Drainage Reports

Abbreveated Water & Sewer Need Reports

Water Study

Wastewater Study

Stormwater Waiver Application

Engineering

FINAL DRAINAGE REPORT

Scottsdale Fire Station #603

Prepared for:

City of Scottsdale

Submitted to:

City of Scottsdale
Capital Project Management
7447 E. Indian School Road
Scottsdale, Arizona 85251

Approved

Prepared by:

Kimley-Horn
7740 N. 16th Street
Suite 300
Phoenix, Arizona 85020

Registered Professional Engineer (Civil)
CERTIFICATE NO.
62869
SHANE R.
JOHANNSEN
DATE SIGNED 12/8/17
ARIZONA U.S.A.
Expires: 12/31/19

191905001
December 2017

Kimley»Horn

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December 2017

FINAL DRAINAGE REPORT

SCOTTSDALE FIRE STATION #603

DECEMBER 2017

Prepared By:

Kimley»Horn

Contents

Appendices

Figures

INTRODUCTION

PROJECT LOCATION AND DESCRIPTION

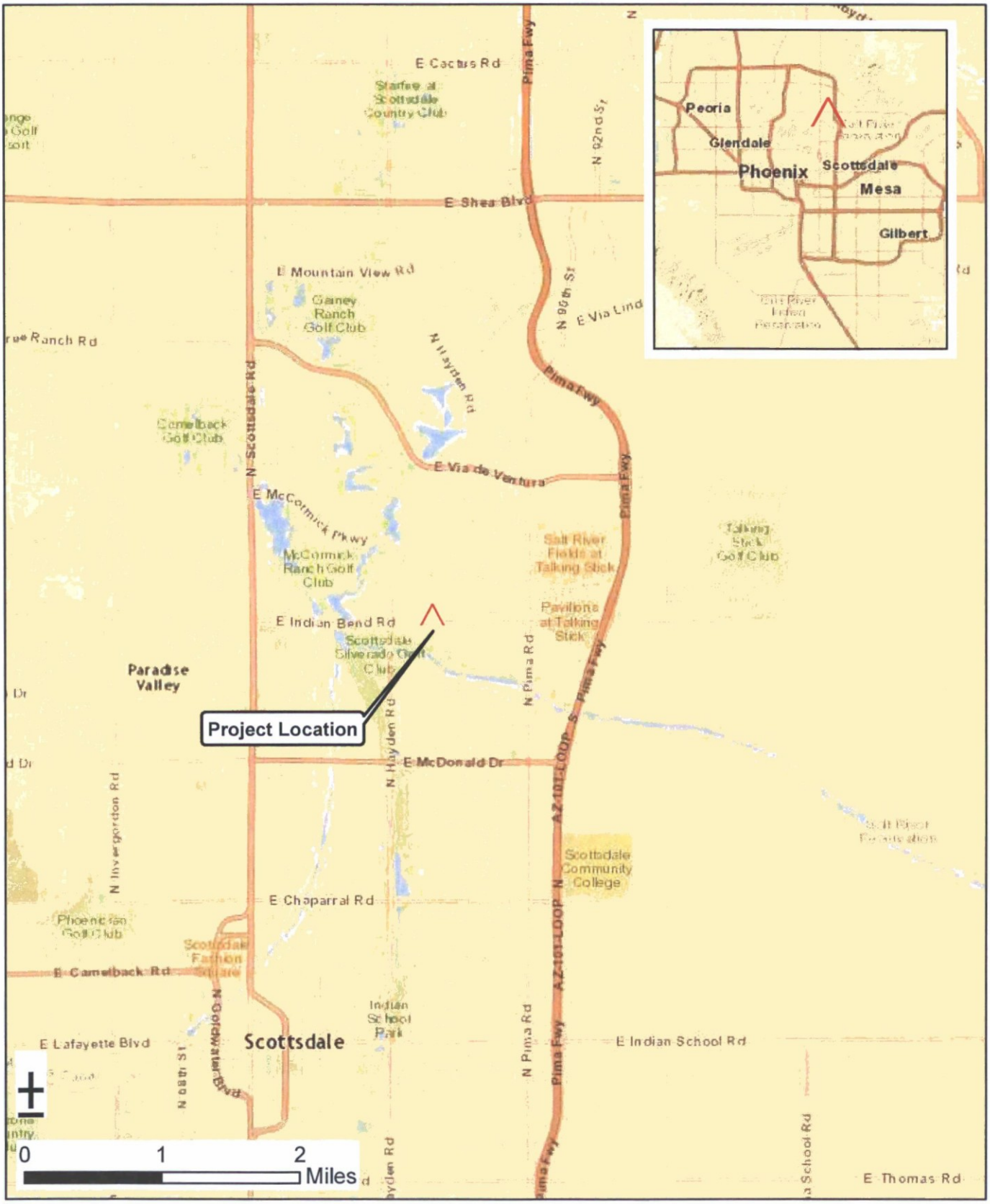
The 1.5-acre Site is located on the south side of Indian Bend Road east of Hayden Road within the City of Scottsdale (City). It lies within a portion of Section 12, Township 2 North, Range 4 East of the Gila and Salt River Base and Meridian. See **Figure 1** and **Figure 2** for the Location and Vicinity Maps.

PURPOSE

This Final Drainage Report for Scottsdale Fire Station #603 has been prepared to meet the drainage plan requirements outlined in Chapter 4 of the City of Scottsdale Design Standards and Policies Manual (DS&PM). This report presents a description of the hydrologic and hydraulic modeling of the proposed drainage systems.

The main purposes of this report are the following:

- Provide final design for onsite improvements such as inlets, storm drains and retention.
- Illustrate compliance with the *DS&PM.*
- Establish drainage parameters and criteria for design.



