COFFEY ENGINEERING, INC.

Drainage Report

32nd and Broadway
1000 Block 32nd Street
San Diego, CA 92102
APN: 539-563-06, 07, 10

(PTS No. 637438)

Prepared for:

The City of San Diego

June 30, 2020

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1. **Existing Conditions**

The project site is located at the intersection of 32nd Street and Broadway Street (APN 539-563-06, -07, and -10). In pre-construction conditions, the site is comprised entirely of undeveloped, vegetated hillside. Approximately 0.97 acres (Basin X) will contribute runoff discharges totaling 1.92 cfs in the 100-year storm event to the hillside via sheet flow, where runoff flows east to an existing 60" RCP before ultimately reaching the San Diego Bay.

For a more complete analysis on the increase of runoff from existing to proposed conditions, an offsite basin consisting of 0.72 acres (Basin Y) of undeveloped area was created that mimics the proposed drainage area footprint. This area contributes Q100=1.42 cfs to the hillside.

See Appendix A- Drainage Map A.

2. **Proposed Project**

In post-construction conditions, the project site will be heavily developed with 42 units and driveway. All runoff from developed areas within the site (Basin A) will discharge to a proposed rip-rap within the 25' drainage easement, near the existing 60" RCP inlet. The 100-year storm event flow rate Q100 has been calculated at 3.62 cfs.

There is a small strip of vegetated hillside along the perimeter of the site that will not be required to be treated, and will sheet flow off the site (Basin B). Flows from this basin are expected to be Q_{100}=0.07 cfs.

Also proposed is an extension of the paved 32nd Street to the southerly extent of the project site. A storm drain inlet will collect street flows and ultimately discharge them to the same rip-rap at the southeast corner of the site near the 60" RCP inlet (Basin C). The flow rate was calculated to be Q_{100}=0.94 cfs.

Expected offsite run-on from the northwesterly hillside will be channeled along the top of the retaining wall and collected by a proposed Type F inlet, where it will discharge to a rip-rap along the hillside south of the proposed road extension (Basin D). The rip-rap is expected to receive Q100=0.36 cfs.

A small portion of the same westerly hillside will not be collected by the proposed Type F inlet, but instead sheet flow around the proposed development and sheet flow to the southerly hillside that Basin D discharges to. This area (Basin E) will contribute 0.14 cfs to the southerly hillside.

There is no expected run-on from the northerly adjacent property. The northerly site currently is being permitted with the City of San Diego for a condominium complex (PTS 595288), which when constructed will capture any potential run-on and discharge away from the project site.

See Appendix A- Drainage Map B.

3. **Purpose and Scope of Report**

This report will evaluate the proposed drainage pipe system and flow rate discharge to the existing 60" RCP.

4. **Method of Calculations**

The Rational Method, as defined by *City of San Diego Drainage Design Manual 2017*, will be used to calculate storm water flow rates. Where noted, the following calculations were used to determine flow properties:

Rainfall Characteristics

Q = C * I * A, where

Q = Flow rate (ft^3/sec)
C = Runoff coefficient
(Runoff coefficient per *City of San Diego Drainage Design Manual 2017* reproduced in Appendix C. Soil type D determined from the *Soil Hydrologic Groups* map from the County of San Diego Hydrology Manual reproduced in Appendix C also.)
I = Rainfall intensity (in/hr.)
A = Area (acres)

5. **Results and Conclusions:**

Based on the calculations, the site (including run-on) will feature a larger discharge to the existing 60" RCP in proposed conditions, from 3.35 cfs to 5.13 cfs. However, no mitigation measures are necessary as there are no anticipated impacts to adjacent properties as all storm water runoff from the habitable area discharges directly to the drainage easement where it is collected by the existing 60" RCP. The 60" RCP can handle 442.60 cfs (see pipe flow calculations in Appendix B). The construction will only increase the 60" RCP's capacity by 0.4%.

An analysis was performed on the tributary area to determine the total flows to the 60" RCP, in order to conclude whether or not the 0.4% capacity increase could be handled. The drainage area ultimately contributing to the flows entering the 60" RCP is 158 acres. Calculations are shown on Drainage Map 'C' – 32nd & Broadway Tributary Area. The total flows that the 60" RCP currently receives are 382.36 CFS. Therefore, the 60" is expected to handle the increased runoff from construction without negative downstream effects.

