SEDIMENT MANAGEMENT

STRATEGIC PLAN

2012-2032

County of Los Angeles Department of Public Works
The Los Angeles County Flood Control District

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EXECUTIVE SUMMARY

Introduction and Purpose

For nearly 100 years, the Los Angeles County Flood Control District (Flood Control District) has fulfilled its mission by providing flood risk management and water conservation for much of the County of Los Angeles. The Flood Control District manages a system of reservoirs, debris basins, and other drainage infrastructure, which reduces the risk of floods and debris flows for downstream communities. In addition, the reservoirs and spreading facilities managed by the Flood Control District enable the storage of flood and storm waters and replenishment of local groundwater resources to supply approximately one third of the region's water supply. In order to maintain the proper functionality of these facilities, the sediment that erodes from the region's mountains and that reaches the reservoirs and debris basins needs to be managed.

In recent years, the Flood Control District has identified new challenges in managing sediment. In particular, recent wildfires have led to an increased inflow of sediment and debris within Flood Control District facilities. This has put pressure on the remaining capacity of existing sediment placement sites, where the Flood Control District has traditionally placed sediment. As a result, the Flood Control District has developed this Sediment Management Strategic Plan (Strategic Plan) and is pursuing new alternatives that can reduce the environmental and social impacts of sediment management.

The Strategic Plan provides an overview of sediment management issues, evaluates various alternatives to help identify optimal solutions for sediment management, and identifies general steps that should be pursued to meet the Flood Control District's mission. The Strategic Plan is guided by the following key objectives:

- Maintaining flood risk management and water conservation;
- Recognizing opportunities for increased environmental stewardship;
- Reducing social impacts related to sediment management;
- Identifying ways to use sediment as a resource; and
- Ensuring the Flood Control District is fiscally responsible in decision-making.

The Strategic Plan balances these objectives with alternatives that address the sediment management needed in order for the facilities managed by the Flood Control District to be able to provide for flood risk management and water conservation and also take into consideration the environment, communities, and the Flood Control District's budget. This Strategic Plan considers input received from numerous stakeholders in the region during the development of this plan and is part of a continuing dialogue about sediment management between the Flood Control District and stakeholders. The Flood Control District understands that some stakeholders desire a more "natural" system and approach to sediment management. However, sediment accumulation in the existing system still needs to be addressed. And so, this Strategic Plan focuses on sediment management with respect to the existing system.

The Strategic Plan contains an overview of sediment management issues and different sediment management alternatives. This Strategic Plan does not specify a selected alternative for specific facilities. Projects such as the Pacoima Reservoir Sediment Removal Project being considered (as of 2012) for implementation in the near future will be developed based on a more detailed and comprehensive analysis as well a public engagement process specific to that project. This Strategic Plan is intended to be an advisory document. The Strategic Plan will guide development of specific sediment management projects for the Flood Control District's numerous facilities. Development of those specific sediment management projects will provide opportunities for additional public input, including that from the local communities affected by each cleanout. Specific sediment management projects that will result in significant environmental impacts will also be subject to environmental review under the

California Environmental Quality Act, which will provide additional opportunities for public involvement during project evaluation. The Strategic Plan is a living document that is open to other alternatives and may be revised in the future as conditions change.

Meeting the Challenges of Sediment Management

Proper planning and maintenance of the flood management and water conservation system is important for protecting public safety and the quality of life in local communities. Many factors must be accounted for to ensure the system remains operational well into the future and is able to provide its flood control and water conservation purposes. The Strategic Plan provides a balanced approach by proactively addressing key issues affecting sediment management. The following paragraphs discuss key issues and challenges addressed in the Strategic Plan:

Maintaining Public Safety and Water Conservation Benefits

The reservoirs and debris basins operated by the Flood Control District address public safety by reducing flood risk. In addition, the reservoirs and groundwater recharge facilities operated by the Flood Control District are critical for water conservation and replenishment of local water resources. This Strategic Plan considers innovative solutions for sediment management while holding both public safety and water conservation as top priorities.

A Project on a Massive Scale

The Flood Control District operates 14 reservoirs and 162 debris basins and anticipates the need to manage 67.5 million cubic yards of sediment between 2012 and 2032. To put that into perspective, the Rose Bowl Stadium in Pasadena could hold approximately 400,000 cubic yards. Figure ES-1 shows the location and expected quantity of sediment for each reservoir and group of debris basins along with available capacity at existing Flood Control District sediment placement sites, which as of 2011 were estimated to have a total remaining capacity of approximately 48 million cubic yards. It is clear that sediment management alternatives must be identified to address the great amount of sediment that naturally erodes from the region's mountains and affects flood risk and water conservation for the region. This Strategic Plan identifies opportunities beyond traditional placement at sediment placement sites, including beneficial use of the sediment in the construction industry, at landfills, and at pits.

Limited Funding

While the Flood Control District's funding has been sufficient for previous sediment management projects, other operational needs must be taken into account when considering the cost and approach of the sediment management alternatives. Planning level costs are identified within the Strategic Plan and will be considered alongside the other benefits and impacts of the sediment management alternatives. Funding availability will need to be reevaluated as specific sediment management projects are developed.

Coordination with Other Agencies

The reservoirs and debris basins operated by the Flood Control District are part of a regional system that includes various facilities, including several flood control basins or dams, operated by the U.S. Army Corps of Engineers (Army Corps of Engineers). The agencies' facilities are connected and sediment management operations at the Flood Control District facilities can affect the Army Corps of Engineers facilities. Therefore, for certain sediment management operations the Flood Control District needs to coordinate with the Army Corps of Engineers.

Furthermore, sediment management operations require environmental regulatory permits from various agencies. As a result, the Flood Control District works with other agencies to obtain those permits.

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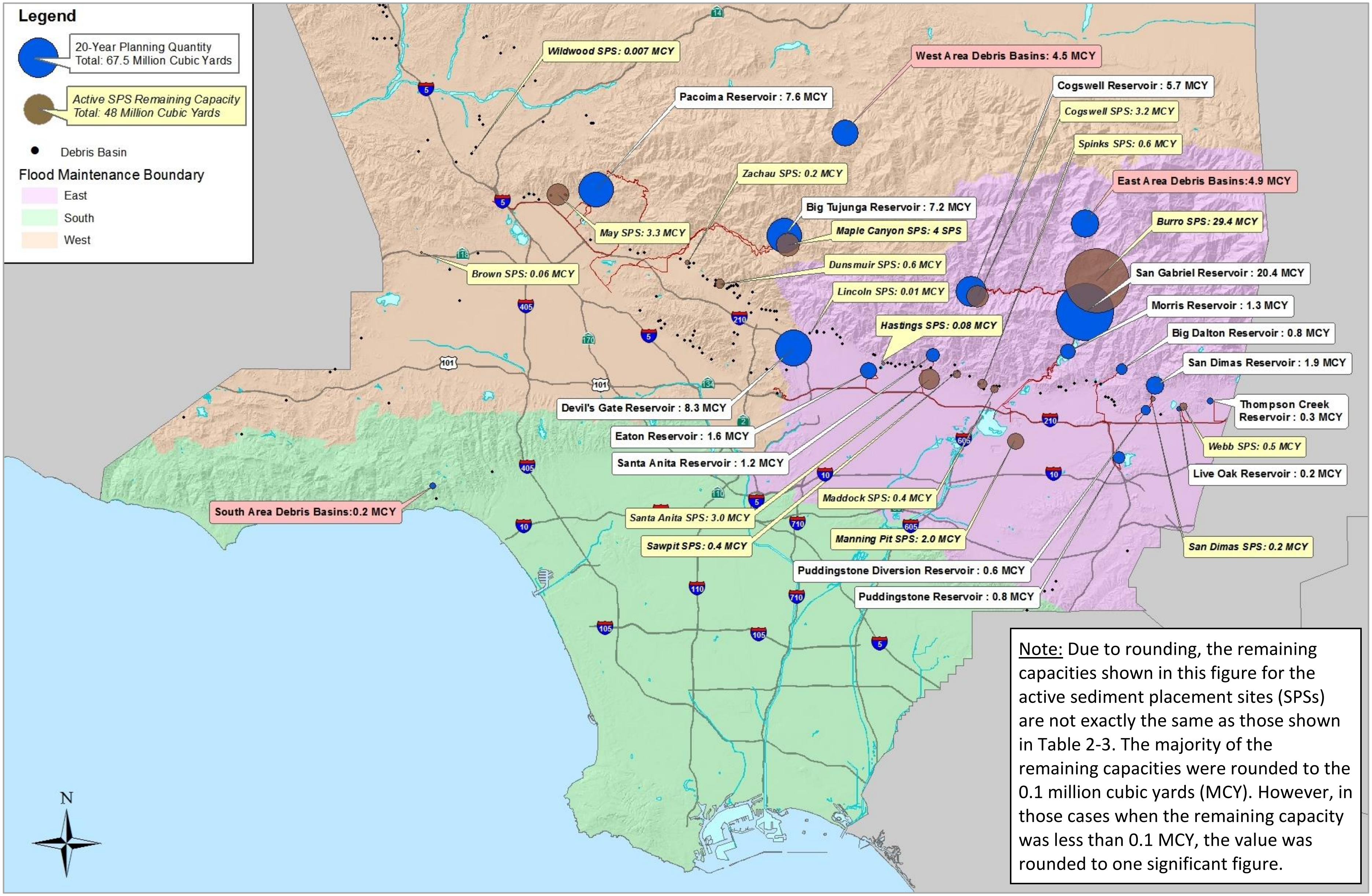
Figure ES- 1 20-Year Planning Quantities and Remaining Capacity at Sediment Placement Sites



Project Partnerships

Some nontraditional alternatives considered in this Strategic Plan would require partnerships. One such example is the processing, transportation, and placement of sediment accumulated in the reservoirs and debris basins on County of Los Angeles beaches (More information about this can be found in Section 6.5.1). Another endeavor that will require project partners, especially the Army Corps of Engineers, will be the pursuit of the Long-Term Vision discussed at the end of this Executive Summary, under Next Steps.

Outreach Strategy

To ensure the Strategic Plan accurately reflects the input of the numerous stakeholders in the Los Angeles region, the Flood Control District engaged agency, industry, and public stakeholders to help shape the various sediment management alternatives under consideration. The tenets of the public outreach program included:

- Stakeholder Task Force: Large task force created to gather input from external stakeholders during the development and review of potential sediment management alternatives to be incorporated into the Strategic Plan. Regulatory agencies, cities, landfill owners and operators, water agencies, sand and gravel companies, environmental groups, and others were invited to participate in the Stakeholder Task Force. All Stakeholder Task Force meetings were open to the public.

- Advisory Working Group: Small group created to gather additional input and a broad perspective from external stakeholders based on the members' diverse experiences and key roles in the stakeholder community. Participation included representatives from local jurisdictions, environmental groups, and the media.

- Public Open Houses: Conducted to provide an open forum for public input during the Strategic Plan review period. Two open houses were held in the general vicinity of major facilities to allow neighboring community members to provide feedback on the alternatives identified in the Strategic Plan.

- Website: Developed a website (www.LASedimentManagement.com) dedicated to sediment management to provide ongoing information to the public on the development of the Strategic Plan and the planning of upcoming sediment management projects.

Based on valuable input from agencies, organizations, industry, and the public through the Stakeholder Task Force, Advisory Working Group, and public open houses, the Flood Control District evaluated numerous sediment management alternatives. This input was used to develop the combined alternatives presented in this plan.

Evaluating the Alternatives

While considering input from stakeholders, the Flood Control District identified and analyzed various alternatives for removal, transport, beneficial use, and placement of the sediment. The alternatives were analyzed based on five main factors - environmental impacts, social impacts, implementability, performance, and approximate 20-year cost. A number of specific concerns were considered within each factor, as shown in Table ES-1.

Table ES-1 Evaluation Factors Considered for Each Sediment Management Alternative

Evaluation Factor	Description	
Environmental Impacts	• Habitat • Water quality	• Groundwater recharge • Air quality
Social Impacts	• Traffic • Scenic and visual impacts	• Noise • Recreation
Implementability	• Construction issues	• Permits or agreements
Performance	• Previous experience • Cleanout capacity	• Number of operations required to address the planning quantity
Cost	• Estimated total cost over 20 years	

Using the five factors, the Flood Control District analyzed each alternative to identify the feasibility for large reservoirs, small reservoirs, and debris basins. The alternatives identified as feasible for each facility type are included in Table ES-2. Subsequently, those alternatives were put together as feasible for each reservoir and the debris basins to create combined sediment management alternatives.

Table ES-2 Feasible Sediment Management Alternatives

Alternative	Feasibility		
	Large Reservoirs	Small Reservoirs	Debris Basins
Removal			
Excavation	✓	✓	✓
Dredging	✓		
Sediment Flushing (previously referred to as Flow Assisted Sediment Transport (FAST))	✓	✓	
Sluicing	✓		
Transportation			
Sluicing	✓		
Trucks (including Low Emission Trucks)	✓	✓	✓
Conveyor Belts	✓	✓	
Slurry Pipes	✓		
Beneficial Uses and Placement			
Aggregate and Other Materials	✓	✓	✓
Daily Cover at Solid Waste Landfills	✓	✓	✓
Fill at Pits	✓	✓	✓
Sediment Placement Sites	✓	✓	✓

As detailed in Section 6.5.1, the use of the sediment for replenishing the beaches in the County of Los Angeles would involve removing the sediment from the reservoirs and debris basins, transporting it to a processing site, processing the sediment for sand and managing the unusable byproducts, transporting the sand to the beaches, and placing the sand there. In order to perform all these tasks, the Flood Control District would need to find cost-sharing and project management partnerships. The Flood Control District understands that as long as better sources of sand are available to those agencies, there may be no interest for those agencies to incur additional expenses to extract sand from the reservoir and debris basin deposits. However, the Flood Control District will continue to analyze this alternative further.

During the analysis of alternatives, additional alternatives were considered, but eliminated based on feasibility. Table ES-3 details the alternatives identified as infeasible during the analysis and the reason(s) for elimination.

Table ES-3 Sediment Management Alternatives Considered, But Eliminated

Alternative	Reasons for Elimination
Transportation	
Trucking in Channels	Channels would need to be reconstructed since channels are not structurally designed to carry truck traffic. Bridge overcrossings would also need to be modified.
Rail	Travel distance is too short for rail to be cost-effective. Trucks would still be required from the reservoir/debris basin to the rail cars.
Two-way Saltwater Pipeline	Implementation and operations costs are very high. There would also be high environmental impact at coastal intake and discharge locations.
Cable-Bucket System	Permanent structures would have high visual impacts. Conveyor belts serve similar purpose, but have lower costs.
Placement & Beneficial Uses	
Offshore	Existing regulations do not allow if onshore alternatives are feasible.

Recommendations

Developing recommended sediment management alternatives for the 14 reservoirs and 162 debris basins the Flood Control District operates is a complex task. Each facility's unique geographic location provides both challenges and opportunities for sediment management and each alternative carries a series of tradeoffs.

For the small reservoirs and debris basins, fewer combined alternatives were feasible. For the larger facilities with a number of combined alternatives, more detailed analysis is warranted before making a determination on the future course of action. Therefore, it is recommended that multiple combined alternatives be considered for future sediment removal projects.

The complete analysis and recommendations for each reservoir and the debris basins are provided in the Strategic Plan in the following order:

- San Gabriel Canyon Reservoirs (Morris, San Gabriel, and Cogswell Reservoirs) – Section 7.
- Other Large Reservoirs (Big Tujunga, Devil's Gate, Pacoima, Puddingstone, San Dimas, and Santa Anita Reservoirs) – Section 8.
- Small Reservoirs (Big Dalton, Live Oak, Puddingstone Diversion, and Thompson Creek Reservoirs) – Section 9.
- Debris Basins – Section 10.

Section 11 provides a summary of the sediment management alternatives and recommendations for all the reservoirs and debris basins along with the general steps that should be pursued in order to implement a sediment management approach based on the alternatives recommended by this Strategic Plan.

Next Steps

This Strategic Plan represents the first step in continued analysis and dialogue with our stakeholders to manage sediment at Flood Control District facilities in ways that consider the needs of all stakeholders. Several next steps have come out of the analysis included in this Strategic Plan.

- **Continue Analysis** – As a planning-level document, the Strategic Plan has identified feasible alternatives, but more analysis is needed prior to choosing a specific alternative for the larger, more complicated reservoirs. Specific analysis will clarify impacts and constraints, but may also identify new opportunities. One such alternative is sediment flushing (previously referred to as Flow Assisted Sediment Transport), which shows promise as a methodology to move sediment downstream in a manner that mimics natural processes. As this analysis continues, the Flood Control District will work cooperatively with stakeholders.

- **Beneficial Uses** – Some of the sediment that reaches the reservoirs and debris basins maintained by the Flood Control District could potentially be used as a resource of aggregate and other materials, daily cover at landfills, and fill at pits. The Flood Control District will continue to explore beneficial use of the sediment. Furthermore, the Flood Control District will remain open to cost sharing and project management partnerships to remove, transport, and process sediment for beach nourishment purposes.

- **Partner with Pit Operators/Acquire Pit(s)** – As mentioned above, sediment from the reservoirs and debris basins could potentially be used as a resource of construction and other materials and as fill for pits. These could potentially be possible through a service agreement with the owners of the sand and gravel processing plants and pits. Placement of sediment at pits could also be accomplished by acquisition of a pit. If not completely filled, the Flood Control District could also use the pits to provide additional groundwater recharge. The Flood Control District will continue efforts to establish the service agreements and to acquire pits in Sun Valley and the Irwindale area.

- **Long-Term Vision** – The flood management and water conservation system in the County of Los Angeles contains some facilities operated by the Flood Control District and others by the Army Corps of Engineers. The Flood Control District will continue to work with the Army Corps of Engineers and local stakeholders to develop a regionwide plan to address sediment as a part of a comprehensive study of how to improve facilities' operations and restore the natural functions of the watersheds while retaining the benefits provided by the current flood management and water conservation system.

The Flood Control District has provided flood risk management and water conservation for almost 100 years. However, new challenges associated with sediment management have emerged. The Flood Control District is always open to hearing and discussing new ideas, so find out how to be involved at www.LASedimentManagement.com and share your ideas.

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ACRONYMS, ABBREVIATIONS, AND SPECIAL TERMS

Acre-feet	Unit of measure used to express volume. One Acre-foot is defined as the volume occupied over a one-acre area to a depth of one foot. One acre-foot is equal to 43,560 cubic feet as well as to 325,850 gallons.
AF	Acre-feet
Army Corps of Engineers	U.S. Army Corps of Engineers
BMPs	Best management practices
Capacity	The measure of water capable of flowing through a channel, measured in cubic feet per second (cfs). Also the measure of how much water a stormwater detention facility holds; this capacity is usually measured in acre-feet.
CEQA	California Environmental Quality Act
cfs	Cubic feet per second
Channel	An open conveyance of surface stormwater having a bottom and sides in a linear configuration. Channels can be natural or man-made. Channels have levees or dikes along their sides to build up their depth. Constructed channels can be plain earth, landscaped, or lined with concrete, stone, or any other hard surface to resist erosion and scour.
County	County of Los Angeles
Cubic feet per second	Unit of measure used to quantify flow. A cubic foot is equivalent to 7.5 gallons of water. Thus, 1 cfs is equal to 7.5 gallons of water passing by you every second.
CY	Cubic yards
Dam	A structure built across a river or stream that limits the amount of water and sediment moving downstream. Dams help reduce the risk of flooding for downstream communities by allowing controlled releases.
DDE	Design Debris Event
Debris basin	A type of facility that is typically located at the mouths of canyons and manage the risk of flooding due to flood water, floatable debris, sediment, boulders, and debris flows that flow from canyons during storms.
Design Debris Event	A Design Debris Event is defined as the quantity of sediment that would be produced by the specific watershed given all the following two conditions had been met: (1) the watershed had been burned four years before, and (2) the watershed was fully saturated when it experienced 24 hours of the type of rain that would be experienced during a 50-year rain event. Design Debris Events are watershed-specific. The term is typically abbreviated as DDE.

Drainage Area	The area (acres, square miles, etc.) from which water is carried off by a drainage system.
East Area	East Flood Maintenance Area
EIR	Environmental Impact Report
FAST	Flow assisted sediment transport. The technique is now referred to as sediment flushing.
Flood	A flood is commonly interpreted as the temporary overflow of lands not normally covered by water, but which are used or usable by man when not inundated.
Flood Control District	Los Angeles County Flood Control District
Flood Risk Management	Various activities and regulations that help reduce or prevent damages caused by flooding. Typical flood risk management activities include structural measures such as reservoirs, debris basins, drainage channels, levees, and bank stabilization; acquisition of flood-prone land; flood insurance programs and studies; river and basin management plans; public education programs; and flood warning and emergency preparedness activities.
FMD	The County of Los Angeles Department of Public Works' Flood Maintenance Division
HDPE	High-density polyethylene
LACDA	Los Angeles County Drainage Area
Los Angeles County Flood Control District	Special district created by the California State Legislature in 1915 as a result of catastrophic floods in the County of Los Angeles.
MCY	Million cubic yards
MWD	Metropolitan Water District of Southern California
NEPA	National Environmental Policy Act
OHV	Off-highway vehicle
Outlet Structure	A hydraulic structure placed at the outlet of a channel, spillway, pipe, etc., for the purpose of dissipating energy and providing a transition to the channel or pipe downstream.
Public Works	The County of Los Angeles Department of Public Works

Reservoir Place behind a dam where flows are captured in order to (1) reduce the risk of flooding for downstream communities and (2) store water for groundwater recharge. In this Strategic Plan, reservoirs are categorized into large and small reservoirs.

Large Reservoirs: Reservoirs that are larger than some of the other reservoirs in respect to the size of the reservoir itself as well as the associated dam, drainage area, and sediment accumulation in the reservoir. This category includes Big Tujunga, Cogswell, Devil's Gate, Morris, Pacoima, Puddingstone, San Dimas, San Gabriel, and Santa Anita Reservoirs. All the large reservoirs except for Devil's Gate Reservoir are operated with a pool of water, that is, some water is typically found in them year-round.

Small Reservoirs: These reservoirs are not only characterized by the smaller size of the reservoir, the associated dam, drainage area, and amount of sediment accumulated in the reservoir, but also limited blasé flows during the dry season. This category included Big Dalton, Eaton, Live Oak, Puddingstone Diversion, and Thompson Creek Reservoirs.

Runoff Surface water resulting from rainfall or snowmelt that flows overland to streams, usually measured in acre-feet. Volume of runoff is frequently given in terms of inches of depth over the drainage area. One inch of runoff from one square mile equals 53.33 acre-feet.

Sediment Soil particles, sand, and minerals washed from the land into aquatic systems as a result of natural and human activities.

Sediment Placement Sites Sites developed by the Flood Control District throughout the County of Los Angeles to be strategically filled with sediment resulting from the cleanout of its facilities. Typically, sediment from the Flood Control District debris basins, reservoirs, and spreading facilities has been permanently placed at the sediment placement cites.

South Area South Flood Maintenance Area

Spillway An outlet pipe or channel serving to discharge water from a dam, ditch, gutter, or basin.

SPS Sediment Placement Site

Stakeholder A person or organized group that has a defined interest in the outcome of a project.

Storm Season October 15th to April 15th

Strategic Plan Sediment Management Strategic Plan

Tributary A stream that contributes its water to another stream or body of water.

Viewshed The area that is visible by human eyes from a specific point

Vulcan Vulcan Materials Company

Water Year October 1st to September 30th

Watercourse Any minor or major lake, river, creek, stream, wash, arroyo, channel, or other topographic feature on or over which waters flow at least periodically. Watercourse includes specifically designated areas in which substantial flood damage may occur.

Watershed An area from which water drains into a lake, stream, or other body of water. A watershed is also often referred to as a basin, with the basin boundary defined by a high ridge or divide, and with a lake or river located at the lower point.

West Area West Flood Maintenance Area

West Fork West Fork of the San Gabriel River

WMD The County of Los Angeles Department of Public Works' Watershed Management Division

WRD The County of Los Angeles Department of Public Works' Water Resources Division

SECTION 1 INTRODUCTION

1.1 PURPOSE OF THE SEDIMENT MANAGEMENT STRATEGIC PLAN

The purpose of this Sediment Management Strategic Plan (Strategic Plan) is to identify strategies to address the Los Angeles County Flood Control District's sediment management needs in order to manage the risk of floods and debris flows and provide for water conservation from 2012 to 2032 in a sustainable manner – taking social, environmental, and economic impacts into account.

As a conceptual-level planning document, the Strategic Plan is intended to provide a broad overview of sediment management and identify potentially feasible alternatives. The alternatives are evaluated in terms of overall impacts, including very rough cost estimates.

For facilities with a number of feasible alternatives, this Strategic Plan represents the first step in a continued analysis and dialogue with our stakeholders to develop specific plans for management at those sites. Furthermore, this Strategic Plan is a living document that is open to other alternatives and may be revised in the future as conditions change. This Strategic Plan is intended to be an advisory document. The Strategic Plan will guide development of specific cleanout plans for the Flood Control District's numerous facilities.

1.2 BACKGROUND

The County of Los Angeles (County) is one of the largest and most populous counties in the United States. More than 10.4 million people reside within its 4,084-square-mile area - an area approximately 25 percent larger than the states of Delaware and Rhode Island combined. The County is comprised of 88 incorporated cities and approximately 140 unincorporated communities. Several erosive mountainous areas are located in the County, including the San Gabriel Mountains and Verdugo Hills. During heavy rainfall, runoff from these areas has the potential to transport large amounts of eroded sediment and vegetative debris. Other mountainous and hilly areas in the County have lower sediment and debris production potentials.

In 1915, the Los Angeles County Flood Control Act was adopted by the California State Legislature after a disastrous regional flood took a heavy toll on lives and property. The act established the Los Angeles County Flood Control District (Flood Control District) and empowered it to manage flood risk and conserve stormwater for groundwater recharge within its boundaries. The Flood Control District, shown in Figure 1-1, covers the 2,753-square-mile portion of the County south of the west to east projection of Avenue S, excluding Catalina Island. It is governed as a special district by the County of Los Angeles Board of Supervisors.

In 1984, the Flood Control District entered into an Operational Agreement with the County. Per the Agreement, the planning, operational, and maintenance activities of the Flood Control District were transferred to the County of Los Angeles Department of Public Works (Public Works).

Between 2007 and 2009, over 11 percent of the County was consumed by wildfires, burning approximately 545 square miles in all. The Station Fire of 2009 alone, which started on August 26 and was fully contained on October 16, burned approximately 250 square miles. The burned watersheds resulted in a significant increase in the amount of debris and eroded sediment travelling down the hillsides during storms and making their way into debris basins and reservoirs. Public Works, on behalf of the Flood Control District, has been tasked with the responsibility of managing the vast majority of this material. Figure 1-2 illustrates the increase in the amount of sediment removed from debris basins maintained by the Flood Control District the Water Year after the Station Fire (i.e., Water Year 2009-10, which extends from October 1, 2009, to September 30, 2010). Public Works' records indicate that during Water Year 2009-10, approximately 1.2 million cubic yards (MCY) of sediment were removed from the debris basins. The subsequent Water Year only approximately 40,000 CY of sediment were removed, which could be due to a number of factors including lower rainfall quantity and intensity.

Figure 1-1 Los Angeles County Flood Control District

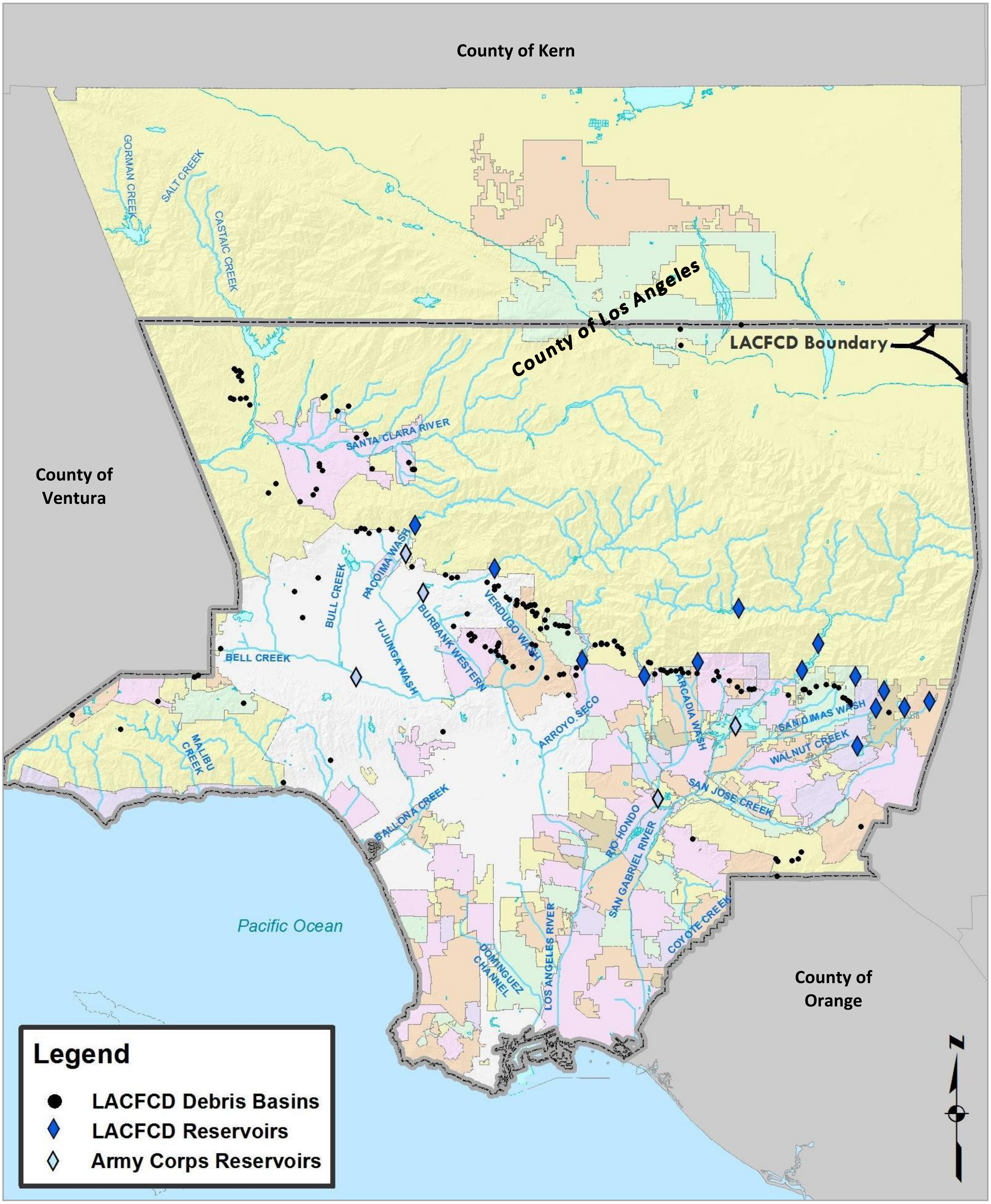
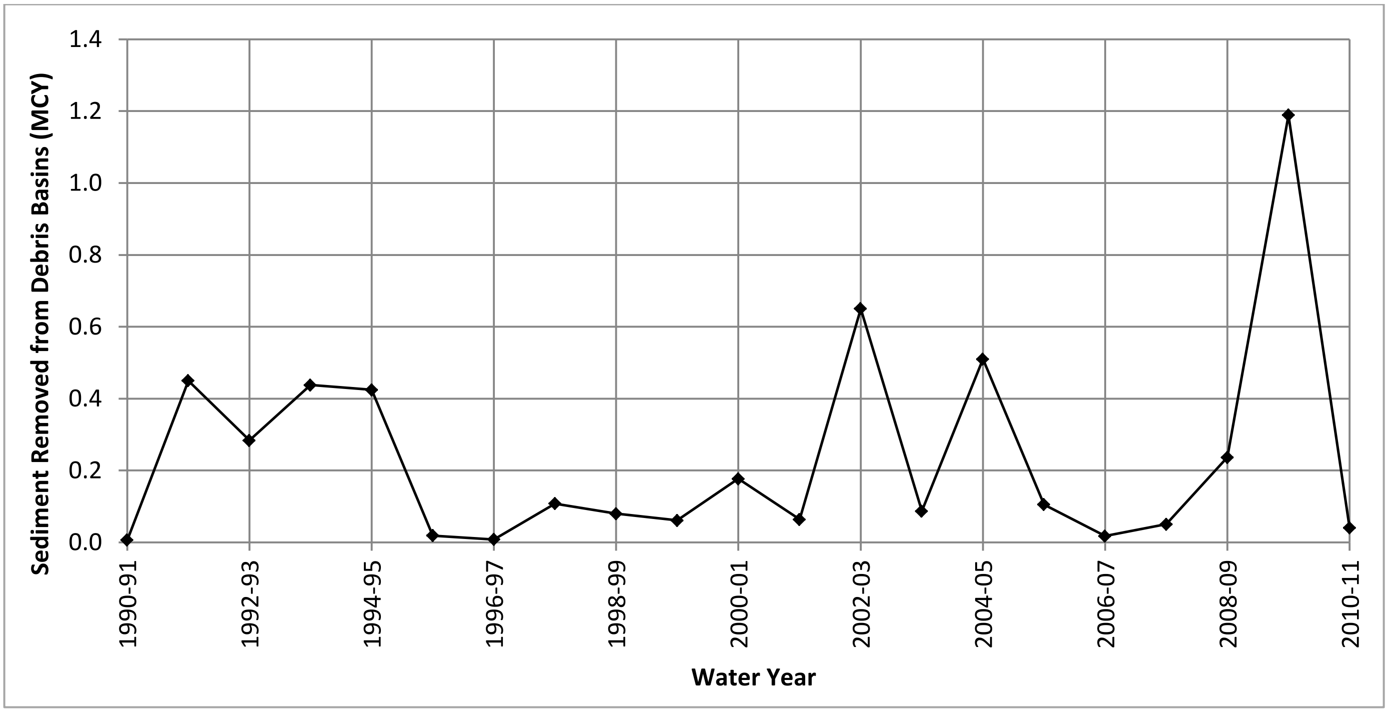


Figure 1-2 Sediment Removed from Debris Basins versus Water Year for Water Years 1990-91 to 2010-11



The Station Fire of 2009 significantly burned the watershed of four reservoirs maintained by the Flood Control District, namely Big Tujunga, Cogswell, Devil's Gate, and Pacoima Reservoirs. Based on surveys conducted before and after the Station Fire, approximately 3.4 MCY of sediment deposited in those four reservoirs during the 2 storm seasons following the Station Fire.

As a result of the fires, the Flood Control District's sediment management needs have far exceeded the projections in the Sediment Management Strategic Plan completed in 2006. This accelerated the need to develop a new plan.

1.3 FLOOD AND DEBRIS FLOW RISK MANAGEMENT, GROUNDWATER RECHARGE, AND SEDIMENT MANAGEMENT

Historically, sediment-laden water travelled from the mountains to the ocean along rivers and tributaries with changing courses, depositing sediment across alluvial fans and floodplains. Development of the Los Angeles Basin drastically changed this natural process. As the population grew, development encroached on the alluvial fans and floodplains. This resulted in exposure of development and people to flood waters and debris flows. Consequently, the existing engineered flood risk management system was developed to manage the risk of floods and debris flows for the Los Angeles Basin and its many residents.

The Flood Control District owns and maintains the vast majority of the flood risk management system within the Flood Control District's boundaries. The Flood Control District is responsible for 500 miles of open channel, 3,035 miles of underground storm drains, 14 dams, and 162 debris basins. The dams help attenuate peak-storm flows, so that downstream components of the system are not overwhelmed. The dams also capture debris flows. The concrete channels help move flood waters that cannot be stored in the reservoirs as efficiently as possible to the ocean using a minimal amount of land area. Debris basins capture sediment and debris that erode from the mountains before they enter downstream facilities. This reduces risk for adjacent communities from debris flows and ensures the system operates as designed by eliminating debris from the concrete channels and storm drains downstream. Sediment-laden flows can cause accelerated wear and reduced capacity for downstream facilities. The other major components of the flood risk management system within the Flood Control District's boundaries are owned and maintained by the U.S. Army Corps of Engineers.

In addition to managing the risk of floods and debris flows, the Flood Control District plays a vital role in recharging the region's groundwater aquifers. The reservoirs behind the dams store rainwater, runoff, and melted snow. When it is safe, controlled releases of water are conveyed through the channels. Water is either captured by water purveyors or allowed to flow downstream to spreading facilities used to recharge the region's groundwater aquifers. Local water sources provide for approximately a third of the region's water demand. In order to supply the remaining water demand, water is imported and reclaimed by various agencies. The Flood Control District system is used to convey and infiltrate some of the imported water as well as the reclaimed water into the groundwater aquifers. The Flood Control District recharges roughly 280,000 acre-feet of water annually, meeting the yearly needs of approximately 550,000 families of 4.

Dams, reservoirs, debris basins, channels, and spreading facilities are affected by the sediment that erodes from the mountains. Sediment impacts the operations at dams and reservoirs in several ways. Sediment accumulation behind a dam can render a dam's outlet valves inoperable if the valves become buried by sediment. It also decreases storage capacity, thus reducing the ability to manage peak-storm flows, capture debris flows, and store water for later use. By virtue of their function, debris basins capture sediment washed from the mountains during storms. Sediment that remains in the debris basin reduces the storage capacity for sediment inflows resulting from future storms. In channels, some sediment deposits as flows travel downstream. Fine sediment in the water infiltrated at spreading facitlities reduces groundwater recharge rates over time. In order to maintain the proper functionality of Flood Control District facilities, sediment has to be managed, with the majority of the sediment management needs being associated with the reservoirs and debris basins.

1.4 EFFECTS OF FIRES

Wildfires greatly increase the amount of runoff and erosion from mountainous watersheds. A recently burned watershed could produce greater than normal sediment volumes due to higher erosion caused by a lack of vegetation or lowered infiltration rates caused by hydrophobic soil. Flood flows from a denuded watershed can transport large quantities of sediment and debris including boulders and vegetation. As much as 120,000 cubic yards of sediment and debris have been produced per square mile of a burned watershed after a major storm. The duration and intensity of a storm, as well as the severity of the burn on a given watershed, determine the debris potential.

The first five years after a fire have proven to be the most critical. Typically by years four and five, vegetation in the burned areas significantly recovers and the debris potential is reduced by about half of what it was immediately after the fire. It takes approximately 10 years for the burned area to return to the prefire debris potential level.

1.5 DEVELOPMENT APPROACH

Various alternatives for sediment removal, transport, beneficial use, and placement were identified and analyzed based on five main factors - environmental impacts, social impacts, implementability, performance, and approximate 20-year cost. A number of specific concerns were considered within each factor, as shown in Table 1-1.

Table 1-1 Evaluation Factors Considered for Each Sediment Management Alternative

Evaluation Factor	Description	
Environmental Impacts	• Habitat • Water quality	• Groundwater recharge • Air quality
Social Impacts	• Traffic • Scenic and visual impacts	• Noise • Recreation
Implementability	• Construction issues	• Permits or agreements
Performance	• Previous experience • Cleanout capacity	• Number of operations required to address the planning quantity
Cost	• Estimated total cost over 20 years	

Using the five factors, the Flood Control District, with input from stakeholders, analyzed each alternative to identify the feasibility for reservoirs, and debris basins. Removal, transport, beneficial use, and placement alternatives identified as feasible for each facility type were put together for each reservoir and the debris basins to create combined sediment management alternatives.

1.6 OUTREACH STRATEGY

The Strategic Plan represents the results of a continuing dialogue about sediment management between the Flood Control District and the numerous stakeholders in the region. To ensure it accurately reflects the input of the numerous stakeholders in the Los Angeles Region, the Flood Control District engaged agency, industry, and public stakeholders to help shape the various sediment management alternatives under consideration. The tenets of the public outreach program included:

- Stakeholder Task Force: created to gather input from external stakeholders during the development and review of potential sediment management alternatives to be incorporated into the Strategic Plan. Regulatory agencies, cities, landfill owners and operators, water agencies, sand and gravel companies, environmental groups, and others were invited to participate in the Stakeholder Task Force. The first Stakeholder Task Force meeting was held in January 2011. The Stakeholder Task Force met approximately every two months throughout the development of the Strategic Plan. All Stakeholder Task Force meetings were open to the public.

- Advisory Working Group: created to gather additional input and a broad perspective from external stakeholders based on the members' diverse experiences and key roles in the stakeholder community. Participation included representatives from local jurisdictions, environmental groups, and the media. The Advisory Working Group met approximately every month.

- Public Open Houses: conducted to provide an open forum for public input during the Strategic Plan review period. Two open houses were held in the general vicinity of major facilities to allow neighboring community members to provide feedback on the alternatives identified in the Strategic Plan.

- Website: developed a website (www.LASedimentManagement.com) dedicated to sediment management to provide ongoing information to the public on the development of the Strategic Plan and the planning of upcoming reservoir sediment removal projects.

Based on valuable input from agencies, organizations, industry, and the public through the Stakeholder Task Force, Advisory Working Group, and Public Open Houses, the Flood Control District evaluated numerous sediment management alternatives. This input was used to develop the combined alternatives presented in this plan.

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SECTION 2 EXISTING FACILITIES

The Flood Control District owns and operates numerous facilities to provide flood and debris flow risk management, water conservation, and sediment management. This section describes those facilities and the areas in which they are located. This section also discusses facilities which are not owned by the Flood Control District, but have been or could be used in relation to sediment management operations. The information provided in this section was current as of October 2012.

2.1 FLOOD MAINTENANCE AREAS

For operational purposes, the Flood Control District has been divided into three separately managed Flood Maintenance Areas – East, West, and South – as shown in Figure 2-1. The Flood Maintenance Areas were used to group the debris basins and associated sediment management needs for this Strategic Plan.

2.1.1 EAST FLOOD MAINTENANCE AREA

The East Flood Maintenance Area (East Area) covers roughly 659 square miles, approximately half of which is open space in the Angeles National Forest. It comprises the portion of the San Gabriel Mountains between Highway 2 (Angeles Crest Highway) and the eastern boundary of the Flood Control District. The San Gabriel Mountains are one of the most active sediment generation areas in the County. The East Area is responsible for managing the sediment that is captured by the Flood Control District facilities in these mountains and their foothills. The foothills in this area are almost fully developed. Therefore, construction of new debris basins will be limited.

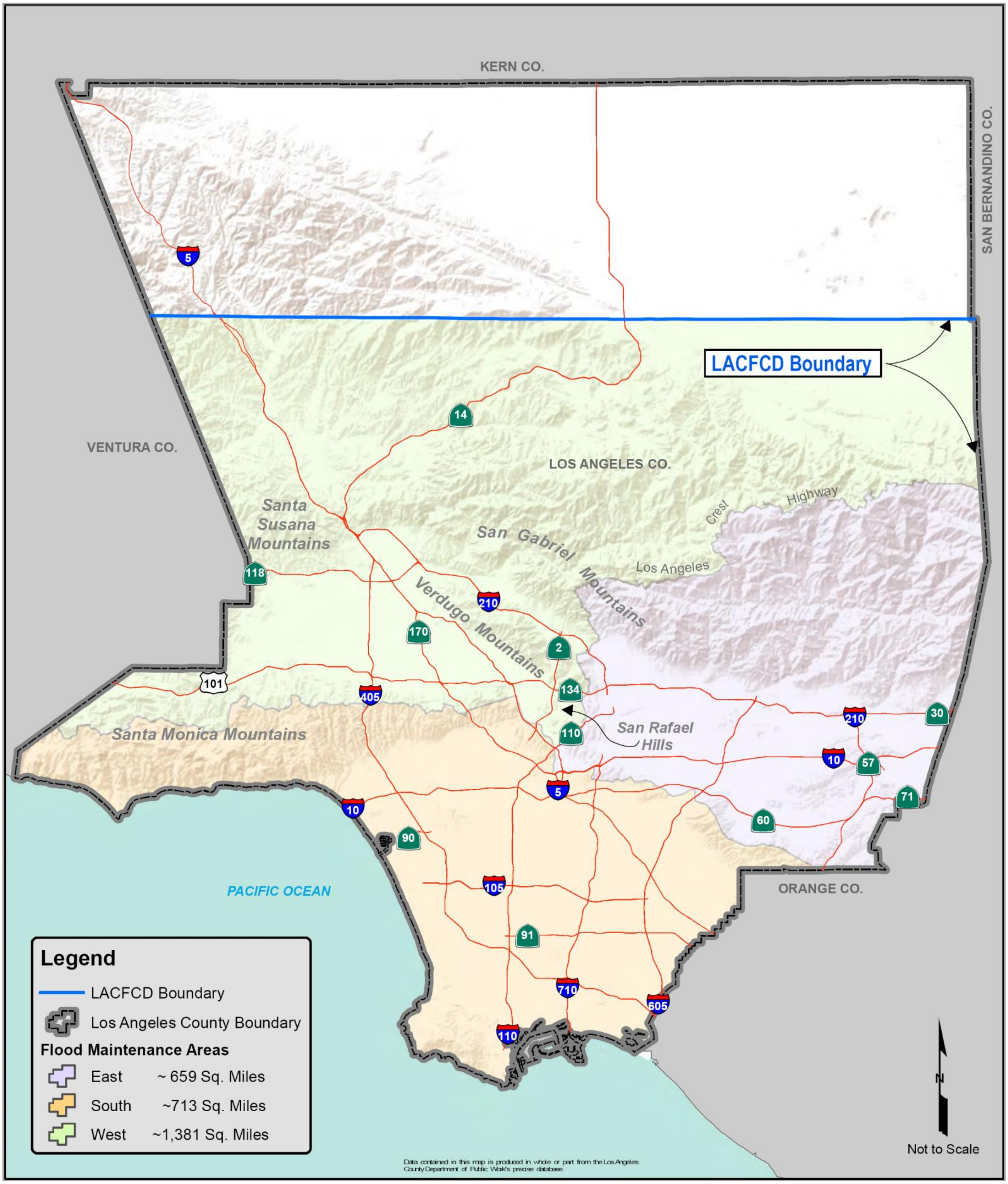
2.1.2 WEST FLOOD MAINTENANCE AREA

The West Flood Maintenance Area (West Area) covers approximately 1,381 square miles, making it the largest of the three flood maintenance areas. It includes the portion of the San Gabriel Mountains west and north of Highway 2 (Angeles Crest Highway), approximately half of the Santa Susana Mountains, the Verdugo Mountains, San Rafael Hills, a small portion of the Santa Monica Mountains, and numerous smaller mountains in the portion of the Santa Clara Watershed within the Flood Control District. The West Area is responsible for managing the sediment that is captured by the Flood Control District facilities in these mountains and their foothills. The San Gabriel Mountains and the Verdugo Mountains are the most active sediment generation areas in the County. The Santa Clara River Watershed Area, in the northern part of the West Area, still has potential for significant development. It is expected that this will result in a number of new debris basins and an increase in the flood maintenance area's sediment management need.

2.1.3 SOUTH FLOOD MAINTENANCE AREA

The South Flood Maintenance Area (South Area) covers approximately 713 square miles. It includes the majority of the Santa Monica Mountains. Construction of new debris basins in this area will be limited due to minimal development potential.

Figure 2-1 The Flood Control District and its Flood Maintenance Areas



2.2 RESERVOIRS

The dams and reservoirs in the County were constructed mainly during the 1920-30s for the management of risks associated with floods and debris flows and for water conservation purposes. At one point, there were 15 dams owned and operated by the Flood Control District. Since Sawpit Dam was decommissioned in 1999, the Flood Control District now owns and operates the 14 dams shown in Figure 2-2.

The U.S. Army Corps of Engineers (Army Corps of Engineers) also owns and operates five dams within the Flood Control District boundaries; namely, Hansen, Lopez, Santa Fe, Sepulveda, and Whittier Narrows Dams (these are also referred to as Flood Control Basins). The Army Corps of Engineers independently operates and maintains its dams; therefore, maintenance of the Army Corps of Engineers facilities is not part of this Strategic Plan. However, due to the relationship between the Army Corps of Engineers facilities and the Flood Control District's facilities, the two agencies coordinate operation of their facilities.

Table 2-1 below provides information about the reservoirs behind the Flood Control District's 14 dams, including historic sediment removal and recently determined available capacities. For a description of the Flood Control District's reservoir cleanout operations by sluicing and excavation please refer to Section 3.3.4.

Table 2-1 Reservoirs in the Flood Control District

Reservoir	Original Capacity (MCY)	Historic Sediment Removal		Conditions as of the Last Survey				
		Sluiced (MCY)	Excavated (MCY)	Date of Last Survey	Sediment Quantity in the Reservoir (MCY)	Available Capacity[a] (MCY)	Percent of Capacity Taken Up by Sediment[b]	Percent of Capacity Available[c]
Big Dalton	1.7	0.0	1.6	Jul 2008	0.0	1.7	0%	100%
Big Tujunga	10.1	3.1	10.4	Aug 2011	2.0	8.1	20%	80%
Cogswell	19.8	1.3	4.4	Aug 2011	3.9	16.8	20%	80%
Devils Gate	7.4	2.2	5.9	Mar 2011	3.9	3.7	53%	47%
Eaton	1.5	0.0	3.3	May 2010	0.5	1.1	33%	67%
Live Oak	0.4	0.0	0.6	Nov 2008	0.008	0.4	2%	98%
Morris	52.1	2.6	0.0	Dec 2010	13.1	36.4	25%	75%
Pacoima	9.8	2.2	0.0	Sep 2010	5.1	4.7	52%	48%
Puddingstone	28.1	0.0	0.0	Sep 2004	1.7	26.4	6%	94%
Puddingstone Diversion	0.2	0.0	1.5	May 2005	0.0	0.4[d]	0%	100%
San Dimas	2.4	0.2	4.4	Aug 2009	0.0	2.5[d]	0%	100%
San Gabriel	86.1	11.8	24.3	Dec 2010	14.4	71.7	17%	83%
Santa Anita	2.2	1.9	0.8	Dec 2010	0.3	1.2	14%	86%
Thompson	1.0	0.0	0.4	Jun 2004	0.2	0.8	20%	80%

Notes

a. Available Capacity = Original Capacity – Sediment Quantity in the Reservoir, or as determined based on the surveys.
   Example: San Gabriel Reservoir's Available Capacity = 86.1 MCY – 14.4 MCY = 71.7 MCY
b. Percent of Capacity Taken up by Sediment = Sediment Quantity in the Reservoir / Original Capacity.
   Example: San Gabriel Reservoir's Capacity Taken Up by Sediment = 14.4 MCY / 86.1 MCY = 17%
c. Percent of Capacity Available = 100% - Percent of Capacity Taken Up by Sediment
   Example: San Gabriel Reservoir's Percent of Capacity Available = 100% - 17% = 83%
d. When a reservoir's available capacity is greater than the original capacity, it could be that the reservoir was overexcavated at some point. Alternatively, it could be a reflection of the inaccuracy of bathymetric surveys, which are used to determine sediment quantities in reservoirs.

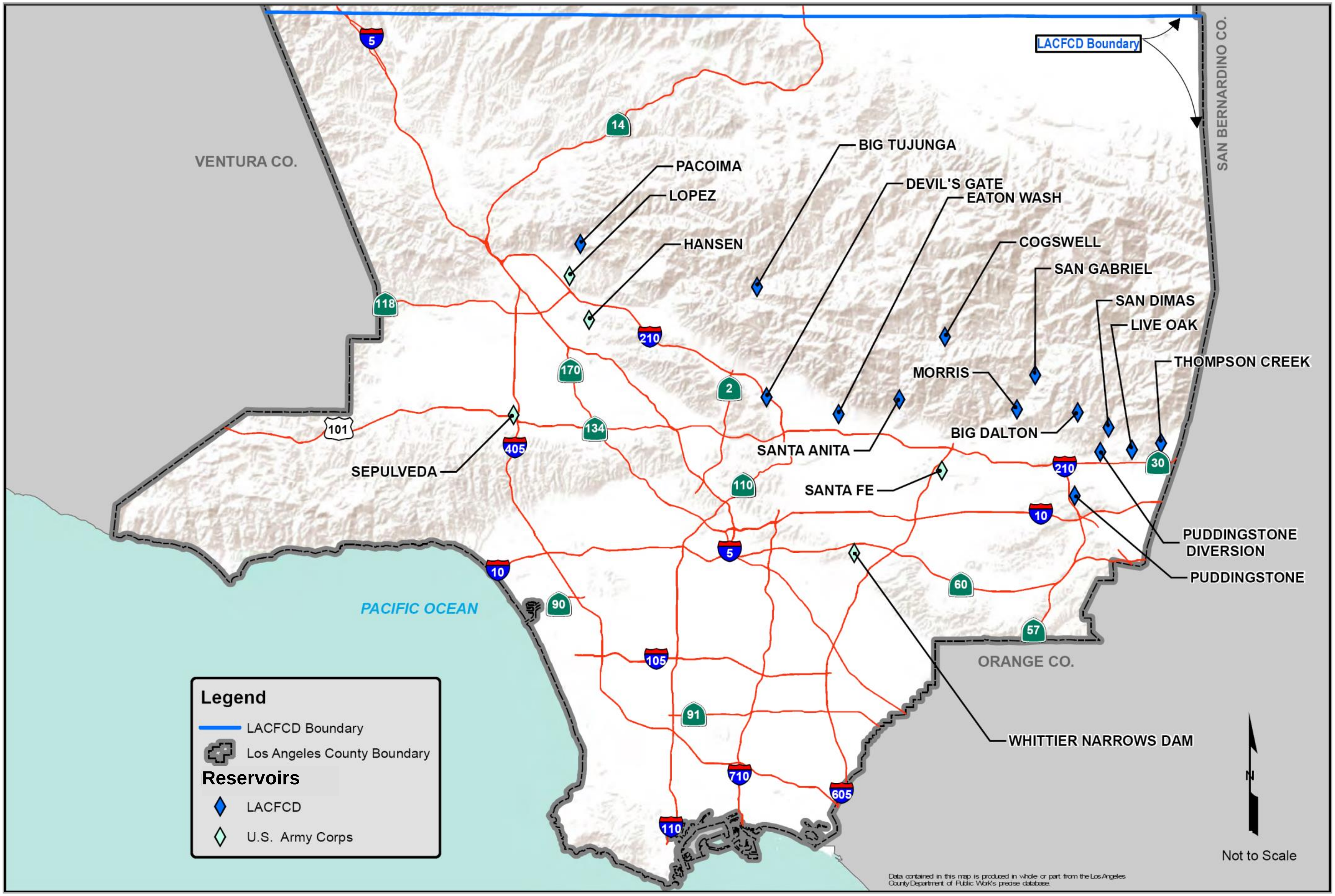
For the purposes of this Strategic Plan, the reservoirs have been categorized into two groups, large reservoirs and small reservoirs. Of the 14 reservoirs, 9 are considered large. Large reservoirs are larger than some of the other reservoirs in respect to the size of the dam, reservoir, drainage area, and sediment accumulation. All the large reservoirs except for Devil's Gate Reservoir are operated with a pool of water.

The large reservoirs are further divided, separating the large and complex system of reservoirs along the San Gabriel River, as seen in Table 2-2. Sections 7-9 of this Strategic Plan comprise the reservoir alternatives analysis according to these categorizations.

Table 2-2 General Categories of Reservoirs

Large Reservoirs		**Small Reservoirs**
San Gabriel River Reservoirs	***Other Large Reservoirs***	
Cogswell	Big Tujunga	Big Dalton
San Gabriel	Devil's Gate	Eaton
Morris	Pacoima	Live Oak
	Puddingstone	Puddingstone Diversion
	San Dimas	Thompson
	Santa Anita	

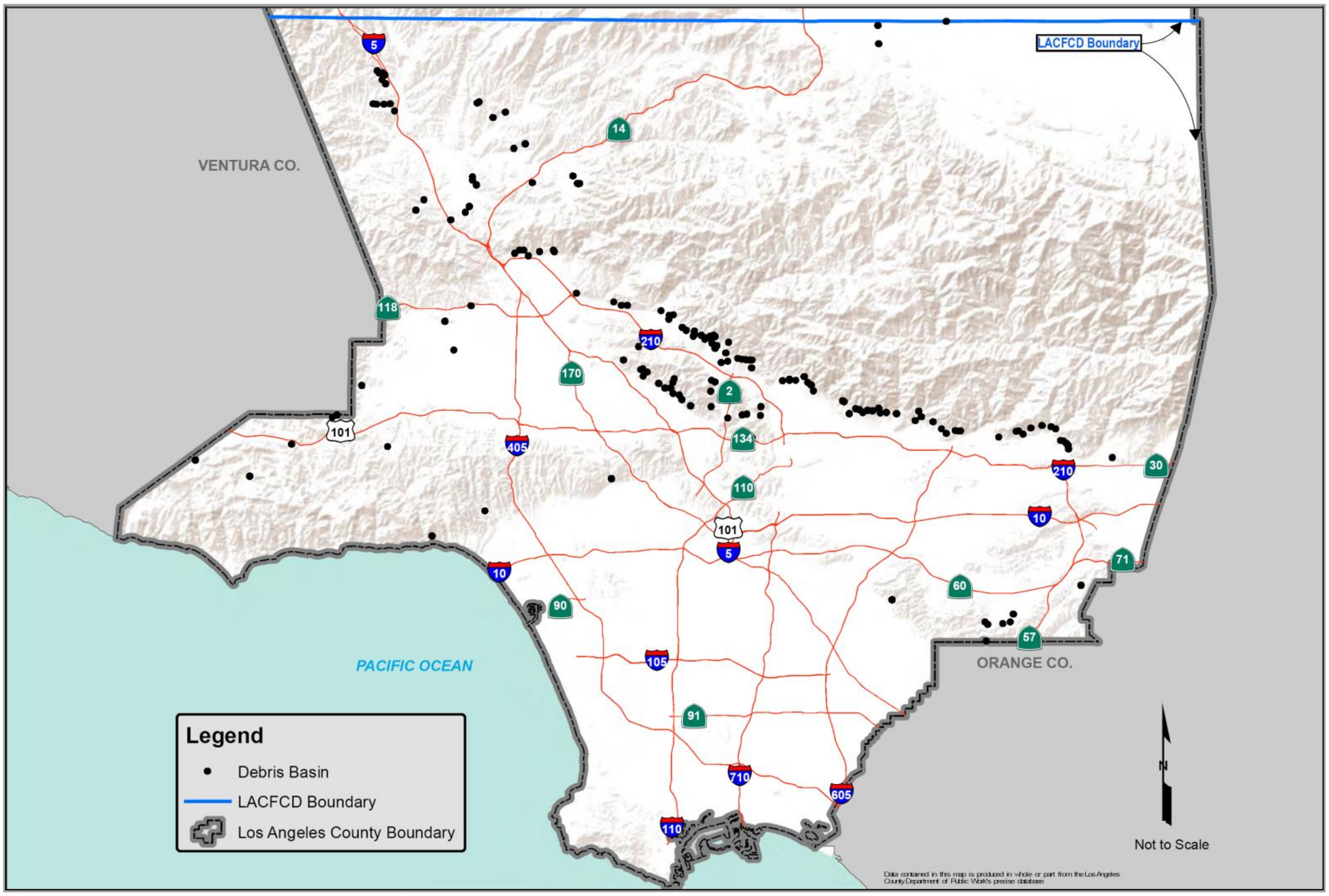
Figure 2-2 Reservoir Locations



2.3 DEBRIS BASINS

Debris basins are instrumental components of the flood risk management system. They are typically located at the mouths of canyons and are used to manage the risk of flooding due to flood water, floatable debris, sediment, boulders, and debris flows that flow from canyons during storms. By settling out the aforementioned materials and allowing the clarified water to flow through, debris basins protect the downstream system. The capacity of most debris basins ranges from 20,000 to 70,000 cubic yards. As of 2012, the Flood Control District was responsible for maintaining the 162 debris basins shown in Figure 2-3. The number of debris basins maintained by the Flood Control District could increase in the future if the maintenance of additional debris basins built by developers is transferred to the Flood Control District.

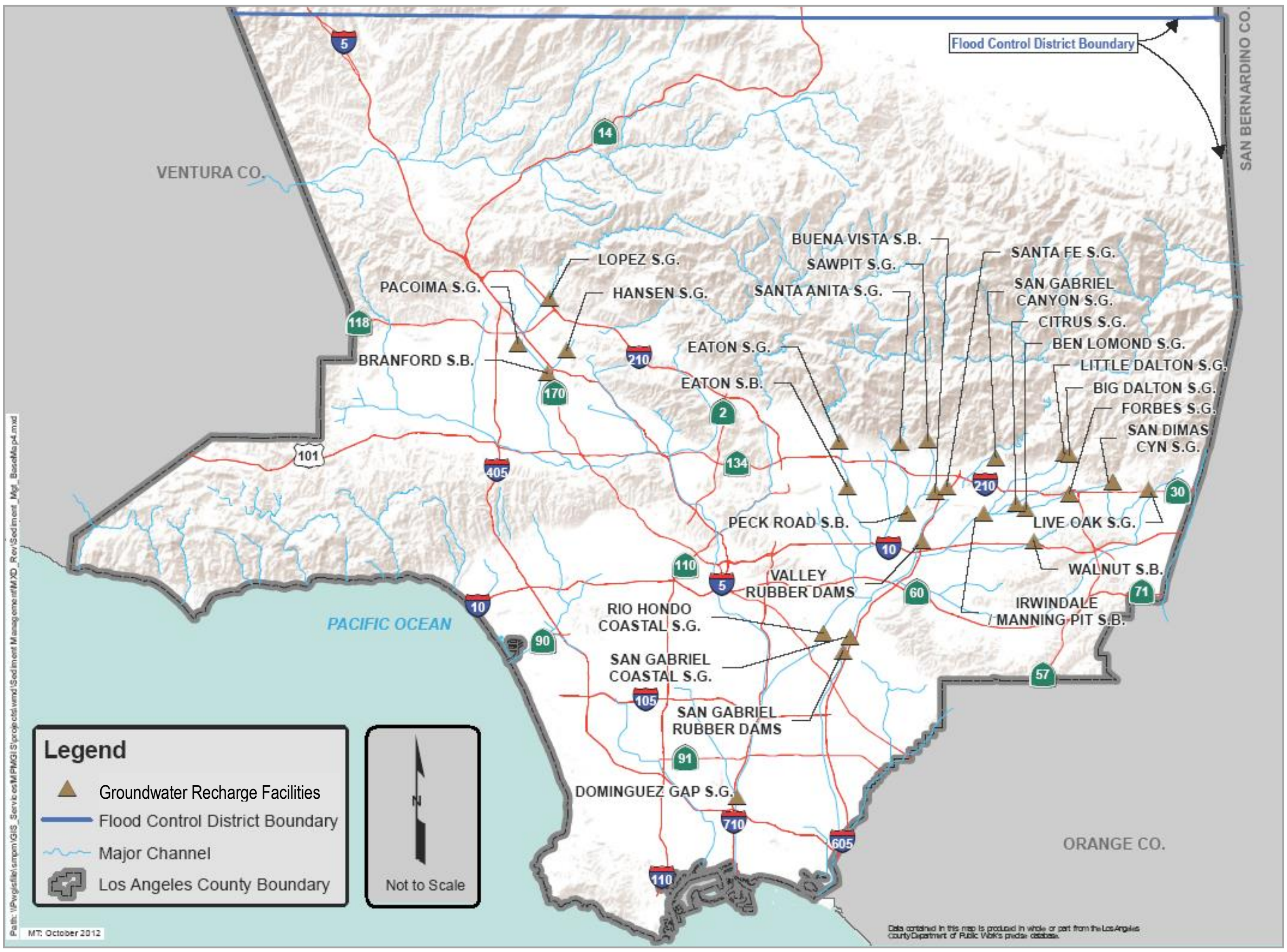
Figure 2-3 Debris Basin Locations



2.4 GROUNDWATER RECHARGE FACILITIES

Groundwater recharge facilities are areas designed for deliberate recharge of groundwater. They are located downstream of reservoirs. This allows for controlled amounts of water in the reservoirs to be released to the recharge facilities in order to recharge groundwater supplies. Groundwater recharge facilities are also used to infiltrate imported water into groundwater aquifers. Groundwater recharge facilities include spreading grounds and riverbed percolation areas. The Flood Control District owns and operates the 26 groundwater recharge facilities shown in Figure 2-4. Additionally, the Flood Control District operates several groundwater recharge facilities for various other agencies. An average of 280,000 acre-feet of water is recharged annually in all. Sediment management operations at reservoirs could potentially impact spreading facilities and their ability to infiltrate water.

Figure 2-4 Groundwater Recharge Facility Locations



2.5 SEDIMENT PLACEMENT SITES

Sediment placement sites (SPSs) are sites developed by the Flood Control District throughout the County to be strategically filled with sediment resulting from the cleanout of the facilities it maintains. Typically, sediment from the debris basins, reservoirs, and spreading facilities maintained by the Flood Control District has been permanently placed at the SPSs. In addition, sediment from the facilities maintained by the Army Corps of Engineers is sometimes deposited at the SPSs. Most of the SPSs used by the Flood Control District are owned in fee; however, there are some that are used under a permit or agreement. Ideally the SPSs are located adjacent to the facilities they serve in order to reduce haul distances. This is especially important to quickly manage the sediment accumulated in debris basins affected by fires.

For the purpose of this Strategic Plan, the SPSs in the Flood Control District have been categorized into three statuses: active, near-capacity, and potential. An active SPS has capacity to receive sediment and is used when necessary. A near-capacity SPS may be able to receive minimal quantities of sediment depending on the site. A potential SPS was intended to operate as an SPS, but currently does not. The potential SPS category includes sites which have previously been used as an SPS. Development of some of the potential SPSs has not yet been pursued. Others have constraints, which include permitting issues or strong community opposition. Figure 2-5 illustrates the location and status of the SPSs in the Flood Control District.

Figure 2-5 SPS Location and Status

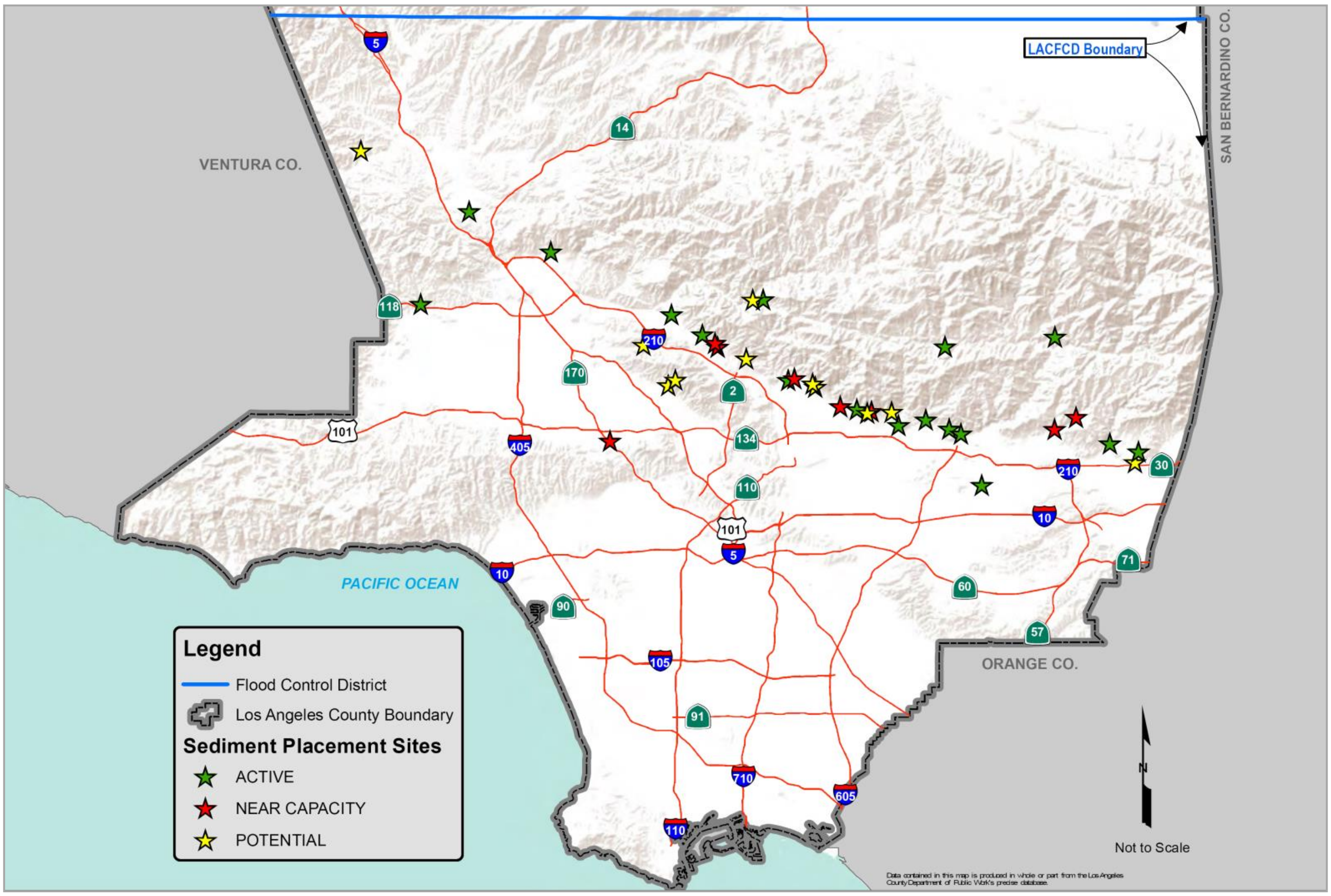


Table 2-3 lists the SPSs by activity status and Flood Maintenance Area as of November 2012. The table also provides information on the estimated remaining capacity. At this time there are 17 SPSs considered active with a combined estimated capacity of 48 MCY. One site in particular, Burro Canyon SPS, has a remaining capacity of approximately 29 MCY, accounting for the bulk of the remaining capacity at all sites. In addition, there are 8 near-capacity SPSs and 11 potential SPSs. The specific predominant constraint or requirement for each potential SPS is detailed in Table 2-4.

Table 2-3 SPS Activity Status and Capacities

Status	Flood Maintenance Area	Facility	Original Capacity (CY)	Estimated Remaining Capacity as of January 2011 (CY)
Active (17 SPSs)	East	Burro[a]	47,175,000	29,425,000
		Cogswell[a]	5,600,000	3,200,000
		Hastings	210,000	80,000
		Lincoln	270,000	12,000
		Maddock	475,000	415,000
		Manning	4,155,000	2,020,000
		San Dimas	Unknown	200,000
		Santa Anita	4,525,000	2,990,000
		Sawpit	1,550,000	390,000
		Spinks	1,150,000	635,000
		Webb	805,000	500,000
	West	Browns	405,000	60,000
		Dunsmuir	2,030,000	560,000
		Maple[b]	12,000,000	4,000,000
		May	4,970,000	3,300,000
		Wildwood	75,000	7,000
		Zachau	510,000	220,000
Near-Capacity (8 SPSs)	East	Auburn	20,000	5,000
		Big Dalton	Unknown	<1,000
		Dalton	1,635,000	<1,000
		Eaton	110,000	<1,000
		West Ravine	Unknown	<1,000
	West	Aqua Vista	40,000	10,000
		Eagle	145,000	<1,000
		Shields	Unknown	<1,000
Potential (11 SPSs)	East	Bailey	130,000	130,000
		Lannan	Unknown	60,000
		Las Flores	15,000	15,000
		Live Oak	295,000	295,000
		Rubio	60,000	25,000
	West	Big Tujunga	5,940,000	150,000
		Del Valle	Unknown	350,000
		Hay	85,000	80,000
		La Tuna	9,000,000	9,000,000
		Sunset Lower	205,000	205,000
		Sunset Upper	345,000	345,000

Notes

a. Cogswell SPS and Burro SPS are designated exclusively for the disposal of sediment from Cogswell and San Gabriel Reservoirs, respectively.

b. The Flood Control District is pursuing the renewal of the U.S. Forest Service Special Use Permit for Maple SPS.

Table 2-4 Potential SPS Status

Potential SPS	Constraint / Other
Bailey	The site is being used as a city park even though the site is owned by the Flood Control District. . It is expected that any attempt to use the site as previously planned, that is, as a sediment placement site, would be met with a high degree of public opposition.
Big Tujunga	Special Use Permit has not been renewed by the issuing agency.
Del Valle	Sites are not developed.
Hay	
Lannan	
Las Flores	
La Tuna	
Live Oak	
Rubio	
Sunset Lower	
Sunset Upper	

2.6 FACILITIES IN THE EAST FLOOD MAINTENANCE AREA

In the East Area there are 12 reservoirs, 17 spreading facilities, 11 active SPSs, 5 SPSs near capacity, and 5 potential SPSs. The East Area maintains 53 debris basins, including 2 debris basins (Fullerton and Harbor Boulevard Debris Basins) located within the boundaries of the South Area. The location of these facilities can be found on Figure 2-6 and Figure 2-7. Table 2-5 provides an alphabetized list of the 53 debris basins in the East Area.

Table 2-5 East Area Debris Basin List

1	Auburn	19	Fullerton	37	Morgan
2	Bailey	20	Gooseberry	38	Mull
3	Beatty	21	Gordon	39	Oak Park
4	Big Dalton	22	Harbor Boulevard	40	Oakglade
5	Bradbury	23	Harrow	41	Rubio
6	Bramhall	24	Hillman	42	Ruby Lower
7	Buena Vista	25	Hook East	43	Santa Anita
8	Carriage House	26	Hook West	44	Sawpit
9	Carter	27	Inverness	45	Sierra Madre Dam
10	Chamberlain	28	Kinneloa East	46	Sierra Madre Villa
11	Crescent Glen	29	Kinneloa West	47	Spinks
12	Crestview	30	Lannan	48	Sturtervant
13	Devonwood	31	Las Flores	49	Sunnyside
14	Emerald East	32	Las Lomas	50	Turnbull
15	Englewild	33	Lincoln	51	Wellington
16	Fair Oaks	34	Little Dalton	52	West Ravine
17	Fern	35	Maddock	53	Westridge
18	Fieldbrook	36	Monument		

Figure 2-6 East Area Debris Basin Map

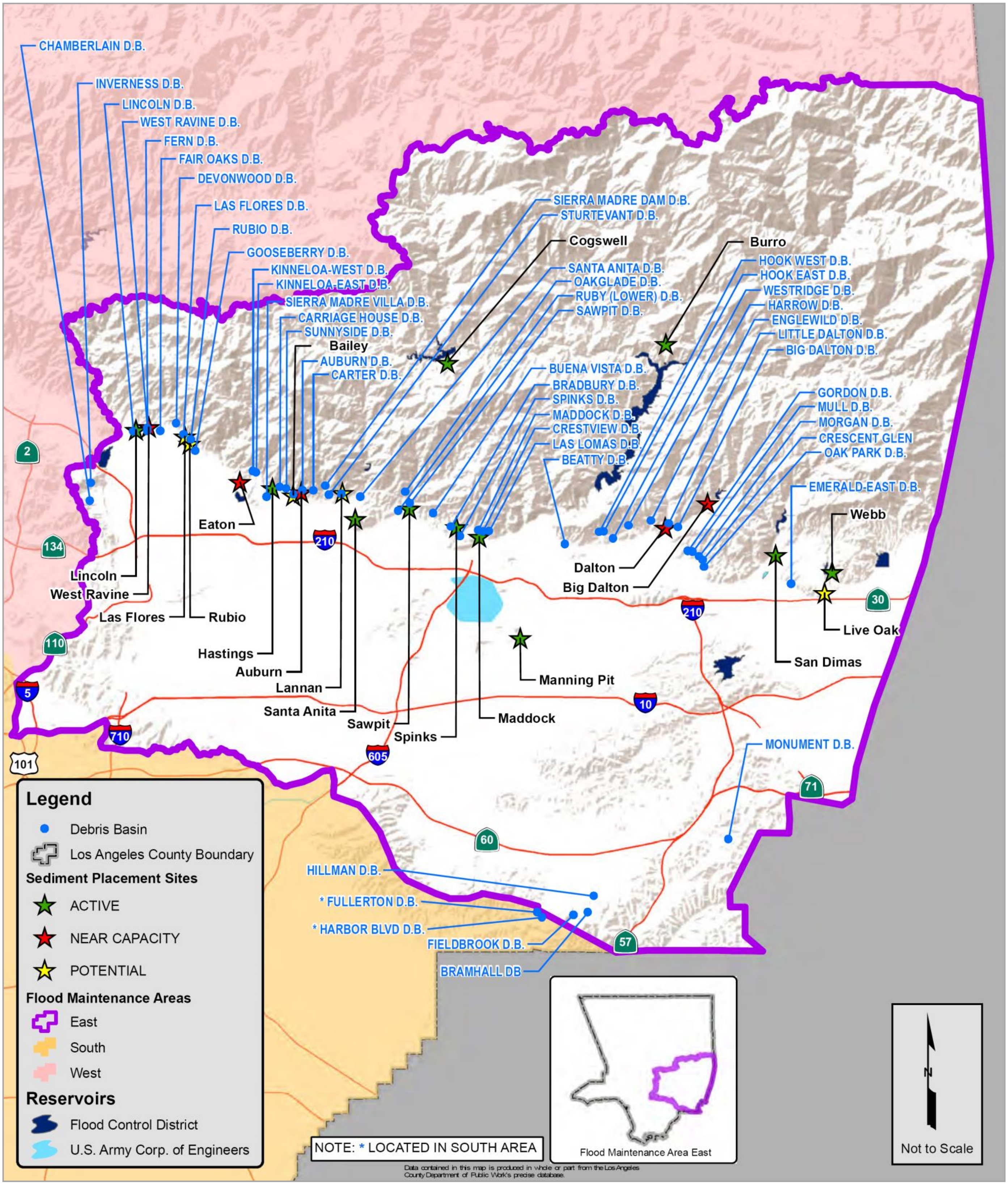
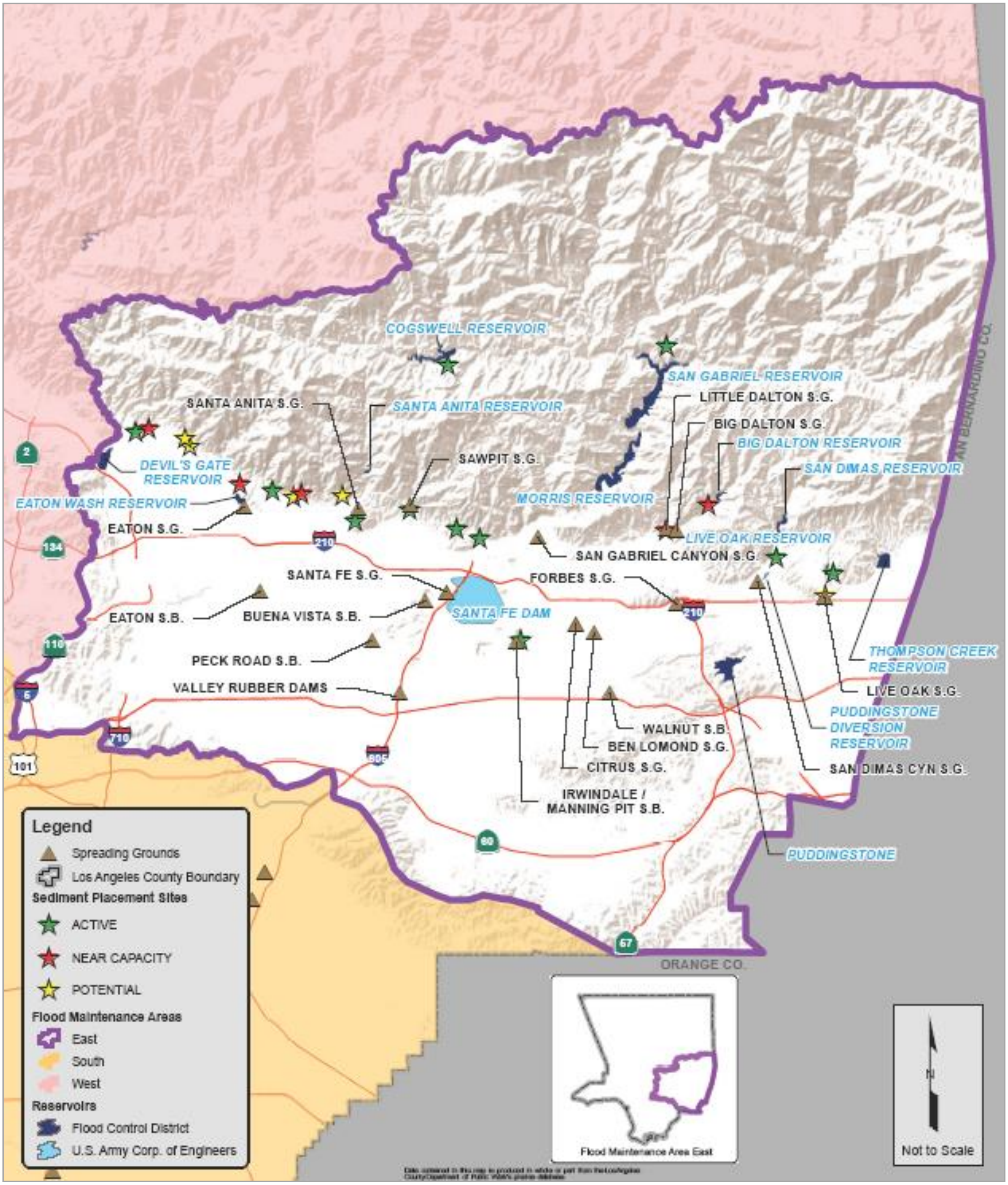


Figure 2-7 East Area Groundwater Recharge Facilities and Reservoirs Map



2.7 FACILITIES IN THE WEST FLOOD MAINTENANCE AREA

In the West Area there are 2 reservoirs, 6 active SPSs, 2 SPSs near capacity, 6 potential SPSs, and 4 spreading facilities. The West Area maintains 106 debris basins, including 1 debris basin (Hazelnut Debris Basin) located within the boundaries of the South Area. The location of these facilities can be found on Figure 2-8 and Figure 2-9. The key for the debris basins on Figure 2-8 can be found in Table 2-6.

Table 2-6 West Area Debris Basin Key

1	Aliso	36	Gould	71	Rowley
2	Arbor Dell	37	Gould Upper	72	Royal Terminus
3	Avenue S	38	Green Hill # 1	73	Saddeback # 1
4	Avenue T-8	39	Green Hill # 2	74	Saddeback # 2
5	Bakerton	40	Greensbrier	75	Saddeback # 3
6	Bell Creek	41	Halls	76	Schoolhouse
7	Big Briar	42	Harter Lane	77	Schwartz
8	Blanchard	43	Haven Way	78	Shadow
9	Blue Gum	44	Hay	79	Shields (Upper)
10	Brace	45	High Sierra	80	Shields
11	Bracemar	46	Hillcrest	81	Skyridge
12	Brand	47	Hipshot # 1	82	Sloan
13	Caitlyn Circle	48	Hog	83	Snover
14	Calle Robleda	49	Irving Drive	84	Sombrero
15	Camp Plenty	50	Knoll	85	Starfall
16	Cardiff	51	La Salle	86	Stetson
17	Cassara	52	La Tuna	87	Stevenson Ranch
18	Chandler	53	Limekiln	88	Stough
19	Childs	54	Linda Vista	89	Stratford
20	Cloud Creek	55	Line "A"	90	Sunset (Lower)
21	Contento	56	Lopez Canyon	91	Sunset (Upper)
22	Cooks	57	May No. 1	92	Sunset Canyon - Deer
23	Cooks M1-A	58	May No. 2	93	Thousand Oaks
24	Copper Hill Line "B"	59	Montana	94	Verdugo
25	Cordoba	60	Moondust	95	Victoria
26	Crystal Springs # 1	61	Mountbatten	96	Ward
27	Deer	62	Mullally	97	Wedgewood
28	Denivelle	63	Mustang	98	Whitney
29	Dry Canyon - South Fork	64	Oak	99	Wilbur
30	Dunsmuir	65	Oakdale	100	Wildwood
31	Eagle	66	Oakmont View Drive	101	William S. Hart Park
32	Elmwood	67	Oliver	102	Wilson
33	Fort Tejon Road	68	Pickens	103	Winery
34	Gold Club Drive	69	Pinelawn	104	Yucca
35	Goss Inlet	70	Rowley (Upper)	105	Zachau
				106	Hazelnut

Figure 2-8 West Area Debris Basin Map

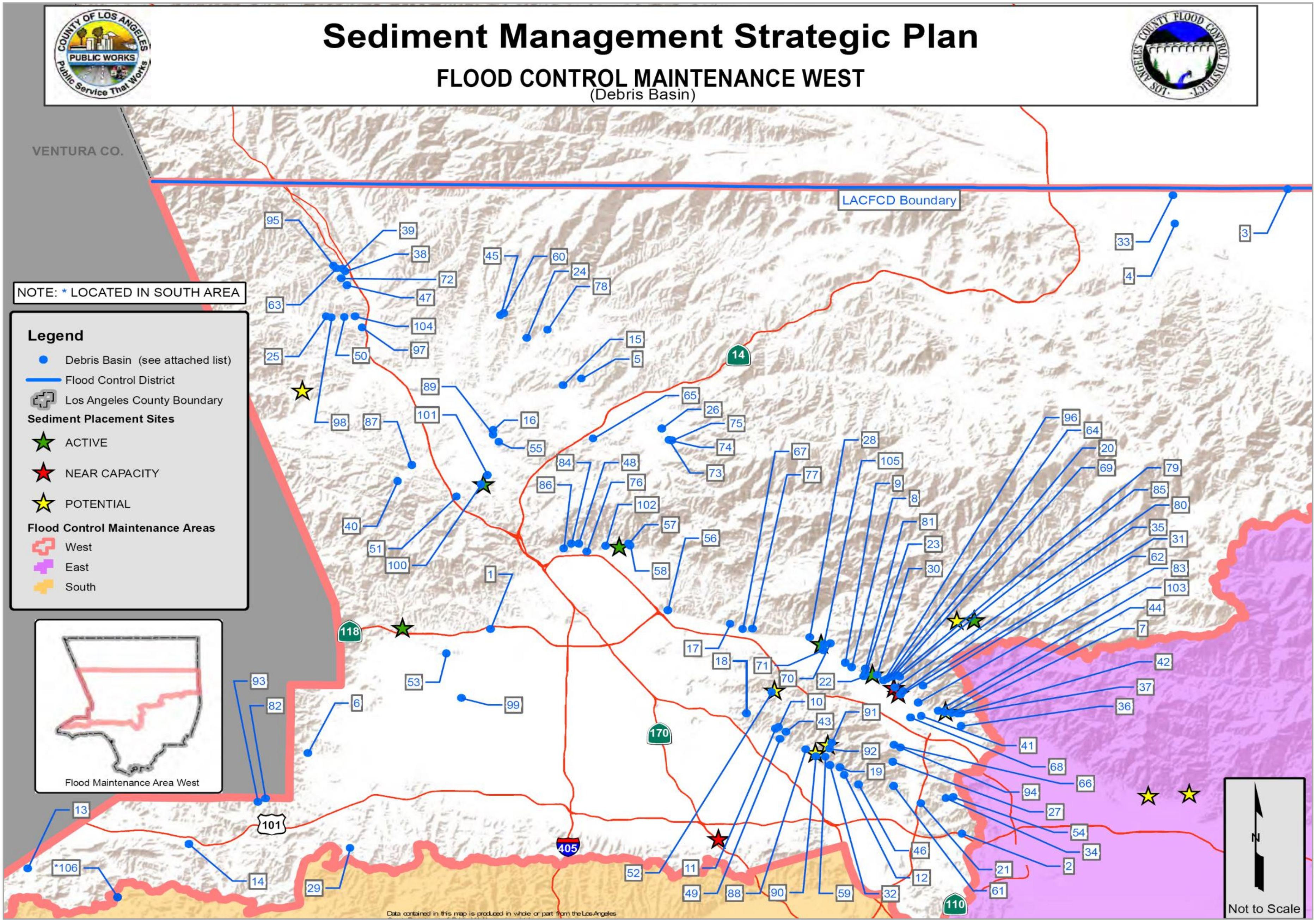
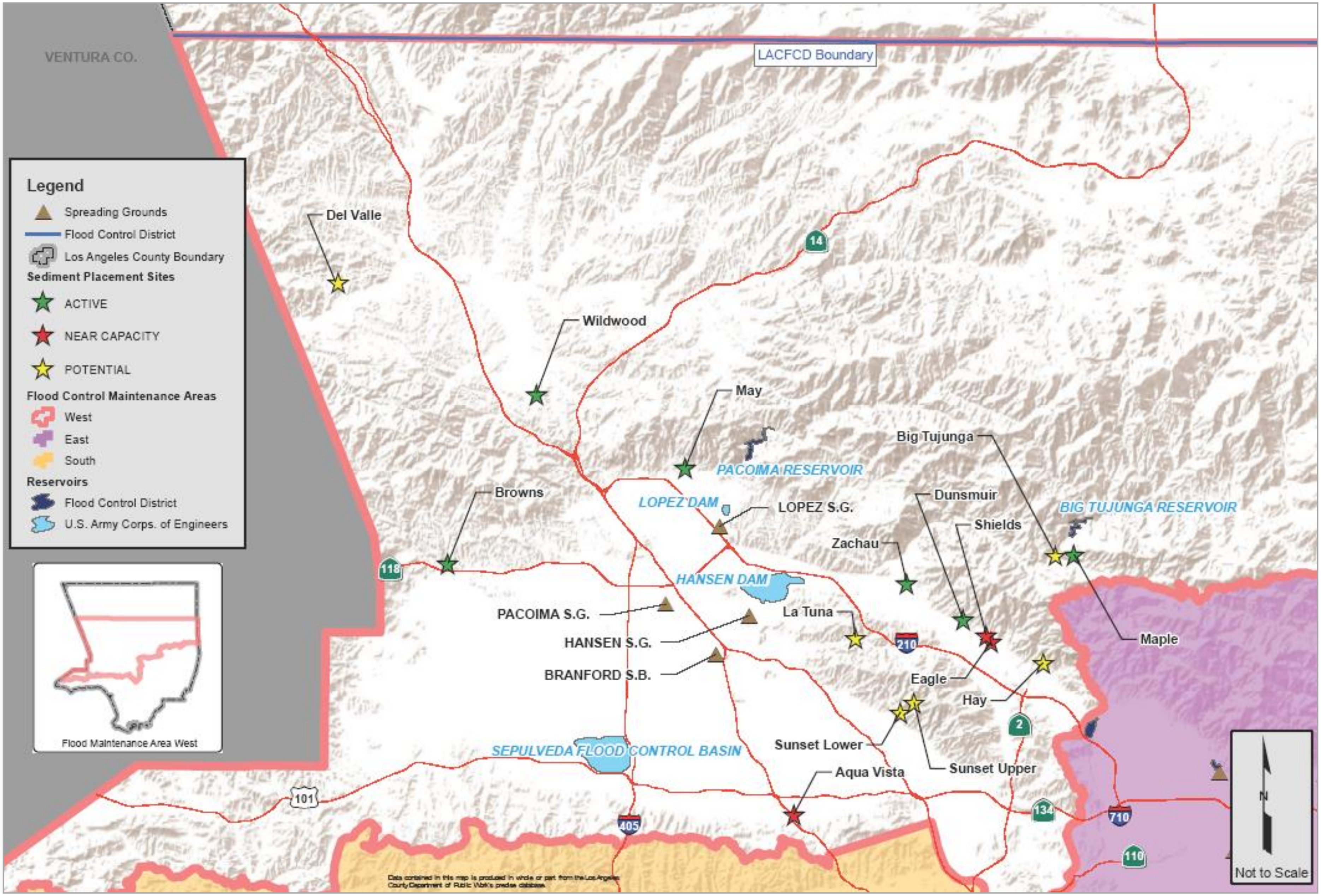


Figure 2-9 West Area Spreading Ground and Reservoir Map



2.8 FACILITIES IN THE SOUTH FLOOD MAINTENANCE AREA

In the South Area there are 8 debris basins, 5 which are maintained by the South Area, 1 by the East Area, and 2 by the West Area. The South Area also has 4 spreading facilities and no reservoirs. The location of these facilities is shown on Figure 2-10.

Figure 2-10 South Area Debris Basin and Spreading Facility Map

2.9 OTHER ENTITIES' FACILITIES RELEVANT TO SEDIMENT MANAGEMENT

While conducting sediment management operations, the Flood Control District sometimes uses facilities owned by other agencies. In the past, the Flood Control District has utilized various solid waste landfills, inert landfills, and inert debris engineered fill operations for sediment placement.

Inactive quarries have the potential of being acquired and developed as SPSs by the Flood Control District, such as was the case for Manning Pit SPS. Additionally, mining does not have to cease before a quarry is able to accept inert debris. This is exemplified by Peck Road Gravel Pit, which in January 2011 was identified as a permitted mining facility and also an inert landfill.

These sediment placement options are addressed further in Sections 6 thru 10.

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SECTION 3 RELEVANT REGULATIONS, POLICIES, & PRACTICES

There are a number of Federal, State, and local regulations that govern Public Works' sediment management operations. Additionally, a number of policies, practices, standards, and guidelines relevant to sediment management have been implemented by the Flood Control District and Public Works for environmental protection, structural safety, and other operational needs.

3.1 REGULATIONS

The Flood Control District's sediment management operations are subject to the following regulations:

- Clean Water Act Section 401 Water Quality Certification
- Clean Water Act Section 404 Permit
- California Fish and Game Code Section 1602 Streambed Alteration Agreement

Additionally, some projects may involve adherence to the requirements of the California Environmental Quality Act, South Coast Air Quality Management District regulations, and/or other Federal regulations. Further investigation will be needed as specific sediment management projects are planned to determine what regulations must be followed and which permits must attained.

3.2 FLOOD CONTROL DISTRICT'S AND PUBLIC WORKS' CURRENT POLICIES

The policies developed by the Flood Control District and Public Works relevant to sediment management are described in this section.

3.2.1 LEVEL OF FLOOD PROTECTION

The Level of Flood and Drainage Protection Standards were published on March 31, 1986, and are contained in File No. 2-15.321. Per the standards, facilities such as dams, debris basins, open channels, and closed conduits shall be designed for the Capital Flood. The Capital Flood is based on a rainfall with a probability of occurrence of once in 50 years (2 percent chance in any year). Furthermore, per the standards, all dams that fall under the control of the State of California laws defining dams shall be constructed to safely pass the probable maximum flood. The probable maximum flood is determined from the probable maximum precipitation, as defined by the National Weather Service.

3.2.2 DAM CLEANOUT POLICY

The Dam Cleanout Policy sets the following criteria for dam cleanouts based on the flood and debris control functions of dams and on dam safety:

- Reservoirs that are used for flood control are to be cleaned out so that the reservoir has the required flood control storage capacity plus the capacity for two design debris events. A Design Debris Event is defined as the quantity of sediment that would be produced by the specific watershed given all the following two conditions had been met: (1) the watershed had been burned four years before, and (2) the watershed was fully saturated when it experienced 24 hours of the type of rain that would be experienced during a 50-year rain event.
- For reservoirs with dams that have loading limits, the criteria for cleanouts are based on dam-by-dam evaluation of the loading limits.

3.2.3 DEBRIS BASIN DESIGN CRITERIA

Debris basin design criteria are detailed in a memorandum dated November 5, 1982, and filed as File No. 2-20.61. According to this policy, debris basins shall be sized based on the tributary area and its potential to produce sediment. Design details are contained in Public Works' Sedimentation Manual.

3.2.4 STANDARD PLANS FOR DEBRIS BASIN OUTLET WORKS

The current Standard Plans for Debris Basin Outlet Works are identified as the County of Los Angeles Department of Public Works Standard Plan 3097-0. They were approved on March 3, 2005. The revisions were made to facilitate maintenance activities and to comply with confined space requirements.

3.2.5 STANDARDS FOR DRAINAGE FACILITIES FOR THE SANTA CLARA RIVER AND MAJOR TRIBUTARIES

On January 15, 1991, Public Works published standards for the design of flood risk management facilities for the Santa Clara River and its major and nonmajor tributary streams. The standards were adopted to maintain environmental balance in the Santa Clara River Basin. The standards address the need to design flood risk management facilities that balance sediment supply and transport to the beaches and proper operation of channels, pipes, etc. The standards touch upon the use and design of debris basins in the Santa Clara River Basin.

3.2.6 PUBLIC WORKS' HYDROLOGY AND SEDIMENTATION MANUALS

Public Works' Hydrology and Sedimentation Manuals describe the techniques to be used for the design of debris basins, storm drains, retention and detention basins, channel projects, and other structures. The current versions of the Hydrology and Sedimentation Manuals are dated January 2006 and March 2006, respectively. Both manuals are available through Public Works' website (http://dpw.lacounty.gov/).

3.3 FLOOD CONTROL DISTRICT'S AND PUBLIC WORKS' CURRENT PRACTICES

To effectively maintain Flood Control District facilities, Public Works and the Flood Control District have established certain practices related to sediment management. This section describes the Flood Control District's and Public Works' current practices.

3.3.1 DEBRIS BASINS CLEANOUT CRITERIA GUIDELINES

On April 1, 1985, Public Works' guidelines for debris basin cleanouts were established. The guidelines indicate the cleanout of debris basins should be initiated as follows:

(a) For debris basins in unburned watersheds, upon the debris basin being 25 percent full.

(b) For debris basins in burned watersheds, upon the debris basin being 5 percent full. When the fire recovery period reaches 5 years, cleanout initiation is gradually phased toward the unburned watershed criteria.

(c) For specified debris basins with limited storage capacity, upon the debris basin being 5 percent full.

The guidelines did not define a burned watershed. However, consistent with relevant permits and certifications, a burned watershed is taken to mean a watershed that has had more than 20 percent of its area burned within the previous 5 years.

Flood Maintenance Division (FMD) crews routinely visit debris basins to check debris levels. Any increasing debris levels are reported to the engineering staff. When debris levels approach the prescribed cleanout threshold, planning for a debris basin cleanout is started.

3.3.2 DEBRIS BASIN CLEANOUT OPERATIONS

Unless otherwise stated, the following tasks are performed by FMD staff and crews once a debris basin has met the cleanout criteria previously mentioned (see Section 3.3.1). If the cleanout is not covered under existing permits, necessary permits are requested. Once the cleanout is approved, the debris basin is dewatered, if necessary, with either active or passive measures. The cleanout schedule and sediment destination are determined based on a variety of factors, including stream inflows, how wet the material is, storm season, bird-nesting season, resource availability, the proximity and availability of SPSs and private facilities used for the disposal of sediment, haul route requirements (refer to Section 3.3.5), etc.

When necessary, a water diversion plan is submitted to the appropriate regulatory agency. In some cases, Water Resources Division (WRD) holds a community meeting about the planned debris basin cleanout. Best Management Practices (BMPs) are employed during cleanout operations. Logistical support and rental equipment such as water meters, sweepers, rock shakers, excavators, loaders, bulldozers, and dump trucks are arranged. If necessary, Geotechnical and Materials Engineering Division is requested to perform sediment and/or water sampling. Existing cut plans or construction plan elevations are referenced to perform the cleanout. In some cases, Survey/Mapping & Property Management Division is requested to place cut stakes in the debris basin. Pre- and post-cleanout documentation is prepared and includes photos, sediment amount removed, and the placement location. For debris basins in burned watersheds, the five percent threshold for a cleanout could be attained quickly, initiating an emergency cleanout. During an emergency cleanout, portions of the routine cleanout operation described above could be eliminated based on public safety needs.

If FMD does not have enough resources and the cleanout is to be performed by a contractor, plans are prepared and advertised. Under this circumstance, FMD still contacts the regulatory agencies, handles the regulatory documentation, but the rest of the tasks are performed by the contractor under the supervision of a Construction Division Inspector.

3.3.3 SEDIMENT FLUSHING

Sediment flushing is a method that allows water flow to transport silts and other light sediment accumulated in the reservoir behind a dam through the dam itself. In the past, the Flood Control District has referred to this method as flow assisted sediment transport (abbreviated as FAST). Sediment flushing at a reservoir can be started at a reservoir that has a low water level or does not have any water (because it is not used to hold water or it has been drained). While this method is able to address the silts and other light sediment, it is not able to address heavier sediment. Heavier sediment still continues to accumulate in the reservoir, even when sediment flushing is employed.

The Flood Control District employs sediment flushing at Devil's Gate Reservoir. Devil's Gate Dam was built for the management of floods and debris flows; its purpose is not to capture and conserve stormwater (groundwater recharge opportunities downstream of the dam are extremely limited). Typically, the reservoir does not hold water. Sediment flushing at Devil's Gate Reservoir is conducted during small storms and during the early stages of larger storms by leaving the lowest gate (sluice gate) open to pass silts and other light sediment through the dam. This is possible because the small flows associated with small storms and the early stages of larger storms are insufficient to move heavy debris downstream; therefore, the operation of the dam is not threatened. However, as storm flows increase, large amounts of heavy debris begin to move towards the sluice gate. This can clog the sluiceway and limit the ability to operate the sluice gate. To prevent impacts to the sluiceway and sluice gate, the gate is closed as higher flows enter the reservoir, creating a pool of water in front of the dam called a buffer pool. The buffer pool slows the storm flows through the reservoir, which causes heavier debris to settle farther upstream in the reservoir away from the dam face. Once storm flows have subsided the sluice gate is opened again to drain the reservoir and to allow passage of sediment with the lower flows.

After large fires, such as the Station Fire of 2009, the amount of sediment and burned vegetative matter delivered to a reservoir can immediately block the dam's outlets, rendering sediment flushing ineffective.

3.3.4 RESERVOIR CLEANOUT OPERATIONS

Given the amount of sediment accumulated in the reservoir behind a dam and the impact that accumulation has on the operation of the dam and the dam's ability to fulfill its purposes, WRD considers different options for cleaning out the reservoir and consults with the Regulatory Division of the Army Corps of Engineers, the California Regional Water Quality Control Board, and the California Department of Fish and Game while planning a reservoir cleanout project. These agencies are involved due to regulations. Reservoir cleanouts typically require a Clean Water Act Section 404 Permit from the Regulatory Division of the Army Corps of Engineers, a Clean Water Act Section 401 Water Quality Certification from the California Regional Water Quality Control Board, and a Streambed Alteration Agreement from the California Department of Fish and Game per Section 1602 of the State Fish and Game Code. Cleanout operations that have significant environmental impact are also subject to environmental review under the California Environmental Quality Act, which includes public involvement.

Reservoir cleanouts that employ sluicing are performed by FMD. Sluicing is a sediment removal method that employs water flow to remove smaller-particle sediment (i.e., sands and silts) from a reservoir. Sluicing involves draining a reservoir to expose the accumulated sediment to incoming water flows so that the water can resuspend the sediment and carry it through the dam's sluice gate or valves. Typically, the sediment-laden water is captured in a reservoir or other facility downstream that is more accessible for sediment removal operations than the reservoir from which sediment was sluiced. The impacts of sediment-laden flows to downstream habitat and to downstream spreading facilities are concerns.

Reservoir cleanouts that require mechanical excavation are performed by contractors. For this type of projects, WRD prepares a Project Concept Report for Public Works Administration approval. The Project Concept Reports include the proposed quantity of sediment to be removed, method of excavation and transport, destination of sediment removed, access routes, and optimal haul routes. When the project concept calls for access through or the construction of any structures on land not owned by the Flood Control District, authorization is obtained from the landowner(s).

3.3.5 HAUL ROUTES

During debris basin and reservoir cleanout operations, trucks are commonly utilized to move sediment from the facility being cleaned and the placement site(s). For operational control, specific haul routes are determined prior to starting the transport of sediment. Some jurisdictions require permits to haul sediment through their streets. In those cases, any necessary jurisdictional permits for the truck traffic are obtained by FMD prior to the start of hauling operations. When permits are not required, FMD or Program Development Division's City Services Group may work with the jurisdictions whose streets may be used during the transportation of sediment to determine an optimal haul route while taking school zones, construction zones, and efficiency into account. Information fliers may be distributed by FMD to the residents along the haul route. Information about the planned cleanout activities and haul routes to be used is posted on Public Works' website by the Public Relations Group.

3.3.6 PLACEMENT LOCATIONS

As discussed in Section 2, potential placement locations for sediment removed from Flood Control District facilities include sediment placement sites, landfills, and pits.

3.3.7 OPERATIONS AT SEDIMENT PLACEMENT SITES

Sediment placement at an SPS occurs when debris basins and reservoirs are cleaned out. Sediment is placed at SPSs according to interim grading and drainage plans developed to provide proper drainage, stability, safety, and efficiency while working toward the ultimate fill plan. During sediment placement at an SPS, operations are supervised by FMD unless the work is performed under contract, in which case the work is inspected by Construction Division.

3.3.8 DEVELOPMENT OF ULTIMATE FILL PLANS FOR SEDIMENT PLACEMENT SITES

The ultimate fill plan is typically developed by Design Division with input from FMD and WRD. The plan identifies drainage improvements such as bench drains, underground drains, debris control structures, landscaping, and other appurtenances. The fill plan may be revised as the site evolves and needs change.

3.3.9 REMOVAL OF MATERIAL FROM SEDIMENT PLACEMENT SITES

Public Works has allowed local agencies and contractors in need of fill for development, road construction, landfill closures, or other projects to take sediment from an SPS under the oversight of Land Development Division Permit Inspectors or an FMD Construction Superintendent. In these situations, Land Development Division would issue a permit for the sediment removal. Upon completion of the removal work, a final evaluation of the SPS would be undertaken by FMD staff to verify that drainage was satisfactory. Over the years, approximately 10 percent of the sediment volume placed in the SPSs has been removed.

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SECTION 4 HISTORICAL SEDIMENT DEPOSITION AND REMOVAL

As a result of their location and function, sediment from the mountains is deposited in reservoirs and debris basins as well as in other facilities maintained by the Flood Control District. The amount of sediment that reaches a facility any given year depends on the size of the watershed, the watershed's vulnerability to erosion, watershed conditions (such as vegetated watershed versus burned watershed), and weather conditions (such as the amount and intensity of rain). Although small quantities of sediment may regularly be deposited into the facilities, it is often several years between significant sediment depositions since sediment is deposited mainly during discrete storm events. Removal of sediment deposited into the facilities is required in order to maintain their functionality. This section summarizes historical sediment deposition and removal for the reservoirs and debris basins.

4.1 RESERVOIRS

The region's reservoirs were constructed to intercept floodwaters and capture sediment and debris in order to provide for flood and debris flow risk management and water conservation. Sediment-laden floodwaters result in accumulation of sediment in the reservoirs. In order to determine changes in the capacity of the reservoirs maintained by the Flood Control District, the reservoirs are surveyed routinely. Since the 1920s, a total of approximately 131 million cubic yards (MCY) of sediment has been intercepted by the reservoirs maintained by the Flood Control District, as shown in Figure 4-1 and Table 4-1. Approximately 83 MCY of sediment has been removed as of May 2011. Based on the latest surveys, there are approximately 45 MCY of sediment in the reservoirs.

Sediment accumulated in the reservoirs reduces the capacity for incoming water and debris flows. Furthermore, sediment accumulation at the face of a dam can cover the dam's valves, making them inoperable. These effects can lead to a dam's inability to manage the risk of floods and debris flows.

In the past, the Flood Control District has employed sluicing and excavation to remove sediment from reservoirs. Given the rate of sediment accumulation, its effect on a dam's flood and debris flow risk management function, and the effect the sediment removal process has on stored water, it is often several years between sediment management projects at each reservoir.

It should also be noted that in addition to positively impacting a dam's ability to provide flood and debris flow risk management, sediment removal at the reservoirs also helps regain the water storage capacity of reservoirs, improving the water conservation capabilities of the facilities.

Figure 4-1 Reservoir Sediment History

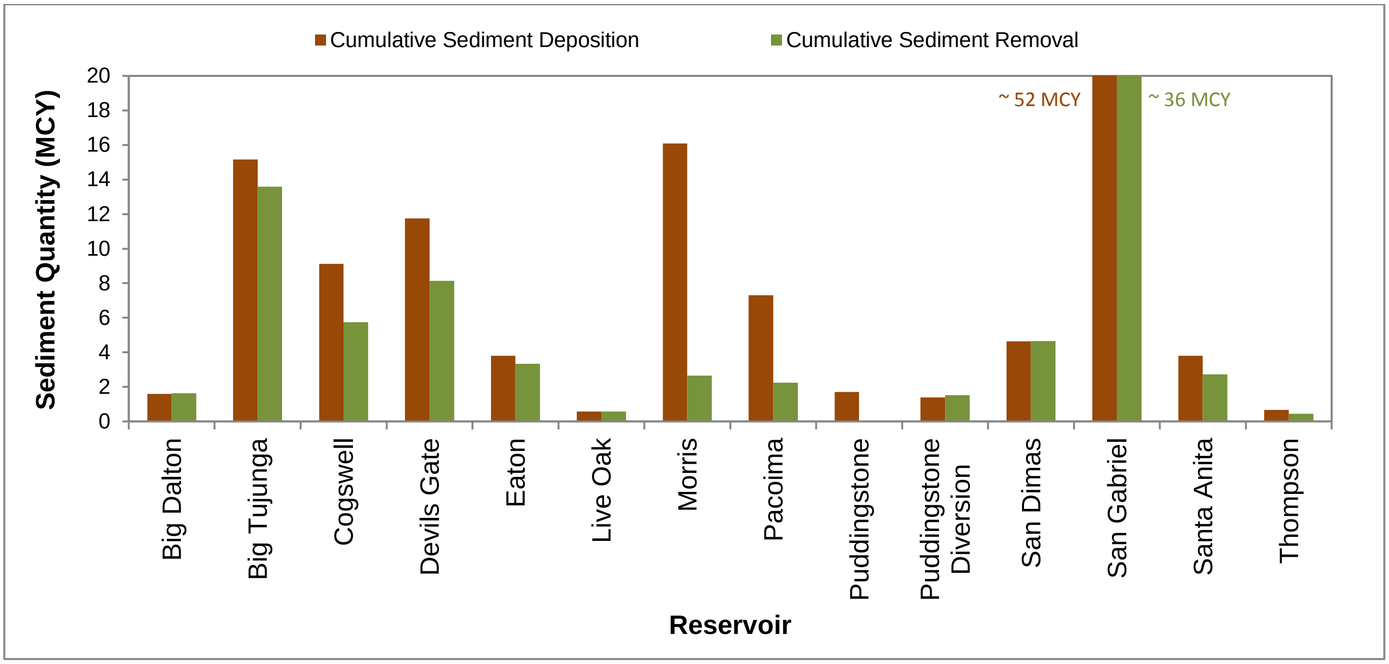


Table 4-1 Reservoir Sediment History in Million Cubic Yards

Reservoir	Construction Date	Total Historical Sediment Accumulation (MCY)	Total Historical Sediment Removal (MCY)	Condition as of Last Survey	
				Date of Last Survey	Sediment Quantity in the Reservoir (MCY)
Big Dalton	1929	1.6	1.6	Jul 2008	0.0
Big Tujunga	1931	15.6	13.5	Aug 2011	2.0
Cogswell	1934	9.6	5.7	Aug 2011	3.9
Devil's Gate	1920	12	8.1	Mar 2011	3.9
Eaton	1937	3.8	3.3	May 2010	0.5
Live Oak	1922	0.6	0.6	Nov 2008	0.008
Morris	1934	16.1	2.6	Dec 2010	13.1
Pacoima	1929	7.3	2.2	Sep 2010	5.1
Puddingstone	1928	1.7	0	Sep 1989	1.7
Puddingstone Diversion	1928	1.4	1.5	Oct 2007	0.0
San Dimas	1922	4.6	4.6	Aug 2009	0.0
San Gabriel	1939	52.1	36.1	Dec 2006	14.4
Santa Anita	1927	3.8	2.7	Dec 2010	0.3
Thompson	1926	0.7	0.4	Jun 2004	0.2
Total		**130.9**	**82.9**	**N/A**	**45.1**

Note:

- The quantities of sediment accumulated and removed from the reservoirs are estimated based on bathymetric surveys and truck counts. Both these methods have a certain level of inaccuracy. As a result, cumulative sediment deposition minus historical removal may not be equal to the sediment quantity in the reservoir as of the last survey.

4.2 DEBRIS BASINS

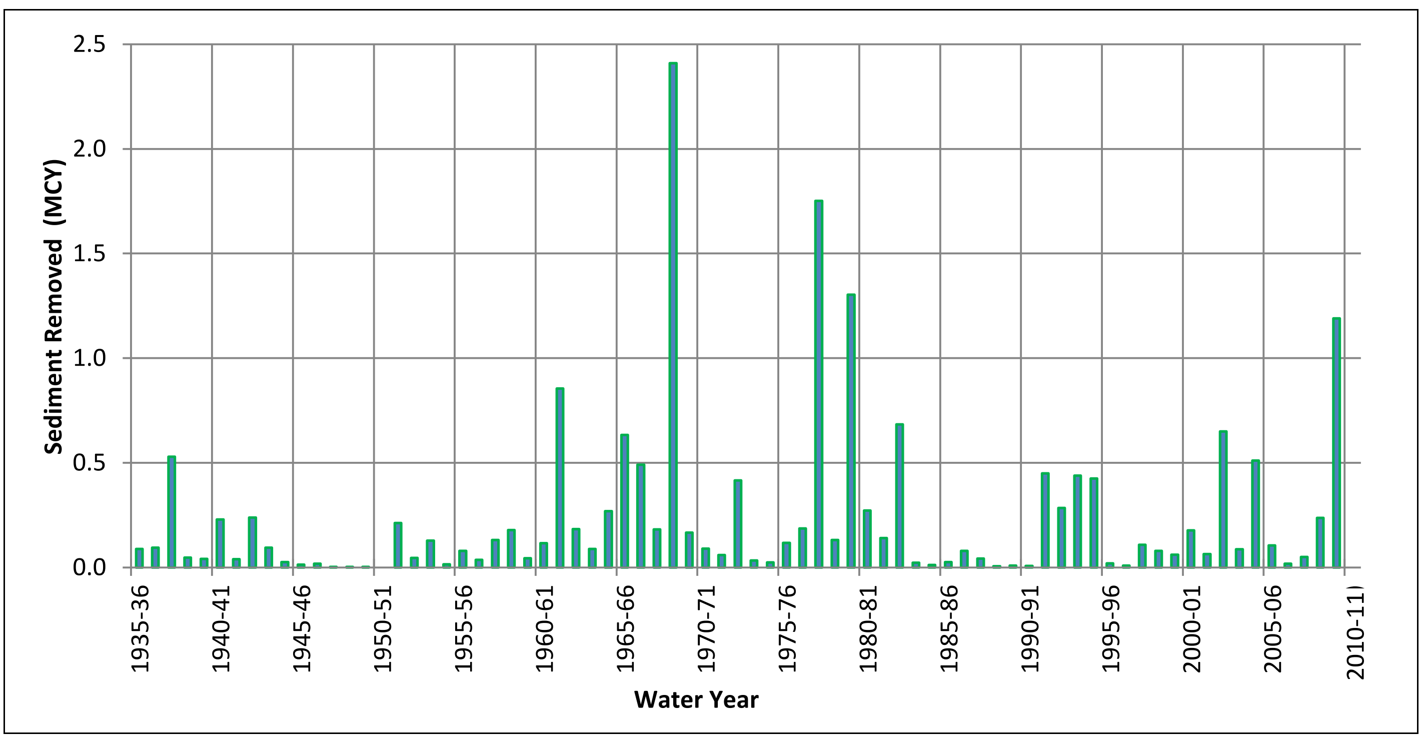
Debris basins are constructed to capture sediment and debris that erode from the mountains before that material enters the downstream system. This capture of sediment and debris provides flood risk management for downstream communities and protects downstream infrastructure (channels and drains) from wear that can result from the erosive properties of sediment-laden flows. Sediment inflow and removal records for the debris basins maintained by the Flood Control District have been kept since Water Year 1935-36. An analysis of the Flood Control District's records shows approximately 18 MCY of sediment have accumulated and been removed from debris basins since then. During that time, approximately 40 percent, or 6.7 MCY, was removed in one 4-year period, as shown in Figure 4-2.

In unburned watersheds, debris basins are cleaned out when they are 25 percent full. The Flood Control District's environmental regulatory permits (dating from the 1990s) require this criterion be met before a cleanout occurs. As with the reservoirs, sediment mainly accumulates in the debris basins during discrete storm events. Furthermore, the areas in which the debris basins are located vary in rainfall potential and debris production potential. Therefore, the time it takes for a debris basin to reach the 25 percent full level varies. For debris basins in an unburned watershed, it could be several years between cleanouts.

A watershed that has had more than 20 percent of its tributary area burned within the previous 5 years is considered a burned watershed. Debris basins in burned watersheds are cleaned out when they are 5 percent full. For some debris basins in burned watersheds, this may lead to multiple cleanouts within a year, as was seen during the 2009-10 Storm Season in the aftermath of the 2009 Station Fire.

Figure 4-2 shows the historical quantity of sediment removed per water year since Water Year 1935-36 from the debris basins maintained by the Flood Control District. The figure illustrates the variability in the quantity of sediment removed from the debris basins each year. The historical records include the effects of heavy rains and fires.

Figure 4-2 Debris Basin Sediment Removal History



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SECTION 5 20-YEAR PLANNING QUANTITIES

Section 4 illustrated how sediment deposition varies by watershed and from year to year. This section describes how this Strategic Plan estimated how much sediment to anticipate and plan for over the 20-year planning period from 2012 to 2032.

5.1 METHODOLOGY

As indicated in Section 4, there are records of sediment accumulation and removal for each reservoir and debris basin. The records include periods with below-average rainfall, periods with above-average rainfall, periods with no fires, and periods following small and large fires affecting the watershed of the reservoirs and debris basins maintained by the Flood Control District. As a result, the records capture the variability of sediment deposition in the reservoirs and debris basins.

For the purpose of this Strategic Plan, it was assumed that rain and fire conditions in the future will be similar to those of the past and that the resulting future sediment accumulation in the reservoirs and debris basins will be similar to the sediment deposition of the past. Based on that assumption, 20-year planning quantities were projected using the Flood Control District's historical records.

The effects of climate change were not considered in the calculation of the 20-year planning quantities. However, as explained in Section 5.1.1, the approach used to develop the 20-year planning quantities offers a factor of safety over the average 20-year periods in the records.

5.1.1 RESERVOIRS

For the reservoirs, the planning quantities were determined with the goal of having no net increase in the amount of sediment accumulated in the reservoirs.

Because the reservoirs are surveyed on an as-needed basis and several years may pass between surveys, there are no records of how much sediment is accumulated in the reservoirs on a yearly basis. While typical sediment delivery is in the form of discrete storm events with large storms delivering most of the sediment, for planning purposes, it was assumed that approximate annual sediment accumulation values could be estimated by equally distributing the change in accumulated sediment among the years in between two surveys.

For example, based on the records, as of 1938 there were 136,000 cubic yards (CY) of sediment in Big Dalton Reservoir. By 1943, that quantity had grown to 161,000 CY. This indicates that during the 5 years between the surveys 25,000 CY of sediment accumulated in the reservoir. Dividing 25,000 CY by 5 years yields an estimated annual inflow of 5,000 CY between 1938 and 1943. The equations below illustrate this calculation.

$$Annual\ sediment\ accumulation\ between\ Survey\ 2\ and\ Survey\ 1 =$$

$$= \frac{(Quantity\ of\ sediment\ in\ reservoir\ during\ Survey\ 2) - (Quantity\ of\ sediment\ in\ reservoir\ during\ Survey\ 1)}{(Year\ of\ Survey\ 2) - (Year\ of\ Survey\ 1)}$$

$$= \frac{161{,}000\ CY - 136{,}000\ CY}{1943 - 1938}$$

$$= \frac{25{,}000\ CY}{5\ years} = 5{,}000\ CY/year$$

Once annual sediment accumulation values were determined, the values were added for each 20-year rolling period for the lifetime of each reservoir. For Big Dalton Reservoir this resulted in 60 individual 20-year periods starting with 1930 to 1949 and ending with 1989 to 2008. The 80th percentile, i.e., the 20-year value below which 80 percent of the 20-year values fell, was selected as the quantity of sediment the Flood Control District should plan to manage during the 20-year period covered by this Strategic Plan.

The 80th percentile was selected for planning purposes because it offers a factor of safety over the average 20-year period yet it is not conservative to the point of planning for the worst 20-year periods. The impact of under-projection is that the Strategic Plan would last less than the 20-year planning period, which would require an updated Strategic Plan to be developed sooner than expected.

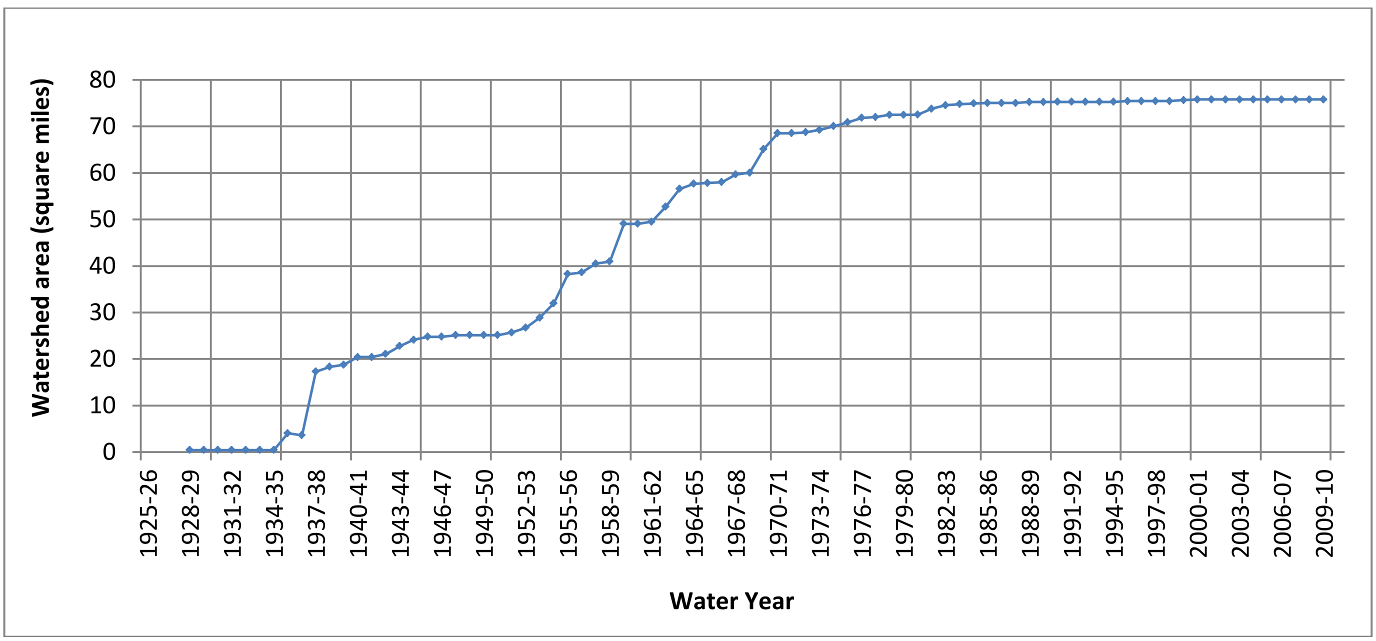
For the four reservoirs significantly impacted by the 2009 Station Fire – Big Tujunga, Cogswell, Devil's Gate, and Pacoima Reservoirs – the 20-year planning quantities also include sediment already in the reservoirs planned for removal as part of the reservoir sediment removal projects in the planning phase as of November 2012.

5.1.2 DEBRIS BASINS

For debris basins, the 20-year planning quantities follow the current sediment removal procedure.

As indicated in Section 4, sediment accumulation and removal records for the debris basins have been kept since Water Year 1935-36. The records show a significant increase in the number of debris basins maintained by the Flood Control District, the size of the watershed area contributing flows to those facilities, and the quantity of sediment needing to be managed. Figure 5-1 shows the watershed area covered by the debris basins managed by the Flood Control District from the late 1920 to the Water Year 2009-2010. As of the writing of this Strategic Plan, the watershed area of the Flood Control District's 162 debris basins was 75.8 square miles. According to the records, by Water Year 1954-55, the watershed area of the debris basins was approximately 32.0 square miles, which is approximately 40 percent of 75.8 square miles.

Figure 5-1 Total Watershed Area Covered by Debris Basins in a Given Year



In order to be able to use the historical records to determine planning quantity for the 162 debris basins, the change in number of debris basins and watershed area covered by them had to be addressed. Data prior to Water Year 1954-55 was not used because the quantity of debris basins and their geographic distribution was not similar enough to today's situation to warrant normalization. The records from Water Year 1954-55 and on were prorated based on the watershed area of the debris basins.

The following example discusses proration of the 1954-55 record. As mentioned previously, the debris basins that had been constructed as of Water Year 1954-55 covered a combined watershed area of 32.0 square miles. According to the records, a total of 14,557 CY were removed from debris basins that year. The ratio of the watershed area covered in 2012 and in 1954-55 was found by dividing the current watershed area (75.8 square miles) by the 1954-55 watershed area (32.0 square miles); the result was 2.37. The 14,557 CY value was then multiplied by 2.37; the result was approximately 34,500 CY, which is the normalized value. The following equations illustrate this calculation.

$$\text{Prorated Amount of Sediment Removed from Debris Basins in Water Year 1954-55} =$$

$$= \text{Sediment quantity removed in Water Year 1954-1955} \times \left(\frac{\text{Watershed Area in Water Year 2009-2010}}{\text{Watershed Area in Water Year 1954-55}}\right)$$

$$= 14{,}557\ CY \times \left(\frac{75.8\ square\ miles}{32.0\ square\ miles}\right)$$

$$= 14{,}557\ CY \times 2.37 = 34{,}500\ CY$$

In order to arrive at planning quantities for each flood maintenance area, the debris basin data was separated by Flood Maintenance Area. Similar to the estimation process for reservoirs, the sediment inflow data for debris basins was used to calculate a removal quantity for each 20-year rolling period. The 80th percentile of each Flood Maintenance Area's data set was selected as the 20-year planning quantity for the subject Flood Maintenance Area.

While the number of debris basins maintained by the Flood Control District may increase as a result of development during the 20-year planning period, this is expected to only have minimal impact on the quantity of sediment needing to be managed because new development will likely only occur in areas of low debris potential. Therefore, the 20-year planning quantities were not prorated to reflect a potential increase due to future development.

5.2 PLANNING QUANTITIES

The total 20-year planning quantity for this Strategic Plan is 67.5 MCY, with approximately 57.9 MCY resulting from the reservoirs and 9.6 MCY from the debris basins, as shown in Table 5-1 and graphically shown in Figure 5-2. This includes the projected 20-year sediment accumulation as well as sediment already in storage at Big Tujunga, Cogswell, Devil's Gate, and Pacoima Reservoirs also planned for removal.

Table 5-1 20-Year Planning Quantities by Flood Maintenance Area

Facilities	20-Year Planning Quantity (MCY)
Reservoirs – East Area	43.1
Reservoirs – West Area	14.8
Subtotal	**57.9**
Debris Basins – East Area	4.9
Debris Basins – West Area	4.5
Debris Basins – South Area	0.2
Subtotal	**9.6**
Total	**67.5**

5.2.1 EAST FLOOD MAINTENANCE AREA

As previously discussed, the East Area maintains 12 reservoirs and 51 debris basins. The 20-year planning quantity for the 12 reservoirs in the East Area is approximately 43.1 MCY, as shown in Table 5-2. The East Area debris basins have a projected 20-year sediment deposition of approximately 4.9 MCY.

Table 5-2 East Area Reservoirs Planning Quantities

Facility	Projected 20-Year Sediment Accumulation (MCY)	Sediment Already in Storage Also Planned for Removal (MCY)	Total 20-Year Planning Quantity (MCY)
Big Dalton Reservoir	0.8	-	0.8
Cogswell Reservoir	2.4	3.3	5.7
Devil's Gate Reservoir	4.3	Up to 4.0	8.3
Eaton Wash Reservoir	1.6	-	1.6
Live Oak Reservoir	0.2	-	0.2
Morris Reservoir	1.3	-	1.3
Puddingstone Diversion Dam	0.6	-	0.6
Puddingstone Reservoir	0.8	-	0.8
San Dimas Reservoir	1.9	-	1.9
San Gabriel Reservoir	20.4	-	20.4
Santa Anita Reservoir	1.2	-	1.2
Thompson Creek Reservoir	0.3	-	0.3
Total	**35.8**	**7.3**	**43.1**

5.2.2 WEST FLOOD MAINTENANCE AREA

The total 20-year planning quantity for the 2 reservoirs within the West Area is approximately 14.8 MCY, as shown in Table 5-3. The West Area debris basins have a projected 20-year sediment accumulation of approximately 4.5 MCY.

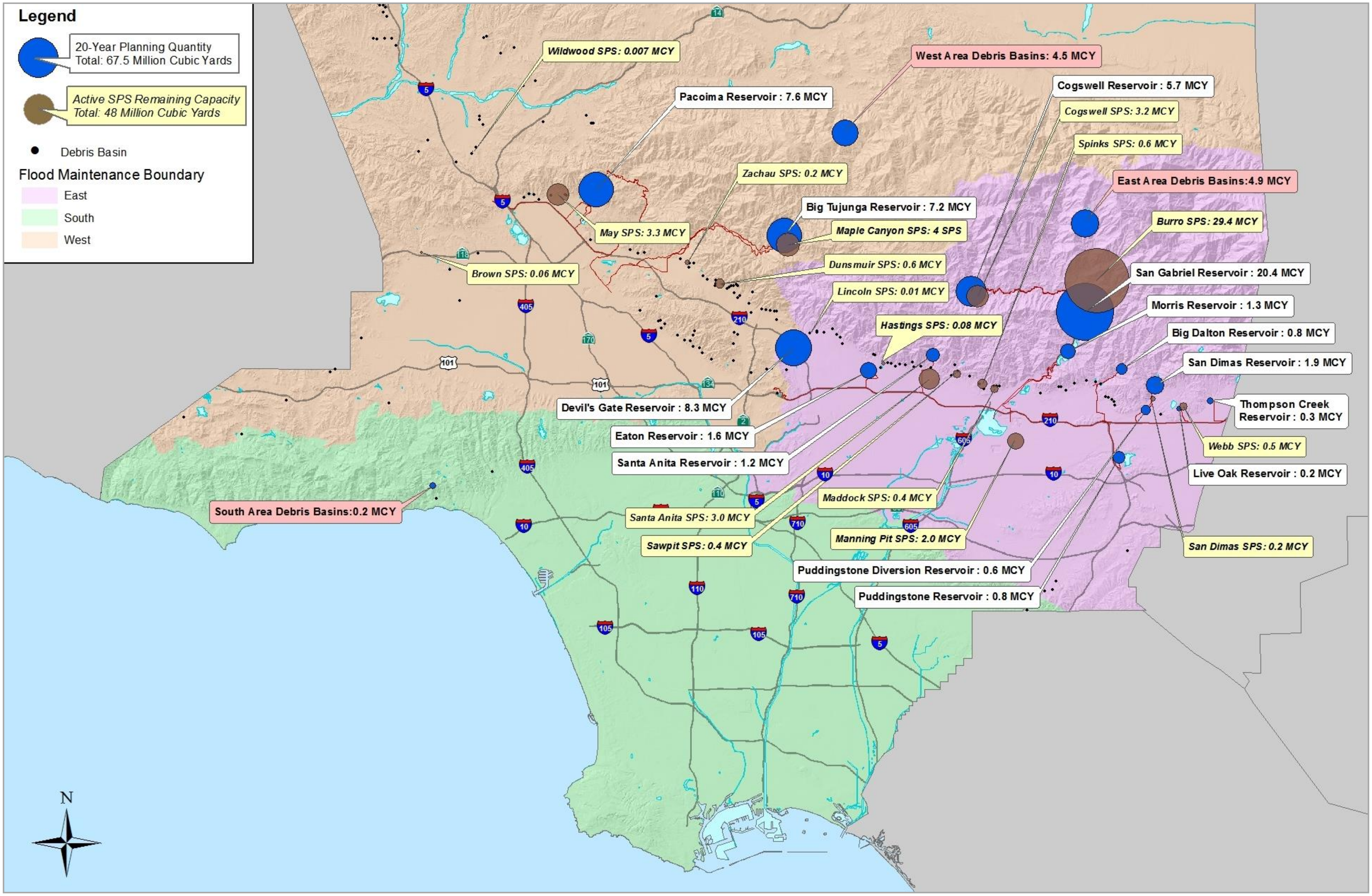
Table 5-3 West Area Reservoirs Planning Quantities

Facility	Projected 20-Year Sediment Accumulation (MCY)	Sediment Already in Storage Also Planned for Removal (MCY)	Total 20-Year Planning Quantity (MCY)
Big Tujunga Reservoir	5.2	2.0	7.2
Pacoima Reservoir	2.4	Up to 5.2	7.6
Total	**7.6**	**7.2**	**14.8**

5.2.3 SOUTH FLOOD MAINTENANCE AREA

As previously discussed, there are no reservoirs located within the South Area. The South Area debris basins have a projected 20-year sediment accumulation of approximately 0.2 MCY.

Figure 5-2 20-Year Planning Quantities and Remaining Capacity at Sediment Placement Sites



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SECTION 6 SEDIMENT MANAGEMENT ALTERNATIVES – INTRODUCTION & GENERAL OVERVIEW

6.1 INTRODUCTION

This section discusses the various sediment management alternatives considered for the reservoirs and debris basins maintained by the Los Angeles County Flood Control District (Flood Control District). Sediment management alternatives are organized in the following categories based on the different phases of the cleanout process.

- Staging and Temporary Sediment Storage Areas (Section 6.2)
- Sediment Removal Alternatives (Section 6.3)
- Transportation Alternatives (Section 6.4)
- Beneficial Use and Placement Alternatives (Section 6.5)

Each sediment management alternative is discussed independently. For example, discussion of excavation only includes the impacts it has on the facility from which the sediment is removed and the cost of excavating the sediment; it does not include the impacts or cost of transporting or placing the excavated sediment. The impacts and costs of potential staging and storage area alternatives, transportation alternatives, and placement alternatives are discussed separately in their respective sections.

Due to the nature of the Strategic Plan, potential impacts are discussed in general terms. The impacts include long-term impacts and temporary impacts; in some cases, the temporary nature of impacts is mentioned. Discussion of the majority of the alternatives is organized as shown below.

- General Description
- Assumptions
- Environmental Impacts
    - Habitat
    - Water Quality
    - Water Conservation
    - Air Quality
- Social Impacts
    - Traffic
    - Noise
    - Scenic and visual impacts Recreation
- Implementability
    - Right of way issues
    - Technical certainty
    - Permitting concerns
- Performance
    - Ability to meet the needs of the reservoirs and debris basins and maintain proper operation
    - Capacity, transport, or removal rate, as applicable
- Cost
    - Order of magnitude 20-year cost estimate
- Conclusion
    - General feasibility for large reservoirs, small reservoirs, and debris basins.

The cost estimates used in this Strategic Plan are based on historic sediment removal projects completed by the Flood Control District, discussion with industry, and additional research. The cost estimates do not include a monetary value for environmental and social impacts. Since there are no market prices for these impacts, artificial ones would need to be created. Economists typically create a cost by studying what people would be willing to pay for a given condition. However, such an approach leads to subjective costs that cannot be compared to the actual dollars that would need to be spent to complete a project.

Performing a cost-benefit analysis using subjective costs could produce skewed cost-benefit ratios that could lead to an appearance that certain alternatives are more favorable than others and dismissal of appropriate alternatives.

Therefore, the Strategic Plan discusses cost separately from environmental impacts, social impacts, implementability, and performance, which allows impacts to be compared in a more objective manner.

Discussion of each alternative includes applicability to the three general categories of facilities – large reservoirs, small reservoirs, and debris basins. As mentioned in Section 2 and shown in Table 6-1, the reservoirs were categorized into large and small reservoirs based on a combination of their capacity and the presence of a standing pool. In general, large reservoirs are operated with a permanent pool of water while small reservoirs are operated dry. Debris basins are significantly different from both large and small reservoirs. Debris basins do not have a pool of water, are typically cleaned in response to an immediate need to remove material between storms, and typically generate significantly less sediment than the reservoirs.

Table 6-1 General Categories of Reservoirs

Large Reservoirs		Small Reservoirs
San Gabriel River Reservoirs	**Other Large Reservoirs**	
Cogswell	Big Tujunga	Big Dalton
San Gabriel	Devil's Gate	Eaton
Morris	Pacoima	Live Oak
	Puddingstone	Puddingstone Diversion
	San Dimas	Thompson
	Santa Anita	

The discussion and conclusions presented in Section 6 provide the basis for which alternatives are considered for each reservoir and the debris basins. Sections 7 through 10 provide more specifics based on location, impacts, and costs. Combinations of alternatives are also considered.

6.2 STAGING AND TEMPORARY SEDIMENT STORAGE AREAS

Depending on the mode of transportation and destination of the sediment, it could be necessary to transfer sediment from one transportation mode to another, which would require a staging area. An example of a staging area could be an area near a reservoir used to transfer sediment from a conveyor belt to trucks.

Temporary sediment storage areas could be beneficial during certain sediment management operations to be able to store temporarily sediment removed from a facility and transport the sediment gradually to its final destination. An example of a temporary sediment storage area would be a downstream basin that is being used for dewatering sluiced sediment.

Staging and temporary sediment storage areas are not typically required for sediment management operations for debris basins. Since the potential impacts of using a staging or temporary sediment storage area are specific to the site, they are discussed within the reservoir-specific sections (Sections 7 through 9).

6.3 SEDIMENT REMOVAL ALTERNATIVES

Section 6.3 discusses sediment removal by means of excavation, dredging, sediment flushing, and sluicing.

6.3.1 EXCAVATION

Excavation - General Description

Sediment removal by excavation requires that the material be generally dry. For reservoirs that do not have a standing pool of water and debris basins, this requirement does not present an issue. This can also be true for reservoirs that are operated with a standing pool of water if only the dry part of the reservoir is to be excavated.

However, in order to excavate the material closest to the dam, a reservoir that has a pool of water would need to be completely drained. Material accumulated closest to the dam presents the greatest potential to inhibit operations.

Excavation of sediment involves the use of conventional excavation equipment such as excavators, backhoes, scrapers, bulldozers, and front-end loaders, as shown in Figure 6-1. As a result, vehicular access to the site is required for excavation.

Excavation – Environmental Impacts

Figure 6-1 Equipment used during excavation

Many debris basins and reservoirs are maintained free of vegetation or habitat; however, some contain significant types or amounts. Within reservoirs, there may also be aquatic habitat. Habitat or vegetation that exists within debris basins and reservoirs could be impacted by excavation activities. Additionally, draining of a reservoir could impact the habitat in the stream below the dam, unless measures are taken to prevent sediment from entering the stream (Flow can typically be bypassed thru the work area or best management practices can be utilized to filter or settle out the debris from the discharged flow). Habitat within the facilities would need to be identified in order to avoid, minimize, or mitigate impacts to plant and wildlife species.

Excavation of sediment from reservoirs and debris basins can be planned to minimize impacts on water conservation. While some losses are expected, most of the water released while draining a reservoir is able to be captured and recharged through downstream facilities, resulting in minimal impact to water conservation quantities.

Emissions from heavy equipment during excavation would minimally affect air quality.

Excavation – Social Impacts

Excavation operations occur within a reservoir or debris basin itself. For the excavation portion alone, there is no increase in traffic in the area surrounding the facility.

For reservoirs in a remote location, excavation operations are not expected to affect the viewshed of any residences. In those cases that a reservoir or debris basin is in close proximity to residences or areas visited by recreational users, excavation activities could have visual and noise impacts.

Recreational uses are not permitted at the majority of the reservoirs and all of the debris basins maintained by the Flood Control District. Therefore, for the most part, excavation does not impact recreational resources. However, in those cases where excavation operations would have an impact on recreation, the impacts are identified within the reservoir-specific sections. In any case, draining of a reservoir in anticipation of excavation activities could potentially impact recreational resources downstream.

Excavation - Implementability

The Flood Control District has conducted numerous sediment removal projects at reservoirs and debris basins using conventional excavation equipment and techniques. Given the Flood Control District's experience, excavating sediment from the reservoirs and debris basins under generally dry conditions is a technically certain method of sediment removal.

As previously mentioned, some reservoirs are operated with a pool of water. For a given reservoir, this could be due to operational concerns, the reservoir's function in the management of flood risk, the reservoir's function in water conservation, or a combination of these reasons. In order not to interfere with a reservoir's operational needs and functions and to minimize hazards to workers, reservoirs are typically drained and excavated outside of the storm season, namely between April 16th and October 14th. However, it could be possible to excavate some material outside of these dates if conditions permit.

Draining of a reservoir is limited by the discharge capacity of the dam's outlets and habitat or stakeholder interests downstream of the reservoir. The time needed to drain the reservoir and get the sediment in the reservoir to an appropriate dryness could limit the time available to excavate sediment from the reservoir.

There are no implementation concerns regarding excavation of sediment from debris basins during the dry season given the relative small size of most debris basins and absence of a standing pool. Debris basins with a burned watershed sometimes need to be cleaned out during the storm season in order to maintain their functionality. Excavation can be implemented during the storm season, even if the material is somewhat wet.

Excavation of sediment from reservoirs and debris basins within Flood Control District property does not present right of way concerns, but requires environmental regulatory permits.

Excavation - Performance

The Flood Control District has effectively used excavation procedures to remove sediment from reservoirs and debris basis in the past. While there may be other issues, the effectiveness of excavation is not a concern for future cleanouts.

Bulldozers, loaders, and excavators used for excavation are among the most commonly used earthmoving machines. It is expected that excavation operations would be able to match the efficiency of any mode of transportation being considered.

Excavation – Cost

The cost to excavate sediment from a reservoir is approximately $3 per cubic yard. Due to the smaller size of debris basins, the cost to excavate sediment is approximately $7.50 per cubic yard. These costs do not include the cost of transporting or placing sediment.

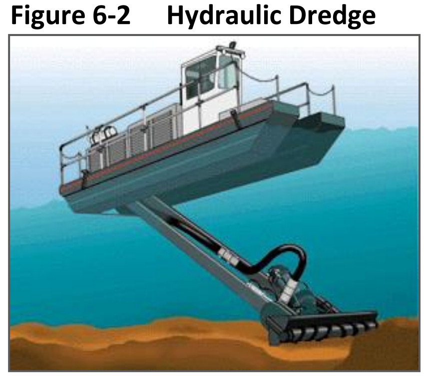
Excavation – Conclusion

☑	Large reservoirs
☑	Small reservoirs
☑	Debris basins

Excavation is a sediment removal method that is feasible at reservoirs, both large and small, and at debris basins.

6.3.2 DREDGING

Figure 6-2 Hydraulic Dredge



Dredging - General Description

Dredging is a type of underwater excavation that is used to remove sediment from a large water body. Generally, dredges either scoop or suction sediment, along with water, from the bottom of a water body. The San Gabriel and Morris Reservoirs Dredging Feasibility Study (2000) completed for the Flood Control District indicates the cutterhead suction dredge would be the most practical type of dredge for the reservoir cleanouts. This plan assumes that is the case still.

Since dredges are designed to be used under water, dredging could not be employed in reservoirs that do not have a pool of water. Dredging is also not a feasible method to remove sediment from debris basins due to both the lack of water and the size of debris basins. Therefore, this section discusses the potential impacts of dredging those reservoirs that usually have a pool of water.

Dredging - Assumptions

The following list presents the assumptions made and taken into account while analyzing dredging as a method to remove sediment from the reservoirs.

- A portable hydraulic cutterhead dredge would be used.
- The dredge would be able to remove sediment at a maximum water depth of approximately 50 feet.
- The dredge would be able to handle only the smaller material in the reservoir. Therefore, sediment from portions of the reservoir with the larger material would need to be removed using a different method.
- The dredge would be able to remove approximately 200 cubic yards of sediment per hour.
- The water-sediment mixture suctioned by the dredge would have a water-sediment ratio of approximately 9 to 1. Therefore, the dredge would have a total discharge of approximately 2,000 cubic yards per hour or 15 cubic feet per second of the sediment/water mixture.
- The dredge would be connected to a 12-inch high-density polyethylene (HDPE) slurry pipeline. (Impacts associated with the use of slurry pipelines are discussed in Section 6.4.4)
- For every 100,000 cubic yards of sediment dredged, a dewatering site of approximately 40 acres would be required to drain the dredged material.
- If a dewatering site is unavailable, a mechanical dewatering machine could be employed to dewater the sediment. The dried sediment would then be placed in a barge or onto a floating conveyor belt to be tranported to the shore for transport to a placement site. However, dewatering machines are very slow and could impact dredging performance.
- Turbidity concerns could be partially mitigated with a silt curtain around the dredge. The curtain would act as a wall to prevent silt from moving beyond the curtain.
- Generally dredging operations would only be able to be conducted six months out of the year because of the need to provide flood protection and water conservation. This limits the water depth and the need for a dewatering area. In wet years, the available timeframe could be less, as it could take longer to drain the reservoir to acceptable levels.
- The dredge would be operated only on weekdays, during two eight-hour shifts, for a total of 16 hours per weekday.
- Dredges could discharge directly to the stream below the dam during the storm season and stormflows could flush the sediment downstream reducing impacts to the habitat in the streamcourse. However, the sediment-laden flows would be inappropriate for groundwater recharge, as suspended sediment in the flows would clog downstream spreading facilities. Also, the quantity of sediment that could be transported in this manner is very uncertain.

Dredging - Environmental Impacts

The potential impacts dredging would have on vegetation and fauna depend on the specifics of the (above ground and underwater) habitat within each reservoir. Existing habitat in the area(s) considered for discharge and drying of dredged material would also need to be determined.

Dredging could impact water quality within a reservoir by increasing turbidity. However, as previously noted, it was assumed that water quality concerns could be partially addressed with a silt curtain around the dredge. A silt curtain would limit the turbidity to the area surrounded by the silt curtain, preventing impacts to the entire reservoir. In the past, water quality regulators have expressed high concern regarding potential residual turbidity in the reservoir as a result of dredging.

Dredging a reservoir (and transporting the dredged slurry via a slurry pipeline) could affect water conservation if the dredging rate is faster than the rate of sediment settling at the downstream facility where the dredged material is being dewatered. Overflows with suspended sediment could result in sediment deposition within channels and spreading facilities downstream of the dewatering area and could significantly impact water conservation quantities.

Dredging - Social Impacts

Since dredging operations would occur within a reservoir itself, there would not be an increase in traffic in the area surrounding the reservoir.

For reservoirs in a remote location, dredging operations are not expected to impact the viewshed of any residences. However, for a reservoir in close proximity to residences or areas visited by recreational users, dredging activities could have visual and noise impacts.

Operating a dredge within a reservoir that serves a recreational purpose would impact recreation by limiting areas around the dredge, pipeline, and discharge locations. However, as previously discussed, the majority of the reservoirs maintained by the Flood Control District are not accessible to the public and do not have permitted recreational uses.

Dredging - Implementability

As previously discussed, dredging can only be conducted at reservoirs with an adequate standing pool. While dredging is a technique that has been used in other areas of the country for decades, pilot testing would need to be completed to identify more accurately feasibility for specific reservoirs.

Dredging would not present right of way concerns. The use of a dredge would require environmental regulatory permits.

Dredging - Performance

Based on the previously mentioned assumptions, a 6-month dredging operation could remove approximately 400,000 CY of sediment from a reservoir. In turn, a total of approximately 4 MCY or 2,500 acre-feet of water-sediment slurry would need to be dewatered. The dredged material could be transported to the shore from the dredge via slurry pipeline, floating conveyor, or another barge.

Alternatively, dredged material could be mechanically dewatered on shore. However, the rate at which a mechanical dewatering machine operates is relatively slow and could likely not meet the need of the large quantities to be removed from the reservoirs.

Dredging – Cost

Dredging, including operating costs, would cost approximately $10.50 per cubic yard of sediment dredged. Employing a mechanical dewatering machine would cost an additional $34.50 per cubic yard. These costs do not include the cost of transporting and placing sediment.

Dredging – Conclusion

☑	Large reservoirs
☒	Small reservoirs
☒	Debris basins

Dredging is a removal alternative that could be feasible at large reservoirs, which have a pool of water. However, it is not feasible at small reservoirs, which do not have a pool of water or at debris basins.

Mechanically dewatering material is not feasible for any dredging operations due to the low efficiency and high cost. It is not considered further as part of this Strategic Plan.

6.3.3 SEDIMENT FLUSHING

Sediment flushing is a method that allows water flows to transport silts and other light sediment accumulated in a facility through the facility. In the past, the Flood Control District has referred to this method as flow assisted sediment transport (abbreviated as FAST). To be consistent with nomenclature used by other agencies throughout the country and the world, the Flood Control District now refers to flow assisted sediment transport as sediment flushing.

Due to the different characteristics of debris basins and reservoirs and the channels downstream of the two types of facilities, the opportunity for implementing flushing at the debris basins and reservoirs is different. For this reason, discussion of sediment flushing and debris basins is separated from the discussion of sediment flushing and reservoirs.

6.3.3.1 SEDIMENT FLUSHING AND DEBRIS BASINS

By the nature of their purpose and design, debris basins serve to settle out the sediment in incoming flows and do not let significant amounts of sediment pass through the facilities. In order for flows to be able to carry sediment past a debris basin, the debris basin would need to be modified. Modification of a debris basin would affect the ability of the debris basin to manage flood risk. Allowing sediment to pass through a debris basin could result in clogged connections between the debris basin and the receiving channel. The sediment-laden flows could exceed the flood-carrying capacity of the channel, clog the channel, or lead to sediment depositing in the channel, which in turn would result in a loss in channel capacity. Sediment deposited in the channels could also make their way into spreading facilities, which in turn could result in loss of capacity and reduced water infiltration rates at spreading facilities. Further, due to the abrasive quality of the sediment, such flows could impact the concrete channels downstream of the debris basins by scouring of the channels' banks and invert over time. All these impacts would lead to additional maintenance at the debris basins and in the channels downstream of the debris basin. Modification of the channels downstream could possibly also be required. For all these reasons, sediment flushing is considered an unsuitable alternative for debris basins.

6.3.3.2 SEDIMENT FLUSHING AND RESERVOIRS

Unlike debris basins, the channels downstream of reservoirs are mostly natural channels instead of lined channels. Reservoirs also differ from debris basins in that flows from reservoirs are able to be regulated. This allows flows to be held and later released to wash out sediment deposited in the channels after sediment flushing is employed at a reservoir. For these reasons, sediment flushing may be a suitable alternative for reservoirs. The process and potential impacts of employing sediment flushing at reservoirs are discussed in the following paragraphs.

Typically, reservoirs are operated with a "Minimum Pool" in the reservoir. This pool serves to slow down stormflows into the reservoir. When sediment-laden stormflows reach this reservoir pool and slow down, the sediment settles to the bottom of the reservoir, away from the dam's gates and valves. In order to employ sediment flushing at a reservoir that is operated with a minimum pool, one of the following two actions would need to be taken prior to a storm event during the storm season. One would be to lower the water level in the reservoir significantly. The other would be to drain the reservoir completely. For those reservoirs that are not operated with a minimum pool, no action would be required prior to a storm event during the storm season.

Following the actions just described, during a storm event (or possibly throughout the entire storm season), stormwater runoff into the reservoir would be allowed to flow through the dam through the low-level gate and valves. This would flush accumulated sediment in the reservoir. However, upon the forecast of large storms, the low-level gate could be closed and the dam valves could be operated under normal flood management guidelines, in order to manage the risk of floods downstream.

Sediment flushing is employed at Devil's Gate Reservoir. Section 3.3.3 includes discussion of the operations at Devil's Gate Reservoir.

It should be noted that in some cases during storm events when very high flow rates are both entering and being released from the reservoir, the flow velocities may be high enough that the sediment does not settle out in the reservoir, and instead is carried through the dam's gates or valves. This is considered a "sediment pass-through" method and most closely mimics natural conditions. It prevents/minimizes sediment accumulation.

The following discussion addresses issues and concerns within the reservoirs and sites downstream of the reservoirs.

Sediment Flushing - Environmental Impacts

Depending on the conditions downstream of the reservoir, sediment flushing could potentially have negative or positive impacts on habitat or infrastructure. Given that existing operational practices (as of 2012) reduce heavily sediment-laden outflows from most facilities, downstream reaches may be sediment starved. In that case, the sediment-laden flows could replenish sediment-poor washes and rivers and positively impact habitat. Alternatively, sediment flushing that results in high volumes of sediment transported downstream could result in excessive accumulation of sediment in reaches, potentially filling in seasonal pools or the streambed, which could negatively affect habitat wildlife.

Sediment flushing could impact water quality in the waterways downstream of the reservoir. That is because the flows from the reservoir during sediment flushing would have a higher turbidity than that of the typical flows during existing dam operations. However, sediment flushing would more closely mimic natural conditions during storm events, and the turbidity in natural runoff is typically high.

Sediment flushing could significantly impact stormwater capture and groundwater recharge. Under the existing operational practices (as of 2012), whenever feasible, stormflows are directed into spreading facilities for groundwater recharge. However, directing sediment-laden water into the spreading facilities could result in sediment depositing on the bottom of the facilities, reducing water infiltration rates and recharge quantities. Similarly, sediment that deposits upstream of the spreading facilities could be resuspended and carried into the spreading facilities by future flows. Furthermore, since stormflows would be used to flush sediments downstream and not be captured and stored in the reservoirs, that volume of stormwater available to be methodically released to maximize groundwater recharge would be reduced.

In addition, employing sediment flushing at the San Gabriel Canyon Reservoirs – Cogswell, San Gabriel, and Morris Reservoirs – could lead to a reduction in the amount of water infiltrated through the streambed of the San Gabriel River. Sediment deposition in the river resulting from sediment flushing at the San Gabriel Canyon Reservoirs could affect percolation rates in the San Gabriel River. However, three measures may help to mitigate these potential issues – (1) performing sediment flushing during the storm season, which gives the ability to wash out the river with less turbid flows; (2) conducting monitoring of river reaches; and (3) using an adaptive management approach.

Air quality would likely not be impacted by employing sediment flushing.

Sediment Flushing – Social Impacts

Traffic and noise would not be impacted by the use of sediment flushing. However, visual characteristics of the waterways could be negatively impacted by the sediment-laden flows. At reservoirs with downstream waterways that have permitted recreational uses such as fishing and swimming, the sediment in the water could potentially impact those recreational uses. However, in some cases, beneficial sediment accumulation could improve vegetation and habitat, which could improve recreational opportunities and aesthetics.

Sediment Flushing – Implementability

Based on previous discussions with regulatory agencies, it appears that sediment flushing will only be allowed when sediment transport would naturally be occurring in the washes/rivers, such as during storm events. Additionally, monitoring and implementation of an adaptive management approach would likely be required. Pilot studies may be required before regulatory agencies would accept sediment flushing as part of the typical operating guidelines for the facility. Additionally, depending on downstream resources, the regulatory agencies may require that a portion of accumulated sediment be removed from the reservoir before a sediment flushing regime can begin. This would be in cases where it is expected that initiating sediment flushing would bring too much sediment to the downstream watercourse, significantly more than the amount expected under natural conditions.

Sediment Flushing – Performance

As mentioned earlier in this section and explained in Section 3.3.3, sediment flushing is employed at Devil's Gate Reservoir. The method is able to address silts and lighter sediment, but it is not able to address the heavier stuff or effectively address large amounts of sediment due to high flows and fires. Due to the Flood Control District's limited use of sediment flushing in the past, it would be beneficial to conduct a pilot study at a reservoir where the method has not been used. A pilot study would help determine the performance as well as the impacts of sediment flushing under conditions that are different from those at Devil's Gate Reservoir.

Sediment Flushing – Cost

The cost to employ flushing could be minimal at the reservoirs. However, employing this method could result in the need for modifications to or additional maintenance of channels and/or spreading facilities. Prior to pursuing sediment flushing at a reservoir, potential costs should be analyzed.

Sediment Flushing – Conclusion

⃠	Large reservoirs
⃠	Small reservoirs
☒	Debris basins

It is recommended that this alternative be evaluated further in the future for both large and small reservoirs. Sediment flushing is not feasible for debris basins.

6.3.4 SLUICING (AS A REMOVAL ALTERNATIVE)

This section focuses on sluicing as a sediment removal method and discusses the impacts of sluicing within a reservoir only. For the impacts of sluicing downstream, see Section 6.4.1.

Sluicing (Removal) - General Description

Sluicing is a sediment removal method that employs water flow to remove smaller-sized sediment (i.e., sands and silts). Sluicing involves draining a reservoir to expose the accumulated sediment to incoming water flows so that the water can resuspend the sediment and carry it through the dam's sluice gate or valves. Typically, the sediment-laden water is captured in a reservoir or other facility downstream that is more accessible for sediment removal operations than the reservoir from which sediment was sluiced. Figure 6-3 shows the channel cut by the water in the sediment at the upstream of Morris Reservoir.

Sluicing (Removal) – Assumptions

The following list presents the assumptions made and taken into account while analyzing sluicing as a method to remove sediment from the reservoirs.

- Equipment (e.g., bulldozers) would be used in the reservoir to push sediment into the water flowing through the reservoir in order to optimize sediment transport and removal from the reservoir.
- The sediment-laden water leaving the reservoir would have a water-sediment ratio of approximately 9-to-1.

Figure 6-3 Sluicing event at Morris Reservoir

Sluicing (Removal) - Environmental Impacts

Impacts from sluicing operations on biological resources within the reservoir would vary, depending on whether the reservoir has a pool year-round. Sluicing operations typically occur after reservoir inundation periods, so there usually is not vegetation within the areas in which equipment would be pushing sediment into the sluiceway. However, this would not be the case for a reservoir that is kept dry, except for storm periods; such a reservoir could have vegetation that would be impacted.

Water quality within the reservoir would not be impacted by sluicing operations since no significant amounts of water would remain in the reservoir after draining it. The only water within a reservoir that is being sluiced would be water flow entering and passing through the reservoir.

Dewatering a reservoir in order to sluice could affect water conservation if the water is released faster than downstream spreading facilities can handle. Furthermore, some of the silt resuspended in the water during dewatering and sluicing can deposit in the channel and affect water conservation efficiency. This is discussed further in Section 6.4.1, which discusses the impacts along the channel downstream of the reservoir.

Sluicing operations within a reservoir would result in equipment emissions. However, based on experience from the Flood Control District's previous sluicing projects, only a few pieces of equipment would be necessary within the reservoir. Therefore, air quality impacts would not be significant.

Sluicing (Removal) - Social Impacts

The social impacts of removing sediment from a reservoir by sluicing are the same as the social impacts associated with excavating and dredging a reservoir (Again, this section focuses on the impacts within or in the proximity of a reservoir). Sluicing activities within a reservoir would not impact traffic or recreational resources. Visual and noise impacts would be experienced by those in proximity of the reservoir.

Sluicing (Removal) - Implementability

The ability to remove sediment from a reservoir by sluicing will be dependent on inflow into the reservoir, which is entirely dependent on the weather or, in the case of San Gabriel and Morris Reservoirs, on an upstream reservoir. Large reservoirs with watersheds that can deliver sufficient inflow during the summer and fall seasons would be sluiced during the summer and fall. Reservoirs with watersheds that deliver inflow only during and immediately after storms would be sluiced during the storm season if it is safe to do so. Typically, sluicing operations occur during or after very wet storm seasons. In addition to inflow, another factor that limits sluicing is the availability of temporary sediment storage areas and the rate at which they can receive the sluiced water-sediment mixture.

Similar to the other methods of sediment removal already discussed, environmental regulatory permits would be needed.

Given that numerous sluicing projects have been conducted in the past by the Flood Control District, sluicing sediment from reservoirs is a technically certain method of sediment removal.

Sluicing (Removal) - Performance

The time required to sluice a given amount of sediment out of a reservoir depends on the inflow into the reservoir and the entrainment of sediment into the water stream as it travels through the reservoir. Typically, sluicing operations occur during or after very wet storm seasons. Based on historical records, the Flood Control District has been able to remove between 150,000 to 2,600,000 CY of sediment in a given sluicing season, depending on the reservoir and the wetness of the storm season during or preceding the sluicing operation.

Sluicing (Removal) – Cost

The cost of sluicing sediment from a reservoir is approximately $2.50 per cubic yard. This does not include costs associated with transporting to and removal from the temporary sediment storage areas or for final placement.

Sluicing (Removal) – Conclusion

☑	Large reservoirs
☒	Small reservoirs
☒	Debris basins

Sluicing as a removal alternative could be feasible at large reservoirs that typically have enough inflow during the dry season. However, it is not feasible at small reservoirs or debris basins, which do not have sufficient flows needed to sluice.

6.4 TRANSPORTATION ALTERNATIVES

Section 6.4 discusses transportation of sediment removed from the reservoirs and debris basins by means of sluicing, trucking, conveyor belt, slurry pipeline, rail, two-way saltwater pipeline, and cable bucket system.

6.4.1 SLUICING (AS A TRANSPORTATION ALTERNATIVE)

Sluicing involves using flow water to carry sediment suspended in it. This section focuses on the impacts sluicing has on the waterways downstream of the reservoirs. For the impacts of sluicing within a reservoir, refer to Section 6.3.4.

Sluicing (Transportation) - Environmental Impacts

Impacts from sluicing operations on biological resources below the dam would vary, depending on whether the watercourse below the dam contains significant aquatic resources. Some reservoirs contain significant fish and amphibian life and habitat downstream of them while others do not. Riparian vegetation could be positively impacted due to the nutrients provided by the sluiced sediment.

As sluiced flows travel downstream, some of the silt in the flows deposits along the waterway. This affects water conservation in two ways. In the case of the San Gabriel River, which has detention basins within the river for groundwater recharge, deposits would lower percolation rates. In other waterways, deposits can remain in the channel, resuspend with future flows, and possibly make it to downstream recharge facilities, causing percolation rates in the recharge facilities to decrease. Washing out the channel after sluicing helps to remove deposits and decrease the impact on groundwater recharge; however, the ability to do so is highly dependent on the availability of base flows or water from upstream reservoirs.

Figure 6-4 Channel flowing with sediment laden flow

Sluicing (Transportation) - Social Impacts

If waterways have permitted recreation uses such as fishing and swimming, that recreation would be impacted. There would be visual impacts along the channel as the flows would not be clear. Additionally, there could be odor impacts and a temporary rise in insects near the channel.

Sluicing (Transportation) - Implementability

Environmental regulatory permits would be needed to sluice sediment along the waterways downstream of the reservoirs. Some of the sediment will settle in the waterway as sediment-laden water travels downstream. Sediment that deposits downstream could reduce the hydraulic capacity of the channel. Such sediment could need to be removed. Environmental regulatory permits would be needed to remove sediment from the waterways.

The ability to transport sediment by sluicing is affected by a channel's slope and other characteristics. In channels that are relatively flat, there would be more sediment deposition than in steeper channels. Therefore, a channel's grade and other characteristics need to be considered.

Sluicing (Transportation) - Performance

Sediment will settle as sediment-laden water travels downstream. Heavy equipment could be used to manage sediment deposition and, if necessary, remove the deposited sediment within the waterway. The sluiced sediment traveling through portions of lined channels can be highly erosive, increasing the need for maintenance and repairs.

Sluicing (Transportation) - Cost

As mentioned previously, the cost for sluicing is approximately $2.50 per cubic yard. This does not include costs associated with transporting to and removal from the temporary sediment storage areas or for placement.

Sluicing (Transportation) – Conclusion

☑	Large reservoirs
☒	Small reservoirs
☒	Debris basins

Sluicing as a transportation alternative is exclusively associated with sluicing as a removal alternative. Therefore, its feasibility for the different types of facilities is the same as for sluicing as a removal alternative.

6.4.2 TRUCKING

Trucking is a transportation method that is suitable for generally dry material and has been used extensively by the Flood Control District to transport sediment from reservoirs and debris basins. In the past, standard trucks have been used along regular roadways. However, the following sections include discussion of low emission trucks as well as trucking in channels.

6.4.2.1 TRADITIONAL & LOW EMISSION TRUCKING

Trucking – General Description

Using trucks to transport sediment from reservoirs and debris basins involves the use of single-dump and double-dump trucks.

The impacts associated with employing traditional or low emission trucks would be the same, except for the impact on air quality. While it is possible that low emission trucks are not currently available in the quantities needed, it is expected that the size of the low emission truck fleet accessible to the Flood Control District will increase in the years to come.

Figure 6-5 Excavation equipment loading single-dump trucks

Trucking – Assumptions

The following list describes the general assumptions made and taken into consideration while analyzing trucking as a method to transport sediment from the reservoirs and debris basins.

- A single-dump truck would handle approximately 8 CY of sediment per trip while a double-dump truck would handle approximately 16 CY of sediment.
- Trucks would average a speed of 15 to 30 miles per hour, and possibly faster depending on the route.
- For trucking operations from reservoirs, approximately 400 truck loads would be transported per day. For operations from debris basins, the number of truck loads would differ depending on the time to load the trucks.
- Trucking operations that are part of sediment removal projects at reservoirs and non-emergency debris basin cleanouts (that is, for debris basins in non-burned watersheds or have not been impacted by a major storm) would generally be conducted during weekdays for eight hours per day. Each trucking operation at a reservoir would last approximately six months.

- Trucking operations that are part of emergency debris basin cleanouts (that is, for a debris basin in a burned watershed with little time in between storms, or has been impacted by a major storm and the storm season has not yet ended) could possibly include operations during the weekend and around-the-clock work hours. The duration of such trucking operations would depend on the quantity of sediment to be removed.
- Trucking impacts can be reduced in some instances by stockpiling the sediment oustide of the reservoir or debris basin and then trucking it at a reduced rate for a longer period of time. This involves double handling of the material and less efficient operations which increases cost.

Trucking – Environmental Impacts

If existing roads are used, no particular impacts would be expected on habitat and water quality. However, if new or temporary roads are used, there would be habitat impacts and potentially water quality impacts associated with the construction and use of those routes.

The use of low emission trucks would result in lower air quality impacts than if standard trucks were used. The Flood Control District will consider opportunities to employ low emission trucks.

Trucking – Social Impacts

Employing trucks could significantly impact traffic. This is especially true along two-lane roads in and out of the remote locations where some of the reservoirs are located. The same would be true along residential streets in the neighborhoods where debris basins are located. Additionally, employing trucks could result in above-normal pavement wear.

Depending on the route and the vicinity along the route, trucking could impact recreational resources with the increase in traffic. Route selection would consider avoidance of neighborhoods and schools, traffic impacts, and trucking efficiency, among other issues. New or temporary roads in some locations would help alleviate some of the social impacts. Heavy truck traffic can also impact pavement which could lead to more re-paving projects, which would also have social impacts.

Trucking – Implementability

Some cities require trucking permits, but if truck routes were able to remain entirely on existing public roads, no right of way concerns would be expected. On the other hand, if new or temporary roads are used, right of way and possibly environmental issues woud need to be addressed.

Trucking – Performance

Based on the assumptions previously stated, approximately 400,000 CY of sediment would be able to be transported from a reservoir during a six-month operation employing single-dump trucks. On the other hand, a six-month operation employing double-dump trucks would be able to transport approximately 800,000 CY of sediment

Trucking – Cost

The cost of employing single-dump trucks is approximately $0.65 per cubic yard per mile traveled. The cost of employing double-dump trucks is approximately $0.30 per cubic yard per mile traveled. This does not include the cost for removing or placing sediment.

Trucking – Conclusion

☑	Reservoirs
☑	Small reservoirs
☑	Debris basins

Trucking is transportation alternative that could be feasible for sediment removed from reservoirs and debris basins. Wherever it is feasible to use trucks, employment of low emission trucks will be considered to reduce air quality impacts.

6.4.2.2 TRUCKING IN CHANNELS

Trucking in Channels - General Description

This method would be similar to trucking alternatives described in the previous section. However, portions of the haul route could include driving within the existing network of concrete-lined flood control channels instead of traveling on roadways.

Figure 6-6 Typical Rectangular Channel

Trucking in Channels - Environmental Impacts

The environmental impact associated with trucking in channels would be similar to other trucking methods, except for potential impacts to water quality for the stream course within the channel. Depending on the specific location, best management practices could be employed to reduce impacts by avoiding contact with the water and reducing the introduction of pollutants through fluid leaks from the trucks. Noise and emissions may be impacted to residents or businesses adjacent to the channels.

Trucking in Channels - Social Impacts

Depending on the location, rerouting truck traffic through channels could reduce traffic impacts on to communities through which the trucks need to travel. Noise could increase or decrease for residents in the vicinity, depending on the location of their house compared to the channel and the street.

Trucking in Channels - Implementability

While this method seems reasonable at first glance, two major concerns severely limit its implementability. First, in areas where social impacts could be avoided by use of this method, the relatively narrow channel widths and low bridge clearances restrict truck traffic within the channels. Channels increase in size further downstream, but arterial roadways and freeways typically become available for truck traffic, reducing the social benefits achieved by trucking within the channels. Second, the heavy, repetitive loads produced by the trucks have been shown in the past to degrade severely the concrete inverts (bottom) of the channels. This was experienced in the Los Angeles River during the Los Angeles County Drainage Area (LACDA) improvements in the 1990s. Because of these obstacles and the tremendous cost to implement significant infrastructure modifications necessary to accommodate trucks in the channels, this methodology in not currently feasible.

Trucking in Channels - Performance

For the very few, if any locations, where this method could be employed without major infrastructure modifications, its use would also be limited to the dry season. Other than this issue, performance is not expected to be a concern if the issues with implementability and social impacts can be overcome.

Trucking in Channels - Cost

New access ramps and modification to the channel bottom to allow for truck loading would significantly increase the cost compared to trucking along roadways. Costs would vary with the specific location and project.

Trucking in Channels – Conclusion

☒	Large reservoirs
☒	Small reservoirs
☒	Debris basins

Given the limited implementability and performance of trucking in channels, this transportation method will no longer be considered for future Flood Control District sediment removal projects.

6.4.3 CONVEYOR BELT

Conveyor Belt – General Description

This could involve the permanent or temporary installation of conveyor belt systems or the use of existing conveyors as a potential transportation alternative for sediment that has been excavated or that needs to be transported from a temporary sediment storage area to another site.

Generally, conveyor belts are not being considered for use at debris basins given the small quantity of sediment.

Figure 6-7 Conveyor Belt System

Excavators load the sediment on a hopper (top left), then the sediment is transported via conveyor belt (top right & bottom left) and eventually placed at a placement location (bottom right).

Conveyor Belt – Assumptions

- Conveyors with a minimum 42-in conveyor width would be used.
- A conveyor efficiency of approximately 800 CY of sediment per hour and 8 hours of operation per day, which result in the movement of approximately 6,400 CY of sediment per day.
- Conveyor operations would last approximately six months during a given year since that is the approximate number of months that sediment can be excavated out of the reservoir.

Conveyor Belt – Environmental Impacts

In order to identify and minimize the potential impacts of a conveyor operation, the habitat along the potential conveyor alignment would have to be studied. If the conveyor could be placed along existing roads, impact on habitat would be expected to be minimal. Water quality and groundwater recharge would not be expected to be impacted.

If the conveyors were to be electrically powered, air quality would only be impacted by fugitive dust as sediment is transported on the conveyor belts or as it passes through a hopper between conveyor belts. However, moisture levels of the sediment could help reduce fugitive dust emissions. Furthermore, enclosing the conveyor system or spraying the sediment with water would also reduce emissions. For systems located in areas where there is inadequate electrical power available, there would be additional air quality impacts from generators.

Conveyor Belt – Social Impacts

There would be some visual disturbances during the life of a conveyor operation. In addition, depending on the alignment of the conveyor belt system, recreational resources could be impacted visually and physically. During the installation and removal of the conveyor belt system there could be additional noise impacts to nearby areas. However, noise would not be expected to be a concern during the operation of the conveyor belt. Tests at local facilities show that the sound levels are within location noise ordinances. The following results were taken from noise testing completed at Santa Anita Sediment Placement Site (SPS) in May 2012. The first two results capture the noise from mainly just the conveyor belt whereas the last three results include the noise from other large construction equipment like scrapers and excavators.

Description	Noise Limit (dBA L_{EQ})	Approximate Distance from Activity (feet)	Measured Noise Level (dBA L_{EQ})
Parking Lot of Arcadia Wilderness Park	60	150	51.2
Near Property Line to the West of Middle SPS	60	400	48.9
Northwest Corner of Lower SPS	75	50	74.9
South Edge of Lower SPS	75	350	61.0
West Edge of Lower SPS	75	400	65.8

For comparison purposes, the following table provides the decibel level of common noises.

Noise Source	Approximate Distance (feet)	Decibel Level (dB)
Passenger car at 65 mph	25	77
Air conditioning unit	100	60
Large electrical transformers	100	50

Modified from: http://www.chem.purdue.edu/chemsafety/training/ppetrain/dblevels.htm

Conveyor Belt – Implementability

Depending on the alignment of the conveyor belt, right of way issues could have to be addressed. Placement of a conveyor belt across or along roads would need to ensure roadway safety issues (e.g., visibility, vehicle clearance, traffic controls) are taken into account. Use of an existing conveyor system would need to be arranged with the owner of the conveyor system.

Conveyor Belt – Performance

Based on the assumptions previously stated, approximately 800,000 CY of sediment could be moved by a conveyor belt system in a 6-month removal operation.

Conveyor Belt – Cost

The cost of a generally linear conveyor belt would be approximately $800 per linear foot. Complex conveyors, that is, conveyors with turns and larger elevation changes, would cost approximately $1,200 per linear foot. This does not include the cost for removing or placing sediment.

Conveyor Belt – Conclusion

☑	Large reservoirs
☑	Small reservoirs
☒	Debris basins

Conveyors are a transportation alternative that could be feasible for sediment removed from reservoirs by excavation. However, transport of sediment from debris basins on conveyors is not feasible.

6.4.4 SLURRY PIPELINE

Slurry Pipelines - General Description

Slurry pipelines would be used in conjunction with the dredging sediment removal alternative. The dredged water-sediment slurry would be pressurized and transported to its destination via the slurry pipeline.

Since dredging is not feasible at debris basins or small reservoirs, slurry pipelines are not either. Since dredging is feasible at the large reservoirs, the use of slurry pipelines to transport sediment dredged from large reservoirs may be feasible. Thus, this section focuses on the use of slurry pipelines for large reservoirs.

Figure 6-8 Slurry Pipeline

Slurry Pipelines - Assumptions

A detailed analysis of the sediment in the reservoirs and consequently of the slurry would be needed in order to design the slurry pipelines and define optimal operating conditions. However, for planning purposes, the following assumptions were made.

- A 12-inch high-density polyethylene (HDPE) slurry pipeline would be permanently installed and used at the frequency at which material would be dredged.
- The HDPE slurry pipeline would be flexible and able to handle sharp turning radii.
- The flow rate in the slurry pipeline would be approximately 15 cubic feet per second, based on the assumed dredge discharge mentioned previously.
- A lift station would be required for approximately every 5,000 feet of pipeline. The cost of installing and operating a lift station is approximately $1 per cubic yard of sediment moved.
- Slurry pipelines would be placed above ground.

Slurry Pipelines - Environmental Impacts

In order to identify and minimize the potential environmental impacts of placing and operating a slurry pipeline, the habitat along the potential alignments would have to be studied. No impacts are expected on water quality and air quality.

Transportation via slurry pipelines could affect water conservation if the discharge rate is faster than the sediment settling rate at the downstream facility where the dredged material is being dewatered. Overflows with suspended sediment can result in sediment deposition within the channel downstream of the dewatering area and downstream spreading facilities and could significantly impact water conservation.

Slurry Pipelines - Social Impacts

If placed above ground, construction of a slurry pipeline would cause some visual disturbances and temporary construction impacts. If the slurry pipeline is placed underground, it could cause visual, traffic, and recreational impacts during construction.

Slurry Pipelines - Implementability

Placement of a slurry pipeline could present both right of way and permitting issues. If a slurry pipeline is to be placed along a roadway, roadway impacts would need to be considered while determining the best alignment.

Employing slurry pipelines to transport sediment would require a discharge location where sediment can be dewatered and temporarily stored. The specifics of the required dewatering area would need to be evaluated if a slurry pipeline is to be pursued for a specific reservoir cleanout project.

Operating the lift stations along a slurry pipeline alignment would require energy. The capacity of the power grid from which the energy would be drawn would need to be evaluated if a slurry pipeline is to be employed.

Slurry Pipelines - Performance

The slurry pipeline would transport approximately 200 CY of sediment per hour, which corresponds to approximately 15 cubic feet of the slurry per second, based on the assumed limitations of a dredging operation. This type of pipeline is also expected to perform for the 20-year planning timeline, which would result in minimal maintenance effort.

Slurry Pipelines - Cost

The cost to install and operate a slurry pipeline is approximately $37.50 per linear foot. Additionally, the cost to install a lift station would be approximately $1 per station per cubic yard moved. These costs do not include the cost for removing or placing sediment.

Slurry Pipelines – Conclusion

☑	Large reservoirs
☒	Small reservoirs
☒	Debris basins

Slurry pipelines are a transportation alternative that could be feasible for sediment removed by dredging from reservoirs. Since wet removal alternatives (dredging or sluicing) are not feasible at debris basins, slurry pipelines are not either.

6.4.5 RAIL LINES

Rail is an extremely efficient mode of transportation, but is limited by the location of its tracks. The following subsections describe the possibility of using existing rail networks or constructing new ones to transport material from sediment removal projects.

6.4.5.1 EXISTING RAIL LINES

Figure 6-9 Train on rail lines

Existing Rail Lines - General Description

There is a relatively extensive rail network in Southern California. Loading and unloading of rail cars can occur at sidings, where a train can "pull over" and not impact through traffic on the main line.

Existing Rail Lines - Environmental Impacts

Use of the existing rail network for transport of sediment would result in minimal air quality, habitat, and other environmental impacts.

Existing Rail Lines - Social Impacts

Additional social impacts associated with the use of the existing rail network are also expected to be very low, except for traffic and noise impacts near sidings, where loading and unloading of the rail cars could occur.

Existing Rail Lines - Implementability

Most existing sidings are associated with a specific business and require negotiation for their use. Furthermore, significant modification of sidings could be required in order to load sediment. Due to the limited locations where sidings are located, use of this alternative would be highly limited.

Existing Rail Lines - Performance

Performance of transport by rail is limited by the proximity of sidings to the origin and destination locations of the sediment. In almost all cases, trucks or some other mode would be required to transport the sediment from its source location to a siding where it could be loaded onto a rail car. Trucks would also likely be needed to transport from another siding to the final placement location.

Existing Rail Lines - Cost

Once the sediment is on the rail cars, transport by rail is relatively inexpensive at approximately $0.03 per cy-mile. However, the cost of loading and unloading the sediment increases the cost of this alternative by $10 per cubic yard. These costs do not include the cost of removing or placing sediment.

Existing Rail Lines – Conclusion

☒	Large reservoirs
☒	Small reservoirs
☒	Debris basins

Given the limited implementability and performance of existing rails, this transportation method will no longer be considered for future Flood Control District sediment removal projects.

6.4.5.2 NEW RAIL LINES

Establishing new rail lines would result in higher social and environmental impacts than any other alternative mainly due to the wide right of way that is required. Given the high social and environmental impact, the implementability of new rail lines would be very low, if at all feasible. It is also highly expensive, costing approximately $150 million per mile to acquire right of way and install.

New Rail Lines – Conclusion

Due to the combination of high social and environmental impacts, limited implementability, and expensive cost, the construction of new rails lines as a transportation method for Flood Control District sediment management projects is not considered as part of the this plan.

6.4.6 TWO-WAY SALTWATER PIPELINE

Two-Way Saltwater Pipeline - General Description

Seawater could possibly be used as a fluid for slurry transport of sediment for facilities that do not have sufficient water naturally tributary to them. It would need to be pumped to the facility from a coastal source, then mixed with sediment and returned to a coastal outfall.

