Power Road: Riggs Road to Chandler Heights Road – Roadway and Drainage Improvements
Town of Queen Creek

Sealed Drainage Design Report
100% Submittal

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1.0 INTRODUCTION

The Power Road, Riggs Road to Chandler Heights Road Roadway and Drainage Improvement Project is located along Power Road within the Town of Queen Creek in Maricopa County, Arizona. The project limits are along Power Road from Riggs Road to just south of Chandler Heights Road. The project will continue to widen the existing Power Road from a two-lane rural section to a 5-lane urban section with bike lanes as well as drainage improvements. The newly widened section of Power Road will tie in to the already widened sections just south of Cloud Road and south of Chandler Heights Road. Currently there is an existing drainage system on the east side of Power Road consisting of a drainage ditch and box culverts. The improvements to Power Road will be on both the East and West side and will include a storm drainage system comprised of catch basins, scuppers, and a box culvert to collect and retain the storm water within the right-of-way of this project.

It was assumed that the project drainage improvements are intended to allow for roadway drainage and that the offsite drainage was not an emphasis. The drainage improvements within this project are considered interim regarding the regional drainage but are not solving all regional drainage issues as that as not part of this roadway project and scope. Regional drainage is being evaluated with the San Tan Regional Study (currently being completed by the Flood Control District of Maricopa County)

Figure 1 illustrates the project location.

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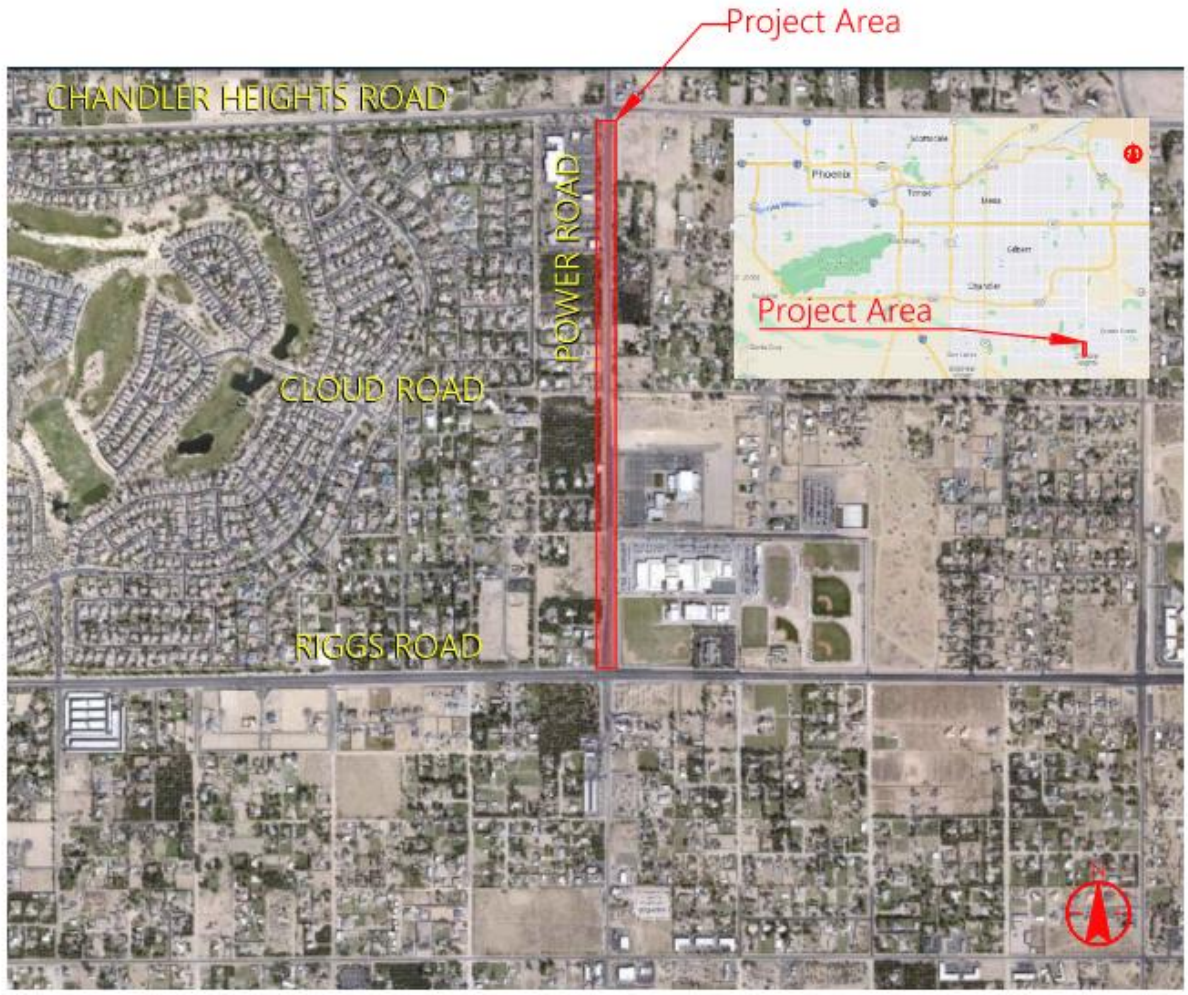

Figure 1 Vicinity Map

1.1 BACKGROUND AND SCOPE

Currently, Power Road varies from an existing six-lane section starting at Riggs Road and narrows down to an existing two-lane section approaching Cloud Road. Power Road then transitions from said two-lane section to an existing five-lane section as it approaches Chandler Heights Road. The existing two-lane section of Power Road will be widened to a five-lane major arterial section due to anticipated development and growth. The widened sections will include on-site drainage improvements for the roadway right-of-way. The 12.1-acre drainage area is bounded by Riggs Road to the south and Chandler Heights Road to the north.

The project scope includes the following:

- Size a storm drain system with enough capacity for the roadway pavement drainage within the project limits. Project limits include Power Road from Riggs Road to approximately 300' south of Chandler Heights Road.
- Analyze the roadside ditch to determine if it has the capacity to pass the expected peak discharge within the ditch

1.2 PURPOSE OF REPORT

The purpose of this report is to document the criteria, assumptions and methodology used for the drainage analysis and results in support of the proposed roadway and drainage improvements.

1.3 FEMA FLOODPLAINS

The Federal Emergency Management Agency (FEMA) has developed Flood Insurance Rate Maps (FIRMS) for Maricopa County and FIRM Panel 04013C3135L & 04013C3150L are located within the project area (See Appendix A for FIRM Panel). The entirety of the project area is located within a Zone X which is defined as areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths less than 1 foot. For these areas, no special considerations are required for construction within areas designated Zone X by FEMA.

2.0 SURVEY AND MAPPING

For this project, a topographic survey was conducted along Power Road. The Vertical Datum for the survey is in NAVD 88 and the projected coordinate system is NAD 1983 HARN State Plane Arizona Central (Intl Feet). Appendix B contains a digital copy of the survey points and the triangulated irregular network (TIN) created using AutoCAD and the survey points.

3.0 DRAINAGE DESIGN CRITERIA AND METHODOLOGY

3.1 METHODOLOGY

Hydrologic and hydraulic calculations for the storm drainage system for Power Road were performed according to the methodology and procedures outlined in the Town of Queen Creek Final Drainage Report Review Checklist (checklist) and the Drainage Design Manual of Maricopa County, Volumes 1 and 2 (FCDMC, 2018) (see Appendix C for Checklist and Manuals).

3.2 DESIGN CRITERIA

For this project, the Town of Queen Creek and the Maricopa County Flood Control District design criteria was utilized. If a conflict or difference between the two design criteria was present, the Town of Queen Creek Design Criteria was used.

3.2.1 Town of Queen Creek Criteria

Criteria for the design and analysis of the proposed drainage improvements are based on the Town of Queen Creek's Final Drainage Report Review Checklist. The following are the design criteria, and their applications utilized:

- Use of Rational Method for Hydrology for areas that are less than 160 acres.
- Inlets and catch basins shall be sized to intercept the runoff from the 10-yr storm event.
- 10-yr storm runoff shall be contained within the curbs and the 100-yr storm runoff is contained within the Right-of-Way.
- The drainage system shall allow for a minimum of one dry traffic lane in each direction for a 100-yr storm event for arterial streets.

3.2.2 Maricopa County Flood Control District Criteria

Criteria for the design and analysis of the proposed drainage improvements area based on the following three Maricopa County Flood Control Districts Manuals: Hydrology Manual, Hydraulic Manual, and the Policies and Standards Manual. The following are the design criteria, and their applications utilized:

- Manning's n-value of 0.015 will be used for paved street flow.
- The time of concentration should not be less than 5-minutes.
- The maximum flow velocities within a storm drain pipe shall not exceed 15 ft/s.
- The minimum velocities within a storm drain pipe shall be 5 ft/s for the design discharge. If the flow depth is less than 1 ft, the minimum velocity is 3 ft/s.
- The minimum pipe size for main lines is 18 in.
- Manning's n-value of 0.013 will be used for Reinforced Concrete Pipe (RCP).

4.0 HYDROLOGY

A hydrologic analysis was conducted for onsite drainage associated with the proposed roadway improvements. The Town's checklist states that the Rational Method must be used for watersheds less than 160 acres. The combined watershed for this project is approximately 11.9 acres and, therefore, the Rational Method is used for estimating design discharges for the proposed drainage infrastructure. The Town's checklist does not specify procedures in performing Rational Method hydrology, therefore the Flood Control District of Maricopa County (District), Hydrology Manual was used as the basis for Rational Method computations.

4.1 PRECIPITATION

Precipitation estimates were obtained from the National Oceanic & Atmospheric Administration (NOAA) Atlas 14 Point-Precipitation-Frequency Atlas from the National Weather Service. The atlas uses latitude and longitude entered by the user to provide depth-duration-frequency rainfall estimates for said area. For this study, latitude and longitude were taken near the project site (Lat. 33.2271°, Long. -111.6857°) and entered into the database. Given the size of the project area, no aerial reduction was applied to the rainfall. The precipitation data obtained was used to determine the Intensity-Duration-Frequency (I-D-F) Curves in the Rational Method computations. The data obtained shows the depth-duration-frequency statistics and is shown on Table 1 below for the project site. Appendix D contains the NOAA Atlas 14 results.

Table 1 Depth-Duration-Frequency Statistics

Duration	Rainfall Depth, in inches					
minutes	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
5	0.251	0.339	0.407	0.499	0.570	0.642
10	0.381	0.516	0.619	0.759	0.867	0.977
15	0.473	0.640	0.768	0.941	1.08	1.21
30	0.637	0.862	1.03	1.27	1.45	1.63
60	0.788	1.07	1.28	1.57	1.79	2.02
120	0.898	1.19	1.42	1.73	1.97	2.22
180	0.945	1.24	1.47	1.80	2.06	2.33
360	1.13	1.45	1.70	2.04	2.31	2.59
720	1.28	1.61	1.88	2.23	2.51	2.79
1440	1.54	1.99	2.34	2.83	3.21	3.62

4.2 RATIONAL EQUATION

The 10-year and 100-year storms were analyzed for the pavement drainage design for this report and analysis. To determine the flows generated during the storm events, the Rational Method was used. The Rational Method equation is as follows:

Q = C i A, in which:

Q = Peak discharge, in cubic feet per second (cfs)
C = Runoff coefficient
i = Rainfall intensity, in inches per hour
A = Drainage area, in acres

The sub-areas were delineated by estimating the contributing area to each of the proposed catch basin inlets or spillage inlets within the project area. The estimated basin drainage areas were defined using AutoCAD Civil 3D. In addition, the proposed roadway contours were utilized in calculating the sub-area surface area. The medians were assumed to be contributing to the street drainage as a conservative measure. This was done to ensure that the system would continue to conform to the design criteria in the future if the medians were to be modified. The edge of the contributing area was assumed to be the right of way line. It was also assumed that outside of the right of way line, the ground is graded away from the road and therefore will not contribute to the drainage of the road.

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The Drainage Concept Plan Exhibit in Appendix D illustrates the locations of the catch-basin inlets as well as the contributing area and flow directions. The location/space/position of the catch basin inlets were selected in accordance with the Town of Queen Creek standards and guidelines.

The runoff coefficient (C-factor) and the rainfall intensity (i) were developed using methodology found in the Flood Control District of Maricopa County's Hydrology manual. Though the type of land use within the right-of-way will vary throughout the project limits, a conservative assumption that all surfaces were impervious/pavement was used. This assumption will allow the drainage system to be adequate if changes to landcover are made in the future. Using Table 3.2 in the District's Hydrology Manual, a C-factor of 0.85 was used for the 10-year event and a value of 0.95 was used for the 100-year event.

The rainfall intensity was determined using the iterative process described in section 3.6.1 of the District Hydrology Manual. The process involves equating the time of concentration using Equation 3.2 in the District Hydrology manual and calculating the intensity based on the NOAA Atlas 14 rainfall data.

The District's time of concentration equation (Equation 3.2) is as follows:

$$T_c = 11.4 * L^{0.5} * K_b^{0.52} * S^{-0.31} * i^{-0.38},$$

in which

T_c = time of concentration, in hours .
L = length of the longest flow path, in miles.
K_b = watershed resistance coefficient (from Table 3.1 in FCD Hydrology Manual)
S = watercourse slope, in feet/mile
i = rainfall intensity, in inches per hour

Per the District Hydrology manual, the time of concentration values were set to have a minimum value of 5 minutes.

The hydrology calculations can be found in Appendix D. The Drainage Concept Plan Exhibit found in Appendix D shows delineation of sub-areas, locations of proposed catch basins, and flow directions. Table 2 below provides the calculated drainage areas, intensity, C-Factor and peak discharges at each sub-area within the study area for the 10- and 100-year storm events.

Table 2 Peak Discharge Summary

Catch Basin/Scupper ID		Drainage Area acres	10-Year				100-Year		
			Intensity in/hr	C-Value	Flow cfs		Intensity in/hr	C-Value	Flow cfs
158+15	East	0.7	4.8	0.85	2.8		7.7	0.95	4.9
158+15	West	0.7	4.8	0.85	3.0		7.7	0.95	5.4
161+34	East	0.5	4.8	0.85	2.1		7.7	0.95	3.7
163+08	West	0.7	4.4	0.85	2.6		7.5	0.95	4.8
164+39	East	0.5	4.9	0.85	1.9		7.7	0.95	3.3
166+87	West	0.6	4.7	0.85	2.4		7.7	0.95	4.3
167+22	East	0.5	4.9	0.85	2.2		7.7	0.95	3.8
172+75	West	0.8	4.4	0.85	2.9		7.4	0.95	5.4
172+75	East	0.8	4.5	0.85	2.9		7.5	0.95	5.4
176+29	East	0.5	4.7	0.85	2.0		7.7	0.95	3.7
176+32	West	0.5	4.7	0.85	1.9		7.7	0.95	3.5
180+67	East	0.5	4.5	0.85	2.1		7.6	0.95	3.9
180+67	West	0.7	4.5	0.85	2.8		7.6	0.95	5.2
186+15	West	0.7	4.3	0.85	2.5		7.3	0.95	4.6
186+16	East	0.6	4.3	0.85	2.1		7.3	0.95	3.9
191+31	West	0.7	4.1	0.85	2.3		7.0	0.95	4.4
191+41	East	0.6	4.1	0.85	2.0		7.0	0.95	3.7
193+98	West	0.5	4.6	0.85	1.9		7.7	0.95	3.4
194+00	East	0.4	4.6	0.85	1.6		7.7	0.95	2.9
196+50	East	0.2	4.9	0.85	1.0		7.7	0.95	1.7
199+50	East	0.3	4.7	0.85	1.3		7.7	0.95	2.3

5.0 HYDRAULIC ANALYSIS

This section of the drainage report documents the hydraulic analysis conducted for the drainage improvements for the new roadway sections. Criteria and methodology described in both the Town of Queen Creek's Checklist and the Districts Hydraulics Manual were used as basis for the hydraulic study.

5.1 ROADWAY HYDRAULICS

Per the Town of Queen Creek requirements, the roadway must be designed to carry the runoff from a 10-year storm event without overtopping the curb. The vertical curb utilized for his project is per MAG STD DTL 220, Type A, which has a curb height of 6 inches. To satisfy the Town of Queen Creek requirements, the roadway drainage must be designed so that at no location along the road the flow depths exceed 6 inches during a 10-year storm event.

In addition, per the Town of Queen Creek requirements, if the road being designed is classified as an arterial street, the roadway drainage must be designed such that the spread from a 100-year storm event allows for one dry lane in each direction. Therefore, the Power Road drainage system must follow this design criteria. The roadway sections vary throughout the project. Each location must be checked against the allowable width to ensure the one dry lane criteria is met.

To convey runoff, the proposed improvements will utilize both scuppers and catch basins. The scuppers are per MAG STD DTL 206 and a modified version of the MAG STD DTL 206 scupper (Detail G of Town of Queen Creek Project No. A1405). The catch basins are Type "M" per the City of Phoenix (COP) STD DTL P1569. The grated inlets are Type "Q" per the COP STD DTL P1572. This section of the report illustrates the procedures and methodologies used to design the MAG 206 scuppers, COP P1569 catch basins, the COP P1572 grated inlets, and the storm drain system to conform to the Town of Queen Creek Design Standards.

5.1.1 Catch Basins/Scuppers

The new catch basins were located and sized to adhere to the design criteria as previously mentioned. To calculate the capacity and efficiency of the catch basins for this project, the procedures and methodologies outlined in Chapter 3 of the District's Hydraulics manual was utilized. The Drainage Concept Plan Exhibit in Appendix D provides an illustration of the catch basin layout with associated contributing area size used for this project.

On-grade catch basins and scuppers are constructed along a continuous grade and generally do not intercept 100% of flow. The flow that is not captured by the on-grade catch basin or scupper is considered "by-pass" flow and will continue downstream to the next catch basin or scupper. Catch basins and scuppers in sag or in sump conditions will collect flow from multiple directions and pond at the catch basin. For clogging factors, Table 6.8 Catch Basin Clogging Factors in the District's "Drainage Policies Standards" was utilized for both on-grade and in sag catch basins and scuppers. Per Table 6.8 the clogging factor for a curb-opening inlet is 1.25L or a 0.8 reduction factor of the curb-opening length. The clogging factor for a grated inlet is 2P (The perimeter of the grate multiplied by 2) or a 50% reduction factor of the grate's perimeter. This perimeter does not include the side of the grate that is flushed with the curb.

The following table, Table 3 provides a summary of each catch basin inlet condition, expected flows from the sub-area hydrology and the catch basin in which by-pass flows (if any) will collect at.

Table 3 Catch Basin Hydrology

Catch Basin/Scupper ID	Inlet Condition	Flow from Sub-Area Drainage (cfs)		By-pass Flow Continues to
		10yr	100yr	
158+15 East (Existing)	On Grade	2.8	4.9	161+34 East (Existing)
158+15 West (Existing)	On Grade	3.0	5.4	163+08 West (Existing)
161+34 East (Existing)	On Grade	2.1	3.7	164+39 East (Existing)
163+08 West	On Grade	2.6	4.8	166+87 West
164+39 East (Existing)	On Grade	1.9	3.3	167+22 East (Existing)
166+87 West	In Sag	2.4	4.3	N/A
167+22 East (Existing)	On Grade	2.2	3.8	172+75 East
172+75 East	On Grade	2.9	5.4	176+29 East
172+75 West	On Grade	2.9	5.4	176+32 West
176+29 East	On Grade	2.0	3.7	180+67 East
176+32 West	On Grade	1.9	3.5	180+67 West
180+67 East	In Sag	2.1	3.9	N/A
180+67 West	In Sag	2.8	5.2	N/A
186+15 West	On Grade	2.5	4.6	191+31 West
186+16 East	On Grade	2.1	3.9	191+41 East
191+31 West	On Grade	2.3	4.4	193+98 West
191+41 East	On Grade	2.0	3.7	194+00 East
193+98 West	In Sag	1.9	3.4	N/A
194+00 East	In Sag	1.6	2.9	N/A
196+50 East	In Sag	1.0	1.7	N/A
199+50 East	In Sag	1.3	2.3	N/A

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Using Chapter 3 in the District's Hydraulics manual, calculations were performed to determine how much flow each catch basin intersects and how much will be by-passed downstream to the next inlet. Tables 4 through 5 illustrate the summary of the flows that are intercepted and by-passed for the on-grade catch basins and the total flow at each of the in-sag catch basins during the 10- and 100-year, respectively.

Table 4 Flow at Inlets for 10-year Storm – Power Road

Catch Basin/Scupper ID	Inlet Type	Peak Sub-Area Flow (cfs)	Curb Opening Length (ft)	Flow Intercepted (cfs)	Flow By-Passed (cfs)	Inlet Efficiency
158+15 East (Existing)	On Grade	2.8	13.0	2.26	0.52	81%
158+15 West (Existing)	On Grade	3.0	9.0	1.80	1.24	59%
161+34 East (Existing)	On Grade	2.1	8.0	1.62	0.99	62%
163+08 West	On Grade	2.6	N/A	2.59	1.2	68%
164+39 East (Existing)	On Grade	1.9	9.0	1.86	0.99	65%
166+87 West	In Sag	2.4	N/A	N/A	0.0	100%
167+22 East (Existing)	On Grade	2.2	9.0	1.99	1.16	63%
172+75 East	On Grade	2.9	17.0	3.59	0.48	88%
172+75 West	On Grade	2.9	N/A	2.06	0.85	71%
176+29 East	On Grade	2.0	13.0	2.20	0.31	88%
176+32 West	On Grade	1.9	N/A	2.01	0.78	72%
180+67 East	In Sag	2.1	13.0	N/A	0.0	100%
180+67 West	In Sag	2.8	N/A	N/A	0.0	100%
186+15 West	On Grade	2.5	N/A	1.89	0.60	75%
186+16 East	On Grade	2.1	10.0	1.99	0.08	96%
191+31 West	On Grade	2.3	N/A	2.21	0.70	76%
191+41 East	On Grade	2.0	9.0	1.69	0.37	82%
193+98 West	In Sag	1.9	N/A	N/A	0.0	100%
194+00 East	In Sag	1.6	10.00	N/A	0.0	100%
196+50 East	In Sag	1.0	4.0	N/A	0.0	100%
199+50 East	In Sag	1.3	4.0	N/A	0.0	100%

Table 5 Flow at Inlets for 100-year Storm – Power Road

Catch Basin/Scupper ID	Inlet Type	Peak Sub-Area Flow (cfs)	Curb Opening Length (ft)	Flow Intercepted (cfs)	Flow By-Passed (cfs)	Inlet Efficiency
158+15 East (Existing)	On Grade	4.9	13.0	3.21	1.7	65%
158+15 West (Existing)	On Grade	5.4	9.0	2.46	2.93	46%
161+34 East (Existing)	On Grade	3.7	8.0	2.41	2.99	45%
163+08 West	On Grade	4.8	N/A	4.50	3.30	58%
164+39 East (Existing)	On Grade	3.3	9.0	2.89	3.38	46%
166+87 West	In Sag	4.3	N/A	N/A	0.0	100%
167+22 East (Existing)	On Grade	3.8	9.0	3.13	4.04	44%
172+75 East	On Grade	5.4	17.0	6.14	3.30	65%
172+75 West	On Grade	5.4	N/A	3.38	2.05	62%
176+29 East	On Grade	3.7	13.0	4.15	2.83	60%
176+32 West	On Grade	3.5	N/A	3.50	2.07	63%
180+67 East	In Sag	3.9	13.0	N/A	0.0	100%
180+67 West	In Sag	5.2	N/A	N/A	0.0	100%
186+15 West	On Grade	4.6	N/A	3.14	1.5	68%
186+16 East	On Grade	3.9	10.0	3.12	0.77	80%
191+31 West	On Grade	4.4	N/A	2.28	1.90	67%
191+41 East	On Grade	3.7	9.0	2.72	1.79	60%
193+98 West	In Sag	3.4	N/A	N/A	0.0	100%
194+00 East	In Sag	2.9	10.00	N/A	0.0	100%
196+50 East	In Sag	1.7	4.0	N/A	0.0	100%
199+50 East	In Sag	2.3	4.0	N/A	0.0	100%

For catch basins in a sag condition, flows will be collected from both sides of the catch basin and will pond at the inlet. Therefore, calculations were performed to determine if the depth of ponding at the catch basin exceeded the Town of Queen Creek's drainage criteria for a 10-year storm event. Both the catch basins (COP P1569) and scuppers (MAG 206) are designed to

have a 2 in. depression compared to the surrounding gutter system, therefore the allowable ponding depth at the inlets is deeper than a normal curb. To conform to the Town of Queen Creek design standards, the ponding depth at the inlets must be less than 8 in. (0.67 ft) for a 10-year storm event.

