5. REGIONAL SEDIMENT MANAGEMENT APPROACHES

This section focuses on RSM approaches as solutions to coastal erosion problems in southern Monterey Bay. Based on the information outlined in Sections 2 to 4, three main approaches to RSM are considered appropriate. These are:

- beach restoration strategies including beach nourishment to slow erosion rates
- eliminate factors that exacerbate erosion
- allow the natural process of dune erosion to continue without intervention.

SMBCEW (2006a) carried out an initial investigation and ranking of a wide variety of erosion response alternatives (including but not exclusively RSM). The list created by SMBCEW (2006a) is presented in Table 12 and includes beach restoration alternatives (beach dewatering and pressure equalizing modules, sand retention devices and other structures/alternatives), and making sure that any future developments have adequate set backs. A full investigation of these methods is outside the scope of this Coastal RSM Plan, but the MBNMS will fund a study for the SMBCEW that further evaluates the higher ranking alternatives, and assesses their role within the RSM framework for southern Monterey Bay.

Table 12. Potential Erosion Response Alternatives (SMBCEW, 2006a)

Alternative	Approach	Specific Method	Rank
Approaches to be used when addressing future developments	Prevent or discourage development in areas threatened by erosion	Transfer of Development Credit	20
		Conservation Easements	19
		Fee Simple Acquisition	18
		Present Use Tax	18
	Avoid threats from erosion permanently or for many years	Rolling Easements	19
		Structural or Habitat Adaptation	17
		Setbacks for Bluff Top Development	17
		Setbacks (Plus Elevation) for Beach Level Development	16
Regional approaches to be used for larger area-wide responses to slow beach erosion		Beach Nourishment - Nearshore Placement	15
		Beach Nourishment – Subaerial Beach Placement	14
		Beach Nourishment - Dredge Sand from Deep or Offshore Deposits	14
		Dune Nourishment (adding both sand and vegetation)	14
		Pressure Equalizing Modules	14
		Beach Dewatering	12
		Submerged Breakwaters/Artificial Reefs	12
		Inter-littoral Cell Transfers	11
		Perched Beaches	11
		Groins	11
		Emergent Breakwaters	10
Site-specific approaches to be used for existing structures that are threatened by erosion	Move or remove structures away from erosive forces	Managed retreat	18
	Move erosive forces away from the threatened structure	Seawalls	8
		Revetments	8
Approaches that reduce factors that exacerbate erosion	Site-specific (often used in combination with other approaches)	Native Plants	12
		Sand Fencing/Dune Guard Fencing	11
		Controlling Surface Runoff	11
		Controlling Groundwater	11
		Berms/Beach Scraping	9/10
	Regional	Sand Mining Cessation	19

5.1 BEACH NOURISHMENT

At locations where it is not considered acceptable to allow natural processes to continue, because the beach resource is being lost and/or important facilities are at risk of erosion, human intervention to alter the shoreline is often considered. In general, there are two types of alteration strategies that are traditionally implemented; soft approaches (a variety of options including beach nourishment) and hard approaches (mainly armoring of different types).

The California Beach Restoration Study (CDBW and SCC, 2002) defines beach nourishment as the introduction of sand on to a beach to supplement a diminished supply of natural sediment, for the purpose of beach restoration, enhancement, or maintenance. The southern Monterey Bay shoreline has no history of beach nourishment, because the majority of the shoreline is undeveloped and the beaches are healthy, being provided with significant amounts of sediment from erosion of the relict dune bluffs (Section 5.3). Beach nourishment, where sand is actually placed using new sources (either from onshore or offshore), is distinct from beach replenishment, where sand sources that have been cut off (e.g. sand mining at Marina), can again become sources (Section 5.2).

SMBCEW (2006b) strongly recommended analysis of the feasibility of beach nourishment for sites at and south of Sand City and this Coastal RSM Plan supports this recommendation. Six of the seven areas of critical erosion are located along the three-mile stretch of shoreline between Sand City and Wharf II where healthy beaches are especially important for recreation and tourism; hence this shoreline could potentially be a receptor for beach nourishment.

Sand City to Wharf II corresponds with the south sub-cell (Section 2.1), which is the stretch of shoreline impacted by relatively low wave energy and low sediment transport rates. The clustering of critical areas of erosion within this single relatively short sub-cell impacted by relatively ‘quiet’ physical conditions provides potential benefits for implementation of beach nourishment strategies. These benefits include:

- The impacts of the nourishment would only be felt within the confines of the sub-cell with little or no far-reaching impacts to the rest of the bay
- The nourishment strategy can be implemented on a sub-cell scale and is not dictated by the problems facing only single facilities
- Beach nourishment is likely to be more feasible if critical areas of erosion are close together and not separated by large distances within a littoral cell
- Low wave energy and low alongshore sediment transport would mean that sediment would remain at the receiver site for a longer period of time. This may lead to a reduced frequency of maintenance of the site through further nourishment, reducing costs
- The location of an apparent alongshore sediment transport convergence close-by (at Sand City) and the associated potential accumulation of sediment offshore that is suitable for nourishment would simplify implementation and reduce costs. The sub-cell is also

adjacent to Monterey Harbor providing a second easily accessible potential source (although much smaller volume)

- The sub-cell is the most accessible area of southern Monterey Bay for transportation of sand from inland sources (if appropriate).

