Engineer's Report for Prado Basin Sediment Management Demonstration Project

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1.0 EXECUTIVE SUMMARY

The purpose of this Engineer's Report is to evaluate the feasibility, necessity, benefit, and cost of performing a sediment management demonstration project for Prado Basin (Basin). The objective of the Prado Basin Sediment Management Demonstration Project (SMDP) is to perform a field demonstration of how sediment can be taken from Prado Basin and reintroduce it into the Lower Santa Ana River (LSAR). Approximately 125 acre-feet (af), or 200,000 cubic yards (cy yd^3), is targeted for removal and re-entrainment. Effective management of sediment will increase the useful life of Prado Dam and the LSAR and preserve these facilities for stormwater capture, conservation and groundwater recharge. The completed demonstration project will provide data, conclusions, and recommendations that examine the feasibility of a long-term program for ongoing sediment management for the Basin and the LSAR.

Prado Dam provides valuable flood control and water conservation benefits for Orange County. These benefits come with the negative side effects of sedimentation within Prado Basin, and accelerated riverbed incision in the LSAR. As sediment laden water enters Prado Basin the velocity of the water slows, and the sediment settles out of the water, thereby reducing the available Basin volume for flood control and water conservation. Water, relatively void of sediment, is released through the dam and has an increased capacity to erode and coarsen the downstream riverbed. Riverbed coarsening reduces infiltration rates by allowing fine grained silts and clays (clogging material) to penetrate deep into the riverbed, beyond the reach of natural flows that would have otherwise transported the clogging material downstream.

From the original construction of Prado Dam in 1941, up until 2008, approximately 25,000 af of storage capacity has been lost below elevation 505 feet mean sea level (ft msl). An estimated storage loss of 50,000 af has occurred Basin-wide since 1941. As of the last aerial survey of the Basin in 2008, approximately 19,800 af of storage space remained below elevation 505 ft msl. At these sedimentation rates, all of the storage space below elevation 505 ft msl would be lost within approximately 50 years.

Several other issues should be given consideration as well:

1) Usable life of the flood control facilities is reduced. Slowing or stopping the filling of Prado Basin will sustain storage capacity beyond the design life of the flood control project. Increasing sediment concentrations in LSAR water in a controlled manner will reduce "sediment starved" conditions and reduce the risks of incising and bank erosion.
2) Habitat destruction occurs as sediments accumulate, the hydraulic gradient and water depths change, which alters habitat types. For example, habitat for the Santa Ana Sucker fish would benefit from reduced sediment accumulation in Prado Basin and an increased hydraulic

gradient upstream of Prado Basin. Restoring sediment flow that would otherwise be impeded by Prado Dam will allow LSAR riparian habitat to remain established and expand to other sections of the river from Prado Dam to the Weir Canyon Road crossing. These LSAR areas are currently sediment starved. The sediment will provide base material for the growth of vegetation along the banks and bed of the river, which will support numerous species of flora and fauna.

3) Reducing riverbed incision by restoring sediment flow in the river will preserve infrastructure within and adjacent to the LSAR. Preventing further filling of Prado Basin with sediments will preserve upstream infrastructure and reduce the need for further bridge or dam raisings.
4) Allowing sediment, particularly sands, to move from the upper watershed to the lower watershed will restore sands to the coastal zone where it will then naturally replenish beaches and coastlines in Southern California.
5) Enhancing and preserving habitat both in the Prado Basin and in the SAR will improve the recreational experiences in both locations and maintain a high quality of life for Southern California residents and visitors.

While the immediate benefits of the SMDP are relatively small when compared to the overall costs, the main benefit of the Prado Basin SMDP will be that it collects data and proves concepts essential to implementing a successful long-term sediment management solution for the Basin and the LSAR. The short term benefits of the SMDP are estimated to be 125 af annually of new stormwater capture for 50 years. A term of 50 years equates to the approximate amount of time the SMDP benefit would be realized if no long-term project becomes a reality, and all storage below elevation 505 is lost. In effect, the SMDP (as a stand-alone project) delays the infilling of the Basin and makes an additional 125 af of stormwater conservation available up until the time the Basin is filled with sediment.

If proven successful, the SMDP will lead to the development and implementation of an on-going sediment management solution for the Basin which should result in the preservation of the Orange County Water District's (OCWD) Prado Water Conservation Program.

The estimated capital cost of the SMDP is $10.4 million, which includes pre-design analysis, engineering, construction, operation, performance monitoring, mitigation, legal and administration costs. Due to the unique nature of the project, the annual operation and maintenance costs are included in the construction costs.

