

5.0 EROSION AND SEDIMENTATION

5.1 BACKGROUND AND SETTING

Humboldt Bay's management includes an inescapable element of concern about sediment, if only because part of the District's "mission" includes managing the channels and dock facilities required for shipping and fishing by a variety of harbor users. The Draft Management Plan states the general nature of this concern as follows, in Section 4.3.4 of Chapter 4.0, Volume II:

(S)edimentation in Humboldt Bay clearly has two sources, and the primary source has been identified as the near-shore Pacific (that is, sediment delivered to Humboldt Bay by inflowing tidewaters). The District's responsibility for maintaining navigable depths in the Bay elevates the District's interest in sediment management within the Bay's watershed, although the District lacks authority to constrain land use practices in the basin.

As a general perspective on sediment distribution in Humboldt Bay, it may be useful to consider sediment distribution to be an element in a dynamic equilibrium with the capability of tidal currents to redistribute sediment delivered from the watershed or the inlet. Tidal dynamics (particularly in combination with wind-driven waves) within the Bay characteristically rework the tidal flats, distributing the sediments according to the capability of tidewaters for moving sediment. Fine sediments (e.g., clays and silts) are characteristically carried by slowly moving tidewater to higher elevations (the "high flats" and "salt marshes" described by Shapiro and Associates 1980). Coarser sediments (e.g., fine sands) are generally moved by more competent flows and end up in the lower intertidal and shallow subtidal zones near smaller channels. The stronger and more turbulent flows in larger channels have a greater competence for moving sediment, and fine sediments are carried out of these larger channels, leaving them dominated by coarser sands, with gravels and larger shell debris in the largest channels.

At the present time it is unclear whether sediment produced within the Humboldt Bay watershed significantly affects the aquatic environment once the sediment reaches tidewater. Recent studies carried out in Arcata Bay related to the effects of mariculture found that the sediment surface elevation first increased, then decreased, and that there was no net sediment surface elevation change over the course of a recently completed three-year study (S. Rumrill, pers. comm.).

This Plan recognizes that a basin-wide concern exists with respect to the sediment mobilization effects of land use practices such as forestry or development. The potential effects of sediment mobilization may include the accumulation of sediment in surface watercourses, with attendant impacts on instream aquatic habitat values. Sediment accumulation may also affect the capability for surface streams to convey storm flows without flooding. When sediment mobilized in the Humboldt Bay watershed reaches the Bay the finer sediments are likely to be distributed according to the dynamic model summarized above, and excess fine material may be exported from the Bay on outgoing tides. Coarser sediments are likely trapped within the larger tidal channels in the Bay, thereby increasing the shoaling that adversely affects navigation.

5.1.1 Sources of Sediment

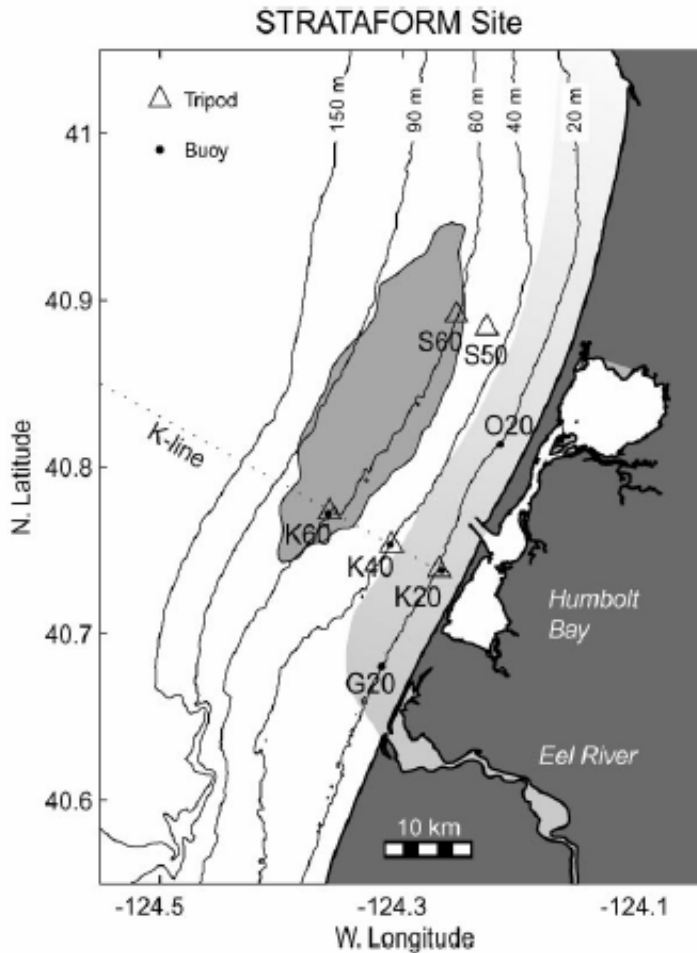
As noted in the Draft Plan, the actual sediment inflow to Humboldt Bay is uncertain. The report by Shapiro and Associates (1980) identified sediment inflow figures that suggested that the bay received approximately 650 thousand to 750 thousand cubic meters (about 23 million to 26.5 million cubic feet) of sediment annually in the late 1960s. The original source for the estimates also estimated that about 90 percent of the sediment entered the bay through the inlet. This general result is still considered the best estimate of sediment inflow at the present time (Costa and Glatzel 2002).