Kimley»Horn Expect More. Experience Better.	City of Scottsdale Fire Station #603	Scottsdale, AZ
	Figure 1. Location Map	

Kimley»Horn Expect More. Experience Better.	City of Scottsdale Fire Station #603	Scottsdale, AZ
	Figure 2. Vicinity Map	

DESCRIPTION OF EXISTING DRAINAGE CONDITIONS AND CHARACTERISTICS

The site is undeveloped and the natural topography across the site slopes from the northwest to the southeast. Indian Bend Road currently has curb, gutter and sidewalk throughout the 330-feet of frontage along the site which will not be impacted with this project. The site does not collect any roadway runoff from Indian Bend Road and there are no offsite flows onto the site in the existing condition.

Picture 1: Existing Site Conditions

The Flood Insurance Rate Map (FIRM) for Maricopa County, Arizona and incorporated areas, Panel Number 04013C1170L, effective date October 16, 2013, indicates the Site is within Zone "X." Zone "X" is defined by FEMA as follows:

> Areas of 0.2% annual flood chance,500-year flood; areas of 1% annual flood chance with average depths of less than 1 foot or with drainage areas 1 square mile; and areas protected by levees from 1% annual chance flood.

The site is within the Lower Indian Bend Wash Area Drainage Master Study which was completed in 2016. The site is also within the Lower Indian Bend Wash Flo-2D project currently in progress by the Flood Control District of Maricopa County.

The FIRM Panel is included as **Figure 3.**

NOTES TO USERS

This map is for use in administering the Nation Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The **community map repository** should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations** (BFEs) and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

Coastal Base Flood Elevations shown on this map apply only landward of 0.0' North American Vertical Datum of 1988 (NAVD 88). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations tables in the Flood Insurance Study report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations table should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study report for this jurisdiction.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures**. Refer to Section 2.4 "Flood Protection Measures" of the Flood Insurance Study report for information on flood control structures for this jurisdiction.

The **projection** used in the preparation of this map was Arizona State Plane Central zone (FIPSZONE 0202). The **horizontal datum** was NAD 83 HARN, GRS1980 spheroid. Differences in datum, spheroid, projection or State Plane zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the North American Vertical Datum of 1988 (NAVD 88). These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum**. Map users wishing to obtain flood elevations referenced to the National Geodetic Vertical Datum of 1929 (NGVD 29) may use the following Maricopa County website application: http://www.fcd.maricopa.gov/Maps/gismaps/apps/gdacs/application/index.cfm

This web tool allows users to obtain point-specific datum conversion values by zooming in and hovering over a VERTCON checkbox on the layers menu on the left side of the screen. The VERTCON grid referenced in this web application was also used to convert existing flood elevations from NGVD 29 to NAVD 88.

To obtain current elevation, description, and/or location information for National Geodetic Survey bench marks shown on this map, please contact the Information Services Branch of the National Geodetic Survey at (301) 713-3242, or visit its website at http://www.ngs.noaa.gov. To obtain information about Geodetic Densification and Cadastral Survey bench marks produced by the Maricopa County Department of Transportation, please visit the Flood Control District of Maricopa County website at:
http://www.fcd.maricopa.gov/Maps/gismaps/apps/gdacs/application/index.cfm.

Base map information shown on this FIRM was derived from multiple sources. Aerial imagery was provided in digital format by the Maricopa County Department of Public Works, Flood Control District. The imagery is dated October 2009 to November 2009. Additional National Agricultural Imagery Program (NAIP) imagery was provided by the Arizona State Land Department (ALRIS) and is dated 2007. The coordinate system used for the production of the digital FIRM is State Plane Arizona Central NAD83 HARN, International Feet.

The **profile baseline** depicted on this map represents the hydraulic modeling baselines that match flood profiles in the FIS report. As a result of improved topographic data, the **profile baseline**, in some cases, may deviate significantly from the channel centerline or appear outside the SFHA.

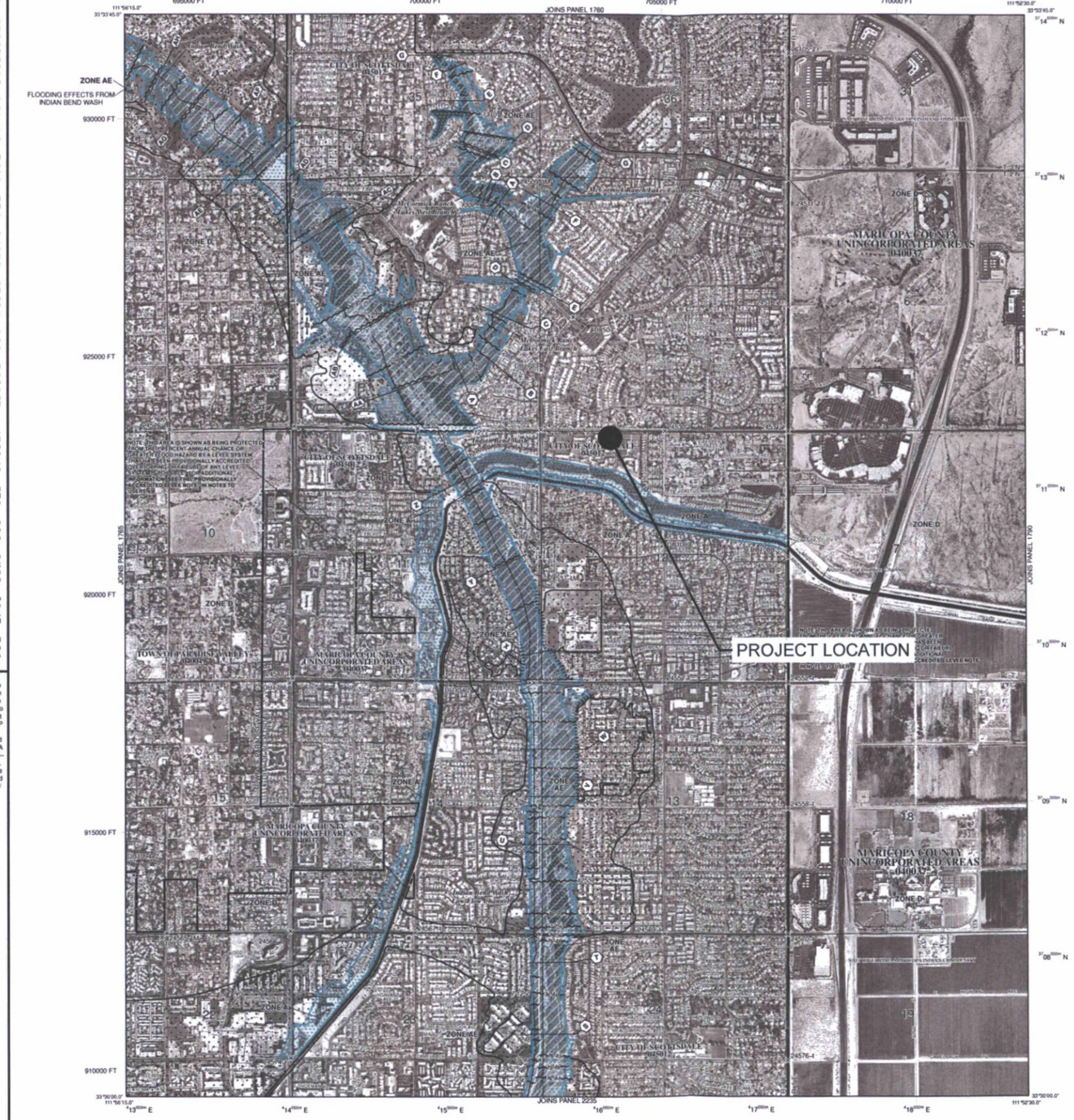
Corporate limits shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels; community map repository addresses; and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

