PRELIMINARY DRAINAGE REPORT

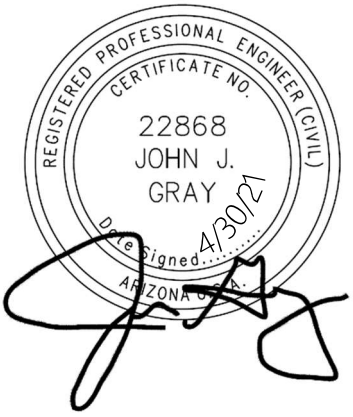
FOR

NORTH SCOTTSDALE AIRPARK

16115 NORTH 81ST STREET
SCOTTSDALE, ARIZONA

Prepared for:
DPA Architects
3719 North 75th Street, Suite 105
Scottsdale, AZ 85251
480-941-3888

Prepared by:
Bowman Consulting Group
1295 W Washing Street, Suite 108
Tempe, Arizona 85281
480-629-8830



April 30, 2021
Bowman Project No. 050941

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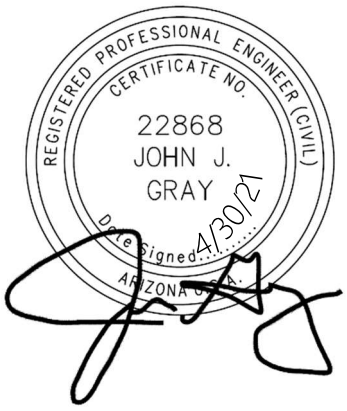


1.0 INTRODUCTION

This project is a 0.81-acre site plan involving the construction of an airplane hangar and is located near the southeast corner of Frank Lloyd Wright Boulevard and Greenway Haydon Loop in the City of Scottsdale, Arizona. As shown in appendix A, the project site is within a portion of Section 1, Township 3 North, Range 4 East of the Gila and Salt River Meridian, Maricopa County, Arizona.

The site will be designed in accordance with the City of Scottsdale and Design Standards and Policies Manual (Reference 1) and the Drainage Policies and Standards for Maricopa County, Arizona (Reference 2).

The purpose of this report is the following:

- Identify the development's offsite flows.
- Establish onsite drainage criteria for the development
- Show compliance with the City of Scottsdale Design Standards (Reference 1).

2.0 FLOODPLAIN DESIGNATION

The site lies within the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM) map number 04013C1320L, with a current effective date of October 16, 2013. The site is located within Zone X. Flood Zone X is defined as:

> 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 of flood.

3.0 OFFSITE DRAINAGE MANAGEMENT

3.1 GENERAL CONCEPT

The site lies within the Scottsdale Road Corridor Drainage Master Plan. The drainage master plan shows that runoff north of the site is intercepted by the CAP canal. The project accepts a small amount of flow from the taxiway directly north of the northeast corner of the site via sheet flow. A proposed onsite catch basin will capture this flow and retain it onsite.

4.0 ONSITE DRAINAGE MANAGEMENT

4.1 GENERAL CONCEPT

Currently the site is undeveloped desert and slopes southeasterly. Once developed, onsite storm water runoff will be retained using underground retention and a surface basin. Catch basins and storm drains will be used to capture and convey the storm water into the retention system.

4.2 DESIGN PEAK FLOWS

Onsite design peak flows were estimated using the Rational Method in accordance with the City of Scottsdale criteria. See appendix A for the corresponding drainage map illustrating the grading and drainage areas for the Project. The runoff

coefficient used in the calculations is 0.95, as the site is comprised of desert landscape, rooftop and concrete. The peak flow calculations are provided in Appendix B.

4.3 STREET INLET AND PIPE STRUCTURES

The onsite runoff will be conveyed into the underground retention system and surface basin via storm drain, and MAG 537 catch basins. These inlet and pipe structures are designed to convey the 10-year peak flow assuming that each type of inlet is 50% clogged. Inlet sizing calculations are provided in Appendix C. A StormCAD model was created to obtain hydraulic grade lines and ensure that the pipes are properly sized. The StormCAD model results are provided in Appendix D.

4.4 RETENTION REQUIREMENT

The retention requirement for the site is the volume of runoff produced by the 100-year 2-hour storm. According to the NOAA Atlas 14 database, the 100-year 2-hour storm rainfall depth is 2.26 inches. A 10-foot diameter corrugated metal pipe and a surface basin are proposed to accommodate the storm water runoff volume. The surface basin will be one foot deep and will maintain 4:1 side slopes. Retention volume calculations are included in Appendix E.