Two-Way Saltwater Pipeline - Environmental Impacts

Depending on the route considered, environmental impacts would be limited to the habitat disturbed due to the installation of the two-way pipeline and pump stations. Much of the pipeline could be located within existing rights of way.

The two-way saltwater pipeline would require high-energy usage, impact wildlife at the pumping intakes, create a higher concentration of sediment at the outfall, and modify the natural process of sediment going to the coast. The coastal intake and outfall location would have very high environmental impacts and are not considered viable options.

Two-Way Saltwater Pipeline - Social Impacts

Construction of approximately 50 miles of two-way piping, many pump stations, and an intake and outfall location would create significant traffic, noise, air quality, and visual impacts.

Two-Way Saltwater Pipeline – Implementability

This alternative is not feasible due to implementability concerns. The concerns are best illustrated by an example; take Morris Reservoir in the San Gabriel Canyon as the example. The horizontal distance from the ocean to Morris Reservoir is approximately 50 miles. The elevation difference is about 1,000 feet. The rate at which water would need to flow in the pipeline is approximately 10 cubic feet per second. Based on these and other assumptions, a total dynamic head of approximately 15,000 feet would need to be overcome to transport seawater from the ocean to Morris Reservoir. Consequently, at least 15 pump stations would be needed along the pipeline transporting saltwater upstream, along with custom made piping and flanges due to the high pressure. The pipeline carrying sediment-laden slurry would need booster pumps approximately every mile. Because of these requirements, significant amounts of electrical or diesel gas power would be required for the implementation of this alternative. Power availability for the pump stations would be a concern that would need to be addressed if this alternative was to be pursued.

Due to the geographically distributed nature of reservoirs, permanent pipeline and pump station infrastructure would be required for each reservoir.

Major environmental permitting issues are also anticipated, particularly for the intake and outfall locations.

Two-Way Saltwater Pipeline – Performance

If the implementability concerns can be addressed, the conveyance capacity of the pipeline would not present performance concerns.

Two-Way Saltwater Pipeline – Cost

The cost of a two-way saltwater pipeline including upstream and downstream piping and pump stations is expected to be approximately $400 million for each reservoir, and cost for operation and maintenance costs of the pipeline could be as high as $10 million. These costs do not include removing or placing sediment.

Two-Way Saltwater Pipeline – Conclusion

☒	Large reservoirs
☒	Small reservoirs
☒	Debris basins

Given the limitations on implementability and the extremely high cost, the use of two-way saltwater pipeline as a transportation method is not considered as part of the this plan.

6.4.7 CABLE BUCKET SYSTEM

Figure 6-10 Cable bucket system

Cable Bucket System - General Description

Cable bucket systems have seen some use in large mining operations worldwide. They function similar to a ski gondola, with a bucket for sediment suspended from an overhead cable, supported by a series of towers.

Cable Bucket System - Environmental Impacts

Depending on the route considered, environmental impacts would be limited to the habitat disturbed due to construction of the support towers and loading and unloading areas.

Cable Bucket System - Social Impacts

The visual impacts associated with a cable bucket system are very high. Due to the complex initial setup, the system would be permanently installed, resulting in a permanent visual impact.

Cable Bucket System - Implementability

The ability to implement this system is limited mainly by the potential environmental permitting issues for constructing the support towers, which is highly dependent on the length and alignment of the route.

Cable bucket systems will require right-of-way acquisition. In addition, overhead limitations such as bridges and power lines may inhibit the use of cable bucket systems.

Because of the construction methods, cable bucket systems are considered permanent systems unlike conveyors that can be dissembled and moved.

Cable Bucket System - Performance

This alternative is expected to perform well, provided the considerable site logistics are addressed. It shares many of the same performance characteristics as conveyor belts. As previously discussed, a conveyor belt system is estimated to move approximately 800,000 CY over a 6-month removal operation.

Cable Bucket System - Cost

The cost of a cable bucket system is expected to be $2,000 per linear foot. This cost does not include the cost of removing or placing of sediment.

Cable Bucket System – Conclusion

☒	Large reservoirs
☒	Small reservoirs
☒	Debris basins

Given the limited implementability and the expensive cost, the use of a cable bucket system as a transportation method will no longer be considered for future Flood Control District sediment removal projects.

6.5 BENEFICIAL USE AND PLACEMENT ALTERNATIVES

Section 6.5 describes beneficial use and placement alternatives for the sediment that reaches the reservoirs and debris basins. Specifically, this section discusses use of the sediment for beach nourishment, use in the aggregate industry and other industries, use as daily cover at solid waste landfills, use as fill at pits, and other potential beneficial uses. This section also discusses placement offshore and at sediment placement sites.

6.5.1 BEACH NOURISHMENT

This section begins by discussing coastal conditions and human interventions that have and continue to influence the coast. Then, this section discusses the transport of sediment within waterways as it relates to beach nourishment. Finally, the extraction of sand from reservoirs and debris basins deposits and the placement of that sand on the beach as part of beach nourishment projects are discussed.

6.5.1.1 COASTAL CONDITIONS AND HUMAN INTERVENTIONS

Without human intervention, most Southern California beaches would naturally be narrow and rocky. The wide beaches in Southern California were created and have been maintained by various agencies through artificial beach nourishment projects (also referred to as beach fill projects) and the construction of protective coastal structures since the 1930s. However, since the 1960s, the rate at which the initial beach nourishment quantities have been replenished has significantly decreased. In the meantime, waves continuously remove the sand that has been artificially placed at the beaches. These facts and other information within this section are discussed in the following references:

- The August 2012 draft of the Los Angeles County Coastal Regional Sediment Management Plan by the U.S. Army Corps of Engineers Los Angeles District and the California Coastal Sediment Management Workgroup
- The 2002 Beach Restoration Study by the California Department of Boating and Waterways and the California Coastal Conservancy
- The 1993 paper titled "The Myth and Reality of Southern California Beaches" by Reinhard E. Flick of the California Department of Boating and Waterways

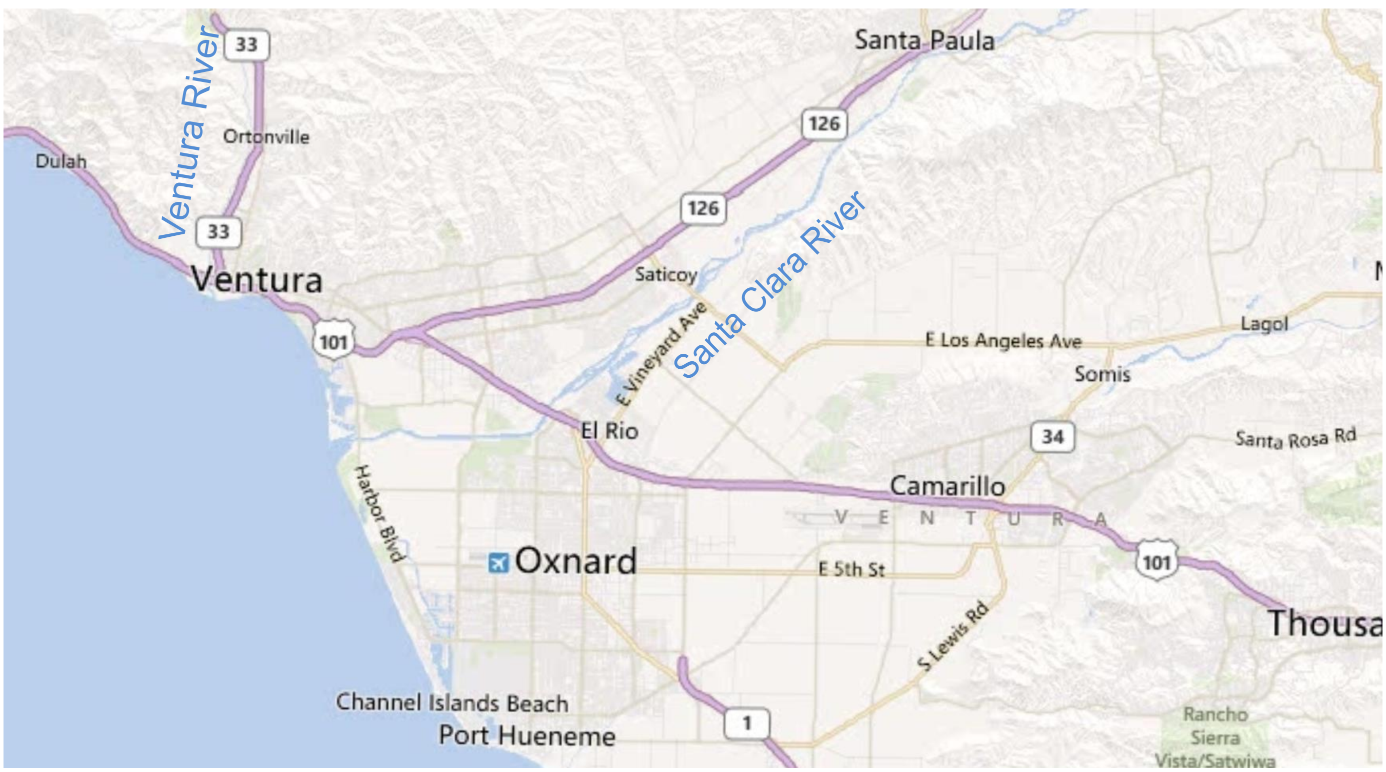
- The 2009 Coastal Regional Sediment Management Plan covering the County of Santa Barbara's and County of Ventura's coasts (from Point Conception to Point Mugu) by U.S. Army Corps of Engineers Los Angeles District, the California Coastal Sediment Management Workgroup, and the multi-County and multi-City Beach Erosion Authority for Clean Oceans and Nourishment
- The April 2012 draft of the Orange County Coastal Regional Sediment Management Plan by the U.S. Army Corps of Engineers Los Angeles District, the California Coastal Sediment Management Workgroup, and the County of Orange
- The Peninsula Beach Preservation Group's website (www.lbpeninsula.org, September 2012)

The following paragraphs discuss in detail the coastal areas within and close to the Flood Control District. The reaches, regions, or littoral cells subsequently described match those described in the aforementioned coastal regional sediment management plans. The reaches, regions, or littoral cells are defined by limits on the movement of sand along the coast or coastal sediment management planning areas rather than watershed boundaries.

Oxnard Plain Reach (County of Ventura)

The Oxnard Plain Reach extends from the Ventura River to Port Hueneme Harbor, as shown in Figure 6-11. The mouths of two rivers – Ventura River and Santa Clara River – are located within the Oxnard Plan Reach. The headwaters and a large portion of the Santa Clara River are located within the boundaries of the Flood Control District. The Flood Control District does not maintain any dams along the Santa Clara River. Within this reach, the ports have affected the wide beaches and have made regular sand bypassing operations necessary.

Figure 6-11 Oxnard Plain Reach



Malibu Region (County of Los Angeles)

The Malibu Region consists of the region between the County of Ventura/County of Los Angeles boundary line and Topanga Canyon, as shown in Figure 6-12. The quantity of sand on the beaches in this region is largely due to the numerous streams that outlet to the coast and the sand retaining bedrock exposures and boulder forms at the mouths of the streams.

Figure 6-12 Malibu Region

Santa Monica Bay Region (County of Los Angeles)

The Santa Monica Bay Region extends from Topanga Canyon (just east of the City of Malibu) to Malaga Cove (near the boundary of the Cities of Torrance and Palos Verdes Estates), as shown in Figure 6-13. Since the Los Angeles River changed course in 1825, the largest waterway reaching this region of the coast is Ballona Creek, which has an estimated annual sediment yield of less than 50,000 cubic yards and delivers generally fine-grained sediment that is not appropriate for beach nourishment.

Figure 6-13 Santa Monica Bay Region

The relatively wide beaches in the Santa Monica Bay Region stem from the construction of various projects and artificial nourishment projects that were completed mostly between the 1930s and 1960s, namely the Santa Monica Breakwater, Hyperion Treatment Plant, Marina del Rey, and a beach nourishment project at Redondo Beach. The Santa Monica Breakwater that was built in the early 1930s helped to prevent coastal erosion. Construction of Hyperion Treatment Plant, from the late 1930s to the late 1940s, and later expansion of the treatment plant contributed over 15 million cubic yards of sand to the beaches between Santa Monica Pier to the City of El Segundo. Construction of Marina del Rey in the 1960s contributed 3.2 million cubic yards of sand that were used to widen Dockweiler Beach. In the late 1960s, approximately 1.4 million cubic yards of sand were dredged from a nearby offshore location and placed at Redondo Beach.

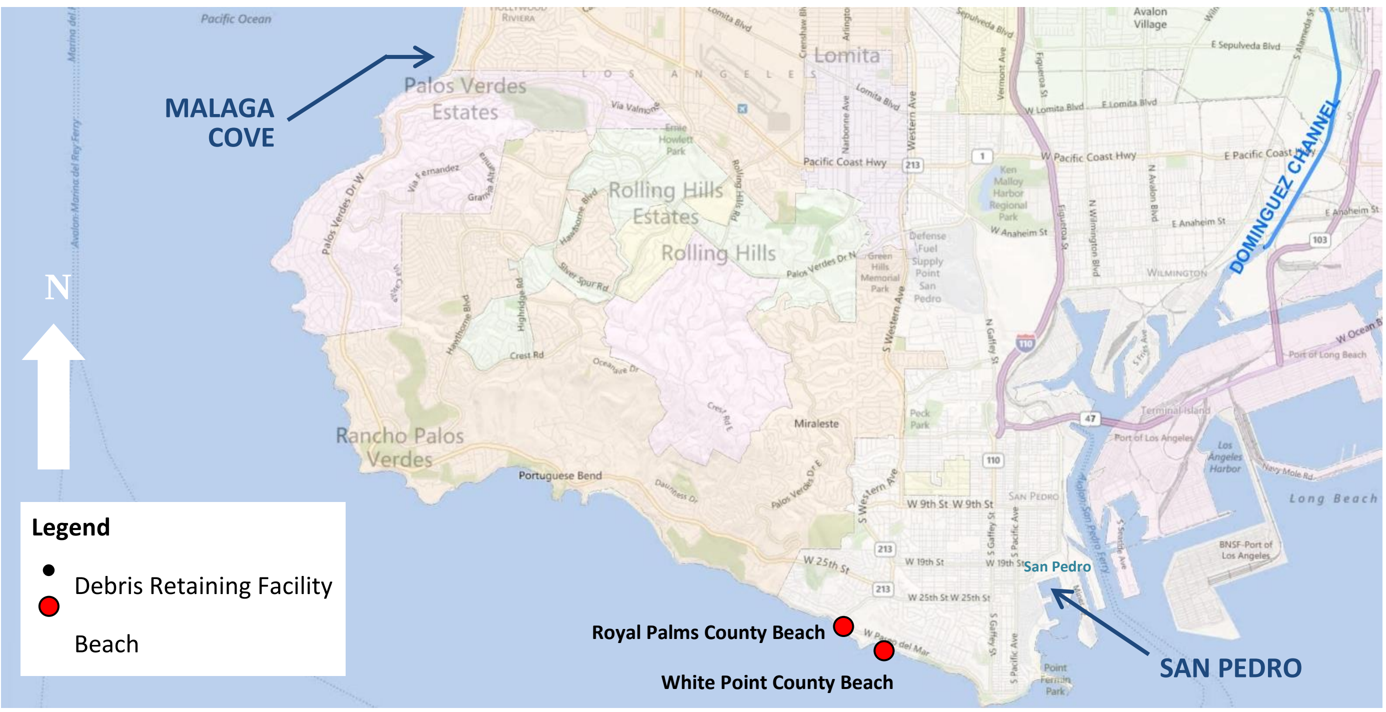
Additionally, between 1969 and 2007, material resulting from maintenance dredging at Marina del Rey was used to nourish Dockweiler Beach and Redondo Beach. These nourishment operations and those of the 1930s to 1960s were opportunistic beach nourishment projects, that is, while the intent of the projects was not beach nourishment, the resulting sand presented an opportunity in terms of beach nourishment.

Overall, as part of artificial beach nourishment projects, more than 35 million cubic yards of sand have been placed in the beaches of the Santa Monica Bay Region. In comparison, per the Flood Control District's records, between the 1940s and 2010, a total of approximately 330,000 cubic yards of sediment were removed from the three debris basins (Cloudcroft, Sullivan, and Nichols) closest to the beaches in the Santa Monica Bay Region.

Palos Verdes Peninsula Region (County of Los Angeles)

The Palos Verdes Peninsula Region extends from Malaga Cove (near the City of Torrance/City of Palos Verdes Estates boundary line) to the City of San Pedro, as shown in Figure 6-14. Only a few streams reach the coast in this region. Much of this region remains unchanged. Beaches in this region are narrow, rocky, and gravelly.

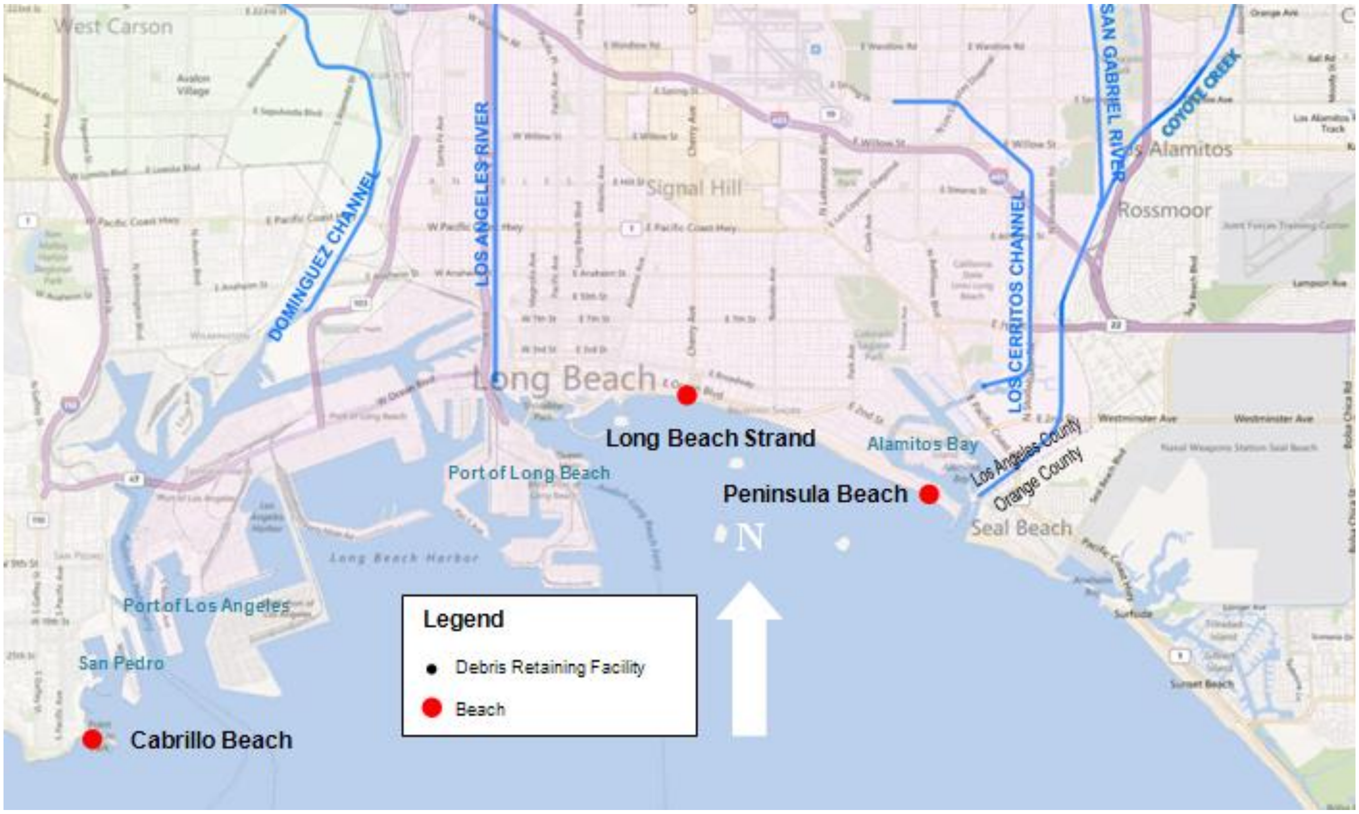
Figure 6-14 Palos Verdes Peninsula Region



Long Beach Region (County of Los Angeles)

The Long Beach Region extends from the City of San Pedro to the County of Los Angeles/County of Orange boundary line, just north of where the San Gabriel River outlets, as shown in Figure 6-15. This region includes 1) the Port of Los Angeles, where the Dominguez Channel outlets; 2) the Port of Long Beach, including Queensway Bay, where the Los Angeles River outlets; and 3) the Long Beach Marina/Alamitos Bay, where the Los Cerritos Channel outlets.

Figure 6-15 Long Beach Region



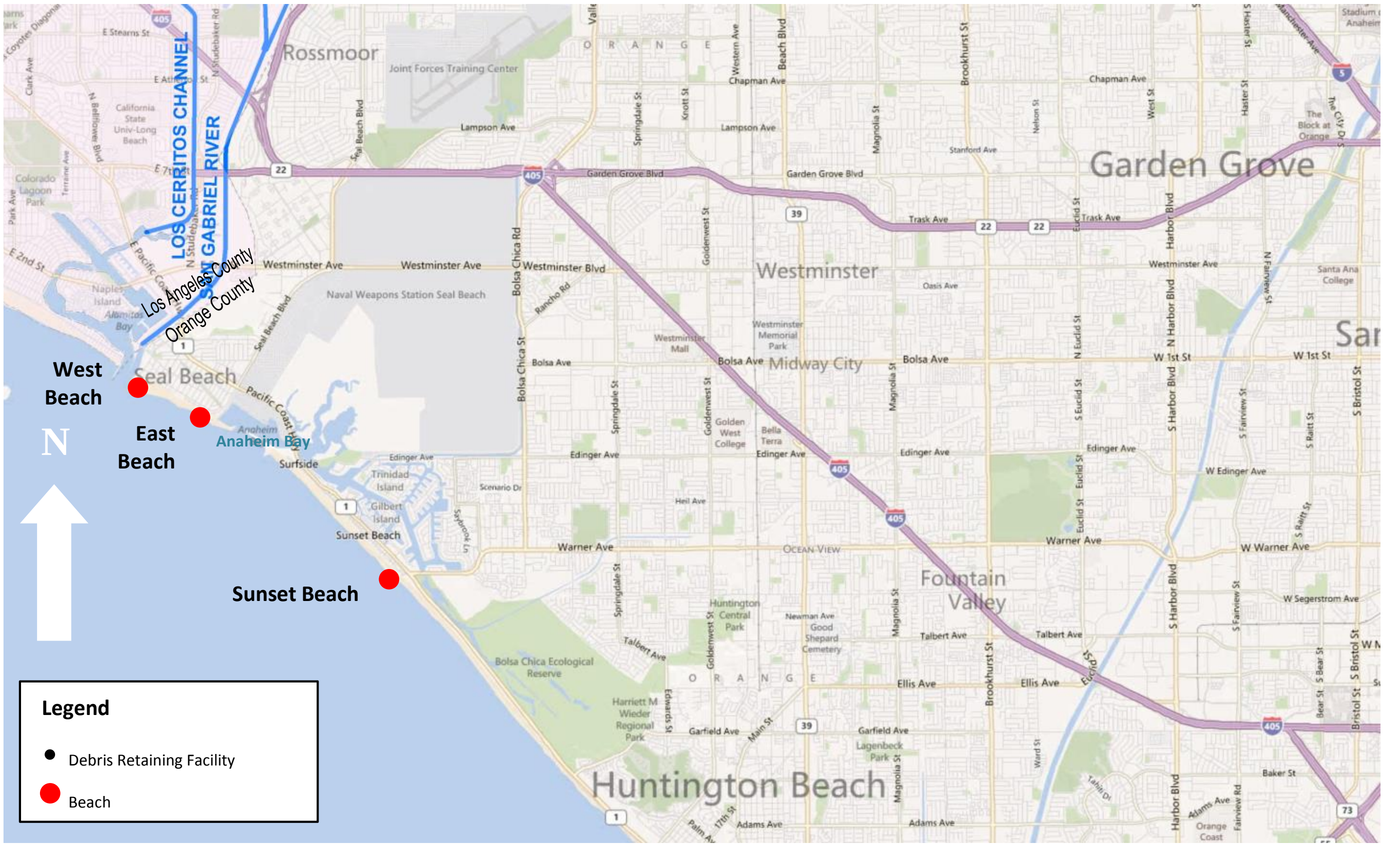
The Long Beach Region includes three beaches – Cabrillo Beach, the City of Long Beach strand, and Peninsula Beach. Cabrillo Beach, located in the Port of Los Angeles, is a man-made beach. The City of Long Beach strand is mostly stable thanks to the protection it receives from the Long Beach Breakwater, which was built in the early 1900s. However, the erosion prone area of the strand near the entrance to Alamitos Bay is dependent on regular sand backpass operations. Similar to Cabrillo Beach, Peninsula Beach is also a man-made beach; it was created with sediment dredged from Alamitos Bay during the construction of Long Beach Marina in the 1950s and 1960s. Because the west jetty of Alamitos Bay and the San Gabriel River prevent natural supply of sand to Peninsula Beach, Peninsula Beach has been replenished by regular sand bypass operations.

Currently, most of the sediment delivered by the Los Angeles River consists of fine-grained silt and clay. If sediment were allowed to flow down the Los Angeles River, there would need to be additional dredging at the port.

Seal Beach Littoral Cell (County of Orange)

The Seal Beach Littoral Cell extends from where the San Gabriel River outlets, just south of the County of Los Angeles/County of Orange boundary line, to the west jetty of Anaheim Bay, as shown in Figure 6-16.

Figure 6-16 Seal Beach Littoral Cell



The mouth of the San Gabriel River is located within this littoral cell. On its journey from its headwaters to the coast, the San Gabriel River passes through three reservoirs maintained by the Flood Control District - Cogswell Reservoir (West Fork of the San Gabriel River), San Gabriel Reservoir, and Morris Reservoir – and two dams maintained by the U.S. Army Corps of Engineers – Santa Fe Dam and Whittier Narrows Dam. Current sand delivery by the San Gabriel River is relatively low; a significant amount of sediment is trapped upstream as the river makes its journey.

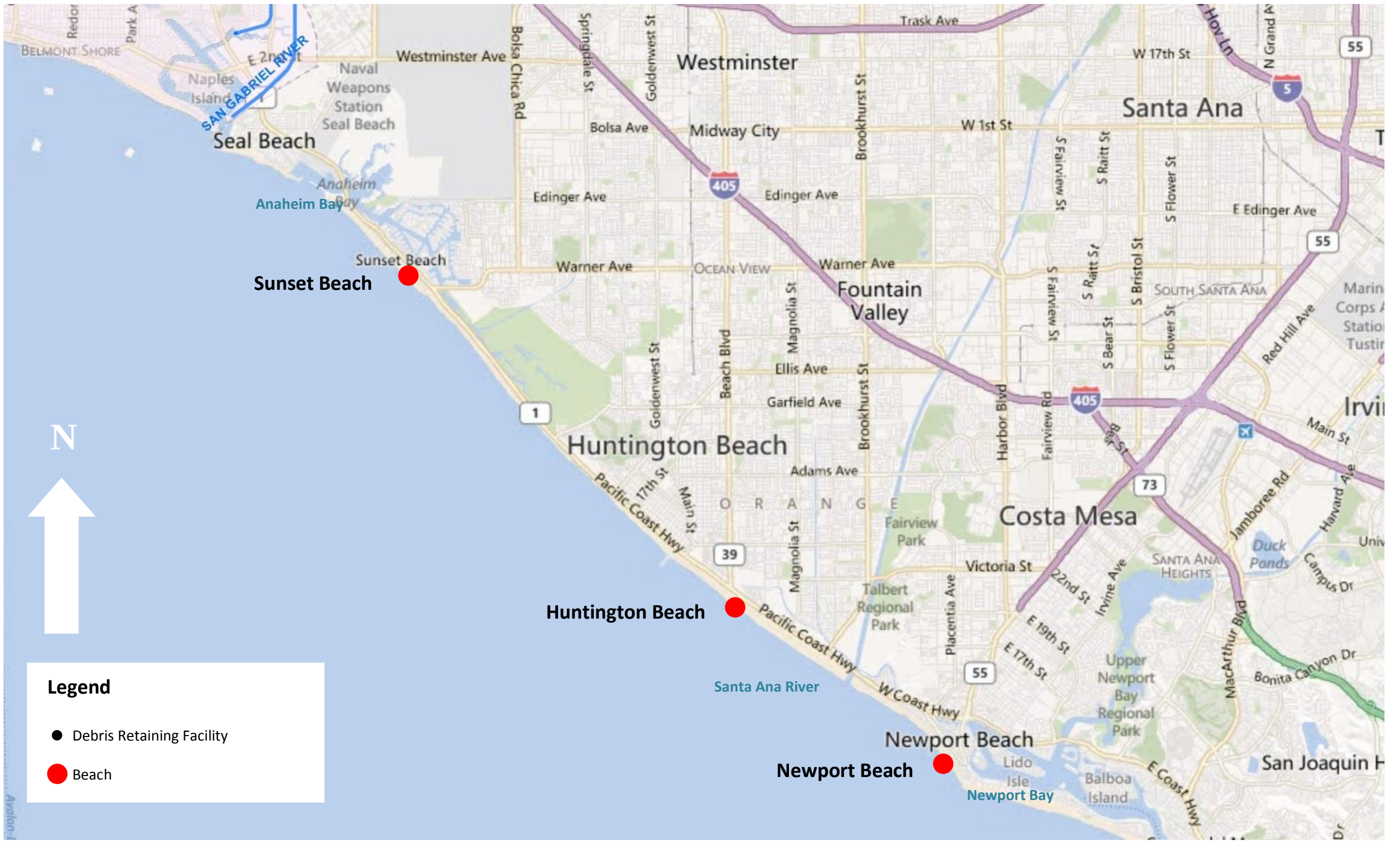
Within the Seal Beach Littoral Cell exist two distinct beaches, East Beach, which consists of the portion east of the City of Seal Beach Municipal Pier, and West Beach, which consists of the portion west of the pier. Due to the Long Beach Breakwater and to the waves that reflect off the west jetty of Anaheim Bay, sand from the East Beach is transported to the West Beach. This has led to widening of West Beach at the expense of East Beach. The issue has been managed with a groin and artificial beach nourishment projects that have employed sand from Anaheim Bay, West Beach, the San Gabriel River, and the City of Palmdale.

Huntington Beach Littoral Cell (County of Orange)

While no waterway managed by the Flood Control District outlets within the Huntington Beach Littoral Cell, it is discussed here due to the interests shared by stakeholders during the development of this Strategic Plan.

The Huntington Beach Littoral Cell extends from the east jetty of Anaheim Bay to the west jetty of Newport Bay, as shown in Figure 6-17. The major, natural contributor of sediment to this littoral cell is the Santa Ana River. Sand within this littoral cell is lost to the Anaheim and Newport Bays and Newport Submarine Canyon.

Figure 6-17 Huntington Beach Littoral Cell



Newport Beach, one of the beaches in this littoral cell, is the result of artificial nourishment. Similar to the beaches at Santa Monica and Venice, prior to artificial nourishment Newport Beach was narrow. More than 9 million cubic yards of sand were placed on Newport Beach between 1935 and 2009 to create and maintain the beach conditions known by many. The material used for the nourishment projects was obtained from the Santa Ana River, Balboa Peninsula, Newport Harbor, and Newport Beach.

Surfside-Sunset Beach, another one of the beaches within this littoral cell, has also been artificially nourished and widened. A total of more than 20 million cubic yards of sediment from Anaheim Bay and offshore were used to nourish Surfside-Sunset Beach from 1945 to 2009. Beach nourishment at Surfside-Sunset Beach is responsible for significant beach width increases not only at Surfside-Sunset Beach, but also at the other beaches within the Huntington Beach Littoral Cell.

6.5.1.2 Transport of Sediment Via Stream Flows and Beach Nourishment

The 2002 Beach Restoration Study by the California Department of Boating and Waterways and the California Coastal Conservancy explains that in natural river systems the sediment transported by water flows can deposit “in the stream channel, in the flood plain adjacent to the stream, or in an estuary at the stream mouth [or be] delivered directly to the ocean.” Based on information in the aforementioned study, an estimated 8 to 36 percent of the sediment that the water flows are able to transport is the size of sand. However, the location where the sediment would be delivered by the water flows must be considered. Since many local beaches were initially created by artificial beach nourishment projects or are the result of decades-long protection by breakwaters and groins, sending sediment down the Los Angeles and San Gabriel Rivers and other waterways would not be able to address the issues of the artificially made beaches. Furthermore, there are also other regional issues to consider, such as the following:

- The water needed to transport sediment all the way to the coast would end up being lost to the ocean. This would reduce the amount of water that is conserved by capturing it in reservoirs and later infiltrating it into the local groundwater aquifers through spreading facilities. In turn, this would result in a greater dependence of imported water, which future availability is uncertain and requires significant energy to be transported into the region.
- The additional sediment that would deposit in the stream channels could also affect water conservation operations as some of the sediment would be resuspended by water flows directed to the spreading facilities and that sediment would then deposit in the facilities and reduce infiltration rates. Remediating this problem would require sediment removal operations at the spreading facilities.
- The additional sediment that would deposit in the stream channels could reduce channel capacity, which could affect the ability to manage flood risk. Restoring flood capacity would require additional maintenance operations in the channels.
- The Port of Long Beach is located at the mouth of the Los Angeles River. As a result, additional sediment carried by the Los Angeles River would mean additional sediment at the Port of Long Beach, which would require additional maintenance dredging operations at the port.

6.5.1.3 IMPACTS OF PROCESSING AND PLACING SEDIMENT AT BEACHES

As discussed in Section 6.5.1.1, various sources of sand in close proximity to the beaches have been used by various agencies since the region's artificial beaches were created in the early 1930s. The sources have included sand dunes excavated for the construction of Hyperion Treatment Plant, sediment dredged during the construction of marinas, sediment from harbors, and offshore deposits. Due to the opportunities afforded by those closer sources of sediment, sediment deposits in the reservoirs and debris basins maintained by the Flood Control District have not been used previously as a source of sediment for beach nourishment purposes.

Beaches - General Description

The sediment that collects in the reservoirs and debris basins contains various soil types and sizes. If sediment that deposit in the reservoirs and debris basins were to be used as a source of sand for beach nourishment, it would need to be processed in order to separate the sand from the silt, clay, and rocks.

The reservoirs and most of the debris basins that are maintained by the Flood Control District are located 30 to 60 miles away from the coast. Placing sand extracted from reservoir and debris basin sediment deposits would entail transporting that sand 30 to 60 miles from the processing site to the beaches by one of the transportation alternatives in Section 6.4, in addition to transporting it from the reservoirs and debris basins to the processing site.

Continued use of sources of sand similar to those previously used could avoid a number of the issues identified below.

Beaches - Environmental Impacts

Beach nourishment would require consideration of environmental impacts to the area disturbed by placement activities. Environmental concerns at the beaches include impacts on Snowy Plovers, Grunion runs, and water quality, which the County of Los Angeles Department of Beaches and Harbors has indicated are easily mitigated and monitored during sand placement. Air quality could be impacted depending on the transportation alternative employed to take the sand from the processing site to the beach. Water conservation quantities are not expected to be impacted by the placement of sand on the beaches; this is assuming that the reservoirs would be drained to excavate the sediment in order to maintain the proper functionality of the reservoirs and not for the main purpose of getting material from which sand can be extracted.

Beaches - Social Impacts

Beach nourishment would likely require sediment to be transported through several communities including those in the foothills and by the beaches. It would also temporarily affect noise, aesthetics, and recreational use of the beach during the placement activities. However, employing this alternatively would positively impact recreation in the long-term by providing wider beaches and possibly improved surfing conditions until the waves naturally moved the sand somewhere else.

Beaches - Implementability

Permitting issues are expected to be a major hurdle for this placement option. Consideration must be given to color, angularity, size, and organic content of the sediment. Based on these requirements and the Sediment Characterization and Potential Use Assessment Report completed for the Flood Control District (2011), approximately less than 25 percent of the reservoir and debris basin sediment deposits would be appropriate for use in beach nourishment projects. This is based on the finding that approximately 25 percent of the deposits match the characteristics of washed sand, which has less stringent characteristics than beach sand. Due to the requirements, reservoirs and debris basin deposits would need to be processed in order to extract sand appropriate for the particular beach; unacceptable material would then need to be transported and used or placed somewhere else. As indicated above, implementing this alternative would require partnerships.

Beaches - Performance

Beach nourishment would require a location where the reservoir and debris basin deposits could be processed and potentially stored until the extracted sand would be able to be placed on the beach.

Since only a fraction of the total sediment could be used for beach nourishment, this alternative represents only a partial solution to the massive quantity of sediment that needs to be managed.

Beaches - Cost

The cost to process and place sediment for beach nourishment would vary with each facility due to differences in sediment characteristics and the distance from the facility to the placement beach. It is expected that the cost would be high. Additional operations and costs associated with extracting sand from the reservoir and debris basin deposits and placing that sand at the beach would require partnerships with other agencies that would benefit from the beach nourishment projects. Based on their responsibilities, potential partnering agencies could include the County of Los Angeles Department of Beaches and Harbors and cities located along the coast.

Beaches - Conclusion

⊘	Reservoirs
⊘	Small reservoirs
⊘	Debris basins

The Flood Control District is open to meeting with agencies willing to share in the additional costs of processing, permitting, transporting, and placing the material. However, the Flood Control District understands that as long as better sources of sand are available to those agencies, there may be no interest for those agencies to incur additional expenses to extract sand from the reservoir and debris basin deposits. The Flood Control District will continue to analyze this alternative further.

6.5.2 AGGREGATE AND OTHER MATERIALS

The sediment that accumulates in the reservoirs and debris basins maintained by the Flood Control District is composed of a wide range of materials, including silts and large boulders. In order to utilize the sediment as a source of material for the aggregate industry and other industries, the sediment would need to be processed into materials of specific grain size and gradations. Figure 6-18 shows a sediment processing plant in the Irwindale area.

Figure 6-18 Sediment Processing Plant in the Irwindale Area

6.5.2.1 ESTIMATED AGGREGATE NEED

In 2006, the California Department of Conservation completed a report titled "Aggregate Availability in California." The report includes estimated 50-year demands for aggregate and the permitted aggregate resources in distinct areas of the State referred to as Production-Consumption Regions. Each Production-Consumption Region includes "a group of aggregate production mines" and "the market they serve." The two most relevant Production-Consumption Regions for this Strategic Plan are the San Gabriel Valley and the San Fernando Valley-Saugus-Newhall Production-Consumption Regions. According to the 2006 report, the estimated 50-year demand for the San Gabriel Valley Production-Consumption Area was over 1 billion tons of aggregate. However, at the time of the report, the Irwindale aggregate companies, which serve the San Gabriel Valley Production-Consumption area, were only permitted to excavate 370 million tons of aggregate. The estimated 50-year need for the San Fernando Valley-Saugus-Newhall Production-Consumption Region was approximately 450 million tons. However, at the time of the report, the San Fernando Valley-Saugus-Newhall Production-Consumption Region only had approximately 88 million tons of permitted resources. Therefore, any outside sediment taken to the aggregate companies would help cover supply deficiencies and provide a benefit to the aggregate industry.

6.5.2.2 DAMS AND DEBRIS BASINS AS POTENTIAL SOURCES

In 2011, a Sediment Characterization and Potential Use Assessment Report was completed for the Flood Control District; the report can be found in Appendix E. The soils investigation conducted for the report was completed on sediment samples representative of the sediment that accumulates in the reservoirs and debris basins. The report indicates that a portion of the sediment that accumulates in the facilities could potentially have commercial value and could be processed into the following products:

- Fill sand (for use as unclassified fill)
- Coarse aggregate
- Aggregate base

- Washed sand (for use in concrete, asphalt, mortar, and such)
- Top soil

Based on the report, the net value of the typical products derived from reservoir and debris basin deposits, considering processing costs, but not the costs of handling at the source or transportation, is estimated at about $1.30 per cubic yard. Depending on the distance from the sediment source to the processing location, the net value of these materials could easily be exceeded by the cost of transporting the materials to an aggregate plant for processing. However, transportation costs are generally unavoidable when removing sediment from a debris basin or reservoir, whether the excavated materials are transported to a sediment processing plant, a landfill, a pit, a sediment placement site, or offshore. Any gains achievable from producing aggregate or other materials would help offset costs associated with managing the sediment that accumulates at the reservoirs and debris basins. The indirect value of diverting sediment from existing sediment placement sites and thereby extending the service life of those facilities is also a benefit. It is envisioned that members of the aggregate industry or other appropriate soil brokers would handle the processing or sorting of the sediment at their facilities.

Based on the results of field explorations, laboratory testing, and economic analyses, the following conclusions are presented:

Major Findings:

- Materials accumulating in the reservoirs and debris basins have commercial value when processed into aggregate materials, which could offset some of the cost of managing sediment at the facilities maintained by the Flood Control District.
- In addition, the service life of existing sediment placement sites could be extended by diverting material from these disposal sites to useful applications.

Other Findings:

- Because of the low value of top soil with respect to the production cost and the amount of waste associated with materials containing more than 70 percent fines, processing low quality materials should be avoided.
- Inclusion of washed sand in the final mix of products generally results in an overall higher valuation. However, washed sand does not provide a significant higher valuation compared to fill sand due to the relatively small gain in value with respect to the increased cost of waste disposal.
- Although fill sand could have similar net valuation compared to washed sand due to waste disposal costs, there may not be sufficient demand to keep up with production, and substantial stockpiling could be necessary.

6.5.2.3 PROPOSED SEDIMENT PROCESSING CONTRACT

As of late 2012, the Flood Control District was in the process of establishing a contract that would allow sediment to be taken to third-party sites where the sediment could potentially be processed into construction or other materials or used otherwise by the third party. In the County of Los Angeles, there are sand and gravel processing plants in the Irwindale, Sun Valley, Claremont, and Palmdale areas. The sediment could be transported to any of these areas from the Flood Control District's reservoirs or debris basins for processing into aggregate material.

6.5.3 DAILY COVER AT SOLID WASTE LANDFILLS

Some solid waste landfills use dirt to cover daily deposits of solid waste in order to avoid odors and other issues. This alternative considers delivering sediment from the Flood Control District's sediment management operations to solid waste landfills for daily cover purposes. Sediment would need to be delivered by truck; the deliveries would meet any regulatory requirements governing the transport of sediment, including regulatory requirements dealing with moisture content, as appropriate. The following discussion is based on landfill operations as of 2012. However, it is important to note that landfill operations, including the quantity of sediment needed for daily cover and tipping fees, change over time. Furthermore, landfill operations are regulated by the landfill's conditional use permit and other permits.

In addition to discussing the general impacts of using sediment from the Flood Control District's sediment management operations as daily cover, this section provides details about a couple of the landfills in the County of Los Angeles, namely Sunshine Canyon Landfill and Scholl Canyon Landfill. Other landfills are not discussed due to their size, restrictions, impending closure (e.g., Puente Hills Landfill), or unknown future (e.g., Chiquita Canyon Landfill).

6.5.3.1 GENERAL

Solid Waste Landfills - Environmental & Social Impacts

It is assumed sediment deliveries from the Flood Control District would only be changing the source of the sediment used as daily cover and not the landfills' operations. Therefore, use of solid waste landfills for placement of sediment from reservoirs and debris basins would have minimal environmental and social impacts. However, if the use of sediment from the Flood Control District's facilities resulted in additional truck traffic, there could be some traffic impacts within the communities surrounding the landfills. It is expected that the agencies that regulate the landfills and their impacts on air quality would address any potential impact on air quality due to stockpiling of sediment, if stockpiling was required.

Solid Waste Landfills - Implementability

Implementation of this alternative would be contingent on a landfill's conditional use permit and any other permits or regulatory requirements.

Landfill acceptance of sediment is constrained to their daily cover needs. The quantity and rate of removal from a cleanout activity would need to match that of the daily cover needs, unless a temporary sediment storage area could be utilized. Temporary storage areas could be located at the removal location, landfill, or another alternate location. Removal operations could also be altered to meet the daily cover needs.

Additionally, landfills have limitations on the maximum stone size and moisture content in sediment used for daily cover. This could limit the implementability of this alternative.

Sediment that is to be placed at a landfill may require testing to determine that it meets the requirements of that landfill.

Solid Waste Landfills - Performance

If sediment from various Flood Control District facilities needed a placement site at the same time and the quantity of sediment available is greater than the quantity that can be accepted by the landfills, a determination would have to be made as to what sediment would be taken to the landfills.

6.5.3.2 SUNSHINE CANYON LANDFILL

Sunshine Canyon Landfill, shown in Figure 6-19, is located at the northwestern end of the San Fernando Valley near the interchange of the 5 and 210 Freeways. As of 2012, the following conditions applied to the landfill.

- Currently the landfill uses approximately 2,000 CY of soil each day as cover.
- The landfill has adequate space to stockpile sediment. Therefore, delivery of sediment would not be constrained to the rate of daily cover needs.

- A tipping fee of approximately $7.50 per cubic yard or less would be assessed for sediment deliveries from the Flood Control District to offset the cost of rehandling stockpiled materials.
- The landfill would be interested in accepting sediment from the Flood Control District for daily cover purposes.
- The landfill is anticipated to remain open until 2037, given current disposal rates.

Figure 6-19 Sunshine Canyon Landfill Aerial

Sunshine Canyon Landfill – Performance

For planning purposes, it was assumed that approximately half of the landfill's daily cover needs could be reserved for sediment from the Flood Control District's sediment management operations. Based on this assumption, a total of approximately 20,000 CY of sediment could be delivered to Sunshine Canyon Landfill in a given month. This rate of acceptance will need to be compared with the rate at which sediment needs to be removed from a facility or a temporary sediment storage area.

Sunshine Canyon Landfill - Cost

As previously discussed, tipping fees at Sunshine Canyon Landfill are approximately $7.00 per cubic yard of sediment. This cost does not include the cost of removing or transporting sediment.

6.5.3.3 SCHOLL CANYON LANDFILL

Scholl Canyon Landfill, shown in Figure 6-20, is located in the City of Glendale just north of State Route 134. As of 2012, the following conditions applied to Scholl Landfill.

- Approximately 300 cubic yards of sediment are used at Scholl Canyon Landfill for cover each day.
- The landfill area has multiple areas for stockpiling material.
- The landfill does not accept dirt delivered on bottom dump trucks; therefore, sediment cannot be delivered to the landfill on double-dump trucks.
- A tipping fee of approximately $5.00 per cubic yard would be charged for clean dirt delivered.

- The landfill is currently interested in receiving clean dirt deliveries.
- As of August 2012, closure of the landfill is scheduled for 2032.

Figure 6-20 Scholl Canyon Landfill

Scholl Canyon Landfill – Performance

Assuming half of the landfill's daily cover needs could be reserved for sediment from the Flood Control District's sediment management operations, approximately 3,000 CY of sediment could be delivered to Scholl Canyon Landfill in a given month. To determine the performance of this alternative, this rate of acceptance is compared with the rate at which sediment would need to be removed from a facility or a temporary sediment storage area in the reservoir-specific sections.

Scholl Canyon Landfill - Cost

As previously discussed, tipping fees for clean dirt at Sunshine Canyon Landfill are approximately $6.00 per cubic yard. This cost does not include the cost of removing or transporting sediment.

6.5.3.4 SOLID WASTE LANDFILL SUMMARY & CONCLUSION

✓	Large reservoirs
✓	Small reservoirs
✓	Debris basins

The alternative to beneficially use sediment for daily cover purposes at Sunshine Canyon and Scholl Canyon Landfills appears to be an available opportunity for the entire period covered by the Strategic Plan. The rate of acceptance of Sunshine Canyon Landfill and Scholl Canyon Landfill will need to be compared with the rate at which sediment would need to be removed from a facility or a temporary sediment storage area in the reservoir-specific sections. For the most part, this alternative alone cannot meet the sediment placement needs of the reservoirs and debris basins. If the entire removal quantity is too great for a landfill's need, this placement alternative could be a partial placement solution.

6.5.4 FILL AT PITS

Pits – General Description

In this Strategic Plan, the term "pits" includes inert landfills, engineered fill operations, quarries (pits) that are currently being mined, and retired pits. Inert landfills are facilities that are permitted to accept inert waste. Engineered fill operations must meet specifications prepared and certified for a specific project designed to act as a structural element. As of February 2012, there was one permitted and active inert landfill in the County of Los Angeles and eight active engineered fill operations.

There are a number of pits that are currently being mined and several that have been retired, which could potentially accept sediment in the future. Most of the facilities are privately owned by members of the aggregate industry and are located near Sun Valley, Irwindale, and Claremont. Figure 6-21 shows the relative location of these three areas. The majority of pits are available in the City of Irwindale area. Figure 6-22 shows an aerial image of some of the Irwindale Pits. There are a few pits located in the Sun Valley area. Figure 6-23 shows an aerial image of some of the pits in Sun Valley. Due to the distance of the Claremont pits from the facilities maintained by the Flood Control District and the fact that there is large number of pits in the Irwindale and Sun Valley area, the Claremont pits are not considered as part of this Strategic Plan. Therefore, this section discusses the pits in the Irwindale and Sun Valley areas only.

Figure 6-21 Location of Pits

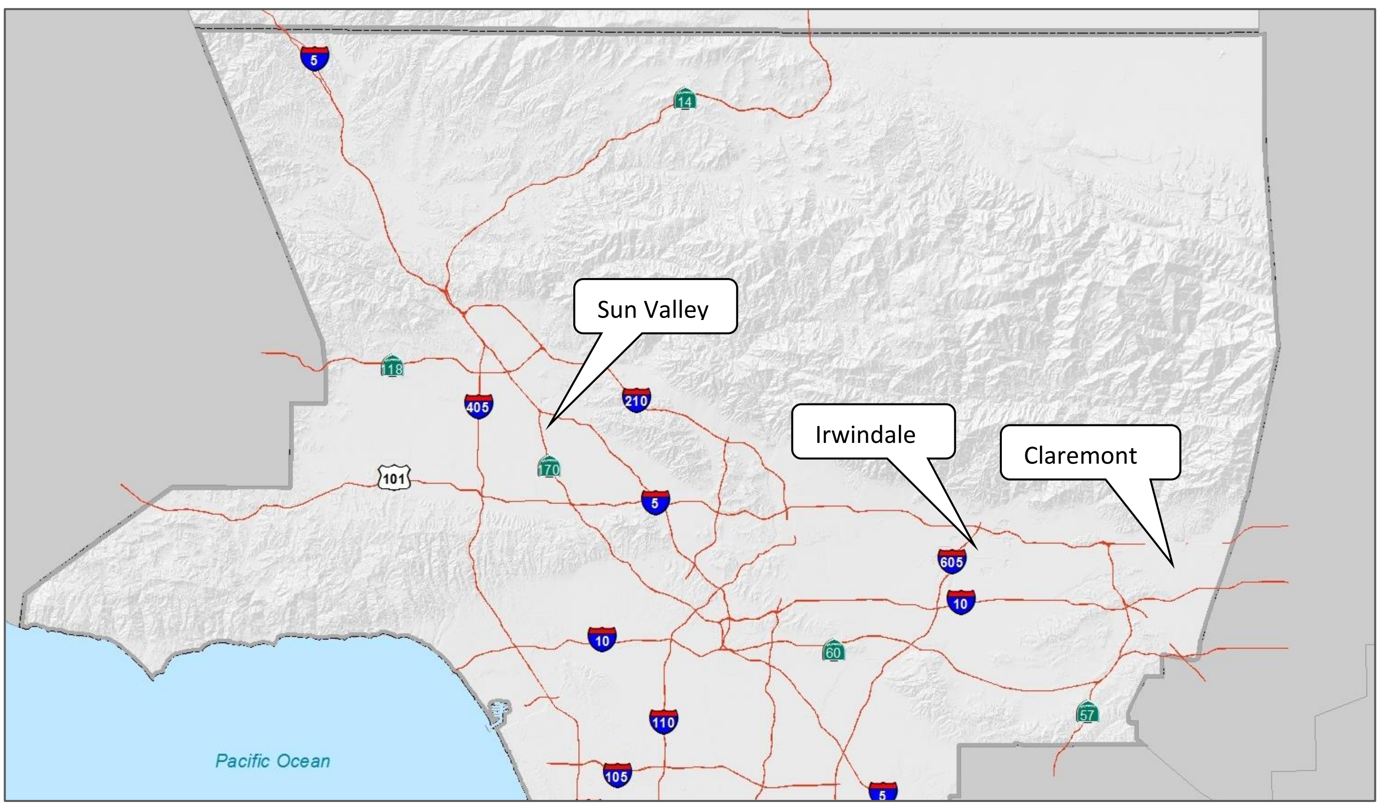
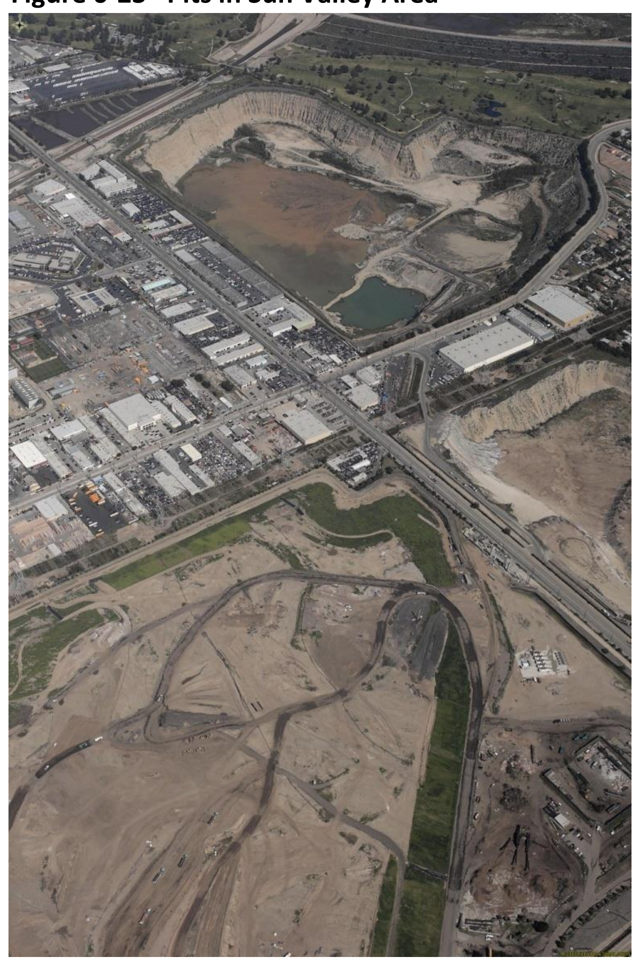


Figure 6-22 Pits in Irwindale Area

Pits – Assumptions

- Agreements can be developed with the gravel operator(s) for their acceptance of sediment from the Flood Control District.
- The gravel operator(s) have an ability to accept both marketable material for processing and sale as sand and aggregate, and non-marketable material for filling pits. Negotations would have to take place for how to value their acceptance of both types of material. For planning purposes, it is assumed they would accept marketable sediment along with an equal amount of non-marketable sediment free of charge.
- Material dredged or sluiced from the reservoirs would likely not be marketable due to the high concentration of fines in the material.
- The tipping fees of future inert landfill and engineered fill operations would be similar to the current tipping fees at the existing inert landfills and engineered fill operations.
- If the Flood Control District was able to acquire a pit for sediment placement, cost would be approximately $1 per cubic yard of available space. This cost is for the acquisition of property only.
- If the Flood Control District was able to acquire a pit for sediment placement, only the material that

Figure 6-23 Pits in Sun Valley Area



would not be accepted at the third-party pit free of charge would be taken to the Flood Control District pit for placement. The cost to place sediment at a Flood Control District pit would be approximately $2 per cubic yard. This cost is only for moving, placing, and grading sediment at the placement location

Pits - Environmental Impacts

Use of inert landfills, engineered fill operations, and pits for placement of sediment from reservoirs and debris basins would have minimal environmental impact because the sites are already disturbed.

Pits - Social Impacts

For the most part, depositing material in the pits would have minimal social impacts given the magnitude of the facilities and their existing uses. If transported by trucks, placing sediment at an inactive facility that is adjacent to residential neighborhoods would result in traffic and noise impacts. Freeway traffic in the region would also be impacted.

Pits - Implementability

No agreement would be needed in order to deliver sediment to the inert landfills or engineered fill operations, unless the operator was willing to engage in a long-term agreement with the Flood Control District for the receipt of sediment at a reduced rate. Agreements would be needed in order to deliver sediment at the pits currently being mined or are still active. As of 2012, development of these agreements was being explored with the companies in the aggregate industry. The possibility of the Flood Control District acquiring retired pits for the purpose of sediment placement will be considered in more detail. The Sun Valley Pits are shown in Figure 6-23.

Pits - Performance

It was assumed that existing and future inert landfill and engineered fill operations would have the capacity to accept material at the rate at which it would need to be delivered for optimum sediment management operations at the reservoir and debris basins. Existing conveyors between some of the facilities could facilitate deliveries to the pits, if use of the conveyor belts can be arranged.

If sediment from several Flood Control District sediment management operations needed to be taken to the subject facilities at the same time and the sum of the quantities exceeded the maximum acceptable quantity, it would have to be determined which sediment to place at the pits.

Pits - Cost

As previously discussed, it is assumed that facilities operated by the gravel industry would accept marketable, high-quality sediment plus an equal amount of non-marketable material free of charge. It is assumed that for the remainder of the material, tipping fees would be as follows:

- Facilities in the Irwindale Area:
  - Single-dump trucks: $9.70 per cubic yard
  - Double-dump trucks: $7.00 per cubic yard
- Facilities in Sun Valley:
  - Single-dump trucks: $15.00 per cubic yard
  - Double-dump trucks: $10.00 per cubic yard

The estimated cost for the Flood Control District to acquire a pit is approximately $1 per cubic yard. Additionally, the cost to place sediment at the acquired pit would be approximately $2 per cubic yard. These costs do not include the cost of removing or transporting sediment.

Pits - Conclusion

☑	Reservoirs
☑	Small reservoirs
☑	Debris basins

Pits are a viable placement alternative for all facilities and the purchase and/or use will be pursued for future cleanout operations. In this Strategic Plan, availability is assumed.

6.5.5 OTHER POTENTIAL BENEFICIAL USES

Other potential uses for the sediment include wetland restoration, replenishment of sediment-poor waterways, and replenishment of reefs. Similar to the use of the sediment for beach nourishment projects, use of the sediment for the aforementioned beneficial uses would require partnerships between the Flood Control District and agencies charged with those tasks. The Flood Control District is open to meeting with agencies willing to share in the additional costs of processing, permitting, transporting, and using the material that accumulates in the Flood Control District's facilities for these beneficial uses.

6.5.6 OFFSHORE

The U.S. Environmental Protection Agency and the Army Corps of Engineers operate a number of offshore sediment placement sites. One of the offshore placement sites is located off San Pedro. Placing sediment that accumulates in the reservoirs and debris basins in offshore placement locations is not feasible because current regulations prohibit use of offshore placement sites, if onshore sites are available. In the case of sediment from Flood Control District facilities, many feasible options would need to be exhausted prior to investigating offshore placement.

Further, the transport distance to the port is more than double that of other placement locations. Additional costs would also result from double-handling the material to transfer it to a barge and then transport the material offshore to the disposal site.

Offshore Placement - Conclusion

☒	Reservoirs
☒	Small reservoirs
☒	Debris basins

Due to the previously stated issues, offshore placement is not considered as a placement location for future Flood Control District sediment removal projects.

6.5.7 SEDIMENT PLACEMENT SITES

As discussed in Section 2.4, sediment placement sites (SPSs) are sites developed by the Flood Control District throughout the County to be strategically filled with sediment resulting from the cleanout of facilities such as reservoirs and debris basins. This section discusses placement at previously used SPSs and at potential new SPSs.

Figure 6-24 Dunsmuir SPS

6.5.7.1 PREVIOUSLY USED SEDIMENT PLACEMENT SITES

As described in Section 2.4, the Flood Control District owns 36 SPSs. Of these, 17 sites that are considered active have a combined estimated remaining capacity of approximately 48 MCY. One site in particular, Burro Canyon SPS, has a remaining capacity of approximately 29 MCY, accounting for the bulk of the remaining capacity at all sites. These facilities will continue to be used as part of the Flood Control District's sediment management operations until other placement alternatives have been fully analyzed and developed for use. As a result, this alternative is not compared with the other placement alternatives considered by the Sediment Management Strategic Plan unless the site is needed for future placement.

6.5.7.2 NEW SEDIMENT PLACEMENT SITES

While it is understood that there are environmental concerns associated with the development of new SPSs, this alternative is still being considered as part of this Sediment Management Strategic Plan. A new SPS and transportation of sediment to it could have fewer impacts than placing and transporting sediment to another placement alternative that is farther away. The uses of specific SPSs are explored further with placement options for various facilities in Sections 7 through 10.

6.5.7.3 SEDIMENT PLACEMENT SITES SUMMARY & CONCLUSION

☑	Reservoirs
☑	Small reservoirs
☑	Debris basins

SPSs are a viable placement alternative for all facilities. Previously used SPSs will continue to be used until other placement alternatives have been fully analyzed and developed for use. Potential new SPSs will continue to be considered in cases where impacts could be less than other alternatives.

6.6 SUMMARY

A number of alternatives were considered for sediment management at large reservoirs, small reservoirs, and debris basins. However, only some are feasible for the sediment management needs of the Flood Control District.

The alternatives identified to be feasible in this section are considered specifically for each reservoir and the debris basins in Sections 7 through 10. In those sections, location specific impacts and quantity specific costs are presented. Additionally, the alternatives are joined to form combined alternatives that address the entire sediment management process and planning quantities for the specific facilities. Figure 6-25 provides a summary of the alternatives for each general category of facility. Those that have been removed from consideration for that category of facility have been shaded out.

Figure 6-25 Alternative Feasibility Summary

ALL ALTERNATIVES CONSIDERED		LARGE RESERVOIRS	SMALL RESERVOIRS	DEBRIS BASINS
Removal Alternatives		**Removal**	**Removal**	**Removal**
Excavation		Excavation	Excavation	Excavation
Dredging		Dredging	Dredging	Dredging
Sediment Flushing		Sediment Flushing	Sediment Flushing	Sediment Flushing
Sluicing		Sluicing	Sluicing	Sluicing
Transportation Alternatives		**Transportation**	**Transportation**	**Transportation**
Sluicing		Sluicing	Sluicing	Sluicing
Trucks (including Low Emission (LE) Trucks)	Analysis	Trucks (inc. LE)	Trucks (inc. LE)	Trucks (inc. LE)
Trucking in Channels		Trucking in Channels	Trucking in Channels	Trucking in Channels
Conveyor Belts		Conveyor Belts	Conveyor Belts	Conveyor Belts
Slurry Pipeline		Slurry Pipeline	Slurry Pipeline	Slurry Pipeline
Rail Lines		Rail	Rail	Rail
Two-Way Saltwater Pipeline		Saltwater Pipeline	Saltwater Pipeline	Saltwater Pipeline
Cable-Bucket Systems		Cable-Bucket	Cable-Bucket	Cable-Bucket
Beneficial Use and Placement Alternatives		**Beneficial Use and Placement**	**Beneficial Use and Placement**	**Beneficial Use and Placement**
Beach Nourishment		Beaches	Beaches	Beaches
Aggregate and Other Materials		Aggregate, etc.	Aggregate, etc.	Aggregate, etc.
Daily Cover at Solid Waste Landfills		Daily Cover	Daily Cover	Daily Cover
Fill at Pits		Fill at Pits	Fill at Pits	Fill at Pits
Offshore		Offshore	Offshore	Offshore
Sediment Placement Sites (SPSs)		SPSs	SPSs	SPSs

Gray boxes indicate alternatives no longer considered for the listed facility type.

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SECTION 7 ALTERNATIVES ANALYSIS & RECOMMENDATIONS FOR RESERVOIRS ALONG THE SAN GABRIEL RIVER

This section discusses the analysis of sediment management alternatives and recommendations for the three reservoirs along the San Gabriel River that the Flood Control District maintains – Cogswell, San Gabriel, and Morris Reservoirs.

Discussion of the sediment management alternatives for each reservoir follows a similar approach as to how alternatives were discussed in Section 6. Each reservoir discussion of the alternatives is organized based on the different phases of the cleanout process, specifically:

1. Staging and Temporary Sediment Storage Areas
2. Sediment Removal Alternatives
3. Transportation Alternatives
4. Placement Alternatives

After the alternatives are discussed, combined alternatives are presented. Combined alternatives were developed by grouping a removal alternative with a transportation alternative and a placement alternative. The total cost of implementing the combined alternative is presented along with a review of the impacts. This Strategic Plan provides recommendations that will guide development of specific cleanout plans for each one of the reservoirs. However, as specific cleanout plans are developed, additional alternatives may be considered.

7.1 INTRODUCTION

The San Gabriel River originates in the San Gabriel Mountains northeast of Los Angeles, draining a rugged, highly erosive, mountainous watershed. Within the mountains there are three dams constructed on the San Gabriel River. Cogswell Reservoir is the uppermost reservoir. It is located along the West Fork of the San Gabriel River (West Fork), as shown in Figure 7-1. San Gabriel Reservoir, the next in the series, is located just downstream of the confluence of the East and West Forks of the river. The final reservoir before the river emerges from the mountains is Morris Reservoir, which is located immediately downstream of San Gabriel Reservoir.

Cogswell, San Gabriel, and Morris Reservoirs are part of the most complex flood risk management and water conservation system managed by the Flood Control District. Releases from upstream reservoirs are captured in the reservoirs below them, in addition to the inflow from each reservoir's own watershed. There are also water rights issues that add to the complexity of the system.

Due to the Army Corps of Engineers' Los Angeles County Drainage Area (LACDA) study, the required water capacity for flood risk management for the reservoirs in San Gabriel Canyon is 50,000 acre-feet or 80 million cubic yards (MCY). The Flood Control District utilizes Cogswell and San Gabriel Reservoir to meet the capacity requirement as the two reservoirs were built to manage the risk of floods, whereas Morris Reservoir was not.

The three reservoirs also stand out in that together their sediment management need of approximately 27.4 million cubic yards (MCY) constitutes nearly half of this Strategic Plan's total 20-year sediment management planning quantity for the entire Flood Control District.

The sediment management alternatives presented in this section include alternatives that purposely move sediment from one reservoir to the next reservoir, with the idea that moving sediment downstream would facilitate accessing the sediment and removing it. The planning quantities are shown in Table 7-1.

Figure 7-1 San Gabriel Canyon Flood Control System

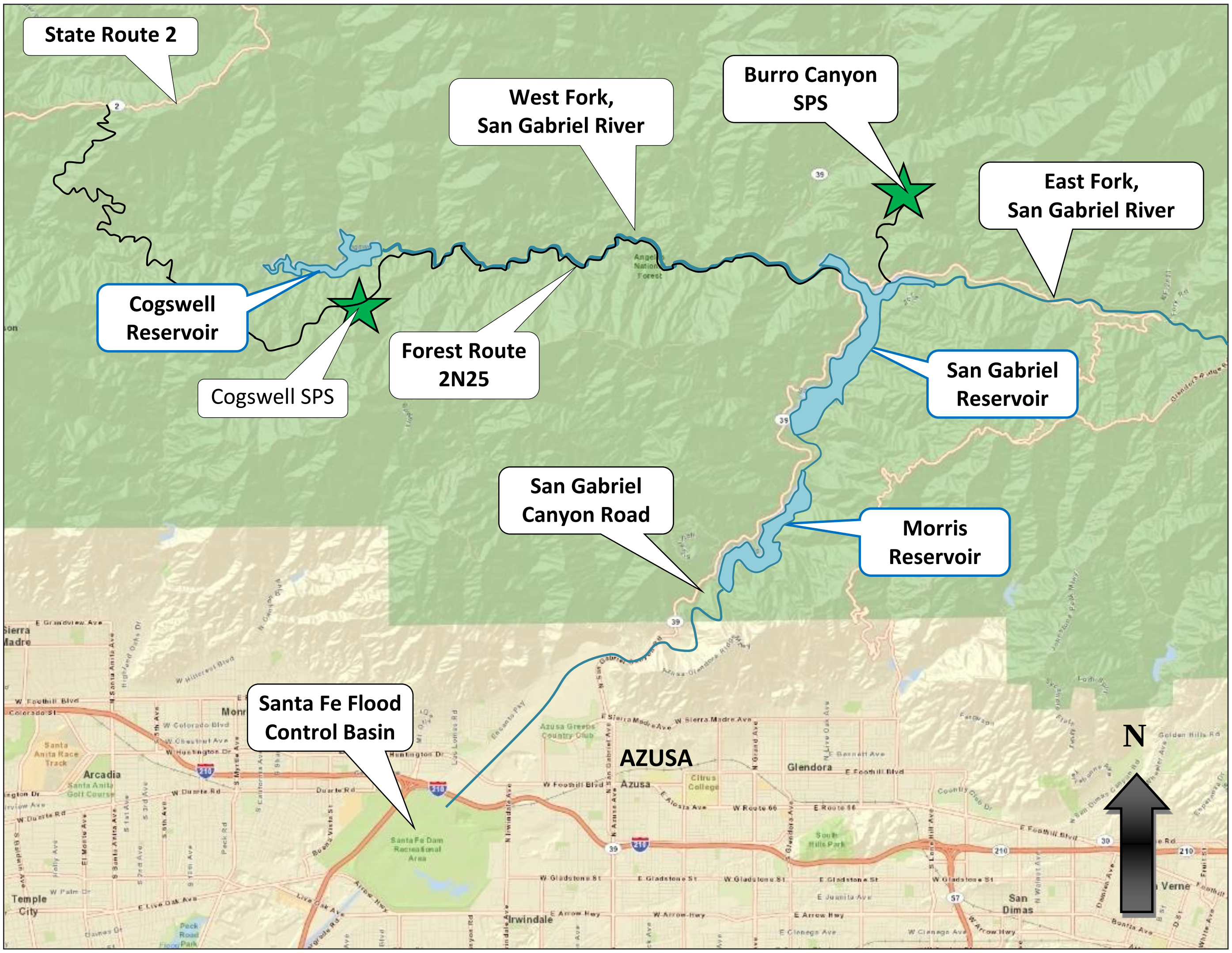


Table 7-1 San Gabriel River Reservoir's Planning Quantities

Reservoir	Projected 20-Year Sediment Accumulation (MCY)	Sediment Already in Storage Also Planned for Removal (MCY)	Sediment from Upstream Reservoir (MCY)	Total 20-Year Planning Quantity (MCY)
Cogswell	2.4	3.3	N/A	5.7
San Gabriel	20.4	-	3.4	23.8
Morris	1.3	-	2	3.3

7.2 COGSWELL RESERVOIR

7.2.1 BACKGROUND

Cogswell Dam, shown in Figure 7-2, is a rockfill dam with concrete cutoff walls and a concrete facing slab on its upstream slope. The dam was constructed in 1934 by the Flood Control District for flood risk management and water conservation. The original storage capacity at spillway was 19.8 million cubic yards (MCY). Cogswell Reservoir has a total drainage area of 39 square miles. Water captured during the storm season behind the dam is gradually released down the West Fork.

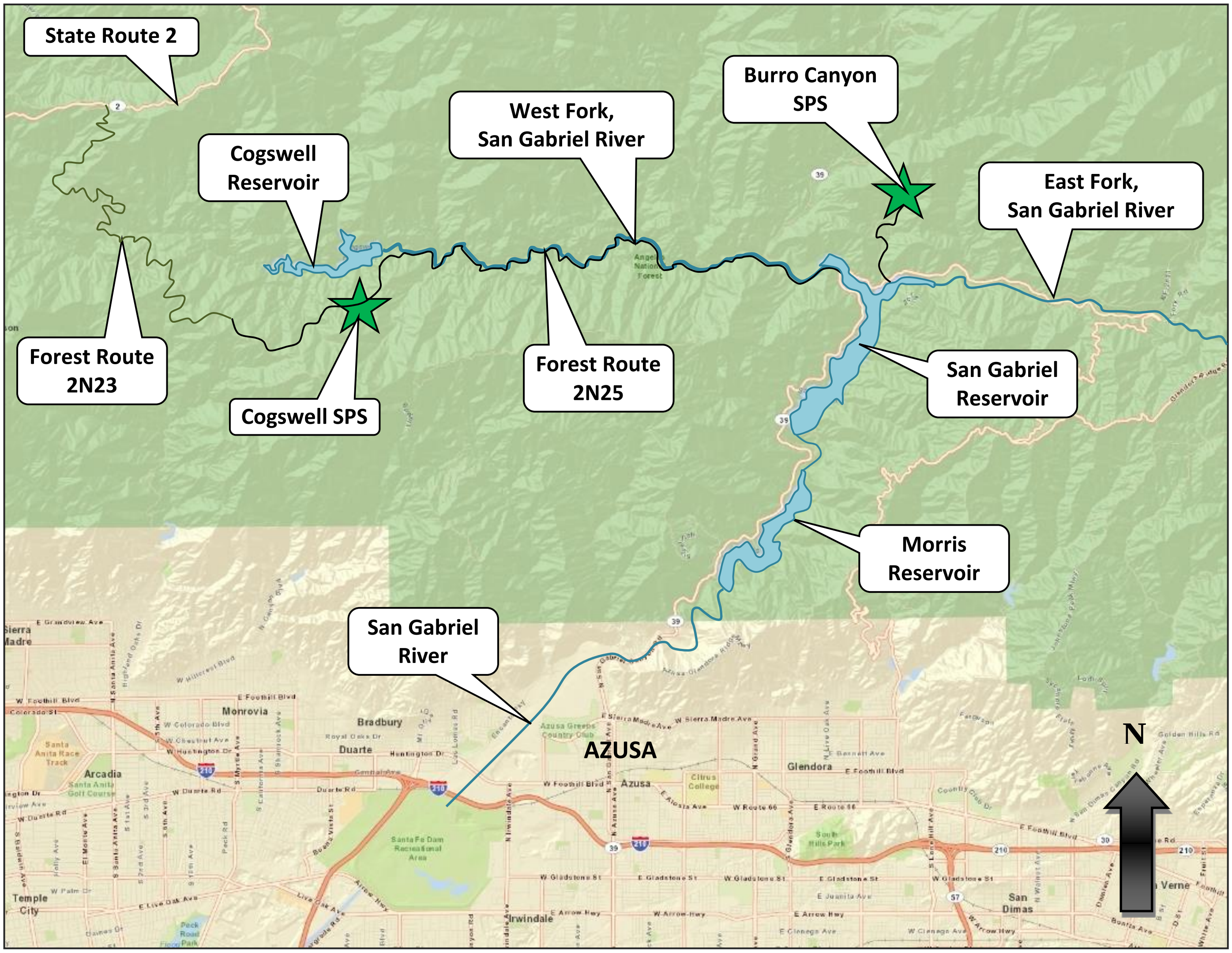
Figure 7-2 Cogswell Dam

7.2.1.1 LOCATION

Cogswell Dam and Reservoir are located in the San Gabriel Canyon of the Angeles National Forest, approximately six miles north of the City of Azusa, as seen in Figure 7-3. Devil's Canyon Creek, Lobo Creek, Bobcat Creek, and the West Fork flow into Cogswell Reservoir. The West Fork continues downstream of Cogswell Dam. As discussed in Section 7.1, San Gabriel and Morris Dams are both located downstream of Cogswell Dam.

There are two sediment placement sites (SPSs) within the vicinity of Cogswell Reservoir – Cogswell SPS and Burro Canyon SPS. Cogswell SPS has a remaining capacity of approximately 3.2 MCY. Burro Canyon SPS has a remaining capacity of approximately 29 MCY, but is reserved solely for sediment removed from San Gabriel Reservoir.

Figure 7-3 Cogswell Reservoir Vicinity Map



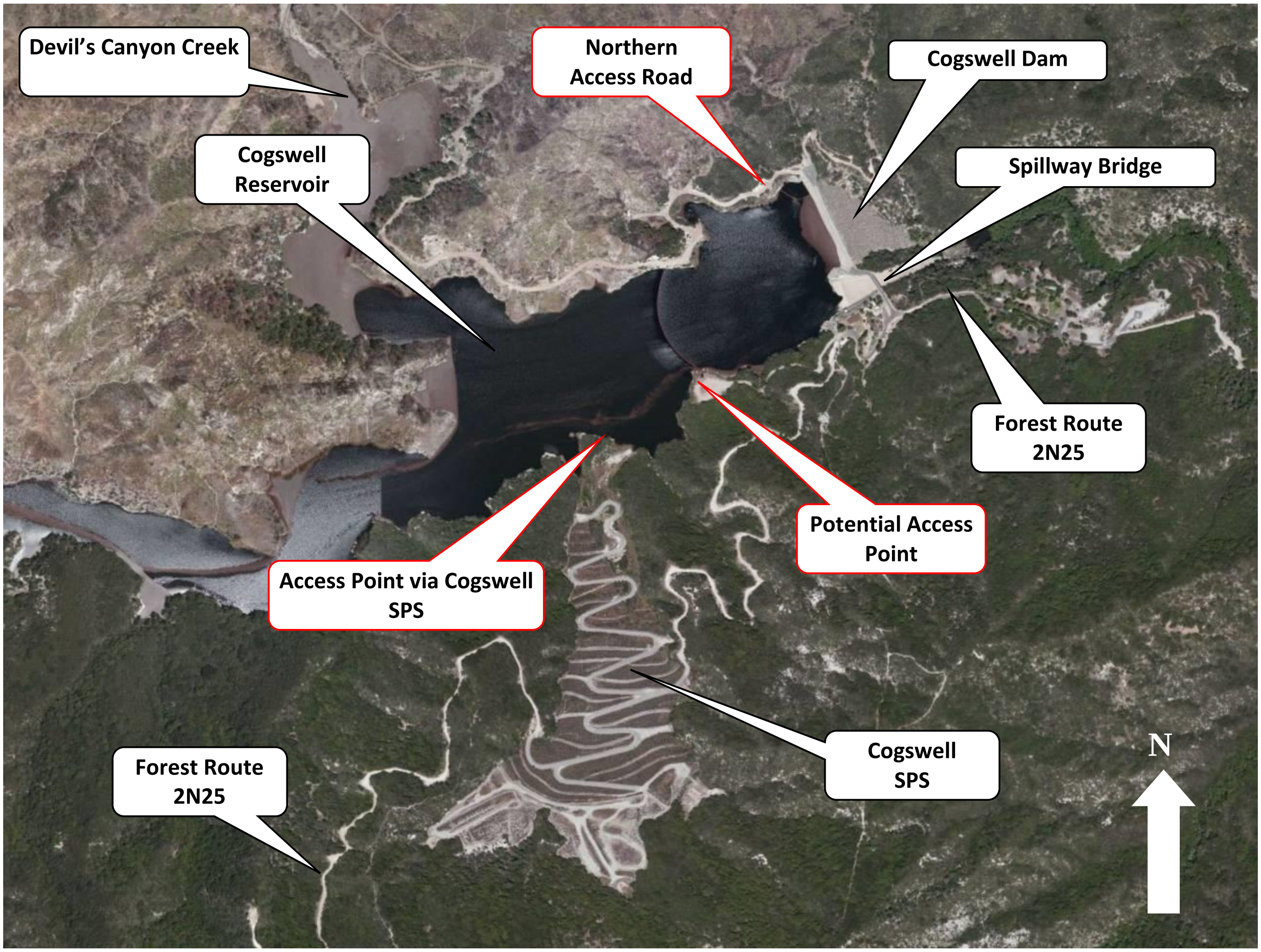
7.2.1.2 ACCESS

Access to the downstream side of the dam is available from San Gabriel Canyon Road (State Route 39) via Forest Route 2N25 as seen in Figure 7-3. Forest Route 2N25 is a sinuous, narrow, paved road located adjacent to the West Fork between Cogswell Dam and San Gabriel Reservoir that is often only wide enough for one-way traffic. There is no vehicular access to the immediate downstream face of Cogswell Dam. Forest Route 2N25 extends westward past Cogswell Dam, through Cogswell SPS, and rounds north until it meets with Forest Route 2N23, which continues north to the Angeles Crest Highway (State Route 2). However, all tractor-semi trailer combinations with 3 axles or greater are prohibited from the portion of State Route 2 that would allow access to Forest Route 2N23.

Access to the body of Cogswell reservoir along the southern side could be established at two locations. One location is approximately 0.2 miles upstream of the dam, as shown in Figure 7-4. Access could also be established from the bottom of Cogswell SPS' access road, approximately 0.5 miles upstream of the dam. A dirt access road into the reservoir would need to be reestablished from either location.

Along the north side of the reservoir there is an unpaved access road that can be reached by travelling over the spillway and crest of the dam. This access road could provide an access point to the body of the reservoir. However, the maximum load capacity of the bridge over the spillway and the impact of heavy use would need to be determined.

Figure 7-4 Cogswell Reservoir Access Points



7.2.1.3 DAM OUTLETS

In addition to being equipped with a variety of valves, Cogswell Dam is also equipped with a sluiceway controlled by a 6- by 6-foot sluice gate at the bottom of the outlet structure.

7.2.1.4 DOWNSTREAM FLOOD CONTROL AND WATER CONSERVATION SYSTEM COMPONENTS

Downstream of Cogswell Dam, along San Gabriel River, there are a total of four other dams. San Gabriel and Morris Dams are located within San Gabriel Canyon. Further downstream are Santa Fe and Whittier Narrows Dams, which are owned and operated by the Army Corps of Engineers.

Water released from Cogswell Dam travels along the West Fork for approximately seven miles until it enters San Gabriel Reservoir. Between Cogswell Dam and San Gabriel Reservoir, the West Fork retains its natural characteristics apart from the embankment of Forest Route 2N25, its crossings, and a series of concrete fishing platforms. Between San Gabriel Dam and Morris Dam, the river is fully contained within Morris Reservoir. Below Morris Dam, the San Gabriel River has an earth bottom, which allows for in-stream infiltration. The water released from Cogswell Reservoir contributes to the quantities infiltrated in-stream or captured for conservation at downstream facilities. Downstream of Whittier Narrows Flood Control Basin, the river is contained in a concrete channel until it outlets at the Pacific Ocean.

There are multiple spreading facilities along the San Gabriel River as well as the Rio Hondo that receive water from all three of the reservoirs along the San Gabriel River.

7.2.1.5 SEDIMENT ACCUMULATION AND REMOVAL HISTORY

Figure 7-5 shows the approximate quantities of sediment accumulated in Cogswell Reservoir since the reservoir's first debris season in 1935. As discussed in Section 3, it is the Flood Control District's policy to retain enough storage capacity within reservoirs used for flood risk management for two incoming design debris events (DDEs), which are calculated and determined for each specific reservoir. Two DDEs for Cogswell Reservoir is approximately 6.7 MCY, allowing for maximum sediment storage of approximately 13.1 MCY. However, as discussed in Section 7.1, the reservoirs in the San Gabriel Canyon need to provide a total of 50,000 acre-feet, or 80 MCY, of combined flood storage for flood risk management. As the Flood Control District utilizes Cogswell and San Gabriel Reservoirs to meet this storage requirement, the combined volume of sediment in storage at these two facilities must not exceed 23.5 MCY.

As of October 2010, the estimated capacity at Cogswell Reservoir was 17.4 MCY. Sediment removal at Cogswell Reservoir to date has been achieved with both sluicing and dry excavation. Approximately 6 MCY of sediment have been removed since 1935. A summary of the historical sediment removal projects can be found in Table 7-2.

Figure 7-5 Graph of Historical Sediment Storage at Cogswell Reservoir

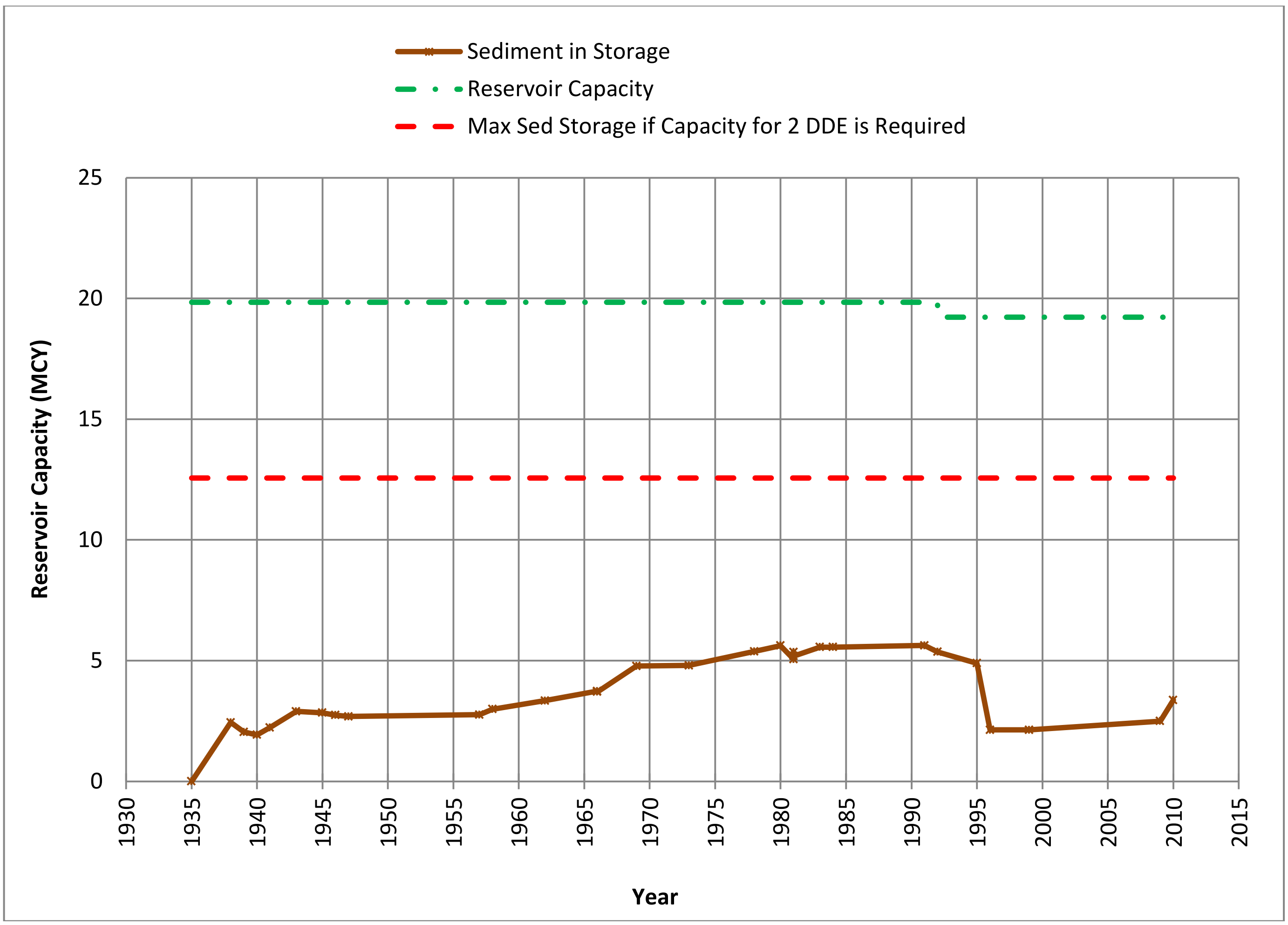


Table 7-2 Cogswell Reservoir Historical Sediment Accumulation and Removal

Survey Date		Reservoir Capacity (MCY)	Quantity Sluiced (MCY)	Quantity Excavated (MCY)	Sediment Accumulation Between Surveys (MCY)	Sediment in Storage (MCY)
October	1935	19.84	-	-	-	-
May	1938	17.40	-	-	2.44	2.44
November	1939	17.79	0.39	-	-	2.05
November	1940	17.91	0.12	-	-	1.93
November	1941	17.61	-	-	0.30	2.23
October	1943	16.94	-	-	0.67	2.90
January	1945	17.00	0.06	-	-	2.84
September	1946	17.10	-	0.14	0.05	2.74
September	1947	17.16	-	0.20	0.14	2.68
December	1957	17.08	-	-	0.08	2.76
October	1958	16.85	-	-	0.22	2.99
November	1962	16.50	-	-	0.35	3.34
June	1966	16.10	0.01	-	0.40	3.74
September	1966	16.13	0.03	-	-	3.71
March	1969	15.07	-	-	1.06	4.77
May	1973	15.04	-	-	0.03	4.80
April	1978	14.46	-	-	0.58	5.38
April	1980	14.22	-	-	0.24	5.62
May	1981	14.78	0.56	-	-	5.06
August	1981	14.49	-	-	0.30	5.35
September	1981	14.65	0.16	-	-	5.19
April	1983	14.28	-	-	0.37	5.56
December	1984	14.50[(a)]	-	-	-	5.56
December	1991	14.43	-	-	0.07	5.63
May	1992	14.70	-	0.56	0.29	5.36
July	1995	15.21	-	0.47	-	4.89
December	1996	17.97	-	3.05	0.29	2.13
November	1999	18.59[(b)]	-	-	-	2.13
December	2009	18.23	-	-	0.36	2.49
July	2010	17.35	-	-	0.87	3.37
August	2011	16.84	-	-	0.513	3.88

Notes:

a. Based on recalculation performed after the survey, information was refitted into the 1985 map that was designated as the new base map.

b. No sediment removal occurred between December 1996 and November 1999. Change in capacity is the result of a new base map designation.

Past Sluicing Projects

Approximately 1.3 MCY of sediment have been removed via sluicing from Cogswell Reservoir during approximately 7 sluicing events, the last which occurred in 1981. Sediment sluiced from Cogswell Reservoir has been captured in the San Gabriel Reservoir.

Past Excavation Projects

Approximately 4.3 MCY of sediment have been excavated from Cogswell Reservoir during 3 cleanout projects. During the first project, which occurred between 1945 and 1947, approximately 0.34 MCY of sediment were excavated from the area near the outlet towers and moved about a quarter of a mile upstream to an area adjacent to the reservoir. Between August 1991 and December 1991, approximately 0.56 MCY of sediment were removed and taken to Cogswell SPS. Both trucks and conveyor belt were used during this removal project, although trucks performed most of the sediment transport due to technical and regulatory difficulties with the conveyor belt and its generator. Between May 1994 and December 1996, approximately 3 MCY of sediment were removed and taken to Cogswell SPS. All of the sediment transport was performed by trucks.

7.2.1.6 SPECIAL CONDITIONS

Cogswell Dam and Reservoir are part of the West Fork Working Group Agreement, an agreement made between the Flood Control District, the California Department of Fish and Game, the U.S. Forest Service, Main San Gabriel Basin Watermaster, San Gabriel Valley Protective Association (which owns the rights to the water stored in the reservoir), San Gabriel River Water Committee (which has diversion rights to the natural flow in San Gabriel Canyon), and California Trout (an organization aimed at protecting and restoring wild trout, steelhead, salmon, and their waters throughout California). The agreement was developed to optimize flood risk management, water conservation, fish habitat, stream conditions, and recreation along the West Fork. A main focus of the agreement is to maintain a stream habitat below Cogswell Reservoir that supports trout and native non-game fish populations at levels that would ensure their survival. To ensure such a habitat, the minimum recommended release for a normal water year ranges from 10 to 20 cubic feet per second (cfs) or 3 to 10 cfs for a dry Water Year, depending on the month. Fish species inhabiting the West Fork include rainbow trout, Santa Ana sucker, speckled dace, and arroyo chub. The West Fork also contains species that are considered invasive, such as largemouth bass and green sunfish.

Although there are no official restrictions, the outflow from Cogswell Reservoir is limited to 2,000 cfs, when possible, to avoid damage to the Forest Route 2N25.

7.2.2 PLANNING QUANTITY & APPROACH

As described in Section 5, the projected 20-year sediment accumulation at Cogswell Reservoir is 2.4 MCY. The Flood Control District is also planning to remove approximately 3.3 MCY of sediment already in the reservoir. Therefore, a total of approximately 5.7 MCY of sediment are planned for removal over the 20-year planning period.

Based on the alternatives analysis, it was concluded that managing the entire 20-year planning quantity using one alternative would not be feasible for Cogswell Reservoir. Thus, the following discussion of alternatives assumes Cogswell Reservoir's planning quantity would be managed by more than one alternative.

As discussed in Section 6, smaller-sized sediment can be removed from a reservoir by any of the removal alternatives considered while the only feasible removal alternative for larger-sized sediment is dry excavation. Given the assumption that approximately 60 percent of Cogswell Reservoir's 5.7-MCY planning quantity, or 3.4 MCY, has the appropriate gradation to be dredged or sluiced and the long-term benefit of conserving as much capacity as possible at Cogswell SPS for removal projects past the 20-year planning period, it was assumed that 3.4 MCY of sediment would be dredged or sluiced from Cogswell Reservoir, while the remaining would be dry excavated and placed at Cogswell SPS.

7.2.3 POTENTIAL STAGING AND TEMPORARY SEDIMENT STORAGE AREAS

No staging or temporary sediment storage areas outside of Cogswell Reservoir are needed for the alternatives being considered for the reservoir.

7.2.4 REMOVAL

The following Section discusses impacts and costs of sediment removal at Cogswell Reservoir through excavation, dredging, and sluicing. Discussion of the transportation and placement alternatives is presented in Sections 7.2.5 and 7.2.6, respectively. Combined alternatives that address all phases of the sediment management process are presented and discussed in Section 7.2.7.

7.2.4.1 EXCAVATION

Under regular operating conditions, Cogswell Reservoir is never completely dry, even outside of the storm season. Therefore, in order to access and excavate sediment from the inundated area, the reservoir would have to be drained. As explained previously, it is assumed that 2.3 MCY of Cogswell Reservoir's 5.7-MCY planning quantity would be excavated.

Access for Excavation Equipment & Operation

As discussed in Section 7.2.1.2, Cogswell Reservoir can be reached from Forest Route 2N25 and access to the body of the reservoir could be established on both the northern and southern sides of the reservoir. The stretch of Forest Route 2N25 between San Gabriel Canyon Road and Cogswell Dam is very narrow and sinuous, but is still adequate to transport excavation equipment into the reservoir.

Excavation - Environmental Impacts

Arroyo chub, Santa Ana speckled dace, rainbow trout, largemouth bass, and channel catfish have been found within the reservoir. The last two species (largemouth bass and channel catfish) are non-native, invasive fish.

As mentioned in Section 6, in order to excavate a reservoir that is operated with a pool of water, the reservoir first needs to be dewatered. Dewatering a reservoir could impact habitat. Dewatering Cogswell Reservoir in preparation for excavation is not expected to greatly impact water conservation as the water released from Cogswell Reservoir would be captured at San Gabriel Reservoir.

Excavation would directly impact the fish habitat within Cogswell Reservoir. However, employing relocation and other mitigation measures would lessen impacts.

Depending on the vegetation present at the chosen access point to the reservoir, there could be some environmental impacts at the access point. The environment along the reservoir would need to be taken into consideration when planning the removal operation.

During past reservoir cleanouts, the most recent of which was completed between 1994 and 1996, environmental regulators required monitoring of the condition of biological resources and water quality before, during, and after the completion of the project. Such requirements are thus anticipated.

There would be an impact to air quality as a result of the equipment necessary for excavation.

Excavation - Social Impacts

Because Cogswell Reservoir does not serve a recreational purpose and is located in a very remote area of the Angeles National Forest that is not in the viewshed of houses or buildings, all the social impacts related to excavation of the reservoir are associated with the recreational resources nearby. Although Forest Route 2N25 is not open to public motor vehicular traffic, the route and trails near the reservoir are frequently used by bicyclists, hikers, campers, and fishermen. The scenic and visual impacts of having excavation equipment in the reservoir would be minimal and temporary for recreational users. Noise from excavation equipment could be a disturbance to recreational users in areas closest to the reservoir.

Excavation - Implementability

Excavation has been used to remove sediment from Cogswell Reservoir in the past, thereby it is technical certain that dry excavation could be implemented. Environmental regulatory permits would need to be obtained prior to excavation.

In order to excavate Cogswell Reservoir, the reservoir would first have to be dewatered. As discussed in Section 6, excavation could only be conducted outside of the storm season. This would leave approximately six months to excavate. It could be possible for work to continue into the storm season, until rain is forecasted.

Excavation - Performance

The effectiveness of excavation would be determined by the transportation mode removing the sediment from the reservoir. It is expected that the excavation equipment would be able to match the rate of removal by any mode of transportation being considered.

Excavation - Cost

As discussed in Section 6, the estimated unit cost to excavate material from a dewatered facility such as Cogswell Reservoir is $3 per cubic yard. The total cost of dry excavating 2.3 MCY of sediment from the reservoir is estimated to be $7 million. This cost does not include the cost of transporting or placing the sediment.

7.2.4.2 DREDGING

As discussed in Section 6, dredging has not been used to remove sediment from the reservoirs maintained by the Flood Control District. In order to accurately determine the technical feasibility of a dredging operation at Cogswell Reservoir, a detailed study would need to be conducted.

The following analysis is based on the assumptions detailed in Section 6 and the assumption that approximately 60 percent of Cogswell Reservoir's 5.7-MCY planning quantity, or 3.4 MCY, has the appropriate gradation to be dredged. Furthermore, it was assumed that the dredge could be connected to a slurry pipeline downstream of the dam. The remaining 2.3 MCY of larger-sized sediment would have to be excavated.

Dredging - Environmental Impacts

Dredging could impact fish habitat, including spawning areas.

Dredging operations could impact water quality by increasing the turbidity of water within the reservoir during operations. Water quality concerns could be partially mitigated with a silt curtain around the dredge. Further study is necessary to determine the level of impact.

Groundwater recharge would not be impacted as the water would be captured downstream at San Gabriel Reservoir.

Dredging - Social Impacts

Dredging would not result in increased traffic in the reservoir's surrounding area. It is expected the presence of the dredge in the reservoir would have minimal and temporary scenic and visual impacts on users of the recreational resources near the reservoir. The noise of the dredge would also be a minimal and temporary disturbance.

Dredging - Implementability

While portable cutterhead Section dredges are available, transporting a dredge to Cogswell Reservoir could be difficult on Forest Route 2N25. Even if the dredge could be transported to the reservoir in pieces, there might not be sufficient space around the reservoir to assemble and launch a dredge.

In order for a cutterhead dredge to be operational in the reservoir, the water level in the reservoir would need to be less than 50 feet. This requirement could necessitate drawing down the reservoir's water level.

As with other projects within Cogswell Reservoir, dredging would require environmental regulatory permits.

Dredging - Performance

Considering the capabilities of the dredging equipment and slurry pipeline discussed in Section 6, it would take approximately nine (9) 6-month dredging operations to remove the entire 3.4 MCY of smaller-sized material that could potentially be dredged of the 5.7-MCY planning quantity for Cogswell Reservoir for the 20-year planning period.

Dredging - Cost

It is estimated that dredging 3.4 MCY of sediment from Cogswell Reservoir would cost $36 million. This cost does not include the cost of transporting or placing the sediment.

7.2.4.3 SLUICING (AS A REMOVAL METHOD)

It is assumed that approximately 60 percent of Cogswell Reservoir's 5.7-MCY planning quantity, or 3.4 MCY, consists of material with particle sizes small enough to potentially be sluiced. Thus, another removal method would have to be employed to remove the larger-sized material that cannot be sluiced. Excavation is the only feasible method to remove the larger-sized material from the reservoir.

This section focuses on sluicing as a sediment removal method and discusses the impacts of sluicing within Cogswell Reservoir only. For the impacts of sluicing downstream of the dam refer to Section 7.2.5.1.

Sluicing (Removal) - Environmental Impacts

Cogswell Reservoir would first have to be dewatered in order to sluice. As discussed, several fish species have been found within Cogswell Reservoir. Additional studies are needed in order to determine if other species are present and the potential impacts sluicing would have on habitat within the reservoir. It could be necessary to relocate species present in the reservoir in order to avoid or reduce impacts.

Given the Flood Control District's previous sluicing projects, it is expected that minimal equipment would need to be employed, so emissions are not anticipated to be significant.

Sluicing (Removal) - Social Impacts

Since Cogswell Reservoir does not serve a recreational purpose, sluicing operations would not have any impacts on recreational users within the reservoir. The only expected traffic impacts within the vicinity of Cogswell Reservoir would be during the mobilization and demobilization of the sluicing operation along Forest Route 2N25. This would temporarily impact users of the recreational resources along the road. Noise could impact recreational users temporarily during the sluicing operation. Impacts are not expected to be significant. The scenic and visual impacts of having excavation equipment in the reservoir as part of sluicing operations would be minimal and temporary for recreational users.

Sluicing (Removal) - Implementability

Given that sluicing projects have been conducted at Cogswell Reservoir in the past, it is technically certain that sluicing could be used to remove sediment from Cogswell Reservoir. However, the ability to sluice would still be dependent on inflow into the reservoir, which is entirely dependent on the weather. In addition to inflow, another factor that limits sluicing is the capacity of the West Fork to receive sediment-laden flows.

Similar to other methods of sediment removal already discussed, sluicing Cogswell Reservoir would require environmental regulatory permits.

Sluicing (Removal) - Performance

It was assumed that if sluicing were to be employed for Cogswell Reservoir, approximately 400,000 CY of sediment could be sluiced in a given year. At this rate, sluicing would have to be performed approximately 9 of the 20 years in the planning period in order to sluice 3.4 MCY of sediment from the reservoir.

As discussed in Section 6, it has been assumed that overall the sediment-water mixture sluiced from a reservoir could have a nine-to-one water-to-sediment ratio. Approximately 19,000 acre-feet of water would be required to sluice 3.4 MCY of sediment from Cogswell Reservoir during the 20-year planning period. All water used to sluice would be captured at San Gabriel Reservoir.

Sluicing (Removal) - Cost

Based on the estimated unit cost for sluicing, sluicing 3.4 MCY would cost approximately $8.5 million. This does not include the cost of downstream removal.

7.2.5 TRANSPORTATION ALTERNATIVES

The following Section discusses transportation of the sediment removed from Cogswell Reservoir. Discussion of the removal alternatives was presented in the previous Section (Section 7.2.4). The placement alternatives are presented in 7.2.6. Combined alternatives that address all phases of the sediment management process are presented and discussed in Section 7.2.7.

7.2.5.1 SLUICING (AS A TRANSPORTATION METHOD)

This section discusses the impacts sluicing would have along the West Fork as sediment moves downstream from Cogswell Reservoir to San Gabriel Reservoir. The impacts sluicing would have within Cogswell Reservoir were discussed in Section 7.2.4.3.

Sluicing (Transport) - Environmental Impacts

Species known to exist within the West Fork include Santa Ana sucker, arroyo chub, Santa Ana speckled dace, rainbow trout, southwestern pond turtle, coast range newt, California red-legged frog, and mountain yellow-legged frog. Vegetation communities observed along the stream channel include Southern Sycamore-Adler Riparian Woodland, White Adler Woodland, Southern Willow Scrub, Southern Coast Live Oak Riparian Forest, and Coastal Sage-Chaparral Scrub.

In general, sluicing activities could cause erosion in certain areas of the West Fork and create deposits along the channel banks in other areas. A previous sluicing event from Cogswell Reservoir had environmental impacts to the downstream habitat in the West Fork that were deemed by many stakeholders to be significant. It is expected that any large quantities of sediment released from the dam would have similar impacts and trigger similar stakeholder concerns. During past reservoir cleanouts, environmental regulators required monitoring of the condition of biological resources and water quality before, during, and after the completion of the project. Such requirements are thus likely for future projects.

Releases from Cogswell Reservoir travel downstream without any significant stream flow losses because the West Fork is primarily in bed rock and shallow alluvium. The water and sediment that pass through the West Fork are captured at the San Gabriel Reservoir.

Sluicing (Transport) - Social Impacts

Some recreational activities are permitted along the West Fork including fishing, hiking, camping, and bicycling. The increased quantities of sediment in the West Fork, as a result of sluicing, would impact fish habitat and spawning areas and thus affect fishing. The sediment-laden flows would impact the scenic and visual characteristics of the West Fork.

Additionally, the US Forest Service permits off-highway vehicle (OHV) use for recreational purposes in an area called the San Gabriel Canyon OHV Area, which is near where the West Fork and San Gabriel Reservoir meet. Further investigation is necessary to determine if sluicing would impact the recreation in this area.

Sluicing (Transport) - Implementability

Sediment from Cogswell Reservoir has been sluiced along the West Fork in the past, so it is known to be technically feasible. In any case, the ability to sluice sediment downstream is dependent on the inflows to Cogswell Reservoir.

As with any other operation within a stream course, sluicing would require environmental regulatory permits. It is anticipated that obtaining permits to move any large quantities of sediment through the West Fork would be difficult.

Sluicing (Transport) – Performance

As discussed in Section 7.2.2, it was assumed that approximately 400,000 CY of sediment could be sluiced from Cogswell Reservoir in a year. As discussed in Section 6, it was assumed that sluice flows would have an approximate 9-to-1 water-to-sediment ratio. Therefore, sluicing sediment along the West Fork would mean 4,000,000 CY of the sediment-water mixture would be sent down the West Fork. The ability of the stream course to handle the sediment and accompanying water volume would need to be considered. Also, sediment deposition locations and the possibility of flushing the stream course to remove the deposits will need to be analyzed if sluicing is to be employed.

Sluicing (Transport) - Cost

The cost of transporting sediment via sluicing is minimal.

7.2.5.2 <u>TRUCKING</u>

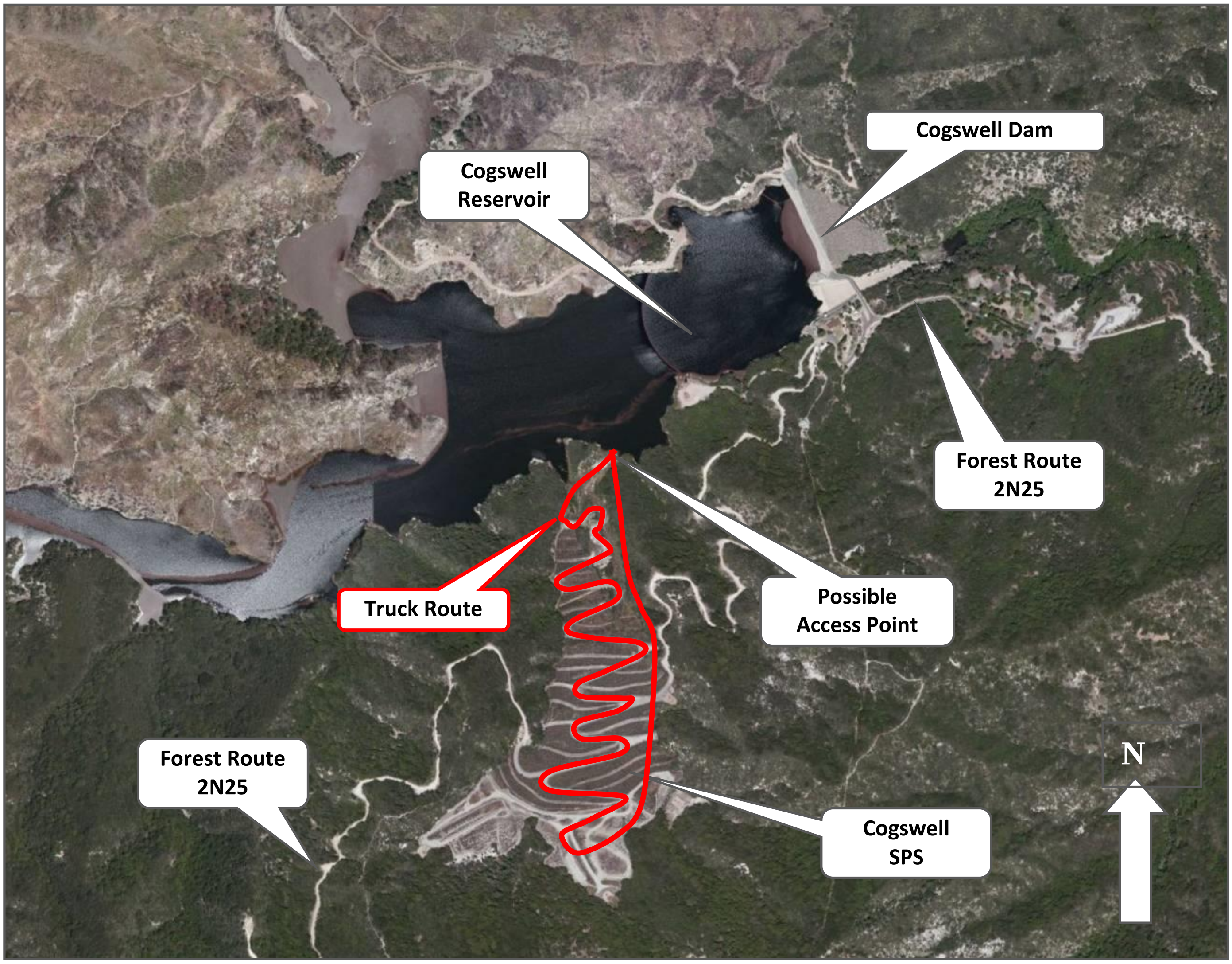
Trucking is a transportation alternative that is suitable for generally dry material. Therefore, it could potentially be used in conjunction with excavation. The material would be loaded directly on to trucks and driven to its destination.

Because Forest Route 2N25 is the only way in and out of the reservoir, the use of trucks is limited by the characteristics of this road. The road is adequate for one-way truck traffic, but it is not for two-way truck traffic. Therefore, trucking was determined not to be a feasible transportation alternative out of the canyon. The analysis discussed in the next pages assumes trucks would travel to Cogswell Reservoir via Forest Route 2N25, transport sediment from the reservoir to Cogswell SPS (located adjacent to the reservoir, approximately 0.5 miles upstream from the dam), and then travel out of the canyon the same way they went in.

Access and Route for Trucking

The lowest portion of the SPS has been filled during previous cleanout projects at Cogswell Reservoir, leaving the remaining capacity available approximately 0.5 miles uphill from the reservoir. Given that the access road to the top of the SPS is sinuous, the driving distance is increased to 1 mile. The access point and potential trucking route from the reservoir to the top of Cogswell SPS is shown in Figure 7-6. An access ramp would need to be established to use this access road.

Figure 7-6 Cogswell SPS Trucking Route and Access Point



Trucking - Environmental Impacts

Since trucks would utilize Forest Route 2N25 and the existing access road through the SPS, there would be no new impacts to habitat. Minimal impact is expected from the construction of an access ramp into the reservoir.

There would be an impact to air quality as a result of the emissions from trucks. The use of low emission trucks would result in lower air quality impacts than if standard trucks were used.

Trucking - Social Impacts

Truck traffic in Cogswell SPS would impact existing recreational activities, such as bicycling or hiking, along Forest Route 2N25, through the SPS.

Cogswell Reservoir is not in the viewshed of houses or buildings. However, there is a possibility Cogswell SPS could be partially viewed from State Route 2 (Angeles Crest Highway). Trucking sediment between the reservoir and the SPS would have some scenic and visual impacts for recreational users.

Trucking – Implementability

The access road in Cogswell SPS is approximately 15 feet wide and very sinuous, allowing only for one-way truck traffic. As done during the sediment removal project in the mid-1990s, an additional temporary access road and ramp could be constructed in the SPS to form a loop for the trucks.

As will be discussed with the placement section, environmental regulatory permits would be needed to utilize Cogswell SPS as a placement site.

Trucking – Performance

Double-dump trucks would not be able to be used because of the winding conditions of the access road through Cogswell SPS.

If single-dump trucks were used, approximately 400,000 CY of sediment could be moved during a 6-month operation. At this rate, it would take approximately six 6-month trucking operations to transport 2.3 MCY of sediment from the reservoir to the SPS.

Since trucking would only occur between the reservoir and the SPS, it could be possible to use off-highway trucks, which have a larger capacity than single-dump trucks, as done during the last cleanout in 1996. Employing off-highway trucks could result in fewer or shorter-duration trucking operations.

It was assumed trucks would travel at an average speed of 10 miles per hour, whether single or off-highway trucks were to be employed.

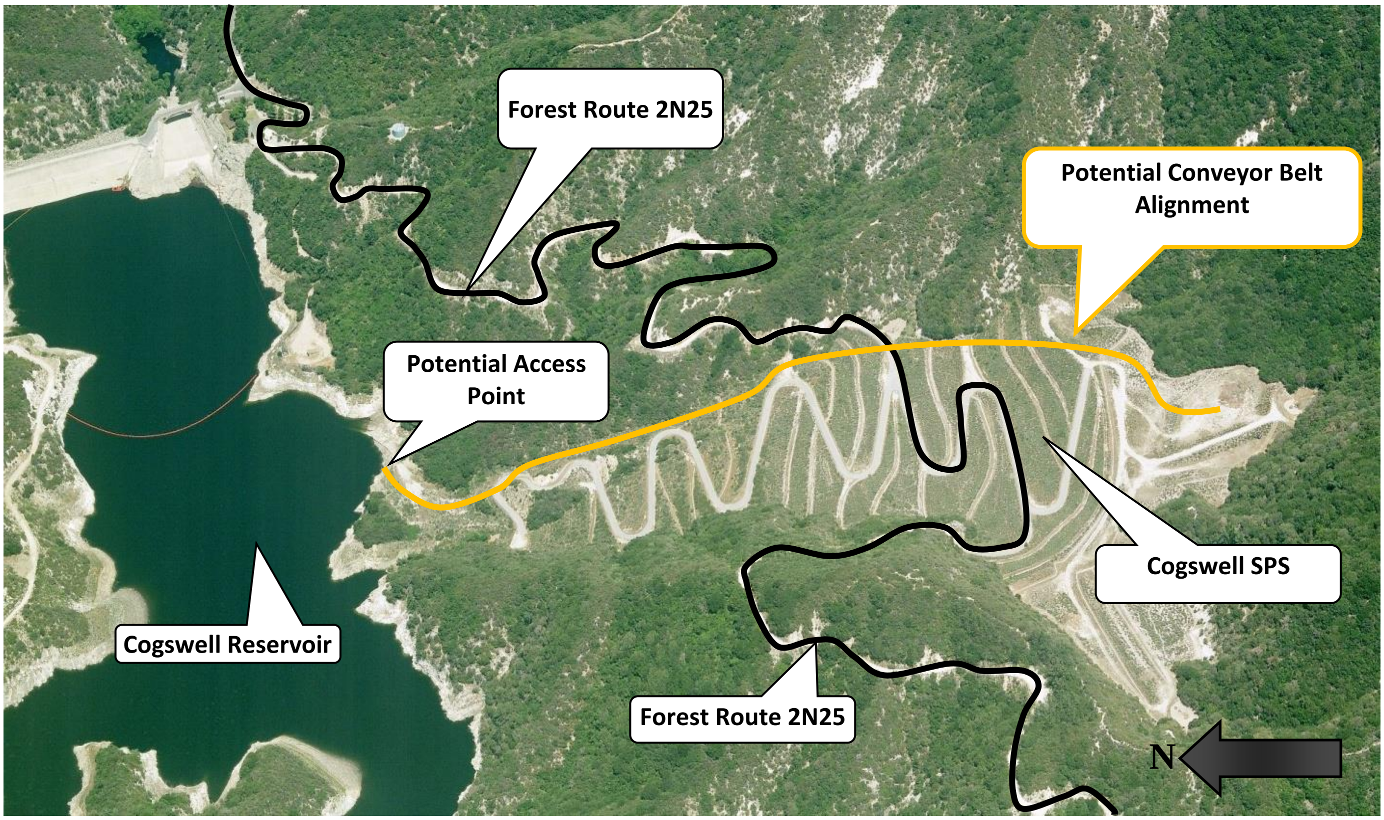
Trucking - Cost

Given the distance from Cogswell Reservoir to Cogswell SPS and assuming the use of single-dump trucks, the estimated trucking cost is around $3 million for 2.3 MCY of sediment. Cost savings could be achieved through the use of the larger capacity off-highway trucks.

7.2.5.3 CONVEYOR BELTS

A conveyor belt could be used in conjunction with excavation. For this analysis, it is assumed the conveyor belt would extend from Cogswell Reservoir to Cogswell SPS, as shown in Figure 7-7. Since the lowest portion of the SPS has been filled during previous removal projects, the remaining capacity is located approximately 0.5 miles uphill from the reservoir. Forest Route 2N25 would be used to mobilize the conveyor components.

Figure 7-7 Cogswell SPS Aerial



Conveyor Belts - Environmental Impacts

No new environmental impacts to habitat are expected from utilizing Forest Route 2N25 to mobilize the conveyor components.

Placement of the conveyor belt within Cogswell SPS would likely impact habitat within the existing fill area. California buckwheat scrub, hoary-leaf ceanothus chaparral, and black willow thickets have recently been identified along the slope of the existing fill. The following birds are considered common inhabitants of the project vicinity: California quail, northern flicker, California towhee, spotted towhee, oak titmouse, belted, kingfisher, western scrub jay, stellar jay, mourning dove, band-tailed pigeon, red-tailed hawk, common raven, northern mockingbird, Anna's hummingbird, wrentit, American coot, mallard and housefinch. Additionally, western gray squirrel, mule deer, raccoon, and black bear have been previously observed on the site. Studies would be needed to determine if any other species are present in the area and the specific impacts placement and operation of a conveyor would have on habitat.

Conveyor Belts - Social Impacts

The conveyor belt would be installed during cleanouts and removed between subsequent cleanouts.

Placement and operation of conveyor belts within Cogswell SPS could impact recreational activities along Forest Route 2N25 through the SPS. It could be possible to either elevate or trench the conveyor belt to maintain access through Forest Route 2N25 and avoid or reduce impacts.

The scenic and visual impacts of placing and operating a conveyor within Cogswell Reservoir and Cogswell SPS are expected to be minimal and temporary for recreational users.

Conveyor Belts - Implementability

The conveyor components could be transported to and from Cogswell Reservoir and SPS along Forest Route 2N25.

Once sediment is excavated from Cogswell Reservoir, it could then be loaded into a hopper inside the body of the reservoir. Sediment would then be conveyed to Cogswell SPS. Given that the minimum curve radius for a conveyor is 300 feet and the access road through the SPS has several turns with a radius less than that, a conveyor belt could not be placed along the access road. However, the conveyor belt could be placed over the existing fill at Cogswell SPS, as shown in Figure 7-7. Further investigation would be needed to determine the exact alignment of the conveyor belt.

It is expected that permitting the use of a conveyor within Cogswell SPS would be included in the environmental regulatory permits to use the SPS for sediment placement. Separate air quality permits could be needed to operate generators to power the conveyor if insufficient electrical power capacity is available in the vicinity of the project site.

Conveyor Belts - Performance

Assuming average or minimal delays due to mechanical difficulties with the conveyor belt or the generators, the conveyor belt would be able to transport approximately 800 CY of sediment per hour. Given this and other assumptions discussed in Section 6, a 6-month conveyor operation could move approximately 800,000 CY of sediment. At this rate it would take approximately three 6-month conveyor operations to transport 2.3 MCY of sediment between Cogswell Reservoir and Cogswell SPS.

Conveyor Belts - Cost

The estimated cost for constructing and operating a conveyor belt from Cogswell Reservoir to Cogswell SPS is approximately $4.2 million.

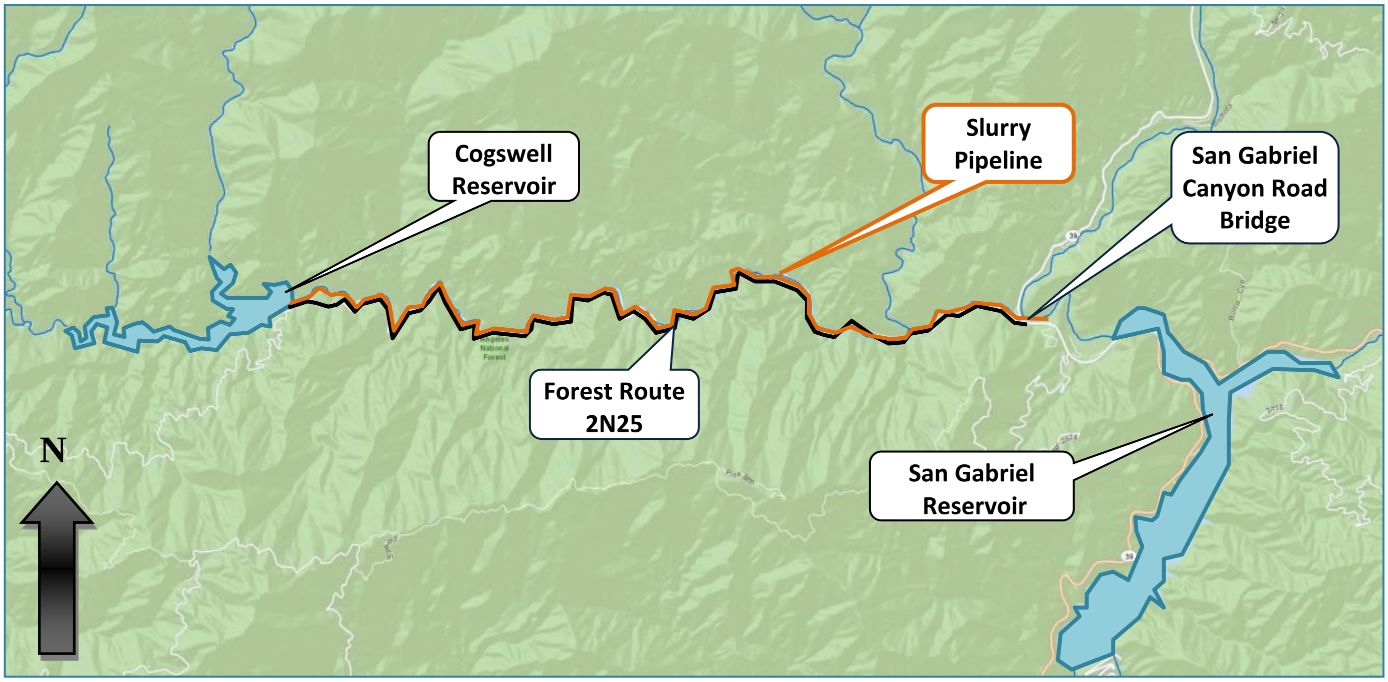
7.2.5.4 SLURRY PIPELINE

As discussed in Section 6, slurry pipelines would be used in conjunction with the dredging removal alternative. A slurry pipeline could be constructed to transport dredged slurry from Cogswell Reservoir to San Gabriel Reservoir. Removal of the material accumulated at San Gabriel Reservoir will be evaluated in Section 7.3.

Route for Slurry Pipeline

Detailed analysis would be needed to determine the specific alignment of a slurry pipeline to transport sediment from Cogswell Reservoir to San Gabriel Reservoir. For the purposes of this Strategic Plan, it was assumed the potential pipeline alignment described here and shown in Figure 7-8 would be feasible. The slurry pipeline would begin at the end of the dredge line on the downstream face of Cogswell Dam. Once the West Fork meets with Forest Route 2N25, the slurry pipeline could be constructed along Forest Route 2N25. Further investigation will be needed to determine the best method to transport the dredged material from the face of the dam to Forest Route 2N25 where the pipeline will begin. Because Forest Route 2N25 is very sinuous and narrow, portions of the slurry pipeline could encroach into the West Fork in order for the road to continue to accommodate traffic. Approximately 7 miles downstream, where Forest Route 2N25 meets with San Gabriel Canyon Road (State Route 39), the slurry pipeline would likely be placed under the San Gabriel Canyon Road bridge over the West Fork. The slurry pipeline would then travel approximately 1.5 miles along the West Fork, until meeting San Gabriel Reservoir.

Figure 7-8 Cogswell Slurry Pipeline Alignment



Slurry Pipeline - Environmental Impacts

There would be impact to habitat where the slurry pipeline would encroach on the West Fork. If required, the area needed to construct booster stations would cause additional impact. Other than construction impacts, a slurry pipeline is not expected to impact the environment along the West Fork. However, the discharge of sediment into San Gabriel Reservoir would increase turbidity and possibly affect the habitat there.

In order to identify and minimize the potential environmental impacts of placing and operating a slurry pipeline from Cogswell Dam to San Gabriel Reservoir, the habitat along the potential alignments would have to be studied.

Water quantity and air quality would not be expected to be impacted.

Species known to exist within the West Fork include Santa Ana sucker, arroyo chub, Santa Ana speckled dace, rainbow trout, southwestern pond turtle, coast range newt, California red-legged frog, and mountain yellow-legged frog. Vegetation communities observed along the stream channel include Southern Sycamore-Adler Riparian Woodland, White Adler Woodland, Southern Willow Scrub, Southern Coast Live Oak Riparian Forest, and Coastal Sage-Chaparral Scrub. A slurry pipeline is not expected to greatly impact any of these species. Further study is needed to determine the extent of environmental impact from slurry pipelines.

In past reservoir cleanouts, the most recent of which was in 1994-96, environmental regulators required monitoring of the condition of biological resources and water quality before, during, and after the completion of the project. Such requirements are thus likely for future projects.

Slurry Pipeline - Social Impacts

If constructed, a slurry pipeline would be a permanent structure for moving sediment from Cogswell Reservoir to San Gabriel Reservoir. Depending on the exact alignment of the slurry pipeline along Forest Route 2N25 and the West Fork, fishing could be impacted. Other recreational activities would be expected to be impacted only during construction of the pipeline.

Slurry Pipeline - Implementability

As mentioned previously, the slurry pipeline transportation alternative would be used in conjunction with the dredging removal alternative. Assuming that dredging is determined to be feasible, it is expected the dredge upstream of the dam would be connected to the slurry pipeline downstream of the dam. Pumps could be needed to move the slurry either over the dam or through a valve on the dam.

As discussed in Section 6, the slurry pipeline would be flexible; therefore, it would be able to handle the turning radii necessary to reach San Gabriel Reservoir.

Booster stations could be needed every mile to keep the slurry moving down the pipeline. Further study is needed to determine if there is sufficient space to place booster stations along the slurry pipeline alignment. Further study is also needed to determine the level of effort that would be required to keep booster stations operational.

Placement of a slurry pipeline along the proposed route would present significant right-of-way and permitting issues.

Slurry Pipeline – Performance

As mentioned previously, a slurry pipeline would be used in conjunction with the dredging alternative. Therefore, if 9 dredging operations were to be conducted during the 20-year planning period to remove the entire 60 percent, or 3.4 MCY, of smaller-sized sediment of Cogswell Reservoir's 5.7-MCY planning quantity, then the slurry pipeline would be used a total of nine times during the 20-year planning period. As discussed in Section 6, the slurry pipeline would need to transport approximately 2,000 CY of the water-sediment slurry per hour or approximately 15 cubic feet of the slurry per second. In total, during a 6-month dredging operation, the slurry pipeline would need to handle a total of 4 MCY or 2,500 acre-feet of slurry. It is expected that the type of slurry pipeline that would be used would be able to perform during the 20-year planning timeline.

For planning purposes, it was assumed that a total of nine lift stations would be required for the 8.5-mile long slurry pipeline between Cogswell Dam and San Gabriel Reservoir.

Slurry Pipeline - Cost

The estimated cost for a slurry pipeline, including the cost of the lift stations, is approximately $48 million. This does not include the cost of dredging material into the slurry pipeline or removal of sediment downstream.

7.2.6 PLACEMENT ALTERNATIVES

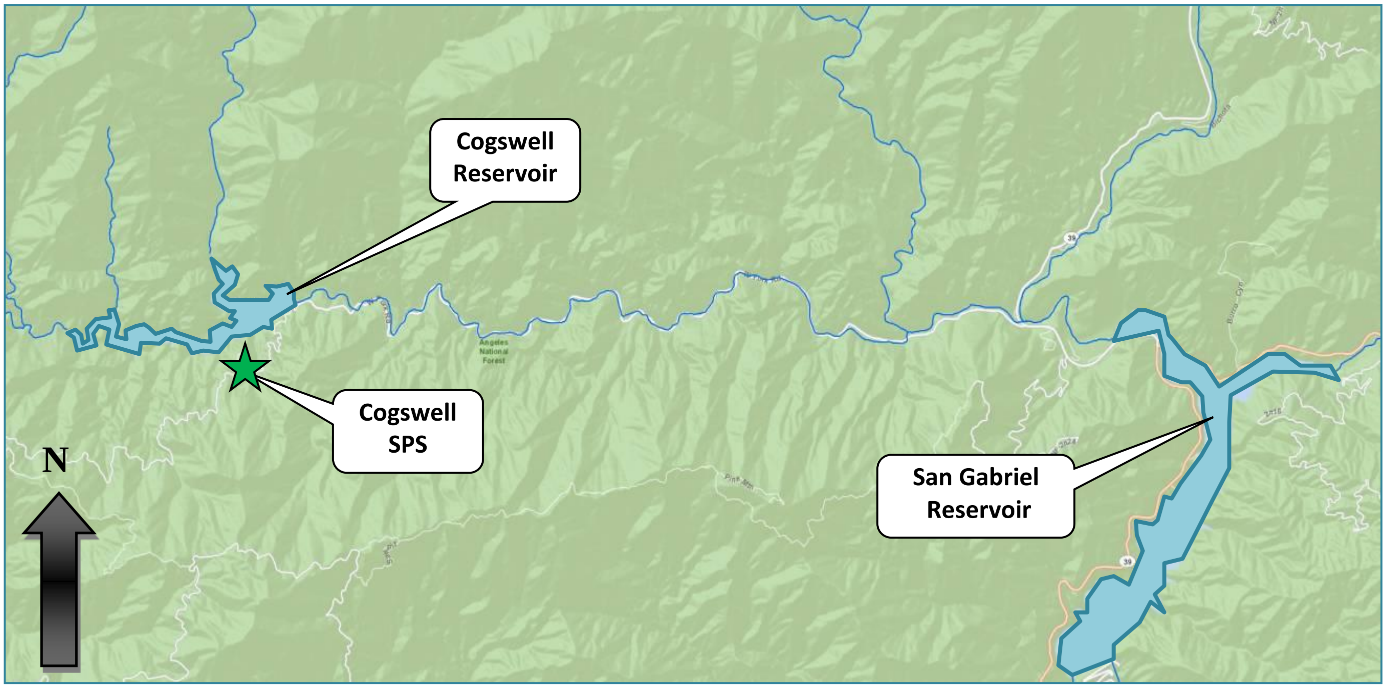
This section discusses potential placement alternatives for sediment removed from Cogswell Reservoir. Given the remote location of Cogswell Dam and the difficult access along Forest Route 2N25, only Cogswell SPS and San Gabriel Reservoir are being considered for placement. Sediment that is transported to San Gabriel Reservoir via sluicing, slurry pipeline, or other method would be removed and placed at sites deemed feasible for San Gabriel Reservoir.

7.2.6.1 COGSWELL SEDIMENT PLACEMENT SITE

This section discusses the impacts associated with employing the remaining capacity at Cogswell SPS for the permanent placement of sediment from Cogswell Reservoir. This placement alternative could potentially be used for sediment excavated from the reservoir and transported either by trucks or a conveyor system to the SPS.

Cogswell SPS is an existing SPS that covers an area of approximately 36.5 acres and currently holds less than 5 MCY of sediment from previous cleanout activities.

Figure 7-9 Cogswell SPS Location



Cogswell SPS – Environmental Impacts

California buckwheat scrub, hoary-leaf ceanothus chaparral, and black willow thickets have recently been identified along the slope of the existing fill at the SPS. Interior live oak woodland, black willow thickets, mulefat thickets, riparian herbaceous, and canyon live oaks are located at the back of the SPS, where new fill would potentially be placed.

The following birds are considered common inhabitants of the project vicinity: California quail, northern flicker, California towhee, spotted towhee, oak titmouse, belted, kingfisher, western scrub jay, stellar jay, mourning dove, band-tailed pigeon, red-tailed hawk, common raven, northern mockingbird, Anna's hummingbird, wrentit, American coot, mallard and housefinch. Additionally, western gray squirrel, mule deer, raccoon, and black bear have been identified in the site. Further study would be needed to determine any other habitat in the area.

Equipment used to place sediment in the SPS could impact on air quality.

Cogswell SPS – Social Impacts

Cogswell SPS is not in the viewshed of any houses or buildings. However, it is possible the site could be partially viewed from State Route 2. The scenic and visual impacts of having equipment in the reservoir would be minimal and temporary for recreational users.

Cogswell SPS – Implementability

Use of Cogswell SPS would require environmental regulatory permits. Vegetation would need to be removed to place sediment at Cogswell SPS. Environmental permitting is a major implementability issue.

Cogswell SPS is also located near a National Forest Inventoried Roadless Area. This land is protected from road construction, reconstruction, and timber harvest, so as not to alter and fragment landscapes. Therefore, expansion of the SPS into these areas would not be a consideration.

Cogswell SPS – Performance

It is estimated that 3.2 MCY of capacity remains at Cogswell SPS. There is not enough capacity to hold the 20-year planning quantity of 5.7 MCY. Since not all of the material could be sluiced or slurried downstream and trucking and conveying out of the West Fork do not appear likely, the Flood Control District would attempt to conserve as much capacity as possible for those materials with no feasible transport alternative out of the West Fork.

Cogswell SPS – Cost

For cost analysis it is assumed that the 2.3 MCY of sediment that would not be able to be sluiced would be placed at Cogswell SPS. Again, up to 3.2 MCY of sediment could be placed at Cogswell SPS.

The cost of placing 2.3 MCY of sediment at Cogswell SPS would be approximately $4.6 million.

7.2.6.2 SAN GABRIEL RESERVOIR (AS A PLACEMENT LOCATION)

For planning purposes, it was assumed that a slurry pipeline transporting sediment from Cogswell Reservoir would terminate in San Gabriel Reservoir. It was also assumed that sediment sluiced from Cogswell Reservoir would be captured in San Gabriel Reservoir. This sediment would impact water quality and increase the amount of sediment that would need to be managed within San Gabriel Reservoir. Section 7.3 discusses the sediment management alternatives for San Gabriel Reservoir.

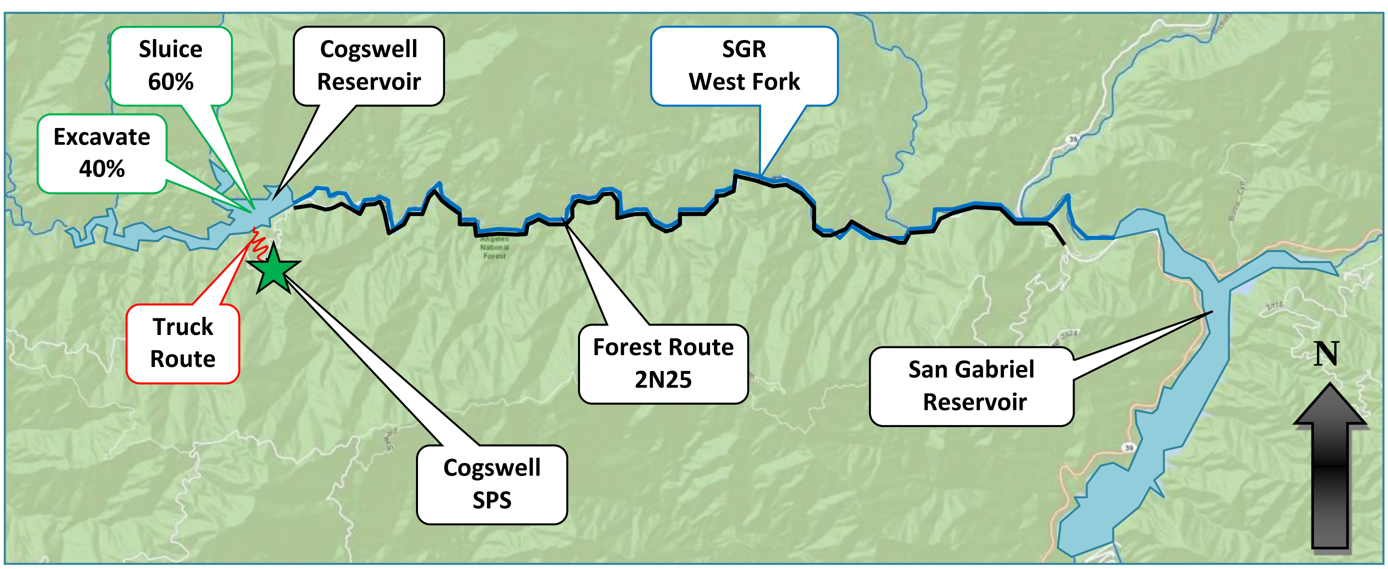
7.2.7 COMBINED SEDIMENT MANAGEMENT ALTERNATIVES

Combining the removal and transportation alternatives for Cogswell Reservoir, there are four sets of feasible options. A description of each of these combined sediment management alternatives is given below.

7.2.7.1 COMBINED ALTERNATIVE 1A: SLUICE (3.4 MCY) → SAN GABRIEL RESERVOIR + EXCAVATE (2.3 MCY) → TRUCKS → COGSWELL SPS

Combined Alternative 1A would involve sluicing sediment to San Gabriel Reservoir as well as excavating material from Cogswell Reservoir and placing at Cogswell SPS. It was assumed that sediment sluiced to San Gabriel Reservoir would be managed with the material to be removed from San Gabriel Reservoir. Figure 7-10 illustrates Combined Alternative 1A.

Figure 7-10 Cogswell Reservoir Combined Alternative 1A



Approximately 400,000 CY of sediment would be sluiced from Cogswell Reservoir to San Gabriel Reservoir in a given year. At this rate, sluicing would have to be performed approximately 9 of the 20-year planning period in order to sluice 3.4 MCY of sediment from the reservoir. In order to address the 2.3 MCY of sediment that is not suitable for sluicing, 6 excavation and trucking operations would be necessary.

Sluiced material would travel approximately 8.5 miles down the West Fork to San Gabriel Reservoir. Material being sluiced would impact habitat along the West Fork.

The remaining 2.3 MCY of material would need to be excavated from Cogswell Reservoir in order to truck to the SPS. This would require draining of the reservoir.

One of the limitations of this alternative is the remaining capacity at Cogswell SPS. Excavation of the total 5.7 MCY of sediment would not be possible because there is neither enough capacity at Cogswell SPS for this material nor a feasible transportation method to remove this material from the West Fork. Up to 3.2 MCY of sediment could be placed at Cogswell SPS. However, it is assumed that only 2.3 MCY of the material that is not suitable for sluicing would be placed at the SPS. Another limitation is the impact to sensitive habitat in the unused area of the SPS, which is also on Forest Service land. It would be necessary and possibly difficult to obtain environmental regulatory permits.

There is an existing road that travels through the SPS from the edge of the reservoir to the top of the existing fill. Utilizing the existing road minimizes new impact to habitat. If a temporary haul route is constructed along the side of the reservoir to create a haul loop, habitat that has grown on the existing fill would be impacted. An access ramp into the reservoir would need to be reestablished. There would also be some impacts to air quality.

Employing this alternative to remove 2.3 MCY of sediment that would not be able to be sluiced would require six 6-month operations over the 20-year period. This is based on the assumption that approximately 400,000 CY of sediment can be moved by a 6-month single-dump trucking operation.

Implementation of this alternative would cost an estimated $25 million. The breakdown of estimated costs is provided in Table 7-3 below.

Table 7-3 Estimated Costs for Combined Alternative 1A

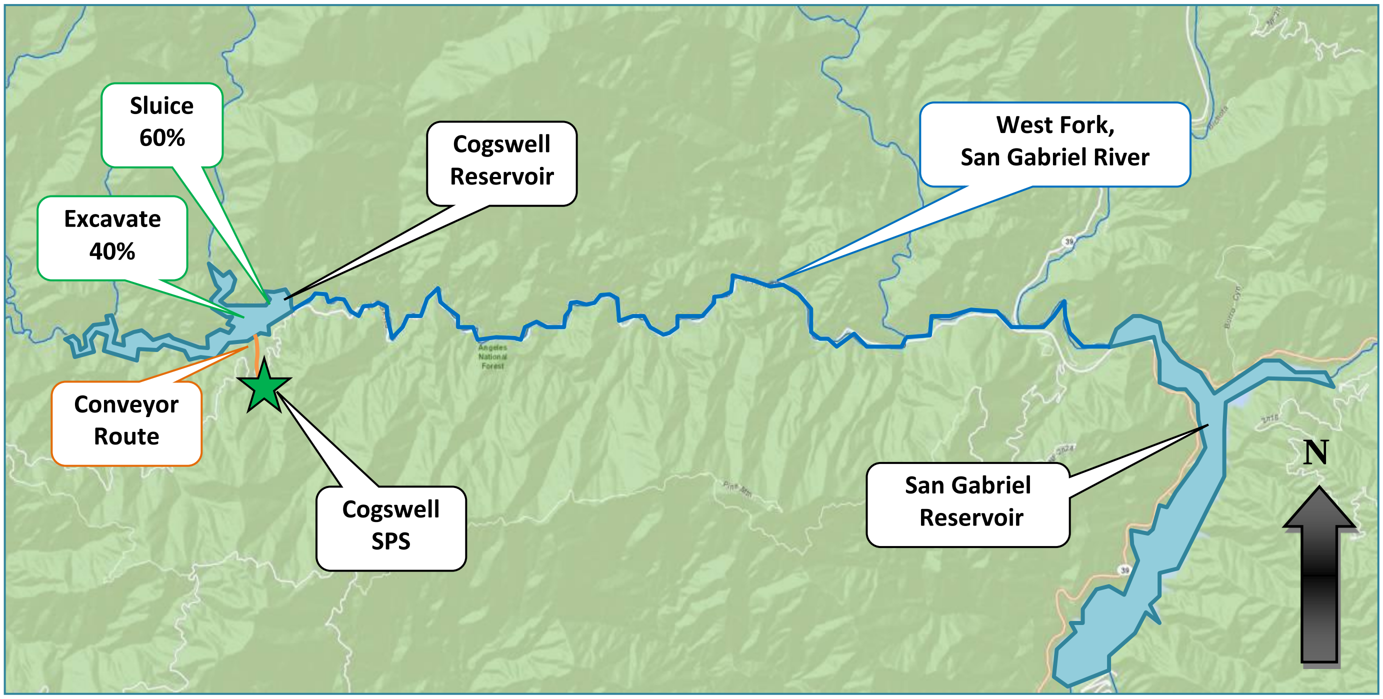
<table>
<tr><th>Activity</th><th>Quantity Removed (MCY)</th><th>Estimated Costs (in millions)</th></tr>
<tr><td>Sluice from Cogswell Reservoir to San Gabriel Reservoir</td><td>3.4</td><td>$9</td></tr>
<tr><td>Excavate material at Cogswell Reservoir that would not be able to be sluiced</td><td rowspan="3">2.3</td><td>$7</td></tr>
<tr><td>Truck non-sluiceable material from Cogswell Reservoir to Cogswell SPS on single-dump trucks</td><td>$3</td></tr>
<tr><td>Place sediment at Cogswell SPS</td><td>$5</td></tr>
<tr><td>Total</td><td>5.7</td><td>$25[(a)]</td></tr>
</table>

Note:
a. Does not include the removal of 3.4 MCY of material from San Gabriel Reservoir

7.2.7.1 Combined Alternative 1B: Sluice (3.4 MCY) → San Gabriel Reservoir + Excavate (2.3 MCY) → Conveyor → Cogswell SPS

Combined Alternative 1B is essentially the same as Combined Alternative 1A, except that the 2.3 MCY of non-sluiceable material would be transported to Cogswell SPS using a conveyor belt instead of trucks. Figure 7-11 illustrates Alternative 1B.

Figure 7-11 Cogswell Reservoir Alternative 1B



A limitation of conveying sediment through the SPS is the impact to sensitive habitat in the unused area of the SPS, which is also on US Forest Service land. The conveyor belts would also be routed in a relatively straight alignment from the edge of the reservoir through the SPS to the top of the existing fill. Some habitat that has since grown on the existing fill would be impacted by the placement of a conveyor belt. An access ramp into the reservoir would need to be reestablished. It would be necessary and possibly difficult to obtain environmental regulatory permits.

Employing this combined alternative would require that sluicing be conducted during 9 of the 20 years in the planning period in order to remove the 3.4 MCY of smaller-sized material from Cogswell Reservoir. Additionally, three 6-month dry excavation and conveyor operations would be required to remove the remaining 2.3 MCY of larger-sized material that cannot be sluiced.

Implementation of this alternative would cost an estimated $25 million. The breakdown of estimated costs is provided in Table 7-4 below.

Table 7-4 Estimated Costs for Combined Alternative 1B

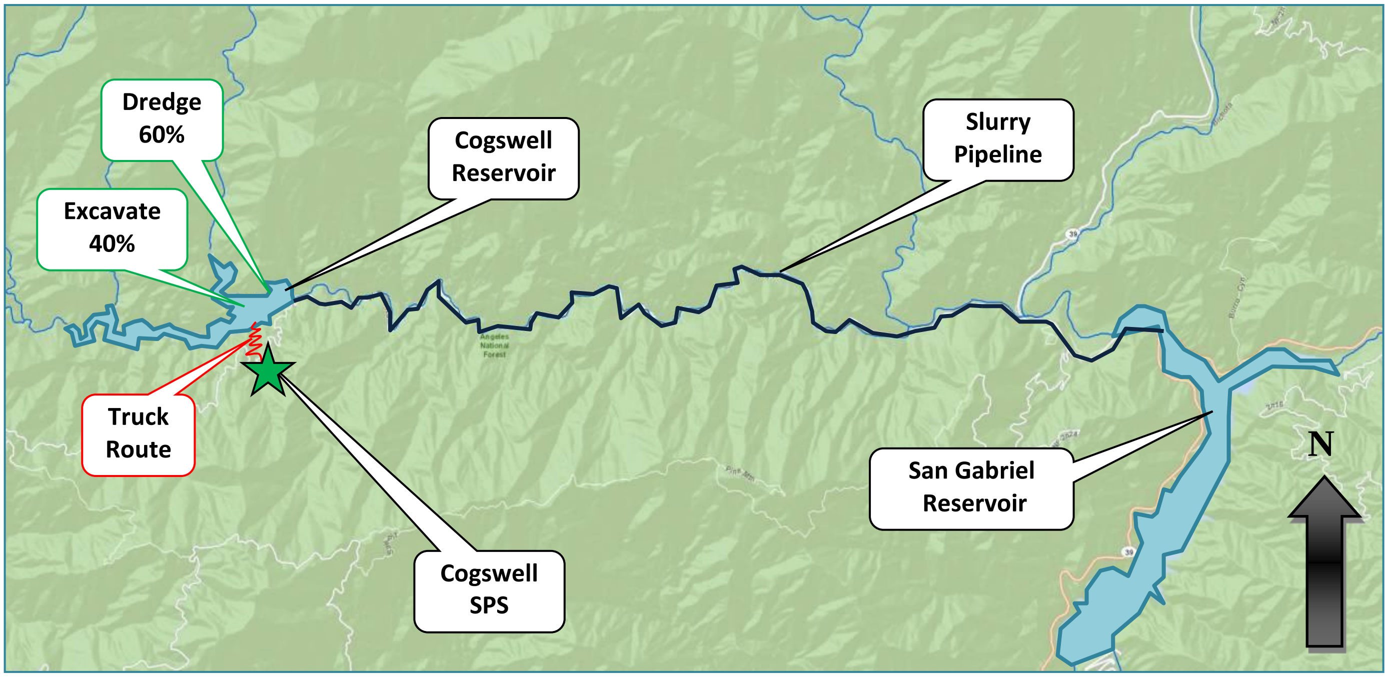
Activity	Quantity Removed (MCY)	Estimated Costs (in millions)
Sluice from Cogswell Reservoir to San Gabriel Reservoir	3.4	\$9
Excavate material at Cogswell Reservoir that is not sluiceable	2.3	\$7
Conveyor belt non-sluiceable material from Cogswell Reservoir to Cogswell SPS		\$4
Place sediment at Cogswell SPS		\$5
Total	**5.7**	**\$25[(a)]**

Note:
a. Does not include the removal of 3.4 MCY of material from San Gabriel Reservoir

7.2.7.2 COMBINED ALTERNATIVE 2A: DREDGE AND SLURRY TO SAN GABRIEL RESERVOIR + TRUCKING TO COGSWELL SPS

Combined Alternative 2A would involve dredging sediment from Cogswell Reservoir and sending it via slurry pipeline to San Gabriel Reservoir. As all of the sediment would not be eligible for transport via slurry pipeline, remaining material would be excavated and brought to Cogswell SPS. It was assumed that sediment slurries to San Gabriel Reservoir would be managed with the material to be removed from San Gabriel. Figure 7-12 illustrates Combined Alternative 2A.

Figure 7-12 Cogswell Reservoir Combined Alternative 2A



As discussed previously, dredging could occur once the reservoir has been lowered to such a level that the maximum depth to the sediment to be dredged is 50 feet. It is assumed that the slurry line could either be directed through a valve in the dam or over the top of the dam. Further study would be needed to determine if there is adequate water to dredge material while keeping a lower reservoir elevation.

From the downstream face of the dam, the slurry pipeline would be constructed along Forest Route 2N25. At some points along Forest Route 2N25, the slurry pipeline could encroach on the river. Booster stations would be needed for every mile of slurry line to keep the mixture moving. The pipeline would outlet into the San Gabriel Reservoir, therefore, no dewatering area is necessary. Approximately 8.5 miles of pipeline would be needed to construct this alignment.

Given the assumptions made regarding dredging operations, it would take nine 6-month dredging operations during the 20-year planning period to remove the 3.4 MCY of dredgeable material from Cogswell Reservoir. If the operations could be conducted on a regular basis, dredging would be conducted approximately every other year.

Just as with the 2.3 MCY non-sluiceable material from Combined Alternative 1A, the remaining 2.3 MCY of larger, non-dredgeable material could be excavated and trucked to Cogswell SPS. This would take approximately six 6-month operations over the 20-year period.

Implementation of this combined alternative would cost an estimated $145 million. The breakdown of estimated costs is provided in Table 7-5 below.

Table 7-5 Estimated Costs for Combined Alternative 2A

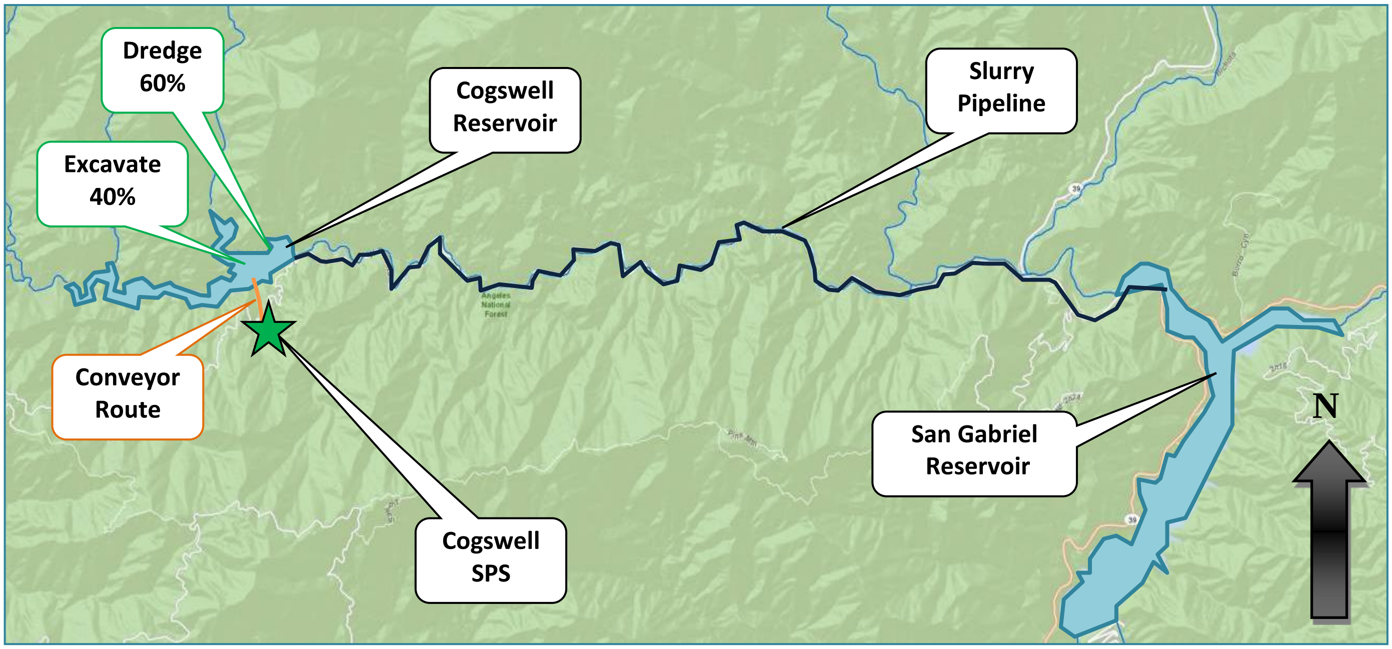
Activity	Quantity Removed (MCY)	Estimated Costs (in millions)
Dredge material from Cogswell Reservoir to San Gabriel Reservoir	3.4	$36
Slurry dredgeable material from Cogswell Reservoir to San Gabriel Reservoir		$48
Booster station every mile from Cogswell Reservoir to San Gabriel Reservoir		$46
Excavate material at Cogswell Reservoir that is not sluiceable	2.3	$7
Truck non-sluiceable material from Cogswell Reservoir to Cogswell SPS on single-dump trucks		$3
Place sediment at Cogswell SPS		$5
Total	**5.7**	**$145**[a]

Note:
a. Does not include the removal of 3.4 MCY of material from San Gabriel Reservoir

7.2.7.3 COMBINED ALTERNATIVE 2B: DREDGE AND SLURRY TO SAN GABRIEL RESERVOIR + CONVEYOR BELT TO COGSWELL SPS

Combined Alternative 2B is essentially a combination of Combined Alternative 2A and Combined Alternative 1B. The dredging aspect of this alternative is the same as for Combined Alternative 2A, meaning that 3.4 MCY of sediment would be dredged and transported via slurry pipeline from Cogswell Reservoir to San Gabriel Reservoir. Similar to Combined Alternative 1B, the 2.3 MCY of larger-sized material would be excavated and conveyed to Cogswell SPS.

Figure 7-13 Cogswell Reservoir Combined Alternative 2B



Employing this combined alternative would require that sluicing be conducted during 9 of the 20 years in the planning period in order to remove the 3.4 MCY of smaller-sized material from Cogswell Reservoir. Addressing the 2.3 MCY of larger-sized material that cannot be sluiced would require three 6-month excavation and conveyor operations.

Implementation of this combined alternative would cost an estimated $145 million. The breakdown of estimated costs is provided in Table 7-6 below.

Table 7-6 Estimated Costs for Combined Alternative 2B

Activity	Quantity Removed (MCY)	Estimated Costs (in millions)
Dredge material from Cogswell Reservoir to San Gabriel Reservoir	3.4	$36
Slurry dredgeable material from Cogswell Reservoir to San Gabriel Reservoir		$48
Booster station every mile from Cogswell Reservoir to San Gabriel Reservoir		$46
Excavate material at Cogswell Reservoir that is not sluiceable	2.3	$7
Conveyor belt non-sluiceable material from Cogswell Reservoir to Cogswell SPS		$4
Place sediment at Cogswell SPS		$5
Total	**5.7**	**$145**[a]

Note:
a. Does not include the removal of 3.4 MCY of material from San Gabriel Reservoir

7.2.8 COGSWELL RESERVOIR SUMMARY AND RECOMMENDATIONS

7.2.8.1 SUMMARY

Over the next 20 years, 5.7 MCY of sediment are planned to be removed from Cogswell Reservoir. For planning purposes, it is assumed that 60 percent of the 5.7 MCY, or 3.4 MCY, is smaller-sized material that could be sluiced or dredged. The remaining 40 percent, or 2.3 MCY, would need to be managed separately. The different sediment management alternatives are briefly explained below and the impacts are shown in Figure 7-7.

Sediment Management Alternatives

1A Sluice (3.4 MCY) → San Gabriel Reservoir
+ Excavate (2.3 MCY) →Trucks → Cogswell SPS
Alternative 1A consists of two components. One component consists of sluicing 3.4 MCY of sediment from Cogswell Reservoir to San Gabriel Reservoir, which would result in habitat and water quality impacts on the West Fork of the San Gabriel River. The other component consists of excavating the 2.3 MCY of larger-sized sediment in Cogswell Reservoir and trucking it to Cogswell SPS. There would be air quality impacts from the trucks and habitat impact to the undeveloped portion of Cogswell SPS.

1B Sluice (3.4 MCY) → San Gabriel Reservoir
+ Excavate (2.3 MCY) →Conveyor → Cogswell SPS
This alternative is similar to 1A except the 2.3 MCY of excavated material would be transported to Cogswell SPS using a conveyor belt. There would be some impacts to the habitat on the existing fill at the SPS where the conveyor belts would be placed.

2A Dredge (3.4 MCY) → Slurry Pipeline → San Gabriel Reservoir
+ Excavate (2.3 MCY) →Trucks → Cogswell SPS
This alternative consists of dredging the 3.4 MCY of smaller-sized material from Cogswell Reservoir and transporting via slurry pipeline to San Gabriel Reservoir. Construction of the slurry pipeline would have some habitat impacts on the West Fork of the San Gabriel River. The 2.3 MCY of larger-sized material in Cogswell Reservoir would be excavated and transported via a conveyor to Cogswell SPS.

2B Dredge (3.4 MCY) → Slurry Pipeline → San Gabriel Reservoir
+ Excavate (2.3 MCY) →Conveyor → Cogswell SPS
This Alternative is similar to Alternative 2A except the 2.3 MCY of larger-sized material would be transported to Cogswell SPS using a conveyor belt. There would be some impacts to the habitat on the existing fill at the SPS where the conveyor belts would be placed.

Recommendations

It is recommended that Alternatives 2A and 2B be considered first due to the high environmental impacts sluicing would have on the West Fork. Sediment flushing should also be considered for this location as additional study is completed.

Table 7-7 Summary of Sediment Management Alternatives for Cogswell Reservoir

	Alternative	Quantity Removed (MCY)	Environmental				Social			Implementability	Performance		Cost
			Habitat	Water Quality	Groundwater Recharge	Air Quality[a]	Traffic	Visual	Noise	Special Permit/ Agreement Required[b]	Previous Experience	# of operations required in next 20 years	$ millions
1A	Sluice to SG Reservoir	3.4	●	●				○			Yes	9	25
	Excavate from Cogswell	2.3	◑			◑		○	○			6	
	Trucks					●		○					
	Cogswell SPS		●			○		○	○	Yes			
1B	Sluice to SG Reservoir	3.4	●	●				○			Yes	9	25
	Excavate from Cogswell	2.3	◑			◑		○	○			3	
	Conveyor Belt		◑					○	○				
	Cogswell SPS		●			○		○	○	Yes			
2A	Dredge	3.4	◑	◑							No	9	145
	Slurry Pipeline to SG Reservoir		◑					◑					
	Excavate from Cogswell	2.3	◑			◑		○	○		Yes	6	
	Trucks					●		○					
	Cogswell SPS		●			○		○	○	Yes			
2B	Dredge	3.4	◑	◑				○	○		No	9	145
	Slurry Pipeline to SG Reservoir		◑					◑					
	Excavate from Cogswell	2.3	◑			◑		○	○		Yes	3	
	Conveyor Belts		◑					○	○				
	Cogswell SPS		●			○		○	○	Yes			

Legend:

●	significant impact
◑	some impact
○	possible impact
	no impact

Notes:
(a) Use of low-emission trucks would reduce air quality impacts from significant impact (●) to some impact (◑).
(b) All options require environmental regulatory permits.

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7.3 SAN GABRIEL RESERVOIR

7.3.1 BACKGROUND

San Gabriel Dam, shown in Figure 7-14, is a compacted earthfill and rockfill embankment with a concrete cutoff wall. The dam was constructed in 1937 by the Flood Control District for flood control, drinking water supply, and water conservation, with power generation uses added later. The original storage capacity at spillway is 86.1 million cubic yards (MCY). With an uncontrolled drainage area 163.5 square miles and a controlled drainage area (from upstream Cogswell Reservoir) of 39.2 square miles, San Gabriel Reservoir has a total drainage area of 203 square miles.

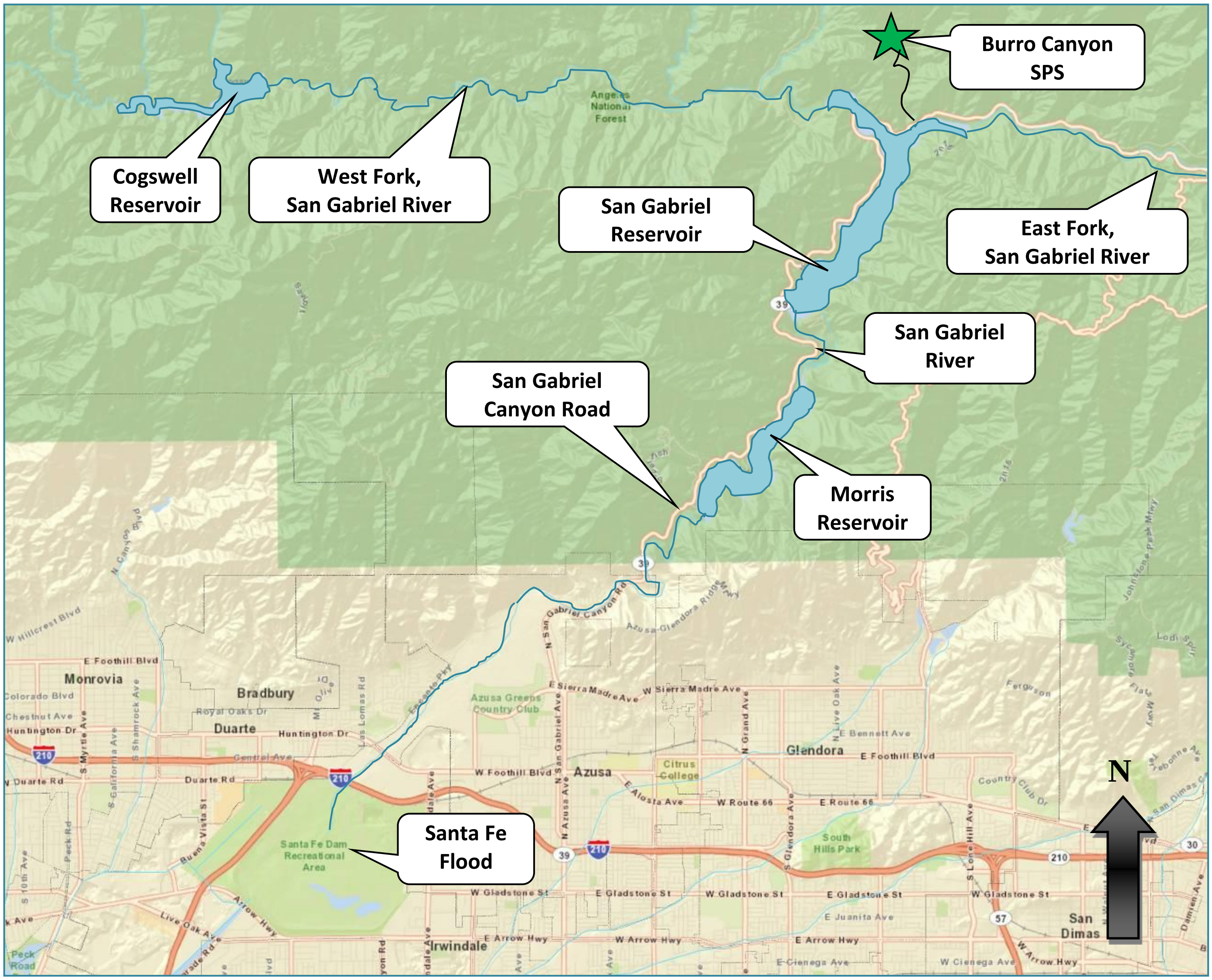
The principal functions of San Gabriel Reservoir are flood control and water conservation. Water captured in the reservoir during the storm season is gradually released into the upper end of Morris Reservoir. The outlet works at San Gabriel Reservoir also direct reservoir releases to a 5 megawatt power plant owned and operated by the Flood Control District and also into the Azusa Conduit on the lower left abutment. The Azusa Conduit is a pipeline owned by the City of Pasadena that directs flows to Pasadena's power plant in Azusa and to a water distribution system that has its headworks in Azusa.

Figure 7-14 San Gabriel Dam

7.3.1.1 LOCATION

San Gabriel Reservoir is located in San Gabriel Canyon approximately eight miles north of the City of Azusa. The reservoir is located within Flood Control District-owned right of way. As discussed in Section 7.1, San Gabriel Reservoir is located between Cogswell and Morris Reservoirs.

Figure 7-15 San Gabriel Reservoir Vicinity Map



7.3.1.2 ACCESS

Access to the reservoir is available via San Gabriel Canyon Road (State Route 39) and Burro Canyon, located off the East Fork Road. State Route 39 and East Fork Road are paved, two-lane roads. East Fork Road is connected to San Gabriel Canyon Road by means of a 2-lane bridge. Access to the downstream maintenance area of the reservoir is available by means of San Gabriel Canyon Road as well.

From East Fork Road there is a maintenance road that runs to Burro Canyon SPS. Just inside the Burro Canyon entrance is the starting point of a corrugated metal lined access tunnel that goes under the East Fork Road; the access ramp (unpaved) continues down into the reservoir bottom (See Figure 7-16). A portion of the ramp into the reservoir could need to be reestablished due to the possibility of fluctuating water levels of the reservoir making contact with the ramp.

Access could be established upstream of the dam along San Gabriel Canyon Road. There is currently no specified access point that is capable of accommodating large equipment, so it would be necessary to construct an access ramp. Some adjacent vegetation could be impacted. Further study would be necessary to determine the optimal location for such an access point. Lastly, the access to the maintenance area on the downstream side of the dam is available by existing access roads as seen in Figure 7-17.

Figure 7-16 San Gabriel Reservoir Access Points

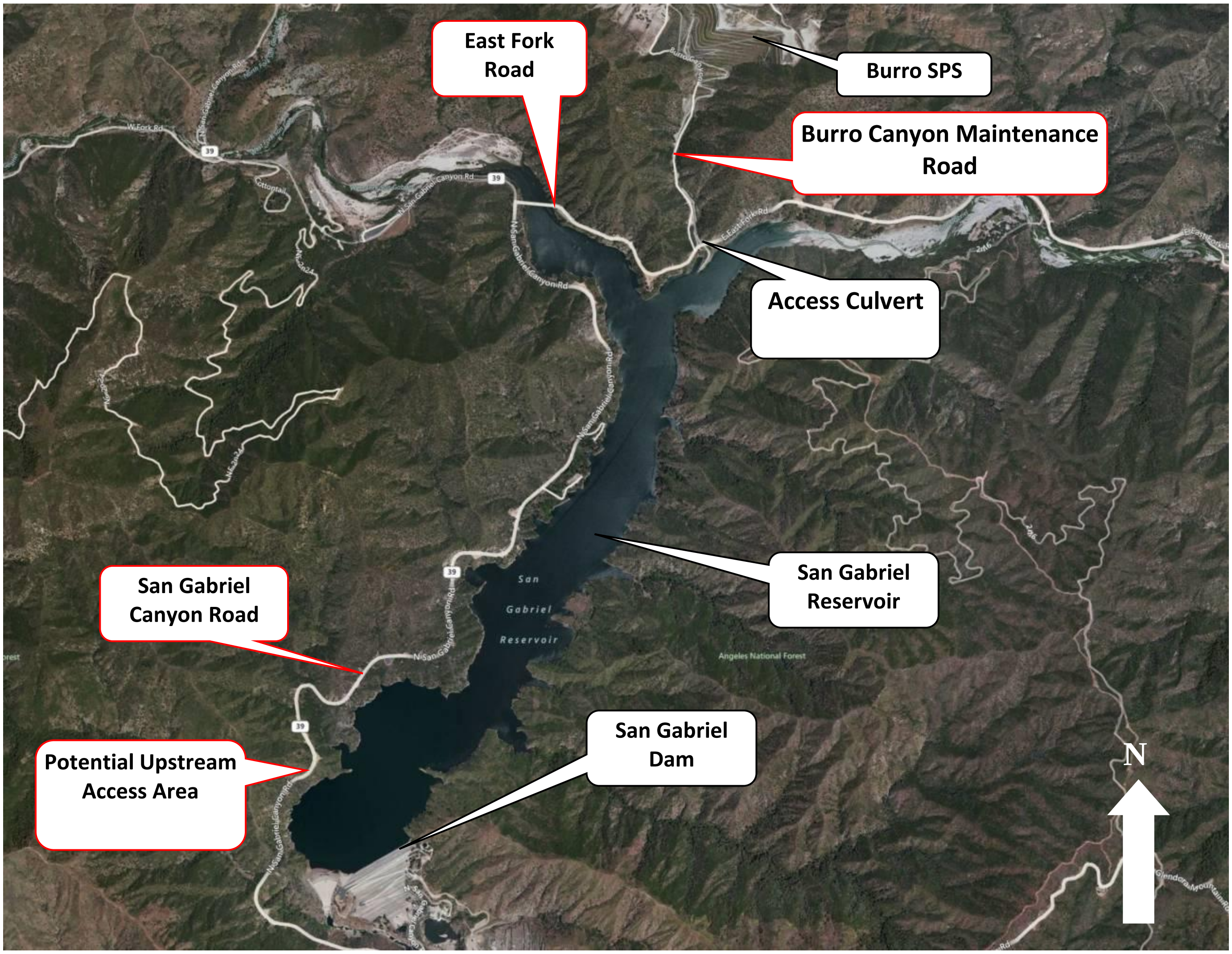
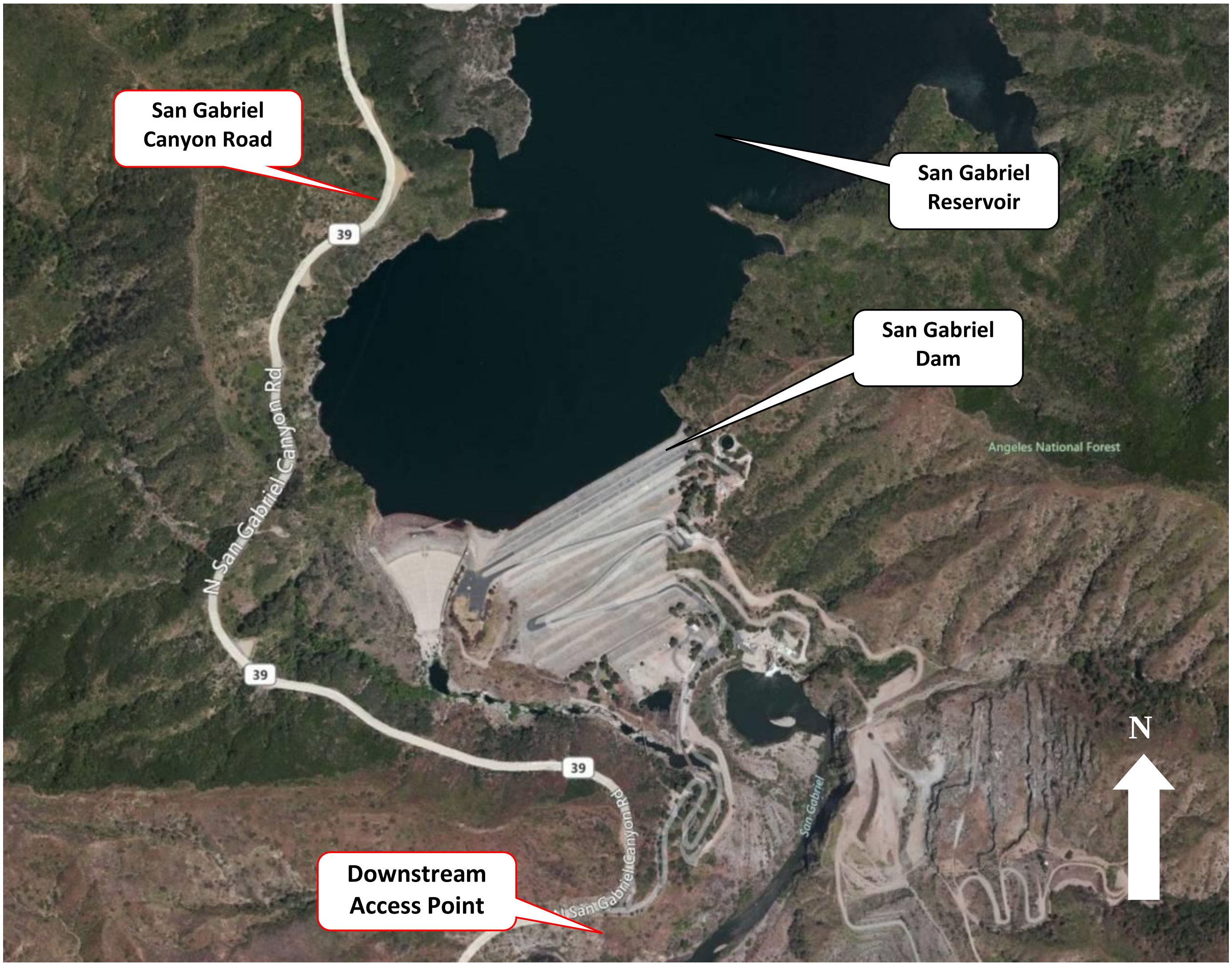


Figure 7-17 San Gabriel Dam and Reservoir Downstream Access Point



7.3.1.3 DAM OUTLETS

In addition to being equipped with a variety of valves, San Gabriel Dam is also equipped with a sluiceway controlled by 6- by 6-foot sluice gate that feeds into a 7-foot diameter tunnel through the dam.

The outlet works at San Gabriel Dam also direct reservoir releases into the Azusa Conduit on the lower left abutment and to a 4.97 megawatt power plant owned and operated by the Flood Control District. The Azusa Conduit is owned by the City of Pasadena and is used to supply its Azusa power plant and the San Gabriel Valley River Water Committee with a portion of the water to which they have rights.

7.3.1.4 DOWNSTREAM FLOOD CONTROL AND WATER CONSERVATION SYSTEM COMPONENTS

Flood control releases flow directly into the upstream end of Morris Reservoir. Further discussion can be found in Section 7.4.

7.3.1.5 SEDIMENT ACCUMULATION AND REMOVAL HISTORY

The San Gabriel Mountains are highly erosive. The watershed of San Gabriel Reservoir is contained in one of the greatest sediment-producing areas in the San Gabriel Mountains. Due to the naturally erosive nature of the watershed and the continued potential for fires, it is not feasible to significantly reduce its sediment-producing potential. Figure 7-18 shows the approximate sediment storage in San Gabriel Reservoir, since the reservoir's first debris season in 1937.

It is the Flood Control District's practice to retain enough storage capacity within reservoirs used for flood control for two incoming design debris events (DDEs), which are calculated and determined for each specific reservoir. However, per the LACDA study discussed in Section 7.1, the San Gabriel Canyon needs to provide a total of 50,000 acre-feet, or 80 MCY, of combined flood control storage. As the Flood Control District utilizes Cogswell Reservoir and San Gabriel to meet this storage requirement, the combined volume of sediment in storage at these two facilities must not exceed 23.5 MCY.

As of December 2006, the remaining capacity at San Gabriel Reservoir was 71.7 MCY, reflecting the sediment accumulation in, and removal from, the reservoir since the dam's construction. Sediment removal at San Gabriel to date has been achieved with both sluicing and excavation. Approximately 36 MCY have been removed since 1937. A summary of the historical sediment removal projects can be found in Table 7-8.

Figure 7-18 Graph of Historical Sediment Storage at San Gabriel Reservoir

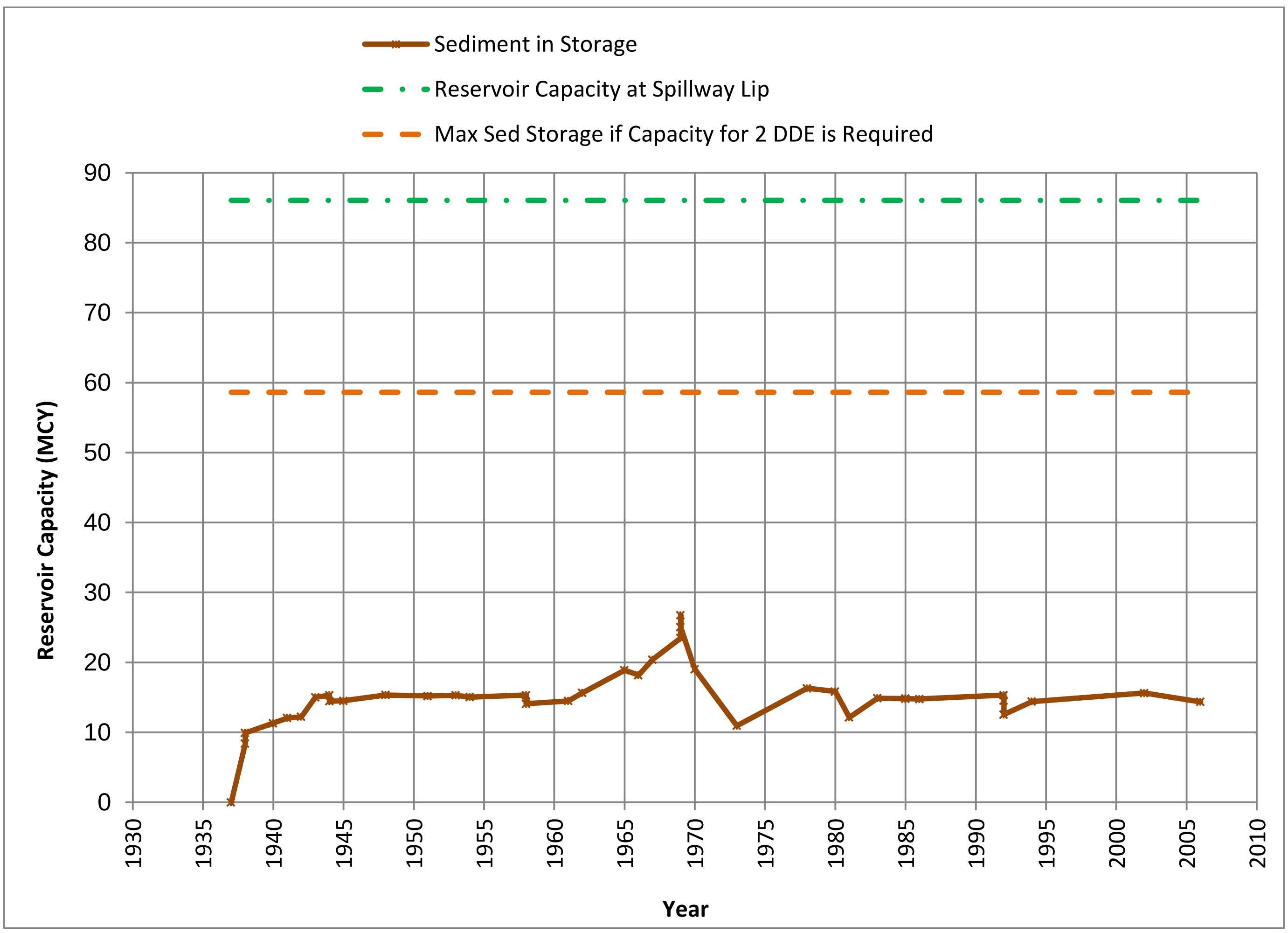


Table 7-8 San Gabriel Reservoir Historical Sediment Accumulation and Removal

Survey Date		Reservoir Capacity (MCY)	Quantity Sluiced (MCY)	Quantity Excavated (MCY)	Sediment Accumulation Between Surveys (MCY)	Sediment in Storage (MCY)
October	1937[a]	86.06	-	-	-	-
April	1938	77.67	-	-	8.39	8.39
October	1938	76.13	-	-	1.53	9.93
November	1940	74.75	-	-	1.38	11.31
September	1941	73.99	-	-	0.76	12.07
October	1942	73.82	0.28	-	0.45	12.24
September	1943	71.04	0.46	-	3.25	15.02
July	1944	70.76	-	-	0.28	15.30
October	1944	71.61	0.92	-	0.06	14.45
November	1945	71.54	0.17	-	0.24	14.52
November	1948	70.70	0.27	-	1.10	15.36
November	1951	70.87	0.34	-	0.18	15.19
January	1953	70.75	0.32	-	0.44	15.31
May	1954	71.01	0.46	-	0.20	15.05
July	1958	70.74	-	-	0.27	15.32
August	1958	71.98	1.27	-	0.04	14.08
September	1961	71.58	-	-	0.40	14.48
November	1962	70.41	-	-	1.17	15.65
December	1965	67.18	-	-	3.23	18.88
April	1966	67.88	2.46	-	1.76	18.18
August	1967	65.66	-	-	2.22	20.40
February	1969	62.56	-	1.26	4.35	23.50
May	1969	59.29	-	-	3.27	26.77
October	1969	61.02	0.14	1.59	-	25.04
October	1970	67.03	2.62	3.40	-	19.03
October	1973	75.11	-	8.07[b]	0.86	10.95
March	1978	69.76	-	-	5.35	16.30
March	1980	70.23	-	2.21	1.74	15.83
February	1981	73.91	-	3.68	-	12.15
April	1983	71.18	-	-	2.73	14.89
January	1985	71.22	0.05	-	-	14.84
August	1985	71.25	0.03	-	-	14.81
September	1986	71.28	0.03	-	-	14.78
March	1992	70.74	-	-	0.54	15.32
August	1992	71.53[c]	-	-	-	14.53
December	1992	73.52	1.98	-	-	12.54
December	1994	71.65	-	-	1.86	14.41
November	2002	70.43	-	-	1.22	15.63
December	2006	71.69	-	4.07[d]	2.80	14.37

Notes:

a. First debris season was assumed to be 1937-38.

b. Approximately 536 acre-feet of sediment entered the reservoir during the cleanout. The contractor removed the 536 acre-feet, but the pre-cleanout and post cleanout surveys did not reflect this amount.

c. No sediment removal occurred between the March 1992 and August 1992 survey dates. To offset this error in sedimentation volumes the comparisons were split. Sediment accumulation was based on the difference between the September 1986 and March 1992 surveys. Sluicing volume was based on the difference between the August 1992 and December 1992 surveys.

d. Approximately 6.1 million tons of sediment was removed by a contractor during the 3-yr cleanout project (Summer 2004 to Fall 2006). Using a factor of 1.5tons/CY, the approximate volume is 4.07 MCY.

