APPENDIX K

Services and Utilities

Technical Memorandum

Proposed Alpine Sierra Development Water & Sewer Facility Evaluation

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Date:	August 26, 2013

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PURPOSE

The Alpine Springs County Water District (ASCWD) recently received revised development plans for the proposed Alpine Sierra Development (ASD). The previous Water & Sewer Facility Evaluation, conducted by Stantec on 3/17/2011, has been updated to reflect the revised development plans. Revisions include lot layout and unit count changes and associated infrastructure alignments. The total number of units will increase from 39 to 47, consisting of 33 single family residential units, with up to 5 of these units having separate guest units, and 14 residential townhome units in a halfplex configuration.

This evaluation details the infrastructure improvements required to provide reliable water and sewer service to ASD and includes an opinion of the associated infrastructure costs. In addition, the impacts of the proposed development on the existing ASCWD system with respect to system service pressures and available fire flows under existing and buildout demand conditions were evaluated. Based on the facilities evaluation, recommended ASCWD system improvements are described that would improve pressure zone supply reliability and increase fire flows in the adjoining Bear Creek Subdivision (BCS) and other subdivisions served by ASCWD system infrastructure.

In addition, easements are identified within ASD that should be acquired by the ASCWD to service as-built ASCWD utility infrastructure (water and sewer) that currently exists on the ASD property, and allow for the installation and maintenance of new water and sewer utility connections and improvements between the ASD property and BCS.

The ASD sewer facility evaluation included the identification of two sewer service connection options, including a gravity flow option and a lift station option, and their associated planning level probable costs.

Water System Hydraulic Modeling

As part of the facilities evaluation for serving potable water to ASD, hydraulic modeling analyses were conducted. The software used was Bentley WaterCAD V8.i.

The current ASCWD system-wide hydraulic model was updated to reflect the ASD revisions. The ability of the ASCWD to supply maximum day demands (MDD) for both the existing water system, and the proposed ASD, was evaluated. Steady state modeling analyses for both the MDD condition and available fire flows were performed to identify facility requirements to serve the project and evaluate infrastructure phasing requirements. In addition, the hydraulic model was used to identify distribution system deficiencies and develop recommendations to mitigate the deficiencies.

ASCWD SYSTEM WATER DEMAND UPDATE

Water demands for the proposed ASD were estimated using demand factors consistent with the Alpine Springs Water District Recommended Long Range Water and Sewer Master Plan (Master Plan) dated December 2006. These demands include average daily unit demands of 0.155 gpm per single family residence (SFU), 0.10 gpm for townhomes and 0.078 gpm for guest houses. A maximum day to average day demand (ADD) ratio of 4.5:1 was used for all units. Demands were included for 5 separate guest houses (mother-in-law units). The actual location of the mother-in-law units is unknown and will be market driven. For planning purposes it was assumed that the mother-in-law units will be located on the larger lots within the eastern portion of the development. The existing system hydraulic model was updated to include the estimated ASD demands. The estimated demands for the ASD are listed in Table 1. The existing system demands taken from the December 2006 ASCWD Master Plan by pressure zone and the estimated ASD build-out demands appear in Table 2.

Table 1: Alpine Sierra Development Estimated Demands

Phase	# of Residences	ADD (gpm)	MDD (gpm)
Phase I, Western Development (14 Townhomes)	14	1.4	6.3
Phase I, Western Development (6 SFU)	6	0.9	4.2
Phase 2A, Eastern Development (4 Guest Houses)	4	0.3	1.4
Phase 2A, Eastern Development (14 SFU)	14	2.2	9.8
Phase 2B, Eastern Development (1 guest House)	1	0.1	0.4
Phase 2B, Eastern Development (13 SFU)	13	2.0	9.1
Totals	**52**	**6.9**	**31.1**

Table 2: System Demand per Pressure Zone

ZONE	ADD (gpm)	ADD (gpd)	MDD[1] (gpm)	MDD (gpd)
Zone 1 (without Alpine Sierra)	17	24,480	77	110,880
Zone 1 (with Alpine Sierra)	24	34,560	108	155,520
Zone 2	24	34,560	108	155,520
Zone 3	49	70,560	221	318,240
Zone 4	12	17,280	54	77,760
Total (With Alpine Sierra):	**109**	**156,960**	**491**	**707,040**

1. ADD to MDD peaking factor = 4.55 (ASCWD Master Plan, Dec. 2006).

Existing Water Supply Capacity & Water Balances Per Zone

The ASCWD water system has a total of seven water supply wells. The production capacities for each well are listed in Table 3. The primary supply sources, used on a daily basis, include 3 horizontal gravity flow wells (HW) that flow directly into the highest pressure zone (Zone 1). Water is distributed down through the system through a series of pressure regulation stations. Well 3 (small HW) and the AME Well (vertical well) are the supply sources within Pressure Zone 3. At the bottom of the water system within Zone 4 are two vertical production wells (Wells R1 and R2) that are normally used for supplying snowmaking water to the Alpine Meadows Ski Area. Well R1, with a capacity of 350 gpm, can be used to supply potable water to the distribution system directly into Zone 4. It is important to note that Well R2 exceeds EPA's secondary standard for manganese and any future usage as a potable water source will require blending or treatment to lower manganese levels. Furthermore, R2 is not equipped with a chlorine feed system. The total supply and demand by pressure zone and the resulting cumulative surplus or deficit can be found in Table 4. The distribution system, as designed, allows for surplus water in the zone above to be used to meet demands in the next lowest zone below. Table 5 is similar to Table 4, but the estimated demands for the ASD have been included.

Table 3: Supply Capacity Summary

Water Sources (gpm):	Supply Capacity (gpm)
Horizontal Well 1	60
Horizontal Well 2&4	118
Horizontal Well 3	14
AME Well	25
Vertical Well R1	350
Vertical Well R2[(a)]	500

[(a)] Well R2 will require improvements prior to use as a potable water supply.

Table 4: Existing System Pressure Zone Surplus/Deficit Summary

Zone	Source	Available Source Supply (gpm)	Available from Upper Zones (gpm)	ADD Demand (gpm)	MDD Demand (gpm)	MDD Surplus/Deficit (gpm)
Zone 1	Wells 1, 2 & 4	178		17	77	101
Zone 2	None	-	70	24	108	-7
Zone 3	Well 3, AME Well	39	-7	49	221	-189
Zone 4	Well R1	350	-189	12	54	107
	Total	**567**		**102**	**460**	

Table 5: Pressure Zone Surplus/Deficit Summary with Alpine Sierra Demands

Zone	Source	Available Source Supply (gpm)	Available from Upper Zones (gpm)	ADD Demand (gpm)	MDD Demand (gpm)	MDD Surplus/Deficit (gpm)
Zone 1	Wells 1, 2 & 4	178		24	108	70
Zone 2			70	24	108	-38
Zone 3	Well 3, AME Well	39	-38	49	221	-220
Zone 4	Well R1	350	-220	12	54	76
	Total	**567**		**109**	**491**	

A review of supply and demand by pressure zone (Table 4) indicates an existing maximum day demand supply deficit in Zone 2 of 7 gpm and Zone 3 of 189 gpm. The addition of the ASD will cause the MDD supply deficit to increase in both Zones by the ASD MDD of 31 gpm. Per Title 22, any new development cannot make an existing deficiency worse. Therefore, in order for the development to occur, water system improvements are required that will increase the MDD water supply to Pressure Zone 2 in an amount at least equal to ASD's maximum day demand.

Design Criteria (Water Facilities)

Design criteria and associated water works standards used in the facility evaluation to identify required water transmission facilities and mitigate the existing supply deficiencies are as follows:

- The water system shall have the ability to meet maximum day demands at all times with available sources of supply but does not include storage tanks as a source of supply (Title 22).
- Maximum day minimum residual pressure (Title 22) 40 PSI.
- Maximum system pressures 150 PSI (ASCWD).
- Minimum pressure during fire flow, coincident with MDD, 20 PSI (Title 22).
- Minimum fire storage required = 120,000 gallons, per ASCW (residential, 1,000 gpm for 2 hours).
- Minimum required Operational & Emergency storage = 1 MDD (Title 22).
- Minimum pipe diameter of 6-in (ASCWD).

- Maximum fire flow pipe velocities of 10-ft/sec (ASCWD).
- The development water plan will include at least two points of connection to the existing water system to provide a reliable water supply.

Water System Storage

ASCWD has a total of six tanks with a combined total storage volume of 1 MG and has adequate available water storage to serve ASD. A summary of ASCWD water storage, including ASD, is shown in Table 6. Of note is that storage available at the top of the system is available for all pressure zones via pressure valves.

Table 6: Pressure Zone Surplus/Deficit Summary with Alpine Sierra Demands

Pressure Zone	MDD (gpm)	Min Req'd O&E (gal)	Fire Storage Req'd	Tank(s)	Available Storage (gal)	Total Req'd Storage	Storage Req'd from Zone 1	Available Surplus Storage
Zone 1	108	155,500	120,000	1, 4, 4A	700,000	275,500	-	424,500
Zone 2	108	156,200		2	100,000	156,200	YES	368,300
Zone 3	221	317,700		3	100,000	317,700	YES	150,600
Zone 4	53	75,600		5	100,000	75,600	YES	175,000
Totals	**490**	**705,000**	**120,000**		**1,000,000**	**825,000**		**175,000**

Proposed Water Facility Improvements to Serve the Alpine Sierra Development

The proposed improvements to serve ASD consist of supply and distribution system improvements. Required improvements identified include sizing of transmission facilities, supply redundancy and satisfying required fire flow and pressure design criteria. The facilities identified during each phase of the development are based on meeting the design requirements and providing at least two points of connection to the existing ASCWD water system to provide supply redundancy and added reliability. Phasing of the water infrastructure is depicted in Figure 1, and recommendations are based on logical segments of work triggered by discrete project development activities. Although the order of development will ultimately be market driven, ASD anticipates that the dense development located nearest Alpine Meadows Road will be developed first and this plan follows that assumption. The improvements have been described in terms of three phases. The phasing sequence is a function of triggering events which can be phased, or possibly developed as one continuous project depending on the pace of development. Note that, if services for the third phase were required prior to Phase 1, some (or all) of the Phase I infrastructure would have to be completed simultaneously. It is important to note that any changes to the phasing order will not necessarily result in changes to the planned/designed infrastructure.

