Drainage Reports

Abbreveated Water & Sewer Need Reports

Water Study

Wastewater Study

Stormwater Waiver Application

HUNTER
ENGINEERING

CIVIL AND SURVEY

Final Drainage Report
For
Primrose School, Wingate Crossing
NWC E. Bell Road &
Thompson Peak Parkway
Scottsdale, Arizona

Registered Professional Engineer (Civil)
CERTIFICATE NO.
31775
JOSEPH PAUL
BURKE
Date Signed 7/13/16
ARIZONA, U.S.A.

EXPIRES: 9/30/18

July, 2016

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13-MD-2016
10/07/16

FINAL DRAINAGE REPORT
FOR

Primrose School, Wingate Crossing
NWC East E. Bell Road and Thompson Peak Parkway
Scottsdale, Arizona

PREPARED FOR

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H.E. PROJECT NO. PRMR001

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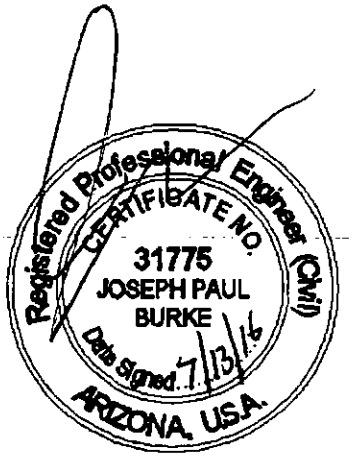


1.0 INTRODUCTION

This drainage statement has been prepared under a contract from Bigsister, LLC, the developer for the Primrose School project. The purpose of this report is to provide a drainage analysis, required by the City of Avondale, to support this development.

The project is located on a proposed pad site within the existing Wingate Crossing commercial development located at the NWC of Bell Road and Thompson Peak Parkway within the City of Scottsdale, Maricopa County, Arizona. The proposed parcel is bordered by existing paved parking and retail/commercial development to the north and east, an existing bank to the south and residential multi-family development to the west. The site is specifically located within the a portion of Section 32, Township 4 North, Range 5 East, of the Gila and Salt River Base and Meridian. Figure 1, in Appendix A, illustrates the location of the project site in relation to the City of Scottsdale street system.

The project consists of the development of an approximate 11,800 SF building on approximate 1.46 acre parcel. The development will be for a stand-alone private school/daycare facility with parking, landscaping and utilities.

2.0 EXISTING DRAINAGE CONDITIONS

2.1 On-site Drainage Conditions

The Wingate Development has in-place drainage infrastructure which includes catch basins, drain pipe and underground storm drain retention piping designed to collect the storm water runoff on the property for the 100-yr, 2-hr storm event. The drainage design was completed in 2007 using the rainfall intensity data from a previous version of the City of Scottsdale's *Design Standards and Policy Manual.* The rainfall intensity taken from the manual and used in the original design was higher than the rainfall intensity in the current city manual which follows the latest NOAA 14 rainfall data. The comparison between the two intensities and how they impact the required retention volume for this development will be applied and discussed in Section 3.0 of this report.

The required retention volume storage for the Wingate Crossing is all provided underground within 10' diameter piping. The drainage is collected from landscape and pavement areas via sheet flow and curb flow to catch basins where it is carried via storm drain piping to the existing underground retention systems. There are five separate underground retention system around the development. They are identified in Exhibit A and B as pipes 1 through 5. According to the original drainage design for the development, the drainage generated from this project site is collected into underground retention pipe 4. Calculations from the original Wingate Crossing design indicate that no additional volume is available within retention basin 4. However the latest NOAA 14 data allows a reduction in rainfall intensity. This reduction in intensity will

allow additional runoff from the proposed development of the site to be re-directed and collected into retention pipe 4.

2.2 Off-site Drainage Conditions

No offsite drainage appears to enter this development. The existing Villas Altozano development to the north and west is designed to detain/retain its own runoff for the 100-yr, 2-hr storm event. Thompson Peak Parkway and E. Bell Road to the east and south appear to intercept offsite flows from entering this development.

