HILGARTWILSON
ENGINEER | PLAN | SURVEY | MANAGE

MASTER DRAINAGE REPORT
FOR
LEVINE GENERAL MOTORS 170

MESA, ARIZONA

Prepared For:
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DATE SIGNED 5/13/19
ARIZONA U.S.A.

May 2019
HILGARTWILSON Project No. 2063

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1.0 INTRODUCTION

1.1 PROJECT NAME, LOCATION AND TOPOGRAPHY

Levine General Motors 170 (the Project) is located in the City of Mesa (the City) in Section 34 of Township 1 South, Range 7 East of the Gila and Salt River Base and Meridian. The Project is comprised of a 170-acre (gross) master planned mixed use development. The Project is bound by Williams Field Road to the north, the future SR24 Freeway alignment to the south, 222nd Street to the east, and Crismon Road to the west, as illustrated on Figure 1 (Vicinity Map) of Appendix A.

The Project is planned as a mixed-use development, which will include a commercial area, medium and high density residential as well as parks and open space. The site is currently comprised of undeveloped desert rangeland which generally slopes from northeast to southwest at approximately 0.5 percent.

1.2 PURPOSE

This Master Drainage Report (MDR) has been prepared in support of the Community Plan for Levine General Motors. The purpose of this report is to provide conceptual hydrologic and hydraulic analyses of the Project property, including existing and proposed drainage systems, and address potential drainage related constraints relative to project development. In addition to identifying the drainage constraints, this report is intended to identify overall drainage management concepts and establish design guidelines for future improvement plans for the property. This report will become the basis for more detailed hydrologic and hydraulic designs, performed during the preliminary and final plat submittals. Site specific drainage reports will be prepared to address internal drainage at the parcel level, and will be submitted in conjunction with the site plan and subdivision plat stages of development of the property as required by the City.

This report has been prepared in accordance with the City's Engineering and Design Standards (EDS, City of Mesa 2019) and the Flood Control District of Maricopa County's (FCDMC) current versions of the Drainage Policies and Standards (DPSM) (FCDMC 2016), Drainage Design Manuals (DDM) for Maricopa County, Volume 1 - Hydrology (FCDMC 2013a) and Volume 2 - Hydraulics (FCDMC 2013b).

1.3 SITE LOCATION RELATIVE TO KNOWN FEMA FLOOD HAZARD ZONES

The property is located within the Federal Emergency Management Agency's (FEMA) Zone X (Shaded) within the FEMA Flood Insurance Rate Map (FIRM) panel number 04013C2790L, revised October 16th, 2013 which is presented on Figure 2 (FEMA Flood Map) of Appendix A. The flood map for this location has a status of "not printed". The Zones associated with this Project are defined below.

Zone X (Shaded):

> The flood insurance rate zone that corresponds to areas between the 100-year and 500-year floodplains, areas of 100-year sheet flow flooding where average depths are less than 1 foot, areas of 100-year stream flooding where the contributing drainage area is less than 1

square mile, or areas protected from the 100-year flood by levees. No base flood elevations or depths are shown within this zone.

2.0 PREVIOUS STUDIES

2.1 EAST MESA AREA DRAINAGE MASTER PLAN UPDATE

In March 2014, the FCDMC completed the *East Mesa Area Drainage Master Plan Update* (ADMPU, FCDMC 2014) which provided an updated hydrologic analysis of the East Mesa Area Drainage Master Plan in which the Project is located within. The analysis detailed the methodology and results of revised HEC-1 models referencing updated parameters including NOAA 14 rainfall precipitation depths. Excerpts from the ADMPU are included for reference in Appendix B.

3.0 MANAGEMENT OF OFFSITE DRAINAGE

3.1 EXISTING PATTERNS

As previously mentioned, tributary drainage areas to the Project generally slope west and southwest, approaching as sheet flow and shallow concentrated flows originating from undeveloped desert rangeland and rural residential drainage areas east of the 222nd Street alignment. Flows passing through the property discharge from the site along the west and southwest boundaries, continuing as sheet and shallow concentrated flows. Runoff generated north and east of the Project are intercepted by a large engineered channel along Williams Field Road and conveyed to the west and then south around the Project.

3.2 PROPOSED PATTERNS

Offsite flows approaching the Project will continue to be received as they do under existing conditions. Engineered channels will route the collected runoff to the historical outfall points within or along the downstream limits of the property.

Grade control will be implemented to reduce channel velocities wherever necessary. Where steeper channels and higher velocities are unavoidable, erosion protection will be provided. Erosion protection for channels will be specified in future phasing with more detailed site plans. The primary channel corridors within the property will likely be designed with many natural elements including the use of native vegetation and typical desert landscaping materials. Some locations, particularly channels located in the vicinity of amenity areas, may be turf lined. Other locations, such as those that may be prone to erosion or that are located in areas of more intense land uses, may include sections that require other linings such as riprap or other robust revetment. All channel linings will be selected in accordance with the City's standards The proposed management of offsite flow is discussed in further detail below.

4.0 HYDROLOGIC ANALYSIS

The amount of offsite runoff approaching the Project from the east was quantified referencing the ADMPU 100-year, 6-hour HEC-1 model in order to adequately size onsite drainage infrastructure for peak flows. Results from the ADMPU report that between the 100-year, 6-hour and 24-hour storm events, the 6-hour event yielded larger flows. A hydrologic exhibit, referenced from the ADMPU, provides detail of the tributary drainage areas impacting the Project which can be seen on Figure 3 (HEC-1 Hydrologic Exhibit) of Appendix A. The following sections further describe the methodology used for the analysis in this report. Hydrologic equations, calculations, and results from the analyses can be found in Appendix C.

4.1 DDMS/HEC-1 ANALYSIS

A HEC-1 analysis using the FCDMC Drainage Design Management System (DDMS) was performed to quantify flows impacting the site generated from the tributary drainage areas (E23 and a portion of E27). Hydrologic calculations used to determine flows can be found Appendix C. An electronic copy of the DDMS model on CD is also provided in Appendix C. The following sections describe the HEC-1/DDMS methodology used for the analysis of this report.

4.1.1 RAINFALL DATA

Precipitation depths were not modified from the original HEC-1 model.

4.1.2 DRAINAGE AREAS

Topographic contour data obtained from the FCDMC was used confirm the delineation of the offsite drainage areas. The obtained topographic data was the same data used in the in the ADMPU hydrologic analyses.

4.1.3 RAINFALL LOSSES

Drainage area E23 remained unchanged compared to the original ADMPU HEC-1 model. As the Project boundary is located completely within the larger drainage area E27, various parameters were required to be reevaluated which are described below.

Composite rainfall loss parameters, used to calculate peak flows and volumes, are determined within DDMS for each sub-basin. These rainfall loss parameters, described in further detail below, are; 1) Initial Abstraction (IA), 2) hydraulic conductivity at natural saturation (XKSAT), 3) soil moisture deficit (DTHETA), and 4) wetting front capillary suction (PSIF).

In order to determine XKSAT, DTHETA, and PSIF, soil data for the site was required, which was referenced from United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) Web Soil Survey website. Shape files were imported into CAD from the NRCS website to calculate the soil type percentage compositions of the individual sub basins. The NCRS Custom Soil Resource Map is provided in Appendix C. It should be noted that soil areas for E23 were compared to the ADMPU model and were nearly identical suggesting that the same methodology was utilized.

The XKSAT, DTHETA, Initial abstraction (IA), and percent impervious (RTIMP) values remained consistent with the ADMPU.

5.0 HYDRAULIC ANALYSIS

5.1 PRELIMINARY OPEN CHANNEL DESIGN

Figure 4 (Master Drainage Exhibit) of Appendix A details the various channel segment ID's and the associated hydrologic flows through the property along with the approximate channel footprint. Hydraflow was used to perform normal depth calculations for each channel section which have been included in Appendix D.

Channels have been sized referencing parameters from the DDM, Volume 2. Design parameters and results for the proposed channel corridors are presented in the Channel Summary Table included in Appendix D. All channels will have a minimum freeboard of 1 foot. Other pertinent design criteria for the channels are described below:

- Manning's n: A Manning's n value of 0.030 has been used to represent the proposed channel lining for the offsite flow drainage corridors. Use of a mid-range roughness coefficient allows for some flexibility in the channel lining, such as a combination of grass with native vegetation, sparsely placed shrubs, and decomposed granite.

- Side Slopes: Offsite drainage conveyance channels located through the property boundary have been designed at 6H: 1V side slopes. Steeper slopes may be utilized depending on the lining composition and location.

- Permissible velocities: A maximum permissible velocity of 5 feet per second (fps) has been used for the preliminary design of the channels, consistent with the maximum velocity specified for natural channels in the DDM.

- Longitudinal Slopes: Preliminary longitudinal slopes were determined based on existing ground slopes and were found to be approximately 0.2 %.

5.2 PRELIMINARY CULVERT DESIGN

Along with the channel configurations, Figure 4 also details approximate locations of culverts throughout the property based on conceptual roadway layouts which will be needed to pass offsite 100-year peak flows under the roads assuming no overtopping. Similar to the open channel calculations, Hydraflow was utilized to quantify the approximate number and size of culverts required to convey flow beneath the roadways with no overtopping. Hydraflow cross sections are included in Appendix D.

6.0 DRAINAGE INFRASTRUCTURE CONSTRUCTION PHASING

The Project will most likely develop various parcels at different times. In order to provide safe conveyance of 100-year peak flows and to minimize flood hazards during the construction of the development, the timing of construction of the proposed drainage corridors will need to be considered in order to safely manage offsite runoff through the site. In addition, temporary interim retention basins may be employed in order to protect the developing properties from runoff generated from undeveloped land within the overall Project boundary.

These interim facilities would be shallow in nature consisting of storage depths of 1 foot or less, sized to retain the existing conditions 100-year, 2-hour runoff generated onsite.

7.0 ONSITE DRAINAGE

The proposed drainage infrastructure to manage stormwater generated within the Project consist of manmade channels, culverts, street drainage networks, and retention basins. This section describes the proposed concepts and future design of the required drainage infrastructure.

7.1 LOT DRAINAGE

Lots are to be graded to drain from the rear to the front and into the street. A minimum lot drainage time of concentration of 5-minutes for residential and commercial will be used to determine rainfall intensities in accordance with the EDS.

7.2 ONSITE STREET DRAINAGE

The Rational Method will be used to calculate 10- and 100-year onsite flows for pavement drainage design. For local streets, the onsite system will be designed to convey the peak 10-year flow between curbs and 100-year flow within the street right-of-way or drainage easements. Where possible, this will be accomplished with the use of 4-inch roll curb. 6-inch vertical curb will be constructed where a 4-inch curb cannot meet the above requirements. Arterial and major collector streets shall be designed utilizing 6-inch vertical curbs and will convey peak flows generated by the 10-year event such that the flows will be limited to a spread of one traffic lane in each direction and 100-year flow within the street right-of-way or drainage easements. Furthermore, an underground storm drain network will be utilized in design where a 6-inch curb cannot meet the aforementioned requirements.

7.3 DRAINAGE STRUCTURES

The drainage design for the Project outlines a system in which street flows will be directed to concentration points throughout the site where catch basins and storm drains will be placed to collect and convey the street runoff to retention basins. Underground storage basins may also be utilized for non-residential developments within the site in accordance with the EDS. Calculations to determine storm drain locations and sizes will be provided with the final drainage plans for each parcel of the development.

Erosion revetment such as riprap aprons, will be designed downstream of all concentrated discharge points, including storm drain pipe outlets, to protect against scour around these areas, facilitate uniform spreading of flows and decrease flow velocities. These structures will be designed in accordance with the design guidelines.

7.4 ONSITE STORMWATER STORAGE REQUIREMENTS

7.4.1 ONSITE RETENTION

The onsite rainfall runoff from the site will be routed via in-street flow and storm drains, where necessary. The City requires 100-year, 2-hour retention to be provided for new developments. The equations to calculate the 100-year, 2-hour required retention volumes are detailed below:

100-Year, 2-Hour

$$V_R = P/12*(C)*A$$

Where:

V_R is the 100-year, 2-hour retention volume (ft^3)
C is the runoff coefficient
P is the 100-year, 2-hour rainfall depth (inches)
A is the drainage area (ft^2).

The NOAA Atlas 14 100-year, 2-hour rainfall depth of 2.21 inches was used as the precipitation depth. The NOAA 14 report for the Project has been included in Appendix C. Runoff coefficients for onsite drainage sub-basins were taken from Table 6.3 of the DPSM detailed in Table 2 below. The applicable runoff coefficients from this table were weighted based on the land uses and gross areas and are presented in Appendix E. Common retention basins may be employed, in lieu of individual basins or underground storage, combining one or more parcels in order to make the most efficient use of the property. Onsite retention solutions will be determined as the Project is developed considering future phasing which will be detailed in subsequent parcel drainage reports.

Table 2:
Land Use Summary Table

Land Use	Density (du/ac)	FCDMC Land Use Class	"C" Coefficient
Medium Density Residential (LMDR)	4-6	150	0.84
Medium Density Residential (MDR)	6-10	170	0.94
High Density Residential (HDR)	15+	190	0.94
Commercial	--	220	0.95
Park/Open Space	--	710	0.31

Excess flows generated from major storm events (those events exceeding the design storm event) will overtop the basins and be routed downstream via channels, in-street flows, storm drain pipes, and other retention basins to historical outfalls. The resulting peak flows discharging from the site will not be increased as a result of development.