<u>Phase 1</u>

Phase I, located along Court B and a portion of Road A, consists of 20 units including 14 townhomes and 6 SFUs. Transmission improvements to serve Phase I include 2,250 LF of 8-inch diameter pipe. Water service to Phase I can be provided via a connection to the existing ASCWD 8-inch pipeline at the intersection of Alpine Springs Road and Road A (see Figure 1). The townhomes are planned along Court B and have the highest service elevations within the ASD. For this reason, the

secondary connection to the development must come from Zone 1 in order to meet service pressure criteria.

Phase 2

The remainder of the ASD is comprised of the western area which has been divided in this evaluation into Phases 2A and 2B (see Figure 1). This eastern area consists of 27 lots containing 27 SFUs and up to 5 separate guest houses.

Phase 2A - consists of an extension of the Phase I piping along Road A and includes piping within Court C and Court D. The total length of pipe is approximately 2,830 LF of 8-inch diameter pipe. A PRV station at the intersection of Road A and Court C is required to reduce service pressures within lower elevation lots along Courts C and D. A secondary emergency supply connection can be made using a check valve connection to the existing 6-in ASCWD main that supplies Zone 2 (Tank 2 main). Although the hydraulic grade of this main is lower than Zone 1, it is sufficient to maintain service pressures above 40 PSI in Zones 2 and 3.

Phase 2B - consists of the extension of the 8-inch diameter pipe westward to the end of Road A (approximately 1,020 LF). A secondary ASD supply connection to the existing 4-inch spring supply main from Horizontal Well #1 will be required. The 4-inch supply main will be converted into a distribution system main and will require relocation of the chlorination facility to a point upstream of the proposed connection point located within ASD. Two existing water mains traverse Lots 9 and 10 of the proposed development. These mains include the existing 4-inch spring supply main and the12-inch snowmaking main. It is assumed that these mains will need to be relocated outside of the development area.

System Deficiencies and Recommended ASCWD Water Supply and Distribution System Improvements

The existing ASCWD distribution system limitations and deficiencies were identified in the hydraulic modeling evaluation, and recommended system improvements to mitigate these deficiencies have been developed.

Noted distribution system deficiencies are as follows:

- Max day supply capacity deficiencies in pressure zones 2 and 3.
- Source water and supply reliability concerns
- Areas with pressure and fire flow deficiencies (available fire flow <1,000 gpm) during maximum day demand conditions.

Zonal Supply Capacities

A review of the existing system supply and demand (Table 4) reveals maximum day supply deficiencies in Zone 2 and Zone 3 of 7 gpm and 189 gpm, respectively. With the addition of ASD, the deficiency will increase the demand deficit in both zones by 31 gpm. It is recommended that excess capacity from Zone 4 be used to mitigate the supply deficiencies within zones 2 and 3. Zone 4 is located at the bottom of the distribution system and is normally supplied by Well R1 with a capacity of 350 gpm. Well R1 is also used to provide snowmaking water to the Alpine Meadows Ski Area. A booster pump station and dedicated 12" pipeline convey the water to the ski area. During an emergency, water from Well R1 can also be delivered into Pressure Zone 1 through a normally closed connection between the snowmaking pipeline and the potable water system. Per ASCWD, the existing booster pump station does not meet the District's standards to reliably supply potable water to the distribution system. Furthermore, there are water quality concerns within the snowmaking pipeline, including the long residence time and potentially very low chlorine residuals, which would require flushing and disinfection prior to potable use. Therefore, use of the snowmaking

pipeline to convey maximum day demands is not practical or acceptable to the ASCWD. The preferred option is to convey excess supply capacity from Well R1 through the existing distribution system from Pressure Zone 4 at the bottom of the valley up through Pressure Zone 3, Pressure Zone 2 and finally into Pressure Zone 1. This can be accomplished by rebuilding the existing B1 pump station (Pump Station B) and installing two new pump stations (Pump Stations C & D). Figure 2 shows the approximate location of proposed pump stations. These booster pump station improvements, sized to mitigate existing deficiencies and supply ASD, are a part of Phase I.

The initial size and capacity of each proposed booster pump station are intended to mitigate the current maximum day supply deficits within Pressure Zones 2 and 3, and would be required to occur with ASD Phase I. It is recommended that ultimately, booster pump stations B, C and D are upgraded to convey the total ASCWD build out maximum day demand to add supply redundancy

and system reliability. This would provide an ability to convey water from Zone 4 to all upper zones in the event that existing wells have future production challenges or diminished capacities. Although these improvements are not imminent, the initial booster pump stations should be designed to accommodate the future retrofit of the larger pump equipment. The proposed pump stations were located adjacent to their corresponding existing pressure reducing stations. The initial and buildout capacities for each of the proposed pump stations are shown in Tables 7 and 8, respectively.

Table 7: Initial Booster Pump Station Capacities (includes ASD)

Pressure Zone	Well Supply (gpm)	MDD with ASD[1] (gpm)	MDD Surplus/ Deficit (no BPS)	Initial BPS Capacity (gpm)	MDD Surplus with Initial BPS (gpm)
1	178	108	70	0	12
2 & 2A	0	206.4	-136.4	200	27
3 (-2A)	39	122.6	-83.6	300	2
4	350	54	296	n/a	194
Total	**567**	**491**			

[1] Existing zonal MDD were obtained from the updated hydraulic model after revising pressure zone boundaries for Pump Zone 2A.

Table 8: Buildout Booster Pump Station Capacities

Pressure Zone	Well Supply[2] (gpm)	Buildout MDD[1] (gpm)	Surplus/ Deficit (no BPS)	Buildout BPS Capacity (gpm)	MDD Surplus with Buildout BPS (gpm)
1	0	108	-108	120	12
2 & 2A	0	253	-253	400	27
3 (-2A)	0	198	-198	600	2
4	850	56	794	850	194
Total	**850**	**615**			

[1] Buildout zonal MDD were obtained from the updated hydraulic model after revising pressure zone boundaries for the proposed Pump Zone 2A.

[2] Well R2 will need to be improved prior to its use as a potable water supply. Well R2 exceeds the Mn standard and would require treatment or blending improvements. In addition, a chlorine feed system improvement would be required.

System Pressure and Fire Flow Deficiencies

Water supply to Zone 2 is from a single 6" feed from Zone 1 through 2" and 3" dual PRVs. These small PRVs limit flow and result in available fire flows below 1,000 gpm within Zone 2 along John Scott Trail (see Figure A-1). The following improvements are recommended to increase supply and fire flows in Zone 2:

- Upsize the 2"/3" regulators to 3"/6".
- Install a second feed pipeline from Zone 1 to Zone 2 to increase supply redundancy and fire flows to Zone 2. This pipe consists of 500 feet of 8-inch ID pipe routed from White Wolf to John Scott Trail and includes a 6" pressure reducing station. The alignment of the proposed pipe is shown in Figure 1.

Pressure and fire flow deficiencies exist in the Juniper Mountain Subdivision (JMS), and fire flow and redundancy deficiencies exist in portions of the Bear Creek Subdivision (BCS) and Alpine Estates Subdivision (AES) along John Scott Trail. In order to correct the deficiencies in JMS, it is recommended that the pressure zone boundaries for Zones 2 and 3 be modified. These modifications consist of creating a separate pressure zone between Zones 2 and 3, identified as Zone 2A. Location of this proposed new pressure zone is shown in Appendix Figure A-2. Facilities required for the creation of Pressure Zone 2A include the installation of approximately 820 feet of 8-inch waterline and two pressure reducing stations. The proposed changes will increase the maximum day demand pressure at the highest point in Zone 2A to 70 psi without use of the existing booster pump. Fire flow throughout Pressure Zone 2A will exceed 1,000 gpm with the only exception located at the highest elevations along Zurs Court. Resulting fire flows at the existing fire hydrant in Zurs Court area are estimated to be 940 gpm with a residual pressure of 20 psi. The proposed facilities significantly improve the available fire flows and pressure in the JMS without operation and maintenance of a local dedicated booster/fire pump system. Figure A-1 in the Appendix presents the available fire flow and MDD service pressures without recommended improvements and Figure A-2 and Figure A-3 present the available fire flow and MDD service pressures with the recommended improvements presented in this memorandum.

Creation of Zone 2A impacts the buildout sizes of the proposed booster pump stations by shifting approximately 100 gpm of maximum day demands from Zone 3 to Zone 2A resulting is an increase in Zone 2 demands and subsequent increase in the amount of water that would need to be pumped up from Zone 3 to Zone 2. Zone 2A will be fed from Zone 2 through two proposed pressure regulating stations. Zone 2A maximum day demands were determined by summing up the hydraulic model node demands within the zone.

Summary of the Recommended ASCWD Supply and Distribution System Reliability Improvements

A summary of the recommended water system improvements needed to address system deficiencies and improve overall system reliability, service pressures and fire flows has been developed. The improvements are listed in order of priority.

- Mitigation of zonal supply deficiencies with the installation of three booster pump stations (pump stations. B, C, &D) that will convey excess supply from Zone 4 to Zone 3, Zone 2 and Zone 1. This is a Phase I improvement to be implemented with Phase I of ASD.

