DRAINAGE STUDY AND HYDRAULIC CALCULATIONS

PREPARED FOR:

ROYSTON - BED AND BREAKFAST
A.P.N. 0324-101-35

County of San Bernardino
LAND DEVELOPMENT
PRELIMINARY
APPROVAL
THE APPROVAL OF THIS REPORT SHALL NOT BE CONSTRUED TO BE A PERMIT FOR, OR AN APPROVAL OF, ANY IMPROVEMENT
By: Eric Valencia (I3784)
Date: 09/11/2020 10:44:54 AM
This report has Preliminary Approval. Prior to Final Approval of the report, all outstanding comments and requirements shall be met.

38433 POTATO CANYON ROAD
OAK GLEN, CA 92399

PREPARED BY:

SITETECH, INC.
8061 CHURCH STREET
HIGHLAND CA 92346
PO BOX 592
PH. (909) 864-3180

REGISTERED PROFESSIONAL ENGINEER
BERNHARD K. MAYER
NO. 36866
Exp. 6-30-22
CIVIL
STATE OF CALIFORNIA

BERNHARD K. MAYER R.C.E. 36866 08/03/2020 DATE

INTRODUCTION

This project is located in the City of Oak Glen on the south side of Potato Canyon Road. The project consists of converting an existing residence to a bed and breakfast with an additional event venue on 14.96 gross acres. The property includes multiple existing structures such as residence, garage, storage shed and accessory dwelling unit. A majority of the site will remain undeveloped. The northerly portion of the site will include the remodel of the existing residence to meet accessibility code for a bed and breakfast, additional driveways to accommodate emergency services and access to the parking lot, decomposed granite and permeable paver parking lot and walkways to and from the proposed bed and breakfast.

The purpose of this study is to determine the rate of storm water runoff which will flow through the property during a 2-year and 100-Year storm event and determine any mitigations which are necessary to protect the proposed development during the storm event. This study shows how the runoff will flow through the undeveloped and developed site.

EXISTING WATERSHED DESCRIPTION

The property has two distinct drainage areas that can be separated by the existing hillside knoll that is located in the center of the property. The southerly portion of this property sheet flows stormwater into the Oak Glen Creek which runs from east to west through the development. The northerly portion of this property sheet flows stormwater westerly through the site. The property receives stormwater runoff from the adjacent property to the east. Stormwater outlets into adjacent properties along the westerly end of the site. The sites existing ground cover consists of annual or perennial grass with minor hardscape for the existing residence. The southerly portion of the site that drains to Oak Glen Creek will not be analyzed as it will remain undeveloped for this project.

PROPOSED WATERSHED DESCRIPTION

As previously mentioned, the southerly portion of the site will be undeveloped and the existing drainage patterns will be unchanged, this area will not be analyzed during this study. The northerly portion of the development will include the construction of an asphalt pavement parking lot with decomposed granite overflow parking along. The proposed parking will be located at the northwesterly portion. Additional improvements include decomposed granite walkways for access to the event venue and bed and breakfast. The existing drainage patterns including off-site run-on and outlet points will be maintained in the proposed condition. A small basin is proposed at the site outlet point to mitigate the increase in volume by developing the site.

METHODOLOGY

Rational Method

The following scenario was modeled:

Existing Condition, 2-year storm
Existing Condition, 100-year storm
Developed Condition, 2-year storm
Developed Condition, 100-year storm

Rainfall depth was derived from the San Bernardino County Flood Control & Water Conservation District Hydrology Manual's isohyetal maps and precipitation frequency Atlas, NOAA Atlas 14.

Rational Method computations were performed using Advanced Engineering Software (aes), ver. 15.0, based on the Hydrology Manual. Discharge was calculated by the software, based on user input of rainfall, soil type, acreage, and land use parameters.

Printouts of the rational method calculations, as well as applicable plates from the Manual, are included in this report.

CONCLUSIONS

This drainage study and the calculations presented herein demonstrate the following:

Total Runoff Leaving the Site:

Off-Site Run-on:

Q_2 =	4.44 cfs	Tc = 14.34 min.
Q_{100} =	16.16 cfs	Tc = 14.34 min.

Existing Condition:

Q_2 =	15.43 cfs	Tc = 10.03 min.
Q_{100} =	50.88 cfs	Tc = 15.45 min.

Proposed Condition:

Q_2 =	15.85 cfs	Tc = 9.95 min.	(+ 0.42 cfs)
Q_{100} =	51.35 cfs	Tc = 9.95 min.	(+ 0.47 cfs)

Volume Mitigation:

$V=1.5(\Delta Q)(Tc)(60)$

ΔQ = 0.47 cfs
TC = 9.95 min.

$V = 1.5(0.47)(9.95)(60) = 421\ ft^3$

Above Ground Infiltration Basin, $V = 456\ ft^3$

PROVIDED BASIN STORAGE MITIGATION = $456\ ft^3 > 421\ ft^3$ = OK

Basin Volume		
Footprint	456	ft^2
Amended Soil Depth	0.0	ft
Amended Soil Porosity	30%	
Gravel Depth	0.0	ft
Gravel Porosity	40%	
Ponding Depth	1.0	ft
Total Storage	456	ft^3

Basin Storage Mitigation	
PreDev, Tc (min)	15.45
PreDev, Q_{100} (cfs)	50.88
PostDev, Tc (min)	9.95
PostDev, Q_{100} (cfs)	51.35
Mitigation Volume (ft^3)	421

