Preliminary Drainage Report

For

McCormick-Stillman Railroad Park - Roundhouse, Splash Pad & Site Improvements

City of Scottsdale, Arizona

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Project No. 19-1519

Date: June 2023

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Table of Contents

List of Figures

Appendix List

1.0 Introduction

Roundhouse, Splash Pad & Site Improvements is a proposed 0.22-acre development to the existing McCormick Stillman Railroad Park. The project is located at 7301 E. Indian Bend Road at the McCormick Stillman Railroad Park in Maricopa County, and is bounded by Indian Bend Road to the North and Scottsdale Road to the West. The project lies within a portion of the northwest corner of Section 11, Township 2 North, Range 4 East of the Gila and Salt River Meridian in Maricopa County, Arizona.

1.1 National Flood Insurance Program

This site is located within FEMA Flood Insurance Rate Map (FIRM) Panel 04013C1770M dated 09-18-2020. This area is classified as being a FEMA Flood Zone X. See Figure 1: FIRM Map.

2.0 Existing Site Conditions

The Project site is currently located in a commercial area that slopes generally from the SW to NE.

3.0 Offsite Drainage

The existing conditions and offsite drainage to the McCormick Stillman Railroad Park (MSRP) consists of two (2) primary tributary areas. The first tributary area is a regional watershed as described in the development plans and Master Drainage Report for the Ritz Carlton Resort/Five Star Development (courtesy CVL Consultants). The tributary area reaches back to the described locations in that report of the Camelback and Mummy Mountain ridgelines. A watershed area of 0.13 square miles results in approximately 760 CFS approaching the MSRP project site in a channel from the Ritz Carlton site under Scottsdale Road, which at the NWC of the MSRP site then crosses Indian Bend Road to outfall to the McCormick Ranch Golf Course inlet channel on the north side of Indian Bend Road. The CVL report confirms that the channel contains the adjacent flow to the MSRP site at the 100-year 6-hour discharge of 760 CFS. **Figure 1** below identifies the vicinity of the Ritz Carlton channel and verifies with a 2D model that the anticipated peak discharge is contained in the channel. The channel is constructed and functioning ahead of the new improvements proposed for the MSRP.

Figure 1- Ritz Carlton Offsite Channel

The second tributary area is the local on-site area considered which has influence on the MSRP site. Generally, the local watershed is bounded by Lincoln Road to the south, Scottsdale Road to the west, and Indian Bend Road to the north, with the project site to the east. A flow depth evaluation was prepared, and flow coverage exhibited in **Figures 2a and 2b** below. The purpose of the on-site evaluation was to confirm that post-developed conditions of the MSRP site did not create an adverse effect to the pre-developed condition of the site. As seen in Figures 2a and 2b, there is no adverse effect to the development of the proposed improvements to the MSRP site. Sheet flow depths shown are typically less than 0.10'-0.50' except for locations where historic swales or new storm drain or basins are proposed in the improved conditions. The figures below from the models that were run do not include existing or proposed storm drainage facilities. This output is a generalization of the character of the surface conditions during the same storm event for the on-site area. Several inlets and storm drainpipe infrastructure is being added to the site design for management of flows at low points in the project.