For information on available products associated with this FIRM, visit the **Map Service Center (MSC)** website at http://msc.fema.gov. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, or digital versions of this map. Many of these products can be ordered or obtained directly from the website.

If you have **questions about this map,** how to order products, or the National Flood Insurance Program in general, please call the **FEMA Map Information eXchange (FMIX)** at **1-877-FEMA MAP** (1-877-336-2627) or visit the FEMA website at http://www.fema.gov/.

Provisionally Accredited Levee Notes to Users: Check with your local community to obtain more information, such as the estimated level of protection provided (which may exceed the 1–percent–annual–chance level) and Emergency Action Plan, on the levee system(s) shown as providing protection for areas on this panel. To maintain accreditation, the levee owner or community is required to submit the data and documentation necessary to comply with Section 65.10 of the NFIP regulations by June 25, 2011. If the community or owner does not provide the necessary data and documentation or if the data and documentation provided indicate the levee system does not comply with Section 65.10 requirements, FEMA will revise the flood hazard and risk information for this area to reflect de-accreditation of the levee system. To mitigate flood risk in residual risk areas, property owners and residents are encouraged to consider flood insurance and floodproofing or other protective measures. For more information on flood insurance, interested parties should visit the FEMA Website at http://www.fema.gov/business/nfip/index.shtm.



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
- 87°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, 1998

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 incorporate previously issued letters of map revision, to update corporate limits, to advance buffer, to change floodway, to add base flood elevation, to change base flood elevations, to add special flood hazard areas, to add roads and road names, and to add floodway.

For community map revision history prior to countywide mapping, refer to the Community Map History table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

MAP SCALE 1" = 1000'
500 0 1000 2000 FEET
300 0 300 600 METERS

NFIP

PANEL 1770L

NATIONAL FLOOD INSURANCE PROGRAM

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

PANEL 1770 OF 4425
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
MARICOPA COUNTY	040037	1770	L
PARADISE VALLEY TOWN OF	040049	1770	L
SCOTTSDALE CITY OF	040012	1770	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
04013C1770L

MAP REVISED
OCTOBER 16, 2013

Federal Emergency Management Agency

Kimley»Horn

7740 North 16th Street, Suite 300
Phoenix, Arizona 85020 (602) 944-5500

NO.	REVISION

SCALE (H): NONE
SCALE (V): NONE
DESIGNED BY: SRJ
DRAWN BY: SRJ
CHECKED BY: ZRS
DATE: DEC 2017

SCOTTSDALE FIRE STATION #603
FIGURE 3
FIRM MAP

PROJECT NO.

DRAWING NAME:

INDIAN BEND ROAD

EAST INDIAN BEND ROAD

AREA = 1.46 AC
V REQ'D = 0.13 AC-FT
V PROV'D = 0.13 AC-FT

WSE 82.50

OUTLET HEADWALL

CB-01
Q_{10} = 1.3 CFS
Q_{100} = 2.1 CFS

CB-02
Q_{10} = 1.3 CFS
Q_{100} = 2.2 CFS

CB-03
Q_{10} = 1.2 CFS
Q_{100} = 2.0 CFS

CB-04
Q_{10} = 0.9 CFS
Q_{100} = 1.5 CFS

PROPOSED DRAINAGE AREA

PROPOSED INLET

PROPOSED MANHOLE

PROPOSED STORM DRAIN

NORTH

GRAPHIC SCALE IN FEET
0 15 30

Kimley»Horn

7740 North 16th Street, Suite 300
Phoenix, Arizona 85020 (602) 944-5500

NO.	REVISION

SCALE (H): 1"=30'
SCALE (V): NONE
DESIGNED BY: SRJ
DRAWN BY: SRJ
CHECKED BY: ZRS
DATE: DEC 2017

SCOTTSDALE FIRE STATION #603
FIGURE 4
ONSITE DRAINAGE

PROJECT NO.