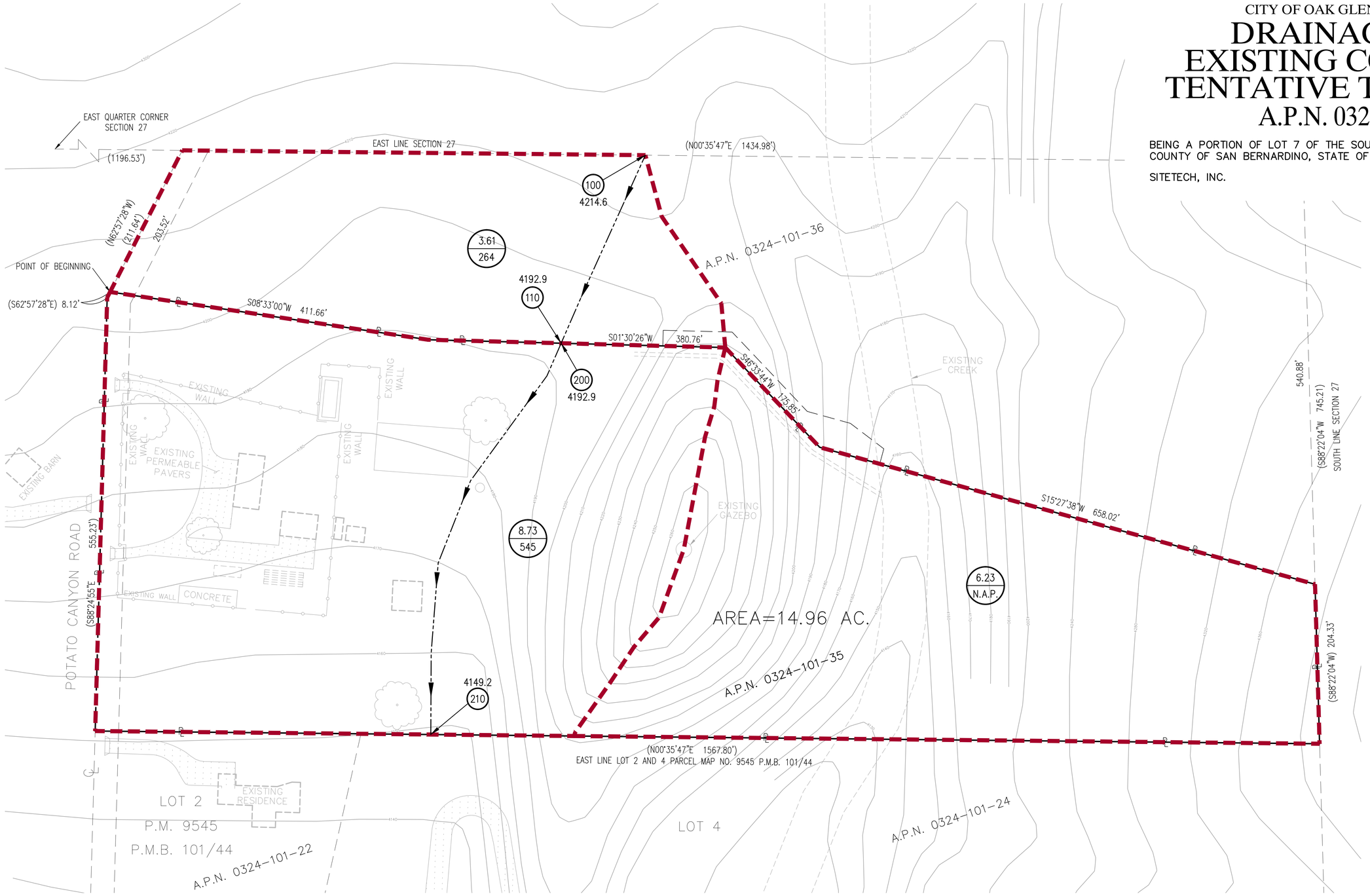
HYDROLOGY MAPS

CITY OF OAK GLEN, CALIFORNIA

DRAINAGE MAP
EXISTING CONDITION
TENTATIVE TRACT 20254
A.P.N. 0324-101-35

BEING A PORTION OF LOT 7 OF THE SOUTH MOUNTAIN SUBDIVISION, IN THE COUNTY OF SAN BERNARDINO, STATE OF CALIFORNIA.

SITETECH, INC. AUGUST, 2020



DRAINAGE LEGEND:

DRAINAGE AREA (AC) 10.00 / 500' FLOW PATH LENGTH

NODE # 100 1800.5 NODE ELEVATION

FLOW LINE

WATERSHED BOUNDARY

LOT COVERAGE:

EXISTING:

- PERVIOUS: 648,986 SQUARE FEET
- IMPERVIOUS: 2,306 SQUARE FEET

POST-DEVELOPED:

- PERVIOUS: 636,686 SQUARE FEET
- IMPERVIOUS: 12,300 SQUARE FEET

OWNER:

MARGARET ROYSTON
PETER ROYSTON
1604 RAINBOW KNOLL
CHINO HILLS, CA 91709
PH: (909) 627-4592

APPLICANT:

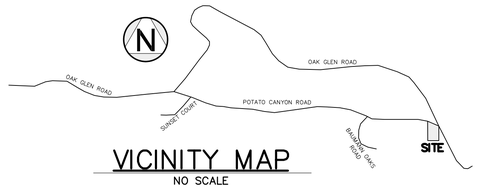
KIRSTEN ROYSTEN
38433 POTATO CANYON ROAD
OAK GLEN, CA 92399
PH: (909) 662-5124

ENGINEER/MAP PREPARER:

SITETECH, INC.
8061 CHURCH STREET
P.O. BOX 592
HIGHLAND CA 92346
PH: (909) 864-3180

60' 0 60' 120'

SCALE: 1"=60'



VICINITY MAP
NO SCALE

FLOW PROCESS CHART:

FROM NODE	TO NODE	FROM ELEV	TO ELEV	Q (CFS) 2 YR/1 HR	Q (CFS) 100 YR/1 HR
100	110	4214.6	4192.9	4.44	16.16
200	210	4192.9	4149.2	15.43	50.88

NOTE:
*NODES 100 TO 110 ANALYZED THE HISTORICAL RUN-ON FROM THE EASTERLY PROPERTY FROM THE EXISTING AND PROPOSED DEVELOPMENT.

REGISTERED PROFESSIONAL ENGINEER BERNHARD K. MAYER NO. 36866 Exp. 6-30-20 CIVIL STATE OF CALIFORNIA

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PH: (909) 864-3180, FAX: (909) 864-0850

BERNHARD K. MAYER R.C.E. 36866 L.S. 7319 AUGUST 03, 2020 DATE

APN: 0324-101-35

C.U.P. FOR BED & BREAKFAST / EVENT VENUE

APPLICANT:
KIRSTEN ROYSTEN
38433 POTATO CANYON ROAD
OAK GLEN, CA 92399
EMAIL: kirsten@royston.com