This Coastal RSM Plan recommends investigation of beach restoration strategies, including beach nourishment, to ameliorate erosion in the southern three-mile stretch of shoreline from north of Sand City to Wharf II.

Two different beach nourishment approaches could be adopted in the southern bight of southern Monterey Bay. These are:

- subaerial placement (on beach)
- nearshore placement (in surf zone)

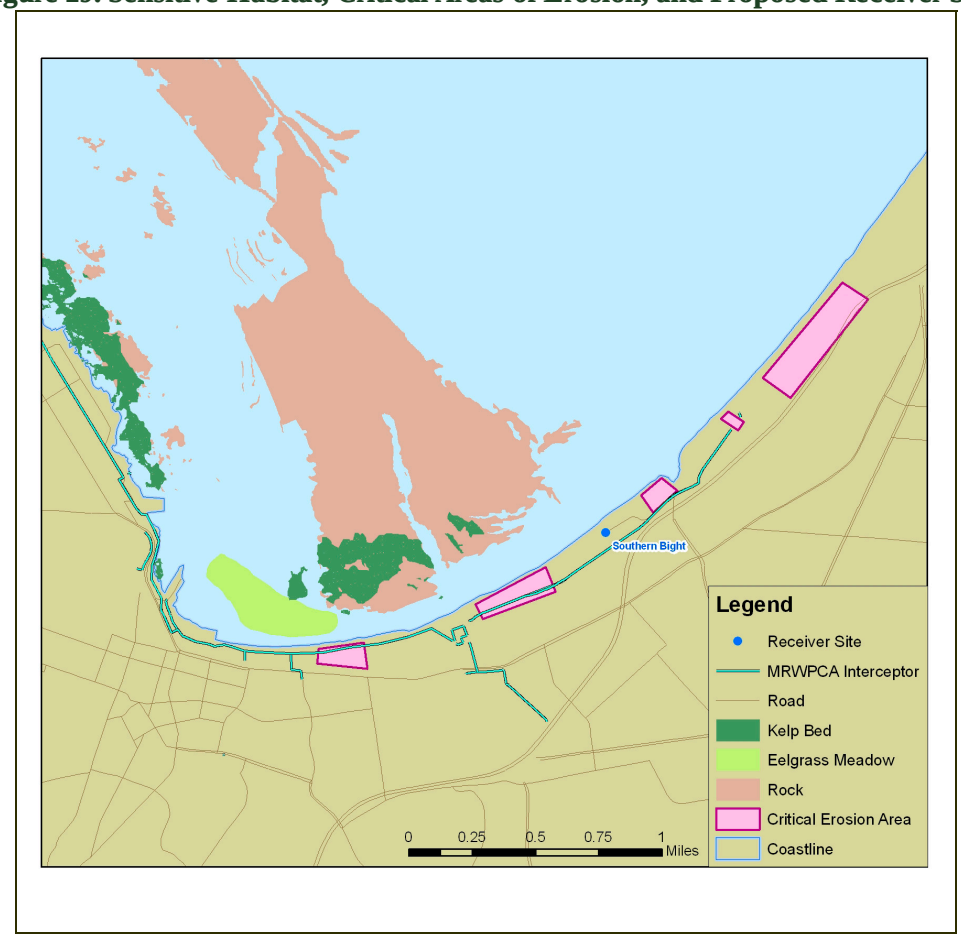
Subaerial placement of sand is nourishment of the dry beach and near the water line (CDBW and SCC, 2002), which results in an immediate artificially wide beach. Waves then redistribute the sand across the entire beach and shoreface profile until equilibrium is reached. Through this process the dry beach narrows from its initial width to accommodate the profile adjustment. The placement location and timing is an important consideration in southern Monterey Bay. The placement should occur away from sensitive resources (kelp, eelgrass, rocky reef, Section 4.1), should not take place during nesting (such as western snowy plover nesting season, March-September, Section 4.2.1), should not occur at times of high beach use (May to September), and should not be constructed so as to interrupt beach access. A strategy to mitigate placement impacts should be a key objective of the placement design (Section 5.1.2).

Nearshore placement nourishes the part of the littoral cell immediately seaward of the surf zone (CDBW and SCC, 2002). The intent is that this sand will buffer waves and at the same time the waves will transport some of the sand onshore to increase the beach width. Nearshore placement of sand should result in a wider dry beach, but at a slower rate than if the same volume of sand were placed directly onto the beach. The viability of nearshore placement depends on a number of factors; sediment compatibility and ecologic impacts are key considerations.

5.1.1 Potential Environmental Impacts of Beach Nourishment

A number of sensitive habitats and species are present in southern Monterey Bay. The southern three-mile stretch of the bay where this Coastal RSM Plan supports potential beach nourishment contains rocky reef, kelp forest and eelgrass meadow (Figure 29), and may contain endangered birds, plants and invertebrates as well as grunion spawning habitat in the dune and beach areas.

