J. CROWLEY GROUP
WATER RESOURCES PLANNING AND POLICY

DRAFT

Technical Memorandum 010-011

TO: Todd Eising, City of Folsom

FROM: Jim Crowley, J. Crowley Group

DATE: August 11, 2014

SUBJECT: 2014 FPA Recycled Water Analysis 2.0

Section 1 Introduction

This recycled water infrastructure analysis provides a discussion and summary of the anticipated recycled water infrastructure needs to serve the Folsom Plan Area (FPA) south of Highway 50. As the area is developed, the City of Folsom intends to install the main transmission pipelines for a recycled water system. Although no supply source is identified at this time, the City would like to install the transmission system with the other utilities to avoid extra costs and congestion in the future once a recycled source is developed. This recycled water infrastructure analysis identifies potential demands and corresponding transmission system infrastructure requirements.

Section 2 Recycled Water Policy Assumptions

Many policy, operational, and design assumptions must be made to preliminarily size the infrastructure requirements. The following lists the assumptions made for this analysis. When the recycled water system is designed for implementation, the City will need to develop policy and design guidelines for the operations and design of the recycled water system.

- The analysis assumes the supply will be delivered from the west at Zone 2 pressures. This analysis does not investigate supply requirements or potential sources. It is assumed the west side supply provides the most infrastructure requirements as a “most intensive” scenario for the environmental documentation.
- Irrigation will be allowed from 9 PM to 6 AM to avoid potential contact with overspray or runoff.
- Flow will be pumped to a storage tank during the non-irrigation times of the day. Supply from the tank will generally meet daily irrigation demands.
- A portion of the FPA on the east side is in the El Dorado Irrigation District (EID) service area. EID requires all new development to include recycled water irrigation of parks, schools, streetscape, and residential. This analysis does not include the EID service area of the FPA.
- This analysis is based on the land use plan provided by MacKay & Somps (May 2014).
- Daily storage is provided, but seasonal storage is not investigated.

Section 3 Recycled System Parcels

This analysis assumes that recycled water will be used for irrigation at parks and schools in the central and west side of the FPA. The transmission main alignment was based on serving all schools and parks west of Placerville Road. Placerville road serves as a natural break as elevations increase considerably to the east, and there are few non-residential parcels east of Placerville Road that are within the Folsom service area. In addition, all streetscape, non-residential, and multi-family medium- and high-density residential near the transmission main alignment will also be served. Parcels initially selected for recycled water use are shown in Figure 1.

Section 4 Recycled Water Demand Projections

4.1 ETo-Based Demand Pattern

Landscape irrigation demand patterns are more accentuated than total potable water demand patterns. Landscape demand is highest during the summer months, and near zero in winter months during the traditional rainy season. Evapotranspiration (ETo) is a measure of irrigation water requirements. Average monthly ETo data from the nearby Fair Oaks CIMIS Station are shown in Table 1. A monthly peaking factor is calculated that is used to convert the annual demands to monthly irrigation demands. Data is presented for an average year (average precipitation) and a dry year with a return frequency of five percent.

The data indicate that ETo during the dry months does not change with hydrology; it remains the same regardless of precipitation during the wet months. As shown in Table 1, the dry year irrigation demand is 10 percent greater than the average year. Due to precipitation and weather patterns in the Sacramento Valley, irrigation demands during the summer months are relatively constant regardless of hydrologic year type. Only the normal year demands are carried forward throughout this analysis, as dry year demands do not influence infrastructure sizing.

Table 1. ETo-Based Irrigation Demands

Month	Precipitation[a], inches		ETo[b], inches	Irrigation Demand[c], inches		Average Year Monthly Peak Factor
	Average	Dry		Average	Dry	
Jan	4.4	2.2	1.59	0	0.3	0.03
Feb	3.8	2.3	2.20	0	0.9	0.04
Mar	3.9	2.2	3.66	1.5	2.7	0.06
Apr	1.9	1.0	5.08	4.7	5.4	0.09
May	0.6	0.3	6.83	7.8	8.0	0.12
Jun	0.1	0.2	7.80	9.3	9.2	0.14
Jul	0.1	0.1	8.67	10.3	10.3	0.15
Aug	0.5	0.1	7.81	9.0	9.3	0.14
Sep	0.5	0.3	5.67	6.5	6.6	0.10
Oct	1.5	0.8	4.03	3.7	4.2	0.07
Nov	3.4	1.9	2.13	0	1.1	0.04
Dec	3.5	1.9	1.59	0	0.5	0.03
Annual Totals	**24.2**	**13.3**	**57.06**	**52.6**	**58.5**	**--**

[a] Folsom Dam Station, Western Regional Climate Center, 1955-1993. Dry year represents five percent return frequency.

[b] CIMIS, Fair Oaks Station No. 131. (April 1977-2005)

[c] Irrigation demand per *A Guide to Estimating Irrigation Water Needs of Landscape Plantings in* California (UC Cooperative Extension and California DWR, August 2000)

4.2 Projected Irrigation Demands

Irrigation demands are based on the unit water factors and irrigated land factors provided in the Folsom SPA SB610 Water Supply Assessment (June 2010). Detailed demand calculations for each parcel are presented in Attachment A. Annual demands per landuse are summarized in Table 2. The total annual demand of the selected parcels is 1,469 acre-feet per year. The monthly irrigation demands are presented in Table 3 using the monthly peaking factors from Table 1. The maximum day demand is estimated as the average day during maximum month (July) times a factor of 1.2. Maximum day demand is approximately 2.8 mgd.

Table 2. Irrigation Demands Per Land Use

Land Use ID	Recycled Irrigated Area, acres	Annual Irrigation Demand, AFY
SF	0	0
SFHD	0	0
MFLD	0	0
MFMD	17.1	64
MFHD	15.3	57
RC	27.7	103
OP	31.5	117
CC	11.8	44
GC	35.7	133
Park	110.9	414
MU-Res	5.9	22
OS	0	0
OSL	0	0
SCH	84.6	316
EXCL RW	0	0
MAJ CIRC	17.4	65
UAW (10 percent)	--	134
Total	**352**	**1,469**

Table 3. Monthly Water Demand[a]

Month	Irrigation Water Demand, Ac-ft	Monthly Average Day Demand, mgd
Jan	41	0.43
Feb	57	0.66
Mar	94	0.99
Apr	131	1.42
May	176	1.85
Jun	201	2.18
Jul	223	2.35
Aug	201	2.11
Sep	146	1.59
Oct	104	1.09
Nov	55	0.60
Dec	41	0.43
Annual Total	1,469	--

[a]Based on Factors in Table 1.