2.0 BACKGROUND INFORMATION

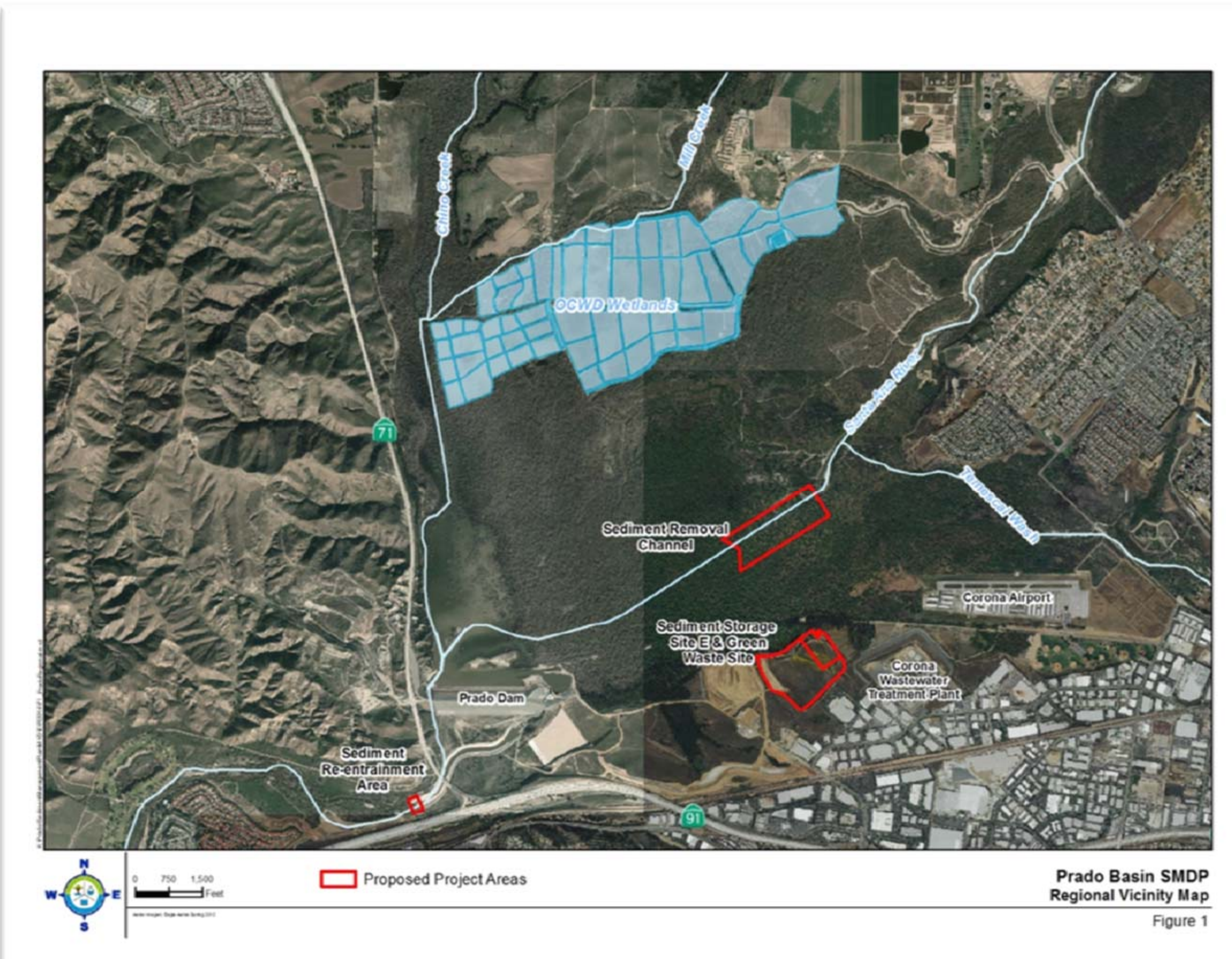
Prado Dam is an existing earth-filled dam that was constructed by the U.S. Army Corps of Engineers (Corps) in 1941 to control floods occurring in the Santa Ana River Watershed. Prado Dam's primary purpose and beneficial use is flood control and the secondary beneficial use is water conservation. Through a joint agreement with OCWD and the Corps, the Corps temporarily stores water at Prado Dam for groundwater recharge purposes. Since commencement of operations at Prado Dam, sedimentation has occurred behind Prado Dam restricting the amount of sediment transported to the lower Santa Ana River and the beaches near the outlet of the river. Over time the sediment has accumulated in the Prado Dam reservoir area which is referred to as the Prado Basin. The accumulation of sediment in Prado Basin has reduced the amount of water conservation storage available for OCWD groundwater recharge operations. Since 1941, data suggests that at least 25,000 acre feet of storage has been lost below the 505 foot elevation due to sediment accumulation behind the dam. If the storage loss continues unabated at this rate of about 370 acre feet per year, ultimately all water conservation storage will be lost. Without sediment management, Prado Basin will continue to accumulate sediment and reduce water conservation storage. In addition to reduced storage below the dam is potentially associated with a number of downstream impacts, such as increased erosion and incising of the river bottom, reduced riparian habitat along the banks of the river, armoring of the river and lower groundwater infiltration rates.

In response for the need for sediment management at Prado Basin, OCWD is proposing a sediment management demonstration project that will remove 200,000 cubic yards of material from the Prado Basin and re-entrain it in a controlled manner back into the lower Santa Ana River, downstream of Prado Dam. When completed, the sediment management demonstration project will provide data, conclusions and recommendations to assess whether to implement a long-term sediment management program at Prado Basin and if so to help design and implement that program. Any future long term sediment management program proposed in the Prado Basin would need to have subsequent CEQA environmental documentation prepared.