It is a controversial point with some members of the public that land uses in the bay's watershed may affect sediment dynamics in the bay. Given the extensive discussions of effects on instream sediment dynamics resulting from logging in Humboldt Bay tributaries, there is little reason to conclude that activities occurring in the Humboldt Bay watershed are *not* associated with the mobilization of soil materials. Some of these sediment materials appear to be deposited in the beds of the tributaries (many references),¹ while other sediments reach the bay and some undoubtedly reach the Pacific Ocean. Other land-disturbing activities also result in sediment mobilization, including in particular the effects that occur because of development activities (see Chapter 6.0).

The generally established perception that the bay entrance is the primary source of sediment that enters the bay's waters is, however, clearly correct. A number of oceanographic studies in the preceding two decades near the Eel River Canyon have addressed the continental slope and shelf, the movement of ocean water, and the movement of sediment. The study results have confirmed beyond a reasonable doubt that sediment delivered to the nearshore Pacific by flood events in the Eel River basin are normally transported northward along the immediate shoreline (Geyer and others 2000, Traykovski and others 2000, Curran and others 2002), with the suspended (that is, finer-grained) sediments generally in a plume that hugs the immediate shoreline (EIR Figure 5-1). On incoming tides, the sediments in such plumes are carried into Humboldt Bay, where they generally are deposited in low-turbulence contexts (see below). Additional oceanographic research (e.g., Pullen and Allen 2000, 2001) has indicated that ocean and atmospheric conditions typically associated with winter storms create large clockwise (anticyclonic) eddies immediately north of Cape Mendocino that push the sediment plume against the shoreline near the bay entrance.

This EIR therefore concludes that the relative sediment inflow to Humboldt Bay waters is dominated by the nearshore Pacific, while the bay's tributaries provide a substantially lower sediment volume.

¹ It is not within the purview of this EIR to address land management activities carried out in the bay's watershed, because these activities fall under the direct regulatory authority of other agencies, including but not limited to the Northcoast Regional Water Quality Control Board, the California Department of Forestry and Fire Protection, the California Coastal Commission, the U. S. Environmental Protection Agency, and the County of Humboldt, among others. As a matter of law, one or more of these agencies has determined that land use activities within the watershed have increased the production of sediment from the watershed (see, e.g., <http://www.waterboards.ca.gov/northcoast/geninfo/wwwdr/wwwdr.html>; viewed February 2006).



EIR Figure 5-1. Eel River Sediment Plume Mapped During Studies of the “STRATAFORM” Project. The typical location of the Eel River plume during downwelling-favorable wind (i.e. trapped against the coast within the 40 m isobath) is also shown in lighter shading. The general location of a flood deposit resulting from Eel River floods in 1995 and 1997 is shown as the dark shaded region. Other information shown in this figure is identified in Traykovski and others (2000), the source of this figure. Also see Curran and others (2002).

5.1.2 Sediment-Related Management Concerns for Humboldt Bay

The possibility that sediment deposited in the channels of the bay’s tributaries may have affected sensitive biological species (particularly salmonids) has been well addressed by regulatory agencies that focus on water quality and on the uses that produce the sediment. This issue is considered briefly in Chapter 11.0 in reference to the affected sensitive species. In general, the District lacks regulatory authority to address land use issues or practices, and they are not addressed in the Draft Plan; there is therefore no nexus to bring a consideration of these activities into this EIR.

The District does, however, have a shared authority regarding sediment management activities within the bay, and managing sediment that is introduced into the bay is a concern for the Draft Plan. Some of the sediment that enters the bay is deposited in channels and basins that are used for shipping, and maintaining these channels and basins for shipping and other navigational uses is a Management Plan consideration.