Figure 29. Sensitive Habitat, Critical Areas of Erosion, and Proposed Receiver Site



Impacts of beach nourishment can occur at the site where the sediments are placed. Sand placement is a concern for two reasons; as a direct impact and as an indirect impact through dispersal of the sand by alongshore and cross-shore transport. Impacts to biological resources can be classified into three major categories (Speybroeck et al., 2006):

- impacts directly related to the construction phases of a nourishment project
- impacts related to the characteristics of the sediments used
- impacts related to the quantity of sediment applied.

The magnitude of these impacts is strongly influenced by the place, time, and size of the project, and the strategy of the activity. Cumulative impacts are also important to consider with respect to the frequency and scale of activity, and for multiple sediment management projects. Indirect effects of nourishment on adjacent habitats via alongshore, cross-shore or wind-driven transport also need to be considered.

Impacts of beach nourishment activities (both subaerial and nearshore placement) associated with

construction may include direct damage and disturbance, placement of sediments which can bury habitat at the site and in down coast areas (the thickness of sand applied can influence the degree of impacts to biological resources), and water quality effects resulting from resuspension and settling of sediments. Mortality of intertidal and subtidal organisms resulting from burial and compaction of sediments can be extremely high. Disturbance to wildlife during construction can be both visual and auditory. The use of heavy equipment to transport and arrange sediments can destroy dune vegetation including threatened species, and compact beach sediments negatively affecting vascular plants and invertebrates, as well as affecting air quality.

Increased turbidity resulting from nearshore and intertidal placement of sediments in the southern bight could negatively affect vegetation and animals living on the offshore rocky reefs, subtidal sand, eelgrass meadows, and kelp forests (Figure 29). Turbidity can adversely affect kelp recruitment and/or juvenile growth depending on proximity of the operations, duration of the turbidity related to project size, sediment characteristics, and hydrodynamics. Eelgrass meadow can also be disturbed by construction activities, indirect sedimentation and turbidity as well as anchoring of support vessels and other activities. Recovery of these habitats can be very slow (2-7 years) and transplantation of eelgrass has been needed in a number of areas where damage to benthic habitat has occurred (SAIC, 2007).

The characteristics of the placed sediment, such as the particle size and proportion of shell fragments can affect habitat quality for burrowing animals and subsequent recovery of the biota and food chain support (Peterson et al., 2000, 2006; Speybroeck et al., 2006). Particle size can also affect beach morphology, compaction, and the subsequent biotic community. Sediments with a high proportion of shell fragments can potentially cement into a pavement, reducing wind-blown and hydrodynamic sand transport and creating a barrier to burrowing animals.

The amount and timing of sediment placement may affect the mortality of the benthic community, its potential recovery, and the prey available to higher trophic levels, birds, fish, marine mammals, following either subaerial or nearshore placement. Species with pelagic larval stages would recolonize more readily than those with direct development as would shorter-lived species in general. The total amount of sediment applied could also affect the potential for post-construction transport of sediments.

Post-construction transport of sand in the southern bight following placement (both subaerial and nearshore) could negatively affect the adjacent kelp forest, rocky reef, and eelgrass meadow through indirect sedimentation of these habitats with the effects depending on project volume and proximity to the habitat. Low relief rocky reefs such as Del Monte Shale Beds are considered potentially more vulnerable to sand inundation and scour. Kelp forests generally occur at depths outside the depth of closure; however, inshore portions of kelp forests may extend into shallow waters during years lacking major storms. Sedimentation can adversely affect all life stages of kelp due to scour and increased mortality of both adults and juveniles.

The beaches and coastal dunes of southern Monterey Bay provide important habitat and resources for the western snowy plover. Management to protect nests, chicks and adults of this threatened bird is ongoing, particularly during the March to September breeding season. The importance of the area to snowy plovers is high and maintaining prey resources for foraging and chick rearing needs to be considered in beach nourishment activities. The entire southern Monterey Bay was originally proposed for designation as critical habitat for western snowy plover; however, it was removed from critical habitat designations in the final rule for this species (September 2005).

Beach invertebrate mortality would be high at subaerial beach nourishment sites due to disturbance and/or burial. Recovery rates vary among species and depends on the scale and timing of the impacts. Periods of six months to greater than two years may be needed for recovery of shorter-lived species depending on the recruitment of planktonic larvae, their survival, and subsequent growth and resulting habitat changes. Recovery of longer-lived species, such as Pismo or razor clams, could take more than 5-10 years. Grunion may respond poorly to nearshore turbidity, but more information is needed. Burial of eggs by a layer of added sediments can prevent successful hatching. Changes in beach profile can reduce spawning activity or potentially trap adult fish above the high tide line.