Stormwater storage basins will be designed such that retained or detained water will preclude a water surface depth over 3.5-feet and will be discharged within 36-hours of the storm event.

7.4.2 RETENTION BASIN DEWATERING

Outlet facilities will generally consist of natural infiltration and gravity bleed-off pipes wherever possible, in accordance with the EDS. Retention basins will be placed at strategic locations to allow retained runoff to discharge to historical outfall locations. It should be noted that there are currently no existing stromdrain networks in the vicinity in which the development can drain via gravity bleed-off. To the extent possible, existing washes and other onsite and offsite drainage infrastructure will be utilized such that retention basins can bleed-off by gravity. However, due to the relatively flat terrain (approximately 0.5 percent), gravity bleed-off may not be feasible for all portions of the site. If gravity bleed-off is not deemed feasible for portions of the Project, other alternatives for dewatering will be considered at final design in accordance with Section 806.21.2.1 of the EDS. Post construction geotechnical tests will be performed in order to determine the natural infiltration rate of each basin.

8.0 FINISHED FLOOR ELEVATIONS

In the event of a storm where retention volumes are exceeded, the Project will be designed with a means to outfall at a number of locations throughout the site. Finished floor elevations within the Project will be set a minimum of 12-inches above the high adjacent 100-year water surface elevation.

9.0 SUMMARY AND CONCLUSIONS

The proposed development will comply with the City of Mesa's required drainage standards as well as Maricopa County Planning and Development Design guidelines and regulations. Levine General Motors 170 will meet the specified retention requirements such that flows generated from the 100-year event will not be anticipated to result in adverse impacts to either downstream existing properties or drainage ways from the Project. This report has determined that:

- The design of the hydraulic facilities is in accordance with the City's and the FCDMC's requirements.
- Channels will be designed to convey offsite 100-year peak flows through the Project with a minimum 1-foot of freeboard. Maximum flow velocities in the channels will be less than permissible velocities for the selected linings.
- Streets will be designed to adequately convey the calculated peak 10-year flows between curbs and 100-year flows within the street right-of-ways or drainage easements.
- Onsite flows will be conveyed to stormwater storage basins or underground storage near low points via surface flow and, when necessary, storm drain pipes.

- Riprap aprons will be placed downstream of all storm drain outlets and other points of concentrated flow to protect against scour.
- Onsite retention basins and underground storage will provide, at a minimum, a storage volume equivalent to the 100-year, 2-hour runoff.
- Basins will be drained within 36 hours. The dewatering of the retention basins will be accomplished by the combination of natural infiltration and bleed-off pipes wherever possible.
- Shallow interim retention basins may be employed upstream of developing parcels in order to protect the properties from runoff generated onsite.
- All finished floor elevations will be set a minimum of 12 inches above the retention basin overflow elevations and 100-year water surface elevations in the adjacent drainage corridors.
- Individual parcel drainage reports will be prepared based on the future phasing of the Project. These reports will contain final calculations and design for the following:
    - In-street flow capacities;
    - Scupper and catch basin sizing;
    - Storm drain pipe system design capacities;
    - Retention basin geometries and volumes;
    - Retention basin high-water outlet structures;
    - Retention dewatering measures.

10.0 REFERENCES

City of Mesa, 2019. *Engineering and Design Standards*. City of Mesa, Arizona. April, 2019.

FCDMC, 2011. *East Mesa Area Drainage Master Plan Update*. Maricopa County, Arizona. August, 2011

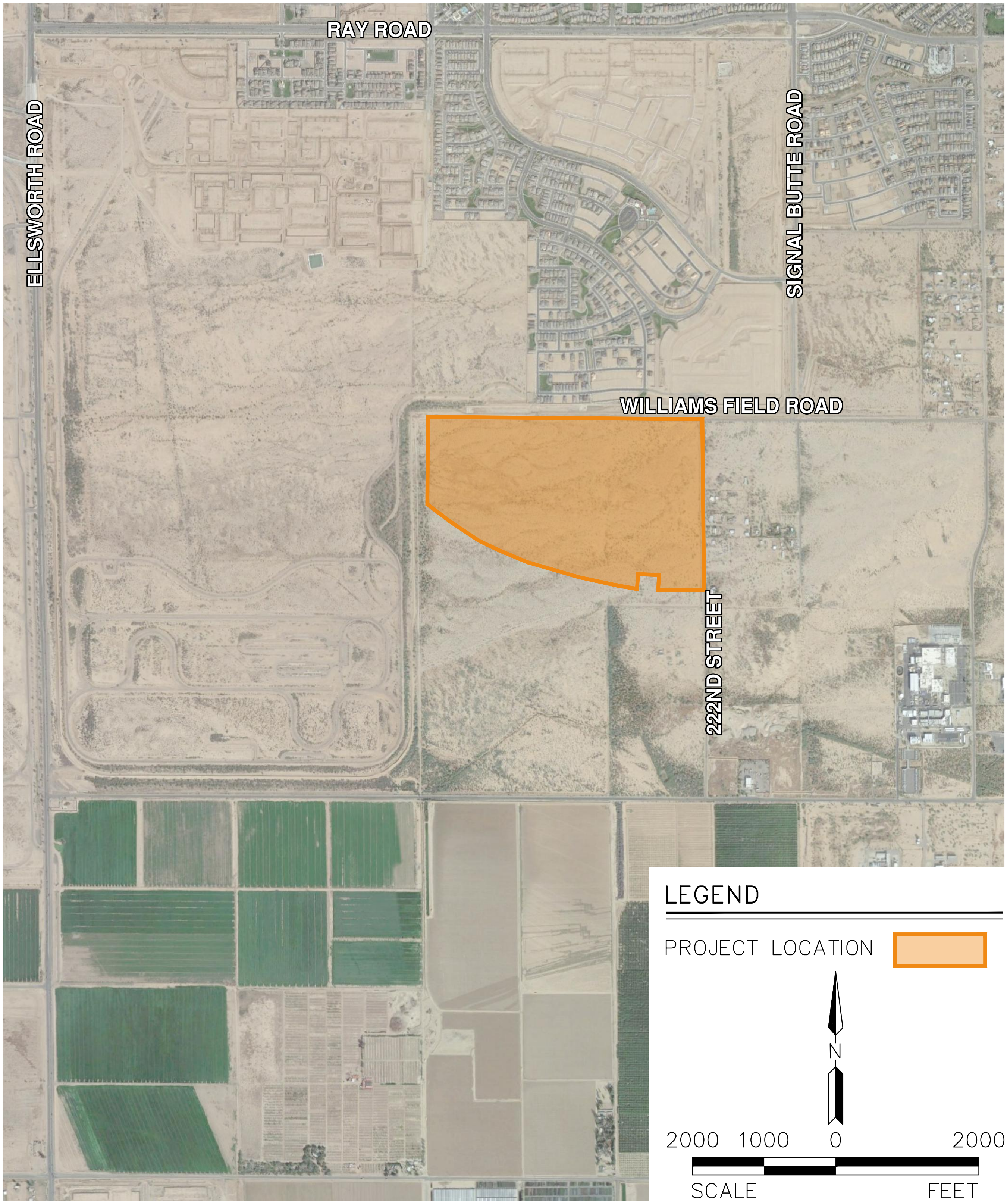
FCDMC, 2013a. *Drainage Design Manual for Maricopa County, Arizona, Volume 1 - Hydrology*. Phoenix, Arizona.

FCDMC, 2013b. *Drainage Design Manual for Maricopa County, Arizona, Volume 2 - Hydraulics*. Phoenix, Arizona.

FCDMC, 2016. *Drainage Policies and Standards Manual for Maricopa County, Arizona*. Phoenix, Arizona.

APPENDIX A

FIGURES



PROJ.NO.:	2063
DATE:	FEB 2019
SCALE:	1" = 2,000'
DRAWN BY:	SL
CHECKED BY:	BB

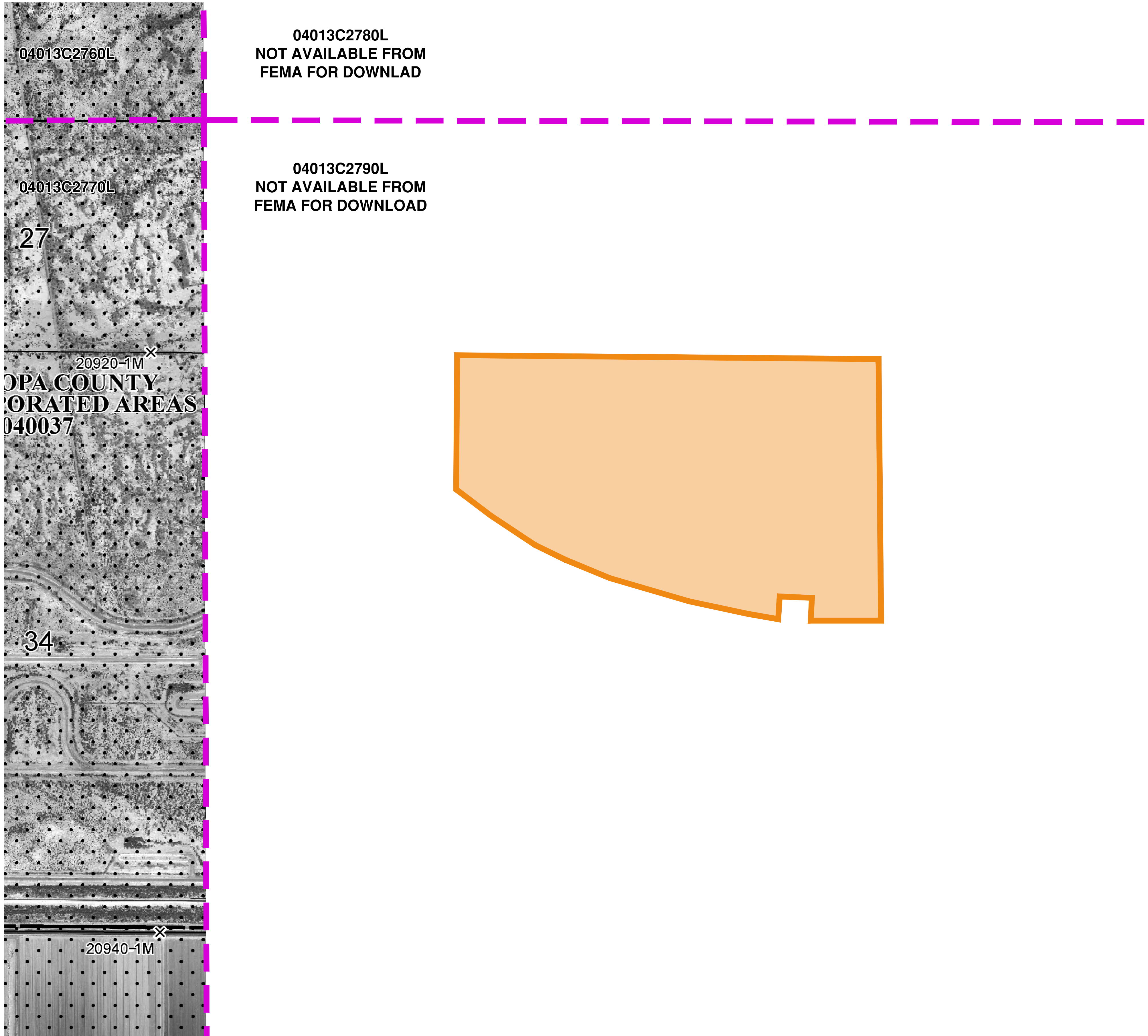
LEVINE 170

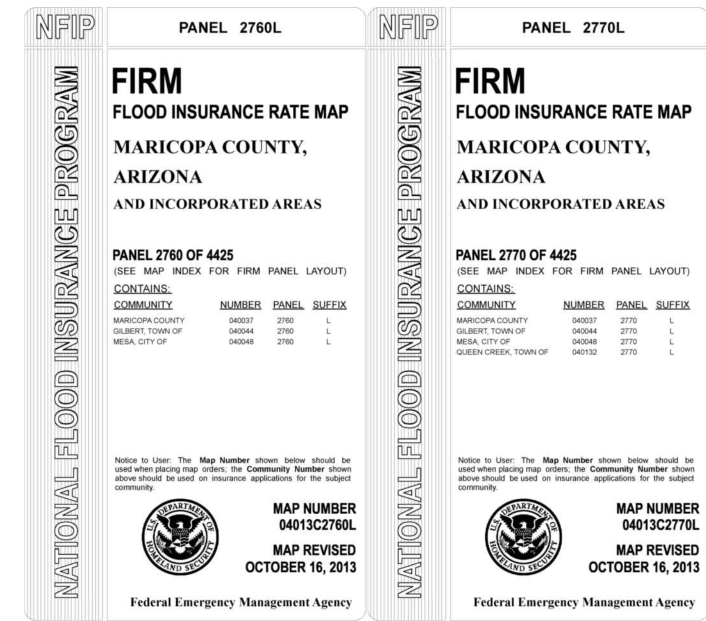
MARICOPA COUNTY, ARIZONA

FIG 1: VICINITY MAP

HILGARTWILSON
2141 E. HIGHLAND AVE., STE. 250
PHOENIX, AZ 85016
P: 602.490.0535 / F: 602.368.2436

U:\2000\2063\2063.01 – Pacific Proving LLC\REPORTS\DRAINAGE\Exhibits\2063 FIG 1 – Vicinity Map.dwg 2/27/2019 3:12 PM