5.1.2.1 Bay Channel Maintenance

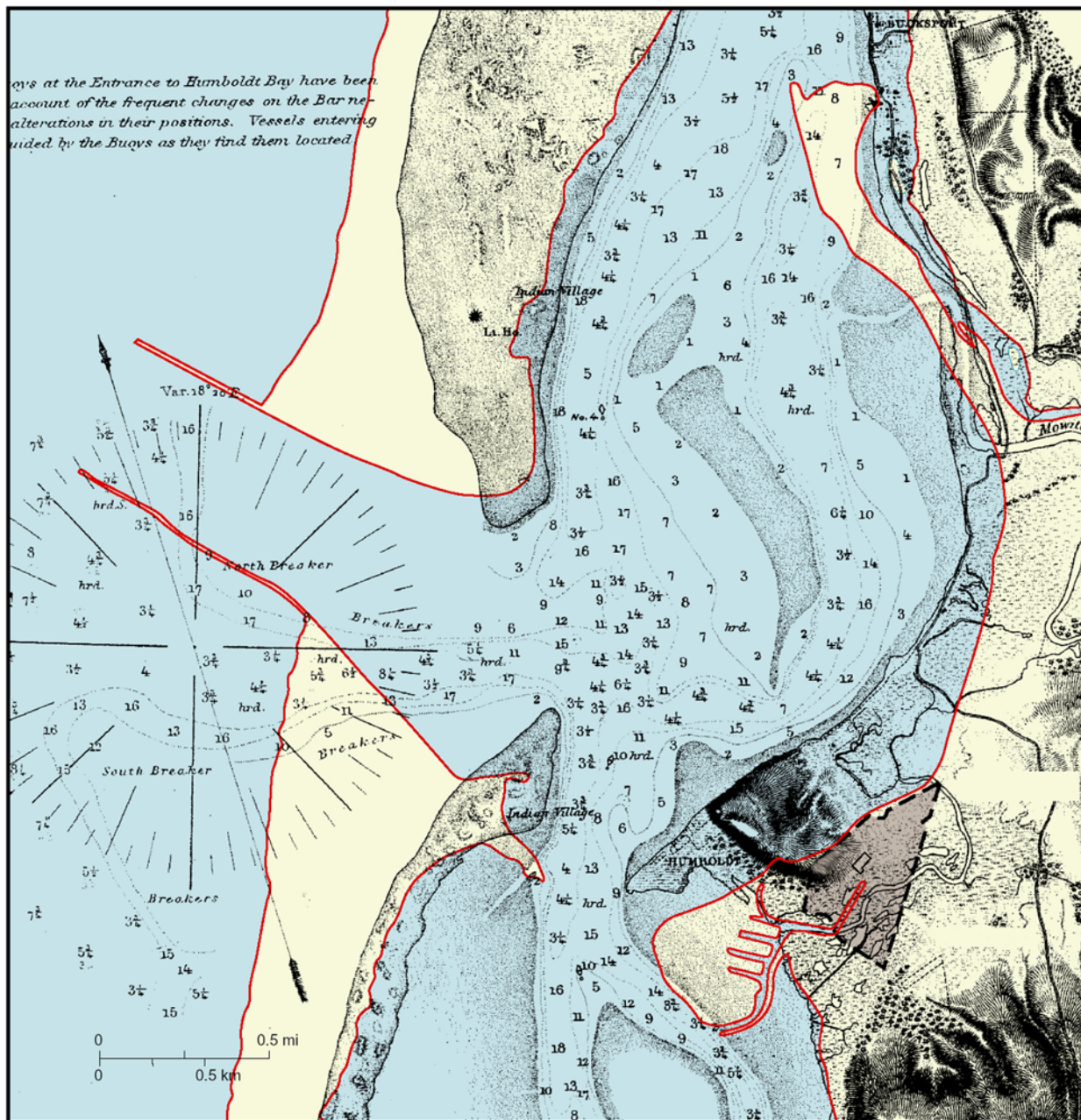
As summarized in Shapiro and Associates (1980), the distribution of sediment particle sizes in Humboldt Bay can be related to current velocities, with cobbles and larger

pebbles in major channels, sand and finer pebbles in smaller channels, sand and mud along the channel margins and lower tidal flats, and increasingly finer-grained sediments from the low tidal flats to the higher-elevation marshlands. This portrayal is largely based on empirical relationships in hydrology which relate the ability of moving water to keep sediment particles suspended in the water medium; larger particles require higher water velocities in order to remain suspended.² As the velocity of moving tidewater decreases, coarser particles settle out until at very low velocities only very fine particles remain in movement. This is a basic physical relationship in sediment hydrology.

Sediment dynamics are related to the dynamics of the bay's overall water movement. That is, tidewater movements are the cause of and the motive factor in sediment movements. A dynamic equilibrium exists between sediment deposition and sediment mobilization by the moving tidewater, and channel and tidal flat forms are functionally related to the forces in moving tides. Humboldt Bay currently has a set of channels that have been formed, in part, as a result of natural hydrodynamics and, in part, as a consequence of channel modifications by human users (i.e., by dredging). Under unmanaged conditions the channels in Humboldt Bay would revert to resemble, to an undetermined degree, the channels present in the bay in the mid-nineteenth century (EIR Figure 5-2). The morphology of the "unmaintained" channels would be determined solely by the hydrodynamics of tidal exchanges and sediment hydrology. It appears to be rather unlikely that such channels would support all of the uses for fishing, recreational boating, and other water-based activities that many residents in the bay region have come to value, much less use of the bay for commercial shipping. Stated more simply, it appears that dredging is, to some degree, required for a variety of human uses of the bay's waters.

The chart in EIR Figure 5-2 demonstrates a relatively shallow Entrance Bay with a now-absent shoal or island exposed at MLLW. The depth figures on the chart are in inconsistent units. The chart indicates a channel along the inside of the Samoa Peninsula that ranged between 3.25 and 5 fathoms (19.5 to 30 feet) deep below MLLW, averaging approximately 4 fathoms (24 feet). The chart also indicates a second channel east of the now non-existent island in Entrance Bay with deeper waters, up to 7 fathoms (42 feet) deep, although this channel would not have been useful for shipping purposes because it became too shallow before reaching the location of the settled waterfront. However, most of Entrance Bay was shallower than 20 feet MLLW.

