COLLEGE PARK EAST
FOCUSED STUDY
IRONWOOD,
GUAVA AND ELDER AVENUE
DRAINAGE SYSTEMS

City of Seal Beach

August 1, 2019

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1. Background

Over 87% (240 acres) of the College Park East Community drains west to the Old Ranch Golf Course through five (5) storm drains. Four (4) of these storm drains were constructed when College Park East was developed in the mid to late 1960s. They consist of:

- 36-inch diameter reinforced concrete pipe (RCP) storm drain between Ironwood Avenue and Guava Avenue intersection and the Old Ranch Golf Course
- 36-inch diameter RCP storm drain between Ironwood Avenue and Elder Avenue intersection and the Old Ranch Golf Course
- 33-inch diameter RCP, 3.33' (W) x 1.75' (H) reinforced concrete box (RCB), and 21-inch diameter RCP storm drain on Candleberry Avenue between Aster Street and the Old Ranch Golf Course
- Double 30-inch diameter RCP, double 21-inch diameter RCP, and 3.33' (W) x 1.75' (H) RCB storm drain on Basswood Avenue between Aster Street and the Old Ranch Golf Course

The Old Ranch Golf Course acts as a retarding basin at the upstream end of Federal Storm Channel (Orange County Flood Control District Facility No. C01S06). Federal Storm Channel is one of the tributary drains that terminate at Los Alamitos Retarding Basin located south of Spinnaker Way and east of San Gabriel River. The Los Alamitos Stormwater Pump Station pumps the tributary flows from the retarding basin into San Gabriel River to provide Expected Value 100-year Flood protection for the upstream drainage area, which includes the westerly portion of College Park East. The regional flood control system serving College Park East is shown on Figure 1.

The portion of College Park East between Lampson Avenue and Candleberry Avenue/Dogwood Avenue is in a sump condition, and drains to the two 36-inch diameter storm drains at Elder Avenue and Guava Avenue at their intersection with Ironwood Avenue. These storm drains extend westerly through narrow easements between residential properties, then across Lampson Avenue, and outlet to a shallow reinforced concrete trapezoidal drainage swale in Old Ranch Golf Course. The drainage swale generally parallels Lampson Avenue and terminates at one of the golf course ponds across Basswood Street. It has a base width of 5 feet and side slopes varying from 3:1 to 5:1. The existing storm drains and their tributary areas are shown on Figure 2.

The drainage area tributary to Guava Avenue and Ironwood Avenue covers 80 acres of low density residential land use, with a design flow (peak flow from High Confidence 25-year Storm) of 96 cfs. The drainage area tributary to Elder Avenue and Ironwood Avenue covers 57 acres of low density residential land use, and has a design flow of 70 cfs. The existing 36-inch diameter storm drains cannot convey the design flows to Old Ranch Golf Course for the following reasons:

- The drainage swale in the Old Ranch Golf course is very shallow, with its invert elevation only about 3.7 feet below the top of curb elevations at Ironwood Avenue. The water surface elevations resulting from the High Confidence 25-year Storm within the golf course are higher than the top of curb elevations of Ironwood Avenue at Guava Avenue and Elder Avenue.
- The 36-inch storm drains were constructed with 0.05% slope, limiting their capacity to less than 30 cfs. This is much lower than the peak flows resulting from even the 5-year storm.

The City's Master Plan of Drainage Update completed in August 2008 (2008 Master Plan) formulated and evaluated two (2) alternative drainage scenarios for College Park East. Only one of these alternatives (Alternative 2) could meet the flood protection criteria. It consisted of RCP storm drains collecting and conveying the runoff to a 300 cfs capacity stormwater pump station in Bluebell Park, and two 54-inch diameter pump station discharge pipes along Aster Street and Basswood Street extending to the Old Ranch Golf Course pond across Basswood Avenue. The estimated cost of these improvements was $41.9 million (2008 dollars, current estimate $54.1 million). Alternative 1 consisted of constructing larger gravity drains to replace and/or parallel existing drains to provide better drainage with the smaller storms, and reduce the duration of flooding during a design storm. The total estimated cost of this alternative was $30.7 million (current cost of $39.6). Because Alternative 2 would require the construction of the pump station and most of the large diameter storm drains in the first phase of implementation at a very high cost, the City proceeded with addressing the most significant flooding problems utilizing gravity drains described in Alternative 1 in the 2008 Master Plan.

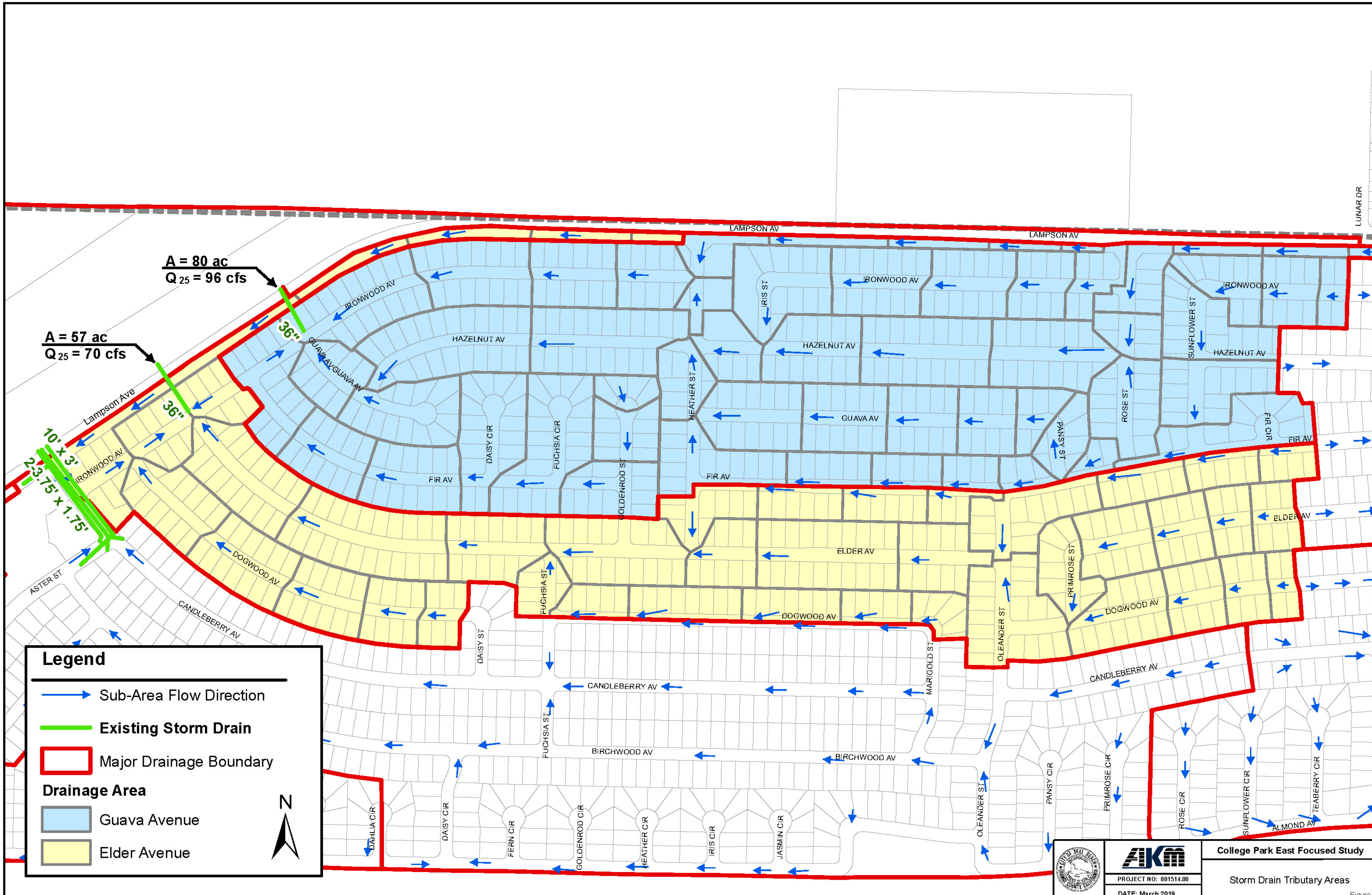
College Park East Focused Study

Site Map

Figure 1

PROJECT NO: 801514.00

DATE: March 2019


A = 80 ac
Q 25 = 96 cfs
A = 57 ac
Q 25 = 70 cfs
36"
36"
10' x 3'
2-3.75' x 1.75'
Lampson Ave
LAMPSON AV
IRONWOOD AV
HAZELNUT AV
GUAVA AV
FIR AV
ELDER AV
DOGWOOD AV
CANDLEBERRY AV
BIRCHWOOD AV
ALMOND AV
ASTER ST
DAISY CIR
FUCHSIA CIR
GOLDENROD ST
HEATHER ST
IRIS ST
PANSY ST
ROSE ST
SUNFLOWER ST
FIR CIR
LUNAR DR
PRIMROSE ST
OLEANDER ST
MARIGOLD ST
FUCHSIA ST
DAISY ST
DAHLIA CIR
FERN CIR
GOLDENROD CIR
HEATHER CIR
IRIS CIR
JASMIN CIR
PANSY CIR
PRIMROSE CIR
ROSE CIR
SUNFLOWER CIR
TEABERRY CIR
Legend
Sub-Area Flow Direction
Existing Storm Drain
Major Drainage Boundary
Drainage Area
Guava Avenue
Elder Avenue
N
AKM
PROJECT NO: 801514.00
DATE: March 2019
College Park East Focused Study
Storm Drain Tributary Areas
Figure 2

The intersection of Aster Street and Candleberry Avenue is in a sump condition, and experienced flooding with the greatest depths in College Park East. In 2008 and 2009, the City constructed 446 feet of double 5' (W) x 3' (H) RCB and 10 feet of 10' (W) x 3' (H) RCB between the Old Ranch Golf Course and Aster Street; 135 feet of 7' (W) x 3' (H) RCB on Aster Street south of Candleberry Avenue, one (1) 7 ft wide catch basin on the east side of Candleberry Avenue at its intersection with Aster Street, and one (1) 21-ft and one 28-ft wide catch basin on the south side of Aster Street west of Candleberry Avenue. The improvements at Guava Avenue and Elder Street were not constructed due to very narrow easements between existing residences.

The City conducted a study to evaluate five (5) additional alternatives to address the drainage problems along Ironwood Avenue at Guava and Elder Avenues in 2012. Some of the alternatives were suggested by the area residents. The 2012 study recommended Alternative 1, which consisted of shallow box culverts as wide as possible to maximize conveyance capacity, and storm drains along Ironwood Avenue, Guava Avenue, Hazelnut Avenue, Fir Avenue and Elder Avenue, as well as purchasing one property at Elder Avenue between Ironwood Avenue and Lampson Avenue. The City purchased the property at 4197 Ironwood Avenue, just westerly of the catch basin at its intersection with Elder Avenue. As with Alternative 1 of the 2008 Master Plan, Alternative 1 of the 2012 study does not provide the selected flood protection. When constructed, it would provide somewhat higher than 5-year storm runoff protection, and reduce the flooding depths for lower frequency storms.

The maximum capacity of the drainage swale in the Old Ranch Golf Course is approximately 110 cfs. This limitation requires the use of a flood flow attenuation facility, such as an in-line detention basin in College Park East. The basin volume can only be optimized with the use of a pump station, which would pump the tributary flows to the downstream drainage swale up to its capacity, and make storage available for the flows above the capacity of the swale.

2. Purpose

The purpose of the Focused Preliminary Design Report is to conduct updated hydrologic and hydraulic studies with High Confidence 25-year Storm peak flows, and further develop Alternative 1 of the 2012 study to reduce flooding along Ironwood Avenue at its intersection with Guava Avenue and Elder Avenue, as well as portions of Guava and Elder Avenues southeasterly of Ironwood Avenue.

3. Hydrologic Studies and Hydraulic Analyses

The hydrologic studies were conducted during the preparation of the 2008 Master Plan of Drainage Update (2008 Master Plan). These studies determined the peak flows resulting from a 10-year storm, as well as High Confidence 25-year storm. Peak flows resulting from 5-year and 2-year storms were determined for the Focused PDR. The tributary areas and the 25-year, 10-year, 5-year and 2-year Storm peak flows are listed in Table 1.

Table 1
Tributary Areas and Peak Flows

Tributary Area	Drainage Area (Acres)	Q_{25} (cfs)	Q_{10} (cfs)	Q_5 (cfs)	Q_2 (cfs)
Ironwood and Guava					
Ironwood and Guava - North	10.5	10.1	7.8		
Ironwood and Guava - East	55.0	68.3	54.4		
Ironwood and Guava - South	14.5	24.2	19.4		
Confluence	80.0	95.7	75.9	57.6	35.6
Ironwwod and Elder					
Ironwwod and Elder - East	44.4	56.3	44.9		
Ironwwod and Elder -South	12.6	16.6	13.2		
Confluence	57.0	70.1	55.7	40.5	24.6
Total	137.0	165.8	131.6		

Hydraulic analyses of the existing storm drains at Guava Avenue and Elder Avenue were conducted during the current study with the Ironwood Avenue water surface elevations at the top of curb and the golf course swale water surface elevations at the top of the outlet pipes (approximate water surface elevation with 10-year storm). These analyses show that the two storm drains can convey 28 cfs and 27 cfs, respectively, which are 35% and 48% of the peak flows resulting from a 10-year storm and 28% and 39% of the peak flows of the High Confidence 25-year Storm. The capacities would be lower with higher water surface elevations in the golf course swale.

The City's 2008 Master Plan determined that the flood protection criteria could not be satisfied without pumping the runoff to the golf course.

Because of the limitations in the existing drainage system and the outlet conditions in the Old Ranch Golf Course, an in-line detention basin and a pump station will be required, with the flows from the two areas combined prior to discharge to the golf course to provide the most effective flood protection.

Hydrologic studies were conducted to develop hydrographs for the 5, 10, and 25-year storms in order to determine the flood flow storage volume with a maximum pumping rate of 110 cfs. The Orange County Unit Hydrograph method was used to develop the hydrographs. The hydrographs are utilized to determine the duration of the flows greater than the golf course concrete swale capacity, as well as the volume of runoff that would be stored in the in-line detention basin and the streets.

3.1 WATER SURFACE CONTROL ELEVATIONS

The water surface control elevations for the hydraulic analyses are the elevations in the drainage swale in Old Ranch Golf Course.

The golf course and the swale were reconstructed in 2003 to accommodate the Target Center and Centex Homes development projects. The hydraulic calculations for the swale were conducted by IKE Engineers and documented in a report entitled *Old Ranch Country Club, Lampson Swale Hydraulic Calculations* dated April 4, 2003. The water surface elevations provided in the report were based on National Geodetic Vertical Datum 1929 (NGVD 29). Because IKE's calculations did not include the paths crossing the swale, the study was subsequently updated. Further changes were made to account for the elevation adjustment at the benchmark used by IKE Engineers. The resulting water surface elevations adjusted to North American Vertical Datum 1988 (NAVD 88) for various frequency storms, and used in this study are listed in Table 2. This table also shows the top of curb elevations and gutter elevations along Ironwood Avenue at Elder Avenue and Guava Avenue.

Table 2
Golf Course Swale Water Surface Elevations (NAVD 88)
and Top of Curb and Gutter Elevations along Ironwood Avenue

Storm Frequency	Elder Avenue				Guava Avenue			
	Q (cfs)	Golf Course Swale Water Surface Elevation (ft)	Top of Curb Elevation (ft)	Gutter Elevation (ft)	Q (cfs)	Golf Course Swale Water Surface Elevation (ft)	Top of Curb Elevation (ft)	Gutter Elevation (ft)
2-year	24.6	13.78	15.52	14.85	35.6	13.85	15.61	14.94
5-year	**40.5**	**14.47**	15.52	14.85	57.6	**14.51**	15.61	14.94
10-year	**55.7**	**15.01**	15.52	14.85	75.9	**15.04**	15.61	14.94
25-year	**70.1**	**15.57**	15.52	14.85	95.7	**15.63**	15.61	14.94
100-year		16.64	15.52	14.85		16.69	15.61	14.94

As shown in Table 2, there would be no flow from the Elder and Guava watersheds to the golf course with the 25-year storm golf course water surface elevations until the runoff ponds well above the top of curb elevations. With ponding at the top of curb elevations, only 34 cfs would discharge to the golf course at Guava and Elder during a 5-year storm compared 40.5 cfs and 57.6 cfs; and only 24 cfs compared 55.7 and 75.9 cfs during a 10-year storm. The remaining volume of runoff will pond above the top of curb. While flow out of College Park East would increase slightly with increased ponding, flooding exceeding the back of sidewalk will occur with both the 5-year (60,000 cubic feet) and 10-year (over 170,000 cubic feet) storms.