- Zone 1 to 2 PRV, Upgrade: Replace existing 2" & 3" PRVs with 3" & 6" PRVs. This will provide fire flows from Zone 1 storage during emergencies and reduce maintenance issues by the installation of a 3" anti-cavitation valve to address the high differential operating pressure at this site.
- Zone 1 to 2, 8" secondary supply main: Install 500' of 8" main along Alpine Meadows Road between White Wolf and John Scott Trail. This improvement provides an increase in service pressures and a significant increase in available fire flows and redundancy throughout Zone 2 and 2A, and provides a needed second connection to Zone 1.
- 6" PRV upgrade: Install a 6" PRV at Booster Station B2 site. Improves fire flow in Deer Park area and in proposed Pressure Zone 2A.
- John Scott Trail 8" Main Upgrade & PRV: Install 820' of 8" main along John Scott Trail between Upper Bench and Mineral Springs and new 3"/6" PRV vault. This allows for the creation of pressure Zone 2A and allows the upper portions of Juniper Mountain to meet fire flows and service pressures without a dedicated booster pump.
- Rebuild Pump Station A: Rebuild will increase capacity to supply pressure Zone 1 MDD with water from Zone 2.
- Additional Capacity to proposed Pump Stations C&D: Added capacity will allow the ASCWD to supply the water system from the bottom during MDD if horizontal wells are out of service.
- Additional Capacity to proposed Pump Stations B: Added capacity will allow the ASCWD to supply the water system from the bottom during MDD if horizontal wells are out of service.
- Additional fire flow and redundancy improvement: Install 920 LF of 6-in diameter main connecting the NE portion of ASD to the BCS. This improvement would provide a third point of connection between Zones 1 and 2 with improvements in fire flow along portions of John Scott Trail in the BCS and AES. This option cannot be a substitute for other improvements.

Table 8 provides a summary of the recommended improvements, trigger events, purpose/benefit of the proposed improvements, initial and buildout capacities, and probable cost. The recommended improvements are depicted in Figures 1, 2, and Figure A-1 in the Appendix.

Opinion of Probable Costs

A planning level opinion of probable costs for the recommended infrastructure improvements has been developed (see Table 8). It should be noted that the cost opinion for each booster pump station includes a pressure relief valve and one fully redundant pump. The probable costs do not include backup power at each pump station. Detailed development of these costs is included in the Appendix.

Stantec has also provided an opinion of probable cost for equipping each booster pump station with a single pump and the cost difference to increase the size of the pump from that needed by the ASD and the size identified for each pump at buildout. This difference is shown as cost to be allocated to ASCWD.

Table 9: Development Water Facilities, Recommended Water Distribution System Improvements & Opinion of Probable Costs

No.	Item Description	Trigger Event	Benefits	Probable Cost	ASCWD Buildout Capacity (gpm)	ASCWD Initial/ Phased Capacity (gpm)	Capacity Required by ASD (gpm)
Alpine Sierra Phase I Development							
1a	ASD Internal Water Supply Improvements	Phase I	Internal on-site infrastructure required for development demands and fire flows.	$265,700	-		all
1b	Installation of Booster Pump Stations B, C and D. Includes installation of 3" by-pass PRV at Booster Station B.	Phase I	Installation of pump stations from bottom of the valley to meet new demands since Zone 2 is resource deficient on MDD. Installed Capacities:				
			Booster Pump Station B (Zones 3/2, Initial Capacity Cost)	$128,800	400	200	31
			Booster Pump Station C&D (Zones 4/3, Initial Capacity Cost)	$351,500	600	300	31
Alpine Sierra Phase 2A Development							
2	ASD Internal Water Supply Improvements	Phase 2A	Internal on-site infrastructure required for development demands and fire flows.	$423,100	-		all
Alpine Sierra Phase 2B Development							
3	ASD Internal Water Supply Improvements	Phase 2B	Internal on-site infrastructure required for development demands and fire flows.	$337,800	-		all
Recommended ASCWD System Improvements (In order of recommended priority)							
4	Zone 1/2 PRV Upgrade: Replace 2"/3" PRVs with 3"&6" PRVs	-	Upgrade will provide fire flow during an emergency from Zone 1 and a new 3" anti-cavitation valve will reduce maintenance requirements.	$54,700	-	-	-

No.	Item Description	Trigger Event	Benefits	Probable Cost	ASCWD Buildout Capacity (gpm)	ASCWD Initial/ Phased Capacity (gpm)	Capacity Required by ASD (gpm)
5	Install 500' of 8" pipe along Alpine Meadows Road (White Wolf to John Scott Trail) & 6" PRV.	-	Upgrade will increase marginal pressures and fire flows (Increased from 950 to 2,500 gpm) along John Scott Trail. This connection provides a much needed second connection between Zones 1 and 2.	$120,000			
6	Install 6" PRV at Existing Booster Station B2 at the end of Cub Lane.	-	Increases fire flow throughout the Deer Park Dr. area.	$44,000			
7	Install 820' of 8" pipe and 3"/6" PRV vault along John Scott Trail between Upper Bench and Mineral Springs		Once installed along with item 6 above, the HGL of this area can be increased to 6810' to create a new pressure zone (2A). The result will be higher pressures in the Juniper Mountain area (70psi) and fire flows in excess of 1,000 gpm with minor exceptions.	$160,000			
8	Rebuild Booster Pump Station A		Rebuild will transfer sufficient water from Zone 2 to Zone 1 to meet MDD at Buildout in case the springs fail. (Design Point: 120 gpm @ 185' TDH; 10hp)	$154,000			
9	Add capacity to Booster Pump Stations C & D		Added capacity will allow the district to supply the water system from the bottom during maximum day demand if springs fail. Basis of design and cost estimate includes one redundant pump (3 pumps @ 300 gpm).	$140,500	600	300	

No.	Item Description	Trigger Event	Benefits	Probable Cost	ASCWD Buildout Capacity (gpm)	ASCWD Initial/ Phased Capacity (gpm)	Capacity Required by ASD (gpm)
10	Add capacity to Booster Pump Station B		Added capacity will allow the district to supply the water system from the bottom during maximum day demand if springs fail. Basis of design and cost estimate includes one redundant pump (3 pumps @ 200 gpm).	$61,000	400	200	
11	Install 920' of 6" main connecting the NE portion of ASD to BCS		This improvement would provide a third point of connection between Zones 1 and 2 with improvements in fire flow along portions of John Scott Trail in the BCS and AES.	$90,000			

Sewer Evaluation

The current evaluation includes the identification of two sewer connection options for the ASD and development of probable cost estimates for each option. The two sewer connection options evaluated included:

- A gravity sewer connection from the proposed development to the existing sewer collection system.
- A sewer lift station and force main to the existing gravity sewer located on the subject property.

Per page 33 of the ASCWD Recommended Long Range Water and Sewer Masterplan prepared by Lumos and Associates dated December 2006, there is sufficient capacity in the existing sewer system to convey flows from the proposed ASD. Lumos conducted a capacity analysis and had the following conclusion: "this capacity analysis concludes that unless substantial growth is seen in the Alpine Springs community, the size of the sewer system will continue to adequately serve the community." Therefore, the current evaluation did not include a hydraulic analysis. The opinion of probable cost developed for each evaluation does not include sewer collection system improvement within the development that would be common to either scenario. Opinion of probable costs for common sewer collection system improvements have been identified as separate items associated with each phase of the development.

Sewer Gravity Flow Option

The first sewer connection option consists of installing an 8-inch gravity flow sewer pipe from the cul-de-sac at the northeast corner of the proposed development through the BCS Common Area to the existing sewer main beneath John Scott Trail. The proposed location and alignment is shown on Figure 3. The proposed alignment required the installation of approximately 400 linear feet of 8-inch diameter sewer main and one manhole. The opinion of probable cost for this option is $94,000. The development of this probable cost is detailed and included in the Appendix.

Sewer Lift Station Option

The second sewer connection option consists of installing a sewer lift station and approximately 1,300 linear feet of 4-inch sewer force main from the lift station to the existing sewer main crossing the property. This planning level evaluation estimated that the lift station would require the installation of two 10-hp pumps with a reliable flow capacity of 100 gpm with on-site standby power. The preliminary location and alignment are shown on Figure 4. The opinion of probable cost for this option is $580,000. The development of this probable cost is detailed in the Appendix. It was assumed that a formal structure is not required for the lift station and that the control panels and generator can be housed in a weather resistant outdoor cabinet/enclosure. Estimated annual operation and maintenance costs for the facility were developed based on the assumption that up to 12 hours per month are required for maintenance of the lift station, average power costs and pump replacement costs. The resulting estimated O&M costs are approximately $5,000 per year. This O&M cost does not include maintaining year-round access to the facility or replacement or repair of major pieces of equipment other than the pumps, or depreciation.

The gravity connection option would be the least cost alternative, be easier to maintain, have a lower potential odor issue, lower chance of overflow, and would require that ASCWD acquire a utility, access and maintenance easement from the BCS.

The opinion of probable costs and trigger events for the proposed sewer facilities are listed in Table 9.

Preliminary Public Utility Easements Associated with the ASD Property

It is important that ASCWD acquire public utility access and maintenance easements for existing and future utility infrastructure (water and sewer) alignments on and adjacent to the ASD property. The identified existing and proposed alignments are shown in Figure 5. Proposed utility, access and maintenance easements of 20-ft are recommended except for the easement for between ASD and BCS which should be 25-ft to provide sufficient area for both water and sewer facilities. Information used in the analysis was obtained from ASCWD and ASD in electronic format (CAD drawing). Results are preliminary and did not include field surveys or development of final easements or legal descriptions.

