Appendix J.1

Preliminary Hydrology Report
MSA Consulting, Inc.

PRELIMINARY HYDROLOGY REPORT

Located in a portion of the North ½ of
Section 15, Township 5 South, Range 7 East, S.B.M.
City of Indio, County of Riverside, California

THE OASIS AT INDIO

August 21, 2023

Prepared for:

B.H. Management, Inc.

11111 Santa Monica Boulevard, Suite 600
Los Angeles, California 90049

MSA Job Number: 2760

MSA CONSULTING, INC.
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LIST OF APPENDICES

PROJECT LOCATION

The proposed project site comprises approximately 182 acres located along the southwest corner of Avenue 42 and Monroe Street, in the City of Indio, Riverside County. The site is described as a portion of Parcel 1-4 of Parcel Map No. 38799, Records of Riverside County California and is assigned Assessor's Parcel Numbers 610-020-001, -010, -012, -013, -021, -034, and -036. A vicinity map obtained from the Riverside TLMA website is included as Appendix A.

EXISTING CONDITIONS

Flood Rate Map

The proposed (to be developed) area is covered by FIRM Panel Number 06065C2251H, effective March 6, 2018, which indicates the project area lies within Zone X which is defined as *"Areas determined to be outside the 0.2% annual chance floodplain."* (Refer to the attached NFIP Flood Insurance Rate Map – Appendix B).

National Cooperative Soil Survey

The existing soil is categorized as hydrologic soil group B as shown on the attached USDA NCSS Hydrologic Soils Map exhibits in Appendix C.

Existing Topography

The subject area is currently being shown as native vegetation. Topographically, the site generally slopes to the southeast. A Phase I Study has been completed for this property.

PROPOSED FLOOD CONTROL REQUIREMENTS

Currently drainage requirements for this project fall under the jurisdiction of the City of Indio. For the purposes of this report, the project tributary area is based on the project boundary, street frontage, and the preliminary grading (Refer to the Preliminary Grading and Drainage Plan included in Appendix G.) The underground stormwater detention and retention basins were sized to provide storage of the 100-year controlling storm event (Refer to the Proposed Underground Storage Volumes included in Appendix E.)

Offsite tributary flood flows will be conveyed along the street frontage of the site following the historical flow path. As the final design documents are generated, a more detailed hydrology report will be prepared for the City to review; that report will include hydraulic calculations for the associated catch basins, storm drain conveyance system, and underground retention facility storage capacities.

The project area has been evaluated as two tributary areas DA-A and DA-B, with each areas storm flows draining to separate retention basins/underground stormwater CMP retention facilities (refer to the Preliminary Hydrology Exhibit included in Appendix G.)

HYDROLOGY ANALYSIS DESIGN CRITERIA

Storm run-off volumes for the 100-year event were obtained utilizing the Synthetic Unit (Shortcut Method) Hydrograph, as described in the *RCFC&WCD Hydrology Manual*. The shortcut method is useful for evaluating those areas less than 200 acres in size. The hydrologic data used for the calculations are as follows:

Hydrologic Soil Group

Soil Group B is defined by RCFCD as – "those soils having moderate infiltration rates. These soils consist chiefly of moderately deep or deep, moderately well drained or well drained that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission."

Antecedent Moisture Condition

AMC II – Moderate runoff potential, an intermediate condition. Per RCFC & WCD Hydrology Manual (Dated: April, 1978): "For the purposes of design hydrology using District methods, AMC II should normally be assumed for both the 10 year and 100 year frequency storm".

Land Use Classifications and Runoff Index Numbers

Runoff Index Numbers were obtained from RCFCD Plate E-6.1 and are summarized below:

Proposed Conditions - Commercial Landscaping	56

Percent of Impervious Cover (RCFCD Plate E-6.3):

Proposed Conditions	
Building	100%
Paving/Hardscape	100%
Landscaping areas	minimal area, not included in these calc.'s

Low Loss Rates:	85%

Precipitation Frequency Estimates

Precipitation depths were obtained from NOAA Atlas 14:

2 Year - 1 Hour Precipitation:	0.353	inches
100 Year – 1 Hour Precipitation:	1.45	inches
100 Year – 3 Hour Precipitation:	2.13	inches
100 Year - 6 Hour Precipitation	2.75	inches
100 Year – 24 Hour Precipitation	4.45	inches
Slope of Intensity Duration Curve:	0.52	

See Appendix D for the NOAA Atlas 14 Point Precipitation Frequency Estimates and respective RCFCD Plates.

Site Infiltration

For the purposes of this report the City of Indio maximum design percolation rate of 1 inch per hour was used in the calculations.

SUMMARY of SYNTHETIC UNIT (SHORTCUT METHOD) ANALYSES

The subject project area of 182 acres is less than the 200-acre limit guideline for utilization of the shortcut method.

It should be noted that the peak flow for the 1-hour storm is not necessarily representative for peak flow. Per RCFCD, peak discharges from the 3-hour storm should normally compare well with rational peaks.

Analyses performed include: flood volume calculations based on RCFCD Synthetic Unit (Shortcut Method) and Underground retention Storage calculations. For the purposes of this report, all hydrologic land use areas were derived from the Proposed Technical Site Plan. The Synthetic Unit Hydrograph Worksheets are included in Appendix E with the Proposed Land Use Summary included in Preliminary Hydrology Exhibit Appendix G.

PRELIMINARY WQMP ANALYSIS

Preliminary design volume and flow for BMP measures were based on Worksheets 1 and 2 from the Riverside County - Whitewater River Region Water Quality Management Plan (Appendix F). Impervious areas for the tributary drainage areas are derived from the Synthetic Unit Hydrograph Worksheets Appendix E. A summary of the design flow and volumes is presented in the Preliminary Hydrology Exhibit Appendix G.

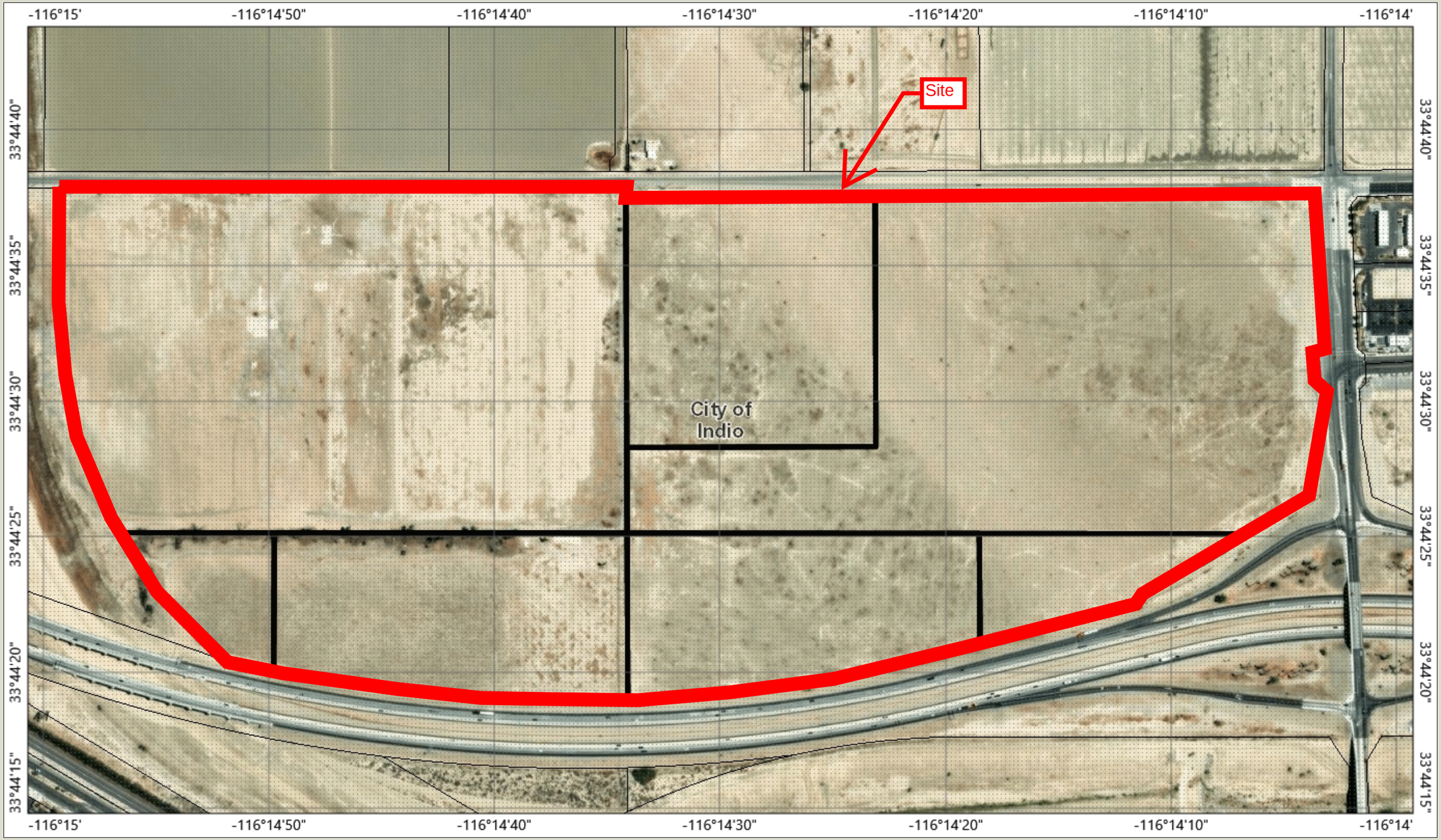
RESULTS AND CONCLUSIONS

As the above narrative and summaries confirm, the preliminary underground retention facility and retention basins has sufficient storage to retain the flood volume from the 100 year storm event, and therefore meet the hydrologic requirements established by the City of Indio.

Appendix A

Riverside County TLMA Vicinity Map

Vicinity Map



Legend

- Parcels
- Blueline Streams
- City Areas
- World Street Map

0 448 897 Feet

IMPORTANT Maps and data are to be used for reference purposes only. Map features are approximate, and are not necessarily accurate to surveying or engineering standards. The County of Riverside makes no warranty or guarantee as to the content (the source is often third party), accuracy, timeliness, or completeness of any of the data provided, and assumes no legal responsibility for the information contained on this map. Any use of this product with respect to accuracy and precision shall be the sole responsibility of the user.

REPORT PRINTED ON... 8/17/2023 8:12:09 AM

Notes

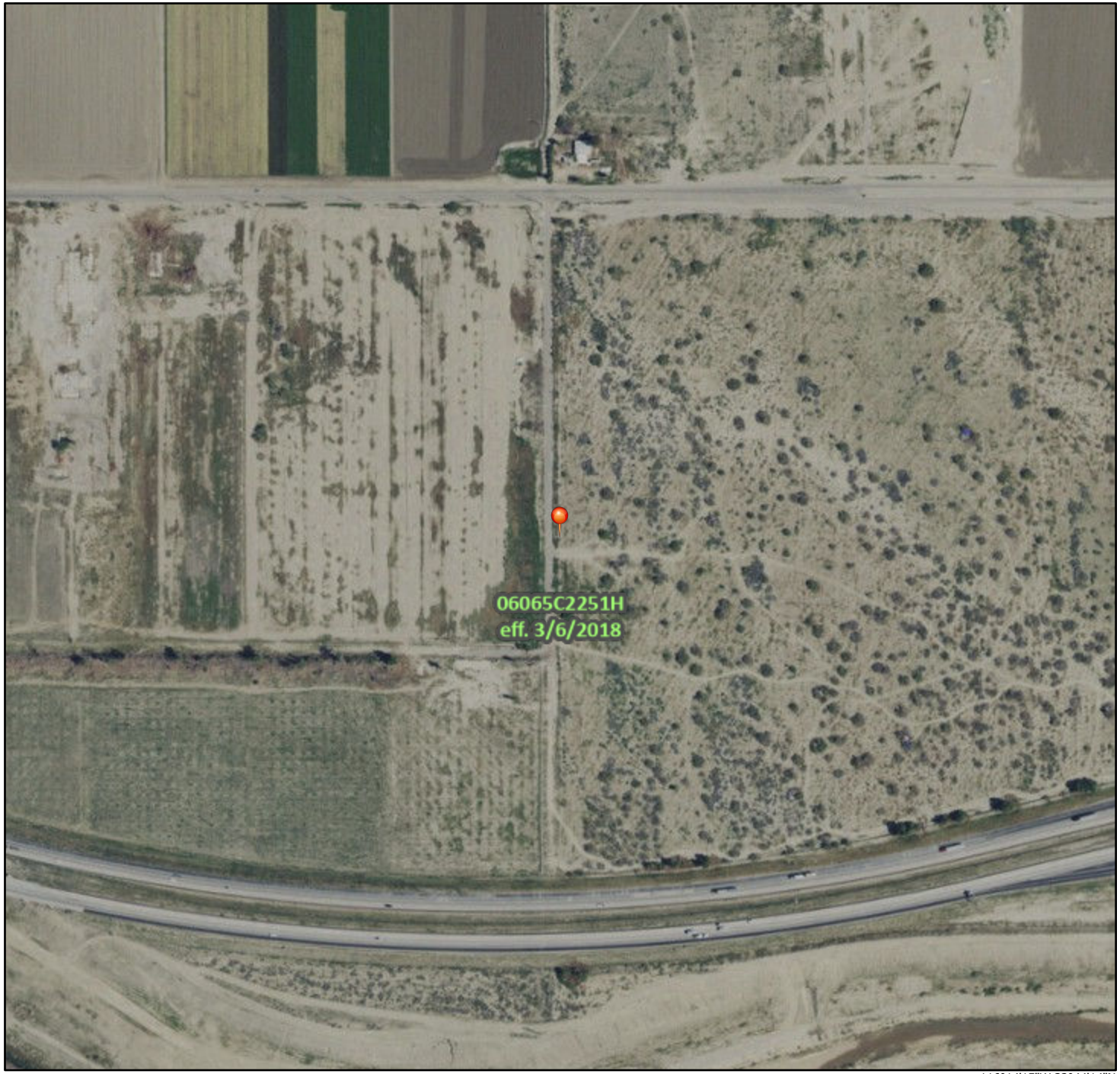
Appendix B

NFIP Flood Insurance Rate Map

National Flood Hazard Layer FIRMette

FEMA

116°14'53"W 33°44'43"N



116°14'15"W 33°44'14"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.

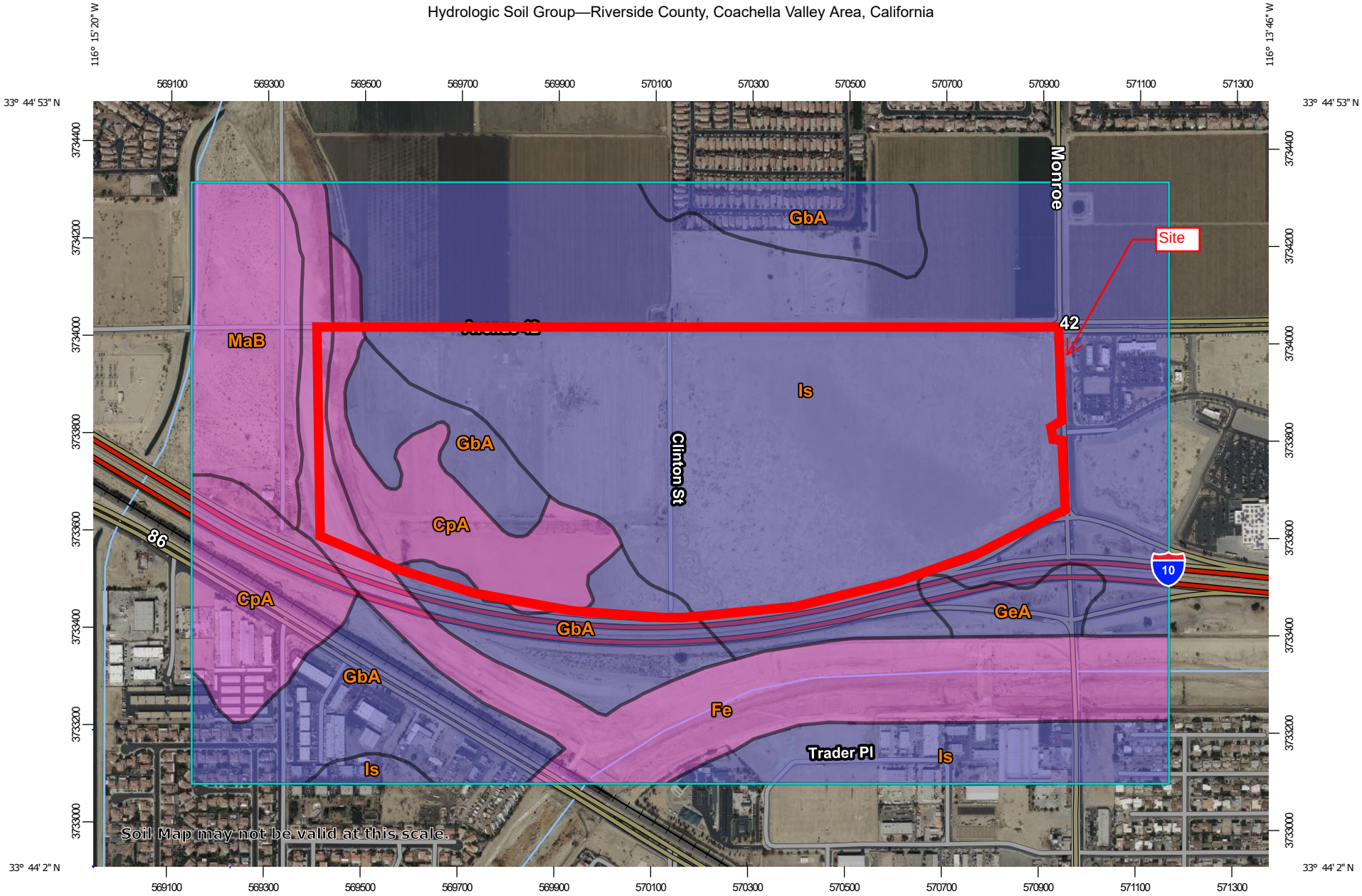
This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 8/16/2023 at 7:38 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 C

USDA NCSS Hydrologic Soils Map



Map Scale: 1:11,100 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 150 300 600 900

Feet: 0 500 1000 2000 3000

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 11N WGS84

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: Riverside County, Coachella Valley Area, California
Survey Area Data: Version 14, Sep 1, 2022

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

Date(s) aerial images were photographed: Mar 15, 2022—May 28, 2022

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
CpA	Coachella fine sand, 0 to 2 percent slopes	A	59.1	9.6%
Fe	Fluvents	A	81.0	13.1%
GbA	Gilman fine sandy loam, 0 to 2 percent slopes	B	98.9	16.0%
GeA	Gilman silt loam, 0 to 2 percent slopes	B	9.8	1.6%
Is	Indio very fine sandy loam	B	335.3	54.2%
MaB	Myoma fine sand, 0 to 5 percent slopes	A	34.9	5.6%
Totals for Area of Interest			**618.9**	**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

Appendix D

NOAA Atlas 14

RCFCD Reference Plates

NOAA Atlas 14, Volume 6, Version 2
Location name: Indio, California, USA*
Latitude: 33.7412°, Longitude: -116.2427°
Elevation: 15 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	**0.065** (0.054-0.078)	**0.100** (0.083-0.121)	**0.152** (0.126-0.185)	**0.200** (0.165-0.245)	**0.274** (0.218-0.348)	**0.339** (0.264-0.439)	**0.412** (0.313-0.548)	**0.497** (0.367-0.680)	**0.631** (0.447-0.901)	**0.754** (0.515-1.11)
10-min	**0.093** (0.077-0.112)	**0.143** (0.119-0.174)	**0.218** (0.181-0.265)	**0.287** (0.236-0.352)	**0.392** (0.312-0.498)	**0.485** (0.378-0.629)	**0.591** (0.449-0.785)	**0.713** (0.527-0.975)	**0.905** (0.640-1.29)	**1.08** (0.738-1.60)
15-min	**0.112** (0.094-0.136)	**0.173** (0.144-0.210)	**0.264** (0.219-0.321)	**0.347** (0.285-0.425)	**0.475** (0.378-0.602)	**0.587** (0.457-0.761)	**0.715** (0.543-0.950)	**0.862** (0.637-1.18)	**1.09** (0.774-1.56)	**1.31** (0.893-1.93)
30-min	**0.163** (0.136-0.198)	**0.252** (0.210-0.306)	**0.384** (0.319-0.467)	**0.504** (0.415-0.618)	**0.690** (0.549-0.876)	**0.853** (0.665-1.11)	**1.04** (0.789-1.38)	**1.25** (0.926-1.72)	**1.59** (1.13-2.27)	**1.90** (1.30-2.81)
60-min	**0.228** (0.190-0.277)	**0.353** (0.294-0.428)	**0.537** (0.446-0.653)	**0.705** (0.581-0.865)	**0.966** (0.769-1.23)	**1.19** (0.930-1.55)	**1.45** (1.10-1.93)	**1.76** (1.30-2.40)	**2.23** (1.58-3.18)	**2.66** (1.82-3.93)
2-hr	**0.317** (0.265-0.384)	**0.470** (0.391-0.570)	**0.698** (0.579-0.849)	**0.906** (0.746-1.11)	**1.23** (0.979-1.56)	**1.51** (1.18-1.96)	**1.83** (1.39-2.44)	**2.20** (1.62-3.01)	**2.76** (1.96-3.94)	**3.27** (2.23-4.83)
3-hr	**0.381** (0.318-0.462)	**0.557** (0.464-0.676)	**0.820** (0.681-0.998)	**1.06** (0.874-1.30)	**1.44** (1.14-1.82)	**1.76** (1.37-2.29)	**2.13** (1.62-2.84)	**2.56** (1.89-3.50)	**3.21** (2.28-4.59)	**3.79** (2.59-5.61)
6-hr	**0.503** (0.419-0.609)	**0.730** (0.608-0.886)	**1.07** (0.888-1.30)	**1.38** (1.14-1.69)	**1.86** (1.48-2.36)	**2.28** (1.77-2.95)	**2.75** (2.09-3.65)	**3.29** (2.43-4.50)	**4.13** (2.92-5.89)	**4.86** (3.32-7.18)
12-hr	**0.606** (0.506-0.735)	**0.902** (0.751-1.09)	**1.34** (1.11-1.63)	**1.73** (1.43-2.12)	**2.33** (1.86-2.96)	**2.85** (2.22-3.70)	**3.44** (2.61-4.57)	**4.10** (3.03-5.60)	**5.10** (3.61-7.28)	**5.98** (4.09-8.84)
24-hr	**0.754** (0.668-0.870)	**1.16** (1.02-1.33)	**1.74** (1.53-2.01)	**2.26** (1.98-2.64)	**3.04** (2.58-3.67)	**3.71** (3.08-4.56)	**4.45** (3.61-5.60)	**5.29** (4.18-6.84)	**6.54** (4.96-8.80)	**7.62** (5.60-10.6)
2-day	**0.871** (0.771-1.00)	**1.35** (1.20-1.56)	**2.04** (1.80-2.37)	**2.66** (2.33-3.10)	**3.58** (3.03-4.31)	**4.35** (3.61-5.34)	**5.20** (4.22-6.54)	**6.15** (4.85-7.94)	**7.56** (5.73-10.2)	**8.76** (6.43-12.2)
3-day	**0.930** (0.823-1.07)	**1.45** (1.28-1.67)	**2.20** (1.94-2.55)	**2.86** (2.50-3.34)	**3.85** (3.26-4.63)	**4.67** (3.88-5.74)	**5.58** (4.53-7.02)	**6.59** (5.21-8.52)	**8.09** (6.14-10.9)	**9.37** (6.87-13.0)
4-day	**0.978** (0.865-1.13)	**1.53** (1.35-1.76)	**2.32** (2.04-2.68)	**3.02** (2.64-3.52)	**4.05** (3.43-4.88)	**4.92** (4.09-6.05)	**5.87** (4.76-7.39)	**6.93** (5.48-8.96)	**8.50** (6.45-11.4)	**9.84** (7.22-13.7)
7-day	**1.03** (0.913-1.19)	**1.61** (1.42-1.86)	**2.45** (2.16-2.83)	**3.18** (2.79-3.72)	**4.28** (3.62-5.15)	**5.19** (4.31-6.37)	**6.18** (5.01-7.78)	**7.28** (5.75-9.41)	**8.91** (6.76-12.0)	**10.3** (7.54-14.3)
10-day	**1.06** (0.939-1.22)	**1.66** (1.47-1.92)	**2.53** (2.23-2.92)	**3.29** (2.88-3.84)	**4.42** (3.74-5.32)	**5.36** (4.45-6.58)	**6.38** (5.18-8.03)	**7.51** (5.93-9.71)	**9.18** (6.96-12.3)	**10.6** (7.76-14.7)
20-day	**1.12** (0.993-1.29)	**1.78** (1.58-2.06)	**2.74** (2.41-3.17)	**3.58** (3.13-4.17)	**4.82** (4.09-5.81)	**5.86** (4.87-7.20)	**6.99** (5.67-8.79)	**8.22** (6.49-10.6)	**10.0** (7.60-13.5)	**11.5** (8.45-16.0)
30-day	**1.16** (1.03-1.34)	**1.88** (1.66-2.17)	**2.93** (2.58-3.39)	**3.86** (3.38-4.50)	**5.24** (4.44-6.31)	**6.39** (5.31-7.85)	**7.62** (6.18-9.59)	**8.97** (7.08-11.6)	**10.9** (8.28-14.7)	**12.5** (9.18-17.4)
45-day	**1.26** (1.11-1.45)	**2.06** (1.82-2.38)	**3.25** (2.86-3.76)	**4.30** (3.76-5.02)	**5.88** (4.98-7.08)	**7.19** (5.97-8.83)	**8.60** (6.97-10.8)	**10.1** (7.99-13.1)	**12.3** (9.34-16.6)	**14.1** (10.4-19.6)
60-day	**1.32** (1.17-1.52)	**2.20** (1.94-2.54)	**3.50** (3.09-4.05)	**4.66** (4.08-5.44)	**6.39** (5.42-7.70)	**7.84** (6.51-9.64)	**9.41** (7.63-11.8)	**11.1** (8.75-14.3)	**13.5** (10.2-18.1)	**15.4** (11.3-21.5)

