



CIVIL ENGINEERING / SURVEYING / PLANNING / LANDSCAPE ARCHITECTURE

## PRELIMINARY DRAINAGE REPORT

Panera, LLC  
Bakery Café #: 6263  
8970 E Shea Blvd.  
Scottsdale, AZ 85260

Date: 01/05/2021  
Cole Project #: 21-0067

**STORMWATER REVIEW BY:**  
**Mohammad Rahman, PE, CFM**  
**Phone: 480-312-2563**  
**Email: mrahman@scottsdaleaz.gov**  
**CASE #: 2-DR-2022**  
**DATE: MARH 14, 2022**  
**REVIEW CYCLE: 1ST**  
**STATUS: CORRECTIONS**

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401 S. 18<sup>th</sup> Street  
Suite 200  
St. Louis, MO 63103  
314.984.9887 tel

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## Section I Introduction

The Panera Bakery Café #6263 is a proposed redevelopment of a commercial site located at 8970 East Shea Blvd, Scottsdale, AZ.



The project is a redevelopment of an existing commercial site, previously a Red Robin Restaurant. The redevelopment of the site will include a complete tear down of the existing 7,612 SF building, construction of a new 3,949 SF Panera Café, and the addition of drive through lanes. There is an existing stormwater storage area in the Southwest corner of the site within an existing drainage easement. This easement will not be intruded upon except where the City of Scottsdale is requiring sidewalk to cross it for pedestrian access. The existing drainage patterns will remain unchanged, and no new storm water infrastructure will be needed.

The purpose of this report is to show that the proposed redevelopment project will have no adverse effects on existing drainage patterns.



The project needs to address stormwater retention requirement, first flush volume requirement, presence of existing retention basin(s) and whether or not these requirements were met as a part of this project.

## Section II      Data Analysis Methods

For this project the Rational Method was used to calculate Pre- and Post-Development runoff. The City of Scottsdale Design Standards and Policies Manual requires the evaluation of the 2-, 10-, and, 100-year storm events for calculating Pre- and Post-Development Runoff for site redevelopment. An assumed time of concentration of 5 minutes was used for both the Pre- and Post-Development calculations. The intensity in in/hr was taken from NOAA-14 and Runoff Coefficients (C-factors) were taken from the Scottsdale DSPM. For pervious landscaping on the site, the C-factor for “Desert landscaping (with impervious weed barrier)” was used.

The lowest floor elevation was set to match the existing building lowest floor elevation, assuming the existing building was designed to be higher than adjacent washes.



Should not be ASSUMED. The FFE should be set based on the maximum HWL for the existing retention basin and such elevation should be clearly stated.  
**- Typical**

**PRE DEVELOPMENT PEAK DISCHARGE (Q) VALUES 2 YEAR 5 MINUTE DESIGN STORM  
FREQUENCY**

Designation	TOTAL AREA (sf)	TOTAL AREA (ACRES)	i (2 YR 5 MIN) (in/hr)	IMPERVIOUS AREA	PERVIOUS AREA (DESERT LANDSCAPE)	COMPOSITE C	Q=CiA (in cfs)
A	8,457	0.19	3.76	7,846	611	0.88	0.64
B	34,069	0.78	3.76	31,569	2,500	0.88	2.59
C	29,198	0.67	3.76	8,973	20,225	0.71	1.80
D	18,368	0.42	3.76	16,625	1,743	0.87	1.39
<b>TOTALS</b>	90,092	2.07		65,013	25,079		6.41

**PRE DEVELOPMENT PEAK DISCHARGE (Q) VALUES 10 YEAR 5 MINUTE DESIGN STORM  
FREQUENCY**

Designation	TOTAL AREA (sf)	TOTAL AREA (ACRES)	i (10 YR 5 MIN) (in/hr)	IMPERVIOUS AREA	PERVIOUS AREA (DESERT LANDSCAPE)	COMPOSITE C	Q=CiA (in cfs)
A	8,457	0.19	6.16	7,846	611	0.88	1.05
B	34,069	0.78	6.16	31,569	2,500	0.88	4.24
C	29,198	0.67	6.16	8,973	20,225	0.71	2.94
D	18,368	0.42	6.16	16,625	1,743	0.87	2.27
<b>TOTALS</b>	90,092	2.07		65,013	25,079		10.51

**PRE DEVELOPMENT PEAK DISCHARGE (Q) VALUES 100 YEAR 5 MINUTE DESIGN STORM  
FREQUENCY**

Designation	TOTAL AREA (sf)	TOTAL AREA (ACRES)	i (100 YR 5 MIN) (in/hr)	IMPERVIOUS AREA	PERVIOUS AREA (DESERT LANDSCAPE)	COMPOSITE C	Q=CiA (in cfs)
A	8,457	0.19	10.3	7,846	611	0.94	1.88
B	34,069	0.78	10.3	31,569	2,500	0.94	7.58
C	29,198	0.67	10.3	8,973	20,225	0.87	5.98
D	18,368	0.42	10.3	16,625	1,743	0.94	4.08
<b>TOTALS</b>	90,092	2.07		65,013	25,079		19.53