Table 10: Sewer Facilities & Opinion of Probable Costs

No.	Item Description	Trigger Event	Benefits	Probable Cost
Option 1	Installation of gravity flow connection to existing sewer in John Scott Trail	Phase 1	On and off-site infrastructure required to convey flows to existing sewer system	$94,000
Option 2	Installation of Sewer Lift Station	Phase 1	On-site infrastructure required to convey flows to existing sewer system	$642,000
3	Phase 1 Sewer Collection Improvements.	Phase 1	On-site internal infrastructure required to collect sewer flows from Alpine Sierra.	$168,000
4	Phase 2A Sewer Collection Improvements, including relocation of existing sewer.	Phase 2A	On-site internal infrastructure required to collect sewer flows from Alpine Sierra.	$408,000
5	Phase 2B Sewer Collection Improvements, including relocation of existing sewer.	Phase 2B	On-site internal infrastructure required to collect sewer flows from Alpine Sierra.	$155,000

APPENDIX

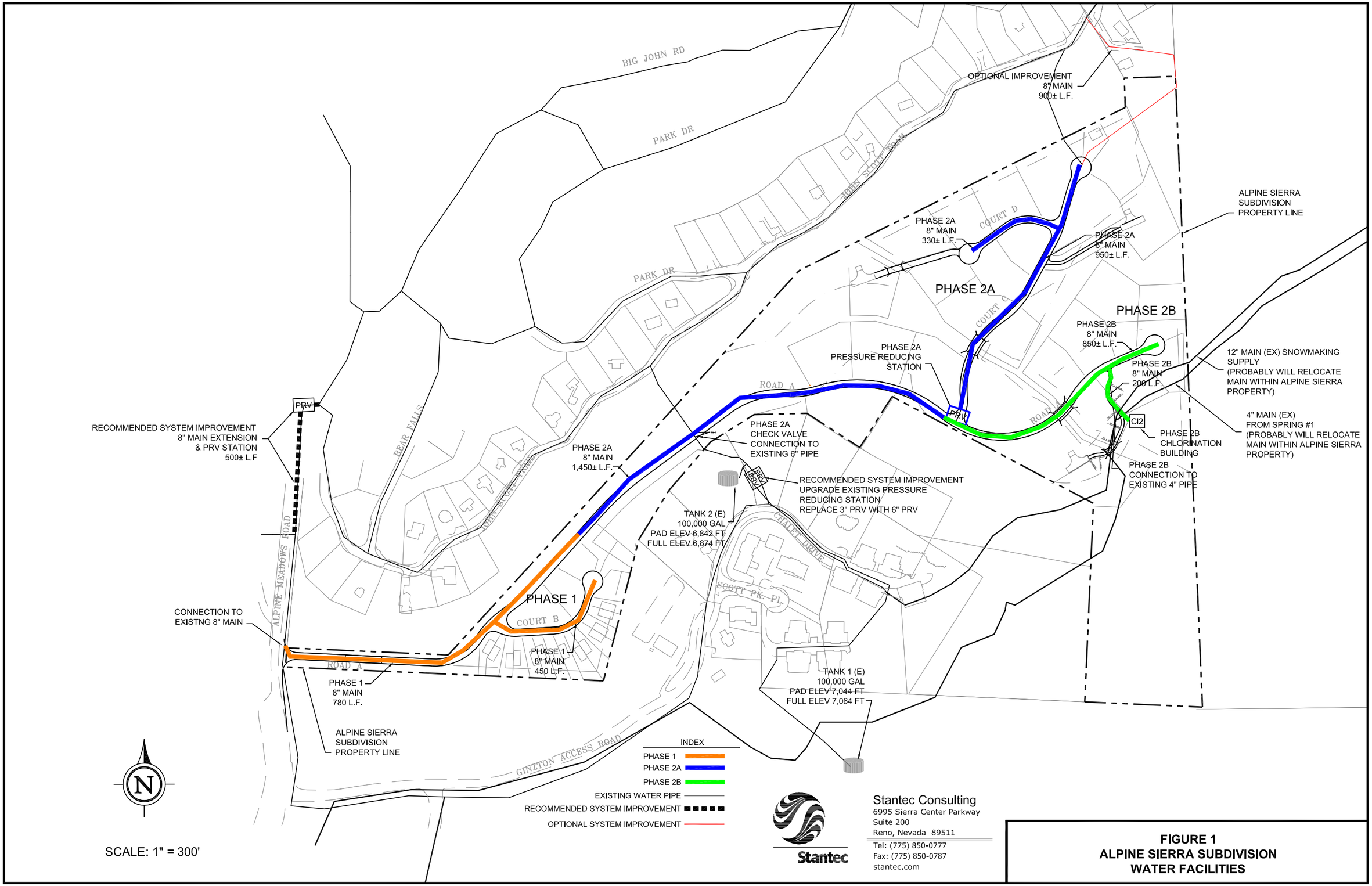

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FIGURE 1
ALPINE SIERRA SUBDIVISION
WATER FACILITIES

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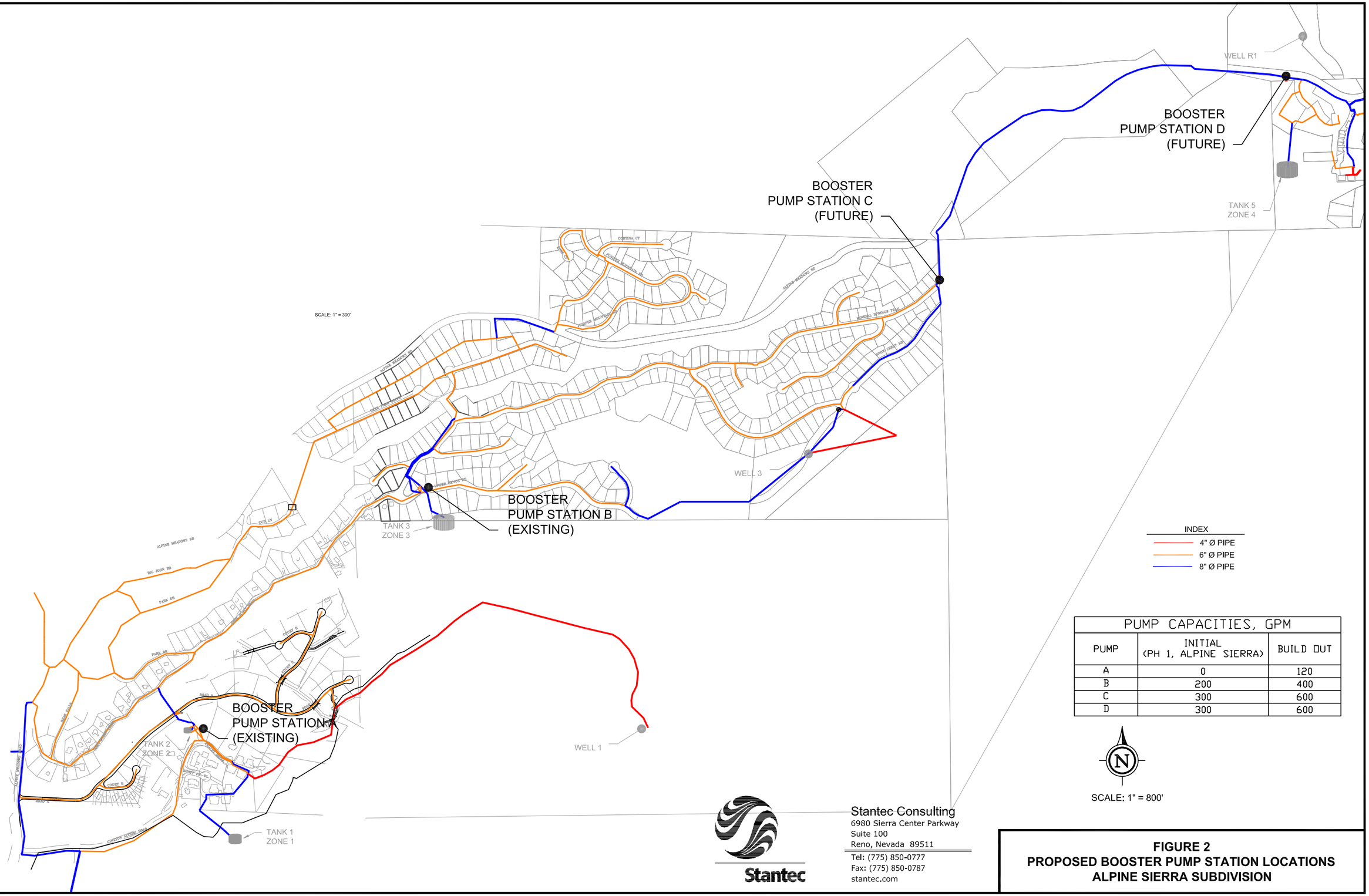

PUMP CAPACITIES, GPM		
PUMP	INITIAL (PH 1, ALPINE SIERRA)	BUILD OUT
A	0	120
B	200	400
C	300	600
D	300	600

FIGURE 2
PROPOSED BOOSTER PUMP STATION LOCATIONS
ALPINE SIERRA SUBDIVISION

FILE SPEC: V:\2053\Active\2013\205300136 ALPINE SIERRA SUBDIVISION\Water Model\Alpine_Model_2013-08-04.dwg
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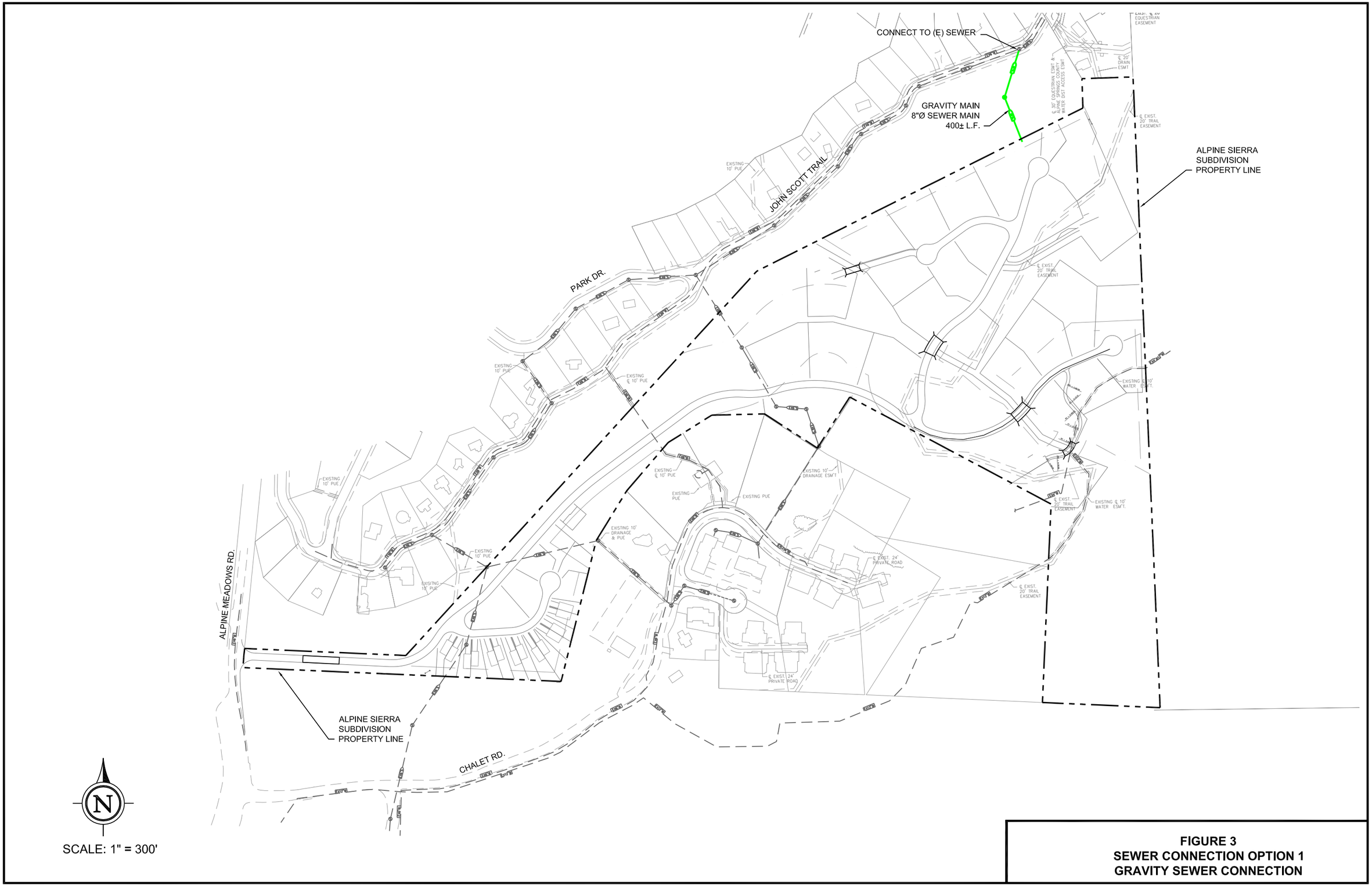