[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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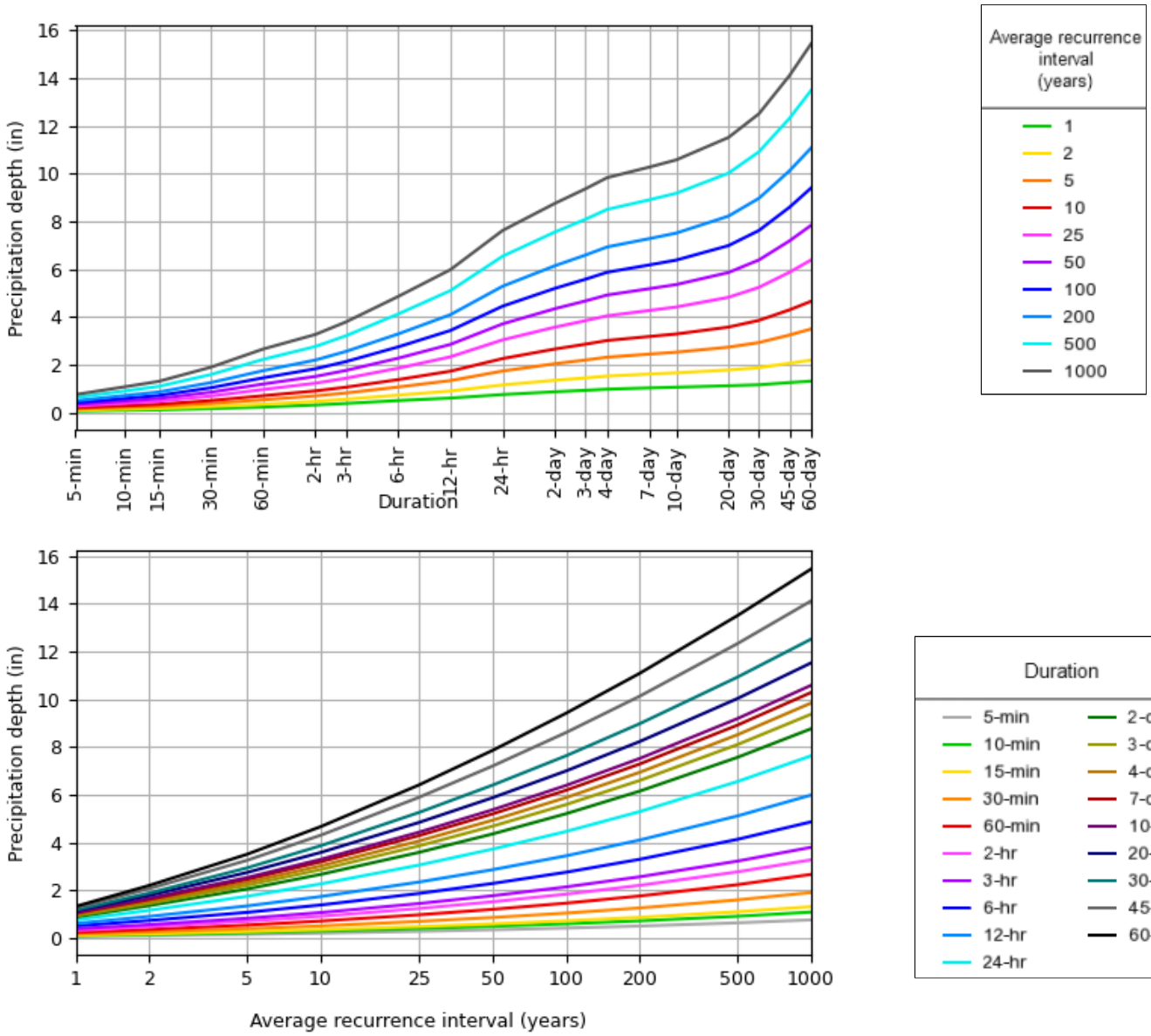
PF graphical

PDS-based depth-duration-frequency (DDF) curves
Latitude: 33.7412°, Longitude: -116.2427°



NOAA Atlas 14, Volume 6, Version 2

Created (GMT): Thu Aug 17 14:35:40 2023

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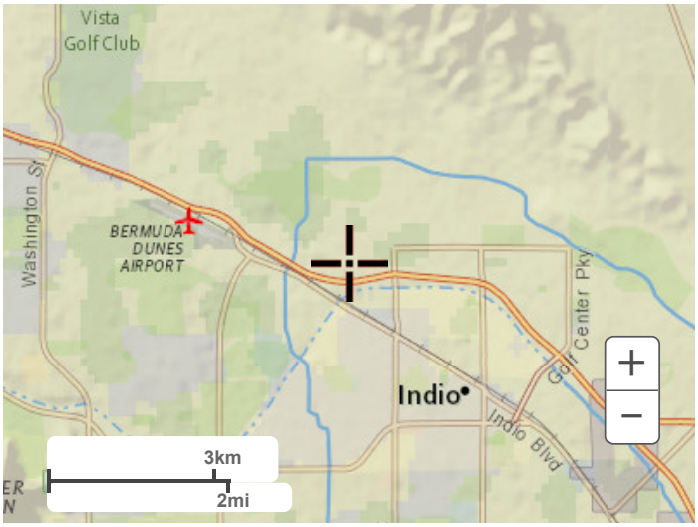
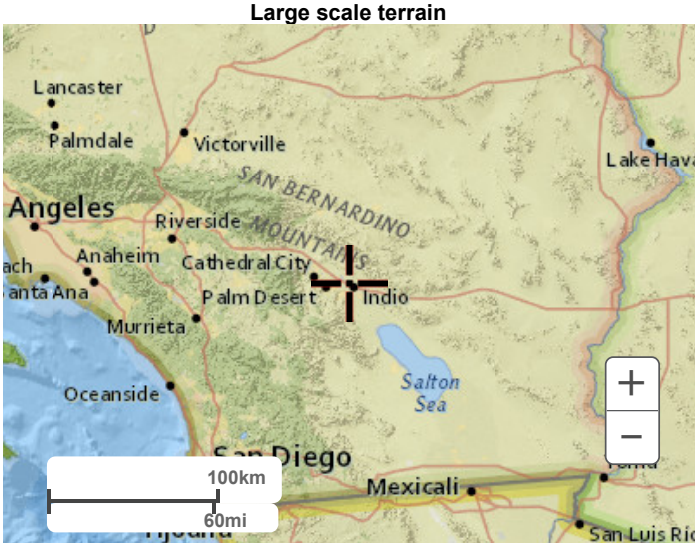
Maps & aerials

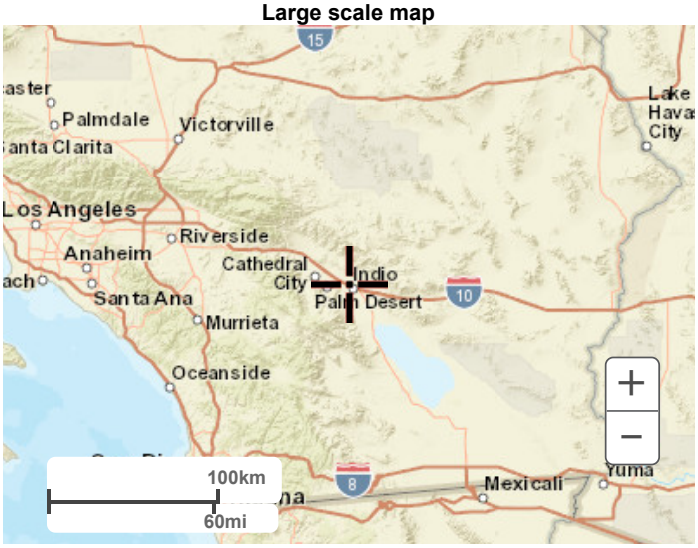
Small scale terrain



Large scale terrain



Large scale map



Large scale aerial

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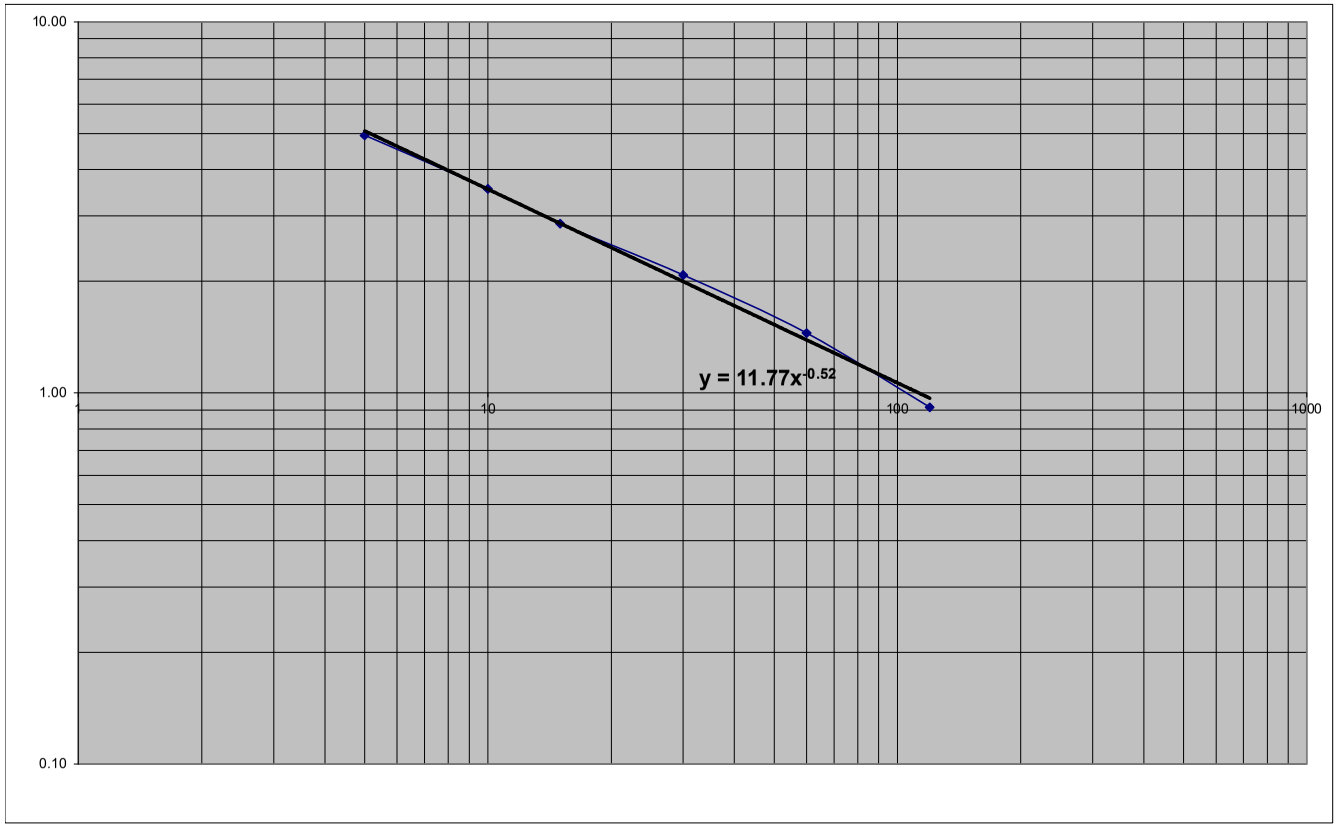
National Oceanic and Atmospheric Administration
National Weather Service
National Water Center
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

NOAA ATLAS 14 INTENSITY - DURATION WORKSHEET

PROJECT NAME	INDIO LOGISTICS AND APARTMENTS
PROJECT NUMBER	2760
STORM EVENT	100 yr
DATE:	August 21, 2023

DATA FROM NOAA ATLAS 14

MINUTES	RAINFALL INTENSITY (in/hr)	RAINFALL DEPTH (in)
5	4.94	0.41
10	3.55	0.59
15	2.86	0.72
30	2.08	1.04
60	1.45	1.45
120	0.92	1.83



INTENSITY VALUES FROM GRAPH

CONSTANT FROM GRAPH	11.76
EXPONENT FROM GRAPH	-0.52

MINUTES	RAINFALL INTENSITY (in/hr)	RAINFALL DEPTH (in)
5	5.09	0.42
10	3.55	0.59
15	2.88	0.72
20	2.48	0.83
25	2.21	0.92
30	2.01	1.00
35	1.85	1.08
40	1.73	1.15
45	1.62	1.22
50	1.54	1.28
55	1.46	1.34
60	1.40	1.40
65	1.34	1.45
70	1.29	1.51
75	1.25	1.56
80	1.20	1.61
85	1.17	1.65
90	1.13	1.70
95	1.10	1.74
100	1.07	1.79
105	1.05	1.83
110	1.02	1.87
115	1.00	1.91
120	0.98	1.95

RUNOFF INDEX NUMBERS OF HYDROLOGIC SOIL-COVER COMPLEXES FOR PERVIOUS AREAS-AMC II

Cover Type (3)	Quality of Cover (2)	Soil Group A	B	C	D
NATURAL COVERS -					
Barren (Rockland, eroded and graded land)		78	86	91	93
Chaparrel, Broadleaf (Manzonita, ceanothus and scrub oak)	Poor	53	70	80	85
	Fair	40	63	75	81
	Good	31	57	71	78
Chaparrel, Narrowleaf (Chamise and redshank)	Poor	71	82	88	91
	Fair	55	72	81	86
Grass, Annual or Perennial	Poor	67	78	86	89
	Fair	50	69	79	84
	Good	38	61	74	80
Meadows or Cienegas (Areas with seasonally high water table, principal vegetation is sod forming grass)	Poor	63	77	85	88
	Fair	51	70	80	84
	Good	30	58	72	78
Open Brush (Soft wood shrubs - buckwheat, sage, etc.)	Poor	62	76	84	88
	Fair	46	66	77	83
	Good	41	63	75	81
Woodland (Coniferous or broadleaf trees predominate. Canopy density is at least 50 percent)	Poor	45	66	77	83
	Fair	36	60	73	79
	Good	28	55	70	77
Woodland, Grass (Coniferous or broadleaf trees with canopy density from 20 to 50 percent)	Poor	57	73	82	86
	Fair	44	65	77	82
	Good	33	58	72	79
URBAN COVERS -					
Residential or Commercial Landscaping (Lawn, shrubs, etc.)	Good	32	56	69	75
Turf (Irrigated and mowed grass)	Poor	58	74	83	87
	Fair	44	65	77	82
	Good	33	58	72	79
AGRICULTURAL COVERS -					
Fallow (Land plowed but not tilled or seeded)		76	85	90	92

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RUNOFF INDEX NUMBERS FOR PERVIOUS AREAS

RUNOFF INDEX NUMBERS OF HYDROLOGIC SOIL-COVER COMPLEXES FOR PERVIOUS AREAS-AMC II

Cover Type (3)	Quality of Cover (2)	Soil Group A	B	C	D
AGRICULTURAL COVERS (cont.) -					
Legumes, Close Seeded (Alfalfa, sweetclover, timothy, etc.)	Poor	66	77	85	89
	Good	58	72	81	85
Orchards, Deciduous (Apples, apricots, pears, walnuts, etc.)		See Note 4			
Orchards, Evergreen (Citrus, avocados, etc.)	Poor	57	73	82	86
	Fair	44	65	77	82
	Good	33	58	72	79
Pasture, Dryland (Annual grasses)	Poor	67	78	86	89
	Fair	50	69	79	84
	Good	38	61	74	80
Pasture, Irrigated (Legumes and perennial grass)	Poor	58	74	83	87
	Fair	44	65	77	82
	Good	33	58	72	79
Row Crops (Field crops - tomatoes, sugar beets, etc.)	Poor	72	81	88	91
	Good	67	78	85	89
Small Grain (Wheat, oats, barley, etc.)	Poor	65	76	84	88
	Good	63	75	83	87
Vineyard		See Note 4			

Notes:

1. All runoff index (RI) numbers are for Antecedent Moisture Condition (AMC) II.

2. Quality of cover definitions:
   Poor-Heavily grazed or regularly burned areas. Less than 50 percent of the ground surface is protected by plant cover or brush and tree canopy.
   Fair-Moderate cover with 50 percent to 75 percent of the ground surface protected.
   Good-Heavy or dense cover with more than 75 percent of the ground surface protected.

3. See Plate C-2 for a detailed description of cover types.

4. Use runoff index numbers based on ground cover type. See discussion under "Cover Type Descriptions" on Plate C-2.

5. Reference Bibliography item 17.

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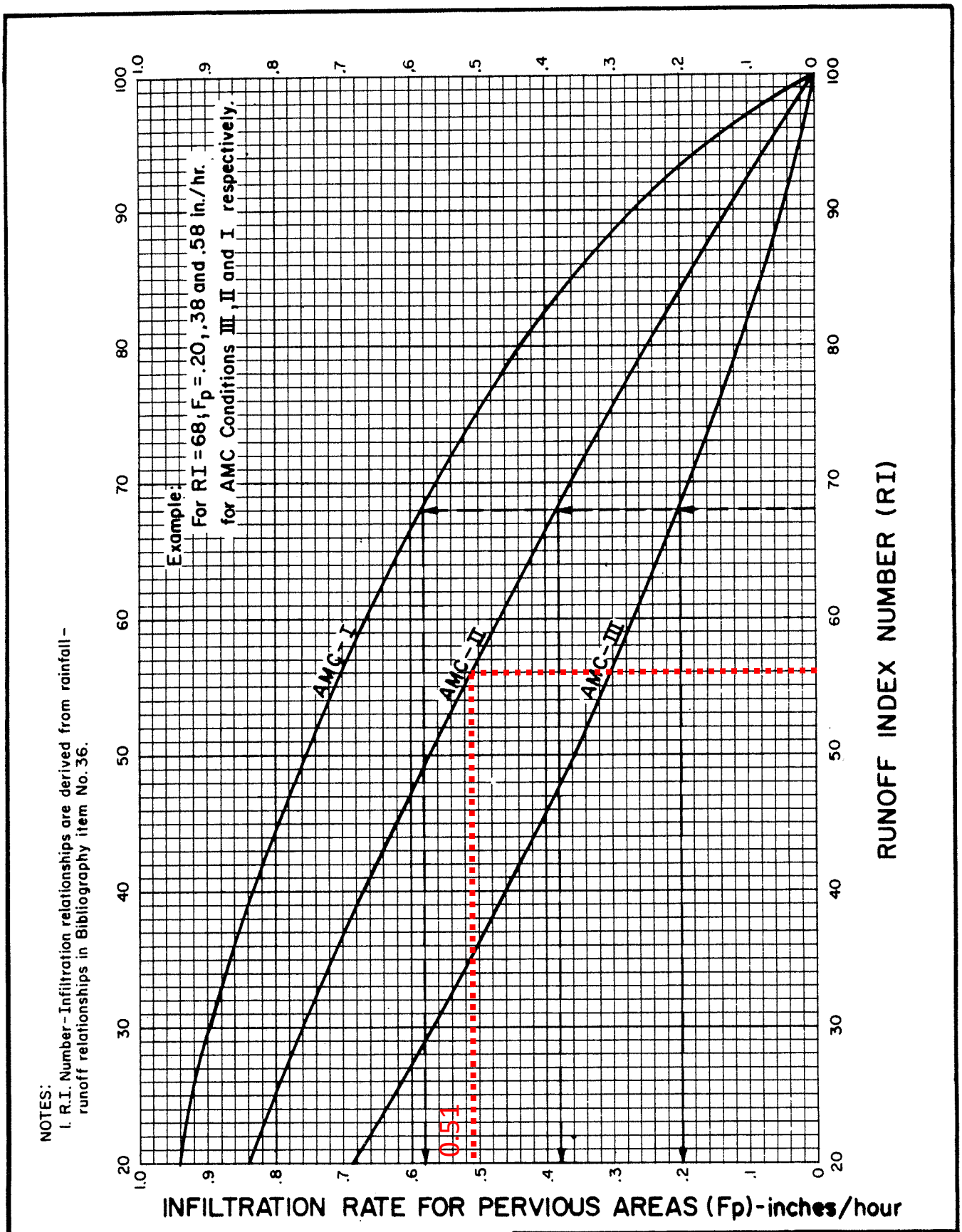
RUNOFF INDEX NUMBERS FOR PERVIOUS AREAS



NOTES:
1. R.I. Number-Infiltration relationships are derived from rainfall-runoff relationships in Bibliography item No. 36.

