

**UPDATE 1 to the
TECHNICAL DRAINAGE STUDY
for
Fort Apache-Sky Pointe Storage**

October 2022

Prepared For:

Zenith Engineering
1980 Festival Plaza Dr., Ste. 450
Las Vegas, NV 89135
(702) 866-9535

Prepared By:

Reynolds Engineering Co.
1925 Village Center Cir., Ste 150
Las Vegas, NV 89134
(702) 582-8008

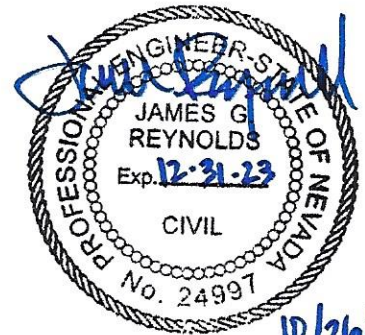
Job No. 21011

UPDATE 1 to the TECHNICAL DRAINAGE STUDY for Fort Apache-Sky Pointe Storage

October 2022

Prepared For:
Zenith Engineering
1980 Festival Plaza Dr., Ste. 450
Las Vegas, NV 89135
(702) 866-9535

Prepared By:
Reynolds Engineering Co.
1925 Village Center Cir., Ste 150
Las Vegas, NV 89134
(702) 582-8008



Job No. 21011

HYDROLOGIC CRITERIA AND DRAINAGE MANUAL
DRAINAGE STUDY INFORMATION FORM

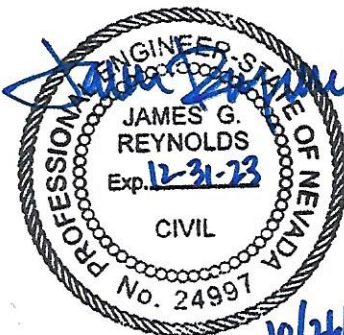
Name of Development: FORT APACHE-SKY POINTE STORAGE Date: 10/26/22
Location of Development: a) Descriptive (Cross Streets) North/South: FORT APACHE RD
East/West: SKY POINTE DR
b) Section: 7 Township: 19 SOUTH Range: 60 EAST
c) APN : 125-07-710-001

Name of Owner: 95 STORAGE LLC CONTACT: BEN MOSHE
Telephone No.: (702) 471-1118 Fax No.: _____ E-Mail Address: BENMOSHE@MYDCOMPANIES.COM
Address: 522 E TWAIN AVE LAS VEGAS, NV 89169

Contact Person-Name: JAMES G. REYNOLDS, P.E. Telephone No.: (702) 582-8008
* E-Mail Address: JR@REYNOLDSENGINEERING.CO ***.CO, NOT .COM*** Fax No.: _____
Firm: REYNOLDS ENGINEERING CO.
Address: 1925 VILLAGE CENTER CIR, CTE 150 LAS VEGAS, NV 89134
Type of Land Development/Land Disturbance Process:

☐	Rezoning	☐	Subdivision Map	☐	Clearing and Grading Only
☐	Parcel Map	☐	Planned Unit Development	☐	Other (Please specify below)
☐	Large Parcel Map	☒	Building Permit		

1. Total Owned Land Area: At Site: 3.88 ACRES Being Developed/Disturbed: 2.8 ACRES
2. Is a portion or all of the subject property located in a designated FEMA Flood Hazard Area? ☐ Yes** ☒ No
3. Is the property bordered or crossed by an existing or proposed Clark County Regional Flood Control District Master Planned Facility? ☐ Yes** ☒ No
4. Proposed type of development (Residential, Commercial, Etc.): COMMERCIAL
5. Approximate upstream land area which drains to the subject site: 4.5 ACRES
6. Has the site drainage been evaluated in the past? ☒ YES ☐ NO If yes, please identify documentation: DS 3626
7. If known, please briefly identify the proposed discharge point(s) of runoff from the site: SKY POINTE DR AT PROPOSED DRIVEWAY; CONSISTENT WITH HISTORICAL DRAINAGE PATTERNS
8. Briefly describe your proposed schedule for the subject project: ASAP



Engineer's Seal

Submit this form as part of the required drainage study to the local entity which has jurisdiction over the subject property. This form may provide sufficient information to serve as the Conceptual Drainage Study.

