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Deerlake Ranch
Tract No. 53138
Storage and Pumping Capacity Study

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Prepared for

Las Virgenes Municipal Water District
4232 Las Virgenes Road
Calabasas, CA 91302

K/J Project No. 1644221*00

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Section 1: Introduction

Deerlake Ranch, Tract No. 53138, is a proposed development encompassing approximately 233 acres west of Porter Ranch and northeast of the Topanga Canyon Boulevard interchange with California Highway 118 (Ronald Reagan Freeway). The proposed development consists of 314 single-family residential lots, one recreation building, one sheriff facility, and 31 open space lots. Due to the large size of the development, Deerlake Ranch will be constructed in three phases.

Potable water will be delivered to Deerlake Ranch by the Las Virgenes Municipal Water District (District). Deerlake Ranch is situated within the District's Twin Lakes pressure zone. Water supply enters the pressure zone through the LV-3 turnout, which is an 8-inch connection to Metropolitan Water District of Southern California's West Valley Feeder No. 2. The Twin Lakes Pump Station adds approximately 530 feet of head to reach the Twin Lakes system hydraulic grade line of 1,585 feet. Twin Lakes also supplies water to the Upper Twin Lakes system via the Upper Twin Lakes Pump Station. Upper Twin Lakes has a hydraulic grade line of 1,805 feet. Features of both systems are presented in Table 1. Deerlake Ranch will be served by the Twin Lakes system, but one alternative involves adding a new reservoir and additional pumping/pressure reducing capacity to the Upper Twin Lakes system to satisfy the Deerlake demand (see Section 2).

Table 1: Twin Lakes and Upper Twin Lakes System Features

Feature	Twin Lakes	Upper Twin Lakes
Duty Pumps	3 x 100 hp 2 x 75 hp	1 x 40 hp
Standby Pumps	1 x 100 hp	1 x 40 hp
Nominal Flow	2,500 gpm	400 gpm
Standby Flow	585 gpm	400 gpm
Pump Station TDH	530 ft	240 ft
Storage	2.0 MG	0.385 MG
Reservoir High Water Level	1,585 ft	1,805 ft

Source: Kennedy/Jenks Consultants, Potable Water Master Plan Update 2014, dated 30 June 2014.

AECOM prepared a DRAFT Water System Design Report (Report) to evaluate the impact of Deerlake Ranch on the District's existing infrastructure. Phase 1 of Deerlake Ranch consists of 103 single-family units, Sheriff Station, Recreation Center, and 16.2 acres of landscape demands. Phase 2 consists of an additional 142 single-family units and 8.4 acres of landscape. Phase 3 consists of an additional 69 single-family units and 11.2 acres landscape. The findings of the Report are summarized in Table 2. Phase 1 can be supplied by the Twin Lakes system without any upgrades; however, Phases 2 and 3 require expansion of the Twin Lakes pumping and storage capacities.

Table 2: Deerlake Ranch Pumping and Storage Analysis by Construction Phase

Deerlake Ranch Phase	Twin Lakes Pumping Demand	Twin Lakes Pumping Surplus / (Deficit)	Twin Lakes Storage Demand	Twin Lakes Storage Surplus / (Deficit)
Phase 1	2,457 gpm	43 gpm	1.84 MG	0.16 MG
Phase 2	2,865 gpm	(365 gpm)	2.11 MG	(0.11 MG)
Phase 3	3,120 gpm	(620 gpm)	2.29 MG	(0.29 MG)

Source: AECOM, DRAFT Water System Design Report for Amended Vesting Tentative Track No. 53138 Deerlake Ranch, Dated 18 March 2016.

Construction of the entire Deerlake Ranch development will require an additional 620 gpm of pumping capacity and 0.29 MG of storage capacity to the Twin Lakes system. Concurrently, the District's Potable Water Master Plan Update 2014 identified pumping and storage deficits for year 2035 of 1,878 gpm and 1.5 MG, respectively, for the Twin Lakes system. Demands from Deerlake Ranch are included in the 2035 pumping and storage deficits identified in the Master Plan.

The primary objective of this study is to evaluate alternatives and recommend project(s) to add 620 gpm of pumping and 0.29 MG of storage capacity to the Twin Lakes System as a result of the deficit created by construction of the Deerlake Ranch development. A secondary objective is to identify opportunities for upsizing recommended project(s) that can advance the District toward meeting the 2035 pumping and storage deficits.

Section 2: Alternatives

2.1 Pumping

Three alternatives were evaluated to increase the pumping capacity in the Twin Lakes system to meet the needs of the Deerlake Ranch development.

2.1.1 Alternative P-1: Modifications at Twin Lakes Pump Station

The Twin Lakes Pump Station was expanded in anticipation of the Deerlake Ranch and Indian Hills developments (Boyle, 2004), with construction at the Pump Station completed in 2009. However, current demand projections through Phase 3 of Deerlake Ranch show the Twin Lakes Pump Station is deficient in pumping capacity. To overcome a deficit of 620 gpm due to Deerlake Ranch, two additional 75 hp pumps can be installed to provide an additional 430 gpm each, totaling 860 gpm for the pump station. The 2009 upgrades to the pump station included two flanged tees on the eastern outlet manifold in anticipation of installing additional pumps. The flanged tees were placed to accommodate future 100 hp pumps. Installation of larger pumps is not recommended since the maximum water velocity past the pump bowl would exceed 5 ft/s (Boyle, 2004). To allow for future expansion, the two new 75 hp pumps can be installed in pump cans sized for 100 hp pumps. A layout of the pump station is presented in Figure 1 of Appendix A with the two new pumps identified as P7 and P8 located on the east discharge manifold.

Twin Lakes Pump Station has a nominal capacity of 2,500 gpm; however, the pump station currently operates at a capacity of 1,600 gpm. This flow restriction is due to the 8-in suction pipeline connecting the District's turnout (LV-3) to the pump station. The District plans to install a parallel 14-in suction pipe to increase suction capacity, including emergency supply, to allow for a higher pumping output (AECOM, 2016).

An opportunity exists to add one additional 100 hp pump to the west discharge manifold. This manifold houses two 100 hp pumps, one 75 hp pump, and one standby 75 hp pump. In the Preliminary Design Report for the original Twin Lakes Pump Station Expansion, Boyle Engineering proposed installing two new pump cans north of the existing west discharge manifold. Space is available to install one new pump at this location. This new pump is shown as P9 in Figure 1 of Appendix A. With the three additional pumps, the maximum total water flow through the east discharge manifold is 2,030 gpm and through the west discharge manifold is 2,615 gpm. The new pump station rating would be 4,060 gpm, assuming one 100 hp pump is on standby. Under this plan, the District would only have a 433 gpm pumping deficit for 2035.

Additional pumps require increasing the capacity of the suction and discharge surge tanks. The suction surge tank has a capacity of 1930 gal and is rated for 350 psi, while the discharge surge tank has a capacity of 2500 gal and is rated for 500 psi. The discharge surge tank was installed as part of the pump station expansion in 2009, while the suction surge tank was installed with the original pump station construction in 1966. Pumps P7 and P8 will require a new suction surge tank to be installed upstream of the east manifold discharge. Pump P9 may also require replacement of the existing suction surge tank. The discharge surge tank was sized with pumps P7 and P8 included, so modifications to the discharge surge tank may not be required.

Evaluation of the existing surge tanks and sizing of new surge tank(s) requires a detailed surge analysis and design, which is beyond the scope of this study.

The Twin Lake Pump Station is supplied electricity through a 500 kilovolt-amp (kVA), 480 volt (V) utility transformer. This utility transformer is feeding an 800 amp (A) distribution switchboard (DSB) 103 that feeds a 600A motor control center (MCC) 103 and a 600A DSB 101. DSB 101 in turn feeds 600A MCC 101. Current electrical loads are shown in Table 3 and the tabulation is shown in Table 4. Assuming the worst case scenario where the 100 hp standby pump is in operation and the 75 hp pump is offline, the existing 500 kVA transformer is at 100 percent capacity and the loads on 600A MCC-101 and MCC-103 are at 79 percent and 47 percent, respectively, when tabulating the electrical loads with 25 percent extra load assigned to the largest motor.

Table 3: Twin Lakes Pump Station Electrical Loads

Load	Size (HP/kVA)	Status	Max Demand (kVA)	Max Demand (Amps)	Load on
P1	75 HP	Duty	80	96	MCC 101
P2	75 HP	Duty	80	96	MCC 101
P3	100 HP	Duty	103	124	MCC 101
P4	100 HP	Duty	103	124	MCC 101
P5	100 HP	Duty	103	124	MCC 103
P6	100 HP	Standby	103	124	MCC 103
Air Compressor	3 HP	Duty	4	4.8	MCC 103
Light Panel	3 kVA	Duty	3	6.25	MCC 101

Source: Boyle Engineering Corporation, Preliminary Design Report, Twin Lakes Pump Station Expansion, Dated September 2004.

Table 4: Twin Lakes Pump Station Electrical Load Tabulation

Load	Max Demand (kVA)	Max Demand (Amps)	Load Capacity (%)
Total Loading on 500 kVA XFMR[(a)]	499	603	100
Total Loading on MCC 101[(b)]	369	446.25	74
Total Loading on MCC 101 with 25% Extra of Largest Motor[(b)]	394.75	477.25	79
Total Loading on MCC 103[(c)]	210	252.8	42
Total Loading on MCC 103 with 25% Extra of Largest Motor[(c)]	235.75	283.8	47

Notes:
(a) Assumes P1 is offline and P6 is online.
(b) Assumes all loads on MCC 101 are online.
(c) Assumes all loads on MCC 103 are online.

Adding two additional pumps P7 and P8 to the eastern discharge manifold impacts the 500 kVA transformer, 600A DSB 103, and 600A MCC 103. Table 5 shows that P7 overloads the utility transformer. P7 and P8 overload the utility transformer and the feeder breaker to MCC 103. Adding pump P9 to the western discharge manifold further impacts the 500 kVA transformer,

600A DSB 103, and 600A MCC 101. It is assumed pumps P7 and P8 are installed before pump P9 as the eastern discharge manifold was constructed to accommodate two additional pumps. Table 5 and Table 6 show that P7, P8, and P9 overload the utility transformer and DSB 103. MCCs 101 and 103 are not overloaded with the additional pumps.

Table 5: Twin Lakes Pump Station Electrical Load with New Pumps P7 and P8

New Load on MCC 103	Size (hp)	Total Transformer Loading (kVA)	Total Transformer Loading (%)	MCC 103 Loading (Amps)	MCC 103 Loading (%)	DSB 103 Loading (Amps)	DSB 103 Loading (%)
P7	75	579	116	380	63	696	87
P7 & P8	150	659	132	476	79	793	99

Table 6: Twin Lakes Pump Station Electrical Load with New Pump P9

New Load on MCC 101	Size (hp)	Total Transformer Loading (kVA)	Total Transformer Loading (%)	MCC 101 Loading (Amps)	MCC 101 Loading (%)	DSB 103 Loading (Amps)	DSB 103 Loading (%)
P9	100	762	152	505	84	917	115

The 500 kVA utility transformer is fully loaded under current electrical loads. Adding one 75 hp pump (P7) on MCC 103 would require the utility transformer to be upgraded to 750 kVA. Adding two 75 hp pumps (P7 and P8) would also require upgrading the utility transformer to 750 kVA as well as upgrading feeder breaker to MCC 103. Adding two 75 hp pumps (P7 and P8) on MCC 103 and one 100 hp pump (P9) on MCC 101 require upgrading the transformer to 1,000 kVA, upgrading DSB 103 from 800A to 1000A, and upgrading the feeder breaker to MCC 103. Table 7 summarizes electrical upgrades at the Twin Lakes Pump Station for new pumps.