2.1 Project Area Setting

The project area is situated within the Prado Basin in western Riverside County. As shown on Figure 1 Prado Basin is bordered to the south by State Route 91 and to the west by State Route 71. The most significant structure in the Prado Basin is Prado Dam. The dam provides flood control for 2,225 square miles of the 2,650 square mile Santa Ana River Watershed. There are four major water bodies that drain into the Prado Basin; Santa Ana River, Chino Creek, Cucamonga Creek/Mill Creek and Temescal Creek. All of these water bodies converge and are impounded behind Prado Dam in a flood control pool during storm flow conditions. Depending on the elevation of the impounded water, the Corps operates Prado Dam by providing controlled condition releases from the flood control pool to the Santa Ana River for use by OCWD to replenish the Orange County Groundwater Basin. The water surface elevation of the impounded pool in Prado Basin varies depending on the time of year, basin inflow and basin outflow, while taking into account flood control, water conservation and natural resource objectives. Currently, the operations at Prado Dam are directed by the "Interim Water Control Plan (During Construction) Prado Dam and Reservoir, Santa Ana River, Orange County, California" dated May 2003 and the Memorandum of Understanding (MOU) between the USACE and OCWD dated July 7, 2006. The USACE is currently following Plan A of the Interim Water Control Plan.

Figure 1: Prado Basin Map



Flood control activities at Prado Dam require that vast portions of Prado Basin be inundated with water for periods of time. These periods of inundation influence vegetation and wildlife at Prado Basin and has created the largest riparian forest in southern California. The dominant vegetation species within the riparian forest is black willow, (Salix goodingii), arroyo willow (Salix lasiolepis), Freemont cottonwood, (Populus fremontii) eucalyptus, sycamore (Platanus recemosa), and mulefat (Baccharis salicifolia). The riparian habitat within Prado Basin is dependent upon periodic flooding. Winter flows create areas of sedimentation that can cycle the community back to earlier successional stages. Periodic floods of large magnitude and migration of the river channel lay down fresh alluvial deposits. The basin contains an expansive riparian forest. At lower elevations in the basin, the riparian forest becomes denser with an over-story of trees reaching as high as 50 ft and an understory of native vegetation. At the higher elevations in the basin the forest is less dense and the understory consists of more non-native vegetation. The basin supports a wide variety of mammal, amphibian and reptile species, several of which are biologically significant.

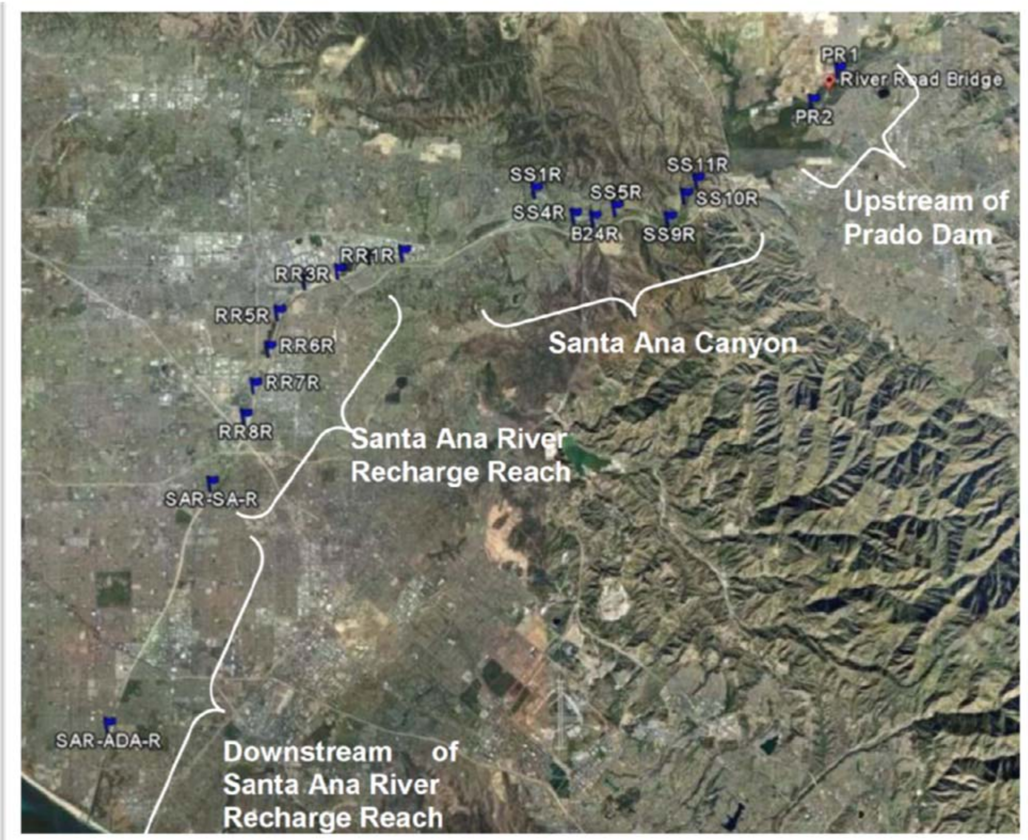
2.2 Lower Santa Ana River

Over the entire reach of the LSAR from Prado Dam to the Pacific Ocean, 37 bridges are present; ranging from small pedestrian, bicycle, and railroad bridges to multi-lane major freeway bridges. The LSAR has been divided into 3 reaches for discussion purposes in this report. Figure 2 shows the reaches of the Santa Ana River.

The first channel reach commences near Prado Dam and ends at North Weir Canyon Road. This reach is primarily a natural channel with braided and meandering patterns and a relatively steep longitudinal slope compared to the remainder of the LSAR.