2.3 FEMA

The current FEMA Flood Insurance Rate Map (FIRM) for this area, map number 04013C1340 L (Revision date October 16, 2013) shows the entire project site is in a flood hazard Shaded Zone X. Shaded Zone X is defined as, "*areas of 0.2% chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or within drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.*

3.0 PROPOSED DRAINAGE CONCEPT

The proposed drainage concept is presented in three parts: on-site drainage conveyance, off-site drainage conveyance, and storm water retention. These three sections make up sections 3.1, 3.2, and 3.3 respectively. Exhibit A, located in the back pocket, provides a graphical illustration of the proposed drainage concept.

3.1 On-site Drainage Conveyance

As discussed in Section 2.0, the Wingate Crossing development has installed drainage infrastructure for the entire development including this project. This development will continue to discharge its storm water runoff to retention pipe 4. In addition, a small area, approximately 0.04 acres, currently contributing to retention pipe 3, will be redirected to retention pipe 4 and a small area, approximately 0.05 acres will be re-directed to retention pipe 3. Section 3.3 shows calculations for pre and post development retention.

3.2 Off-site Drainage Conveyance:

As discussed in Section 2.2, no offsite drainage appears to impact the Wingate Development.

3.3 Storm Water Retention

The City of Scottsdale requires that all runoff from the 100-year, 2-hour event generated from the project site and generated offsite along the site frontage is required to be retained onsite. In addition, all offsite historic flows impacting the site are required to be mitigated and routed through the site with historical flow patterns maintained. If historical flow patterns leaving the site cannot be maintained, then offsite flows up to the 100-yr storm event shall be retained onsite.

The required retention volume for the drainage area tributary to retention pipe 4 under existing **pre-development** conditions per design guidelines affective in 2007:

VR = P/12*A*C
Where:
V_R = Required retention volume in acre-feet
P = 100-year, 2-hour rainfall intensity (2.82)
A = Drainage area = 1.34 acres*
C = Runoff coefficient 0.95 for commercial, 0.31 for landscaping *
* Refer to Exhibit A for commercial and landscaping drainage areas.

VR=2.82/12 * (0.36 acres * 0.31 + 1.34 acres * 0.95) * 43,560 sf/acre =
VR = 14,174 CF

The required retention volume for the drainage area tributary to retention pipe 4 under proposed **post-development** conditions per current design guidelines:

VR = P/12*A*C
Where:
V_R = Required retention volume in acre-feet
P = 100-year, 2-hour rainfall intensity (2.42)
A = Drainage area = 1.74 acres*
C = Runoff coefficient 0.86 for commercial and industrial areas
* Refer to Exhibit A for drainage areas.

VR=2.42/12 * 1.69 acres * 0.86 * 43,560 sf/acre =
VR = 12,767 CF

The provided retention volume for the drainage area tributary to retention pipe 4 under proposed **post-development** conditions per current design guidelines:

VP = 166 LF of 10' dia cmp pipe * 78.54 CF/LF = **13,038 CF**

3.4 Storm Water Disposal

All of the existing retention piping within the Wingate Crossing development is interconnected via storm drain piping. Each retention pipe is drained by metering the flow at a low bleed off rate. All of the storm water retention from the pipe systems is carried through an existing 12" storm drain pipe west to an existing headwall and culvert system which carries flows from an existing wash south under E. Bell Road. This development will not alter the existing bleed off system.

