Preliminary Drainage Study
"Villas by the Sea"

Lots 1-8, Block 257 Map No. 697/854

1011 Grand Avenue
San Diego, California 92109

Prepared for:
KTDT, Inc.
4641 Ingraham Street
San Diego, CA 92109

Prepared by:

Christensen Engineering & Surveying

7888 Silverton Avenue, Suite "J"
San Diego, CA 92126
(858) 271-9901

April 25, 2021

PTS No. 686049

Introduction

This project involves the demolition of all existing improvements on the property located at 1011 Grand Avenue (commercial development) and the construction of a mixed-use project consisting of 40 residential apartment units and 4 commercial units with parking garage, utilities, treatment BMPs and landscaping.

The attached drainage area maps are from a topographic survey by Christensen Engineering & Surveying, dated August 07, 2020. As shown on the pre-construction drainage area map, drainage from the site is by surface flow and is urban in character. Prior to construction site runoff flows westerly onto Cass Street (1.90 cfs for the 100-yr storm). No offsite run-on flows through the project site. The project prior to development is commercial with no drainage conveyance system nor runoff treatment.

Following construction, site runoff flows to Grand Avenue from a curb outlet, then flows westerly to Cass Street and joins runoff from a Cass Street curb outlet and from the unnamed alley southerly of the site (1.85 cfs). Due to a change in slope precipitation intensity is decreased slightly, which results in a decrease in total site runoff (0.05 cfs). The ultimate collection of runoff into the public storm drain system remains the same (at a curb inlet Dawes Street southerly of Oliver Avenue). The site has 23,027 sf of imperviousness existing and a proposed 23,807 of imperviousness, following development, a change from 94.4% to 97.6% area of imperviousness.

Impervious area runoff will be treated by two raised standard Filterra units due to the site being hydromodification exempt and being classified a non-infiltration site. The site is required to treat 1.5 times the flow based runoff (weight adjusted runoff coefficient) times 0.2 in/hr times the area flowing to the Filterra units). After treatment, runoff is conveyed to two curb outlets, one in Grand Avenue and Cass Street. The required retention element of the project is achieved through flow from 496 sf of roof runoff flowing over 514 sf of landscaping in 18" amended soil in a raised planter at the NE corner of the property and a vegetated swale along the easterly boundary, discharging to the unnamed alley southerly of the project site, by sheet flow. The project discharges runoff to a hardened conveyance system that discharges to an exempt water body (Mission Bay). Runoff flows onto Cass Street then flows southerly to Oliver Avenue and then easterly to Dawes Street and then southerly to a westerly curb inlet and then flows easterly to another curb inlet and then southerly in a 39" RCP drain to

Mission Bay that is lower than the 100-yr BFE of 8'. It discharges from a 30" pipe at an elevation of -2.30' NGVD29 which equates to -.0.21' NAVD88.

Section 404 of CWA regulates the discharge of dredged or fill material into waters of the United States. Section 404 is regulated by the Army Corps of Engineers. Section 401 of CWA requires that the State provide certification that any activity authorized under Section 404 is in compliance with effluent limits, the state's water quality standards, and any other appropriate requirements of state law. Section 401 is administered by the State Regional Water Quality Control Board. The project does not require a Federal CWA Section 404 permit nor Section 401 Certification because it does not cause dredging or filling in waters of the United States and is in compliance with the State Water Quality Standards. See separate SWQMP.

The Rational Method was used to calculate the anticipated flow for the 100-year storm return frequency event using the method outlined in the City of San Diego Drainage Design Manual.

DECLARATION OF RESPONSIBLE CHARGE

I hereby declare that I am the 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 standards. I understand that the check of project drawings and specifications by the City of San Diego is confined to review only and does not relieve me, as engineer of work, of my responsibilities for project design

_____
Antony K. Christensen
RCE 54021 Exp. 12-31-21
JN A2020-62

04-25-21
Date

[2]

Calculations

1. Intensity Calculation

Existing Condition

 From the City of San Diego Drainage Design Manual, Figure A-4
Tc = Time of concentration

$Tc = (1.8 (1.1-C) D^{1/2})/S^{1/3}$

Since the difference in elevation is 3.8' (25'-21.2') and the distance traveled is 272', S=1.4%. C = 0.85 (pre-construction).

