

September 1st, 2023

Plan #: 32-DR-2022

Review Cycle: 4

Reviewed By: GA

Date: 03/22/2024

Status: Accepted

PRELIMINARY DRAINAGE STUDY

for

AutoNation Scottsdale Ford

8555 E Frank Lloyd Wright Boulevard

Scottsdale, AZ 85260

APN: 215-51-009-V

Prepared for:

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ATTACHMENT 5 – Referenced Storm Drain Plans

I. INTRODUCTION

a. Background/Purpose

The purpose of this study is to determine storm water runoff and site drainage for the proposed re-construction of an auto dealership in the city of Scottsdale, Arizona. The development is being completed by AutoNation, Inc. The project site is located at 8555 E Frank Lloyd Wright Boulevard and consists of approximately 2.729 acres within a 5.77-acre parcel. The subject property is located in SE ¼ S1-T3N-R4E and is bounded by E Frank Lloyd Wright Boulevard to the north, existing Chevrolet auto dealership to the east, and N Northsight Boulevard to the south and west. Site elevations range from approximately 1504 to 1513 feet above mean sea level (MSL). See Vicinity Map in Attachment 1.

The project site property was developed as an auto dealership and service center with four buildings, AC pavement drive aisles and parking, concrete hardscape, commercial landscaping, and an onsite private storm drain system.

The project proposes to demolish three existing buildings and construct a new dealership building with rooftop parking, covered service bays, and a new detached car wash building. The project also proposes to revise the parking layout, revise existing landscape areas along the western property line, and install new storm drain system with underground retention to accommodate onsite stormwater storage. The existing dealership showroom in the northern portion of the property will be protected in place.

Per FEMA Flood Insurance Rate Map Panel 1320, effective date of October 16, 2013, the project site is in FEMA Flood Zone X. Zone X areas are determined to be outside of the 0.2% annual chance floodplain (see Attachment 1).

The Environmentally Sensitive Lands Overlay (ESL) is a set of zoning regulations to guide development throughout Scottsdale. The environmentally sensitive lands are located north and east of the Central Arizona Project. The subject property is located south of the Central Arizona Project thus subject property is not located in an Environmentally Sensitive Lands Ordinance (ESLO) area.

II. EXISTING DRAINAGE CONDITIONS AND PROPOSED DRAINAGE MANAGEMENT PLAN

a. Existing Drainage Condition

In the existing condition, onsite runoff generally sheet flows south across the lot to two existing concrete ribbon gutters then shallow concentrated flow in the gutters takes onsite flows to two existing catch basin inlets at localized low points. Runoff is then conveyed via 6"-10" PVC storm drains to the existing public storm drain manhole outside the southeast property corner (see detail A, Proposed Drainage Map). This public storm drain system is owned by the City of Scottsdale. A city quarter section map showing existing stormwater system in the project vicinity of the project site is included in Attachment 5. A drainage map is provided in Attachment 2.

The subject property does not receive runoff from the adjacent public right-of-way or neighboring developments.

Runoff in the public right-of-way on E Frank Lloyd Wright Boulevard and N Northsight Boulevard flows to existing curb inlets and discharges to the existing City-owned public storm drain system.

b. Proposed Drainage Management Plan

Existing drainage patterns shall remain similar to the existing condition. A portion of our private storm drain that conveys private flow to an offsite public manhole is being abandoned due to the existing pipe being undersized for existing & proposed flows. An encroachment permit shall be required for any work within the public ROW. Runoff from the proposed building roof area on the west side of the site will be captured via roof inlets and discharge to adjacent AC pavement, and sheet flow to onsite v-gutter towards onsite storm drain inlets. The storm drainpipe from the inlets will route the stormwater to the proposed underground retention system. Runoff from the proposed building roof area on the east side of the site will be captured via roof inlets and discharge directly to the proposed storm drain and eventually discharge to the proposed underground retention system. Three additional catch basin inlets and an underground retention system, which are discussed in the following section, are proposed. The basin will be constructed within the southern parking lot to capture and retain runoff as required for the proposed re-development. If the retention system overflows from excess retention requirements, the runoff will flow to the public storm drain system south of the property conveyed via newly installed storm drain that is sized appropriately.

Existing private storm drain on the west side of the project site are not adequately sized to convey 100-year storm runoff flows. New storm drain line will replace this existing line to meet these requirements. Analysis of the storm drain system and catch basins for adequacy will be provided during the preparation of finals plans.

A map of the proposed drainage patterns is included in Attachment 2

c. Stormwater Storage Requirements

Due to the existing and proposed conditions both being similar in impervious area, the first flush runoff storage requirements do not apply for this project. Because the project site has been previously developed with minimal landscaped area, the proposed development does not increase runoff volume significantly. The increase in required retention volume will be retained onsite via a proposed perforated 4'-diameter CMP underground retention systems by Contech. A total of 488 cu-ft of runoff will be captured and retained onsite from a tributary onsite drainage area. The retained volume will be drained in time not to exceed 36 hours through supported tested percolation rate or other supported rate acceptable to the city, or alternatively, through the use of dry wells. Adequate calculations and supporting documents will be provided during final plans.

Table 1 – Project Site Area and Runoff Volume Summary

PROJECT SITE	Area (ac)	% Imp.	C	V ₁₀₀ (cf)
Existing Condition	2.729	96%	0.928	25,087
Proposed Condition	2.729	99%	0.944	25,535
DIFFERENCE	---	+3%	0.015	+488

The proposed underground stormwater storage tanks (USST) must meet the City's USSTT policy in Section 4-1.202 of the City's Design Standards & Policies Manual (DSPM), which includes but is not limited to the following:

- a) The owner must dedicate a public drainage easement over the USST, with no major vegetation such as trees within the easement. At a minimum, the easement should extend at a projected slope of 1:1 from the bottom of the pipe.
- b) The USST must have at least a 75-year life, including the lining and coating.
- c) The USST must drain by gravity.
- d) Specify MAG supplemental standard detail 2554 for corrugated metal pipes.
- e) A minimum of two access points must be provided for each USST.
- f) An Operations and Maintenance (O & M) Manual must be prepared for the system prior to approval of final plans.
- g) Final plans must include signs at each end of the USST.
- h) A signed and notarized Ownership and Responsibility Statement must be provided prior to approval of final plans.
- i) Add the required warning signs.