Section 5 Recycled Water System

This section develops the recycled water transmission system within the FPA. The distribution systems within each development parcel are not considered at this time. The recycled water system is set to mirror the potable water system pressure zones to allow interconnectivity while a recycled water supply is being developed and/or during emergencies.

5.1 Demand Assignment

Demands developed in this technical memorandum are grouped together and assigned to node locations. Parcel node assignments and a figure of the node system are included in Attachment A and summarized in Table 4. All street irrigation (MAJ CIRC) is spread proportionally to each demand node based on proportion of parcel demands assigned to each node. A diurnal time pattern was established to simulate system demands over a 24-hour period. For this analysis it is assumed that the recycled water use will occur between 9 PM to 6 AM to reflect the probable schedules of programmed irrigation controllers. The time pattern used in this extended period analysis is illustrated on Figure 2.

Table 4. Demand Node Assignment

Pressure Zone	Node	Max Day Base Demand, gpm
Zone 2	3	164
	4	403
	5	140
	6	28
Subtotal:		735
Zone 3	7	242
	8	9
	9	100
	10	92
	11	14
	12	57
	19	49
	20	39
	22	318
Subtotal:		919
Zone 4	23	3
	24	142
	25	56
	26	75
	27	24
Subtotal:		301
Total:		1,954

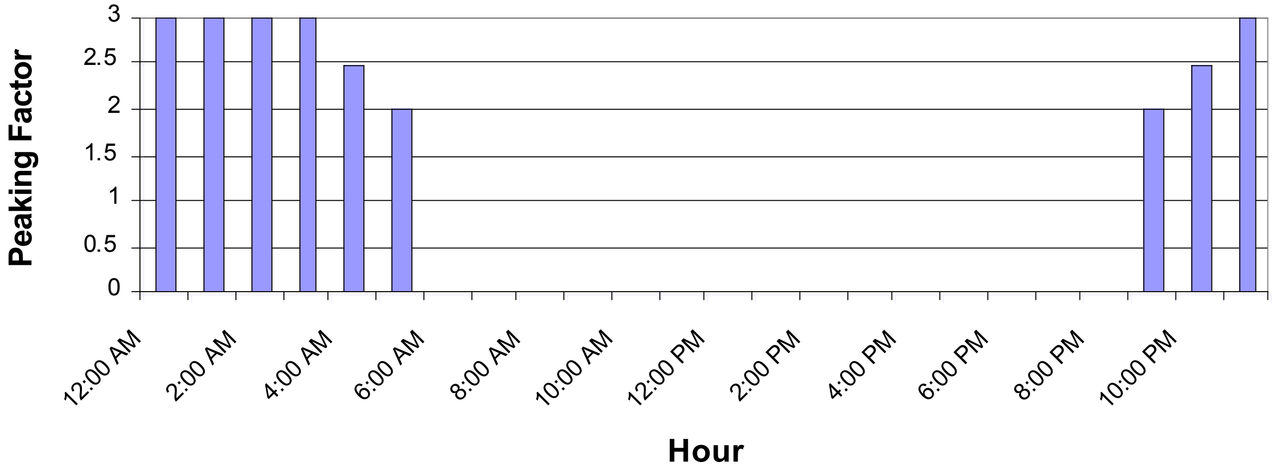


Figure 2. Demand Peaking Curve for 24-Hour Maximum Day Period

5.2 Supply Location

Actual supply source and location are unknown at this time. The supply could come from the west side, the east side, or even a future scalping plant within Folsom. This analysis aims to identify the supply location with the most distribution infrastructure requirements as a worst-case condition. The analysis assumes the worst-case supply condition is a supply coming from the west side of the FPA. It is assumed the supply will be delivered to the FPA at Zone 2 pressures. The supply will then need to be pumped up to Zone 3 pressures and the Zone 3 Tank.

5.3 System Development

An extended period simulation hydraulic model of the FPA transmission system was developed using EPANet, a hydraulic pressure-system modeling software. A distribution system consisting of storage, booster pumping, and transmission mains was developed and input into the model. Sizing and modeling assumptions used to create the system are summarized in Table 5. These design criteria should be reviewed and further developed by the City during the FPA recycled water system design process.

Table 5. Sizing and Modeling Assumptions

Element	Value
Daily Storage	Volume equal to one maximum day demand
Pressure range	30 psi – 100 psi
Pipeline velocity	3 to 5 feet per second maximum
Pipeline roughness coefficient	130
Minimum transmission main diameter	8-in

5.4 System Operational Strategy

The system is developed to mirror the potable water system pressure zones. The supply will feed into the west side of the FPA at Zone 2 pressures. Supply will then be boosted up into Zone 3, pumping into the Zone 3 Storage Tank. Zone 4 demands will be supplied through a booster pumping station located at the Zone 3 Storage Tank site. Because Zone 4 demands are relatively small, a Zone 4 storage tank is not necessary. The Zone 3 Storage Tank is sized to provide the required storage for all system demands. In general, the system operation assumes the Zone 3 booster pumping station fills the Zone 3 tank during non-irrigation times (daytime), and that the tank is drawn down during the irrigation demand schedule (nighttime).

It is likely that a supply source will not be available when the FPA installs the initial recycled water system infrastructure. Therefore, the system will be supplied by the potable system. Interconnections will be provided at each potable water pressure zone as shown on the system figure (Figure 3). Interconnections are governed by State regulations and include elements such as reduced pressure principle backflow devices to prevent cross-system contamination.