**POST DEVELOPMENT PEAK DISCHARGE (Q) VALUES 2 YEAR 5 MINUTE DESIGN STORM  
FREQUENCY**

Designation	TOTAL AREA (sf)	TOTAL AREA (ACRES)	i (2 YR 5 MIN) (in/hr)	IMPERVIOUS AREA	PERVIOUS AREA (DESERT LANDSCAPE)	COMPOSIT E C	Q=CiA (in cfs)
A	8,457	0.19	3.76	7,846	611	0.88	0.64
B	33,633	0.77	3.76	30,488	3,145	0.87	2.54
C	29,198	0.67	3.76	8,115	21,083	0.71	1.78
D	18,011	0.41	3.76	16,677	1,334	0.88	1.37
<b>TOTALS</b>	89,299	2.05		63,126	26,173		6.33

**POST DEVELOPMENT PEAK DISCHARGE (Q) VALUES 10 YEAR MINUTE DESIGN STORM FREQUENCY**

Designation	TOTAL AREA (sf)	TOTAL AREA (ACRES)	i (10 YR 5 MIN) (in/hr)	IMPERVIOUS AREA	PERVIOUS AREA (DESERT LANDSCAPE)	COMPOSIT E C	Q=CiA (in cfs)
A	8,457	0.19	6.16	7,846	611	0.88	1.05
B	33,633	0.77	6.16	30,488	3,145	0.87	4.16
C	29,198	0.67	6.16	8,115	21,083	0.71	2.91
D	18,011	0.41	6.16	16,677	1,334	0.88	2.24
<b>TOTALS</b>	89,299	2.05		63,126	26,173		10.37

**POST DEVELOPMENT PEAK DISCHARGE (Q) VALUES 100 YEAR 5 MINUTE DESIGN STORM  
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A	8,457	0.19	10.3	7,846	611	0.94	1.88
B	33,633	0.77	10.3	30,488	3,145	0.94	7.47
C	29,198	0.67	10.3	8,115	21,083	0.86	5.96
D	18,011	0.41	10.3	16,677	1,334	0.94	4.01
<b>TOTALS</b>	89,299	2.05		63,126	26,173		19.32

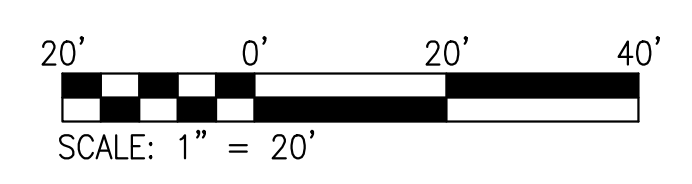
## **Section III            Conclusions**

Our calculations using the rational method, existing and proposed site condition, and parameters from the City of Scottsdale and NOAA-14 show that the proposed redevelopment of the site will result in less runoff than the existing conditions, and therefore will not need any changes to the existing stormwater system.