III. DESIGN CRITERIA AND ASSUMPTIONS

a. Methodology

The required retention volumes were calculated per City's standard formula for runoff volumes for a 100-year, 2-hour storm event. Hydrologic calculations were performed to determine the 100-year peak flow discharges using the Rational Method per City of Scottsdale Design Standards and Policies Manual Chapter 4 Section 1.504 for watersheds of less than 160 acres. A technical description of the Rational Method is provided in the City's design manual. The results of the hydrologic calculations are included in Attachment 3.

b. Hydrologic Parameters/Assumptions

Soil Type: Hydrologic soil ratings are based on a scale of A through D, where A is the most pervious, providing the least runoff. Per the map from NRCS (see Attachment 1), the studied area consists mostly of Group C soils with a small amount of Group A soils.

Runoff Coefficient (C): Runoff coefficients are per City of Scottsdale Design Standards and Policies Manual 2018, Figure 4-1.5. The weighted runoff coefficient is calculated and used for each drainage subarea.

Rainfall Precipitation: Per NOAA Atlas 14, Volume 1, Version 5 (see Attachment 1).

Time of Concentration (T_c): The time of concentration is assumed to be 10 minutes for all drainage subareas.

Rainfall Intensity (I): Per NOAA precipitation values based on storm event (100-year) and time of concentration.

c. Lowest Floor Elevations

Per the Scottsdale Revised Code, Chapter 37 – Floodplain and Stormwater Regulation, if a new structure is in Flood Hazard Zone X, the lowest floor shall be at least (14) inches above the highest adjacent grade. The basis for the lowest floor elevation is that the project site is located within FEMA Flood Zone X which is determined to be outside of a floodplain.

IV. ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY REQUIREMENTS

a. ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY (ADEQ) REQUIREMENTS

The proposed project exceeds the requirement of more than one acre of disturbed area and will submit a Stormwater Pollution Prevention Plan (SWPPP) for review by the Arizona Department of Environmental Quality (ADEQ) Water Quality Division (ADWQ). The Notice of Intent (NOI) and the case level requirements for the Arizona Department of Environmental Quality (ADEQ) will be provided when the final plans are submitted for review.

V. CONCLUSION

The project's new storm drain inlets, pipe network, and underground retention system are sized per city requirements. Storm drain hydraulic sizing calculations will be included during final plans. Project discharge locations will remain unchanged with overflow runoff entering the public storm drain system on North Northsight Boulevard. With the implementation of a new underground retention system, downstream drainage conveyance system will not have an adverse impact due to the proposed project site developments.

VI. REFERENCES

1. City of Scottsdale. Design Standards & Policies Manual (2018).
2. Flood Control District of Maricopa County. Drainage Policies and Standards (2018).
3. Flood Control District of Maricopa County. Drainage Design Manual: Vol. I - Hydrology (2018).
4. NOAA Atlas 14, Volume 1, Version 5 (2022).
5. Web Soil Survey, Aguila-Carefree Area, Arizona, Parts of Maricopa and Pinal Counties. United States Natural Resource Conservation Service

ATTACHMENT 1
Vicinity Map
NOAA Precipitation Data
NRCS Soil Map
FIRM Map

VICINITY MAP:
AutoNation Scottsdale Ford
8555 E Frank Lloyd Wright
Scottsdale, AZ 85260



(NOT TO SCALE)



NOAA Atlas 14, Volume 1, Version 5
Location name: Scottsdale, Arizona, USA*
Latitude: 33.6306°, Longitude: -111.8967°
Elevation: 1506.76 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 & aeries](#)