4.0 CONCLUSION

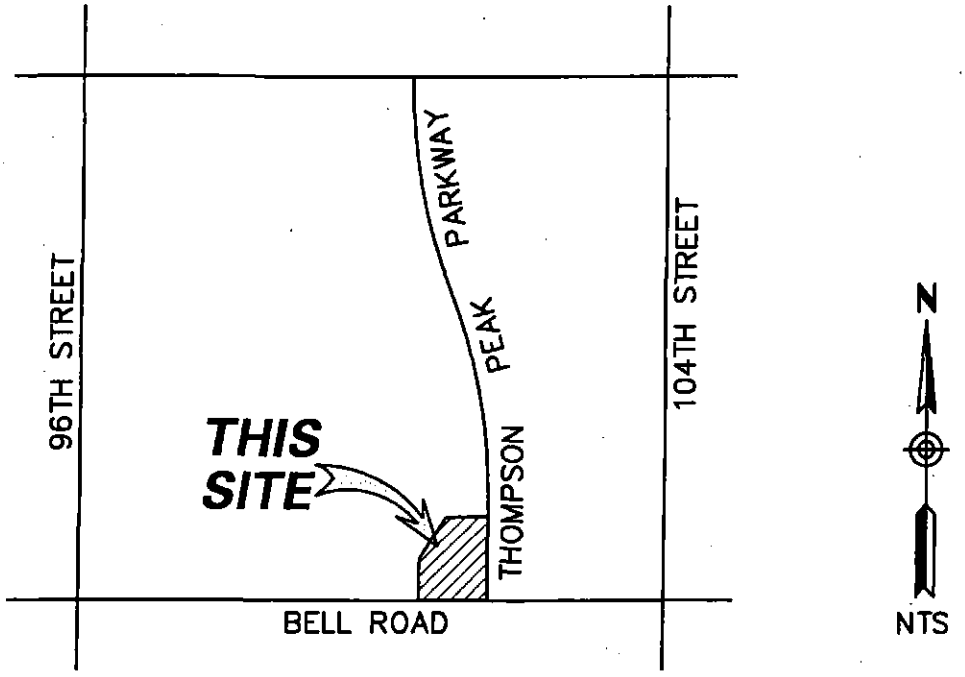
Based on the results of this study, it can be concluded that:

- The proposed drainage system can detain and convey the on-site storm water flows to the proposed outfall location.
- The drainage improvements have been designed according to requirements put forth in the City of Scottsdale's *Design Standards and Policy Manual.*
- The proposed finished floor elevations are above the 100-year water surface elevation and meet the City of Scottsdale and FEMA requirements for Flood Hazard Zone X.
- The proposed underground detention system shall bleed off within the required 36 hour period.

5.0 REFERENCES

1) City of Scottsdale's *Design Standards and Policy Manual* as accessed from the City of Scottsdale website at http://www.scottsdaleaz.gov/ on May 1st, 2012.
2) Drainage Design Manual for Maricopa County, Arizona, Volume I, Hydrology, 1992.
3) Drainage Design Manual for Maricopa County, Arizona, Volume II, Hydraulics, 2013.
4) NOAA Atlas 14 precipitation frequency estimates, NOAA's National Weather Service.

APPENDIX A
FIGURES & EXHIBITS



VICINITY MAP
FIGURE 1

LEGEND

SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A	No Base Flood Elevations determined.
ZONE AE	Base Flood Elevations determined.
ZONE AH	Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
ZONE AO	Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
ZONE AR	Special Flood Hazard Area formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
ZONE A99	Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
ZONE V	Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
ZONE VE	Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

ZONE X	Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

ZONE X	Areas determined to be outside the 0.2% annual chance floodplain.
ZONE D	Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

	1% annual chance floodplain boundary
	0.2% annual chance floodplain boundary
	Floodway boundary
	Zone D boundary
	CBRS and OPA boundary
	Boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.
513	Base Flood Elevation line and value; elevation in feet*
(EL 987)	Base Flood Elevation value where uniform within zone; elevation in feet*

* Referenced to the North American Vertical Datum of 1988 (NAVD 88)

A — A	Cross section line
23 — 23	Transect line
97°07'30", 32°22'30"	Geographic coordinates referenced to the North American Datum of 1983 (NAD 83)
4275000mN	1000-meter Universal Transverse Mercator grid ticks, zone 12
6000000 M	5000-foot grid ticks: Arizona State Plane coordinate system, central zone (FIPSZONE 0202), Transverse Mercator
DX5510	Bench mark (see explanation in Notes to Users section of this FIRM panel)
M1.5	River mile

MAP REPOSITORIES
Refer to Map Repositories list on Map Index

EFFECTIVE DATE OF COUNTYWIDE
FLOOD INSURANCE RATE MAP
April 15, 1988

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL
December 3, 1993 September 30, 1995 July 19, 2001 September 30, 2005
October 16, 2013 - to change base flood elevations, to add roads and road names, to add floodway, to advance suffix, to add special flood hazard areas, to incorporate previously issued letters of map revision, to add base flood elevation, to update corporate limits, and to change floodway.