4.5 STORM WATER DISSIPATION

The City of Scottsdale requires retained storm water to be drained from the basin within a 36-hour time period. In order to conform to this design requirement, a drywell will be used. A drywell percolation rate of 0.1 cfs will be assumed until a percolation test is completed. Dissipation calculations are located in Appendix E.

5.0 ULTIMATE OUTFALL

An outfall will be provided for each onsite drainage area to allow flow in excess of the design storm or in back to back events to leave the drainage area without inundating finished floors of structures within that area. The ultimate outfall for the project site is located near at the proposed driveway at an elevation of 1509.53. From here, excess runoff will flow south down 81st Street.

Finished floors will be set a minimum of 14 inches above the highest applicable ultimate outfall of the lot, drainage area, or project.

6.0 CONCLUSION

The proposed development shall be designed in compliance with the City of Scottsdale design standards and other applicable drainage standards set forth by the Flood Control District of Maricopa County. This report has established:

- Onsite storm water from storms up to the 100-year 2-hour event will be retained in in a surface basin and underground retention system.
- Offsite flows will be properly routed through the site and retained.

- Catch basins and storm drains will be sized for the 10-year storm event.
- The retention will drain via drywell within 36-hours.
- Finished floors will be set a minimum of 14 inches above the highest applicable ultimate outfall of the lot, drainage area, or project.

7.0 REFERENCES

1. City of Scottsdale, 2018. Design Standards and Policies Manual. City of Scottsdale, Arizona.

2. Flood Control District of Maricopa County, August 22, 2018. Drainage Policies and Standards for Maricopa County, Arizona. Flood Control District of Maricopa County, Phoenix, Arizona.