DRAWING NAME

PROPOSED ONSITE HYDROLOGY AND HYDRAULICS

The Rational Method was used to calculate the onsite flows for the 10-year and 100-year events. See **Figure 4** for the Onsite Drainage Map. A runoff coefficient of 0.90 was applied to the entire site for the 10-year event and 0.95 for the 100-year event per the DS&PM. Trench drains will be installed at the west, southwest and southeast corners of the site and a MAG 535 inlet will be installed at the northeast corner to capture runoff from the site. **Table 1** below shows the inlet summary and detailed runoff calculations can be found in **Appendix A.**

Table 1. Inlet Summary

Inlet ID	Inlet Type	Inlet Condition	Rational Coefficient	Q-10 [cfs]	Depth [ft]	Rational Coefficient	Q-100 [cfs]	Depth [ft]
CB-01	Trench Drain	On-Grade	0.90	1.3	0.11	0.95	2.1	0.13
CB-02	Trench Drain	Sump	0.90	1.3	0.13	0.95	2.2	0.16
CB-03	Trench Drain	Sump	0.90	1.2	0.25	0.95	2.0	0.25
CB-04	MAG 535	Sump	0.90	0.9	0.15	0.95	1.5	0.21

After the runoff is captured in the inlets a storm drain system will convey the runoff to the retention basin at the northeast corner of the site. The storm drain material will be High Density Polyethylene (HDPE). StormCAD was used to model the proposed system to verify that the 10-year event can be conveyed within the storm drain system. See **Appendix B** for the StormCAD profiles and output tables.

PROPOSED ONSITE RETENTION

The proposed retention plan will include one retention basin at the northeast corner of the site. Per discussions with the City during pre-application meetings, the basin is designed to store the difference between the pre-development and post development 100-year 2-hour storm event. The National Oceanic and Atmospheric Administration (NOAA) Atlas 14 lists the precipitation depth as 2.19-inches for the 100-year 2-hour storm event. C-Values of 0.45 and 0.95 were applied to the pre-development and post-development conditions, respectively, per Figure 4.1-4 of the DS&PM. The onsite retention basin is designed to store 0.13 ac-ft of runoff. See **Table 2** for the retention summary and **Appendix C** for detailed retention calculations.

Table 2. Pre Vs. Post-Development Retention

Basin ID	Area [ac]	Rational Coefficient	Volume Required [ac-ft]	Volume Provided [ac-ft]
Pre-Development	1.46	0.45	0.12	N/A
Post-Development	1.46	0.95	0.25	N/A
Difference	1.46	0.50	0.13	0.13

This project will install one drywell in the proposed retention basin to assist with storm water percolation. The Geotechnical Engineering Report for this project shows that the percolation rates would not allow the basin to drain within 36-hours. See **Appendix D** for excerpts from this report showing the percolation rates.

SPECIAL CONDITIONS

During the pre-application meetings, the City has waived the 100-year 2-hour retention requirements for this site. The retention requirements for this site will be the difference between the pre-development condition and the post-development condition for the 100-year 2-hour storm event. These calculations are located in **Appendix C.**

DATA ANALYSIS METHODS

HYDROLOGY

The Rational Method was used to calculate the 10-year and 100-year peak discharges for the project onsite flows. NOAA Atlas 14 was used to determine precipitation depths and intensities and Figure 4.1-4 of the City DS&PM was used to determine runoff coefficients.

HYDRAULICS

Bentley Flowmaster V8i was used to size storm drain inlets. A clogging factor of 0.5 was applied all grate inlets per the FCDMC Drainage Design Manual – Hydraulics. Refer to **Appendix B** for inlet calculations.

Bentley StormCAD was used to size the storm drain system. Refer to **Appendix B** for output summary table and profiles.

CONCLUSIONS

- Onsite runoff will be captured in trench drains and catch basins then conveyed retention basin through an HDPE storm drain system.
- Runoff will be stored in one retention basin on the site. This basin will retain the difference between the pre-development and post-development conditions.
- There is no offsite runoff in the existing conditions. Roadway runoff from Indian Bend Road is conveyed through existing curb and gutter past the project site.

REFERENCES

City of Scottsdale, *Design Standards and Policies Manual*, January 2010.

Flood Control District of Maricopa County, *Drainage Design Manual for Maricopa County, Arizona – Hydrology,* revised 2013.

Flood Control District of Maricopa County, *Drainage Design Manual for Maricopa County, Arizona – Hydraulics,* revised 2013.

Flood Control District of Maricopa County, *Drainage Policies and Standards for Maricopa County, Arizona*, revised 2016.

Federal Highway Administration, *Hydraulic Engineering Circular 22: Urban Drainage Design Manual*, revised 2013.

Ricker Atkinson McBee Morman & Associates, Inc, Geotechnical Engineering Report: City of Scottsdale Fire Station 603, August 2017.

Appendix A – Hydrology

NOAA 14 Rainfall Data

Proposed 10-year Hydrology

Proposed 100-year Hydrology

Kimley»Horn

Rainfall Information

General Project Information			
Project	Scottsdale Fire Station #603		
Designed by	SRJ	Date	12/6/2017

NOAA 14 Rainfall Depth Data [in]										
	Storm Event [yr]									
Duration	1	2	5	10	25	50	100	200	500	1000
5-min:	0.19	0.24	0.33	0.40	0.49	0.55	0.63	0.70	0.79	0.87
10-min:	0.28	0.37	0.50	0.60	0.74	0.84	0.95	1.06	1.21	1.32
15-min:	0.35	0.46	0.62	0.75	0.91	1.05	1.18	1.32	1.50	1.64
30-min:	0.47	0.62	0.84	1.00	1.23	1.41	1.59	1.77	2.02	2.20
60-min:	0.58	0.76	1.03	1.24	1.52	1.74	1.96	2.19	2.49	2.73
2-hr:	0.68	0.88	1.17	1.40	1.71	1.94	2.19	2.43	2.76	3.02
3-hr:	0.75	0.96	1.26	1.50	1.83	2.09	2.37	2.65	3.05	3.37
6-hr:	0.90	1.14	1.46	1.71	2.06	2.33	2.61	2.90	3.30	3.61
12-hr:	1.00	1.26	1.59	1.85	2.21	2.48	2.76	3.04	3.42	3.71
24-hr:	1.17	1.49	1.92	2.27	2.75	3.13	3.52	3.93	4.50	4.94
2-day:	1.27	1.62	2.12	2.52	3.08	3.52	3.99	4.48	5.16	5.70
3-day:	1.34	1.72	2.26	2.69	3.30	3.79	4.31	4.86	5.62	6.24
4-day:	1.42	1.82	2.40	2.86	3.53	4.06	4.63	5.23	6.09	6.78
7-day:	1.59	2.03	2.68	3.21	3.95	4.55	5.18	5.86	6.81	7.58
10-day:	1.72	2.20	2.91	3.47	4.26	4.89	5.57	6.27	7.26	8.05
20-day:	2.12	2.73	3.60	4.26	5.15	5.83	6.52	7.22	8.17	8.90
30-day:	2.48	3.19	4.20	4.96	5.99	6.78	7.59	8.41	9.52	10.40
45-day:	2.86	3.69	4.85	5.72	6.85	7.71	8.57	9.42	10.60	11.40
60-day:	3.16	4.08	5.36	6.29	7.50	8.39	9.28	10.20	11.30	12.10