***New Required Field**

****Review and concurrence of the Clark County Regional Flood Control District is required.**

	Revision	Date
Local Entity File No. _____		

REFERENCE:

STANDARD FORM 1

REYNOLDS ENGINEERING CO.

LAS VEGAS, NEV

October 26, 2022

City of Las Vegas
Department of Public Works
Flood Control Section
495 S Main St, 1st Floor
Las Vegas, NV 89101

Attn: Albert Sung, P.E.

Re: Update 1 TDS for Fort Apache-Sky Pointe Storage (DS 5557)
Reynolds Engineering Co. Job No. 21011

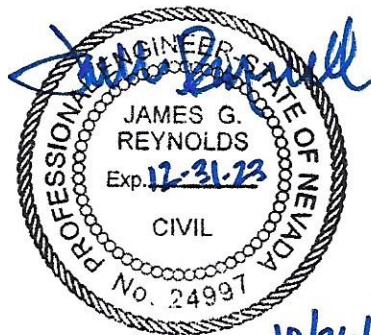
Dear Mr. Sung:

This letter certifies that all documents comprising Update 1 to the Technical Drainage Study for Fort Apache-Sky Pointe Storage provided on CD matches 100% of the hardcopy submittal.

Respectfully submitted,

Reynolds Engineering Co.

James G. Reynolds, P.E.
Principal Civil Engineer



10/26/22

REYNOLDS ENGINEERING CO.

LAS VEGAS, NEV

October 26, 2022

City of Las Vegas
Department of Public Works
Flood Control Section
495 S Main St, 1st Floor
Las Vegas, NV 89101

Attn: Albert Sung, P.E.

Re: Update 1 to TDS for Fort Apache-Sky Pointe Storage (DS 5557)
Reynolds Engineering Co. Job No. 21011

Dear Mr. Sung:

This letter is being furnished as an update to the Technical Drainage Study for Fort Apache-Sky Pointe Storage (DS 5557). The study was approved by City of Las Vegas Public Works on July 6, 2022. Sky Pointe Dr was subsequently identified as NDOT right-of-way. The grading plans were revised to call out NDOT standards for off-site improvements in the roadway and the study was submitted to NDOT for review on September 7, 2022. A 10-year spread calculation for Sky Pointe Dr was included as required, however, the calculation showed that NDOT's criterion for max. spread in the outside travel lane was not met given the 14-ft. travel lane and an approx. spread of 8 ft. NDOT's comment letter dated October 10, 2022 requested storm drain and drop inlets be installed in Sky Pointe Dr to remove the necessary flow from the roadway in order to meet the spread criterion. In lieu of this cost prohibitive measure to collect the 1 cfs required to meet the criterion, a detention basin was designed to detain some of the runoff from on-site basin OND1 in the southwest of the site, which reduced peak flow in the north half of Sky Pointe Dr as necessary to meet the criterion. The response to NDOT was submitted on the same date of this letter.

Attached are the letter and calculations that accompanied the initial submittal to NDOT, the NDOT comment letter, the aforementioned response to NDOT with detention basin calculations, and revised grading plans that show the detention basin and now call

out NDOT standard drawings for the driveway in Sky Point Dr. Also attached are the drainage study approval letter and grading plan with the subject areas that have changed clouded.

The impact of the detention basin on overall drainage design is considered negligible with respect to peak flow in the adjacent roadways ultimately conveyed intersection shown in the approved study. As such, no revision to the hydrologic or hydraulic analyses from the approved study have been made or are included in this submittal. The purpose of this letter is to ensure the grading plans associated with the drainage study match those submitted in support of the off-site permit and to provide justification for the detention basin shown on the updated plans.

If you have any questions regarding this submittal or require additional information to complete your review, please contact this office.

Respectfully submitted,

Reynolds Engineering Co.