Tc = 6.6 minutes.

From Figure A-1

I_{100} = 4.0 inches

Post-Construction Condition

$Tc = (1.8 (1.1-C) D^{1/2})/S^{1/3}$

Since the difference in elevation is 3' (23.5'-20.5') and the distance traveled is 280', S=1.1%. C = 0.70 (portion of site exposed to rainfall is multi-residential but Commercial C=0.85 is used).

Tc = 7.3 minutes.

From Figure A-1

I_{100} = 3.9 inches

2. *Coefficient Determination*

Pre-Construction:

From Table A-1 for Commercial:

    $C = 0.85$

Post-Construction:

From Table A-1 for Commercial:
(Multi-Residential is not used)

    $C = 0.85$

3. *Volume calculations*

$Q = CIA$

Areas of Drainage

Pre-Construction

Area draining to Cass Street	$S = 0.5598$ Ac

Post-Construction

Area of entry pumped to westerly Filterra	$E = 0.0247$ Ac
Area of building conveyed To westerly Filterra	$FW = 0.2417$ Ac
Area of building conveyed To easterly Filterra	$FE = 0.2596$ Ac
Area amended soil planter, vegetated swale and easterly concrete walkway to alley	$AL = 0.0339$ Ac

Pre-Construction

$Q_{100S} = (0.85) (4.0) (0.5598)$

$Q_{100PC} = 1.90$ cfs

Post-Construction

$Q_{100E} = (0.85) (3.9) (0.0247)$
$Q_{100FW} = (0.85) (3.9) (0.2417)$
$Q_{100FE} = (0.85) (3.9) (0.2596)$
$Q_{100AL} = (0.85) (3.9) (0.0339)$

$Q_{100E} = 0.08$ cfs
$Q_{100FW} = 0.80$ cfs
$Q_{100FE} = 0.86$ cfs
$Q_{100AL} = 0.11$ cfs

$Q_{TOTAL} = 1.85$ cfs

4. *Discussion*

Due to a change in slope the total calculated runoff decreases from 1.90 cfs to 1.85 cfs. Runoff is conveyed to Grand Avenue (0.86 cfs) which then flows westerly to Cass Street and then southerly where it joins runoff discharging to Cass Street from a curb outlet and alley (0.88 cfs). The ultimate collection of runoff into the public storm drain system remains the same (at the westerly curb inlet on Dawes Street southerly of Oliver Avenue).

Runoff from Area E is conveyed to a catch basin equipped with a pump to convey it to the westerly Filterra unit. Sizing of the pump will be determined at the time of ministerial permit processing.

The volume of runoff conveyed to the Grand Avenue curb outlet is 0.86 cfs and its velocity is will be 2.9 fps. The volume of runoff conveyed to the Cass Street curb outlet is 0.88 cfs and its velocity is will be 2.9 fps.

5.   Water Quality Treatment

The site is categorized as non-infiltration and hydromodification exempt so qualifies for treatment with a proprietary biofiltration unit. The following depicts the calculations:

Easterly Filterra Unit

A= 11,306 sf = 0.2596 ac
I = 0.2 in/hr
C=0.9 for runoff treatment

Q = CIA (1.5)
Q = 0.9*0.2*0.2596*1.5
Q = 0.070 cfs

Westerly Filterra Unit

A= 10,527 sf = 0.2417 ac
I = 0.2 in/hr
C=0.9 for runoff treatment

Q = CIA (1.5)
Q = 0.9*0.2*0.2417*1.5
Q = 0.065 cfs

A 4' x 8' Filterra is capable of treating 0.0741 cfs and so is adequate for each area being treated.

A Filterra unit with 8" bypass is capable of conveying 1.2 cfs.
Since the maximum100-yr flow to the Filterra units is 0.62 cfs the units are adequate.

