Technical Memorandum

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From:	Ying Poon, P.E., D.Sc.
Copy to:	Frank Cheng, LACDPW
Date:	August 7, 2018
Project Number:	P2233
Re:	Dominguez Channel Estuary Bathymetry and Sediment Transport Study Sediment Accumulation Model – 80% Deliverable

1. Background

The Dominguez Channel Watershed is highly urbanized, with flows through the watershed that are mainly routed through a storm drain system which conveys flood flows via the Dominguez Channel (DC). The DC is a 25.3 km (15.7 mi) flood control channel operated and maintained by the Los Angeles County Flood Control District (LACFCD) that discharges into the Port of Los Angeles (POLA). The channel consists of a fresh water portion and estuarine portion, as illustrated in Figure 1. The fresh water portion is a rectangular concrete channel that extends from 116th Street, in the City of Hawthorne, to Vermont Avenue. The drainage area above Vermont Avenue makes up about 56% of the DC Watershed. The estuarine portion of the DC, also referred to as the DC Estuary (DCE), extends 13.3 km (8.26 mi) from Vermont Avenue to Henry Ford Avenue, where it discharges into the Consolidated Slip. The DCE is a clay-lined, trapezoidal channel with riprap sides. The watershed of the DCE includes the Torrance Lateral, also shown in Figure 1, which runs through the Montrose Superfund Site.

The Total Maximum Daily Load (TMDL) for Toxic Pollutants in Dominguez Channel and Greater Los Angeles and Long Beach Harbor Waters (Harbor Toxics TMDL), which became effective March 2012, sets limits on the discharge from the Greater Harbor Watershed to protect receiving water beneficial uses and aquatic life (LARWQCB 2011). The DC Watershed is part of the Greater Harbor Watershed that discharges into the Los Angeles and Long Beach (LA/LB) Harbor and San Pedro Bay; thus, the DC is subject to the Harbor Toxics TMDL. Responsible parties for the DCE Subgroup that are identified in the Harbor Toxics TMDL include: Los Angeles County, LACFCD, Caltrans, and the Cities of Carson, Compton, Gardena, Los Angeles, Long Beach, and Torrance. As part of the TMDL implementation plan, Phase 1 actions required a Contaminated Sediment Management Plan (CSMP) to be developed for the DCE (Caltrans et al. 2014). The CSMP addresses contaminated sediment in both the DC and DCE, and outlines actions to support the reduction of legacy sediment contamination in the estuary. The CSMP identifies a number of special studies to be conducted to help inform the CSMP Group on how to proceed with implementing the CSMP. One of these special studies is the DCE Bathymetry and Sediment Transport Study.

2. STUDY OVERVIEW

On behalf of the CSMP group, the Los Angeles County Department of Public Works (LACDPW) has taken the lead on conducting and managing the DCE Bathymetry and Sediment Transport Study (Study). A team of consultants led by CDM Smith has been selected to conduct the Study. The consultant team includes CDM Smith; Everest International Consultants, Inc. (Everest); and Pi Environmental, LLC (Pi Environmental). CDM Smith has developed a work plan (CDM Smith 2017) to describe the bathymetric and monitoring approach that will be used to estimate sediment loads transported in the DCE. Objectives of the Study are as follows:

- *Bathymetric Survey*: The bathymetric survey will determine current sub-surface sediment elevations, which will be compared with channel invert elevations to estimate sedimentation in the DCE. Results from the bathymetric survey will be used to calibrate the sediment accumulation model.
- *Flow and Sediment Monitoring*: Flow and sediment data will be used to estimate sediment loading in the DCE under dry weather and wet weather conditions. Results from monitoring activities will be used to calibrate the sediment accumulation model.
- *Sediment Accumulation Modeling:* A sediment accumulation model will be developed to estimate the average annual sediment accumulation rate within the DCE, using recent data obtained through the bathymetric survey, flow and sediment monitoring, as-built drawings of the channel, and the 2006 bathymetric survey conducted by the POLA.
- *Sediment Remediation Plan:* Evaluate scenarios to determine potential sediment remediation plans for preventing undesirable sediment buildup in the DCE.