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	0.194 (0.161-0.237)	0.253 (0.212-0.310)	0.341 (0.283-0.416)	0.409 (0.338-0.498)	0.501 (0.406-0.607)	0.570 (0.458-0.686)	0.643 (0.506-0.772)	0.714 (0.554-0.856)	0.812 (0.613-0.974)	0.886 (0.656-1.06)
10-min	0.295 (0.245-0.361)	0.385 (0.322-0.472)	0.520 (0.430-0.634)	0.623 (0.514-0.758)	0.762 (0.619-0.924)	0.869 (0.697-1.04)	0.979 (0.771-1.18)	1.09 (0.843-1.30)	1.24 (0.933-1.48)	1.35 (0.998-1.62)
15-min	0.366 (0.304-0.448)	0.478 (0.399-0.585)	0.645 (0.534-0.786)	0.772 (0.637-0.940)	0.945 (0.767-1.15)	1.08 (0.864-1.30)	1.21 (0.956-1.46)	1.35 (1.04-1.62)	1.53 (1.16-1.84)	1.67 (1.24-2.01)
30-min	0.493 (0.409-0.603)	0.643 (0.538-0.788)	0.868 (0.719-1.06)	1.04 (0.858-1.27)	1.27 (1.03-1.54)	1.45 (1.16-1.74)	1.63 (1.29-1.96)	1.82 (1.41-2.17)	2.06 (1.56-2.48)	2.25 (1.67-2.70)
60-min	0.610 (0.506-0.746)	0.796 (0.666-0.975)	1.07 (0.890-1.31)	1.29 (1.06-1.57)	1.58 (1.28-1.91)	1.80 (1.44-2.16)	2.02 (1.59-2.43)	2.25 (1.74-2.69)	2.55 (1.93-3.06)	2.79 (2.06-3.35)
2-hr	0.713 (0.600-0.853)	0.923 (0.780-1.11)	1.23 (1.03-1.46)	1.46 (1.21-1.74)	1.78 (1.47-2.11)	2.02 (1.64-2.39)	2.27 (1.81-2.67)	2.52 (1.98-2.96)	2.86 (2.19-3.36)	3.12 (2.34-3.68)
3-hr	0.791 (0.667-0.968)	1.01 (0.857-1.25)	1.32 (1.11-1.62)	1.57 (1.30-1.91)	1.91 (1.57-2.31)	2.19 (1.77-2.62)	2.47 (1.96-2.96)	2.77 (2.16-3.31)	3.18 (2.40-3.80)	3.50 (2.59-4.19)
6-hr	0.953 (0.819-1.13)	1.20 (1.03-1.43)	1.53 (1.31-1.81)	1.80 (1.52-2.12)	2.16 (1.80-2.53)	2.44 (2.00-2.85)	2.73 (2.21-3.18)	3.03 (2.41-3.54)	3.44 (2.66-4.01)	3.75 (2.84-4.38)
12-hr	1.07 (0.923-1.26)	1.35 (1.16-1.59)	1.70 (1.46-2.00)	1.98 (1.69-2.32)	2.35 (1.98-2.75)	2.64 (2.20-3.07)	2.94 (2.41-3.41)	3.24 (2.62-3.76)	3.63 (2.87-4.24)	3.94 (3.06-4.63)
24-hr	1.25 (1.10-1.45)	1.59 (1.40-1.84)	2.05 (1.79-2.37)	2.42 (2.10-2.79)	2.93 (2.53-3.38)	3.34 (2.85-3.84)	3.76 (3.19-4.33)	4.20 (3.52-4.83)	4.81 (3.96-5.55)	5.30 (4.30-6.14)
2-day	1.35 (1.18-1.56)	1.72 (1.50-1.99)	2.25 (1.96-2.60)	2.68 (2.31-3.08)	3.27 (2.80-3.76)	3.73 (3.17-4.29)	4.22 (3.56-4.87)	4.74 (3.95-5.48)	5.45 (4.47-6.32)	6.02 (4.86-7.01)
3-day	1.45 (1.27-1.67)	1.86 (1.63-2.13)	2.45 (2.14-2.80)	2.92 (2.54-3.34)	3.59 (3.10-4.10)	4.12 (3.54-4.71)	4.70 (4.00-5.38)	5.30 (4.47-6.09)	6.15 (5.10-7.08)	6.84 (5.60-7.91)
4-day	1.56 (1.37-1.78)	1.99 (1.76-2.27)	2.64 (2.32-3.00)	3.16 (2.77-3.60)	3.91 (3.41-4.45)	4.52 (3.91-5.14)	5.17 (4.44-5.89)	5.87 (4.98-6.71)	6.85 (5.74-7.85)	7.66 (6.33-8.82)
7-day	1.76 (1.54-2.02)	2.25 (1.97-2.58)	2.98 (2.61-3.41)	3.58 (3.13-4.09)	4.43 (3.84-5.06)	5.13 (4.41-5.85)	5.87 (5.01-6.71)	6.66 (5.63-7.65)	7.79 (6.49-8.97)	8.71 (7.16-10.1)
10-day	1.91 (1.68-2.18)	2.44 (2.15-2.79)	3.24 (2.84-3.69)	3.88 (3.39-4.41)	4.79 (4.16-5.44)	5.52 (4.76-6.27)	6.30 (5.39-7.18)	7.13 (6.05-8.14)	8.31 (6.94-9.51)	9.26 (7.64-10.7)
20-day	2.36 (2.09-2.69)	3.05 (2.69-3.46)	4.03 (3.55-4.57)	4.78 (4.19-5.42)	5.80 (5.06-6.57)	6.58 (5.73-7.47)	7.39 (6.39-8.41)	8.23 (7.06-9.39)	9.35 (7.95-10.7)	10.2 (8.61-11.8)
30-day	2.78 (2.44-3.16)	3.58 (3.15-4.06)	4.72 (4.16-5.35)	5.60 (4.92-6.34)	6.79 (5.92-7.68)	7.70 (6.70-8.72)	8.65 (7.48-9.79)	9.61 (8.25-10.9)	10.9 (9.29-12.4)	11.9 (10.1-13.6)
45-day	3.24 (2.87-3.67)	4.18 (3.70-4.73)	5.52 (4.88-6.23)	6.52 (5.75-7.37)	7.85 (6.89-8.87)	8.86 (7.74-10.0)	9.90 (8.59-11.2)	10.9 (9.44-12.4)	12.3 (10.5-14.1)	13.4 (11.4-15.4)
60-day	3.60 (3.19-4.06)	4.65 (4.13-5.25)	6.13 (5.43-6.91)	7.21 (6.38-8.13)	8.64 (7.61-9.74)	9.70 (8.50-10.9)	10.8 (9.39-12.2)	11.8 (10.3-13.4)	13.3 (11.4-15.1)	14.3 (12.2-16.4)