NFIP

PANEL 2760L

NATIONAL FLOOD INSURANCE PROGRAM

FIRM

FLOOD INSURANCE RATE MAP

MARICOPA COUNTY, ARIZONA

AND INCORPORATED AREAS

PANEL 2760 OF 4425

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
MARICOPA COUNTY	040037	2760	L
GILBERT, TOWN OF	040044	2760	L
MESA, CITY OF	040048	2760	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 04013C2760L

MAP REVISED OCTOBER 16, 2013

Federal Emergency Management Agency

NFIP

PANEL 2770L

NATIONAL FLOOD INSURANCE PROGRAM

FIRM

FLOOD INSURANCE RATE MAP

MARICOPA COUNTY, ARIZONA

AND INCORPORATED AREAS

PANEL 2770 OF 4425

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
MARICOPA COUNTY	040037	2770	L
GILBERT, TOWN OF	040044	2770	L
MESA, CITY OF	040048	2770	L
QUEEN CREEK, TOWN OF	040132	2770	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 04013C2770L

MAP REVISED OCTOBER 16, 2013

Federal Emergency Management Agency

LEGEND

PROJECT LOCATION

FEMA MAP LIMITS

N

1000 500 0 1000

SCALE FEET

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LEVINE 170

MARICOPA COUNTY, ARIZONA

FIG 2: FEMA FLOOD MAP

PROJ. NO.: 2063
DATE: FEB 2019
SCALE: 1" = 1,000'
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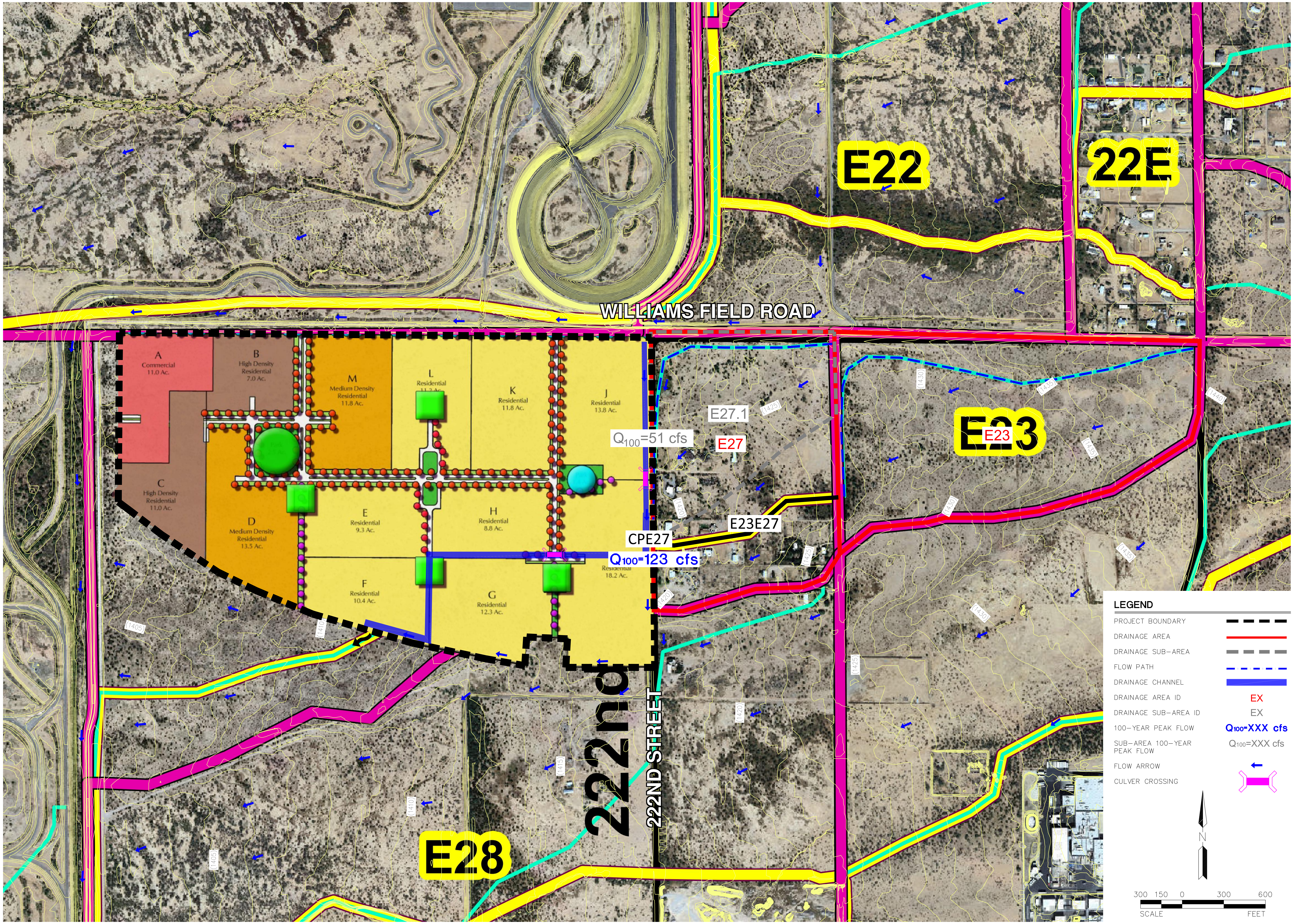

REV.:

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LEVINE 170

CITY OF MESA, ARIZONA

FIG 3: HEC-1 HYDROLOGY EXHIBIT

HILGARTWILSON
PROJ NO.: 2063
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SCALE: 1" = 300'
DRAWN: BB
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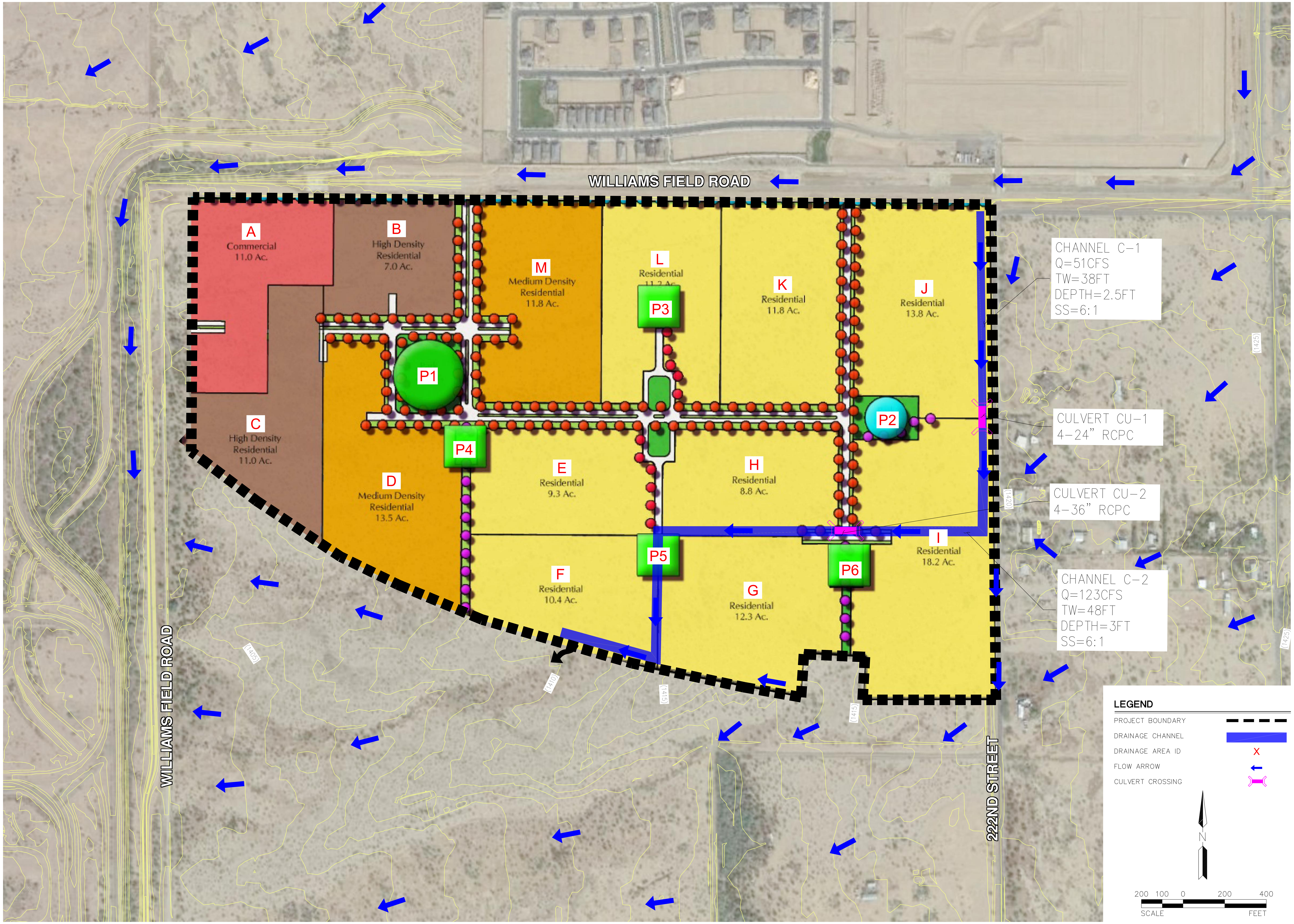
APPROVED: BB
DWG. NO.
3
SHT. 3 OF 4

U:\2000\2063\2063.01 — Pacific Proving LLC\REPORTS\DRAINAGE\Exhibits\2063 FIG 3 — East Mesa ADMP.dwg 2/27/2019 1:59 PM



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LEVINE 170

CITY OF MESA, ARIZONA

FIG 4: MASTER DRAINAGE EXHIBIT

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SCALE: 1" = 200'
DRAWN: SL
DESIGNED: HW
APPROVED: BB

DWG. NO.
4

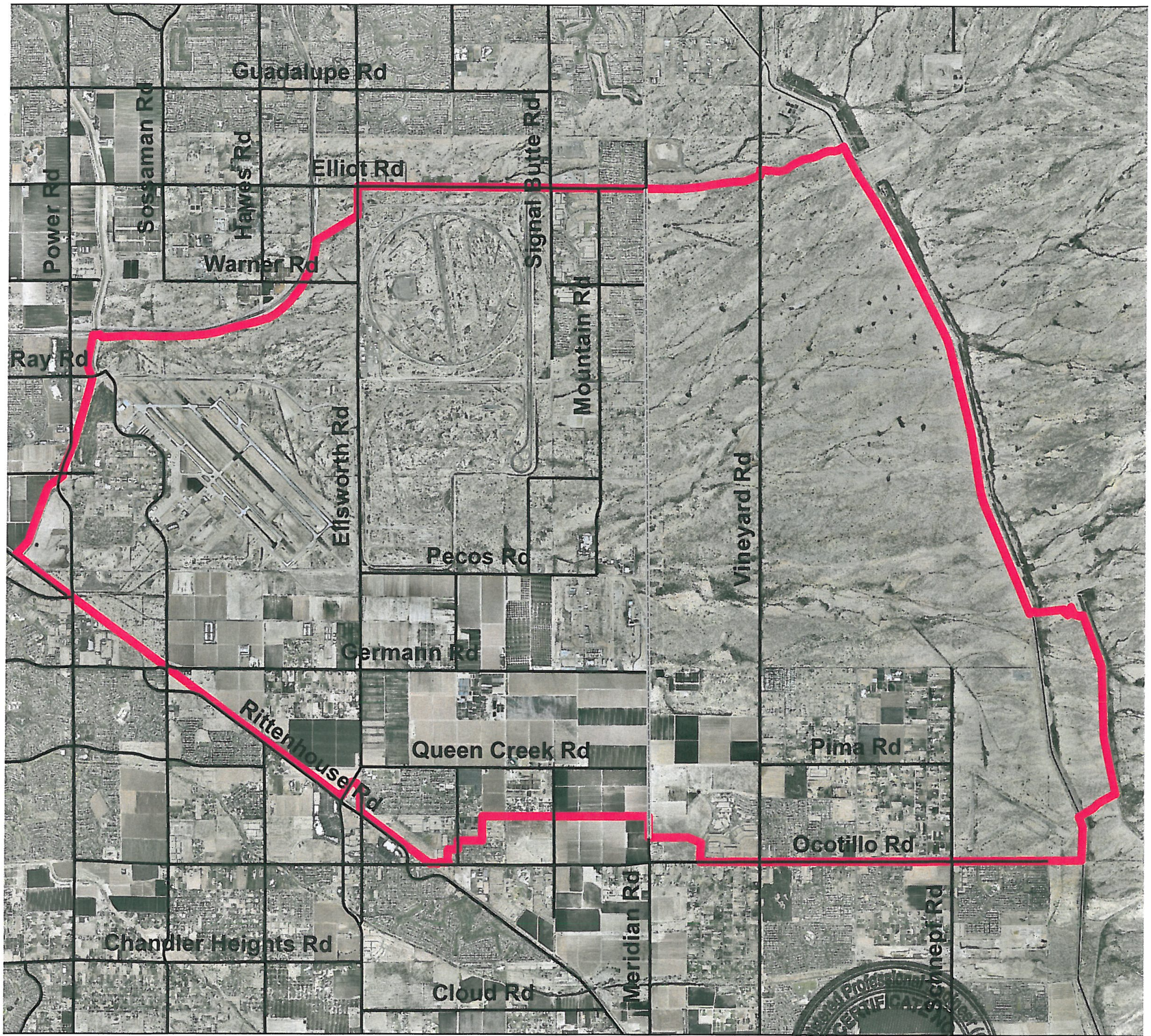
SHT. 4 OF 4

U:\2000\2063\2063.01 – Pacific Proving LLC\REPORTS\DRAINAGE\Exhibits\2063 FIG 4 – Drainage Summary Exhibit.dwg 2/27/2019 3:30 PM

APPENDIX B

PREVIOUS DRAINAGE STUDIES

East Mesa Area Drainage Master Plan Update



Prepared by:
Flood Control District of Maricopa County
Engineering Division
Hydrology & Hydraulics Branch
August 2011

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CERTIFICATE NO.
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REGESTER
Date Signed 8/11/11
ARIZONA, U.S.A.

