Drainage Reports

Abbreveated Water & Sewer Need Reports

Water Study

Wastewater Study

Stormwater Waiver Application

FINAL DRAINAGE REPORT

Cabana on Hayden

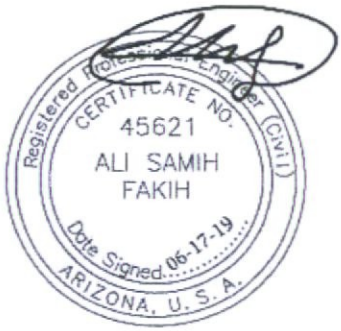
2240 N. Hayden Rd.
Scottsdale, AZ 85257

Prepared For:

GREENLIGHT
COMMUNITIES

8135 E. Indian Bend Road, Suite 101
Scottsdale, AZ 85250
Phone:480.609.6779

Plan # _____
Case # 2-DR-2019
Q-S # _____
☑ Accepted
☐ Corrections
N. Baronas 6-28-19
Reviewed By Date



Prepared by:

SEG

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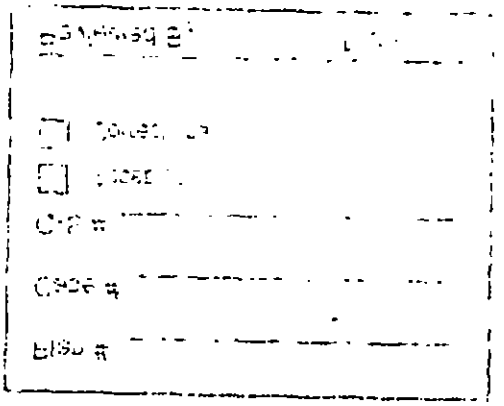
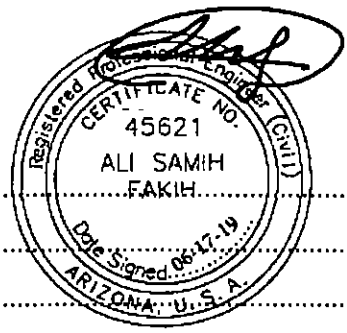
Project Number: 181207

Date: January 10, 2019 (DRB)
Revision Date: March 6, 2019 (DRB)
Revision Date: May 20, 2019 (DRB)
Revision Date: June 17, 2019 (DRB)
Case No.: 2-DR-2019 Plan Check No.: TBD





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APPENDIX:

1. INTRODUCTION

This Preliminary Drainage Report represents the storm water analysis for Green Light Community Cabana on Hayden multi-family Residential development proposed in Scottsdale, Arizona. The purpose of this report is to provide the hydrologic and hydraulic analyses, required by the City of Scottsdale, to support the proposed site plan for said development. This report includes discussions and calculations defining the storm water management concepts for the collection and conveyance necessary to comply with the drainage requirements of the City of Scottsdale and Maricopa County. Preparation of this report has been done in accordance with the requirements of the City of Scottsdale Design Standards & Policies Manual (DS&PM) 2018 [1], and the Drainage Design Manuals for Maricopa County, Arizona, Volumes I[2] and Volume II[3].

2. LOCATION AND PROJECT DESCRIPTION

2.1 LOCATION:

The subject property consists of land bound by East Oak Street to the North, North Hayden Road to the East, East Monte Vista Road to the South and a private sub-division area to the West. It is further defined as follows:

- A portion of the Southeast quarter of Section 35, Township 2 North, Range 4 East of the Gila and Salt River Base and Meridian, Maricopa County, Scottsdale, Arizona.
- Parcel ID: APN: 131-10-151
- Address: 2240 N. Hayden Road, Scottsdale, AZ

Refer to **FIGURE 1** - **Vicinity Map** for the project's location with respect to major cross streets

2.2 EXISTING AND PROPOSED DEVELOPMENTS SURROUNDING THE SITE:

The site is bound as follows:

- South: Parcel 131-10-052; Parcel 131-10-109; Parcel 131-10-110; Cox Heights Four Amended subdivision; Zoning is R1-7
- West: Parcel 131-10-014; Parcel 131-10-050; Parcel 131-10-052; Cox Heights Four Amended subdivision; Zoning is R1-7
- North: Parcel 131-10-013; Cox Heights Four Amended subdivision; Zoning is R1-7
  Parcel 131-23-006B; Property subdivision; Zoning is R1-7
  Parcel 131-23-006A; Property subdivision; Zoning is R-5
- East: Parcel 131-37-094; Cox Heights Unit One subdivision; Zoning is S-R
  Parcel 131-37-093; Cox Heights Unit One subdivision; Zoning is R1-7
  Parcel 131-37-087; Cox Heights Unit One subdivision; Zoning is R1-7
  Parcel 131-37-086; Cox Heights Unit One subdivision; Zoning is R1-7

Refer to **FIGURE 4** Quarter Section Map for the parcel information of the site.

2.3 EXISTING SITE DESCRIPTION:

The project area includes approximately 192,866 SF (4.43 AC) gross, 139,823 SF (3.21 AC) net of land designated as R-5 per COS Zoning Map 04. The site is currently developed as a church.

Refer to **FIGURE 2** attached for an aerial of the site.

2.4 PROPOSED SITE DEVELOPMENT:

Site development includes the demolition of the existing church and the parking lot, and construction of a new multi-family apartment with 89 units, zoning R-5. The development will include proposed access to North Hayden Road and East Oak Street.

Refer to **Appendix III** – Grading and Drainage Plans for site layout.

2.5 FLOOD HAZARD ZONE:

FIRM Map Number 04013C2235L dated October 16, 2013 indicates this site is designated as Zone "X". As such, it is defined as areas determined to be outside the 0.2% annual chance floodplain and therefore is not in a special flood hazard area.

Refer to **FIGURE 3** for the FIRM.

3. EXISTING DRAINAGE CONDITIONS

3.1 OFF-SITE DRAINAGE PATTERNS:

The adjacent roadways convey runoff via curb and gutter. The land of the adjacent westerly parcel slope away from the subject project. Therefore, the site is not affected by any offsite flow adjacent to the property.

3.2 ON-SITE DRAINAGE:

In accordance with the existing topographic survey, the site is separated into 6 sub-areas. Refer to **Existing Condition Drainage Area Map** in **Appendix II**,

The existing onsite stormwater is mainly conveyed through overland flow and roadway drainage. For drainage area EX-5, one retention basin has been developed for stormwater storage. For drainage areas EX-1, EX-2, EX-3, EX-4 and EX-6, all flow onsite is conveyed to offsite locations through roadway drainage. The discharge from onsite to offsite has been calculated as follows:

- **EX-1**
- Q_{100} = (0.57)*(7.43 in/hr)*(0.86 ac.) = **3.64 cfs existing**
- **EX-2**
  Q_{100} = (0.95)*(7.43 in/hr)*(0.27 ac.) = **1.91 cfs existing**
- **EX-3**
  Q_{100} = (0.88)*(7.43 in/hr)*(0.73 ac.) = **4.82 cfs existing**
- **EX-4**
  Q_{100} = (0.57)*(7.43 in/hr)*(0.30 ac.) =**1.26 cfs existing**
- **EX-6**
  Q_{100} = (0.68)*(7.43 in/hr)*(0.17 ac.) = **0.85 cfs existing**

Existing retention basin EX-5 is isolated from incoming flows and only captures runoff from within its own area. The calculated provided retention for EX-5 Basin is **35,357 cf.** Based on the topographic survey information, the surrounding drainage areas flow away from the basin. Therefore, the existing

retention basin volume does not reflect the actual required storage for the site and will not be used as the basis for comparison in the required storage analysis.

EXISTING BASIN EX-5					
ELEV.	AREA	DEPTH	AVG V	SUM V	COMMENT
(FT)	(SF)	(FT)	(CF)	(CF)	
1225.75	32,580			0.00	Pond Bottom
		1.00	35,356.97		
1226.75	38,134			35,356.97	HWE/Weir

4. PROPOSED STORM WATER MANAGEMENT

4.1 DESIGN INTENT:

This project is subject to Pre vs Post or First Flush retention, whichever is greater, while maintain a minimum volume of existing conditions. Based on the below calculations, the project has been designed for the first flush retention volume. On-site drainage will be handled within paved areas through catch basins, and underground storm systems where necessary. On-site retention will be provided within two one-foot open retention basins and underground retention and have discharge of the storm water within thirty-six hours via proposed drywells.

Pre-Development

V_r = 2.16/12*3.22 ac * 0.65 = **0.377 ac ft (16,410.80 cf) REQUIRED STORAGE**

Post-Development

V_r = 2.16/12*3.22 ac * 0.80 = **0.463 ac ft (20,838 cf) REQUIRED STORAGE**

V_r = Post – Pre = 20,197.90 – 16,410.80 = **3,787.10 cf**

First Flush

V_r = 0.5/12*3.22 ac * 0.80 = **0.107 ac ft (4,675.44 cf) REQUIRED STORAGE**

First flush volume is larger, and thus it will be used.

Refer to Section 5 below for a discussion on proposed finished floor elevations. Refer to **Proposed Conditions Drainage Area Map, in Appendix II.**

4.2 DESIGN STORM REQUIREMENTS:

The storm water system will be designed in accordance with City of Scottsdale Design Standards and Polices Manual.

4.3 LAND CHARACTERISTICS

Stormwater will be directed to onsite underground storage pipes. Based on the DS&PM, runoff coefficients for the 100-year storm event used are as follows:

- C=0.94 for roof areas
- C=0.95 for paved surface
- C=0.45 for undisturbed natural desert or desert landscape

HYDROLOGIC ANALYSIS: The hydrologic analysis is determined using the procedures in the City of Scottsdale Design Standards & Policies Manual and the Drainage Design Manual for Maricopa County, Arizona, Volume I. The Rational Method was utilized to compute the on-site peak discharges. The Rational Method equation is displayed as shown below:

$Q=C_{wt}IA$

Where: C_{wt} = The runoff coefficient relating runoff to rainfall

I = Average rainfall intensity in inches/hour, lasting for Tc

Tc = The time of concentration (Using Five minutes for the developed areas)

A = The contributing drainage area in acres

- **Drainage Area 1 (DA-1)**
  Q_{100} = (0.95)*(7.43 in/hr)*(0.21ac.) = **1.46 cfs proposed**
- **Drainage Area 2 (DA-2)**
  Q_{100} = (0.87)*(7.43 in/hr)*(0.36 ac.) = **2.32 cfs proposed**
- **Drainage Area 3 (DA-3)**
  Q_{100} = (0.82)*(7.43 in/hr)*(0.84 ac.) = **5.11 cfs proposed**
- **Drainage Area 4 (DA-4)**
  Q_{100} = (0.78)*(7.43 in/hr)*(0.43 ac.) = **2.48 cfs proposed**
- **Drainage Area 5 (DA-5)**
  Q_{100} = (0.91)*(7.43 in/hr)*(0.83 ac.) = **5.63 cfs proposed**
- **Drainage Area 6 (DA-6)**
  Q_{100} = (0.95)*(7.43 in/hr)*(0.24 ac.) = **1.70 cfs proposed**
- **Drainage Area 7 (DA-7)**
  Q_{100} = (0.45)*(7.43 in/hr)*(0.14 ac.) = **0.48 cfs proposed**
- **Drainage Area 8 (DA-8)**
  Q_{100} = (0.45)*(7.43 in/hr)*(0.09 ac.) = **0.31 cfs proposed**
- **Drainage Area 9 (DA-9)**
  Q_{100} = (0.45)*(7.43 in/hr)*(0.07 ac.) = **0.24 cfs proposed**

Overall project area includes **3.22 Acres at C_{wt} = 0.80** (Proposed conditions)
Overall site runoff = Q_{100} = **19.20 cfs**

In case of overflow, DA-1 and DA-3 overflows into DA-2, towards the ultimate outfall along Oak Street A at an ultimate outfall elevation of 1224.98. DA-4 will overflow to Hayden Road. Meanwhile, DA-5, DA-6, and DA-8 will overflow into DA-7, towards the ultimate outfall along Monte Vista Road at an ultimate outfall of 1224.87. DA-9 will overflow to Oak Street. See **Final Grading Plan** in **Appendix III** for ultimate outfall and surface outfall locations.

Refer to the **Proposed Condition Drainage Area Map** and Calculations in **Appendix II**.

4.4 STORMWATER RETENTION:

In accordance with the COS request to provide retention, the first flush retention for the entire site is calculated in this report to determine potential impact on the site. Onsite underground retention pipes are proposed. The underground storage system will comply with the City of Scottsdale underground storage policy.

REQUIRED STORAGE:

Stormwater storage for required First Flush treatment is calculated In accordance with the COS – DS&PM.
Required Retention (Acre-Feet) = $(0.5"/12)*A*(C_{prop})$

Based on the C-value identified in Section 4.3 above, the following retention is required for each drainage area:

Basin-1 (Underground Storage): Drainage Areas DA-1 through DA-7, $C_w = 0.80$
First Flush: $V_r = 0.5/12*3.22$ ac * 0.80 = **0.107 ac ft (4,675.44 cf) REQUIRED STORAGE**

Basin-2 (Retention Basin): Drainage Areas DA-9 , $C_w = 0.45$
$V_r = 7.43/12*0.09$ ac * 0.45 = **0.008 ac ft (331.21 cf) REQUIRED STORAGE**
$V_p = 545$ cf

Basin-3 (Retention Basin): Drainage Areas DA-8 , $C_w = 0.45$
$V_r = 7.43/12*0.07$ac * 0.45 = **0.006 ac ft (250.05 cf) REQUIRED STORAGE**
$V_p = 380$ cf

Note: for first flush purposes, an environmental structure such as a Maxwell-Plus Dual Chamber Dry Well will be installed.

STORAGE PROVIDED:

Retention Basin 1 (Underground Storage Pipes):

Storage volume of underground piping is calculated using $V = \pi r^2 L$.

- One proposed 10' Dia. CMP storage pipe, 65 lf = $3.1416*5^2 * 65' = 5{,}103$ cf > 4,676 cf

Retention Basin 2 (Open Retention):

BASIN 2					
ELEV.	AREA	DEPTH	AVG V	SUM V	COMMENT
(FT)	(SF)	(FT)	(CF)	(CF)	
1224.5	592			0.00	Pond Bottom
		0.50	534.42		
1225.0	1,546			534.42	HWE/Weir

Retention Basin 3 (Open Retention):

BASIN 3					
ELEV.	AREA	DEPTH	AVG V	SUM V	COMMENT
(FT)	(SF)	(FT)	(CF)	(CF)	
1224.5	419			0.00	Pond Bottom
		0.50	380.52		
1225.0	1,103			380.52	HWE/Weir

STORMWATER DISCHARGE:

For Basins with no direct bleed-off available, Drywells are proposed in the on-site storage facilities to dispose of the stormwater within thirty-six (36) hours. The calculation is as follows:

- Minimum percolating rate of a drywell (for planning purposes) = 0.1 cfs
- Volume to be drained in 36 hours = 0.1 cfs * 36 hours * 3600 sec/hour = 12,960 cf = 0.298 acre-feet.
- The number of drywells will be reduced if geotechnical testing for percolation rates determine adequate infiltration is available in the native soils at lower depths. If the percolation rate of the drywells is less than 0.1 cfs the number of drywells may have to be increased.

Basin 1 Underground Storage Pipe Provided storage = 5,103 cf
5,103 cf / 12,960 cf per drywell = 0.39 = 1 drywell required.

Basins 2 and 3 are both less than 1' deep and will not require drywells.

4.5 PIPE CAPACITY CALCULATIONS:

For the proposed drainage design, 18" HDPE pipes have been proposed to connect from the catch basins to the underground storage system. The proposed 18" storm drains can adequately convey the maximum 100-year, 2-hour event runoff, Q_{100} = **5.63 cfs** . Refer to **Appendix II** for pipe capacity calculations.

4.6 STORM DRAIN INLET CALCULATIONS

Catch basins per MAG Standard Detail 535 are proposed for storm drain inlets within the parking lots, and a riser inlet has been proposed above the underground storage pipe at the east end of Lot 4. Using a clogging factor of 0.50, the MAG 535 catch basins can convey a maximum flow of 10.30 cfs. The proposed catch basin inlets can adequately convey the maximum 100-year, 2-hour event runoff, Q_{100} = **5.91 cfs**. The proposed 30" riser can adequately convey the 100-year, 2-hour event runoff Q_{100} = **1.46 cfs**. Refer to **Appendix II** for inlet capacity calculations.

5. FLOOD SAFETY FOR

5.1 FINISHED FLOOR ELEVATIONS

This project lies in an "X" Flood Zone. Therefore, the finished floor elevation is set a minimum of 14" above the low lot outfall elevation minimum of 12 inches above the 100-year high-water elevation of any adjacent streets and drainage paths. This will ensure that each building will be well above the 100-year water level

6. CONCLUSIONS

6.1 OVERALL PROJECT:

1. The finish floor elevations will be designed a minimum of 14" above the lowest top of curb grade adjacent to the building, or 6" above the highest top of curb grade adjacent to the building, whichever is highest.
2. On-site storm water storage will be provided for the first flush storm event and discharge within 36 hours.

6.2 PROJECT PHASING:

This project will be constructed in a single phase.

7. WARNING AND DISCLAIMER OF LIABILITY

RE: following page.