APPENDIX

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

The values in Table A–1 are typical for urban areas. However, if the basin contains rural or agricultural land use, parks, golf courses, or other types of nonurban land use that are expected to be permanent, the appropriate value should be selected based upon the soil and cover and approved by the City.

A.1.3.   Rainfall Intensity

The rainfall intensity (I) is the rainfall in inches per hour (in/hr.) for a duration equal to the T_c for a selected storm frequency. Once a particular storm frequency has been selected for design and a T_c calculated for the drainage area, the rainfall intensity can be determined from the Intensity-Duration-Frequency Design Chart (Figure A-1).

ELEV.	FACTOR
0-1500	1.00
1500-3000	1.25
3000-4000	1.42
4000-5000	1.60
5000-6000	1.7
DESERT	1.25

TO OBTAIN CORRECT INTENSITY, MULTIPLY INTENSITY ON CHART BY FACTOR FOR DESIGN ELEVATION.

RAINFALL

INTENSITY - DURATION - FREQUENCY CURVES

FOR

COUNTY OF SAN DIEGO
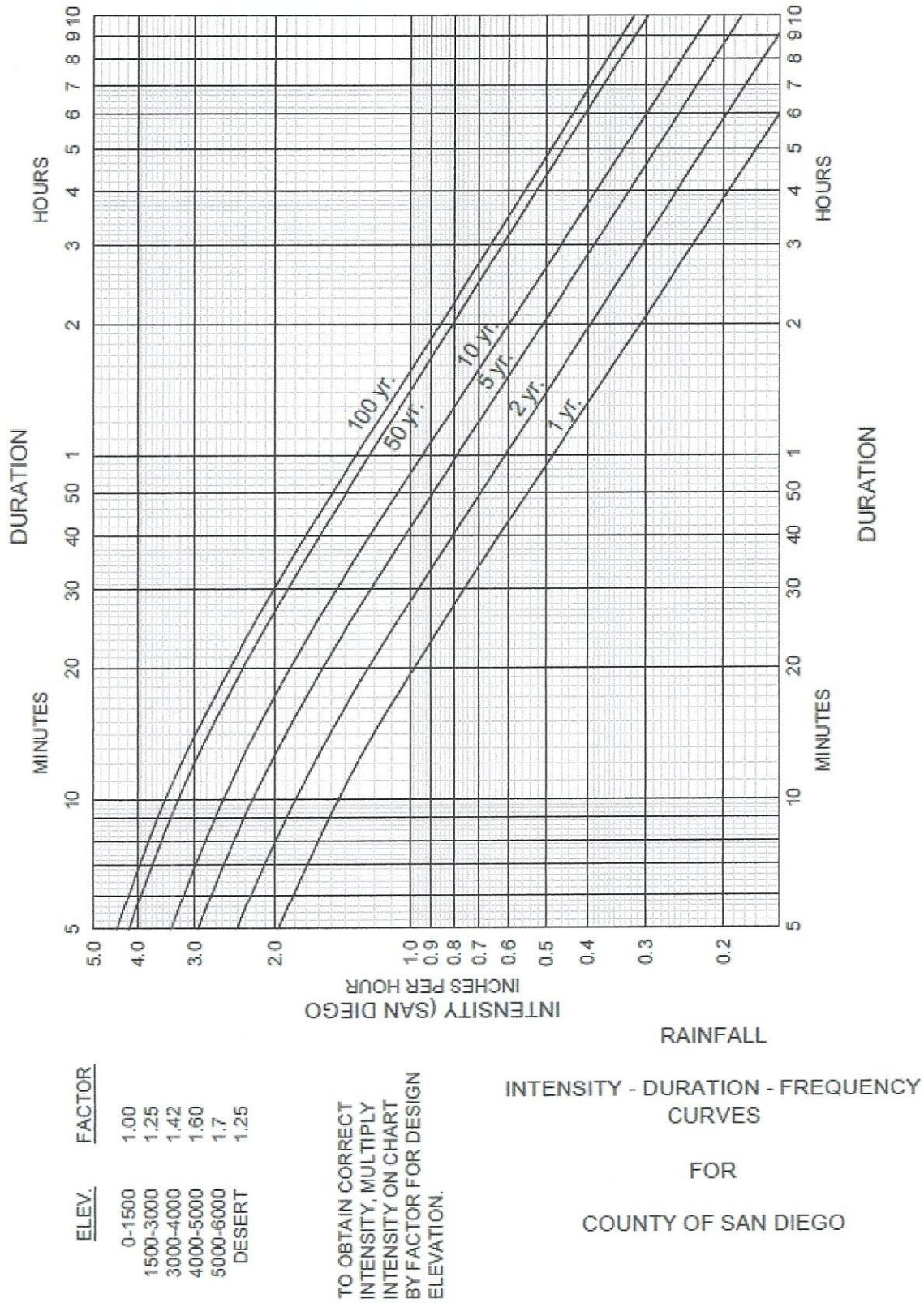
Figure A-1. Intensity-Duration-Frequency Design Chart