5.1.2 Mitigation Measures

Adverse impacts to the coastal habitats in the southern bight from beach nourishment activities can be reduced by:

- establishing no work zones to avoid disturbance by vehicles, equipment and other activities
- restricting vehicles and pipeline alignments to outside vegetated dune areas and sensitive habitats
- minimizing use of heavy equipment with use of lighter equipment preferred to reduce mortality and habitat damage from compaction during construction
- matching the particle size characteristics of sand used for nourishment with those at the receiver site as closely as possible
- creating refuges in project design to reduce impacts, maintain food chain support and facilitate biological recovery by nourishing small sections of beach (less than 2,000 feet) interspersed with undisturbed sections of habitat
- selecting a placement location that avoids direct impacts to sensitive habitats and species and minimizes potential indirect turbidity and sedimentation impacts to sensitive nearshore habitats (eelgrass meadow, kelp forests, rocky reef)
- incorporating buffer distances from kelp forests, rocky reef and eelgrass meadow into project design to minimize potential impacts from turbidity; recommended buffers range from 500 feet (MEC, 2000) to 1,000 feet (Chambers Group, 1992).
- timing project construction activities to avoid key biological periods such as breeding and recruitment

  - avoiding nesting and spawning seasons for western snowy plovers and grunion.
  - avoiding recruitment periods for key invertebrates with planktonic larvae, such as sand crabs and clams
  - avoiding peak shorebird migration periods and wintering
- implement monitoring and protective measures for sensitive species and habitats during construction (e.g. shorebird, sea otter, grunion)
- conducting pre- and post-project monitoring of ecological responses and recovery for a sufficient time period to inform design of future projects and adaptive management using a modified BACI (Before-After, Control-Impact) approach
- implementing mitigation (e.g. restoration, transplantation etc.) to offset any inadvertent and/or unavoidable habitat loss.

5.1.3 Potential Receiver Site in the Southern Bight

Given the location of the critical areas of erosion and the need to avoid adverse impacts to local sensitive habitat in the southern bight, this Coastal RSM Plan recommends a receiver site location for both subaerial and nearshore sand placement between the Monterey Beach Resort and the Ocean Harbor House condominiums (Figure 29). This receiver site is considered suitable for two main reasons:

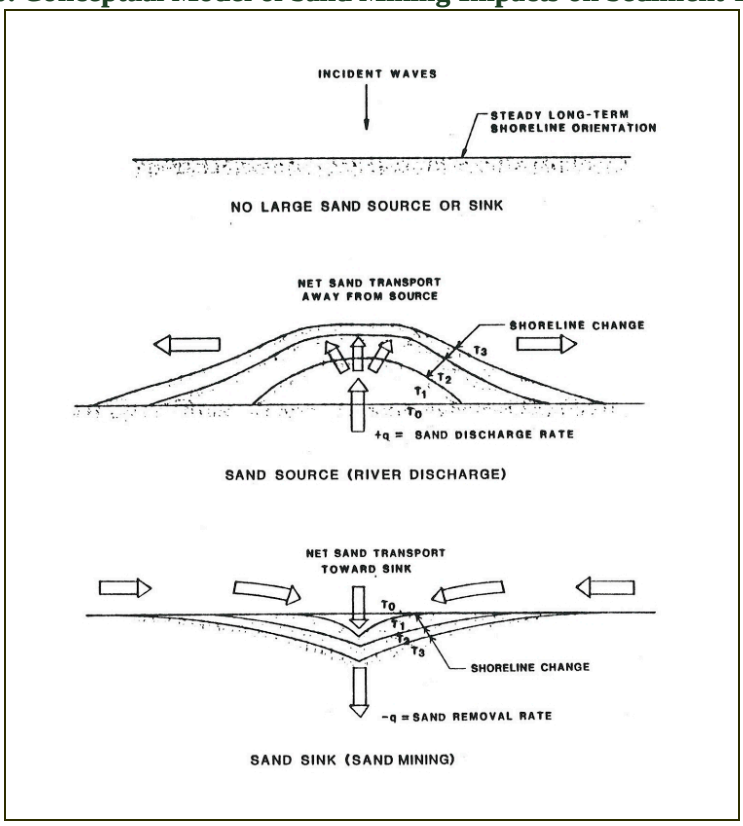
- The net alongshore sediment transport rate is low and to the north, but the gross transport rate is high in both northerly and southerly directions. This location is fairly central to the southern bight and would allow the sand to be transported most effectively to cover the critical erosion areas. A location further to the north would be unlikely to cover critical areas of erosion towards Monterey Harbor given the overall net transport to the north, and a location further to the south would place it too close to the critical habitat located offshore
- This location is far enough away from the sensitive kelp, eelgrass and rocky reef habitat so as not to cause disturbance through sedimentation or turbidity during construction and post-construction phases of the project

5.2 ELIMINATE FACTORS THAT EXACERBATE EROSION

The main human factor that affects the sediment budget, exacerbating shoreline erosion in southern Monterey Bay, is hydraulic sand mining from the beach at Marina. Closure of the operation would allow approximately 200,000 yd^3/year of sand to remain in the littoral budget, to supply both up coast and down coast beaches (beach replenishment). Battalio and Everts (1989) determined that the former sand mining operations at Sand City acted as sediment sinks drawing in large quantities of sand from the surrounding littoral zone, and re-orienting the shoreline (Figure 30). They described a process whereby sediment from up coast and down coast moves towards the sink, created by the removal of beach sand by the mines, causing those portions of the shoreline to erode. Battalio and Everts (1989) model shows reasonable agreement with measured shoreline erosion rates (from aerial photographs) between 1949 and 1988. In this

Coastal RSM Plan, the conceptual model is used to explain the impacts to shoreline erosion that sand mining has had both historically and currently.

