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				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.

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

	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	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
	Excavate		◑		○	◑		○	○				
1	Trucks	1.9				●	●	◑	◑		Yes	3	25
	Irwindale Pits									Yes			
	Excavate		◑		○	◑		○	○				
	Conveyor		○				○	◑	○				
2	San Dimas SPS	1.9	○			○		◑	◑		Yes	4	35-40
	Trucks					●	●	◑	◑				
	Irwindale Pits/Landfills									Yes			
	Sluice	1.3	●	●	◑			◑					
	Puddingstone Div. Reservoir		◑	●	○			◑	◑				
3	Excavate		◑		○	◑		○	○		Yes	20	25
	Trucks	1.9				●	●	◑	◑				
	Irwindale Pits									Yes			
	Dredge		○	◑	○			○	○				
	Slurry Pipeline	1.3	◑				○	◑					
4	Puddingstone Diversion Res.		◑	●	○			◑	◑		No	7	35-40
	Excavate		○		○	◑		○	○				
	Trucks	1.9				●	●	◑	◑				
	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: 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
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
	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
◑	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
1	Excavate	1.6	◑		○	◑		○	○		Yes	2	20
	Trucks					●	●	◑	◑				
	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
1	Excavate	210,000	◑		○	◑		○	○		Yes	2	3.0
	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.

11.3.4 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.