DRAINAGE REPORTS

ABBREVEATED WATER & SEWER NEED REPORTS

WATER STUDY

WASTERWATER STUDY

STORMWATER WAIVER APPLICATION

PRELIMINARY DRAINAGE DESIGN REPORT
FOR
71ST STREET & EARLL DRIVE
PRELMINARY DESIGN
A proposed residential subdivision located in the City of
Scottsdale, Arizona

Prepared:

July 9, 2015

Prepared for:

K. Hovnanian Great Western Homes, LLC
20830 North Tatum Blvd, Suite 250
Scottsdale, Arizona
Tel: (480)824-4200

Prepared by:

Hoskin Ryan Consultants, Inc.
6245 N. 24th Parkway, Suite 100
Phoenix, AZ 85016
(602)252-8384

HRC 15-015-02

PROJECT TRACKING SHEET

STAFF CONTACTS						
CURRENT PLANNING	DESIGN CONSULTANT	ENGINEERING	FIRE	LONG RANGE PLANNING	STORM WATER	TRANSPORTATION
MT	Steve V.	Jeri Pulkinen	R. King	T. Reynolds	R. Anderson	

PROJECT NAME: GALLERY
Coordinator: Brad Carr, AICP

DRAINAGE COMMENTS / DRAIN:

Administrative Review:

1st Review completed by ????? on ??/??/??. READY FOR SUBSTANTIVE REVIEW? NO ☐ YES ☐
2nd Review completed by ????? on ??/??/??. READY FOR SUBSTANTIVE REVIEW? NO ☐ YES ☐
3rd Review completed by ????? on ??/??/??. READY FOR SUBSTANTIVE REVIEW? NO ☐ YES ☐

Application Deficiencies:

A.

Substantive Review:

1st Review completed by R. Anderson on 8/11/15. READY TO BE DETERMINED? NO ☐ YES ☒

Proposed rezoning is acceptable to stormwater management.

The preliminary plat submittal will need to include a preliminary grading and drainage plan and preliminary drainage report for stormwater review and approval.

The development has the following issues that will need to be addressed and resolved as part of the preliminary plat submittal:

1. The drainage report states the site will be graded to drain from south to north which is in conflict with existing grades which slope north to south. Based on minimum street slope requirements and the need to tie the proposed internal street into existing Earll Drive grades, the grading concept will likely require filling of the site with the use of up to around four feet of retaining walls (at south end) around the perimeter of the site to make up grade differences between proposed grades and adjacent existing site grades/ privacy walls/ and buildings on property lines. The City of Scottsdale will recommend the applicant and his engineer consider the use of site grading that generally follows existing site grades with the use of a storm drain system to distribute site flows that would be collected in the proposed cul de sac and distribute them to the existing storm drain system in Earll Drive.

2. The preliminary drainage report requests a full waiver of stormwater storage requirements based on the capacity of the existing storm drain system located in Earll Drive. The preliminary drainage report in support of the preliminary plat application will need to illustrate there is excess capacity in the Earll Drive storm drain system including reaches of this system downstream to qualify for a waiver under this criteria which the current analysis does not accomplish.

3. Based on a review of aerial photographs, the site was previously developed around the 1960's with what appears to be single family residence with substantial disturbance and use of the

remainder of the site. The applicant and his engineer should be aware of the City's stormwater storage policy relating to previously developed sites as it will likely reduce the total required storage volume for this site as calculated in the report and may influence the decision to pursue a stormwater storage waiver as requested in item number 2 above. The policy is based on the increase in stormwater runoff from the proposed and previous developments. Richard Anderson of Stormwater Management should be contacted at 480-312-2729 to discuss city policy and requirements relating to this issue. The preliminary drainage report in support of the preliminary plat application will need to include calculations that determine the required stormwater storage volume for this project based on this policy.

2nd Review completed by ????? on ??/??/??. READY TO BE DETERMINED? NO ☐ YES ☐
3rd Review completed by ????? on ??/??/??. READY TO BE DETERMINED? NO ☐ YES ☐

All comments *MUST* include the Ordinance, Policy, or DS&PM Section Numbers; please initial and date at the end of each of your comments.

Ordinance Issues:

1.

Policy and Design Related Issues:

2.

Technical Corrections to be resolved prior the final plans submittal:

3.

WATER & SEWER COMMENTS:

Substantive Review:
1st Review completed by dman on 07/31/15. READY TO BE DETERMINED? NO ☐ YES ☒
2nd Review completed by ????? on ??/??/??. READY TO BE DETERMINED? NO ☐ YES ☐
3rd Review completed by ????? on ??/??/??. READY TO BE DETERMINED? NO ☐ YES ☐

All comments *MUST* include the Ordinance, Policy, or DS&PM Section Numbers; please initial and date at the end of each of your comments.

Ordinance Issues:

4.

Policy and Design Related Issues:


N 71ST ST
N 71ST ST
330025
330030
E EARLL DR
1242
1241
1243

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Appendices

1 INTRODUCTION

Hoskin Ryan Consultants, Inc. (HRC) has been contracted by K Hovnanian Great Western Homes, L.L.C., to provide preliminary drainage services for a 1.2-acre property within the City of Scottsdale (the City). The Gallery (Site) is located within Section 27, Township 2N and Range 4E (Figure 1). The Site is bounded on the north by Earll Drive, on the east by Vinson Automotive and a dirt parking lot, on the west by the Earll Street Residences Condominium, and on the south by an automotive collision repair specialist. The purpose of this report is to document the hydrologic & hydraulic conditions of the Site, and to demonstrate that the Site may be developed in accordance with drainage criteria established by the City of Scottsdale.

2 EXISTING DRAINAGE CONDITIONS

2.1 Flood Insurance Rate Map

The Flood Insurance Rate Map (FIRM) for Maricopa County, Arizona and Incorporated Areas, Map Number 04013C2235L (Figure 2), dated October 16, 2013, as published by the Federal Emergency Management Agency (FEMA) (Ref. 1), displays The Site in a Zone "X" , as defined below:

Zone "X"– Areas determined to be outside the 0.2% annual chance floodplain.

2.2 Off-Site Flow

Off-site flow is not anticipated to flow across the Site. The existing development intercepts off-site flows from the south, east, and west. The Earll Drive right-of-way intercepts off-site flows from the north. A 90-inch RCP stormdrain pipe lies beneath Earll Drive and terminates in the Indian Bend Wash. Catch basins along Earl Drive drain into this 90-inch pipe.

2.3 On-Site Flow

On-site runoff sheet flows across the Site from the northwest to the southeast. The Site has a gradient fall of approximately 2-feet from the northwest to the southeast. See Figure 3 for existing conditions.

3 PROPOSED DRAINAGE PLAN

The analysis and discussion in this report are based on the preliminary on- & off-site drainage map (Figure 3) and meet the drainage requirements outlined in the City of Scottsdale's *Design Standards and Policies Manual* (Ref. 2).

3.1 Off-Site Flow

The existing drainage system along Earll Drive intercepts off site flows.

3.2 On-Site Flow

The Site will be re-graded to allow water to flow south to north, towards Earll Drive. Lots will drain towards the center of the street, which will convey flow towards Earll Drive. Existing catch basins in Earll Drive will direct the flow into the existing 90-inch RCP.

4 SPECIAL CONDITIONS

On-site storage for the 100-year 2-hour discharge volume is typically required. However, a waiver has been requested to reduce the required on-site storage and is included in Appendix F. The Site is adjacent to a 90-inch trunk storm drain which conveys runoff to Indian Bend Wash, with catch basins along Earll Drive. The design report for the storm drain (Ref. 3) illustrates that, at the location of the Site, the contributing watershed extends over 0.7 square miles and the pipe conveys 347 cfs at 3.23 hours

during a 10-year 6-hour storm (see Appendix E). Runoff from the Site is minimal and will be conveyed within the storm drain prior to the peak flow.

5 DATA ANALYSIS METHODS

All hydrologic and hydraulic methods used for this report are in accordance with the *Design Standards and Policies Manual for the City of Scottsdale* (Ref. 2), the *Flood Control District of Maricopa County Hydrology Manual* (Ref. 4) and the *Flood Control District of Maricopa County Hydraulic Manual* (Ref. 5).

5.1 Hydrology

Hydrologic analyses was performed using the rational method in accordance with procedures and parameters recommended in the *Design Standards and Policies Manual for the City of Scottsdale* (Ref. 2), as shown below. On-site flows were determined for the 2, 10, 25, and 100-year storms. Calculations are provided in Appendix B and summarized in Table 1.

$$Q = C\,i\,A$$

where: Q = computed runoff in cfs
C = runoff coefficient
i = rainfall intensity (inches)
A = sub-basin area (acres)

The runoff "C" coefficients employed are from Figure 4.1-4 of the *Scottsdale Design Standards and Policies Manual* (Ref. 2). These "C" values correspond to the proposed R-5 zoning. The "C" value for 2, 10, and 25-year storms is 0.76. The "C" value for a 100-year storm is 0.94. Existing and proposed runoff from the Site is summarized in Table 1.

Table 1: Peak Discharge Summary

Scenario	Peak Discharge (cfs)			
	2-yr	10-yr	25-yr	100-yr
Existing Flow	1	1	2	3
Proposed Flow	2	3	4	7

The existing Site does not have on-site storage facilities, but rather all runoff flows to the surrounding properties. 100-year 2-hour storage requirements for both the existing and proposed conditions are listed in Table 2 and summarized in Appendix C. Due to the proximity of the trunk storm drain pipe in Earll Drive, a Stormwater Storage Waiver is included in this report.

Table 2: 100-year 2-Hour Storage Volumes

Scenario	Runoff Coefficient	100-year 2-hour Volume (ac-ft)
Existing Conditions	0.45	0.083
Proposed Conditions	0.94	0.173

5.2 Hydraulics

Flows up to the 100-year 2 hour storm will be contained within the street cross section. Calculations for street capacities are shown in Appendix D.

6 CONCLUSIONS

1) The storm water storage may be waived per the Stormwater Storage Waiver, due to the small lot size and proximity to a main storm drain system.
2) Off-site flow will not affect the site.
3) The street cross section will adequately contain and convey the 100-year 2-hour storm runoff.
4) The site will be developed per City requirements.

7 WARNING AND DISCLAIMER OF LIABILITY

A completed Warning and Disclaimer of Liability form is included in Appendix G of this report.

8 REFERENCES

1. Federal Emergency Management Agency, "*Flood Insurance Rate Maps for Maricopa County Arizona, and Incorporated Areas, Map Number 04013C2235L*", October 16, 2013.

2. City of Scottsdale, "*Design Standards and Policies Manual*", February 2010.

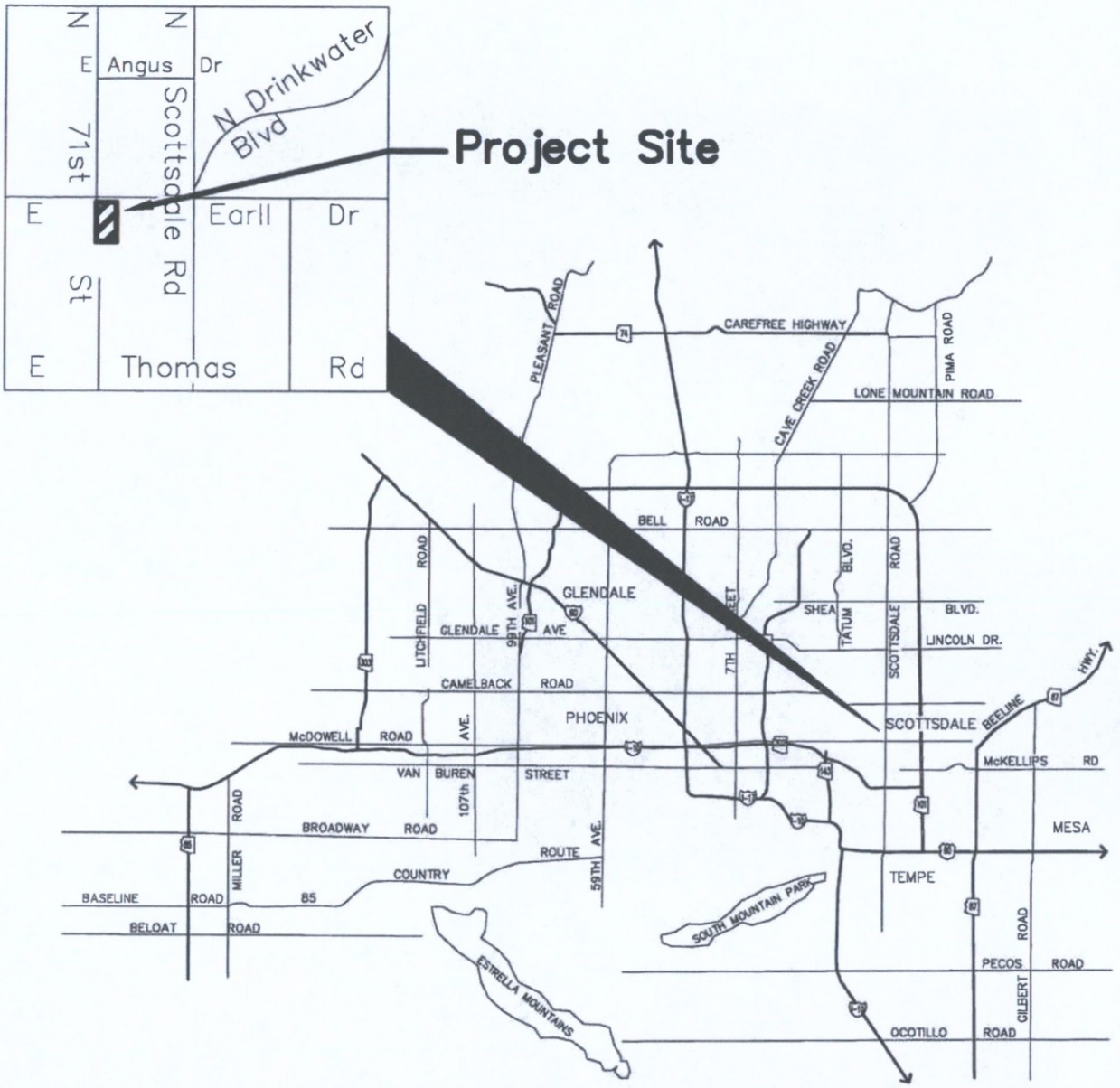
3. Parsons Brinckerhoff, *Osborn Road Storm Drain, Final Design Report*, March 31, 2000.

4. The Flood Control District of Maricopa County, "*Drainage Design Manual for Maricopa County, Arizona, Volume I Hydrology*", August 15, 2013.

5. The Flood Control District of Maricopa County, "*Drainage Design Manual for Maricopa County, Arizona, Volume II Hydraulics*", August 15, 2013.

6. National Oceanic and Atmospheric Administration, *NOAA Atlas 14, Precipitation-Frequency Atlas of the United States, Volume 1 Version 4.0: Semiarid Southwest (Arizona, Southeast California, Nevada, New Mexico, Utah)*, 2006.

7. Parsons Brinkerhoff, "*As-Built" Plans for the Construction of Osborn Road Storm Drain, Phase II, Thomas Road and 61st Place to Indian Bend Wash*, April 28, 2000.