² Stokes' Law is an empirical relationship that relates "settling velocity" to sediment particle characteristics and to the density and viscosity of the "transport medium." Thus denser (generally colder and/or saltier) water will move larger particles than less-dense water at a given velocity. Very fine particles, especially some kinds of clay minerals, sometimes flocculate into somewhat larger particles, affecting the settling rate; however, clay flocs have a very high volume with respect to mass and tend to be carried into marshlands by even minor tidal movements. Other hydrodynamic relationships exist that reflect the capability of flowing water to carry out "work" on the sediments with which it is in contact. This summary is an oversimplification of the physical relationship, and interested readers are encouraged to study a good hydrology text for additional information.



EIR Figure 5-2. Preliminary Survey of Humboldt Bay, California, U.S. Coast Survey, 1858 (edition of 1879), (original scale 1:30,000) (aids to navigation corrected to 1885). Depths are in feet below mean lower low water to lowest dotted line, then in fathoms. Red line delineates present shoreline and jetties from USGS Fields Landing 7.5 minute Quadrangle (1989). (Source: Figure 9-21 in PG&E 2002.)

It is unlikely that the channels in the bay would revert to precisely the configuration shown in the figure if dredging were discontinued, because other factors have changed in the 150 years since the chart in EIR Figure 5-2 was prepared. The construction of the jetties stabilized the bay entrance, and the configuration of the entrance affects the water (and thus the sediment) dynamics in Entrance Bay. The overall size of the bay's tidal prism has been decreased by the diking of about 11,000 acres of former

saltmarsh, which likely decreased the capability of tidewaters for moving sediment. The conditions shown in EIR Figure 5-2 are thus an abstraction of how the bay might appear when sediment hydrology is controlled solely by tidewater hydrology. The bay's appearance would likely come to resemble the conditions in the figure, to greater rather than lesser degree, if dredging were not carried out within the channels, although the actual configuration cannot be predicted.

For the most part the sediment dynamics in the bay are not particularly a concern for the Management Plan. However, in the context of the major channels in Entrance Bay the behavior of sediment is a substantial Plan concern, because these channels are regularly dredged in order to maintain mandated depths and cross-sectional areas. An issue of concern raised for this EIR regards the nature of the relationship between the dredging and the sedimentation rates in these channels, namely whether or not the creation of the larger channels and basins were not likely to be associated with reduced water velocities and therefore with increased settlement, especially for finer sediment particles.

The current relationship between the channel dredging and the effect of channel enlargement on sediment dynamics is based on Section 5.3.4 in the "Deepening EIS/EIR" (HBHRC and Army Corps of Engineers 1995):

"5.3.4 Hydrodynamics

"5.3.4.1 Project Impacts

"Humboldt Harbor and Bay Navigation Channels

"The hydrodynamics of Humboldt Bay are discussed in Section 4.3.2. The removal of dredged material from Humboldt Harbor navigation channels will leave depressions that do not change the local hydrodynamics substantially. A "Humboldt Bay Numerical Hydrodynamics and Sedimentation Study" conducted by the Corps' Waterways Experiment Station (COE/WES 1994d), concluded that with the implementation of the proposed project the channel velocities will decrease due to an increase in the cross-sectional area. The tide range will not be significantly changed. The results of the sedimentation study also indicate that the proposed project will also have a significantly lower inflow of sediment (decreased shoaling), when compared to the existing condition. Waters moving over the channels will deposit their suspended sediment load into the dredged channels; however, current velocities will not change markedly. No significant impact to channel hydrodynamics is expected during or after dredging."

The paragraph excerpted above appears to be inconsistent with general models of sediment mobilization and transport [the cited WES study (Evans 1994) is included in an appendix to the EIS/EIR and feasibility study]. The quoted paragraph concludes that there will be a "significantly lower inflow of sediment" following dredging, a conclusion that is generally not compatible with the physical processes known to occur in hydrogeomorphology. This conclusion also appears to be generally inconsistent with the hydrodynamic modeling results reported by Evans (1994). The quoted paragraph concludes that water velocities in the channels will decrease, and that sediment will be deposited in the dredged channels, results that were also stated in Evans (1994); these expectations are consistent with known physical processes affecting sediment deposition and mobilization. It is unclear on what basis the

EIS/EIR concluded that the sedimentation rates in the bay's channels would be reduced by the deepening project.³

Based upon known principles of physical and hydrological science, this EIR finds that the expected effect of creating enlarged channels in Entrance Bay would be decreased water velocities and less "tractive force" to keep sediments suspended, leading to increased sediment deposition (assuming that a sediment supply is available, which is indicated by independent evidence). The velocity of the tidal flows in Entrance Bay channels are largely controlled by tidal elevations and the volumes of water that flow into and out of Arcata Bay and South Bay, and these elevations and volumes are not affected by the channel changes in Entrance Bay. The flow of a given water volume per unit time through enlarged channels would be expected to produce decreased channel-flow velocities in Entrance Bay, as stated in the deepening EIS/EIR. Dynamically this relationship would favor sediment deposition until the channels had been filled enough so that the water began to remove as much sediment as it deposited, at which time further morphological changes would cease.