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INFILTRATION RATE FOR PERVIOUS AREAS VERSUS RUNOFF INDEX NUMBERS

PLATE E-6.2

ACTUAL IMPERVIOUS COVER

Land Use (1)	Range-Percent	Recommended Value For Average Conditions-Percent(2)
Natural or Agriculture	0 - 10	0
Single Family Residential: (3)		
40,000 S. F. (1 Acre) Lots	10 - 25	20
20,000 S. F. (½ Acre) Lots	30 - 45	40
7,200 - 10,000 S. F. Lots	45 - 55	50
Multiple Family Residential:		
Condominiums	45 - 70	65
Apartments	65 - 90	80
Mobile Home Park	60 - 85	75
Commercial, Downtown Business or Industrial	80 -100	90

Notes:

1. Land use should be based on ultimate development of the watershed. Long range master plans for the County and incorporated cities should be reviewed to insure reasonable land use assumptions.

2. Recommended values are based on average conditions which may not apply to a particular study area. The percentage impervious may vary greatly even on comparable sized lots due to differences in dwelling size, improvements, etc. Landscape practices should also be considered as it is common in some areas to use ornamental gravels underlain by impervious plastic materials in place of lawns and shrubs. A field investigation of a study area should always be made, and a review of aerial photos, where available may assist in estimating the percentage of impervious cover in developed areas.

3. For typical horse ranch subdivisions increase impervious area 5 percent over the values recommended in the table above.

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IMPERVIOUS COVER FOR DEVELOPED AREAS

PLATE E-6.3

Appendix E

Proposed Land Use Areas
RCFCD Synthetic Unit Hydrograph Worksheets
Proposed Underground Storage Volumes

THE OASIS AT INDIO
MSA JOB #2760
PROPOSED LAND USE AREAS - SYNTHETIC UNIT
August 21, 2023

DRAINAGE AREA	LAND USE		
	PROPOSED COMMERCIAL / INDSUTRIAL RI=56 (acres)	PROPOSED APARTMENTS RI=56 (acres)	TOTAL (acres)
DA-A	0.000	78.280	0.000
DA-B	103.780	0.000	103.780
TOTAL	**103.780**	**78.280**	182.060

AREA RECONCILIATION

TOTAL LAND USE AREAS		
LAND USE	182.060	
TOTAL HYDROLOGIC AREA		**182.060**
SURVEY BOUNDARY	182.060	
SUBTRACT:	0	
OFFSITE STREETS:	1.811	
TOTAL AREA		**180.249**

RCFCD SYNTHETIC UNIT HYDROGRAPH - SHORTCUT METHOD

DATA INPUT SHEET

DATE	August 21, 2023
WORKSHEET PREPARED BY:	NM
PROJECT NAME	THE OASIS AT INDIO
PROJECT NUMBER	2760
CONCENTRATION POINT DESIGNATION	Retention Basin
AREA DESIGNATION	DA-A
AMC NUMBER	2

Low Loss Conditions: X=Existing; D=Developed; BS=Retention

AREA DESIG	SOIL GROUP	TRIBUTARY AREAS	ACRES	LOW LOSS CONDITION	RI NUMBER	AMC II INFILTRATION RATE	IMPERVIOUS PERCENT
7	B	MF - APARTMENTS	78.282	D	56	0.51	0.80

LENGTH OF WATERCOURSE (L)	4,700 ft
LENGTH TO POINT OPPOSITE CENTROID (Lca)	2,350 ft
ELEVATION OF HEADWATER	526.0 ft
ELEVATION OF CONCENTRATION POINT	503.0 ft
AVERAGE MANNINGS 'N' VALUE	0.02
STORM FREQUENCY (YEAR)	100
LOW LOSS RATE (Storm Events > 10 Years)	**85%**
POINT RAIN FROM NOAA ATLAS	**14**
1-HOUR	1.45 in
3-HOUR	2.13 in
6-HOUR	2.75 in
24-HOUR	4.45 in

BASIN CHARACTERISTICS:

ELEVATION	AREA
503.0 ft	39,635 sf
504.0 ft	72,733 sf
505.0 ft	107,438 sf
506.0 ft	143,557 sf
507.0 ft	181,090 sf

PERCOLATION RATE (in/hr)	1.0 in/hr
DRYWELL DATA	
NUMBER USED	
PERCOLATION RATE	
LOWEST FLOWLINE ELEVATION	503.00
LOWEST PAD ELEVATION	508.0

RCFC & WCD HYDROLOGY MANUAL	SYNTHETIC UNIT HYDROGRAPH METHOD BASIC DATA CALCULATION FORM	PROJECT: THE OASIS AT INDIO Job No.: 2760 BY: NM DATE: 8/21/23

PHYSICAL DATA

[1] CONCENTRATION POINT	Retention Basin
[2] AREA DESIGNATION	DA-A
[3] AREA - ACRES	78.282
[4] L-FEET	4700
[5] L-MILES	0.890
[6] La-FEET	2350.00
[7] La-MILES	0.445
[8] ELEVATION OF HEADWATER	526
[9] ELEVATION OF CONCENTRATION POINT	503
[10] H-FEET	23
[11] S-FEET/MILE	25.8
[12] S^0.5	5.08
[13] L*LCA/S^0.5	0.078
[14] AVERAGE MANNINGS 'N'	0.02
[15] LAG TIME-HOURS	0.18
[16] LAG TIME-MINUTES	10.9
[17] 100% OF LAG-MINUTES	10.9
[18] 200% OF LAG-MINUTES	21.8

RAINFALL DATA

[1] AMC	II
[2] FREQUENCY-YEARS	100
FROM NOAA ATLAS	**14**
[3] STORM DURATION:	Point Rain
1-HOUR	1.45 in
3-HOUR	2.13 in
6-HOUR	2.75 in
24-HOUR	4.45 in

STORM EVENT SUMMARY

STORM DURATION		1-HOUR	3-HOUR	6-HOUR	24-HOUR
RAINFALL VOLUME	(cu-ft)	412,039	605,271	781,453	**1,264,533**
SOIL LOSSES	(cu-ft)	40,579	121,736	240,030	**629,387**
EFFECTIVE RAIN	(in)	1.31	1.70	1.91	2.24
FLOOD VOLUME	(cu-ft)	371,460	483,535	541,423	**635,146**
	(acre-ft)	8.53	11.10	12.43	**14.58**
REQUIRED STORAGE	(cu-ft)	363,058	#DIV/0!	#DIV/0!	#DIV/0!
	(acre-ft)	8.33	#DIV/0!	#DIV/0!	#DIV/0!
FACTOR OF SAFETY		1.19	#DIV/0!	#DIV/0!	#DIV/0!
STORAGE PROVIDED	(cu-ft)	431,899			
	(acre-ft)	9.92			
PEAK FLOW	(cfs)	n/a	154.17	134.60	38.07
MAXIMUM WSEL	(ft)	506.57	#DIV/0!	#DIV/0!	#DIV/0!
DEPTH	(ft)	3.57	#DIV/0!	#DIV/0!	#DIV/0!
LOWEST FLOWLINE ELEVATION		503.00			
DIFFERENCE	(ft)	-3.57	#DIV/0!	#DIV/0!	#DIV/0!
LOWEST PAD ELEVATION		508.0			
DIFFERENCE	(ft)	1.43	#DIV/0!	#DIV/0!	#DIV/0!
ESTIMATED TIME TO DEWATER BASIN Based on Total Flood Volume & Average Percolation Rate	(days)	1.8	#DIV/0!	#DIV/0!	#DIV/0!

NOTE: PEAK FLOW FOR THE 1-HOUR STORM IS NOT REPRESENTATIVE. PER RCFCD PEAK DISCHARGES FROM THE 3-HOUR STORM SHOULD NORMALLY COMPARE WELL WITH RATIONAL PEAKS.

RCFC & WCD HYDROLOGY MANUAL	SYNTHETIC UNIT HYDROGRAPH METHOD BASIC DATA CALCULATION FORM AMC II	PROJECT: THE OASIS AT INDIO Job No.: 2760 BY: NM DATE: 8/21/23

AVERAGE ADJUSTED LOSS RATE

SOIL GROUP [Plate C-1]	LAND USE	RI NUMBER [Plate E-6.1]	PERVIOUS AREA INFILTRATION RATE (in/hr) [Plate E-6.2]	DECIMAL PERCENT OF AREA IMPERVIOUS [Plate E-6.3]	ADJUSTED INFILTRATION RATE (in/hr)	AREA	AREA WEIGHTED AVERAGE	MAX AVERAGE ADJUSTED INFILTRATION RATE (in/hr)	LOW LOSS CONDITION	LOW LOSS RATE PER RCFC/2322	MIN AVERAGE ADJUSTED INFILTRATION RATE
B	MF - APARTMENTS	56	0.51	80%	0.14	78.282	1.000	0.1428	DEVELOPED	0.2600	0.2600
					SUM	78.282	SUM	0.1428			0.2600

VARIABLE LOSS RATE CURVE (24-HOUR STORM ONLY)

Fm= 0.0714

C= 0.00132

$F_t=C(24-(T/60))^{1.55}+F_m$ = 0.00132 (24-(T/60))^1.55 + 0.07 in/hr

CONSTANT LOSS RATE (3 & 6 HOUR STORMS) = **0.1428**

LOW LOSS RATE = **0.8500**

Where:

T=Time in minutes. To get an average value for each unit time period, Use T=1/2 the unit time for the first time period, T=1 1/2 unit time for the second period, etc.

NOTE: Low loss rates established per RCFC/2322 (Dated: May-30-95)
For 10 Year Storms or Less
Undeveloped Condition: Low Loss = 90%
Developed Condition: Low Loss = 0.9 - (0.8 * %impervious)
Basin Site: Low Loss = 10%
For 100 Year Storm - Low Loss should be between 80% & 90% of the Rainfall Rate

RCFC & WCD
HYDROLOGY MANUAL

SYNTHETIC UNIT HYDROGRAPH METHOD

SHORTCUT METHOD

1-HOUR STORM

UNIT HYDROGRAPH and EFFECTIVE RAIN CALCULATION FORM

PROJECT: THE OASIS AT INDIO
Job No.: 2760
BY: NM DATE 8/21/23

DRAINAGE AREA-ACRES	78.28
UNIT TIME-MINUTES	5
LAG TIME - MINUTES	10.92
UNIT TIME-PERCENT OF LAG	45.8
TOTAL ADJUSTED STORM RAIN-INCHES	1.45
CONSTANT LOSS RATE-in/hr	0.14
LOW LOSS RATE - PERCENT	85.00%

Basin Percolation Rate	1.0 in/hr	
Maxwell Drywells		
Number	0	
Drywell Percolation Rate	0.00 cfs	0.00 cfm

Unit Time Period	Time Minutes	Time Hours	Pattern Percent (Plate E-5.9)	Storm Rain in/hr	Loss Rate in/hr Max	Loss Rate in/hr Low	Effective Rain in/hr	Flood Hydrograph Flow cfs	Volume In cu-ft	Basin Volume cu-ft	Basin Losses Percolation Area sf	Basin Losses Maximum Percolation cu-ft	Basin Losses Percolation Out cu-ft	Total In Basin cu-ft	Total In Basin ac-ft	Basin WSEL ft
1	5	0.08	3.6	0.63	0.14	0.53	0.48	38.17	11,452	11,452	46,482	323	323	11,129	0.26	503.20
2	10	0.17	4.2	0.73	0.14	0.62	0.59	46.41	13,924	25,053	54,615	379	379	24,674	0.57	503.45
3	15	0.25	4.4	0.77	0.14	0.65	0.62	49.16	14,748	39,422	63,207	439	439	38,983	0.89	503.70
4	20	0.33	4.6	0.80	0.14	0.68	0.66	51.91	15,572	54,555	72,256	502	502	54,054	1.24	503.98
5	25	0.42	5.0	0.87	0.14	0.74	0.73	57.40	17,220	71,274	78,905	548	548	70,726	1.62	504.17
6	30	0.50	5.6	0.97	0.14	0.83	0.83	65.64	19,693	90,419	86,327	599	599	89,819	2.06	504.38
7	35	0.58	6.4	1.11	0.14	0.95	0.97	76.63	22,989	112,808	95,006	660	660	112,148	2.57	504.63
8	40	0.67	8.1	1.41	0.14	1.20	1.27	99.98	29,994	142,142	106,378	739	739	141,403	3.25	504.96
9	45	0.75	13.1	2.28	0.14	1.94	2.14	168.65	50,596	191,999	121,047	841	841	191,158	4.39	505.37
10	50	0.83	34.5	6.00	0.14	5.10	5.86	**462.57**	**138,772**	329,930	157,459	1,093	1,093	328,836	7.55	506.36
11	55	0.92	6.7	1.17	0.14	0.99	1.02	80.75	24,225	353,061	162,820	1,131	1,131	351,931	8.08	506.51
12	60	1.00	3.8	0.66	0.14	0.56	0.52	40.92	12,276	364,207	165,403	1,149	1,149	**363,058**	**8.33**	**506.57**

EFFECTIVE RAIN & FLOOD VOLUMES SUMMARY

TOTAL RAINFALL	1.45 in
RAINFALL VOLUME	412,039 cu-ft
SOIL LOSSES	40,579 cu-ft
EFFECTIVE RAIN	1.31 in
FLOOD VOLUME	8.53 acft
FLOOD VOLUME	371,460 cu-ft
REQUIRED STORAGE	8.33
REQUIRED STORAGE	363,058 cu-ft
MAX WSEL	506.57 ft
PEAK FLOW RATE	462.57 cfs
TOTAL BASIN LOSSES	8,402 cu-ft
AVERAGE PERCOLATION RATE	140.04 cf/min

RCFC & WCD
HYDROLOGY MANUAL

SYNTHETIC UNIT HYDROGRAPH METHOD

SHORTCUT METHOD

3-HOUR STORM

UNIT HYDROGRAPH and EFFECTIVE RAIN CALCULATION FORM

PROJECT: THE OASIS AT INDIO
Job No.: 2760
BY: NM DATE

DRAINAGE AREA-ACRES	78.28
UNIT TIME-MINUTES	5
LAG TIME - MINUTES	10.92
UNIT TIME-PERCENT OF LAG	45.8
TOTAL ADJUSTED STORM RAIN (in)	2.13
CONSTANT LOSS RATE (in/hr)	0.14
LOW LOSS RATE - PERCENT	85.00%

Basin Percolation Rate	1.0 in/hr	
Maxwell Drywells		
Number	0	
Drywell Percolation Rate	0.00 cfs	0.00 cfm

Unit Time Period	Time		Pattern	Storm Rain	Loss Rate in/hr		Effective Rain	Flood Hydrograph Flow	Volume In	Basin Volume	Basin Losses			Total In Basin		Basin WSEL
	Minutes	Hours	Percent	in/hr	Max	Low	in/hr	cfs	cu-ft	cu-ft	Percolation Area sf	Maximum Percolation cu-ft	Percolation Out cu-ft	cu-ft	ac-ft	ft
			(Plate E-5.9)													
1	5	0.08	1.3	0.33	0.14	0.28	0.19	14.96	4,487	4,487	42,318	294	294	4,193	0.10	503.08
2	10	0.17	1.3	0.33	0.14	0.28	0.19	14.96	4,487	8,680	44,825	311	311	8,369	0.19	503.15
3	15	0.25	1.1	0.28	0.14	0.24	0.14	10.92	3,276	11,645	46,598	324	324	11,322	0.26	503.20
4	20	0.33	1.5	0.38	0.14	0.33	0.24	18.99	5,698	17,019	49,811	346	346	16,673	0.38	503.30
5	25	0.42	1.5	0.38	0.14	0.33	0.24	18.99	5,698	22,371	53,011	368	368	22,003	0.51	503.40
6	30	0.50	1.8	0.46	0.14	0.39	0.32	25.04	7,513	29,516	57,284	398	398	29,118	0.67	503.53
7	35	0.58	1.5	0.38	0.14	0.33	0.24	18.99	5,698	34,816	60,453	420	420	34,396	0.79	503.62
8	40	0.67	1.8	0.46	0.14	0.39	0.32	25.04	7,513	41,909	64,694	449	449	41,460	0.95	503.75
9	45	0.75	1.8	0.46	0.14	0.39	0.32	25.04	7,513	48,973	68,918	479	479	48,495	1.11	503.88
10	50	0.83	1.5	0.38	0.14	0.33	0.24	18.99	5,698	54,192	72,039	500	500	53,692	1.23	503.97
11	55	0.92	1.6	0.41	0.14	0.35	0.27	21.01	6,303	59,995	74,532	518	518	59,477	1.37	504.05
12	60	1.00	1.8	0.46	0.14	0.39	0.32	25.04	7,513	66,990	77,244	536	536	66,454	1.53	504.12
13	65	1.08	2.2	0.56	0.14	0.48	0.42	33.11	9,934	76,388	80,888	562	562	75,827	1.74	504.23
14	70	1.17	2.2	0.56	0.14	0.48	0.42	33.11	9,934	85,761	84,521	587	587	85,174	1.96	504.33
15	75	1.25	2.2	0.56	0.14	0.48	0.42	33.11	9,934	95,108	88,145	612	612	94,496	2.17	504.44
16	80	1.33	2.0	0.51	0.14	0.43	0.37	29.08	8,724	103,220	91,290	634	634	102,586	2.36	504.53
17	85	1.42	2.6	0.66	0.14	0.56	0.52	41.18	12,355	114,942	95,834	666	666	114,276	2.62	504.66
18	90	1.50	2.7	0.69	0.14	0.59	0.55	43.20	12,961	127,237	100,600	699	699	126,538	2.90	504.80
19	95	1.58	2.4	0.61	0.14	0.52	0.47	37.15	11,145	137,683	104,650	727	727	136,956	3.14	504.91
20	100	1.67	2.7	0.69	0.14	0.59	0.55	43.20	12,961	149,917	108,894	756	756	149,161	3.42	505.03
21	105	1.75	3.3	0.84	0.14	0.72	0.70	55.31	16,592	165,753	113,468	788	788	164,965	3.79	505.16
22	110	1.83	3.1	0.79	0.14	0.67	0.65	51.27	15,382	180,347	117,682	817	817	179,530	4.12	505.28
23	115	1.92	2.9	0.74	0.14	0.63	0.60	47.24	14,171	193,701	121,539	844	844	192,857	4.43	505.38
24	120	2.00	3.0	0.77	0.14	0.65	0.62	49.26	14,777	207,634	125,563	872	872	206,762	4.75	505.49
25	125	2.08	3.1	0.79	0.14	0.67	0.65	51.27	15,382	222,144	129,754	901	901	221,243	5.08	505.61

RCFC & WCD
HYDROLOGY MANUAL

SYNTHETIC UNIT HYDROGRAPH METHOD

SHORTCUT METHOD

3-HOUR STORM

UNIT HYDROGRAPH and EFFECTIVE RAIN CALCULATION FORM

PROJECT: THE OASIS AT INDIO
Job No.: 2760
BY: NM DATE

DRAINAGE AREA-ACRES	78.28
UNIT TIME-MINUTES	5
LAG TIME - MINUTES	10.92
UNIT TIME-PERCENT OF LAG	45.8
TOTAL ADJUSTED STORM RAIN (in)	2.13
CONSTANT LOSS RATE (in/hr)	0.14
LOW LOSS RATE - PERCENT	85.00%

Basin Percolation Rate	1.0 in/hr	
Maxwell Drywells		
Number	0	
Drywell Percolation Rate	0.00 cfs	0.00 cfm

Unit Time Period	Time		Pattern	Storm	Loss Rate		Effective	Flood	Volume	Basin	Basin Losses			Total In Basin		Basin
	Minutes	Hours	Percent	Rain	in/hr		Rain	Hydrograph	In	Volume	Percolation Area	Maximum Percolation	Percolation Out			WSEL
				in/hr	Max	Low	in/hr	Flow cfs	cu-ft	cu-ft	sf	cu-ft	cu-ft	cu-ft	ac-ft	ft
			(Plate E-5.9)													
26	130	2.17	4.2	1.07	0.14	0.91	0.93	73.47	22,040	243,283	135,859	943	943	242,339	5.56	505.78
27	135	2.25	5.0	1.28	0.14	1.09	1.14	89.61	26,882	269,221	143,350	995	995	268,226	6.16	505.99
28	140	2.33	3.5	0.89	0.14	0.76	0.75	59.34	17,803	286,028	147,286	1,023	1,023	285,006	6.54	506.09
29	145	2.42	6.8	1.74	0.14	1.48	1.60	125.92	37,777	322,783	155,803	1,082	1,082	321,701	7.39	506.32
30	150	2.50	7.3	1.87	0.14	1.59	1.72	136.01	40,803	362,504	165,008	1,146	1,146	361,358	8.30	506.56
31	155	2.58	8.2	2.10	0.14	1.78	1.95	**154.17**	**46,251**	407,609	175,461	1,218	1,218	406,390	9.33	506.84
32	160	2.67	5.9	1.51	0.14	1.28	1.37	107.76	32,329	438,719	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
33	165	2.75	2.0	0.51	0.14	0.43	0.37	29.08	8,724	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
34	170	2.83	1.8	0.46	0.14	0.39	0.32	25.04	7,513	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
35	175	2.92	1.8	0.46	0.14	0.39	0.32	25.04	7,513	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
36	180	3.00	0.6	0.15	0.14	0.13	0.01	0.83	250	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!

EFFECTIVE RAIN & FLOOD VOLUMES SUMMARY

TOTAL RAIN	2.13 in
RAINFALL VOLUME	605,271 cu-ft
SOIL LOSSES	121,736 cu-ft
EFFECTIVE RAIN	1.70 in
FLOOD VOLUME	11.10 acft
FLOOD VOLUME	483,535 cu-ft
REQUIRED STORAGE	#DIV/0!
REQUIRED STORAGE	#DIV/0!
MAX WSEL	#DIV/0!
PEAK FLOW RATE	154.17 cfs
TOTAL BASIN LOSSES	#DIV/0!
AVERAGE PERCOLATION RATE	#DIV/0!