**Section IV      References and Appendices**

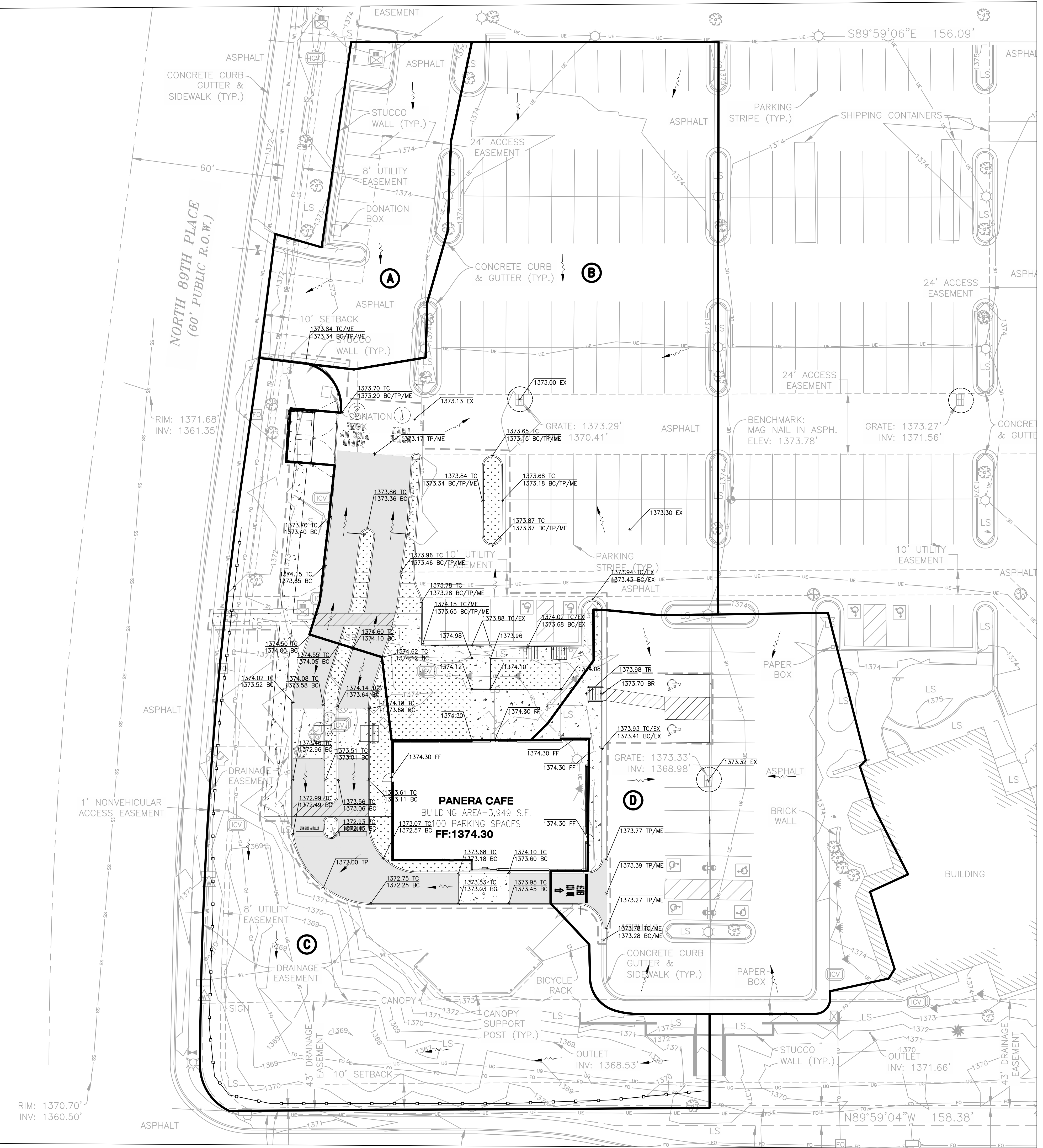
**Appendix A**  
**Post-Development Drainage Area Map**

USER: Paul Henderson TAB: C5.0  
 DATE: January 4, 2022 - 3:12:55 PM  
 DRAWING: S:\085\0852021\21-0067\Design\Survey\Hydraulic\Cola\Drainage\Report\LD\_PLAN\_GROUND\_21-0067.dwg



### GRADING ABBREVIATIONS

- BC BOTTOM OF CURB FACE
- TC TOP OF CURB FACE
- BR BOTTOM OF RAMP
- TR TOP OF RAMP
- TP TOP OF PAVEMENT
- ME MATCH EXISTING
- FF FINISHED FLOOR
- EX EXISTING TO REMAIN



POST DEVELOPMENT PEAK DISCHARGE (Q) VALUES 2 YEAR 5 MINUTE DESIGN STORM FREQUENCY

Designation	TOTAL AREA (sf)	TOTAL AREA (ACRES)	i (2 YR 5 MIN) (in/hr)	IMPERVIOUS AREA	PERVIOUS AREA (DESERT LANDSCAPE)	COMPOSITE C	Q=CiA (in cfs)
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D	18,011	0.41	3.76	16,677	1,334	0.88	1.37
<b>TOTALS</b>	<b>89,299</b>	<b>2.05</b>		<b>63,126</b>	<b>26,173</b>		<b>6.33</b>

POST DEVELOPMENT PEAK DISCHARGE (Q) VALUES 10 YEAR MINUTE DESIGN STORM FREQUENCY

Designation	TOTAL AREA (sf)	TOTAL AREA (ACRES)	i (10 YR 5 MIN) (in/hr)	IMPERVIOUS AREA	PERVIOUS AREA (DESERT LANDSCAPE)	COMPOSITE C	Q=CiA (in cfs)
A	8,457	0.19	6.16	7,846	611	0.88	1.05
B	33,633	0.77	6.16	30,488	3,145	0.87	4.16
C	29,198	0.67	6.16	8,115	21,083	0.71	2.91
D	18,011	0.41	6.16	16,677	1,334	0.88	2.24
<b>TOTALS</b>	<b>89,299</b>	<b>2.05</b>		<b>63,126</b>	<b>26,173</b>		<b>10.37</b>