The second geomorphic unit is the groundwater recharge reach, extending from North Weir Canyon Road to the Garden Grove Freeway (22 Freeway). This section has a natural bed, but its banks have been significantly modified. The river in this reach is contained within a regular, trapezoidal channel with a bottom width of about 325 ft. Several drop and grade-control structures were constructed in this reach to help maintain the river slope and prevent excessive incision. Temporary "T&L" and "parallel runner" levees are regularly constructed, maintained and modified by OCWD to enhance infiltration of water into the riverbed in the groundwater recharge reach. Additionally Flow diversion structures located in this river reach divert flows to adjacent recharge basins Additionally Flow diversion structures located in this river reach divert flows to adjacent recharge basins.

Figure 2: LSAR Reaches



The final geomorphic reach is located between the downstream end of the recharge reach (downstream of the Garden Grove Freeway) and the Pacific Ocean. This reach has a mild longitudinal slope and has been converted to a trapezoidal shape and rectangular shape near the Pacific Ocean. A portion of the channel is concrete lined. The first stretch of this reach runs through a golf course and appears to have a somewhat natural shape. A hardscape (grouted stone) channel exists under the golf course fill. Below the golf course (just above 17th Street) the channel is fully lined to just above Adams Avenue. At the lower channel portion (below Adams Avenue) it has a natural riverbed with concrete lined earthen levees and is subjected to tidal fluctuations. It is therefore prone to periodic sediment deposition depending on flood flows and tidal patterns (Golder, 2009).

3.0 PROJECT DESCRIPTION

3.1 Purpose and Need

The Prado Basin SMDP will demonstrate the feasibility of removing sediment from Prado Basin and re-entraining that sediment into the LSAR. The project goal is to remove approximately 125 af, or 200,000 yd^3, of sediment from Prado Basin and re-entrain it into the LSAR. The SMDP will provide the data, operational experience and develop the framework to support the implementation of a long-term sediment management solution for Prado Basin and the LSAR. The primary objective of the project is ultimately to preserve the water conservation efforts provided by the Dam and LSAR for OCWD into the future. Overall project benefits include;

1. Prevent further loss of reservoir volume in Prado Basin to enhance flood control capabilities and water storage and conservation capabilities. If feasible, increase reservoir volume in Prado Basin.
2. Diminish further degradation of the LSAR due to sediment-starved stream flows.
3. Allow for normal operation of the dam to take place to relieve flood flows as necessary.
4. Allow operation of the dam to take place to maximize water diversion and infiltration in the LSAR between Weir Canyon Road and the 22 Freeway.
5. Enhance and restore habitat in the Santa Ana River by preventing further degradation and, to some extent aggrading the river in certain locations through natural sediment transport processes.
6. Increase infiltration rates in the Santa Ana River, where applicable, by reducing riverbed sediment coarsening and incising, and modifying the composition of riverbed sediments to increase its permeability.
7. Reduce coastal erosion processes by providing sediment loads to the Santa Ana River for beach replenishment through discharge to the Pacific Ocean.
8. Enhance and restore high-value habitat in Prado Basin by preventing further accumulation of sediments in the basin.
9. Protect civil infrastructure within Prado Basin and in the LSAR.

Although not fully defined in this report, the largest regional benefit of the project will be the protection of critical infrastructure currently impacted by sediment accumulation in Prado Basin. This includes the dam itself; levees around the reservoir (Prado Basin); upland bridges and roads affected by Prado Basin ground elevation changes; the SARI line; infrastructure adjacent to and in proximity to the LSAR; and coastal infrastructure, beaches, and developments. The value of these benefits will range in the billions of dollars by way of avoiding future costs to repair, protect or rebuild critical infrastructure.

To meet these objectives for long term sediment management, the SMDP is being developed to learn critical lessons regarding sediment management. The objectives of the SMDP are to:

- Verify modeling results regarding where and to what extent sediments will accumulate within the LSAR.
- Verify Prado Basin modeling results regarding movement of sediments and materials within Prado Basin following its removal.
- Determine the feasibility of moving sediments from Prado Basin to the LSAR.
- Determine the changes in habitat value in the LSAR due to increased sediments in the LSAR.
- Determine effects on OCWD operations, if any, due to increased sediments in the LSAR.
- Determine the costs and cost/benefits of long term sediment management.

In addition to these learning objectives, a key objective for the SMDP is to conduct the SMDP so as not to impact dam operations or the flood capacity of the LSAR and to mitigate impacts from the SMDP.

The overall goal of the SMDP is to meet all of the above SMDP objectives. A number of alternatives for the SMDP were evaluated for their ability to meet the SMDP objectives and learn the critical lessons necessary to evaluate the feasibility of and plan a long term sediment management strategy for the LSAR.