6. **Clean Water Act (CWA) Compliance**

The proposed project is exempt from permitting under Federal Clean Water Act section 401 or 404 because it does not directly discharge into navigable waters of the United States.

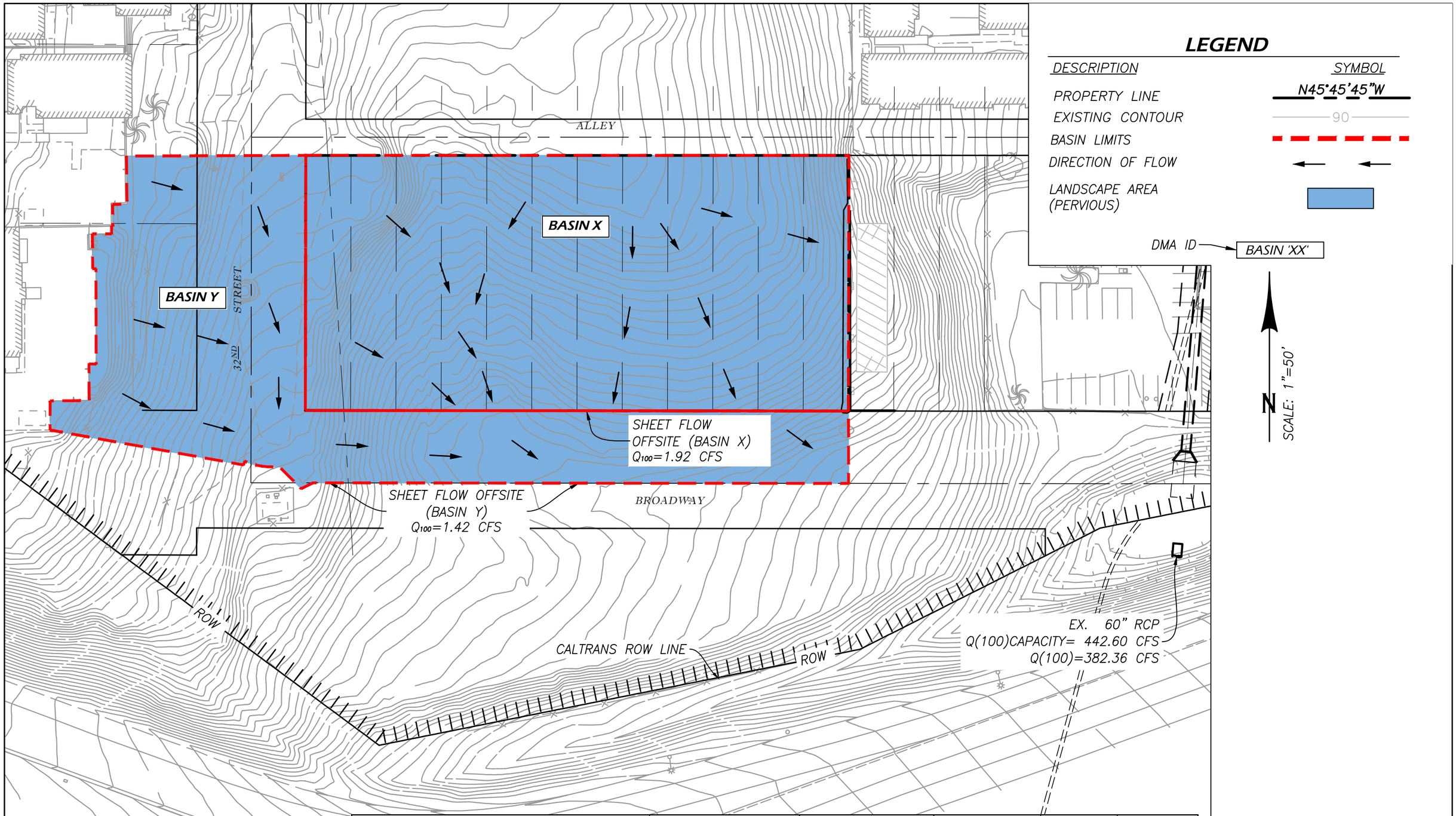
7. **Declaration of Responsible Charge**

I hereby declare that I am the Civil Engineer of work for this project, that I have exercised responsible charge over the design of the project as defined in section 6703 of the business and professions code, and that the design is consistent with current design.