Past Sluicing Projects

The first sluicing event at San Gabriel Dam was conducted in 1942. From 1942 to 2006, 11.4 MCY of sediment were sluiced to Morris Reservoir immediately downstream. While detailed impacts are not available for other events, the 1992 sluicing event resulted in sediment accumulation in the riparian habitat immediately downstream of the sluice tunnel called Brown's Gulch. Flows from major storms that occurred afterward in 1993, 1995, and 1998 scoured out this sediment, along with the riparian vegetation. These events demonstrated that habitat conditions in Browns Gulch are dynamic.

Past Excavation Projects

Approximately 24.3 MCY of sediment has been excavated from San Gabriel Reservoir. Burro Canyon SPS, located north of the San Gabriel Reservoir, was used to dispose at least 14.5 MCY of the excavated sediment.

7.3.1.6 SPECIAL CONDITIONS

San Gabriel Dam discharges directly into Morris Reservoir. Therefore, operations take into account conditions at Morris Dam to minimize water conservation losses. Additionally, the San Gabriel River Water Committee has a water right to the normal flow of the river up to 135 cfs. The San Gabriel River Water Committee takes its water from both the Azusa Conduit and an intake at the mouth of the canyon downstream of Morris Reservoir. The Azusa Conduit has intakes at San Gabriel Dam and at Morris Dam. The intake at San Gabriel Dam allows its use under most reservoir pool levels, except when the reservoir pool is extremely low or the reservoir is completely drained. The intake at Morris Dam could only be used when the pool in Morris Reservoir is extremely high. The water treatment facilities for the San Gabriel River Water Committee have regulatory restrictions that prohibit intake of water with elevated levels of turbidity.

The U.S. Forest Service operates an OHV recreation area in San Gabriel Reservoir. The OHV Staging Area is located at the reservoir's uppermost reach in the West Fork. OHV activities in the reservoir occur primarily at the confluence of the West and East Forks, although the Forest Service allows OHV activities to go down further in the reservoir when reservoir pool levels expose more area.

7.3.2 PLANNING QUANTITIES & APPROACH

As described in Section 5.3, the 20-year projected sediment inflow to San Gabriel Reservoir is 20.4 MCY. For planning purposes, it is assumed that in addition to that quantity 3.4 MCY of sediment would be sluiced or sent in a slurry pipeline from Cogswell Reservoir to San Gabriel Reservoir. As a result, the 20-year planning quantity for San Gabriel Reservoir is 23.8 MCY.

7.3.3 POTENTIAL STAGING AND TEMPORARY SEDIMENT STORAGE AREAS

No outside staging or stockpile areas are needed for the alternatives being considered for San Gabriel Reservoir.

7.3.4 REMOVAL

The following Section discusses the impacts and costs of sediment removal at San Gabriel Reservoir by means of excavation, dredging, and sluicing. Discussion of the transportation and placement alternatives is presented in Sections 7.3.5 and 7.3.6, respectively. Combined alternatives that address all phases of the sediment management process are presented and discussed in Section 7.3.7.

7.3.4.1 EXCAVATION

Excavation has been conducted at San Gabriel Reservoir in the past. Under regular operating conditions, San Gabriel Reservoir is never completely dry, even outside of the storm season. Therefore, the reservoir must be drained in order to excavate and remove sediment near the dam.

Access is available from a maintenance road and ramp to Burro Canyon. From this maintenance road, access into the reservoir is achieved through a corrugated metal-lined tunnel that crosses under East Fork Road into the reservoir. This location would be optimal for sediment that would be excavated and brought to Burro Canyon SPS.

For sediment that is proposed to go elsewhere downstream, it could be necessary to establish new access roads into the reservoir further downstream. Further study would be needed to determine an optimal location for access that would minimize impact to habitat surrounding the reservoir.

Excavation - Environmental Impacts

An environmental concern with excavation and associated drainage of the reservoir is the impact on the aquatic habitat within San Gabriel Reservoir. Based on previous projects at the reservoir, the species in the reservoir consist almost entirely of non-native species such as largemouth bass, catfish, crappie, and bluegill. Further study would be needed to determine any additional species. A mitigation measure that is employed to address fish is the placement of a blocking net. In preparation for drainage of the reservoir, blocking nets are placed upstream of the reservoir to prevent fish, especially the threatened Santa Ana Sucker, from making their way into the reservoir. Native fish found in the waterway downstream of the nets or in the reservoir are captured and relocated upstream of the nets, which prevent their reentry into the project area. Non-native species found in the waterway downstream of the nets or in the reservoir are removed and disposed of in a manner specified by the California Department of Fish and Game. Use of blocking nets or other mitigation measures would reduce the impact on fish.

Depending on vegetation present at the access points, there could be some additional environmental impacts. San Gabriel Canyon Road is very close to the reservoir, so minimal, if any, impact is expected. The environment along the reservoir would be taken into consideration when choosing the precise access point.

While some losses are expected, most of the water released while draining the reservoir would likely be captured in downstream facilities, resulting in minimal impact to water conservation.

As discussed earlier, there would also be an impact to air quality as a result of the equipment necessary for excavation. However, it should be noted that the U.S. Forest Service operates an OHV area in San Gabriel Reservoir, which also produces emissions.

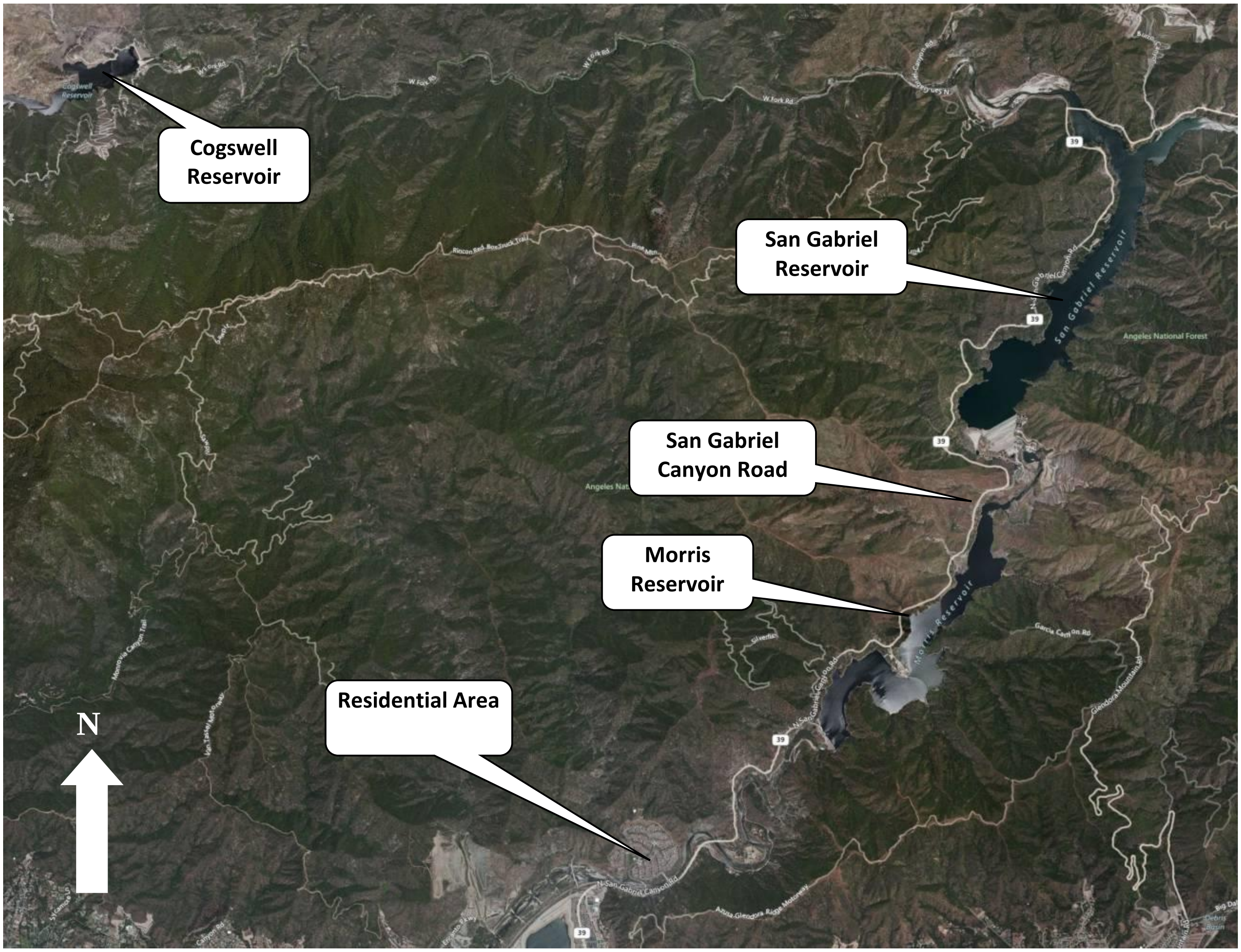
During past reservoir cleanouts, including the most recent one that was carried out between 2004 and 2006, environmental regulators required monitoring of the condition of biological resources and water quality before, during, and for several years after the completion of the project. Such requirements are thus likely for future projects.

Excavation - Social Impacts

Excavation would occur within the reservoir itself. For the excavation portion alone, there would be no increase in traffic in the surrounding area.

The nearest residential area to San Gabriel is 5 miles downstream, as shown in Figure 7-19. San Gabriel Canyon Road is frequented by members of the public travelling to recreational areas further upstream. The noise from excavation equipment is not expected to impact the downstream residential area.

Figure 7-19 Residential Area near Morris Reservoir



San Gabriel Reservoir is not in the viewshed of any houses or buildings. However, the reservoir is located alongside San Gabriel Canyon Road, which is frequented by recreational users, most of whom are on their way to recreational areas in San Gabriel Canyon that are out of the reservoir's viewshed. The scenic and visual impacts of excavation on recreational users would be minimal and the operation would be temporary.

The Forest Service permits OHV operation in an area at the confluence of the West Fork and San Gabriel Reservoir called the San Gabriel Canyon OHV Area. Access to water within the reservoir is prohibited, but removal of sediment from this area could impact recreation in the OHV Area. Shoreline fishing is allowed at the back edge of the reservoir pool. Sediment removal operations would impact this activity. Sediment removal operations would make the reservoir pool inaccessible to recreational users, either by lowering it to be well within the excavation work area, or completely draining it.

Excavation - Implementability

Since sediment has been removed via excavation at San Gabriel Reservoir in the past, there is technical certainty that excavation could be successfully implemented.

There are no right of way concerns related to excavating sediment from San Gabriel Reservoir since the Flood Control District has full rights for the maintenance and operation of San Gabriel Reservoir. However, an excavation operation would require environmental regulatory permits.

Excavation - Performance

In order to excavate San Gabriel Reservoir, the reservoir must first be dewatered. As discussed in Section 6.3.1, excavation could only be conducted over the summer months. Therefore, dewatering would begin no earlier than mid-April, after the conclusion of the storm season. The reservoir level would remain low or be completely drained until the start of the next storm season in mid-October. Additionally, flows coming into the reservoir have to significantly decrease before the necessary fish blocking nets could be installed, which further reduces the period available to excavate. It could be possible for work to continue into the storm season until rain is forecasted. During the cleanout project conducted between 2004 and 2006, excavation had to wait as late as August and had to end as early as mid-October (due to forecasted rains).

It is expected that the excavation equipment would be able to match the rate of removal by any mode of transportation being considered. However, the restrictions imposed by the fish protection requirements significantly impact the performance effectiveness of excavation to the point that this alternative might not be able to completely remove San Gabriel Reservoir's 23.8-MCY planning quantity.

Excavation - Cost

As discussed previously, the estimated unit cost to excavate material under dewatered conditions from a facility such as San Gabriel Reservoir is $3 per cubic yard. Excavating 23.8 MCY of sediment would cost approximately $69 million.

7.3.4.2 <u>DREDGING</u>

As discussed in Section 6, dredging has not been used to remove sediment from the reservoirs maintained by the Flood Control District. In order to accurately determine the technical feasibility of a dredging operation at San Gabriel Reservoir, detailed studies would need to be conducted.

The following analysis is based on the assumptions detailed in Section 6, the assumption that the sediment-water slurry resulting from dredging of San Gabriel Reservoir would be discharged into Morris Reservoir, and the assumption that approximately 2 MCY of San Gabriel Reservoir's 23.8-MCY planning quantity would be dredged,. As discussed previously, the remaining 21.8 MCY of larger-sized sediment would have to be excavated.

Dredging - Environmental Impacts

During previous studies at San Gabriel Reservoir, largemouth bass, catfish, crappie, and bluegill were found to be present in the reservoir. All those species are non-native invasive species that environmental regulators would like to see removed. Therefore, impacts from dredging to their spawning areas or habitat are not anticipated to be considered a significant adverse impact. Further study would be needed to determine any impacts on other fish, animals, and vegetation.

It is expected that during dredging operations there would be some impact to water quality within San Gabriel Reservoir. As mentioned in Section 6, water quality concerns could be partially addressed with a silt curtain around the dredge. Additionally, discharging the sediment-water slurry from San Gabriel Reservoir into Morris Reservoir could possibly result in elevated turbidity in Morris Reservoir. Increased turbidity at San Gabriel and Morris Reservoirs could negatively affect water intake operations by the San Gabriel River Water Committee.

Groundwater recharge could possibly be impacted because Morris Reservoir may be unable to capture all the sediment-water slurry resulting from dredging operations at San Gabriel Reservoir.

Dredging - Social Impacts

The nearest residential area to San Gabriel is 5 miles downstream. San Gabriel Canyon Road is frequented by members of the public, most of who are travelling to recreational areas further upstream. The noise of the dredge is not expected to be a disturbance nor would it impact traffic.

OHV activities within the reservoir would potentially be impacted when reservoir pool levels are high. Shoreline fishing activities would potentially be impacted when reservoir pool levels are so low that the exposed, relatively soft reservoir bottom renders safe access to the reservoir pool edge infeasible. This soft bottom condition would also render safe conditions for OHV activities infeasible; however, the effect is not a reduction in available area for OHV activities, merely no increase in available area.

San Gabriel Reservoir is not in the viewshed of any houses or buildings. However, the reservoir is located alongside San Gabriel Canyon Road, which is frequented by recreational users, most of who are travelling to other recreational areas in San Gabriel Canyon that are out of the reservoir's viewshed. The scenic and visual impacts of dredging operations on recreational users would be minimal and temporary.

Dredging - Implementability

No additional right of way is required for implementation of a dredging operation within San Gabriel Reservoir. As discussed in Section 6, dredging sediment (and transporting it via a slurry pipeline) could affect water conservation.

From past studies completed for the Flood Control District including consultation with dredging professionals, it has been determined that portable cutterhead suction dredges are available in a size suitable for use at the Flood Control District's reservoirs. As the dredge could reach a maximum depth of 50 feet, the reservoir water level would need to be lowered. From there, the material could be dredged to a slurry pipeline either through or over the dam.

Similar to other sediment management activities, dredging would require environmental regulatory permits.

Dredging - Performance

San Gabriel Reservoir's entire 23.8-MCY planning quantity cannot be handled by dredging alone. For planning purposes, it was assumed that only 2 MCY would be dredged, since the ability to remove the sediment from Morris Reservoir would be very limited. Sediment management alternatives for Morris Reservoir are discussed in Section 7.4.

Considering the capabilities of the dredging equipment and slurry pipeline discussed in Section 6, it would take approximately seven dredging operations to dredge 2 MCY of sediment from San Gabriel Reservoir.

Dredging - Cost

Based on the estimated unit cost for dredging, dredging 2 MCY of sediment would cost approximately $21 million.

7.3.4.3 SLUICING (AS A REMOVAL METHOD)

This section focuses on sluicing as a sediment removal method and discusses the impacts of sluicing within San Gabriel Reservoir only. For impacts of sluicing downstream of the dam refer to Section 7.3.5.1.

Sluicing (Removal) - Environmental Impacts

Within San Gabriel Reservoir itself, the impacts on vegetation and animal species would be expected to be similar to the impacts associated with excavating sediment from the reservoir, since in both cases the reservoir would need to be drained. For a discussion of the expected impacts, refer to Section 7.3.4.1.

Largemouth bass, catfish, crappie, and bluegill have been previously found in San Gabriel Reservoir. These fish are non-native invasive species. As with excavation, these fish would need to be removed and disposed of as specified by the California Department of Fish and Game. Blocking nets would need to be installed upstream of the work area to protect native and non-invasive fish, and such fish found downstream of the nets captured and relocated upstream of the nets. Further study would be needed to determine any additional species that could be impacted.

If mechanical agitation of material is to be conducted there would be an air quality impact from equipment emissions. However, given the Flood Control District's previous sluicing projects, only a few pieces of equipment would be necessary within the reservoir, so air quality impacts in the reservoir are not expected to be significant, especially considering that an OHV Area is already operating in the reservoir.

Impacts to water quality for the stream course within the reservoir are unavoidable when sluicing. Water deliveries to the Azusa Conduit would have to occur at the intake at Morris Dam. Groundwater recharge could possibly be impacted because Morris Reservoir may be unable to capture all the used for the sluicing operation at San Gabriel Reservoir.

The elevated turbidity in Morris Reservoir, though minimal in regards to groundwater recharge operations, could impact the water supply operations of the San Gabriel River Water Committee, as its treatment plants have stringent regulatory restrictions on the turbidity of the water the facilities could take in. State water quality regulators oppose treating the sluice water coming out of San Gabriel Reservoir or treating the water in Morris Reservoir. Therefore, the Flood Control District entered into agreements with the San Gabriel River Water Committee to coordinate reservoir and groundwater recharge operations with the San Gabriel River Water Committee's member entities to reduce impacts to them.

The Flood Control District also entered into an agreement with the City of Azusa (a San Gabriel River Water Committee member entity) to partially fund the City's construction of additional wells and pipelines in the lower San Gabriel Canyon. These additional facilities were designed and constructed to work in unison with groundwater recharge operations to provide supplementary water to San Gabriel River Water Committee member entities for direct use or blending with turbid water during periods when sluicing activities at San Gabriel Reservoir elevate turbidity levels in Morris Reservoir. With the use of these additional facilities, water quality impacts from sluicing on the San Gabriel River Water Committee are anticipated to be minimized.

Sluicing (Removal) - Social Impacts

San Gabriel Reservoir is not in the viewshed of any houses or buildings. However, the reservoir is located along San Gabriel Canyon Road, which is frequented by recreation users. The scenic and visual impacts of dredging operations on recreational users would be minimal and temporary.

The Forest Service permits OHV operation in an area at the confluence of the West Fork and San Gabriel Reservoir called the San Gabriel Canyon OHV Area. Access to water within the reservoir is prohibited, but removal of sediment from the reservoir could impact this form of recreation by restricting OHV access to areas being worked.

Shoreline fishing is allowed at the back edge of the pool in San Gabriel Reservoir. Sluicing would impact this activity.

Sluicing (Removal) - Implementability

Given that sluicing projects have been conducted at San Gabriel Reservoir in the past, it is technically certain that sluicing could be used to remove sediment from San Gabriel Reservoir. Though proven, the alternative still necessitates water availability. For planning purposes, a water-to-sediment ratio of 9-to-1 is being used. Being downstream of Cogswell Reservoir there could be water released to assist with sluicing, but the amount available is limited by the West Fork Management Plan's instream flow goals for fisheries in the West Fork. It is expected that most of the water for sluicing at San Gabriel would be from recession flows.

As stated above for excavation, implementation of the fish blocking nets has to wait until flows coming into the reservoir are low enough to allow for net installation and the nets to block fish without impinging them against the nets. Waiting for the proper flow conditions could delay sediment removal operations well into the summer, significantly reducing the window for sediment removal operations and the flow with which to implement sluicing.

Environmental regulatory permits would be needed prior to any sluicing events.

Sluicing (Removal) - Performance

The entire planning quantity cannot be handled by sluicing alone. For planning purposes, it is assumed that 2 MCY would be sluiced, limited by the ability to remove the sediment from Morris Dam.

In order to sluice San Gabriel Reservoir, the reservoir must first be completely dewatered. Material sluiced from San Gabriel would go directly into Morris Reservoir.

Sluicing (Removal) - Cost

Based on the estimated unit cost for sluicing, the cost of sluicing 2 MCY is approximately $5 million, not including the cost of mitigation measures to be taken within the reservoir and payments to the City of Azusa to provide supplemental water to the San Gabriel River Water Committee member entities.

7.3.5 TRANSPORTATION

The following Section discusses the impacts and costs of transporting sediment removed from San Gabriel Reservoir by means of sluicing, trucking, and conveyor belt. Discussion of the removal alternatives was presented in Section 7.3.4. The placement alternatives are presented in 7.3.6. Combined alternatives that address all phases of the sediment management process are presented and discussed in Section 7.3.7.

7.3.5.1 SLUICING (AS A TRANSPORTATION METHOD)

The following Section explains the impacts of sluicing after sediment has passed through the dam.

Sluicing - Environmental Impacts

As shown in Figure 7-20, the sluice tunnel from San Gabriel Reservoir empties into Brown's Gulch. Brown's Gulch is the lowest 0.5-mile reach of Browns Canyon. The area of the watercourse is approximately 3 acres. Its confluence with the San Gabriel River is located downstream of the plunge pool that is at the base of the dam. Brown's Gulch is known to have fish, amphibian, insects, reptiles, and many birds and mammals. A study would need to be conducted to determine the current state of this area and other habitat that could be impacted.

It should be noted that flows from major storms could be expected to scour out and thus remove habitat from Brown's Gulch. Future sluicing would be expected to impact habitat only when the watercourse has not been recently scoured out. It could be possible, under such conditions, to construct an earthen sluice channel from the San Gabriel Reservoir sluice gates to the upstream end of Morris Reservoir. This channel would prevent the sluice flows from excessively scouring the riparian habitat and otherwise damaging existing habitat. Approximately 0.8 acres of riparian habitat would be impacted by the sluice channel compared to the impact on the full 3 acres during sluicing without the channel. This loss of habitat is still considered a potential adverse impact; however, the potential impact could be less significant after application of other mitigation measures, such as removal and relocation of native fish, amphibians and reptiles.

Once sluice flows reach the confluence below the plunge pool impacts to habitat should be greatly diminished. From here the sluiced material would continue directly into Morris Reservoir but increased turbidity in Morris Reservoir from the addition of sluiced material could still cause impacts in regards to water quality, as described previously.

Also discussed previously, there would be minimal impacts to groundwater recharge because the water used for the sluicing operation would be captured behind Morris Dam and (when decanted by Morris Dam) at groundwater recharge facilities downstream.

Figure 7-20 San Gabriel Dam Sluicing Schematic

Sluicing - Social Impacts

No social impacts (e.g., traffic, recreation, and aesthetics) are expected as a result of sluicing material from San Gabriel Reservoir to Morris Reservoir.

Sluicing – Implementability

Sluicing has been conducted from San Gabriel Reservoir in the past, so it is known to be technically feasible. The ability to sluice sediment is dependent on the inflows to San Gabriel Reservoir which could be supplemented by releases from Cogswell Reservoir, provided those releases do not impact the West Fork Management Plan's instream flow goals for fisheries in the West Fork. Based on the assumption stated in Section 6 and previous experiences at San Gabriel Reservoir, it was estimated that between 300,000 to 500,000 CY of sediment could possibly be sluiced from San Gabriel Reservoir during one sluicing operation.

As discussed, environmental regulatory permits would be needed prior to any sluicing events.

Sluicing – Performance

Given the assumptions discussed in Section 6 and historic events, it was estimated that if sluicing was to be conducted at San Gabriel Reservoir, approximately 400,000 CY of sediment could be sluiced from San Gabriel Reservoir to Morris Reservoir in a year. It is also assumed that adequate water supply is available to sluice and that material within San Gabriel Reservoir would be mechanically agitated to move sediment downstream.

At this rate, sediment would have to be sluiced from San Gabriel Reservoir to Morris Reservoir during 9 years of the 20-year planning period in order to sluice a total of 2 MCY of sediment.

Sluicing – Cost

As discussed previously, sluicing 2 MCY would cost approximately $5 million, not including the cost of mitigation measures taken within the reservoir, payments to the City of Azusa to provide supplemental water to the San Gabriel River Water Committee member entities, and mitigation measures taken within Brown's Gulch.

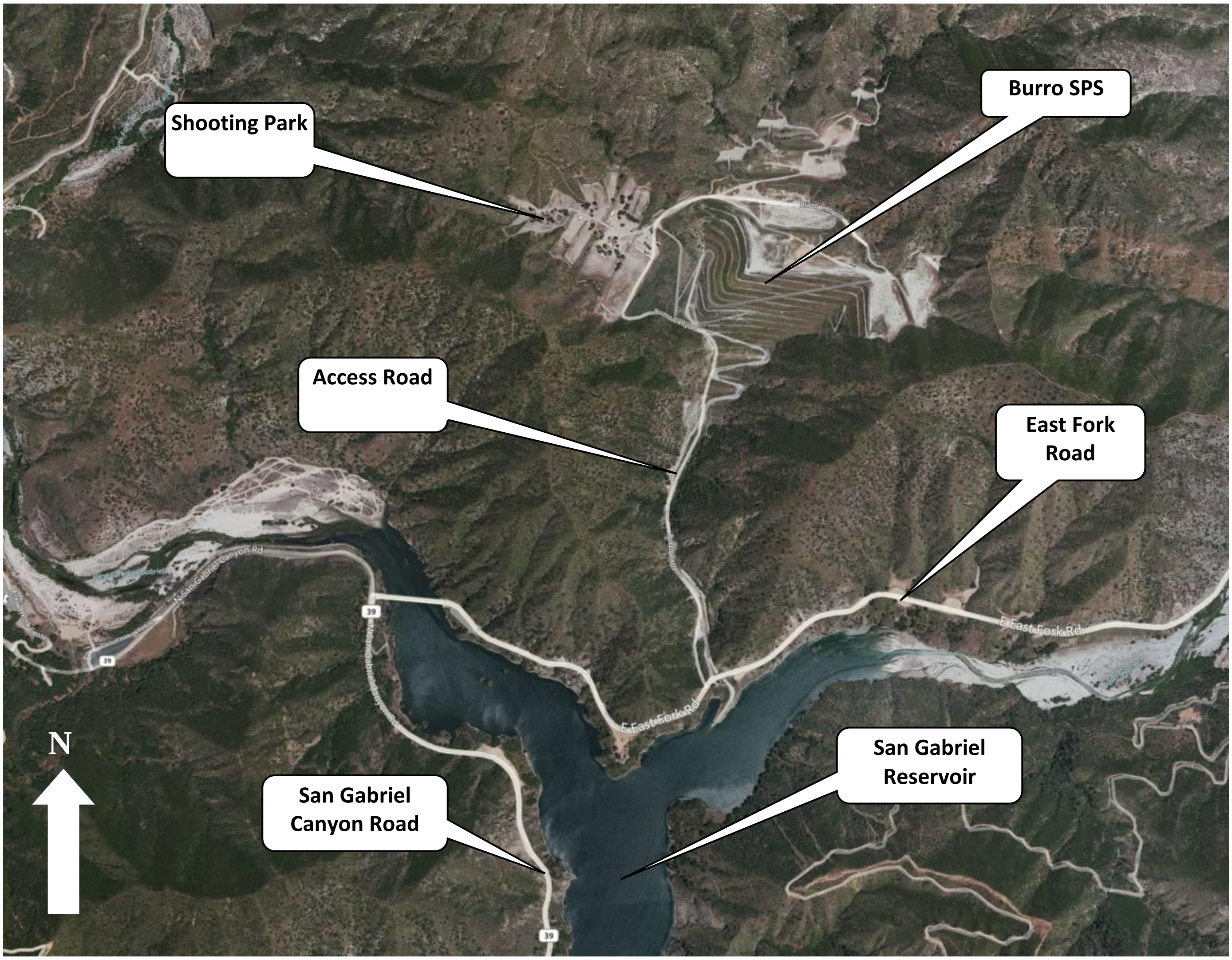
7.3.5.2 TRUCKING

If trucking is to be used for sediment removal from San Gabriel Reservoir, trucks would be used in conjunction with excavation. The material would be loaded directly on to the truck and driven to its final placement location. Two locations are being considered for this analysis; Burro Canyon SPS and the Irwindale Pits. Depending on the final placement location, different access points into the reservoir could be used.

Trucking - Access and Route for Trucking

Access for trucks into San Gabriel Reservoir could be made through the access points described previously. If trucks are driving to Burro Canyon SPS, the access point on the East Fork would be utilized. Burro Canyon SPS is approximately 1.5 miles from the East Fork access point to the top of Burro Canyon SPS as seen in Figure 7-21.

Figure 7-21 Trucking Access to Burro Canyon SPS



If sediment is to be trucked to the Irwindale Pits, constructing an access point along San Gabriel Canyon Road closer to the dam would be recommended. For this analysis it is assumed an access point would be established approximately 0.5 mile upstream of San Gabriel Dam. Trucks would then travel south along San Gabriel Canyon Road. In an effort to avoid the impact to the communities downstream, it is proposed to use an access road for the San Gabriel Canyon Spreading Ground as well as the access road to a conveyor belt owned by Vulcan Materials Company to travel down to Foothill Boulevard, away from the residential areas. Access into the spreading ground is available through the entrance to the parking lot for the bike trail at the north end of the spreading grounds, as seen in Figure 7-22. These access roads are parallel to the Gabriel Bike Trail.

Figure 7-22 San Gabriel Trucking Route to Irwindale

Trucking - Environmental Impacts

The trucks used for sediment removal would utilize San Gabriel Canyon Road, East Fork Road, and an existing maintenance road. There would be no impact to habitat from the trucking aspect of the removal as both of the roads are established. There could be some impact to habitat where new access points need to be established. Further study would be needed to make this determination.

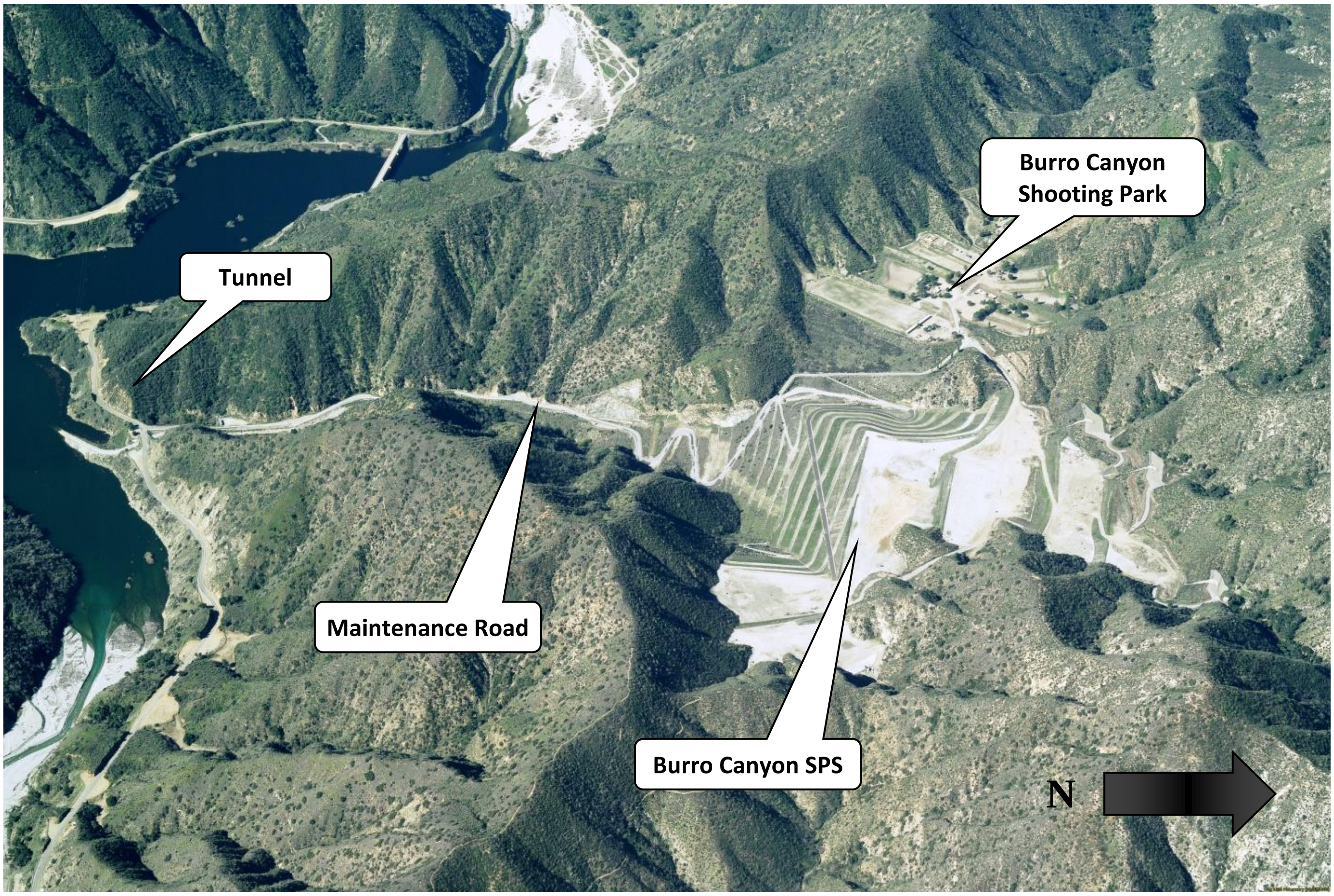
As discussed previously, trucking would impact air quality. The use of low emission trucks would result in lower air quality impacts than if standard trucks were used.

Trucking - Social Impacts

<u>To Burro Canyon SPS</u>

The maintenance route to Burro Canyon SPS is also the access route to the Burro Canyon Shooting Park which is adjacent to the SPS as seen in Figure 7-23. There would be an increase to traffic, noise, and scenic impacts to the recreational users of the shooting park.

Figure 7-23 Burro Canyon SPS



To Irwindale Pits

Trucks would need to enter San Gabriel Canyon Road, which is frequently used by recreational users on their way to recreational facilities upstream of the reservoir. Traffic controls would need to be utilized to prevent hazards at the trucks' entry/exit from the reservoir. There would be traffic impacts to recreational users during hauling operations.

In using the access route described earlier, trucks would avoid driving through downtown Azusa. However, there are two neighborhoods, as seen in Figure 7-24, along San Gabriel Canyon Road that would be affected by the truck traffic for sediment removal.

The proposed route also intersects an access path to the San Gabriel River Gabriel Bike Trail. If trucking is utilized, access from that path could be temporarily limited for the safety of bike trail users. Given that there are several nearby access points to the bike trail, this is expected to be a minimal inconvenience..

Additionally, there is a Geology Area & Park currently proposed for the area where the bike trail meets with Todd Avenue, as seen in Figure 7-25. This project site would need to be taken into consideration if trucking is proposed along this route as the increased truck traffic and noise would affect the facility. This would also remove Todd Avenue from consideration as the route to Foothill Boulevard.

Figure 7-24 Residential Area Impact on San Gabriel Canyon Road

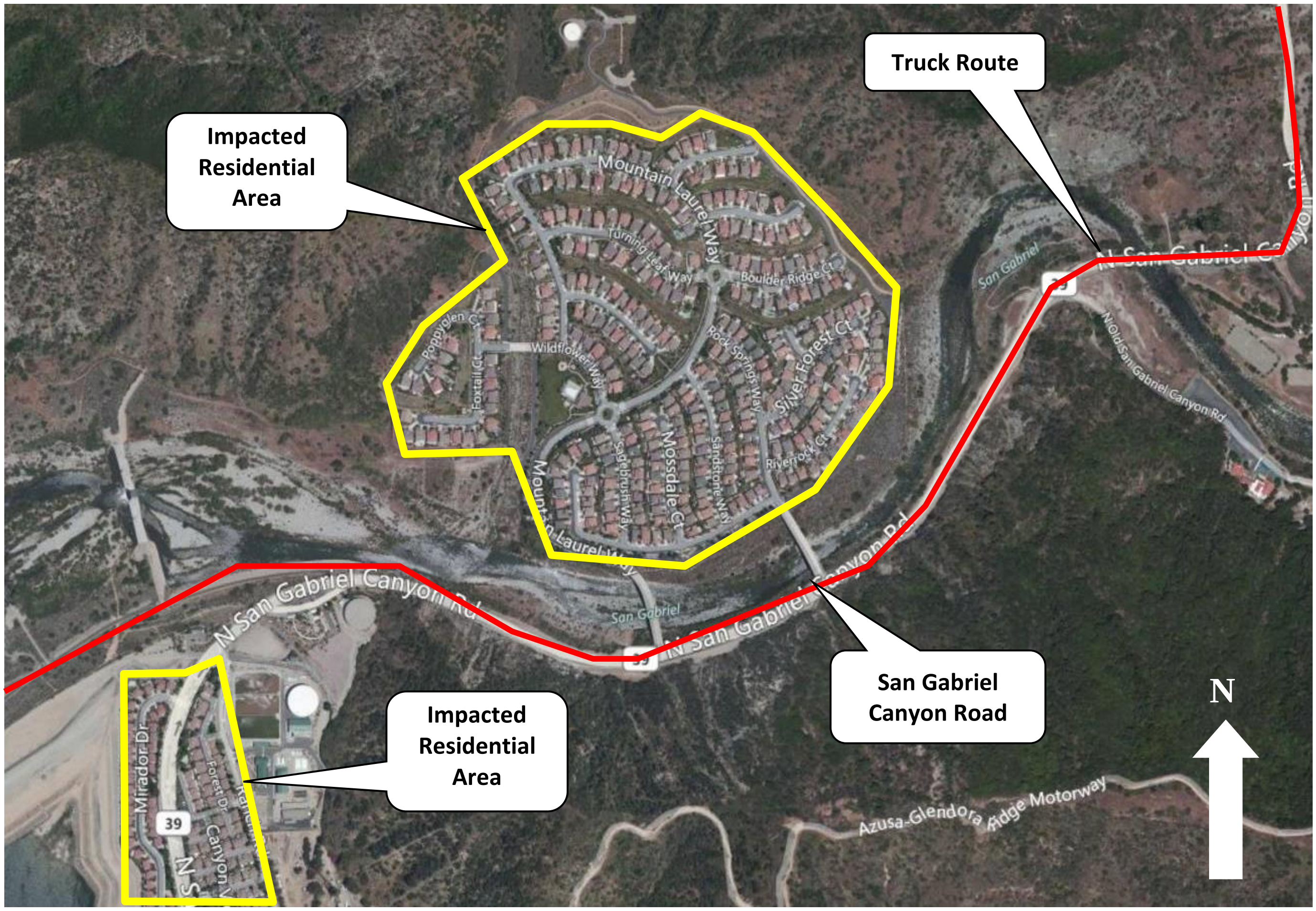
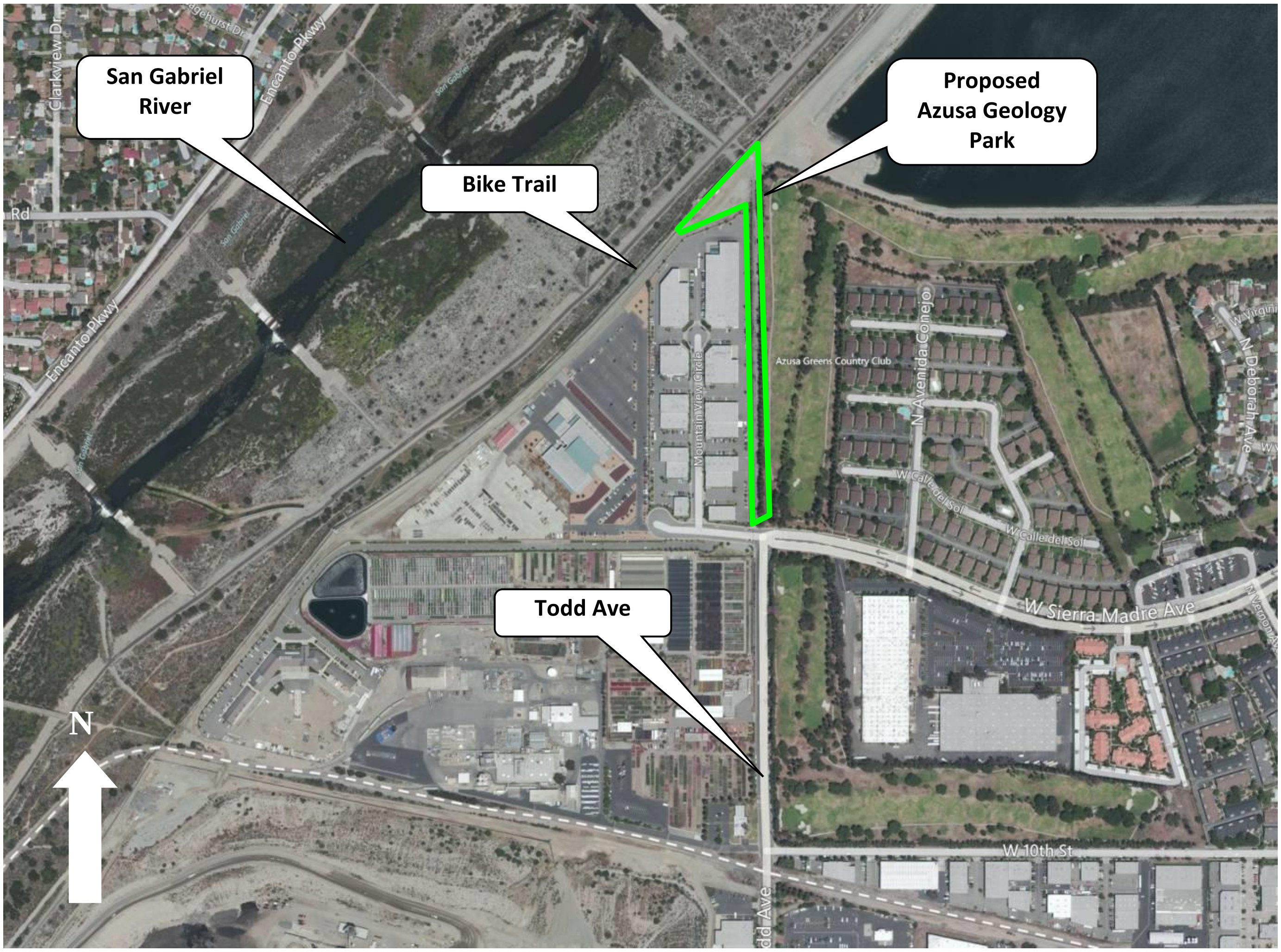


Figure 7-25 Trucking Impact to Proposed Azusa Geology Park and Trail



Trucking - Implementability

At San Gabriel Reservoir, access allows for double-dump trucks with a capacity of 16 CY to be utilized. As discussed previously, these trucks are standard for construction projects and should be readily available. Traveling from the East Fork access point to Burro Canyon SPS, there could be some complications traveling through the East Fork Road undercrossing. Further investigation would be necessary to determine if any modifications would need to be made.

From the San Gabriel Canyon Road access point headed south, no restrictions are expected until diverting to the access road near the bike trail. Further investigation is needed to determine if there are any limitations with the use of this proposed route.

Trucking - Performance

Given the following assumptions, it was determined that if excavation and trucking were to be implemented for San Gabriel Canyon Reservoir, approximately 400,000 CY could be removed per cleanout. In order to manage the full 23.8 MCY of sediment using trucking alone, both placement sites, Burro Canyon SPS and the Irwindale Pits, would need to be utilized. For planning purposes, it is assumed that approximately two thirds of the material or 15.9 MCY of sediment would be taken from the East Fork access point to Burro Canyon SPS and that the remaining one third or 7.9 MCY would be taken to the pits in Irwindale. A smaller quantity of sediment was assumed to be taken to Irwindale, as sediment from Morris Reservoir could be concurrently transported using trucks on the same route. The alternatives for Morris Reservoir are explained in Section 7.4. Additionally, these quantities were established for planning purposes only. Further investigation should be made to optimize transportation of sediment using trucks as specific removal projects are planned.

To Burro Canyon SPS

Approximately 14.9 MCY of sediment would be brought to Burro SPS. This is a 5-mile roundtrip from San Gabriel Reservoir. Assuming double-dump trucks are used, there would be a total of approximately 400 trips per day, totaling 6,400 CY per day or approximately 800,000 CY over the 6 operating months. Given that the East Fork access point is located upstream in the reservoir, it could be possible to extend the cleanout until rain is forecasted.

At this rate, it would take approximately twenty 6-month removal projects to place the 14.9 MCY.

To Irwindale Pits

Approximately 8 MCY of sediment would be brought to the pits in the Irwindale area. This is a 14 mile roundtrip from San Gabriel Reservoir. Assuming double-dump trucks are used, there would be a total of approximately 400 trips per day, totaling 6,400 CY per day or approximately 800,000 CY over the 6 operating months.

At this rate, it would take approximately ten 6-month removal projects to place the 8 MCY.

Trucking - Cost

Given the distance from San Gabriel Reservoir to Burro Canyon SPS and assuming the use of double-dump trucks, the estimated trucking cost is approximately $112 million for 14.9 MCY of sediment. This does not include the cost for any possibly needed modifications to the East Fork access point.

From San Gabriel Reservoir to the Irwindale Pits, assuming the use of double-dump trucks as well, the estimated trucking cost is approximately $168 million for 8 MCY.

This makes the estimated cost for trucking the total 23.8-MCY planning quantity approximately $288 million, excluding access modifications and environmental and social impact mitigation.

7.3.5.3 CONVEYOR BELTS

The use of a conveyor belts would be in conjunction with excavation and would only be brought to Burro Canyon SPS.

Access and Route for Conveyor Belt

If a conveyor belt is to be used to remove sediment from sediment from San Gabriel Reservoir to Burro Canyon SPS, the East Fork access point would be utilized. Taking this route, the conveyor belt would travel through the tunnel under East Fork Road and be aligned alongside the maintenance road to the SPS as shown in Figure 7-26 below. Burro Canyon SPS is approximately 1.5 miles from the East Fork access point to the top of Burro Canyon SPS.

Figure 7-26 San Gabriel Conveyor Alignment to Burro Canyon SPS

Conveyor Belts - Environmental Impacts

Additional study would need to be conducted to determine if there is habitat, especially in the drainage along the access road to Burro Canyon SPS/Shooting Park that would be impacted by the proposed conveyor belt route. However, with the utilization of existing access ramps and roads, the habitat impacts are expected to be minimal.

Conveyor Belts - Social Impacts

The conveyor alignment could adversely impact the tunnel located beneath East Fork Road at the mouth of Burro Canyon.

Since the conveyor belt would utilize the access road to the Burro SPS, the road width available for the recreational users of the Burro Canyon Shooting Park would be restricted. There would also be a noise and a scenic impact from the conveyor belt along the access road for these recreational users.

Conveyor Belts - Implementability

If a conveyor belt is used for sediment removal from San Gabriel Reservoir, it would be installed during cleanouts and removed between subsequent cleanouts. Once sediment is excavated, it could then be loaded into a hopper inside the body of the reservoir. Approximately 1.5 miles of conveyor belt would need to be constructed along

Burro Canyon SPS maintenance road. Sediment would then be conveyed through a tunnel under the East Fork Road to the maintenance road and then alongside the maintenance road to Burro Canyon SPS. If necessary, it would be possible to either trench or elevate the conveyor belt in a location crossing the maintenance road.

Environmental regulatory permits would be needed prior to any conveyor activities.

Conveyor Belts – Performance

Conveyor Belts Alone

Given the following assumptions as well as those described in Section 6, it was determined that if two conveyor belts were to be used at San Gabriel Reservoir approximately 1,600,000 CY could be removed per cleanout. It was determined that if conveyor belts were to be used to convey the full 23.8-MCY planning quantity, it could be necessary to use a larger conveyor than described in Section 6. For this planning document, it was assumed that two conveyor belts as described in Section 6 would be used simultaneously.

The conveyor belts would have a combined capacity of 1,600 CY per hour. Sediment would be brought to Burro Canyon SPS. The operation would run 8 hours per day, 5 days per week, and 6 months per year. Given that the East Fork access point is located upstream in the reservoir, it could be possible to extend the cleanout until rain is forecasted.

At this rate, it would take approximately fourteen 6-month removal projects to place the 23.8 MCY of material.

Conveyor Belts Combined with Trucking

It would also be possible to combine the conveying operations with trucking from the front of San Gabriel Reservoir to the Irwindale Pits as described previously. Given this scenario, 8 MCY would be trucked from the front of San Gabriel Reservoir leaving 14.9 MCY to be conveyed to Burro Canyon SPS.

Given the same assumption of using two conveyor belts, it would take approximately ten 6-month removal projects to place the 14.9 MCY of material. As stated before, removal of 8 MCY of sediment from San Gabriel Reservoir using trucks would take approximately ten 6-month removal projects. As both transportation methods require excavation, the projects could be completed simultaneously.

Conveyor Belts - Cost

The estimated cost for constructing and operating a conveyor belt 1.5 miles from San Gabriel Reservoir to Burro Canyon SPS is approximately $6 million.

7.3.5.4 SLURRY PIPELINE

A slurry pipeline is not being considered for the San Gabriel Reservoir alternatives because Morris Reservoir is within such close proximately to San Gabriel. The slurry from the dredge would be discharged directly into Morris Reservoir.

7.3.6 PLACEMENT

This section discusses potential placement alternatives for sediment removed from San Gabriel Reservoir. Specifically, this section discusses the placement of sediment at pits and the existing Burro Canyon Sediment Placement Site. Given the location of San Gabriel Reservoir and the large quantity of sediment to be managed, sediment may be transported into Morris Reservoir. Sediment that is transported to Morris Reservoir via sluicing, slurry pipeline, or other method would be removed and placed at sites deemed feasible for Morris Reservoir.

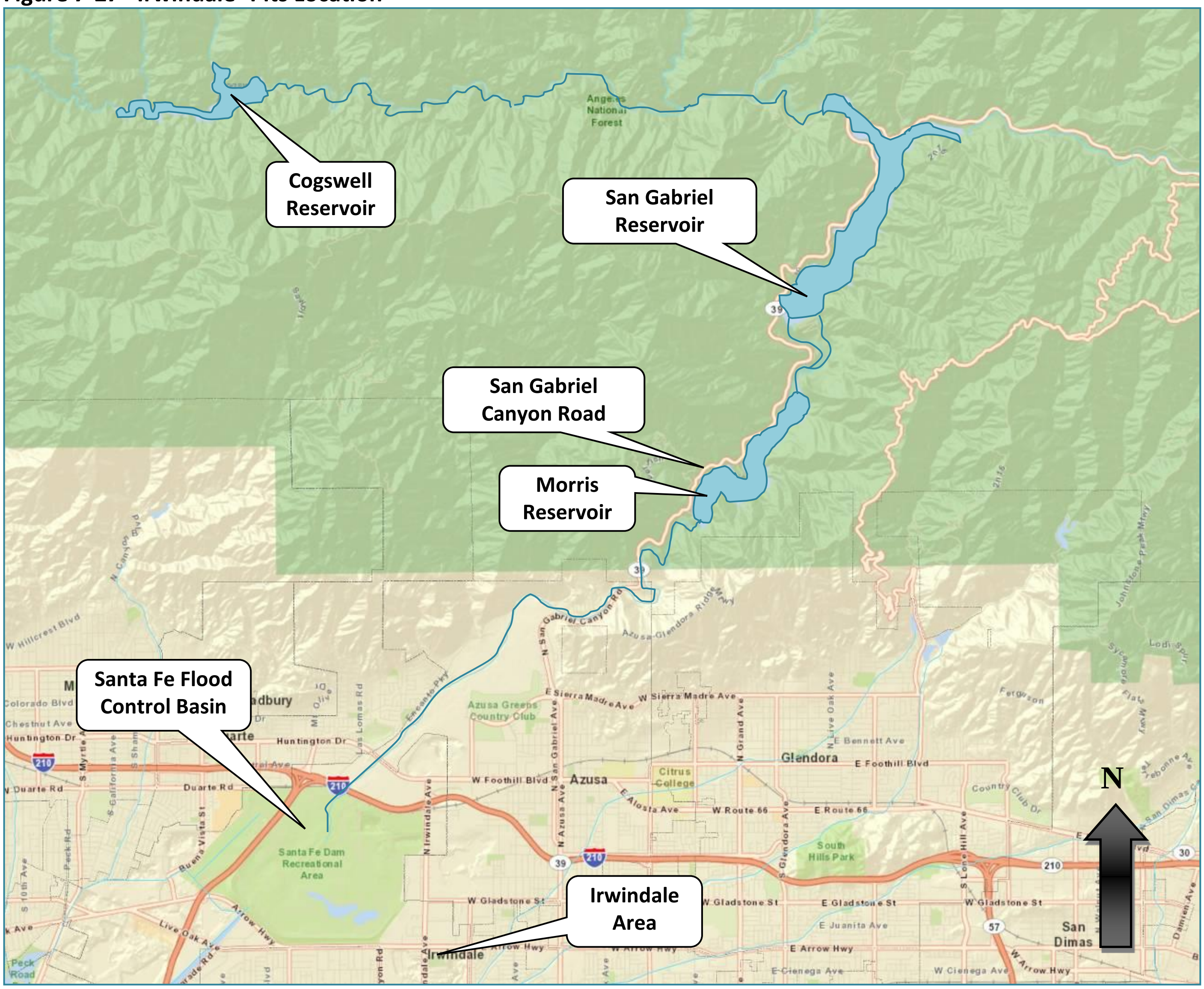
7.3.6.1 LANDFILLS

Although Section 6 identified landfills as a feasible placement alternative for reservoirs, the long distance and limited available capacity prohibit their use for sediment removed from San Gabriel Reservoir.

7.3.6.2 PITS

The general impacts of employing pits for sediment placement were discussed in Section 6. There are multiple pits in Irwindale. Figure 7-27 shows the location of the pits in relation of San Gabriel Reservoir. From San Gabriel Reservoir to the pits, the distance is approximately 14 miles, depending on the specific pit identified for use, the mode of transportation used, and the route.

Figure 7-27 Irwindale Pits Location



It is assumed that the entire 8 MCY of material from San Gabriel Reservoir that is proposed for transport out of the canyon would be marketable. Given that assumption and other assumptions discussed in Section 6, it was assumed that pits operated by the gravel industry would accept the entire 8 MCY of sediment from San Gabriel Reservoir free of charge.

As discussed in Section 6, the acquisition of pits for the placement of sediment from facilities under the jurisdiction of the Flood Control District should be pursued. Acquisition of a quarry in Irwindale would be most desirable for sediment management operations related to San Gabriel Reservoir. It would cost a total of $3 per cubic yard to acquire and place the 8 MCY of sediment at the Flood Control District-owned pit.

7.3.6.3 BURRO CANYON SEDIMENT PLACEMENT SITES

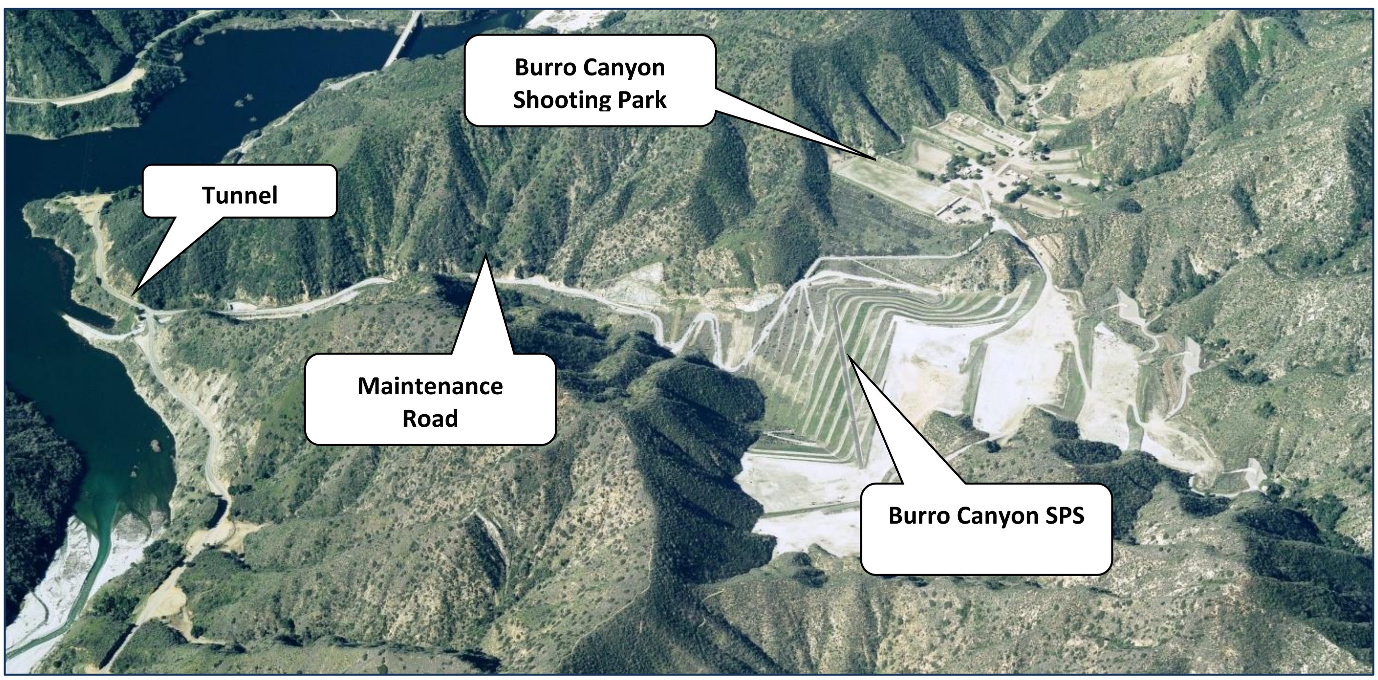
This section discusses the impacts associated with utilizing Burro Canyon SPS for the permanent placement of sediment from San Gabriel Reservoir. This placement alternative could potentially be used for sediment excavated from the reservoir and transported either by trucks or a conveyor system to the SPS.

Cogswell SPS is an existing SPS that currently holds less than 5 MCY of sediment and covers an area of approximately 36.5 acres from a previous cleanout effort.

Burro Canyon SPS, shown in Figure 7-28, is an existing SPS located approximately 1.3 miles upstream from the East Fork access point to San Gabriel Dam. Sediment placement in the SPS began in the later 1960s and continues to be considered for placement of sediment removed from San Gabriel Reservoir.

No other previously-used SPS or new canyon-SPS was considered for disposal of sediment from San Gabriel Reservoir.

Figure 7-28 Burro Canyon SPS



Burro Canyon SPS – Environmental

The Curve and Williams Fires of 2002 consumed all of the vegetation at Burro Canyon SPS. The San Gabriel Reservoir post-fire sediment removal project (2004-06) included hydroseeding the SPS with native species. Since that time, it is expected that the hydroseed sprouted and that some vegetation and other habitat above the fill lines have been reestablished. Further study would be needed to determine the extent and potential impacts and need for mitigation.

Burro Canyon SPS – Social

Burro Canyon SPS is located in a relatively remote area. The only nearby recreation area is the Burro Canyon Shooting Park which is located on sediment previously placed in the SPS. The shooting park and the SPS share the same access road. It is expected that recreational users of the shooting park would experience increased traffic, noise, and scenic impact. It could be necessary to relocate the shooting park within the boundary of the SPS.

Burro Canyon SPS – Implementability

It would be necessary to obtain environmental regulatory permits to use Burro Canyon SPS. It should also be noted that although Burro SPS pre-dates the Burro Canyon Shooting Park, the forced closure of shooting ranges elsewhere in Los Angeles County (including one in Azusa) have made gun users, especially law enforcement and homeland security entities, increasingly reliant on the Burro Canyon Shooting Park for their ongoing training and practice.

Burro Canyon SPS – Performance

Burro Canyon is estimated to have a remaining capacity of 29 MCY. With the total 20-year planning quantity for San Gabriel Reservoir at only 23.8 MCY, there is ample space to meet this need.

Burro Canyon SPS – Cost

If 23.8 MCY of sediment were to be placed at Burro Canyon SPS it would cost approximately $5 million. This accounts only for the cost of placing the sediment in the SPS. Further study would be necessary to determine the cost of mitigation.

7.3.7 COMBINED SEDIMENT MANAGEMENT ALTERNATIVES

Given the quantity of sediment planned to be managed at San Gabriel Reservoir, it is going to be necessary to use multiple sediment management alternatives simultaneously. A description of each of these combined sediment management alternatives is given below. More specific details regarding the environmental impacts, social impacts, feasibility, implementability, and cost for individual alternatives are given in the previous subsections. Combined impacts and costs are described below.

7.3.7.1 COMBINED SEDIMENT ALTERNATIVE 1A: EXCAVATE (23.8 MCY) → TRUCKS → BURRO CANYON SPS (15.8 MCY) & IRWINDALE PITS (8 MCY)

Excavation of the total 23.8 MCY of sediment expected to be removed in the next 20-years in conjunction with trucking would need to occur approximately 20 times. Of the 23.8 MCY, 8 MCY would be taken to a pit in Irwindale with approximately 10 removals. The other 15.8 MCY that would be taken to Burro Canyon SPS would need to be taken approximately every year for the 20 years. It could be possible in some years to take more than planned to Burro Canyon SPS, if rain is not forecasted early. It is expected that most excavation could only occur over summer months.

Trucking to Irwindale

The trucks performing the removal of 8 MCY to Irwindale would travel partially along San Gabriel Canyon Road and partially on a private access road near the San Gabriel River Bicycle Trail. By routing the trucks along the access road no truck traffic would pass through downtown Azusa. There would be some social impacts to a few neighboring communities and likely to the bike trail users.

Utilizing existing roads and access roads minimizes new impact to habitat. There would be some impacts to air quality.

There are several options in the Irwindale area. Sediment that is trucked from the reservoir could be brought to either a privately owned pit or a pit that the Flood Control District could purchase in the future. The Flood Control District intends to pursue the purchase of a new pit as well as the use of those existing.

Trucking to Burro Canyon SPS

The trucks performing the removal of 15.8 MCY to Burro Canyon SPS would travel along the maintenance road to Burro Canyon SPS that is also the access to the Burro Canyon Shooting Park. By routing the trucks along the maintenance road there could be some social impacts to the recreational users of the shooting park and the impacts to transport operations from the recreational users.

Utilizing existing roads and access roads minimizes new impact to habitat. It could be necessary to widen the road which would impact any potential habitat along that corridor. There would be some impacts to air quality.

The sediment would then be placed in the unused area of Burro Canyon SPS. Existing habitat would have to be removed in order to place sediment. Appropriate mitigation would also need to occur.

Implementation of this alternative could cost is estimated to be between $375 million and $395 million. The breakdown of estimated costs, not including those for mitigation or the construction of access point modifications, is provided in the following table.

Figure 7-29 San Gabriel Combines Alternative 1A

Table 7-9 Estimated Costs for Combined Alternative 1A

Activity	Quantity Removed (MCY)	Estimated Costs (in millions)
Excavate Material at San Gabriel	23.8	\$72
Truck from San Gabriel to Irwindale	8	\$168
Place sediment at an Irwindale Pit		\$(17)[a]-\$5
Truck from San Gabriel to Burro Canyon SPS	15.8	\$119
Place sediment at Burro Canyon SPS		\$32
Total	**23.8**	**\$375 to \$395**

Notes:

a. If 8 MCY of marketable material are brought to an existing quarry, a \$17 M credit is assumed. Estimated cost is between a \$17 M credit and an actual cost of \$5 M.

7.3.7.2 COMBINED SEDIMENT ALTERNATIVE 1B: SLUICE (2 MCY) → MORRIS RESERVOIR + EXCAVATE (21.8 MCY) → TRUCKS → BURRO CANYON SPS (13.8 MCY) & IRWINDALE PITS (8 MCY)

Combined Alternative 1B is essentially the same as alternative 1A except that 2MCY of sediment would be sluiced to Morris Reservoir. Morris Reservoir is directly downstream of San Gabriel Reservoir. Figure 7-30 shows the combined alternative. There could be some environmental impacts to the area immediately outside of the sluice tunnel and to the water supply system of the San Gabriel River Water Committee; however, there are mitigation measures that could be taken to minimize the impact. If sluicing were added to the alternative the cost is estimated between $355-375 million. The breakdown of estimated costs is provided in Table 7-10.

Figure 7-30 San Gabriel Combined Alternative 1B

Table 7-10 Estimated Costs for Combined Alternative 1B

Activity	Quantity Removed (MCY)	Estimated Costs (in millions)
Sluice to Morris Reservoir	2	$5
Excavate Material at San Gabriel	21.8	$66
Truck from San Gabriel to Irwindale Pits	13.8	$168
Place sediment at an Irwindale Pit		$(17)[a]-5
Truck from San Gabriel to Burro Canyon SPS	8	$104
Place sediment at Burro Canyon SPS		$28
Total	**23.8**	**$355-375**

Notes:
a. If 8 MCY of marketable material are brought to an existing quarry, a $17 M credit is assumed. Estimated cost is between a $17 M credit and an actual cost of $5 M.

7.3.7.3 COMBINED SEDIMENT ALTERNATIVE 1C: DREDGE (2 MCY) → SLURRY PIPELINE → MORRIS RESERVOIR + EXCAVATE (21.8 MCY) → TRUCKS → BURRO CANYON SPS (13.8 MCY) & IRWINDALE PITS (8 MCY)

Combined Alternative 1C, as shown in Figure 7-31, is essentially the same as alternative 1B except that instead of sluicing 2 MCY of sediment, it would be dredged through to Morris Reservoir. Morris Reservoir is directly downstream of San Gabriel Reservoir. If dredging were added to the alternative the cost is estimated between $370-390 million. The breakdown of estimated costs is provided in Table 7-11.

Figure 7-31 San Gabriel Combined Alternative 1C

Table 7-11 Estimated Costs for Combined Alternative 1C

Activity	Quantity Removed (MCY)	Estimated Costs (in millions)
Dredge to Morris Reservoir	2	$21
Excavate Material at San Gabriel	21.8	$66
Truck from San Gabriel to Irwindale Pits	8	$168
Place sediment at an Irwindale Pit		$(17)[a]-5
Truck from San Gabriel to Burro Canyon SPS	13.8	$104
Place sediment at Burro Canyon SPS		$28
Total	**23.8**	**$370-390**

Note:

a. If 8 MCY of marketable material are brought to an existing quarry, a $17 M credit is assumed. Estimated cost is between a $17 M credit and an actual cost of $5 M.

7.3.7.4 COMBINED SEDIMENT ALTERNATIVE 2A: EXCAVATE → TRUCKS → IRWINDALE PITS + EXCAVATE TO CONVEYOR BELTS → BURRO CANYON SPS

Excavation of the total 23.8 MCY of sediment expected to be removed in the next 20-years in conjunction with trucking and conveyor belts simultaneously would need to occur approximately 10 times. Of the 23.8 MCY, 8 MCY would be trucked to a pit in Irwindale, as discussed previously.

The remaining 15.8 MCY would be transported by conveyor belt to Burro Canyon SPS using either two 4-foot wide conveyor belts or a larger belt with a capacity to move 1,600 CY/hour. The conveyor would start from inside the basin or at the downstream face of the dam. From there, the belt(s) would travel through the existing masonry tunnel and alongside the maintenance road approximately 1.5 miles to Burro Canyon SPS.

The maintenance road is also accessed by recreational users of the Burro Canyon Shooting Park located adjacent to the SPS. There could be some social impacts to those recreational users, and these users could impact transport operations. It could also be necessary to trench or elevate the conveyor system in some areas to maintain access along this road.

Habitat along the maintenance road would be impacted by the construction of a conveyor system. If portions of the conveyor system are trenched, there could be more opportunity for habitat to recover along that portion of the alignment.

The sediment would then be placed in the unused area of Burro Canyon SPS. Existing habitat would have to be removed in order to place sediment. Appropriate mitigation would also need to occur.

Implementation of this alternative could cost an estimated $275-300 million. The breakdown of estimated costs is provided in Table 7-12.

Figure 7-32 San Gabriel Combined Alternative 2A

Table 7-12 Estimated Costs for Combined Alternative 2A

Activity	Quantity Removed (MCY)	Estimated Costs (in millions)
Excavate Material at San Gabriel	23.8	$72
Truck from San Gabriel to Irwindale Pits	8	$168
Place sediment at an Irwindale Pit		$(17)[a]-5
Convey Material from San Gabriel to Burro Canyon SPS	15.8	$21
Place sediment at Burro Canyon SPS		$32
Total	**23.8**	**$275-300**

Notes:

a. If 8 MCY of marketable material are brought to an existing quarry, a $17 M credit is assumed. Estimated cost is between a $17 M credit and an actual cost of $5 M.

7.3.7.5 COMBINED SEDIMENT ALTERNATIVE 2B: DRY EXCAVATION → TRUCKS → IRWINDALE PITS (8 MCY) + CONVEYOR BELT TO BURRO CANYON SPS (13.8 MCY) + SLUICE TO MORRIS RESERVOIR (2 MCY)

Combined Alternative 2B is essentially the same as alternative 2A except that 2 MCY of sediment that would have been sent on a conveyor belt to Burro Canyon would be sluiced to Morris Reservoir. Morris Reservoir is directly downstream of San Gabriel Reservoir. There could be some environmental impacts to the area immediately outside of the sluice tunnel; however, there are mitigation measures that could be taken to minimize the impact. If sluicing were added to the alternative, the cost is estimated between $270-295 million. The breakdown of estimated costs is provided in Table 7-13.

Figure 7-33 San Gabriel Combined Alternative 2B

Table 7-13 Estimated Costs for Combined Alternative 2B

Activity	Quantity Removed (MCY)	Estimated Costs (in millions)
Sluice to Morris Reservoir	2	$5
Excavate Material at San Gabriel	21.8	$66
Truck from San Gabriel to Irwindale	8	$168
Place sediment at an Irwindale Pit		$(17)[a]-5
Conveyor Belt from San Gabriel to Burro Canyon SPS	13.8	$21
Place sediment at Burro Canyon SPS		$28
Total	**23.8**	**$270-295**

Notes:

a. If 8 MCY of marketable material are brought to an existing quarry, a $17 M credit is assumed. Estimated cost is between a $17 M credit and an actual cost of $5 M.

7.3.7.6 Combined Sediment Alternative 2C: Excavate → Trucks → Irwindale Pits (8 MCY) + Conveyor Belt to Burro Canyon SPS (13.8 MCY) + Dredge to Morris Reservoir (2 MCY)

Combined Alternative 2C is essentially the same as alternative 2B except that instead of sluicing 2 MCY of sediment, it would be dredged through to Morris Reservoir. Morris Reservoir is directly downstream of San Gabriel Reservoir. If dredging were added to the alternative, the cost is estimated between $285-310 million. The breakdown of estimated costs is provided in the following table.

Figure 7-34 San Gabriel Combined Alternative 2C

Table 7-14 Estimated Costs for Combined Alternative 2C

Activity	Quantity (MCY)	Estimated Costs (in millions)
Dredge to Morris Reservoir	2	$21
Excavate Material at San Gabriel	21.8	$66
Truck excavated material from San Gabriel to Irwindale	8	$168
Place excavated material at an Irwindale Pit		$(17)[a]-5
Convey excavated material from San Gabriel to Burro Canyon SPS	13.8	$21
Place excavated material sediment at Burro Canyon SPS		$28
Total	**23.8**	**$285-310**

Notes:

a. If 8 MCY of marketable material are brought to an existing quarry, a $17 M credit is assumed. Estimated cost is between a $17 M credit and an actual cost of $5 M.

7.3.8 SAN GABRIEL RESERVOIR SUMMARY AND RECOMMENDATIONS

7.3.8.1 SUMMARY

Over the next 20 years, 23.8 MCY of sediment are planned to be removed from San Gabriel Reservoir, including 3.4 MCY that could potentially be sluiced or delivered by slurry pipeline from Cogswell Reservoir. The different sediment management alternatives are briefly explained below and the impacts are shown in Table 7-15.

Sediment Management Alternatives

1A Excavate (23.8 MCY) → Trucks → Burro Canyon SPS (15.8 MCY) & Irwindale Pits (8 MCY)
Alternative 1A proposes to excavate the entire 23.8 MCY of sediment from San Gabriel Reservoir and truck 15.8 MCY to Burro Canyon SPS and the remaining 8 MCY to the Irwindale pits. There would be air quality impacts from the trucks as well as some habitat impact to the undeveloped portion of Burro Canyon SPS. The trucks driving to Irwindale would cause some traffic, noise, and visual impacts.

1B Sluice (2 MCY) → Morris Reservoir
+ Excavate (21.8 MCY) → Trucks → Burro Canyon SPS (13.8 MCY) & Irwindale Pits (8 MCY)
This alternative is similar to 1A except that 2 MCY of the 23.8 MCY would be sluiced from San Gabriel Reservoir to Morris Reservoir and the remaining 21.8 MCY would be excavated and trucked. As a result of the sluicing operations, there would be some habitat impacts immediately downstream of the San Gabriel Reservoir sluice tunnel.

1C Dredge (2 MCY) → Slurry Pipeline → Morris Reservoir
+ Excavate (21.8 MCY) → Trucks → Burro Canyon SPS (13.8 MCY) & Irwindale Pits (8 MCY)
This alternative is similar to 1B except instead of sluicing 2 MCY of sediment from San Gabriel Reservoir to Morris Reservoir the sediment would be dredged and transported via a slurry pipeline from San Gabriel Reservoir to Morris Reservoir. Dredging would have some water quality and visual impacts.

2A Excavate (15.8 MCY)→ Conveyor Belts → Burro Canyon SPS
+ Dry Excavate (8 MCY) → Trucks → Irwindale Pits
Alternative 2A is essentially the same as 1A, except that instead of trucking 15.8 MCY to Burro Canyon SPS, the

sediment would be transported via conveyor belts. There may be some habitat impacts over the alignment to Burro Canyon SPS.

2B Sluice (2 MCY) → Morris Reservoir
+ Excavate (13.8 MCY) → Conveyor Belts → Burro Canyon SPS
+ Excavate (8 MCY) → Trucks → Irwindale Pits
This alternative is similar to 2A except that 2 MCY of material would be sluiced to Morris Reservoir. As discussed, this would have some habitat impacts immediately downstream of the San Gabriel sluice tunnel. This would leave 13.8 MCY to be transported by conveyor belt to Burro Canyon SPS and 8 MCY to be trucked to Irwindale pits.

2C Dredge (2 MCY) → Slurry Pipeline → Morris Reservoir
+ Excavate (13.8 MCY) → Conveyor Belts → Burro Canyon SPS
+ Excavate (8 MCY) → Trucks → Irwindale Pits
This alternative is similar to 2B except that instead of sluicing 2 MCY to Morris Reservoir that quantity of sediment would be dredged. As mentioned, dredging would have some water quality and visual impacts.

Recommendations

It is recommended that all the alternatives detailed here be considered for future sediment removal projects at San Gabriel Reservoir.

Table 7-15 Summary of Sediment Management Alternatives for San Gabriel Reservoir

Alternative		Quantity Removed (MCY)	Environmental				Social			Implementability	Performance		Cost
			Habitat	Water Quality	Groundwater Recharge	Air Quality[a]	Traffic	Visual	Noise	Special Permit/ Agreement Required[b]	Previous Experience	# of operations required in next 20 years	$ millions
1A	Excavate	23.8	◑		○	◑		◑	◑		Yes		375-395
	Trucks to Burro Canyon SPS	15.8				●	○	○	○			19	
	Burro Canyon SPS		●			○				Yes			
	Trucks to Irwindale Pits	8				●	●	◑	◑			10	
	Irwindale Pits									Yes			
1B	Sluice to Morris Reservoir	2	●	●	○			○			Yes	5	355-375
	Excavate	21.8	◑		○	◑		◑	◑			16	
	Trucks to Burro Canyon SPS					●	○	○	○				
	Burro Canyon SPS	13.8	●			○				Yes			
	Trucks to Irwindale Pits	8				●	●	◑	◑			10	
	Irwindale Pits									Yes			
1C	Dredge to Morris Reservoir	2	◑	◑	○			○	○		No	7	370-390
	Excavate	21.8	◑		○	◑		◑	◑		Yes	16	
	Trucks to Burro Canyon SPS					●	○	○	○				
	Burro Canyon SPS	13.8	●			○				Yes			
	Trucks to Irwindale Pits	8				●	●	◑	◑			10	
	Irwindale Pits									Yes			
2A	Excavate	23.8	◑		○	◑		◑	◑		Yes	19	275-300
	Conveyor Belts	15.8	◑					◑	○				
	Burro Canyon SPS		●			○				Yes			
	Trucks to Irwindale Pits	8				●	●	◑	◑			10	
	Irwindale Pits									Yes			
2B	Sluice to Morris Reservoir	2	●	●	○			○			Yes	5	270-295
	Excavate	21.8	◑		○	◑		◑	◑			16	
	Conveyor Belts	13.8	◑					◑	○				
	Burro Canyon SPS		●			○				Yes			
	Trucks to Irwindale Pits	8				●	●	◑	◑			10	
	Irwindale Pits									Yes			
2C	Dredge to Morris Reservoir	2	○	◑	○			○	○		No	7	285-310
	Excavate	21.8	◑		○	◑		◑	◑		Yes	16	
	Conveyor Belts	13.8	◑					◑	○				
	Burro Canyon SPS		●			○				Yes			
	Trucks to Irwindale Pits	8				●	●	◑	◑			10	
	Irwindale Pits									Yes			

Legend:

●	significant impact
◑	some impact
○	possible impact
	no impact

Notes:

(a) Use of low-emission trucks would reduce air quality impacts from significant impact (●) to some impact (◑).
(b) All options require environmental regulatory permits.

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7.4 MORRIS RESERVOIR

7.4.1 BACKGROUND

Morris Dam, shown in Figure 7-35, is a concrete gravity dam that was constructed in 1934 by the City of Pasadena for water supply. The City later transferred the facility to the Metropolitan Water District of Southern California (MWD), which in turn transferred the facility to the Los Angeles County Flood Control District (Flood Control District) in 1995. The original storage capacity at spillway is 52.1 million cubic yards (MCY). With an uncontrolled drainage area 14.3 square miles and a controlled drainage area (from upstream San Gabriel and Cogswell) of 202.7 square miles, Morris has a total drainage area of 217 square miles.

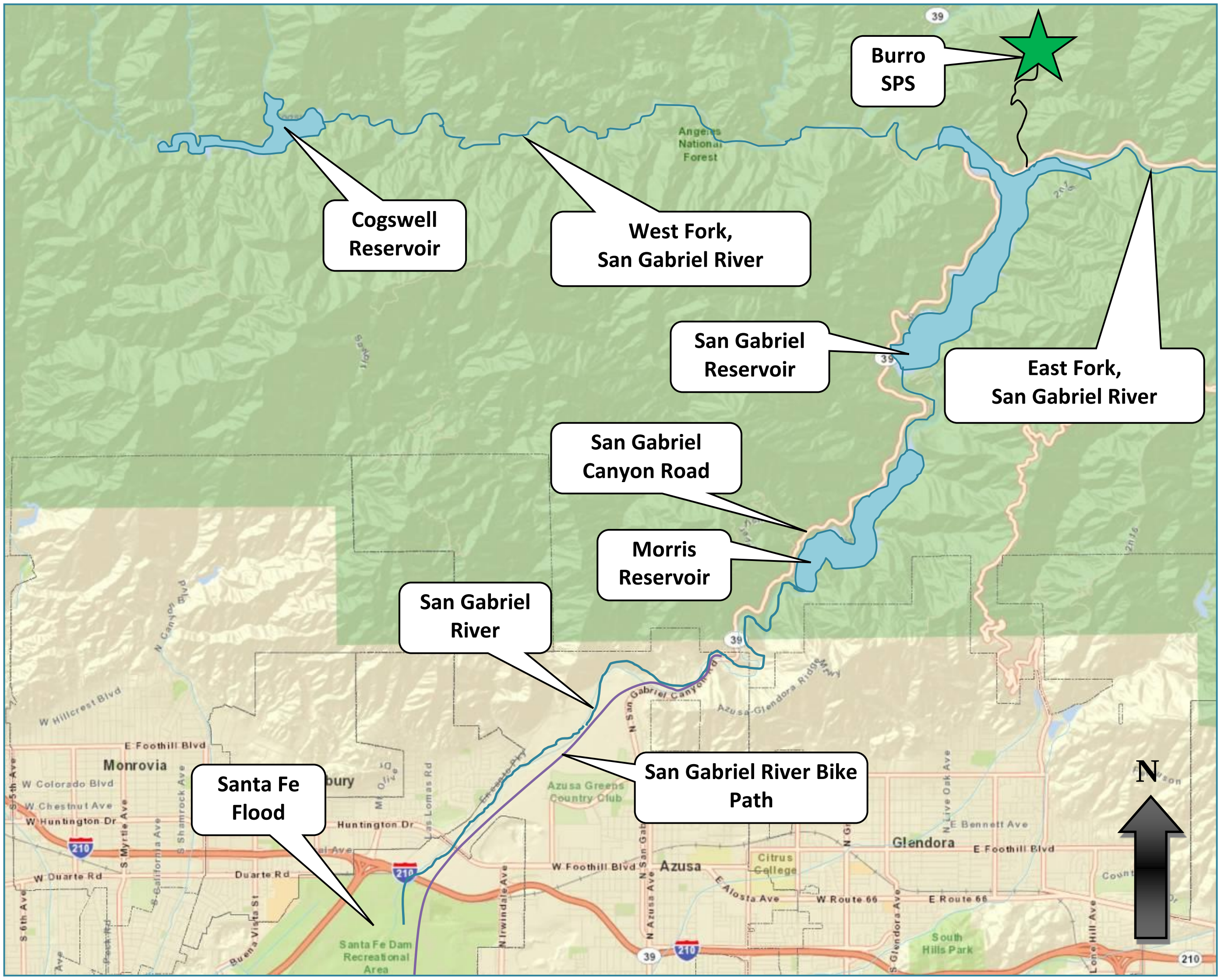
The principal function of Morris Dam is water conservation. Water captured during the storm season behind the dam is gradually released into the San Gabriel River or directed into the Azusa Conduit, if water levels are very high due to the raising of steel radial gates on the spillway to create additional storage capacity. Water released into the river would percolate within the river (since the river bottom is unlined) or be directed into the San Gabriel Canyon Spreading Grounds, and the water supply system of the San Gabriel River Water Committee for treatment and distribution, or to Santa Fe Spreading Grounds. Occasionally, per adjudicated water rights to the lower San Gabriel River, large releases are made for ground water recharge in the Central Basin with flows directed to spreading operations within the San Gabriel River and at San Gabriel Coastal and Rio Hondo Coastal Spreading Grounds.

Figure 7-35 Morris Dam

7.4.1.1 LOCATION

Morris Reservoir is located in the San Gabriel Canyon in the San Gabriel Mountains approximately four miles north of the City of Azusa. The dam and most of the reservoir are located within Flood Control District-owned right of way. The U.S. Forest Service owns a parcel within the reservoir. As discussed in Section 7.1, San Gabriel Dam and Cogswell Dam are both located upstream of Morris Dam.

Figure 7-36 Vicinity Map for Morris Dam

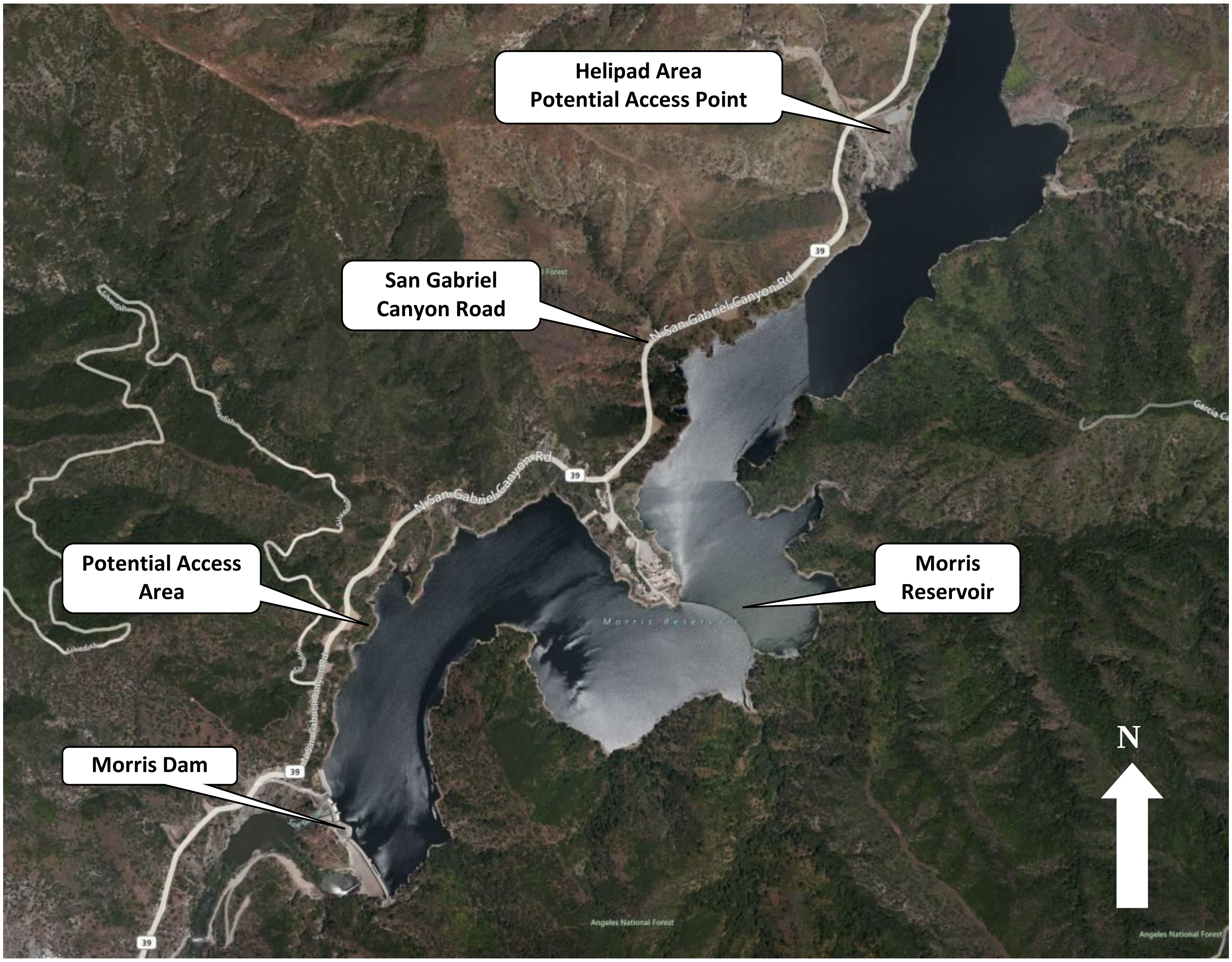


7.4.1.2 Access

Access to the reservoir is available via San Gabriel Canyon Road (State Route 39), a paved, two-way road maintained by Caltrans. From any access point, a road would need to be constructed into the bottom of the reservoir. The elevation difference from San Gabriel Canyon Road to the bottom of the reservoir increases closer to the face of the dam.

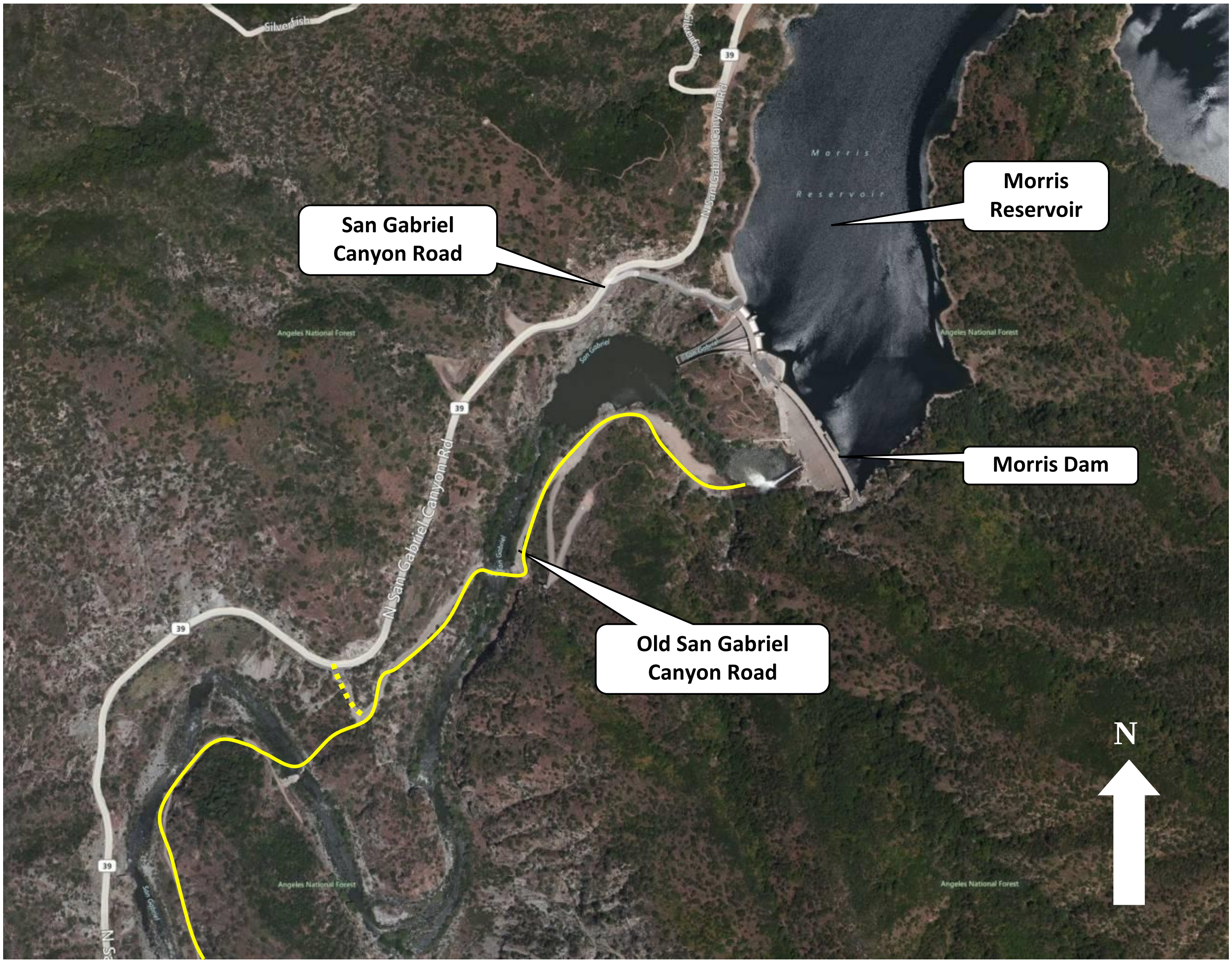
There are two potential access points for Morris Reservoir. The first is located approximately 2 miles northeast of the dam at the upstream access area near the Morris helipad. The second is located approximately 0.5 miles north of the dam. Because it is closer to the dam the access road would likely be steep and difficult to construct. However, it would be valuable to have an access point further downstream in the reservoir. These potential access points are shown in Figure 7-37.

Figure 7-37 Morris Reservoir Upstream Access Points



Access to the downstream maintenance area of the dam is available by means of Old San Gabriel Canyon Road. Old San Gabriel Road is an unpaved roadway beginning at San Gabriel Canyon Road approximately 1.5 miles downstream of the dam. The roadway varies in width. Approximately 3,500 feet of the roadway is washed out and would have to be rebuilt, if it is to be used for vehicular access. Currently, the Flood Control District accesses Old San Gabriel Canyon Road upstream of the area that is washed out, as seen in Figure 7-38.

Figure 7-38 Morris Reservoir Access at Old San Gabriel Canyon Road



7.4.1.3 SPILLWAY & DAM OUTLETS CHARACTERISTICS

Although it also provides flood risk reduction and captures sediment, the principal function of Morris Dam is water conservation. Water captured behind the dam during the storm season is gradually released and redirected to the San Gabriel River and the San Gabriel River Water Committee's water supply.

In addition to controlling water releases, the valves on the dam could also serve as outlets for sluicing and dredging operations. There are no sluice gates at Morris, so sluicing was previously conducted using two lower outlet valves. These two outlets are fixed with 48-inch hydraulic gates. Needle valves on both outlets were abandoned as flood release outlets and permanently removed decades ago. In June 2012, as a part of inlet/outlet works rehabilitation, jet flow valves are to be installed to replace the removed valves. Though small amounts of sediment could pass through, the new jet flow valves would need to be removed during any large sluicing operations.

7.4.1.4 DOWNSTREAM FLOOD CONTROL

In addition to releases from San Gabriel Dam, a few streams that traverse the San Gabriel Mountains flow into Morris Reservoir. Downstream, the San Gabriel River flows into Santa Fe Dam and Flood Control Basin, an Army Corps of Engineers facility used to manage the risk of floods. In the length of river between Morris Dam and Santa Fe Flood Control Basin, there are 10 drop structures, also owned by the Army Corps of Engineers, to control the erosion and scouring of the San Gabriel River.

Downstream of Santa Fe Dam, the watercourse is improved with levees and an unlined (soft) bottom for 15.5 miles. The channel then transitions to a reinforced concrete channel. Outflows are controlled by releases from Morris Dam with the exception of major flood events, during which flows often go over the spillway.

7.4.1.5 SEDIMENT ACCUMULATION AND REMOVAL HISTORY

Figure 7-39 shows the approximate sediment storage in Morris Reservoir since the reservoir's first debris season in the 1930s. Since Morris Reservoir is not operated for flood risk management, there is not a quantitative storage capacity that must be maintained based on Design Debris Events. Instead, sediment removal events are required to prevent impact to the valves or water conservation.

Table 7-16 shows the reservoir capacity at spillway in addition to the historical sediment storage. As of October 2010, the remaining capacity was 37.2 MCY due to sediment accumulation and removal since the dam's construction. Sediment removal at Morris to date has only been done twice and both times during sluicing projects. Approximately 0.5 MCY of sediment were successfully removed during the pilot sluicing project in 1991. During the second sluicing in 1998, approximately 2.1 MCY were removed.

Figure 7-39 Graph of Historical Sediment Storage at Morris Reservoir

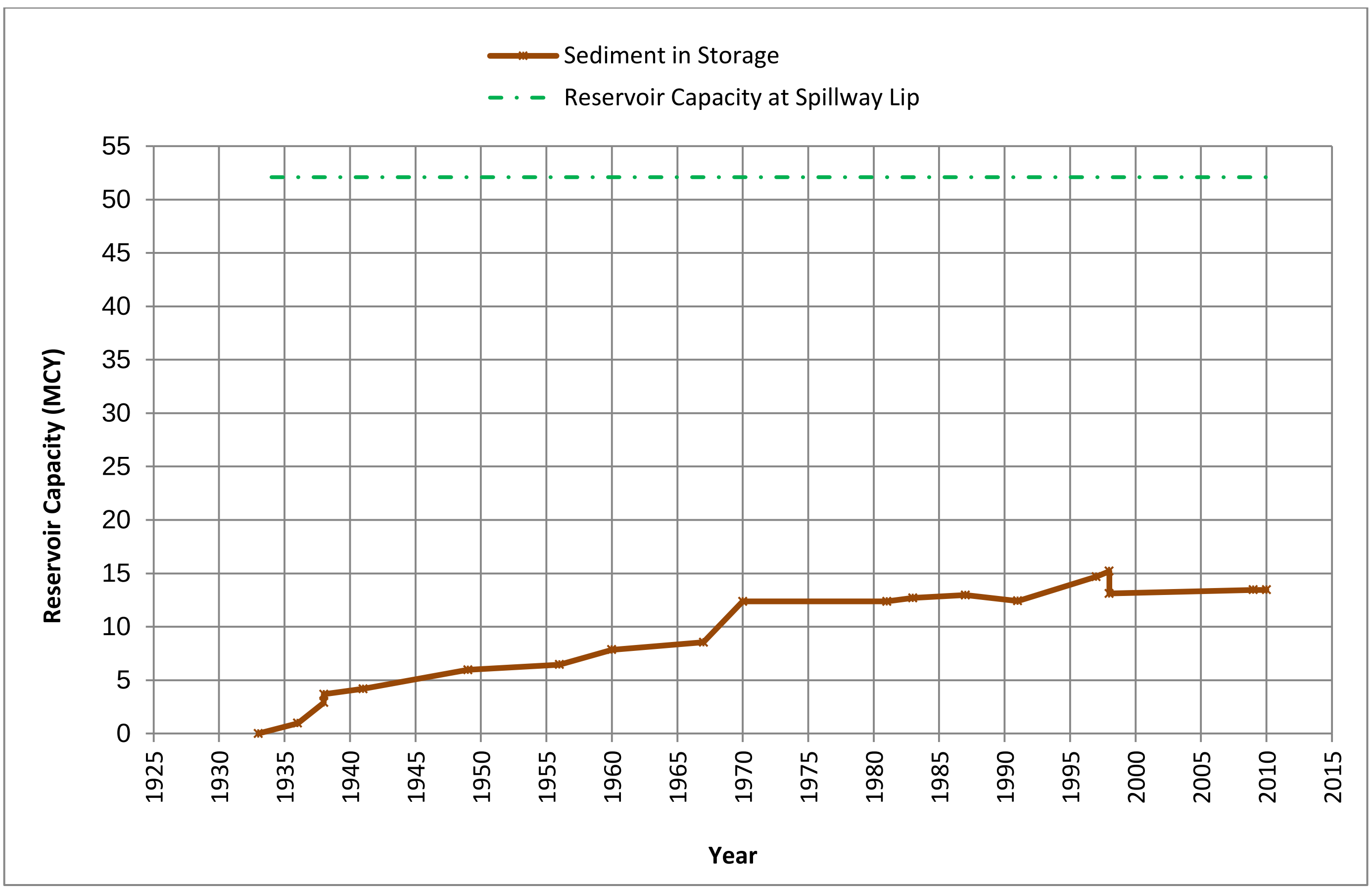


Table 7-16 Morris Reservoir Historical Sediment Accumulation and Removal

Survey Date		Reservoir Capacity[a] (MCY)	Quantity Sluiced (MCY)	Quantity Excavated (MCY)	Sediment Accumulation Between Surveys [b][c] (MCY)	Sediment in Storage (MCY)
October	1933	52.11	-	-	-	-
February	1936	51.14	-	-	0.97	0.97
March	1938	49.23	-	-	1.92	2.88
October	1938	48.43	-	-	0.80	3.68
June	1941	47.92	-	-	0.51	4.19
December	1949	46.15	-	-	1.77	5.96
September	1956	45.67	-	-	0.49	6.45
November	1960	44.26	-	-	1.41	7.85
January	1967	43.56	-	-	0.70	8.55
October	1970	39.75	-	-	3.81	12.36
December	1981	36.72	-	-	-	12.36
November	1983	36.38	-	-	0.33	12.70
November	1987	36.11	-	-	0.27	12.97
October	1991	37.05	0.55[d]	-	-	12.42
April	1997	34.78	-	-	2.27	14.68
September	1998	34.27	-	-	0.52[e]	15.20
December	1998	36.36	2.10[f]	-	-	13.10
October	2009	36.02	-	-	0.35	13.45

Notes

a. Capacity at elevation 1,152 feet.
b. Accumulation is a combination of storm sediment and sluicing from the upstream San Gabriel Reservoir.
c. First debris season assumed to be 1933-34.
d. Estimate of amount sluiced in 1991 Pilot Sluicing Project. There is no record of pre-sluice survey that was apparently taken in 9/91.
e. No sluicing from San Gabriel Reservoir occurred between April 1997 and September 1998.
f. Calculated estimate of difference between the reservoir bottoms per the pre-and post-sluice surveys of the 1998 sluicing. Post-sluice (December 1998) reservoir capacity is back-calculated using this estimate.

Past Sluicing Projects

The first sluicing event at Morris Dam conducted in 1991 was a pilot study to determine if sediment would sluice through Morris Dam and to evaluate the transport of sediment in the San Gabriel River. The project successfully removed approximately 550,000 CY of sediment from the reservoir. No agitation equipment was used during this event however, water hoses we used to push sediment into the low flows.

As a part of this project, fish and turtle relocations were conducted, in the reservoir and downstream of the dam, respectively. A biological assessment of the impacted areas was conducted before, during, and after the project. The conclusion was that most biological impacts from sluicing were short-term, and the expected recovery period would be approximately 500 days. At that time, it was estimated that the cost of sediment removal was approximately $1/CY.

In 1998, at the conclusion of a six-year National Environmental Policy Act (NEPA)/California Environmental Quality Act (CEQA) process for the San Gabriel Canyon Sediment Management Plan, a second sluicing event was conducted and removed approximately 2.1 MCY of sediment. Mechanical agitation equipment was used to facilitate sediment transport.

The sediment that was washed from behind Morris Dam was mainly left in place through the length of the river channel from Morris Dam to the Drop Structures. Starting at the beginning of March 1999, water was released from Morris Dam in an effort to move sediments downstream. These flows sent the water from Morris Dam, through the Drop Structures, to the reservoir behind Santa Fe Dam. The water was pooled there to allow the sediment to settle out and then the water was released from Santa Fe Dam to downstream groundwater recharge facilities.

The 1998-99 storm season following the sluicing operation was lower than average, so storm flows and water stored in the reservoirs in San Gabriel canyon were not sufficient to conduct an extended post-sluicing flush of the river below Morris Dam. In July 1999, the Flood Control District utilized for flushing imported water that was purchased by a local water entity for groundwater replenishment and released at an outlet located just downstream of Morris Dam. These imported water releases were completed in September 1999. The 1999-2000 storm season was one of the driest on record for the San Gabriel Canyon. In February 2000, the Flood Control District again utilized released imported water for flushing. The imported water flowed from below Morris Dam, through the Drop Structures, and was pooled behind the Santa Fe Dam prior to being released downstream for groundwater recharge. With each of the flushes and releases of imported water, additional sediments were washed downstream. As a result of consecutive dry rainfall years, there was a persistent presence of sediment in the river channel until there was adequate water supply to flush the river with a combination of imported water and Morris releases.

The Flood Control District engaged an environmental consultant to conduct monitoring and reporting during and for 5 years after the 1998 sluicing to identify impacts to the upper San Gabriel ecosystem. The summary of the post-sluicing impacts at Morris prepared by the consultant states: "…overall, the sluicing from Morris Reservoir [in 1998] had some short term effects on the downstream aquatic habitat, but the habitat recovered in around 2 to 3 years after the sluicing."

7.4.1.6 SPECIAL CONDITIONS

The San Gabriel River Water Committee has a water right to the normal flow of the river, up to 135 cfs. The San Gabriel River Water Committee takes its water from both the Azusa Conduit and an intake at the mouth of the canyon downstream of Morris Reservoir. The Azusa Conduit has intakes at San Gabriel Dam and at Morris Dam. The intake at San Gabriel Dam allows its use under most reservoir pool levels, except when the reservoir pool is extremely low or the reservoir is completely drained. The intake at Morris Dam could only be used when the pool in Morris Reservoir is extremely high. The water treatment facilities for the San Gabriel River Water Committee have regulatory restrictions that prohibit intake of water with elevated levels of turbidity.

7.4.2 PLANNING QUANTITY & APPROACH

As described in Section 5, the 20-year planning quantity for sediment inflow into Morris Reservoir is 1.3 MCY. It is assumed for planning purposes that some sediment from San Gabriel Reservoir would be sluiced to Morris Reservoir. For planning purposes, it is estimated that approximately 2 MCY could be sluiced into Morris Reservoir in the 20 years without severely impacting the ability to manage sediment at Morris Reservoir.

The 20-year planning quantity for Morris Reservoir is 3.3.MCY.

7.4.3 POTENTIAL STAGING AND TEMPORARY SEDIMENT STORAGE AREAS

Staging areas are needed at Morris to drain water from sediment mixtures and to transfer sediment from one mode of transportation to another. Several candidate sites were examined, but only 2 were deemed feasible. This section includes a description of the 2 staging areas that are included in the plan.

7.4.3.1 SANTA FE FLOOD CONTROL BASIN

Background

Santa Fe Flood Control Basin, shown in Figure 7-40 is owned and operated by the Army Corps of Engineers. It is located in the City of Irwindale approximately 7.5 miles downstream of Morris Dam. Santa Fe Flood Control Basin was cleaned out twice, at the Army Corps of Engineers' request, after the 1998 Morris sluicing project. The cleanouts occurred in an area in front of the dam's outlet works. Santa Fe could be used as a staging area for sluiced sediment.

Figure 7-40 Santa Fe Flood Control Basin Aerial

Santa Fe Flood Control Basin - Environment

Environmentally sensitive areas are located in the basin and include willow-dominated riparian habitat. Both the least Bell's vireo and the coastal California gnatcatcher have been documented in or near this area. Incoming sediment could be temporarily disruptive to the existing habitats. Excavation of sluiced sediment could cause significant disruption of riparian habitat areas. Implementation of appropriate mitigation measures would be needed.

Santa Fe Flood Control Basin - Social

A large portion of Santa Fe Flood Control Basin is a recreational area. The area that would be used for sediment management is located within the improved flood waterway area outside of the recreational area, as seen in Figure 7-41. However, there are several bike trails and hiking trails adjacent to the potential area of impact. Although impacts would be temporary, consideration for these areas would need to be taken when determining traffic paths for conducting any sediment removal projects, which would include transport of the sediment to site(s) that, would be designated at the time the projects are actually planned.

Excavation of material from Santa Fe Flood Control Basin would likely increase noise and visual impacts to the users of the recreational areas as well.

Another facility potentially impacted by sediment removal operations, especially transport, at the Santa Fe facility is the City of Hope National Medical Center, located at the northwest corner of the basin. Consideration of this facility would also need to taken when planning sediment removal activities.

Figure 7-41 Santa Fe Flood Control Basin Designation

Santa Fe Flood Control Basin - Implementability

Any use of Santa Fe Flood Control Basin would require an agreement with the Army Corps of Engineers, as well as environmental regulatory permits. There is currently sediment in storage behind Santa Fe Dam that would need to be removed before the site could be used for new sediment management projects. The Army Corps of Engineers has indicated that, if allowed, the Flood Control District would need to remove as much sediment as would be brought into the basin, but could leave sediment at the level it was before a cleanout began.

Assuming the Army Corps of Engineers allows the Flood Control District to use Santa Fe Flood Control Basin and the Flood Control District obtains all required permits, Santa Fe Flood Control Basin would be a feasible staging area.

Santa Fe Flood Control Basin - Performance

The existing willow-dominated riparian habitat within the basin limits the available space for sediment storage to approximately 580,000 CY. This limited capacity restricts the quantity of sediment that could be sluiced in any one year.

Given the following assumptions, it was determined that if Santa Fe Flood Control Basin is to be used as a stockpiling area for sediment from Morris Reservoir, the sediment would have to be removed and sent to Santa Fe Flood Control Basin every two years or so.

- The entire 3.3 MCY planning quantity for Morris Reservoir would be stockpiled at Santa Fe Flood Control Basin at some point during several removal projects
- Sediment removal operations at Morris Reservoir are able to be conducted in a way that the maximum stockpiling capacity at Santa Fe Flood Control Basin is able to be utilized during each sediment removal project

The limited capacity at Santa Fe Flood Control Basin leads to a low performance rating. While not preferred, increasing the size of the stockpile area and impacting existing habitat would need to be considered to make this alternative feasible to implement.

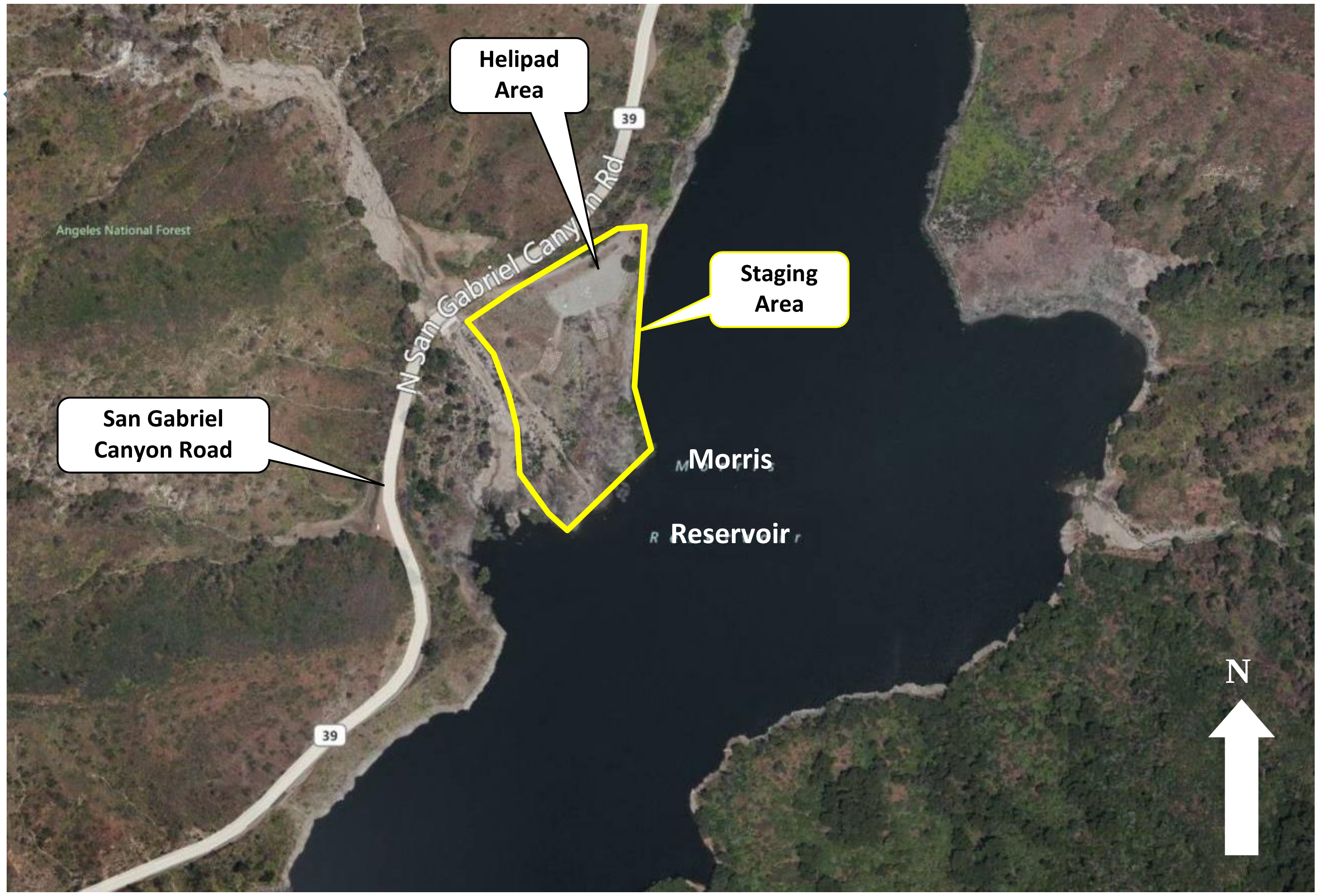
Santa Fe Flood Control Basin - Cost

The approximate cost to remove 3.3 MCY of sediment from Santa Fe Flood Control Basin is $10 million.

7.4.3.2 UPSTREAM STAGING AREA

Located approximately 1.8 miles north of Morris Dam to the east of San Gabriel Canyon Road and adjacent to the reservoir is a parcel that could serve as a possible access point and/or staging area. There is a helipad at the northern-most portion of the parcel, as shown in Figure 7-42. It is assumed that at least 4 acres of the site would be available for staging material while maintaining ample space for access through the helipad.

Figure 7-42 Helipad Area



Upstream Staging Area – Environment

Existing habitat may be impacted if this location is utilized as a staging area. Further study will be needed to determine what habitat exists.

Upstream Staging Area - Social

The upstream access area is located on Flood Control District property and is not available for public use. San Gabriel Canyon Road is travelled frequently by the public to access recreational facilities upstream, so there would be a minor visual impact when the site is being used. There would also be noise from equipment at the site.

Upstream Staging Area - Implementability

The upstream access area is owned and maintained by the Flood Control District; therefore, no acquisition or leasing would be needed. However, the Flood Control District is currently leasing a portion of this parcel for the use of beekeeping. If this site is selected for future use, it would be minimal effort to discontinue the lease. There would be little work to prepare the site to be used for staging and/or transferring the sediment.

Upstream Staging Area - Feasibility

For this plan, it is assumed that the 4 acres would be adequate for staging and/or transferring the sediment.

7.4.4 REMOVAL

The following Section discusses the impacts and costs of sediment removal at Morris Reservoir by means of excavation, dredging, and sluicing. Discussion of the transportation and placement alternatives is presented in Sections 7.4.5 and 7.4.6, respectively. Combined alternatives that address all phases of the sediment management process are presented and discussed in Section 7.4.7.

7.4.4.1 EXCAVATION

While excavation as described in Section 6.3.1 has not been used at Morris Reservoir, it has been successfully used by the Flood Control District at several other reservoirs.

Access for Excavation Equipment & Operation

The upstream access point described earlier is the assumed access point for excavation.

Excavation - Environmental Impacts

A major environmental concern with excavation is the impact on the aquatic habitat within Morris Reservoir. As previously described, past projects have taken measures to conduct fish removals (since the fish species in the reservoir were non-native invasive species) and relocate sensitive species of turtles and garter snakes prior to final drawdown of the reservoir pool. The downstream habitat is not expected to be impacted by excavation.

For excavation, it is assumed that the upstream access point, 0.5 miles upstream of the dam, would be utilized. Depending on the vegetation present at the chosen access point, there could also be some environmental impacts. The environment along the reservoir would be taken into consideration when choosing the precise access point.

Another concern is the impact to water conservation. To address concerns, water drained from the reservoir would be captured by downstream groundwater recharge facilities such as the soft-bottomed San Gabriel River, the San Gabriel Canyon Spreading Grounds, and Santa Fe Spreading Grounds. The Azusa Conduit intake at San Gabriel Dam would be used to deliver flows to the San Gabriel River Committee per its diversion rights.

Excavating the reservoir is not expected to have impact on water quality. There would be temporary air quality impacts as a result of operation of excavation equipment.

Excavation - Social Impacts

Excavation would occur within the reservoir itself. For the excavation portion alone, there would be no increase in traffic in the surrounding area. Impacts to traffic from transportation methods will be evaluated in Section 7.4.5.

The nearest residential area to Morris is 1.5 miles downstream, as shown in Figure 7-43. Morris Reservoir is not in the viewshed of any houses or buildings. Therefore the scenic and visual impacts of excavation would be minimal and the operation would be temporary.

There are no recreational areas within the immediate vicinity of Morris Reservoir. San Gabriel Canyon Road is frequented by members of the public travelling to recreational areas further upstream. Though unlikely, the noise from traditional excavation equipment could impact the downstream residential area.

Figure 7-43 Location of Residential Area to Morris Reservoir

Excavation - Implementability

The Flood Control District has conducted many excavation projects. Despite not having used this method at Morris, the technology is proven and there is technical certainty that excavation could be successfully implemented.

Environmental regulatory permits would need to be obtained prior to any excavation.

Excavation - Performance

In order to dry excavate Morris Reservoir the reservoir must first be dewatered. As discussed previously, excavation could only be conducted over the summer months. Therefore dewatering would begin no earlier than mid-April, after the conclusion of the storm season. This would leave approximately six months to excavate. The performance effectiveness of excavation would be determined by the transportation mode removing the sediment from the reservoir. It is expected that the excavation equipment would be able to match the rate of removal by any mode of transportation being considered.

Excavation - Cost

The removal of 3.3 MCY from Morris Reservoir by means of excavation is $10 million. This only includes the cost of excavating material.

7.4.4.2 DREDGING

As discussed in Section 6, dredging has not been used to remove sediment from the reservoirs maintained by the Flood Control District. In order to accurately determine the technical feasibility of a dredging operation at Cogswell Reservoir, detailed analysis would need to be conducted.

The following analysis is based on the assumptions detailed in Section 6 and the assumption that the entire 3.3 MCY of Morris Reservoir's planning quantity has the appropriate gradation to be dredged. Furthermore, it was assumed that the dredge could be connected to a slurry pipeline downstream of the dam.

Dredging - Environmental Impacts

It is expected that there would be an impact to water quality by increasing turbidity within the reservoir during dredging. Further study is necessary to determine the level of impact to other areas of concern.

Black crappie, bluegill, channel catfish, largemouth bass, rainbow trout, redear sunfish, and smallmouth bass have been previously found in Morris Reservoir. Black crappie and smallmouth bass are non-native game fish. Southwestern pond turtles and two striped garter snakes have been previously located in the Morris Reservoir vicinity.

There could be other species present within Morris Reservoir. Additional studies would be needed in order to identify the potential impacts dredging would have on vegetation and fauna. Furthermore, area(s) considered for discharge and drying of dredge material would also need to be determined.

As discussed in Section 6, dredging sediment (and transporting it via a slurry pipeline) could affect water conservation.

Dredging - Social Impacts

The nearest residential area to Morris Reservoir is 1.5 miles downstream. There are no recreational areas within the immediate vicinity of Morris Reservoir. San Gabriel Canyon Road is frequented by members of the public travelling to recreational areas further upstream. The noise of the dredge is not expected to be a disturbance to the downstream residents or recreational users.

Dredging of Morris Reservoir is not expected to have a long-lasting impact on traffic. Conducting dredging operations within the reservoir would not impact any recreational resources because Morris Reservoir is not a resource for active recreation.

Morris Reservoir is not in the viewshed of any houses or buildings. Therefore the scenic and visual impacts of dredging would be minimal and the operations would be temporary.

Dredging - Implementability

As discussed previously, dredging is not considered to be a proven method to remove sediment from the reservoirs maintained by the Flood Control District as it has not been used in the past.

From past studies completed for the Flood Control District including consultation with dredging professionals, it has been determined that portable cutterhead suction dredges are available in a size suitable for use at the Flood Control District's reservoirs. As the dredge could reach a maximum depth of 50 feet, the reservoir water level would need to be lowered. From there, the material could be dredged to a slurry pipeline through the dam to a downstream area to dewater.

As with any other operation within Morris Reservoir, dredging would require environmental regulatory permits.

Maintenance of a dredging operation at Morris Reservoir is not expected to be different from the maintenance that would be required for a dredging operation that has been discussed in the document for any of the other reservoirs under the jurisdiction of the Flood Control District.

Dredging - Performance

Considering the capabilities of the dredging equipment and slurry pipeline discussed in Section 6, it would take approximately nine 6-month removals operations to dredge the entire 3.3 MCY 20-year planning quantity for Morris Reservoir.

Due to the volume of water needed to dredge, a dewatering area is necessary. Assuming the total volume would double with the water and also that a 3-foot-high stockpile could be accommodated, the area needed for 400,000 CY is 165 acres. There is not an area of 165 acres available for dewatering within the reservoir.

If an area is available downstream to dewater, a slurry pipeline could be used to convey the slurry downstream. Depending on the location of the staging area for dewatering, the clear water remaining once the sediment is removed, could continue to be used for groundwater recharge.

Fine sediments that remain in the water could cause clogging of spreading basins. Once fines are introduced, they cannot be removed from some of these basins, especially those at Santa Fe Spreading Grounds. It could be possible to relocate the dredge to clean out the much deeper basins at San Gabriel Canyon Spreading Grounds, but further investigation would be needed to determine feasibility.

Dredging - Cost

The estimated cost of dredging 3.3 MCY of material is $35 million. If it is determined that the material must be mechanically dewatered the estimated cost of dredging would be $114 million bringing the total to $149 million just for removal via dredge.

7.4.4.3 SLUICING

This section describes the impact of sluicing to Cogswell Reservoir itself. The impacts of sluicing on the downstream area of the San Gabriel River will be evaluated in Sluicing (Transportation) in Section 7.4.5. Given the quantity of sediment in storage at Morris Reservoir and that some material has been sluiced from San Gabriel Reservoir, it is assumed that 3.3 MCY of sediment would be sluiceable.

Sluicing (Removal) - Environmental Impacts

Within Morris Reservoir itself, the impacts on vegetation and animal species would be expected to be similar to the impacts associated with excavating sediment from the reservoir since in both cases the reservoir would need to be drained.

During a sluicing operation, water quality within the reservoir would be expected to be poor due to the higher-than-normal sediment concentration. Sediment traveling downstream could clog the river and its ability to percolate water. Subsequent storms and releases are expected to move more of this sediment further downstream.

As discussed in Section 6, removing sediment from a reservoir by sluicing could affect water conservation. However, at Morris Reservoir, the Azusa Conduit could also be used to hold some of the water during sluicing to assist with groundwater recharge after.

Sluicing operations within Morris Reservoir would result in increased emissions within the reservoir. However, the amount of equipment that would be employed in a sluicing operation would not be expected to be high, given the Flood Control District's previous sluicing projects, so impacts are not expected to be significant.

Sluicing (Removal) - Social Impacts

The only expected traffic and noise impacts for the residents within the vicinity of Morris Reservoir would be during the mobilization and demobilization of the sluicing operation along San Gabriel Canyon Road. However, as stated previously, a large number of pieces of equipment would not be expected to be needed for the sluicing operation.

Morris Reservoir is not in the viewshed of any houses or buildings. Therefore, the scenic and visual impacts of dredging would be minimal and the operations would be temporary.

Since Morris Reservoir does not serve a recreational purpose, sluicing would not have any impacts on recreational resources within the reservoir.

Sluicing (Removal) - Implementability

Sluicing at Morris Reservoir is a proven method of sediment removal. Though proven, the alternative still necessitates water availability. For planning purposes a water-to-sediment ratio of 9-to-1 is being used. Being downstream of two reservoirs, water supply for Morris is not expected to be a problem. However, it could still be necessary to time the sluicing events after larger storm years.

As any other operation within Morris Reservoir, sluicing would require environmental permits. It is possibly that certain permits could contain stipulations to quantify and limit the amount of sediment released, which would affect the implementability of this method. In the past, extensive water quality and biological monitoring was required as a condition to certain permits.

Sluicing (Removal) – Performance

In order to sluice Morris Reservoir, the reservoir must first be dewatered. From the past two sluicing events, it was determined that the water released during this time, though turbid, was still suitable for recharge in the riverbed.

For more efficient sluicing, it is recommended to use mechanical agitation equipment to facilitate sediment transport. Using such equipment would increase the sediment able to be sluiced.

Sluicing (Removal) - Cost

Based on the estimated unit cost for sluicing, the cost of sluicing 3.3 MCY is approximately $8 million.

7.4.5 TRANSPORTATION

The following Section discusses the impacts and costs of transporting sediment removed from Morris Reservoir by means of sluicing, trucking, conveyor belt, and slurry pipeline. Discussion of the removal alternatives was presented in Section 7.4.4. The placement alternatives are presented in 7.4.6. Combined alternatives that address all phases of the sediment management process are presented and discussed in Section 7.4.7.

7.4.5.1 SLUICING

The following paragraphs discuss the impacts of sluicing after sediment has passed through the dam.

Sluicing (Transportation) - Environmental Impacts

In general, sluicing activities could cause scour/erosion in certain areas and create deposits along the channel banks in other areas. Temporary disturbance of riparian habitats and associated wildlife could occur, but the level of disturbance would likely be similar to that occurring under natural flood conditions.

Prior to the 1998 sluicing, a baseline survey was conducted to characterize the condition of the San Gabriel River ecosystem in areas that would potentially be impacted by sluicing operations planned for both Morris Reservoir and the San Gabriel Reservoir located upstream. Riparian habitat, aquatic habitat, and water and sediment quality were evaluated. These areas were surveyed from 1999 through 2003, 5 years after the 1998 sluicing event, to determine the ecological impact of sluicing and recovery of the riparian and aquatic systems following sluicing. Similar surveys continued from 2004 through 2008 in anticipation of planned sluicing from San Gabriel Reservoir, which did not occur.

The San Gabriel River north of the Santa Fe Dam is located within a Significant Ecological Area (SEA) No. 22 as identified in the Los Angeles County General Plan and includes species listed as threatened or endangered by State and Federal agencies.

The results of this ecological evaluation show that the 1998 sluicing of sediments from Morris Reservoir had only short-term effects on riparian and aquatic habitat quality. The sluicing could have had a slight positive impact on riparian habitat by increasing substrate for the recruitment of riparian plant seedlings. Although the quality of downstream aquatic habitat was less than pre-sluicing conditions over the short term, aquatic habitat quality recovered to pre-sluicing baseline conditions within 2 to 3 years. It should also be noted that the years immediately after the 1998 sluicing had below average rainfall, which also impacted aquatic habitat. The results indicate that future removal of Morris Reservoir sediments by sluicing would result in only short-term impacts on downstream riparian and aquatic habitats. Although past monitoring indicated short-term and non-significant impacts, it is likely that regulatory permits continue to require extensive water quality and biological monitoring during and after sluicing operations.

As discussed in Section 6, transporting sediment via sluicing could affect water conservation.

Also discussed previously, Santa Fe Flood Control Basin would be the staging area for sluiced material.

Sluicing (Transportation) - Social Impacts

Residential development adjacent to the San Gabriel River downstream of Morris Dam has increased since the previous sluicing events. As a result, recreational uses such as bicycling, hiking, and horse riding have also increased in those areas. There would be visual impacts to the recreational users along San Gabriel River.

The Santa Fe Dam Basin is an Army Corps of Engineers facility. With permission from the Army Corps of Engineers, portions of the basin could serve as staging areas for dewatering, drying, and processing sediment sluiced or otherwise removed from Morris Reservoir. Truck traffic would need to be managed to minimize noise in and travel through adjacent residential areas and in the vicinity of the City of Hope.

Additional social impacts include potential odor from sluiced material both in the San Gabriel River and in Santa Fe Flood Control Basin. The appearance of the water would be dirty and unappealing. There could also be an increase in black flies and/or mosquitoes.

Sluicing (Transportation) – Implementability

In order to sluice, the Flood Control District would need to utilize Santa Fe Flood Control Basin as a staging area. As discussed in Section 6, this would require an agreement with the Army Corps of Engineers. There is currently sediment in storage behind Santa Fe Dam that would need to be removed before the site could be used for new sediment management projects. Due to limited available storage capacity at the basin, the Army Corps of Engineers would require the Flood Control District to pre-excavate the expected amount of sediment to be sluiced to their facility.

Following the sluicing events, San Gabriel River would need to be flushed to remove sediment caught in the channel. For planning purposes it is assumed that 2/3 of the sluiced sediment volume would make it to Santa Fe Flood Control Basin during that initial winter. Over the following 2-3 years the remainder sediment caught in the channel would continue downstream. It is thus possible that sediment removal from Santa Fe would have to occur in consecutive years. Recharge within the San Gabriel River and Santa Fe Flood Control Basin would also be reduced. It should be noted that the Flood Control District was able to avoid waste to the ocean and fulfilled all of the water entities' groundwater replenishment requests during and after the 1991 and 1998 sluicing operations.

Sluicing (Transportation) - Performance

Although sluicing could remove over 2 MCY of sediment per year, the constraints of removal from Santa Fe Reservoir are limited by Santa Fe Flood Control Basin. For planning purposed, it was determined that if sluicing was to be conducted from Morris Reservoir to Santa Fe Flood Control Basin, approximately 773,000 CY could be removed per sluicing event. It is assumed that adequate water supply is available to sluice and that material within Morris Reservoir would be mechanically agitated to move sediment downstream. It is also assumed that sediment in Santa Fe could be adequately removed before the next cleanout.

At this rate, it would take approximately five 6-month sluicing projects to remove the 20-year quantity of 3.3 MCY.

Sluicing (Transportation) – Cost

As discussed previously, sluicing 3.3 MCY would cost approximately $8 million.

7.4.5.2 TRUCKING

Trucking from Morris Reservoir would be conducted in conjunction with excavation. The material would be loaded directly on to the truck and driven to its final placement location. For this analysis the assumed final location is a pit in Irwindale approximately 8 miles downstream.

Access and Route for Trucking

Access for trucks into Morris Reservoir would be made from a point approximately 0.5 miles upstream of the dam as described in previously. From this access point, trucks would drive in and out of the reservoir. Trucks would then travel south along San Gabriel Canyon Road. In an effort to avoid the impact to the communities downstream, it is proposed to use the route described previously for trucks going from San Gabriel Reservoir to Irwindale. Utilize the access road for the San Gabriel Canyon Spreading Ground to travel down to Foothill Boulevard, away from the residential areas. As mentioned previously, this route is adjacent to an existing bike trail.

Trucking - Environmental Impacts

The trucks used for sediment removal would utilize San Gabriel Canyon Road and existing access roads. There would be no environmental impact to habitat from the trucking aspect of the removal.

As discussed previously, there would be an impact to air quality. The use of low emission trucks would result in lower air quality impacts than if standard trucks were used.

Trucking - Social Impacts

In using the access road described in previously, trucks would avoid driving through downtown Azusa. As discussed, two neighborhoods along San Gabriel Canyon Road, recreational users of the bike trail, and potentially the users of the proposed Geology Area & Park would be affected by the truck traffic, increased noise, and scenic impact during sediment removal. See Section 6 for more details on general trucking impacts.

Trucking - Implementability

At Morris reservoir, access allows for double-dump trucks with a capacity of 16 CY to be utilized. As discussed previously, these trucks are standard for construction projects and should be readily available. Further investigation is needed to determine if there are any limitations with the use of this proposed route near the bike trail.

The use and availability of low emission vehicles would need to be explored further as specific cleanout plans are formed.

Trucking - Performance

Given the following assumptions, it was determined that if excavation was to be implemented for Morris Reservoir, approximately 800,000 CY could be removed per cleanout. Sediment would be brought to the Irwindale area, a 15 miles roundtrip from the access area 0.5 miles upstream of the dam.

At this rate it would take approximately five 6-month cleanout projects to remove the 3.3 MCY 20-year planning quantity.

Trucking - Cost

Given the distance from Morris Reservoir to Irwindale and assuming the use of double-dump trucks, the estimated trucking cost is approximately $15 million for 3.3 MCY.

7.4.5.3 CONVEYOR BELTS

The use of a conveyor belts would be in conjunction with excavation. Downstream of Morris Reservoir there is an existing conveyor belt owned by Vulcan Materials Company (Vulcan). That conveyor belt terminates at a Vulcan pit just north of the 210 Freeway. Cooperative use of the existing Vulcan conveyor belt would need to be established in order to implement this alternative. Otherwise, a separate system for this length would need to be constructed.

Figure 7-44 Existing Conveyor Belt Alignment

Access and Route for Conveyor Belt

A conveyor belt could begin inside the reservoir and travel through a valve in the dam to the downstream face of the dam. From here, the conveyor belt could be constructed along Old San Gabriel Canyon Road. As mentioned in previously, a portion of Old San Gabriel Road has been washed out and would need repair if it is to be used, even just for access to the conveyor belts.

Old San Gabriel Canyon Road ends at San Gabriel Canyon Road approximately 2 miles downstream of Morris dam. The conveyor would then have to be routed across to the West side of San Gabriel Canyon Road. From here, the conveyor belt could be aligned with the bike trail and continue downstream to the point where it eventually meets with the existing Vulcan conveyor belt. There are multiple places where the conveyor belt would need to be configured to accommodate regular traffic or access on the bike trail. This could involve trenching the conveyor belts underground or bridging the conveyor over certain points.

See the alignment of the existing Vulcan conveyor belt in Figure 7-44 and the whole alignment in Figure 7-45.

Figure 7-45 Morris Conveyor Belt Alignment

Conveyor Belts - Environmental Impacts

Some habitat along Old San Gabriel Canyon Road would be impacted by repairing the road. Additional use of the area outside of the established road would also need to be considered. Additional habitat adjacent to the bike trail would also likely be impacted.

Conveyor Belts - Social Impacts

Along Old San Gabriel Canyon Road there is a religious facility, an equestrian facility, and also the headquarters building of the San Gabriel River Mountains Conservancy. Access to these facilities would not be inhibited by the proposed conveyor belt. However, there would likely be noise and visual impacts associated with the conveyor running along that road. It could be possible to trench the conveyor belt underground to minimize impacts.

Similar to trucking, the two neighborhoods along San Gabriel Canyon Road shown in Figure 7-24 on page 7-49 would be affected by the conveyor belt. It would likely be necessary to trench the conveyor belt, so as not to block access to the neighborhoods from San Gabriel Canyon Road as the conveyor alignment crosses these roads.

Based on the use in other projects, the noise from conveyor belts has proven to be minimal. It is not expected to impact the nearby neighborhoods. However, a conveyor belt could cause temporary noise and scenic impacts to recreational users of the bike trail, though there is already an existing conveyor belt near a portion of the bike trail.

Conveyor Belts - Implementability

Once sediment is excavated, it could then be loaded into a hopper inside the body of the reservoir. Sediment would then need to be conveyed either over the dam using a vertical bucket conveyor or through one of the valve tunnels on the dam using a more traditional conveyor belt system. The valve would have to be removed to accommodate the conveyor.

Approximately 2 miles of conveyor belt would need to be constructed along Old San Gabriel Canyon Road which travels south from Morris Dam to San Gabriel Canyon Road. Old San Gabriel Canyon road has several curves and depending on the specific alignment, possibly elevation changes; both which could present complications with conveyor construction.

As discussed, the conveyor would need to be routed to the west side of San Gabriel Canyon Road. From here, the conveyor belt could be constructed along the area adjacent to the bike trail. About 0.5 miles downstream are two access roads to a development on the west side of the San Gabriel River. Further downstream, there are several access points to the bike trail. The conveyor belt could need to be trenched or elevated to maintain access in some of these locations.

Approximately 1.5 miles downstream, adjacent to the San Gabriel Canyon Spreading Grounds, there is an existing conveyor belt. The existing conveyor system is approximately 1.8 miles long and terminates at an existing Vulcan pit between Interstate 210 and West Foothill Boulevard just west of North Irwindale Avenue. If the Flood Control District is able to use the existing conveyor belt, material could be transferred from the new conveyor belt to the existing conveyor belt to be brought to the pit.

If the Flood Control District is not able to use the existing conveyor belt, the new conveyor belt could be extended the additional 1.8 miles, adjacent to the existing conveyor belt to carry the material to the existing Vulcan pit.

Environmental regulatory permits would be needed to place a conveyor belt in the proposed alignments.

Conveyor Belts - Performance

Conveyor systems have the ability to handle relatively circuitous alignments as long as the turning radii are no less than approximately 300 feet. From examination of aerial imagery, the existing access roads for Morris Dam appear to meet these criteria.

Given the following assumptions, it was determined that if conveyor belts were to be used at Morris Reservoir approximately 560,000 CY could be removed per cleanout. The conveyor belt would have a capacity of 800 CY/hour. Sediment would be brought to the Vulcan Pit, approximately 5.4 miles from Morris Dam, just north of the 210 Freeway.

At this rate it would take approximately seven 6-month cleanout projects to remove the entire 3.3 MCY 20-year quantity.

Conveyor Belts - Cost

If Vulcan's existing conveyor system could be rented, it is estimated that the cost to transport the sediment via conveyor from Morris Reservoir to the Vulcan Pit would be reduced to approximately $23.5 million. The $23.5 million estimated cost is based on an estimated cost of $23 million to construct and operate a new conveyor system from Morris Reservoir to the northern end of Vulcan's existing conveyor belt and an estimated rental cost of $0.5 million for use of Vulcan's existing conveyor belt.

If the Flood Control District were unable to rent Vulcan's existing conveyor system, then the new conveyor system would have to extend from Morris Reservoir to the Vulcan Pit. The estimated cost for constructing and operating a new conveyor belt from Morris Reservoir to the Vulcan Pit is approximately $34 million.

7.4.5.4 SLURRY PIPELINE

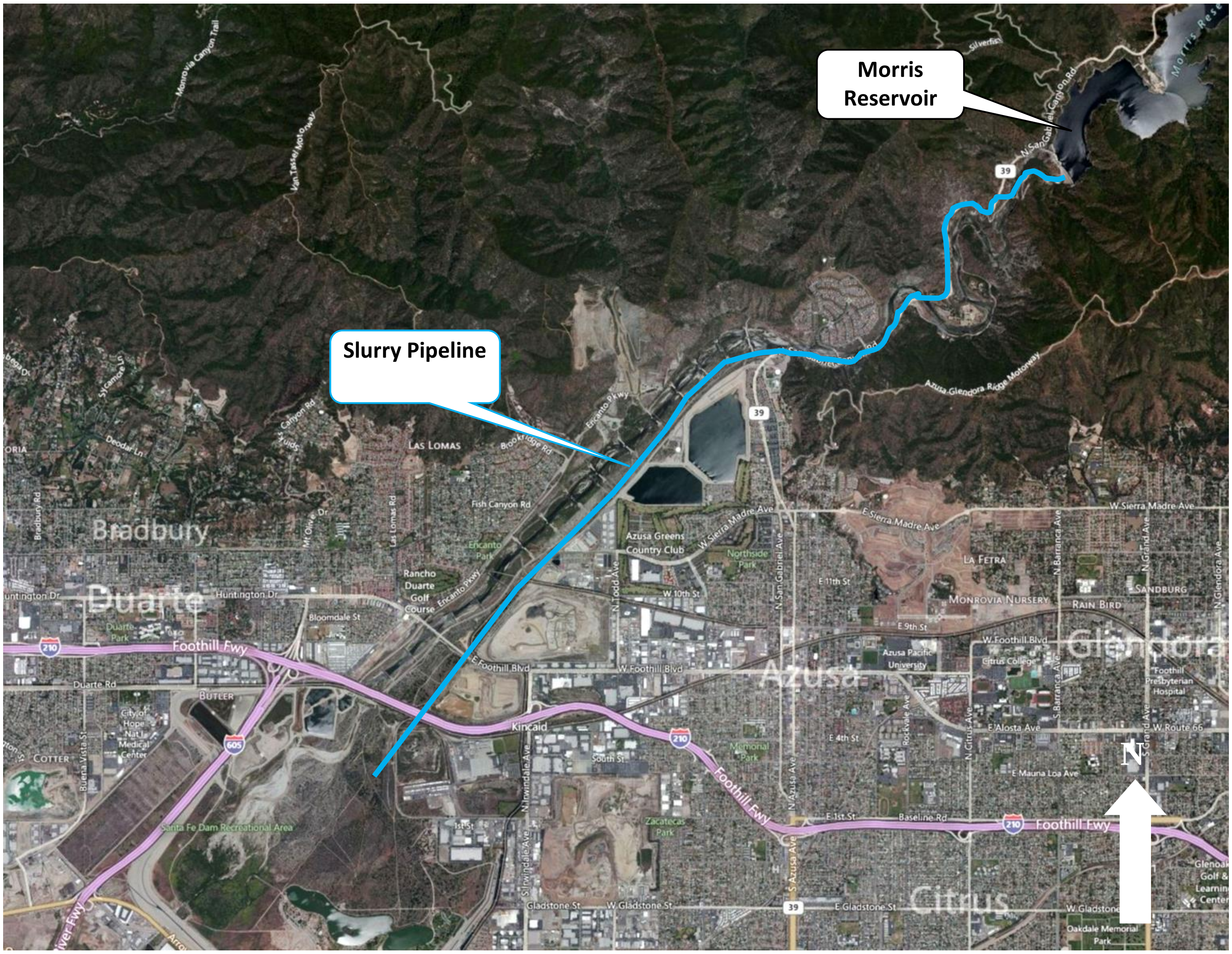
As discussed in Section 7.4.4.2, slurry pipelines would be used in conjunction with dredging. A slurry pipeline could be constructed to transport slurry material to Santa Fe Flood Control Basin to dewater. As discussed, it is assumed that the entire 3.3 MCY would be dredgeable.

Route for Slurry Pipeline

A slurry pipeline would begin at the end of the dredge line on the downstream face of Morris dam. From here, the slurry pipeline could be constructed along Old San Gabriel Canyon Road. As mentioned previously, a portion of Old San Gabriel Road has been washed out and would need repair if it is to be used, even just for access to the slurry pipeline.

Old San Gabriel Canyon Road ends at San Gabriel Canyon Road approximately 2 miles downstream of Morris dam. The slurry pipeline would then have to be routed across San Gabriel Canyon Road to the side that the San Gabriel River Bicycle Trail is located. From here, the slurry pipeline could be aligned with the bike trail and continue downstream to Santa Fe Flood Control Basin. There are multiple places where the slurry pipeline could need to be configured to accommodate regular traffic or access on the bike trail. This could involve trenching the slurry pipeline underground or bridging the slurry pipeline over certain points. See the alignment of the pipeline in Figure 7-46.

Figure 7-46 Morris Slurry Pipeline Alignment



Slurry Pipelines - Environmental Impacts

In order to identify and minimize the potential environmental impacts of placing and operating a slurry pipeline from Morris Dam to Santa Fe Flood Control Basin or a pit further downstream, the habitat along the potential alignments would have to be studied. Water quality, groundwater recharge, and air quality would not be expected to be impacted, provided the capacity of the electric power grid in the area could accommodate the pipeline's booster stations.

Slurry Pipelines - Social Impacts

Along Old San Gabriel Canyon Road, there is a religious facility, an equestrian facility, and also the headquarters building of the San Gabriel River Mountains Conservancy. Access to these facilities would not be inhibited by the proposed slurry pipeline. There would likely be a visual impacts associated with the pipeline running long that road. It could be possible to trench the pipeline underground to minimize visual impacts.

Access to the two neighborhoods previously mentioned and the bike trail would also need to be accommodated in design of the slurry pipeline.

Noise from a slurry pipeline is not expected to impact the nearby neighborhoods, recreational users of the bike trail, or potentially users of the Geology Area & Park, though there would likely be a visual impact.

Slurry Pipelines - Implementability

As with dredging, the Flood Control District has never used slurry pipelines to transport sediment. The ability to use a slurry pipeline relies on dredged material and with neither having ever been used; further study is recommended to determine the technical certainty of this alternative.

Assuming that dredging is determined to be efficient, the dredged material would be routed in the dredge's line to the downstream face of the dam to connect to the slurry pipeline. Pumps could be needed to be used to move the slurry mix either over the dam or through a valve tunnel in the dam.

As discussed in Section 6, the slurry pipeline is flexible and would be able to handle the turning radii necessary to reach the Santa Fe Flood Control Basin or a pit located further downstream. This type of pipe is expected to perform well past the 20-year planning timeline resulting in minimal maintenance effort.

Approximately 7 miles of slurry pipeline would be constructed along Old San Gabriel Road and the Gabriel Bike Path to Santa Fe Flood Control Basin. For planning purposes, it is assumed booster stations would be needed every mile to keep the slurry moving down the pipeline. Further evaluation would be needed to determine whether the existing electric power grid in the area and whether there is adequate land space to accommodate the pipeline's booster stations. Placement of a slurry pipeline and booster stations along the proposed route would present right-of-way and permitting issues.

It is assumed that there would be adequate capacity and location at either Santa Fe Flood Control Basin or an acquired pit to dewater the slurry mixture.

Slurry Pipelines - Performance

As mentioned previously, a slurry pipeline would be used in conjunction with the dredging alternative. Therefore, if 9 dredging operations were to be conducted during the 20-year planning period to remove the entire 3.3 MCY of planning quantity, then the slurry pipeline would be used a total of nine times during the 20-year planning period. As discussed in Section 6, the slurry pipeline would need to transport approximately 2,000 CY of the water-sediment slurry per hour or approximately 15 cubic feet of the slurry per second. In total, during a 6-month dredging operation, the slurry pipeline would need to handle a total of 4 MCY or 2,500 acre-feet of slurry. It is expected that the type of slurry pipeline that would be used would be able to perform during the 20-year planning timeline.

For planning purposes, it was assumed that a total of nine lift stations would be required for the 6.4-mile long slurry pipeline between Morris Dam and Santa Fe Flood Control Basin.

Slurry Pipelines – Cost

The estimated cost for a slurry pipeline, including the cost of booster station, from Morris Reservoir to Santa Fe Flood Control Basin is approximately $36 million. The cost from Morris Reservoir to an acquired pit is estimated at approximately $46 million. Both costs include the cost of booster station approximately every mile for 7 miles.

7.4.6 PLACEMENT

7.4.6.1 LANDFILLS

Although Section 6 identified landfills as a feasible placement alternative for reservoirs, the long distance and limited available capacity prohibit the use for Morris Reservoir.

7.4.6.2 PITS

The general impacts of employing pits for sediment placement were discussed in Section 6. There are multiple pits in Irwindale. From the upstream access point of Morris Reservoir to the pits, the distance is approximately 15 miles, depending on the specific pit identified for use, the mode of transportation used, and the route. From Santa Fe Flood Control Basin, the distance is approximately 2 miles and can also vary depending on the specific pit identified for use, the mode of transportation used, and the route.

It is assumed that the entire 3.3 MCY of material from Morris Reservoir that is proposed for transport out of the canyon would be marketable. Given that assumption and other assumptions discussed in Section 6, it was assumed that pits operated by the gravel industry would accept the entire 3.3 MCY of sediment from Morris Reservoir free of charge.

As discussed in Section 6, the acquisition of pits for the placement of sediment from facilities under the jurisdiction of the Flood Control District should be pursued. Acquisition of a quarry in Irwindale would be most desirable for sediment management operations related to Morris Reservoir. It would cost a total of $3 per cubic yard to acquire and place the 3.3 MCY of sediment at the Flood Control District-owned pit.

7.4.6.3 SEDIMENT PLACEMENT SITES

Burro Canyon SPS is located approximately 8.5 miles upstream from Morris Dam. Due to the extensive need for sediment placement locations for both San Gabriel Reservoir and Cogswell Reservoir, Burro Canyon was not included in the placement alternatives for Morris. Burro Canyon SPS could be considered in the future, if all of the placement alternatives from this plan are exhausted. More information about the impacts of Burro Canyon SPS can be found in Section 7.3.

No other previously-used SPS or new canyon-SPS was considered for disposal of sediment from Morris Reservoir.

7.4.7 COMBINED SEDIMENT MANAGEMENT ALTERNATIVES

Combining the removal and transportation alternatives for Morris Reservoir there are five sets of feasible options. A description of each of these combined sediment management alternatives is given below. More specific details regarding the environmental impacts, social impacts, feasibility, implementability, and cost for individual alternatives are given in the previous subsection. Combined impacts and costs are described below.

7.4.7.1 COMBINED ALTERNATIVE 1: EXCAVATION → TRUCKS → IRWINDALE PITS

Combined Alternative 1 would involve excavating then trucking the sediment partially along San Gabriel Canyon Road and partially on a private access road near the Gabriel Bike Path. By routing the trucks along the access road no truck traffic would pass through downtown Azusa. There would be some social impacts to a few neighboring communities and likely to the bike trail users.

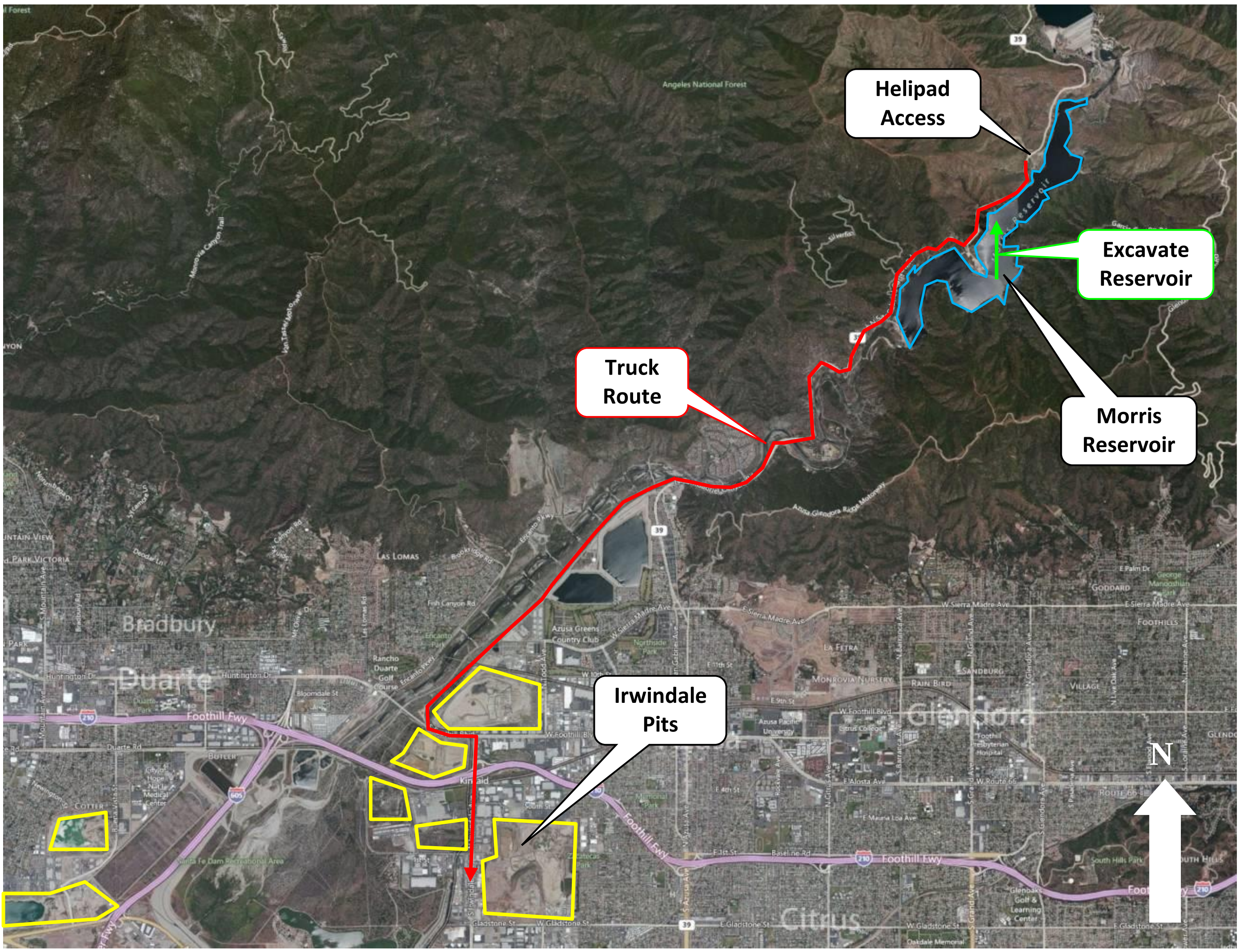
Utilizing existing roads and access roads minimizes new impact to habitat. There would be some impacts to air quality. From this access route, the sediment could ultimately be brought to a placement site in Irwindale. There are several potential pit options in the Irwindale area. The Flood Control District intends to pursue the purchase of a new pit as well as the use of those existing.

Given the assumption regarding excavation and trucking, it would take approximately five 6-month cleanout projects to remove the total 3.3 MCY 20-years in conjunction with trucking. Implementation of this alternative could cost from an estimated $35 million to $50 million depending on the destination of the sediment. The breakdown of estimated costs is provided in the following table.

Table 7-17 Estimated Costs for Combined Alternative 1

Activity	Quantity Removed (MCY)	Estimated Costs (in millions)
Excavate Material at Morris Reservoir	3.3	$10
Truck from Morris to Irwindale Pits		$15
Place sediment at an Irwindale Pit		$10-$23
Total	**3.3**	**$35-$50**

Figure 7-47 Morris Reservoir Combined Alternative 1



7.4.7.2 <u>COMBINE ALTERNATIVE 2: EXCAVATION → CONVEYOR BELT → VULCAN CONVEYOR BELT → SELECT IRWINDALE PIT</u>

Combined Alternative 2 would involve excavating and transporting it on a conveyor belts downstream. It is assumed that the conveyor system could either be directed through a low valve on the dam or over the top of the dam. More study would be needed to determine the most efficient way to transport the sediment from the reservoir to the downstream face of the dam.

The conveyor system would be approximately 4 feet wide would start either from inside the basin or at the downstream face of the dam, depending on removal technique, and continue along Old San Gabriel Road as seen in Figure 7-48. At the end of Old San Gabriel Canyon Road, the conveyor belt would need to cross San Gabriel Canyon Road to reach the west side of the road. From there, the conveyor belt would run adjacent to the bike trail for almost 2 miles. At this location, there is an existing conveyor belt owned by Vulcan Materials Company (Vulcan). If the Flood Control District is able to rent the existing conveyor system from Vulcan temporarily during these cleanouts, the new conveyor could connect to an existing conveyor system that bring the sediment to a pit owned by Vulcan located just north of the 210 Freeway. If the existing conveyor belt is not available for use, it could be possible to construct a new conveyor belt adjacent to the existing one. This conveyor belt could possibly end at the Vulcan Pit just north of the 210 Freeway as well.

There are residents on the lower portion of Old San Gabriel Road. If the conveyor system is located above ground, there could be some visual impact. It could be necessary to trench the conveyor system in some areas to maintain access.

Habitat along Old San Gabriel Canyon Road as well as along the bike trail would be impacted by the construction of a conveyor system. If portions of the conveyor system are trenched, there could be more opportunity for habitat to recover along that portion of the alignment.

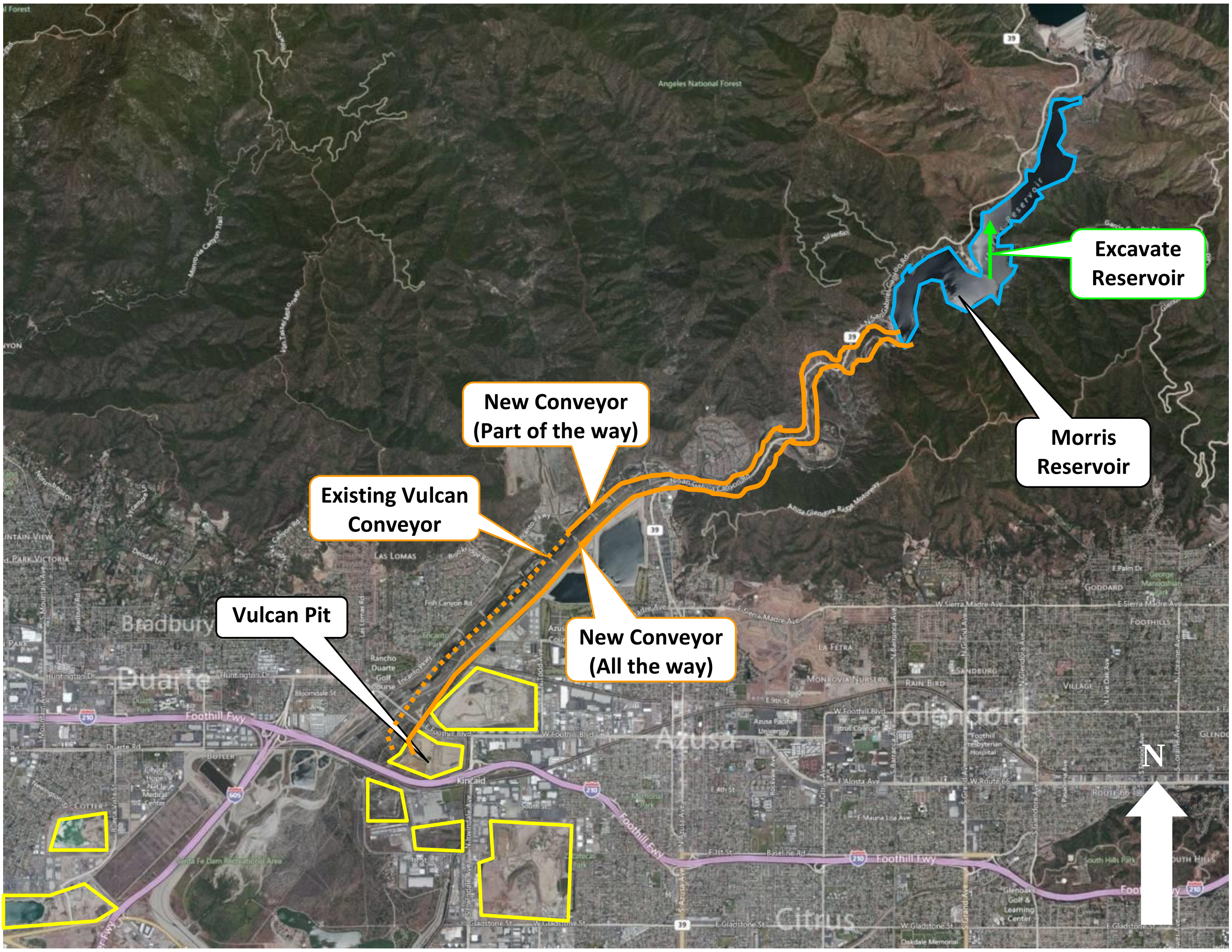
For the total 3.3 MCY of sediment to be removed in the next 20-years using conveyor belts, it would require approximately seven 6-month removal projects.

As discussed previously, it is assumed that the all of the material would be left with Vulcan. The total cost would be between approximately $55 million and $65 million. The breakdown of estimated costs is provided in the following table.

Table 7-18 Estimated Costs for Combined Alternative 2

Activity	Quantity Removed (MCY)	Estimated Costs (in millions)	
Excavate Material at Morris	3.3	$10	
Transport via New Conveyor Belt from Reservoir to Northern End of Existing Conveyor + Transport via Existing Conveyor Belt from Northern End of Existing Conveyor to Vulcan Pit		$23 + $0.5	-
Transport on New Conveyor Belt from Reservoir to Vulcan Pit		-	$34
Place at an Existing Pit		$23	
Total	**3.3**	**$55**	**$65**

Figure 7-48 Morris Reservoir Combined Alternative 2



7.4.7.3 COMBINED ALTERNATIVE 3: DREDGE → SLURRY PIPELINE → SANTA FE → TRUCKS→ IRWINDALE PITS

Combined alternative 3 would involve dredging material to a slurry pipeline that would carry the sediment downstream to downstream Santa Fe Flood Control Basin. As discussed previously, dredging could occur once the reservoir has been lowered to such a level that the maximum depth to the sediment to be dredged is 50 feet. It is assumed that the slurry line could either be directed through a valve tunnel in the dam or over the top of the dam. Further study would be needed to determine if there is adequate water to dredge material while keeping a lower reservoir elevation.

From the downstream face of the dam, the slurry pipeline would be constructed along Old San Gabriel Road. At the end of Old San Gabriel Canyon Road, the slurry pipeline would need to cross San Gabriel Canyon Road to the west side of San Gabriel Canyon Road. From there, the slurry pipeline would run adjacent to the bike trail for approximately 7 miles to Santa Fe Flood Control Basin. In some areas, it could be necessary to trench the slurry line. Booster stations would be needed for every mile of slurry line to keep the mixture moving. It is assumed that there would be an adequate area to dewater the slurried material. Further study would be necessary to verify this assumption.

Sediment that is trucked from the reservoir could be brought to either a privately owned pit or a pit that the Flood Control District could purchase in the future. The Flood Control District intends to pursue the purchase of a new pit as well as the use of those existing.

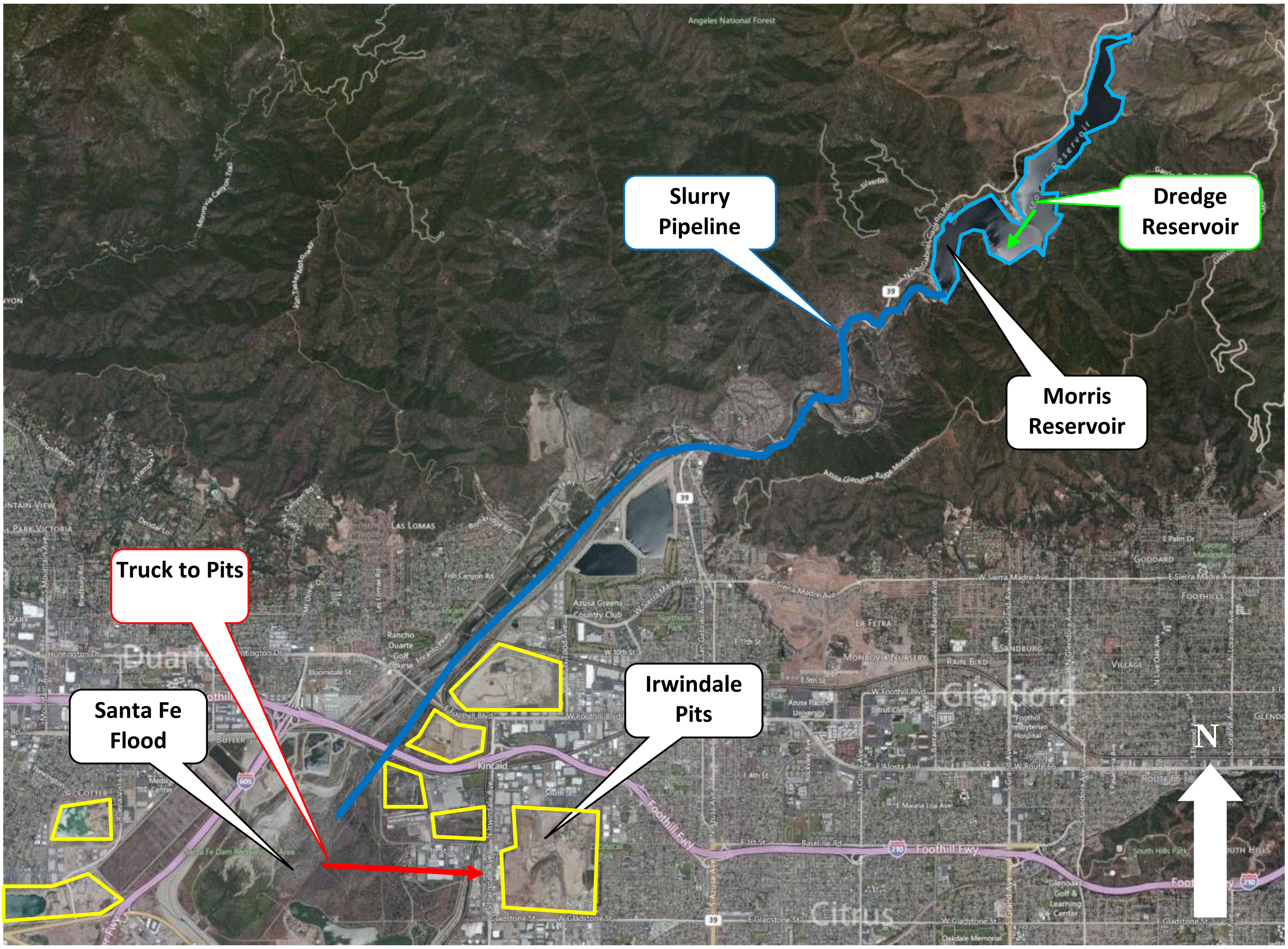
For the total 3.3 MCY of sediment to be removed in the next 20-years via dredging to a slurry pipeline, there would need to be approximately nine 6-month cleanouts. Implementation of this alternative could cost from an estimated $145 million to $165 million depending on the destination of the sediment. The breakdown of estimated costs is provided in the following table.

Table 7-19 Estimated Costs for Combined Alternative 3

Activity	Quantity Removed (MCY)	Estimated Costs (in millions)
Dredge Material at Morris	3.3	$36
Slurry Material from Morris to Acquired Pit		$46[(a)]
Slurry Material from Morris to Santa Fe Flood Control Basin		$36
Excavate Material from Santa Fe Flood Control Basin		$10
Truck Material from Santa Fe to an Irwindale Pit		$2
Place sediment at either and Acquired or Existing Pit		$16-$36
Total	**3.3**	**$145-$165**

a. Material slurried directly to an acquired pit would be at its final placement location.

Figure 7-49 Morris Reservoir Combined Alternative 3



7.4.7.4 COMBINED ALTERNATIVE 4: SLUICING → SANTA FE FLOOD CONTROL BASIN → TRUCKS → IRWINDALE PITS

Combined Alternative 4 involves sluicing the material from Morris Reservoir approximately 8 miles down the San Gabriel River to Santa Fe Flood Control Basin. Trucks performing the removal from Santa Fe Flood Control Basin would then travel along various existing roads in the Irwindale area depending on the exact location of placement. Figure 7-50 shows the alignment of these combined alternatives. Irwindale is a highly industrial city and it is expected that there would be minimal social impact as a result of trucking sediment. The area surrounding specific truck routes would be taken into consideration as specific projects are implemented. There could be some disruption to bike trail use within Santa Fe Flood Control Basin.

Material being sluiced down the San Gabriel River would have temporary and likely minimal impacts on river habitat. Impacts on the existing willow area in the Santa Fe Flood Control Basin would need to be studied. Utilizing existing roads when trucking sediment out of Santa Fe Flood Control Basin would minimize additional impact to habitat, though there would be impacts to air quality, due to using trucks for transport.

There are several options in the Irwindale area. Sediment that is trucked from the reservoir could be brought to either a privately owned pit or a pit that the Flood Control District could purchase in the future. The Flood Control District intends to pursue the purchase of a new pit as well as the use of those existing.

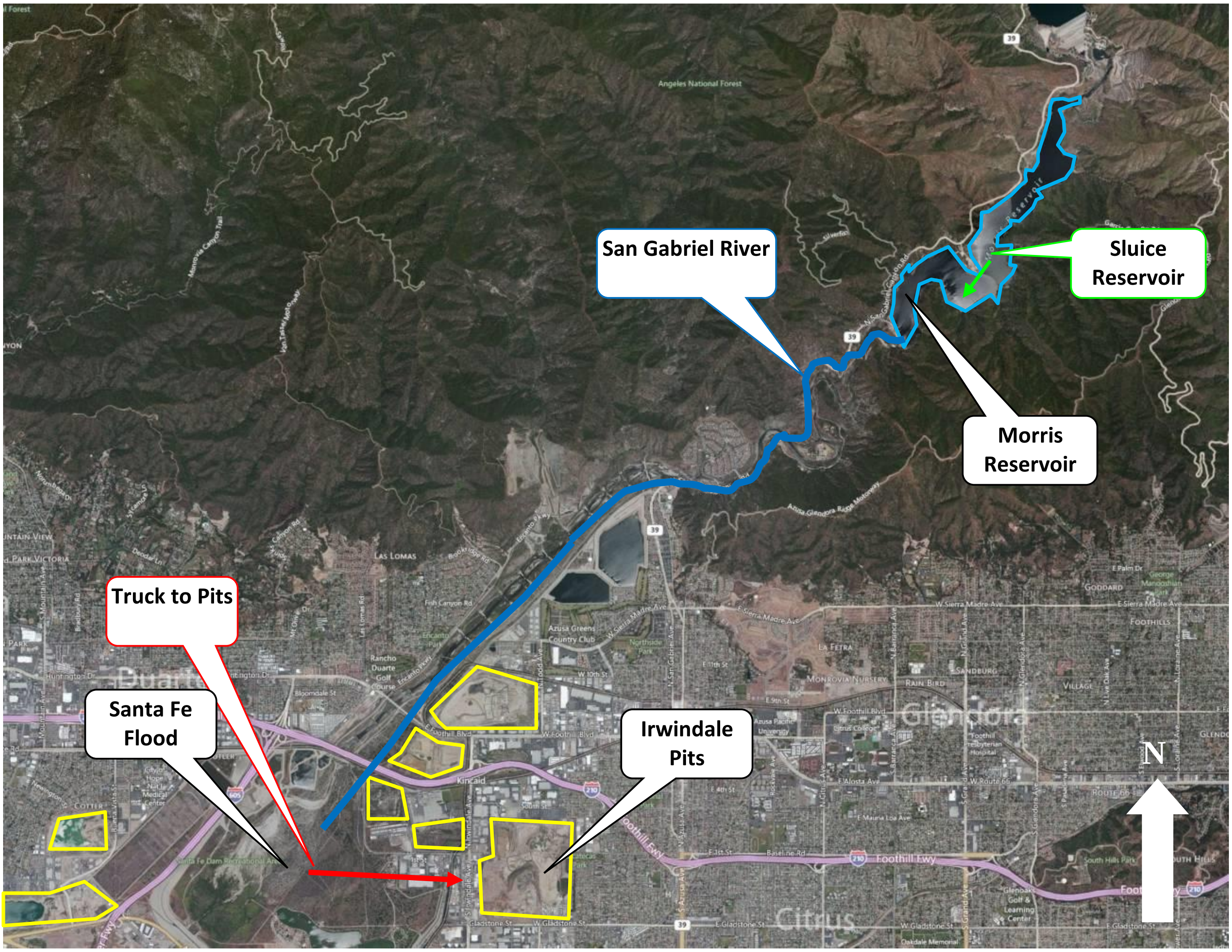
It would take five 6-month sluicing cleanouts to remove the total 3.3 MCY 20-year planning quantity using this combined alternative.

Implementation of this alternative could cost from an estimated $30 million to $45 million depending on the destination of the sediment. The breakdown of estimated costs is provided in the following table.

Table 7-20 Estimated Costs for Combined Alternative 4

Activity	Quantity Removed (MCY)	Estimated Costs (in millions)
Sluice Material from Morris To Santa Fe	3.3	$8
Excavate Material from Santa Fe		$10
Truck Material from Santa Fe Flood Control Basin to Irwindale Pits		$2
Place sediment at either an Acquired or Existing Pit		$10-$23
Total	**3.3**	**$30-$45**

Figure 7-50 Morris Reservoir Combined Alternative 4



7.4.8 MORRIS RESERVOIR SUMMARY AND RECOMMENDATIONS

7.4.8.1 SUMMARY

Over the next 20 years, 3.3 MCY of sediment are planned to be removed from Morris Reservoir, including the estimated 2 MCY that could potentially be sluiced or delivered by slurry pipeline from San Gabriel Reservoir. The quantity sluiced from San Gabriel Reservoir to Morris Reservoir is limited by the ability to remove the sediment from Morris Dam. The different alternatives for managing the sediment accumulated in Morris Reservoir are briefly explained below and the impacts are shown in Table 7-21.

Sediment Management Alternatives

1 Excavate → Trucks → Irwindale Pits
Alternative 1 proposes to excavate 3.3 MCY of sediment from Morris Reservoir and truck it to the Irwindale pits. Given the location of Morris Reservoir, there would be some noise and visual impacts associated with excavation within the reservoir. There would also be some traffic, noise, and visual impacts from the trucks driving to the Irwindale pits.

2 Excavate → Conveyor → Vulcan Conveyor Belt → Irwindale Pits
This Alternative is similar to Alternative 1 except that the material would be transported by conveyor belt from Morris Reservoir to the Irwindale pits. There would be some habitat impacts along Old San Gabriel Canyon Road and San Gabriel Canyon Road where the conveyor alignment is proposed.

3 Dredge → Slurry Pipeline → Santa Fe Flood Control Basin → Excavate → Trucks→ Irwindale Pits
Alternative 3 proposes to dredge the 3.3 MCY of sediment from Morris Reservoir and transport the material via slurry pipeline to Santa Fe Flood Control Basin (FCB). From Santa Fe FCB, the sediment would be excavated and trucked to a pit in Irwindale. There would be some water quality impacts within Morris Reservoir and some visual and noise impacts from the dredge. There would also be some habitat impacts along Old San Gabriel Canyon Road and San Gabriel Canyon Road where the slurry pipeline alignment is proposed.

4 Sluice → Santa Fe Flood Control Basin → Excavate → Trucks → Irwindale Pits
Alternative 4 proposes to sluice the entire 3.3 MCY to Santa Fe FCB. Similar to Alternative 3, the material in Santa Fe FCB would be excavated and trucked to a pit in Irwindale. There would be habitat impacts and some water quality impacts to the San Gabriel River and in Santa Fe FCB as a result of sluicing. There would also be some increased in traffic, noise, and visual impacts due to excavation in Santa Fe FCB and trucking.

Recommendations

It is recommended that Alternatives 1, 2, and 4 be considered for future sediment removal projects at Morris Reservoir. Due to the high cost, Alternative 3, which involves dredging, should be considered only after all previous recommendations are deemed infeasible.

Table 7-21 Summary of Sediment Management Alternatives for Morris Reservoir

Alternative		Quantity Removed (MCY)	Environmental				Social			Implementability	Performance		Cost
			Habitat	Water Quality	Groundwater Recharge	Air Quality[a]	Traffic	Visual	Noise	Special Permit/ Agreement Required[b]	Previous Experience	# of operations required in next 20 years	$ millions
1	Excavate	3.3	◑		○	◑		◑	◑		Yes	5	35-50
	Trucks					●	●	◑	◑				
	Irwindale Pits									Yes			
2	Excavate	3.3	◑		○	◑		◑	◑		Yes	7	55-65
	Conveyor Belts		◑					◑	○				
	Irwindale Pits									Yes			
3	Dredge	3.3	○	◑	○			○	○		No	9	145-165
	Slurry Pipeline to Santa Fe Basin		◑					◑					
	Santa Fe Basin		◑	●	○	◑		◑	◑	Yes	Yes		
	Trucks					●	●	◑	◑				
	Irwindale Pits									Yes			
4	Sluice	3.3	●	●	◑			◑			Yes	5	30-45
	Santa Fe Basin		◑	●	○	◑		◑	◑	Yes			
	Trucks					●	●	◑	◑				
	Irwindale Pits									Yes			

Legend:

●	significant impact
◑	some impact
○	possible impact
	no impact

Notes:
(a) Use of low-emission trucks would reduce air quality impacts from significant impact (●) to some impact (◑).
(b) All options require environmental regulatory permits.

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SECTION 8 ALTERNATIVES ANALYSIS AND RECOMMENDATIONS FOR OTHER LARGE RESERVOIRS

This section provides background information and discusses the analysis of sediment management alternatives and recommendations for the following reservoirs:

- Big Tujunga Reservoir
- Devil's Gate Reservoir *
- Pacoima Reservoir
- Puddingstone Reservoir
- San Dimas Reservoir
- Santa Anita Reservoir

As discussed in Sections 3 and 6, in general, these facilities are larger than some of the other reservoirs in respect to the size of the dam, reservoir, drainage area, and sediment accumulation. Additionally, all the reservoirs above except for Devil's Gate Reservoir are operated with a pool of water.

*This Strategic Plan only provides background information for Devil's Gate Reservoir because the Los Angeles County Flood Control District (Flood Control District) is currently in the process of preparing an Environmental Impact Report (EIR) for Devil's Gate Reservoir Sediment Removal and Management Project. Since the EIR will thoroughly discuss all possible alternatives to remove, transport, and place sediment for Devil's Gate Reservoir, this Strategic Plan does not include alternatives for the reservoir.

Similar to Section 7, discussion of the alternatives for each reservoir is organized based on the different phases of the cleanout process, specifically:

1. Staging and Temporary Sediment Storage Areas
2. Sediment Removal Alternatives
3. Transportation Alternatives
4. Placement Alternatives

After the individual alternatives are discussed, combined alternatives that address the entire sediment management process are presented. Combined alternatives were developed by grouping a removal alternative with a transportation alternative and a placement alternative. The total cost of implementing the combined alternative is presented along with a review of the impacts. This Strategic Plan provides recommendations that will guide development of specific cleanout plans for each one of the reservoirs. However, as specific cleanout plans are developed additional alternatives may be considered.

8.1 BIG TUJUNGA RESERVOIR

8.1.1 BACKGROUND

Big Tujunga Dam, shown in Figure 8-1, is a variable radius arch concrete dam that was constructed between 1930 and 1931 and had an original storage capacity at spillway of approximately 10.1 million cubic yards (MCY). In 2011, a retrofit project to ensure the dam's seismic stability and increase spillway capacity was completed. With a drainage area of approximately 82.3 square miles, Big Tujunga Dam is operated for flood risk management and water conservation purposes. Big Tujunga Reservoir is not accessible to the public and is not used for recreation.

Figure 8-1 Big Tujunga Dam

8.1.1.1 LOCATION

Big Tujunga Reservoir is located within Federal land in the Angeles National Forest, in the Big Tujunga Canyon of the San Gabriel Mountains, approximately 8 miles east of the Sunland community of the City of Los Angeles. Big Tujunga Creek, Fox Creek, and a few unnamed, natural streams that traverse the San Gabriel Mountains flow into Big Tujunga Reservoir. The waterway downstream of the dam is known as Big Tujunga Wash. The wash flows through Big Tujunga Wash Mitigation Area and into Hansen Flood Control Basin, a U.S. Army Corps of Engineers (Army Corps of Engineers) facility used to manage the risk of floods. Figure 8- shows the location of Big Tujunga Reservoir and several key facilities. Figure 8-2 shows an aerial of the reservoir.

There are two sediment placement sites (SPSs) within the immediate vicinity of Big Tujunga Reservoir – Maple SPS and Big Tujunga SPS. Big Tujunga SPS has very little remaining capacity. As of 2012, Maple SPS had an estimated remaining capacity of approximately 4.4 MCY.