3.2 Alternatives Analysis

A wide variety of alternatives were examined in the planning and pre-design phase of the Prado Basin SMDP. These alternatives included;

A. No action;

B. Dam removal;

C. Flushing of sediments from the basin by installation of low-level gates and modification of basin geometry;

D. Flushing of sediments from the basin by passing sediment through outlet structure and modification of basin geometry;

E. Removal and trucking of sediments to the coast for beach sand replenishment;

F. Removal and trucking of sediments to disposal or reclamation facilities;

G. Removal of sediments for sediment re-entrainment in the Lower Santa Ana River through a portion of the abandoned SARI line running under the dam;

H. Removal of sediments for sediment re-entrainment in the Lower Santa Ana River through a new pipe constructed through the dam; and

I. Removal of sediments, for re-entrainment in the Lower Santa Ana River through a pipe slurry system over the dam.

J. Use of Chino Creek as source for sediment

K. Use of Temescal creek as source for sediment

Through extensive pre-design analysis it was determined that the most feasible alternative with the lowest overall cost, least environmental impact and greatest probability of success was to remove sediments from the Basin by dredging, temporarily stockpile those sediments near the Dam and pump those sediments around the Dam in a water/sediment slurry mixture through a pipeline for re-entrainment in the Lower Santa Ana River. A Pre-Design Engineering Analysis performed by OCWD and their consulting team details the alternatives analysis, and is the basis of information for this report.

3.3 Proposed Project

The purpose of the Prado Basin Sediment Management Demonstration Project (Project) is to explore practical and beneficial methods to remove 200,000 cubic yards of sediment from Prado Basin and re-entrain the sediment into the lower Santa Ana River, below Prado Dam to help restore sediment migration to habitats and beaches downstream and to help maintain water conservation storage behind Prado Dam. The demonstration project will be implemented over a one to three year period. A shown on Figure 1 the Project involves three activities; 1) construction and operation of a sediment removal channel, 2) construction and operation of sediment storage and handling area and a green waste processing area and 3) sediment re-entrainment activities.

Sediment Removal Channel

The sediment removed from the Prado Basin for re-entrainment will be removed from a sediment removal channel. The sediment removal channel will parallel the alignment of the Santa Ana River in the southeast portion of Prado Basin. The western end of the channel will be located approximately 1,700 feet from the Prado Dam outlet works. The sediment removal channel will have a length of 2,000 feet, a width of 500 feet and a depth of six to 15 feet. A 30 foot access road will be provided along both sides of the channel alignment. A 300 foot buffer area is proposed around the perimeter of the sediment channel. The intent of the buffer area is to allow for modifications to the alignment during the detail design phase to minimize impacts to sensitive areas.

In order to construct the sediment removal channel all vegetation within the channel will have to be removed. The alignment of the channel to the maximum extent possible will extend through areas that contain arundo or other non-native vegetation. The vegetation removal will occur outside of nesting season. The removed vegetation will be trucked to a green waste area where it will be processed and converted to mulch and/or firewood.

The sediment will be removed from the sediment removal channel with hydraulic dredge operating in the wetted channel. A dredging barge will travel up and down the sediment removal channel by anchoring spuds into the ground. The collected sediment slurry will be conveyed by booster pumps to a sediment storage site through a temporary above ground discharge pipeline.

Sediment Storage and Handling Area/Green Waste Processing Area

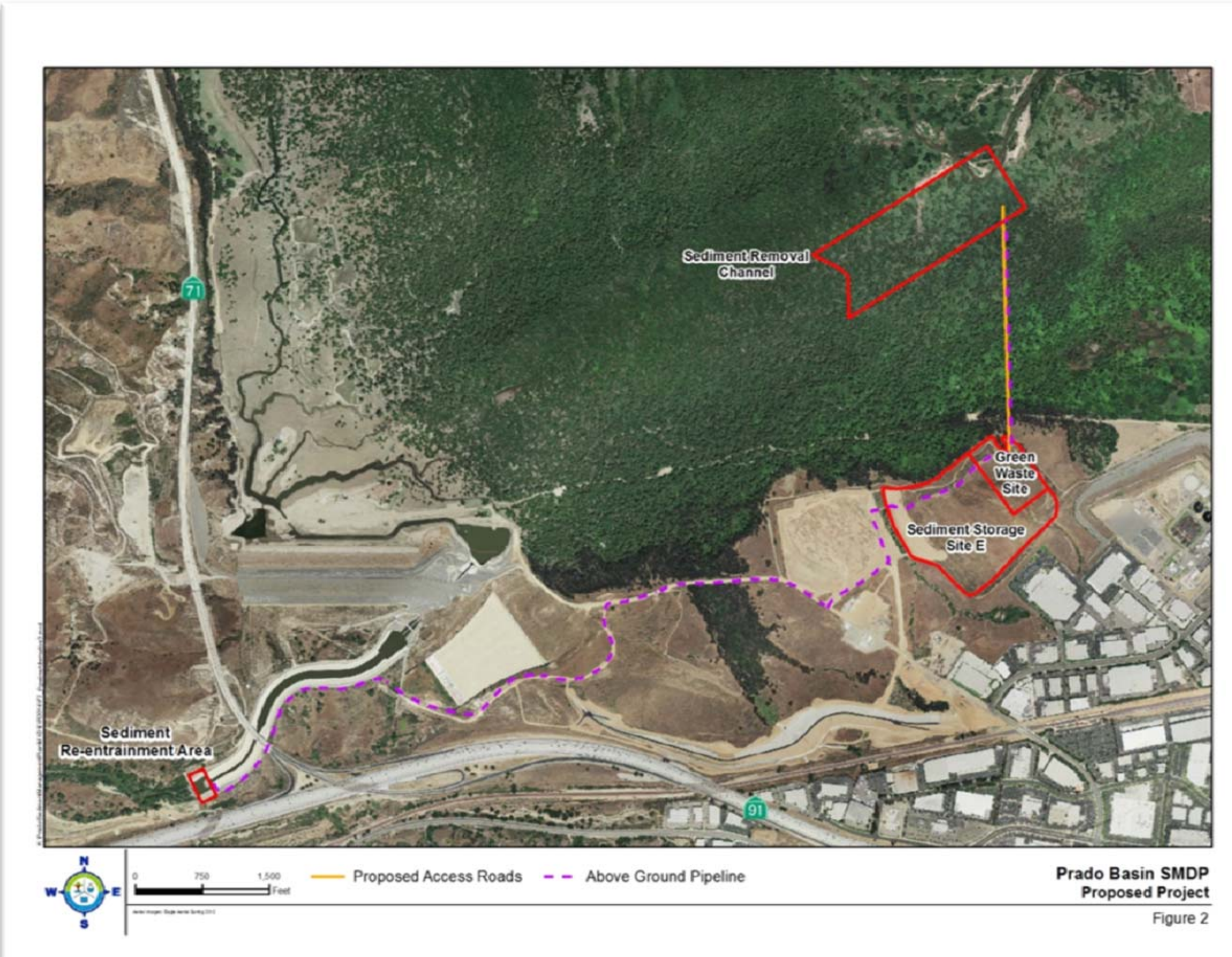
The project includes sediment storage and handling area and green waste area to process the vegetation removed from the site and to prepare the sediment for re-entrainment. The vegetation removed from the sediment removal channel and sediment storage site will be processed at the green waste area.