The Districts Hydraulics Manual provides equations for calculating the weir and orifice flow into the catch basin for a given depth. Per the Districts Hydraulics Manual, if the depth for a given flow rate is calculated to be less than the curb opening plus the 2-in depression (h+a/2), then the flow through the inlet is considered weir flow. Otherwise, the flow through the inlet is considered to be orifice flow.

Equation 3.11 for weir flow is as follows:

$Q = C_W * (L + 1.8\ W) * d^{1.5}$, in which

Q = Amount of street flow intercepted by the inlet, in cubic feet per second
C_W = Weir coefficient (2.3 was used for this project per District guidance)
W = Width of grate or depressed gutter, in ft
d = Depth of flow, in feet (measured from water surface to project cross slope)
L = Length of curb opening or slot, in feet

Equation 3.14 for orifice flow is as follows:

$Q = C_O*h*L*(2*g*d_O)^{0.5}$, in which

Q = Amount of street flow intercepted by the inlet, in cubic feet per second
C_O = Orifice coefficient (0.67 was used for this project per District guidance)
h = Height of curb opening, in feet
L = Length of curb opening or slot, in feet
g = Gravity, 32.2 ft/sec^2
d_O = Effective depth at the center of the curb opening, in feet

Grated inlets are calculated differently for both weir and orifice flow. A grate catch basin will operate as a weir if the depth of ponding at the curb is less than the grate height. When the ponding depth is greater than the grate height, the grate then acts as an orifice.

Equation 3.21 shows the capacity of a grate catch basin operating as a weir:

$Q = C_W * P * d^{1.5}$, in which

Q = Amount of street flow intercepted by the inlet, in cubic feet per second
C_W = Weir coefficient (3.0 was used for this project per District guidance)
P = Perimeter of the grate, disregarding bars and side against curb, in feet
d = Depth of flow at curb, in feet
g = Gravity, 32.2 ft/sec^2

Equation 3.22 for a grate catch basin operating as an orifice is:

$Q = C_O * A_g * (2gd)^{0.5}$, in which

Q = Amount of street flow intercepted by the inlet, in cubic feet per second
C_O = Orifice coefficient (0.67 was used for this project per District guidance)
A_g = Clear opening area of the grate, in square feet
d = Depth of flow at curb, in feet

Tables 6 through 7 below display the ponding results at each catch basin or scupper in sag conditions.

Table 6 Ponding Depth at Sag During 10-year Event – Power Road

Catch Basin/Scupper ID	Curb Opening Length (ft)	Total Flow (sub-area flow and by-pass) (cfs)	Depth at Catch Basin (ft)	Spread from Ponding (ft)
166+87 West	N/A	3.6	0.31	11.7
180+67 East	13.0	2.4	0.18	1.50
180+67 West	N/A	3.6	0.31	11.7
193+98 West	N/A	2.6	0.25	8.20
194+00 East	10.0	1.9	0.18	1.50
196+50 East	4.0	1.0	0.17	1.50
199+50 East	4.0	1.3	0.21	3.20

Table 7 Ponding Depth at Sag During 100-year Event – Power Road

Catch Basin/Scupper ID	Curb Opening Length (ft)	Total Flow (sub-area flow and by-pass) (cfs)	Depth at Catch Basin (ft)	Spread from Ponding (ft)
166+87 West	N/A	7.50	0.50	18.20
180+67 East	13.0	6.70	0.37	13.20
180+67 West	N/A	7.20	0.49	18.20
193+98 West	N/A	5.40	0.40	13.20
194+00 East	10.0	4.70	0.33	11.70
196+50 East	4.0	1.70	0.25	8.20
199+50 East	4.0	2.30	0.31	11.70

The results shown on Table 6 indicate that the maximum water surface elevation during a 10-year storm event at a catch basin is 3.7 in (0.31 ft). Table 7 shows that during the 100-year storm, the maximum water surface elevation is 6.0 in (0.50 ft) equating to a maximum spread of 18.20 ft with a total allowable spread of 25 feet. Therefore, the Town of Queen Creek design standards are met.

The final catch basin design is illustrated in Table 8. Table 8 displays the designed opening widths for each proposed catch basin or scupper in addition to opening widths of the existing catch basin and scuppers.

Table 8 Catch Basin and Scupper Sizing for Power Road

Catch Basin/Scupper ID	Type	Width (ft)
158+15 East	COP 1569 (Existing)	13.0
158+15 West	COP P1573 (Existing)	9.0
161+34 East	MAG 206 Scupper (Existing)	8.0
163+08 West	COP P1572	10.0
164+39 East	MAG 533 (Existing)	9.0
166+87 West	COP P1572	10.0
167+22 East	COP P1572	9.0
172+75 West	COP P1572	10.0
172+75 East	COP P1569	17.0
176+29 East	COP P1569	13.0
176+32 West	COP P1572	10.0
180+67 East	COP P1569	10.0
180+67 West	COP P1572	10.0
186+15 West	COP P1572	10.0
186+16 East	COP P1569	13.0
191+31 West	COP P1572	10.0
191+41 East	COP P1569	9.0
193+98 West	COP P1572	10.0
194+00 East	COP 1569-2	10.0
196+50 East	MAG 206 Scupper	4.0
199+50 East	MAG 206 Scupper	4.0

5.1.2 Roadway Drainage

To determine the depth and spread that the flow generated from a 10- and 100-yr event within the project area will produce, equation 3.2 from the District Hydraulics manual was utilized. The equation is as follows:

$Qt = (0.56 / n)\ Sx^{1.67} * S^{0.5} * T^{2.67}$, in which

Qt = Theoretical gutter carrying capacity, in cubic feet per second
n = Manning's roughness coefficient (0.015 was used for this project)
Sx = Pavement cross slope, in feet/feet (0.02 ft/ft for this project)
S = Longitudinal Slope, in feet/feet
T = Spread of flow pavement, in feet

Tables 9 and 10 display the resulting depth and spread for the 10- and 100-yr discharges along Power Rd.

Table 9 10-yr Roadway Drainage Depth and Spread

Catch Basin/Scupper ID	Average Longitudinal Slope (ft/ft)	Total Flow (cfs)	Spread (ft)	Maximum Depth (in)
158+15 East	0.0137	2.8	9.7	2.3
158+15 West	0.0148	3.0	9.9	2.4
161+34 East	0.0100	2.6	10.1	2.4
163+08 West	0.0091	3.8	11.8	2.8
164+39 East	0.0101	2.9	10.4	2.5
166+87 West	0.0099	3.6	11.4	2.7
167+22 East	0.0097	3.2	10.9	2.6
172+75 East	0.0099	4.1	11.9	2.9
172+75 West	0.0100	2.9	10.5	2.6
176+29 East	0.0102	2.5	9.9	2.4
176+32 West	0.0088	2.8	10.6	2.5
180+67 East	0.0087	2.4	10.0	2.4
180+67 West	0.0086	3.6	11.7	2.8
186+15 West	0.0065	2.5	10.7	2.6
186+16 East	0.0070	2.1	9.9	2.4
191+31 West	0.0049	2.9	12.0	2.9
191+41 East	0.0055	2.1	10.3	2.5
193+98 West	0.0040	2.6	11.9	2.9
194+00 East	0.0043	1.9	10.5	2.5
196+50 East	0.0048	1.0	8.0	1.9
199+50 East	0.0023	1.3	10.1	2.4

Table 10 100-yr Roadway Drainage Depth and Spread

Catch Basin/Scupper ID	Average Longitudinal Slope (ft/ft)	Total Flow (cfs)	Spread (ft)	Maximum Depth (in)
158+15 East	0.0137	4.9	12.0	2.9
158+15 West	0.0148	5.4	12.3	3.0
161+34 East	0.0100	5.4	13.2	3.2
163+08 West	0.0091	7.8	15.4	3.7
164+39 East	0.0101	6.3	14.0	3.4
166+87 West	0.0099	7.5	15.0	3.6
167+22 East	0.0097	7.2	14.8	3.6
172+75 East	0.0099	9.4	16.4	3.9
172+75 West	0.0100	5.4	13.3	3.2
176+29 East	0.0102	7.0	14.5	3.5
176+32 West	0.0088	5.6	13.7	3.3
180+67 East	0.0087	6.7	14.7	3.5
180+67 West	0.0086	7.2	15.2	3.6
186+15 West	0.0065	4.6	13.6	3.3
186+16 East	0.0070	3.9	12.5	3.0
191+31 West	0.0049	5.9	15.6	3.7
191+41 East	0.0055	4.5	13.8	3.3
193+98 West	0.0040	5.4	15.7	3.8
194+00 East	0.0043	4.7	14.7	3.5
196+50 East	0.0048	1.7	9.9	2.4
199+50 East	0.0023	2.3	12.7	3.1

Table 9 indicates that the maximum water surface elevation along Power Road is 2.9 in. Table 10 shows that during the 100-year storm, the maximum water surface elevation is 3.9 in and a maximum spread of 16.4 ft. Therefore, the Town of Queen Creek design standards are met.

The average velocity for each drainage sub-area was evaluated and is displayed in Tables 9 through 10. Velocity shown is a correlation between the sub-area drainage distance and the Time of Concentration (T_C). For calculated T_C values below 5 minutes, 5 minutes was used in other calculations. Calculated T_C (even if it is less than 5 minutes) are shown below.

Table 11 10-yr Roadway Drainage Average Velocity – Power Road

Catch Basin/Scupper ID	Average Sub-Area Slope (ft/ft)	Sub-Area Drainage Distance (ft)	T_c (min)	Average Velocity (ft/s)
158+15 East	0.0146	395	5.1	1.3
158+15 West	0.0141	408	5.2	1.3
161+34 East	0.0114	352	5.2	1.1
163+08 West	0.0100	515	6.7	1.3
164+39 East	0.0124	320	5.0	1.1
166+87 West	0.0111	395	5.6	1.2
167+22 East	0.0119	310	5.0	1.0
172+75 East	0.0108	519	6.5	1.3
172+75 West	0.0105	550	6.8	1.3
176+29 East	0.0104	382	5.7	1.1
176+32 West	0.0099	372	5.7	1.1
180+67 East	0.0100	450	6.3	1.2
180+67 West	0.0098	454	6.3	1.2
186+15 West	0.0075	495	7.3	1.1
186+16 East	0.0080	503	7.3	1.2
191+31 West	0.0058	536	8.4	1.1
191+41 East	0.0062	542	8.3	1.1
193+98 West	0.0059	284	5.9	0.8
194+00 East	0.0057	291	6.1	0.8
196+50 East	0.0067	179	5.0	0.6
199+50 East	0.0043	226	5.8	0.6

Table 12 100-yr Roadway Drainage Average Velocity – Power Road

Catch Basin/Scupper ID	Average Sub-Area Slope (ft/ft)	Sub-Area Drainage Distance (ft)	T_c (min)	Average Velocity (ft/s)
158+15 East	0.0146	395	5.0	1.3
158+15 West	0.0141	408	5.0	1.4
161+34 East	0.0114	352	5.0	1.2
163+08 West	0.0100	515	5.5	1.5
164+39 East	0.0124	320	5.0	1.1
166+87 West	0.0111	395	5.0	1.3
167+22 East	0.0119	310	5.0	1.0
172+75 East	0.0108	519	5.4	1.6
172+75 West	0.0105	550	5.6	1.6
176+29 East	0.0104	382	5.0	1.3
176+32 West	0.0099	372	5.0	1.2
180+67 East	0.0100	450	5.2	1.4
180+67 West	0.0098	454	5.2	1.5
186+15 West	0.0075	495	6.0	1.4
186+16 East	0.0080	503	6.0	1.4
191+31 West	0.0058	536	6.8	1.3
191+41 East	0.0062	542	6.8	1.3
193+98 West	0.0059	284	5.0	0.9
194+00 East	0.0057	291	5.0	1.0
196+50 East	0.0067	179	5.0	0.6
199+50 East	0.0043	226	5.0	0.8

Table 11 indicates that the maximum average velocity along Power Road during the 10-year event is 1.3 ft/s. The maximum average velocity along Power Road is 1.6 ft/s occurring during the 100-year event, shown in Table 12.

Complete hydraulic calculations can be found in Appendix D.

5.1.3 Culvert Capacity

For this project, three existing 60 in. pipe culverts will be replaced by a double barrel 10 ft. x 4 ft. x 68 ft. reinforced box culvert along the east side of Power Road crossing Cloud Road. An analysis was performed to find the flow depth utilizing the flow data from the San Tan Area Drainage Master Study (ADMS).

Table 13 displays the results of the analysis of the box culvert. Appendix D contains the calculations.

Table 13 Power Road Culvert

Culvert	Discharge cfs	Exit Velocity ft/s	Normal Depth in.
Double Barrel 10' x 14'	147	6.46	13.7

5.1.4 Drainage Ditch

The design of the drainage system for Power Road includes relocating the existing ditch that currently runs through the east side of Power Road, beginning approximately 550' south of Cloud Road and continuing up to the existing box culvert at Chandler Heights Road. The relocation of the ditch to the east is due to the widening of the roadway. The drainage ditch is not considered a flood control channel and will not be designed as such. The ditch will be designed to convey the flows for the purpose of allowing the catch basins, scuppers, and storm drains to properly drain, only. Any flood control improvements resulting in this area is ancillary and not the purpose of the ditch. The flood control improvements will not be quantified or identified as part of this study.

An analysis was performed on the ditch to find the depth of flow. The results are shown on Table 14 below. Appendix D contains the calculations.

Table 14 Power Road Ditch

Channel Slope ft/ft	Left Side Slope H:V	Right Side Slope H:V	Bottom Width (ft)	Normal Depth (in.)
0.0031	4:1	3:1	8.0	23.8

6.0 SUMMARY AND CONCLUSIONS

This section summarizes the findings and conclusions of the hydrologic and hydraulic analysis of the proposed Power Road Improvement Project.

6.1 STREET DRAINAGE

The results of the proposed catch basin and storm drain system conclude that the proposed system will not cause the flow to overtop the 6-inch vertical curbs during the 10-year event and that there will be at minimum one dry lane of traffic in each direction during the 100-year event. The Autodesk Storm and Sanitary System Analysis (2013) program was used to verify the velocities in the reinforced concrete pipes that are transferring flow from the west side of Power Road to the east and into the existing drainage ditch. Refer to Appendix E for the Autodesk Storm and Sanitary files. All pipes meet the criteria below with one exception.

- The maximum flow velocities within a storm drain pipe shall not exceed 15 ft/s.
- The minimum velocities within a storm drain pipe shall be 5 ft/s for the design discharge. If the flow depth is less than 1 ft, the minimum velocity is 3 ft/s.
- The minimum pipe size for main lines is 18 inches.
- The minimum pipe size for lateral lines is 15 inches.
- Manning's n-value of 0.013 will be used for Reinforced Concrete Pipe (RCP).

For the inlet 191+41E, the 18-inch pipe is surcharging in the 100-year storm. Increasing the pipe size from 8-inch pipe to a 24-inch pipe would eliminate the surcharge but the minimum velocity would not be met. Therefore the 18-inch pipe was not modified. During a 100-year event, the inlet will underperform, but additional bypass flow will continue to the 194+00E inlet, which is functioning properly. As such, the depth and spread are meeting the requirements.

August 22, 2025

Appendix A – FEMA FIRM PANEL

(Data is provided in report and digitally)

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 table 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.

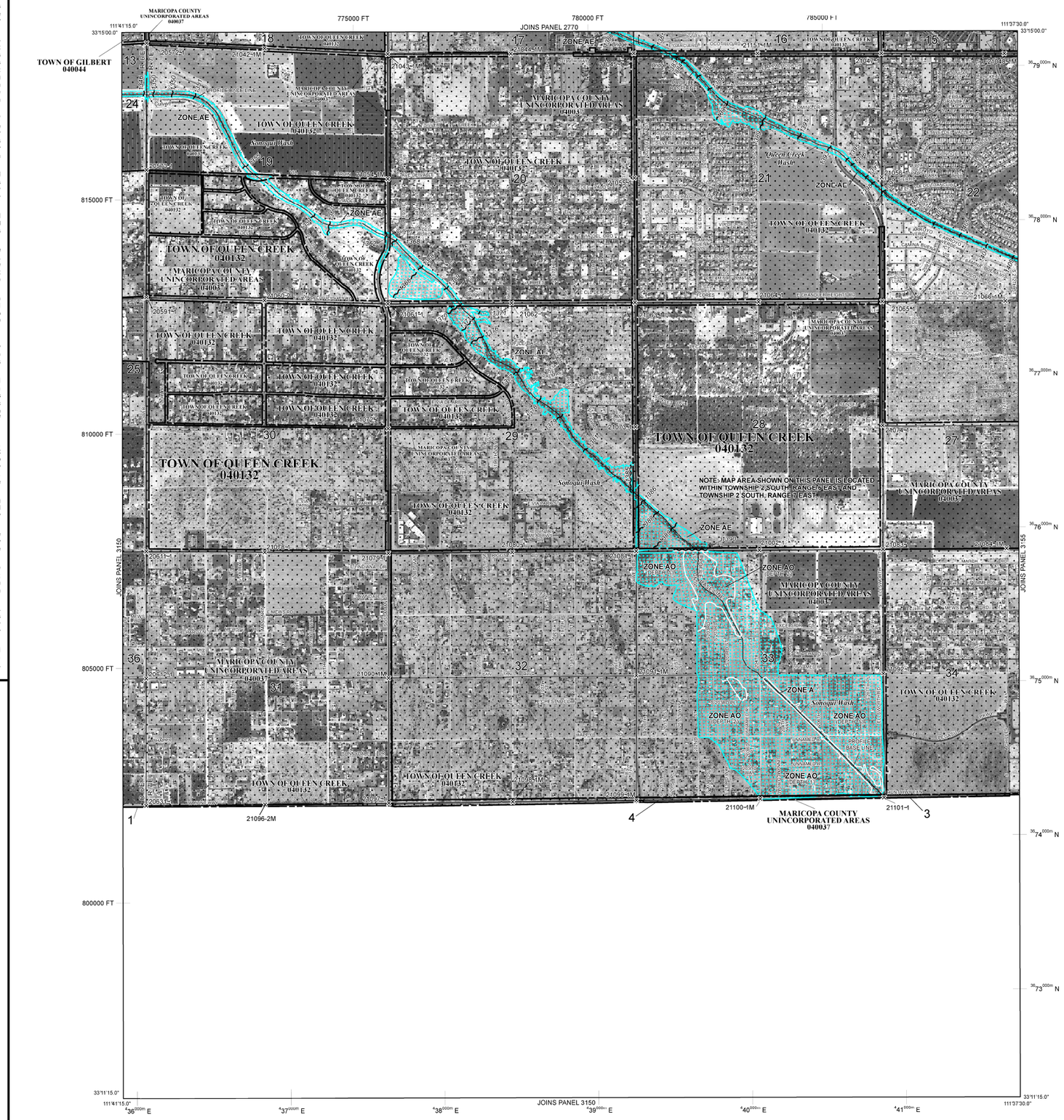
The **profile base line** depicted on this map represents the hydraulic modeling baselines that match flood profiles in the FIS report. As a result of improved topographic data, the profile base line, in some cases, may deviate significantly from the channel centerline or appear outside the SFHA.

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 **FEMA 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 MSC 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/



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*

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

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

MAP REPOSITORIES
Refer to Map Repositories list on Map Index

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

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL
September 4, 1991 December 3, 1993 July 19, 2001 September 30, 2005
October 16, 2013 - to incorporate previously issued letters of map revision, to update corporate limits, to add base flood elevation, to add special flood hazard areas, to advance suffix, to change base flood elevations, to add floodway, to change floodway, and to add roads and road names.

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 3135L

FIRM

FLOOD INSURANCE RATE MAP

MARICOPA COUNTY, ARIZONA

AND INCORPORATED AREAS

PANEL 3135 OF 4425
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
MARICOPA COUNTY	040037	3135	L
GILBERT, TOWN OF	040044	3135	L
QUEEN CREEK, TOWN OF	040132	3135	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
04013C3135L

MAP REVISED
OCTOBER 16, 2013

Federal Emergency Management Agency

NATIONAL FLOOD INSURANCE PROGRAM

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The **profile base line** 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 base line, in some cases, may deviate significantly from the channel centerline or appear outside the SFHA.

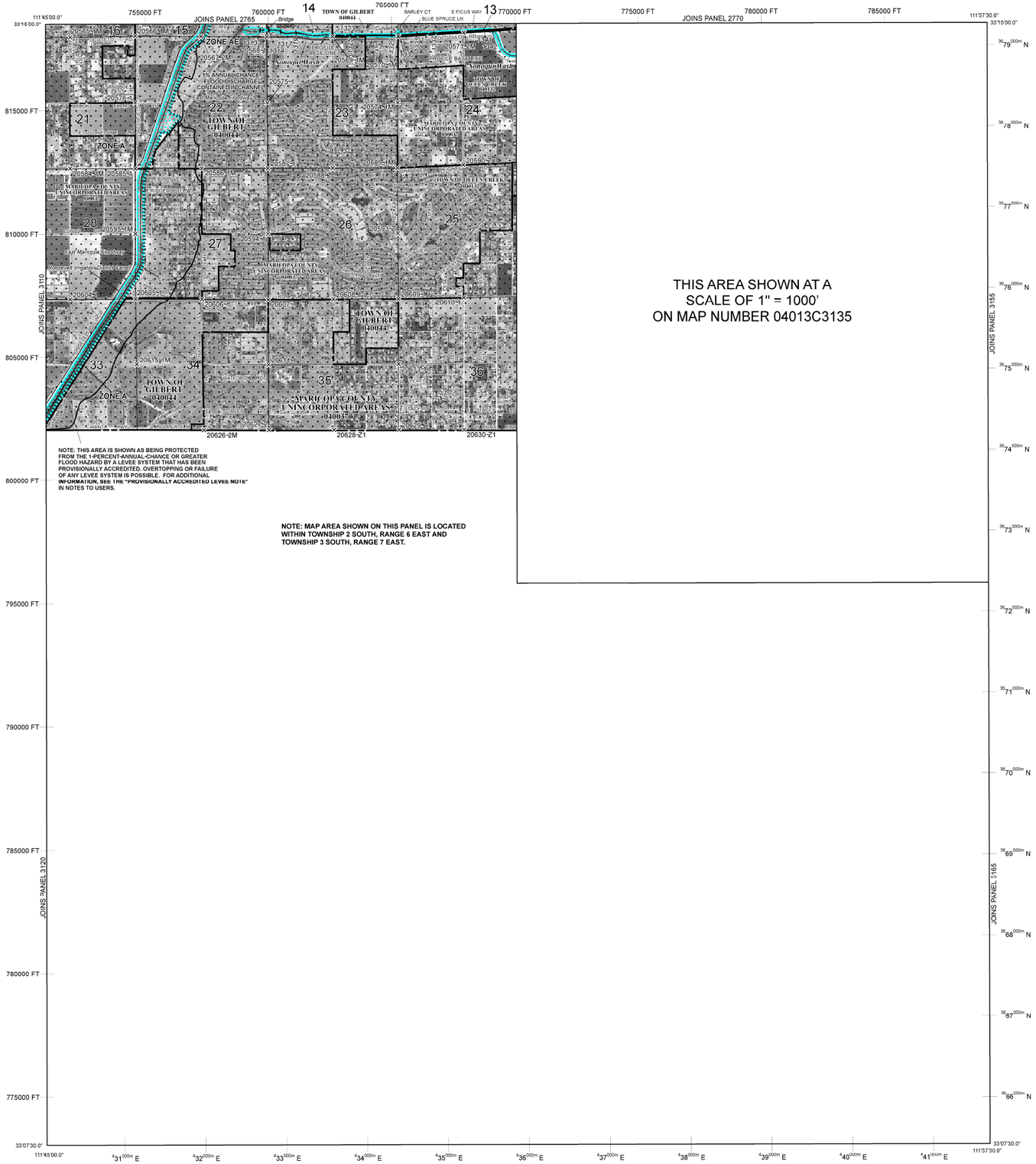
Corporate limits shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

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

MAP REPOSITORIES
Refer to Map Repositories list on Map Index

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

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL
September 4, 1991 December 3, 1993 July 19, 2001 September 30, 2005
October 16, 2013 - to advance suffix, to change base flood elevations, to add base flood elevation, to update corporate limits, to change floodway, to add special flood hazard areas, to add floodway, to add roads and road names, and to incorporate previously issued letters of map revision.