5.5 Infrastructure Requirements

The proposed recycled water distribution and storage system is presented in Figure 3. The system consists of 12-inch diameter transmission mains serving Pressure Zones 2 and 3, and 8-inch lines serving Pressure Zone 4. Only one Zone 3 booster pumping station is required. However, two alternative locations are shown on the figure. The final location will be determined in the future by the location of the actual parcels served, the pace of development, and final hydraulic analysis. A pressure reducing bypass system will be included at the booster pumping station site to allow flow from the Zone 3 Tank to back-feed Zone 2 demands during emergencies or other conditions when the supply is temporarily offline. The Zone 3 booster pumping station is sized to fill the Zone 3 tank during the 15 hours of non-irrigation demand in the daytime. For this planning level, the pumps station capacity is assumed to be 2,000 gpm and total dynamic head of approximately 200 feet.

Similarly, there are two alternative Tank 3 locations proposed. The final location will be determined during system design based on the actual hydraulic needs and site availability. The tank is set to mirror the Zone 3 potable water tank with a base elevation of 550 feet. However, final system demands, hydraulics, and site characteristics may allow a range of base elevation options of approximately 520-550 feet.

The Pressure Zone 4 system only serves eight parcels, and only three of them are parks/schools with larger demands. The planned system is a closed booster pump system that will draw from Tank 3 storage to meet the Zone 4 demands and maintain pressures. Depending on final system demands, the system could include a hydro-pneumatic surge tank at the Tank 3 site. Zone 4 booster pumping capacity is 300 gpm at total dynamic head of approximately 200 feet.

The recycled water system is summarized in Table 6. Site layouts for each booster pumping station and storage tank optional locations are presented in Attachment B.

Table 6. Recycled Water Infrastructure Summary

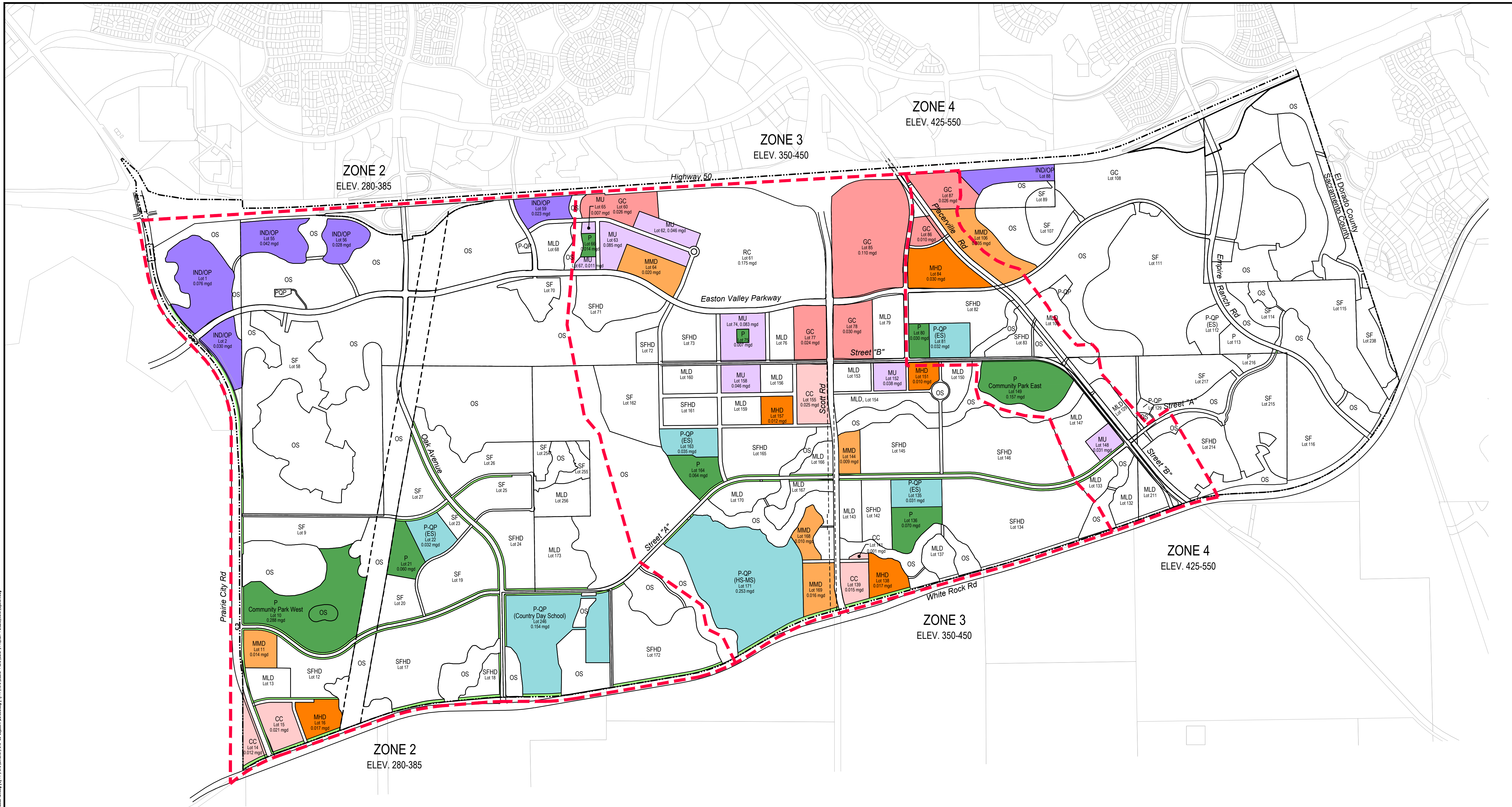
Element	Length/Capacity
Transmission Pipeline	
8-inch	10,300 feet
12-inch	67,200 feet
Zone 3 Booster Pumping Station	2,000 gpm 200 feet TDH
Zone 3 Storage Tank	2.8 million gallons
Zone 4 Booster Pumping Station	300 gpm 200 feet TDH

The proposed infrastructure represents a planning-level analysis using the assumptions listed at the beginning of this technical memorandum. Supply, storage, and pumping requirements will be further refined in the future during preliminary design efforts and in coordination with actual development progress. Preliminary design will also include cost to benefit analysis to provide service to the proposed lots, with possible recommendations to reduce the number of parcels served.

Section 6 Summary and Next Steps

This technical memorandum presents the planning-level requirements for the recycled water system. The following lists items to address next as the environmental documentation and design process moves forward.