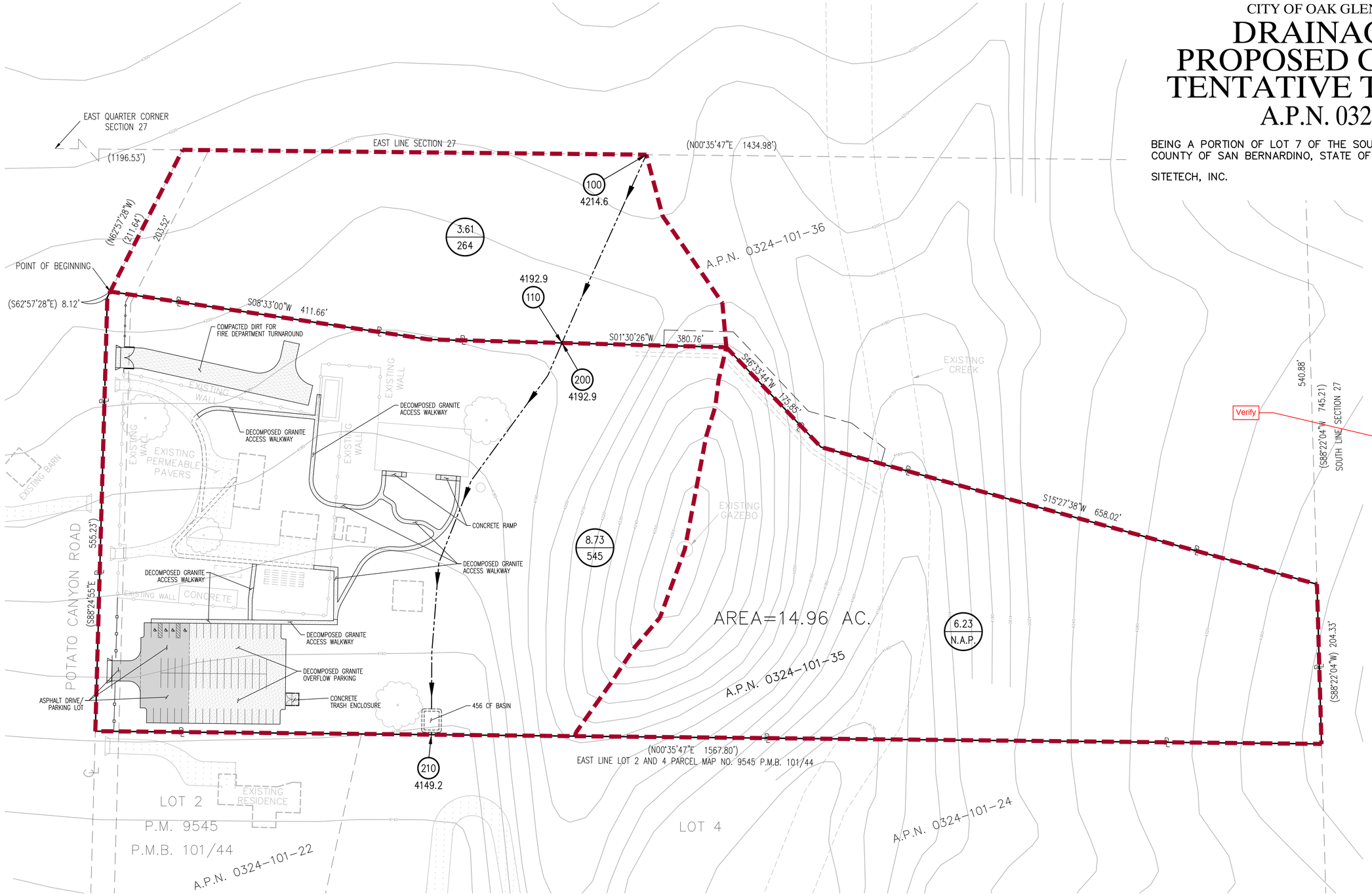
PLOT PLAN DATE:
AUGUST 03, 2020

CITY OF OAK GLEN, CALIFORNIA

DRAINAGE MAP
PROPOSED CONDITION
TENTATIVE TRACT 20254
A.P.N. 0324-101-35

BEING A PORTION OF LOT 7 OF THE SOUTH MOUNTAIN SUBDIVISION, IN THE COUNTY OF SAN BERNARDINO, STATE OF CALIFORNIA.

SITETECH, INC. AUGUST, 2020



DRAINAGE LEGEND:

DRAINAGE AREA (AC) — 10.00 / 500' (FLOW PATH LENGTH)
NODE # 100 / 1800.5 (NODE ELEVATION)
FLOW LINE
WATERSHED BOUNDARY

LOT COVERAGE:

EXISTING:

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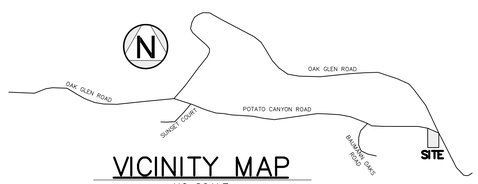

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NO SCALE

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APPLICANT:
KIRSTEN ROYSTEN
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OAK GLEN, CA 92399
EMAIL: kirsten@royston.com

PLOT PLAN DATE:
AUGUST 03, 2020

HYDROLOGY

ROYSTON - DRAINAGE AREAS					
		FT^2	AC	%	COMPOSITE CN VALUE
EXISTING CONDITION	A_T=	808734	18.57	---	69
	A_{PERV}=	806428	18.51	99.7%	
	A_{IMP}=	2306	0.05	0.3%	
100-110	A_T=	157442	3.61	---	69
	A_{PERV}=	157442	3.61	100.0%	
	A_{IMP}=	0	0.00	0.0%	
200-210	A_T=	380108	8.73	---	69
	A_{PERV}=	377802	8.67	99.4%	
	A_{IMP}=	2306	0.05	0.6%	
N.A.P.	A_T=	271184	6.23	---	69
	A_{PERV}=	271184	6.23	100.0%	
	A_{IMP}=	0	0.00	0.0%	
PROPOSED CONDITION	A_T=	808734	18.57	---	69
	A_{PERV}=	796434	18.28	98.5%	
	A_{IMP}=	12300	0.28	1.5%	
100-110	A_T=	157442	3.61	---	69
	A_{PERV}=	157442	3.61	100.0%	
	A_{IMP}=	0	0.00	0.0%	
200-210	A_T=	380108	8.73	---	70
	A_{PERV}=	367808	8.44	96.8%	
	A_{IMP}=	12300	0.28	3.2%	
N.A.P.	A_T=	271184	6.23	---	69
	A_{PERV}=	271184	6.23	100.0%	
	A_{IMP}=	0	0.00	0.0%	
CN VALUES USED: RESIDENTIAL LANDSCAPING (56), GRASS, ANNUAL/PERENNIAL (69) AND BLDG/PCC/AC PAVEMENT (98). THIS SITE IS CLASSIFIED AS HYDROLOGIC SOIL GROUP B.					