EXAMPLE:

Given: Watercourse Distance (D) = 70 Feet
Slope (s) = 1.3%
Runoff Coefficient (C) = 0.41
Overland Flow Time (T) = 9.5 Minutes

$$T = \frac{1.8\,(1.1-C)\sqrt{D}}{\sqrt[3]{s}}$$

SOURCE: Airport Drainage, Federal Aviation Administration, 1965
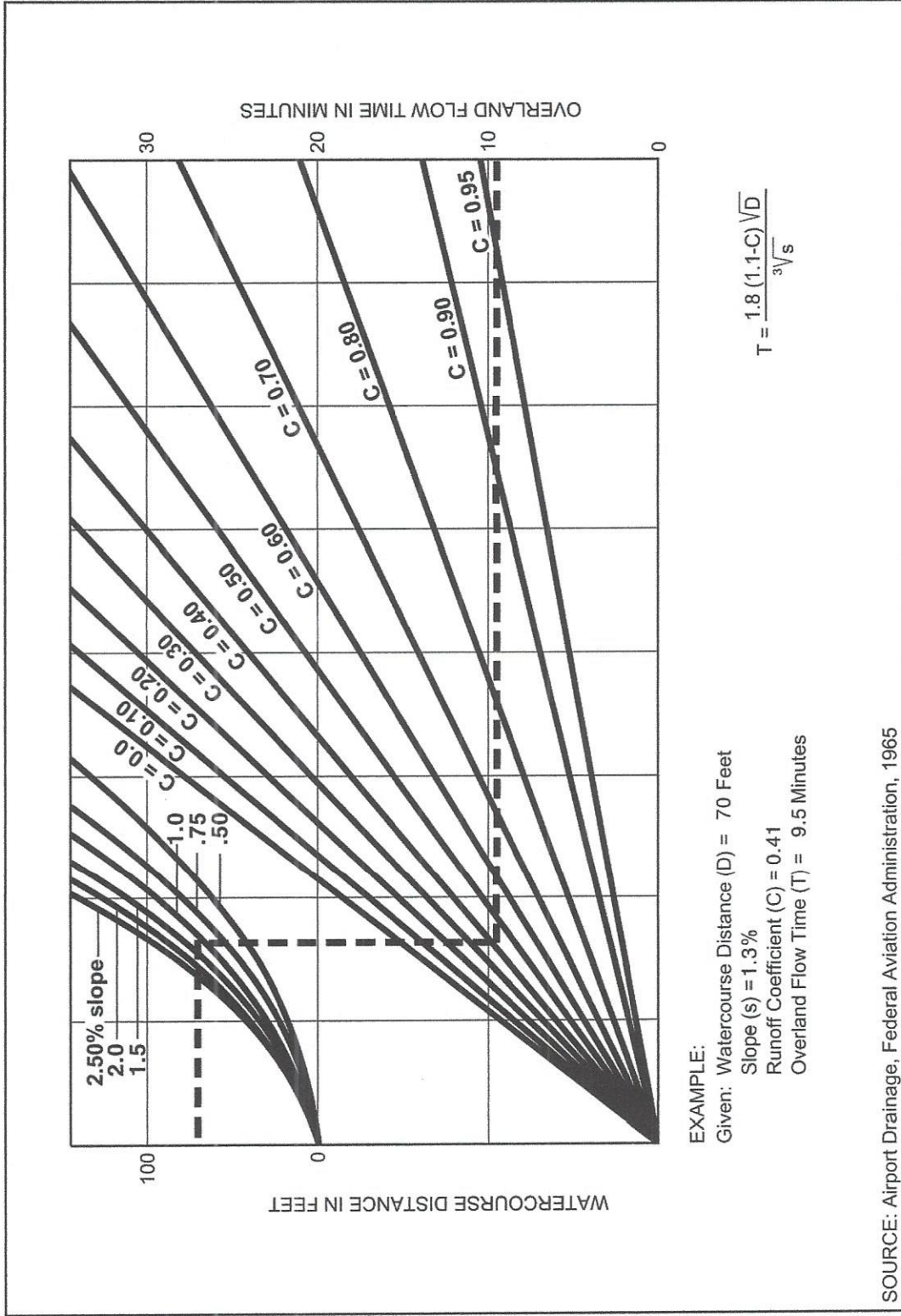
Figure A-4. Rational Formula – Overland Time of Flow Nomograph