Everest is responsible for the Sediment Accumulation Modeling described in the third bullet. Under this task, a sediment accumulation model was developed to help determine sediment transport conditions in the DCE. The model was designed based on a previously developed hydrodynamic and sediment transport model of the LA/LB Harbor, referred to as the Water Resources Action Plan (WRAP) Model. The WRAP Model has been utilized for simulating sediment and organic contaminant transport for TMDL applications. The WRAP Model has been developed and calibrated under the guidance of the Harbor Technical Work Group

(HTWG) and has been peered reviewed. The peer reviewers have concluded that the model is adequately calibrated and suitable for use with simulating sediment and organic chemical transport in the greater LA/LB Harbor, including the DCE. The model has been accepted by the RWQCB for use with simulating various TMDL management and compliance scenarios.

The original plan for the Study was to use the collected bathymetry data, together with another set of bathymetry data collected by the Port of Los Angeles (POLA) in 2006, to estimate the sedimentation rate along the DCE for the past twelve years. This estimated sedimentation rate can then be used to further validate the sediment transport component of the WRAP model, specifically for the DCE. However, as described below in Section 3, the bathymetry data was found to be unusable for estimating the sedimentation rate. Hence, it was decided on July 2, 2018 at the team conference call that the WRAP Model would be used to estimate the long-term sedimentation rate along the DCE. The model setup for estimating sedimentation rates along the DCE would follow the same 20-year model simulation period that has been accepted and used by the RWQCB for simulating TMDL model scenarios.

This technical memorandum summarizes the use of the WRAP Model to simulate the long-term sedimentation rate along the DCE. As mentioned earlier, the analyses of the bathymetry data are provided in Section 3. A description of the WRAP Model is provided in Section 4, followed by a discussion, in Section 5, of the use of the model to simulate sedimentation along the DCE.

3. BATHYMETRIC SURVEY DATA ANALYSES

The bathymetric survey to determine channel bed elevations was conducted by Pi Environmental over a three-day period at the end of March 2018 (Pi Environmental 2018). This survey was conducted using a WASSP S3 multibeam echosounder coupled with a Hemisphere VS330 RTK GPS for spatial positioning, both of which were mounted to an aluminum jon boat. The equipment was deployed from the Consolidated Slip (CS) and access to the DCE was made from beneath a railroad bridge.

Bathymetry data of the channel bed elevations were provided as a point file (i.e., x, y, z) corresponding to the same data locations used in the previous 2006 bathymetry survey. Sedimentation along the DCE was determined from differences in elevation between the 2006 and 2018 surveys. To illustrate bathymetry changes along the DCE, the channel was divided into five reaches, as shown in Figure 2. Reach 1 extends from Victoria Street to Avalon Boulevard. This section of the DCE contains discharges from the Del Amo and Torrance Laterals. Reach 2 continues from Avalon Boulevard downstream to Wilmington Avenue. Reach 3 runs from Wilmington Avenue to Sepulveda Boulevard. Reach 4 extends from Sepulveda Boulevard to the downstream end of the DCE at Henry Ford Avenue. The figure also shows Reach 0 extending from the top of the channel at Vermont Avenue to

Victoria Street. Reach 0 is excluded from the bathymetry evaluation since no bathymetry data were taken in this reach in 2006. However, the WRAP Model-simulated sedimentation along the DCE, described in Section 5 below, will include results for this reach.

The results of the bathymetry data and analysis for Reaches 1 through 4 are presented in Figures 3 to 6, respectively. In each figure, bathymetry data from 2006 and 2018 are shown in the upper panels. The lower left panels show the elevation difference between the 2018 and 2006 surveys. The lower right panels depict the average annual sedimentation rate based on elevation difference. Sedimentation rates based on the bathymetry data are summarized in Table 1.