MAP SCALE 1" = 1000'

500 0 1000 2000 FEET

METERS

300 0 300 600

300 0 300 600

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 1340L

FIRM

FLOOD INSURANCE RATE MAP

MARICOPA COUNTY, ARIZONA

AND INCORPORATED AREAS

PANEL 1340 OF 4425

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
SCOTTSDALE, CITY OF	045012	1340	L

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
04013C1340L

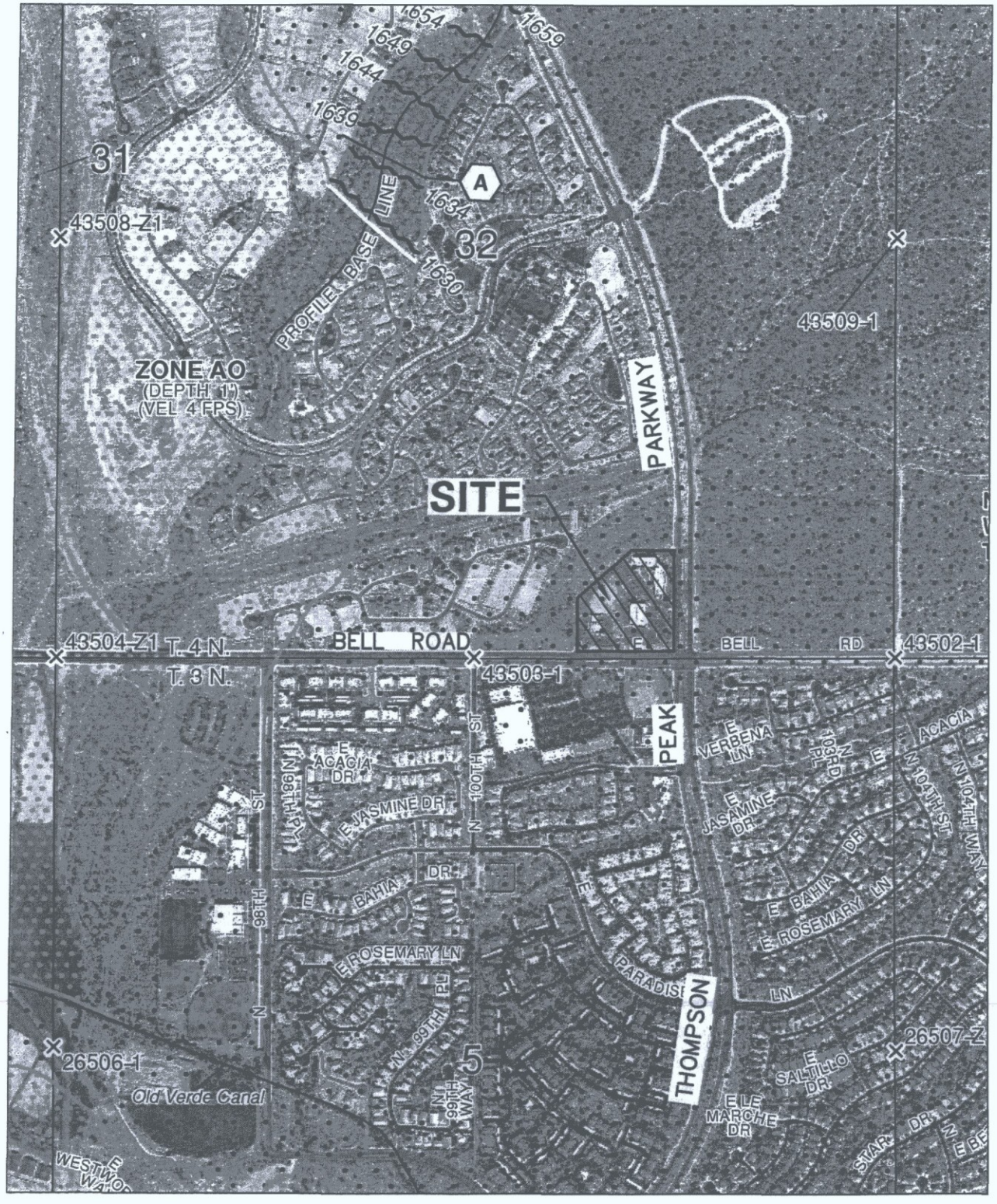
MAP REVISED
OCTOBER 16, 2013

Federal Emergency Management Agency

This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at www.msc.fema.gov

MAP LEGEND

FIRM PANEL

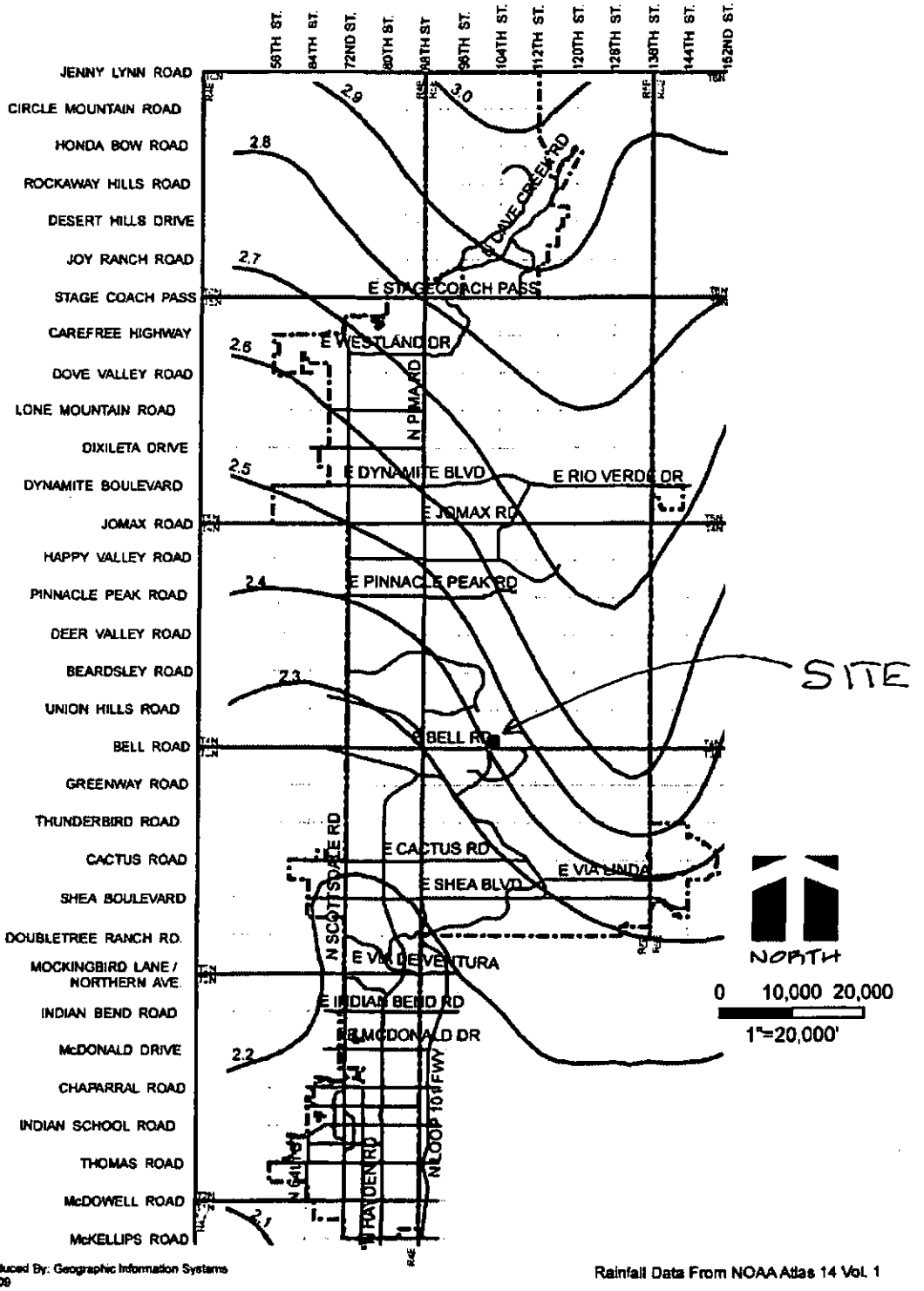


PORTION OF PANEL SHOWING SITE
FIGURE 2

APPENDIX B
REFERENCE MATERIAL

ISOPLUVIALS

100 Year 2 Hour Precipitation in Inches



a. Increasing the percent impervious on the L card to reflect the amount of impervious surfaces that will exist under fully developed conditions
b. Recalculate the time of concentration (**Tc**) based on the proposed drainage system, after full development. Normally there should be a reduction in **Tc** after development
c. The existing condition model must be sub-divided, as necessary, to create concentration points which will match the sub-watershed areas above each proposed storage facility under fully developed conditions
d. Each separate storage facility proposed must be modeled as it will physically exist under fully developed conditions with appropriate routing and combining operations through each basin and through the entire watershed. The modeling of storage capacity provided, as one hypothetical reservoir at the outlet with all the upstream storage arbitrarily combined at this one location, is not acceptable
