VERY PRELIMINARY

Precipitation Investigation for the City of Long Beach

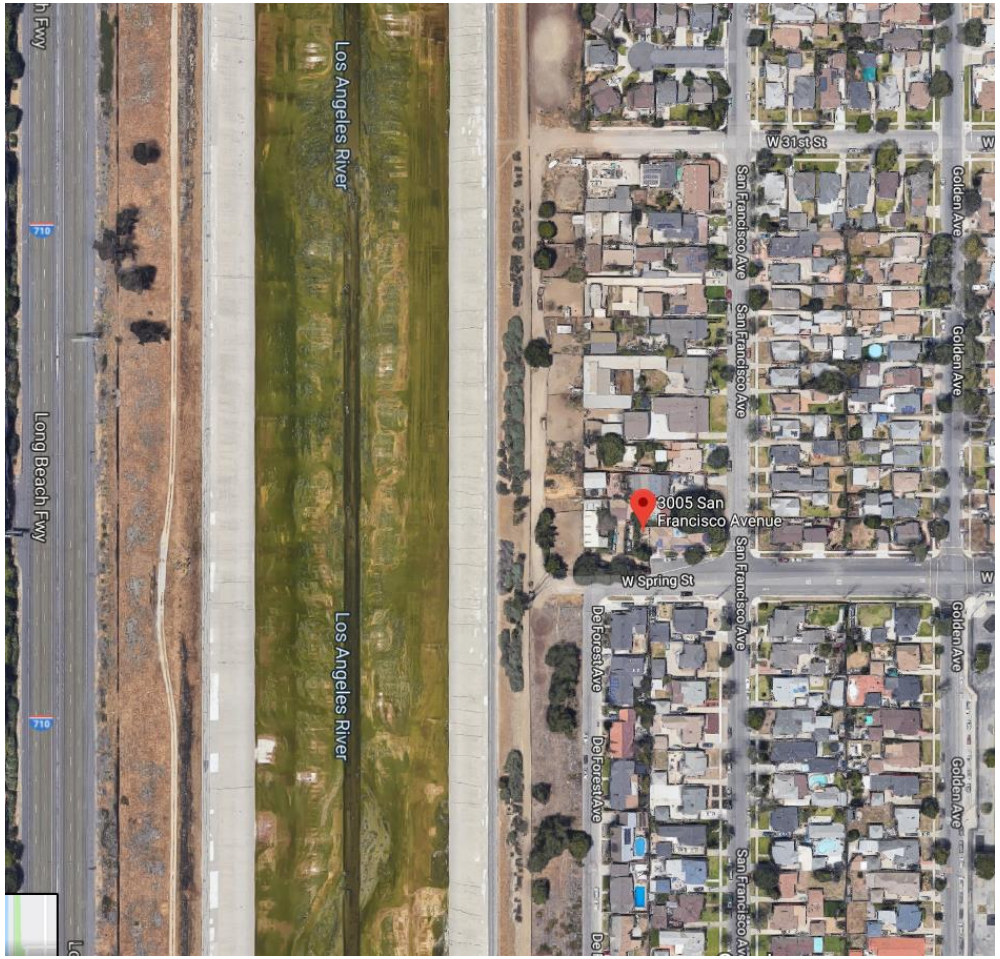
May 24, 2019

Hromadka & Associates
Hydrologic, Earth and Atmospheric Sciences

VERY PRELIMINARY

Case Summary – 3005 San Francisco Ave.

- Plaintiffs claim that their property suffered extensive flooding damage as a result of storms on Jan. 22 2017 and Feb 17, 2017. They claim that flooding originates from runoff which is trapped between the Los Angeles River Berm and adjacent properties. They claim that inadequate drainage in this area causes runoff to pool onto their property causing damage