In order to remove and re-entrain sediments back into the Santa Ana River to achieve an adequate sediment concentration, the sediment will need to be re-entrained under flow conditions of 500 cfs and greater. Therefore, it will be necessary to store the removed sediments for a period of time until adequate releases are occurring from Prado Dam. The slurry collected from the hydraulic dredging will be processed at a sediment storage site to prepare it for re-entrainment back into the river. Once the slurry is processed it will be pumped into the first de-watering basin to begin the drying process. Once the sediment is dry it will be temporarily stockpiled for re-entrainment.

Sediment Re-entrainment

When Santa Ana River flows are at a sufficient rate, the sediment will be re-mixed into a slurry using water from the Santa Ana River and then pumped through an above ground temporary discharge pipeline to a sediment re-entrainment area. A crane will be positioned on the levee to secure the discharge end of the re-entrainment pipeline to insure even distribution of sediment into the river.

Figure 3: Proposed Project Site



Site Access Routes

Access for equipment and labor will be required to implement the SMDP. Sediment removal equipment will need to be mobilized and demobilized, which will require access for vehicles. Some portions of the project may require sediment movement with trucks or heavy equipment, requiring access. Access roads will be minimized to the extent practicable. The proposed access roads can be seen on Figure 3 above. It is anticipated that the access routes will need to be approximately 30 ft wide to allow for construction traffic to proceed in opposing directions.

3.4 Regulatory and Permitting

The Project area spans from Prado Basin to the Pacific Ocean which includes properties in Riverside and Orange County. The majority of the physical activities for the project will occur on USACE property as well as Orange County Public Works

(OCPW) and OCWD property. Listed below are the anticipated permits and other approvals required to implement the project.

- Endangered Species Act (ESA) Section 7 USACE Section 404 Permit
- USACE Non-Recreational Outgrant Permit
- State Historic Preservation Officer (SHPO) Section 106 Consultation
- Air Quality Conformity Determination
- California Department of Fish and Wildlife (CDFW) Streambed Alteration Agreement
- California Endangered Species Act (CESA) Compliance- CDFG Incidental Take Permit/Consistency Determination
- Regional Water Quality Control Board (RWQCB) Section 401 Water Quality Certitfication Permit
- RWQCB Section 402 National Pollutant Discharge Elimination System (NPDES) Dewatering Permit
- California General Construction Stormwater NPDES Permit
- Right of Entry/Encroachment Permits, RCFCD, OCFCD, CA State Parks

3.5 Performance Monitoring

One of the purposes of the Project is to provide data, conclusions and recommendations to help design and implement a long-term sediment management program at Prado Basin. A series of monitoring plans have been incorporated into the Project to measure the effects to water quality, wildlife and aquatic species, riparian habitat and to the substrate of the Sana Ana River. The following is a summary of the project monitoring programs.

Sensitive Species Monitoring Program

The Project will implement Sensitive Species Monitoring Program to monitor the presence of special status species occurring in the project area and the quantity and quality of habitat during the duration of the Project. The focus of the program will be onsite monitoring conducted by qualified biologist, approved by CDFW to help direct project activities to avoid and/or minimize impacts to sensitive biological resources. The onsite biologist will 1) inspect the project site for any special status wildlife species and prepare a list of species observed and record their activity during construction and operation of the project, 2) ensure that habitats within the construction activity impact area are not occupied by special status species and the quality of that habitat is maintained, 3) in the event of the discovery of a special status species the biologist will determine if the project activity will cause adverse impacts and 4) if it is determined that the project activity will have the potential to adversely affect special status species and no other measures are available to avoid adverse impacts, the biologist will require the project activity to cease in that area until the species is no longer in harm's way or is relocated outside of the construction activity impact area.

Riparian Habitat Monitoring Program

The Project will implement a Riparian Habitat Monitoring Program to determine project effects in the lower Santa Ana River riparian habitat. Baseline surveys will be conducted in the soft bottom portions of the lower Santa Ana River to document existing habitat conditions and changes to riparian habitat after the Project is completed. A combination of aerial photography of before and after conditions and will be conducted. The monitoring plan will be implemented annually for 5 years following conclusion of the Project.