With respect to the bay's management, expectations based on these well-established physical science relationships indicate that increasing channel depths and cross-sections should inevitably lead to enhanced localized sediment deposition in the channels, as the physical processes in the bay seek an equilibrium between erosion and deposition. Any channel cross-section larger than the "equilibrium" channel would require increased maintenance (i.e., periodic removal of the accumulated sediment by dredging). This prediction appears to be consistent with the increased sediment volumes maintenance-dredged from the channels in Entrance Bay since the deepening project was completed. In general, removing increased sediment volumes as part of the channel maintenance program should be expected to continue indefinitely as part of the bay's management.⁴

A corollary consideration with respect to sediment management, which applies for channels and turning basins as well as for marinas, large and small docks, and some other water-dependent uses located mostly along the Eureka shoreline, concerns

³ The modeling study carried out to evaluate the hydrodynamics in Humboldt Bay and the adjacent Pacific Ocean was a "desktop study," conducted in Mississippi, and was not based upon "synoptic" data obtained in the bay. It appears that the Corps author and reviewers approximated conditions in the bay based on published descriptions of the bay's channels and sediment distributions, and upon input forcing from astronomical tide models. The model was run to approximate tidal dynamics published for the bay, given the pre-deepening channel geometry reported by prior maintenance dredging projects, with the altered channel geometry proposed by the deepening project as the factor to be assessed. This approach is valid, if imprecise. It is unclear whence came the EIS's stated conclusion that post-project channel sedimentation rates would be lower than pre-project rates; it appears to the current EIR's authors that the EIS's preparers attributed study results stated for the bay entrance to the channels within Entrance Bay.

⁴ It should be noted, however, that increased sea level will result in increased water volumes entering and leaving Arcata Bay and South Bay. The increased tidewater volumes in the bay's extremes should be associated with marginally increased scour potential in Entrance Bay, which would reduce the sediment volumes that needed to be removed by maintenance-dredging to a minor extent.

dredge spoil disposal. Currently all dredge spoil from federally authorized channel maintenance-dredging is disposed at the Humboldt Open Ocean Disposal Site (HOODS), a one-square-mile zone located approximately three miles west of the entrance to the bay. The HOODS was approved by all relevant state and federal agencies in the mid-1990s, and ongoing spoil disposal at the site is consistent with state and federal management plans and existing permits. Existing approvals for the HOODS represent a finding by the approving agencies that disposal at the site complies with appropriate state and federal laws. That is, the disposal of the dredge spoil from channel maintenance-dredging is a “settled issue” not before the District’s decision-makers as part of the Draft Plan, and it is not addressed in this EIR.

The District currently (early 2006) is proceeding with a maintenance-dredging project for a number of small facilities along the Eureka inner reach.⁵ That project proposes spoil disposal on the outer beach of the Samoa Peninsula. In the future these spoils may also be directed to other locations. In any event, the current dredging project is independent of the Draft Plan, and also independent of this EIR. This EIR presumes that the Draft Plan’s policies regarding spoil disposal will guide future District actions when the Plan has been adopted -- future spoil disposal may occur at the HOODS or in other locations.

5.1.2.2 Tidal Flats, Marshlands, and Sea Level

Over time natural estuaries establish a dynamic balance between sediment deposition and erosion in channels and on tidal flats, and estuaries can maintain relatively constant tidal dynamics for geologically and biologically relevant periods so long as sea levels remain relatively constant. Eventually most estuaries develop fringing marshlands that buffer the encroachment of high water levels into the adjacent uplands. The physical dynamics of the marsh/water interaction create circumstances favorable to sediment deposition and additional marsh establishment, but the moving tidewater over tidal flats retards sediment deposition and reduces the rate at which the saltmarsh “progrades” onto the tidal flat.

The dynamics of sediment in shallow tidewaters over flats and within marshes is dependent (as above) on the ability of the water to move sediment. Where water velocities over tidal flats are sufficiently high, fine-grained sediments are prevented from settling. However, when tidewater enters a saltmarsh the water velocity is slowed substantially and the ability of the water to keep sediment in suspension is reduced. Consequently most marshlands are zones in which sediment is deposited, with the sediment surface elevation at equilibrium between sediment deposition and sediment erosion by the water that slowly filters among the marsh plants.

The surface elevations of tidal flats and fringing marshlands are determined, to a great extent, by sea level acting in the context of local basin characteristics, weather, and wind conditions. While the localized factors in a specific location influence the tidewater movements, sea level is the most important factor in driving overall tidewater

⁵ The maintenance of dredged depths for areas not included in an authorized federal project is the responsibility of local agencies, including the District. Maintenance for federally authorized projects, such as the Humboldt Bay channels covered by the Deepening EIR/EIS, is a federal responsibility.

dynamics. Sea level along the California coast is expected to increase during the current century by approximately 0.2 to 0.8 meters (about eight to about 30 inches; see Chapter 4.0). This increase will significantly affect the elevations of the tidal flat and saltmarsh surfaces in Humboldt Bay.

The initial effect of the sea level increase will be a deepening of the bay's water for each tidal stage. The effect of the depth increase may not be substantial on tidal flat ecosystem elements, but the expected primary effect on saltmarshes is a combination of burial by sediment and "drowning" by immersion for increasingly long periods as tidal elevations increase. An additional effect on the marshlands is likely to be destructive erosion of the marsh surface by wave action, which will occur in deeper waters above the marsh plain which would not allow for an attenuation of wave energy. Thus the anticipated effect of sea level increase on the remnant saltmarshes of Humboldt Bay is the loss of these marshes.