James G. Reynolds, P.E.
Principal Civil Engineer

APPENDIX

APPROVAL LETTER(S)

CITY OF LAS VEGAS			DATE:
INTER-OFFICE MEMORANDUM			July 6, 2022
TO: Land Development Services Department of Building & Safety			FROM: Albert Sung, P.E. Flood Control Project Engineer Department of Public Works
SUBJECT:	Drainage Study for:		COPIES TO:
	Fort Apache - Sky Pointe Storage		Reynolds Engineering Co.
Cross Streets:	NWC of Sky Pointe Drive & Fort Apache Rd.		95 Storage LLC
File Number:	F:\Depot\DSMemos\DS5557C.doc		Bart Anderson, P.E., DevCo
Parcel Number:	125-07-710-001		NDOT
Zoning Action:	21-0530-TMP1; 21-0530-SUP1; 21-0530-SDR1 & 21-0530-VAR1		
FEMA Flood Zone	YES	NO X	
Proposed Storm Drain	YES	NO X	

HISTORY	DATE RECEIVED	DATE REVIEWED	COMMENTS	REVIEW FEES	FEES PAID Payment Trn #
1 st Submittal	3/24/2022	4/9/2022	Not Approved	\$400.00	4704077: \$400
2 nd Submittal	5/3/2022	5/23/2022	Not Approved	\$400.00	4771836: \$400
3 rd Submittal	6/22/2022	7/6/2022	See Comments Below	N/C	N/C
			TOTAL FEES (LDDRS):	\$800.00	----

REMARKS:

The Drainage Study for the subject project has been reviewed and:

X	is approved subject to conformance to all City standards and the following conditions:
	must be resubmitted or supplemented including the following:
	is conditionally approved subject to Clark County Regional Flood Control District concurrence.
	is conditionally approved subject to Clark County Public Works Department concurrence.

NOTE: Any future changes to the proposed design (or design assumptions) as outlined in the approved drainage study and attached preliminary grading plan which affect drainage must be addressed in a Drainage Study Update and accepted by the *City of Las Vegas Flood Control Section*. Additionally, conditional acceptance of a drainage study is valid for a period of one (1) year. If the proposed construction has not been completed in that time period, the *City of Las Vegas* reserves the right to require additional conditions and/or submission and acceptance of a complete drainage study update prior to further construction of a project.

NOTE: Please be advised that all land surface area disturbances over 1 acre or any area adjacent to a water way must submit to the Nevada Division of Environmental Protection a "Notice of Intent" to discharge that certifies a stormwater pollution prevention plan has been developed and is maintained on site; for inclusion in the Stormwater General Permit No. NVR100000. A phased construction unit in a contiguous subdivision is considered under construction until all stripped or disturbed surface areas have been covered by paving, building construction or planting. For more information, including forms and applications see <http://ndep.nv.gov/bwpc/storm01.htm> or call (775) 687-9429.

END OF REMARKS
HDR/AYS

T/R/S: T19S/R60E/07
AREA G-07

GRADING PLAN FROM ORIGINAL STUDY

RESPONSE TO NDOT

October 26, 2022

REYNOLDS ENGINEERING CO.

LAS VEGAS, NEV

October 26, 2022

Nevada Department of Transportation
District 1 Office
123 E Washington Ave
Las Vegas, NV 89101

Attn: Permits

Re: Response to NDOT Comments for Fort Apache-Sky Pointe Storage
Reynolds Engineering Co. Job No. 21011

To Whom It May Concern:

Reynolds Engineering Co. is in receipt of the comment letter from Rupali Mohansingh, P.E., of NDOT Hydraulics Section dated October 10, 2022, for the above referenced project. A copy of the letter is provided in the Appendix of this submittal. Each comment has been retyped verbatim and addressed as follows:

Comment 1: Please include additional drop inlets to contain spread violation on Sky Point Dr, and submit spread calculations.

Response 1: It is unreasonable to request this project install new storm drain and drop inlet in Sky Pointe Dr to remove 1 cfs from the roadway to meet the spread criterion. Instead, a detention basin behind solid grout CMU wall with a 12" x 8" opening has been added in the southwest of the site to detain a portion of runoff from on-site basin OND1. The design limits 10-year flow from OND1 into Sky Pointe Dr to 1 cfs. Peak 10-year flow in the roadway has therefore been reduced to 6 cfs. Spread in the 14-ft wide travel lane has been reduced to 7 ft, or 1/2 lane width as required.

