.1.2 Adaptation option: reservoir management

The City of San Diego’s Lake Hodges Reservoir controls flows from approximately 87% of the San Dieguito River watershed. The primary purpose of the Lake Hodges Reservoir is water storage; however, the Reservoir can provide ancillary flood management benefits. In the past, extreme river flooding has occurred when the reservoir is full and extreme rainfall runoff events overtop the dam spillway and is conveyed downstream. The majority of the extreme river discharge at Del Mar has been contributed by the flow spilling over the dam spillway.

In 2012, The San Diego County Water Authority (SDCWA) completed the Lake Hodges Projects that connected Lake Hodges to SDCWA’s new Olivenhain Reservoir for the purpose of improving water supply and storage (SDCWA 2016). The connection also allows water to be pumped back and forth between Hodges Reservoir and Olivenhain Reservoir (SDWCA 2016).

While the primary purpose is water storage, the improved reservoir system and operations could provide improved flood management.

As part of the Adaptation Plan, the City can coordinate with the City of San Diego and the San Diego County Water Authority (SDCWA) to explore Lake Hodges reservoir management and operations options for improving River flood management at present and with climate change. Increasing reservoir storage has the potential to at least partially offset the projected increase in River flood risk with climate change and sea-level rise-induced channel deposition. Storage volume could be increased through management of the Lake Hodge Project via pump operation or by dredging sediment from the reservoir that has been delivered by the River and accumulated in the reservoir. Dredging reservoir sediment could potentially be compatible with beach nourishment and wetland sediment placement adaptation measures. This approach is logical in that it moves sediment trapped in the reservoir to the coast, where it is needed and would have naturally deposited without the reservoir; however, there are a range of constraints and feasibility issues that would need to be consider including transporting (e.g., trucking) sediment.

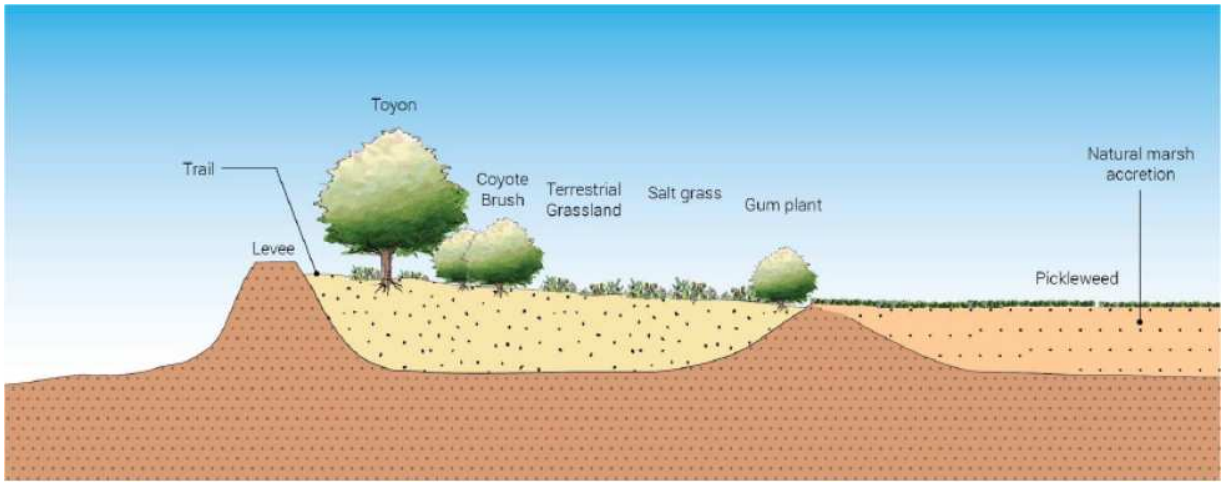
7.1.3 Adaptation option: levees with partial retreat

Levees, such as engineered earth embankments, can be built along the River corridor up to elevations above flood levels to reduce the flood risk to areas behind the levees. The Adaptation Plan includes levees in combination with partial retreat assets away from the River flood corridor. Retreat would consist of removing structures and restoring developed land to wetlands to expand wetland floodplain habitat, thereby reducing flood levels and providing new habitat that can be designed to be resilient to sea-level rise. Figure 7.1 shows an example of potential levee alignments and partial retreat/habitat restoration areas. As shown in this example, the Public Works Yard south of the River could be relocated (per the high priority adaptation measures) and portions of the Fairgrounds (e.g., to the west) could be restored to wetland. The Fairgrounds has already completed the Phase 1 wetland restoration at the South Overflow Parking Lot (south of Jimmy Durante Blvd. and east of Jimmy Durante Bridge) and plans to restore the rest of the lot to wetlands in Phase 2, which is scheduled to be implemented soon. The actual proposed levee alignments and wetland restoration areas would need to be planned in greater detail and would be different than shown in the example. The locations of the levees would also need to be assessed and planned in greater detail, for example, so that the levees tie into high ground.

The levees could be designed as “living levees” by creating gently-sloping upland, transition, and wetland habitats between the levee and the river (Figure 7.2). This approach is being adopted in wetland restoration practice to enhance habitat diveristy and provide wetland buffers and high tide refuge. Higher elevation transition and upland areas also provide space for wetland to migrate to with sea-level rise. Constructing living levees may be compatible with channel dredging if dredged materal can be placed to build the habitat slope adjacent to the levee. Soil for levee construction would need to meet specific engineering criteria and may need to be imported from off-site.