The existing drainage system with only two 36-inch RCP outlet drains at Elder Avenue and Guava Avenue provides only 2-year storm protection to the tributary areas.

4. Alternative Projects

As described in the previous sections, flood protection for the peak flows from a High-Confidence 25-year Storm is not possible without flood flow attenuation facilities and a pump station within College Park East.

In this focused study, three (3) alternative projects were evaluated. Only one of the alternatives will provide High Confidence 25-year Storm protection along Ironwood Avenue. The other two alternatives provide lower levels of flood protection but improve the existing conditions:

1. Alternative 1 of the 2012 study, consisting of shallow storm drains and box culverts providing 5-year + storm protection at Ironwood Avenue
2. Storm drains, pump station improvements, and pump station discharge pipes to the Old Ranch Golf Course swale, providing 10-year storm protection at Ironwood Avenue
3. Reinforced concrete box in-line detention basin, storm drains, a pump station, and discharge pipes to the Old Ranch Golf Course swale to provide 25-year protection at Ironwood Avenue

4.1 Alternative 1 – Provide 5-year + Storm Protection with a Gravity Drain System:

This is Alternative 1 of the 2012 study. It is illustrated on Figure 3. It provides greater levels of protection than the existing system, somewhat greater than 5-year storm. It consists of shallow box culverts and storm drains to be able to drain out to the golf course swale as long as the water level in the golf course is at the elevations calculated in the 2003 IKE study. Its estimated cost is $10,677,123, as detailed in Table 3.

4.2 Alternative 2 – Provide 10-year Storm Protection with Pump Station:

This alternative will collect the tributary runoff into a 48-inch storm drain pipe system and convey it to a new pump station at 4197 Ironwood Avenue. The pump station will discharge up to 110 cfs to the drainage swale in the Old Ranch Golf Course. The total peak flow of the 10-year Storm is 132 cfs. Flows above 110 cfs occur for an approximate period of 14 minutes. The volume of runoff that cannot be discharged by the pump station, estimated at 14,260 cubic feet, will be stored in the streets. The street cross sectional area available for storage below the top of curb is approximately 9 square feet. The runoff that cannot be pumped by the pump station will cover an approximate length of 1,700 feet at and below the top of curb. This will include approximately 700 feet of Ironwood Avenue between Elder Avenue and northeast of Guava Avenue, as well as approximately 700 feet of Elder Avenue and 300 feet of Guava Avenue southeasterly of Ironwood Avenue.

The proposed 48-inch pipe and its appurtenant catch basins and laterals will be constructed at shallow depth between the existing water and sewer lines to eliminate the need to relocate these facilities and reduce the construction cost. Relocation of other utilities such as gas, cable, electric, as well as service laterals will be required.

The plan view of this alternative is presented on Figure 4, and the required facilities are listed in Table 4. The estimated implementation cost is detailed in Table 5. Preliminary plan and profile are included in Appendix A.

Table 3
Alternative 1 Implementation Cost Estimates

Location	Type	Quantity	Unit Cost	Cost
Guava Avenue	30-inch RCP	65	$585	$38,025
	24-inch RCP	27	$513	$13,851
	Double 5.5' W x 2.5' H RCB	430	$3,355	$1,442,650
	Remove Exist. CB	2	$5,000	$10,000
	10-ft Catch Basin	1	$16,848	$16,848
	14-ft Catch Basin	1	$21,992	$21,992
	28-ft Catch Basin	4	$37,706	$150,824
	Sewer Manhole	5	$20,000	$100,000
	Modify Exist. SS Manhole	1	$8,000	$8,000
	Remove Exist. SS Manhole and Sewer Line	1	$10,000	$10,000
	New 8-inch Water Line	300	$400	$120,000
	8-inch VCP Sewer	600	$500	$300,000
			Sub - Total =	**$2,232,190**
Fir Avenue	36-inch RCP	95	$635	$60,325
	24-inch RCP	37	$513	$18,981
	21-ft Catch Basin	2	$29,214	$58,428
			Sub - Total =	**$137,734**
Elder Avenue	30-inch RCP	34	$585	$19,890
	24-inch RCP	34	$513	$17,442
	6' W x 3' H RCB	110	$2,079	$228,690
	Remove Exist. CB	2	$6,000	$12,000
	14-ft Catch Basin	2	$21,992	$43,984
	28-ft Catch Basin	2	$37,706	$75,412
			Sub - Total =	**$397,418**
Ironwood Avenue	36-inch RCP	120	$635	$76,200
	30-inch RCP	135	$585	$78,975
	24-inch RCP	60	$513	$30,780
	Triple 7' W x 3' H RCB	278	$5,859	$1,628,802
	Single 11' W x 3' H RCB	198	$3,024	$598,752
	Double 6' W x 2.5' H RCB	233	$1,985	$462,505
	Concrete Headwall	1	$60,000	$60,000
	14-ft Catch Basin	1	$21,992	$21,992
	21-ft Catch Basin	2	$29,214	$58,428
	28-ft Catch Basin	1	$37,706	$37,706
	SD and Sewer System	1	$20,000	$20,000
	Modify Exist. SS Manhole	2	$5,000	$10,000
	Remove Exist. SS Manhole	1	$5,000	$5,000
	New 8-inch Water Line	520	$450	$234,000
	New 8-inch Sewer Line	480	$550	$264,000
	New 10-inch Sewer Line	106	$600	$63,600
	New Sewer Manhole	5	$20,000	$100,000
			Demolish Existing Building	**$300,000**
			Site Improvements	**$300,000**
			Total Construction Cost	**$7,118,082**
			Contingency (20%)	**$1,423,616**
			Design and Construction Management (25%)	**$2,135,425**
			Grand Total =	**$10,677,123**

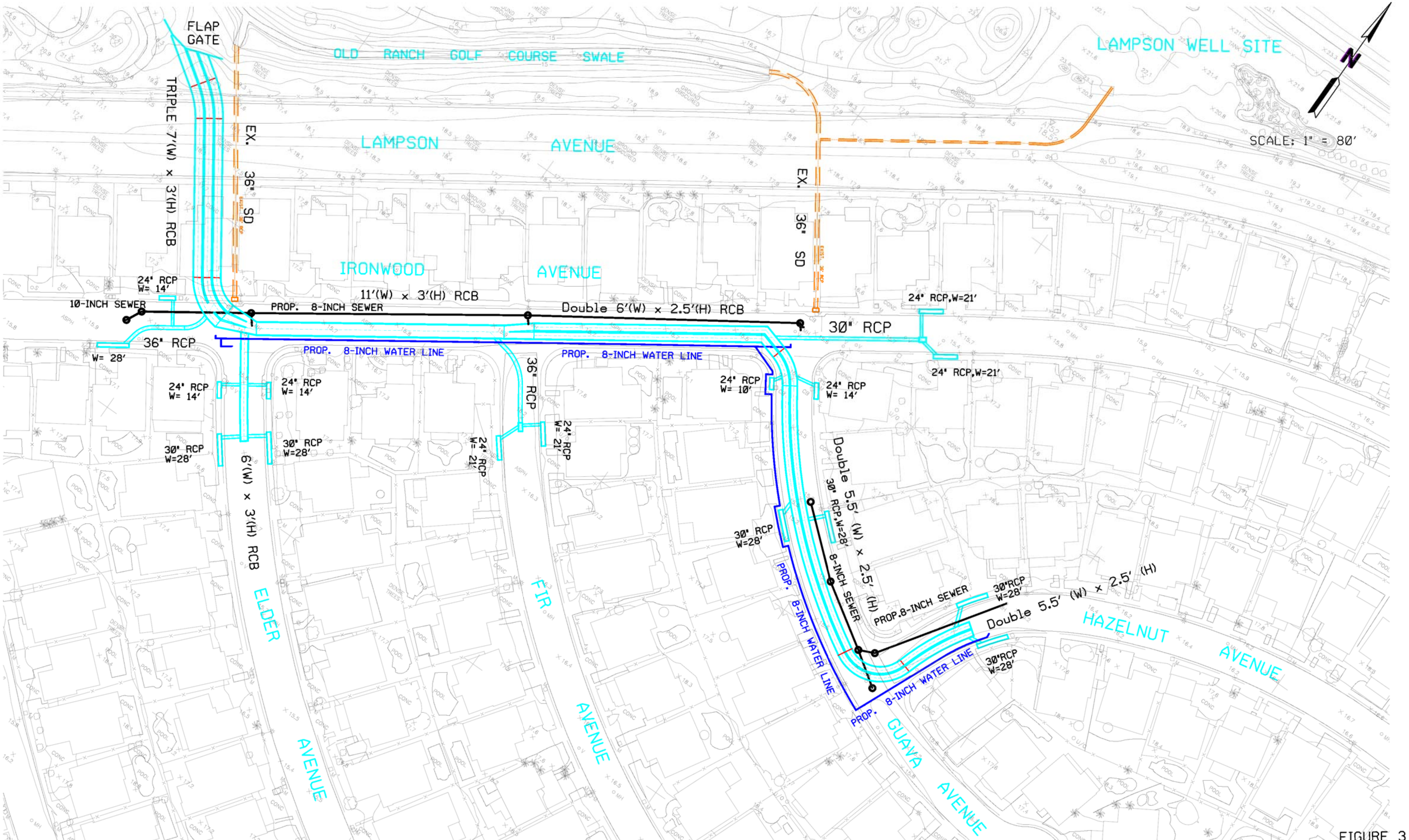


FIGURE 3

CITY OF SEAL BEACH · INCORPORATED · ORANGE COUNTY, CALIFORNIA

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PROJECT NUMBER: 0801514.00
DATE: JULY 2019

COLLEGE PARK EAST FOCUSED STUDY

GUAVA AVENUE AND ELDER AVENUE ALTERNATIVE 1

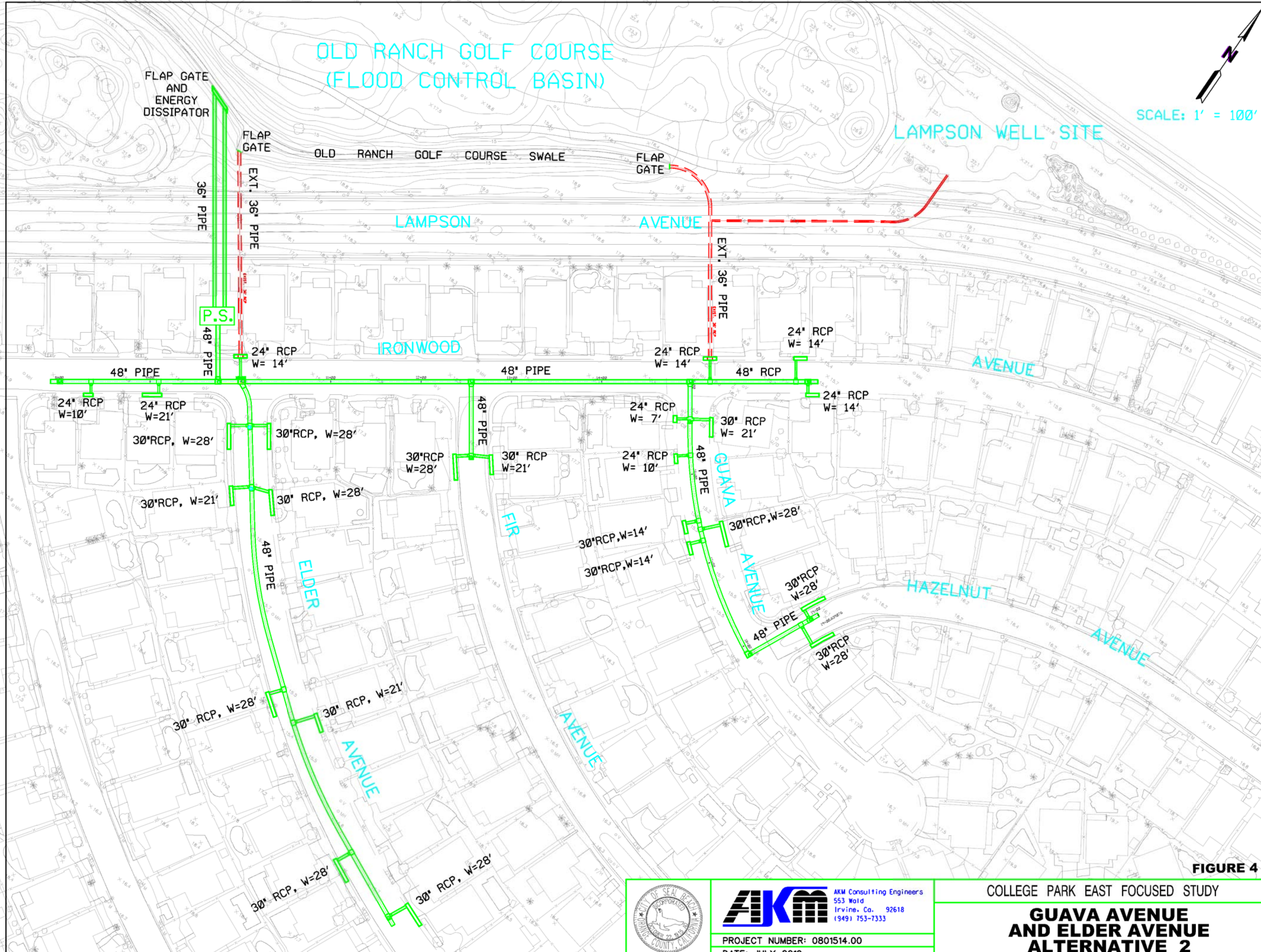


FIGURE 4

COLLEGE PARK EAST FOCUSED STUDY

GUAVA AVENUE AND ELDER AVENUE ALTERNATIVE 2

PROJECT NUMBER: 0801514.00

DATE: JULY 2019

Table 4
Alternative 2 Facilities

Location	Design Flow 25-yr/10-yr	Type of Facility	Quantity
Hazelnut Avenue	68 cfs/ 55 cfs	48-inch RCP	78’
		30-inch RCP	32’
		28-ft Catch Basin	2
Guava Avenue	68 cfs/ 55 cfs	48-inch RCP	310’
		30-inch RCP	53’
		24-inch RCP	36’
		7-ft Catch Basin	1
		10-ft Catch Basin	1
		14-ft Catch Basin	2
		21-ft Catch Basin	1
		28-ft Catch Basin	1
Ironwood Avenue between Guava Avenue and Fir Avenue	78 cfs/ 62 cfs	48-inch RCP	376’
		24-inch RCP	55’
		14-ft Catch Basin	3
Ironwood Avenue between Fir Avenue and Elder Avenue	92 cfs/ 81 cfs	48-inch RCP	440’
		24-inch RCP	47’
		10-ft Catch Basin	1
		14-ft Catch Basin	1
		21-ft Catch Basin	1
Ironwood Avenue between Elder Avenue and Pump Station influent box	147 cfs/ 126 cfs	48-inch RCP	40’
Ironwood Avenue to Pump Station	166 cfs/ 132 cfs	6’ (w) x 4’ (H) RCB	60’
Pump Station	110 cfs	36-inch FM RCP	540’
		Axial Flow Pumps	2
		Flap Gate	2
		Energy Dissipater	1
Ironwood Avenue southwest of Pump Station influent box	17 cfs/ 13 cfs	48-inch RCP 10-ft Catch Basin 21-ft Catch Basin	180’ 2 1
Fir Avenue	24 cfs	48-inch RCP	82’
		30-inch RCP	33’
		21-ft Catch Basin	1
		28-ft Catch Basin	1
Elder Avenue	56 cfs	48-inch RCP	620’
		30-inch RCP	160’
		21-ft Catch Basin	2
		28-ft Catch Basin	6

