Calculation of 100-Year Still Water Level and Wave Runup for Levee Design at Oakland International Airport, California

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In order to maintain their accreditation in the National Flood Insurance Program, the levees protecting Oakland International Airport (OAK) were evaluated for their ability to protect the airport from 100-year flooding due to tides, storm surge, and waves in San Francisco Bay. Historical tidal data, hydrodynamic and wave modeling, and empirical relations were used to determine the levee height and armor type necessary for this level of protection. To determine what level of protection is necessary at OAK, coastal conditions had to be evaluated for the 100-year (1% annual chance) still water level (SWL), total water level (TWL), and erosive power. Total water level is equal to the sum of SWL (including both tidal stage and storm surge) and wave runup. Since OAK is located well within shallow San Francisco Bay, ocean swell and tsunami are not items of concern (Borrero et al, 2006). Due to limited computational resources and the limited correlation between observed still water level (including storm surge) and wind velocity, a ranking method was developed to determine which SWL and wind events generated the largest annual total water levels, which were then determined accurately via a two-dimensional wave model.

Key Words - *waves; levees; flooding*

Theme: Flood Control

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A Sediment Budget for Two Reaches of Alameda Creek: support for flood control channel management

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Sediment deposition in flood control channels is a chronic problem for managers tasked with dual objectives to maintain both flood protection and aquatic or riparian habitat. Alameda County Flood Control and Water Conservation District (the District) has periodically dredged sediment from lower Alameda Creek to maintain channel flood capacity. Because dredging is costly and disrupts habitat, and because obtaining permits is becoming more difficult, the District is seeking to minimize dredging frequency. Conceptually this is achieved by reducing sediment supply from upstream, or modifying the channel for more efficient sediment transport. To potentially address upstream sediment supply, we evaluated two reaches identified by others as probable sources of sediment to the flood control channel: a highly incised reach of Arroyo De La Laguna and upper Alameda Creek in Sunol Valley. We developed a sediment budget for these reaches to identify the dominant processes and quantify rates of sediment supply and storage over time (1901 to 2006 over four decadal time periods). The budget was constructed from field and air photo bank erosion surveys, current and historical bed elevation surveys, tree coring to estimate floodplain age, and interpretation of USGS suspended sediment and bed load data. During the most recent period (1994-2006), roughly 6% of the sediment mass passing through the Niles gage was derived from net channel erosion, mostly from the Arroyo De La Laguna reach. While not the major source hypothesized by others, it remains substantial given the reach only comprises 0.25% of the watershed stream network length. Recommendations include identifying and quantifying potentially manageable sources of sediment throughout the watershed, enacting restoration approaches that encourage upstream sediment storage, and studying solutions to increase sediment transmission through the flood control channel. These efforts aim to reduce or eliminate downstream dredging requirements.

Key Words - *Alameda Creek; flood control channel; sediment budget*

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U.S. Army Corps of Engineers Delta Initiatives

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The Delta covers about 738,000 acres interlaced with hundreds of miles of waterways. Much of the land is below sea level and relies on over 1,100 miles of levees for protection against flooding. In recognition of the socio-economic and environmental importance of the Delta and the serious threat of levee failure with disastrous and wide-spread consequences, Congress passed the CALFED Bay-Delta Authorization Act in 2004. This Act directed the U.S. Army Corps of Engineers (USACE) to undertake the construction and implementation of levee stability programs or projects for such purposes as flood control, ecosystem restoration, water supply, water conveyance and water quality. In May 2006, USACE submitted the CALFED Levee Stability Program (LSP) Report to Congress. One submission for consideration under the LSP was the proposed Bethel Island – Horseshoe Bend project. This project was chosen based on Bethel Island's population and development, active funding participation by the Department of Water Resources (DWR), cooperation from resources agencies, and the opportunity for ecosystem restoration. Also in 2006, DILFS (Delta Islands and Levees Feasibility Study) was initiated by USACE with DWR to investigate flood damage reduction, ecosystem restoration, water supply, water quality, and recreation within the Delta. Whereas the LSP is generally considered to provide short-term actions within the Delta, DILFS considers a long term approach that would improve resistance to seismic events, and decrease erosion and seepage potential at islands determined critical to water quality, water supply, and protection of significant public infrastructure. The study is also considering setback levees, floodplain reconnection, restoration of wetlands and riparian habitats in the Delta. Once completed, this study would serve as a decision document that could provide USACE the authority in conjunction with other Federal, State, and local agencies, to address a wide range of water and related land resources problems throughout the Delta.

Key Words - *Delta; US Army Corps of Engineers; ecosystem restoration; flood damage reduction*

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