APPENDIX A

Exhibits

Bowman

1295 West Washington Ste 108
Tempe, Arizona 85281

Phone: (480) 629-8830
www.bowmanconsulting.com

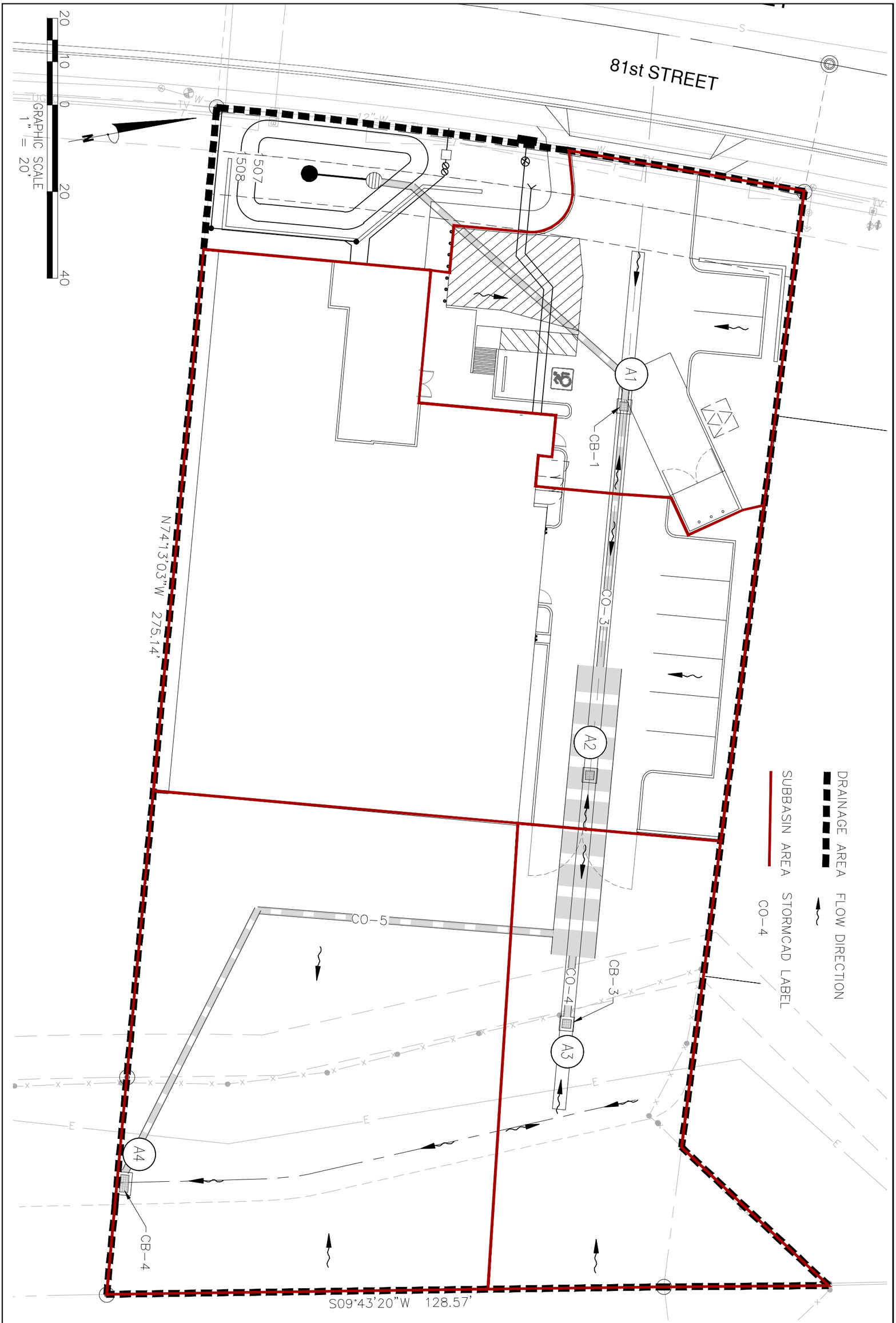
SCOTTSDALE AIRPARK

SCOTTSDALE, AZ

VICINITY MAP

JOB #	050941
DATE	3/9/21
SCALE	N.T.S.
DRAWN	HMT
SHT 1 OF 1	