Table 7: Twin Lakes Pump Station Electrical Upgrades Required for New Pumps

Upgrade Required	P7	P7, P8	P7, P8, P9
Upsize Transformer from 500 kVA to 750 kVA	X	X	
Upsize Transformer from 500 kVA to 1,000 kVA			X
Upgrade DSB 103 from 800A to 1,000A			X
Upgrade Feeder Breaker to MCC 103 from 400AT to 500AT		X	X

2.1.2 Alternative P-2: Emergency Pump and Power at Twin Lakes Pump Station

To meet the required pumping capacity without permanently expanding the Twin Lakes Pump Station, an emergency pump and power trailer can be installed at the pump station. The pump would be an above grade vertical turbine pump with hard piping connections to the inlet and outlet pipe manifolds. Emergency power in the form of a trailer mounted generator would also

be required to power the pump. This setup allows the pump to operate as an emergency backup supply primarily to pump water for meeting the system-wide peak demand. The emergency pump can also supply water if power to the pump station is interrupted, allowing the District to continue pumping into the Twin Lakes system until the District's temporary emergency power trailer is brought to the site and put into operation.

A new pipe connection to the suction and discharge pipes is required to supply water to the temporary above grade pump. This requires excavation across the eastern portion of the pump station site, crossing existing water pipes and electrical conduits. The temporary power generator, assumed to be trailer mounted, will need to be exercised periodically to ensure proper operation. Operation of the temporary pump will require integration with SCADA. While a temporary pump may be viable to meet the Phase 2 demands, it is not a permanent solution. This alternative also requires permitting through the Air Quality Management District, increased maintenance for operations staff, development and executing of a testing schedule, and exposes the District to risk for maintaining a temporary pump and generator in perpetuity. Due to these reasons, this alternative is eliminated.

2.1.3 Alternative P-3: Modifications at Upper Twin Lakes Pump Station

The Upper Twin Lakes Pumping Station is equipped with two 40 hp pumps, each capable of providing 400 gpm of pumping capacity. One pump is operated as a duty pump and the other is reserved for standby, although the pump station and supporting infrastructure were sized to allow for both pumps to operate simultaneously for a total capacity of 800 gpm (Boyle, 2001). The connecting pipeline between the Upper Twin Lakes Pump Station and Tank is sized at 12 inches. A 6-inch PRV inside the pump station allows Upper Twin Lakes to supply emergency water to the Twin Lakes system. The PRV has a maximum suggested flow of 1,800 gpm and an intermittent maximum flow of 2,250 gpm. The CMU building housing the pumps and PRV was constructed on a small lot without space reserved for future expansion. Since Deerlake Ranch is within the Twin Lakes pressure zone, adding pumping capacity to the Upper Twin Lakes zone does not satisfy the 620 gpm pumping deficit in the Twin Lakes zone. Therefore, this alternative is eliminated.

2.2 Storage

Nine alternatives were evaluated to increase the storage capacity in the Twin Lakes system to meet the needs of the Deerlake Ranch development. The first alternative consists of replacing the existing 0.4 MG Twin Lakes Tank 1 with a 0.7 MG tank, the second consists of a new 0.3 MG Upper Twin Lakes Tank 2, and the remaining seven alternatives consist of new 0.3 MG tanks located within the Twin Lakes system.

2.2.1 Alternative S-1: Replace Twin Lakes Tank 1

Twin Lakes Tank 1 has a capacity of 0.4 MG. The bottom floor of Tank 1 is approximately six feet higher than the bottom floor of Tank 2. By re-grading the site around Tank 1 to match the bottom floor of Tank 2, a replacement 0.7 MG tank can be constructed with the same bottom floor and high water elevations to match Tank 2. The replacement 0.7 MG Tank 1 will have an

internal diameter of 63 feet, which is 10.5 feet larger than the existing 0.4 MG Tank 1. A preliminary layout of the replacement 0.7 MG Tank 1 is presented in Figure 2. To limit the amount of re-grading required for the replacement 0.7 MG Tank 1, the center of the tank can be shifted closer to Tank 2 while still maintaining a 15-ft wide access road around and between both tanks.

Purchasing additional land to accommodate the larger Tank 1 is not required, but a temporary easement is likely needed for construction. The District has a maintenance easement for the access road to the tank site. Since the easement does not allow improvements to the access road, no access road improvements are considered in this alternative. Visual impact of the new tank to the communities below is anticipated to be minimal since the new tank will have the same height as the original tank, although it will be 10.5 feet wider and 6 feet lower. Due to the significant grading required to lower the tank site by approximately six feet, retaining walls may be required and spoils must be hauled off-site through the Indian Hills neighborhood.

2.2.2 Alternative S-2: New Upper Twin Lakes Tank 2

The Upper Twin Lakes tank has a current capacity of 0.385 MG and resides on an oversized lot designed to support a temporary tank. The space reserved for the temporary tank is not large enough to construction a 0.3 MG tank with a 15-ft wide access road; however, by utilizing the temporary tank space and extending the property line, a 0.3 MG tank can be constructed at the site. Figure 3 shows a preliminary layout of the Upper Twin Lakes Tank site with the new 0.3 MG tank. The adjacent property owner is the Mountains Recreation and Conservation Authority (MRCA). A land purchase agreement or easement is required to construct the 0.3 MG tank. Visual impact of the new tank to the communities below is minimal since the tank is located behind a hillside. An existing storm drain pipeline will also need to be relocated to accommodate the new tank.

The 12-in pipeline currently serving the Upper Twin Lakes Tank can also serve the new 0.3 MG tank. At the District's maximum acceptable velocity of 10 feet per second (fps), approximately 3,500 gpm of water can flow down to the Upper Twin Lakes Pump Station. The limiting factor allowing flow from the Upper Twin Lakes system to the Twin Lakes system is the 6-in PRV, which has a maximum continuous flow of 1,800 gpm and an intermittent maximum flow of 2,250 gpm. A parallel pipe with an above grade PRV can be installed at the Upper Twin Lakes Pump Station to increase the amount of water that can flow from Upper Twin Lakes to Twin Lakes. The two booster pumps in the Upper Twin Lakes Pump Station have a combined supply of 800 gpm, which limits the rate at which the Upper Twin Lake Tanks can refill.

A summary of the existing Twin Lakes and Upper Twin Lakes tanks, along with the proposed tank at each site, is presented in Table 8.

Table 8: Summary of New and Proposed Storage Tanks at Existing Sites

Feature	Twin Lakes 1	Twin Lakes 2	Upper Twin Lakes 1	New Twin Lakes 1 (Alt. S-1)	New Upper Twin Lakes 2 (Alt. S-2)
Storage	0.4 MG	1.6 MG	0.385 MG	0.7 MG	0.3 MG
Internal Diameter	52'-6"	95'-0"	60'-0"	63'-0"	54'-0"
Reservoir High Water Level	1585 ft	1585 ft	1805 ft	1585 ft	1805 ft
Reservoir Bottom Floor	1561 ft	1555 ft	1787 ft	1555 ft	1787 ft

2.2.3 Alternative S-3: New Tank near Fern Ann Falls Rd

A new 0.3 MG tank can be constructed near Fern Ann Falls Road in the existing Indian Falls development with a bottom elevation of 1560 ft. This tank location, shown in Figures 4 and 5, requires the purchase of property from a private land owner. Access to the tank is via a private driveway, likely owned by the same property owner. The pipeline connection to the new tank would be off the existing 8-in pipeline in Fern Ann Falls Rd. Approximately 625 linear feet (LF) of 8-in pipe is required to reach the proposed tank. Since the property is owned by a private owner and the tank is located within the Indian Hills development, this alternative is eliminated.

2.2.4 Alternative S-4: New Tank near Johnson Mountain Way

A new 0.3 MG tank can be constructed near Johnson Mountain Way in the existing Indian Falls development with a bottom elevation of 1560 ft. This tank location, shown in Figures 4 and 5, requires the purchase of property from a private land owner. A new access road following a similar alignment of an existing dirt needs to be constructed. The pipeline connection to the new tank would be off the existing 12-in pipeline at the intersection of Ewana Place and Annepe Way. Approximately 675 LF of 8-in pipe is required to reach the proposed tank. Since the property is owned by a private owner and the tank is located within the Indian Hills development, this alternative is eliminated.

2.2.5 Alternative S-5: New Tank Northwest of Deerlake Ranch

A new 0.3 MG tank can be constructed northwest of Deerlake Ranch with a bottom elevation of 1560 ft. This tank location, shown in Figures 4 and 6, requires the purchase of property from a private land owner and easements from private owners and the MRCA for the pipeline. A new access road needs to be constructed. The pipeline connection to the new tank would be off a proposed 8-in pipe in the Deerlake Ranch development, on Schindler Way. Approximately 3,500 LF of 8-in pipe constructed through rolling hills is required to reach the proposed tank. Due to the long pipeline and the multiple property owners, this alternative is eliminated.

2.2.6 Alternative S-6: New Tank at Horse Rest Area

A new 0.3 MG tank can be constructed at the “Horse Rest Area” within the Deerlake Ranch development. This tank location, shown in Figures 4 and 6, does not require the purchase of property since the developer already owns the land. However, the bottom elevation of a tank proposed at this site is 1530 ft. In order to reach the high water elevation of 1585 ft, the tank

needs to be 55 ft tall or the site needs to be significantly built-up. Since the site does not meet the elevation requirements for a new storage tank within the Twin Lakes pressure zone, this alternative is eliminated.

2.2.7 Alternative S-7: New Tank at Mountain Peak North of Deerlake Ranch

This alternative considers a new 0.3 MG tank on a ridgeline north of Deerlake Ranch. The location is shown in Figures 4 and 6, and requires purchase of land from a private owner. Additional easements from private owners and MRCA are required for a supply pipeline and access road. Approximately 1,925 LF of 8-in pipe from the tank will follow the access road and connect to the proposed 8-in pipe within Deerlake Ranch on Canoga Avenue. The bottom elevation of the tank is 1670 ft, well above the targeted elevation of 1560 ft. To reach the elevation of 1670 ft, a booster pump station needs to be constructed near the 1570 ft elevation to pump the water to the new tank. A PRV also needs to be installed to reduce the head of the water down to 1585 ft to enter the Twin Lakes pressure zone (similar to alternative S-2). Since alternative S-2 has preferable existing conditions including an existing pump station, PRV, and partially graded site, this alternative is eliminated.

2.2.8 Alternative S-8: New Tank Beyond Mountain Peak North of Deerlake Ranch

A new 0.3 MG tank can be constructed north of Deerlake Ranch, beyond the ridgeline, with a bottom elevation of 1560 ft. This tank location, shown in Figures 4 and 6, requires the purchase of property from MRCA for the tank and an easement from MRCA for the connecting pipeline. The 8-in pipe is 1,925 LF with the majority of the pipeline following an existing trail. Since the tank is located behind the ridgeline, there is no visual impact to the Deerlake Ranch community. However, since the entire pipeline and tank are located within MRCA property, this alternative is eliminated.

2.2.9 Alternative S-9: New Tank Northwest of Unit 205 at Deerlake Ranch Property Boundary

This alternative considers a new 0.3 MG tank at the northern border of Deerlake ranch, northwest of Unit 205. This tank location, shown in Figures 4 and 6, requires property within Deerlake Ranch to be dedicated to the District. A draft layout of the tank was created by the developer and is attached as Appendix B. Extensive grading is required to build up a site large enough to house a tank that is approximately 30 ft in height and 50 ft in diameter; however, the grading work is not part of the tank construction since it would be conducted by the developer as part of the Deerlake Ranch construction. Retaining walls ranging from 1-ft to 25-ft tall are required. A new access road is to be constructed between units 203 and 204, with slopes ranging from 15 to 18.5 percent. A temporary grading easement with MRCA has already been granted to the developer for soil work in this area, so additional permitting is not anticipated at this time, assuming the final design of the tank and access road are entirely within Deerlake Ranch's development limits. Approximately 675 LF of 8-in pipe is required to reach the tank, with the pipe connection in Canoga Avenue.

Visual impact is high as the tank will be fully visible by the community below. If additional land is acquired from MRCA, the tank can be shifted north and landscaping can be planted to limit the visual impact. MRCA may be more willing to sell additional land for the tank construction if the tank access road is allowed to be used as a horse trail connecting an existing horse trail near the tank with Canoga Avenue. Through negotiations with MRCA, it may be possible to move the tank location north further onto MRCA property. This move allows the slope of the access road and the retaining wall heights to be reduced, which can result in significant cost savings.