NOAA Atlas 14, Volume 6, Version 2
Location name: Yucaipa, California, USA*
Latitude: 34.0533°, Longitude: -116.9662°
Elevation: 4177.8 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sarah Dietz, Sarah Heim, Lillian Hiner, Kazungu Maitaria, Deborah Martin, Sandra Pavlovic, Ishani Roy, Carl Trypaluk, Dale Unruh, Fenglin Yan, Michael Yekta, Tan Zhao, Geoffrey Bonnin, Daniel Brewer, Li-Chuan Chen, Tye Parzybok, John Yarchoan

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.160 (0.133-0.194)	0.205 (0.170-0.249)	0.268 (0.222-0.327)	0.322 (0.264-0.396)	0.399 (0.317-0.508)	0.463 (0.360-0.602)	0.531 (0.403-0.708)	0.605 (0.446-0.830)	0.713 (0.504-1.02)	0.804 (0.548-1.19)
10-min	0.229 (0.190-0.278)	0.294 (0.244-0.357)	0.384 (0.318-0.468)	0.461 (0.379-0.567)	0.572 (0.454-0.728)	0.664 (0.516-0.863)	0.761 (0.577-1.01)	0.868 (0.639-1.19)	1.02 (0.722-1.46)	1.15 (0.785-1.71)
15-min	0.276 (0.230-0.336)	0.355 (0.295-0.432)	0.464 (0.384-0.566)	0.558 (0.458-0.686)	0.692 (0.550-0.881)	0.802 (0.624-1.04)	0.921 (0.698-1.23)	1.05 (0.773-1.44)	1.24 (0.873-1.77)	1.39 (0.950-2.06)
30-min	0.408 (0.339-0.495)	0.524 (0.435-0.637)	0.685 (0.567-0.835)	0.823 (0.676-1.01)	1.02 (0.811-1.30)	1.18 (0.920-1.54)	1.36 (1.03-1.81)	1.55 (1.14-2.12)	1.83 (1.29-2.61)	2.06 (1.40-3.05)
60-min	0.587 (0.488-0.713)	0.754 (0.626-0.917)	0.986 (0.816-1.20)	1.18 (0.972-1.46)	1.47 (1.17-1.87)	1.70 (1.32-2.22)	1.96 (1.48-2.61)	2.23 (1.64-3.06)	2.63 (1.85-3.76)	2.96 (2.02-4.38)
2-hr	0.827 (0.688-1.00)	1.03 (0.853-1.25)	1.31 (1.08-1.59)	1.55 (1.27-1.91)	1.90 (1.51-2.42)	2.19 (1.71-2.85)	2.51 (1.90-3.34)	2.85 (2.10-3.91)	3.36 (2.37-4.80)	3.77 (2.57-5.59)
3-hr	1.03 (0.856-1.25)	1.26 (1.05-1.54)	1.59 (1.32-1.94)	1.88 (1.54-2.31)	2.29 (1.82-2.92)	2.64 (2.05-3.43)	3.01 (2.28-4.01)	3.42 (2.52-4.69)	4.01 (2.83-5.74)	4.51 (3.08-6.69)
6-hr	1.52 (1.26-1.84)	1.84 (1.53-2.24)	2.31 (1.91-2.81)	2.71 (2.22-3.33)	3.30 (2.62-4.20)	3.79 (2.94-4.92)	4.32 (3.27-5.75)	4.90 (3.61-6.72)	5.75 (4.06-8.23)	6.47 (4.41-9.58)
12-hr	2.14 (1.78-2.60)	2.68 (2.22-3.26)	3.42 (2.83-4.17)	4.06 (3.33-4.99)	4.99 (3.96-6.34)	5.74 (4.46-7.47)	6.56 (4.97-8.74)	7.44 (5.48-10.2)	8.72 (6.15-12.5)	9.77 (6.66-14.5)