The surface area of the inundation at incremental water surface elevations was found in AutoCAD and the values input in the SA card in HEC-1. The submerged orifice calculation for the outflow was prepared using FlowMaster. Note the calculation utilized an orifice height of 4", or 0.34 ft. to account for 50% clogging as required. A rating table shows the outflow of the detention basin at corresponding water surface elevations used for the SQ card in HEC-1. Velocity at the outflow during peak stage of 87.08 ft. exceeded 5 fps. The bottom of the detention basin is called out to be lined with 4" loose riprap and the swale within the NDOT right-of-way is called out to be lined with Class 300 riprap on the attached grading plans. The detention basin drains within the 6-hour design storm, which meets the Clark County Regional Flood Control District criterion it drain completely within 24 hours.

Refer to the attached grading plan, HEC-1 model, and FlowMaster worksheets.

Comment 2: **This drainage study is acceptable in concept. Final approval by the hydraulic division will be based on review of final design documents submitted with the NDOT Right-of-Way Occupancy Permit application that must be submitted for the project.**

Response 2: Acknowledged.

If you have any questions regarding this submittal or require additional information to complete your review, please contact this office.

Respectfully submitted,

Reynolds Engineering Co.

James G. Reynolds, P.E.
Principal Civil Engineer

```

*****
*
* FLOOD HYDROGRAPH PACKAGE (HEC-1) *
* JUN 1998 *
* VERSION 4.1 *
*
* RUN DATE 26OCT22 TIME 09:56:02 *
*
*****

```

```

*****
*
* U.S. ARMY CORPS OF ENGINEERS *
* HYDROLOGIC ENGINEERING CENTER *
* 609 SECOND STREET *
* DAVIS, CALIFORNIA 95616 *
* (916) 756-1104 *
*
*****

```

```

X   X XXXXXXX XXXXX   X
X   X X   X   X   X   XX
X   X X   X   X   X   X
XXXXXXX XXXX   X   XXXXX X
X   X X   X   X   X   X
X   X X   X   X   X   X
X   X XXXXXXX XXXXX   XXX