NO SCALE

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The Gallery
At 71st St & Earll Dr
Location and Vicinity Map

FIGURE 1

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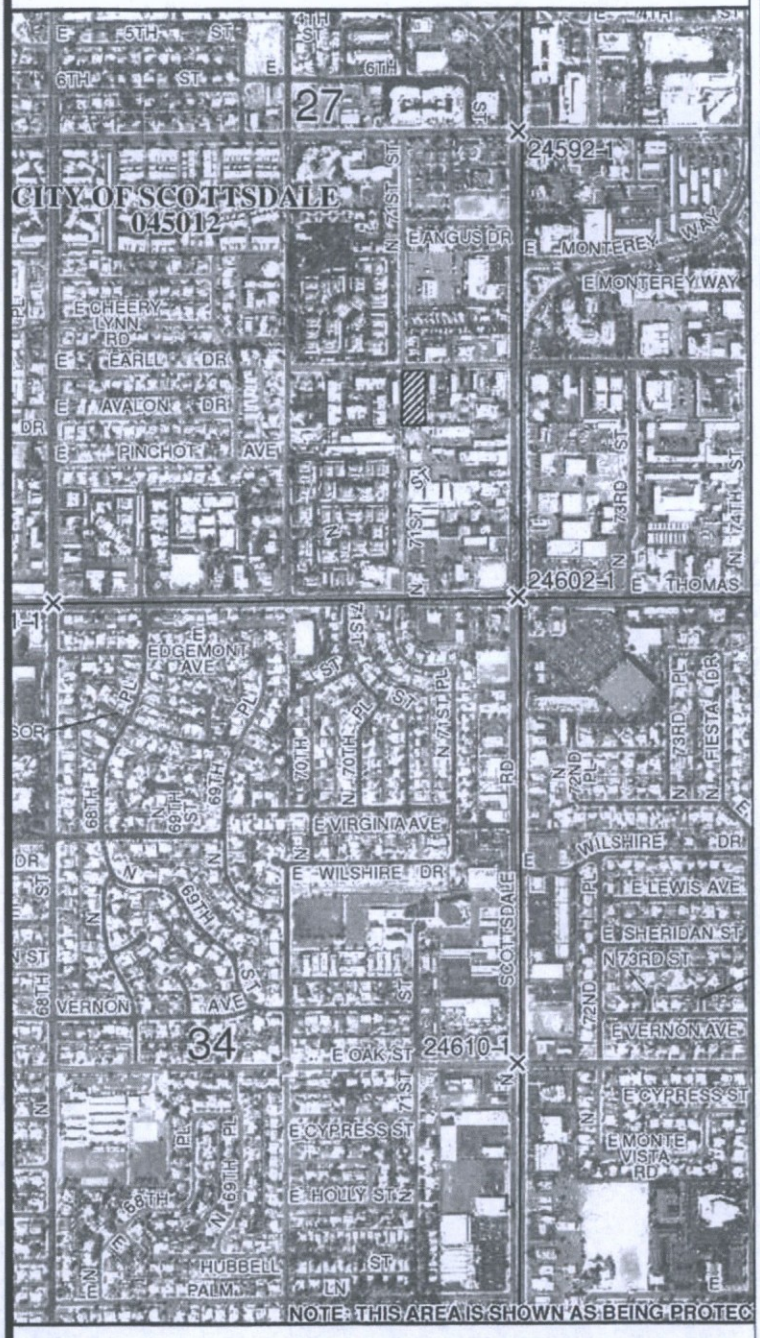

MAP SCALE 1" = 1000'

500 0 1000 2000 FEET

METE

NFIP

PANEL 2235L

NATIONAL FLOOD INSURANCE PROGRAM

FIRM

FLOOD INSURANCE RATE MAP

MARICOPA COUNTY, ARIZONA

AND INCORPORATED AREAS

PANEL 2235 OF 4425

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
MARICOPA COUNTY	040037	2235	L
MESA, CITY OF	040048	2235	L
SCOTTSDALE, CITY OF	045012	2235	L
TEMPE, CITY OF	040054	2235	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
04013C2235L

MAP REVISED
OCTOBER 16, 2013

Federal Emergency Management Agency

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The Gallery At 71st & Earll Dr

FLOOD INSURANCE RATE MAP

FIGURE 2

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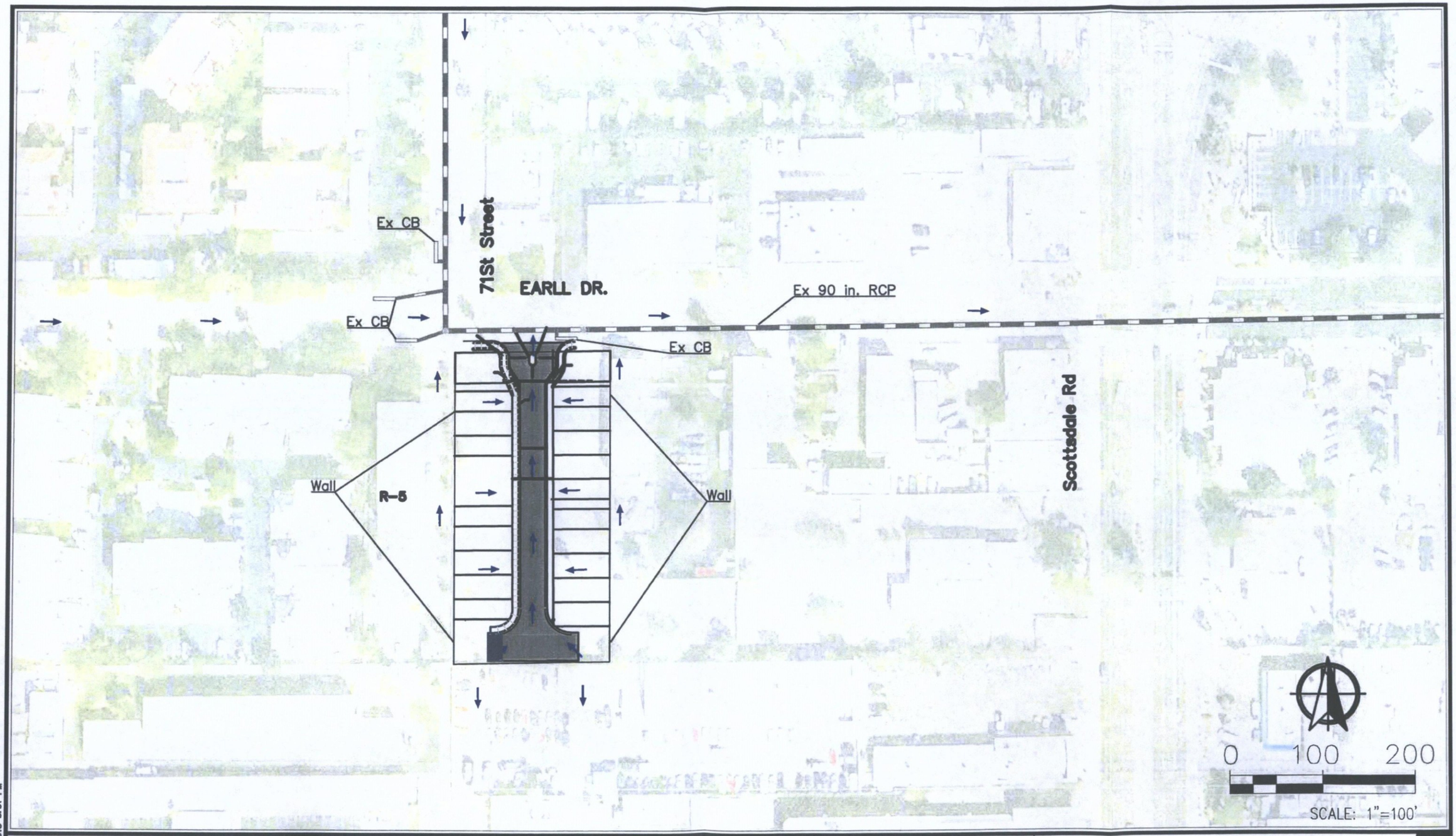

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LEGEND

Existing Storm Drain Pipe
Wall
Flow Direction Arrow
Existing Man hole

The Gallery
Preliminary Drainage Map On-Site & Off-Site

FIGURE 3

Appendix A: NOAA Rainfall Precipitation

NOAA Atlas 14, Volume 1, Version 5
Location name: Scottsdale, Arizona, US*
Latitude: 33.4835°, Longitude: -111.9281°
Elevation: 1244 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	0.183 (0.153–0.222)	0.239 (0.202–0.290)	0.324 (0.272–0.394)	0.390 (0.325–0.471)	0.480 (0.393–0.576)	0.549 (0.444–0.656)	0.619 (0.491–0.738)	0.691 (0.539–0.822)	0.787 (0.598–0.938)	0.860 (0.641–1.03)
10-min	0.278 (0.233–0.338)	0.363 (0.307–0.442)	0.494 (0.414–0.599)	0.594 (0.495–0.717)	0.730 (0.598–0.876)	0.835 (0.675–0.998)	0.941 (0.747–1.12)	1.05 (0.820–1.25)	1.20 (0.909–1.43)	1.31 (0.975–1.56)
15-min	0.344 (0.289–0.419)	0.450 (0.380–0.548)	0.612 (0.513–0.742)	0.737 (0.613–0.889)	0.905 (0.741–1.09)	1.04 (0.837–1.24)	1.17 (0.926–1.39)	1.30 (1.02–1.55)	1.48 (1.13–1.77)	1.62 (1.21–1.94)
30-min	0.464 (0.389–0.564)	0.607 (0.512–0.738)	0.825 (0.691–1.00)	0.992 (0.826–1.20)	1.22 (0.998–1.46)	1.39 (1.13–1.67)	1.57 (1.25–1.87)	1.75 (1.37–2.09)	2.00 (1.52–2.38)	2.19 (1.63–2.61)
60-min	0.574 (0.481–0.698)	0.751 (0.633–0.913)	1.02 (0.855–1.24)	1.23 (1.02–1.48)	1.51 (1.24–1.81)	1.73 (1.39–2.06)	1.95 (1.54–2.32)	2.17 (1.69–2.59)	2.47 (1.88–2.95)	2.71 (2.01–3.23)
2-hr	0.664 (0.567–0.792)	0.861 (0.735–1.03)	1.15 (0.981–1.37)	1.38 (1.16–1.63)	1.68 (1.40–1.98)	1.92 (1.57–2.25)	2.16 (1.74–2.53)	2.40 (1.90–2.82)	2.73 (2.11–3.21)	2.99 (2.26–3.53)
3-hr	0.722 (0.613–0.867)	0.926 (0.790–1.12)	1.22 (1.03–1.46)	1.45 (1.22–1.73)	1.77 (1.47–2.10)	2.03 (1.66–2.40)	2.30 (1.85–2.72)	2.58 (2.04–3.05)	2.97 (2.27–3.51)	3.29 (2.45–3.90)
6-hr	0.869 (0.754–1.02)	1.10 (0.959–1.30)	1.41 (1.23–1.66)	1.66 (1.43–1.94)	2.00 (1.70–2.32)	2.27 (1.89–2.62)	2.55 (2.09–2.94)	2.83 (2.28–3.27)	3.22 (2.53–3.73)	3.52 (2.70–4.10)
12-hr	0.972 (0.851–1.13)	1.23 (1.08–1.43)	1.56 (1.36–1.80)	1.82 (1.58–2.10)	2.17 (1.86–2.49)	2.43 (2.06–2.79)	2.71 (2.26–3.11)	2.99 (2.46–3.44)	3.36 (2.70–3.89)	3.66 (2.88–4.26)
24-hr	1.16 (1.04–1.31)	1.48 (1.32–1.67)	1.92 (1.71–2.15)	2.26 (2.01–2.54)	2.74 (2.42–3.07)	3.12 (2.74–3.49)	3.52 (3.06–3.93)	3.93 (3.39–4.39)	4.49 (3.84–5.03)	4.94 (4.18–5.54)
2-day	1.26 (1.12–1.42)	1.61 (1.44–1.81)	2.11 (1.88–2.37)	2.51 (2.23–2.82)	3.07 (2.72–3.44)	3.52 (3.09–3.94)	3.99 (3.48–4.48)	4.48 (3.88–5.03)	5.17 (4.43–5.81)	5.72 (4.85–6.45)
3-day	1.33 (1.19–1.50)	1.70 (1.52–1.91)	2.24 (1.99–2.51)	2.67 (2.37–2.99)	3.28 (2.90–3.67)	3.77 (3.30–4.21)	4.28 (3.73–4.80)	4.83 (4.17–5.41)	5.60 (4.78–6.28)	6.21 (5.25–6.99)
4-day	1.40 (1.25–1.58)	1.79 (1.60–2.02)	2.36 (2.10–2.65)	2.83 (2.51–3.17)	3.48 (3.07–3.90)	4.01 (3.52–4.49)	4.58 (3.98–5.12)	5.18 (4.47–5.80)	6.02 (5.13–6.74)	6.71 (5.66–7.53)
7-day	1.55 (1.38–1.75)	1.98 (1.77–2.24)	2.62 (2.33–2.94)	3.13 (2.78–3.52)	3.86 (3.41–4.33)	4.44 (3.90–4.98)	5.07 (4.41–5.68)	5.73 (4.95–6.43)	6.66 (5.68–7.48)	7.42 (6.25–8.34)
10-day	1.69 (1.51–1.90)	2.16 (1.93–2.43)	2.85 (2.54–3.20)	3.41 (3.02–3.81)	4.18 (3.69–4.67)	4.81 (4.22–5.37)	5.47 (4.76–6.11)	6.16 (5.33–6.89)	7.14 (6.10–7.99)	7.92 (6.70–8.88)
20-day	2.07 (1.86–2.32)	2.67 (2.39–2.98)	3.52 (3.15–3.93)	4.17 (3.71–4.64)	5.04 (4.47–5.61)	5.71 (5.05–6.35)	6.39 (5.62–7.12)	7.08 (6.20–7.89)	8.01 (6.95–8.95)	8.72 (7.51–9.76)
30-day	2.42 (2.16–2.71)	3.12 (2.79–3.48)	4.11 (3.66–4.57)	4.86 (4.33–5.40)	5.87 (5.20–6.52)	6.64 (5.86–7.38)	7.44 (6.54–8.26)	8.25 (7.21–9.16)	9.34 (8.10–10.4)	10.2 (8.75–11.3)
45-day	2.81 (2.52–3.13)	3.62 (3.25–4.03)	4.76 (4.27–5.31)	5.61 (5.02–6.25)	6.73 (6.00–7.49)	7.57 (6.73–8.43)	8.42 (7.45–9.38)	9.27 (8.16–10.3)	10.4 (9.08–11.6)	11.2 (9.76–12.6)
60-day	3.11 (2.80–3.46)	4.01 (3.61–4.46)	5.28 (4.74–5.86)	6.20 (5.55–6.88)	7.39 (6.61–8.21)	8.28 (7.37–9.19)	9.17 (8.13–10.2)	10.0 (8.87–11.2)	11.2 (9.81–12.5)	12.0 (10.5–13.4)

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

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

Please refer to NOAA Atlas 14 document for more information.