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" = 2000'
1000 0 2000 4000 FEET
600 0 600 1200 METERS

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 3150L

FIRM

FLOOD INSURANCE RATE MAP

MARICOPA COUNTY, ARIZONA AND INCORPORATED AREAS

PANEL 3150 OF 4425
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
MARICOPA COUNTY	040037	3150	L
GILBERT, TOWN OF	040044	3150	L
QUEEN CREEK, TOWN OF	040132	3150	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 04013C3150L

MAP REVISED OCTOBER 16, 2013

Federal Emergency Management Agency

August 22, 2025

Appendix B – TOPOGRAPHIC SURVEY

(Data is provided digitally only)

August 22, 2025

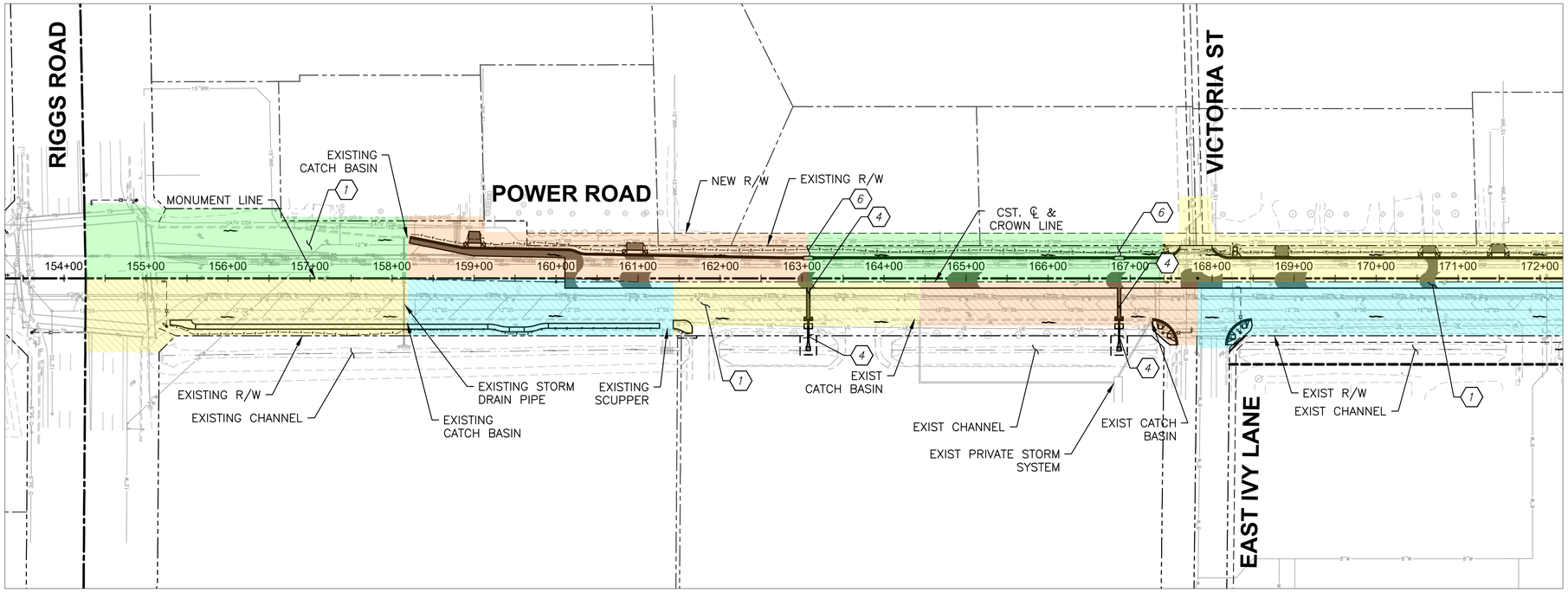
Appendix C – DESIGN CRITERIA AND MANUALS

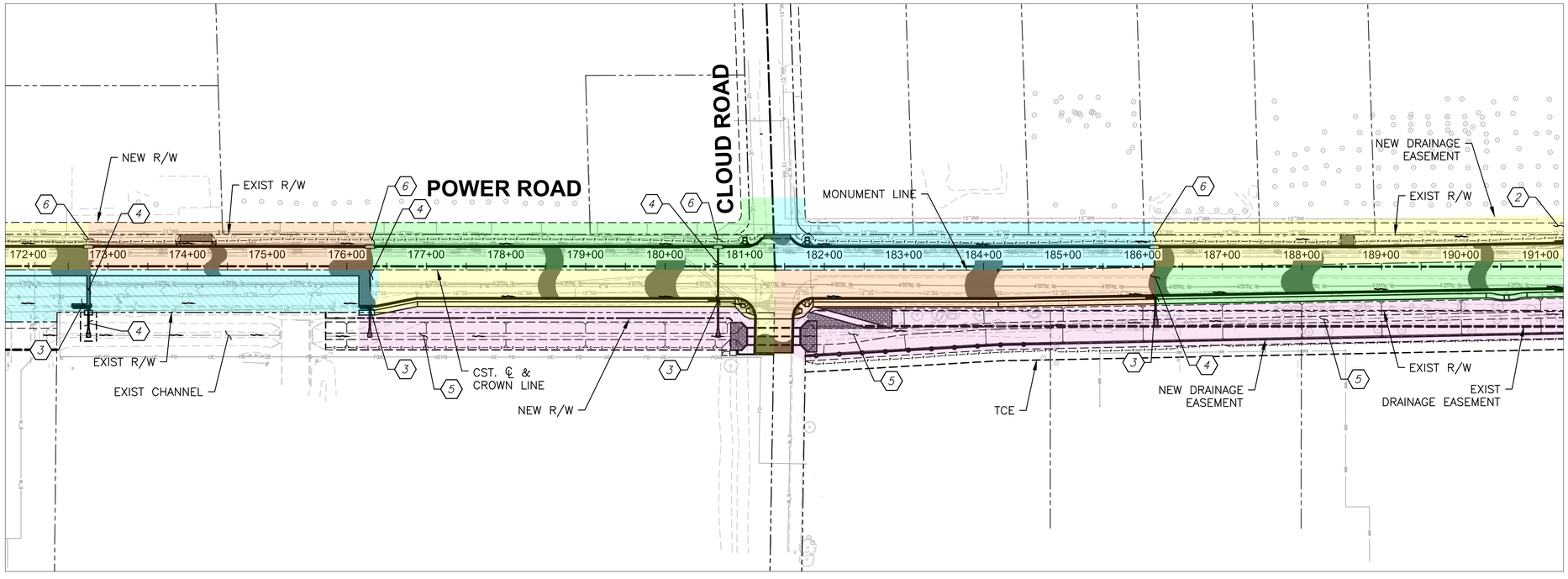
(Data is provided digitally only)

August 22, 2025

Appendix D – HYDROLOGY AND HYDRAULICS CALCULATIONS

(Data is provided in report and digitally)





DRAINAGE CONSTRUCTION NOTES		QUANTITY
1	Drainage Basin Delineated Within ROW (Color Hatch, Typ.)	SF
2	Concrete Scupper (MAG 206-1 and 206-2)	EA
3	Catch Basin (Type M Per City of Phoenix P1569-2)	EA
4	RCP Storm Pipe	LF
5	Conveyance Drainage Swale (Typ.)	LF
6	Catch Basin (Type Q Per City of Phoenix P1572)	EA

LEGEND

EXISTING DRAINAGE AREAS

N

0' 40' 80' 160'

HORZ. SCALE: 1"=80'

Contact Arizona 811 at least two full working days before you begin excavation
ARIZONA811
Call 811 or click Arizona811.com

TOWN OF QUEEN CREEK

POWER ROAD:
RIGGS ROAD TO CHANDLER HEIGHTS ROAD
ROADWAY AND DRAINAGE IMPROVEMENTS

Stantec
3133 West Frye Road
Chandler, Arizona 85226
Tel. 480.687.6100
www.stantec.com

DRAINAGE CONCEPT PLAN

DESIGNED BY	MH	CIP PROJ NO. A1405	
DRAWN BY	BE		
DRAWING NO.	DC01	SHEET 1 OF 2	

PROJECT NO. A1405, POWER ROAD: RIGGS ROAD TO CHANDLER HEIGHTS ROAD ROADWAY & DRAINAGE IMPROVEMENTS 100% SUBMITTAL 08/15/2025

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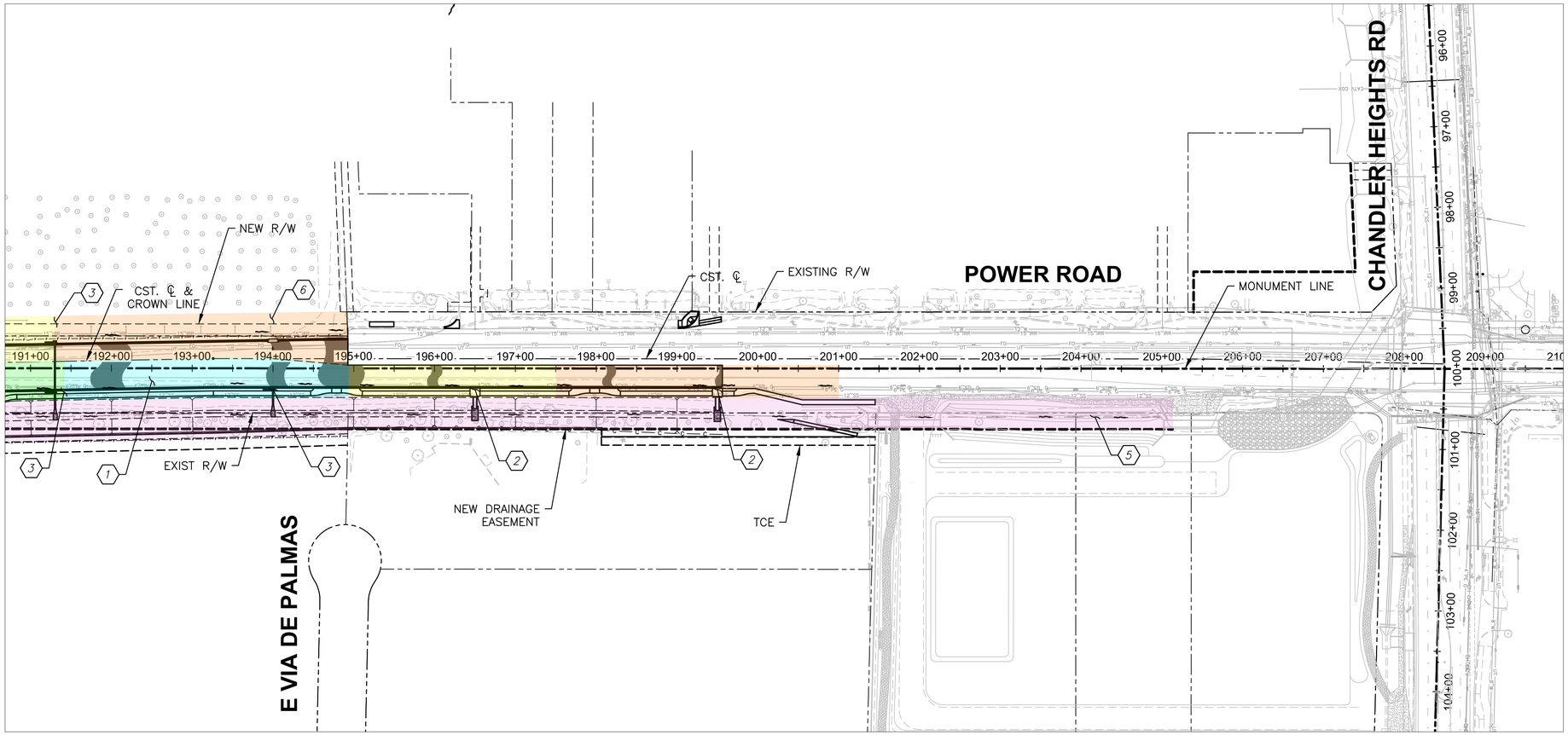

DRAINAGE CONSTRUCTION NOTES		QUANTITY
1	Drainage Basin Delineated Within ROW (Color Hatch, Typ.)	SF
2	Concrete Scupper (MAG 206–1 and 206–2)	EA
3	Catch Basin (Type M Per City of Phoenix P1569–2)	EA
4	RCP Storm Pipe	LF
5	Conveyance Drainage Swale (Typ.)	LF
6	Catch Basin (Type Q Per City of Phoenix P1572)	EA

N

0' 40' 80' 160'

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Tel 480.687.6100
www.stantec.com

DRAINAGE CONCEPT PLAN

DESIGNED BY	MH	CIP PROJ NO. A1405
DRAWN BY	BE	
DRAWING NO.	DC02	SHEET 2 OF 2

PROJECT NO. A1405, POWER ROAD: RIGGS ROAD TO CHANDLER HEIGHTS ROAD ROADWAY & DRAINAGE IMPROVEMENTS 100% SUBMITTAL 08/15/2025

V:\1817\Active\181711207\600_DESIGN\610_Calculations\612_Drainage\BasinMap\0819_2025_-BASIN-MAP.dwg, 8/22/2025 10:49:21 AM

Site specific depth-duration-frequency statistics

Duration	Rainfall Depth, in inches					
minutes	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
5	0.251	0.339	0.407	0.499	0.570	0.642
10	0.381	0.516	0.619	0.759	0.867	0.977
15	0.473	0.640	0.768	0.941	1.08	1.21
30	0.637	0.862	1.03	1.27	1.45	1.63
60	0.788	1.07	1.28	1.57	1.79	2.02
120	0.898	1.19	1.42	1.73	1.97	2.22
180	0.945	1.24	1.47	1.80	2.06	2.33
360	1.13	1.45	1.70	2.04	2.31	2.59
720	1.28	1.61	1.88	2.23	2.51	2.79
1440	1.54	1.99	2.34	2.83	3.21	3.62

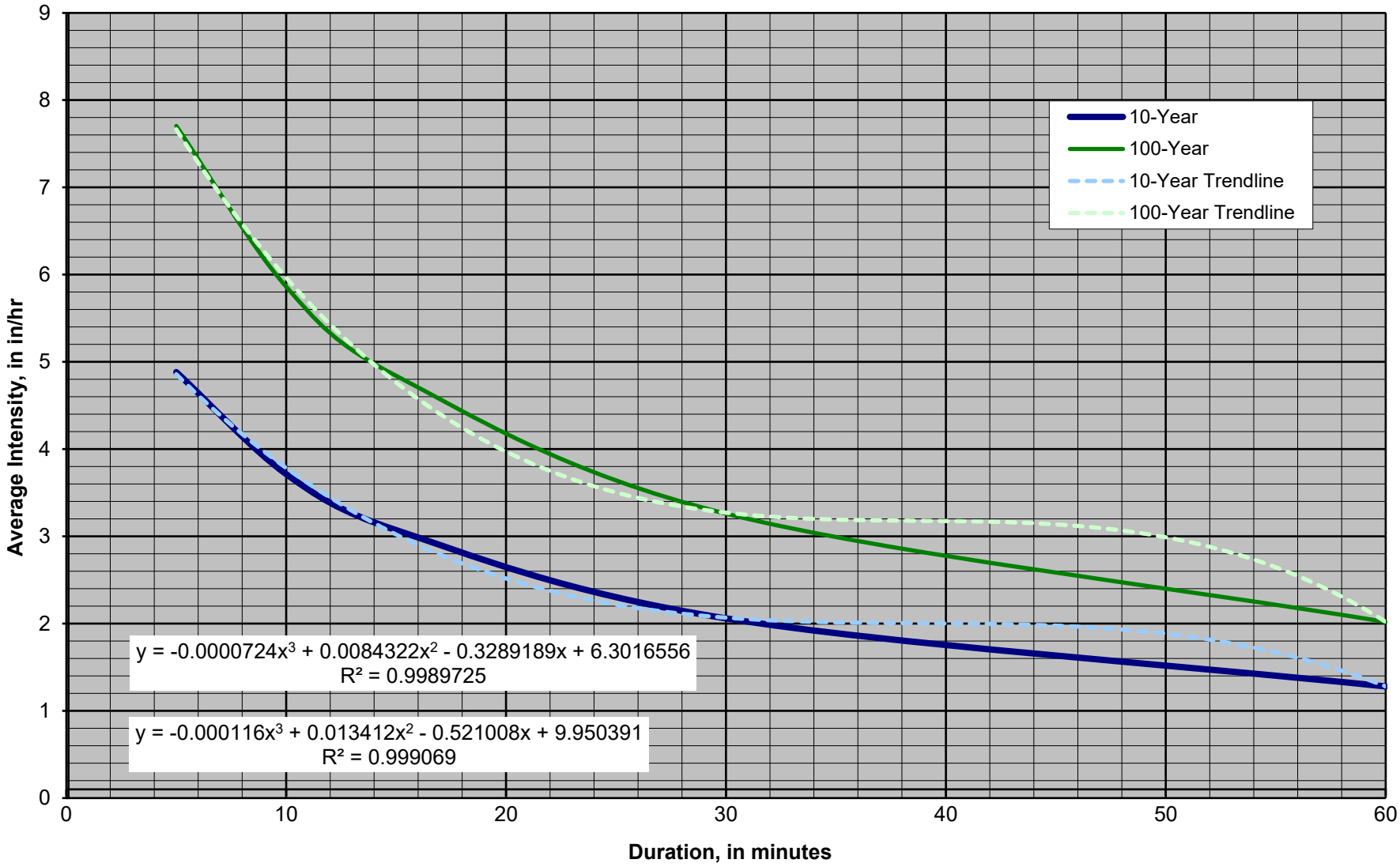
Site specific intensity-duration-frequency statistics

Duration	Average Intensity, in in/hr					
minutes	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
5	3.01	4.07	4.88	5.99	6.84	7.70
10	2.29	3.10	3.71	4.55	5.20	5.86
15	1.89	2.56	3.07	3.76	4.32	4.84
30	1.27	1.72	2.06	2.54	2.90	3.26
60	0.788	1.07	1.28	1.57	1.79	2.02
120	0.449	0.595	0.710	0.865	0.985	1.11
180	0.315	0.413	0.490	0.600	0.687	0.777
360	0.188	0.242	0.283	0.340	0.385	0.432
720	0.107	0.134	0.157	0.186	0.209	0.233
1440	0.064	0.083	0.098	0.118	0.134	0.151

Flood Control District of Maricopa County Land Use Category

Land Use Code	Land Use Category	Runoff Coefficients by Storm Frequency								Resistance Coefficients		
		2 -10 Year		25-Year		50 Year		100 Year				
		Min	Max	Min	Max	Min	Max	Min	Max	Type	m	b
AG	Agricultural	0.10	0.20	0.11	0.22	0.12	0.24	0.13	0.25	B	-0.01375	0.08
C1	Commercial 1	0.55	0.65	0.61	0.72	0.66	0.78	0.69	0.81	A	-0.00625	0.04
C2	Commercial 2	0.75	0.85	0.83	0.94	0.90	0.95	0.94	0.95	A	-0.00625	0.04
DL1	Desert Landscaping 1	0.55	0.85	0.61	0.94	0.66	0.95	0.69	0.95	B	-0.01375	0.08
DL2	Desert Landscaping 2	0.30	0.40	0.33	0.44	0.36	0.48	0.38	0.50	B	-0.01375	0.08
GR	Gravel Roadways & Shoulders	0.60	0.70	0.66	0.77	0.72	0.84	0.75	0.88	B	-0.01375	0.08
I1	Industrial 1	0.60	0.70	0.66	0.77	0.72	0.84	0.75	0.88	A	-0.00625	0.04
I2	Industrial 2	0.70	0.80	0.77	0.88	0.84	0.95	0.88	0.95	A	-0.00625	0.04
LDR	Low Density Residential	0.42	0.48	0.46	0.55	0.50	0.64	0.53	0.70	A	-0.00625	0.04
LPC	Lawns/Parks/Cemeteries	0.10	0.25	0.11	0.28	0.12	0.30	0.13	0.31	A	-0.00625	0.04
MDR	Medium Density Residential	0.48	0.65	0.53	0.72	0.58	0.78	0.60	0.80	A	-0.00625	0.04
MFR	Multiple Family Residential	0.65	0.75	0.72	0.83	0.78	0.90	0.82	0.94	A	-0.00625	0.04
NDR	Undeveloped Desert Rangeland	0.30	0.40	0.33	0.44	0.36	0.48	0.38	0.50	B	-0.01375	0.08
NHS	Hillslopes, Sonoran Desert	0.40	0.55	0.45	0.60	0.48	0.66	0.50	0.70	C	-0.02500	0.15
NMT	Mountain Terrain	0.50	0.70	0.65	0.80	0.70	0.90	0.75	0.90	D	-0.03000	0.20
P	Pavement and Rooftops	0.75	0.85	0.83	0.94	0.90	0.95	0.94	0.95	A	-0.00625	0.04
VLDR	Very Low Density Residential	0.33	0.42	0.36	0.50	0.40	0.60	0.45	0.65	A	-0.00625	0.04