I understand that the check of project drawings and specifications by the City of San Diego is confined to a review only and does not relieve me, as Engineer of Work, of my responsibilities for project design.

Michael C. Kinnear Date
RCE 76785
Exp. 12-31-20

Appendix A –Drainage Map



Drainage Basin ID (Type)	Impervious Area (SF)	Pervious Area (SF)	Basin Area (SF)	Total (AC)	C-Value
X (Sheet Flows to Hillside)	0	42,322	42,322	0.97	0.45
Y (Sheet Flows to Hillside)	0	31,278	31,278	0.72	0.45
Total	**0**	**73,600**	**73,600**	**1.69**	

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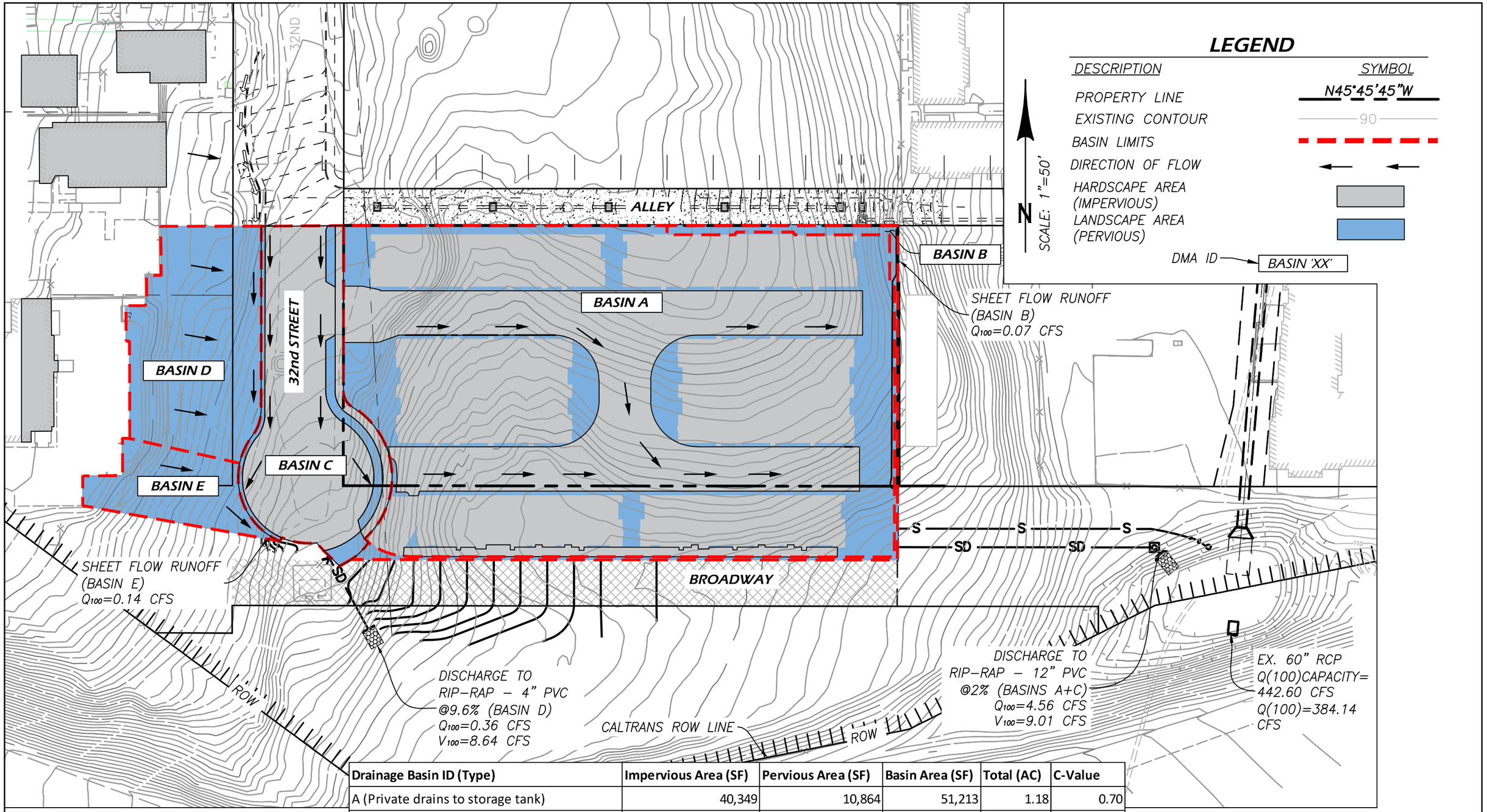
DRAINAGE MAP A
EXISTING CONDITIONS
32ND AND BROADWAY