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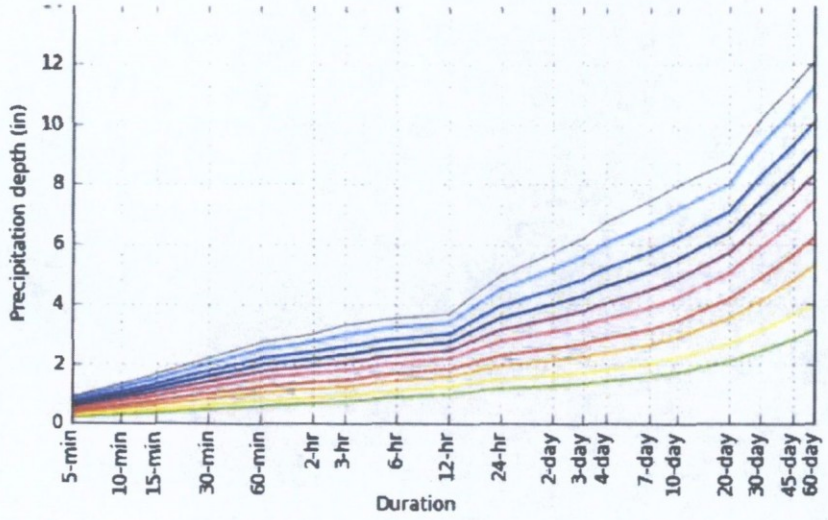
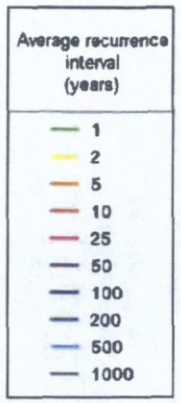
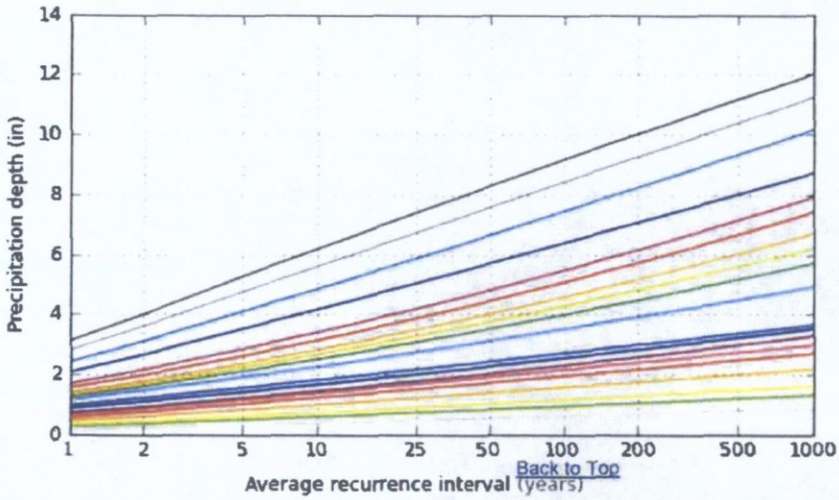
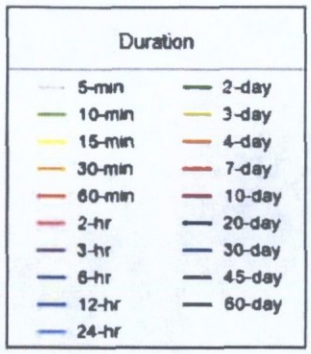
PF graphical









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NOAA Atlas 14, Volume 1, Version 5

Maps & aerials

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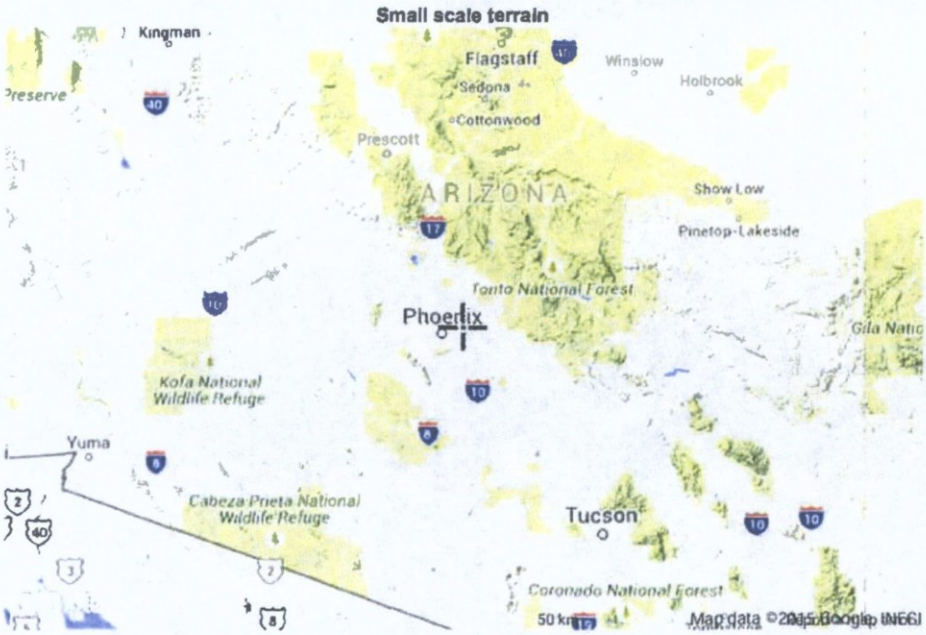
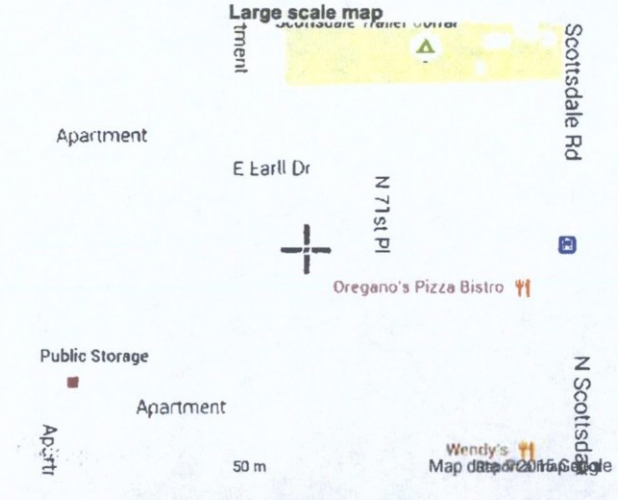
Small scale terrain

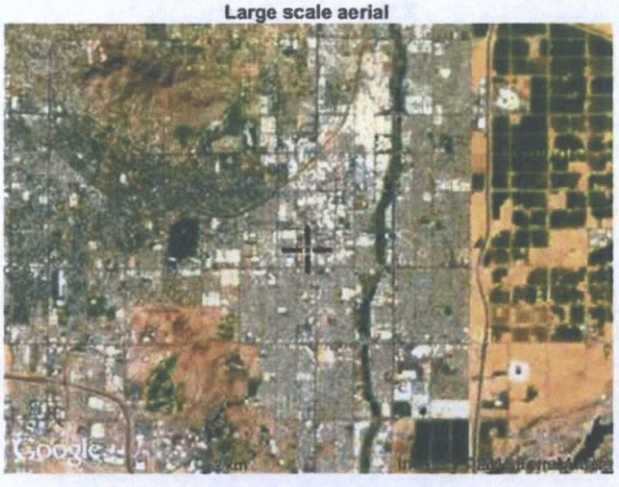


Large scale terrain

Large scale map



Large scale aerial



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US Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service
Office of Hydrologic Development
1325 East West Highway
Silver Spring, MD 20910

The Gallery
Rainfall Data Summary per NOAA Atlas 14

Reference: *NOAA Atlas 14*, dated 2003, as obtained from the *Precipitation Frequency Data Server* website, http://hdsc.nws.noaa.gov/hdsc/pfds/sa/az_pfds.html, June 2015

Notes: (1) Values for 5, 10, 15, 30, and 60-minute intensities taken from NOAA Atlas 14.
(2) Remaining intensity values were interpolated between known values.

Storm Event	Precipitation Depth (inches)
2-Year, 1-Hour	0.75
10-Year, 1-Hour	1.23
25-Year, 1-Hour	1.51
100-Year, 1-Hour	1.95

Tc (min.)	Site-Specific Precipitation Intensity (inches/hour)			
	i2	i10	i25	i100
5	**2.87**	**4.68**	**5.76**	**7.43**
6	2.73	4.46	5.48	7.07
7	2.59	4.23	5.21	6.72
8	2.46	4.01	4.93	6.36
9	2.32	3.78	4.66	6.01
10	**2.18**	**3.56**	**4.38**	**5.65**
11	2.10	3.44	4.23	5.45
12	2.03	3.32	4.08	5.26
13	1.95	3.19	3.92	5.06
14	1.88	3.07	3.77	4.87
15	**1.80**	**2.95**	**3.62**	**4.67**
16	1.76	2.89	3.54	4.57
17	1.72	2.82	3.46	4.47
18	1.68	2.76	3.38	4.36
19	1.64	2.69	3.31	4.26
20	1.60	2.63	3.23	4.16
21	1.56	2.56	3.15	4.06
22	1.52	2.50	3.07	3.96
23	1.49	2.43	2.99	3.85
24	1.45	2.37	2.91	3.75
25	1.41	2.30	2.83	3.65
26	1.37	2.24	2.75	3.55
27	1.33	2.17	2.68	3.45
28	1.29	2.11	2.60	3.34
29	1.25	2.04	2.52	3.24
30	**1.21**	**1.98**	**2.44**	**3.14**
31	1.19	1.96	2.41	3.10
32	1.18	1.93	2.38	3.06
33	1.16	1.91	2.35	3.02
34	1.15	1.88	2.32	2.98
35	1.13	1.86	2.29	2.94
36	1.12	1.83	2.25	2.90
37	1.10	1.81	2.22	2.86
38	1.09	1.78	2.19	2.82
39	1.07	1.76	2.16	2.78
40	1.06	1.73	2.13	2.74
41	1.04	1.71	2.10	2.70
42	1.03	1.68	2.07	2.66
43	1.01	1.66	2.04	2.62
44	1.00	1.63	2.01	2.58
45	0.98	1.61	1.98	2.55
46	0.97	1.58	1.94	2.51
47	0.95	1.56	1.91	2.47
48	0.93	1.53	1.88	2.43
49	0.92	1.51	1.85	2.39
50	0.90	1.48	1.82	2.35
51	0.89	1.46	1.79	2.31
52	0.87	1.43	1.76	2.27
53	0.86	1.41	1.73	2.23
54	0.84	1.38	1.70	2.19
55	0.83	1.36	1.67	2.15
56	0.81	1.33	1.63	2.11
57	0.80	1.31	1.60	2.07
58	0.78	1.28	1.57	2.03
59	0.77	1.26	1.54	1.99
60	**0.751**	**1.23**	**1.51**	**1.95**

Appendix B: Hydrologic Calculations

The Gallery Proposed Conditions Flow
RATIONAL METHOD CALCULATIONS

References:

1. City of Scottsdale, *Drainage Standards and Policies Manual*, February 2010.
2. FCDMC, *Drainage Design Manual-Hydrology*, August 15, 2013.
3. NOAA Atlas 14, *Point Precipitation Frequency Estimates*, http://hdsc.nws.noaa.gov/hdsc/pfds/sa/az_pfds.html, extracted July 2015.

$Q = C\,i\,A$

C = runoff coefficient, from Table 3.2 FCDMC Manual
i = rainfall intensity (in/hr)
A = area (ac)

$Tc = 11.4\,(L^{0.5})\,(Kb^{0.52})\,(S^{-0.31})\,(i^{-0.38})$

Tc min = 5 min
L = longest flow path length (mi)
Kb = watershed resistance coefficient, $K_b = m\log_{10}A+b$
S = slope of longest flow path (ft/mi)
Kb MIN per Table 3.1 FCDMC hydrology Manual
m = -0.0063
b = 0.04

Sub-Basin I.D.	Area, A (Ac)	Runoff Coefficient, C				Flow Path					Time of Concentration, Tc					Rainfall Intensity, I (in/hr)				Peak Discharge (cfs)			
						Length, L		Elevations		Slope, S		Calculated Tc (min)											
		2-Yr	10-Yr	25-Yr	100-Yr	(ft)	(mi)	High	Low	(ft/mi)	Kb	2-Yr	10-Yr	25-Yr	100-Yr	2-Yr	10-Yr	25-Yr	100-Yr	2-Yr	10-Yr	25-Yr	100-Yr
10	1.02	0.76	0.76	0.76	0.94	308	0.06	2	0	34	0.040	7	6	5	5	2.59	4.46	5.76	7.43	2	3	4	7

The Gallery Existing Conditions Flow
RATIONAL METHOD CALCULATIONS

References:
1. City of Scottsdale, *Drainage Standards and Policies Manual* , February 2010.
2. FCDMC, *Drainage Design Manual-Hydrology* , August 15, 2013.
3. NOAA Atlas 14, *Point Precipitation Frequency Estimates* , http://hdsc.nws.noaa.gov/hdsc/pfds/sa/az_pfds.html, extracted July 2015.

$Q = C\,i\,A$

C = runoff coefficient, from Table 3.2 FCDMC Manual
i = rainfall intensity (in/hr)
A = area (ac)

$Tc = 11.4\,(L^{0.5})\,(Kb^{0.52})\,(S^{-0.31})\,(i^{-0.38})$
Tc min = 5 min
L = longest flow path length (mi)
Kb = watershed resistance coefficient, $K_b = m\log_{10}A+b$
S = slope of longest flow path (ft/mi)
Kb MOD HIGH per Table 3.1 FCDMC hydrology Manual
m = -0.025
b = 0.15

Sub-Basin I.D.	Area, A (Ac)	Runoff Coefficient, C				Flow Path					Time of Concentration, Tc					Rainfall Intensity, I (in/hr)				Peak Discharge (cfs)			
						Length, L		Elevations		Slope, S		Calculated Tc (min)											
		2-Yr	10-Yr	25-Yr	100-Yr	(ft)	(mi)	High	Low	(ft/mi)	Kb	2-Yr	10-Yr	25-Yr	100-Yr	2-Yr	10-Yr	25-Yr	100-Yr	2-Yr	10-Yr	25-Yr	100-Yr
10	1.02	0.37	0.37	0.37	0.45	308	0.06	2	0	34	0.150	17	13	12	11	1.72	3.19	4.08	5.45	1	1	2	3

Appendix C: Storm Water Storage Calculations

Hoskin • Ryan Consultants, Inc.
creative engineering solutions

BY: DATE:
CHECK: DATE:
PROJECT:
PROJECT NUMBER:
SUBJECT:

$V_R = C[P/12]A$

Pre-development

where

$C = 0.45$

$P = 2.16$ in. ← Pre 100yr 2hr Storm

$A = 1.02$ Acres $= 44,431.2$ Ft^2

$V_R = 3596.93$ Ft^3

Post Development

where

$C = 0.94$

$P = 2.16$ in

$A = 1.02$ Acres

$V_P = 7513.76$ Ft^3

$\Delta V_R = 3,916.83$ Ft^3

$Fee = \$1.87(\Delta V) = \$7,328.22$

Appendix D: Street Flow Calculations

71st Street and Earll Drive
STREET CAPACITY TABLES

Residential Subdivision Street - 4-inch Roll Curb
Design Criteria: Flow to Top of Curb

Top of Curb	4 "
Half Street Width to B/C =	14.00 ft
Street Cross-Slope, Sx =	2.00%
Crown Height (ht. above low gutter) =	3.38 "
Flow Area to Top of Curb =	2.62 ft^2
Wetted Perimeter =	13.42 ft
Manning's 'n' value =	0.016