Site specific intensity-duration-frequency graph



4/20/2023

NOAA Atlas 14, Volume 1, Version 5
Location name: Queen Creek, Arizona, USA*
Latitude: 33.2271°, Longitude: -111.6857°
Elevation: 1370.4 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	**0.191** (0.162-0.233)	**0.251** (0.213-0.304)	**0.339** (0.286-0.410)	**0.407** (0.340-0.489)	**0.499** (0.410-0.597)	**0.570** (0.463-0.681)	**0.642** (0.512-0.766)	**0.715** (0.561-0.852)	**0.814** (0.622-0.971)	**0.889** (0.665-1.06)
10-min	**0.291** (0.247-0.354)	**0.381** (0.324-0.463)	**0.516** (0.434-0.624)	**0.619** (0.517-0.745)	**0.759** (0.624-0.909)	**0.867** (0.704-1.04)	**0.977** (0.779-1.17)	**1.09** (0.853-1.30)	**1.24** (0.946-1.48)	**1.35** (1.01-1.62)
15-min	**0.361** (0.306-0.439)	**0.473** (0.401-0.574)	**0.640** (0.538-0.774)	**0.768** (0.641-0.924)	**0.941** (0.773-1.13)	**1.08** (0.873-1.28)	**1.21** (0.966-1.45)	**1.35** (1.06-1.61)	**1.54** (1.17-1.83)	**1.68** (1.25-2.01)
30-min	**0.486** (0.412-0.591)	**0.637** (0.541-0.773)	**0.862** (0.725-1.04)	**1.03** (0.863-1.24)	**1.27** (1.04-1.52)	**1.45** (1.18-1.73)	**1.63** (1.30-1.95)	**1.82** (1.43-2.16)	**2.07** (1.58-2.47)	**2.26** (1.69-2.70)
60-min	**0.602** (0.510-0.731)	**0.788** (0.669-0.957)	**1.07** (0.897-1.29)	**1.28** (1.07-1.54)	**1.57** (1.29-1.88)	**1.79** (1.46-2.14)	**2.02** (1.61-2.41)	**2.25** (1.76-2.68)	**2.56** (1.95-3.05)	**2.79** (2.09-3.35)
2-hr	**0.693** (0.587-0.827)	**0.898** (0.765-1.08)	**1.19** (1.01-1.43)	**1.42** (1.20-1.70)	**1.73** (1.44-2.05)	**1.97** (1.61-2.33)	**2.22** (1.79-2.62)	**2.47** (1.95-2.91)	**2.80** (2.16-3.30)	**3.07** (2.31-3.63)
3-hr	**0.739** (0.629-0.889)	**0.945** (0.808-1.14)	**1.24** (1.05-1.50)	**1.47** (1.24-1.77)	**1.80** (1.49-2.14)	**2.06** (1.68-2.44)	**2.33** (1.87-2.76)	**2.61** (2.06-3.09)	**3.00** (2.29-3.55)	**3.32** (2.47-3.94)
6-hr	**0.894** (0.774-1.05)	**1.13** (0.982-1.33)	**1.45** (1.25-1.70)	**1.70** (1.46-1.98)	**2.04** (1.73-2.37)	**2.31** (1.92-2.67)	**2.59** (2.12-2.99)	**2.87** (2.31-3.32)	**3.27** (2.56-3.77)	**3.58** (2.74-4.14)
12-hr	**1.01** (0.892-1.16)	**1.28** (1.12-1.46)	**1.61** (1.41-1.84)	**1.88** (1.63-2.13)	**2.23** (1.93-2.53)	**2.51** (2.14-2.83)	**2.79** (2.34-3.15)	**3.07** (2.54-3.48)	**3.45** (2.79-3.94)	**3.75** (2.97-4.30)
24-hr	**1.21** (1.10-1.34)	**1.54** (1.40-1.70)	**1.99** (1.80-2.19)	**2.34** (2.11-2.57)	**2.83** (2.53-3.11)	**3.21** (2.86-3.52)	**3.62** (3.19-3.97)	**4.04** (3.52-4.43)	**4.61** (3.97-5.07)	**5.07** (4.31-5.59)
2-day	**1.28** (1.17-1.42)	**1.64** (1.49-1.81)	**2.14** (1.94-2.36)	**2.54** (2.30-2.80)	**3.09** (2.78-3.40)	**3.53** (3.14-3.88)	**3.99** (3.53-4.39)	**4.47** (3.92-4.92)	**5.14** (4.43-5.67)	**5.67** (4.83-6.29)
3-day	**1.35** (1.24-1.49)	**1.73** (1.58-1.90)	**2.27** (2.07-2.49)	**2.70** (2.45-2.96)	**3.30** (2.99-3.62)	**3.79** (3.40-4.15)	**4.31** (3.83-4.71)	**4.85** (4.27-5.31)	**5.61** (4.87-6.15)	**6.22** (5.34-6.85)
4-day	**1.42** (1.31-1.56)	**1.81** (1.66-1.99)	**2.39** (2.19-2.61)	**2.86** (2.61-3.12)	**3.52** (3.19-3.83)	**4.05** (3.65-4.42)	**4.62** (4.13-5.04)	**5.22** (4.62-5.69)	**6.08** (5.30-6.64)	**6.76** (5.85-7.41)

7-day	**1.57** (1.45-1.71)	**2.00** (1.84-2.19)	**2.64** (2.42-2.88)	**3.15** (2.89-3.43)	**3.88** (3.54-4.21)	**4.47** (4.05-4.86)	**5.09** (4.58-5.53)	**5.75** (5.12-6.25)	**6.69** (5.86-7.28)	**7.44** (6.45-8.12)
10-day	**1.68** (1.55-1.84)	**2.15** (1.98-2.34)	**2.83** (2.61-3.08)	**3.38** (3.10-3.66)	**4.14** (3.79-4.49)	**4.76** (4.32-5.16)	**5.42** (4.88-5.86)	**6.10** (5.45-6.60)	**7.06** (6.22-7.67)	**7.83** (6.83-8.51)
20-day	**2.09** (1.93-2.29)	**2.70** (2.48-2.95)	**3.55** (3.26-3.87)	**4.20** (3.85-4.57)	**5.08** (4.63-5.53)	**5.75** (5.22-6.26)	**6.43** (5.81-7.00)	**7.12** (6.39-7.76)	**8.06** (7.16-8.80)	**8.77** (7.73-9.60)
30-day	**2.45** (2.24-2.66)	**3.15** (2.89-3.42)	**4.14** (3.80-4.50)	**4.90** (4.48-5.32)	**5.92** (5.38-6.43)	**6.70** (6.06-7.28)	**7.49** (6.76-8.16)	**8.30** (7.44-9.05)	**9.39** (8.33-10.3)	**10.2** (9.00-11.2)
45-day	**2.87** (2.63-3.13)	**3.70** (3.39-4.04)	**4.88** (4.47-5.32)	**5.74** (5.25-6.26)	**6.88** (6.25-7.50)	**7.74** (7.01-8.45)	**8.61** (7.76-9.40)	**9.47** (8.49-10.3)	**10.6** (9.41-11.6)	**11.5** (10.1-12.6)
60-day	**3.21** (2.94-3.50)	**4.14** (3.79-4.52)	**5.44** (4.98-5.93)	**6.39** (5.83-6.97)	**7.62** (6.93-8.30)	**8.53** (7.72-9.30)	**9.43** (8.51-10.3)	**10.3** (9.27-11.3)	**11.5** (10.2-12.6)	**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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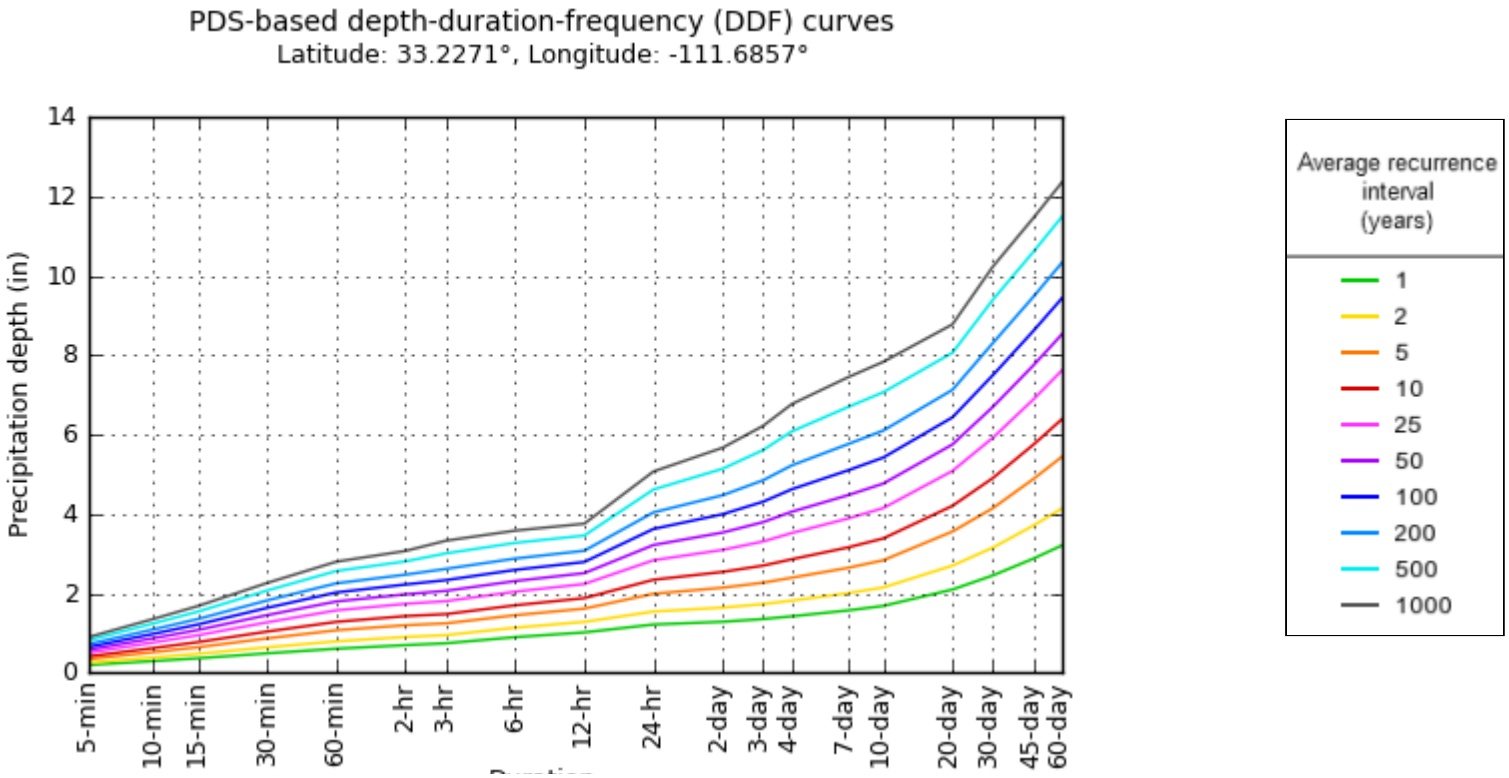
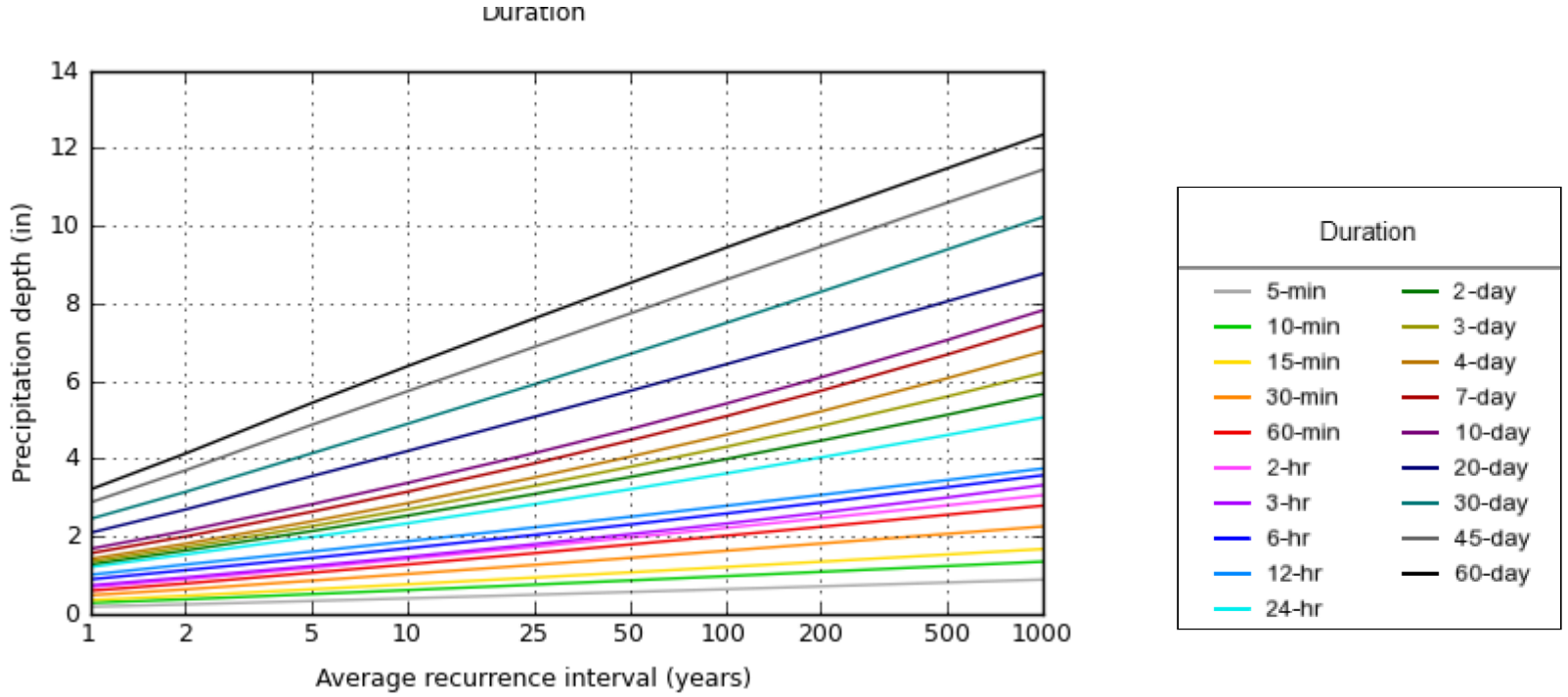
PF graphical





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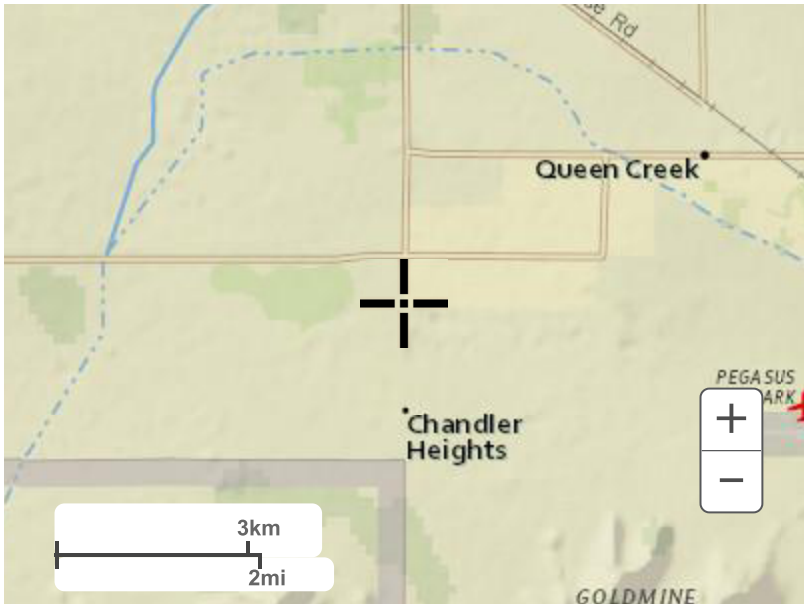
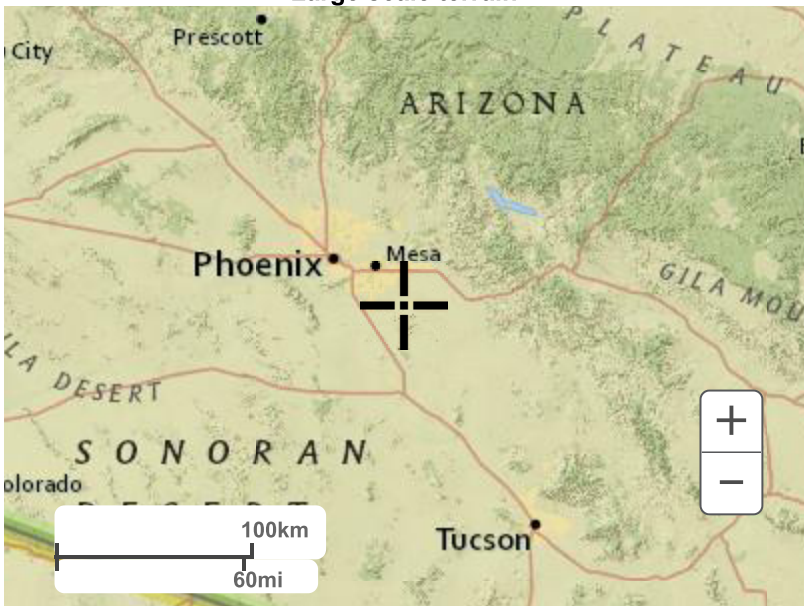
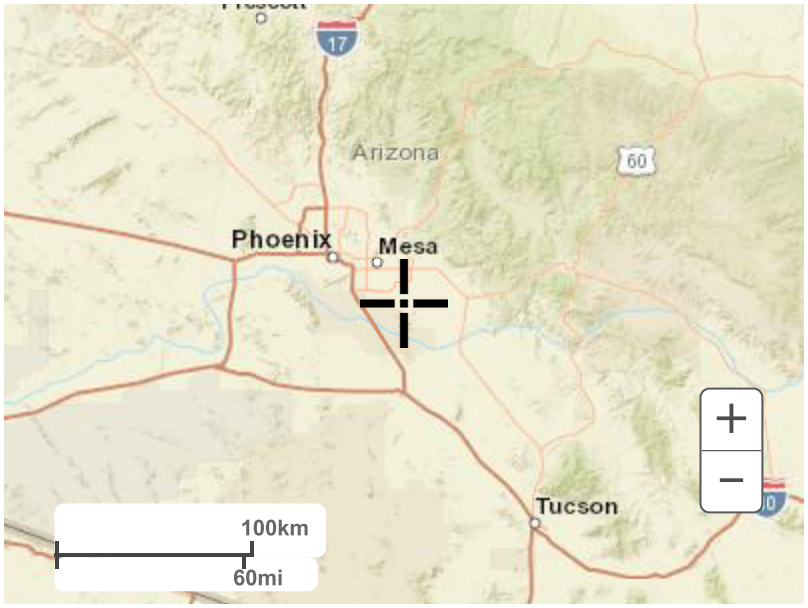
Small scale terrain



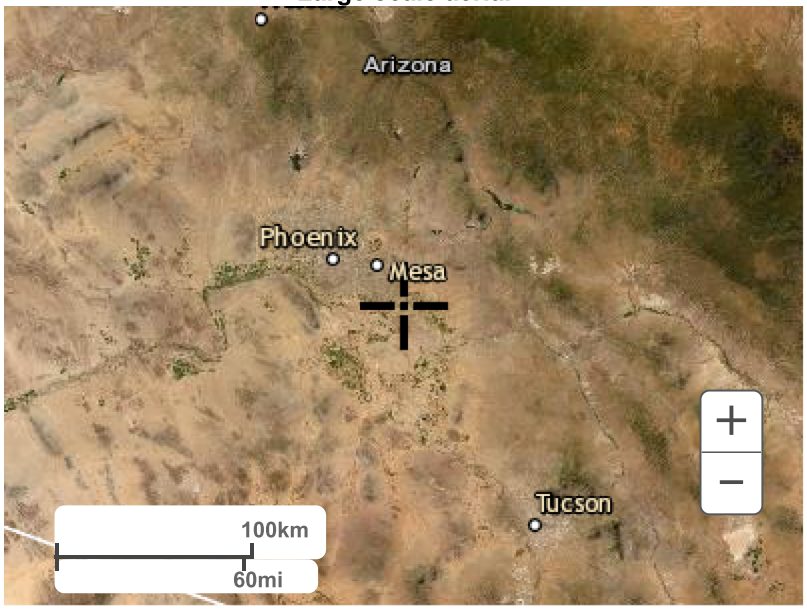
Large scale terrain



Large scale map



Large scale aerial



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NOAA Atlas 14, Volume 1, Version 5
Location name: Queen Creek, Arizona, USA*
Latitude: 33.2271°, Longitude: -111.6857°
Elevation: 1370.4 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/hour)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**2.29** (1.94-2.80)	**3.01** (2.56-3.65)	**4.07** (3.43-4.92)	**4.88** (4.08-5.87)	**5.99** (4.92-7.16)	**6.84** (5.56-8.17)	**7.70** (6.14-9.19)	**8.58** (6.73-10.2)	**9.77** (7.46-11.7)	**10.7** (7.98-12.8)
10-min	**1.75** (1.48-2.12)	**2.29** (1.94-2.78)	**3.10** (2.60-3.74)	**3.71** (3.10-4.47)	**4.55** (3.74-5.45)	**5.20** (4.22-6.22)	**5.86** (4.67-6.99)	**6.53** (5.12-7.78)	**7.43** (5.68-8.87)	**8.11** (6.07-9.71)
15-min	**1.44** (1.22-1.76)	**1.89** (1.60-2.30)	**2.56** (2.15-3.10)	**3.07** (2.56-3.70)	**3.76** (3.09-4.51)	**4.30** (3.49-5.14)	**4.85** (3.86-5.78)	**5.40** (4.23-6.43)	**6.14** (4.69-7.33)	**6.71** (5.02-8.03)
30-min	**0.972** (0.824-1.18)	**1.27** (1.08-1.55)	**1.72** (1.45-2.08)	**2.07** (1.73-2.49)	**2.53** (2.08-3.04)	**2.90** (2.35-3.46)	**3.26** (2.60-3.89)	**3.64** (2.85-4.33)	**4.14** (3.16-4.94)	**4.52** (3.38-5.41)
60-min	**0.602** (0.510-0.731)	**0.788** (0.669-0.957)	**1.07** (0.897-1.29)	**1.28** (1.07-1.54)	**1.57** (1.29-1.88)	**1.79** (1.46-2.14)	**2.02** (1.61-2.41)	**2.25** (1.76-2.68)	**2.56** (1.95-3.05)	**2.79** (2.09-3.35)
2-hr	**0.346** (0.294-0.414)	**0.449** (0.382-0.538)	**0.597** (0.506-0.713)	**0.712** (0.598-0.850)	**0.866** (0.718-1.03)	**0.986** (0.806-1.17)	**1.11** (0.893-1.31)	**1.23** (0.974-1.45)	**1.40** (1.08-1.65)	**1.53** (1.16-1.81)
3-hr	**0.246** (0.209-0.296)	**0.315** (0.269-0.380)	**0.413** (0.351-0.498)	**0.491** (0.414-0.588)	**0.599** (0.497-0.713)	**0.686** (0.560-0.813)	**0.776** (0.622-0.918)	**0.870** (0.686-1.03)	**1.00** (0.764-1.18)	**1.11** (0.823-1.31)
6-hr	**0.149** (0.129-0.176)	**0.189** (0.164-0.222)	**0.241** (0.209-0.283)	**0.283** (0.243-0.331)	**0.341** (0.288-0.395)	**0.385** (0.321-0.446)	**0.432** (0.354-0.499)	**0.480** (0.386-0.554)	**0.546** (0.427-0.630)	**0.597** (0.457-0.692)
12-hr	**0.084** (0.074-0.096)	**0.106** (0.093-0.121)	**0.134** (0.117-0.152)	**0.156** (0.136-0.177)	**0.185** (0.160-0.210)	**0.208** (0.177-0.235)	**0.231** (0.194-0.262)	**0.255** (0.211-0.289)	**0.287** (0.232-0.327)	**0.311** (0.247-0.357)
24-hr	**0.051** (0.046-0.056)	**0.064** (0.058-0.071)	**0.083** (0.075-0.091)	**0.097** (0.088-0.107)	**0.118** (0.106-0.129)	**0.134** (0.119-0.147)	**0.151** (0.133-0.165)	**0.168** (0.147-0.184)	**0.192** (0.165-0.211)	**0.211** (0.180-0.233)
2-day	**0.027** (0.024-0.030)	**0.034** (0.031-0.038)	**0.045** (0.040-0.049)	**0.053** (0.048-0.058)	**0.064** (0.058-0.071)	**0.074** (0.065-0.081)	**0.083** (0.074-0.091)	**0.093** (0.082-0.103)	**0.107** (0.092-0.118)	**0.118** (0.101-0.131)
3-day	**0.019** (0.017-0.021)	**0.024** (0.022-0.026)	**0.031** (0.029-0.035)	**0.037** (0.034-0.041)	**0.046** (0.041-0.050)	**0.053** (0.047-0.058)	**0.060** (0.053-0.065)	**0.067** (0.059-0.074)	**0.078** (0.068-0.085)	**0.086** (0.074-0.095)
4-day	**0.015** (0.014-0.016)	**0.019** (0.017-0.021)	**0.025** (0.023-0.027)	**0.030** (0.027-0.032)	**0.037** (0.033-0.040)	**0.042** (0.038-0.046)	**0.048** (0.043-0.052)	**0.054** (0.048-0.059)	**0.063** (0.055-0.069)	**0.070** (0.061-0.077)