Figure 8-2 Big Tujunga Reservoir Vicinity Map

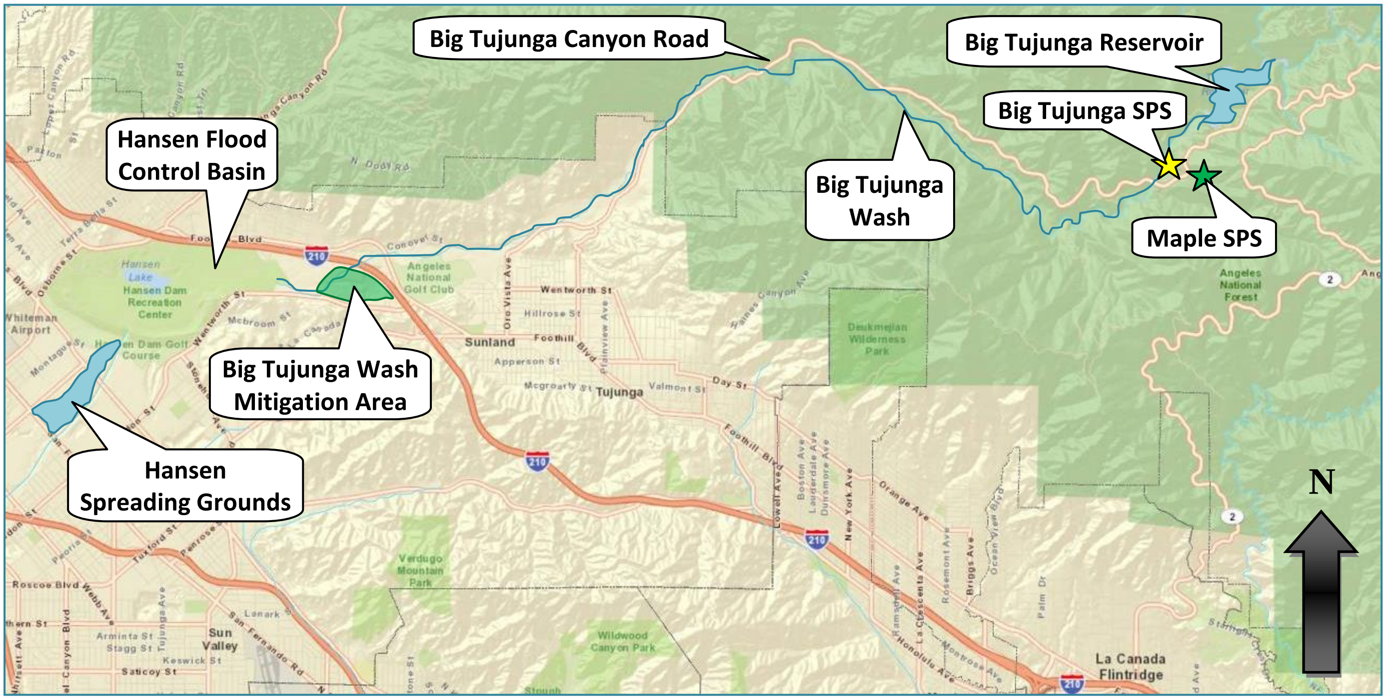
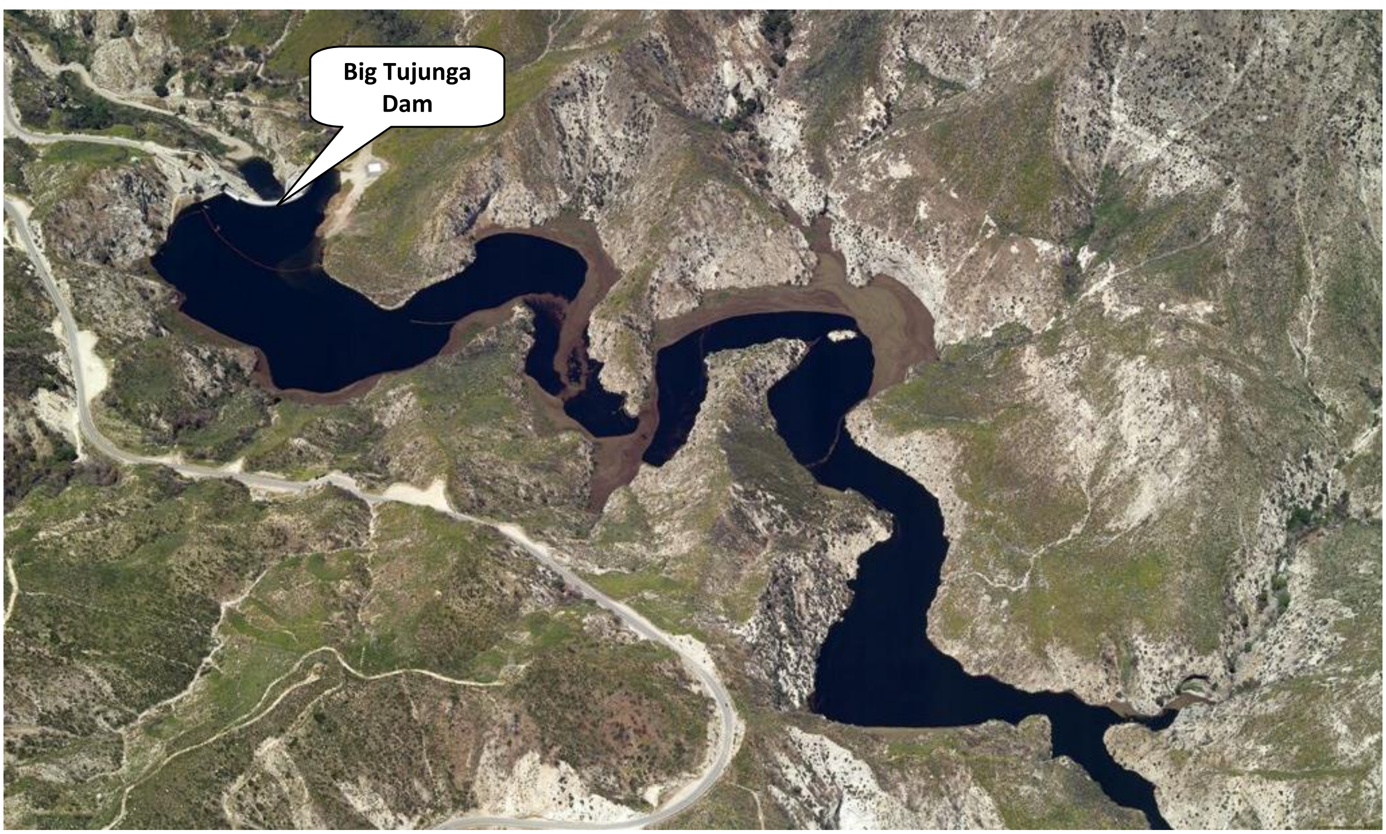


Figure 8-2 Big Tujunga Reservoir Aerial Image



8.1.1.2 ACCESS

There are two access roads maintained by the Flood Control District that provide access to the Big Tujunga Dam and the body of the reservoir, as shown in Figure 8-3. One of the access roads is a fully paved two-way access road that runs to a parking area on the south abutment of the dam and continues pass the dam as an unpaved road, providing access to the body of the reservoir. The other access road is an unpaved access road that stems from the paved access road, partially travels along Big Tujunga Wash, passes by the north abutment, and provides a second access point to the body of the reservoir.

Figure 8-3 Access roads to Big Tujunga Dam and Reservoir

8.1.1.3 DAM OUTLETS

In addition to being equipped with a variety of valves, Big Tujunga Dam is also equipped with a sluiceway controlled by a 5- by 5-foot sluice gate.

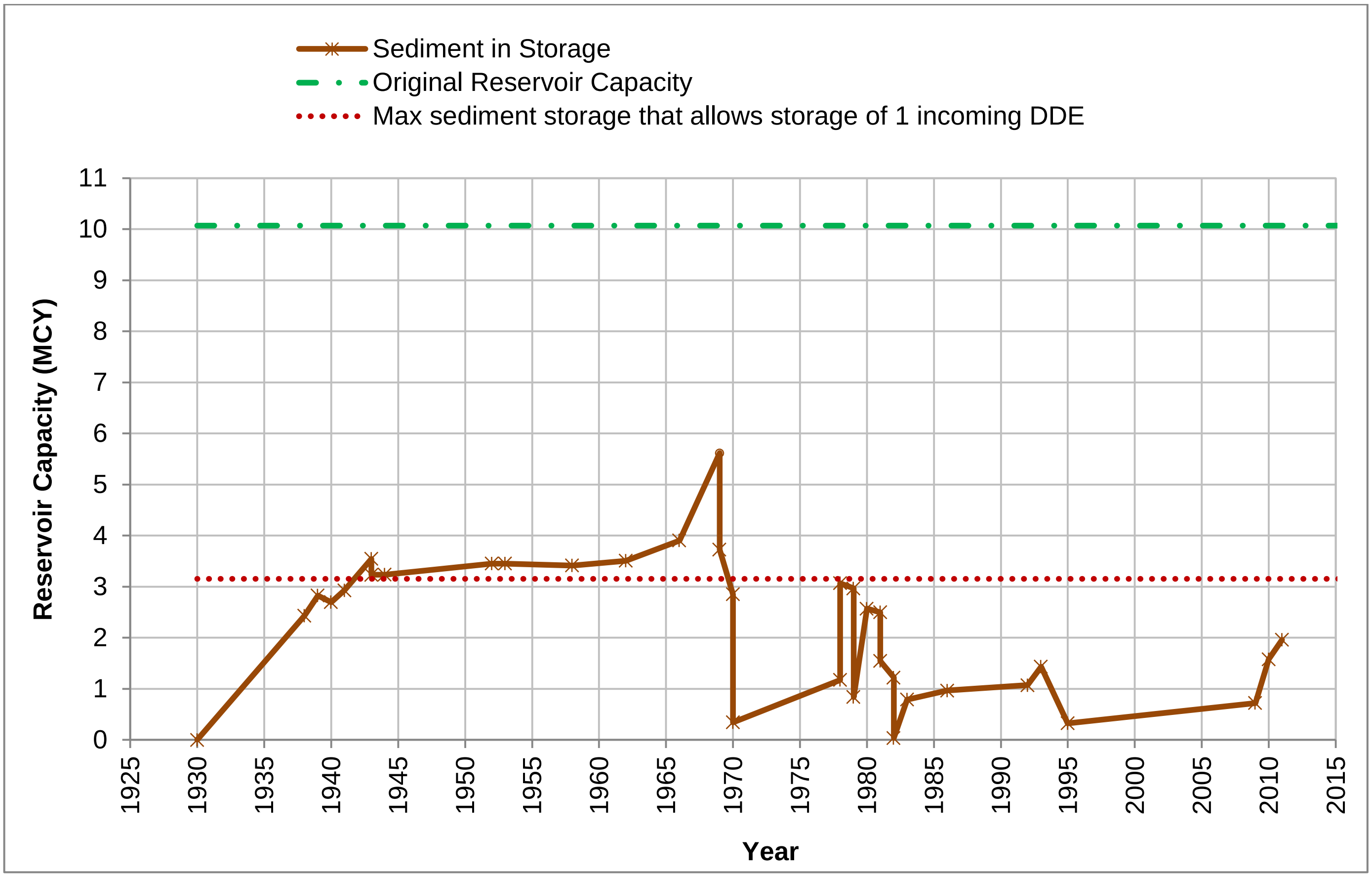
8.1.1.4 DOWNSTREAM FLOOD CONTROL AND WATER CONSERVATION SYSTEM COMPONENTS

Water that passes through Big Tujunga Dam travels approximately 14 miles along Big Tujunga Wash to the Army Corps of Engineers' Hansen Flood Control Basin. Between the aforementioned facilities, the wash retains its natural characteristics and is augmented by numerous creeks. Downstream of Hansen Flood Control Basin water flows along Tujunga Wash, a concrete-lined channel. The channel passes by Hansen Spreading Grounds and Tujunga Spreading Grounds. Near Studio City, Tujunga Wash flows into the Los Angeles River.

8.1.1.5 SEDIMENT DEPOSITION AND REMOVAL HISTORY

Figure 8-4 shows the approximate sediment storage in Big Tujunga Reservoir since the reservoir's first debris season in the early 1930s. For reference purposes, the figure shows the original reservoir capacity at spillway lip and the maximum sediment storage that allows for the storage of one incoming design debris event (DDE). Due to the configuration of Big Tujunga Reservoir, capacity is not available for two DDEs at this location.

Figure 8-4 Graph of Historical Sediment Storage at Big Tujunga Reservoir



Per the Flood Control District's records, which are summarized in Table 8-1, between Big Tujunga Reservoir's first debris season and June 2012, sediment has been removed from the reservoir on 17 occasions. Sluicing operations have been conducted 10 times, starting with the first removal activity shown by the 1940 survey. Prior to 1969, sluicing was the only method used to remove sediment from the reservoir. After 1970, only one small sluicing operation was conducted in 1982. Since 1970, excavation has been the dominant mode of cleanout. Big Tujunga SPS and Maple SPS have been used for the placement of some of the material removed from the reservoir.

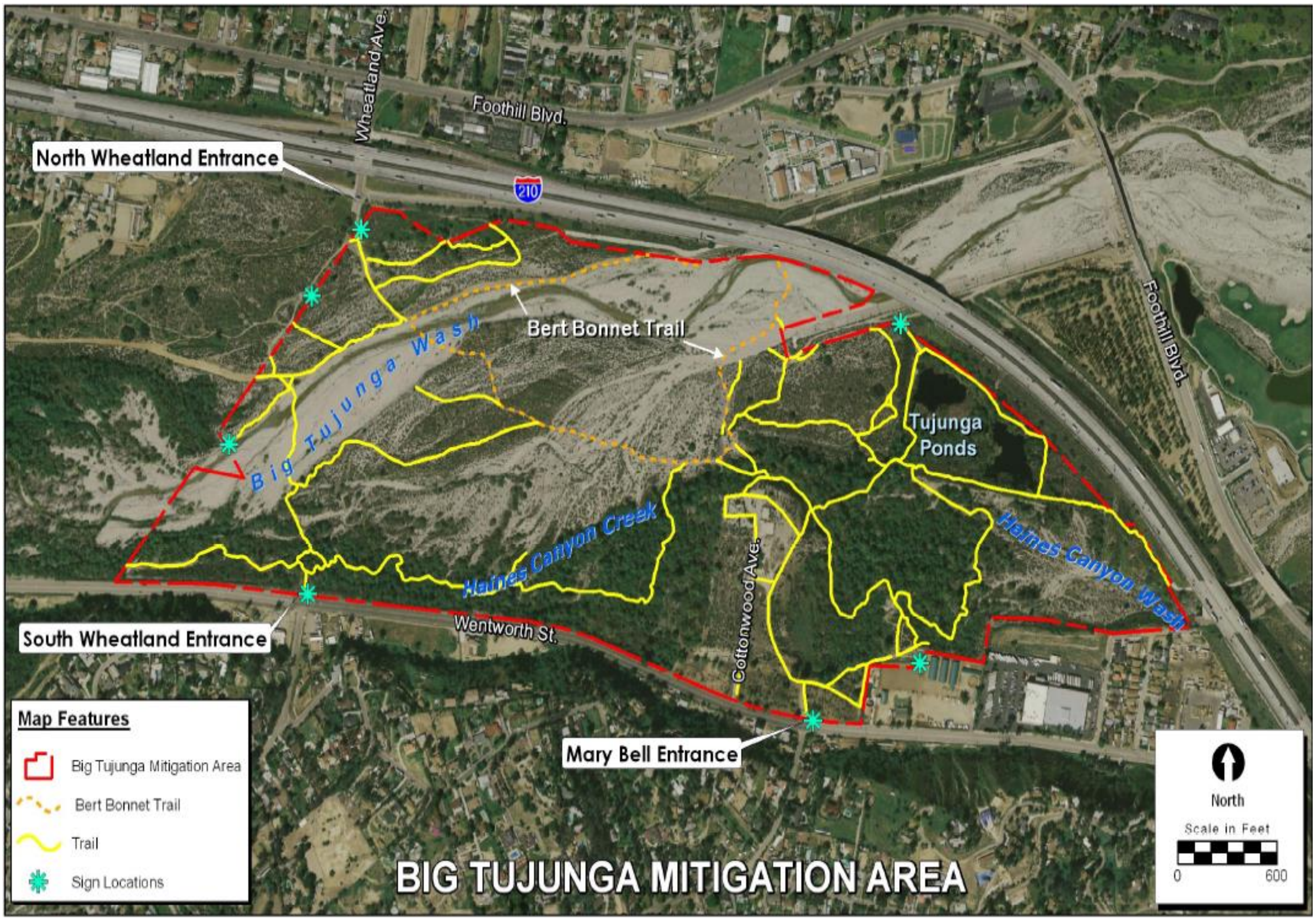
Table 8-1 Big Tujunga Reservoir historical sediment accumulation and removal

Survey Date		Reservoir Capacity (MCY)	Quantity Sluiced (MCY)	Quantity Excavated (MCY)	Sediment Accumulated Between Surveys (MCY)	Sediment in Storage (MCY)
October	1930	10.07	-	-	-	-
May	1938	7.64	-	-	2.43	2.43
October	1939	7.24	-	-	0.40	2.83
February	1940	7.37	0.13	-	-	2.70
July	1941	7.14	1.24	-	1.47	2.93
February	1943	6.52	-	-	0.62	3.54
April	1943	6.83	0.31	-	-	3.23
June	1944	6.83	0.27	-	0.27	3.23
September	1952	6.61	-	-	0.22	3.45
October	1953	6.61	-	-	-	3.45
June	1958	6.65	0.21	-	0.18	3.42
July	1962	6.56	0.12	-	0.22	3.51
October	1966	6.16	-	-	0.40	3.91
March	1969	4.45	0.01	0.14	1.87	5.62
November	1969	6.34	0.53	1.36	-	3.72
February	1970	7.21	-	0.87	-	2.85
October	1970	9.72	0.30	2.21	-	0.34
March	1978	8.89	-	-	0.83	1.17
April	1978	7.00	-	-	1.89	3.07
May	1979	7.10	-	0.10	-	2.97
December	1979	9.23	-	2.13	-	0.84
March	1980	7.50	-	-	1.73	2.57
May	1981	7.57	-	0.07	-	2.50
December	1981	8.52	-	0.95	-	1.55
May	1982	8.85	0.03	0.30	-	1.22
November	1982	10.03	-	1.18	-	0.04
April	1983	9.28	-	-	0.75	0.79
December	1986	9.10	-	-	0.18	0.97
July	1992	9.00	-	-	0.10	1.07
June	1993	8.63	-	-	0.36	1.43
November	1995	9.74	-	1.11	-	0.33
October	2009	9.34	-	-	0.40	0.72
August	2010	8.49	-	-	0.86	1.58
August	2011	8.11	-	-	0.38	1.96

8.1.1.6 SPECIAL CONDITIONS

Big Tujunga Wash Mitigation Area is located downstream of Big Tujunga Reservoir, just upstream of Hansen Flood Control Basin. The site has a conservation easement and is partly owned by the Flood Control District. The conservation easement and use as a mitigation area prohibit certain activities within the property. Figure 8-5 shows an aerial view of Big Tujunga Wash Mitigation Area.

Figure 8-5 Big Tujunga Wash Mitigation Area



8.1.2 PLANNING QUANTITY AND APPROACH

As described in Section 5, the projected 20-year sediment accumulation at Big Tujunga Reservoir is 5.2 MCY. The Flood Control District is also planning to remove the sediment currently in the reservoir, which amounts to approximately 2 MCY and resulted largely from the Station Fire of 2009. Therefore, a total of approximately 7.2 MCY of sediment are planned for removal during the 20-year planning period.

Approximately two thirds of Big Tujunga Reservoir's total 7.2-MCY planning quantity consists of material with particle sizes that are small enough to be dredged or sluiced. Given this assumption, if dredging or sluicing was to be employed, approximately 4.8 MCY of sediment could potentially be dredged or sluiced while the remaining 2.4 MCY of larger-sized material would need to be excavated.

8.1.3 POTENTIAL STAGING AND TEMPORARY SEDIMENT STORAGE AREA

8.1.3.1 HANSEN FLOOD CONTROL BASIN

Hansen Flood Control Basin – Background

Hansen Flood Control Basin, shown in Figure 8-6, is a facility owned and operated by the Army Corps of Engineers that is located approximately 14 miles downstream of Big Tujunga Dam at the confluence of Big Tujunga Wash and Little Tujunga Wash, along the northeastern edge of the San Fernando Valley. The flood control basin reduces the risk from debris-laden floodwaters along Tujunga Wash between the facility and the Los Angeles River. A secondary use of the flood control basin is recreation. Hansen Dam directs flows from the flood control basin to the concrete-lined Tujunga Wash.

Hansen Flood Control Basin could potentially be suitable as the outlet of a slurry pipeline or the endpoint of a sluicing operation from Big Tujunga Reservoir. Based on discussions with the Army Corps of Engineers regarding the use of some of their other facilities in sediment management operations by the Flood Control District, it is assumed that the Flood Control District would need to preexcavate the expected amount of sediment to be delivered to Hansen Flood Control Basin. Assuming that all the material that could potentially be dredged or sluiced from Big Tujunga Reservoir could be temporarily stored at the flood control basin, that would mean a total of 4.8 MCY of sediment would have to be preexcavated and removed from Hansen Flood Control Basin. The entire 4.8 MCY would not be removed at one time; they would be distributed among the number of dredging or sluicing projects from Big Tujunga Reservoir.

Figure 8-6 Hansen Flood Control Basin

Hansen Flood Control Basin – Environmental Impacts

Hansen Flood Control Basin includes environmentally sensitive areas. Studies would be needed to identify specifically what is actually located within the flood control basin and how impacts to the existing habitats could be avoided, minimized, or mitigated.

Water quality would be impacted at Hansen Flood Control Basin if it were to serve as the outlet of a slurry pipeline or the endpoint of a sluicing operation.

Air quality impacts are possible as a result of removing sediment within Hansen Flood Control Basin and operations to transport it to another location.

Hansen Flood Control Basin – Social Impacts

Traffic and noise would increase near Hansen Flood Control Basin during removal of sediment from the flood control basin in preparation for deliveries of sediment from Big Tujunga Reservoir via a slurry pipeline or sluicing. The hours of operation at Hansen Flood Control Basin could be limited to minimize impacts.

The visual and scenic characteristics of the flood control basin would also be impacted by preexcavation operations and delivery of sediment via slurry pipeline or sluicing. Additionally, the sediment deliveries from Big Tujunga Reservoir could result in odor impacts and the attraction of vectors.

Deliveries of water and sediment to Hansen Flood Control Basin via a slurry pipeline from Big Tujunga Reservoir or via Tujunga Wash after a sluicing operation at the reservoir could impact recreational resources at the flood control basin. Impacts could possibly be minimized by adjusting flow rates or by placing berms to divert them to the least used areas.

Hansen Flood Control Basin – Implementability

The Flood Control District would need to coordinate with the Army Corps of Engineers for use of Hansen Flood Control Basin as a temporary sediment storage area. Coordination would involve issues such as preexcavation of material, permission to truck or place a conveyor within the flood control basin in order to remove the sediment, etc. The Flood Control District would also need to obtain environmental regulatory permits.

Hansen Flood Control Basin – Performance

Existing habitat within Hansen Flood Control Basin could potentially limit the capacity that could be made available at the flood control basin for sediment storage. This possibility needs to be considered.

Using Hansen Flood Control Basin as the endpoint of dredging and sluicing operations from Big Tujunga Reservoir would reduce the distance sediment would have to travel on other transportation methods. Sediment preexcavated from Hansen Flood Control Basin in preparation for the deliveries of sediment from Big Tujunga Reservoir could be trucked or transported via a conveyor belt to a pit in Sun Valley.

Hansen Flood Control Basin – Cost

The cost associated with using Hansen Flood Control Basin as a temporary sediment storage area depends on the amount of sediment to be stored at the flood control basin and the destination of the sediment needing to be preexcavated from the basin. The estimated cost to excavate sediment from a facility like Hansen Flood Control Basin is approximately $3 per cubic yard. Excavating 4.8 MCY of sediment from the flood control basin would cost approximately $14 million. Additionally, it is possible royalties would have to be paid to the Army Corps of Engineers for the sediment excavated and removed from Hansen Flood Control Basin.

8.1.4 REMOVAL ALTERNATIVES

The following section discusses the impacts and costs of sediment removal at Big Tujunga Reservoir by means of excavation, dredging, and sluicing. Discussion of the transportation and placement alternatives is presented in Sections 8.1.5 and 8.1.6, respectively. Combined alternatives that address all phases of the sediment management process are presented and discussed in Section 8.1.7.

8.1.4.1 EXCAVATION

Under regular operating conditions, Big Tujunga Reservoir is never completely dry, even outside of the storm season. Therefore, in order to access and excavate sediment from the inundated area the reservoir must be drained. Nonetheless, excavation has been the primary sediment removal method used at Big Tujunga Reservoir since the late 1970s.

Excavation - Environmental Impacts

The U.S. Fish and Wildlife Service has designated Big Tujunga Wash (between Big Tujunga Dam and Hansen Flood Control Basin) as critical habitat for the Santa Ana sucker, a federally threatened species. In 2011, several biological surveys of Big Tujunga Reservoir and its vicinity were conducted. Downstream of Big Tujunga Dam, the three special status fish species native to the area – Arroyo chub, Santa Ana speckled dace, and Santa Ana sucker – were observed. The surveys also identified the existence of willow riparian forest downstream of the dam. The surveys revealed no special status fish species within Big Tujunga Reservoir. Habitat within Big Tujunga Reservoir would need to be studied further to identify specific impacts to plant and wildlife species as a result of draining the reservoir and excavating it.

Excavating the reservoir is not expected to have impact on water quality. As discussed in Section 6, dewatering a reservoir in order to excavate it could impact water conservation if the water is released faster than spreading facilities downstream of the reservoir can handle. Emissions during excavation of the reservoir could potentially impact air quality.

Excavation - Social Impacts

Due to the remote location of Big Tujunga Reservoir, excavation operations are not expected to impact the viewshed of any residences. However, the viewshed of visitors to the Angeles National Forest travelling in the vicinity of the reservoir would be impacted during completion of the excavation operations.

Since there are no permitted recreational uses within Big Tujunga Reservoir, excavation operations would not conflict with such use. Draining the reservoir in anticipation of excavation activities could potentially impact recreation or the viewshed along Big Tujunga Wash.

Excavation - Implementability

There are no right of way concerns related to excavating sediment from Big Tujunga Reservoir since the Flood Control District is authorized to access the dam and reservoir for the maintenance and operation purposes. However, an excavation operation would require environmental regulatory permits. Given the Flood Control District's experience, excavating sediment from Big Tujunga Reservoir under dry conditions is a technically certain method of sediment removal.

Excavation - Performance

Prior to excavation, the reservoir must be completely drained, a process that depends on the initial reservoir level, the amount of inflow into the reservoir, valve operations, and downstream channel conditions. Approximately two months would be required to drain the reservoir and begin excavating sediment. For additional performance discussion, refer to Section 6.

Excavation - Cost

The cost to excavate sediment from a reservoir is approximately $3 per cubic yard. Excavating 7.2 MCY of sediment would cost approximately $22 million.

8.1.4.2 DREDGING

Approximately two thirds of Big Tujunga Reservoir's 7.2-MCY planning quantity consists of material with particle sizes that are small enough to be dredged or sluiced. Therefore, if dredging were employed at Big Tujunga Reservoir, another removal method would have to be employed to remove the larger-sized material. Excavation is the only feasible method to remove the larger-sized material from the reservoir. For the impacts associated with excavating material from Big Tujunga Reservoir, refer to Section **Error! Reference source not found.**.

Dredging - Environmental Impacts

As previously discussed, no special status fish species were observed within Big Tujunga Reservoir during previous biological surveys. However, in order to determine the potential impacts dredging would have on habitat, the specifics of the habitat within the reservoir would need to be determined. Furthermore, existing habitat in the area(s) considered for discharge and dewatering of dredged material would need to be determined.

Dredging could impact water quality within the reservoir by increasing turbidity. However, as discussed in Section 6, water quality concerns could be partially addressed with a silt curtain around the dredge. As discussed in Section 6, dredging sediment (and transporting it via a slurry pipeline) could affect water conservation.

Dredging - Social Impacts

Dredging Big Tujunga Reservoir is not expected to have any traffic impacts. Due to the reservoir's remote location, impacts on noise levels and visual resources would not be expected either. In addition, recreation would not be impacted because it is not permitted at Big Tujunga Reservoir.

Dredging - Implementability

No additional right of way is anticipated to be required for implementation of a dredging operation within Big Tujunga Reservoir. Concerns associated with dewatering of dredged material outside of the reservoir parcels are discussed in Section 8.1.3.

Similar to other operations within Big Tujunga Reservoir, dredging would require environmental regulatory permits.

As discussed in Section 6, while dredging is a technique that has been used in other areas of the country for decades, is not a technique that has been employed in the reservoirs under the Flood Control District's jurisdiction. Big Tujunga Reservoir's narrowness could be a maneuverability concern.

Dredging - Performance

Considering the capabilities of the dredging equipment and slurry pipelines discussed in Section 6, it would take approximately twelve (12) 6-month dredging operations to dredge the 4.8 MCY of sediment that could potentially be dredged from Big Tujunga Reservoir during the 20-year planning period.

Furthermore, as discussed in Section 6, as sediment is dredged water is also drawn by the dredge, which leads to water-sediment mixture with an approximated ratio of 9-to-1 that needs to be dewatered. This means that the Flood Control District would need to dewater approximately 4 MCY or 2,500 acre-feet of the water-sediment mixture for each of the 12 dredging operations. Given the assumed capabilities of the dredging equipment, the water-sediment mixture would flow into the dewatering area at a rate of approximately 15 cubic feet per second (cfs).

Dredging - Cost

Based on the estimated unit cost for dredging, dredging 4.8 MCY of sediment would cost approximately $50 million.

8.1.4.3 SLUICING (AS A REMOVAL METHOD)

Approximately two thirds of Big Tujunga Reservoir's 7.2-MCY planning quantity consists of material with particle sizes small enough to be sluiced. Therefore, another removal method would have to be employed to remove the larger-sized material that cannot be sluiced. Excavation is the only feasible method to remove the larger-sized material from the reservoir.

This section focuses on sluicing as a sediment removal method and discusses the impacts of sluicing within Big Tujunga Reservoir only. For the impacts of sluicing downstream of the dam refer to Section 8.1.5 1.

Sluicing (Removal) - Environmental Impacts

Within Big Tujunga Reservoir itself, sluicing would be expected to impact the reservoir's habitat in a similar manner as excavating sediment from the reservoir would since in both cases the reservoir would need to be drained. See the discussion under Excavation (Section 8.1.4.1) for more information.

As discussed in Section 6, removing sediment from a reservoir by sluicing could affect water conservation.

Sluicing operations within Big Tujunga Reservoir would result in equipment emissions. However, given the Flood Control District's previous sluicing projects, only a few pieces of equipment would be necessary within the reservoir, so air quality impacts at the reservoir are not expected to be significant.

Sluicing (Removal) - Social Impacts

Removal of sediment from Big Tujunga Reservoir through sluicing would impact the view from ridges above the reservoir as the reservoir needs to be drained and there would be equipment within the reservoir. There are no permitted recreational activities in the reservoir, so no impacts on recreation are expected.

Sluicing (Removal) - Implementability

Access to Big Tujunga Reservoir and activities within the reservoir do not pose any right of way concerns. Similar to other sediment removal alternatives already discussed, sluicing Big Tujunga Reservoir would require environmental regulatory permits. Given that sluicing projects have been conducted in the past at Big Tujunga Reservoir, it is technically certain that sluicing can be used to remove sediment from the reservoir. However, it is important to note that the ability to sluice will be dependent on inflow into the reservoir, which is entirely dependent on the weather. In addition to inflow, another factor that limits sluicing is the availability of temporary storage areas and the rate at which they can receive the sluiced water-sediment mixture.

Sluicing (Removal) - Performance

As previously discussed, it has been assumed that approximately two thirds (4.8 MCY) of the 7.2-MCY planning quantity for Big Tujunga Reservoir could potentially be sluiced. Based on an analysis of the records of the previously sluiced quantities from Big Tujunga Reservoir, it has been assumed that an average 300,000 cubic yards

(CY) of sediment could potentially be sluiced from Big Tujunga Reservoir in a given year. Given this assumption, sluicing would have to be performed approximately 16 of the 20 years in the planning period in order to sluice 4.8 MCY of sediment from the reservoir.

Sluicing (Removal) - Cost

Based on the estimated unit cost for sluicing, sluicing 4.8 MCY of sediment would cost approximately $12 million.

8.1.5 TRANSPORTATION ALTERNATIVES

The following section discusses the impacts and costs of transporting sediment removed from Big Tujunga Reservoir by means of sluicing, trucking, conveyor belt, and slurry pipeline. Discussion of the removal alternatives was presented in Section 8.1.4. The placement alternatives are presented in Section 8.1.6. Combined alternatives that address all phases of the sediment management process are presented and discussed in Section 8.1.7.

8.1.5.1 SLUICING (AS A TRANSPORTATION METHOD)

This section focuses on the impacts of utilizing sluicing as a transport method to move sediment downstream of Big Tujunga Dam along Big Tujunga Wash to Hansen Flood Control Basin. For the impacts of sluicing operations within Big Tujunga Reservoir, refer to the discussion of sluicing as a removal method in the previous section. Impacts at Hansen Flood Control Basin were discussed in Section 8.1.3.1.

Sluicing (Transport) - Environmental Impacts

Vegetation and wildlife surveys immediately downstream of Big Tujunga Dam have indicated the presence of three special status fish species native to the area – Arroyo chub, Santa Ana speckled dace, and Santa Ana sucker. The surveys also identified the existence of willow riparian forest downstream of the dam. Sluicing activities could be temporarily disruptive to the existing habitat. Farther downstream in Big Tujunga Wash Mitigation Area, sensitive species have been found in the prospective sluiceway during wet years. Sluice flows could impact the fish unless they are relocated prior to sluicing.

Water quality along Big Tujunga Wash would be impacted by sluicing. The increase concentration of sediment in the water would result in higher turbidity than normal. As discussed in Section 6, transporting sediment via sluicing could affect water conservation.

Sluicing (Transport) - Social Impacts

Sluicing sediment along Big Tujunga Wash is not expected to have impacts on traffic or noise levels. Visual impacts will consist of flows in Big Tujunga Wash with higher levels of sediment than normal. Recreation along Big Tujunga Wash and within Big Tujunga Wash Mitigation Area could be temporarily impacted by sluicing operations.

Sluicing (Transport) - Implementability

While sluicing sediment along Big Tujunga Wash would not require right of way agreements, possibly accessing the wash with equipment to manage the deposition of sediment along the wash would need them. Due to the conservation easement on Big Tujunga Wash Mitigation Area, equipment would not be able to access the portion of the wash that passes through the mitigation area.

The Flood Control District would need to obtain environmental regulatory permits in order to sluice sediment along Big Tujunga Wash.

Sluicing (Transport) - Performance

It was assumed that sluice flows would have an approximate 9-to-1 water-to-sediment ratio. Therefore, sluicing 300,000 CY of sediment from Big Tujunga Reservoir would mean that 3,000,000 CY or approximately 1,900 AF of the water-sediment mixture would be sent down Big Tujunga Wash. The ability of the stream course to handle said volumes will need to be considered. In addition, sediment deposition locations and the possibility of flushing the stream course to remove the deposits will need to be analyzed if sluicing is to be employed. If sediment deposits within the Big Tujunga Wash Mitigation Area were unable to be removed by flushing, the deposits could lead to flooding of the mitigation area.

Sluicing (Transport) - Cost

The cost of transporting sediment via sluicing is minimal.

8.1.5.2 Trucking

Trucking could be employed to transport sediment from Big Tujunga Reservoir, a staging area, and/or a temporary sediment storage area. This section focuses on the impacts associated with trucking sediment along the general routes shown in Figure 8-7 and the potential temporary route shown in Figure 8-8.

Figure 8-7 Potential truck routes for Big Tujunga Reservoir's sediment

Figure 8-8 Potential truck route around Sunland

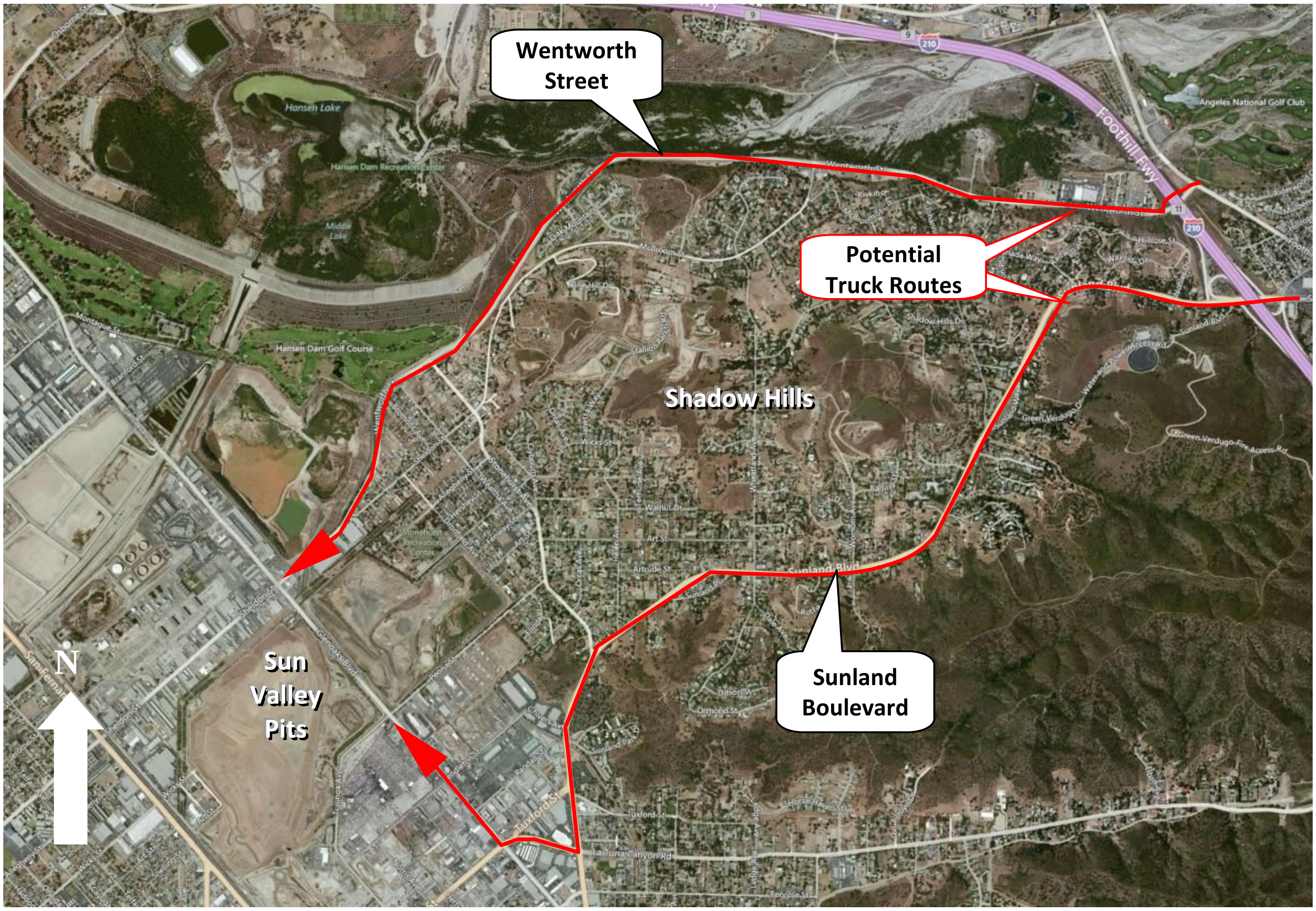
Trucking - Environmental Impacts

If existing roads were to be used to truck sediment along the general routes shown in Figure 8-7, no particular impacts would be expected on habitat or water quality. However, if the potential route shown in Figure 8-8 were used, there would be habitat impacts and potentially water quality impacts associated with the construction of the new roadway. The use of low emission trucks would reduce air quality impacts.

Trucking - Social Impacts

Employing trucks could significantly impact traffic, especially along the two-lane Big Tujunga Canyon Road. In turn, this could impact access to recreational resources along Big Tujunga Canyon Road as well as along other roads in the truck routes. Residents along Big Tujunga Canyon Road would be impacted by the increase in traffic. Additionally, it is possible that trucks traveling to the pits in Sun Valley would not be able to avoid travelling adjacent to the Shadow Hills' neighborhoods along Wentworth Street or Sunland Boulevard as shown in Figure 8-9. In order for trucks traveling to and from Big Tujunga Reservoir to avoid passing through residential neighborhoods along Oro Vista Avenue (or Mount Gleason Avenue) and Foothill Boulevard in Sunland, trucking along the potential temporary trucking route previously shown in Figure 8-8 would need to be explored.

Figure 8-9 Potential truck route along Shadow Hills



Trucking - Implementability

Available access at Big Tujunga Reservoir and the routes discussed in this section would allow the use of double dump trucks.

If truck routes were able to remain entirely on existing public roads, no right of way or permitting concerns would be expected.

Based on records from the County of Los Angeles Assessor's Office (Parcel Map 2548 Sheet 2 dated 2009 and Parcel Map 2551 Sheet 9 dated 2008), there are two unconnected road easements that appear to have been meant for the extension of Big Tujunga Canyon Road from Oro Vista Avenue to Foothill Boulevard. However, one of the easements is partially occupied by golf course improvements. Trucking along the potential temporary truck route shown in Figure 8-8 would require right of way agreements with the property owners of the parcels traversed by the route and removal of the golf course improvements within the road easement.

Trucking - Performance

The following assumptions were made while considering trucking as an alternative to transporting all or part of Big Tujunga Reservoir's 7.2-MCY planning quantity.

- Double dump trucks with a capacity of approximately 16 CY per truck would be used.

- Between Big Tujunga Reservoir and the pits in Sun Valley, trucks would travel at an average speed of 30 miles per hour. However, for trips between Big Tujunga Reservoir and Maple SPS and between Hansen Flood Control Basin and the pits in Sun Valley, trucks would travel at an average speed of 15 miles per hour.

Using these assumptions, estimates on the number of truck operations were determined, as shown in Table 8-2 (under the following cost section).

Trucking - Cost

The estimated cost to construct the temporary access road shown in Figure 8-8 is approximately $150,000 each time it is constructed. There could also be mitigation costs. These costs would need to be added, as appropriate, to the cost subsequently shown.

Trucking unit costs on double dump trucks were estimated to be $0.30 per CY per mile based on a loading time of 1 minute per truck. The cost of trucking will vary depending on the quantity to be trucked, the origin and destination, and the type of truck that can be used. The estimated trucking costs for the various scenarios range from $12 million to $73 million, as shown in Table 8-2.

Table 8-2 Estimated trucking performance and costs for Big Tujunga Reservoir

Origin	Destination(s)	Roundtrip Distance (miles)	Quantity of Sediment (MCY)	Number of Separate Truck Operations Required	Estimated Cost (in millions)
Big Tujunga Reservoir	Pits in Sun Valley	34	7.2	9	$73
			2.8(a)	4	$29
Big Tujunga Reservoir	Maple Canyon SPS	4.5	4.4(b)	6	$6
Hansen Flood Control Basin	Pits in Sun Valley	8	4.8(c)	6	$12

Notes:

a. Difference between the planning quantity (7.2 MCY) and the expected remaining capacity at Maple SPS (4.4 MCY).

b. Estimated remaining capacity at Maple SPS.

c. Portion of the 7.2-MCY planning quantity that is estimated to be able to be dredge or sluiced

8.1.5.3 CONVEYOR BELTS

This section discusses the impacts of utilizing a conveyor belt to transport sediment from Big Tujunga Reservoir to Maple SPS, from Big Tujunga Reservoir to the pits in Sun Valley, and from Hansen Flood Control Basin to the pits in Sun Valley. Sediment to be transported on a conveyor belt would have to be excavated from its location.

Figure 8-10 to Figure 8-12 show the general alignments of the conveyor routes. As Figure 8-10 shows, a conveyor from Big Tujunga Reservoir to Maple SPS could potentially be placed along the access road that passes by south abutment of the dam. Figure 8-11 shows a conveyor route that starts at the reservoir and travels along Big Tujunga Canyon Road, through Big Tujunga Wash Mitigation Area, and along Wentworth Street. This should not be taken to indicate feasibility of the alignment; potential conveyor alignments will need to be analyzed in the future if conveyors are to be employed. Figure 8-12 shows there is an existing private conveyor system that crosses Tujunga Wash just downstream of Hansen Flood Control Basin and connects the pits with each other. The possibility of developing an agreement with Vulcan Materials Company (Vulcan), which owns the conveyor belt and the pits in Sun Valley, should be explored.

Figure 8-10 Potential conveyor alignment between Tujunga Reservoir to Maple SPS

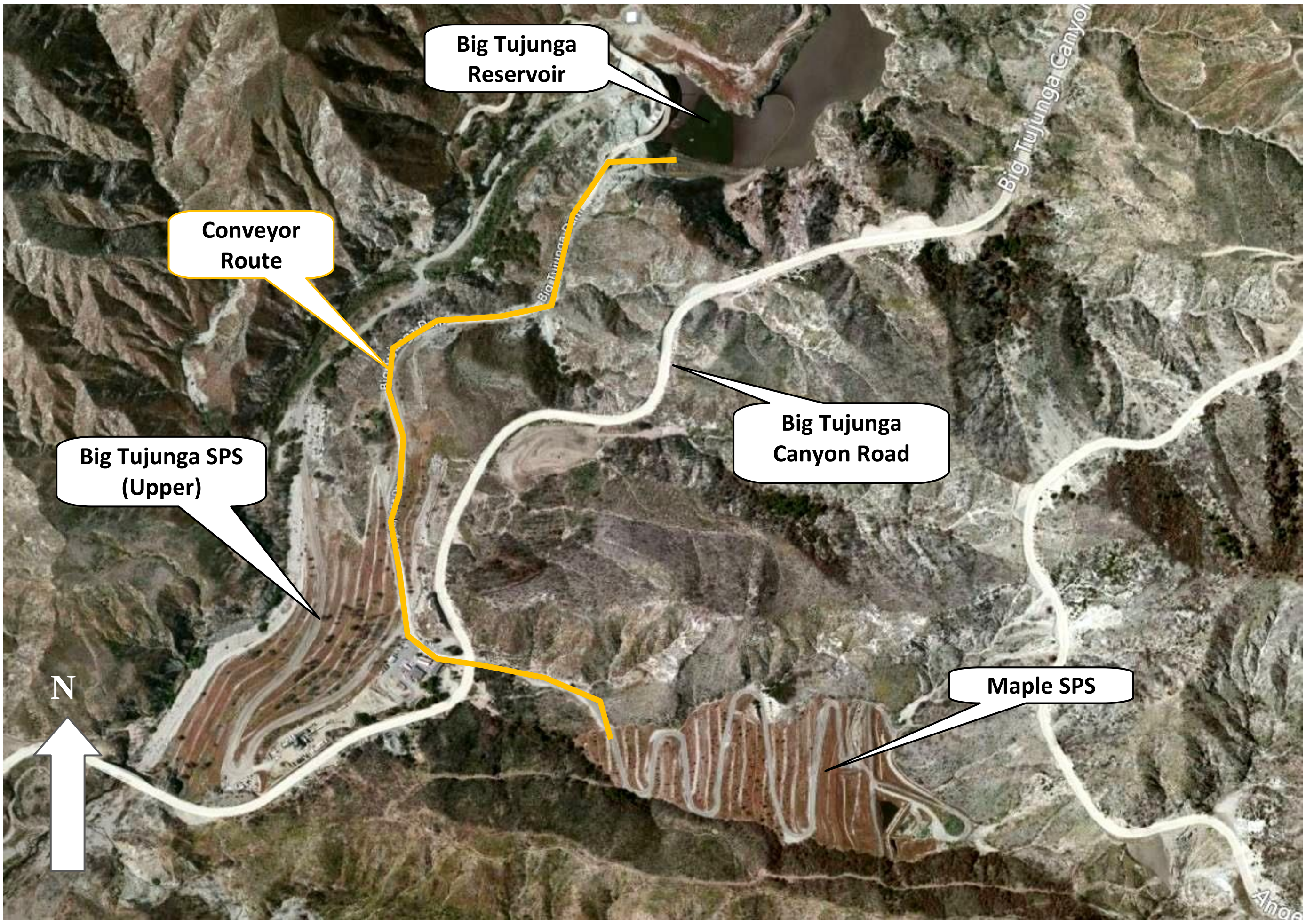


Figure 8-11 Potential conveyor alignment between Big Tujunga Reservoir and pits in Sun Valley

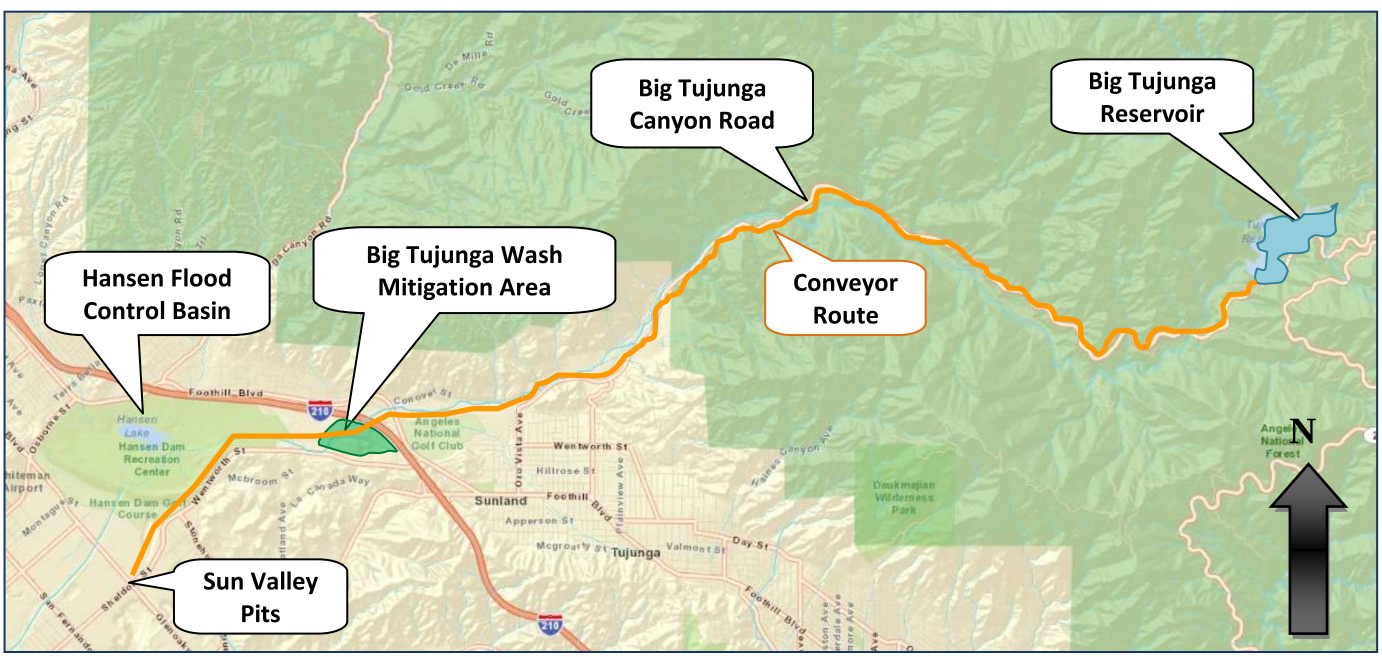


Figure 8-12 Potential conveyor alignment between Hansen Flood Control Basin and pits in Sun Valley

Conveyor Belts - Environmental Impacts

In order to identify and minimize the potential impacts of a conveyor operation, the habitat along the potential conveyor alignment would have to be studied. If the conveyor were able to be placed along existing roads, impact on habitat would be expected to be minimal. Water quality would not be expected to be impacted.

Conveyor Belts - Social Impacts

There would be some visual disturbances during the life of a conveyor operation. A conveyor from Big Tujunga Reservoir to Maple SPS would not impact recreation as neither site is open to the public for recreational use. On the other hand, placing a conveyor along Big Tujunga Canyon Road from Big Tujunga Reservoir to the pits in Sun Valley, adjacent to Big Tujunga Wash Mitigation area, or within Hansen Flood Control Basin and over Hansen Dam could impact recreation resources or access to them.

Conveyor Belts - Implementability

Right of way and permitting issues associated with placement of a conveyor system within Maple SPS would be addressed as part of the U.S Forest Special Use Permit required use of Maple SPS. Placement of a conveyor belt across and along Big Tujunga Canyon road would need to ensure roadway safety issues are taken into account. As a result of the conservation easement on Big Tujunga Wash Mitigation Area, a conveyor would not be able to be placed through the mitigation area. Therefore, a feasible conveyor alignment between the end of Big Tujunga Canyon Road (at Oro Vista Avenue) and the pits in Sun Valley would need to be determined. Agreement by the

Army Corps of Engineers would be required for placement of a conveyor system within Hansen Flood Control Basin and over Hansen Dam. Use of the existing conveyor system connecting the pits in Sun Valley would need to be arranged with Vulcan.

Conveyor Belts - Performance

For conveyor operations beginning in Big Tujunga Reservoir, it was assumed that operations would last approximately six months during a given year since that is the approximate number of months that sediment can be excavated out of the reservoir. Conveyor operations from Hansen Flood Control Basin could be conducted for a longer period, possibly up to nine months per year. Using these assumptions, estimates on the number of conveyor operations were determined, as shown in Table 8-3 (under the following cost section).

Conveyor Belts - Cost

Based on the unit cost for a new conveyor and use of an existing conveyor belt, the following estimates were determined.

Table 8-3 Estimated performance and costs for conveyors for Big Tujunga Reservoir

Origin	Destination(s)	Conveyor Length (miles)	Quantity of Sediment (MCY)	Number of Conveyor Operations Required	Estimated Cost (in millions)
Big Tujunga Reservoir	Maple Canyon SPS	1.3	4.4(a)	6	$8
			2.4	3	
Big Tujunga Reservoir	Pits in Sun Valley	15	7.2	9	$86
			2.8(b)	4	
Hansen Flood Control Basin	Existing conveyor downstream of Hansen Dam	1.6	4.8(c)	4	$7
Existing conveyor “pick up” point	Pits in Sun Valley	1.5	4.8(c)		$1

<u>Notes:</u>

a. Estimated remaining capacity at Maple SPS.
b. Difference between the planning quantity (7.2 MCY) and the expected remaining capacity at Maple SPS (4.4 MCY).
c. Portion of the 7.2-MCY planning quantity that is estimated to be able to be dredged or sluiced

8.1.5.4 Slurry Pipeline

As discussed in Section 6, slurry pipelines would be used in conjunction with dredging. This section discusses the impacts of constructing a slurry pipeline to transport to Hansen Flood Control Basin the 4.8 MCY of smaller-sized material that could potentially be dredged at Big Tujunga Reservoir.

If a dredging and slurry pipeline alternative was to be employed at Big Tujunga Reservoir, a feasible slurry pipeline alignment would have to be determined. For planning purposes, the alignment shown in Figure 8-13 was assumed to be feasible. The subsequent discussion is based on this assumption.

Figure 8-13 Big Tujunga Reservoir slurry pipeline alignment used for planning purposes

Slurry Pipeline - Environmental Impacts

In order to identify and minimize the potential environmental impacts of placing and operating a slurry pipeline from Big Tujunga Reservoir to Hansen Flood Control Basin, the habitat along the potential alignments would have to be studied. No impacts are expected on water quality and air quality.

Slurry Pipeline - Social Impacts

If placed above ground, construction of the slurry pipeline would cause some visual disturbances. Access to recreational resources, such as Big Tujunga Wash Mitigation Area, could be impacted along the conveyor alignment.

Slurry Pipeline - Implementability

Placement of a slurry pipeline would present both right of way and permitting issues. If the slurry pipeline was to be placed along Big Tujunga Canyon Road, roadway impacts would need to be considered while determining the best alignment.

Slurry Pipeline - Performance

A slurry pipeline would be permanently installed and used at the frequency at which material would be dredged. Based on the assumptions that a dredge could remove approximately 200 CY of sediment per hour and a water-to-sediment ratio of 9-to-1, the slurry pipeline would need to be able to transport approximately 2,0000 CY of the water-sediment slurry per hour (or approximately 15 cubic feet of the slurry per second). The slurry pipelines discussed in Section 6 are able to handle flow of this magnitude.

The approximately 14-mile slurry pipeline from Big Tujunga Dam to Hansen Flood Control Basin may require 14 booster pumps.

Slurry Pipeline - Cost

Based on the estimated unit cost for a slurry pipeline presented in Section 6, the estimated cost of constructing a slurry pipeline of approximately 14 miles from Big Tujunga Dam to Hansen Flood Control Basin is approximately $3 million. Given an installation and operation cost of $1 per CY of sediment per booster pump, the cost of installing and operating 14 booster pumps to transport 4.8 MCY of sediment was estimated to be $101 million.

8.1.6 PLACEMENT ALTERNATIVES

This section discusses the potential placement alternatives for sediment removed from Big Tujunga Reservoir. Specifically, this section discusses the placement of sediment at pits and the existing Maple Sediment Placement Site. Discussion of the removal and transportation was presented in Sections 8.1.4 and 8.1.5, respectively. Combined alternatives that address all phases of the sediment management process are presented and discussed in Section 8.1.7.

8.1.6.1 PITS

The general impacts of employing pits for sediment placement were discussed in Section 6. There are multiple pits in Sun Valley. Figure 8-14 shows the location of the pits in relation to the Big Tujunga Reservoir and Hansen Flood Control Basin. From Big Tujunga Reservoir to the pits, the distance is approximately 15 to 17 miles, depending on the route, which can vary according to the mode of transportation used. From Hansen Flood Control Basin, the distance is approximately 3 to 4 miles.

Figure 8-14 Location of Sun Valley Pits

It was assumed that one third of Big Tujunga's 7.2-MCY planning quantity, or 2.4 MCY, would be marketable. Given that assumption and other assumptions discussed in Section 6, it was assumed that pits operated by the gravel industry would accept a total of 4.8 MCY of sediment from Big Tujunga Reservoir free of charge. Depending on the type of truck used to deliver sediment to the third-party owned pits, tipping fees of $10 to $15 per cubic yard would have to be paid for the remaining 2.4 MCY of sediment.

As discussed in Section 6, the acquisition of pits for the placement of sediment from facilities under the jurisdiction of the Flood Control District should be pursued. Acquisition of a quarry in Sun Valley would be most desirable for sediment management operations related to Big Tujunga Reservoir. It would cost a total of $3 per cubic yard to acquire and place the 2.4 MCY of sediment at the Flood Control District-owned pit.

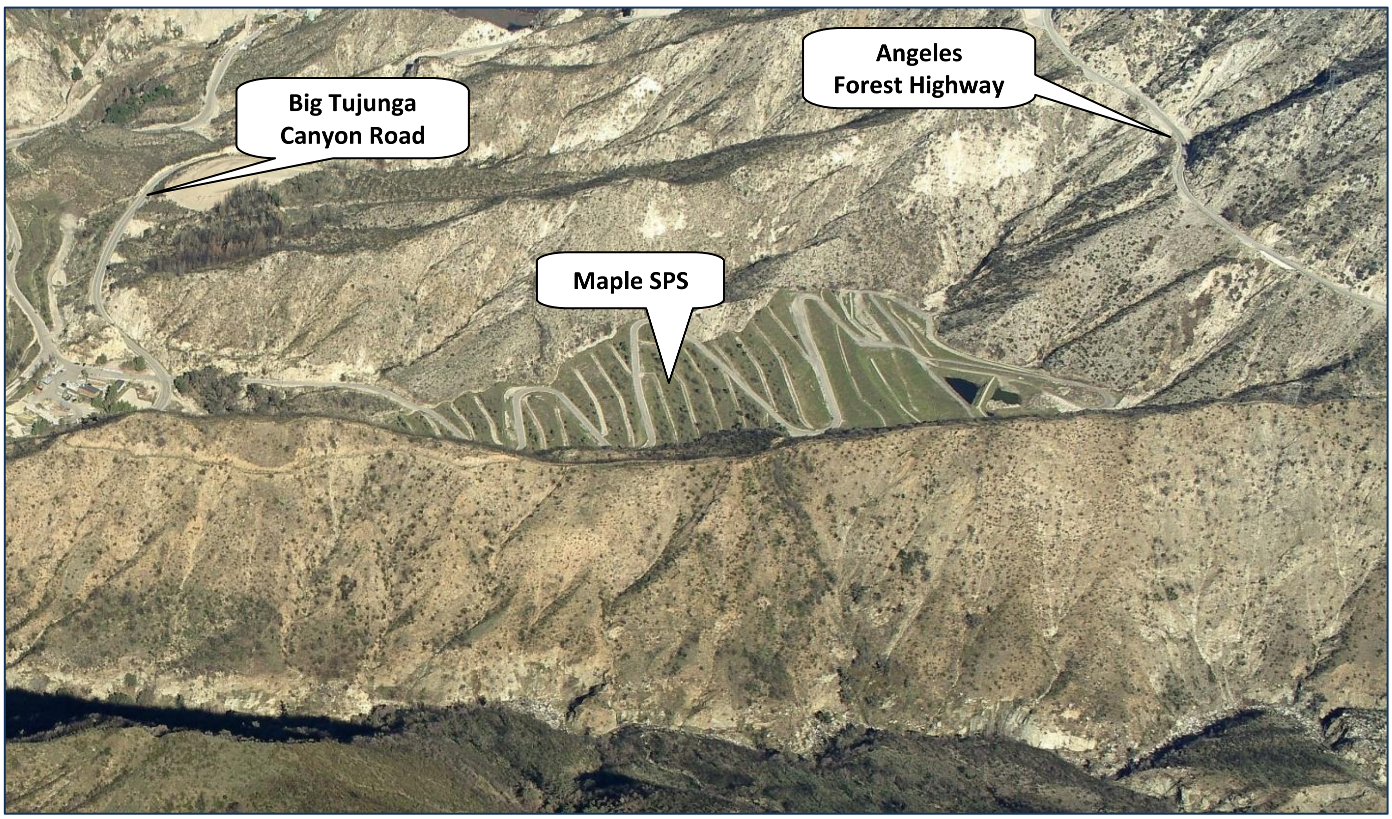
8.1.6.2 MAPLE SEDIMENT PLACEMENT SITE

This section discusses the impacts associated with employing the remaining capacity at Maple SPS for the permanent placement of sediment from Big Tujunga Reservoir. This placement alternative could potentially be used for sediment excavated from the reservoir and transported either by trucks or by a conveyor system to the SPS.

Maple SPS – Background

Maple SPS, shown in Figure 8-15, is located just south of Big Tujunga Dam and Reservoir, across Big Tujunga Canyon Road. The SPS is located on Federal land and has been used previously for the placement of sediment from Big Tujunga Reservoir under a Special Use Permit from the Forest Service. As previously mentioned, as of 2012 the site has an estimated remaining capacity for approximately 4.4 MCY of sediment.

Figure 8-15 Maple Sediment Placement Site



Maple SPS – Environmental Impacts

Maple SPS was burned during the Station Fire of 2009. During biological surveys conducted after the fire, the vegetation observed to be present within the SPS included chaparral, California annual grassland, and California sycamore woodland. There is also a coast live oak stand along the access road to the SPS. The stand is not expected to be impacted by the operations. On the other hand, the rest of habitat would be impacted by placement of sediment at the SPS. Subsequent to filling the SPS, the site would be revegetated with native species.

Water quality and quantity would not be impacted by temporary storage of sediment Maple SPS. Air quality would be affected by emissions of equipment used at the site.

Maple SPS – Social Impacts

During placement of sediment in Maple SPS, there could be localized traffic impacts on Big Tujunga Canyon Road if trucks were used to transport sediment from the reservoir to the SPS. Impacts on recreation, if any, would be in the form of travel delays. Placing sediment at the SPS would alter the scenic characteristics of the area. Due to the remote location of the SPS, any noise associated with placing sediment at Maple SPS is not considered to have significant impact.

Maple SPS – Implementability

In order to be able to use Maple SPS, the Flood Control District would need to obtain a Special Use Permit from the U.S. Forest Service. As of June 2012, the Flood Control District is seeking to renew its previous Special Use Permit for the site.

Maple SPS – Performance

Maple SPS' capacity is sufficient to address approximately 60 percent of Big Tujunga Reservoir's 7.2-MCY planning quantity.

Maple SPS - Cost

Given the assumed costs to place sediment at an SPS, the cost to place 4.4 MCY of sediment at Maple SPS was estimated to be $9 million. The cost to place only the 2.8 MCY of sediment that would not be able to be dredged or sluiced was estimated to be $5 million.

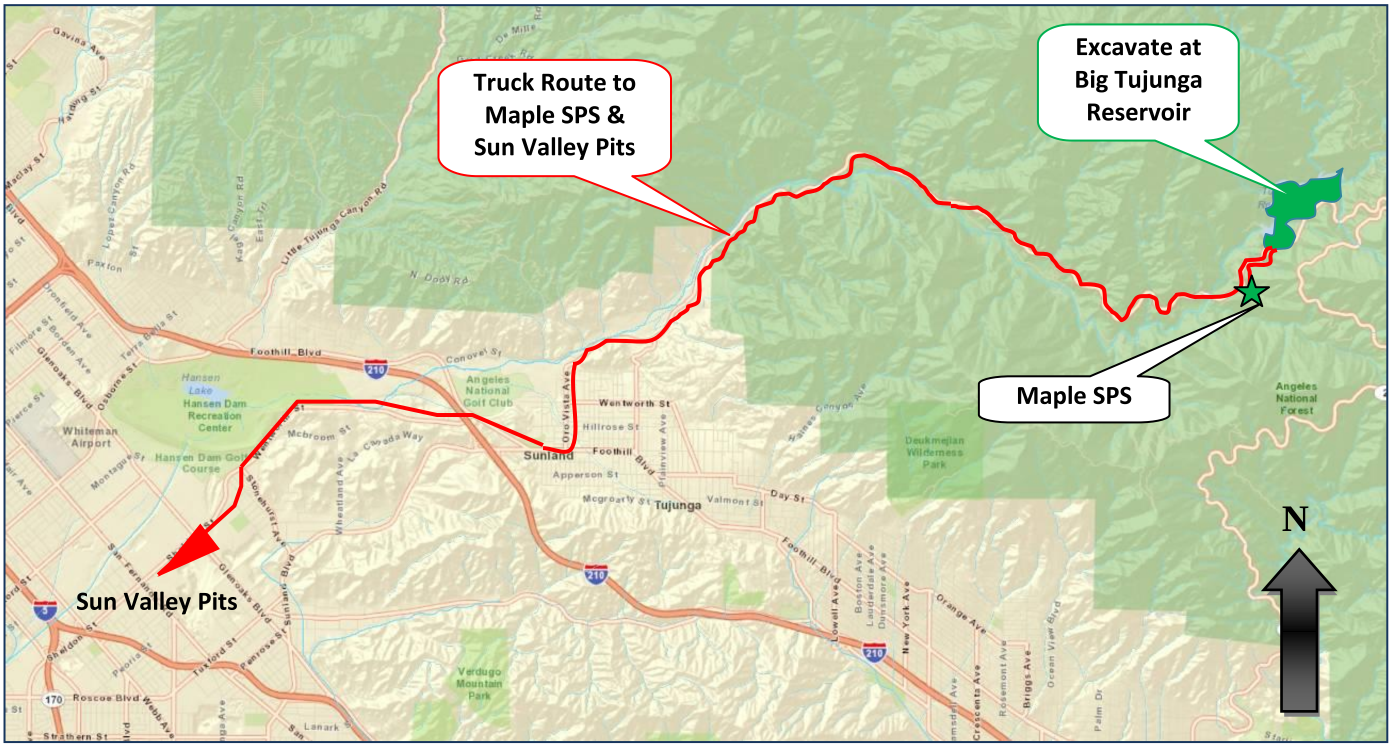
8.1.7 COMBINED SEDIMENT MANAGEMENT ALTERNATIVES

The following presents six sets of combined sediment management alternatives for Big Tujunga Reservoir. A description of each of these and the combined impacts and costs are subsequently provided. For specific details regarding environmental impacts, social impacts, feasibility, implementability, and cost for the individual removal, transportation, and placement components refer to Sections 8.1.3 to 8.1.6. Please note that combined alternatives that include dredging and sluicing assume two thirds of Big Tujunga Reservoir's 7.2-MCY planning quantity, or 4.8 MCY, could potentially be dredged or sluiced and that the remainder would have to be excavated and transported out of the reservoir by another means.

8.1.7.1 COMBINED ALTERNATIVE 1A: EXCAVATE (7.2 MCY) → TRUCKS → MAPLE SPS (4.4 MCY, CAPACITY EXHAUSTED) & SUN VALLEY PITS (2.8 MCY)

This alternative involves draining the reservoir, excavating the sediment under dry conditions, and trucking it to Maple SPS and the pits in Sun Valley. Due to the need to fully drain the reservoir, this alternative would be implementable approximately six months during a given year. Exhausting Maple SPS' capacity would mean 4.4 MCY of sediment would be permanently placed at the SPS while the rest would be placed at the pits in Sun Valley. Figure 8-16 illustrates this alternative.

Figure 8-16 Big Tujunga Reservoir Combined Alternative 1A



This alternative requires that the Flood Control District obtain the Forest Service Special Use Permit required to place sediment at Maple SPS.

Air quality would be impacted by the use of excavation equipment and trucks. Habitat would be impacted by the permanent placement of sediment in Maple SPS.

In order to remove Big Tujunga Reservoir's entire 7.2-MCY planning quantity during the 20-year planning period, sediment removal operations involving excavation in conjunction with trucking would need to occur approximately 8 times. This equates to a cleanout approximately every two to three years.

Trucks travelling between Big Tujunga Reservoir and Maples SPS would only have localized impacts on traffic. For the most part, trucks directly transporting sediment from Big Tujunga Reservoir to a site in Sun Valley would travel along nonresidential roads. However, the route would pass along Sunland and Shadow Hills, as previously shown on Figure 8-7 and Figure 8-9. If the trucking route previously shown in Figure 8-8 could be arranged, trucking through Sunland would be avoided.

Implementation of this alternative could cost an estimated $65 million. The breakdown of the estimated costs is provided in Table 8-4.

Table 8-4 Estimated costs for Big Tujunga Reservoir's Combined Alternative 1A

Activity	Quantity (MCY)	Estimated Cost (in millions)
Excavate sediment from Big Tujunga Reservoir	7.2	$22
Truck to Maple SPS	4.4	$6
Place at Maple SPS		$9
Truck sediment that does not fit in Maple SPS to pits in Sun Valley	2.8	$29
Place at pits in Sun Valley		$0[(a)]
Total	**7.2**	**$65**

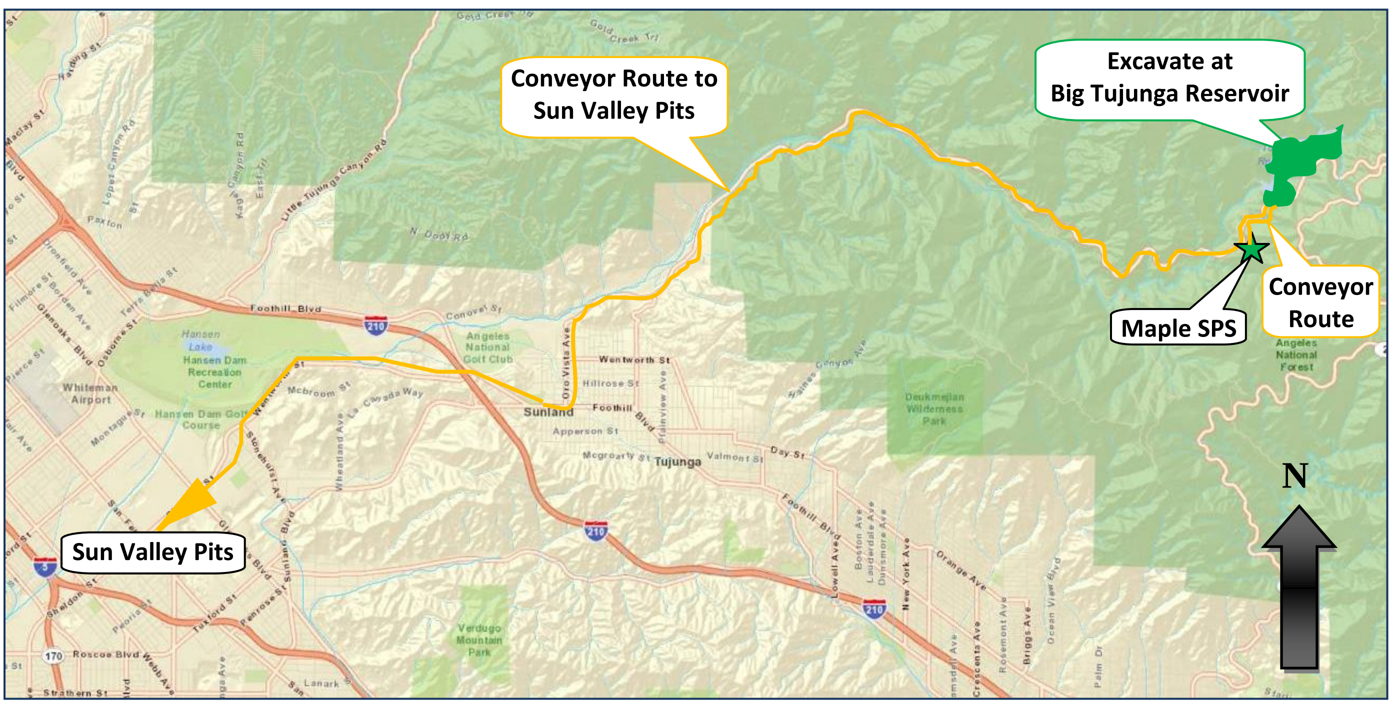
Note:

a. This assumes that most of the 2.8 MCY of sediment taken to third-party pits is marketable and that no tipping fees would have to be paid for the small fraction that would not be marketable.

8.1.7.2 Combined Alternative 1B: Excavate (7.2 MCY) → Conveyor → Maple SPS (4.4 MCY) & Sun Valley Pits (2.8 MCY)

This alternative is basically the same as Combined Alternative 1A, except that conveyors would be used instead of trucks. Figure 8-17 shows a representation of this alternative.

Figure 8-17 Big Tujunga Reservoir Combined Alternative 1B



Using conveyor belts would result in different air quality impacts and traffic impacts than using trucks. Placement of a conveyor belt along Big Tujunga Canyon Road from Big Tujunga Reservoir to the pits in Sun Valley would require working out an alignment that considers roadway impacts.

In order to remove Big Tujunga Reservoir's entire 7.2 MCY planning quantity during the 20-year planning period, sediment removal operations involving excavation in conjunction with the use of conveyor would need to occur approximately 9 times.

Implementation of this alternative could cost an estimated $125 million. The breakdown of the estimated costs is provided in Table 8-5.

Table 8-5 Estimated costs for Big Tujunga Reservoir's Combined Alternative 1B

Activity	Quantity (MCY)	Estimated Cost (in millions)
Excavate sediment from Big Tujunga Reservoir	7.2	$22
Convey to Maple SPS	4.4	$8
Place at Maple SPS		$9
Convey sediment that does not fit in Maple SPS to the pits in Sun Valley	2.8	86
Place sediment at ___		$0[a]
Total	**7.2**	**$125**

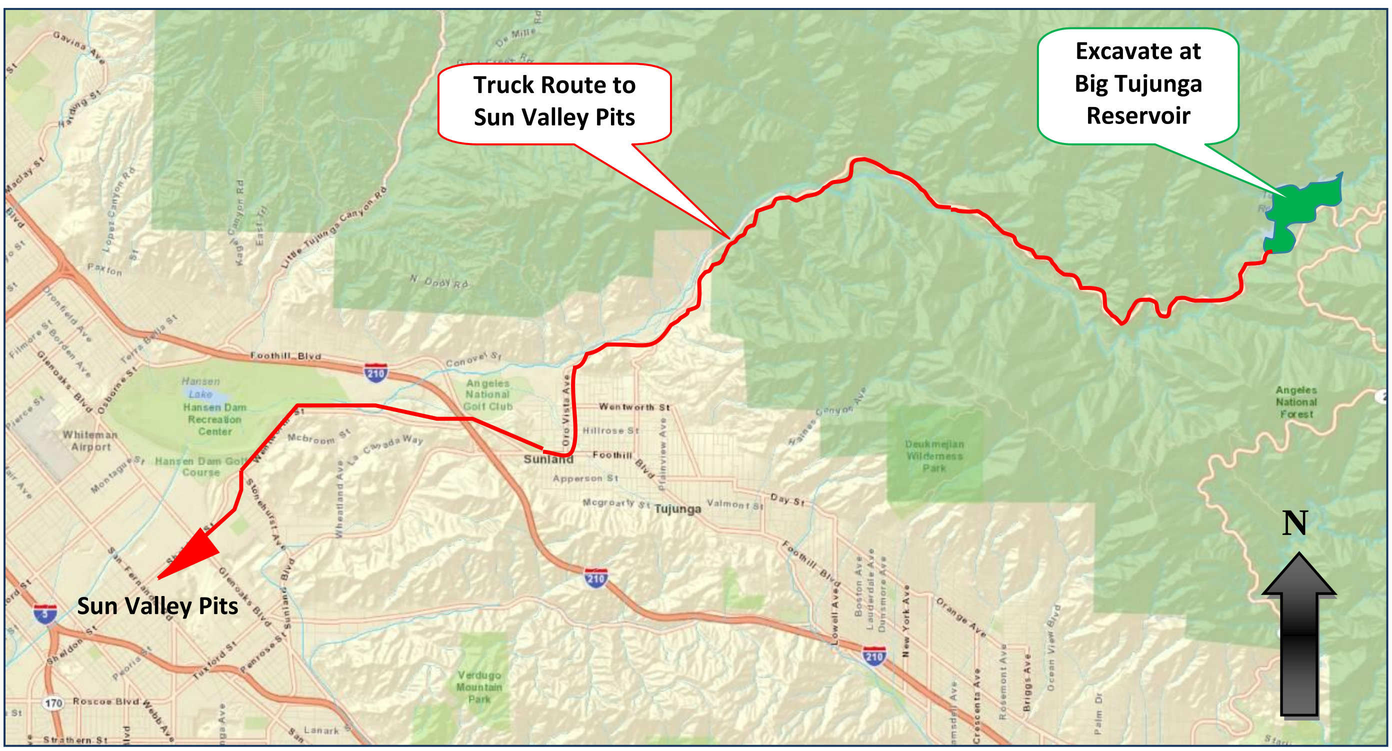
Note:

a. This assumes that most of the 2.8 MCY of sediment taken to third-party pits is marketable and that no tipping fees would have to be paid for the small fraction that would not be marketable.

8.1.7.3 Combined Alternative 2A: Excavate → Trucks → Sun Valley Pits

This alternative consists of transporting all sediment excavated from Big Tujunga Reservoir by truck and placing it at the pits in Sun Valley. Figure 8-18 shows a representation of this alternative.

Figure 8-18 Big Tujunga Reservoir Combined Alternative 2A



As discussed under Alternative 1A, for the most part, trucks directly transporting sediment from Big Tujunga Reservoir to a site in Sun Valley would travel along nonresidential roads. However, the route would pass along Sunland and Shadow Hills, as previously shown on Figure 8-7 and Figure 8-9. If the trucking route previously shown in Figure 8-8 could be arranged, trucking through Sunland would be avoided.

Employing Combined Alternative 2A to manage Big Tujunga Reservoir's 7.2-MCY planning quantity could require approximately 9 separate excavation and trucking operations, each which would last approximately 6 months and would consist of approximately 400 truck trips per weekday.

The estimated costs associated with this alternative total $100 million to $120 million, as shown in Table 8-6.

Table 8-6 Estimated costs for Big Tujunga Reservoir's Combined Alternative 2A

Activity	Quantity (MCY)	Estimated Cost (in millions)
Excavate sediment from Big Tujunga Reservoir	7.2	$22
Truck to pits in Sun Valley		$73
Place sediment at pit in Sun Valley		$7-24[a]
Total	**7.2**	**$100-120**

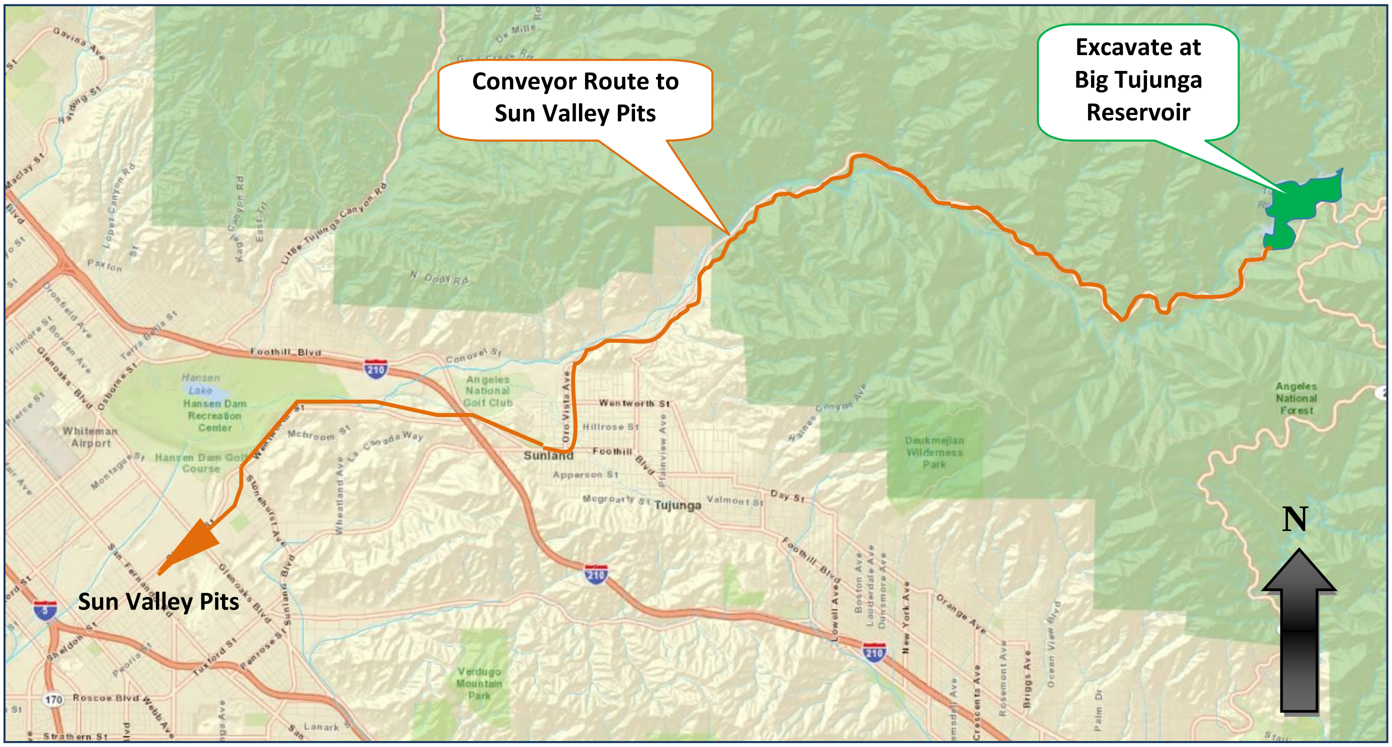
Note:

a. This assumes 33.3 percent of the sediment is marketable and would be accepted free of charge, that another 33.3 percent would also be accepted free of charge. The lower cost assumes the remainder of the material would be placed at a pit acquired by the Flood Control District. The higher cost pertains to the scenario in which the Flood Control District was not able to acquire a pit and had to pay tipping fees would have to be paid on the remainder 33.4 percent.

8.1.7.4 Combined Alternative 2B: Excavate → Conveyor → Sun Valley Pits

This alternative is basically the same as Combined Alternative 2A, except that conveyors would be used instead of trucks. Figure 8-19 shows a representation of this alternative. Placement of a conveyor belt along Big Tujunga Canyon Road from Big Tujunga Reservoir to the pits in Sun Valley would require working out an alignment that considers roadway impacts.

Figure 8-19 Big Tujunga Reservoir Combined Alternative 2B



Given the assumed conveyor efficiency and 6-month long operations per year, approximately 9 excavation and conveyor operations would have to be employed to remove the 7.2-MCY planning quantity from Big Tujunga Reservoir.

The estimated costs associated with this alternative total $115 million to $130 million, as shown in Table 8-7.

Table 8-7 Estimated costs for Big Tujunga Reservoir's Combined Alternative 2B

Activity	Quantity (MCY)	Estimated Cost (in millions)
Excavate sediment from Big Tujunga Reservoir	7.2	$22
Convey to pits in Sun Valley		$86
Place sediment at pits in Sun Valley		$7-24[a]
Total	7.2	$115-130

Note:

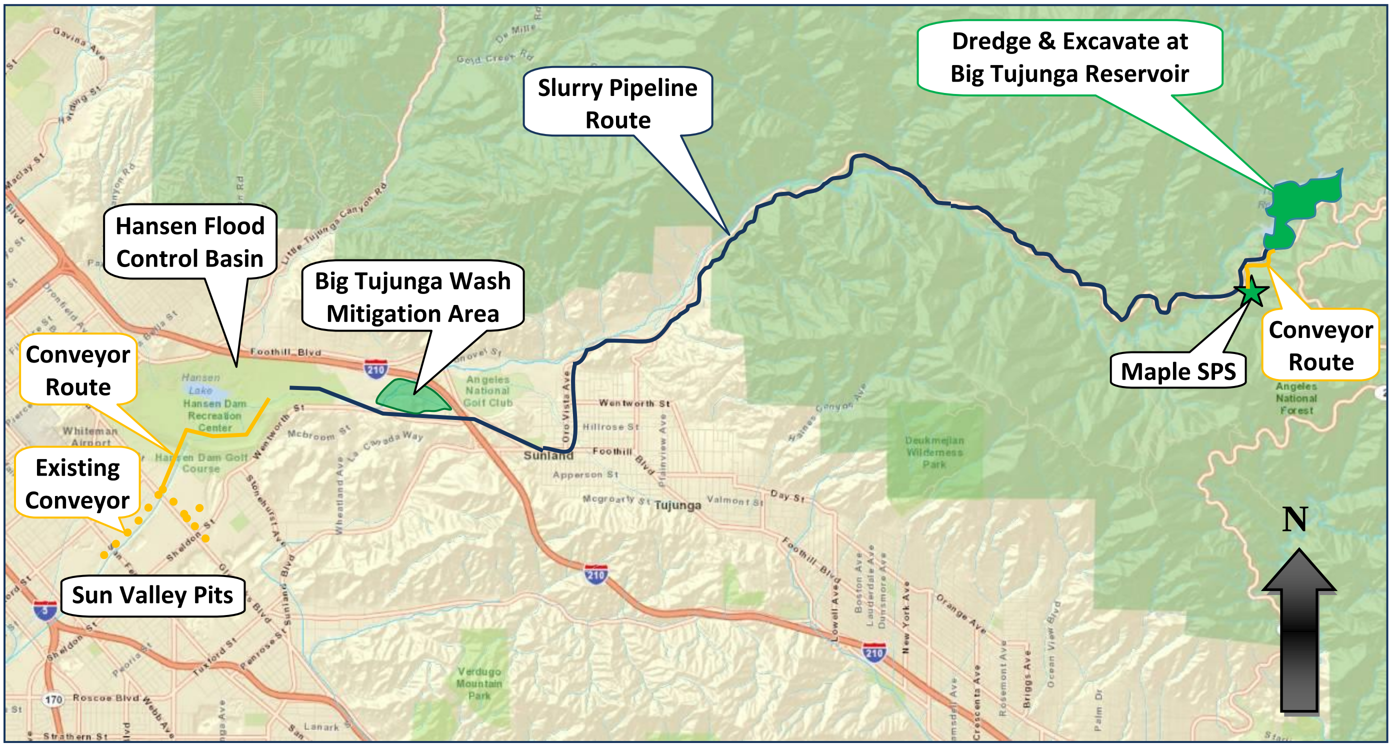
a. This assumes 33.3 percent of the sediment is marketable and would be accepted free of charge, that another 33.3 percent would also be accepted free of charge. The lower cost assumes the remainder of the material would be placed at a pit acquired by the Flood Control District. The higher cost pertains to the scenario in which the Flood Control District was not able to acquire a pit and had to pay tipping fees would have to be paid on the remainder 33.4 percent.

8.1.7.5 COMBINED ALTERNATIVE 3: DREDGE (4.8 MCY) → SLURRY PIPELINE → HANSEN FLOOD CONTROL BASIN → EXCAVATE → CONVEYOR → SUN VALLEY PITS + EXCAVATE (2.4 MCY) → CONVEYOR → MAPLE SPS

This alternative would involve sediment removal operations at the Army Corps of Engineers' Hansen Flood Control Basin in addition to sediment removal operations at Big Tujunga Reservoir. First, in order to create capacity for the material to be delivered to Hansen Flood Control Basin, sediment would be excavated from the basin and trucked to a privately or Flood Control District owned quarry in Sun Valley. Subsequently, sediment would be dredged from

Big Tujunga Reservoir and the sediment-water mixture transported to the basin through a slurry pipeline. Additionally, because the large material in Big Tujunga Reservoir would not be able to be dredged, the large material would have to be excavated. It was assumed the large material would be excavated and transported to Maple SPS on a conveyor. Figure 8-20 shows a representation of this alternative.

Figure 8-20 Big Tujunga Reservoir Combined Alternative 3



Implementation of this alternative is highly dependent on the ability to obtain permission from the Army Corps of Engineers to use Hansen Flood Control Basin as a dewatering and temporary sediment storage area for the dredged material and the ability to create enough capacity for the operations.

Given the assumptions made regarding dredging operations and assuming capacity at Hansen Flood Control Basin would not limit the dredging operations, it could take 12 dredging operations during the 20-year planning period to remove the 4.8-MCY of smaller sediment from the Big Tujunga Reservoir. Conveying the 4.8 MCY of sediment that would need to be preexcavated from Hansen to the pits in Sun Valley was approximated to be able to be done in 6 conveyor operations. The 2.4 MCY of larger material remaining in Big Tujunga Reservoir after dredging could be excavated and conveyed to Maple SPS in approximately 3 conveyor operations.

Implementation of this alternative could cost from an estimated $210 million to $245 million, depending on the destination of the sediment. The breakdown of the estimated costs is provided in Table 8-8.

Table 8-8 Estimated costs for Big Tujunga Reservoir's Combined Alternative 3

Activity	Quantity (MCY)	Estimated Cost (in millions)
Excavate material at Hansen Flood Control Basin to create capacity	4.8 (Sediment that could potentially be dredged)	$14
Convey material on new conveyor from Hansen Flood Control Basin to existing conveyor downstream of Hansen Dam		$7
Convey material on existing conveyor to the pits in Sun Valley		$1
Place sediment at pits in Sun Valley		$14-48[(a)]
Dredge sediment from Big Tujunga Reservoir		$50
Construct and operate slurry pipeline from Big Tujunga Reservoir to Hansen Flood Control Basin		$104
Excavate larger material that cannot be dredged	2.4 (Sediment too large to be dredged)	$7
Convey larger material that cannot be dredge to Maple SPS		$8
Place at Maple SPS		$5
Total	**7.2**	**$210-245**

Note:

a. This assumes 33.3 percent of the sediment is marketable and would be accepted free of charge, that another 33.3 percent would also be accepted free of charge. The lower cost assumes the remainder of the material would be placed at a pit acquired by the Flood Control District. The higher cost pertains to the scenario in which the Flood Control District was not able to acquire a pit and had to pay tipping fees would have to be paid on the remainder 33.4 percent.

8.1.7.6 COMBINED ALTERNATIVE 4A: SLUICE (4.8 MCY) → HANSEN FLOOD CONTROL BASIN → EXCAVATE → CONVEYOR → SUN VALLEY PITS + EXCAVATE (2.4 MCY) → CONVEYOR → MAPLE SPS

This alternative is very similar to Combined Alternative 3 except for the part that for this alternative sediment would be sluiced from Big Tujunga Reservoir to Hansen Flood Control Basin along Big Tujunga Wash as opposed to dredging the reservoir and transporting the sediment in an enclosed slurry pipeline. Employing this alternative would result in habitat impacts along Big Tujunga Wash while Combined Alternative 3 would not. Figure 8-21 shows a representation of this alternative.

Figure 8-21 Big Tujunga Reservoir Combined Alternative 4A

Given the assumptions made regarding sluicing operations and assuming capacity at Hansen Flood Control Basin would not limit the sluicing operations, it could take 16 sluicing operations during the 20-year planning period to remove the 4.8 MCY of smaller sediment from the Big Tujunga Reservoir. Excavating and conveying the remaining 2.4 MCY to Maple SPS would require approximately 3 conveyor operations.

Implementation of this alternative could cost from an estimated $70 million to $100 million, depending on the destination of the sediment. The breakdown of the estimated costs is provided in Table 8-9.

Table 8-9 Estimated costs for Big Tujunga Reservoir's Combined Alternative 4A

Activity	Quantity (MCY)	Estimated Cost (in millions)
Excavate material at Hansen Flood Control Basin to create capacity	4.8 (Sediment that could potentially be sluiced)	$14
Convey material on new conveyor from Hansen Flood Control Basin to existing conveyor downstream of the basin		$7
Convey material on existing conveyor to the pits in Sun Valley		$1
Place sediment at pits in Sun Valley		$14-48[a]
Sluice sediment from Big Tujunga Reservoir		$12
Excavate larger material that cannot be sluiced	2.4 (Sediment too large to be sluiced)	$7
Convey to Maple SPS the larger material that cannot be sluiced		$8
Place at Maple SPS		$5
Total	**7.2**	**$70-100**

Note:

a. This assumes 33.3 percent of the sediment is marketable and would be accepted free of charge, that another 33.3 percent would also be accepted free of charge. The lower cost assumes the remainder of the material would be placed at a pit acquired by the Flood Control District. The higher cost pertains to the scenario in which the Flood Control District was not able to acquire a pit and had to pay tipping fees would have to be paid on the remainder 33.4 percent.

8.1.7.7 COMBINED ALTERNATIVE 4B: SLUICE (4.8 MCY) → HANSEN FLOOD CONTROL BASIN → EXCAVATE → CONVEYOR → SUN VALLEY PITS + EXCAVATE (2.4 MCY) → TRUCKS → MAPLE SPS

This alternative is very similar to Combined Alternative 4A except that the larger-sized sediment that would not be able to be sluiced would be excavated from Big Tujunga Reservoir and trucked to the pits in Sun Valley. Figure 8-22 shows a representation of this alternative.

Figure 8-22 Big Tujunga Reservoir Combined Alternative 4B

Given the assumptions made regarding sluicing operations and assuming capacity at Hansen Flood Control Basin would not limit the sluicing operations, it could take 16 sluicing operations during the 20-year planning period to remove the 4.8-MCY of smaller sediment from the Big Tujunga Reservoir. Excavating and conveying the remaining 2.4 MCY to Maple SPS would require approximately 3 conveyor operations.

Implementation of this alternative could cost from an estimated $70 million to $90 million, depending on the destination of the sediment. The breakdown of the estimated costs is provided in Table 8-10.

Table 8-10 Estimated costs for Big Tujunga Reservoir's Combined Alternative 4B

Activity	Quantity (MCY)	Estimated Cost (in millions)
Excavate material at Hansen Flood Control Basin to create capacity	4.8 (Sediment that could potentially be sluiced)	$14
Convey material on new conveyor from Hansen Flood Control Basin to existing conveyor downstream of the basin		$7
Convey material on existing conveyor to the pits in Sun Valley		$1
Sluice sediment from Big Tujunga Reservoir		$12
Excavate larger material that cannot be sluiced	2.4 (Sediment too large to be sluiced)	$7
Truck the larger material that cannot be sluiced to the pits in Sun Valley		$24
Place sediment at pits in Sun Valley	7.2	$7-24[a]
Total	**7.2**	**$70-90**

Note:

a. This assumes 33.3 percent of the sediment is marketable and would be accepted free of charge, that another 33.3 percent would also be accepted free of charge. The lower cost assumes the remainder of the material would be placed at a pit acquired by the Flood Control District. The higher cost pertains to the scenario in which the Flood Control District was not able to acquire a pit and had to pay tipping fees would have to be paid on the remainder 33.4 percent.

8.1.8 SUMMARY AND RECOMMENDATIONS

8.1.8.1 SUMMARY

Over the next 20 years, 7.2 MCY of sediment are planned to be removed Big Tujunga Reservoir including the 2 MCY currently accumulated in the reservoir. The different management alternatives are briefly explained below and the impacts are shown in Table 8-11.

Sediment Management Alternatives

1A Excavate (7.2 MCY) → Trucks → Maple SPS (4.4 MCY) & Sun Valley Pits (2.8 MCY)
This alternative involves draining the reservoir, excavating the sediment under dry conditions, and trucking it to Maple SPS and the pits in Sun Valley. Maple SPS would be filled; the rest of the sediment would be placed at the pits in Sun Valley. Habitat would be impacted along Big Tujunga Wash due to draining of the reservoir.

1B Excavate (7.2 MCY) → Conveyor → Maple SPS (4.4 MCY) & Sun Valley Pits (2.8 MCY)
This alternative is similar to Alternative 1A, but instead of trucks, this alternative involves a conveyor over 10 miles in length. Habitat could be impacted depending on the conveyor route.

2A Excavate → Trucks → Sun Valley Pits
This alternative consists of transporting all sediment excavated from Big Tujunga Reservoir by truck and placing it at the pits in Sun Valley. Maple Canyon SPS would not be used.

2B Excavate → Conveyor → Sun Valley Pits
This alternative is the same as Alternative 2A, except that conveyors would be used. Placement of a conveyor along Big Tujunga Canyon Road from Big Tujunga Reservoir to the pits in Sun Valley would require designing an alignment that considers roadway impacts.

3 Dredge (4.8 MCY) → Slurry Pipeline → Hansen Flood Control Basin → Excavate → Conveyor → Sun Valley Pits + Excavate (2.4 MCY) → Conveyor → Maple SPS

Smaller-sized material would be dredged and transported via slurry pipeline to Hansen Flood Control Basin (Hansen FCB). The larger-sized material would be excavated and transported to Maple SPS on a conveyor. This alternative is highly dependent on the ability to obtain permission from the Army Corps of Engineers to use Hansen FCB and the ability to create enough capacity for the operations.

4A Sluice (4.8 MCY) → Hansen Flood Control Basin → Excavate → Conveyor → Sun Valley Pits + Excavate (2.4 MCY) → Conveyor → Maple SPS

This alternative is very similar to Alternative 3 except sediment would be sluiced rather than dredged and the larger material would be placed at the pits in Sun Valley. Employing this alternative would result in habitat impacts along Big Tujunga Wash. Additionally, this alternative would require designing a conveyor alignment that considers roadway impacts.

4B Sluice (4.8 MCY) → Hansen Flood Control Basin → Excavate → Conveyor → Sun Valley Pits + Excavate (2.4 MCY) → Trucks → Maple SPS

This alternative is basically the same as Alternative 4A, except that transportation of the larger materials would be via trucks as opposed to a conveyor.

Table 8-11 Summary of Sediment Management Alternatives for Big Tujunga Reservoir

Alternative		Quantity Removed (MCY)	Environmental				Social			Implementability	Performance		Cost
			Habitat	Water Quality	Groundwater Recharge	Air Quality[a]	Traffic	Visual	Noise	Special Permit/ Agreement Required[b]	Previous Experience	# of operations required in next 20 years	$ Millions
1A	Excavation	7.2	◑		○	◑		○	○		Yes	9	65
	Trucks					●	●	◑	◑				
	Maple Canyon SPS	4.4	◑					◑		Yes			
	Pits in Sun Valley	2.8								Yes			
1B	Excavation	7.2	◑		○	◑		○	○		Yes	9	125
	Conveyor		◑					◑	○				
	Maple Canyon SPS	4.4	◑			○		◑		Yes			
	Pits in Sun Valley	2.8								Yes			
2A	Excavation	7.2	◑		○	◑		○	○		Yes	9	100-120
	Trucks					●	●	◑	◑				
	Pits in Sun Valley									Yes			
2B	Excavation	7.2	◑		○	◑		○	○		Yes	9	115-130
	Conveyor		◑					◑	○				
	Pits in Sun Valley									Yes			
3	Dredge	4.8	○	◑	○			○	○		No	12	210-245
	Slurry Pipeline to Hansen FCB		◑							Yes			
	Hansen FCB		◑	●	○	◑		◑	◑				
	Conveyor from Hansen FCB to Pits in Sun Valley		○					◑	○	Yes			
	Pits in Sun Valley									Yes			
	Excavation	2.4	◑		○	◑		○	○		Yes	3	
	Conveyor							◑	○				
	Maple Canyon SPS		◑					◑		Yes			
4A	Sluice to Hansen FCB	4.8	●	●	◑			◑		Yes	Yes	16	70-100
	Hansen FCB		◑	●	○	◑		◑	○	Yes			
	Conveyor from Hansen FCB to Pits in Sun Valley		○					◑	○				
	Pits in Sun Valley									Yes			
	Excavation	2.4	◑		○	◑		○	○			3	
	Conveyor		◑					◑	○				
	Maple Canyon SPS		◑					◑		Yes			
4B	Sluice to Hansen FCB	4.8	●	●	◑			◑		Yes	Yes	16	70-90
	Hansen FCB		◑	●	○	◑		◑	○	Yes			
	Conveyor from Hansen FCB to Pits in Sun Valley		○					◑	○				
	Pits in Sun Valley									Yes			
	Excavation	2.4	◑		○	◑		○	○			3	
	Trucks					●	●	◑	◑				
	Pits in Sun Valley												

Legend:

●	significant impact
◑	some impact
○	possible impact
	no impact

Notes:

(a) Use of low-emission trucks would reduce air quality impacts from significant impact (●) to some impact (◑).

(b) All options require environmental regulatory permits.

8.1.8.2 RECOMMENDATIONS

It is recommended that all the alternatives detailed here, except Alternative 3, be considered for future sediment removal projects at Big Tujunga Reservoir. Additionally, combining the alternatives should be taken into consideration. Alternative 3 should be considered only after all other alternatives are deemed infeasible. This recommendation is based on the high estimated cost.

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8.2 DEVIL'S GATE RESERVOIR

8.2.1 BACKGROUND

Devil's Gate Dam, shown in Figure 8-23, is an arched concrete gravity dam that was constructed in 1920 by the Flood Control District and had an original storage capacity of approximately 7.4 MCY. With a drainage area of 31.9 square miles, Devil's Gate Dam is operated for flood risk management as well as used for recreational purposes.

Figure 8-23 Aerial of Devil's Gate Reservoir

8.2.1.1 LOCATION

Devil's Gate Dam and Reservoir are located in between the cities of La Cañada Flintridge (approximately 2.2 miles southeast) and Altadena (approximately 2.6 miles west) in the City of Pasadena, as shown in Figure 8-24. The dam and reservoir are part of the Hahamongna Watershed Park. Located just off Interstate 210, this dam and reservoir are surrounded by residential buildings. While the reservoir looks to be relatively dry at most times, the water captured in the reservoir is released into the Arroyo Seco concrete channel just downstream of the dam and sent downstream into the Los Angeles River. The reservoir is long and broad, with a length of approximately 1.1 miles and an average width of 850 feet with relatively flat-side slopes. Figure 8-25 shows the topography of Devils Gate Reservoir.

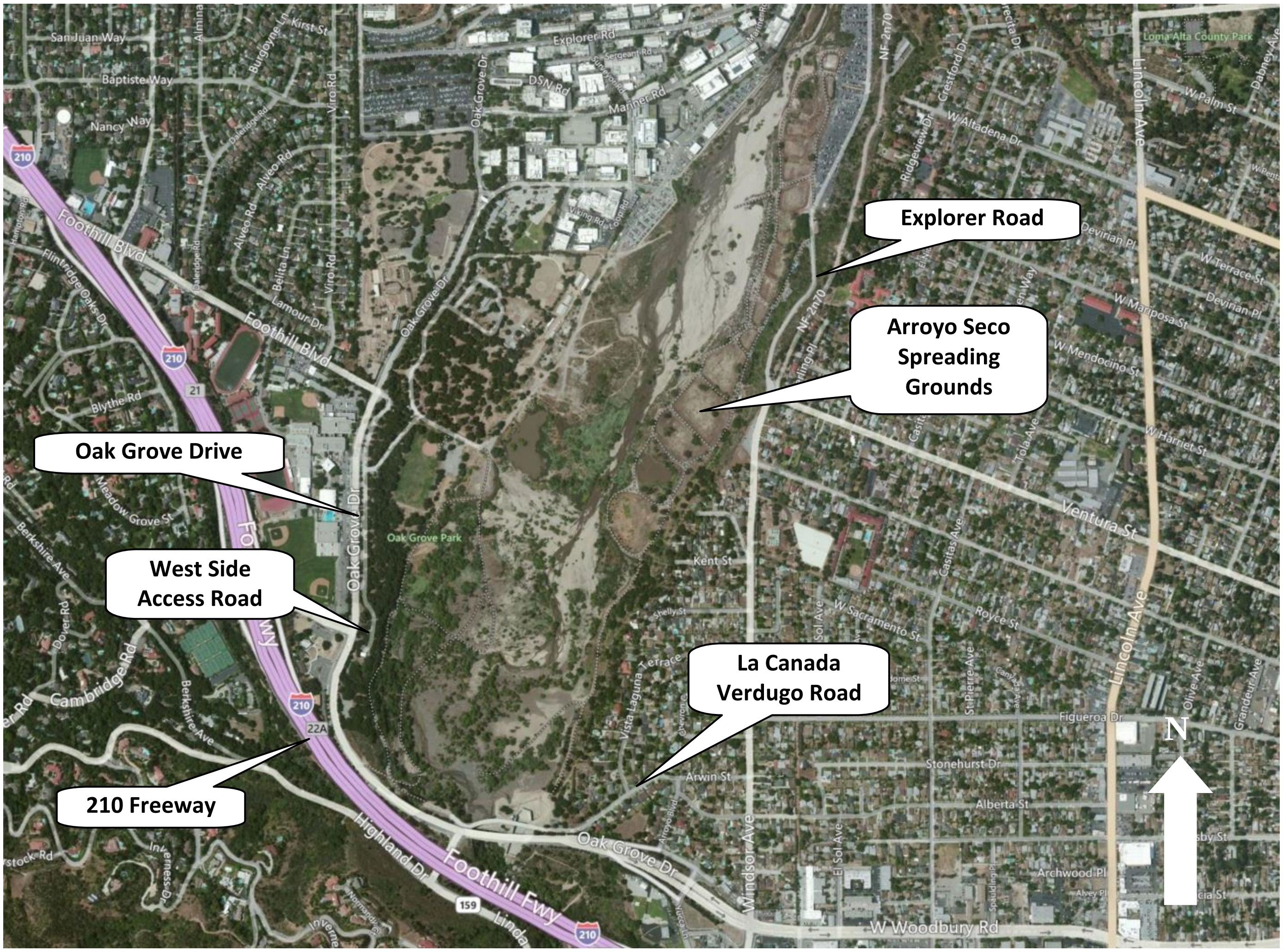
Figure 8-24 Vicinity Map of Devil's Gate Reservoir

Figure 8-25 Devil's Gate Reservoir Topography

8.2.1.2 ACCESS

Access to the dam and reservoir is available on all sides, as shown in Figure 8-26. The dam can be accessed through the west side access road off Oak Grove Drive or La Canada Verdugo Road while the upstream end of the reservoir can be accessed through various access roads off of Explorer Road. All of these roads can accommodate two-way traffic for their entire lengths.

Figure 8-26 Devil's Gate Dam and Vicinity



8.2.1.3 DAM OUTLETS

In addition to being equipped with a variety of valves, Devil's Gate Dam is also equipped with two 7-foot by 10-foot slide gates and a 5-foot by 5-foot sluice gate.

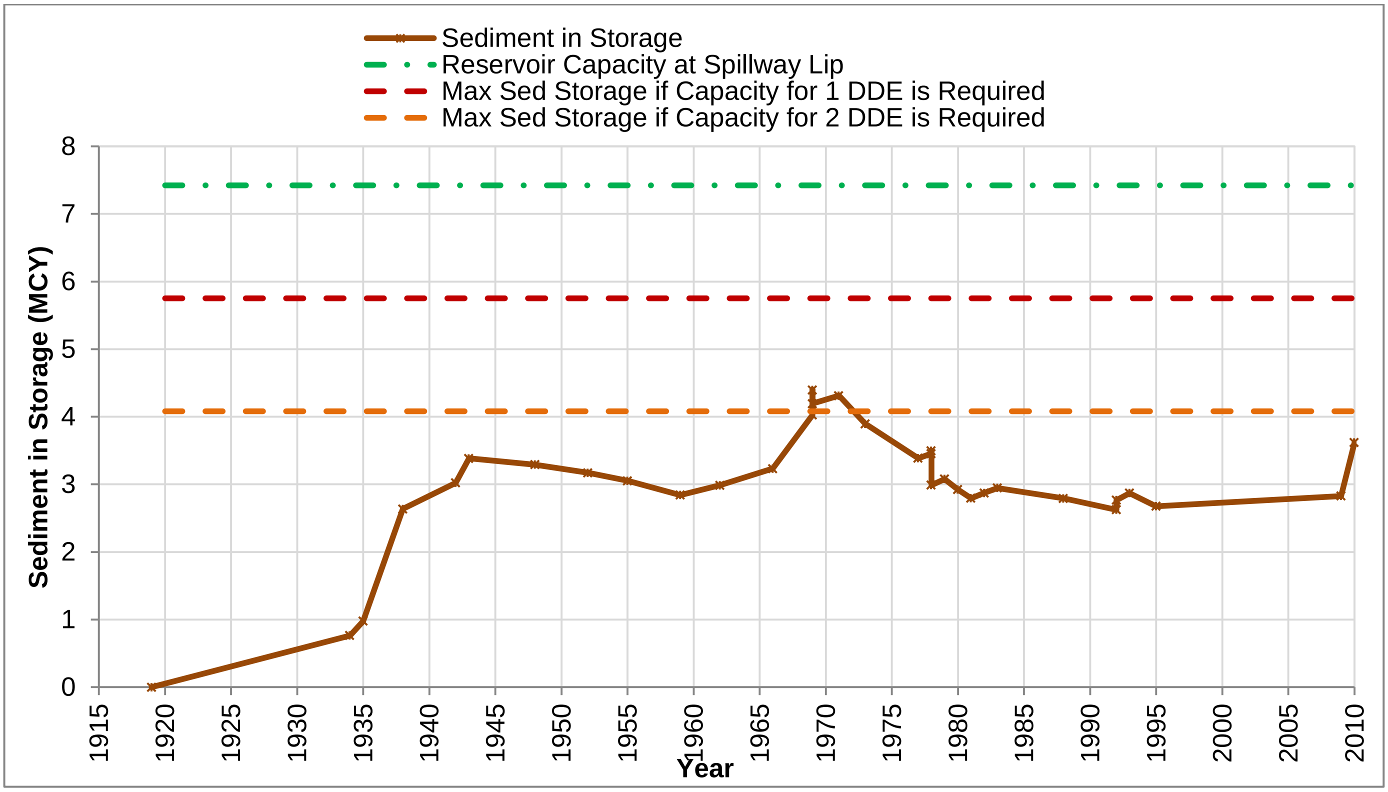
8.2.1.4 DOWNSTREAM FLOOD CONTROL AND WATER CONSERVATION SYSTEM COMPONENTS

Water that passes through the Arroyo Seco can be diverted to the Arroyo Seco Spreading Grounds, upstream and east of Devil's Gate Reservoir. Devil's Gate Reservoir is not designed to store water during dry months as there are no groundwater recharge facilities immediately downstream of the reservoir. The dam discharges to the Arroyo Seco, which eventually joins the Los Angeles River downstream.

8.2.1.5 SEDIMENT DEPOSITION AND REMOVAL HISTORY

Figure 8-27 shows the approximate sediment storage in Devil's Gate Reservoir. It is the Flood Control District's policy to retain enough storage capacity within a reservoir for two DDEs, which are calculated and determined for each specific reservoir. The graph shows that the Flood Control District has reduced the quantity of sediment in storage at Devil's Gate Reservoir on numerous occasions, even before reaching the threshold capacity.

Figure 8-27 Graph of Historical Sediment Storage at Devil's Gate Reservoir



Sediment has been removed 32 times in the 92-year life of the reservoir as shown in Table 8-12. Table 8-12 shows that both excavation and sluicing have been used to remove sediment from Devils Gate Reservoir in the past. The majority of the sediment (73 percent) has been removed through excavation.

Table 8-12 Devils Gate Reservoir historical sediment accumulation and removal

Survey Date		Reservoir Capacity @ Elevation 1,054 ft (MCY)	Quantity Sluiced (MCY)	Quantity Excavated (MCY)	Sediment Accumulated Between Surveys (MCY)	Sediment in Storage (MCY)
October	1919	7.42	-	-	-	-
September	1934	6.66	-	0.08	0.84	0.76
June	1935	6.45	-	-	0.21	0.98
June	1938	4.79	-	-	1.66	2.64
January	1942	4.40	1.04	0.04	1.46	3.02
December	1943	4.04	0.10	0.03	0.50	3.38
Fall	1948	4.13	0.12	0.07	0.10	3.29
July	1952	4.25	0.41	0.14	0.43	3.17
September	1955	4.37	-	0.12	-	3.05
December	1959	4.58	-	0.28	0.07	2.84
May	1962	4.44	-	0.70	0.84	2.99
September	1966	4.19	0.08	0.60	0.92	3.23
February	1969	3.40	-	0.03	0.83	4.03
March	1969	3.02	-	-	0.37	4.40
November	1969	3.23	0.19	0.01	-	4.19
December	1971	3.11	-	0.23	0.35	4.31
October	1973	3.53	-	0.47	0.06	3.90
March	1977	4.04	-	0.75	0.24	3.39
March	1978	3.97	-	0.24	0.31	3.45
July	1978	3.93	-	-	0.04	3.50
December	1978	4.43	-	0.51	-	2.99
February	1979	4.34	0.25	0.12	0.47	3.08
March	1980	4.50	-	0.45	0.30	2.92
July	1981	4.63	-	0.32	0.19	2.79
September	1982	4.55	-	0.10	0.18	2.87
April	1983	4.48	-	0.05	0.13	2.95
June	1988	4.63	-	0.20	0.05	2.79
February	1992	4.80	-	0.17	-	2.62
July	1992	4.66	-	-	0.14	2.77
April	1993	4.68	-	-	0.10	2.87
November	1995	4.94	-	0.19	-	2.68
April	2009	4.79	-	0.02	0.18	2.83
April	2010	3.99	-	-	0.79	3.62
March	2011	3.72	-	-	0.27	3.89

8.2.2 PLANNING QUANTITY AND ASSUMED SEDIMENT CHARACTERISTICS

As described in Section 5, the 20-year planning quantity for sediment deposition into Devil's Gate Reservoirs is 4.3 MCY. The Flood Control District is also planning to remove the sediment currently in the reservoir, which amounts to approximately 4 MCY. Therefore, a total of approximately 8.3 MCY of sediment are planned for removal over the next 20 years.

8.2.3 DISCUSSION

During the Station Fire of 2009, almost all the undeveloped portion of the watershed tributary to Devil's Gate Reservoir was burned, making increased sediment accumulation at the reservoir inevitable during subsequent storm events. As a result, the reservoir's capacity was reduced significantly. As of June 2012, the reservoir did not have capacity to contain another major debris event safely and the outlet works have a risk of becoming clogged and inoperable. In order to maintain the proper functionality of the reservoir, the sediment accumulated in it has to be removed.

As of the June 2012, the Flood Control District was actively planning the Devil's Gate Reservoir Sediment Removal and Management Project and preparing an Environmental Impact Report (EIR) for the project. The Notice of Preparation for the Devil's Gate Reservoir Sediment Removal and Management Project EIR was issued in September 2011. The EIR will thoroughly discuss all feasible alternatives to remove, transport, and place sediment for Devil's Gate Reservoir. Please refer to www.LASedimentMangement.com for updates on the EIR.

8.3 PACOIMA RESERVOIR

8.3.1 BACKGROUND

Pacoima Dam, shown in Figure 8-28, is a concrete constant-angle arch dam that was constructed between 1925 and 1929 and had an original storage capacity at spillway of approximately 9.8 million cubic yards (MCY). With a drainage area of 28.2 square miles, Pacoima Dam is operated for flood risk management and water conservation purposes. Water impounded during the storm season behind the dam is gradually released and diverted into downstream spreading grounds to recharge groundwater. Pacoima Reservoir is not accessible to the public and is not used for recreation.

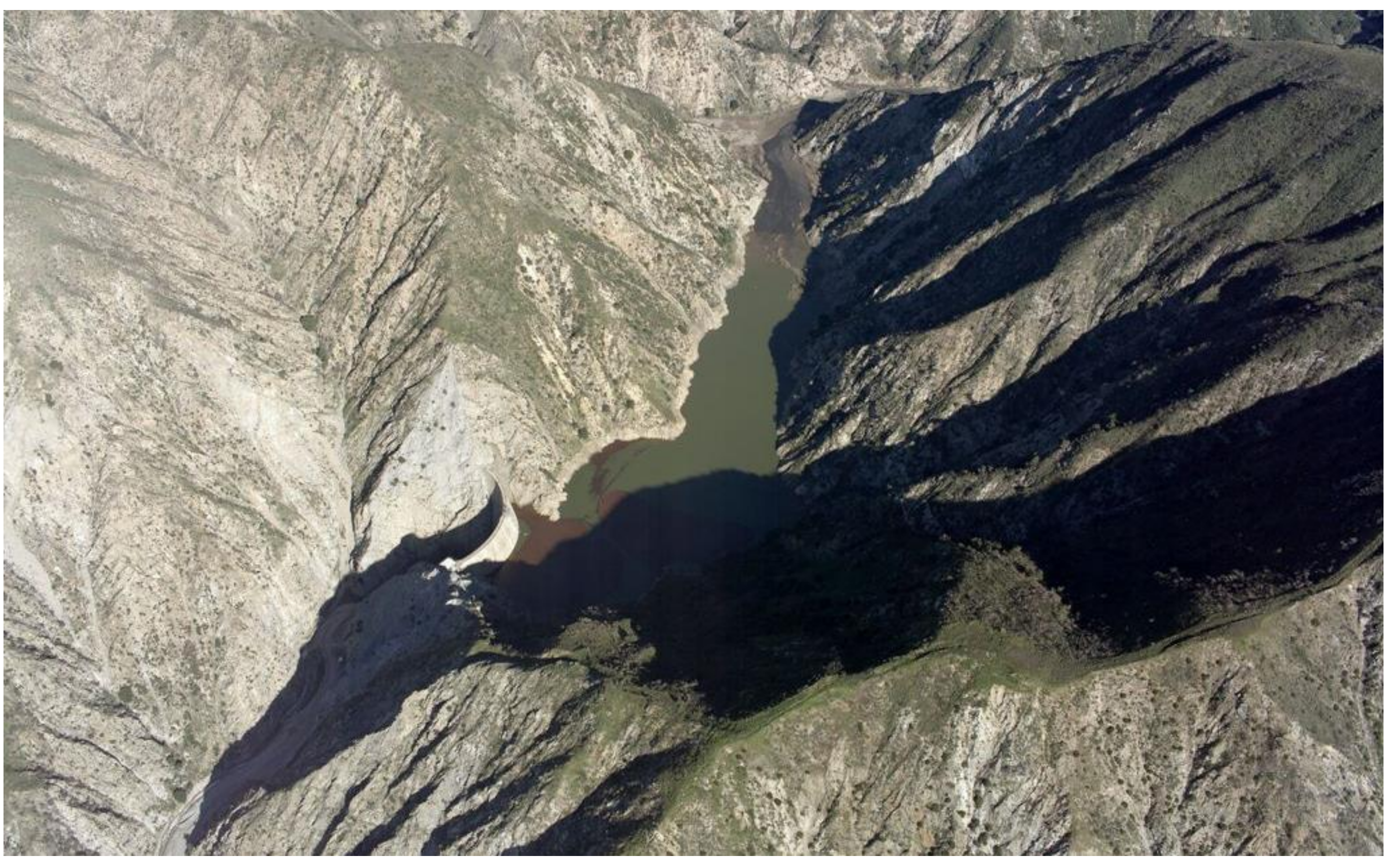
Figure 8-28 Pacoima Dam

8.3.1.1 LOCATION

Pacoima Dam and Reservoir are located in the Pacoima Canyon of the San Gabriel Mountains, approximately four miles north of the Cities of Los Angeles and San Fernando. The dam and reservoir are located within Flood Control District easements. Pacoima Creek and a few unnamed, natural streams that traverse the San Gabriel Mountains flow into Pacoima Reservoir. The waterway downstream of the dam is known as Pacoima Wash. The wash flows into Lopez Flood Control Basin, an Army Corps of Engineers facility used to manage the risk of floods. Figure 8-29 shows Pacoima Reservoir and the surroundings. Figure 8-30 shows an aerial of Pacoima Reservoir.

Figure 8-29 Pacoima Reservoir Vicinity Map

Figure 8-30 Pacoima Reservoir Topography

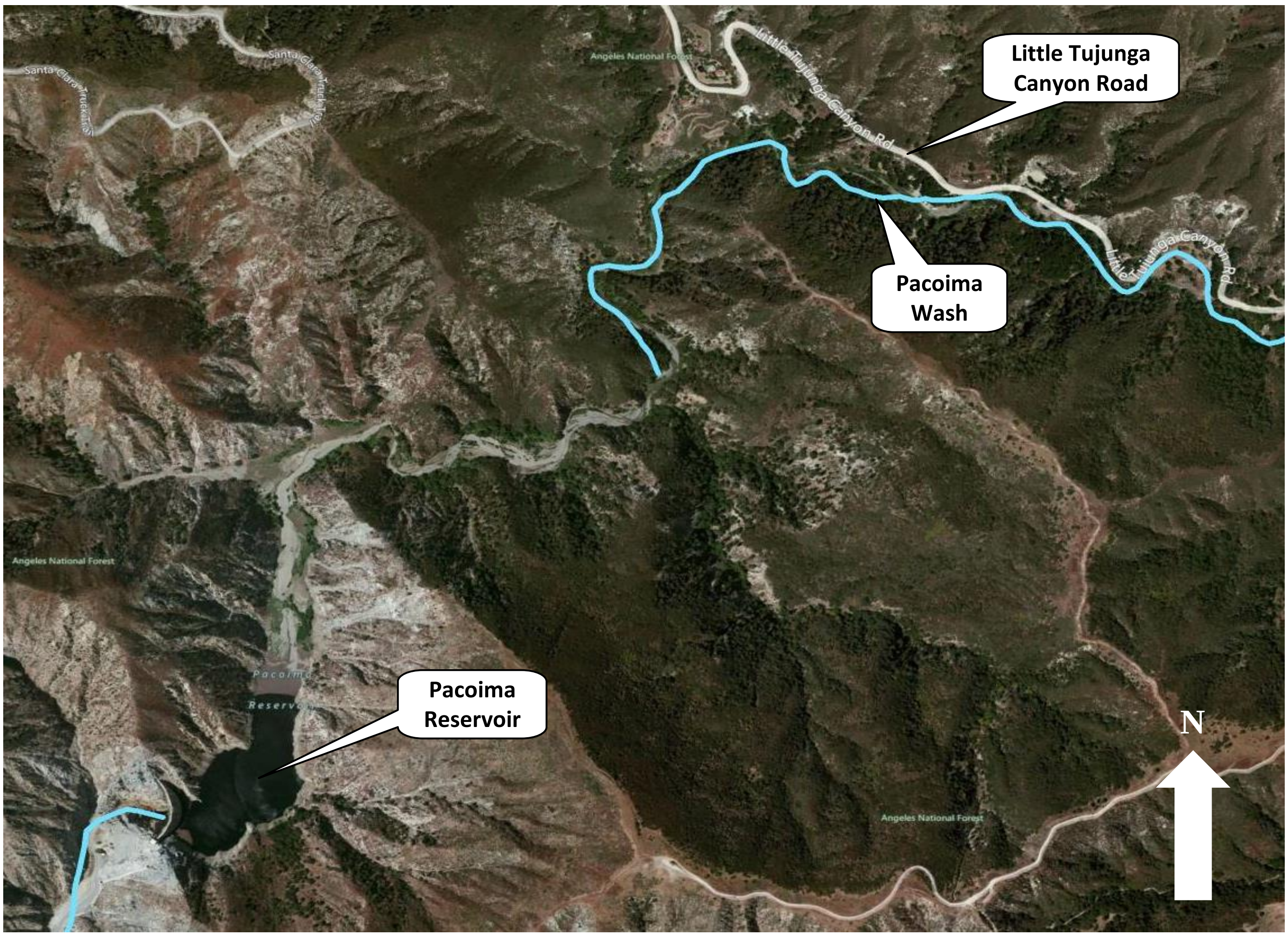


8.3.1.2 ACCESS

Vehicular access to the downstream area of the dam is available on Pacoima Canyon Road, an access road maintained by the Flood Control District and located on an easement through private property. The unpaved road begins at Gavina Avenue, a public local road, and runs northward along the east side of Pacoima Canyon. While Pacoima Canyon Road varies in width, it can accommodate two-way traffic for the majority of its length. The access road ends approximately 250 feet from the downstream toe of the dam. There is no vehicular access to the crest of the dam.

The Flood Control District owns a property that can be used to establish access from Little Tujunga Canyon Road to the back of Pacoima Reservoir. In the past, the back of the reservoir was connected to Little Tujunga Canyon Road through an easement along Pacoima Wash, which is shown on Figure 8-31.

Figure 8-31 Upstream end of Pacoima Reservoir



8.3.1.3 DAM OUTLETS

In addition to being equipped with a variety of valves, Pacoima Dam is also equipped with a sluiceway controlled by 5- by 5-foot slide gate.

8.3.1.4 DOWNSTREAM FLOOD CONTROL AND WATER CONSERVATION SYSTEM COMPONENTS

Water that passes through Pacoima Dam travels along Pacoima Wash to the Army Corps of Engineers' Lopez Flood Control Basin. Downstream of Lopez Flood Control Basin, the water flows through the concrete-lined Pacoima Wash Channel and passes by Lopez Spreading Grounds and Pacoima Spreading Grounds. Pacoima Wash Channel flows into the Los Angeles River downstream.

8.3.1.5 SEDIMENT DEPOSITION AND REMOVAL HISTORY

Figure 8-32 shows the approximate quantities of sediment accumulated in Pacoima Reservoir since the reservoir's first debris season in the mid-1920s. At Pacoima Reservoir as well as other reservoirs, it is the Flood Control District's practice to retain enough capacity within a reservoir for two incoming design debris events (DDEs), which are calculated and determined for each specific reservoir. For reference purposes, Table 8-13 shows Pacoima Reservoir's original reservoir capacity at spillway lip and the maximum sediment accumulation that allows for the storage of both one and two incoming DDEs. The graph shows that the Flood Control District has reduced the quantity of accumulated sediment at Pacoima Reservoir on numerous occasions, even before reaching the threshold capacity. Per the Flood Control District's records, which are summarized in Table 8-13, between Pacoima Reservoir's first debris season and June 2012, seven sediment removal projects were conducted at the reservoir, all of which were accomplished via sluicing.

Figure 8-32 Graph of Historical Sediment Accumulation at Pacoima Reservoir

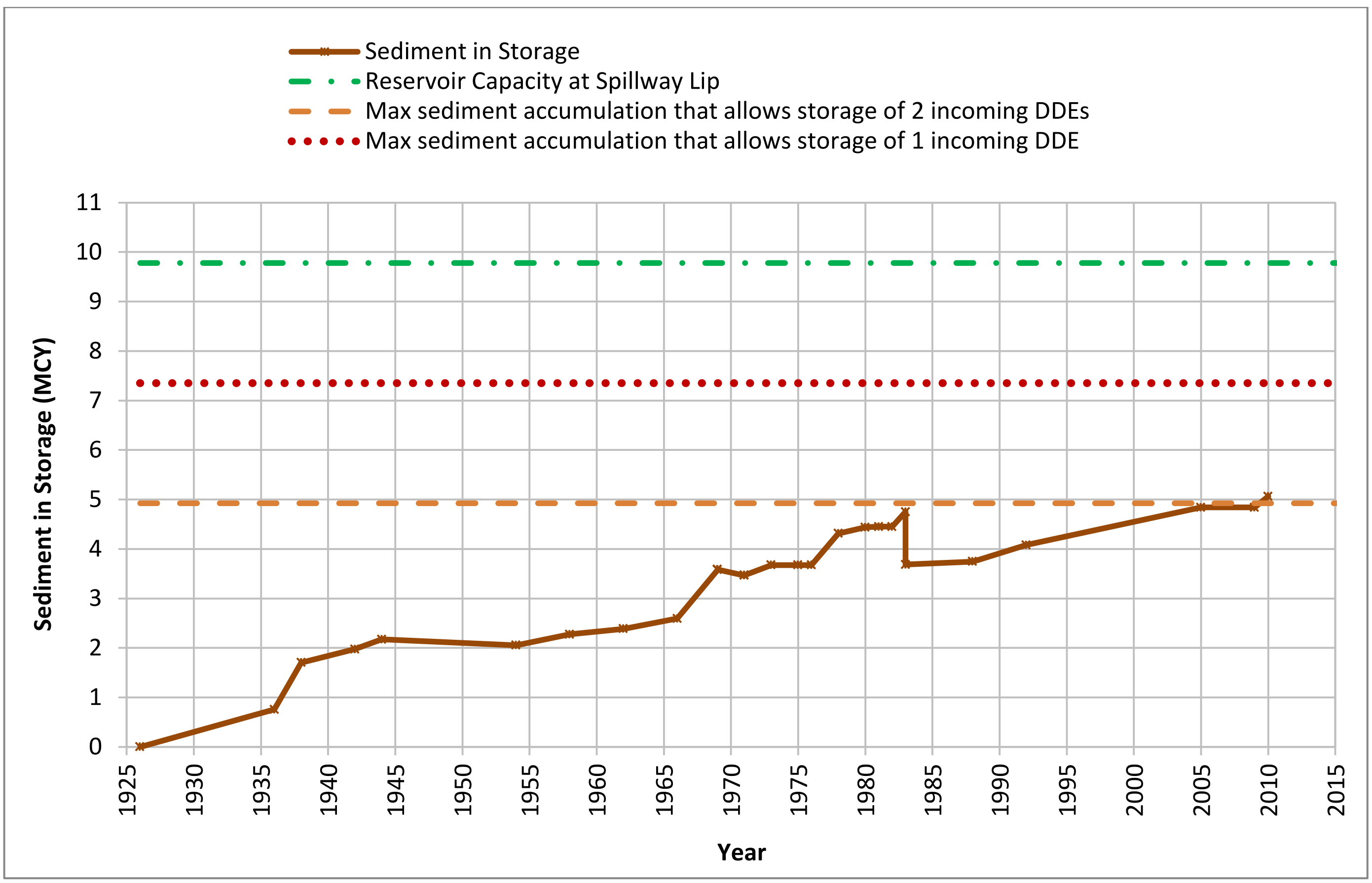


Table 8-13 Pacoima Reservoir Historical Sediment Accumulation and Removal

Survey Date		Reservoir Capacity (MCY)	Quantity Sluiced (MCY)	Quantity Excavated (MCY)	Sediment Accumulated Between Surveys (MCY)	Sediment in Storage (MCY)
October	1926	9.78	-	-	-	-
January	1936	9.02	-	-	0.76	0.76
March	1938	8.07	-	-	0.95	1.70
October	1942	7.80	-	-	0.27	1.97
December	1944	7.61	0.09	-	0.29	2.17
October	1954	7.72	0.18	-	0.07	2.05
June	1958	7.50	0.29	-	0.51	2.27
May	1962	7.39	0.08	-	0.20	2.39
August	1966	7.18	-	-	0.21	2.59
March	1969	6.20	-	-	0.99	3.58
August	1969	6.19	0.36	-	0.37	3.59
February	1971	6.31	0.12	-	-	3.47
October	1971	6.34[a]	-	-	-	3.47
May	1973	6.10	-	-	0.24	3.67
August	1975	6.11 [b]	-	-	-	3.67
December	1976	6.10 [b]	-	-	-	3.67
May	1978	5.46	-	-	0.64	4.31
March	1980	5.34	-	-	0.13	4.44
December	1981	5.32	-	-	0.01	4.45
October	1982	5.33 [b]	-	-	-	4.45
March	1983	5.03	-	-	0.30	4.75
August	1983	6.09	1.07	-	-	3.68
March	1988	6.03	-	-	0.06	3.75
July	1992	5.70	-	-	0.33	4.08
December	2005	4.94	-	-	0.76	4.84
January	2009	4.95 [b]	-	-	-	4.84
September	2010	4.73	-	-	0.22	5.06

Notes:

a. An earthquake in 1971 caused compaction of materials in the reservoir. There are no sluicing or excavation records between the February and October 1971 surveys.

b. Survey accuracy is responsible for the apparent change in reservoir capacity. No sediment removal project was conducted.

8.3.1.6 PAST SLUICING PROJECTS

As of 2012, the most recent and largest sluicing project at Pacoima Reservoir was an 8-week effort conducted in 1983. The project involved sluicing approximately 1 MCY of sediment from Pacoima Reservoir to Lopez Flood Control Basin; that is, approximately 1 MCY of sediment from Pacoima Reservoir were transported to Lopez Flood Control Basin through sediment-laden waters that flowed downstream along Pacoima Wash. Lopez Flood Control Basin was used as the dewatering site for the sediment-laden water from Pacoima Reservoir. Then the sediment was removed from Lopez Flood Control Basin by truck. The sediment was placed at the site of a new development near the flood control basin that needed fill material. The sluicing operation cost approximately $895,000 in 2011 dollars. Additionally, approximately $625,000 in 2011 dollars was spent on repairs needed after the sluicing operation. Removal of the sluiced sediment at Lopez Flood Control Basin totaled approximately $5.2 million in 2011 dollars. Therefore, the total cost of the 1-MCY sluicing project of 1983 was approximately $6.7 million in 2011 dollars.

The second largest sluicing project conducted at Pacoima Reservoir removed approximately 360,000 CY of sediment. While detailed records of the 1969 sluicing effort are not available, it was determined sluicing was accomplished using flows as low as 10 cubic feet per second (cfs).

8.3.2 PLANNING QUANTITY AND APPROACH

As described in Section 5, the projected 20-year sediment accumulation at Pacoima Reservoir is 2.4 MCY. The Flood Control District is also planning to remove up to an additional 5.2 MCY of sediment. As a result, the total 20-year planning quantity for Pacoima Reservoir is 7.6 MCY of sediment.

As discussed in Section 6, smaller-sized sediment can be removed from a reservoir by any of the removal alternatives considered. However, larger-sized sediment cannot be dredged or sluiced; this leaves excavation as the only removal alternative for larger-sized sediment. It was assumed that approximately 60 percent of Pacoima Reservoir’s 7.6-MCY planning quantity, or 4.6 MCY, could potentially be dredged or sluiced. Given this assumption, if dredging or sluicing was to be employed, approximately 3.0 MCY of sediment would have to be excavated from Pacoima Reservoir during the 20-year planning period in order to address the reservoir’s entire planning quantity.

8.3.3 POTENTIAL STAGING AND TEMPORARY SEDIMENT STORAGE AREAS

8.3.3.1 LOPEZ FLOOD CONTROL BASIN

Lopez Flood Control Basin – Background

Lopez Flood Control Basin, shown in Figure 8-33, is a facility under the jurisdiction of the Army Corps of Engineers that is approximately 2.2 miles downstream of Pacoima Dam. Lopez Flood Control Basin reduces the risk of debris-laden floodwaters between the facility and the Los Angeles River. It also serves as an inlet structure to direct flows into the Pacoima Wash Channel. A limited secondary use of Lopez Flood Control Basin is passive and low-impact recreation.

As discussed in Section 8.3.1.6, Lopez Flood Control Basin was used as a temporary sediment storage area for the sediment sluiced from Pacoima Reservoir in 1983. The Flood Control District recently engaged in discussions with the Army Corps of Engineers regarding the use of Lopez Flood Control Basin as a temporary sediment storage area for future sluicing operations from Pacoima Reservoir. Due to limited available storage capacity at the basin, the Army Corps of Engineers would require the Flood Control District to preexcavate the expected amount of sediment to be sluiced to their facility. Based on this requirement and a limitation due to the existing willow habitat in Lopez Flood Control Basin, a maximum capacity of approximately 500,000 CY would be available for temporary sediment storage.

Lopez Flood Control Basin could also be suitable for the temporary storage of dredged material and material transported via a conveyor belt from Pacoima Dam to the basin.

Figure 8-33 Lopez Flood Control Basin

Lopez Flood Control Basin – Environmental Impacts

As previously mentioned, as of 2012, a portion of Lopez Flood Control Basin contained willow habitat. Several special status animal and plant species are known to be present within or near Lopez Flood Control Basin, including willow flycatchers, Olive-sided flycatchers, yellow warblers, yellow-breasted chat, and Least Bell's Vireo. Special requirements to avoid impact to protected birds limit activity during the nesting season, which extends from February 1st to August 15th.

Water quality would be impacted at Lopez Flood Control Basin if it were to serve as the outlet of a slurry pipeline or the endpoint of a sluicing operation.

Air quality impacts are possible as a result of removing sediment within Lopez Flood Control Basin and transporting it to a permanent placement location. The most likely method would be excavating the basin under dry conditions and trucking the sediment out to a location yet to be determined.

Lopez Flood Control Basin – Social Impacts

Traffic and noise would increase near Lopez Flood Control Basin during removal of sediment from the basin. The hours of operation could be limited to minimize disturbance to residents.

The scenic and visual characteristics of Lopez Flood Control Basin and the view from neighboring communities would also be impacted by operations in the basin. However, it is expected that the actual storage of sediment at Lopez Flood Control Basin would minimally alter the visual characteristics of the basin as the temporary sediment storage area is expected to be very similar to the existing conditions (as of 2012).

Using Lopez Flood Control Basin as a temporary sediment storage area could potentially interfere with existing and future recreational features (e.g., trails and model aircraft flying area) in the basin. However, it may be possible to minimize interference by placing berms to divert flows away from recreational areas.

Lopez Flood Control Basin – Performance

The limited capacity at Lopez Flood Control Basin is a concern that needs to be analyzed further. While not preferred, increasing the size of the temporary sediment storage area and impacting existing habitat may need to be considered.

Lopez Flood Control Basin – Implementability

As has been discussed in this section, the Flood Control District would need to coordinate with the Army Corps of Engineers for use of Lopez Flood Control Basin as a staging or temporary sediment storage area. Coordination would involve issues such as preexcavation of material, permission to truck or place a conveyor within the flood control basin in order to remove the sediment, etc. The Flood Control District would also need to obtain environmental regulatory permits.

There is high technical certainty that once capacity has been made available at Lopez Flood Control Basin and the necessary permits are obtained, Lopez Flood Control Basin would be able to capture incoming flows of sediment from Pacoima Reservoir since it has been used previously for this purpose.

Lopez Flood Control Basin – Cost

As previously discussed, use of Lopez Flood Control Basin as a temporary storage area would require preexcavation and removal of the expected amount of sediment to be delivered to the basin. The estimated cost to excavate sediment from a facility like Lopez Flood Control Basin is approximately $3 per cubic yard. Excavating 4.6 MCY of sediment from the basin would cost approximately $14 million. Additionally, it is possible royalties would have to be paid to the Army Corps of Engineers for the sediment excavated and removed from Lopez Flood Control Basin.

8.3.3.2 CANYON SITES

Canyon Sites – Background

There are two unnamed canyons totaling approximately 100 acres that are located along Pacoima Canyon Road, approximately 1 mile downstream of Pacoima Dam, as shown in Figure 8-34. As of 2012, environmental documents were being prepared by another agency for a surface mining project proposed by the owner of a couple parcels within the canyons. Alternatively, the canyons present an opportunity for the management of sediment from Pacoima Reservoir. The canyons could serve as a staging area to transfer sediment transported via conveyors from Pacoima Reservoir to trucks or for temporary storage of sediment so that it could be gradually taken to a placement site.

Figure 8-34 Canyons downstream of Pacoima Dam

Canyon Sites – Environmental Impacts

Prior to being burned during the Sayre Fire in 2008, both canyons contained sage and chaparral habitat. Studies would be needed to identify the habitat within the canyons.

For use as a staging area, only a portion (approximately five acres) of one canyon would be impacted by sediment operations. Nearby mitigation sites could be used to offset the impacts to the canyons. Additionally, once work is complete, habitat could be reestablished on disturbed areas.

Air quality would be affected by emissions of equipment used at the site, but this alternative would have minimal impact to water quality and ground water recharge.

Canyon Sites – Social Impacts

Use of the canyons as a staging or temporary sediment storage area would create visual impacts and increase noise, particularly for the neighborhood located across from the canyons, on the other side of Pacoima Wash. Restrictions on working hours and equipment noise would limit impacts.

There are no permitted recreational activities in the canyons. As a result, no impacts on recreation are expected. Nonetheless, stakeholders have expressed a concern over potential disruption of people's recreational use of the canyons. Some stakeholders have also expressed concern that temporary storage of sediment in the canyons could change wind conditions and possibly affect hang gliding activities near the canyons.

Canyon Sites – Implementability

Acquisition of the parcels and environmental permitting complexity are concerns that would need to be addressed in order for this alternative to be implemented.

Canyon Sites – Performance

The canyons have adequate space to accommodate staging operations or the temporary storage of sediment. Therefore, performance of the canyons as potential staging or temporary sediment storage areas is not a concern.

Canyon Sites – Cost

The cost to acquire and mitigate for the use of a canyon staging or temporary sediment storage area was estimated to be approximately $5 million.

8.3.4 REMOVAL ALTERNATIVES

The following section discusses the impacts and costs of sediment removal at Pacoima Reservoir by means of excavation, dredging, and sluicing. Discussion of the transportation and placement alternatives is presented in Sections 8.3.5 and 8.3.6, respectively. Combined alternatives that address all phases of the sediment management process are presented and discussed in Section 8.3.7.

8.3.4.1 EXCAVATION

Excavation has not previously been used at Pacoima Reservoir to remove accumulated material. Under regular operating conditions, Pacoima Reservoir is never completely dry, even outside of the storm season. Since there is no access to the back of Pacoima Reservoir (as of 2012), an access road would need to be constructed if excavation is to be employed (refer to Figure 8-31).

Excavation – Environmental Impacts

During a previous biological survey, a two-striped garter snake was observed along Pacoima Creek. Fish resembling the arroyo chub, the only known native species to Pacoima Creek, have also been observed along Pacoima Creek. Reestablishment of the access road to the back of Pacoima Reservoir and complete drainage of the reservoir should consider potential impacts to these and other species.

Emissions during construction of the back access road to Pacoima Reservoir and during excavation of the reservoir could potentially impact air quality.

Excavation – Social Impacts

Using excavation to remove the sediment accumulated in Pacoima Reservoir is not expected to impact traffic other than during the mobilization and the demobilization of the operations.

Due to the remote location of Pacoima Reservoir, reestablishment of the back access road and excavation operations are not expected to impact the viewshed of any residences. However, such operations could impact the view of visitors to the ridges above the reservoir.

As previously stated, there are no permitted recreational uses within Pacoima Reservoir; therefore, the road construction and excavation operations would not conflict with such use. Draining the reservoir in anticipation of excavation activities is not expected to impact recreation along Pacoima Wash as the wash does not have permitted recreational uses either. Moreover, as long as flows from Pacoima Reservoir into Lopez Flood Control Basin are able to be restricted to nonrecreational areas within the flood control basin, impact to recreational resources at Lopez Flood Control Basin would not be expected as a result of draining Pacoima Reservoir.

Excavation – Implementability

Pacoima Reservoir and the potential location of the access road to the back of the reservoir are located within Flood Control District right of way.

Reestablishment of the access road and excavation of the reservoir would require environmental regulatory permits.

Given the Flood Control District's experience with excavating sediment from other reservoirs and constructing roads in remote areas, implementing such operations for the purpose of managing sediment at Pacoima Reservoir is technically certain.

Maintenance of the access road into the back of Pacoima Reservoir would depend on the type of road constructed and the degree to which future storm flows would affect the road.

Excavation – Performance (for Excavation)

The reservoir must be completely drained of water prior to excavation, a process that depends on the initial reservoir level, valve operations, and downstream channel conditions. Approximately two months would be required to drain the reservoir and begin excavating sediment. For additional performance concerns, refer to Section 6.

Excavation – Cost

The cost to excavate sediment from a reservoir is approximately $3 per cubic yard. Excavating Pacoima Reservoir's entire 7.6-MCY planning quantity would cost approximately $23 million. Alternatively, excavation of only the 3.0 MCY of larger-sized material that would not be able to be dredged or sluiced would cost approximately $9 million.

8.3.4.2 Dredging

As discussed previously, approximately 60 percent of Pacoima Reservoir's 7.6-MCY planning quantity, or 4.6 MCY, could potentially be dredged. Therefore, if dredging is employed at Pacoima Reservoir, excavation would have to be employed to remove the remaining 3.0 MCY. For the impacts associated with excavating material from Pacoima Reservoir, refer to Section 8.3.4.1.

Dredging – Environmental Impacts

Largemouth bass, a species that is not native to the west coast of the country, has been observed within Pacoima Reservoir. There may be other species present within Pacoima Reservoir. In order to ascertain the potential impacts dredging would have on the habitat within Pacoima Reservoir, the specifics of the habitat would need to be determined. Furthermore, existing habitat in the area(s) considered for discharge and drying of dredged material would also need to be determined.

Dredging could impact water quality within the reservoir by increasing turbidity. However, as discussed in Section 6, water quality concerns could be partially addressed with a silt curtain around the dredge. As discussed in Section 6, dredging sediment (and transporting it via a slurry pipeline) could affect water conservation.

Dredging – Social Impacts

Dredging of Pacoima Reservoir is not expected to have a long-lasting impact on traffic. Due to the reservoir's remote location, impacts on noise levels and visual resources would not be expected either. In addition, recreation would not be impacted because it is not permitted at Pacoima Reservoir.

Dredging – Implementability

No additional right of way is anticipated to be required for implementation of a dredging operation within Pacoima Reservoir. Concerns associated with stockpiling of dredged material outside of the reservoir parcels are discussed in Section 8.1.3.

As for any other operation within Pacoima Reservoir, dredging would require environmental regulatory permits.

As discussed in Section 6, while dredging is a technique that has been used in other areas of the country for decades, dredging has not previously been employed by the Flood Control District. Analysis would be needed to determine if dredging is implementable at Pacoima Reservoir. It is expected that a dredging operation at Pacoima Reservoir would be more difficult to implement compared to other reservoirs under the jurisdiction of the Flood Control District, particularly due to the lack of roadway access to the body of the reservoir.

Dredging – Performance

Considering the capabilities of the dredging equipment and slurry pipeline discussed in Section 6, it would take approximately twelve (12) 6-month dredging operations to dredge the entire 4.6 MCY of material that could potentially be able to be dredged from Pacoima Reservoir during the 20-year planning period. Each 6-month dredging operation would remove approximately 400,000 CY of sediment from the reservoir.

As discussed in Section 6, because the dredge would draw water in addition to sediment, approximately 4 MCY or 2,500 acre-feet of water-sediment slurry would need to be dewatered as a result of each dredging operation. Given the assumed capabilities of the dredging equipment, the water-sediment mixture would flow into the dewatering area at a rate of approximately 15 cfs. Dewatering requirements and the availability of a dewatering area would need to be evaluated as part of a reservoir-specific planning effort.

Dredging – Cost

Based on the estimated unit cost, dredging the entire 4.6 MCY of sediment that could potentially be dredged from Pacoima Reservoir during the 20-year planning period would cost approximately $48 million.

8.3.4.3 SLUICING (AS A REMOVAL METHOD)

Similar to dredging, approximately 60 percent of Pacoima Reservoir's 7.6-MCY planning quantity, or 4.6 MCY, could be small enough to sluice. Therefore, if sluicing is employed at Pacoima Reservoir, excavation would have to be employed to remove the remaining 3.0 MCY. For the impacts associated with excavating material from Pacoima Reservoir, refer to Section 8.3.4.1. This section focuses on sluicing as a sediment removal method and discusses the impacts of sluicing within Pacoima Reservoir only.

Sluicing (Removal) – Environmental Impacts

Within Pacoima Reservoir itself, sluicing would be expected to impact habitat in a similar manner as excavating sediment from the reservoir would since in both cases the reservoir would need to be drained. See the discussion under Excavation (Section 8.3.4.1) for more information.

As discussed in Section 6, employing sluicing to remove sediment would not impact water quality within the reservoir but could impact groundwater recharge.

Given the Flood Control District's previous sluicing projects, only a few pieces of equipment would be necessary within the reservoir in order to remove sediment by sluicing. Therefore, air quality impacts would not be significant.

Sluicing (Removal) – Social Impacts

Removal of sediment from Pacoima Reservoir through sluicing could impact the view from ridges above the reservoir as the reservoir needs to be drained and there would be equipment within the reservoir. There are no permitted recreational activities in the reservoir, so no impacts on recreation are expected.

Sluicing (Removal) – Implementability

Access to Pacoima Reservoir and activities within the reservoir do not pose any right of way concerns.

Similar to other methods of sediment removal already discussed, sluicing Pacoima Reservoir would require environmental regulatory permits.

Given that seven sluicing projects were conducted at Pacoima Reservoir in the past, it is technically certain that sluicing is able to be used to remove sediment from Pacoima Reservoir.

Sluicing (Removal) – Performance

Based on previous experiences, historical inflows into the reservoir, and Lopez Flood Control Basin's capacity, it was estimated that approximately 500,000 CY of sediment could be removed from Pacoima Reservoir in a year by sluicing. At this rate, sluicing would have to be performed approximately 9 of the 20 years in the planning period in order to sluice 4.6 MCY of sediment from the reservoir. However, it is important to note that the ability to sluice and quantity of sluiced material is dependent on inflow into the reservoir, which is entirely dependent on the weather.

In addition to inflow, another factor that limits sluicing is the availability of temporary storage areas and the rate at which they can receive the sluiced water-sediment mixture. As discussed in Section 6, it was assumed that the water-sediment slurry sluiced from a reservoir could have a nine-to-one water-to-sediment ratio. Therefore, sluicing 500,000 CY of sediment would result in the need to dewater 5 MCY or 3,000 AF of water-sediment slurry.

Sluicing (Removal) – Cost

Based on the estimated unit cost, sluicing 4.6 MCY of sediment from Pacoima Reservoir during the 20-year planning period would cost approximately $12 million.

8.3.5 TRANSPORTATION ALTERNATIVES

The following section discusses the impacts and costs of transporting sediment removed from Pacoima Reservoir by means of sluicing, trucking, conveyor belt, and slurry pipeline. Discussion of the removal alternatives was presented in Section 8.3.4. The placement alternatives are presented in Section 8.3.6. Combined alternatives that address all phases of the sediment management process are presented and discussed in Section 8.3.7.

8.3.5.1 SLUICING (AS A TRANSPORT METHOD)

This section focuses on the impacts of utilizing sluicing as a transport method to move sediment downstream of Pacoima Dam along Pacoima Wash to Lopez Flood Control Basin. For the impacts of sluicing operations within Pacoima Reservoir, refer to the discussion of sluicing as a removal method in Section 8.3.4.3. Impacts at Lopez Flood Control Basin were discussed in Section 8.3.3.1.

Sluicing (Transport) – Environmental Impacts

Past vegetation and wildlife surveys conducted along Pacoima Wash between Pacoima Dam and Lopez Flood Control Basin have indicated the presence of riparian habitat, special status plant species such as Plummer's mariposa lily and Davidson's bush mallow, and least Bell's vireo, a California-listed endangered species. Sluicing activities could be temporarily disruptive to the existing habitat.

Transporting sediment via sluicing would impact water quality along Pacoima Wash. As discussed in Section 6, transporting sediment via sluicing could affect water conservation.

Sluicing (Transport) – Social Impacts

Sluicing sediment along Pacoima Wash is not expected to have impacts on traffic or noise levels. Visual impacts would consist of flows in Pacoima Wash with higher levels of sediment than normal. No impacts are expected to Los Angeles Mission College's Athletic Field immediately west of Pacoima Wash. Stakeholders have expressed concern over potential impacts to areas used by hang gliding activities downstream Pacoima Reservoir and adjacent to Pacoima Wash.

Sluicing (Transport) – Implementability

While sluicing sediment along Pacoima Wash would not require right of way agreements, accessing the wash with equipment to manage the deposition of sediment along the wash would need them. Additionally, the Flood Control District would need to obtain environmental regulatory permits in order to sluice sediment along Pacoima Wash.

Given that as of 2012, seven sluicing operations have been conducted to transport sediment downstream of Pacoima Dam, sluicing is a technically certain method of transporting sediment downstream of the dam.

Sluicing (Transport) – Performance

As noted in the previous section that discussed sluicing as a removal method, approximately 500,000 CY of sediment could be sluiced from Pacoima Reservoir in a year. Given a nine-to-one water-to-sediment ratio, this would mean during a sluicing year approximately 5 MCY or 3,000 AF of water-sediment slurry would be transported along Pacoima Wash in a year. The ability of Pacoima Wash to handle said volumes will need to be considered. In addition, sediment deposition locations and the possibility of flushing the stream course to remove the deposits will need to be analyzed if sluicing is to be employed.

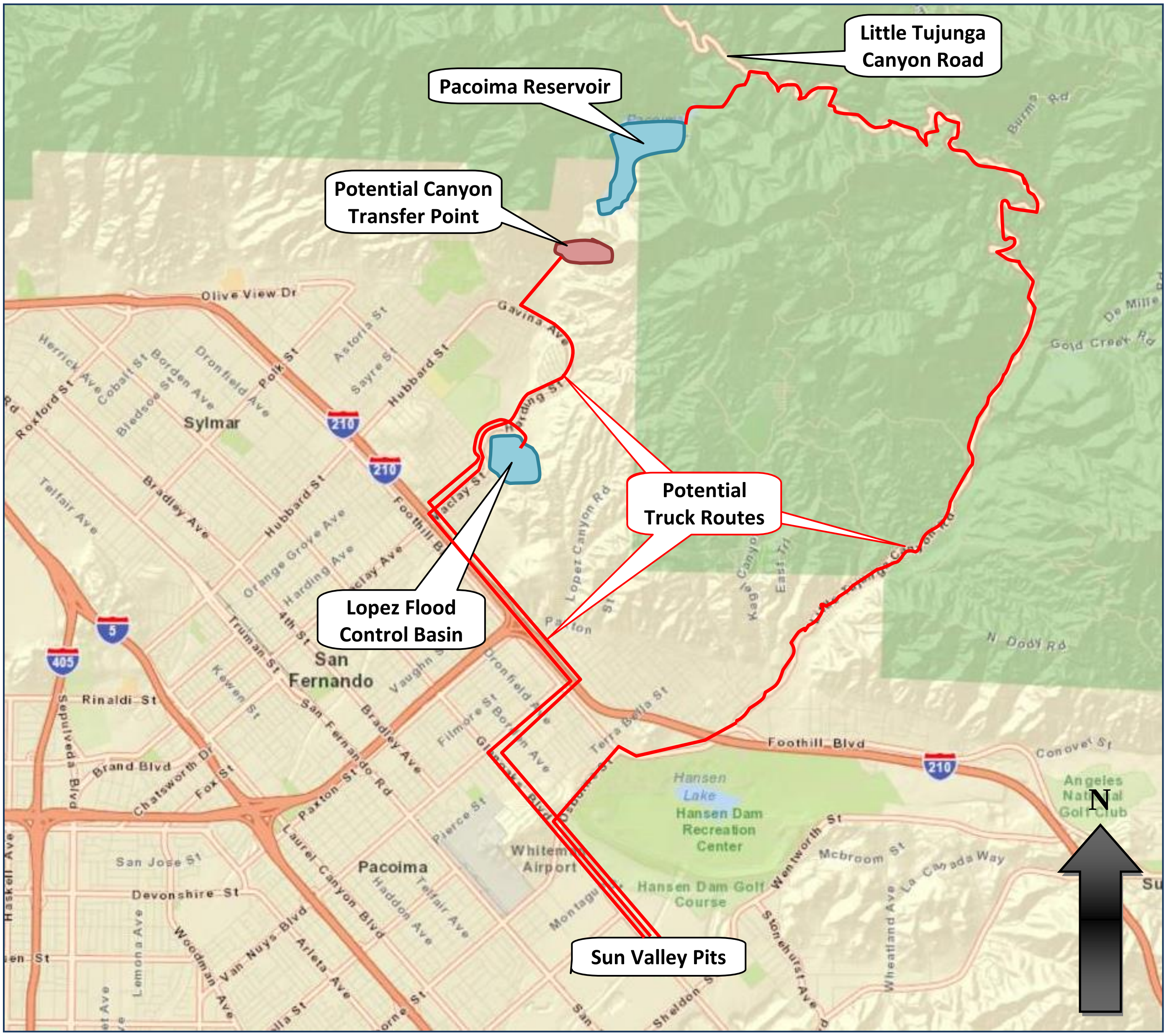
Sluicing (Transport) – Cost

The cost of transporting sediment via sluicing is minimal.

8.3.5.2 TRUCKING

Trucking could be employed to transport sediment from Pacoima Reservoir, a staging area, and/or a temporary sediment storage area to a placement location. As of 2012, there was no access to the back of the reservoir. In order to truck sediment directly from the reservoir to a placement location, the access road from Little Tujunga Canyon Road to the back of the reservoir would need to be reestablished. Refer to the impacts associated with the reestablishment of the access road into Pacoima Reservoir were discussed under Excavation, in Section 8.3.4.1. This section focuses on the impacts associated with trucking sediment along the general routes shown in Figure 8-35.

Figure 8-35 General potential trucking routes for transportation of sediment from Pacoima Reservoir



Trucking – Environmental Impacts

Since existing roads would be used to truck sediment along the general routes previously shown, no particular impacts would be expected on habitat, water quality, or groundwater recharge. The use of low emission trucks would reduce air quality impacts.

Trucking – Social Impacts

Employing trucks could significantly impact traffic, especially if trucking sediment from behind Pacoima Reservoir as Little Tujunga Canyon Road is a two-lane, sinuous road. For the most part, trucks would travel along nonresidential roads; however, neighborhoods cannot be avoided entirely, as shown on Figure 8-36 through Figure 8-39. Restrictions on trucking start and end times would help reduce noise and visual impacts in residential areas. Access to recreational resources along Little Tujunga Canyon Road could potentially be impacted with the increase in traffic.

Figure 8-36 Potential truck route from Pacoima Reservoir

Figure 8-37 Potential truck route from Lopez Flood Control Basin

Figure 8-38 Potential truck route from potential canyon transfer point

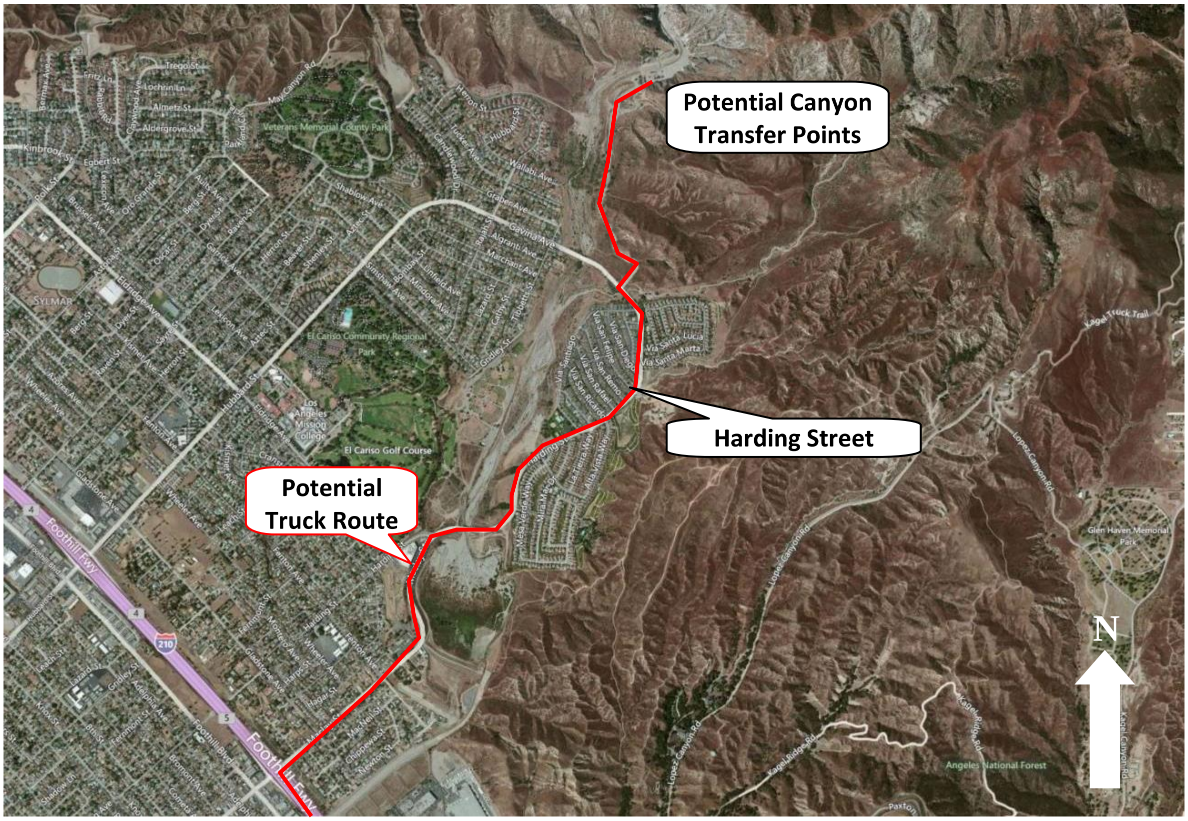


Figure 8-39 Potential truck route to pits in Sun Valley

Trucking – Implementability

Since trucking would occur on existing public roads, there are no right of way or permitting concerns.

Trucking – Performance

The following assumptions were made while considering trucking as an alternative for transporting all or part of Pacoima Reservoir's 7.6-MCY planning quantity.

- Single dump trucks with a capacity of approximately 8 CY per truck would be required when trucking directly from the reservoir due to the narrow and winding conditions of Little Tujunga Canyon Road.
- Double dump trucks with a capacity of approximately 16 CY per truck would be used when traveling from the canyon sites or Lopez Flood Control Basin.
- Between Pacoima Reservoir and the pits in Sun Valley, trucks would travel at an average speed of 20 miles per hour. For trips between the canyons sites and the pits in Sun Valley and Lopez Flood Control Basin and the pits, trucks would travel at an average speed of 30 miles per hour.

Using these assumptions, estimates on the number of trucking operations were determined, as shown in Table 8-14 under the subsequent cost section.

Trucking – Cost

Trucking unit costs on single dump and double dump trucks were estimated to be $0.65 and $0.30 per CY per mile, respectively, based on a loading time of 1 minute per truck. The cost of trucking will vary depending on the quantity to be trucked, the origin and destination, and the type of truck that can be used. The estimated trucking costs for the various scenarios range from $21 million to $158 million, as shown in Table 8-14.

Table 8-14 Estimated trucking costs for Pacoima Reservoir

Destination	Origin	Type of Truck	Roundtrip Distance (miles)	Quantity of Sediment (MCY)	Number of Trucking Operations	Total (millions)
Pits in Sun Valley	Back of Pacoima Reservoir	Single dump	32	7.6	19	$158
				3.0[a]	8	$62
	Canyon Transfer Points	Double dump	19	7.6	10	$43
	Lopez Flood Control Basin	Double dump	15	7.6	10	$34
				4.6[b]	6	$21

Notes:

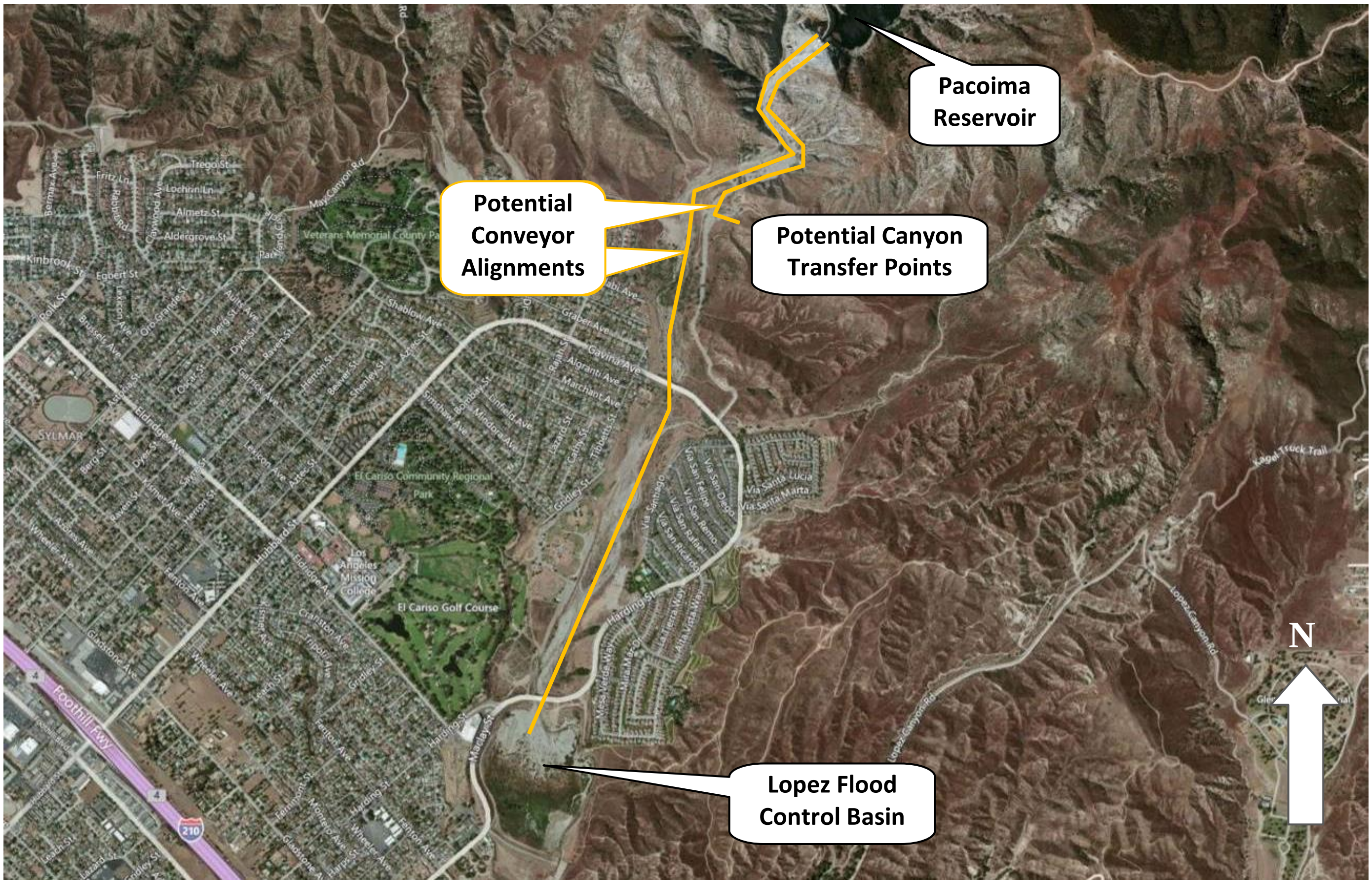
a. Approximate amount of Pacoima Reservoir's 7.6-MCY planning quantity that is too large to dredge or sluice from the reservoir.

b. Approximate amount of sediment that would need to be transported out of Lopez Flood Control Basin if the basin was to be used as the outlet of a slurry pipeline or the endpoint of a sluicing operation from Pacoima Reservoir.

8.3.5.3 CONVEYOR BELTS

Conveyor belts could be used in conjunction with removal activities by excavation. This section discusses the impacts of utilizing a conveyor belt to transport sediment from Pacoima Reservoir through Pacoima Dam and on to a canyon transfer point or Lopez Flood Control Basin. The potential conveyor alignments are shown in Figure 8-40.

Figure 8-40 Potential conveyor belt alignments



Conveyor Belts – Environmental Impacts

In order to identify and minimize the potential impacts of placing and operating a conveyor belt from Pacoima Reservoir to one of the temporary sediment storage areas downstream, the habitat along the potential conveyor alignments would have to be studied. Placement of a conveyor belt along Pacoima Canyon Road would be expected to have less impact on the environment than placement of a conveyor belt along Pacoima Wash. Water quality, groundwater recharge, and air quality would not be expected to be impacted.

Conveyor Belts – Social Impacts

Installation and operation of a conveyor belt would cause some visual disturbances. No recreational resources would be impacted as there are no permitted recreational areas along the potential conveyor alignments.

Conveyor Belts – Implementability

Placement of a conveyor belt along Pacoima Canyon Road would not be expected to present any right of way issues since the road is located within a Flood Control District easement. No permitting issues would be expected either. On the other hand, placement of a conveyor belt along Pacoima Wash would present both right of way and permitting issues.

If a conveyor belt was to be placed through the sluice gate in Pacoima Dam, the conveyor belt would have to be less than five feet wide. The elevation gain and loss from one side of the dam to the other would also need to be considered in the design of the conveyor belt. The topographical conditions between Pacoima Dam and the potential temporary sediment storage areas would not be expected to lead to technical issues as the grade and curves along the potential alignments appear to be within the operational constraints of conveyor belts.

Conveyor Belts – Performance

Since conveyor belts would be used in conjunction with excavation operations and excavation at Pacoima Reservoir could be conducted approximately six months out of the year, it was assumed conveyors from Pacoima Reservoir to either a canyon site or Lopez Flood Control Basin would last approximately six months during a given year. Based on this assumption and other assumptions discussed in Section 6 for conveyor operations, it would take approximately ten (10) 6-month conveyors operations during the 20-year planning period to transport 7.6 MCY of sediment from Pacoima Reservoir.

Conveyor Belts – Cost

A conveyor belt from Pacoima Reservoir to one of the canyon sites downstream of the dam would have a generally challenging alignment. As discussed in Section 6, the estimated cost of a more difficult conveyor is approximately $1,200 per linear foot. Based on this unit cost and a conveyor length of approximately 1 mile, the cost of the conveyor belt would be approximately $6 million.

The cost of a conveyor belt from Pacoima Reservoir to Lopez Flood Control Basin would be approximately $12 million, based on the assumption that approximately 1 mile of the conveyor would have a difficult alignment and the remaining 1.5 mile would have a generally linear alignment. As discussed in Section 6, the cost for a generally linear conveyor belt would be approximately $800 per linear foot.

8.3.5.4 SLURRY PIPELINE

As discussed in Section 6, slurry pipelines would be used in conjunction with dredging. A slurry pipeline could be constructed to transport dredged material from Pacoima Reservoir to Lopez Flood Control Basin.

The slurry pipeline would begin at the end of the dredge line on the downstream face of Pacoima Dam. From there, the slurry pipeline could possibly be constructed along one of two alignments, as shown in Figure 8-41.

If a dredging and slurry pipeline alternative was to be employed at Pacoima Reservoir, the feasibility of the alignments would have to be analyzed in detail. One potential alignment could be along Pacoima Wash all the way from Pacoima Dam to Lopez Flood Control Basin. The other could potentially be along Pacoima Canyon Road from Pacoima Dam to Gavina Avenue then along Pacoima Wash from Gavina Avenue to the basin. The later could require placing the slurry pipeline underground as it crossed Gavina Avenue or potentially placing it underground along Pacoima Canyon Road.

Figure 8-41 Potential Slurry Pipeline Alignments for Pacoima Reservoir

Slurry Pipeline – Environmental Impacts

In order to identify and minimize the potential environmental impacts of placing and operating a slurry pipeline from Pacoima Dam to Lopez Flood Control Basin, the habitat along the potential alignments would have to be studied. No impacts are expected on water quality, groundwater recharge, and air quality.

Slurry Pipeline – Social Impacts

If placed above ground, construction of the slurry pipeline would cause some visual disturbances. No recreational resources would be impacted as there are no permitted recreational areas along the potential slurry pipeline alignments.

Slurry Pipeline – Implementability

Placement of a slurry pipeline along Pacoima Wash and across Gavina Avenue would present both right of way and permitting issues. No right of way or permitting issues are to be expected for placement of a slurry pipeline along Pacoima Canyon Road since the road is located within a Flood Control District easement.

Slurry Pipeline – Performance

A slurry pipeline would be permanently installed and used at the frequency at which material would be dredged. Based on the assumptions that a dredge could remove approximately 200 CY of sediment per hour and a water-to-sediment ratio of 9 to 1 for dredging operation, the slurry pipeline would need to be able to transport approximately 2,0000 CY of the water-sediment slurry per hour (or approximately 15 cubic feet of the slurry per second). The slurry pipelines discussed in Section 6 are able to handle flow of this magnitude.

The approximately 2.5-mile slurry pipeline from Pacoima Dam to Lopez Flood Control Basin would require 3 booster pumps.

Slurry Pipeline – Cost

Based on the estimated construction cost of $37.50 per linear foot for above ground slurry pipelines, the estimated cost of constructing a slurry pipeline of approximately 2.5 miles from Pacoima Dam to Lopez Flood Control Basin is approximately $500,000. Given an installation and operation cost of $1 per CY of sediment per booster pump, the cost of installing and operating 3 booster pumps to transport 2.9 MCY of sediment was estimated to be $13 million.

8.3.6 PLACEMENT ALTERNATIVES

This section discusses the impacts and costs of potential placement alternatives for sediment removed from Pacoima Reservoir. Specifically, this section discusses the placement of sediment at pits and potential new sediment placement site(s). Discussion of the removal and transportation was presented in Sections 8.3.4 and 8.3.5, respectively. Combined alternatives that address all phases of the sediment management process are presented and discussed in Section 8.3.7.

8.3.6.1 PITS

As discussed in Section 6, there are multiple pits in Sun Valley. Refer back to Figure 8-35 on page 8-59 for the location of the pits in relation to Pacoima Reservoir and Lopez Flood Control Basin. The one-way trucking distance from the back of Pacoima Reservoir, the canyon sites downstream of the reservoir, and Lopez Flood Control Basin to the pits ranges from 8.5 miles to 16 miles. The general impacts of employing pits for sediment placement were discussed in Section 6.

It was assumed that 40 percent of Pacoima Reservoir's 7.6-MCY planning quantity, or 3.0 MCY, would be marketable. Given that assumption and other assumptions discussed in Section 6, it was assumed that pits operated by the gravel industry would accept a total of 6.0 MCY of sediment from Pacoima Reservoir free of charge. Depending on the type of truck used to deliver sediment to the third-party owned pits, tipping fees of $10 to $15 per cubic yard would have to be paid for the remaining 1.6 MCY of sediment. If the 1.6 MCY of sediment were to be trucked from the Pacoima Reservoir, single dump trucks would have to be used; therefore, the tipping fees would total approximately $24 million. If the 1.6 MCY of sediment were to be trucked from the canyon sites or Lopez Flood Control Basin, double dump trucks would be able to be used; therefore, the tipping fees would be approximately $16 million.

However, as discussed in Section 6, the acquisition of pits for the placement of sediment from facilities under the jurisdiction of the Flood Control District should be pursued. For planning purposes, it was assumed that the only material that would be placed at a Flood Control District-owned pit would be material that would not be accepted at the third-party owned pits for free. It would cost a total of $3 per cubic yard to acquire and place 1.6 MCY of sediment at the Flood Control District-owned pit. The cost to place 1.6 MCY in a Flood Control District-owned pit, including the cost to acquire the pit, would be approximately $4.8 million.

8.3.6.2 POTENTIAL NEW CANYON SEDIMENT PLACEMENT SITE(S)

This section discusses the impacts associated with developing a sediment placement site in one or both of the canyons discussed in Section 8.3.3.2. This placement alternative could potentially be used in combination the transportation alternative involving a conveyor from Pacoima Dam to the canyons.

Canyon SPSs – Environmental Impacts

If the canyons were to be used for placement, both canyons could be highly impacted over the life of the project. Nearby mitigation sites could be used to offset the impacts to the canyons. Additionally, once work is complete, habitat could be reestablished on disturbed areas. Air quality would be affected by emissions of equipment used at the site for placement, but this alternative would have minimal impact to water quality and quantity.

Canyon SPSs – Social Impacts

Development and use of the canyons as a sediment placement site would have some visual impacts. However, grading the SPSs in a manner that resembles the natural terrain nearby could reduce those visual impacts. There would be some noise impacts, particularly for the neighborhood located across Pacoima Wash from the canyons. Limits on working hours and equipment noise would limit impacts.

There are no permitted recreational activities in the canyons. As a result, no impacts on recreation are expected. Nonetheless, stakeholders have expressed a concern over potential disruption of people's recreational use of the canyons. Some stakeholders have also expressed concern that temporary storage of sediment in the canyons could change wind conditions and possibly affect hang gliding activities near the canyons.

Canyon SPSs - Implementability

Acquisition of the parcels and environmental permitting complexity are concerns that could likely be addressed. The Flood Control District may possibly need to obtain environmental regulatory permits in order to develop a sediment placement site in one or both of the canyon sites.

Canyon SPSs - Performance

With an approximate placement capacity of 19 MCY, the canyons would easily be able to serve Pacoima Reservoir's 20-year sediment management need of 4.8 MCY.

Canyon SPSs - Cost

The cost to acquire, develop a sediment placement site, and mitigate the impacts of such use was estimated to be approximately $6 million.

8.3.7 COMBINED SEDIMENT MANAGEMENT ALTERNATIVES

There are six combined sediment management alternatives for Pacoima Reservoir. A description of each of these and the combined impacts and costs are subsequently provided. For specific details regarding environmental impacts, social impacts, feasibility, implementability, and cost for the individual removal, transportation, temporary sediment storage, and placement components refer to Sections 8.1.3 through 8.1.6. Please note that combined alternatives that include dredging and sluicing assume 60 percent of Pacoima Reservoir's planning quantity could be dredged or sluiced and that the remainder would have to be excavated and trucked from the back of the reservoir.

All the combined sediment management alternatives, except for Combined Alternative 5, show a range in cost. The lower cost is based on the assumption that 40 percent of the 20-year planning quantity is marketable, that the gravel industry will accept the 40 percent plus an additional 40 percent of the material free of charge, and that the remaining 20 percent is placed at a quarry the Flood Control District has acquired. The higher cost assumes the

Flood Control District was not able to acquire a quarry and so that all sediment has to be delivered to the gravel industry. The assumption is that the Flood Control District would have to pay tipping fees ($10/CY) for 20 percent of the 20-year planning quantity.

8.3.7.1 COMBINED ALTERNATIVE 1: EXCAVATE → TRUCKS → SUN VALLEY PITS

This alternative involves draining the reservoir, excavating the sediment under dry conditions, and then trucking the sediment through a back access road. The sediment would be trucked to the pits in Sun Valley. Figure 8-42 and Figure 8-43 schematically illustrate this alternative. Due to the need to fully drain the reservoir, this alternative would be implementable approximately six months during a given year.