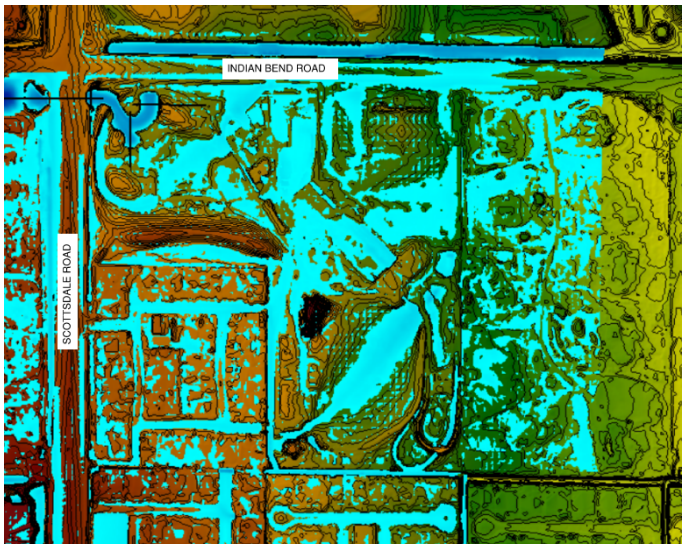


Figure 2a- Onsite Existing Conditions

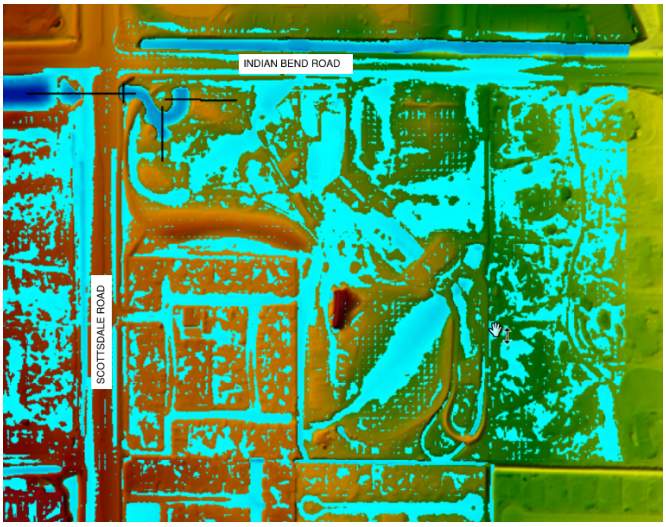


Figure 2b- Onsite Proposed Conditions

4.0 Onsite Hydrology

Onsite water storage will retain 100% of the 100-year, 2-hour storm event per Maricopa County and City of Scottsdale requirements.

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

ΔC is equal to the increase in the weighted average runoff coefficient over disturbed area (Cpost – Cpre).

City of Scottsdale standards require all retention facilities to drain their volume from the 100-year, 2-hour storm event (1.51" NOAA Atlas 14) within a 36-hour period. The basin will be drained within 36 hours with the use of an orifice plate attached to a headwall.

5.0 Methodology and Criteria

The following section provides an overview of the rational method and time of concentration to be used during final design for sizing of drainage structures.

5.1 Rational Method

The Rational Method was used to calculate storm drain peak flow at critical locations throughout the development, as outlined in the Maricopa County Drainage Manual Volume 2. The storm drain peak flows were calculated as follows:

$$Q_P = C \times i \times A_d$$

where:

Q_P = Peak flow (cfs)
C = Runoff coefficient
i = Intensity corresponding to Tc
A_d = Area in acres

5.2 Time of Concentration

Inlet time estimated, system time established based on summation of travel time in system and initial time of concentration based upon the following equation, with the initial lot T_c being 10 minutes:

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

where:

T_c = Time of concentration (hrs): minimum of 5 minutes
L = Length of the longest flow path (miles)
K_b = Watershed resistance coefficient – (See Maricopa County Drainage Manual, Hydrology)
S = Watercourse slope (ft/mi)
i = Rainfall intensity (in/hr)

6.0 Drainage Infrastructure

The following section provides an overview of the storm water drainage system that will be designed to collect and dispose of runoff generated during peak flow.

6.1 Onsite Retention Requirements

Surface and grading features are to be implemented to route storm water to Nyloplast catch basins and towards the retention area at the north end of the site. The Nyloplast catch basins will route stormwater via plastic pipe to a bubble up structure located within the retention/detention basin. The basin shall meet all applicable requirements of the City of Scottsdale Stormwater Storage Section 4.1.201.