Table 5
Alternative 2 Implementation Cost Estimates

Location	Type	Quantity (LF/EA)	Unit Cost	Sub-Total
Hazelnut Avenue	48-inch RCP	78	$756	$58,968
	30-inch RCP	32	$581	$18,576
	28-ft Catch Basin	2	$37,706	$75,411
	Manhole	1	$14,850	$14,850
Guava Avenue	48-inch RCP	310	$756	$234,360
	30-inch RCP	53	$581	$30,767
	24-inch RCP	36	$513	$18,468
	7-ft Catch Basin	1	$13,001	$13,001
	10-ft Catch Basin	1	$16,848	$16,848
	14-ft Catch Basin	2	$21,992	$43,983
	21-ft Catch Basin	1	$29,214	$29,214
	28-ft Catch Basin	1	$37,706	$37,706
	Junction Structure	4	$11,340	$45,360
	Manhole	2	$14,850	$29,700
Ironwood Avenue between Guava Avenue and Fir Avenue	48-inch RCP	376	$756	$284,256
	24-inch RCP	55	$513	$28,215
	14-ft Catch Basin	3	$21,992	$65,975
	36-inch Flap Gate	1	$30,000	$30,000
	Junction Structure	2	$11,340	$22,680
	Manhole	3	$14,850	$44,550
Ironwood Avenue between Fir Avenue and Elder Avenue	48-inch RCP	520	$756	$393,120
	24-inch RCP	47	$513	$24,111
	10-ft Catch Basin	1	$16,848	$16,848
	14-ft Catch Basin	1	$21,992	$21,992
	21-ft Catch Basin	1	$29,214	$29,214
	Junction Structure	3	$11,340	$34,020
	Manhole	3	$14,850	$44,550
Pump Station	Pump Station Influent Box 8'x4'	60	$2,335	$140,100
	36" RCP Discharge Pipe	540	$635	$342,630
	Pump Station	1	$10,500,000	$10,500,000
	36-inch Flap Gates	2	$10,000	$20,000
	Energy Dissipator	1	$100,000	$100,000
	Site Improvements	1	$100,000	$100,000
Fir Avenue	48-inch RCP	82	$756	$61,992
	30-inch RCP	33	$581	$19,157
	21-ft Catch Basin	1	$29,214	$29,214
	28-ft Catch Basin	1	$37,706	$37,706
	Manhole	1	$14,850	$14,850
Elder Avenue	48-inch RCP	620	$756	$468,720
	30-inch RCP	160	$581	$92,880
	21-ft Catch Basin	2	$29,214	$58,428
	28-ft Catch Basin	6	$37,706	$226,233
	Junction Structure	6	$11,340	$68,040
	Manhole	6	$14,850	$89,100
			Construction Cost =	**$14,075,790**
			Contingency (20%) =	**$2,815,158**
			Design and Construction Management (25%) =	**$4,222,737**
			Grand Total =	**$21,113,684**

4.3 Alternative 3 – Provide 25-year Storm Protection with Pump Station:

This alternative incorporates an in-line detention basin (12'W x 9.5'H reinforced concrete box; RCB) to collect and convey the tributary runoff to a new 110 cfs capacity pump station at 4197 Ironwood Avenue, and provide storage for the volume of runoff above the pump station capacity. It also includes connecting storm drains and catch basins, a 110 cfs pump station, and two 36-inch diameter discharge pipes terminating at the Old Ranch Golf Course drainage swale. Flows above 110 cfs will be stored in the in-line detention basin to provide 25-year storm protection. The volume above 110 cfs is approximately 76,000 cubic feet. Maintaining the wet well operating level below the normal depth of flow up to 110 cfs in the influent box will allow the use of the volume above the normal depth for storage. At 110 cfs, the depth of flow in the box is 1.33 foot. The remaining volume is 80,400 cubic foot, which is sufficient to store the entire runoff above 110 cfs.

Due to the large and deep RCB in-line detention basin, relocation of sewer, water, and other utilities are required. The plan view of this alternative is shown on Figure 5, and the required system elements are listed in Table 6. The estimated implementation cost is detailed in Table 7. Table 8 shows the water and sewer facilities that need to be relocated. Table 9 shows the cost of utility relocation, and Table 10 illustrates the total implementation cost of Alternative 3. Plan and profile of this alternative are presented in Appendix B.

Table 6- Alternative 3 Facilities

Location	Design Flow	Type of Facility	Quantity
Hazelnut Avenue	68 cfs	9'W x 2'H RCB	98'
		30-inch RCP	28'
		28-ft Catch Basin	2
Guava Avenue	68 cfs	12'W x 9.5' H RCB	267'
		30-inch RCP	41'
		24-inch RCP	27'
		7-ft Catch Basin	1
		10-ft Catch Basin	1
		14-ft Catch Basin	2
		21-ft Catch Basin	1
		28-ft Catch Basin	1
Ironwood Avenue between Guava Avenue and Fir Avenue	96 cfs	12'W x 9.5'H RCB	257'
		24-inch RCP	60'
		36-inch RCP	133'
		14-ft Catch Basin	3
Ironwood Avenue between Fir Avenue and Elder Avenue	166 cfs	12'W x 9.5'H RCB	296'
		7' W x 3' H RCB	54'
		24-inch RCP	60'
		14-ft Catch Basin	2
On Pump Station property from Ironwood Avenue crossing Lampson Avenue to Golf Course	110 cfs	36-inch FM RCP	540'
		Pump Station	1
		Flap Gate	1
		Energy Dissipater	1
Fir Avenue	24 cfs	7' W x 3'H RCB	83'
		30-inch RCP	30'
		21-ft Catch Basin	1
		28-ft Catch Basin	1
Elder Avenue	56 cfs	48-inch RCP	620'
		30-inch RCP	160'
		21-ft Catch Basin	2
		28-ft Catch Basin	6

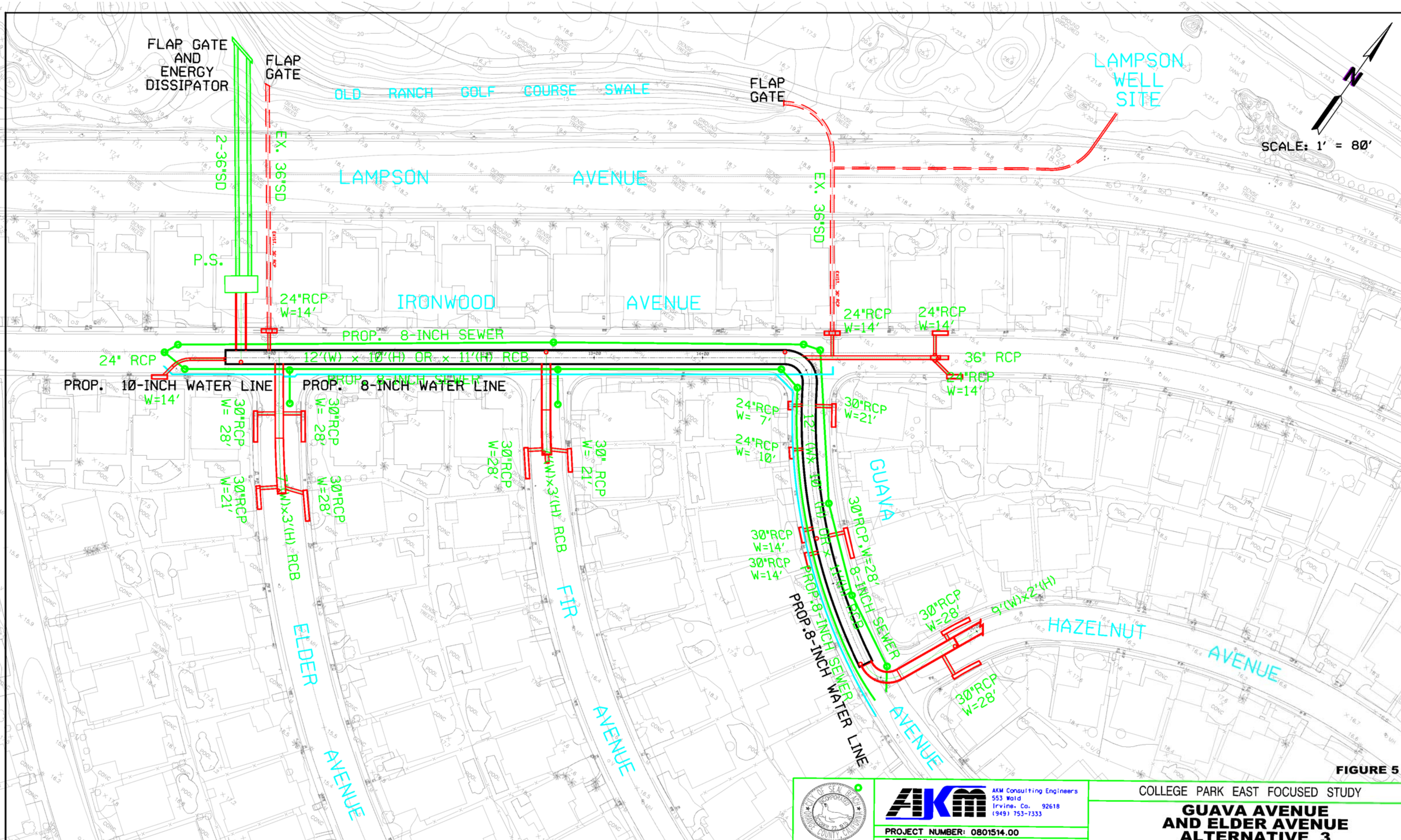


FIGURE 5

GUAVA AVENUE AND ELDER AVENUE ALTERNATIVE 3

Table 7
Alternative 3 Implementation Cost Estimates

Location	Type	Quantity (LF/EA)	Unit Cost	Sub-Total
Hazelnut Avenue	9' (W) x 2' (H) RCB	98	$1,998	$195,804
	30-inch RCP	28	$581	$16,254
	28-ft Catch Basin	2	$37,706	$75,411
	RCP to RCB Connection	2	$5,000	$10,000
	36-inch Manhole Shaft	1	$5,400	$5,400
Guava Avenue	12' (W) x 9.5' (H) RCB	267	$4,935	$1,317,645
	30-inch RCP	41	$581	$23,801
	24-inch RCP	27	$513	$13,851
	7-ft Catch Basin	1	$13,001	$13,001
	10-ft Catch Basin	1	$16,848	$16,848
	14-ft Catch Basin	2	$21,992	$43,983
	21-ft Catch Basin	1	$29,214	$29,214
	28-ft Catch Basin	1	$37,706	$37,706
	RCP to RCB Connection	6	$5,000	$30,000
	36-inch Manhole Shaft	2	$5,400	$10,800
Ironwood Avenue between Guava Avenue and Fir Avenue	12' (W) x 9.5' (H) RCB	257	$4,935	$1,268,295
	24-inch RCP	60	$513	$30,780
	36-inch RCP	133	$635	$84,455
	14-ft Catch Basin	3	$21,992	$65,975
	RCP Junction Srtucture	1	$9,450	$9,450
	Pipe Manhole	1	$12,150	$12,150
	36-inch Flap Gate	1	$30,000	$30,000
	RCB to RCB Connection	1	$6,000	$6,000
	36-inch Manhole Shaft	2	$5,400	$10,800
Ironwood Avenue between Fir Avenue and Elder Avenue	12' (W) x 9.5' (H) RCB	296	$4,935	$1,460,760
	7' (W) x 3' (H) RCB	54	$1,836	$99,144
	24-inch RCP	60	$513	$30,780
	14-ft Catch Basin	2	$21,992	$43,983
	RCP to RCB Connection	2	$5,000	$10,000
	RCB to RCB Connection	1	$6,000	$6,000
	36-inch Manhole Shaft	1	$5,400	$5,400
Pump Station	Pump Station Influent Box	60	$2,040	$122,400
	36" RCP	540	$635	$342,630
	Pump Station	1	$10,500,000	$10,500,000
	36-inch Flap Gates	2	$10,000	$20,000
	Energy Dissipator	1	$100,000	$100,000
	Standby Generator	1	$300,000	$300,000
	Site Improvements	1	$100,000	$100,000
Fir Avenue	7' (W) x 3' (H) RCB	83	$1,836	$152,388
	30-inch RCP	30	$581	$17,415
	21-ft Catch Basin	1	$29,214	$29,214
	28-ft Catch Basin	1	$37,706	$37,706
	RCP to RCB Connection	2	$5,000	$10,000
	RCB to RCB Connection	1	$6,000	$6,000
	36-inch Manhole Shaft	1	$5,400	$5,400
Elder Avenue	48-inch RCP	620	$1,836	$1,138,320
	30-inch RCP	160	$581	$92,880
	21-ft Catch Basin	2	$29,214	$58,428
	28-ft Catch Basin	6	$37,706	$226,233
	RCP to RCB Connection	8	$5,000	$40,000
	RCB to RCB Connection	1	$6,000	$6,000
	36-inch Manhole Shaft	6	$5,400	$32,400
			Construction Cost =	**$18,351,102**
			Contingency (20%) =	**$3,670,220**
			Design and Construction Management (25%) =	**$5,505,330**
			Grand Total =	**$27,526,652**

Table 8 - Relocation of Water and Sewer Lines

Location	Type of Facility	Quantity
Guava Avenue	West 8-inch Water	340’
	East 8-inch Sewer	327’
	West 8-inch Sewer	303’
	Sewer Manhole	4
Ironwood Avenue between Guava Avenue and Elder Avenue	South 8-inch Water	655’
	North 8-inch Sewer	608’
	South 8-inch Sewer	600’
	Sewer Manhole	10

Table 9
Relocation of Water Line and Sewer Line Construction Cost Estimates

Location	Type	Quantity (LF/EA)	Unit Cost	Sub-Total
Guava Avenue	West 8-inch Water Line	340	$500	$170,000
	East 8-inch Sewer Line	327	$600	$196,200
	West 8-inch Sewer Line	303	$600	$181,800
	Sewer Manhole	4	$20,000	$80,000
	Reconstruct Sidewalk/Curb & Gutter	400	$216	$86,400
Ironwood Avenue between Guava Avenue and Elder Avenue	South 8-inch Water Line	655	$500	$327,500
	North 8-inch Sewer Line	608	$600	$364,800
	South 8-inch Sewer Line	600	$600	$360,000
	Sewer Manhole	10	$20,000	$200,000
	Reconstruct Sidewalk/Curb & Gutter	680	$216	$146,880
			Construction Cost =	**$2,113,580**
			Contingency (20%) =	**$422,716**
			Design and Construction Management (25%) =	**$634,074**
			Sub-Grand Total =	**$3,170,370**

Table 10
Summary of Alternative 3 Implementation Cost Estimates

1). Storm Drain System			**$27,526,652**
2). Relocation of Water and Sewer Lines			**$3,170,370**
		Grand Total =	**$30,697,022**

4.4 Pump Station

The pump station will have a below ground wet well and an above ground motor room. The wet well will have two 55 cfs mixed flow main pumps (lead and lag) run by variable frequency drive operated inverter duty electric motors. Possible alternatives are Cascade MF3012CD4 mixed flow pump with 51^{0} impeller pitch, and Sulzer 30 PO propeller pump with +2 propeller pitch, both operating at a maximum rotational speed of 590 rpm. Either pump would be operated by a 250 HP motor. In order to cover the entire range of possible inlet and outlet water surface elevations and keep the pump in its proper operating range, a seal weir will be necessary. The pumps will discharge from the wet well into the seal weir chamber, which in turn will discharge into an outfall chamber and the golf course swale through two 36-inch diameter cement mortar lined and coated steel pipes. The pump station will have two 8-foot wide pumping bays with a 1-foot thick dividing wall between the pumps. Suction umbrellas (6-foot diameter) will be attached to each pump's suction bell to reduce the entrance velocity and minimize the possibility of vortexing when water levels in the wet well drop to near the pump shutoff elevations.

The lead pump will start when the water level in the pump station's wet well reaches 1.3 foot elevation (1.3 feet above the invert elevation of the inlet reinforced concrete box). It will adjust speed to control the flow and maintain a constant level in the wet well. If the water level drops to 0.0 foot, the lead pump will stop. If the wet well water level rises with the lead pump operating at full speed, the lag (second) pump will start, and the two pumps will operate at the same speed to maintain level in the wet well. The pumps will be stopped at 0.0 ft and -2.0 ft when the water level drops. The pump station will have a sump pump to pump out the wet well when the two main pumps are not operating.