e. As a minimum, the 2, 10 and 100-year frequency events shall be analyzed
f. Comparison of discharge values for existing and post development conditions must be made at concentration points just downstream from each proposed storage facility; other critical locations such as road crossings; and at points where flows exit the proposed development.

4-1.807 CALCULATION OF RUNOFF VOLUMES

The only accepted method for determining the required stormwater storage volume is the standard formula described below. HEC-1 modeling can be used for storage basin design and analysis, or if a pre-versus post volume difference is needed. City ordinance requires on-site storage of runoff from the 100-year, 2-hour frequency event.

A. Standard Formula for Runoff Volumes

Vr = (P/12) AC

Vr = *Required storage volume in acre-feet.*

P = *Precipitation amount = The depth of the 100-year 2-hour rainfall, from figure in Appendix 4-1D at the site.*

A = *Area in acres; the developed portion of the entire site in acres, to the centerline of adjacent streets, on which any man made change is planned, including, but not limited to: construction, excavation, filling, grading, paving, or mining.*

C = *Runoff coefficient; Rational Method values from Figure 4.1-4.*

B. HEC-1 Computer Modeling

The HEC-1 model or similar computer program is not to be used to determine the ordinance required 100-year, 2-hour stormwater storage runoff volumes. The HEC-1 program may be used for the purpose of analyzing storage basin routing or for pre versus post analysis (a six-hour storm; procedures described in Section 4-1.806 paragraphs D and E must be used). Use modified Puls level pool routing option in HEC-1 for hydrograph routing through storage basins and lakes. For permanent lakes assume no available storage below the normal water surface elevation.