Drainage Basin ID (Type)	Impervious Area (SF)	Pervious Area (SF)	Basin Area (SF)	Total (AC)	C-Value
A (Private drains to storage tank)	40,349	10,864	51,213	1.18	0.70
B (Sheet flow to easterly hillside)	0	1,525	1,525	0.04	0.45
C (Storm drain at street to storage tank)	8,525	1,262	9,787	0.22	0.95
D (Run-on to southerly hillside rip-rap)	0	8,027	8,027	0.18	0.45
E (Run-on diverted to southerly hillside)	0	3,048	3,048	0.07	0.45
Total	**48,874**	**24,726**	**73,600**	**1.69**	

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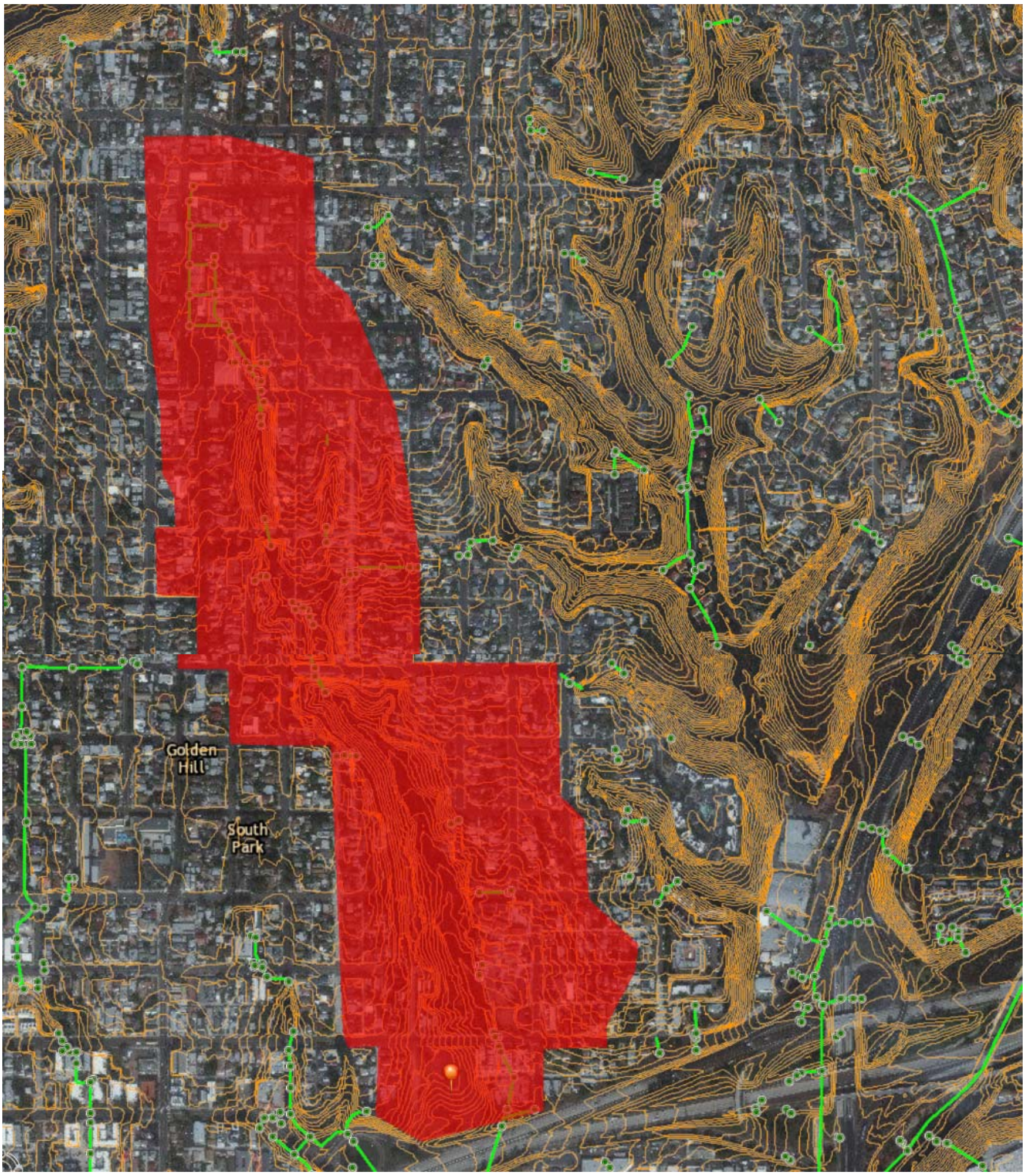
DRAINAGE MAP B
PROPOSED CONDITIONS-SWQMP
32ND AND BROADWAY