FIGURE 3
SEWER CONNECTION OPTION 1
GRAVITY SEWER CONNECTION

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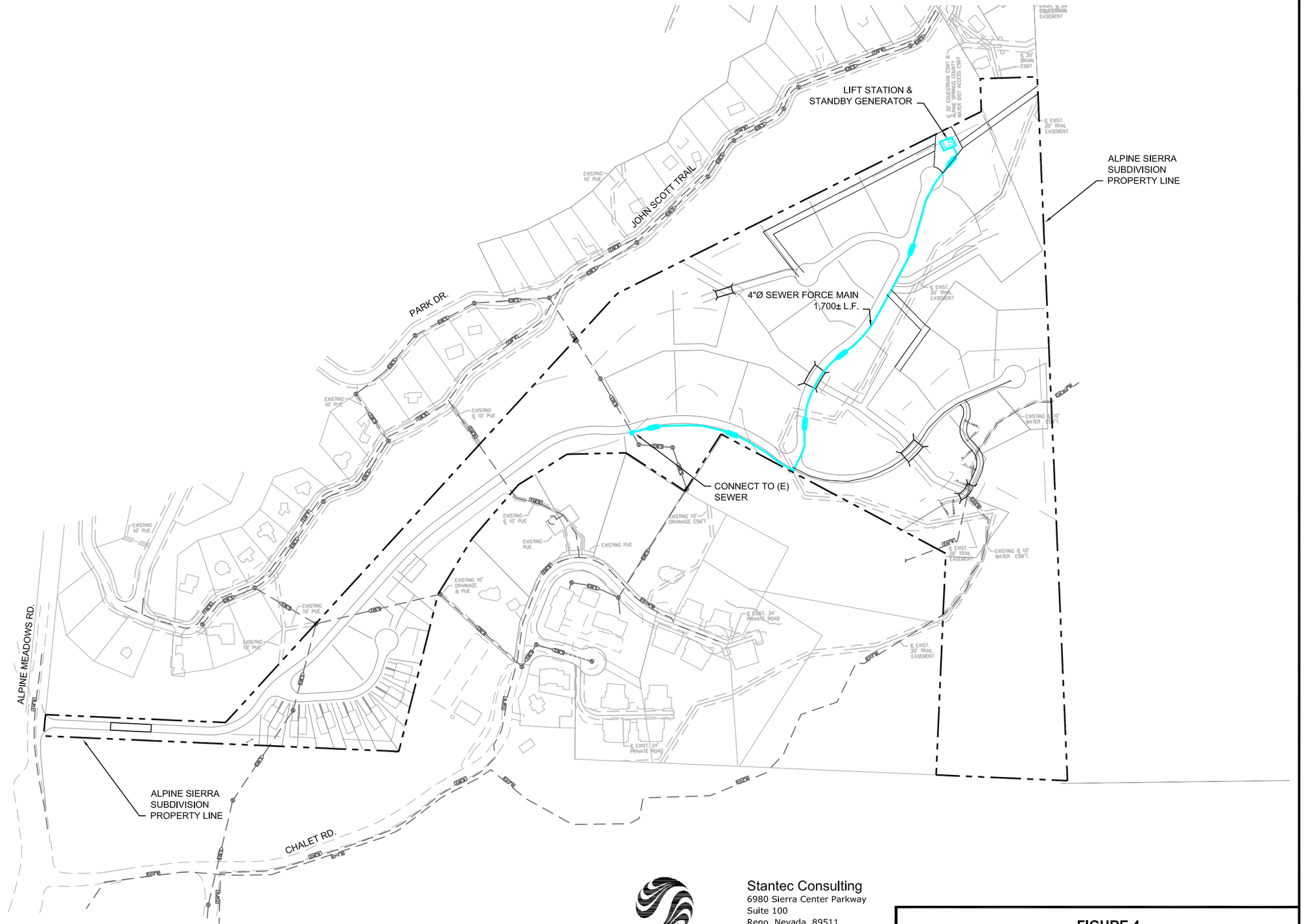
PLOT DATE: Aug 14, 2013 - 6:38pm



SCALE: 1" = 300'

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FIGURE 4
SEWER CONNECTION OPTION 2
SEWER LIFT STATION & FORCE MAIN

FILE SPEC: V:\2053\Active\2013\205300136 ALPINE SIERRA SUBDIVISION\drawing\Sewer Figure_2013.dwg
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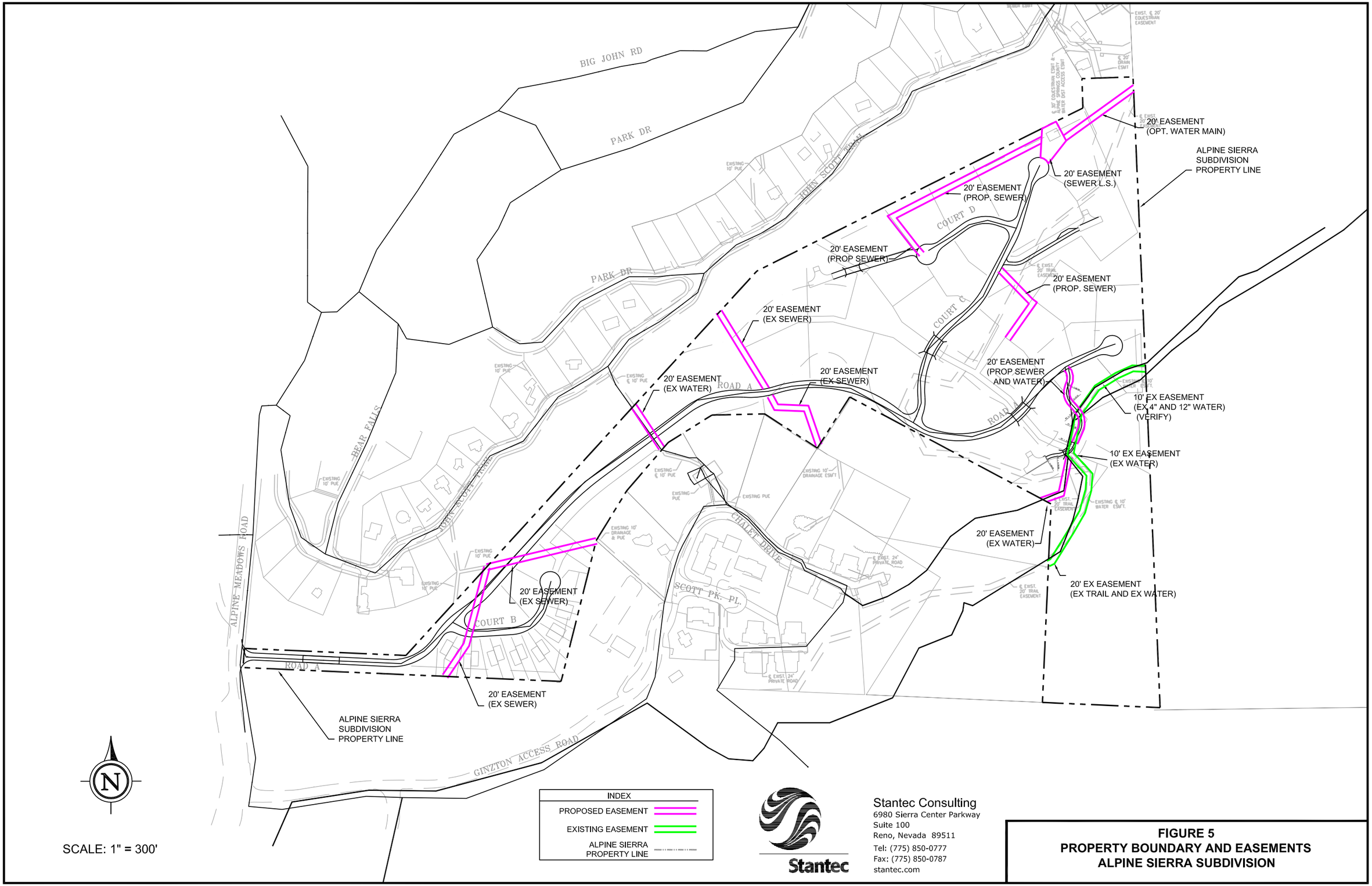

SCALE: 1" = 300'