Assuming an eventual stabilization of sea level at a higher elevation, the expected interactions of sediments, marsh plants, and tidewater would lead to a gradual re-establishment of saltmarshes around the margins of the bay at appropriately higher elevations. The dynamic course of such events cannot be predicted accurately, and the duration is likely to be on the order of centuries.

5.2 ISSUES TO BE ADDRESSED AND THRESHOLDS OF SIGNIFICANCE

The CEQA Environmental Checklist items do not address directly the issues or concerns relating to hydrodynamics in Humboldt Bay; none of the Checklist items are clearly applicable to this context. Comments received in response to the Notice of Preparation indicated that some commenters felt that this EIR should address the environmental effects of land uses in the Humboldt Bay watershed that are associated with sedimentation, which is essentially a comment that the EIR should incorporate an assessment of the effects of logging on the concerns addressed by the Plan. In addition, comments made to the District in response to the NOP suggested that the District evaluate in the Plan EIR all of the effects of past and ongoing dredging projects (this comment is partly directed at toxic concerns, which are considered elsewhere in this EIR). Finally, some commenters indicated that the rationale for maintaining deep dredged channels in Humboldt Bay was questionable, and that dredging was simply providing a place for more sediment to settle into, establishing a never-ending stream of dredging operations with attendant costs and associated environmental impacts.

To address thresholds of significance for such concerns, this EIR adopts a "threshold of significance" convention throughout the EIR that the potential environmental effect of the plan is considered significant if the proposed policies in the plan increase the potential for occurrence of a possible environmental effect (impact) beyond the degree that would exist if the policies included in the plan did not exist or were not carried out. The assessment of environmental effect for such issues requires a judgement regarding the likelihood that Plan-related actions will create or exacerbate adverse conditions that would not occur without the Plan. If a reasonable argument suggests that the Plan's policies would create new adverse conditions that do not occur now or exacerbate existing adverse conditions, then the effect of the policies is called environmentally significant.

5.3 ENVIRONMENTAL EFFECTS OF PROPOSED PLAN AND PLAN ALTERNATIVES

5.3.1 “No Project” (Existing Master Plan)

The 1975 Master Plan includes general policy guidance that indicates a continued focus on dredging and channel maintenance in the central part of Humboldt Bay, including a number of specific directions to District decision-makers to work collaboratively with the U. S. Army Corps of Engineers to deepen and widen the navigation channels in Entrance Bay. The Master Plan balances these directions with land use designations and policy statements that protect environmentally sensitive resources. Nonetheless, the generalized nature of the policy guidance in the Master Plan is substantially more direct in encouraging dredging than are the policies in the Draft Management Plan.

The Master Plan included direction to the District to use dredge spoils to carry out “land reclamation” within the bay’s watershed, and the Master Plan included a map and description of 17 locations within the watershed at which filling with spoil was considered to be a desirable action. A number of the suggested sites were in the bay’s waters (one site was outside the bay adjacent to the South Jetty), but most were in industrially designated uplands, in coastal wetlands near the bay margin, or in environmentally sensitive dunelands on the Samoa Peninsula. The recommended disposal of dredge spoil in wetlands and dunelands is largely incompatible with policies in the Coastal Act, except under certain conditions (the disposal of spoil in wetlands is also largely incompatible with the federal Clean Water Act, except under certain conditions), and such options are not likely to be feasible at the present time. The identified ocean disposal site would now be considered as likely to exacerbate shoaling problems in the bay entrance, and would likely not be approved. Generally the Master Plan’s recommendations for spoil disposal appear to be infeasible and inapplicable for current management purposes.

It should be noted that the 1975 Master Plan also included the following commentary (page IV-27):

“Sediment contributed by tributary streams should be controlled by stream restoration and control of local runoff from grazing, logging or construction. ... The District should pursue research in order to understand the dynamics and ecology of sedimentation in Humboldt Bay, in the interests of long-term maintenance of the mud flat habitat and enhancement of commercially harvestable species.”

In implementing the guidance of the 1975 Master Plan, the District adopted a number of ordinances. Ordinance No. 7 includes a policy (in Article IV, Section 2) regarding “navigation” that “(m)aintenance and improvement of existing navigational channels shall be supported and encouraged.” Article IV, Section 8, presents the following explicit policy guidance, which constitutes the District’s present policy guidance with respect to dredging and spoil disposal:

“(a) Diking, exclusive of the maintenance and repair of existing dikes, and filling shall be avoided whenever and wherever possible and only permitted after full consideration of potential damages and benefits and alternative methods of accomplishing the project objectives has determined the proposed diking and filling is essential.

“(b) Dredging shall be limited to maintenance and improvement of navigational channels and areas related for water related development.

“(c) Disposal of dredge spoils from within the jurisdiction of the District shall be regulated by the District.”

These policies are generally compatible with the policies included in the Draft Management Plan. However, the Master Plan and ordinance policies are insufficiently detailed to provide adequate guidance to District decision-makers about sediment management, given the vastly increased regulatory attention turned on these activities in the early 21st Century. This EIR finds that this existing policy focus of the 1975 Master Plan, in combination with the District’s implementing ordinances, is less protective of a variety of environmentally sensitive resources than are the policies in the Draft Management Plan.