1. Continue to evaluate potential recycled water sources and work to obtain the necessary volume of supply.
2. Work with FPA developer group to identify planned development phases and refine actual demands within a cost to benefit analysis to finalize system requirements.
3. Initiate system design task based on selected infrastructure phases developed in previous steps.
4. In future pre-design phase, City of Folsom should develop recycled water system operational policies and design criteria.
5. Finalize phase 1 design and begin construction in coordination with other infrastructure construction within the FPA.



Legend
Pressure Zone Boundary

Figure 1 - Selected Parcels for Non-Potable Water
FPA - Non-Potable Water Analysis

City of Folsom, California
Scale 1"=800' August 2014

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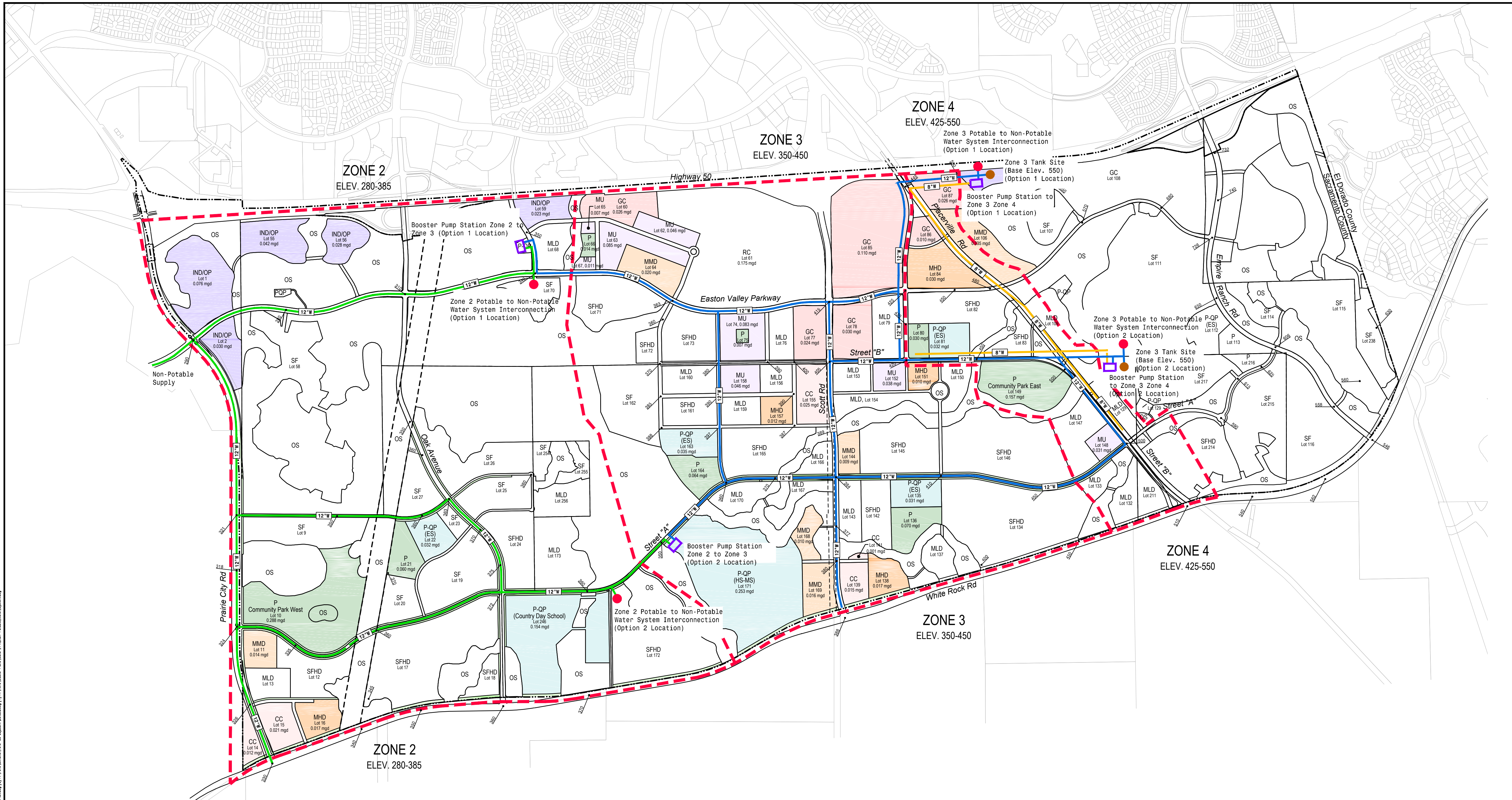

Legend

- Pressure Zone Boundary
- Zone 2 Non-Potable Water Pipe & Size
- Zone 3 Non-Potable Water Pipe & Size
- Zone 4 Non-Potable Water Pipe & Size
- Potable to Non-Potable Water System Interconnection
- Non-Potable Booster Pump Station
- Non-Potable Water Tank

Figure 3 - Proposed Non-Potable Water Infrastructure
FPA - Non-Potable Water Analysis