8. REFERENCES

1. *Design Standards & Policies Manual, City of Scottsdale – January 2018*
2. *Drainage Design Manual for Maricopa County, Arizona, Volume I, Hydrology, Flood Control District of Maricopa County, Fourth Edition, Dec 14, 2018*
3. *Drainage Design Manual for Maricopa County, Arizona, Volume II, Hydraulics, Flood Control District of Maricopa County, Dec 14, 2018*

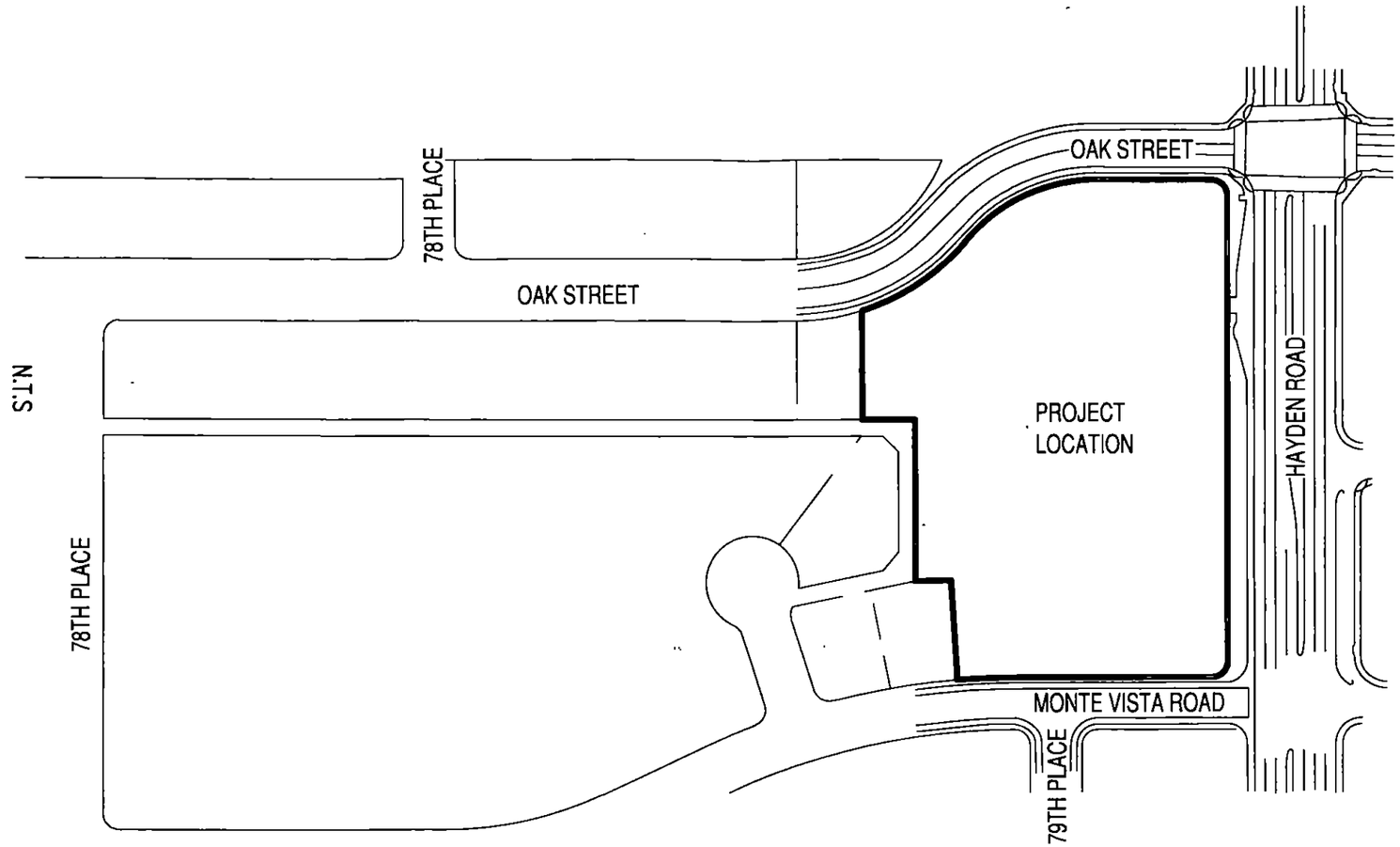


FIGURE 1
VICINITY MAP

NORTH

N.T.S

FIGURE 2 ARIAL MAP

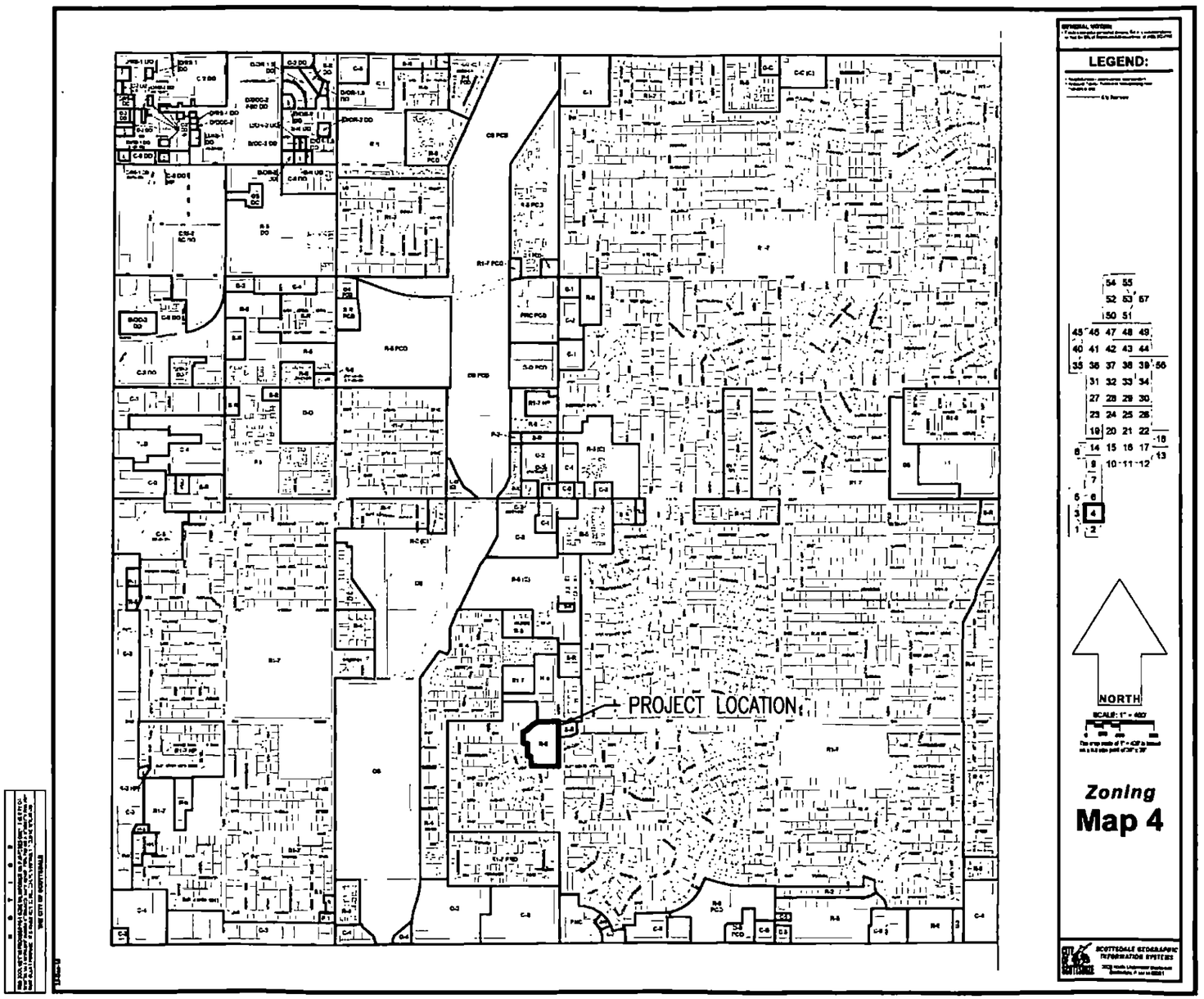
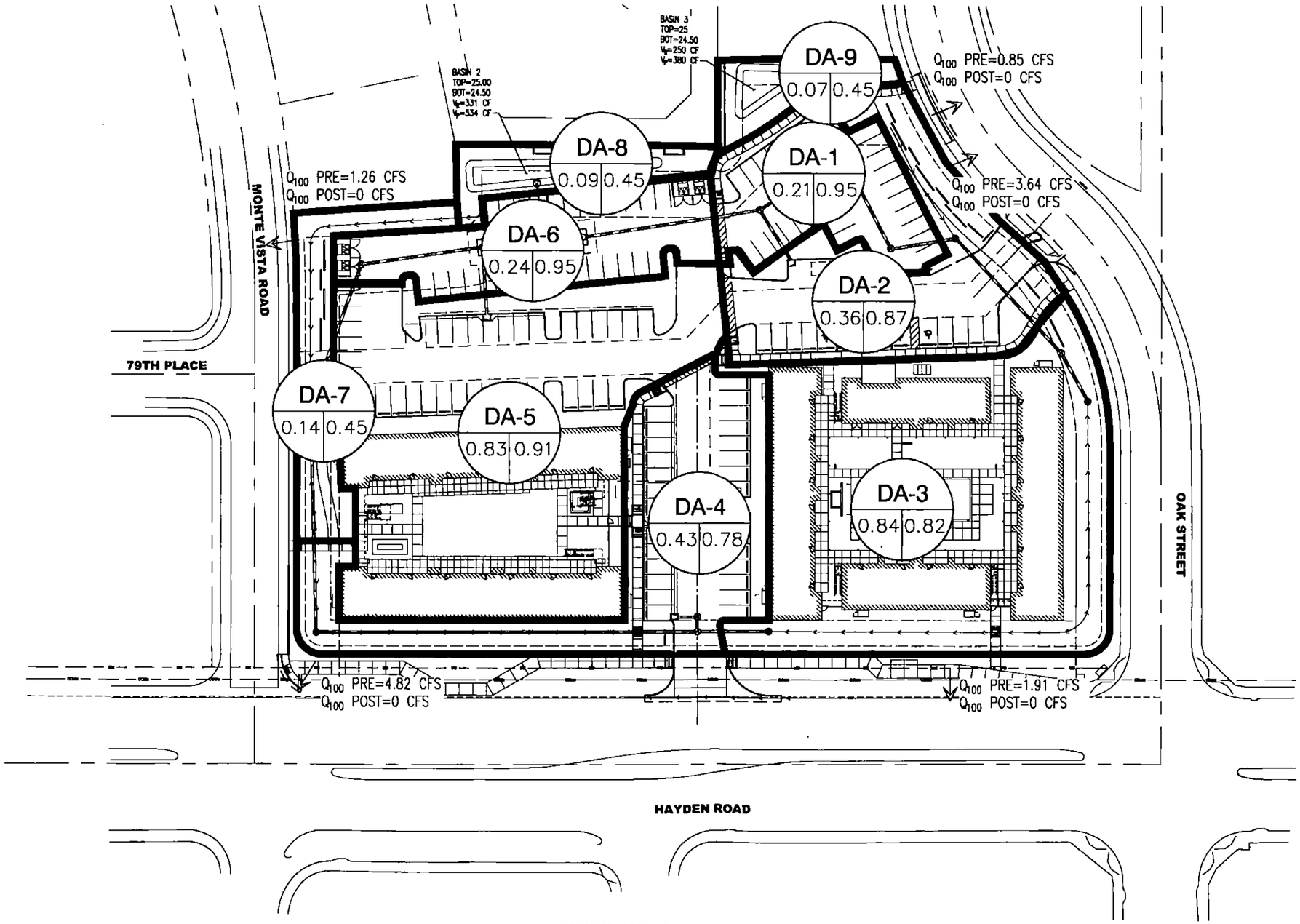


FIGURE 4
QUARTER
SECTION
MAP

CABANA ON HAYDEN
PROPOSED CONDITION DAM
2240 N. HAYDEN RD. SCOTTSDALE, AZ 85257



SEG
8280 E GELDING DR #101, SCOTTSDALE, ARIZONA 85260
WWW.AZSEG.COM TEL: 480 588 7206

GREENLIGHT COMMUNITIES

PROJECT: CABANA ON HAYDEN
LOCATION: 2240 N. HAYDEN RD. SCOTTSDALE, AZ 85257

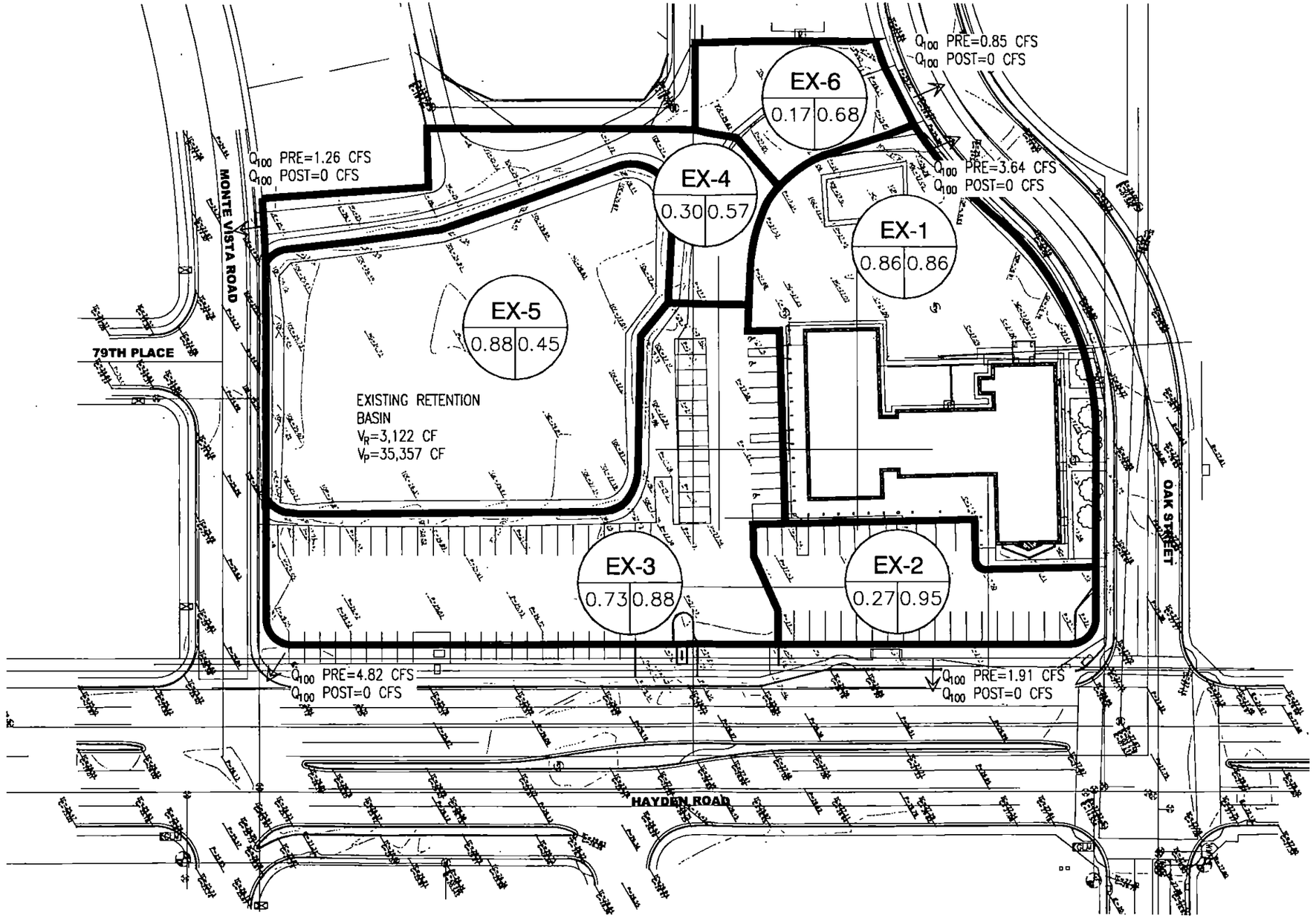
DRAWN: AVINA
DESIGNED: AVINA
CHECKED:
PROJ. MGR: SIN

DATE: 6/17/19
ISSUED FOR: DR SUBMITTAL

REVISION NO.	DATE
1	
2	
3	
4	

JOB NO.: 181207
SHEET TITLE: PROPOSED CONDITION DRAINAGE AREA MAP

CABANA ON HAYDEN
EXISTING CONDITION DAM
2240 N. HAYDEN RD. SCOTTSDALE, AZ 85257



SEG
8280 E GELDING DR #101 SCOTTSDALE, ARIZONA 85260
WWW.AZSEG.COM TEL: 480.588.7226

GREENLIGHT COMMUNITIES

PROJECT: CABANA ON HAYDEN
LOCATION: 2240 N. HAYDEN RD. SCOTTSDALE, AZ 85257

DRAWN: AVINA
RECHECKED: AVINA
CHECKED:
FINAL QCR: SIN

DATE: 5/19/2019
ISSUED FOR: CONSTRUCTION DOCUMENTS

REVISION NO.:	DATE:
1	
2	
3	
4	

JOB NO.: 181207

SHEET TITLE: EXISTING CONDITION DRAINAGE AREA MAP

GRADING & DRAINAGE LANGUAGE

WARNING AND DISCLAIMER OF LIABILITY

The City's Stormwater and Floodplain Management Ordinance is intended to minimize the occurrence of losses, hazards and conditions adversely affecting the public health, safety and general welfare which might result from flooding.

The Stormwater and Floodplain Management Ordinance identifies floodplains, floodways, flood fringes and special flood hazard areas. However, a property outside these areas could be inundated by floods. Also, much of the city is a dynamic flood area; floodways, floodplains, flood fringes and special flood hazard areas may shift from one location to another, over time, due to natural processes.

WARNING AND DISCLAIMER OF LIABILITY

The flood protection provided by the Stormwater and Floodplain Management Ordinance is considered reasonable for regulatory purposes and is based on scientific and engineering considerations. Floods larger than the base flood can and will occur on rare occasions. Floodwater heights may be increased by constructed or natural causes. The Stormwater and Floodplain Management Ordinance does not create liability on the part of the city, any officer or employee thereof, or the federal, state or county government for any flood damages that result from reliance on the Ordinance or any administrative decision lawfully made thereunder.

Compliance with the Stormwater and Floodplain Management Ordinance does not ensure complete protection from flooding. Flood-related problems such as natural erosion, streambed meander, or constructed obstructions and diversions may occur and have an adverse effect in the event of a flood. You are advised to consult your own engineer or other expert regarding these considerations.

I have read and understand the above.