CAD FILE NAME: P:\050941 – North Scottsdale Airpark Unit 1 Lot 35\050941-01-001 (ENG)\Engineering\Exhibits\050941-EXH-VICMAP.dwg 03/09/2021



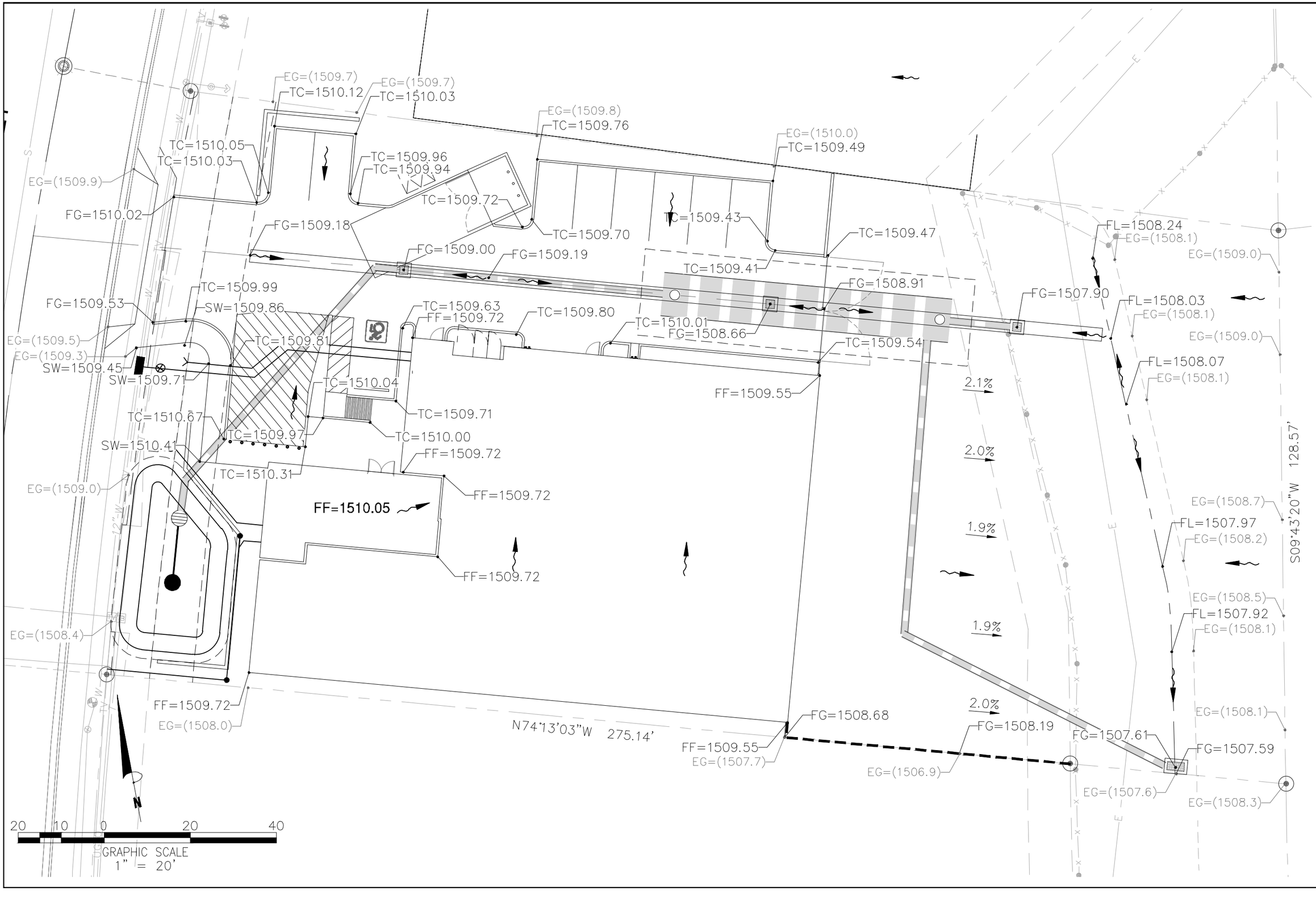
SHT 1 OF 2	JOB # 050941	**Bowman**	1295 West Washington Ste 108 Tempe, Arizona 85281 Phone: (480) 629-8830 www.bowmanconsulting.com
DRAWN HMT	DATE FEB. 2021		
	SCALE AS NOTED		