24-hr	2.87 (2.54-3.31)	3.74 (3.31-4.32)	4.95 (4.37-5.73)	5.98 (5.24-6.98)	7.47 (6.32-8.99)	8.67 (7.19-10.7)	9.95 (8.06-12.5)	11.3 (8.93-14.7)	13.3 (10.1-17.9)	14.9 (10.9-20.8)
2-day	3.45 (3.05-3.97)	4.60 (4.06-5.30)	6.23 (5.49-7.20)	7.66 (6.70-8.93)	9.77 (8.28-11.8)	11.5 (9.57-14.2)	13.4 (10.9-16.9)	15.6 (12.3-20.1)	18.7 (14.1-25.2)	21.3 (15.6-29.7)
3-day	3.70 (3.28-4.26)	4.98 (4.41-5.75)	6.83 (6.03-7.90)	8.48 (7.42-9.89)	11.0 (9.28-13.2)	13.1 (10.8-16.0)	15.4 (12.5-19.4)	18.0 (14.2-23.2)	21.8 (16.5-29.4)	25.1 (18.4-35.1)
4-day	4.05 (3.58-4.66)	5.47 (4.84-6.32)	7.54 (6.65-8.73)	9.39 (8.22-10.9)	12.2 (10.3-14.7)	14.5 (12.1-17.9)	17.1 (13.9-21.6)	20.1 (15.8-26.0)	24.4 (18.5-32.9)	28.2 (20.6-39.3)
7-day	4.73 (4.19-5.46)	6.39 (5.65-7.37)	8.75 (7.72-10.1)	10.8 (9.49-12.6)	14.0 (11.8-16.8)	16.6 (13.7-20.4)	19.4 (15.7-24.5)	22.6 (17.8-29.3)	27.3 (20.7-36.8)	31.3 (22.9-43.6)
10-day	5.21 (4.61-6.00)	7.02 (6.21-8.09)	9.58 (8.45-11.1)	11.8 (10.4-13.8)	15.2 (12.8-18.3)	17.9 (14.9-22.0)	20.9 (17.0-26.4)	24.3 (19.1-31.4)	29.2 (22.1-39.3)	33.3 (24.4-46.4)
20-day	6.37 (5.64-7.34)	8.62 (7.62-9.94)	11.8 (10.4-13.6)	14.5 (12.7-17.0)	18.6 (15.7-22.4)	21.9 (18.2-26.9)	25.5 (20.7-32.1)	29.5 (23.2-38.1)	35.2 (26.7-47.5)	40.1 (29.3-55.8)
30-day	7.59 (6.72-8.75)	10.3 (9.09-11.9)	14.0 (12.4-16.2)	17.3 (15.2-20.2)	22.1 (18.7-26.6)	26.0 (21.6-32.0)	30.3 (24.6-38.2)	35.0 (27.6-45.3)	41.8 (31.6-56.3)	47.4 (34.7-66.1)
45-day	9.10 (8.06-10.5)	12.3 (10.8-14.1)	16.7 (14.7-19.3)	20.6 (18.0-24.0)	26.2 (22.2-31.5)	30.8 (25.6-37.9)	35.8 (29.0-45.1)	41.3 (32.6-53.4)	49.3 (37.3-66.4)	56.0 (41.0-78.0)
60-day	10.6 (9.37-12.2)	14.1 (12.5-16.3)	19.1 (16.9-22.1)	23.5 (20.5-27.3)	29.8 (25.2-35.9)	35.0 (29.1-43.0)	40.6 (32.9-51.2)	46.8 (36.9-60.6)	55.8 (42.3-75.3)	63.4 (46.4-88.4)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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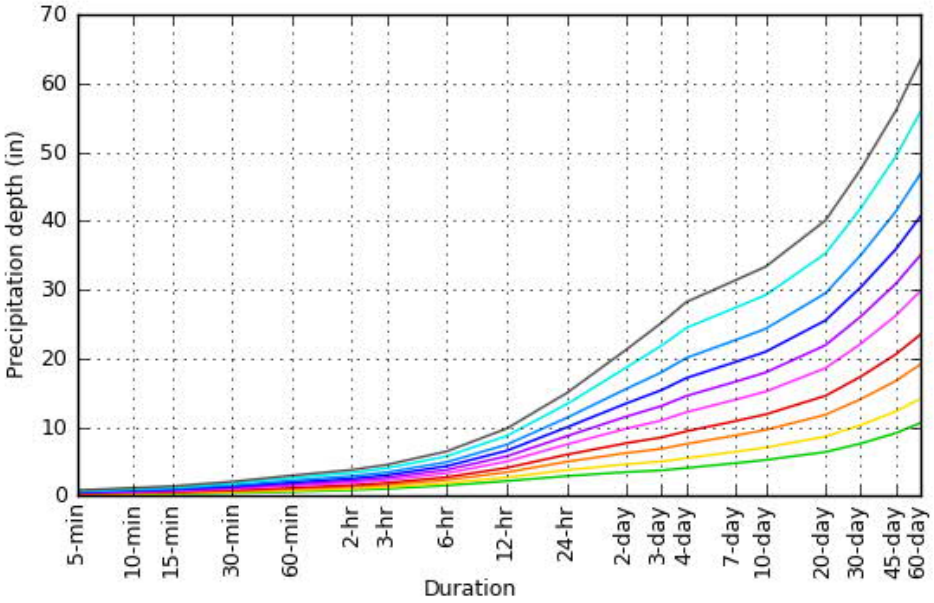
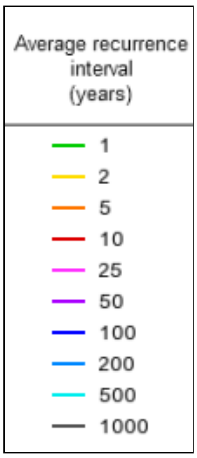
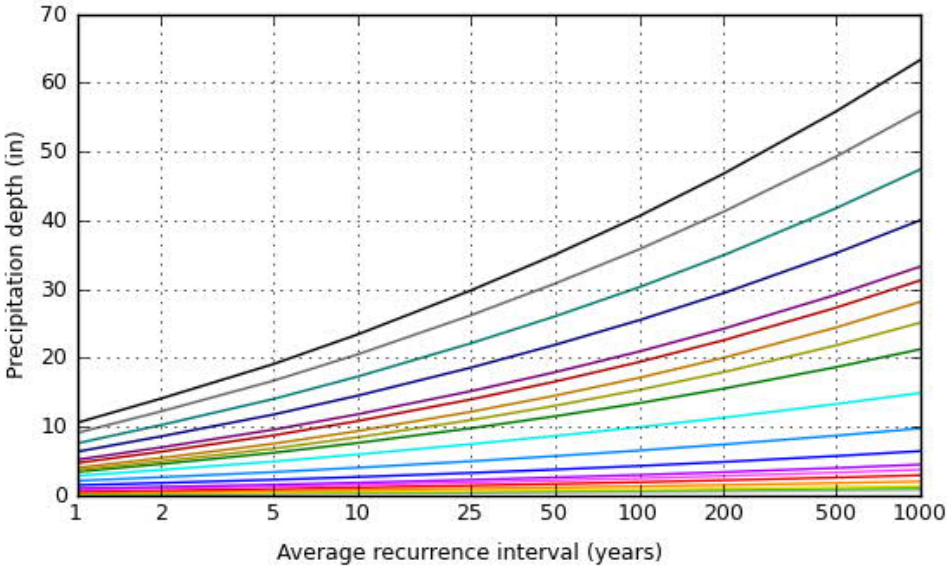
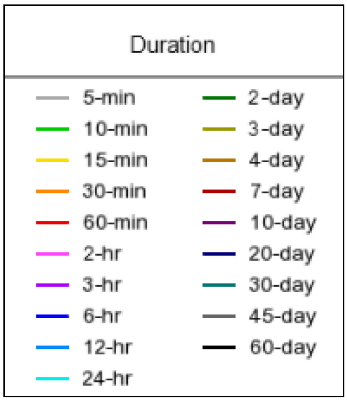
PF graphical