DRAINAGE MAP 'C'

32ND AND BROADWAY - TRIBUTARY AREA



Q=CIA = 382.36 CFS

C = 0.55 (TRIBUTARY AREA IS SINGLE-FAMILY OR UNDEVELOPED)

I = 4.4 IN/HR

TRIBUTARY AREA (A) = 158 ACRES

Appendix B –Calculation/Evaluations

100 Year Storm

Table A - Pre Construction Flow Conditions

		Summary				Hydraulics of Existing Structures	
Flow ID (Basin)	Runoff Coefficient, C	(5 min minimum) Total time-of-concentration, T_c (min)	Rainfall Intensity, I (in/hr)	Basin Area, A (acres)	**Q (cfs)**	Flow ID (Basin)	Flow Description
X	0.45	5.00	4.40	0.97	**1.92**	X	Sheet flow to hillside
Y	0.45	5.00	4.40	0.72	**1.42**	Y	Sheet flow to hillside
				Sum =	**3.35**		

Table B - Post Construction Flow Conditions

		Summary				Hydraulics of Proposed Structures	
Flow ID (Basin)	Runoff Coefficient, C	(5 min minimum) Total time-of-concentration, T_c (min)	Rainfall Intensity, I (in/hr)	Basin Area, A (acres)	**Q (cfs)**	Flow ID (Basin)	Flow Description
A	0.70	5.00	4.40	1.18	**3.62**	A	A (Private drains to storage tank)
B	0.45	5.00	4.40	0.04	**0.07**	B	B (Sheet flow to easterly hillside)
C	0.95	5.00	4.40	0.22	**0.94**	C	C (Storm drain at street to storage tank)
D	0.45	5.00	4.40	0.18	**0.36**	D	D (Run-on to southerly hillside rip-rap)
E	0.45	5.00	4.40	0.07	**0.14**	E	E (Run-on diverted to southerly hillside)
				Sum =	**5.13**		

Runoff Coefficients					
Pre-Construction Conditions					
Drainage Basin ID (Type)	**Impervious Area (SF)**	**Pervious Area (SF)**	**Basin Area (SF)**	**Total (AC)**	**C-Value**
X (Sheet Flows to Hillside)	0	42,322	42,322	0.97	0.45
Y (Sheet Flows to Hillside)	0	31,278	31,278	0.72	0.45
Total	**0**	**73,600**	**73,600**	**1.69**	
Post-Construction Conditions					
Drainage Basin ID (Type)	**Impervious Area (SF)**	**Pervious Area (SF)**	**Basin Area (SF)**	**Total (AC)**	**C-Value**
A (Private drains to storage tank)	40,349	10,864	51,213	1.18	0.70
B (Sheet flow to easterly hillside)	0	1,525	1,525	0.04	0.45
C (Storm drain at street to storage tank)	8,525	1,262	9,787	0.22	0.95
D (Run-on to southerly hillside rip-rap)	0	8,027	8,027	0.18	0.45
E (Run-on diverted to southerly hillside)	0	3,048	3,048	0.07	0.45
Total	**48,874**	**24,726**	**73,600**	**1.69**	