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Scale 1"=800' *August 2014*

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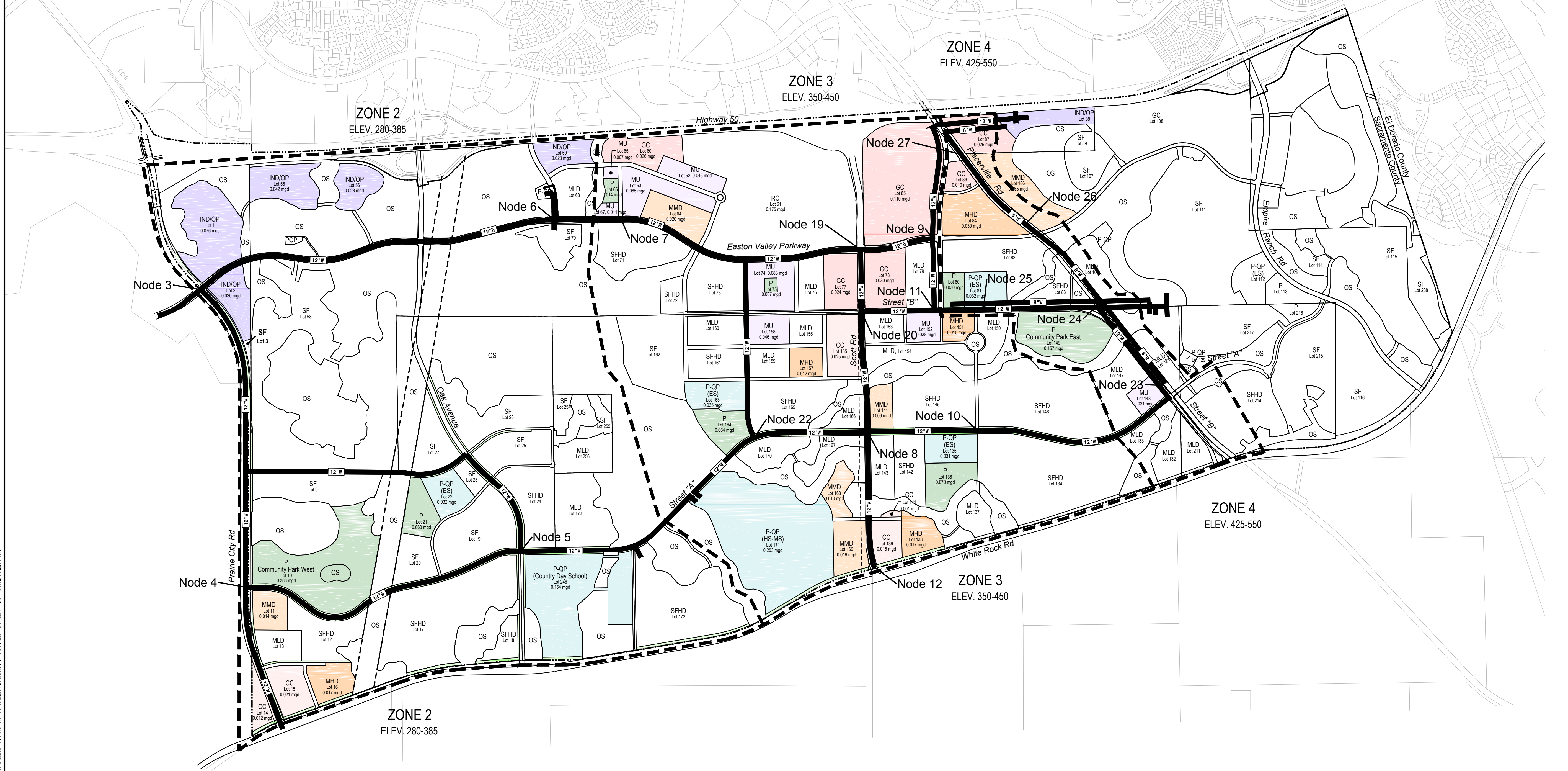
Attachment A
Parcel Demand Calculations and Assignment



Legend
- Pressure Zone Boundary
- Zone 2 Non-Potable Water Pipe & Size
- Zone 3 Non-Potable Water Pipe & Size
- Zone 4 Non-Potable Water Pipe & Size

Figure A-1 - Non-Potable Water Hydraulic Analysis
FPA - Non-Potable Water Analysis

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Non-Potable Water Demands Parcel Summary

Parcel No.	Land Use	Acreage	Irrigated Acreage	Irrigated Acreage Reduction Factor	Unit Irrigation Demand Factor	Irrigtion Demand, AFY
1	IND/OP	30.09	12.036	0.40	3.73	44.9
2	IND/OP	11.76	4.704	0.40	3.73	17.5
10	P	47.86	45.467	0.95	3.73	169.6
11	MMD	8.56	2.140	0.25	3.73	8.0
14	CC	6.26	1.878	0.30	3.73	7.0
15	CC	11.06	3.318	0.30	3.73	12.4
16	MHD	9.77	2.931	0.30	3.73	10.9
21	P	10.03	9.529	0.95	3.73	35.5
22	PQP-SCHOOL	10.02	5.010	0.50	3.73	18.7
55	IND/OP	16.60	6.640	0.40	3.73	24.8
56	IND/OP	11.02	4.408	0.40	3.73	16.4
57	PQP	0.82	0.779	0.50	3.73	2.9
59	IND/OP	9.20	3.680	0.40	3.73	13.7
60	GC	13.65	4.095	0.30	3.73	15.3
61	RC	110.82	27.705	0.25	3.73	103.3
62	MU-RES	7.88	0.788	0.10	3.73	2.9
63	MU-RES	14.53	1.453	0.10	3.73	5.4
64	MMD	12.83	3.208	0.25	3.73	12.0
65	MU-RES	1.12	0.112	0.10	3.73	0.4
66	P	2.26	2.147	0.95	3.73	8.0
67	MU-RES	1.82	0.182	0.10	3.73	0.7
69	PQP	1.23	1.169	0.50	3.73	4.4
74	MU-RES	14.14	1.414	0.10	3.73	5.3
75	P	1.15	1.093	0.95	3.73	4.1
77	GC	12.57	3.771	0.30	3.73	14.1
78	GC	15.83	4.749	0.30	3.73	17.7
80	P	5.01	4.760	0.95	3.73	17.8
81	PQP-SCHOOL	10.01	5.005	0.50	3.73	18.7
84	MHD	20.03	6.009	0.30	3.73	22.4
85	GC	57.90	17.370	0.30	3.73	64.8
86	GC	5.31	1.593	0.30	3.73	5.9
87	GC	13.71	4.113	0.30	3.73	15.3
106	MMD	22.17	5.543	0.25	3.73	20.7
135	PQP-SCHOOL	9.89	4.945	0.50	3.73	18.4
136	P	11.70	11.115	0.95	3.73	41.5
138	MHD	9.11	2.733	0.30	3.73	10.2
139	CC	7.80	2.340	0.30	3.73	8.7
140	MMD	0.10	0.025	0.25	3.73	0.1
141	CC	0.72	0.216	0.30	3.73	0.8
144	MMD	6.41	1.603	0.25	3.73	6.0
148	MU-RES	5.26	0.526	0.10	3.73	2.0
149	P	26.12	24.814	0.95	3.73	92.6
151	MHD	5.70	1.710	0.30	3.73	6.4
152	MU-RES	6.52	0.652	0.10	3.73	2.4
155	CC	13.41	4.023	0.30	3.73	15.0
157	MHD	6.34	1.902	0.30	3.73	7.1
158	MU-RES	7.86	0.786	0.10	3.73	2.9
163	PQP-SCHOOL	11.02	5.510	0.50	3.73	20.6
164	P	10.61	10.080	0.95	3.73	37.6
168	MMD	7.21	1.803	0.25	3.73	6.7
169	MMD	11.23	2.808	0.25	3.73	10.5
171	PQP-SCHOOL	79.63	39.815	0.50	3.73	148.5
246	PQP-SCHOOL	48.69	24.345	0.50	3.73	90.8
	Subtotal	3,339.76	340.5			1,270.2
	Major Circulation	173.64	17.364	0.10	3.73	64.8
	Total	**3,513.40**				**1,335**