Figure 8-42 Pacoima Reservoir's Alternative 1, Map 1 of 2

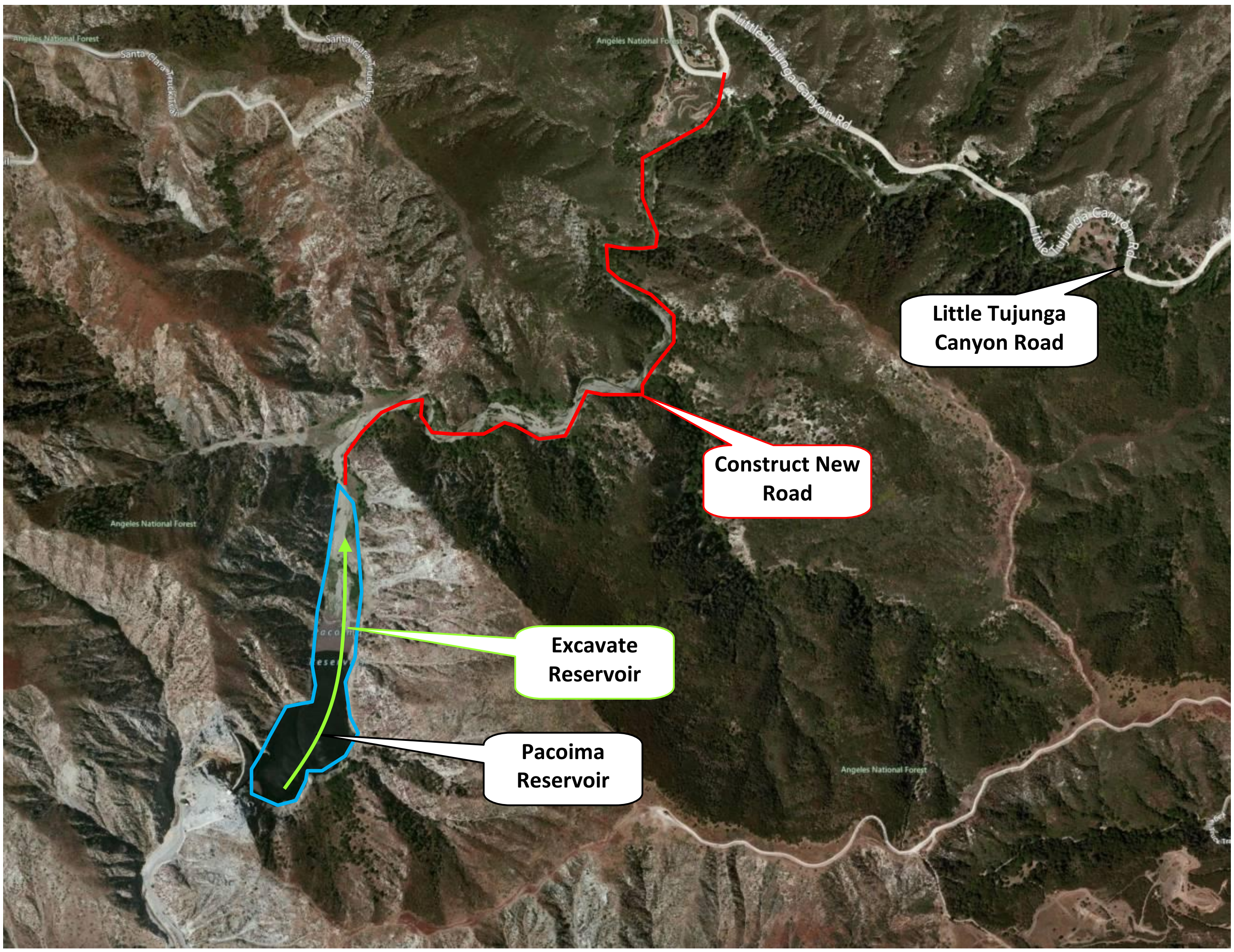


Figure 8-43 Pacoima Reservoir's Alternative 1, Map 2 of 2

Construction of an access road to the back of Pacoima Reservoir is required for this alternative, which would result in impact to habitat. Further analysis is needed to determine if there are various potential road alignments, and if so, which one would have the least environmental impact. In any case, mitigation of environmental impacts would be required as they would not be able to be avoided. Air quality would be impacted by the use of excavation equipment and trucks. Use of low emission trucks would reduce air quality impacts.

In order to remove the entire 7.6 MCY planning quantity during the 20-year planning period, sediment removal operations involving excavation in conjunction with trucking would need to occur during approximately 19 of the 20 years. This assumes an operation duration of approximately six months per cleanout.

For the most part, trucks directly transporting sediment from Pacoima Reservoir to a site in Sun Valley would travel along nonresidential roads. However, the route would pass along some residential areas, as previously shown on Figures 8-37 to 8-40.

Implementation of this alternative could cost an estimated $190 million to $200 million. The breakdown of the estimated costs is provided in Table 8-15.

Table 8-15 Estimated costs for Pacoima Reservoir's Alternative 1

Activity	Estimated Cost (in millions)
Construct and mitigate for road from Little Tujunga Canyon Road to back of Pacoima Reservoir	$ 2
Excavate sediment from Pacoima	$ 23
Truck sediment to pits in Sun Valley	$ 158
Place sediment at pits in Sun Valley	$ 5-15
Total	$ 190-200

8.3.7.2 COMBINED ALTERNATIVE 2A: EXCAVATE → CONVEYOR → CANYON TRANSFER POINT → TRUCKS → SUN VALLEY PITS

This alternative consists of draining Pacoima Reservoir, excavating the sediment, transporting it to a canyon temporary sediment storage area via a conveyor belt through the dam, and then trucking it from the temporary sediment storage area to a placement site. Figure 8-44 and Figure 8-45 schematically illustrate this alternative.

Figure 8-44 Pacoima Reservoir's Alternative 2A – Map 1 of 2

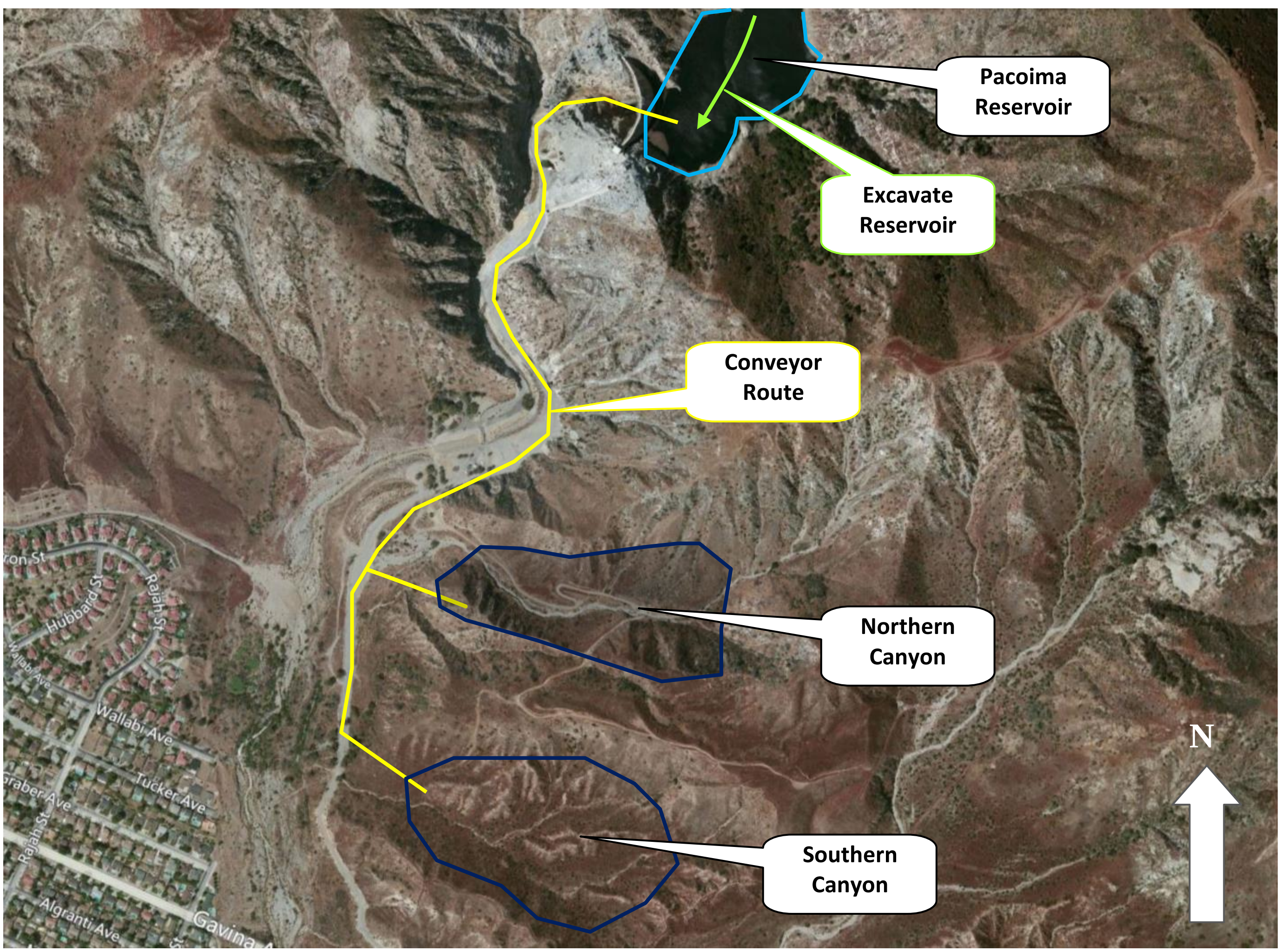


Figure 8-45 Pacoima Reservoir's Alternative 2A – Map 2 of 2

One of the limitations of this alternative is the Flood Control District's ability to acquire or obtain permission to use one of the canyons downstream of Pacoima Reservoir for the transfer of sediment from conveyor belt to trucks.

The conveyor belt could be placed along Pacoima Canyon Road, which would limit interference with habitat along the conveyor's alignment.

Employing this combined alternative to remove the entire 7.6 MCY planning quantity during the 20-year planning period would require 10 separate operations. This is based on the assumptions that 800 CY (or approximately 1,200 tons) of sediment could be transported on the conveyor belt every hour, 8 hours per day, 4 months a year.

Implementation of this alternative could cost an estimated $85 million to $95 million. The breakdown of the estimated costs is provided in Table 8-16.

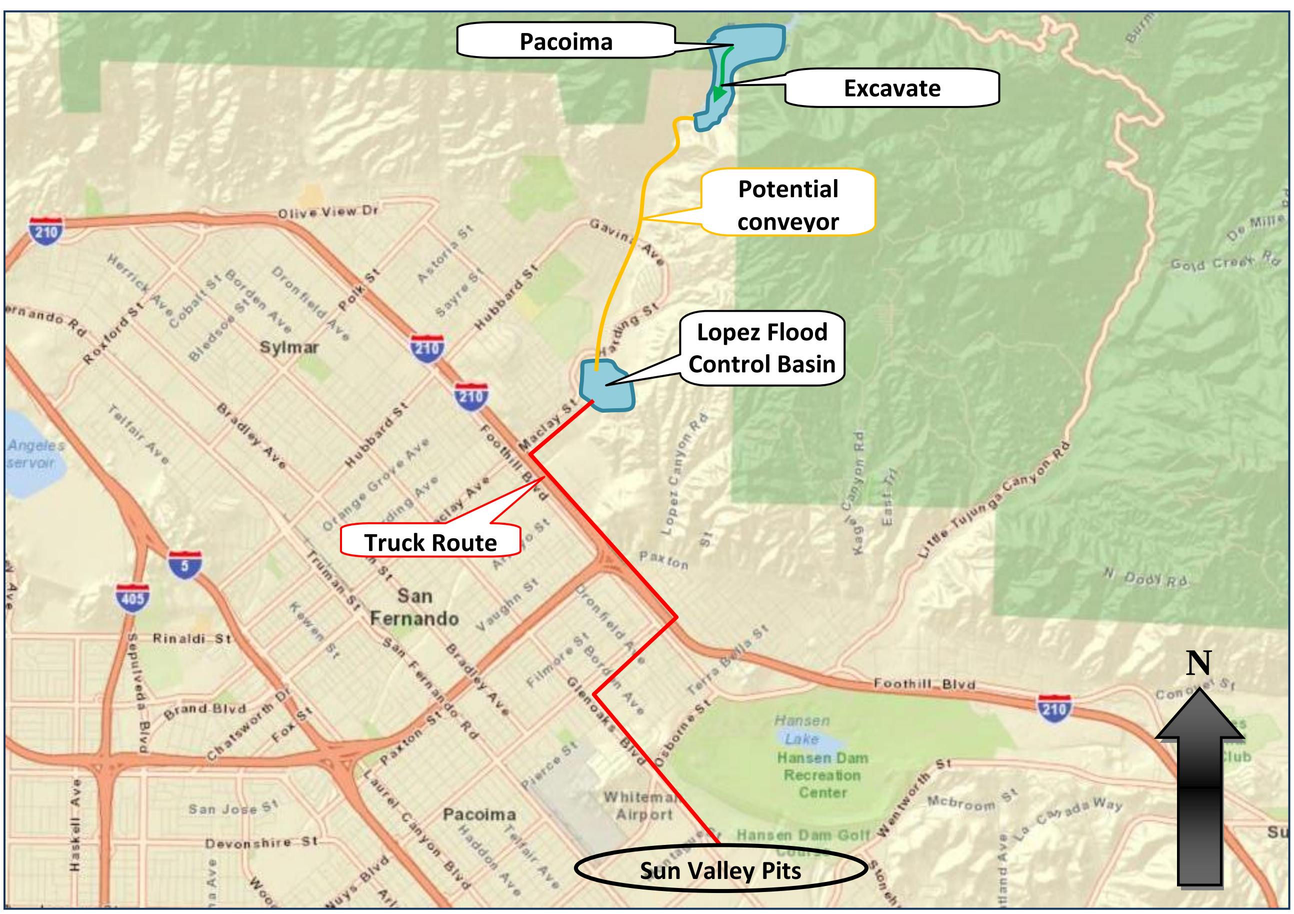
Table 8-16 Estimated costs for Pacoima Reservoir's Alternative 2A

Activity	Estimated Cost
Construct and mitigate for temporary access roads to Pacoima Reservoir	$2 M
Excavate material	$23 M
Acquire canyon temporary sediment storage area	$2 M
Mitigate for use of the canyon temporary sediment storage area	$3 M
Convey sediment from Pacoima Reservoir to canyon temporary sediment storage area	$6 M
Truck to pits in Sun Valley	$43 M
Place sediment at pits in Sun Valley	$5-15 M
Total	**$85-95 M**

8.3.7.3 COMBINED ALTERNATIVE 2B: EXCAVATE → CONVEYOR → LOPEZ FLOOD CONTROL BASIN TRANSFER POINT → TRUCKS → SUN VALLEY PITS

Combined Alternative 2B is essentially the same as Combined Alternative 2A, except for the endpoint of the conveyor belt and potential temporary sediment storage area. In Combined Alternative 2B, the conveyor would extend from Pacoima Reservoir to Lopez Flood Control Basin. Figure 8-46 illustrates this alternative.

Figure 8-46 Pacoima Reservoir's Alternative 2B



This alternative would require the Army Corps of Engineers' permission for the Flood Control District to use Lopez Flood Control Basin for staging and stockpiling operations. In addition, permission from the Army Corps of Engineers would need to be acquired in order to place the conveyor belt along Pacoima Wash.

Implementation of this alternative would require 10 separate cleanout operations, which could cost an estimated $75 million to $85 million. The breakdown of the estimated costs is provided in Table 8-17.

Table 8-17 Estimated costs for Pacoima Reservoir's Alternative 2B

Activity	Estimated Cost
Construct and mitigate for temporary access roads to Pacoima Reservoir	$2 M
Excavate material	$23 M
Convey sediment from Pacoima Reservoir to Lopez Flood Control Basin	$12 M
Truck to the pits in Sun Valley	$34 M
Place sediment at the pits in Sun Valley	$5-15 M
Total	**$75-85 M**

8.3.7.4 Combined Alternative 3: Dredge (4.6 MCY) → Slurry Pipeline → Lopez Flood Control Basin → Excavate → Trucks → Sun Valley Pits + Excavate (3.0 MCY) → Trucks → Pits in Sun Valley

This alternative would involve sediment removal operations at the Army Corps of Engineers' Lopez Flood Control Basin in addition to sediment removal operations at Pacoima Reservoir. First, in order to create capacity for the material to be delivered to Lopez Flood Control Basin, sediment would be excavated from the basin and trucked to the pits in Sun Valley. Subsequently, sediment would be dredged from Pacoima Reservoir and the sediment-water mixture transported to the basin through a slurry pipeline. Additionally, because the large material in Pacoima Reservoir would not be able to be dredged, the larger material would have to be excavated. It was assumed the large material would then be trucked to a pit in Sun Valley. Figure 8-47 and Figure 8-48 illustrate this alternative.

Figure 8-47 Pacoima Reservoir's Alternative 3 – Map 1 of 2

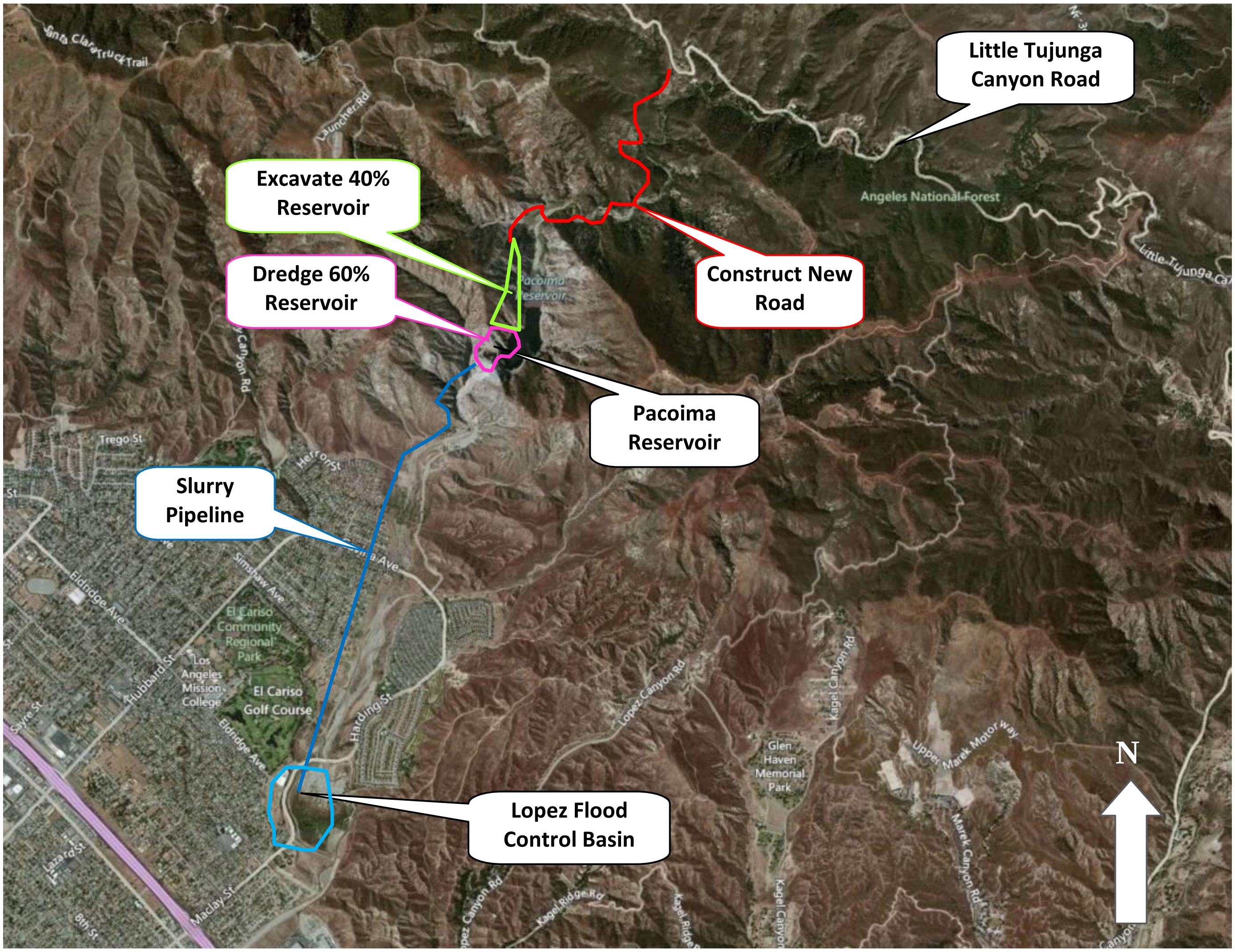


Figure 8-48 Pacoima Reservoir's Alternative 3 – Map 2 of 2

Implementation of this alternative is highly dependent on the ability to obtain permission from the Army Corps of Engineers to use Lopez Flood Control Basin as a dewatering and temporary sediment storage area for the dredged material and the ability to create enough capacity for the operations.

Given the assumptions made regarding dredging operations and assuming capacity at Lopez Flood Control Basin would not limit the dredging operations, it could take 12 dredging operations during the 20-year planning period to remove the 4.6 MCY of sediment that could potentially be dredged from Pacoima Reservoir. If the operations could be conducted on a regular basis, the interval between the dredging operations would range from one to two years. The remaining 3.0 MCY of larger material that could not be dredged would need to be excavated and removed in possibly 8 separate operations. Dredging and excavation operations may be able to be conducted in the same year, just during different parts of the year.

Trucks used to transport sediment would pass through several residential areas as previously shown on Figure 8-36 through Figure 8-39.

Implementation of this alternative could cost from an estimated $185 million to $195 million. The breakdown of the estimated costs is provided in Figure 8-17.

Table 8-18 Estimated costs for Pacoima Reservoir's Alternative 3

Activity	Estimated Cost
Excavate material at Lopez Flood Control Basin to create capacity	$14 M
Truck material from Lopez Flood Control Basin on double-dump trucks	$21 M
Place sediment at pits in Sun Valley	$5-15 M
Dredge sediment from Pacoima Reservoir	$48 M
Construct and operate slurry pipeline	$22 M
Construct and mitigate for temporary access roads to Pacoima Reservoir	$2 M
Excavate the larger material that cannot be dredged	$9 M
Truck the larger material from the reservoir to the pits in Sun Valley on single-dump trucks	$62 M
Total	**$185-195 M**

8.3.7.5 COMBINED ALTERNATIVE 4: SLUICE (4.6 MCY) → LOPEZ FLOOD CONTROL BASIN → EXCAVATE → TRUCKS → SUN VALLEY PITS + EXCAVATE (3.0 MCY) → TRUCKS → PITS IN SUN VALLEY

Combined Alternative 4 would involve sediment removal operations at the Army Corps of Engineers' Lopez Flood Control in addition to sediment removal operations at Pacoima Reservoir. It was assumed that sediment within the Lopez Flood Control Basin would be excavated and trucked to a placement site. Once capacity had been made available at the basin, Pacoima Reservoir would be drained to expose the accumulated sediment. Water flowing through the reservoir would then carry the sediment from Pacoima Reservoir to Lopez Flood Control Basin, returning the basin's capacity to where it had been prior to the presluicing excavation at the basin and the sluicing operation at Pacoima. Figure 8-49 and Figure 8-50 illustrate this alternative.

Figure 8-49 Pacoima Reservoir's Alternative 4 – Map 1 of 2

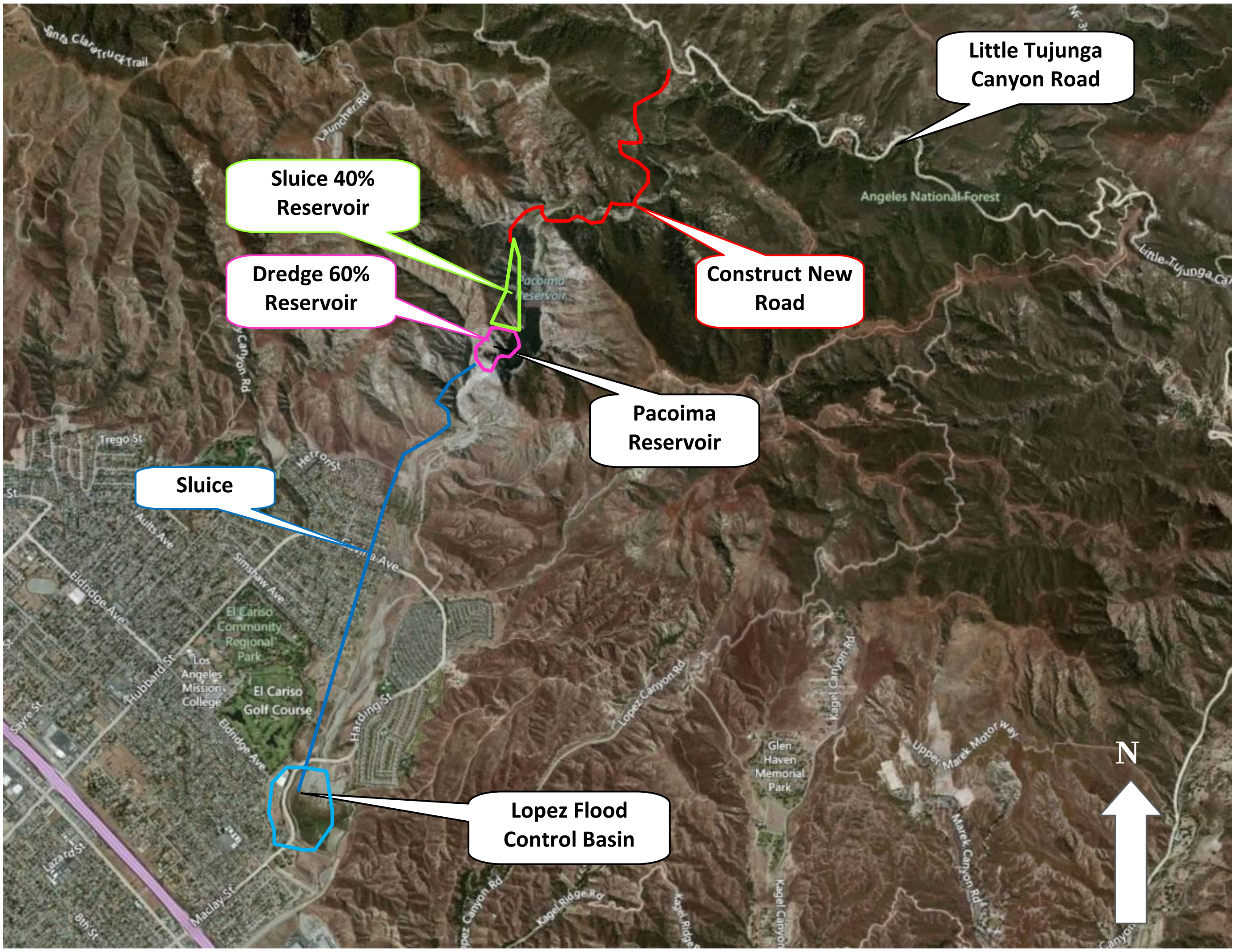
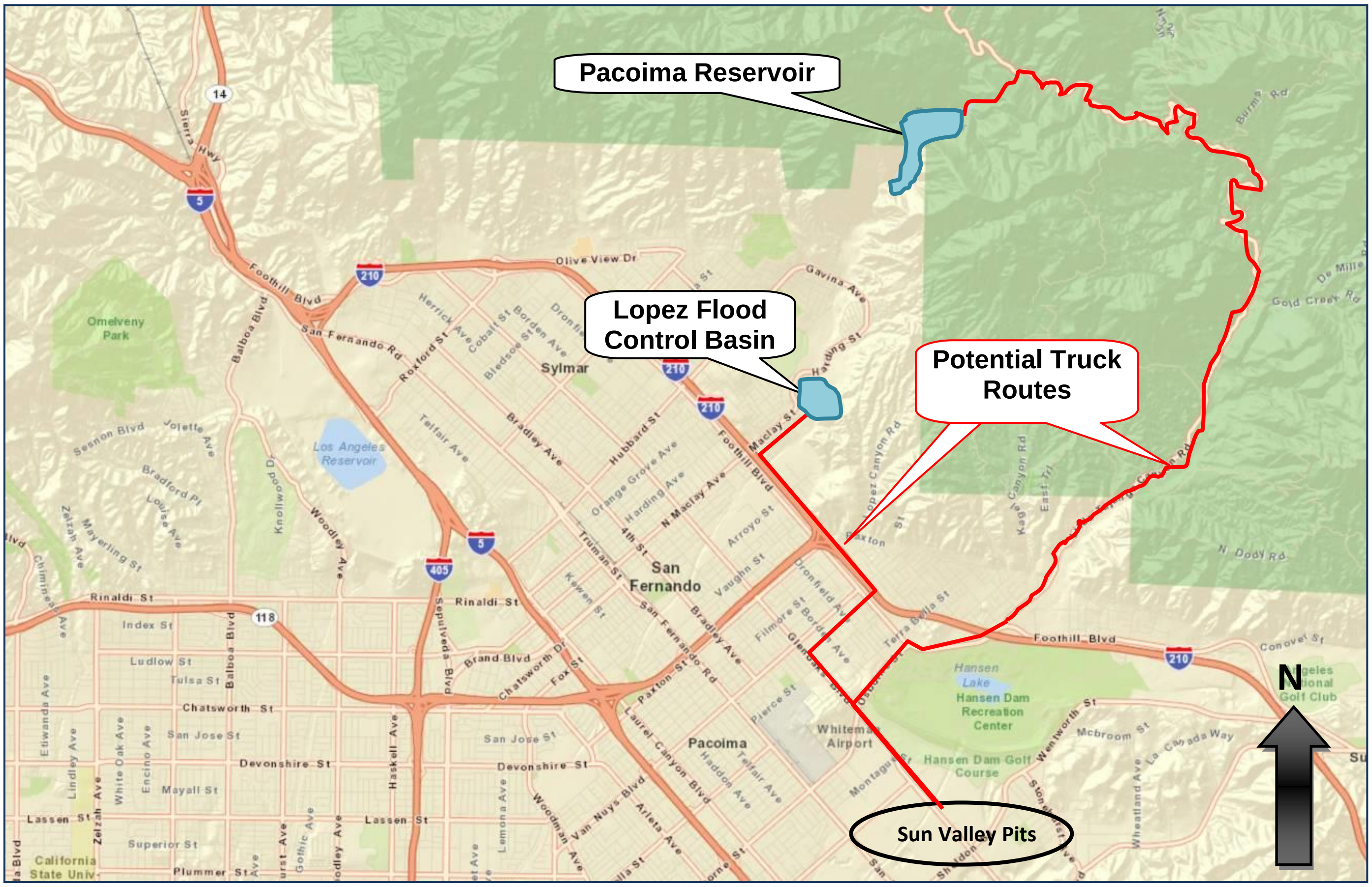


Figure 8-50 Pacoima Reservoir's Alternative 4 – Map 2 of 2



Implementation of this alternative is highly dependent on the ability to obtain permission from the Army Corps of Engineers to use Lopez Flood Control Basin as a dewatering and temporary sediment storage area for the sluiced material and the ability to create enough capacity for the operations.

Given the assumptions made regarding sluicing operations, it could take 9 sluicing operations during the 20-year planning period to remove the 4.6 MCY of smaller material in the planning quantity from Pacoima Reservoir. Similar to Combined Alternative 3, the remaining 3.0 MCY of larger material would need to be excavated and removed in possibly 8 separate operations. Sluicing and excavation operations may be able to be conducted in the same year.

Implementation of this alternative could cost an estimated $125 million to $135 million. The breakdown of the estimated costs is provided in Table 8-19.

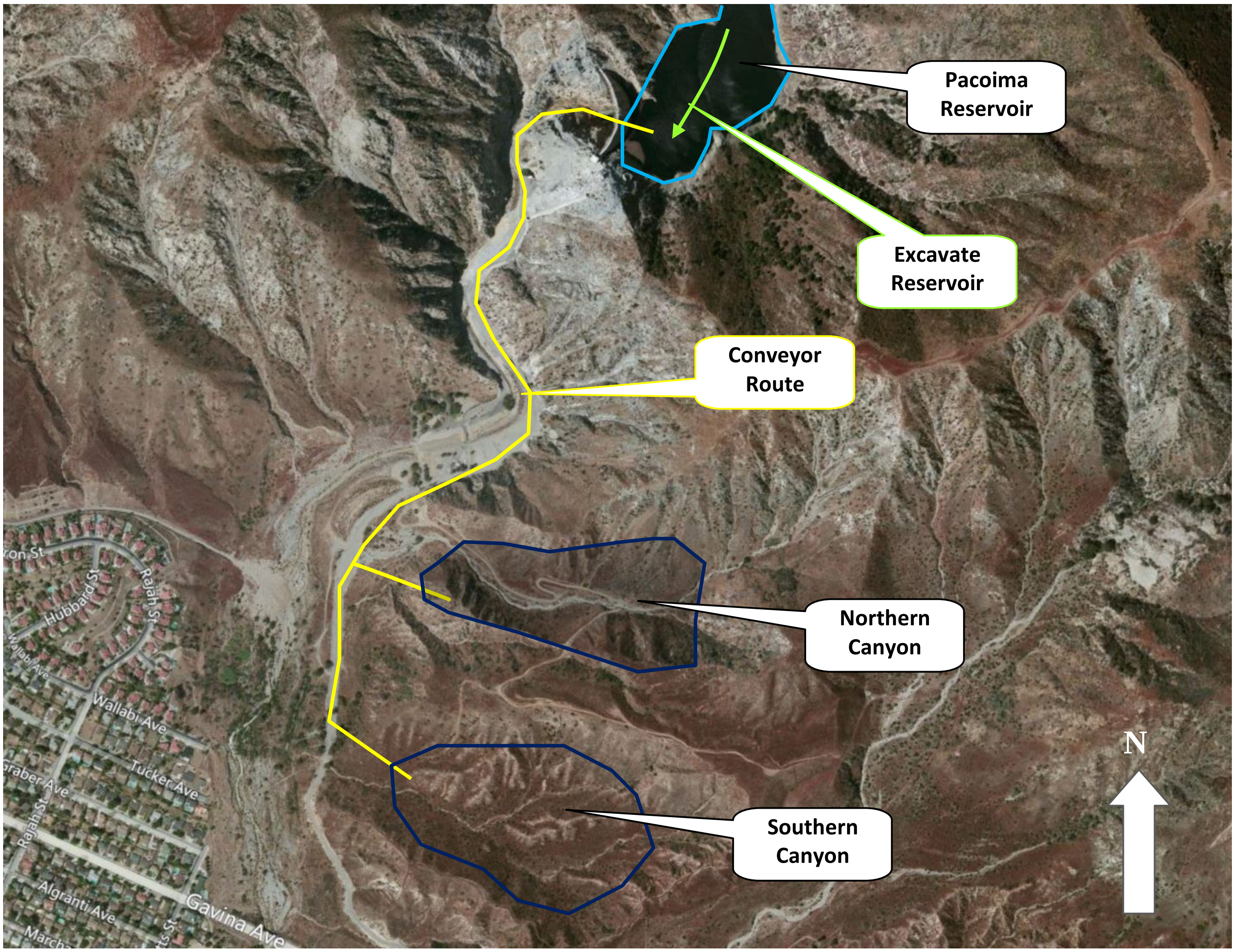
Table 8-19 Estimated costs for Pacoima Reservoir's Alternative 4

Activity	Estimated Cost
Excavate material at Lopez Flood Control Basin to create capacity	$14 M
Truck material from Lopez Flood Control Basin on double-dump trucks	$21 M
Place sediment at pits in Sun Valley	$5-15 M
Sluice sediment to Lopez Flood Control Basin	$12 M
Construct and mitigate for temporary access roads to Pacoima Reservoir	$2 M
Excavate material that cannot be sluiced	$9 M
Truck sediment that can be dredged from reservoir to pits in Sun Valley on single-dump trucks	$62 M
Total	**$125-135 M**

8.3.7.6 COMBINED ALTERNATIVE 5: EXCAVATE → CONVEYOR → PERMANENT PLACEMENT AT NEW CANYON SPS

Combined Alternative 5 involves excavating the sediment from Pacoima Reservoir under dry conditions and transporting it via a conveyor belt through Pacoima Dam to one or both of the canyons downstream of Pacoima Dam, just like Combined Alternative 2A. The difference is that a sediment placement site would be developed at the canyon(s) and sediment would permanently be placed there. Figure 8-51 shows a representation of this alternative.

Figure 8-51 Pacoima Reservoir's Combined Alternative 5



Similar to Combined Alternative 2A, one of the limitations of this alternative is the Flood Control District's ability to acquire one of the canyons downstream of Pacoima Dam. Another concern is the ability to secure environmental regulatory permits required for the development and use of a canyon sediment placement site.

Placing the conveyor belt along Pacoima Canyon Road would limit interference with habitat along the conveyor's alignment. However, development and use of the sediment placement site would highly impact habitat in the canyons over the life of the placement site. Nearby mitigation sites could be used to offset the impacts to the canyons. Additionally, once work is complete, habitat could be reestablished on disturbed areas.

Using a conveyor to transport 7.6 MCY of sediment from Pacoima Reservoir to a Canyon Sediment Placement Site would require 14 separate operations. This is based on the assumptions that 800 CY (or approximately 1,200 tons) of sediment could be transported on the conveyor belt every hour, 8 hours per day, 4 months a year.

Implementation of this alternative could cost an estimated $35 million. The breakdown of the estimated costs is provided in Table 8-20.

Table 8-20 Estimated costs for Pacoima Reservoir's Alternative 5

Activity	Estimated Cost
Construct and mitigate for temporary access roads to Pacoima Reservoir	$2 M
Excavate material	$23 M
Acquire canyon temporary sediment storage area	$2 M
Mitigate for use of the canyon temporary sediment storage area	$3 M
Develop SPS	$1 M
Convey sediment from Pacoima Reservoir to canyon temporary sediment storage area	$6 M
Total	**$35 M**

8.3.8 SUMMARY AND RECOMMENDATIONS

8.3.8.1 SUMMARY

Over the next 20 years, up to 7.6 MCY of sediment are planned to be removed from Pacoima Reservoir including the 5.2 MCY currently accumulated in the reservoir. The different management alternatives are briefly explained below and the impacts are shown in **Error! Reference source not found.**.

Sediment Management Alternatives

1 Excavate → Trucks → Sun Valley Pits
This alternative involves draining the reservoir, excavating the sediment under dry conditions, and then trucking the sediment through a back access road to the pits in Sun Valley.

2A Excavate → Conveyor → Canyon Transfer Point → Trucks → Sun Valley Pits
This alternative consists of draining the reservoir, excavating the sediment, transporting it to a temporary sediment storage area via a conveyor belt through the dam, and then trucking it to a placement site. One of the limitations of this alternative is the ability to acquire or obtain permission to use one of the canyons downstream of Pacoima Dam for temporary storage.

2B Excavate → Conveyor → Lopez Flood Control Basin Transfer Point → Trucks → Sun Valley Pits
This alternative is essentially the same as Alternative 2A, except for the conveyor endpoint and potential temporary sediment storage area would be at Lopez Flood Control Basin (FCB). Use of Hansen FCB and placement of the conveyor along Pacoima Wash would require permission from the Army Corps of Engineers.

3 Dredge (4.6 MCY) → Slurry Pipeline → Lopez Flood Control Basin → Excavate → Trucks → Sun Valley Pits
+ Excavate (3.0 MCY) → Trucks → Pits in Sun Valley
Smaller-sized material would be dredged and transported via slurry pipeline to Lopez FCB. The larger-sized material would be excavated and trucked to the pits in Sun Valley. This alternative is highly dependent on the ability to obtain permission from the Army Corps of Engineers to use Lopez FCB and the ability to create enough capacity for the operations.

4 <u>Sluice (4.6 MCY) → Lopez Flood Control Basin → Excavate →Trucks → Sun Valley Pits + Excavate (3.0 MCY) → Trucks → Pits in Sun Valley</u>
This alternative is very similar to Alternative 3 except sediment would be sluiced rather than dredged. Employing this alternative would result in habitat impacts along Big Tujunga Wash.

5 <u>Excavate → Conveyor → Permanent Placement at New Canyon SPS</u>
Alternative 5 involves excavating the sediment from Pacoima Reservoir under dry conditions and transporting it via a conveyor belt through Pacoima Dam to one or both of the canyons downstream of Pacoima Dam, just like Alternative 2A. The difference is that a sediment placement site (SPS) would be developed at the canyon(s) and sediment would permanently be placed there.

Table 8-21 Summary of Sediment Management Alternatives for Pacoima Reservoir

Alternative		Quantity Removed (MCY)	Environmental				Social			Implementability	Performance		Cost
			Habitat	Water Quality	Groundwater Recharge	Air Quality[a]	Traffic	Visual	Noise	Special Permit/Agreement Required[b]	Previous Experience	Number of years out of 20 years that would require cleanout operations	$ Millions
1	Excavation	7.6	◑		○	◑		○	○		Yes	19	190-200
	Trucks		●			●	●	◑	◑				
	Pits in Sun Valley									Yes			
2A	Excavation	7.6	◑		○	◑		○	○		Yes	10	85-95
	Conveyor		○					○	○				
	Canyon Transfer Point		◑					◑	○	Yes			
	Trucks					●	●	◑	◑				
	Pits in Sun Valley									Yes			
2B	Excavation	7.6	◑		○	◑		○	○		Yes	10	75-85
	Conveyor		○					○	○				
	Lopez FCB Transfer Point		○					◑	○	Yes			
	Trucks					●	●	◑	◑				
	Pits in Sun Valley									Yes			
3	Dredge	4.6	◑	◑	○			○	○	Yes	No	12[c]	185-195
	Slurry Pipeline to Lopez FCB		○					○		Yes			
	Lopez FCB		◑	●		◑		◑	◑				
	Trucks					●	●	◑	◑				
	Pits in Sun Valley									Yes			
	Excavation	3.0	◑		○	◑		○	○		Yes	8[c]	
	Trucks					●	●	◑	◑				
	Pits in Sun Valley									Yes			
4	Sluice to Lopez FCB	4.6	●	●	◑			◑		Yes	Yes	9[d]	125-135
	Lopez FCB		◑	●		◑		◑	◑				
	Trucks					●	●	◑	◑				
	Pits in Sun Valley									Yes			
	Excavation	3.0	◑		○	◑		○	○			8[d]	
	Trucks		●				●	◑	◑				
	Pits in Sun Valley									Yes			

(Table continued on next page)

Alternative		Quantity Removed (MCY)	Environmental				Social			Implementability	Performance		Cost
			Habitat	Water Quality	Groundwater Recharge	Air Quality[(a)]	Traffic	Visual	Noise	Special Permit/Agreement Required[(b)]	Previous Experience	Number of years out of 20 years that would require cleanout operations	$ Millions
5	Excavation	7.6	◑		○	◑		○	○		Yes	10	35
	Conveyor		○					◑	○				
	Canyon SPS		●					◑	○	Yes			

Legend:

●	significant impact
◑	some impact
○	possible impact
	no impact

Notes:

(a) Use of low-emission trucks would reduce air quality impacts from significant impact (●) to some impact (◑).
(b) All options require environmental regulatory permits.

Recommendations

It is recommended that Combined Alternatives 2A, 2B, 4, and 5 be considered for future sediment removal projects at Pacoima Reservoir. Additionally, further combining the aforementioned alternatives should be taken into consideration. For example, it may be possible for the excavation and conveyor alternatives (2A or 2B) to follow a sluicing project (Alternative 4) in order to take advantage of the already drained reservoir. This could help to reduce environmental impacts, increase performance, and reduce costs.

Combined Alternatives 1 and 3 should be considered only after all previous recommendations are deemed infeasible. Alternative 1 requires high number of cleanout operations and has a high estimated cost. Similarly, Alternative 3 has a high cost compared to other alternatives.

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8.4 PUDDINGSTONE RESERVOIR

8.4.1 BACKGROUND

Puddingstone Dam, shown in Figure 8-52, was constructed in 1928 by the Flood Control District. The dam is comprised of three concrete-faced earth embankments. With a drainage area of 33.1 square miles and a reservoir capacity of 28 MCY, the dam functions as a flood risk management, water conservation, and recreational facility. Water impounded during the storm season behind the dam is gradually released and diverted into the downstream spreading facilities to recharge groundwater within the operating limits for recreational activities.

Figure 8-52 Puddingstone Dam

8.4.1.1 LOCATION

Puddingstone Reservoir is situated in Bonelli Regional Park, approximately 1.5 miles south of the City of San Dimas, as shown in Figure 8-53. Located well downstream of the other reservoirs, Puddingstone Reservoir is a collection point for San Dimas Reservoir, Puddingstone Diversion Reservoir, and Live Oak Reservoir outflows. The reservoir is currently used as a recreational lake and is very broad, approximately 0.7 mile across, with relatively flat side slopes. Figure 8-54 shows the topography of Puddingstone Reservoir.

Figure 8-53 Puddingstone Reservoir Vicinity Map

Figure 8-54 Puddingstone Reservoir Topography

8.4.1.2 ACCESS

Access to both the dam and reservoir is available from Raging Waters Drive, Via Verde, Fisherman Park Road, and Puddingstone Drive, as shown in Figure 8-55.

Figure 8-55 Puddingstone Reservoir Access

8.4.1.3 <u>DAM OUTLETS</u>

The only dam outlets that Puddingstone Dam is equipped with are two slide gates that are 5 feet by 6 feet and 4 feet by 5 feet.

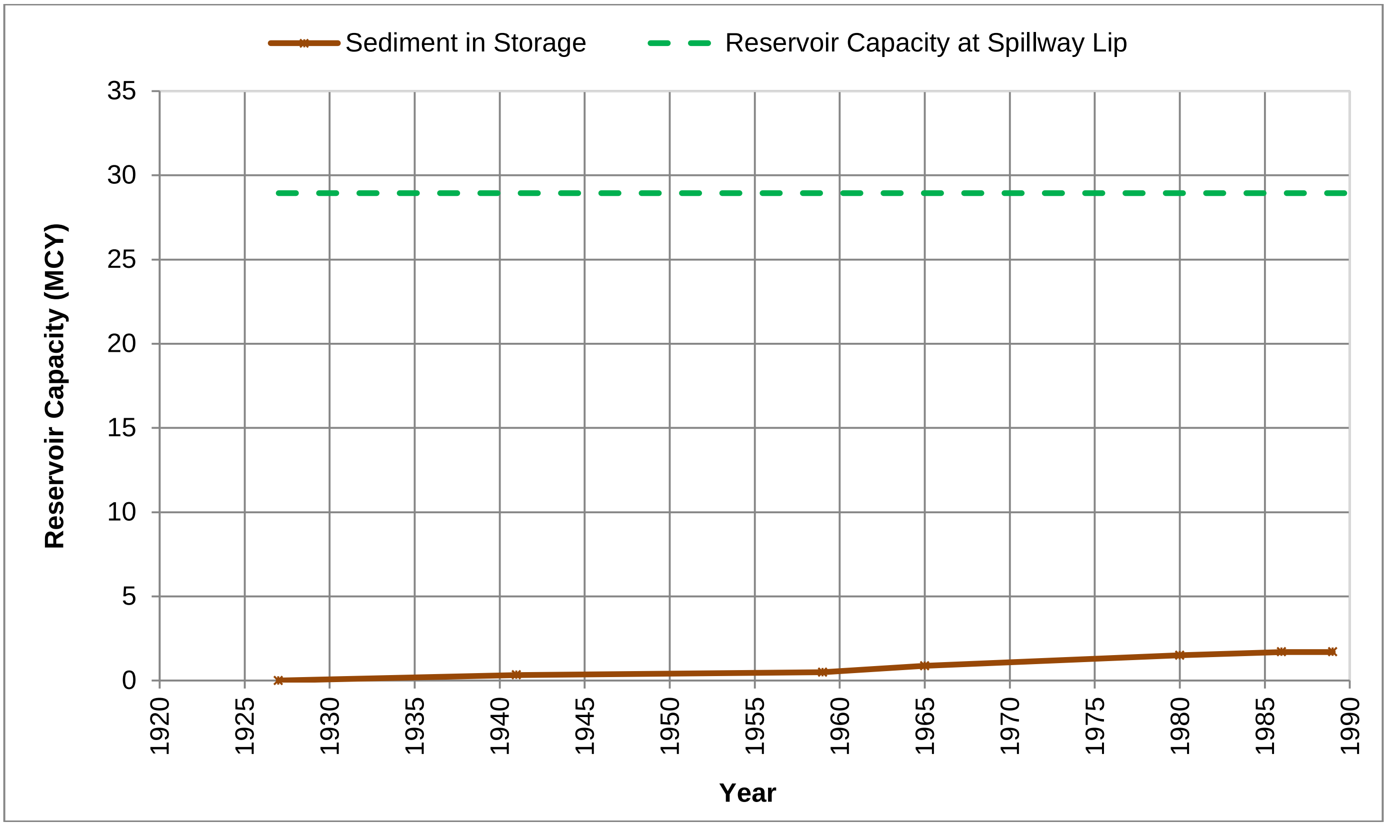
8.4.1.4 <u>DOWNSTREAM FLOOD CONTROL AND WATER CONSERVATION SYSTEM COMPONENTS</u>

Live Oak Wash, Puddingstone Diversion Channel, Marshall Canyon Channel, and Emerald Wash are the major channels that discharge into Puddingstone Reservoir, in additional to many underground storm drains. Puddingstone Reservoir is not subject to significant sediment compared to other dams because San Dimas Dam, Live Oak Dam, Puddingstone Diversion Dam, and numerous debris basins capture the sediment before the flows enter Puddingstone Dam. Puddingstone Dam discharges into Walnut Creek, which feeds the Walnut Creek Spreading Grounds and eventually discharges into the San Gabriel River.

8.4.1.5 <u>SEDIMENT DEPOSITION AND REMOVAL HISTORY</u>

Figure 8-56 shows the approximate sediment storage in Puddingstone Reservoir. As shown by the figure, the sediment that has accumulated in the reservoir over past 80 years has taken up approximately 6 percent of the reservoir's capacity. Therefore, sediment accumulation at Puddingstone Reservoir is not a great concern.

Figure 8-56 Graph of Historical Sediment Storage at Puddingstone Reservoir



Sediment has been removed once in the 84-year life of the reservoir, as shown in Table 8-22.

Table 8-22 Summary of Sediment Removed

Survey Date		Reservoir Capacity (MCY)	Quantity Sluiced (MCY)	Quantity Excavated (MCY)	Sediment Accumulated Between Surveys (MCY)	Sediment in Storage (MCY)
October	1927	28.1	-	-	-	-
January	1941	27.7	-	-	0.3	0.3
September	1959	27.6	-	-	0.2	0.5
November	1965	27.2	-	-	0.4	0.9
November	1980	26.7	-	-	0.6	1.5
January	1986	26.4	-	-	0.2	1.7
September	1989	26.4	-	0.006	0	1.7

8.4.2 PLANNING QUANTITIES

As described in Section 5, the 20-year planning quantity for sediment inflow into Puddingstone Reservoir is 0.8 MCY.

8.4.3 SUMMARY AND RECOMMENDATIONS

8.4.3.1 SUMMARY

Over the next 20 years, 0.8 MCY of sediment is estimated to be deposited in the Puddingstone Reservoir.

Excavation has been used in the past in Puddingstone Reservoir, however, only 6,453 CY of sediment was removed, which is not a significant amount compared to the 1.7 MCY currently stored in the reservoir. However, the 1.7 MCY of sediment that has accumulated in the past 80 years for a 33.1 square mile watershed is not significant compared to other similarly sized reservoirs. For comparison, Pacoima Dam has a similar watershed of 28.2 square miles but has seen 7.3 MCY of accumulated sediment during the past 80 years.

In addition, a complete draw down of the reservoir would have a major impact to wildlife and habitat. Drawing down the reservoir may not be a viable option due to the year round recreational use of the reservoir for boating and fishing. Raging Waters, a recreational water park, also uses the reservoir to serve its needs. Due to the environmental constraints with wildlife and the social constraints with the recreational use of Bonelli Park, any alternative that requires dewatering, such as excavation or sluicing, of the reservoir would have high environmental and social impacts and is not be considered a viable option at this time.

8.4.3.2 RECOMMENDATION

Due the minimal amount of sediment stored and expected, the primary function of recreation for Puddingstone Reservoir, and the environmental and social impacts that would be caused by removing sediment from the reservoir, it is recommended that Puddingstone Reservoir not be cleaned out unless sediment accumulation impacts operation of the reservoir.

8.5 SAN DIMAS RESERVOIR

8.5.1 BACKGROUND

San Dimas Dam, shown in Figure 8-57, is a concrete gravity arch dam that was constructed in 1922 by the Flood Control District and functions as a flood risk management and water conservation facility. With a drainage area of 16.2 square miles, San Dimas Dam had an original storage capacity of 2.4 MCY. Water impounded during the storm season behind the dam is gradually released and diverted into the downstream spreading facilities to recharge groundwater.

Figure 8-57 San Dimas Dam

8.5.1.1 LOCATION

San Dimas Reservoir is located at the southern end of San Dimas Canyon in the San Gabriel Mountains, approximately 3 miles northeast of the City of San Dimas. Figure 8-58 shows a vicinity map of San Dimas Reservoir.

Figure 8-58 San Dimas Reservoir Vicinity Map

San Dimas Canyon is a steep-walled, deeply incised canyon that opens out into the upper alluvial fan of the Foothill Basin, located in the San Gabriel Valley, as shown in Figure 8-59. Due to the shape of the canyon, San Dimas Reservoir is long, narrow, and sinuous with a length of approximately 0.8 mile and an average width of 300 feet. The canyon side slopes are rocky and as steep as 1:1 horizontal to vertical.

Figure 8-59 San Dimas Reservoir Topography

8.5.1.2 ACCESS

Access to the downstream and upstream sides of the dam is available off San Dimas Canyon Road, which is a sinuous paved road running along the east side of the reservoir and terminating at the north end of the reservoir, as shown in Figure 8-60. San Dimas Canyon Road south of the dam is wide enough for two-way traffic. The road narrows north of the dam to about 20 feet wide, becoming more difficult to accommodate two-way traffic. The access road to the downstream side of the dam is paved and over 30 feet wide. There is also a recently constructed paved, non-public access road leading from San Dimas Canyon Road (approximately 200 feet north of the dam) into the body of the reservoir, allowing vehicular access to the upstream side of the dam for sediment removal. This road is approximately 25 feet wide and adequate for two-way traffic.

Figure 8-60 San Dimas Access

8.5.1.3 <u>DAM OUTLETS</u>

San Dimas Dam is equipped with multiple valves and two slide gates that are 4 feet by 6 feet that are near the bottom of the reservoir. Modifications to the risers will be needed, if sluicing or a slurry pipeline alternative is used.

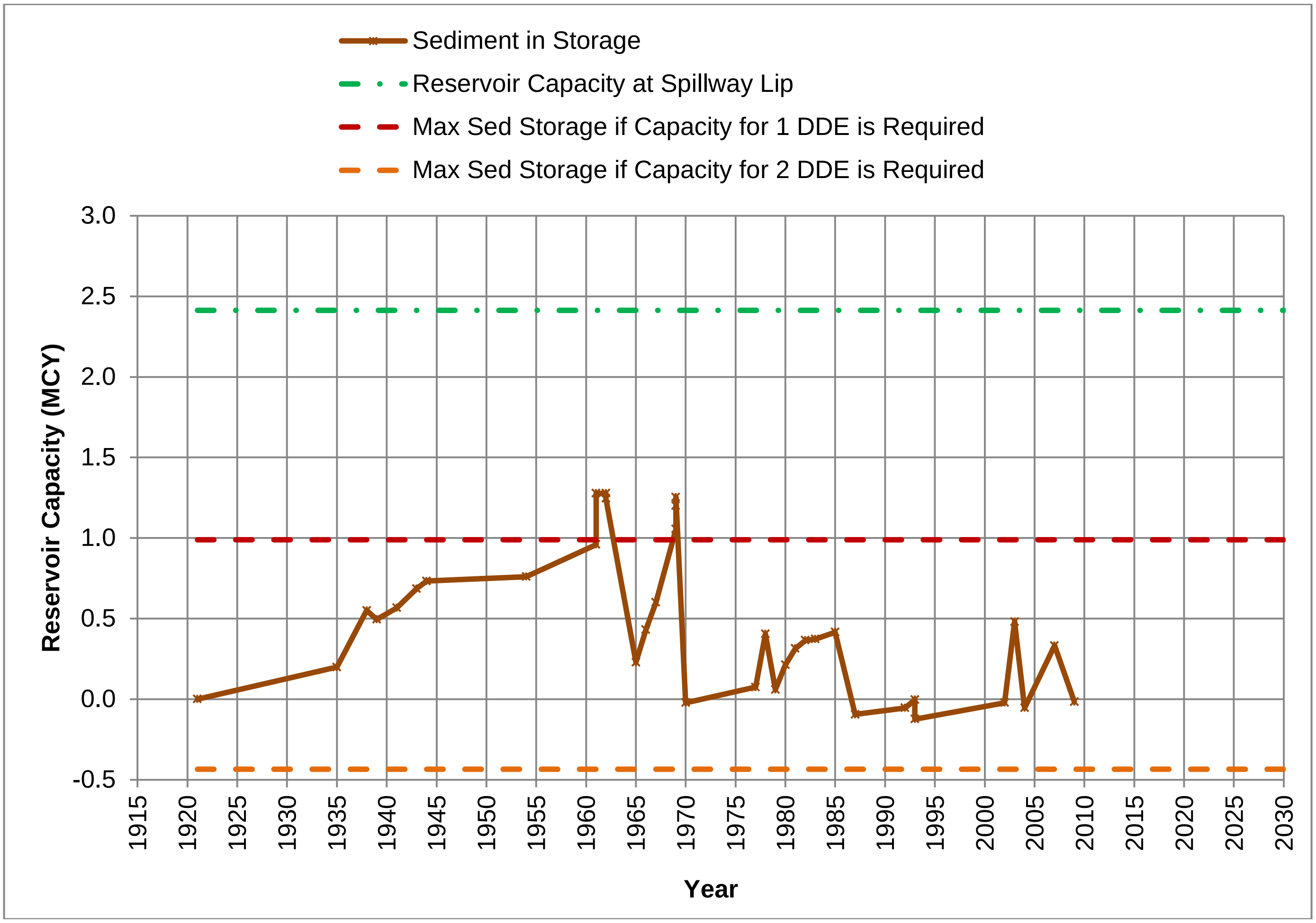
8.5.1.4 <u>DOWNSTREAM FLOOD CONTROL AND WATER CONSERVATION SYSTEM COMPONENTS</u>

Water that passes through San Dimas Dam travels 1.5 miles downstream along San Dimas Creek to the Puddingstone Diversion Reservoir. Puddingstone Diversion Dam can either divert flows to Puddingstone Reservoir or San Dimas Wash. The San Dimas Spreading Grounds is immediately downstream of Puddingstone Diversion Dam. All flows from the San Dimas Dam watershed are tributary to the San Gabriel River.

8.5.1.5 <u>SEDIMENT DEPOSITION AND REMOVAL HISTORY</u>

Figure 8-61 shows the approximate sediment storage in San Dimas Reservoir. It is the Flood Control District's practice to retain enough storage capacity within a reservoir for two DDEs, which are calculated and determined for each specific reservoir. For reference purposes, Table 8-23 shows the original reservoir capacity at spillway lip and the maximum sediment storage that allows for the storage of one and two DDEs. The graph shows that the Flood Control District has reduced the quantity of sediment in storage at San Dimas Reservoir on numerous occasions.

Figure 8-61 Graph of Historical Sediment Storage at San Dimas Reservoir



Sediment has been removed 9 times in the 89-year life of the reservoir. Table 8-23 shows that both excavation and sluicing have been used to remove sediment from San Dimas Reservoir in the past. The majority of the sediment (95 percent) has been removed through excavation.

Table 8-23 Summary of Historic Sediment Inflows and Cleanouts – San Dimas Reservoir

Survey Date		Reservoir Capacity (MCY)	Quantity Sluiced (MCY)	Quantity Excavated (MCY)	Sediment Accumulated Between Surveys (MCY)	Sediment in Storage (MCY)
October	1921	2.41	-	-	-	0.20
December	1935	2.21	-	-	0.20	0.55
May	1938	1.86	-	-	0.35	0.55
November	1939	1.92	0.05	-	-	0.62
December	1941	1.85	-	-	0.07	0.74
October	1943	1.73	-	-	0.12	0.79
November	1944	1.68	-	-	0.05	0.81
October	1954	1.65	-	-	0.03	1.01
August	1961	1.45	-	-	0.20	1.33
November	1961	1.14	-	-	0.32	1.33
January	1962	1.14	-	-	-	1.43
April	1962	1.18	0.012	-	0.09	1.71
November	1965	2.20	0.06	1.24	0.28	1.92
August	1966	2.00	-	-	0.20	2.08
April	1967	1.82	-	-	0.17	2.54
February	1969	1.37	-	-	0.45	2.68
March	1969	1.22	-	-	0.15	2.74
November	1969	1.17	-	-	0.05	2.77
November	1970	2.44	-	1.31	0.03	2.87
July	1977	2.35	-	-	0.10	3.20
March	1978	2.02	-	-	0.33	3.20
November	1979	2.36	-	0.35	-	3.35
March	1980	2.21	-	-	0.15	3.45
November	1981	2.11	-	-	0.10	3.50
October	1982	2.06	-	-	0.05	3.51
April	1983	2.05	-	-	0.01	3.56
May	1985	2.00	-	-	0.04	3.56
May	1987	2.52	-	0.51	-	3.60
December	1992	2.48	-	-	0.04	3.65
March	1993	2.42	-	-	0.05	3.65
June	1993	2.55	-	0.12	-	3.75
November	2002	2.44	-	-	0.10	4.25
September	2003	1.94	-	-	0.50	4.25
October	2004	2.48	-	0.53	-	4.64
January	2007	2.09	-	-	0.39	4.64
July	2009	2.47	-	0.35	0	0.20

Historically, excavated material has been placed at San Dimas SPS.

8.5.2 PLANNING QUANTITY AND ASSUMED SEDIMENT CHARACTERISTICS

As described in Section 5, the 20-year planning quantity for sediment inflow into San Dimas Reservoir is 1.9 MCY.

Approximately two thirds of the sediment in San Dimas Reservoir's planning quantity could potentially consist of particle sizes small enough to be dredged or sluiced. Given this assumption, if dredging or sluicing was to be employed, approximately 1.3 MCY of sediment could potentially be dredged or sluiced while the remaining 0.6 MCY would need to be excavated.

8.5.3 POTENTIAL STAGING AND TEMPORARY SEDIMENT STORAGE AREAS

8.5.3.1 SAN DIMAS SPS

The San Dimas SPS, as shown in Figure 8-62, is currently owned by the Flood Control District and was originally developed for the receipt of sediment form San Dimas and Puddingstone Diversion Reservoirs and other local debris retaining facilities.

Figure 8-62 San Dimas SPS Looking Southwest

San Dimas SPS - Environmental Impacts

If the open spaces that have been clear of vegetation are used as a staging or temporary sediment storage area then there will be minimal habitat impact. Air quality will be minimally impacted due to equipment used when spreading and compacting the sediment.

San Dimas SPS - Social Impacts

Visual and noise impacts may affect local residents directly on the east side of the SPS and a golf course directly to the west.

San Dimas SPS – Implementabilty

San Dimas SPS has been used to place sediment from past San Dimas Reservoir cleanouts. Environmental permits may be required for any modifications to the SPS.

San Dimas SPS – Performance

The San Dimas SPS is an active facility with an area of approximately 25 acres and a total remaining capacity of approximately 201,000 CY (about 50 percent of its total capacity). The material at the SPS can be excavated, gradually transported out, and placed at an alternative placement site to increase capacity at the SPS. This will maintain capacity at the SPS for future cleanouts.

San Dimas SPS – Cost

There is no additional cost to use San Dimas SPS as it is already owned by the Flood Control District. However, if the SPS is used to transition between different transportation methods, it will incur additional costs to manage and spread the sediment at the SPS ($2/CY) and place the material in trucks ($7.50/CY).

8.5.3.2 PUDDINGSTONE DIVERSION RESERVOIR

Puddingstone Diversion Reservoir, as shown in Figure 8-63, is approximately 2 miles downstream of San Dimas Dam along San Dimas Creek and is owned and operated by the Flood Control, refer to Section 9.5 for more information regarding Puddingstone Diversion Reservoir.

Figure 8-63 Puddingstone Diversion Reservoir

Puddingstone Diversion Reservoir - Environmental Impacts

Environmental permitting may be required to use Puddingstone Diversion Reservoir as a collection point for San Dimas outflows. Impacts to water quality and conservation are not expected.

Puddingstone Diversion Reservoir –Social Impacts

The reservoir is adjacent to residential properties to the South and the San Dimas Canyon Golf Course to the North. Any operations would increase traffic and noise near the reservoir. The hours of operation could be limited to minimize disturbance to the residents.

Puddingstone Diversion Reservoir – Implementabilty

Puddingstone Diversion Reservoir naturally collects sediment from San Dimas Reservoir outflows. There are no implementability issues expected.

Puddingstone Diversion Reservoir – Performance

As of October 2007, the reservoir had a capacity of 361,000 CY. This volume would be sufficient to stage or temporarily store sediment at this location. However, sediment would need to be immediately removed in order to restore the flood risk management functionality of the reservoir.

Puddingstone Diversion Reservoir – Cost

There is no additional cost to use Puddingstone Diversion Reservoir as it is already owned by the Flood Control District. However, if the Reservoir is used to transition between different transportation methods, it will incur additional costs to excavate the material ($3/CY).

8.5.4 REMOVAL ALTERNATIVES

The following section discusses impacts and costs of sediment removal at San Dimas Reservoir by means of excavation, dredging, and sluicing. Discussion of the transportation and placement alternatives is presented in Sections 8.5.5 and 8.5.6, respectively. Combined alternatives that address all phases of the sediment management process are presented and discussed in Section 8.5.7.

8.5.4.1 EXCAVATION

Excavation has been used in the past at San Dimas Reservoir and could be used in conjunction with either the conveyor or trucking transportation modes. Much of the reservoir bed is exposed during the dry season due to the limited inflow from the small watershed.

Excavation - Environmental Impacts

Emission from heavy equipment used during excavation will impact air quality within the proximity of the excavation site.

Excavating the reservoir is not expected to have impacts on water quality. As discussed in Section 6, dewatering a reservoir in order to excavate it could impact water conservation if the water is released faster than spreading facilities downstream of the reservoir can handle.

Excavation - Social Impacts

Excavation will have minimal social impacts due to the remote location of San Dimas Dam. Recreational users that hike in the vicinity of the reservoir may be subject to air quality and noise impacts.

Excavation – Implementability

Environmental permits may be required prior to the excavation operation. However, there are no implementability concerns with using excavation as a removal method.

Excavation – Performance

This method has performed well in the past and its ability to be used for sediment removal is not a concern for future cleanouts. For additional performance discussion, refer to Section 6.

Excavation – Cost

The cost to excavate sediment from a reservoir is approximately $3 per cubic yard. Excavating 1.9 MCY of sediment would cost approximately $5.7 million over a 20-year period.

8.5.4.2 DREDGING

Approximately two-thirds of San Dimas Reservoir's planning quantity meets the characteristics of dredgeable material. Therefore, if dredging is to be employed at San Dimas Reservoir, another removal method would have to be employed to remove the non-dredgeable material. Excavation with either trucking or conveyors is likely the only feasible methods to remove the larger, non-dredgeable material from the reservoir.

Dredging - Environmental Impacts

Dredging could impact water quality within San Dimas Reservoir by increasing the turbidity. However, as discussed in Section 6, water quality concerns could be partially addressed with a silt curtain around the dredge. As discussed in Section 6, dredging sediment (and transporting it via a slurry pipeline) could affect water conservation.

There are also some minor impacts to air quality due the dredging equipment.

Dredging - Social Impacts

Dredging will have minimal social impact due to the remote location of San Dimas Dam. Recreational users that hike along North San Dimas Canyon Road may be subject to air quality and noise impacts.

Dredging – Implementability

The reservoir would need to be drained to a certain depth for the hydraulic dredge to be operable.

No additional right of way is anticipated to be required for implementation of a dredging operation within the reservoir. Dredging would require environmental regulatory permits.

Dredging has not previously been employed by the Flood Control District and is not considered to be a proven method to remove sediment from the reservoir under the Flood Control District's jurisdiction.

Drawing down the reservoir significantly may still be needed in order to meet the 50-foot water depth capabilities of the hydraulic dredge. Another limitation of dredging may the availability of an area to dewater material downstream.

Dredging – Performance

Assuming a dredge can operate at 200 CY per hour and operate all year round, a dredging operation can be performed for 6 months every 3 years and remove 1.3 MCY.

Dredging – Cost

Based on the estimated unit cost of $10.50/CY for dredging and $2/CY for two booster pumps required to pump the material to Puddingstone Diversion Reservoir, dredging 1.3 MCY of sediment would cost approximately $15.9 million.

8.5.4.3 Sluicing (As a Removal Method)

Historically, sluicing has accounted for only about 5 percent of the sediment that has been removed from San Dimas Reservoir. Sluicing events in 1939, 1962, and 1965 removed a total of about 245,000 CY from the reservoir. In contrast to this amount, over 4.4 MCY of sediment has been removed by 7 different excavations between 1965 and 2009.

Sluicing would only be effective for finer materials and would still require excavation for larger materials. It is estimated that approximately two thirds of the material meets the characteristics of sluiceable material. The sediment would travel along San Dimas Creek and be captured by the Puddingstone Diversion Dam.

This section focuses on sluicing as a sediment removal method and discusses the impacts of sluicing within San Dimas Reservoir only. For the impacts of sluicing downstream of the dam refer to Section 8.5.5.1.

Sluicing (Removal) – Environmental Impacts

Within San Dimas Reservoir itself, sluicing would be expected to impact vegetation and animal species in a similar manner as excavating sediment from the reservoir would, since in both cases the reservoir would need to be drained. See the discussion under Excavation for more information.

During a sluicing operation, water quality within the reservoir would be impacted due to the higher-than-normal sediment concentration. As discussed in Section 6, removing sediment from a reservoir by sluicing could affect water conservation.

Sluicing operations within San Dimas Reservoir would result in equipment emissions. However, given the Flood Control District's previous sluicing projects, only a few pieces of equipment would be necessary within the reservoir.

Sluicing (Removal) – Social Impacts

Due to the remote location of the reservoir, minimal noise and visual impacts would be associated with sluicing.

Sluicing (Removal) – Implementability

Base flows from San Dimas Creek have shown to be sufficient to use sluicing as a means of removing sediment from San Dimas Reservoir. In the past, the flows have supported sluicing events with an average sediment removal of 75,000 CY per event. Environmental permitting will be required to use sluicing to remove sediment from San Dimas Reservoir.

Sluicing (Removal) – Performance

Based on previous cleanout data of 75,000 CY per event, a cleanout will be required almost every year to remove the 1.3 MCY of sluiceable material.

Sluicing (Removal) – Cost

The cost to sluice sediment from a reservoir is approximately $2.5 per cubic yard. Sluicing 1.3 MCY of sediment would cost approximately $3.2 million over a 20-year period.

8.5.5 TRANSPORTATION ALTERNATIVES

The following section discusses the impacts and costs of transporting sediment removed from San Dimas Reservoir. The alternatives discussed include sluicing, trucking, conveyor belts, and slurry pipelines. Discussion of the removal alternatives was presented in Section 8.5.4. The placement alternatives are presented in 8.5.6. Combined alternatives that address all phases of the sediment management process are presented and discussed in Section 8.5.7.

8.5.5.1 SLUICING (AS A TRANSPORT METHOD)

This section focuses on the impacts of utilizing sluicing as a transport method to move sediment downstream of San Dimas Dam along San Dimas Creek to the Puddingstone Diversion Reservoir. For the impacts of sluicing operations within San Dimas Reservoir, refer to the discussion of sluicing as a removal method in the previous section. Impacts at Puddingstone Diversion Reservoir were discussed in Section 8.5.3.2.

Sluicing (Transport) – Environmental Impacts

Several sensitive species exist within San Dimas Creek. Sluicing along the creek could result in some scouring of the streambed, temporary loss of native habitat and wildlife, and probable sediment deposition and accumulation in the channel.

Sluicing would impact water quality by increasing the turbidity within San Dimas Creek and Puddingstone Diversion Reservoir. As discussed in Section 6, transporting sediment via sluicing could affect water conservation.

Sluicing (Transport) – Social Impacts

Minimal noise and visual impacts would be associated with sluicing. Visual impacts will consist of flows in San Dimas Creek with higher levels of sediment than normal. Recreation along the creek could be impacted by sluicing operations.

Sluicing (Transport) – Implementability

Base flows from San Dimas Creek have shown to be sufficient to use sluicing as a means of transporting sediment along San Dimas Creek. Environmental permitting will be required to use sluicing to transport sediment.

Modifications to the risers attached to the slide gates may be required in order to pass the sluiced material downstream.

Sluicing (Transport) – Performance

Based on previous cleanout data of 75,000 CY per event, a cleanout will be required almost every year to remove the 1.3 MCY of sluiceable material.

Sluicing (Transport) – Cost

The cost to sluice sediment from a reservoir is approximately $2.5 per cubic yard. Sluicing 1.3 MCY of sediment would cost approximately $3.2 million over a 20-year period.

8.5.5.2 TRUCKING

Trucks could operate as a stand-alone transportation mode from the body of San Dimas Reservoir to the final placement location or in conjunction with sluicing and conveyors where the sediment is transported to the San Dimas SPS or Puddingstone Diversion Reservoir and then trucked to its final placement location. Truck access to the dam and the body of the reservoir is available along North San Dimas Canyon Road.

Trucking - Environmental Impacts

Since existing roads would be used to truck sediment, no particular impacts would be expected on habitat, water quality, or water conservation. Air quality would be impacted due to the truck operations to the residents and recreational users within proximity of the haul route. Employing low emission trucks would reduce air quality impacts.

Trucking - Social Impacts

The haul route travels through a residential area and will impact the traffic and noise for the residents with properties near the proximity of the haul route. However, residential properties do not immediately face North San Dimas Canyon Road.

Trucking – Implementability

Trucking, combined with excavation, has been the primary method to remove sediment from the reservoir. Double dump trucks can be used for this operation since the haul route mainly uses major roadways and the reservoir is very accessible.

Trucking – Performance

Double dump trucks, which have the capacity for approximately 16 CY, can operate for 6 months and transport 800,000 CY of sediment. A cleanout operation can be performed every 6-7 years and remove the total 20-year quantity of 1.9 CY

Trucking – Cost

Assuming a trucking unit cost of approximately $0.30/CY-Mile for a double dump truck, the estimated trucking cost to transport 1.9 MCY of sediment from San Dimas Reservoir to a pit in the Irwindale area is approximately $14.9 million.

Conveyor Belts

A conveyor system can be combined with excavation in order to transport the material one mile downstream to the San Dimas SPS along the shoulder of North San Dimas Canyon Road.

Conveyor Belts - Environmental Impacts

The conveyor system would be installed along the existing road from the outlet of the slide gate tunnel and have minimal impact on habitat along the route. A conveyor system would have very minimal air quality impacts unless a generator is used as discussed in Section 6.

Conveyor Belts - Social Impact

Use of a conveyor belt system may result in visual intrusion issues to residents or recreational users along the conveyance route; however, the impact is expected to be minimal.

The conveyor system may not be able to accommodate two-way traffic along North San Dimas Canyon Road and may significantly impact traffic.

The conveyor system will cross Golden Hills Road and will impact traffic access for the residents who live in the proximity of the SPS. An overhead conveyor can be used at this intersection to alleviate traffic concerns.

Conveyor Belts – Implementability

Conveyor systems have the ability to handle relatively circuitous alignments as long as the turning radii are no less than approximately 300 feet. Because of the infrequent need for cleanouts, a conveyor would be installed on a temporary basis.

Conveyor Belts – Performance

Assuming a conveyor system can operate at 500 CY per hour and operate for 6 months, a conveyor operation would be required every 5 years to remove the total 20-year quantity of 1.9 MCY.

Conveyor Belts – Cost

Conveyor costs are approximately $800/LF for installation and operating costs. The cost for 1 mile of conveyor would be approximately $4.2 million.

8.5.5.3 SLURRY PIPELINE

A slurry pipeline would only be feasible if dredging is used. The dredge will pump the sediment/water into a 12-inch high-density polyethylene (HDPE) slurry pipeline that would run along the shoulder of North San Dimas Canyon Road and eventually discharge into the Puddingstone Diversion Reservoir. The sediment can be dewatered at the reservoir and eventually excavated and trucked out to the final placement site. Impacts associated with using Puddingstone Diversion Reservoir were discussed previously.

Slurry Pipeline - Environmental Impacts

The slurry pipeline would be constructed along the roadway and not likely impact habitat. Water quality at the dewatering site would be impacted by high turbidity.

Slurry Pipeline - Social Impacts

The slurry pipeline would impact traffic as the pipe would be placed along the shoulder of North San Dimas Canyon Road. Portions of the slurry pipe that cross intersections (such as at Golden Hills Road) could be installed underground.

The slurry pipeline may not be able to accommodate two-way traffic along North San Dimas Canyon Road and may impact traffic.

Slurry Pipeline – Implementability

Sediment in San Dimas Reservoir could be removed with hydraulic dredging and transported through the dam to a slurry pipeline. The pipeline could be constructed down the shoulder of North San Dimas Canyon Road and the Puddingstone Diversion Reservoir where dredge spoil piles could be created awaiting removal for final placement. The pipeline to the reservoir would be approximately 2 miles long. Booster pumps will likely be needed to pump the slurry material to the reservoir due to the lack of grade along North San Dimas Canyon Road. The slurry pipeline will need to be installed underground at intersections to eliminate traffic impacts.

Modifications to the risers attached to the slide gates may be required in order to pass the sluiced material downstream.

Slurry Pipeline – Performance

Assuming a dredge operation can remove 200 CY per hour, the 12-inch HDPE slurry pipeline will have approximately 15 cubic feet per second (cfs) flowing in it.

Slurry Pipeline – Cost

The slurry pipeline cost is approximately $37.50/LF for an above ground 12-inch HDPE slurry pipeline. For a 2-mile long slurry pipe, the total cost is approximately $400,000.

8.5.6 PLACEMENT ALTERNATIVES

This section discusses the impacts and costs at potential placement alternatives for sediment removed from San Dimas Reservoir. Specifically, this section discusses the placement of sediment at pits and the existing San Dimas Sediment Placement Site. Discussion of the removal and transportation was presented in Sections 8.5.4 and 8.5.5, respectively. Combined alternatives that address all phases of the sediment management process are presented and discussed in Section 8.5.7.

Combined alternatives that address all phases of the sediment management process are presented and discussed in Section 8.5.7.

8.5.6.1 LANDFILLS

Scholl Canyon Landfill is the closest landfill to San Dimas Reservoir at a distance of 27 miles. More information regarding the landfill can be found in Section 6.

8.5.6.2 QUARRY WITH EXISTING OPERATIONS

There are existing operational pits in the Irwindale area (13 miles away) and the Claremont area (8 miles away) that could accept material from San Dimas Reservoir as discussed in Section 6.

It is assumed that one third of the material will be high quality material that will be of value to the existing operational pits. In exchange for this high quality material, it is assumed that the Flood Control District will be allowed to place the same amount of lower quality material in the operational quarry pits. The remaining one third of the material that will be placed at the pit will be subject to a tipping fee.

8.5.6.3 ACQUIRED QUARRY

As discussed previously, the acquisition of a quarry for placement of sediment from facilities under the jurisdiction of the Flood Control District is being pursued for sediment management. Acquisition of a quarry in the Irwindale area would be most desirable for sediment management operations related to Puddingstone Diversion Reservoir.

It will be assumed that acquiring a quarry could potentially cost the Flood Control District approximately $1 per CY and that placement of sediment would cost $2 per CY.

In order to conserve space in an acquired quarry, the high quality material can still be taken an existing quarry operation where the Flood Control District can place an equivalent volume of lower quality material. The remaining material can be placed at the acquired quarry.

8.5.6.4 SEDIMENT PLACEMENT SITES

As mentioned earlier, San Dimas SPS is an existing SPS that is one mile downstream of San Dimas Dam. While the remaining available capacity at San Dimas SPS was approximately 200,000 as of the writing of the Strategic Plan, it was assumed that the capacity would be reserved for emergencies. Thus, this Strategic Plan does not include placing sediment from San Dimas Reservoir at San Dimas Sediment Placement Site.

8.5.7 COMBINED SEDIMENT MANAGEMENT ALTERNATIVES

8.5.7.1 COMBINED ALTERNATIVE 1: EXCAVATION > TRUCKING > IRWINDALE PITS

The sediment can be excavated and placed directly into a double dump truck and transported to the final placement site at a pit in the Irwindale area, as shown in Figure 8-64 and Figure 8-65. It would take 3 cleanout events, or a cleanout every 6-7 years, to remove the expected 20-year quantity. The total cost is estimated to be approximately $20-25 million, as shown in Table 8-24. It is assumed that only one third of the material will be subject to a tipping or acquisition fee as discussed in Section 8.5.6.

Figure 8-64 San Dimas Management Alternative 1 – Map 1 of 2

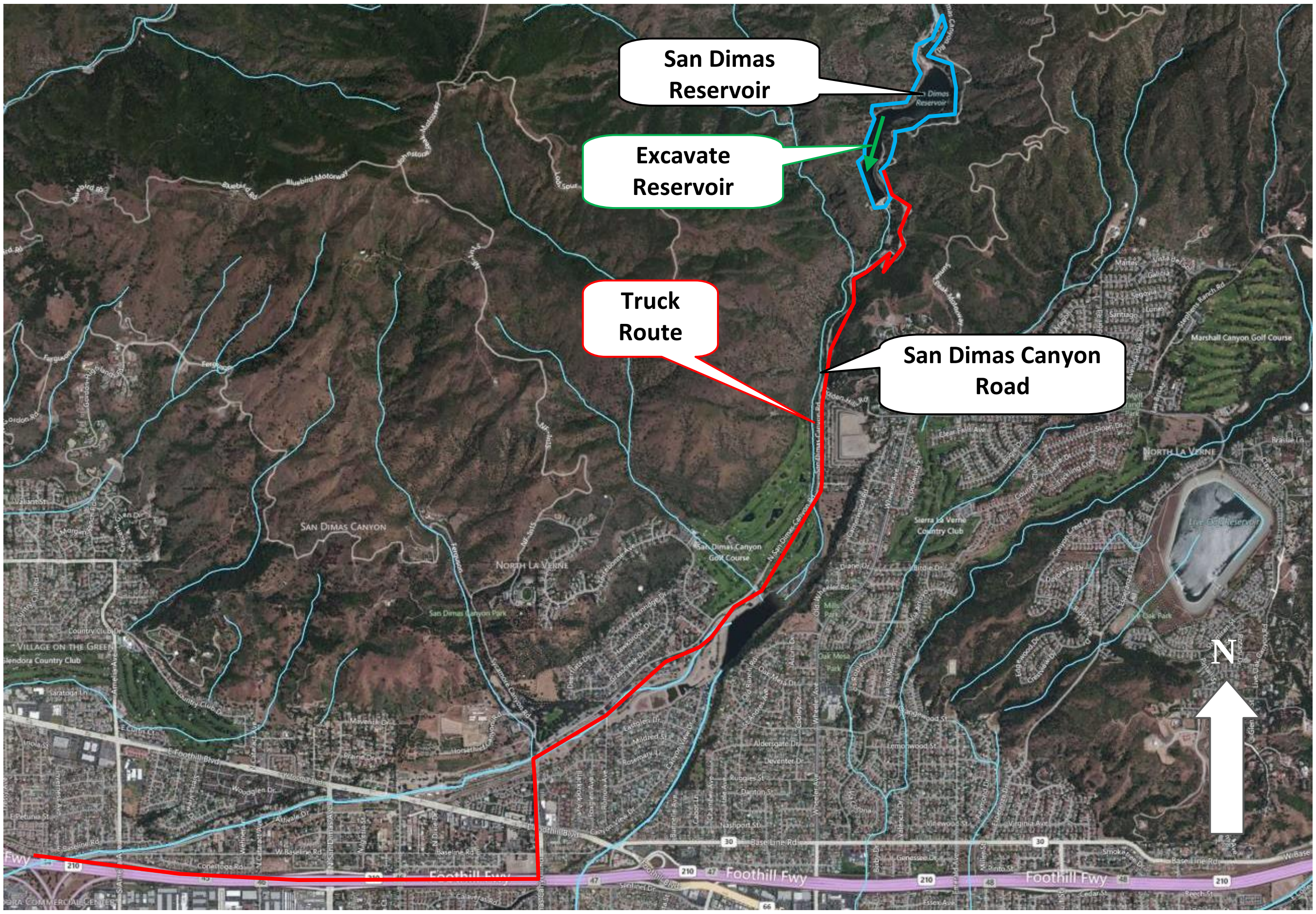


Figure 8-65 San Dimas Management Alternative 1 – Map 2 of 2

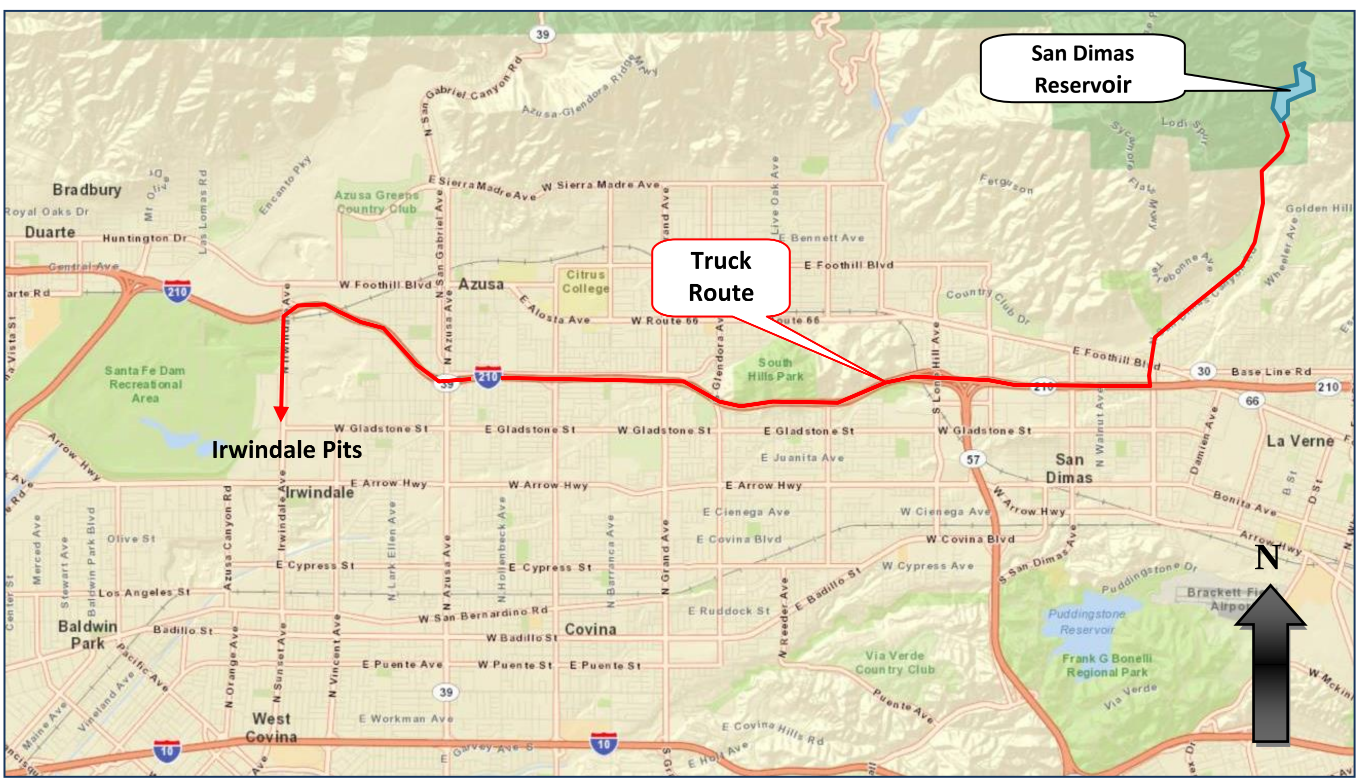


Table 8-24 San Dimas Management Alternative 1 Cost Estimate

Activity	Amount (MCY)	Distance (MI)	Unit Cost	Unit	Total Cost ($ Millions)
Excavation at San Dimas Reservoir	1.9		$ 3.00	CY	$ 5.7
Double Dump Truck from Reservoir to Pit		26	$ 0.30	MI-CY	$ 14.9
Pit Placement Fee			$ 3.00 - 7.00	CY	$ 1.9 - 4.5
				Total	**$ 20 – 25**

8.5.7.2 COMBINED ALTERNATIVE 2: EXCAVATION > CONVEYOR > SAN DIMAS SPS > EXCAVATION > TRUCK > IRWINDALE PITS & LANDFILLS

This combined alternative would consist of excavating sediment from San Dimas Reservoir and transporting the sediment via a conveyor system to San Dimas SPS, where it would be stored temporarily. Then, from San Dimas SPS, the sediment would be transported out gradually via double dump trucks at a rate that would reduce social impacts. From San Dimas SPS, the sediment would be taken to either a pit or a landfill. This combined alternative is illustrated by Figure 8-66 and Figure 8-67. It would take 4 cleanout events, or a cleanout every 5 years, to remove the expected 20-year quantity. The total cost is estimated to be approximately $35-40 million, as shown in Table 8-25. It is assumed that only one third of the material will be subject to a tipping or acquisition fee as discussed in Section 8.5.6.

Figure 8-66 San Dimas Management Alternative 2 – Map 1 of 2

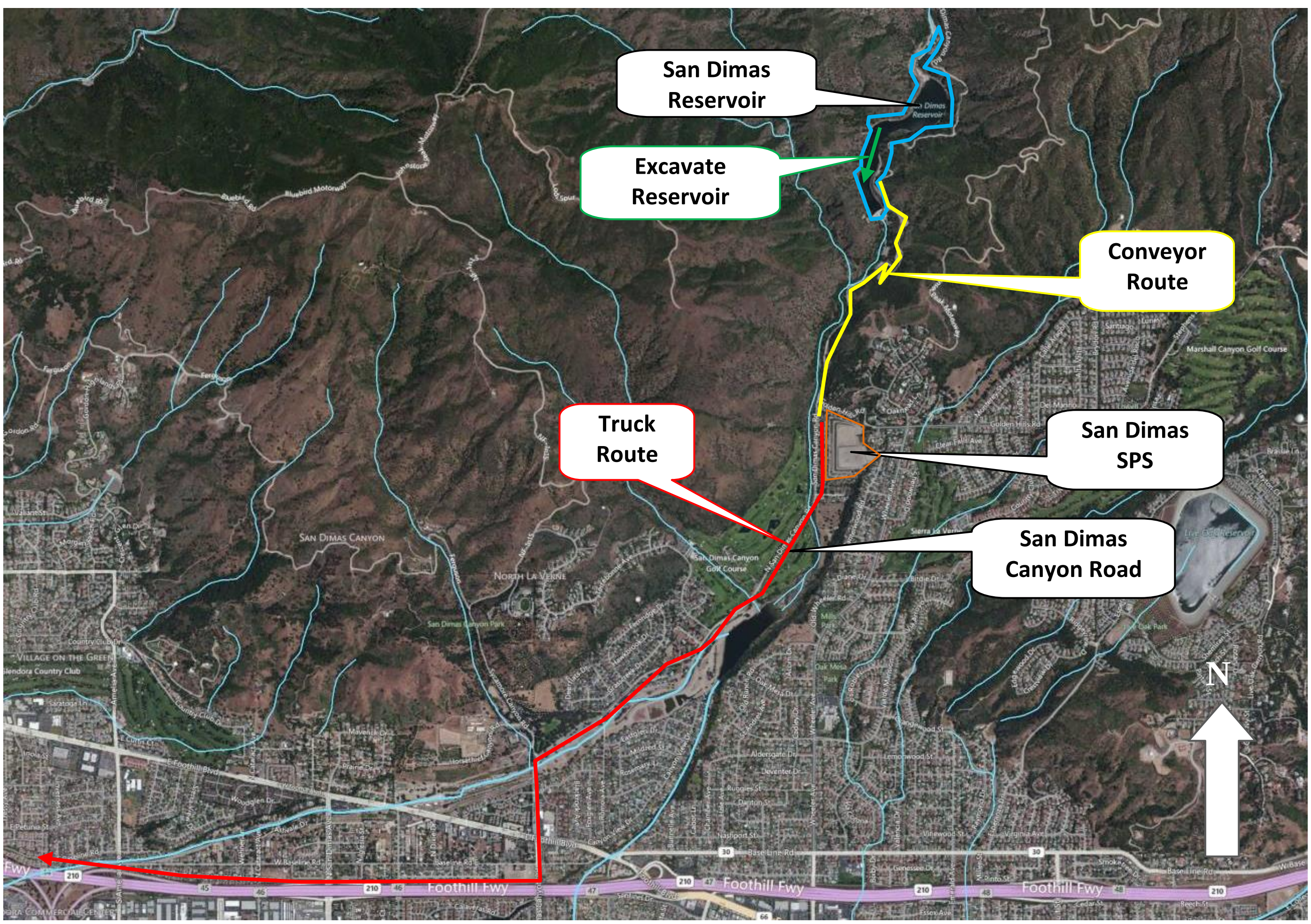


Figure 8-67 San Dimas Management Alternative 2 – Map 2 of 2

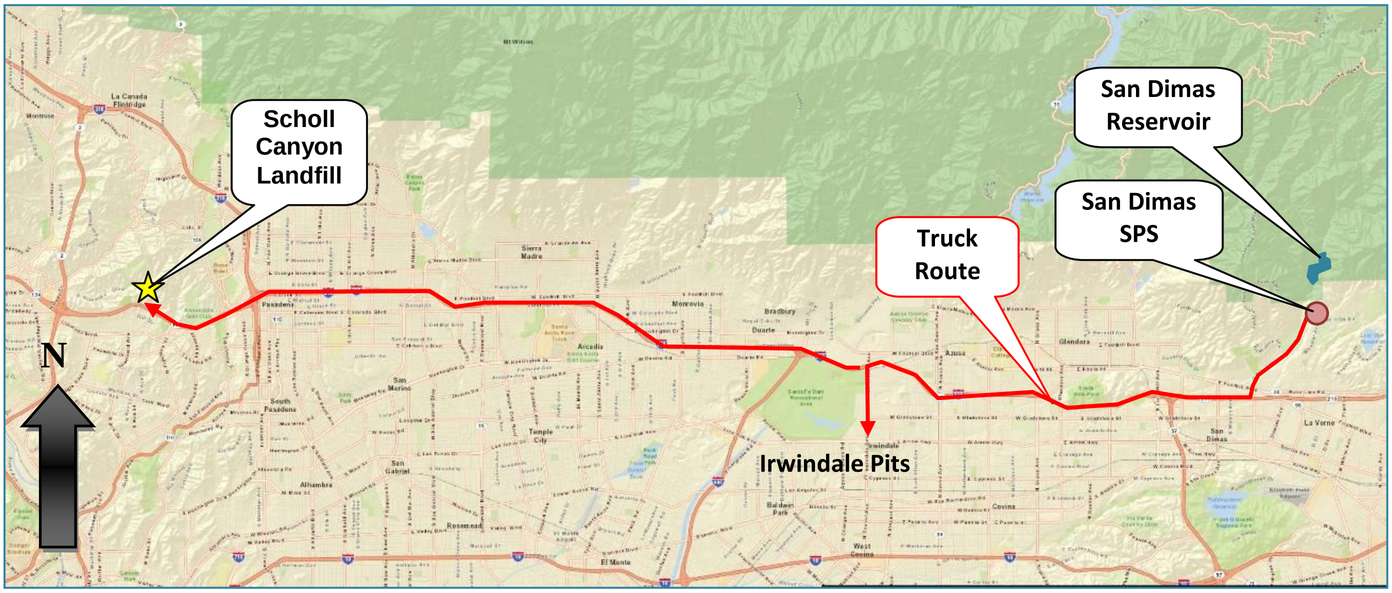


Table 8-25 San Dimas – Alternative 2 Cost Estimate

Activity	Amount (MCY)	Distance (MI)	Unit Cost	Unit	Total Cost ($ Millions)
Excavation at San Dimas Reservoir	1.9		$ 3.00	CY	$ 5.7
Conveyor from Reservoir to SPS		1	$ 800.00	LF	$ 4.2
Spreading at San Dimas SPS			$ 2.00	CY	$ 3.8
Excavation from SPS			$ 3.00	CY	$ 5.7
Double Dump Truck from SPS		24 -52	$ 0.30	MI-CY	$ 13.8 - 19.0
Pit or Landfill Placement Fee			$ 3.00-7.00	CY	$ 1.9 – 4.5
				Total	**$ 35 – 40**

8.5.7.3 COMBINED ALTERNATIVE 3: SLUICING > PUDDINGSTONE DIVERSION RESERVOIR > EXCAVATION > TRUCKING > IRWINDALE PITS + EXCAVATION > TRUCKING > IRWINDALE PITS

Two thirds of the sediment can be sluiced from the reservoir and into the San Dimas Creek and eventually to the Puddingstone Diversion Reservoir as shown in Figure 8-68. The material will be dewatered at the reservoir, excavated, and transported out via trucks to a pit in the Irwindale area, as shown in Figure 8-69.

Refer to Section 9.5, for more information regarding removal alternatives for the Puddingstone Diversion Reservoir. The remaining one third of the larger material would not be suitable for sluicing and will have to be excavated similar to option 1. It would take 20 sluicing events, or a cleanout every year, to remove the 20-year planning quantity. The total cost is estimated to be approximately $25 million, as shown on Table 8-26 below. It is assumed that only one third of the material will be subject to a tipping or acquisition fee as discussed in Section 8.5.6.

Figure 8-68 San Dimas Management Alternative 3 – Map 1 of 2

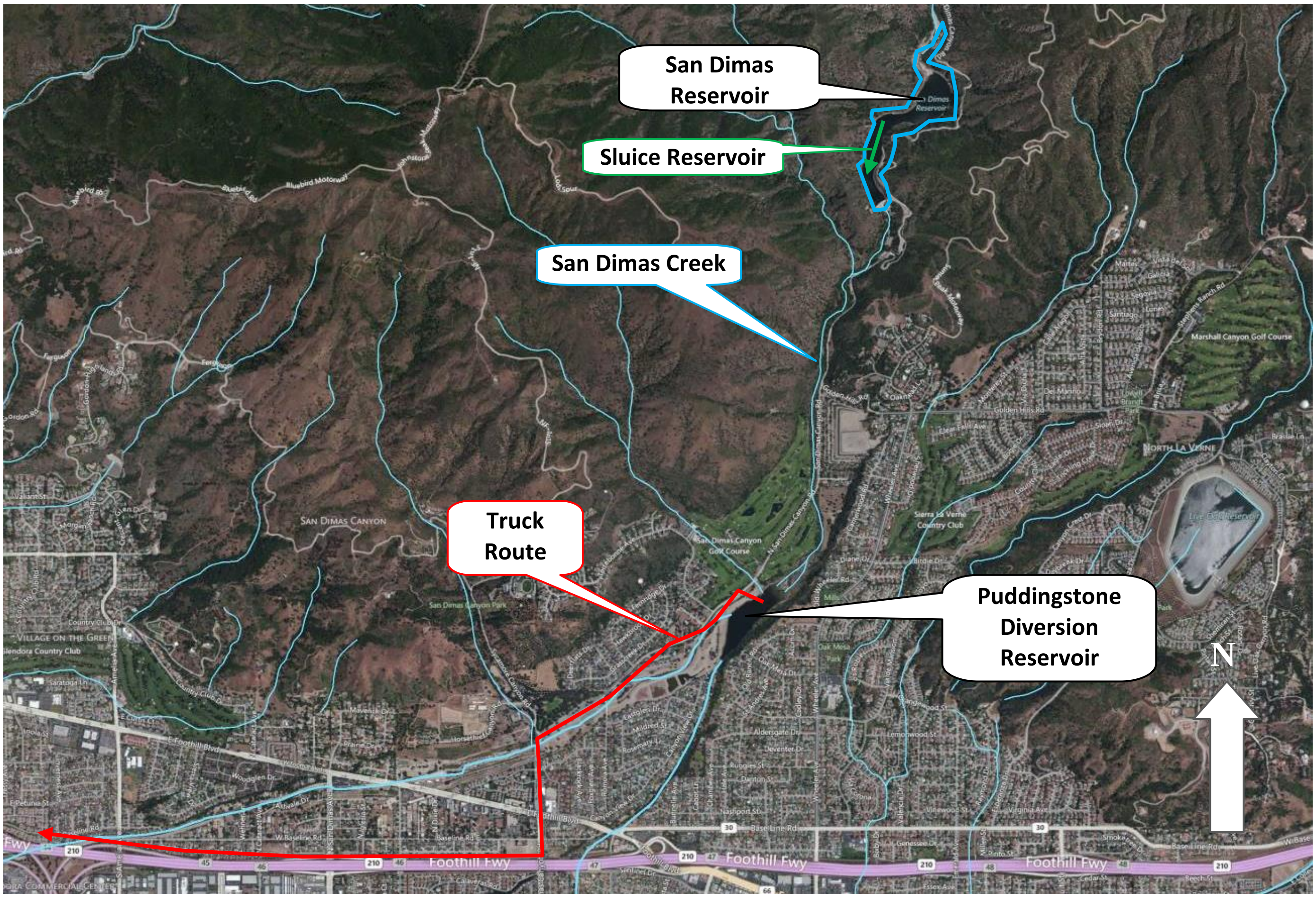


Figure 8-69 San Dimas Management Alternative 3 – Map 2 of 2

Table 8-26 San Dimas – Alternative 3 Cost Estimate

Activity	Amount (MCY)	Distance (MI)	Unit Cost	Unit	Total Cost ($ Millions)
Sluicing at San Dimas Reservoir	1.3		$ 2.50	CY	$ 3.2
Excavation at Puddingstone Diversion Reservoir			$ 3.00	CY	$ 3.8
Double Dump Truck from Puddingstone Diversion Reservoir to Pits		22	$ 0.30	MI-CY	$ 8.4
Excavation at San Dimas Reservoir	0.6		$ 3.00	CY	$ 1.9
Double Dump Truck from San Dimas Reservoir to Pit	0.6	26	$ 0.30	MI-CY	$ 5.0
Pit Placement Fee	1.9		$ 3.00-7.00	CY	$ 1.9 – 4.5
				Total	**$ 25**

8.5.7.4 COMBINED ALTERNATIVE 4: DREDGING > PUDDINGSTONE DIVERSION RESERVOIR > EXCAVATION > TRUCKING IRWINDALE PITS + EXCAVATION > TRUCKING > IRWINDALE PITS

Two thirds of the sediment can be dredged from the reservoir and transported via slurry pipeline into the Puddingstone Diversion Reservoir, as shown in Figure 8-70. The material will be dewatered at the Puddingstone Diversion Reservoir, excavated, and transported out via trucks to a pit in the Irwindale area, as shown in Figure 8-71. Refer to Section 9.5 for more information regarding removal alternatives for the Puddingstone Diversion Reservoir. The remaining one third of the larger material would not be suitable for dredging and will have to be excavated similar to Alternative 1. It would take 7 cleanouts, or a cleanout every 3 years, to remove the 20-year planning quantity. The total cost is estimated to be approximately $35-40 million, as shown on Table 8-27 below. It is assumed that only one third of the material will be subject to a tipping or acquisition fee as discussed in Section 8.5.6.

Figure 8-70 San Dimas Management Alternative 4 – Map 1 of 2

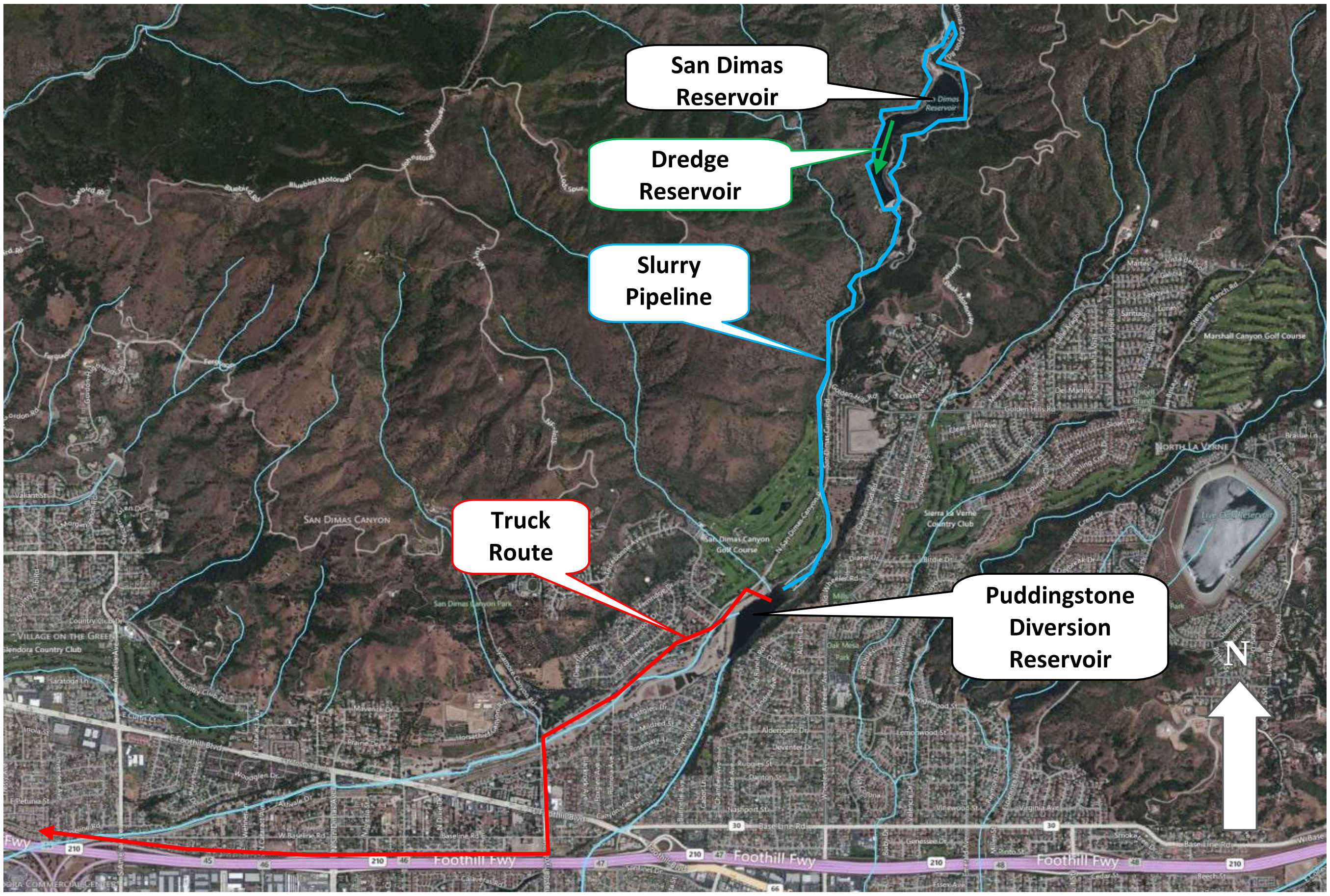


Figure 8-71 San Dimas Management Alternative 4 – Map 2 of 2

Table 8-27 San Dimas – Alternative 4 Cost Estimate

Activity	Amount (MCY)	Distance (MI)	Unit Cost	Unit	Total Cost ($ Millions)
Dredging (2/3) at San Dimas Reservoir	1.3		$ 12.50	CY	$ 15.9
Excavation at Puddingstone Diversion Reservoir			$ 3.00	CY	$ 3.8
Double Dump Truck from Puddingstone Diversion Reservoir to Pits		22	$ 0.30	MI-CY	$ 8.4
Excavation (1/3) at San Dimas Reservoir	0.6		$ 3.00	CY	$ 1.9
Double Dump Truck from San Dimas Reservoir to Pit		26	$ 0.30	MI-CY	$ 5.0
Placement at Pits	1.9		$ 3.00-7.00	CY	$ 1.9 - 4.5
				Total	**$ 35 - 40**

8.5.8 SUMMARY AND RECOMMENDATIONS

8.5.8.1 SUMMARY

Over the next 20 years, 1.9 MCY of sediment is planned to be removed from San Dimas Reservoir. The different management alternatives are briefly explained below and the impacts are shown in Table 8-28.

Sediment Management Alternatives

1 Excavate → Trucks → Irwindale Pits
Excavating the sediment and truck it to a pit in the Irwindale area.

2 Excavate → Conveyor → San Dimas SPS → Excavation → Trucks → Irwindale Pits & Landfills
Excavate the sediment and place it on a conveyor system where it will be transported to the San Dimas SPS. From the SPS, the sediment can be gradually transported out via trucks to a pit in the Irwindale area or a landfill.

3 Sluice (1.3 MCY) → Puddingstone Diversion Reservoir → Excavate → Trucks → Irwindale Pits + Excavate (0.6 MCY) → Trucks → Irwindale Pits
It is assumed that two thirds of the 1.9 MCY will be small enough to sluice. Sluice 1.6 MCY from San Dimas Dam along San Dimas Creek to the Puddingstone Diversion Reservoir, where the sediment will be excavated and trucked to a pit in the Irwindale area. The larger material (0.6 MCY) will be excavated similar to alternative one.

4 Dredge (1.3 MCY) → Slurry Pipeline → Puddingstone Diversion Reservoir → Excavate → Trucks → Irwindale Pits + Excavate (0.6 MCY) → Trucks → Irwindale Pits
It is assumed that two thirds of the 1.9 MCY will be small enough to dredge. Dredge 1.6 MCY from San Dimas Dam into a slurry pipeline along San Dimas Canyon Road and discharge the sediment to the Puddingstone Reservoir. The sediment will be excavated from the Puddingstone Reservoir and trucked to a pit in the Irwindale area. The larger material (0.6 MCY) will be excavated similar to alternative one.

Table 8-28 San Dimas Reservoir Summary Table

Alternative		Quantity Removed (MCY)	Environmental				Social			Implementability	Performance		Cost
			Habitat	Water Quality	Groundwater Recharge	Air Quality[1]	Traffic	Visual	Noise	Special Permit/Agreement Required[2]	Previous Experience	# of Operations Required in Next 20 years	$ Millions
1	Excavation	1.9	◑		○	◑		○	○		Yes	3	25
	Trucks					●	●	◑	◑				
	Irwindale Pits									Yes			
2	Excavation	1.9	◑		○	◑		○	○		Yes	4	35-40
	Conveyor		○				○	◑	○				
	San Dimas SPS		○			○		◑	◑				
	Trucks					●	●	◑	◑				
	Irwindale Pits/Landfills									Yes			
3	Sluice	1.3	●	●	◑			◑			Yes	20	25
	Puddingstone Div. Reservoir		◑	●	○			◑	◑				
	Excavation	1.9	◑		○	◑		○	○				
	Trucks					●	●	◑	◑				
	Irwindale Pits									Yes			
4	Dredge	1.3	○	◑	○			○	○		No	7	35-40
	Slurry Pipeline		◑				○	◑					
	Puddingstone Diversion Res.		◑	●	○			◑	◑				
	Excavation	1.9	○		○	◑		○	○				
	Trucks					●	●	◑	◑				
	Irwindale Pits									Yes			

Legend

●	significant impact
○	possible impact
◑	some impact
	no impact

Notes: (a) Use of low-emission trucks would reduce air quality impacts from significant impact (●) to some impact (◑).
(b) All options require environmental regulatory permit.

8.5.8.2 RECOMMENDATION

It is recommended that all the alternatives be considered for future sediment removal projects at San Dimas Reservoir.

8.6 SANTA ANITA RESERVOIR

8.6.1 BACKGROUND

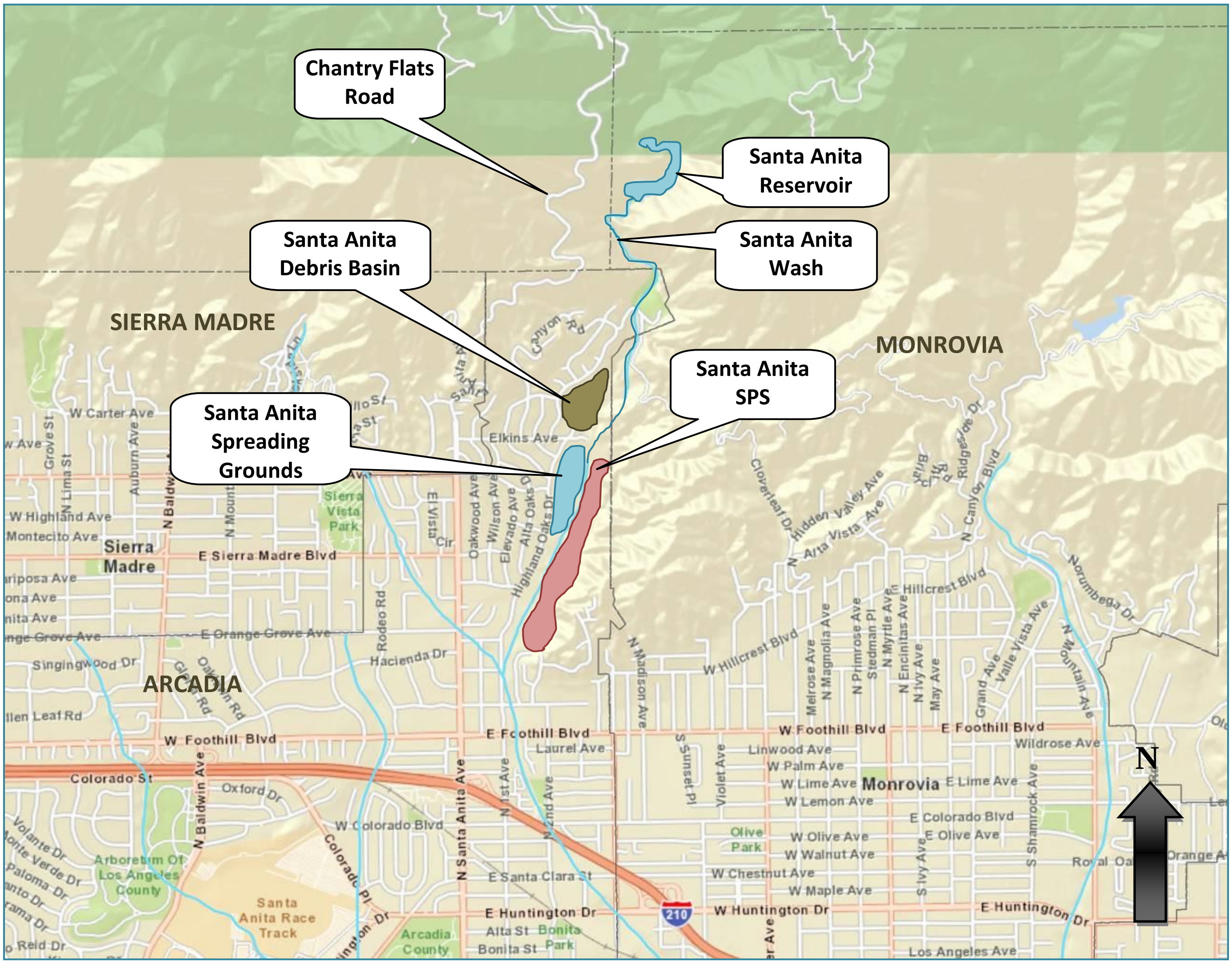
Santa Anita Dam, shown in Figure 8-72, is a concrete, constant angle arch dam that was built in 1927 by the Flood Control District and functions as a flood risk management and water conservation facility. With a drainage area of 10.8 square miles, Santa Anita Dam had an original storage capacity of 2.2 MCY. Water impounded during the storm season behind the dam is released gradually and diverted into the downstream spreading facilities to recharge groundwater. However, the first 20 cubic feet per second (cfs) discharged from the dam is diverted to a water intake for the City of Sierra Madre. Santa Anita Reservoir is not accessible to the public and is not used for recreation.

Figure 8-72 Santa Anita Dam

8.6.1.1 LOCATION

Santa Anita Reservoir is located in the San Gabriel Mountains, on Santa Anita Wash, approximately 2.5 miles north of the City of Arcadia, as shown in Figure 8-73.

Figure 8-73 Santa Anita Reservoir Vicinity Map



Santa Anita Canyon is a steep-walled, deeply incised canyon that opens out into the upper alluvial fan of the Los Angeles Basin. Due to the shape of the canyon, Santa Anita reservoir is long and narrow, with a length of approximately 1,500 feet and an average width of 200 feet. The canyon side slopes are rocky and can exceed 2:1 horizontal to vertical.

The average gradient of Santa Anita Wash below the dam is 310 feet per mile. The natural watercourse below the reservoir terminates 1.3 miles downstream in Santa Anita Debris Basin, which is operated by the Flood Control District. Figure 8-74 shows the topography of Santa Anita Canyon at the dam and reservoir.

Figure 8-74 Santa Anita Reservoir Topography

8.6.1.2 ACCESS

Access to the top of the dam is available off Chantry Flats Road via the Flood Control District's access road. Both Chantry Flats Road and the access road are very narrow and winding. Chantry Flats Road can accommodate two-way traffic for most of its length, but the access road can only accommodate one-way traffic. At the top of the dam, an unpaved road runs along the west side of the reservoir allowing vehicular access to the upstream end of the reservoir.

Located on the downstream side of the dam, Santa Anita Debris Basin, Spreading Grounds, and SPS can be accessed via Elkins Avenue, a residential road, as shown in Figure 8-75.

Figure 8-75 Santa Anita Dam Access

8.6.1.3 Dam Outlets

In addition to being equipped with a variety of valves, Santa Anita Dam is also equipped with a sluiceway controlled by a 5-foot by 5-foot sluice gate. An access tunnel, with dimension of at least 5 feet by 5 feet is not used to discharge water but connects the south edge of the reservoir with an access road on the east side of Santa Anita Wash downstream of the dam.

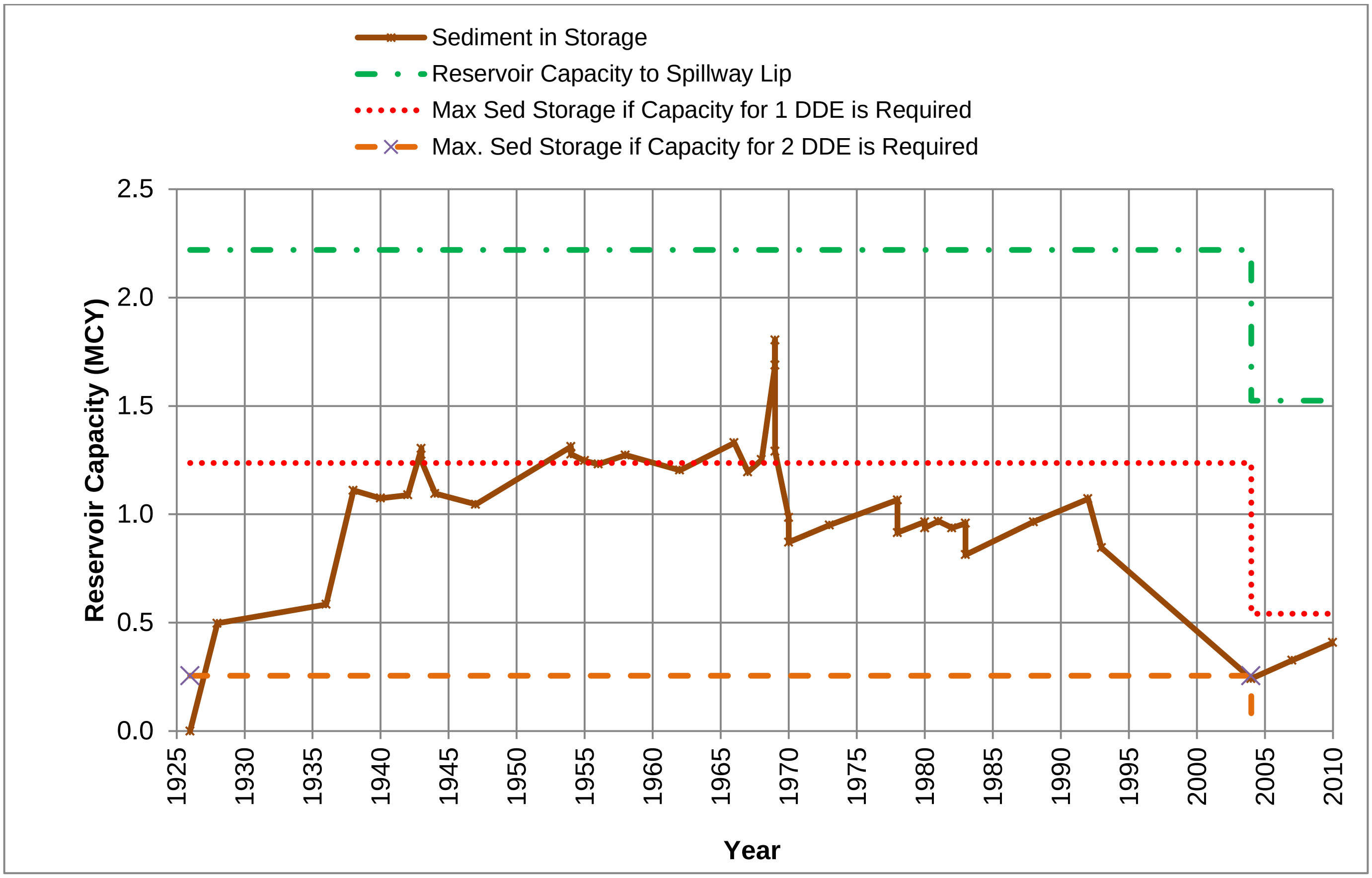
8.6.1.4 Downstream Flood Control and Water Conservation System Components

Water that passes through Santa Anita Dam travels 1.3 miles along Santa Anita Wash then to the Santa Anita Debris Basin, which is adjacent to the Santa Anita Spreading Grounds and Santa Anita SPS. Santa Anita Wash continues downstream where it joins the Rio Hondo, which eventually flows into the Los Angeles River.

8.6.1.5 Sediment Deposition and Removal History

Figure 8-76 shows the approximate sediment storage in Santa Anita Reservoir. It is the Flood Control District's practice to retain enough storage capacity within a reservoir for two DDEs, which are calculated and determined for each specific reservoir. For reference purposes, Table 8-29 shows the original reservoir capacity at spillway lip and the maximum sediment storage that allows for the storage of one and two DDEs. The graph shows that the Flood Control District has reduced the quantity of sediment in storage at Santa Anita Reservoir on numerous occasions.

Figure 8-76 Graph of Historical Sediment Storage at Santa Anita Reservoir



Note: For July 2004, sediment in storage volume based on new maximum capacity figure of 1.5 MCY.

Sediment has been removed 21 times in the 87-year life of the reservoir. Table 8-29 shows that both excavation and sluicing have been used to remove sediment from Santa Anita Reservoir in the past. The majority of the sediment (69 percent) has been removed through sluicing.

Table 8-29 Summary of Historic Sediment inflows and Cleanouts – Santa Anita Reservoir

Survey Date		Reservoir Capacity (MCY)	Quantity Sluiced (MCY)	Quantity Excavated (MCY)	Sediment Accumulated Between Surveys (MCY)	Sediment in Storage (MCY)
October	1926	2.22	-	-	-	-
March	1928	1.72	-	-	0.50	0.50
January	1936	1.64	-	-	0.09	0.58
July	1938	1.11	-	-	0.53	1.11
February	1940	1.15	0.26	-	0.22	1.07
February	1942	1.13	0.04	-	0.05	1.09
March	1943	0.92	-	-	0.21	1.30
September	1943	0.97	0.10	-	0.05	1.25
May	1944	1.12	0.15	-	-	1.10
January	1947	1.17	0.07	-	0.02	1.05
February	1954	0.91	0.02	-	0.29	1.31
July	1954	0.94	0.25	-	0.21	1.28
August	1955	0.97	0.03	-	-	1.25
February	1956	0.99	0.08	-	0.06	1.23
September	1958	0.95	-	-	0.04	1.27
April	1962	1.02	0.13	-	0.06	1.20
September	1966	0.89	0.02	-	0.15	1.33
June	1967	1.02	0.13	-	-	1.20
October	1968	0.97	0.02	-	0.08	1.25
February	1969	0.53	-	-	0.44	1.69
March	1969	0.42	-	-	0.12	1.80
November	1969	0.93	0.12	0.39	-	1.29
February	1970	1.23	-	0.33	0.03	0.99
November	1970	1.35	-	0.11	-	0.87
October	1973	1.27	-	-	0.08	0.95
April	1978	1.15	-	-	0.12	1.07
May	1978	1.31	0.15	-	-	0.91
March	1980	1.26	-	-	0.05	0.96
August	1980	1.28	0.03	-	-	0.94
December	1981	1.25	-	-	0.03	0.97
September	1982	1.25	-	-	-	0.94
March	1983	1.23	-	-	0.02	0.96
June	1983	1.38	0.15	-	-	0.81
February	1988	1.36	-	-	0.03	0.96
July	1992	1.22	-	-	0.13	1.07
April	1993	1.34	0.12	-	-	0.85
July	2004	1.28	-	-	0.06	0.24
July	2007	1.20	-	-	0.14	0.33
December	2010	1.22	-	-	0.01	0.41

Note: For July 2004, sediment in storage volume based on new maximum capacity figure of 1.5 MCY.

Historically, excavated material has been placed at Santa Anita SPS. This SPS is approximately 1.1 miles downstream of the reservoir.

8.6.2 PLANNING QUANTITY AND ASSUMED SEDIMENT CHARACTERISTICS

As described in Section 5, the 20-year planning quantity for sediment inflow into Santa Anita Reservoir is 1.2 MCY.

Approximately two thirds of the sediment in Santa Anita Reservoir's planning quantity could potentially be small enough to be dredged or sluiced. Given this assumption, if dredging or sluicing was to be employed, approximately 0.8 MCY of sediment could potentially be dredged or sluiced while the remaining 0.4 MCY would need to be excavated.

8.6.3 POTENTIAL STAGING AND TEMPORARY SEDIMENT STORAGE AREAS

8.6.3.1 SANTA ANITA SPS

Santa Anita SPS, as shown in Figure 8-77, is currently owned by the Flood Control District and was originally developed for the receipt of sediment from Santa Anita Reservoir and Debris Basin. As part of the 2011 cleanout project, the Upper Middle Santa Anita SPS was cleared of vegetation. As part of the mitigation efforts from the Upper Middle Santa Anita SPS clearing, the Lower Santa Anita SPS will be re-vegetated once the SPS reaches ultimate capacity. The Upper Santa Anita SPS is currently used as a temporary stockpiling area for debris basin cleanouts. There are no plans to develop the Lower Middle Santa Anita SPS as a SPS.

Figure 8-77 Santa Anita SPS

Santa Anita SPS – Environmental Impacts

Lower Middle Santa Anita SPS is currently vegetated by oak woodlands, which would be impacted if the entire site were used. However, currently there are no plans to develop the Lower Middle Santa Anita SPS as a future SPS. Upper Santa Anita SPS is currently used as a staging or temporary sediment storage area and using this area will have minimal environmental impacts. Lower Santa Anita SPS will be re-vegetated and will not be available to use as a temporary storage area.

Santa Anita SPS – Social Impacts

There is no permitted recreational use of the area, but visual and noise impacts may affect residents near the SPS.

Santa Anita SPS – Implementability

Santa Anita SPS has been used to place sediment from past Santa Anita Reservoir cleanouts; however, environmental permits may be required for modifications to the SPS.

Santa Anita SPS – Performance

The entire SPS has 3 MCY of remaining capacity; however, there are no plans to develop the entire SPS due to the environmental impacts associated with expansion as discussed above. The existing material at the SPS can be excavated, gradually transported out, and placed at an alternative placement site in order to restore capacity at the SPS and be used for future cleanout projects.

Santa Anita SPS – Cost

There is no additional cost to use Santa Anita SPS as it is already owned by the Flood Control District. However, if the SPS is used to transition between different transportation methods, it will incur additional costs to manage and spread the sediment at the SPS ($2/CY) and place the material in trucks ($7.50/CY).

8.6.3.2 SANTA ANITA DEBRIS BASIN

Santa Anita Debris Basin, as shown in Figure 8-78, is approximately 1.3 miles downstream of the reservoir and is owned and operated by the Flood Control District.

Figure 8-78 Santa Anita Debris Basin

Santa Anita Debris Basin – Environmental Impacts

Additional environmental permitting would be required to use the debris basin as a staging area during the dry months as it is heavily vegetated. Impacts to water quality and conservation are not expected.

Santa Anita Debris Basin – Social Impacts

The debris basin is adjacent to several residential properties on the west, and any operations in the debris basin would increase traffic and noise in the vicinity of the debris basin. The hours of operation could be limited to minimize disturbance to the residents.

Santa Anita Debris Basin – Implementability

Santa Anita Debris Basin can be used as a staging area, but the availability will be limited to the dry season due to the need to use the debris basin to capture sediment during the storm season. Environmental regulatory permits would also be required to use this site for staging or temporary sediment storage.

Santa Anita Debris Basin – Performance

The debris basin has a capacity of 395,000 CY, which would be sufficient space to stage sediment at this location. The debris basin has been used as a staging area in previous sluicing events.

Santa Anita Debris Basin – Cost

There is no additional cost to use Santa Anita Debris Basin as it is already owned by the Flood Control District. However, if the debris basin is used to transition between different transportation methods, it will incur additional costs to manage and spread the sediment ($2/CY) and place the material in trucks ($7.50/CY).

8.6.4 REMOVAL ALTERNATIVES

The following section discusses the impacts and costs of sediment removal at Santa Anita Reservoir by means of excavation, dredging, and sluicing. Discussion of the transportation and placement alternatives is presented in Sections 8.6.5 and 8.6.6, respectively. Combined alternatives that address all phases of the sediment management process are presented and discussed in Section 8.6.7.

8.6.4.1 EXCAVATION

Excavation has been used in the past in Santa Anita Reservoir and could be used in conjunction with the conveyor transportation mode.

Excavation – Environmental Impacts

Emissions from heavy equipment used during excavation will impact air quality within the proximity of the excavation site.

Excavating the reservoir is not expected to have impact on water quality. As discussed in Section 6, dewatering a reservoir in order to excavate it could impact water conservation if the water is released faster than spreading facilities downstream of the reservoir can handle.

Excavation – Social Impacts

Excavation will have minimal social impact due to the remote location of Santa Anita Dam. Recreational users that hike in the vicinity of the reservoir may be subject to air quality and noise impacts.

Excavation – Implementability

Environmental permits may be required prior to the excavation operation; however, there are no implementability concerns with using excavation as a removal method.

Excavation – Performance

This method has performed well in the past and its ability to be used for sediment removal is not a concern for future cleanouts. For additional performance discussion, refer to Section 6.

Excavation – Cost

The cost to excavate sediment from a reservoir is approximately $3 per cubic yard. Excavating 1.2 MCY of sediment would cost approximately $3.6 million over a 20-year period.

8.6.4.2 DREDGING

Approximately two-thirds of Santa Anita Reservoir's planning quantity meets the characteristics of dredgeable material. Therefore, if dredging were to be employed at Santa Anita Reservoir, another removal method would have to be employed to remove the non-dredgeable material. Excavation with conveyors may be the only feasible method to remove the larger, non-dredgeable material from the reservoir.

Dredging – Environmental Impacts

Dredging could impact water quality within Santa Anita Reservoir by increasing the turbidity. However, as discussed in Section 6, water quality concerns could be partially addressed with a silt curtain around the dredge. As discussed in Section 6, dredging sediment (and transporting it via a slurry pipeline) could affect water conservation.

There are also some minor impacts to air quality due the dredging equipment.

Dredging – Social Impacts

Dredging will have minimal social impact due to the remote location of Santa Anita Dam. Recreational users that hike along Chantry Flats Road may be subject to air quality and noise impacts.

Dredging – Implementability

The reservoir would need to be drained to a certain depth for the hydraulic dredge to be operable.

No additional right of way is anticipated to be required for implementation of a dredging operation within the reservoir. Dredging would require environmental regulatory permits.

Dredging has not previously been employed by the Flood Control District and is not considered a proven method to remove sediment from the reservoirs managed by the Flood Control District.

Drawing down the reservoir significantly may still be needed in order to meet the 50-foot water depth capabilities of the hydraulic dredge. Another limitation of dredging is the availability of an area to dewater material downstream.

Dredging – Performance

Assuming a dredge can operate at 200 CY per hour and operate for 6 months, a dredging operation can be performed 5 or 6 times during the 20 year period to remove 0.8 MCY.

Dredging – Cost

Based on the estimated unit cost of $10.50/CY for dredging, dredging 0.8 MCY of sediment would cost approximately $8.5 million.

8.6.4.3 SLUICING (AS A REMOVAL METHOD)

Sluicing would only be effective for finer materials and would still require excavation for larger materials. It is estimated that approximately two thirds of the material meets the characteristics of sluiceable material.

This section focuses on sluicing as a sediment removal method and discusses the impacts of sluicing within Santa Anita Reservoir only. For the impacts of sluicing downstream of the dam refer to Section 8.6.5.1.

Sluicing (Removal) – Environmental Impacts

Within Santa Anita Reservoir itself, sluicing would be expected to impact vegetation and animal species in a similar manner as excavating sediment from the reservoir would since in both cases the reservoir would need to be drained. See the discussion under Excavation for more information.

During a sluicing operation, water quality within the reservoir would be impacted due to the higher-than-normal sediment concentration. As discussed in Section 6, removing sediment from a reservoir by sluicing could affect water conservation.

Sluicing operations within Santa Anita Reservoir would result in equipment emissions. However, given the Flood Control District's previous sluicing projects, only a few pieces of equipment would be necessary within the reservoir.

Sluicing (Removal) – Social Impacts

Due to the remote location of the reservoir, minimal noise and visual impacts would be associated with sluicing.

Sluicing (Removal) – Implementability

Base flows from Santa Anita Wash have shown to be sufficient to use sluicing as a means of removing sediment from Santa Anita Reservoir. In the past, the flows have supported sluicing events with an average sediment removal of 100,000 CY per event. Environmental permitting will be required to use sluicing to remove sediment from Santa Anita Reservoir.

Sluicing (Removal) – Performance

Based on previous cleanout data, a sluicing event can remove up to 100,000 CY of sediment at this site. Assuming, two thirds of the material is sluiceable, a sluicing event would be required every 2-3 years to remove 0.8 MCY.

Sluicing (Removal) – Cost

The cost to sluice sediment from a reservoir is approximately $2.50 per cubic yard. Sluicing 0.8 MCY of sediment would cost approximately $2.0 million over a 20-year period.

8.6.5 TRANSPORTATION ALTERNATIVES

The following section discusses the impacts and costs of transporting sediment removed from Santa Anita Reservoir. The alternatives discussed include sluicing, trucking, conveyor belts, and slurry pipelines. Discussion of the removal alternatives was presented in Section 8.6.4. The placement alternatives are presented in Section 8.6.6. Combined alternatives that address all phases of the sediment management process are presented and discussed in Section 8.6.7.

8.6.5.1 SLUICING (AS A TRANSPORT METHOD)

This section focuses on the impacts of utilizing sluicing as a transport method to move sediment downstream of Santa Anita Dam along Santa Anita Wash to the Santa Anita Debris Basin. For the impacts of sluicing operations within Santa Anita Reservoir, refer to the discussion of sluicing as a removal method in the previous section. Impacts at Santa Anita Debris Basin were discussed in Section 8.6.3.2.

Sluicing (Transport) – Environmental Impacts

Major sluicing releases of sediment through the dam to the Santa Anita Wash would likely be disruptive to downstream riparian and aquatic habitats.

Sluicing would impact water quality by increasing the turbidity within Santa Anita Wash. As discussed in Section 6, transporting sediment via sluicing could affect water conservation.

Drinking water supplies could be impacted by high turbidity within Santa Anita Wash as the City of Sierra Madre operates a drinking water intake between the dam and the debris basin.

Sluicing (Transport) – Social Impacts

Minimal noise and visual impacts would be associated with sluicing. Visual impacts will consist of flows in Santa Anita Wash with higher levels of sediment than normal. Recreation along the wash could be impacted by sluicing operations.

Sluicing (Transport) – Implementability

Base flows from Santa Anita Wash have shown to be sufficient to use sluicing as a means of transporting sediment along Santa Anita Wash. Environmental permitting will be required to use sluicing to transport sediment.

Sluicing (Transport) – Performance

Based on previous cleanout data, a sluicing event can remove approximately 100,000 CY of sediment. Assuming, two thirds of the material is sluiceable, a sluicing event would be required every 2-3 years to remove 0.8 MCY.

Sluicing (Transport) – Cost

The cost to sluice sediment from a reservoir is approximately $2.50 per cubic yard. Sluicing 0.8 MCY of sediment would cost approximately $2.0 million over a 20-year period.

8.6.5.2 TRUCKING

Due to the roadway configuration and load limitations along Chantry Flats Road, trucks cannot operate as a stand-alone transportation mode from the body of Santa Anita Reservoir. However, they are feasible for use in conjunction with sluicing and conveyors where the sediment is transported to the Santa Anita SPS and then trucked to its final placement location. Trucks can access the Santa Anita SPS via N. Santa Anita Avenue and Elkins Avenue.

Trucking – Environmental Impacts

Since existing roads would be used to truck sediment, no particular impacts would be expected on habitat, water quality, or water conservation. Air quality would be impacted due to the truck operations to the residents within proximity of the haul route. Employing low emission trucks would reduce air quality impacts.

Trucking – Social Impacts

Sediment hauling activities would impact traffic and noise for residents in proximity to the truck haul routes, particularly for residential areas to the west and south of the project site, the Arcadia Wilderness Park, the Highland Oaks Elementary School, and the Foothill Middle School.

Trucking – Implementability

All routes pass through the residential areas in the City of Arcadia, although the trucks could alternate use of multiple routes to reduce traffic on any given route. Double dump trucks can be used for this operation.

An alternative route is to utilize single dump trucks along the Eastern access road along Santa Anita Wash and exit the access road at Sycamore Avenue, which would reduce residential impacts. However, the access road along the wash would need to be improved and there might be major impacts to Foothill Middle School which is adjacent to the access road entrance.

Another option would be to utilize single dump trucks inside the 20’-wide and 12’-high Santa Anita Wash. An invert access ramp could be constructed at Foothill Blvd. or the existing access ramp at Colorado Blvd. could be used. A structural analysis of the channel must be completed in order to determine if the channel has the structural integrity to handle the trucks. In addition, utilities and bridge clearances must be checked since single dump trucks are 11 to 13’ in height. A drawback of this option is that the channel would only allow one way traffic, therefore access of residential streets would still be required.

For this analysis, only the Elkins Ave. truck route was shown for the combined management alternatives (Section 8.6.7), however, a combination of all these alternatives could be used to reduce social impacts.

Trucking – Performance

Double dump trucks, which have the capacity for approximately 16 CY, can operate for 6 months and transport 800,000 CY of sediment. A cleanout operation can be performed every 10 years and remove the total 20-year quantity of 1.2 MCY.

This method has performed well in the past, and its ability to successfully perform sediment removal is not a concern for future cleanouts.

Trucking – Cost

Trucking costs are approximately $0.30/CY-Mile for a double dump truck, and assuming the sediment is taken to a pit in the Irwindale area which is 12 miles away (one way), the total cost for the 20-year period for 1.2 MCY of removal is approximately $8.8 million.

8.6.5.3 CONVEYOR BELTS

A conveyor system can be combined with excavation in order to transport the material 1.3 miles downstream through the access tunnel to the Santa Anita SPS, as performed in 2011.

Conveyor Belts – Environmental Impacts

The conveyor system would be installed along the existing access road from the outlet of the access tunnel and have minimal impact on habitat along the route. A conveyor system would have very minimal air quality impacts.

Conveyor Belts – Social Impact

Use of a conveyor belt system may result in visual impacts for residents or recreational users along the conveyance route, however, the impact is expected to be minimal. Also, while the conveyor operations will create some noise, it has not been an issue for past operations.

Conveyor Belts – Implementability

Conveyor systems have the ability to handle relatively circuitous alignments as long as the turning radii are no less than approximately 300 feet. Because of the infrequent need for cleanouts, a conveyor would be installed on a temporary basis.

Conveyor Belts – Performance

Assuming a conveyor system can operate at 500 CY per hour and operate for 6 months, a conveyor operation would be required every 8 years to remove the total 20-year quantity of 1.22 MCY.

Conveyor Belts – Cost

Conveyor costs are approximately $800/LF for installation and operating costs. The cost for 1.3 miles of conveyor would be approximately $5.5 million.

8.6.5.4 SLURRY PIPELINE

A slurry pipeline would only be feasible if dredging is used. The dredge would pump the sediment/water into a 12-inch HDPE slurry pipeline that could possibly be routed through the access tunnel, along the access road, and eventually discharge into the debris basin. This would require significant modification to the upstream tunnel entrance since it is normally sealed when the reservoir contains water. The sediment could be dewatered at the debris basin and eventually trucked out to the final placement site. Impacts associated with using Santa Anita Debris Basin were discussed previously.

Slurry Pipeline – Environmental Impacts

The slurry pipeline would be constructed along the existing access road and not likely impact habitat. Water quality at the dewatering site would be impacted by high turbidity. In addition, water supplies to the City of Sierra Madre would be impacted because their intake would be bypassed by the slurry pipeline.

Slurry Pipeline – Social Impacts

The slurry pipeline would have minimal social impact since it would be placed along the remote access road.

Slurry Pipeline – Implementability

While it is technically feasible, the biggest implementability concern with the slurry pipeline is the connection through the upstream end of the access tunnel. The remainder of the route does not present implementability concerns.

Slurry Pipeline – Performance

Assuming a dredge operation can remove 200 CY per hour, the 12-inch HDPE slurry pipeline would have approximately 15 cfs flowing in it. No booster stations would be required due to the elevation change from the reservoir to the debris basin.

Slurry Pipeline – Cost

The slurry pipeline cost is approximately $37.50/LF for an above ground 12-inch HDPE pipe. For a 1.5 mile long slurry pipe, the total cost is approximately $297,000.

8.6.6 PLACEMENT ALTERNATIVES

This section discusses the impacts and costs at potential placement alternatives for sediment removed from Santa Anita Reservoir. Specifically, this section discusses the placement of sediment at landfills and pits. Discussion of the removal and transportation was presented in Sections 8.6.4 and 8.6.5, respectively. Combined alternatives that address all phases of the sediment management process are presented and discussed in Section 8.6.7.

Combined alternatives that address all phases of the sediment management process are presented and discussed in Section 8.6.7.

8.6.6.1 LANDFILLS

Scholl Canyon Landfill is the closest landfill to Santa Anita Reservoir at a distance of 13 miles. More information regarding the landfill can be found in Section 6.

8.6.6.2 QUARRY WITH EXISTING OPERATIONS

There are existing operational pits in the Irwindale area at a distance of 12 miles that could accept material from Santa Anita Reservoir as discussed in Section 6.

It is assumed that one third of the material will be high quality material that will be of value to the existing operational pits. In exchange for this high quality material, it is assumed that the Flood Control District will be allowed to place the same amount of lower quality material in the operational quarry pits. The remaining one third of the material that will be placed at the pit will be subject to a tipping fee.

8.6.6.3 ACQUIRED QUARRY

As discussed previously, the acquisition of a quarry for placement of sediment from facilities under the jurisdiction of the Flood Control District is being pursued for sediment management. Acquisition of a quarry in the Irwindale area would be most desirable for sediment management operations related to Santa Anita Reservoir.

It will be assumed that acquiring a quarry could potentially cost the Flood Control District approximately $1 per CY and that placement of sediment would cost $2 per CY.

In order to conserve space in an acquired quarry, the high quality material can still be taken an existing quarry operation where the Flood Control District can place an equivalent volume of lower quality material. The remaining material can be placed at the acquired quarry.

8.6.6.4 SEDIMENT PLACEMENT SITES

As mentioned earlier, Santa Anita SPS is an existing SPS, 1.5 miles downstream of Santa Anita Dam. The SPS can be filled until the remaining currently available capacity is filled. However, there are no plans to expand the SPS and increase capacity.

8.6.7 COMBINED SEDIMENT MANAGEMENT ALTERNATIVES

8.6.7.1 COMBINED ALTERNATIVE 1: EXCAVATION > CONVEYOR > SANTA ANITA SPS > EXCAVATION > TRUCKING > IRWINDALE PITS & LANDFILLS

The sediment can be excavated and placed on a conveyor system to the Santa Anita SPS, as shown in Figure 8-79. Once remaining capacity at the SPS is exhausted, the material at the SPS can be gradually transported out via trucks at a rate that reduces social impacts and be taken to either a pit in the Irwindale area or a landfill, as shown in Figure 8-80. It would take 3 cleanout events, or every 8 years, to remove the expected 20-year quantity. The total cost is estimated to be approximately $30 million, as shown in Table 8-30. It is assumed that only one third of the material will be subject to a tipping or acquisition fee as discussed in Section 8.6.6.

Figure 8-79 Santa Anita Reservoir Management Alternative 1 – Map 1 of 2

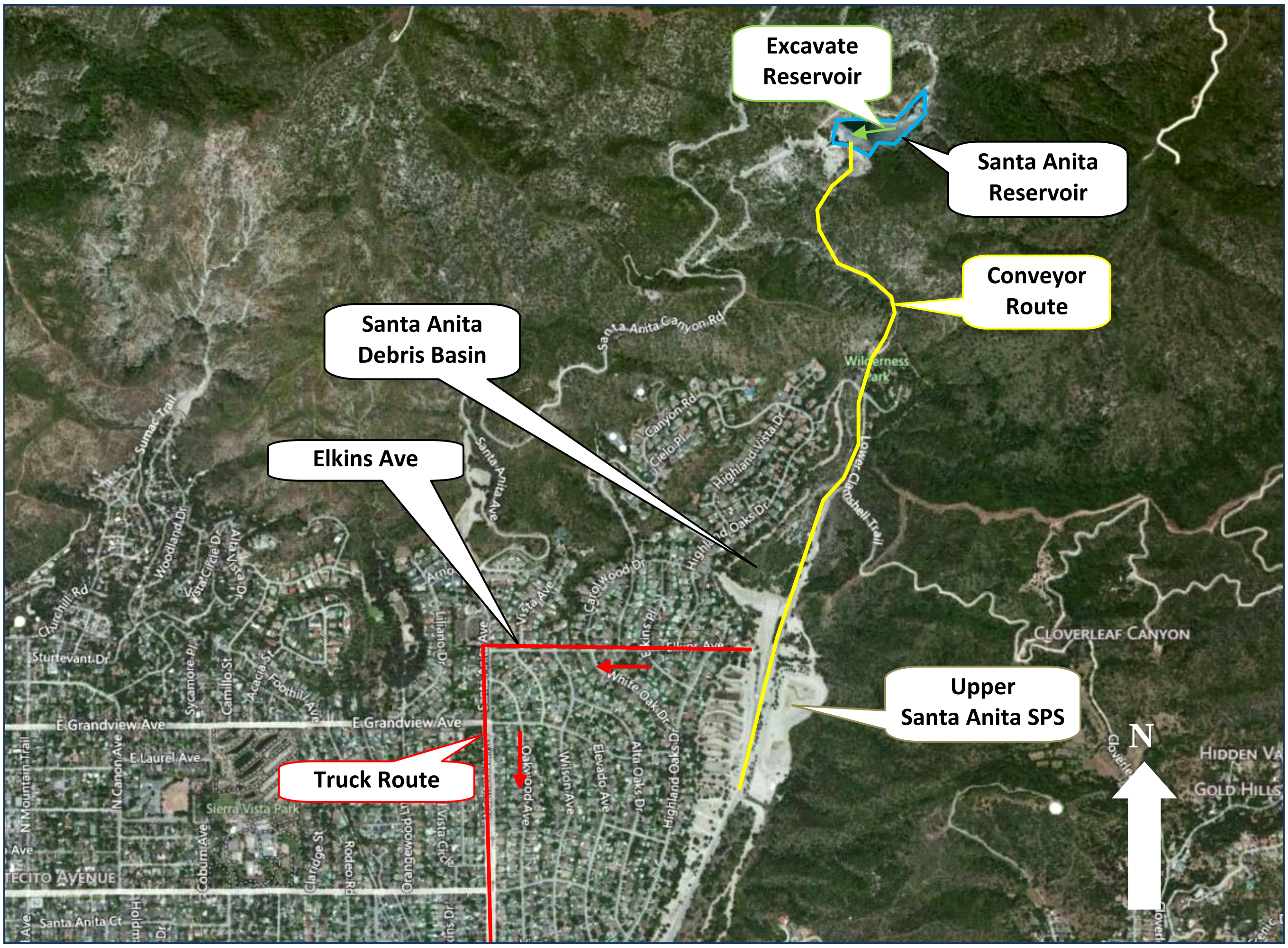


Figure 8-80 Santa Anita Reservoir Management Alternative 1 – Map 2 of 2

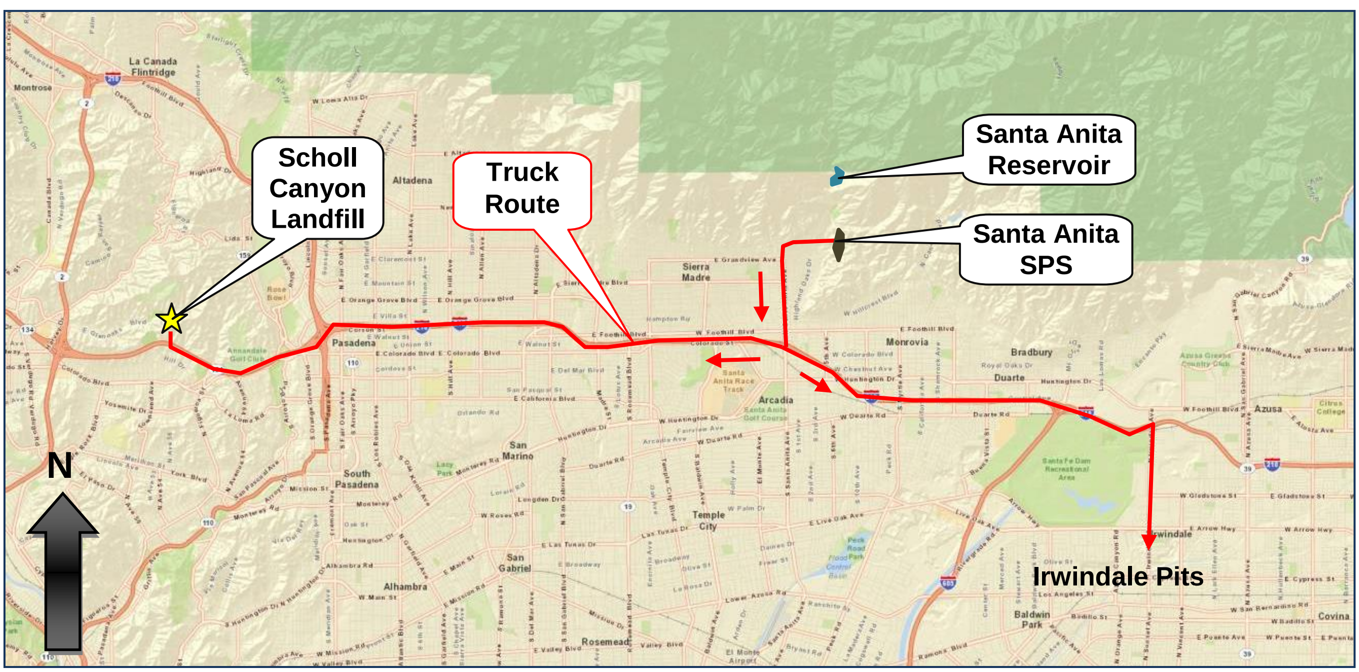


Table 8-30 Santa Anita – Alternative 1 Cost Estimate

Activity	Amount (MCY)	Distance (MI)	Unit Cost	Unit	Total Cost ($ Millions)
Excavation at Santa Anita Reservoir	1.2		$ 3.00	CY	$ 3.6
Conveyor System from Reservoir to SPS		1.3	$ 800.00	LF	$ 5.5
Spreading Sediment at SPS			$ 2.00	CY	$ 2.4
Excavation at SPS			$ 7.50	CY	$ 9.2
Double Dump Truck to Pits/Landfills		24	$ 0.30	MI-CY	$ 8.8 - 9.0
Pit or Landfill Placement Fee			$ 3.00 - $ 7.00	CY	$ 1.2 – 2.8
				Total	**$ 30**

8.6.7.2 Combined Alternative 2: Sluicing > Santa Anita SPS > Excavate > Trucking > Irwindale Pits & Landfills + Excavation > Conveyor Belt > Santa Anita SPS > Excavate > Trucking > Irwindale Pits & Landfills

Two thirds of the sediment can be sluiced from the reservoir and into Santa Anita Wash and eventually placed at Santa Anita SPS, as shown in Figure 8-81. The material will be dewatered at the debris basin, transported to the SPS, and gradually transported out via trucks to the final placement location at a pit in the Irwindale area or a landfill at a rate that reduces social impacts, as shown in Figure 8-82. However, the remaining one third of the larger material would not be suitable for sluicing and will have to be excavated similar to alternative 1. It would take 7 sluicing events, or a cleanout approximately every 3 years, to remove the 20-year planning quantity. The total cost is estimated to be approximately $30 million, as shown in Table 8-31 below. It is assumed that only one third of the material will be subject to a tipping or acquisition fee as discussed in Section 8.6.6.

Figure 8-81 Santa Anita Reservoir Management Alternative 2 – Map 1 of 2

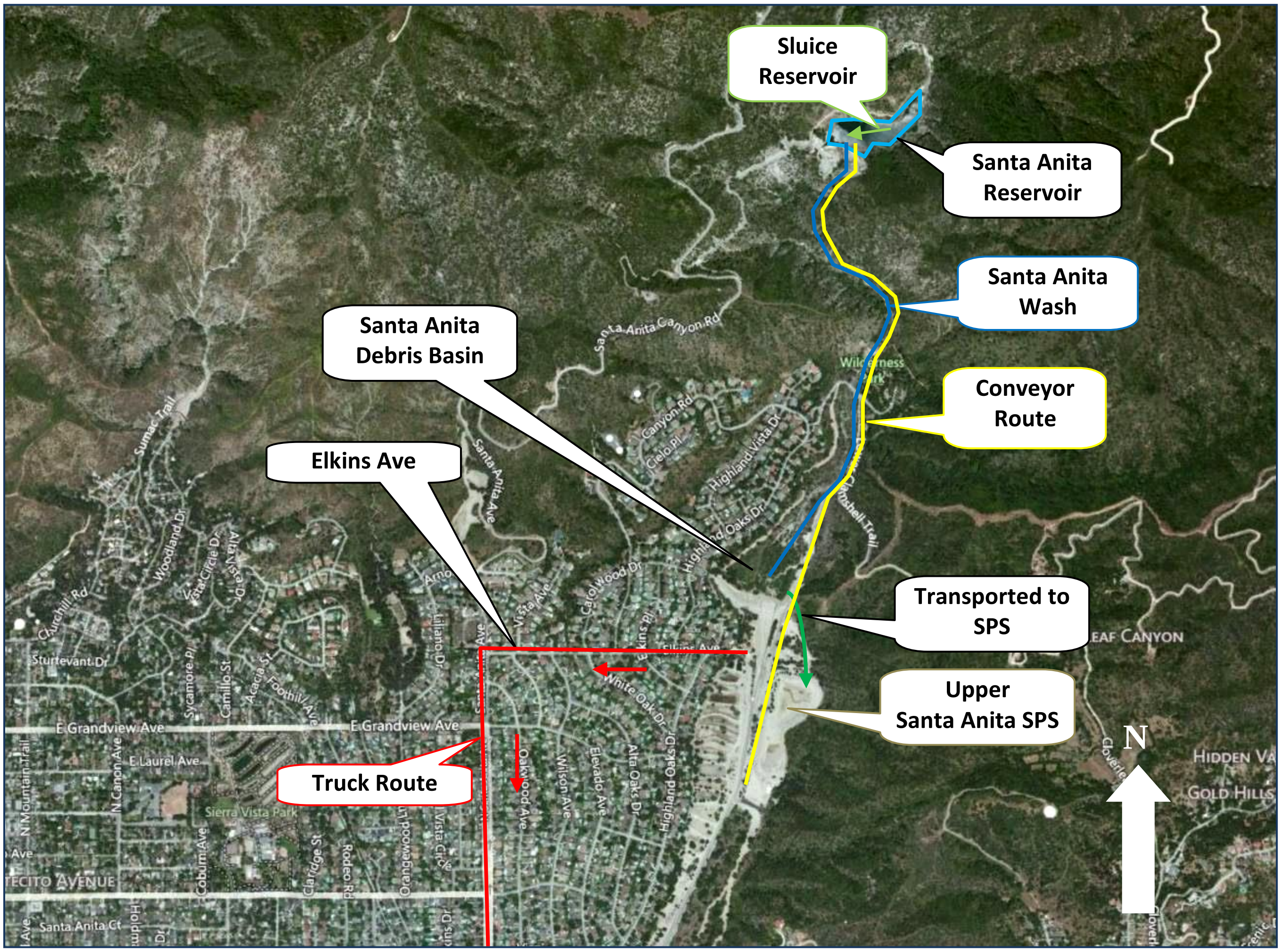


Figure 8-82 Santa Anita Reservoir Management Alternative 2 – Map 2 of 2

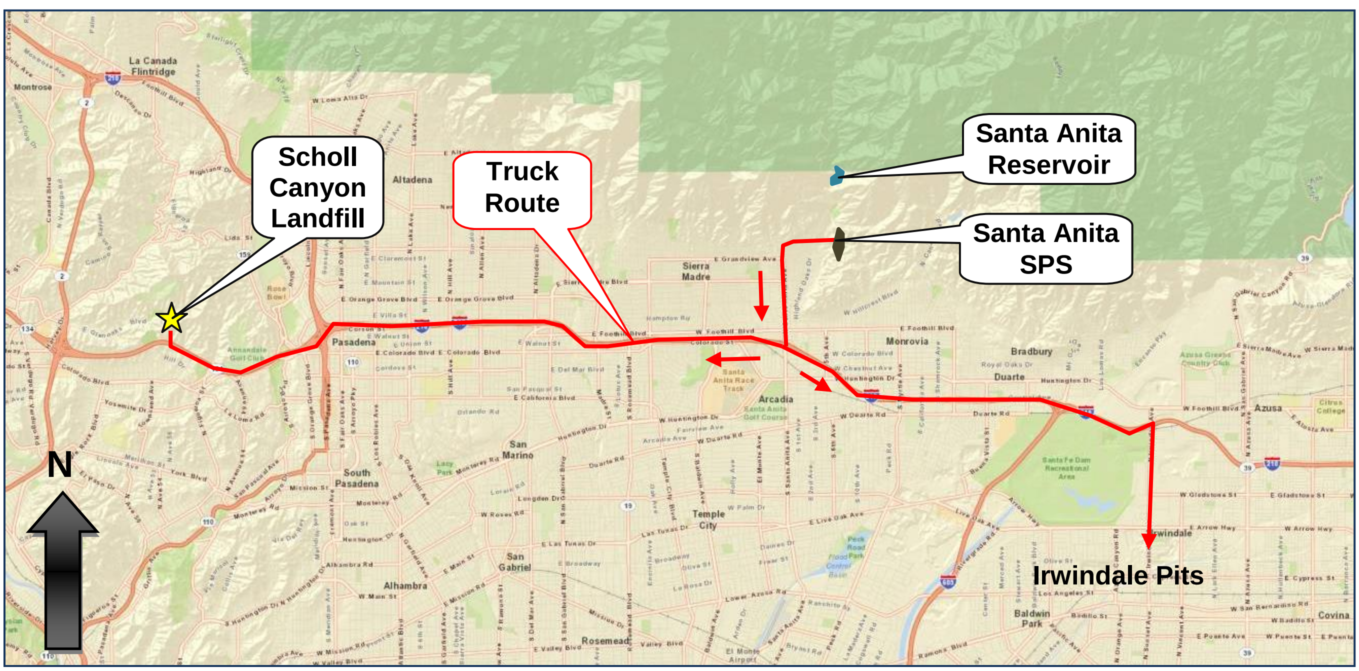


Table 8-31 Santa Anita – Alternative 2 Cost Estimate for Existing Quarry

Activity	Amount (CY)	Distance (MI)	Unit Cost	Unit	Total Cost ($ Millions)
Sluicing (2/3) at Santa Anita Reservoir	0.8		$ 2.50	CY	$ 2.0
Excavation (1/3) at Santa Anita Reservoir	0.4		$ 3.00	CY	$ 1.2
Conveyor		1.3	$ 800.00	LF	$ 5.5
Spreading Sediment at SPS	1.2		$ 2.00	CY	$ 2.4
Excavation at SPS			$ 7.50	CY	$ 9.2
Double Dump Truck to Pits/Landfills		24	$ 0.30	MI-CY	$ 8.8 - 9.0
Pit or Landfill Placement Fee			$ 3.00 - $ 7.00	CY	$ 1.2 – 2.8
				Total	**$30**

8.6.7.3 COMBINED ALTERNATIVE 3: DREDGING → SLURRY PIPELINE → SANTA ANITA DEBRIS BASIN/SANTA ANITA SPS → EXCAVATION > TRUCKING → LANDFILLS & PITS + EXCAVATION → CONVEYOR BELT → SANTA ANITA SPS → EXCAVATION → TRUCKING → LANDFILLS & PITS

Combined Alternative 3 involves dredging and transporting two thirds of Santa Anita Reservoir's planning quantity via a 12-inch HDPE slurry pipeline to Santa Anita Debris Basin, as shown in Figure 8-83. The material would be dewatered at the debris basin and then temporarily stored at Santa Anita SPS. From the SPS, the sediment would be transported out gradually via trucks to the final placement location, either a landfill or a pit in the Irwindale area, at a rate that would reduce social impacts, as shown in Figure 8-84. The remaining one third of the planning quantity that would not be suitable for dredging would be excavated similar to Alternative 1. It would take 5 or 6 dredging events, or a cleanout approximately every 3 or 4 years, to remove the expected 20-year planning quantity. The total cost is estimated to be approximately $35-40 million, as shown in Table 8-32 below. It is assumed that only one third of the material will be subject to a tipping or acquisition fee as discussed in Section 8.6.6.

Figure 8-83 Santa Anita Reservoir Management Alternative 3 – Map 1 of 2

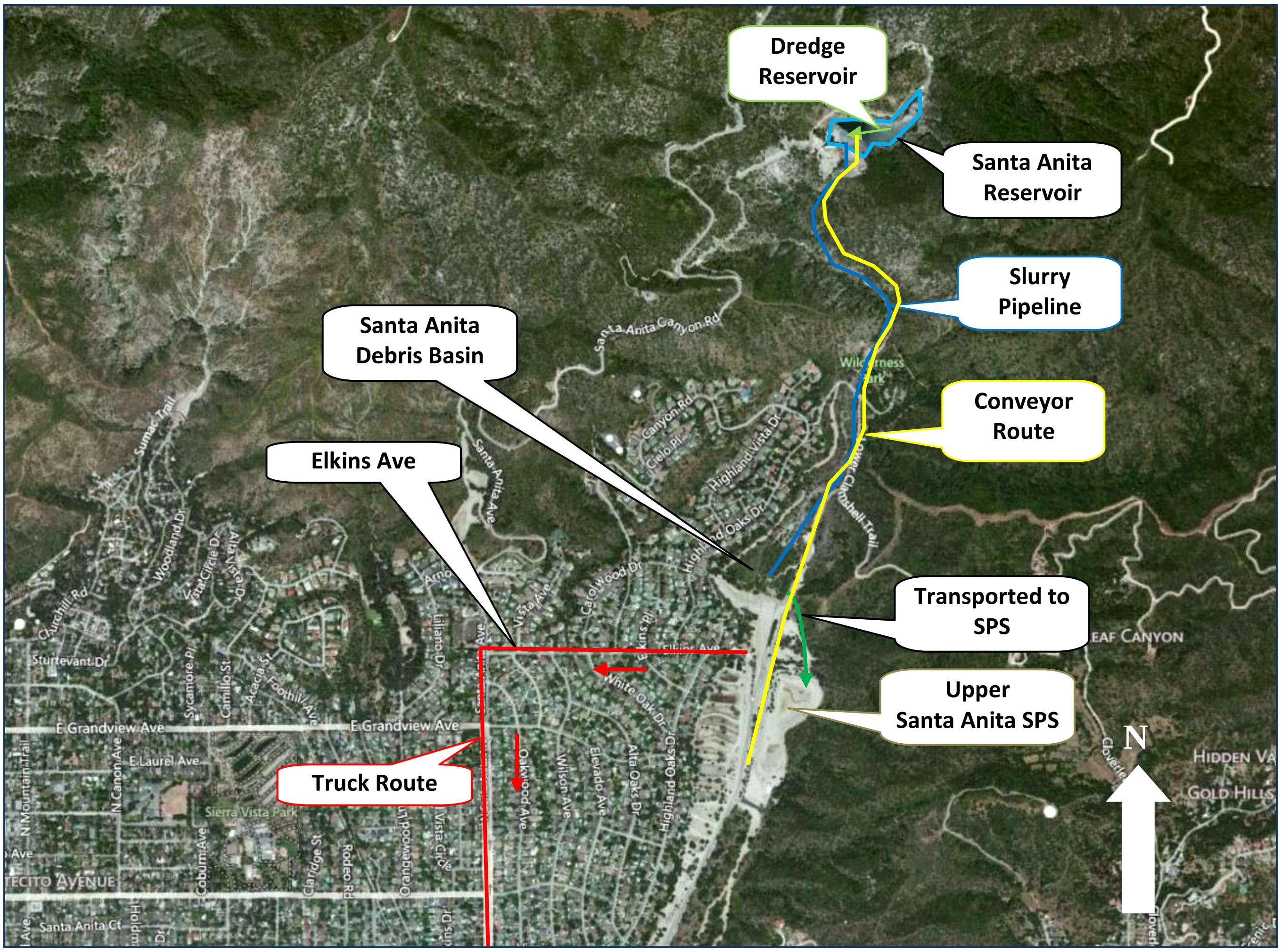


Figure 8-84 Santa Anita Reservoir Management Alternative 3 – Map 2 of 2

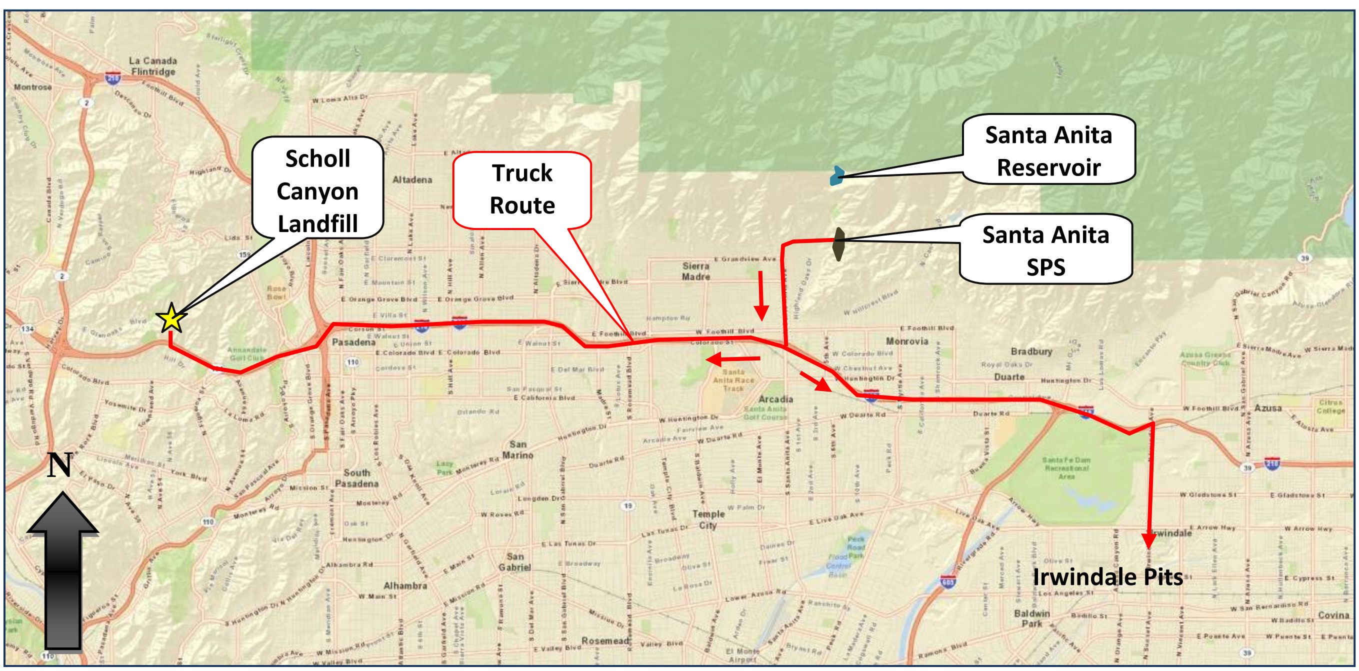


Table 8-32 Santa Anita – Alternative 3 Cost Estimate for Existing Quarry

Activity	Amount (MCY)	Distance (MI)	Unit Cost	Unit	Total Cost
Dredging (2/3) at Santa Anita Reservoir	0.8		$ 10.50	CY	$ 8.5
Slurry Pipeline		1.3	$37.50	LF	$ 0.3
Excavation (1/3) at Santa Anita Reservoir	0.4		$ 3.00	CY	$ 1.2
Conveyor from Reservoir to SPS		1.3	$ 800.00	LF	$ 5.5
Spreading Sediment at SPS	1.2		$ 2.00	CY	$ 2.4
Excavation at SPS			$ 7.50	CY	$ 9.2
Double Dump Truck to Pits/Landfills		24	$ 0.30	MI-CY	$ 8.8 - 9.0
Pit or Landfill Placement Fee			$ 3.00 - $ 7.00	CY	$ 1.2 – 2.8
				Total	**$ 35 – 40**

8.6.8 SUMMARY AND RECOMMENDATIONS

8.6.8.1 SUMMARY

Over the next 20 years, 1.2 MCY of sediment is planned to be removed from Santa Anita Reservoir. The different management alternatives are briefly explained below and the impacts are shown in Table 8-33. All the alternatives will use Santa Anita SPS as a temporary storage area where the sediment can be transported out gradually in order to reduce traffic impacts.

Management Alternatives

1 Excavation → Conveyor → Santa Anita SPS → Excavate → Trucks → Irwindale Pits & Landfill
Excavate the sediment and place it on a conveyor where it will transport the sediment to the Santa Anita SPS. The sediment can be gradually transported out to a pit in the Irwindale area or landfill.

2 Sluice (0.8 MCY)→Santa Anita Debris Basin→Santa Anita SPS→Excavate→Trucks→Irwindale Pits & Landfill + Excavate (0.4 MCY) → Trucks → Irwindale Pits
Sluice the smaller sediment (0.8 MCY) from the Santa Anita Reservoir to the Santa Anita Debris basin where the sediment can be dewatered. The dewatered sediment can be placed at the Santa Anita SPS using excavation equipment where it can be excavated and transported out gradually via trucks to a pit in the Irwindale area or a landfill. The larger sediment (0.4 MCY) must be removed via alternative one.

3 Dredge(0.8 MCY)→Santa Anita Debris Basin→Santa Anita SPS→Excavate→Trucks→Irwindale Pits & Landfill + Excavate (0.4 MCY) → Trucks → Irwindale Pits
Dredge the smaller sediment from the Santa Anita Reservoir where it can be transported via a slurry pipeline to the Santa Anita Debris Basin where it can be dewatered. The dewatered sediment can be placed at the Santa Anita SPS using excavation equipment where it can be excavated and transported out gradually via trucks to a pit in the Irwindale area or a landfill. The larger sediment (0.4 MCY) must be removed via alternative one.

Table 8-33 Santa Anita Reservoir Summary Table

Alternative		Quantity Removed (MCY)	Environmental				Social			Implementability	Performance		Cost
			Habitat	Water Quality	Groundwater Recharge	Air Quality[a]	Traffic	Visual	Noise	Special Permit/Agreement Required[b]	Previous Experience	# of Operations Required in Next 20 years	$ Millions
1	Excavation	1.2	◑		○	◑		○	○		Yes	3	30
	Conveyor							◑					
	Santa Anita SPS		○					◑	◑				
	Trucks					●	●	●	●				
	Irwindale Pits/Landfill									Yes			
2	Sluice	0.8	●	●	◑			◑			Yes	7	30
	Santa Anita DB/SPS		●	●	○	◑		◑	◑				
	Conveyor	0.4						◑					
	Excavation	1.2	◑			◑			◑				
	Trucks					●	●	●	●				
	Irwindale Pits/Landfill									Yes			
3	Dredge	0.8	◑	◑	○	◑			○		No	6	35-40
	Slurry Pipeline							◑					
	Santa Anita DB/SPS		●	●	○	◑		◑	◑		Yes		
	Conveyor	0.4						◑					
	Excavation	1.2	◑			◑		◑	◑				
	Trucks					●	●	●	●				
	Irwindale Pits/Landfill									Yes			

Legend:

●	significant impact
○	possible impact
◑	some impact
	no impact

Notes: (a) Use of low-emission trucks would reduce air quality impacts from significant impact (●) to some impact (◑).
(b) All options require environmental regulatory permit.

8.6.8.2 RECOMMENDATION

It is recommended that all the alternatives be considered for future sediment removal projects at Santa Anita Reservoir.

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SECTION 9 ALTERNATIVES ANALYSIS AND RECOMMENDATIONS FOR SMALL RESERVOIRS

Section 9 discusses the sediment management alternatives for the small reservoirs - Big Dalton, Eaton, Live Oak, Puddingstone Diversion, and Thompson Creek. The small reservoirs are not only characterized by the smaller size of the dam, reservoir, drainage area, and sediment quantity, but also limited base flows during the dry season. Due to the limited amount of base flows, sediment removal, and transportation alternatives that require water such as sluicing, dredging, and slurry pipeline are not feasible for small reservoirs. Thus, those alternatives are not discussed in this section.

9.1 BIG DALTON RESERVOIR

9.1.1 BACKGROUND

Big Dalton Dam, shown in Figure 9-1, is a multiple arch concrete dam that was constructed in 1929 by the Los Angeles County Flood Control District (Flood Control District) and is operated for flood risk management and water conservation. With a drainage area of 4.5 square miles, Big Dalton Reservoir had an original storage capacity of approximately 1.7 million cubic yards (MCY). Water impounded during the storm season behind the dam is gradually released and diverted into the downstream spreading facilities to recharge groundwater.

Figure 9-1 Big Dalton Dam

9.1.1.1 LOCATION

Big Dalton Reservoir is located in the Big Dalton Canyon of the San Gabriel Mountains, approximately four miles northeast of the City of Glendora in the Angeles National Forest, as shown in Figure 9-2.

Big Dalton Canyon has relatively gentle side slopes that vary from roughly 2:1 to 3:1 (horizontal vertical) in the immediate vicinity of the reservoir. The canyon opens out into the upper alluvial fan of the Los Angeles Basin, with Big Dalton Dam near the mouth of the canyon. Big Dalton Reservoir is roughly arc shaped, with a length of approximately 1,300 feet and an average width of 400 feet. Figure 9-3 shows the topography of Big Dalton Canyon at the dam and reservoir.

Figure 9-2 Big Dalton Dam Vicinity Map

Figure 9-3 Big Dalton Reservoir Topography

9.1.1.2 ACCESS

Access to the dam is available off Big Dalton Canyon Road, a small two-lane road until it enters Angeles National Forest jurisdiction where it transitions to a single-lane, paved, private road. This fully paved access road runs by a narrow parking area just upstream of the west abutment of the dam. Beyond, at the top of the dam, Big Dalton Canyon Road changes to an unpaved road that loops around the body of the reservoir. Approximately, 0.4 miles north of the dam abutment, an unpaved access road runs down into the body of the reservoir. Figure 9-4 shows the approximate location of the access roads.

Figure 9-4 Location of Access Road to Big Dalton Reservoir

9.1.1.3 DAM OUTLETS

In addition to being equipped with a variety of valves, Big Dalton Dam is also equipped with a sluiceway controlled by a 3-foot by 3-foot sluice gate.

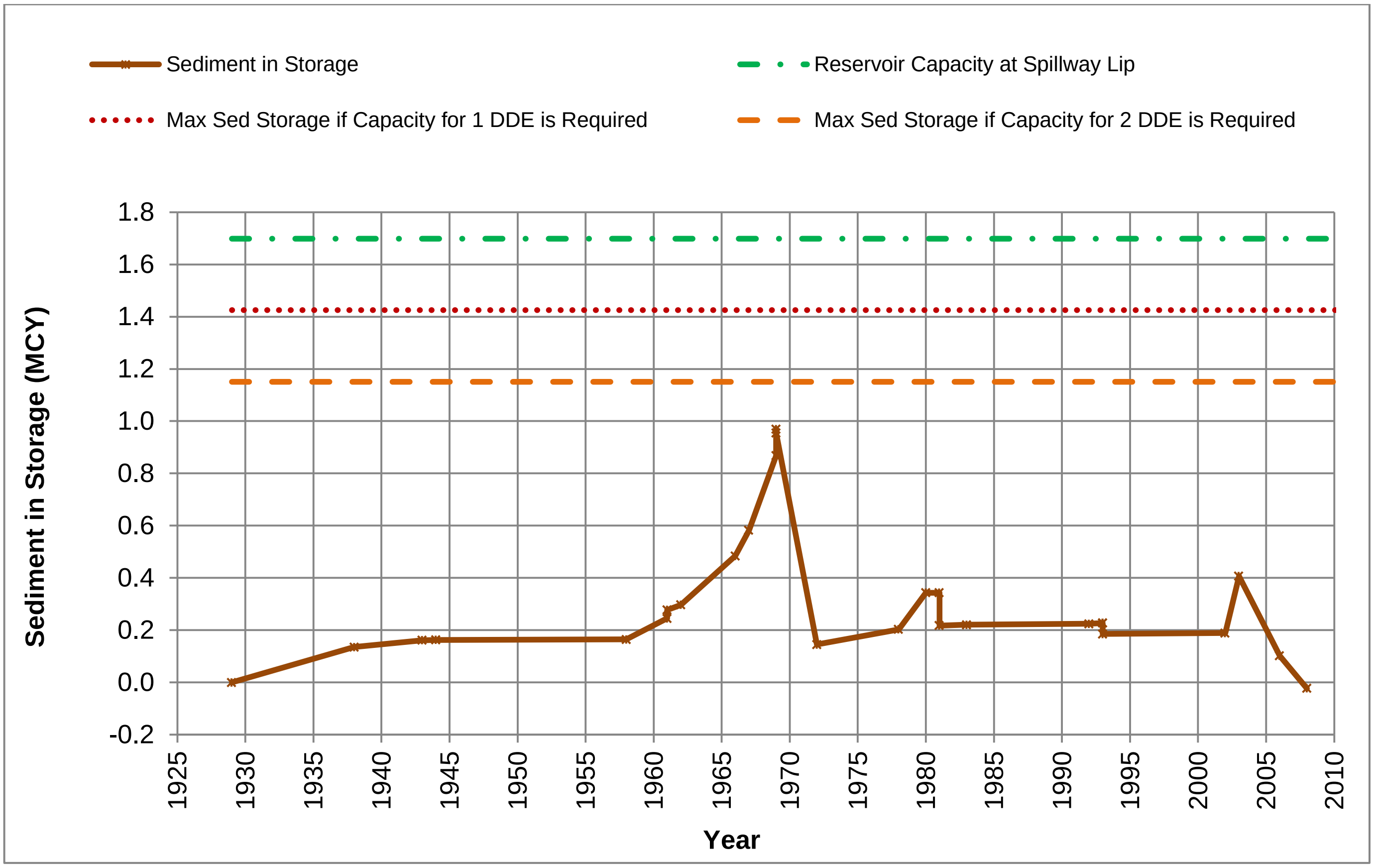
9.1.1.4 DOWNSTREAM FLOOD CONTROL AND WATER CONSERVATION SYSTEM COMPONENTS

Water that passes through Big Dalton Dam travels through Big Dalton Wash to Big Dalton Debris Basin and then the Big Dalton Spreading Grounds. San Dimas Wash and Little Dalton Wash feed into Big Dalton Wash, which connects to Walnut Creek and eventually flows to the San Gabriel River.