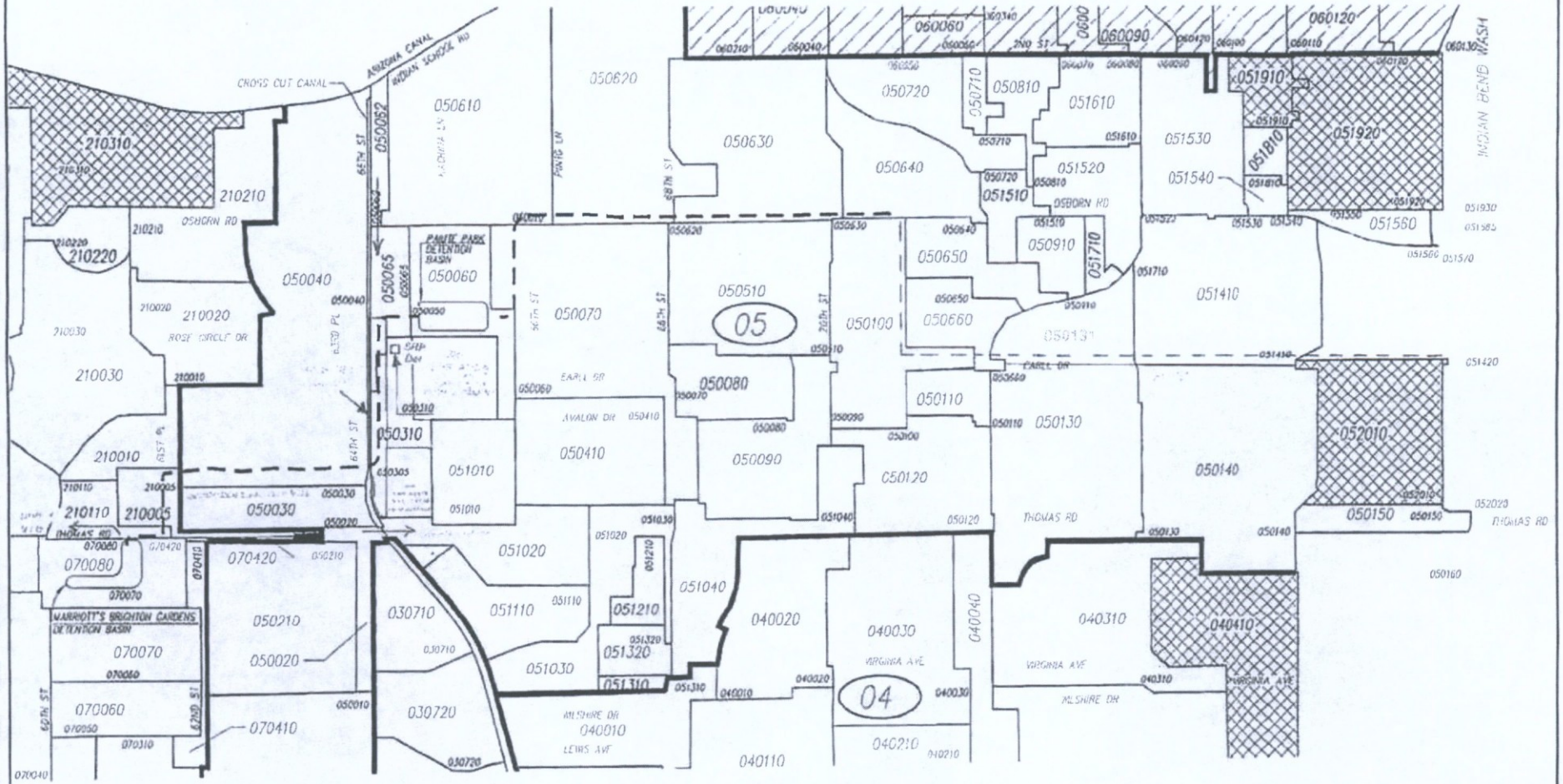
Longitudinal Slope (ft/ft)	Velocity of Flow (fps)	Half-Street Flow Rate (cfs)
0.15%	1.21	3.17
0.20%	1.40	3.66
0.25%	1.57	4.09
0.30%	1.71	4.49
0.35%	1.85	4.84
0.40%	1.98	5.18
0.45%	2.10	5.49
0.50%	2.21	5.79
0.55%	2.32	6.07
0.60%	2.43	6.34
0.65%	2.52	6.60
0.70%	2.62	6.85
0.75%	2.71	7.09
0.80%	2.80	7.32
0.85%	2.89	7.55
0.90%	2.97	7.77
0.95%	3.05	7.98
1.00%	3.13	8.19
1.05%	3.21	8.39
1.10%	3.28	8.59
1.15%	3.36	8.78
1.20%	3.43	8.97
1.25%	3.50	9.16
1.30%	3.57	9.34
1.35%	3.64	9.52
1.40%	3.70	9.69
1.45%	3.77	9.86
1.50%	3.83	10.03
1.55%	3.90	10.20
1.60%	3.96	10.36
1.65%	4.02	10.52
1.70%	4.08	10.68
1.75%	4.14	10.83
1.80%	4.20	10.99
1.85%	4.26	11.14
1.90%	4.32	11.29
1.95%	4.37	11.44
2.00%	4.43	11.58
2.05%	4.48	11.73
2.10%	4.54	11.87
2.15%	4.59	12.01
2.20%	4.64	12.15
2.25%	4.70	12.28
2.30%	4.75	12.42
2.35%	4.80	12.55
2.40%	4.85	12.69
2.45%	4.90	12.82
2.50%	4.95	12.95
2.55%	5.00	13.08
2.60%	5.05	13.20
2.65%	5.10	13.33
2.70%	5.14	13.46
2.75%	5.19	13.58
2.80%	5.24	13.70
2.85%	5.29	13.83
2.90%	5.33	13.95
2.95%	5.38	14.07
3.00%	5.42	14.18
3.05%	5.47	14.30
3.10%	5.51	14.42
3.15%	5.56	14.53
3.20%	5.60	14.65
3.25%	5.64	14.76
3.30%	5.69	14.88
3.35%	5.73	14.99
3.40%	5.77	15.10
3.45%	5.82	15.21
3.50%	5.86	15.32
3.55%	5.90	15.43
3.60%	5.94	15.54
3.65%	5.98	15.65
3.70%	6.02	15.75
3.75%	6.06	15.86
3.80%	6.10	15.96
3.85%	6.14	16.07
3.90%	6.18	16.17
3.95%	6.22	16.28
4.00%	6.26	16.38
4.05%	6.30	16.48
4.10%	6.34	16.58
4.15%	6.38	16.68
4.20%	6.42	16.78

Residential Subdivision Street - 4-inch Roll Curb
Design Criteria: Flow to ROW

Top of Curb	4 "
Half Street Width to B/C =	14.00 ft
Street Cross-Slope, Sx =	2.00%
Crown Height (ht. above low gutter) =	3.38 "
Sidewalk Width =	4.00 ft
Sidewalk Slope =	1.50%
CL to ROW Width =	20.00 ft
Remaining ROW Width =	2.00 ft
ROW Slope =	0.30%
Flow Depth at Gutter=	4.79 "
Flow Area to ROW =	4.23 ft2
Wetted Perimeter	20.00 ft
Manning's 'n' value =	0.018

Longitudinal Slope (ft/ft)	Velocity of Flow (fps)	Half-Street Flow Rate (cfs)
0.15%	1.17	4.95
0.20%	1.35	5.71
0.25%	1.51	6.39
0.30%	1.65	7.00
0.35%	1.79	7.56
0.40%	1.91	8.08
0.45%	2.03	8.57
0.50%	2.14	9.03
0.55%	2.24	9.47
0.60%	2.34	9.90
0.65%	2.44	10.30
0.70%	2.53	10.69
0.75%	2.62	11.06
0.80%	2.70	11.43
0.85%	2.79	11.78
0.90%	2.87	12.12
0.95%	2.95	12.45
1.00%	3.02	12.78
1.05%	3.10	13.09
1.10%	3.17	13.40
1.15%	3.24	13.70
1.20%	3.31	13.99
1.25%	3.38	14.28
1.30%	3.45	14.57
1.35%	3.51	14.84
1.40%	3.58	15.12
1.45%	3.64	15.38
1.50%	3.70	15.65
1.55%	3.76	15.91
1.60%	3.82	16.16
1.65%	3.88	16.41
1.70%	3.94	16.66
1.75%	4.00	16.90
1.80%	4.05	17.14
1.85%	4.11	17.38
1.90%	4.16	17.61
1.95%	4.22	17.84
2.00%	4.27	18.07
2.05%	4.33	18.29
2.10%	4.38	18.51
2.15%	4.43	18.73
2.20%	4.48	18.95
2.25%	4.53	19.16
2.30%	4.58	19.37
2.35%	4.63	19.58
2.40%	4.68	19.79
2.45%	4.73	20.00
2.50%	4.78	20.20
2.55%	4.82	20.40
2.60%	4.87	20.60
2.65%	4.92	20.80
2.70%	4.96	20.99
2.75%	5.01	21.19
2.80%	5.06	21.38
2.85%	5.10	21.57
2.90%	5.15	21.76
2.95%	5.19	21.94
3.00%	5.23	22.13
3.05%	5.28	22.31
3.10%	5.32	22.49
3.15%	5.36	22.67
3.20%	5.41	22.85
3.25%	5.45	23.03
3.30%	5.49	23.21
3.35%	5.53	23.38
3.40%	5.57	23.56
3.45%	5.61	23.73
3.50%	5.65	23.90
3.55%	5.69	24.07
3.60%	5.73	24.24
3.65%	5.77	24.41
3.70%	5.81	24.57
3.75%	5.85	24.74
3.80%	5.89	24.90
3.85%	5.93	25.07
3.90%	5.97	25.23
3.95%	6.01	25.39
4.00%	6.04	25.55
4.05%	6.08	25.71
4.10%	6.12	25.87
4.15%	6.16	26.03
4.20%	6.19	26.18

Appendix E: Excerpts from Previous Reports



PORTION OF ORIGINAL DRAINAGE MAP FROM
STP PAPAGO WATERSHED STUDY
KIMLEY-HORN, 1997
PARSONS BRINCKERHOFF ANNOTATIONS IN RED

OSBORN OUTFALL
ALTERNATIVE ANALYSIS

DRAINAGE MAP

PARSONS BRINCKERHOFF

FIGURE 3

+	DIVERSION TO	05Qspl	0.	3.83	0.	0.	0.	0.45
+	HYDROGRAPH AT	05Qpip	103.	3.83	43.	27.	27.	0.45
+	ROUTED TO	05DETA	103.	3.83	43.	27.	27.	0.45
+	HYDROGRAPH AT	050610	99.	3.17	10.	6.	6.	0.08
+	2 COMBINED AT	050610	137.	3.17	53.	32.	32.	0.54
+	ROUTED TO	05062A	136.	3.20	53.	32.	32.	0.54
+	HYDROGRAPH AT	050620	110.	3.17	12.	7.	7.	0.10
+	2 COMBINED AT	050620	243.	3.17	64.	39.	39.	0.63
+	ROUTED TO	05063A	243.	3.20	64.	39.	39.	0.63
+	HYDROGRAPH AT	050630	120.	3.13	9.	6.	6.	0.06
+	2 COMBINED AT	050630	342.	3.17	74.	45.	45.	0.70
+	ROUTED TO	05064A	339.	3.20	74.	45.	45.	0.70
+	HYDROGRAPH AT	050640	15.	3.10	1.	1.	1.	0.01
+	2 COMBINED AT	050640	349.	3.20	75.	46.	46.	0.70
+	ROUTED TO	05066A	347.	3.23	75.	46.	46.	0.70
+	HYDROGRAPH AT	050100	79.	3.17	6.	4.	4.	0.03

	2 COMBINED AT						
+		050660	411.	3.20	81.	49.	49.	0.74
	ROUTED TO						
+		05013A	409.	3.23	81.	49.	49.	0.74
	HYDROGRAPH AT						
+		050131	55.	3.13	4.	3.	3.	0.02
	2 COMBINED AT						
+		050131	447.	3.23	85.	52.	52.	0.76
	ROUTED TO						
+		05141A	443.	3.27	85.	52.	52.	0.76
	HYDROGRAPH AT						
+		051410	178.	3.13	13.	8.	8.	0.07
	2 COMBINED AT						
+		051410	556.	3.23	98.	60.	60.	0.83
	ROUTED TO						
+		05142A	551.	3.27	98.	60.	60.	0.83

1

SUMMARY OF KINEMATIC WAVE - MUSKINGUM-CUNGE ROUTING
(FLOW IS DIRECT RUNOFF WITHOUT BASE FLOW)

SUMMARIES REMOVED FOR PRINTOUT- SEE ELECTRONIC FILE

1 SUMMARY OF DAM OVERTOPPING/BREACH ANALYSIS FOR STATION 210ST
(PEAKS SHOWN ARE FOR INTERNAL TIME STEP USED DURING BREACH FORMATION)

PLAN 1 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	0.00	1.00	1.00
STORAGE	0.	8.	8.
OUTFLOW	0.	0.	0.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	0.55	0.00	4.	0.	0.00	9.97	0.00

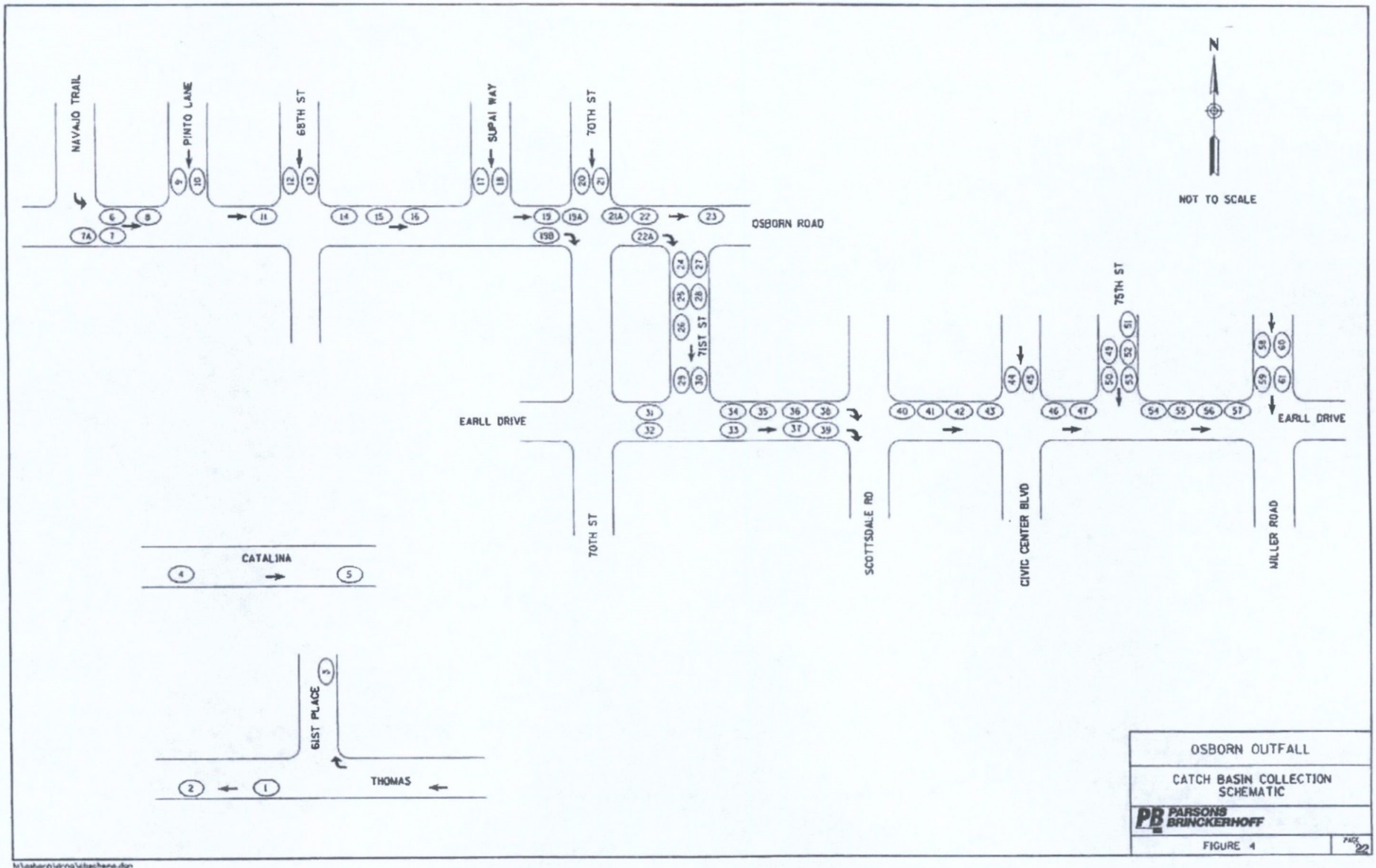

N
NOT TO SCALE
NAVAJO TRAIL
PINTO LANE
68TH ST
SUPAI WAY
70TH ST
OSBORN ROAD
71ST ST
75TH ST
EARLL DRIVE
EARLL DRIVE
70TH ST
SCOTTSDALE RD
CIVIC CENTER BLVD
MILLER ROAD
CATALINA
61ST PLACE
THOMAS
OSBORN OUTFALL
CATCH BASIN COLLECTION SCHEMATIC
PARSONS BRINCKERHOFF
FIGURE 4
PAGE 22