Section 3: Evaluation of Alternatives

3.1 Evaluation of Pumping Alternatives

Deerlake Ranch requires an additional pumping capacity in the Twin Lakes system of 365 gpm for Phase 2 and an additional 620 gpm for Phases 2 and 3 (365 gpm for Phase 2 and 255 gpm for Phase 3). Alternatives P-1 and P-2 involve modifications and/or additions to the Twin Lakes Pump Station, whereas alternative P-3 considers modifications to the Upper Twin Lakes Pump Station. Since the supply to Upper Twin Lakes Pump Station is the Twin Lakes system, adding pumping capacity to the Upper Twin Lakes system only exacerbates the pumping shortage in the Twin Lakes system. Therefore, Alternative P-3 is not a viable option.

Alternative P-1 includes the addition of up to two 75 hp and one 100 hp pumps at the Twin Lakes Pump Station. The east discharge manifold has two flanged outlets in anticipation of additional pumps sized for 100 hp. Adding one 75 hp pump will meet the Phase 2 demands and adding an additional 75 hp pump will meet the Phase 3 demands, although the pumps should be installed in pump cans sized for 100 hp pumps to allow the District to upsize the pumps in the future. It is more cost effective and less interruptive to operations at the pump station to install both pumps at one time to meet the entire Deerlake Ranch demands. A separate study of the suction and discharge surge tanks will need to be undertaken to evaluate the adequacy of the tanks; however, it appears that the 2,500 gallon discharge surge tank is adequately sized since it was installed during the previous pump station expansion which was designed while considering the future impact of adding two more pumps. Adding two pumps will require upgrading the 500 kVA transformer to 750 kVA and the distribution switchboard from 800 A to 1,000 A.

Alternatives P-2 and P-3 were eliminated due to fatal flaws discussed in the previous section.

3.2 Evaluation of Storage Alternatives

Nine storage alternatives were considered in this study. S-1 involved replacing the existing 0.4 MG Twin Lakes Tank 1 with a 0.7 MG tank, S-2 consisted of a new 0.3 MG Upper Twin Lakes Tank 2, and Alternatives S-3 through S-9 evaluated locations for a new 0.3 MG tank at a site not currently owned by the District. Alternatives S-3 through S-8 had fatal flaws that resulted in their elimination from consideration as described in Section 2.2. As a result, only Alternatives S-1, S-2 and S-9 are considered further. To determine which storage alternative is preferable, an evaluation matrix is presented in Table 9.

Table 9: Storage Evaluation Matrix

Evaluation Criteria	S-1	S-2	S-9
Visual Impact	+	+	-
Ease of Construction	-	-	+
Acquisition of Additional Property	+	-	0
Ease of Operations	+	-	0
Service Interruptions / Impacts	-	+	+
Distribution System Reliability	-	-	+
Upgrades to Adjacent Infrastructure	+	0	0
Overall Assessment	**+2**	**-2**	**+2**

The storage alternatives are evaluated with a '+', '-', or '0' system. Alternatives considered advantageous for the criterion receive a '+' while alternatives that are disadvantageous receive a '-' score and neutral receive a '0' score.

- Visual Impact: Storage alternatives with minimal aesthetic impacts to the nearby communities receive a positive score.
- Ease of Construction: Minimal construction work receives a positive score.
- Acquisition of Additional Property: Alternatives that do not require additional acquisition receive a positive score.
- Ease of Operations: Alternatives that have minimal impact on the existing system operations receive a positive score.
- Service Interruptions / Impacts: Minimal service interruptions during construction receive a positive score.
- Distribution System Reliability: Increased redundancy receives a positive score.
- Upgrades to Adjacent Infrastructure: Alternatives that do not require upsizing upstream pipes or pumps receive a positive score.

Based on these criteria, storage alternatives S-1 and S-9 are preferred. Alternative S-1 received a high score since the visual impact of a replacement tank is negligible, a replacement tank can be constructed within the existing property limits, system operations will be unchanged, and the supply pipeline appears to be sufficient for the larger tank. Hydraulic modeling is needed to confirm additional flow to the larger tank meets the requirements outlined in the Master Plan for existing piping, which is beyond the scope of this report. The cons to this alternative are the significant grading required through hard rock anticipated to be encountered during excavation, the site is relatively tight for construction, the District will be without 0.4 MG of storage during construction, spoil materials must be hauled out through the Indian Hills development, and the tank does not improve distribution system reliability.

The other preferred alternative is S-9. Alternative S-9 has the highest ease of construction since the developer will perform the site grading leaving a level pad for constructing the new

tank. Additionally, service interruptions will be negligible since the existing system will not be affected while the tank is under construction. The reliability of the system is also increased since the new tank will be located a different area of the zone where if a water main break occurs on the supply pipeline feeding Twin Lakes Tanks 1 and 2, the new tank with Alternative S-9 will continue to provide water supply. However, the alternative will have a visual impact to the Deerlake Ranch community, may require property acquisition from MRCA, requires the District to operate and maintain a third tank in the Twin Lakes system, and may require upgrades to the existing 8-in supply pipelines northeast of Highway 118. Hydraulic modeling is needed to confirm that additional flow to the new tank meets the requirements outlined in the Master Plan, which is beyond the scope of this report.

Alternative S-2 is not a preferred alternative. While it has a negligible impact since the new tank will be constructed adjacent to the existing tank, has minimal service interruptions, and does not require an upgrade to the supply pipeline or pump station, the site is tight for construction, additional property must be acquired from MRCA, and the District's system operational strategy may need to change to account for water storage in a higher pressure zone. Pumping to a higher pressure zone results in added electricity cost to operate the pump, maintenance cost for pump and PRV upkeep, and it operates the system inefficiently. This alternative may be suitable for a temporary solution, but the permanent loss of a standby pump is unacceptable to the District. This alternative is eliminated.

3.3 Capital and O&M Costs

The capital cost for a new above grade welded steel tank is dependent on the size of the tank. Smaller tanks have a higher unit cost, expressed as a cost per gallon, than larger tanks. Fixed fees such as mobilization are spread over a larger tank volume and materials are more efficient on a structure to volume basis. For the purposes of this study, a unit cost of $1.05 per gallon is used for 0.3 MG tanks and $0.85 is used for 0.7 MG tanks. These unit costs include excavation for the ring wall footing, construction of the ring wall, fabrication and erection of the welded steel tank, coating of the interior and exterior of the tank, and tank appurtenances including but not limited to inlet and outlet piping connections, overflow piping, ventilation, measurement instrumentation, and mixing equipment.

Similarly to welded steel tanks, pump stations are also expressed as a unit cost per horsepower. A unit cost of $1,750 per horsepower is used for new pumps. This unit cost includes excavation for the new pump can, procurement and installation of the pump and motor, suction and discharge piping, two butterfly valves, control valve, pressure transmitter, and site repaving. Pump electrical panel and related cable runs are additional. Electrical supply upgrades such as a larger transformer and larger switchgear, if applicable, are estimated separately and in addition to the $1,750 per horsepower unit cost.

Welded steel storage tanks require operation and maintenance (O&M) costs after the initial capital expenditure. Every ten to fifteen years the interior and exterior coating of the tank needs to be removed and recoated to prevent corrosion of the steel. Operations staff also have costs associated with valve and equipment maintenance. O&M costs are assumed to be 2 percent of the initial capital cost per year.

Pump O&M requires servicing the pump and rebuilding the pump components every ten to fifteen years. Energy costs are also included in O&M costs. This study assumes 2 percent of the initial capital costs per year are required for O&M and 14.5 cents per kilowatt hour ($0.145/kWh) for energy costs.

Based on the above assumptions, a conceptual opinion of probable construction cost was developed for pumping alternative P-1 and storage alternatives S-1 and S-9. The opinion of probable construction cost is a Class 5 estimate in accordance with American Association of Cost Engineers. A Class 5 estimate contains an assumed accuracy of +50% to -30% of the actual cost of the alternatives. O&M and energy costs are included in the analysis for a 30 year period, in which the future annual costs are calculated in present value dollars. A summary of the estimated project lifecycle costs for each alternative is presented in Table 10 and the detailed capital cost estimate is attached as Appendix C.

Table 10: Pumping and Storage Cost Evaluation

Cost	P-1	S-1	S-9
Capital Cost	$465,000	$1,656,000	$1,724,000[(a)]
Tank O&M Cost	$0	$150,000[(b)]	$170,000
Pump O&M Cost	$214,000	$0	$0
Pump Energy Cost	$275,000	$0	$0
Total	**$954,000**	**$1,806,000**	**$1,894,000**

Notes:
(a) Alternative S-9 includes a cost of $1,200,000 for retaining wall construction related to the tank construction. Moving the tank to the north and refining the design may reduce the cost of grading, reducing the overall cost.
(b) Tank O&M cost for alternative S-1 reflects only the net increase in O&M for the 0.7 MG tank in lieu of the existing 0.4 MG tank.

As shown in Table 10, alternatives S-1 and S-9 are nearly equal in cost. Alternative S-2 requires significant grading required to lower the existing Twin Lakes Tank 1 site by 6 ft. Over 1,400 cubic yards (CY) of grading is required at a cost of $700 per CY. Alternative S-9 requires two retaining walls. One wall is approximately 130 ft long with heights ranging from 1 ft to 7 ft, and the other wall is approximately 400 ft long with heights ranging from 5 ft to 25 ft. While the grading costs for this alternative will be borne by the developer, the costs of the retaining walls push the overall cost higher than the other alternatives. If additional land is acquired from MRCA, the tank can be moved further north which reduces the extent of retaining walls required and lowers the overall cost of the alternative.

O&M costs were calculated per the assumptions stated previously and projected over a 30 year planning horizon. Annual inflation was assumed to be 2 percent and the discount rate was assumed to be 2.84 percent based on the 2015 average nominal rate of a 30 year U.S. Treasury note.

Section 4: Conclusion

Based on the evaluation in the previous section, this reviews preferred projects to meet Deerlake Phase 2 and Phase 3 demands, as well as identify any opportunities for meeting the Twin Lakes 2035 demands.

4.1 Meeting Deerlake Phase 2 Demands

Deerlake Phase 2 requires 365 gpm of pumping capacity and 0.11 MG of storage capacity to be added to the Twin Lakes system. To meet the 365 gpm pumping shortfall, one 75 hp pump can be installed at the Twin Lakes Pump Station to provide 430 gpm of pumping capacity. This requires upgrading the transformer, as described in Section 2.1.1. An analysis of the suction and discharge surge tanks is also suggested.

To meet the 0.11 MG storage shortfall, it may be possible to use the Upper Twin Lakes Tank as supplemental storage for the Twin Lakes system since the 2014 Master Plan identified a 0.15 MG existing storage surplus in the tank. An existing 6-in PRV connection between the Upper Twin Lakes and Twin Lakes zones allows water to move downgradient to the 1585 ft HGL. To confirm this excess storage volume, SCADA data from 01 June 2015 through 30 June 2016 for daily tank minimum and maximum levels were analyzed. After removing data outliers that showed a minimum tank level of 0 ft, the average minimum tank level was 8.94 ft and the average maximum tank level was 14.26 ft. This amounts to 112,500 gal of daily water use. The Master Plan defines storage as being composed of three components: fire, emergency, and daily operational storage. The required fire and emergency storage for the Upper Twin Lakes system is 150,000 gal and 18,000 gal, respectively. Table 11 details the volume calculations for using the Upper Twin Lakes Tank to meet the storage requirements for Deerlake Phase 2.

Table 11: Upper Twin Lakes Tank Storage Analysis

Value	Volume (gal)
Fire Storage	150,000
Emergency Storage	18,000
Daily Operational Storage	112,500
Total Required	**280,500**
Tank Capacity	**385,000**
Available	104,500
Deerlake Phase 2	110,000
Deficit	**-5,500**

As shown in Table 11, the Upper Twin Lakes Tank is not large enough to meet the storage requirement for Deerlake Phase 2. While a temporary 10,000 gal Baker Tank could be installed adjacent to the tank to allow for temporary additional storage, this is not advisable. In addition to requiring the District to modify its current operations to accommodate the temporary tank, the daily operational storage required for the Upper Twin Lakes Zone is variable. The current daily operational storage is at its lowest level in years due to drought restrictions. With the loosening

of the drought restrictions, demand and the corresponding daily operational storage will increase. Therefore the excess storage currently at Upper Twin Lakes Tank is not a reliable source for future storage. To meet Deerlake Phase 2 storage demand, a permanent storage alternative (S-1 or S-9) should be constructed.