Water Quality Monitoring Program

The Project will implement a water quality monitoring plan that will monitor for a wide range of constituents. The monitoring program will include testing water quality for organic chemicals including pesticides, PCBs, PAHs and hydrocarbons, metals, turbidity, total dissolved solids, major ions, nutrients, and indicator bacteria. Water quality samples will be collected at multiple locations, including in the Prado Basin reservoir pool, at the below Prado Dam sampling location, and downstream within the waters where sediment re-entrainment will occur. The monitoring program will be implemented before construction of the project, during operation of the Project and after the Project is completed.

The pre-project evaluation will include additional sampling of the sediment from the alignment along where sediment removal is to occur. Samples will be collected from bores advanced to the anticipated bottom of the dredge. Approximately 20 bores will be conducted. Sediment samples from the bores will be analyzed for grain size, metals, pesticides, PCBs, ammonia, and indicator bacteria.

Aliquots of sediment samples from the bores will be used to further evaluate potential water quality impacts from the project by mixing the sediment with water to create a slurry similar to the slurry anticipated from the dredging. The supernatant from the sediment/water mixture will be tested for a range of constituents including metals, boron, oil and grease, pesticides, PCBs, ammonia, bacterial indicators, TDS, field parameters including dissolved oxygen, sulfides, MBAS, and turbidity. These analyses will be completed before sediment is dredged from the area of the corresponding bore and the data will be used to determine if any sediment should be left in place and not dredged.

During re-entrainment of sediment, water quality sampling will be conducted at below Prado Dam (upstream of the re-entrainment site) and at a location immediately down gradient of the re-entrainment site. Comparison of the water quality data from these two sites will be used to assess water quality changes during the project. If significant differences between upstream and downstream samples are observed during sediment re-entrainment activities, the rate of sediment re-entrainment will be adjusted to ensure they are within acceptable threshold ranges that are provided in the Regional Water Quality Control Board's Basin Plan. However, because sediment re-entrainment will occur under high flow with elevated levels turbidity, there could be a temporary increase over the turbidity threshold level. The water quality sampling methodologies, sample frequency, and locations will be coordinated with and approved by Regional Water Quality Control Board prior to the start of any construction activity.

Dam Operations and Structures Monitoring Program

The Project will implement a Dam Operations and Structures Monitoring Program to determine if removal of sediments from Prado Basin affects dam seepage. The monitoring program will monitor and evaluate pre-project and post-project condition water levels near the dam. Water levels will be monitored with use of piezometers, boring samples or other approaches approved by the Corps.

Sediment Movement Monitoring Program

The Project will implement a Sediment Movement Monitoring Program to determine sediment profile changes in the Prado Basin and along segments of the lower Santa Ana River and upstream of sediment removal channel. The purpose of the monitoring plan to monitor changes to sediment deposition and erosion patterns along the lower Santa Ana River and head cutting and migration of sediments into the Prado Basin. The monitoring program will calculate volumes removed by dredging, volumes that accumulate after dredging, volumes that erode after dredging, areas of disposition and erosion.

4.0 FINANCIAL ANALYSIS

4.2 Overview

The Prado Basin SMDP benefits include new storage volume created in Prado Basin as a result of the sediment removal activities. Due to the relatively small amount of sediment planned for re-entrainment for the project no quantifiable benefit is expected downstream of Prado Dam in the LSAR. Costs to achieve the creation of new volume in the Basin include pre-design, final design, mitigation/environmental documentation, pre-construction studies/monitoring, construction, post construction studies / monitoring and project evaluation and reporting.

The benefits of the SMDP are estimated to be 125 af annually of new stormwater capture for 50 years. A term of 50 years equates to the approximate amount of time the SMDP benefit would be realized if no long-term project becomes a reality, and all storage below elevation 505 is lost. In effect, the SMDP (as a stand-alone project) delays the infilling of the Basin and makes an additional 125 af of stormwater conservation available up until the time the Basin is filled with sediment.

4.3 Project Costs

The Prado Basin SMDP costs presented here include all costs to plan, design, construct, mitigate, monitor and report the results of the SMDP. No long term costs have been included for the eventual long-term sediment management program for Prado Basin. Due to the unique nature of this project the operation and maintenance costs are included in the construction costs. The removal, stockpiling and re-entrainment of the sediment are included in the construction costs. All construction activities are expected to take up to three years, with monitoring and reporting lasting up to an additional five years. The overall project may last up to 8 years but may conclude in as few as 7 years. The SMDP is highly dependent on storm event frequency and intensity in any given year of the project. A more detailed description of the projected schedule can be found later in this report.

Approximately $1,239,485 of the preliminary design cost presented in 1 was previously authorized by the OCWD Board of Directors to perform analysis to evaluate the feasibility of the project. Other preliminary design costs include USACE fees and other permit fees for the project. All remaining costs will require future Board approval. The budget presented here assumes one year of clearing, grubbing, site preparation and dredging. It has been assumed that one to two years for re-entrainment operations will be required to achieve the 200,000 yd^3 (125 af) goal of sediment removal.