Table 1. Sedimentation Rate based on Bathymetry Data

Channel Reach	Sedimentation Rate (mm/yr)
Reach 1	44
Reach 2	40
Reach 3	1.8
Reach 4	-23

The sedimentation rates along the DCE that were estimated based on the change in bathymetry were found to be unrealistically high. First, they are similar to the sedimentation rate of 28 to 41 mm/yr at the CS, as estimated by Everest (2017) based on bathymetry data. Located downstream of the DCE, which was built as a sediment trap, the CS is expected to have much higher sedimentation rates than the DCE. Second, there is insufficient sediment coming from the DC Watershed to allow for the DCE sedimentation rates that were calculated based on the bathymetry data. As shown in Figure 7, annual sediment loadings discharged into the DCE from the DC Watershed ranged from 1.0 million kg/yr to 6.2 million kg/yr, with an average of 2.8 million kg/yr. Even under the unrealistic assumption that all sediment from the watershed deposits uniformly within the DCE, the theoretical maximum sedimentation rate in the DCE is only approximately 6.3mm/yr. This estimate assumes uniform sediment deposition along the entire length of the channel. In reality, only a small percentage (e.g., 10 to 20%) of the sediment from the watershed may deposit within the DCE. Hence, the sedimentation rate along the DCE is more likely to be on the order of about 0.6 mm/yr to 1.3 mm/yr. These rates are an order of magnitude smaller than those estimated based on the bathymetry data.

4. Sediment Accumulation Model

The DCE is a hydrodynamically active area that experiences continuous erosion and deposition of the sediment bed due to tidal flows and storm water discharges. The sediment accumulation model of the DCE has been developed based on the WRAP Model, a three-dimensional hydrodynamic, sediment transport, and chemical fate model of the LA/LB Harbor and San Pedro Bay. The WRAP Model was developed by Everest for the Port of Long Beach and Port of Los Angeles (Ports) for other TMDL compliance applications. The WRAP Model has been calibrated and validated to simulate physical and chemical processes, including tidal exchange, storm water discharges, sediment transport, and fate of organic contaminants (Everest 2017).

4.1 WRAP Model

The WRAP Model utilizes the Environmental Fluid Dynamics Code (EFDC) modeling platform, which is a surface water modeling system developed and distributed by the Environmental Protection Agency (EPA) Center for Exposure Assessment Modeling, and is consistent with the model developed by EPA for the Harbor Toxics TMDL. Specifically, the WRAP Model uses the dynamically-coupled hydrodynamic, sediment, and contaminant components of EFDC. In total, the WRAP Model simulates four distinct yet interacting processes: hydrodynamics, mixing, sediment transport, and toxic chemical transport. Extensive development and calibration efforts have been made over the last decade to evaluate these four processes. The model calibration utilized a comprehensive set of hydrodynamic (water level, velocity), mixing (dye, salinity), sediment transport (sediment tracer, deposition/erosion), and toxic chemical data – including metals and organic chemicals (Everest 2017). Ultimately, the WRAP Model has been calibrated and peer-reviewed to simulate physical and chemical processes including tidal exchange, storm water discharges, sediment transport, and fate of organic contaminants in the LA/LB Harbor.

4.1.1 Model Grid

The WRAP Model grid, shown in Figure 8, covers the entire LA/LB Harbor, San Pedro Bay, and tidally influenced portions of the DC, Los Angeles River (LAR), and San Gabriel River (SGR). The DCE extends approximately 13.3 km (8.26 mi) from Vermont Avenue to Henry Ford Avenue, where it connects to the CS. The tidally influenced portion of the LAR extends approximately 4 km (2.5 mi) from Willow Street to Ocean Boulevard, and then flows into Queensway Bay. The SGR Estuary stretches about 3 km (1.88 mi) from Spring Street, just downstream of the SGR and Coyote Creek confluence, to the Pacific Ocean. The estuarine portions of these rivers are earth-bottom channels with riprap sides that discharge directly to the harbor or San Pedro Bay. The WRAP Model grid extends approximately 8 km (5 mi) beyond the Federal Breakwater and into the ocean. Vertically, the water column is defined by five uniform layers.

Bathymetry data for the WRAP Model were obtained from National Oceanic and Atmospheric Administration (NOAA) nautical charts 18749 and 18751. The vast majority of the harbor and San Pedro Bay was recently surveyed by NOAA in 2013. The NOAA 2013 survey was comprised of four data sets covering the LA/LB Harbor (NOAA 2013a), eastern San Pedro Bay (NOAA 2013b), area offshore of the Federal Breakwater (NOAA 2013c), and area downcoast of Anaheim Bay (NOAA 2013d). Bathymetry data for areas outside the NOAA 2013 survey extent were primarily based on NOAA nautical chart 18749, covering San Pedro Bay (NOAA 2004a), and chart 18751 for LA/LB Harbor (NOAA 2004b).