NORTH SCOTTSDALE AIRPARK

SCOTTSDALE, AZ

PRELIMINARY DRAINAGE EXHIBIT

CAD FILE NAME: P:\050941 - North Scottsdale Airpark Unit 1 Lot 35\050941-01-001 (ENG)\Engineering\Exhibits\050941-PR-DDM.dwg 04/30/2021



NORTH SCOTTSDALE AIRPARK

SCOTTSDALE, AZ

PRELIMINARY DRAINAGE EXHIBIT

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Bowman

JOB #	050941
DATE	FEB. 2021
SCALE	AS NOTED
DRAWN	HMT
SHT	OF

CAD FILE NAME: P:\050941 - North Scottsdale Airpark Unit 1 Lot 35\050941-01-001 (ENG)\Engineering\Exhibits\050941-PR-DDM.dwg 04/30/2021

National Flood Hazard Layer FIRMette

FEMA

111°54'38"W 33°38'10"N

111°54'W 33°37'40"N

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

1:6,000

Basemap: USGS National Map: Orthoimagery: Data refreshed October, 2020

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 Cross Sections with 1% Annual Chance
- 17.5 Water Surface Elevation
- Coastal Transect
- 513 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 2/22/2021 at 5:15 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.

APPENDIX B

Rational Calculations

Peak Inlet Flow Calculations Using The Rational Method

Project:	Scottsdale Airpark
Proj #:	050941
Date:	4/30/21
By:	HT

Rainfall Depth-Duration-Frequency (D-D-F), (inch)					
Desired Fequency	Time				
	5 min	10 min	15 min	30 min	60 min
10-Yr	0.41	0.62	0.77	1.03	1.28
100-Yr	0.64	0.97	1.21	1.63	2.01
Rainfall Intensity-Duration-Frequency (I-D-F), (in/hr)					
10-Yr	4.88	3.72	3.07	2.06	1.28
100-Yr	7.63	5.81	4.84	3.26	2.01

AF for Cw per Cw_{100-Yr}		
Freq.	Typical	Applic.
2-Yr	1.00	1.00
5-Yr	1.00	1.00
10-Yr	1.00	1.00
25-Yr	1.10	1.00
50-Yr	1.20	1.00
100-Yr	1.25	1.00

AF=Frequency Adjustment Factor

Drainage Area ID:	-----				10-Yr			100-Yr		
					Cw is adjusted as a function of the 100-year value per the table above					
Concent. Point	Contributing Sub-basins	Total Area (ac)	2-10 year Cw	Tc (min)	Cw AF=1.00	i (in/hr)	Q 10-Yr (cfs)	Cw AF=1.00	i (in/hr)	Q 100-Yr (cfs)
1	A1	0.121	0.95	5.0	0.95	4.88	0.6	0.95	7.63	0.9
2	A2	0.305	0.95	5.0	0.95	4.88	1.4	0.95	7.63	2.2
3	A3	0.120	0.95	5.0	0.95	4.88	0.6	0.95	7.63	0.9
4	A4	0.222	0.95	5.0	0.95	4.88	1.0	0.95	7.63	1.6

Notes:

APPENDIX C

Inlet Sizing Calculations

CATCH BASIN DESIGN FOR 10-YR EVENT

Project: North Scottsdale Airpark
Project #: 050941
Prepared by: HT **DATE:** 4/30/2021

INTENT: Verify adequacy of catch basin/scupper size per following equations, capacities are as noted below. Evaluation compares capacity at maximum ponding depth to the peak flow. Calculations are as outlined in the Drainage Design Manual for Maricopa County unless otherwise specified.