CAUTION: Do not use the built-in orifice equation in the HEC-1 model because errors can result. It is necessary to build a stage discharge table and input to the model.

4-1.808 METHODS FOR ESTIMATING WATER SURFACE ELEVATIONS AND INUNDATION LIMITS

The engineer may use any standard method for the determination of water surface elevations. Only the U.S. Army Corps of Engineers' HEC-2, Water Surface Profiles program and the HEC-RAS, River Analysis System are supported by the City. Prior approval by city staff is required for the use of other methods.

2. Time of Concentration

Time of concentration "**Tc**" is the total time of travel from the most hydraulically remote part of the watershed to the concentration point of interest. The calculation of "Tc" must follow FCDMC Hydrology Manual procedures.

***Note: Do not add a standard set amount of time to the estimated "Tc" for lot runoff delay (such as 5 or 10 minutes).** Natural land slopes are too variable in Scottsdale to add a set amount of time for lot runoff.

3. Runoff Coefficients

Use Figure 4.1-4 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 (average lot size)			
R1-1-1901	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 (35,000 square feet/lot)	0.40	0.56	0.62
R1-18 (18,000 square feet/lot)	0.43	0.58	0.64
R1-10 (10,000 square feet/lot)	0.47	0.62	0.67
R1-7 (7,000 square feet/lot)	0.51	0.64	0.94
Townhouses (R-2, R-4)	0.63	0.74	0.94
Apartments & Condominiums (R-3, R-5)	0.76	0.83	0.94
Specific Surface Type Values			
Paved streets, parking lots (concrete or asphalt), roofs, drive-ways, 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	045
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