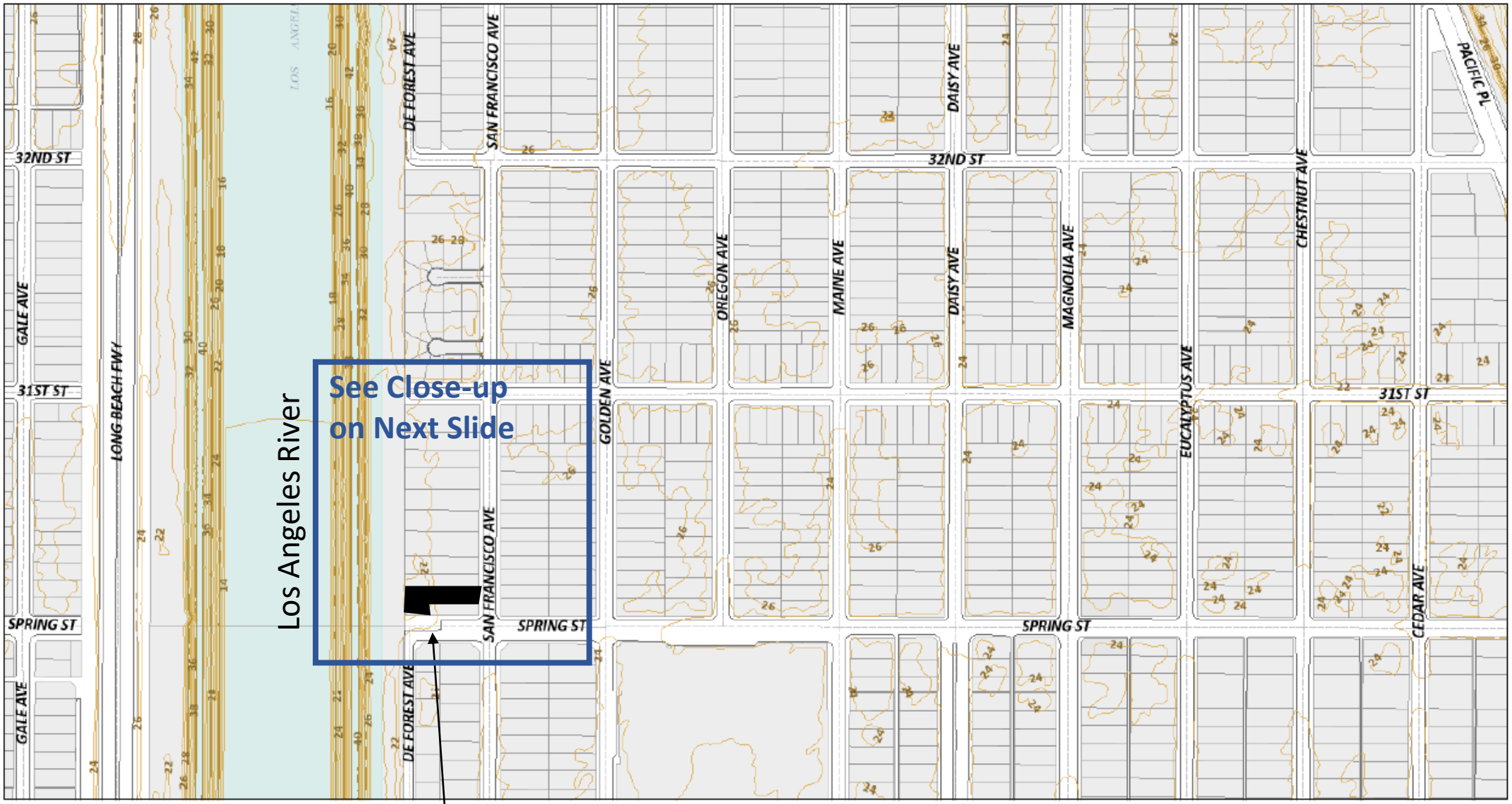


VERY PRELIMINARY

Site Description

VERY PRELIMINARY

VERY PRELIMINARY

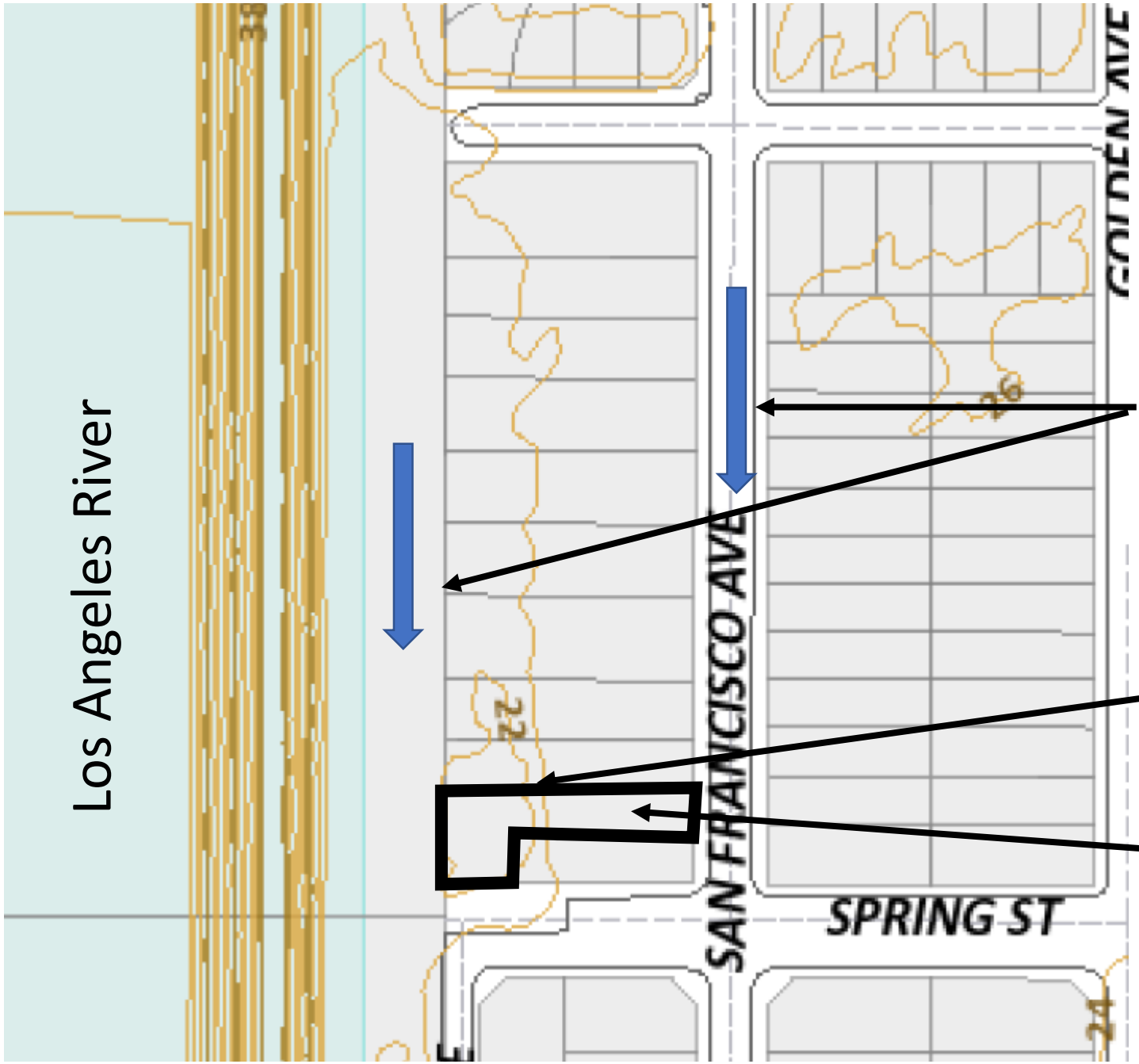


Plaintiff Property

Hromadka & Associates
Hydrologic, Earth and Atmospheric Sciences

VERY PRELIMINARY

VERY PRELIMINARY



Note: General direction of runoff is from North to South

Note: Topography indicates that a sump condition exists on the property

Plaintiff Property

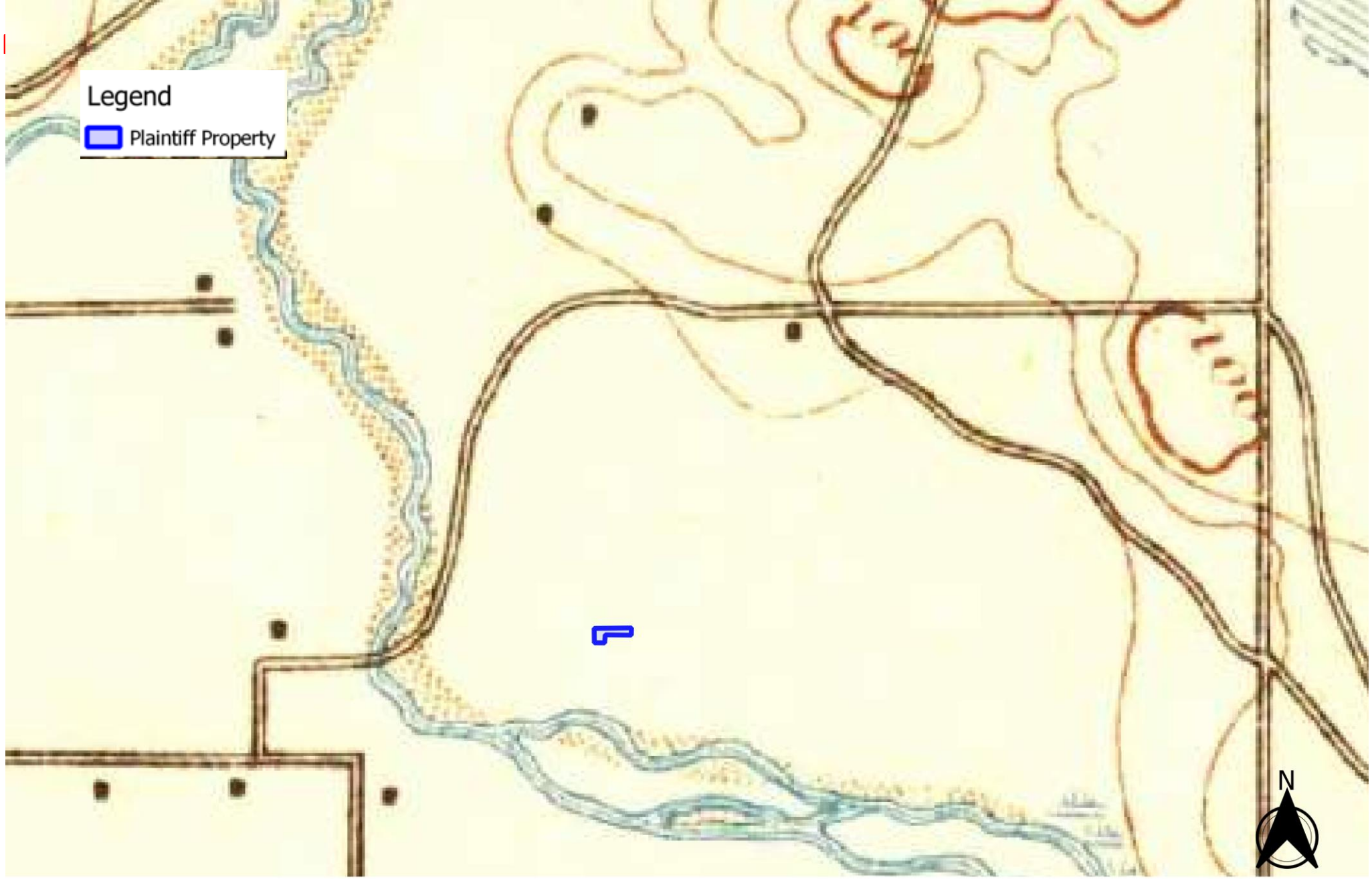
VERY PRELIMINARY

VERY PRELIMINARY

Historic Topography

VERY PRELIMINARY

VERY PRELI



Hromadka & A
Hydrologic, Earth and Atr

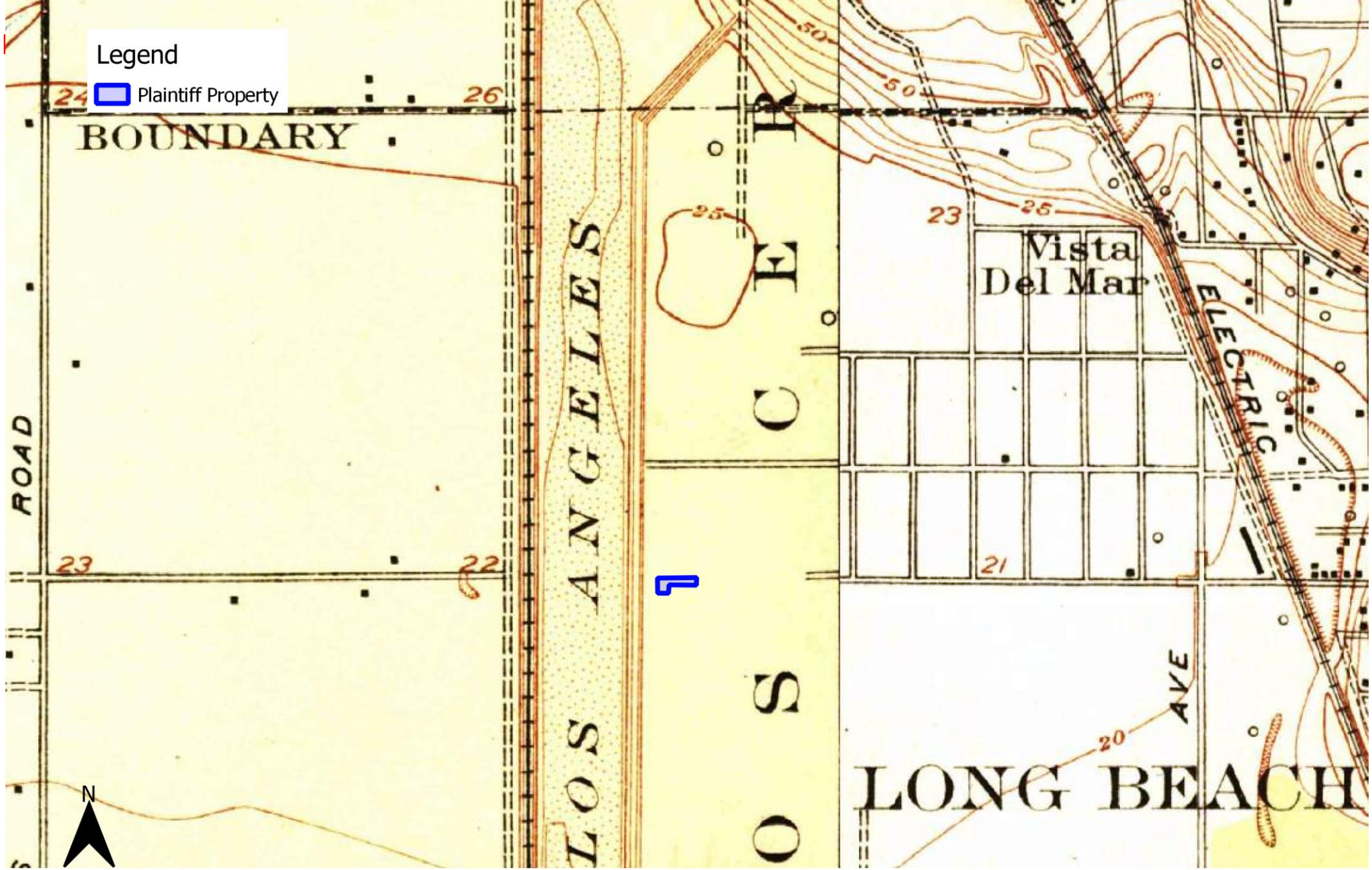
Hromadka & Associates
Hydrologic, Earth and Atmospheric Sciences