Figure 30. Conceptual Model of Sand Mining Impacts on Sediment Transport



5.2.1 Impacts of Sand Mining at Sand City

The 1985-2005 dune erosion rates at Sand City and south of Sand City (Monterey Beach Resort and Del Monte Beach) are lower than those during the sand mining period between 1940 and 1984. The decrease in erosion rate is likely to be related to the complete cessation of mining at Sand City in 1990 (Section 2.5.3). In this case, the mine has ceased to be a sink for sediment from the surrounding littoral zone (Figure 30), the shoreline has re-adjusted to the new condition, resulting in lower erosion rates.

5.2.2 Impacts of Sand Mining at Marina

After the Salinas River changed course in about 1910, there was significant accretion of the shoreline both north and south of the Salinas River as measured by the long term (1910-2002) shoreline change (Figure 14, Hapke et al., 2006). However, between 1970 and 2002 the shoreline

eroded between the Salinas River and Marina sand mine. The switch from accretion to erosion is believed to correlate with the start-up and continuation of hydraulic sand mining at Marina. The change from accretion to erosion only occurs south of the Salinas River mouth, whereas to the north of the mouth the shoreline continues to accrete (Figure 14). Assuming that the input of sediment from the river has remained constant, the recent losses to the south of the mouth are likely to be related to the mining operation, which acts as a sediment sink (Figure 30).

The estimates of Thornton et al. (2006) show that at Marina State Beach (south of the mining operation) there has been significant increase in erosion rates post-1984 (Table 3). This increase is believed to be related to the increase in extraction rate at the Marina sand mining operation in the mid-1980s, with further increases in extraction in the 1990s and 21st century (Table 4). The mining effectively intercepts the predominant transport of sand to the north during the winter (Section 2.2) resulting in a large loss from the littoral budget. Since the sediment transport is both north and south at the mine location (Oradiwe, 1986), the increase in extraction rate has resulted in less sand available to be transported down coast, exacerbating the rate of erosion at the Sanctuary Beach Resort and Marina State Beach.

An aerial photograph of the dredge pond at Marina taken after the storm of January 2008 (Figure 17, right panel) shows how effective the mined area is at trapping sediment from the littoral zone. Prior to the storm, the pond was filled with water. During the storm, waves and surge overtopped the berm and broke loose the 80-ton dredge that was chained inside the pond. The overtopping waves transported large quantities of sand from the littoral zone, which was deposited in the pond. The photograph in Figure 17 (right panel) was taken on January 15, 2008 and shows the pond has been completely filled with sediment. The wrack line is landward of the former pond indicating that swash entered the pond and then swept further inland.

5.2.3 Beneficial Impacts of Sand Mine Closure

Stopping the mining of sand from the beach at Marina would release approximately 200,000 yd^3/year of sediment to replenish down coast (and up coast) beaches in southern Monterey Bay. This estimate of sediment lost from the littoral cell is equivalent to the volume of sediment supplied to the cell from erosion of the 12 miles of dunes between the Salinas River and Wharf II. The mining of 200,000 yd^3/year of sand is the equivalent of approximately two feet of beach over a ten-mile length (distance to Wharf II) every year (assuming 1.7 yd^3 of sand equates to one square foot of beach). Loss of two feet of beach each year is approximately 50% of the ongoing erosion along southern Monterey Bay. Considering the coarser sizes of the mined sand and the finer sizes of the dune sands, the impact of sand mining may be larger than 50% of all erosion. Hence, retention of the sediment that would otherwise be lost from the budget through mining would have a major benefit, not only for Marina, but for all of southern Monterey Bay.

The sand mining operation at Marina disrupts sand transport, removes vegetation, adversely affects shorebirds, and ultimately results in beach erosion and loss of habitat needed by sensitive

species and other biological resources (Brown and McLachlan, 2002; Magoon and Lent, 2005). Mining sand from the surf zone causes erosion and loss of western snowy plover breeding and wintering habitat. Sand removal by dredging can disturb incubating western snowy plovers, destroy their nests or chicks, and result in the loss of invertebrates and natural wave-cast kelp and other debris that western snowy plovers use for foraging. Reducing or stopping sand mining would result in increased beach widths, reduced erosion and enhanced beach and dune habitats for shorebirds and other sensitive species, as well as the biological resources that support them.

This Coastal RSM Plan recommends closure of the beach sand mining operation at Marina because of its impact on the regional rates of shoreline erosion, particularly at the Sanctuary Beach Resort critical area of erosion. This resort is located approximately one mile south of the sand mine and the erosion rates of the dunes on which it is located are directly affected by the extraction of sand from the beach at the mine. Replenishment of the beach in front of the Sanctuary Beach Resort with sand that would otherwise be removed from the system by the mine would provide a larger and more effective buffer to waves in front of the dunes, reducing the erosion rate.