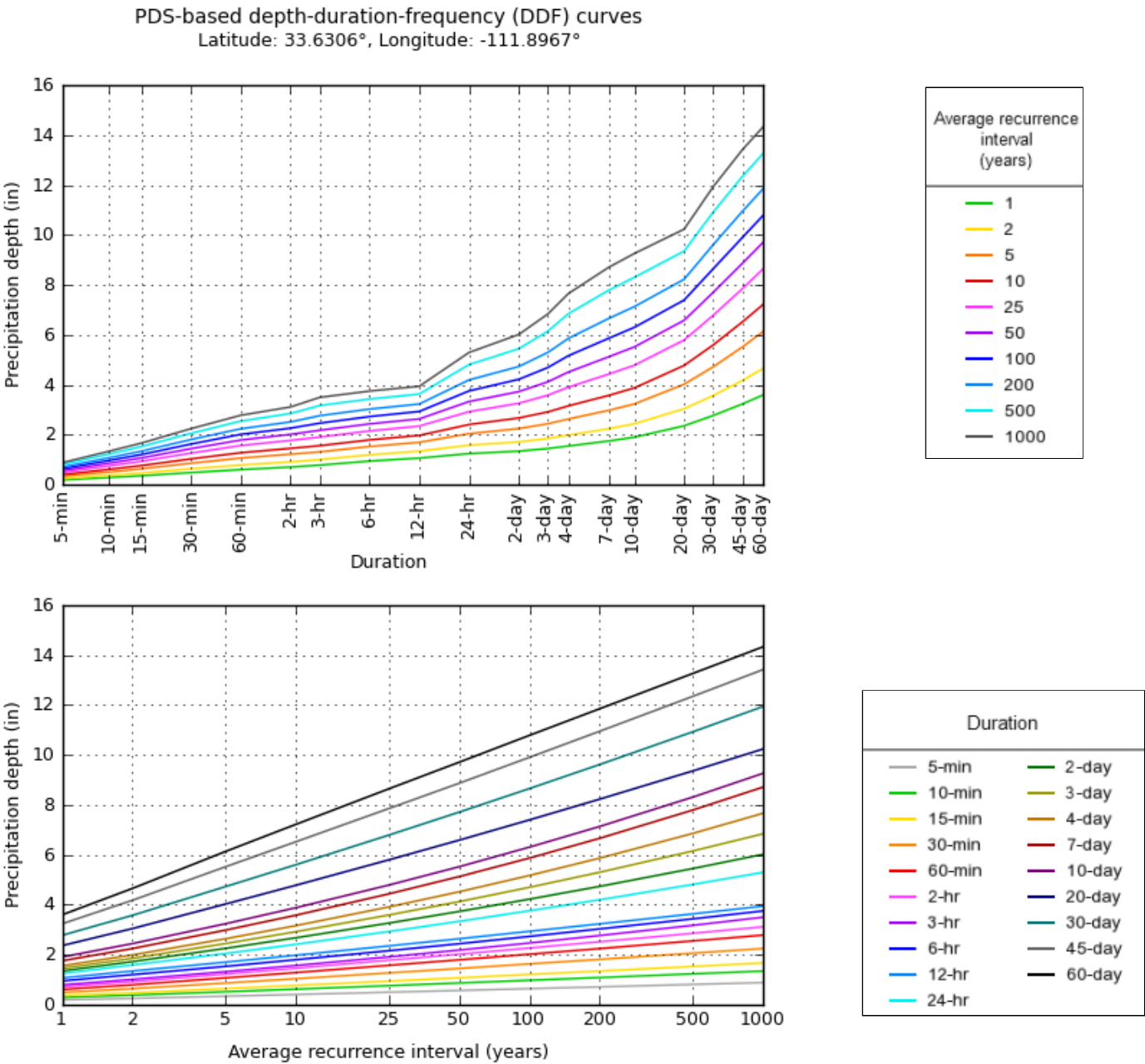
¹ Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

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

Please refer to NOAA Atlas 14 document for more information.

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PF graphical



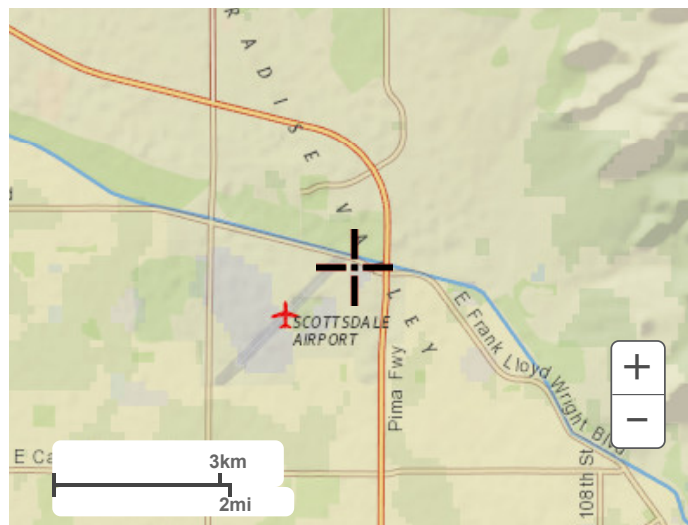
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Maps & aerials

Small scale terrain



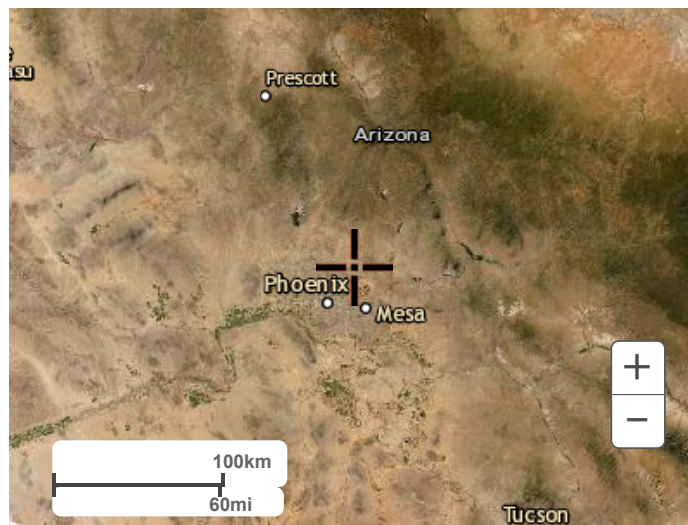
Large scale terrain



Large scale map



Large scale aerial



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Hydrologic Soil Group—Aguila-Carefree Area, Arizona, Parts of Maricopa and Pinal Counties (21139 - Scottsdale Ford)



MAP LEGEND

Area of Interest (AOI)

 Area of Interest (AOI)