PDS-based depth-duration-frequency (DDF) curves
Latitude: 34.0533°, Longitude: -116.9662°









NOAA Atlas 14, Volume 6, Version 2

Created (GMT): Fri Mar 13 16:01:10 2020

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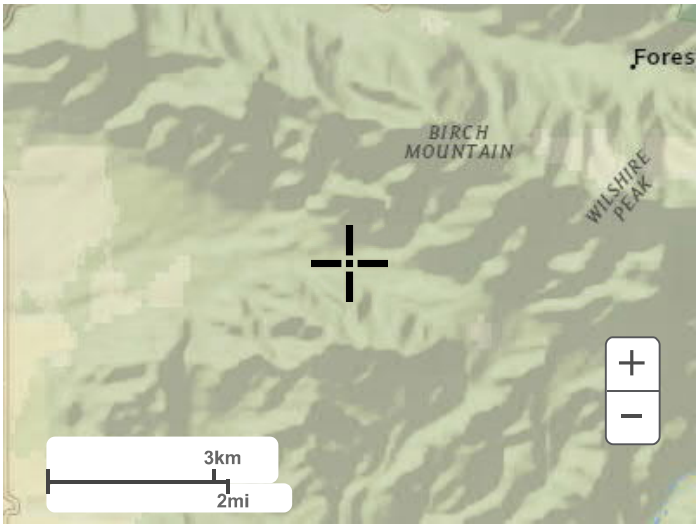
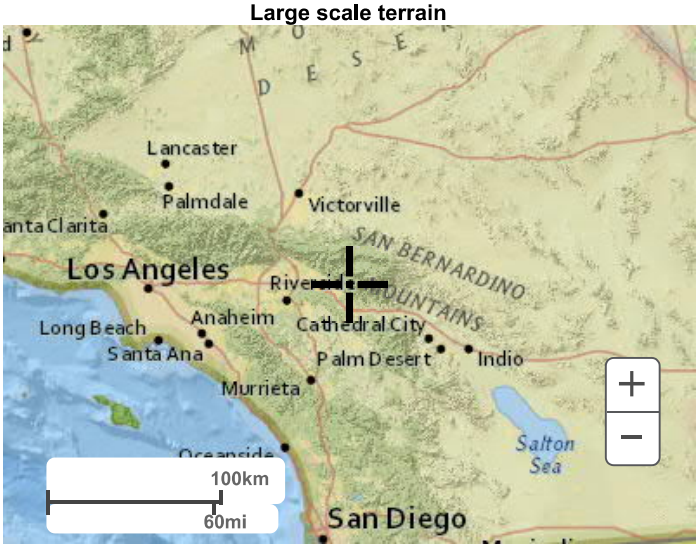
Maps & aerials

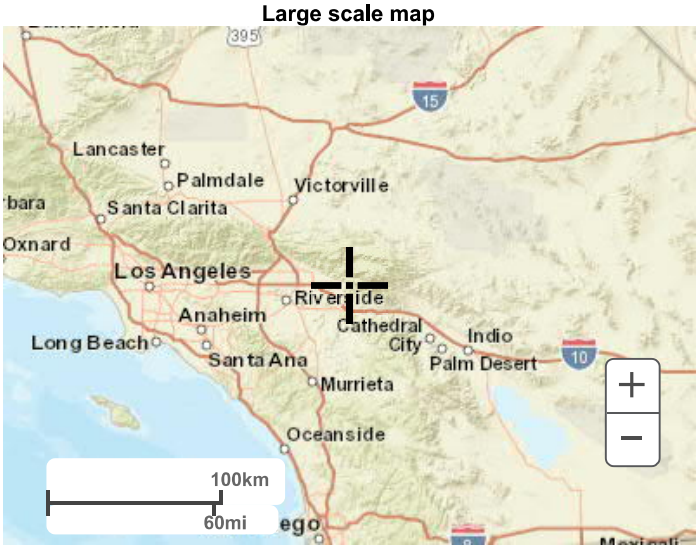
Small scale terrain



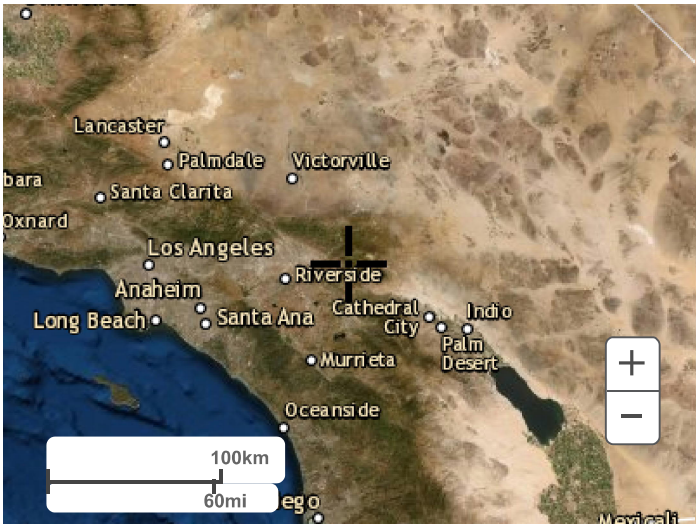
Large scale terrain



Large scale map



Large scale aerial



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US Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service
National Water Center
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

Disclaimer

Curve (1) Numbers of Hydrologic Soil-Cover Complexes For Pervious Areas-AMC II

Cover Type (3)	Quality of Cover (2)	Soil Group A	B	C	D
NATURAL COVERS -					
Barren (Rockland, eroded and graded land)		78	86	91	93
Chaparral, Broadleaf (Manzonita, ceanothus and scrub oak)	Poor	53	70	80	85
	Fair	40	63	75	81
	Good	31	57	71	78
Chaparral, Narrowleaf (Chamise and redshank)	Poor	71	82	88	91
	Fair	55	72	81	86
Grass, Annual or Perennial	Poor	67	78	86	89
	Fair	50	69	79	84
	Good	38	61	74	80
Meadows or Cienegas (Areas with seasonally high water table, principal vegetation is sod forming grass)	Poor	63	77	85	88
	Fair	51	70	80	84
	Good	30	58	71	78
Open Brush (Soft wood shrubs - buckwheat, sage, etc.)	Poor	62	76	84	88
	Fair	46	66	77	83
	Good	41	63	75	81
Woodland (Coniferous or broadleaf trees predominate. Canopy density is at least 50 percent.)	Poor	45	66	77	83
	Fair	36	60	73	79
	Good	25	55	70	77
Woodland, Grass (Coniferous or broadleaf trees with canopy density from 20 to 50 percent)	Poor	57	73	82	86
	Fair	44	65	77	82
	Good	33	58	72	79
URBAN COVERS -					
Residential or Commercial Landscaping (Lawn, shrubs, etc.)	Good	32	56	69	75
Turf (Irrigated and mowed grass)	Poor	58	74	83	87
	Fair	44	65	77	82
	Good	33	58	72	79
AGRICULTURAL COVERS -					
Fallow (Land plowed but not tilled or seeded)		77	86	91	94

SAN BERNARDINO COUNTY
HYDROLOGY MANUAL

CURVE NUMBERS FOR PERVIOUS AREAS

Figure C-3 (1 of 2)