Table A-1. Runoff Coefficients for Rational Method

Land Use	Runoff Coefficient (C)
	Soil Type [1]
Residential:	
Single Family	0.55
Multi-Units	0.70
Mobile Homes	0.65
Rural (lots greater than ½ acre)	0.45
Commercial [2]	
80% Impervious	0.85
Industrial [2]	
90% Impervious	0.95

Note:
[1] Type D soil to be used for all areas.
[2] Where actual conditions deviate significantly from the tabulated imperviousness values of 80% or 90%, the values given for coefficient C, may be revised by multiplying 80% or 90% by the ratio of actual imperviousness to the tabulated imperviousness. However, in case shall the final coefficient be less than 0.50. For example: Consider commercial property on D soil.

Actual imperviousness = 50%
Tabulated imperviousness = 80%
Revised C = (50/80) x 0.85 = 0.53

Pipe Flow Calculations

12” PVC @ 2% Discharging to Rip-Rap (Basins A+C)

```
                        PIPE FLOW PROGRAM              DATE: 04-12-2019
                                                       TIME: 20:13:59

(1)  Diameter (inches) ...  12.          (2)  Mannings n .......      .010
(3)  slope (ft/ft) .......   .0200       (4)  Q (cfs) ..........     4.56
(5)  depth (ft) ..........  0.61         (6)  depth/Diameter ...     0.61
     Velocity (fps) ......  9.01              Velocity Head ....     1.26
     Area (Sq. Ft.) ......  0.51
     Critical Depth ......  0.89              Critical Slope ...     0.0086
     Critical Velocity ...  6.17              Froude Number ....     2.20
```

4” PVC @ 9.6% Discharging to Rip-Rap (Basin D)

```
                        PIPE FLOW PROGRAM              DATE: 09-06-2019
                                                       TIME: 13:02:17

(1)  Diameter (inches) ...  4.           (2)  Mannings n .......      .010
(3)  slope (ft/ft) .......   .0960       (4)  Q (cfs) ..........     0.36
(5)  depth (ft) ..........  0.16         (6)  depth/Diameter ...     0.48
     Velocity (fps) ......  8.64              Velocity Head ....     1.16
     Area (Sq. Ft.) ......  0.04
     Critical Depth ......  0.31              Critical Slope ...     0.0183
     Critical Velocity ...  4.22              Froude Number ....     4.31
```

Capacity of 60” PVC @ 2.89% Under I-94

```
                        PIPE FLOW PROGRAM              DATE: 09-10-2019
                                                       TIME: 13:29:01

(1)  Diameter (inches) ...  60.          (2)  Mannings n .......      .013
(3)  slope (ft/ft) .......   .0289       (4)  Q (cfs) ..........   442.60
(5)  depth (ft) ..........  5.00         (6)  depth/Diameter ...     1.00
     Velocity (fps) ......  22.54             Velocity Head ....     7.89
     Area (Sq. Ft.) ......  19.63
     Critical Depth ......  4.92              Critical Slope ...     0.0261
     Critical Velocity ...  22.61             Froude Number ....      N/A
```

Flows from site (Pre-construction) to 60” PVC @ 2.89% Under I-94

```
                        PIPE FLOW PROGRAM              DATE: 09-10-2019
                                                       TIME: 13:31:55

(1)  Diameter (inches) ...  60.          (2)  Mannings n .......      .013
(3)  slope (ft/ft) .......    .0289      (4)  Q (cfs) ..........     3.35
(5)  depth (ft) ..........   0.31        (6)  depth/Diameter ...     0.06
     Velocity (fps) ......   6.65             Velocity Head ....     0.69
     Area (Sq. Ft.) ......   0.50
     Critical Depth ......   0.50             Critical Slope ...     0.0039
     Critical Velocity ...   3.30             Froude Number ....     2.56
```

Flows from site (Post-construction) to 60” PVC @ 2.89% Under I-94

```
                        PIPE FLOW PROGRAM              DATE: 09-10-2019
                                                       TIME: 13:32:56

(1)  Diameter (inches) ...  60.          (2)  Mannings n .......      .013
(3)  slope (ft/ft) .......    .0289      (4)  Q (cfs) ..........     5.13
(5)  depth (ft) ..........   0.38        (6)  depth/Diameter ...     0.08
     Velocity (fps) ......   7.56             Velocity Head ....     0.89
     Area (Sq. Ft.) ......   0.68
     Critical Depth ......   0.62             Critical Slope ...     0.0037
     Critical Velocity ...   3.69             Froude Number ....     2.63
```