9.1.1.5 SEDIMENT DEPOSITION AND REMOVAL HISTORY

Figure 9-5 shows the approximate sediment storage in Big Dalton Reservoir since 1929. It is the Flood Control District's policy to retain enough storage capacity within a reservoir for two design debris events (DDEs), which are calculated and determined for each specific reservoir. For reference purposes, Figure 9-5 shows the original reservoir capacity at spillway lip and the maximum sediment storage that allows for the storage of both one and two DDEs. The graph shows that the Flood Control District has reduced the quantity of sediment in storage at Big Dalton Reservoir on numerous occasions, even before reaching the threshold capacity.

Figure 9-5 Graph of Historical Sediment Storage at Big Dalton Reservoir



Sediment has been removed 6 times in the 84-year life of the reservoir. Table 9-1 shows that both excavation and sluicing have been used to remove sediment from Big Dalton Reservoir in the past, although sluicing has only been done once.

Table 9-1 Summary of Historic Sediment inflows and Cleanouts – Big Dalton Reservoir

Survey Date		Reservoir Capacity (MCY)	Quantity Sluiced (MCY)	Quantity Excavated (MCY)	Sediment Accumulated Between Records (MCY)	Sediment in Storage (MCY)
October	1929	1.70	-	-	-	-
March	1938	1.56	-	-	0.14	0.14
October	1943	1.54	-	-	0.03	0.16
September	1944	1.54	-	-	0.00	0.16
October	1958	1.53	-	-	0.00	0.16
September	1961	1.45	-	-	0.08	0.25
November	1961	1.42	-	-	0.03	0.28
January	1962	1.40	-	-	0.02	0.30
August	1966	1.21	-	-	0.19	0.48
April	1967	1.12	-	-	0.10	0.58
January	1969	0.83	-	-	0.29	0.87
March	1969	0.73	-	-	0.10	0.97
December	1969	0.74	0.015	-	-	0.96
January	1972	1.55	-	0.81	-	0.15
October	1978	1.50	-	-	0.06	0.20
March	1980	1.36	-	-	0.14	0.34
August	1981	1.36	-	-	-	0.34
October	1981	1.48	-	0.13	-	0.22
April	1983	1.48	-	-	0.00	0.22
December	1992	1.47	-	-	0.00	0.22
March	1993	1.47	-	-	0.00	0.23
July	1993	1.47	-	-	-	0.23
September	1993	1.51	-	0.04	-	0.19
November	2002	1.51	-	-	0.00	0.19
September	2003	1.29	-	-	0.22	0.41
November	2006	1.60	-	0.48	0.18	0.10
July	2008	1.72	-	0.13	0.01	(0.02)

Historically, excavated material has been placed at Big Dalton Sediment Placement Site (SPS), which is immediately downstream of the reservoir. However, Big Dalton SPS has almost no remaining capacity and is unable to store additional sediment.

9.1.2 PLANNING QUANTITY

As described in Section 5, the 20-year planning quantity for sediment inflow into Big Dalton Reservoir is 0.8 MCY.

9.1.3 POTENTIAL STAGING AND TEMPORARY SEDIMENT STORAGE AREAS

9.1.3.1 BIG DALTON SEDIMENT PLACEMENT SITE

Big Dalton SPS could be used as a temporary sediment storage area and the sediment could be gradually transported to a permanent placement site. However, due to the agreement between the USFS and the Flood Control District, the SPS must be re-vegetated and restored to its natural condition.

9.1.3.2 BIG DALTON DEBRIS BASIN

Big Dalton Debris Basin, shown in Figure 9-6, is approximately 2 miles downstream of the reservoir and is owned and operated by the Flood Control District. The debris basin can be used as a staging area to transition between transportation methods.

Figure 9-6 Big Dalton Debris Basin

Big Dalton Debris Basin - Environmental Impacts

Additional environmental permitting may be required to use the debris basin as a staging area during the dry months as it is heavily vegetated. Impacts to water quality and conservation are not expected.

Big Dalton Debris Basin - Social Impacts

The debris basin itself is not adjacent to any residential properties. However, the road leading up to the west side of the debris basin, Glendora Mountain Road, passes through a residential area and if trucks were to be used for the removal of sediment, it would increase traffic and noise near the debris basin. The hours of operation could be limited to minimize disturbance to the residents.

Big Dalton Debris Basin – Implementability

Big Dalton Debris Basin can be used as a staging area, but the availability will be limited to the dry season due to the need to use the debris basin to capture sediment during the storm season. Environmental regulatory permits would also be required to use this site for staging or temporary sediment storage.

Big Dalton Debris Basin – Performance

The debris basin has a capacity of 580,000 CY, which would be sufficient to stage sediment.

Big Dalton Debris Basin – Cost

There is no additional cost to use Big Dalton Debris Basin as it is already owned by the Flood Control District. However, if the debris basin is used to transition between different transportation methods, it will incur additional costs to manage and spread the sediment at the debris basin ($2/CY) and place the material in trucks ($7.50/CY).

9.1.3.3 DALTON SPS

Dalton SPS, shown in Figure 9-7, is approximately 0.2 miles west of Big Dalton Debris Basin and 2.2 miles downstream of Big Dalton Dam and has been used in the past to place sediment from debris basin cleanouts. The SPS can be used as a temporary storage location where the sediment can be placed there initially then gradually transported out at a rate that reduces impact to the surrounding communities.

Figure 9-7 Dalton SPS

Dalton SPS - Environmental Impacts

If the open spaces that have been cleared of vegetation are used as a staging or temporary sediment storage area then there will be minimal habitat impact. Air quality will be minimally impacted due to equipment used when spreading and compacting the sediment.

Dalton SPS - Social Impacts

Dalton SPS is in a residential area that can be accessed with the same roadways that are used to access Big Dalton Debris Basin. The road leading up to the SPS, Glendora Mountain Road, is within a residential area and if trucks were used for the removal of sediment to a pit in the Irwindale area, it would impact traffic and noise.

Dalton SPS - Implementability

Dalton SPS has been used to place sediment from Big Dalton and Little Dalton Debris Basin cleanouts in the past. However, environmental permits may be required for modifications to the SPS. The SPS does not have any remaining capacity. However, the existing material at Dalton SPS can be excavated, gradually transported out, and placed at an alternative placement site in order to increase capacity at the SPS, so that the SPS can be used as a temporary sediment storage area for Big Dalton Dam cleanout projects.

Dalton SPS – Performance

Dalton SPS has been used to place sediment from debris basin cleanouts, but does not have any remaining capacity. In order to create capacity, existing material at the SPS would need to be removed prior to the reservoir cleanout. If material were removed, it can be gradually transported at a rate that reduces impact to the community.

Dalton SPS – Cost

There is no additional cost to use Big Dalton SPS as it is already owned by the Flood Control District. However, if the SPS is used to transition between different transportation methods, it will incur additional costs to manage and spread the sediment at the SPS ($2/CY) and place the material in trucks ($7.50/CY).

9.1.4 REMOVAL

Due to the small watershed and limited inflows during the dry season, wet removal methods such as sluicing or dredging are not possible. Without water, the only practical means of removing sediment from debris basins is conventional excavation.

The following section discusses the impacts and costs of sediment removal at Big Dalton Reservoir by means of excavation. Discussion of the transportation and placement alternatives is presented in Sections 9.1.5 and 9.1.6, respectively. Combined alternatives that address all phases of the sediment management process are presented and discussed in Section 9.1.7.

9.1.4.1 EXCAVATION

Excavation has been the primary method for sediment removal used at Big Dalton Reservoir. Due to the small watershed and limited inflows, Big Dalton Reservoir can be dewatered very quickly, if it is not already dry during the dry months.

Excavation - Environmental Impacts

Emissions from heavy equipment used during excavation will impact air quality within the proximity of the excavation site.

Excavating the reservoir is not expected to have impacts on water quality. As discussed in Section 6, dewatering a reservoir in order to excavate it could impact water conservation, if the water is released faster than spreading facilities downstream of the reservoir can handle.

Sensitive wildlife may be present during cleanout operations and could impact operations. Procedures would need to be put in place to protect sensitive species.

Excavation - Social Impacts

Excavation will have minimal social impacts due to the remote location of Big Dalton Dam. Recreational users that hike in the vicinity of the reservoir may be subject to air quality and noise impacts.

Excavation – Implementability

Environmental permits may be required prior to the excavation operation; however, there are no implementability concerns with using excavation as a removal method.

Excavation - Performance

This method has performed well in the past and its ability to be used for sediment removal is not a concern for future cleanouts. For additional performance discussion, refer to Section 6.3.1.

Excavation – Cost

The cost to excavate sediment from a reservoir is approximately $3 per cubic yard. Excavating 0.8 MCY of sediment would cost approximately $2.4 million over a 20-year period.

9.1.5 TRANSPORTATION

The following section discusses the impacts and costs of transporting sediment removed from Big Dalton Reservoir by means of trucking and conveyor belt. Discussion of the removal alternatives was presented in Section 9.1.4. The placement alternatives are presented in 9.1.6. Combined alternatives that address all phases of the sediment management process are presented and discussed in Section 9.1.7.

9.1.5.1 TRUCKING

Truck access to the dam and the body of the reservoir is available along existing roads. Once out of the reservoir, trucks could travel along Big Dalton Canyon Road to Glendora Mountain Road and then to Interstate 210 via North Valley Center Avenue, Foothill Boulevard, and North San Dimas Avenue. The distance to Interstate 210 is approximately 7 miles.

Trucking - Environmental Impacts

Since existing roads would be used to truck sediment, no particular impacts would be expected on habitat, water quality, or water conservation. Air quality would be impacted due to the truck operations to the residents within proximity of the haul route. Employing low emission trucks would reduce air quality impacts.

Trucking - Social Impacts

The haul route travels through a residential area and will impact traffic and noise for the residents with properties facing Glendora Mountain Road and North Valley Center Avenue. Big Dalton Canyon Road also serves recreational uses, and truck operations would impact recreational users.

Trucking – Implementability

Trucking, combined with excavation, has been the primary method to remove sediment from the reservoir and no major implementability issues are anticipated. The access road along Big Dalton Canyon Road may not be suitable for the amount of traffic created by the cleanout project and may need to be improved. Single dump trucks should be used for this operation due to the limited and sinuous access to the reservoir. Double dump trucks can be used, if sediment is transported from Big Dalton Debris Basin or Dalton SPS.

Trucking – Performance

Single dump trucks, which have the capacity for approximately 8 CY, can operate for 6 months and transport 400,000 CY of sediment. A cleanout operation can be performed every 10 years and remove the total 20-year quantity of 0.8 MCY.

This method has performed well in the past and its ability to be used to transport sediment is not a concern for future cleanouts.

Trucking – Cost

Trucking costs are approximately $0.65/CY-Mile for a single dump truck, and assuming the sediment is taken to the a pit in the Irwindale area which is 16 miles away (one way), the total cost for the 20-year period for 0.8 MCY of transport is approximately $16.8 million.

If sediment is transported from Big Dalton Debris Basin or Dalton SPS, then double dump trucks can be used, which cost $0.30/CY-Mile. The total cost for the 20-year period to transport the material 14 miles (one way) to a pit in the Irwindale area is approximately $6.8 million.

9.1.5.2 CONVEYOR BELTS

A conveyor system could be used to transport excavated material 1.5 miles from Big Dalton Reservoir to along Big Dalton Canyon Road to the Big Dalton Debris Basin, which could serve as a staging area from which the sediment could be trucked out.

Conveyor Belts - Environmental Impacts

Since existing roads would be used for the conveyor system from the reservoir to the debris basin, no particular impacts would be expected on habitat, water quality, or water conservation. A conveyor system would have very minimal air quality impacts unless generators are used as discussed in Section 6. If Big Dalton Canyon Road has to be widened in order to stage the conveyor system, there would be significant environmental impacts.

Conveyor Belts - Social Impacts

The conveyor system would impact recreational use of Big Dalton Canyon Road. Use of a conveyor belt system may result in visual and access issues to residents or recreational users along the conveyance route.

The conveyor system may impact vehicular access along Big Dalton Canyon Road as a five feet width footprint will be required for the conveyor belt system and may encroach upon the roadway.

Conveyor Belts – Implementability

Big Dalton Canyon Road is fairly narrow. Nonetheless, a small ground-level conveyor may be feasible. However, due to the narrowness of Big Dalton Canyon Road, during times when a conveyor system were located on the road, the road would not be able to be used for two-way traffic. Because of the infrequent need for cleanouts, a conveyor would be installed on a temporary basis. Conveyor systems have the ability to handle relatively circuitous alignments as long as the turning radii are no less than approximately 300 feet.

Conveyor Belts – Performance

Assuming a conveyor system can operate at 500 CY per hour and operate for 6 months, a conveyor operation can be performed twice during the 20-year period and remove the total 20-year quantity of 0.8 MCY.

Conveyor Belts – Cost

Conveyor costs are approximately $800/LF for installation and operating cost. The cost for 1.5 miles of conveyor would be approximately $6.3 million.

9.1.6 PLACEMENT

This section discusses potential placement alternatives for sediment removed from Big Dalton Reservoir.

9.1.6.1 LANDFILLS

Scholl Canyon Landfill is the closest landfill to Big Dalton Reservoir at a distance of 27 miles from the reservoir area. More information regarding the landfill can be found in Section 6.5.1.

9.1.6.2 QUARRY WITH EXISTING OPERATIONS

There are existing operational quarries in the Irwindale (16 miles) and Claremont (13.5 miles) areas that could accept material from Big Dalton Reservoir as discussed in Section 6.5.2.

It is assumed that one-third of the material will be high quality material that will be of value to the existing operational quarries. In exchange for this high quality material, it is assumed that the Flood Control District will be allowed to place the same amount of lower quality material in the operational quarry pits. The remaining one third of the material that will be placed at the pit will be subject to a tipping fee.

9.1.6.3 ACQUIRED QUARRY

As discussed previously, the acquisition of a quarry for placement of sediment from facilities managed by the Flood Control District is being pursued for sediment management. Acquisition of a quarry in the Irwindale area would be most desirable for sediment management operations related to Big Dalton Reservoir.

It will be assumed that acquiring a quarry could potentially cost the Flood Control District approximately $1 per CY and that placement of sediment would cost $2 per CY.

In order to conserve space in an acquired quarry, the high quality material can still be taken an existing quarry operation where the Flood Control District can place an equivalent volume of lower quality material. The remaining material can be placed at the acquired quarry.

9.1.6.4 SEDIMENT PLACEMENT SITES

Big Dalton SPS

Big Dalton SPS, which served Big Dalton Dam, currently holds 3 MCY of sediment and does not have any remaining capacity. The existing material at the SPS cannot be transported out gradually because the SPS needs to be revegetated once the SPS is full in accordance with the permit obtained from the USFS.

Dalton SPS

Dalton SPS, which serves Little Dalton and Big Dalton Debris Basins, currently holds 1.6 MCY of sediment and does not have any remaining capacity. The existing material at the SPS can be transported out gradually to restore capacity at the SPS.

9.1.7 COMBINED SEDIMENT MANAGEMENT ALTERNATIVES

9.1.7.1 COMBINED ALTERNATIVE 1: EXCAVATION > TRUCKING > IRWINDALE PITS

Combined Alternative 1 would involve excavating sediment from Big Dalton Reservoir and transporting it via single dump trucks to a pit in the Irwindale area as shown in Figure 9-8. Residents along the haul route and recreational users of Big Dalton Canyon Road would be impacted during the cleanout. If this alternative were employed, cleanout would be expected to be performed every 10 years to remove the expected 20-year quantity. The total cost is estimated to be approximately $20 million, as shown below in Table 9-2. It is assumed that only one-third of the material will be subject to a tipping or acquisition fee as discussed in Section 9.1.6.

Figure 9-8 Big Dalton Reservoir Management Alternative 1

Table 9-2 Big Dalton Management Alternative 1 Cost Estimate

Activity	Amount (MCY)	Distance (MI)	Unit Cost	Unit	Total Cost ($ Millions)
Excavation at Big Dalton Reservoir			$ 3.00	CY	$ 2.4
Single Dump Truck from Reservoir to Irwindale Pit	0.8	32	$ 0.65	CY-MI	$16.8
Pit Placement Fee			$ 3.00-9.70	CY	$ 0.8-2.6
				Total	**$20**

9.1.7.2 COMBINED ALTERNATIVE 2: EXCAVATION>TRUCKING>DALTON SPS> EXCAVATION>TRUCKING>IRWINDALE PITS

Similar to the previous option, sediment can be excavated and placed directly into a single dump truck and transported to the SPS, as shown in Figure 9-9. The material can be gradually removed via trucks at a rate that reduces social impacts and taken to either a pit in the Irwindale area or a landfill. The excavation is expected to be performed every 10 years to remove the expected 20-year quantity. The total cost is estimated to be approximately $20-25 million, as shown below in Table 9-3. It is assumed that only one-third of the material will be subject to a tipping or acquisition fee as discussed in Section 9.1.6.

Figure 9-9 Big Dalton Reservoir Management Alternative 2

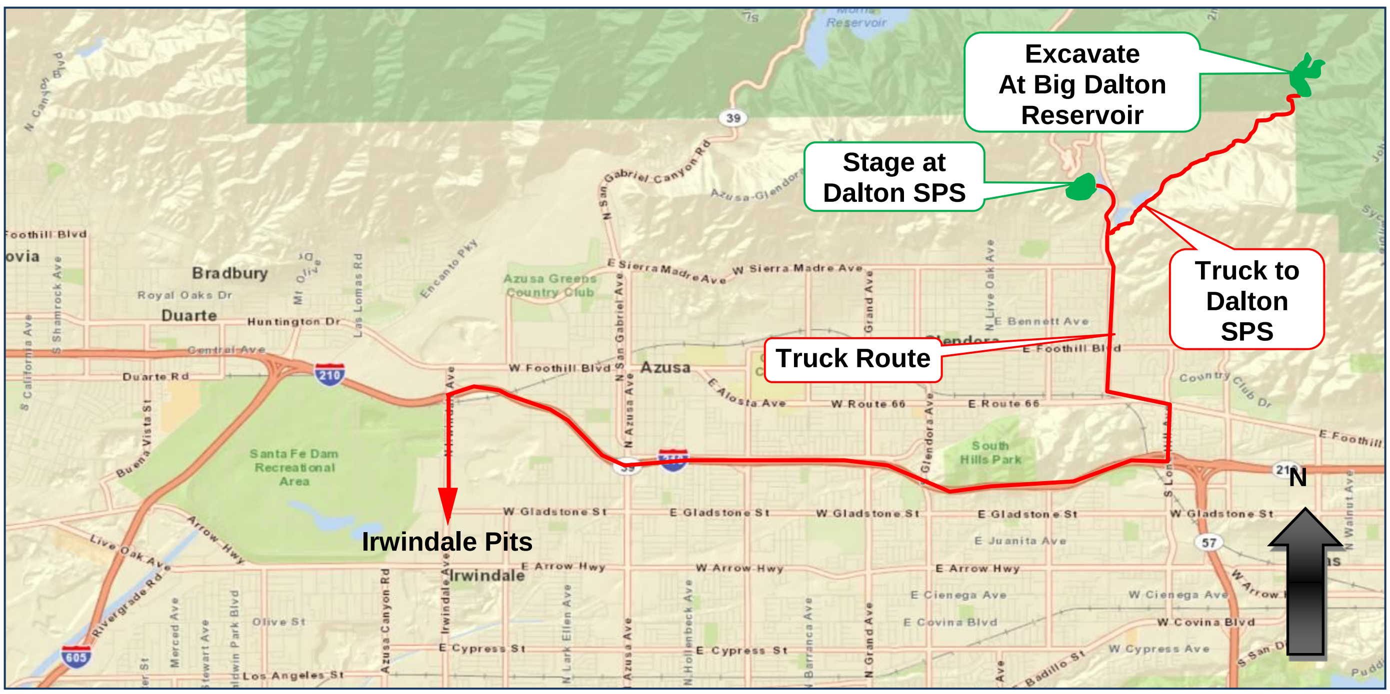


Table 9-3 Big Dalton Management Alternative 2 Cost Estimate

Activity	Amount (MCY)	Distance (MI)	Unit Cost	Unit	Total Cost ($ Millions)
Excavation at Big Dalton Reservoir			$ 3.00	CY	$ 2.4
Single Dump Truck from Reservoir to Dalton SPS		4.4	$ 0.65	CY-MI	$ 2.3
Spreading at Dalton SPS			$ 2.00	CY	$ 1.6
Excavation at Dalton SPS	0.8		$ 7.50	CY	$ 6.1
Double Dump Truck to Pits/Landfills		32 -54	$ 0.30	MI-CY	$ 7.8 – 9.5
Pit/Landfill Placement Fee			$ 3.00 - $ 7.00	CY	$ 0.8 - 1.9
				Total	**$ 20-25**

9.1.7.3 COMBINED ALTERNATIVE 3: EXCAVATION > CONVEYOR > BIG DALTON DB > EXCAVATION > TRUCKING > IRWINDALE PITS

In order to reduce social impacts along Big Dalton Canyon Road, the excavated material can be placed along a 1.5 mile long conveyor down Big Dalton Canyon Road and staged at the Big Dalton Debris Basin, where the sediment will be trucked with double dump trucks to a pit in the Irwindale area, as shown in Figure 9-10. A cleanout is expected to be performed every 10 years to remove the expected 20-year quantity. The total cost is estimated to be approximately $25 million, as shown below in Table 9-4. It is assumed that only one-third of the material will be subject to a tipping or acquisition fee as discussed in Section 9.1.6.

Figure 9-10 Big Dalton Reservoir Management Alternative 3

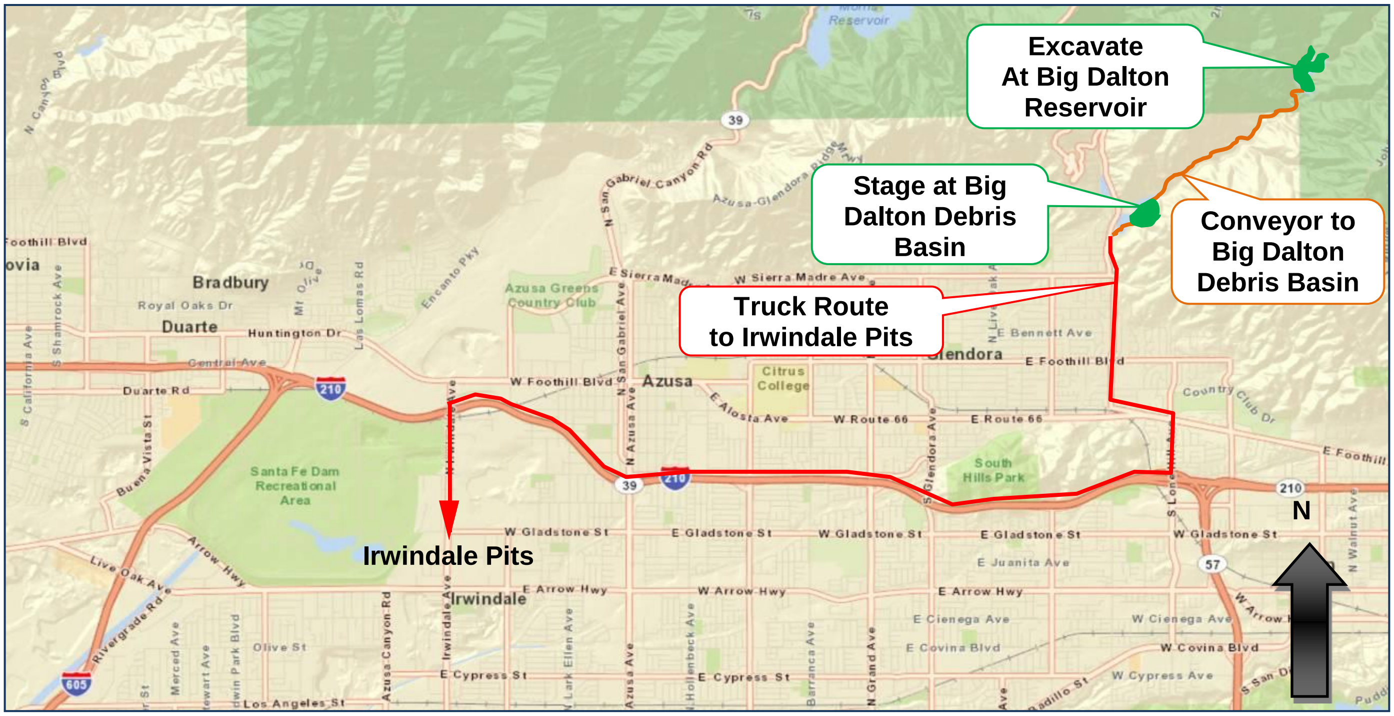


Table 9-4 Big Dalton Management Alternative 3 Cost Estimate

Activity	Amount (MCY)	Distance (MI)	Unit Cost	Unit	Total Cost ($ Millions)
Excavation at Big Dalton Reservoir	0.8		$ 3.00	CY	$ 2.4
Conveyor from Reservoir to Debris Basin		1.5	$ 800.00	LF	$ 6.3
Spreading at Debris Basin			$ 2.00	CY	$ 1.6
Excavation at Debris Basin			$ 7.50	CY	$ 6.1
Double Dump Truck from Debris Basin to Pit		28	$ 0.30	MI-CY	$ 6.8
Pit Placement Fee			$ 3.00-7.00	CY	$ 0.8-1.9
				Total	**$25**

9.1.8 SUMMARY AND RECOMMENDATIONS

9.1.8.1 SUMMARY

Over the next 20 years, 0.8 MCY of sediment is planned to be removed from Big Dalton Reservoir. The different management alternatives are briefly explained below and the impacts are shown in Table 9-5.

Management Alternatives

1. Excavate → Trucks → Irwindale Pits
   Excavate the sediment and truck it to a pit in the Irwindale area.

2. Excavate → Trucks → Dalton SPS → Dry Excavation → Trucks → Irwindale Pits & Landfills
   Excavate the sediment and truck it to Dalton SPS, where the material can be trucked out gradually to a pit or a landfill to reduce the truck frequency.

3. Excavate → Conveyor → Big Dalton Debris Basin → Dry Excavation → Trucks → Irwindale Pits
   Excavate the sediment then place it on a conveyor system where the material will be transported to the Big Dalton Debris Basin. The material at the debris basin will be excavated and transported via trucks to a pit in the Irwindale area.

Table 9-5 Big Dalton Reservoir Summary Table

Alternative		Quantity Removed (CY)	Environmental				Social			Implementability	Performance		Cost
			Habitat	Water Quality	Groundwater Recharge	Air Quality(a)	Traffic	Visual	Noise	Special Permit/Agreement Required(b)	Previous Experience	# of Operations Required in Next 20 years	$ Millions
	Excavate		◑		○	◑		○	○				
1	Trucks	0.8				●	●	●	●		Yes	2	20
	Irwindale Pits									Yes			
	Excavate		◑		○	◑		○	○				
	Trucks					●	●	◑	◑				
2	Dalton SPS	0.8	◑			◑		◑	◑		Yes	2	20-25
	Trucks					●	●	●	●				
	Irwindale Pits/Landfills									Yes			
	Excavate		◑		○	◑		○	○				
	Conveyor		○				○	◑	○				
3	Big Dalton DB	0.8				◑		◑	◑		Yes	2	25
	Trucks					●	●	●	●				
	Irwindale Pits									Yes			

Legend:

●	significant impact
○	possible impact
◑	some impact
	no impact

Notes:
(a) Use of low-emission trucks would reduce air quality impacts from significant impact (●) to some impact (◑).
(b) All options require environmental regulatory permit.

9.1.8.2 RECOMMENDATION

It is recommended that all the alternatives be investigated further for Big Dalton Reservoir.

9.2 EATON WASH RESERVOIR

9.2.1 BACKGROUND

Eaton Wash Dam, shown in Figure 9-11, is a clay-core earth-fill embankment dam located in the City of Pasadena that was constructed by the Army Corps of Engineers and transferred to the Flood Control District in February 1937. The dam functions as flood risk management and water conservation facility. With a drainage area of 12.4 square miles, Eaton Wash Dam had an original storage capacity of 1.5 MCY. Water impounded during the storm season behind the dam is gradually released and diverted into the downstream spreading facilities to recharge groundwater.

Figure 9-11 Eaton Wash Dam

9.2.1.1 LOCATION

Eaton Reservoir is located on Eaton Wash in the City of Pasadena, approximately 0.8 miles south of where the wash exits the foothills as shown in Figure 9-12. Eaton Reservoir is located on the alluvial fan created by sediment moving down from the San Gabriel Mountains. It is in a mixed-use residential and light industrial area adjacent to the intersection of New York Drive and Altadena Drive. Eaton Reservoir is roughly square, with a width and length of approximately 1,000 feet. Figure 9-13 shows the topography of Eaton Wash at the dam and reservoir.

Figure 9-12 Eaton Wash Dam Vicinity Map

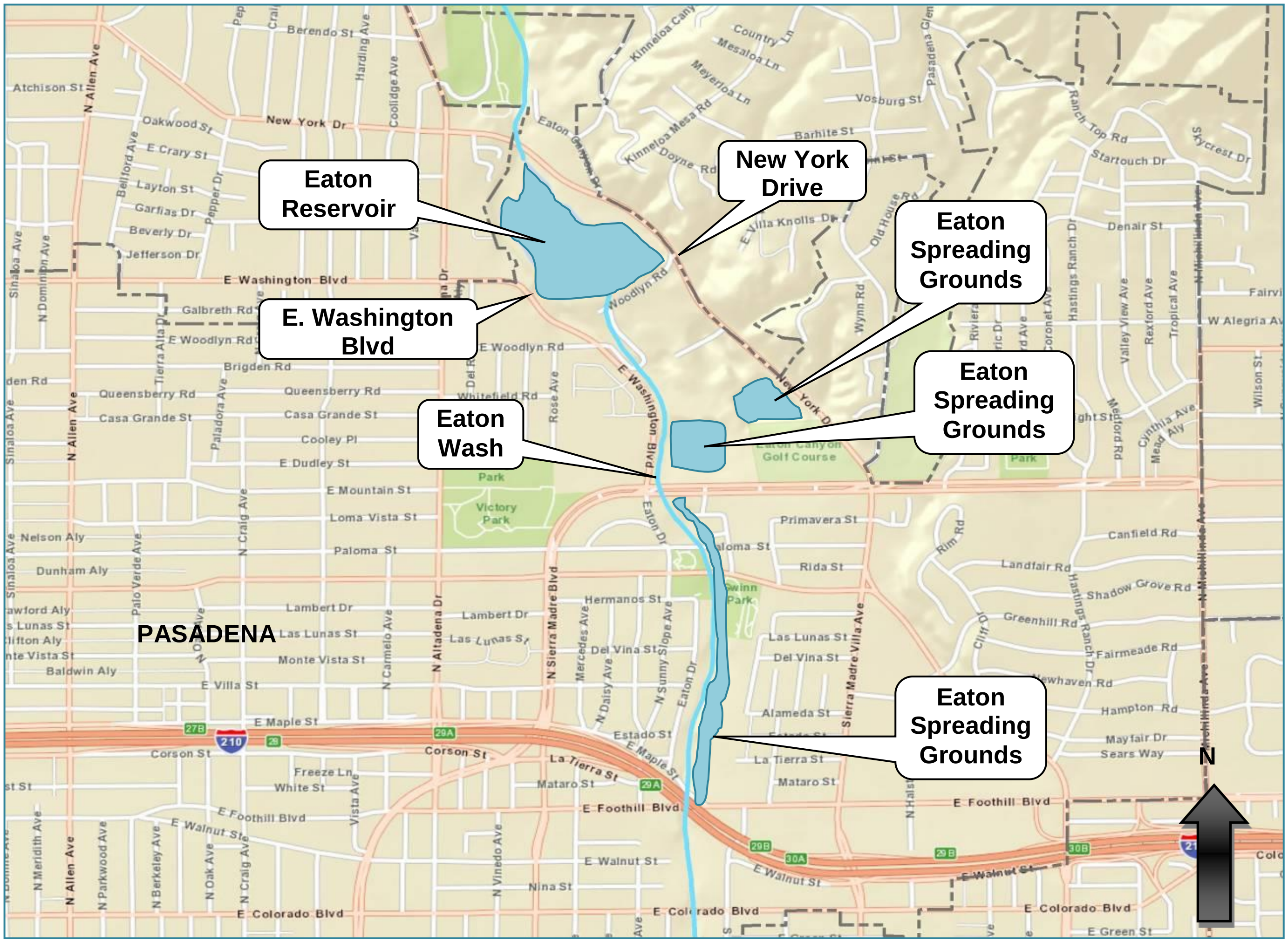


Figure 9-13 Eaton Wash Reservoir Topography

9.2.1.2 ACCESS

Ready access to both the dam and reservoir body is available off New York Drive. There is also access to the west side of the reservoir off East Washington Boulevard. Both of these are major roadways with excellent access to Interstate 210, as shown in Figure 9-14.

Figure 9-14 Location of Access Road to Eaton Reservoir

9.2.1.3 <u>DAM OUTLETS</u>

Eaton Wash Dam is equipped with four slide gates that are all 5 feet by 7 feet.

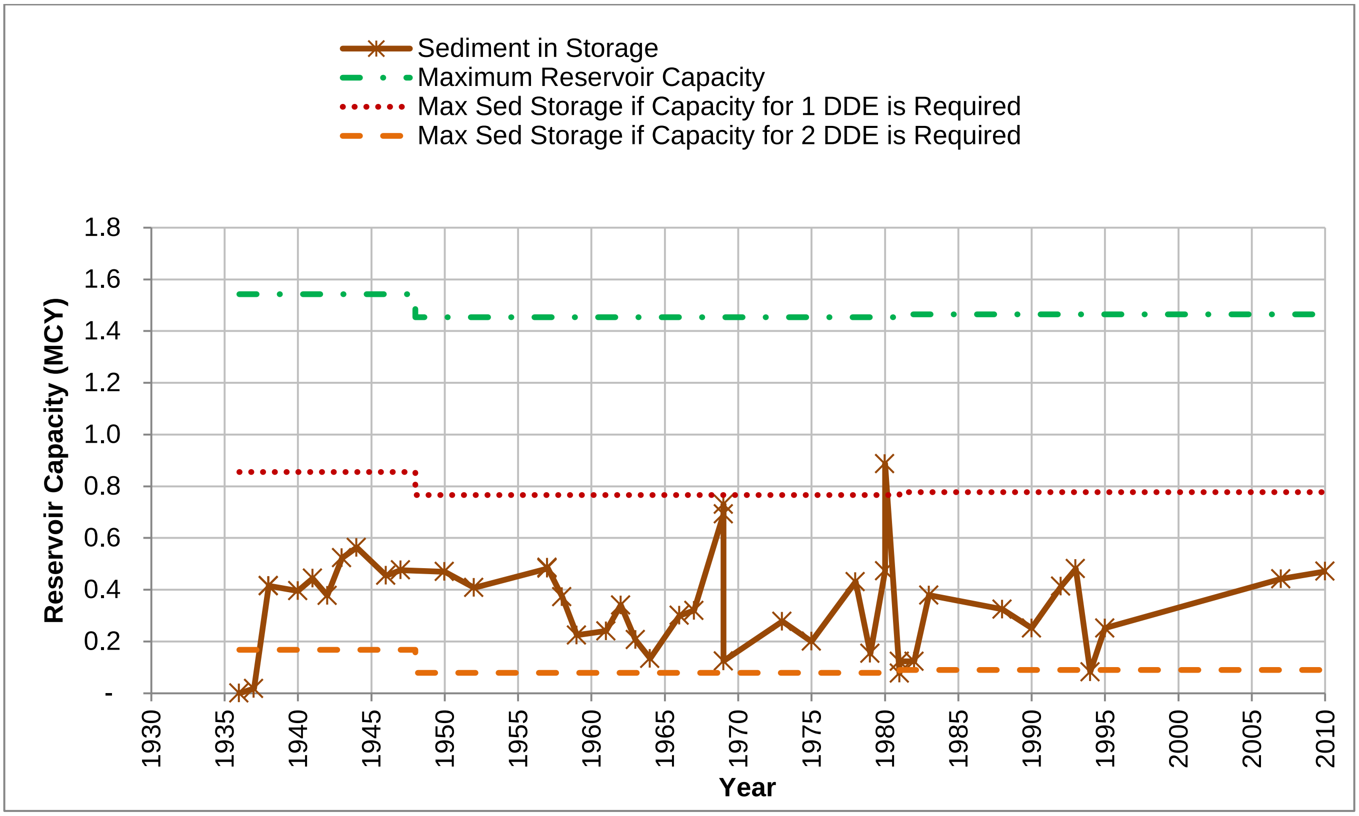
9.2.1.4 <u>DOWNSTREAM FLOOD CONTROL AND WATER CONSERVATION SYSTEM COMPONENTS</u>

Water that passes through Eaton Wash Dam travels along Eaton Wash, which serves the Eaton Wash Spreading Grounds, then to the Rio Hondo, which eventually discharges into the Los Angeles River.

9.2.1.5 <u>SEDIMENT DEPOSITION AND REMOVAL HISTORY</u>

Figure 9-15 shows the approximate sediment storage in Eaton Reservoir. It is the Flood Control District's practice to retain enough storage capacity within a reservoir for two DDEs, which are calculated and determined for each specific reservoir. The graph shows that the Flood Control District has reduced the quantity of sediment in storage at Eaton Reservoir on numerous occasions.

Figure 9-15 Graph of Historical Sediment Storage at Eaton Reservoir



Note:
The maximum storage capacity changed from 1.54 MCY to 1.45 MCY in the 1940s due to an 88,000 CY blanket fill placed at the face of the dam between the spillway and the outlet tower sometime after 1947.

Sediment has been excavated from the Eaton Reservoir 21 times in the 75-year life of the reservoir. Sediment has never been sluiced from the reservoir.

Table 9-6 gives a summary of these removals.

Table 9-6 Summary of Historic Sediment Inflows and Cleanouts – Eaton Reservoir

Survey Date		Reservoir Capacity (MCY)	Quantity Excavated (MCY)	Sediment Deposited (MCY)	Sediment in Storage (MCY)
October	1936	1.54	-	-	-
April	1937	1.52	-	0.02	0.02
May	1938	1.13	-	0.40	0.42
December	1938	1.13	0.00	-	0.41
October	1940	1.15	0.02	-	0.40
August	1941	1.10	-	0.05	0.44
September	1942	1.16	0.19	0.13	0.38
October	1943	1.02	0.07	0.21	0.52
October	1944	0.98	-	0.04	0.56
October	1946	1.09	0.11	-	0.45
June	1947	1.07	-	0.02	0.48
June	1950	1.07	0.01	-	0.47
January	1952	1.13	0.06	0.00	0.41
May	1957	1.06	-	0.07	0.48
October	1957	1.06	-	0.00	0.49
November	1958	1.17	0.11	-	0.37
December	1959	1.32	0.15	-	0.22
September	1961	1.30	-	0.02	0.24
May	1962	1.20	-	0.10	0.34
October	1963	1.34	0.13	-	0.21
February	1964	1.41	0.07	-	0.13
April	1966	1.24	-	0.17	0.30
July	1967	1.22	0.00	0.02	0.32
January	1969	0.85	-	0.37	0.69
February	1969	0.81	-	0.04	0.73
December	1969	1.42	0.60	-	0.12
September	1973	1.26	0.00	0.15	0.28
July	1975	1.34	0.08	-	0.20
March	1978	1.11	-	0.23	0.43
September	1979	1.39	0.28	-	0.15
February	1980	1.07	-	0.32	0.47
February	1980	0.66	-	0.41	0.89
January	1981	1.46	0.81	-	0.08
July	1981	1.42	-	0.05	0.12
October	1982	1.42	-	-	0.12
April	1983	1.16	-	0.26	0.38
March	1988	1.22	0.05	-	0.32
June	1990	1.29	0.07	-	0.25
May	1992	1.13	-	0.16	0.41
March	1993	1.06	-	0.07	0.48
January	1994	1.46	0.40	-	0.08
June	1995	1.29	-	0.17	0.25
July	2007	1.10	0.11	0.30	0.44
May	2010	1.07	-	0.03	0.47

9.2.2 PLANNING QUANTITY

As described in Section 5.3, the 20-year planning quantity for sediment inflow into Eaton Reservoir is 1.6 MCY.

9.2.3 POTENTIAL STAGING AND TEMPORARY SEDIMENT STORAGE AREAS

There are no downstream areas available for a potential staging or temporary sediment storage area.

9.2.4 REMOVAL

Due to the small watershed and limited inflows during the dry season, in addition to the lack of a staging or temporary storage area, wet removal methods such as sluicing or dredging are not possible. The only practical means of removing sediment from debris basins is conventional excavation.

The following section discusses the impacts and costs of sediment removal at Eaton Reservoir by means of excavation. Discussion of the transportation and placement alternatives is presented in Sections 9.2.5 and 9.2.6, respectively. Combined alternatives that address all phases of the sediment management process are presented and discussed in Section 9.2.7.

9.2.4.1 EXCAVATION

Excavation has been the primary method for sediment removal used at Eaton Reservoir as it is usually dry during the summer months due to the limited inflow.

Excavation - Environmental Impacts

Emissions from heavy equipment used during excavation will impact air quality within the proximity of the excavation site.

Excavating the reservoir is not expected to impact water quality. If the water released while draining the reservoir is able to be captured and infiltrated in downstream spreading grounds, then there would be no adverse impact on water conservation either.

Excavation - Social Impacts

Excavation equipment will increase noise for the residents in the proximity of the excavation site. The west side of the reservoir is bordered by many residential and commercial properties. There are a few residential properties on the east of the reservoir also that will be impacted by the excavation operations.

Excavation – Implementability

Environmental permits may be required prior to the excavation operation; however, there are no implementability concerns with using excavation as a removal method.

Excavation – Performance

This method has performed well in the past and its ability to be used for sediment removal is not a concern for future cleanouts. For additional performance discussion, refer to Section 6.3.1.

Excavation – Cost

The cost to excavate sediment from a reservoir is approximately $3 per cubic yard. Excavating 1.6 MCY of sediment would cost approximately $4.8 million over a 20-year period.

9.2.5 TRANSPORTATION

The following section discusses the impacts and costs of transporting sediment removed from Eaton Reservoir by means trucking. Discussion of the removal alternatives was presented in Section 9.2.4. The placement alternatives are presented in 9.2.6. Combined alternatives that address all phases of the sediment management process are presented and discussed in Section 9.2.7.

9.2.5.1 TRUCKING

Truck access to the dam and the body of the reservoir is available along both New York Drive and East Washington Blvd, which are major roadways. Trucks can continue South until North Sierra Madre Blvd and then to Interstate 210. The distance to Interstate 210 is approximately 1.5 miles.

Trucking - Environmental Impacts

Since existing roads would be used to truck sediment, no particular impacts would be expected on habitat, water quality, or water conservation. Air quality would be impacted due to the truck operations to the residents within proximity of the haul route. Employing low emission trucks would reduce air quality impacts.

Trucking - Social Impacts

The haul route travels through a residential area and will impact the traffic and noise for the residents with properties near the proximity of the haul route. However, residential properties do not immediately face the major roadways. In addition, Pasadena High School is directly adjacent to the haul route and modifications may be needed to accommodate the school.

Trucking – Implementability

Trucking, combined with excavation, has been the primary method to remove sediment from the reservoir. Double dump trucks can be used for this operation since the haul route is through major roadways and the reservoir is very accessible.

Trucking – Performance

Double dump trucks, which have the capacity for approximately 16 CY, can operate for 6 months and transport 800,000 CY of sediment. A cleanout operation can be performed every 10 years and remove the total 20-year quantity of 1.6 MCY.

This method has performed well in the past and its ability to be used for sediment removal is not a concern for future cleanouts.

Trucking - Cost

Trucking costs are approximately $0.30/CY-Mile for a double dump truck, and assuming the sediment is taken to a pit in the Irwindale area, which is 12 miles away (one way), the total cost for the 20-year period for 1.6 MCY of transport is approximately $11.5 million.

9.2.5.2 CONVEYOR BELTS

A conveyor system would only be feasible if a staging or temporary storage area is available. Since there are no feasible locations nearby, conveyor systems are not a viable transportation method for Eaton Reservoir.

9.2.6 PLACEMENT

This section discusses potential placement alternatives for sediment removed from Eaton Reservoir.

9.2.6.1 LANDFILLS

Scholl Canyon Landfill is the closest landfill to Eaton Reservoir at a distance of 8.7 miles from the reservoir area. More information regarding the landfill can be found in Section 6.5.1.

9.2.6.2 QUARRY WITH EXISTING OPERATIONS

There are existing operational quarries in the Irwindale area, 12 miles away, which could accept material from Eaton Reservoir as discussed in Section 6.5.2.

It is assumed that one third of the material will be high quality material that will be of value to the existing operational quarries. In exchange for this high quality material, it is assumed that the Flood Control District will be allowed to place the same amount of lower quality material in the operational quarry pits. The remaining one third of the material that will be placed at the pit will be subject to a tipping fee.

9.2.6.3 ACQUIRED QUARRY

As discussed previously, the acquisition of a quarry for placement of sediment from facilities maintained by the Flood Control District is being pursued for sediment management. Acquisition of a quarry in the Irwindale area would be most desirable for sediment management operations related to Eaton Reservoir.

It will be assumed that acquiring a quarry could potentially cost the Flood Control District approximately $1 per CY and that placement of sediment would cost $2 per CY.

In order to conserve space in an acquired quarry, the high quality material can still be taken an existing quarry operation where the Flood Control District can place an equivalent volume of lower quality material. The remaining material can be placed at the acquired quarry.

9.2.7 COMBINED SEDIMENT MANAGEMENT ALTERNATIVES

9.2.7.1 COMBINED ALTERNATIVE 1:

EXCAVATION > TRUCKS > PLACEMENT SITE

Excavation and trucking to a pit in the Irwindale area is the only viable method to remove sediment from Eaton Reservoir, as shown in Figure 9-16. A cleanout is expected to be performed every 10 years to remove the expected 20-year quantity. The total cost is estimated to be approximately $20 million, as shown in Table 9-7. It is assumed that only one third of the material will be subject to a tipping fee or acquisition fee as discussed in Section 9.2.6.

Figure 9-16 Eaton Reservoir Management Alternative

Table 9-7 Eaton Reservoir Cost Estimate

Activity	Amount (MCY)	Distance (MI)	Unit Cost	Unit	Total Cost ($ Millions)
Excavation at Eaton Reservoir	1.6		$ 3.00	CY	$ 4.6
Double Dump Truck from Reservoir to Irwindale Pit		24	$ 0.30	CY-MI	$ 11.5
Pit Placement Fee			$ 3.00-7.00	CY	$ 1.5 - 3.7
				Total	**$ 20**

9.2.8 SUMMARY AND RECOMMENDATIONS

Over the next 20 years, 1.6 MCY of sediment is planned to be removed from Eaton Reservoir. The only viable option is to excavate the material, transport it via trucks, and place it at a pit in the Irwindale area, which has been the primary removal method in the past. It is recommended that excavation and trucking continue as the main removal method for Eaton Reservoir.

Table 9-8 indicates the impacts of this alternative.

Table 9-8 Eaton Reservoir Summary Table

	Alternative	Quantity Removed (MCY)	Environmental				Social			Implementability	Performance		Cost
			Habitat	Water Quality	Groundwater Recharge	Air Quality[a]	Traffic	Visual	Noise	Special Permit/Agreement Required[b]	Previous Experience	# of Operations Required in Next 20 years	$ Millions
	Excavate		◑		○	◑		○	○				
1	Trucks	1.6				●	●	◑	◑		Yes	2	20
	Irwindale Pits									Yes			

Legend:

●	significant impact
○	possible impact
◑	some impact
	no impact

Notes: (a) Use of low-emission trucks would reduce air quality impacts from significant impact (●) to some impact (◑).
(b) All options require environmental regulatory permit.

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9.3 LIVE OAK RESERVOIR

9.3.1 BACKGROUND

Live Oak Dam, shown in Figure 9-17, is an arched concrete gravity dam that was built by the Flood Control District in 1922 and functions as a flood risk management and water conservation facility. With a drainage area of 2.3 square miles, Live Oak Dam had an original storage capacity of 400,000 CY. Water impounded during the storm season behind the dam is gradually released and diverted into the downstream facilities to recharge groundwater.

Figure 9-17 Live Oak Dam

9.3.1.1 LOCATION

Live Oak Dam is located in Unincorporated Area of the County of Los Angeles about 2 miles north of the City of Claremont and 2.5 miles northeasterly of the City of La Verne in the Southern foothills of the San Gabriel Mountains adjacent to the Pomona Valley, as shown in Figure 9-18.

Located on the Live Oak Creek, approximately 0.9 mile north of West Baseline Road, the dam and reservoir are the initial flood control component in Live Oak Canyon. The reservoir is short and narrow with a length of approximately 0.2 miles and an average width of 200 feet, with relatively flat side slopes.

The side slopes of the reservoir and canyon downstream of dam are heavily vegetated with trees and brush. Downstream of the dam, the watercourse passes across several private properties. Figure 9-19 shows the topography of Live Oak Reservoir

Figure 9-18 Live Oak Reservoir Vicinity Map

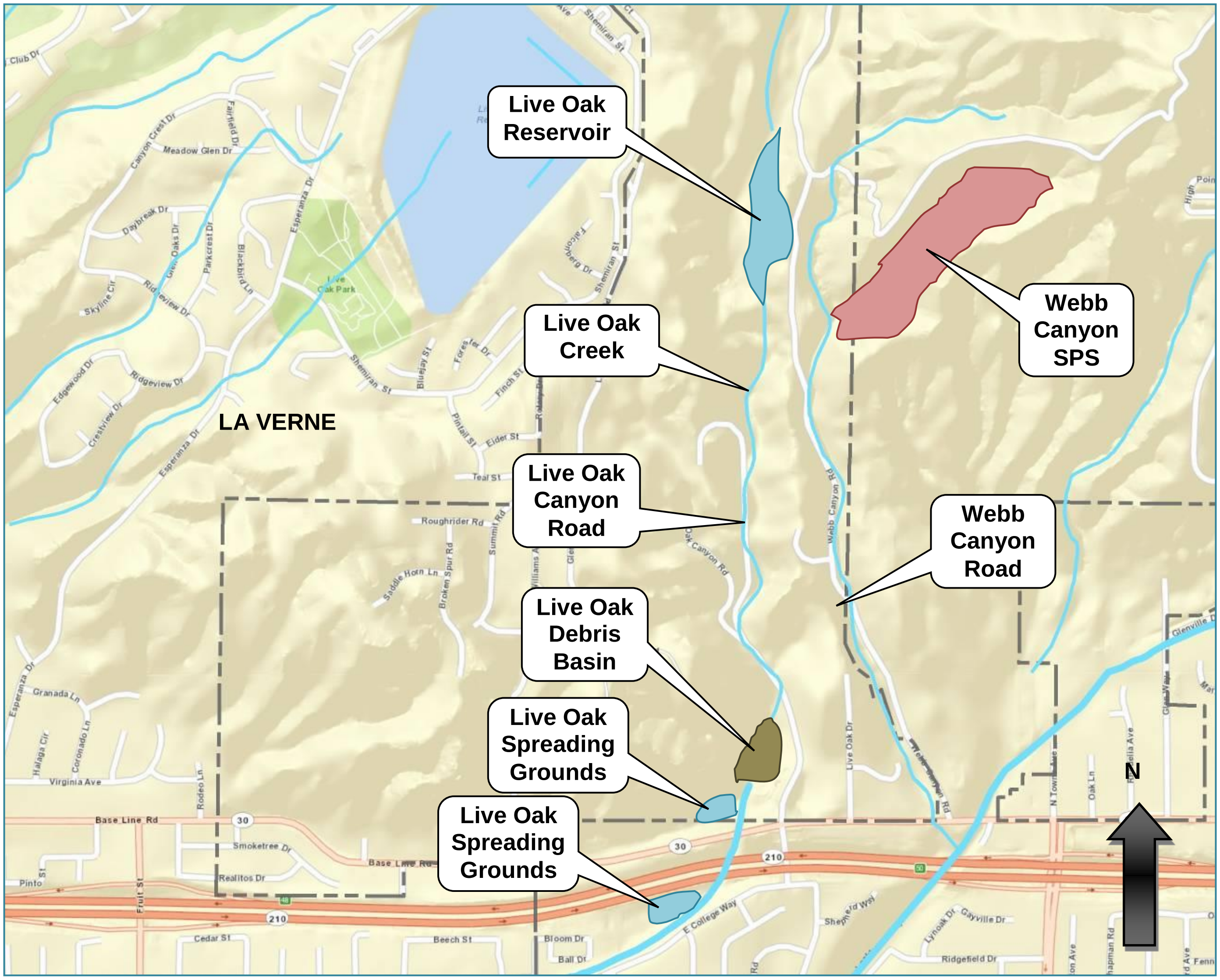


Figure 9-19 Live Oak Reservoir Topography

9.3.1.2 ACCESS

Access to the dam and reservoir is limited to Webb Canyon Road. The road can accommodate two-way traffic for its entire length. On the east abutment of the dam, there is unpaved access into the body of the reservoir.

Live Oak Canyon Road approaches the west abutment of the dam, but there is only a foot trail connecting the Live Oak Canyon Road to the dam. Additionally, Live Oak Canyon Road is very narrow and sinuous. Figure 9-20 shows the dam vicinity and access roads of Live Oak Reservoir.

Figure 9-20 Live Oak Dam Access

9.3.1.3 DAM OUTLETS

Live Oak Dam is equipped with 2 valves and a 36-inch by 42-inch sluice gate.

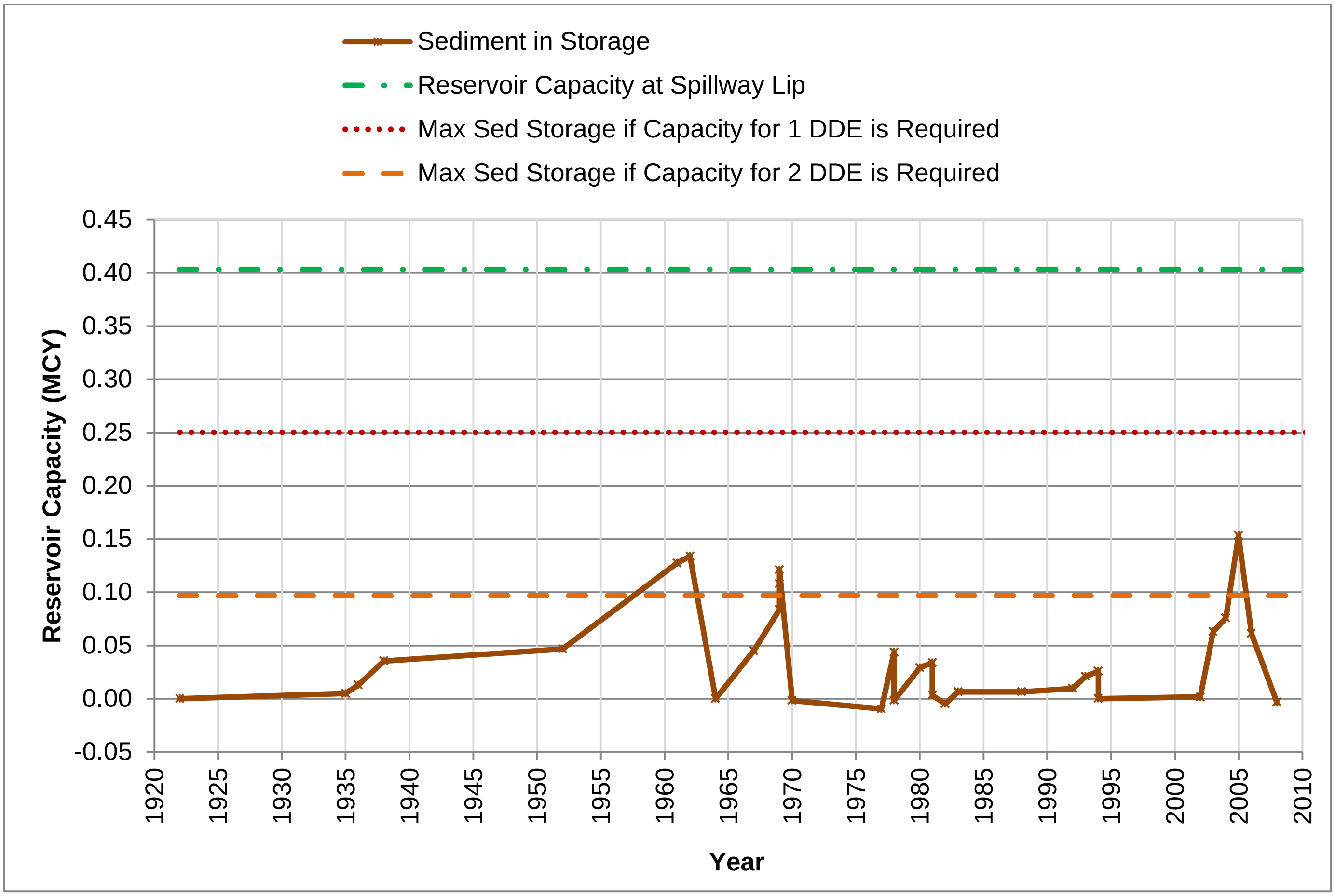
9.3.1.4 DOWNSTREAM FLOOD CONTROL AND WATER CONSERVATION SYSTEM COMPONENTS

Water that passes through Live Oak Dam travels along a watercourse through private properties, and then flows through the Live Oak Debris Basin, which is adjacent to the Live Oak Spreading Grounds. Live Oak Wash eventually discharges into the Puddingstone Reservoir, which is tributary to Walnut Creek and then the San Gabriel River.

9.3.1.5 SEDIMENT DEPOSITION AND REMOVAL HISTORY

Figure 9-21 shows the approximate sediment storage in Live Oak Reservoir. It is the Flood Control District's practice to retain enough storage capacity within a reservoir for two DDEs, which are calculated and determined for each specific reservoir. The graph shows that the Flood Control District has reduced the quantity of sediment in storage at Live Oak Reservoir on numerous occasions.

Figure 9-21 Graph of Historical Sediment Storage at Live Oak Reservoir



Sediment has been removed 9 times in the 89-year life of the reservoir. Table 9-9 gives a summary of these removals and shows that only excavation has been used to remove sediment from Live Oak Reservoir in the past.

Table 9-9 Summary of Historic Sediment Inflows and Cleanouts – Live Oak Reservoir

Survey Date		Reservoir Capacity (CY)	Quantity Sluiced (CY)	Quantity Excavated (CY)	Sediment Deposited (CY)	Accum. Sediment Production (CY)	Sediment in Storage (CY)
October	1922	403,333	-	-	-	-	-
December	1935	398,493	-	-	4,840	4,840	4,840
March	1936	390,427	-	-	8,067	12,907	12,907
May	1938	367,840	-	-	22,587	35,493	35,493
November	1952	345,253	-	-	11,293	46,787	46,787
December	1961	264,587	-	-	80,667	127,453	127,453
December	1962	258,133	-	-	6,453	133,907	133,907
January	1964	392,040	-	133,907	-	133,907	-
March	1967	346,867	-	-	45,173	179,080	45,173
January	1969	308,147	-	-	38,720	217,800	83,893
February	1969	283,947	-	-	24,200	242,000	108,093
December	1969	271,040	-	-	12,907	254,907	121,000
October	1970	393,653	-	141,973	19,360	274,267	(1,613)
October	1977	401,720	-	8,067	(0)	274,267	(9,680)
March	1978	348,480	-	-	53,240	327,507	43,560
December	1978	393,653	-	46,787	1,613	329,120	(1,613)
March	1980	363,000	-	-	30,653	359,773	29,040
May	1981	358,160	-	-	4,840	364,613	33,880
Septembe	1981	388,813	-	30,653	-	364,613	3,227
Septembe	1982	396,880	-	6,453	(1,613)	363,000	(4,840)
April	1983	385,587	-	-	11,293	374,293	6,453
Septembe	1988	385,587	-	-	-	374,293	6,453
July	1992	382,360	-	-	3,227	377,520	9,680
May	1993	371,067	-	-	11,293	388,813	20,973
August	1994	366,227	-	-	4,840	393,653	25,813
October	1994	392,040	-	25,813	-	393,653	-
December	2002	390,427	-	-	1,613	395,267	1,613
August	2003	329,120	-	-	61,307	456,573	62,920
April	2004	316,213	-	-	12,907	469,480	75,827
May	2005	238,773	-	-	77,440	546,920	153,267
November	2006	330,733	-	88,733	(3,227)	543,693	61,307
November	2008	395,267	-	90,347	25,813	569,507	(3,227)

9.3.2 PLANNING QUANTITY

As described in Section 5, the 20-year planning quantity for sediment inflow into Live Oak Reservoir is 210,000 CY.

9.3.3 POTENTIAL STAGING AND TEMPORARY SEDIMENT STORAGE AREAS

9.3.3.1 WEBB SEDIMENT PLACEMENT SITE

Webb SPS could be used as a temporary sediment storage area and the sediment could be gradually transported to a permanent placement site. However, due to the small amount of sediment to be removed combined with the high environmental impacts associated with expanding Webb SPS, this alternative will not be investigated further.

9.3.4 REMOVAL

Due to the small watershed and limited inflows during the dry season, wet removal methods such as sluicing or dredging are not possible as the reservoir is dry during the summer months. Without water, the only practical means of removing sediment from debris basins is conventional excavation.

The following section discusses the impacts and costs of sediment removal at Live Oak Reservoir by means of excavation. Discussion of the transportation and placement alternatives is presented in Sections 9.3.5 and 9.3.6, respectively. Combined alternatives that address all phases of the sediment management process are presented and discussed in Section 9.3.7.

9.3.4.1 EXCAVATION

Excavation has been the primary method for sediment removal used at Live Oak Reservoir.

Excavation – Environmental Impacts

Emissions from heavy equipment used during dry exaction will impact air quality within the proximity of the excavation site.

Excavating the reservoir is not expected to have impact on water quality. As discussed in Section 6, dewatering a reservoir in order to dry excavate it could impact water conservation if the water is released faster than spreading facilities downstream of the reservoir can handle.

There is some sensitive vegetation near the back of the reservoir, however, they can be worked around, or if unavoidable, a reservoir plan can be completed to reduce further impacts.

Excavation – Social Impacts

The excavation equipment will increase noise for the residents in the proximity of the excavation site. There are a few residents that overlook the reservoir from the west side and will be visually impacted. There are also many residents on the downstream side of the dam that will be affected.

Excavation – Implementability

Environmental permits may be required prior to the excavation operation; however, there are no implementability concerns with using dry excavation as a removal method.

Excavation – Performance

This method has performed well in the past and its ability to be used for sediment removal is not a concern for future cleanouts. For additional performance discussion, refer to Section 6.3.1.

Excavation – Cost

The cost to excavate sediment from a reservoir is approximately $3 per cubic yard. Excavating 210,000 CY of sediment would cost approximately $630,000 over a 20-year period.

9.3.5 TRANSPORTATION

The following section discusses the impacts and costs of transporting sediment removed from Live Oak Reservoir by means of sluicing, trucking, conveyor belt, and slurry pipeline. Discussion of the removal alternatives was presented in Section 9.3.4. The placement alternatives are presented in 9.3.6. Combined alternatives that address all phases of the sediment management process are presented and discussed in Section 9.3.7.

9.3.5.1 TRUCKING

Truck access to the dam and the body of the reservoir is available along Webb Canyon Road. Trucks can access Interstate 210, which is one mile away, via Baseline Road and Towne Avenue.

Trucking – Environmental Impacts

Since existing roads would be used to truck sediment, no particular impacts would be expected on habitat, water quality, or water conservation. Air quality would be impacted due to the truck operations to the residents within proximity of the haul route. Employing low emission trucks would reduce air quality impacts.

Trucking – Social Impacts

The haul route that travels through Webb Canyon Road is in a remote area with only a minimal number of residential properties that use Webb Canyon Road to access their property. The haul route through Baseline Road and Towne Avenue are major roadways and will have minimal impact. The overall air quality, noise, and traffic impact is expected to be minimal.

Trucking – Implementability

Trucking, combined with excavation, has been the primary method to remove sediment from the reservoir and no implementability issues are anticipated. Double dump trucks should be used for this operation since Webb Canyon Road is very accessible with minimal social impact and the remaining haul route is through major roadways.

Trucking – Performance

Double dump trucks, which have the capacity for approximately 16 CY, can operate for 6 months and transport 800,000 CY of sediment. A cleanout operation can be performed every 10 years and remove the total 20-year quantity of 210,000 CY.

This method has performed well in the past and its ability to be used to transport sediment is not a concern for future cleanouts.

Trucking – Cost

Trucking costs are approximately $0.30/CY-Mile for a double dump truck, and assuming the sediment is taken to a pit in the Irwindale area, which is 17 miles away (one way), the total cost for the 20-year period for 210,000 CY of transport is approximately $2.1 million.

9.3.5.2 CONVEYOR BELTS

A conveyor system is not practical at this location. Webb SPS is the only accessible staging location, but is less than 0.5 miles from the reservoir, with minimal increased impact for trucks to drive directly to the reservoir.

9.3.6 PLACEMENT

This section discusses potential placement alternatives for sediment removed from Live Oak Reservoir.

9.3.6.1 LANDFILLS

Scholl Canyon Landfill is the closest landfill to Live Oak Reservoir at a distance of 29 miles from the reservoir area. More information regarding the landfill can be found in Section 6.5.1.

9.3.6.2 QUARRIES WITH EXISTING OPERATIONS

There are existing operational quarries in the Irwindale area (17 miles) and Claremont area (5 miles) which could accept material from Live Oak Reservoir, but require a tipping fee as discussed in Section 6.5.2.

It is assumed that one third of the material will be high quality material that will be of value to the existing operational quarries. In exchange for this high quality material, it is assumed that the Flood Control District will be allowed to place the same amount of lower quality material in the operational quarry pits. The remaining one third of the material that will be placed at the pit will be subject to a tipping fee.

9.3.6.3 ACQUIRED QUARRY

As discussed previously, the acquisition of a quarry for placement of sediment from facilities under the management of the Flood Control District is being pursued for sediment management. Acquisition of a quarry in the Irwindale area would be most desirable for sediment management operations related to Live Oak Reservoir.

It will be assumed that acquiring a quarry could potentially cost the Flood Control District approximately $1 per CY and that placement of sediment would cost $2 per CY.

In order to conserve space in an acquired quarry, the high quality material can still be taken an existing quarry operation where the Flood Control District can place an equivalent volume of lower quality material. The remaining material could be placed at the acquired quarry.

9.3.6.4 SEDIMENT PLACEMENT SITES

Webb SPS is approximately 0.5 miles away from Live Oak Dam along Webb Canyon Road. The SPS has approximately 510,000 CY of remaining capacity and 304,000 CY of deposited sediment. The existing material at the SPS could be removed and gradually transported out in order to restore the capacity at Webb SPS. In order to maintain capacity and create long term solutions, this analysis will assume that Webb SPS will not be available.

9.3.7 COMBINED SEDIMENT MANAGEMENT ALTERNATIVES

9.3.7.1 COMBINED ALTERNATIVE 1:

EXCAVATION > TRUCKS > IRWINDALE PITS

Excavation and trucking to an Irwindale Pit is the only viable option for Live Oak Reservoir, as shown in Figure 9-22. A cleanout is expected to be performed twice during the 20-year period to remove the expected 20-year quantity.

The estimated cost to place the material to an existing pit in Irwindale is approximately $3.0 million, as shown below in Table 9-10. It is assumed that only one-third of the material will be subject to a tipping fee or acquisition fee as discussed in Section 9.4.6.

Figure 9-22 Live Oak Reservoir Management Alternative

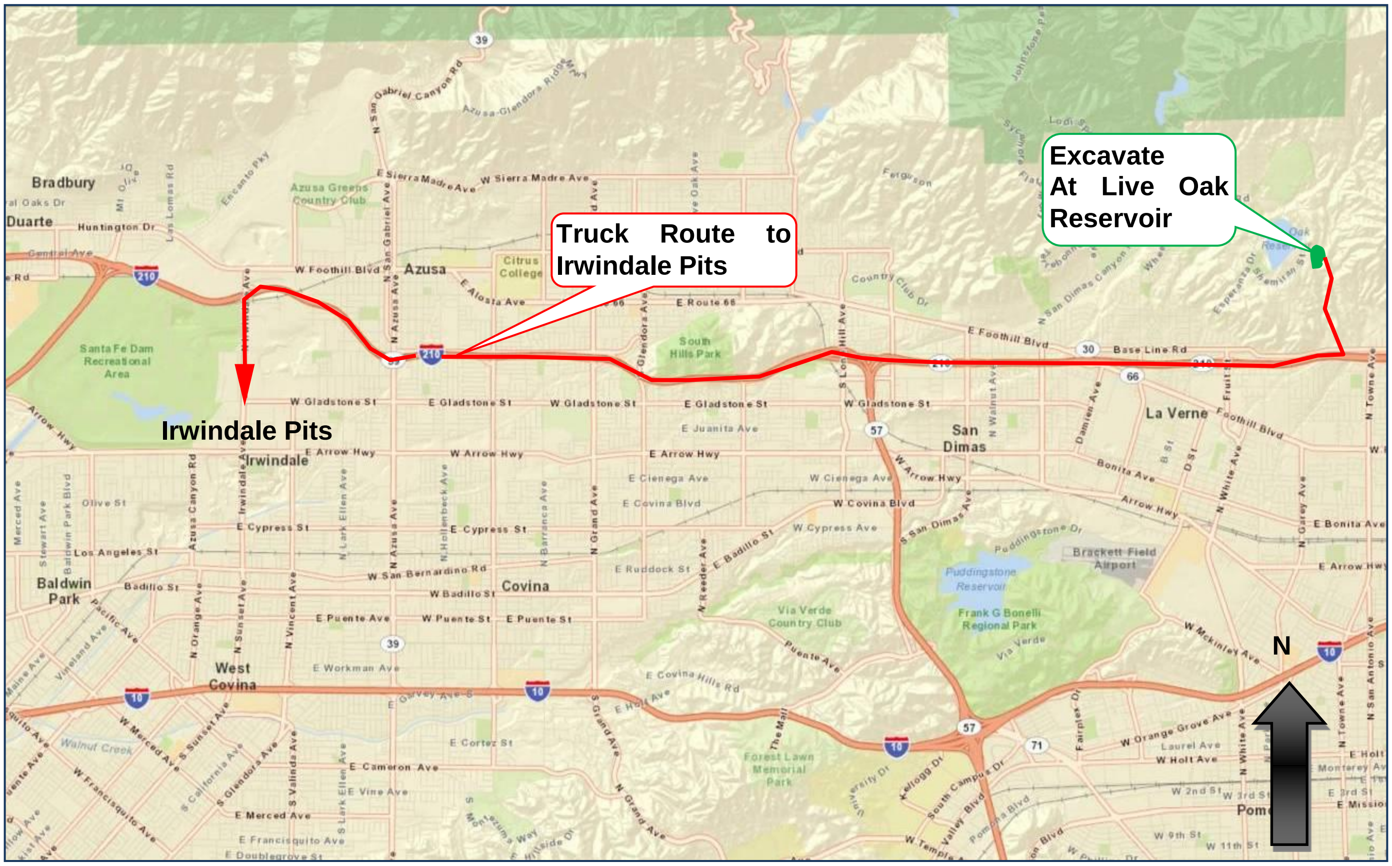


Table 9-10 Live Oak Reservoir Management Alternative – Cost Estimate

Activity	Amount (CY)	Distance (MI)	Unit Cost	Unit	Total Cost ($ Millions)
Excavation at Live Oak Reservoir	210,000		$ 3.00	CY	$ 0.6
Double Dump Truck from Reservoir to Irwindale Pit	210,000	34	$ 0.30	CY-MI	$ 2.1
Pit Placement Fee	210,000		$ 3.00 - 7.00	CY	$ 0.2 - 0.5
				Total	**$ 3.0**

9.3.8 SUMMARY

Over the next 20 years, 210,000 CY of sediment is planned to be removed from Live Oak Reservoir. The only viable option is to excavate the material, transport it via trucks, and place it at a pit in the Irwindale area, which has been the primary removal method in the past. It is recommended that excavation and trucking continue as the main removal method for Live Oak Reservoir. Table 9-11 shows the impacts of this alternative.

Table 9-11 Live Oak Reservoir Summary Table

Alternative		Quantity Removed (CY)	Environmental				Social			Implementability	Performance		Cost
			Habitat	Water Quality	Groundwater Recharge	Air Quality[a]	Traffic	Visual	Noise	Special Permit/Agreement Required[b]	Previous Experience	# of Operations Required in Next 20 years	$ Millions
	Excavate		◑		○	◑		○	○				
1	Trucks	210,000				●	●	◑	◑		Yes	2	3.0
	Irwindale Pits									Yes			

Legend:

●	significant impact
○	possible impact
◑	some impact
	no impact

Notes: (a) Use of low-emission trucks would reduce air quality impacts from significant impact (●) to some impact (◑).
(b) All options require environmental regulatory permit.

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9.4 PUDDINGSTONE DIVERSION RESERVOIR

9.4.1 BACKGROUND

Puddingstone Diversion Dam, shown in Figure 9-23, is an earth embankment dam with a 4-inch concrete facing slab, which was constructed in 1928 by the Flood Control District and functions as a flood risk management, water conservation, and water diversion facility. With a drainage area of 3.67 square miles, Puddingstone Diversion Dam had an original storage capacity of 239,000 CY. Water impounded during the storm season behind the dam is gradually released and diverted into the downstream spreading facilities to recharge groundwater.

Figure 9-23 Puddingstone Diversion Dam

9.4.1.1 LOCATION

The dam and adjoining reservoir are located on the San Dimas Creek, approximately 2.1 miles northeast of the City of San Dimas, as shown in Figure 9-24. Located downstream of the San Dimas Reservoir, Puddingstone Diversion Dam is the final flood control component in San Dimas Canyon before water is discharged into a concrete channel. The reservoir is short and narrow, with a length of approximately 1,500 feet and an average width of 400 feet, with relatively flat sided slopes. Figure 9-25 shows the topography of Puddingstone Diversion Reservoir.

Figure 9-24 Puddingstone Diversion Reservoir Vicinity Map

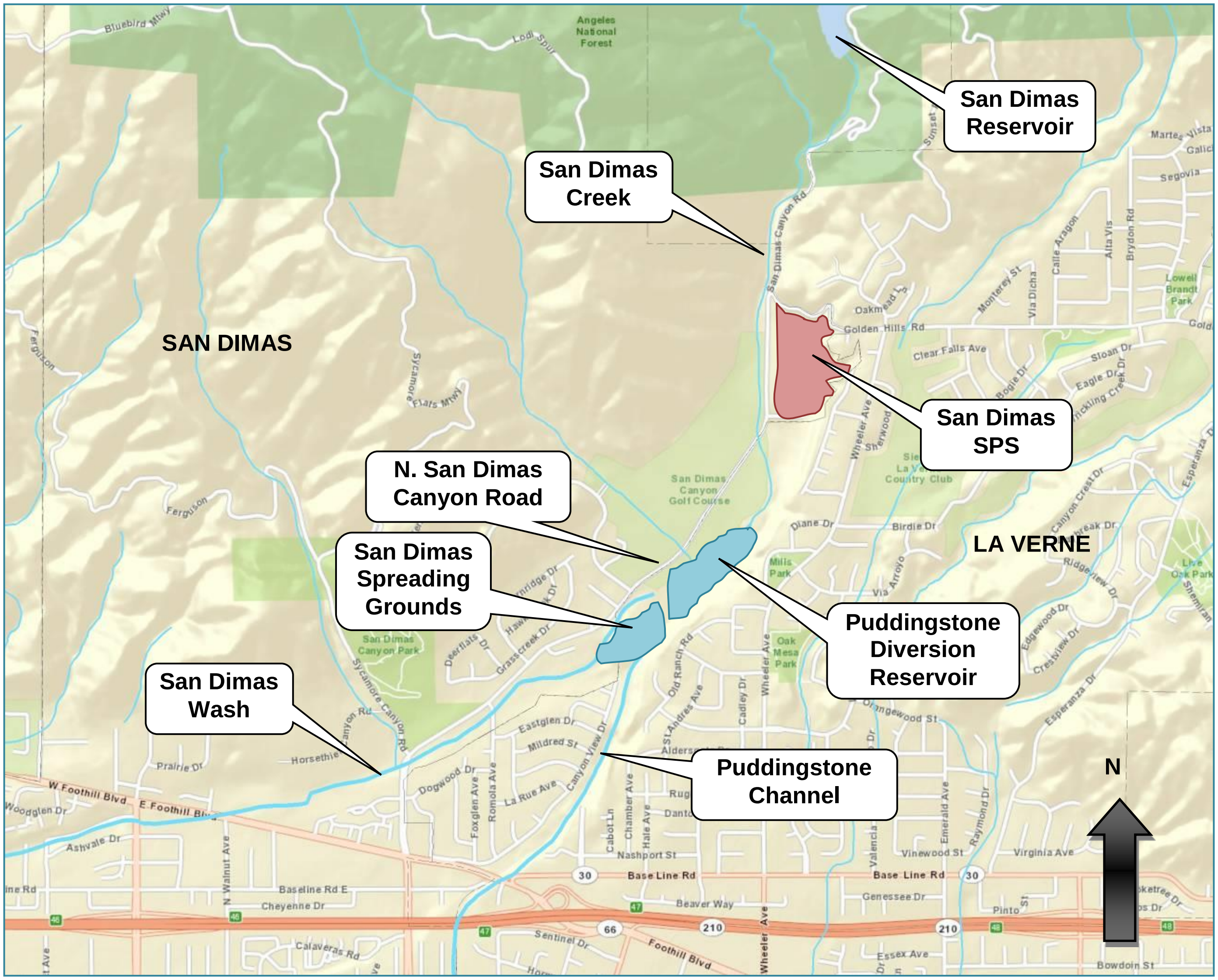


Figure 9-25 Puddingstone Diversion Reservoir Topography

9.4.1.2 ACCESS

Access to the dam and reservoir is limited to North San Dimas Canyon Road. The road can accommodate two-way traffic for its entire length. There is a single-lane, unpaved, access road to the body of the reservoir from North San Dimas Canyon Road. Figure 9-26 shows the dam vicinity and access roads of Puddingstone Diversion Reservoir.

Figure 9-26 Puddingstone Reservoir Access

9.4.1.3 <u>Dam Outlets</u>

Puddingstone Diversion Dam is equipped with four radial gates and a 24-inch gate valve.

9.4.1.4 <u>Downstream Flood Control and Water Conservation System Components</u>

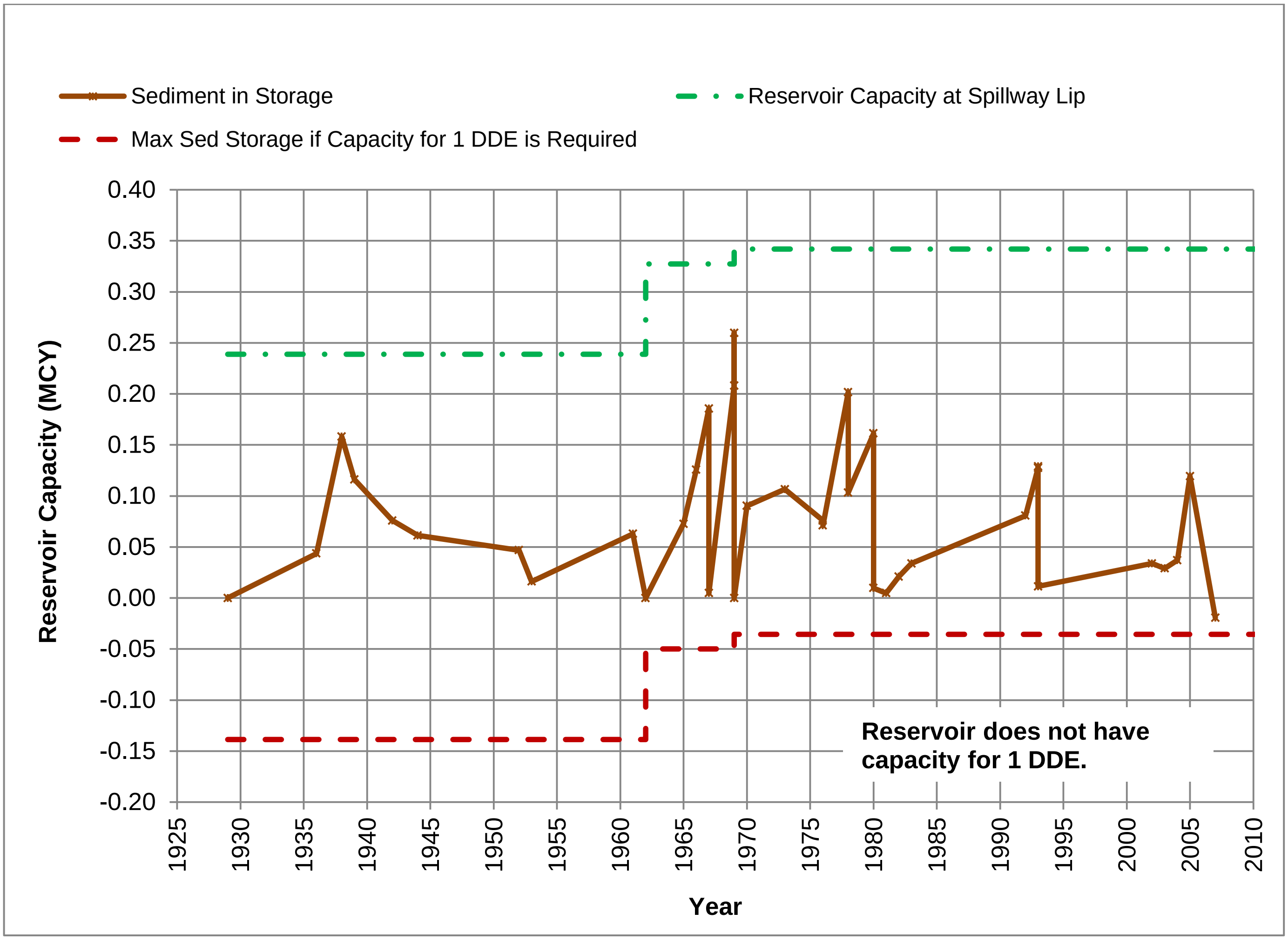
Puddingstone Diversion Reservoir receives and stores flow from San Dimas Wash. Once in the reservoir, up to 3,000 cubic feet per second can be sent to Puddingstone Diversion Channel, which eventually discharges to Puddingstone Dam. It is considered a diversion because flows to Puddingstone Diversion Dam are not tributary to Puddingstone Dam. The flow is diverted to alleviate San Dimas Wash, which does not have the capacity to handle the entire capital storm event from the upstream watershed. All flows over the dam spillway flow into San Dimas Wash. A 24-inch gate valve can be opened to allow the flows into the San Dimas Spreading Grounds, which are immediately downstream of the dam along San Dimas Wash. Puddingstone Diversion Dam is tributary to the San Gabriel River watershed.

9.4.1.5 SEDIMENT DEPOSITION AND REMOVAL HISTORY

The main purpose of Puddingstone Diversion Dam is to divert the flow to Puddingstone Dam to alleviate San Dimas Wash. Sediment storage is an additional side benefit due to the diversion.

Figure 9-27 shows the approximate sediment storage in Puddingstone Diversion Reservoir. It is the Flood Control District's practice to retain enough storage capacity within a reservoir for two DDEs, which are calculated and determined for each specific reservoir. However, the graph shows that Puddingstone Diversion does not have enough capacity for even one DDE. The inability to capture a DDE is not a major concern for this reservoir due to the fact that the upstream San Dimas Dam captures most of the sediment from the undeveloped watershed and the reservoir's main purpose is flood diversion.

Figure 9-27 Graph of Historical Sediment Storage at Puddingstone Diversion Reservoir



Sediment has been removed 16 times in the 82-year life of the reservoir. Table 9-12 gives a summary of these removals and shows that only dry excavation has been used to remove sediment from Puddingstone Diversion Reservoir in the past.

Table 9-12 Summary of Historic Sediment Inflows and Cleanouts – Puddingstone Diversion Dam

Survey Date	Reservoir Capacity (MCY)	Quantity Sluiced (<CY)	Quantity Excavated (MCY)	Sediment Deposited (MCY)	Accumulated Sediment Production (MCY)	Sediment in Storage (MCY)
October 1929	0.24	-	-	-	-	-
June 1936	0.20	-	-	0.04	0.04	0.04
March 1938	0.08	-	-	0.11	0.16	0.16
November 1939	0.12	-	0.04	0.00	0.16	0.12
October 1942	0.16	-	0.04	-	0.16	0.08
September 1944	0.18	-	0.06	0.04	0.20	0.06
February 1952	0.19	-	0.01	-	0.20	0.05
September 1953	0.22	-	0.04	0.01	0.21	0.02
November 1961	0.18	-	-	0.05	0.26	0.06
October 1962	0.33	-	0.18	0.03	0.29	-
October 1965	0.25	-	-	0.07	0.36	0.07
May 1966	0.20	-	-	0.05	0.41	0.13
March 1967	0.14	-	-	0.06	0.47	0.19
October 1967	0.32	-	0.18	-	0.47	0.00
January 1969	0.12	-	-	0.20	0.68	0.21
March 1969	0.07	-	-	0.05	0.73	0.26
October 1969	0.34	-	0.27	-	0.73	-
November 1970	0.25	-	-	0.09	0.82	0.09
June 1973	0.24	-	-	0.02	0.84	0.11
January 1976	0.27	-	0.03	-	0.84	0.08
November 1976	0.27	-	0.00	-	0.84	0.07
March 1978	0.14	-	-	0.13	0.97	0.20
November 1978	0.24	-	0.10	-	0.97	0.10
March 1980	0.18	-	-	0.06	1.02	0.16
November 1980	0.33	-	0.15	-	1.02	0.01
August 1981	0.34	-	0.00	-	1.02	0.00
September 1982	0.32	-	-	0.02	1.04	0.02
April 1983	0.31	-	-	0.01	1.05	0.03
June 1992	0.26	-	-	0.05	1.10	0.08
January 1993	0.21	-	-	0.05	1.15	0.13
March 1993	0.21	-	-	0.00	1.15	0.13
October 1993	0.33	-	0.12	-	1.15	0.01
November 2002	0.31	-	-	0.02	1.17	0.03
October 2003	0.31	-	0.14	0.13	1.30	0.03
April 2004	0.30	-	-	0.01	1.31	0.04
May 2005	0.22	-	-	0.08	1.39	0.12
October 2007	0.36	-	0.14	-	1.39	(0.02)

Notes: 1. Excavation created an additional 89,000 CY of capacity
2. Excavation created an additional 14,520 CY of capacity

9.4.2 PLANNING QUANTITY

As described in Section 5.3, the 20-year planning quantity for sediment inflow into Puddingstone Diversion Reservoir is 0.6 MCY.

9.4.3 POTENTIAL STAGING AND TEMPORARY SEDIMENT STORAGE AREAS

9.4.3.1 SAN DIMAS SPS

The San Dimas SPS, as shown in Figure 9-28, is currently owned by the Flood Control District and was originally developed for the receipt of sediment form San Dimas and Puddingstone Diversion Reservoirs. It is located 0.7 miles north, upstream of the reservoir along North San Dimas Canyon Road.

Figure 9-28 San Dimas SPS Looking Southwest

San Dimas SPS - Environmental Impacts

If the open spaces that have been cleared of vegetation are used as a staging or temporary sediment storage area then there will be minimal habitat impact. Air quality will be minimally impacted due to equipment used when compacting and spreading the sediment.

San Dimas SPS - Social Impacts

Visual and noise impacts may affect local residents directly on the east side of the SPS, and recreational users at the golf course directly to the west.

San Dimas SPS – Implementabilty

San Dimas SPS has been used to place sediment from past Puddingstone Diversion Reservoir cleanouts in the past. Environmental permits would be required for any modifications to the SPS.

San Dimas SPS – Performance

The San Dimas SPS is an active facility with an area of approximately 25 acres and a total remaining capacity of approximately 201,000 CY (about 50 percent of its total capacity). The existing material at the SPS can be excavated, gradually transported out, and placed at an alternative placement site to restore capacity at the SPS and be used for future cleanout projects.

San Dimas SPS – Cost

There is no additional cost to use San Dimas SPS as it is already owned by the Flood Control District. However, if the SPS is used to transition between different transportation methods, it will incur additional costs to manage and spread the sediment at the SPS ($2/CY) and place the material in trucks ($3/CY).

9.4.4 REMOVAL

Even though Puddingstone Diversion Dam has a small watershed and limited inflows during the dry season, flows could be discharged from the upstream San Dimas Dam in order to provide water to sluice or dredge sediment. However, due to the fact that there are no downstream areas for potential staging or temporary storage, wet removal methods such as sluicing or dredging are not possible.

The following section discusses the impacts and costs of sediment removal at Puddingstone Diversion Reservoir by means of dry excavation. Discussion of the transportation and placement alternatives is presented in Sections 9.4.5 and 9.4.6, respectively. Combined alternatives that address all phases of the sediment management process are presented and discussed in Section 9.4.7.

9.4.4.1 EXCAVATION

Excavation has been the only method for sediment removal used at Puddingstone Diversion Reservoir, as it is usually dry during the summer months due to the limited inflow.

Excavation - Environmental Impacts

Emissions from heavy equipment used during exaction will impact air quality within the proximity of the excavation site.

Excavating the reservoir is not expected to have impact on water quality. As discussed in Section 6, dewatering a reservoir in order to excavate it could impact water conservation if the water is released faster than spreading facilities downstream of the reservoir can handle.

Sensitive wildlife inhabits the area and procedures would need to be put in place to protect the sensitive species.

Excavation - Social Impacts

The excavation equipment will increase noise for the residents in the proximity of the excavation site. The south side of the reservoir is bordered by many residential properties while the San Dimas Canyon Golf Course borders the north side of the reservoir.

Excavation – Implementability

Environmental permits may be required prior to the excavation operation: however, there are no implementability concerns with using excavation as a removal method.

Excavation – Performance

This method has performed well in the past and its ability to be used for sediment removal is not a concern for future cleanouts. For additional performance discussion, refer to Section 6.3.1

Excavation – Cost

The cost to excavate sediment from a reservoir is approximately $3 per cubic yard. Excavating 0.6 MCY of sediment would cost approximately $1.8 million over a 20-year period.

9.4.5 TRANSPORTATION

The following section discusses the impacts and costs of transporting sediment removed from Puddingstone Diversion Reservoir by trucking. Discussion of the removal alternatives was presented in Section 9.4.4. The placement alternatives are presented in 9.4.6. Combined alternatives that address all phases of the sediment management process are presented and discussed in Section 9.4.7.

9.4.5.1 TRUCKING

Truck access to the dam and the body of the reservoir is available along North San Dimas Canyon Road, which can access Interstate 210.

Trucking - Environmental Impacts

Since existing roads would be used to truck sediment, no particular impacts would be expected on habitat, water quality, or water conservation. Air quality would be impacted due to the truck operations to the residents within proximity of the haul route. Employing low emission trucks would reduce air quality impacts.

Trucking - Social Impacts

The haul route travels through a residential area and will impact the traffic and noise for the residents with properties near the proximity of the haul route. However, residential properties do not immediately face North San Dimas Canyon Road.

Trucking – Implementability

Trucking, combined with excavation, has been the primary method to remove sediment from the reservoir. Double dump trucks can be used for this operation since the haul route mainly uses major roadways and the reservoir is very accessible.

Trucking – Performance

Double dump trucks, which have the capacity for approximately 16 CY, can operate for 6 months and transport 800,000 CY of sediment. A cleanout operation can be performed every 10 years and remove the total 20-year quantity of 0.6 MCY

This method has performed well in the past and its ability to be used to transport sediment is not a concern for future cleanouts.

Trucking – Cost

Trucking costs are approximately $0.30/CY-Mile for a double dump truck, and assuming the sediment is taken to a pit in the Irwindale area, which is 11 miles away (one way), the total cost for the 20-year period for 0.6 MCY of transport is approximately $4 million.

9.4.5.2 CONVEYOR BELTS

A conveyor system can be combined with excavation in order to transport the material 0.7 miles upstream to the San Dimas SPS. One option is to place the conveyor system on the North San Dimas Canyon Road shoulder to the SPS. Another option is to place the conveyor inside San Dimas Creek to the SPS.

Conveyor Belts - Environmental Impacts

A conveyor system would have very minimal air quality impacts unless generators are used as discussed in Section 6. No environmental impacts are expected if the conveyor was placed on the roadway. If the conveyor was placed inside San Dimas Creek, it would impact habitat and sensitive species along the creek.

Conveyor Belts - Social Impact

Use of the conveyor belt system may result in visual intrusion issues to the residents and recreational users of the golf course.

If the conveyor was placed along North San Dimas Canyon Road, it would significantly impact recreational users of the golf course as golf carts need to cross San Dimas Canyon Road in order to access the south side of the course. In addition, residents who live on Caballo Ranch Road, just south of the SPS may be subject to traffic and access impacts.

If the conveyor was placed inside the creek, the conveyor would need to cross North San Dimas Canyon Road to access the SPS, which could impact traffic along the roadway.

Conveyor Belts – Implementability

Due to North San Dimas Canyon Road being a residential street, an overhead conveyor system will be required at driveways and intersections, as residents may not be able to access their properties and recreational users of the golf course may be impacted due to the ground level conveyor system. Additional right-of-way and use agreements may be required to implement conveyor systems.

If the conveyor was placed inside San Dimas Creek, it would require environmental permitting.

Conveyor Belts – Performance

Assuming a conveyor system can operate at 500 CY per hour, a conveyor operation would be required every 10 years to remove the total 20-year quantity of 0.6 MCY.

Conveyor Belts – Cost

Conveyor costs are approximately $800/LF for installation and operating costs. The cost for 0.7 miles of conveyor would be approximately $2.9 million.

9.4.6 PLACEMENT

This section discusses potential placement alternatives for sediment removed from Puddingstone Diversion Reservoir.

9.4.6.1 LANDFILLS

Scholl Canyon Landfill is the closest landfill to Live Oak Reservoir at a distance of 27 miles from the reservoir area. More information regarding the landfill can be found in Section 6.5.1.

9.4.6.2 QUARRY WITH EXISTING OPERATIONS

There are existing operational quarries in the Irwindale area (11 miles) and the Claremont area (7 miles), which could accept material from Puddingstone Diversion Dam as discussed in Section 6.5.2.

It is assumed that 10 percent of the material will be high quality material that will be of value to the existing operational quarries. In exchange for this high quality material, it is assumed that the Flood Control District will be allowed to place the same amount of lower quality material in the operational quarry pits. The remaining 80 percent of the material that will be placed at the pit will be subject to a tipping fee.

9.4.6.3 ACQUIRED QUARRY

As discussed previously, the acquisition of a quarry for placement of sediment from facilities under the jurisdiction of the Flood Control District is being pursued for sediment management. Acquisition of a quarry in the Irwindale area would be most desirable for sediment management operations related to Puddingstone Diversion Reservoir.

It will be assumed that acquiring a quarry could potentially cost the Flood Control District approximately $1 per CY and that placement of sediment would cost $2 per CY.

In order to conserve space in an acquired quarry, the high quality material can still be taken an existing quarry operation where the Flood Control District can place an equivalent volume of lower quality material. The remaining material can be placed at the acquired quarry.

9.4.6.4 SEDIMENT PLACEMENT SITES

San Dimas SPS is the closest sediment placement site to Puddingstone Diversion Reservoir; it is approximately 0.7 miles north of the reservoir along North San Dimas Canyon Road. San Dimas SPS is also close to San Dimas Reservoir, which is approximately a mile north of the SPS along North San Dimas Canyon Road. San Dimas SPS has total remaining capacity of approximately 200,000 CY. However, it is proposed that San Dimas SPS not be used as a sediment placement alternative for sediment from Puddingstone Diversion Reservoir. Because the planning quantity for San Dimas Reservoir is much larger than the planning quantity for Puddingstone Diversion Reservoir (2.1 MCY versus 0.6 MCY) and San Dimas Reservoir is farther from alternative sediment placement locations, it seems best to use San Dimas SPS for San Dimas Reservoir. In any case, this Strategic Plan proposes to reserve the capacity at San Dimas SPS for emergency purposes; this is stated in Section 8.5.6.4.

9.4.7 COMBINED SEDIMENT MANAGEMENT ALTERNATIVES

9.4.7.1 COMBINED ALTERNATIVE 1: EXCAVATION > TRUCKING > IRWINDALE PITS

This combined alternative would involve excavating and trucking sediment from Puddingstone Reservoir to a pit in the Irwindale area, as shown in Figure 9-29. A cleanout is expected to be performed every 10 years during the 20-year period to remove the expected 20-year quantity. The estimated cost for this alternative is approximately $7-9 million, as shown below in Table 9-13. It is assumed that 80 percent of the material would be subject to a tipping or acquisition fee as discussed in Section 9.4.6.

Figure 9-29 Puddingstone Diversion Reservoir Management Alternative

Table 9-13 Puddingstone Diversion Management Alternative - Cost Estimate

Activity	Amount (MCY)	Distance (MI)	Unit Cost	Unit	Total Cost ($ millions)
Excavation at Puddingstone Diversion Reservoir	0.6		$ 3.00	CY	$ 1.8
Double Dump Truck from Reservoir to Irwindale Pits		22	$ 0.30	CY-MI	$ 4.1
Placement at Pits			$ 3.00-7.00	CY	$ 1.4 - 3.4
				Total	**$ 7 – 9**

Given the minimal social impacts associated with trucking sediment between Puddingstone Diversion Reservoir and Irwindale Reservoir, there seems to be no major advantage to installing a conveyor system to transport sediment from Puddingstone Diversion Reservoir to San Dimas SPS so that sediment could be trucked out of the area gradually. Therefore, that combined alternative is not included in this Strategic Plan.

9.4.8 SUMMARY

Over the next 20 years, 0.6 MCY of sediment is planned to be removed for Puddingstone Diversion Reservoir. The only viable option is to excavate the material, transport it via trucks, and place it at a pit in the Irwindale area, which has been the primary removal method in the past. It is recommended that excavation and trucking continue as the main removal method for Puddingstone Diversion Reservoir. Table 9-14 shows the impacts of this alternative.

Table 9-14 - Puddingstone Diversion Reservoir Summary Table

			Environmental				Social			Implementability	Performance		Cost
	Alternative	Quantity Removed (MCY)	Habitat	Water Quality	Groundwater Recharge	Air Quality[a]	Traffic	Visual	Noise	Special Permit/Agreement Required[b]	Previous Experience	# of Operations Required in Next 20 years	$ Millions
1	Excavate	0.6	◑		○	◑		○	○		Yes	2	7-9
	Trucks					●	●	◑	◑				
	Irwindale Pits									Yes			

Legend:

●	significant impact
○	possible impact
◑	some impact
	no impact

Notes:
(a) Use of low-emission trucks would reduce air quality impacts from significant impact (●) to some impact (◑).
(b) All options require environmental regulatory permit.

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9.5 THOMPSON CREEK RESERVOIR

9.5.1 BACKGROUND

Thompson Creek Dam, shown in Figure 9-30, is a concrete-core, gravel-fill dam, which was constructed in 1928 by the Flood Control District and functions as a flood risk management and water conservation facility. With a drainage area of 3.51 square miles, Thompson Creek Dam had an original storage capacity of 1.0 MCY. Water impounded during the storm season behind the dam is gradually released and diverted into the downstream spreading facilities to recharge groundwater.

Figure 9-30 Thompson Creek Dam

9.5.1.1 LOCATION

The dam and adjoining reservoir are located on Thompson Creek, approximately 3 miles north of the City of Claremont, as shown in Figure 9-31.

Figure 9-31 Thompson Creek Reservoir Vicinity Map

Thompson Creek Reservoir and Dam are the initial flood control components in Thompson Creek. The reservoir is short and broad, with a length of approximately 500 feet and an average width of 600 feet, with relatively flat-sided slopes around the reservoir. Figure 9-32 shows the topography of Thompson Reservoir.

Figure 9-32 Thompson Creek Reservoir Topography

9.5.1.2 ACCESS

Access to the dam is available off North Mills Avenue, which runs past the east abutment of the dam. An unpaved road provides access to the west side of the reservoir from North Mills Avenue. Beyond the top of the dam, North Mills Ave extends approximately 0.2 mile and then changes to the unpaved Coble Canyon Mountain Way.

There is also unpaved access to the toe and top of the dam from North Mills Avenue or Thompson Creek Channel maintenance access road. Figure 9-33 shows the dam vicinity and access roads of Thompson Reservoir.

Figure 9-33 Thompson Creek Access

9.5.1.3 DAM OUTLETS

Thompson Creek Dam is equipped with four slide gates that vary in dimension.

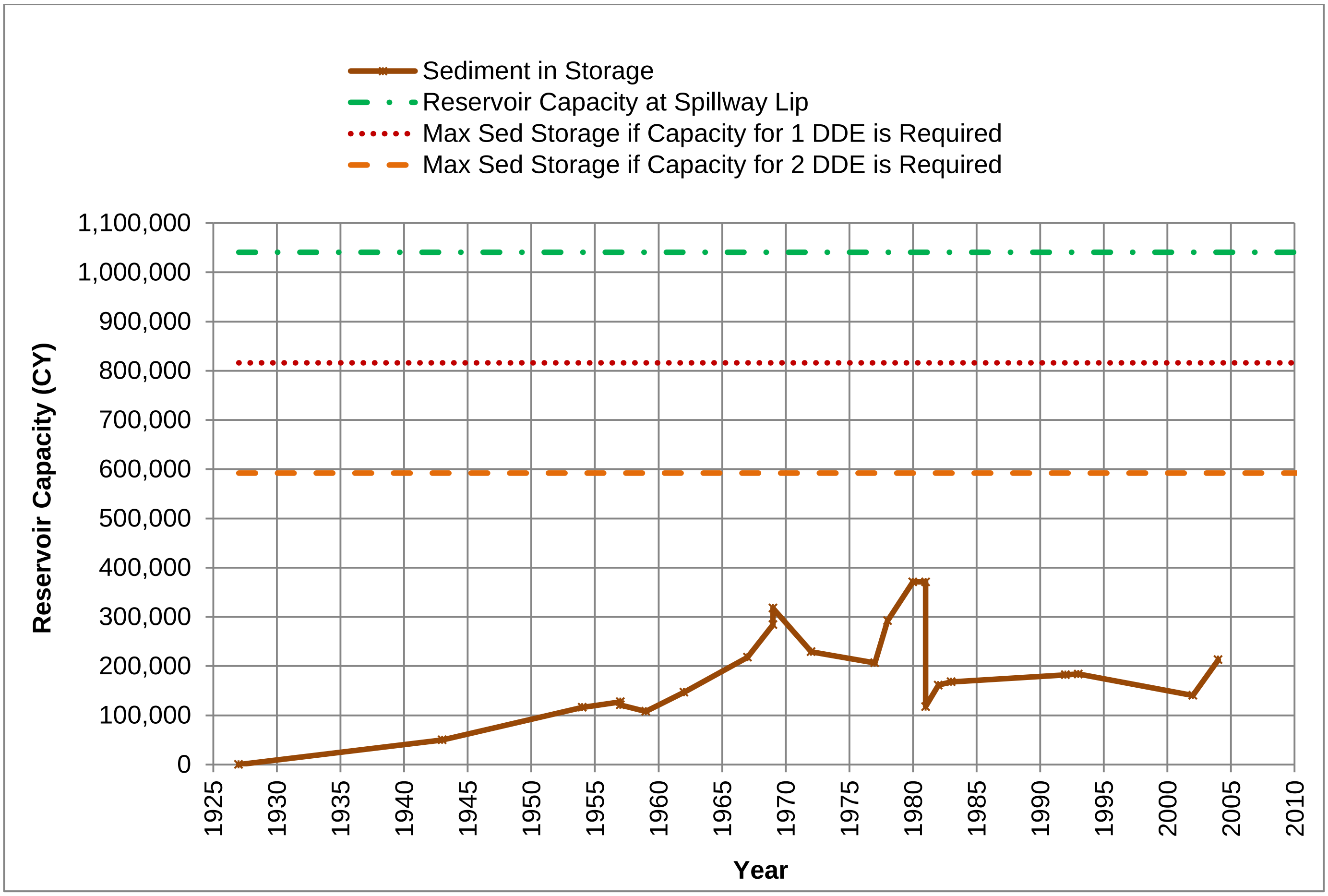
9.5.1.4 DOWNSTREAM FLOOD CONTROL AND WATER CONSERVATION SYSTEM COMPONENTS

Water that passes through Thompson Dam travels along Thompson Creek, which serves the Thompson Creek Spreading Grounds, which are immediately downstream of the dam. Thompson Creek flows continue on to San Jose Creek, which eventually discharge into the San Gabriel River.

9.5.1.5 SEDIMENT DEPOSITION AND REMOVAL HISTORY

Figure 9-34 shows the approximate sediment storage in Thompson Creek Reservoir. It is the Flood Control District's practice to retain enough storage capacity within a reservoir for two DDEs, which are calculated and determined for each specific reservoir. For reference purposes, Table 9-15 shows the original reservoir capacity at spillway lip and the maximum sediment storage that allows for the storage of both one and two incoming DDEs. The graph shows that the Flood Control District has reduced the quantity of sediment in storage at Thompson Creek Reservoir on numerous occasions.

Figure 9-34 Graph of Historical Sediment Storage at Thompson Creek Reservoir



Sediment has been removed 9 times in the 84-year life of the reservoir. Table 9-15 gives a summary of these removals and shows that only excavation has been used to remove sediment from Thompson Creek Reservoir in the past.

Table 9-15 Summary of Historic Sediment Inflows and Cleanouts – Thompson Creek Reservoir

Date		Reservoir Capacity (CY)	Quantity Sluiced (CY)	Quantity Excavated (CY)	Sediment Deposited (CY)	Accum. Sediment Production (CY)	Sediment in Storage (CY)
October	1927	1,040,598	0	0	0	0	0
January	1943	990,585	0	0	50,013	50,013	50,013
September	1954	924,438	0	3,227	69,373	119,386	116,160
January	1957	913,145	0	8,067	19,360	138,746	127,453
June	1957	919,598	0	6,453	0	138,746	121,000
December	1959	932,505	0	12,907	0	138,746	108,093
July	1962	893,785	0	0	38,720	177,466	146,813
February	1967	822,798	0	0	70,987	248,453	217,800
January	1969	756,652	0	0	66,147	314,599	283,946
February	1969	722,772	0	0	33,880	348,479	317,826
December	1972	811,505	0	88,733	0	348,479	229,093
November	1977	834,092	0	22,587	0	348,479	206,506
August	1978	748,585	0	0	85,506	433,986	292,013
March	1980	669,532	0	9,680	88,733	522,719	371,066
June	1981	672,759	0	0	0	522,719	371,066
October	1981	926,051	0	253,293	0	522,719	117,773
September	1982	882,492	0	0	43,560	566,279	161,333
April	1983	876,038	0	0	6,453	572,732	167,786
June	1992	861,518	0	0	14,520	587,252	182,306
June	1993	859,905	0	0	1,613	588,865	183,920
February	2002	903,465	0	43,560	0	588,865	140,360
June	2004	830,865	0	0	72,600	661,465	212,960

9.5.2 PLANNING QUANTITY

As described in Section 5.3, the 20-year planning quantity for sediment inflow into Thompson Reservoir is 260,000 CY.

9.5.3 POTENTIAL STAGING AND TEMPORARY SEDIMENT STORAGE AREAS

There are no downstream areas available for a potential staging or temporary sediment storage area.

9.5.4 REMOVAL

Due to the small watershed and limited inflows during the dry season, in addition to the lack of a staging or temporary storage area, wet removal methods such as sluicing or dredging are not possible as the reservoir is dry during the summer months. Without water, the only practical means of removing sediment from debris basins is conventional excavation.

The following section discusses the impacts and costs of sediment removal at Thompson Creek Reservoir by means of excavation. Discussion of the transportation and placement alternatives is presented in Sections 9.5.5 and 9.5.6, respectively. Combined alternatives that address all phases of the sediment management process are presented and discussed in Section 9.5.7.

9.5.4.1 EXCAVATION

Excavation has been the primary method for sediment removal used at Thompson Creek Reservoir, as it is usually dry during the summer months due to limited inflows.

Excavation - Environmental Impacts

Emissions from heavy equipment used during excavation will impact air quality within the proximity of the excavation site.

Excavating the reservoir is not expected to have impact on water quality. As discussed in Section 6, dewatering a reservoir in order to dry excavate it could impact water conservation if the water is released faster than spreading facilities downstream of the reservoir can handle.

Excavation - Social Impacts

Excavation equipment will increase noise for the residents in the proximity of the excavation site. There are a few residential properties on the east side of the dam across the street from North Mills Ave.

Excavation – Implementability

Environmental permits may be required prior to the excavation operation; however, there are no implementability concerns with using excavation as a removal method.

Excavation – Performance

This method has performed well in the past and its ability to be used for sediment removal is not a concern for future cleanouts. For additional performance discussion, refer to Section 6.3.1.

Excavation – Cost

The cost to excavate sediment from a reservoir is approximately $3 per cubic yard. Excavating 260,000 CY of sediment would cost approximately $0.8 million over a 20-year period.

9.5.5 TRANSPORTATION

The following section discusses the impacts and costs of transporting sediment removed from Thompson Creek Reservoir by means of trucking. Discussion of the removal alternatives was presented in Section 9.5.4. The placement alternatives are presented in 9.5.6. Combined alternatives that address all phases of the sediment management process are presented and discussed in Section 9.5.7.

9.5.5.1 TRUCKING

Truck access to the dam and the body of the reservoir is available along existing roads. Once out of the reservoir, trucks could use North Mills Road to Interstate 210 via West Baseline Road. The distance to Interstate 210 is approximately 2.4 to 3.4 miles, depending on whether the truck traveled east or west on West Baseline Road.

Trucking – Environmental Impacts

Since existing roads would be used to truck sediment, no particular impacts would be expected on habitat, water quality, or water conservation. Air quality would be impacted due to the truck operations to the residents within proximity of the haul route. Employing low emission trucks would help minimize air quality impacts.

Trucking - Social Impacts

The haul route travels through a residential area and will impact the traffic and noise for the residents with properties near the proximity of the haul route. North Mills Road is also used by residents to access the hiking trail behind Thompson Creek thus the additional truck traffic may impact recreational use.

Trucking – Implementability

Trucking, combined with excavation, has been the primary method to remove sediment from the reservoir. Double dump trucks can be used for this operation since the haul route is through major roadways and the reservoir is very accessible.

Trucking – Performance

Double dump trucks, which have the capacity for approximately 8 CY, can operate for 6 months and transport 800,000 CY of sediment. A cleanout operation can be performed every 10 years and remove the total 20-year quantity of 260,000 CY.

This method has performed well in the past and its ability to be used to transport sediment is not a concern for future cleanouts.

Trucking – Cost

Trucking costs are approximately $0.30/CY-Mile for a double dump truck, and assuming the sediment is taken to a pit in the Irwindale area, which is 12 miles away (one way), the total cost for the 20-year period for 260,000 CY of removal is approximately $1.9 million.

9.5.5.2 CONVEYOR BELTS

A conveyor system would only be feasible if a staging area is available. Since there are no feasible locations nearby, conveyor systems are not a viable transportation method for Thompson Creek Reservoir.

9.5.6 PLACEMENT

This section discusses potential placement alternatives for sediment removed from Thompson Creek Reservoir.

9.5.6.1 LANDFILLS

Scholl Canyon Landfill is the closest landfill to Thompson Creek Reservoir at a distance of 32 miles from the reservoir area. More information regarding the landfill can be found in Section 6.5.1.

9.5.6.2 QUARRY WITH EXISTING OPERATIONS

There are existing operational quarries in the Claremont area (3 miles) or Irwindale area (12 miles) that could accept material from Thompson Creek Reservoir as discussed in Section 6.5.2.

It is assumed that one-third of the material will be high quality material that will be of value to the existing operational quarries. In exchange for this high quality material, it is assumed that the Flood Control District will be allowed to place the same amount of lower quality material in the operational quarry pits. The remaining one-third of the material that will be placed at the pit will be subject to a tipping fee.

9.5.6.3 ACQUIRED QUARRY

As discussed previously, the acquisition of a quarry for placement of sediment from facilities managed by the Flood Control District is being pursued for sediment management. Acquisition of a quarry in the Irwindale area would be most desirable for sediment management operations related to Thompson Creek Reservoir.

It will be assumed that acquiring a quarry could potentially cost the Flood Control District approximately $1 per CY and that placement of sediment would cost $2 per CY.

In order to conserve space in an acquired quarry, the high quality material can still be taken an existing quarry operation where the Flood Control District can place an equivalent volume of lower quality material. The remaining material can be placed at the acquired quarry.

9.5.7 COMBINED SEDIMENT MANAGEMENT ALTERNATIVES

9.5.7.1 COMBINED ALTERNATIVE 1:

EXCAVATION > TRUCKING > IRWINDALE PITS

Excavation and trucking to the Irwindale Pits is the only viable method to remove sediment from Thompson Creek Reservoir, as shown in Figure 9-35. A cleanout is expected to be performed every ten years to remove the expected 20-year quantity. The total cost is estimated to be approximately $3.0-3.5 million, as shown below in Table 9-16. It is assumed that only one third of the material will be subject to a tipping fee or acquisition fee as discussed in Section 9.4.6.

Figure 9-35 Thompson Creek Management Alternative

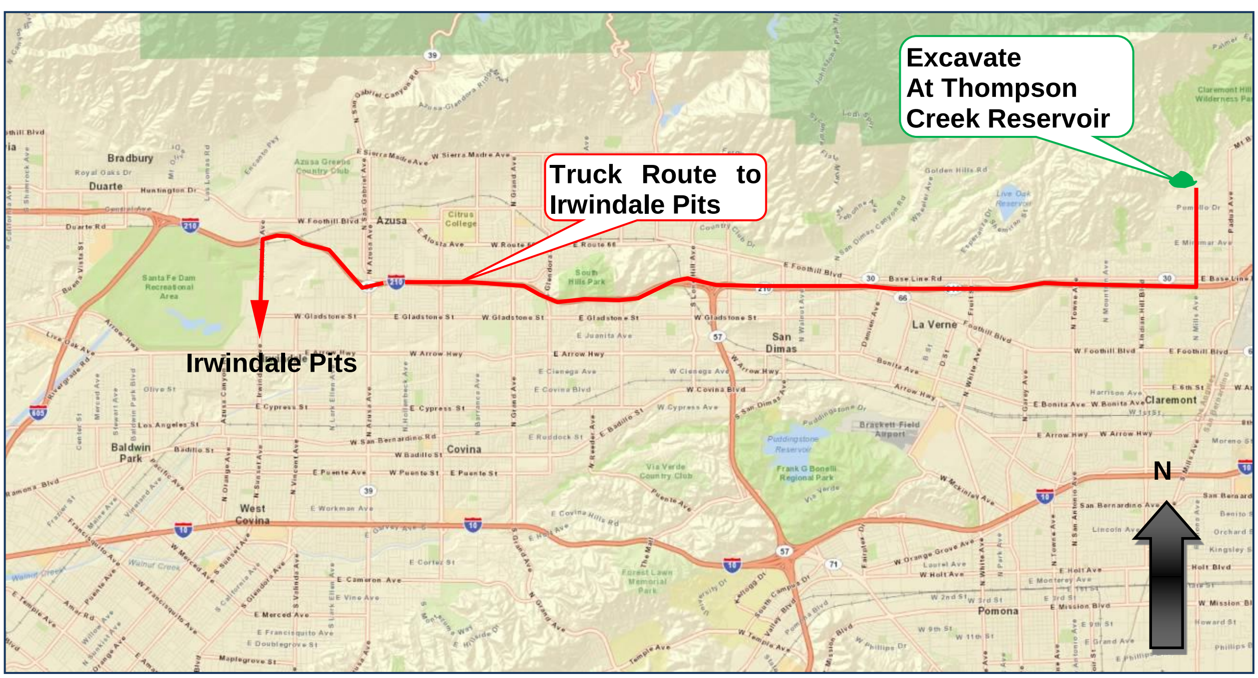


Table 9-16 Thompson Creek Management Alternative - Cost Estimate

	Amount (CY)	Distance (MI)	Unit Cost	Unit	Total Cost ($ Millions)
Activity	260,000		$ 3.00	CY	$ 0.78
Double Dump Truck from Reservoir to Irwindale Pits	260,000	24	$ 0.30	CY-MI	$ 1.87
Pit Placement Fee			$ 3.00 -7.00	CY	$ 0.26 -0.61
				Total	**$3.0 – 3.5**

9.5.8 SUMMARY

Over the next 20 years, 260,000 CY of sediment is planned to be removed from Thompson Creek Reservoir. The only viable option is to excavate the material, transport it via trucks, and place it at a pit in the Irwindale area, which has been the primary removal method in the past. It is recommended that dry excavation and trucking continue as the main removal method for Thompson Creek Reservoir. Table 9-17 shows the impacts of this alternative.

Table 9-17 Thompson Creek Reservoir Summary Table

	Alternative	Quantity Removed (CY)	Environmental				Social			Implementability	Performance		Cost
			Habitat	Water Quality	Groundwater Recharge	Air Quality[a]	Traffic	Visual	Noise	Special Permit/Agreement Required[b]	Previous Experience	# of Operations Required in Next 20 years	$ Millions
1	Excavate	260,000	◑		○	◑		○	○		Yes	2	3.0-3.5
	Trucks					●	●	●	●				
	Irwindale Pits									Yes			

Legend:

●	significant impact
○	possible impact
◑	some impact
	no impact

Notes: (a) Use of low-emission trucks would reduce air quality impacts from significant impact (●) to some impact (◑).
(b) All options require environmental regulatory permit.

SECTION 10 ALTERNATIVES ANALYSIS AND RECOMMENDATION FOR DEBRIS BASINS

This section discusses the analysis of sediment management alternatives and recommendations for the debris basins maintained by the Los Angeles County Flood Control District (Flood Control District).

Discussion of the sediment management alternatives for the debris basins follow a similar approach as to how alternatives were discussed in Section 6. The discussion of the alternatives is organized based on the different phases of the cleanout process, specifically:

1. Sediment Removal Alternatives
2. Transportation Alternatives
3. Placement Alternatives

After the alternatives are discussed, combined alternatives are presented. Combined alternatives were developed by grouping a removal alternative with a transportation alternative and a placement alternative. The total cost of implementing the combined alternative is presented along with a review of the impacts.

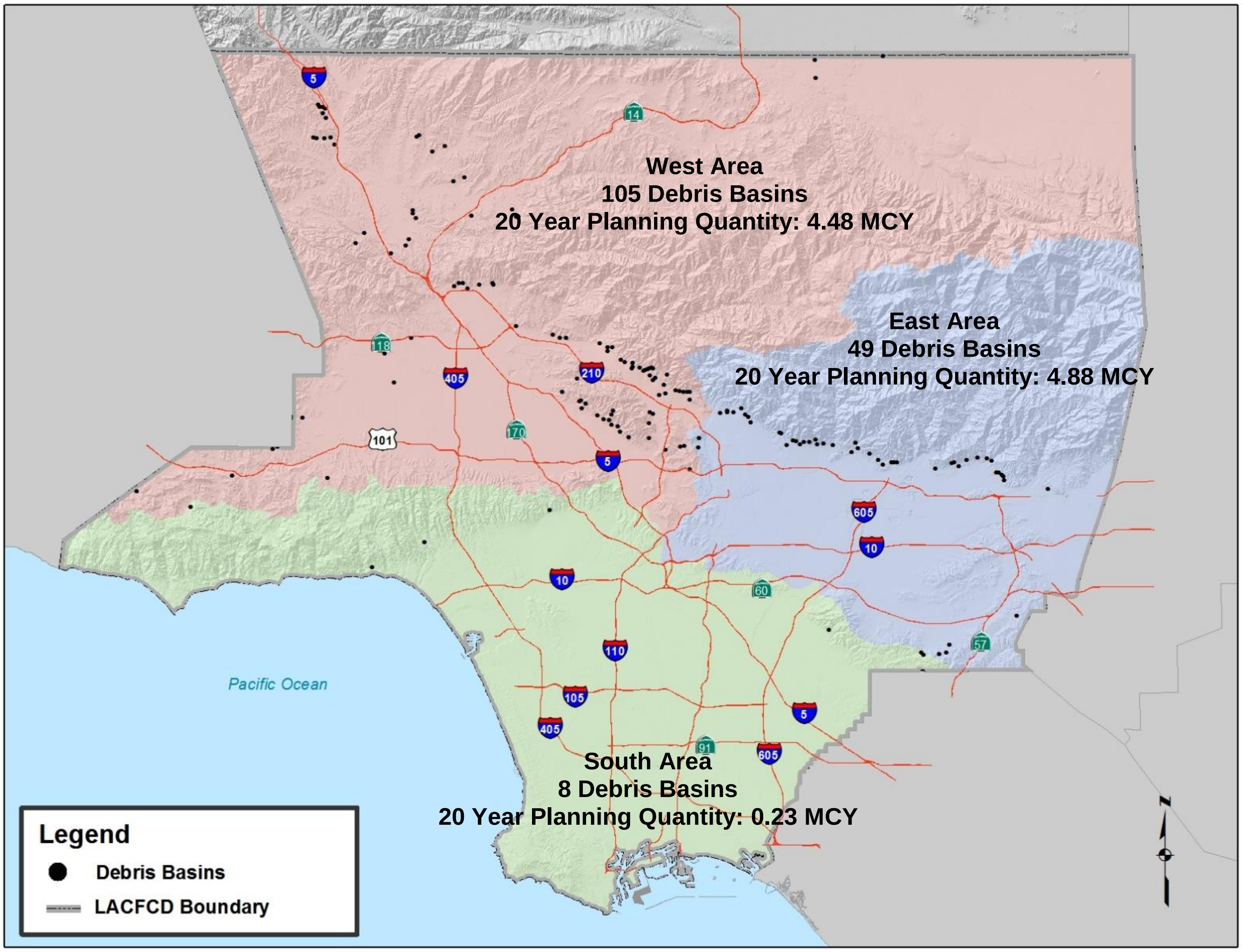
10.1 DEBRIS BASINS REVIEW

Debris basins range in size. The smallest debris basin, Bracemar Debris Basin in Burbank, has a capacity of only 700 CY. The largest debris basin, Little Dalton Debris Basin in Glendora, has a capacity of 661,000 CY. However, most debris basins have a capacity in the range of 20,000 to 70,000 CY. Unlike dams, which are designed for flood risk mitigation, water conservation, and debris retention, a debris basin's sole purpose is for debris flow flood risk mitigation. The debris basins capture sediment and other debris and allow the decanted water to flow into the downstream storm drains or channel system. If sediment and other debris were permitted to enter the downstream conveyance system, blockage could occur, possibly causing flooding and property damage. Increased sediment loads in storm flows also increase the volume of discharged water and accelerate surface wear in the downstream system of drains and channels and thus shorten their service life, causing large-scale, multi-million dollar re-construction projects.

For operation and maintenance purposes, the Flood Control District has three separately managed Flood Maintenance Areas – East, West, and South. Figure 10-1 shows the three regions and the debris basins located in each region along with the planned sediment cleanout quantities. In all, there are 162 debris basins managed by the Flood Control District with a planned cleanout requirement of about 10 MCY over 20 years.

As discussed in Section 5, in unburned watersheds, debris basins are cleaned out when they are at least 25 percent full of sediment. In burned watersheds, where the potential for debris flows is higher, debris basins are cleaned out when they are at least 5 percent full of sediment. For some debris basins in burned watersheds, multiple cleanouts within a year may be required, as occurred during the 2009-10 storm season in the aftermath of the 2009 Station Fire.

Figure 10-1 Debris Basin Locations and Expected 20-Year Cleanout Quantities



10.2 REMOVAL

As discussed in Section 6, because debris basins are not designed to retain water and the small watersheds do not produce dry season runoff, wet removal methods such as sluicing or dredging are not possible. Without water, the only feasible alternative for removing sediment from debris basins is excavation.

The following section discusses the impacts and costs of sediment removal at debris basins by means of excavation. Discussion of the transportation and placement alternatives is presented in Sections 10.3 and 10.4, respectively. Combined alternatives that address all phases of the sediment management process are presented and discussed in Section 10.5.

10.2.1 EXCAVATION

Excavation – Environmental Impacts

Sediment removal and other maintenance activities at the 162 existing Flood Control District debris basins are authorized under Section 1605, Long-term Streambed Alteration Agreement, from California Department of Fish and Game for continued implementation of the Flood Control District's Debris Basin Maintenance Program. The Section 1605 Agreement includes requirements for avoiding and/or mitigating detrimental environmental effects of sediment removal from the debris basins and transport of excavated sediment.

Excavation – Social Impacts

Residential areas are often located in proximity to Flood Control District debris basins as debris basins are designed to reduce flood risk for downstream communities. Noise generated from motorized equipment used in sediment removal activities and from the transfer of sediment to dump trucks may be temporarily bothersome to nearby residents and recreational users of nearby trails.

The length of time it takes to clean sediment out of a debris basin depends on its size, the amount of sediment accumulated in the basin, and the distance between the basin and the sediment placement site. Smaller debris basins typically can be cleaned out in 1 to 3 days, while medium, and larger basins can require from 1 to 6 weeks to be cleaned out.

Excavation – Implementability

Excavation of sediment from debris basins can be performed with conventional earthmoving equipment and techniques. Some of the equipment used for this purpose also has the ability to transport the excavated sediment for short to moderate distances. Excavation has been used to remove sediment from debris basins throughout the County since their original construction.

Excavation – Performance

The Flood Control District has effectively used excavation to remove sediment from debris basis in the past. While there may be other issues, the effectiveness of dry excavation is not a concern for future cleanouts.

Bulldozers, loaders, and excavators used for dry excavation are among the most commonly used earthmoving machines. It is expected that excavation operations would be able to match the efficiency of any mode of transportation being considered.

Excavation – Cost

The estimated cost of excavation at a debris basin is $7.50 per cubic yard. In emergency situations, the cost of excavation at debris basins could potentially reach up to $65 per cubic yard. However, for the cost analysis in Section 10.5, a value of $7.50 per cubic yard will be used for planning purposes.

10.3 TRANSPORTATION

The following section discusses the impacts and costs of transporting sediment removed from debris basins by means trucking. Discussion of the removal alternatives was presented in Section 10.2. The placement alternatives are presented in 10.4. Combined alternatives that address all phases of the sediment management process are presented and discussed in Section 10.5.

10.3.1 TRUCKING

Trucking is the conventional mode of transport that has been used for movement of sediment from debris basins to placement sites. Trucking from debris basins requires excavating the basin using standard heavy construction equipment.

Trucking – Environmental Impacts

Historically, sediment removal from debris basins has been accomplished by excavating accumulated sediment and transferring it to dump trucks for transport to designated sediment placement sites. Truck traffic, noise, and emissions generated from ongoing sediment removal and transport activities would occur at approximately the same levels as historically generated for each debris basin.

The use of low emission trucks would result in lower air quality impacts than if standard trucks were used. The Flood Control District will consider opportunities to employ low emission trucks.

Because established roadways would be used by trucks traveling to and from debris basins and designated placement sites, adverse effects on native vegetation or wildlife resources are not anticipated.

Trucking – Social Impacts

Truck trips to and from the debris basins during sediment removal activities occur for short periods of time at individual debris basins undergoing cleanout operations. Truck operations impact traffic, air quality, noise, and dust for residents along the haul route from the debris basin to the placement location. Under certain circumstances, proposed haul routes are presented to affected cities, and information flyers are distributed to properties along the route prior to the initiation of hauling activities.

Trucking – Implementability

Trucking is a proven method to remove the sediment from debris basins and has been the primary transportation method since their original construction. Trucks are hired with an as-needed service work contract and are available at any time. The Flood Control District also owns a few trucks, which can be used for debris basin cleanouts.

Once sediment has been excavated, it can be loaded in trucks for transport offsite and placement. Single-load and double-load trucks are available, but access limitations at the most of the debris basins only allow for single-load trucks which have a capacity of 8 CY.

Trucking – Performance

An average debris basin can be cleaned in less than 2 weeks, and many smaller debris basins can be a cleaned in a day. However, in emergency circumstances following a fire or a major storm, the number of truck trips per cleanout could double or triple compared to those discussed above, and the number of trips per hour would likely be increased. In emergency circumstances, the debris basins could be cleared in a day or two depending on the size of the basin, in order to create capacity for the next possible storm. During the 2009-10 storm season, approximate 1.2 MCY of sediment was removed from debris basin cleanouts.

Trucking – Cost

For debris basin cleanouts, a cost of $0.65 per CY per mile (one-way) will be used in this study. Surveys of trucking suppliers have indicated that if the low emission trucks are used, there could be an estimated 15 percent increase in trucking costs.

10.4 PLACEMENT

This section discusses potential placement alternatives for sediment removed from debris basins.

10.4.1 EXISTING SPSS

Although Flood Control District SPSs are located in proximity to many debris basins, most of the current SPSs are already at or near their design capacities and, therefore, are not available for meeting the 20-year planning goals for sediment removal from debris basins. However, active SPS's that have remaining capacity will continue to be used until other alternatives are identified and developed for use.

10.4.2 LANDFILLS

Sediment from debris basin cleanouts during dry months will be suitable for landfill cover. Typically, material cleaned out during storm events is too wet to be used as cover at a landfill. Material taken to landfills will be subject to inspection by the landfill operators. Table 10-1 below shows the landfills that are available to collect sediment from debris basin cleanouts.

Table 10-1 Daily cover needs, location, and tipping fees of landfills considered

Landfill	Estimated Daily Cover Need (CY)	Location	Tipping Fee (per CY)
Scholl Canyon	300	Eagle Rock	$5.00
Sunshine Canyon	2,000	Sylmar	$7.50

10.4.3 EXISTING PITS

There are existing pits operations (quarries and inert fill sites) in the Irwindale, Sun Valley, and Claremont area that could accept material from all the debris basins. The Flood Control District is currently working with various pit operators to streamline our working arrangement. One or more of these pits could also be acquired by the Flood Control District.

10.5 ALTERNATIVES ANALYSIS

10.5.1 BACKGROUND

East Area

The East Flood Maintenance Area covers approximately 659 square miles, the northern half of which is comprised of undeveloped areas of the San Gabriel Mountains in the Angeles National Forest and the San Gabriel River watershed above Whittier Narrows, and the Upper Los Angeles River watershed including and east of Devils Gate Reservoir. The San Gabriel Mountains are the most active sediment generation area in the Flood Control District. The southern half of the East Area contains a portion of the Puente Hills, The East Area contains 49 debris basins (30 percent of the Flood Control District total of 162), including 5 of the 6 largest debris basins (Little Dalton, Sawpit, Big Dalton, Sierra Madre Villa, and Santa Anita). The 20-year planning goal for sediment removal from debris basins in the East Area is 4.88 MCY.

West Area

The West Flood Maintenance Area covers 1,381 square miles and is by far the largest of the three Flood Control District flood management areas. The West Area includes a large portion of the upper Los Angeles River watershed (West of Devil's Gate Reservoir), the Santa Clara River watershed, and portions of the San Gabriel, Santa Susana, Verdugo, and Santa Monica mountains. The West Area contains 105 debris basins, 65 percent of the Flood Control District's total. The 20-year planning goal for sediment removal from debris basins in the West Area is 4.48 MCY.

South Area

The South Flood Maintenance Area covers 713 square miles, most of which is heavily developed (e.g., Santa Monica, Los Angeles, and Long Beach). It contains only eight debris basins, 5 percent of the Flood Control District total. The 20-year planning goal for sediment removal from debris basins in the South Area is 0.23 MCY.

10.5.2 COST

For this analysis, it will be assumed that the sediment will be placed at either the pits in the Sun Valley area for the West and South Areas or the pits in the Irwindale area for the East Area. Table 10-2 below shows the tipping fees for the pits in the Irwindale and Sun Valley area along with the excavation and trucking fees.

Table 10-2 Debris Basin Analysis Unit Costs

Description	Rate	Unit
Excavation	$7.50	/CY
Trucking	$0.65	/MI - CY
Irwindale Tipping Fee	$9.70	/CY
Sun Valley Tipping Fee	$15.00	/CY

A summary for the three areas of the estimated cost to excavate and truck the sediment from the debris basin cleanouts to a placement location for the next 20 years is shown below in Table 10-3.

Table 10-3 Cost Summary for Debris Basin Cleanouts

Area	Planned Removal Amount (MCY)	Placement	Cost (Millions)
East	4.88	Irwindale Pits	$127
West	4.48	Sun Valley Pits	$143
South	0.23	Sun Valley Pits	$9
Total	**9.59**		**$279**

10.6 SUMMARY AND RECOMMENDATIONS

Over the next 20 years, close to 10 MCY of sediment are planned to be removed from the 162 debris basins managed by the Flood Control District.

Sediment Management Alternatives

Every removal, transport, and placement alternative was analyzed for the debris basins. However, many of the alternatives are not implementable due to the following reasons:

- Debris basins have smaller watersheds compared to dams thus there are no base flows, which make wet removal and transport methods such as dredging, sluicing, and slurry pipeline infeasible.
- Debris basins need to be cleaned out during the storm season in order to provide capacity for the next potential storm, thus the excavated material is very wet which makes conveyor transport and landfill placement infeasible.
- The distributed nature of the debris basins makes cable bucket and conveyor systems impractical. In addition, most of the debris basins are located in residential areas and do not have the right-of-way or a downstream site to receive the sediment.
- Debris basins do not provide a water conservation need so water quality and groundwater recharge impacts were not included in the summary table.

The only alternative for managing the sediment that accumulates at the debris basins is to excavate it and truck it. Table 10-4 shows the impacts of doing so, in addition, to the impacts of placing the sediment at pits, sediment placement sites, and landfills.

Recommendation

It is recommended that excavation and trucking continue as the removal and transport method for debris basins.

Table 10-4 Debris Basins Summary Table

Alternative	Environmental		Social			Implementability	Performance	Unit Cost	
	Habitat	Air Quality[a]	Traffic	Visual	Noise	Special Permit Required[b]	Previous Experience	Dollars	Unit
Excavate	○	◑		◑	●		YES	7.5	CY
Trucking		●	●	●	●		YES	0.65	MI-CY
Pits				○			YES	5-15	CY
Sediment Placement Sites	○	○		●	◑		YES	2	CY
Landfills							YES	varies	CY

Legend:

●	significant impact
○	possible impact
◑	some impact
	no impact

Notes: (a) Use of low-emission trucks would reduce air quality impacts from significant impact (●) to some impact (◑).
(b) All options require environmental regulatory permits.

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SECTION 11 SUMMARY AND NEXT STEPS

This section summarizes the alternatives analysis and recommendations for the reservoirs and debris basins and discusses the general steps that should be pursued in order to implement a sediment management approach based on the alternatives recommended by this Strategic Plan.

For facilities with a number of feasible alternatives, this Strategic Plan represents the first step in a continued analysis and dialogue with our stakeholders to develop specific plans for management at those sites. Furthermore, this Strategic Plan is a living document that is open to other alternatives and may be revised in the future as conditions change.

The following pages provide a summary of the sediment management alternatives that were identified as potentially feasible for each reservoir and the debris basins, given current conditions. The summary is presented in the following order:

- San Gabriel Canyon Reservoirs
  - Cogswell Reservoir
  - San Gabriel Reservoir
  - Morris Reservoir
- Other Large Reservoirs
  - Big Tujunga Reservoir
  - Pacoima Reservoir
  - Puddingstone Reservoir
  - San Dimas Reservoir
  - Santa Anita Reservoir
- Small Reservoirs
  - Big Dalton
  - Eaton
  - Live Oak
  - Puddingstone Diversion
  - Thompson Creek
- Debris Basins

Devil's Gate Reservoir - The Flood Control District is currently in the process of preparing an Environmental Impact Report (EIR) for the Devil's Gate Reservoir Sediment Removal and Management Project. Since the EIR will thoroughly discuss alternatives to remove, transport, and place sediment from Devil's Gate Reservoir, this Strategic Plan does not discuss alternatives for that reservoir. Information about the EIR for the Devil's Gate Reservoir Sediment Removal and Management Project can be found at www.LASedimentManagement.com.

11.1 SAN GABRIEL CANYON SUMMARY & RECOMMENDATIONS

11.1.1 COGSWELL RESERVOIR

Over the next 20 years, 5.7 MCY of sediment are planned to be removed from Cogswell Reservoir. For planning purposes, it is assumed that 60 percent of the 5.7 MCY, or 3.4 MCY, is smaller-sized material that could be sluiced or dredged. The remaining 40 percent, or 2.3 MCY, would need to be managed separately. The different sediment management alternatives are briefly explained below and the impacts are shown in Table 11-1.

Sediment Management Alternatives

1A Sluice (3.4 MCY) → San Gabriel Reservoir
+ Excavate (2.3 MCY) →Trucks → Cogswell SPS
Alternative 1A consists of two components. One component consists of sluicing 3.4 MCY of sediment from Cogswell Reservoir to San Gabriel Reservoir, which would result in habitat and water quality impacts on the West Fork of the San Gabriel River. The other component consists of excavating the 2.3 MCY of larger-sized sediment in Cogswell Reservoir and trucking it to Cogswell SPS. There would be air quality impacts from the trucks and habitat impact to the undeveloped portion of Cogswell SPS.

1B Sluice (3.4 MCY) → San Gabriel Reservoir
+ Excavate (2.3 MCY) →Conveyor → Cogswell SPS
This alternative is similar to 1A except the 2.3 MCY of excavated material would be transported to Cogswell SPS using a conveyor belt. There would be some impacts to the habitat on the existing fill at the SPS where the conveyor belts would be placed.

2A Dredge (3.4 MCY) → Slurry Pipeline → San Gabriel Reservoir
+ Excavate (2.3 MCY) →Trucks → Cogswell SPS
This alternative consists of dredging the 3.4 MCY of smaller-sized material from Cogswell Reservoir and transporting via slurry pipeline to San Gabriel Reservoir. Construction of the slurry pipeline would have some habitat impacts on the West Fork of the San Gabriel River. The 2.3 MCY of larger-sized material in Cogswell Reservoir would be excavated and transported via a conveyor to Cogswell SPS.

2B Dredge (3.4 MCY) → Slurry Pipeline → San Gabriel Reservoir
+ Excavate (2.3 MCY) →Conveyor → Cogswell SPS
This Alternative is similar to Alternative 2A except the 2.3 MCY of larger-sized material would be transported to Cogswell SPS using a conveyor belt. There would be some impacts to the habitat on the existing fill at the SPS where the conveyor belts would be placed.

Recommendations

It is recommended that Alternatives 2A and 2B be considered first due to the high environmental impacts sluicing would have on the West Fork. Sediment flushing should also be considered for this location as additional study is completed.

Table 11-1 Summary of Sediment Management Alternatives for Cogswell Reservoir

Alternative		Quantity Removed (MCY)	Environmental: Habitat	Environmental: Water Quality	Environmental: Groundwater Recharge	Environmental: Air Quality[a]	Social: Traffic	Social: Visual	Social: Noise	Implementability: Special Permit/ Agreement Required[b]	Performance: Previous Experience	Performance: # of operations required in next 20 years	Cost: $ Millions
1A	Sluice to SG Reservoir	3.4	●	●				○			Yes	9	25
	Excavate from Cogswell	2.3	◑			◑		○	○			6	
	Trucks					●		○					
	Cogswell SPS		●			○		○	○	Yes			
1B	Sluice to SG Reservoir	3.4	●	●				○			Yes	9	25
	Excavate from Cogswell	2.3	◑			◑		○	○			3	
	Conveyor Belt		◑					○	○				
	Cogswell SPS		●			○		○	○	Yes			
2A	Dredge	3.4	◑	◑							No	9	145
	Slurry Pipeline to SG Reservoir		◑					◑					
	Excavate from Cogswell	2.3	◑			◑		○	○		Yes	6	
	Trucks					●		○					
	Cogswell SPS		●			○		○	○	Yes			
2B	Dredge	3.4	◑	◑				○	○		No	9	145
	Slurry Pipeline to SG Reservoir		◑					◑					
	Excavate from Cogswell	2.3	◑			◑		○	○		Yes	3	
	Conveyor Belts		◑					○	○				
	Cogswell SPS		●			○		○	○	Yes			

Legend:

●	significant impact
◑	some impact
○	possible impact
	no impact

Notes:

(a) Use of low-emission trucks would reduce air quality impacts from significant impact (●) to some impact (◑).
(b) All options require environmental regulatory permits.

11.1.2 SAN GABRIEL RESERVOIR

Over the next 20 years, 23.8 MCY of sediment are planned to be removed from San Gabriel Reservoir, including 3.4 MCY that could potentially be sluiced or delivered by slurry pipeline from Cogswell Reservoir. The different sediment management alternatives are briefly explained below and the impacts are shown in Table 11-2.

Sediment Management Alternatives

1A Excavate (23.8 MCY) → Trucks → Burro Canyon SPS (15.8 MCY) & Irwindale Pits (8 MCY)
Alternative 1A proposes to excavate the entire 23.8 MCY of sediment from San Gabriel Reservoir and truck 15.8 MCY to Burro Canyon SPS and the remaining 8 MCY to the Irwindale pits. There would be air quality impacts from the trucks as well as some habitat impact to the undeveloped portion of Burro Canyon SPS. The trucks driving to Irwindale would cause some traffic, noise, and visual impacts.

1B Sluice (2 MCY) → Morris Reservoir
+ Excavate (21.8 MCY) → Trucks → Burro Canyon SPS (13.8 MCY) & Irwindale Pits (8 MCY)
This alternative is similar to 1A except that 2 MCY of the 23.8 MCY would be sluiced from San Gabriel Reservoir to Morris Reservoir and the remaining 21.8 MCY would be excavated and trucked. As a result of the sluicing operations, there would be some habitat impacts immediately downstream of the San Gabriel Reservoir sluice tunnel.

1C Dredge (2 MCY) → Slurry Pipeline → Morris Reservoir
+ Excavate (21.8 MCY) → Trucks → Burro Canyon SPS (13.8 MCY) & Irwindale Pits (8 MCY)
This alternative is similar to 1B except, instead of sluicing 2 MCY of sediment from San Gabriel Reservoir to Morris Reservoir, the sediment would be dredged and transported via a slurry pipeline from San Gabriel Reservoir to Morris Reservoir. Dredging would have some water quality and visual impacts.

2A Excavate (15.8 MCY)→ Conveyor Belts → Burro Canyon SPS
+ Excavate (8 MCY) → Trucks → Irwindale Pits
Alternative 2A is essentially the same as 1A except that instead of trucking 15.8 MCY to Burro Canyon SPS the sediment would be transported via conveyor belts. There may be some habitat impacts over the alignment to Burro Canyon SPS.

2B Sluice (2 MCY) → Morris Reservoir
+ Excavate (13.8 MCY) → Conveyor Belts → Burro Canyon SPS
+ Excavate (8 MCY) → Trucks → Irwindale Pits
This alternative is similar to 2A except that 2 MCY of material would be sluiced to Morris Reservoir. As discussed, this would have some habitat impacts immediately downstream of the San Gabriel sluice tunnel. This would leave 13.8 MCY to be transported by conveyor belt to Burro Canyon SPS and 8 MCY to be trucked to Irwindale pits.

2C Dredge (2 MCY) → Slurry Pipeline → Morris Reservoir
+ Excavate (13.8 MCY) → Conveyor Belts → Burro Canyon SPS
+ Excavate (8 MCY) → Trucks → Irwindale Pits
This alternative is similar to 2B except that instead of sluicing 2 MCY to Morris Reservoir that quantity of sediment would be dredged. As mentioned, dredging would have some water quality and visual impacts.

Recommendations

It is recommended that all the alternatives detailed here be considered for future sediment removal projects at San Gabriel Reservoir.

Table 11-2 Summary of Sediment Management Alternatives for San Gabriel Reservoir

			Environmental				Social			Implementability	Performance		Cost
Alternative		Quantity Removed (MCY)	Habitat	Water Quality	Groundwater Recharge	Air Quality[a]	Traffic	Visual	Noise	Special Permit/ Agreement Required[b]	Previous Experience	# of operations required in next 20 years	$ Millions
1A	Excavate	23.8	◑		○	◑		◑	◑		Yes	19	375-395
	Trucks to Burro Canyon SPS	15.8				●	○	○	○				
	Burro Canyon SPS		●			○				Yes			
	Trucks to Irwindale Pits	8				●	●	◑	◑			10	
	Irwindale Pits									Yes			
1B	Sluice to Morris Reservoir	2	●	●	○			○			Yes	5	355-375
	Excavate	21.8	◑		○	◑		◑	◑			16	
	Trucks to Burro Canyon SPS					●	○	○	○				
	Burro Canyon SPS	13.8	●			○				Yes			
	Trucks to Irwindale Pits	8				●	●	◑	◑			10	
	Irwindale Pits									Yes			
1C	Dredge to Morris Reservoir	2	◑	◑	○			○	○		No	7	370-390
	Excavate	21.8	◑		○	◑		◑	◑		Yes	16	
	Trucks to Burro Canyon SPS					●	○	○	○				
	Burro Canyon SPS	13.8	●			○				Yes			
	Trucks to Irwindale Pits	8				●	●	◑	◑			10	
	Irwindale Pits									Yes			
2A	Excavate	23.8	◑		○	◑		◑	◑		Yes	19	275-300
	Conveyor Belts	15.8	◑					◑	○				
	Burro Canyon SPS		●			○				Yes			
	Trucks to Irwindale Pits	8				●	●	◑	◑			10	
	Irwindale Pits									Yes			
2B	Sluice to Morris Reservoir	2	●	●	○			○			Yes	5	270-295
	Excavate	21.8	◑		○	◑		◑	◑			16	
	Conveyor Belts	13.8	◑					◑	○				
	Burro Canyon SPS		●			○				Yes			
	Trucks to Irwindale Pits	8				●	●	◑	◑			10	
	Irwindale Pits									Yes			
2C	Dredge to Morris Reservoir	2	○	◑	○			○	○		No	7	285-310
	Excavate	21.8	◑		○	◑		◑	◑		Yes	16	
	Conveyor Belts	13.8	◑					◑	○				
	Burro Canyon SPS		●			○				Yes			
	Trucks to Irwindale Pits	8				●	●	◑	◑			10	
	Irwindale Pits									Yes			

Legend:

●	significant impact
◑	some impact
○	possible impact
	no impact

Notes:

(a) Use of low-emission trucks would reduce air quality impacts from significant impact (●) to some impact (◑).
(b) All options require environmental regulatory permits.

11.1.3 MORRIS RESERVOIR

Over the next 20 years, 3.3 MCY of sediment are planned to be removed from Morris Reservoir, including the estimated 2 MCY that could potentially be sluiced or delivered by slurry pipeline from San Gabriel Reservoir. The quantity sluiced from San Gabriel Reservoir to Morris Reservoir is limited by the ability to remove the sediment from Morris Reservoir. The different alternatives for managing the sediment accumulated in Morris Reservoir are briefly explained below and the impacts are shown in Table 11-3.

Sediment Management Alternatives

1 Excavate → Trucks → Irwindale Pits
Alternative 1 proposes to excavate 3.3 MCY of sediment from Morris Reservoir and truck it to the Irwindale pits. Given the location of Morris Reservoir, there would be some noise and visual impacts associated with excavation within the reservoir. There would also be some traffic, noise, and visual impacts from the trucks driving to the Irwindale pits.

2 Excavate → Conveyor → Vulcan Conveyor Belt → Irwindale Pits
This Alternative is similar to Alternative 1 except that the material would be transported by conveyor belt from Morris Reservoir to the Irwindale pits. There would be some habitat impacts along Old San Gabriel Canyon Road and San Gabriel Canyon Road where the conveyor alignment is proposed.

3 Dredge → Slurry Pipeline → Santa Fe Flood Control Basin → Excavate → Trucks→ Irwindale Pits
Alternative 3 proposes to dredge the 3.3 MCY of sediment from Morris Reservoir and transport the material via slurry pipeline to Santa Fe Flood Control Basin (FCB). From Santa Fe FCB, the sediment would be excavated and trucked to a pit in Irwindale. There would be some water quality impacts within Morris Reservoir and some visual and noise impacts from the dredge. There would also be some habitat impacts along Old San Gabriel Canyon Road and San Gabriel Canyon Road where the slurry pipeline alignment is proposed.

4 Sluice → Santa Fe Flood Control Basin → Dry Excavate → Trucks → Irwindale Pits
Alternative 4 proposes to sluice the entire 3.3 MCY to Santa Fe FCB. Similar to Alternative 3, the material in Santa Fe FCB would be excavated and trucked to a pit in Irwindale. There would be habitat impacts and some water quality impacts to the San Gabriel River and in Santa Fe FCB as a result of sluicing. There would also be some increased in traffic, noise, and visual impacts due to excavation in Santa Fe FCB and trucking.

Recommendations

It is recommended that Alternatives 1, 2, and 4 be considered for future sediment removal projects at Morris Reservoir. Due to the high cost, Alternative 3, which involves dredging, should be considered only after all previous recommendations are deemed infeasible.

Table 11-3 Summary of Sediment Management Alternatives for Morris Reservoir

Alternative		Quantity Removed (MCY)	Environmental				Social			Implementability	Performance		Cost
			Habitat	Water Quality	Groundwater Recharge	Air Quality[a]	Traffic	Visual	Noise	Special Permit/ Agreement Required[b]	Previous Experience	# of operations required in next 20 years	$ Millions
1	Excavate	3.3	◑		○	◑		◑	◑		Yes	5	35-50
	Trucks					●	●	◑	◑				
	Irwindale Pits									Yes			
2	Excavate	3.3	◑		○	◑		◑	◑		Yes	7	55-65
	Conveyor Belts		◑					◑	○				
	Irwindale Pits									Yes			
3	Dredge	3.3	○	◑	○			○	○		No	9	145-165
	Slurry Pipeline to Santa Fe Basin		◑					◑					
	Santa Fe Basin		◑	●	○	◑		◑	◑	Yes	Yes		
	Trucks					●	●	◑	◑				
	Irwindale Pits									Yes			
4	Sluice	3.3	●	●	◑			◑			Yes	5	30-45
	Santa Fe Basin		◑	●	○	◑		◑	◑	Yes			
	Trucks					●	●	◑	◑				
	Irwindale Pits									Yes			

Legend:

●	significant impact
◑	some impact
○	possible impact
	no impact

Notes:

(a) Use of low-emission trucks would reduce air quality impacts from significant impact (●) to some impact (◑).
(b) All options require environmental regulatory permits.

11.2 OTHER LARGE RESERVOIRS SUMMARY AND RECOMMENDATIONS

11.2.1 BIG TUJUNGA RESERVOIR

Over the next 20 years, 7.2 MCY of sediment are planned to be removed from Big Tujunga Reservoir, including the 2 MCY currently accumulated in the reservoir. The different sediment management alternatives are briefly explained below and the impacts are shown in Table 11-4.

Sediment Management Alternatives

1A Excavate (7.2 MCY) → Trucks → Maple SPS (4.4 MCY) & Sun Valley Pits (2.8 MCY)
This alternative involves draining the reservoir, excavating the sediment under dry conditions, and trucking it to Maple SPS and the pits in Sun Valley. Maple SPS would be filled; the rest of the sediment would be placed at the pits in Sun Valley. Habitat would be impacted along Big Tujunga Wash due to draining of the reservoir.

1B Excavate (7.2 MCY) → Conveyor → Maple SPS (4.4 MCY) & Sun Valley Pits (2.8 MCY)
This alternative is similar to Alternative 1A, but instead of trucks this alternative involves a conveyor over 10 miles in length. Habitat could be impacted depending on the conveyor route.

2A Excavate → Trucks → Sun Valley Pits
This alternative consists of transporting all sediment excavated from Big Tujunga Reservoir by truck and placing it at the pits in Sun Valley. Maple Canyon SPS would not be used.

2B Excavate → Conveyor → Sun Valley Pits
This alternative is basically the same as Alternative 2A, except that conveyors would be used. Placement of a conveyor along Big Tujunga Canyon Road from Big Tujunga Reservoir to the pits in Sun Valley would require designing an alignment that takes roadway impacts into account.

3 Dredge (4.8 MCY) → Slurry Pipeline → Hansen Flood Control Basin → Excavate → Conveyor → Sun Valley Pits + Excavate (2.4 MCY) → Conveyor → Maple SPS
Smaller-sized material would be dredged and transported via slurry pipeline to Hansen Flood Control Basin (Hansen FCB). The larger-sized material would be excavated and transported to Maple SPS on a conveyor. This alternative is highly dependent on the ability to obtain permission from the Army Corps of Engineers to use Hansen FCB and the ability to create enough capacity for the operations.

4A Sluice (4.8 MCY) → Hansen Flood Control Basin → Dry Excavate → Conveyor → Sun Valley Pits + Excavate (2.4 MCY) → Conveyor → Maple SPS
This alternative is very similar to Alternative 3 except sediment would be sluiced rather than dredged and the larger material would be placed at the pits in Sun Valley. Employing this alternative would result in habitat impacts along Big Tujunga Wash. Additionally, this alternative would require designing a conveyor alignment that takes roadway impacts into account.

4B Sluice (4.8 MCY) → Hansen Flood Control Basin → Excavate → Conveyor → Sun Valley Pits + Excavate (2.4 MCY) → Trucks → Maple SPS
This alternative is basically the same as Alternative 4A, except that transportation of the larger materials would be via trucks as opposed to a conveyor.

Recommendations

It is recommended that all the alternatives detailed here, except Alternative 3 be considered for future sediment removal projects at Big Tujunga Reservoir. Additionally, combining the alternatives should be taken into consideration. Alternative 3 should be considered only after all other alternatives are deemed infeasible. This recommendation is based on the high estimated cost.

Table 11-4 Summary of Sediment Management Alternatives for Big Tujunga Reservoir

Alternative		Quantity Removed (MCY)	Environmental				Social			Implementability	Performance		Cost
			Habitat	Water Quality	Groundwater Recharge	Air Quality[a]	Traffic	Visual	Noise	Special Permit/ Agreement Required[b]	Previous Experience	# of operations required in next 20 years	$ Millions
1A	Excavate	7.2	◑		○	◑		○	○		Yes	9	65
	Trucks					●	●	◑	◑				
	Maple Canyon SPS	4.4	◑					◑		Yes			
	Pits in Sun Valley	2.8								Yes			
1B	Excavate	7.2	◑		○	◑		○	○		Yes	9	125
	Conveyor		◑					◑	○				
	Maple Canyon SPS	4.4	◑			○		◑		Yes			
	Pits in Sun Valley	2.8								Yes			
2A	Excavate	7.2	◑		○	◑		○	○		Yes	9	100-120
	Trucks					●	●	◑	◑				
	Pits in Sun Valley									Yes			
2B	Excavate	7.2	◑		○	◑		○	○		Yes	9	115-130
	Conveyor		◑					◑	○				
	Pits in Sun Valley									Yes			
3	Dredge	4.8	○	◑	○			○	○		No	12	210-245
	Slurry Pipeline to Hansen FCB		◑							Yes			
	Hansen FCB		◑	●	○	◑		◑	◑				
	Conveyor from Hansen FCB		○					◑	○	Yes			
	Pits in Sun Valley									Yes			
	Excavate	2.4	◑		○	◑		○	○		Yes	3	
	Conveyor							◑	○				
	Maple Canyon SPS		◑					◑		Yes			
4A	Sluice to Hansen FCB	4.8	●	●	◑			◑		Yes	Yes	16	70-100
	Hansen FCB		◑	●	○	◑		◑	○	Yes			
	Conveyor from Hansen FCB		○					◑	○				
	Pits in Sun Valley									Yes			
	Excavate	2.4	◑		○	◑		○	○			3	
	Conveyor		◑					◑	○				
	Maple Canyon SPS		◑					◑		Yes			
4B	Sluice to Hansen FCB	4.8	●	●	◑			◑		Yes	Yes	16	70-90
	Hansen FCB		◑	●	○	◑		◑	○	Yes			
	Conveyor from Hansen FCB		○					◑	○				
	Pits in Sun Valley									Yes			
	Excavate	2.4	◑		○	◑		○	○			3	
	Trucks					●	●	◑	◑				
	Pits in Sun Valley												

Legend:

●	significant impact
◑	some impact
○	possible impact
	no impact

Notes:

(a) Use of low-emission trucks would reduce air quality impacts from significant impact (●) to some impact (◑).

(b) All options require environmental regulatory permits.

11.2.2 PACOIMA RESERVOIR

Over the next 20 years, up to 7.6 MCY of sediment are planned to be removed from Pacoima Reservoir, including the 5.2 MCY currently accumulated in the reservoir. The different sediment management alternatives are briefly explained below and the impacts are shown in Table 11-5.

Sediment Management Alternatives

1 Excavate → Trucks → Sun Valley Pits

This alternative involves draining the reservoir, excavating the sediment, and then trucking the sediment through a back access road to the pits in Sun Valley.

2A Excavate → Conveyor → Canyon Transfer Point → Trucks → Sun Valley Pits

This alternative consists of draining the reservoir, excavating the sediment, transporting it to a temporary sediment storage area via a conveyor belt through the dam, and then trucking it to a placement site. One of the limitations of this alternative is the ability to acquire or obtain permission to use one of the canyons downstream of Pacoima Reservoir for temporary storage.

2B Excavate → Conveyor → Lopez Flood Control Basin Transfer Point → Trucks → Sun Valley Pits

This alternative is essentially the same as Alternative 2A, except for the conveyor endpoint and potential temporary sediment storage area would be at Lopez Flood Control Basin (FCB). Use of Hansen FCB and placement of the conveyor along Pacoima Wash would require permission from the Army Corps of Engineers.

3 Dredge (4.6 MCY) → Slurry Pipeline → Lopez Flood Control Basin → Dry Excavate → Trucks → Sun Valley Pits
+ Excavate (3.0 MCY) → Trucks → Pits in Sun Valley

Smaller-sized material would be dredged and transported via slurry pipeline to Lopez FCB. The larger-sized material would be excavated and trucked to the pits in Sun Valley. This alternative is highly dependent on the ability to obtain permission from the Army Corps of Engineers to use Lopez FCB and the ability to create enough capacity for the operations.

4 Sluice (4.6 MCY) → Lopez Flood Control Basin → Excavate →Trucks → Sun Valley Pits
+ Excavate (3.0 MCY) → Trucks → Pits in Sun Valley

This alternative is very similar to Alternative 3 except sediment would be sluiced rather than dredged. Employing this alternative would result in habitat impacts along Big Tujunga Wash.

5 Excavate → Conveyor → Permanent Placement at New Canyon SPS

Alternative 5 involves excavating the sediment from Pacoima Reservoir and transporting it via a conveyor belt through the dam to one or both of the canyons downstream of the reservoir, just like Alternative 2A. The difference is that a sediment placement site (SPS) would be developed at the canyon(s) and sediment would permanently be placed there.

Recommendations

It is recommended that Alternatives 2A, 2B, 4, and 5 be considered for future sediment removal projects at Pacoima Reservoir. Additionally, combining the alternatives should be taken into consideration. For example, it may be possible for the excavation and conveyor alternatives (2A or 2B) to follow a sluicing project (Alternative 4) in order to take advantage of the already drained reservoir. This could help to reduce environmental impacts, increase performance, and reduce costs.

Alternatives 1 and 3 should be considered only after all previous recommendations are deemed infeasible. Alternative 1 requires high number of cleanout operations and has a high estimated cost. Similarly, Alternative 3 has a high cost compared to other alternatives.

Table 11-5 Summary of Sediment Management Alternatives for Pacoima Reservoir

Alternative		Quantity Removed (MCY)	Environmental				Social			Implementability	Performance		Cost
			Habitat	Water Quality	Groundwater Recharge	Air Quality[a]	Traffic	Visual	Noise	Special Permit/Agreement Required[b]	Previous Experience	Number of years out of 20 years that would require cleanout operations	$ Millions
1	Excavate	7.6	◑		○	◑		○	○		Yes	19	190-200
	Trucks		●			●	●	◑	◑				
	Pits in Sun Valley									Yes			
2A	Excavate	7.6	◑		○	◑		○	○		Yes	10	85-95
	Conveyor		○					○	○				
	Canyon Transfer Point		◑					◑	○	Yes			
	Trucks					●	●	◑	◑				
	Pits in Sun Valley									Yes			
2B	Excavate	7.6	◑		○	◑		○	○		Yes	10	75-85
	Conveyor		○					○	○				
	Lopez FCB Transfer Point		○					◑	○	Yes			
	Trucks					●	●	◑	◑				
	Pits in Sun Valley									Yes			
3	Dredge	4.6	◑	◑	○			○	○		No	12[c]	185-195
	Slurry Pipeline to Lopez FCB		○					○		Yes			
	Lopez FCB		◑	●		◑		◑	◑				
	Trucks					●	●	◑	◑				
	Pits in Sun Valley									Yes			
	Excavate	3.0	◑		○	◑		○	○		Yes	8[c]	
	Trucks					●	●	◑	◑				
	Pits in Sun Valley									Yes			
4	Sluice to Lopez FCB	4.6	●	●	◑			◑		Yes	Yes	9[d]	125-135
	Lopez FCB		◑	●		◑		◑	◑				
	Trucks					●	●	◑	◑				
	Pits in Sun Valley									Yes			
	Excavate	3.0	◑		○	◑		○	○			8[d]	
	Trucks		●				●	◑	◑				
	Pits in Sun Valley									Yes			
5	Excavate	7.6	◑		○	◑		○	○		Yes	10	35
	Conveyor		○					◑	○				
	Canyon SPS		●					◑	○	Yes			

Legend:

●	significant impact
◑	some impact
○	possible impact
	no impact

Notes:

(a) Use of low-emission trucks would reduce air quality impacts from significant impact (●) to some impact (◑).
(b) All options require environmental regulatory permits.
(c) Dredging and dry excavation may be able to be conducted in the same year, just during different parts of the year.
(d) Sluicing and dry excavation may be able to be conducted in the same year.

11.2.3 PUDDINGSTONE RESERVOIR

Over the next 20 years, 0.8 MCY of sediment is estimated to be deposited in the Puddingstone Reservoir.

Excavation has been used in the past in Puddingstone Reservoir, however, only 6,453 CY of sediment was removed, which is not a significant amount compared to the 1.7 MCY currently stored in the reservoir. However, the 1.7 MCY of sediment that has accumulated in the past 80 years for a 33.1 square mile watershed is not significant compared to other similarly sized reservoirs. For comparison, Pacoima Reservoir has a similar watershed of 28.2 square miles but has seen 7.3 MCY of accumulated sediment during the past 80 years.

In addition, a complete draw down of the reservoir would have a major impact to wildlife and habitat. Also, drawing down the reservoir may not be a viable option due to the year-round recreational use of the reservoir for boating and fishing. Raging Waters, a recreational water park, also uses the reservoir to serve its needs. Due to the environmental constraints with wildlife and the social constraints with the recreational use of Bonelli Park, any alternative that requires dewatering, such as excavation or sluicing, of the reservoir would have high environmental and social impacts and is not be considered a viable option at this time.

Recommendation

Due the minimal amount of sediment stored and expected, the primary function of recreation for Puddingstone Reservoir, and the environmental and social impacts that would be caused by removing sediment from the reservoir, it is recommended that Puddingstone Reservoir not be cleaned out unless sediment accumulation impacts operation of the reservoir.

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11.2.4 SAN DIMAS RESERVOIR

Over the next 20 years, 1.9 MCY of sediment are planned to be removed from San Dimas Reservoir. The different sediment management alternatives are briefly explained below and the impacts are shown in Table 11-6.

Sediment Management Alternatives

1 Excavate → Trucks → Irwindale Pits
Excavate the sediment and truck it to a pit in the Irwindale area.

2 Excavate → Conveyor → San Dimas SPS → Excavate→ Trucks → Irwindale Pits & Landfills
Excavate the sediment and place it on a conveyor system where it will be transported to the San Dimas SPS. From the SPS, the sediment can be gradually transported out via trucks to a pit in the Irwindale area or a landfill.

3 Sluice (1.3 MCY) → Puddingstone Diversion Reservoir → Excavate → Trucks → Irwindale Pits
+ Excavate (0.6 MCY) → Trucks → Irwindale Pits
It is assumed that two thirds of the 1.9 MCY will be small enough to sluice. Sluice 1.6 MCY from San Dimas Reservoir along San Dimas Creek to the Puddingstone Diversion Reservoir, where the sediment will be excavated and trucked to a pit in the Irwindale area. The larger material (0.6 MCY) will be excavated similar to alternative one.

4 Dredge (1.3 MCY) → Slurry Pipeline → Puddingstone Diversion Reservoir → Excavate → Trucks → Irwindale Pits
+ Excavate (0.6 MCY) → Trucks → Irwindale Pits
It is assumed that two thirds of the 1.9 MCY will be small enough to dredge. Dredge 1.6 MCY from San Dimas Reservoir into a slurry pipeline along San Dimas Canyon Road and discharge the sediment to the Puddingstone Reservoir. The sediment will be excavated from the Puddingstone Reservoir and trucked to a pit in the Irwindale area. The larger material (0.6 MCY) will be excavated similar to alternative one.

Recommendation

It is recommended that all the alternatives detailed here be considered for future sediment removal projects at San Dimas Reservoir.

Table 11-6 San Dimas Reservoir Summary Table

Alternative		Quantity Removed (MCY)	Environmental				Social			Implementability	Performance		Cost
			Habitat	Water Quality	Groundwater Recharge	Air Quality[1]	Traffic	Visual	Noise	Special Permit/Agreement Required[2]	Previous Experience	# of Operations Required in Next 20 years	$ Millions
1	Excavate	1.9	◑		○	◑		○	○		Yes	3	25
	Trucks					●	●	◑	◑				
	Irwindale Pits									Yes			
2	Excavate	1.9	◑		○	◑		○	○		Yes	4	35-40
	Conveyor		○				○	◑	○				
	San Dimas SPS		○			○		◑	◑				
	Trucks					●	●	◑	◑				
	Irwindale Pits/Landfills									Yes			
3	Sluice	1.3	●	●	◑			◑			Yes	20	25
	Puddingstone Div. Reservoir		◑	●	○			◑	◑				
	Excavate	1.9	◑		○	◑		○	○				
	Trucks					●	●	◑	◑				
	Irwindale Pits									Yes			
4	Dredge	1.3	○	◑	○			○	○		No	7	35-40
	Slurry Pipeline		◑				○	◑					
	Puddingstone Diversion Res.		◑	●	○			◑	◑				
	Excavate	1.9	○		○	◑		○	○				
	Trucks					●	●	◑	◑				
	Irwindale Pits									Yes			

Legend:

●	significant impact
◑	some impact
○	possible impact
	no impact

Notes:

(a) Use of low-emission trucks would reduce air quality impacts from significant impact (●) to some impact (◑).
(b) All options require environmental regulatory permits.

11.2.5 SANTA ANITA RESERVOIR

Over the next 20 years, 1.2 MCY of sediment are planned to be removed from Santa Anita Reservoir. The different management alternatives are briefly explained below and the impacts are shown in Table 11-7. All the alternatives will use Santa Anita SPS as a temporary storage area where the sediment can be gradually transported out in order to reduce traffic impacts.

Management Alternatives

1 Excavate → Conveyor → Santa Anita SPS → Excavate → Trucks → Irwindale Pits & Landfill
Excavate the sediment and place it on a conveyor, where it will transport the sediment to the Santa Anita SPS. The sediment can be gradually transported out to a pit in the Irwindale area or landfill.

2 Sluice (0.8 MCY) →Santa Anita Debris Basin→Santa Anita SPS→ Excavate→Trucks→Irwindale Pits & Landfill + Excavate (0.4 MCY) → Conveyor → Santa Anita SPS → Excavate → Trucks → Irwindale Pits & Landfill
Sluice the smaller sediment (0.8 MCY) from the Santa Anita Reservoir to the Santa Anita Debris basin, where the sediment can be dewatered. The dewatered sediment can be placed at the Santa Anita SPS using excavation equipment where it can be excavated and transported out gradually via trucks to a pit in the Irwindale area or a landfill. The larger sediment (0.4 MCY) must be removed via alternative one.

3 Dredge(0.8 MCY)→Santa Anita Debris Basin→Santa Anita SPS→ Excavate→Trucks→Irwindale Pits & Landfill + Excavate (0.4 MCY) → Conveyor → Santa Anita SPS → Excavate → Trucks → Irwindale Pits & Landfill
Dredge the smaller sediment from the Santa Anita Reservoir, where it can be transported via a slurry pipeline to the Santa Anita Debris Basin, where it can be dewatered. The dewatered sediment can be placed at the Santa Anita SPS using excavation equipment, where it can be excavated and transported out gradually via trucks to a pit in the Irwindale area or a landfill. The larger sediment (0.4 MCY) must be removed via alternative one.

Recommendation

It is recommended that all the alternatives detailed here be considered for future sediment removal projects at Santa Anita Reservoir.

Table 11-7 Santa Anita Reservoir Summary Table

Alternative		Quantity Removed (MCY)	Environmental				Social			Implementability	Performance		Cost
			Habitat	Water Quality	Groundwater Recharge	Air Quality[a]	Traffic	Visual	Noise	Special Permit/Agreement Required[b]	Previous Experience	# of Operations Required in Next 20 years	$ Millions
1	Excavate	1.2	◑		○	◑		○	○		Yes	3	30
	Conveyor							◑					
	Santa Anita SPS		○					◑	◑				
	Trucks					●	●	●	●				
	Irwindale Pits/Landfill									Yes			
2	Sluice	0.8	●	●	◑			◑			Yes	7	30
	Santa Anita DB/SPS		●	●	○	◑		◑	◑				
	Conveyor	0.4						◑					
	Excavate	1.2	◑			◑			◑				
	Trucks					●	●	●	●				
	Irwindale Pits/Landfill									Yes			
3	Dredge	0.8	◑	◑	○	◑			○		No	6	35-40
	Slurry Pipeline							◑					
	Santa Anita DB/SPS		●	●	○	◑		◑	◑		Yes		
	Conveyor	0.4						◑					
	Excavate	1.2	◑			◑		◑	◑				
	Trucks					●	●	●	●				
	Irwindale Pits/Landfill									Yes			

Legend:

●	significant impact
◑	some impact
○	possible impact
	no impact

Notes:

(a) Use of low-emission trucks would reduce air quality impacts from significant impact (●) to some impact (◑).

(b) All alternatives require environmental regulatory permits.

11.3 SMALL RESERVOIRS

11.3.1 BIG DALTON RESERVOIR

Over the next 20 years, 0.8 MCY of sediment are planned to be removed from Big Dalton Reservoir. The different management alternatives are briefly explained below and the impacts are shown in Table 11-8.

Management Alternatives

1 Excavate → Trucks → Irwindale Pits
Excavate the sediment and truck it to a pit in the Irwindale area.

2 Excavate → Trucks → Dalton SPS → Excavate → Trucks → Irwindale Pits & Landfills
Excavate the sediment and truck it to Dalton SPS, where the material can be trucked out gradually to a pit or a landfill to reduce the truck frequency.

3 Excavate → Conveyor → Big Dalton Debris Basin → Dry Excavate → Trucks → Irwindale Pits
Excavate the sediment then place it on a conveyor system where the material will be transported to the Big Dalton Debris Basin. The material at the debris basin will be excavated and transported via trucks to a pit in the Irwindale area.

Recommendation

It is recommended that all the alternatives detailed here be investigated further for Big Dalton Reservoir.

Table 11-8 Big Dalton Reservoir Summary Table

	Alternative	Quantity Removed (CY)	Environmental				Social			Implementability	Performance		Cost
			Habitat	Water Quality	Groundwater Recharge	Air Quality[a]	Traffic	Visual	Noise	Special Permit/Agreement Required[b]	Previous Experience	# of Operations Required in Next 20 years	$ Millions
1	Excavate	0.8	◑		○	◑		○	○		Yes	2	20
	Trucks					●	●	●	●				
	Irwindale Pits									Yes			
2	Excavate	0.8	◑		○	◑		○	○		Yes	2	20-25
	Trucks					●	●	◑	◑				
	Dalton SPS		◑			◑		◑	◑				
	Trucks					●	●	●	●				
	Irwindale Pits/Landfills									Yes			
3	Excavate	0.8	◑		○	◑		○	○		Yes	2	25
	Conveyor		○				○	◑	○				
	Big Dalton DB					◑		◑	◑				
	Trucks					●	●	●	●				
	Irwindale Pits									Yes			

Legend:

●	significant impact
◑	some impact
○	possible impact
	no impact

Notes:

(a) Use of low-emission trucks would reduce air quality impacts from significant impact (●) to some impact (◑).
(b) All options require environmental regulatory permits.

11.3.2 EATON RESERVOIR

Over the next 20 years, 1.6 MCY of sediment are planned to be removed from Eaton Reservoir. The only viable option is to excavate the material, transport it via trucks, and place it at a pit in the Irwindale area. It is recommended that excavation and trucking continue as the main removal method for Eaton Reservoir. Table 11-9 indicates the impacts of this alternative.

Table 11-9 Eaton Reservoir Summary Table

Alternative		Quantity Removed (MCY)	Environmental				Social			Implementability	Performance		Cost
			Habitat	Water Quality	Groundwater Recharge	Air Quality(a)	Traffic	Visual	Noise	Special Permit/Agreement Required(b)	Previous Experience	# of Operations Required in Next 20 years	$ Millions
	Excavate		◑		○	◑		○	○				
1	Trucks	1.6				●	●	◑	◑		Yes	2	20
	Irwindale Pits									Yes			

11.3.3 LIVE OAK

Over the next 20 years, 210,000 CY of sediment is planned to be removed from Live Oak Reservoir. The only viable option is to excavate the material, transport it via trucks, and place it at a pit in the Irwindale area, which has been the primary removal method in the past. It is recommended that excavation and trucking continue as the main removal method for Live Oak Reservoir. Table 11-10 shows the impacts of this alternative.

Table 11-10 Live Oak Reservoir Summary Table

Alternative		Quantity Removed (CY)	Environmental				Social			Implementability	Performance		Cost
			Habitat	Water Quality	Groundwater Recharge	Air Quality(a)	Traffic	Visual	Noise	Special Permit/Agreement Required(b)	Previous Experience	# of Operations Required in Next 20 years	$ Millions
	Excavate		◑		○	◑		○	○				
1	Trucks	210,000				●	●	◑	◑		Yes	2	3.0
	Irwindale Pits									Yes			

Legend:

●	significant impact
◑	some impact
○	possible impact
	no impact

Notes:

(a) Use of low-emission trucks would reduce air quality impacts from significant impact (●) to some impact (◑).
(b) All alternatives require environmental regulatory permits.

11.3.4 PUDDINGSTONE DIVERSION RESERVOIR

Over the next 20 years, 0.6 MCY of sediment are planned to be removed from Puddingstone Diversion Reservoir. The only viable option is to excavate the material, transport it via trucks, and place it at a pit in the Irwindale area, which has been the primary removal method in the past. It is recommended that excavation and trucking continue as the main removal method for Puddingstone Diversion Reservoir. Table 11-11 shows the impacts of this alternative.

Table 11-11 Puddingstone Diversion Reservoir Summary Table

Alternative		Quantity Removed (MCY)	Environmental				Social			Implementability	Performance		Cost
			Habitat	Water Quality	Groundwater Recharge	Air Quality[a]	Traffic	Visual	Noise	Special Permit/Agreement Required[b]	Previous Experience	# of Operations Required in Next 20 years	$ Millions
1	Excavate	0.6	◑		○	◑		○	○		Yes	2	7-9
	Trucks					●	●	◑	◑				
	Irwindale Pits									Yes			

11.3.5 THOMPSON CREEK RESERVOIR

Over the next 20 years, 260,000 CY of sediment are planned to be removed from Thompson Creek Reservoir. The only viable option is to excavate the material, transport it via trucks, and place it at a pit in the Irwindale area, which has been the primary removal method in the past. It is recommended that excavation and trucking continue as the main removal method for Thompson Creek Reservoir. Table 11-12 shows the impacts of this alternative.

Table 11-12 Thompson Creek Reservoir Summary Table

Alternative		Quantity Removed (CY)	Environmental				Social			Implementability	Performance		Cost
			Habitat	Water Quality	Groundwater Recharge	Air Quality[a]	Traffic	Visual	Noise	Special Permit/Agreement Required[b]	Previous Experience	# of Operations Required in Next 20 years	$ Millions
1	Excavate	260,000	◑		○	◑		○	○		Yes	2	3.0-3.5
	Trucks					●	●	●	●				
	Irwindale Pits									Yes			

Legend:

●	significant impact
◑	some impact
○	possible impact
	no impact

Notes:

(a) Use of low-emission trucks would reduce air quality impacts from significant impact (●) to some impact (◑).
(b) All alternatives require environmental regulatory permits.

11.4 DEBRIS BASINS

Over the next 20 years, close to 10 MCY of sediment are planned to be removed from the 162 debris basins managed by the Flood Control District.

Sediment Management Alternatives

Every removal, transport, and placement alternative was analyzed for the debris basins. However, many of the alternatives are not implementable due to the following reasons:

- Debris basins have smaller watersheds compared to reservoir, thus, there are no base flows which make wet removal and transport methods such as dredging, sluicing, and slurry pipeline infeasible.
- Debris basins need to be cleaned out during the storm season in order to provide capacity for the next potential storm, thus, the excavated material is very wet which makes conveyor transport and landfill placement infeasible.
- The distributed nature of the debris basins makes cable bucket and conveyor systems impractical. In addition, most of the debris basins are located in residential areas and do not have the right-of-way or a downstream site to receive the sediment.
- Debris basins do not provide a water conservation need so water quality and groundwater recharge impacts were not included in the summary table.

The only alternative for managing the sediment that accumulates at the debris basins is to excavate it and truck it. Table 11-13 shows the impacts of doing so in addition to the impacts of placing the sediment at pits and sediment placement sites.

Recommendation

It is recommended that excavation and trucking continue as the removal and transport method for debris basins.

Table 11-13 Debris Basins Summary Table

Alternative	Environmental		Social			Implementability	Performance	Unit Cost	
	Habitat	Air Quality[(a)]	Traffic	Visual	Noise	Special Permit/Agreement Required[(b)]	Previous Experience	Dollars	Unit
Excavate	◑	◑		◑	●		Yes	7.5	CY
Trucks		●	●	●	●		Yes	0.65	MI-CY
Pits							Yes	5-15	CY
Sediment Placement Sites	○	○		●	●		Yes	2	CY
Landfills						Yes	Yes	VARIES	CY

Legend:

●	significant impact
◑	some impact
○	possible impact
	no impact

Notes: (a) Use of low-emission trucks would reduce air quality impacts from significant impact (●) to some impact (◑).
(b) All alternatives require environmental regulatory permits.

11.5 NEXT STEPS

This Strategic Plan represents the first step in continued analysis and dialogue with our stakeholders to manage sediment at Flood Control District facilities in ways that consider the needs of all stakeholders. Several next steps have come out of the analysis included in the plan.

- **Continue Analysis** – As a planning-level document, the Strategic Plan has identified feasible alternatives, but more analysis is needed prior to choosing a specific alternative for the larger, more complicated reservoirs. Specific analysis will clarify impacts and constraints, but may also identify new opportunities. One such alternative is sediment flushing (previously referred to as Flow Assisted Sediment Transport), which shows promise as a methodology to move sediment downstream in a manner that mimics natural processes. As this analysis continues, the Flood Control District will work cooperatively with stakeholders.

- **Beneficial Uses** – Some of the sediment that reaches the reservoirs and debris basins maintained by the Flood Control District could potentially be used as a resource of aggregate and other materials, daily cover at landfills, and fill at pits. The Flood Control District will continue to explore beneficial use of the sediment. Furthermore, the Flood Control District will remain open to cost sharing and project management partnerships to remove, transport, and process sediment for beach nourishment purposes.