Catherine W. Regester

EXPIRES 9/30/11

Table 4.5.1-1 Existing Conditions HEC-1 Model Results in Model Order													
HEC-1 ID	Area (Sq. Mi.)	10 Year				50 Year				100 Year			
		6 Hour		24 Hour		6 Hour		24 Hour		6 Hour		24 Hour	
		Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)	Peak (cfs)	Time (Hr)
E8E6	1.1	121	6.17	**182**	14.08	221	6.25	**251**	15	253	6.75	**307**	15.33
CPE6	3.63	214	5.5	**510**	13.5	643	5.67	**1174**	13.5	977	5.67	**1514**	13.5
DRE9	3.63	1	5.5	**8**	13.5	13	5.67	**238**	13.5	144	5.67	**509**	13.5
DE6S	3.63	177	5.5	**502**	13.5	630	5.67	**936**	13.5	833	5.67	**1005**	13.5
E6E15	3.63	167	6.17	**428**	15.42	547	7.33	**826**	15.08	747	7.17	**938**	15
E15	0.78	181	4.92	**202**	12.92	359	4.92	**375**	12.92	447	4.92	**458**	12.92
DRE9	3.63	1	5.5	**8**	13.5	13	5.67	**238**	13.5	144	5.67	**509**	13.5
RTE6E9	3.63	1	6.25	**7**	14.08	11	6.08	**199**	13.83	132	5.92	**456**	13.75
E9	0.72	166	5	**177**	13	319	5	**329**	13	397	5	**401**	13
CPE9	4.35	53	5.08	**171**	13	188	5.08	**321**	13	258	5	**591**	13.67
DRR5	4.35	1	5.08	**49**	13	63	5.08	**159**	13	112	5	**374**	13.67
DE9S	4.35	52	5.08	**122**	13	125	5.08	**163**	13	146	5	**217**	13.67
E9E16	4.35	39	6	**107**	13.75	116	5.75	**150**	13.67	138	5.75	**196**	14.5
E16	0.4	**120**	4.83	110	12.83	**220**	4.83	204	12.83	**269**	4.83	250	12.83
CPE16	4.75	38	6	**122**	13.5	141	5.5	**212**	13.25	191	5.17	**269**	12.92
E16E15	4.75	35	6.42	**120**	14	138	5.83	**209**	13.58	187	5.67	**259**	13.42
CPE15	12.37	180	6.17	**423**	14	536	7.25	**888**	15.08	742	7.17	**1078**	14.92
E15E24	12.37	66	7.58	**412**	15.58	421	7.5	**859**	15.5	624	7.67	**1046**	15.33
CPE24	14.73	69	5.33	**630**	15.58	559	6.25	**1224**	15.58	840	7.75	**1470**	15.42
E24E28	14.73	57	8.92	**600**	16.5	552	7.33	**1190**	16.5	821	8.75	**1427**	16.33
E23	0.11	**51**	4.5	46	12.5	**95**	4.5	85	12.5	**115**	4.5	104	12.5
E23E27	0.11	**23**	5.75	21	13.83	**51**	5.58	46	13.58	**66**	5.5	61	13.5
E27	0.47	**186**	4.83	173	12.83	**321**	4.83	299	12.83	**387**	4.83	356	12.83
CPE27	0.58	**178**	4.83	173	12.83	**312**	4.83	299	12.83	**377**	4.83	356	12.83
E27E28	0.58	**163**	5	160	13	**283**	5	272	13	**346**	5	329	13
E28	0.56	**257**	4.83	249	12.83	**426**	4.83	401	12.83	**503**	4.83	470	12.83
CPE28	15.87	176	4.92	**599**	16.5	549	7.33	**1190**	16.5	818	7	**1427**	16.33
E28E31	15.87	153	5.58	**591**	16.92	536	8	**1166**	17	791	7.5	**1400**	16.83
E25	0.93	523	4.58	**529**	12.58	**834**	4.58	824	12.5	**984**	4.5	965	12.5
RETE25	0.93	523	4.58	**529**	12.58	**834**	4.58	824	12.5	**984**	4.5	965	12.5
DIVE25	0.93	0	0	0	0	0	0	0	0	0	0	0	0
E25E29	0.93	0	0	0	0	0	0	0	0	0	0	0	0

East Mesa Area Drainage Master Plan Update

Existing Conditions 100 Year 6 Hour HEC-1 Schematic

HILGARTWILSON
ENGINEER | PLAN | SURVEY | MANAGE

APPENDIX C

PRELIMINARY HYDROLOGIC CALCULATIONS AND ELECTRONIC DATA FILES (CD)

HEC-1/DDMSW ANALYSIS

Major Basin ID	Type	Area		2 Yr	5 Yr	10 Yr	25 Yr	50 Yr	100 Yr
Major Basin 01									
E23	Hydrograph	0.1100	Flow (cfs)						115
			Volume (Inches)						0.936
			Volume (Ac-Ft)						5.64
			Ac-Ft/Sq Mi						51.27
			Time to Peak (Hrs)						4.50
E23E27	Routed	0.1100	Flow (cfs)						33
			Volume (Inches)						0.936
			Volume (Ac-Ft)						5.64
			Ac-Ft/Sq Mi						51.27
			Time to Peak (Hrs)						4.83
E27	Hydrograph	0.0900	Flow (cfs)						103
			Volume (Inches)						1.236
			Volume (Ac-Ft)						5.93
			Ac-Ft/Sq Mi						65.89
			Time to Peak (Hrs)						4.50
CPE27	Combined	0.2000	Flow (cfs)						123
			Volume (Inches)						1.068
			Volume (Ac-Ft)						11.56
			Ac-Ft/Sq Mi						57.80
			Time to Peak (Hrs)						4.58
E27.1	Hydrograph	0.0500	Flow (cfs)						51
			Volume (Inches)						1.107
			Volume (Ac-Ft)						3.01
			Ac-Ft/Sq Mi						60.20
			Time to Peak (Hrs)						4.58

Area ID	Sub Basin Parameters Area (sq mi)	Length (mi)	Slope (ft/mi)	S-Graph	Lca (mi)	Lag (min)	Velocity (f/s)	Kn	Rainfall Losses IA (in)	DTHETA	PSIF (in)	XKSAT (in/hr)	RTIMP (%)
Major Basin ID: 01													
E23	0.113	0.67	22.4	VALLEY	0.33	31.40	1.87	0.070	0.35	0.35	4.72	0.315	
E27	0.090	0.49	18.4	VALLEY	0.68	34.30	1.25	0.063	0.33	0.30	6.34	0.165	4
E27.1	0.051	0.49	18.4	VALLEY	0.68	38.10	1.13	0.070	0.35	0.39	6.16	0.164	

Sub Basin	Land Use Code	Area (sq mi)	Area (%)	Initial Loss (IA)	Percent Impervious (RTIMP)	Vegetation Cover (%)	DTHETA	Kn		Description
Major Basin ID: 01										
E23	900	0.1132	100.0	0.35	0	25.0	DRY	0.070	*	Vacant (Existing land use database only)
		0.1132	**100.0**							
E27	120	0.0222	24.6	0.30	5	30.0	NORMAL	0.060	*	Estate Residential (1/5 du per acre to 1 du per acre)
	130	0.0191	21.1	0.30	15	50.0	NORMAL	0.050	*	Large Lot Residential - Single Family (1-2 du per acre)
	900	0.0491	54.3	0.35	0	25.0	DRY	0.070	*	Vacant (Existing land use database only)
		0.0904	**100.0**							
E27.1	900	0.0509	100.0	0.35	0	25.0	DRY	0.070	*	Vacant (Existing land use database only)
		0.0509	**100.0**							

* Non default value

Area ID	Book Number	Map Unit	Soil ID	Area (sq mi)	Area (%)	XKSAT	Rock Percent (%)	Effective Rock (%)	Comments

Major Basin ID: 01

Area ID	Book Number	Map Unit	Soil ID	Area (sq mi)	Area (%)	XKSAT	Rock Percent (%)	Effective Rock (%)	Comments
E23	645	1	6451	0.012	10.60	0.410	-	100	
	645	22	64522	0.015	13.40	0.040	-	100	
	645	77	64577	0.001	1.20	0.050	-	100	
	645	78	64578	0.003	2.50	0.050	-	100	
	645	112	645112	0.082	72.20	0.390	-	100	
E27	645	77	64577	0.031	33.80	0.050	-	100	
	645	78	64578	0.017	18.90	0.050	-	100	
	645	112	645112	0.043	47.30	0.390	-	100	
E27.1	645	77	64577	0.025	49.90	0.050	-	100	
	645	112	645112	0.026	50.10	0.390	-	100	

Route ID	LOB N	Chan N	ROB N	Length (ft)	Slope (ft/ft)	Max Elev (ft)		1.	2.	3.	4.	5.	6.	7.	8.
NORMAL DEPTH															
Major Basin 01															
E23E27	0.045	0.040	0.045	6,329.70	0.0037	6.00	X:	-	500.00	950.00	1,003.00	1,007.00	1,061.00	1,511.00	2,011.00
							Y:	6.00	3.00	2.00	1.00	1.00	2.00	3.00	6.00