NOAA 14 Rainfall Intensity [in/hr]										
	Storm Event									
Duration	1	2	5	10	25	50	100	200	500	1000
5-min:	2.23	2.92	3.95	4.74	5.82	6.65	7.50	8.36	9.52	10.40
10-min:	1.70	2.21	3.00	3.61	4.43	5.06	5.71	6.36	7.26	7.92
15-min:	1.40	1.83	2.48	2.98	3.66	4.20	4.72	5.28	6.00	6.56
30-min:	0.94	1.23	1.67	2.00	2.46	2.82	3.18	3.54	4.04	4.40
60-min:	0.58	0.76	1.03	1.24	1.52	1.74	1.96	2.19	2.49	2.73
2-hr:	0.34	0.44	0.59	0.70	0.86	0.97	1.10	1.22	1.38	1.51
3-hr:	0.25	0.32	0.42	0.50	0.61	0.70	0.79	0.88	1.02	1.12
6-hr:	0.15	0.19	0.24	0.29	0.34	0.39	0.44	0.48	0.55	0.60
12-hr:	0.083	0.105	0.133	0.154	0.184	0.207	0.230	0.253	0.285	0.309
24-hr:	0.049	0.062	0.080	0.095	0.115	0.130	0.147	0.164	0.188	0.206
2-day:	0.026	0.034	0.044	0.053	0.064	0.073	0.083	0.093	0.108	0.119
3-day:	0.019	0.024	0.031	0.037	0.046	0.053	0.060	0.068	0.078	0.087
4-day:	0.015	0.019	0.025	0.030	0.037	0.043	0.049	0.055	0.064	0.071
7-day:	0.009	0.012	0.016	0.019	0.024	0.027	0.031	0.035	0.041	0.045
10-day:	0.007	0.009	0.012	0.014	0.018	0.020	0.023	0.026	0.030	0.034
20-day:	0.004	0.006	0.008	0.009	0.011	0.012	0.014	0.015	0.017	0.019
30-day:	0.003	0.004	0.006	0.007	0.008	0.009	0.011	0.012	0.013	0.014
45-day:	0.003	0.003	0.004	0.005	0.006	0.007	0.008	0.009	0.010	0.011
60-day:	0.002	0.003	0.004	0.004	0.005	0.006	0.006	0.007	0.008	0.008

Kimley»Horn

Rational Method Calculations

General Project Information			
Designed by	SRJ	Date	12/6/2017
Design Storm Event		10	
Minimum T_c [min]		5	

Drainage Area Information			Hydrology		
Inlet ID	Rational Coefficient	Area [ac]	I [in/hr]	T_c [min]	Q [cfs]
CB-01	0.90	*0.30*	*4.7*	*5.0*	*1.3*
CB-02	0.90	*0.30*	*4.7*	*5.0*	*1.3*
CB-03	0.90	*0.28*	*4.7*	*5.0*	*1.2*
CB-04	0.90	*0.21*	*4.7*	*5.0*	*0.9*

Kimley»Horn

Rational Method Calculations

General Project Information			
Designed by	SRJ	Date	12/6/2017
Design Storm Event		100	
Minimum T_c [min]		5	

Drainage Area Information			Hydrology		
Inlet ID	Rational Coefficient	Area [ac]	I [in/hr]	T_c [min]	Q [cfs]
CB-01	0.95	*0.30*	*7.5*	*5.0*	*2.1*
CB-02	0.95	*0.30*	*7.5*	*5.0*	*2.2*
CB-03	0.95	*0.28*	*7.5*	*5.0*	*2.0*
CB-04	0.95	*0.21*	*7.5*	*5.0*	*1.5*

Appendix B – Hydraulics

FlowMaster Inlet Calculations

StormCAD Plan / Profile / Output Table

Retention Calculations

Worksheet for CB-01 10yr

Project Description

Solve For	Efficiency

Input Data

Discharge		1.30	ft³/s
Slope		0.00940	ft/ft
Gutter Width		0.00	ft
Gutter Cross Slope		0.00	ft/ft
Road Cross Slope		0.01	ft/ft
Roughness Coefficient		0.015	
Grate Width		20.00	ft
Grate Length		1.00	ft
Grate Type	P-50 mm (P-1-7/8")		
Clogging		50.00	%

Options

Grate Flow Option	Exclude None

Results

Efficiency	100.00	%
Intercepted Flow	1.30	ft³/s
Bypass Flow	0.00	ft³/s
Spread	14.04	ft
Depth	0.11	ft
Flow Area	0.78	ft²
Gutter Depression	0.00	ft
Total Depression	0.00	ft
Velocity	1.67	ft/s
Splash Over Velocity	4.08	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.00	
Grate Flow Ratio	1.00	
Active Grate Length	0.50	ft

Worksheet for CB-02 10yr

Project Description

Solve For	Spread

Input Data

Discharge		1.30	ft³/s
Gutter Width		0.00	ft
Gutter Cross Slope		0.00	ft/ft
Road Cross Slope		0.01	ft/ft
Grate Width		20.00	ft
Grate Length		1.00	ft
Local Depression		0.00	in
Local Depression Width		0.00	ft
Grate Type	P-50 mm (P-1-7/8")		
Clogging		50.00	%

Results

Spread	24.06	ft
Depth	0.13	ft
Gutter Depression	0.00	ft
Total Depression	0.00	ft
Open Grate Area	9.00	ft²
Active Grate Weir Length	21.00	ft