RCFC & WCD
HYDROLOGY MANUAL

SYNTHETIC UNIT HYDROGRAPH METHOD

SHORTCUT METHOD

6-HOUR STORM

UNIT HYDROGRAPH and EFFECTIVE RAIN CALCULATION FORM

PROJECT: THE OASIS AT INDIO
Job No.: 2760
BY: NM DATE 8/21/23

DRAINAGE AREA-ACRES	78.28
UNIT TIME-MINUTES	5
LAG TIME - MINUTES	10.92
UNIT TIME-PERCENT OF LAG	45.8
TOTAL ADJUSTED STORM RAIN (in)	2.75
CONSTANT LOSS RATE (in/hr)	0.14
LOW LOSS RATE - PERCENT	85.00%

Basin Percolation Rate	1.0 in/hr	
Maxwell Drywells		
Number	0	
Drywell Percolation Rate	0.00 cfs	0.00 cfm

Unit Time Period	Time Minutes	Time Hours	Pattern Percent (Plate E-5.9)	Storm Rain in/hr	Loss Rate in/hr Max	Loss Rate in/hr Low	Effective Rain in/hr	Flood Hydrograph Flow cfs	Volume In cu-ft	Basin Volume cu-ft	Basin Losses Percolation Area sf	Basin Losses Maximum Percolation cu-ft	Basin Losses Percolation Out cu-ft	Total In Basin cu-ft	Total In Basin ac-ft	Basin WSEL ft
1	5	0.08	0.5	0.17	0.14	0.14	0.02	1.75	526	526	39,949	277	277	248	0.01	503.00
2	10	0.17	0.6	0.20	0.14	0.17	0.06	4.36	1,307	1,555	40,565	282	282	1,274	0.03	503.02
3	15	0.25	0.6	0.20	0.14	0.17	0.06	4.36	1,307	2,581	41,178	286	286	2,295	0.05	503.04
4	20	0.33	0.6	0.20	0.14	0.17	0.06	4.36	1,307	3,602	41,789	290	290	3,312	0.08	503.06
5	25	0.42	0.6	0.20	0.14	0.17	0.06	4.36	1,307	4,619	42,397	294	294	4,325	0.10	503.08
6	30	0.50	0.7	0.23	0.14	0.20	0.09	6.96	2,089	6,413	43,470	302	302	6,111	0.14	503.11
7	35	0.58	0.7	0.23	0.14	0.20	0.09	6.96	2,089	8,200	44,538	309	309	7,891	0.18	503.14
8	40	0.67	0.7	0.23	0.14	0.20	0.09	6.96	2,089	9,979	45,602	317	317	9,663	0.22	503.17
9	45	0.75	0.7	0.23	0.14	0.20	0.09	6.96	2,089	11,751	46,662	324	324	11,427	0.26	503.21
10	50	0.83	0.7	0.23	0.14	0.20	0.09	6.96	2,089	13,516	47,717	331	331	13,184	0.30	503.24
11	55	0.92	0.7	0.23	0.14	0.20	0.09	6.96	2,089	15,273	48,767	339	339	14,934	0.34	503.27
12	60	1.00	0.8	0.26	0.14	0.22	0.12	9.57	2,870	17,804	50,281	349	349	17,455	0.40	503.32
13	65	1.08	0.8	0.26	0.14	0.22	0.12	9.57	2,870	20,325	51,788	360	360	19,966	0.46	503.36
14	70	1.17	0.8	0.26	0.14	0.22	0.12	9.57	2,870	22,836	53,289	370	370	22,466	0.52	503.41
15	75	1.25	0.8	0.26	0.14	0.22	0.12	9.57	2,870	25,336	54,784	380	380	24,955	0.57	503.45
16	80	1.33	0.8	0.26	0.14	0.22	0.12	9.57	2,870	27,825	56,273	391	391	27,435	0.63	503.50
17	85	1.42	0.8	0.26	0.14	0.22	0.12	9.57	2,870	30,305	57,755	401	401	29,904	0.69	503.54
18	90	1.50	0.8	0.26	0.14	0.22	0.12	9.57	2,870	32,774	59,232	411	411	32,362	0.74	503.58
19	95	1.58	0.8	0.26	0.14	0.22	0.12	9.57	2,870	35,232	60,702	422	422	34,811	0.80	503.63
20	100	1.67	0.8	0.26	0.14	0.22	0.12	9.57	2,870	37,681	62,166	432	432	37,249	0.86	503.67
21	105	1.75	0.8	0.26	0.14	0.22	0.12	9.57	2,870	40,119	63,624	442	442	39,677	0.91	503.72
22	110	1.83	0.8	0.26	0.14	0.22	0.12	9.57	2,870	42,547	65,076	452	452	42,096	0.97	503.76
23	115	1.92	0.8	0.26	0.14	0.22	0.12	9.57	2,870	44,966	66,522	462	462	44,504	1.02	503.80
24	120	2.00	0.9	0.30	0.14	0.25	0.15	12.17	3,652	48,155	68,429	475	475	47,680	1.09	503.86

RCFC & WCD
HYDROLOGY MANUAL

SYNTHETIC UNIT HYDROGRAPH METHOD

SHORTCUT METHOD

6-HOUR STORM

UNIT HYDROGRAPH and EFFECTIVE RAIN CALCULATION FORM

PROJECT: THE OASIS AT INDIO
Job No.: 2760
BY: NM DATE 8/21/23

DRAINAGE AREA-ACRES	78.28
UNIT TIME-MINUTES	5
LAG TIME - MINUTES	10.92
UNIT TIME-PERCENT OF LAG	45.8
TOTAL ADJUSTED STORM RAIN (in)	2.75
CONSTANT LOSS RATE (in/hr)	0.14
LOW LOSS RATE - PERCENT	85.00%

Basin Percolation Rate	1.0 in/hr	
Maxwell Drywells		
Number	0	
Drywell Percolation Rate	0.00 cfs	0.00 cfm

Unit Time Period	Time		Pattern Percent	Storm Rain in/hr	Loss Rate in/hr		Effective Rain in/hr	Flood Hydrograph Flow cfs	Volume In cu-ft	Basin Volume cu-ft	Basin Losses			Total In Basin		Basin WSEL ft
	Minutes	Hours	(Plate E-5.9)		Max	Low					Percolation Area sf	Maximum Percolation cu-ft	Percolation Out cu-ft	cu-ft	ac-ft	
25	125	2.08	0.8	0.26	0.14	0.22	0.12	9.57	2,870	50,550	69,861	485	485	50,065	1.15	503.90
26	130	2.17	0.9	0.30	0.14	0.25	0.15	12.17	3,652	53,716	71,754	498	498	53,218	1.22	503.96
27	135	2.25	0.9	0.30	0.14	0.25	0.15	12.17	3,652	56,870	73,321	509	509	56,360	1.29	504.01
28	140	2.33	0.9	0.30	0.14	0.25	0.15	12.17	3,652	60,012	74,539	518	518	59,494	1.37	504.05
29	145	2.42	0.9	0.30	0.14	0.25	0.15	12.17	3,652	63,146	75,754	526	526	62,620	1.44	504.08
30	150	2.50	0.9	0.30	0.14	0.25	0.15	12.17	3,652	66,271	76,966	534	534	65,737	1.51	504.12
31	155	2.58	0.9	0.30	0.14	0.25	0.15	12.17	3,652	69,388	78,174	543	543	68,845	1.58	504.15
32	160	2.67	0.9	0.30	0.14	0.25	0.15	12.17	3,652	72,497	79,379	551	551	71,946	1.65	504.19
33	165	2.75	1.0	0.33	0.14	0.28	0.19	14.78	4,433	76,379	80,884	562	562	75,817	1.74	504.23
34	170	2.83	1.0	0.33	0.14	0.28	0.19	14.78	4,433	80,250	82,385	572	572	79,678	1.83	504.27
35	175	2.92	1.0	0.33	0.14	0.28	0.19	14.78	4,433	84,111	83,882	583	583	83,528	1.92	504.31
36	180	3.00	1.0	0.33	0.14	0.28	0.19	14.78	4,433	87,961	85,374	593	593	87,368	2.01	504.36
37	185	3.08	1.0	0.33	0.14	0.28	0.19	14.78	4,433	91,801	86,863	603	603	91,198	2.09	504.40
38	190	3.17	1.1	0.36	0.14	0.31	0.22	17.38	5,214	96,413	88,650	616	616	95,797	2.20	504.45
39	195	3.25	1.1	0.36	0.14	0.31	0.22	17.38	5,214	101,011	90,433	628	628	100,383	2.30	504.50
40	200	3.33	1.1	0.36	0.14	0.31	0.22	17.38	5,214	105,598	92,211	640	640	104,957	2.41	504.55
41	205	3.42	1.2	0.40	0.14	0.34	0.25	19.99	5,996	110,953	94,287	655	655	110,299	2.53	504.61
42	210	3.50	1.3	0.43	0.14	0.36	0.29	22.59	6,777	117,076	96,661	671	671	116,405	2.67	504.68
43	215	3.58	1.4	0.46	0.14	0.39	0.32	25.20	7,559	123,963	99,331	690	690	123,274	2.83	504.76
44	220	3.67	1.4	0.46	0.14	0.39	0.32	25.20	7,559	130,832	101,994	708	708	130,124	2.99	504.84
45	225	3.75	1.5	0.50	0.14	0.42	0.35	27.80	8,340	138,464	104,953	729	729	137,736	3.16	504.92
46	230	3.83	1.5	0.50	0.14	0.42	0.35	27.80	8,340	146,076	107,785	749	749	145,327	3.34	505.00
47	235	3.92	1.6	0.53	0.14	0.45	0.39	30.41	9,122	154,449	110,203	765	765	153,684	3.53	505.07
48	240	4.00	1.6	0.53	0.14	0.45	0.39	30.41	9,122	162,805	112,616	782	782	162,023	3.72	505.14
49	245	4.08	1.7	0.56	0.14	0.48	0.42	33.01	9,903	171,926	115,250	800	800	171,126	3.93	505.21
50	250	4.17	1.8	0.59	0.14	0.50	0.45	35.62	10,685	181,811	118,105	820	820	180,990	4.15	505.29

RCFC & WCD
HYDROLOGY MANUAL

SYNTHETIC UNIT HYDROGRAPH METHOD

SHORTCUT METHOD

6-HOUR STORM

UNIT HYDROGRAPH and EFFECTIVE RAIN CALCULATION FORM

PROJECT: THE OASIS AT INDIO
Job No.: 2760
BY: NM DATE 8/21/23

DRAINAGE AREA-ACRES	78.28
UNIT TIME-MINUTES	5
LAG TIME - MINUTES	10.92
UNIT TIME-PERCENT OF LAG	45.8
TOTAL ADJUSTED STORM RAIN (in)	2.75
CONSTANT LOSS RATE (in/hr)	0.14
LOW LOSS RATE - PERCENT	85.00%

Basin Percolation Rate	1.0 in/hr	
Maxwell Drywells		
Number	0	
Drywell Percolation Rate	0.00 cfs	0.00 cfm

Unit Time Period	Time Minutes	Time Hours	Pattern Percent (Plate E-5.9)	Storm Rain in/hr	Loss Rate in/hr Max	Loss Rate in/hr Low	Effective Rain in/hr	Flood Hydrograph Flow cfs	Volume In cu-ft	Basin Volume cu-ft	Basin Losses Percolation Area sf	Basin Losses Maximum Percolation cu-ft	Basin Losses Percolation Out cu-ft	Total In Basin cu-ft	Total In Basin ac-ft	Basin WSEL ft
51	255	4.25	1.9	0.63	0.14	0.53	0.48	38.22	11,466	192,457	121,180	842	842	191,615	4.40	505.37
52	260	4.33	2.0	0.66	0.14	0.56	0.52	40.83	12,248	203,863	124,474	864	864	202,998	4.66	505.46
53	265	4.42	2.1	0.69	0.14	0.59	0.55	43.43	13,029	216,027	127,987	889	889	215,138	4.94	505.56
54	270	4.50	2.1	0.69	0.14	0.59	0.55	43.43	13,029	228,167	131,493	913	913	227,254	5.22	505.66
55	275	4.58	2.2	0.73	0.14	0.62	0.58	46.03	13,810	241,064	135,218	939	939	240,125	5.51	505.76
56	280	4.67	2.3	0.76	0.14	0.65	0.62	48.64	14,592	254,717	139,161	966	966	253,751	5.83	505.87
57	285	4.75	2.4	0.79	0.14	0.67	0.65	51.24	15,373	269,124	143,322	995	995	268,129	6.16	505.99
58	290	4.83	2.4	0.79	0.14	0.67	0.65	51.24	15,373	283,502	146,700	1,019	1,019	282,484	6.48	506.08
59	295	4.92	2.5	0.83	0.14	0.70	0.68	53.85	16,155	298,638	150,208	1,043	1,043	297,595	6.83	506.17
60	300	5.00	2.6	0.86	0.14	0.73	0.72	56.45	16,936	314,531	153,891	1,069	1,069	313,463	7.20	506.27
61	305	5.08	3.1	1.02	0.14	0.87	0.88	69.48	20,843	334,306	158,473	1,101	1,101	333,206	7.65	506.39
62	310	5.17	3.6	1.19	0.14	1.01	1.05	82.50	24,751	357,956	163,954	1,139	1,139	356,818	8.19	506.54
63	315	5.25	3.9	1.29	0.14	1.09	1.14	90.32	27,095	383,913	169,969	1,180	1,180	382,733	8.79	506.70
64	320	5.33	4.2	1.39	0.14	1.18	1.24	98.13	29,439	412,172	176,518	1,226	1,226	410,946	9.43	506.87
65	325	5.42	4.7	1.55	0.14	1.32	1.41	111.16	33,347	444,293	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
66	330	5.50	5.6	1.85	0.14	1.57	1.71	**134.60**	**40,380**	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
67	335	5.58	1.9	0.63	0.14	0.53	0.48	38.22	11,466	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
68	340	5.67	0.9	0.30	0.14	0.25	0.15	12.17	3,652	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
69	345	5.75	0.6	0.20	0.14	0.17	0.06	4.36	1,307	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
70	350	5.83	0.5	0.17	0.14	0.14	0.02	1.75	526	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
71	355	5.92	0.3	0.10	0.14	0.08	0.01	1.17	352	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
72	360	6.00	0.2	0.07	0.14	0.06	0.01	0.78	234	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!

EFFECTIVE RAIN & FLOOD VOLUMES SUMMARY

TOTAL RAINFALL	2.75 in
RAINFALL VOLUME	781,453 cu-ft
SOIL LOSSES	240,030 cu-ft
EFFECTIVE RAIN	1.91 in
FLOOD VOLUME	12.43 acft
FLOOD VOLUME	541,423 cu-ft
REQUIRED STORAGE	#DIV/0!
REQUIRED STORAGE	#DIV/0!
MAX WSEL	#DIV/0!
PEAK FLOW RATE	134.60 cfs
TOTAL BASIN LOSSES	#DIV/0!
AVERAGE PERCOLATION RATE	#DIV/0!

RCFC & WCD
HYDROLOGY MANUAL

SYNTHETIC UNIT HYDROGRAPH METHOD

SHORTCUT METHOD

24-HOUR STORM

UNIT HYDROGRAPH and EFFECTIVE RAIN CALCULATION FORM

PROJECT: THE OASIS AT INDIO
Job No.: 2760
BY: NM DATE 8/21/23

DRAINAGE AREA-ACRES	78.28	VARIABLE LOSS RATE (AVG) IN/HR		Basin Percolation Rate	1.0 in/hr
UNIT TIME-MINUTES	15	Fm = Minimum value on loss curve (in/hr)	0.07		
LAG TIME - MINUTES	10.92	C	0.00132	Maxwell Drywells	
UNIT TIME-PERCENT OF LAG	137%	Low Loss Rate (percent)	85.00%	Number	0
TOTAL ADJUSTED STORM RAIN (in)	4.45			Drywell Percolation Rate	0.00 cfs 0.00 cfm

Unit Time Period	Time Minutes	Hours	Pattern Percent	Storm Rain in/hr	Loss Rate in/hr		Effective Rain	Flood Hydrograph Flow	Volume In	Basin Volume	Basin Losses			Total In Basin		Basin WSEL
											Percolation Area	Maximum Percolation	Percolation Out			
			(Plate E-5.9)		Max	Low	in/hr	cfs	cu-ft	cu-ft	sf	cu-ft	cu-ft	cu-ft	ac-ft	ft
1	15	0.25	0.2	0.036	0.252	0.030	0.01	0.42	379	379	39,862	830	379	0	0.00	503.00
2	30	0.50	0.3	0.053	0.249	0.045	0.01	0.63	569	569	39,975	833	569	0	0.00	503.00
3	45	0.75	0.3	0.053	0.246	0.045	0.01	0.63	569	569	39,975	833	569	0	0.00	503.00
4	60	1.00	0.4	0.071	0.243	0.061	0.01	0.84	759	759	40,089	835	759	0	0.00	503.00
5	75	1.25	0.3	0.053	0.241	0.045	0.01	0.63	569	569	39,975	833	569	0	0.00	503.00
6	90	1.50	0.3	0.053	0.238	0.045	0.01	0.63	569	569	39,975	833	569	0	0.00	503.00
7	105	1.75	0.3	0.053	0.235	0.045	0.01	0.63	569	569	39,975	833	569	0	0.00	503.00
8	120	2.00	0.4	0.071	0.232	0.061	0.01	0.84	759	759	40,089	835	759	0	0.00	503.00
9	135	2.25	0.4	0.071	0.229	0.061	0.01	0.84	759	759	40,089	835	759	0	0.00	503.00
10	150	2.50	0.4	0.071	0.226	0.061	0.01	0.84	759	759	40,089	835	759	0	0.00	503.00
11	165	2.75	0.5	0.089	0.224	0.076	0.01	1.05	948	948	40,202	838	838	111	0.00	503.00
12	180	3.00	0.5	0.089	0.221	0.076	0.01	1.05	948	1,059	40,268	839	839	220	0.01	503.00
13	195	3.25	0.5	0.089	0.218	0.076	0.01	1.05	948	1,169	40,334	840	840	328	0.01	503.01
14	210	3.50	0.5	0.089	0.215	0.076	0.01	1.05	948	1,277	40,398	842	842	435	0.01	503.01
15	225	3.75	0.5	0.089	0.213	0.076	0.01	1.05	948	1,384	40,462	843	843	541	0.01	503.01
16	240	4.00	0.6	0.107	0.210	0.091	0.02	1.26	1,138	1,679	40,639	847	847	832	0.02	503.02
17	255	4.25	0.6	0.107	0.207	0.091	0.02	1.26	1,138	1,970	40,813	850	850	1,120	0.03	503.02
18	270	4.50	0.7	0.125	0.205	0.106	0.02	1.48	1,328	2,448	41,098	856	856	1,591	0.04	503.03
19	285	4.75	0.7	0.125	0.202	0.106	0.02	1.48	1,328	2,919	41,380	862	862	2,057	0.05	503.04
20	300	5.00	0.8	0.142	0.200	0.121	0.02	1.69	1,517	3,575	41,772	870	870	2,704	0.06	503.05
21	315	5.25	0.6	0.107	0.197	0.091	0.02	1.26	1,138	3,842	41,932	874	874	2,969	0.07	503.05
22	330	5.50	0.7	0.125	0.194	0.106	0.02	1.48	1,328	4,297	42,204	879	879	3,417	0.08	503.06
23	345	5.75	0.8	0.142	0.192	0.121	0.02	1.69	1,517	4,935	42,586	887	887	4,048	0.09	503.07
24	360	6.00	0.8	0.142	0.189	0.121	0.02	1.69	1,517	5,565	42,962	895	895	4,670	0.11	503.08
25	375	6.25	0.9	0.160	0.187	0.136	0.02	1.90	1,707	6,377	43,448	905	905	5,472	0.13	503.10
26	390	6.50	0.9	0.160	0.184	0.136	0.02	1.90	1,707	7,179	43,928	915	915	6,264	0.14	503.11
27	405	6.75	1.0	0.178	0.182	0.151	0.03	2.11	1,897	8,161	44,515	927	927	7,233	0.17	503.13
28	420	7.00	1.0	0.178	0.179	0.151	0.03	2.11	1,897	9,130	45,094	939	939	8,191	0.19	503.15
29	435	7.25	1.0	0.178	0.177	0.151	0.00	0.08	73	8,264	44,576	929	929	7,335	0.17	503.13
30	450	7.50	1.1	0.196	0.175	0.166	0.02	1.68	1,509	8,845	44,923	936	936	7,909	0.18	503.14
31	465	7.75	1.2	0.214	0.172	0.182	0.04	3.27	2,944	10,853	46,124	961	961	9,892	0.23	503.18
32	480	8.00	1.3	0.231	0.170	0.197	0.06	4.86	4,377	14,269	48,167	1,003	1,003	13,265	0.30	503.24
33	495	8.25	1.5	0.267	0.167	0.227	0.10	7.86	7,074	20,339	51,797	1,079	1,079	19,260	0.44	503.35
34	510	8.50	1.5	0.267	0.165	0.227	0.10	8.04	7,239	26,499	55,480	1,156	1,156	25,343	0.58	503.46
35	525	8.75	1.6	0.285	0.163	0.242	0.12	9.63	8,668	34,012	59,972	1,249	1,249	32,762	0.75	503.59
36	540	9.00	1.7	0.303	0.160	0.257	0.14	11.22	10,096	42,858	65,262	1,360	1,360	41,498	0.95	503.75
37	555	9.25	1.9	0.338	0.158	0.287	0.18	14.21	12,786	54,284	72,094	1,502	1,502	52,782	1.21	503.95
38	570	9.50	2.0	0.356	0.156	0.303	0.20	15.79	14,211	66,993	77,245	1,609	1,609	65,384	1.50	504.11
39	585	9.75	2.1	0.374	0.154	0.318	0.22	17.37	15,634	81,017	82,682	1,723	1,723	79,295	1.82	504.27
40	600	10.00	2.2	0.392	0.152	0.333	0.24	18.95	17,055	96,350	88,626	1,846	1,846	94,503	2.17	504.44
41	615	10.25	1.5	0.267	0.149	0.227	0.12	9.29	8,359	102,862	91,151	1,899	1,899	100,963	2.32	504.51
42	630	10.50	1.5	0.267	0.147	0.227	0.12	9.46	8,513	109,475	93,714	1,952	1,952	107,523	2.47	504.58
43	645	10.75	2.0	0.356	0.145	0.303	0.21	16.65	14,987	122,510	98,768	2,058	2,058	120,453	2.77	504.73

RCFC & WCD
HYDROLOGY MANUAL

SYNTHETIC UNIT HYDROGRAPH METHOD

SHORTCUT METHOD

24-HOUR STORM

UNIT HYDROGRAPH and EFFECTIVE RAIN CALCULATION FORM

PROJECT: THE OASIS AT INDIO
Job No.: 2760
BY: NM DATE 8/21/23

DRAINAGE AREA-ACRES	78.28	VARIABLE LOSS RATE (AVG) IN/HR		Basin Percolation Rate	1.0 in/hr
UNIT TIME-MINUTES	15	Fm = Minimum value on loss curve (in/hr)	0.07		
LAG TIME - MINUTES	10.92	C	0.00132	Maxwell Drywells	
UNIT TIME-PERCENT OF LAG	137%	Low Loss Rate (percent)	85.00%	Number	0
TOTAL ADJUSTED STORM RAIN (in)	4.45			Drywell Percolation Rate	0.00 cfs 0.00 cfm