0.1 0 0.1 0.2 0.3 0.4 mi

1896 USGS Topography

RELIMINARY

VERY PRELI



Hromadka & Associates
Hydrologic, Earth and Atmospheric Sciences

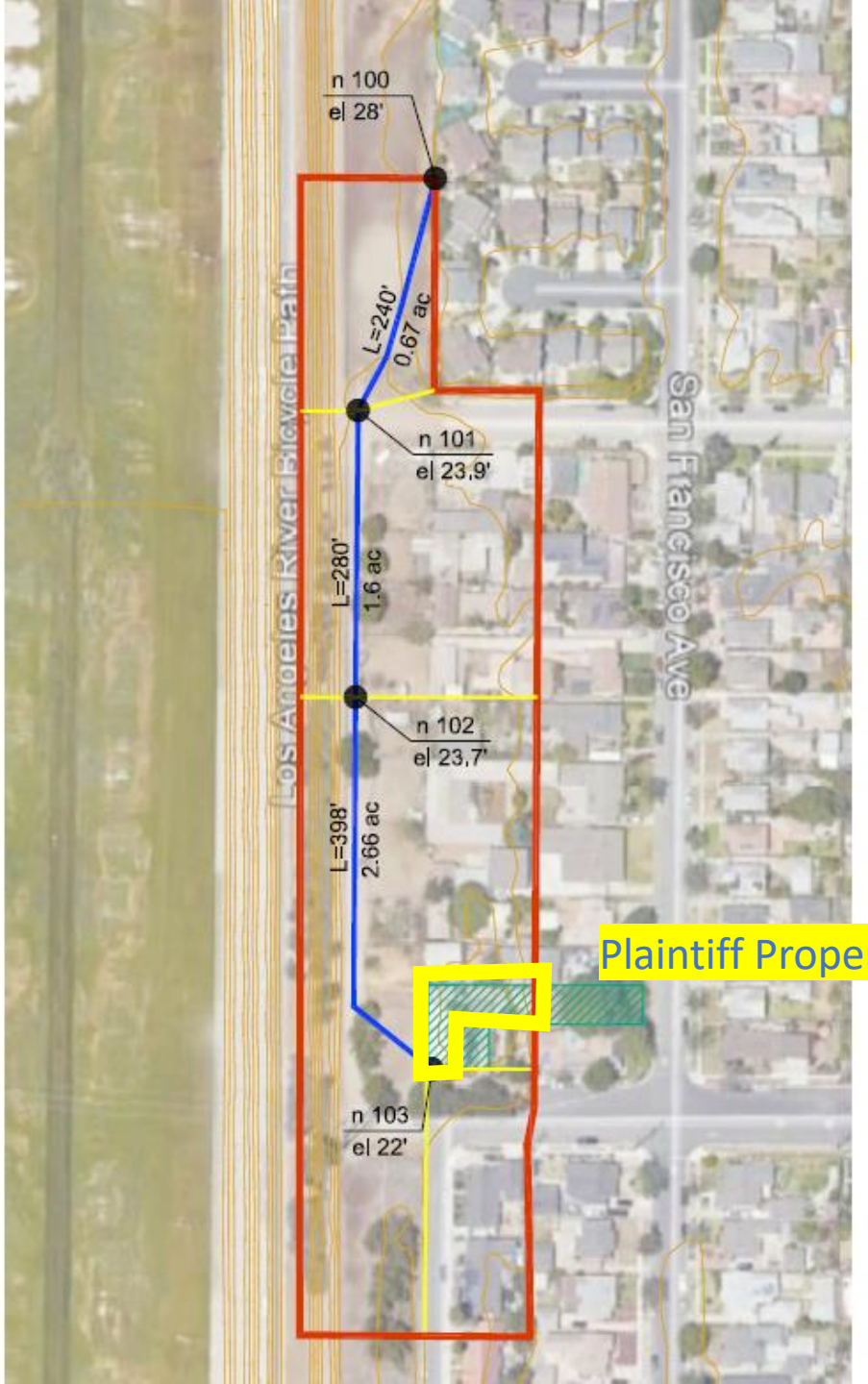
0.1 0 0.1 0.2 0.3 0.4 mi

1924/1925 USGS
Topography

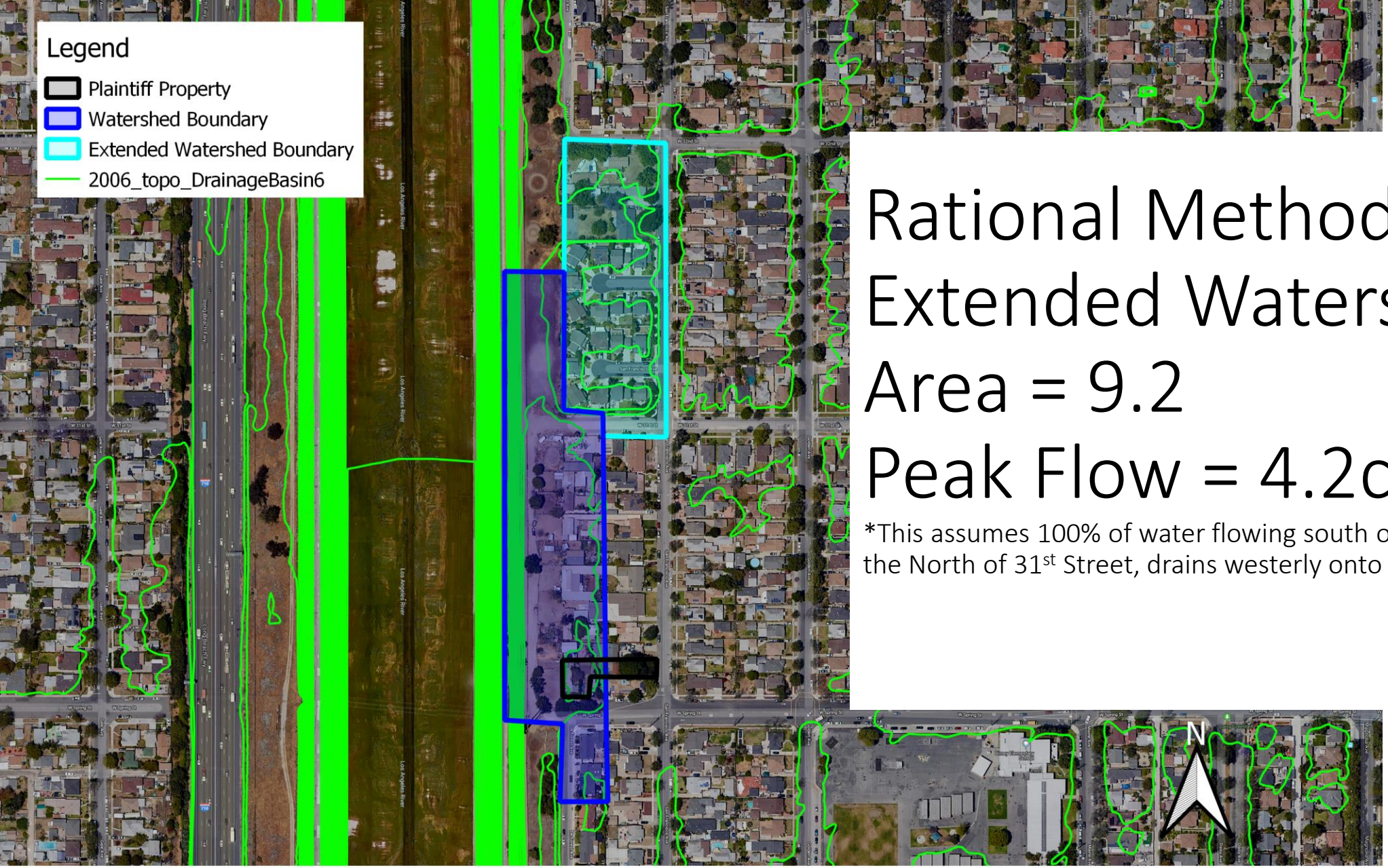
RELIMINARY

VERY PRELIMINARY

Rational Method Model
Area = 5.5 acres
Peak Flow = 2.5cfs



ELIMINARY



Rational Method Model Extended Watershed*

Area = 9.2

Peak Flow = 4.2cfs

*This assumes 100% of water flowing south on San Francisco Ave from the North of 31st Street, drains westerly onto 31st street

Hromadka & Associates
Hydrologic, Earth and Atmospheric Sciences

250 0 250 500 750 1000 ft

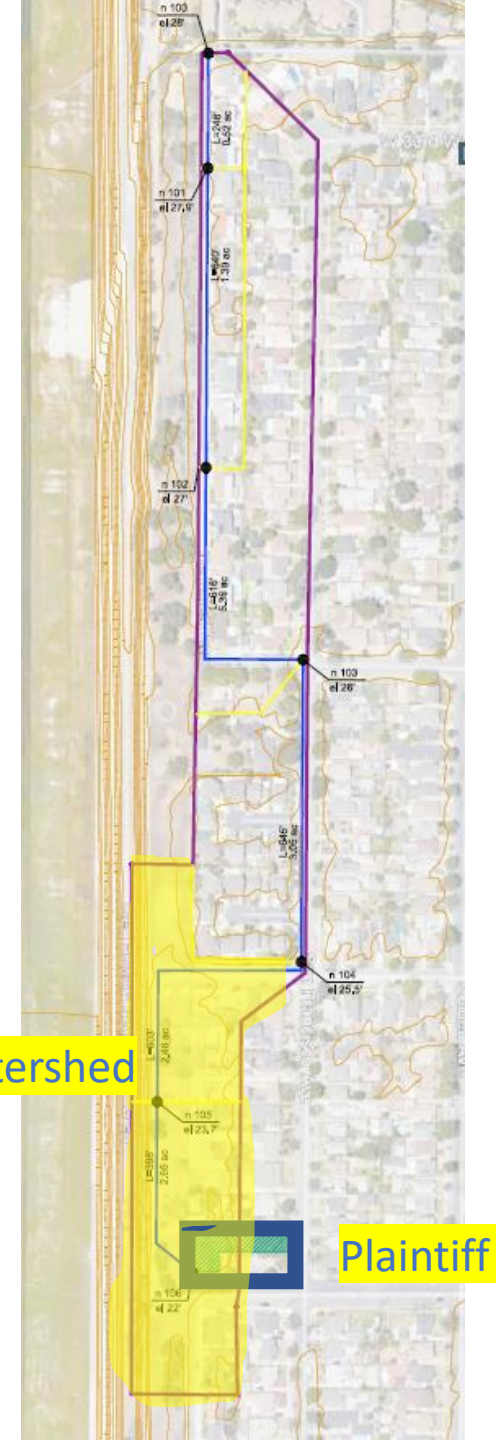
Watershed Boundaries

VERY PRELIMINARY

Rational Method Model
Extended Watershed*
Area = 16 acres**
Peak Flow = 6.4cfs

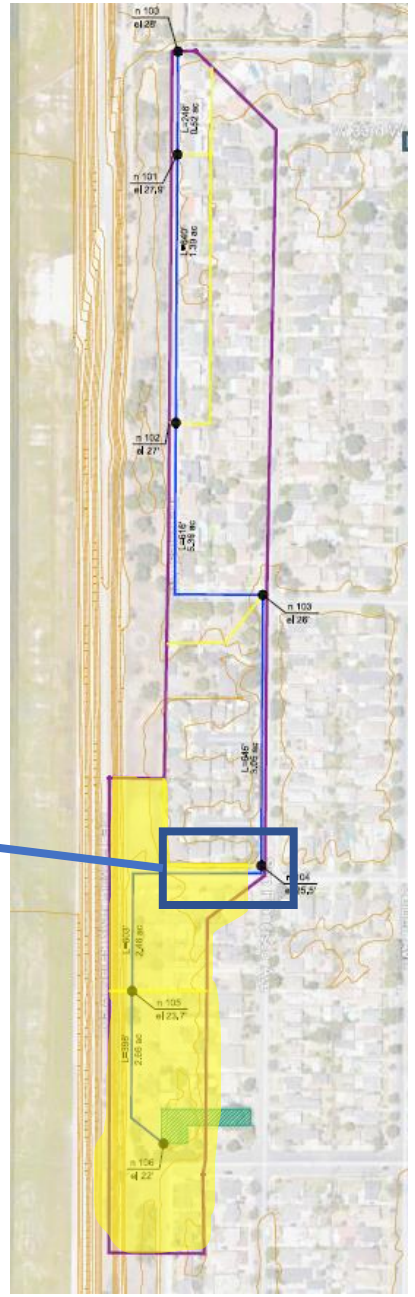
*This assumes 100% of water flowing south on San Francisco Ave from the North of 31st Street, drains westerly onto 31st street

**This assumes 32nd Street does NOT act as a barrier to southward flow on San Francisco Ave, which is a worst case scenario. The Master Plan indicates that 32nd Street does in fact act as a barrier to southward flow on San Francisco Ave.



Intersection at Issue: 31st Street and San Francisco Ave

Figure 1. Image showing the intersection of San Francisco Ave and 31st Street and the width of 31st street (35.05 ft)



VERY PRELIMINARY

Intersection at Issue: 31st Street and San Francisco Ave (DHM Grid)