Worksheet for CB-03 10yr

Project Description

Solve For	Spread

Input Data

Discharge		1.20	ft³/s
Gutter Width		0.00	ft
Gutter Cross Slope		0.00	ft/ft
Road Cross Slope		0.03	ft/ft
Grate Width		20.00	ft
Grate Length		1.00	ft
Local Depression		0.00	in
Local Depression Width		0.00	ft
Grate Type	P-50 mm (P-1-7/8")		
Clogging		50.00	%

Results

Spread	10.02	ft
Depth	0.25	ft
Gutter Depression	0.00	ft
Total Depression	0.00	ft
Open Grate Area	9.00	ft²
Active Grate Weir Length	21.00	ft

Worksheet for CB-04 10yr

Project Description

Solve For	Spread

Input Data

Discharge		0.90	ft³/s
Gutter Width		0.00	ft
Gutter Cross Slope		0.00	ft/ft
Road Cross Slope		0.01	ft/ft
Grate Width		2.50	ft
Grate Length		3.00	ft
Local Depression		0.00	in
Local Depression Width		0.00	ft
Grate Type	P-50 mm (P-1-7/8")		
Clogging		50.00	%

Results

Spread	30.69	ft
Depth	0.15	ft
Gutter Depression	0.00	ft
Total Depression	0.00	ft
Open Grate Area	3.38	ft²
Active Grate Weir Length	5.50	ft

Worksheet for CB-01 100yr

Project Description

Solve For	Efficiency

Input Data

Discharge		2.10	ft³/s
Slope		0.00940	ft/ft
Gutter Width		0.00	ft
Gutter Cross Slope		0.00	ft/ft
Road Cross Slope		0.01	ft/ft
Roughness Coefficient		0.015	
Grate Width		20.00	ft
Grate Length		1.00	ft
Grate Type	P-50 mm (P-1-7/8")		
Clogging		50.00	%

Options

Grate Flow Option	Exclude None

Results

Efficiency	100.00	%
Intercepted Flow	2.10	ft³/s
Bypass Flow	0.00	ft³/s
Spread	16.80	ft
Depth	0.13	ft
Flow Area	1.11	ft²
Gutter Depression	0.00	ft
Total Depression	0.00	ft
Velocity	1.88	ft/s
Splash Over Velocity	4.08	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.00	
Grate Flow Ratio	1.00	
Active Grate Length	0.50	ft

Worksheet for CB-02 100yr

Project Description

Solve For	Spread

Input Data

Discharge		2.20	ft³/s
Gutter Width		0.00	ft
Gutter Cross Slope		0.00	ft/ft
Road Cross Slope		0.01	ft/ft
Grate Width		20.00	ft
Grate Length		1.00	ft
Local Depression		0.00	in
Local Depression Width		0.00	ft
Grate Type	P-50 mm (P-1-7/8")		
Clogging		50.00	%

Results

Spread	29.84	ft
Depth	0.16	ft
Gutter Depression	0.00	ft
Total Depression	0.00	ft
Open Grate Area	9.00	ft²
Active Grate Weir Length	21.00	ft

Worksheet for CB-03 100yr

Project Description

Solve For	Spread

Input Data

Discharge		2.00	ft³/s
Gutter Width		0.00	ft
Gutter Cross Slope		0.00	ft/ft
Road Cross Slope		0.03	ft/ft
Grate Width		20.00	ft
Grate Length		1.00	ft
Local Depression		0.00	in
Local Depression Width		0.00	ft
Grate Type	P-50 mm (P-1-7/8")		
Clogging		50.00	%

Results

Spread	10.07	ft
Depth	0.25	ft
Gutter Depression	0.00	ft
Total Depression	0.00	ft
Open Grate Area	9.00	ft²
Active Grate Weir Length	21.00	ft