FIGURE 4.1-4 RUNOFF COEFFICIENTS FOR USE WITH RATIONAL METHOD

NOAA Atlas 14, Volume 1, Version 5
Location name: Scottsdale, Arizona, US*
Latitude: 33.6414°, Longitude: -111.8622°
Elevation: 1634 ft*
* source: Google Maps

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	0.209 (0.174-0.257)	0.274 (0.228-0.336)	0.369 (0.304-0.452)	0.441 (0.362-0.539)	0.537 (0.434-0.654)	0.610 (0.488-0.738)	0.684 (0.537-0.826)	0.759 (0.586-0.914)	0.858 (0.646-1.03)	0.934 (0.689-1.13)
10-min	0.318 (0.264-0.392)	0.416 (0.347-0.512)	0.561 (0.463-0.688)	0.671 (0.550-0.820)	0.817 (0.660-0.995)	0.929 (0.742-1.12)	1.04 (0.818-1.26)	1.15 (0.892-1.39)	1.30 (0.984-1.57)	1.42 (1.05-1.72)
15-min	0.395 (0.328-0.486)	0.516 (0.430-0.635)	0.696 (0.574-0.853)	0.832 (0.682-1.02)	1.01 (0.819-1.23)	1.15 (0.920-1.39)	1.29 (1.01-1.56)	1.43 (1.11-1.73)	1.62 (1.22-1.95)	1.76 (1.30-2.13)
30-min	0.531 (0.441-0.654)	0.695 (0.580-0.855)	0.936 (0.773-1.15)	1.12 (0.919-1.37)	1.36 (1.10-1.66)	1.55 (1.24-1.88)	1.74 (1.36-2.10)	1.93 (1.49-2.32)	2.18 (1.64-2.63)	2.37 (1.75-2.87)
60-min	0.657 (0.546-0.809)	0.860 (0.717-1.06)	1.16 (0.956-1.42)	1.39 (1.14-1.69)	1.69 (1.36-2.06)	1.92 (1.53-2.32)	2.15 (1.69-2.60)	2.38 (1.84-2.88)	2.70 (2.03-3.25)	2.94 (2.17-3.55)
2-hr	0.766 (0.643-0.921)	0.992 (0.835-1.20)	1.32 (1.10-1.58)	1.57 (1.30-1.88)	1.90 (1.56-2.27)	2.16 (1.75-2.57)	2.42 (1.93-2.87)	2.68 (2.10-3.18)	3.03 (2.32-3.59)	3.30 (2.48-3.93)
3-hr	0.833 (0.699-1.02)	1.07 (0.900-1.31)	1.39 (1.17-1.71)	1.65 (1.37-2.02)	2.01 (1.64-2.44)	2.30 (1.85-2.77)	2.59 (2.05-3.12)	2.90 (2.26-3.48)	3.32 (2.51-3.98)	3.66 (2.70-4.39)
6-hr	1.00 (0.859-1.19)	1.26 (1.08-1.50)	1.61 (1.38-1.91)	1.89 (1.59-2.23)	2.26 (1.89-2.66)	2.56 (2.10-2.99)	2.86 (2.32-3.34)	3.17 (2.52-3.71)	3.58 (2.78-4.19)	3.91 (2.96-4.58)
12-hr	1.16 (1.00-1.36)	1.46 (1.26-1.72)	1.84 (1.58-2.15)	2.14 (1.83-2.50)	2.55 (2.15-2.96)	2.86 (2.38-3.32)	3.18 (2.61-3.69)	3.50 (2.84-4.06)	3.93 (3.11-4.58)	4.26 (3.31-4.99)
24-hr	1.38 (1.22-1.58)	1.75 (1.55-2.01)	2.27 (2.00-2.61)	2.69 (2.35-3.08)	3.27 (2.84-3.74)	3.73 (3.21-4.26)	4.21 (3.59-4.83)	4.72 (3.98-5.41)	5.42 (4.49-6.23)	5.99 (4.89-6.91)
2-day	1.53 (1.34-1.76)	1.96 (1.71-2.25)	2.58 (2.25-2.95)	3.07 (2.67-3.52)	3.77 (3.26-4.31)	4.33 (3.71-4.95)	4.92 (4.18-5.65)	5.55 (4.67-6.38)	6.42 (5.31-7.42)	7.13 (5.82-8.28)
3-day	1.65 (1.45-1.89)	2.12 (1.86-2.42)	2.81 (2.46-3.21)	3.37 (2.94-3.84)	4.17 (3.61-4.74)	4.81 (4.14-5.48)	5.50 (4.69-6.28)	6.23 (5.26-7.14)	7.27 (6.04-8.36)	8.12 (6.65-9.38)
4-day	1.77 (1.57-2.03)	2.28 (2.01-2.60)	3.05 (2.68-3.46)	3.67 (3.21-4.16)	4.56 (3.96-5.17)	5.29 (4.57-6.00)	6.08 (5.20-6.91)	6.92 (5.85-7.89)	8.12 (6.76-9.29)	9.11 (7.49-10.5)
7-day	2.02 (1.77-2.32)	2.59 (2.27-2.97)	3.47 (3.03-3.98)	4.19 (3.65-4.79)	5.22 (4.51-5.96)	6.06 (5.20-6.93)	6.97 (5.93-7.98)	7.95 (6.69-9.14)	9.35 (7.74-10.8)	10.5 (8.58-12.2)
10-day	2.21 (1.94-2.52)	2.84 (2.50-3.24)	3.79 (3.32-4.32)	4.56 (3.98-5.19)	5.66 (4.90-6.43)	6.55 (5.64-7.44)	7.51 (6.41-8.55)	8.54 (7.21-9.75)	9.99 (8.31-11.5)	11.2 (9.18-12.9)
20-day	2.76 (2.43-3.15)	3.57 (3.14-4.06)	4.74 (4.16-5.39)	5.64 (4.94-6.41)	6.87 (5.99-7.81)	7.83 (6.79-8.90)	8.83 (7.60-10.1)	9.86 (8.42-11.3)	11.3 (9.52-13.0)	12.4 (10.3-14.3)
30-day	3.25 (2.87-3.70)	4.21 (3.71-4.77)	5.59 (4.91-6.33)	6.65 (5.83-7.52)	8.09 (7.06-9.16)	9.22 (8.00-10.4)	10.4 (8.96-11.8)	11.6 (9.91-13.1)	13.2 (11.2-15.1)	14.5 (12.2-16.6)
45-day	3.85 (3.40-4.37)	4.98 (4.40-5.65)	6.62 (5.84-7.50)	7.85 (6.90-8.90)	9.51 (8.32-10.8)	10.8 (9.39-12.3)	12.1 (10.5-13.8)	13.5 (11.5-15.4)	15.3 (13.0-17.6)	16.8 (14.1-19.4)
60-day	4.32 (3.82-4.89)	5.61 (4.96-6.34)	7.43 (6.56-8.41)	8.78 (7.72-9.94)	10.6 (9.25-12.0)	11.9 (10.4-13.5)	13.3 (11.5-15.1)	14.7 (12.6-16.7)	16.5 (14.1-19.0)	18.0 (15.2-20.8)