Appendix C –Reference Tables & Figures (City of San Diego Drainage Manual 2017)

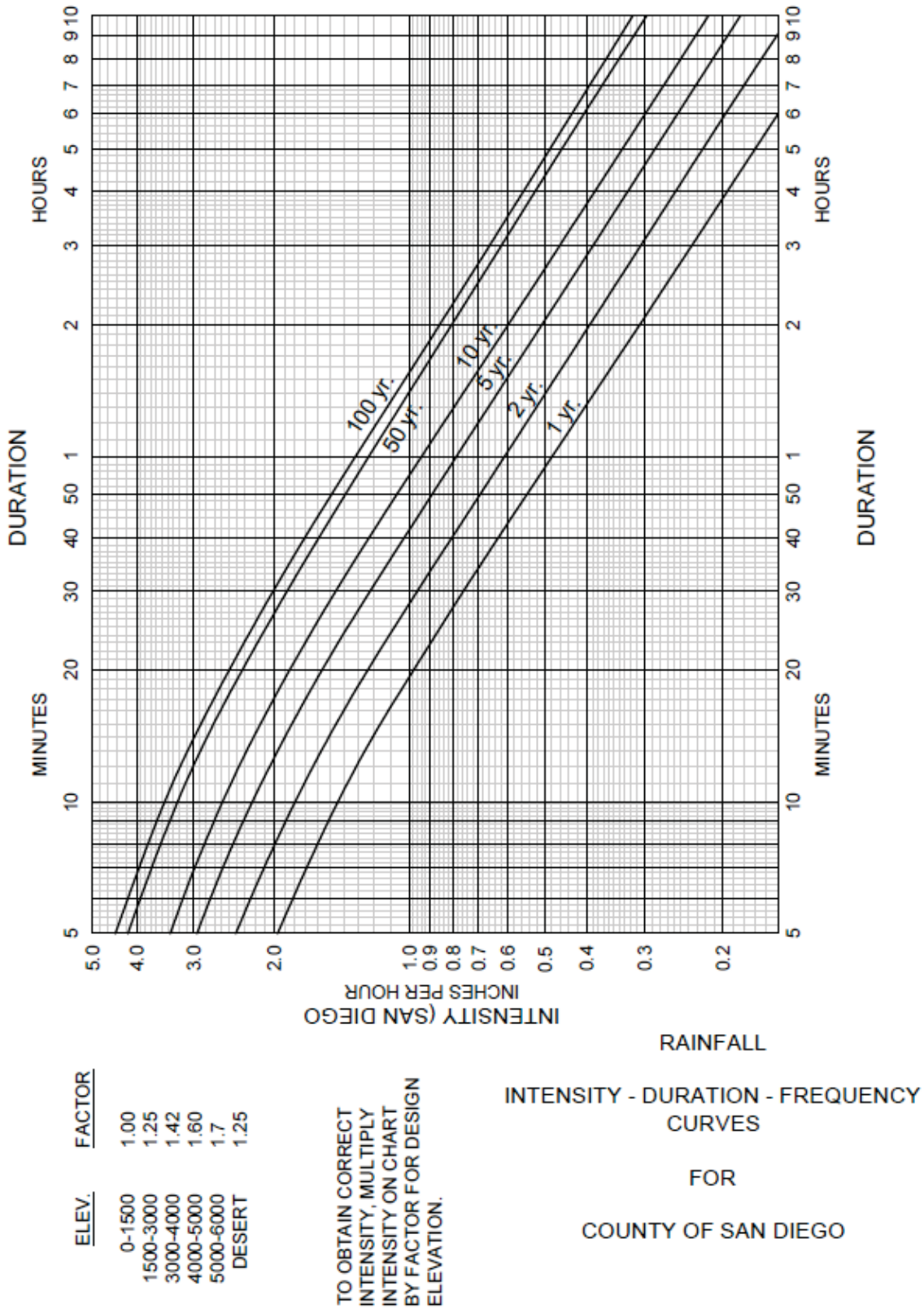
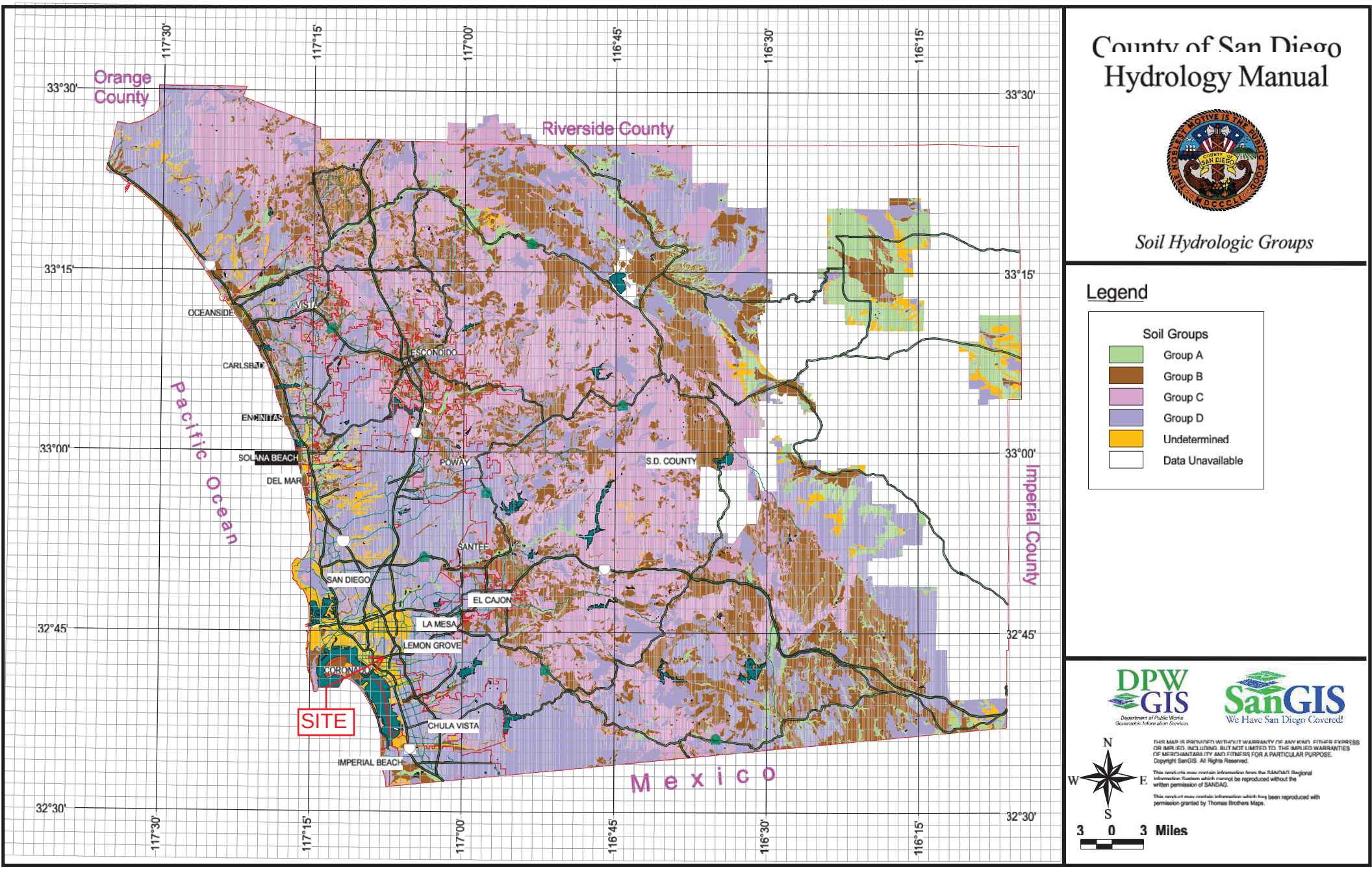


Figure A-1. Intensity-Duration-Frequency Design Chart



County of San Diego Hydrology Manual

Soil Hydrologic Groups

Legend

Soil Groups

- Group A
- Group B
- Group C
- Group D
- Undetermined
- Data Unavailable

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