4.2 Meeting Deerlake Phase 2 and 3 Demands

Deerlake Phases 2 and 3 require a total of 620 gpm of pumping capacity and 0.29 MG of storage capacity to be added to the Twin Lakes system. To satisfy the pumping shortfall, an additional 75 hp pump can be installed in a pump can sized for 100 hp at the Twin Lakes Pump Station. Installing the pumps in oversized pump cans allows the District to replace the 75 hp pumps in the future with 100 hp pumps. Since both Phase 2 and Phase 3 require an additional pump, the combined pumping capacity of two 75 hp pumps totals 860 gpm. The two pumps require an upgraded electrical transformer and feeder breaker, as described in Section 2.1.1. An analysis of the suction and discharge surge tanks is also suggested.

To meet the 0.29 MG of storage deficit, the existing 0.4 MG Twin Lakes Tank 1 can be replaced with a new 0.7 MG tank, a new 0.3 MG Upper Twin Lakes Tank 2 can be constructed, a new 0.3 MG tank within Deerlake Ranch can be constructed. An evaluation of the storage alternatives summarized in Table 9 determined replacing the Twin Lakes Tank 1 or constructing a new 0.3 MG tank within Deerlake Ranch to be the preferred alternatives. This cost difference between the two alternatives may change after incorporating the cost of land acquisition from MRCA and potential redesign of Alternative S-9 to reduce the retaining walls. Hydraulic modeling should be performed to evaluate the impact of the new tank on the existing distribution piping.

4.3 Meeting Twin Lakes 2035 Demands

The 2014 Master Plan Update identified a 1,878 gpm pumping deficit and 1.5 MG storage deficit in the Twin Lakes zone. Replacing 75 hp pumps P7 and P8 with 100 hp pumps will provide a total pumping supply of 1,170 gpm. Figure 1 shows an additional pump, P-9, which can be added to the west discharge manifold to provide an additional 585 gpm, bringing the total up to 1,755 gpm. Other modifications to the pump station can be undertaken to increase the suction pipe capacity to allow for larger pumps to be installed in order to meet the required 1,878 gpm of pumping capacity required. A detailed evaluation of the existing pump station will need to be undertaken to determine how much the pump station can be expanded and at what cost.

To meet the 1.5 MG storage deficit, which will be 1.2 MG after constructing the storage required for Phase 3 of Deerlake Ranch, the District can elect to construct a larger Twin Lakes Tank 1, a larger Deerlake Ranch tank, or pursue other storage alternatives identified in this report. Constructing Alternative S-9 first allows the District to delay construction of Alternative S-1 until it is needed. If Alternative S-1 is constructed and Alternative S-9 delayed, Alternative S-9 may not be viable for construction in the future after the Deerlake Ranch is developed. A detailed evaluation of each storage alternative and the resulting impact on the system will need to be conducted.

References

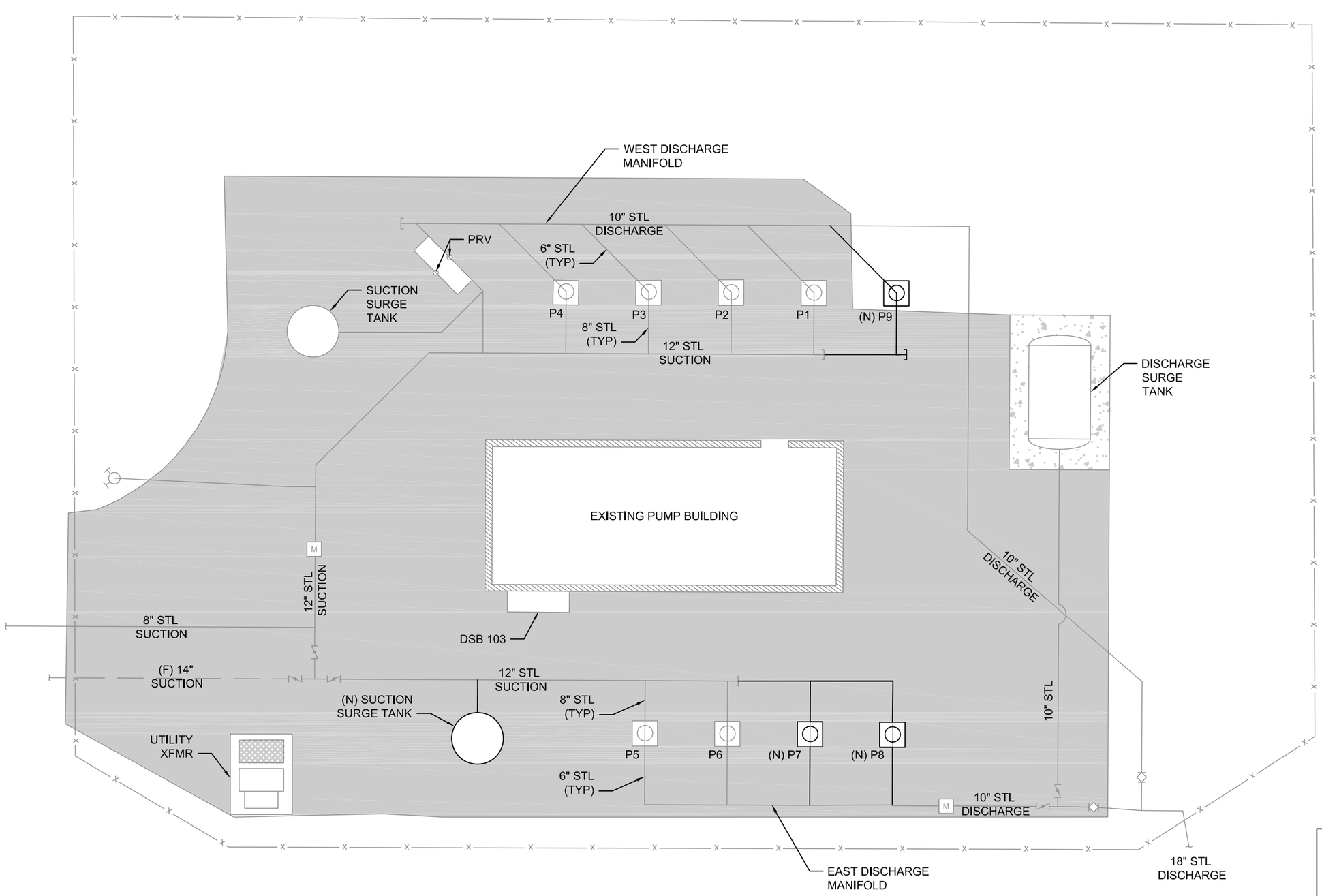
AECOM. DRAFT Water System Design Report for Amended Vesting Tentative Track No. 53138 Deerlake Ranch. LVMWD #2130.04. Dated 18 March 2016.

Boyle Engineering Corporation. Design Memorandum, Upper Twin Lakes Pump Station and Tank. LVMWD #2173.00. Dated November 2001.

Boyle Engineering Corporation. Preliminary Design Report, Twin Lakes Pump Station Expansion. LVMWD #2297.00. Dated September 2004.

Kennedy/Jenks Consultants. Potable Water Master Plan Update 2014 for the Las Virgenes Municipal Water District. LVMWD #2562.00. Dated 30 June 2014.

Appendix A: Figures



LEGEND

(F)	FUTURE
(N)	NEW
DSB	DISTRIBUTION SWITCHBOARD
P	PUMP
PRV	PRESSURE REDUCING VALVE
STL	STEEL
TYP	TYPICAL
XFMR	TRANSFORMER

Kennedy/Jenks Consultants

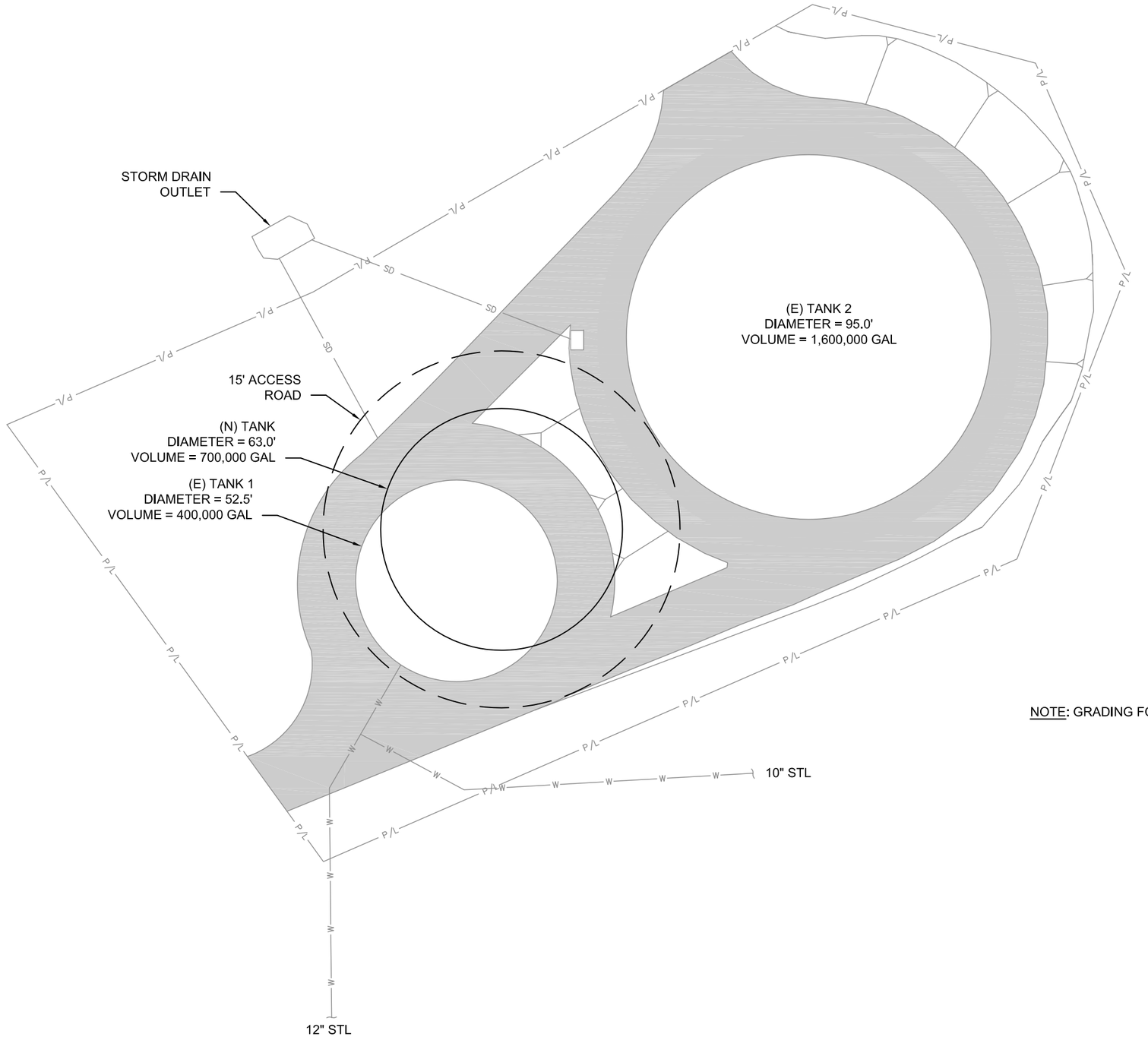
Las Virgenes Municipal Water District
Deerlake Ranch Storage and Pumping Capacity

Twin Lakes Pump Station Modifications: Alternative P-1

K/J 1644221*00
July 2016

Figure 1

Q:\Ventura\2016\1644221 00_ LVMWD-Deerlake Ranch Storage and Pumping Capacity Study\09-Reports\CAD\las virgenes- 1.dwg BRANDON HALE 7/8/2016 9:19 AM



N

LEGEND

(E)	EXISTING
(N)	NEW
P/L	PROPERTY LINE
GAL	GALLON
SD	STORM DRAIN
STL	STEEL
W	WATER

NOTE: GRADING FOR REPLACEMENT TANK NOT SHOWN.