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FIGURE 5
PROPERTY BOUNDARY AND EASEMENTS
ALPINE SIERRA SUBDIVISION

FILE SPEC: V:\2053\Active\2013\205300136 ALPINE SIERRA SUBDIVISION\Water Model\Alpine_Model_2013-08-04.dwg
PLOT DATE: Aug 14, 2013 - 8:28pm

Phase 1 - Alpine Sierra Subdivision Water Improvements
Opinion of Probable Costs

Phase 1 -	Alpine Sierra Subdivision Water Improvements								
1.0	Mobilization/Demobilization	1	L.S.	$	15,000	$	15,000	**$**	**15,000**
2.0	**Pipelines**								
2.1	8" Pipe (Alpine Meadows Rd to Ph1 Development)	1,200	L.F.	$	80	$	96,000		
2.3	8" Pipe (Pipe within Court B)	450	L.F.	$	80	$	36,000		
3.0	**Appurtenances**								
3.1	Fire Hydrants	3	EACH	$	6,000	$	18,000		
3.2	Check Valve Connection	1	L.S.	$	15,000	$	15,000		
						Subtotal		**$**	**165,000**
4.0	**Engineering, Permitting, Etc.**								
4.1	Engineering, Pre-Design and Design (8%)					$	14,400		
4.2	Construction Management (10%)					$	18,000		
4.3	Permitting/ROW/Legal (5%)					$	9,000		
						Subtotal		**$**	**41,400**
5.0	**Other**								
5.1	Contingency (20%)					$	44,300		
						Total		**$**	**265,700**

Phase 2A - Alpine Sierra Subdivision Water Improvements
Opinion of Probable Costs

Phase 2A	Alpine Sierra Subdivision Water Improvements								
1.0	Mobilization/Demobilization	1	L.S.	$	2,500	$	2,500	**$**	**2,500**
2.0	**Pipelines**								
2.1	8" Pipe (Ph 1 to Court C)	1,450	L.F.	$	80	$	116,000		
2.1	8" Pipe (Pipe within Court C)	955	L.F.	$	80	$	76,400		
2.1	8" Pipe (Pipe within Court D)	335	L.F.	$	80	$	26,800		
3.0	**Appurtenances**								
3.1	PRV Station (2" & 6")	1	L.S.	$	35,000	$	35,000		
3.2	Fire Hydrants	5	EACH	$	6,000	$	30,000		
						Subtotal		**$**	**284,200**
4.0	**Engineering, Permitting, Etc.**								
4.1	Engineering, Pre-Design and Design (8%)					$	22,900		
4.2	Construction Management (10%)					$	28,700		
4.3	Permitting/ROW/Legal (5%)					$	14,300		
						Subtotal		**$**	**65,900**
5.0	**Other**								
5.1	Contingency (20%)					$	70,500		
						Total		**$**	**423,100**

Phase 2B - Alpine Sierra Subdivision Water Improvements
Opinion of Probable Costs

Phase 2B	Alpine Sierra Subdivision Water Improvements								
1.0	Mobilization/Demobilization	1	L.S.	$	10,000	$	10,000	**$**	**10,000**
2.0	**Pipelines**								
2.1	4" Spring Pipe Replacement	650	L.F.	$	45	$	29,250		
2.2	8" Pipe (see Water Plan Figure)	850	L.F.	$	70	$	59,500		
2.3	12" Snowmaking Pipe Replacement	500	L.F.	$	80	$	40,000		
3.0	**Appurtenances**								
3.1	Chlorination Facility	1	L.S.	$	75,000	$	75,000		
3.2	Connect 6" Ph 2 main to 4" existing main	1	L.S.	$	10,000	$	10,000		
3.3	Fire Hydrants	1	EACH	$	6,000	$	6,000		
						Subtotal		**$**	**219,750**
4.0	**Engineering, Permitting, Etc.**								
4.1	Engineering, Pre-Design and Design (8%)					$	18,000		
4.2	Construction Management (10%)					$	23,000		
4.3	Permitting/ROW/Legal (5%)					$	11,000		
						Subtotal		**$**	**52,000**
5.0	**Other**								
5.1	Contingency (20%)					$	56,000		
						Total		**$**	**337,800**

Optional Items - Alpine Sierra Subdivision
Opinion of Probable Costs

	Alpine Sierra Subdivision Water Improvements								
1.0	Mobilization/Demobilization	1	L.S.	$	5,000	$	5,000	**$**	**5,000**
2.0	**Pipelines**								
2.1	8" Pipe (Main connecting Phase 2 to ASCWD 6" main in John Scott Trail)	920	L.F.	$	80	$	73,600		
3.0	**Appurtenances**								
						Subtotal		**$**	**73,600**
4.0	**Engineering, Permitting, Etc.**								
4.1	Engineering, Pre-Design and Design (8%)					$	6,300		
4.2	Construction Management (10%)					$	7,900		
4.3	Permitting/ROW/Legal (5%)					$	3,900		
						Subtotal		**$**	**18,100**
5.0	**Other**								
5.1	Contingency (20%)					$	19,300		
						Total		**$**	**120,000**

Booster Pump Stations C & D
Opinion of Probable Costs

	Pump Stations C & D - Buildout Capacity 600 GPM								
1.0	Mobilization/Demobilization	1	L.S.	$	20,000	$	20,000	**$**	**20,000**
2.0	**Pipelines**								
3.0	**Pump Stations C & D**								
3.1	Sitework	1	L.S.	$	5,000.00	$	5,000		
3.3	Pumps for C (300gpm/pump @ 180') Submersible Pump & Pitless Adpater (20hp)	3	EACH	$	25,000	$	75,000		
3.4	Pumps for D (300gpm/pump @ 200') Submersible Pump & Pitless Adpater (20hp)	3	EACH	$	25,000	$	75,000		
3.5	Electrical	2	L.S.	$	30,000	$	60,000		
3.6	Electrical Improvements - Offsite	2	L.S.	$	20,000	$	40,000		
3.7	Telemetry Improvements	2	L.S.	$	20,000	$	40,000		
3.8	Site Piping	2	L.S.	$	10,000	$	20,000		
3.9	Pressure Relief Valve	2	EACH	$	5,000	$	10,000		
						Subtotal		**$**	**325,000**
4.0	**Engineering, Permitting, Etc.**								
4.1	Engineering, Pre-Design and Design					$	27,000		
4.2	Construction Management (6%)					$	20,700		
4.3	Permitting/ROW/Legal (5%)					$	17,300		
						Subtotal		**$**	**65,000**
5.0	**Other**								
5.1	Contingency (20%)					$	82,000		
						Total		**$**	**492,000**

Phase 1 - Booster Pump Stations C & D
Opinion of Probable Costs

Phase 1	Pump Stations C & D - Capacity 300 GPM								By: BEL 8/7/13
1.0	Mobilization/Demobilization	1	L.S.	$	15,000	$	15,000	**$**	**15,000**
2.0	**Pipelines**								
3.0	**Pump Stations C & D**								
3.1	Sitework	1	L.S.	$	5,000.00	$	5,000		
3.3	Pumps for C (300gpm/pump @ 180') Submersible Pump & Pitless Adpater (20hp)	1	EACH	$	25,000	$	25,000		
3.4	Pumps for D (300gpm/pump @ 200') Submersible Pump & Pitless Adpater (20hp)	1	EACH	$	25,000	$	25,000		
3.5	Electrical	2	L.S.	$	25,000	$	50,000		
3.6	Electrical Improvements - Offsite	2	L.S.	$	20,000	$	40,000		
3.7	Telemetry Improvements	2	L.S.	$	20,000	$	40,000		
3.8	Site Piping	2	L.S.	$	8,000	$	16,000		
3.9	Pressure Relief Valve	2	EACH	$	5,000	$	10,000		
						Subtotal		**$**	**211,000**
4.0	**Engineering, Permitting, Etc.**								
4.1	Engineering, Pre-Design and Design					$	27,000		
4.2	Construction Management					$	22,600		
4.3	Permitting/ROW/Legal					$	17,300		
						Subtotal		**$**	**66,900**
5.0	**Other**								
5.1	Contingency (20%)					$	58,600		
						Total		**$**	**351,500**

Booster Pump Stations B
Opinion of Probable Costs

	Pump Station B - Buildout Capacity 400 GPM							By: DSK 11/23/10
1.0	Mobilization/Demobilization	1	L.S.	$	6,000	$	6,000	**$ 6,000**
2.0	**Pipelines**							
3.0	**Pump Stations B**							
3.1	Sitework	1	L.S.	$	5,000.00	$	5,000	
3.3	Pumps for B (200gpm/pump @ 220') Submersible Pump & Pitless Adpater (15hp)	3	EACH	$	20,000	$	60,000	
3.5	Electrical	1	L.S.	$	25,000	$	25,000	
3.7	Telemetry Improvements	1	L.S.	$	15,000	$	15,000	
3.8	Site Piping	1	L.S.	$	10,000	$	10,000	
3.90	Pressure Relief Valve	1	EACH	$	5,000	$	5,000	
							Subtotal	**$ 120,000**
4.0	**Engineering, Permitting, Etc.**							
4.1	Engineering, Pre-Design and Design					$	13,500	
4.2	Construction Management (10%)					$	12,600	
4.3	Permitting/ROW/Legal (5%)					$	6,300	
							Subtotal	**$ 32,400**
5.0	**Other**							
5.1	Contingency (20%)					$	31,700	
							Total	**$ 190,100**

Phase 1 - Booster Pump Stations B
Opinion of Probable Costs

Phase 1	Pump Station B - Capacity 200 GPM							By: BEL 8/7/13
1.0	Mobilization/Demobilization	1	L.S.	$	5,000	$	5,000	**$ 5,000**
2.0	**Pipelines**							
3.0	**Pump Stations B**							
3.1	Sitework	1	L.S.	$	5,000.00	$	5,000	
3.3	Pumps for B (200gpm/pump @ 220') Submersible Pump & Pitless Adpater (15hp)	1	EACH	$	20,000	$	20,000	
3.5	Electrical	1	L.S.	$	20,000	$	20,000	
3.7	Telemetry Improvements	1	L.S.	$	18,000	$	18,000	
3.8	Site Piping	1	L.S.	$	8,000	$	8,000	
3.90	Pressure Relief Valve	1	EACH	$	2,500	$	2,500	
							Subtotal	**$ 73,500**
4.0	**Engineering, Permitting, Etc.**							
4.1	Engineering, Pre-Design and Design					$	13,500	
4.2	Construction Management					$	9,000	
4.3	Permitting/ROW/Legal					$	6,300	
							Subtotal	**$ 28,800**
5.0	**Other**							
5.1	Contingency (20%)					$	21,500	
							Total	**$ 128,800**