Plan Check #	Owner	Date

APPENDIX I

Rainfall Data

Location name: Scottsdale, Arizona, USA*
Latitude: 33.4723°, Longitude: -111.9096°
Elevation: 1221.9 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]

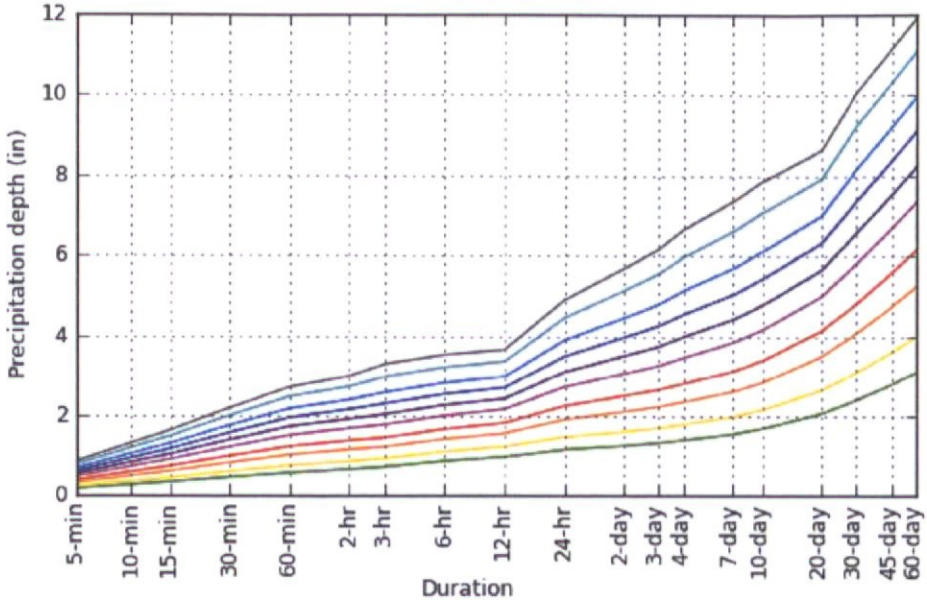
Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.183 (0.153-0.222)	0.239 (0.201-0.290)	0.324 (0.272-0.393)	0.390 (0.325-0.471)	0.479 (0.393-0.576)	0.549 (0.444-0.656)	0.619 (0.491-0.738)	0.691 (0.539-0.823)	0.788 (0.598-0.939)	0.861 (0.641-1.03)
10-min	0.278 (0.233-0.338)	0.363 (0.306-0.442)	0.494 (0.414-0.598)	0.594 (0.495-0.717)	0.730 (0.598-0.876)	0.835 (0.675-0.998)	0.942 (0.747-1.12)	1.05 (0.820-1.25)	1.20 (0.910-1.43)	1.31 (0.976-1.57)
15-min	0.344 (0.289-0.419)	0.450 (0.380-0.548)	0.612 (0.513-0.742)	0.736 (0.613-0.888)	0.905 (0.741-1.09)	1.04 (0.837-1.24)	1.17 (0.926-1.39)	1.30 (1.02-1.55)	1.49 (1.13-1.77)	1.63 (1.21-1.94)
30-min	0.464 (0.389-0.564)	0.606 (0.511-0.738)	0.824 (0.691-0.999)	0.992 (0.826-1.20)	1.22 (0.998-1.46)	1.40 (1.13-1.67)	1.57 (1.25-1.87)	1.76 (1.37-2.09)	2.00 (1.52-2.38)	2.19 (1.63-2.61)
60-min	0.574 (0.481-0.699)	0.750 (0.633-0.913)	1.02 (0.855-1.24)	1.23 (1.02-1.48)	1.51 (1.24-1.81)	1.73 (1.40-2.06)	1.95 (1.54-2.32)	2.17 (1.70-2.59)	2.48 (1.88-2.95)	2.71 (2.02-3.23)
2-hr	0.665 (0.567-0.793)	0.861 (0.735-1.03)	1.15 (0.980-1.37)	1.38 (1.16-1.63)	1.68 (1.40-1.98)	1.92 (1.57-2.25)	2.16 (1.74-2.54)	2.40 (1.90-2.82)	2.73 (2.11-3.21)	2.99 (2.26-3.54)
3-hr	0.723 (0.614-0.868)	0.927 (0.791-1.12)	1.22 (1.03-1.46)	1.45 (1.22-1.73)	1.78 (1.47-2.11)	2.03 (1 66-2.41)	2.30 (1 85-2.72)	2.58 (2.04-3.05)	2.97 (2.27-3.52)	3.29 (2.45-3.90)
6-hr	0.869 (0.754-1.02)	1.10 (0.959-1.30)	1.41 (1.22-1.66)	1.66 (1.43-1.94)	2.00 (1.69-2.32)	2.27 (1.89-2.62)	2.54 (2.09-2.94)	2.83 (2.28-3.27)	3.22 (2.52-3.73)	3.52 (2.70-4.10)
12-hr	0.972 (0.851-1.13)	1.23 (1.08-1.42)	1.56 (1.36-1.80)	1.82 (1.57-2.09)	2.16 (1.86-2.49)	2.43 (2.06-2.79)	2.71 (2.26-3.10)	2.98 (2.46-3.43)	3.36 (2.70-3.88)	3.65 (2.88-4.25)
24-hr	1.16 (1.04-1.29)	1.47 (1.32-1.64)	1.90 (1.71-2.13)	2.24 (2.00-2.51)	2.72 (2.41-3.03)	3.09 (2.73-3.44)	3.49 (3.05-3 88)	3.89 (3.38-4.33)	4.45 (3.82-4.96)	4.89 (4.16-5.47)
2-day	1.25 (1.12-1.40)	1.60 (1.44-1.79)	2.10 (1.88-2.35)	2.50 (2.23-2.79)	3.05 (2.71-3.41)	3.50 (3.08-3.90)	3.96 (3.47-4.43)	4.45 (3.87-4.98)	5.13 (4.41-5.75)	5.67 (4.83-6.38)
3-day	1.32 (1.19-1.48)	1.69 (1.52-1.89)	2.22 (1.99-2.48)	2.65 (2.36-2.96)	3.25 (2.89-3.63)	3.74 (3.29-4.17)	4.25 (3.72-4.74)	4.79 (4.16-5.35)	5.55 (4.76-6.20)	6.16 (5.23-6.91)
4-day	1.39 (1.25-1.56)	1.78 (1.60-1.99)	2.35 (2.10-2.62)	2.80 (2.50-3.13)	3.45 (3.06-3.85)	3.98 (3.51-4.43)	4.54 (3.97-5.06)	5.13 (4.45-5.72)	5.97 (5.11-6.66)	6.65 (5.63-7.44)
7-day	1.54 (1.38-1.72)	1.97 (1.77-2.21)	2.60 (2.32-2.90)	3.10 (2.77-3.47)	3.82 (3.39-4.27)	4.40 (3.88-4.90)	5.02 (4.39-5.60)	5.67 (4.92-6.33)	6.59 (5.64-7.36)	7.34 (6.22-8.21)
10-day	1.68 (1.50-1.87)	2.14 (1.93-2.40)	2.83 (2.53-3.15)	3.38 (3.02-3.76)	4.15 (3.68-4.61)	4.76 (4.20-5.29)	5.42 (4.75-6.02)	6.11 (5.31-6.79)	7.07 (6.07-7.87)	7.85 (6.67-8.75)
20-day	2.06 (1.85-2.29)	2.65 (2.38-2.95)	3.49 (3.14-3.88)	4.13 (3.70-4.59)	4.99 (4.45-5.54)	5.66 (5.02-6.28)	6.33 (5.60-7.03)	7.01 (6.17-7.80)	7.93 (6.91-8.84)	8.64 (7.47-9.65)
30-day	2.40 (2.16-2.67)	3.09 (2.78-3.44)	4.07 (3.65-4.52)	4.82 (4.31-5.33)	5.82 (5.18-6.44)	6.59 (5.85-7.28)	7.37 (6.51-8.15)	8.17 (7.18-9.04)	9.24 (8.07-10.3)	10.1 (8.71-11.2)
45-day	2.79 (2.51-3.10)	3.59 (3.24-3.99)	4.73 (4.26-5.25)	5.57 (5.00-6.18)	6.68 (5.98-7.40)	7.51 (6.70-8.33)	8.36 (7.42-9.27)	9.20 (8.13-10.2)	10.3 (9.04-11.5)	11.1 (9.71-12.4)
60-day	3.09 (2.79-3.42)	3.99 (3.60-4.41)	5.24 (4.73-5.80)	6.15 (5.53-6.80)	7.34 (6.59-8.11)	8.22 (7.35-9.09)	9.10 (8.10-10.1)	9.95 (8.83-11.0)	11.1 (9.77-12.3)	11.9 (10.4-13.3)

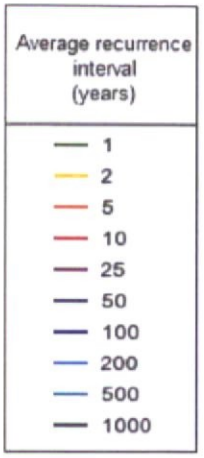
[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

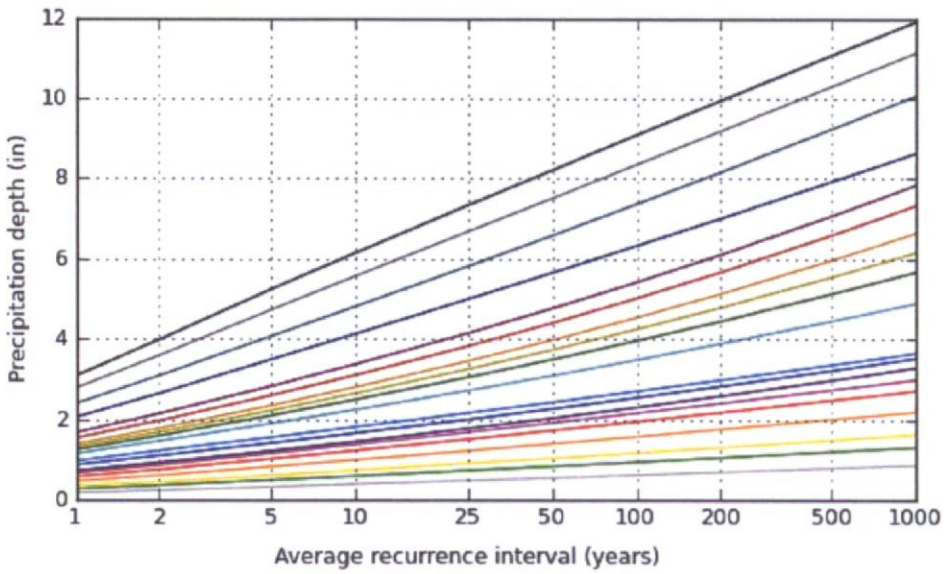
Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper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

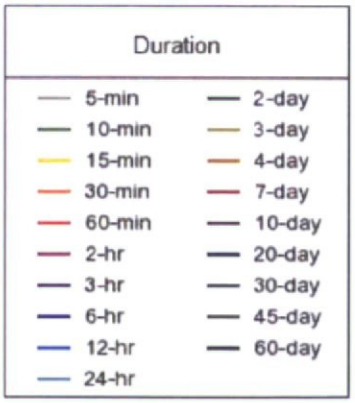
Please refer to NOAA Atlas 14 document for more information.

PDS-based depth-duration-frequency (DDF) curves
Latitude: 33.4723°, Longitude: -111.9096°









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Small scale terrain

Location name: Scottsdale, Arizona, USA*
Latitude: 33.4723°, Longitude: -111.9096°
Elevation: 1221.9 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/hour)[1]

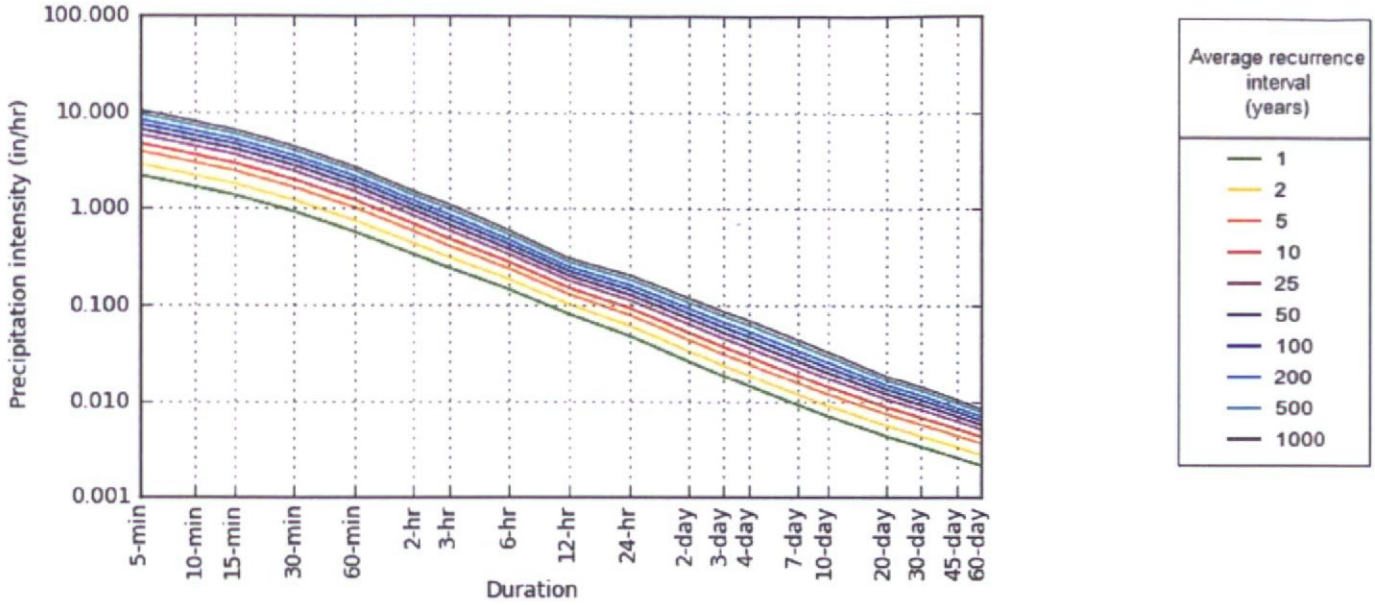
Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	2.20 (1.84-2.66)	2.87 (2.41-3.48)	3.89 (3.26-4.72)	4.68 (3.90-5.65)	5.75 (4.72-6.91)	6.59 (5.33-7.87)	7.43 (5.89-8.86)	8.29 (6.47-9.88)	9.46 (7.18-11.3)	10.3 (7.69-12.3)
10-min	1.67 (1.40-2.03)	2.18 (1.84-2.65)	2.96 (2.48-3.59)	3.56 (2.97-4.30)	4.38 (3.59-5.26)	5.01 (4.05-5.99)	5.65 (4.48-6.74)	6.31 (4.92-7.51)	7.19 (5.46-8.57)	7.87 (5.86-9.39)
15-min	1.38 (1 16-1.68)	1.80 (1.52-2.19)	2.45 (2.05-2.97)	2.94 (2.45-3 55)	3.62 (2.96-4.34)	4.14 (3.35-4.95)	4.67 (3.70-5.57)	5.22 (4.07-6.21)	5.94 (4.51-7.08)	6.50 (4.84-7.76)
30-min	0.928 (0.778-1.13)	1.21 (1.02-1.48)	1.65 (1.38-2.00)	1.98 (1.65-2.39)	2.44 (2.00-2.93)	2.79 (2.25-3.33)	3.15 (2.50-3.75)	3.51 (2.74-4.18)	4.00 (3.04-4.77)	4.38 (3.26-5.23)
60-min	0.574 (0.481-0.699)	0.750 (0.633-0.913)	1.02 (0.855-1.24)	1.23 (1.02-1.48)	1.51 (1.24-1.81)	1.73 (1.40-2.06)	1.95 (1.54-2.32)	2.17 (1.70-2.59)	2.48 (1.88-2.95)	2.71 (2.02-3.23)
2-hr	0.332 (0.284-0.396)	0.430 (0.368-0.514)	0.577 (0.490-0.686)	0.688 (0.578-0.816)	0.841 (0.698-0.991)	0.958 (0.784-1.13)	1.08 (0.870-1.27)	1.20 (0.951-1.41)	1.37 (1.06-1.61)	1.49 (1.13-1.77)
3-hr	0.241 (0.204-0.289)	0.309 (0.263-0.373)	0.406 (0.344-0.488)	0.483 (0.406-0.577)	0.591 (0.490-0.702)	0.677 (0 553-0.802)	0.767 (0.615-0.907)	0.860 (0.678-1.02)	0.990 (0.757-1.17)	1.10 (0.816-1.30)
6-hr	0.145 (0.126-0.171)	0.184 (0.160-0.216)	0.236 (0.204-0.277)	0.277 (0.238-0.324)	0.334 (0.283-0.387)	0.379 (0.316-0.437)	0.425 (0.349-0.491)	0.472 (0.380-0.547)	0.537 (0.422-0.623)	0.588 (0.451-0.685)
12-hr	0.081 (0.071-0.093)	0.102 (0.089-0.118)	0.129 (0.113-0.149)	0.151 (0.131-0.173)	0.180 (0.154-0.206)	0.202 (0.171-0.231)	0.225 (0.188-0.258)	0.248 (0.204-0.284)	0.279 (0.224-0.322)	0.303 (0.239-0.352)
24-hr	0.048 (0.043-0.054)	0.061 (0.055-0.069)	0.079 (0.071-0.089)	0.094 (0.084-0.104)	0.113 (0.101-0.126)	0.129 (0.114-0.144)	0.145 (0.127-0.162)	0.162 (0.141-0.181)	0.186 (0.159-0.207)	0.204 (0.173-0.228)
2-day	0.026 (0.023-0.029)	0.033 (0.030-0.037)	0.044 (0.039-0.049)	0.052 (0.046-0.058)	0.064 (0.056-0.071)	0.073 (0.064-0.081)	0.083 (0.072-0.092)	0.093 (0.081-0.104)	0.107 (0.092-0.120)	0.118 (0.101-0.133)
3-day	0.018 (0.016-0.021)	0.023 (0.021-0.026)	0.031 (0.028-0.035)	0.037 (0.033-0.041)	0.045 (0.040-0.050)	0.052 (0.046-0.058)	0.059 (0.052-0.066)	0.067 (0.058-0.074)	0.077 (0.066-0.086)	0.086 (0.073-0.096)
4-day	0.014 (0.013-0.016)	0.019 (0.017-0.021)	0.024 (0.022-0.027)	0.029 (0.026-0.033)	0.036 (0.032-0.040)	0.041 (0.037-0.046)	0.047 (0.041-0.053)	0.053 (0.046-0.060)	0.062 (0.053-0.069)	0.069 (0.059-0.077)
7-day	0.009 (0.008-0.010)	0.012 (0.011-0.013)	0.015 (0.014-0.017)	0.018 (0.016-0.021)	0.023 (0.020-0.025)	0.026 (0.023-0.029)	0.030 (0.026-0.033)	0.034 (0.029-0.038)	0.039 (0.034-0.044)	0.044 (0.037-0.049)
10-day	0.007 (0.006-0.008)	0.009 (0.008-0.010)	0.012 (0.011-0.013)	0.014 (0.013-0.016)	0.017 (0.015-0.019)	0.020 (0.018-0.022)	0.023 (0.020-0.025)	0.025 (0.022-0.028)	0.029 (0.025-0.033)	0.033 (0.028-0.036)
20-day	0.004 (0.004-0.005)	0.006 (0.005-0.006)	0.007 (0.007-0.008)	0.009 (0.008-0.010)	0.010 (0.009-0.012)	0.012 (0.010-0.013)	0.013 (0.012-0.015)	0.015 (0.013-0.016)	0.017 (0.014-0.018)	0.018 (0.016-0.020)
30-day	0.003 (0.003-0.004)	0.004 (0.004-0.005)	0.006 (0.005-0.006)	0.007 (0.006-0.007)	0.008 (0.007-0.009)	0.009 (0.008-0.010)	0.010 (0.009-0.011)	0.011 (0.010-0.013)	0.013 (0.011-0.014)	0.014 (0.012-0.016)
45-day	0.003 (0.002-0.003)	0.003 (0.003-0 004)	0.004 (0.004-0.005)	0.005 (0.005-0.006)	0.006 (0.006-0.007)	0.007 (0.006-0.008)	0.008 (0.007-0.009)	0.009 (0.008-0.009)	0.010 (0.008-0.011)	0.010 (0.009-0.011)
60-day	0.002 (0.002-0.002)	0.003 (0.002-0.003)	0.004 (0.003-0.004)	0.004 (0.004-0.005)	0.005 (0.005-0.006)	0.006 (0.005-0.006)	0.006 (0.006-0.007)	0.007 (0.006-0.008)	0.008 (0.007-0.009)	0.008 (0.007-0.009)

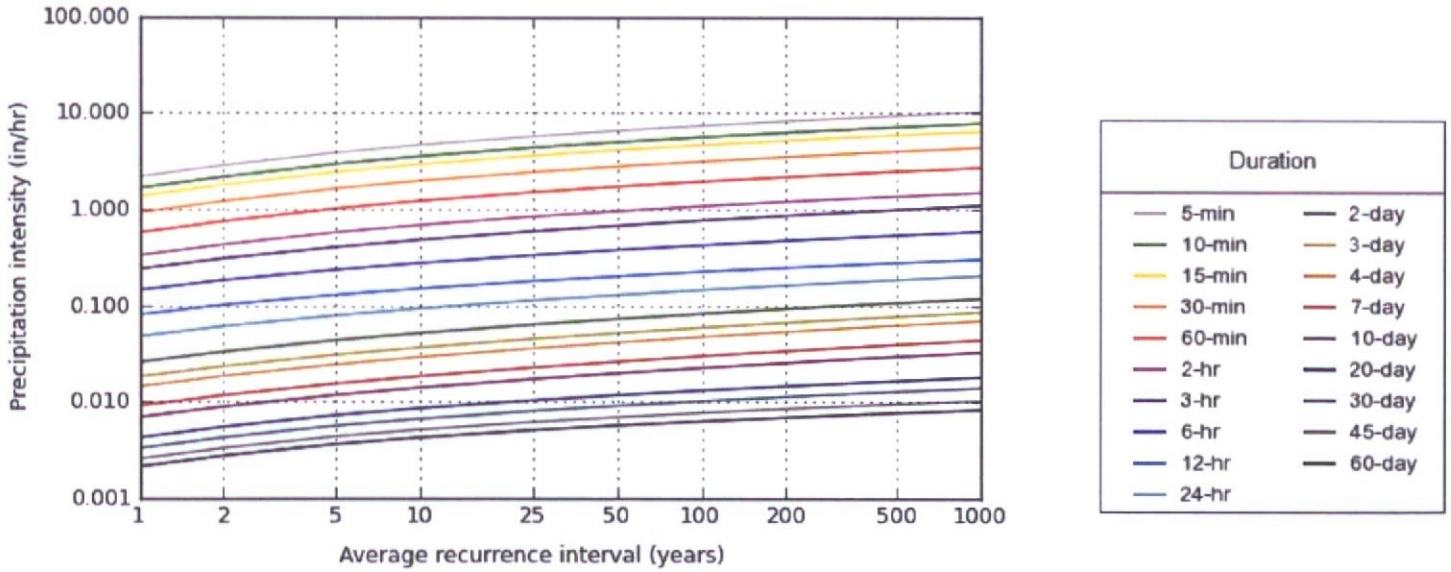
[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

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.