Figure 7.1
Living Levees

Figure 7.2
Living Levee Cross Section



The levees would need to be planned and designed to avoid potential impacts to existing habitats, sediment transport, and flood levels upstream and downstream. By combining levees with partial retreat and habitat restoration, the intent would be to construct the levees in currently developed areas, avoid construction in existing wetland areas, and create new restored upland and wetland habitats that could mitigate for potential habitat impacts. The effects of levees and restored areas on river sediment transport, deposition, and scour during storm events would also need to be analyzed. For example, the effect of the San Dieguito Lagoon Restoration on sediment transport and the potential to reduce sand supply to the beach during storm events was an important consideration in the project evaluation and design. Constructing levees to protect portions of the City and Fairgrounds that would otherwise flood during storm events could potentially increase sand transport to the beach, however this would need to be fully evaluated. Confining river flows within a levee system also has the potential to increase flood levels upstream and downstream of the levee system, which would also need to be fully evaluated and addressed in planning and design. Within the levee system (i.e., between the levees), River flood levels would also likely increase and a plan and design to reduce any potential increase in flood risk to bridges crossing the river would need to be developed.

7.1.4 Adaptation option: raise structures

The elevation of homes, buildings, and infrastructure such as roads can be raised to above river flood levels in the future, similar to the adaptation measure for raising structures to address North Beach coastal flooding. A key difference is that the area of potential river flooding is larger than the area of coastal flooding and a greater number of structures would need to be raised. Raising structures can include raising buildings on pile foundations and/or modifying building design/construction so that the second floor is above the target flood level and contains all flood-sensitive features, while the first floor is used for parking and/or storage and is designed to be durable and resilient to flood damage.

Raising roads and vulnerable utilities can be accomplished by placing fill to rebuild roads and replace utilities at higher elevations. Other options for raising roads and utilities may include replacing at-grade roads with pile-supported causeways.

As part of the City's existing floodplain management program, the City already requires that the construction or re-construction of North Beach buildings in the current river floodplain raise buildings above the existing 100-year river flood elevation to meet Federal Emergency Management Agency (FEMA) National Flood Insurance Program (NFIP) requirements. FEMA is in the process of revising the effective Flood Insurance Rate Maps and accompanying flood levels; however, the NFIP does not currently consider sea-level rise and climate change. The City can consider modifying floodplain development policies and regulations to address sea-level rise and facilitate the raising of structures over time through redevelopment.

7.1.5 Adaptation option: relocate structures

The City can consider relocating public buildings, utilities, and other infrastructure as the river flood risk to public structures increases. For at-risk private property and structures, the City

could consider incentives for facilitating relocation to allow for wetland restoration along the river. As noted above, a greater number of structures are within the river flood risk area than the coastal flood risk area.

The City can follow the development of state-wide retreat and relocation programs and pursue studies of how such programs could be implemented in the City of Del Mar. Options for facilitating structure removal could include rolling easements, relocation incentive programs, transfer of development rights programs, and programs for acquisition, buyout, or equity transfer of ownership in situations where doing so provides a commensurate public benefit.

7.2 River adaptation monitoring

The monitored criteria for river adaptation are channel deposition (e.g., driven by sea-level rise) and the flood risk due to sea-level rise, channel deposition, and potential for climate change to increase extreme precipitation and river discharge. Table 7.2.1 includes the projected increase in flood risk with sea-level rise/channel deposition and climate change from the Coastal Hazards, Vulnerability, and Risk Assessment (ESA 2016). These projections assume that deposition is not limited by sediment supply and that the river bed profile and flood profiles would increase in elevation with sea-level rise, with a rate and amount of deposition equal to the rate and amount of sea-level rise.

Table 7.2.1
Projected river flood risk with sea-level rise

Sea-level rise and channel deposition	**0 ft**	**1ft**	**2 ft**	**3 ft**	**5.5 ft**
Annual chance of extreme flooding (1% chance event)	1%	5%	6%	6%	20%
Annual chance of significant flooding (1980 event)	5%	15%	25%	50%	100%

Table 7.2.2 presents criteria to initiate planning for adaptation measures and anticipated extreme risk of flooding ranges over which measures will be effective. Based on the guiding principles, the flood risk criteria and thresholds are set to limit the risk of extreme river flooding and damage to less than 5% annual-chance of occurrence. Adaptation planning would be needed as river flooding and damage increases to 5%.The risk of more frequent, less severe, but still significant flooding such as the 1980 San Dieguito river flood event is estimated to currently be around 5% annual-chance. Adaptation to reduce extreme flood risk would reduce the risk of more frequent flooding.

Table 7.2.2
River flooding monitoring criteria to consider adaptation options

Criteria & Thresholds	**Annual risk of extreme flooding***	**5%**	**15%**	**50%**	**100%**
Adaptation Options	**Protect**	Channel dredging			
			Reservoir management		
			Levee with partial retreat		
	Accommodate	Raise structures			
	Retreat		Relocate infrastructure		

**Risk of flooding without adaptations*

7.3 River adaptation coastal permitting

As discussed previously, Coastal Development Permit review and approval for River adaptation measures may fall within the California Coastal Commission and/or the City's coastal permitting jurisdiction and, depending on the jurisdiction, may be processed through either the City of Del Mar's LCP and/or pursuant to the California Coastal Act. The likely coastal permitting mechanisms for River adaptation measures are summarized below for the purpose of informing the development of the LCP Amendment as a next step. The likely coastal permitting mechanisms for river adaptation measures are summarized in Table 7.3 for the purpose of informing the development of the LCP Amendment as a next step. Other approvals and permits would also be required and would need to be addressed separately.

Table 7.3
Summary of likely California Coastal Act approval and permitting process for wetland adaptation measures

Adaptation Measure	**LCP Jurisdiction**	**CCC Jurisdiction**	**Note**
River channel dredging		✓	• Below water
Reservoir management			• Partnering with City of San Diego
Raise structures	✓		• LCP redevelopment policies and regs.
Relocate infrastructure	✓		• LCP policies