POST DEVELOPMENT PEAK DISCHARGE (Q) VALUES 100 YEAR 5 MINUTE DESIGN STORM FREQUENCY

Designation	TOTAL AREA (sf)	TOTAL AREA (ACRES)	i (100 YR 5 MIN) (in/hr)	IMPERVIOUS AREA	PERVIOUS AREA (DESERT LANDSCAPE)	COMPOSITE C	Q=CiA (in cfs)
A	8,457	0.19	10.3	7,846	611	0.94	1.88
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<b>TOTALS</b>	<b>89,299</b>	<b>2.05</b>		<b>63,126</b>	<b>26,173</b>		<b>19.32</b>

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 St. Louis, MO 63103  
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 DATE: 1/5/2022

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**Appendix B**  
**Pre-Development Drainage Area Map**

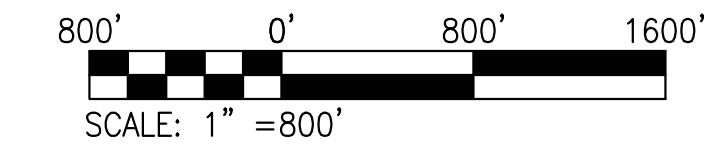
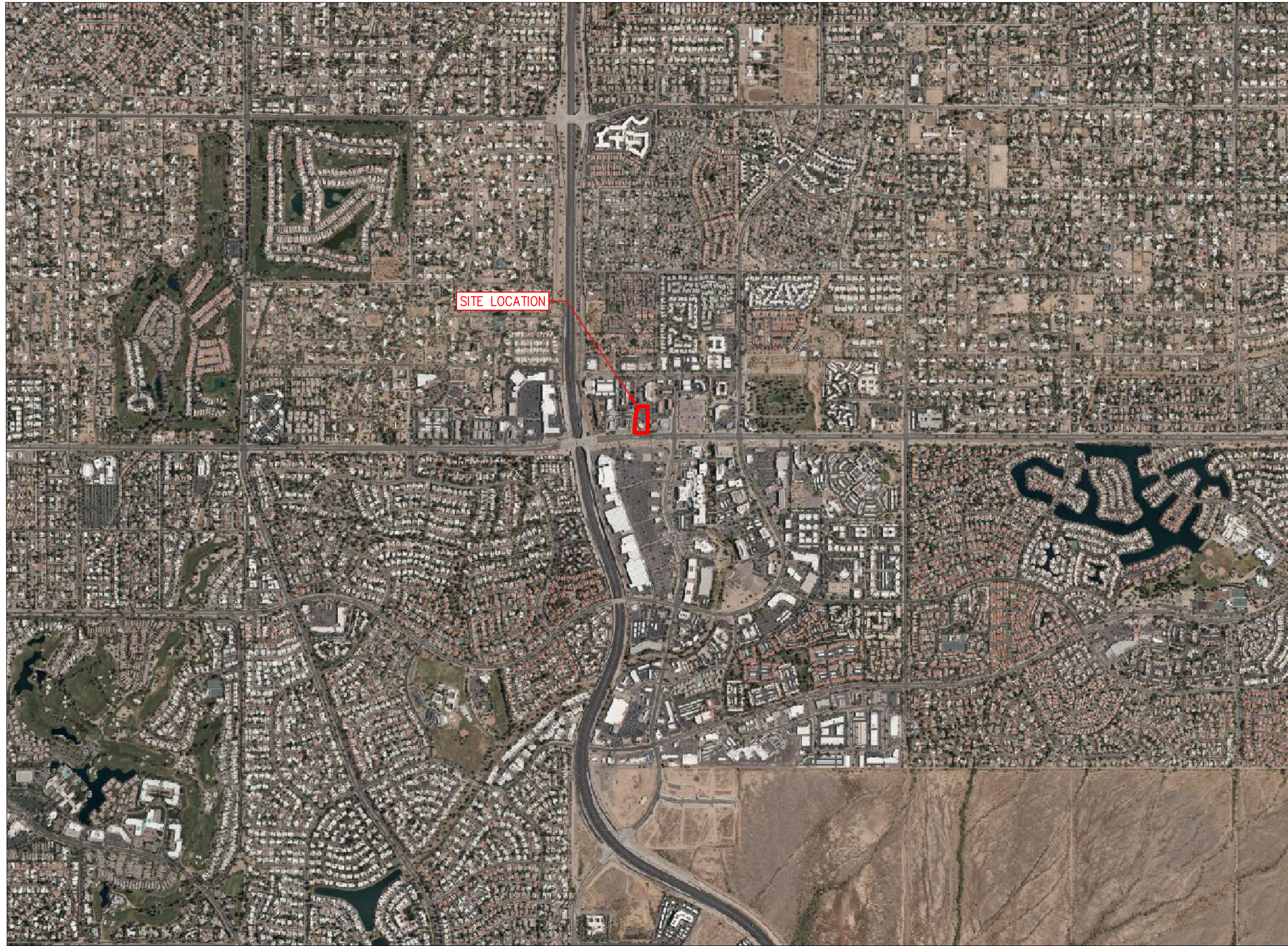