The motors and the motor control center will be housed in an above ground structure which will match the architecture of the existing house. It will be sound insulated to minimize noise outside the structure when the pump station is operating. A 500 kW standby generator and an 800 amp automatic transfer switch will be provided to operate the pump station during commercial power outages. The preliminary plan and section of the pump station are shown on Figures 6 and 7. The pump station site plan is provided on Figure 8

Because of the deep in-line detention basin and the submergence required over the pumps' suction bells/umbrellas, the bottom of the wet well will be approximately at elevation -8.6 feet (26.5 feet below existing pad elevation. The total excavation will be approximately 4.5 feet lower (2.5 feet for the thickness of the wet well structure bottom, and 2 feet for a crushed rock bedding). Excavation will require hydraulically pressed in vibration free shoring plates, the depth of which will depend on the soil profile below the site. It is expected that groundwater will be encountered, and the excavation will need to be dewatered within the shored area to provide dry conditions at the bottom for a firm foundation.

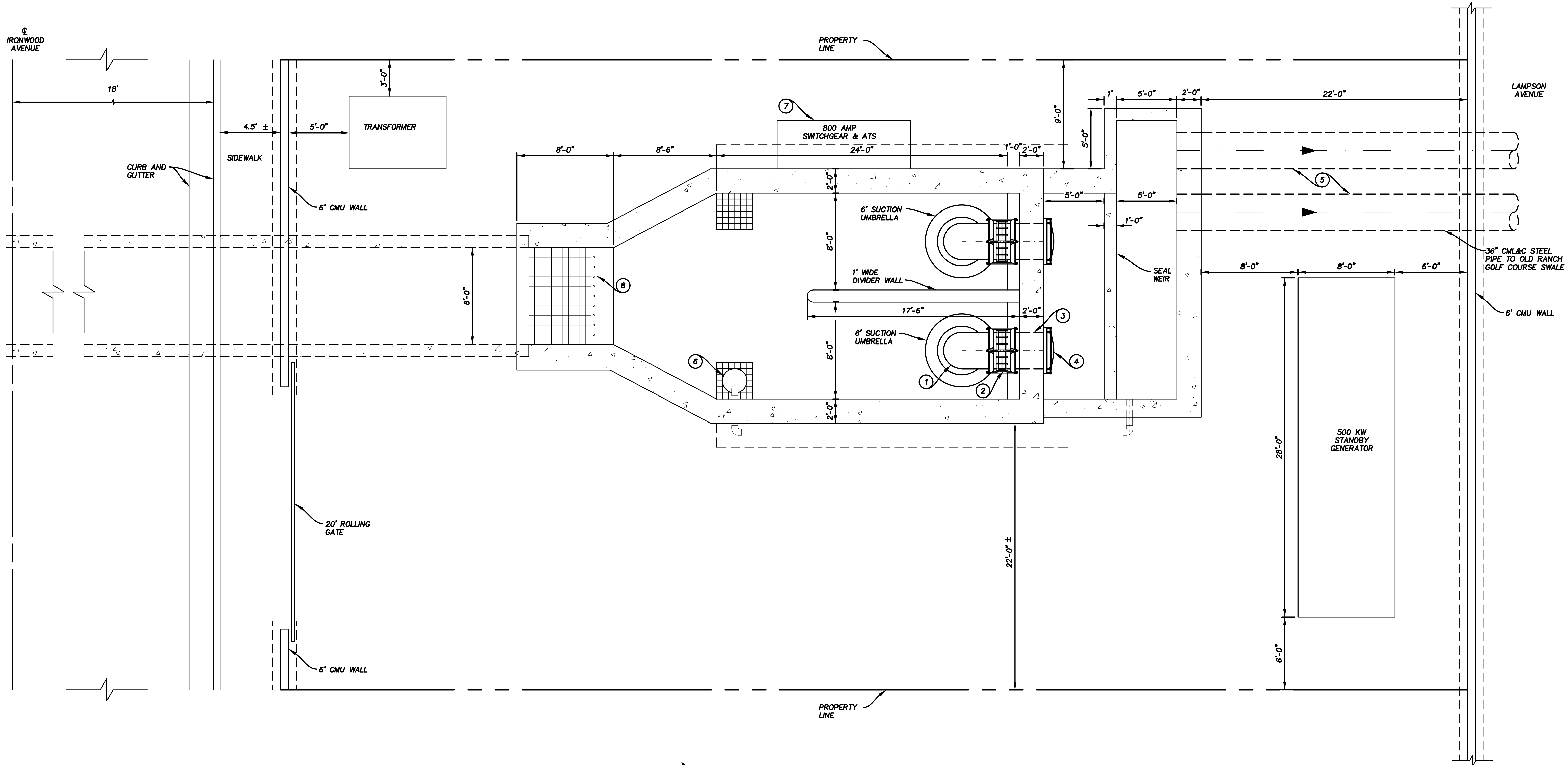
4.5 Summary of Alternatives Evaluated

Drainage of the westerly 240 acres of College Park East community is constrained by several factors, the primary one being the initial construction of very shallow outlet facilities. Additionally, the storm drains constructed during the development of the area are not large enough to provide the level of flood protection even if the outlet drainage systems were lower. The 2008 Master Plan formulated an alternative to overcome these constraints. This alternative consisted of storm drains collecting and conveying the runoff to a new pump station in Bluebell Park, which would then pump the runoff to a pond in Old Ranch Golf Course. The City could not construct this system due to its high cost.

This Focused Study evaluated three alternatives, which provide various levels of flood protection to the area draining to Ironwood Avenue at Elder Avenue and Guava Avenue. Table 11 summarizes and compares the three alternatives.

Table 11 – Comparison of Drainage System Options

	Alternative 1	Alternative 2	Alternative 3
Description	Shallow storm drains and box culverts draining to Old Ranch Golf Course swale by gravity through a 3-7'(W) x 3'(H) RCB	Shallow RCP storm drains and a pump station at 4197 Ironwood Avenue to discharge up to 110 cfs to the Old Ranch Golf Course swale	RCP and RCB storm drains and in-line detention basin and a pump station at 4197 Ironwood Avenue to discharge up to 110 cfs to the Old Ranch Golf Course swale
Protection Level	5-year storm +	10-year storm	25-yr storm
Utility Impacts	Yes - Requires relocation of water and sewer lines in Guava Avenue and Ironwood Avenue, as well as house service laterals	Minimal - mostly house service laterals	Yes - Requires relocation of water and sewer lineson Guava Avenue and Ironwood Avenue, as well as house service laterals
Utility Relocation Cost	$1,821,900	-	$3,170,370
Total Cost	$10,677,123	$21,113,684	$30,697,022



PUMP STATION PLAN

SCALE: ¼" =1'-0"

CONSTRUCTION NOTES:

1. 55 CFS, 27 FT TDH PUMP, 250 HP MOTOR.
2. 36" FLEX COUPLING.
3. 36" I.D. CEMENT MORTAR LINED STEEL PIPE.
4. 36" FLAP GATE.
5. 36" I.D. CEMENT MORTAR LINED AND COATED STEEL PIPE.
6. SUMP PUMP.
7. 800 AMP SWITCHGEAR AND AUTOMATIC TRANSFER SWITCH
8. TRASH RACK

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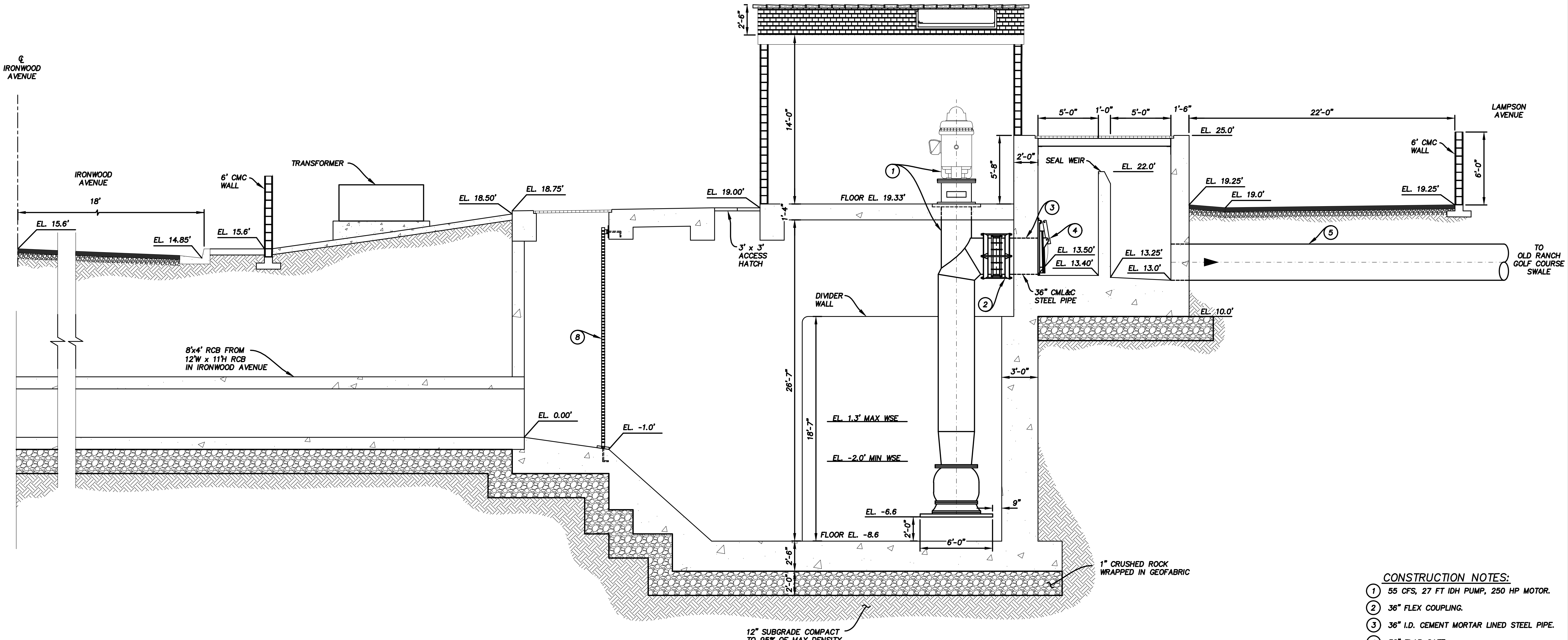
ALTERNATIVE 3
STORMWATER PUMP STATION PLAN

FIGURE 6



PUMP STATION SECTION

SCALE: ¼" =1'-0"

CONSTRUCTION NOTES:

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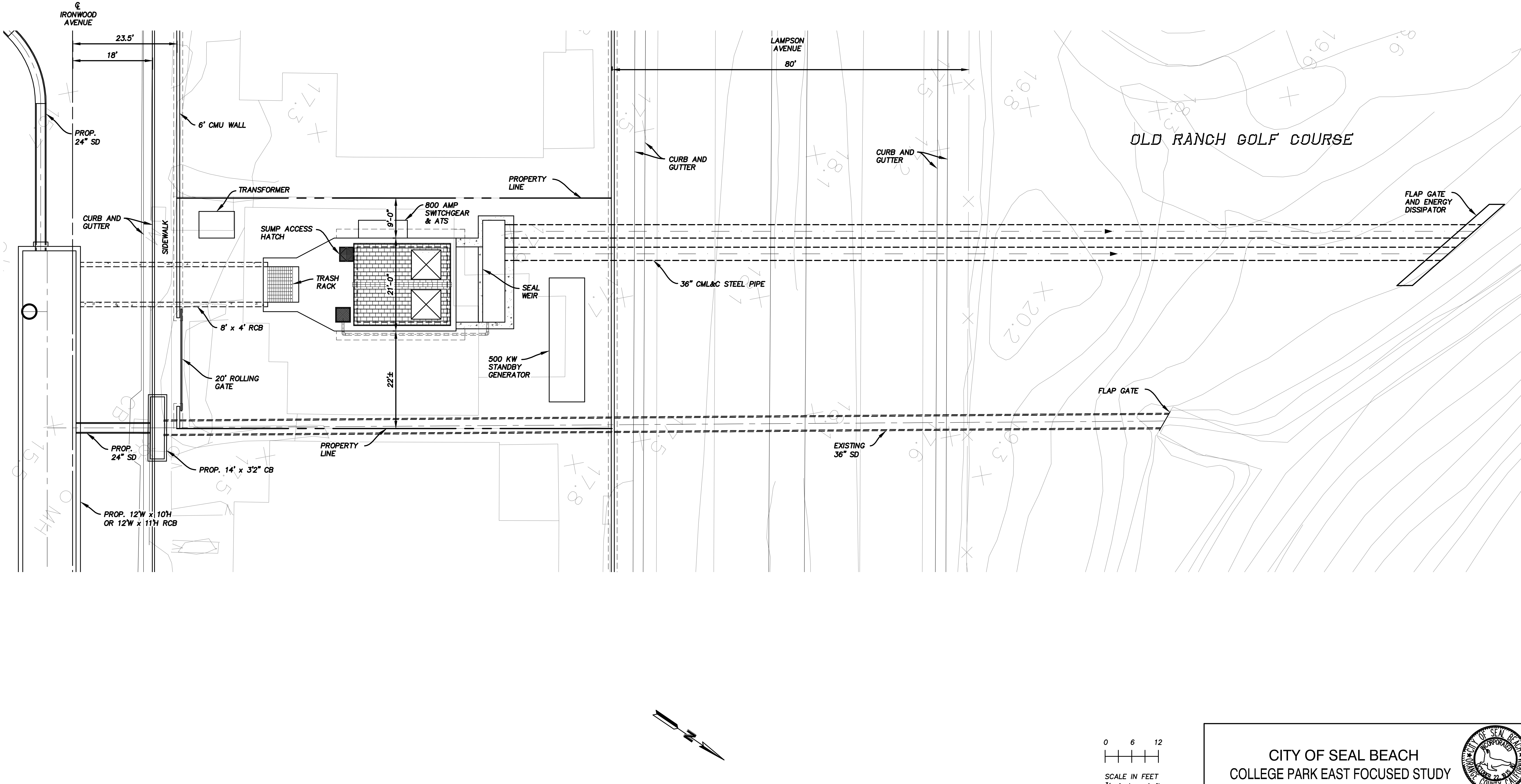
ALTERNATIVE 3
STORM WATER PUMP STATION SECTION

FIGURE 7



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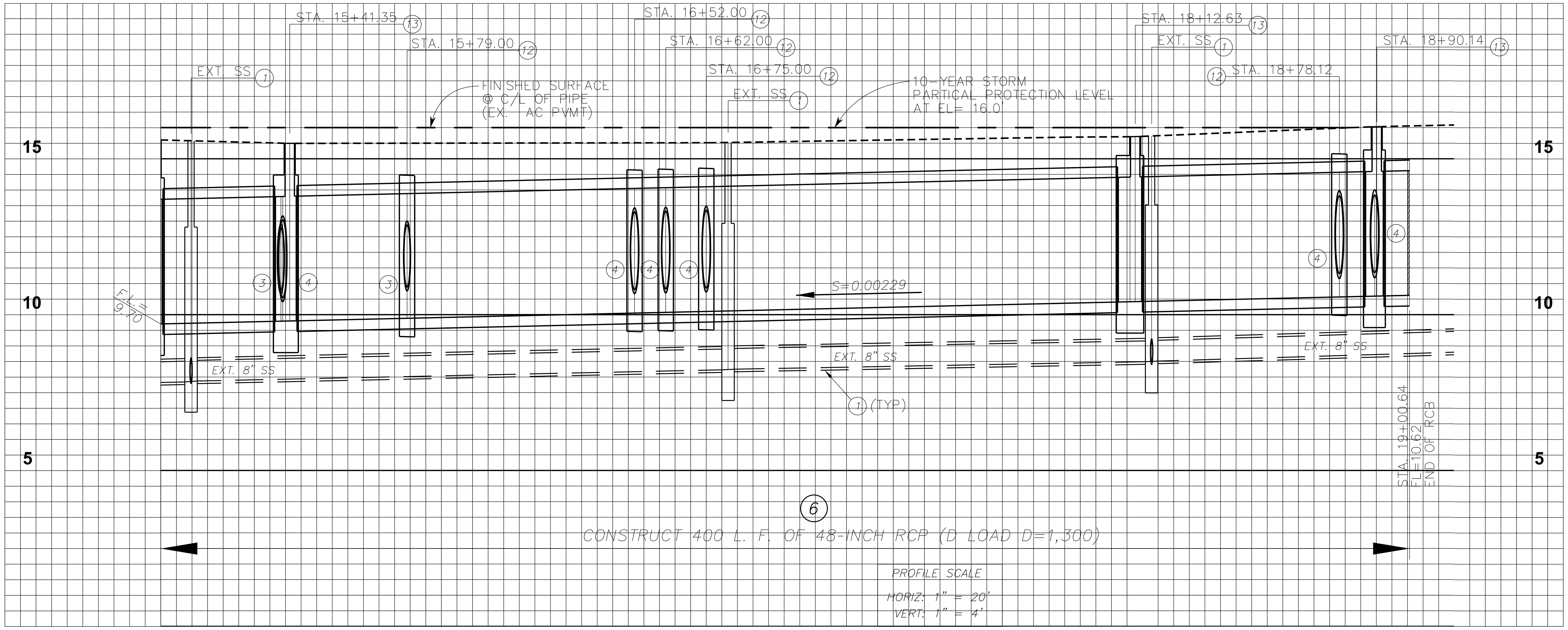
ALTERNATIVE 3
STORMWATER PUMP STATION PLAN

FIGURE 8

APPENDIX A



STORM DRAIN CONSTRUCTION NOTES

NOTE: 1) ALL CURB OPENING CATCH BASINS SHALL BE EQUIPPED WITH AUTOMATIC RETRACTABLE SCREEN AND INSERTED FILTER PER CITY APPROVAL.