4.1.2 Model Inputs

Hydrodynamics in the LA/LB Harbor and San Pedro Bay are driven by tide, wind, and river flows. The model domain and boundary conditions of the WRAP Model are shown in Figure 9. Tide and wind boundary conditions were specified using data from the NOAA National Ocean Service. Water levels and meteorological parameters are monitored as part of the Physical Oceanographic Real-Time System (PORTS®) for the LA/LB Harbor, as listed in Table 2. Water levels and temperatures are monitored at the NOAA LA Outer Harbor tide gage (indicated by the yellow star in Figure 9) and are applied at the ocean tide boundary (yellow line). Tides are mixed and semi-diurnal with two daily highs and two daily lows. Tidal datums based on the latest National Tidal Datum Epoch (NTDE), spanning 1983 to 2001, are provided in Table 3. Wind speed, wind gust, and wind direction are monitored at the other seven NOAA meteorological stations located throughout LA/LB Harbor (magenta asterisks in Figure 9). Since spatially-varying wind conditions can play a critical role in the circulation patterns within the LA/LB Harbor, the WRAP Model is configured to use wind data from these seven NOAA stations in order to drive the model.

Watershed loadings for flow and sediment were determined for sources discharging into the Greater Harbor waters using analytical methods. Storm water inflows were simulated with approximately 200 model inflows, as indicated by the orange dots shown in Figure 9. The Greater Harbor waters receive discharges from four major rivers – the LAR, SGR, Coyote Creek (a tributary of SGR), and DC. The LAR and SGR Watersheds comprise 90% of the Greater Harbor drainage area and flow into Eastern San Pedro Bay. The DC Watershed drains into the DC Estuary, which enters the harbor at the CS. The remaining areas were grouped together and referred to as the Nearshore Watershed.

Table 2. NOAA PORTS® Station Summary

STATION	ID	DATA MONITORED
Angels Gate	9410647	Wind speed, gusts, direction, air temperature, air pressure
Badger Avenue Bridge	9410691	Wind speed, gusts, direction
Berth 161	9410690	Wind speed, gusts, direction
LA Outer Harbor	9410660	Water level, temperature, air pressure
Pier 400	9410666	Wind speed, gusts, direction
Pier F	9410670	Wind speed, gusts, direction, air temperature, air pressure
Pier J	9410665	Wind speed, gusts, direction
Pier S	9410692	Wind speed, gusts, direction

Table 3. Tidal Datums for Los Angeles Outer Harbor

TIDAL DATUM	ELEVATION (M, MLLW)
Highest Observed Water Level (01/10/05)	2.414
Mean Higher High Water (MHHW)	1.674
Mean High Water (MHW)	1.449
Mean Sea Level (MSL)	0.861
Mean Low Water (MLW)	0.287
North American Vertical Datum – 1988 (NAVD88)	0.062
Mean Lower Low Water (MLLW)	0.000
Lowest Observed Water Level (12/17/33)	-0.832

Source: NOAA 2011
Tidal Epoch 1983 – 2001

4.1.3 Model Sediment Parameters

For simulating sediment transport, the WRAP Model uses five sediment classes, as shown in Table 4. Sediment bed properties were established using a compilation of sediment grain size, bulk density, and porosity data. Data from multiple studies conducted in different years were required in order to provide sufficient spatial representation of the sediments. Sediment properties for the WRAP Model were specified using Thiessen polygons determined based on the sediment data, as illustrated in Figure 10. The Thiessen polygons for the sediment bed silt fraction (see "Percent Silt" legend) were based on the sediment grain size data (listed in the "Sediment Data" legend). In general, the sediments in the Greater Harbor are predominantly silts, while sediments outside the breakwater are mostly sands.