<u>Note</u>: Use formula for watercourse distances in excess of 100 feet.

Type of conveyance is a: Grand Avenue Curb Outlet
Depth of channel equals .25 Feet
Bottom Width Equals 3
Side slope equals .01
Slope of conveyance equals 1.5 %
Roughness equals .013
Flow quantity equals .8611061 CFS
Area equals .2983021 Square Feet
Velocity equals 2.882983 FPS
Depth of flow equals 9.940111E-02 Feet

Type of conveyance is a: Cass Street Curb Outlet
Depth of channel equals .25 Feet
Bottom Width Equals 3
Side slope equals .01
Slope of conveyance equals 1.5 %
Roughness equals .013
Flow quantity equals .8809075 CFS
Area equals .302505 Square Feet
Velocity equals 2.909043 FPS
Depth of flow equals .1008011 Feet

DRAINAGE AREA MAPS

PRE-DEVELOPMENT DRAINAGE AREA MAP
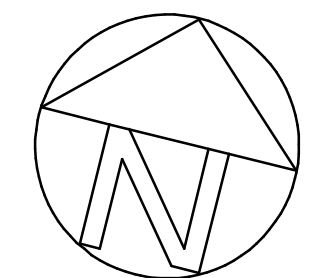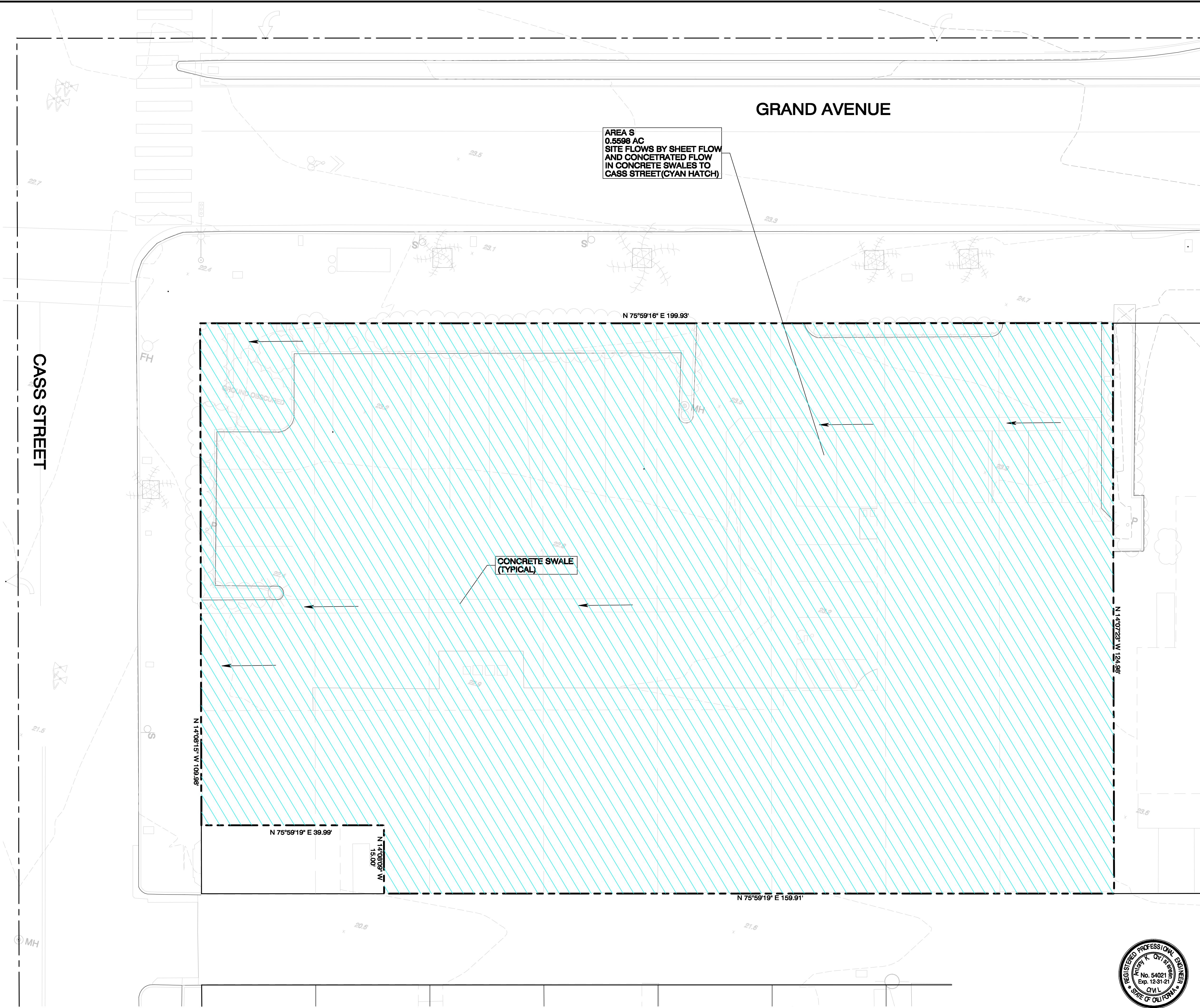
POST-CONSTRUCTION DRAINAGE AREA MAP

LEGAL DESCRIPTION:

LOTS 1 THROUGH 8 IN BLOCK 257 OF PACIFIC BEACH, ACCORDING TO MAPS THEREOF
NOS. 697 AND 854, FILED IN THE OFFICE OF THE COUNTY RECORDER OF SAN DIEGO COUNTY,
JANUARY 8, 1892 AND SEPTEMBER 24, 1898 RESPECTIVELY. EXCEPTING FROM SAID LOT 1 THE
SOUTH 15 FEET THEREOF. ALSO EXCEPTING FROM SAID LOT 2 THE SOUTH 15 FEET OF THE
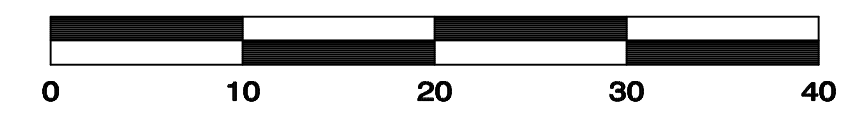WESTERLY 15 FEET THEREOF.

APN: 423-154-02-00

BENCHMARK

CITY OF SAN DIEGO BENCHMARK LOCATED AT THE NORTHWESTERLY CORNER OF
GRAND AVENUE AND DAWES STREET.
ELEVATION 28.320' MEAN SEA LEVEL (N.G.V.D. 1929).