Kennedy/Jenks Consultants

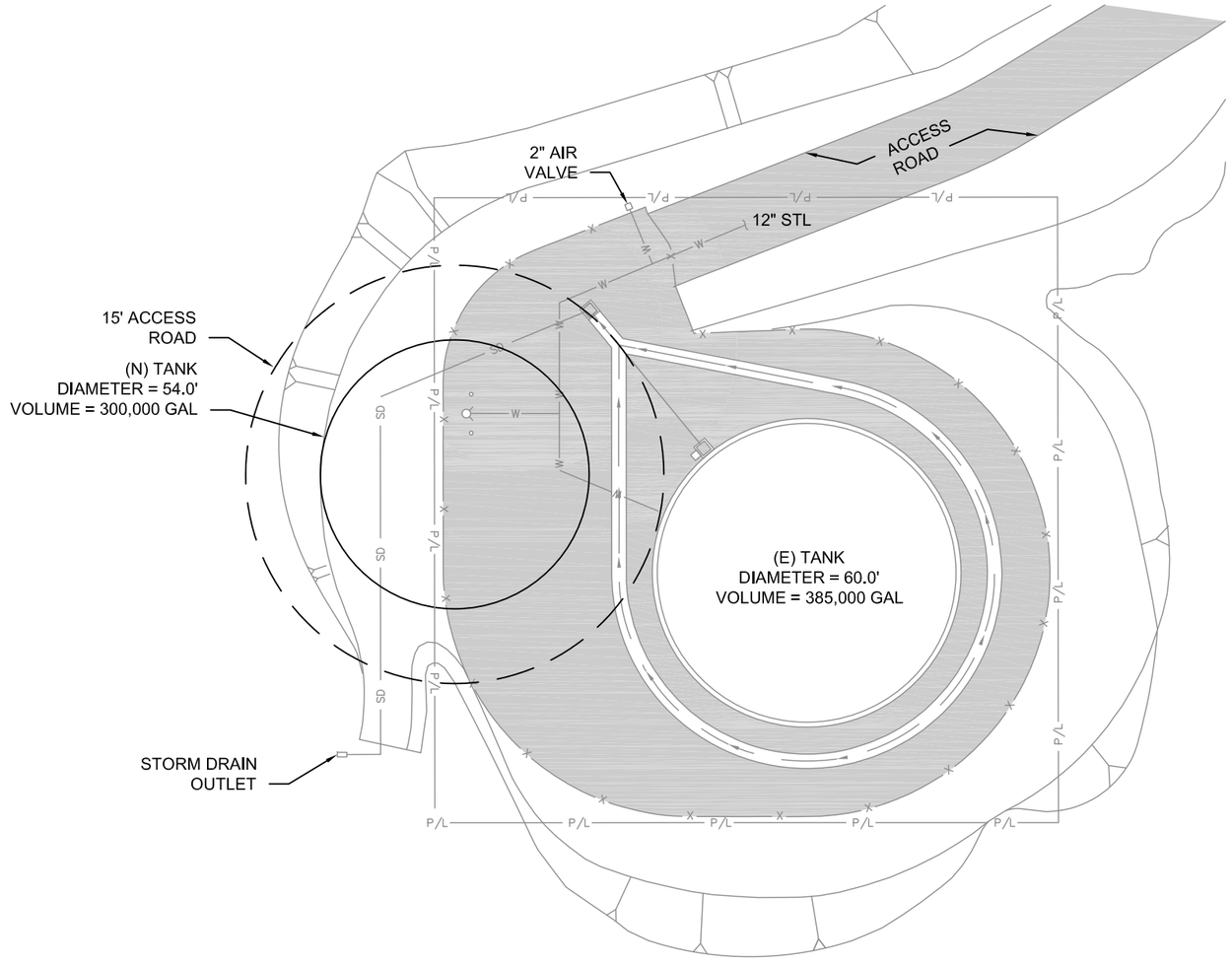
Las Virgenes Municipal Water District
Deerlake Ranch Storage and Pumping Capacity

Twin Lakes Tank S-1 Replacement:
Alternative S-1

K/J 1644221*00
July 2016

Figure 2

Q:\Ventura\2016\1644221 00_ LVMWD-Deerlake Ranch Storage and Pumping Capacity Study\09-Reports\CAD\las virgenes - 2.dwg ERICK ALMALEL 7/7/2016 10:01 AM



LEGEND

(E)	EXISTING
(N)	NEW
P/L	PROPERTY LINE
GAL	GALLON
SD	STORM DRAIN
STL	STEEL
W	WATER

NOTE: GRADING FOR NEW TANK NOT SHOWN.

Kennedy/Jenks Consultants

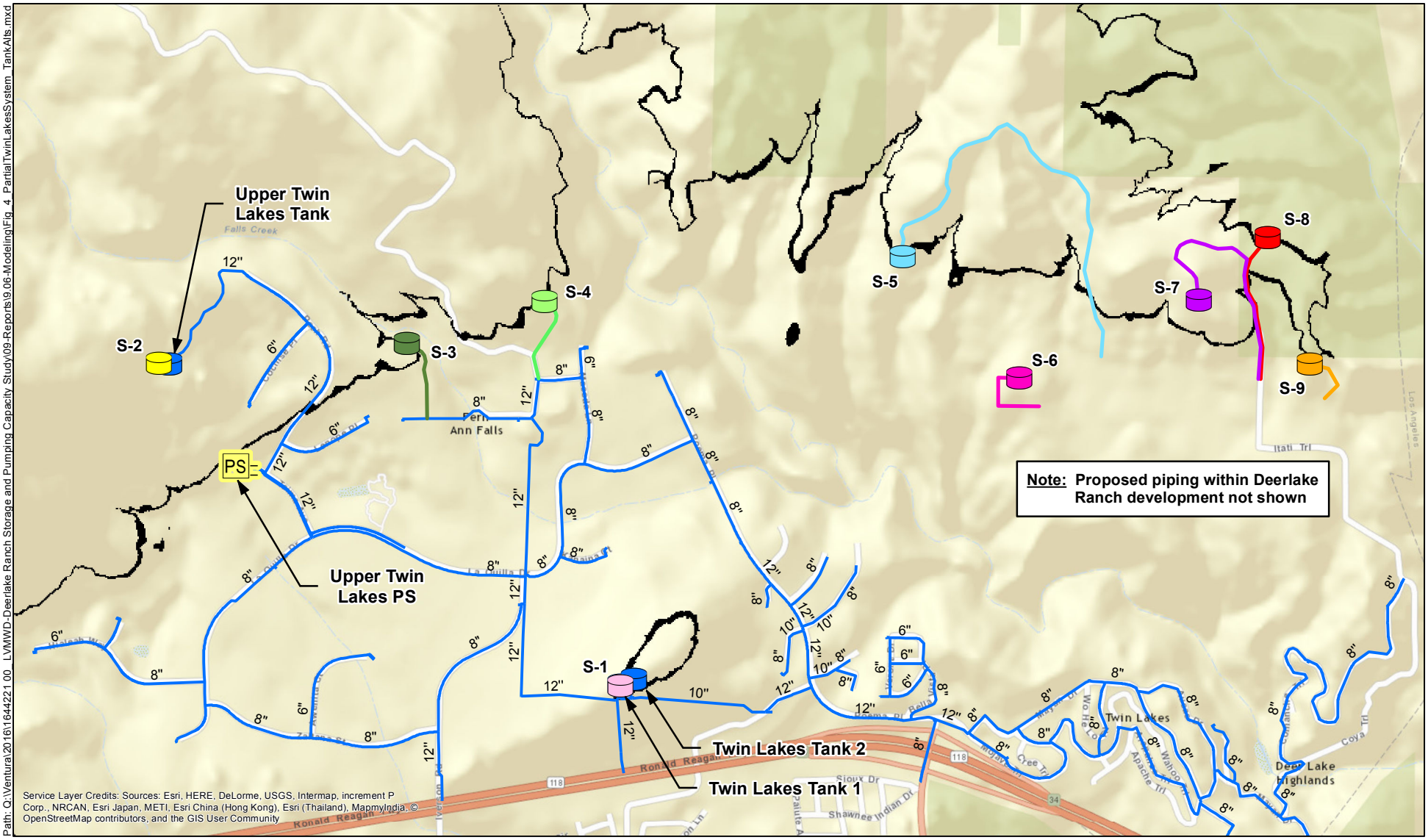
Las Virgenes Municipal Water District
Deerlake Ranch Storage and Pumping Capacity

Upper Twin Lakes Tank 2:
Alternative S-2

K/J 1644221*00
July 2016

Figure 3

Q:\Ventura\2016\1644221 00_ LVMWD-Deerlake Ranch Storage and Pumping Capacity Study\09-Reports\CAD\las virgenes - 3.dwg ERICK ALMALEL 7/7/2016 10:05 AM



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LEGEND

Potential Tanks

- S-1
- S-2
- S-3
- S-4
- S-5
- S-6
- S-7
- S-8
- S-9

Pipelines to Potential Tanks

- S-3 Pipeline
- S-4 Pipeline
- S-5 Pipeline
- S-6 Pipeline
- S-7 Pipeline
- S-8 Pipeline
- S-9 Pipeline

- Existing Pump Station
- Existing Tank
- Existing Potable Water Lines
- Elevation Band 1,555 ft - 1,565 ft

N

0 500 1,000

Scale: Feet

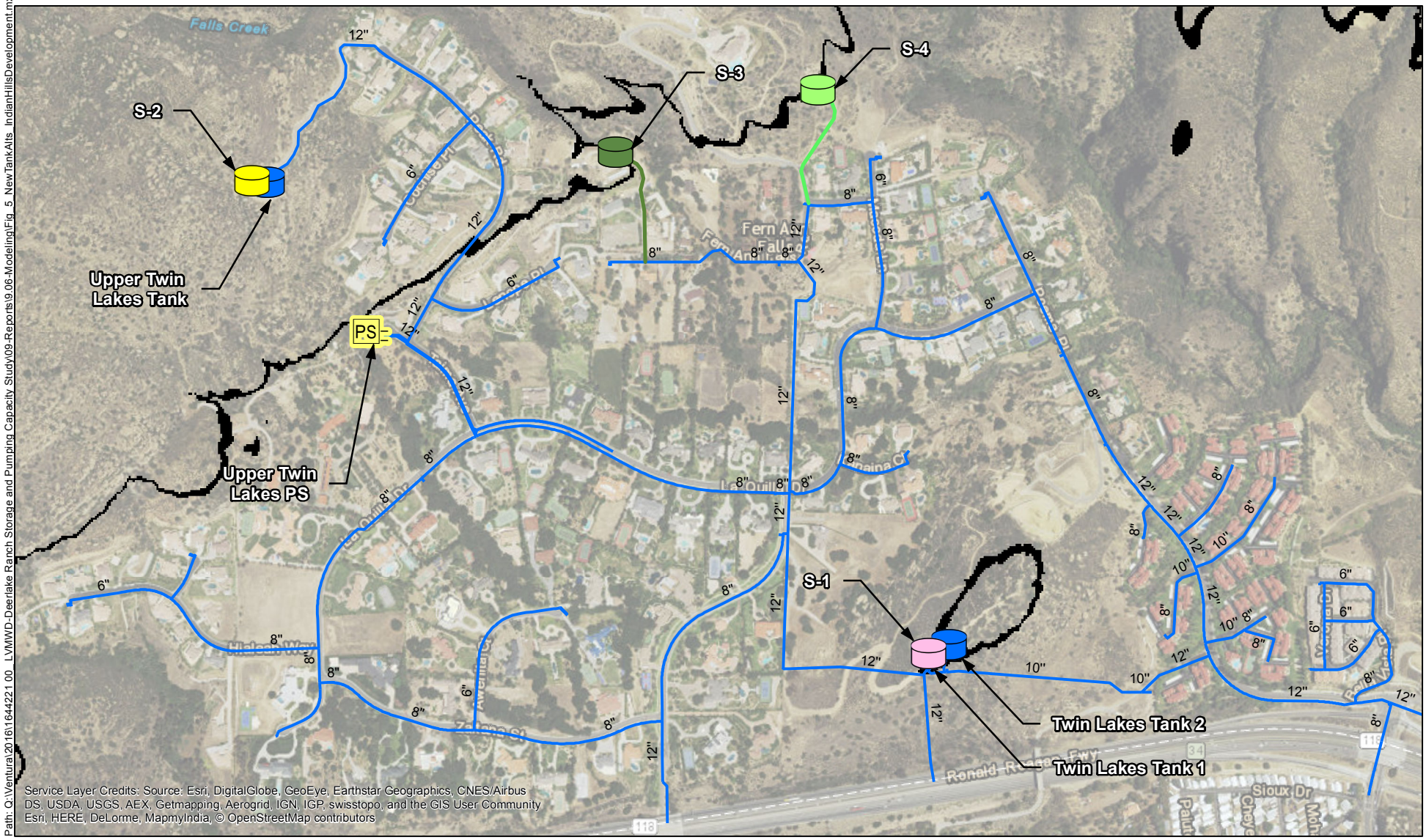
Kennedy/Jenks Consultants

Las Virgenes Municipal Water District
Deerlake Ranch Storage and Pumping Capacity