- **Partner with Pit Operators/Acquire Pit(s)** – As mentioned above, sediment from the reservoirs and debris basins could potentially be used as a resource of construction and other materials and as fill for pits. These could potentially be possible through a service agreement with the owners of the sand and gravel processing plants and pits. Placement of sediment at pits could also be accomplished by acquisition of a pit. If not completely filled, the Flood Control District could also use the pits to provide additional groundwater recharge. The Flood Control District will continue efforts to establish the service agreements and to acquire pits in Sun Valley and the Irwindale area.

- **Long-Term Vision** – The flood control and water conservation system in the County of Los Angeles contains some facilities operated by the Flood Control District and others by the Army Corps of Engineers. The Flood Control District will continue to work with the Army Corps of Engineers and local stakeholders to develop a regionwide plan to address sediment as a part of a comprehensive study of how to improve facilities' operations and restore the natural functions of the watersheds while retaining the benefits provided by the current flood management and water conservation system.

The Flood Control District has provided flood risk management and water conservation for almost 100 years. However, new challenges associated with sediment management have emerged. The Flood Control District is always open to hearing and discussing new ideas, so find out how to be involved at www.LASedimentManagement.com and share your ideas.

APPENDIX A ADVISORY WORKING GROUP MEMBERS

Given the complexity, regional impacts, and broad interests in sediment management, Public Works realized the need for creating a small advisory group to provide additional input and a broad perspective based on the members' diverse experiences and key roles in the stakeholder community. The Flood Control District appreciates the time the members dedicated to this effort and the input provided. The Sediment Management Advisory Working Group was comprised of external members and members from within the Flood Control District / the County of Los Angeles Department of Public Works. The external members consisted of the following:

Tim Brick	Managing Director of the Arroyo Seco Foundation
Jerry Burke	Assistant Public Works Director and City Engineer for the City of Glendora
Rebecca Drayse	Director of TreePeople's Natural Urban Systems Group
Laura Garrett	Conservation Chair of the Pasadena Audubon
Dr. Shelley Luce	Executive Director of the Santa Monica Bay Restoration Commission
Jeff Pratt / Karl Novak	Director of the County of Ventura Public Works Agency / Division Manager of the County of Ventura Public Works Agency's Operations & Maintenance
Dan Rix	City Engineer for the City of Pasadena
Milad Taghavi	Assistant Director of Water Quality at the Los Angeles Department of Water and Power
Tony Zampiello	Assistant Executive Officer of the Main San Gabriel Basin Watermaster

Note: While the people above participated in the Advisory Working Group, their participation and mention here does not intend to imply that they were in agreement with the Strategic Plan's recommendations.

The internal members included the following:

Gail Farber	Chief Engineer of the Flood Control District
Mark Pestrella	Assistant Director of the County of Los Angeles Department of Public Works
Diego Cadena	Deputy Director over the Department's Water Branch Divisions
Rudy Lee	Assistant Deputy Director / Division Engineer over Flood Maintenance Division
Chris Stone	Assistant Deputy Director / Division Engineer over Water Resources Division
Keith Lilley	Assistant Division Engineer – Water Resources Division
Gary Hildebrand	Assistant Deputy Director / Division Engineer over Watershed Management Division
Terri Grant	Assistant Division Engineer – Watershed Management Division
Jolene Guerrero	Senior Civil Engineer – Watershed Management Division
Dan Sharp	Civil Engineer – Watershed Management Division

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APPENDIX B LOS ANGELES COUNTY DEPARTMENT OF PUBLIC WORKS STAFF PARTICIPANTS

Numerous staff from the County of Los Angeles Department of Public Works provided assistance during the development of the Sediment Management Strategic Plan. The Flood Control District appreciates everyone's assistance.

Gail Farber	Mark Pestrella	Diego Cadena	
Gary Hildebrand	Rudy Lee	Bob Spencer	Chris Stone

Lani Alfonso	James Hilovsky	Kavita Mahulikar	Phil Siongco
Zahid Atashzay	Anna Ho	Linda Lee Miller	Sean Spencer
Marcela Benavides	Jack Husted	TJ Moon	Ed Teran
John Bodenchak	Amir Ibrahim	Samangi Mudalige	Emiko Thompson
Tom Budinger	Bill Johnson	Cung Nguyen	Mia Thong
John Burton	Mie Joness	Citlalith Perez	Jim Thurow
Ryan Butler	Max Khanukayev	Nikolaus Reppuhn	Rona Tintut
Youssef Chebabi	Sree Kumar	John Rice	Erik Updyke
Jemellee Cruz	Elaine Kunitake	Ken Rickard	Sonia Valdez
Jennifer Dang	Robert Larson	Laura Rockett	Mark White
Jared Deck	Kerjon Lee	Ryan Romo	Pat Wood
Robert Dominguez	Gerald Ley	Andrew Ross	Grace Yu
Norma Espinosa	Jewel Libid	Steve Ross	Ken Zimmer
Terri Grant	Keith Lilley	Lindsay Sagorski	
Jolene Guerrero	Mark Lombos	Adriana Sandoval	
Steve Hennessee	Katie Mac	Dan Sharp	

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APPENDIX C STAKEHOLDER TASK FORCE MEMBER INVITEE LIST

The following is a cumulative list of the invitees to the Stakeholder Task Force meetings held between January 2011 and May 2012. The list grew as stakeholders requested to be included in the Sediment Management Strategic Plan's distribution list or attended a previous meeting. A list of the attendees for each Stakeholder Task Force meeting can be found in Appendix C, subsequent to each meeting summary.

Agency/Organization	Name	Title
Anchor QEA, LLC	Shelly Anghera	
Arroyo Seco Foundation	Jonathan Frame	Watershed Coordinator
Arroyo Seco Foundation	Tim Brick	Managing Director
Arroyo Seco Foundation	Wilson Lau	Watershed Coordinator
Board of Supervisors Office	Kathryn Leibrich	Chief Deputy (Fifth District)
California Coastal Commission	John (Jack) Ainsworth	Deputy Director
California Department of Fish and Game	Ed Pert	Regional Manager South Coast Region
California Department of Fish and Game	Helen Birss	Environmental Program Manager
California Department of Fish and Game	Kelly Schmoker	
California Department of Fish and Game	Sarah Rains	
California Department of Fish and Game	Terri Dickerson	Senior Environmental Scientist
California Department of Forestry	Mikel Martin	Southern Region Chief
California Department of Transportation - District 7	James McCarthy	Deputy District Director of Planning
California Native Plant Society/Public	Barbara Eisenstein	
California Native Plant Society San Gabriel Mountains Chapter	Gabi McLean	
California Native Plant Society/ Theodore Payne Foundation	Snowdy Dodson	Board Member
California Regional Water Quality Control Board - Los Angeles Region	Deb Smith	Chief Deputy Executive Officer
California Regional Water Quality Control Board - Los Angeles Region	LB Nye	
California Regional Water Quality Control Board - Los Angeles Region	Sam Unger	Executive Officer
California Regional Water Quality Control Board - Los Angeles Region	Valerie Carillo	Engineering Geologist Certification and Wetlands Unit
Chevy Chase Estates Garden Club	Marianne Bamford	Treasurer
Chevy Chase Estates Garden Club	Mary Betlach	President
Chief Transportation & Engineering Contractors	Jose L. Aceituno	Estimator / Project Manager
City of Arcadia Public Works Services Department	Phil Wray	City Engineer
City of Arcadia Public Works Services Department	Ken Herman	Deputy Public Works Services Director
City of Arcadia Public Works Services Department	Tom Tait	Public Works Director
City of Azusa	Carl Hassel	City Engineer
City of Azusa	Daniel Bobadilla	Principal Civil Engineer
City of Bradbury	Dominic Milano	City Engineer
City of Burbank	Sean Corrigan	Chief City Engineer
City of Claremont	Craig Bradshaw	City Engineer
City of Duarte	Craig Hensley	Director of Public Works
City of Glendale	Roubik Golanian	City Engineer

Agency/Organization	Name	Title
City of Glendora	Jerry Burke	Assistant Public Works Director/City Engineer
City of Irwindale	Kwok Tam	Director of Public Works/City Engineer
City of La Cañada Flintridge	Ying Kwan	City Engineer
City of La Verne	Dan Keesey	Public Works Department Head
City of Los Angeles	Fred Burnett	
City of Los Angeles	Gary Lee Moore	City Engineer
City of Los Angeles Bureau of Sanitation	Khalil Gharios	Division Manager
City of Los Angeles City Council District 2	Mary Benson	Senior Community Representative
City of Los Angeles Department of Building and Safety Code Enforcement Bureau	Wayne Tsuda	Program Manager
City of Monrovia	Jun Cervantes	City Engineer
City of Monrovia	Mark Carney	Department Director
City of Pasadena	Dan Rix	City Engineer
City of San Dimas	Krishna Patel	Director of Public Works
City of San Dimas	Lisa Bugrova	Environmental Coordinator
City of Santa Clarita	Kerry Breyer	Senior Engineer
City of Santa Clarita	Oliver Cramer	Analyst
City of Santa Clarita	Robert Newman	Director of Public Works
City of Sierra Madre	Bruce Inman	Director of Public Works
City of Sierra Madre	Chris Cimino	Deputy Director of Public Works
Community Forest Advisory Committee/ Theodore Payne Foundation	Lynette Kampe	Executive Director
Council for Watershed Health	Deborah Glaser	Policy & Comm.
Council for Watershed Health	Drew Ready	Program Manager/ Watershed Coordinator
Council for Watershed Health	Nancy Steele	Executive Director
County of Los Angeles Department of Beaches and Harbors	Cesar Espinosa	Planner
County of Los Angeles Department of Beaches and Harbors	Paul Wong	
County of Los Angeles Department of Beaches and Harbors	Santos H. Kreimann	Director
County of Los Angeles Department of Regional Planning	Nooshin Paidar	
County of Los Angeles Department of Regional Planning	Susan Tae	
County of Los Angeles Department of Public Health	Cindy Chen	Chief, R.E.H.S
County of Los Angeles Department of Public Health	Jonathan E. Fielding	Director
County of Ventura Public Works Agency	Jeff Pratt	Director
Crescenta Valley Town Council	Charly Shelton	
Crescenta Valley Town Council	Cheryl Davis	Chair for La Crescenta Town Council
CUCA	Roberta Medford	
Englander Knabe & Allen (EKA)	Alex Cherin	Vice President
EnviroMINE, Inc.	Crystal Howard	Manager
Foothill Municipal Water District	Nina Jazmadarian	General Manager
Foothill Trails District Neighborhood Council	Nancy Woodruff	President
Foothill Trails District Neighborhood Council	Vikki Brink	Committee E8 Chair (Equestrian)

Agency/Organization	Name	Title
Friends of Hahamongna	Mary Barrie	
Geosyntec Consultants	Mark Hanna	
H&B	Christle Balvin	
Holliday Rock Company	John Holliday	President
JPL	Merilee Fellows	Manager of Environmental Communications
JPL	Steve Slaten	Cleanup Program Manager
Katherine Padilla & Associates (KP&A)	Katherine Padilla	President
LA-32 Neighborhood Council & Sierra Club - Angeles Chapter	Tom Williams	
Los Angeles Audubon	Travis Longcore	President
Los Angeles Department of Water and Power	Andy Niknafs	
Los Angeles Department of Water and Power	Susan Avila Suarez	
Los Angeles Department of Water and Power	Milad Taghavi	Assistant Director of Water Quality
Main San Gabriel Watermaster & Raymond Basin Management Board	Tony Zampiello	Executive Officer
Main San Gabriel Watermaster & Raymond Basin Management Board	Wendy La	Staff Engineer
Main San Gabriel Basin Watermaster	Kevin Smead	
Metropolitan Water District	John V. Foley	
Mountains Restoration Trust	Debbie Bruschaber	Co-Executive Director
Neighborhood Unitarian Church	Hannelore Bauer	
Neighborhood Unitarian Church	Robin Robinson	
Pasadena Audubon	Laura Garrett	
Pasadena Audubon	Mickey Long	
Pasadena Star-News	Frank Giradot	Editor
Peck Road Gravel	Nick Bubalo	President
Port of Long Beach	Robert Kanter	
Public	Alex Squiers	
Public	Allen Savedoff	
Public	Andrea Hessing	
Public	Arthur Golding	
Public	Bill Eutz	
Public	Bill Weisman	
Public	Bruce Campbell	
Public	Bryan Helm	
Public	Cam Stone	
Public	Carole Scurlock	
Public	Caroline Brown	
Public	Dan Feinberg	
Public	Dan Kronstadt	
Public	Darren Thorne	
Public	Dave Czamanske	
Public	Dennis Van Bremen	
Public	Dianne Patrizzi	
Public	Elizabeth Lanski	
Public	Emily Green	

Agency/Organization	Name	Title
Public	Ginger Alberti	
Public	Ginny Heringer	
Public	Glen Owens	
Public	James Kimmick	
Public	Janica Jones	
Public	Julia Tarnawski	
Public	Karen Bonfigli	
Public	Kiran Magiawala	
Public	Laurie Walcutt	
Public	Lisa Novick	
Public	Lori Paul	
Public	Madeline Graham	
Public	Marianne Simort	
Public	Mary Hayden	
Public	Michael Sabo	
Public	Mike Lawler	
Public	Millie Paul	
Public	Morton Gorel	
Public	Nancy Busacca	
Public	Nils Brink	
Public	Robert Conner	
Public	Robert Ruby	
Public	Rody Stephenson	
Public	Roger Klemm	
Public	Sally Kalaghan	
Public	Scott Wilson	
Public	Sharon Olsen	
Public	Stan Smith	
Public	Susan Bartow	
Public	Suzanna Mast	
Public	Terry Young	
Public	Thomas Holaday	
Public	Tim Martinez	
Public	Tori Collender	
Public	William Bertrand	
Public	Wynesta Dale	
Public	Rebecca Latta	
Republic Services (Sunshine Canyon Landfill)	David Cieply	General Manager of Sunshine Canyon Landfill
Republic Services	Rafael Garcia	Communications Relation Manager
Republic Services, Inc/BFI of California, Inc.	Kurt Bratton	Market Vice President
San Fernando Valley Audubon Society	Dave Weeshoff	President
San Gabriel and Lower Los Angeles Rivers and Mountains Conservancy	Belinda Faustinos	Executive Officer
San Gabriel and Lower Los Angeles Rivers and Mountains Conservancy	Luz Torres	Staff Biologist

Agency/Organization	Name	Title
San Gabriel and Lower Los Angeles Rivers and Mountains Conservancy	Valorie Shatynski	Acting Executive Officer
Sanitation Districts of Los Angeles County	Bob Asgian	Division Engineer
Sanitation Districts of Los Angeles County	Sam Shammas	Project Engineer
Sanitation Districts of Los Angeles County	Stephen R. Maguin	Executive Director
Santa Monica Bay Restoration Commission	Shelly Luce	
Santa Monica Mountains Conservancy Angeles District	Joseph T. Edmiston	Executive Director
SCS Engineers	Dan Vidal	Project Director
Shadow Hills Property Owners Association (SHPOA)	Dave DePinto	
Sierra Club	Darrell Clark	Chairman
Sierra Club	Don Bremner	
Sierra Club	Linda Doran	
Sierra Club - Angeles Chapter	George Watland	Conservation Program Coordinator
Sierra Club - Angeles Chapter	Joan Licari	Chair, San Gabriel Task Force
South Coast Air Quality Management District	Barry R Wallerstein	Executive Officer
Stetson Engineers, Inc. (Raymond Basin Management Board)	Steve Johnson	Corporate Senior Vice-President, Principal Engineer
The Port of Los Angeles	Christopher Cannon	
Theodore Payne Foundation	Andrew Nabagiez	
Theodore Payne Foundation	Andrew Peck	
Theodore Payne Foundation	Ann Schultz	
Theodore Payne Foundation	Destiny Floyd	
Theodore Payne Foundation	Imran Asif	
Theodore Payne Foundation	Jeanne Kirhofer	
Theodore Payne Foundation	Kevin Steinhauer	
Theodore Payne Foundation	Leslie Lipton	
Total Transportation Services, Inc.	Bill Allen	
Total Transportation Services, Inc.	Richard Echler	Development Manager
Total Transportation Services, Inc.	Tony Williamson	Director, Business Development & Diversity Services
Total Transportation Services, Inc.	Vic LaRosa	President
Trammell Crow Company	Jason Gremillion	
Transition San Fernando Valley	Bruce Woodside	Steering Committee Member
TreePeople	Rebecca Drayse	Director of the Natural Urban Systems Group
U.S. Army Corps of Engineers	Daniel P. Swenson	Chief, Los Angeles Section, North Coast Branch
U.S. Army Corps of Engineers	Ned Araujo	
U.S. Army Corps of Engineers	R. Mark Toy	
U.S. Army Corps of Engineers	Savoth Hy	Civil Engineer
U.S. Army Corps of Engineers	Jon Sweeten	Civil Engineer
U.S. Army Corps of Engineers Los Angeles District (SPL)	Tomas G. Beauchamp	Chief, Operations Branch
U.S. Fish and Wildlife Service	Ren Lohoefener	Regional Director, Pacific Southwest
U.S Forest Service – Angeles National Forest	Esmeralda Bracamonte	San Gabriel River Ranger District Resources Officer
U.S Forest Service – Angeles National Forest	Graham Breakwell	

Agency/Organization	Name	Title
U.S Forest Service – Angeles National Forest	Justin Seastrand	Environmental Coordinator
U.S Forest Service – Angeles National Forest	Lisa Northrop	Resources and Planning Staff Officer
U.S Forest Service – Angeles National Forest	Marty Dumpis	Deputy Forest Supervisor
U.S Forest Service – Angeles National Forest	Mike McIntyre	District Ranger
U.S Forest Service – Angeles National Forest	Joseph Holzinger	Permit Administration
U.S Forest Service – Angeles National Forest	Sonja Bergdahl	Forest Engineer
U.S Forest Service – Angeles National Forest	Tasha Hernandez	Santa Clara/Mojave Rivers Ranger District Resources Officer
United Rock Products	Dave Huss	
United Rock Products	Martin Fuentes	Operations Manager
United Rock Products	Russ Caruso	
United States Forest Service	Chris Fabbro	Lands Specialist
Upper San Gabriel Valley Municipal Water District	Shane Chapman	
Urban Wild Network	Laurie Gould	
Urban Wild Network	Susan Rudnicki	
US Army Corps of Engineers	Mike Farris	O&M Section Chief
USDA - Forest Service	Sean Barry	Assistant Resource Officer - San Gabriel River Regional District
Vulcan Materials Company	Charles St. John	LA Regional Environmental Manager
Vulcan Materials Company	Gary Goellner	Regional Operation Manager
Vulcan Materials Company	Jeff Cameron	
Vulcan Materials Company	Mike Linton	Vice President
Waste Connections Inc.	Mike Dean	District Manager
Waste Connections Inc.	Sid Rodriguez	Raw Materials Coordinator HMA - Operations Western Division - Irwindale
Waste Connections Inc.	Steve Cassulo	Administration
Waste Connections Inc. / SCS Engineers	Dan Vidal	Project Director
Waste Connections Inc. / SCS Engineers	Robert Johnson	Senior Project Director
Waste Management	Brent Anderson	District Manager
Waste Management	Damon DeFrates	
Watershed Conservation Authority	Jane Beesley	Deputy Executive Officer
Watershed Conservation Authority	Rob Romanek	Project Manager
Weston Solutions	Michael Drennan	Vice President, California Regional Manager
Weston Solutions	Rod Tobias	

APPENDIX D STAKEHOLDER TASK FORCE MEETING DOCUMENTS

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Los Angeles County Flood Control District
Sediment Management Strategic Plan
Task Force Meeting # 1
January 31, 2011

LA County Department of Public Works Headquarters Building
900 South Fremont Avenue. Alhambra, CA 91803

Goal

Manage sediment in order to provide for the flood protection and water conservation needs of the region while balancing environmental, social, and economic impacts.

Agenda

Welcome

Sediment Management Needs and Current Methods

Sediment Management Strategic Plan
- What are the challenges we are trying to address?
- What opportunities are there?

Task Force Purpose and Structure
- What is your role?

Potential Solutions
- Transport
- Reuse
- Placement
- Other

Considerations, Constraints, and Challenges

Next Steps

If you have any questions or concerns please contact:
Dan Sharp at (626) 458-4345 or dsharp@dpw.lacounty.gov

Sediment Management Strategic Plan
Task Force Meeting # 1
January 31, 2011 2:00-4:00 pm

Los Angeles County Department of Public Works Headquarters
900 South Fremont Avenue, Alhambra, CA 91803
Conference Rooms A &B

Meeting Summary

Note: For reference purposes, the meeting agenda, Task Force invitation list, and Task Force Meeting # 1 list of attendees are attached. For a copy of the presentation please email Marcela Benavides at mbenavides@dpw.lacounty.gov.

Welcome

Gary Hildebrand, Division Head of the Watershed Management Division of the Los Angeles County Department of Public Works, welcomed and thanked the attendees. He indicated sediment management is necessary in order to provide for the flood protection and water conservation needs of the region. He explained that the goal of the Task Force is to find sediment management solutions that balance environmental, social, and economic impacts. Gary also introduced the Sediment Management Strategic Plan Project Team: Lani Alfonso, Dan Sharp, Marcela Benavides, and Laura Rockett.

Presentation

Dan Sharp gave a presentation that provided background information about the Los Angeles County Flood Control District. He also talked about the Sediment Management Strategic Plan, the purpose and structure of the Task Force, and potential sediment transport, sediment reuse, sediment placement, and other alternatives.

Alternatives Brainstorming Session

After the presentation, the attendees broke up into six (6) groups to brainstorm about additional alternatives. Below is a compiled list of the notes from the breakout groups.

Transportation Alternatives
- If the system is more natural there may not be any need for transportation
- Truck sediment, deal with dust issues, investigate hybrid/alternative fuel/more environmentally friendly trucks to subsidize cost and reduce environmental impacts
- Sluice, sluice during flooding, investigate alternative sluicing methods
- Slurry pipeline, other pipelines
- Rail, railroad-type tracks embedded into flood control channels with flat transport cars
- Conveyors, conveyors that generate power

Re-use Alternatives
- Beach replenishment, beach rehabilitation, restoration of coastal wetlands
- Use to fill/rehabilitate gravel pits
- Inert landfill cover, alternative daily cover at landfills

- Rip rap, channel armoring, gabions
- Agricultural industry – topsoil, land replenishment
- Landscaping industry – turf replacement, nurseries
- Landform grading
- Housing and development industry
- County's and other agencies' construction projects such as ports, schools, roads, and bridges as well as for filling smaller sites like the Gold Line
- Brownfield development (for cap)
- Mine for re-use, e.g., mine from behind Santa Fe Dam including stockpile
- Multi-use processing, grade and classify material
- Sell the material, have a sediment/soil broker, market the sediment, commercial reuse, commercial involvement
- Alternative uses, make glass or something with it
- Research alternative uses of sediment

Placement Alternatives
- Back to hills, back to mountains
- Offshore (explore environmental benefits), drilling mud
- Shoreline, beaches
- Build an island in the Harbor (like Japan)
- Inland desert (appropriate locations adjacent to railroad)
- Gravel pits, gravel pits in Irwindale, hillside mines
- Landfills (inert landfills), identify distance to landfills. Example: Puente Hills landfill closure → open space
- Restoration projects, restore coastal wetlands, restore SPS when filled (make more naturally landscaped – work with community/scientific community)
- Parks and Recreation use
- Transportation/grading
- "Send it to the moon" (or other places out of the County)

Other Alternatives
- Change/reconfigure/re-engineer the system, retrofit dams, deepen channels, structure upstream, gabions, regain capacity at reservoirs, improve facilities (bring up to size)
- Purchase land along the channels to make a more natural system, relocate residents in danger zone, mimic nature (bigger piles, better shape, native habitat)
- Clean out sediment before it gets too far into a debris basin or reservoir
- Conduct outreach/educate the public about alternatives
- Restore sediment placement sites after filled to make them seem more natural - work with community & scientific community
- Require use of sediment on all development projects requiring fill
- Prevention - erosion control, invasive removal so that natives can grow and prevent erosion
- Prepare downstream facilities for incoming sediment from sluicing operations – if sluicing a certain amount of sediment, remove that same amount of sediment from downstream facilities first
- Phase sediment removal
- Communication – language, modes, timing, feedback (Models of Communication: Newhall Land, Ventura Watershed Protection District, Rim of the Valley)

Other Thoughts

- All sides must be flexible
- There must be diversity and transparency in the process, transparency, results, timing/convenience
- The right people need to be involved (expertise), credibility, consult existing stakeholder groups
- Learn from the past
- Have to combine multiple ideas
- Approach should be interdisciplinary/collaborative - allow for flood protection, water conservation, and watershed health; consider biological and recreational components
- Incorporate multi-use components including passive and active recreation in sediment placement site planning and use
- Augustus F. Hawkins Natural Park built on organic and sediment landfill
- There should be internal collaboration
- Consider all feasible options, do not limit
- Cost, Consider cost issues, cost/benefit of water conservation/flood protection vs. sediment, long-term view of cost
- Determine the cost managing the sediment as it is currently done. Compare the cost of the alternatives with that cost.
- Credit system/other funding sources
- Replacement of downstream sediment for economic value
- Filling pits complicated by water at bottom of old pits
- Organic and silt problematic
- Timing – needs vs. availability
- In-house environmental review, independent oversight committee for EIRs
- Adhering to existing development rules, land-use policy
- Existing Flood Control District facilities
- Local solutions

Consideration, Constraints, and Challenges

Following the breakout session the Task Force discussed considerations, constraints, and challenges related to sediment management. The items discussed with the whole group are summarized below.

- The economic value of ecosystems, including stormwater interception, pollution filtration, carbon sequestration, recreation opportunities should be considered. Various groups have developed economic values for ecosystems. Consider using those numbers in the evaluation.
- The animals and plants that reside in the region's open space need to be considered.
- The actual people affected need to be represented better. Who is representing them? Homeowners associations do not always speak on everyone's behalf. Should consider more than the immediate neighborhood; need to consider the region. Are those who use downstream facilities being considered?
- The impact to the environment needs to be evaluated in a broader scope.
- The solutions need to be optimized. There is not going to be one solution to the problem; it is going to be a combination and optimization of many methods.
- Project goals and criteria need to be clear.
    - How do you put a price on any one specific consideration?

  - There is no one solution to the problem.
- The environment needs to be taken into consideration.
- There needs to be a transparent process. Is it possible to invite some groups to assist in the selection of the consultant to perform work for this project?

  Response: The consultant has already been chosen from a list of as-needed consultants the Los Angeles County Department of Public Works has. The Consultant's work will be discussed openly with the Task Force and anything found to be unacceptable will be reconsidered. It is feasible to amend the consultant's scope, as necessary.
- Short-term projects are appearing to be a bigger deal through the presentation. If they are not currently being considered a high priority, they need to be. We need to consider the short-term projects highly now as they will be a big part of the long-term plan.
- The scope of work for the project needs to consider the long-term approach.
- Upstream effects need to be evaluated.
- An integrated approach needs to be taken.

Upcoming Clean-Out and Sediment Placement Site Projects

While the Strategic Plan is being developed, Public Works will continue to plan various needed sediment removal/placement projects. There will be a separate process to outreach to stakeholders as the plan for each specific project is developed. Task Force attendees were invited to sign-up to receive information about the following upcoming projects:

- Big Tujunga Reservoir clean-out
- Devil's Gate Reservoir clean-out
- Cogswell Reservoir clean-out
- Eaton Wash Dam clean-out
- La Tuna Sediment Placement Site
- Pacoima Reservoir clean-out
- Morris Reservoir clean-out

Any pertinent information from the work being done on the upcoming projects and the Sediment Management Strategic Plan will be shared between the groups.

Next Steps

The Task Force will reconvene in approximately 2 months.

In the meantime, Public Works will contract a consultant to complete a Sediment Management Study that will assist in the development of the Sediment Management Strategic Plan. While it is not feasible to provide the Scope of Work for the study at this time, as requested at the meeting, the scope will be provided to the Task Force as soon as possible.

The County will work with the Task Force and other stakeholders to obtain any relevant information that could be used in the development of the Strategic Plan. This includes the previously developed economic values for ecosystems mentioned during the meeting.

Contact Information

Please contact Dan Sharp or any other member of the Project Team if you have any questions, comments, or suggestions throughout the project.

- Lani Alfonso: lalfonso@dpw.lacounty.gov, (626) 458-7165
- Dan Sharp: dsharp@dpw.lacounty.gov, (626) 458-4345

- Marcela Benavides: mbenavides@dpw.lacounty.gov, (626) 458-4166
- Laura Rockett: lrockett@dpw.lacounty.gov, (626) 458-4363

SEDIMENT MANAGEMENT STRATEGIC PLAN TASK FORCE MEETING # 1 ATTENDEES

Agency/Organization	Name
Arroyo Seco Foundation	Tim Brick
Board of Supervisors Office	K. Leibrich
California Department of Fish and Game	Kelly Schmoker
California Department of Fish and Game	Sarah Rains
California Native Plant Society San Gabriel Mountains Chapter	Gabi McLean
California Regional Water Quality Control Board - Los Angeles Region	Valerie Carillo
City of Burbank	Sean Corrigan
City of Los Angeles	Fred Burnett
City of Pasadena	Dan Rix
City of San Dimas	Krishna Patel
City of San Dimas	Lisa Monreal
City of Santa Clarita	Kerry Breyer
City of Sierra Madre	Bruce Inman
City of Sierra Madre	Chris Cimino
County of Los Angeles Department of Public Health	Cindy Chen
Friends of Hahamonga	Mary Barrie
Los Angeles Department of Water and Power	Susan Avila Suarez
Main San Gabriel Basin Watermaster	Carol Williams
Pasadena Audubon	Laura Garrett
Pasadena Audubon	Mickey Long
Public and CA Native Plant Society/LA County Oak Task	Rebecca Latta
Public and CA Native Plants Society	Barbara Eistenstein
Public	Caroline Brown
Public	Tim Martinez
Public	Cam Stone
Public	Carole Seurlock
Public	Glen Owens
Public	Emily Green
Raymond Basin Management Board	Tony Zampiello
Raymond Basin Management Board	Steve Johnson
Sanitation Districts of Los Angeles County	Bob Asgian
Sierra Club Angeles Chapter - Pasadena Group	Dave Czamanske
Sierra Club Angeles Chapter	Joan Licari
The San Gabriel and Lower Los Angeles Rivers and Mountains Conservancy	Luz Torres
U.S. Army Corps of Engineers	Daniel P. Swenson
U.S. Army Corps of Engineers	Ned Araujo
U.S. Forest Service	Sonja Bergdahl
U.S. Forest Service	Lisa Northrop
United Rock Products	Dave Huss
Vulcan Materials Company	Charles St. John

Agency/Organization	Name
Vulcan Materials Company	Gary Goellner
Watershed Conservation Authority	Rob Romanek
Watershed Conservation Authority	Jane Beesly
Weston Solutions	Michael Drennan

Los Angeles County Flood Control District
Sediment Management Strategic Plan Task Force Meeting # 2
and
Upcoming Reservoir Cleanout Projects Meeting

Monday, April 18, 2011
1:30 pm to 4:30 pm

LA County Department of Public Works Headquarters Building
900 South Fremont Avenue. Alhambra, CA 91803
Conference Rooms A&B

Goal

Manage sediment in order to provide for the flood protection and water conservation needs of the region while balancing environmental, social, and economic impacts.

Agenda

1. Welcome
2. Sediment Management Strategic Plan
   Follow-up from the First Task Force Meeting
3. Listening Session
   Project Development Process Feedback
4. Sediment Management Strategic Plan
   Alternatives Screening Tool
5. California Department of Fish and Game
   and California Regional Water Quality Control Board Permits
6. Upcoming Reservoir Cleanout Projects
   Big Tujunga, Cogswell, Devil's Gate, Pacoima, Morris
7. Wrap Up

Los Angeles County Flood Control District
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and Upcoming Reservoir Cleanout Projects Meeting

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Meeting Summary

Note: For reference purposes the following are included in the meeting summary:

- Meeting agenda (page 14).
- Invitation list for the meeting (page 15).
- List of attendees (page 18).

Welcome

Diego Cadena, Deputy Director over the Water Branch of the Los Angeles County Department of Public Works (Public Works), welcomed and thanked the attendees. He explained that this particular Task Force meeting was expanded to include additional items which are planned to enhance the Department's future engagement on both the Sediment Management Strategic Plan (Strategic Plan) and upcoming reservoir cleanout projects.

Follow-up from the First Strategic Plan Task Force Meeting

Gary Hildebrand, Division Head of the Watershed Management Division of Public Works, discussed the following items as a follow-up to the first Strategic Plan Task Force meeting, which was held on January 31, 2011.

- A summary of the last Strategic Plan Task Force meeting was provided in the invitation email to this second meeting of the Strategic Plan Task Force. Comments or concerns regarding that summary are being accepted. [Comments or concerns can be sent to SedimentMgmtPlan@dpw.lacounty.gov.]

- As requested at the previous Strategic Plan Task Force meeting, copies of the Sediment Management Study's consultant scope of work were available for pick up during this second meeting. The scope of work is also available upon request via email *[Please send requests to SedimentMgmtPlan@dpw.lacounty.gov].*

  [As part of the Sediment Management Study, the consultant will analyze, screen, and recommend potential sediment management methods that the Los Angeles County Flood Control District (Flood Control District) may use to address the region's sediment management needs from 2012 to 2032 under the Flood Control District's jurisdiction. The Sediment Management Study is different from the environmental documentation work that will be performed for Devil's Gate Reservoir].

- The consultants performing the Sediment Management Study have begun their work. The consultants have started their reconnaissance and background information gathering and will be assisting in evaluating alternative sediment management solutions.

- During the first Strategic Plan Task Force meeting, questions were brought up regarding the Flood Control District's use of agreements with gravel pits and landfills for placing sediment. The Flood Control District is planning to use these agreements for some of the upcoming reservoir cleanout projects.

- The Flood Control District is no longer separately pursuing the development of the La Tuna Sediment Placement Site. Development of La Tuna Sediment Placement Site will now be considered as one of the alternatives to be evaluated in the development of the Strategic Plan, with the input from the Strategic Plan Task Force.

- The Strategic Plan Task Force meetings were intended to serve as a forum for agency and organizational stakeholder discussion rather than as a community meeting and so, Strategic Plan Task Force meetings have been scheduled during the work day. Many of the stakeholders in attendance are representing public agencies and are unable to attend in the evenings due to overtime budget constraints. A series of community meetings in the evenings will be additionally scheduled however Strategic Plan Task Force meetings will continue to be held during the day.

- In response to the many comments regarding the Flood Control District's coordination with the California Department of Fish and Game and the California Regional Water Quality Control Board, both agencies were invited to describe their regulatory processes and to answer questions about their permits during this second meeting of the Strategic Plan Task Force.

Listening Session Summary

Roger Klemm - Public
- Sediment is a valuable resource and it is a flow that will never stop. Use it for beach replenishment and road construction.
- Flows are intermittent, need to take that into account. Take a little every year instead of performing a huge cleanout every ten years.

Dr. Clyde (Tom) Williams – Sierra Club/LA 32 Neighborhood Council
- Where are the design and operation and maintenance (O&M) manuals?
- Take exception to the comment that "estimating needs is difficult."
- Engineers are expected to solve difficult problems.

Suzanna Mast - Public
- Concerned about the La Tuna site which has 60 oaks to be removed.
- La Tuna and other sites that require taking out oaks should be removed from consideration.

Lynnette Kampe – Theodore Payne Foundation

- Cost effectiveness should take into account long-term recurring costs. Cost of lost habitat should be carried into perpetuity.

Snowdy Dodson – California Native Plant Society and Theodore Payne Foundation

- Preserve the diversity of oak woodlands. Any open space or natural space is a valuable resource. Arcadia Woodland could have been used as a natural open space area. To purchase similar open space would have been millions and millions of dollars. One oak tree is worth $30K, when combined into a woodland the overall cost is even greater.

Marianne Simon - Public

- Stood by and let the Arcadia Woodland be plowed under and did not complain. Here as a voice for the oak trees.
- Sites should not be placed on a pristine resource.
- Sediment is a resource: rich and fertile soil to be possibly used by farmers.
- Look upstream and see if we can slow the sediment moving downstream. More difficult to deal with a problem once it has rolled downstream.

Lisa Novick - Public

- Concerned about proposal to clear-cut mature oaks in La Tuna Canyon.
- Science Magazine article about 6th mass extinctions – current loss of species.
- Burned area has left seed stocks significantly decreased.
- La Tuna is the last natural area. No sediment or fill on pristine landscapes.
- Do a cost analysis on how much it would cost to take to the Vulcan Material site.

Scott Wilson – Neighborhood Church

- Read book titled “Control of Nature.” About 1/3 of the book is dedicated to FCD.
- Propose to change the name of the Flood Control District.
- Peabody Coal Mines in AZ pipe coal across state and place it in Colorado River power stations.
- Can’t we have a natural approach to this?
- Can’t we pipe to ocean?

Robin Robinson – Neighborhood Unitarian Church

- Believes approach should be consistent with environmental principals.
- We should have respect for the interconnected web of all beings.
- We should find alternative ways.
- Follow precautionary principle – if you are going to do harm to the environment try and find an alternative way.

Lori Paul - Public

- Interesting to have listening session before the rest of the program to comment on.
- Devil’s Gate was not originally included on sign-in/interest sheet but added after the beginning of this meeting.
- The county has acquired properties back in the 50s so it is cheap to use because it is already owned. Everything is done in emergency mode.
- Emphasize that these lands are absolutely irreplaceable.
- CEQA is not up to date.

- SPS lands need to be transferred to Parks and Recreation.
- Lands have value and need to be protected.
- Represent isolated areas of habitat that once were interconnected.
- Notification of public for Arcadia was insufficient; we are in the internet age and notification should have been done over internet and should be done for any destruction of environment in the future.
- Mitigation measures are insufficient or not being done with appropriate public involvement.
- Not clear that the correct trees are being planted by Big T as mitigation.

Rody Stephenson - Public

- La Tuna Canyon should be taken off the table.
- Consider Verdugo Mountain Wilderness Area across from La Tuna – give it to the Nature Conservancy.
- Interested in Devil's Gate project. About 15 acres of mostly willows may need to be taken out. Spare as many trees as possible.
- Wants to know who the EIR contractor is and the schedule and budget, why aren't they presenting. Additionally when will scoping meeting for CEQA be held?

  [Public Works is still in the process of hiring a consultant to complete the environmental documentation for the Devil's Gate reservoir cleanout project]

Julia Tarnawski – Landowner in Shadow Hills/La Tuna Canyon

- Don't ignore wildlife corridors. All kinds of creatures use these areas to travel for food and their lifestyles.
- Keep the trails open.
- Going to La Tuna will interfere with wildlife corridors.
- Leave La Tuna alone.

Laurie Walcutt - Public

- There has to be another longer-sited natural solution. Many reuses of sediment. Use the material for building materials. Maybe adobe or other building material.
- Manage the forests better to prevent fires and these kinds of debris flows.

Christle Balvin – Urban Wild Network

- Restate/reconsider mission statement for DPW.
- Areas that have been chosen are where nature grows and where there is wildlife.
- Public can understand what engineers understand – prepare good, transparent documents.

Bruce Campbell - Public

- South Central Farmers support group.
- There are other needs for sediments.
- Alleged mudflows coming from Station Fire area.
- Trees are needed for hillside stability.
- Public workers are not the problems but some of the top management responsible for destruction of wildlife should change or should hit unemployment line.
- There could be species impacts.
- Don't mess with habitat for sediment sites.

Bill Weisman - Public

- Lives immediately downhill, in the shadow, of Dunsmuir SPS.
- Likes the idea of minimal impact to environment, but not seeing it.
- Sediment is stacked up in terraces like a layer cake with complicated drainage systems and hydroseeding to prevent erosion.
- Hope the placement is seismically stable as engineers state.
- Smells diesel fumes when SPS is in operation; smell of fumes can't be mitigated.
- Required backup alarms echo through canyons; that impact can't be mitigated either.
- Haul routes rip up pavement and there have been several accidents.
- There is a proposed development near La Tuna called Canyon Hills with 200 proposed homes that already have their entitlements. The La Tuna site impacts should be added to the impacts of the proposed development to determine a cumulative impact.

Teresa Young - Public

- LA Basin has never been planned.
- Situations like natural occurrences hit us in wrong places.
- FCD has responsibility to clean out debris basins each year.
- Focus on planning with a review to the value of our land.
- Cost analysis considering the value of trees not the cost to tear them down.
- Golden Oak Borer is coming north; that will affect our oak trees.
- Asking the wrong questions. The questions should be – do we value these trees?
- Vulcan Materials asked if they can have sediment. Use the Vulcan Durbin pit. Concerned with how close it is to the 605 freeway. Sediment was said to be bad and would cause eutrophication of the water tables.

Charly Shelton – Crescenta Valley Town Council

- Defends trees and loves the sediment.
- Works for newspaper in La Crescenta area.
- Sensitive to any other losses after Station Fire and small local fire.
- Dealing with lots of sediment.
- Oaks matter a lot. Trees are a big thing to their small town. Town is made better by giant oak trees.
- Vulcan material site is an option.
- Consider monetary gain of trees at $30K/piece and how much public support is worth.
- Meeting turnout shows that people care.
- Don't forget who you work for – we want trees kept.

Laurie Gould - Public

- Stood as symbolic guard at gate to Arcadia oaks.
- Don't want to see any more loss of oaks.

David Czamanske – Sierra Club – Pasadena Group & Urbanwild Network

- Movement of sediment
  - Sluice in pipeline or open channel to ocean is best long-term solution.
  - Coal slurry was moved 300 miles from Navajo Reservation to power plant.
- Fish and Game has a problem with sluicing.

- Push for low emission trucks – company in Japan.
- Need for technology forcing regulations – Department should put requirements in bidding process to require contracts to supply low emissions vehicles.
- Oak Woodlands Habitat Strategic Alliance has prepared an Oak Woodlands Habitat Conservation Plan for LA County – keep this document and organization in mind.
- The fact that County owns land should not be a prime consideration for what happens to that land.
- Confused by procedure - there are two divisions working on the problem. What is the relationship between these two divisions and future planning? Looking for Department to respond.
- If this Department can't solve problems to the issues will be taken to the Board and then to the courts.

Laura Garrett – Pasadena Audubon & Urban Wild Network

- Urbanwild Network is new organization born from disaster of Arcadia oaks.
- Arcadia was a horrible price to pay for a lesson.
- Thought DPW worked for the public.
- Level of arrogance was breathtaking.
  - Public was repeatedly ignored.
  - Woke us up.
- Would like a new paradigm for 21st Century
  - Transparency to public.
  - Work with nature not against it.
- Think outside box – listen to public. You can come to us for help.
- Destroying habitat is very bad. Find alternatives.

Madeline Graham – Public (read by moderator)

- There has to be a better solution than cutting down oaks.

<u>Sediment Management Strategic Plan – Alternatives Screening Tool Presentation</u>

Dan Sharp of Los Angeles County DPW Watershed Management Division presented on the Alternatives Screening Tool which will be used to evaluate alternatives for the Sediment Management Strategic Plan. The Alternatives Screening Tool will be developed with input from the Task Force and other stakeholders. While consideration will be taken for stakeholders concerns and opinions, the Flood Control District must meet its primary goal to manage sediment in order to provide for the flood risk management and water conservation needs of the region while balancing economic, environmental, and social concerns. The Department is proposing four evaluation factors:

Technical Feasibility Factor:

- Ability to meet needs
  - Peak demand
  - Long-term (20-year) needs
- Technical certainty
- Maintenance intensity
- Right-of-way
- Permitting complexity

- Consistency with surrounding land use

Cost Factor:
- Unit present value cost
- Initial cost & long-term operations costs
- Single number in today's dollars

Environmental Factor:
- Habitat
- Water quality
- Air quality / emissions

Social / Quality of Life Factor:
- Traffic
- Noise
- Scenic resources

This list is not final. Feedback forms were given to attendees and are being sent out to Task Force members not in attendance to comment on the proposed factors, propose additional factors and/or considerations, and also to suggest weights for each factor. The weighting of all factors will equal 100%. The Department aims to get a broad perspective on the Screening Tool and will not be taking the feedback as a vote since we retain the responsibility to carry out our mandate within a limited budget. The forms must be returned to Public Works by May 2, 2011 for consideration. Any additional comments or questions regarding the Sediment Management Strategic Plan may be submitted at any time to SedimentMgmtPlan@dpw.lacounty.gov.

Once the Screening Tool is developed, it will be used to evaluate categories of alternatives. Results will be reviewed by both Public Works staff and the Task Force. Alternatives that pass the screening process will be analyzed in more depth. Results of that analysis will be reviewed by both Public Works staff and the Task Force.

Questions and Comments on Alternative Screening Tool:

Question (Q): Please give details of contract, who, how much, timeframe, etc.
Answer (A): The consultant contract is with AECOM and Tetra Tech. The scope is for approximately $1.3 Million and work will proceed through the submittal of their draft report in December 2011. Copies of the Sediment Management Study Scope of Work were available at this meeting and are available upon request.

Q: Is there a web page for design and O&M manuals?
A: Some of the design and O&M manuals are available online but not necessarily all of them and not necessarily on the same page. The Department can send this information out.

Q: Will this group have input to the specific factors and how they will be used?
A: Yes, we have feedback forms that ask for input on these specific factors and the weights for those factors.

Q: Which County Supervisor does the Department report to for this project?
A: The Department reports to all five supervisors.

Q: What Federal agencies have authority?
A: Many Federal agencies have authority however it depends on the project.

Comment: Consider beneficial uses of beach replenishment.
Comment noted.

> *[As part of the Sediment Management Study, the consultant will analyze beach replenishments as one of the beneficial reuses of sediment]*

Comment: 20-years is not long term. Emphasis should be put to a sustainable, forever plan.
<u>Response:</u> The plan will strive to find sustainable solutions so that at the end of 20 years there won't be a need for an additional plan.

Other comments
- 20-years is not long-term. Emphasis should be put on a sustainable, forever plan.
- Encourage to state that this is a forever plan.
- Call it sustainability.
- Three environmental factors: water quantity and stability should be added for sustainability.
- Local, regional and global climate change should be added.
- Adding numerical values for a number of criteria is not good enough. There should be gateway criteria first.

Comments noted.

<u>California Department of Fish and Game – Presentation</u>

Helen Birss, Environmental Program Manager, and Terri Dickerson, Senior Environmental Scientist, of the California Department of Fish and Game (DFG), presented a summary of the process and role of DFG generally. They indicated they were not at the meeting to speak specifically about permitting sediment management projects.

- DFG is 1 of 4 trustee agencies for the California Environmental Quality Act (CEQA). DFG has jurisdiction by law over natural resources.
- The roles of DFG are to comment on CEQA documents and develop Streambed Alteration Agreements.
- Sediment management projects typically require a Streambed Alternation Agreement, which falls under Section 1600 of the Fish & Game Code.
- If there is a permit process that is when DFG becomes a responsible agency.
- DFG has jurisdiction over streambed, bank, and riparian habitat.
- Although DFG does not have discretionary authority to deny a Streambed Alteration Agreement, DFG works with the project proponent to avoid and minimize impacts to resources. Any remaining impacts are addressed through compensatory mitigation.
- See www.dfg.ca.gov → resource management tab for CEQA and Streambed Alternation Program.
- DFG is the State counterpart of US Fish and Wildlife Service.

- The law requires any person, state or local governmental agency, or public utility to notify DFG of any proposed activity that will alter a river, stream, or lake.
- Based on this notification and other information, DFG then determines whether a Lake and Streambed Alteration Agreement is required.
- The end goal is to have an agreement in place that satisfies everybody.

Questions and Comments for Fish & Game:

Comment: Term agreement says 2 parties are in agreement.
Comment noted.

Q: If there is a violation, like in Arcadia, when you find retroactively or if there is no streambed alternation agreement – what is being done?
A: To speak on generalities, arbitration is between DFG and Public Works. The Arcadia Agreement is in compliance.

Q: Is sediment removal being considered streambed alteration?
A: Yes.

Q: Are you going to provide comment on the report of the sediment management study?
A (Dan Sharp, DPW): A copy of the study will be sent to DFG for review.

Q: What are the most recent Streambed Alteration Agreements?
A: Terri Dickerson asked the person who asked the question to see her after the meeting to discuss how she would get that information to him.

Q: If the SPS is above the riparian habitat do you have any jurisdiction?
A: Most likely not though there may be indirect impacts that could possibly be considered.

Q: If someone works in a streambed without a permit, is there any enforcement?
A: If someone works in a streambed without a permit they may be penalized. Enforcement would be by Fish & Game. The County had an agreement [for the Santa Anita Reservoir sediment removal and placement project].

Q: Was there an agreement between all agencies and the public in Arcadia?
A: The agreement is between Fish & Game and Public Works. Public involvement would happen during CEQA. Look at FAQs under CEQA online. There are some requests out to get more information about what happened in Arcadia.

Comment: I read that CEQA does not require that the public be notified. It says that the public may be notified.
Response: There is a State Clearinghouse for CEQA documents you can go to individually.

California Regional Water Quality Control Board – Los Angeles Region Presentation

LB Nye, Senior Environmental Scientist for the Los Angeles Regional Water Quality Control Board (Regional Board), presented on the permitting process of the Regional Board.

- Regional Board is an environmental resources agency.

- Regional Board regulates under the Clean Water Act as well as the Porter-Cologne Water Quality Control Act.
- Protect water ways even if they are dried up or lined with concrete.
- Section 401 of the Clean Water Act says that states must certify projects such as sediment management.
- A 401 Certification typically includes conditions such as BMPs.
- Waste Discharge Requirements (WDR) are developed under Porter-Cologne.
- Regional Board may choose one of two ways to permit a project. Different projects are appropriate for different approaches. A Section 401 Certification is fastest.
- A WDR (with the 401 incorporated) takes longer and has public hearings. It is better if you are trying to balance competing issues.
- Regional Board protects beneficial uses of waters of the state.
- When considering these projects, the Regional Board looks at the long-term and short-term plan. Emergencies happen and short-term is needed however long-term plans are preferred.
- Regional Board needs to know that project proponent has looked at all alternatives including project alternatives that work with the environment.
- Regional Board's approach (in order): avoid, minimize, mitigate.
- Monitoring may be required if there are impacts to water quality.

Questions and Comments for the Regional Board:

Q: What about runoff from placement of debris?
A: A permitted project would have requirements for compliance with the permit. If they are not in compliance there can be enforcement.

Q: Concerned with water recharge after the Station Fire – where is the protection for recharge aquifer zones?
A: Regional Board would only be involved with recharge at explicit recharge facilities such as spreading grounds.

Q: Did the Arcadia/Santa Anita project have a 401 Certification or a WDR?
A: Regional Board did certify where the sediment was being taken from, however there is no waterway at the location where the sediment is being taken, therefore sediment placement did not require certification.

Comment: So much decision making happens in small sections. Even when minimizing impacts, you can have something like La Tuna.
Response: One of the most important things is to look at the different alternatives.

Comment: Concerned with La Tuna not being considered individually and instead being rolled into the long-term plan. It seems like a clever way to trick the public.
Response (Gary Hildebrand, DPW): La Tuna will be going through the same screening and evaluation process as all of the other sediment management alternatives being analyzed during the development of the Sediment Management Strategic Plan. Everyone will be collectively involved throughout the process.

Post-Fire Reservoir Sediment Removal Projects

Ken Zimmer, of Los Angeles County DPW Water Resources Division, presented on the upcoming five reservoir cleanout projects: Cogswell, Pacoima, Big Tujunga, Morris, and Devil's Gate.

Approximately 160,000 acres of land were burned during the Station Fire in 2009. Another 2,000 acres were burned in the Morris Fire of 2009.

The Flood Control District has 3 major concerns when it comes to reservoirs: 1) protect the outlet valves, 2) adequate capacity for Flood and Debris Control, and 3) water conservation storage.

There are several regulating agencies depending on the project location, including the Regional Board, Fish & Game, US Army Corps of Engineers, and sometimes the US Forest Service. The timeline to begin a reservoir cleanout following a fire in a watershed can take anywhere from 2-3 years. That is 2-3 years before any sediment is removed. The following is a summary of the upcoming reservoir cleanout projects.

Devil's Gate Reservoir:

- A full Environmental Impact Report (EIR) will be completed for this reservoir per the Board of Supervisors motion.
- 68% of watershed burned.
- 10 times more sediment has been deposited than has accumulated in the past16 years.
- Some valves are currently inoperable.
- Sediment has risen 23 feet at the face of the dam.
- Scoping meetings will be the most important time for public input and participation is highly encouraged.
- Interim operational measures will be taken.

Cogswell:

- 90% of watershed burned.
- There has been 6 times the annual sediment accumulation.
- Sediment has risen 30 feet at the face of the dam.
- Plan is to place sediment removed on a 27-acre portion of Cogswell Sediment Placement Site, 20 of which will need to be mitigated.

Pacoima:

- 76% of watershed burned.
- Sediment rose 15 feet at the face of the dam.
- 50% capacity is taken up.
- Plan is to sluice 2.4 MCY to Lopez Dam. The sediment would then be taken from Lopez Dam to Vulcan Pit.

Big Tujunga:

- 87% of watershed burned.
- Sediment rose 25 ft at the face of the dam.
- Plan is to bring removed sediment to already burned Maple Sediment Placement Site.

Morris:

- 35% of watershed burned.
- Plan is to truck to local mining areas.
- Currently completing mitigated negative declaration.

More sediment is expected to come in over the next 5 years. There will be community meetings held on weeknights and weekends regarding these projects.

Questions and Comments on Post-Fire Reservoir Sediment Removal

Q: Have other are Sediment Placement Sites besides Maple Sediment Placement Site been burned?
A: Some have been burned. Cogswell Sediment Placement Site was not.

Q: Where is the ~25,000 CY from Devil's Gate proposed to go?
A: Scholl Canyon Landfill.

Q: For which reservoir cleanouts was La Tuna Sediment Placement Site supposed to be the sediment placement location?
A (Chris Stone, DPW): Multiple projects were being considered – possibly Big Tujunga, which would be a multi-year cleanout process. La Tuna will now go through the Strategic Plan process and alternate placement sites will be used for upcoming reservoir cleanouts.

Q: Where do we find information regarding any upcoming scoping meetings?
A: DPW will be diligent about sharing this information. Information will also be placed on the reservoir cleanout website *[http://www.dpw.lacounty.gov/wrd/Removal/index.cfm]*.

Q: When will the initial environmental study at Cogswell be completed?
A: There is currently no timeline.

Q: How many small debris basins are located in the areas affected by recent fires?
A: Approximately 28 debris basins.

Q: Will there be EIRs for all of the reservoir cleanout projects?
A: Only for Devil's Gate as directed by the Board of Supervisors.

Q: If DPW is not pursuing La Tuna, why are there "death tags" to cut down oaks?
A: The tags on the trees are not to indicate that those trees will be cut down but rather used for a biological survey of the area.

Comment: A list of attendees should be put online.
Response (Diego Cadena, DPW): We will have to talk to our County Council before we share any contact information. We must respect peoples' privacy. [We will provide names of attendees, but emails will remain private.]

Other comments:

- It is still unclear what happened in Arcadia. Did it happen because material could not be sluiced? Isn't DFG a trustee for public lands? It doesn't make sense.

- Clarification should be given about the different CEQA document - Mitigated Negative Declarations, EIRs, EAs … etc.
- An EIR should be completed for all projects. It is the only way to build confidence in the operations of the Department.
- What will we do when the pits are all gone? Sustainable solutions need to be developed.
- Why can't we use the sediment to build barrier to protect the San Onofre Nuclear Plant and the millions of people in San Diego from tsunamis?
- Managers/decision makers should go out to the field and see these sites they are giving approval to destroy. The trees torn down will not be restored within our lifetimes.
- There is a large range of emotions under all of these comments and DPW needs to listen carefully.

Comments noted.

Wrap Up

Gary Hildebrand wrapped up the meeting by discussing how the region's sediment affects us all. He spoke of the need to continue to collectively develop optimal solutions for this difficult problem we are facing. Water Resources Division and Watershed Management Division are working very closely on all of these projects. Both divisions are also working very closely with DPW administration.

Given the complexity, regional impacts, and broad interests in sediment managementand drawing on the experience with the Integrated Regional Water Management Plan agencies DPW realized that creating a small advisory group to provide decision-making guidance on the sediment management projects could be fruitful. Therefore, DPW Administration decided to form a small Sediment Management Advisory Working Group to provide additional input and perspective based on the members' diverse experience and key roles in the stakeholder community. This group is comprised of:

- Tim Brick, Managing Director of the Arroyo Seco Foundation,
- Jerry Burke, Assistant Public Works Director and City Engineer for the City of Glendora,
- Rebecca Drayse, Director of Tree People's Natural Urban Systems Group,
- Tom Erb, Director of Water Resources at the Los Angeles Department of Water and Power,
- Laura Garrett, Conservation Chair of the Pasadena Audubon,
- Frank Girardot, Editor of the Pasadena Star-News,
- Dr. Shelly Luce, Executive Director of the Santa Monica Bay Restoration Commission,
- Jeff Pratt, Director of the County of Ventura Public Works Agency,
- Dan Rix, City Engineer for the City of Pasadena, and
- Tony Zampiello, Assistant Executive Officer of the Main San Gabriel Basin.

The group will be providing feedback on all of the Flood Control District's sediment management efforts which DPW will compile and share with the stakeholders.

Gary thanked everyone for attending and expressed his hope for continued participation in the development of the Sediment Management Strategic Plan and our upcoming reservoir cleanout projects.

Sediment Management Strategic Plan
Task Force Meeting # 2 Attendee List

Agency/Organization	Name	Title
Arroyo Seco Foundation	Tim Brick	Managing Director
California Department of Fish and Game	Helen Birss	Environmental Program Manager
California Department of Fish and Game	Terri Dickerson	Senior Environmental Scientist
California Dept. of Fish and Game	Kelly Schmoker	
California Native Plan Society/Public	Barbara Eistenstein	
California Native Plant Society/ Thedore Payne Foundation	Snowdy Dodson	Board Member
California Regional Water Quality Control Board - Los Angeles Region	Deb Smith	
California Regional Water Quality Control Board - Los Angeles Region	LB Nye	
California Regional Water Quality Control Board - Los Angeles Region	Sam Unger	Executive Officer
Chevy Chase Estates Garden Club	Marianne Bamford	Treasurer
Chevy Chase Estates Garden Club	Mary Betlach	President
Chief Transportation & Engineering Contractors	Jose L. Aceituno	Estimator / Project Manager
City of LA - CD #2	Mary Benson	Community Representative
City of Sierra Madre	Oliver Cramer	Analyst
Community Forest Advisory Committee/Theodore Payne Foundation	Lynette Kampe	Executive Director (Theodore Payne Foundation)
County of Los Angeles Department of Beaches and Harbors	Paul Wong	
Crescenta Valley Town Council	Charly Shelton	
CUCA	Roberta Medford	
EnviroMINE Inc.	Crystal Howard	Manager
Friends of Hahamonga	Mary Barrie	
Hintz & Balvin Communications	Christle Balvin	
LA-32 Neighborhood Council & Sierra Club - Angeles Chapter	Tom Williams	Board Member
Los Angeles and San Gabriel Rivers Watershed Council	Nancy Steele	Executive Director
Los Angeles Department of Water and Power	Susan Avila Suarez	
Neighborhood Unitarian Church	Robin Robinson	
Neighborhood Unitarian Universalist Church - 7th Principle Committee	Hennelore Bauer	
Pasadena Audubon	Laura Garrett	
Public	Alex Squiers	
Public	Allen Savedoff	
Public	Andrea Hessing	

Agency/Organization	Name	Title
Public	Bill Eutz	
Public	Bill Weisman	
Public	Bruce Campbell	
Public	Cam Stone	
Public	Dan Kronstadt	
Public	Darren Thorne	
Public	Dave Czamanske	
Public	Elizabeth Lanski	
Public	Emma Stark	
Public	Ginger Alberti	
Public	Ginny Heringer	
Public	Glen Owens	
Public	James Kimmick	
Public	Janica Jones	
Public	Karen Bonfigli	
Public	Laurie Walcutt	
Public	Lisa Novick	
Public	Lori Paul	
Public	Madeline Graham	
Public	Marianne Simort	
Public	Mary Hayden	
Public	Michael Sabo	
Public	Millie Paul	
Public	Morton Gorel	
Public	Robert Conner	
Public	Robert Ruby	
Public	Rody Stephenson	
Public	Roger Klemm	
Public	Sally Kalaghan	
Public	Scott Wilson	
Public	Sharon Olsen	
Public	Susan Bartow	
Public	Suzanna Mast	
Public	Terry Young	
Public	Tori Collender	
Public	William Bertrand	
Public	Wynesta Dale	
Raymond Basin Management Board	Tony Zampiello	Executive Officer
Republic Services	Ruford Garcia	Communications Relation Manager
Resident - Shadow Hills/La Tuna Cyn	Julia Tarnawski	Public
Sanitation Districts of Los Angeles County	Sam Shammas	Project Engineer

Agency/Organization	Name	Title
Sierra Club	Don Bemner	
Sierra Club	Linda Doran	
Slake Magazine	Emily Green	
Stetson Engineers, Inc. (Raymond Basin Management Board)	Steve Johnson	Corporate Senior Vice-President, Principal Engineer
Theodore Payne Foundation	Andrew Peck	
Theodore Payne Foundation	Ann Schultz	
Theodore Payne Foundation	Destiny Floyd	
Theodore Payne Foundation	Imran Asif	
Theodore Payne Foundation	Kevin Steinhauer	
Theodore Payne Foundation	Leslie Lipton	
Thomas Payne Foundation	Jeanne Kirhofer	
Trammell Crow Company	Jason Gremillion	
Transition San Fernando Valley	Bruce Woodside	Steering Committee Member
U.S. Forest Service - Angeles National Forest	Esmeralda Bracamonte	San Gabriel River Ranger District Resources Officer
U.S. Forest Service - Angeles National Forest	Tasha Hernandez	Santa Clara/Mojave Rivers Ranger District Resources Officer
United Rock Products	Russ Caruso	
Urban Wild Network	Laurie Gould	
Urban Wild Network	Susan Rudnicki	
Vulcan Materials Company	Jeff Camron	
Vulcan Materials Company	Mike Linton	Vice President
Waste Connections Inc. - SCS Engineers	Robert Johnson	Senior Project Director
Weston Solutions	Michael Drennan	Vice President, California Regional Manager
Weston Solutions	Rod Tobias	

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Los Angeles County Flood Control District
Sediment Management Strategic Plan Task Force Meeting # 3

Wednesday, June 29, 2011
2:30 pm to 4:30 pm

LA County Department of Public Works Headquarters Building
900 South Fremont Avenue. Alhambra, CA 91803
Conference Rooms B&C

Goal

Manage sediment in order to provide for the flood risk management and water conservation needs of the region while balancing environmental, social, and economic concerns.

Agenda

1. Welcome
2. Follow-up from the Second Task Force Meeting
3. Background on Sediment Processes
4. Sediment Management Alternatives
5. Alternatives Ranking Tool
6. Feedback Received
7. Tentative Ranking Results & Next Steps
8. Moderated Discussion
9. Wrap-up

Notes

Please email questions and comments regarding the Sediment Management Strategic Plan to SedimentMgmtPlan@dpw.lacounty.gov.

For additional information regarding all sediment management projects please visit www.lasedimentmanagement.com.

Los Angeles County Flood Control District
Sediment Management Strategic Plan Task Force Meeting # 3

Wednesday, June 29, 2011
2:30 pm to 4:30 pm

LA County Department of Public Works Headquarters Building
900 South Fremont Avenue. Alhambra, CA 91803
Conference Rooms B & C

Meeting Summary

Note: For reference purposes the following are included in the meeting summary:

- Meeting agenda (page 8).
- Invitation list for the meeting (page 9).
- List of attendees (page 15).

<u>Welcome & follow-up from the second Task Force meeting</u>

Gary Hildebrand, Division Head of the Watershed Management Division of the Department of Public Works (Public Works), welcomed Task Force members, discussed the agenda, and summarized the major themes of comments from the last Task Force meeting. The major themes included:

- Openness and the need for transparency.
- Care for the environment.
- The need for long-term sustainable solutions.

Gary shared that during the initial meetings with the Sediment Management Advisory Working Group the Working Group raised many of the same concerns as the Task Force.

<u>Background on Sediment Processes</u>

Marcela Benavides of the Watershed Management Division discussed the following:

- A history of major flooding in the Los Angeles Basin, the creation of the Los Angeles County Flood Control District (Flood Control District), and the construction of dams.
- A description of sediment accumulation and its affect on dam operations.
- Debris basins and their operation.
- The reasons why the Sediment Management Strategic Plan is being developed.

<u>Sediment Management Alternatives</u>

Gerard Dalziel of AECOM, a member of the consultant team working on the Sediment Management Study, discussed the transportation alternatives and sediment processing and placement site types under consideration.

- Transportation alternatives include:
    - Trucking - standard, low emission, and in channels.

  - Cable bucket systems.
  - Conveyor belts.
  - Sluicing and slurry pipelines.
  - A combination of trucking and rail transport.
- Processing location alternatives include:
  - Existing processing facilities.
  - New processing facilities in industrial areas, landfills, and active sediment placement sites (SPSs) and remote or residential areas with recoverable or sensitive habitat.
- Placement alternatives include:
  - Currently active and new SPSs either on Flood Control District property or newly acquired property.
  - Quarry pits.
  - Ocean placement and beach replenishment.
  - Landfills as daily or final cover.

Alternatives Ranking Tool

Bill Brownlie of Tetra Tech Inc., another member of the consultant team working on the Sediment Management Study, described the tool being used to rank the various alternatives

- The ranking tool is composed of five major factors, each which is scored to a maximum of 10 points, with 10 being best. The factors are:
  - Environmental Factor
  - Social/Quality of Life Factor
  - Performance Factor
  - Implementability Factor
  - Cost Factor
- Each factor is composed of several criteria. The maximum points attributed to each criterion within a factor are based on the relative importance of that criterion when compared with the other criteria in the same factor.
- A description of how the criteria are scored and how the tool is used was provided.

Feedback Received

Dan Sharp of the Watershed Management Division discussed the feedback received from the last meeting and how it had been implemented into the ranking tool, as summarized below.

- Add long-term (>20 year) sustainability → The tool now includes a Performance Factor that includes long term needs.
- Add wildlife corridors to the environment factors under consideration → Corridors were included in the Environmental Factor criteria.
- Include effects on groundwater recharge → Recharge was included as a criterion in the Environmental Factor.
- Consider effects on recreation → Added as a criterion in the Social Factor.
- Screen for the environment first → The tool was revised to add the ability to isolate and review the social and environmental factors.

Tentative Ranking Results & Next Steps

Dan explained the tool had been used to rank the alternatives based on the tool's Environmental Factor and the Social/Quality of Life Factor only, with a 50 percent weight applied to each factor. He presented and discussed the tentative rankings of the transportation, processing locations, and placement alternatives that resulted from that approach. Comments on the ranking tool and tentative results were requested by July 14th [*The due date was changed to July 18th at 9 am subsequent to the meeting*].

The next steps are as follows:

- Incorporate feedback from the Task Force on the ranking tool and tentative results.
- Combine transportation alternatives with processing location and placement alternatives.
- Analyze cost, performance, and implementability for the subregional solutions.

Moderated Discussion

1. Dave Czamanske - Sierra Club

- What happens at a sediment processing site? What comes in/goes out?

  Response: The facility would take our unprocessed material and turn it into usable material like construction material.

- What about using the sediment for construction materials? How do you deal with organics?

  Response: We are currently working on that with our consultants. Representative sediment samples taken from three of our facilities have not shown significant organic content; however there are ways to deal with the organics if they are there.

2. Vicki Brink - Foothill Trails District Neighborhood Council, Equestrian Center Owner/Operator

- I have tried to get the sand from Santa Anita. We pay $600 for 15 CY of sand. Equestrian and other private facilities have a great need for sand. Everything behind Santa Anita Dam is usable. It's a great commodity; let's try to use all of it. Talk to the Vulcan Pit operators; placement in a quarry is good. Was the community near Santa Anita Dam and Santa Anita Sediment Placement Site aware a conveyor belt was going to be used? It is going to be loud.

  Response: The Flood Control District definitely agrees with trying to beneficially use as much of the sediment as possible. Use of sediment is looking promising.

- Placing sediment in La Tuna Canyon does not make sense; it seems sediment would be moved from behind one dam to a site behind another dam.

  Response: There is little erosion at sediment placement sites due to the way drainage is configured at the sites.

3. Teresa Young - San Gabriel Mountains Regional Conservancy

- Beginning to understand what the Flood Control District is working on.
- Personal experience with conveyor belts is that they are extremely noisy. A slurry pipeline is less noisy however sediment movement is an on and off process which may cause the pipe

to become caked with material. Paint pipe to blend in with environment. May be better than trucks.

- How do you realistically weigh environmental questions including the true impact to bird populations? Birds may disappear during times of disturbance but can come back. It is difficult to assess the true value of environmental areas since they are ecological systems. The Flood Control District should not go through sensitive areas.

  Response: The Flood Control District agrees and does not mean to diminish any the comments, but there are some sites that may be reasonably considered to have a much higher environmental impact than others.

4. Snowdy Dodson - California Native Plant Society/Theodore Payne Foundation

- After all of the dams and debris basins were put up, this area became unsustainable. Are there any plans in the works to eliminate the need for dams or debris basins?

  Response: We have a two-fold issue. We have infrastructure (that is, the dams and channels) resulting from the decisions that were made many decades ago on how flood risk and water conservation would be managed in the Los Angeles Basin. We are living with the system resulting from the decisions made many decades ago. For the immediate near future (say 20-30 years), we need to make sure the system we currently have is able to perform its functions and so we need to identify and implement solutions in a relatively short time frame (next few decades). Looking way down the line, at a much longer term period, there are studies that are under way to see if we can incorporate some more natural, sustainable features. Studies underway with the Army Corps of Engineers include ecosystem restoration studies along the Los Angeles River and Arroyo Seco. We need to see what we can do within existing constraints including development has been built right up to the channel system. It took us many decades to get to where we are today, it will take us many decades to change the system as a whole.

5. Linda Doran - Sierra Club

- We have a highly unnatural system. Are there any engineering solutions that could start to let some of the sediment flow downstream? There is a CALTECH study concerning 20-year cycles in sediment production. Using sediment and filling pits with sediment is great, but we have a lot more sediment to deal with in the long term. We cannot hold the mountains back. Sediment production will continue. We need a 100 or 150-year plan. We need to allow the rivers to become more natural and carry sediment to the beach. Maybe we need to start buying property where the floodplain would be. We don't want the rivers to meander all over, but let the river be a river. Can we find an in-between plan? Let's think of a plan 100 years out so we can start to live more sustainably.

6. Kiran Magiawala – Public (Retired Engineer)

- American Rivers is a large non-profit organization that looks at the long-term revitalization of rivers.
- Start a long-term study and include long-term issues and pass it on through generations if scope is too large.
- In regards to placing sediment on landfills, maybe using the clay materials in the sediment as landfill caps may reduce methane emissions from the landfills.

7. Susan Rudnicki - Urbanwild Network

- Under the cost factor on the tool there is no analysis for the loss of mature habitat. There are monetary values for individual trees. The values should be quantified, that is very important to make decisions.
- It has been mentioned that a lot of time is needed to change the system as a whole. On the Mississippi River floodplain, the Army Corps of Engineers has been forced to make choices as to what is going to be in the flooding. In the event of a catastrophe, time will be taken away from us.

8. Paul Wong - County of Los Angeles, Department of Beaches and Harbors

- The ranking tool and effort seem to be fair. However, there may be some lack of knowledge about the coastal area.
- At Broad Beach in Malibu they are trying to place 600,000 CY of material on their beaches; they are looking at dredging it from offshore locations. The cost of dredging offshore to replenish the beach is expected to cost $20-30 per cubic yard (CY). Investigate cost sharing of beach nourishment. Offshore pit resulting from the dredging of sand for beach replenishment may accelerate beach erosion at nearby beaches.
- Another placement option to consider is off the coast of Redondo Beach where there is a marine canyon, which has a long-term capacity on the order of 1 billion CY. If there is a long-term, renewable permit with the respective environmental agencies, it can be assured that there will be capacity for the next 100 years.

9. Lynnette Kampe - Theodore Payne Foundation

- The Theodore Payne Foundation is opposed to destruction of natural resources for the purpose of debris disposal.
- Consider the diversity of the plant community in addition to oaks. There are many unique plant communities that need to be considered.
- It is a hopeful beginning to see the public desire to protect natural spaces recognized as well as the redirection of thought to use the sediment instead of disposing of it. The stakeholders will be watching the rest of the process to see the results.

10. Scott Wilson - North East Trees

- Perpetuation of the current practices is making the situation worse. Put the material where nature meant it to go, i.e., where we are now sitting. It seems as though the Flood Control District disregards the value of trees because it owns a piece of property. It gets more expensive every time we do the same thing. If it's too much to handle now, use 1 percent of available funding per year to produce long-term sediment management solutions. If you don't do anything towards it, it will never happen.

11. Nancy Woodruff - Foothill Trails District Neighborhood Council

- Learned about La Tuna Canyon Sediment Placement Site (SPS) about a year and a half ago. La Tuna Canyon is a ravine behind La Tuna Debris Basin. It doesn't make sense to fill a ravine with sediment. A 100-year plan would make more sense than a 20-year plan. The La Tuna Canyon community would like Public Works to continue to consider Vulcan Pit. We need a specific plan emphasizing the high value of habitat. Currently there are more environmental concerns and protections via plans for La Tuna Canyon than there were when the site in La Tuna Canyon was designated as an SPS.

Response: We have investigating placing sediment at pits very seriously.

12. Lori Paul - Biologist/Naturalist

- What is the cost of the current planning effort costing the tax payers? I heard someone say $1.5 Million.

  Response: The total contract with the consultant is approximately $850,000. There are additional optional tasks for about $500,000 that we do not know if we will need.

- The ranking spreadsheet is an arcane tool. What is restorable habitat? The devil is in the details; if bad data is used then results are faulty. Areas that have habitat value should never be considered. All areas with habitat should be removed entirely from consideration and placed in a conservation easement or protected somehow. Using of sediment and sluicing should be a priority.

  Response: At this point we are evaluating the alternatives with a very broad brush to put them in relative categories. In the next phase of analysis, we will identify specific sites and get into the details.

13. Caroline Brown – Public (Resident of Sierra Madre)

- Could the channels be redesigned to handle bulked flow and allow the sediment to flow through?
- There are a lot of empty areas between the mountains and the harbor covered with cement. Why not place solar panels there? Sediment could be used to bulk up areas where needed.

14. Cameron Stone – Public

- The natural system historically got sediment to the ocean. At that time sediment used to be a valuable resource. When the infrastructure was built to control water, sediment became a waste product and nothing was built to handle it. We spent money on infrastructure to deal with other waste products such as sewage. We need to come up with a system to use natural processes to move and process the sediment.

Teresa Young - San Gabriel Mountains Regional Conservancy (Spoke 3rd)

- Mitigation can't always make up for losses. Areas like the Arcadia Woodlands can't be mitigated; they are irreplaceable. Habitat mitigation studies have shown that habitat mitigation has been done poorly and isn't always successful. For example, mitigating with seedlings in a new area does not always work. Mitigation is a very poor stopgap.

15. Snowdy Dodson - California Native Plant Society/Theodore Payne Foundation

- What specific kinds of comments do you want for the 7/14 deadline?

  Response: Comments on the ranking tool itself and the scores given; however, any comments are welcome. The ranking tool will be available for download on our website (www.lasedimentmanagement.com). We understand there is a lot of information there, but we would like to keep our process as transparent as possible. In the next step we will look at specific details. [*The deadline for comments was changed to July 18th at 9 am subsequent to the meeting*]

Dave Czamanske – Sierra Club (Spoke 1st)

- Consider extending the deadline of when the comments are due. [*The deadline for comments was changed to July 18th at 9 am subsequent to the meeting*]

16. Julia Tarnawski - Resident of Shadow Hills/La Tuna Canyon

- There are about 60 oak trees that have been marked in the La Tuna Canyon area; that is very threatening.

  Response: Those are biological survey markers that identify that tree has been quantified and identified. It is not to indicate that any trees will be removed.

Reservoir Cleanout Projects Update

Keith Lilley of the Water Resources Division is the new project manager for the upcoming reservoir cleanout projects, including the Devil's Gate Dam cleanout. He provided an update on the sediment cleanout projects and specifically the Devil's Gate Environmental Impact Report (EIR). Chambers Group has been hired to prepare the EIR. The initial scoping meeting for Devil's Gate is scheduled to be in September or October 2011.

Information regarding reservoir cleanout projects currently in the planning phase can be found at www.lasedimentmanagement.com.

Wrap Up

Gary Hildebrand thanked the attendees for their participation. He explained that the next steps will be evaluating how the alternatives can be applied to each sub-regional grouping. The next Task Force Meeting is tentatively planned for sometime in late August. Lastly, he requested comments on the alternatives ranking tool by July 14th, and closed the meeting. [The deadline for comments has since been postponed until Monday, July 18, 2011]

Sediment Management Strategic Plan
Task Force Meeting # 3 Attendee List

Agency/Organization	Name	Title
Arroyo Seco Foundation	Wilson Lau	Watershed Coordinator
California Native Plant Society/ Theodore Payne Foundation	Snowdy Dodson	Board Member
California Regional Water Quality Control Board - Los Angeles Region	LB Nye	
City of Arcadia Public Works Services Department	Tom Tait	Public Works Director
City of Los Angeles City Council District 2	Mary Benson	Senior Community Representative
City of Monrovia	Mark Carney	Department Director
City of Santa Clarita	Kerry Breyer	Senior Engineer
Community Forest Advisory Committee/Theodore Payne Foundation	Lynette Kampe	Executive Director
County of Los Angeles Department of Beaches and Harbors	Paul Wong	Chief, Planning Division
EnviroMINE, Inc.	Crystal Howard	Manager
Foothill Municipal Water District	Nina Jazmadarian	General Manager
Foothill Trails District Neighborhood Council	Vikki Brink	Committee E8 Chair (Equestrian)
Foothill Trails District Neighborhood Council	Nancy Woodruff	President
Friends of Hahamonga	Mary Barrie	
Katherine Padilla & Associates (KP&A)	Katherine Padilla	President
Los Angeles Department of Water and Power	Susan Avila Suarez	
Los Angeles/San Gabriel River Watershed Council	Deborah Glaser	Policy & Comm.
Neighborhood Unitarian Church	Robin Robinson	
Public	Nils Brink	
Public	Caroline Brown	
Public	Kiran Magiawala	
Public	Glen Owens	
Public	Lori Paul	
Public	Cam Stone	
Public (Resident of Shadow Hills/La Tuna Canyon)	Julia Tarnawski	Public
Public	Scott Wilson	
Public	Terry Young	
Raymond Basin Management Board	Wendy La	Staff Engineer
San Gabriel and Lower Los Angeles Rivers and Mountains Conservancy	Luz Torres	Staff Biologist

Agency/Organization	Name	Title
Sanitation Districts of Los Angeles County	Sam Shammas	Project Engineer
SCS Engineers	Dan Vidal	Project Director
Shadow Hills Property Owners Association (SHPOA)	Dave DePinto	
Sierra Club	Dave Czamanske	
Sierra Club	Linda Doran	
Slake Magazine	Emily Green	
Stetson Engineers, Inc. (Raymond Basin Management Board)	Steve Johnson	Corporate Senior Vice-President, Principal Engineer
Total Transportation Services, Inc.	Tony Williamson	Director, Business Development & Diversity Services
U.S Forest Service - Angeles National Forest	Graham Breakwell	
United Rock Products	Russ Caruso	
United States Forest Service	Chris Fabbro	Lands Specialist
Urbanwild Network	Laurie Gould	
Urbanwild Network	Susan Rudnicki	
US Army Corps of Engineers	Mike Farris	O&M Section Chief
USDA - Forest Service	Sean Barry	Assistant Resource Officer - San Gabriel River Regional District
Vulcan Materials Company	Jeff Cameron	
Vulcan Materials Company	Gary Goellner	Regional Operation Manager
Vulcan Materials Company	Mike Linton	Vice President
Watershed Conservation Authority	Jane Beesley	Deputy Executive Officer
Watershed Conservation Authority	Rob Romanek	Project Manager
Weston Solutions	Michael Drennan	Vice President, California Regional Manager

Los Angeles County Flood Control District
Sediment Management Strategic Plan Task Force Meeting # 4

Wednesday, September 7, 2011
2:00 pm to 4:00 pm

LA County Department of Public Works Headquarters Building
900 South Fremont Avenue. Alhambra, CA 91803
Conference Room C

Goal

Manage sediment in order to provide for the flood risk management and water conservation needs of the region while balancing environmental, social, and economic concerns.

Agenda

1. Welcome and introduction
2. Planning quantities
3. Alternatives analysis process
4. Analysis of transportation alternatives for sediment from two groups of debris basins in the West Area
   - Truck to existing rail network
   - Low emission trucking
   - Standard trucking
   - Slurry pipelines
   - Sluicing in existing channels
   - Cable/buckets systems
   - Conveyor systems
   - Trucking in channels
   - New rail lines
5. Analysis of placement alternatives for sediment from two groups of debris basins in the West Area
   - Sanitary landfills for cover
   - Pits
   - Inert debris fill operations
   - Remote locations with recoverable habitat
   - Beaches
   - Offshore
6. *Devil's Gate Environmental Impact Report process – brief update*
7. Next steps & closing remarks

Released to the public on November 1, 2011

Los Angeles County Flood Control District
Sediment Management Strategic Plan Task Force Meeting # 4

Wednesday, September 7, 2011
2:00 pm to 4:00 pm

LA County Department of Public Works Headquarters Building
900 South Fremont Avenue. Alhambra, CA 91803
Conference Room C

Meeting Summary

Note: For reference purposes the following are included in the meeting summary, which may also be found at our website, www.lasedimentmanagement.com.

- Meeting agenda (page 8).
- Invitation list for the meeting (page 9).
- List of attendees (page 14).

The PowerPoint presentation from the meeting can also be found on the website.

Welcome and Introduction: Terri Grant

Terri Grant, Assistant Division Head of the Watershed Management Division, welcomed Task Force members, outlined the goals and agenda for the Task Force meeting, and presented the Strategic Plan Process and progress to date for this planning effort. The major focus of Task Force Meeting # 4 was to:

- Present detailed analyses of sediment transportation and placement alternatives for two groups of debris basins in the West Area of the Flood Control District; and
- Obtain feedback from the Task Force regarding which alternatives to evaluate further.

Terri also noted we are considering a longer term sustainable vision for the Flood Control District that includes mimicking natural sediment transport processes along with other modifications to the system.

Planning Quantities and Alternatives Analysis Process: Dan Sharp

Dan Sharp of the Watershed Management Division discussed the following:

- Key concepts:
  - Need to periodically remove sediment from reservoirs and debris basins in order to manage flood risk and provide for water conservation.
  - Pursuing sediment management with a balanced approach to environmental, social, and economic concerns.
- The derivation of the 20-year sediment management planning quantities for Flood Control District facilities for the period 2012-2032. The total is estimated to be over 80 million cubic yards (debris basins ≈ 10 MCY and dams ≈ 70 MCY) based on the 80th percentile of observed 20-year sediment production periods.

- Remaining capacity at active Sediment Placement Sites (SPSs) is small compared to 20-year planning quantities.
- Active SPSs will continue to be used while other sediment management solutions are developed.
- Flood Control District facilities within subregions West 2 and West 3 comprise 62 debris basins along the foothills of the San Gabriel Mountains and Verdugo Hills. These debris basins have a combined 20-year sediment planning quantity of 3.6 MCY.
- The alternatives analysis process for West 2 and 3 are now being extended beyond environmental and social considerations to encompass project performance, implementability, and cost.
- Sediment processing for commercial reuse of the sediment is currently under investigation.

<u>Analysis of Transportation Alternatives: Gerard Dalziel</u>

Gerard Dalziel of AECOM presented the analysis of the following sediment transportation alternatives for subregions West 2 and 3:

- Truck to existing rail network
- Low emission trucking
- Standard trucking
- Slurry pipelines
- Sluicing in existing channels
- Cable/bucket systems
- Conveyor belt systems
- Trucking in channels

New rail lines were not evaluated due to high environmental and social concerns.

<u>Conclusion:</u> Due to the wide geographic distribution and relatively small quantity of sediment coming into debris basins, trucking appears to be the most feasible alternative for the West 2 and West 3 subregions. We will continue to evaluate alternatives for debris basins in the remaining subregions. It was also noted that when we evaluate the reservoirs, more alternatives will likely be feasible due to relatively large sediment quantities located in a single location as well as the availability of water for sluicing and slurry pipelines.

<u>Analysis of Transportation Alternatives: Open Discussion</u>

1. Vic LaRosa, President, Total Transportation Services, Inc.
   - How many truckloads are envisioned for transporting 3.6 MCY of sediment?

     <u>Response:</u> 3.6 MCY/10 CY per truck = 360,000 truckloads.
   - Was consideration given to trucking sediment at night?

     <u>Response:</u> No, social impacts to residential communities would be more adverse than daytime operations when many people are away from home.
   - Was the difference in fuel costs for low emission trucks factored into the analysis?

     <u>Response</u>: No, cost difference presented is based on the cost to bring in additional low emission trucks from outside of the region.
   - Currently the Port of Los Angeles is evaluating the performance of low emission trucks powered by liquid natural gas (LNG) and methane which have a diesel fuel cost equivalent of $2.20-$2.50 per gallon. In addition, testing of all-electric trucks using hydrogen fuel cell technology is underway with the delivery of the first such truck just

three weeks ago. Additional hydrogen gas distribution lines within the LA area are needed for this technology to reach its full potential. Initial testing of the all-electric trucks found them very powerful and quiet, and with the added benefit of having no polluting emissions.

Response: We would like to talk to you.

2. Rody Stephenson, Public
   - Consider running slurry pipelines in the flood control channels and using saltwater for the water supply.
     Response: This approach will be investigated.

3. Dave Weeshoff, President, San Fernando Valley Audubon Society
   - Consider using effluent from the Tillman Water Reclamation Plant as a water source for sluicing and slurry pipeline operations. Currently most of this effluent flows down the Los Angeles River to the ocean.

     Response: We will consider reclaimed water as a source of water for slurry pipelines and sluicing.

4. Unidentified Speaker
   - Is the County looking for one solution for all situations, e.g., an infrastructure similar to a wastewater treatment system?

     Response: No, the infrastructure for sediment management would only be used for particular events when it is needed. There is a constant supply of sewage [but not a constant supply of sediment].

5. Kiran Magiawala, Public
   - The County of Los Angeles Sanitation Districts and the Metropolitan Water District should be consulted to determine the availability of excess reclaimed water that may be able to be used for the transport of sediment.
     Response: This will be considered.

6. Kelly Schmoker, California Department of Fish and Game
   - Are you going to consider lifetime cost? Some alternatives may have a lifetime that is longer than 20 years.
     Response: Most alternatives can be adequately analyzed considering a 20-year period. If the lifetime of an alternative is longer than 20 years, we will consider that.

7. Mary Barrie, Friends of Hahamongna
   - Maintenance roads adjacent to flood control channels being considered for the placement of slurry pipelines or conveyor belt systems are sometimes used as recreational trails. Recreational use may be a more important use.
     Response: Impacts to recreation are part of the analysis.

8. Rody Stephenson, Public
   - Will the remaining portion of the analysis address the Flood Control District's reservoirs and facilities in other areas?
     Response: Yes.

Analysis of Placement Alternatives: Bill Brownlie

Bill Brownlie of Tetra Tech described the analysis of the following sediment placement alternatives for subregions West 2 and 3:

- Landfill cover
- Pits in industrial areas
- Inert debris fill operations
- Remote locations with recoverable habitat
- Beaches
- Offshore Placement

Conclusion: The use of sediment as landfill cover is an option for limited quantities and we will continue to pursue pits and inert debris fill operations. Beach replenishment and offshore disposal are technically feasible and can be pursued if partner agencies are identified or if other alternatives do not work out. No suitable remote locations were found. We are also discussing processing alternatives with the aggregate industry.

Analysis of Placement Alternatives: Open Discussion

Dan opened the discussion by pointing out that new SPSs in locations with sensitive habitat such as La Tuna Canyon were not being discussed since they are not being considered at this time while there are other viable placement alternatives.

9. Snowdy Dodson, Southern California Native Plant Society/Theodore Payne Foundation
   - What is meant by "wet" vs. "dry" sediment?

     Response: Sediment that is cleaned out from the debris basins during the storm season is likely to be wet due to flood runoff flowing through the basin. Sediment that is to be compacted needs to be dry, so wet sediment needs to be allowed to dry before compaction.
   - Sage-scrub vegetation is valuable habitat and there is only 10% left in the area. Using sage-scrub habitat as an example of "recoverable" habitat is not a good example from that perspective. More appropriate examples of recoverable habitat include fallow agricultural land or barren areas that have had the top soil scraped clean. It is not just the plants that are important with respect to habitat but also the organisms such as bacteria, hibernating toads, etc. that are important components of the ecosystem.

     Response: We will be more careful with our descriptions. Note that none of the alternatives under consideration affect any habitat, recoverable or sensitive.

10. Dianne Patrizzi, Public/Media
    - Why are there debris basin cleanouts during the wet season?

      Response: To manage the risk of flood. Sometimes sediment needs to be cleaned out during the wet season to recover space needed to capture sediment from subsequent storm events.

11. Theresa Young, San Gabriel Mountains Regional Conservancy
    - The placement analysis did not consider the beneficial aspects of offshore sediment placement that could result from capping pollutants such as DDT. Offshore placement could improve the environmental health of the ocean, including the near-shore fish population.

Response: If offshore placement looks favorable based on the analysis, specific placement locations and other considerations will be taken into account.

12. Vic LaRosa, Total Transportation Services, Inc.
    - Is processing of sediment for use in the construction industry under consideration? It could potentially offset some of the sediment management costs. Follow up on processing options and the quantities of materials needed by the aggregate industry.

      Response: The Flood Control District is currently having discussions with the aggregate industry.

13. Rody Stephenson, Public
    - Filling pits that have just been dug up doesn't seem to make sense.

      Response: Filling pits is being evaluated along with the rest of the alternatives.

14. Mary Barrie, Friends of Hahamongna
    - Where do landfills currently get the sediment they use for cover?

    Response: Mainly from onsite grading operations.

15. Unidentified Speaker
    - I think landfills need to mitigate for their operations. Could they utilize Flood Control District sediment as part of their mitigation?
    - What percentage of the debris basin sediment is organic (containing roots and stumps)? What is the cost to remove the organics?

      Response: Approximately 5-10% or sometimes higher depending on the watershed conditions (burned vs. unburned). The cost of processing is part of the discussions we are having with the aggregate industry.

16. Christle Balvin, Urbanwild Network
    - Have you talked to any of the beach cities regarding sediment placement for beach nourishment?

      Response: The Flood Control District has initiated discussions with the Los Angeles County Department of Beaches and Harbors regarding beach nourishment and we are aware there is currently a project at Broad Beach in Malibu.
    - Laguna Beach sand losses have been extensive. Sediment is a valuable resource! It should be viewed in that light. We would like to talk to you further about the beach nourishment alternative.

      Response: The Flood Control District is open to such discussions as well as working with other agencies although it looks like some cities and other agencies may have better options in terms of sources of beach sand.

17. Kiran Magiawala, Public
    - Offshore studies conducted in 2005 of the tsunami hazard along the southern California coast should be reviewed as part of any proposal to place sediment offshore due to the potential to affect wave patterns.

      Response: Studies would have to be conducted to determine the effects of offshore placement.

18. Cesar Espinosa, Los Angeles County Department of Beaches and Harbors
    - Have there been discussions with the Port of Long Beach regarding the use of sediment for the Middle Harbor Redevelopment Project?

      Response: Yes. We have been told they have sufficient sediment for the first phase of the project. We are aware there will be a second phase.

      Correction: During the meeting it was indicated that we were told priority is given to contaminated sediment but the priority is given to dredged marine sediment.

19. Theresa Young, San Gabriel Mountains Regional Conservancy
    - Please tell us what you have looked at so that we (the Task Force) can be more helpful.

      Response: We will continue to provide regular updates to the Task Force.

20. Lynnette Kampe, Theodore Payne Foundation
    - Can you repeat that La Tuna SPS is off the table?

    Response: Though La Tuna isn't completely off the table, at this time we are focused on other alternatives that seem feasible and appropriate.

21. Snowdy Dodson, Southern California Native Plant Society/Theodore Payne Foundation
    - Once the La Tuna Canyon SPS alternative is "off the table", the Flood Control District should transfer the land to a natural resource agency or County Parks for use as a recreation area and/or wildlife habitat.

      Response: We could consider that option once other sediment management alternatives are developed.

Devil's Gate Environmental Impact Report Update: Keith Lilley

Keith Lilley of the Water Resources Division discussed the following:

- The Environmental Impact Report (EIR) process for the Devil's Gate Reservoir Sediment Removal and Management Project is underway. The EIR is being prepared by an environmental consulting firm, Chambers Group, with a target completion in 18-24 months.
- There are two public meetings scheduled as part of the EIR process. Fliers were made available after the meeting.
  - October 5, 2011 6:30-8:30 pm at the Rose Bowl in Pasadena
  - October 15, 2011 9-11 am at the La Cañada High School Cafeteria
- The Flood Control District has completed an interim sediment cleanout of 13,000 cubic yards at the face of the dam. This material has been temporarily placed at Johnson Field until the EIR is completed. The upcoming storm season will bring sediment to the face of the dam once again.
- Contract work currently going on includes the installation of walkways and modification of the trash rack as preventive measures. That work is anticipated to be completed in October.
- Additional information regarding the reservoir sediment removal projects is available at www.lasedimentmanagement.com.

Additional Comments from Task Force Members

22. Dave Czamanske
    - The Task Force meetings are really information and status meetings rather than meetings to fully engage Task Force members in substantive tasks or activities that support the development of the Strategic Plan. The group should be renamed appropriately.

      Response: Comment was noted.
    - What is the relationship between the Advisory Working Group and the Task Force?

      Response: Both the Advisory Working Group and Task Force are receiving the same briefing information and the feedback from the two groups is contributing to the process. We will bring an update at the next Task Force meeting.

23. Christle Balvin
    - I now understand that the Devil's Gate Dam EIR process is separate from the development of the Strategic Plan, with the later being the focus of the Task Force meetings.

Next Steps & Closing Remarks: Terri Grant

At the conclusion of the meeting Terri confirmed that the Task Force meeting #4 PowerPoint slide presentation would be posted on the project website. She then thanked the attendees for their participation and adjourned the meeting.

Sediment Management Strategic Plan
Task Force Meeting # 4 Attendee List

Agency/Organization	Name	Title
Arroyo Seco Foundation	Tim Brick	Managing Director
Arroyo Seco Foundation	Jonathan Frame	Watershed Coordinator
California Department of Fish and Game	Terri Dickerson	Senior Environmental Scientist
California Department of Fish and Game	Kelly Schmoker	
California Native Plant Society/ Thedore Payne Foundation	Snowdy Dodson	Board Member
California Regional Water Quality Control Board - Los Angeles Region	LB Nye	
City of Burbank	Sean Corrigan	Chief City Engineer
City of Glendora	Jerry Burke	Assistant Public Works Director/City Engineer
City of Santa Clarita	Oliver Cramer	Analyst
Community Forest Advisory Committee/ Theodore Payne Foundation	Lynette Kampe	Executive Director
County of Los Angeles Department of Beaches and Harbors	Cesar Espinosa	Planner
Crescenta Valley Town Council	Charly Shelton	
EnviroMINE, Inc.	Crystal Howard	Manager
Public	Kiran Magiawala	
Public	Glen Owens	
Public	Bryan Helm	
Public	Thomas Holaday	
Public	Dianne Patrizzi	
Public	Robert Ruby	
Public	Carole Scurlock	
Public	Rody Stephenson	
Republic Services	David Cieply	General Manager
Resident - Shadow Hills/La Tuna Cyn	Julia Tarnawski	Public
Sanitation Districts of Los Angeles County	Sam Shammas	Project Engineer
Sierra Club	Don Bremner	
Sierra Club Angeles Chapter	Joan Licari	Chair, San Gabriel Task Force
Total Transportation Services, Inc.	Tony Williamson	Director, Business Development & Diversity Services
Total Transportation Services, Inc.	Vic LaRosa	President
Total Transportation Services, Inc.	Bill Allen	
United Rock Products	Martin Fuentes	Operations Manager
Vulcan Materials Company	Jeff Cameron	
Vulcan Materials Company	Gary Goellner	Regional Operation Manager
Waste Connections Inc.	Mike Dean	District Manager
Waste Connections Inc. SCS Engineers	Dan Vidal	Project Director
Watershed Conservation Authority	Rob Romanek	Project Manager

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Los Angeles County Flood Control District
Sediment Management Strategic Plan
Stakeholder Task Force Meeting # 5

Tuesday, November 15, 2011
1:00 pm

LA County Department of Public Works Headquarters Building
900 South Fremont Avenue. Alhambra, CA 91803
Conference Room B

Goal

Manage sediment in order to provide for the flood risk management and water conservation needs of the region while balancing environmental, social, and economic concerns.

Agenda

Welcome & Introduction

Follow-up from the Fourth Task Force Meeting

Pacoima & Morris Reservoirs - Analysis to Date
- Sediment Removal Alternatives
- Placement Alternatives
- Transportation Alternatives

Discussion

Devil's Gate Environmental Impact Report Process – Brief Update

Wrap-up/Next Steps

Los Angeles County Flood Control District
Sediment Management Strategic Plan
Stakeholder Task Force Meeting # 5

Tuesday, November 15, 2011
1:00 pm

LA County Department of Public Works Headquarters Building
900 South Fremont Avenue. Alhambra, CA 91803
Conference Room B

Meeting Summary

Note: For reference purposes the following are included in the meeting summary, which may be found at our website, www.lasedimentmanagement.com.

- Meeting agenda (page 7).
- Invitation list for the meeting (page 8).
- List of attendees (page 15).

The PowerPoint presentation from the meeting can also be found on the website.

Welcome and Introduction: Gary Hildebrand

Gary Hildebrand, Division Head of Watershed Management Division, welcomed Stakeholder Task Force members to the meeting. He told attendees that this meeting would provide an update on the status of the sediment management planning effort while sharing the analysis to date of alternatives for two reservoirs. The next Stakeholder Task Force meeting is expected to be in late January and will provide recommendations for sediment management at Pacoima and Morris Reservoirs. A subsequent Stakeholder Task Force meeting will be held to share the findings and recommendations for all Flood Control District reservoirs and debris basins.

Follow-up from the Fourth Stakeholder Task Force Meeting: Terri Grant

Terri Grant, Assistant Division Head of Watershed Management Division, provided the follow-up from last meeting. She addressed past inquiries to extend the 20-year Sediment Management Strategic Plan and indicated that the possibility of developing a separate Long-Term Vision for the Flood Control District in partnership with the Army Corps of Engineers is being investigated.

She described the purpose of the Task Force and explained the group will now be called the "Stakeholder Task Force" to reflect the fact that input and participation from all members of the community are welcome. She proceeded to describe the composition and purpose of the Advisory Working Group.

Next, Terri discussed the comprehensive timeline for sediment management. A schematic helped to illustrate the relation between ongoing sediment management projects, the upcoming reservoir cleanouts, the 20-year Sediment Management Strategic Plan, and the Long-Term Flood Control District Vision.

Reservoir Analysis to Date: Dan Sharp

Dan Sharp of Watershed Management Division presented the reservoir analysis to date for both Pacoima and Morris Reservoirs. He started by reminding the Stakeholder Task Force how dams operate and what their purposes are. Dan also reminded everyone that during the initial ranking of alternatives only environmental and social impacts were considered. Now that the more in-depth analysis is being conducted, performance, implementability, and cost are also being considered. The discussion included:

- Possible placement sites
- Removal methods
- Staging areas
- Access to the reservoirs
- Modes of transportation

Dan also briefly discussed trucking in channels, new rail lines, a two-way salt water pipeline, and cable bucket systems. He indicated that as a result of the analysis it is recommended to no longer pursue these alternatives.

Discussion

1. Rody Stephenson, La Cañada-Flintridge Resident
   - Some of the dams have permanent lakes. Devil's Gate is dry. How do you decide which dams are used to store water?
     Response: It depends on the ability to conserve water downstream of the dam. There are no spreading grounds along the Arroyo Seco downstream of Devil's Gate Dam, so water from Devil's Gate flows to the Los Angeles River and ultimately the ocean. However, a small amount of groundwater recharge does occur from holding a pool at the dam. The Flood Control District has ongoing studies to evaluate the feasibility of pumping water from Devil's Gate Reservoir back to the existing Arroyo Seco Spreading Grounds and to Eaton Dam to enable recharge to occur in the spreading grounds along Eaton Wash.

2. Dave Weeshoff, Audubon Society
   - When the dams were originally constructed, what were the Flood Control District's plans for removing sediment deposits?
     Response: The dams were constructed with sluice gates to enable sediment movement through the dams to the downstream channels. In addition, sediment placement sites (SPSs) in close proximity to the dams were acquired for sediment placement purposes. Some of the SPSs are full and there are some challenges with sluicing, hence we are looking for the best alternatives to manage future sediment deposition.

3. Kiran Magiawala, Public
   - There is an ongoing study for a desalination plant at Redondo Beach that will produce 25-50 million gallons per day of fresh water. Consideration should be given to any potential impacts that sediment management plans may have on the plant.
     Response: We will do so.

4. Carl Hassel, City Engineer, City of Azusa
   - Does the 5.2 MCY of sediment for Morris Reservoir include sediment from San Gabriel and Cogswell Reservoirs?
     Response: No, that quantity is just for Morris Reservoir. The estimated 20-year quantity for San Gabriel Reservoir is approximately 29 MCY and for Cogswell Reservoir it is 5 MCY.
   - Is this plan only for Pacoima and Morris Reservoirs?
     Response: No, the next steps will include planning for the other reservoirs as well as debris basins in addition to Pacoima and Morris.

5. Snowdy Dodson, California Native Plant Society
   - Are any of the dams suitable to experiment with dam removal?
     Response: That option could be studied as part of a future planning effort that looks at the entire system from a long-term perspective. The dams were built for flood control and water conservation and impacts will need to be evaluated.
   - Could the big dams be removed and replaced with a series of smaller dams?
     Response: Theoretically yes but it would be extremely difficult from a practical standpoint. The large dams are strategically located and it would be challenging to replace their benefit with a series of smaller dams.

6. Rody Stephenson, La Cañada-Flintridge Resident
   - What percentage of water is captured and used for groundwater recharge?
     Response: Over 90% of the San Gabriel River runoff is captured and recharged annually. Due to less favorable geologic conditions, recharge percentages on the Los Angeles River system are not as high.
   - Would sediment placed in an upstream SPS likely wash out in future storms?
     Response: Not likely because the sediment is placed methodically with a drainage system and is engineered to be stable. The bulk of the material stays where we place it.

Devil's Gate Environmental Impact Report Process – Brief Update: Keith Lilley

Keith Lilley, Assistant Division Head of Water Resources Division, provided a progress update on the preparation of the Environmental Impact Report (EIR) for the Devil's Gate Reservoir Sediment Removal and Management Project and the status of the Interim Measures Project for Devil's Gate Dam. Key points:

- EIR
  - At the two scoping meetings for the Devil's Gate EIR, the public showed a high interest in alternatives other than trucking because of the potential traffic and air quality impacts.
  - The EIR will address a full array of alternatives with technical studies and analyses.
  - A copy of the Draft EIR will be available in approximately 6-9 months. It will be available at the same locations that the Initial Study was.
  - Target completion date for the Devil's Gate EIR is late 2013.
  - Information regarding the EIR process is posted on the web at www.lasedimentmanagement.com\devilsgate. A summary of the public comments will also be posted on the website.
- Interim Measures Project
  - The Interim Measures Project to remove sediment that accumulated near the upstream face of the dam is complete.
  - 13,000 cubic yards of sediment were removed and temporarily placed at Johnson Field, an inactive former spreading ground upstream of the dam on the east side of the reservoir area.
  - Trash racks were extended vertically to reduce plugging of the dam outlet works from sedimentation.
  - New log booms were installed to capture floating debris and prevent it from reaching the face of the dam and interfering with flow through the outlet works.

Discussion

1. Snowdy Dodson, California Native Plant Society
   - What is the bottom of the Devil's Gate Reservoir made of? Is it suitable for infiltration?
     Response: The entire reservoir area has a natural earth bottom. However, deposition of fine sediment does tend to seal the bottom of the reservoir area minimizing infiltration.
   - Could the reservoir bottom be punctured to improve infiltration of water?
     Response: The holes would likely plug with sediment due to the high pressure exerted by the water and sediment above them. We have found that optimal infiltration is achieved in basins approximately 5 to 8 feet deep that have regular maintenance to keep the bottom free of fine sediment and vegetation.

2. Mary Barrie, Friends of Hahamongna
   - Normally comments submitted are provided to the public in full during the EIR process. Why is it planned to only provide summaries of the comments?

Response: We will provide a summary of the comments received during the scoping process on our website. While not required by CEQA (the California Environmental Quality Act), we will include copies of the actual scoping comments in an appendix of the Draft EIR. Comments received during the public comment period after the Draft EIR is released are required to be included in the Final EIR.

- Why isn't water conservation at Devil's Gate Reservoir part of the current sediment management planning and normal dam operations?
  Response: There are spreading grounds operated by the City of Pasadena at the upstream end of the reservoir; however, water conservation at Devil's Gate Dam is very limited because there are no downstream spreading grounds along the Arroyo Seco that can recharge dam releases to groundwater. The Flood Control District is evaluating potential projects that would pump water from Devil's Gate Reservoir to the upstream spreading grounds or to spreading grounds along Eaton Wash to the east.

3. Dave Weeshoff, Pasadena Audubon Society
   - Where does the Arroyo Seco flow into?
     Response: The Arroyo Seco flows into the Los Angeles River near the interchange of the 5 and 110 freeways, near downtown Los Angeles.

4. Rody Stephenson, La Cañada-Flintridge Resident
   - Are there other EIRs currently being prepared for other projects in the Devil's Gate Reservoir area?
     Response: Yes, there is a separate Hahamongna Multi-use Project EIR that is being prepared by the City of Pasadena.
   - To what extent are the consultants working on the Devil's Gate EIR and the Sediment Management Strategic Plan working together? Collaboration could eliminate duplication of effort.
     Response: Flood Control District staffs working on the projects are in constant contact.
   - What about excavating a sediment trap upstream of the Devil's Gate Reservoir?
     Response: This alternative will be evaluated as part of the EIR process.

5. Dave Weeshoff, Audubon Society
   - Is there an opportunity for groundwater recharge along the Los Angeles River?
     Response: The Dominguez Gap Spreading Grounds is the only location on the lower Los Angeles River affording an opportunity to recharge runoff. However, the underlying geology at that location is not favorable for infiltration.
   - Could water be recharged to create a barrier against seawater intrusion into the groundwater table?
     Response: We have an active program of injecting water along the coast to act as a seawater intrusion barrier. Approximately one third of the water used is reclaimed water.

Wrap-up/Next Steps

The next step is to complete the analysis for Pacoima and Morris Reservoirs. This analysis is planned to be presented at the next Stakeholder Task Force Meeting.

In addition, the analysis of the other reservoirs and the remaining debris basins will also be completed. The findings and recommendations for all of the remaining facilities will be shared at the beginning of a public review period.

Terri Grant responded as follows to questions regarding the Sediment Management Advisory Working Group.

- The Advisory Working Group meets approximately once a month and has met five times already.
- The Advisory Working Group meetings are not public meetings so as to keep the size of meetings small and potentially more efficient from a time standpoint while retaining input from a broad range of representatives. However, the public is welcome to the Stakeholder Task Force meetings.
- The Advisory Working Group will remain active for the future long-term planning effort that will review the Flood Control District system of facilities and operations.
- The Advisory Working Group members are open to receiving comments from the public. *[Note – Their emails are now available on the sediment management website (www.lasedimentmanagement.com)]*

A final comment by one of the attendees was that the Advisory Working Group appears to be heavily weighted towards environmental interests and that consideration should be given to adding more business and local governmental entities to the Advisory Working Group.

Gary Hildebrand thanked the attendees for their participation and adjourned the meeting at 2:30 pm.

Sediment Management Strategic Plan
Stakeholder Task Force Meeting # 5 Attendee List

Agency/Organization	Name	Title
City of Azusa	Carl Hassel	City Engineer
City of Santa Clarita	Kerry Breyer	Senior Engineer
Community Forest Advisory Committee/ Theodore Payne Foundation	Lynette Kampe	Executive Director
EnviroMINE, Inc.	Crystal Howard	Manager
Englander Knabe & Allen (EKA)	Alex Cherin	Vice President
Friends of Hahamongna	Mary Barrie	
Los Angeles Department of Water and Power	Andy Niknafs	
Neighborhood Unitarian Church	Hannelore Bauer	
Neighborhood Unitarian Church	Robin Robinson	
Public	Dave Czamanske	
Public	Kiran Magiawla	
Public	Rody Stephenson	
Public	Wynesta Dale	
San Fernando Valley Audubon Society	Dave Weeshoff	President
Sanitation Districts of Los Angeles County	Sam Shammas	Project Engineer
Theodore Payne Foundation	Snowdy Dodson	Board Member
Total Transportation Services, Inc.	Tony Williamson	Director, Business Development & Diversity Services
Total Transportation Services, Inc.	Richard Echler	Development Manager
U.S. Army Corps of Engineers Los Angeles District (SPL)	Tomas G. Beauchamp	Chief, Operations Branch
Vulcan Materials Company	Gary Goellner	Regional Operation Manager
Waste Connections Inc.	Steve Cassulo	Administration
Watershed Conservation Authority	Rob Romanek	Project Manager

Los Angeles County Flood Control District
Sediment Management Strategic Plan Task Force Meeting # 6

Monday, February 6, 2012
2:30 pm

LA County Department of Public Works Headquarters Building
900 South Fremont Avenue. Alhambra, CA 91803
Alhambra Room

Goal

Manage sediment in order to provide for the flood risk management and water conservation needs of the region while balancing environmental, social, and economic concerns.

Agenda

Welcome & Introduction

Follow-up from the Fifth Task Force Meeting

Pacoima & Morris Reservoirs - Analysis to Date
- Combined sediment management alternatives & estimated costs

Discussion

Devil's Gate Environmental Impact Report Process – Brief Update

Wrap-up/Next Steps

Los Angeles County Flood Control District
Sediment Management Strategic Plan
Stakeholder Task Force Meeting # 6

Monday, February 6, 2012
2:30 pm

LA County Department of Public Works Headquarters Building
900 South Fremont Avenue. Alhambra, CA 91803
Alhambra Room

Meeting Summary

Welcome and Introduction: Terri Grant

Terri Grant, Assistant Division Head of Watershed Management Division, welcomed Stakeholder Task Force members to the meeting. Terri announced that work on the Strategic Plan continued and that the Strategic Plan was expected to be released in mid-April. She shared that in January the Advisory Working Group had been on a field trip of several Flood Control District facilities. She also shared that the Flood Control District had met with the U.S. Army Corps of Engineers to discuss development of a Long-Term Vision and that the U.S. Army Corps of Engineers had given a presentation to the Advisory Working Group meeting. Terri also mentioned that the Flood Control District was continuing to talk to the aggregate industry and determining the best way to include the aggregate industry in the sediment management process. Terri explained that the purpose of the meeting was to share the analysis of alternatives for Morris and Pacoima Reservoirs and to obtain input from the Stakeholder Task Force.

Timeline: Dan Sharp

Dan Sharp of Watershed Management Division reviewed the status of the project in terms of the past Stakeholder Task Force meetings and the future meeting and public review period. He also reviewed the relationship between the Strategic Plan and the debris basin cleanouts, the planning of the Station Fire Reservoir Cleanouts, other future reservoir cleanouts, and the Long-Term Vision.

Morris and Pacoima Reservoirs Alternatives Review: Dan Sharp

1. Morris Reservoir

   Dan presented a map that showed the location of Morris Reservoir in relation to San Gabriel Reservoir, the San Gabriel River, San Gabriel Canyon Road, the U.S. Army Corps of Engineers' Santa Fe Flood Control Basin, and the pits in Irwindale. He then discussed the five combined sediment management alternatives considered for Morris Reservoir – (1) Excavation + Truck, (2) Excavation + Conveyor, (3) Dredge + Pipe, (4) Dredge + Truck, and (5) Sluicing – along with the general impacts and/or concerns and the estimated 20-year cost of implementing each alternative. Dan concluded his discussion about the alternatives considered for Morris Reservoir by comparing all the alternatives in a summary table.

2. Pacoima Reservoir

   Similar to his earlier discussion, Dan began his discussion about Pacoima Reservoir by presenting a map that showed the location of Pacoima Reservoir in relation to Pacoima Wash, Little Tujunga Canyon Road, the "Northern" Canyon, the "Southern" Canyon, the U.S. Army Corps' Lopez Flood Control Basin, and the 210 Freeway. He discussed the six combined sediment management alternatives considered for Pacoima Reservoir – (1) Excavation + Trucks, (2) Excavation + Conveyor [to canyons] + Trucks, (3) Dredge + Slurry Pipeline [to Lopez] + Trucks, (4) Sluice to Lopez + Trucks, (5) Excavation + Conveyor + Canyon Sediment Placement Site, and (6) Dredge + Dewater + Trucks. Dan then compared the six alternatives considered for Pacoima Reservoir by reviewing a summary table.

Upcoming Reservoir Sediment Removal Projects – Brief Update: Keith Lilley

Keith Lilley, Assistant Division Head of Water Resources Division, provided a status update for the Morris, Eaton, Pacoima, Big Tujunga, Cogswell, and Devil's Gate Reservoirs Sediment Removal Projects.

1. Morris and Eaton Reservoirs: These two reservoirs have not had significant inflow of sediment. Therefore, they are not on the fast track; the two reservoirs are being monitored.

2. Pacoima Reservoir: Alternatives for the upcoming Pacoima Reservoir Sediment Removal Project are undergoing a more refined analysis.

3. Big Tujunga Reservoir: A Mitigated Negative Declaration is expected to be released in June. It is expected the project will employ a conveyor or low emission trucks and that good aggregate will be separated from the rest of the sediment and taken out slowly based on need.

4. Cogswell Reservoir: The road to the reservoir is very narrow. Downstream of the reservoir, in the West Fork of the San Gabriel River, there are Santa Ana Suckers. It is expected that in the future, the reservoir will be operated differently.

5. Devil's Gate Reservoir: Analysis of many alternatives and feasibilities is underway. The draft Environmental Impact Report is anticipated to be released in October. Start of the project is expected to be the same.

Wrap-up/Next Steps: Terri Grant

Terri indicated the next Stakeholder Task Force meeting would be in April and that during that meeting, the Strategic Plan's alternatives for all the debris basins and reservoirs would be presented. She said that the Flood Control District would be developing a proposal to work with the aggregate industry and that it would continue to work in the U.S. Army Corps of Engineers. Then Terri thanked the attendees for their participation and adjourned the meeting.

Sediment Management Strategic Plan
Stakeholder Task Force Meeting # 6 Attendee List

Agency/Organization	Name	Title
California Native Plant Society / Theodore Payne Foundation	Snowdy Dodson	Board Member
City of Azusa	Carl Hassel	City Engineer
City of Santa Clarita	Kerry Breyer	Senior Engineer
Community Forest Advisory Committee / Theodore Payne Foundation	Lynette Kampe	Executive Director
Council for Watershed Health	Deborah Glaser	Lead Researcher / Policy and Climate
Englander Knabe & Allen (EKA)	Alex Cherin	Vice President
EnviroMINE, Inc.	Crystal Howard	Manager
Friends of Hahamongna	Mary Barrie	
Los Angeles Department of Water and Power	Andy Niknafs	
Neighborhood Unitarian Church	Robin Robinson	
Public	Dave Czamanske	
Public	Kiran Magiawala	
Public	Rody Stephenson	
Public	Wynesta Dale	
San Fernando Valley Audubon Society	Dave Weeshoff	President
Sanitation Districts of Los Angeles County	Sam Shammas	Project Engineer
Total Transportation Services, Inc.	Richard Echler	Development Manager
Total Transportation Services, Inc.	Tony Williamson	Director, Business Development & Diversity Services
U.S. Army Corps of Engineers	Tomas G. Beauchamp	Chief, Operations Branch
U.S. Forest Service - Angeles National Forest	Graham Breakwell	
Vulcan Materials Company	Gary Goellner	Regional Operation Manager
Waste Connections Inc.	Steve Cassulo	Administration
Watershed Conservation Authority	Rob Romanek	Project Manager

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Appendix E

Sediment Characterization
and Potential Use Assessment Report

Project No. BAS 11-58E
October 6, 2011

Daniel B. Sharp, P.E.
County of Los Angeles Department of Public Works
Watershed Management Division
900 South Fremont Avenue
Alhambra, California 91803

Subject: REPORT FOR SEDIMENTATION STUDY
SEDIMENTATION CHARACTERIZATION AND POTENTIAL USE ASSESSEMENT
Los Angeles, California
Project No. BAS 11-58E

Dear Mr. Sharp:

The purpose of this report is to summarize the results of our Sediment Characterization and Potential Use Assessment phases of the work plan outlined in our Proposal for Development of Sediment Pilot Study Work Plan dated May 2, 2011, and to provide justified recommendations for the field pilot study.

We appreciate the opportunity to provide our professional services on this project. If you have any questions regarding this report or if we can be of further service, please do not hesitate to contact us.

Tetra Tech, Inc.
1360 Valley Vista Drive, Diamond Bar, CA 91765
Tel 908.860.5096 Fax 909.860.5094 www.tetratech.com

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EXECUTIVE SUMMARY

The results of our investigation indicate that materials accumulating in debris basins and reservoirs have value and may be processed into useful construction materials to broadly include:

- Coarse Aggregate
- Washed Concrete Sand
- Aggregate Base
- Fill Sand
- Top Soil

The net value of materials, considering processing costs but no handling at the source or transportation, is estimated at about $1 per ton for average materials derived from debris basins or reservoirs. Pending haul rates and distances, the net value of these materials may easily be eroded by the cost of hauling materials to a production plant. However, transportation costs are unavoidable when excavating out a debris basin or reservoir, whether the excavated materials are transported to a Sediment Placement Site (SPS) for disposal or to a production plant for processing to useful materials. Any gains achievable from producing construction materials would offset costs associated with cleaning out debris basins or reservoirs. The indirect value of diverting waste from SPS's and extending the service life of these facilities should also be taken into consideration.

A pilot plant is recommended and will provide insight into plant logistics, processes, marketing and distribution. Due to the expense of a wet process required for washed concrete sand, the pilot plant is recommended to be conducted in two mobilizations: a dry process and a wet process. The data collected during a pilot plant operation will be directly applicable to processing of any earth material. The costs of the pilot test are anticipated to be significantly offset by the value of the material produced.

SEDIMENT CHARACTERIZATION

Sediment Characterization Program

Our sediment characterization consisted of test pit and hand-auger explorations performed at the May SPS, Devil's Gate Reservoir and Santa Fe Dam. The locations of these sites within the greater Los Angeles area are shown on the attached Figure 1. The locations of the explorations are shown on the attached Figures 2 through 4 and are summarized in the following table.

Site	Date of Explorations	Type of Exploration	Number of Explorations	Depth of Exploration
May SPS	June 1, 2011	Test Pit	4	10 to 12 feet
Devil's Gate	June 9, 2011	Hand Auger	12	2 to 8 feet
Santa Fe Dam	June 14, 2011	Hand Auger	5	2 to 3 feet

The study sites where chosen based on accessibility and representation of different depositional environments. The materials encountered at the sites are considered representative of the following environments:

- May SPS materials are generally representative of debris basin sediments after the Station Fire of July through November 2009.
- Devil's Gate materials are generally representative of materials accumulating in a reservoir.
- Santa Fe materials are generally representative of materials placed by a sluicing operation.

An environment which may not be represented are debris basins within steep valleys incised into the surrounding mountains such as the debris basin shown in the photograph on the cover of this report where rock falls, rolling sediments, or debris flows with abundant cobbles and boulders are prevalent.

Sampling with a 4-inch diameter hand auger as was the case with the Devil's Gate explorations precludes sampling cobbles or boulders. Cobbles and boulders were observed at some locations within Devil's Gate reservoir and in some cases were encountered as refusal in the exploration. Therefore, some bias toward finer materials is expected in the sampling results. A hand auger was also used for the Santa Fe Dam explorations. However, minimal bias due to sampling is anticipated at this location because of the character of the material. The sluiced material sampled at the top of the existing Santa Fe Dam stockpile consists of sand that is relatively clean of oversized materials. This material is typical of pumped hydraulic fills as evidenced by few cobbles observed at the surface. The May SPS explorations were performed with a large bucket hydraulic excavator. The resultant stockpiled spoils were sampled with a shovel at the top third, mid third and bottom third of the stockpile in general accordance with ASTM D75. The May SPS materials are anticipated to have minimum bias due to sampling.

Laboratory tests were performed to evaluate the quality of the materials encountered and included the following.

- 26 particle size gradation tests (ASTM D6913)
- 6 plasticity index tests (ASTM D4318)
- 5 sand equivalent tests (ASTM D2419)
- 7 organic impurities tests (ASTM C40)
- 4 organic content tests (ASTM D2974)
- 4 sodium sulfate soundness tests (ASTM C88)

The results of all laboratory tests are included in Appendix A. The particle size gradations are summarized graphically with respect to the material specifications described in the following section on the attached Figures 5, 6, and 7 for the May SPS, Devil's Gate Reservoir, and Santa Fe Dam, respectively. The results of the other material quality tests are summarized in the following table.

Site	Test				
	Plasticity Index	**Sand Equivalent(1)**	**Organic Impurities(2)**	**Organic Content(2)**	**Sodium Sulfate Soundness(1)**
SPS May	Not Tested	25 to 27%	Darker than Standard	2.5 to 4.4%	5% loss
Devil's Gate	Non-Plastic to 12	74 to 89%	Standard to Darker than Standard	4.6% to 11.9%	1% to 2% loss
Santa Fe Dam	Not Tested	Not Tested	Not Tested	Not Tested	Not Tested
Typical Limits	- 6 maximum for aggregate base and sub-base - 4 maximum for asphalt sand	- 30% or better typical for fill sand - 50% or better typical for aggregate base	- Darker than Standard(3) rejected for concrete aggregates	- Less than 5% for unclassified fill; - 2 to 20% ideal for top soil	- Less than10% for concrete aggregates

(1) Performed only on predominantly granular material (i.e., Soil Category B, C or D materials as described in the following table) which are potentially suitable for concrete aggregates.
(2) Performed only on materials which appeared to have a relatively high organic content.
(3) Darker than Standard refers to soil when subjected to a specified chemical reagent provides a darker color relative to when the soil is subjected to a second standard color reagent. For a more precise description, the color may be described in comparison to glass color standards and provided a value of 1 through 5, where 3 is Standard, 4 and 5 are Darker than Standard, and 1 and 2 are Lighter than Standard. A Darker than Standard color would typically be rejected, or require more investigation, according to standard concrete practice.

Organic impurities and contents were evaluated only for materials which appeared to have a relatively high organic content as evidenced by color and odor. The following photograph shows typical soil with apparent organic impurities as observed in the test pits of May SPS.

Source Materials

For the purposes of this study, the soils encountered may be categorized as shown in the following table.

Category	Quality	Soil Group Symbols(1)	Soil Group Names(1)
A	Low	*SM/ML, SM*	borderline *Silty Sand* to *Sandy Silt*; *Silty Sand*
B	Low to Intermediate	*SP-SM/SM, SW-SM/SM, SM*	borderline *Poorly Graded Sand with Silt* to *Silty Sand*; borderline *Well Graded Sand with Silt* to *Silty Sand*; *Silty Sand*
C	Intermediate to High	*SP, SW, SP-SM, SW-SM*	*Poorly Graded Sand*; *Well Graded Sand*; *Poorly Graded Sand with Silt*; *Poorly Graded Sand with Silt and Gravel*; *Well Graded Sand with Silt*; *Well Graded Sand with Silt and Gravel*
D	High	*GP, GW, GP-GM, GW-GM, GM*	*Poorly Graded Gravel*; *Well Graded Gravel*; *Poorly Graded Gravel with Silt*; *Poorly Graded Gravel with Silt and Sand*; *Well Graded Gravel with Silt*; *Well Graded Gravel with Silt and Sand*; *Silty Gravel*

(1) ASTM D2488, Description and Identification of Soils, using borderline cases described in Appendix X3 of the referenced standard.

The relative occurrences of the soil categories described above are summarized in the following table for the May SPS, Devil's Gate Reservoir, and Santa Fe Dam. The approximate near surface distribution of soil categories are shown in plan view on the attached Figures 2, 3, and 4 for the May SPS, Devil's Gate Reservoir and Santa Fe Dam, respectively.

Site	Category A (%)	Category B (%)	Category C (%)	Category D (%)
May SPS	0	100	0	0
Devil's Gate Reservoir	48	23	29	0
Santa Fe Dam	63	37	0	0
Average	**37**	**53**	**10**	**0**

The soil categories described above exclude cohesive clays, and the Category D gravel was not encountered in our explorations. That is, the materials encountered generally appear to consist of silt, sand and lesser amounts of gravel, particles that may be eroded and transported by moderate flow velocities, and tend to exclude cohesive clay and heavy gravel which are expected to be erodible only at higher flow velocities as predicted by the Hjulström diagram (Sundborg, 1956). Although not encountered at our exploration locations and not expected to be typical of most debris basins or reservoirs, Category D materials are expected in some areas. For example, Category D materials may be found in limited quantities at the headwaters of reservoirs where high flow velocities occur. They may also be found in debris basins within steep valleys incised into the surrounding mountains where rock falls, rolling sediments and debris flows with abundant cobbles and boulders are prevalent.

POTENTIAL USE ASSESSMENT

Product Values

For the purposes of this study, construction materials that may be derived from debris basins or reservoirs are categorized as shown in the following table.

Category	Nationally Recognized Standard	Applicable Local Product Names	Processing	Estimated Value
Top Soil	ASTM D5268	Top Soil (without amendments) Unclassified Fill	Dry Screen	\$3/ton
Fill Sand	N/A	Fill Sand Unclassified Fill	Dry Screen	\$6/ton
Coarse Aggregate	ASTM C33	¾-Inch Rock Class 1 Permeable Material	Dry Screen	\$15/ton
Aggregate Base	ASTM D1241	Crushed Aggregate Base Select Subbase Class 2 Permeable Material	Blend of Coarse Aggregate and Fill Sand	\$13/ton
Washed Sand	ASTM C33	Concrete Sand Asphalt Sand Mortar Sand	Wash Screen	\$15/ton

Fill Sand is generally used for imported structural fill and is subject to the project specific requirements. As a result, there is no nationally recognized or local standard for this material. Unclassified fill as described in Section 300-4.1 of the Standard Specifications for Public Works Construction, which beyond a restriction on oversized cobbles and boulders has few requirements, would generally fall into this category, but may also be considered Top Soil for non-structural applications.

For the purposes of this investigation, the following criteria are taken as representative of local practice for Fill Sand in most circumstances.

- Fill Sand should generally have a Sand Equivalent of 30 or greater.
- Fill Sand should generally have less than 25 percent passing the No. 200 sieve.
- Fill Sand should generally have an Expansion Index of 20 or less.

With the exception of Fill Sand, the particle size gradations specified by the referenced standards are shown with respect to the gradation of the site soils for the May SPS, Devil's Gate Reservoir and Santa Fe Dam on the attached Figures 5, 6, and 7, respectively.

The estimated values of the materials were determined by conducting a telephone survey of 6 suppliers local to the greater Los Angeles area, referencing material costs using estimating software, CostWorks® by RSMeans, for the Los Angeles area, 2011, 2nd quarter, interviewing senior level management of 1 major local supplier, and engaging a subconsultant, JMS Consulting Engineer, to review our estimated values.

Production Costs

Production costs are anticipated to vary pending, but not necessarily limited to, the following factors.

- Site access and development including entitlements, permits, flood control, storm water pollution prevention plan, and post-extraction reclamation, if any
- Equipment selection, acquisition and maintenance
- Mobilization and haul distance, if material is trucked to processing site
- Process, dry versus wet

The pilot processing plant described in the following section is intended to evaluate the costs associated with the above or similar factors. For the purposes of this study, the anticipated costs associated with producing the materials described herein are shown in the following table.

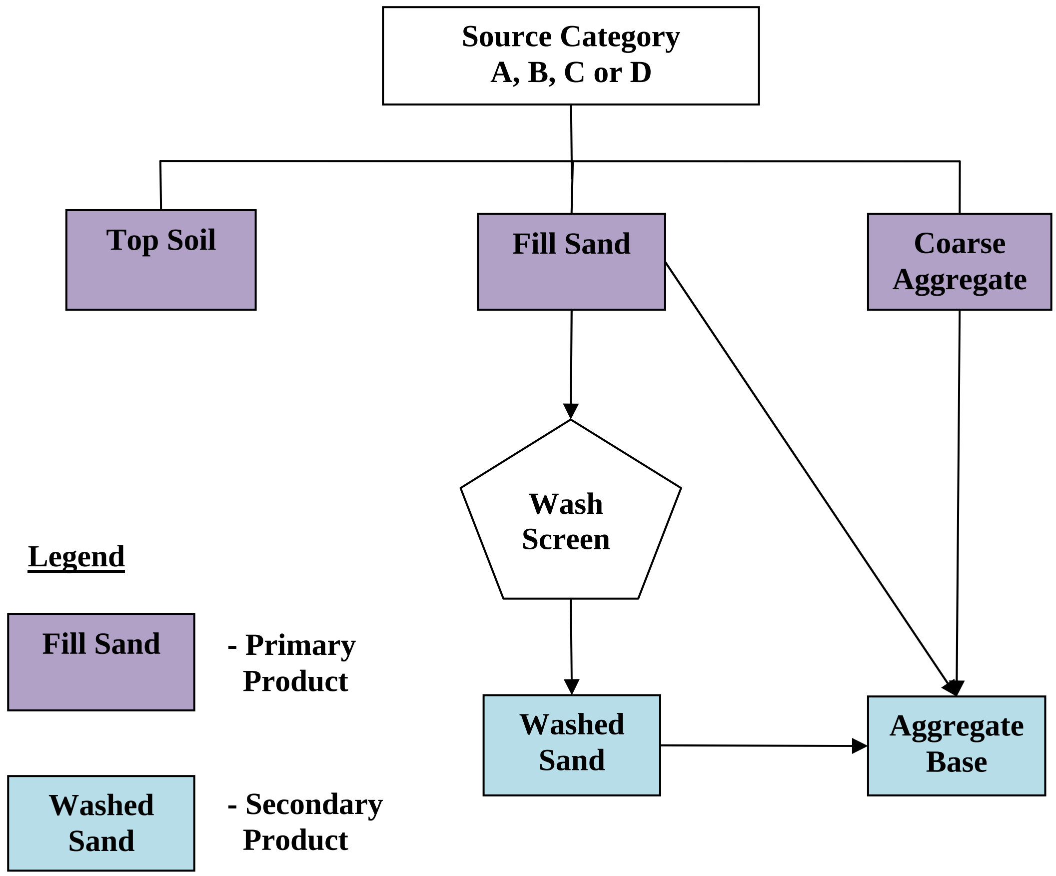
Process	Cost
Dry Screen	$4/ton
Wash Screen	$9/ton
Waste Disposal	$5/ton

Use Assessment Methodology

In general, our methodology is based on three premises: (1) source materials, provided they meet certain durability qualifications, may be grouped into broad categories based solely on gradation to include primarily silt, silt and sand mixtures, primarily sand, and primarily gravel, with material value generally increasing with coarser materials; (2) the relative proportions of primary materials used in construction that may be derived from a source category may be estimated by considering certain grain sizes, namely coarse gravel taken as coarser than ⅜ inch, fine gravel and sand taken as finer than ⅜ inch, and the least desirable fines taken as finer than the standard sized No. 200 sieve; and (3) the primary materials may be used as feeder stock to produce other secondary materials used in construction. This forms the basis for evaluation of the economic potential of a specific sediment source.

Since gradations by their nature are relative proportions of silt, sand, and gravel sized particles, it is feasible to estimate the quantities of processed construction materials that may be produced from the pilot study sites by evaluating the relative occurrences of the soil Categories A through

D previously described. The desired final products may be derived by processing the basic source categories into primary products of Top Soil, Fill Sand, and Coarse Aggregate. Secondary products may be produced by further processing or blending of primary products. For instance, Washed Sand may be derived from washing Fill Sand. Aggregate Base may be derived from blending Coarse Aggregate and Fill Sand. The flow chart below shows the derivation of secondary products from primary products.



Laboratory tests were performed for two main tasks: (1) to characterize the source materials into the 4 source categories and (2) to evaluate which products may be produced from the available sources. The following table summarized the laboratory tests performed and how the results are used to evaluate potential products from source materials.

Task	Test Description	Test Standard	Purpose and Criteria
1	Gradation	ASTM D6913	• classify source material into Category A, B, C or D material;
	Atterberg Limits	ASTM D4318	
2	Organic Impurities	ASTM C40	• if Darker than Standard, Washed Sand may not be produced as a secondary product; • if Standard, all products may be produced;
	Organic Content	ASTM D2974	• only applicable if Darker than Standard result for organic impurities; • if greater than 5 percent, only low value primary Top Soil may be produced;
	Gradation	ASTM D6913	• if greater than 70 percent passing the No. 200 sieve, the source material is not suitable for primary Top Soil and is Waste; • for a given Source Category: - percent passing the ⅜-inch sieve determines the relative proportion of primary Fill Sand produced by dry screening; - percent retained on the 1-inch sieve determines the relative proportion of material available for crushing; - the remaining material minus the above determines the relative proportion of primary Coarse Aggregate produced by dry screening. • Category C and/or D source materials are needed to produce secondary Aggregate Base; • percent passing the No. 200 sieve determines the relative proportions of secondary Washed Sand and Waste produced by wash screening of primary Fill Sand.
	Sand Equivalent	ASTM D2419	• at least 30 for higher quality Fill Sand • at least 50 for Aggregate Base
	Soundness	ASTM C88	• less than 10 percent for Coarse Aggregate and Washed Sand

For the purposes of this study, materials with apparent high organic impurities are avoided in the production of Washed Sand because Portland cement products, a common application for Washed Sand, require a low amount of organic impurities. Materials with apparent high organic impurities such as those derived from materials eroded after wild fires are recommended to be selectively processed to produce primarily Top Soil and Fill Sand and some screened Coarse Aggregate.

When secondary products are produced, there is a commensurate reduction in the production of primary products. Our study considers the following possible production options with respect to secondary products derived from primary products. The primary products consisting of Top Soil, Fill Sand and Coarse Aggregate are produced for all the options in addition to the secondary products.

- Option 1 – No Washed Sand and no Aggregate Base is produced.
- Option 2 – All available Washed Sand is produced but no Aggregate Base is produced.
- Option 3 – All available Aggregate Base is produced but no Washed Sand is produced. Results are identical to Option 1 if no Category C or D materials are available since Fill Sand derived from Category B materials are not suitable for Aggregate Base.
- Option 4 – First, all available Washed Sand is produced. If Fill Sand remains, all available Aggregate Base is produced. Results are identical to Option 2 if no material with organic impurities is present because all Fill Sand is processed into Washed Sand.

Detailed flow charts showing the products that may be derived from the source materials were developed using the methodology described above and are shown for the May SPS, Devil's Gate Reservoir, and Santa Fe Dam on Figures 8, 9 and 10, respectively, and are summarized in the following table. These flow charts are suitable for use for any site but the percentage proportions of source material categories and material quality are specific to each site. The flow charts are intended to assist with the evaluation of available materials and selection of final products.

Material	**Relative Proportions of Products**											
	May SPS Figure 8				**Devil's Gate Reservoir Figure 9**				**Santa Fe Dam Figure 10**			
	Option				**Option**				**Option**			
	1	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**
Top Soil	33%	33%	33%	33%	24%	24%	24%	24%	63%	63%	63%	63%
Fill Sand	62%	30%	62%	30%	70%	36%	66%	32%	34%	0%	34%	0%
Coarse Aggregate	5%	5%	5%	5%	2%	2%	0%	0%	3%	3%	3%	3%
Aggregate Base	0%	0%	0%	0%	0%	0%	6%	6%	0%	0%	0%	0%
Washed Sand	0%	25%	0%	25%	0%	27%	0%	27%	0%	24%	0%	24%
Waste Silt	0%	7%	0%	7%	4%	11%	4%	11%	0%	10%	0%	10%

The estimated gross and net dollar value of processed materials is shown in detail for the above described production options on the flow charts shown on the attached Figures 8 through 10, and summarized in the following table. These estimated gross and net dollar values are based on the estimated values of individual products and production costs presented, and a gross mass of processed material of 50,000 tons, chosen arbitrarily as a readily scalable value.

Based on 50,000 Tons of Processed Material			
Site	**Gross Value**	**Net Value**	**Estimated Net Value per Ton of Source Material(4)**
May SPS	\$274,031 to \$368,216(1)	\$73,930 to \$101,139(1)	\$1.48 to \$2.02
Devil's Gate Reservoir	\$261,497 to \$270,876(2)	\$11,412 to \$20,791(2)	\$0.22 to \$0.41
Santa Fe Dam	\$220,485 to \$296,243(3)	\$20,485 to \$32,270(3)	\$0.41 to \$0.65
		Average	**\$1.12**

(1) See Options 1 through 4, Figure 8.
(2) See Options 2 and 4, Figure 9.
(3) See Options 1 through 4, Figure 10.
(4) The apparent higher value of May SPS materials relative to the other sites is a result of the absence of poorer quality Category A materials, which generally produce low value Top Soil and negative value Waste. Similar higher values may be obtained from the Devil's Gate Reservoir and Santa Fe Dam sites by selectively extracting Category B and C material.

SUMMARY OF FINDINGS

Based on the results of our field explorations, laboratory testing and economic analyses, the following conclusions are presented:

Major Findings

- Materials accumulating in debris basins or reservoirs have commercial value, once processed into construction materials, which may offset some of the cost of cleaning out these facilities.
- In addition, the service life of existing SPS's may be extended by diverting material from these disposal sites to useful applications.
- A pilot plant will help identify costs or obstacles associated with plant logistics, processes, marketing and distribution before any large scale investments are considered.
- The cost of the pilot plant, excluding handling at the source or transportation to the pilot plant, will be significantly offset by the value of the materials produced.

Other Findings

- Because of the low value of Top Soil with respect to the production cost and the amount of Waste associated with materials containing more than 70 percent fines, processing Category A materials should be avoided.

- Based on the Devil's Gate Reservoir results, Category A materials are anticipated to be present at the downstream, lowest reach of the reservoir, which is the location most critical to be cleaned out. This is an unfavorable condition.
- The cost of cleaning out the lower reach of Devil's Gate Reservoir where Category A materials are anticipated to prevail may be offset by extracting more favorable materials at the middle to upper reaches.
- Inclusion of Washed Sand in the final mix of products generally results in an overall higher valuation. However, with a relatively small reduction in the value of Washed Sand from $15 to $13 per ton, which may be anticipated in the current economic conditions, the inclusion of higher value Washed Sand is no longer predicted to result in a significantly higher overall valuation due to the relatively small gain in value with respect to the increased cost of waste disposal.
- However, although unwashed materials may have a similar net valuation to higher value Washed Sand pending the relative cost of waste disposal to the marketable value of Washed Sand, such materials may not be in sufficient demand to keep up with production and substantial stockpiling may be necessary.

PILOT STUDY PLAN

The following additional investigations are recommended.

- A pilot production plant is recommended to verify the validity of the processes summarized in the attached flow charts, including the quantities of materials and waste generated and the logistics of the operations. Because of the substantial costs associated with a wet process including permitting, staging, water usage, and waste silt disposal, the pilot production plant is recommended to be deployed in two separate mobilizations, an initial dry process mobilization and a second wet process mobilization. The dry process mobilization is anticipated to consist of the following:
    - A 4-inch grizzly to screen out oversized cobbles
    - A power double-screen having a 1-inch screen and a ⅜-inch screen
    - As an option, a second single ⅜-inch screen may also be provided and dedicated to the production of Top Soil where materials with organic impurities are prevalent
    - A crusher
    - A front-end loader
    - A tractor-dozer
    - A plant supervisor
    - An equipment operator
    - A laborer

Photograph (right) – Power Double-Screen Operation

- The wet process mobilization is anticipated to consist of the following in addition to the above:

  - A ⅜-inch wash screen
  - At least 3 successive desilting ponds and an estimated water supply of 300,000 gallons per day
  - A stormwater pollution prevention plan
  - A disposal site for waste silt

- The associated costs, based on the pilot production plant, including permitting, labor, equipment rental and maintenance, and ancillary costs will be evaluated and compared with the gross processed product valuation.

- The erosion and deposition model under development as part of this study should be integrated with the source material categories presented herein to evaluate whether an integrated model to predict processed product valuation is feasible. This will allow for preliminary evaluation for the likely options for the final processed product.

For a pilot plant, the upfront and fixed costs become a smaller proportion of the overall cost as the duration of the pilot production program increases. As a result, we recommend a minimum of 3 months for the dry process phase of the pilot production program. For the purposes of this analyses and report, we assume that the pilot plant will be mobilized to the May SPS. We understand that material will not be recycled from the May SPS, but will be transported to the May SPS pilot plant by others.

To facilitate a pilot production program, a quote was obtained from a local contractor, O&B Equipment, to provide the equipment and operators for the pilot plant described above. The provided quote is summarized as follows.

- Mobilization and start up costs: $22,000
- Dry processing by double-screening: $2/ton
- Crushing of course materials, if any: $6,000/week (expect crushing for 1 week out of every 4 weeks of production)

The costs associated with the pilot plant, excluding handling at the source and transportation to the pilot plant, are anticipated to be significantly offset by the value of the material produced, as predicted by our model and summarized in the table below.

Material	Gross Value(1)	Estimated Production Cost	Estimated Waste Disposal Cost	Net Value
May SPS-type Materials	$411,000	$190,000	$1,000	$220,000
Devil's Gate Reservoir-type Materials	$290,000	$190,000	$46,000	$54,000
Santa Fe Dam-type Materials	$331,000	$190,000	$1,000	$140,000
Average	**$344,000**	**$190,000**	**$16,000**	**$138,000**
Estimated Engineering and Management Fees				**$55,000**
Net Cost				**$83,000 credit**

(1) Estimated as the Gross Value from Option 1 (i.e., no wet processing) of Figures 8, 9 and 10, for the May SPS, Devil's Gate Reservoir, and the Santa Fe Dam, respectively, scaled by a factor of 1.5 to account for 75,000 tons processed during the pilot plant operation.

In summary, our fees for the pilot study at May SPS are anticipated to be **$245,000**, including an estimated $190,000 in production and $55,000 in engineering and management fees. Our estimated fees do not include any transportation, neither from the source to the pilot plant nor from the pilot plant to a buyer, or any waste disposal.

The total cost of the pilot study will also include transportation provided by others. These costs may be wholly or partially offset by the estimated gain of $83,000 derived from the produced materials, pending haul rates and distances.

Our estimated fees are based on a quote from our subcontractor, O&B Equipment, and the following assumptions:

- Approximately 75,000 tons of source material will be processed in a period of 3 months, i.e., the anticipated production rate is 25,000 tons per month.
- The May SPS, or a similar suitable and accessible site, will be made available for the pilot plant. Approximately at least 2 acres are required.
- Source materials will either be readily available on site or transported to the pilot plant by others.
- Waste will be disposed of by others.
- Water will be provided by others for dust control or similar purposes, and is not included in our estimated fees presented above.

- A loader at the source locations will be provided by others to excavate and handle source materials, and is not included in our estimated fees presented above.

LIMITATIONS

The pilot study test sites were explored to the degree practicable. The following limitations of the methods used should be considered when evaluating the data presented.

- For the May SPS site, only the uppermost cell of the disposal site was investigated. Materials encountered in the test pits were limited to a relatively narrow gradation range falling into material Category B. This result may not be representative of the site as a whole, where broader material gradation is anticipated.
- The Devil's Gate Reservoir site was explored more comprehensively than the other sites and is considered to be most representative of the types of materials to be derived from reservoirs of this nature.
- Large reservoirs such as the Devil's Gate show a large degree of downstream sorting of materials, with Category A materials near the dam and a gradual transition to coarse materials from Categories B to C upstream. Category D materials were not encountered but are expected at the headwaters where high flow velocities or steep slopes subject to sediment gravity flows prevail. As a result, if material is selectively removed from the downstream end near the dam where removal is most critical, only poorer quality Category A materials should be anticipated.
- For the Santa Fe Dam site, only the upper few feet of the stockpile were explored by hand-auger explorations, and therefore the sampling cannot be considered representative of the stockpile as a whole.

CLOSURE

Tetra Tech appreciates the opportunity to be of service on this project. If you have any questions regarding this letter or if we can be of further service, please do not hesitate to contact the undersigned.

Respectfully submitted,
Tetra Tech

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Bryan A. Stirrat, P.E.
President

Filename: Final Report - Sediment Characterization and Potential Use Assessment 2011-10-06.doc

Distribution: Addressee (1 hardcopy + pdf by email to dsharp@dpw.lacounty.gov)

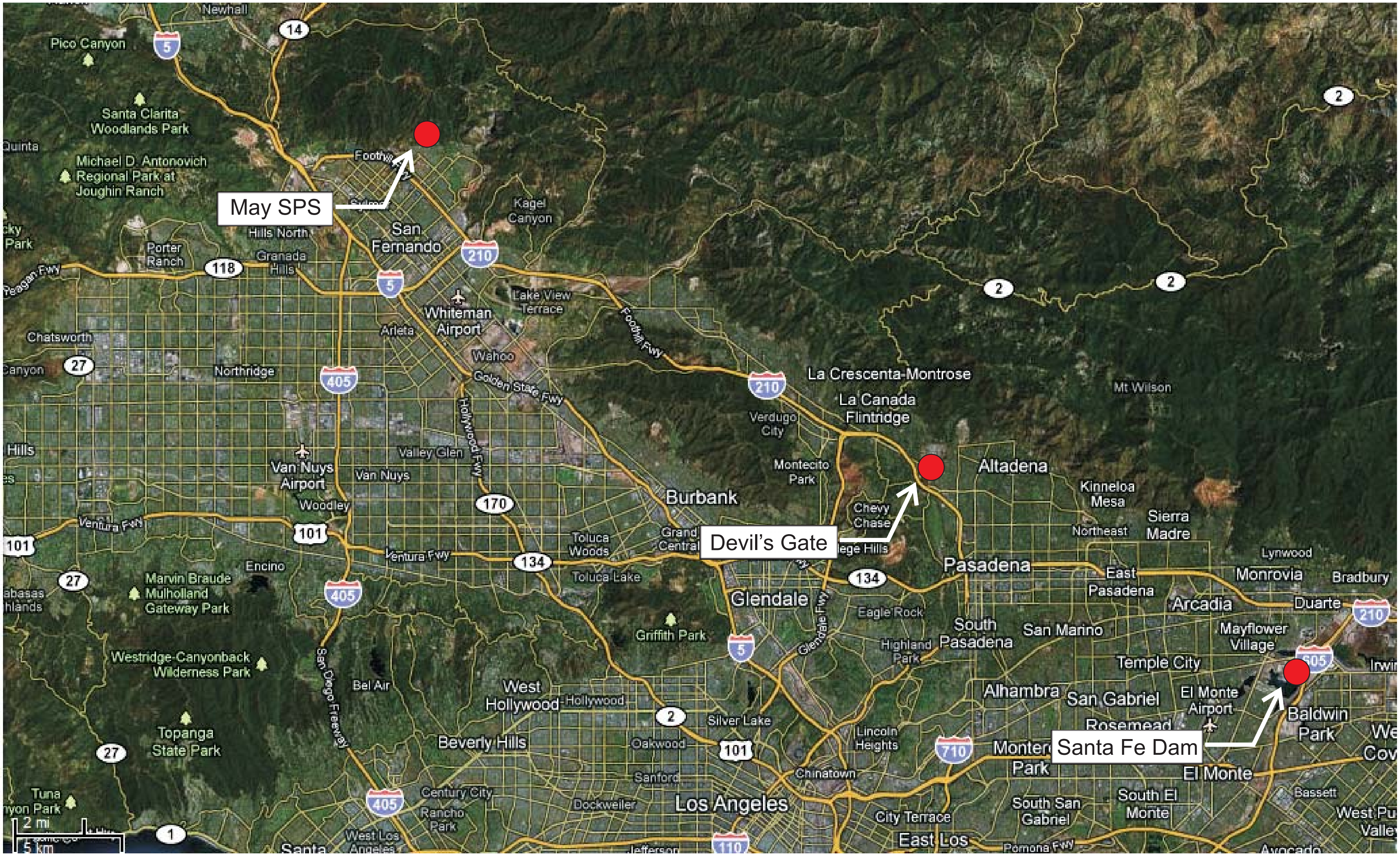
REFERENCES

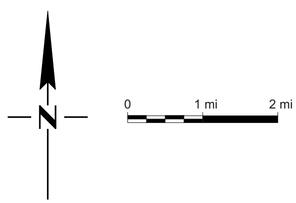
ASTM D5268, "Standard Specification for Topsoil Used for Landscaping Purposes."

ASTM C33, "Standard Specification for Concrete Aggregates."

ASTM D1241, "Standard Specification for Materials for Soil-Aggregate Subbase, Base, and Surface Courses."

Sundborg, A., 1956, "The River Klarälven, a Study of Fluvial Processes," Geografiska Annaler, Ser. A, Vol. 38, Fig. 16, p. 197.





NOTE: ALL LOCATIONS, DIRECTIONS AND DIMENSIONS ARE APPROXIMATE

TETRA TECH

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LACDPW Sedimentation Study

Site Location Map

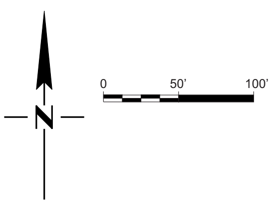
Project Name:	LACDPW Sedimentation Study
Project Number: BAS 11-58E	DATE: August 2011

Figure: 1

Legend:

TP-4 Test pit locations

Soil Category B: SP-SM/SM, SW-SM/SM, SM



NOTE: ALL LOCATIONS, DIRECTIONS AND DIMENSIONS ARE APPROXIMATE

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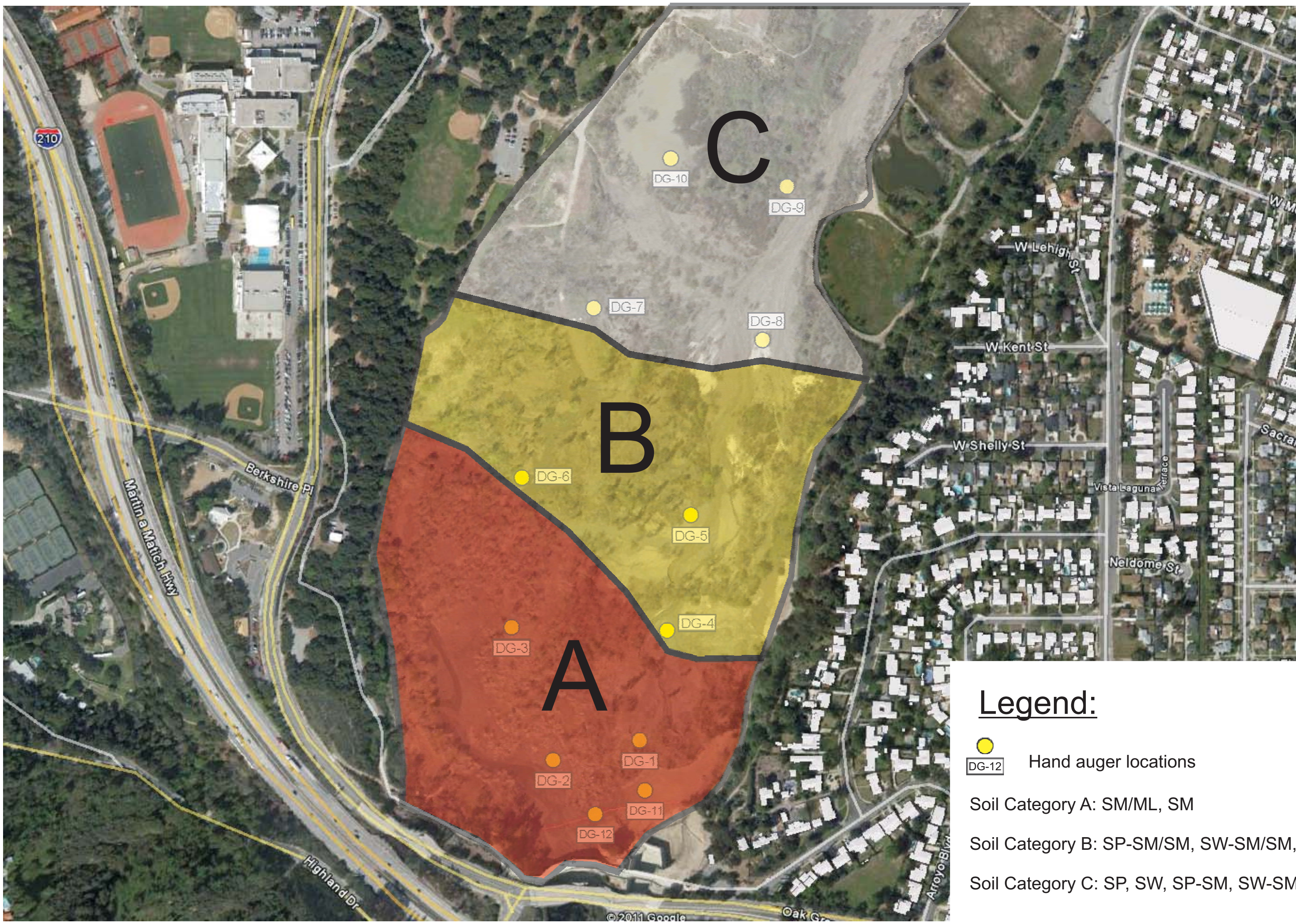
Project Name: LACDPW Sedimentation Study	
Project Number: BAS 11-58E	DATE: August 2011

May SPS
Exploration Location and
Soil Category Map

Figure: 2



Legend:

DG-12 Hand auger locations

Soil Category A: SM/ML, SM

Soil Category B: SP-SM/SM, SW-SM/SM, SM

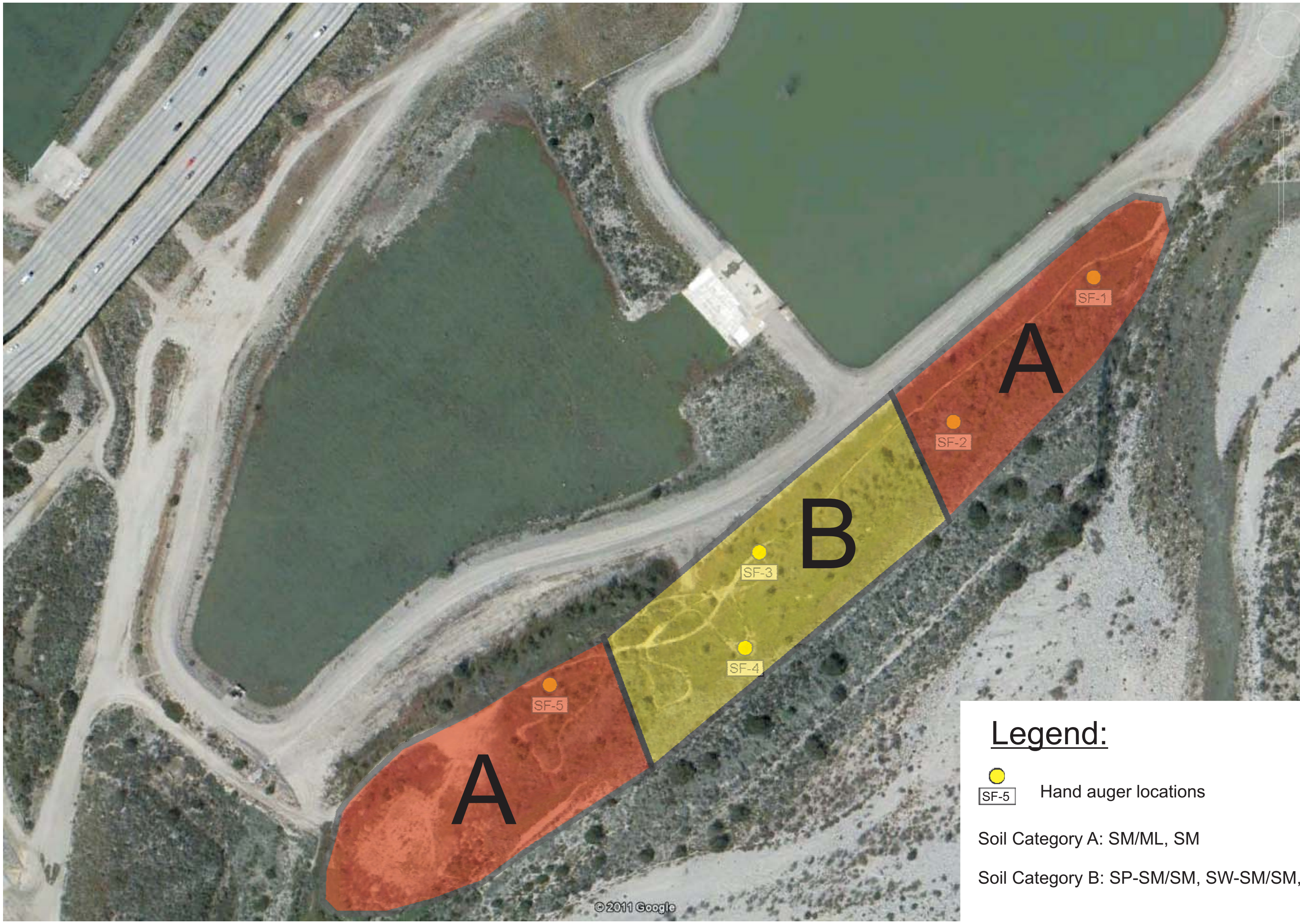
Soil Category C: SP, SW, SP-SM, SW-SM

N

0 300' 600'

NOTE: ALL LOCATIONS, DIRECTIONS AND DIMENSIONS ARE APPROXIMATE

TETRA TECH	1360 Valley Vista Drive Diamond Bar, CA 91765 Phone (909) 860-5096	Devil's Gate Exploration Location and Soil Category Map
Project Name:	LACDPW Sedimentation Study	
Project Number: BAS 11-58E	DATE: August 2011	Figure: 3



Legend:

SF-5 Hand auger locations

Soil Category A: SM/ML, SM

Soil Category B: SP-SM/SM, SW-SM/SM, SM

N

0 100' 200'

NOTE: ALL LOCATIONS, DIRECTIONS AND DIMENSIONS ARE APPROXIMATE

TETRA TECH
1360 Valley Vista Drive
Diamond Bar, CA 91765
Phone (909) 860-5096

Project Name: LACDPW Sedimentation Study

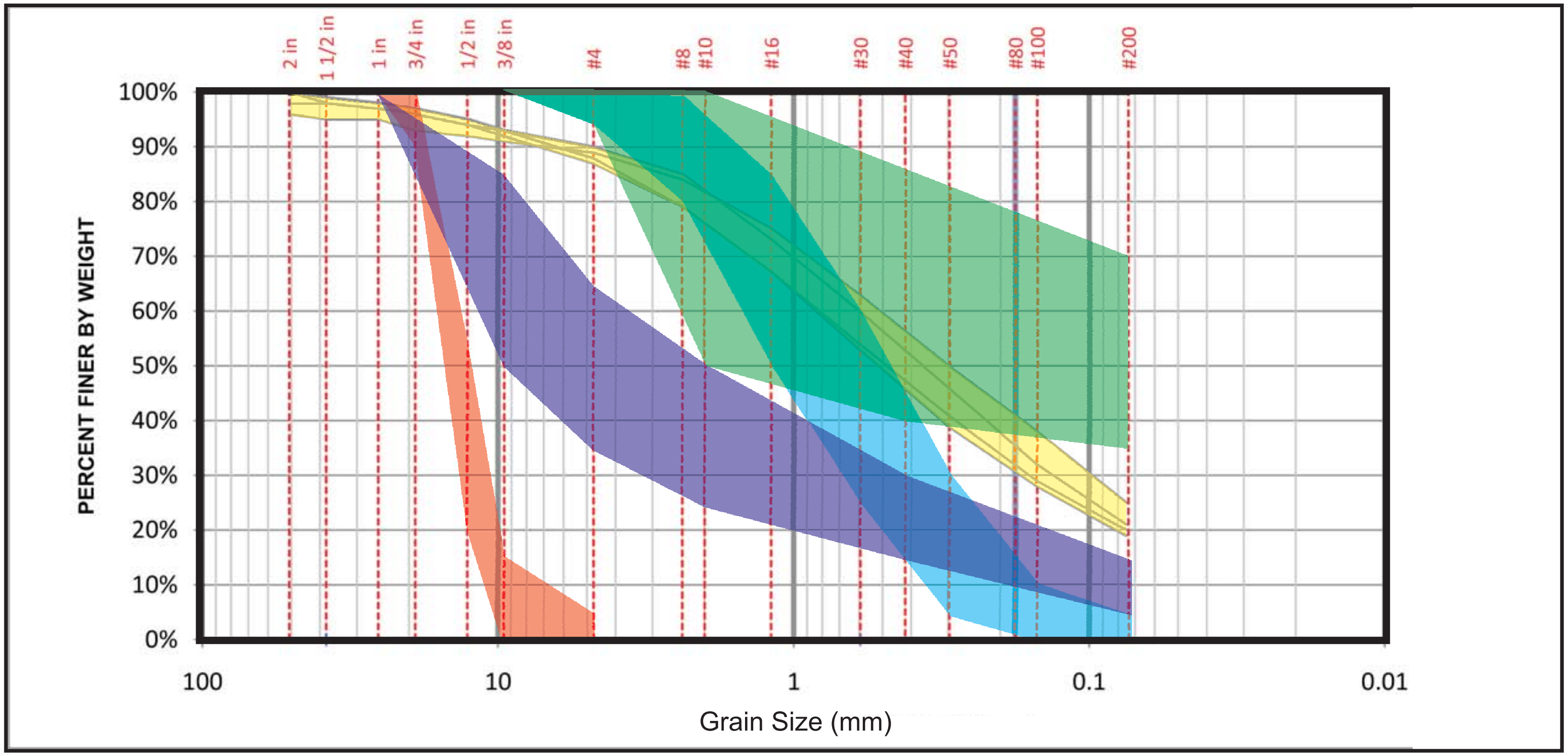
Project Number: BAS 11-58E

DATE: August 2011

Santa Fe Dam
Exploration Location and
Soil Category Map

Figure: 4

Soil Gradation Results for May SPS



LEGEND:

- Specification for #6 Coarse Aggregate (ASTM C 33)
- Specification for Fine Aggregate (ASTM C 33)
- Site soils
- Suggested gradation meeting specification for Topsoil (ASTM D 5268)
- Specification for Aggregate Base Gradation C (ASTM D 1241)

TETRA TECH
1360 Valley Vista Drive
Diamond Bar, CA 91765
Phone (909) 860-5096

Project Name: LACDPW Sedimentation Study

Project Number: BAS 11-58E

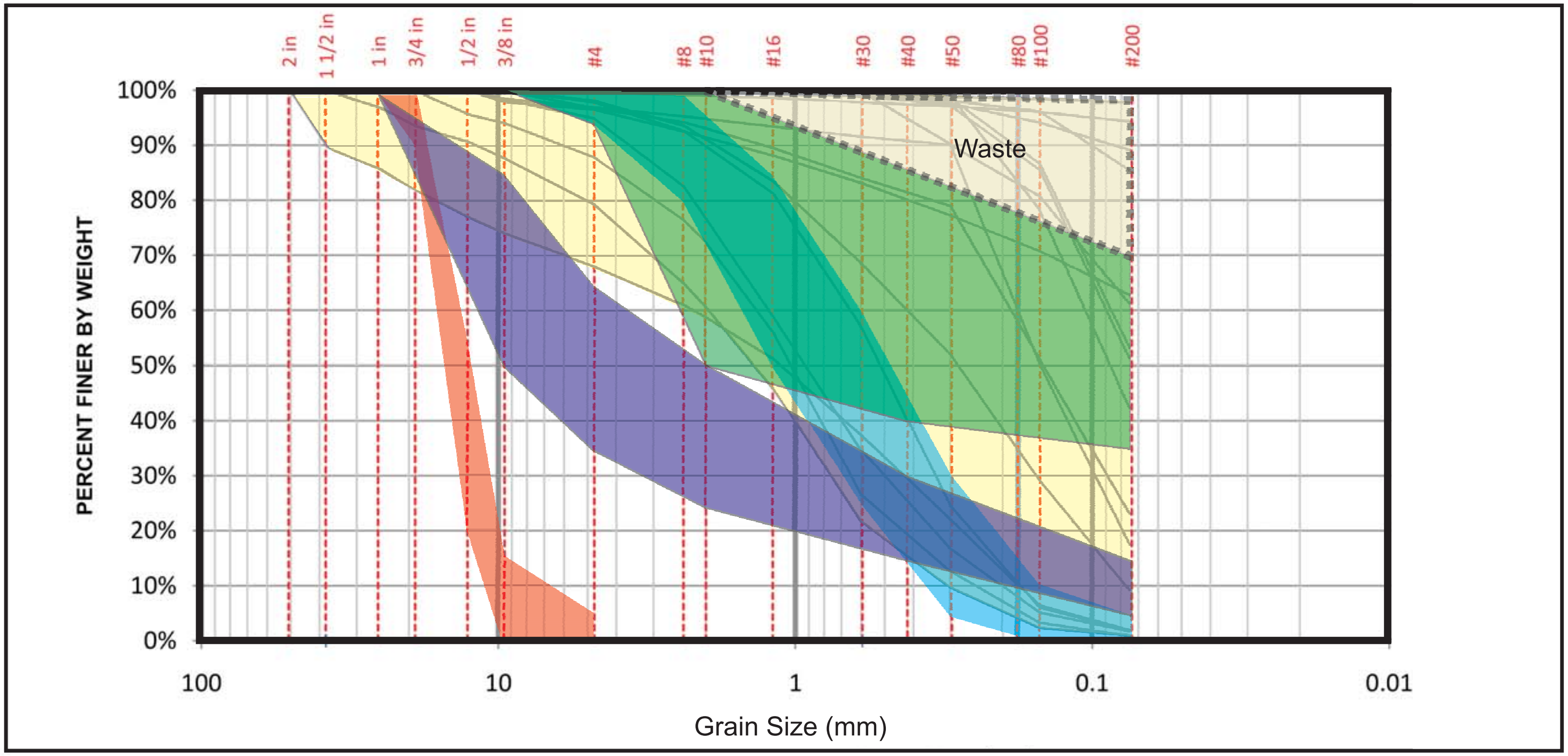
DATE: July 2011

LACDPW Sedimentation Study

May SPS

FIGURE 5

Soil Gradation Results for Devil's Gate



LEGEND:

- Specification for #6 Coarse Aggregate (ASTM C 33)
- Specification for Fine Aggregate (ASTM C 33)
- Site soils
- Suggested gradation meeting specification for Topsoil (ASTM D 5268)
- Specification for Aggregate Base Gradation C (ASTM D 1241)

TETRA TECH
1360 Valley Vista Drive
Diamond Bar, CA 91765
Phone (909) 860-5096

Project Name: LACDPW Sedimentation Study

Project Number: BAS 11-58E

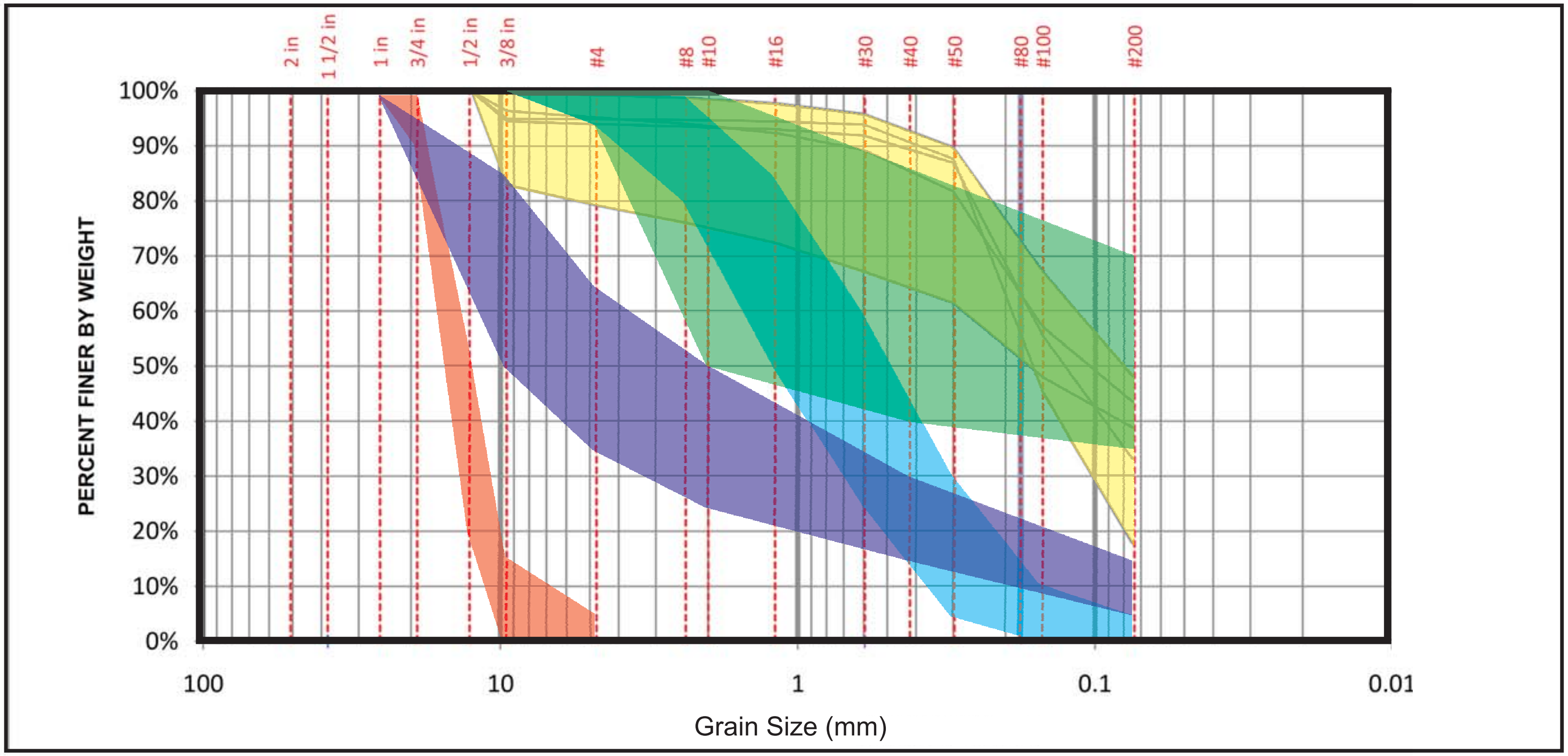
DATE: July 2011

LACDPW Sedimentation Study

Devil's Gate

FIGURE 6

Soil Gradation Results for Santa Fe Dam



LEGEND:

- Specification for #6 Coarse Aggregate (ASTM C 33)
- Specification for Fine Aggregate (ASTM C 33)
- Site soils
- Suggested gradation meeting specification for Topsoil (ASTM D 5268)
- Specification for Aggregate Base Gradation C (ASTM D 1241)

TETRA TECH
1360 Valley Vista Drive
Diamond Bar, CA 91765
Phone (909) 860-5096

Project Name: LACDPW Sedimentation Study

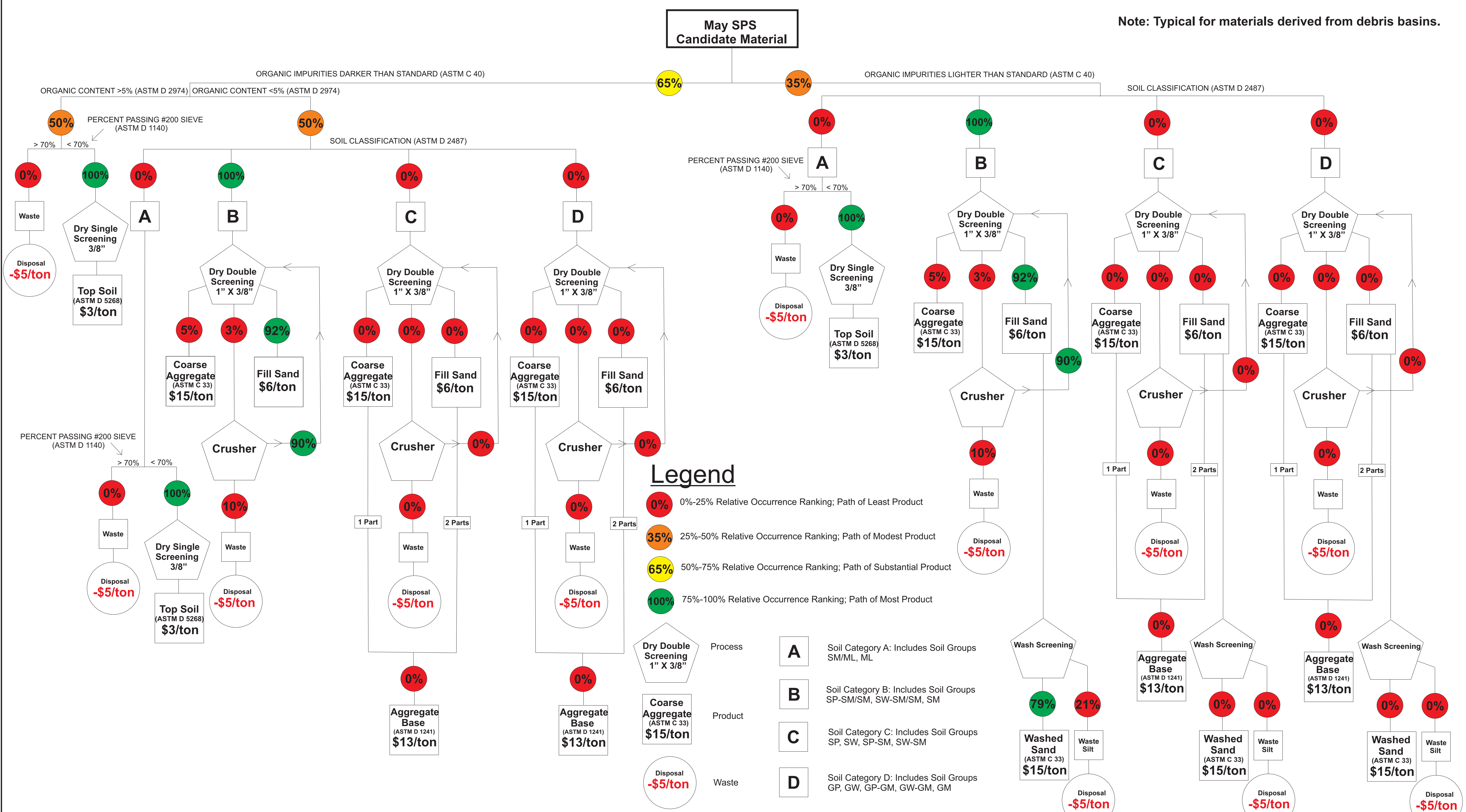
Project Number: BAS 11-58E

DATE: July 2011

LACDPW Sedimentation Study

Santa Fe Dam

FIGURE 7



ESTIMATED VALUE OF MATERIALS BASED ON 50,000 TONS OF PROCESSED MATERIAL

Product	Option 1 - No Washed Sand, No Aggregate Base				Option 2 - Washed Sand, No Aggregate Base				Option 3 - No Washed Sand, Aggregate Base				Option 4 - Washed Sand, Aggregate Base			
	Quantity (tons)	Gross Value	Estimated Cost	Net Value	Quantity (tons)	Gross Value	Estimated Cost	Net Value	Quantity (tons)	Gross Value	Estimated Cost	Net Value	Quantity (tons)	Gross Value	Estimated Cost	Net Value
Top Soil	16,250	$48,750	-$65,000	-$16,250	16,250	$48,750	-$65,000	-$16,250	16,250	$48,750	-$65,000	-$16,250	16,250	$48,750	-$65,000	-$16,250
Fill Sand	31,050	$186,300	-$124,200	$62,100	14,950	$89,700	-$59,800	$29,900	31,050	$186,300	-$124,200	$62,100	14,950	$89,700	-$59,800	$29,900
Coarse Aggregate	2,599	$38,981	-$10,395	$28,586	2,599	$38,981	-$10,395	$28,586	2,599	$38,981	-$10,395	$28,586	2,599	$38,981	-$10,395	$28,586
Aggregate Base	--	--	--	--	--	--	--	--	0	$0	$0	$0	0	$0	$0	$0
Washed Sand	--	--	--	--	12,719	$190,785	-$114,471	$76,314	--	--	--	--	12,719	$190,785	-$114,471	$76,314
Waste	101	--	-$506	-$506	3,482	--	-$17,411	-$17,411	101	--	-$506	-$506	3,482	--	-$17,411	-$17,411
	TOTALS	$274,031	-$200,101	$73,930		$368,216	-$267,077	$101,139		$274,031	-$200,101	$73,930		$368,216	-$267,077	$101,139

TETRA TECH
1360 Valley Vista Drive
Diamond Bar, CA 91765
Phone (909) 860-5096

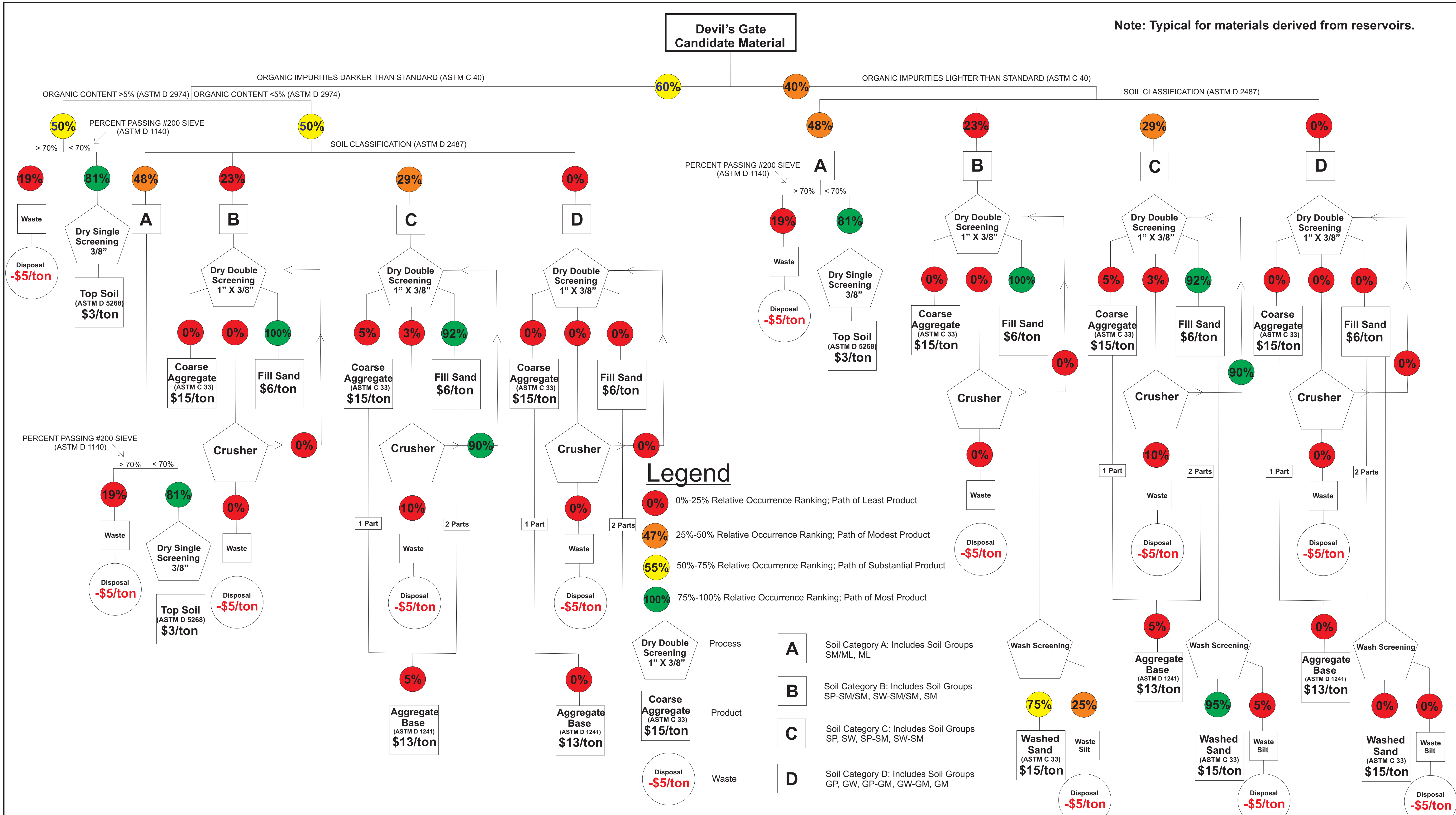
Project Name: LACDPW Sedimentation Study