GRAND AVENUE

AREA S
0.5598 AC
SITE FLOWS BY SHEET FLOW
AND CONCETRATED FLOW
IN CONCRETE SWALES TO
CASS STREET(CYAN HATCH)

CASS STREET

N 75°59'16" E 199.93'

FH

CONCRETE SWALE
(TYPICAL)

N 14°07'23" W 124.98'

N 14°08'15" W 109.98'

N 75°59'19" E 39.99'

N 14°00'00" W 15.00'

N 75°59'19" E 159.91'

SCALE: 1" = 10'
CONTOUR INTERVAL: 1'

0   10   20   30   40

Prepared By:

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Project Address:

1011 GRAND AVENUE
SAN DIEGO, CA 92109

Revision 5:
Revision 4:
Revision 3:
Revision 2:
Revision 1:

Project Name:

1011 GRAND UNITS

Original Date: FEBRUARY 15, 2021

Sheet Title:

Sheet 1 of 1 Sheets

**PRE-CONSTRUCTION
DRAINAGE AREA MAP**

DEP#

PRELIMINARY

FEBRUARY 15, 2021

ANTONY K. CHRISTENSEN, RCE 54021   Date

REGISTERED PROFESSIONAL ENGINEER
No. 54021
Exp. 12-31-21
CIVIL
STATE OF CALIFORNIA

JN A2020-62

POST-DEVELOPMENT DRAINAGE AREA MAP
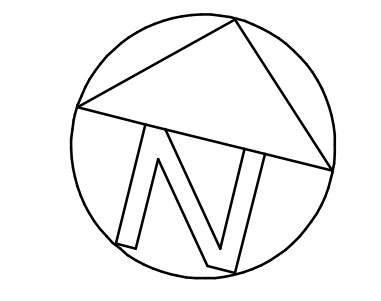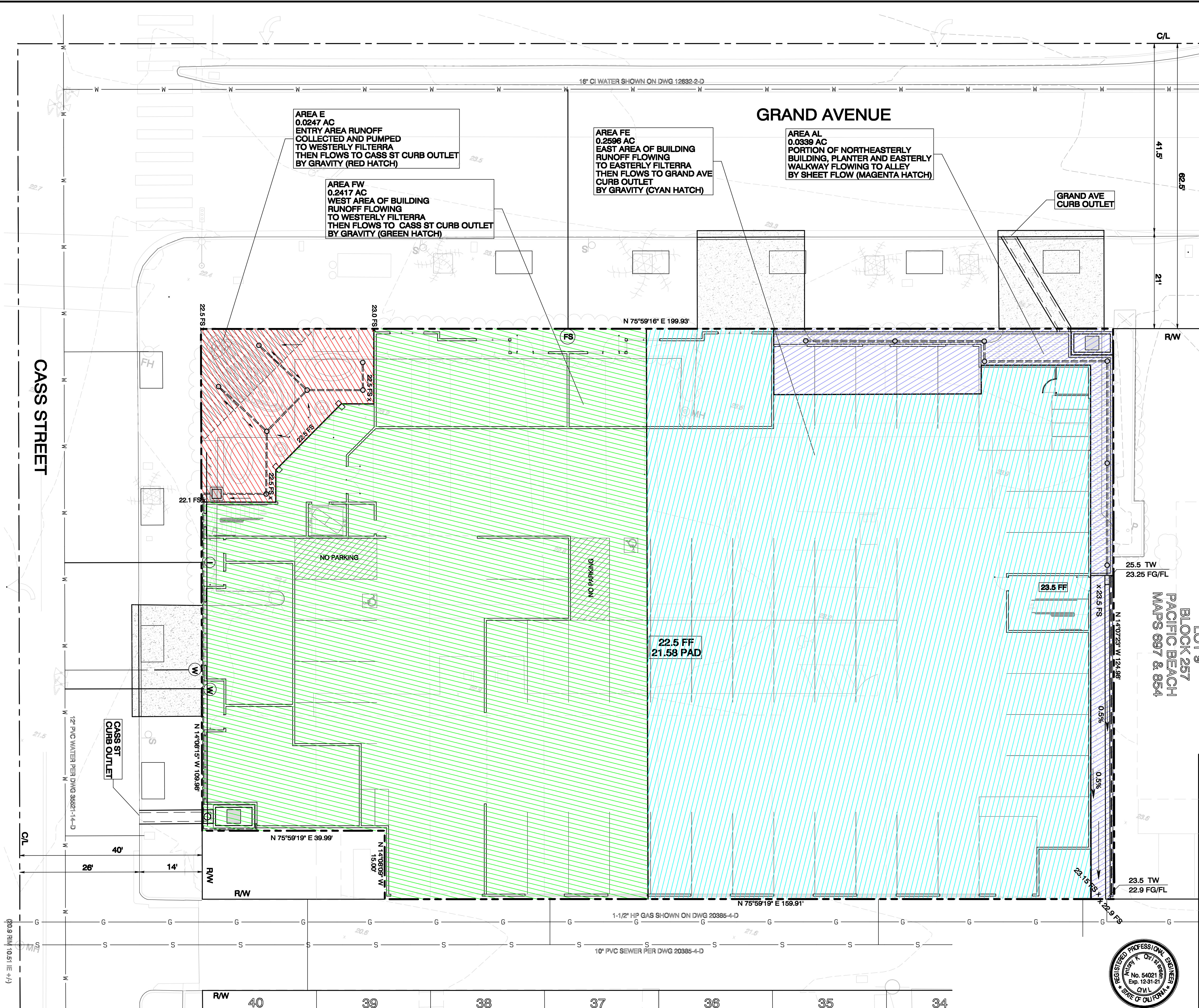
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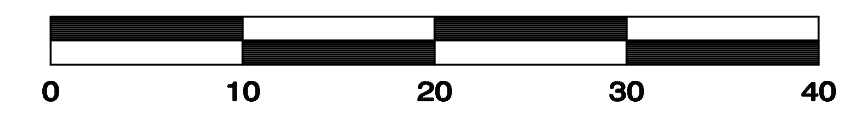
APN: 423-154-02-00