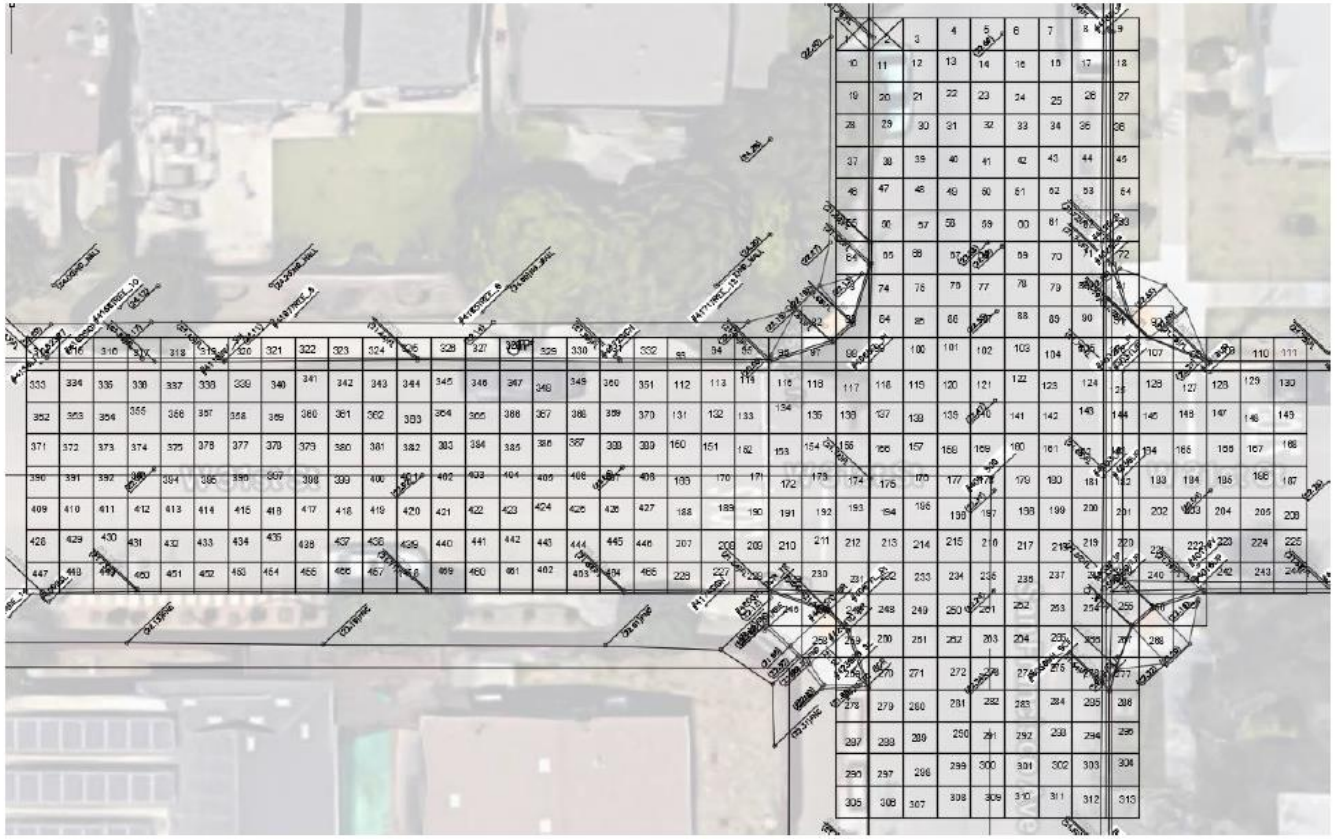
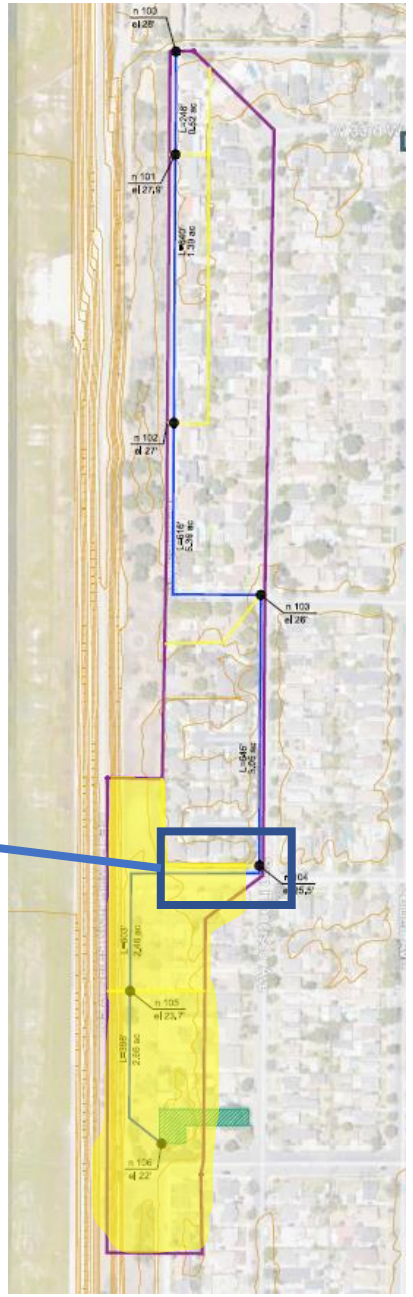
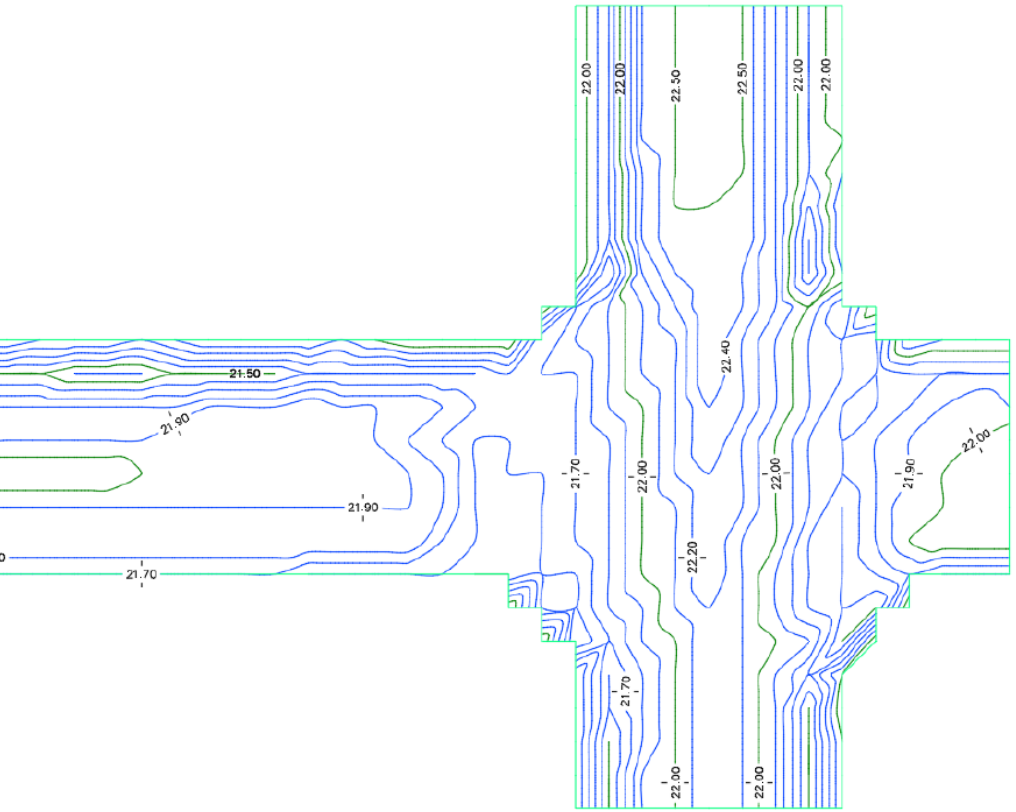


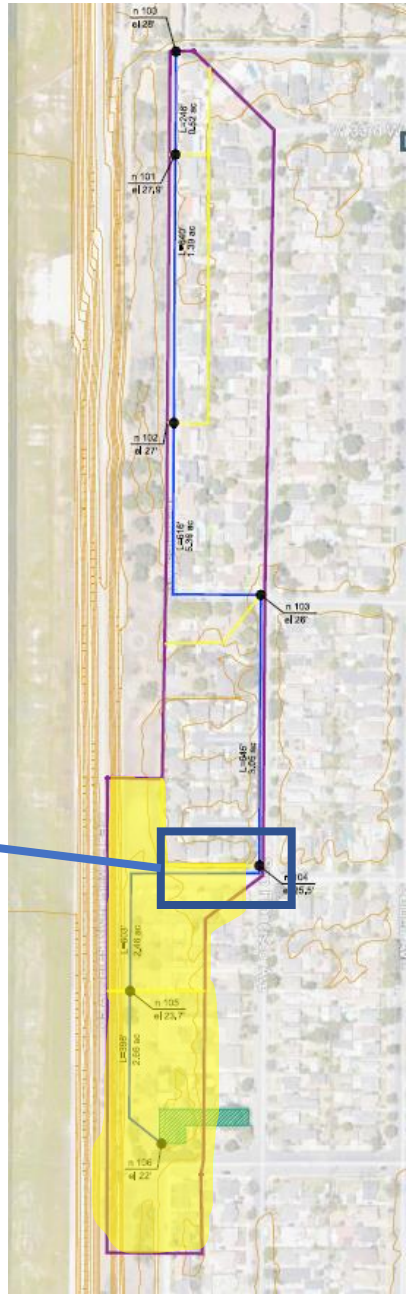
Figure 4. Alignment of the DHM grid with the roads from Google map (The width of San Francisco Ave = Width of 31st St = 35 ft.). On the road, there are 7 DHM cells, whose width is 5 ft. each. To include the walkway, there are two extra cells on San Francisco Av and one extra cell on 31st Street.



VERY PRELIMINARY

ıe: 31st Street and (Elevation Contours)



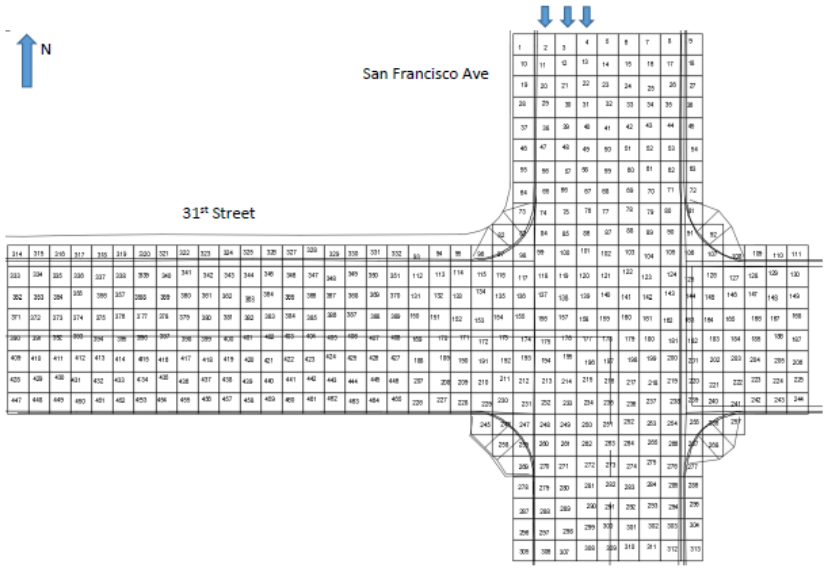


VERY PRELIMINARY

VERY PRELIMINARY

Intersection at Issue: 31st Street and San Francisco Ave (DHM Setup)

Inflow at three nodes



Boundary Conditions

1. The inflow hydrograph is at cells 2,3,4 (shown in the figure)
2. There are six outflow cells along each direction. The outflow boundary cells are
   333, 353, 371, 409,428 and 447 (West of 31st St)
   130, 149, 168, 206, 225 and 244 (East of 31st St)
   306,307,308,310,311 and 312 (South of San Francisco Ave)

Inflow Hydrograph: Two different hydrographs at inlet cells were used.