PDS-based intensity-duration-frequency (IDF) curves
Latitude: 33.4723°, Longitude: -111.9096°





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APPENDIX II

Calculations

2. A rainfall runoff model using the USACE's HEC 1 Flood Hydrograph Package (generally used for watersheds that are larger than 160 acres, irregular in shape and contour, or if routing of flows is necessary).

B. **Watershed Conditions**

Watersheds are subject to change. Grading and drainage plans shall consider all watershed conditions that would result in the greatest peak discharge rate, to:

1. Size drainage facilities, and
2. Determine lowest floor elevations.

C. **Split-Flow Conditions**

Projects in northern parts of Scottsdale must address split-flow channel conditions where applicable. These splits in the alluvial channels usually include highly erosive soils and are generally unstable and unpredictable. In setting lowest floor elevations relative to upstream splits, assume that 100% of the flow could go either direction in any given flood event. For infrastructure design, the estimate of the actual split, based on a hydraulic analysis of the current channel cross sections, must include a minimum safety factor of 30% of the total flow. If there are extenuating factors affecting the stability of the split, the safety factor should be increased accordingly.

D. **Environmentally Sensitive Lands**

For special considerations regarding Environmentally Sensitive Lands, refer to the City Zoning Ordinance and DSPM Chapter 2 Section 2-2. Modification of natural watercourses with a flow of 50 cfs or greater are addressed in the City Zoning Ordinance.

E. **The Rational Method**

1. Precipitation. Precipitation input is rainfall intensity, "i," and can be obtained directly from NOAA 14.
2. Time of Concentration. Time of concentration "t_c" is the total time of travel from the most hydraulically remote part of the watershed to the concentration point of interest. The calculation of "t_c" must follow FCDMC Hydrology Manual procedures.
3. Runoff Coefficients. Use Fig. 4-1.5, Runoff Coefficients for Use with Rational Method, or equivalent to obtain the runoff coefficients or "C" values. Composite "C" values for the appropriate zoning category or weighted average values calculated for the specific site are both acceptable approaches.

RUNOFF COEFFICIENTS – "C" VALUE

LAND USE	STORM FREQUENCY		
Composite Area-wide Values	2-25 Year	50 Year	100 Year
Commercial & Industrial Areas	0.80	0.83	0.86
Residential Areas – Single Family, slopes 10% or less			
R1-190	0.33	0.50	0.53
R1-130	0.35	0.51	0.59

R1-70	0.37	0.52	0.60
R1-43	0.38	0.55	0.61
R1-35	0.40	0.56	0.62
R1-18	0.43	0.58	0.64
R1-10	0.47	0.62	0.70
R1-7	0.51	0.66	0.80
R1-5	0.54	0.69	0.86
Residential Areas – Single Family, slopes greater than 10%			
R1-190	0.65	0.74	0.82
R1-130	0.68	0.76	0.84
R1-70	0.69	0.77	0.85
R1-43	0.70	0.77	0.85
R1-35	0.70	0.78	0.85
R1-18	0.71	0.79	0.86
R1-10	0.75	0.82	0.88
R1-7	0.81	0.86	0.91
R1-5	0.85	0.89	0.92
Townhouse (R-2, R-4)	0.63	0.74	0.94
Apartments & Condominiums (Condos) (R-3, R-5)	0.76	0.83	0.94
Specified Surface Type Values			
Paved streets, parking lots (concrete or asphalt), roofs, driveways, etc.	0.90	0.93	0.95
Lawns, golf courses, & parks (grassed areas)	0.20	0.25	0.30
Undisturbed natural desert or desert landscaping (no impervious weed barrier)	0.37	0.42	0.45
Desert landscaping (with impervious weed barrier)	0.63	0.73	0.83
Mountain terrain - slopes greater than 10%	0.60	0.70	0.80
Agricultural areas (flood irrigated fields)	0.16	0.18	0.20
Gravel floodways and shoulders	0.68	0.78	0.82

FIGURE 4-1.5 RUNOFF COEFFICIENTS FOR RATIONAL METHOD

F. **HEC-1 Model**

1. Minimum submittals
   a. A printout of the input data.
   b. A schematic (routing) diagram of the stream network.
   c. The runoff summary output table, including drainage basin name, area, 2, 10, and 100- year flow values.
   d. Electronic input file(s) on compact disc (CD) or digital versatile/video disc (DVD).
   e. Supporting documentation and source material for parameter selection.

Weighted Runoff Coefficient-Calculations (Cw)

PROPOSED OVERALL SITE C_w					
	BUILDING or CONCRETE	ASPHALT	DESERT LANDSCAPE	TOTAL AREA	Cwt
C-VALUE	0.95	0.95	0.45		
AREA (ac)	1.22	1.20	0.63	**3.22**	**0.80**
DA-1	0.00	0.21	0.00	0.21	0.95
DA-2	0.13	0.17	0.06	0.36	0.87
DA-3	0.62	0.00	0.22	0.84	0.82
DA-4	0.00	0.28	0.14	0.43	0.78
DA-5	0.47	0.30	0.06	0.83	0.91
DA-6	0.00	0.24	0.00	0.24	0.95
DA-7	0.00	0.00	0.14	0.14	0.45
DA-8	0.00	0.00	0.09	0.09	0.45
DA-9	0.00	0.00	0.07	0.07	0.45

EXISTING OVERALL SITE C_w					
	BUILDING or CONCRETE	ASPHALT	DESERT LANDSCAPE	TOTAL AREA	Cwt
C-VALUE	0.95	0.95	0.45		
AREA (ac)	0.25	1.05	1.91	**3.22**	**0.65**
EX-1	0.25	0.00	0.61	0.86	0.60
EX-2	0.00	0.27	0.00	0.27	0.95
EX-3	0.00	0.64	0.10	0.73	0.88
EX-4	0.00	0.07	0.23	0.30	0.57
EX-5	0.00	0.00	0.88	0.88	0.45
EX-6	0.00	0.08	0.09	0.17	0.68

Required Storage Volume Calculations

						Vr=1*(P/12)*Cw*A P=100-yr, 2-hr=2.16 in.
Drainage Area ID	Area (acres)	C_w (-)	intensity (in/hr)	Q (cfs)	Volume Req. (acre-ft)	Volume Req. (CF)
RETENTION BASIN 1						
DA-1	0.21	0.95	7.43	1.46	0.035	1,545.51
DA-2	0.36	0.87	7.43	2.32	0.056	2,453.03
DA-3	0.84	0.82	7.43	5.11	0.124	5,393.92
Basin 1 Totals:	**1.41**	**0.85**		**8.90**	**0.216**	**9,392.46**
RETENTION BASIN 2						
DA-4	0.43	0.78	7.43	2.48	0.060	2,615.77
DA-5	0.83	0.91	7.43	5.63	0.136	5,943.22
DA-6	0.24	0.95	7.43	1.70	0.041	1,795.51
DA-7	0.14	0.45	7.43	0.48	0.012	510.06
DA-8	0.09	0.45	8.43	0.36	0.008	331.21
DA-9	0.07	0.45	9.43	0.30	0.006	250.05
Basin 2 Totals:	**1.81**	**0.77**		**10.30**	**0.249**	**11,445.82**
Totals	**3.22**			**19.20**	**0.47**	**20,838.28**

Existing Required Storage Volume Calculations

						Vr=1*(P/12)*Cw*A P=100-yr, 2-hr=2.16in.
Drainage Area ID	Area (acres)	C_w (-)	intensity (in/hr)	Q (cfs)	Volume Req. (acre-ft)	Volume Req. (CF)
RETENTION BASIN 1						
EX-1	0.86	0.60	7.43	3.80	0.092	4,014.49
EX-2	0.27	0.95	7.43	1.91	0.046	2,011.17
EX-3	0.73	0.88	7.43	4.82	0.117	5,085.62
EX-4	0.30	0.57	7.43	1.26	0.031	1,333.89
EX-5	0.88	0.45	7.43	2.96	0.072	3,121.66
EX-6	0.17	0.68	7.43	0.85	0.021	896.25
Totals:	**3.22**	**0.65**		**15.60**	**0.378**	**16,463.08**
Totals	**3.22**			**15.60**	**0.38**	**16,463.08**

Inlet Capacity - Sump Locations

Description: Calculation of 30" Inlet Capacity for CMP Riser Inlet
Date: March 4, 2019
Location: 2240 N. Hayden RD. Scottsdale, AZ 85257
Reference: Drainage Design Manual for Maricopa County, Vol. II, Hydraulics, pg. 3-27

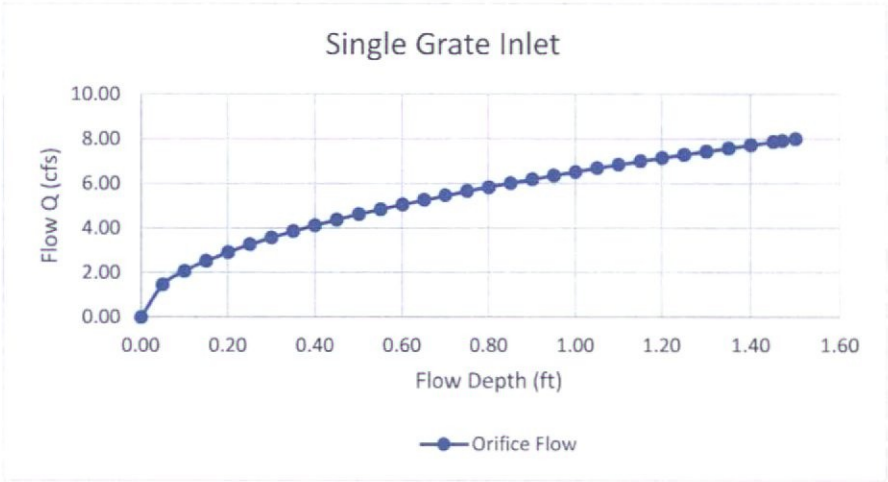
Orifice EQ. $Q_i = C_o A(2gd)^{0.5}(C_f)$

Where: $C_o = 0.67$, and C_f = clogging factor = 0.5

A = **2.43** **sq.ft.**

where,
A = Total area of grate minus
area of longitudinal & lateral bars

Depth (ft)	Orifice Qi (cfs)
0.00	0.00
0.05	1.46
0.10	2.07
0.15	2.53
0.20	2.92
0.25	3.27
0.30	3.58
0.35	3.86
0.40	4.13
0.45	4.38
0.50	4.62
0.55	4.84
0.60	5.06
0.65	5.27
0.70	5.47
0.75	5.66
0.80	5.84
0.85	6.02
0.90	6.20
0.95	6.37
1.00	6.53
1.05	6.69
1.10	6.85
1.15	7.01
1.20	7.16
1.25	7.30
1.30	7.45
1.35	7.59
1.40	7.73
1.45	7.87
1.47	7.92
1.50	8.00



Inlet Capacity - Sump Locations

Description: Calculation of Inlet Capacity for Single MAG 535 Catch Basin
Date: March 4, 2019
Location: 2240 N. Hayden RD. Scottsdale, AZ 85257
Reference: Drainage Design Manual for Maricopa County, Vol. II, Hydraulics, pg. 3-27

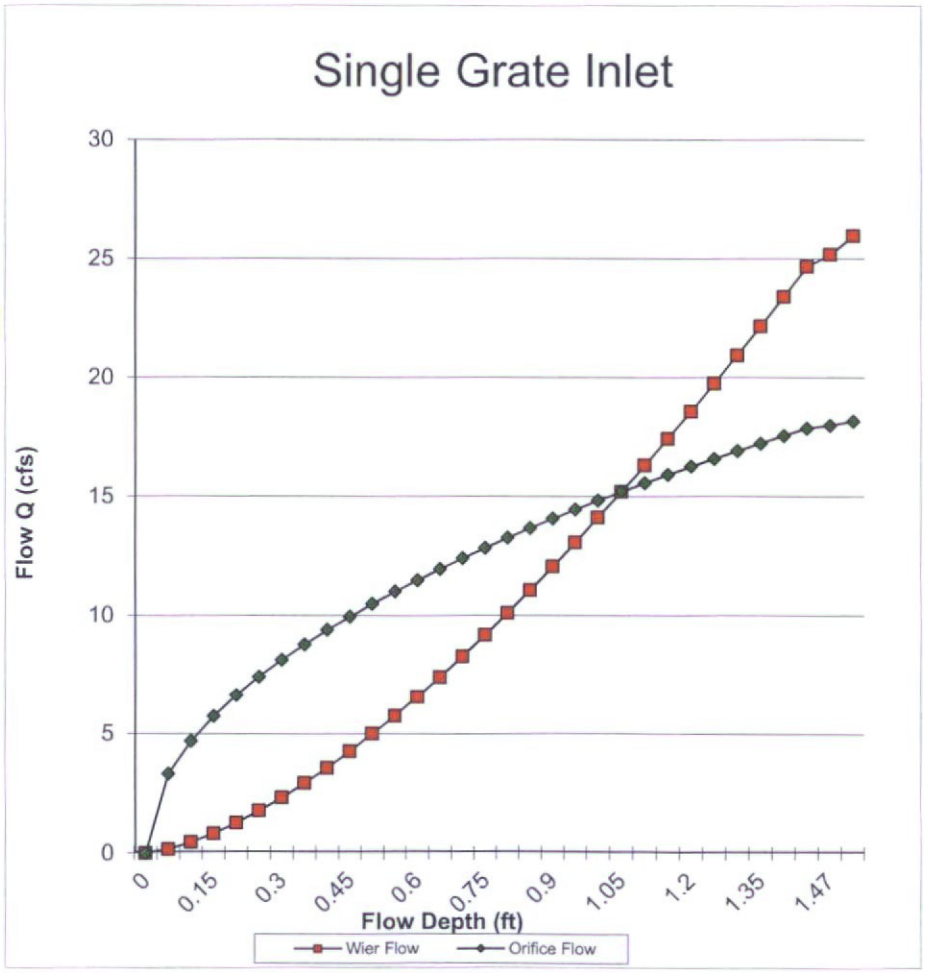
Weir EQ. $Q_i = C_w P d^{1.5} (C_f)$ **Orifice EQ.** $Q_i = C_o A (2gd)^{0.5} (C_f)$

Where: $C_w = 3.0$, $C_o = 0.67$, and C_f = clogging factor = 0.5

P =	**5.80**	**ft**
A =	**5.42**	**sq.ft.**

where,
P = Perimeter of Catchbasin minus area of longitudinal & lateral bars
A = Total area of grate minus area of longitudinal & lateral bars

Depth (ft)	Weir Qi (cfs)	Orifice Qi (cfs)
0.00	0.00	0.00
0.05	0.10	3.26
0.10	0.28	4.61
0.15	0.51	5.64
0.20	0.78	6.52
0.25	1.09	7.29
0.30	1.43	7.98
0.35	1.80	8.62
0.40	2.20	9.22
0.45	2.63	9.77
0.50	3.08	10.30
0.55	3.55	10.81
0.60	4.04	11.29
0.65	4.56	11.75
0.70	5.10	12.19
0.75	5.65	12.62
0.80	6.23	13.03
0.85	6.82	13.43
0.90	7.43	13.82
0.95	8.06	14.20
1.00	8.70	14.57
1.05	9.36	14.93
1.10	10.04	15.28
1.15	10.73	15.63
1.20	11.44	15.96
1.25	12.16	16.29
1.30	12.90	16.61
1.35	13.65	16.93
1.40	14.41	17.24
1.45	15.19	17.55
1.47	15.51	17.67
1.50	15.98	17.85



APPENDIX III

Grading and Drainage Plans

FINA . DRAINAGE REPOR' '

Cabana on Hayden

2240 N. Hayden Rd.
Scottsdale, AZ 85257

Prepared For:

GREENLIGHT
COMMUNITIES

8135 E. Indian Bend Road, Suite 101
Scottsdale, AZ 85250
Phone:480.609.6779

Plan # _____
Case # 2-DR-2019
Q-S # _____
☑ Accepted
☐ Corrections
N. Baronas 6-28-19
Reviewed By Date

Prepared by:

SEG

Sustainability Engineering Group
8280 E. Gelding Drive, Suite 101
Scottsdale, AZ 85260
480.588.7226 www.azSEG.com

Project Number: 181207

Date: January 10, 2019 (DRB)
Revision Date: March 6, 2019 (DRB)
Revision Date: May 20, 2019 (DRB)
Revision Date: June 17, 2019 (DRB)
Case No.: 2-DR-2019 **Plan Check No.: TBD**

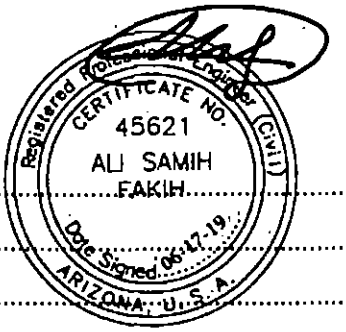


Table of Contents

LIST OF FIGURES:

APPENDIX:

1. INTRODUCTION

This Preliminary Drainage Report represents the storm water analysis for Green Light Community Cabana on Hayden multi-family Residential development proposed in Scottsdale, Arizona. The purpose of this report is to provide the hydrologic and hydraulic analyses, required by the City of Scottsdale, to support the proposed site plan for said development. This report includes discussions and calculations defining the storm water management concepts for the collection and conveyance necessary to comply with the drainage requirements of the City of Scottsdale and Maricopa County. Preparation of this report has been done in accordance with the requirements of the City of Scottsdale Design Standards & Policies Manual (DS&PM) 2018 [1], and the Drainage Design Manuals for Maricopa County, Arizona, Volumes I[2] and Volume II[3].