6.1.1 Required Retention Volume

$$V_{required} = (\Delta C \times P \times A)/12$$

where:

$V_{required}$ = Volume Required (cf)
ΔC = runoff coefficient (Cpost - Cpre)
P = 1.51-inches (100-year, 2-hour design storm)
A = Area (sf)

7.0 Conclusions

This report concluded that:

- This site has sufficient retention capacity to retain peak flows per Maricopa County and City of Scottsdale design standards.
- The site will be designed to comply with Maricopa County Drainage Policies and Standards Manual and City of Scottsdale Design Standards and Policies Manual.

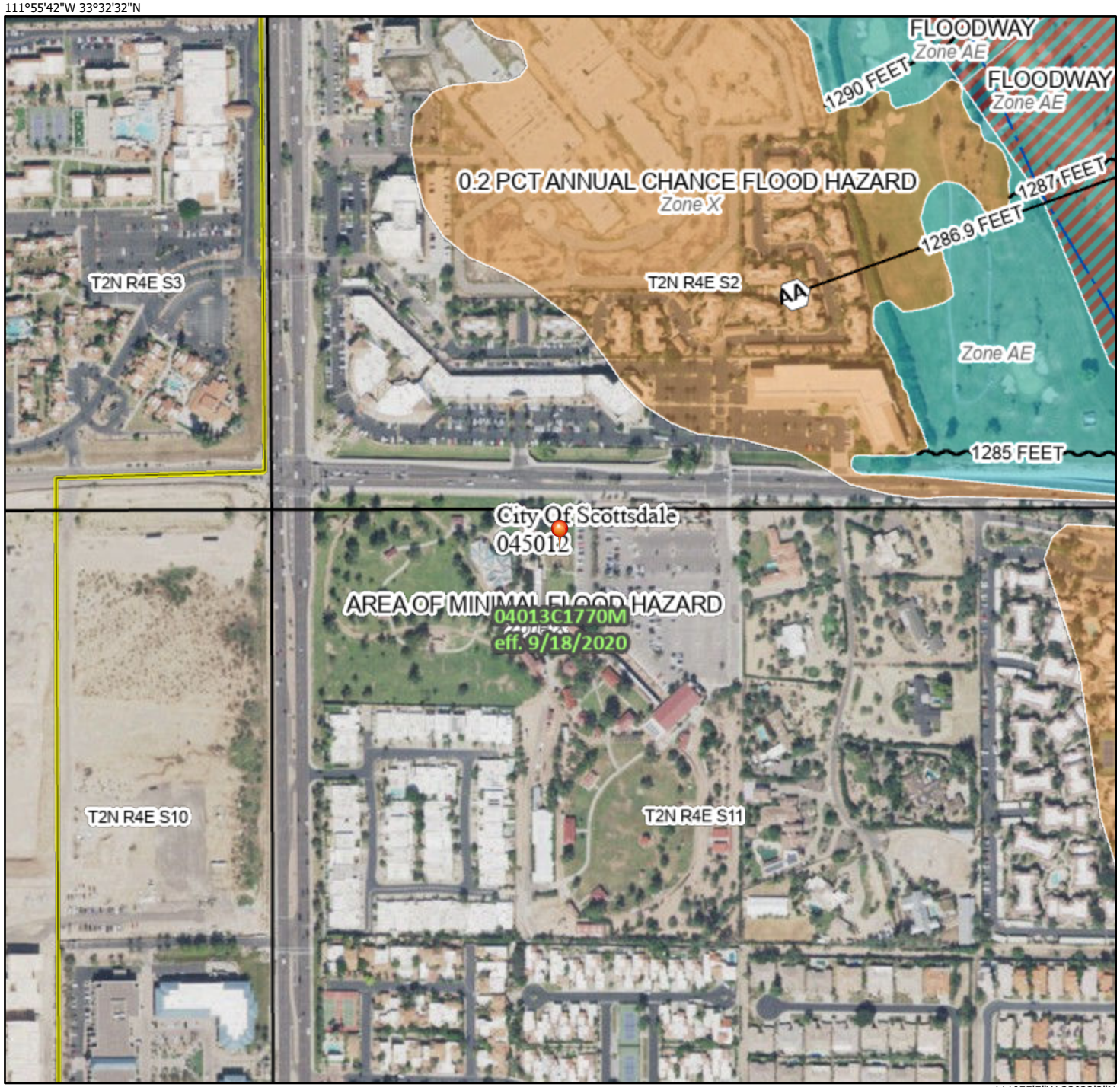
Appendix A

Figures and Exhibits

National Flood Hazard Layer FIRMette

FEMA

111°55'42"W 33°32'32"N



111°55'5"W 33°32'2"N

0 250 500 1,000 1,500 2,000 Feet

1:6,000

Basemap Imagery Source: USGS National Map 2023

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- 20.2 / 17.5 Cross Sections with 1% Annual Chance / Water Surface Elevation
- Coastal Transect
- Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