1 — PROTECT EXISTING UTILITIES IN PLACE; SUCH AS SEWER, WATER, CABLE, GAS, ELECTRICAL, ETC.

2 — CONDUCT POTHOLING TO VERIFY THE UTILITIES' LOCATIONS, MATERIAL, AND DEPTH, AND COORDINATION OF RELOCATION EXISTING UTILITIES BY THEIR RESPECTIVE OWNERS.

3 — CONSTRUCT 24-INCH RCP (D-LOAD PER PROFILE).

4 — CONSTRUCT 30-INCH RCP (D-LOAD PER PROFILE).

6 — CONSTRUCT 48-INCH RCP (D-LOAD PER PROFILE) WITH PUMP STATION OUT-FLOW RATE OF 100 CFS.

7 — CONSTRUCT CURB OPENING CATCH BASIN PER SPPWC STD. PLAN NO. 300-3, W=7'.

8 — CONSTRUCT CURB OPENING CATCH BASIN PER SPPWC STD. PLAN NO. 300-3, W=10'.

9 — CONSTRUCT CURB OPENING CATCH BASIN PER SPPWC STD. PLAN NO. 300-3, W=14'.

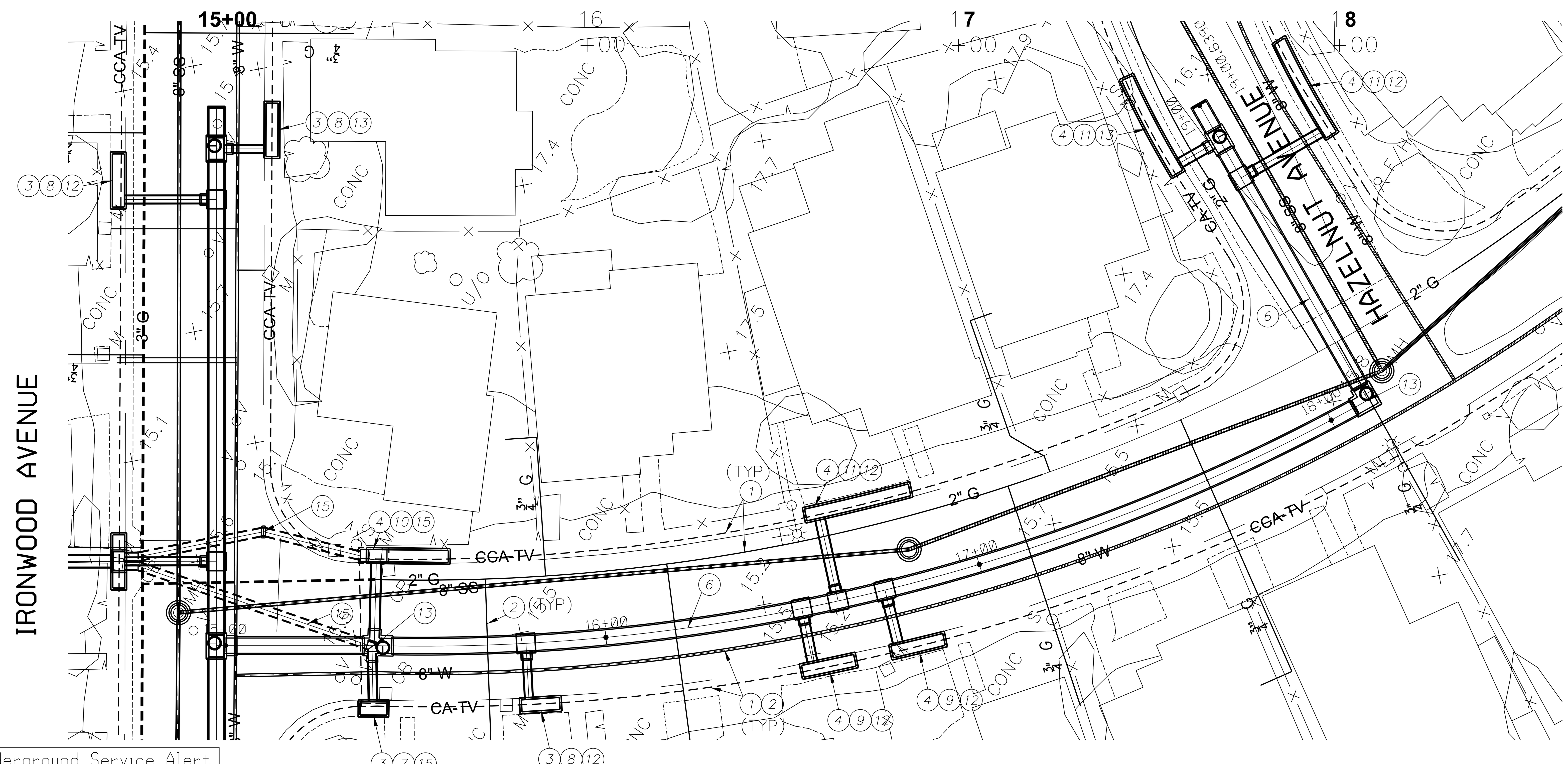
10 — CONSTRUCT CURB OPENING CATCH BASIN PER SPPWC STD. PLAN NO. 300-3, W=21'.

11 — CONSTRUCT CURB OPENING CATCH BASIN PER SPPWC STD. PLAN NO. 300-3, W=28'.

12 — CONSTRUCT JUNCTION STRUCTURE - PIPE TO PIPE PER SPPWC STD. PLAN NO. 331-3.

13 — CONSTRUCT MANHOLE - PIPE TO PIPE WITH 36-INCH MANHOLE SHAFT WITHOUT REDUCER PER SPPWC STD. PLAN NO. 322-2 AND 326-2.

15 — REMOVE OR ABANDON WITH PLUGS EXISTING STORM DRAIN FACILITY IN PLACE.



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1). DUE TO THE FACT OF SHALLOW DEPTH OF PUBLIC UTILITIES; SUCH AS GAS, WATER, SEWER, CABLE, TELEPHONE, ELECTRIC, ETC., COORDINATION WITH THE RESPECTIVE UTILITY OWNERS MUST BE CONDUCTED DURING THE FINAL DESIGN STAGE.

2). THIS PROPOSED STORM DRAIN OPTION IS CONTROLLED BY THE DEPTH OF THE EXISTING SEWER AND THE BACKWATER FROM THE GOLF COURSE. THE FUTURE PUMP STATION OUTFLOW CAPACITY IS ABOUT 100 CFS. UNDER SUCH CONDITION, THE SYSTEM CAN PROVIDE 10-YEAR STORM PARTICAL PROTECTION TO AN ELEVATION LEVEL OF 16-FOOT.

3). SEVERAL STREET LOW POINTS WITH FLAT SLOPES ARE ALONG IRONWOOD AVENUE, GUAVA AVENUE, AND ELDER AVENUE. THEREFORE, EVEN COMPLETION OF THIS PROPOSED STORM DRAIN SYSTEM LOCAL FLOODING WILL STILL OCCUR DURING THE STORM. THE UPSTREAM DRAINAGE SYSTEM EXTENSION SHALL BE REFERRED TO THE CITY STORM DRAIN MASTER PLAN.

4). THE EXISTING SEWER MAIN IS BELOW THE PROPOSED STORM DRAIN, AND SHALL BE PROTECT IN PLACE. THE SEWER LATERAL (HOUSE CONNECTION) CROSSINGS AT THE PROPOSED STORM DRAIN SYSTEM SHALL ALSO BE PROTECTED IN PLACE. FOR ANY CONFLICTED SEWER LATERAL, IT SHALL BE RELOCATED PER SPPWC STD. PLAN NO. 223-2.

5). AT CATCH BASIN LOCATION, LOCAL DEPRESSION SHALL BE CONSTRUCTED PER SPPWC STD. PLAN NO. 313-3.

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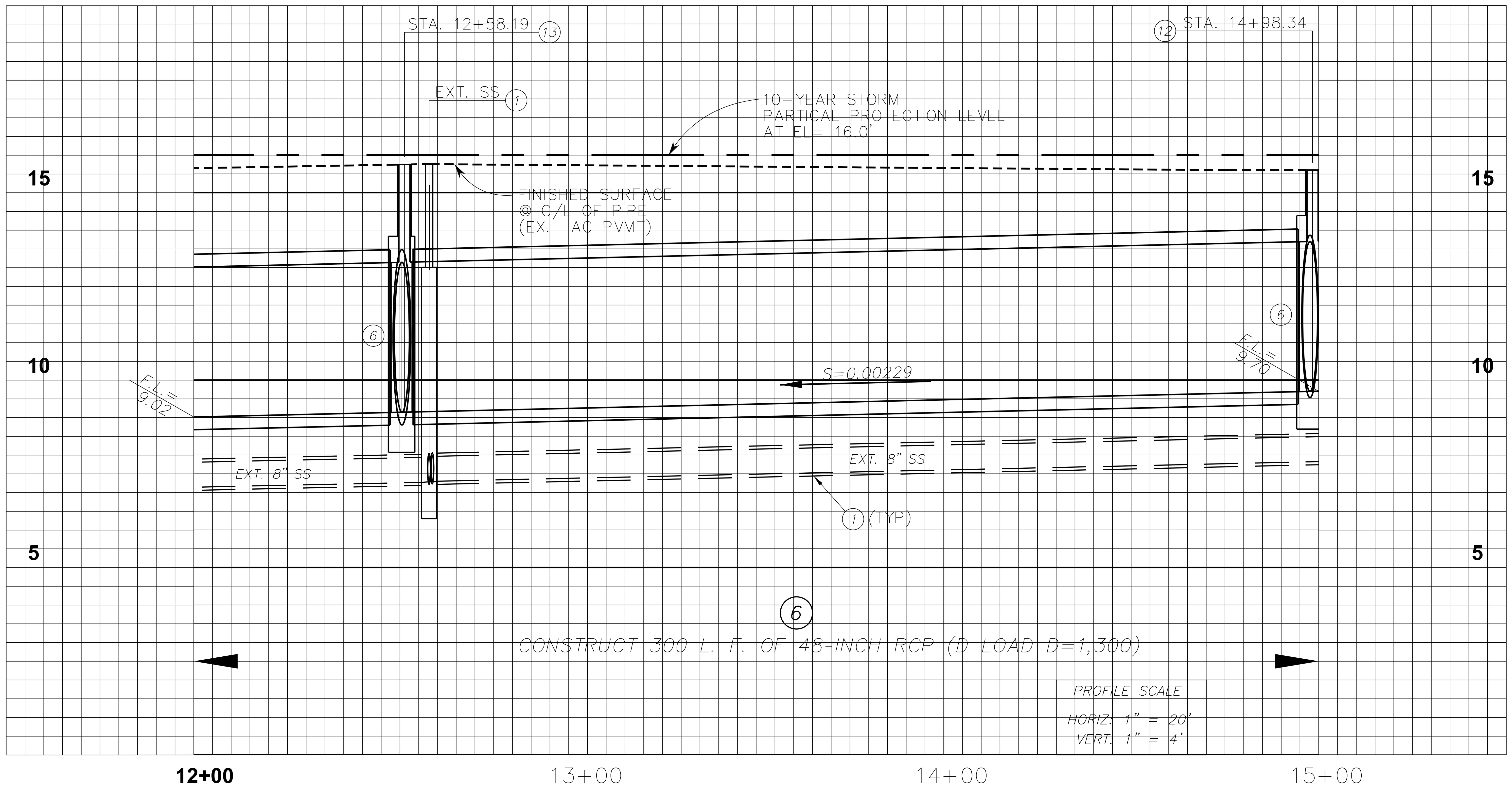
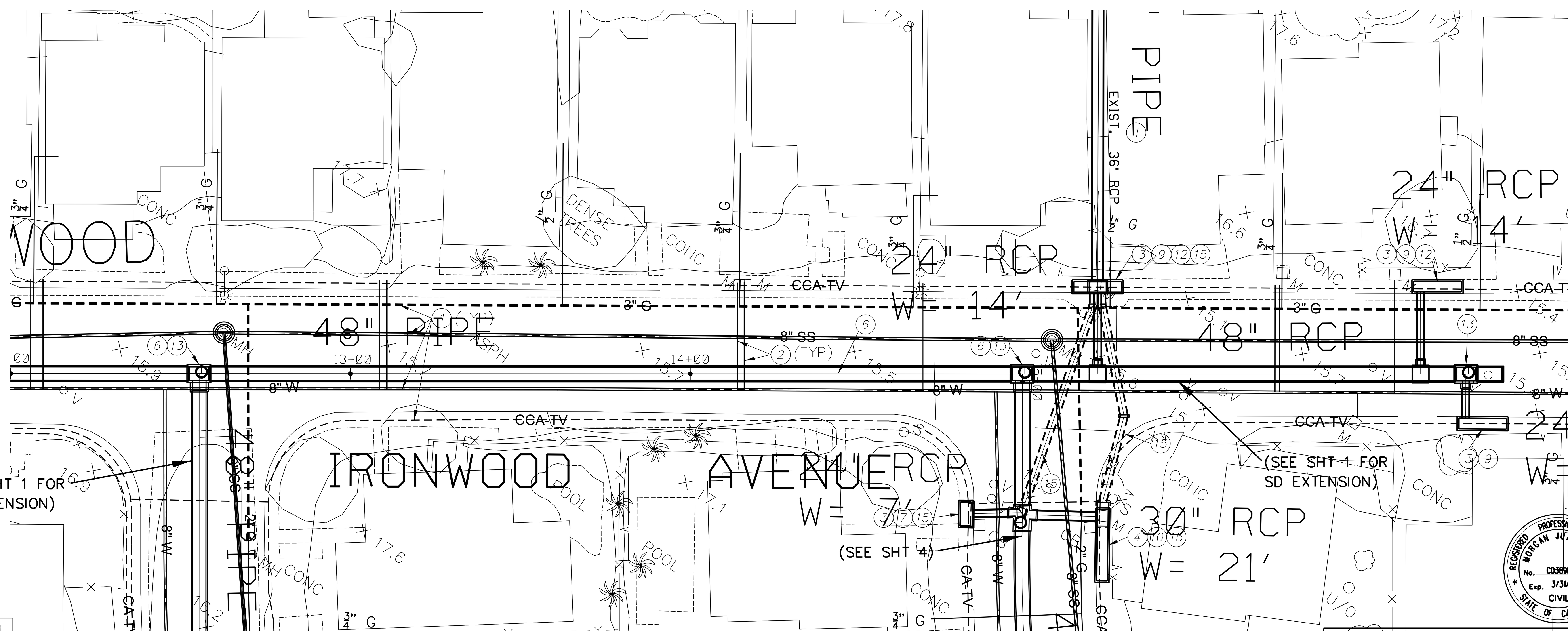
PUBLIC WORKS DEPARTMENT
IRONWOOD AVENUE DRAINAGE SYSTEMS
FOCUSED STUDY

TITLE: IRONWOOD AVENUE
OPTION NO. 1 - 10-YEAR STORM PIPE SYSTEM
BETWEEN ELDER AVENUE AND GUAVA AVENUE

STA. 15+00 TO STA. 19+00





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6 — CONSTRUCT 48-INCH RCP (D-LOAD PER PROFILE) WITH PUMP STATION OUT-FLOW RATE OF 100 CFS.

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9 — CONSTRUCT CURB OPENING CATCH BASIN PER SPPWC STD. PLAN NO. 300-3, W=14'.

10 — CONSTRUCT CURB OPENING CATCH BASIN PER SPPWC STD. PLAN NO. 300-3, W=21'.