2. LOCATION AND PROJECT DESCRIPTION

2.1 LOCATION:

The subject property consists of land bound by East Oak Street to the North, North Hayden Road to the East, East Monte Vista Road to the South and a private sub-division area to the West. It is further defined as follows:

- A portion of the Southeast quarter of Section 35, Township 2 North, Range 4 East of the Gila and Salt River Base and Meridian, Maricopa County, Scottsdale, Arizona.
- Parcel ID: APN: 131-10-151
- Address: 2240 N. Hayden Road, Scottsdale, AZ

Refer to **FIGURE 1 - Vicinity Map** for the project's location with respect to major cross streets

2.2 EXISTING AND PROPOSED DEVELOPMENTS SURROUNDING THE SITE:

The site is bound as follows:

- South: Parcel 131-10-052; Parcel 131-10-109; Parcel 131-10-110; Cox Heights Four Amended subdivision; Zoning is R1-7
- West: Parcel 131-10-014; Parcel 131-10-050; Parcel 131-10-052; Cox Heights Four Amended subdivision; Zoning is R1-7
- North: Parcel 131-10-013; Cox Heights Four Amended subdivision; Zoning is R1-7
  Parcel 131-23-006B; Property subdivision; Zoning is R1-7
  Parcel 131-23-006A; Property subdivision; Zoning is R-5
- East: Parcel 131-37-094; Cox Heights Unit One subdivision; Zoning is S-R
  Parcel 131-37-093; Cox Heights Unit One subdivision; Zoning is R1-7
  Parcel 131-37-087; Cox Heights Unit One subdivision; Zoning is R1-7
  Parcel 131-37-086; Cox Heights Unit One subdivision; Zoning is R1-7

Refer to **FIGURE 4** Quarter Section Map for the parcel information of the site.

2.3 EXISTING SITE DESCRIPTION:

The project area includes approximately 192,866 SF (4.43 AC) gross, 139,823 SF (3.21 AC) net of land designated as R-5 per COS Zoning Map 04. The site is currently developed as a church.

Refer to **FIGURE 2** attached for an aerial of the site.

2.4 PROPOSED SITE DEVELOPMENT:

Site development includes the demolition of the existing church and the parking lot, and construction of a new multi-family apartment with 89 units, zoning R-5. The development will include proposed access to North Hayden Road and East Oak Street.

Refer to **Appendix III** – Grading and Drainage Plans for site layout.

2.5 FLOOD HAZARD ZONE:

FIRM Map Number 04013C2235L dated October 16, 2013 indicates this site is designated as Zone "X". As such, it is defined as areas determined to be outside the 0.2% annual chance floodplain and therefore is not in a special flood hazard area.

Refer to **FIGURE 3** for the FIRM.

3. EXISTING DRAINAGE CONDITIONS

3.1 OFF-SITE DRAINAGE PATTERNS:

The adjacent roadways convey runoff via curb and gutter. The land of the adjacent westerly parcel slope away from the subject project. Therefore, the site is not affected by any offsite flow adjacent to the property.

3.2 ON-SITE DRAINAGE:

In accordance with the existing topographic survey, the site is separated into 6 sub-areas. Refer to **Existing Condition Drainage Area Map** in **Appendix II**,

The existing onsite stormwater is mainly conveyed through overland flow and roadway drainage. For drainage area EX-5, one retention basin has been developed for stormwater storage. For drainage areas EX-1, EX-2, EX-3, EX-4 and EX-6, all flow onsite is conveyed to offsite locations through roadway drainage. The discharge from onsite to offsite has been calculated as follows:

- **EX-1**
- Q_{100} = (0.57)*(7.43 in/hr)*(0.86 ac.) = **3.64 cfs existing**
- **EX-2**
  Q_{100} = (0.95)*(7.43 in/hr)*(0.27 ac.) = **1.91 cfs existing**
- **EX-3**
  Q_{100} = (0.88)*(7.43 in/hr)*(0.73 ac.) = **4.82 cfs existing**
- **EX-4**
  Q_{100} = (0.57)*(7.43 in/hr)*(0.30 ac.) =**1.26 cfs existing**
- **EX-6**
  Q_{100} = (0.68)*(7.43 in/hr)*(0.17 ac.) = **0.85 cfs existing**

Existing retention basin EX-5 is isolated from incoming flows and only captures runoff from within its own area. The calculated provided retention for EX-5 Basin is **35,357 cf.** Based on the topographic survey information, the surrounding drainage areas flow away from the basin. Therefore, the existing

retention basin volume does not reflect the actual required storage for the site and will not be used as the basis for comparison in the required storage analysis.

EXISTING BASIN EX-5					
ELEV.	AREA	DEPTH	AVG V	SUM V	COMMENT
(FT)	(SF)	(FT)	(CF)	(CF)	
1225.75	32,580			0.00	Pond Bottom
		1.00	35,356.97		
1226.75	38,134			35,356.97	HWE/Weir

4. PROPOSED STORM WATER MANAGEMENT

4.1 DESIGN INTENT:

This project is subject to Pre vs Post or First Flush retention, whichever is greater, while maintain a minimum volume of existing conditions. Based on the below calculations, the project has been designed for the first flush retention volume. On-site drainage will be handled within paved areas through catch basins, and underground storm systems where necessary. On-site retention will be provided within two one-foot open retention basins and underground retention and have discharge of the storm water within thirty-six hours via proposed drywells.

Pre-Development

V_r = 2.16/12*3.22 ac * 0.65 = **0.377 ac ft (16,410.80 cf) REQUIRED STORAGE**

Post-Development

V_r = 2.16/12*3.22 ac * 0.80 = **0.463 ac ft (20,838 cf) REQUIRED STORAGE**

V_r = Post – Pre = 20,197.90 – 16,410.80 = **3,787.10 cf**

First Flush

V_r = 0.5/12*3.22 ac * 0.80 = **0.107 ac ft (4,675.44 cf) REQUIRED STORAGE**

First flush volume is larger, and thus it will be used.

Refer to Section 5 below for a discussion on proposed finished floor elevations. Refer to **Proposed Conditions Drainage Area Map, in Appendix II.**

4.2 DESIGN STORM REQUIREMENTS:

The storm water system will be designed in accordance with City of Scottsdale Design Standards and Polices Manual.

4.3 LAND CHARACTERISTICS

Stormwater will be directed to onsite underground storage pipes. Based on the DS&PM, runoff coefficients for the 100-year storm event used are as follows:

- C=0.94 for roof areas
- C=0.95 for paved surface
- C=0.45 for undisturbed natural desert or desert landscape

HYDROLOGIC ANALYSIS: The hydrologic analysis is determined using the procedures in the City of Scottsdale Design Standards & Policies Manual and the Drainage Design Manual for Maricopa County, Arizona, Volume I. The Rational Method was utilized to compute the on-site peak discharges. The Rational Method equation is displayed as shown below:

$Q=C_{wt}IA$

Where: C_{wt} = The runoff coefficient relating runoff to rainfall

I = Average rainfall intensity in inches/hour, lasting for Tc

Tc = The time of concentration (Using Five minutes for the developed areas)

A = The contributing drainage area in acres

- **Drainage Area 1 (DA-1)**
  Q_{100} = (0.95)*(7.43 in/hr)*(0.21ac.) = **1.46 cfs proposed**
- **Drainage Area 2 (DA-2)**
  Q_{100} = (0.87)*(7.43 in/hr)*(0.36 ac.) = **2.32 cfs proposed**
- **Drainage Area 3 (DA-3)**
  Q_{100} = (0.82)*(7.43 in/hr)*(0.84 ac.) = **5.11 cfs proposed**
- **Drainage Area 4 (DA-4)**
  Q_{100} = (0.78)*(7.43 in/hr)*(0.43 ac.) = **2.48 cfs proposed**
- **Drainage Area 5 (DA-5)**
  Q_{100} = (0.91)*(7.43 in/hr)*(0.83 ac.) = **5.63 cfs proposed**
- **Drainage Area 6 (DA-6)**
  Q_{100} = (0.95)*(7.43 in/hr)*(0.24 ac.) = **1.70 cfs proposed**
- **Drainage Area 7 (DA-7)**
  Q_{100} = (0.45)*(7.43 in/hr)*(0.14 ac.) = **0.48 cfs proposed**
- **Drainage Area 8 (DA-8)**
  Q_{100} = (0.45)*(7.43 in/hr)*(0.09 ac.) = **0.31 cfs proposed**
- **Drainage Area 9 (DA-9)**
  Q_{100} = (0.45)*(7.43 in/hr)*(0.07 ac.) = **0.24 cfs proposed**

Overall project area includes **3.22 Acres at C_{wt} = 0.80** (Proposed conditions)
Overall site runoff = Q_{100} = **19.20 cfs**

In case of overflow, DA-1 and DA-3 overflows into DA-2, towards the ultimate outfall along Oak Street A at an ultimate outfall elevation of 1224.98. DA-4 will overflow to Hayden Road. Meanwhile, DA-5, DA-6, and DA-8 will overflow into DA-7, towards the ultimate outfall along Monte Vista Road at an ultimate outfall of 1224.87. DA-9 will overflow to Oak Street. See **Final Grading Plan** in **Appendix III** for ultimate outfall and surface outfall locations.

Refer to the **Proposed Condition Drainage Area Map** and Calculations in **Appendix II.**

4.4 STORMWATER RETENTION:

In accordance with the COS request to provide retention, the first flush retention for the entire site is calculated in this report to determine potential impact on the site. Onsite underground retention pipes are proposed. The underground storage system will comply with the City of Scottsdale underground storage policy.

REQUIRED STORAGE:

Stormwater storage for required First Flush treatment is calculated In accordance with the COS – DS&PM.
Required Retention (Acre-Feet) = (0.5"/12)*A*(C_{prop})

Based on the C-value identified in Section 4.3 above, the following retention is required for each drainage area:

Basin-1 (Underground Storage): Drainage Areas DA-1 through DA-7, C_w = 0.80
First Flush: V_r = 0.5/12*3.22 ac * 0.80 = **0.107 ac ft (4,675.44 cf) REQUIRED STORAGE**

Basin-2 (Retention Basin): Drainage Areas DA-9 , C_w = 0.45
V_r = 7.43/12*0.09 ac * 0.45 = **0.008 ac ft (331.21 cf) REQUIRED STORAGE**
V_p = 545 cf

Basin-3 (Retention Basin): Drainage Areas DA-8 , C_w = 0.45
V_r = 7.43/12*0.07ac * 0.45 = **0.006 ac ft (250.05 cf) REQUIRED STORAGE**
V_p = 380 cf

Note: for first flush purposes, an environmental structure such as a Maxwell-Plus Dual Chamber Dry Well will be installed.

STORAGE PROVIDED:

Retention Basin 1 (Underground Storage Pipes):

Storage volume of underground piping is calculated using V = $\pi r^2 L$.

- One proposed 10' Dia. CMP storage pipe, 65 lf = 3.1416*5^2 * 65' = 5,103 cf > 4,676 cf

Retention Basin 2 (Open Retention):

BASIN 2					
ELEV.	AREA	DEPTH	AVG V	SUM V	COMMENT
(FT)	(SF)	(FT)	(CF)	(CF)	
1224.5	592			0.00	Pond Bottom
		0.50	534.42		
1225.0	1,546			534.42	HWE/Weir

Retention Basin 3 (Open Retention):

BASIN 3					
ELEV.	AREA	DEPTH	AVG V	SUM V	COMMENT
(FT)	(SF)	(FT)	(CF)	(CF)	
1224.5	419			0.00	Pond Bottom
		0.50	380.52		
1225.0	1,103			380.52	HWE/Weir

STORMWATER DISCHARGE:

For Basins with no direct bleed-off available, Drywells are proposed in the on-site storage facilities to dispose of the stormwater within thirty-six (36) hours. The calculation is as follows:

- Minimum percolating rate of a drywell (for planning purposes) = 0.1 cfs
- Volume to be drained in 36 hours = 0.1 cfs * 36 hours * 3600 sec/hour = 12,960 cf = 0.298 acre-feet.
- The number of drywells will be reduced if geotechnical testing for percolation rates determine adequate infiltration is available in the native soils at lower depths. If the percolation rate of the drywells is less than 0.1 cfs the number of drywells may have to be increased.

Basin 1 Underground Storage Pipe Provided storage = 5,103 cf
5,103 cf / 12,960 cf per drywell = 0.39 = 1 drywell required.

Basins 2 and 3 are both less than 1' deep and will not require drywells.

4.5 PIPE CAPACITY CALCULATIONS:

For the proposed drainage design, 18" HDPE pipes have been proposed to connect from the catch basins to the underground storage system. The proposed 18" storm drains can adequately convey the maximum 100-year, 2-hour event runoff, Q_{100} = **5.63 cfs** . Refer to **Appendix II** for pipe capacity calculations.

4.6 STORM DRAIN INLET CALCULATIONS

Catch basins per MAG Standard Detail 535 are proposed for storm drain inlets within the parking lots, and a riser inlet has been proposed above the underground storage pipe at the east end of Lot 4. Using a clogging factor of 0.50, the MAG 535 catch basins can convey a maximum flow of 10.30 cfs. The proposed catch basin inlets can adequately convey the maximum 100-year, 2-hour event runoff, Q_{100} = **5.91 cfs**. The proposed 30" riser can adequately convey the 100-year, 2-hour event runoff Q_{100} = **1.46 cfs**. Refer to **Appendix II** for inlet capacity calculations.

5. FLOOD SAFETY FOR

5.1 FINISHED FLOOR ELEVATIONS

This project lies in an "X" Flood Zone. Therefore, the finished floor elevation is set a minimum of 14" above the low lot outfall elevation minimum of 12 inches above the 100-year high-water elevation of any adjacent streets and drainage paths. This will ensure that each building will be well above the 100-year water level

6. CONCLUSIONS

6.1 OVERALL PROJECT:

1. The finish floor elevations will be designed a minimum of 14" above the lowest top of curb grade adjacent to the building, or 6" above the highest top of curb grade adjacent to the building, whichever is highest.
2. On-site storm water storage will be provided for the first flush storm event and discharge within 36 hours.

6.2 PROJECT PHASING:

This project will be constructed in a single phase.

7. WARNING AND DISCLAIMER OF LIABILITY

RE: following page.

8. REFERENCES

1. *Design Standards & Policies Manual, City of Scottsdale – January 2018*
2. *Drainage Design Manual for Maricopa County, Arizona, Volume I, Hydrology, Flood Control District of Maricopa County, Fourth Edition, Dec 14, 2018*
3. *Drainage Design Manual for Maricopa County, Arizona, Volume II, Hydraulics, Flood Control District of Maricopa County, Dec 14, 2018*