Booster Pump Station A
Opinion of Probable Costs

	Pump Station A - Rebuild Capacity 120 GPM								
1.0	Mobilization/Demobilization	1	L.S.	$	5,000	$	5,000	**$**	**5,000**
2.0	**Pipelines**								
3.0	**Pump Station A**								
3.1	Sitework	1	L.S.	$	2,500.00	$	2,500		
3.3	Pumps for B (60gpm/pump @ 185') Submersible Pump & Pitless Adpater (5hp)	3	EACH	$	15,000	$	45,000		
3.5	Electrical	1	L.S.	$	20,000	$	20,000		
3.7	Telemetry Improvements	1	L.S.	$	15,000	$	15,000		
3.8	Site Piping	1	L.S.	$	10,000	$	10,000		
3.90	Pressure Relief Valve	1	EACH	$	2,500	$	2,500		
							Subtotal	**$**	**95,000**
4.0	**Engineering, Permitting, Etc.**								
4.1	Engineering, Pre-Design and Design					$	13,500		
4.2	Construction Management (10%)					$	10,000		
4.3	Permitting/ROW/Legal (5%)					$	5,000		
							Subtotal	**$**	**28,500**
5.0	**Other**								
5.1	Contingency (20%)					$	25,700		
							Total	**$**	**154,200**

ASCWD Recommended System Improvement
Opinion of Probable Costs

	John Scott Trail from Upper Bench to Mineral Springs							By: BEL 8/7/13
1.0	Mobilization/Demobilization	1	L.S.	$	5,000	$	5,000	**$ 5,000**
2.0	**Pipelines**							
2.1	8" Pipe (John Scott Trail)	820	L.F.	$	80	$	65,600	
3.0	**Appurtenances**							
3.1	PRV Station (3" & 6")	1	L.S.	$	35,000	$	35,000	
						Subtotal		**$ 100,600**
4.0	**Engineering, Permitting, Etc.**							
4.1	Engineering, Pre-Design and Design					$	12,000	
4.2	Construction Management (10%)					$	10,600	
4.3	Permitting/ROW/Legal (5%)					$	5,300	
						Subtotal		**$ 27,900**
5.0	**Other**							
5.1	Contingency (20%)					$	26,700	
						Total		**$ 160,200**

Recommended System Improvement - ASCWD
Opinion of Probable Costs

	Alpine Meadows Road from White Wolf to John Scott Trail							By: DSK 10/7/10
1.0	Mobilization/Demobilization	1	L.S.	$	5,000	$	5,000	**$ 5,000**
2.0	**Pipelines**							
2.1	8" Pipe	500	L.F.	$	80	$	40,000	
3.0	**Appurtenances**							
3.1	PRV Station (6")	1	L.S.	$	30,000	$	30,000	
						Subtotal		**$ 70,000**
4.0	**Engineering, Permitting, Etc.**							
4.1	Engineering, Pre-Design and Design					$	10,000	
4.2	Construction Management (10%)					$	7,500	
4.3	Permitting/ROW/Legal (5%)					$	3,800	
						Subtotal		**$ 21,300**
5.0	**Other**							
5.1	Contingency (20%)					$	19,300	
						Total		**$ 120,000**

Option 1 - Gravity Sewer Flow Option
Alpine Sierra Subdivision Development
Opinion of Probable Cost
Alpine Springs County Water District

Option 1 -	Alpine Sierra Subdivision Sewer Improvements								
1.0	Mobilization/Demobilization	1	L.S.	$	7,500	$	7,500	**$**	**7,500**
2.0	**Sewer Main**								
2.1	8" Sewer Main	400	L.F.	$	75	$	30,000		
2.2	48" Manhole	1	L.S.	$	10,000	$	10,000		
2.3	Connect to existing Manholes	1	L.S.	$	5,000	$	5,000		
2.4	Traffic Control	1	L.S.	$	5,000	$	5,000		
2.5	Street Repair	1	L.S.	$	5,000	$	5,000		
						Subtotal		**$**	**55,000**
3.0	**Engineering, Permitting, Etc.**								
3.1	Engineering Design (10%)					$	6,300		
3.2	Construction Management & Bidding Assistance (10%)					$	6,300		
3.3	Permitting & ROW Assistance (5%)					$	3,100		
						Subtotal		**$**	**15,700**
4.0	**Other**								
4.1	Contingency (20%)					$	15,600		
						Total		**$**	**94,000**

Phase 1 Sewer Collection
Alpine Sierra Subdivision Development
Opinion of Probable Cost
Alpine Springs County Water District

Phase 1 -	Sewer Collection System Improvements								
1.0	Mobilization/Demobilization	1	L.S.	$	20,000	$	20,000	**$**	**20,000**
2.0	**Sewer Main**								
2.1	8" Sewer Main (includes relocation)	600	L.F.	$	70	$	42,000		
2.2	48" Manhole	5	L.S.	$	10,000	$	50,000		
						Subtotal		**$**	**92,000**
3.0	**Engineering, Permitting, Etc.**								
3.1	Engineering Design (10%)					$	11,200		
3.2	Construction Management & Bidding Assistance (10%)					$	11,200		
3.3	Permitting & ROW Assistance (5%)					$	5,600		
						Subtotal		**$**	**28,000**
4.0	**Other**								
4.1	Contingency (20%)					$	28,000		
						Total		**$**	**168,000**

Phase 2A - Sewer Collection
Alpine Sierra Subdivision Development
Opinion of Probable Cost
Alpine Springs County Water District

Phase 2 -	Sewer Collection System Improvements								
1.0	Mobilization/Demobilization	1	L.S.	$	6,000	$	6,000	**$**	**6,000**
2.0	**Sewer Main**								
2.1	8" Sewer Main	2,230	L.F.	$	70	$	156,100		
2.2	48" Manhole	11	L.S.	$	10,000	$	110,000		
						Subtotal		**$**	**266,100**
3.0	**Engineering, Permitting, Etc.**								
3.1	Engineering Design (10%)					$	27,200		
3.2	Construction Management & Bidding Assistance (10%)					$	27,200		
3.3	Permitting & ROW Assistance (5%)					$	13,600		
						Subtotal		**$**	**68,000**
4.0	**Other**								
4.1	Contingency (20%)					$	68,000		
						Total		**$**	**408,000**

Phase 2B - Sewer Collection
Alpine Sierra Subdivision Development
Opinion of Probable Cost
Alpine Springs County Water District

Phase 3 -	Sewer Collection System Improvements								By: DSK 2/2011
1.0	Mobilization/Demobilization	1	L.S.	$	5,000	$	5,000	**$**	**5,000**
2.0	**Sewer Main**								
2.1	8" Sewer Main	780	L.F.	$	75	$	58,500		
2.2	48" Manhole	4	L.S.	$	10,000	$	40,000		
						Subtotal		**$**	**98,500**
3.0	**Engineering, Permitting, Etc.**								
3.1	Engineering Design (10%)					$	10,400		
3.2	Construction Management & Bidding Assistance (10%)					$	10,400		
3.3	Permitting & ROW Assistance (5%)					$	5,200		
						Subtotal		**$**	**26,000**
4.0	**Other**								
4.1	Contingency (20%)					$	25,900		
						Total		**$**	**155,000**