ID	Method	Duration	2 Yr	5 Yr	10 Yr	25 Yr	50 Yr	100 Yr
DEFAULT	NOAA14	5 MIN	0.251	0.340	0.408	0.500	0.572	0.645
	NOAA14	10 MIN	0.383	0.518	0.621	0.762	0.871	0.981
	NOAA14	15 MIN	0.474	0.642	0.770	0.944	1.079	1.216
	NOAA14	30 MIN	0.639	0.865	1.037	1.272	1.453	1.638
	NOAA14	1 HOUR	0.791	1.070	1.283	1.574	1.799	2.027
	NOAA14	2 HOUR	0.897	1.193	1.422	1.731	1.971	2.219
	NOAA14	3 HOUR	0.944	1.239	1.472	1.797	2.055	2.324
	NOAA14	6 HOUR	1.126	1.438	1.686	2.025	2.293	2.572
	NOAA14	12 HOUR	1.278	1.611	1.874	2.231	2.505	2.785
	NOAA14	24 HOUR	1.547	1.982	2.330	2.809	3.184	3.579

```
1****************************************                                          ***************************************
 *                                      *                                          *                                     *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                                          *    U.S. ARMY CORPS OF ENGINEERS     *
 *             JUN   1998               *                                          *    HYDROLOGIC ENGINEERING CENTER    *
 *           VERSION 4.1                *                                          *         609 SECOND STREET           *
 *                                      *                                          *       DAVIS, CALIFORNIA 95616       *
 *  RUN DATE   27FEB19  TIME  14:13:48  *                                          *           (916) 756-1104            *
 *                                      *                                          *                                     *
 ****************************************                                          ***************************************



                                     X     X  XXXXXXX   XXXXX           X
                                     X     X  X        X     X         XX
                                     X     X  X        X                X
                                     XXXXXXX  XXXX     X       XXXXX    X
                                     X     X  X        X                X
                                     X     X  X        X     X          X
                                     X     X  XXXXXXX   XXXXX          XXX



          THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

          THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
          THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
          NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
          DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL   LOSS RATE:GREEN AND AMPT INFILTRATION
          KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

1                                                 HEC-1 INPUT                                                     PAGE  1

         LINE           ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

            1           ID        Flood Control District of Maricopa County
            2           ID        EMADMPU6_20110518 - EMADMPU6 20110518
            3           ID        100 YEAR
            4           ID        6 Hour  Storm
            5           ID        Unit Hydrograph: S-Graph
            6           ID        Storm: Multiple
            7           ID        02/27/2019
                        *DIAGRAM
            8           IT       5  1JAN99       0    2000
            9           IO       5
           10           IN      15
                        *
           11           JD   2.572  0.0001
           12           PC   0.000   0.008   0.016   0.025   0.033   0.041   0.050   0.058   0.066   0.074
           13           PC   0.087   0.099   0.118   0.138   0.216   0.377   0.834   0.911   0.931   0.950
           14           PC   0.962   0.972   0.983   0.991   1.000
           15           JD   2.557  0.5000
           16           PC   0.000   0.008   0.016   0.025   0.033   0.041   0.050   0.058   0.066   0.074
           17           PC   0.087   0.099   0.118   0.138   0.216   0.377   0.834   0.911   0.931   0.950
           18           PC   0.962   0.972   0.983   0.991   1.000
                        *
                        *

           19           KK     E23   BASIN
           20           KM
           21           BA   0.113
           22           LG    0.35    0.35    4.72    0.32       0
           23           UI       0      12      28      56      72      91     136     134     101      79
           24           UI      61      38      21      17      12       4       4       4       4       0
           25           UI       0       0       0       0       0       0       0       0       0       0
           26           UI       0       0       0       0       0       0       0       0       0       0
           27           UI       0       0       0       0       0       0       0       0       0       0
                        *

           28           KK  E23E27   ROUTE
           29           KM
           30           RS       1    FLOW
           31           RC   0.045   0.040   0.045    6330  0.0037    6.00
           32           RX    0.00  500.00  950.00 1003.00 1007.00 1061.00 1511.00 2011.00
           33           RY    6.00    3.00    2.00    1.00    1.00    2.00    3.00    6.00
                        *

           34           KK     E27   BASIN
           35           KM
           36           BA   0.090
           37           LG    0.33    0.30    6.34    0.17       4
           38           UI       0       9      17      38      49      61      80     110      86      69
           39           UI      55      43      28      15      13       9       5       3       3       3
           40           UI       3       0       0       0       0       0       0       0       0       0
           41           UI       0       0       0       0       0       0       0       0       0       0
           42           UI       0       0       0       0       0       0       0       0       0       0
                        *
1                                                 HEC-1 INPUT                                                     PAGE  2

         LINE           ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10


           43           KK   CPE27 COMBINE
           44           KM
           45           HC       2
                        *

           46           KK   E27.1   BASIN
           47           BA   0.051
           48           LG    0.35    0.39    6.16    0.16       0
           49           UI       0       5       7      17      23      28      34      47      55      42
           50           UI      35      28      23      16       9       8       5       5       2       1
           51           UI       1       1       1       0       0       0       0       0       0       0
           52           UI       0       0       0       0       0       0       0       0       0       0
           53           UI       0       0       0       0       0       0       0       0       0       0
```

```
                              *
             54           ZZ
1
                    SCHEMATIC DIAGRAM OF STREAM NETWORK
 INPUT
  LINE      (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

   NO.      (.) CONNECTOR        (<---) RETURN OF DIVERTED OR PUMPED FLOW

    19         E23
                 V
                 V
    28      E23E27
                 .
                 .
    34           .         E27
                 .           .
                 .           .
    43       CPE27...........
                 .
                 .
    46           .       E27.1

 (***) RUNOFF ALSO COMPUTED AT THIS LOCATION
1****************************************                                                 ***************************************
 *                                      *                                                 *                                     *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                                                 *    U.S. ARMY CORPS OF ENGINEERS     *
 *             JUN   1998               *                                                 *    HYDROLOGIC ENGINEERING CENTER    *
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 *                                      *                                                 *       DAVIS, CALIFORNIA 95616       *
 *  RUN DATE   27FEB19  TIME  14:13:48   *                                                 *           (916) 756-1104            *
 *                                      *                                                 *                                     *
 ****************************************                                                 ***************************************




                                    Flood Control District of Maricopa County
                                    EMADMPU6_20110518 - EMADMPU6 20110518
                                    100 YEAR
                                    6 Hour  Storm
                                    Unit Hydrograph: S-Graph
                                    Storm: Multiple
                                    02/27/2019

    9 IO          OUTPUT CONTROL VARIABLES
                        IPRNT           5  PRINT CONTROL
                        IPLOT           0  PLOT CONTROL
                        QSCAL          0.  HYDROGRAPH PLOT SCALE

      IT          HYDROGRAPH TIME DATA
                         NMIN           5  MINUTES IN COMPUTATION INTERVAL
                        IDATE      1JAN99  STARTING DATE
                        ITIME        0000  STARTING TIME
                           NQ        2000  NUMBER OF HYDROGRAPH ORDINATES
                       NDDATE      7JAN99  ENDING DATE
                       NDTIME        2235  ENDING TIME
                        ICENT          19  CENTURY MARK

                  COMPUTATION INTERVAL    0.08 HOURS
                       TOTAL TIME BASE  166.58 HOURS

           ENGLISH UNITS
                DRAINAGE AREA         SQUARE MILES
                PRECIPITATION DEPTH   INCHES
                LENGTH, ELEVATION     FEET
                FLOW                  CUBIC FEET PER SECOND
                STORAGE VOLUME        ACRE-FEET
                SURFACE AREA          ACRES
                TEMPERATURE           DEGREES FAHRENHEIT

   11 JD          INDEX STORM NO. 1
                         STRM        2.57  PRECIPITATION DEPTH
                         TRDA        0.00  TRANSPOSITION DRAINAGE AREA

   12 PI            PRECIPITATION PATTERN
                     0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
                     0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
                     0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
                     0.00      0.00      0.00      0.01      0.01      0.01      0.01      0.01      0.01      0.03
                     0.03      0.03      0.05      0.05      0.05      0.15      0.15      0.15      0.03      0.03
                     0.03      0.01      0.01      0.01      0.01      0.01      0.01      0.00      0.00      0.00
                     0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
                     0.00      0.00

   15 JD          INDEX STORM NO. 2
                         STRM        2.56  PRECIPITATION DEPTH
                         TRDA        0.50  TRANSPOSITION DRAINAGE AREA

   16 PI            PRECIPITATION PATTERN
                     0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
                     0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
                     0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
                     0.00      0.00      0.00      0.01      0.01      0.01      0.01      0.01      0.01      0.03
                     0.03      0.03      0.05      0.05      0.05      0.15      0.15      0.15      0.03      0.03
                     0.03      0.01      0.01      0.01      0.01      0.01      0.01      0.00      0.00      0.00
                     0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
                     0.00      0.00
1
                                                              RUNOFF SUMMARY
                                                      FLOW IN CUBIC FEET PER SECOND
                                                    TIME IN HOURS,  AREA IN SQUARE MILES

                                           PEAK    TIME OF     AVERAGE FLOW FOR MAXIMUM PERIOD      BASIN     MAXIMUM     TIME OF
           OPERATION        STATION        FLOW     PEAK                                             AREA      STAGE     MAX STAGE
+                                                              6-HOUR      24-HOUR     72-HOUR
```

	HYDROGRAPH AT						
+		E23	115.	4.50	11.	3.	1.	0.11
	ROUTED TO						
+		E23E27	33.	4.83	11.	3.	1.	0.11
	HYDROGRAPH AT						
+		E27	103.	4.50	12.	3.	1.	0.09
	2 COMBINED AT						
+		CPE27	123.	4.58	22.	6.	2.	0.20
	HYDROGRAPH AT						
+		E27.1	51.	4.58	6.	2.	1.	0.05

*** NORMAL END OF HEC-1 ***

NOAA 14 REPORT

NOAA Atlas 14, Volume 1, Version 5
Location name: Queen Creek, Arizona, USA*
Latitude: 33.3041°, Longitude: -111.6121°
Elevation: 1413.45 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sarah Dietz, Sarah Heim, Lillian Hiner, Kazungu Maitaria, Deborah Martin, Sandra Pavlovic, Ishani Roy, Carl Trypaluk, Dale Unruh, Fenglin Yan, Michael Yekta, Tan Zhao, Geoffrey Bonnin, Daniel Brewer, Li-Chuan Chen, Tye Parzybok, John Yarchoan

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**0.192** (0.162-0.233)	**0.251** (0.213-0.306)	**0.339** (0.285-0.411)	**0.406** (0.339-0.491)	**0.498** (0.409-0.600)	**0.570** (0.462-0.683)	**0.642** (0.511-0.769)	**0.715** (0.559-0.855)	**0.814** (0.620-0.975)	**0.889** (0.664-1.07)
10-min	**0.292** (0.247-0.355)	**0.381** (0.324-0.465)	**0.516** (0.434-0.626)	**0.619** (0.516-0.747)	**0.758** (0.622-0.913)	**0.867** (0.703-1.04)	**0.977** (0.777-1.17)	**1.09** (0.851-1.30)	**1.24** (0.944-1.48)	**1.35** (1.01-1.63)
15-min	**0.362** (0.306-0.440)	**0.473** (0.402-0.576)	**0.640** (0.538-0.776)	**0.767** (0.640-0.927)	**0.940** (0.771-1.13)	**1.08** (0.871-1.29)	**1.21** (0.964-1.45)	**1.35** (1.06-1.61)	**1.54** (1.17-1.84)	**1.68** (1.25-2.02)
30-min	**0.487** (0.411-0.593)	**0.637** (0.541-0.776)	**0.862** (0.724-1.05)	**1.03** (0.861-1.25)	**1.27** (1.04-1.52)	**1.45** (1.17-1.74)	**1.63** (1.30-1.95)	**1.82** (1.42-2.17)	**2.07** (1.58-2.48)	**2.26** (1.69-2.71)
60-min	**0.603** (0.509-0.734)	**0.788** (0.669-0.961)	**1.07** (0.896-1.29)	**1.28** (1.07-1.54)	**1.57** (1.29-1.89)	**1.79** (1.45-2.15)	**2.02** (1.61-2.42)	**2.25** (1.76-2.69)	**2.56** (1.95-3.07)	**2.80** (2.09-3.36)
2-hr	**0.691** (0.585-0.827)	**0.897** (0.762-1.08)	**1.19** (1.00-1.43)	**1.42** (1.19-1.70)	**1.73** (1.43-2.05)	**1.97** (1.60-2.34)	**2.21** (1.77-2.62)	**2.46** (1.94-2.91)	**2.80** (2.14-3.30)	**3.06** (2.30-3.63)
3-hr	**0.737** (0.626-0.891)	**0.943** (0.803-1.14)	**1.24** (1.05-1.50)	**1.47** (1.23-1.77)	**1.80** (1.48-2.15)	**2.05** (1.67-2.45)	**2.32** (1.85-2.76)	**2.60** (2.04-3.09)	**2.99** (2.28-3.56)	**3.31** (2.45-3.94)
6-hr	**0.892** (0.770-1.05)	**1.13** (0.976-1.33)	**1.44** (1.24-1.69)	**1.69** (1.45-1.98)	**2.03** (1.71-2.36)	**2.30** (1.91-2.67)	**2.58** (2.10-2.99)	**2.86** (2.30-3.31)	**3.25** (2.54-3.77)	**3.56** (2.72-4.14)
12-hr	**1.01** (0.889-1.16)	**1.28** (1.12-1.46)	**1.61** (1.41-1.83)	**1.87** (1.63-2.13)	**2.23** (1.92-2.52)	**2.50** (2.13-2.82)	**2.78** (2.33-3.14)	**3.06** (2.53-3.47)	**3.44** (2.78-3.92)	**3.74** (2.96-4.28)
24-hr	**1.22** (1.09-1.38)	**1.54** (1.38-1.74)	**1.97** (1.75-2.22)	**2.31** (2.05-2.60)	**2.79** (2.45-3.13)	**3.16** (2.75-3.55)	**3.55** (3.06-3.99)	**3.95** (3.36-4.45)	**4.51** (3.76-5.09)	**4.95** (4.07-5.61)
2-day	**1.27** (1.14-1.43)	**1.61** (1.44-1.82)	**2.09** (1.86-2.35)	**2.46** (2.19-2.77)	**2.98** (2.63-3.34)	**3.39** (2.96-3.79)	**3.81** (3.29-4.26)	**4.25** (3.63-4.76)	**4.85** (4.06-5.46)	**5.33** (4.39-6.03)
3-day	**1.36** (1.23-1.51)	**1.73** (1.57-1.93)	**2.26** (2.04-2.50)	**2.68** (2.40-2.97)	**3.26** (2.92-3.61)	**3.73** (3.31-4.13)	**4.23** (3.71-4.68)	**4.75** (4.12-5.26)	**5.47** (4.68-6.08)	**6.05** (5.11-6.76)
4-day	**1.45** (1.33-1.60)	**1.85** (1.69-2.04)	**2.42** (2.21-2.66)	**2.89** (2.62-3.17)	**3.55** (3.20-3.88)	**4.08** (3.66-4.47)	**4.64** (4.14-5.09)	**5.24** (4.62-5.76)	**6.09** (5.29-6.71)	**6.78** (5.83-7.50)
7-day	**1.60** (1.47-1.76)	**2.04** (1.87-2.25)	**2.68** (2.44-2.94)	**3.20** (2.91-3.50)	**3.93** (3.55-4.30)	**4.52** (4.06-4.95)	**5.16** (4.59-5.65)	**5.83** (5.14-6.39)	**6.78** (5.89-7.46)	**7.55** (6.48-8.34)
10-day	**1.74** (1.60-1.91)	**2.22** (2.04-2.43)	**2.91** (2.66-3.18)	**3.47** (3.16-3.78)	**4.25** (3.86-4.63)	**4.88** (4.39-5.32)	**5.54** (4.96-6.04)	**6.24** (5.54-6.82)	**7.23** (6.32-7.92)	**8.02** (6.94-8.82)
20-day	**2.16** (1.97-2.37)	**2.77** (2.52-3.04)	**3.63** (3.31-3.98)	**4.29** (3.89-4.70)	**5.18** (4.69-5.67)	**5.86** (5.28-6.42)	**6.56** (5.87-7.19)	**7.26** (6.47-7.97)	**8.22** (7.25-9.05)	**8.95** (7.83-9.89)
30-day	**2.52** (2.31-2.76)	**3.23** (2.96-3.53)	**4.23** (3.87-4.62)	**4.99** (4.56-5.44)	**6.02** (5.47-6.56)	**6.81** (6.16-7.43)	**7.62** (6.86-8.33)	**8.44** (7.55-9.24)	**9.55** (8.46-10.5)	**10.4** (9.13-11.5)
45-day	**2.95** (2.70-3.23)	**3.79** (3.46-4.15)	**4.96** (4.52-5.42)	**5.82** (5.31-6.37)	**6.96** (6.32-7.61)	**7.82** (7.07-8.56)	**8.69** (7.82-9.51)	**9.55** (8.54-10.5)	**10.7** (9.47-11.7)	**11.5** (10.2-12.7)
60-day	**3.29** (3.01-3.60)	**4.23** (3.87-4.62)	**5.51** (5.04-6.02)	**6.45** (5.88-7.05)	**7.67** (6.98-8.38)	**8.58** (7.77-9.37)	**9.48** (8.56-10.4)	**10.4** (9.30-11.3)	**11.5** (10.3-12.6)	**12.4** (10.9-13.6)