Unit Time Period	Time Minutes	Hours	Pattern Percent (Plate E-5.9)	Storm Rain in/hr	Loss Rate in/hr Max	Loss Rate in/hr Low	Effective Rain in/hr	Flood Hydrograph Flow cfs	Volume In cu-ft	Basin Volume cu-ft	Basin Losses Percolation Area sf	Basin Losses Maximum Percolation cu-ft	Basin Losses Percolation Out cu-ft	Total In Basin cu-ft	Total In Basin ac-ft	Basin WSEL ft
44	660	11.00	2.0	0.356	0.143	0.303	0.21	16.82	15,138	135,591	103,839	2,163	2,163	133,428	3.06	504.87
45	675	11.25	1.9	0.338	0.141	0.287	0.20	15.58	14,023	147,451	108,182	2,254	2,254	145,197	3.33	505.00
46	690	11.50	1.9	0.338	0.139	0.287	0.20	15.75	14,171	159,367	111,623	2,325	2,325	157,042	3.61	505.10
47	705	11.75	1.7	0.303	0.137	0.257	0.17	13.10	11,787	168,829	114,356	2,382	2,382	166,447	3.82	505.17
48	720	12.00	1.8	0.320	0.135	0.272	0.19	14.66	13,196	179,643	117,479	2,447	2,447	177,196	4.07	505.26
49	735	12.25	2.5	0.445	0.133	0.378	0.31	24.66	22,191	199,387	123,181	2,566	2,566	196,821	4.52	505.42
50	750	12.50	2.6	0.463	0.131	0.393	0.33	26.22	23,597	220,417	129,255	2,693	2,693	217,724	5.00	505.58
51	765	12.75	2.8	0.498	0.129	0.424	0.37	29.18	26,265	243,989	136,063	2,835	2,835	241,155	5.54	505.77
52	780	13.00	2.9	0.516	0.127	0.439	0.39	30.74	27,667	268,822	143,235	2,984	2,984	265,838	6.10	505.97
53	795	13.25	3.4	0.605	0.125	0.514	0.48	37.92	34,126	299,964	150,515	3,136	3,136	296,829	6.81	506.17
54	810	13.50	3.4	0.605	0.123	0.514	0.48	**38.07**	**34,261**	331,089	157,728	3,286	3,286	327,803	7.53	506.36
55	825	13.75	2.3	0.409	0.121	0.348	0.29	22.76	20,483	348,287	161,713	3,369	3,369	344,918	7.92	506.46
56	840	14.00	2.3	0.409	0.119	0.348	0.29	22.90	20,614	365,532	165,710	3,452	3,452	362,080	8.31	506.57
57	855	14.25	2.7	0.481	0.117	0.409	0.36	28.67	25,802	387,881	170,889	3,560	3,560	384,321	8.82	506.71
58	870	14.50	2.6	0.463	0.116	0.393	0.35	27.40	24,664	408,985	175,780	3,662	3,662	405,323	9.30	506.84
59	885	14.75	2.6	0.463	0.114	0.393	0.35	27.54	24,790	430,113	180,676	3,764	3,764	426,349	9.79	506.97
60	900	15.00	2.5	0.445	0.112	0.378	0.33	26.28	23,649	449,998	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
61	915	15.25	2.4	0.427	0.110	0.363	0.32	25.01	22,506	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
62	930	15.50	2.3	0.409	0.109	0.348	0.30	23.74	21,362	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
63	945	15.75	1.9	0.338	0.107	0.287	0.23	18.25	16,422	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
64	960	16.00	1.9	0.338	0.105	0.287	0.23	18.38	16,538	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
65	975	16.25	0.4	0.071	0.104	0.061	0.01	0.84	759	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
66	990	16.50	0.4	0.071	0.102	0.061	0.01	0.84	759	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
67	1005	16.75	0.3	0.053	0.101	0.045	0.01	0.63	569	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
68	1020	17.00	0.3	0.053	0.099	0.045	0.01	0.63	569	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
69	1035	17.25	0.5	0.089	0.098	0.076	0.01	1.05	948	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
70	1050	17.50	0.5	0.089	0.096	0.076	0.01	1.05	948	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
71	1065	17.75	0.5	0.089	0.095	0.076	0.01	1.05	948	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
72	1080	18.00	0.4	0.071	0.093	0.061	0.01	0.84	759	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
73	1095	18.25	0.4	0.071	0.092	0.061	0.01	0.84	759	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
74	1110	18.50	0.4	0.071	0.091	0.061	0.01	0.84	759	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
75	1125	18.75	0.3	0.053	0.089	0.045	0.01	0.63	569	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
76	1140	19.00	0.2	0.036	0.088	0.030	0.01	0.42	379	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
77	1155	19.25	0.3	0.053	0.087	0.045	0.01	0.63	569	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
78	1170	19.50	0.4	0.071	0.086	0.061	0.01	0.84	759	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
79	1185	19.75	0.3	0.053	0.084	0.045	0.01	0.63	569	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
80	1200	20.00	0.2	0.036	0.083	0.030	0.01	0.42	379	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
81	1215	20.25	0.3	0.053	0.082	0.045	0.01	0.63	569	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
82	1230	20.50	0.3	0.053	0.081	0.045	0.01	0.63	569	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
83	1245	20.75	0.3	0.053	0.080	0.045	0.01	0.63	569	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
84	1260	21.00	0.2	0.036	0.079	0.030	0.01	0.42	379	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
85	1275	21.25	0.3	0.053	0.078	0.045	0.01	0.63	569	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
86	1290	21.50	0.2	0.036	0.077	0.030	0.01	0.42	379	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!

RCFC & WCD
HYDROLOGY MANUAL

SYNTHETIC UNIT HYDROGRAPH METHOD

SHORTCUT METHOD

24-HOUR STORM

UNIT HYDROGRAPH and EFFECTIVE RAIN CALCULATION FORM

PROJECT: THE OASIS AT INDIO
Job No.: 2760
BY: NM DATE 8/21/23

DRAINAGE AREA-ACRES	78.28	VARIABLE LOSS RATE (AVG) IN/HR		Basin Percolation Rate	1.0 in/hr
UNIT TIME-MINUTES	15	Fm = Minimum value on loss curve (in/hr)	0.07		
LAG TIME - MINUTES	10.92	C	0.00132	Maxwell Drywells	
UNIT TIME-PERCENT OF LAG	137%	Low Loss Rate (percent)	85.00%	Number	0
TOTAL ADJUSTED STORM RAIN (in)	4.45			Drywell Percolation Rate	0.00 cfs 0.00 cfm

Unit Time Period	Time Minutes	Hours	Pattern Percent (Plate E-5.9)	Storm Rain in/hr	Loss Rate in/hr Max	Loss Rate in/hr Low	Effective Rain in/hr	Flood Hydrograph Flow cfs	Volume In cu-ft	Basin Volume cu-ft	Basin Losses Percolation Area sf	Basin Losses Maximum Percolation cu-ft	Basin Losses Percolation Out cu-ft	Total In Basin cu-ft	Total In Basin ac-ft	Basin WSEL ft
87	1305	21.75	0.3	0.053	0.076	0.045	0.01	0.63	569	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
88	1320	22.00	0.2	0.036	0.076	0.030	0.01	0.42	379	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
89	1335	22.25	0.3	0.053	0.075	0.045	0.01	0.63	569	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
90	1350	22.50	0.2	0.036	0.074	0.030	0.01	0.42	379	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
91	1365	22.75	0.2	0.036	0.074	0.030	0.01	0.42	379	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
92	1380	23.00	0.2	0.036	0.073	0.030	0.01	0.42	379	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
93	1395	23.25	0.2	0.036	0.072	0.030	0.01	0.42	379	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
94	1410	23.50	0.2	0.036	0.072	0.030	0.01	0.42	379	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
95	1425	23.75	0.2	0.036	0.072	0.030	0.01	0.42	379	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
96	1440	24.00	0.2	0.036	0.071	0.030	0.01	0.42	379	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!

EFFECTIVE RAIN & FLOOD VOLUMES SUMMARY

TOTAL RAINFALL	4.45 in
RAINFALL VOLUME	1,264,533 cu-ft
SOIL LOSSES	629,387 cu-ft
EFFECTIVE RAIN	2.24 in
FLOOD VOLUME	14.58 acft
FLOOD VOLUME	635,146 cu-ft
REQUIRED STORAGE	#DIV/0!
REQUIRED STORAGE	#DIV/0!
MAX WSEL	#DIV/0!
PEAK FLOW RATE	38.07 cfs
TOTAL BASIN LOSSES	#DIV/0!
AVERAGE PERCOLATION RATE	#DIV/0!

BASIN VOLUME WORKSHEET

PROECT THE OASIS AT INDIO
JOB No. 2760
BASIN DESIGNATION: Retention Basin

BASIN CHARACTERISTICS

CONTOUR ELEVATION	DEPTH		AREA		VOLUME		
	INCR (ft)	TOTAL (ft)	INCR (sf)	TOTAL (sf)	INCR (cuft)	TOTAL (cuft)	(acre-ft)
503	0	0		39,635	0	0	0.00
504	1	1	33,098	72,733	55,353	55,353	1.27
505	1	2	34,705	107,438	89,523	144,877	3.33
506	1	3	36,119	143,557	125,062	269,939	6.20
507	1	4	37,533	181,090	161,961	431,899	9.92

WHERE: $$V = \frac{1}{3}(E_1 - E_2)\left(A_1 + A_2 + \sqrt{A_1 A_2}\right)$$

RCFCD SYNTHETIC UNIT HYDROGRAPH - SHORTCUT METHOD

DATA INPUT SHEET

DATE	August 21, 2023
WORKSHEET PREPARED BY:	NM
PROJECT NAME	THE OASIS AT INDIO
PROJECT NUMBER	2760
CONCENTRATION POINT DESIGNATION	Retention Basin
AREA DESIGNATION	DA-B
AMC NUMBER	2

Low Loss Conditions: X=Existing; D=Developed; BS=Retention

AREA DESIG	SOIL GROUP	TRIBUTARY AREAS	ACRES	LOW LOSS CONDITION	RI NUMBER	AMC II INFILTRATION RATE	IMPERVIOUS PERCENT
1	B	COMMERCIAL/INDUSTRIAL	101.035	D	56	0.51	0.95
10	B	IID SUBSTATION	2.433	BS	56	0.51	0.20

LENGTH OF WATERCOURSE (L)	4,500 ft
LENGTH TO POINT OPPOSITE CENTROID (Lca)	2,250 ft
ELEVATION OF HEADWATER	526.0 ft
ELEVATION OF CONCENTRATION POINT	507.0 ft
AVERAGE MANNINGS 'N' VALUE	0.02
STORM FREQUENCY (YEAR)	100
LOW LOSS RATE (Storm Events > 10 Years)	**85%**
POINT RAIN FROM NOAA ATLAS	**14**
1-HOUR	1.45 in
3-HOUR	2.13 in
6-HOUR	2.75 in
24-HOUR	4.45 in

BASIN CHARACTERISTICS:

ELEVATION	AREA
506.0 ft	242,519 sf
507.0 ft	266,090 sf
508.0 ft	289,993 sf
509.0 ft	314,194 sf
510.0 ft	338,707 sf

PERCOLATION RATE (in/hr)	1.0 in/hr
DRYWELL DATA	
NUMBER USED	
PERCOLATION RATE	
LOWEST FLOWLINE ELEVATION	510.00
LOWEST PAD ELEVATION	509.5

RCFC & WCD HYDROLOGY MANUAL	SYNTHETIC UNIT HYDROGRAPH METHOD BASIC DATA CALCULATION FORM	PROJECT: THE OASIS AT INDIO Job No.: 2760 BY: NM DATE: 8/21/23

PHYSICAL DATA

[1] CONCENTRATION POINT	Retention Basin
[2] AREA DESIGNATION	DA-B
[3] AREA - ACRES	103.468
[4] L-FEET	4500
[5] L-MILES	0.852
[6] La-FEET	2250.00
[7] La-MILES	0.426
[8] ELEVATION OF HEADWATER	526
[9] ELEVATION OF CONCENTRATION POINT	507
[10] H-FEET	19
[11] S-FEET/MILE	22.3
[12] S^0.5	4.72
[13] L*LCA/S^0.5	0.077
[14] AVERAGE MANNINGS 'N'	0.02
[15] LAG TIME-HOURS	0.18
[16] LAG TIME-MINUTES	10.9
[17] 100% OF LAG-MINUTES	10.9
[18] 200% OF LAG-MINUTES	21.7

RAINFALL DATA

[1] AMC	II
[2] FREQUENCY-YEARS	100
FROM NOAA ATLAS	**14**
[3] STORM DURATION:	Point Rain
1-HOUR	1.45 in
3-HOUR	2.13 in
6-HOUR	2.75 in
24-HOUR	4.45 in

STORM EVENT SUMMARY

STORM DURATION		1-HOUR	3-HOUR	6-HOUR	24-HOUR
RAINFALL VOLUME	(cu-ft)	544,606	800,007	1,032,873	**1,671,377**
SOIL LOSSES	(cu-ft)	30,815	92,446	184,079	**609,451**
EFFECTIVE RAIN	(in)	1.37	1.88	2.26	2.83
FLOOD VOLUME	(cu-ft)	513,791	707,562	848,794	**1,061,926**
	(acre-ft)	11.79	16.24	19.49	**24.38**
REQUIRED STORAGE	(cu-ft)	492,041	641,247	720,457	**775,376**
	(acre-ft)	11.30	14.72	16.54	**17.80**
FACTOR OF SAFETY		2.36	1.81	1.61	1.50
STORAGE PROVIDED	(cu-ft)	1,160,555			
	(acre-ft)	26.64			
PEAK FLOW	(cfs)	n/a	210.11	184.24	55.77
MAXIMUM WSEL	(ft)	507.86	508.36	508.62	**508.81**
DEPTH	(ft)	1.86	2.36	2.62	**2.81**
LOWEST FLOWLINE ELEVATION		510.00			
DIFFERENCE	(ft)	2.14	1.64	1.38	1.19
LOWEST PAD ELEVATION		509.5			
DIFFERENCE	(ft)	1.64	1.14	0.88	0.69
ESTIMATED TIME TO DEWATER BASIN Based on Total Flood Volume & Average Percolation Rate	(days)	1.0	1.3	1.6	2.3

NOTE: PEAK FLOW FOR THE 1-HOUR STORM IS NOT REPRESENTATIVE. PER RCFCD PEAK DISCHARGES FROM THE 3-HOUR STORM SHOULD NORMALLY COMPARE WELL WITH RATIONAL PEAKS.

RCFC & WCD HYDROLOGY MANUAL	SYNTHETIC UNIT HYDROGRAPH METHOD BASIC DATA CALCULATION FORM AMC II	PROJECT: THE OASIS AT INDIO Job No.: 2760 BY: NM DATE: 8/21/23

AVERAGE ADJUSTED LOSS RATE

SOIL GROUP [Plate C-1]	LAND USE	RI NUMBER [Plate E-6.1]	PERVIOUS AREA INFILTRATION RATE (in/hr) [Plate E-6.2]	DECIMAL PERCENT OF AREA IMPERVIOUS [Plate E-6.3]	ADJUSTED INFILTRATION RATE (in/hr)	AREA	AREA WEIGHTED AVERAGE	MAX AVERAGE ADJUSTED INFILTRATION RATE (in/hr)	LOW LOSS CONDITION	LOW LOSS RATE PER RCFC/2322	MIN AVERAGE ADJUSTED INFILTRATION RATE
B	COMMERCIAL/INDUSTRIAL	56	0.51	95%	0.07	101.035	0.976	0.0722	DEVELOPED	0.1400	0.1367
B	IID SUBSTATION	56	0.51	20%	0.42	2.433	0.024	0.0098	BASIN	0.1000	0.0024
					SUM	103.468		SUM	0.0820		0.1391

VARIABLE LOSS RATE CURVE (24-HOUR STORM ONLY)

Fm= 0.041022436

C= 0.00076

$F_t = C(24-(T/60))^{1.55} + F_m$ = 0.00076 (24-(T/60))^1.55 + 0.04 in/hr

CONSTANT LOSS RATE (3 & 6 HOUR STORMS) = **0.0820**

LOW LOSS RATE = **0.8500**

Where:

T=Time in minutes. To get an average value for each unit time period, Use T=1/2 the unit time for the first time period, T=1 1/2 unit time for the second period, etc.

NOTE: Low loss rates established per RCFC/2322 (Dated: May-30-95)
For 10 Year Storms or Less
Undeveloped Condition: Low Loss = 90%
Developed Condition: Low Loss = 0.9 - (0.8 * %impervious)
Basin Site: Low Loss = 10%
For 100 Year Storm - Low Loss should be between 80% & 90% of the Rainfall Rate

RCFC & WCD
HYDROLOGY MANUAL

SYNTHETIC UNIT HYDROGRAPH METHOD

SHORTCUT METHOD

1-HOUR STORM

UNIT HYDROGRAPH and EFFECTIVE RAIN CALCULATION FORM

PROJECT: THE OASIS AT INDIO
Job No.: 2760
BY: NM DATE 8/21/23

DRAINAGE AREA-ACRES	103.47
UNIT TIME-MINUTES	5
LAG TIME - MINUTES	10.87
UNIT TIME-PERCENT OF LAG	46.0
TOTAL ADJUSTED STORM RAIN-INCHES	1.45
CONSTANT LOSS RATE-in/hr	0.08
LOW LOSS RATE - PERCENT	85.00%

Basin Percolation Rate	1.0 in/hr	
Maxwell Drywells		
Number	0	
Drywell Percolation Rate	0.00 cfs	0.00 cfm

Unit Time Period	Time		Pattern	Storm Rain	Loss Rate		Effective Rain	Flood Hydrograph	Volume In	Basin Volume	Basin Losses			Total In Basin		Basin WSEL
	Minutes	Hours	Percent	in/hr	in/hr			Flow			Percolation Area	Maximum Percolation	Percolation Out			
			(Plate E-5.9)		Max	Low	in/hr	cfs	cu-ft	cu-ft	sf	cu-ft	cu-ft	cu-ft	ac-ft	ft
1	5	0.08	3.6	0.63	0.08	0.53	0.54	56.79	17,038	17,038	244,099	1,695	1,695	15,343	0.35	506.06
2	10	0.17	4.2	0.73	0.08	0.62	0.65	67.69	20,306	35,648	245,825	1,707	1,707	33,941	0.78	506.13
3	15	0.25	4.4	0.77	0.08	0.65	0.68	71.32	21,395	55,336	247,650	1,720	1,720	53,616	1.23	506.21
4	20	0.33	4.6	0.80	0.08	0.68	0.72	74.95	22,484	76,100	249,575	1,733	1,733	74,367	1.71	506.29
5	25	0.42	5.0	0.87	0.08	0.74	0.79	82.21	24,662	99,029	251,701	1,748	1,748	97,281	2.23	506.38
6	30	0.50	5.6	0.97	0.08	0.83	0.89	93.10	27,930	125,211	254,129	1,765	1,765	123,446	2.83	506.49
7	35	0.58	6.4	1.11	0.08	0.95	1.03	107.62	32,287	155,733	256,959	1,784	1,784	153,949	3.53	506.61
8	40	0.67	8.1	1.41	0.08	1.20	1.33	138.48	41,545	195,494	260,646	1,810	1,810	193,684	4.45	506.76
9	45	0.75	13.1	2.28	0.08	1.94	2.20	229.25	68,775	262,459	266,799	1,853	1,853	260,607	5.98	507.02
10	50	0.83	34.5	6.00	0.08	5.10	5.92	**617.74**	**185,321**	445,928	282,577	1,962	1,962	443,965	10.19	507.68
11	55	0.92	6.7	1.17	0.08	0.99	1.08	113.07	33,921	477,886	285,325	1,981	1,981	475,905	10.93	507.80
12	60	1.00	3.8	0.66	0.08	0.56	0.58	60.42	18,127	494,032	286,713	1,991	1,991	**492,041**	**11.30**	**507.86**

EFFECTIVE RAIN & FLOOD VOLUMES SUMMARY

TOTAL RAINFALL	1.45 in
RAINFALL VOLUME	544,606 cu-ft
SOIL LOSSES	30,815 cu-ft
EFFECTIVE RAIN	1.37 in
FLOOD VOLUME	11.79 acft
FLOOD VOLUME	513,791 cu-ft
REQUIRED STORAGE	11.30
REQUIRED STORAGE	492,041 cu-ft
MAX WSEL	507.86 ft
PEAK FLOW RATE	617.74 cfs
TOTAL BASIN LOSSES	21,750 cu-ft
AVERAGE PERCOLATION RATE	362.50 cf/min

RCFC & WCD
HYDROLOGY MANUAL

SYNTHETIC UNIT HYDROGRAPH METHOD

SHORTCUT METHOD

3-HOUR STORM

UNIT HYDROGRAPH and EFFECTIVE RAIN CALCULATION FORM

PROJECT: THE OASIS AT INDIO
Job No.: 2760
BY: NM DATE

DRAINAGE AREA-ACRES	103.47
UNIT TIME-MINUTES	5
LAG TIME - MINUTES	10.87
UNIT TIME-PERCENT OF LAG	46.0
TOTAL ADJUSTED STORM RAIN (in)	2.13
CONSTANT LOSS RATE (in/hr)	0.08
LOW LOSS RATE - PERCENT	85.00%

Basin Percolation Rate	1.0 in/hr	
Maxwell Drywells		
Number	0	
Drywell Percolation Rate	0.00 cfs	0.00 cfm

Unit Time Period	Time		Pattern Percent	Storm Rain in/hr	Loss Rate in/hr		Effective Rain	Flood Hydrograph Flow	Volume In	Basin Volume	Basin Losses			Total In Basin		Basin WSEL
	Minutes	Hours	(Plate E-5.9)		Max	Low	in/hr	cfs	cu-ft	cu-ft	Percolation Area sf	Maximum Percolation cu-ft	Percolation Out cu-ft	cu-ft	ac-ft	ft
1	5	0.08	1.3	0.33	0.08	0.28	0.25	26.11	7,832	7,832	243,245	1,689	1,689	6,143	0.14	506.02
2	10	0.17	1.3	0.33	0.08	0.28	0.25	26.11	7,832	13,975	243,815	1,693	1,693	12,282	0.28	506.05
3	15	0.25	1.1	0.28	0.08	0.24	0.20	20.77	6,232	18,514	244,236	1,696	1,696	16,818	0.39	506.07
4	20	0.33	1.5	0.38	0.08	0.33	0.30	31.44	9,432	26,250	244,953	1,701	1,701	24,549	0.56	506.10
5	25	0.42	1.5	0.38	0.08	0.33	0.30	31.44	9,432	33,981	245,670	1,706	1,706	32,275	0.74	506.13
6	30	0.50	1.8	0.46	0.08	0.39	0.38	39.44	11,832	44,107	246,609	1,713	1,713	42,395	0.97	506.17
7	35	0.58	1.5	0.38	0.08	0.33	0.30	31.44	9,432	51,827	247,325	1,718	1,718	50,110	1.15	506.20
8	40	0.67	1.8	0.46	0.08	0.39	0.38	39.44	11,832	61,942	248,262	1,724	1,724	60,218	1.38	506.24
9	45	0.75	1.8	0.46	0.08	0.39	0.38	39.44	11,832	72,050	249,200	1,731	1,731	70,319	1.61	506.28
10	50	0.83	1.5	0.38	0.08	0.33	0.30	31.44	9,432	79,751	249,914	1,736	1,736	78,016	1.79	506.31
11	55	0.92	1.6	0.41	0.08	0.35	0.33	34.11	10,232	88,248	250,702	1,741	1,741	86,507	1.99	506.34
12	60	1.00	1.8	0.46	0.08	0.39	0.38	39.44	11,832	98,339	251,637	1,747	1,747	96,592	2.22	506.38
13	65	1.08	2.2	0.56	0.08	0.48	0.48	50.11	15,032	111,624	252,869	1,756	1,756	109,868	2.52	506.43
14	70	1.17	2.2	0.56	0.08	0.48	0.48	50.11	15,032	124,900	254,100	1,765	1,765	123,136	2.83	506.48
15	75	1.25	2.2	0.56	0.08	0.48	0.48	50.11	15,032	138,168	255,330	1,773	1,773	136,395	3.13	506.54
16	80	1.33	2.0	0.51	0.08	0.43	0.43	44.77	13,432	149,827	256,411	1,781	1,781	148,046	3.40	506.58
17	85	1.42	2.6	0.66	0.08	0.56	0.58	60.77	18,232	166,279	257,937	1,791	1,791	164,487	3.78	506.65
18	90	1.50	2.7	0.69	0.08	0.59	0.61	63.44	19,032	183,520	259,535	1,802	1,802	181,717	4.17	506.71
19	95	1.58	2.4	0.61	0.08	0.52	0.53	55.44	16,632	198,350	260,910	1,812	1,812	196,538	4.51	506.77
20	100	1.67	2.7	0.69	0.08	0.59	0.61	63.44	19,032	215,570	262,507	1,823	1,823	213,747	4.91	506.84
21	105	1.75	3.3	0.84	0.08	0.72	0.76	79.44	23,832	237,579	264,548	1,837	1,837	235,742	5.41	506.93
22	110	1.83	3.1	0.79	0.08	0.67	0.71	74.11	22,232	257,974	266,413	1,850	1,850	256,124	5.88	507.01
23	115	1.92	2.9	0.74	0.08	0.63	0.66	68.77	20,632	276,757	268,029	1,861	1,861	274,895	6.31	507.07
24	120	2.00	3.0	0.77	0.08	0.65	0.68	71.44	21,432	296,328	269,712	1,873	1,873	294,455	6.76	507.14
25	125	2.08	3.1	0.79	0.08	0.67	0.71	74.11	22,232	316,687	271,462	1,885	1,885	314,802	7.23	507.22