Partial Twin Lakes System with Storage Tank Alternatives

K/J 1644221*00
July 2016

Figure 4



Path: Q:\Ventura\2016\1644221.00_LVMWD-Deerlake Ranch Storage and Pumping Capacity Study\09-Reports\9.06-Modeling\Fig_5_NewTankAlts_IndianHillsDevelopment.mxd

LEGEND

- PS — Existing Pump Station
- Existing Tank
- Existing Potable Water Lines
- Elevation Band 1,555 ft - 1,565 ft

Potential Tanks

- S-1
- S-2
- S-3
- S-4

Pipelines to Potential Tanks

- S-3 Pipeline
- S-4 Pipeline

N

0 400 800

Scale: Feet

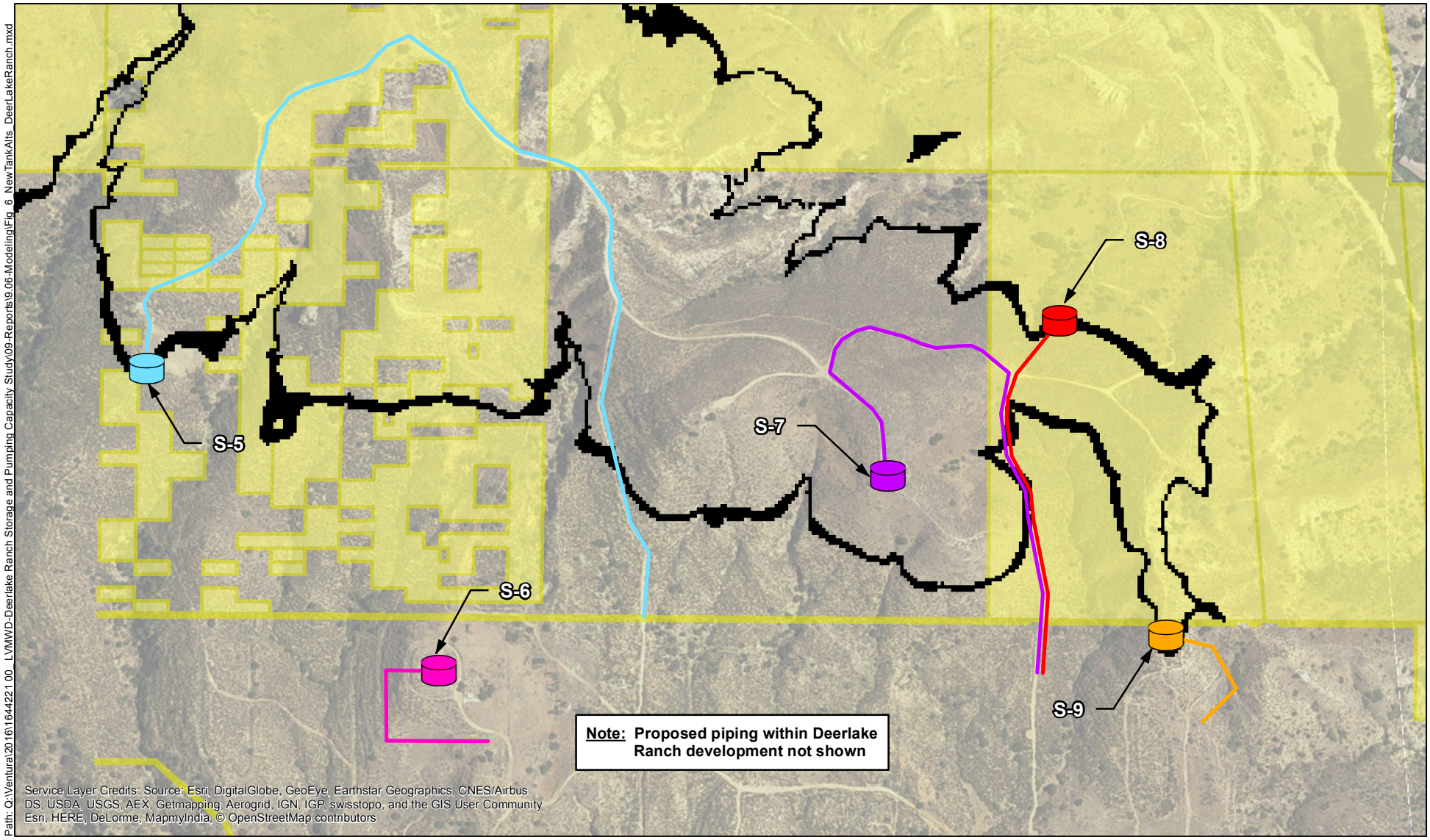
Kennedy/Jenks Consultants

Las Virgenes Municipal Water District
Deerlake Ranch Storage and Pumping Capacity

New Tank Alternatives near Indian Hills Development

K/J 1644221*00
July 2016

Figure 5



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LEGEND

Potential Tanks

- S-5
- S-6
- S-7
- S-8
- S-9

Pipelines to Potential Tanks

- S-5 Pipeline
- S-6 Pipeline
- S-7 Pipeline
- S-8 Pipeline
- S-9 Pipeline

- MRCA Parcels
- Elevation Band 1,555 ft - 1,565 ft

N

0 250 500

Scale: Feet

Kennedy/Jenks Consultants

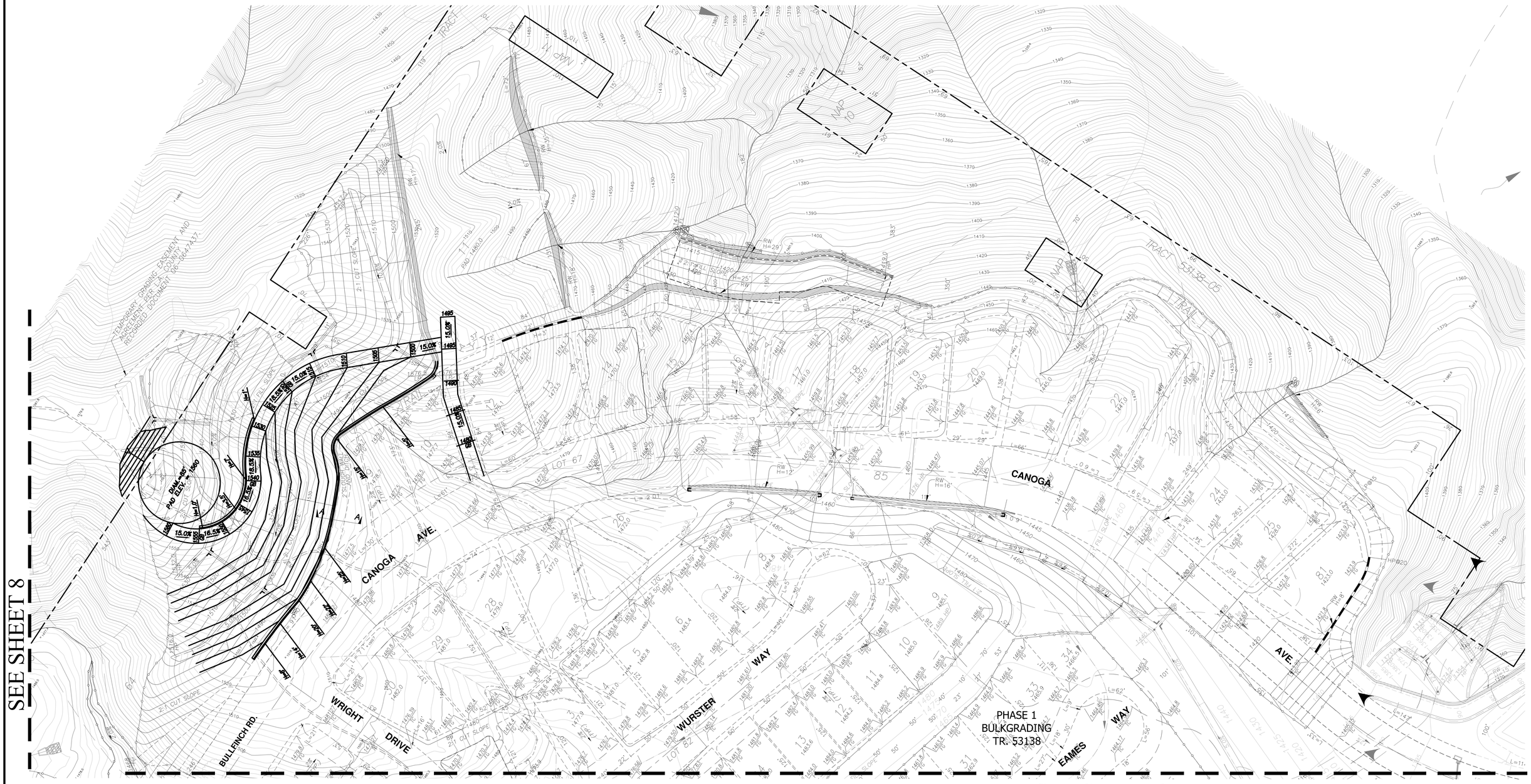
Las Virgenes Municipal Water District
Deerlake Ranch Storage and Pumping Capacity

New Tank Alternatives near Deerlake Ranch Development

K/J 1644221*00
July 2016

Figure 6

Appendix B: Storage Alternative S-9 Site Layout



CONSTRUCTION NOTES:

1. CONSTRUCT EDGE BERM PER DETAIL A/2
2. CONSTRUCT TERRACE DRAIN PER DETAIL B/2
3. CONSTRUCT INTERCEPTOR DRAIN PER DETAIL C/2
4. CONSTRUCT TRAIL PER DETAIL D/2 TYPE PER PLAN
5. CONSTRUCT V-DITCH PER DETAIL E/2
6. CONSTRUCT SPLASH WALL PER DETAIL M/2
7. ~~CONSTRUCT PEDESTRIAN TRAIL AND TERRACE DRAIN PER DETAIL~~ NOT USED
8. PREVIOUSLY ABANDONED OIL WELL TO BE PROTECTED IN PLACE
9. CONSTRUCT SLOUGH WALL PER DETAIL H/2
10. CONST. RET. WALL PER SEPARATE PERMIT
11. CONSTRUCT TERRACE AND DOWNDRAIN INTERSECTION PER DETAIL J/2
12. CONSTRUCT CONTECH ARMORFLEX PER DETAIL G/2
13. CONSTRUCT GROUTED RIP RAP APRON PER DETAIL K/2
14. CONSTRUCT CONCRETE ACCESS DRIVEWAYS PER DETAIL L/2
15. CONSTRUCT DITCH TO PIPE TRANSITION PER DETAIL N/2
16. CONSTRUCT DOWN DRAIN TO CONCRETE TO CONCRETE CHANNEL TRANSITION PER DETAIL O/2
17. CUT LOT AND CUT/FILL TRANSITION LOT PER DETAIL P/3
18. CONSTRUCT OPEN DOWN DRAIN PER DETAIL Q/3
19. TYPICAL VERDURA WALL PER DETAIL R/3 PER SEPARATE PLAN
20. CONSTRUCT FAN INLET PER DETAIL S/3
21. CONSTRUCT WALL DRAIN 1 PER DETAIL T/3
22. CONSTRUCT TRAIL DRAIN CROSSING PER DETAIL U/3
23. INSTALL SUBDRAIN PER DETAIL V/3 AND GEOTECHNICAL CONSULTANT'S DIRECTION.
24. CONSTRUCT WALL DRAIN AT VERDURA WALL PER DETAIL W/3
25. CONSTRUCT ROUGH GRADE PAD DRAINAGE PIPE X/3 INLET AND OUTLET PER DETAIL
26. CONSTRUCT PIPE CULVERT HEADWALL, STRAIGHT, PER CALTRANS STD. D89 H=5'-8", L=21', D1=D2=24"
27. CONSTRUCT DOWN DRAIN TO PARKWAY DRAIN PER AWPA 151-2.
28. EXISTING POWER POLE TO REMAIN - PROTECT IN PLACE.
29. EXISTING POWER POLE TO RELOCATED - PER SEPARATE PLAN.
30. EXISTING FIRE HYDRANT TO REMAIN - PROTECT IN PLACE.
31. EXISTING FIRE HYDRANT TO BE REMOVED.
32. EXISTING 8" ACP WATER LINE TO BE REMOVED.
33. CONSTRUCT DRIVEWAY APPROACH PER SPPWC 110-2, TYPE 2, RESIDENTIAL.
34. CONSTRUCT DRIVEWAY APPROACH PER SPPWC 110-2, TYPE 3, COMMERCIAL.
35. CONSTRUCT END OF WALL CATCH BASIN PER DETAIL Y/3 SIZE PER PLAN.
36. CONSTRUCT WALL DRAIN PER DETAIL W1/3

HATCH LEGEND

- LIMITS OF GEOGRID
- LIMITS OF RESTRICTED USE ZONE

SCALE 1" = 40'

40 0 20 40 80 160

Scale: 1 inch = 40 ft.