Worksheet for CB-04 100yr

Project Description

Solve For	Spread

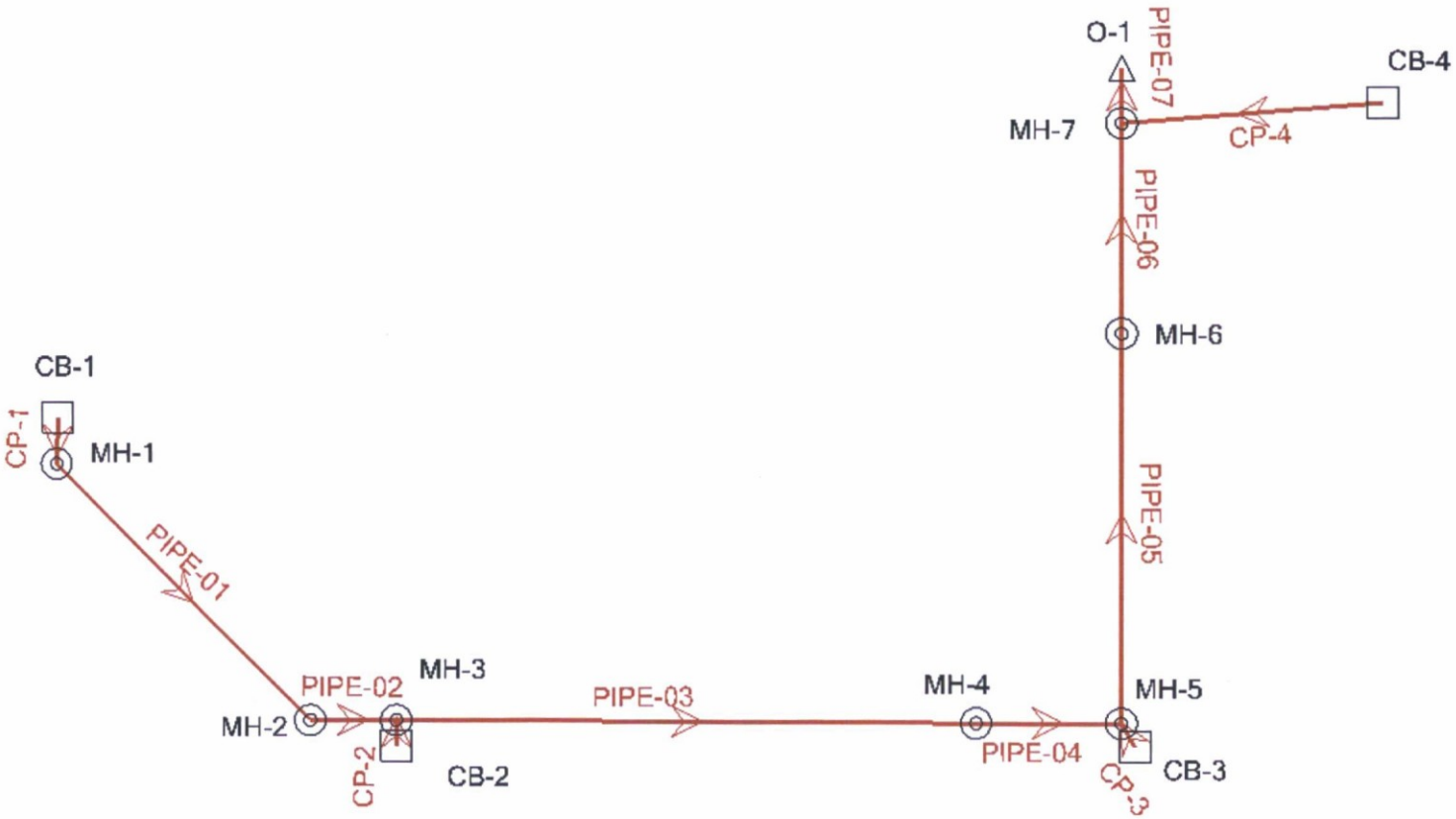
Input Data

Discharge		1.50	ft³/s
Gutter Width		0.00	ft
Gutter Cross Slope		0.00	ft/ft
Road Cross Slope		0.01	ft/ft
Grate Width		2.50	ft
Grate Length		3.00	ft
Local Depression		0.00	in
Local Depression Width		0.00	ft
Grate Type	P-50 mm (P-1-7/8")		
Clogging		50.00	%

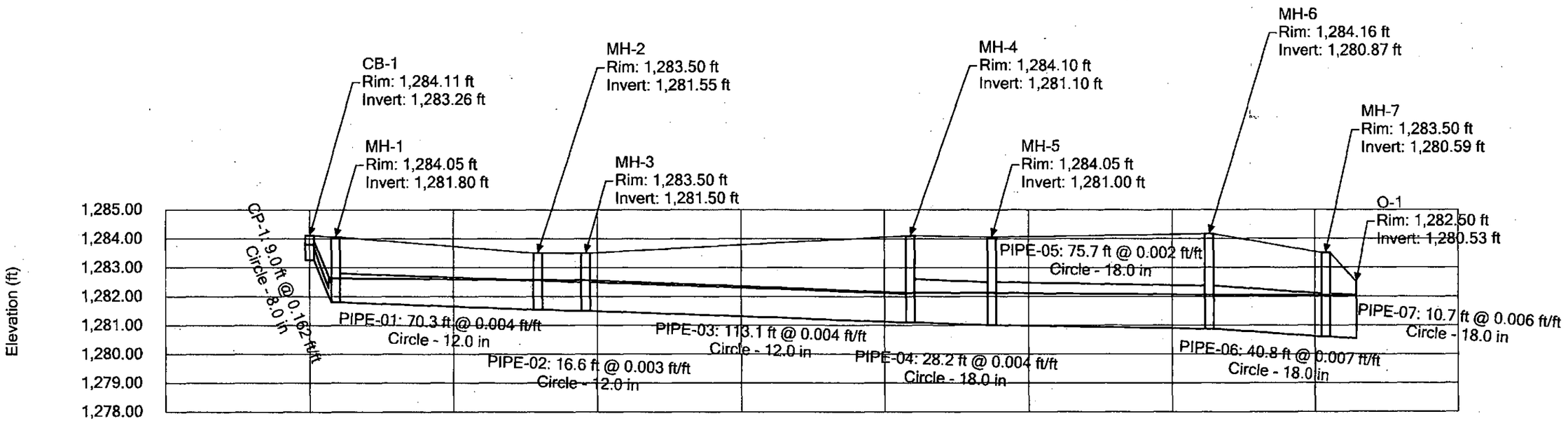
Results

Spread	42.37	ft
Depth	0.21	ft
Gutter Depression	0.00	ft
Total Depression	0.00	ft
Open Grate Area	3.38	ft²
Active Grate Weir Length	5.50	ft

SCOTTSDALE FIRE STATION #603
STORMCAD - PLAN VIEW



Profile Report
Engineering Profile - Mainline (FireStationStormCAD.stsw)