Table 1: Project Cost Estimate

Description	Projected Expenses
Design	
Preliminary Design	$1,239,485
Corps Fees	$98,098
Final Design	$300,000
Mitigation/Environmental Documentation	$480,000
Subtotal	**$2,117,583**
Construction	
Pre-Construction Studies and Monitoring	$300,000
Dredging/Re-entrainment Contract	$6,000,000
Operations Management/Monitoring/CM	$840,000
Permitting Fees	$120,000
Project Evaluation/Reporting	$250,000
Subtotal	**$7,510,000**
Project Contingency (10%)	$751,000
Total Project Budget	**$10,378,583**
Prop 84 Grant (Pending)	($750,000)
Project Cost to OCWD	**$9,628,583**

Due to the short overall life of the demonstration project (7 to 8 years) all cost should be considered capital costs. Once the demonstration project concludes the site will be allowed to return to its natural state. No long-term commitment to operation and maintenance is a part of the demonstration project. An extension of the SMDP would be analyzed once field data starts to be collected and analyzed. Any commitment to ongoing operation and maintenance of the project would be considered part of a separate project, subject to approval at a later date.

4.4 Project Benefits

Removal of 200,000 yd^3 equates to approximately 125 af of new storage volume. For this analysis it has been assumed that the new storage volume will be utilized on average, two times each year, for a total benefit of 250 af per year of new stormwater capture/recharge. The short term benefits of the SMDP are estimated to be 125 af annually of new stormwater capture for 50 years. A term of 50 years equates to the approximate amount of time the SMDP benefit would be realized if no long-term project becomes a reality, and all storage below elevation 505 is lost. In effect, the SMDP (as a stand-alone project) delays the infilling of the Basin and makes an additional 125 af of stormwater conservation available up until the time the Basin is filled with sediment. Since this is a demonstration project, the actual cost benefits would be determined based on the information obtained from this pilot project and would be accounted for in the long term project.

5.0 PROJECT SCHEDULE

Preliminary design activities started in the summer of 2009. The remaining project activities for the Prado Basin SMDP are expected to take from seven to eight years to complete. It will take two to three years perform the construction phase of the project (pre-construction monitoring, clearing/grubbing, sediment removal and re-entrainment), and an additional five years to complete all post-construction monitoring, analysis and reporting. The schedule of the SMDP will be highly dependent on meteorological conditions during the construction phase of the project. If storm frequency and intensity conditions are ideal, all sediment re-entrainment may be completed as early as the end of year three of the project. Initial results from the project will be reported within one to two years after sediment re-entrainment begins. For planning purposes the following schedule (Table 2) assumes a total of three years for construction phase activities and a total of five years for post-construction phase activities.

Due to the presence of endangered species habitat in the project site, the start of the clearing and grubbing activities must be performed outside of bird nesting season. Therefore, field construction activities using heavy equipment must begin between September and March of the first year, clearing and grubbing must also be performed with little or no water in Prado Basin. Dredging activities can take place during nesting season by attenuating the noise produced from the dredging activities. Pre-construction monitoring will begin prior to clearing and grubbing. Due to the clearing and grubbing constraints, these activities have been conservatively scheduled for the fall of 2015.

Table 2: Project Schedule

Activity	Date	
	Start	Stop
Preliminary Design	Summer 2009	Fall 2014
Final Design	Spring 2015	Summer 2015
Permitting	Spring 2014	Summer 2015
Pre-Construction/Construction Monitoring	Fall 2015	Fall 2018
Dredging/Re-entrainment	Fall 2015	Fall 2018
Mitigation	Fall 2015	Fall 2018
Post-Construction Monitoring	Fall 2018	Fall 2023
Analysis/Reporting	Fall 2015	Fall 2023

6.0 CONCLUSIONS AND RECOMMENDATIONS

The Prado Basin Sediment Management Demonstration Project will examine the feasibility of performing a sediment management demonstration project for Prado Basin. The objective of the SMDP is to perform a field demonstration of how sediment can be taken from Prado Basin and reintroduce it into the LSAR, thereby restoring sediment transport processes to the LSAR. Effective management of sediment will increase the useful life of Prado Dam and the LSAR and preserve these facilities for stormwater capture, conservation and groundwater recharge.

From the original construction of Prado Dam in 1941, up until 2008, approximately 25,000 af of storage capacity has been lost below elevation 505 ft msl, with an estimated storage loss of 50,000 af Basin-wide since 1941. As of the last aerial survey of the Basin in 2008, an approximate 19,800 af of storage remained below elevation 505 ft msl. At current sedimentation rates, all 19,800 af of storage below elevation 505 ft msl would be lost within approximately 50 years.

While more difficult to quantify, but no less critical to OCWD's groundwater recharge efforts and regional water supply, the ongoing coarsening of the recharge reach of the LSAR will benefit greatly from the development of a long-term sediment management solution. Other benefits which would be realized, should long-term sediment management be implemented at Prado Dam, include ecosystem restoration above and below the Dam, infrastructure protection above and below the Dam (including the Dam itself), recreational enhancement above and below the Dam, and beach replenishment.

While the immediate benefits of the SMDP are relatively small when compared to the overall costs, the main benefit of the Prado Basin SMDP will be that it collects data and proves concepts essential to implementing a successful long-term sediment management solution for the Basin and the LSAR.

Given the loss of storage in Prado Basin, and the ongoing coarsening in the LSAR, it is recommended that OCWD proceed with the Prado Basin Sediment Management Demonstration Project.

7.0 REFERENCES

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