OWNER/SUBDIVIDER:
FORESTAR CHATSWORTH, LLC
4590 MACARTHUR BLVD.
SUITE 600
NEWPORT BEACH, CA 92660
PH: (949) 748-6714

NO.	DATE	REVISIONS	APPROVED BY

DESIGNER	J.V.F.
DESIGNED BY:	J.V.F.
DRAFTED BY:	J.V.F.
CHECKED BY:	M.S.

REGISTERED PROFESSIONAL ENGINEER SIEW HUAT NG NO. 46026 EXP.12-31-16 CIVIL STATE OF CALIFORNIA

PLANS PREPARED BY:
UNITED CIVIL, INC.
30141 AGOURA ROAD, SUITE 215
AGOURA HILLS, CA 91301
PH: (818) 707-8648
FAX: (818) 707-8649

6/24/2016
SIEW HUAT NG DATE
R.C.E. 46026 EXP. 12-31-2016

PHASE 2
BULK GRADING PLAN
VTTM 53138
LOS ANGELES COUNTY
DEPARTMENT OF PUBLIC WORKS

PROJECT NO. 14-1264

SHEET 10
OF 10

Appendix C: Opinion of Probable Construction Cost

OPINION OF PROBABLE CONSTRUCTION COST **KENNEDY/JENKS CONSULTANTS**

Project: Las Virgenes Municipal Water District - Deerlake Ranch Pumping and Storage Analysis

Prepared By: BH
Date Prepared: 8-Jul-16
K/J Proj. No. 1644221*00

Building, Area: Alternative P-1: Modifications at Twin Lakes Pump Station

Current at ENR
Escalated to ENR
Months to Midpoint of Construct

Estimate Type: X **Conceptual** **Construction**
Preliminary (w/o plans) **Change Order**
Design Development @ **% Complete**

Spec. Section	Item No.	Description	Qty	Units	Materials $/Unit	Materials Total	Installation $/Unit	Installation Total	Sub-contractor $/Unit	Sub-contractor Total	Total
DIVISION 1 - GENERAL REQUIREMENTS											
						0		0		0	0
						0		0		0	0
SUBTOTAL - DIVISION 1						0		0		0	0
DIVISION 2 - SITE WORK											
						0		0		0	0
						0		0		0	0
SUBTOTAL - DIVISION 2						0		0		0	0
DIVISION 3 -CONCRETE											
						0		0		0	0
						0		0		0	0
SUBTOTAL - DIVISION 3						0		0		0	0
DIVISION 4 -MASONRY											
						0		0		0	0
								0		0	0
SUBTOTAL - DIVISION 4						0		0		0	0
DIVISION 5 -METALS											
						0		0		0	0
						0		0		0	0
SUBTOTAL - DIVISION 5						0		0		0	0
DIVISION 6 -WOOD & PLASTICS											
						0		0		0	0
						0		0		0	0
SUBTOTAL - DIVISION 6						0		0		0	0
DIVISION 7 -THERMAL & MOISTURE PROTECTION											
						0		0		0	0
						0		0		0	0
SUBTOTAL - DIVISION 7						0		0		0	0

OPINION OF PROBABLE CONSTRUCTION COST **KENNEDY/JENKS CONSULTANTS**

Project: Las Virgenes Municipal Water District - Deerlake Ranch Pumping and Storage Analysis

Prepared By: BH
Date Prepared: 8-Jul-16
K/J Proj. No. 1644221*00

Building, Area: Alternative P-1: Modifications at Twin Lakes Pump Station

Current at ENR
Escalated to ENR
Months to Midpoint of Construct

Estimate Type: X **Conceptual** **Construction**
Preliminary (w/o plans) **Change Order**
Design Development @ **% Complete**

Spec. Section	Item No.	Description	Qty	Units	Materials $/Unit	Materials Total	Installation $/Unit	Installation Total	Sub-contractor $/Unit	Sub-contractor Total	Total
DIVISION 8 -DOORS & WINDOWS											
						0		0		0	0
						0		0		0	0
SUBTOTAL - DIVISION 8						0		0		0	0
DIVISION 9 -FINISHES											
						0		0		0	0
						0		0		0	0
SUBTOTAL - DIVISION 9						0		0		0	0
DIVISION 10 -SPECIALTIES											
						0		0		0	0
						0		0		0	0
SUBTOTAL - DIVISION 10						0		0		0	0
DIVISION 11 - EQUIPMENT											
11215	2	100 hp Pumps	200	hp	900.00	180,000	850.00	170,000		0	350,000
						0		0		0	0
SUBTOTAL - DIVISION 11						180,000		170,000		0	350,000
DIVISION 12 - FURNISHINGS											
						0		0		0	0
						0		0		0	0
SUBTOTAL - DIVISION 12						0		0		0	0
DIVISION 13 - SPECIAL CONSTRUCTION											
						0		0		0	0
						0		0		0	0
SUBTOTAL - DIVISION 13						0		0		0	0
DIVISION 14 - CONVEYING SYSTEMS											
						0		0		0	0
						0		0		0	0
SUBTOTAL - DIVISION 14						0		0		0	0

OPINION OF PROBABLE CONSTRUCTION COST **KENNEDY/JENKS CONSULTANTS**

Project: Las Virgenes Municipal Water District - Deerlake Ranch Pumping and Storage Analysis

Building, Area: Alternative P-1: Modifications at Twin Lakes Pump Station

Prepared By: BH
Date Prepared: 8-Jul-16
K/J Proj. No. 1644221*00

Current at ENR
Escalated to ENR
Months to Midpoint of Construct

Estimate Type: X **Conceptual** **Construction**
Preliminary (w/o plans) **Change Order**
Design Development @ **% Complete**

Spec. Section	Item No.	Description	Qty	Units	Materials $/Unit	Materials Total	Installation $/Unit	Installation Total	Sub-contractor $/Unit	Sub-contractor Total	Total
DIVISION 15 - MECHANICAL											
						0		0		0	0
						0		0		0	0
SUBTOTAL - DIVISION 15						0		0		0	0
DIVISION 16 - ELECTRICAL											
	1	Replace 500kVA xfmr with 750kVA xfmr	1	LS		0		0	10,000.00	10,000	10,000
	2	Replace 800A swbd with 1000A swbd	1	LS		0		0	50,000.00	50,000	50,000
	3	Replace 400AT feeder breaker with 600 AT	1	LS		0		0	5,000.00	5,000	5,000
	4	Pump Panels	2	EA		0		0	25,000.00	50,000	50,000
SUBTOTAL - DIVISION 16						0		0		115,000	115,000
DIVISION 17 - INSTRUMENTATION											
						0		0		0	0
						0		0		0	0
SUBTOTAL - DIVISION 17						0		0		0	0
TOTAL						**$ 180,000**		**$ 170,000**		**$ 115,000**	**$ 465,000**

Estimate Accuracy	
+50%	-30%

Estimated Range of Probable Cost		
+50%	Total Est.	-30%
$698,000	**$465,000**	**$326,000**

OPINION OF PROBABLE CONSTRUCTION COST **KENNEDY/JENKS CONSULTANTS**

Project: Las Virgenes Municipal Water District - Deerlake Ranch Pumping and Storage Analysis

Prepared By: BH
Date Prepared: 8-Jul-16
K/J Proj. No. 1644221*00

Building, Area: Alternative S-1: Replace Twin Lakes Tank 1

Current at ENR
Escalated to ENR
Months to Midpoint of Construct

Estimate Type: X **Conceptual** **Construction**
Preliminary (w/o plans) **Change Order**
Design Development @ **% Complete**

Spec. Section	Item No.	Description	Qty	Units	Materials $/Unit	Materials Total	Installation $/Unit	Installation Total	Sub-contractor $/Unit	Sub-contractor Total	Total
DIVISION 1 - GENERAL REQUIREMENTS											
						0		0		0	0
						0		0		0	0
SUBTOTAL - DIVISION 1						0		0		0	0
DIVISION 2 - SITE WORK											
02050	1	Demolish 0.4 MG Tank	1	LS		0	25,000.00	25,000		0	25,000
02301	2	Grading	1,415	CY	375.00	530,625	325.00	459,875		0	990,500
02705	3	Paving	3,015	SF	3.50	10,553	3.00	9,045		0	19,598
SUBTOTAL - DIVISION 2						541,178		493,920		0	1,035,098
DIVISION 3 -CONCRETE											
						0		0		0	0
						0		0		0	0
SUBTOTAL - DIVISION 3						0		0		0	0
DIVISION 4 -MASONRY											
						0		0		0	0
								0		0	0
SUBTOTAL - DIVISION 4						0		0		0	0
DIVISION 5 -METALS											
						0		0		0	0
						0		0		0	0
SUBTOTAL - DIVISION 5						0		0		0	0
DIVISION 6 -WOOD & PLASTICS											
						0		0		0	0
						0		0		0	0
SUBTOTAL - DIVISION 6						0		0		0	0
DIVISION 7 -THERMAL & MOISTURE PROTECTION											
						0		0		0	0
						0		0		0	0
SUBTOTAL - DIVISION 7						0		0		0	0

OPINION OF PROBABLE CONSTRUCTION COST **KENNEDY/JENKS CONSULTANTS**

Project: Las Virgenes Municipal Water District - Deerlake Ranch Pumping and Storage Analysis

Building, Area: Alternative S-1: Replace Twin Lakes Tank 1

Prepared By: BH
Date Prepared: 8-Jul-16
K/J Proj. No. 1644221*00

Current at ENR
Escalated to ENR
Months to Midpoint of Construct

Estimate Type: X **Conceptual** **Construction**
Preliminary (w/o plans) **Change Order**
Design Development @ **% Complete**

Spec. Section	Item No.	Description	Qty	Units	Materials $/Unit	Materials Total	Installation $/Unit	Installation Total	Sub-contractor $/Unit	Sub-contractor Total	Total
DIVISION 8 -DOORS & WINDOWS											
						0		0		0	0
						0		0		0	0
SUBTOTAL - DIVISION 8						0		0		0	0
DIVISION 9 -FINISHES											
						0		0		0	0
						0		0		0	0
SUBTOTAL - DIVISION 9						0		0		0	0
DIVISION 10 -SPECIALTIES											
						0		0		0	0
						0		0		0	0
SUBTOTAL - DIVISION 10						0		0		0	0
DIVISION 11 - EQUIPMENT											
						0		0		0	0
						0		0		0	0
SUBTOTAL - DIVISION 11						0		0		0	0
DIVISION 12 - FURNISHINGS											
						0		0		0	0
						0		0		0	0
SUBTOTAL - DIVISION 12						0		0		0	0
DIVISION 13 - SPECIAL CONSTRUCTION											
13211	1	Welded Steel Tank	700,000	gal	0.45	315,000	0.40	280,000		0	595,000
						0		0		0	0
SUBTOTAL - DIVISION 13						315,000		280,000		0	595,000
DIVISION 14 - CONVEYING SYSTEMS											
						0		0		0	0
						0		0		0	0
SUBTOTAL - DIVISION 14						0		0		0	0