Scenario: 10-yr
Current Time Step: 0.000 h
Conduit FlexTable: DOT Report

Label	Diameter (in)	Length (Unified) (ft)	Slope (Calculated) (ft/ft)	Flow (cfs)	-Node- Upstream Downstream	-Invert- Upstream Downstream (ft)	-Ground- Upstream Downstream (ft)	-HGL- Upstream Downstream (ft)	Velocity (ft/s)
CP-1	8.0	9.0	0.162	1.30	CB-1	1,283.26	1,284.11	1,283.80	13.33
-	-	-	-	-	MH-1	1,281.80	1,284.05	1,282.63	-
PIPE-01	12.0	70.3	0.004	1.30	MH-1	1,281.80	1,284.05	1,282.63	3.23
-	-	-	-	-	MH-2	1,281.55	1,283.50	1,282.57	-
PIPE-02	12.0	16.6	0.003	1.30	MH-2	1,281.55	1,283.50	1,282.57	1.66
-	-	-	-	-	MH-3	1,281.50	1,283.50	1,282.56	-
PIPE-03	12.0	113.1	0.004	2.60	MH-3	1,281.50	1,283.50	1,282.56	3.31
-	-	-	-	-	MH-4	1,281.10	1,284.10	1,282.13	-
PIPE-04	18.0	28.2	0.004	2.60	MH-4	1,281.10	1,284.10	1,282.13	3.82
-	-	-	-	-	MH-5	1,281.00	1,284.05	1,282.12	-
PIPE-05	18.0	75.7	0.002	3.80	MH-5	1,281.00	1,284.05	1,282.12	3.19
-	-	-	-	-	MH-6	1,280.87	1,284.16	1,282.05	-
PIPE-06	18.0	40.8	0.007	3.80	MH-6	1,280.87	1,284.16	1,282.05	5.38
-	-	-	-	-	MH-7	1,280.59	1,283.50	1,282.04	-
PIPE-07	18.0	10.7	0.006	4.70	MH-7	1,280.59	1,283.50	1,282.04	5.28
-	-	-	-	-	O-1	1,280.53	1,282.50	1,282.03	-
CP-2	8.0	4.9	0.047	1.30	CB-2	1,281.73	1,282.98	1,282.60	3.72
-	-	-	-	-	MH-3	1,281.50	1,283.50	1,282.56	-
CP-3	8.0	5.3	0.151	1.20	CB-3	1,281.80	1,283.52	1,282.32	12.69
-	-	-	-	-	MH-5	1,281.00	1,284.05	1,282.12	-
CP-4	12.0	50.3	0.004	0.90	CB-4	1,280.81	1,282.93	1,282.07	1.15
-	-	-	-	-	MH-7	1,280.59	1,283.50	1,282.04	-

Appendix C – Retention

Kimley»Horn

Retention Volume Calculations

General Project Information			
Project	Scottsdale Fire Station #603		
Designed by	SRJ	Date	12/6/2017
Design Storm Event [yr]	100		
Duration [hr]	2		

Basin Name	Area [ac]	Rational Coefficient	Volume Required [ac-ft]	Volume Provided [ac-ft]	Basin Bottom Area [ft^2]	Percolation Rate [in/hr]	De-rating Factor	Discharge per Drywell [cfs]	No. of Dry Wells	Drain Down Time [hrs]
Proposed	*1.46*	0.95	*0.25*							
Existing	*1.46*	0.45	*0.12*							
Difference	*1.46*	0.50	*0.13*	0.13	1,472	0.86	2.0	0.10	1	16

Appendix D – Excerpts from RAMM Geotechnical Engineering Report

FIELD EXPLORATIONS

Test Borings:

Subsurface conditions at the site were explored by drilling Test Borings 1 and 2 to depths of 20.0 feet in the building area and Test Borings 3 and 4 to depths of 5.0 feet in the pavement area, at the locations shown on the Site Plan in Appendix A. The test borings were drilled with a CME 55 drill rig using 7-inch diameter, hollow-stem augers. The drilling equipment and crew were provided by Wildcat Drilling, Inc. The test boring locations were determined in the field by a field technician from our firm who also directed the drill crew. During the field explorations, representative disturbed and undisturbed samples were obtained, the test borings logged and soils field classified by our field technician. The relatively undisturbed samples were obtained by driving a 3-inch diameter, ring-lined, open-end sampler into the soil with a 140-pound hammer dropping 30 inches. In addition to drilling and sampling, continuous penetration testing using a 2-inch diameter rod and the 140-pound hammer dropping 30 inches was performed and extended to depths of 7.0 feet adjacent to Test Borings 1 and 2. The results of the field explorations are presented on the Test Boring Logs in Appendix A.

Percolation Tests

The percolation test was performed in general accordance with ASTM D-3385 (Double-Ring Infiltrometer) procedures. After presoaking, the following stabilized infiltration rates, based on a water depth of 3.75 inches, were measured:

		Calculated Infiltration Rate			
DRI #	Depth	(cm/hr)	(inch/hour)	(minutes/inch)	$Ft^3/Hr/Ft^2$
1	5 ft	2.19	0.86	69.59	0.07

* Note:

- The Calculated Infiltration Rates are based on the lowest measured Flow Reading after the rate has stabilized.

The flow readings measured at the time of our field exploration/percolation testing are based on soil conditions at the depth and location indicated. The infiltration rates of retention basins may vary significantly due to such factors as location and depth relative to the percolation tests conducted at the time of our field exploration, type of cover in retention basin bottom (grass, rock, etc.), degree of compaction of the retention basin bottoms, placement of fill in the retention basins and the amount and type of sediment load deposited in the basin during storm events. The City of Scottsdale Drainage Policies and Standards require that a de-rating factor be applied to the results

of Double-Ring Infiltrometer percolation testing. The calculated infiltration rates presented above have not had a de-rating factor applied.

LABORATORY ANALYSIS

Representative samples obtained during the field exploration were subjected to the following laboratory tests.

Type of Test	Type of Sample	Number of Samples Tested
Compression	Undisturbed	2
Swell	Remolded	2
Percent Passing No. 200 Sieve and Atterberg Limits	Representative	2
Moisture Content/Dry Density *	Undisturbed	10

* Reported in the Test Boring Logs

The results of the laboratory tests are presented in Appendix B.

SUBSURFACE CONDITIONS

The subsurface conditions encountered at the test boring locations were relatively uniform. The results of the test borings are presented in Appendix A, in the Test Boring Logs. In general, the near surface soils encountered in Test Borings 1 and 2 to depths of 20.0 feet (the full depth of exploration) and 5 feet (full depth of exploration) in Test Borings 3 and 4, consisted of sandy clay with a trace of gravel. These soils were firm to stiff, had medium plasticity and intermittent light to moderate cementation below 4 to 5 feet. Soil moisture contents were described as nearly dry. No groundwater was observed in any of the test borings during the drilling operations.

DISCUSSIONS OF TEST RESULTS

Remolded samples of the near surface soil exhibited moderate swell potential following wetting when tested in the laboratory. Undisturbed samples of the shallow site surface soils were found to undergo slight compression during loading to approximate foundation loads. Upon wetting at approximate foundation loads, the soils underwent extensive additional compression.

FOUNDATION DESIGN RECOMMENDATIONS

Spread Footings:

The proposed building can be supported on shallow spread footings. Due to existing site surface soil condition and our laboratory compression test results, footings should be founded on at least