12 — CONSTRUCT JUNCTION STRUCTURE - PIPE TO PIPE PER SPPWC STD. PLAN NO. 331-3.

13 — CONSTRUCT MANHOLE - PIPE TO PIPE WITH 36-INCH MANHOLE SHAFT WITHOUT REDUCER PER SPPWC STD. PLAN NO. 322-2 AND 326-2.

15 — REMOVE OR ABANDON WITH PLUGS EXISTING STORM DRAIN FACILITY IN PLACE.

GENERAL NOTES:

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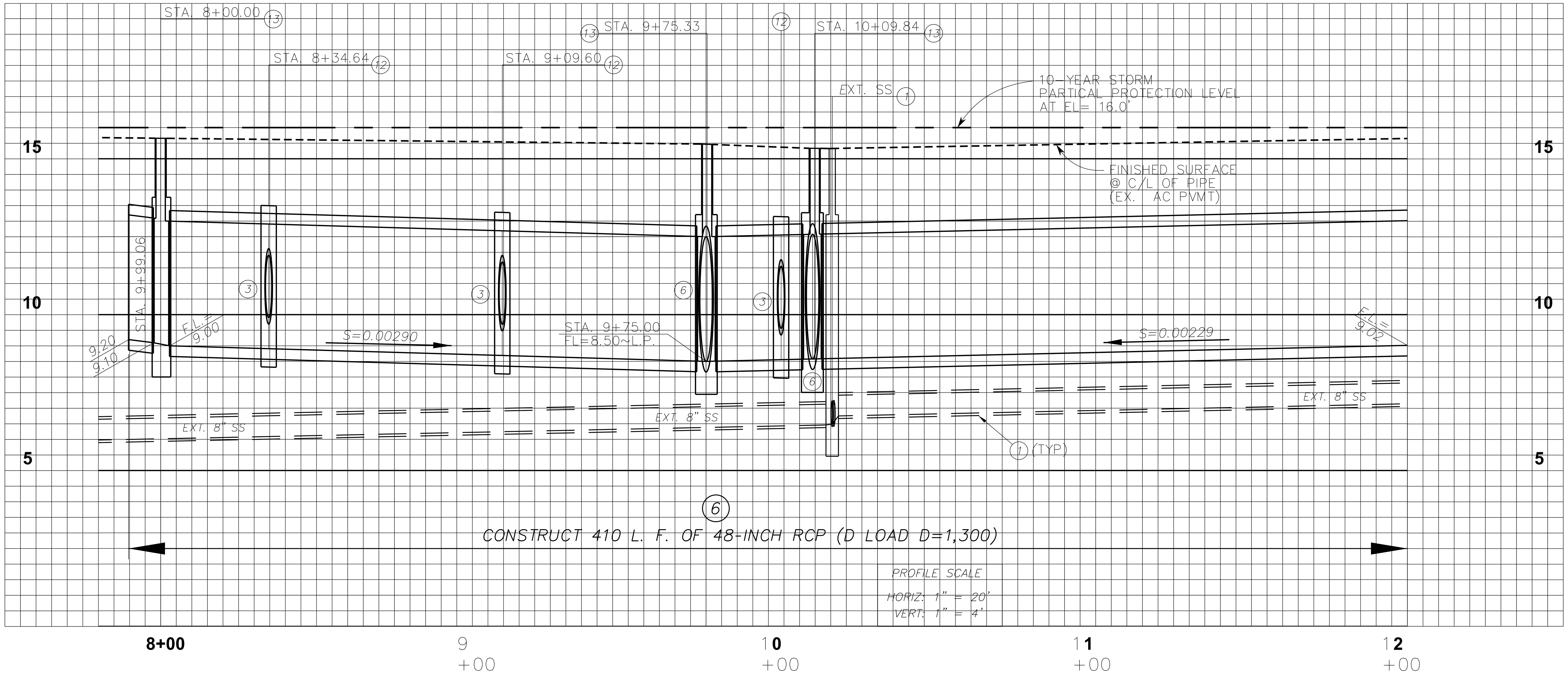

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5 — CONSTRUCT 36-INCH RCP (D-LOAD PER PROFILE).

6 — CONSTRUCT 48-INCH RCP (D-LOAD PER PROFILE) WITH PUMP STATION OUT-FLOW RATE OF 100 CFS.

8 — CONSTRUCT CURB OPENING CATCH BASIN PER SPPWC STD. PLAN NO. 300-3, W=10'.

9 — CONSTRUCT CURB OPENING CATCH BASIN PER SPPWC STD. PLAN NO. 300-3, W=14'.

10 — CONSTRUCT CURB OPENING CATCH BASIN PER SPPWC STD. PLAN NO. 300-3, W=21'.

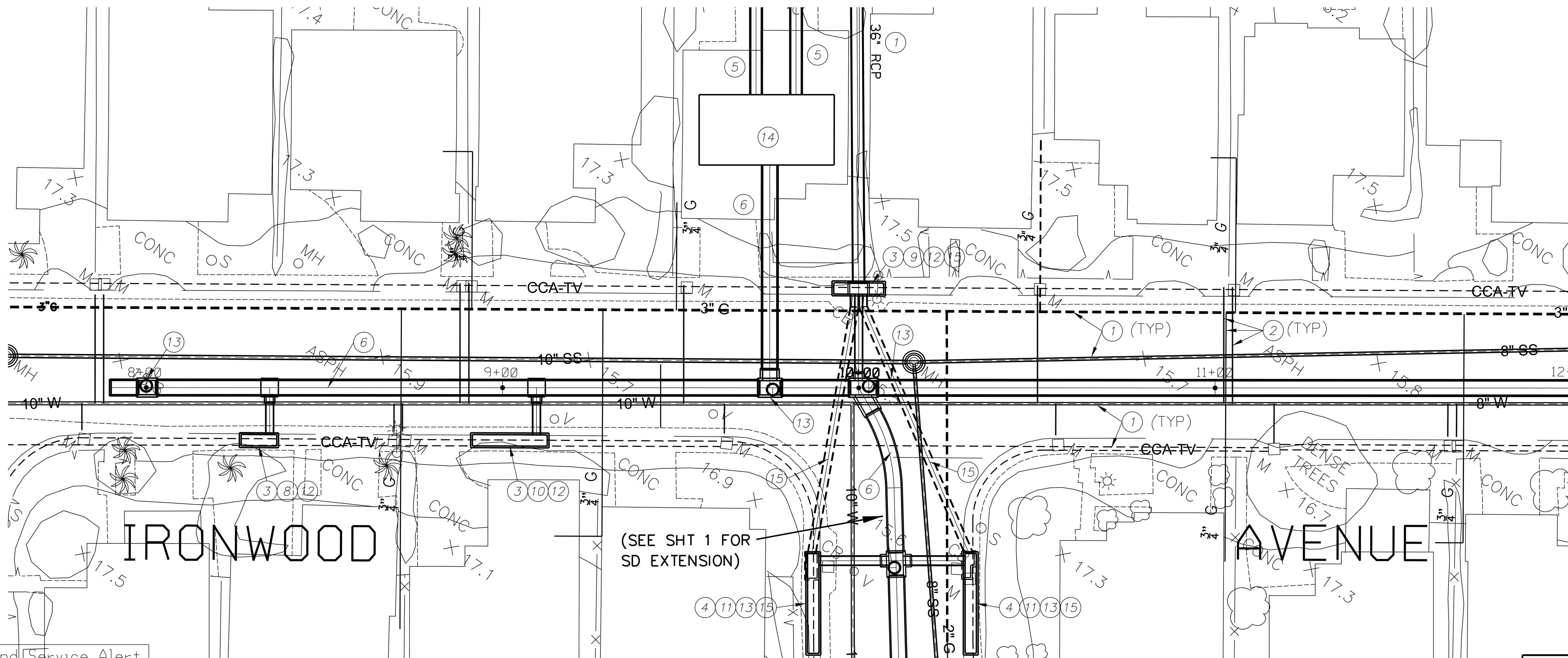
11 — CONSTRUCT CURB OPENING CATCH BASIN PER SPPWC STD. PLAN NO. 300-3, W=28'.

12 — CONSTRUCT JUNCTION STRUCTURE - PIPE TO PIPE PER SPPWC STD. PLAN NO. 331-3.

13 — CONSTRUCT MANHOLE - PIPE TO PIPE WITH 36-INCH MANHOLE SHAFT WITHOUT REDUCER PER SPPWC STD. PLAN NO. 322-2 AND 326-2.

14 — CONSTRUCT FULLY EQUIPPED PUMP STATION PER FUTURE PUMP STATION PLANS.

15 — REMOVE OR ABANDON WITH PLUGS EXISTING STORM DRAIN FACILITY IN PLACE.



ELDER AVENUE

GENERAL NOTES:

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2). THIS PROPOSED STORM DRAIN OPTION IS CONTROLLED BY THE DEPTH OF THE EXISTING SEWER AND THE BACKWATER FROM THE GOLF COURSE. THE FUTURE PUMP STATION OUTFLOW CAPACITY IS ABOUT 100 CFS. UNDER SUCH CONDITION, THE SYSTEM CAN PROVIDE 10-YEAR STORM PARTICAL PROTECTION TO AN ELEVATION LEVEL OF 16-FOOT.

3). SEVERAL STREET LOW POINTS WITH FLAT SLOPES ARE ALONG IRONWOOD AVENUE, GUAVA AVENUE, AND ELDER AVENUE. THEREFORE, EVEN COMPLETION OF THIS PROPOSED STORM DRAIN SYSTEM LOCAL FLOODING WILL STILL OCCUR DURING THE STORM. THE UPSTREAM DRAINAGE SYSTEM EXTENSION SHALL BE REFERRED TO THE CITY STORM DRAIN MASTER PLAN.

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5). AT CATCH BASIN LOCATION, LOCAL DEPRESSION SHALL BE CONSTRUCTED PER SPPWC STD. PLAN NO. 313-3.

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No. C038983
Exp. 3/31/19
CIVIL
STATE OF CALIFORNIA

AKM Consulting Engineers
553 Wald
Irvine, Ca. 92618
(949) 753-7333

PROJECT:
CITY OF SEAL BEACH
PUBLIC WORKS DEPARTMENT
IRONWOOD AVENUE DRAINAGE SYSTEMS
FOCUSED STUDY

TITLE:
IRONWOOD AVENUE
OPTION NO. 1 - 10-YEAR STORM PIPE SYSTEM
BETWEEN ELDER AVENUE AND GUAVA AVENUE

STA. 8+00 TO STA. 12+00

GENERAL NOTES: THE PROPOSED DRAINAGE IMPROVEMENTS PRESENTED HEREIN ARE SHALLOW. THIS PRELIMINARY DESIGN IS BASED ON THE BEST INFORMATION AVAILABLE, CONSISTING OF CITY AS-BUILT PLANS, UTILITY OWNERS' PLANS, AND SEWER MANHOLE SURVEY DATA.

1). DUE TO THE FACT OF SHALLOW DEPTH OF PUBLIC UTILITIES; SUCH AS GAS, WATER, SEWER, CABLE, TELEPHONE, ELECTRIC, ETC., COORDINATION WITH THE RESPECTIVE UTILITY OWNERS MUST BE CONDUCTED DURING THE FINAL DESIGN STAGE.

2). THIS PROPOSED STORM DRAIN OPTION IS CONTROLLED BY THE DEPTH OF THE EXISTING SEWER AND THE BACKWATER FROM THE GOLF COURSE. THE FUTURE PUMP STATION OUTFLOW CAPACITY IS ABOUT 100 CFS. UNDER SUCH CONDITION, THE SYSTEM CAN PROVIDE 10-YEAR STORM PARTIAL PROTECTION TO AN ELEVATION LEVEL OF 16-FOOT.

3). SEVERAL STREET LOW POINTS WITH FLAT SLOPES ARE ALONG IRONWOOD AVENUE, GUAVA AVENUE, AND ELDER AVENUE. THEREFORE, EVEN COMPLETION OF THIS PROPOSED STORM DRAIN SYSTEM LOCAL FLOODING WILL STILL OCCUR DURING THE STORM. THE UPSTREAM DRAINAGE SYSTEM EXTENSION SHALL BE REFERRED TO THE CITY STORM DRAIN MASTER PLAN.

4). THE EXISTING SEWER MAIN IS BELOW THE PROPOSED STORM DRAIN, AND SHALL BE PROTECT IN PLACE. THE SEWER LATERAL (HOUSE CONNECTION) CROSSINGS AT THE PROPOSED STORM DRAIN SYSTEM SHALL ALSO BE PROTECTED IN PLACE. FOR ANY CONFLICTED SEWER LATERAL, IT SHALL BE RELOCATED PER SPPWC STD. PLAN NO. 223-2.

5). AT CATCH BASIN LOCATION, LOCAL DEPRESSION SHALL BE CONSTRUCTED PER SPPWC STD. PLAN NO. 313-3.

6). FLAP GATE SHALL BE INSTALLED AT THE EXISTING 36-INCH PIPE OUTLET HEADWALL, AND AN ENERGY DISSIPATOR SHALL BE CONSTRUCTED AT THE PUMP STATION OUTLET PIPE.

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OMER ZEKI KAYIRAN
No. 29330
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CIVIL
STATE OF CALIFORNIA

AKM Consulting Engineers
553 Wald
Irvine, Ca. 92618
(949) 753-7333

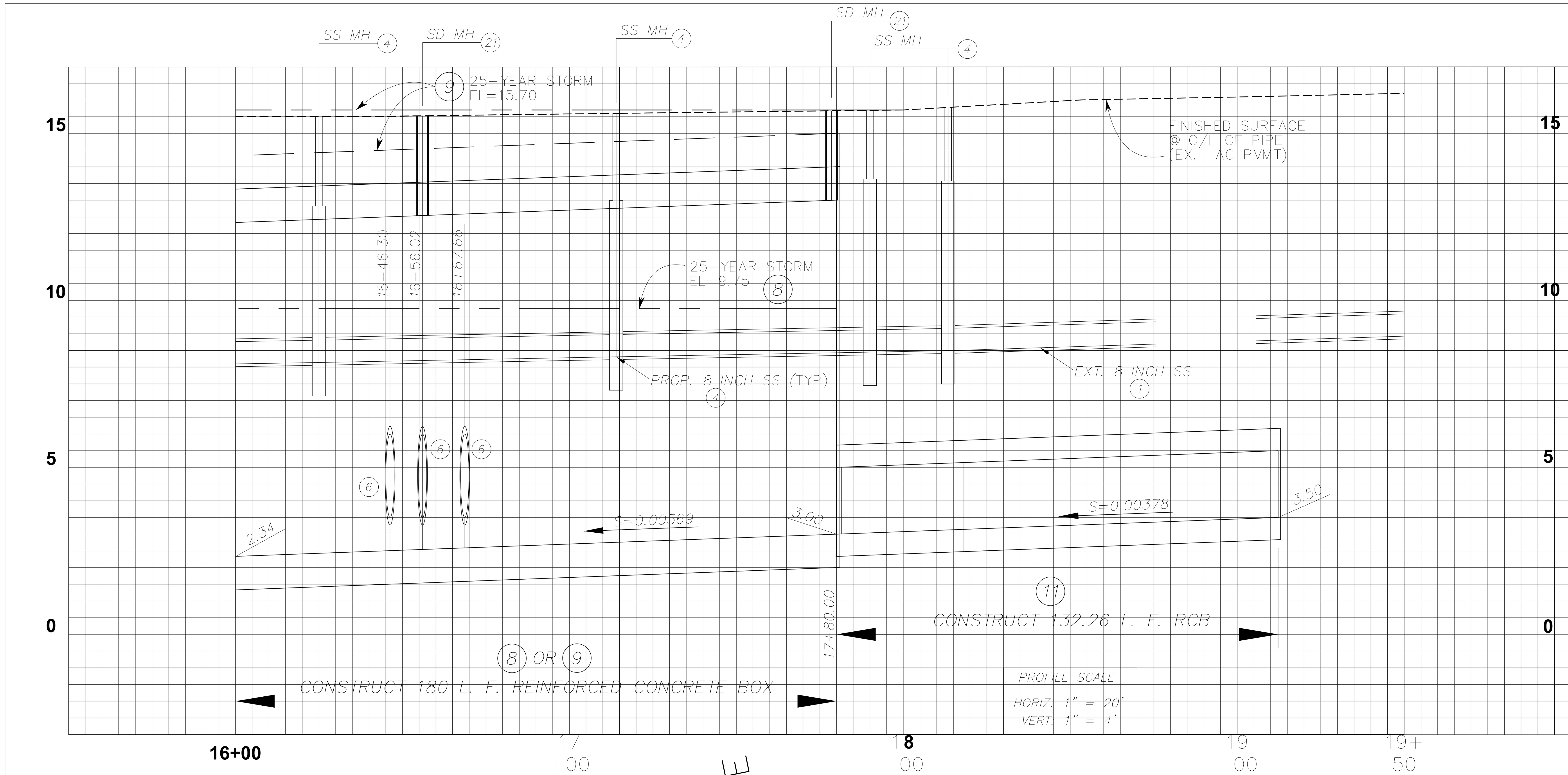
PROJECT: CITY OF SEAL BEACH
PUBLIC WORKS DEPARTMENT
IRONWOOD AVENUE DRAINAGE SYSTEMS
FOCUSED STUDY

CITY OF SEAL BEACH
INCORPORATED OCTOBER 22, 1915 AD
ORANGE COUNTY, CALIFORNIA

TITLE: IRONWOOD AVENUE
OPTION NO. 1 - 10-YEAR STORM PIPE SYSTEM
BETWEEN ELDER AVENUE AND GUAVA AVENUE

INDEX MAP

APPENDIX B



STORM DRAIN CONSTRUCTION NOTES

NOTE: 1) ALL CURB OPENING CATCH BASINS SHALL BE EQUIPPED WITH AUTOMATIC RETRACTABLE SCREEN AND INSERTED FILTER PER CITY APPROVAL.