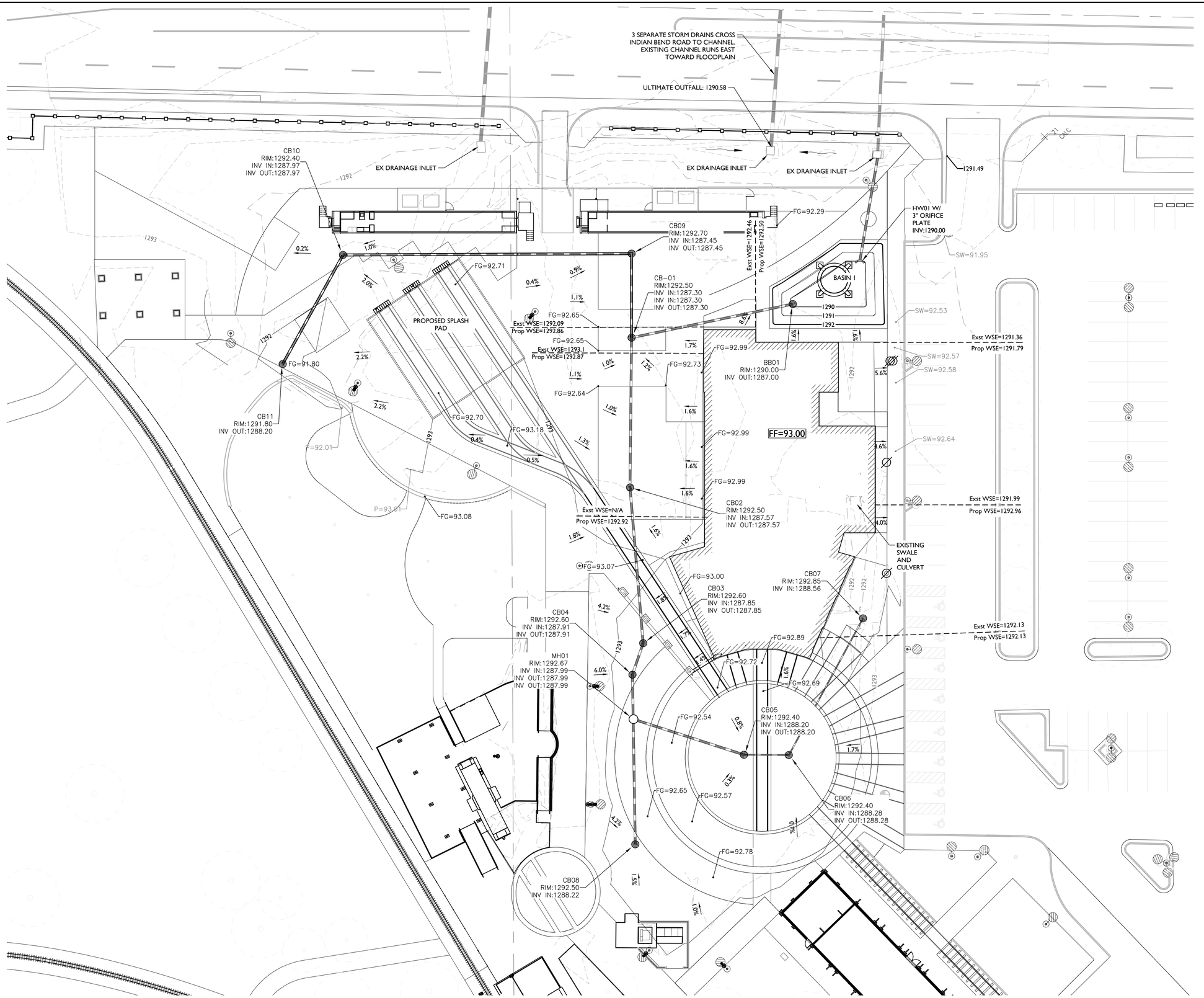
N

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 6/12/2023 at 12:35 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.



BENCHMARK

MARICOPA COUNTY ENGINEERING DEPARTMENT BRASS CAP IN HAND HOLE AT THE INTERSECTION OF INDIAN BEND ROAD AND SCOTTSDALE ROAD (DOWN 0.56').

ELEVATION = 1297.40' NGVD 29
NORTHING = 923523.2320'
EASTING = 697230.4840'

20 0 20 40
scale: 1" = 20' feet

DWL ARCHITECTS+
2333 N Central Ave
Phoenix AZ 85004
o 602.264.9731
dwlarchitects.com

PRELIMINARY
NOT ISSUED FOR CONSTRUCTION

CITY OF SCOTTSDALE
ROUNDHOUSE, SPLASH PAD & SITE IMPROVEMENTS
7301 E. INDIAN BEND ROAD
SCOTTSDALE, AZ 85250

McCORMICK-STILLMAN RAILROAD PARK EST. 1975

REVISIONS

No.	Description	Date

DESIGN DEVELOPMENT

KEY:

SHEET TITLE:
GRADING & DRAINAGE PLAN

SHEET NUMBER:
C-101

DRAWN BY:	REVIEWED BY:
NJD	MEL
DATE:	PROJECT NUMBER:
04/28/2023	1939.00

12/4/2006 1:54:55 PM

Retention Calculations

Project: MSRP - Preliminary Retention
Storm Event: 100-yr 2-hr
Prepared by: Nick Delp **Date:** 6/7/2023