5.3.2 Proposed Management Plan

The Draft Management Plan incorporates an explicit consideration of sediment management, primarily in the policies that regulate dredging and dredge spoil disposal. The following policies directly or indirectly cover actions that could affect the District’s participation or management of activities that could affect the sediment dynamics in the bay and the hydrodynamics of the bay itself.

Harbor Policies:

- HWM-1: Safe navigation in Humboldt Bay is a priority
- HWM-2: Dredging may be authorized to meet Plan purposes
- HWM-3: Re-deposition of dredged materials within Humboldt Bay may be authorized to meet Plan purposes
- HWM-4: Placement of fill within Humboldt Bay may be authorized to meet Plan purposes
- HWM-5: Potential dredged-material management options and alternative disposal methods shall be identified in a Long Term Management Strategy for Humboldt Bay
- HWM-6: Sediment dynamics in Humboldt Bay shall be identified and a sediment management approach for Humboldt Bay shall be developed

Recreation Policies:

- RFA-8: Minor amounts of fill authorized
- RSA-2: Assistance to, maintenance of, and consideration of marinas

Conservation Policies:

- CAS-5: Fill placement may be used for habitat enhancement purposes
- CEP-2: Dredging may be approved under certain circumstances

The Draft Management Plan is intended to provide a “self-mitigating” programmatic management program for Humboldt Bay. In general, the goal in such an approach is to assure that policies that could result in adverse effects are accompanied by other policies that moderate or prevent possible adverse effects. For example, policies CEP-4 through CEP-11 were included in the HBMP in order to assure that no adverse long-term impacts remain as a consequence of Plan implementation. However, as noted

throughout this EIR, the Plan's success in avoiding impacts depends entirely on the full implementation of all of the Plan's policies.

5.3.2.1 Watershed Impacts

Both the Draft Plan and this EIR have stated unequivocally in several contexts that the District, as a matter of law, lacks direct jurisdiction over upland uses in the Humboldt Bay watershed. Moreover, also as a matter of law the District is legally pre-empted from regulating certain specific land uses, such as forestry and logging, the regulation of which is explicitly delegated to the California Department of Forestry and Fire Protection. In addition, potential impacts resulting from forestry operations and land use management are also under the legal jurisdictions of other California agencies having statutory (e.g., the Regional Water Quality Control Board) or trust (e.g., the Department of Fish and Game) obligations. Included in these effects regulated by other agencies is the use of herbicides and other biocides or growth stimulators. The effects of forestry and logging are outside of the subject-material jurisdiction for District regulation, and there is simply no nexus that can bring them into this EIR.

Similar conclusions apply with respect to non-forestry land use activities in other parts of the Humboldt Bay uplands. Agricultural uses, residential and commercial uses, future development, and other "land use" concerns fall under the purview of other local (e.g., the County of Humboldt), state (e.g., the Coastal Commission), and federal (e.g., the U. S. Environmental Protection Agency) agencies with statutory or trust obligations that the District lacks, and these activities (and their impacts) are beyond the relevant coverage of the Draft Plan and this EIR.

Notwithstanding the lack of subject-matter jurisdiction, the District does have concerns about sedimentation resulting from upland land uses.⁶ This concern is identified in Plan policy HWM-6, which directs the District to develop a *Humboldt Bay Sediment and Dredged Material Management Plan*, acting collaboratively with the agencies, entities, and interested parties that have regulatory jurisdiction and/or concerns about the potential for upland land uses to adversely affect sediment generation within the watershed. This EIR finds that the Plan's policies regarding sediment-management in the Humboldt Bay watershed do not present a reasonable likelihood of resulting in significant environmental effects; no mitigation is necessary.

5.3.2.2 Channel Maintenance

As summarized above, the setting for the Draft Plan includes substantial existing maintenance dredging activity associated with various harbor-related uses, mostly in Entrance Bay. Navigation channel maintenance is authorized (actually, channel maintenance is required) pursuant to existing federal laws, and the option of not carrying out maintenance dredging pursuant to these laws would only be available with a change in federal law; such a change is not part of the Draft Management Plan, and is not an action considered in this EIR. With respect to dredging and

⁶ Watershed effects are additionally concerns with respect to overall bay ecosystem processes and sensitive species; the District's concerns in these subject areas are included in the EIR coverage in other chapters, particularly Chapter 8.0 and Chapter 11.0.

sedimentation, the Draft Plan includes a number of relevant policies in Section 3.2, Chapter 3.0, Section III.

This EIR finds that policies authorizing dredging to meet Plan purposes are necessary for Humboldt Bay. As described in the setting section of this chapter, without dredging the channel configuration in Humboldt Bay would be determined solely by the hydrodynamics of the bay's waters and the associated dynamics of sediment deposition and mobilization. The configuration of the bay's channels, given the current configuration of the entrance and the tidal prism available today, cannot be identified with certainty, but it is unlikely that the configuration of channels, islands, and tidal flats would be compatible with current uses in the bay, or with the full range of uses that local residents would like to practice in the bay. Shipping as a commercial activity (including barges as well as trans-ocean freight vessels) would almost certainly be affected significantly. It is unknown whether safe passage could be maintained for smaller craft, including fishing boats and larger recreational vessels.