[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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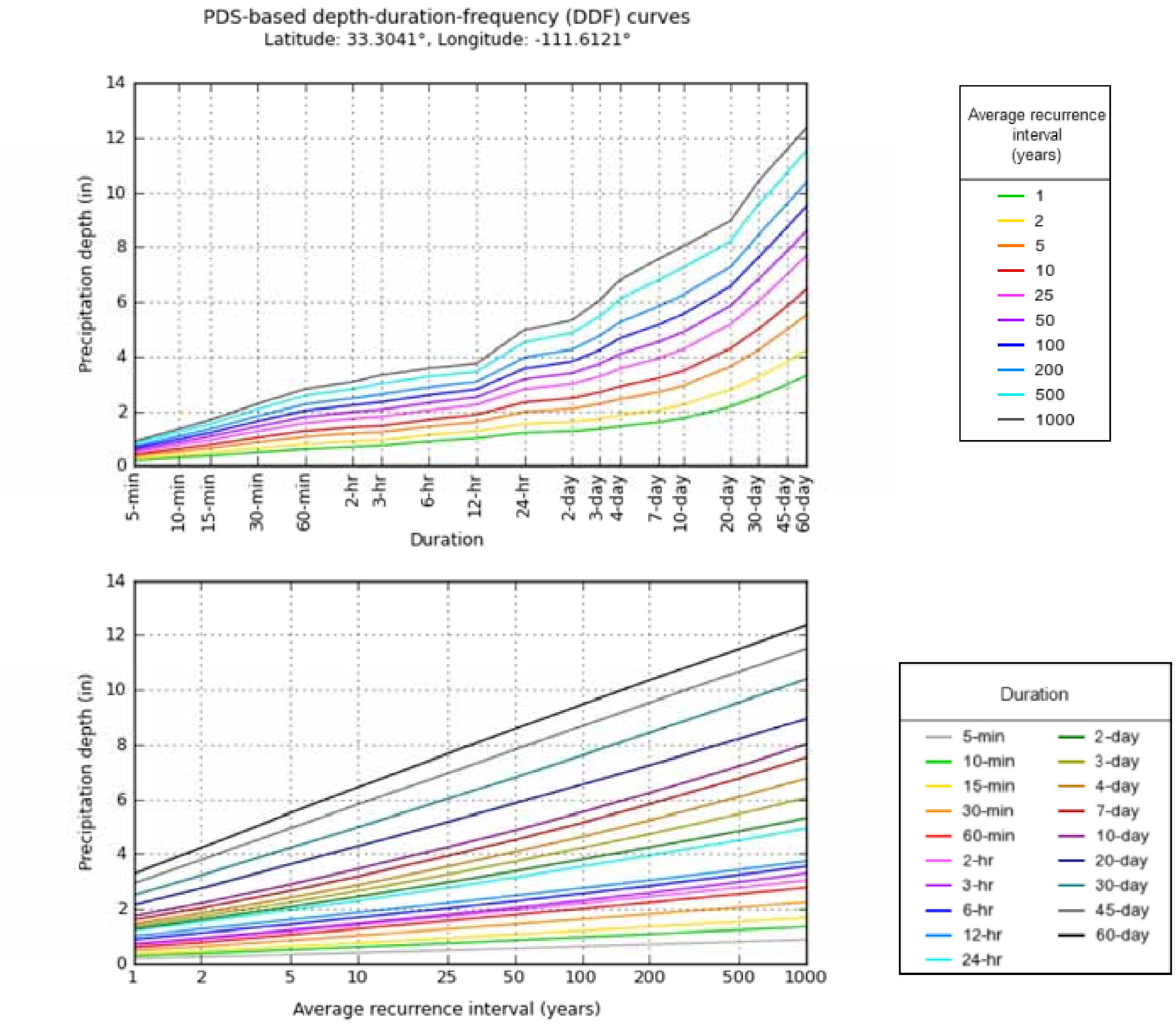
PF graphical



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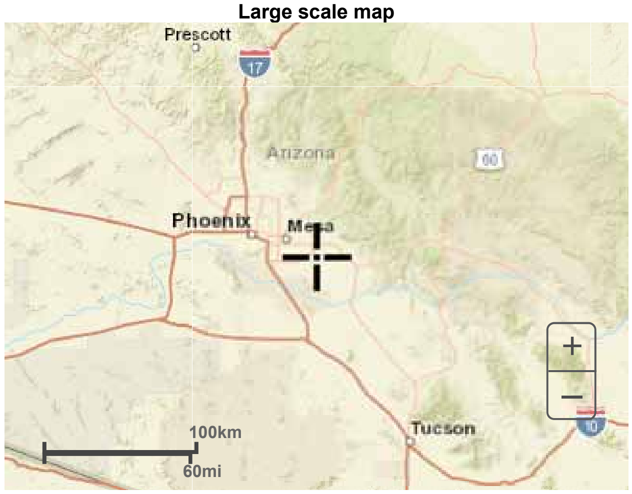
Maps & aerials

Small scale terrain

Large scale terrain

Large scale map



Large scale aerial

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US Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service
National Water Center
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

NRCS SOILS REPORT

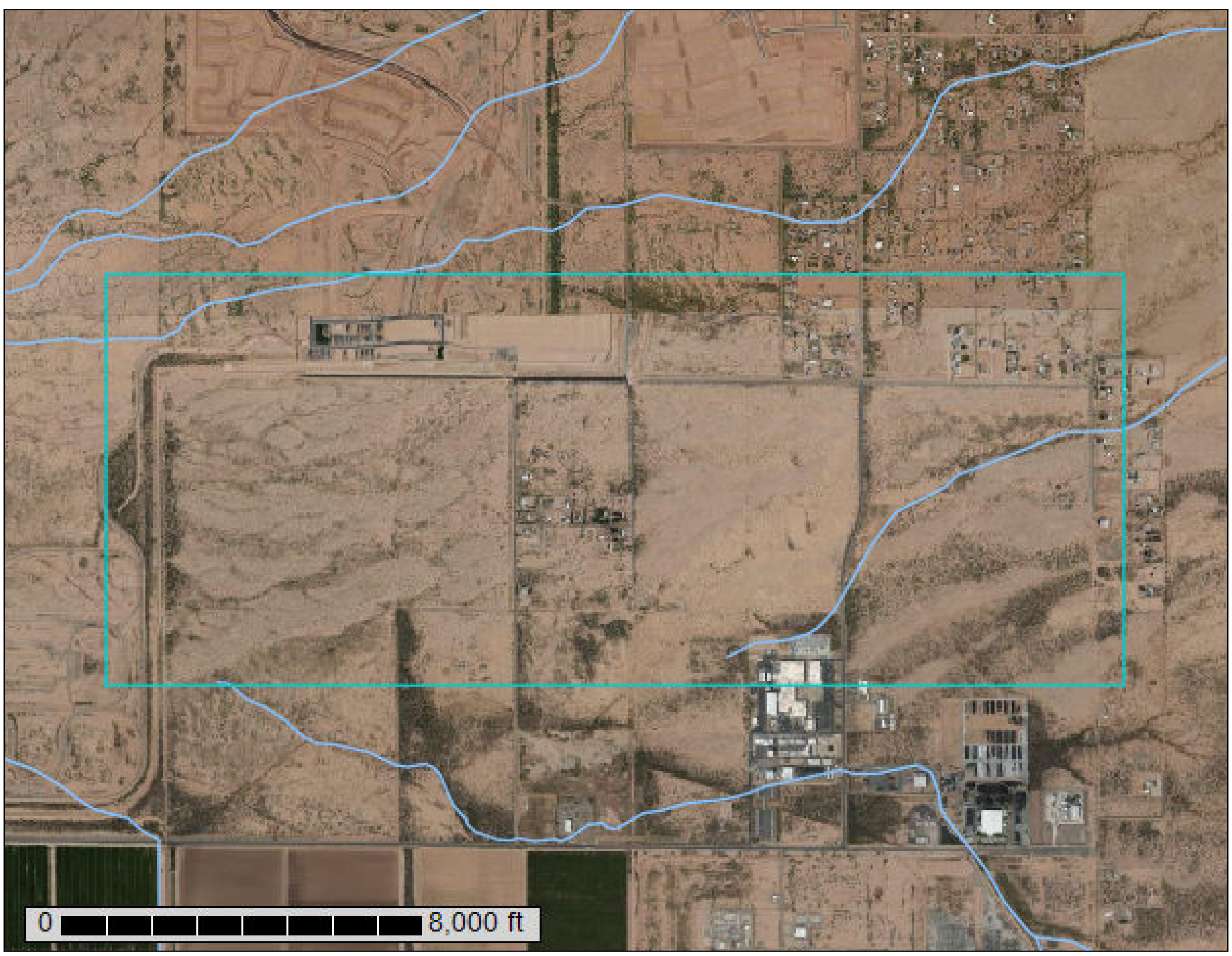
United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Aguila-Carefree Area, Arizona, Parts of Maricopa and Pinal Counties; and Eastern Pinal and Southern Gila Counties, Arizona



February 18, 2019

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

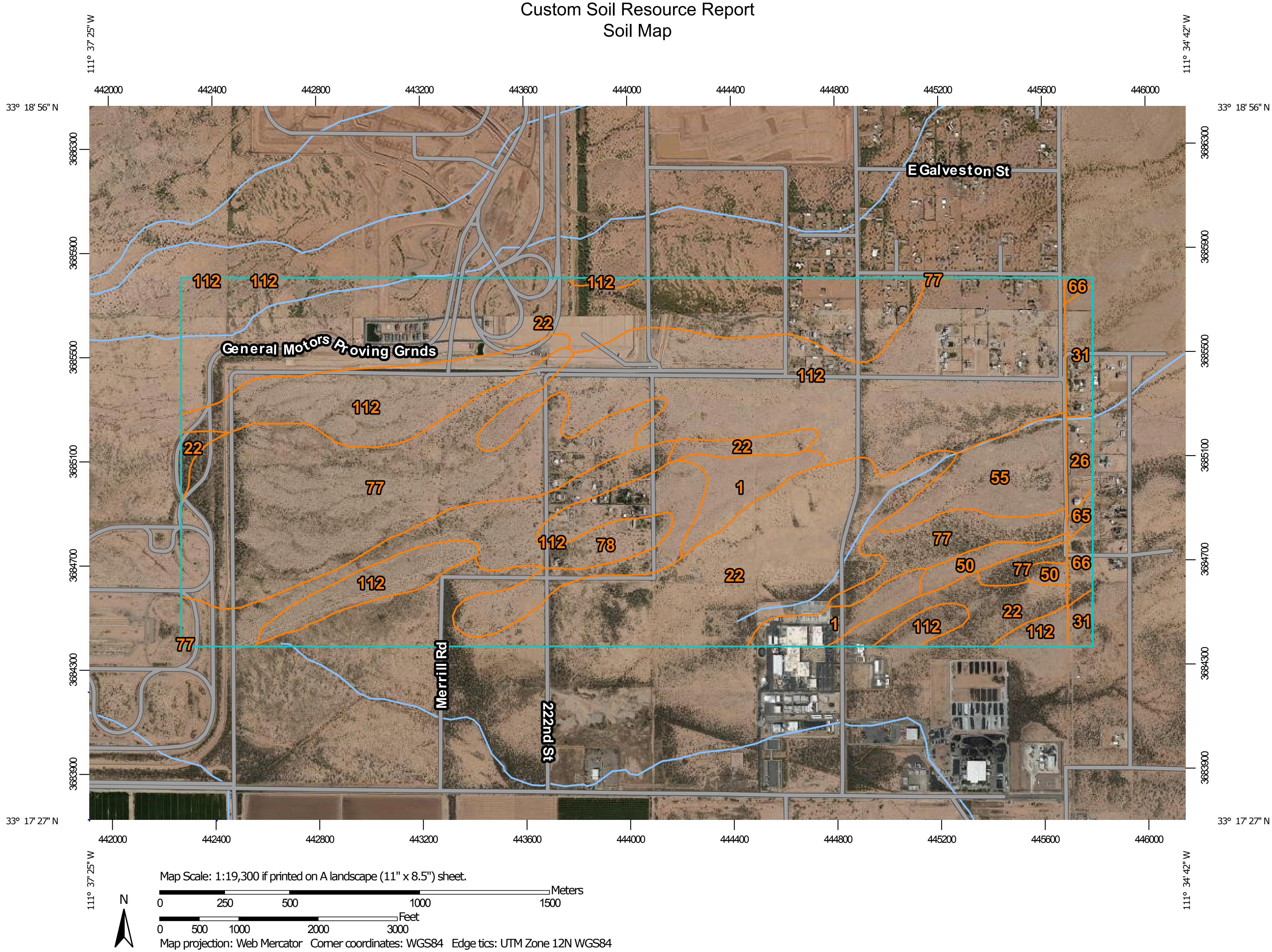
Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Soil Map



Map Scale: 1:19,300 if printed on A landscape (11" x 8.5") sheet.