Table 5
Check of Hydraulic Grade Line at Inlets

Inlet	Flow Captured (cfs)	Connector Size (in)	Connector Length (ft)	Friction Loss (ft)[1]	Entrance Loss (ft)[2]	HGL at Connection (ft)[3]	HGL at Inlet (ft)	Inlet Elevation (ft)	Freeboard (ft)
1	9	Modeled by Storm Cad					1269.8	1271.1	1.3
3	2	Modeled by Storm Cad					1264.2	1267.5	3.3
4	3	Modeled by Storm Cad					1265.0	1267.0	2.0
5	3	Modeled by Storm Cad					1264.0	1266.7	2.7
6	5	18	14	0.03	0.06	1257.1	1257.2	1259.5	2.3
7 & 7A	7	18	34	0.13	0.12	1257.1	1257.4	1259.7	2.3
8	2	18	14	0.00	0.01	1257.1	1257.1	1259.1	2.0
9	4	18	27	0.03	0.04	1255.2	1255.3	1259.2	3.9
10	4	18	10	0.01	0.04	1255.2	1255.3	1259.1	3.8
11	6	18	14	0.04	0.09	1252.3	1252.4	1256.1	3.7
12	4	18	15	0.02	0.04	1252.6	1252.7	1256.1	3.4
13	4	18	58	0.07	0.04	1252.6	1252.7	1255.8	3.1
14	3	18	17	0.01	0.02	1250.0	1250.1	1254.1	4.0
15	2	Modeled by Storm Cad					1249.4	1253.3	3.9
16	4	12	44	0.46	0.20	1246.6	1249.1	1252.0	2.9
17	3	18	33	0.02	0.02	1248.7	1248.7	1252.5	3.8
18	1.5	18	7	0.00	0.01	1246.7	1248.7	1252.2	3.5
19 & 19A	4	Modeled by Storm Cad					1248.1	1250.8	2.7
19B	2	15	25	0.02	0.02	1246.5	1246.5	1250.1	3.6
20	7	18	7	0.03	0.12	1247.7	1247.9	1251.4	3.5
21	6	18	33	0.09	0.09	1247.7	1247.9	1251.7	3.8
21A	2	12	35	0.00	0.00	1246.5	1246.5	1250.3	3.8
22	5	18	46	0.09	0.06	1244.2	1244.3	1248.5	4.2
22A	1	12	25	0.02	0.01	1244.2	1244.2	1247.6	3.4
23	8	Modeled by Storm Cad					1245.5	1247.8	2.3
24	8	Modeled by Storm Cad					1243.8	1247.5	3.7
25	5	Modeled by Storm Cad					1243.3	1246.5	3.2
26	5	Modeled by Storm Cad					1242.9	1245.9	3.0
27	7	18	29	0.11	0.12	1243.6	1243.8	1247.4	3.6
28	4	18	29	0.04	0.04	1243.6	1243.7	1246.9	3.2
29	6	18	13	0.04	0.09	1239.6	1239.7	1243.1	3.4
30	8	18	29	0.14	0.16	1239.6	1239.9	1243.0	3.1
31	9	18	36	0.23	0.20	1239.6	1240.0	1242.5	2.5
32	7	18	22	0.08	0.12	1239.6	1239.8	1243.0	3.2
33	5	18	6	0.01	0.06	1239.6	1239.7	1242.4	2.7
34 & 35	11	18	37	0.34	0.30	1239.6	1240.2	1242.5	2.3
36	5	Modeled by Storm Cad					1239.0	1241.8	2.8
37	3	18	8	0.01	0.02	1238.6	1238.7	1241.9	3.2
38	3	Modeled by Storm Cad					1237.9	1241.3	3.4
39	2	15	8	0.00	0.01	1237.6	1237.6	1241.0	3.4
40	9	18	50	0.31	0.20	1235.1	1235.6	1238.5	2.9
41	7	18	50	0.18	0.12	1235.1	1235.4	1237.5	2.1
42	7	18	50	0.13	0.12	1234.9	1234.9	1237.1	2.2
43	3	18	50	0.03	0.02	1233.3	1233.3	1236.1	2.8
44	7	18	18	0.07	0.12	1234.2	1234.4	1236.1	1.7
45	5	18	46	0.09	0.06	1234.2	1234.4	1236.3	1.9
46	3	18	55	0.04	0.02	1232.8	1232.8	1235.4	2.6
47	15	Modeled by Storm Cad					1232.0	1233.5	1.5
49	13	24	37	0.47	0.13	1231.9	1232.5	1234.0	1.5
50	3.5	18	37	0.03	0.03	1231.9	1231.9	1233.6	1.7
51	4	18	4	0.00	0.04	1231.9	1231.9	1234.5	2.6
52	5	18	4	0.01	0.06	1231.9	1231.9	1234.0	2.1
53	3	18	4	0.00	0.02	1231.9	1231.9	1233.5	1.6
54	4	18	45	0.03	0.04	1230.9	1231.0	1233.0	2.0
55	4	Modeled by Storm Cad					1231.7	1232.4	0.7
56	6	Modeled by Storm Cad					1231.2	1231.6	0.4
57	8	Modeled by Storm Cad					1230.8	1231.2	0.5
58	8	18	38	0.19	0.16	1230.9	1231.2	1231.2	0.0
59	3	18	28	0.03	0.02	1230.9	1230.9	1231.1	0.2
60	7	18	5	0.02	0.12	1230.9	1231.0	1231.3	0.3
61	2	18	6	0.00	0.01	1230.9	1230.9	1231.1	0.2

[1] Assumes connector pipe is flooded for full length

[2] Assumes entrance loss at inlet equal 0.5 times velocity head

[3] HGL at Storm Cad node near inlet. See mainline model or lateral models

Table 4
Catch Basin Bypass Relationships

Inlet	Station and Offset	Design Condition	Flow at Inlet (cfs)	Bypass to Inlet (cfs)	Flow Captured (cfs)	Bypass Flow (cfs)	Half Street Width (ft)	Allowable Spread (ft)	Calculated Spread (ft)
1	11+95, 84' Rt	HEC-1	21	0	9	12	36	28	34[a]
2	Exist @ 10+80, 84' Rt	HEC-1	0	12	12	0	36	28	19
3	17+30, 30' Rt	Rational	3	0	2	1	20	14	8
4	29+47, 7' Rt	Rational	3	0	3	0	15	9	13[a]
5	34+71, 23' Rt	Rational	3	0	3	0	15	9	13[a]
6	50' Lt @ Navajo Tr.	Curb Full	5	0	5	0	NA	NA	NA
7	66+63, 72' Lt	Curb Full	8	0	5	3	NA	NA	NA
7A	68+83, 58' Lt	Curb Full	0	3	2	1	NA	NA	NA
8	71+70, 7' Lt	HEC-1	2	0	2	0	21	15	10
9	72+17, 34' Lt	Curb Full	4	0	4	0	NA	NA	NA
10	72+52, 45' Lt	Curb Full	4	0	4	0	NA	NA	NA
11	81+42, 7' Lt	HEC-1	6	0	6	0	22	16	12
12	83+05, 34' Lt	Curb Full	4	0	4	0	NA	NA	NA
13	82+73, 68' Lt	Curb Full	4	0	4	0	NA	NA	NA
14	86+30, 16' Lt	HEC-1	6	0	3	3	32	26	21
15	88+30, 40' Lt	HEC-1	3	3	3	3	32	26	17
16	92+20, 38' Lt	HEC-1	3	3	4	2	32	26	20
17	92+85, 120' Lt	Curb Full	3	0	3	0	NA	NA	NA
18	93+13, 63' Lt	Curb Full	2	0	1.5	0.5	NA	NA	NA
19	95+10, 30' Lt	HEC-1	3	2	4	1	32	26	19
19A	95+10, 39' Lt (Exist)	HEC-1	0	1	0.3	0.7	32	26	3
19B	95+10, 32' Rt (Exist)	Rational	3	0	2	1	32	26	9
20	95+38, 61' Lt	Curb Full	8	0	7	1	NA	NA	NA
21	95+80, 143' Lt	Curb Full	8	0	6	2	NA	NA	NA
21A	96+20, 39' Lt (Exist)	HEC-1	0	0	0	0	32	20	0
22	99+00, 37' Lt	HEC-1	6	2	5	3	32	20	20
22A	101+56, 27' Rt (Exist)	Rational	2	0	1	1	32	20	20
23	101+85, 38' Lt	HEC-1	6	2	6	2	32	20	18
24	104+56, 10' Rt	HEC-1	13	0	8	5	20	14	20[a]
25	106+36, 10' Rt	HEC-1	0	5	5	0	20	14	18[a]
26	108+11, 10' Rt	HEC-1	6	0	5	1	20	14	17[a]
27	108+04, 31' Lt	HEC-1	11	0	7	4	20	14	20[a]
28	106+21, 30' Lt	HEC-1	0	4	4	0	20	14	18[a]
29	114+59, 10' Rt	HEC-1	12	1	8	7	20	14	20[a]
30	114+71, 30' Lt	HEC-1	15	0	8	7	20	14	20[a]
31	114+96, 36' Rt	HEC-1	13	0	9	4	20	14	20[a]
32	20' Rt @ 71st St	HEC-1	11	0	7	4	20	14	19[a]
33	116+60, 4' Rt	HEC-1	0	10[b]	5	5	20	14	18[a]
34	116+01, 37' Lt	HEC-1	0	13[b]	7	6	20	14	20[a]
35	116+13, 37' Lt	HEC-1	0	6	4	2	20	14	13
36	118+65, 36' Lt	HEC-1	3	2	5	0	20	14	14
37	118+61, 3' Rt	HEC-1	0	5	3	2	20	14	13
38	121+18, 37' Lt	HEC-1	3	0	3	0	20	14	15
39	121+17, 3' Rt	Rational	1	2	2	1	20	14	13
40	129+25, 51' Lt	HEC-1	15	0	9	6	32	26	23
41	131+95, 51' Lt	HEC-1	7	6	7	6	32	26	24
42	132+60, 50' Lt	HEC-1	7	6	7	6	32	26	20
43	134+66, 55' Lt	HEC-1	0	6	3	3	32	26	15
44	134+84, 101' Lt	Curb Full	9	0	7	2	NA	NA	NA
45	136+49, 97' Lt	Curb Full	9	0	5	4	NA	NA	NA
46	136+03, 58' Lt	HEC-1	0	3	3	0	30	24	8
47	139+49, 61' Lt	HEC-1	18	0	18	0	32	26	25
48	141+54, 143' Lt	Curb Full	16	0	13	4	NA	NA	NA
50	141+54, 36' Lt	Curb Full	0	4	3.5	0.5	NA	NA	NA
51	141+95, 231' Lt	Curb Full	13	0	4	9	NA	NA	NA
52	141+95, 126' Lt	Curb Full	0	9	5	4	NA	NA	NA
53	141+95, 71' Lt	Curb Full	0	4	3	1	NA	NA	NA
54	142+30, 47' Lt	HEC-1	5	0	4	1	20	14	17[a]
55	144+00, 46' Lt	HEC-1	5	1	4	2	20	14	16[a]
56	146+32, 46' Lt	HEC-1	5	1	6	0	20	14	17[a]
57	147+77, 49' Lt	HEC-1	5	1	5	1	20	14	14
58	148+11, 110' Lt	Curb Full	11	0	8	3	NA	NA	NA
59	148+11, 81' Lt	Curb Full	0	3	3	0	NA	NA	NA
60	148+58, 130' Lt	Curb Full	9	0	7	2	NA	NA	NA
61	148+58, 70' Lt	Curb Full	0	2	2	0	NA	NA	NA

[a] Runoff enters street as point discharge. Encroachment criteria temporarily exceeded.

[b] Half street capacity exceeded. Flows will overtop crown. Bypass from catch basins 29, 30, 31 and 32 divided between catch basins 33 and 34.

[c] Pavement spread exceeded on north half of roadway. Total 18' dry pavement expected during 10-year storm.

Appendix F: Stormwater Storage Waiver

Request for Stormwater Storage Waiver

City of Scottsdale Case Numbers:

___ - PA - ___ ___ - ZN - ___ ___ - UP - ___ ___ - DR - ___ ___ - PP - ___ PC#_____

The applicant/developer must complete and submit this form to the city for processing and obtain approval of waiver request ***before submitting improvement plans***. Denial of the waiver may require the developer to submit a revised site plan to the Development Review Board.

Date 07-09-2015 **Project Name** 71st Street and Earll Drive (the Gallery)
Project Location 71st Street and Earll Drive
Applicant Contact Laura Marquis **Company Name** Hoskin Ryan Consultants
Phone (602) 252-8384 Fax (602) 252-8385 E-mail laura m@hoskinryan.com
Address 6245 N. 24th Parkway, Suite 100 Phoenix AZ 85016

Waiver Criteria

A project must meet at least one of three criteria listed below for the city to consider waiving some or all required stormwater storage. **However, regardless of the criteria, a waiver will only be granted if the applicant can demonstrate that the effect of a waiver will not increase the potential for flooding on any property.** Check the applicable box and provide a signed engineering report and supporting engineering analysis that demonstrate the project meets the criteria and that the effect of a waiver will not increase the potential for flooding on any property.

If the runoff for the project has been included in a storage facility at another location, the applicant must demonstrate that the stormwater storage facility was specifically designed to accommodate runoff from the subject property and that the runoff will be conveyed to this location through an adequately designed conveyance facility.

☒ 1. The development is adjacent to a conveyance facility that an engineering analysis shows is designed and constructed to handle the additional runoff from the site as a result of development.

☐ 2. The development is on a parcel less than one-half acre in size.

☐ 3. Stormwater storage requirements conflict with requirements of the Environmentally Sensitive Lands Ordinance (ESLO).