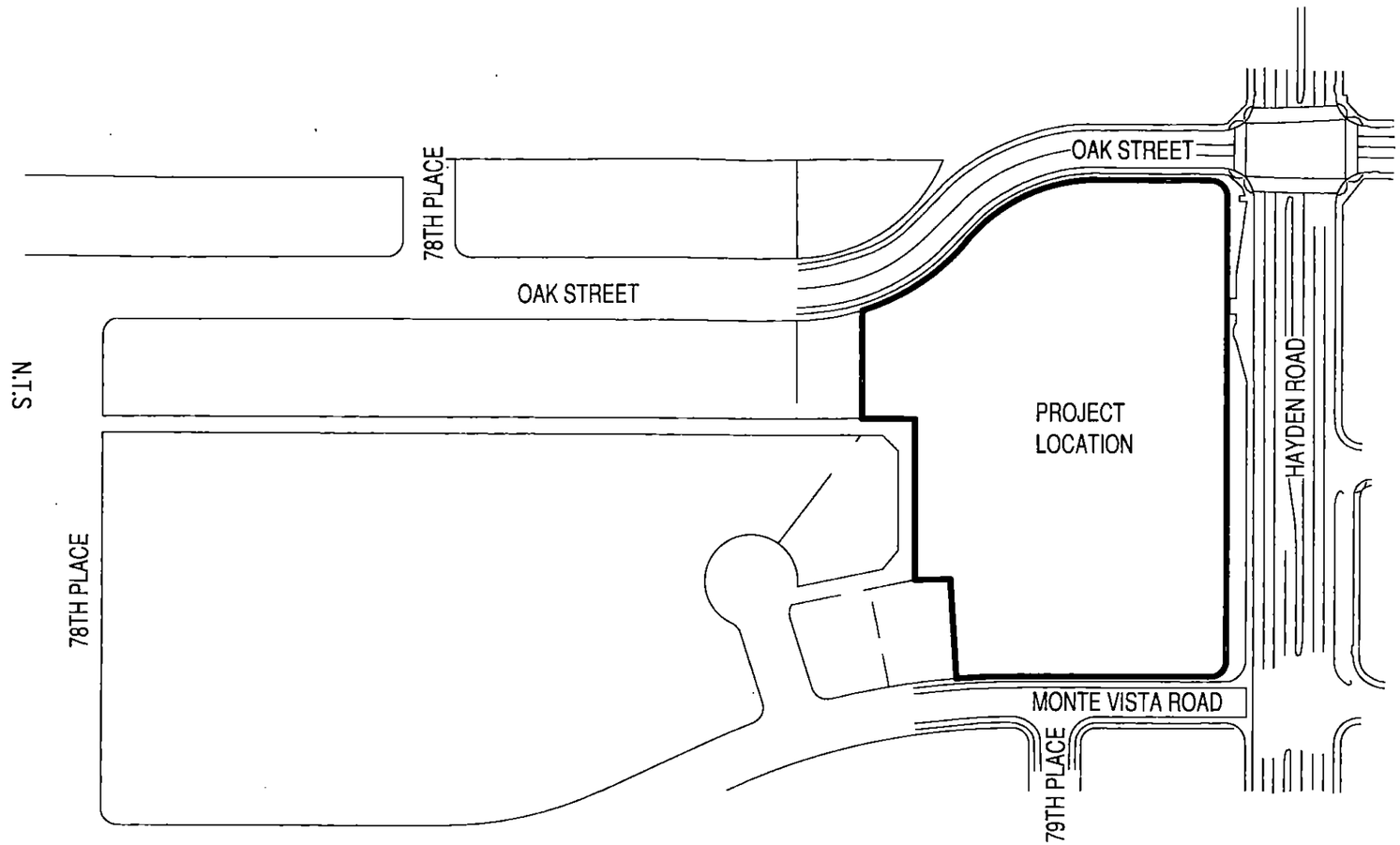


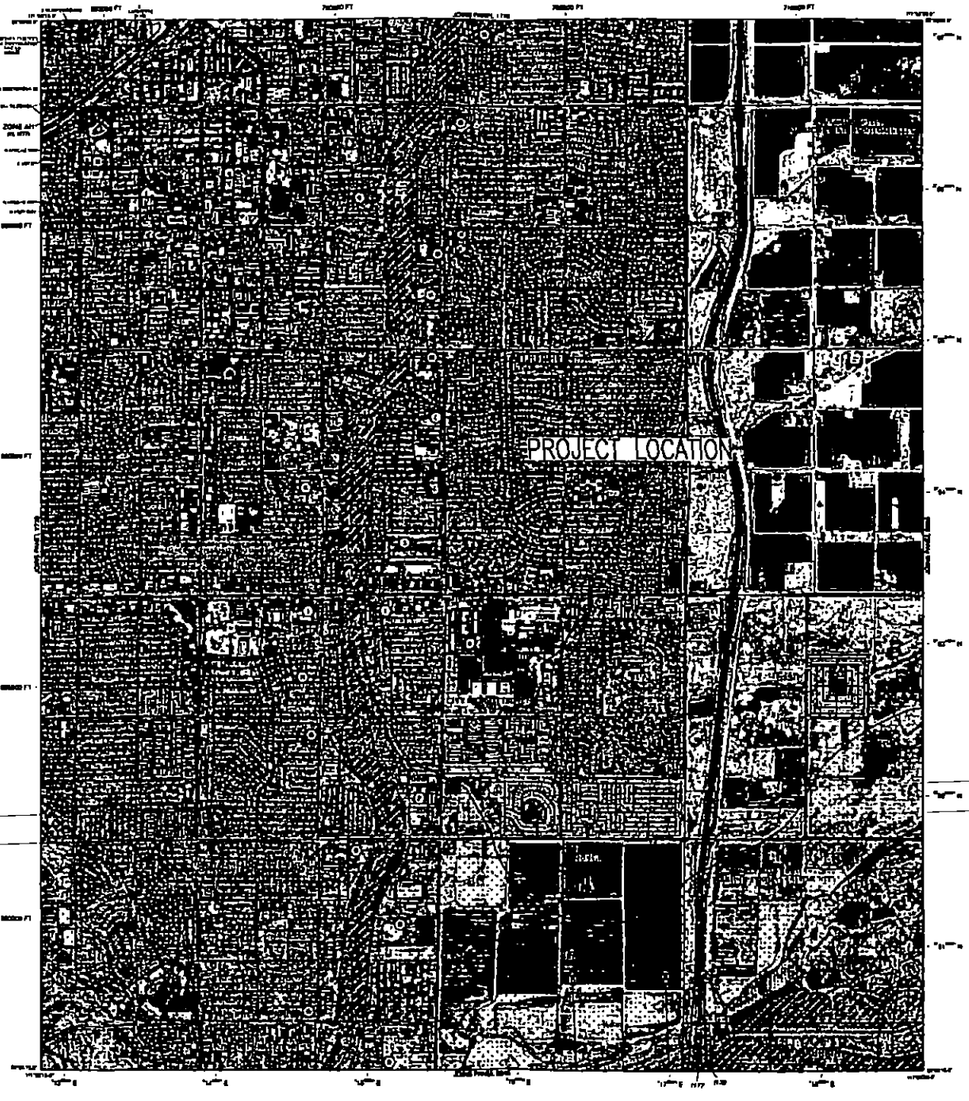
FIGURE 1
VICINITY MAP

NORTH

N.T.S

FIGURE 2 ARIAL MAP

NOTES TO USERS



LEGEND

FIRM
FLOOD INSURANCE RATE MAP
MARICOPA COUNTY, ARIZONA
AND INCORPORATED AREAS

PANEL 2235 OF 4425

NFIP
NATIONAL FLOOD INSURANCE PROGRAM

PANEL 2235L

MAP REVISED
OCTOBER 16, 2013

FIGURE 3
FIRM MAP

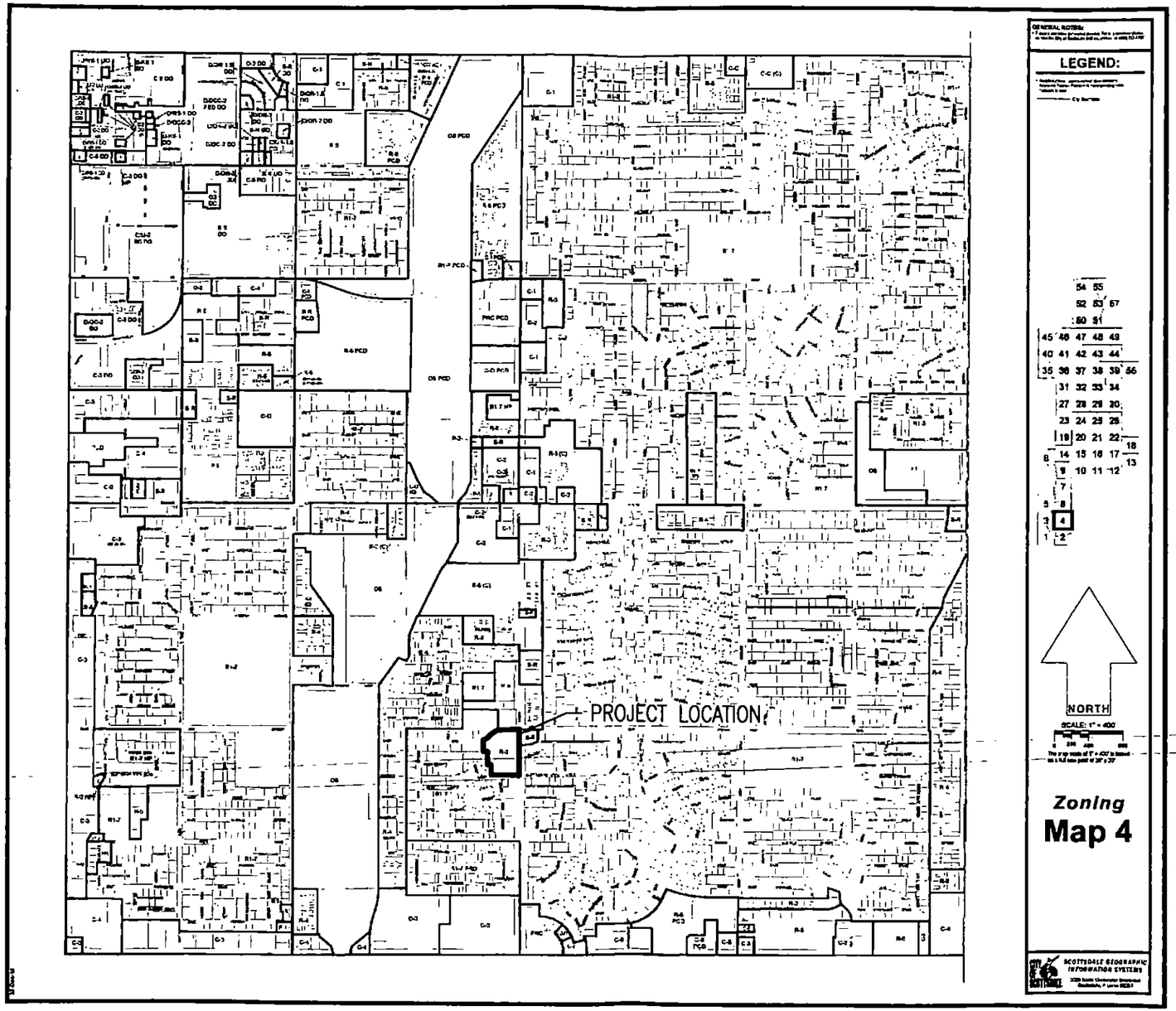


FIGURE 4
QUARTER
SECTION
MAP

GRADING & DRAINAGE LANGUAGE

WARNING AND DISCLAIMER OF LIABILITY

The City's Stormwater and Floodplain Management Ordinance is intended to minimize the occurrence of losses, hazards and conditions adversely affecting the public health, safety and general welfare which might result from flooding.

The Stormwater and Floodplain Management Ordinance identifies floodplains, floodways, flood fringes and special flood hazard areas. However, a property outside these areas could be inundated by floods. Also, much of the city is a dynamic flood area; floodways, floodplains, flood fringes and special flood hazard areas may shift from one location to another, over time, due to natural processes.

WARNING AND DISCLAIMER OF LIABILITY

The flood protection provided by the Stormwater and Floodplain Management Ordinance is considered reasonable for regulatory purposes and is based on scientific and engineering considerations. Floods larger than the base flood can and will occur on rare occasions. Floodwater heights may be increased by constructed or natural causes. The Stormwater and Floodplain Management Ordinance does not create liability on the part of the city, any officer or employee thereof, or the federal, state or county government for any flood damages that result from reliance on the Ordinance or any administrative decision lawfully made thereunder.

Compliance with the Stormwater and Floodplain Management Ordinance does not ensure complete protection from flooding. Flood-related problems such as natural erosion, streambed meander, or constructed obstructions and diversions may occur and have an adverse effect in the event of a flood. You are advised to consult your own engineer or other expert regarding these considerations.

I have read and understand the above.

Plan Check #	Owner	Date

Location name: Scottsdale, Arizona, USA*
Latitude: 33.4723°, Longitude: -111.9096°
Elevation: 1221.9 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]

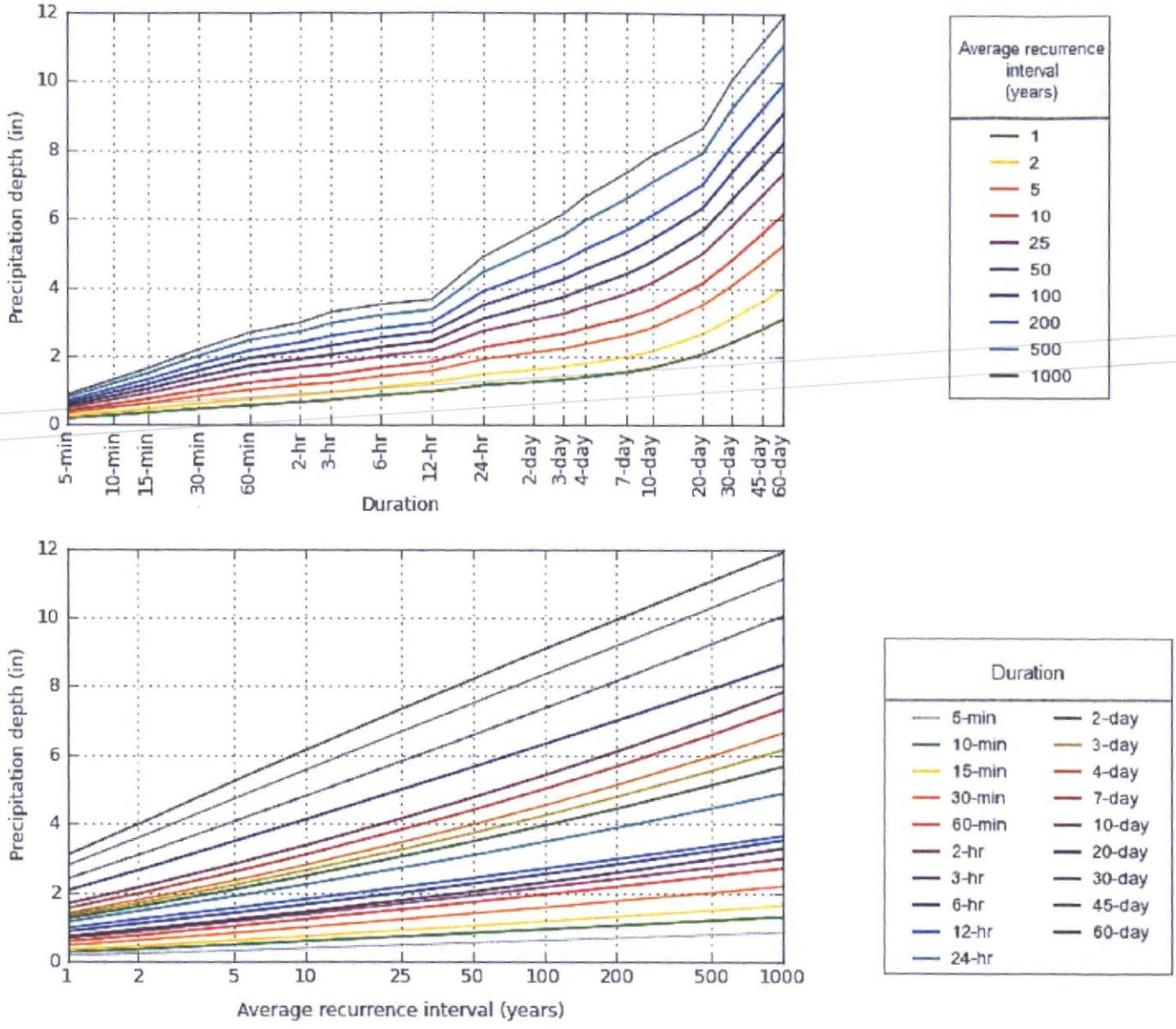
Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.183 (0.153-0.222)	0.239 (0.201-0.290)	0.324 (0.272-0.393)	0.390 (0.325-0.471)	0.479 (0.393-0.576)	0.549 (0.444-0.656)	0.619 (0.491-0.738)	0.691 (0.539-0.823)	0.788 (0.598-0.939)	0.861 (0.641-1.03)
10-min	0.278 (0.233-0.338)	0.363 (0.306-0.442)	0.494 (0.414-0.598)	0.594 (0.495-0.717)	0.730 (0.598-0.876)	0.835 (0.675-0.998)	0.942 (0.747-1.12)	1.05 (0.820-1.25)	1.20 (0.910-1.43)	1.31 (0.976-1.57)
15-min	0.344 (0.289-0.419)	0.450 (0.380-0.548)	0.612 (0.513-0.742)	0.736 (0.613-0.888)	0.905 (0.741-1.09)	1.04 (0.837-1.24)	1.17 (0.926-1.39)	1.30 (1.02-1.55)	1.49 (1.13-1.77)	1.63 (1.21-1.94)
30-min	0.464 (0.389-0.564)	0.606 (0.511-0.738)	0.824 (0.691-0.999)	0.992 (0.826-1.20)	1.22 (0.998-1.46)	1.40 (1.13-1.67)	1.57 (1.25-1.87)	1.76 (1.37-2.09)	2.00 (1.52-2.38)	2.19 (1.63-2.61)
60-min	0.574 (0.481-0.699)	0.750 (0.633-0.913)	1.02 (0.855-1.24)	1.23 (1.02-1.48)	1.51 (1.24-1.81)	1.73 (1.40-2.06)	1.95 (1.54-2.32)	2.17 (1.70-2.59)	2.48 (1.88-2.95)	2.71 (2.02-3.23)
2-hr	0.665 (0.567-0.793)	0.861 (0.735-1.03)	1.15 (0.980-1.37)	1.38 (1.16-1.63)	1.68 (1.40-1.98)	1.92 (1.57-2.25)	2.16 (1.74-2.54)	2.40 (1.90-2.82)	2.73 (2.11-3.21)	2.99 (2.26-3.54)
3-hr	0.723 (0.614-0.868)	0.927 (0.791-1.12)	1.22 (1.03-1.46)	1.45 (1.22-1.73)	1.78 (1.47-2.11)	2.03 (1.66-2.41)	2.30 (1.85-2.72)	2.58 (2.04-3.05)	2.97 (2.27-3.52)	3.29 (2.45-3.90)
6-hr	0.869 (0.754-1.02)	1.10 (0.959-1.30)	1.41 (1.22-1.66)	1.66 (1.43-1.94)	2.00 (1.69-2.32)	2.27 (1.89-2.62)	2.54 (2.09-2.94)	2.83 (2.28-3.27)	3.22 (2.52-3.73)	3.52 (2.70-4.10)
12-hr	0.972 (0.851-1.13)	1.23 (1.08-1.42)	1.56 (1.36-1.80)	1.82 (1.57-2.09)	2.16 (1.86-2.49)	2.43 (2.06-2.79)	2.71 (2.26-3.10)	2.98 (2.46-3.43)	3.36 (2.70-3.88)	3.65 (2.88-4.25)
24-hr	1.16 (1.04-1.29)	1.47 (1.32-1.64)	1.90 (1.71-2.13)	2.24 (2.00-2.51)	2.72 (2.41-3.03)	3.09 (2.73-3.44)	3.49 (3.05-3.88)	3.89 (3.38-4.33)	4.45 (3.82-4.96)	4.89 (4.16-5.47)
2-day	1.25 (1.12-1.40)	1.60 (1.44-1.79)	2.10 (1.88-2.35)	2.50 (2.23-2.79)	3.05 (2.71-3.41)	3.50 (3.08-3.90)	3.96 (3.47-4.43)	4.45 (3.87-4.98)	5.13 (4.41-5.75)	5.67 (4.83-6.38)
3-day	1.32 (1.19-1.48)	1.69 (1.52-1.89)	2.22 (1.99-2.48)	2.65 (2.36-2.96)	3.25 (2.89-3.63)	3.74 (3.29-4.17)	4.25 (3.72-4.74)	4.79 (4.16-5.35)	5.55 (4.76-6.20)	6.16 (5.23-6.91)
4-day	1.39 (1.25-1.56)	1.78 (1.60-1.99)	2.35 (2.10-2.62)	2.80 (2.50-3.13)	3.45 (3.06-3.85)	3.98 (3.51-4.43)	4.54 (3.97-5.06)	5.13 (4.45-5.72)	5.97 (5.11-6.66)	6.65 (5.63-7.44)
7-day	1.54 (1.38-1.72)	1.97 (1.77-2.21)	2.60 (2.32-2.90)	3.10 (2.77-3.47)	3.82 (3.39-4.27)	4.40 (3.88-4.90)	5.02 (4.39-5.60)	5.67 (4.92-6.33)	6.59 (5.64-7.36)	7.34 (6.22-8.21)
10-day	1.68 (1.50-1.87)	2.14 (1.93-2.40)	2.83 (2.53-3.15)	3.38 (3.02-3.76)	4.15 (3.68-4.61)	4.76 (4.20-5.29)	5.42 (4.75-6.02)	6.11 (5.31-6.79)	7.07 (6.07-7.87)	7.85 (6.67-8.75)
20-day	2.06 (1.85-2.29)	2.65 (2.38-2.95)	3.49 (3.14-3.88)	4.13 (3.70-4.59)	4.99 (4.45-5.54)	5.66 (5.02-6.28)	6.33 (5.60-7.03)	7.01 (6.17-7.80)	7.93 (6.91-8.84)	8.64 (7.47-9.65)
30-day	2.40 (2.16-2.67)	3.09 (2.78-3.44)	4.07 (3.65-4.52)	4.82 (4.31-5.33)	5.82 (5.18-6.44)	6.59 (5.85-7.28)	7.37 (6.51-8.15)	8.17 (7.18-9.04)	9.24 (8.07-10.3)	10.1 (8.71-11.2)
45-day	2.79 (2.51-3.10)	3.59 (3.24-3.99)	4.73 (4.26-5.25)	5.57 (5.00-6.18)	6.68 (5.98-7.40)	7.51 (6.70-8.33)	8.36 (7.42-9.27)	9.20 (8.13-10.2)	10.3 (9.04-11.5)	11.1 (9.71-12.4)
60-day	3.09 (2.79-3.42)	3.99 (3.60-4.41)	5.24 (4.73-5.80)	6.15 (5.53-6.80)	7.34 (6.59-8.11)	8.22 (7.35-9.09)	9.10 (8.10-10.1)	9.95 (8.83-11.0)	11.1 (9.77-12.3)	11.9 (10.4-13.3)

[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.