1) Land Uses are based on the approved Folsom Plan Area Specific Plan, adopted June 28, 2011.
2) Water demands and outdoor demand fractions are taken from Appendix M1- Water Supply Assessmen
Tables 2-4, 2-6 and 2-7

City of Folsom
Recycled Water EPAnet Model Demand Assignment

Total Max Day Demand = 2,814,560 gpd

Node	Elevation	Percent to Node	Node Demand, gpd	Node Demand, gpm	Zone	Zone Total, gpm
1	290	0.000	0	0	2	
2	290	0.000	0	0	2	
3	290	0.084	236,103	164	2	
4	324	0.206	580,793	403	2	
5	385	0.071	201,208	140	2	
6	340	0.014	40,072	28	2	735 Zone 2 total
7	363	0.124	348,744	242	3	
8	384	0.005	13,244	9	3	
9	425	0.051	143,561	100	3	
10	410	0.047	132,734	92	3	
11	420	0.007	19,522	14	3	
12	388	0.029	82,021	57	3	
13	450	0.000	-	-	3	
14	480	0.000	-	-	3	
15	445	0.000	-	-	3	
16	500	0.000	-	-	3	
17	500	0.000	-	-	3	
19	415	0.025	70,417	49	3	
20	405	0.020	55,466	39	3	
22	350	0.163	457,911	318	3	919 Zone 3 total
23	500	0.002	4,347	3	4	
24	500	0.073	205,085	142	4	
25	440	0.029	80,702	56	4	
26	480	0.039	108,638	75	4	
27	445	0.012	33,993	24	4	301 Zone 4 total
		Totals:	2,814,560	1,955		1,955