The Draft Management Plan assumes that future shipping activities, recreational activities, mariculture uses, and other uses will resemble those carried out during the period when the Plan was drafted. The fact that some degree of dredging appears to be necessary for almost all of the anticipated bay uses suggests strongly that dredging would be required even if future use patterns in the bay were shifted to different mixtures of uses.⁷

Policy HWM-2 directs the District to authorize dredging to carry out Plan purposes and establishes conditions under which dredging may be authorized. This EIR finds that the conditions included within Policy HWM-2, together with the requirements of many of the other policies in Chapter 5.0 of the Draft Plan, are expected to reduce potential environmental effects related to the dredging policies in the Plan to acceptable levels. Stated differently, policies already included in the Draft Plan largely or fully mitigate the potential adverse effects of Plan policies related to dredging or dredge-spoil disposal, and additional mitigation measures do not appear to be required. It should be noted, however, that the management of Humboldt Bay occurs in a constantly shifting regulatory context, and this EIR cannot conclude that the Plan adequately anticipates and will incorporate mitigation measures for all events that may be deemed to be adverse effects in the future.

5.3.2.3 Tidal Flats, Marshlands, and Sea Level

The effects of sea level increase on tidelands and marshlands within Humboldt Bay are considered, together with other consequences of sea level increase, in Section 4.1.3 of this EIR, where the interaction of sea level increase and the lack of a policy focus in the Plan for such an increase are judged to be an environmentally significant effect.

⁷ This EIR cannot predict with certainty that future management decisions made by District decision-makers will completely resemble those made during the Plan's formulation. The proposed Plan provides policy guidance for future decision-makers, and the EIR assumes that future decisions will be compatible with those policies. Based upon an assumption that a "balance" of bay uses will be maintained, the policy-based prediction that dredging will be required for virtually all possible management directions that might be taken appears to be robust. However, the "extent" of dredging selected by future decision-makers cannot be predicted.

The effect is identified as a policy gap in the Draft Plan regarding sea level increase, and a new policy (Policy HSM-7) is recommended for addition to the Draft Plan as a mitigation measure for this omission. The policy directs the District to consult with interested and affected federal, state, and local governments and other interested parties with respect to this issue. The desired result of these consultations is a planning approach for dealing with the sea level increase in Humboldt Bay.

While the recommended new policy is focused primarily on shoreline protection, the policy also incorporates considerations of the effects of sea level increase on the tidelands and marshlands on the bayward side of the shorelines. Consequently this EIR finds that the incorporation of the new policy constitutes a policy-level mitigation of the identified concern about the effect of sea level increase on tidelands and marshlands.

The Draft Plan already includes a policy focus that includes planning for wetlands within the bay watershed. In particular, Policy CAE-3 already requires that the District and other interested parties plan for maintaining marshlands. Such planning could include, for example, the pro-active discharge of dredge spoil to build up tideland elevations to anticipated future levels needed for marshlands when sea level is higher. These existing Plan policies, in combination with new Policy HSM-7, provide a policy framework for appropriate action. Other mitigation is not required.

A measure identifying the additional policy is incorporated below as mitigation for the policy concern identified in this section; this is the same measure that is specified in Section 4.4.2.

5.4 POLICY CONSIDERATIONS FOR MITIGATING POTENTIALLY SIGNIFICANT EFFECTS

The policies in the Draft Plan adequately address potential impacts from dredging activities and spoil disposal as these are understood at the present time. While future regulatory actions of other agencies may require mitigation measures that are not currently known, it does not appear that the Draft Management Plan need incorporate additional mitigation measures to address sediment management for most concerns. However, the potential effects of sea level increase are not adequately considered in the Draft Plan, and an additional policy element should be included in the Draft Plan to address this issue (note: this is the same policy recommended in Section 4.4.2).

5.4.1 Bay Surface Elevations and Effects on Tidelands and Marshlands

The District' shares a role with federal, state, and local agencies and other affected parties in crafting a coherent response to sea level increase, including addressing effects of that increase on tidelands and marshlands within the bay, possible erosion of shoreline features, and possible damage to or loss of protected features behind existing levees. The incorporation of the following additional policy into the Shoreline Management section in the Draft Plan provides guidance to the District with respect to this issue (added text underlined):

HSM-7: Identify needs for potential shoreline improvements necessary to accommodate bay water surface elevation changes, including potential effects of climate change

Policy: The District shall consult with the County of Humboldt, the City of Arcata, the City of Eureka, other affected local agencies, relevant state and federal agencies, and affected local parties to identify the potential effects on the Humboldt Bay shoreline and nearby areas that may occur because of meteorological or climate-related water surface-level fluctuations in the bay prior to the year 2050. Based upon these consultations, the District and other affected parties shall develop a plan that identifies any necessary shoreline alterations or maintenance programs needed to accommodate the water-level fluctuations. The District shall adopt findings with respect to the contents and recommendations of this plan when approving District operational programs or when approving any application for project approval submitted to the District.

The incorporation of this additional policy into the Plan will reduce the potential Plan-related consequences below a threshold of CEQA significance.

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