For a full storage waiver, a conflict with ESLO is limited to:

- Property located in the hillside landform as defined in the city Zoning Ordinance
- Property in the upper desert landform that has a land slope steeper than 5% as defined in the city Zoning Ordinance
- Property within the ESL zoning overlay district where the only viable location for a stormwater storage basin requires blasting

This full waiver only applies to those portions of property meeting one of these three requirements.

Partial waivers are available for projects or portions of properties within the Environmentally Sensitive Lands Zoning Overlay District, not meeting any of the three full waiver criteria above, if post-development peak discharge rates do not exceed pre-development conditions, based on the 10- and 100-year storm events.

By signing below, I certify that the stated project meets the waiver criteria selected above as demonstrated by the attached documentation.

Laura Marquis
Engineer

July 9, 2015
Date

Planning, Neighborhood & Transportation Division
7447 E Indian School Road, Suite 105, Scottsdale, AZ 85251 • Phone: 480-312-2500 • Fax: 480-312-7781

Request for Stormwater Storage Waiver

City of Scottsdale Case Numbers:

___ - PA - ___ ____ - ZN - ____ ____ - UP - ____ ____ - DR - ___ ____ - PP - ____ PC#_____

CITY STAFF TO COMPLETE THIS PAGE

Project Name _____

Check Appropriate Boxes:

☐ Meets waiver criteria (specify): ☐ 1 ☐ 2 ☐ 3

☐ Recommend approve waiver.

☐ Recommend deny waiver:
- ☐ None of waiver criteria met.
- ☐ Downstream conditions prohibit waiver of any storage.
- ☐ Other:

Explain: _____

_____

☐ Return waiver request:
- ☐ Insufficient data provided.
- ☐ Other: _____

Explain: _____

_____

Recommended Conditions of Waiver:
- ☐ All storage requirements waived.
- ☐ Post-development peak discharge rates do not exceed pre-development conditions.
- ☐ Other:

Explain: _____

_____

☐ **Waiver approved per above conditions.**

☐ **Waiver denied.**

_____ _____

Floodplain Administrator or Designee Date

Planning, Neighborhood & Transportation Division

7447 E Indian School Road, Suite 105, Scottsdale, AZ 85251 • Phone: 480-312-2500 • Fax: 480-312-7781

Request for Stormwater Storage Waiver

City of Scottsdale Case Numbers:

___ - PA - ___ ___ - ZN - ___ ___ - UP - ___ ___ - DR - ___ ___ - PP - ___ PC#_____

In-Lieu Fee and In-Kind Contributions

In-lieu fees are only applicable to projects where post-development peak discharge rates exceed pre-development levels, based on the 10- and 100-year storm events. If the city grants a waiver, the developer is required to calculate and contribute an in-lieu fee based on what it would cost the city to provide a storage basin, sized as described below, including costs such as land acquisition, construction, landscaping, design, construction management, and maintenance over a 75-year design life. The fee for this cost is $1.87 per cubic foot of stormwater storage for a virtual storage basin designed to mitigate the increase in runoff associated with the 100-year/2-hour storm event. The applicant may submit site-specific in-lieu fee calculations subject to the Floodplain Administrator's approval.

The Floodplain Administrator considers in-kind contributions on a case-by-case basis. An in-kind contribution can serve as part of or instead of the calculated in-lieu fee. In-kind contributions must be stormwater related and must constitute a public benefit. In-lieu fees and in-kind contributions are subject to the approval of the Floodplain Administrator or designee.

Project Name 71st Street and Earll Drive

The waived stormwater storage volume is calculated using a simplified approach as follows:

$V = \Delta CRA$; where
V = stormwater storage volume required, in cubic feet,
ΔC = increase in weighted average runoff coefficient over disturbed area ($C_{post} - C_{pre}$),
R = 100-year/2-hour precipitation depth, in feet (DSPM, Appendix 4-1D, page 11), and
A = area of disturbed ground, in square feet

Furthermore,

$V_w = V - V_p$; where
V_w = volume waived,
V = volume required, and
V_p = volume provided

R = _____
ΔC= _____
A = _____
V = _____
V_p= _____
V_w= _____

☐ An in-lieu fee will be paid, based on the following calculations and supporting documentation:
In-lieu fee ($) = V_w (cu. ft.) x $1.87 per cubic foot = _____

☐ An in-kind contribution will be made, as follows:

_____
_____
_____

☐ No in-lieu fee is required. Reason:

_____
_____

Approved by:

_____ _____
Floodplain Administrator or Designee Date

Planning, Neighborhood & Transportation Division
7447 E Indian School Road, Suite 105, Scottsdale, AZ 85251 • Phone: 480-312-2500 • Fax: 480-312-7781

Appendix G: Warning and Disclaimer of Liability

Appendix 4-1C

WARNING & DISCLAIMER OF LIABILITY

The Drainage and Floodplain Regulations and Ordinances of the City of Scottsdale are intended to "minimize the occurrence of losses, hazards and conditions adversely affecting the public health, safety and general welfare which might result from flooding caused by the surface runoff of rainfall" (Scottsdale Revised Code §37-16).

As defined in S.R.C. §37-17, a flood plain or "*Special flood hazard* area means an area having flood and/or flood related erosion hazards as shown on a FHBM or FIRM as zone A, AO, A1-30, AE, A99, AH, or E, and those areas identified as such by the floodplain administrator, delineated in accordance with subsection 37-18(b) and adopted by the floodplain board." It is possible that a property could be inundated by greater frequency flood events or by a flood greater in magnitude than a 100-year flood. Additionally, much of the Scottsdale area is a dynamic flood area; that is, the floodplains may shift from one location to another, over time, due to natural processes.

WARNING AND DISCLAIMER OF LIABILITY PURSUANT TO S.R.C §37-22
"The degree of flood protection provided by the requirements in this article 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 man-made or natural causes. This article (Chapter 37, Article II) shall not create liability on the part of the city, any officer or employee thereof, or the federal government for any flood damages that result from reliance on this article or any administrative decision lawfully made thereunder."

Compliance with Drainage and Floodplain Regulations and Ordinances does not insure complete protection from flooding. The Floodplain Regulations and Ordinances meet established local and federal standards for floodplain management, but neither this review nor the Regulations and Ordinances take into account such flood related problems as natural erosion, streambed meander or man-made obstructions and diversions, all of which may have an adverse affect 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. If I am an agent for an owner I have made the owner aware of and explained this disclaimer.

Plan Check No.	Laura Margis Owner or Agent	07-09-2015 Date

CASE FILE

PRELIMINARY WATER BASIS OF DESIGN REPORT
FOR
Gallery

A residential community located in the
City of Scottsdale, Arizona

Accepted w/ Comment

City of Scottsdale
Water Resources Administration
9379 E. San Salvador
Scottsdale, AZ 85258

Doug Mann 7.31.15

Prepared:

July 9, 2015

Prepared for:

K Hovnanian Great Western Homes, LLC
20830 N. Tatum Boulevard, Suite 250
Phoenix, Arizona 85050
Tel: (480) 824-4200

Prepared by:

Hoskin Ryan Consultants, Inc
6245 N. 24th Parkway, Suite 100
Phoenix, AZ 85016
Tel: (602) 252-8384

12-ZN-2015
7/15/15

Professional Engineer (Civil)
CERTIFICATE NO.
32836
PAUL M.
HAAS
Date Signed 7-9-15
ARIZONA, U.S.A.

EXP. 9-30-16

Hoskin • Ryan Consultants, Inc.
creative engineering solutions

15-015

TABLE OF CONTENTS

APPENDICES

EXHIBITS

1.3 Topographic Conditions and City of Scottsdale Pressure Zones

The existing topography for Gallery varies slightly. The site has a gradient fall of approximately 2 feet from the north to south, sloping at approximately 0.65%. The project site currently is undeveloped space. Onsite elevations range from approximately 1241 to 1243 feet above mean sea level (MSL).

There are several pressure zones throughout the City of Scottsdale. Gallery is within Pressure Zone 1 which is located between the elevations of 1,180 and 1,280 (Ref. 1). The lowest proposed ground elevation for Gallery is designed at an approximate elevation of 1,243feet. The highest proposed ground elevation for Gallery is 1,244.5 feet.

1.4 Existing Facilities

Gallery will be supplied from a 6-inch water line in Earll Drive that will connect to the proposed 8-inch line that will run through the site servicing all 18 lots.

You Are putting An eight on A 6? Does A 6" lose to much head under Fire Flow?

2.0 WATER SYSTEM DESIGN PARAMETERS

2.1 Water System Requirements

The design criteria used in the analysis was based upon the criteria required by the City of Scottsdale Design Standards & Policies Manual (Ref. 1). The water system requirements that serve as the basis of the proposed water plan are listed below:

- For single-family residential developments, the unit demand is 248.2 gallons per household per day.
- The maximum day demand is 2.0 times the average day demand, and the peak hour demand is 1.75 times the maximum day demand.
- The minimum required pressure throughout the water distribution system for average day, maximum day, and peak hour flow demand is 50 pounds per square inch (psi). Maximum water pressure at all service locations is not to exceed 120 psi. The minimum allowable pressure for maximum day plus fire flow is 30 psi.

3.0 PROPOSED WATER SYSTEM

3.1 Water Demand Calculations

Gallery projected potable water demands for the average day, maximum day, and peak hour are listed below in *Table 3.1.1 Water Demand Calculations*. Demands are calculated based on the criteria listed above in *Table 2.1.1 City of Scottsdale Unit Water Demands*. Detailed calculations for the site are included in the Appendix.

Table 3.1.1 Water Demand Calculations

Average Day Demand (gpm)	Maximum Day Demand (gpm)	Peak Hour Demand (gpm)
3.1	6.2	10.9

4.0 WATER SYSTEM MODELING

4.1 Water Distribution System

Gallery's water distribution system will consist of an 8-inch water distribution main in the local street. Water meters for residential and landscape use will be provided based on City of Scottsdale requirements. The water distribution system has been designed to meet the requirements outlined in Section 2.0 of this report. The water supply will be provided from an existing 6-inch line in Earll Drive.

4.2 Water Model Analysis

Gallery's proposed water system network was analyzed using Haestad Methods WaterCAD version 6.5. Demands for the individual lots were assigned to nodes based on their proximity to each node. The project was modeled for the Average Day, Max Day, Peak Hour, and Max Day plus Fire Flow. A pump was used to match the condition in the field by using a three point pump curve and the results of a fire hydrant test (Appendix E). The model output reports are located in the Appendix. Elevations of all junctions were set based on the existing topography of the site. A fire flow demand of 500 gpm was assigned to all single family unit nodes. A Hazen-Williams "C" value of 130 was used for all pipes within the system. Exhibit 2 shows the approximate location and size of the proposed distribution mains within Gallery.

4.3 Water Model Results

Based on the results of the water model, the system provides a minimum pressure of 82 psi within the site during the peak hour demand and a maximum pressure of 83 psi for the average day demand. These pressures are within the acceptable range from the City of Scottsdale *Design Standards & Policies Manual* (Ref. 1). The appropriate fire flow can be obtained at all junctions on site while maintaining a pressure greater than 30 psi. A detailed list of all junctions and pipes can be found in Appendices A, B, C, and D.

APPENDIX

APPENDIX A

WaterCAD Analysis – Average Day

Scenario: Average Day
Steady State Analysis
Junction Report

Label	Elevation (ft)	Type	Base Flow (gpm)	Pattern	Demand (Calculated) (gpm)	Calculated Hydraulic Grade (ft)	Pressure (psi)
J-1	1,243.00	Demand	0.00	Fixed	0.00	1,432.45	81.97
J-2	1,241.00	Demand	3.10	Fixed	3.10	1,432.45	82.83

Scenario: Average Day
Steady State Analysis
Pipe Report

Label	Length (ft)	Diameter (in)	Material	Hazen-Williams C	Check Valve?	Minor Loss Coefficient	Control Status	Discharge (gpm)	Pressure Pipe Headloss (ft)	Headloss Gradient (ft/1000ft)	Velocity (ft/s)
P-1	83.00	6.0	Ductile Iron	130.0	true	0.00	Open	3.10	0.00	0.00	0.04
P-2	126.00	6.0	Ductile Iron	130.0	true	0.00	Open	3.10	0.00	0.00	0.04
P-3	330.00	8.0	Ductile Iron	130.0	true	0.00	Open	3.10	0.00	0.00	0.02

APPENDIX B

WaterCAD Analysis – Maximum Day

Scenario: Maximum Day
Steady State Analysis
Junction Report

Label	Elevation (ft)	Type	Base Flow (gpm)	Pattern	Demand (Calculated) (gpm)	Calculated Hydraulic Grade (ft)	Pressure (psi)
J-1	1,243.00	Demand	0.00	Fixed	0.00	1,432.45	81.97
J-2	1,241.00	Demand	6.20	Fixed	6.20	1,432.45	82.83

Scenario: Maximum Day
Steady State Analysis
Pipe Report

Label	Length (ft)	Diameter (in)	Material	Hazen-Williams C	Check Valve?	Minor Loss Coefficient	Control Status	Discharge (gpm)	Pressure Pipe Headloss (ft)	Headloss Gradient (ft/1000ft)	Velocity (ft/s)
P-1	83.00	6.0	Ductile Iron	130.0	true	0.00	Open	6.20	0.00	0.01	0.07
P-2	126.00	6.0	Ductile Iron	130.0	true	0.00	Open	6.20	0.00	0.01	0.07
P-3	330.00	8.0	Ductile Iron	130.0	true	0.00	Open	6.20	0.00	0.00	0.04

APPENDIX C

WaterCAD Analysis – Peak Hour

Scenario: Peak Hour
Steady State Analysis
Junction Report

Label	Elevation (ft)	Type	Base Flow (gpm)	Pattern	Demand (Calculated) (gpm)	Calculated Hydraulic Grade (ft)	Pressure (psi)
J-1	1,243.00	Demand	0.00	Fixed	0.00	1,432.44	81.96
J-2	1,241.00	Demand	10.90	Fixed	10.90	1,432.44	82.83

Scenario: Peak Hour
Steady State Analysis
Pipe Report

Label	Length (ft)	Diameter (in)	Material	Hazen-Williams C	Check Valve?	Minor Loss Coefficient	Control Status	Discharge (gpm)	Pressure Pipe Headloss (ft)	Headloss Gradient (ft/1000ft)	Velocity (ft/s)
P-1	83.00	6.0	Ductile Iron	130.0	true	0.00	Open	10.90	0.00	0.02	0.12
P-2	126.00	6.0	Ductile Iron	130.0	true	0.00	Open	10.90	0.00	0.02	0.12
P-3	330.00	8.0	Ductile Iron	130.0	true	0.00	Open	10.90	0.00	0.00	0.07

APPENDIX D

WaterCAD Analysis – Maximum Day + Fire Flow

Scenario: Max Day + Fire Flow
Fire Flow Analysis
Fire Flow Report

Label	Satisfies Fire Flow Constraints?	Needed Fire Flow (gpm)	Available Fire Flow (gpm)	Total Flow Needed (gpm)	Total Flow Available (gpm)	Calculated Residual Pressure (psi)	Minimum Zone Pressure (psi)	Calculated Minimum Zone Pressure (psi)	Minimum Zone Junction
J-1	true	1,000.00	1,200.00	1,000.00	1,200.00	67.10	20.00	67.97	J-2
J-2	true	1,000.00	1,200.00	1,006.20	1,206.20	64.28	20.00	67.10	J-1

FH?

what happens if 6" pipe installed ?