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

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

Please refer to NOAA Atlas 14 document for more information.

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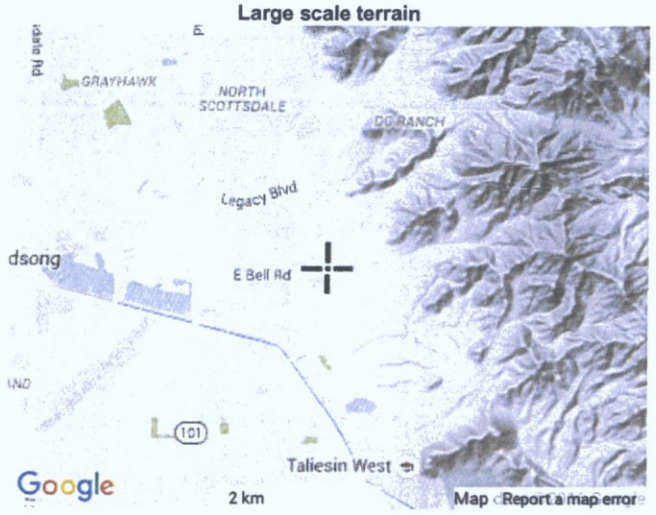
PF graphical

Large scale terrain



Large scale map

Large scale aerial