7-day	**0.009** (0.009-0.010)	**0.012** (0.011-0.013)	**0.016** (0.014-0.017)	**0.019** (0.017-0.020)	**0.023** (0.021-0.025)	**0.027** (0.024-0.029)	**0.030** (0.027-0.033)	**0.034** (0.030-0.037)	**0.040** (0.035-0.043)	**0.044** (0.038-0.048)
10-day	**0.007** (0.006-0.008)	**0.009** (0.008-0.010)	**0.012** (0.011-0.013)	**0.014** (0.013-0.015)	**0.017** (0.016-0.019)	**0.020** (0.018-0.022)	**0.023** (0.020-0.024)	**0.025** (0.023-0.028)	**0.029** (0.026-0.032)	**0.033** (0.028-0.035)
20-day	**0.004** (0.004-0.005)	**0.006** (0.005-0.006)	**0.007** (0.007-0.008)	**0.009** (0.008-0.010)	**0.011** (0.010-0.012)	**0.012** (0.011-0.013)	**0.013** (0.012-0.015)	**0.015** (0.013-0.016)	**0.017** (0.015-0.018)	**0.018** (0.016-0.020)
30-day	**0.003** (0.003-0.004)	**0.004** (0.004-0.005)	**0.006** (0.005-0.006)	**0.007** (0.006-0.007)	**0.008** (0.007-0.009)	**0.009** (0.008-0.010)	**0.010** (0.009-0.011)	**0.012** (0.010-0.013)	**0.013** (0.012-0.014)	**0.014** (0.012-0.016)
45-day	**0.003** (0.002-0.003)	**0.003** (0.003-0.004)	**0.005** (0.004-0.005)	**0.005** (0.005-0.006)	**0.006** (0.006-0.007)	**0.007** (0.006-0.008)	**0.008** (0.007-0.009)	**0.009** (0.008-0.010)	**0.010** (0.009-0.011)	**0.011** (0.009-0.012)
60-day	**0.002** (0.002-0.002)	**0.003** (0.003-0.003)	**0.004** (0.003-0.004)	**0.004** (0.004-0.005)	**0.005** (0.005-0.006)	**0.006** (0.005-0.006)	**0.007** (0.006-0.007)	**0.007** (0.006-0.008)	**0.008** (0.007-0.009)	**0.009** (0.008-0.009)

[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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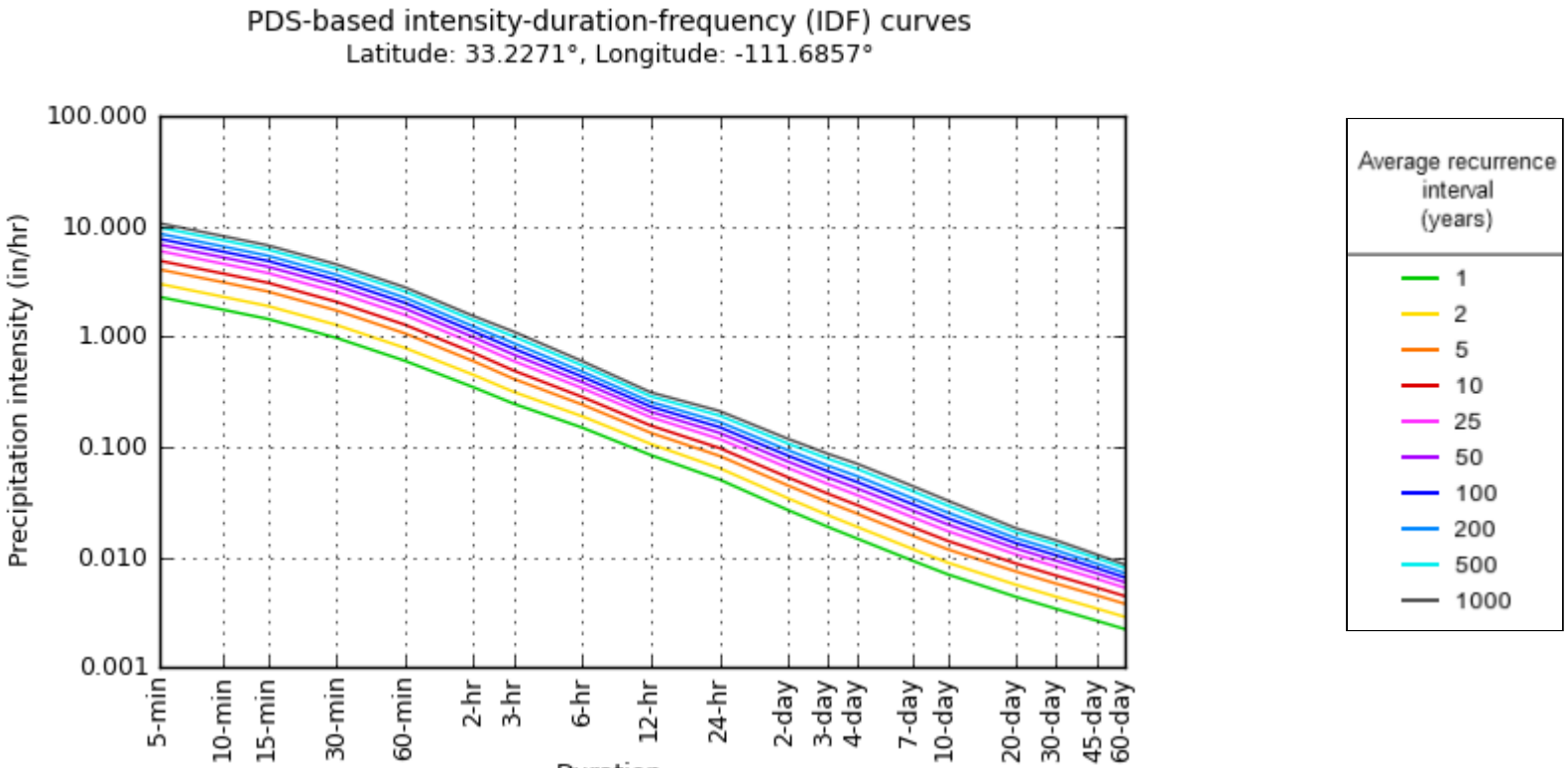
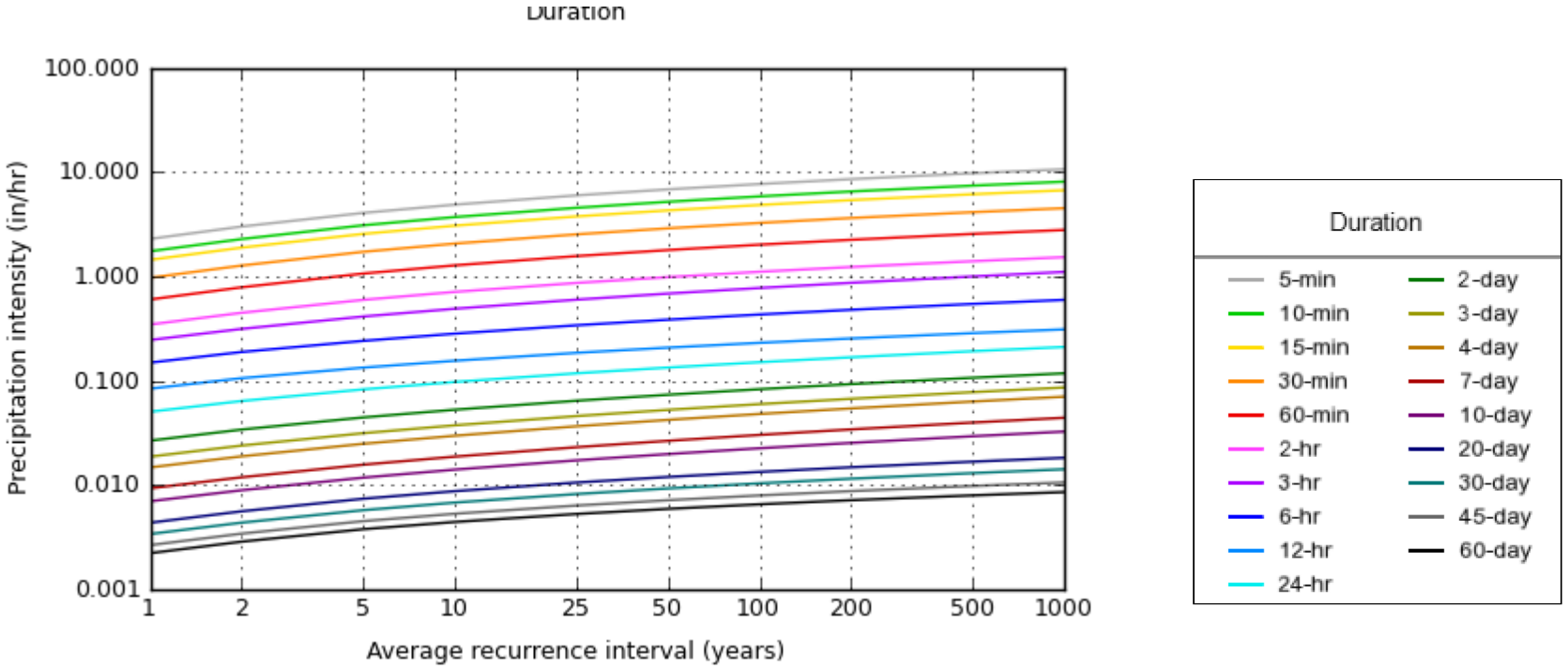
PF graphical





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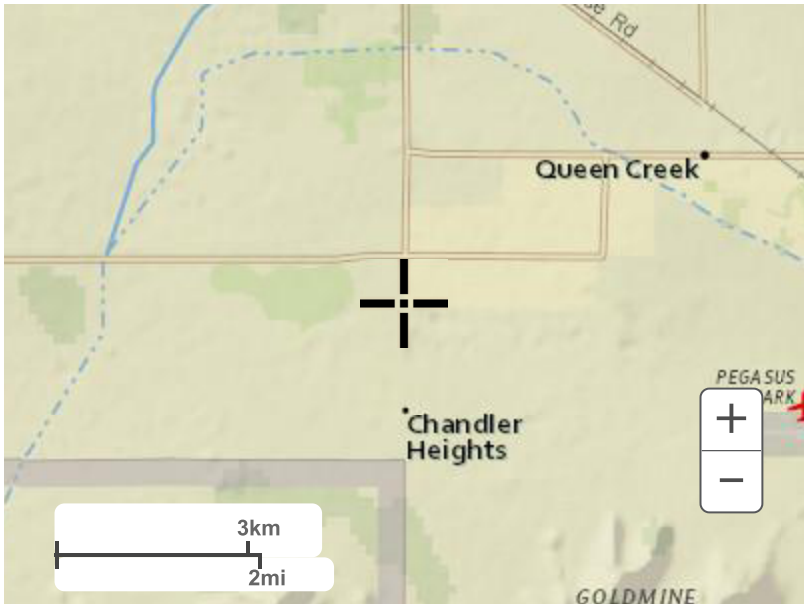
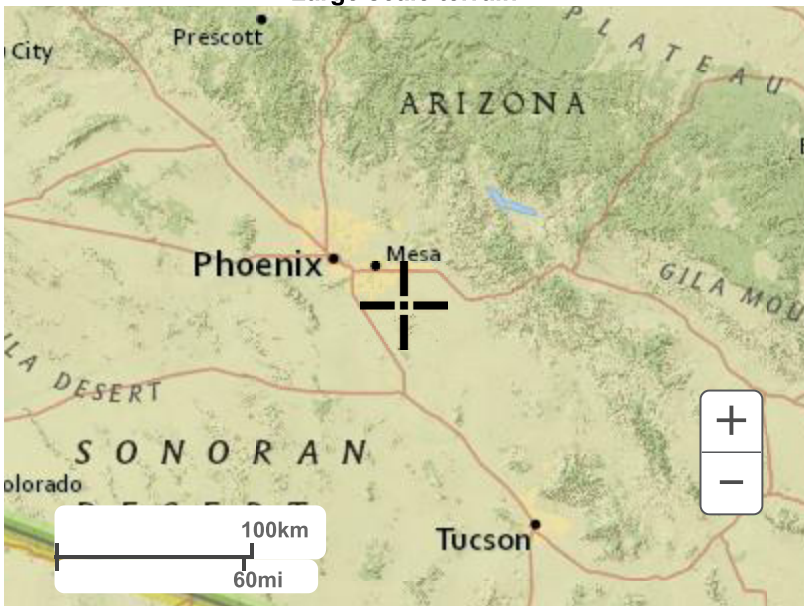
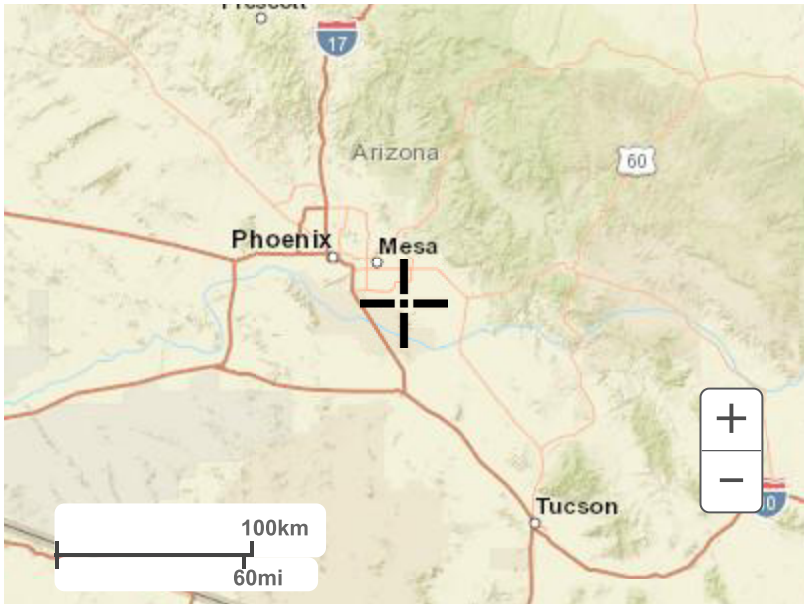


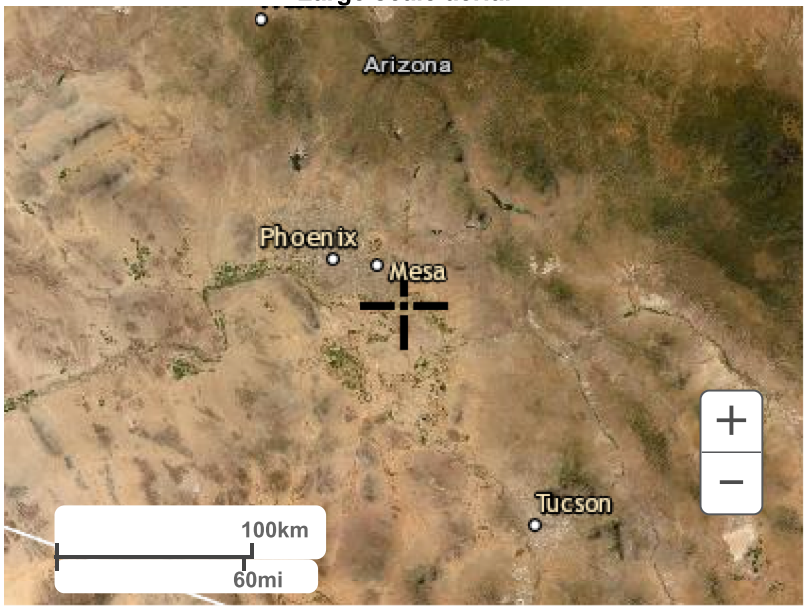
Large scale terrain



Large scale map



Large scale aerial



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National Weather Service
National Water Center
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

Disclaimer

Client	Town of Queen Creek				
Project Name	Power Rd Roadway and Drainage Improvement	Date:	08/18/25	By:	SGG
Storm Frequency	10yr	Date Checked:	08/19/25	By:	ZNW
Calculation	Power Rd Sub-basin Hydrology	Date Revised:	TBD	By:	

Stantec Proj. No. 181711207

Catch Basin Sta: 158+15 East EXIST CB

Runoff Coefficient

Land Use Code	Subarea, in sq. feet	Total Subarea acres	Runoff Coefficient	Kb
P	29,498	0.68	0.850	0.04

Total Area = 0.677 acres
Weighted C = 0.850
Weighted Kb = 0.0411

Time of Concentration

Flood Control District of Maricopa County method

U/S Elev =	1390.17	feet				
D/S Elev =	1384.42	feet				
Length =	395	feet	0.075 miles	**T_c =**	5.08	minutes
Slope =	0.0146	ft/ft	76.89 ft/mile	**Intensity =**	4.84	in/hr
Kb =	0.04					
$i_{assumed}$ =	4.84	in/hr		**Peak Q =**	2.79	cfs

Catch Basin Sta: 158+15 West EXIST CB

Runoff Coefficient

Land Use Code	Subarea, in sq. feet	Total Subarea acres	Runoff Coefficient	Kb
P	32,383	0.7434	0.85	0.0408

Total Area = 0.74 acres
Weighted C = 0.85
Weighted Kb = 0.04

Time of Concentration

Flood Control District of Maricopa County method

U/S Elev =	1390.17	feet				
D/S Elev =	1384.41	feet				
Length =	408	feet	0.077 miles	**T_c =**	5.2	minutes
Slope =	0.0141	ft/ft	74.50 ft/mile	**Intensity =**	4.80	in/hr
Kb =	0.04					
$i_{assumed}$ =	4.80	in/hr		**Peak Q =**	3.04	cfs

Client	Town of Queen Creek				
Project Name	Power Rd Roadway and Drainage Improvement	Date:	08/18/25	By:	SGG
Storm Frequency	10yr	Date Checked:	08/19/25	By:	ZNW
Calculation	Power Rd Sub-basin Hydrology	Date Revised:	TBD	By:	

Stantec Proj. No. 181711207

Catch Basin Sta: 161+34 East — EXIST SCUPPER

Runoff Coefficient

Land Use Code	Subarea, in sq. feet	Total Subarea acres	Runoff Coefficient	Kb
P	22,260	0.51	0.85	0.04

Total Area = 0.51 acres
Weighted C = 0.85
Weighted Kb = 0.04

Time of Concentration

Flood Control District of Maricopa County method

U/S Elev =	1385.39	feet				
D/S Elev =	1381.37	feet				
Length =	352	feet	0.067 miles	**T_c =**	5.2	minutes
Slope =	0.0114	ft/ft	60.35 ft/mile	**Intensity =**	4.80	in/hr
Kb =	0.04					
$i_{assumed}$ =	4.80	in/hr		**Peak Q =**	2.08	cfs

Catch Basin Sta: 163+08 West — NEW CB

Runoff Coefficient

Surface Type	Subarea, in sq. feet	Total Subarea acres	Runoff Coefficient	Kb
P	29,860	0.69	0.85	0.04

Total Area = 0.69 acres
Weighted C = 0.85
Weighted Kb = 0.04

Time of Concentration

Flood Control District of Maricopa County method

U/S Elev =	1385.39	feet				
D/S Elev =	1380.26	feet				
Length =	514.84	feet	0.098 miles	**T_c =**	6.7	minutes
Slope =	0.0100	ft/ft	52.57 ft/mile	**Intensity =**	4.44	in/hr
Kb =	0.04					
$i_{assumed}$ =	4.44	in/hr		**Peak Q =**	2.59	cfs

Client	Town of Queen Creek				
Project Name	Power Rd Roadway and Drainage Improvement	Date:	08/18/25	By:	SGG
Storm Frequency	10yr	Date Checked:	08/19/25	By:	ZNW
Calculation	Power Rd Sub-basin Hydrology	Date Revised:	TBD	By:	

Stantec Proj. No. 181711207

Catch Basin Sta: 164+39 East EXIST CB

Runoff Coefficient

Land Use Code	Subarea, in sq. feet	Total Subarea acres	Runoff Coefficient	Kb
P	19,681	0.45	0.85	0.04

Total Area = 0.45 acres
Weighted C = 0.85
Weighted Kb = 0.04

Time of Concentration

Flood Control District of Maricopa County method

U/S Elev =	1382.38	feet				
D/S Elev =	1378.41	feet				
Length =	320.09	feet	0.061 miles	**T_c =**	5.0	minutes
Slope =	0.0124	ft/ft	65.49 ft/mile	**Intensity =**	4.86	in/hr
Kb =	0.04					
$i_{assumed}$ =	4.86	in/hr		**Peak Q =**	1.9	cfs

Catch Basin Sta: 166+87 West NEW CB

Runoff Coefficient

Surface Type	Subarea, in sq. feet	Total Subarea acres	Runoff Coefficient	Kb
P	25,685	0.59	0.85	0.04

Total Area = 0.59 acres
Weighted C = 0.85
Weighted Kb = 0.04

Time of Concentration

Flood Control District of Maricopa County method

U/S Elev =	1380.83	feet				
D/S Elev =	1376.44	feet				
Length =	395	feet	0.075 miles	**T_c =**	5.6	minutes
Slope =	0.0111	ft/ft	58.64 ft/mile	**Intensity =**	4.71	in/hr
Kb =	0.04					
$i_{assumed}$ =	4.71	in/hr		**Peak Q =**	2.4	cfs

Client	Town of Queen Creek				
Project Name	Power Rd Roadway and Drainage Improvement	Date:	08/18/25	By:	SGG
Storm Frequency	10yr	Date Checked:	08/19/25	By:	ZNW
Calculation	Power Rd Sub-basin Hydrology	Date Revised:	TBD	By:	

Stantec Proj. No. 181711207

Catch Basin Sta: 167+22 East EXIST CB

Runoff Coefficient

Land Use Code	Subarea, in sq. feet	Total Subarea acres	Runoff Coefficient	Kb
P	22,803	0.52	0.85	0.04