1 — PROTECT EXISTING UTILITIES IN PLACE; SUCH AS SEWER, WATER, CABLE, GAS, ELECTRICAL, ETC.

2 — CONDUCT POTHOLING TO VERIFY THE UTILITIES' LOCATIONS, MATERIAL, AND DEPTH, AND COORDINATION OF RELOCATION EXISTING UTILITIES BY THEIR RESPECTIVE OWNERS.

3 — REMOVE AND RECONSTRUCT 8-INCH WATER LINE WITH ITS ASSOCIATED LATERALS.

4 — REMOVE AND RECONSTRUCT 8-INCH SEWER LINE WITH ITS ASSOCIATED LATERALS.

6 — CONSTRUCT 30-INCH RCP (D-LOAD PER PROFILE).

8 — CONSTRUCT 12'(W) X 10'(H) REINFORCED CONCRETE BOX (RCB) WITH PUMP STATION OUT-FLOW RATE OF 110 CFS.

9 — CONSTRUCT 12'(W) X 11'(H) REINFORCED CONCRETE BOX (RCB) WITH PUMP STATION OUT-FLOW RATE OF 100 CFS.

11 — CONSTRUCT 9'(W) X 2'(H) REINFORCED CONCRETE BOX (RCB).

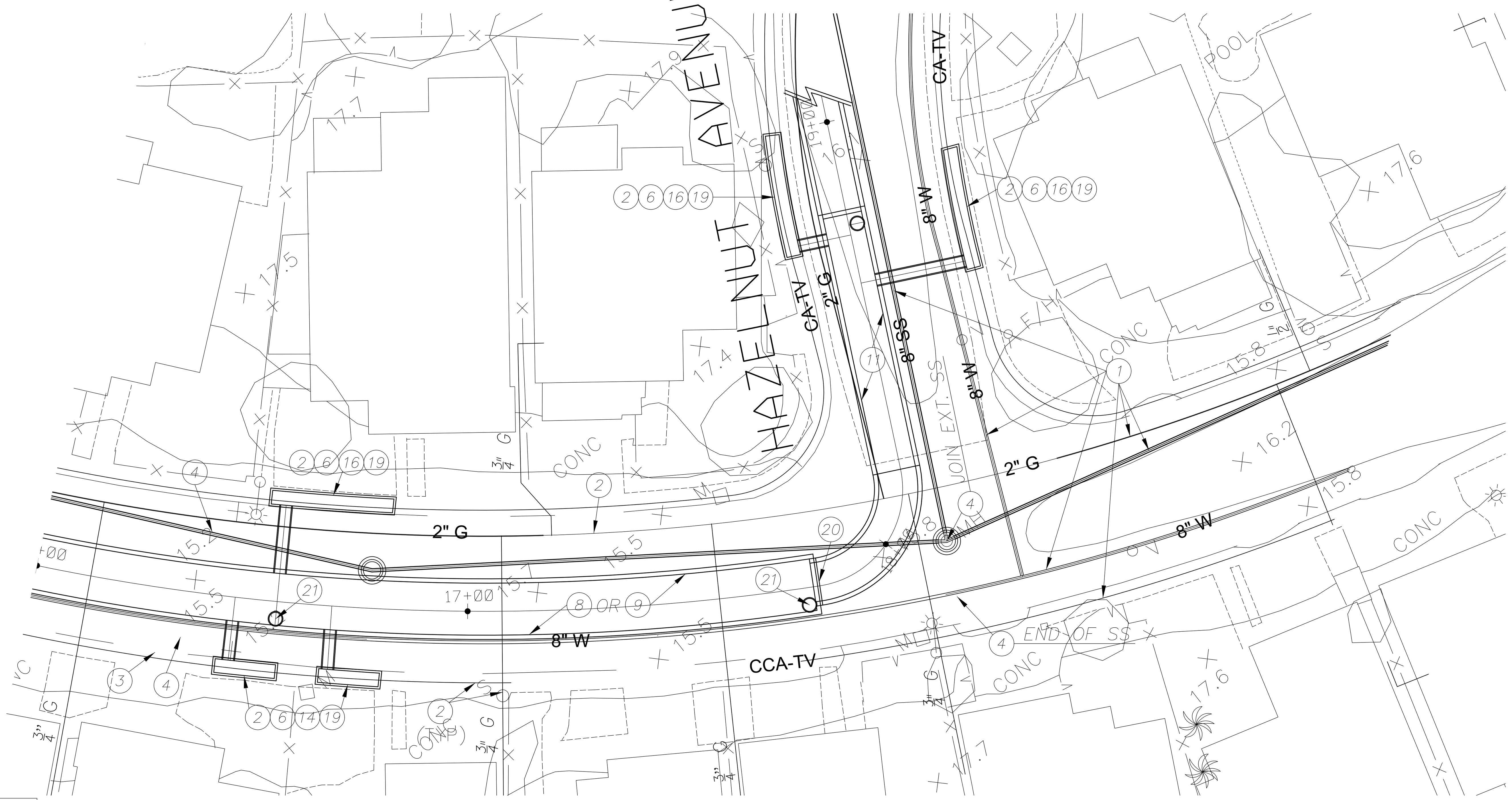
14 — CONSTRUCT CURB OPENING CATCH BASIN PER SPPWC STD. PLAN NO. 300-3, W=14'.

16 — CONSTRUCT CURB OPENING CATCH BASIN PER SPPWC STD. PLAN NO. 300-3, W=28'.

19 — CONSTRUCT JUNCTION STRUCTURE - PIPE TO RCB PER SPPWC STD. PLAN NO. 333-2.

20 — CONSTRUCT JUNCTION STRUCTURE - RCB TO RCB.

21 — CONSTRUCT 36-INCH BOX STORM DRAIN CONCRETE MANHOLE WITHOUT REDUCER PER SPPWC STD. PLAN NO. 323-2.



GENERAL NOTES:

THE PROPOSED DRAINAGE IMPROVEMENTS PRESENTED HEREIN ARE SHALLOW. THIS PRELIMINARY DESIGN IS BASED ON THE BEST INFORMATION AVAILABLE, CONSISTING OF CITY AS-BUILT PLANS, UTILITY OWNERS' PLANS, AND SEWER MANHOLE SURVEY DATA.

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2). THIS PROPOSED STORM DRAIN OPTION IS CONTROLLED BY TWO ELEMENTS: (a) THE OUTLET PUMP STATION FLOW RATE; AND (b) THE EFFECTIVE STORAGE VOLUME OF THE RCB.

CONDITION NO. 1: THE PUMP OUTFLOW RATE = 100 CFS, RCB LENGTH = 820 FEET, AND RCB SIZE = 12'(W) x 11'(H).
CONDITION NO. 2: THE PUMP OUTFLOW RATE = 110 CFS, RCB LENGTH = 820 FEET, AND RCB SIZE = 12'(W) x 10'(H).

3). THE FLOOD PROTECTION LEVEL UNDER THE ABOVE TWO CONDITIONS:
CONDITION NO. 1: PARTIAL PROTECTION OF 25-YEAR STORM.
CONDITION NO. 2: FULL PROTECTION OF 25-YEAR STORM.

4). RELOCATION OF EXISTING WATER LINE AND SEWER LINE WITH THEIR ASSOCIATED LATERALS IS REQUIRED TO PROVIDE AVAILABLE SPACE FOR CONSTRUCTING THE DRAINAGE SYSTEM.

5). SEVERAL STREET LOW POINTS WITH FLAT SLOPES ARE ALONG IRONWOOD AVENUE, GUAVA AVENUE, AND ELDER AVENUE. THEREFORE, EVEN COMPLETION OF THIS PROPOSED STORM DRAIN SYSTEM LOCAL FLOODING WILL STILL OCCUR DURING THE STORM. THE UPSTREAM DRAINAGE SYSTEM EXTENSION SHALL BE REFERRED TO THE CITY STORM DRAIN MASTER PLAN.

6). AT CATCH BASIN LOCATION, LOCAL DEPRESSION SHALL BE CONSTRUCTED PER SPPWC STD. PLAN NO. 313-3.

N

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SCALE IN FEET
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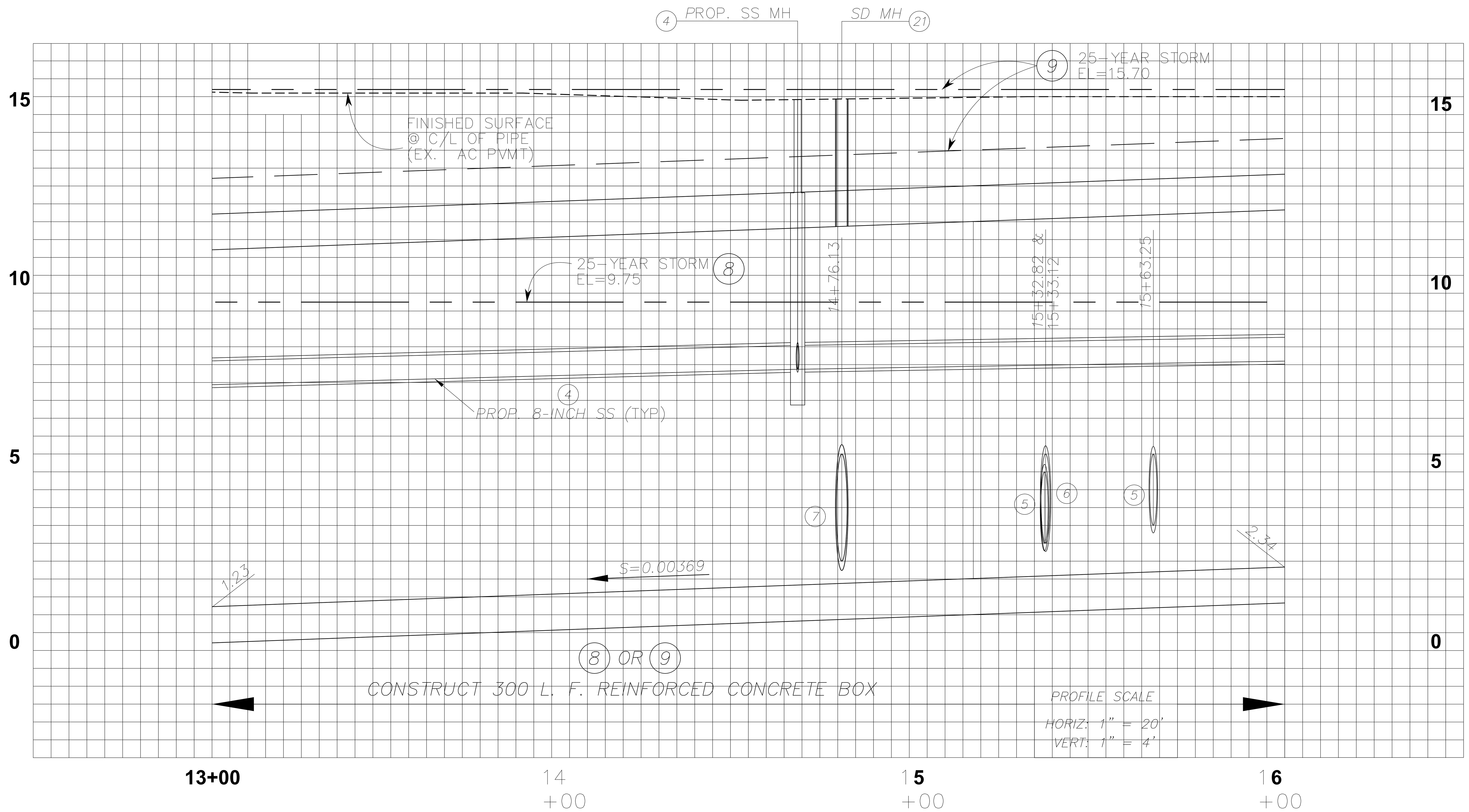
MORGAN JUAN YING
No. C038983
Exp. 3/31/19
CIVIL
STATE OF CALIFORNIA

PROJECT:
CITY OF SEAL BEACH
PUBLIC WORKS DEPARTMENT
IRONWOOD AVENUE DRAINAGE SYSTEMS
FOCUSED STUDY

AKM Consulting Engineers
553 Wald
Irvine, Ca. 92618
(949) 753-7333

TITLE:
IRONWOOD AVENUE
OPTION NO. 2 - 25-YEAR STORM RCB SYSTEM
BETWEEN ELDER AVENUE AND GUAVA AVENUE

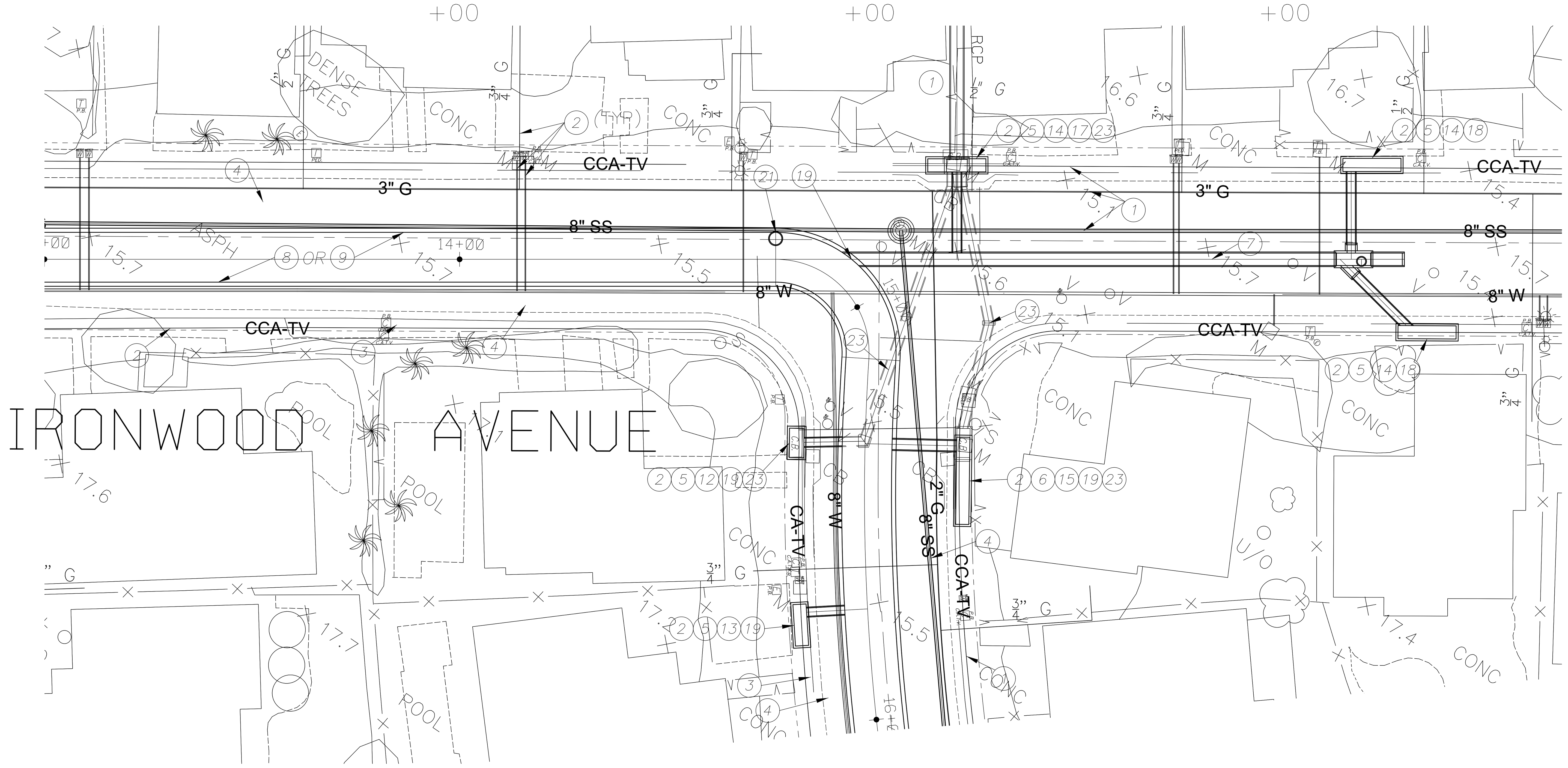
STA. 17+00 TO STA. 19+00



STORM DRAIN CONSTRUCTION NOTES

NOTE: 1) ALL CURB OPENING CATCH BASINS SHALL BE EQUIPPED WITH AUTOMATIC RETRACTABLE SCREEN AND INSERTED FILTER PER CITY APPROVAL.