Curb open catch basin:

For length of curb opening: $Q_{CO} = C_w (L + 1.8W) d^{1.5} (F_{CL})$

Where:

C_w = 2.3

W = (Scupper) 1.42 ft — MAG 533 W = 2. ft; Curb Opening W = 1.42 ft

F_{CL} = 0.80 Clogging factor for curb-open catch basin/scuppers

Grated catch basin:

For the grated portion of the catch basin: $Q_{GR} = C_w P d^{1.5} (F_{CL})$

Where:

F_{CL} = 0.50 Clogging factor for **Grated** portion of the catch basin

C_w = 3.0

MAG 537 Single P = 7.67 ft

MAG 537 Double *P = 10.75 ft

*Perimeter calculated at edge of concrete collar

Concentration Point	Inlet ID	Flow Q_{10}	Catch Basin/Scupper Type and Length (ft)	Water Height (d)	Max. Flow into Catch Basin (CFS)
A1	CB A1	0.6	MAG 537 Single	0.20	1.0
A2	CB A2	1.4	MAG 537 Single	0.25	1.4
A3	CB A3	0.6	MAG 537 Single	0.14	0.6

Flow-By Catch Basin Calculation

Project Data

Project Title: Inlet A4

Designer: HT

Project Date: Tuesday, February 23, 2021

Project Units: U.S. Customary Units

Curb and Gutter Analysis: Curb and Gutter Analysis

Gutter Input Parameters

Longitudinal Slope of Road: 0.0150 ft/ft

Cross-Slope of Pavement: 0.0200 ft/ft

Uniform Gutter Geometry

Manning's n: 0.0150

Gutter Width: 0.0010 ft

Design Flow: 1.0000 cfs

Gutter Result Parameters

Width of Spread: 6.5208 ft

Gutter Depression: 0.0000 in

Area of Flow: 0.4252 ft^2

Eo (Gutter Flow to Total Flow): 0.0004

Inlet Input Parameters

Inlet Location: Inlet on Grade

Inlet Type: Grate

Grate Type: P - 1-1/8

Grate Width: 4.4200 ft

Grate Length: 2.4100 ft

Local Depression: 1.0000 in

Inlet Result Parameters

Intercepted Flow: 1.0000 cfs

Bypass Flow: 0.0000 cfs

Approach Velocity: 2.3518 ft/s

Splash-over Velocity: 7.1221 ft/s

Efficiency: 1.1614

APPENDIX D

StormCAD Model Results

FlexTable: Catch Basin Table

Active Scenario: 10-year

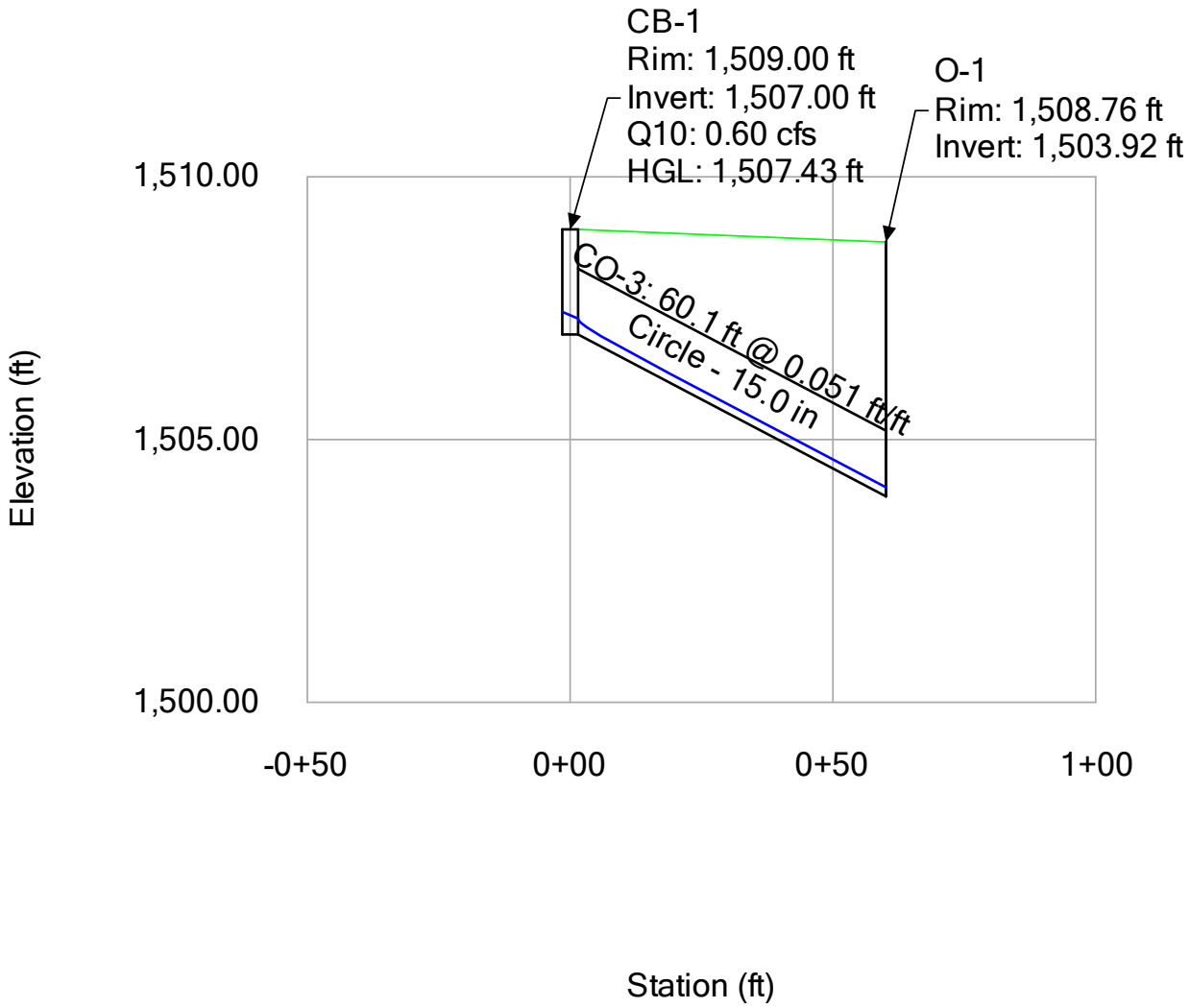
ID	Label	Elevation (Rim) (ft)	Elevation (Invert) (ft)	Flow (Additional Subsurface) (cfs)	Hydraulic Grade Line (In) (ft)
43	CB-1	1,509.00	1,507.00	0.60	1,507.43
48	CB-3	1,507.91	1,504.12	0.60	1,504.55
36	CB-4	1,507.64	1,505.64	1.00	1,506.20