RCFC & WCD
HYDROLOGY MANUAL

SYNTHETIC UNIT HYDROGRAPH METHOD

SHORTCUT METHOD

3-HOUR STORM

UNIT HYDROGRAPH and EFFECTIVE RAIN CALCULATION FORM

PROJECT: THE OASIS AT INDIO
Job No.: 2760
BY: NM DATE

DRAINAGE AREA-ACRES	103.47
UNIT TIME-MINUTES	5
LAG TIME - MINUTES	10.87
UNIT TIME-PERCENT OF LAG	46.0
TOTAL ADJUSTED STORM RAIN (in)	2.13
CONSTANT LOSS RATE (in/hr)	0.08
LOW LOSS RATE - PERCENT	85.00%

Basin Percolation Rate	1.0 in/hr	
Maxwell Drywells		
Number	0	
Drywell Percolation Rate	0.00 cfs	0.00 cfm

Unit Time Period	Time		Pattern	Storm	Loss Rate		Effective	Flood	Volume	Basin	Basin Losses			Total In Basin		Basin
	Minutes	Hours	Percent	Rain	in/hr		Rain	Hydrograph	In	Volume	Percolation Area	Maximum Percolation	Percolation Out			WSEL
				in/hr	Max	Low	in/hr	Flow cfs	cu-ft	cu-ft	sf	cu-ft	cu-ft	cu-ft	ac-ft	ft
			(Plate E-5.9)													
26	130	2.17	4.2	1.07	0.08	0.91	0.99	103.44	31,032	345,834	273,969	1,903	1,903	343,932	7.90	507.32
27	135	2.25	5.0	1.28	0.08	1.09	1.20	124.77	37,432	381,364	277,024	1,924	1,924	379,440	8.71	507.45
28	140	2.33	3.5	0.89	0.08	0.76	0.81	84.77	25,432	404,873	279,046	1,938	1,938	402,935	9.25	507.54
29	145	2.42	6.8	1.74	0.08	1.48	1.66	172.78	51,833	454,767	283,337	1,968	1,968	452,800	10.39	507.71
30	150	2.50	7.3	1.87	0.08	1.59	1.78	186.11	55,833	508,632	287,969	2,000	2,000	506,632	11.63	507.91
31	155	2.58	8.2	2.10	0.08	1.78	2.01	**210.11**	**63,033**	569,665	292,998	2,035	2,035	567,630	13.03	508.12
32	160	2.67	5.9	1.51	0.08	1.28	1.43	148.77	44,632	612,263	296,411	2,058	2,058	610,205	14.01	508.26
33	165	2.75	2.0	0.51	0.08	0.43	0.43	44.77	13,432	623,637	297,322	2,065	2,065	621,572	14.27	508.30
34	170	2.83	1.8	0.46	0.08	0.39	0.38	39.44	11,832	633,404	298,105	2,070	2,070	631,334	14.49	508.33
35	175	2.92	1.8	0.46	0.08	0.39	0.38	39.44	11,832	643,166	298,887	2,076	2,076	641,091	14.72	508.36
36	180	3.00	0.6	0.15	0.08	0.13	0.07	7.44	2,232	643,323	298,900	2,076	2,076	**641,247**	**14.72**	**508.36**

EFFECTIVE RAIN & FLOOD VOLUMES SUMMARY

TOTAL RAIN	2.13 in
RAINFALL VOLUME	800,007 cu-ft
SOIL LOSSES	92,446 cu-ft
EFFECTIVE RAIN	1.88 in
FLOOD VOLUME	16.24 acft
FLOOD VOLUME	707,562 cu-ft
REQUIRED STORAGE	14.72 acft
REQUIRED STORAGE	641,247 cu-ft
MAX WSEL	508.36 ft
PEAK FLOW RATE	210.11 cfs
TOTAL BASIN LOSSES	66,315 cu-ft
AVERAGE PERCOLATION RATE	368.41 cf/min

RCFC & WCD
HYDROLOGY MANUAL

SYNTHETIC UNIT HYDROGRAPH METHOD

SHORTCUT METHOD

6-HOUR STORM

UNIT HYDROGRAPH and EFFECTIVE RAIN CALCULATION FORM

PROJECT: THE OASIS AT INDIO
Job No.: 2760
BY: NM DATE 8/21/23

DRAINAGE AREA-ACRES	103.47
UNIT TIME-MINUTES	5
LAG TIME - MINUTES	10.87
UNIT TIME-PERCENT OF LAG	46.0
TOTAL ADJUSTED STORM RAIN (in)	2.75
CONSTANT LOSS RATE (in/hr)	0.08
LOW LOSS RATE - PERCENT	85.00%

Basin Percolation Rate	1.0 in/hr	
Maxwell Drywells		
Number	0	
Drywell Percolation Rate	0.00 cfs	0.00 cfm

Unit Time Period	Time		Pattern Percent	Storm Rain in/hr	Loss Rate in/hr		Effective Rain	Flood Hydrograph Flow	Volume In	Basin Volume	Basin Losses			Total In Basin		Basin WSEL
	Minutes	Hours	(Plate E-5.9)		Max	Low	in/hr	cfs	cu-ft	cu-ft	Percolation Area sf	Maximum Percolation cu-ft	Percolation Out cu-ft	cu-ft	ac-ft	ft
1	5	0.08	0.5	0.17	0.08	0.14	0.08	8.65	2,596	2,596	242,760	1,686	1,686	911	0.02	506.00
2	10	0.17	0.6	0.20	0.08	0.17	0.12	12.10	3,629	4,540	242,940	1,687	1,687	2,853	0.07	506.01
3	15	0.25	0.6	0.20	0.08	0.17	0.12	12.10	3,629	6,482	243,120	1,688	1,688	4,794	0.11	506.02
4	20	0.33	0.6	0.20	0.08	0.17	0.12	12.10	3,629	8,423	243,300	1,690	1,690	6,733	0.15	506.03
5	25	0.42	0.6	0.20	0.08	0.17	0.12	12.10	3,629	10,363	243,480	1,691	1,691	8,672	0.20	506.03
6	30	0.50	0.7	0.23	0.08	0.20	0.15	15.54	4,662	13,334	243,756	1,693	1,693	11,641	0.27	506.05
7	35	0.58	0.7	0.23	0.08	0.20	0.15	15.54	4,662	16,304	244,031	1,695	1,695	14,609	0.34	506.06
8	40	0.67	0.7	0.23	0.08	0.20	0.15	15.54	4,662	19,271	244,306	1,697	1,697	17,575	0.40	506.07
9	45	0.75	0.7	0.23	0.08	0.20	0.15	15.54	4,662	22,237	244,581	1,698	1,698	20,538	0.47	506.08
10	50	0.83	0.7	0.23	0.08	0.20	0.15	15.54	4,662	25,200	244,856	1,700	1,700	23,500	0.54	506.09
11	55	0.92	0.7	0.23	0.08	0.20	0.15	15.54	4,662	28,162	245,130	1,702	1,702	26,460	0.61	506.10
12	60	1.00	0.8	0.26	0.08	0.22	0.18	18.98	5,695	32,155	245,501	1,705	1,705	30,450	0.70	506.12
13	65	1.08	0.8	0.26	0.08	0.22	0.18	18.98	5,695	36,145	245,871	1,707	1,707	34,438	0.79	506.14
14	70	1.17	0.8	0.26	0.08	0.22	0.18	18.98	5,695	40,133	246,240	1,710	1,710	38,423	0.88	506.15
15	75	1.25	0.8	0.26	0.08	0.22	0.18	18.98	5,695	44,118	246,610	1,713	1,713	42,405	0.97	506.17
16	80	1.33	0.8	0.26	0.08	0.22	0.18	18.98	5,695	48,100	246,979	1,715	1,715	46,385	1.06	506.18
17	85	1.42	0.8	0.26	0.08	0.22	0.18	18.98	5,695	52,080	247,348	1,718	1,718	50,362	1.16	506.20
18	90	1.50	0.8	0.26	0.08	0.22	0.18	18.98	5,695	56,058	247,717	1,720	1,720	54,337	1.25	506.21
19	95	1.58	0.8	0.26	0.08	0.22	0.18	18.98	5,695	60,032	248,085	1,723	1,723	58,309	1.34	506.23
20	100	1.67	0.8	0.26	0.08	0.22	0.18	18.98	5,695	64,005	248,454	1,725	1,725	62,279	1.43	506.24
21	105	1.75	0.8	0.26	0.08	0.22	0.18	18.98	5,695	67,974	248,822	1,728	1,728	66,246	1.52	506.26
22	110	1.83	0.8	0.26	0.08	0.22	0.18	18.98	5,695	71,941	249,190	1,730	1,730	70,211	1.61	506.28
23	115	1.92	0.8	0.26	0.08	0.22	0.18	18.98	5,695	75,906	249,557	1,733	1,733	74,173	1.70	506.29
24	120	2.00	0.9	0.30	0.08	0.25	0.21	22.43	6,728	80,901	250,020	1,736	1,736	79,165	1.82	506.31

RCFC & WCD
HYDROLOGY MANUAL

SYNTHETIC UNIT HYDROGRAPH METHOD

SHORTCUT METHOD

6-HOUR STORM

UNIT HYDROGRAPH and EFFECTIVE RAIN CALCULATION FORM

PROJECT: THE OASIS AT INDIO
Job No.: 2760
BY: NM DATE 8/21/23

DRAINAGE AREA-ACRES	103.47
UNIT TIME-MINUTES	5
LAG TIME - MINUTES	10.87
UNIT TIME-PERCENT OF LAG	46.0
TOTAL ADJUSTED STORM RAIN (in)	2.75
CONSTANT LOSS RATE (in/hr)	0.08
LOW LOSS RATE - PERCENT	85.00%

Basin Percolation Rate	1.0 in/hr	
Maxwell Drywells		
Number	0	
Drywell Percolation Rate	0.00 cfs	0.00 cfm

Unit Time Period	Time Minutes	Time Hours	Pattern Percent (Plate E-5.9)	Storm Rain in/hr	Loss Rate in/hr Max	Loss Rate in/hr Low	Effective Rain in/hr	Flood Hydrograph Flow cfs	Volume In cu-ft	Basin Volume cu-ft	Basin Losses Percolation Area sf	Basin Losses Maximum Percolation cu-ft	Basin Losses Percolation Out cu-ft	Total In Basin cu-ft	Total In Basin ac-ft	Basin WSEL ft
25	125	2.08	0.8	0.26	0.08	0.22	0.18	18.98	5,695	84,860	250,387	1,739	1,739	83,121	1.91	506.33
26	130	2.17	0.9	0.30	0.08	0.25	0.21	22.43	6,728	89,849	250,850	1,742	1,742	88,107	2.02	506.35
27	135	2.25	0.9	0.30	0.08	0.25	0.21	22.43	6,728	94,835	251,312	1,745	1,745	93,089	2.14	506.37
28	140	2.33	0.9	0.30	0.08	0.25	0.21	22.43	6,728	99,817	251,774	1,748	1,748	98,069	2.25	506.39
29	145	2.42	0.9	0.30	0.08	0.25	0.21	22.43	6,728	104,797	252,236	1,752	1,752	103,045	2.37	506.41
30	150	2.50	0.9	0.30	0.08	0.25	0.21	22.43	6,728	109,773	252,697	1,755	1,755	108,018	2.48	506.42
31	155	2.58	0.9	0.30	0.08	0.25	0.21	22.43	6,728	114,746	253,159	1,758	1,758	112,988	2.59	506.44
32	160	2.67	0.9	0.30	0.08	0.25	0.21	22.43	6,728	119,716	253,619	1,761	1,761	117,955	2.71	506.46
33	165	2.75	1.0	0.33	0.08	0.28	0.25	25.87	7,761	125,716	254,176	1,765	1,765	123,950	2.85	506.49
34	170	2.83	1.0	0.33	0.08	0.28	0.25	25.87	7,761	131,711	254,732	1,769	1,769	129,942	2.98	506.51
35	175	2.92	1.0	0.33	0.08	0.28	0.25	25.87	7,761	137,703	255,287	1,773	1,773	135,930	3.12	506.53
36	180	3.00	1.0	0.33	0.08	0.28	0.25	25.87	7,761	143,691	255,842	1,777	1,777	141,914	3.26	506.56
37	185	3.08	1.0	0.33	0.08	0.28	0.25	25.87	7,761	149,675	256,397	1,781	1,781	147,895	3.40	506.58
38	190	3.17	1.1	0.36	0.08	0.31	0.28	29.31	8,794	156,688	257,047	1,785	1,785	154,903	3.56	506.61
39	195	3.25	1.1	0.36	0.08	0.31	0.28	29.31	8,794	163,697	257,697	1,790	1,790	161,907	3.72	506.64
40	200	3.33	1.1	0.36	0.08	0.31	0.28	29.31	8,794	170,701	258,347	1,794	1,794	168,907	3.88	506.66
41	205	3.42	1.2	0.40	0.08	0.34	0.31	32.76	9,827	178,734	259,091	1,799	1,799	176,934	4.06	506.70
42	210	3.50	1.3	0.43	0.08	0.36	0.35	36.20	10,859	187,794	259,932	1,805	1,805	185,989	4.27	506.73
43	215	3.58	1.4	0.46	0.08	0.39	0.38	39.64	11,892	197,881	260,867	1,812	1,812	196,069	4.50	506.77
44	220	3.67	1.4	0.46	0.08	0.39	0.38	39.64	11,892	207,962	261,801	1,818	1,818	206,144	4.73	506.81
45	225	3.75	1.5	0.50	0.08	0.42	0.41	43.08	12,925	219,069	262,831	1,825	1,825	217,243	4.99	506.85
46	230	3.83	1.5	0.50	0.08	0.42	0.41	43.08	12,925	230,169	263,861	1,832	1,832	228,336	5.24	506.90
47	235	3.92	1.6	0.53	0.08	0.45	0.45	46.53	13,958	242,294	264,985	1,840	1,840	240,454	5.52	506.95
48	240	4.00	1.6	0.53	0.08	0.45	0.45	46.53	13,958	254,412	266,107	1,848	1,848	252,564	5.80	506.99
49	245	4.08	1.7	0.56	0.08	0.48	0.48	49.97	14,991	267,555	267,237	1,856	1,856	265,699	6.10	507.04
50	250	4.17	1.8	0.59	0.08	0.50	0.51	53.41	16,024	281,723	268,456	1,864	1,864	279,859	6.42	507.09

RCFC & WCD
HYDROLOGY MANUAL

SYNTHETIC UNIT HYDROGRAPH METHOD

SHORTCUT METHOD

6-HOUR STORM

UNIT HYDROGRAPH and EFFECTIVE RAIN CALCULATION FORM

PROJECT: THE OASIS AT INDIO
Job No.: 2760
BY: NM DATE 8/21/23

DRAINAGE AREA-ACRES	103.47
UNIT TIME-MINUTES	5
LAG TIME - MINUTES	10.87
UNIT TIME-PERCENT OF LAG	46.0
TOTAL ADJUSTED STORM RAIN (in)	2.75
CONSTANT LOSS RATE (in/hr)	0.08
LOW LOSS RATE - PERCENT	85.00%

Basin Percolation Rate	1.0 in/hr	
Maxwell Drywells		
Number	0	
Drywell Percolation Rate	0.00 cfs	0.00 cfm

Unit Time Period	Time Minutes	Time Hours	Pattern Percent (Plate E-5.9)	Storm Rain in/hr	Loss Rate in/hr Max	Loss Rate in/hr Low	Effective Rain in/hr	Flood Hydrograph Flow cfs	Volume In cu-ft	Basin Volume cu-ft	Basin Losses Percolation Area sf	Basin Losses Maximum Percolation cu-ft	Basin Losses Percolation Out cu-ft	Total In Basin cu-ft	Total In Basin ac-ft	Basin WSEL ft
51	255	4.25	1.9	0.63	0.08	0.53	0.54	56.86	17,057	296,915	269,762	1,873	1,873	295,042	6.77	507.15
52	260	4.33	2.0	0.66	0.08	0.56	0.58	60.30	18,090	313,132	271,157	1,883	1,883	311,249	7.15	507.21
53	265	4.42	2.1	0.69	0.08	0.59	0.61	63.74	19,122	330,371	272,639	1,893	1,893	328,478	7.54	507.27
54	270	4.50	2.1	0.69	0.08	0.59	0.61	63.74	19,122	347,600	274,121	1,904	1,904	345,696	7.94	507.33
55	275	4.58	2.2	0.73	0.08	0.62	0.64	67.18	20,155	365,852	275,690	1,915	1,915	363,937	8.35	507.39
56	280	4.67	2.3	0.76	0.08	0.65	0.68	70.63	21,188	385,125	277,348	1,926	1,926	383,199	8.80	507.46
57	285	4.75	2.4	0.79	0.08	0.67	0.71	74.07	22,221	405,420	279,093	1,938	1,938	403,482	9.26	507.54
58	290	4.83	2.4	0.79	0.08	0.67	0.71	74.07	22,221	425,703	280,837	1,950	1,950	423,753	9.73	507.61
59	295	4.92	2.5	0.83	0.08	0.70	0.74	77.51	23,254	447,007	282,669	1,963	1,963	445,044	10.22	507.69
60	300	5.00	2.6	0.86	0.08	0.73	0.78	80.96	24,287	469,331	284,589	1,976	1,976	467,354	10.73	507.77
61	305	5.08	3.1	1.02	0.08	0.87	0.94	98.17	29,451	496,805	286,952	1,993	1,993	494,813	11.36	507.87
62	310	5.17	3.6	1.19	0.08	1.01	1.11	115.39	34,616	529,428	289,757	2,012	2,012	527,416	12.11	507.98
63	315	5.25	3.9	1.29	0.08	1.09	1.20	125.71	37,714	565,130	292,634	2,032	2,032	563,098	12.93	508.10
64	320	5.33	4.2	1.39	0.08	1.18	1.30	136.04	40,813	603,911	295,742	2,054	2,054	601,857	13.82	508.23
65	325	5.42	4.7	1.55	0.08	1.32	1.47	153.26	45,977	647,834	299,261	2,078	2,078	645,756	14.82	508.38
66	330	5.50	5.6	1.85	0.08	1.57	1.77	**184.24**	**55,273**	701,029	303,524	2,108	2,108	698,921	16.04	508.55
67	335	5.58	1.9	0.63	0.08	0.53	0.54	56.86	17,057	715,978	304,722	2,116	2,116	713,862	16.39	508.60
68	340	5.67	0.9	0.30	0.08	0.25	0.21	22.43	6,728	720,590	305,091	2,119	2,119	718,471	16.49	508.62
69	345	5.75	0.6	0.20	0.08	0.17	0.12	12.10	3,629	722,100	305,212	2,120	2,120	719,981	16.53	508.62
70	350	5.83	0.5	0.17	0.08	0.14	0.08	8.65	2,596	722,577	305,251	2,120	2,120	**720,457**	**16.54**	**508.62**
71	355	5.92	0.3	0.10	0.08	0.08	0.02	1.77	531	720,988	305,123	2,119	2,119	718,869	16.50	508.62
72	360	6.00	0.2	0.07	0.08	0.06	0.01	1.03	310	719,179	304,978	2,118	2,118	717,061	16.46	508.61

EFFECTIVE RAIN & FLOOD VOLUMES SUMMARY

TOTAL RAINFALL	2.75 in
RAINFALL VOLUME	1,032,873 cu-ft
SOIL LOSSES	184,079 cu-ft
EFFECTIVE RAIN	2.26 in
FLOOD VOLUME	19.49 acft
FLOOD VOLUME	848,794 cu-ft
REQUIRED STORAGE	16.54 acft
REQUIRED STORAGE	720,457 cu-ft
MAX WSEL	508.62 ft
PEAK FLOW RATE	184.24 cfs
TOTAL BASIN LOSSES	131,733 cu-ft
AVERAGE PERCOLATION RATE	365.92 cf/min

RCFC & WCD
HYDROLOGY MANUAL

SYNTHETIC UNIT HYDROGRAPH METHOD

SHORTCUT METHOD

24-HOUR STORM

UNIT HYDROGRAPH and EFFECTIVE RAIN CALCULATION FORM

PROJECT: THE OASIS AT INDIO
Job No.: 2760
BY: NM DATE 8/21/23

DRAINAGE AREA-ACRES	103.47	VARIABLE LOSS RATE (AVG) IN/HR		Basin Percolation Rate	1.0 in/hr
UNIT TIME-MINUTES	15	Fm = Minimum value on loss curve (in/hr)	0.04		
LAG TIME - MINUTES	10.87	C	0.00076	Maxwell Drywells	
UNIT TIME-PERCENT OF LAG	138%	Low Loss Rate (percent)	85.00%	Number	0
TOTAL ADJUSTED STORM RAIN (in)	4.45			Drywell Percolation Rate	0.00 cfs 0.00 cfm