OPINION OF PROBABLE CONSTRUCTION COST **KENNEDY/JENKS CONSULTANTS**

Project: Las Virgenes Municipal Water District - Deerlake Ranch Pumping and Storage Analysis

Prepared By: BH
Date Prepared: 8-Jul-16
Building, Area: Alternative S-1: Replace Twin Lakes Tank 1
K/J Proj. No. 1644221*00

Current at ENR
Escalated to ENR
Months to Midpoint of Construct

Estimate Type: **X** **Conceptual** **Construction**
Preliminary (w/o plans) **Change Order**
Design Development @ **% Complete**

Spec. Section	Item No.	Description	Qty	Units	Materials $/Unit	Materials Total	Installation $/Unit	Installation Total	Sub-contractor $/Unit	Sub-contractor Total	Total
DIVISION 15 - MECHANICAL											
15050	1	8-in CML&C Steel Pipe	50	LF	60.00	3,000	60.00	3,000		0	6,000
15050	2	Storm Drain Piping	1	LS	5,000.00	5,000	5,000.00	5,000		0	10,000
SUBTOTAL - DIVISION 15						8,000		8,000		0	16,000
DIVISION 16 - ELECTRICAL											
						0		0		0	0
						0		0		0	0
SUBTOTAL - DIVISION 16						0		0		0	0
DIVISION 17 - INSTRUMENTATION											
17010	1	Communication Equipment	1	LS		0		0	10,000	10,000	10,000
						0		0		0	0
SUBTOTAL - DIVISION 17						0		0		10,000	10,000
TOTAL						**$ 864,178**		**$ 781,920**		**$ 10,000**	**$ 1,656,098**

Estimate Accuracy	
+50%	-30%

Estimated Range of Probable Cost		
+50%	Total Est.	-30%
$2,484,000	**$1,656,000**	**$1,159,000**

OPINION OF PROBABLE CONSTRUCTION COST **KENNEDY/JENKS CONSULTANTS**

Project: Las Virgenes Municipal Water District - Deerlake Ranch Pumping and Storage Analysis

Prepared By: BH
Date Prepared: 8-Jul-16
K/J Proj. No. 1644221*00

Building, Area: Alternative S-9: New Tank Northwest of Unit 205 at Deerlake Ranch Property Boundary

Current at ENR
Escalated to ENR
Months to Midpoint of Construct

Estimate Type: **X** **Conceptual** **Construction**
Preliminary (w/o plans) **Change Order**
Design Development @ **% Complete**

Spec. Section	Item No.	Description	Qty	Units	Materials $/Unit	Materials Total	Installation $/Unit	Installation Total	Sub-contractor $/Unit	Sub-contractor Total	Total
DIVISION 1 - GENERAL REQUIREMENTS											
						0		0		0	0
						0		0		0	0
SUBTOTAL - DIVISION 1						0		0		0	0
DIVISION 2 - SITE WORK											
02705	1	Paving	11,575	SF	3.50	40,513	3.00	34,725		0	75,238
						0		0		0	0
SUBTOTAL - DIVISION 2						40,513		34,725		0	75,238
DIVISION 3 -CONCRETE											
03300	1	Retaining Wall	1,200	CY	500.00	600,000	500.00	600,000		0	1,200,000
						0		0		0	0
SUBTOTAL - DIVISION 3						600,000		600,000		0	1,200,000
DIVISION 4 -MASONRY											
						0		0		0	0
						0		0		0	0
SUBTOTAL - DIVISION 4						0		0		0	0
DIVISION 5 -METALS											
						0		0		0	0
						0		0		0	0
SUBTOTAL - DIVISION 5						0		0		0	0
DIVISION 6 -WOOD & PLASTICS											
						0		0		0	0
						0		0		0	0
SUBTOTAL - DIVISION 6						0		0		0	0
DIVISION 7 -THERMAL & MOISTURE PROTECTION											
						0		0		0	0
						0		0		0	0
SUBTOTAL - DIVISION 7						0		0		0	0

OPINION OF PROBABLE CONSTRUCTION COST **KENNEDY/JENKS CONSULTANTS**

Project: Las Virgenes Municipal Water District - Deerlake Ranch Pumping and Storage Analysis

Prepared By: BH
Date Prepared: 8-Jul-16

Building, Area: Alternative S-9: New Tank Northwest of Unit 205 at Deerlake Ranch Property Boundary

K/J Proj. No. 1644221*00

Current at ENR
Escalated to ENR
Months to Midpoint of Construct

Estimate Type: **X** **Conceptual** **Construction**
Preliminary (w/o plans) **Change Order**
Design Development @ **% Complete**

Spec. Section	Item No.	Description	Qty	Units	Materials $/Unit	Materials Total	Installation $/Unit	Installation Total	Sub-contractor $/Unit	Sub-contractor Total	Total
DIVISION 8 -DOORS & WINDOWS											
						0		0		0	0
						0		0		0	0
SUBTOTAL - DIVISION 8						0		0		0	0
DIVISION 9 -FINISHES											
						0		0		0	0
						0		0		0	0
SUBTOTAL - DIVISION 9						0		0		0	0
DIVISION 10 -SPECIALTIES											
						0		0		0	0
						0		0		0	0
SUBTOTAL - DIVISION 10						0		0		0	0
DIVISION 11 - EQUIPMENT											
						0		0		0	0
						0		0		0	0
SUBTOTAL - DIVISION 11						0		0		0	0
DIVISION 12 - FURNISHINGS											
						0		0		0	0
						0		0		0	0
SUBTOTAL - DIVISION 12						0		0		0	0
DIVISION 13 - SPECIAL CONSTRUCTION											
13211	1	Welded Steel Tank	300,000	gal	0.55	165,000	0.50	150,000		0	315,000
						0		0		0	0
SUBTOTAL - DIVISION 13						165,000		150,000		0	315,000
DIVISION 14 - CONVEYING SYSTEMS											
						0		0		0	0
						0		0		0	0
SUBTOTAL - DIVISION 14						0		0		0	0

OPINION OF PROBABLE CONSTRUCTION COST **KENNEDY/JENKS CONSULTANTS**

Project: Las Virgenes Municipal Water District - Deerlake Ranch Pumping and Storage Analysis

Prepared By: BH
Date Prepared: 8-Jul-16
K/J Proj. No. 1644221*00

Building, Area: Alternative S-9: New Tank Northwest of Unit 205 at Deerlake Ranch Property Boundary

Current at ENR
Escalated to ENR
Months to Midpoint of Construct

Estimate Type: **X** **Conceptual** **Construction**
Preliminary (w/o plans) **Change Order**
Design Development @ **% Complete**

Spec. Section	Item No.	Description	Qty	Units	Materials $/Unit	Materials Total	Installation $/Unit	Installation Total	Sub-contractor $/Unit	Sub-contractor Total	Total
DIVISION 15 - MECHANICAL											
15050	1	8-in CML&C Steel Pipe	700	LF	60.00	42,000	60.00	42,000		0	84,000
15050	2	Storm Drain Piping	1	LS	10,000.00	10,000	10,000.00	10,000		0	20,000
SUBTOTAL - DIVISION 15						52,000		52,000		0	104,000
DIVISION 16 - ELECTRICAL											
						0		0		0	0
						0				0	0
SUBTOTAL - DIVISION 16						0		0		0	0
DIVISION 17 - INSTRUMENTATION											
17010	1	Communication Equipment	1	LS		0		0	30,000	30,000	30,000
						0		0		0	0
SUBTOTAL - DIVISION 17						0		0		30,000	30,000
TOTAL						**$ 857,513**		**$ 836,725**		**$ 30,000**	**$ 1,724,238**

Estimate Accuracy	
+50%	-30%

Estimated Range of Probable Cost		
+50%	Total Est.	-30%
$2,586,000	**$1,724,000**	**$1,207,000**

PUMP Net Present Value Calculation 1

Assumptions/Conversions

1 hp =	0.7457	kw
Cost =	$ 0.145	kw/hr
Inflation =	2%	
Discount rate[1] =	2.84%	
Cost for new hp[2] =	$ 2,000	$/hp

Twin Lakes Pump Station:

200 hp =	149	kw
Cost for 1 hour =	$ 21.63	
Cost for 9 hour operation =	$ 194.63	
Cost for 365 day operation =	$ 10,300.67	
Cost for new pumps =	$ 400,000	

1. Nominal average 2015 rate for 30 year U.S. treasury note
2. Price includes cost of new electrical equipment

Year	Elec Cost	O&M Cost
0	$ 10,301	$ 8,000
1	$ 10,507	$ 8,160
2	$ 10,717	$ 8,323
3	$ 10,931	$ 8,490
4	$ 11,150	$ 8,659
5	$ 11,373	$ 8,833
6	$ 11,600	$ 9,009
7	$ 11,832	$ 9,189
8	$ 12,069	$ 9,373
9	$ 12,310	$ 9,561
10	$ 12,556	$ 9,752
11	$ 12,808	$ 9,947
12	$ 13,064	$ 10,146
13	$ 13,325	$ 10,349
14	$ 13,592	$ 10,556
15	$ 13,863	$ 10,767
16	$ 14,141	$ 10,982
17	$ 14,423	$ 11,202
18	$ 14,712	$ 11,426
19	$ 15,006	$ 11,654
20	$ 15,306	$ 11,888
21	$ 15,612	$ 12,125
22	$ 15,925	$ 12,368
23	$ 16,243	$ 12,615
24	$ 16,568	$ 12,867
25	$ 16,899	$ 13,125
26	$ 17,237	$ 13,387
27	$ 17,582	$ 13,655
28	$ 17,934	$ 13,928
29	$ 18,292	$ 14,207
30	$ 18,658	$ 14,491
NPV	**$ 275,299**	**$ 213,811**

TANK Net Present Value Calculation 1

300,000 gal Tank

Cost =	$ 1.05	$/gal
Inflation =	2%	
Discount rate[1] =	2.84%	

New Deerlake Ranch Tank

Cost for 300,000 gal tank $ 315,000

1. Nominal average 2015 rate for 30 year U.S. treasury note

Year	O&M Cost
0	$ 6,300
1	$ 6,426
2	$ 6,555
3	$ 6,686
4	$ 6,819
5	$ 6,956
6	$ 7,095
7	$ 7,237
8	$ 7,381
9	$ 7,529
10	$ 7,680
11	$ 7,833
12	$ 7,990
13	$ 8,150
14	$ 8,313
15	$ 8,479
16	$ 8,649
17	$ 8,822
18	$ 8,998
19	$ 9,178
20	$ 9,361
21	$ 9,549
22	$ 9,740
23	$ 9,934
24	$ 10,133
25	$ 10,336
26	$ 10,543
27	$ 10,753
28	$ 10,968
29	$ 11,188
30	$ 11,412
TOTAL	**$ 168,376**

TANK Net Present Value Calculation 2

700,000 gal Tank

Cost =	$ 0.85	$/gal
Inflation =	2%	
Discount rate[1] =	2.84%	

New Upper Twin Lakes Tank 1

Cost for 700,000 gal tank $ 595,000

1. Nominal average 2015 rate for 30 year U.S. treasury note

Year	O&M Cost
0	$ 11,900
1	$ 12,138
2	$ 12,381
3	$ 12,628
4	$ 12,881
5	$ 13,139
6	$ 13,401
7	$ 13,669
8	$ 13,943
9	$ 14,222
10	$ 14,506
11	$ 14,796
12	$ 15,092
13	$ 15,394
14	$ 15,702
15	$ 16,016
16	$ 16,336
17	$ 16,663
18	$ 16,996
19	$ 17,336
20	$ 17,683
21	$ 18,036
22	$ 18,397
23	$ 18,765
24	$ 19,140
25	$ 19,523
26	$ 19,914
27	$ 20,312
28	$ 20,718
29	$ 21,133
30	$ 21,555
TOTAL	**$ 318,043**