1. PROTECT EXISTING UTILITIES IN PLACE; SUCH AS SEWER, WATER, CABLE, GAS, ELECTRICAL, ETC.
2. CONDUCT POTHOLING TO VERIFY THE UTILITIES' LOCATIONS, MATERIAL, AND DEPTH, AND COORDINATION OF RELOCATION EXISTING UTILITIES BY THEIR RESPECTIVE OWNERS.
3. REMOVE AND RECONSTRUCT 8-INCH WATER LINE WITH ITS ASSOCIATED LATERALS.
4. REMOVE AND RECONSTRUCT 8-INCH SEWER LINE WITH ITS ASSOCIATED LATERALS.
5. CONSTRUCT 24-INCH RCP (D-LOAD PER PROFILE).
6. CONSTRUCT 30-INCH RCP (D-LOAD PER PROFILE).
7. CONSTRUCT 36-INCH RCP (D-LOAD PER PROFILE).
8. CONSTRUCT 12'(W) X 10'(H) REINFORCED CONCRETE BOX (RCB) WITH PUMP STATION OUT-FLOW RATE OF 110 CFS.
9. CONSTRUCT 12'(W) X 11'(H) REINFORCED CONCRETE BOX (RCB) WITH PUMP STATION OUT-FLOW RATE OF 100 CFS.
12. CONSTRUCT CURB OPENING CATCH BASIN PER SPPWC STD. PLAN NO. 300-3, W=7'.
13. CONSTRUCT CURB OPENING CATCH BASIN PER SPPWC STD. PLAN NO. 300-3, W=10'.
14. CONSTRUCT CURB OPENING CATCH BASIN PER SPPWC STD. PLAN NO. 300-3, W=14'.
15. CONSTRUCT CURB OPENING CATCH BASIN PER SPPWC STD. PLAN NO. 300-3, W=21'.
17. CONSTRUCT TRANSITION STRUCTURE - PIPE TO PIPE PER SPPWC STD. PLAN NO. 340-2.
18. CONSTRUCT MANHOLE PIPE TO PIPE WITH 36-INCH MANHOLE SHAFT WITHOUT REDUCER PER SPPWC STD. PLAN NO. 322-2 AND 326-2.
19. CONSTRUCT JUNCTION STRUCTURE - PIPE TO RCB PER SPPWC STD. PLAN NO. 333-2.
20. CONSTRUCT JUNCTION STRUCTURE - RCB TO RCB.
21. CONSTRUCT 36-INCH BOX STORM DRAIN CONCRETE MANHOLE WITHOUT REDUCER PER SPPWC STD. PLAN NO. 323-2.
23. REMOVE OR ABANDON WITH PLUGS EXISTING STORM DRAIN FACILITY IN PLACE.



GENERAL NOTES:

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2). THIS PROPOSED STORM DRAIN OPTION IS CONTROLLED BY TWO ELEMENTS: (a) THE OUTLET PUMP STATION FLOW RATE; AND (b) THE EFFECTIVE STORAGE VOLUME OF THE RCB.

CONDITION NO. 1: THE PUMP OUTFLOW RATE = 100 CFS, RCB LENGTH = 820 FEET, AND RCB SIZE = 12'(W) x 11'(H).
CONDITION NO. 2: THE PUMP OUTFLOW RATE = 110 CFS, RCB LENGTH = 820 FEET, AND RCB SIZE = 12'(W) x 10'(H).

3). THE FLOOD PROTECTION LEVEL UNDER THE ABOVE TWO CONDITIONS:
CONDITION NO. 1: PARTIAL PROTECTION OF 25-YEAR STORM.
CONDITION NO. 2: FULL PROTECTION OF 25-YEAR STORM.

4). RELOCATION OF EXISTING WATER LINE AND SEWER LINE WITH THEIR ASSOCIATED LATERALS IS REQUIRED TO PROVIDE AVAILABLE SPACE FOR CONSTRUCTING THE DRAINAGE SYSTEM.

5). SEVERAL STREET LOW POINTS WITH FLAT SLOPES ARE ALONG IRONWOOD AVENUE, GUAVA AVENUE, AND ELDER AVENUE. THEREFORE, EVEN COMPLETION OF THIS PROPOSED STORM DRAIN SYSTEM LOCAL FLOODING WILL STILL OCCUR DURING THE STORM. THE UPSTREAM DRAINAGE SYSTEM EXTENSION SHALL BE REFERRED TO THE CITY STORM DRAIN MASTER PLAN.

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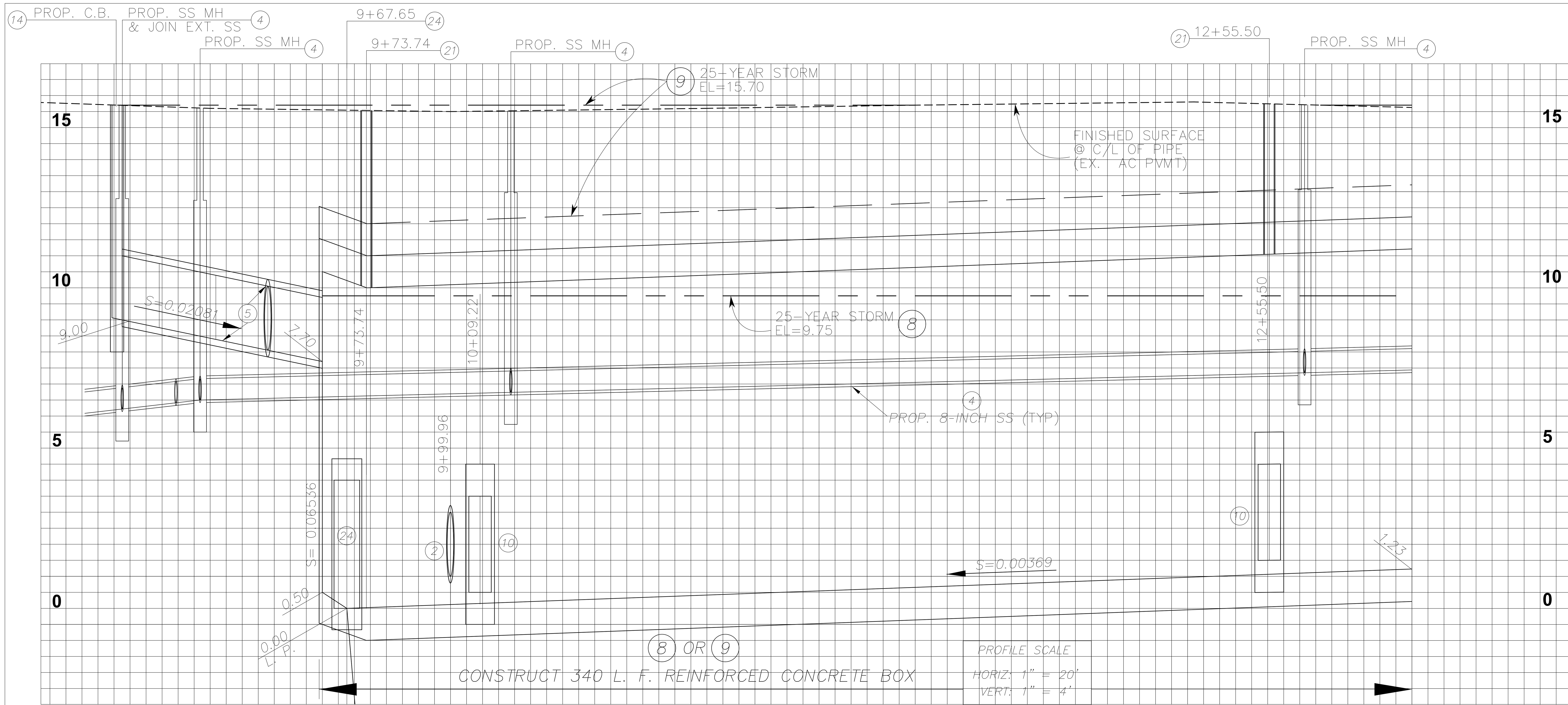
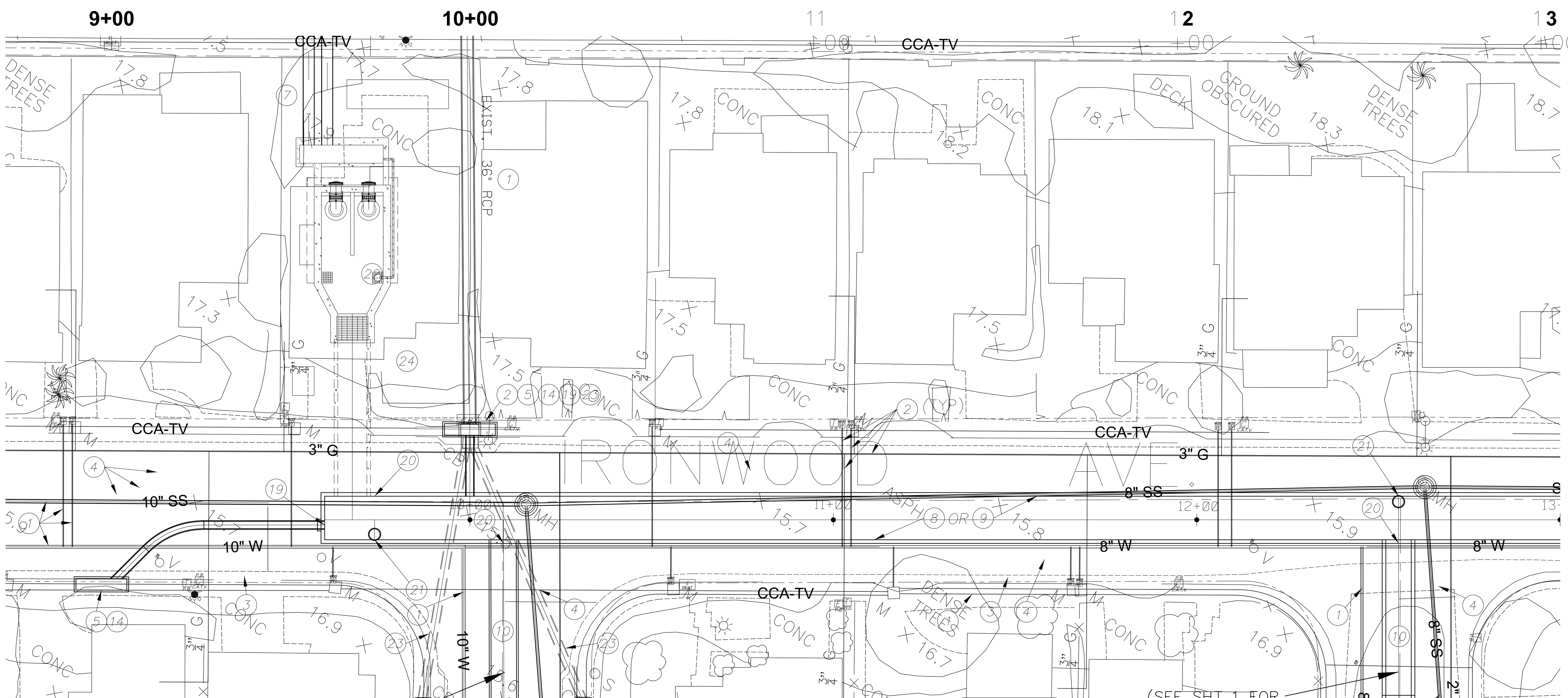
Irvine, Ca. 92618
(949) 753-7333

PROJECT:
CITY OF SEAL BEACH
PUBLIC WORKS DEPARTMENT
IRONWOOD AVENUE DRAINAGE SYSTEMS
FOCUSED STUDY

TITLE:
IRONWOOD AVENUE
OPTION NO. 2 - 25-YEAR STORM RCB SYSTEM
BETWEEN ELDER AVENUE AND GUAVA AVENUE

STA. 14+00 TO STA. 17+00





ELDER AVENUE IRONWOOD AVENUE FIR AVENUE

STORM DRAIN CONSTRUCTION NOTES

NOTE: 1) ALL CURB OPENING CATCH BASINS SHALL BE EQUIPPED WITH AUTOMATIC RETRACTABLE SCREEN AND INSERTED FILTER PER CITY APPROVAL.

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3 — REMOVE AND RECONSTRUCT 8-INCH WATER LINE WITH ITS ASSOCIATED LATERALS.

4 — REMOVE AND RECONSTRUCT 8-INCH SEWER LINE WITH ITS ASSOCIATED LATERALS.

5 — CONSTRUCT 24-INCH RCP (D-LOAD PER PROFILE).

7 — CONSTRUCT 36-INCH STEEL PIPE.

8 — CONSTRUCT 12'(W) X 10'(H) REINFORCED CONCRETE BOX (RCB) WITH PUMP STATION OUT-FLOW RATE OF 110 CFS.

9 — CONSTRUCT 12'(W) X 11'(H) REINFORCED CONCRETE BOX (RCB) WITH PUMP STATION OUT-FLOW RATE OF 100 CFS.

10 — CONSTRUCT 7'(W) X 3'(H) REINFORCED CONCRETE BOX (RCB).

14 — CONSTRUCT CURB OPENING CATCH BASIN PER SPPWC STD. PLAN NO. 300-3, W=14'.

19 — CONSTRUCT JUNCTION STRUCTURE - PIPE TO RCB PER SPPWC STD. PLAN NO. 333-2.

20 — CONSTRUCT JUNCTION STRUCTURE - RCB TO RCB.

21 — CONSTRUCT 36-INCH BOX STORM DRAIN CONCRETE MANHOLE WITHOUT REDUCER PER SPPWC STD. PLAN NO. 323-2.

22 — CONSTRUCT FULLY EQUIPPED PUMP STATION PER FUTURE PUMP STATION PLANS.

23 — REMOVE OR ABANDON WITH PLUGS EXISTING STORM DRAIN FACILITY IN PLACE.

24 — CONSTRUCT 8'(W) X 4'(H) REINFORCED CONCRETE BOX (RCB).

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REGISTERED PROFESSIONAL ENGINEER MORGAN JUAN YING No. C038983 Exp. 3/31/19 CIVIL STATE OF CALIFORNIA

AKM Consulting Engineers
553 Wald
Irvine, Ca. 92618
(949) 753-7333

PROJECT: CITY OF SEAL BEACH
PUBLIC WORKS DEPARTMENT
IRONWOOD AVENUE DRAINAGE SYSTEMS
FOCUSED STUDY

TITLE: IRONWOOD AVENUE
OPTION NO. 2 - 25-YEAR STORM RCB SYSTEM
BETWEEN ELDER AVENUE AND GUAVA AVENUE

STA. 9+60 TO STA. 14+00

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OPTION NO. 2 - 25-YEAR STORM RCB SYSTEM
BETWEEN ELDER AVENUE AND GUAVA AVENUE

INDEX MAP

SHT. 1 OF 4