Curve (1) Numbers of Hydrologic Soil-Cover Complexes For Pervious Areas-AMC II

Cover Type (3)	Quality of Cover (2)	Soil Group A	B	C	D
AGRICULTURAL COVERS (Continued)					
Legumes, Close Seeded (Alfalfa, sweetclover, timothy, etc.)	Poor	66	77	85	89
	Good	58	72	81	85
Orchards, Evergreen (Citrus, avocados, etc.)	Poor	57	73	82	86
	Fair	44	65	77	82
	Good	33	58	72	79
Pasture, Dryland (Annual grasses)	Poor	68	79	86	89
	Fair	49	69	79	84
	Good	39	61	74	80
Pasture, Irrigated (Legumes and perennial grass)	Poor	58	74	83	87
	Fair	44	65	77	82
	Good	33	58	72	79
Row Crops (Field crops - tomatoes, sugar beets, etc.)	Poor	72	81	88	91
	Good	67	78	85	89
Small grain (Wheat, oats, barley, etc.)	Poor	65	76	84	88
	Good	63	75	83	87

Notes:

1. All curve numbers are for Antecedent Moisture Condition (AMC) II.
2. Quality of cover definitions:

   Poor-Heavily grazed, regularly burned areas, or areas of high burn potential. Less than 50 percent of the ground surface is protected by plant cover or brush and tree canopy.

   Fair-Moderate cover with 50 percent to 75 percent of the ground surface protected.

   Good-Heavy or dense cover with more than 75 percent of the ground surface protected.
3. See Figure C-2 for definition of cover types.

SAN BERNARDINO COUNTY
HYDROLOGY MANUAL

CURVE NUMBERS FOR PERVIOUS AREAS

Figure C-3 (2 of 2)

```
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                          Analysis prepared by:

                          SITETECH,INC.

 ************************* DESCRIPTION OF STUDY *************************
* 2 YEAR 1 HOUR DESIGN STORM                                            *
* ROYSTON – BED & BREAKFAST                                             *
* EXISTING CONDITION                                                    *
 ************************************************************************

  FILE NAME: RSTN2E.DAT
  TIME/DATE OF STUDY: 09:59 07/31/2020
==========================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
==========================================================================
                    --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =    2.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =   6.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  *USER-DEFINED LOGARITHMIC INTERPOLATION USED FOR RAINFALL*

  SLOPE OF INTENSITY DURATION CURVE(LOG(I;IN/HR) vs. LOG(Tc;MIN)) = 0.7000
  USER SPECIFIED 1-HOUR INTENSITY(INCH/HOUR) = 0.7540

  *ANTECEDENT MOISTURE CONDITION (AMC) II ASSUMED FOR RATIONAL METHOD*

  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  =================  ======  ===== ====== ===== =======
  1   30.0     20.0    0.018/0.018/0.020   0.67    2.00 0.0313 0.167 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.00 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*
  *USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED

**************************************************************************
  FLOW PROCESS FROM NODE    100.00 TO NODE    110.00 IS CODE =  21
--------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
==========================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   264.00
  ELEVATION DATA: UPSTREAM(FEET) =   4214.60  DOWNSTREAM(FEET) =   4192.90
```

```
  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   14.338
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  2.054
  SUBAREA Tc AND LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  NATURAL GOOD COVER
  "GRASS"                    B        3.61      0.69     1.000    61   14.34
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.69
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.000
  SUBAREA RUNOFF(CFS) =      4.44
  TOTAL AREA(ACRES) =      3.61   PEAK FLOW RATE(CFS) =      4.44

****************************************************************************
  FLOW PROCESS FROM NODE    200.00 TO NODE    210.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   545.00
  ELEVATION DATA: UPSTREAM(FEET) =   4192.90  DOWNSTREAM(FEET) =   4149.20

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   10.029
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  2.637
  SUBAREA Tc AND LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  RESIDENTIAL
  ".4 DWELLING/ACRE"         B        8.73      0.75     0.900    56   10.03
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.75
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.900
  SUBAREA RUNOFF(CFS) =     15.43
  TOTAL AREA(ACRES) =      8.73   PEAK FLOW RATE(CFS) =     15.43
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =        8.7  TC(MIN.) =     10.03
  EFFECTIVE AREA(ACRES) =      8.73  AREA-AVERAGED Fm(INCH/HR)=  0.67
  AREA-AVERAGED Fp(INCH/HR) =  0.75  AREA-AVERAGED Ap = 0.900
  PEAK FLOW RATE(CFS)   =      15.43
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS
```

```
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                          Analysis prepared by:
```