PDS-based depth-duration-frequency (DDF) curves
Latitude: 33.4723°, Longitude: -111.9096°



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Version 5
Location name: Scottsdale, Arizona, USA*
Latitude: 33.4723°, Longitude: -111.9096°
Elevation: 1221.9 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/hour)[1]

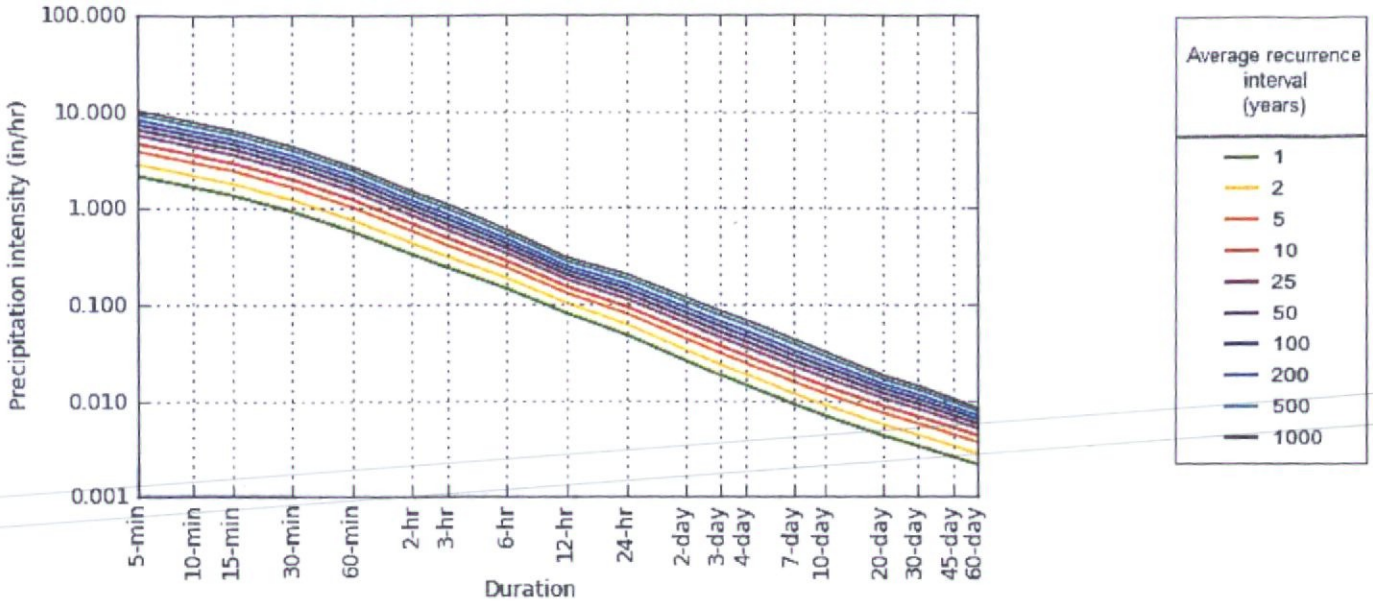
Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	2.20 (1.84-2.66)	2.87 (2.41-3.48)	3.89 (3.26-4.72)	4.68 (3.90-5.65)	5.75 (4.72-6.91)	6.59 (5.33-7.87)	7.43 (5.89-8.86)	8.29 (6.47-9.88)	9.46 (7.18-11.3)	10.3 (7.69-12.3)
10-min	1.67 (1.40-2.03)	2.18 (1.84-2.65)	2.96 (2.48-3.59)	3.56 (2.97-4.30)	4.38 (3.59-5.26)	5.01 (4.05-5.99)	5.65 (4.48-6.74)	6.31 (4.92-7.51)	7.19 (5.46-8.57)	7.87 (5.86-9.39)
15-min	1.38 (1.16-1.68)	1.80 (1.52-2.19)	2.45 (2.05-2.97)	2.94 (2.45-3.55)	3.62 (2.96-4.34)	4.14 (3.35-4.95)	4.67 (3.70-5.57)	5.22 (4.07-6.21)	5.94 (4.51-7.08)	6.50 (4.84-7.76)
30-min	0.928 (0.778-1.13)	1.21 (1.02-1.48)	1.65 (1.38-2.00)	1.98 (1.65-2.39)	2.44 (2.00-2.93)	2.79 (2.25-3.33)	3.15 (2.50-3.75)	3.51 (2.74-4.18)	4.00 (3.04-4.77)	4.38 (3.26-5.23)
60-min	0.574 (0.481-0.699)	0.750 (0.633-0.913)	1.02 (0.855-1.24)	1.23 (1.02-1.48)	1.51 (1.24-1.81)	1.73 (1.40-2.06)	1.95 (1.54-2.32)	2.17 (1.70-2.59)	2.48 (1.88-2.95)	2.71 (2.02-3.23)
2-hr	0.332 (0.284-0.396)	0.430 (0.368-0.514)	0.577 (0.490-0.686)	0.688 (0.578-0.816)	0.841 (0.698-0.991)	0.958 (0.784-1.13)	1.08 (0.870-1.27)	1.20 (0.951-1.41)	1.37 (1.06-1.61)	1.49 (1.13-1.77)
3-hr	0.241 (0.204-0.289)	0.309 (0.263-0.373)	0.406 (0.344-0.488)	0.483 (0.406-0.577)	0.591 (0.490-0.702)	0.677 (0.553-0.802)	0.767 (0.615-0.907)	0.860 (0.678-1.02)	0.990 (0.757-1.17)	1.10 (0.816-1.30)
6-hr	0.145 (0.126-0.171)	0.184 (0.160-0.216)	0.236 (0.204-0.277)	0.277 (0.238-0.324)	0.334 (0.283-0.387)	0.379 (0.316-0.437)	0.425 (0.349-0.491)	0.472 (0.380-0.547)	0.537 (0.422-0.623)	0.588 (0.451-0.685)
12-hr	0.081 (0.071-0.093)	0.102 (0.089-0.118)	0.129 (0.113-0.149)	0.151 (0.131-0.173)	0.180 (0.154-0.206)	0.202 (0.171-0.231)	0.225 (0.188-0.258)	0.248 (0.204-0.284)	0.279 (0.224-0.322)	0.303 (0.239-0.352)
24-hr	0.048 (0.043-0.054)	0.061 (0.055-0.069)	0.079 (0.071-0.089)	0.094 (0.084-0.104)	0.113 (0.101-0.126)	0.129 (0.114-0.144)	0.145 (0.127-0.162)	0.162 (0.141-0.181)	0.186 (0.159-0.207)	0.204 (0.173-0.228)
2-day	0.026 (0.023-0.029)	0.033 (0.030-0.037)	0.044 (0.039-0.049)	0.052 (0.046-0.058)	0.064 (0.056-0.071)	0.073 (0.064-0.081)	0.083 (0.072-0.092)	0.093 (0.081-0.104)	0.107 (0.092-0.120)	0.118 (0.101-0.133)
3-day	0.018 (0.016-0.021)	0.023 (0.021-0.026)	0.031 (0.028-0.035)	0.037 (0.033-0.041)	0.045 (0.040-0.050)	0.052 (0.046-0.058)	0.059 (0.052-0.066)	0.067 (0.058-0.074)	0.077 (0.066-0.086)	0.086 (0.073-0.096)
4-day	0.014 (0.013-0.016)	0.019 (0.017-0.021)	0.024 (0.022-0.027)	0.029 (0.026-0.033)	0.036 (0.032-0.040)	0.041 (0.037-0.046)	0.047 (0.041-0.053)	0.053 (0.046-0.060)	0.062 (0.053-0.069)	0.069 (0.059-0.077)
7-day	0.009 (0.008-0.010)	0.012 (0.011-0.013)	0.015 (0.014-0.017)	0.018 (0.016-0.021)	0.023 (0.020-0.025)	0.026 (0.023-0.029)	0.030 (0.026-0.033)	0.034 (0.029-0.038)	0.039 (0.034-0.044)	0.044 (0.037-0.049)
10-day	0.007 (0.006-0.008)	0.009 (0.008-0.010)	0.012 (0.011-0.013)	0.014 (0.013-0.016)	0.017 (0.015-0.019)	0.020 (0.018-0.022)	0.023 (0.020-0.025)	0.025 (0.022-0.028)	0.029 (0.025-0.033)	0.033 (0.028-0.036)
20-day	0.004 (0.004-0.005)	0.006 (0.005-0.006)	0.007 (0.007-0.008)	0.009 (0.008-0.010)	0.010 (0.009-0.012)	0.012 (0.010-0.013)	0.013 (0.012-0.015)	0.015 (0.013-0.016)	0.017 (0.014-0.018)	0.018 (0.016-0.020)
30-day	0.003 (0.003-0.004)	0.004 (0.004-0.005)	0.006 (0.005-0.006)	0.007 (0.006-0.007)	0.008 (0.007-0.009)	0.009 (0.008-0.010)	0.010 (0.009-0.011)	0.011 (0.010-0.013)	0.013 (0.011-0.014)	0.014 (0.012-0.016)
45-day	0.003 (0.002-0.003)	0.003 (0.003-0.004)	0.004 (0.004-0.005)	0.005 (0.005-0.006)	0.006 (0.006-0.007)	0.007 (0.006-0.008)	0.008 (0.007-0.009)	0.009 (0.008-0.009)	0.010 (0.008-0.011)	0.010 (0.009-0.011)
60-day	0.002 (0.002-0.002)	0.003 (0.002-0.003)	0.004 (0.003-0.004)	0.004 (0.004-0.005)	0.005 (0.005-0.006)	0.006 (0.005-0.006)	0.006 (0.006-0.007)	0.007 (0.006-0.008)	0.008 (0.007-0.009)	0.008 (0.007-0.009)

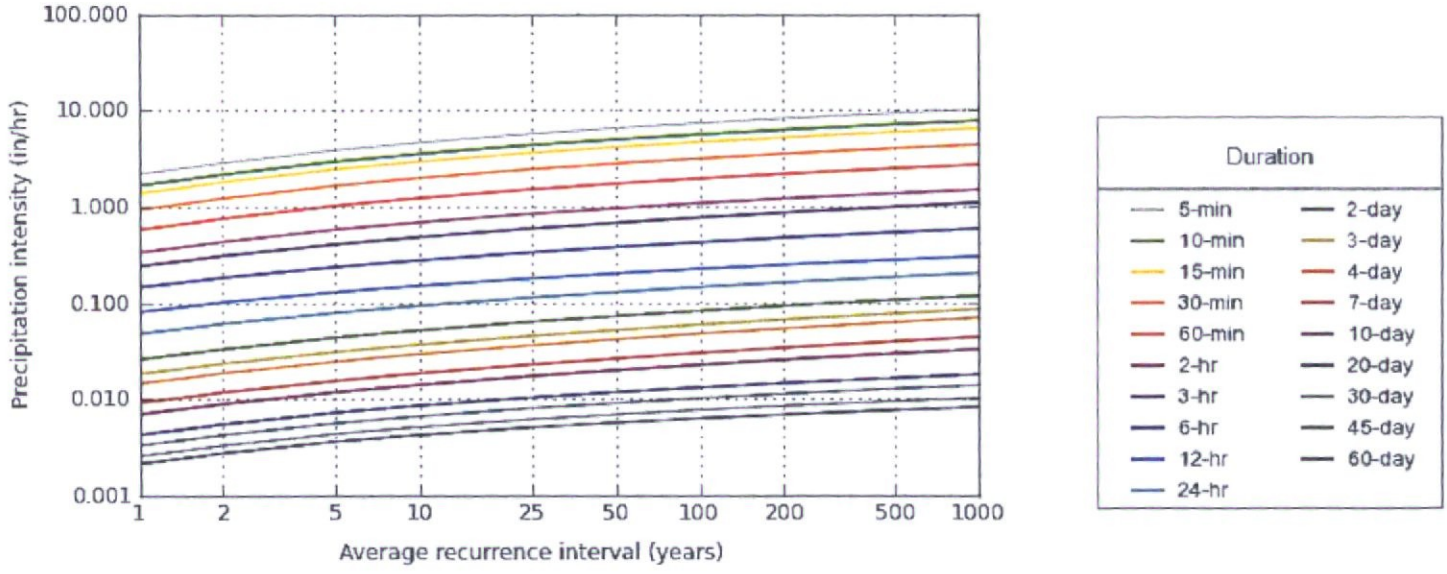
[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

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.

PDS-based intensity-duration-frequency (IDF) curves
Latitude: 33.4723°, Longitude: -111.9096°





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APPENDIX II

Calculations

2. A rainfall runoff model using the USACE's HEC 1 Flood Hydrograph Package (generally used for watersheds that are larger than 160 acres, irregular in shape and contour, or if routing of flows is necessary).

B. **Watershed Conditions**

Watersheds are subject to change. Grading and drainage plans shall consider all watershed conditions that would result in the greatest peak discharge rate, to:

1. Size drainage facilities, and
2. Determine lowest floor elevations.

C. **Split-Flow Conditions**

Projects in northern parts of Scottsdale must address split-flow channel conditions where applicable. These splits in the alluvial channels usually include highly erosive soils and are generally unstable and unpredictable. In setting lowest floor elevations relative to upstream splits, assume that 100% of the flow could go either direction in any given flood event. For infrastructure design, the estimate of the actual split, based on a hydraulic analysis of the current channel cross sections, must include a minimum safety factor of 30% of the total flow. If there are extenuating factors affecting the stability of the split, the safety factor should be increased accordingly.

D. **Environmentally Sensitive Lands**

For special considerations regarding Environmentally Sensitive Lands, refer to the City Zoning Ordinance and DSPM Chapter 2 Section 2-2. Modification of natural watercourses with a flow of 50 cfs or greater are addressed in the City Zoning Ordinance.

E. **The Rational Method**

1. Precipitation. Precipitation input is rainfall intensity, "i," and can be obtained directly from NOAA 14.
2. Time of Concentration. Time of concentration "t_c" is the total time of travel from the most hydraulically remote part of the watershed to the concentration point of interest. The calculation of "t_c" must follow FCDMC Hydrology Manual procedures.
3. Runoff Coefficients. Use Fig. 4-1.5, Runoff Coefficients for Use with Rational Method, or equivalent to obtain the runoff coefficients or "C" values. Composite "C" values for the appropriate zoning category or weighted average values calculated for the specific site are both acceptable approaches.

RUNOFF COEFFICIENTS – "C" VALUE

LAND USE	STORM FREQUENCY		
Composite Area-wide Values	2-25 Year	50 Year	100 Year
Commercial & Industrial Areas	0.80	0.83	0.86
Residential Areas – Single Family, slopes 10% or less			
R1-190	0.33	0.50	0.53
R1-130	0.35	0.51	0.59

R1-70	0.37	0.52	0.60
R1-43	0.38	0.55	0.61
R1-35	0.40	0.56	0.62
R1-18	0.43	0.58	0.64
R1-10	0.47	0.62	0.70
R1-7	0.51	0.66	0.80
R1-5	0.54	0.69	0.86
Residential Areas – Single Family, slopes greater than 10%			
R1-190	0.65	0.74	0.82
R1-130	0.68	0.76	0.84
R1-70	0.69	0.77	0.85
R1-43	0.70	0.77	0.85
R1-35	0.70	0.78	0.85
R1-18	0.71	0.79	0.86
R1-10	0.75	0.82	0.88
R1-7	0.81	0.86	0.91
R1-5	0.85	0.89	0.92
Townhouse (R-2, R-4)	0.63	0.74	0.94
Apartments & Condominiums (Condos) (R-3, R-5)	0.76	0.83	0.94
Specified Surface Type Values			
Paved streets, parking lots (concrete or asphalt), roofs, driveways, etc.	0.90	0.93	0.95
Lawns, golf courses, & parks (grassed areas)	0.20	0.25	0.30
Undisturbed natural desert or desert landscaping (no impervious weed barrier)	0.37	0.42	0.45
Desert landscaping (with impervious weed barrier)	0.63	0.73	0.83
Mountain terrain - slopes greater than 10%	0.60	0.70	0.80
Agricultural areas (flood irrigated fields)	0.16	0.18	0.20
Gravel floodways and shoulders	0.68	0.78	0.82

FIGURE 4-1.5 RUNOFF COEFFICIENTS FOR RATIONAL METHOD

F. **HEC-1 Model**

1. Minimum submittals
   a. A printout of the input data.
   b. A schematic (routing) diagram of the stream network.
   c. The runoff summary output table, including drainage basin name, area, 2, 10, and 100- year flow values.
   d. Electronic input file(s) on compact disc (CD) or digital versatile/video disc (DVD).
   e. Supporting documentation and source material for parameter selection.