**Appendix C**  
**On-Site Aerial Map**



**Appendix D**  
**Off-Site Aerial Map**

USER: Paul Henderson TAB: AERIAL 800  
 DATE: January 4, 2022 - 4:02:37 PM  
 DRAWING: S:\JOBS\Jobs\2021\21-0067\CAD\21-0067\_Plan\_Aerial\_21-0067.dwg



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DRAWN BY	PGB	Job Number	21-0067
CHECKED BY	CAW	Sheet Number	
DRAWING SCALE	AS SHOWN		

**Appendix E**  
**Calculation Supporting Data**



**NOAA Atlas 14, Volume 1, Version 5**  
**Location name: Sedona, Arizona, USA\***  
**Latitude: 34.4°, Longitude: -111.7°**  
**Elevation: 4370.37 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**

<b>PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches/hour)<sup>1</sup></b>										
<b>Duration</b>	<b>Average recurrence interval (years)</b>									
	<b>1</b>	<b>2</b>	<b>5</b>	<b>10</b>	<b>25</b>	<b>50</b>	<b>100</b>	<b>200</b>	<b>500</b>	<b>1000</b>
<b>5-min</b>	<b>2.90</b> (2.47-3.42)	<b>3.76</b> (3.19-4.40)	<b>5.09</b> (4.30-5.95)	<b>6.16</b> (5.18-7.19)	<b>7.68</b> (6.41-8.94)	<b>8.93</b> (7.37-10.4)	<b>10.3</b> (8.38-11.9)	<b>11.7</b> (9.43-13.6)	<b>13.8</b> (10.9-16.2)	<b>15.5</b> (12.1-18.3)
<b>10-min</b>	<b>2.21</b> (1.88-2.60)	<b>2.86</b> (2.43-3.35)	<b>3.87</b> (3.27-4.53)	<b>4.68</b> (3.94-5.47)	<b>5.84</b> (4.88-6.80)	<b>6.79</b> (5.61-7.89)	<b>7.81</b> (6.37-9.08)	<b>8.90</b> (7.18-10.4)	<b>10.5</b> (8.29-12.3)	<b>11.8</b> (9.18-13.9)
<b>15-min</b>	<b>1.83</b> (1.55-2.15)	<b>2.36</b> (2.01-2.77)	<b>3.20</b> (2.70-3.74)	<b>3.87</b> (3.26-4.52)	<b>4.83</b> (4.03-5.62)	<b>5.61</b> (4.64-6.52)	<b>6.45</b> (5.27-7.50)	<b>7.36</b> (5.93-8.58)	<b>8.66</b> (6.85-10.2)	<b>9.75</b> (7.58-11.5)
<b>30-min</b>	<b>1.23</b> (1.05-1.45)	<b>1.59</b> (1.35-1.87)	<b>2.15</b> (1.82-2.52)	<b>2.60</b> (2.19-3.05)	<b>3.25</b> (2.71-3.79)	<b>3.78</b> (3.12-4.39)	<b>4.34</b> (3.55-5.05)	<b>4.95</b> (4.00-5.77)	<b>5.83</b> (4.61-6.84)	<b>6.57</b> (5.11-7.75)
<b>60-min</b>	<b>0.762</b> (0.647-0.895)	<b>0.984</b> (0.836-1.16)	<b>1.33</b> (1.13-1.56)	<b>1.61</b> (1.36-1.89)	<b>2.01</b> (1.68-2.34)	<b>2.34</b> (1.93-2.72)	<b>2.69</b> (2.19-3.13)	<b>3.07</b> (2.47-3.57)	<b>3.61</b> (2.85-4.23)	<b>4.06</b> (3.16-4.80)
<b>2-hr</b>	<b>0.447</b> (0.388-0.517)	<b>0.568</b> (0.492-0.658)	<b>0.750</b> (0.650-0.866)	<b>0.902</b> (0.776-1.04)	<b>1.12</b> (0.954-1.29)	<b>1.30</b> (1.10-1.49)	<b>1.50</b> (1.24-1.72)	<b>1.71</b> (1.40-1.96)	<b>2.01</b> (1.62-2.33)	<b>2.27</b> (1.79-2.63)
<b>3-hr</b>	<b>0.325</b> (0.287-0.373)	<b>0.411</b> (0.364-0.471)	<b>0.531</b> (0.468-0.607)	<b>0.631</b> (0.553-0.718)	<b>0.775</b> (0.673-0.881)	<b>0.893</b> (0.768-1.01)	<b>1.02</b> (0.869-1.16)	<b>1.16</b> (0.975-1.33)	<b>1.37</b> (1.12-1.57)	<b>1.54</b> (1.24-1.78)
<b>6-hr</b>	<b>0.201</b> (0.180-0.225)	<b>0.250</b> (0.224-0.282)	<b>0.311</b> (0.278-0.350)	<b>0.365</b> (0.324-0.409)	<b>0.441</b> (0.388-0.495)	<b>0.503</b> (0.439-0.563)	<b>0.570</b> (0.492-0.639)	<b>0.641</b> (0.545-0.721)	<b>0.742</b> (0.619-0.839)	<b>0.826</b> (0.677-0.939)