SITETECH,INC.

```
 ************************* DESCRIPTION OF STUDY *************************
* 100 YEAR 1 HOUR DESIGN STORM                                          *
* ROYSTON – BED & BREAKFAST                                             *
* EXISTING CONDITION                                                    *
 ************************************************************************

  FILE NAME: RSTN100E.DAT
  TIME/DATE OF STUDY: 09:58 07/31/2020
==========================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
==========================================================================
                    --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =  100.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =   6.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  *USER-DEFINED LOGARITHMIC INTERPOLATION USED FOR RAINFALL*

  SLOPE OF INTENSITY DURATION CURVE(LOG(I;IN/HR) vs. LOG(Tc;MIN)) = 0.7000
  USER SPECIFIED 1-HOUR INTENSITY(INCH/HOUR) = 1.9600

  *ANTECEDENT MOISTURE CONDITION (AMC) III ASSUMED FOR RATIONAL METHOD*

  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  =================  ======  ===== ====== ===== =======
  1   30.0     20.0    0.018/0.018/0.020   0.67    2.00 0.0313 0.167 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.00 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*
  *USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED

**************************************************************************
  FLOW PROCESS FROM NODE    100.00 TO NODE    110.00 IS CODE =  21
--------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
==========================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   264.00
  ELEVATION DATA: UPSTREAM(FEET) =   4214.60  DOWNSTREAM(FEET) =   4192.90
```

```
  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   14.338
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  5.339
  SUBAREA Tc AND LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  NATURAL GOOD COVER
  "GRASS"                    B        3.61      0.36     1.000    80   14.34
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.36
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.000
  SUBAREA RUNOFF(CFS) =     16.16
  TOTAL AREA(ACRES) =      3.61   PEAK FLOW RATE(CFS) =     16.16

****************************************************************************
  FLOW PROCESS FROM NODE    200.00 TO NODE    210.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   545.00
  ELEVATION DATA: UPSTREAM(FEET) =   4192.90  DOWNSTREAM(FEET) =   4149.20

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   10.029
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  6.856
  SUBAREA Tc AND LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  RESIDENTIAL
  ".4 DWELLING/ACRE"         B        8.73      0.42     0.900    76   10.03
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.42
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.900
  SUBAREA RUNOFF(CFS) =     50.88
  TOTAL AREA(ACRES) =      8.73   PEAK FLOW RATE(CFS) =     50.88
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =        8.7  TC(MIN.) =     10.03
  EFFECTIVE AREA(ACRES) =      8.73  AREA-AVERAGED Fm(INCH/HR)=  0.38
  AREA-AVERAGED Fp(INCH/HR) =  0.42  AREA-AVERAGED Ap = 0.900
  PEAK FLOW RATE(CFS)   =      50.88
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS
```

```
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                          Analysis prepared by:

                          SITETECH,INC.

 ************************* DESCRIPTION OF STUDY *************************
* 2 YEAR 1 HOUR DESIGN STORM                                            *
* ROYSTON – BED & BREAKFAST                                             *
* PROPOSED CONDITION                                                    *
 ************************************************************************

  FILE NAME: RSTN2P.DAT
  TIME/DATE OF STUDY: 09:57 07/31/2020
==========================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
==========================================================================
                    --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =    2.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =   6.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  *USER-DEFINED LOGARITHMIC INTERPOLATION USED FOR RAINFALL*

  SLOPE OF INTENSITY DURATION CURVE(LOG(I;IN/HR) vs. LOG(Tc;MIN)) = 0.7000
  USER SPECIFIED 1-HOUR INTENSITY(INCH/HOUR) = 0.7540

  *ANTECEDENT MOISTURE CONDITION (AMC) II ASSUMED FOR RATIONAL METHOD*

  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  =================  ======  ===== ====== ===== =======
  1   30.0     20.0    0.018/0.018/0.020   0.67    2.00 0.0313 0.167 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.00 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*
  *USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED

**************************************************************************
  FLOW PROCESS FROM NODE    100.00 TO NODE    110.00 IS CODE =  21
--------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
==========================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   264.00
  ELEVATION DATA: UPSTREAM(FEET) =   4214.60  DOWNSTREAM(FEET) =   4192.90
```

```
  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   14.338
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  2.054
  SUBAREA Tc AND LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  NATURAL GOOD COVER
  "GRASS"                    B        3.61      0.69     1.000    61   14.34
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.69
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.000
  SUBAREA RUNOFF(CFS) =      4.44
  TOTAL AREA(ACRES) =      3.61   PEAK FLOW RATE(CFS) =      4.44

****************************************************************************
  FLOW PROCESS FROM NODE    200.00 TO NODE    210.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   545.00
  ELEVATION DATA: UPSTREAM(FEET) =   4192.90  DOWNSTREAM(FEET) =   4149.20

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    9.947
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  2.653
  SUBAREA Tc AND LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  PUBLIC PARK                B        8.73      0.75     0.850    56    9.95
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.75
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.850
  SUBAREA RUNOFF(CFS) =     15.85
  TOTAL AREA(ACRES) =      8.73   PEAK FLOW RATE(CFS) =     15.85
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =        8.7  TC(MIN.) =      9.95
  EFFECTIVE AREA(ACRES) =      8.73  AREA-AVERAGED Fm(INCH/HR)=  0.64
  AREA-AVERAGED Fp(INCH/HR) =  0.75  AREA-AVERAGED Ap = 0.850
  PEAK FLOW RATE(CFS)   =      15.85
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS
```

```
**************************************************************************
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                          Analysis prepared by:

                          SITETECH,INC.

 ************************* DESCRIPTION OF STUDY *************************
* 100 YEAR 1 HOUR DESIGN STORM                                          *
* ROYSTON – BED & BREAKFAST                                             *
* PROPOSED CONDITION                                                    *
 ************************************************************************

  FILE NAME: RSTN100P.DAT
  TIME/DATE OF STUDY: 09:56 07/31/2020
==========================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
==========================================================================
                    --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =  100.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =   6.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  *USER-DEFINED LOGARITHMIC INTERPOLATION USED FOR RAINFALL*

  SLOPE OF INTENSITY DURATION CURVE(LOG(I;IN/HR) vs. LOG(Tc;MIN)) = 0.7000
  USER SPECIFIED 1-HOUR INTENSITY(INCH/HOUR) = 1.9600

  *ANTECEDENT MOISTURE CONDITION (AMC) III ASSUMED FOR RATIONAL METHOD*

  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  =================  ======  ===== ====== ===== =======
  1   30.0     20.0    0.018/0.018/0.020   0.67    2.00 0.0313 0.167 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.00 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*
  *USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED

**************************************************************************
  FLOW PROCESS FROM NODE    100.00 TO NODE    110.00 IS CODE =  21
--------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
==========================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   264.00
  ELEVATION DATA: UPSTREAM(FEET) =   4214.60  DOWNSTREAM(FEET) =   4192.90
```

```
  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   14.338
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  5.339
  SUBAREA Tc AND LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap      SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  NATURAL GOOD COVER
  "GRASS"                    B        3.61      0.36     1.000    80   14.34
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.36
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.000
  SUBAREA RUNOFF(CFS) =     16.16
  TOTAL AREA(ACRES) =      3.61   PEAK FLOW RATE(CFS) =     16.16

****************************************************************************
  FLOW PROCESS FROM NODE    200.00 TO NODE    210.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   545.00
  ELEVATION DATA: UPSTREAM(FEET) =   4192.90  DOWNSTREAM(FEET) =   4149.20

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    9.947
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  6.896
  SUBAREA Tc AND LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap      SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  PUBLIC PARK                B        8.73      0.42     0.850    76    9.95
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.42
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.850
  SUBAREA RUNOFF(CFS) =     51.35
  TOTAL AREA(ACRES) =      8.73   PEAK FLOW RATE(CFS) =     51.35
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =        8.7  TC(MIN.) =      9.95
  EFFECTIVE AREA(ACRES) =      8.73  AREA-AVERAGED Fm(INCH/HR)=  0.36
  AREA-AVERAGED Fp(INCH/HR) =  0.42  AREA-AVERAGED Ap = 0.850
  PEAK FLOW RATE(CFS)   =      51.35
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS
```