Total Area = 0.52 acres
Weighted C = 0.85
Weighted Kb = 0.04

Time of Concentration

Flood Control District of Maricopa County method

U/S Elev =	1379.51 feet					
D/S Elev =	1375.83 feet					
Length =	310 feet	0.059 miles	**T_c =**	5.0		minutes
Slope =	0.0119 ft/ft	62.82 ft/mile	**Intensity =**	4.86		in/hr
Kb =	0.04					
$i_{assumed}$ =	4.86 in/hr		**Peak Q =**	2.2		cfs

Catch Basin Sta: 172+75 West NEW CB

Runoff Coefficient

Land Use Code	Subarea, in sq. feet	Total Subarea acres	Runoff Coefficient	Kb
P	33,738	0.77	0.85	0.04

Total Area = 0.77 acres
Weighted C = 0.85
Weighted Kb = 0.04

Time of Concentration

Flood Control District of Maricopa County method

U/S Elev =	1376.60 feet					
D/S Elev =	1370.85 feet					
Length =	549.50 feet	0.104 miles	**T_c =**	6.8		minutes
Slope =	0.0105 ft/ft	55.29 ft/mile	**Intensity =**	4.42		in/hr
Kb =	0.04					
$i_{assumed}$ =	4.42 in/hr		**Peak Q =**	2.9		cfs

Client	Town of Queen Creek				
Project Name	Power Rd Roadway and Drainage Improvement	Date:	08/18/25	By:	SGG
Storm Frequency	10yr	Date Checked:	08/19/25	By:	ZNW
Calculation	Power Rd Sub-basin Hydrology	Date Revised:	TBD	By:	

Stantec Proj. No. 181711207

Catch Basin Sta: 172+75 East NEW CB

Runoff Coefficient

Land Use Code	Subarea, in sq. feet	Total Subarea acres	Runoff Coefficient	Kb
P	33,095	0.76	0.85	0.04

Total Area = 0.76 acres
Weighted C = 0.85
Weighted Kb = 0.04

Time of Concentration

Flood Control District of Maricopa County method

U/S Elev =	1376.17	feet				
D/S Elev =	1370.54	feet				
Length =	519	feet	0.098 miles	**T_c =**	6.5	minutes
Slope =	0.0108	ft/ft	57.24 ft/mile	**Intensity =**	4.49	in/hr
Kb =	0.04					
$i_{assumed}$ =	4.49	in/hr		**Peak Q =**	2.9	cfs

Catch Basin Sta: 176+29 East NEW CB

Runoff Coefficient

Land Use Code	Subarea, in sq. feet	Total Subarea acres	Runoff Coefficient	Kb
P	22,132	0.51	0.85	0.04

Total Area = 0.51 acres
Weighted C = 0.85
Weighted Kb = 0.04

Time of Concentration

Flood Control District of Maricopa County method

U/S Elev =	1371.41	feet				
D/S Elev =	1367.43	feet				
Length =	381.39	feet	0.072 miles	**T_c =**	5.7	minutes
Slope =	0.0104	ft/ft	55.10 ft/mile	**Intensity =**	4.70	in/hr
Kb =	0.04					
$i_{assumed}$ =	4.7	in/hr		**Peak Q =**	2.0	cfs

Client	Town of Queen Creek				
Project Name	Power Rd Roadway and Drainage Improvement	Date:	08/18/25	By:	SGG
Storm Frequency	10yr	Date Checked:	08/19/25	By:	ZNW
Calculation	Power Rd Sub-basin Hydrology	Date Revised:	TBD	By:	

Stantec Proj. No. 181711207

Catch Basin Sta: 176+32 West NEW CB

Runoff Coefficient

Land Use Code	Subarea, in sq. feet	Total Subarea acres	Runoff Coefficient	Kb
P	21,191	0.49	0.85	0.04

Total Area = 0.49 acres
Weighted C = 0.85
Weighted Kb = 0.04

Time of Concentration

Flood Control District of Maricopa County method

U/S Elev =	1371.41	feet				
D/S Elev =	1367.74	feet				
Length =	372	feet	0.070 miles	**T_c =**	5.7	minutes
Slope =	0.0099	ft/ft	52.07 ft/mile	**Intensity =**	4.69	in/hr
Kb =	0.04					
$i_{assumed}$ =	4.69	in/hr		**Peak Q =**	1.9	cfs

Catch Basin Sta: 180+67 East NEW CB

Runoff Coefficient

Surface Type	Subarea, in sq. feet	Total Subarea acres	Runoff Coefficient	Kb
P	23,509	0.54	0.85	0.04

Total Area = 0.54 acres
Weighted C = 0.85
Weighted Kb = 0.04

Time of Concentration

Flood Control District of Maricopa County method

U/S Elev =	1368.22	feet				
D/S Elev =	1363.74	feet				
Length =	450	feet	0.085 miles	**T_c =**	6.3	minutes
Slope =	0.0100	ft/ft	52.58 ft/mile	**Intensity =**	4.55	in/hr
Kb =	0.04					
$i_{assumed}$ =	4.55	in/hr		**Peak Q =**	2.1	cfs

Client	Town of Queen Creek				
Project Name	Power Rd Roadway and Drainage Improvement	Date:	08/18/25	By:	SGG
Storm Frequency	10yr	Date Checked:	08/19/25	By:	ZNW
Calculation	Power Rd Sub-basin Hydrology	Date Revised:	TBD	By:	

Stantec Proj. No. 181711207

Catch Basin Sta: 180+67 West NEW CB

Runoff Coefficient

Surface Type	Subarea, in sq. feet	Total Subarea acres	Runoff Coefficient	Kb
P	31,337	0.72	0.85	0.04

Total Area = 0.72 acres
Weighted C = 0.85
Weighted Kb = 0.04

Time of Concentration

Flood Control District of Maricopa County method

U/S Elev =	1368.29 feet					
D/S Elev =	1363.86 feet					
Length =	453.78 feet	0.086 miles	**T_c =**	6.3		minutes
Slope =	0.0098 ft/ft	51.58 ft/mile	**Intensity =**	4.55		in/hr
Kb =	0.04					
$i_{assumed}$ =	4.55 in/hr		**Peak Q =**	2.8		cfs

Catch Basin Sta: 186+15 West NEW CB

Runoff Coefficient

Surface Type	Subarea, in sq. feet	Total Subarea acres	Runoff Coefficient	Kb
P	29,338	0.67	0.85	0.04

Total Area = 0.67 acres
Weighted C = 0.85
Weighted Kb = 0.04

Time of Concentration

Flood Control District of Maricopa County method

U/S Elev =	1364.03 feet					
D/S Elev =	1360.30 feet					
Length =	495.28 feet	0.094 miles	**T_c =**	7.3		minutes
Slope =	0.0075 ft/ft	39.76 ft/mile	**Intensity =**	4.32		in/hr
Kb =	0.04					
$i_{assumed}$ =	4.32 in/hr		**Peak Q =**	2.5		cfs

Client	Town of Queen Creek				
Project Name	Power Rd Roadway and Drainage Improvement	Date:	08/18/25	By:	SGG
Storm Frequency	10yr	Date Checked:	08/19/25	By:	ZNW
Calculation	Power Rd Sub-basin Hydrology	Date Revised:	TBD	By:	

Stantec Proj. No. 181711207

Catch Basin Sta: 186+16 East NEW CB

Runoff Coefficient

Surface Type	Subarea, in sq. feet	Total Subarea acres	Runoff Coefficient	Kb
P	24,568	0.56	0.85	0.04

Total Area = 0.56 acres
Weighted C = 0.85
Weighted Kb = 0.04

Time of Concentration

Flood Control District of Maricopa County method

U/S Elev =	1364.03 feet					
D/S Elev =	1360.03 feet					
Length =	502.66 feet	0.095 miles	**T_c =**	7.3		minutes
Slope =	0.0080 ft/ft	42.02 ft/mile	**Intensity =**	4.33		in/hr
Kb =	0.04					
$i_{assumed}$ =	4.33 in/hr		**Peak Q =**	2.1		cfs

Catch Basin Sta: 191+31 West New CB

Runoff Coefficient

Surface Type	Subarea, in sq. feet	Total Subarea acres	Runoff Coefficient	Kb
P	28,894	0.66	0.85	0.04

Total Area = 0.66 acres
Weighted C = 0.85
Weighted Kb = 0.04

Time of Concentration

Flood Control District of Maricopa County method

U/S Elev =	1360.79 feet					
D/S Elev =	1357.66 feet					
Length =	535.83 feet	0.101 miles	**T_c =**	8.4		minutes
Slope =	0.0058 ft/ft	30.83 ft/mile	**Intensity =**	4.09		in/hr
Kb =	0.04					
$i_{assumed}$ =	4.09 in/hr		**Peak Q =**	2.3		cfs

Client	Town of Queen Creek				
Project Name	Power Rd Roadway and Drainage Improvement	Date:	08/18/25	By:	SGG
Storm Frequency	10yr	Date Checked:	08/19/25	By:	ZNW
Calculation	Power Rd Sub-basin Hydrology	Date Revised:	TBD	By:	

Stantec Proj. No. 181711207

Catch Basin Sta: 191+41 East — New Cb

Runoff Coefficient

Surface Type	Subarea, in sq. feet	Total Subarea acres	Runoff Coefficient	Kb
P	24,636	0.57	0.85	0.04

Total Area = 0.57 acres
Weighted C = 0.85
Weighted Kb = 0.04

Time of Concentration

Flood Control District of Maricopa County method

U/S Elev =	1360.79 feet					
D/S Elev =	1357.44 feet					
Length =	542.26 feet	0.103 miles	**T_c =**	8.3		minutes
Slope =	0.0062 ft/ft	32.64 ft/mile	**Intensity =**	4.11		in/hr
Kb =	0.04					
$i_{assumed}$ =	4.11 in/hr		**Peak Q =**	2.0		cfs

Catch Basin Sta: 193+98 West — New CB

Runoff Coefficient

Surface Type	Subarea, in sq. feet	Total Subarea acres	Runoff Coefficient	Kb
P	20,664	0.47	0.85	0.04

Total Area = 0.47 acres
Weighted C = 0.85
Weighted Kb = 0.04

Time of Concentration

Flood Control District of Maricopa County method

U/S Elev =	1358.13 feet					
D/S Elev =	1356.47 feet					
Length =	283.92 feet	0.054 miles	**T_c =**	5.9		minutes
Slope =	0.0059 ft/ft	30.91 ft/mile	**Intensity =**	4.65		in/hr
Kb =	0.04					
$i_{assumed}$ =	4.65 in/hr		**Peak Q =**	1.9		cfs

Client	Town of Queen Creek				
Project Name	Power Rd Roadway and Drainage Improvement	Date:	08/18/25	By:	SGG
Storm Frequency	10yr	Date Checked:	08/19/25	By:	ZNW
Calculation	Power Rd Sub-basin Hydrology	Date Revised:	TBD	By:	

Stantec Proj. No. 181711207

Catch Basin Sta: 194+00 East — New CB

Runoff Coefficient

Surface Type	Subarea, in sq. feet	Total Subarea acres	Runoff Coefficient	Kb
P	17,355	0.40	0.85	0.04

Total Area = 0.40 acres
Weighted C = 0.85
Weighted Kb = 0.04

Time of Concentration

Flood Control District of Maricopa County method

U/S Elev =	1358.13 feet					
D/S Elev =	1356.48 feet					
Length =	291.04 feet	0.055 miles	**T_c =**	6.1		minutes
Slope =	0.0057 ft/ft	29.97 ft/mile	**Intensity =**	4.60		in/hr
Kb =	0.04					
$i_{assumed}$ =	4.6 in/hr		**Peak Q =**	1.6		cfs

Catch Basin Sta: 196+50 East — NEW SCUPPER

Runoff Coefficient

Surface Type	Subarea, in sq. feet	Total Subarea acres	Runoff Coefficient	Kb
P	10,252	0.24	0.85	0.04

Total Area = 0.24 acres
Weighted C = 0.85
Weighted Kb = 0.04

Time of Concentration

Flood Control District of Maricopa County method

U/S Elev =	1356.93 feet					
D/S Elev =	1355.74 feet					
Length =	178.84 feet	0.034 miles	**T_c =**	5.0		minutes
Slope =	0.0067 ft/ft	35.13 ft/mile	**Intensity =**	4.86		in/hr
Kb =	0.04					
$i_{assumed}$ =	4.86 in/hr		**Peak Q =**	1.0		cfs

Client	Town of Queen Creek				
Project Name	Power Rd Roadway and Drainage Improvement	Date:	08/18/25	By:	SGG
Storm Frequency	10yr	Date Checked:	08/19/25	By:	ZNW
Calculation	Power Rd Sub-basin Hydrology	Date Revised:	TBD	By:	

Stantec Proj. No. 181711207

Catch Basin Sta: 199+50 East **NEW SCUPPER**

Runoff Coefficient

Surface Type	Subarea, in sq. feet	Total Subarea acres	Runoff Coefficient	Kb
P	14,000	0.32	0.85	0.04

Total Area = 0.32 acres
Weighted C = 0.85
Weighted Kb = 0.04

Time of Concentration

Flood Control District of Maricopa County method

U/S Elev =	1356.46	feet				
D/S Elev =	1355.49	feet				
Length =	226.13	feet	0.043 miles	**T_c =**	5.8	minutes
Slope =	0.0043	ft/ft	22.65 ft/mile	**Intensity =**	4.65	in/hr
Kb =	0.04					
$i_{assumed}$ =	4.65	in/hr		**Peak Q =**	1.3	cfs

Client	Town of Queen Creek				
Project Name	Power Rd Roadway and Drainage Improvement	Date:	08/11/25	By:	SGG
Storm Frequency	100yr	Date Checked:	08/11/25	By:	ZNW
Calculation	Power Rd Sub-basin Hydrology	Date Revised:		By:	

Stantec Proj. No. 181711207

Catch Basin Sta: 158+15 East Exist CB

Runoff Coefficient

Land Use Code	Subarea, in sq. feet	Total Subarea acres	Runoff Coefficient	Kb
P	29,498	0.677	0.95	0.04

Total Area = 0.677 acres
Weighted C = 0.945
Weighted Kb = 0.0411

Time of Concentration

Flood Control District of Maricopa County method

U/S Elev =	1390.17 feet				
D/S Elev =	1384.42 feet				
Length =	394.58 feet	0.075 miles	**T_c =**	5.0	minutes
Slope =	0.01456 ft/ft	76.89 ft/mile	**Intensity =**	7.67	in/hr
Kb =	0.04				
$i_{assumed}$ =	7.67 in/hr		**Peak Q =**	4.91	cfs

Catch Basin Sta: 158+15 West EXIST CB

Runoff Coefficient

Land Use Code	Subarea, in sq. feet	Total Subarea acres	Runoff Coefficient	Kb
P	32,383	0.7434	0.95	0.0408

Total Area = 0.7434 acres
Weighted C = 0.945
Weighted Kb = 0.04

Time of Concentration

Flood Control District of Maricopa County method

U/S Elev =	1390.17 feet				
D/S Elev =	1384.41 feet				
Length =	408.09 feet	0.077 miles	**T_c =**	5.0	minutes
Slope =	0.014110 ft/ft	74.50 ft/mile	**Intensity =**	7.67	in/hr
Kb =	0.0408				
$i_{assumed}$ =	7.67 in/hr		**Peak Q =**	5.39	cfs

Client	Town of Queen Creek				
Project Name	Power Rd Roadway and Drainage Improvement	Date:	08/11/25	By:	SGG
Storm Frequency	100yr	Date Checked:	08/11/25	By:	ZNW
Calculation	Power Rd Sub-basin Hydrology	Date Revised:		By:	

Stantec Proj. No. 181711207

Catch Basin Sta: 161+34 East — EXIST SCUPPER

Runoff Coefficient

Land Use Code	Subarea, in sq. feet	Total Subarea acres	Runoff Coefficient	Kb
P	22,260	0.51	0.95	0.04

Total Area = 0.51 acres
Weighted C = 0.95
Weighted Kb = 0.04

Time of Concentration

Flood Control District of Maricopa County method

U/S Elev =	1385.39 feet				
D/S Elev =	1381.37 feet				
Length =	351.72 feet	0.067 miles	**T_c =**	5.0	minutes
Slope =	0.0114 ft/ft	60.35 ft/mile	**Intensity =**	7.67	in/hr
Kb =	0.04				
$i_{assumed}$ =	7.67 in/hr		**Peak Q =**	3.70	cfs

Catch Basin Sta: 163+08 West — NEW CB

Runoff Coefficient

Surface Type	Subarea, in sq. feet	Total Subarea acres	Runoff Coefficient	Kb
P	29,860	0.69	0.95	0.04

Total Area = 0.69 acres
Weighted C = 0.95
Weighted Kb = 0.04

Time of Concentration

Flood Control District of Maricopa County method

U/S Elev =	1385.39 feet				
D/S Elev =	1380.26 feet				
Length =	514.84 feet	0.098 miles	**T_c =**	5.5	minutes
Slope =	0.0100 ft/ft	52.57 ft/mile	**Intensity =**	7.46	in/hr
Kb =	0.04				
$i_{assumed}$ =	7.46 in/hr		**Peak Q =**	4.83	cfs

Client	Town of Queen Creek				
Project Name	Power Rd Roadway and Drainage Improvement	Date:	08/11/25	By:	SGG
Storm Frequency	100yr	Date Checked:	08/11/25	By:	ZNW
Calculation	Power Rd Sub-basin Hydrology	Date Revised:		By:	

Stantec Proj. No. 181711207

Catch Basin Sta: 164+39 East EXIST CB

Runoff Coefficient

Land Use Code	Subarea, in sq. feet	Total Subarea acres	Runoff Coefficient	Kb
P	19,681	0.45	0.95	0.04

Total Area = 0.45 acres
Weighted C = 0.95
Weighted Kb = 0.04

Time of Concentration

Flood Control District of Maricopa County method

U/S Elev =	1382.38	feet				
D/S Elev =	1378.41	feet				
Length =	320.09	feet	0.061 miles	**T_c =**	5.0	minutes
Slope =	0.0124	ft/ft	65.49 ft/mile	**Intensity =**	7.67	in/hr
Kb =	0.04					
$i_{assumed}$ =	7.67	in/hr		**Peak Q =**	3.27	cfs

Catch Basin Sta: 166+87 West NEW CB

Runoff Coefficient

Surface Type	Subarea, in sq. feet	Total Subarea acres	Runoff Coefficient	Kb
P	25,685	0.59	0.95	0.04

Total Area = 0.59 acres
Weighted C = 0.95
Weighted Kb = 0.04

Time of Concentration

Flood Control District of Maricopa County method

U/S Elev =	1380.83	feet				
D/S Elev =	1376.44	feet				
Length =	395.27	feet	0.075 miles	**T_c =**	5.0	minutes
Slope =	0.0111	ft/ft	58.64 ft/mile	**Intensity =**	7.67	in/hr
Kb =	0.04					
$i_{assumed}$ =	7.67	in/hr		**Peak Q =**	4.27	cfs

Client	Town of Queen Creek				
Project Name	Power Rd Roadway and Drainage Improvement	Date:	08/11/25	By:	SGG
Storm Frequency	100yr	Date Checked:	08/11/25	By:	ZNW
Calculation	Power Rd Sub-basin Hydrology	Date Revised:		By:	

Stantec Proj. No. 181711207

Catch Basin Sta: 167+22 East EXIST CB

Runoff Coefficient

Land Use Code	Subarea, in sq. feet	Total Subarea acres	Runoff Coefficient	Kb
P	22,803	0.52	0.95	0.04

Total Area = 0.52 acres
Weighted C = 0.95
Weighted Kb = 0.04

Time of Concentration

Flood Control District of Maricopa County method

U/S Elev =	1379.51 feet				
D/S Elev =	1375.83 feet				
Length =	309.74 feet	0.059 miles	**T_c =**	5.0	minutes
Slope =	0.0119 ft/ft	62.82 ft/mile	**Intensity =**	7.67	in/hr
Kb =	0.04				
$i_{assumed}$ =	7.67 in/hr		**Peak Q =**	3.79	cfs

Catch Basin Sta: 172+75 West NEW CB

Runoff Coefficient

Land Use Code	Subarea, in sq. feet	Total Subarea acres	Runoff Coefficient	Kb
P	33,738	0.77	0.95	0.04

Total Area = 0.77 acres
Weighted C = 0.95
Weighted Kb = 0.04

Time of Concentration

Flood Control District of Maricopa County method

U/S Elev =	1376.60 feet				
D/S Elev =	1370.85 feet				
Length =	549.50 feet	0.104 miles	**T_c =**	5.6	minutes
Slope =	0.0105 ft/ft	55.29 ft/mile	**Intensity =**	7.43	in/hr
Kb =	0.04				
$i_{assumed}$ =	7.43 in/hr		**Peak Q =**	5.44	cfs

Client	Town of Queen Creek				
Project Name	Power Rd Roadway and Drainage Improvement	Date:	08/11/25	By:	SGG
Storm Frequency	100yr	Date Checked:	08/11/25	By:	ZNW
Calculation	Power Rd Sub-basin Hydrology	Date Revised:		By:	

Stantec Proj. No. 181711207

Catch Basin Sta: 172+75 East NEW CB

Runoff Coefficient

Land Use Code	Subarea, in sq. feet	Total Subarea acres	Runoff Coefficient	Kb
P	33,095	0.76	0.95	0.04

Total Area = 0.76 acres
Weighted C = 0.95
Weighted Kb = 0.04

Time of Concentration

Flood Control District of Maricopa County method

U/S Elev =	1376.17	feet				
D/S Elev =	1370.54	feet				
Length =	519.35	feet	0.098 miles	T_c =	5.4	minutes
Slope =	0.0108	ft/ft	57.24 ft/mile	Intensity =	7.52	in/hr
Kb =	0.04					
$i_{assumed}$ =	7.52	in/hr		Peak Q =	5.40	cfs

Catch Basin Sta: 176+29 East NEW CB

Runoff Coefficient

Land Use Code	Subarea, in sq. feet	Total Subarea acres	Runoff Coefficient	Kb
P	22,132	0.51	0.95	0.04

Total Area = 0.51 acres
Weighted C = 0.95
Weighted Kb = 0.04

Time of Concentration

Flood Control District of Maricopa County method

U/S Elev =	1371.41	feet				
D/S Elev =	1367.43	feet				
Length =	381.39	feet	0.072 miles	T_c =	5.0	minutes
Slope =	0.0104	ft/ft	55.10 ft/mile	Intensity =	7.67	in/hr
Kb =	0.04					
$i_{assumed}$ =	7.67	in/hr		Peak Q =	3.68	cfs

Client	Town of Queen Creek				
Project Name	Power Rd Roadway and Drainage Improvement	Date:	08/11/25	By:	SGG
Storm Frequency	100yr	Date Checked:	08/11/25	By:	ZNW
Calculation	Power Rd Sub-basin Hydrology	Date Revised:		By:	

Stantec Proj. No. 181711207

Catch Basin Sta: 176+32 West NEW CB

Runoff Coefficient

Surface Type	Subarea, in sq. feet	Total Subarea acres	Runoff Coefficient	Kb
P	21,191	0.49	0.95	0.04

Total Area = 0.49 acres
Weighted C = 0.95
Weighted Kb = 0.04

Time of Concentration

Flood Control District of Maricopa County method

U/S Elev =	1371.41 feet					
D/S Elev =	1367.74 feet					
Length =	372.18 feet	0.070 miles	**T_c =**	5.0		minutes
Slope =	0.0099 ft/ft	52.07 ft/mile	**Intensity =**	7.67		in/hr
Kb =	0.04					
$i_{assumed}$ =	7.67 in/hr		**Peak Q =**	3.5		cfs