APPENDIX E

Fire Hydrant Flow Tests

ALLIANCE FIRE PROTECTION CO.

Phone: (480) 966-9178 Fax: (480) 967-9191
2114 East Cedar Street • Tempe, Arizona 85281
E-mail Address: afpc@afpc.com

AZ Lic. C-16 58130
AZ Lic. L-16 74007
NV Lic. C-41a 30135

FIRE HYDRANT FLOW TEST

Name: Hoskin-Ryan Consultants
The Gallery
71st And Earl
Scottsdale AZ

Date: 06/08/15
Time: 7:30 AM
Report #
Tech: R.Pfeiff

Static Hydrant: NWC of 71st & Earl EL 1241
Flowing Hydrant: NEC of 71st & Earl

Elevation:
Elevation:

Dist. Between Hydrants: 100 yards
Type of Supply: City Main

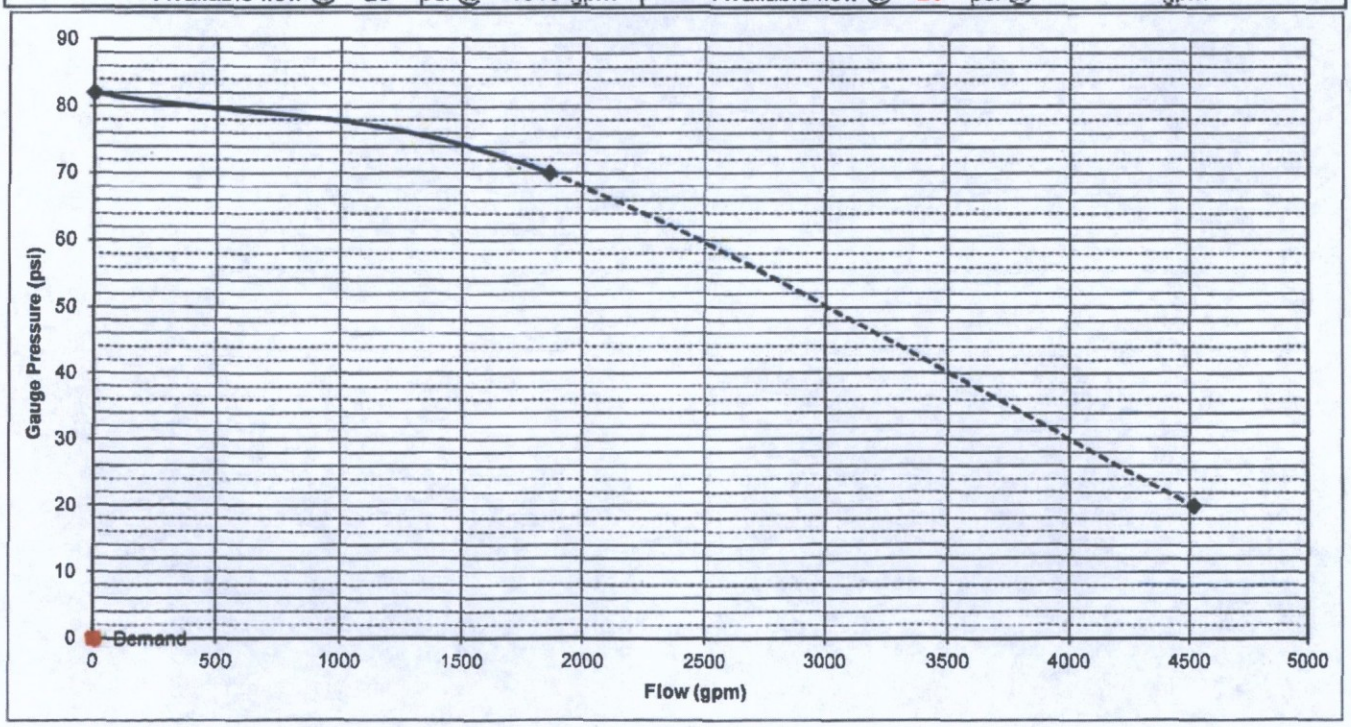
Diameter of Main: Unknown

Static Pressure:	A	82.0	B	
Residual Pressure:	A	70.0	B	

Pump Present: NO
Tank Present: NO HGL STAT 1430
Req. GPM: Req. PSI:

Hydrant:	A	A	B	B
Outlet Diameter:	3.5			
Pitot Reading:	32.0			
Coeff:	0.90			
Discharge GPM:	1860	0	0	0

Flow A				Flow B			
Static pressure of	82	psi @	0 gpm	Static pressure of	0	psi @	0 gpm
Residual pressure of	70	psi @	1860 gpm	Residual pressure of	0	psi @	0 gpm
Available flow @	20	psi @	4516 gpm	Available flow @	20	psi @	gpm

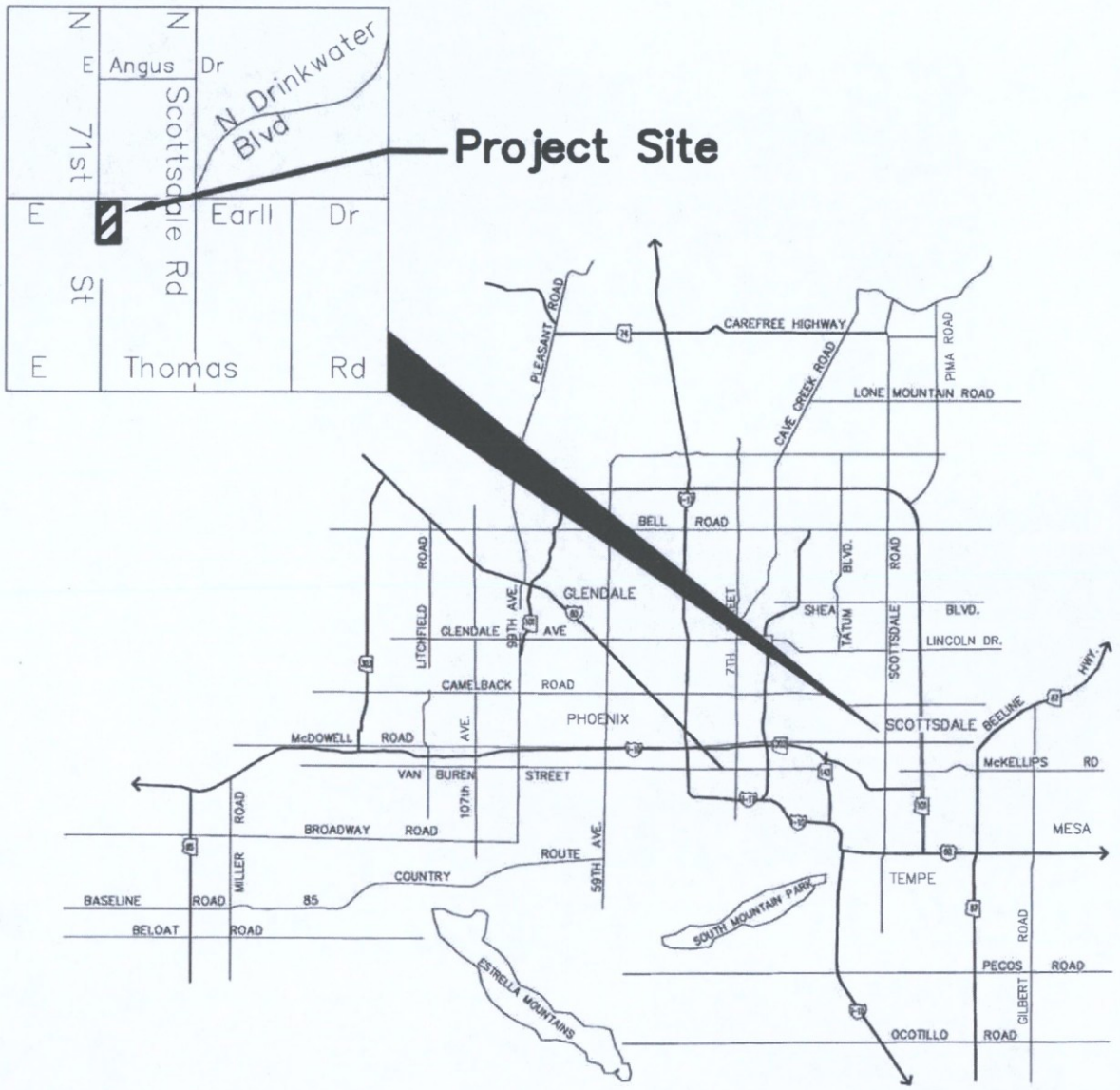


Comments:

NOTES:

1. Flowing hydrant is assumed to be on a circulating main or downstream of the pressure test hydrant on a dead-end system.
2. Flow analysis assumes a gravity flow system with no distribution pumps and having no demand, other than the test
3. The distance between hydrants, elevations & main diameters are for information only.

EXHIBITS



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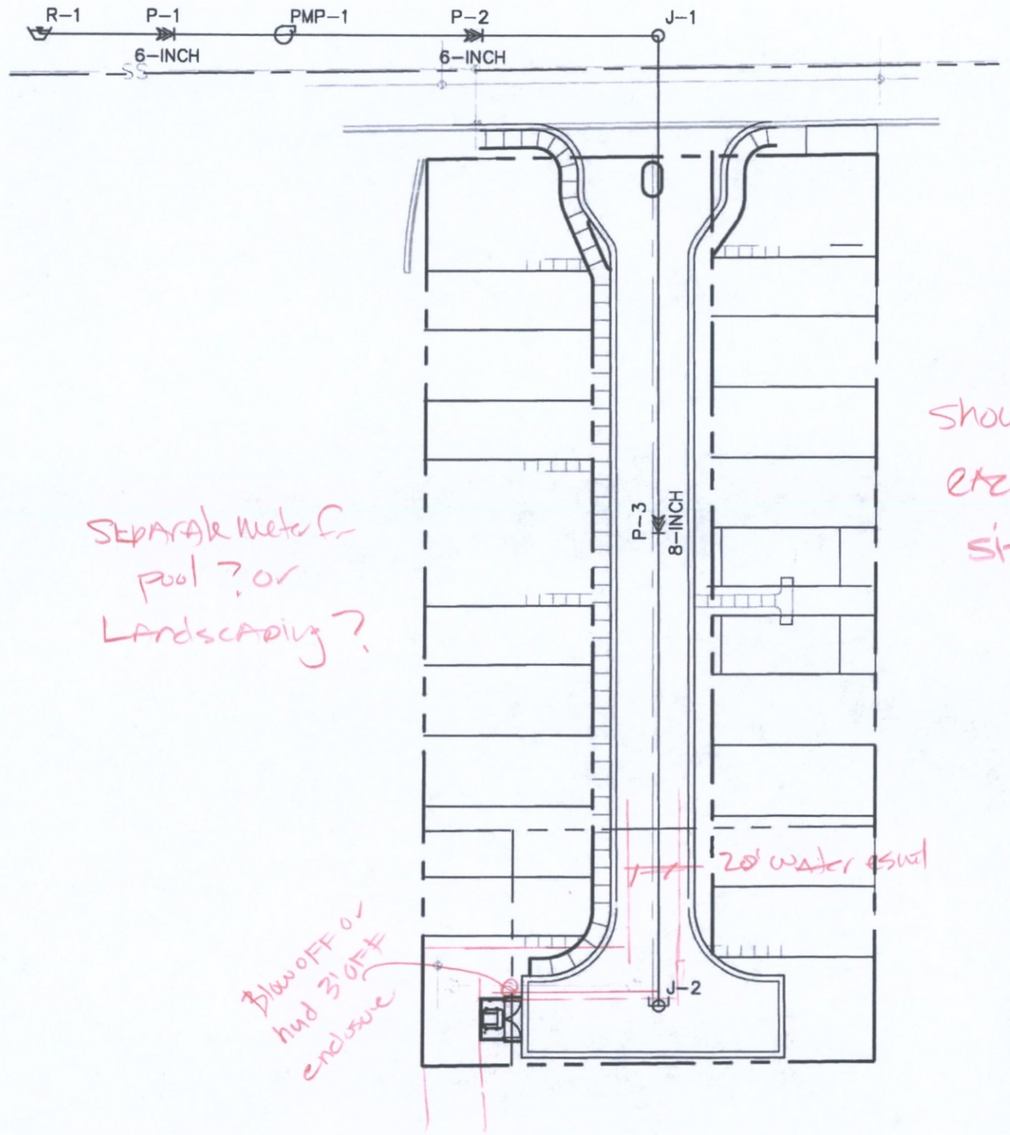
Office (602) 252-8384 | Fax (602) 252-8385 | ww.hoskinryan.com

The Gallery At 71st St & Earll Dr

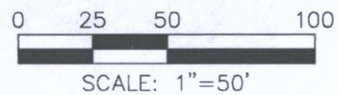
Location and Vicinity Map

FIGURE 1



Separate meter for pool? or Landscaping?

Show concept for each Lot's meter siting



LEGEND

- JUNCTION
- RESERVOIR
- PUMP
- PIPE

Are you proposing a FH or blow off at end of line?

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LEGEND

GALLERY
WATER DISTRIBUTION MAP

EXHIBIT 2

CASE FILE

PRELIMINARY WASTEWATER BASIS OF DESIGN REPORT
FOR
Gallery

A residential community located in the
City of Scottsdale, Arizona

Accepted w/ Comment
City of Scottsdale
Water Resources Administration
9379 E. San Salvador
Scottsdale, AZ 85258
Doug Mann 7.31.15

Prepared:

July 9, 2015

Prepared for:

K Hovnanian Great Western Homes, LLC
20830 N. Tatum Boulevard, Suite 250
Phoenix, Arizona 85050
Tel: (480) 824-4200

Prepared by:

Hoskin Ryan Consultants, Inc
6245 N. 24th Parkway, Suite 100
Phoenix, AZ 85016
Tel: (602) 252-8384

12-ZN-2015
7/15/15

Registered Professional Engineer (Civil)
CERTIFICATE NO.
32836
PAUL M.
HAAS
Date Signed 7-9-15
ARIZONA, U.S.A.

EXP. 9-30-16

Hoskin • Ryan Consultants, Inc.
creative engineering solutions

HRC 15-015

TABLE OF CONTENTS

APPENDIX

EXHIBITS

1.0 INTRODUCTION

1.1 Project Description

K Hovnanian Great Western Homes is planning the development of a 1.2-acre high density residential subdivision known as Gallery. Gallery is being developed in one phase.

The purpose of this report is to provide a preliminary basis of design for the wastewater system for the proposed development of Gallery. The proposed site will be developed in one phase and includes 18 single-family residential lots, a community pool, and open space. This report has been prepared to meet the requirements of the City of Scottsdale, the Maricopa County Environmental Services Department (MCESD), the Arizona Administrative Code (AAC), and the Arizona Department of Environmental Quality (ADEQ).

1.2 Project Location

Gallery is located southeast of the intersection of 71st Street and Earll Drive in Scottsdale, Arizona. The site is bounded on the north by Earll Drive, on the east by an existing automotive repair service, on the west by a small apartment complex, and on the south by an accident repair shop.

More specifically, the project is located within the southeast quarter of Section 27 of Township 2 North, Range 4 East, of the Gila and Salt River Meridian, within the City of Scottsdale, Arizona. The location of the property is depicted in *Exhibit 1- Location and Vicinity Map*.

1.3 Topographic Conditions

The existing topography for the Gallery varies slightly. The site has a gradient fall of approximately 2 feet from the north to south, sloping at approximately 0.65%. Onsite elevations range from approximately 1,241 to 1,243 feet above mean sea level (MSL). The project site currently is undeveloped land.