$V = \Delta C * A * P / 12$ [1]
Where:
V = Runoff Volume
C = Runoff Coefficient
A = Drainage Area
P = 1.51 in

Surface Retention Basin Volume Calculations

Basin ID	*Elevation*	*Area (ft^2)*	*Incremental Volume (ft^3)*	*Volume Provided, V_p (ft^3)*
Basin 1	1290	480		
	1291	928	704	
	1292	1,502	1,215	
				1,919

Volume Required and Summary

$V = \Delta C * A * P / 12$ [1]
Where:
V = Runoff Volume
C = Runoff Coefficient
A = Drainage Area
P = 1.51 in

Basin ID	*Sub-Basin ID*	*Sub Basin Area Description*	*Contributing Area (ft^2)*	*C =*	*Volume Required, V_R (ft^3)*	*Volume Provided, V_p (ft^3)*	*Estimated Water Depth (ft)*
Total Site		Pre-Existing Condition	65,072	0.63	5,159		
		Post-Development	65,072	0.79	6,469		
		ΔTotal	65,072	0.16	1,310	1,919	1.37

Notes:
(1) Equation 3.3 taken from Maricopa County Drainage Design Manual - Hydrology

Weighted Runoff Coefficient by Area

Project: 19-1519 - Roundhouse, Splash Pad, & Site Improvements

Prepared By: Nick Delp **Date:** 6/7/2023

Burden Orchard Sub Basin Areas:

Sub Basin Area: Pre-Existing Condition

Area Description	"C"	Area
Impervious	0.95	32,587
Green Landscaping	0.30	32,485
Total Area	---	65,072
	Weighted "C"	**0.63**

Sub Basin Area: Post-Development

Area Description	"C"	Area
Impervious	0.95	49,187
Green Landscaping	0.30	15,885
Total Area	---	65,072
	Weighted "C"	**0.79**

Basin Bleedoff Calculations with Orifice Plate

Project:	19-1519 - MSRP Roundhouse, Splash Pad & Bunkhouse Improvements		
Location:	Basin 1		
Prepared By:	Nick Delp	**Date:**	6/7/2023

Basin Volume Calculations

Elevation	Area	Incremental Volume	Cumulative Volume
1290	478	0	0
1291	928	703	703
1292	1,502	1,215	1,918
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0

Orifice Information

Invert of Orifice	1290.00
Dia of Orifice	3"
Bleedoff Volume Required	1,918 CF

Orifice Bleedoff Results

Time to Bleedoff	2.0 hours
Calculated Bleedoff Volume	1,939 CF
Peak Orifice Discharge	0.38 CFS

Summary of Time Step Analysis

Time (Min)	Basin Volume (CF)	Basin WSE	Hydraulic Depth (ft)	Orifice Discharge (cfs)
0	1918.0	1292.00	2.13	0.38
10	1687.2	1291.81	1.94	0.37
20	1466.9	1291.63	1.75	0.35
30	1257.2	1291.46	1.58	0.33
40	1058.0	1291.29	1.42	0.31
50	869.5	1291.14	1.26	0.30
60	691.6	1290.98	1.11	0.28
70	524.9	1290.75	0.87	0.25
80	377.0	1290.54	0.66	0.21
90	248.2	1290.35	0.48	0.18
100	138.8	1290.20	0.32	0.15
110	48.8	1290.07	0.19	0.12
120	0.0	1290.00	0.13	0.09
130	0.0	1290.00	0.13	0.09
120	0.0	1290.00	0.13	0.09

Nyloplast Inlet Capacity Table

DISCLAIMER: SAFETY FACTORS ARE NOT INCLUDED IN THESE CALCULATIONS. ACTUAL CALCULATIONS SHOULD BE CARRIED OUT AND VERIFIED BY THE DESIGN ENGINEER TAKING INTO ACCOUNT ALL LOCAL CONDITIONS. NYLOPLAST RECOMMENDS USING A MINIMUM SAFETY FACTOR OF 1.25 FOR PAVED AREAS AND 2.0 FOR TURF AREAS. ADS/NYLOPLAST IS NOT RESPONSIBLE FOR MISUSE OF THIS TOOL.

Input	
Type of Grate	12" Standard
Head (ft)	4

Properties	
Orifice Flow Area (in)	**60.62**
Orifice Flow Area (ft)	**0.42**
Weir Flow Perimeter (in)	**43.75**
Weir Flow Perimeter (ft)	**3.65**

Solution	
Capacity (cfs)	**4.03**
Capacity (gpm)	**1807.04**

$$Q_{weir} = CLH^{3/2}$$

$C = 3.33\ Weir\ Discharge\ Coefficient$

$L = Perimeter\ of\ Grate\ Opening\ (ft)$

$H = Flow\ Height\ of\ Water\ Surface\ Above\ Weir\ (ft)$

$$Q_{orifice} = CA\sqrt{2gh}$$

$C = 0.60\ Orifice\ Discharge\ Coefficient$

$A = Area\ of\ the\ Orifice\ (ft^2)$

$g = Gravitational\ Constant\ \left(32.2\frac{ft}{s^2}\right)$

$H = Depth\ of\ Water\ Above\ Center\ of\ Orifice\ (ft)$

REV 2.1.21