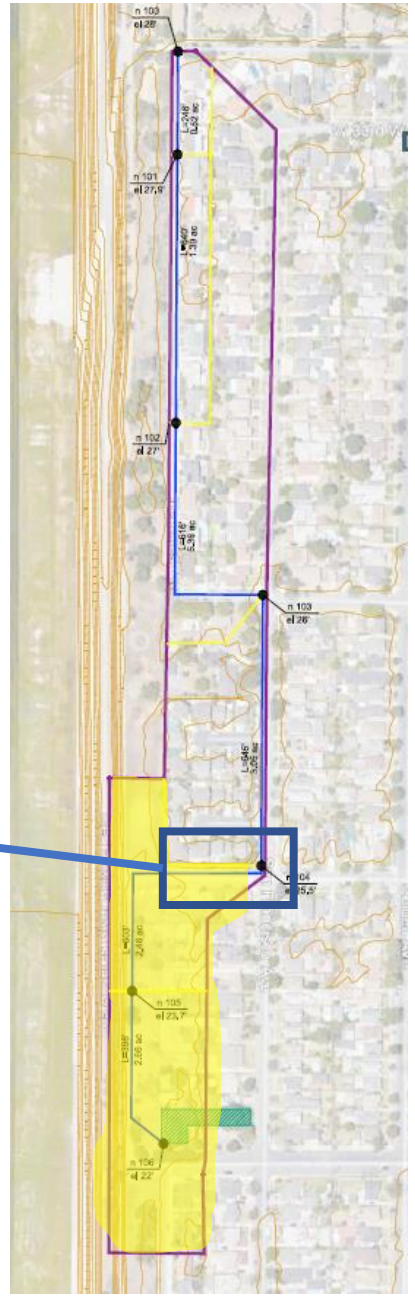
Case A

Time (hrs)	Q (cfs)
0	0
1	1.5
2	0

Case B

Time (hrs)	Q (cfs)
0	0
1	1.5
3	1.5
4	0

Used Tolerance values in DHM
RETENTION WATER DEPTH (FEET) = 0.05
TOLERANCE OF CHANGE IN WATER DEPTH (FEET) = 0.05
PERCENTAGE OF CHANGE IN WATER DEPTH = 5 %

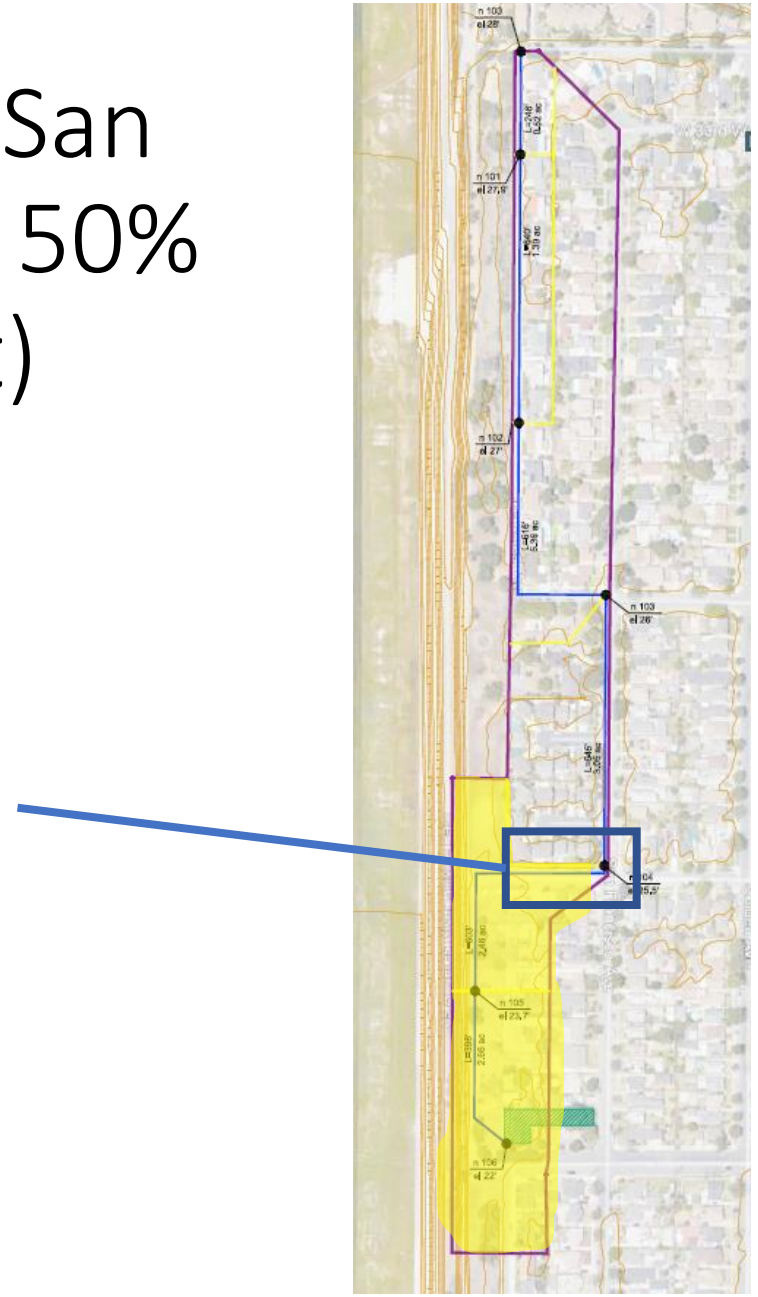


VERY PRELIMINARY

Intersection at Issue: 31st Street and San Francisco Ave (DHM Indicated about 50% of flow drains westerly on 31st Street)

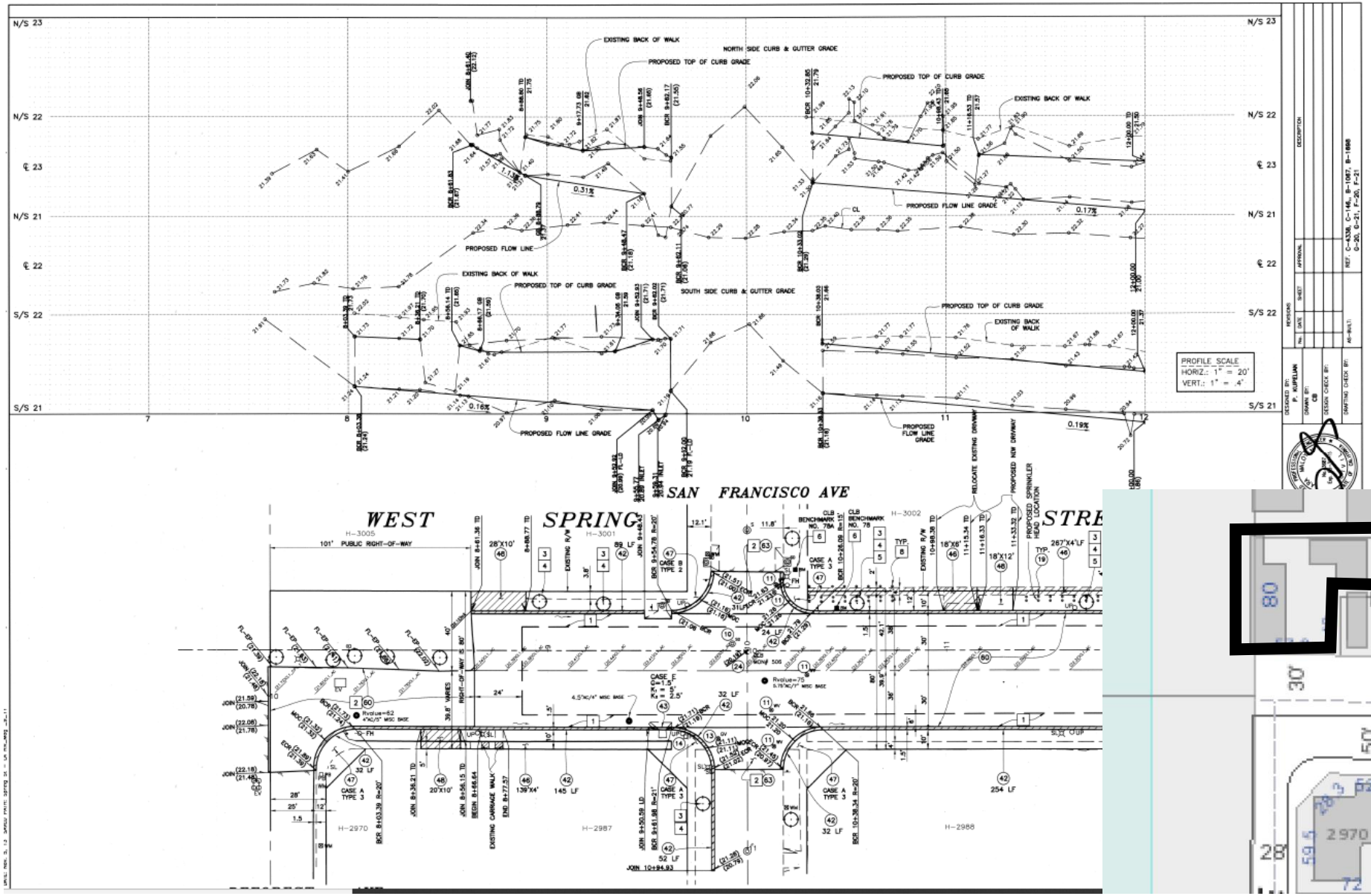
Case B: Table 2 has the % results. Total inflow = 67.5 cfs; Total outflow = 67.02 cfs

Time (hrs)	Inflow (cfs)	Outflow (cfs)	% flow to West of 31st street	% flow to East of 31st street	% flow South of San Francisco Ave
0.00	0.00	0.00	0.00	0.00	0.00
0.20	0.9	0.32	0.00	0.00	100.00
0.40	1.8	1.9	55.26	0.00	44.74
0.60	2.7	2.43	49.79	0.00	50.21
0.80	3.6	3.21	46.11	0.00	53.89
1.00	4.5	4.42	49.77	0.00	50.23
1.20	4.5	4.5	49.78	0.00	50.22
1.40	4.5	4.5	49.78	0.00	50.22
1.60	4.5	4.5	49.78	0.00	50.22
1.80	4.5	4.5	49.78	0.00	50.22
2.00	4.5	4.5	49.78	0.00	50.22
2.20	4.5	4.5	49.78	0.00	50.22
2.40	4.5	4.5	49.78	0.00	50.22
2.60	4.5	4.5	49.78	0.00	50.22
2.80	4.5	4.5	49.78	0.00	50.22
3.00	4.5	4.5	49.78	0.00	50.22
3.20	3.6	3.7	50.54	0.00	49.46
3.40	2.7	2.9	55.52	0.00	44.48
3.60	1.8	1.81	55.25	0.00	44.75
3.80	0.9	1.33	57.89	0.00	42.11
4.00	0	0	0.00	0.00	0.00