Unit Time Period	Time Minutes	Hours	Pattern Percent	Storm Rain in/hr	Loss Rate in/hr		Effective Rain	Flood Hydrograph Flow	Volume In	Basin Volume	Basin Losses			Total In Basin		Basin WSEL
											Percolation Area	Maximum Percolation	Percolation Out			
			(Plate E-5.9)		Max	Low	in/hr	cfs	cu-ft	cu-ft	sf	cu-ft	cu-ft	cu-ft	ac-ft	ft
1	15	0.25	0.2	0.036	0.145	0.030	0.01	0.56	501	501	242,566	5,053	501	0	0.00	506.00
2	30	0.50	0.3	0.053	0.143	0.045	0.01	0.84	752	752	242,589	5,054	752	0	0.00	506.00
3	45	0.75	0.3	0.053	0.142	0.045	0.01	0.84	752	752	242,589	5,054	752	0	0.00	506.00
4	60	1.00	0.4	0.071	0.140	0.061	0.01	1.11	1,003	1,003	242,612	5,054	1,003	0	0.00	506.00
5	75	1.25	0.3	0.053	0.138	0.045	0.01	0.84	752	752	242,589	5,054	752	0	0.00	506.00
6	90	1.50	0.3	0.053	0.137	0.045	0.01	0.84	752	752	242,589	5,054	752	0	0.00	506.00
7	105	1.75	0.3	0.053	0.135	0.045	0.01	0.84	752	752	242,589	5,054	752	0	0.00	506.00
8	120	2.00	0.4	0.071	0.133	0.061	0.01	1.11	1,003	1,003	242,612	5,054	1,003	0	0.00	506.00
9	135	2.25	0.4	0.071	0.132	0.061	0.01	1.11	1,003	1,003	242,612	5,054	1,003	0	0.00	506.00
10	150	2.50	0.4	0.071	0.130	0.061	0.01	1.11	1,003	1,003	242,612	5,054	1,003	0	0.00	506.00
11	165	2.75	0.5	0.089	0.129	0.076	0.01	1.39	1,254	1,254	242,635	5,055	1,254	0	0.00	506.00
12	180	3.00	0.5	0.089	0.127	0.076	0.01	1.39	1,254	1,254	242,635	5,055	1,254	0	0.00	506.00
13	195	3.25	0.5	0.089	0.125	0.076	0.01	1.39	1,254	1,254	242,635	5,055	1,254	0	0.00	506.00
14	210	3.50	0.5	0.089	0.124	0.076	0.01	1.39	1,254	1,254	242,635	5,055	1,254	0	0.00	506.00
15	225	3.75	0.5	0.089	0.122	0.076	0.01	1.39	1,254	1,254	242,635	5,055	1,254	0	0.00	506.00
16	240	4.00	0.6	0.107	0.121	0.091	0.02	1.67	1,504	1,504	242,659	5,055	1,504	0	0.00	506.00
17	255	4.25	0.6	0.107	0.119	0.091	0.02	1.67	1,504	1,504	242,659	5,055	1,504	0	0.00	506.00
18	270	4.50	0.7	0.125	0.118	0.106	0.01	0.72	651	651	242,580	5,054	651	0	0.00	506.00
19	285	4.75	0.7	0.125	0.116	0.106	0.01	0.88	793	793	242,593	5,054	793	0	0.00	506.00
20	300	5.00	0.8	0.142	0.115	0.121	0.03	2.89	2,605	2,605	242,761	5,058	2,605	0	0.00	506.00
21	315	5.25	0.6	0.107	0.113	0.091	0.02	1.67	1,504	1,504	242,659	5,055	1,504	0	0.00	506.00
22	330	5.50	0.7	0.125	0.112	0.106	0.01	1.35	1,211	1,211	242,632	5,055	1,211	0	0.00	506.00
23	345	5.75	0.8	0.142	0.110	0.121	0.03	3.36	3,020	3,020	242,799	5,058	3,020	0	0.00	506.00
24	360	6.00	0.8	0.142	0.109	0.121	0.03	3.51	3,157	3,157	242,812	5,059	3,157	0	0.00	506.00
25	375	6.25	0.9	0.160	0.107	0.136	0.05	5.52	4,964	4,964	242,979	5,062	4,964	0	0.00	506.00
26	390	6.50	0.9	0.160	0.106	0.136	0.05	5.66	5,098	5,098	242,992	5,062	5,062	36	0.00	506.00
27	405	6.75	1.0	0.178	0.104	0.151	0.07	7.67	6,903	6,939	243,163	5,066	5,066	1,873	0.04	506.01
28	420	7.00	1.0	0.178	0.103	0.151	0.07	7.82	7,035	8,908	243,345	5,070	5,070	3,839	0.09	506.02
29	435	7.25	1.0	0.178	0.102	0.151	0.08	7.96	7,167	11,005	243,540	5,074	5,074	5,931	0.14	506.02
30	450	7.50	1.1	0.196	0.100	0.166	0.10	9.96	8,968	14,900	243,901	5,081	5,081	9,818	0.23	506.04
31	465	7.75	1.2	0.214	0.099	0.182	0.11	11.97	10,769	20,587	244,428	5,092	5,092	15,495	0.36	506.06
32	480	8.00	1.3	0.231	0.098	0.197	0.13	13.96	12,568	28,063	245,121	5,107	5,107	22,957	0.53	506.09
33	495	8.25	1.5	0.267	0.096	0.227	0.17	17.82	16,038	38,995	246,135	5,128	5,128	33,867	0.78	506.13
34	510	8.50	1.5	0.267	0.095	0.227	0.17	17.96	16,164	50,031	247,158	5,149	5,149	44,882	1.03	506.18
35	525	8.75	1.6	0.285	0.094	0.242	0.19	19.96	17,960	62,842	248,346	5,174	5,174	57,668	1.32	506.23
36	540	9.00	1.7	0.303	0.092	0.257	0.21	21.95	19,755	77,423	249,698	5,202	5,202	72,221	1.66	506.28
37	555	9.25	1.9	0.338	0.091	0.287	0.25	25.80	23,221	95,442	251,369	5,237	5,237	90,205	2.07	506.35
38	570	9.50	2.0	0.356	0.090	0.303	0.27	27.79	25,013	115,218	253,202	5,275	5,275	109,943	2.52	506.43
39	585	9.75	2.1	0.374	0.088	0.318	0.29	29.78	26,805	136,748	255,199	5,317	5,317	131,432	3.02	506.52
40	600	10.00	2.2	0.392	0.087	0.333	0.30	31.77	28,596	160,027	257,357	5,362	5,362	154,666	3.55	506.61
41	615	10.25	1.5	0.267	0.086	0.227	0.18	18.90	17,014	171,680	258,437	5,384	5,384	166,295	3.82	506.65
42	630	10.50	1.5	0.267	0.085	0.227	0.18	19.03	17,131	183,426	259,527	5,407	5,407	178,019	4.09	506.70
43	645	10.75	2.0	0.356	0.083	0.303	0.27	28.45	25,603	203,623	261,399	5,446	5,446	198,177	4.55	506.78

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HYDROLOGY MANUAL

SYNTHETIC UNIT HYDROGRAPH METHOD

SHORTCUT METHOD

24-HOUR STORM

UNIT HYDROGRAPH and EFFECTIVE RAIN CALCULATION FORM

PROJECT: THE OASIS AT INDIO
Job No.: 2760
BY: NM DATE 8/21/23

DRAINAGE AREA-ACRES	103.47	VARIABLE LOSS RATE (AVG) IN/HR		Basin Percolation Rate	1.0 in/hr
UNIT TIME-MINUTES	15	Fm = Minimum value on loss curve (in/hr)	0.04		
LAG TIME - MINUTES	10.87	C	0.00076	Maxwell Drywells	
UNIT TIME-PERCENT OF LAG	138%	Low Loss Rate (percent)	85.00%	Number	0
TOTAL ADJUSTED STORM RAIN (in)	4.45			Drywell Percolation Rate	0.00 cfs 0.00 cfm

Unit Time Period	Time Minutes	Hours	Pattern Percent (Plate E-5.9)	Storm Rain in/hr	Loss Rate in/hr Max	Loss Rate in/hr Low	Effective Rain in/hr	Flood Hydrograph Flow cfs	Volume In cu-ft	Basin Volume cu-ft	Basin Losses Percolation Area sf	Basin Losses Maximum Percolation cu-ft	Basin Losses Percolation Out cu-ft	Total In Basin cu-ft	Total In Basin ac-ft	Basin WSEL ft
44	660	11.00	2.0	0.356	0.082	0.303	0.27	28.58	25,718	223,895	263,279	5,485	5,485	218,410	5.01	506.86
45	675	11.25	1.9	0.338	0.081	0.287	0.26	26.84	24,160	242,570	265,010	5,521	5,521	237,049	5.44	506.93
46	690	11.50	1.9	0.338	0.080	0.287	0.26	26.97	24,272	261,320	266,701	5,556	5,556	255,764	5.87	507.01
47	705	11.75	1.7	0.303	0.079	0.257	0.22	23.38	21,040	276,804	268,033	5,584	5,584	271,220	6.23	507.06
48	720	12.00	1.8	0.320	0.077	0.272	0.24	25.36	22,821	294,041	269,515	5,615	5,615	288,426	6.62	507.12
49	735	12.25	2.5	0.445	0.076	0.378	0.37	38.48	34,629	323,055	272,010	5,667	5,667	317,389	7.29	507.23
50	750	12.50	2.6	0.463	0.075	0.393	0.39	40.45	36,408	353,796	274,654	5,722	5,722	348,074	7.99	507.34
51	765	12.75	2.8	0.498	0.074	0.424	0.42	44.28	39,856	387,931	277,589	5,783	5,783	382,147	8.77	507.46
52	780	13.00	2.9	0.516	0.073	0.439	0.44	46.26	41,632	423,780	280,672	5,847	5,847	417,932	9.59	507.59
53	795	13.25	3.4	0.605	0.072	0.514	0.53	55.66	50,093	468,025	284,477	5,927	5,927	462,098	10.61	507.75
54	810	13.50	3.4	0.605	0.071	0.514	0.53	**55.77**	**50,195**	512,293	288,284	6,006	6,006	506,287	11.62	507.91
55	825	13.75	2.3	0.409	0.070	0.348	0.34	35.46	31,910	538,197	290,476	6,052	6,052	532,146	12.22	508.00
56	840	14.00	2.3	0.409	0.069	0.348	0.34	35.57	32,010	564,155	292,556	6,095	6,095	558,060	12.81	508.09
57	855	14.25	2.7	0.481	0.067	0.409	0.41	43.10	38,793	596,854	295,176	6,150	6,150	590,704	13.56	508.19
58	870	14.50	2.6	0.463	0.066	0.393	0.40	41.35	37,219	627,923	297,666	6,201	6,201	621,721	14.27	508.30
59	885	14.75	2.6	0.463	0.065	0.393	0.40	41.46	37,314	659,035	300,159	6,253	6,253	652,782	14.99	508.40
60	900	15.00	2.5	0.445	0.064	0.378	0.38	39.71	35,736	688,518	302,521	6,303	6,303	682,216	15.66	508.50
61	915	15.25	2.4	0.427	0.063	0.363	0.36	37.95	34,158	716,373	304,753	6,349	6,349	710,024	16.30	508.59
62	930	15.50	2.3	0.409	0.062	0.348	0.35	36.20	32,577	742,602	306,855	6,393	6,393	736,209	16.90	508.68
63	945	15.75	1.9	0.338	0.061	0.287	0.28	28.87	25,982	762,190	308,425	6,426	6,426	755,765	17.35	508.74
64	960	16.00	1.9	0.338	0.061	0.287	0.28	28.97	26,070	781,835	309,999	6,458	6,458	**775,376**	**17.80**	**508.81**
65	975	16.25	0.4	0.071	0.060	0.061	0.01	1.21	1,086	776,462	309,568	6,449	6,449	770,013	17.68	508.79
66	990	16.50	0.4	0.071	0.059	0.061	0.01	1.30	1,171	771,184	309,145	6,441	6,441	764,744	17.56	508.77
67	1005	16.75	0.3	0.053	0.058	0.045	0.01	0.84	752	765,496	308,690	6,431	6,431	759,065	17.43	508.75
68	1020	17.00	0.3	0.053	0.057	0.045	0.01	0.84	752	759,817	308,235	6,422	6,422	753,395	17.30	508.73
69	1035	17.25	0.5	0.089	0.056	0.076	0.03	3.43	3,089	756,484	307,968	6,416	6,416	750,068	17.22	508.72
70	1050	17.50	0.5	0.089	0.055	0.076	0.03	3.52	3,168	753,236	307,707	6,411	6,411	746,826	17.14	508.71
71	1065	17.75	0.5	0.089	0.054	0.076	0.03	3.61	3,245	750,071	307,454	6,405	6,405	743,666	17.07	508.70
72	1080	18.00	0.4	0.071	0.054	0.061	0.02	1.83	1,650	745,316	307,073	6,397	6,397	738,918	16.96	508.68
73	1095	18.25	0.4	0.071	0.053	0.061	0.02	1.92	1,724	740,642	306,698	6,390	6,390	734,252	16.86	508.67
74	1110	18.50	0.4	0.071	0.052	0.061	0.02	2.00	1,796	736,049	306,330	6,382	6,382	729,667	16.75	508.65
75	1125	18.75	0.3	0.053	0.051	0.045	0.00	0.22	195	729,862	305,834	6,372	6,372	723,491	16.61	508.63
76	1140	19.00	0.2	0.036	0.051	0.030	0.01	0.56	501	723,992	305,364	6,362	6,362	717,630	16.47	508.61
77	1155	19.25	0.3	0.053	0.050	0.045	0.00	0.37	331	717,961	304,881	6,352	6,352	711,610	16.34	508.59
78	1170	19.50	0.4	0.071	0.049	0.061	0.02	2.30	2,068	713,677	304,537	6,345	6,345	707,333	16.24	508.58
79	1185	19.75	0.3	0.053	0.049	0.045	0.00	0.51	459	707,792	304,066	6,335	6,335	701,458	16.10	508.56
80	1200	20.00	0.2	0.036	0.048	0.030	0.01	0.56	501	701,959	303,598	6,325	6,325	695,634	15.97	508.54
81	1215	20.25	0.3	0.053	0.047	0.045	0.01	0.64	580	696,214	303,138	6,315	6,315	689,899	15.84	508.52
82	1230	20.50	0.3	0.053	0.047	0.045	0.01	0.71	637	690,536	302,683	6,306	6,306	684,230	15.71	508.50
83	1245	20.75	0.3	0.053	0.046	0.045	0.01	0.77	692	684,922	302,233	6,297	6,297	678,626	15.58	508.48
84	1260	21.00	0.2	0.036	0.045	0.030	0.01	0.56	501	679,127	301,769	6,287	6,287	672,840	15.45	508.47
85	1275	21.25	0.3	0.053	0.045	0.045	0.01	0.88	796	673,636	301,329	6,278	6,278	667,358	15.32	508.45
86	1290	21.50	0.2	0.036	0.044	0.030	0.01	0.56	501	667,859	300,866	6,268	6,268	661,591	15.19	508.43

RCFC & WCD
HYDROLOGY MANUAL

SYNTHETIC UNIT HYDROGRAPH METHOD

SHORTCUT METHOD

24-HOUR STORM

UNIT HYDROGRAPH and EFFECTIVE RAIN CALCULATION FORM

PROJECT: THE OASIS AT INDIO
Job No.: 2760
BY: NM DATE 8/21/23

DRAINAGE AREA-ACRES	103.47	VARIABLE LOSS RATE (AVG) IN/HR		Basin Percolation Rate	1.0 in/hr
UNIT TIME-MINUTES	15	Fm = Minimum value on loss curve (in/hr)	0.04		
LAG TIME - MINUTES	10.87	C	0.00076	Maxwell Drywells	
UNIT TIME-PERCENT OF LAG	138%	Low Loss Rate (percent)	85.00%	Number	0
TOTAL ADJUSTED STORM RAIN (in)	4.45			Drywell Percolation Rate	0.00 cfs 0.00 cfm

Unit Time Period	Time Minutes	Hours	Pattern Percent	Storm Rain in/hr	Loss Rate in/hr		Effective Rain	Flood Hydrograph Flow	Volume In	Basin Volume	Basin Losses			Total In Basin		Basin WSEL
											Percolation Area	Maximum Percolation	Percolation Out			
			(Plate E-5.9)		Max	Low	in/hr	cfs	cu-ft	cu-ft	sf	cu-ft	cu-ft	cu-ft	ac-ft	ft
87	1305	21.75	0.3	0.053	0.044	0.045	0.01	0.99	890	662,481	300,435	6,259	6,259	656,222	15.06	508.41
88	1320	22.00	0.2	0.036	0.043	0.030	0.01	0.56	501	656,723	299,974	6,249	6,249	650,474	14.93	508.39
89	1335	22.25	0.3	0.053	0.043	0.045	0.01	1.08	973	651,447	299,551	6,241	6,241	645,207	14.81	508.37
90	1350	22.50	0.2	0.036	0.043	0.030	0.01	0.56	501	645,708	299,091	6,231	6,231	639,477	14.68	508.36
91	1365	22.75	0.2	0.036	0.042	0.030	0.01	0.56	501	639,978	298,632	6,221	6,221	633,757	14.55	508.34
92	1380	23.00	0.2	0.036	0.042	0.030	0.01	0.56	501	634,258	298,173	6,212	6,212	628,046	14.42	508.32
93	1395	23.25	0.2	0.036	0.042	0.030	0.01	0.56	501	628,548	297,716	6,202	6,202	622,345	14.29	508.30
94	1410	23.50	0.2	0.036	0.041	0.030	0.01	0.56	501	622,847	297,259	6,193	6,193	616,654	14.16	508.28
95	1425	23.75	0.2	0.036	0.041	0.030	0.01	0.56	501	617,155	296,803	6,183	6,183	610,972	14.03	508.26
96	1440	24.00	0.2	0.036	0.041	0.030	0.01	0.56	501	611,473	296,348	6,174	6,174	605,299	13.90	508.24

EFFECTIVE RAIN & FLOOD VOLUMES SUMMARY

TOTAL RAINFALL	4.45 in
RAINFALL VOLUME	1,671,377 cu-ft
SOIL LOSSES	609,451 cu-ft
EFFECTIVE RAIN	2.83 in
FLOOD VOLUME	24.38 acft
FLOOD VOLUME	1,061,926 cu-ft
REQUIRED STORAGE	17.80 acft
REQUIRED STORAGE	775,376 cu-ft
MAX WSEL	508.81 ft
PEAK FLOW RATE	55.77 cfs
TOTAL BASIN LOSSES	456,626 cu-ft
AVERAGE PERCOLATION RATE	317.10 cf/min

BASIN VOLUME WORKSHEET

PROECT THE OASIS AT INDIO
JOB No. 2760
BASIN DESIGNATION: Retention Basin

BASIN CHARACTERISTICS

CONTOUR ELEVATION	DEPTH		AREA		VOLUME		
	INCR (ft)	TOTAL (ft)	INCR (sf)	TOTAL (sf)	INCR (cuft)	TOTAL (cuft)	(acre-ft)
506	0	0		242,519	0	0	0.00
507	1	1	23,571	266,090	254,214	254,214	5.84
508	1	2	23,903	289,993	277,956	532,169	12.22
509	1	3	24,201	314,194	302,012	834,182	19.15
510	1	4	24,513	338,707	326,373	1,160,555	26.64

WHERE: $$V = \frac{1}{3}(E_1 - E_2)\left(A_1 + A_2 + \sqrt{A_1 A_2}\right)$$

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CONTECH CONSTRUCTION PRODUCTS INC.

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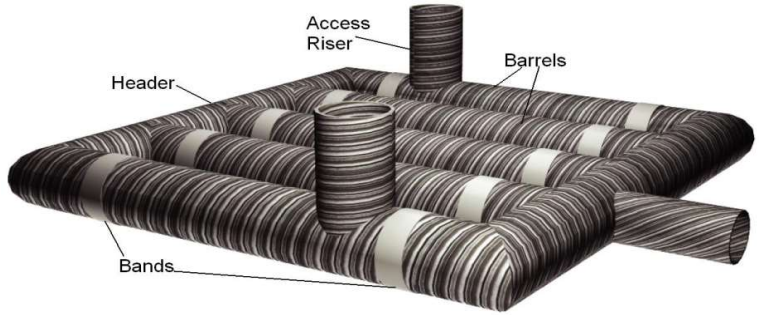
dyods@contech-cpi.com



Project Summary

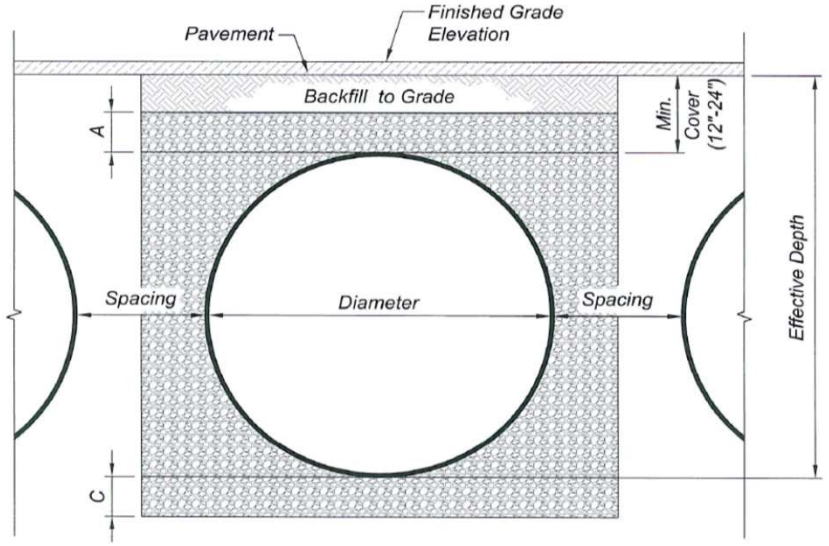
Date:	8/21/2023
Project Name:	THE OASIS AT INDIO
City / County:	City of Indio / Riverside County
State:	CA
Designed By:	NM
Company:	MSA Consulting, Inc.
Telephone:	(760) 320-9811

Enter Information in Blue Cells

Corrugated Metal Pipe Calculator

Storage Volume Required (cf):	203,247
Limiting Width (ft):	72.00
Invert Depth Below Asphalt (ft):	10.00
Solid or Perforated Pipe:	Perforated
Shape Or Diameter (in):	72
Number Of Headers:	0
Spacing between Barrels (ft):	3.00
Stone Width Around Perimeter of System (ft):	2
Depth A: Porous Stone Above Pipe (in):	24
Depth C: Porous Stone Below Pipe (in):	24
Stone Porosity (0 to 40%):	40

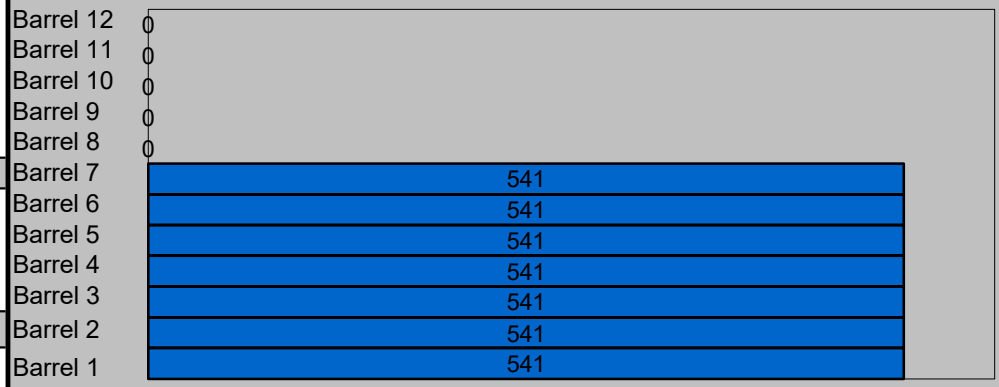
28.27 ft^2 Pipe Area



System Sizing

Pipe Storage:	107,075	cf	
Porous Stone Storage:	96,690	cf	
Total Storage Provided:	203,765	cf	100.3% Of Required Storage
Number of Barrels:	7	barrels	
Length per Barrel:	541.0	ft	
Length Per Header:	0.0	ft	
Rectangular Footprint (W x L):	64. ft x 545. ft		

System Layout



CONTECH Materials

Total CMP Footage:	3,787	ft
Approximate Total Pieces:	161	pcs
Approximate Coupling Bands:	154	bands
Approximate Truckloads:	81	trucks

Construction Quantities**

Total Excavation:	12919	cy
Porous Stone Backfill For Storage:	8953	cy stone
Backfill to Grade Excluding Stone:	0	cy fill

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

Appendix F

Riverside County Whitewater River Region WQMP Worksheets

Whitewater Watershed

BMP Design Volume, V_{BMP} & Design Flow Rate , Q_{BMP} (Rev. 06-2014)

Legend: Required Entries / Calculated Cells

Company Name	MSA Consulting, Inc	Date	August 21, 2023
Designed By	NM	County/City Case No.	
Company Project Number/Name	2760 - THE OASIS AT INDIO		
Drainage Area Number/Name	DA-A		

Enter the Area Tributary to this Feature (A_{TRIB}) — A_{TRIB} = 78.280 acres

Determine the Impervious Area Ratio

Determine the Impervious Area Within A_{TRIB} (A_{IMP}) — A_{IMP} = 70.452 acres

Calculate the Impervious Area Ratio (I_F)

$I_F = A_{IMP}/A_{TRIB}$ — I_F = 0.90

Calculate the Composite Runoff Coefficient, C for the BMP Tributary Area

Use the following equation based on the WEF/ASCE Method

$C_{BMP} = 0.858I_f^3 - 0.78I_f^2 + 0.774I_f + 0.04$ — C_{BMP} = 0.73

Determine Design Storage Volume, V_{BMP}

Calculate V_U, the 80% Unit Storage Volume $V_U = 0.40 \times C_{BMP}$ — V_U = 0.29 (in*ac)/ac