<b>12-hr</b>	<b>0.124</b> (0.111-0.139)	<b>0.154</b> (0.138-0.172)	<b>0.188</b> (0.168-0.210)	<b>0.217</b> (0.194-0.242)	<b>0.257</b> (0.228-0.286)	<b>0.287</b> (0.253-0.320)	<b>0.319</b> (0.279-0.356)	<b>0.351</b> (0.304-0.393)	<b>0.398</b> (0.339-0.448)	<b>0.437</b> (0.368-0.496)
<b>24-hr</b>	<b>0.076</b> (0.069-0.084)	<b>0.095</b> (0.086-0.105)	<b>0.119</b> (0.107-0.131)	<b>0.138</b> (0.124-0.152)	<b>0.164</b> (0.148-0.180)	<b>0.185</b> (0.165-0.202)	<b>0.206</b> (0.184-0.226)	<b>0.228</b> (0.202-0.250)	<b>0.258</b> (0.226-0.283)	<b>0.281</b> (0.244-0.310)
<b>2-day</b>	<b>0.045</b> (0.040-0.050)	<b>0.056</b> (0.051-0.063)	<b>0.071</b> (0.063-0.079)	<b>0.082</b> (0.073-0.092)	<b>0.098</b> (0.087-0.110)	<b>0.111</b> (0.098-0.123)	<b>0.124</b> (0.109-0.138)	<b>0.137</b> (0.120-0.153)	<b>0.156</b> (0.135-0.174)	<b>0.170</b> (0.147-0.191)
<b>3-day</b>	<b>0.032</b> (0.029-0.036)	<b>0.040</b> (0.037-0.045)	<b>0.051</b> (0.046-0.056)	<b>0.059</b> (0.053-0.065)	<b>0.071</b> (0.063-0.078)	<b>0.080</b> (0.071-0.088)	<b>0.089</b> (0.079-0.099)	<b>0.099</b> (0.088-0.110)	<b>0.113</b> (0.099-0.125)	<b>0.124</b> (0.107-0.137)
<b>4-day</b>	<b>0.026</b> (0.024-0.029)	<b>0.032</b> (0.029-0.036)	<b>0.041</b> (0.037-0.045)	<b>0.047</b> (0.043-0.052)	<b>0.057</b> (0.051-0.062)	<b>0.064</b> (0.058-0.070)	<b>0.072</b> (0.064-0.079)	<b>0.080</b> (0.071-0.088)	<b>0.091</b> (0.080-0.101)	<b>0.100</b> (0.087-0.111)
<b>7-day</b>	<b>0.017</b> (0.016-0.019)	<b>0.022</b> (0.020-0.024)	<b>0.027</b> (0.024-0.030)	<b>0.031</b> (0.028-0.034)	<b>0.037</b> (0.034-0.041)	<b>0.042</b> (0.038-0.046)	<b>0.047</b> (0.042-0.052)	<b>0.052</b> (0.046-0.057)	<b>0.059</b> (0.052-0.065)	<b>0.064</b> (0.056-0.071)
<b>10-day</b>	<b>0.013</b> (0.012-0.015)	<b>0.017</b> (0.015-0.018)	<b>0.021</b> (0.019-0.023)	<b>0.024</b> (0.022-0.026)	<b>0.028</b> (0.026-0.031)	<b>0.032</b> (0.029-0.035)	<b>0.035</b> (0.031-0.038)	<b>0.038</b> (0.034-0.042)	<b>0.043</b> (0.038-0.047)	<b>0.047</b> (0.041-0.051)
<b>20-day</b>	<b>0.009</b> (0.008-0.009)	<b>0.011</b> (0.010-0.012)	<b>0.013</b> (0.012-0.014)	<b>0.015</b> (0.014-0.016)	<b>0.017</b> (0.016-0.019)	<b>0.019</b> (0.017-0.021)	<b>0.021</b> (0.019-0.022)	<b>0.022</b> (0.020-0.024)	<b>0.024</b> (0.022-0.026)	<b>0.026</b> (0.023-0.028)
<b>30-day</b>	<b>0.007</b> (0.006-0.008)	<b>0.009</b> (0.008-0.009)	<b>0.010</b> (0.010-0.011)	<b>0.012</b> (0.011-0.013)	<b>0.014</b> (0.012-0.015)	<b>0.015</b> (0.014-0.016)	<b>0.016</b> (0.015-0.018)	<b>0.018</b> (0.016-0.019)	<b>0.019</b> (0.017-0.021)	<b>0.020</b> (0.018-0.022)
<b>45-day</b>	<b>0.006</b> (0.005-0.006)	<b>0.007</b> (0.006-0.008)	<b>0.008</b> (0.008-0.009)	<b>0.010</b> (0.009-0.011)	<b>0.011</b> (0.010-0.012)	<b>0.012</b> (0.011-0.013)	<b>0.013</b> (0.012-0.015)	<b>0.014</b> (0.013-0.016)	<b>0.016</b> (0.014-0.017)	<b>0.017</b> (0.015-0.019)
<b>60-day</b>	<b>0.005</b> (0.004-0.005)	<b>0.006</b> (0.005-0.006)	<b>0.007</b> (0.007-0.008)	<b>0.008</b> (0.007-0.009)	<b>0.009</b> (0.009-0.010)	<b>0.010</b> (0.009-0.011)	<b>0.011</b> (0.010-0.012)	<b>0.012</b> (0.011-0.013)	<b>0.013</b> (0.012-0.014)	<b>0.014</b> (0.012-0.015)