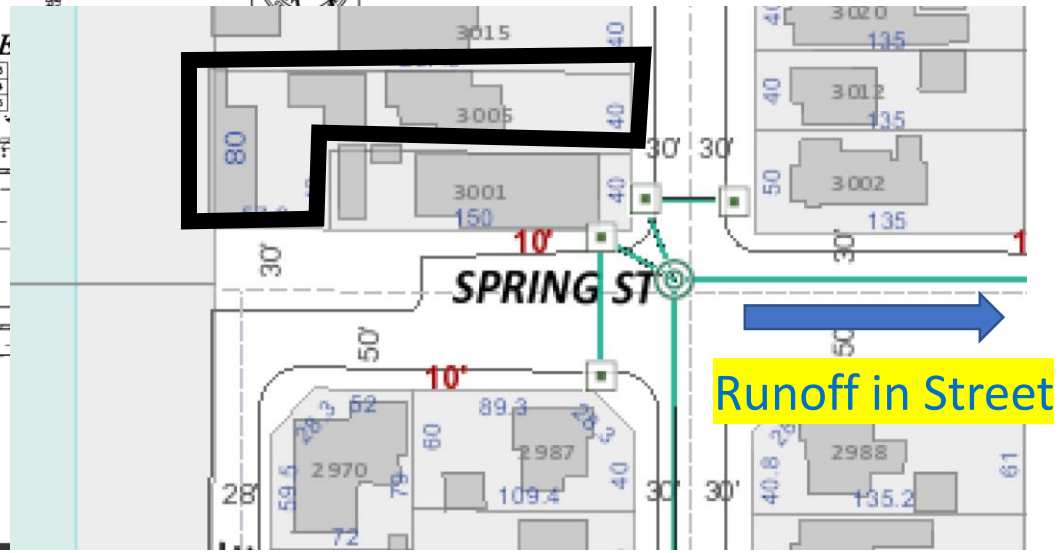


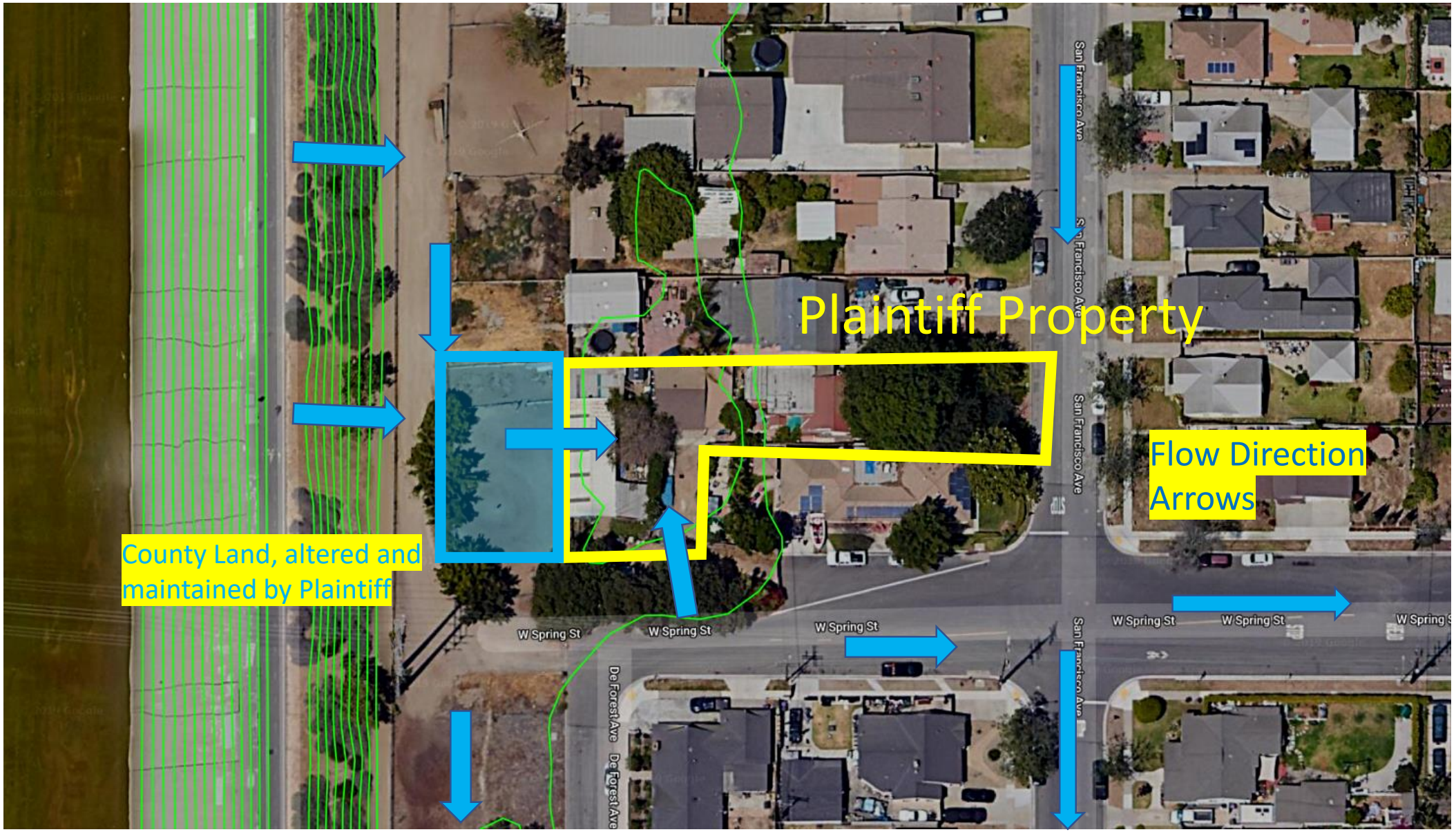
VERY PRELIMINARY

VERY PRELIMINARY



Note: Street Plans indicate that runoff in street (east of intersection w/ San Francisco) flows eastward along Spring Street





VERY PRELIMINARY

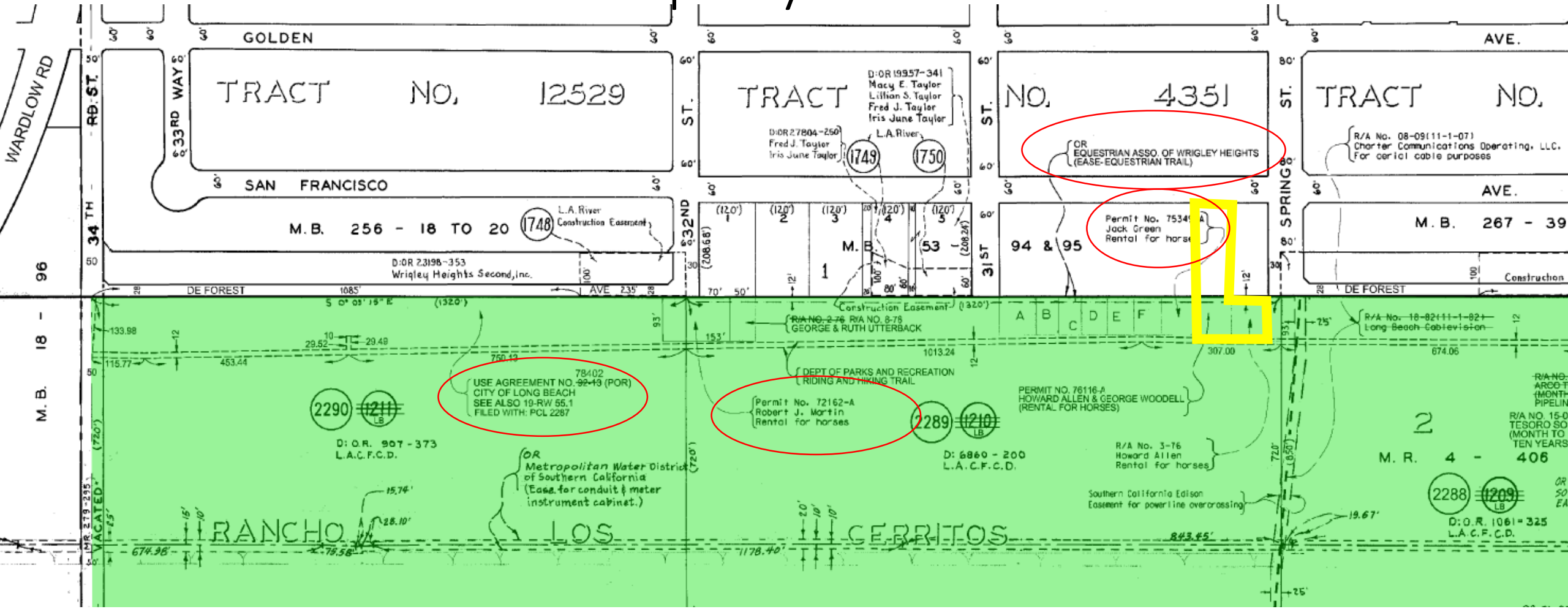
VERY PRELIMINARY

Hromadka & Associates
Hydrologic, Earth and Atmospheric Sciences

VERY PRELIMINARY

VERY PRELIMINARY

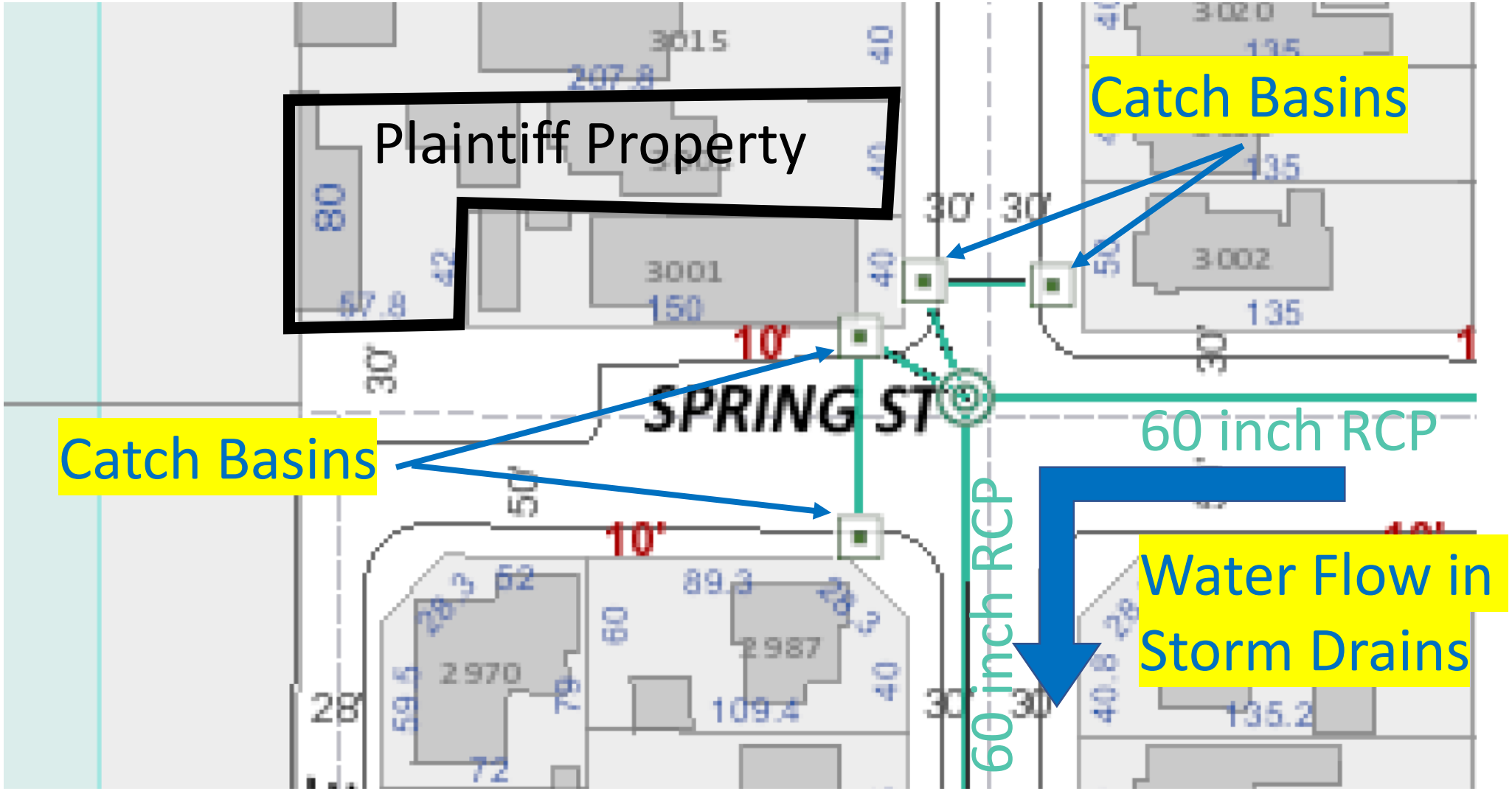
Additional Use/Rental Agreements Upstream of Plaintiff Property