5.2.4 Potential Strategy for Stopping Mining

One of the primary conclusions of this Coastal RSM Plan is that the ongoing sand mining operation in Marina by CEMEX is contributing significantly to down coast beach erosion. The appropriateness of the CEMEX operation could be questioned on the basis of environmental impacts related to erosion and endangered species, and whether U.S. Army Corps of Engineers jurisdiction does in fact exist, despite a historic finding to the contrary. The possibility of an alternative mining operation or a buy-out and/or resort development alternatives could also be examined. The primary value of the mined sand is sand pack around well casings for domestic and monitoring wells. There is reportedly no other commercial source for this kind of sand on the west coast with the present closest alternative source in Colorado. Hence, the economic consequences to CEMEX of closing the mine would need to be weighed against the continuing loss of critical habitat, impact on endangered species and damages to down coast structures from erosion. Below are suggested approaches to address this problem.

1. Examine history of mining operation. The current Marina mining operation was started in 1965 by Lone Star Industries, who originally reported to the California State Lands Commission (CSLC) under their general permit for mining, but stopped reporting mining amounts from the dredging operation in 1967. A question to answer is did the CSLC have jurisdiction over this operation originally. The North Monterey County LCP was certified by the Coastal Commission in 1983. The sand mining activity description and resource addendums in the certified LCP should be examined. The City of Marina annexed part of the plant property in 1986. In 1987 Lone

Star Industries filed a mining restoration plan, which is available through the County Public Works and also at the California Mining and Geology Board. This should be obtained. After annexing, Marina amended their LCP so the plant property could have a hotel of destination. Therefore, it is recommended that the LCP be examined. In addition, and the amount of taxes or royalties (if any) received from this operation by government entities needs to be considered because these funds might be affected if beach sand mining is halted.

2. Increase public awareness of the adverse impacts associated with continued operations. It is important that efforts to resolve the adverse impacts associated with the present mining operation have the full support of the general community, including business leaders and government officials. It is therefore recommended that the findings of this Coastal RSM Plan be given wide distribution through official and media channels. An article should be published in the Monterey Herald newspaper and other media outlets. Such an article would raise many issues that need to be addressed beforehand that include the local economic value of how much royalties and taxes are derived from the mining operation by the City of Marina, Monterey County and the State of California, how many local people are employed, alternative sources of sand, and in particular sand that is used for water wells. The local communities and businesses that are particularly adversely impacted, such as the nearby Sanctuary Beach Resort and tourist communities along with beaches along the entire southern Monterey Bay shoreline, need to be made aware of how the negative impacts of the mining operation are directly affecting them. Informing CEMEX of the situation, including concern from local officials, may result in voluntary modifications to their beach sand extraction operations.

3. Challenge the regulatory loophole allowing mining on the back beach by requesting the U.S. Army Corps of Engineers revisit their determination on non-jurisdiction. The Corps normally makes a jurisdictional determination before it processes or demands permit applications. The public never sees jurisdictional determinations unless they are requested. Public notices for permits occur only if the Corps asserts jurisdiction and requires permits. If the Corps 'disclaims' jurisdiction over a geographic area or activity, public notice is not required. The USACE has reportedly determined that they did not have jurisdiction over the back beach sand mining operation.

The Corps determination of non-jurisdiction for the back-beach sand mining may be demonstrably inconsistent with later determinations of jurisdiction the Corps has made (at other beach locations in the San Francisco Corps District) for beach grading and barrier beach breaching to regulate flooding. Since the late 1990s, the Corps has asserted jurisdiction over beach grading below the high tide line (legal boundary for Corps Clean Water Act Section 404 jurisdiction) at multiple sites in the Golden Gate National Recreation Area (public notice and permits issued). The Corps has also issued public notices and permits for beach breaching at stream mouth lagoons in Santa Cruz, Sonoma (Russian River), and Lake Talawa and Earl (Del Norte County). It should be determined if a permit is required for the Salinas River mouth breaching, which would be even closer. Also, the Corps generally regulates gravel and sand

mining in rivers. The main point is that the Corps' prevalent analysis of jurisdiction in these cases indicates that the geographic area in which beach grading and breaching occurs falls within Corps jurisdiction, and the activity of dredging sand from areas that intermittently fall within tidal influence (lagoons that breach) is also within Corps jurisdiction.

The Corps has regulatory authority under two laws: Clean Water Act Section 404 and Rivers and Harbors Act Section 10. The two jurisdictions differ, but both are predicated on 'commerce clause' nexus for federal jurisdiction, which is based on interstate or foreign commerce. Even before the nuances of Section 10 and 404 are in view, sand mining itself in 'waters of the U.S.' helps establish jurisdiction because sand may be sold in interstate commerce and the lagoon is subject to intermittent tidal action. At Marina beach, the mined lagoon has a drift-line delineating its edge evident in aerial photos (Figure 17), and tides in winter capture the lagoon and make it at least temporarily subject to tidal flows. The lagoon is by definition an impoundment. The industrial activity of sand mining and potential interstate sales of sand (or concrete) obtained from waters supports federal jurisdiction.