Attachment B
Option Pumping and Storage Tank Site Layouts

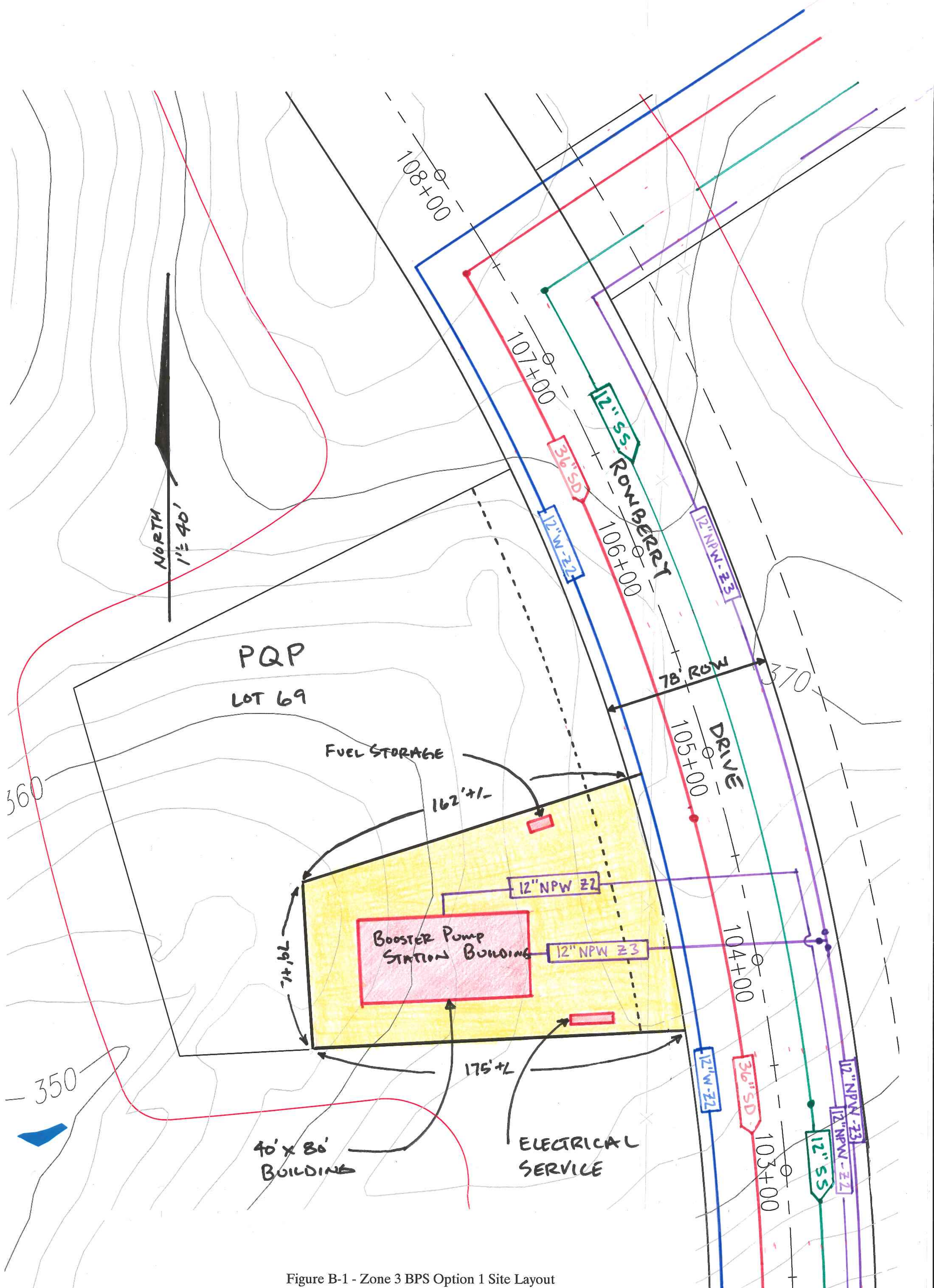

Figure B-1 - Zone 3 BPS Option 1 Site Layout
FPA - Non-Potable Water Analysis

City of Folsom, Scale 1"=800' — California, August 2014

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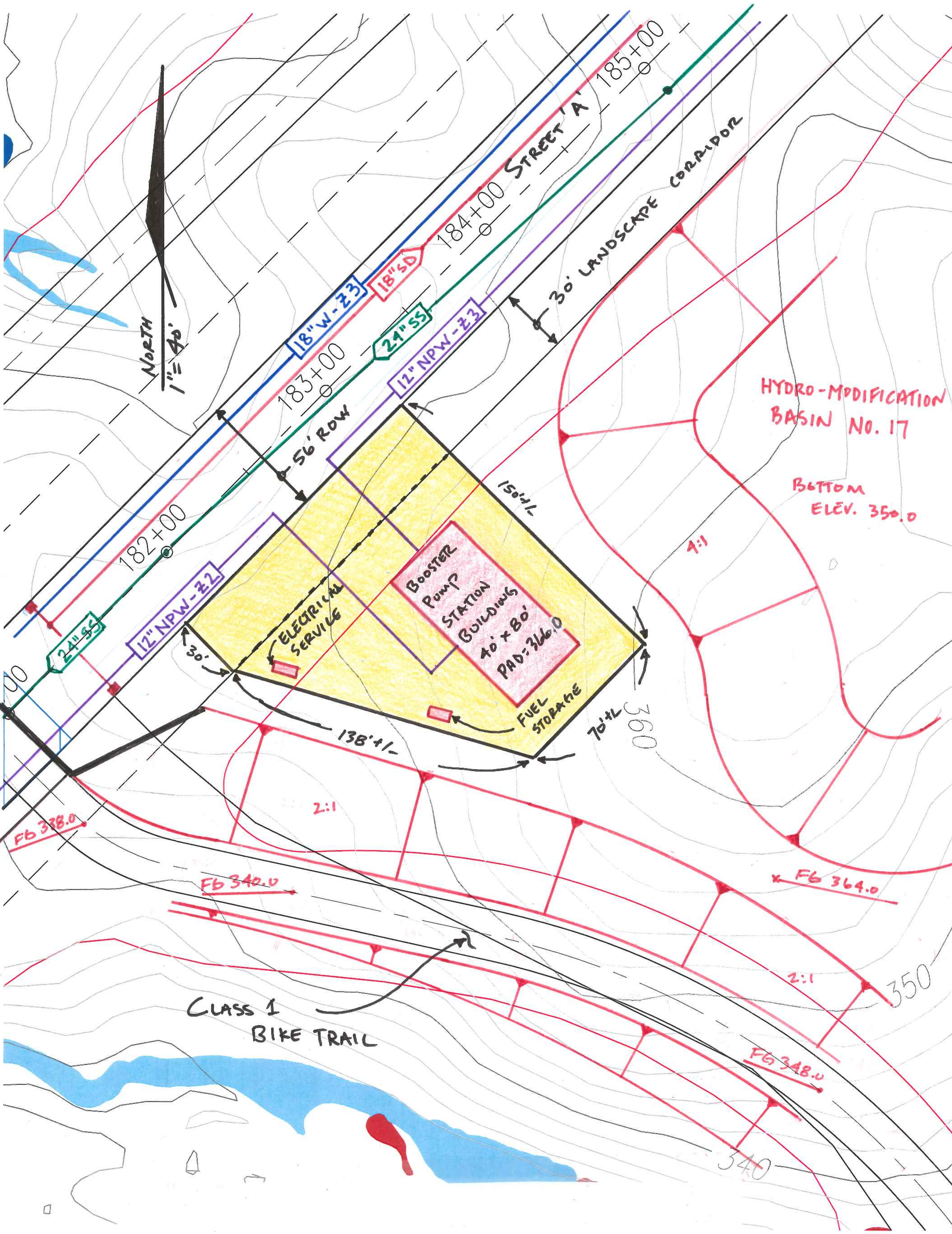