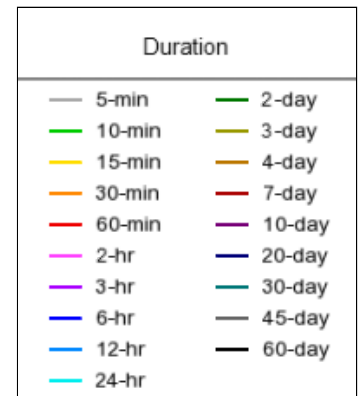
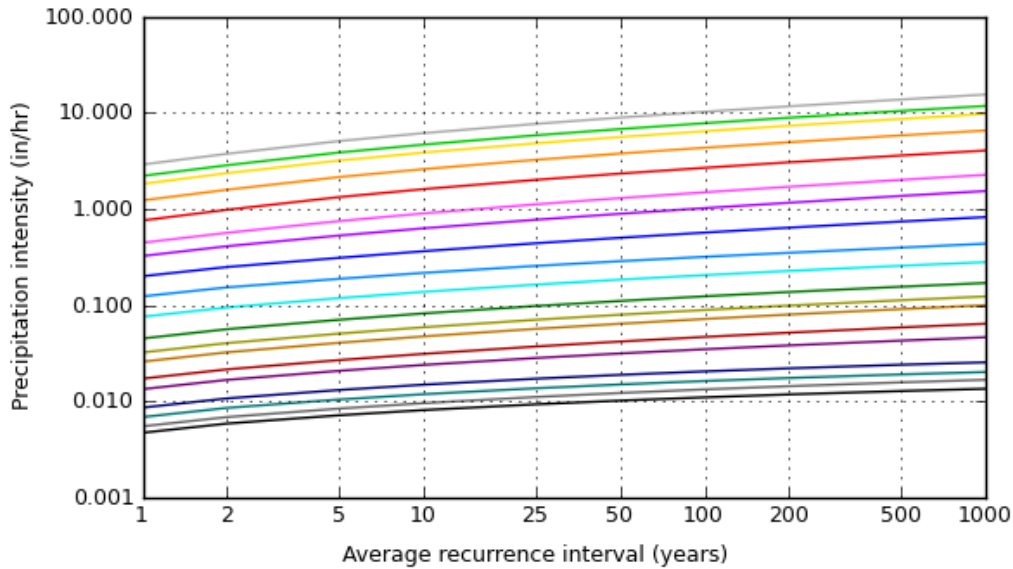
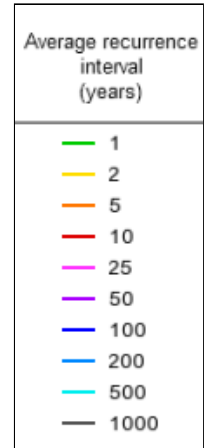
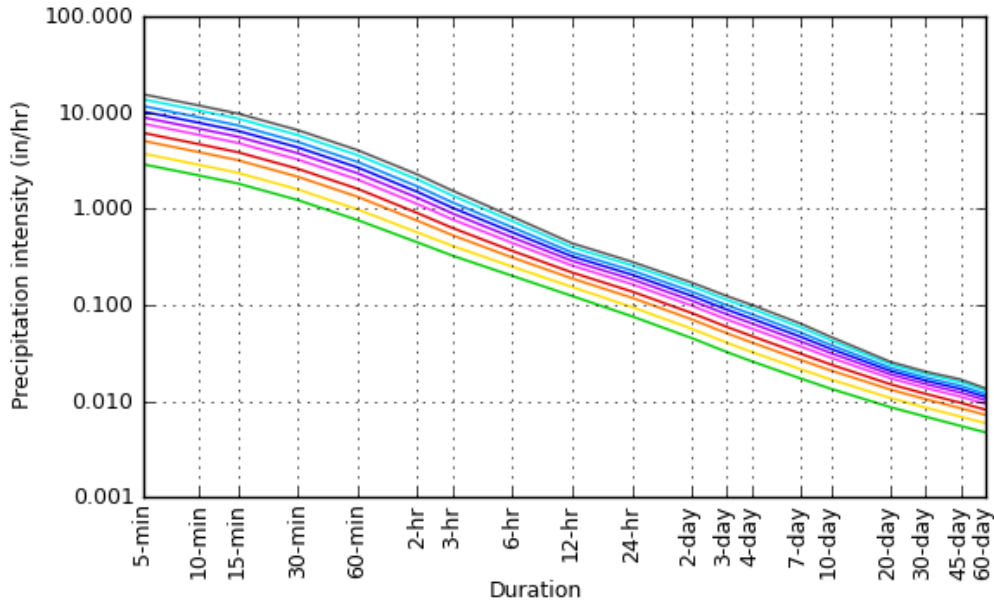
<sup>1</sup> Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS). Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration 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 intensity-duration-frequency (IDF) curves