Section 404 regulates discharges of earthen fill (including sand), but not excavation or dredging per se. But the Corps has determined that enough incidental discharge is associated with excavation in gravel and sand mining operations along California rivers to support regulation under 404.

So, there seems to be a disparity in that the Marina sand mine (lack of) regulatory environment radically differs from other sand or gravel mining operations or other beach grading operations in the San Francisco District office. The USACE should therefore be asked to revisit their rationale in disclaiming jurisdiction under 404 at Monterey Bay beaches quarried for sand.

Under Section 10 of the Rivers and Harbors Act (RHA), the Corps jurisdiction may even be stronger. Section 10 is also based on the federal nexus of 'interstate commerce', but the legal construction of 'navigable waters' has been expanded by courts to include 'existing improvements: artificial waterbodies' (33 CFR 329.8(a)). A canal or other artificial waterbody that is subject to ebb and flow of the tide is also a navigable water of the U.S. This is explained further in Section 329.12 and 329.13, which establish the shoreward limit of Section 10 jurisdiction at the mean high water line, including enclosed embayments, shoals, or marshes that may not currently be navigable, but remain navigable in law. In short, once the lagoon the mine digs is captured by tides, it remains permanently subject to Section 10 jurisdiction even after the re-growth of the berm cuts it off from tides.

There are a number of consequences of re-regulation of beach mining by the Corps. The Corps would have to assert jurisdiction consistent with other substantially similar activities and areas regulated, and initiate the permit process. This would include:

- the issuance of a public notice for public comment and public interest review

- a NEPA (National Environmental Policy Act) analysis including whether 'significant' indirect impacts may occur (this includes analysis of sand budget for beach and indirect effects on beach erosion), which would necessarily trigger an EIS and full alternatives analysis if significant impacts are supported by substantial evidence
- Endangered Species Act (ESA) Section 7 consultation with USFWS for impacts to at least Yadon's wallflower

Once the Corps issues a disclaimer of jurisdiction, landowners can legally challenge re-assertion of jurisdiction in court and argue 'estoppel' issues (based on their reliance on Corps previous determination), so the Corps is reluctant to reverse itself. But if convincing evidence exists such that the corps previous determination could be so inconsistent that they would not hold up to legal challenge, the most defensible legal position would be to reassert jurisdiction.

Thus the key to getting a review of jurisdiction is:

- making the case for inconsistency
- showing at least implicitly that a successful legal challenge to the jurisdictional disclaimer at Marina could be brought forward as a result of their other relevant jurisdictional determinations for gravel/sand mining activity and beach grading below the high tide line.

4. Assess the mining operation's adverse impacts on the basis of the Endangered Species Act. There are many endangered species in the area; snowy plover, legless lizards, Yadon's Wall Flowers etc. Lone Star Industries did not get a take permit for endangered species. An example of a recent precedent case is the pumping of the Sacramento River that caused a big loss of endangered salmon fingerlings that resulted in a decision of 'taking' and the pumping had to be greatly decreased.

5. Alternative mining operation on the property. Are there sufficient placer sands of the same quality on the property to move the mining operation further back on the property so as not to 'take' sand from the littoral zone? This would be a more expensive mining operation, but would have less of an environmental impact.

6. Buy-out and/or change use to resort development. A buy-out of the property would be expensive, although may be shown to be cost effective over the long term. The problem would be to generate the funds for a buy-out. The alternative is for CEMEX to either develop or sell to a developer. The property is already permitted in the Marina LCP to be developed with a hotel of destination with conditions of restoring the dunes. It may be possible to negotiate a buy-out of the mining operation, while CEMEX retained the rights for development at a much reduced cost. It was suggested by a knowledgeable local politician that if agreements for development could be obtained through the Coastal Commission in a simplified manner, then CEMEX would be highly interested in developing the property for other uses.

5.3 ALLOW DUNE EROSION TO CONTINUE

This 'no action' approach allows the natural processes of dune erosion to continue without human intervention. Section 3 shows that within the portion of the littoral cell north of Sand City (apart from the Sanctuary Beach Resort), there are no permanent structures or facilities known to be at risk either on the beach or on top of the dunes. The dunes are also sufficiently wide so there is no immediate threat of flooding to the low-lying areas behind the dunes. In addition, erosion of the dunes along this stretch of shoreline is providing large quantities of sediment to the littoral system, maintaining the beaches in a healthy condition and providing benefits for sensitive species and habitats (Section 4).

This Coastal RSM Plan recommends that the dunes between the Salinas River and north of Sand City be allowed to erode without intervention.

5.4 OTHER POTENTIAL EROSION RESPONSE ALTERNATIVES

5.4.1 Hard Structural Approaches

Hard structural approaches generally refer to armoring the shoreline to prevent erosion, and include seawalls, revetments, and riprap. As coastal development has grown in California, the use of coastal armoring to protect oceanfront property and infrastructure has become more common. Ten percent of the entire 1100 mile coastline of California has now been armored, including 33% of the coastline of the four southern California counties (San Diego, Orange, Los Angeles and Ventura).