Figure B-2 - Zone 3 BPS Option 2 Site Layout
FPA - Non-Potable Water Analysis

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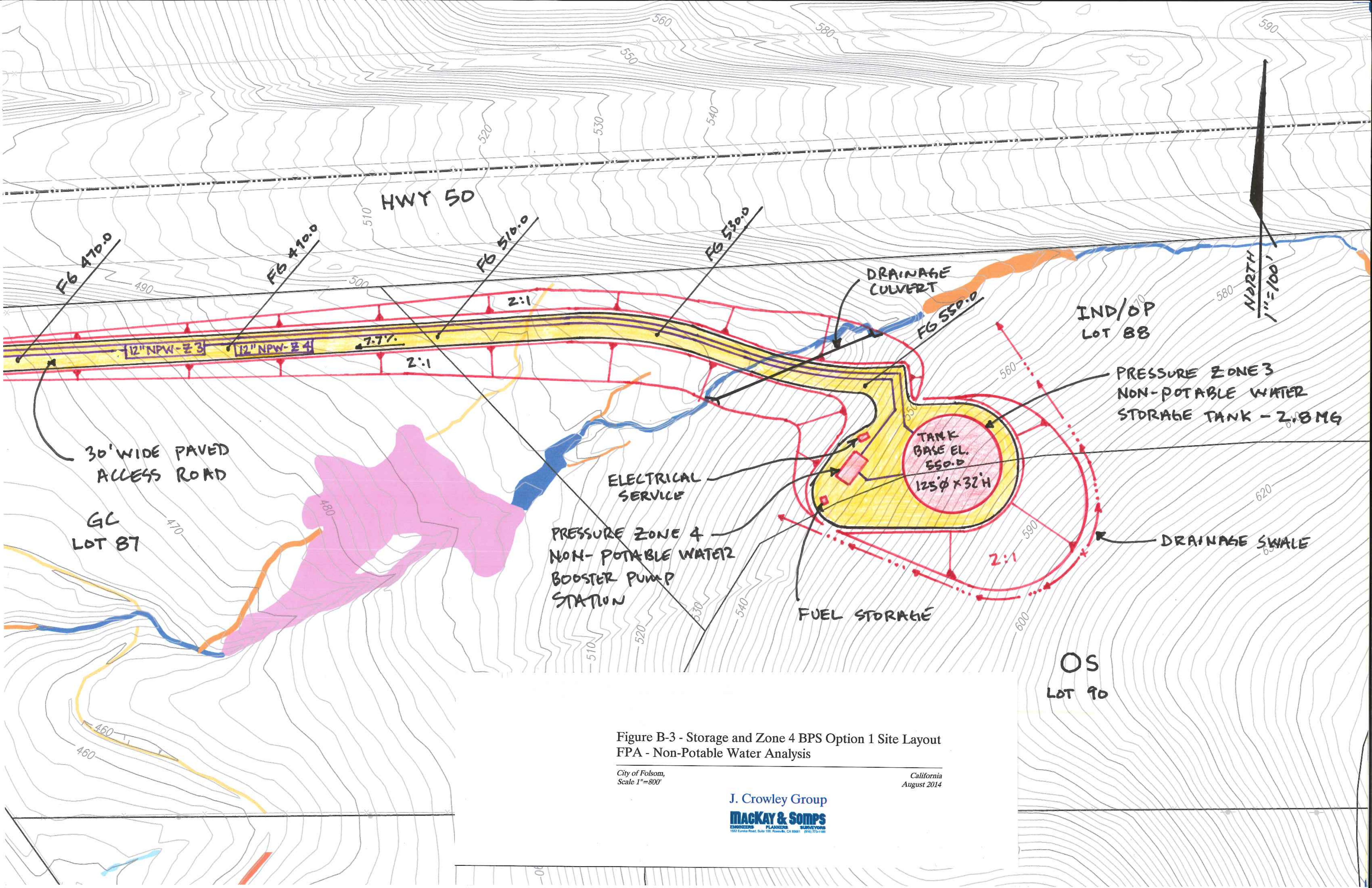

Figure B-3 - Storage and Zone 4 BPS Option 1 Site Layout
FPA - Non-Potable Water Analysis

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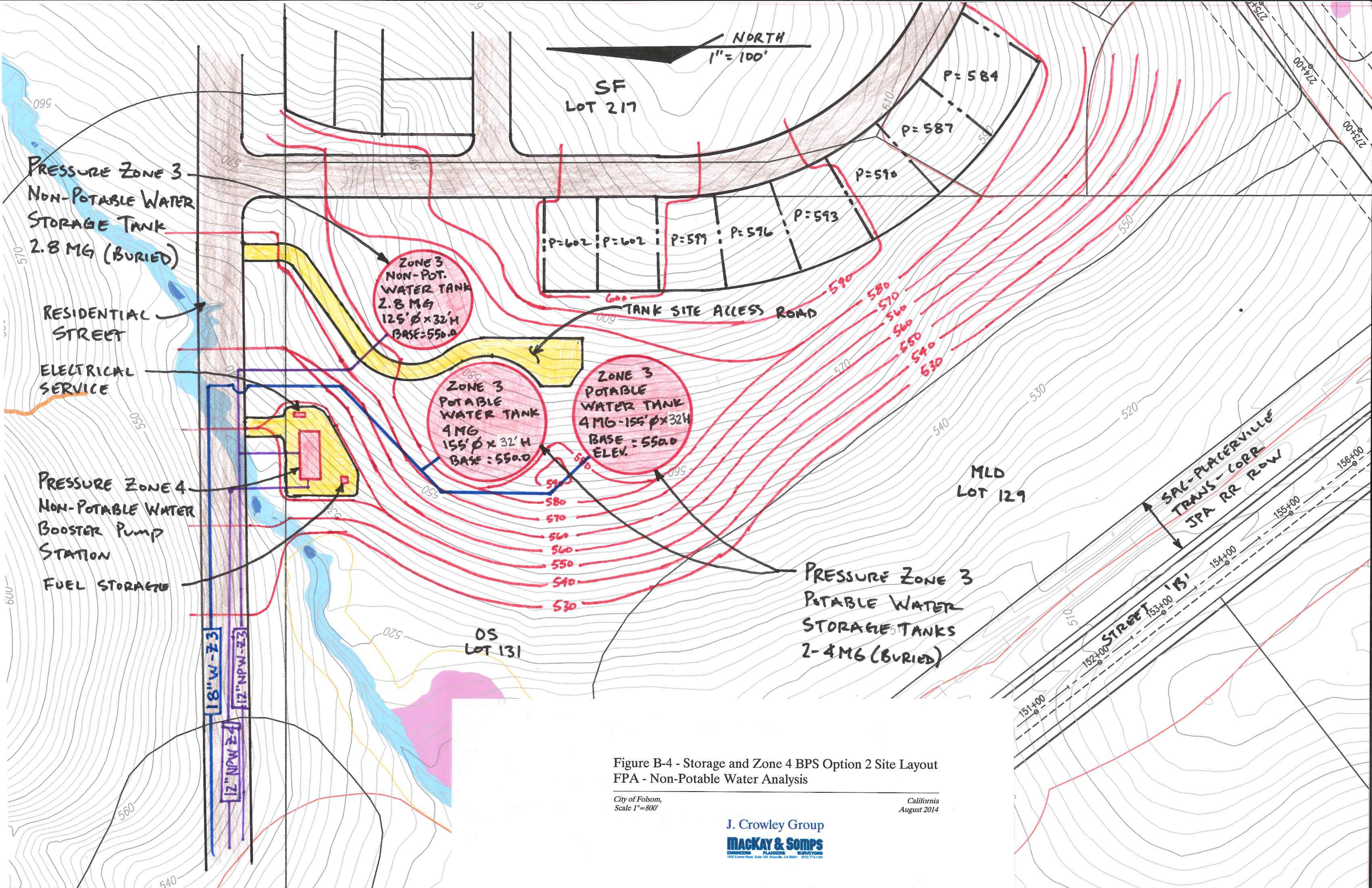

Figure B-4 - Storage and Zone 4 BPS Option 2 Site Layout
FPA - Non-Potable Water Analysis

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