Table 4. WRAP Model Sediment Classes

Sediment Class	Type	Diameter (mm)
Coarse Sand	Gravel	2.0 – 4.0
	Very Coarse Sand	1.0 – 2.0
	Coarse Sand	0.5 – 1.0
	Medium Sand	0.25 – 0.50
Fine Sand	Fine Sand	0.125 – 0.25
	Very Fine Sand	0.0625 – 0.125
Coarse Silt	Coarse Silt	0.0312 – 0.0625
	Medium Silt	0.0156 – 0.0312
Fine Silt	Fine Silt	0.0078 – 0.0156
	Very Fine Silt	0.0039 – 0.0078
Clay	Clay	<0.0039

4.2 Dominguez Channel Estuary

The WRAP Model grid was designed as a curvilinear, orthogonal grid with a higher resolution of cells (i.e., smaller grid cells) in the estuarine areas and progressively larger cells towards the outer harbor and ocean areas. In general, using smaller grid cells improves model predictions, but increases computation times and may affect model stability – especially during high flow conditions. Originally, grid cells along the DCE were defined using three cells across its width and a longitudinal interval of approximately 60 m. To improve model predictions in the DCE, grid cells were refined to five cells across at a longitudinal interval of 30 m.

With the refined grid along the DCE, the WRAP Model was used to simulate sediment loadings from the surrounding watershed, along with resuspension and erosion of the sediment bed. Storm drains and sediment bed data along the DCE are illustrated in Figure 11. In the figure, storm drain discharge locations are indicated by red stars, while the locations of sediment data taken in 2011 are indicated by yellow dots. The sediment grain size data were collected from a total of 16 locations. Sediment characteristics vary along the channel, and are primarily sands and silts with clay fractions typically between 5% and 15%.

The model grid for Reach 0 and Reach 1 is shown in Figure 12 (red dots indicate storm drain discharge locations in Figures 12 to 15). The upstream end of the DCE (Reach 0) receives discharges from the fresh water portion of the watershed at Vermont Avenue, which accounts for 56% of the drainage area. Based on sediment data taken near Victoria Street, sediments in Reach 0 are mostly sand (64%) and silt (30%). Reach 1 extends from Victoria Street to Avalon Boulevard. This section of the DCE includes discharges from the Del Amo and Torrance Laterals. Grain size data were available at five locations along Reach 1. Near Victoria Street, sediments are mostly sand (64%) and silt (29%). Between Main Street and Del Amo Boulevard, sediments become mainly silt (58%) and sand (29%). The downstream end of Reach 2 between Del Amo and Avalon Boulevards is composed of silt (48%) and sand (39%).

Reach 2 continues from Avalon Boulevard downstream to Wilmington Avenue, as shown in Figure 13, and contains three storm water discharges. The upper half of Reach 2 is mainly silt (61%) and sand (21%). Near 213th Street, sediment data indicates a higher amount of clays (20%) than is typically found in the channel. The lower half of Reach 2 is dominated by sand (55%) and silt (35%).

Reach 3, which runs from Wilmington Avenue to Sepulveda Boulevard, contains two storm water discharges and four sediment data locations, as shown in Figure 14. Sediments at the upper end of Reach 3 are mainly silts (49%) and sand (40%). Sediment data from the other three locations indicate that sediments are comprised more of sand (59%) than silt (33%).

Reach 4, as shown in Figure 15, runs from Sepulveda Boulevard to the downstream end of the DCE at Henry Ford Avenue. Sediment data were available from only three locations above Pacific Coast Highway (PCH). Near Sepulveda Boulevard, sediments are mainly silt (64%) and have higher portion of clay (25%). The remaining sediment data indicate a composition of mostly silt (55%) and sand (33%).

5. DOMINGUEZ CHANNEL ESTUARY SEDIMENTATION SIMULATION

The sedimentation rate in the DCE was determined based on a 20-year simulation period developed for the WRAP Model, to conduct long term TMDL management simulations (Everest 2018). Model inputs (e.g., tide, wind, and inflows) were derived from a historical 10-year period and then repeated to obtain a 20-year period. The historical period extended from 2004 through 2013, which covers a range of hydrologic conditions and is representative of long-term conditions. Watershed loadings were developed as continuous time series of flows and sediment concentrations for all inflows, which were estimated with analytical methods based on available data. For sediment, seasonal average concentrations for dry weather, first flush, and wet weather TSS concentrations were specified for the four major watersheds. Details on the inputs for the DCE are discussed below.