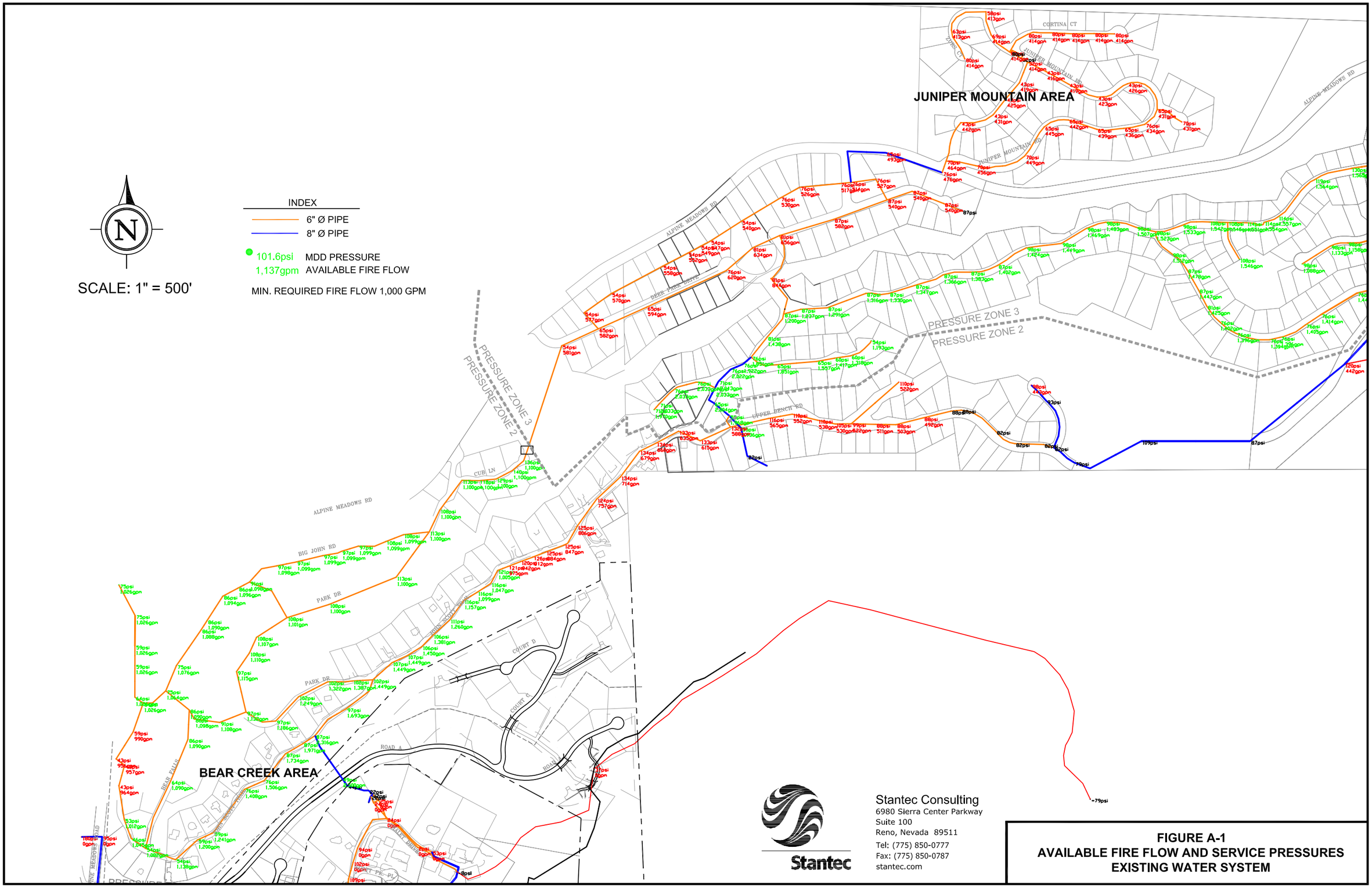

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FIGURE A-1
AVAILABLE FIRE FLOW AND SERVICE PRESSURES
EXISTING WATER SYSTEM

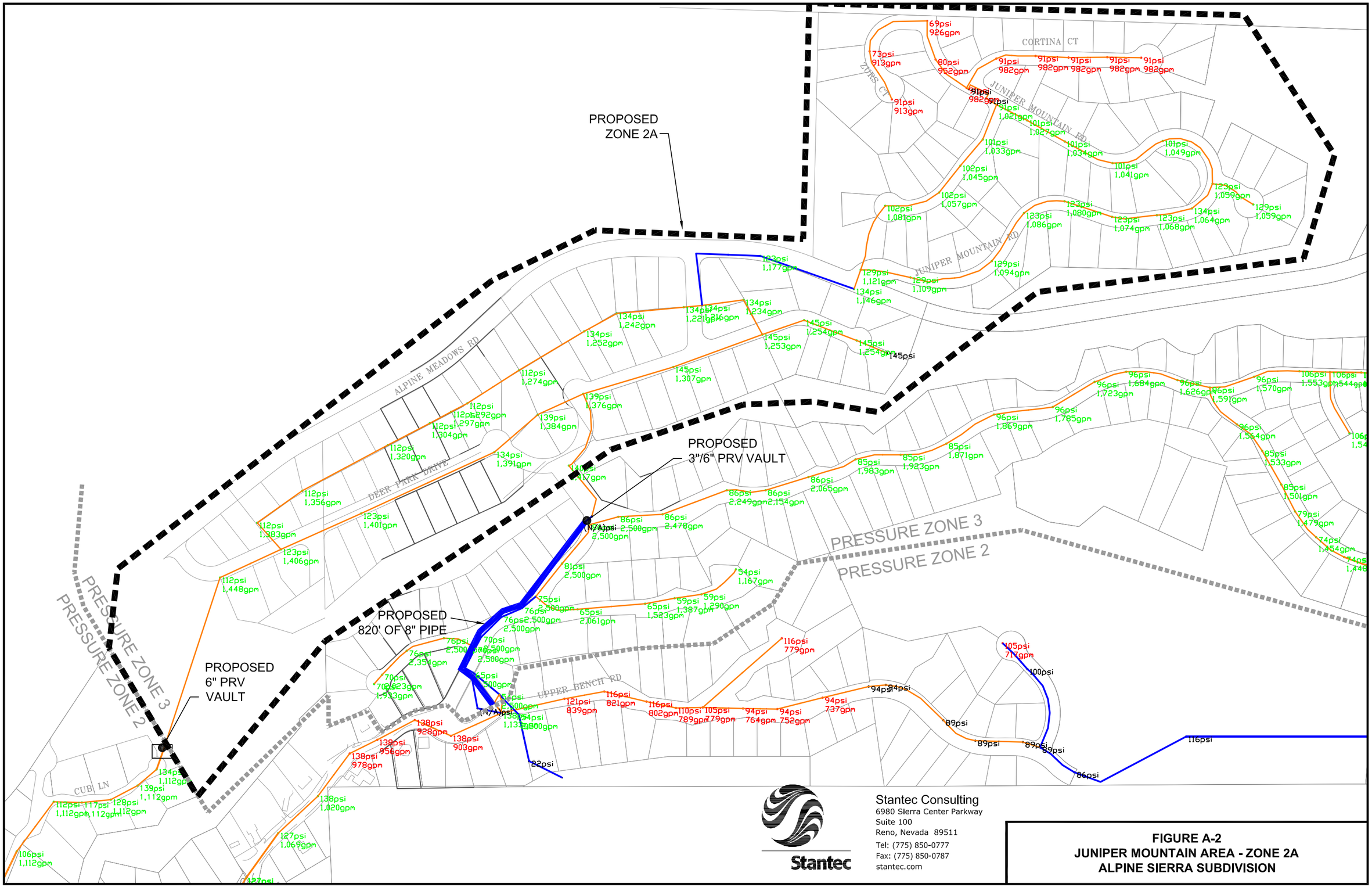

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FIGURE A-2
JUNIPER MOUNTAIN AREA - ZONE 2A
ALPINE SIERRA SUBDIVISION

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PLOT DATE: Aug 15, 2013 - 9:45am

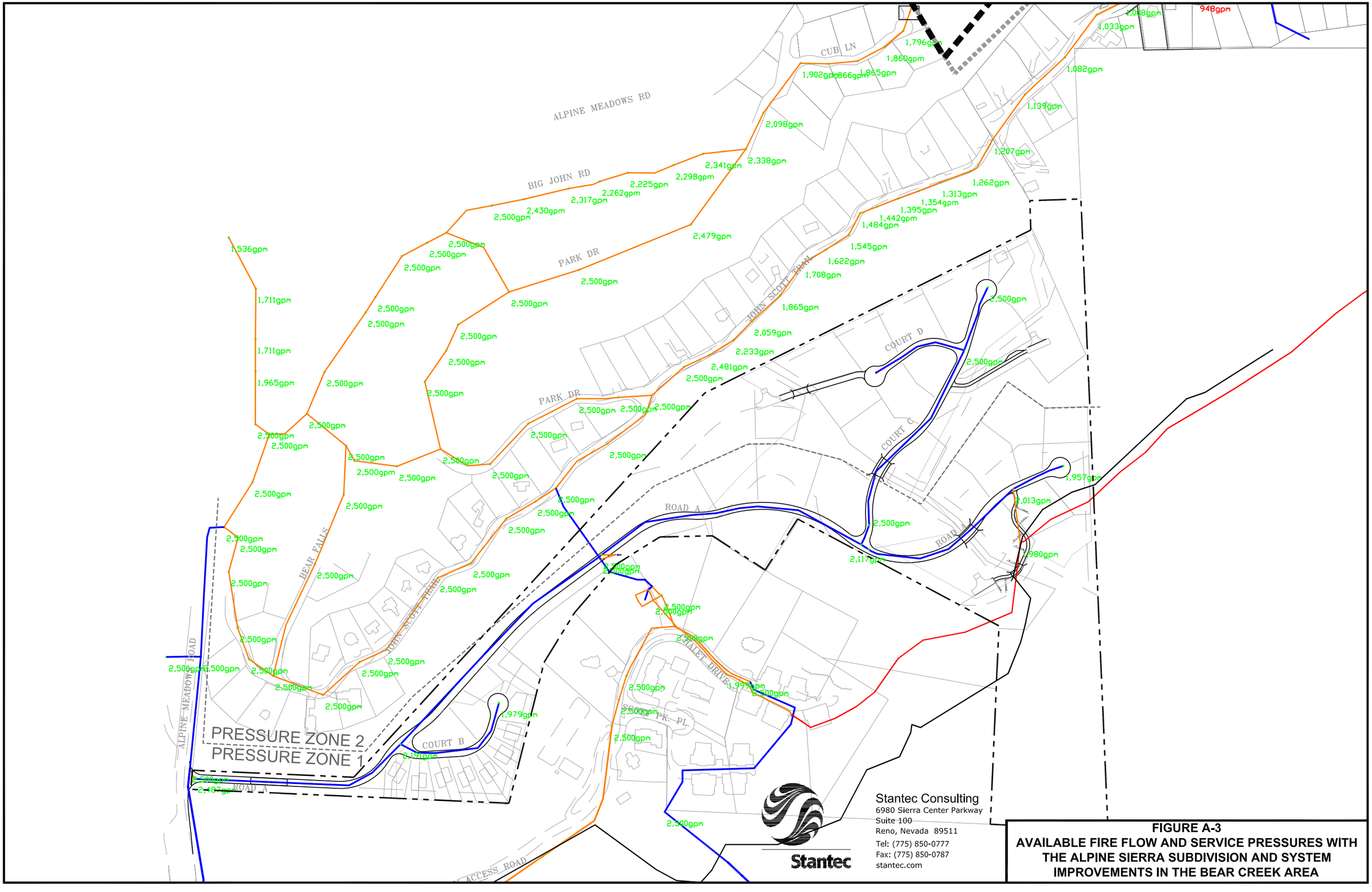

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FIGURE A-3
AVAILABLE FIRE FLOW AND SERVICE PRESSURES WITH THE ALPINE SIERRA SUBDIVISION AND SYSTEM IMPROVEMENTS IN THE BEAR CREEK AREA

FILE SPEC: V:\2053\Active\2013\205300136 ALPINE SIERRA SUBDIVISION\Water Model\Alpine_Model_2013-08-04.dwg
PLOT DATE: Aug 23, 2013 - 9:34am