Meters: 0, 250, 500, 1000, 1500

Feet: 0, 500, 1000, 2000, 3000

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 12N WGS84

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features

- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features

- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background

- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Aguila-Carefree Area, Arizona, Parts of Maricopa and Pinal Counties
Survey Area Data: Version 12, Sep 15, 2018

Soil Survey Area: Eastern Pinal and Southern Gila Counties, Arizona
Survey Area Data: Version 13, Sep 15, 2018

Your area of interest (AOI) includes more than one soil survey area. These survey areas may have been mapped at different scales, with a different land use in mind, at different times, or at different levels of detail. This may result in map unit symbols, soil properties, and interpretations that do not completely agree across soil survey area boundaries.

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Apr 1, 2018—Jun 1, 2018

MAP LEGEND	MAP INFORMATION
	The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
1	Antho sandy loams	39.8	3.2%
22	Contine clay loam	425.9	34.5%
50	Estrella loams	12.4	1.0%
55	Gilman loams	41.4	3.3%
77	Mohall clay loam	225.3	18.2%
78	Mohall clay loam, calcareous solum	73.7	6.0%
112	Tremant gravelly sandy loams	381.3	30.9%
Subtotals for Soil Survey Area		**1,199.8**	**97.1%**
Totals for Area of Interest		**1,235.5**	**100.0%**

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
26	Dateland loam, 0 to 2 percent slopes	8.5	0.7%
31	Denure sandy loam, 1 to 3 percent slopes	16.7	1.4%
65	Mohall clay loam, 0 to 5 percent slopes	2.4	0.2%
66	Mohall sandy loam, 0 to 3 percent slopes	8.1	0.7%
Subtotals for Soil Survey Area		**35.7**	**2.9%**
Totals for Area of Interest		**1,235.5**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

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APPENDIX D

PRELIMINARY HYDRAULIC CALCULATIONS

PRELIMINARY CHANNEL CALCULATIONS

CHANNEL PARAMETER SUMMARY

Project: Inner Loop

Prepared by: BB

Date: Feb, 2019

Channel ID	Model Q[1] [ft^3/sec]	Side Slopes [H:V]	Minimum Channel Bottom Width [ft]	Channel Top Width [ft]	Total Channel Depth [ft]	Manning's n[2]	Slope [%]	Velocity[3] [ft/sec]	Water Surface Depth[4] [ft]	Freeboard Provided[5] [ft]	Top Width of Flow [ft]	Cross-Sectional Area of Flow [ft^2]	Froude Number[6,7]
C-1	51	6:1	8	38	2.50	0.030	0.20	2.11	1.45	1.05	25.40	24.21	0.38
C-2	123	6:1	12	48	3.00	0.030	0.20	2.62	1.97	1.03	35.64	46.93	0.40

NOTES:

(1) Model Q is peak flow determined in DDMSW/HEC-1.

(2) Channels are currently modeled as having a composite channel lining that may consist of desert landscaping, turf, riprap or a combination thereof.

(3) Maximum allowable velocity of 5ft/sec from Table 6.2 of the Drainage Design Manual of Maricopa County, Hydraulics: Rational Method, Chapter 3 (August, 2013).

(4) Maximum flow depth of 3 ft from Section 1.4.3 of the Drainage Design Manual of Maricopa County, Hydraulics: Safety, Chapter 1 (August, 2013).

(5) Minimum 1 ft of freeboard required from Section 6.5.4 of the Drainage Design Manual of Maricopa County, Hydraulics: Feeboard, Chapter 6 (August, 2013).

(6) $Fr=V/(g*D)^{0.5}$ where V=velocity, g=32.2 ft/s^2, and D=(Cross-sectional area)/(Top width)

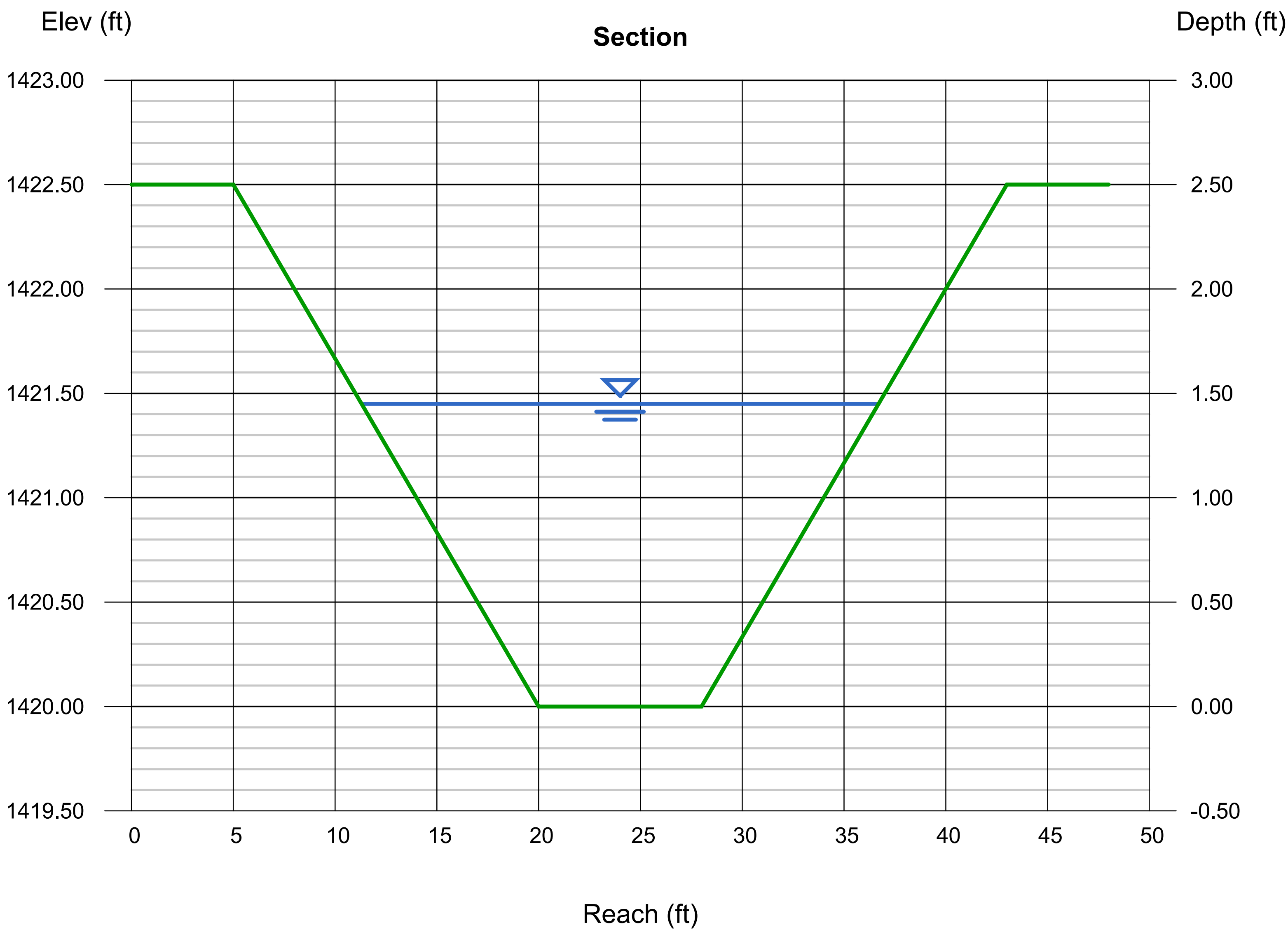
(7) Fr<0.86 indicates subcritical flow and Fr>0.86 indicates supercritical flow

Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Wednesday, Feb 27 2019

C-1 (Q = 51CFS)

Trapezoidal		**Highlighted**	
Bottom Width (ft)	= 8.00	Depth (ft)	= 1.45
Side Slopes (z:1)	= 6.00, 6.00	Q (cfs)	= 51.00
Total Depth (ft)	= 2.50	Area (sqft)	= 24.21
Invert Elev (ft)	= 1420.00	Velocity (ft/s)	= 2.11
Slope (%)	= 0.20	Wetted Perim (ft)	= 25.64
N-Value	= 0.030	Crit Depth, Yc (ft)	= 0.87
		Top Width (ft)	= 25.40
Calculations		EGL (ft)	= 1.52
Compute by:	Known Q		
Known Q (cfs)	= 51.00		



Channel Report

C-2 (Q = 123CFS)

Trapezoidal

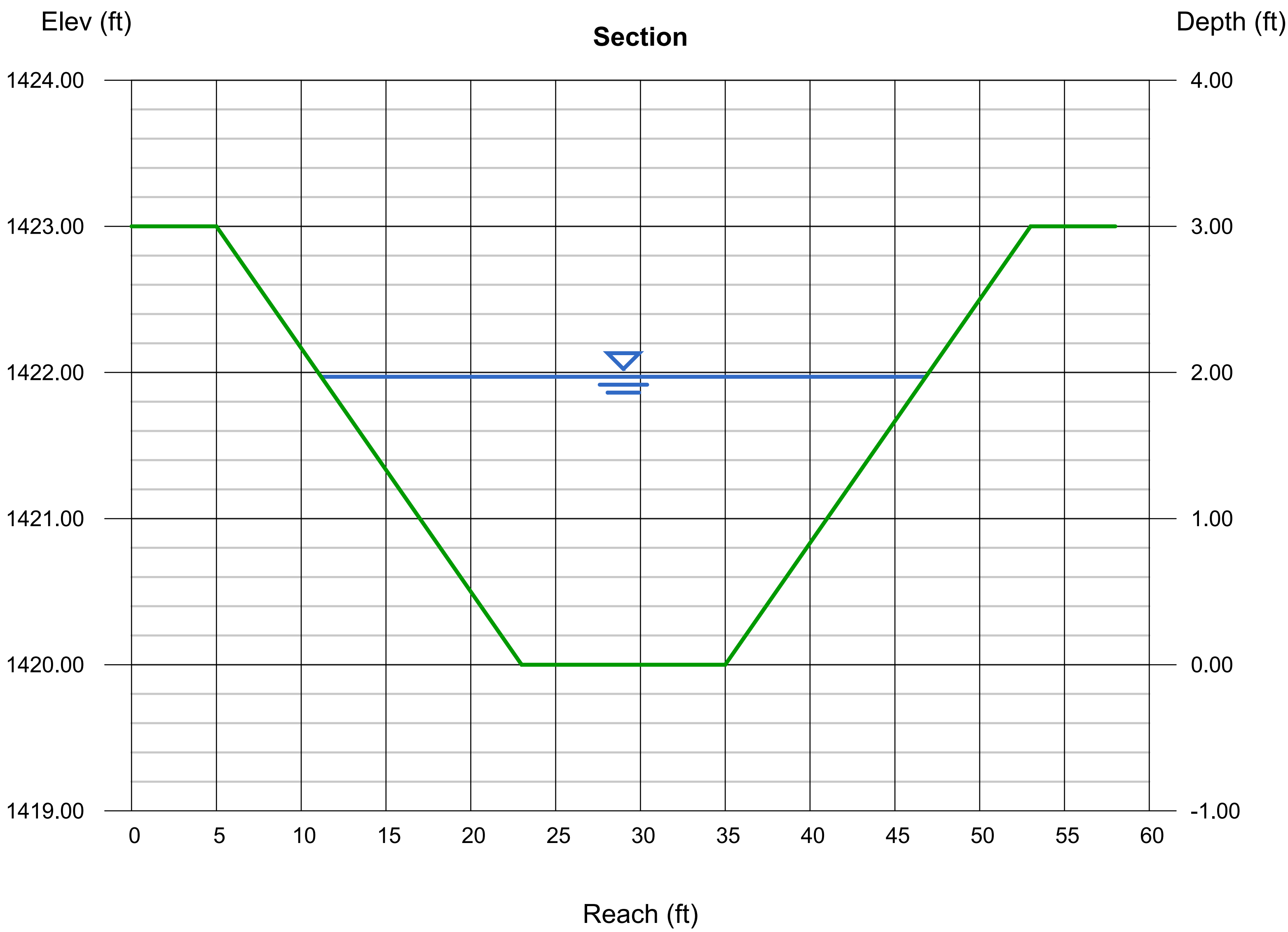
Bottom Width (ft)	=	12.00
Side Slopes (z:1)	=	6.00, 6.00
Total Depth (ft)	=	3.00
Invert Elev (ft)	=	1420.00
Slope (%)	=	0.20
N-Value	=	0.030

Calculations

Compute by:		Known Q
Known Q (cfs)	=	123.00

Highlighted

Depth (ft)	=	1.97
Q (cfs)	=	123.00
Area (sqft)	=	46.93
Velocity (ft/s)	=	2.62
Wetted Perim (ft)	=	35.97
Crit Depth, Yc (ft)	=	1.21
Top Width (ft)	=	35.64
EGL (ft)	=	2.08



PRELIMINARY CULVERT CALCULATIONS

CULVERT SUMMARY

Project: Levine 170

Prepared by: BB

Date: Feb, 2019

Culvert ID	Model Q[(1)] [cfs]	Quantity	Culvert Type
CU-1	51	4	24" RCPC
CU-2	123	4	36" RCPC

Notes:

(1) Model Q referneced from calculated HEC-1.