5.1 DCE WATERSHED LOADINGS

In the DC Watershed, flow data were periodically available at Artesia Boulevard, located just upstream of Vermont Avenue, which accounts for the fresh water portion of the DC Watershed. A continuous flow time series from 2004 to 2013 was generated from flow data, with estimated flows to fill data gaps (Everest 2017). The LACDPW Watershed Management Division periodically monitors flows at Artesia Boulevard (LACDPW 2013). Automated samplers are triggered when flow measurements are taken; continuous flow monitoring is not used here. Thus, the flow data contains data gaps that necessitated the use of data from another location to estimate flows. Flow data are available from nearby gages for the LAR, SGR, and Coyote Creek; however, these watersheds are substantially larger than the DC Watershed. Flow data in the DC indicate flow characteristics with a relatively sharp rise and decline in flows, and an overall shorter duration for wet weather flows compared to the other watersheds, which is expected to due to the smaller drainage area of the DC Watershed. Hence, flow data from Ballona Creek, which is located outside the Greater Harbor watershed, were used to fill flow data gaps. A volume rating curve between the DC and Ballona Creek was developed to determine a scale factor, which showed a strong correlation (R^2=0.91) (Everest 2017).

Discharges for the DC Estuary Watershed were estimated based on drainage areas. Dry weather flows were estimated based on a correlation between urban dry weather flows and drainage area that was previously developed using flow data from the LAR, SGR, BC Watersheds (Stein and Ackerman 2007). This dry weather flow correlation was also used in the Harbor Toxics TMDL. For wet weather, flows were estimated by scaling the flows at Vermont Avenue based on drainage area. Individual scaling factors were determined for each storm water discharge along the channel. These scaling factors were calculated as the ratio of the storm water drainage area to the drainage area above Vermont Avenue.

Annual flow volumes for the DCE during the 20-year simulation period are compared to annual precipitation in Figure 16. In the figure, annual precipitation for the DC Watershed is shown in the upper panel. The lower panel shows the annual flow volume during dry and wet weather conditions. Overall, flow volumes correspond to precipitation patterns, with greater flow volumes occurring during wetter years (i.e., higher precipitation). However, years 1 and 2, which correspond to watershed loadings from 2004 and 2005, had the highest flow volumes due to several large rain events that occurred between December 2004 and February 2005. In the DCE, there are continuous dry weather flows, as illustrated by distinction of dry and wet weather flow volumes. On average, wet weather flows account for 61% of the total volume.

Sediment concentrations for the DC Watershed were estimated using TSS data, as shown in Figure 17. Seasonal, average TSS concentrations were determined for dry, first flush, and wet weather conditions (Everest 2017). "Dry weather" concentrations refers to those concentrations occurring during non-wet weather conditions, since perennial base flows occur year round. Wet weather conditions represent flows generated by rainfall, while the first flush refers to the single rain event that occurs at the beginning of the wet season, which starts in October. In the DCE, seasonal average TSS concentrations were determined based on data from the LACDPW monitoring location at Artesia Boulevard that were collected from 2003 to 2014. The top panel of Figure 17 shows the range in data, as well as the seasonal averages. Separate sediment estimates were made for the Torrance Lateral and Port land uses, as shown in the middle and bottom panels. For the Torrance Lateral, a separate sediment estimate was required for estimating organic contaminants. Although the TSS data were limited, the estimated seasonal TSS concentrations were similar, compared to the data from Artesia Boulevard. Sediment estimates were also made for Port land use areas, which showed overall lower TSS concentrations.

The seasonal average TSS concentrations developed for the WRAP Model are summarized in Table 5. The DC TSS concentrations were applied to the flow estimates for discharges into the DCE. In general, TSS concentrations for the DCE are lower than TSS estimates for the LAR and SGR/Coyote Creek. The Torrance Lateral TSS concentrations were applied only to the Torrance Lateral discharge. In the DCE, Port land use TSS concentrations were used for discharges in the lower portion of the channel along Reach 4.

Sediment loadings were calculated based on the time series flows and seasonal average TSS concentrations. The sediment loadings into the DCE over the 20-year simulation period are provided in Figure 18. In the figure, sediment loadings are shown for each channel reach. The total sediment loadings for the DCE ranged from 1.0 to 6.2 million kg/yr with an average of 2.9 million kg/yr. About half of the sediment loadings are from the fresh water portion of the watershed. Overall, 53% of the sediment loadings were discharged into Reach 0 and 30% of were discharged into Reach 1. Reach 2 receives 8% of the sediment loadings, followed by 3% in Reach 3 and 6% in Reach 4.