Soils

Soil Rating Polygons

 A
 A/D
 B
 B/D
 C
 C/D
 D
 Not rated or not available

Soil Rating Lines

 A
 A/D
 B
 B/D
 C
 C/D
 D
 Not rated or not available

Soil Rating Points

 A
 A/D
 B
 B/D

 C
 C/D
 D
 Not rated or not available

Water Features

 Streams and Canals

Transportation

 Rails
 Interstate Highways
 US Routes
 Major Roads
 Local Roads

Background

 Aerial Photography

MAP INFORMATION

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

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

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

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

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

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

Soil Survey Area: Aguila-Carefree Area, Arizona, Parts of Maricopa and Pinal Counties
Survey Area Data: Version 16, Sep 16, 2021

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

Date(s) aerial images were photographed: May 15, 2020—May 22, 2020

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

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
2	Antho gravelly sandy loams	A	2.0	31.2%
55	Gilman loams	C	4.5	68.8%
Totals for Area of Interest			6.5	100.0%

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

NOTES TO USERS

This map is for use in administering the National 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 this 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 to landward of 0.57 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.fdm.maricopa.gov/Maps/gismaps/apsa/gisapp/gisapp/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://hqn.nwrngs.noaa.gov>. To obtain information about Geodetic Certification and Cadastral Survey bench marks conducted by the Maricopa County Department of Transportation, please visit the Flood Control District of Maricopa County website at: <http://www.fdm.maricopa.gov/Maps/gismaps/apsa/gisapp/gisapp/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 Aerial Imagery Program (NAIP) imagery was provided by the Arizona State Land Department (ASLD) and is dated 2007. The coordinate system used for the production of the digital FIRM is State Plane Arizona Central NAD83 (NAD83), International Feet.

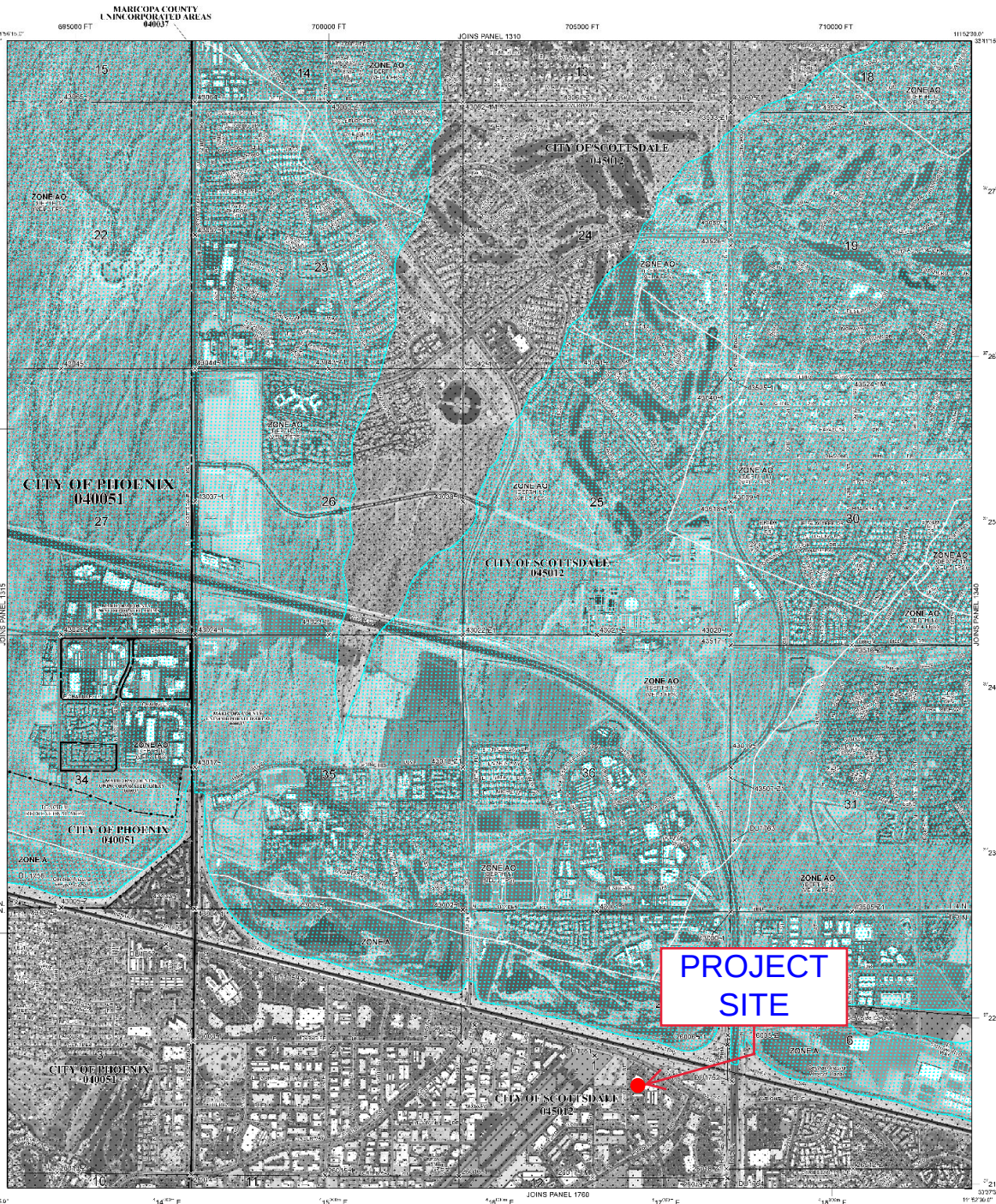
The **profile base line** depicted on this map represents the hydraulic modeling boundaries that match flood profiles in the FIS report. As a result of improved topographic data, the profile base line, in some cases, may deviate significantly from the channel centerline or appear outside the SFHA.