Calculate the design storage volume of the BMP, V_{BMP}

$$V_{BMP}\ (ft^3) = \frac{V_U\ (in\text{-}ac/ac) \times A_T\ (ac) \times 43{,}560\ (ft^2/ac)}{12(in/ft)}$$

V_{BMP} = 83,006 ft^3

BMP Design Flow Rate, Q_{BMP}

$Q_{BMP} = C_{BMP} \times I \times A_{TRIB}$ — Q_{BMP} = 11.43 ft^3/s

I = Design Rainfall Intensity, 0.2 in/hr

Notes:

Whitewater Watershed

BMP Design Volume, V_{BMP} & Design Flow Rate, Q_{BMP} (Rev. 06-2014)

Legend: Required Entries / Calculated Cells

Company Name	MSA Consulting, Inc	Date	August 21, 2023
Designed By	NM	County/City Case No.	
Company Project Number/Name	2760 - THE OASIS AT INDIO		
Drainage Area Number/Name	DA-B		

Enter the Area Tributary to this Feature (A_{TRIB}) — A_{TRIB} = 103.780 acres

Determine the Impervious Area Ratio

Determine the Impervious Area Within A_{TRIB} (A_{IMP}) — A_{IMP} = 93.402 acres

Calculate the Impervious Area Ratio (I_F)

$I_F = A_{IMP}/A_{TRIB}$ — I_F = 0.90

Calculate the Composite Runoff Coefficient, C for the BMP Tributary Area

Use the following equation based on the WEF/ASCE Method

$C_{BMP} = 0.858I_f^3 - 0.78I_f^2 + 0.774I_f + 0.04$ — C_{BMP} = 0.73

Determine Design Storage Volume, V_{BMP}

Calculate V_U, the 80% Unit Storage Volume $V_U = 0.40 \times C_{BMP}$ — V_U = 0.29 (in*ac)/ac

Calculate the design storage volume of the BMP, V_{BMP}

$$V_{BMP}\ (ft^3) = \frac{V_U\ (in\text{-}ac/ac) \times A_T\ (ac) \times 43{,}560\ (ft^2/ac)}{12(in/ft)}$$

V_{BMP} = 110,046 ft^3

BMP Design Flow Rate, Q_{BMP}

$Q_{BMP} = C_{BMP} \times I \times A_{TRIB}$ — Q_{BMP} = 15.16 ft^3/s

I = Design Rainfall Intensity, 0.2 in/hr

Notes:

Appendix G

Preliminary Hydrology Exhibit
Preliminary Grading and Drainage Plan

IN THE CITY OF INDIO, COUNTY OF RIVERSIDE, STATE OF CALIFORNIA

PRELIMINARY HYDROLOGY EXHIBIT
RCFCD SYNTHETIC UNIT (SHORTCUT METHOD)

EXHIBIT DATE: AUGUST 17, 2023

REVISIONS

NO.	DATE	DESCRIPTION

DATA TABLE

APPLICANT / LAND OWNER:	B.H. MANAGEMENT, INC.		
ADDRESS:	11111 SANTA MONICA BOULEVARD, SUITE 600 LOS ANGELES, CALIFORNIA 90049		
CONTACT:	DAVID UM	**TELEPHONE:**	
EXHIBIT PREPARER:	MSA CONSULTING, INC.		
ADDRESS:	34200 BOB HOPE DRIVE RANCHO MIRAGE, CALIFORNIA 92270		
CONTACT:	PAUL DEPALATIS, AICP	**TELEPHONE:**	(760) 320-9811
SOURCE OF TOPOGRAPHY:	INLAND AERIAL SURVEYS, INC.		
ADDRESS:	7117 ARLINGTON AVENUE, SUITE "A" RIVERSIDE, CALIFORNIA 92503		
DATE OF TOPOGRAPHY:	JULY 27, 2022	**TELEPHONE:**	(619) 606-5020
ASSESSOR'S PARCEL NUMBER:	610-020-001, -010, -012, -013, -021, -034, -036		

LEGAL DESCRIPTION:

PARCEL 1 OF PARCEL MAP NO. 23228 P.M.B. 151/21-23, LOCATED IN SECTION 15, TOWNSHIP 5 SOUTH, RANGE 7 EAST, SAN BERNARDINO MERIDIAN.

EXISTING ZONING:	INDUSTRIAL PARK DISTRICT (IP)
PROPOSED ZONING:	INDUSTRIAL PARK DISTRICT (IP)
EXISTING GENERAL PLAN LAND USE:	WORKPLACE EMPLOYMENT DISTRICT
PROPOSED GENERAL PLAN LAND USE:	WORKPLACE EMPLOYMENT DISTRICT

PUBLIC UTILITY PURVEYORS:

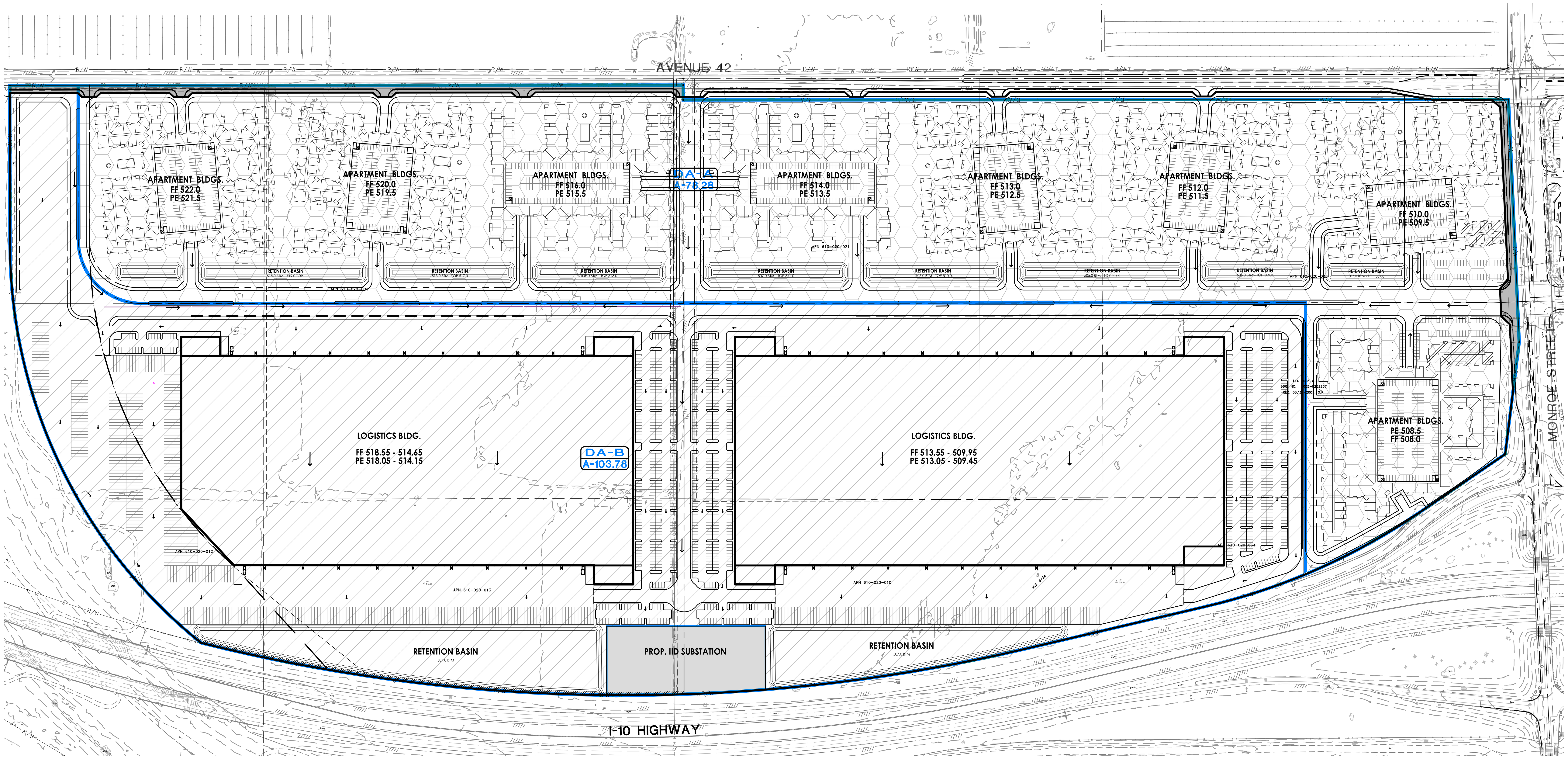
ELECTRIC:	IMPERIAL IRRIGATION DISTRICT	(760) 335-3640
GAS:	SOUTHERN CALIFORNIA GAS COMPANY	(877) 238-0092
TELEPHONE:	FRONTIER COMMUNICATIONS	(800) 921-8101
WATER:	INDIO WATER AUTHORITY	(760) 391-4038
CABLE:	SPECTRUM	(877) 719-3278
SEWER:	VALLEY SANITARY DISTRICT	(760) 238-5400
USA:	UNDERGROUND SERVICE ALERT	(800) 227-2600

FEMA FLOOD ZONE DESIGNATION:

ZONE "X": AREA OF MINIMAL FLOOD HAZARD

AS SHOWN ON RIVERSIDE COUNTY, CALIFORNIA, FLOOD INSURANCE RATE MAPS, COMMUNITY PANEL MAP NUMBER: 06065C2251H
EFFECTIVE DATE: MARCH 6, 2018

LIQUEFACTION:	MODERATE LIQUEFACTION ZONE
SCHOOL DISTRICT:	DESERT SANDS UNIFIED
NOTES:	1. THIS MAP INCLUDES THE ENTIRE CONTIGUOUS OWNERSHIP OF THE LAND DIVIDER. LAND DIVIDER.



LEGEND

DRAINAGE FLOW

TRIBUTARY AREA BOUNDARY

DRAINAGE AREA ID AREA (AC) — A=X.X

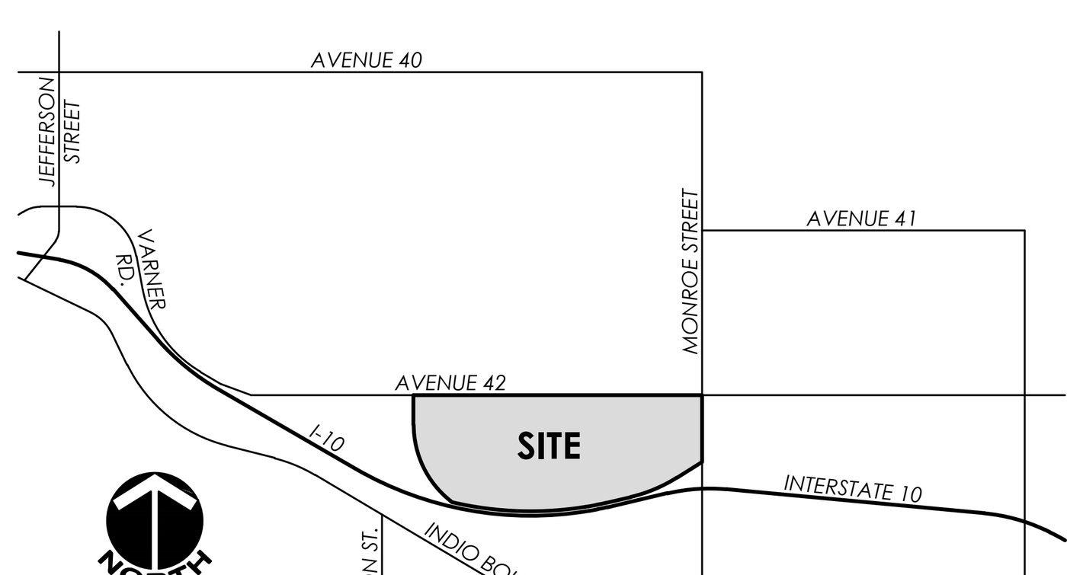
LAND USE LEGEND

OFFSITE STREET

COMMERCIAL

MULTIFAMILY APARTMENTS

PROPOSED IID SUBSTATION



VICINITY MAP
N.T.S.

LEGEND

679.3 EXISTING SPOT ELEVATIONS
EXISTING CONTOURS
EXISTING EASEMENT DELTA
EXISTING CABLE
EXISTING IRRIGATION DRAIN LINE
EXISTING EASEMENT
EXISTING ELECTRIC
EXISTING GAS
EXISTING IRRIGATION
EXISTING LOT LINE
EXISTING EDGE OF PAVEMENT
EXISTING TELEPHONE
EXISTING OVERHEAD TELEPHONE
EXISTING RIGHT OF WAY
EXISTING SEWER
EXISTING SEWER FORCE MAIN
EXISTING WATER
EXISTING PROJECT BOUNDARY
PROPOSED PROJECT BOUNDARY
PROPOSED AND EXISTING CENTER LINE
PROPOSED CURB
PROPOSED EASEMENT
PROPOSED LOT LINE
PROPOSED RIGHT OF WAY
23 PROPOSED PARKING STALLS

ABBREVIATIONS

(E)	EAST
(N)	NORTH
(S)	SOUTH
(W)	WEST
A.C.	ASPHALT CONCRETE
AC	ACREAGE
APN	ASSESSORS PARCEL NUMBER
BNDRY	BOUNDARY
C/L	CENTERLINE
C&G	CURB AND GUTTER
E/P	EDGE OF PAVEMENT
ESMT.	EASEMENT
EX.	EXISTING
MAX.	MAXIMUM
M.B.	MAP BOOK
MIN.	MINIMUM
NO.	NUMBER
N.T.S.	NOT TO SCALE
O/H	OVERHEAD
OS/PP	OPEN SPACE / PARKS
PG.	PAGE
P/L	PROPERTY LINE
PROP.	PROPOSED
P.U.E.	PUBLIC UTILITY EASEMENT
R	RADIUS
R-L	LOW DENSITY (RESIDENTIAL)
R/W	RIGHT OF WAY
SF	SQUARE FEET
STD.	STANDARD
TYP.	TYPICAL
UG	UNDERGROUND

DRAINAGE AREA A
PROPOSED LAND USE SUMMARY

LAND USE	AREA (acres)	RI NUMBER	AMC II INFILTRATION RATE (in/hr)	IMPERVIOUS PERCENT
APARTMENTS	78.28	56	0.51	100.0
TOTAL AREA	78.28			

STORM EVENT SUMMARY

STORM DURATION		1-HOUR	3-HOUR	6-HOUR	24-HOUR
RAINFALL VOLUME	(cu-ft)	412,039	605,271	781,453	**1,264,533**
SOIL LOSSES	(cu-ft)	40,579	121,736	240,030	**629,387**
EFFECTIVE RAIN	(in)	1.31	1.70	1.91	2.24
FLOOD VOLUME	(cu-ft)	371,460	483,535	541,423	**635,146**
	(acre-ft)	8.53	11.10	12.43	**14.58**
REQUIRED STORAGE	(cu-ft)	363,058	#DIV/0!	#DIV/0!	#DIV/0!
	(acre-ft)	8.33	#DIV/0!	#DIV/0!	#DIV/0!
FACTOR OF SAFETY		1.19	#DIV/0!	#DIV/0!	#DIV/0!
STORAGE PROVIDED	(cu-ft)	431,899			
	(acre-ft)	9.92			
PEAK FLOW	(cfs)	n/a	154.17	134.60	38.07
MAXIMUM WSEL	(ft)	506.57	#DIV/0!	#DIV/0!	#DIV/0!
DEPTH	(ft)	3.57	#DIV/0!	#DIV/0!	#DIV/0!
LOWEST FLOWLINE ELEVATION		503.00			
DIFFERENCE	(ft)	-3.57	#DIV/0!	#DIV/0!	#DIV/0!
LOWEST PAD ELEVATION		508.0			
DIFFERENCE	(ft)	1.43	#DIV/0!	#DIV/0!	#DIV/0!
ESTIMATED TIME TO DEWATER BASIN Based on Total Flood Volume & Average Percolation Rate	(days)	1.8	#DIV/0!	#DIV/0!	#DIV/0!

DRAINAGE AREA B
PROPOSED LAND USE SUMMARY

LAND USE	AREA (acres)	RI NUMBER	AMC II INFILTRATION RATE (in/hr)	IMPERVIOUS PERCENT
COMMERCIAL/INDUSTRIAL	103.78	56	0.51	100.0
TOTAL AREA	103.78			

STORM EVENT SUMMARY

STORM DURATION		1-HOUR	3-HOUR	6-HOUR	24-HOUR
RAINFALL VOLUME	(cu-ft)	544,606	800,007	1,032,873	**1,671,377**
SOIL LOSSES	(cu-ft)	30,815	92,446	184,079	**609,451**
EFFECTIVE RAIN	(in)	1.37	1.88	2.26	2.83
FLOOD VOLUME	(cu-ft)	513,791	707,562	848,794	**1,061,926**
	(acre-ft)	11.79	16.24	19.49	**24.38**
REQUIRED STORAGE	(cu-ft)	492,041	641,247	720,457	**775,376**
	(acre-ft)	11.30	14.72	16.54	**17.80**
FACTOR OF SAFETY		2.36	1.81	1.61	1.50
STORAGE PROVIDED	(cu-ft)	1,160,555			
	(acre-ft)	26.64			
PEAK FLOW	(cfs)	n/a	210.11	184.24	55.77
MAXIMUM WSEL	(ft)	507.86	508.36	508.62	**508.81**
DEPTH	(ft)	1.86	2.36	2.62	**2.81**
LOWEST FLOWLINE ELEVATION		510.00			
DIFFERENCE	(ft)	2.14	1.64	1.38	1.19
LOWEST PAD ELEVATION		509.5			
DIFFERENCE	(ft)	1.64	1.14	0.88	0.69
ESTIMATED TIME TO DEWATER BASIN Based on Total Flood Volume & Average Percolation Rate	(days)	1.0	1.3	1.6	2.3

TOTAL HYDROLOGIC AREA

COMMERCIAL/INDUSTRIAL	103.78	AC
APARTMENTS	78.28	AC
TOTAL HYDROLOGIC AREA	181.75	AC

NORTH

0' 150' 300' 450' 600'
SCALE 1"=150'

FEBRUARY 2023

MSA CONSULTING, INC.
Civil Engineering • Land Surveying • Landscape Architecture
Planning • Environmental Services • Dry Utility Coordination • GIS
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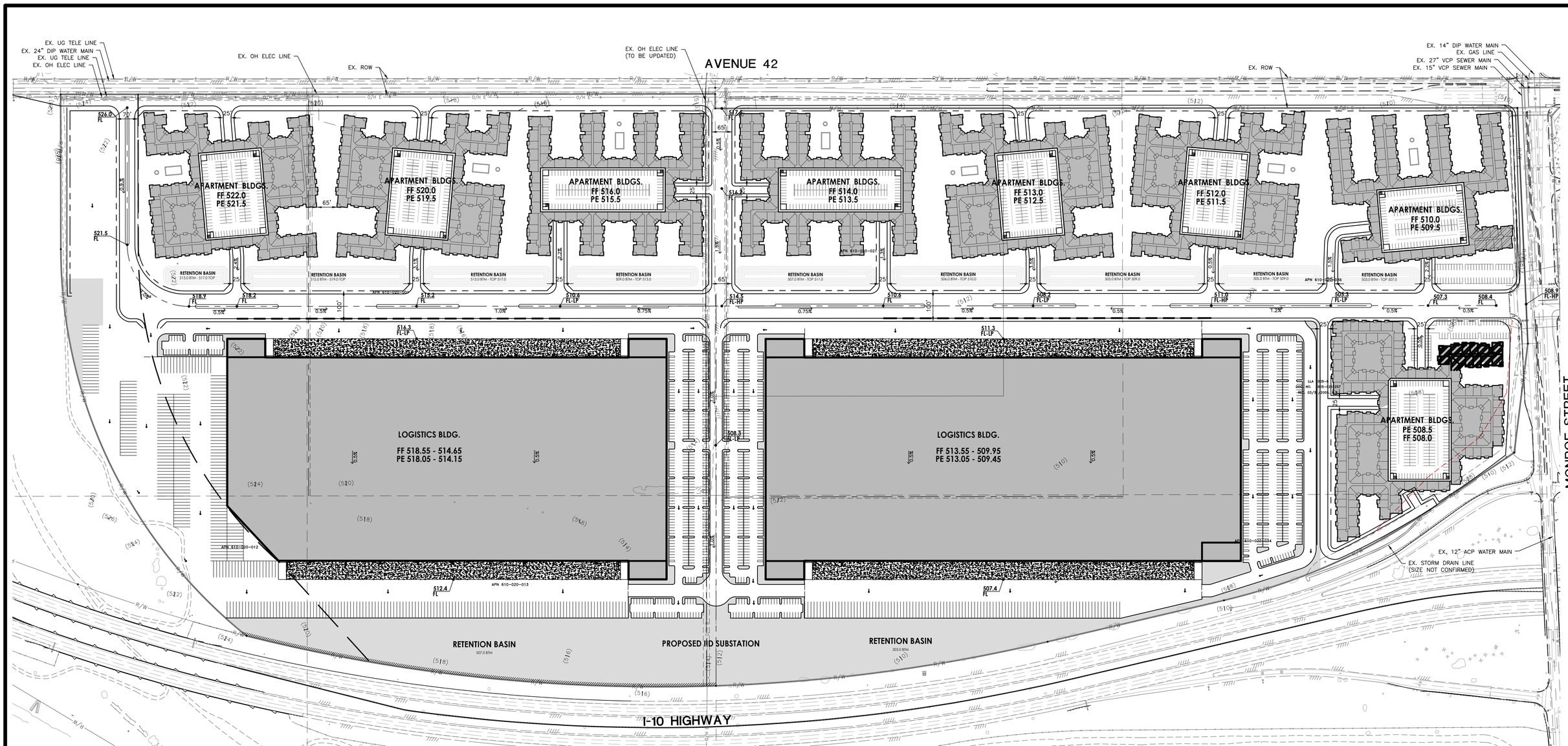
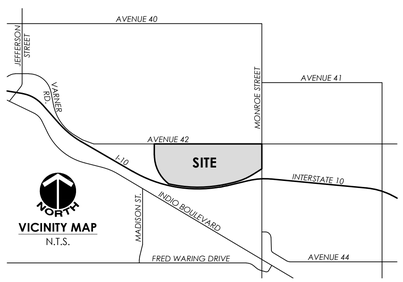
CHECK BY	MTC





CONCEPTUAL GRADING EXHIBIT

LEGEND

- EXISTING CABLE
- EXISTING EASEMENT
- EXISTING ELECTRIC
- EXISTING GAS
- EXISTING IRRIGATION
- EXISTING LOT LINE
- EXISTING EDGE OF PAVEMENT
- EXISTING TELEPHONE
- EXISTING OVERHEAD TELEPHONE
- EXISTING RIGHT OF WAY
- EXISTING SEWER
- EXISTING WATER
- EXISTING CENTERLINE
- PROJECT BOUNDARY
- PROPOSED RIGHT OF WAY
- PROPOSED APARTMENT SITE-PLAN
- PROPOSED LOGISTICS CENTER SITE-PLAN
- PROPOSED PRIVATE STREET CURB
- PROPOSED RETENTION WALL
- PROPOSED COMMERCIAL AREA

NORTH

0' 150' 300' 450' 600'

SCALE 1"=150'

AUGUST 2023

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