BENCHMARK
CITY OF SAN DIEGO BENCHMARK LOCATED AT THE NORTHWESTERLY CORNER OF GRAND AVENUE AND DAWES STREET.
ELEVATION 28.320' MEAN SEA LEVEL (N.G.V.D. 1929).

GRAND AVENUE

16" CI WATER SHOWN ON DWG 12632-2-D

AREA E
0.0247 AC
ENTRY AREA RUNOFF
COLLECTED AND PUMPED
TO WESTERLY FILTERRA
THEN FLOWS TO CASS ST CURB OUTLET
BY GRAVITY (RED HATCH)

AREA FW
0.2417 AC
WEST AREA OF BUILDING
RUNOFF FLOWING
TO WESTERLY FILTERRA
THEN FLOWS TO CASS ST CURB OUTLET
BY GRAVITY (GREEN HATCH)

AREA FE
0.2596 AC
EAST AREA OF BUILDING
RUNOFF FLOWING
TO EASTERLY FILTERRA
THEN FLOWS TO GRAND AVE
CURB OUTLET
BY GRAVITY (CYAN HATCH)

AREA AL
0.0339 AC
PORTION OF NORTHEASTERLY
BUILDING, PLANTER AND EASTERLY
WALKWAY FLOWING TO ALLEY
BY SHEET FLOW (MAGENTA HATCH)

GRAND AVE
CURB OUTLET

CASS STREET

N 75°59'16" E 199.93'

NO PARKING

NO PARKING

22.5 FF
21.58 PAD

23.5 FF

25.5 TW
23.25 FG/FL

CASS ST
CURB OUTLET

LOT 9
BLOCK 257
PACIFIC BEACH
MAPS 697 & 854

12" PVC WATER PER DWG 38821-1-4-D

N 14°08'15" W 109.98'

N 75°59'19" E 39.99'

N 14°08'09" W 15.00'

40'   26'   14'

R/W   R/W   R/W

N 75°59'19" E 159.91'

23.5 TW
22.9 FG/FL

1-1/2" HP GAS SHOWN ON DWG 20385-4-D

10" PVC SEWER PER DWG 20385-4-D

40   39   38   37   36   35   34

SCALE: 1" = 10'
CONTOUR INTERVAL: 1'

0   10   20   30   40

PRELIMINARY

FEBRUARY 15, 2021

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