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 this separately printed **Map Index** for an overview map of the county showing the report of map panels, 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 (SFHA) 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, AV, 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 shallow (in) flooding, vehicles are determined.
- ZONE AR** Special Flood Hazard Area formerly protected from the 1% annual chance flood by a flood control system and subsequently determined. Zone AR indicates that the former flood control system is being removed to provide protection from the 1% annual chance or greater flood.
- ZONE AVP** Area to be protected from the 1% annual chance flood by a local 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 contained 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.
- Base Flood Elevation line and value, elevation in feet (ELL 1007)
- Base Flood Elevation value where surface within zone, elevation in feet
- Cross section line
- Traverse line
- Geographic coordinates referenced to the North American Datum of 1983 (NAD 83)
- 1000 meter Universal Transverse Mercator grid data, zone 12
- 1000-foot grid lines; Arizona State Plane coordinate system, central zone (FIPSZONE 8002), Transverse Mercator
- Beach mark (see explanation in notes to labels section of this FIRM panel)
- Minor mile
- MAP RECORITORS
- Pin's Map Repository for Map Data

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

EFFECTIVE DATE OF REVISION TO THIS FIRM: October 16, 2013

October 16, 2013 - The map was revised to reflect the results of the Flood Insurance Study report for this jurisdiction. The map was revised to reflect the results of the Flood Insurance Study report for this jurisdiction. The map was revised to reflect the results of 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 1-800-638-6626.

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

MAP SCALE 1" = 1000'

800 0 1000 2000 FEET

800 0 1000 2000 METERS

PANEL 1320

FIRM

FLOOD INSURANCE RATE MAP

MARICOPA COUNTY,

ARIZONA

AND INCORPORATED AREAS

PANEL 1320 OF 4425

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY NUMBER PANEL SHEET

MARICOPA COUNTY 10000 700 1

MARICOPA COUNTY 10000 700 1

MARICOPA COUNTY 10000 700 1

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ATTACHMENT 2

Drainage Area Map

ATTACHMENT 3

**Hydrology Calculations &
Retention System Details**

HYDROLOGY CALCULATIONS - STORAGE VOLUME

City of Scottsdale Design Standards & Policies Manual (2018) Chapter 4-1.201

Flood Control District of Maricopa County (FCDMC) Drainage Policies and Standards (2018)

FCDMC Drainage Design Manual: Volume I - Hydrology (2018)

PROJECT: Scottsdale Ford

DATE: 07/18/2023

CALCS BY: LDR

PROJECT SITE DATA/NOTES:

1. Located in Lower Desert Area (not in ESLO area)
2. FEMA Flood Zone X
3. NRCS Hydrologic Soil Group A/C
4. Use Rational Method for projects < 160 acres
5. Rainfall data per NOAA Atlas 14, Volume 1, Version 5
6. Time of concentration (Tc) assumed to be standard value per City/County codes. Time of concentration minimum, per City of Scottsdale, is 5.0 minutes.

Runoff Coefficient (C) Values:

Land Use / Surface Cover	C _x
Paved streets, parking lots, roofs, driveways, etc.	0.95
Undisturbed natural desert or desert landscaping (no impervious weed barrier)	0.45

Per Figure 4-1.5 Runoff Coefficients for Rational Method of City of Scottsdale Design Standards & Policies Manual (2018)

REQUIRED STORAGE VOLUME:

Storage Volume Req. = max[Design Volume, First Flush Volume]

1. Design Volume (for sites that have been previously developed):

$$V_R = \Delta C(R/12)A$$

V_R = Required storage volume (cf)

ΔC = C_{POST} - C_{PRE} = change in weighted avg runoff coefficient for disturbed area

R = Precipitation amount for 100-year, 2-hour storm event per NOAA (in)

A = Drainage area (sf)

Project Site	Total Area		Impervious Area		Pervious Area		$C = \frac{\sum C_x A_x}{\sum A_x}$	R (in)	V _R (cf)
	(sf)	(ac)	(sf)	(%)	(sf)	(%)			
EXISTING	118,884	2.729	113,545	96%	5,339	4%	0.928	2.73	25,087
PROPOSED	118,884	2.729	117,485	99%	1,399	1%	0.944	2.73	25,535
							ΔC = 0.017	ΔV =	448

STORAGE VOLUME PROVIDED:

BMP STORAGE: Perforated CMP by Contech			
CMP Storage			
Diameter	4	ft	
Pipe Area	12.57	sf	
No. of Rows	2	ea.	
Row Length	8	ft	
No. of Headers	1	ea	
Header Length	10	ft	
Total Pipe Length	26	ft	
Pipe Storage	327	cf	
Gravel Pit Storage			
System Length	14.00	ft	
System Width	12.00	ft	
System Depth	4.34	ft	
Stone Porosity	0.40		
Gravel Pit Storage	161	cf	
Total BMP Storage	488	cf	

HYDROLOGY CALCULATIONS - RUNOFF PEAK FLOWS

Per Drainage Design Manual for Maricopa County (2018)

PROJECT: Scottsdale Ford

DATE: 07/18/2023

CALCS BY: LDR

Per the City of Scottsdale Hydrology Design Manual:

$$Q = C \times I \times A$$

Q = Peak discharge from a given area (cfs)

C = Adjusted runoff factor (unitless) = $(\sum C_x A_x / \sum A_x)$

A = Tributary area to BMP (ac)

i = Rainfall intensity = 0.979 in/hr (100-yr, 10-min)

L = 0.10 miles

K_b = 0.0352

S = 49.173341 ft/mile

I = 0.5 in/hr

$$T_c = 11.1 \times L^{0.5} \times K_b^{0.52} \times S^{-0.31} \times i^{-0.38}$$

T_c = time of concentration, in hours

S = Watershed slope, in ft/mile

L = length of longest flow path, in miles

i = rainfall intensity, in inches/hour

K_b = watershed resistance coefficient

EXISTING CONDITION - PROJECT SITE:

MODIFIED RATIONAL METHOD: 100-YEAR, 6-HOUR STORM EVENT

Drainage Area			Impervious Area		Pervious Area		$C = \frac{\sum C_x A_x}{\sum A_x}$	T_c (min)	P_{100} (in)	I (in/hr)	Peak Flow: Q (cfs)
ID	SF	AC	(sf)	(%)	(sf)	(%)					
1A	118,884	2.729	113,545	96%	5,339	4%	0.85	15.3	1.21	4.74	10.99
TOTAL	118,884	2.729	113,545	96%	5,339	4%	0.85		1.21		10.99

EXISTING CONDITION - PROPERTY LIMITS

MODIFIED RATIONAL METHOD: 100-YEAR, 6-HOUR STORM EVENT

Drainage Area			Impervious Area		Pervious Area		$C = \frac{\sum C_x A_x}{\sum A_x}$	T_c (min)	P_{100} (in)	I (in/hr)	Peak Flow: Q (cfs)
ID	SF	AC	(sf)	(%)	(sf)	(%)					
1A	84,446	1.939	77,196	91%	7,250	9%	0.85	15	1.21	4.75	7.82
1B	167,459	3.844	159,240	95%	8,219	5%	0.85	15	1.21	4.75	15.51
TOTAL	251,905	5.783	236,436	94%	15,469	6%	0.85				23.32

PROPOSED CONDITION - PROJECT SITE:

MODIFIED RATIONAL METHOD: 100-YEAR, 6-HOUR STORM EVENT

Drainage Area			Impervious Area		Pervious Area		$C = \frac{\sum C_x A_x}{\sum A_x}$	T_c (min)	P_{100} (in)	I (in/hr)	Peak Flow: Q (cfs)
ID	SF	AC	(sf)	(%)	(sf)	(%)					
1A	118,884	2.729	117,485	99%	1,399	1%	0.85	15	1.21	4.75	11.01
TOTAL	118,884	2.729	117,485	99%	1,399	1%	0.85		1.21		11.01

PROPOSED CONDITION - PROPERTY LIMITS

MODIFIED RATIONAL METHOD: 100-YEAR, 6-HOUR STORM EVENT

Drainage Area			Impervious Area		Pervious Area		$C = \frac{\sum C_x A_x}{\sum A_x}$	T_c (min)	P_{100} (in)	I (in/hr)	Peak Flow: Q (cfs)
ID	SF	AC	(sf)	(%)	(sf)	(%)					
1A	95,724	2.198	88,395	92%	7,329	8%	0.85	15	1.21	4.75	8.86
1B	101,615	2.333	93,397	92%	8,219	8%	0.85	15	1.21	4.75	9.41
1C	54,566	1.253	54,566	100%	0	0%	0.85	15	1.21	4.75	5.05
TOTAL	251,905	5.783	236,357	94%	15,548	6%	0.85				23.32

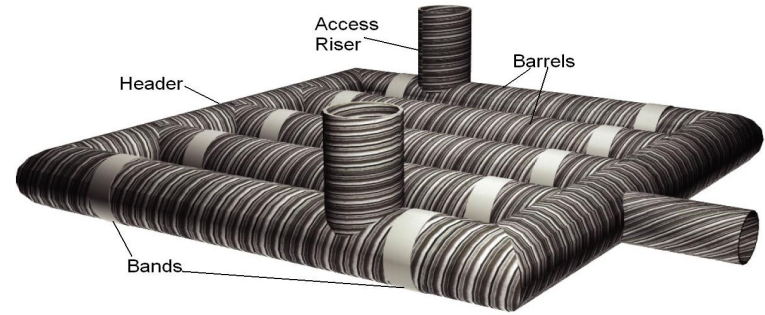
DYODS™

Design Your Own Detention System



CONTECH
CMP DETENTION SYSTEMS

For design assistance, drawings,
and pricing send completed worksheet to:
dyods@contech-cpi.com



Project Summary

Date:	7/18/2023	Enter Information in Blue Cells
Project Name:	AutoNation Ford Scottsdale	
City / County:	Scottsdale	
State:	AZ	
Designed By:	LDR	
Company:	CDR	
Telephone:	(949) 610-8997	

Corrugated Metal Pipe Calculator

Storage Volume Required (cf):	449	12.57 ft ² Pipe Area
Limiting Width (ft):	15.00	
Invert Depth Below Asphalt (ft):	10.00	
Solid or Perforated Pipe:	Perforated	
Shape Or Diameter (in):	48	
Number Of Headers:	1	
Spacing between Barrels (ft):	2.00	
Stone Width Around Perimeter of System (ft):	1	
Depth A: Porous Stone Above Pipe (in):	0	
Depth C: Porous Stone Below Pipe (in):	4	
Stone Porosity (0 to 40%):	40	

System Sizing

Pipe Storage:	327 cf	
Porous Stone Storage:	161 cf	
Total Storage Provided:	488 cf	108.6% Of Required Storage
Number of Barrels:	2 barrels	
Length per Barrel:	8.0 ft	
Length Per Header:	10.0 ft	
Rectangular Footprint (W x L):	12. ft x 14. ft	

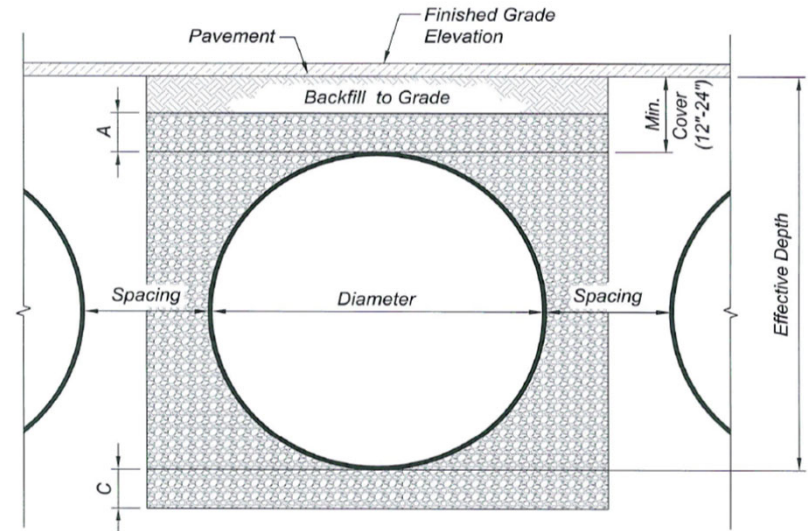
CONTECH Materials

Total CMP Footage:	26 ft
Approximate Total Pieces:	3 pcs
Approximate Coupling Bands:	2 bands
Approximate Truckloads:	1 trucks