Catch Basin Sta: 180+67 East NEW CB

Runoff Coefficient

Surface Type	Subarea, in sq. feet	Total Subarea acres	Runoff Coefficient	Kb
P	23,509	0.54	0.95	0.04

Total Area = 0.54 acres
Weighted C = 0.95
Weighted Kb = 0.04

Time of Concentration

Flood Control District of Maricopa County method

U/S Elev =	1368.22 feet					
D/S Elev =	1363.74 feet					
Length =	449.89 feet	0.085 miles	**T_c =**	5.2		minutes
Slope =	0.0100 ft/ft	52.58 ft/mile	**Intensity =**	7.59		in/hr
Kb =	0.04					
$i_{assumed}$ =	7.59 in/hr		**Peak Q =**	3.87		cfs

Client	Town of Queen Creek				
Project Name	Power Rd Roadway and Drainage Improvement	Date:	08/11/25	By:	SGG
Storm Frequency	100yr	Date Checked:	08/11/25	By:	ZNW
Calculation	Power Rd Sub-basin Hydrology	Date Revised:		By:	

Stantec Proj. No. 181711207

Catch Basin Sta: 180+67 West NEW CB

Runoff Coefficient

Surface Type	Subarea, in sq. feet	Total Subarea acres	Runoff Coefficient	Kb
P	31,337	0.72	0.95	0.04

Total Area = 0.72 acres
Weighted C = 0.95
Weighted Kb = 0.04

Time of Concentration

Flood Control District of Maricopa County method

U/S Elev =	1368.29	feet				
D/S Elev =	1363.86	feet				
Length =	453.78	feet	0.086 miles	**T_c =**	5.2	minutes
Slope =	0.0098	ft/ft	51.58 ft/mile	**Intensity =**	7.59	in/hr
Kb =	0.04					
$i_{assumed}$ =	7.59	in/hr		**Peak Q =**	5.16	cfs

Catch Basin Sta: 186+15 West NEW CB

Runoff Coefficient

Surface Type	Subarea, in sq. feet	Total Subarea acres	Runoff Coefficient	Kb
P	29,338	0.67	0.95	0.04

Total Area = 0.67 acres
Weighted C = 0.95
Weighted Kb = 0.04

Time of Concentration

Flood Control District of Maricopa County method

U/S Elev =	1364.03	feet				
D/S Elev =	1360.30	feet				
Length =	495.28	feet	0.094 miles	**T_c =**	6.0	minutes
Slope =	0.0075	ft/ft	39.76 ft/mile	**Intensity =**	7.29	in/hr
Kb =	0.04					
$i_{assumed}$ =	7.29	in/hr		**Peak Q =**	4.64	cfs

Client	Town of Queen Creek				
Project Name	Power Rd Roadway and Drainage Improvement	Date:	08/11/25	By:	SGG
Storm Frequency	100yr	Date Checked:	08/11/25	By:	ZNW
Calculation	Power Rd Sub-basin Hydrology	Date Revised:		By:	

Stantec Proj. No. 181711207

Catch Basin Sta: 186+16 EAST NEW CB

Runoff Coefficient

Surface Type	Subarea, in sq. feet	Total Subarea acres	Runoff Coefficient	Kb
P	24,568	0.56	0.95	0.04

Total Area = 0.56 acres
Weighted C = 0.95
Weighted Kb = 0.04

Time of Concentration

Flood Control District of Maricopa County method

U/S Elev =	1364.03 feet				
D/S Elev =	1360.03 feet				
Length =	502.66 feet	0.095 miles	**T_c =**	6.0	minutes
Slope =	0.0080 ft/ft	42.02 ft/mile	**Intensity =**	7.30	in/hr
Kb =	0.04				
$i_{assumed}$ =	7.30 in/hr		**Peak Q =**	3.89	cfs

Catch Basin Sta: 191+31 WEST NEW CB

Runoff Coefficient

Surface Type	Subarea, in sq. feet	Total Subarea acres	Runoff Coefficient	Kb
P	28,894	0.66	0.95	0.04

Total Area = 0.66 acres
Weighted C = 0.95
Weighted Kb = 0.04

Time of Concentration

Flood Control District of Maricopa County method

U/S Elev =	1360.79 feet				
D/S Elev =	1357.66 feet				
Length =	535.83 feet	0.101 miles	**T_c =**	6.8	minutes
Slope =	0.0058 ft/ft	30.83 ft/mile	**Intensity =**	6.98	in/hr
Kb =	0.04				
$i_{assumed}$ =	6.98 in/hr		**Peak Q =**	4.37	cfs

Client	Town of Queen Creek				
Project Name	Power Rd Roadway and Drainage Improvement	Date:	08/11/25	By:	SGG
Storm Frequency	100yr	Date Checked:	08/11/25	By:	ZNW
Calculation	Power Rd Sub-basin Hydrology	Date Revised:		By:	

Stantec Proj. No. 181711207

Catch Basin Sta: 191+41 EAST NEW CB

Runoff Coefficient

Surface Type	Subarea, in sq. feet	Total Subarea acres	Runoff Coefficient	Kb
P	24,636	0.57	0.95	0.04

Total Area = 0.57 acres
Weighted C = 0.95
Weighted Kb = 0.04

Time of Concentration

Flood Control District of Maricopa County method

U/S Elev =	1360.79	feet				
D/S Elev =	1357.44	feet				
Length =	542.26	feet	0.103 miles	**T_c =**	6.8	minutes
Slope =	0.0062	ft/ft	32.64 ft/mile	**Intensity =**	6.99	in/hr
Kb =	0.04					
$i_{assumed}$ =	6.99	in/hr		**Peak Q =**	3.74	cfs

Catch Basin Sta: 193+98 WEST NEW CB

Runoff Coefficient

Surface Type	Subarea, in sq. feet	Total Subarea acres	Runoff Coefficient	Kb
P	20,664	0.47	0.95	0.04

Total Area = 0.47 acres
Weighted C = 0.95
Weighted Kb = 0.04

Time of Concentration

Flood Control District of Maricopa County method

U/S Elev =	1358.13	feet				
D/S Elev =	1356.47	feet				
Length =	283.92	feet	0.054 miles	**T_c =**	5.0	minutes
Slope =	0.0059	ft/ft	30.91 ft/mile	**Intensity =**	7.67	in/hr
Kb =	0.04					
$i_{assumed}$ =	7.67	in/hr		**Peak Q =**	3.44	cfs

Client	Town of Queen Creek				
Project Name	Power Rd Roadway and Drainage Improvement	Date:	08/11/25	By:	SGG
Storm Frequency	100yr	Date Checked:	08/11/25	By:	ZNW
Calculation	Power Rd Sub-basin Hydrology	Date Revised:		By:	

Stantec Proj. No. 181711207

Catch Basin Sta: 194+00 EAST NEW CB

Runoff Coefficient

Surface Type	Subarea, in sq. feet	Total Subarea acres	Runoff Coefficient	Kb
P	17,355	0.40	0.95	0.04

Total Area = 0.40 acres
Weighted C = 0.95
Weighted Kb = 0.04

Time of Concentration

Flood Control District of Maricopa County method

U/S Elev =	1358.13	feet				
D/S Elev =	1356.48	feet				
Length =	291.04	feet	0.055 miles	**T_c =**	5.0	minutes
Slope =	0.0057	ft/ft	29.97 ft/mile	**Intensity =**	7.67	in/hr
Kb =	0.04					
$i_{assumed}$ =	7.67	in/hr		**Peak Q =**	2.89	cfs

Catch Basin Sta: 196+50 EAST NEW SCUPPER

Runoff Coefficient

Surface Type	Subarea, in sq. feet	Total Subarea acres	Runoff Coefficient	Kb
P	10,252	0.24	0.95	0.04

Total Area = 0.24 acres
Weighted C = 0.95
Weighted Kb = 0.04

Time of Concentration

Flood Control District of Maricopa County method

U/S Elev =	1356.93	feet				
D/S Elev =	1355.74	feet				
Length =	178.84	feet	0.034 miles	**T_c =**	5.0	minutes
Slope =	0.0067	ft/ft	35.13 ft/mile	**Intensity =**	7.67	in/hr
Kb =	0.04					
$i_{assumed}$ =	7.67	in/hr		**Peak Q =**	1.71	cfs

Client	Town of Queen Creek				
Project Name	Power Rd Roadway and Drainage Improvement	Date:	08/11/25	By:	SGG
Storm Frequency	100yr	Date Checked:	08/11/25	By:	ZNW
Calculation	Power Rd Sub-basin Hydrology	Date Revised:		By:	

Stantec Proj. No. 181711207

Catch Basin Sta: 199+50 EAST NEW SCUPPER

Runoff Coefficient

Surface Type	Subarea, in sq. feet	Total Subarea acres	Runoff Coefficient	Kb
P	14,000	0.32	0.95	0.04

Total Area = 0.32 acres
Weighted C = 0.95
Weighted Kb = 0.04

Time of Concentration

Flood Control District of Maricopa County method

U/S Elev =	1356.46	feet				
D/S Elev =	1355.49	feet				
Length =	226.13	feet	0.043 miles	**T_c =**	5.0	minutes
Slope =	0.0043	ft/ft	22.65 ft/mile	**Intensity =**	7.67	in/hr
Kb =	0.04					
$i_{assumed}$ =	7.67	in/hr		**Peak Q =**	2.33	cfs

10-Year

Worksheet for Curb Inlet On Grade - 158+15 East (Existing)

Project Description	
Solve For	Efficiency

Input Data	
Discharge	2.80 cfs
Slope	0.014 ft/ft
Gutter Width	2.00 ft
Gutter Cross Slope	0.030 ft/ft
Road Cross Slope	0.020 ft/ft
Roughness Coefficient	0.015
Curb Opening Length	10.4 ft
Local Depression	2.0 in
Local Depression Width	18.0 in

Results	
Efficiency	84.01 %
Intercepted Flow	2.35 cfs
Bypass Flow	0.45 cfs
Spread	9.6 ft
Depth	2.5 in
Flow Area	0.9 ft²
Gutter Depression	0.2 in
Total Depression	2.2 in
Velocity	2.97 ft/s
Equivalent Cross Slope	0.065 ft/ft
Length Factor	0.639
Total Interception Length	16.3 ft

10-Year

Worksheet for Curb Inlet On Grade - 161+34 East (Existing)

Project Description	
Solve For	Efficiency

Input Data	
Discharge	2.60 cfs
Slope	0.010 ft/ft
Gutter Width	2.00 ft
Gutter Cross Slope	0.030 ft/ft
Road Cross Slope	0.020 ft/ft
Roughness Coefficient	0.015
Curb Opening Length	6.4 ft
Local Depression	2.0 in
Local Depression Width	18.0 in

Results	
Efficiency	64.87 %
Intercepted Flow	1.69 cfs
Bypass Flow	0.91 cfs
Spread	9.9 ft
Depth	2.6 in
Flow Area	1.0 ft²
Gutter Depression	0.2 in
Total Depression	2.2 in
Velocity	2.59 ft/s
Equivalent Cross Slope	0.064 ft/ft
Length Factor	0.441
Total Interception Length	14.5 ft

10-Year

Worksheet for Curb Inlet On Grade - 164+39 East (Existing)

Project Description	
Solve For	Efficiency

Input Data	
Discharge	2.90 cfs
Slope	0.010 ft/ft
Gutter Width	2.00 ft
Gutter Cross Slope	0.030 ft/ft
Road Cross Slope	0.020 ft/ft
Roughness Coefficient	0.015
Curb Opening Length	7.2 ft
Local Depression	2.0 in
Local Depression Width	18.0 in

Results	
Efficiency	67.64 %
Intercepted Flow	1.96 cfs
Bypass Flow	0.94 cfs
Spread	10.3 ft
Depth	2.7 in
Flow Area	1.1 ft²
Gutter Depression	0.2 in
Total Depression	2.2 in
Velocity	2.67 ft/s
Equivalent Cross Slope	0.063 ft/ft
Length Factor	0.466
Total Interception Length	15.5 ft

10-Year

Worksheet for Curb Inlet On Grade - 167+22 East (existing)

Project Description	
Solve For	Efficiency

Input Data	
Discharge	3.20 cfs
Slope	0.010 ft/ft
Gutter Width	2.00 ft
Gutter Cross Slope	0.030 ft/ft
Road Cross Slope	0.020 ft/ft
Roughness Coefficient	0.015
Curb Opening Length	7.2 ft
Local Depression	2.0 in
Local Depression Width	18.0 in

Results	
Efficiency	65.37 %
Intercepted Flow	2.09 cfs
Bypass Flow	1.11 cfs
Spread	10.8 ft
Depth	2.8 in
Flow Area	1.2 ft²
Gutter Depression	0.2 in
Total Depression	2.2 in
Velocity	2.69 ft/s
Equivalent Cross Slope	0.061 ft/ft
Length Factor	0.445
Total Interception Length	16.2 ft

10-Year

Worksheet for Curb Inlet On Grade - 172+75 East

Project Description	
Solve For	Efficiency

Input Data	
Discharge	4.10 cfs
Slope	0.010 ft/ft
Gutter Width	2.00 ft
Gutter Cross Slope	0.030 ft/ft
Road Cross Slope	0.020 ft/ft
Roughness Coefficient	0.015
Curb Opening Length	13.6 ft
Local Depression	2.0 in
Local Depression Width	18.0 in

Results	
Efficiency	90.52 %
Intercepted Flow	3.71 cfs
Bypass Flow	0.39 cfs
Spread	11.9 ft
Depth	3.1 in
Flow Area	1.4 ft²
Gutter Depression	0.2 in
Total Depression	2.2 in
Velocity	2.88 ft/s
Equivalent Cross Slope	0.058 ft/ft
Length Factor	0.730
Total Interception Length	18.6 ft

10-Year

Worksheet for Curb Inlet On Grade - 176+29 East

Project Description	
Solve For	Efficiency

Input Data	
Discharge	2.50 cfs
Slope	0.010 ft/ft
Gutter Width	2.00 ft
Gutter Cross Slope	0.030 ft/ft
Road Cross Slope	0.020 ft/ft
Roughness Coefficient	0.015
Curb Opening Length	10.4 ft
Local Depression	2.0 in
Local Depression Width	18.0 in

Results	
Efficiency	90.44 %
Intercepted Flow	2.26 cfs
Bypass Flow	0.24 cfs
Spread	9.7 ft
Depth	2.6 in
Flow Area	1.0 ft²
Gutter Depression	0.2 in
Total Depression	2.2 in
Velocity	2.58 ft/s
Equivalent Cross Slope	0.065 ft/ft
Length Factor	0.729
Total Interception Length	14.3 ft

10-Year

Worksheet for Curb Inlet In Sag - 180+67 East

Project Description	
Solve For	Spread

Input Data		
Discharge	2.40	cfs
Gutter Width	2.00	ft
Gutter Cross Slope	0.030	ft/ft
Road Cross Slope	0.020	ft/ft
Curb Opening Length	10.4	ft
Opening Height	0.5	ft
Curb Throat Type	Horizontal	
Local Depression	2.0	in
Local Depression Width	18.0	in
Throat Incline Angle	90.00	degrees

Results		
Spread	8.9	ft
Depth	2.4	in
Gutter Depression	0.2	in
Total Depression	2.2	in

10-Year

Worksheet for Curb Inlet On Grade - 186+16 East

Project Description	
Solve For	Efficiency

Input Data	
Discharge	2.10 cfs
Slope	0.007 ft/ft
Gutter Width	2.00 ft
Gutter Cross Slope	0.030 ft/ft
Road Cross Slope	0.020 ft/ft
Roughness Coefficient	0.015
Curb Opening Length	10.4 ft
Local Depression	2.0 in
Local Depression Width	18.0 in

Results	
Efficiency	97.67 %
Intercepted Flow	2.05 cfs
Bypass Flow	0.05 cfs
Spread	9.8 ft
Depth	2.6 in
Flow Area	1.0 ft²
Gutter Depression	0.2 in
Total Depression	2.2 in
Velocity	2.15 ft/s
Equivalent Cross Slope	0.065 ft/ft
Length Factor	0.876
Total Interception Length	11.9 ft

10-Year

Worksheet for Curb Inlet On Grade - 191+41 East

Project Description	
Solve For	Efficiency

Input Data	
Discharge	2.10 cfs
Slope	0.006 ft/ft
Gutter Width	2.00 ft
Gutter Cross Slope	0.030 ft/ft
Road Cross Slope	0.020 ft/ft
Roughness Coefficient	0.015
Curb Opening Length	10.4 ft
Local Depression	2.0 in
Local Depression Width	18.0 in

Results	
Efficiency	99.10 %
Intercepted Flow	2.08 cfs
Bypass Flow	0.02 cfs
Spread	10.3 ft
Depth	2.7 in
Flow Area	1.1 ft²
Gutter Depression	0.2 in
Total Depression	2.2 in
Velocity	1.96 ft/s
Equivalent Cross Slope	0.063 ft/ft
Length Factor	0.927
Total Interception Length	11.2 ft

10-Year

Worksheet for Curb Inlet In Sag - 194+00 East

Project Description	
Solve For	Spread

Input Data		
Discharge	1.90	cfs
Gutter Width	2.00	ft
Gutter Cross Slope	0.030	ft/ft
Road Cross Slope	0.020	ft/ft
Curb Opening Length	8.0	ft
Opening Height	0.5	ft
Curb Throat Type	Horizontal	
Local Depression	2.0	in
Local Depression Width	18.0	in
Throat Incline Angle	90.00	degrees

Results		
Spread	8.6	ft
Depth	2.3	in
Gutter Depression	0.2	in
Total Depression	2.2	in

10-Year

Worksheet for Curb Inlet In Sag - 196+50 East

Project Description	
Solve For	Spread

Input Data	
Discharge	1.00 cfs
Gutter Width	2.00 ft
Gutter Cross Slope	0.030 ft/ft
Road Cross Slope	0.020 ft/ft
Curb Opening Length	3.2 ft
Opening Height	0.5 ft
Curb Throat Type	Horizontal
Local Depression	2.0 in
Local Depression Width	18.0 in
Throat Incline Angle	90.00 degrees

Results	
Spread	8.0 ft
Depth	2.2 in
Gutter Depression	0.2 in
Total Depression	2.2 in

10-Year

Worksheet for Curb Inlet In Sag - 199+50 East

Project Description	
Solve For	Spread

Input Data	
Discharge	1.30 cfs
Gutter Width	2.00 ft
Gutter Cross Slope	0.030 ft/ft
Road Cross Slope	0.020 ft/ft
Curb Opening Length	3.2 ft
Opening Height	0.5 ft
Curb Throat Type	Horizontal
Local Depression	2.0 in
Local Depression Width	18.0 in
Throat Incline Angle	90.00 degrees

Results	
Spread	9.5 ft
Depth	2.5 in
Gutter Depression	0.2 in
Total Depression	2.2 in

10-Year

Worksheet for Curb Inlet On Grade - 158+15 West (Existing)

Project Description	
Solve For	Efficiency

Input Data	
Discharge	3.00 cfs
Slope	0.015 ft/ft
Gutter Width	2.00 ft
Gutter Cross Slope	0.030 ft/ft
Road Cross Slope	0.020 ft/ft
Roughness Coefficient	0.015
Curb Opening Length	7.2 ft
Local Depression	2.0 in
Local Depression Width	18.0 in

Results	
Efficiency	62.27 %
Intercepted Flow	1.87 cfs
Bypass Flow	1.13 cfs
Spread	9.7 ft
Depth	2.6 in
Flow Area	1.0 ft²
Gutter Depression	0.2 in
Total Depression	2.2 in
Velocity	3.11 ft/s
Equivalent Cross Slope	0.065 ft/ft
Length Factor	0.418
Total Interception Length	17.2 ft

10-Year

Worksheet for Grate Inlet On Grade - 163+08 West

Project Description	
Solve For	Efficiency

Input Data	
Discharge	3.80 cfs
Slope	0.009 ft/ft
Gutter Width	2.00 ft
Gutter Cross Slope	0.030 ft/ft
Road Cross Slope	0.020 ft/ft
Roughness Coefficient	0.015
Grate Width	2.00 ft
Grate Length	10.0 ft
Grate Type	P-50 mm x 100 mm (P-1-7/8"-4")
Clogging	50.0 %

Options	
Grate Flow Option	Exclude None

Results	
Efficiency	68.77 %
Intercepted Flow	2.61 cfs
Bypass Flow	1.19 cfs
Spread	11.7 ft
Depth	3.0 in
Flow Area	1.4 ft²
Gutter Depression	0.2 in
Total Depression	0.2 in
Velocity	2.74 ft/s
Splash Over Velocity	8.52 ft/s
Frontal Flow Factor	1.000
Side Flow Factor	0.469
Grate Flow Ratio	0.412
Active Grate Length	5.0 ft

10-Year

Worksheet for Grate Inlet In Sag - 166+87 West

Project Description	
Solve For	Spread

Input Data	
Discharge	3.60 cfs
Gutter Width	2.00 ft
Gutter Cross Slope	0.030 ft/ft
Road Cross Slope	0.020 ft/ft
Grate Width	2.00 ft
Grate Length	10.0 ft
Local Depression	2.0 in
Local Depression Width	18.0 in
Grate Type	P-50 mm x 100 mm (P-1-7/8"-4")
Clogging	50.0 %

Results	
Spread	11.7 ft
Depth	3.1 in
Gutter Depression	0.2 in
Total Depression	2.2 in
Open Grate Area	8.0 ft²
Active Grate Weir Length	12.0 ft

10-Year

Worksheet for Grate Inlet On Grade - 172+75 West

Project Description	
Solve For	Efficiency

Input Data	
Discharge	2.90 cfs
Slope	0.010 ft/ft
Gutter Width	2.00 ft
Gutter Cross Slope	0.030 ft/ft
Road Cross Slope	0.020 ft/ft
Roughness Coefficient	0.015
Grate Width	2.00 ft
Grate Length	10.0 ft
Grate Type	P-50 mm x 100 mm (P-1-7/8"-4")
Clogging	50.0 %

Options	
Grate Flow Option	Exclude None

Results	
Efficiency	71.92 %
Intercepted Flow	2.09 cfs
Bypass Flow	0.81 cfs
Spread	10.4 ft
Depth	2.7 in
Flow Area	1.1 ft²
Gutter Depression	0.2 in
Total Depression	0.2 in
Velocity	2.66 ft/s
Splash Over Velocity	8.52 ft/s
Frontal Flow Factor	1.000
Side Flow Factor	0.482
Grate Flow Ratio	0.458
Active Grate Length	5.0 ft

10-Year

Worksheet for Grate Inlet On Grade - 176+32 West

Project Description	
Solve For	Efficiency

Input Data	
Discharge	2.80 cfs
Slope	0.009 ft/ft
Gutter Width	2.00 ft
Gutter Cross Slope	0.030 ft/ft
Road Cross Slope	0.020 ft/ft
Roughness Coefficient	0.015
Grate Width	2.00 ft
Grate Length	10.0 ft
Grate Type	P-50 mm x 100 mm (P-1-7/8"-4")
Clogging	50.0 %

Options	
Grate Flow Option	Exclude None

Results	
Efficiency	73.10 %
Intercepted Flow	2.05 cfs
Bypass Flow	0.75 cfs
Spread	10.5 ft
Depth	2.8 in
Flow Area	1.1 ft²
Gutter Depression	0.2 in
Total Depression	0.2 in
Velocity	2.51 ft/s
Splash Over Velocity	8.52 ft/s
Frontal Flow Factor	1.000
Side Flow Factor	0.508
Grate Flow Ratio	0.454
Active Grate Length	5.0 ft