Culvert Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Wednesday, Feb 27 2019

CU-1 (4-24IN RCPC)

Invert Elev Dn (ft)	=	1420.00
Pipe Length (ft)	=	100.00
Slope (%)	=	0.20
Invert Elev Up (ft)	=	1420.20
Rise (in)	=	24.0
Shape	=	Circular
Span (in)	=	24.0
No. Barrels	=	4
n-Value	=	0.012
Culvert Type	=	Circular Concrete
Culvert Entrance	=	Square edge w/headwall (C)
Coeff. K,M,c,Y,k	=	0.0098, 2, 0.0398, 0.67, 0.5

Embankment

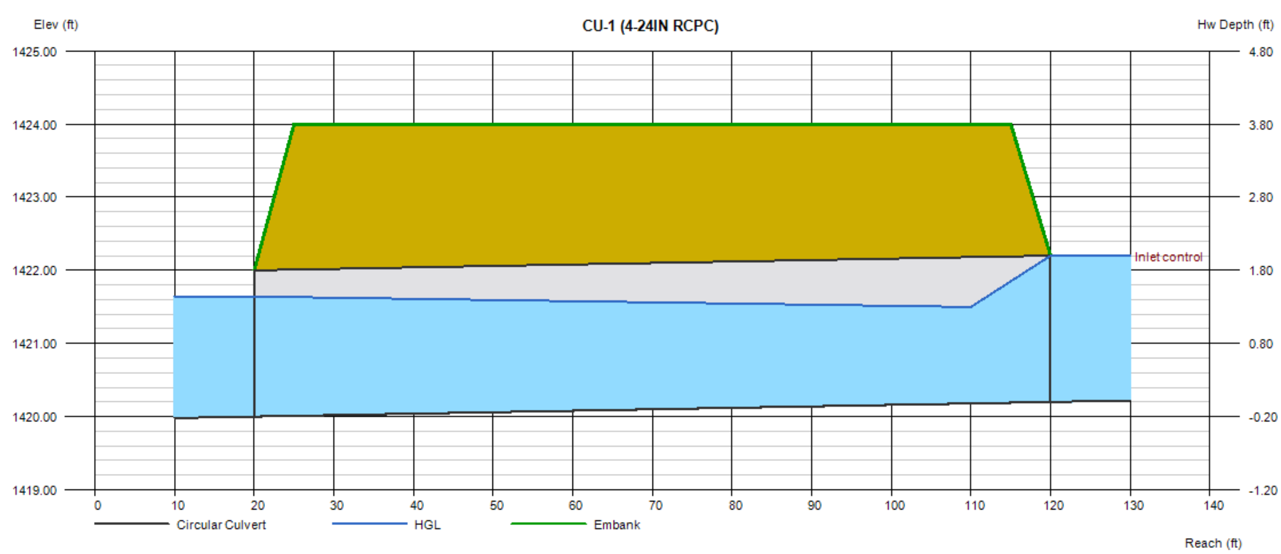
Top Elevation (ft)	=	1424.00
Top Width (ft)	=	90.00
Crest Width (ft)	=	90.00

Calculations

Qmin (cfs)	=	51.00
Qmax (cfs)	=	51.00
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	51.00
Qpipe (cfs)	=	51.00
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	4.62
Veloc Up (ft/s)	=	5.99
HGL Dn (ft)	=	1421.64
HGL Up (ft)	=	1421.48
Hw Elev (ft)	=	1422.20
Hw/D (ft)	=	1.00
Flow Regime	=	Inlet Control



Culvert Report

CU-2 (4-36IN RCPC)

Invert Elev Dn (ft)	=	1417.00
Pipe Length (ft)	=	100.00
Slope (%)	=	0.20
Invert Elev Up (ft)	=	1417.20
Rise (in)	=	36.0
Shape	=	Circular
Span (in)	=	36.0
No. Barrels	=	4
n-Value	=	0.012
Culvert Type	=	Circular Concrete
Culvert Entrance	=	Square edge w/headwall (C)
Coeff. K,M,c,Y,k	=	0.0098, 2, 0.0398, 0.67, 0.5

Embankment

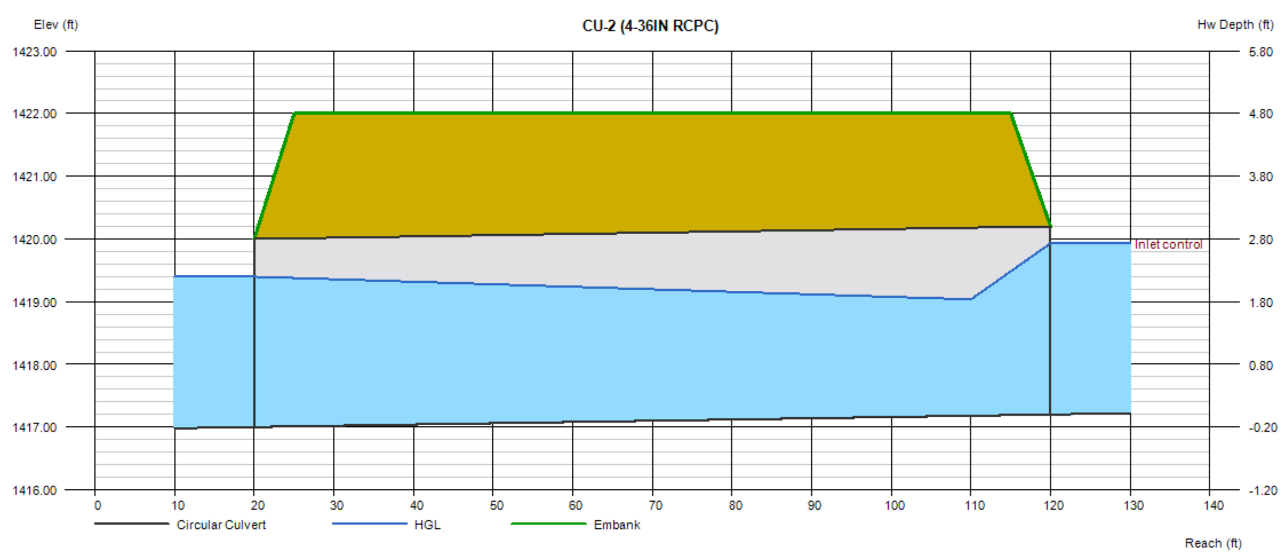
Top Elevation (ft)	=	1422.00
Top Width (ft)	=	90.00
Crest Width (ft)	=	90.00

Calculations

Qmin (cfs)	=	123.00
Qmax (cfs)	=	123.00
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	123.00
Qpipe (cfs)	=	123.00
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	5.08
Veloc Up (ft/s)	=	6.96
HGL Dn (ft)	=	1419.40
HGL Up (ft)	=	1419.00
Hw Elev (ft)	=	1419.93
Hw/D (ft)	=	0.91
Flow Regime	=	Inlet Control



HILGARTWILSON

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APPENDIX E

PRELIMINARY RETENTION CALCULATIONS

Sub-Basin Hydraulic Parameters - Developed Conditions

Project: Levine 170

Prepared by: BB

Date: Feb, 2019

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Drainage Subarea ID(s)	Retention Basin	Land Use Category					Total Area	Total Area
		Medium Density Residential (LMDR)	Medium Density Residential (MDR)	High Density Residential (HDR)	Commercial	Park/Open Space		
		[ft^2]	[ft^2]	[ft^2]	[ft^2]	[ft^2]	[ft^2]	[ac]
ONSITE DRAINAGE AREAS								
A	RB-A	0	0	0	479,160	0	479,160	11.0
B	RB-B	0	0	304,920	0	0	304,920	7.0
C	RB-C	0	0	479,160	0	0	479,160	11.0
D	RB-D	0	588,060	0	0	0	588,060	13.5
E	RB-E	405,108	0	0	0	0	405,108	9.3
F	RB-F	453,024	0	0	0	0	453,024	10.4
G	RB-G	535,788	0	0	0	0	535,788	12.3
H	RB-H	383,328	0	0	0	0	383,328	8.8
I	RB-I	792,792	0	0	0	0	792,792	18.2
J	RB-J	601,128	0	0	0	0	601,128	13.8
K	RB-K	514,008	0	0	0	0	514,008	11.8
L	RB-L	487,872	0	0	0	0	487,872	11.2
M	RB-M	0	514,008	0	0	0	514,008	11.8
P1	RB-P1	0	0	0	0	108,900	108,900	2.5
P2	RB-P2	0	0	0	0	43,560	43,560	1.0
P3	RB-P3	0	0	0	0	39,204	39,204	0.9
P4	RB-P4	0	0	0	0	39,204	39,204	0.9
P5	RB-P5	0	0	0	0	39,204	39,204	0.9
P6	RB-P6	0	0	0	0	39,204	39,204	0.9
TOTAL		4,173,048	1,102,068	784,080	479,160	309,276	6,847,632	157.2

WEIGHTED RUNOFF COEFFICIENT CALCULATIONS

Project: Levine 170

Prepared by: BB

Date: Feb, 2019

Land Use[1]	Density (du/ac)	FCDMC Land Use Class	C Coefficient
Medium Density Residential (LMDR)	4-6	150	0.84
Medium Density Residential (MDR)	6-10	170	0.94
High Density Residential (HDR)	15+	190	0.94
Commercial	--	220	0.95
Park/Open Space	--	710	0.31

NOTES:

(1) From Table 6.3 of the FCDMC Drainage Policies and Standards, Arizona (January, 2016)

Drainage Subarea ID(s)	Concentration Point	Subarea Surface Types & Areas							Weighted C Coefficient
		Medium Density Residential (LMDR) [ft^2]	Medium Density Residential (MDR) [ft^2]	High Density Residential (HDR) [ft^2]	Commercial [ft^2]	Park/Open Space [ft^2]	Total [ft^2]	Total [ac]	C_w - 100 Year
ONSITE DRAINAGE AREAS									
A	RB-A	0	0	0	479,160	0	479,160	11.0	0.95
B	RB-B	0	0	304,920	0	0	304,920	7.0	0.94
C	RB-C	0	0	479,160	0	0	479,160	11.0	0.94
D	RB-D	0	588,060	0	0	0	588,060	13.5	0.94
E	RB-E	405,108	0	0	0	0	405,108	9.3	0.84
F	RB-F	453,024	0	0	0	0	453,024	10.4	0.84
G	RB-G	535,788	0	0	0	0	535,788	12.3	0.84
H	RB-H	383,328	0	0	0	0	383,328	8.8	0.84
I	RB-I	792,792	0	0	0	0	792,792	18.2	0.84
J	RB-J	601,128	0	0	0	0	601,128	13.8	0.84
K	RB-K	514,008	0	0	0	0	514,008	11.8	0.84
L	RB-L	487,872	0	0	0	0	487,872	11.2	0.84
M	RB-M	0	514,008	0	0	0	514,008	11.8	0.94
P1	RB-P1	0	0	0	0	108,900	108,900	2.5	0.31
P2	RB-P2	0	0	0	0	43,560	43,560	1.0	0.31
P3	RB-P3	0	0	0	0	39,204	39,204	0.9	0.31
P4	RB-P4	0	0	0	0	39,204	39,204	0.9	0.31
P5	RB-P5	0	0	0	0	39,204	39,204	0.9	0.31
P6	RB-P6	0	0	0	0	39,204	39,204	0.9	0.31
TOTAL		**4,173,048**	**1,102,068**	**784,080**	**479,160**	**309,276**	**6,847,632**	**157.2**	--

RETENTION CALCULATION TABLE

Project: Levine 170

Prepared by: BB

Date: Feb, 2019

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Volume Required = C * (P/ 12) * A   Where: A= Plan-view area of an individual drainage area

Cw=Weighted Runoff Coefficient (100-Yr)

P=2.21 in (100-Yr, 2-Hr)

Retention Basin ID	Drainage Area(s)	Total Area A [ft^2]	Total Area A [ac]	Weighted Runoff "C" Coefficient	100-Yr, 2-Hr Volume Required [ft^3]	100-Yr, 2-Hr Volume Required [ac-ft]
RB-A	A	479,160	11.0	0.95	83,833	1.9
RB-B	B	304,920	7.0	0.94	52,787	1.2
RB-C	C	479,160	11.0	0.94	82,951	1.9
RB-D	D	588,060	13.5	0.94	101,803	2.3
RB-E	E	405,108	9.3	0.84	62,670	1.4
RB-F	F	453,024	10.4	0.84	70,083	1.6
RB-G	G	535,788	12.3	0.84	82,886	1.9
RB-H	H	383,328	8.8	0.84	59,301	1.4
RB-I	I	792,792	18.2	0.84	122,645	2.8
RB-J	J	601,128	13.8	0.84	92,995	2.1
RB-K	K	514,008	11.8	0.84	79,517	1.8
RB-L	L	487,872	11.2	0.84	75,474	1.7
RB-M	M	514,008	11.8	0.94	88,983	2.0
RB-P1	P1	108,900	2.5	0.31	6,217	0.1
RB-P2	P2	43,560	1.0	0.31	2,487	0.1
RB-P3	P3	39,204	0.9	0.31	2,238	0.1
RB-P4	P4	39,204	0.9	0.31	2,238	0.1
RB-P5	P5	39,204	0.9	0.31	2,238	0.1
RB-P6	P6	39,204	0.9	0.31	2,238	0.1
TOTAL		6,847,632	157.2	--	1,073,584	24.6