1.4 Existing Facilities/Conditions

12" Being Relocated?

There is an existing 12-inch sewer line that crosses the site along the west property line. There is also an abandoned 8-inch line along the west property line. Offsite wastewater flow will travel from south of the site and pass through the site before entering the existing system on Earll Drive. The existing sewer line at Earll Dr. flows to the east. From there, the sewer line flows to the ~~City of Scottsdale Wastewater Treatment Plant~~ Princess Metering Station.

2.0 WASTEWATER DESIGN PARAMETERS

2.1 Population

Gallery will consist of 18 single-family residential units on approximately 1.2-acres. The average population used is 2.5 people per single-family residential dwelling unit. The total residential population is estimated to be 45.

2.2 Wastewater Flow Design Criteria

The design criteria used in this Preliminary Wastewater Basis of Design Report was based upon the criteria required by the City of Scottsdale Design Standards & Policies Manual (Ref. 1). The specific design criteria used for this report are listed below:

- All construction shall comply with MAG Standards and Specifications and the City of Scottsdale Design Standards.
- The population is 2.5 persons per dwelling unit (single family residential).
- High density residential have an average flow of 140 gpd per unit
- The average wastewater flow per residential person per unit is 100 gpcd (gallons

per capita per day).

- Sewer lines are designed to provide mean velocities, when flowing full, of not less than 2.5 fps and not more than 10 fps based on Manning's formula.
- The maximum daily flow is calculated by multiplying the average daily flow by a peaking factor of 4.0 for single family residential.
- A Manning's roughness coefficient ("n") of 0.013 is used.
- For dry weather peak hour flows, the depth to diameter ratio (d/D) for diameters less than 12 inches shall be no greater than 0.65 for the max flow condition and no greater than 0.70 for diameters 12 inches and greater.
- Sewer pipe material will be per City of Scottsdale's Wastewater Design Standards as indicated in City of Scottsdale Allowable Materials List. Sewer lines 8 inches through 15-inches may be VCP or PVC SDR35.
- The sewer capacities are based on the minimum slope between nodes. A minimum slope of 0.0052 ft/ft for 8-inch pipe and 0.0030 ft/ft for 12-inch pipe will be used for this report.

3.0 PROPOSED WASTEWATER SYSTEM

3.1 Proposed Wastewater Design

The sewer lines needed for Gallery will be constructed within the site and will connect to the existing sewer line in Earll Drive. The current land uses are the basis for the size and location of all proposed infrastructure within this report. The downstream sewer mains are of sufficient size to accept generated flows from the development.

3.2 Wastewater Flow Calculations

The wastewater flows for Gallery are summarized in Table 3.2.1 below. The average daily flow (ADF) and maximum daily flow (MDF) are based on the most downstream manhole on the line. Sewer demand calculations are included in the Appendix.

Table 3.2.1 – The Reserve Daily Flow Summary

SERVICE	AVG. DAILY FLOW (GPD)	(GPM)	MAX. DAILY FLOW (GPD)	(GPM)
OFFSITE*	27,994	19.44	111,976	77.74
ONSITE	4,500	3.13	18,000	12.50

*Existing manhole that services two commercial buildings and high density residential.

3.3 Pipe Sizing Calculations

The proposed wastewater pipes sizes were developed utilizing the previously outlined design criteria in Section 2. All pipes have been designed to convey the maximum daily flow at or less than a depth to Diameter (d/D) ratio of 0.65 for pipes ~~less than~~ 12 inches in and smaller diameter. All mean velocities, while flowing full, will exceed 2.5 fps. Exhibit 2, in conjunction with the wastewater demand calculations in the Appendix, show the location, size, flow rate, and contributing flows for each pipe section throughout the wastewater collection system.

4.0 CONCLUSIONS

Based on the analysis presented in this Preliminary Wastewater Basis of Design Report, the following conclusions are drawn:

1. This report was prepared in accordance with the recommendations and design parameters of the City of Scottsdale.

2. The proposed wastewater system and velocities for Gallery are in accordance with the City of Scottsdale design criteria.

3. The selected pipe sizes meet the design specifications required by the City of Scottsdale. The design flows within Gallery will not negatively impact the capacity of the existing downstream sewer lines. The proposed wastewater system will ultimately flow to the City of Scottsdale WWTP.

4. The computerized pipe capacity analysis was completed utilizing an Excel spreadsheet program based on Manning's Equation. The sewer system will accommodate all contributing flows based on the design criteria in Section 2.2.

5. The design of the wastewater system was based on generally accepted engineering practices and in accordance with City of Scottsdale requirements.

5.0 REFERENCES

1. *City of Scottsdale, Design Standards & Policies Manual*, January 2010.
2. *Arizona Administrative Code, Title 18, Chapter9, Code No. R18-9-E301*, September 2005.
3. *Arizona Department of Environmental Quality, Engineering Bulletin No. 11, Chapter IV*, July 1978.

APPENDIX

GALLERY
WASTEWATER FLOW AND PIPE CAPACITY CALCULATIONS

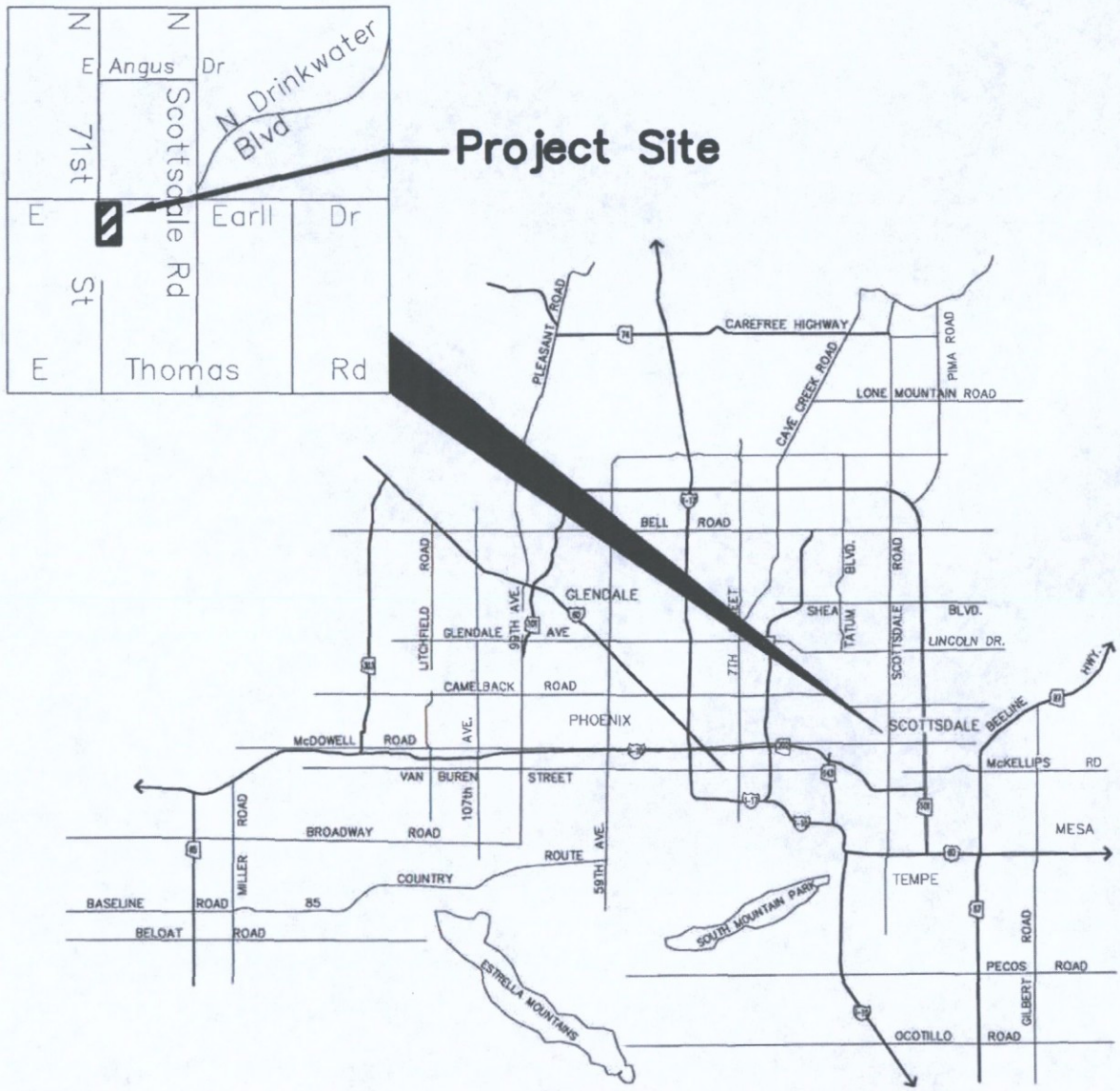
FROM	TO	CONTRIBUTING UNITS	ADF/UNIT[3] (GPD)	ADF (GPD)	TOTAL ADF (GPD)	DESIGN VELOCITY[2] (ADF) (FPS)	SERVICE AREA POPULATION	TOTAL POPULATION	PEAKING FACTOR	MDF (GPD)	PIPE SIZE (IN.)	PIPE SLOPE[1] (FT/FT)	PIPE CAPACITY (GPD)	SURPLUS CAPACITY (GPD)	% CAPACITY	FLOW DEPTH (IN.)	DEPTH/ DIAMETER (IN./IN.)	DESIGN VELOCITY[2] (MDF) (FPS)
E1[4]	E2	152	140	21,280	21,280	0.93	0	0	4.50	95,760	12	0.0030	1,261,154	1,165,394	7.6	2.24	0.19	1.45
E1[5]	E2	1	6714	6,714	6,714	0.60	0	0	3.00	20,142	12	0.0030	1,261,154	1,241,012	1.6	1.06	0.09	0.85
E2	A1	0	250	0	27,994	1.00	0	0	4.00	111,976	12	0.0030	1,261,154	1,149,178	8.9	2.42	0.20	1.55
A1	E3	18	250	4,500	32,494	1.05	45	45	4.00	129,976	12	0.0030	1,261,154	1,131,178	10.3	2.60	0.22	1.58
TOTAL		171			32,494		45		4.00	129,976								

Notes:
(1) Sewer capacities are based on the minimum slope in the sewer run.
(2) Based on ADEQ Bulletin No.11 Figure IV-3, Velocity and Discharge for Partially Full Circular Sewers.
(3) Commercial average day flows are calculated using sq. ft based on City of Scottsdale Requirements
(4) Flow is calculated from offsite high density residential apartment complex
(5) Flow is calculated from two offsite commericial buildings

Residential Ave. Daily Flow per unit = 250 GPD
Residential Ave. Daily Flow per capita = 100
Population/D.U. = 2.5
Manning's n = 0.013

Full Flow Capacity = $1.4861/n*A*R^{2/3}*S^{1/2}$
$A = \pi/4*(D/12)^2$
R = D/4 For Circular Pipe Flowing full
S = Pipe slope
D = Pipe Diameter in Inches

EXHIBITS



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The Gallery At 71st St & Earll Dr

Location and Vicinity Map

FIGURE 1

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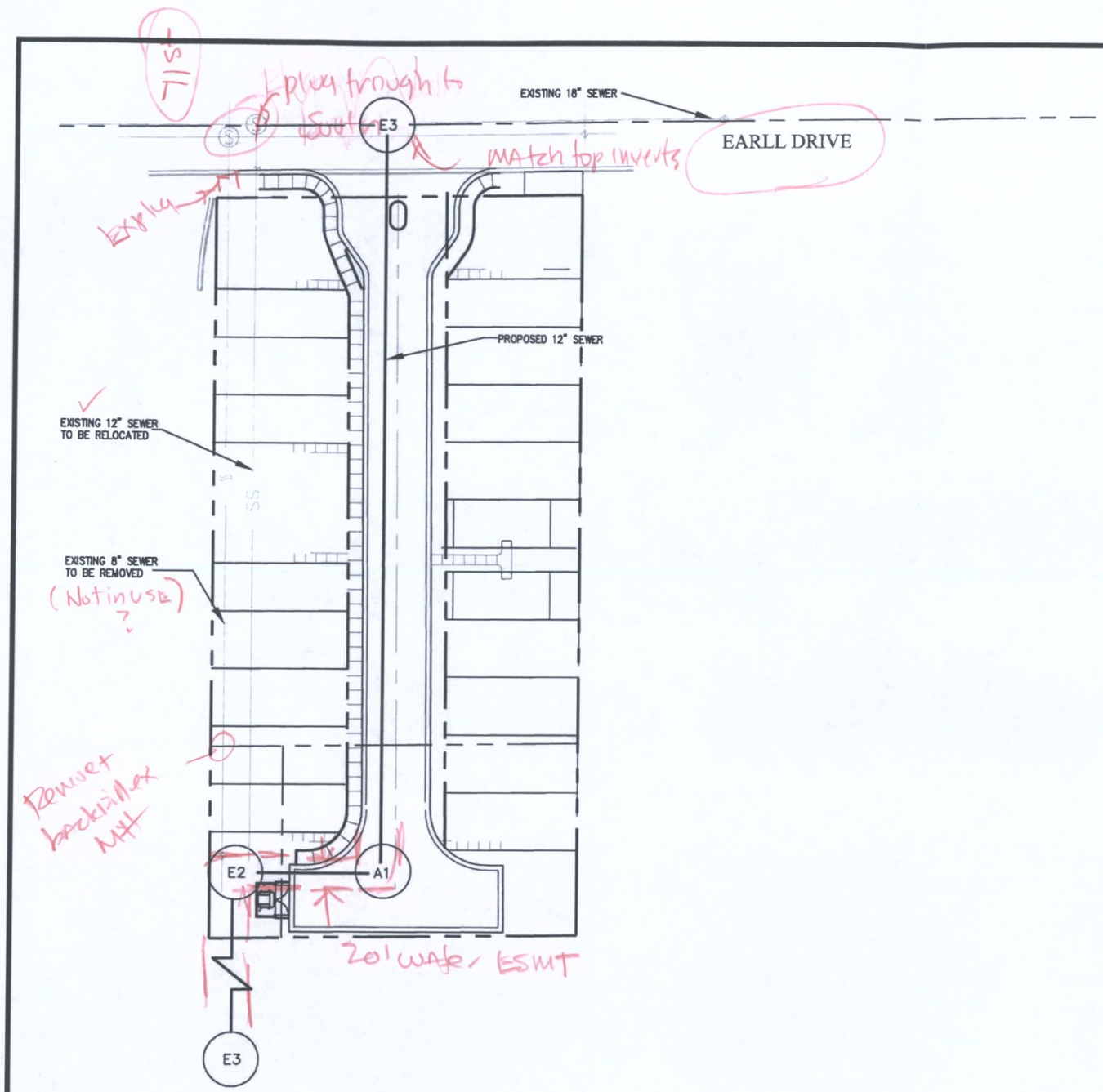

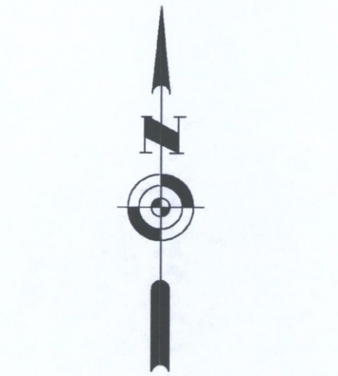

LEGEND

A1 NODE

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LEGEND

GALLERY SEWER MAP

EXHIBIT 2