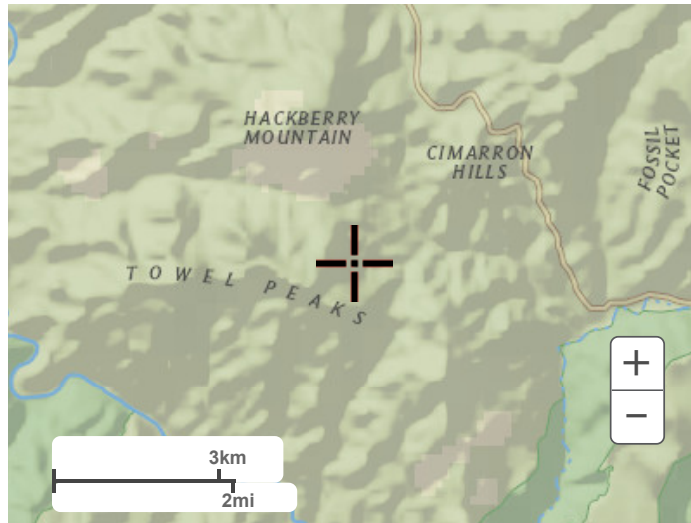
Latitude: 34.4000°, Longitude: -111.7000°



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### Maps & aerials

Small scale terrain



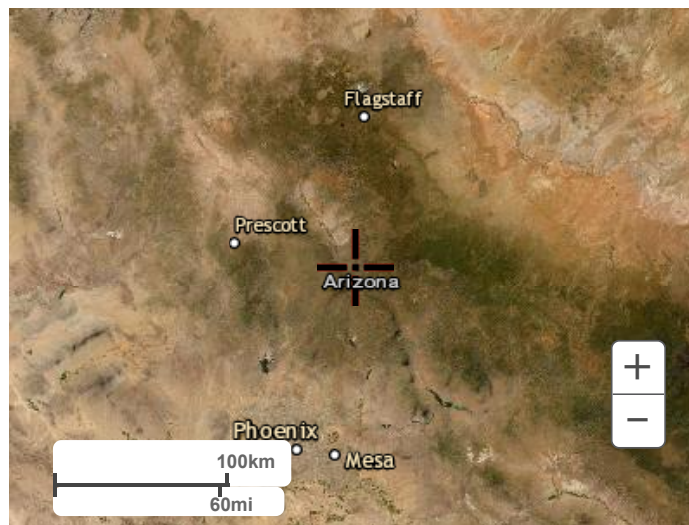
Large scale terrain



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](mailto:HDSC.Questions@noaa.gov)

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**RUNOFF COEFFICIENTS – “C” VALUE**

LAND USE	STORM FREQUENCY		
	2-25 Year	50 Yea r	100 Yea r
Composite Area-wide Values			
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