FlexTable: Conduit Table

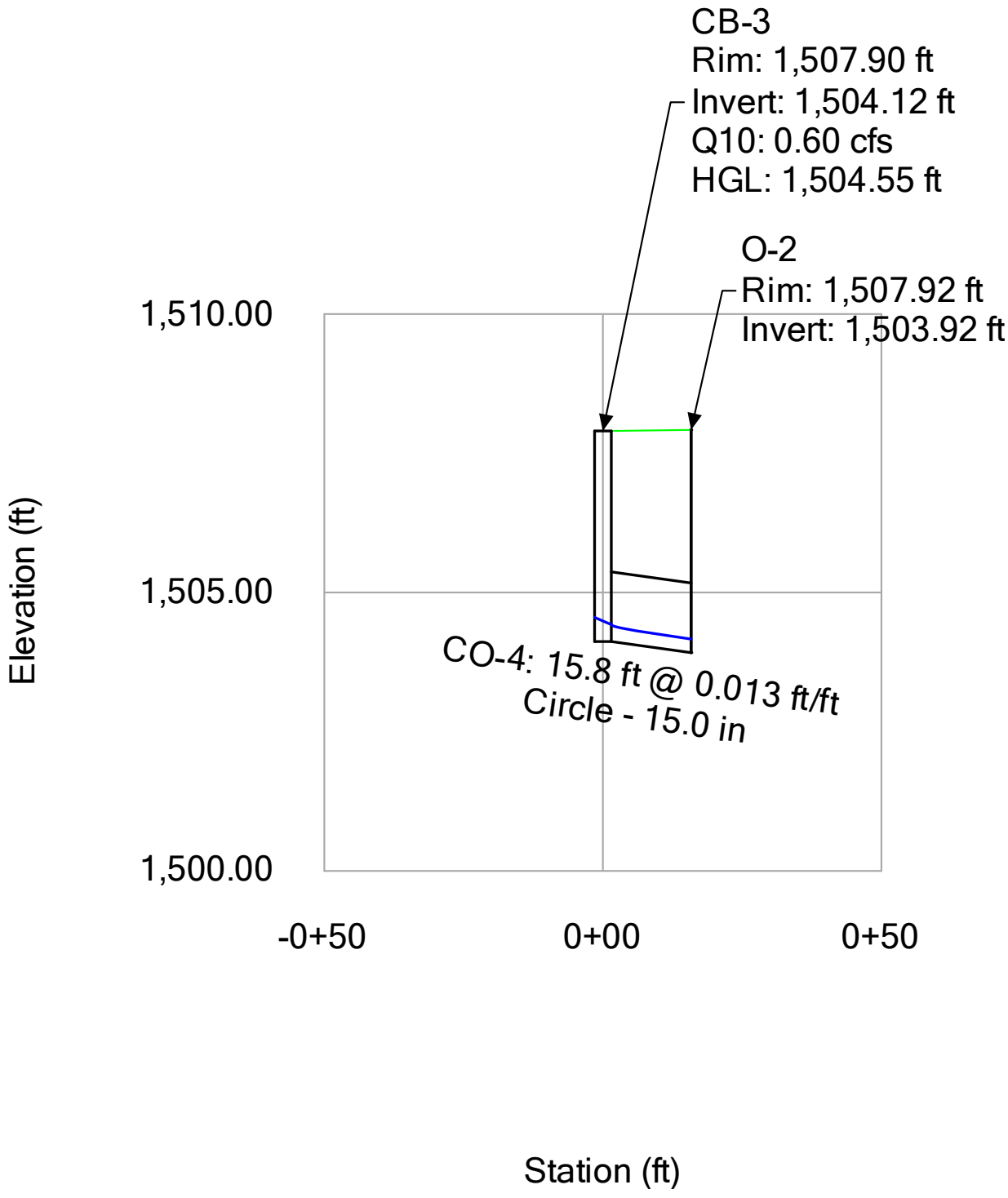
Active Scenario: 10-year

ID	Label	Start Node	Stop Node	Length (Scaled) (ft)	Slope (Calculated) (ft/ft)	Diameter (in)	Manning's n	Flow (cfs)	Velocity (ft/s)
41	CO-3	CB-1	O-1	60.1	0.051	15.0	0.013	0.60	5.86
50	CO-4	CB-3	O-2	15.8	0.013	15.0	0.013	0.60	3.58
52	CO-5	CB-4	O-3	139.1	0.012	15.0	0.013	1.00	4.12

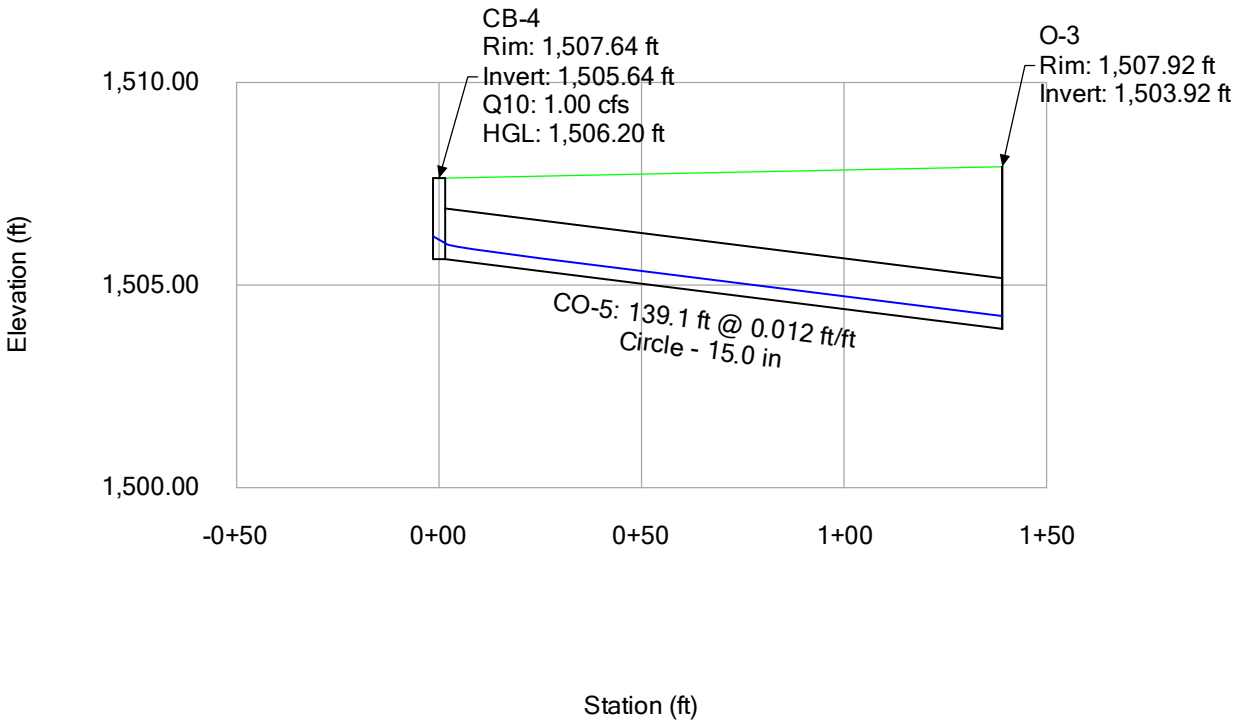
Profile Report
Engineering Profile - CB-1 to O-1 (050941.stsw)
Active Scenario: 10-year