Project Number: BAS 11-58E

DATE: August 2011

Candidate Material Flow Chart for May SPS

Figure 8



ESTIMATED VALUE OF MATERIALS BASED ON 50,000 TONS OF PROCESSED MATERIAL

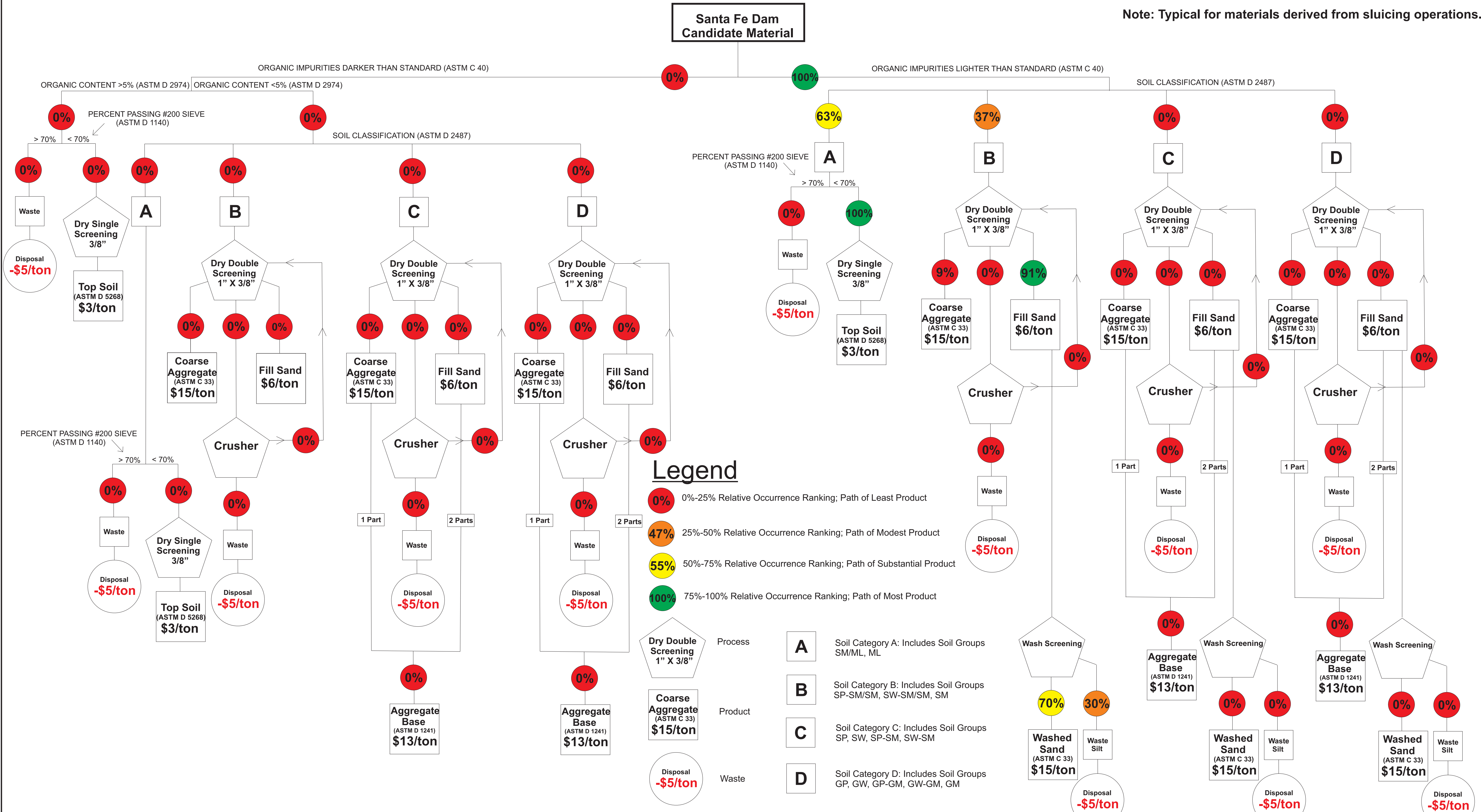
Product	Option 1 - No Washed Sand, No Aggregate Base				Option 2 - Washed Sand, No Aggregate Base				Option 3 - No Washed Sand, Aggregate Base				Option 4 - Washed Sand, Aggregate Base			
	Quantity (tons)	Gross Value	Estimated Cost	Net Value	Quantity (tons)	Gross Value	Estimated Cost	Net Value	Quantity (tons)	Gross Value	Estimated Cost	Net Value	Quantity (tons)	Gross Value	Estimated Cost	Net Value
Top Soil	25,758	$77,274	-$103,032	-$25,758	25,758	$77,274	-$103,032	-$25,758	25,758	$77,274	-$103,032	-$25,758	25,758	$77,274	-$103,032	-$25,758
Fill Sand	17,388	$104,328	-$69,552	$34,776	7,452	$44,712	-$29,808	$14,904	15,825	$94,949	-$63,300	$31,650	5,889	$35,333	-$23,556	$11,778
Coarse Aggregate	782	$11,723	-$3,126	$8,597	782	$11,723	-$3,126	$8,597	0	$0	$0	$0	0	$0	$0	$0
Aggregate Base	--	--	--	--	--	--	--	--	2,345	$30,480	-$9,379	$21,102	2,345	$30,480	-$9,379	$21,102
Washed Sand	--	--	--	--	8,519	$127,788	-$76,673	$51,115	--	--	--	--	8,519	$127,788	-$76,673	$51,115
Waste	6,072	--	-$30,362	-$30,362	7,489	--	-$37,446	-$37,446	6,072	--	-$30,362	-$30,362	7,489	--	-$37,446	-$37,446
	TOTALS	$193,325	-$206,072	-$12,747		$261,497	-$250,085	$11,412		$202,704	-$206,072	-$3,369		$270,876	-$250,085	$20,791

TETRA TECH
1360 Valley Vista Drive
Diamond Bar, CA 91765
Phone (909) 860-5096

Project Name: LACDPW Sedimentation Study
Project Number: BAS 11-58E
DATE: August 2011

Candidate Material Flow Chart for Devil's Gate

Figure 9



ESTIMATED VALUE OF MATERIALS BASED ON 50,000 TONS OF PROCESSED MATERIAL																
Product	Option 1 - No Washed Sand, No Aggregate Base				Option 2 - Washed Sand, No Aggregate Base				Option 3 - No Washed Sand, Aggregate Base				Option 4 - Washed Sand, Aggregate Base			
	Quantity (tons)	Gross Value	Estimated Cost	Net Value	Quantity (tons)	Gross Value	Estimated Cost	Net Value	Quantity (tons)	Gross Value	Estimated Cost	Net Value	Quantity (tons)	Gross Value	Estimated Cost	Net Value
Top Soil	31,500	$94,500	-$126,000	-$31,500	31,500	$94,500	-$126,000	-$31,500	31,500	$94,500	-$126,000	-$31,500	31,500	$94,500	-$126,000	-$31,500
Fill Sand	16,835	$101,010	-$67,340	$33,670	0	$0	$0	$0	16,835	$101,010	-$67,340	$33,670	0	$0	$0	$0
Coarse Aggregate	1,665	$24,975	-$6,660	$18,315	1,665	$24,975	-$6,660	$18,315	1,665	$24,975	-$6,660	$18,315	1,665	$24,975	-$6,660	$18,315
Aggregate Base	--	--	--	--	--	--	--	--	0	$0	$0	$0	0	$0	$0	$0
Washed Sand	--	--	--	--	11,785	$176,768	-$106,061	$70,707	--	--	--	--	11,785	$176,768	-$106,061	$70,707
Waste	0	--	$0	$0	5,051	--	-$25,253	-$25,253	0	--	$0	$0	5,051	--	-$25,253	-$25,253
	TOTALS	$220,485	-$200,000	$20,485		$296,243	-$263,973	$32,270		$220,485	-$200,000	$20,485		$296,243	-$263,973	$32,270

TETRA TECH
1360 Valley Vista Drive
Diamond Bar, CA 91765
Phone (909) 860-5096

Project Name: LACDPW Sedimentation Study
Project Number: BAS 11-58E
DATE: August 2011

Candidate Material Flow Chart for Santa Fe Dam

Figure 10

Appendix A

Laboratory Test Results

SMITH-EMERY Laboratories

Sieve Analysis of Aggregate

ASTM C136

791/781 East Washington Boulevard, Los Angeles, CA 90021

Tel. No. (213) 745-5333; Fax No. (213) 746-0744

Client: KFM GeoScience
Project: LADPW Sedimentation Study
Location:
Material Description: Brown SILTY SAND
Source:
Remark: Sampled by client

SEL REPORT No.: G-11-8507
SEL FILE No.: 40126-1
Date Tested: 6/14/11
Date Sampled: NA
Sample No.: TP-2
Depth: 0–4

Sieve Size	2"	1 1/2"	1"	3/4"	1/2"	3/8"	No.4	No.8	No.16	No.30	No.50	No.100	No.200
Percent Passing	**98**	**98**	**97**	**96**	**94**	**92**	**87**	**79**	**67**	**53**	**39**	**28**	**19**
C33 Lower Limit						100	95	80	50	25	5	0	
C33 Upper Limit						100	100	100	85	60	30	10	

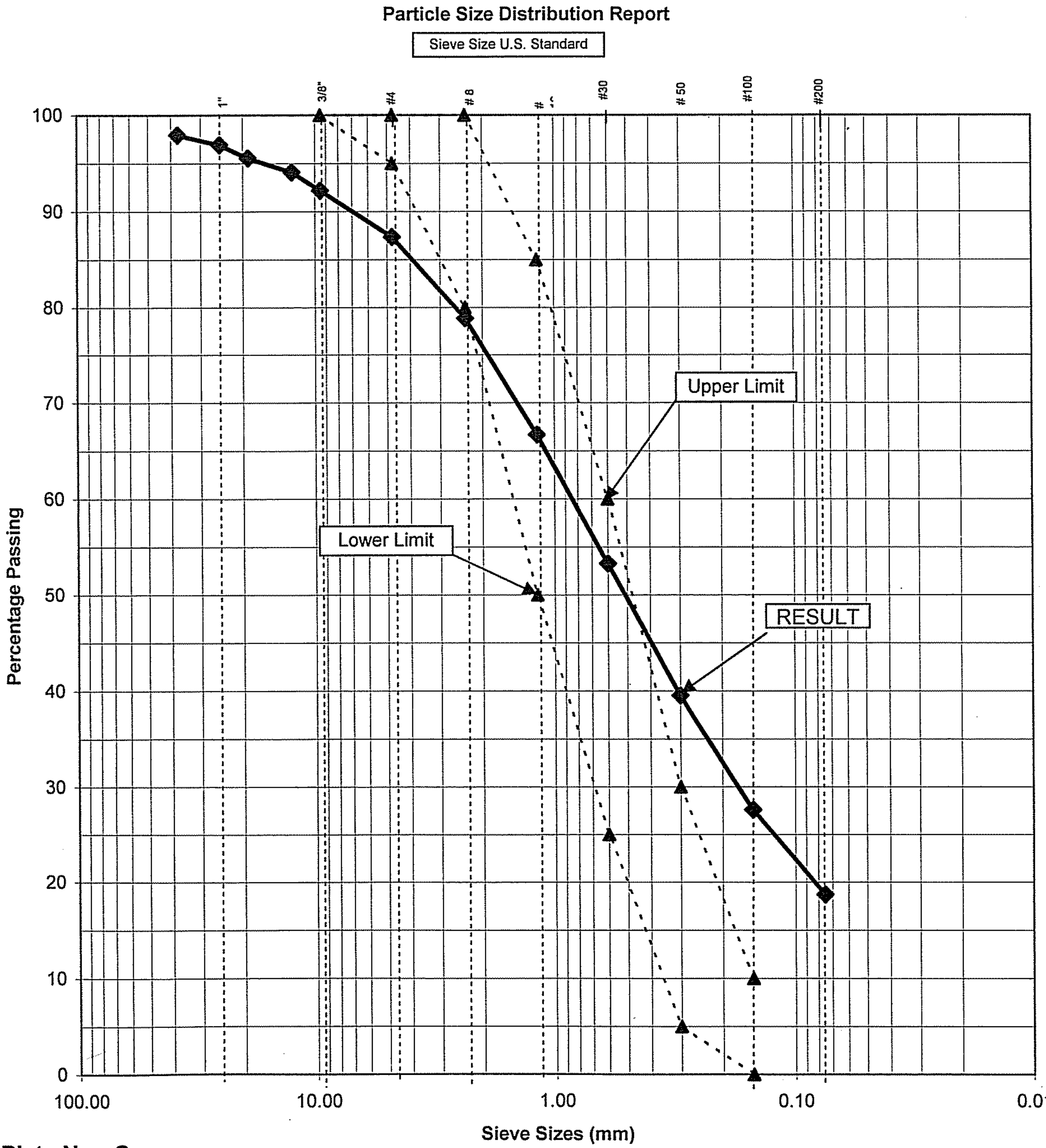


Plate No.: C

SMITH-EMERY Laboratories

Sieve Analysis of Aggregate

ASTM C136

791/781 East Washington Boulevard, Los Angeles, CA 90021

Tel. No. (213) 745-5333; Fax No. (213) 746-0744

Client: KFM GeoScience — SEL REPORT No.: G-11-8507

Project: LADPW Sedimentation Study — SEL FILE No.: 40126-1

Location: — Date Tested: 6/14/11

Material Description: Black SILTY SAND — Date Sampled: NA

Source: — Sample No.: TP-2

Remark: Sampled by client — Depth: 5–11

Sieve Size	2"	1 1/2"	1"	3/4"	1/2"	3/8"	No.4	No.8	No.16	No.30	No.50	No.100	No.200
Percent Passing	**100**	**98**	**97**	**96**	**94**	**93**	**90**	**85**	**73**	**60**	**46**	**32**	**21**
C33 Lower Limit						100	95	80	50	25	5	0	
C33 Upper Limit						100	100	100	85	60	30	10	

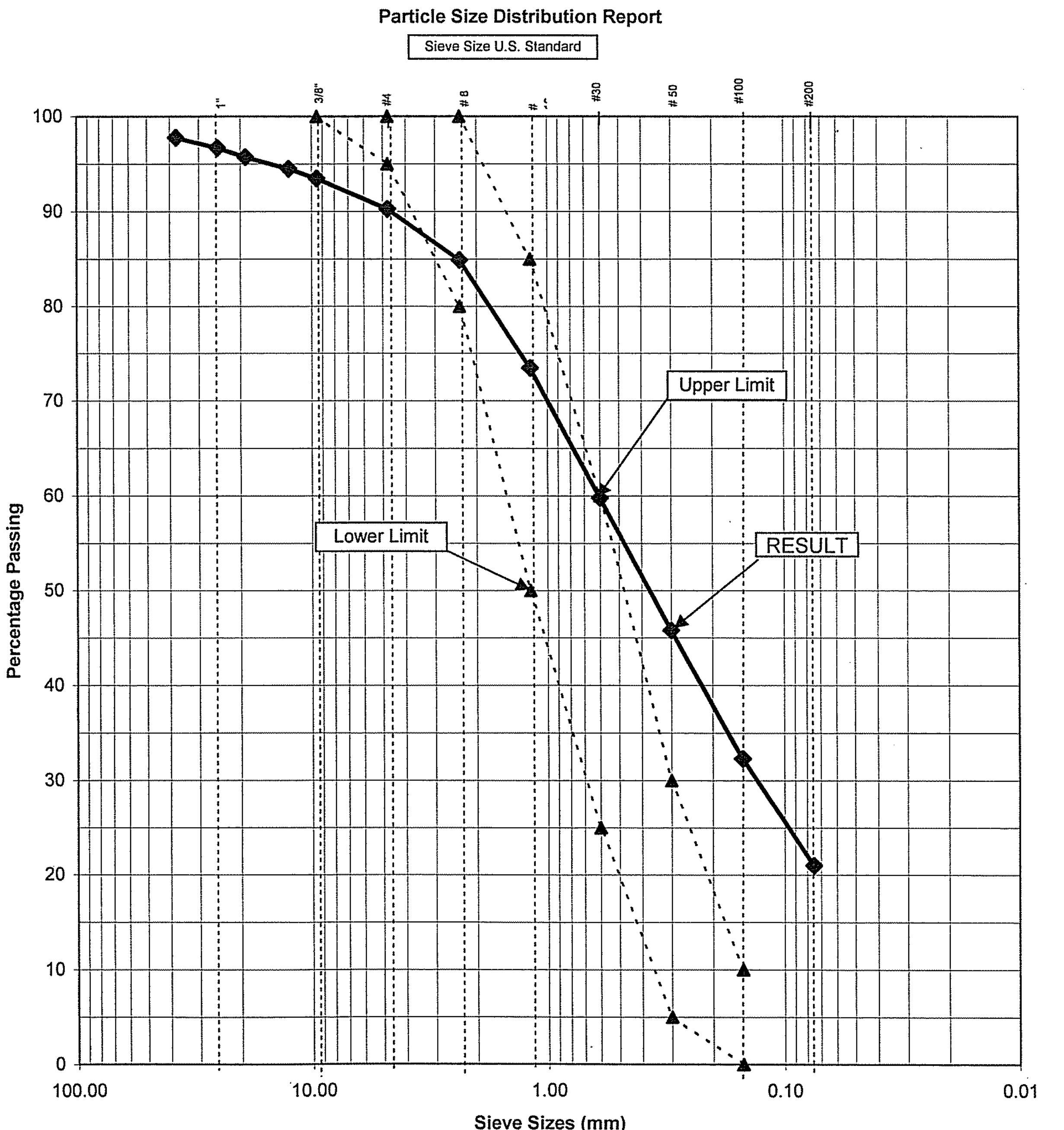


Plate No.: D

SMITH-EMERY Laboratories

Sieve Analysis of Aggregate

ASTM C136

791/781 East Washington Boulevard, Los Angeles, CA 90021

Tel. No. (213) 745-5333; Fax No. (213) 746-0744

Client: KFM GeoScience — SEL REPORT No.: G-11-8507

Project: LADPW Sedimentation Study — SEL FILE No.: 40126-1

Location: — Date Tested: 6/14/11

Material Description: Brown SILTY SAND — Date Sampled: NA

Source: — Sample No.: TP-3

Remark: Sampled by client — Depth: 0–3

Sieve Size	2"	1 1/2"	1"	3/4"	1/2"	3/8"	No.4	No.8	No.16	No.30	No.50	No.100	No.200
Percent Passing	**100**	**99**	**98**	**97**	**95**	**93**	**88**	**79**	**67**	**54**	**41**	**29**	**20**
C33 Lower Limit						100	95	80	50	25	5	0	
C33 Upper Limit						100	100	100	85	60	30	10	

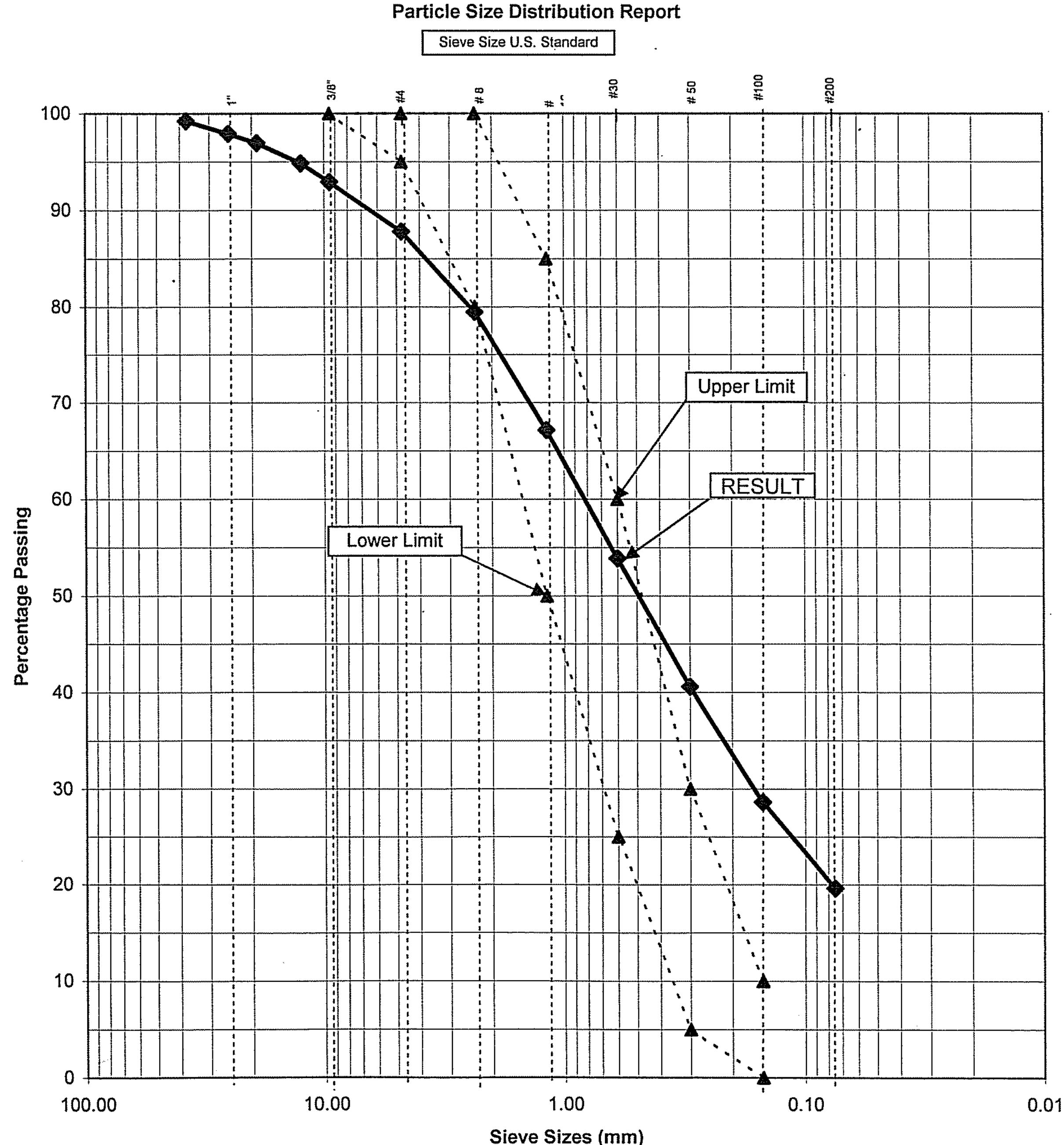


Plate No.: A

SMITH-EMERY Laboratories

Sieve Analysis of Aggregate

ASTM C136

791/781 East Washington Boulevard, Los Angeles, CA 90021

Tel. No. (213) 745-5333; Fax No. (213) 746-0744

Client: KFM GeoScience
Project: LADPW Sedimentation Study
Location:
Material Description: Black SILTY SAND
Source:
Remark: Sampled by client

SEL REPORT No.: G-11-8507
SEL FILE No.: 40126-1
Date Tested: 6/14/11
Date Sampled: NA
Sample No.: TP-3
Depth: 3–12

Sieve Size	2"	1 1/2"	1"	3/4"	1/2"	3/8"	No.4	No.8	No.16	No.30	No.50	No.100	No.200
Percent Passing	**96**	**95**	**95**	**93**	**92**	**91**	**89**	**84**	**75**	**63**	**50**	**38**	**25**
C33 Lower Limit						100	95	80	50	25	5	0	
C33 Upper Limit						100	100	100	85	60	30	10	

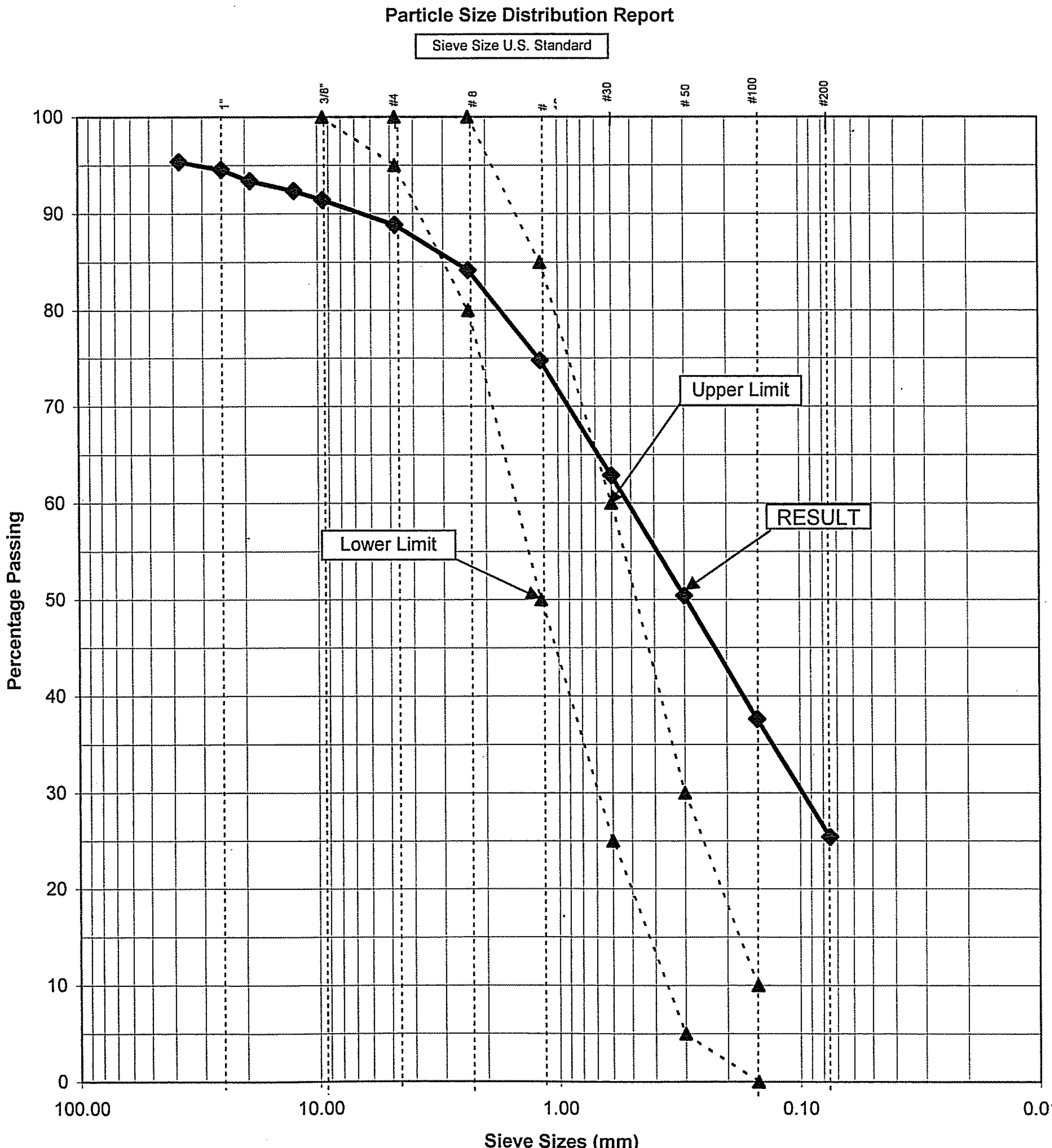


Plate No.: B

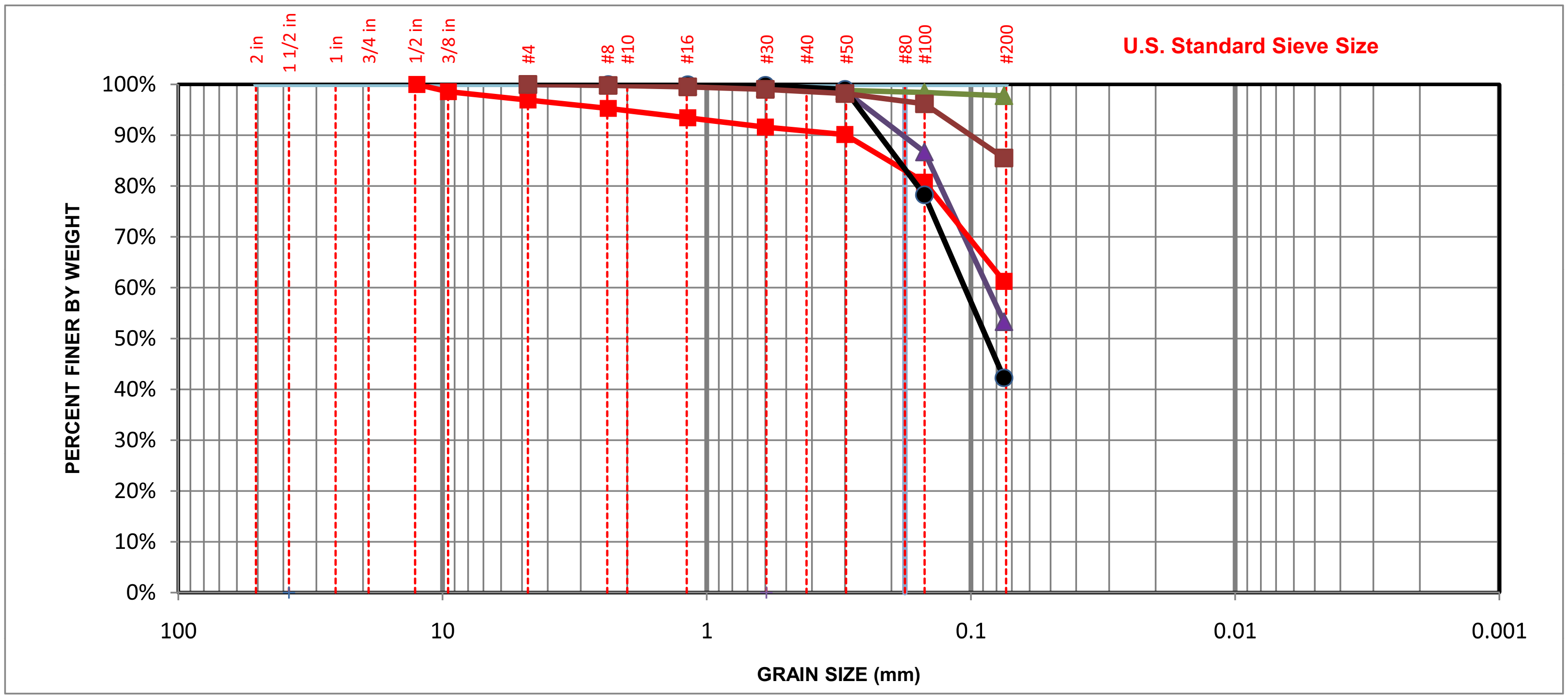
KFM GEOSCIENCE
1360 Valley Vista Drive
Diamond Bar, CA 91765
Phone (909) 860-5096

GRAIN SIZE DISTRIBUTION ANALYSIS
(ASTM C136/C117/D422)

Job Name: LADPW Sedimentation Study
Job Number: BAS 11-58E
Sampled By: MS
Date Sampled: June 9, 2011

Tested By : MN
Date Completed: June 17, 2011
Input By: MN
Lab Number: 27

Sample Description: Samples from Devil's Gate; samples DG-1a, 1b, 2a, 2b and 3



	Sample #	Lab #	LL	PI	USCS	Gravel	Sand	Fines	2μ
●	DG-1a	27			SM	0.0%	57.7%	42.3%	
■	DG-1b	27	41	2	ML	0.0%	14.5%	85.5%	
▲	DG-2a	27	52	12	MH	0.0%	2.2%	97.8%	
▲	DG-2b	27			ML	0.1%	46.6%	53.3%	
■	DG-3	27			ML	3.1%	35.7%	61.3%	

KFM GEOSCIENCE

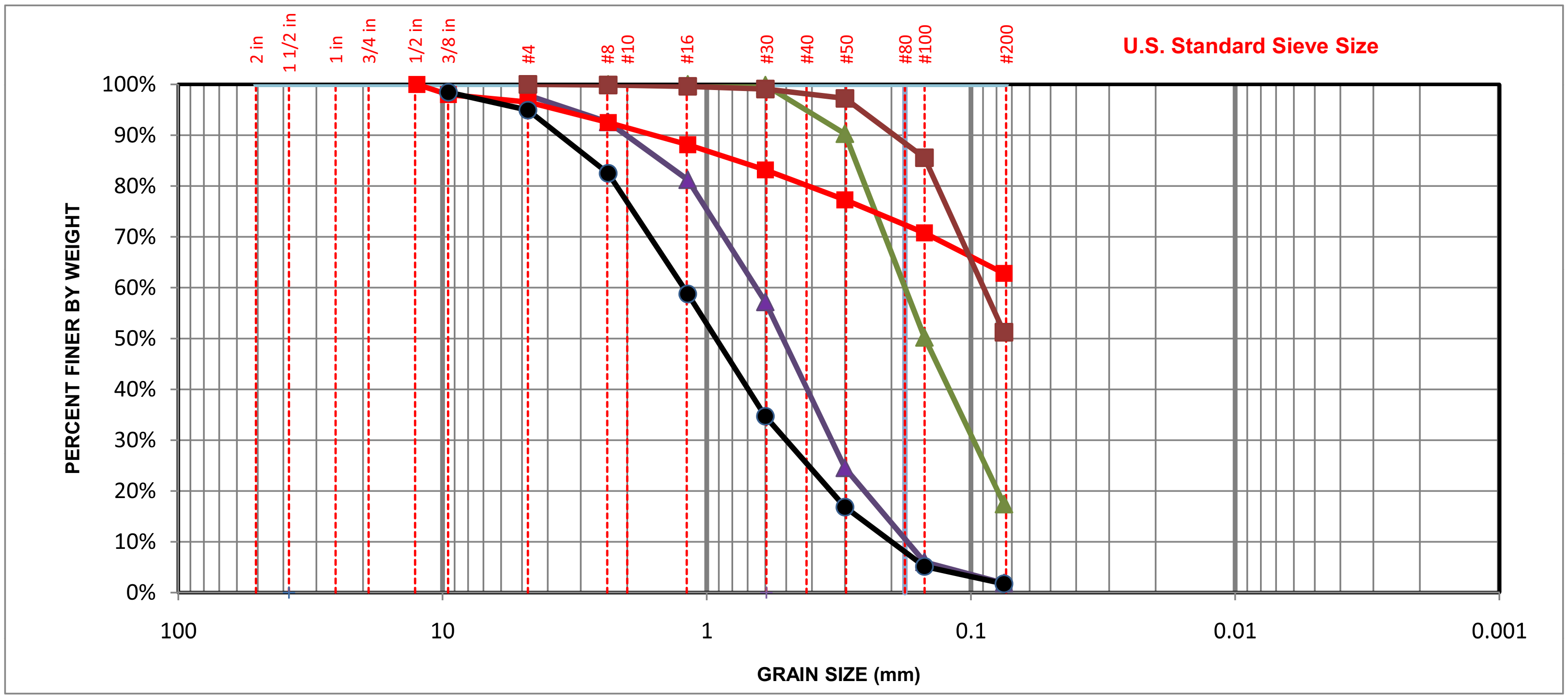
1360 Valley Vista Drive
Diamond Bar, CA 91765
Phone (909) 860-5096

GRAIN SIZE DISTRIBUTION ANALYSIS

(ASTM C136/C117/D422)

Job Name:	LADPW Sedimentation Study	Tested By :	MN
Job Number:	BAS 11-58E	Date Completed:	June 17, 2011
Sampled By:	MS	Input By:	MN
Date Sampled:	June 9, 2011	Lab Number:	27

Sample Description: Samples from Devil's Gate; samples DG-4a, 5a, 5b, 6a and 6b



	Sample #	Lab #	LL	PI	USCS	Gravel	Sand	Fines	2μ
●	DG-4a	27			SP	5.1%	93.2%	1.7%	
■	DG-5a	27			ML	0.0%	48.8%	51.2%	
▲	DG-5b	27			SM	0.0%	82.6%	17.4%	
▲	DG-6a	27			SP	2.1%	96.0%	1.9%	
■	DG-6b	27		NP	ML	3.5%	33.7%	62.8%	

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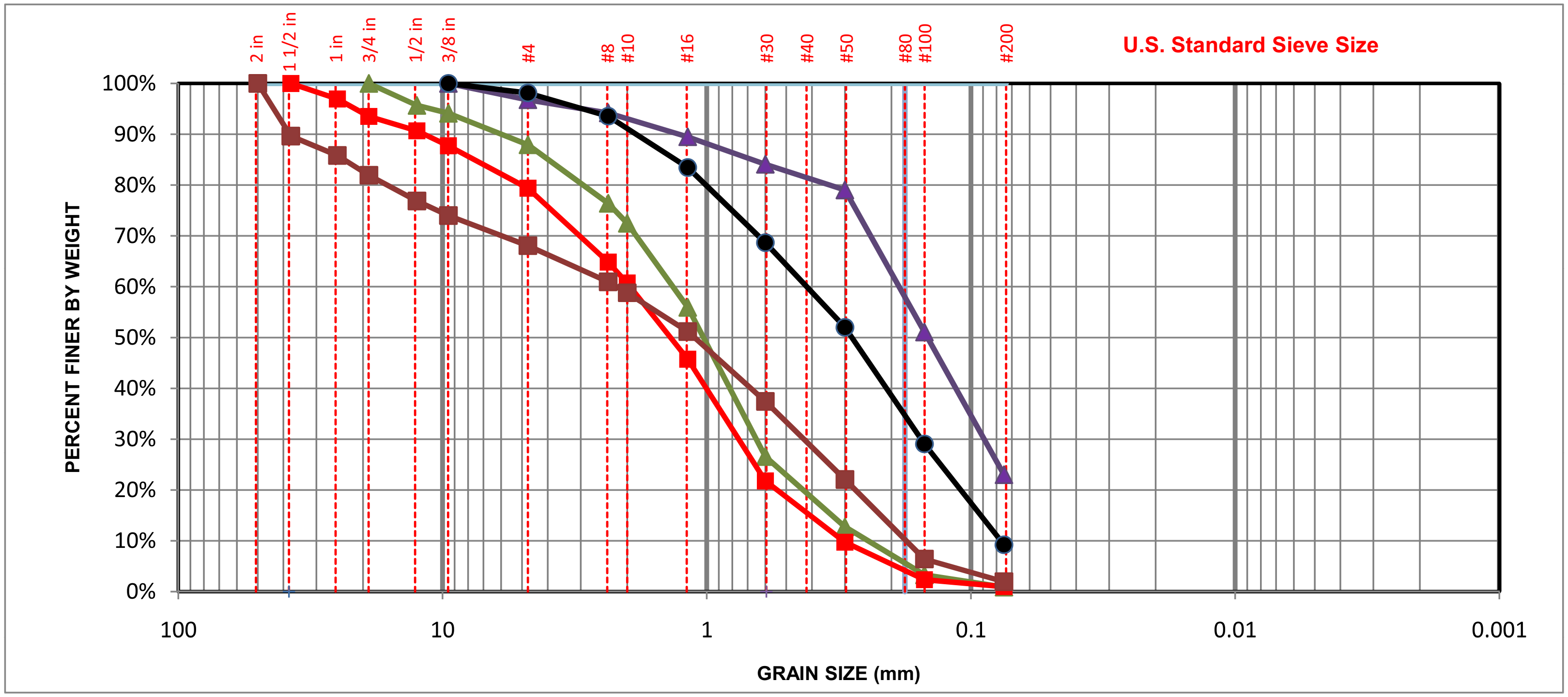
1360 Valley Vista Drive
Diamond Bar, CA 91765
Phone (909) 860-5096

GRAIN SIZE DISTRIBUTION ANALYSIS
(ASTM C136/C117/D422)

Job Name:	LADPW Sedimentation Study	Tested By :	MN
Job Number:	BAS 11-58E	Date Completed:	June 17, 2011
Sampled By:	MS	Input By:	MN
Date Sampled:	June 9, 2011	Lab Number:	27

Sample Description: Samples from Devil's Gate; samples DG-7, 8, 9a, 9b and 10



	Sample #	Lab #	LL	PI	USCS	Gravel	Sand	Fines	2µ
●	DG-7	27			SP	1.9%	88.9%	9.2%	
■	DG-8	27			SP	31.9%	66.1%	1.9%	
▲	DG-9a	27			SP	12.1%	87.0%	0.9%	
▲	DG-9b	27			SM	3.2%	73.8%	23.0%	
■	DG-10	27			SP	20.6%	78.4%	1.0%	

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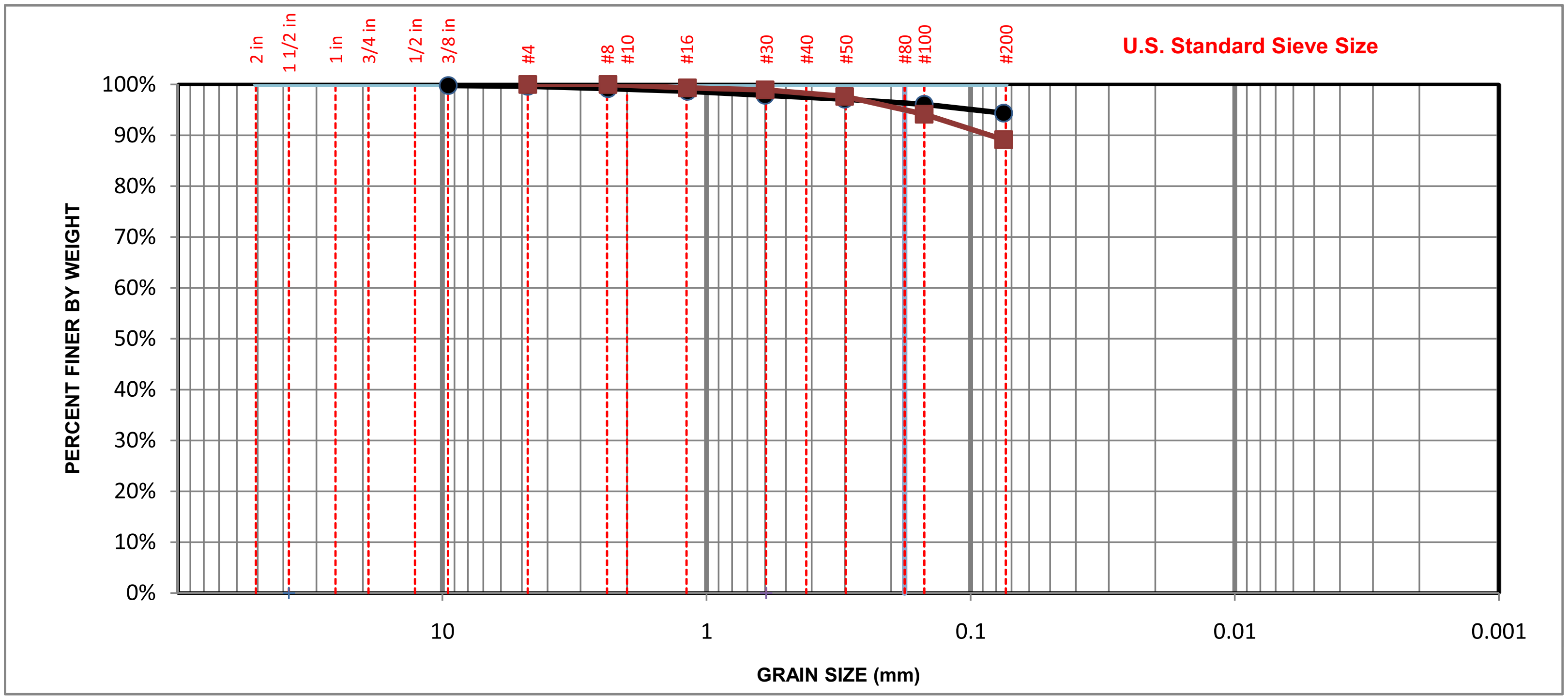
1360 Valley Vista Drive
Diamond Bar, CA 91765
Phone (909) 860-5096

GRAIN SIZE DISTRIBUTION ANALYSIS
(ASTM C136/C117/D422)

Job Name:	LACDPW Sedimentation Study	Tested By :	MN
Job Number:	BAS 11-58E	Date Completed:	June 17, 2011
Sampled By:	MCS	Input By:	MN
Date Sampled:	June 9, 2011	Lab Number:	27

Sample Description: Samples from Devil's Gate; DG-11 and DG-12



	Sample #	Lab #	LL	PI	USCS	Gravel	Sand	Fines	2μ
●	DG-11	27	48	7	ML	0.4%	5.3%	94.4%	
■	DG-12	27	50	12	MH	0.0%	10.8%	89.2%	
▲									
▲									
■									

KFM GEOSCIENCE

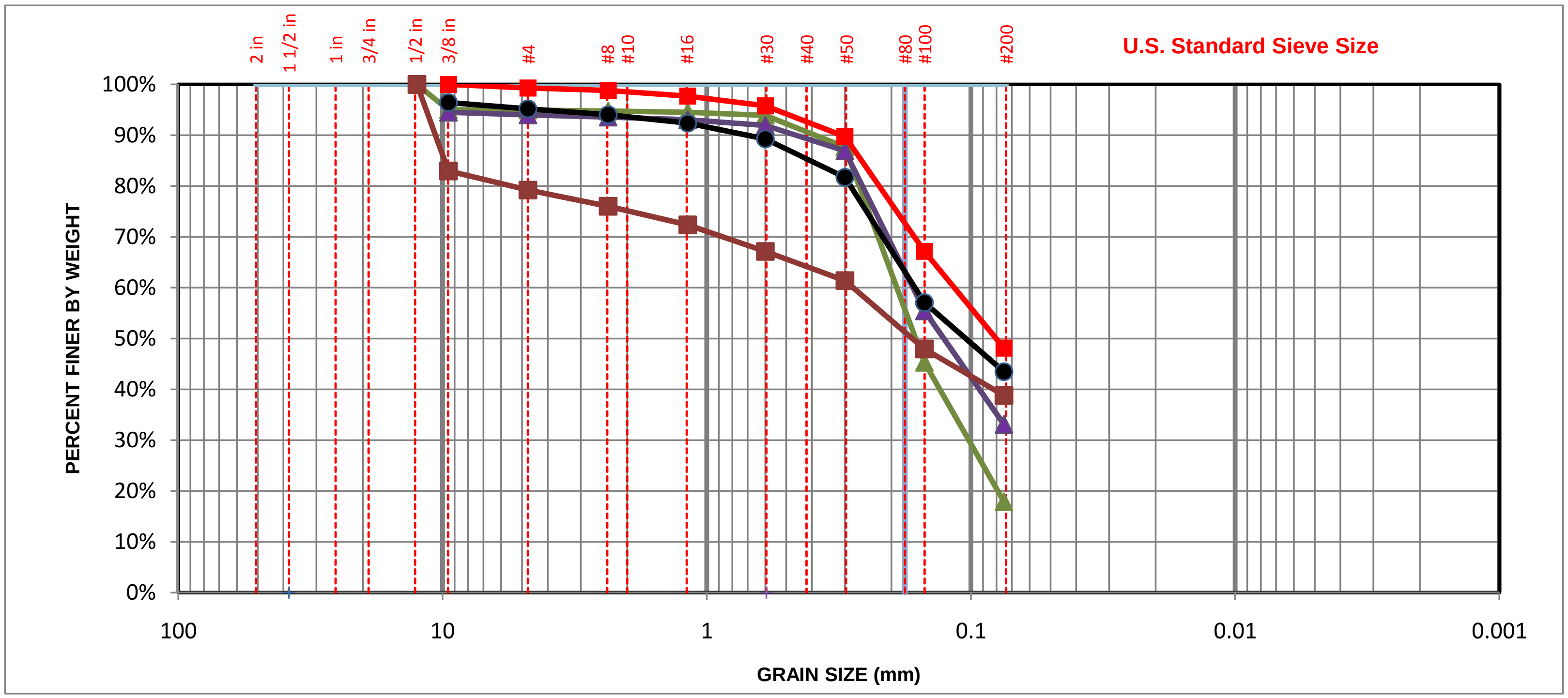
1360 Valley Vista Drive
Diamond Bar, CA 91765
Phone (909) 860-5096

GRAIN SIZE DISTRIBUTION ANALYSIS

(ASTM C136/C117/D422)

Job Name:	LADPW Sedimentation Study	Tested By :	MN
Job Number:	BAS 11-58E	Date Completed:	June 17, 2011
Sampled By:	MS	Input By:	MN
Date Sampled:	June 9, 2011	Lab Number:	27

Sample Description: Samples from Santa Fe Dam, SF-1 to SF-5



	Sample #	Lab #	LL	PI	USCS	Gravel	Sand	Fines	2μ
●	SF-1	27			SM	4.8%	51.7%	43.5%	
■	SF-2	27			SM	20.8%	40.4%	38.8%	
▲	SF-3	27			SM	5.0%	77.1%	17.9%	
▲	SF-4	27			SM	6.0%	60.9%	33.1%	
■	SF-5	27			SM	0.7%	51.2%	48.1%	

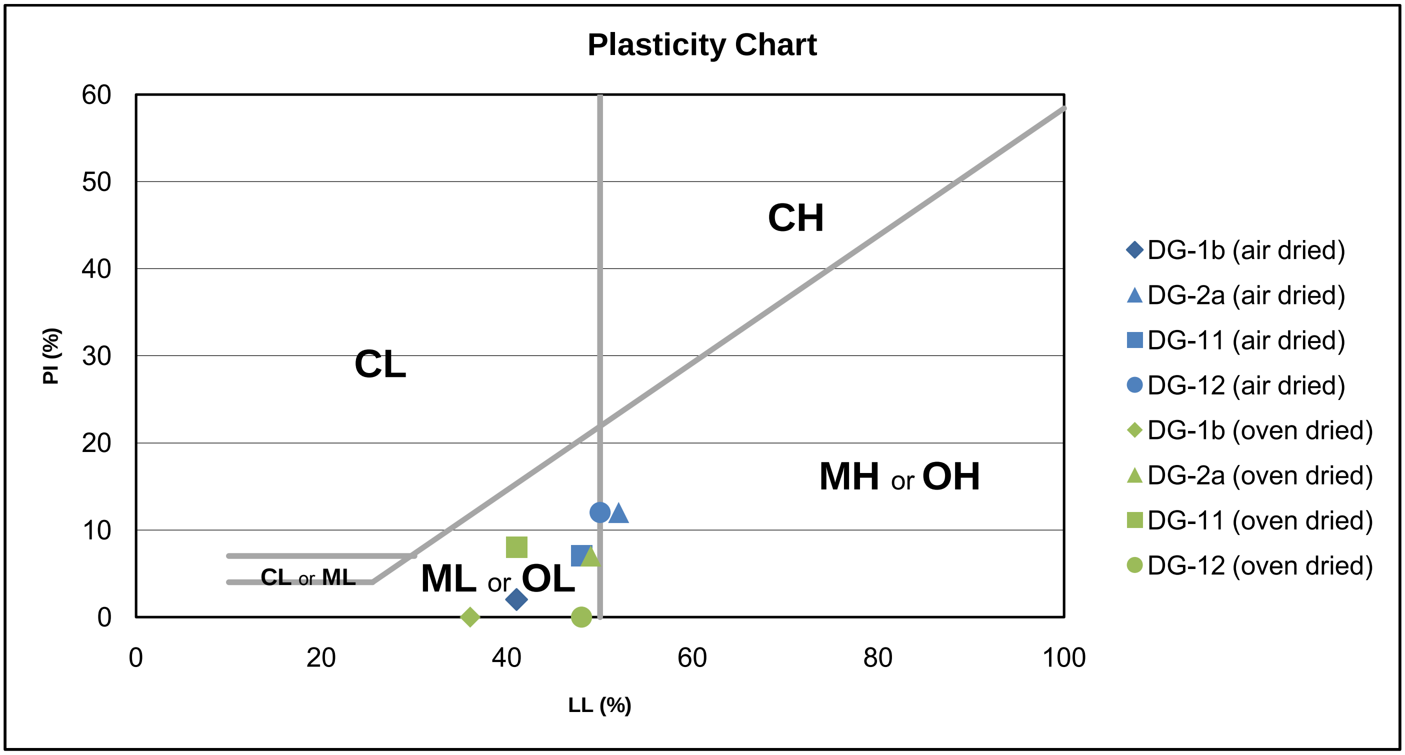
KFM GEOSCIENCE
1360 Valley Vista Drive
Diamond Bar, CA 91765
Phone (909) 860-5096

ATTERBERG LIMITS

ASTM D 4318

Job Name:	LACDPW Sed. Study	Tested By :	MN, JC
Job Number:	BAS 11-58E	Date Completed:	August 16, 2011
Sampled By:	MCS	Input By:	MN, JC
Date Sampled:	June 9, 2011	Lab Number:	27, 34

Sample ID	Liquid Limit	Plasticity Index	USCS Classification
DG-1b (air dried)	41	2	ML
DG-2a (air dried)	52	12	MH
DG-4b (air dried)	NP	NP	ML
DG-6b (air dried)	NP	NP	ML
DG-11 (air dried)	48	7	ML
DG-12 (air dried)	50	12	MH
DG-1b (oven dried)	36	0	ML
DG-2a (oven dried)	49	7	ML
DG-11 (oven dried)	41	8	ML
DG-12 (oven dried)	48	0	ML



SMITH-EMERY LABORATORIES
An Independent Commercial Testing Laboratory
781 E. Washington Boulevard - 2nd Floor Los Angeles, California 90021 ◆ (213) 745-5333 ◆ Fax (213) 749-7232

June 23, 2011

SEL File No.: 40126-1
SEL Report No.: G-11-8518

KFM GeoScience
1360 Valley Vista Drive
Diamond Bar, CA 91765

Attn: Mr. Michael Stojanoff

RE: LADPW Sedimentation Study
Los Angeles, California

Incompliance with the request by your authorized representative, Smith-Emery Laboratories has completed testing for the sediment samples for sand equivalent, organic impurities and organic matter in accordance with ASTM standard test method.

Test results are as follows:

REPORT OF TEST

Date Sample Received: 6/10/11 **Date Tested:** 6/21/11
Sampled By: Client

Sample I.D.	Test Method	Results
TP3 @ 3 – 12ft	ASTM D2974 Organic Matter	4.4
TP2 @ 5 – 11 ft	ASTM D2974 Organic Matter	2.5
TP3 @ 3 – 12 ft	ASTM C40 Organic Impurities	Darker Than Standard
TP2 @ 5 – 11 ft	ASTM C40 Organic Impurities	Darker Than Standard
TP3 @ 0 – 3 ft	ASTM D2419 Method A ave. of three	27
TP2 @ 5 – 11 ft	ASTM D2419 Method A ave. of three	25

Should you have any questions regarding the contents of this report, please call.

Respectfully submitted,
SMITH-EMERY GEOSERVICES

ANGELITO CABANILLA
Geotechnical Laboratory Manager
AC/ac
cc: 2-Addresse

SMITH-EMERY LABORATORIES
An Independent Commercial Testing Laboratory
781 E. Washington Boulevard - 2nd Floor Los Angeles, California 90021 ◆ (213) 745-5333 ◆ Fax (213) 749-7232

August 1, 2011

SEL File No.: 40126-1
SEL Report No.: G-11-8562

KFM GeoScience
1360 Valley Vista Drive
Diamond Bar, CA 91765

Attn: Mr. Michael Stojanoff

RE: LADPW Sedimentation Study
Los Angeles, California

Incompliance with the request by your authorized representative, Smith-Emery Laboratories has completed testing for the sediment samples for organic impurities and organic matter in accordance with ASTM standard test method.

Test results are as follows:

REPORT OF TEST

Date Sample Received: 7/27/11 **Date Tested:** 7/28/11
Sampled By: Client

Sample I.D.	ASTM D2974 Organic Matter		ASTM C40 Organic Impurities	
	As received Moisture Content (%)	Ash Content After 440°C	Organic Plate Color No.	Remarks
DG-2b @ 1.5 – 4.0ft	30.4	**4.6**	**5**	Darker Than Standard
DG-3 @ 0.0 – 3.0 ft	44.3	**11.9**	**5**	Darker Than Standard
DG-5b @ 2.0 – 4.0 ft	–	–	**5**	Darker Than Standard
DG-7 @ 0.0 – 1.5 ft	–	–	**4**	Darker Than Standard
DG-8 @ 0.0 – 1.5 ft	–	–	**3**	Standard

Should you have any questions regarding the contents of this report, please call.

Respectfully submitted,
SMITH-EMERY GEOSERVICES

ANGELITO CABANILLA
Geotechnical Laboratory Manager
AC/ac
cc: 2-Addresse

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An Independent Commercial Testing Laboratory
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August 2, 2011

SEL File No.: 40126-1
SEL Report No.: G-11-8568

KFM GeoScience
1360 Valley Vista Drive
Diamond Bar, CA 91765

Attn: Mr. Michael Stojanoff

RE: LADPW Sedimentation Study
Los Angeles, California

Incompliance with the request by your authorized representative, Smith-Emery Laboratories has completed testing for the sediment samples for sand equivalent in accordance with ASTM D 2419 standard dry method.

Test results are as follows:

REPORT OF TEST

Date Sample Received: 7/27/11 **Date Tested:** 8/1/11

Sampled By: Client

Sample I.D.	Test Method	Results
DG-5b @ 2.0 – 4.0ft	ASTM D2419 Method A ave. of three	**74**
DG-7 @ 0.0 – 1.5 ft	ASTM D2419 Method A ave. of three	**88**
DG-8 @ 0.0 – 1.5 ft	ASTM D2419 Method A ave. of three	**89**

Should you have any questions regarding the contents of this report, please call.

Respectfully submitted,
SMITH-EMERY GEOSERVICES

ANGELITO CABANILLA
Geotechnical Laboratory Manager
AC/ac
cc: 2-Addresse

SMITH-EMERY LABORATORIES
An Independent Commercial Testing Laboratory
781 E. Washington Boulevard - 2nd Floor Los Angeles, California 90021 ◆ (213) 745-5333 ◆ Fax (213) 749-7232

July 5, 2011

SEL File No.: 40126-1
SEL Report No.: G-11-8528

KFM GeoScience
1360 Valley Vista Drive
Diamond Bar, CA 91765

Attn: Mr. Michael Stojanoff

RE: LADPW Sedimentation Study
Los Angeles, California

Incompliance with the request by your authorized representative, Smith-Emery Laboratories has completed testing for the sediment samples for soundness test using sodium sulfate solution in accordance with ASTM standard test method.

Test results are as follows:

REPORT OF TEST

Date Sample Received: 6/10/11 **Date Tested:** 6/23/11

Sampled By: Client

Sample I.D.	Test Method	Results Loss after 5 cycles
TP2 @ 5 – 11 ft	ASTM C88 by Sodium Sulfate	**5**
TP3 @ 0 – 3 ft	ASTM C88 by Sodium Sulfate	**5**

Note: Sample tested are passing 3/8" and the calculated weighted losses are base from the original grading of samples as received per ASTM C88.

Should you have any questions regarding the contents of this report, please call.

Respectfully submitted,
SMITH-EMERY GEOSERVICES

ANGELITO CABANILLA
Geotechnical Laboratory Manager
AC/ac
cc: 2-Addresse

SMITH-EMERY LABORATORIES
An Independent Commercial Testing Laboratory

781 E. Washington Boulevard - 2nd Floor Los Angeles, California 90021 ◆ (213) 745-5333 ◆ Fax (213) 749-7232

August 12, 2011

SEL File No.: 40126-1
SEL Report No.: G-11-8580

KFM GeoScience
1360 Valley Vista Drive
Diamond Bar, CA 91765

Attn: Mr. Michael Stojanoff

RE: LADPW Sedimentation Study
Devil's Gate,Los Angeles, California

Incompliance with the request by your authorized representative, Smith-Emery Laboratories has completed testing for the sediment samples for soundness test using sodium sulfate solution in accordance with ASTM standard test method.

Test results are as follows:

REPORT OF TEST

Date Sample Received: 7/27/11 **Date Tested:** 8/1/11

Sampled By: Client

Sample I.D.	Test Method	Results Loss after 5 cycles
DG7 @ 0.0'– 1.5'	ASTM C88 by Sodium Sulfate (Fine)	**1**
DG8 @0.0'– 1.5'	ASTM C88 by Sodium Sulfate (Coarse)	**2**
DG8 @ 0.0'– 1.5'	ASTM C88 by Sodium Sulfate (Fine)	**2**

Note: Sample DG8 tested for both coarse and fine the calculated weighted losses are base from the original grading of samples as received per ASTM C88. Sieve analysis data provided by client per ASTM C136.

Should you have any questions regarding the contents of this report, please call.

Respectfully submitted,
SMITH-EMERY GEOSERVICES

ANGELITO CABANILLA
Geotechnical Laboratory Manager
AC/ac
cc: 2-Addresse

APPENDIX F STAKEHOLDER COMMENTS AND RESPONSES

Commenter	Comment	Response
U.S. Army Corps of Engineers	Flood Control District operations have the potential to impact the U.S. Army Corps of Engineers' dams and vice versa. Describe the comprehensive Los Angeles County Drainage Area project, recognize the existing partnership between the U.S. Army Corps and the Flood Control District, and state the need for the U.S. Army Corps major involvement in the Strategic Plan.	The relationship between the facilities maintained by the Flood Control District and the facilities maintained by the U.S. Army Corps of Engineers is now discussed in: - The Executive Summary, under Coordination with Other Agencies - Section 1.3 - Section 2.2 Furthermore, specific coordination with the U.S. Army Corps of Engineers is discussed in Sections 7, 8, and 11, where potential use of the U.S. Army Corps of Engineers' Santa Fe, Hansen, and Lopez Flood Control Basins as potential staging and temporary sediment storage areas is discussed.
	Describe the Los Angeles County Drainage Area project under "A Project on a Massive Scale" in the Executive Summary. Consider including a map that shows the U.S. Army Corps of Engineers dams in relation to the Flood Control District's facilities.	The Section of the Executive Summary mentioned refers to the effort to manage sediment from the 14 reservoirs and 162 debris basins maintained by the Flood Control District. The suggested map is now included in Section 1.2.
	The Executive Summary did not discuss beneficially using sediment in the construction industry.	The Executive Summary now lists Aggregate and Other Materials under Beneficial and Placement Alternatives. The discussion of Beneficial Uses under Next Steps has also been revised. Additionally, see Section 6.5.2 for a more detailed discussion.
	In Section 2.2, indicate the Flood Control District will coordinate with the U.S. Army Corps of Engineers to ensure that the U.S. Army Corps of Engineers are not impacted by the Strategic Plan.	Section 2.2 now says that "due to the relationship between the Army Corps of Engineers facilities and the Flood Control District's facilities, the two agencies coordinate operation of their facilities."
	Indicate that the Flood Control District will work with the Corps to explore the idea of developing a regionwide plan for a more comprehensive solution.	Among the next steps for the Flood Control District, the Executive Summary and Section 11 indicate the Flood Control District will work on a Long-Term Vision with the U.S. Army Corps of Engineers and local stakeholders.
	In Section 3.3.4, add a reference to the Regulatory Division of the Army Corps.	The reference has been added. See Section 3.3.4.
	Section 6.3.3.2 did not discuss impacts of sluicing to channels and dams downstream of the dam being sluiced.	Sluicing as a "sediment removal alternative" is discussed separately from sluicing as a "sediment transportation alternative." The impacts sluicing would have on downstream channels and dams are discussed in Section 6.4.1 - Sluicing (as a transportation alternative).

Commenter	Comment	Response
U.S. Army Corps of Engineers / (California) Coastal Sediment Management Workgroup	Provide links to the (California) Coastal Sediment Management Workgroup and the California Coastal Regional Sediment Management Plans on the Flood Control District's sediment management website and vice versa.	As of the preparation of this summary, this was being coordinated with the requesting agency.
	Section 6.5.3 indicates there are sand reserves offshore of Southern California that can be used for beach nourishment. Were any specific sources of offshore sand and sediment for beach replenishment purposes determined as part of this Strategic Plan? Were any impacts and/or assessments associated with procurement and placement of offshore sand on beaches for beach nourishment purposes analyzed and are they similar to those associated with placing upland sand on the beach?	The section that discusses beach nourishment (now Section 6.5.1) now mentions a few previously used sources of sand for beach nourishment projects by agencies other than the Flood Control District. Determining specific sources of sand for beach replenishment purposes and analyzing the impacts of using offshore sand deposits for beach nourishment is beyond the scope of the Flood Control District's Sediment Management Strategic Plan and the mission of the Flood Control District.
	Discussion among the County of Los Angeles Department of Public Works, the County of Los Angeles Department of Beaches and Harbors, and the (California) Coastal Sediment Management Workgroup may provide the potential partners required to make the use of sediment from the Flood Control District's facilities for beach nourishment purposes possible. A potential demonstration project to monitor the benefits of placing this material would provide information for future long-term beneficial use projects.	As indicated in Section 6.5.1, the Flood Control District is open to meeting with agencies willing to share the additional costs of processing, permitting, transporting, and placing the material. The Flood Control District will analyze the beach nourishment alternative further; this is now indicated in Section 6.5.1.
	The amount of sediment captured at the two debris basins close enough to the coast to warrant consideration as a source for coastal restoration efforts (Cloudcroft and Sullivan Debris Basins) and the sand that would result from processing that sediment might discourage efforts to process the material, obtain permits, etc.	Per the Flood Control District's records, the total amount of sediment removed from Cloudcroft and Sullivan Debris Basins since the Flood Control District began maintaining the facilities in the early 1970s is approximately 14,000 and 180,000 cubic yards, respectively. It is agreed that the amount of sediment captured at these facilities and the amount of sand that could result might discourage efforts to process the material, obtain permits, etc so that the sediment could be used in coastal restoration projects.
	Maybe the sediment could be used for coastal wetland restoration activities.	Reference to potential use in wetland restoration activities is now discussed in Section 6.5.5.

Commenter	Comment	Response
City of Los Angeles Department of Water and Power	Section 8.1.3.1 discusses the use of Hansen Flood Control Basin as a potential staging or temporary storage area for sediment that accumulates or passes through Big Tujunga Reservoir. The section indicates that if Hansen Flood Control Basin was to be used as a staging or temporary sediment storage area for sediment from Big Tujunga Reservoir, material at Hansen Flood Control Basin would likely need to be pre-excavated to create capacity for sediment from the reservoir. Where would preexcavated material from Hansen Flood Control Basin be placed? Could sediment from Big Tujunga Reservoir not be taken directly to a pit in Sun Valley?	Please see Section 8.1.7, which presents the combined sediment management alternatives for Big Tujunga Reservoir. The section includes information about the potential destination of material preexcavated from Hansen Flood Control Basin if said facility was to be used as a staging or temporary sediment storage area for sediment from Big Tujunga Reservoir. The Section also discusses alternatives that involve taking sediment directly from Big Tujunga Reservoir to a pit in Sun Valley.
	Are alternatives that would allow for water released from reservoirs prior to dry excavation or water used in dredging operations to be conserved by other means besides infiltration in the spreading grounds being studied?	The Strategic Plan did not explore water conservation alternatives. However, water conservation is part of the Flood Control District's mission, so it will be considered outside of this Strategic Plan.
	Will sluicing flows be treated or screened as they flow downstream?	The Flood Control District does not anticipate treating or screening sluicing flows as they flow downstream. Treating flows as they flow downstream would have to meet its own set of regulations.
	How will sediment placement be incorporated into plans to use the pits in Sun Valley for groundwater infiltration when the properties are acquired from the current owners?	As of 2012, acquisition of Sheldon Pit and Calmat Pit is not being actively pursued by the Flood Control District for water conservation. The Flood Control District is moving forward with development of a facility at Strathern Pit to temporarily store storemwater until it can be diverted to adjacent groundwater recharge facilities.
	How are continued sediment inflows considered?	The planning quantity considers continued inflow and multiple cleanout projects during the 20-year planning period. See Section 11 or Sections 7 to 9.
	Do the forecasted volumes consider the effect of fires?	The approach used to develop the planning quantity considers fires and some variations in the weather, as those occurrences are captured in historical removal quantities. Actual sediment delivery will depend on the weather and watershed conditions. See Section 5.

Commenter	Comment	Response
Coastal Conservancy & Santa Monica Mountains Conservancy	The natural supply of sand to the coast has been diminished by upstream dams and other structures. Beaches have been shrinking and the county's beaches are increasingly dependent on human intervention to maintain adequate beach widths.	Please see the draft Los Angeles County Coastal Regional Management Plan dated August 2012 (http://www.dbw.ca.gov/csmw/crsmp.aspx), which was prepared by the U.S. Army Corps of Engineers and the California Coastal Sediment Management Workgroup. The plan discusses how most of the beaches in the County of Los Angeles were never nourished by the Los Angeles, San Gabriel, or Santa Clara Rivers. Section 6.5.1 of the Flood Control District's Sediment Management Strategic Plan has been expanded to discuss the issue of beaches in more detail. In any case, the Flood Control District is open to partnering with other agencies interested in obtaining sediment from the Flood Control District's facilities to process it and obtain sand from it for beach nourishment projects.
	The draft Strategic Plan does not give enough attention to the beneficial uses to which the sediment could be put. The first and foremost beneficial use is beach nourishment.	Section 6 has been revised to more clearly present the beneficial uses discussed in the Strategic Plan. One of the revisions includes discussion of a proposed sediment processing contract (Section 6.5.2.3). The Flood Control District is pursuing contracts that could allow for private companies to receive sediment from the Flood Control District to 1) process the sediment and obtain aggregate or other materials from it or 2) use the sediment to reclaim their quarries. Regarding beach nourishment, see the response to the previous comment.
	The State Coastal Conservancy and the Santa Monica Mountains Conservancy would like to work with the County to identify ways to use the sediment as a resource rather than sending it to a landfill, gravel pit, or sediment placement site.	The Flood Control District is open to ideas and partnering with other agencies interesting in solving the region's sediment management issues.
County of Los Angeles Department of Beaches and Harbors	Please explain which offshore sand reserves are available in Southern California.	Identifying offshore sand reserves is beyond the scope of the Strategic Plan. However, revisions to Section 6.5.1 now discuss previously used sources of sand for beach nourishment projects conducted by agencies responsible for such projects.
	Please explain the types of environmental impacts associated with beach nourishment. Some environmental concerns, such as Snowy Plovers, Grunion runs, and water quality can easily be mitigated and monitored during sand placement.	The specified environmental concerns are now included in Section 6.5.1.3.
	Recreational use of beaches is only affected temporarily during beach placement. Noise and aesthetics are two temporary impacts that are outweighed by the long-term recreational benefits. The long-term recreation benefits beaches include wider beaches and enhancement of surfing conditions.	The temporary nature of the impacts specified is now discussed in Section 6.5.1.3. The long-term recreation benefits are now also included in the section.

Commenter	Comment	Response
Main San Gabriel Basin Watermaster	Sluicing of materials from the three San Gabriel Canyon Reservoirs has the potential to reduce the ability to maximize conservation of storm runoff if not executed properly. If sediment that settles in the river during sluicing operations is not removed in a timely manner, there is the potential for prolonged adverse impacts to groundwater replenishment opportunities. Large scale sluicing could result in lost opportunities to replenish local and imported water supplies into the Main San Gabriel Basin. This could result in lower groundwater elevations that will impact the production rates of existing wells and overall supply.	Water sluiced from Cogswell Reservoir would be captured at San Gabriel Reservoir. As a result, sluicing sediment from Cogswell Reservoir should not adversely impact opportunities for recharging groundwater downstream. Because Morris Reservoir has a smaller capacity that San Gabriel Reservoir, all the water used to sluice sediment from San Gabriel Reservoir could potentially not be captured in Morris Reservoir. Therefore, sluicing San Gabriel Reservoir could possibly impact groundwater recharge opportunities. Sections 7.3 and 11.1.2 have been revised accordingly. With respect to sluicing of Morris Reservoir, it is agreed that if sediment deposits in the river as a result of the sluicing operations are not removed in a timely manner, there could be prolonged adverse impacts to groundwater recharge opportunities. Section 11 indicates that sluicing of Morris Reservoir could have some impact on groundwater recharge.
	The Strategic Plan states that there is "no impact" on groundwater recharge relative to all of the sediment management alternatives for both Cogswell and San Gabriel Reservoirs. We believe there may be indirect impacts to overall operations to consider before that statement can be made.	Since water released from Cogswell Reservoir would be captured at San Gabriel Reservoir, all the sediment management alternatives for Cogswell Reservoir are not expected to have adverse impacts on groundwater recharge. Revisions have been made in Sections 7.3 and 11.1.2 indicating the potential for the various sediment management alternatives at San Gabriel Reservoir to impact groundwater recharge.
	The Main San Gabriel Watermaster is reserving the option to comment in detail on proposed sediment removal methods, specifically, alternatives including "sluicing" until all options are further developed.	Comment noted.
	The Main San Gabriel Watermaster strongly supports project specific analysis in development of proper environmental documentation prior to any planned sediment removal that includes sluicing as a component.	Specific sediment management projects that will result in significant environmental impacts will be subject to environmental review under the California Environmental Quality Act, which will provide additional opportunities for public involvement during project evaluation.
Sanitation Districts of Los Angeles County	Scholl Canyon Landfill currently utilize approximately 300 cubic yards of sediment per day for cover, not 200 cubic yards as stated in the plan.	The correction has been made in Sections 6.5.5.3 and 10.4.2.
	Based on the current tonnage, the closure date for Scholl Canyon Landfill is scheduled for February 2032, not 2024 as stated in the plan.	The correction has been made in Section 6.5.5.3.
	In terms of dollars per cubic year, the tipping fee at School Canyon Landfill for clean dirt is approximately $5.00 per cubic yard, not $6.00 per cubic yard.	The correction has been made in Section 6.5.5.3 and 10.4.2. In Sections 8 and 9, where placement fee was addressed (for example, in Table 8.-25), the revision did not lead to any other changes.

Commenter	Comment	Response
Santa Monica Bay Restoration Commission	The Strategic Plan does not go far enough in exploring possible alternatives and analyzing how they may benefit the Strategic Plan's five objectives. Landfill cover and gravel pits are the only two "reuse" alternatives deemed viable by the plan, and they were presented as placement alternatives, with no discussion of their relative values as resources. Sediment needs to be considered as a resource for our waterways, floodplains, beaches and reefs, as well as for landfill cover and aggregate industry uses.	Section 6 of the Strategic Plan has been revised to more clearly discuss beneficial use of the sediment. Section 6.5 now discusses the use of sediment in beach nourishment, in the aggregate and other industries, as daily cover at solid waste landfills, as fill at pits, for wetland restoration, for replenishment of sediment-poor waterways, and for replenishment of reefs.
	An important step toward an integrated and resource-focused approach to sediment management is incorporation of additional environmental impacts and values into the cost-benefit analysis for the sediment management alternatives. The cost-benefit ratio of alternatives may shift by doing so.	Language was added to Section 6.1 to explain why the cost-benefit analysis for the alternatives does not include a monetary value for things such environmental and social impacts.
	Regarding the use of sediment for beach nourishment purposes, regulatory and operational barriers may be reduced if other County departments and other agencies are included as partners.	Additional discussion of the beach nourishment alternative is now included in Section 6.5.1. As stated in the Strategic Plan, the Flood Control District is open to meeting with agencies willing to share in the additional costs of processing, permitting, transporting, and placing the material.
	It is understood that rigorous studies for accurate and reliable sediment management projections with respect to climate change were beyond the scope of the Strategic Plan. There should be a process to update the Strategic Plan with new data and information as science develops.	The Long-Term Vision discussed in the Executive Summary and in Section 11 will consider climate change.
	Flow assisted sediment transport and sluicing deserve more study. The Strategic Plan should evaluate flow assisted sediment transport as a mechanism for restoring some natural sediment transport through the system.	To be consistent with nomenclature used by other agencies throughout the country and the world, the Flood Control District now refers to flow assisted sediment transport as sediment flushing. Revised Section 6.3.3 includes a discussion of sediment flushing, including recommendations for a pilot study.

Commenter	Comment	Response
The San Gabriel and Lower Los Angeles Rivers and Mountains Conservancy	Lessening environmental impacts is critical to the protection of the region's rich biodiversity and watershed functions. The San Gabriel and Lower Los Angeles Rivers and Mountains Conservancy (RMC) supports the recommendations which have been identified to likely have the least environmental impacts, particularly with regards to habitat. It is commendable that alternatives have generally been weighted highly against environmental impacts.	The Flood Control District understands the desire to manage sediment by means that have a low impact on the environment. As specific reservoir sediment removal projects are planned, the alternatives will be analyzed in more detail and to the extent practical, an effort will be made to pursue those alternatives that have lower environmental and social impacts.
	The Flood Control District is encouraged to study and welcome input on opportunities for integrated and multi-benefit projects. Consider constructing trail running paths along conveyor routes, enhancing park amenities, or providing educational showcases of the sediment management process.	To the extent possible, the Flood Control District will try to incorporate multi-benefit components in its projects.
	The Flood Control District should take an active role in seeking out and developing partnerships with other parties to help cover the cost and allow the beneficial use of sediment along the coast.	Section 6.5.1, which discusses beach nourishment, mentions a few previously used sources of sand for beach nourishment projects by agencies other than the Flood Control District. The Flood Control District will analyze the beach nourishment alternative further; this is now indicated in Section 6.5.1.
	The natural process of sediment transportation from the San Gabriel Mountains to coastal regions has been interrupted by flood control structures. Seeking partnerships with agencies interested in beach nourishment projects will help conserve the beaches of the County of Los Angeles, which represent a significant economic and environmental asset to the region. The RMC would like to assist in identifying opportunities for partnerships that would allow for this beneficial use of the sediment.	Please see the Los Angeles County Coastal Regional Management Plan dated August 2012 (http://www.dbw.ca.gov/csmw/crsmp.aspx), which was prepared by the U.S. Army Corps of Engineers and the California Coastal Sediment Management Workgroup. The coastal plan discusses how most of the beaches in Los Angeles County were never nourished by the Los Angeles, San Gabriel, or Santa Clara Rivers. Section 6.5.1 of the Flood Control District's Sediment Management Strategic Plan has been expanded to discuss the issue of beaches in more detail. The Flood Control District is grateful and welcomes the RMC's help in identifying agencies willing to partner and share the cost of investigating and implementing the necessary processes to use the sediment that accumulates in the Flood Control District's facilities for beach nourishment purposes.
	Flood Control District and Public Works efforts to engage stakeholders and allow for their input to inform the planning process have been commendable. Continue to utilize and expand upon the stakeholder strategies used during the development of the Sediment Management Strategic Plan in other planning processes.	The Flood Control District intends to continue to use an expanded stakeholder outreach and involvement effort in other planning processes.
	Initiate work on the Long-Term Vision with the Army Corps as soon as it is reasonably possible, while public interest is high.	As of 2012, the Flood Control District is discussing with the Army Corps the various alternatives by which a Long-Term Vision can be completed.

Commenter	Comment	Response
Arroyo Seco Foundation	The comment period should be extended for 90 days.	The Flood Control District granted the 90-day extension requested by several stakeholders. The comment period for the Strategic Plan was from April 23, 2012 to August 28, 2012.
	While the Strategic Plan presents a great deal of valuable detail about sediment issues throughout the County, it does not integrate that information into the larger goals of watershed management. The focus of the Strategic Plan is too narrow. The County needs to re-evaluate the entire flood control system. The Strategic Plan should incorporate opportunities for river restoration, the progress of the Los Angeles River Revitalization Movement, and other watershed management efforts. There are numerous river restoration programs in Los Angeles County that would benefit from a more comprehensive approach to sediment management. The Strategic Plan should incorporate findings from the U.S. Army Corps of Engineers Los Angeles River and Arroyo Seco Ecosystem Restoration Studies.	While the focus of the Sediment Management Strategic Plan is sediment management, the Strategic Plan discusses various components of watershed management, specifically water quality, groundwater recharge (which is associated with water supply), and habitat in terms of the impacts caused by the different sediment management alternatives discussed in the Strategic Plan. The Long-Term Vision discussed in the Executive Summary and Section 11, will have a broader focus. The Flood Control District intends to work collaboratively with the U.S. Army Corps of Engineers on that effort given that part of the flood control system in the region is owned and maintained by the U.S. Army Corps of Engineers.
	The Strategic Plan, which is intended to be a living document, should be formally reviewed by the County, the public and technical experts every three years.	The Flood Control District will review and revise the plan as conditions change.
	Sediment management should be seen as a critical element of the Integrated Regional Water Management Plan (IRWMP) program. Integrated Regional Water Management is the best approach to planning for issues such as sediment management.	The IRWMP program is a separate effort from this Strategic Plan. However, since the Flood Control District plays an integral role in the IRWMP program, the Flood Control District is able to provide the following information. Participants of the IRWMP program are currently working on an IRWMP Update, which includes sediment management as an element of the update. Information presented in the Strategic Plan is being incorporated into the IRWMP Update. The Flood Control District plans to work with the IRWMP program in the development of the Long-Term Vision.
	The Greater Los Angeles County IRWMP Leadership Committee and the five regional subgroups have not been provided with a presentation on the material contained in the Sediment Management Strategic Plan [as of May 30, 2012], which is vital to their work. The bodies should review the Strategic Plan and provide input.	A presentation about the Strategic Plan was given to the IRWMP Leadership Committee in February 2011. In June 2012, staff gave presentations about the Strategic Plan and encouraged review and input during meetings of the subregional steering committees. Various members of IRWMP, such as the Main San Gabriel Watermaster and the City of Los Angeles Department of Water and Power, and the Sanitation Districts of Los Angeles County are on the Strategic Plan Stakeholder Task Force email distribution list and thus were aware and attended some meetings of the Strategic Plan Stakeholder Task Force. The Advisory Working Group also included members of the IRWMP program.

Commenter	Comment	Response
Arroyo Seco Foundation	Sediment is not a waste product that should simply be disposed of, yet that is the approach taken by the Strategic Plan.	Section 6.5 has been revised to more clearly present the beneficial uses discussed in the Strategic Plan. Specifically, Section 6.5 discusses use of the sediment for beach nourishment, use in the aggregate industry and other industries, use as daily cover at solid waste landfills, use as fill at pits, and other potential beneficial uses.
	Stormwater is another neglected resource. Large volumes of stormwater flow through concrete channels to the ocean. This huge waste of clean water is unacceptable. One way is to restore river channels where possible, to develop more natural stream environments that will aid in replenishing groundwater.	The Flood Control District plays a vital role in recharging the region's groundwater aquifers. The reservoirs behind the dams store rainwater, runoff, and melted snow. When it is safe, controlled releases of water are conveyed through the channels. Water is either captured by water purveyors or allowed to flow downstream to 1 of the 27 Flood Control District spreading facilities to recharge the region's groundwater aquifers. The Flood Control District recharges roughly 275,000 acre-feet of water annually, meeting the yearly needs of approximately 550,000 families of 4. It is important to note that the same groundwater recharge opportunities are not available in all the watersheds. Soil characteristics and existing development and available space play an important role in the creation of additional groundwater recharge opportunities. Similarly, river restoration may not be possible everywhere.
	Rivers don't just transport water. Another key function is to transport sediment, a resource of great value, the least of which is monetary. It provides habitat for fish and aquatic species. It supports biodiverse riparian flora and fauna. It fills our valleys and the coastal plain. It nourishes the rivers and beaches in Southern California. It can be used for construction purposes.	Sediment flushing (previously referred to as flow assisted sediment transport) and sluicing, discussed in Sections 6.3.3, 6.3.4, and 6.4.1, discuss the rivers' ability to transport sediment. Section 6.3.3.2 now discusses the potential for sediment-laden flows to replenish sediment-poor washes and rivers, positively impacting habitat. However, it also mentions that sediment-laden flows could have an adverse effect on habitat by filling in seasonal pools or the streambed. Uncontrolled sediment-laden flows have the potential to fill our valleys and coastal plain. This is one of the reasons why the rivers were channelized. During the growth of Los Angeles basin in the early 1900s, that natural filling of valleys and the coastal plain collided with development and put people and infrastructure at risk. Now that the LA Basin is as developed as it is, there are no empty valleys or plains to fill with sediment. Some beaches could be nourished by the rivers, but it is important to note that a number of the beaches in California are man-made and that the rivers never nourished them (See Section 6.5.1). Use of sediment for construction purposes is now discussed is Section 6.5.2.
	The sediment video, website, and open house have all been good tools for education, but outreach has been insufficient. Outreach needs to be ongoing and linked to other campaigns about watershed and environmental awareness.	The Flood Control District is working on increasing outreach and education regarding sediment management and other activities by the Flood Control District.

Commenter	Comment	Response
Arroyo Seco Foundation	The Strategic Plan includes favorable references to Flow Assisted Sediment Transport (FAST), a method also known as sediment pass-through, but eventually rejects it as "uncertain" and infeasible for current projects. The Arroyo Seco Foundation feels that FAST and the principles of sediment pass-through can be an effective and relative inexpensive technique for sediment management that merits considerable more thorough analysis and testing. It can also be used in conjunction with river restoration and watershed management programs to improve habitat and environmental conditions.	Revised Section 6.3.3 includes a discussion of sediment flushing (previously referred to as Flow assisted Sediment Transport), including recommendations for a pilot study.
	The United States Geological Survey has collected sediment transport data for the Los Angeles River in one location for only a few decades. The County of Los Angeles Department of Public Works should take on this responsibility in the future as part of the Sediment Management program.	The Flood Control District monitors sediment as needed to ensure the ability to operate the flood risk management and water conservation facilities.
	The lack of participation in the California Coastal Sediment Management Workgroup by the County of Los Angeles Department of Public Works is deeply troubling. The Department needs to participate in and learn from a program like the Coastal Sediment Management Workgroup and play an active role in the broader issue of sediment management.	During the development of the Strategic Plan, the Flood Control District communicated with staff from the U.S. Army Corps of Engineers Los Angeles District and the Los Angeles County Department of Beaches and Harbors regarding the development of the Coastal Regional Sediment Management Plans. Both agencies were always invited to the Strategic Plan Stakeholder Task Force meetings and staff from both agencies attended several meetings. However, the Flood Control District was not made aware of any public or multi-agency meetings for the Coastal Regional Sediment Management Plans. It is important to note that the focus of the Coastal Regional Sediment Management Plans is the coast. The revised Section 6.5.1 of the Strategic Plan incorporates information in the August 2012 draft of the Los Angeles County Coastal Regional Sediment Management Plan as well as other coastal plans. On a slightly separate note, the Flood Control District has been involved in the development of the Sediment Management Chapter of the Water Plan Update 2013 led by the California Department of Water Resources.
	Ongoing exchanges with scientists and academic experts and the study of best practices and new approaches emerging around our planet are key.	Members of academia were part of the Advisory Working Group and this Strategic Plan's Stakeholder Task Force. Additionally, the Flood Control District intends to involve academia in the effort to develop the Long-Term Vision mentioned in the Executive Summary and Section 11.

Commenter	Comment	Response
Arroyo Seco Foundation	Given the nature of variable sediment loads, projected sediment loads should come with appropriate likelihood estimates. The uncertainty of projections should drive the need for more scientific investigation into the relationship between discharge and sediment load.	The amount of sediment that reaches a facility any given year depends on the size of the watershed, the watershed's vulnerability to erosion, watershed conditions (such as vegetated watershed versus burned watershed), and weather conditions (such as amount and intensity of rain). In addition to discussing this in Section 4, the variability of sediment deposition in the reservoir and debris basins is now also discussed in Section 5, which discusses the calculation of the planning quantities. Furthermore, due to the variability in rainfall, flood risk management purposes, water conservation purposes, and operational needs, the amount of water released and allowed to flow through the dams varies. In turn, all those factors influence how much sediment may be in the flows. The approach used to calculate the 20-year planning quantities offers a factor of safety over the average 20-year period, yet it is not conservative to the point of planning for the worse 20-year periods.
	The Strategic Plan identifies about 60 million cubic yards of active, near capacity, and potential sediment placement sites. The plan projects just less than 58 million cubic yards of accumulated sediment in need of removal from major reservoirs. Approximately 43 million of the 58 million cubic yards will be accumulated in the next 20 years. Continuing to convert woodlands and wild canyons into blighted sediment dumps is unsustainable.	The total planning quantity addressed by the Strategic Plan in 67.5 MCY, including not only the sediment that will reach the reservoirs, but also the numerous debris basins maintained by the Flood Control District. The objectives of the Strategic Plan included recognizing opportunities for increased environmental stewardship, reducing social impacts related to sediment management, and identifying ways to use sediment as a resource. Section 6 of the Strategic Plan has been revised to more clearly discuss beneficial use of the sediment. Section 6.5 now discusses use of the sediment in beach nourishment, in the aggregate and other industries, as daily cover at solid waste landfills, as fill at pits, for wetland restoration, for replenishment of sediment-poor waterways, and for replenishment of reefs. Sections 6 through 11 include a very limited number of alternatives that involve placement of sediment in a new sediment placement site. Sediment flushing (previously referred to as flow assisted sediment transport) and sluicing are also discussed in Sections 6.3.3, 6.3.4, and 6.4.1.
	An adaptive management strategy that actively considers alternatives besides trucking and tests their feasibility and implementation needs to be developed. Pilot projects should be implemented.	Section 6.4 discusses the various transportation alternatives that were identified. The alternatives are further analyzed for each reservoir or group of debris basins in Sections 7 through 10. Revised Section 6.3.3 includes a discussion of sediment flushing, including recommendations for a pilot study.
California Native Plant Society	It is disappointing that there is no greater push to find ways to use the sediment removed from the debris basins. That seemed to be a major theme during the meetings - put the sediment to use to cover landfills; to be used by companies like Vulcan that need sand, gravel, and rock; or to fill holes near freeways such as the 605. Instead, the main plan in this Strategic Plan seems to be business as usual - fill in existing sites with sediment. The sediment placement sites look a lot like open space that could be used for parks and recreation and habitat for native flora and fauna.	The Strategic Plan includes discussion of various use and placement alternatives for the sediment that reaches the reservoirs and debris basins maintained by the Flood Control District. Section 6 has been revised to more clearly discuss beneficial use of the sediment. Section 6.5 now discusses use of the sediment in beach nourishment, in the aggregate and other industries, as daily cover at solid waste landfills, as fill at pits, for wetland restoration, for replenishment of sediment-poor waterways, and for replenishment of reefs. Many of the alternatives for the various reservoirs and the debris basins include placement alternatives other than placement at sediment placement sites, where the Flood Control District has typically placed sediment. The Flood Control District asked stakeholders for ideas and researched and considered all suggestions.

Commenter	Comment	Response
California Native Plant Society	Prime natural habitat should be designated as "hands-off", e.g. La Tuna Canyon.	Development of a sediment placement site at La Tuna Canyon is not an alternative that is included in the Strategic Plan. The Flood Control District is unable to commit to a complete hands-off position at this time because of unknown future circumstances. Section 6.5.5.2 indicates that while it is understood that there are environmental concerns associated with the development of new sediment placement sites, this alternative is still being considered because a new sediment placement site and transportation of sediment to it could have fewer impacts than placing and transporting sediment to another placement alternative that is farther away.
	Future sediment placement sites should be vetted by the environmental community to assure that areas of ecological significance are not destroyed.	As indicated in the Executive Summary of the Strategic Plan, during the development of specific sediment management projects opportunities to provide input will be given. Furthermore, specific sediment management projects that will result in significant environmental impacts will also be subject to environmental review under the California Environmental Quality Act, which will provide additional opportunities for public involvement during project evaluation.
	Air quality impacts, while not desirable, may be reduced through use of clean(er) trucks. Can we be assured that the trucks used for sediment removal will be clean air vehicles?	As indicated in Section 6.4.2.1, the Flood Control District will consider opportunities to employ low emission trucks.
Citizens Against Strip Mining in the San Fernando Valley	Citizens Against Strip Mining in the San Fernando Valley understands how the buildup of sediment in Pacoima Reservoir necessitates action and acknowledges the importance of conducting the project in a timely and efficient manner. However, the organization has a number of concerns.	The action described in the comment seems to refer to the upcoming Pacoima Reservoir Sediment Removal Project. This upcoming project is one of the specific sediment management projects alluded to in the Executive Summary of the Strategic Plan. The discussion of alternatives and impacts in Sections 6, 8, and 11 of the Strategic Plan relative to Pacoima Reservoir does not constitute the detailed analysis that will need to be completed for the Pacoima Reservoir Sediment Removal Project. Environmental documents will be prepared for the upcoming Pacoima Reservoir Sediment Removal Project in accordance with the requirements of the California Environmental Protection Act. The comments received specific to the Pacoima Reservoir Sediment Removal Project were forwarded to the appropriate team; the comments will be considered during the planning of the Pacoima Reservoir Sediment Removal Project. Additionally, the comments are included in this comment summary and addressed here relative to the Strategic Plan.

Commenter	Comment	Response
Citizens Against Strip Mining in the San Fernando Valley	Given the impact that excavation, conveying sediment, and or sluicing would have on air quality, the environment, health, and the social atmosphere in the Sylmar community, Citizens Against Strip Mining in the San Fernando Valley would like information about California Environmental Quality Act process and scheduling for the upcoming Pacoima Reservoir Sediment Removal Project. In addition, we would like more details on whether the County of Los Angeles Department of Public Works plans on investigating what specific health risks may occur during the upcoming Pacoima Reservoir Sediment Removal Project. The neighborhood is densely populated with younger children and the elderly; according to large-scale scientific studies these groups remain at increased risk of respiratory illness from silicate and dust particles from similar types of construction projects in similar climates.	Notifications about meetings in relation to the California Environmental Quality Act process for the Pacoima Reservoir Sediment Removal Project will be sent out in advance of the meetings. Citizens Against Strip Mining in the San Fernando Valley is in the email distribution list for the project, thus the group will be notified of the meetings. Specifics regarding the studies that will be conducted as part of the California Environmental Quality Act process will be discussed when said process begins.
	Outdoor recreation is a vital component of the Sylmar community. Recreation areas within the community include Sylmar Recreation Center, El Cariso County Park, Veterans Memory County Park, and Los Angeles Mission College. Additionally, over the next 18 months, new facilities including several soccer fields will be built. Release of large amounts of particulates and other pollutants and loud construction noise would impact those that use the recreational facilities. However, these issues are not addressed in the sediment removal plan.	Section 6 discussed the impacts that the various sediment management alternatives considered during the development of the Strategic Plan could have on air quality, noise, and recreation among other impacts. Section 8.3 provided additional discussion of the impacts of the various sediment management alternatives analyzed for Pacoima Reservoir as part of the Strategic Plan. Specific impacts on recreational resources will be analyzed during review of specific sediment management projects.
	Based on the understanding of Citizens Against Strip Mining in the San Fernando Valley, silicate would be carried into the airspace directly above and behind our community during the sediment removal, transportation, and placement operations. Has the impact of high-wind driven silica been analyzed? Have health risks (namely silicosis) been identified and addressed?	Identification of specific health risks is beyond the scope of the Strategic Plan. The Strategic Plan is a planning-level document. Air quality concerns for the upcoming Pacoima Sediment Removal Project will be analyzed as required by the California Environmental Protection Act.
	The Strategic Plan does not include an analysis of the impacts to local businesses or economic interests. This makes the Citizens Against Strip Mining in the San Fernando Valley group questions the accuracy of the Sediment Management Alternative Summary. While a majority of the impacts to businesses likely stem from the disrupted flow of traffic, noise, and the presence of industrial vehicles, it is unknown if additional side effects should be taken into consideration. A disproportionately large number of businesses in the Sylmar community are minority-owned.	The comments will be considered during the planning of the upcoming Pacoima Sediment Removal Project and associated public outreach effort.

Commenter	Comment	Response
Citizens Against Strip Mining in the San Fernando Valley	It is understood build-up of sediment within Pacoima Reservoir needs to be removed. For decades this removal process occurred in a less visually and culturally obtrusive manner through the use of Little Tujunga Canyon Road behind the reservoir. Why is it so important now to create a new and more disruptive process disproportionately affecting thousands of middle and low income residents?	Sections 8.3.1.5 and 8.3.1.6 summarize the previous sediment removal projects at Pacoima Reservoir. All previous sediment removal projects involved sluicing, a method that employs water flow (see Sections 6.3.4 and 6.4.1 for additional information). Sluicing allows smaller-sized sediment (i.e., sands and silts) in a reservoir to be moved downstream through the waterway to a facility that is more accessible, but it leaves larger-sized sediment in the reservoir. Revisions to Section 8.3.1.6 explain how in 1983, during the most recent sediment removal project at Pacoima Reservoir, sediment from Pacoima Reservoir was sluiced from Pacoima Reservoir to Lopez Flood Control Basin; that is, sediment from Pacoima Reservoir was transported to Lopez Flood Control Basin through sediment-laden waters that flowed downstream along Pacoima Wash. The sediment was then removed from Lopez Flood Control Basin by truck and used to fill and grade the site of a new residential development. Little Tujunga Canyon Road has not been used in the past to transport sediment out of the reservoir. However, that may be a method that could be employed in the future to remove the larger-sized sediment in the reservoir. The Sediment Management Alternatives included in Section 8.3.7 present ways to deal with the total 7.2-MCY planning quantity for Pacoima Reservoir. This Strategic Plan was developed due to the diminishing capacity at existing sediment placement sites and the desire to pursue new alternatives that can reduce the environmental and social impacts of sediment management.
	Why was a community-wide notification about this project not made further in advance and with more recruitment of local residents? The group (Citizens Against Strip Mining in the San Fernando Valley) believes that persons that will be affected by the project were not involved. There was no proper canvassing or community recruitment.	The Strategic Plan is an overview of alternatives for managing sediment for the next 20 years. In early 2011, when development of the Strategic Plan began, members of approximately 50 agencies and organizations believed to be able to provide comprehensive and regional input for external stakeholders were invited to participate in the Strategic Plan Stakeholder Task Force. With time, the Stakeholder Task Force grew and its meetings were also attended by numerous members of the public, which were welcome to attend. In late April (2012), a press release went out notifying people of the open houses that were held in May for the draft Strategic Plan. If the question refers to the upcoming Pacoima Reservoir Sediment Removal project, the reason why no community-wide notification has been sent out about that project as of October 2012 is because the project is still in the planning phase. As explained in an earlier response, environmental documents under the California Environmental Quality Act will be prepared for the Pacoima Reservoir Sediment Removal Project. A public scoping meeting will be held in the future to request input from the public on the types of environmental issues, mitigation, and alternatives to consider in the environmental document to be prepared for the Pacoima Reservoir Sediment Removal Project. A community-wide notification will be sent out regarding the meeting when a date for it has been set. Additionally, people can email reservoircleanouts@dpw.lacounty.gov requesting to be added to the email distribution list for the Pacoima Reservoir Sediment Removal Project (or any of the other upcoming reservoir sediment removal projects; see www.lasedimentmanagement.com/projects.aspx.

Commenter	Comment	Response
Citizens Against Strip Mining in the San Fernando Valley	Have suitable plans been identified to treat contaminated sediment removed from the reservoirs?	Since most of the reservoirs and debris basins maintained by the Flood Control District are located above developed areas, the sediment that reaches the facilities is mostly from undeveloped watersheds that contain naturally occurring materials. In 2010, the Flood Control District analyzed soil samples representative of the sediment removed from reservoirs and debris basins maintained by the Flood Control District and compared the results with threshold levels for all contaminants specified in the Amended Waste Discharge Requirement for Disposal and On-Site Use of Non-Hazardous Contaminated Soils and Related Wastes at Municipal Solid Waste Landfills. The analysis revealed that constituents in the soil samples were well below the all the threshold levels. If additional sediment analysis is required, it will be conducted during the planning of specific reservoir sediment removal projects and any environmental documents required under the California Environmental Protection Act.
	Where will sediment be taken? Our group, Citizens Against Strip Mining in the San Fernando Valley, is concerned that key decisions are being made concerning the location where the sediment will be placed without involving actual residents living near the selected site.	The Strategic Plan is an overview of alternatives for managing sediment for the next 20 years. At this time, no decisions have been made about which alternatives will be employed to manage the sediment at the various facilities. As discussed in the Executive Summary and Section 11, more analysis is needed prior to choosing specific alternatives.
	If contoured landscape mounds are created from the sediment, are those mounds stable?	Placement of sediment in sediment placement sites is performed in accordance with site-specific, engineered grading plans and an erosion and sediment control plan. This involves a comprehensive review of the sediment placement site, proper placement and compaction of material (often carried in several phases), installation of temporary and permanent drainage structures, and positioning of perimeter controls.
	Have possible contractors for sediment management operations been identified?	Contractors for specific sediment management projects will be identified once the specific sediment management projects are defined.
	Several residents in the Sylmar community have experienced adverse serious health consequences as a result of the existing May Sediment Placement Site. The proposed development of a sediment placement site in the neighboring Kagel Canyon places the Sylmar community in line to become the most densely populated area with sediment placement sites nearby.	At this time, no decisions have been made about which alternatives will be employed to manage the sediment at the various facilities, including Pacoima Reservoir. Alternatives and associated impacts for the upcoming Pacoima Reservoir Sediment Removal Project will be analyzed as required by the California Environmental Protection Act.
	It is very likely that the values of properties within sight or ability to hear sounds from operations related to sediment management at Pacoima Reservoir would decrease.	Aesthetics and noise impacts will be considered during the California Environmental Protection Act process for the upcoming Pacoima Reservoir Sediment Removal Project.

Commenter	Comment	Response
Citizens Against Strip Mining in the San Fernando Valley	Citizens Against Strip Mining in the San Fernando Valley accepts that cost is an important component to consider in analyzing alternatives. However, it is not understood how some of the actual figures were generated and how costs such as fire and safety supervision, law enforcement, hospital admissions due to injury, medical assessment for respiratory illness, wildlife relocation cost, and viewshed loss apparently were not included.	As stated in Section 6.1, the costs included in the plan are order of magnitude costs and are based on historic sediment removal projects completed by the Flood Control District, discussion with industry, and additional research. Section 6.1 has been revised to explain why a monetary value for environmental and social impacts was not included as part of the cost estimates. Specific unit costs used in the Strategic Plan are detailed throughout Section 6. In order to calculate the order of magnitude cost of an alternative, the unit cost was multiplied by the number of such units that would be involved if such alternative was to be employed. For example, the cost of trucking 7.6 million cubic yards of sediment from the back of Pacoima Reservoir to the pits in Sun Valley was determined by multiplying the unit cost of transporting sediment on single dump trucks ($0.65 per cubic yard per mile) by 32 miles, then by 7.6 million cubic yards. This resulted in a magnitude cost estimate of $158 million (See Table 8-14 in Section 8).
	The Strategic Plan does not include an analysis of impacts to the quality of life of residents in terms of animal and plant habitat loss, viewshed loss, noise pollution, loss of open space, impacts on outdoor recreation, sports disruption, and other cultural and social features.	While the strategic plan did not discuss impact on habitat, viewsheds, noise, recreation in terms of the quality of life of residents, those concerns were discussed.
	Citizens Against Strip Mining in the San Fernando Valley understands that there is not yet an official final recommendation for Pacoima Reservoir; however, we question the statement in Section 11.3 that says "alternatives 1 and 3 should be considered only after all previous recommendations are deemed infeasible." This language implies that some determination and cost benefit analysis is already being applied to decision making concerning alternative choices; and without citizen participation or appropriate notification.	The Strategic Plan discusses the impacts of possible sediment management alternatives for each of the reservoirs and the debris basins. The research and discussions in the Strategic Plan will provide planners of future projects valuable information of impacts, including cost, so that project planners can focus on alternatives that are not cost prohibitive. The future planning of feasible projects will include community participation.
Environmental Defense Fund	The Environmental Defense Fund supports the use of low emission vehicles as outlined in the Strategic Plan, as diesel emissions have been identified as a significant contributor to air pollution. Investigation of all options for zero emission and low emission vehicles in establishing program requirements is encouraged.	The Flood Control District will consider opportunities to employ low emission trucks.

Commenter	Comment	Response
Granada Hills North Neighborhood Council	Sunshine Canyon Landfill has adequate space to stockpile sediment, but only on those areas of the landfill that are not exposed to the winds or adjacent to residential areas. The landfill is subjected to extremely high winds in excess of 100 mph. The community most certainly would vigorously oppose any additional truck trips generated by this material. Questions as to the amount of water contained in each load, and the potential for generating additional $PM_{2.5}$ or PM_{10} would have to be addressed. Further, the community would insist that the material would have to be tested by the County prior to its arrival and to certify that it contained no hazardous material before being accepted by the landfill for use as daily, interim, and/or final cover.	The Section that discusses the use of the sediment as daily cover at landfills (now Section 6.5.3) has been revised to include concerns regarding potential air quality impacts due to the stockpiling of sediment at the landfills, additional truck trips from delivery of sediment to the landfill, and the moisture content of sediment deliveries to the landfill. With respect to the potential for hazardous materials in the sediment, the sediment and debris that reach most of the reservoirs and debris basins maintained by the Flood Control District originates from largely undeveloped watersheds. In 2010, the Flood Control District analyzed soil samples representative of the sediment removed from reservoirs and debris basins maintained by the Flood Control District. The analysis revealed that constituents in the soil samples were well below threshold levels for all contaminants specified in the Amended Waste Discharge Requirement for Disposal and On-Site Use of Non-Hazardous Contaminated Soils and Related Wastes at Municipal Solid Waste Landfills.
	There are constraints within Sunshine Canyon Landfill's Conditional Use Permit (CUP) on the amount of tonnage that can be accepted daily by the landfill, including any materials put to a beneficial use."	The Flood Control District understands landfills have conditional use permits and other permits that they must abide by. Section 6.5.3 has been revised to indicate this.
Open Space Now	Going to a hardware store and exploring the cost of sand or other products made from sediment gives one an appreciation of its value.	The Flood Control District recognizes that sediment has values and is continuing to explore beneficial uses. Section 6 of the Strategic Plan has been revised to more clearly discuss beneficial use of the sediment. Section 6.5 now discusses use of the sediment in beach nourishment, in the aggregate and other industries, as daily cover at solid waste landfills, as fill at pits, for wetland restoration, for replenishment of sediment-poor waterways, and for replenishment of reefs.
	As the population has increased and the areas around streams, rivers, and flood channels have become multi-use centers for recreation, aquatic and riparian habitat, and equestrian activities, the County of Los Angeles Department of Public Works' planning has lagged behind the realities of current land use scarcity and demand.	The focus of the Sediment Management Strategic Plan is the management of sediment in relation to flood risk management and water conservation. For over ten years, the Flood Control District has pursued multi-benefit projects with the Los Angeles River and San Gabriel River Master Plans. The following are a few examples of multi-use benefits projects that are located within Flood Control District right of way and/or have been constructed or include(d) other major involvement by the Flood Control District and the County of Los Angeles Department of Public Works: Big Tujunga Wash Mitigation Area, Dominguez Channel Bike Trail, Dominguez Gap Wetlands, Los Angeles River Bike Trail, Rio Hondo Bicycle Trail, Rio Hondo Coastal Spreading Grounds, San Gabriel Coastal Spreading Grounds, San Gabriel River Bicycle Trail, Tujunga Wash Greenway and Stream Restoration, and equestrian trails along the rivers.

Commenter	Comment	Response
Open Space Now	The Strategic Plan listed the members of the Sediment Management Advisory Working Group. Based on that, readers of the Strategic Plan may conclude that the members are in agreement with most of the Strategic Plan's recommendations when that may not be the case.	The Flood Control District did not intend to imply that the members of the Sediment Management Advisory Working Group were in agreement with the Strategic Plan's recommendations by listing their names. However, their input was valuable in the development of the Strategic Plan. A note has been added in Appendix A, where members of the Sediment Management Advisory Working Group are listed, to prevent readers from arriving at such a conclusion.
Pasadena Audubon Society	Such a large project requires regional coordination. The County of Los Angeles Department of Public Works and Flood Control District should work with the U.S. Forest Service, the U.S. Army Corps of Engineers, U.S. Fish and Wildlife, California Fish and Game, the Integrated Regional Water Management Plan, and the California Coastal Sediment Management Work Group. This is especially critical because it has been repeatedly stated that methods like flow assisted sediment transport cannot be utilized because of regulatory restrictions. Rather than giving up on such methods, the County of Los Angeles Department of Public Works and Flood Control District should work with these agencies to resolve these issues. We should be looking around the world for strategies to create a system that is sustainable and effective. Minimally, the plan should include the pilot plan discussed at the Advisory Working Group meetings.	The Flood Control District works closely with the agencies and entities listed. Since the beginning, the Sediment Management Strategic Plan Stakeholder Task Force included members from all the agencies listed and more. During the second Stakeholder Task Force meeting in April 2011, staff from the California Department of Fish and Game and California Regional Water Quality Control Board gave presentations about their processes and roles with respect to sediment management projects. Members of the Integrated Regional Water Management Plan were on the distribution list of the Stakeholder Task Force and also part of the Sediment Management Advisory Working Group. The U.S. Army Corps of Engineers, which is a member of the California Coastal Sediment Management Work Group, was included in the Stakeholder Task Force. With respect to flow assisted sediment transport, to be consistent with nomenclature used by other agencies throughout the country and the world, the Flood Control District has made the determination to refer to flow assisted sediment transport as sediment flushing from now on. Revised Section 6.3.3 includes a discussion of sediment flushing, including recommendations for a pilot study. Re-creation of the flood risk management and water conservation system is beyond the scope of the Strategic Plan. The Long-Term Vision mentioned under Next Steps in the Executive Summary and in Section 11 will have a broader focus.
	The lack of understanding of biological resources is disturbing. Every debris basin, every dam, every part of the system is habitat and has inhabitants. Burned chaparral is extremely valuable to many plants and animals called "fire followers" that only appear once the chaparral has been burned. All habitats have value. I have seen reports from the County of Los Angeles Department of Public Works that fail to list many species that I know to be in an area. The one or two cursory visits that biological consultants make to a site do not tell the entire story. I would like to see ecologists and biologists on staff that can become familiar enough with the areas and can explain their significance to the other county employees.	The Flood Control District hires consultant biologists to assist in project planning that will affect habitat. The Flood Control District is hopeful that increased outreach efforts for public input will bring issues like those in the comment even more into the project planning process.

Commenter	Comment	Response
Pasadena Audubon Society	The Strategic Plan needs to recognize that not all impacts are equal. Impacts on air quality can be temporary, while the loss of a canyon or woodlands is more permanent. Even if lost woodland is replanted, it will take decades before it matures and it will never be like it was before. The Strategic Plan needs to describe the types of habitats and the type of impact.	It is agreed that not all impacts are equal. The beginning of Section 6 now states that due to the nature of the Strategic Plan, potential impacts were discussed in general terms and that some of the impacts are long-term, while others are temporary. During the planning of specific sediment management projects, the habitat that could potentially be affected by the specific project will be analyzed.
Sylmar Hang Gliding Association	The Sylmar Hang Gliding Association believes that all of the alternatives in the Strategic Plan for Pacoima Reservoir will negatively impact the community, our members, and the future of hang gliding in Los Angeles. We recognize the importance of sediment removal and seek to support an alternative that will cause the minimum negative effects to our powerless flight activities over, in, and adjacent to the Pacoima Wash. The Sylmar Hang Gliding Association looks forward to working closely with the County in an effort to identify the least harmful methods of removing the sediment in Pacoima Reservoir.	As indicated by the comment, there is no current concept without some negative impacts. The input provided helps the Flood Control District's efforts to understand all of the potential impacts. The Flood Control District appreciates the association's recognition of the importance of sediment removal operations and desire to work with the Flood Control District. There will be opportunities for public input as the upcoming Pacoima Reservoir Sediment Removal Project is planned. People can email reservoircleanouts@dpw.lacounty.gov to request to be added to the email distribution list for the Pacoima Reservoir Sediment Removal Project.
	The Pacoima Reservoir Sediment Removal Project may have significant effects on one of the world's most famous and historic foot launched, powerless, flying sites as well as on the enthusiasts and spectators of the sports of hang gliding and paragliding. Some of the County's six alternatives in the Strategic Plan will have more serious effects than others, so it is our desire that the County of Los Angeles Department of Public Works, through the process of the California Environmental Quality Act, adequately study, evaluate, and effectively minimize any negative effects that this project may have on these sports, the participants, and the businesses and communities that rely on them.	The Pacoima Reservoir Sediment Removal Project is one of the specific sediment management projects alluded to in the Executive Summary of the Strategic Plan. The discussion of alternatives and impacts in Sections 6, 8, and 11 of the Strategic Plan relative to Pacoima Reservoir does not constitute the detailed analysis that will need to be completed for the Pacoima Reservoir Sediment Removal Project. Environmental documents under the California Environmental Quality Act will be prepared for the Pacoima Reservoir Sediment Removal Project. The comments received specific to the Pacoima Reservoir Sediment Removal Project were forwarded to the appropriate team; the comments will be considered during the planning of the Pacoima Reservoir Sediment Removal Project. Additionally, the comments are included in this comment summary and addressed here relative to the Strategic Plan.

Commenter	Comment	Response
Sylmar Hang Gliding Association	Hang gliding enthusiasts have been granted permanent use of more than 20 acres within Pacoima Wash for hang gliding activities by the private landowner. It is common for hang gliders and paragliders to land in one area in Pacoima Wash, very near the south side of Pacoima Dam. This area is commonly referred to by the Sylmar Hang Gliding Association as an "emergency landing area." The Sylmar Hang Gliding Association is supportive of alternatives that would reduce possible deviation of Pacoima Wash. The highest potential for this problem is likely with the sluicing alternative. This could be mitigated by periodic river bed grading, using a significant amount of sediment fill to raise the level of the land adjacent to and west of the Pacoima Wash to prevent the wash from changing course, eroding the banks, and endangering homes and property southwest of the Gavina Street bridge. Rip rap could be another possible solution.	The concern over potential impacts to existing uses of the land near Pacoima Reservoir has been added to Section 8.3.5.1. As the upcoming Pacoima Reservoir Sediment Removal Project is planned, the sediment management alternatives for the reservoir will be analyzed in further detail and potential impacts and mitigation measures will be considered. Any mitigation efforts within private right of way would need to be coordinated with the property owner in addition to other requirements.
	In past years, there has been significant erosion to the west side of Pacoima Wash. In one case, the river came within a few feet of the fence lines of developed residential parcels. This damage was repaired by the government's importation of dirt, raising the elevation of the land, and providing a "buffer zone" that has prevented damage to developed property to date. Over the past 40 years, much of this "buffer zone' has been lost and it would benefit the community to have it returned. The loss of land due to erosion reduces the area of safe, stable, undeveloped land on which the Sylmar Hang Gliding Association operates. Both City of Los Angeles Councilmember Richard Alarcón and Pacoima Beautiful, a non-profit corporation, have proposed development of a park or trail adjacent to the west side of the Pacoima Creek, south of the Gavina Street bridge. The Sylmar Hang Gliding Association believes an opportunity exists for the county to deposit a significant portion of the sediment from the Pacoima Dam in a manner that will help protect property, provide cultural and recreational opportunities, and significantly reduce the cost of sediment transport. The possibility of a partnering with these projects might provide additional opportunities for this sediment project.	This could be explored further with the City. However, putting fill in the wash would impact its capacity and any approved proposal would need to ensure no increased flood risk.
	The Sylmar Hang Gliding Association is supportive of alternatives that would reduce truck traffic in the area between Pacoima Dam and Lopez Flood Control Basin.	The Flood Control District appreciates the input provided.
	The Pacoima Canyon is recognized as one of the highest winds areas in southern California. Historical wind data is recorded at nearby County of Los Angeles Fire Department Camp 9 and available through the Department of Water Resources. Studies of the historical number of days the winds in this area come from the northern hemisphere, or exceed 15 mph, are pertinent to the choice of alternative proposals. The Sylmar Hang Gliding Association is supportive of alternatives that would reduce airborne dust and particulates that would negatively impact local residents and those hang gliding and paragliding above the areas impacted by the sediment management project.	Alternatives and associated air quality impacts for the upcoming Pacoima Reservoir Sediment Removal Project will be analyzed as required by the California Environmental Protection Act.
	Temporary or permanent use of the Northern and Southern Canyons as sediment placement sites as discussed in Section 8.3 could negatively affect the quality of the soaring conditions due to changes in the natural contouring of the ridges and canyons in Pacoima Canyon.	This concern has been added to the potential impacts discussed in Sections 8.3.3.2 and 8.3.6.2, which discuss the canyon sites as potential staging and temporary sediment areas and potential new sediment placement sites, respectively.

Commenter	Comment	Response
Sylmar Hang Gliding Association	We feel that value of our local viewshed is immense. Traditional grading, filling, and re-vegetating would not do enough to minimize the damage to the natural, aesthetic qualities of the area. We would like the county to recognize the importance of retaining the natural beauty of these hills, by avoiding cutting or filling in the area. If this is not possible, we would ask the county to utilize the highest level of contour grading to retain the most natural look.	Section 8.3.6.2 now includes discussion of grading that resembles natural terrain as a method to reduce visual impacts.
	A popular hiking trail from Pacoima Wash to the top of Kagel Mountain and eastward along the rim has been used for decades by the local community and by members of the Sylmar Hang Gliding Association both as recreation as well as a means to retrieve our vehicles from the top of the mountains after flying. The Sylmar Hang Gliding Association is supportive of alternatives that would reduce negative impacts on the hiking trail.	The trail described appears to traverse private land and U.S. Government land. During the planning of the upcoming Pacoima Reservoir Sediment Removal Project, the Flood Control District may need to acquire land or an easement, but that has not been analyzed yet. Typically, when considering if recreational uses are to be allowed on properties owned by the Flood Control District, potential conflicts with the operations of the Flood Control District facilities are carefully evaluated.
Theodore Payne Foundation	Natural open space, whether it is oak woodland or chaparral, provides habitat, species preservation, watershed benefits, air quality benefits, and natural landscape character that are cause for preservation. Use of sediment placement sites is therefore seen as an alternative to be used only as a last resort.	Comment noted. As stated in the Strategic Plan, the Flood Control District is pursuing other sediment management alternatives.
	Destruction of habitat should be seen as a permanent impact, with full restoration not truly feasible. None the less, if habitat is destroyed, a credible effort at partial restoration should be included in any plans. When considering those alternatives, the cost of that restoration should include monitoring and maintenance costs.	Any necessary mitigation measures required due to sediment management operations will be determined during the planning phase of specific sediment management projects.
	The beneficial use of sediment, whether as cover for landfill or derivation of construction and other materials is preferable.	The Flood Control District will continue alternatives to beneficially use the sediment. Section 6.5.2.3 now discusses a proposed sediment processing contract that could allow for private companies to (1) process the sediment and obtain aggregate or other materials from it or (2) use the sediment to reclaim their quarries.
	Mitigation of air quality impacts from trucks could and should be mitigated by planting trees along the transport route, with particulate matter capture by leaves and carbon dioxide sequestration in the biomass of the trees.	During the development of specific sediment management projects, alternatives and associated details will be evaluated in greater detail than they were in the Strategic Plan. Mitigation alternatives of impacts such as these will be analyzed at that point.

Commenter	Comment	Response
Theodore Payne Foundation	Regarding the alternatives included in the Strategic Plan, the Theodore Payne Foundation offers the following opinions. - Cogswell Reservoir: No desirable alternative. 1B, 1C, and 2B being the LEAST desirable. - Morris Reservoir: Alternative 1 appears preferable - Big Tujunga: Alternatives 2A and 2B seem preferable - Pacoima Reservoir: Alternatives 2A and 2B seem preferable - Puddingstone Reservoir: n/a - San Dimas Reservoir: Alternative 1 appears preferable - For Santa Anita, Big Dalton, Live Oak, Puddingstone, and Thompson Reservoirs the use of pits and landfill cover (alternative 1) is logical and desirable.	The Flood Control District appreciates the opinions provided. As specific sediment management projects are planned for the reservoirs, the alternatives will be analyzed in further detail. A number of factors are involved in selecting which alternatives are implemented.
UCLA La Kretz Center for California Conservation Science	The supply and transport of coarse sediments are fundamental geomorphic processes underlying the physical integrity and biological integrity of streams, as well as the health of beaches and nearshore habitats. Success of future stream restoration efforts planned within watershed impacted by dams and debris basins will be dependent upon the ability to receive adequate supplies of sediment from upstream in order to avoid excess erosion along naturalized reaches. A watershed-based assessment, considering current and future restoration efforts and coastal needs, should be undertaken in order to support the Draft Plan's stated objectives of increased environmental stewardship and using sediment as a resource. Furthermore, such an assessment should clearly link to and support the many other related initiatives taking place County-wide, to fully integrate regional water resources planning.	The Long-Term Vision discussed in the Executive Summary and Section 11, will consider sediment management with respect to stream restoration.
	The Strategic Plan dismissed the feasibility of using accumulated sediment at beaches. A value of 20 percent is given as the amount of accumulated sediment that would be appropriate for beach placement (Section 6.5.3), but no references or data are provided to support this number. The Flood Control District should provide a more thoroughly documented discussion of opportunities and constraints for sediment use at beaches (in coordination with needs identified in the Coastal Regional Sediment Management Plans).	Beach nourishment as a beneficial use of the sediment that accumulates in the reservoirs and debris basins is now discussed in Section 6.5.1. The section now includes information provided in several coastal regional sediment management plans prepared by the California Coastal Sediment Management Workgroup. In Section 6.5.1.3, it is now indicated that based on the finding that approximately 25 percent of the deposits match the characteristics of washed sand, which has less stringent characteristics than beach sand, approximately less than 25 percent of the reservoir and debris basin sediment deposits would be appropriate for use in beach nourishment projects. However, the Flood Control District will analyze this alternative further.

Commenter	Comment	Response
UCLA La Kretz Center for California Conservation Science	The Strategic Plan leaves open the potential for new sediment placement sites (Section 6.5.5.2). The use of undisturbed habitat for sediment placement would be inconsistent with the Draft Plan's objective of increased environmental stewardship and contrary to the need for preserving regional open spaces. The Draft Plan does not currently provide the level of detailed quantification of environmental impacts / tradeoffs of the various management options to support the use of new sediment placement sites. The Flood Control District should provide a rigorous quantification of environmental impacts before making any recommendation for the use of undisturbed areas for sediment placement.	The Flood Control District is aware that there are environmental concerns associated with the development of new sediment placement sites. The Strategic Plan includes a very limited number of alternatives involving new sediment placement sites. However, this alternative still remains because in some cases it could have fewer impacts than other alternatives. Due to the nature of the Strategic Plan, the plan does not provide detailed quantification of impacts. However, at this time, no decisions have been made about which alternatives will be employed to manage the sediment at the various facilities. As discussed in the Executive Summary and Section 11, more analysis is needed prior to choosing specific alternatives. Specific sediment management projects that will result in significant environmental impacts will be subject to environmental review and community input under the California Environmental Quality Act.
	Predicted climate change has the potential to result in sediment accumulation quantities significantly greater than historic rates, creating further urgency for developing sustainable long-term management approaches. The 20-year planning quantity calculation assumption that "future sediment accumulation in the reservoirs and debris basins will be similar to the sediment deposition of the past" (Section 5.1) should be reassessed. Regional climate change scenarios and predicted effects on wildfire do not support this assumption.	Section 5.1 now states that the effects of climate change were not considered in the calculation of the 20-year planning quantities. In Section 5.1.1, it is indicated that the impact of under-projections is that the Strategic Plan would last less than the 20-year planning period, which would require an updated Strategic Plan to be developed sooner than expected. The Strategic Plan is a living document that may be revised in the future as conditions change; such changes may include incorporating new information that become available about the impacts to sediment management due to climate change. The Long-Term Vision discussed in the Executive Summary and in Section 11 will consider climate change.
	The Strategic Plan should be revised to identify areas of coordination / integration with the Los Angeles County Coastal Regional Sediment Management Plan, the Los Angeles Basin Stormwater Conservation Study, and the Greater Los Angeles County Integrated Regional Water Management Plan.	It is anticipated that development of the Long-Term Vision discussed in the Executive Summary and in Section 11 will involve greater coordination between agencies and integration of related efforts.
	The Flood Control District should develop a prioritized approach and timeline for conducting watershed-based evaluations of sediment management options, incorporating a full assessment of watershed and channel opportunities and constraints along the entire waterway, from the reservoir/debris basin downstream to the coast.	This recommendation would be addressed by the Long-Term Vision discussed under Next Steps in the Executive Summary and Section 11.
	The Flood Control District should identify approaches to evaluating flow assisted sediment management (FAST) feasibility, possibly through a pilot study. Apply the most current hydrologic/hydraulic and sediment transport modeling approaches to determine engineering feasibility, within the context of a watershed-based assessment.	To be consistent with nomenclature used by other agencies throughout the country and the world, the Flood Control District now refers to flow assisted sediment transport as sediment flushing. Revised Section 6.3.3 includes a discussion of sediment flushing, including recommendations for a pilot study.

Commenter	Comment	Response
West Pasadena Resident's Association	As downstream residents of the Arroyo Seco, we recognize the importance of managing flood risk, but we also urge the County to expand their plan to include larger goals for comprehensive watershed management, where sediment is not solely thought of as a waste product to be trucked off and dumped at a different site. This practice is not sustainable beyond 20 years with the large volume of sediment that is predicted.	While the focus of the Sediment Management Strategic Plan is sediment management, the Strategic Plan discusses various components of watershed management, specifically water quality, groundwater recharge (which is associated with water supply), and habitat in terms of the impacts caused by the different sediment management alternatives discussed in the Strategic Plan. Section 6 discusses a number of sediment management alternatives that go beyond trucking the sediment and placing it at a different site; the Section has been has been revised to more clearly discuss beneficial use of the sediment. Section 6.5 now discusses of the sediment in beach nourishment, in the aggregate and other industries, as daily cover at solid waste landfills, as fill at pits, for wetland restoration, for replenishment of sediment-poor waterways, and for replenishment of reefs. While the focus of the Strategic Plan cannot be expanded at this point, the Long-Term Vision discussed in the Executive Summary and Section 11, will have a broader focus.
	Restoration of the Arroyo Seco would create a riparian habitat that can be enjoyed by people and the many wild creatures living in our Arroyo Seco.	The Flood Control District is currently working with the U.S. Army Corps of Engineers on an Ecosystem Restoration Study of the Arroyo Seco.

Commenter	Comment	Response
Jerry Baker	After reviewing the Strategic Plan and numerous technical publications and proceedings of various organizations and associations involving flood control and sediment management, it is my opinion that the County of Los Angeles Department of Public Works is actively and willfully resisting the implementation of modern innovative sediment management strategies and intentionally ignoring advancements and innovations that have been made in the field. While the body of agencies and organizations responsible for establishing and executing sediment management plans and projects are moving towards interagency planning and cooperation on a regional scale, and employing strategies that optimize sediment management across multiple projects and agencies, the Department continues to act as an insular agency moving forward with a long range Strategic Plan lacking even a rudimentary examination of potential innovative solutions to the environmental, social, and fiscal impacts of the current flood control system and its need for perpetual costly maintenance. Instead, we are offered a parochial list of debris basins and reservoirs where the Department's lack of vision and innovation has led to yet another decade or more of sediment accumulation that must be addressed at great expense to the taxpayer and the environment. By failing to contemplate more sustainable and efficient sediment management practices such as Flow assisted Sediment Transport and beach deposition, by failing to make provisions for pilot projects and studies to identify new and innovative sediment management strategies, and by the Department's apparent lack of coordination with other regional agencies, the Strategic Plan amounts to nothing more than a roadmap for repeating of the mistakes of the past and ensuring the continued destruction of wild places and massive expenditures of taxpayer dollars on future sediment removal projects.	In early 2011, when development of the Strategic Plan began, members of approximately 50 agencies and organizations believed to be able to provide comprehensive and regional input for external stakeholders were invited to participate in the Strategic Plan Stakeholder Task Force. A number of Federal, State, and local agencies were invited to participate and some of the agencies attended several meetings of the Stakeholder Task Force. The Stakeholder Task Force Invitee List and attendance to Stakeholder Task Force meetings are located in the Appendix of the Strategic Plan. Separate from the Stakeholder Task Force, the Flood Control District also works closely and meets regularly with a number of agencies on numerous issues. During development of the Strategic Plan, the Flood Control District asked stakeholders for ideas about how to manage sediment and researched and considered all suggestions. The Strategic Plan provides an overview of the alternatives. Revised Section 6.3.3 includes a discussion of sediment flushing (previously referred to as Flow assisted Sediment Transport), including recommendations for a pilot study. Section 6.5.1 contains a revised discussion on beach nourishment as a beneficial use for the sediment. The Flood Control District will analyze the beach nourishment alternative further.
	Consideration of FlowAssisted Sediment Transport (FAST) should be a critical element of any long range sediment management plan. The FAST terminology is somewhat unique to the County of Los Angeles Department of Public Works, being called "sediment pass-through" in the world of hydraulic engineering, but the principle is the same. In simple terms, the sediment management technique involves opening a dam's flood gates at the onset of a flood event to allow sediment to pass through in its natural manner, and then closing the gates while there is sufficient water in the watershed to replenish the reservoir. Since major flood events are responsible for an extremely large portion of the total sediment transport in a watershed, the goal of this technique is to open the dam and let the flood event more or less take its natural course. Not only is sediment accumulation drastically reduced, but as sediment takes its natural course downstream it creates and maintains aquatic habitat and ultimately replenishes the sand on local beaches.	Revised Section 6.3.3 includes a discussion of sediment flushing (previously referred to as flow assisted sediment transport), including recommendations for a pilot study.

Commenter	Comment	Response
Jerry Baker	Throughout the Strategic Plan, temporary impacts such as air pollution, traffic, and noise are treated as equivalent to permanent habitat destruction. This perverse and misguided lack of prioritization frequently leads the County of Los Angeles Department of Public Works to choose obliterating rare habitat from the face of the Earth for all eternity as a temporary mitigation of traffic and/or noise.	A general statement in now included at the beginning of Section 6 regarding the long-term and temporary nature of some of the impacts.
	The County of Los Angeles Department of Public Works demonstrates a fundamental ignorance of the biological diversity and significance of California's unique ecosystems, and maintains a cavalier attitude towards their destruction. In considering potential alternatives, the Department treats mitigation sites as functionally equivalent to having fully repaired the environmental destruction brought about by their projects. Department staff indicated that once work was completed at Santa Anita Sediment Placement Site, the location of the Arcadia Woodlands, habitat could be reestablished. A visit to the site shows how ludicrous in the notion that you can destroy habitat and then casually replace it or restore it. In describing the solution to the environmental disaster of filling in two canyons adjacent to Pacoima Wash – an area known to contain both the endangered Davidson's bush mallow and Nevin's barberry in addition to being a likely location for six other endangered or threatened plant species – the Department's staff demonstrate their complete ignorance of the significance of the area and the complexity of the habitat they would be destroying by casually suggesting that, "once work is complete, habitat could be re-established on disturbed areas." In addition to the erroneous beliefs concerning the efficacy of mitigation sites, the Department consistently understated the habitat they schedule for demolition. At the Arcadia Woodlands, the Department chose to characterize the destruction of a nearly pristine Coast Live Oak riparian woodland – one of the last on flat land remaining in all of the County of Los Angeles – as nothing more than the casual "removal of native vegetation." The Department's egregious behavior could be minimized if the Department were required to maintain an independent group permanently and adequately staffed with professional wildlife and fisheries biologists, botanists, and other relevant scientists with real power to influence the development and selection of project alternatives.	At this time, no decisions have been made about which alternatives will be employed to manage the sediment at Pacoima Reservoir or other facilities. As discussed in the Executive Summary and Section 11, more analysis is needed prior to choosing specific alternatives. The discussion of alternatives and impacts in Sections 6, 8, and 11 of the Strategic Plan relative to Pacoima Reservoir does not constitute the detailed analysis that will need to be completed for the Pacoima Reservoir Sediment Removal Project. Environmental documents will be prepared for the upcoming Pacoima Reservoir Sediment Removal Project in accordance with the requirements of the California Environmental Protection Act. Those environmental documents will consider in detail potential impacts on habitat as well as other impacts. The Flood Control District hires consultant biologists to assist in project planning that will affect habitat. The Flood Control District is hopeful that increased outreach efforts for public input will bring issues like those in the comment even more into the project planning process.

Commenter	Comment	Response
Jerry Baker	The County of Los Angeles Department of Public Works needs to get more involved with regional efforts to coordinate sediment management, and needs to pioneer efforts to identify innovative and effective sediment management strategies. A successful Sediment Management Strategic Plan must identify a specific plan for research and development of new sediment management techniques. The (California) Coastal Sediment Management Workgroup (CSMW) is a collaborative effort between various State and Federal agencies chaired by the Army Corps of Engineers. The CSMW is currently developing individually-tailored regional sediment management plans for individual littoral cells designed to coordinate the beneficial reuse of sediment resources in a regional context to help to restore natural processes and simultaneously address sediment imbalances. Unfortunately, the Sediment Management Strategic Plan makes no mention of the Los Angeles County Coastal Regional Sediment Management Plan being developed by the CSMW. Not only does the Sediment Management Strategic Plan feature no coordination with other regional agencies or the CSMWG's regional sediment management plan, but it specifically and categorically rejects FAST and sediment placement at beaches, the only sediment management alternatives that have any potential to contribute solutions to the coastal sediment deficit that the CSMW is working to address.	During the development of the Strategic Plan, the Flood Control District communicated with staff from the U.S. Army Corps of Engineers Los Angeles District and the Los Angeles County Department of Beaches and regarding the development of the Coastal Regional Sediment Management Plans. Both agencies were always invited to the Strategic Plan Stakeholder Task Force meetings and staff from both agencies attended several meetings. However, the Flood Control District was not made aware of any public or multi-agency meetings for the Coastal Regional Sediment Management Plans. The Flood Control District has reviewed the coastal plans available at www.dbw.ca.gov/csmw/crsmp.aspx. The revised Section 6.5.1 of the Strategic Plan incorporates information in these coastal plans. As now indicated in Section 6.5.1, the Flood Control District will analyze the beach nourishment alternative further. On a slightly separate note, the Flood Control District has been involved in the development of the Sediment Management Chapter of the Water Plan Update 2013 led by the California Department of Water Resources. Revised Section 6.3.3 includes a discussion of sediment flushing (previously referred to as flow assisted sediment transport), including recommendations for a pilot study. Additionally, the Flood Control District is pursuing contracts that could allow for private companies to receive sediment from the Flood Control District to (1) process the sediment and obtain aggregate or other materials from it or (2) use the sediment to reclaim their quarries. This is now discussed in Section 6.5.2.3.
	The Sediment Management Strategic Plan rejects transporting sediment to beaches on the basis of cost, but does not deduct the potential offset from the cost of sand replenishment projects. This omission artificially inflates the cost of transporting sediments to local beaches and leads to the rejection of that alternative.	As indicated in the previous response, the Flood Control District will analyze the beach nourishment alternative further.

Commenter	Comment	Response
Christle Balvin	I would like to suggest that the County of Los Angeles Department of Public Works give serious thought to changing its mission and developing a new operational structure that is dedicated as much to water and habitat conservation as it is to flood control. Toward that end, the name of County Flood Control should change to the County Department of Flood Control and Water Conservation.	The Department of Public Works is a County of Los Angeles Department that provides numerous services to the unincorporated areas of the County (as well as cities that have contracted the Department of Public Works to do so). The services include designing and constructing County buildings, providing waste management, and more; see the Department's website at www.dpw.lacounty.gov for more information. The Flood Control District is a special district that was created in 1915 by the Los Angeles County Flood Control Act to provide for the control and conservation of flood and storm waters. As such, the Flood Control District is responsible for flood control and water conservation. Since 1985, the Department of Public Works has been responsible to perform both the Department's responsibilities and the Flood Control District's responsibilities. However, the two agencies remain separate agencies.
	The entire system needs to be reexamined and new technologies developed and implemented not just to prevent flooding but to conserve water. In fact, the ongoing drought may make water conservation even more important in the long-run than flood protection.	As explained in the comment above, the Flood Control District currently plays a major role in water conservation. The existing system not only serves to manage the risk of floods but also to conserve flood and storm waters. The Long-Term Vision discussed in the Executive Summary and Section 11, will have a broader focus.
	The County of Los Angeles Department of Public Works needs to recognize that it has the important but difficult task of balancing competing interests wanting to use the often rural areas around its many dams and reservoirs. These areas are now enjoyed by hikers, equestrians, birders, Frisbee golf clubs, fishermen, bikers, campers … and the list goes on. So aside from its own engineering activities, the Department should recognize, respect and work to balance the various needs and uses for these publically-owned lands over which it has stewardship.	The Flood Control District recognizes the need to balance competing interests. The general analysis of sediment management alternatives presented in the Strategic Plan includes discussion of social impacts associated with each sediment management alternative. The need to balance competing interests is one of the reasons why we invited so many stakeholders to participate in the development of this Strategic Plan and will outreach to the public in the future for specific projects.
	The DPW (Flood Control) budget should provide adequately for financing of long-range planning and research projects as well as the implementation of pilot projects on appropriate reservoirs. The most sustainable and efficient should be carefully studied and re-applied wherever appropriate.	Among the Flood Control District's next steps discussed in the Executive Summary and Section 11 is developing Long-Term Vision with the U.S. Army Corps of Engineers and local stakeholders. Additionally, Section 6.3.3 includes a discussion of sediment flushing and recommendations for a pilot study.
	Sediment has value and should no longer be treated as a waste product. The current system of operating without much cooperation between the County of Los Angeles Department of Public Works and other agencies or businesses related to sediment (sand and gravel industry), has been costly enough for taxpayers. In this new age of reduced federal and county budgets, the idea of creating a profit from sediment and plowing the profit back into Department operations may be new but well worth exploring.	The Flood Control District has worked with businesses and other agencies in the past. Additionally, the Flood Control District is pursuing contracts that could allow for private companies to receive sediment from the Flood Control District to 1) process the sediment and obtain aggregate or other materials from it or 2) use the sediment to reclaim their quarries.

Commenter	Comment	Response
Christle Balvin	To make some of the sediment "beach ready," the County might explore agreements with the sand and gravel industry to process and refine sand not only for beaches but for home gardens and the construction industry.	Section 6.5.2.3 discusses a proposed sediment processing contract that could allow for private companies to (1) process the sediment and obtain aggregate or other materials from it or (2) use the sediment to reclaim their quarries. The Flood Control District will analyze the beach nourishment alternative further.
	The draft Strategic Plan shows no consideration of working with other entities such as the U.S. Army Corps of Engineers or the Integrated Regional Water Management Plan (IRWMP) program, both of which are also seeking solutions to water and sediment problems. Nor does it propose working with some of the new environmental centers such as the one at Caltech where top scientist and researches are bringing new information, data, and potential solutions to the fore. DPW needs to establish working groups that involve universities, other related agencies, and representatives of the public with perspectives and knowledge of water, sediment, and bio-diversity issues (they do exist and have been in attendance at many of the Sediment Task Force meetings)	In early 2011, when development of the Strategic Plan began, members of approximately 50 agencies and organizations were invited to participate in the development of the Strategic Plan. The U.S. Army Corps of Engineers was among those agencies; staff from the agency attended several Stakeholder Task Force meetings. Agencies involved in the Integrated Regional Water Management Plan program were also invited to participate in the Stakeholder Task Force and the Sediment Management Advisory Working Group. People involved in agencies focused on the environment also participated in both groups. See the Appendix for additional information. The groups were created to gather input from external stakeholders. The Flood Control District intends to involve academia in the effort to develop the Long-Term Vision mentioned in the Executive Summary and Section 11.
	Devil's Gate Dam, with ample wet-season water, should be considered a pilot project for the flow assisted sediment transport method. I understand that if uncontrolled, there are potential flood spots along the cement channel around Avenue 64 and sections of Highland Park. Let's correct them so that this method can again be used to get sediment naturally out from behind Devils Gate dam and down toward the coast. Or let's consider developing a sediment treatment or soil refinement plant near the Cornfields where sediment could be scooped up from the channel, processed, and taken by adjacent rail system to the Azusa sand and gravel yards. Let's be innovative.	The Flood Control District actually already operates Devil's Gate Reservoir in a manner that uses water flows to transport sediment through the dam. Section 3.3.3 now discusses that. Furthermore, the Flood Control District is looking at opportunities to use sediment beneficially.

Commenter	Comment	Response
Joyce Dillard	The numbers and/or illustrations do not match. Table 4-1 does not always match the listings in other tables. There appears to be flawed available capacity. [Attached to the comments was an analysis based on the information in Figure ES-1 and Tables 2-1, 2-3, and 4-1]	The Flood Control District has reviewed the specified figure and tables along with the analysis provided by the commenter. • Figure ES-1 and Table 2-3: A note has been added to Figure ES-1 to explain that due to rounding, the Active SPS Remaining Capacities shown in the figure do not exactly match the values presented in Table 2-3. • Table 2-1: Columns in Table 2-1 have rearranged and brief explanations of the calculations are now provided below the table. • Table 4-1: The values in the table were revised as follows. The majority of the Total Historical Sediment Accumulation and Total Historical Sediment Removal values were rounded to the closest 0.1 million cubic yards (MCY). For values less than 0.1 MCY, the values were rounded to one significant figure. The table now shows the quantity of sediment.
	There is no reference to atmospheric river analysis for flood planning, current and any historical data.	The focus of the Sediment Management Strategic Plan is sediment management, not flood planning. The study of the movement of water vapor in the atmosphere, including through atmospheric rivers, is beyond the scope of the Strategic Plan. Therefore, atmospheric rivers are not mentioned in the Strategic Plan.
	There is no air quality analysis or odor analysis.	Sections 6 to 10 include discussion of the impacts the alternatives would have on air quality. The potential for odors is mentioned for several alternatives discussed in Sections 6 to 8.
	Why was there no outreach to the Sunshine Canyon Landfill oversight groups?	In early 2011, when development of the Strategic Plan began, members of approximately 50 agencies and organizations believed to be able to provide comprehensive and regional input for external stakeholders were invited to participate in the Strategic Plan Stakeholder Task Force. At that time, the Flood Control District was not aware of the Sunshine Canyon Landfill oversight groups, but the Flood Control District consulted with the landfill itself. In the future, as specific sediment management projects are planned, there will opportunities for additional stakeholder involvement. If plans for one of the specific projects ends up involving sediment deliveries to Sunshine Canyon Landfill, the Flood Control District will outreach to Sunshine Canyon Landfill and other stakeholders will have the opportunity to comment then.
	Beneficial uses are not clear.	Section 6 has been revised to more clearly present the beneficial uses discussed in the Strategic Plan. Section 6.5 now discusses the use of sediment in beach nourishment, in the aggregate and other industries, as daily cover at solid waste landfills, as fill at pits, for wetland restoration, for replenishment of sediment-poor waterways, and for replenishment of reefs.
	Since the infrastructure is aging, what capital improvements or capacity expansion is needed?	Determination of capital improvement projects that would expand the capacity of the Flood Control District's facilities is beyond the scope of the Strategic Plan. The need for capital improvement projects is evaluated through separate efforts.
	The Strategic Plan does not consider the impact of overweight trucks on road conditions, broken sewers and water mains, heavy traffic, and diesel fuel on air quality.	Selection of trucking routes would consider any vehicle weight restrictions on streets. Adhering with weight restrictions should prevent broken sewers and water mains due to overweight vehicles. Sections 6 to 10 discuss the impact trucks would have on traffic and air quality.

Commenter	Comment	Response
Joyce Dillard	Section 5.1.2 states that "While the number of debris basins maintained by the Flood Control District may increase as a result of development during the 20-year planning period, this is expected to only have minimal impact on the quantity of sediment needing to be managed because new development will likely only occur in areas of low debris potential. Therefore, the 20-year planning quantities were not prorated to reflect a potential increase due to future development." How can this be assumed when density is part of the Southern California Association of Governments and municipal process, even in hillside/mountain areas? There needs to be some backup to this statement.	As indicated in the statement, the assumption that development will only have a minimal impact on the quantity of sediment needing to be managed is based on the expectation that new development will likely occur in areas of low debris potential. This goes back to information provided in Section 2.1, which discussed the Flood Control District's three flood maintenance areas and the potential for construction of new debris basins within each area. In the case that such assumptions are wrong, the impact of such error is not significant. If the new debris basins resulted in a 10 percent increase in the amount of sediment needing to be managed from the debris basins, that would mean approximately 10.6 million cubic yards of sediment would need to be managed in relation to the debris basins, as opposed the Strategic Plan's 9.6 million cubic yards. If the new debris basins resulted in a 25 percent increase, it would mean 12 million cubic yards as opposed 9.6 million cubic yards. Adding 1 million cubic yards or 2.4 million cubic yards to the 67.5 million cubic yard planning quantity would not have a great impact on the discussion of alternatives in the Strategic Plan.
	How will the alluvial fan research at the California State University, San Bernardino be addressed by the Strategic Plan?	The Flood Control District is an on-going partner in the Alluvial Fan Task Force led by Department of Water Resources and the California State University, San Bernardino. While both the Alluvial Fan Task Force and this Sediment Management Strategic Plan are concerned with the risk presented by floods, their goals are different. The Alluvial Fan Task Force was mostly concerned with the planning of new developments on alluvial fans. The Sediment Management Strategic Plan is concerned with the maintenance of existing facilities that help manage flood risk for existing communities downstream of those facilities.
	Effects on habitat are underplayed in this document.	The Strategic Plan discusses potential impacts on habitat in a general sense under each alternative's Environmental Impacts discussion. More detailed analysis of habitat impacts will be conducted during the planning of specific sediment management projects.
	What is the projected budget for this Strategic Plan? Is there sufficient funding available or is more needed?	The Strategic Plan consists of an overview of alternatives for managing sediment for the next 20 years. While Section 11 presents a number of sediment management alternatives along with each alternative's order of magnitude estimated cost, at this time, no decisions have been made about which alternatives will be employed to manage the sediment at the various facilities. As discussed in the Executive Summary and Section 11, more analysis is needed prior to choosing specific alternatives. Considering all the alternatives provided in Section 11, just at the reservoirs, managing sediment between 2012 to 2032 could cost $500 million to $1 billion.

Commenter	Comment	Response
Joyce Dillard	The Strategic Plan is just a sediment removal plan, heavy on trucking, lean in flood management planning, and way too expensive to be taxpayer financed and realized.	The focus of the Sediment Management Strategic Plan is sediment management, which is preformed to maintain the proper functionality of the reservoirs and debris basins maintained by the Flood Control District. Reservoirs and debris basins play a major role in the management of flood risk. Therefore, this Strategic Plan is directly connected with flood risk management. Additionally, the reservoirs play a major role in our region's ability to capture and use storm runoff to recharge local groundwater aquifers. The Strategic Plan provides an overview of alternatives for managing sediment for the next 20 years. A number of sediment transport alternatives are discussed in Sections 6 to 11. In addition to trucking, the sediment management alternatives presented in Section 11 include transport alternatives such as sluicing, conveyor belts, and slurry pipelines. The costs presented in the Strategic Plan are order of magnitude 20-year cost estimates. Sediment management is indeed a high cost necessity for the region. However, if the sediment that erodes from the highly-erosive San Gabriel Mountains and other mountains/hills in the regions is not managed, the quality of life in the region would be jeopardized. Flood risk would not be able to be managed as it has been for the last 75 years or so. Furthermore, the region's ability to capture and use stormwater would be diminished.
	The Strategic Plan considers the feasibility of alternatives under perfect conditions. It does not consider major weather events or fires.	Section 4 summarizes historical sediment deposition at the reservoirs and debris basins and removal from the facilities. The historical records include the effects of heavy rains and fires, since both were experienced during the period covered by the records. Section 5 discusses the calculation of the planning quantities. Because the calculation of the planning quantities employed the historical records, the planning quantities consider major weather events or fires, at least to the extent they occurred during the period covered by the records.
	Transporting sediment by rail would have air quality impacts similar to transporting it by diesel trucks.	Section 6.4.5 indicates transporting sediment by rail was determined to be an infeasible sediment transport alternative given the limited implementability and performance along with other factors.
	The Strategic Plan does not address relocation of wildlife, quarantine periods, permitting, nesting patterns, and plants. This aspect is part of overall watershed health and should not be ignored.	Due to the planning-level nature of the Strategic Plan, impacts on habitat are discussed in general terms in Sections 6 through 10. Environmental regulatory permits are mentioned under the discussion of implementability. More detailed analysis will be conducted during the planning of specific sediment management projects.
	Water conservation measures are absent from the Strategic Plan, yet the focus for the Integrated Regional Water Management Planning is for water conservation for water supply as well as water quality.	This Strategic Plan is an effort that is separate from the Integrated Regional Water Management Plan program. However, due to the relationship between sediment accumulation and capacity for water storage in reservoirs, the sediment management alternatives presented in Strategic Plan are indeed associated with water conservation. The impacts the various sediment management alternatives would have on water quality are discussed in general terms in Sections 6 to 10.
	Monitoring is not discussed.	Due to the unique aspects of each site, each sediment management project will require different monitoring. The Flood Control District will provide the appropriate and necessary monitoring including monitoring needed to comply with requirements established by the regulators in connections with permits.

Commenter	Comment	Response
Joyce Dillard	There is no consideration of the capacity or lifetime of landfills, other than the limitations of Scholl Canyon Landfill. There is no analysis of landfill projections based on density development, with an emphasis on sports stadiums and hotels.	Section 6.5.1 explains that some solid waste landfills employ dirt to cover daily solid waste deposits. The use of sediment at landfills for daily cover purposes would not take away capacity reserved for solid waste, but rather substitute or augment the source(s) where dirt is obtained for daily cover purposes. Therefore, the Strategic Plan is only concerned with the years during which that opportunity is available. Section 6.5.1.2 has been revised to indicate that per the Sunshine Canyon Landfill's website, the landfill is anticipated to remain open until 2037, given current disposal rates. Based on information provided by Scholl Canyon Landfill's operator, Section 6.5.1.3 now indicates closure of Scholl Canyon Landfill is scheduled for 2032. Therefore, the alternative to beneficially use sediment for daily cover purposes at Sunshine Canyon and Scholl Canyon Landfills appears to be an available opportunity for the entire period covered by the Strategic Plan, that is, 2012 to 2032. Evaluating the capacity remaining at landfills is outside the authorities of the Flood Control District. As a result, the estimated closure years were obtained from the landfill operators, either through the landfill website or communication with the operator.
	What should be anticipated as to the near-term and long-term need?	As indicated in the Executive Summary, the Strategic Plan's total 20-year planning quantity amounts to 67.5 million cubic yards. Section 5 details how the planning quantity was calculated and indicates that the total planning quantity includes the projected 20-year sediment accumulation at all the reservoirs and debris basins as well as sediment already in storage at Big Tujunga, Cogswell, Devil's Gate, and Pacoima Reservoirs planned for removal during the next few years. No near-term quantities of sediment to be removed from the debris basins can be given. As discussed in Section 4, sediment is removed from debris basins when a certain threshold is met. The time it takes for sediment in a debris basin to reach that threshold depends upon natural and unpredictable occurrences associated with weather and filres .
	Toxic sediment will be transported out of state. Please explain your strategy.	The Strategic Plan does not make such a statement nor address toxics. No toxics are anticipated. However, if determined to be present, the Flood Control District will follow applicable disposal requirements.
	It does not appear you have incorporated the LA Regional Dredged Material Management Plan by the US Army Corps of Engineers and its impact on your plan.	The Los Angeles County Regional Dredged Material Management Plan prepared by the U.S. Army Corps of Engineers Los Angeles District relates to the management of contaminated sediment that has been dredged, not the management of sediment from largely natural watershed, which is the type of sediment that reaches the Flood Control District's reservoirs and debris basins and is the focus of this Strategic Plan.
	The Strategic Plan does not explore wetlands mitigation banking.	Wetlands mitigation banking and any other forms of mitigation are issues that will be considered during the development of specific sediment management projects if necessary.

Commenter	Comment	Response
Rick Grubb	Between 1940 and 1969, “sluicing” was the only method used to remove sediment from Big Tujunga Reservoir. Arroyo Toads flourished here during that period. Thanks to changes to the dam and operational methods, Arroyo Toads have since been (nearly) extirpated from Sunland due to the habitat loss of sandy rills and sand bars they need within the river channels to survive. The high water flows from Big Tujunga Dam have scoured the habitat in the river bed. Removal of sediment via truck/other means is depriving the river of the material needed to naturally replenish the riverbed. Please explain how the sediment removal 20 year plan overall, and the sediment plans for the Big Tujunga Wash in particular, will address the recovery of Arroyo Toads to Sunland and other riverbeds similarly impacted by LACFCD dam high flows and subsequent sediment removal activity over the next 20 year period.	Once the upcoming Big Tujunga Reservoir Sediment Removal Project is completed, the Flood Control District hopes to operate Big Tujunga Reservoir to pass some sediment flows through the dam and to the downstream river reaches when possible. Natural high flows from the canyon will still occasionally scour the wash as they would if the dam had never been constructed.
John Holmes	Any alternative that exposes sediment to the atmosphere is unconscionable. The only humane sediment removal project from Pacoima Reservoir is to move sediment to Lopez Flood Control Basin through an enclosed pipe, then from there remove the sediment immediate via truck to the Sun Valley Pits. Transporting sediment via an open conveyor from Pacoima Reservoir to the canyons downstream of the dam or to Lopez Flood Control Basin will expose sediment to the air and so will the creation of a new sediment placement site. Updraft air will bring incredible amounts of sediment fine particles high into the air. Air will spread the airborne particles through the San Fernando Valley and into the City of Los Angeles.	Alternatives for the upcoming Pacoima Reservoir Sediment Removal project will be analyzed in detail as the specific project is planned.
Susette Horspool	The County of Los Angeles Apollo Community Regional Park consists of 26 acres of 3 reclamation ponds stocked with fish and islands that attract waterfowl. Around the periphery is a path with grassy areas and small playgrounds for young children. All of it is man-made. It is entirely possible to build such an environment in Hahamongna Park north of Devil’s Gate Dam. I suggest that you use the sediment from Devil's Gate Dam to build wildlife islands in the center of the floodplain. The resulting lake could be used for water reclamation and/or as a detention basin stocked with grasses and fish. Benefits include the following: (1) Saved transportation costs and neighborhood disruption. (2) Utilization of the sediment as the valuable resource it is. With each year of sediment removal the island/s could be expanded or heightened. (3) Enhancement of a recharge point for the aquifer and possibly a reclamation location for sewage - the rich water would further the growth of water plants and the introduction of native fish and frogs. (4) Creation of a unique city park that helps reduce crime - The US Forest Service found that creating nature areas with trees seems to help deter crime. The “Man-Made Islands Create Habitat” article at http://news.minnesota.publicradio.org addresses an end-result situation similar to Hahamongna, with a solution that we could easily and cost effectively implement - using sediment to build wildlife islands.	On September 2011, the Flood Control District issued a Notice of Preparation of the Environmental Impact Report (EIR) for the Devil’s Gate Reservoir Sediment Removal and Management Project. The EIR for the subject project will evaluate several options for removing sediment from the reservoir. The draft EIR is expected to be completed in March 2013.

Commenter	Comment	Response
Ann Job	Stakeholders pay taxes that provide the budget monies for Sediment Removal Projects. Why should stakeholders' monies be used to negatively impact their lives?! The decision on which alternative (or combination of alternatives) the LA County Department of Public Works will employ should not be based on cost alone. In fact, stakeholders would argue that the financial cost should be far less important than the cost of the stakeholders' air quality, health issues, viewshed, home values and quality of life.	People living within the boundaries of the Flood Control District pay a flood control assessment to provide for the management of flood risk and water conservation. The Flood Control District has an obligation to spend the money as efficiently as possible. As indicated in the Executive Summary of the Strategic Plan, during the development of specific sediment management projects, opportunities to provide input will be given. Furthermore, specific sediment management projects that will result in significant environmental impacts will also be subject to environmental review under the California Environmental Quality Act, which will provide additional opportunities for public involvement during project evaluation.
Roger Klemm	It is time to realize that dumps are by nature finite, sediment flow is for all intents infinite, and we need to move beyond a finite planning horizon. Summarily rejecting from serious consideration those alternatives which offer the capacity to handle non-ending sediment flows just because they are logistically challenging is short-sighted. Please reconsider ways to convey sediment to the beaches - ultimately we will all benefit! And releasing a little sediment here and there can help habitat in some watersheds, too!	The Flood Control District will analyze the beach nourishment alternative further; this is now indicated in Section 6.5.1. Sediment flushing (previously referred to as flow assisted sediment transport) and sluicing, two methods that involve the release of sediment-laden flows, are discussed in Sections 6.3.3, 6.3.4, and 6.4.1. Section 6.3.3 recommends conducting a sediment flushing pilot study.
C. McDougald	Does the County have any insurance that would cover health or property values impacts due to having dump sites located so close to homes? Have potential lawsuits been factored into your cost analysis so you can better determine which method is most cost effective? We shall fight this action and drag this through the courts if needed. Have you factored in lower values and less revenue to the county from property taxes as a result of dump sites in local neighborhoods?	Sediment unavoidably accumulates within the reservoirs and debris basins marinated by the Flood Control District. If this material is not periodically removed, downstream residents and property would be at risk for flooding and debris flows at potentially catastrophic costs. While no method of managing the sediment is without impacts, this Strategic Plan is part of the Flood Control District's efforts minimize impacts by exploring new ideas and incorporating lessons that have been learned from past projects.
Orville Magoon	The Strategic Plan appears to have failed to consider the impact of structures and other works on the supply of sediments to coasts and / shores. As you know, loss of sediment to coasts and / or shores may result in serious erosion and may further result in litigation. I suggest that you consider these impacts.	Please see the Los Angeles County Coastal Regional Management Plan dated August 2012 (http://www.dbw.ca.gov/csmw/crsmp.aspx), which was prepared by the U.S. Army Corps of Engineers and the California Coastal Sediment Management Workgroup. The coastal plan discusses how most of the beaches in Los Angeles County were never nourished by the Los Angeles, San Gabriel, or Santa Clara Rivers. Section 6.5.1 of the Flood Control District's Sediment Management Strategic Plan has been expanded to discuss the issue of beaches in more detail. In any case, the Flood Control District will analyze the beach nourishment alternative further.

Commenter	Comment	Response
Lori Paul	The Strategic Plan is so far-reaching in scope and so greatly affects parkland and natural resources of this region as well as flood safety and water supply, that a substantially greater outreach effort is necessary to experts in several fields and academic disciplines than has occurred thus far in the process. There are many outside of the usual participants to date who would be able to provide valuable input and viable alternatives for innovative sediment and flood control management. During the extended review period, please work to extend outreach re: the current DRAFT SMSP. Greater outreach is not something those of us who volunteer our personal time can assure by ourselves. It requires active County participation and open-minded support.	In early 2011, when development of the Strategic Plan began, members of approximately 50 agencies and organizations believed to be able to provide comprehensive and regional input for external stakeholders were invited to participate in the Strategic Plan Stakeholder Task Force. Additionally, with time, the Stakeholder Task Force grew and its meetings were also attended by numerous members of the public, which were welcome to attend. The Stakeholder Task Force Invitee List and attendance to Stakeholder Task Force meetings are located in the Appendix of the Strategic Plan. In late April (2012), a press release went out notifying people of the open houses that were held in May for the draft Strategic Plan. In June 2012, staff gave presentations about the draft plan to the five Integrated Regional Water Management Plan (IRWMP) Subregional Steering Committees, the IRWMP Leadership Committee, and the Upper San Gabriel Valley Municipal Water District.
	Greater commitment is needed on the part of the County of Los Angeles Department of Public Works to implement a plan that will not require the ongoing, unsustainable destruction of local canyons and remnant natural habitat, such as the lost Arcadia Oak Woodland and in the remaining chaparral and oaks in the upper zone of the Maple Canyon sediment fill. The best way to accomplish this is to simply take these imperiled places off the table. Period. Once canyons and other natural sites are no longer available for destruction, the sediment management problem can be put in proper perspective. It becomes clear that sediment management and associated flood control extends well beyond the 20 years currently targeted by the draft Strategic Plan.	Section 6.5.5.2 indicates that while it is understood that there are environmental concerns associated with the development of new sediment placement sites, this alternative is still being considered because a new sediment placement site and transportation of sediment to it could have fewer impacts than placing and transporting sediment to another placement alternative that is farther away. Nevertheless, Sections 6 through 11 include a very limited number of alternatives that involve placement of sediment in a new sediment placement site. The Long-Term Vision discussed in the Executive Summary and Section 11, will consider a planning period greater than the 20-year planning period of the Strategic Plan.
	If current methods prevail, we will not only lose more wildlands, critical habitat, and recreational parkland adjacent to towns and cities, we will indeed run out of physical places to dump sediments, unless one wishes to do so on top of local neighborhoods. The mountains surrounding us are never going to stop releasing flood waters, sediment and rock into historic water courses and flood plains. Therefore, the classification of such ongoing, ceaseless sediment accumulation as "waste" must change.	The Strategic Plan discusses various beneficial uses for the sediment. Section 6 has been revised to more clearly present that discussion. Section 6.5 now discusses the use of sediment in beach nourishment, in the aggregate and other industries, as daily cover at solid waste landfills, as fill at pits, for wetland restoration, for replenishment of sediment-poor waterways, and for replenishment of reefs.

Commenter	Comment	Response
Lori Paul	For the record, I am disappointed that the Sediment Management Strategic Plan Team is no longer working in close partnership with the U.S. Forest Service, particularly in the vicinity of Big Tujunga Reservoir where there is great concern regarding the endangered Santa Ana sucker fish (Catostomus santaanae) in Big Tujunga Creek, riparian habitat and recreational lands. Close cooperation with this federal agency is essential to the success of any sediment removal project that impacts the National Forest.	The Flood Control District does work closely with the U.S. Forest Service. The fact that the U.S. Forest Service did not conduct the public scoping required for the project by the National Environmental Protection during a Flood Control District meeting for the Strategic Plan was not because the Flood Control District had stopped working with the U.S. Forest Service. Both agencies agreed that the proper procedure was for the U.S. Forest Service to conduct a meeting focused entirely on public scoping for the Big Tujunga Reservoir Removal Project. The Flood Control District attended the public scoping meeting held by the U.S. Forest Service in July 2012. The Flood Control District continues to work closely with the U.S. Forest Service on that project as well as other projects.
Johnathan Perisho	While one of the objectives of the Strategic Plan is to identify ways to us sediment as a resource, the Strategic Plan treats sediment as a waste product. The Strategic Plan is essentially concerned with doing what has always been done. Looking for new places to dump sediment is not new strategy. Dumping sediment in a landfill is not radically different from dumping sediment on a pristine location. Any landfill in question would have once been pristine and new landfills will also cover over what was at some time pristine.	Various beneficial use and placement alternatives are discussed in the Strategic Plan. Section 6 has been revised to more clearly present the beneficial uses discussed in the Strategic Plan. Section 6.5 now discusses the use of sediment in beach nourishment, in the aggregate and other industries, as daily cover at solid waste landfills, as fill at pits, for wetland restoration, for replenishment of sediment-poor waterways, and for replenishment of reefs. The alternative involving the landfills consists of using the sediment to substitute or augment the source(s) where dirt is obtained from for daily cover purposes. Section 6.5.2.3 discusses a proposed sediment processing contract that could allow for private companies to 1) process the sediment and obtain aggregate or other materials from it or 2) use the sediment to reclaim their quarries.
	Beneficial use of sediment in the current system means manually scouring, transporting, and dumping the sediment somewhere. Although every positive impact helps, the potential for beneficial use is likely insignificant relative to the 67.5-million-cubic-yard planning quantity.	As discussed in the response to the previous comment, the Strategic Plan discusses various beneficial use alternatives. The Flood Control District will continue to look into the feasibility of beneficially using the sediment.
	Riparian habitats dependent on fluvial process are not functioning; they are threatened with abatement and decline even with heavy civic expenditures. The existing system fundamentally maintains ongoing loss of key riparian habitat both at debris points and downstream habitats unable to sustain themselves without flood regimes and sedimentation. The existing system also results in a need to manage invasive species. Where natural systems function, adapted habitat self maintains.	The Long-Term Vision discussed in the Executive Summary and Section 11, will consider stream restoration.
	At what point does creating easements for water flows to carry sediment to the ocean become as expensive as trucking all of the sediment away with all of those associated costs?	Regional cooperation would be needed in order for existing commercial and residential properties along the channels to be acquired, vacated, and demolished to create the wider channels so that the channels could carry water flows with significant amounts of sediment.

Commenter	Comment	Response
Johnathan Perisho	The lack of lasting solutions for ongoing problems must be recognized. We need a long-term plan that goes well beyond 20 years. Different questions can be considered by models for 100-year periods and longer. What is the potential, what are the benefits, and what are the costs of daylighting streams and of buyback programs to increase the easements on which the rivers and other water ways flow? How much land would be necessary to replicate largely self-maintaining fluvial processes in key channels? How could these systems be implemented in phases that will be fiscally responsible beyond a 20-year plan? What can slow the need for sediment management interventions? Could smaller debris basins be emptied as shallow layers in large dedicated conveyance channels allowed to naturally scour by floods? Could this reduce costs of sediment management? Please broaden the scope of study and commit to making comprehensive long-term models, assessments, and plans.	The Long-Term Vision discussed in the Executive Summary and in Section 11 will have a broader focus and will consider issues on a time-scale longer than the 20-year planning period of the Strategic Plan. Questions such as the ones specified in the comment could be analyzed during the Long-Term Vision.
	Beaches are eroding. The existing system leads to maintenance of the beaches to address erosion.	Please see the Los Angeles County Coastal Regional Management Plan dated August 2012 (http://www.dbw.ca.gov/csmw/crsmp.aspx), which was prepared by the U.S. Army Corps of Engineers and the California Coastal Sediment Management Workgroup. The plan discusses how most of the beaches in Los Angeles County were created with fill rather than by the Los Angeles, San Gabriel, or Santa Clara Rivers. Section 6.5.1 of the Flood Control District's Sediment Management Strategic Plan has been expanded to discuss the issue of beaches in more detail. The Flood Control District will analyze the beach nourishment alternative further.
	Extreme events, such as wildfires, can overload the system over very short intervals.	The reservoirs and debris basins are designed to accommodate conditions greater than those present under normal conditions. For example, the majority of the reservoirs were designed with a capacity great enough to allow the capture of twice the great amount of sediment that would be produced by the specific watershed given all the following two conditions had been met: (1) the watershed had been burned four years before, and (2) the watershed was fully saturated when it experienced 24 hours of the type of rain that would be experienced during a 50-year rain event.

Commenter	Comment	Response
Stan Smith	The Pacoima Reservoir Sediment Removal Project will affect the local community of Sylmar dramatically. Are estimates being calculated measuring the adverse business, social, and environmental effects that may accompany the Pacoima Reservoir Sediment Removal Project?	The upcoming Pacoima Reservoir Sediment Removal Project is one of the specific sediment management projects alluded to in the Executive Summary of the Strategic Plan. The comments received specific to the Pacoima Reservoir Sediment Removal Project were forwarded to the appropriate team; the comments will be considered during the planning of the Pacoima Reservoir Sediment Removal Project. Analysis and determination of business impacts is beyond the scope of the Strategic Plan. Environmental and social impacts resulting from the sediment management alternatives considered for Pacoima Reservoir as part of the Strategic Plan are discussed in Section 8.3.
	It has come to light that a small number of landholders with property directly behind Pacoima Reservoir may hold sway over which alternative is most economically feasible. Has this issue been brought to light in any of the literature presented on the sediment removal plan?	Most of the land directly behind Pacoima Reservoir is owned by the U.S. Government. The U.S. Government's ownership of the land does not influence the economic feasibility of the sediment management alternatives that would involve accessing the reservoir or the sediment in it from Little Tujunga Canyon Road, the major road located at the back of the reservoir. The impacts associated with those alternatives and all alternatives considered in the Strategic Plan for Pacoima Reservoir are discussed in Section 8.3.
	For Pacoima Reservoir, the costs of constructing and operating a conveyor belt system and slurry pipeline may appear to be significantly less than the road construction and trucking expenses detailed in Pacoima Reservoir's Sediment Management Alternative 1 (Sections 8.3.7.1 and 11.3). However, have safety and risk concerns associated with each alternative also been included in the Strategic Plan's cost estimates?	As stated in Section 6.1, the costs included in the plan are order of magnitude costs and are based on historic sediment removal projects completed by the Flood Control District, discussion with industry, and additional research. The discussion of alternatives and impacts in Sections 6, 8, and 11 of the Strategic Plan relative to Pacoima Reservoir does not constitute the detailed analysis that will need to be completed for the Pacoima Reservoir Sediment Removal Project. Said detailed analysis will include a more detailed analysis of cost.

Commenter	Comment	Response
Stan Smith	In Section 11.2.2, the cost estimates for the various sediment management alternatives for Pacoima Reservoir suggest that the cost of alternative 1 (trucking all the sediment to the pits in Sun Valley) is nearly 2.5 times greater than any of the other alternatives. Interestingly, the cost estimates do not consider the costs associated with loss of commerce, cultural values, etc. I am moved to ask the following questions: Is 150 million the price of the lifestyle of a few thousand mostly working class residents in Sylmar? What do you think would happen if a project of this type, and with the accompanying alternatives to choose from, was proposed to occur in the middle of a community like La Cañada Flintridge or La Crescenta (neighboring communities to Sylmar)?	Please see the response to the previous comment.
Leona "Nobody" Swan	The 'best' method to manage sediment at Big Tujunga Reservoir is to release the sand and debris buildup around the dam and let it travel downstream as if there was no dam! The proposed plan does not consider the best method to address the sediment impediment problem. The Sunland Arroyo toads need persistent sandy rills and sandbars for continued survival. Drastic actions and "emergency" procedures are costly and do not provide a best solution. Ask "What would Nature do?" Then try to do the Nature thing. The beaches would also benefit from the release of sediment.	See the response above. For more information about the region's beaches, see Section 6.5.1.

<table>
<tr><th>Commenter</th><th>Comment</th><th>Response</th></tr>
<tr><td rowspan="11">Various*</td><td>It is understood that the upcoming Pacoima Reservoir Sediment Removal Project must be completed in order to manage the risk of floods and to provide for water conservation for the region. The community near Pacoima Reservoir is highly residential and includes the elderly and children. Please do the project in a way that will have less impact and won't disrupt our daily lives.</td><td rowspan="11">The upcoming Pacoima Reservoir Sediment Removal Project is one of the specific sediment management projects alluded to in the Executive Summary of the Strategic Plan. The discussion of alternatives and impacts in Sections 6, 8, and 11 of the Strategic Plan relative to Pacoima Reservoir does not constitute the detailed analysis that will need to be completed for the Pacoima Reservoir Sediment Removal Project. The comments received specific to the Pacoima Reservoir Sediment Removal Project were forwarded to the appropriate team within the Flood Control District; the comments will be considered during the planning of the Pacoima Reservoir Sediment Removal Project. Alternatives for the upcoming project and associated potential impacts will be analyzed in more detail in accordance with the requirements of the California Environmental Protection Act. As required by the act, an environmental document that will be prepared for the upcoming Pacoima Reservoir Sediment Removal Project. Stakeholders will have opportunities to provide input through the California Environmental Protection Act process for the upcoming project. Notifications about meetings in relation to the California Environmental Quality Act process for the Pacoima Reservoir Sediment Removal Project will be sent out in advance of the meetings.</td></tr>
<tr><td>The Department of Public Works needs to consider all the issues associated with sediment management operations at Pacoima Reservoir and make decisions based on the input of the stakeholders as their needs and lives should be the most important consideration.</td></tr>
<tr><td>People in the community near Pacoima Reservoir suffer from allergies and asthma. Pets have been affected too. We are afraid sediment management operations related to Pacoima Reservoir could make air quality conditions worse. Do not employ methods that will introduce dust into the air or that will impact air quality.</td></tr>
<tr><td>Pacoima Canyon experiences very high winds. Unhealthy air blowing into the San Fernando Valley for 25 years is not a great plan.</td></tr>
<tr><td>Do not use the Lopez Flood Control Basin for sediment storage. It will affect air quality and noise levels.</td></tr>
<tr><td>Don't use Maclay Street or Foothill Boulevard. That would impact traffic, noise, and pollution levels. Traffic is already bad.</td></tr>
<tr><td>Use the Strategic Plan's Sediment Management Alternatives 1 for Pacoima Reservoir / Use Little Tujunga Canyon Road for transporting/trucking the sediment. Using Little Tujunga Canyon Road has less impact on pollution, noise, neighborhoods, health, habitat, and water quality.</td></tr>
<tr><td>No more dirt dump sites in Sylmar - Sylmar already has May Sediment Placement Site, which is an environmental nightmare and a disaster for the many families who live near that dirt dump site. People have allergies and other respiratory problems. Very fine inert dust has built up on lawns, killing the grass. A dirt dump below Kagel Mountain will negatively affect the view and the natural beauty of the mountains will forever be impacted.</td></tr>
<tr><td>Find a less urban and more deserted location than Sylmar to dump sediment. We do not need more pollution and unsightly piles of rubble to deal with.</td></tr>
<tr><td>There is a big concern about impacts to home values as a result of the upcoming Pacoima Reservoir Sediment Removal Project.</td></tr>
<tr><td>Why was such little notice given about all these plans for the upcoming Pacoima Reservoir Sediment Removal Project? Very little people seem to not know about this project. Why aren't more meetings being held? Please provide information about what actions to take to stop this decision.</td></tr>
</table>

* **Commenters include:** Marat Akopian, Evelyn Alejo, Dionne Y. Ash, Jeff Bigman, Judy Hsieh Bigman, David A. Boysen, Emelinem19, Floree Evangelista, Carol Graham-Henke, Marty Guerrero, Ann Job, Denise Kaji, Orlando Lepe, Michael Lubliner, Lisa McDonald, C. McDougald, Elizabeth Mendez, Marilyn Narvaez, Ethel Carolina Ortez-Salazar, Armen Pashkam, Dennis M. Pikop, Cynthia Ramirez, Roberto Walter Salazar, Lanny Sandak, Kevin Tan, Cristy Torres, Dennis Urie, M. Carmen Maldonado Urie, Lourdes Uy, Marcelito Uy, and Darrell Vivian.

Commenter	Comment	Response
Various*	There are a lot of homes near Lopez Flood Control Basin. Why is it being considered as a storage area for sediment from Pacoima Reservoir?	Because Lopez Flood Control Basin is downstream of Pacoima Reservoir, water and sediment-laden flows released from Pacoima Reservoir end up at Lopez Flood Control Basin. Downstream of Lopez Flood Control Basin, flows travel along the concrete-lined Pacoima Wash Channel. Sending sediment-laden flow waters down the concrete channel would create a number of issues, including scouring of the channel (which would in turn lead to additional maintenance) and impacts to groundwater recharge (due to losses in the infiltration rates of spreading facilities downstream). Lopez Flood Control Basin has the potential to provide sufficient capacity to capture sediment-laden flows from Pacoima Reservoir so that the sediment in the flows can be separated from the water, and thus prevent the previously mentioned issues. Additionally, Lopez Flood Control Basin is more accessible than the back of Pacoima Reservoir. For these reasons, Lopez Flood Control Basin is considered as a potential sediment storage location for sediment sluiced from the reservoir. Because of its capacity and accessibility, Lopez Flood Control Basin is also considered as a potential storage area for sediment dredged from the reservoir and transported via slurry pipeline to the basin and also for sediment excavated from the reservoir and transported by a conveyor belt to the basin.
	Are there alternative plans or other areas besides Lopez Flood Control Basin that can be used for storing the sediment from Pacoima Reservoir?	Section 8.3 discusses the various alternatives that were considered for Pacoima Reservoir as part of this Strategic Plan. At this time no decisions have been made regarding which alternative will be employed to manage sediment at Pacoima Reservoir. Alternatives for the upcoming Pacoima Reservoir Sediment Removal Project will be analyzed in more detail as that specific project is planned.
	Is there alternative access from and to Pacoima Reservoir to spare Maclay Street from traffic/chaos resulting for a Pacoima Reservoir Sediment Removal project?	Currently, there is no access to the back of Pacoima Reservoir from Little Tujunga Canyon Road. However, Section 8.3.1.2 discusses the possibility of establishing access from Little Tujunga Canyon Road to the back of Pacoima Reservoir.
	Approximately when will work on the Pacoima Reservoir Sediment Removal Project start?	The Flood Control District intends to begin preparing an Environmental Impact Report (EIR) for the Pacoima Reservoir Sediment Removal Project in January 2013. The EIR process will better determine the actual start date of the project originally scheduled for summer of 2014. Additional Information about the project is available at dpw.lacounty.gov/lacfcd/sediment/prj.aspx?prj=2 or by emailing reservoircleanouts@dpw.lacounty.gov.

* **Commenters include:** Marat Akopian, Evelyn Alejo, Dionne Y. Ash, Jeff Bigman, Judy Hsieh Bigman, David A. Boysen, Emelinem19, Floree Evangelista, Carol Graham-Henke, Marty Guerrero, Ann Job, Denise Kaji, Orlando Lepe, Michael Lubliner, Lisa McDonald, C. McDougald, Elizabeth Mendez, Marilyn Narvaez, Ethel Carolina Ortez-Salazar, Armen Pashkam, Dennis M. Pikop, Cynthia Ramirez, Roberto Walter Salazar, Lanny Sandak, Kevin Tan, Cristy Torres, Dennis Urie, M. Carmen Maldonado Urie, Lourdes Uy, Marcelito Uy, and Darrell Vivian.

Commenter	Comment	Response
Chris Ziegler	I have arrived at the conclusion that the overall cost to the taxpayer would be optimized via a partial renaturalization of the flood control channels. Keep debris basins, but restore water ways soft bottoms. Sluice sediment to the ocean. The dredging of shipping lanes is considerably lower impact than the current situation.	Sections 6.3.4 and 6.4.1 discuss sluicing in general terms. Sections 7 and 8 discuss sluicing in terms of specific larger-sized reservoirs. Among the impacts discussed are negative impacts to groundwater recharge and potential impacts on habitat. While sluicing is a component of several of the sediment management alternatives included in Section 11, more analysis is needed prior to choosing a specific alternative for the larger, more complicated reservoirs. The Long-Term Vision will look at opportunities to restore channels.
	Material from debris basins should be utilized to widen the multi-use paths adjacent the flood channels. The current 10 foot wide paths fall very short of being sufficient for bicyclist moving at 20+ miles per hour and pedestrians. I suspect that we need to widen paths to 25 feet at a minimum, leaving roughly 8 feet unpaved for runners that need a soft surface.	Flood Control District right of way is limited and may not be able to accommodate the multi-use path width specified in the comment. Additionally, some of the existing multi-use paths are located along flood channels consists of the channels levees of limited width.