Table 5. WRAP Model Seasonal Average TSS Concentrations

Location	Dry Weather TSS (mg/L)	First Flush TSS (mg/L)	Wet Weather TSS (mg/L)
Los Angeles River (LAR)	56	1,040	273
Coyote Creek	49	897	195
Dominguez Channel (DC)	39	470	130
Torrance Lateral	38	658	194
Port Land Uses	16	99	90
Machado Lake	--	--	16

5.2 Sedimentation Rate

Watershed loadings were simulated for a 20-year duration with sedimentation and resuspension of the channel bed. The sedimentation rates were determined based on changes in bed height. The sedimentation rates in the DCE are illustrated in Figures 19 to 22. The figures contain spatial plots of the average annual sedimentation rates by cell. Yellow, orange, or red colors indicate deposition, while green and blue colors show erosion. Bed changes ±1 mm/yr are colored by gray, indicating little to no changes. Overall, sediment conditions, whether erosional or depositional, vary along the channel. Reach 0, 1, and 2 show the most variability in sedimentation rates. The highest deposition occurs at the upstream end of the channel in Reach 0, while the greatest erosion occurs in Reach 2. The least amount of change is observed in Reaches 3 and 4.

Annual sedimentation rates in Reach 0 and 1 are shown in Figure 19. The greatest sedimentation occurs at the upstream end above Victoria Street (Reach 0), which receives roughly half of the total sediment loadings. Sedimentation rates decline downstream along Reach 0, then increase at the channel bend above Victoria Street. In general, Reach 1 is erosional along the center portion of the channel and depositional along the edges. With the exception of the area near Victoria Street, sediment grain sizes along Reach 1 are generally comprised of mainly silts (48% to 64%).

Figure 20 shows greater variability in bed changes along Reach 2. Between Avalon Boulevard and 213th Street, the center portion of the channel is erosional with deposition at the edges. The highest erosion rates occur in the vicinity of 213th Street. Sediments in this area have a higher clay fraction and lower sand fraction (20% clay, 65% silt, and 14% sand) than that typically found in other portions of the channel. In the lower half of Reach 2, sediments are primarily sands, and erosion rates at the center of the channel are lower. In general, significant changes in sedimentation rates correspond to changes in bed characteristics.

Bed changes are minimal along Reach 3 and 4, as shown in Figures 21 and 22, respectively. Reach 3 is generally stable and erosional overall. Bed changes show little to no changes except near Alameda Street, which is erosional. Similarly, little to no changes in the bed are observed along Reach 4, which is also generally erosional. Most of the erosion in Reach 4 occurs near Sepulveda Boulevard, where sediments have a high silt (64%) and clay (25%) fraction.

The average annual sedimentation rates for each channel reach are summarized in Table 6. The sedimentation rates were calculated as the area-averaged rate. Overall, the sedimentation rate in the DCE was 1.4 mm/yr. This rate varied along the channel, with the highest sediment accumulation occurring at the upstream end along Reach 0, which receives the highest amount of sediment. The sedimentation rate then declines over Reach 1 and 2, and becomes erosional along Reach 3 and 4.

Table 6. Dominguez Channel Estuary Average Sedimentation Rates

CHANNEL REACH	SEDIMENTATION RATE (MM/YR)
Reach 0	13.5
Reach 1	2.2
Reach 2	0.3
Reach 3	-1.0
Reach 4	-0.5
DCE	1.4

6. SUMMARY

The WRAP Model has been updated to simulate sediment transport through the DCE. The model grid along the DCE was refined to allow the evaluation of bathymetric changes, which occur due to sediment loadings from the watershed and tidal exchange with the harbor. Sediment loadings were determined based on previously developed methodologies from the WRAP Model. Based on a 20-year simulation period, the overall sedimentation rate in the DCE is estimated to be approximately 1.4 mm/yr. Sedimentation rates varied along the channel. The upper portion of the DCE (Reaches 0, 1, and 2) is more hydrodynamically active, with erosion occurring in the channel center and deposition along the edges. Generally, significant changes in sedimentation rates correspond to changes in bed composition. This suggests that the accuracy of bed changes may depend on how accurately the bed characteristics are spatially defined, both horizontally and vertically.

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