Profile Report
Engineering Profile - CB-3 to O-2 (050941.stsw)
Active Scenario: 10-year



Profile Report
Engineering Profile - CB-4 to O-3 (050941.stsw)
Active Scenario: 10-year



APPENDIX E

Retention and Dissipation Calculations

RETENTION WORKSHEET FOR 100-YR, 2-HR EVENT

Project: 050941 Scottsdale Airpark
Description: Preliminary
Prepared by: HT DATE: 4/30/2021

Basin A Summary

Extra Provided		Required Drywells
305 cf	**0.0070 Ac-ft**	**1.0**

Volume Required:

Vr= D/12 x A x C

D = 100yr 2hr Rainfall, 2.26
A = Area in Square Feet
C = Coefficient of Runoff

Sub Area Type	Area (sf)	Runoff Coefficient	Retention Required (cf)	Retention Required (ac-ft)
Concrete/Roof	20,601	0.95	3,686 cf	0.08 Ac-ft
Desert L/S	14,600	0.70	1,925 cf	0.04 Ac-ft
Totals			5,611 cf	0.13 Ac-ft
		Total Retention Required	**5,611 cf**	**0.13 Ac-ft**

Retention Basin Volume Provided:

Contour Elevation	Depth Increment	Area (sf)	Volume (cf)	Cumm. Volume (cf)
1507.00	0.00	447	0	0
1508.00	1.00	860	653	653
TOTAL DEPTH:	**0.00**		**Volume Provided:**	**653**
			Estimated High Water:	**1,508.00**

Underground Retention Volume Provided:

Pipe Diameter (ft)	Pipe Length (ft)	Volume (cf)
10.00	67.00	5,262
	Volume Provided:	**5,262 cf**
	Total Volume Provided:	**5,915 cf**

Dissipation Calculations

Retention Required (cf)	Derated Surface Percolation Rate (cf/hr/sf)	Basin Bottom Area (sf)	Surface Percolation in 36hrs (cf)	Volume to be Drained Through Drywells (cf)
5,611	0.00	0	0	5,611

Dissipation Calculations for Drywells

Volume to be drain Through Drywells (cf)	Drywell Percolation Rate (cf/36hr)	Number of Drywells Required
5,611	12,960	1.0

APPENDIX F

Warning and Disclaimer Liability

GRADING & DRAINAGE LANGUAGE

WARNING AND DISCLAIMER OF LIABILITY

The City's Stormwater and Floodplain Management Ordinance is intended to minimize the occurrence of losses, hazards and conditions adversely affecting the public health, safety and general welfare which might result from flooding.

The Stormwater and Floodplain Management Ordinance identifies floodplains, floodways, flood fringes and special flood hazard areas. However, a property outside these areas could be inundated by floods. Also, much of the city is a dynamic flood area; floodways, floodplains, flood fringes and special flood hazard areas may shift from one location to another, over time, due to natural processes.

WARNING AND DISCLAIMER OF LIABILITY

The flood protection provided by the Stormwater and Floodplain Management Ordinance is considered reasonable for regulatory purposes and is based on scientific and engineering considerations. Floods larger than the base flood can and will occur on rare occasions. Floodwater heights may be increased by constructed or natural causes. The Stormwater and Floodplain Management Ordinance does not create liability on the part of the city, any officer or employee thereof, or the federal, state or county government for any flood damages that result from reliance on the Ordinance or any administrative decision lawfully made thereunder.

Compliance with the Stormwater and Floodplain Management Ordinance does not ensure complete protection from flooding. Flood-related problems such as natural erosion, streambed meander, or constructed obstructions and diversions may occur and have an adverse effect in the event of a flood. You are advised to consult your own engineer or other expert regarding these considerations.

I have read and understand the above.

_____	_____	_____
Plan Check #	Owner	Date