Hromadka & Associates
Hydrologic, Earth and Atmospheric Sciences

VERY PRELIMINARY

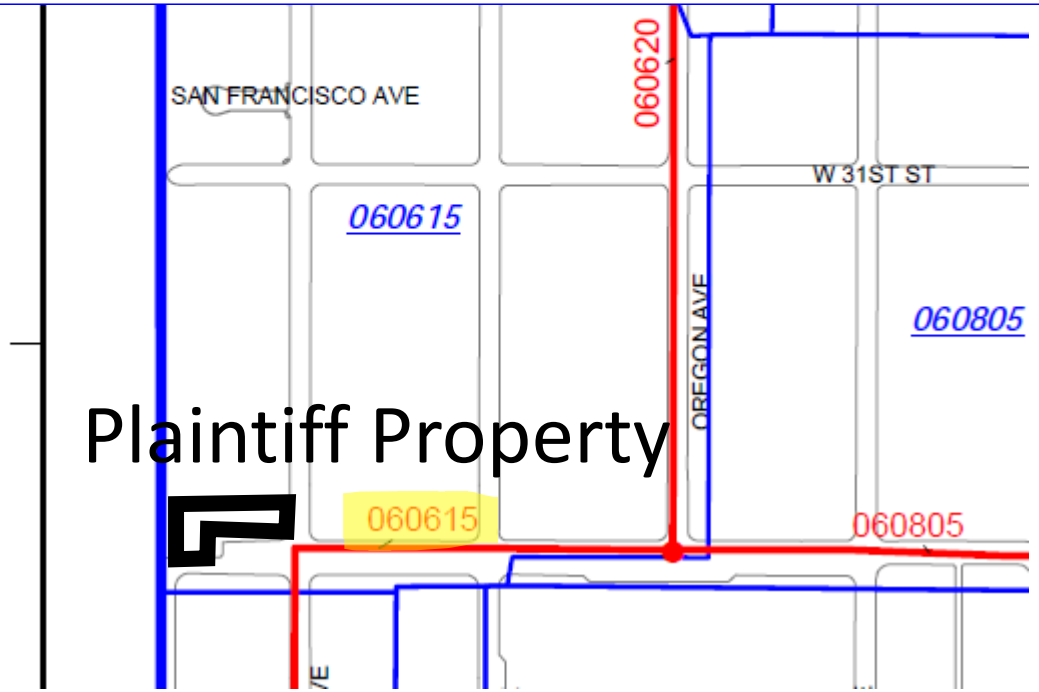
Storm Drain System Near Plaintiff Property



VERY PRELIMINARY

City of Long Beach Master Plan of Drainage

Conv. ID	Map Atlas No	Ownership		Elevations		Existing Section				Dge Area (acres)	Return Period (Years)			Capacity (cfs)	Replacement Size
				Ground	Invert	Length (ft)	Slope	Man N	Size		10	25	50		
Major Basin: 06															
060615	22 F20	City	US	19.00	8.60	1,984	0.0010	0.013	60" Dia Pipe	196	Hydrology (cfs)	96.0	125.0	146.0	82.2	66" Dia RCP
			DS	20.00	6.62						Depth in Street (ft)	0.50	0.80	1.00		



Note: According to MPD, the 60-inch pipe near Plaintiff Property is deficient for the 10, 25, and 50 year design storm, with water depth in the street ranging from 0.5 ft to 1ft

VERY PRELIMINARY

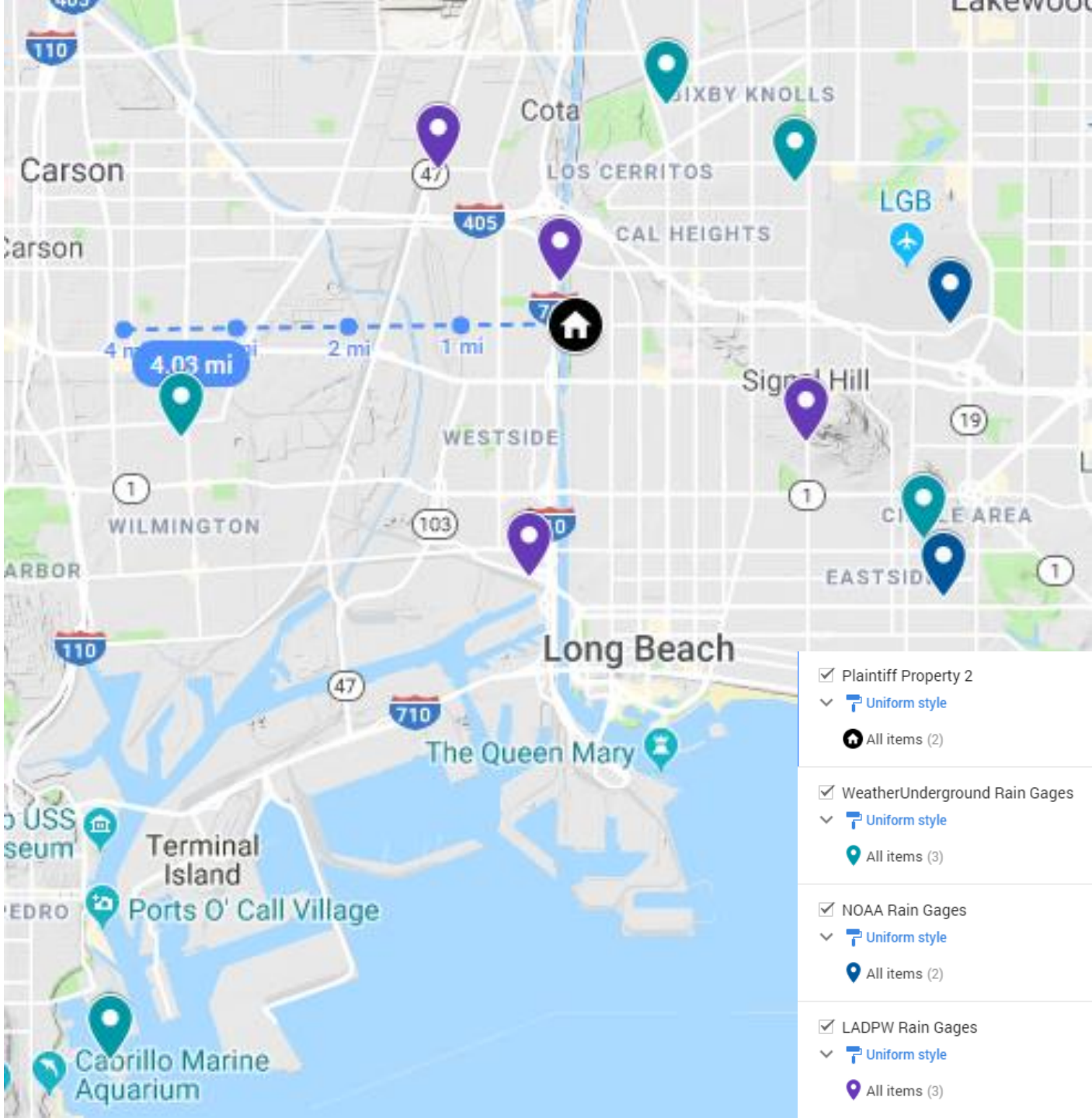
Precipitation Assessment

VERY PRELIMINARY

VERY PRELIMINARY

Rain Gage Map

- Over 27 weather gages examined
- Of those, 12 gages recorded precipitation data on January 22, 2017 (see map to right)



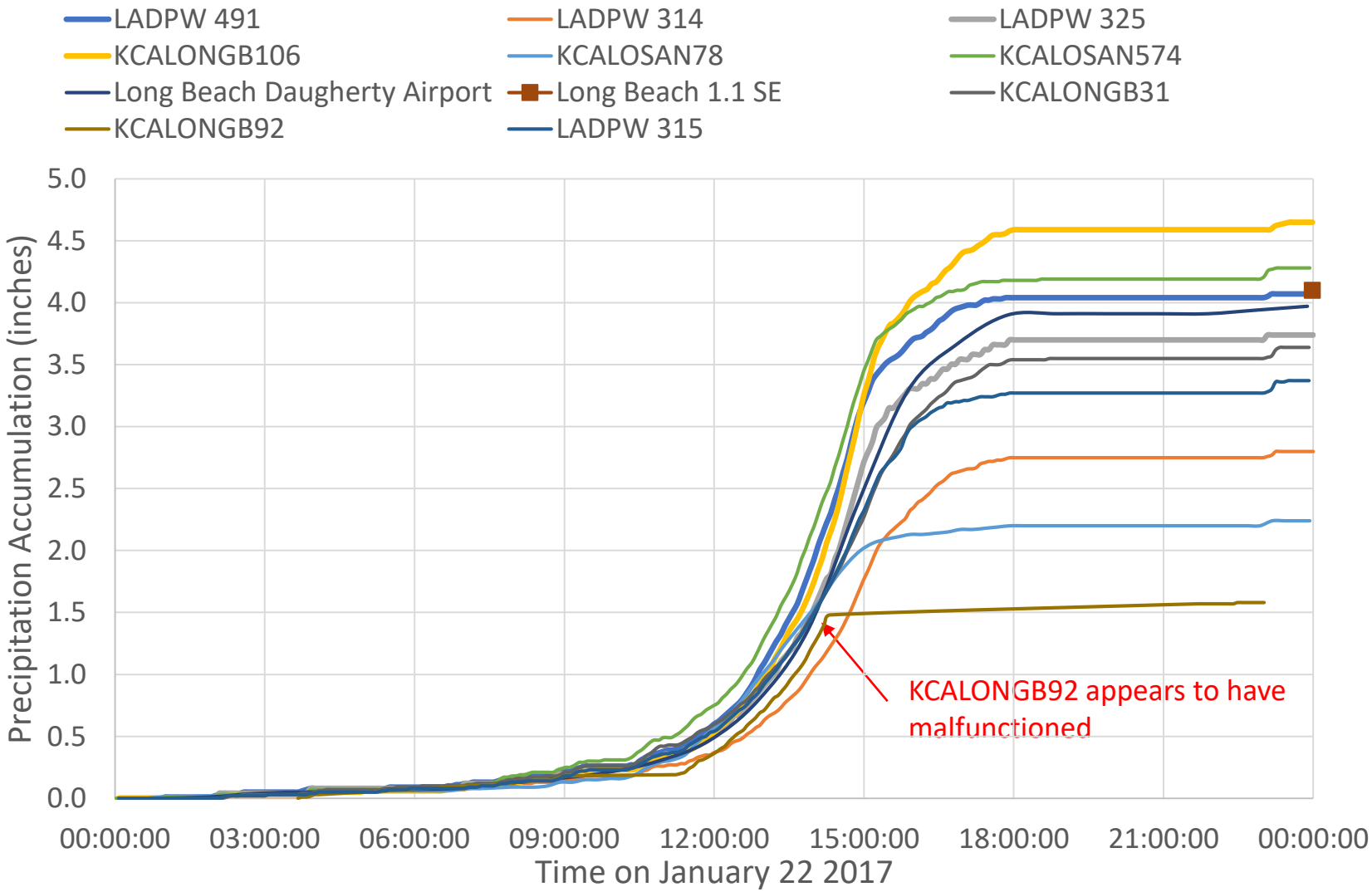
Rain Gage Table

Gage ID	Type	Gage Name	Operator	Latitude	Longitude	Elevation (feet)	Data From	Data To	Data Years	Approximate Distance to 3005 San Francisco Ave. (miles)	Data for Event
314	ALERT	L.A. River @ Wardlow Precip	LADPW	33.81722	-118.20638	32				0.4	Y
315	ALERT	Dominguez Water Co. Precip	LADPW	33.83166	-118.22527	49				1.8	Y
KCALONGB31	Event	Bixby Knolls	WU	33.84	-118.19	82				2.1	Y
491	ALERT	West Long Beach Pump Plant	LADPW	33.77916	-118.21111	8				2.3	Y
325	ALERT	Signal Hill City Hall Precip	LADPW	33.79666	-118.16833	140				2.3	Y
KCALONGB92	Event	Long Beach - California Heights	WU	33.83	-118.17	82				2.3	Y
USW00023129	Daily	Long Beach Daugherty Airport, US CA	NOAA	33.8116	-118.146	31	1943	2018	75	3.3	Y
WBAN:23129	Hourly	Long Beach Daugherty Airport CA US	NOAA	33.8116	-118.146	31	1943	2018	75	3.3	Y
KCALONGB106	Event	Fountain House	WU	33.784	-118.15	69	2016	2018	2	3.7	Y
KCALOSAN574	Event	Zoe's Yard	WU	33.797	-118.265	52	2016	2018	2	3.7	Y
US1CALA0038	Daily	Long Beach 1.1 SE, CA US	NOAA	33.7766	-118.147	49				4.1	Y
KCALOSAN78	Event	Cabrillo Way Dry Boat Storage	WU	33.717	-118.276	26	2013	2018	2	7.8	Y