Weighted Runoff Coefficient-Calculations (Cw)

PROPOSED OVERALL SITE C_w					
	BUILDING or CONCRETE	ASPHALT	DESERT LANDSCAPE	TOTAL AREA	Cwt
C-VALUE	0.95	0.95	0.45		
AREA (ac)	1.22	1.20	0.63	**3.22**	**0.80**
DA-1	0.00	0.21	0.00	0.21	0.95
DA-2	0.13	0.17	0.06	0.36	0.87
DA-3	0.62	0.00	0.22	0.84	0.82
DA-4	0.00	0.28	0.14	0.43	0.78
DA-5	0.47	0.30	0.06	0.83	0.91
DA-6	0.00	0.24	0.00	0.24	0.95
DA-7	0.00	0.00	0.14	0.14	0.45
DA-8	0.00	0.00	0.09	0.09	0.45
DA-9	0.00	0.00	0.07	0.07	0.45

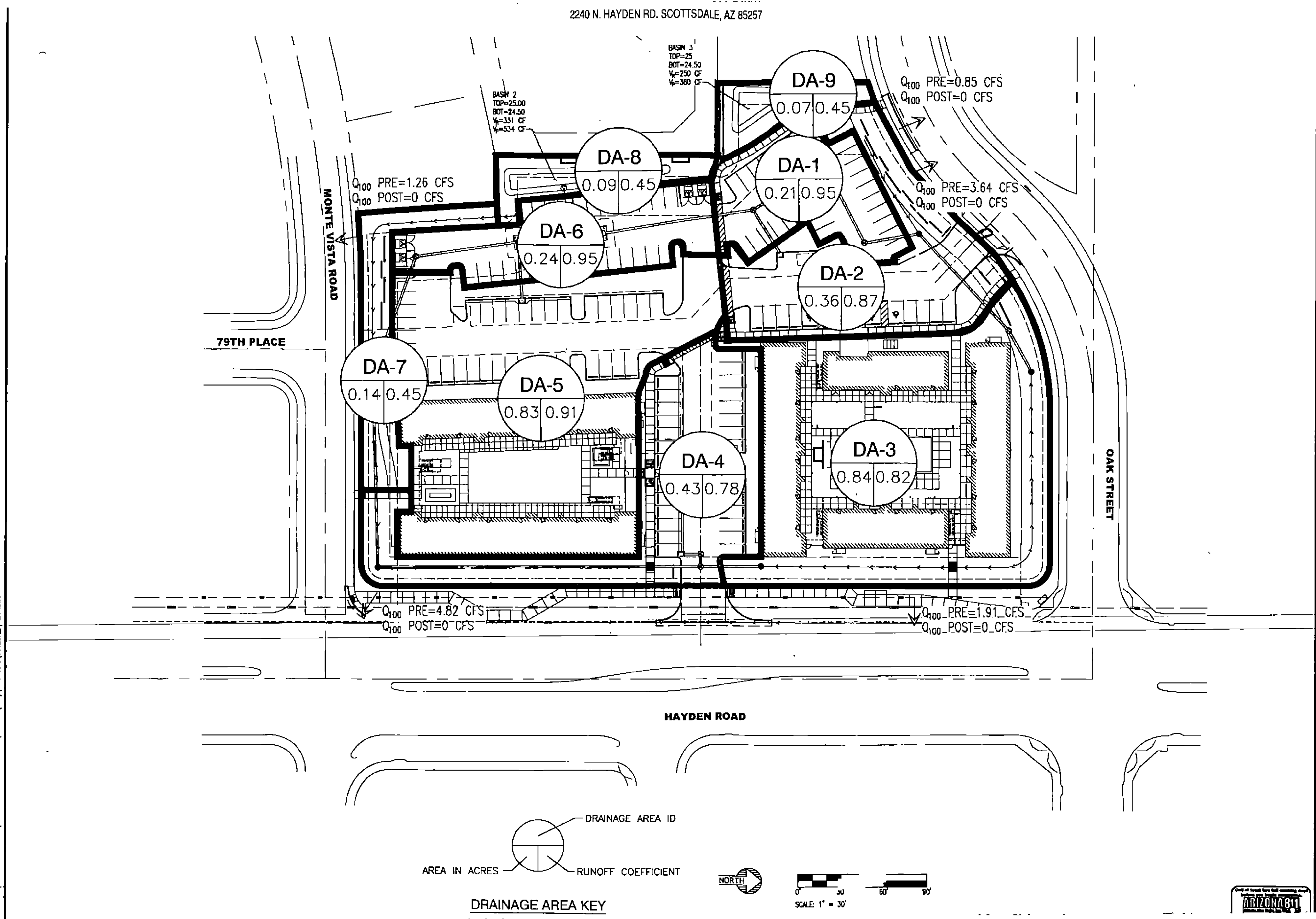
EXISTING OVERALL SITE C_w					
	BUILDING or CONCRETE	ASPHALT	DESERT LANDSCAPE	TOTAL AREA	Cwt
C-VALUE	0.95	0.95	0.45		
AREA (ac)	0.25	1.05	1.91	**3.22**	**0.65**
EX-1	0.25	0.00	0.61	0.86	0.60
EX-2	0.00	0.27	0.00	0.27	0.95
EX-3	0.00	0.64	0.10	0.73	0.88
EX-4	0.00	0.07	0.23	0.30	0.57
EX-5	0.00	0.00	0.88	0.88	0.45
EX-6	0.00	0.08	0.09	0.17	0.68

Required Storage Volume Calculations

						Vr=1*(P/12)*Cw*A P=100-yr, 2-hr=2.16 in.
Drainage Area ID	Area (acres)	C_w (-)	intensity (in/hr)	Q (cfs)	Volume Req. (acre-ft)	Volume Req. (CF)
RETENTION BASIN 1						
DA-1	0.21	0.95	7.43	1.46	0.035	1,545.51
DA-2	0.36	0.87	7.43	2.32	0.056	2,453.03
DA-3	0.84	0.82	7.43	5.11	0.124	5,393.92
Basin 1 Totals:	**1.41**	**0.85**		**8.90**	**0.216**	**9,392.46**
RETENTION BASIN 2						
DA-4	0.43	0.78	7.43	2.48	0.060	2,615.77
DA-5	0.83	0.91	7.43	5.63	0.136	5,943.22
DA-6	0.24	0.95	7.43	1.70	0.041	1,795.51
DA-7	0.14	0.45	7.43	0.48	0.012	510.06
DA-8	0.09	0.45	8.43	0.36	0.008	331.21
DA-9	0.07	0.45	9.43	0.30	0.006	250.05
Basin 2 Totals:	**1.81**	**0.77**		**10.30**	**0.249**	**11,445.82**
Totals	**3.22**			**19.20**	**0.47**	**20,838.28**

Existing Required Storage Volume Calculations

						Vr=1*(P/12)*Cw*A P=100-yr, 2-hr=2.16in.
Drainage Area ID	Area (acres)	C_w (-)	intensity (in/hr)	Q (cfs)	Volume Req. (acre-ft)	Volume Req. (CF)
RETENTION BASIN 1						
EX-1	0.86	0.60	7.43	3.80	0.092	4,014.49
EX-2	0.27	0.95	7.43	1.91	0.046	2,011.17
EX-3	0.73	0.88	7.43	4.82	0.117	5,085.62
EX-4	0.30	0.57	7.43	1.26	0.031	1,333.89
EX-5	0.88	0.45	7.43	2.96	0.072	3,121.66
EX-6	0.17	0.68	7.43	0.85	0.021	896.25
Totals:	**3.22**	**0.65**		**15.60**	**0.378**	**16,463.08**
Totals	**3.22**			**15.60**	**0.38**	**16,463.08**



SEG

8280 E GELDING DR #101, SCOTTSDALE, ARIZONA 85260

WWW.AZSEG.COM TEL. 480 588 7226

GREENLIGHT COMMUNITIES

PROJECT: CABANA ON HAYDEN

LOCATION: 2240 N. HAYDEN RD. SCOTTSDALE, AZ 85257

DRAWN: AVINA

DESIGNED: AVINA

CHECKED:

PROJ. MGR: SIN

DATE: 6/17/19

ISSUED FOR: DR SUBMITTAL

REVISION NO. / DATE

JOB NO.: 181207

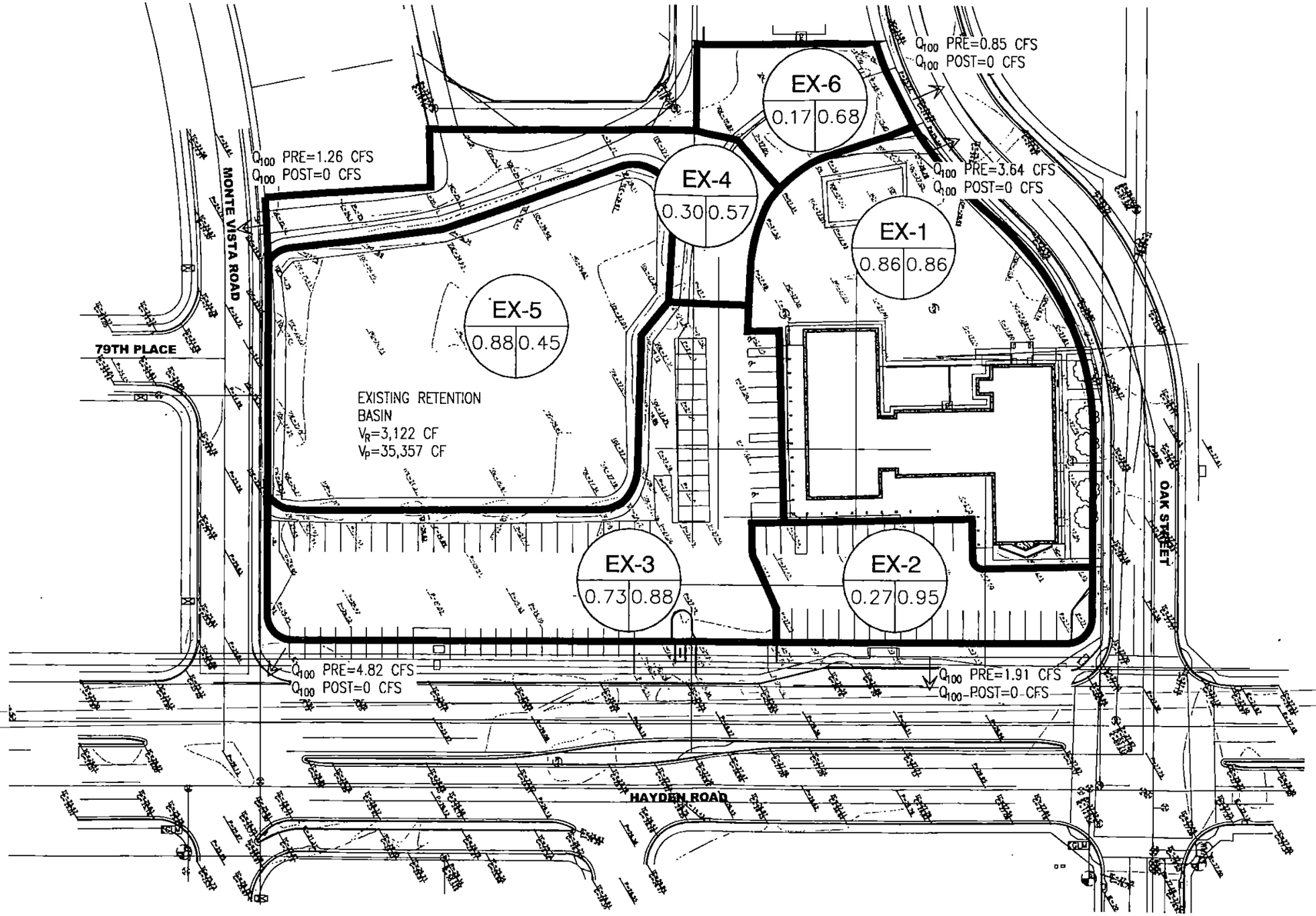
SHEET TITLE: PROPOSED CONDITION DRAINAGE AREA MAP

SHEET NO.:

-DR-2019
CHECK #: TBD

PROJECTS\DECO COMMUNITIES\CABANA ON HAYDEN 181207\11 CAD (SEG)\11.3 CD'S\181207_P-DAM.DWG

2240 N. HAYDEN RD. SCOTTSDALE, AZ 85257



SEG
8280 E GELDING DR # 101, SCOTTSDALE, ARIZONA 85260
WWW.AZSEG.COM TEL. 480 588 7228

GREENLIGHT COMMUNITIES

PROJECT: CABANA ON HAYDEN
LOCATION: 2240 N. HAYDEN RD. SCOTTSDALE, AZ 85257

DRAWN: AVINA
REVIEWED: AVINA
CHECKED:
FIELD WORK: SIN

DATE: 5/19/2019
ISSUED FOR: CONSTRUCTION DOCUMENTS

REVISION NO.:	DATE:
1	
2	
3	
4	

JOB NO.: 181207

SHEET TITLE: EXISTING CONDITION DRAINAGE AREA MAP

SHEET NO.:

DR-2019
ECK #: TBD

Call at least two full working days before you begin excavation
ARIZONA811

X:\PROJECTS\DEVCO COMMUNITIES\CABANA ON HAYDEN 181207\11 CAD (SEG)\11.3 CD'S\181207_EX-DRAI.DWG

Inlet Capacity - Sump Locations

Description: Calculation of 30" Inlet Capacity for CMP Riser Inlet
Date: March 4, 2019
Location: 2240 N. Hayden RD. Scottsdale, AZ 85257
Reference: Drainage Design Manual for Maricopa County, Vol. II, Hydraulics, pg. 3-27

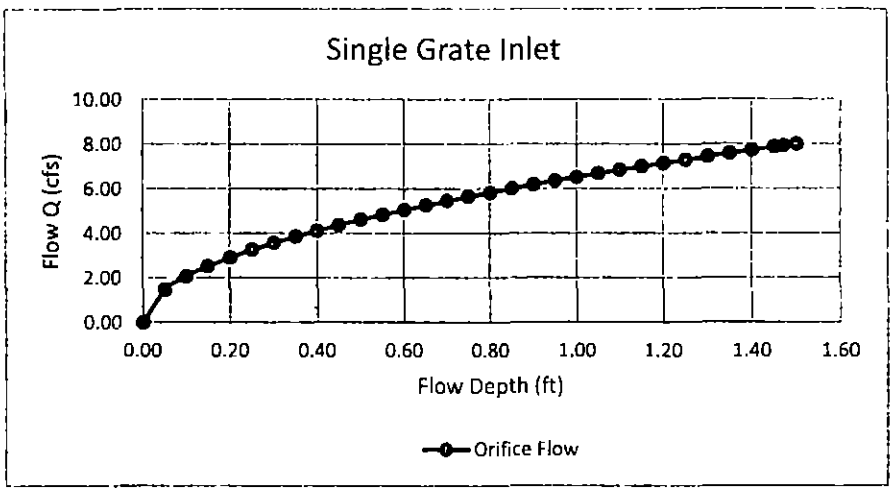
Orifice EQ. $Q_i = C_o A(2gd)^{0.5}(C_f)$

Where: $C_o = 0.67$, and C_f = clogging factor = 0.5

A = 2.43 sq.ft. where,

A = Total area of grate minus area of longitudinal & lateral bars

Depth (ft)	Orifice Qi (cfs)
0.00	0.00
0.05	1.46
0.10	2.07
0.15	2.53
0.20	2.92
0.25	3.27
0.30	3.58
0.35	3.86
0.40	4.13
0.45	4.38
0.50	**4.62**
0.55	4.84
0.60	5.06
0.65	5.27
0.70	5.47
0.75	5.66
0.80	5.84
0.85	6.02
0.90	6.20
0.95	6.37
1.00	6.53
1.05	6.69
1.10	6.85
1.15	7.01
1.20	7.16
1.25	7.30
1.30	7.45
1.35	7.59
1.40	7.73
1.45	7.87
1.47	7.92
1.50	8.00



Inlet Capacity - Sump Locations

Description: Calculation of Inlet Capacity for Single MAG 535 Catch Basin
Date: March 4, 2019
Location: 2240 N. Hayden RD. Scottsdale, AZ 85257
Reference: Drainage Design Manual for Maricopa County, Vol. II, Hydraulics, pg. 3-27

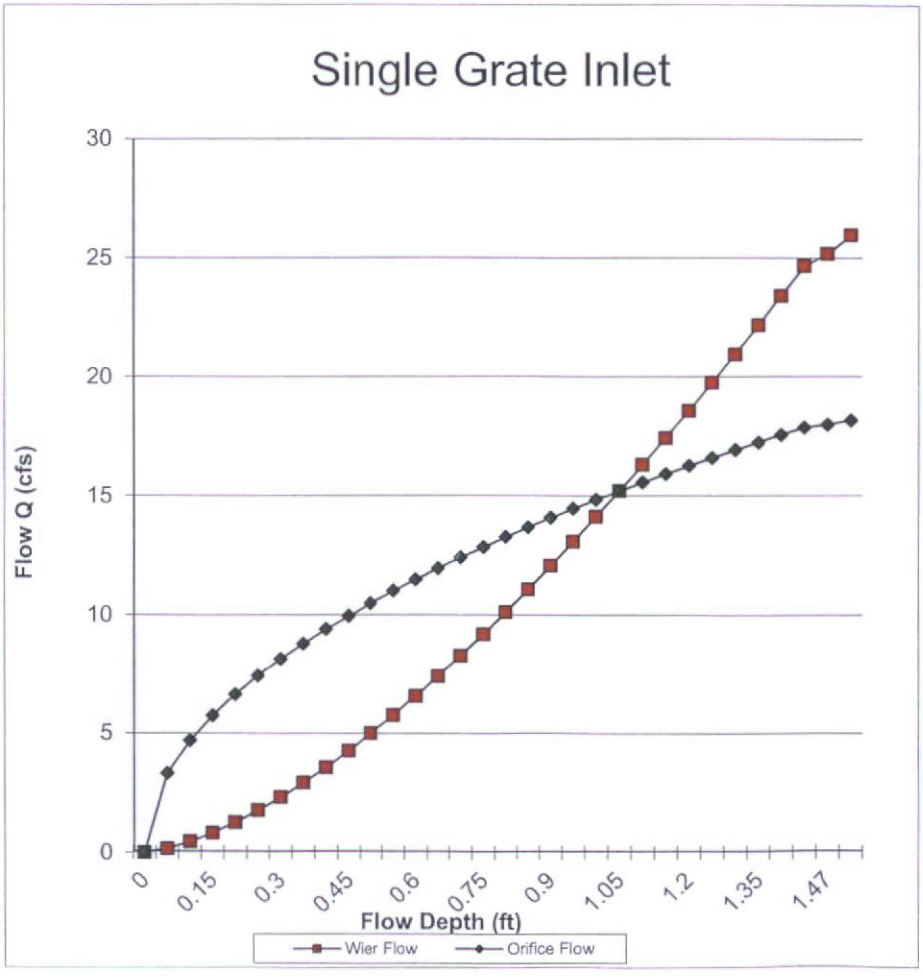
Weir EQ. $Q_i = C_w P d^{1.5} (C_f)$ **Orifice EQ.** $Q_i = C_o A (2gd)^{0.5} (C_f)$

Where: $C_w = 3.0$, $C_o = 0.67$, and C_f = clogging factor = 0.5

P =	**5.80**	**ft**
A =	**5.42**	**sq.ft.**

where,
P = Perimeter of Catchbasin minus area of longitudinal & lateral bars
A = Total area of grate minus area of longitudinal & lateral bars

Depth (ft)	Weir Qi (cfs)	Orifice Qi (cfs)
0.00	0.00	0.00
0.05	0.10	3.26
0.10	0.28	4.61
0.15	0.51	5.64
0.20	0.78	6.52
0.25	1.09	7.29
0.30	1.43	7.98
0.35	1.80	8.62
0.40	2.20	9.22
0.45	2.63	9.77
0.50	3.08	**10.30**
0.55	3.55	10.81
0.60	4.04	11.29
0.65	4.56	11.75
0.70	5.10	12.19
0.75	5.65	12.62
0.80	6.23	13.03
0.85	6.82	13.43
0.90	7.43	13.82
0.95	8.06	14.20
1.00	8.70	14.57
1.05	9.36	14.93
1.10	10.04	15.28
1.15	10.73	15.63
1.20	11.44	15.96
1.25	12.16	16.29
1.30	12.90	16.61
1.35	13.65	16.93
1.40	14.41	17.24
1.45	15.19	17.55
1.47	15.51	17.67
1.50	15.98	17.85



APPENDIX III

Grading and Drainage Plans