Construction Quantities**

Total Excavation:	63 cy
Porous Stone Backfill For Storage:	15 cy stone
Backfill to Grade Excluding Stone:	36 cy fill

**Construction quantities are approximate and should be verified upon final design



System Layout

Barrel 12	
Barrel 11	
Barrel 10	
Barrel 9	
Barrel 8	
Barrel 7	
Barrel 6	
Barrel 5	
Barrel 4	
Barrel 3	
Barrel 2	8
Barrel 1	8

Barrel Footage (w/o headers)

A UES Company

April 25, 2023

Royce Eklund, P.E.
Commercial Development Resources
3117 Whiting Avenue
Charlotte, NC 28205

**RE: Scottsdale Ford Service Center
8555 East Frank Lloyd Wright Boulevard
Scottsdale, Arizona
Project No. 220662SA
Storm Water Retention**

Mr. Eklund:

This letter presents provides recommendations for the proposed underground storm water retention system.

Given the existing facilities and time constraints it is not feasible to conduct a typical double ring percolation testing at this time for the proposed underground retention system. We have reviewed our testing results from various sites within an a mile radius of the site. Percolation rates generally range from 35 to 60 minutes per inch. Typically, the percolation rate is de-rated or a factor of safety (0.5) applied for future working conditions. Therefore, a preliminary design rate of **120 minutes per inch** should be used for designing the system.

Once construction begins and a test pit can be excavated within the proposed system, contact our office to perform a percolation test to verify the working conditions of the system. It is also recommended to include a contingency to install a drywell for higher capacity if the percolation testing is not favorable.

If there are any further questions, please call.

Respectfully submitted,
SPEEDIE & ASSOCIATES, LLC.



Keith R. Gravel, P.E.

ATTACHMENT 4

Storm Drain Hydraulic Calculations

A. MIN. SD PIPE CALCULATIONS

*These are preliminary pipe capacity calculations.

**Final pipe capacity calculations will be included in Final Hydrology Report

PROJECT: Scottsdale Ford

LOCATION: Scottsdale, AZ

DATE: 07/18/2023

For full flow in a circular storm drain:

$$Q_f = 1.49 * (n^{-1}) * (A_f) * (R_f^{2/3}) * (S_0^{1/2})$$

Where Q_f = full flow rate (cfs)

n = Manning's roughness factor

$A_f = (\pi * D^2 / 4)$ = flow area at full flow (ft²)

$R_f = (D/4)$ = hydraulic radius at full flow (ft)

S_0 = longitudinal slope (ft/ft)

For minimum circular pipe size required:

$$D_r = [2.16 * (n) * (Q) / (S_0^{1/2})]^{3/8}$$

Where D_r = minimum size pipe required (ft)

n = Manning's roughness factor

Q = flow rate (cfs)

S_0 = longitudinal slope (ft/ft)

SD DATA TABLE:

SIZE	D (ft)	A _f (ft ²)	R _f (ft)	Q _f * n / (S ₀) ^{1/2}
3" PIPE	0.25	0.049	0.063	0.012
4" PIPE	0.33	0.087	0.083	0.025
6" PIPE	0.50	0.196	0.125	0.073
8" PIPE	0.67	0.349	0.167	0.158
10" PIPE	0.83	0.545	0.208	0.286
12" PIPE	1.00	0.785	0.250	0.464
15" PIPE	1.25	1.227	0.313	0.842
18" PIPE	1.50	1.767	0.375	1.369
24" PIPE	2.00	3.142	0.500	2.949

Avg. Manning Roughness Coefficients for Closed Conduits:

Pipe Material	PVC	HDPE	RCP	CONC
"n" Value (per SDCHM Table A-2)	0.011	0.012	0.013	0.014

Existing Pipe Size Check

PIPE NO.	Q ₁₀₀ (cfs)	S ₀ (ft/ft)	Material	n	D _r (ft)	d _r (in)	REQUIRED SIZE	EXISTING PIPE SIZE	REPLACE
1	8.86	0.010	PVC	0.011	1.32	15.86	18" PIPE	6" PIPE	YES
2	8.86	0.010	PVC	0.011	1.32	15.86	18" PIPE	6" PIPE	YES
3	23.32	0.014	PVC	0.011	1.78	21.41	24" PIPE	12" PIPE	YES

Proposed Pipe Size - Project Area

PIPE NO.	Q ₁₀₀ (cfs)	S ₀ (ft/ft)	Material	n	D _r (ft)	d _r (in)	USE	Q _{Full} (cfs)	CHECK: Q _{Full} > Q ₁₀₀
4	9.41	0.008	HDPE	0.012	1.46	17.48	18" PIPE	10.21	YES 108%
5	9.41	0.019	HDPE	0.012	1.24	14.86	15" PIPE	9.67	YES 103%
6	23.32	0.014	HDPE	0.012	1.84	22.12	24" PIPE	29.08	YES 125%

ATTACHMENT 5

Referenced Storm Drain Plans

CITY OF SCOTTSDALE  **SCOTTSDALE GEOGRAPHIC INFORMATION SYSTEMS**
3629 North Drinkwater Boulevard
Scottsdale, Arizona 85251