10-Year

Worksheet for Grate Inlet In Sag - 180+67 West

Project Description	
Solve For	Spread

Input Data	
Discharge	3.60 cfs
Gutter Width	2.00 ft
Gutter Cross Slope	0.030 ft/ft
Road Cross Slope	0.020 ft/ft
Grate Width	2.00 ft
Grate Length	10.0 ft
Local Depression	2.0 in
Local Depression Width	18.0 in
Grate Type	P-50 mm x 100 mm (P-1-7/8"-4")
Clogging	50.0 %

Results	
Spread	11.7 ft
Depth	3.1 in
Gutter Depression	0.2 in
Total Depression	2.2 in
Open Grate Area	8.0 ft²
Active Grate Weir Length	12.0 ft

10-Year

Worksheet for Grate Inlet On Grade - 186+15 West

Project Description	
Solve For	Efficiency

Input Data	
Discharge	2.50 cfs
Slope	0.007 ft/ft
Gutter Width	2.00 ft
Gutter Cross Slope	0.030 ft/ft
Road Cross Slope	0.020 ft/ft
Roughness Coefficient	0.015
Grate Width	2.00 ft
Grate Length	10.0 ft
Grate Type	P-50 mm x 100 mm (P-1-7/8"-4")
Clogging	50.0 %

Options	
Grate Flow Option	Exclude None

Results	
Efficiency	76.33 %
Intercepted Flow	1.91 cfs
Bypass Flow	0.59 cfs
Spread	10.6 ft
Depth	2.8 in
Flow Area	1.1 ft²
Gutter Depression	0.2 in
Total Depression	0.2 in
Velocity	2.18 ft/s
Splash Over Velocity	8.52 ft/s
Frontal Flow Factor	1.000
Side Flow Factor	0.571
Grate Flow Ratio	0.448
Active Grate Length	5.0 ft

10-Year

Worksheet for Grate Inlet On Grade - 191+31 West

Project Description	
Solve For	Efficiency

Input Data	
Discharge	2.90 cfs
Slope	0.005 ft/ft
Gutter Width	2.00 ft
Gutter Cross Slope	0.030 ft/ft
Road Cross Slope	0.020 ft/ft
Roughness Coefficient	0.015
Grate Width	2.00 ft
Grate Length	10.0 ft
Grate Type	P-50 mm x 100 mm (P-1-7/8"-4")
Clogging	50.0 %

Options	
Grate Flow Option	Exclude None

Results	
Efficiency	76.26 %
Intercepted Flow	2.21 cfs
Bypass Flow	0.69 cfs
Spread	11.8 ft
Depth	3.1 in
Flow Area	1.4 ft²
Gutter Depression	0.2 in
Total Depression	0.2 in
Velocity	2.04 ft/s
Splash Over Velocity	8.52 ft/s
Frontal Flow Factor	1.000
Side Flow Factor	0.599
Grate Flow Ratio	0.408
Active Grate Length	5.0 ft

10-Year

Worksheet for Grate Inlet In Sag - 193+98 West

Project Description	
Solve For	Spread

Input Data	
Discharge	2.60 cfs
Gutter Width	2.00 ft
Gutter Cross Slope	0.030 ft/ft
Road Cross Slope	0.020 ft/ft
Grate Width	2.00 ft
Grate Length	10.0 ft
Local Depression	2.0 in
Local Depression Width	18.0 in
Grate Type	P-50 mm x 100 mm (P-1-7/8"-4")
Clogging	50.0 %

Results	
Spread	9.6 ft
Depth	2.5 in
Gutter Depression	0.2 in
Total Depression	2.2 in
Open Grate Area	8.0 ft²
Active Grate Weir Length	12.0 ft

100-Year

Worksheet for Curb Inlet On Grade - 158+15 East (Existing)

Project Description	
Solve For	Efficiency

Input Data	
Discharge	4.90 cfs
Slope	0.014 ft/ft
Gutter Width	2.00 ft
Gutter Cross Slope	0.030 ft/ft
Road Cross Slope	0.020 ft/ft
Roughness Coefficient	0.015
Curb Opening Length	10.4 ft
Local Depression	2.0 in
Local Depression Width	18.0 in

Results	
Efficiency	67.97 %
Intercepted Flow	3.33 cfs
Bypass Flow	1.57 cfs
Spread	11.9 ft
Depth	3.1 in
Flow Area	1.4 ft²
Gutter Depression	0.2 in
Total Depression	2.2 in
Velocity	3.40 ft/s
Equivalent Cross Slope	0.058 ft/ft
Length Factor	0.469
Total Interception Length	22.2 ft

100-Year

Worksheet for Curb Inlet On Grade - 161+34 East (Existing)

Project Description	
Solve For	Efficiency

Input Data	
Discharge	5.40 cfs
Slope	0.010 ft/ft
Gutter Width	2.00 ft
Gutter Cross Slope	0.030 ft/ft
Road Cross Slope	0.020 ft/ft
Roughness Coefficient	0.015
Curb Opening Length	6.4 ft
Local Depression	2.0 in
Local Depression Width	18.0 in

Results	
Efficiency	46.62 %
Intercepted Flow	2.52 cfs
Bypass Flow	2.88 cfs
Spread	13.1 ft
Depth	3.4 in
Flow Area	1.7 ft²
Gutter Depression	0.2 in
Total Depression	2.2 in
Velocity	3.09 ft/s
Equivalent Cross Slope	0.055 ft/ft
Length Factor	0.294
Total Interception Length	21.7 ft

100-Year

Worksheet for Curb Inlet On Grade - 164+39 East (Existing)

Project Description	
Solve For	Efficiency

Input Data	
Discharge	6.30 cfs
Slope	0.010 ft/ft
Gutter Width	2.00 ft
Gutter Cross Slope	0.030 ft/ft
Road Cross Slope	0.020 ft/ft
Roughness Coefficient	0.015
Curb Opening Length	7.2 ft
Local Depression	2.0 in
Local Depression Width	18.0 in

Results	
Efficiency	47.87 %
Intercepted Flow	3.02 cfs
Bypass Flow	3.28 cfs
Spread	13.9 ft
Depth	3.6 in
Flow Area	2.0 ft²
Gutter Depression	0.2 in
Total Depression	2.2 in
Velocity	3.22 ft/s
Equivalent Cross Slope	0.053 ft/ft
Length Factor	0.304
Total Interception Length	23.7 ft

100-Year

Worksheet for Curb Inlet On Grade - 167+22 East (existing)

Project Description	
Solve For	Efficiency

Input Data	
Discharge	7.20 cfs
Slope	0.010 ft/ft
Gutter Width	2.00 ft
Gutter Cross Slope	0.030 ft/ft
Road Cross Slope	0.020 ft/ft
Roughness Coefficient	0.015
Curb Opening Length	7.2 ft
Local Depression	2.0 in
Local Depression Width	18.0 in

Results	
Efficiency	45.33 %
Intercepted Flow	3.26 cfs
Bypass Flow	3.94 cfs
Spread	14.7 ft
Depth	3.8 in
Flow Area	2.2 ft²
Gutter Depression	0.2 in
Total Depression	2.2 in
Velocity	3.28 ft/s
Equivalent Cross Slope	0.051 ft/ft
Length Factor	0.285
Total Interception Length	25.3 ft

100-Year

Worksheet for Curb Inlet On Grade - 172+75 East

Project Description	
Solve For	Efficiency

Input Data	
Discharge	9.40 cfs
Slope	0.010 ft/ft
Gutter Width	2.00 ft
Gutter Cross Slope	0.030 ft/ft
Road Cross Slope	0.020 ft/ft
Roughness Coefficient	0.015
Curb Opening Length	13.6 ft
Local Depression	2.0 in
Local Depression Width	18.0 in

Results	
Efficiency	67.38 %
Intercepted Flow	6.33 cfs
Bypass Flow	3.07 cfs
Spread	16.3 ft
Depth	4.1 in
Flow Area	2.7 ft²
Gutter Depression	0.2 in
Total Depression	2.2 in
Velocity	3.53 ft/s
Equivalent Cross Slope	0.049 ft/ft
Length Factor	0.463
Total Interception Length	29.4 ft

100-Year

Worksheet for Curb Inlet On Grade - 176+29 East

Project Description	
Solve For	Efficiency

Input Data	
Discharge	7.00 cfs
Slope	0.010 ft/ft
Gutter Width	2.00 ft
Gutter Cross Slope	0.030 ft/ft
Road Cross Slope	0.020 ft/ft
Roughness Coefficient	0.015
Curb Opening Length	10.4 ft
Local Depression	2.0 in
Local Depression Width	18.0 in

Results	
Efficiency	61.68 %
Intercepted Flow	4.32 cfs
Bypass Flow	2.68 cfs
Spread	14.5 ft
Depth	3.7 in
Flow Area	2.1 ft²
Gutter Depression	0.2 in
Total Depression	2.2 in
Velocity	3.32 ft/s
Equivalent Cross Slope	0.052 ft/ft
Length Factor	0.413
Total Interception Length	25.2 ft

100-Year

Worksheet for Curb Inlet In Sag - 180+67 East

Project Description	
Solve For	Spread

Input Data		
Discharge	6.70	cfs
Gutter Width	2.00	ft
Gutter Cross Slope	0.030	ft/ft
Road Cross Slope	0.020	ft/ft
Curb Opening Length	10.4	ft
Opening Height	0.5	ft
Curb Throat Type	Horizontal	
Local Depression	2.0	in
Local Depression Width	18.0	in
Throat Incline Angle	90.00	degrees

Results		
Spread	17.6	ft
Depth	4.5	in
Gutter Depression	0.2	in
Total Depression	2.2	in

100-Year

Worksheet for Curb Inlet On Grade - 186+16 East

Project Description	
Solve For	Efficiency

Input Data	
Discharge	3.90 cfs
Slope	0.007 ft/ft
Gutter Width	2.00 ft
Gutter Cross Slope	0.030 ft/ft
Road Cross Slope	0.020 ft/ft
Roughness Coefficient	0.015
Curb Opening Length	10.4 ft
Local Depression	2.0 in
Local Depression Width	18.0 in

Results	
Efficiency	82.66 %
Intercepted Flow	3.22 cfs
Bypass Flow	0.68 cfs
Spread	12.4 ft
Depth	3.2 in
Flow Area	1.6 ft²
Gutter Depression	0.2 in
Total Depression	2.2 in
Velocity	2.49 ft/s
Equivalent Cross Slope	0.056 ft/ft
Length Factor	0.622
Total Interception Length	16.7 ft

100-Year

Worksheet for Curb Inlet On Grade - 191+41 East

Project Description	
Solve For	Efficiency

Input Data	
Discharge	4.50 cfs
Slope	0.006 ft/ft
Gutter Width	2.00 ft
Gutter Cross Slope	0.030 ft/ft
Road Cross Slope	0.020 ft/ft
Roughness Coefficient	0.015
Curb Opening Length	7.2 ft
Local Depression	2.0 in
Local Depression Width	18.0 in

Results	
Efficiency	62.66 %
Intercepted Flow	2.82 cfs
Bypass Flow	1.68 cfs
Spread	13.7 ft
Depth	3.5 in
Flow Area	1.9 ft²
Gutter Depression	0.2 in
Total Depression	2.2 in
Velocity	2.36 ft/s
Equivalent Cross Slope	0.053 ft/ft
Length Factor	0.421
Total Interception Length	17.1 ft

100-Year

Worksheet for Curb Inlet In Sag - 194+00 East

Project Description	
Solve For	Spread

Input Data		
Discharge	4.70	cfs
Gutter Width	2.00	ft
Gutter Cross Slope	0.030	ft/ft
Road Cross Slope	0.020	ft/ft
Curb Opening Length	10.4	ft
Opening Height	0.5	ft
Curb Throat Type	Horizontal	
Local Depression	2.0	in
Local Depression Width	18.0	in
Throat Incline Angle	90.00	degrees

Results		
Spread	13.9	ft
Depth	3.6	in
Gutter Depression	0.2	in
Total Depression	2.2	in

100-Year

Worksheet for Curb Inlet In Sag - 196+50 East

Project Description	
Solve For	Spread

Input Data		
Discharge	1.70	cfs
Gutter Width	2.00	ft
Gutter Cross Slope	0.030	ft/ft
Road Cross Slope	0.020	ft/ft
Curb Opening Length	3.2	ft
Opening Height	0.5	ft
Curb Throat Type	Horizontal	
Local Depression	2.0	in
Local Depression Width	18.0	in
Throat Incline Angle	90.00	degrees

Results		
Spread	11.4	ft
Depth	3.0	in
Gutter Depression	0.2	in
Total Depression	2.2	in

100-Year

Worksheet for Curb Inlet In Sag - 199+50 East

Project Description	
Solve For	Spread

Input Data		
Discharge	1.90	cfs
Gutter Width	2.00	ft
Gutter Cross Slope	0.030	ft/ft
Road Cross Slope	0.020	ft/ft
Curb Opening Length	3.2	ft
Opening Height	0.5	ft
Curb Throat Type	Horizontal	
Local Depression	2.0	in
Local Depression Width	18.0	in
Throat Incline Angle	90.00	degrees

Results		
Spread	12.3	ft
Depth	3.2	in
Gutter Depression	0.2	in
Total Depression	2.2	in

100-Year

Worksheet for Curb Inlet On Grade - 158+15 West (Existing)

Project Description	
Solve For	Efficiency

Input Data	
Discharge	5.40 cfs
Slope	0.015 ft/ft
Gutter Width	2.00 ft
Gutter Cross Slope	0.030 ft/ft
Road Cross Slope	0.020 ft/ft
Roughness Coefficient	0.015
Curb Opening Length	7.2 ft
Local Depression	2.0 in
Local Depression Width	18.0 in

Results	
Efficiency	47.66 %
Intercepted Flow	2.57 cfs
Bypass Flow	2.83 cfs
Spread	12.2 ft
Depth	3.2 in
Flow Area	1.5 ft²
Gutter Depression	0.2 in
Total Depression	2.2 in
Velocity	3.58 ft/s
Equivalent Cross Slope	0.057 ft/ft
Length Factor	0.302
Total Interception Length	23.8 ft

100-Year

Worksheet for Grate Inlet On Grade - 163+08 West

Project Description	
Solve For	Efficiency

Input Data	
Discharge	7.80 cfs
Slope	0.009 ft/ft
Gutter Width	2.00 ft
Gutter Cross Slope	0.030 ft/ft
Road Cross Slope	0.020 ft/ft
Roughness Coefficient	0.015
Grate Width	2.00 ft
Grate Length	10.0 ft
Grate Type	P-50 mm x 100 mm (P-1-7/8"-4")
Clogging	50.0 %

Options	
Grate Flow Option	Exclude None

Results	
Efficiency	58.74 %
Intercepted Flow	4.58 cfs
Bypass Flow	3.22 cfs
Spread	15.4 ft
Depth	3.9 in
Flow Area	2.4 ft²
Gutter Depression	0.2 in
Total Depression	0.2 in
Velocity	3.27 ft/s
Splash Over Velocity	8.52 ft/s
Frontal Flow Factor	1.000
Side Flow Factor	0.391
Grate Flow Ratio	0.323
Active Grate Length	5.0 ft

100-Year

Worksheet for Grate Inlet In Sag - 166+87 West

Project Description	
Solve For	Spread

Input Data	
Discharge	7.50 cfs
Gutter Width	2.00 ft
Gutter Cross Slope	0.030 ft/ft
Road Cross Slope	0.020 ft/ft
Grate Width	2.00 ft
Grate Length	10.0 ft
Local Depression	2.0 in
Local Depression Width	18.0 in
Grate Type	P-50 mm x 100 mm (P-1-7/8"-4")
Clogging	0.0 %

Results	
Spread	16.1 ft
Depth	4.1 in
Gutter Depression	0.2 in
Total Depression	2.2 in
Open Grate Area	16.0 ft²
Active Grate Weir Length	14.0 ft

100-Year

Worksheet for Grate Inlet On Grade - 172+75 West

Project Description	
Solve For	Efficiency

Input Data	
Discharge	5.40 cfs
Slope	0.010 ft/ft
Gutter Width	2.00 ft
Gutter Cross Slope	0.030 ft/ft
Road Cross Slope	0.020 ft/ft
Roughness Coefficient	0.015
Grate Width	2.00 ft
Grate Length	10.0 ft
Grate Type	P-50 mm x 100 mm (P-1-7/8"-4")
Clogging	50.0 %

Options	
Grate Flow Option	Exclude None

Results	
Efficiency	63.24 %
Intercepted Flow	3.42 cfs
Bypass Flow	1.98 cfs
Spread	13.1 ft
Depth	3.4 in
Flow Area	1.7 ft²
Gutter Depression	0.2 in
Total Depression	0.2 in
Velocity	3.09 ft/s
Splash Over Velocity	8.52 ft/s
Frontal Flow Factor	1.000
Side Flow Factor	0.415
Grate Flow Ratio	0.372
Active Grate Length	5.0 ft

100-Year

Worksheet for Grate Inlet On Grade - 176+32 West

Project Description	
Solve For	Efficiency

Input Data	
Discharge	5.60 cfs
Slope	0.009 ft/ft
Gutter Width	2.00 ft
Gutter Cross Slope	0.030 ft/ft
Road Cross Slope	0.020 ft/ft
Roughness Coefficient	0.015
Grate Width	2.00 ft
Grate Length	10.0 ft
Grate Type	P-50 mm x 100 mm (P-1-7/8"-4")
Clogging	50.0 %

Options	
Grate Flow Option	Exclude None

Results	
Efficiency	63.62 %
Intercepted Flow	3.56 cfs
Bypass Flow	2.04 cfs
Spread	13.7 ft
Depth	3.5 in
Flow Area	1.9 ft²
Gutter Depression	0.2 in
Total Depression	0.2 in
Velocity	2.97 ft/s
Splash Over Velocity	8.52 ft/s
Frontal Flow Factor	1.000
Side Flow Factor	0.432
Grate Flow Ratio	0.360
Active Grate Length	5.0 ft

100-Year

Worksheet for Grate Inlet In Sag - 180+67 West

Project Description	
Solve For	Spread

Input Data	
Discharge	7.20 cfs
Gutter Width	2.00 ft
Gutter Cross Slope	0.030 ft/ft
Road Cross Slope	0.020 ft/ft
Grate Width	2.00 ft
Grate Length	10.0 ft
Local Depression	2.0 in
Local Depression Width	18.0 in
Grate Type	P-50 mm x 100 mm (P-1-7/8"-4")
Clogging	0.0 %

Results	
Spread	15.7 ft
Depth	4.0 in
Gutter Depression	0.2 in
Total Depression	2.2 in
Open Grate Area	16.0 ft²
Active Grate Weir Length	14.0 ft

100-Year

Worksheet for Grate Inlet On Grade - 186+15 West

Project Description	
Solve For	Efficiency

Input Data	
Discharge	4.60 cfs
Slope	0.007 ft/ft
Gutter Width	2.00 ft
Gutter Cross Slope	0.030 ft/ft
Road Cross Slope	0.020 ft/ft
Roughness Coefficient	0.015
Grate Width	2.00 ft
Grate Length	10.0 ft
Grate Type	P-50 mm x 100 mm (P-1-7/8"-4")
Clogging	50.0 %

Options	
Grate Flow Option	Exclude None

Results	
Efficiency	68.55 %
Intercepted Flow	3.15 cfs
Bypass Flow	1.45 cfs
Spread	13.4 ft
Depth	3.5 in
Flow Area	1.8 ft²
Gutter Depression	0.2 in
Total Depression	0.2 in
Velocity	2.53 ft/s
Splash Over Velocity	8.52 ft/s
Frontal Flow Factor	1.000
Side Flow Factor	0.505
Grate Flow Ratio	0.365
Active Grate Length	5.0 ft

100-Year

Worksheet for Grate Inlet On Grade - 191+31 West

Project Description	
Solve For	Efficiency

Input Data	
Discharge	5.90 cfs
Slope	0.005 ft/ft
Gutter Width	2.00 ft
Gutter Cross Slope	0.030 ft/ft
Road Cross Slope	0.020 ft/ft
Roughness Coefficient	0.015
Grate Width	2.00 ft
Grate Length	10.0 ft
Grate Type	P-50 mm x 100 mm (P-1-7/8"-4")
Clogging	50.0 %

Options	
Grate Flow Option	Exclude None

Results	
Efficiency	67.48 %
Intercepted Flow	3.98 cfs
Bypass Flow	1.92 cfs
Spread	15.5 ft
Depth	4.0 in
Flow Area	2.4 ft²
Gutter Depression	0.2 in
Total Depression	0.2 in
Velocity	2.43 ft/s
Splash Over Velocity	8.52 ft/s
Frontal Flow Factor	1.000
Side Flow Factor	0.522
Grate Flow Ratio	0.320
Active Grate Length	5.0 ft

100-Year

Worksheet for Grate Inlet In Sag - 193+98 West

Project Description	
Solve For	Spread

Input Data	
Discharge	5.40 cfs
Gutter Width	2.00 ft
Gutter Cross Slope	0.030 ft/ft
Road Cross Slope	0.020 ft/ft
Grate Width	2.00 ft
Grate Length	10.0 ft
Local Depression	2.0 in
Local Depression Width	18.0 in
Grate Type	P-50 mm x 100 mm (P-1-7/8"-4")
Clogging	0.0 %

Results	
Spread	13.0 ft
Depth	3.4 in
Gutter Depression	0.2 in
Total Depression	2.2 in
Open Grate Area	16.0 ft²
Active Grate Weir Length	14.0 ft

Worksheet for Box Culvert

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Roughness Coefficient	0.013
Channel Slope	0.00310 ft/ft
Height	4.0 ft
Bottom Width	20.00 ft
Discharge	147.00 cfs

Results	
Normal Depth	13.7 in
Flow Area	22.8 ft²
Wetted Perimeter	22.3 ft
Hydraulic Radius	12.3 in
Top Width	20.00 ft
Critical Depth	14.3 in
Percent Full	28.5 %
Critical Slope	0.00270 ft/ft
Velocity	6.46 ft/s
Velocity Head	0.65 ft
Specific Energy	1.79 ft
Froude Number	1.067
Discharge Full	715.68 cfs
Slope Full	0.00310 ft/ft
Flow Type	Supercritical

GVF Input Data	
Downstream Depth	0.0 in
Length	0.0 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Average End Depth Over Rise	0.0 %
Normal Depth Over Rise	28.5 %
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	13.7 in
Critical Depth	14.3 in
Channel Slope	0.00310 ft/ft
Critical Slope	0.00270 ft/ft

Worksheet for Trapezoidal Channel - 1

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Roughness Coefficient	0.020
Channel Slope	0.00310 ft/ft
Left Side Slope	4.000 H:V
Right Side Slope	3.000 H:V
Bottom Width	8.00 ft
Discharge	147.00 cfs

Results	
Normal Depth	23.8 in
Flow Area	29.6 ft²
Wetted Perimeter	22.4 ft
Hydraulic Radius	15.8 in
Top Width	21.86 ft
Critical Depth	20.4 in
Critical Slope	0.00568 ft/ft
Velocity	4.97 ft/s
Velocity Head	0.38 ft
Specific Energy	2.36 ft
Froude Number	0.754
Flow Type	Subcritical

GVF Input Data	
Downstream Depth	0.0 in
Length	0.0 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	0.00 ft/s
Upstream Velocity	0.00 ft/s
Normal Depth	23.8 in
Critical Depth	20.4 in
Channel Slope	0.00310 ft/ft
Critical Slope	0.00568 ft/ft

August 22, 2025

Appendix E – DIGITAL FILES

(Data is provided digitally)