Shoreline armoring may lead to physical changes to the beach, ecological impacts, and beach access limitations. Physical impacts include the placement loss of usable beach caused by the footprint of the armoring structure. Armoring prevents erosion of sand from the bluffs that would normally nourish the beach, incrementally increasing erosion potential. Passive erosion is the drowning and narrowing of a beach in front of a structure while adjacent, unarmored shoreline segments continue to retreat (Griggs, 2005). Eventually, a peninsula effect can occur when the armor juts out into the water, impacting alongshore sediment transport. In addition, erosion rates tend to be increased at the flanks of the armoring, thus exacerbating erosion of adjacent stretches of shoreline. Armoring also fixes the back beach while the rest of the shoreface erodes. This can change wave energy dissipation and the adjacent shore geometry.

Ecological impacts occur primarily from the enhancement of reflected wave energy from the structure interacting with the incoming waves. This active erosion affects the entire sandy beach ecosystem by reducing the distribution and abundance of wrack, sandy beach invertebrates, and shorebirds (Dugan et al., 2008). From a recreational viewpoint, shoreline armoring reduces the

usable beach width and over time on an eroding shoreline, can significantly reduce lateral beach access. There is also the visual impact of most existing coastal protection structures.

One example of historic shoreline armoring along southern Monterey Bay shows the harm associated with this practice as well as the restoration potential when it is removed. Stilwell Hall was built in the 1940s as the Fort Ord soldier's club between Sand City and Marina (Figure 1). In 1978, 650 feet of riprap and broken concrete was placed at the base of the bluff to protect Stilwell Hall from bluff erosion, which was further augmented in 1985 (Figure 31). The riprap extended out onto the beach (placement loss), reducing the width of the beach in front of the armoring compared to the adjacent beaches. As dune erosion continued on the adjacent shoreline, the beach in front of the structure continued to narrow and disappear (passive erosion), while adjacent to the structure the shoreline and bluff continued to erode back. Erosion on the flanks of the structure is increased owing to enhanced wave energy by waves reflected off the sidewalls of the structure (or bluffs in this case) exacerbating erosion to the shoreline, which is evident in Figure 31 (left panel). Continuing erosion along the adjacent shoreline created a riprap armored peninsula jutting out into the bay, which disrupted public access along the beach as well as reduced alongshore sediment transport. The riprap was eventually removed and Stilwell Hall was torn down in 2004. The now unprotected sandy bluff eroded rapidly during the winters of 2005 and 2006, and has reached a new equilibrium with restoration of the beach in front of the former structure (Figure 31, right panel).

Figure 31. Stilwell Hall Armoring Before and After Removal

Photo taken: Unknown

Photo taken: October 28, 2005; California Coastal Records project by Kenneth and Gabrielle Adelman

This Coastal RSM Plan recommends that, whenever possible, soft approaches should be adopted for RSM.

5.4.2 Dewatering

Dewatering is defined as the manipulation of groundwater within the beach to increase natural accretion processes. Beach dewatering works on the principle that if the beach face is dry when the wave runup swashes up the beach, then the water can infiltrate into the beach and deposit sediment. If the beach face is saturated, then the infiltration is limited and sediment is transported off the beach with the receding backwash. Dewatering is an effort to lower groundwater levels to enhance this natural infiltration process. Dewatering can either be active (with pumps and pipes), or passive (without pumps such as the pressure equalizing module - PEM). These dewatering technologies are relatively new to shoreline management and are not being investigated as part of this Coastal RSM Plan because they are to be investigated as part of the complementary project that will be funded by MBNMS and carried out under the SMBCEW process.

5.4.3 Retention

Sand retention, while often covered under hard structures such as groins or jetties, can also be a soft approach through the use of geotextiles. Retention techniques enhance the ability of the beach to retain sand. They include artificial reefs which can serve dual purposes as habitat and recreation (surfing), and geotextiles placed in a cross–shore orientation acting as 'soft' groins, which can accumulate sand on their up coast side while still enabling sediment to overtop and thus avoid some of the down coast impacts associated with harder groins and jetties. Retention techniques are not being investigated as part of this Coastal RSM Plan, but may be investigated as part of the associated MBNMS project.

5.4.4 Bluff Top Development Set Back

Bluff top set back is a technique for locating new development so that it can be safe from erosion and slope failure for some identified time period. Normally the set back is established by determining where the facility can be placed at present, so that it will have an acceptable factor of safety (FS) against slope instability (normally taken as FS greater than or equal to 1.5 for static conditions and FS greater than or equal to 1.1 for dynamic or pseudo-static conditions) and add to that both the anticipated amount of erosion over the identified time period and a buffer. After the identified time period is over, the facility can be expected to be at risk from erosion and there will be the future question about whether the development should be removed or whether it should be protected. In order to secure the future of new development along southern Monterey Bay this Coastal RSM Plan recommends:

- consideration of an extended planning horizon of 100 years for large cost or long-term projects to be incorporated into revised Local Coastal Programs.

- development of a strong set back ordinance in the Land Use Plans for oceanfront development that puts high use facilities at an appropriate distance from the ocean.