- There are 6 rain gages approximately 2 miles away (or less) from the San Francisco Ave. property, with one rain gage (an ALERT gage operated by LADPW) approximately 0.4 miles away

Rain Gage Precipitation Graph

- Rain data shows that the January 22, 2017 storm occurred between 9am and 6pm
- The most intense precipitation occurred from around 12pm to 3pm
- All the rain gages show good agreement as to the rainfall timing and general accumulation pattern.
- Rain Gage KCALONGB92 appears to have abruptly malfunctioned just before 3:00pm and so will not be carried forward in this analysis



VERY PRELIMINARY

VERY PRELIMINARY

Rain Gage Precipitation Table

Gage ID	Type	Gage Name	Operator	Distance to San Francisco Ave. Property	Peak 5 minute duration precipitation (inches)	Peak 10 minute duration precipitation (inches)	Peak 15 minute duration precipitation (inches)	Peak 30 minute duration precipitation (inches)	Peak 60 minute duration precipitation (inches)	Peak 2 hour duration precipitation (inches)	Peak 3 hour duration precipitation (inches)	Peak 6 hour duration precipitation (inches)	Peak 12 hour duration precipitation (inches)	Peak 24 hour duration precipitation (inches)
314	ALERT	L.A. River @ Wardlow Precip	LADPW	0.4	0.08	0.16	0.24	0.47	0.83	1.34	1.74	2.43	2.69	2.8
315	ALERT	Dominguez Water Co. Precip	LADPW	1.8	0.09	0.17	0.25	0.47	0.9	1.55	2.11	2.88	3.19	3.37
KCALONGB31	Event	Bixby Knolls	WU	2.1	0.09	0.18	0.26	0.48	0.88	1.56	2.1	3.02	3.45	3.64
491	ALERT	West Long Beach Pump Plant	LADPW	2.3	0.14	0.27	0.38	0.71	1.28	2.16	2.76	3.59	3.95	4.07
325	ALERT	Signal Hill City Hall Precip	LADPW	2.3	0.12	0.24	0.35	0.71	1.22	1.97	2.48	3.23	3.62	3.74
USW00023129	Daily	Long Beach Daugherty Airport, US CA	NOAA	3.3										3.97
WBAN:23129	Hourly	Long Beach Daugherty Airport CA US	NOAA	3.3					1.02	1.93	2.5	3.44	3.83	3.97
KCALONGB106	Event	Fountain House	WU	3.7	0.16	0.31	0.45	0.88	1.56	2.47	3.09	4.14	4.53	4.65
KCALOSAN574	Event	Zoe's Yard	WU	3.7	0.13	0.24	0.36	0.69	1.26	2.23	2.86	3.68	4.10	4.28
US1CALA0038	Daily	Long Beach 1.1 SE, CA US	NOAA	4.1										4.1
KCALOSAN78	Event	Cabrillo Way Dry Boat Storage	WU	7.8	0.05	0.10	0.15	0.28	0.53	1.05	1.45	1.97	2.14	2.24

VERY PRELIMINARY

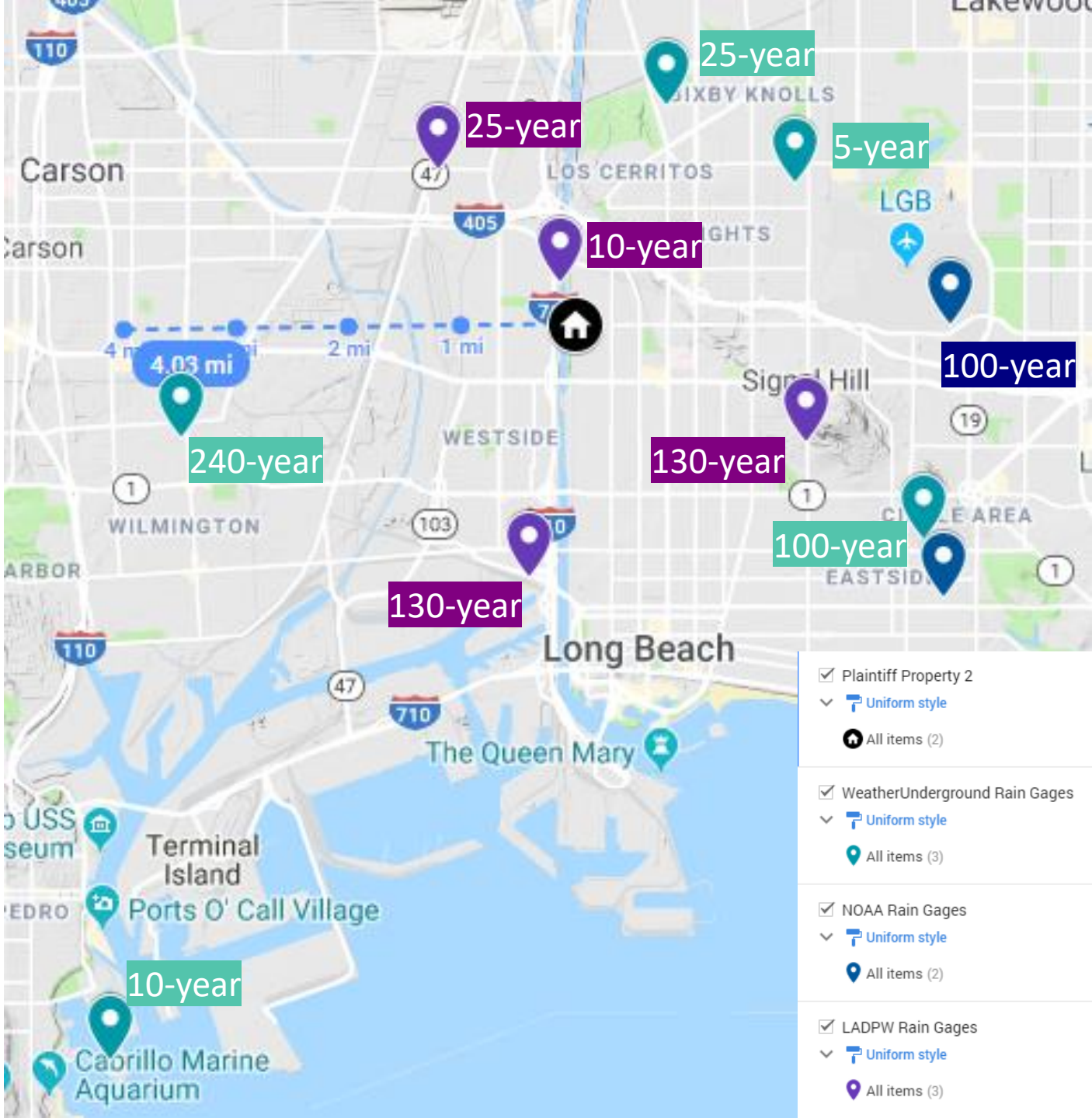
Rain Gage Precipitation Return Frequency (RF) – Ordered by Distance to San Francisco Ave Property

Gage ID	Type	Gage Name	Operator	Distance to San Francisco Ave. Property	Peak 5 minute duration Return Frequency (years)	Peak 10 minute duration Return Frequency (years)	Peak 15 minute duration Return Frequency (years)	Peak 30 minute duration Return Frequency (years)	Peak 60 minute duration Return Frequency (years)	Peak 2 hour duration Return Frequency (years)	Peak 3 hour duration Return Frequency (years)	Peak 6 hour duration Return Frequency (years)	Peak 12 hour duration Return Frequency (years)	Peak 24 hour duration Return Frequency (years)
314	ALERT	L.A. River @ Wardlow Precip	LADPW	0.4	N/A	N/A	N/A	2	5	5	10	10	5	2
315	ALERT	Dominguez Water Co. Precip	LADPW	1.8	N/A	N/A	1	2	5	10	25	10	10	5
KCALONGB31	Event	Bixby Knolls	WU	2.1	N/A	N/A	1	2	5	10	25	25	10	5
491	ALERT	West Long Beach Pump Plant	LADPW	2.3	1	2	5	10	25	90 (92)	130 (131)	100 (102)	50	10
325	ALERT	Signal Hill City Hall Precip	LADPW	2.3	N/A	2	2	10	25	80 (79)	130 (128)	120 (119)	25	10
USW00023129	Daily	Long Beach Daugherty Airport, US CA	NOAA	3.3										10
WBAN:23129	Hourly	Long Beach Daugherty Airport CA US	NOAA	3.3					10	50	100	100	25	10
KCALONGB106	Event	Fountain House	WU	3.7	1	2	5	25	100	190 (186)	240 (238)	230 (232)	100	25
KCALOSAN574	Event	Zoe's Yard	WU	3.7	1	1	2	10	25	100	100	100	50	10
US1CALA0038	Daily	Long Beach 1.1 SE, CA US	NOAA	4.1										10
KCALOSAN78	Event	Cabrillo Way Dry Boat Storage	WU	7.8	N/A	N/A	N/A	1	2	5	10	10	5	2

- The closest short-term rain gage to the San Francisco Ave Property location shows a RF of 10 years for the 3 and 6 hour durations
- 2 ALERT Rain Gages approximately 2 miles away show RFs of 100 years for the 2, 3, and 6 hour durations

VERY PRELIMINARY

Rain Gage RF Map
3 Hour Duration



Hromadka & Associates
Hydrologic, Earth and Atmospheric Sciences

VERY PRELIMINARY

Precipitation Ranking

NAME	DATE	PRCP
LONG BEACH DAUGHERTY AIRPORT, CA US	1/26/1956	5.02
LONG BEACH DAUGHERTY AIRPORT, CA US	1/22/2017	3.97
LONG BEACH DAUGHERTY AIRPORT, CA US	1/4/1995	3.75
LONG BEACH DAUGHERTY AIRPORT, CA US	1/30/1979	3.72
LONG BEACH DAUGHERTY AIRPORT, CA US	3/1/1983	3.46
LONG BEACH DAUGHERTY AIRPORT, CA US	12/4/1974	3.17
LONG BEACH DAUGHERTY AIRPORT, CA US	12/7/1992	3.05
LONG BEACH DAUGHERTY AIRPORT, CA US	1/25/1956	3.01
LONG BEACH DAUGHERTY AIRPORT, CA US	2/20/1996	2.78
LONG BEACH DAUGHERTY AIRPORT, CA US	2/17/2017	2.77
LONG BEACH DAUGHERTY AIRPORT, CA US	1/7/1995	2.57
LONG BEACH DAUGHERTY AIRPORT, CA US	3/25/1998	2.57
LONG BEACH DAUGHERTY AIRPORT, CA US	2/12/2003	2.53
LONG BEACH DAUGHERTY AIRPORT, CA US	1/9/2005	2.49
LONG BEACH DAUGHERTY AIRPORT, CA US	2/11/2005	2.48
LONG BEACH DAUGHERTY AIRPORT, CA US	1/20/2010	2.46
LONG BEACH DAUGHERTY AIRPORT, CA US	2/3/1975	2.44
LONG BEACH DAUGHERTY AIRPORT, CA US	1/7/1974	2.42
LONG BEACH DAUGHERTY AIRPORT, CA US	2/8/1962	2.38

VERY PRELIMINARY