```

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
 THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
 NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
 DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION
 KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

```

LINE      ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

*DIAGRAM
1  ID
2  ID      RESPONSE TO NDOT COMMENTS
3  ID      TECHNICAL DRAINAGE STUDY
4  ID      FORT APACHE-SKY POINTE STORAGE
5  ID      INTERIM (PROPOSED) CONDITION
6  ID      INPUT FILE NAME: 21011P.DAT
7  ID
8  ID      ANALYSIS BY: REYNOLDS ENGINEERING CO.
9  ID      1925 VILLAGE CENTER CIR, STE 150
10 ID      LAS VEGAS, NV 89134
11 ID      (702) 582-8008
12 ID
13 ID      SCS UNIT HYDROGRAPH METHOD AND KINEMATIC WAVE ROUTING
14 ID
15 ID      *****
16 ID
17 ID      RECURRENCE PERIOD(S): ..... 10-, 100-YEAR
18 ID      DESIGN STORM DURATION: ..... 6-HOUR
19 ID      STORM DISTRIBUTION: ..... SDN 3
20 ID      DEPTH AREA REDUCTION FACTOR: ..... NONE
21 ID
22 ID      SITE IS LOCATED OUTSIDE MCCARRAN AIRPORT RAINFALL AREA
23 ID
24 ID      DESIGN RAINFALL DEPTH (INCHES)
25 ID      10-YEAR: ..... 1.61
26 ID      100-YEAR: ..... 2.86
27 ID
28 ID      DEPTH RATIO FOR JR CARD
29 ID      10-YEAR: ..... 0.564
30 ID      100-YEAR: ..... 1.00
31 ID
32 ID      *****
33 ID
34 ID      IT      5      0      0      73
35 ID      IO      5      0      0
36 ID      IN      5      0      0
37 ID      JR      PREC 0.564 1.00
38 ID      *
39
40 KK      OFX1
41 KM
42 BA      0.0053
43 PB      2.86
44 PC      0.000 0.020 0.057 0.070 0.087 0.108 0.124 0.130 0.130 0.130
45 PC      0.130 0.130 0.130 0.133 0.140 0.142 0.148 0.158 0.172 0.181
46 PC      0.190 0.197 0.199 0.200 0.201 0.204 0.214 0.229 0.241 0.249
47 PC      0.251 0.256 0.270 0.278 0.281 0.283 0.295 0.322 0.352 0.409
48 PC      0.499 0.590 0.710 0.744 0.781 0.812 0.819 0.835 0.851 0.856
49 PC      0.860 0.868 0.876 0.888 0.910 0.926 0.937 0.950 0.970 0.976
50 PC      0.982 0.985 0.987 0.989 0.990 0.993 0.993 0.994 0.995 0.998
51 PC      0.998 0.999 1.000
52 LS      0      94.0
53 UD      0.074
54 ID      *
55
56 KK      OFX2
57 KM
58 BA      0.0027
59 LS      0      98.0
60 UD      0.050
61 ID      *
62
63 KK      OND1
64 KM
65 BA      0.0014
66 LS      0      98.0
67 UD      0.055
68 ID      *
69
70 KK      DET1
71 KM      ON-SITE DETENTION BASIN TO DETAIN 1 CFS IN 10-YEAR EVENT TO MEET NDOT
72 KM      SPREAD CRITERION IN TRAVEL LANE IN SKY POINTE DR
73 KO      1
74 RS      1      STOR      0.
75 SA      0.00 0.0056 0.0098 0.0100 0.0105 0.0120 0.0141 0.219
76 SQ      0      0.65 1.09 1.40 1.65 1.86 2.06 2.24
77 SE      85.61 85.75 86.00 86.25 86.50 86.75 87.00 87.25
78 ID      *
79
80 KK      OND2
81 KM
82 BA      0.0029
83 LS      0      98.0
84 UD      0.050
85 ID      *
86
87 KK      CPP0
88 KM      COMBINE DET1 AND OND2 HYDROGRAPHS AT EAST SITE BOUNDARY
89 HC      2
90 ID      *
91
92 KK      ONI3
93 KM
94 BA      0.0017
95 LS      0      94.0

```

LINE	ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10
82	UD 0.058
	*
83	KK OFX3
84	KM
85	BA 0.0018
86	LS 0 98.0
87	UD 0.050
	*
88	KK CPP1
89	KM COMBINE OFX1, OFX2, CPPO, ONI3 AND OFX3 HYDROGRAPHS AT INTERSECTION
90	KM OF SKY POINTE AND FORT APACHE;
91	KM MANUALLY ADD Q100 FLOW OF 234 CFS FROM SHG STUDY
92	HC 5
	*
93	ZZ

SCHEMATIC DIAGRAM OF STREAM NETWORK

INPUT LINE	(V) ROUTING	(--->) DIVERSION OR PUMP FLOW
NO.	(.) CONNECTOR	(<---) RETURN OF DIVERTED OR PUMPED FLOW
38	OFX1	
	.	
52	.	
	OFX2	
	.	
57	.	OND1
	.	V
	.	V
62	.	DET1
	.	.
70	.	.
	.	OND2
	.	.
75	.	CPP0.....
	.	.
78	.	.
	.	ONI3
	.	.
83	.	.
	.	OFX3
	.	.
88	CPP1.....	

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

*
* FLOOD HYDROGRAPH PACKAGE (HEC-1)
* JUN 1998
* VERSION 4.1
*
* RUN DATE 26OCT22 TIME 09:56:02
*

*
* U.S. ARMY CORPS OF ENGINEERS
* HYDROLOGIC ENGINEERING CENTER
* 609 SECOND STREET
* DAVIS, CALIFORNIA 95616
* (916) 756-1104
*

RESPONSE TO NDOT COMMENTS
TECHNICAL DRAINAGE STUDY
FORT APACHE-SKY POINTE STORAGE
INTERIM (PROPOSED) CONDITION
INPUT FILE NAME: 21011P.DAT

ANALYSIS BY: REYNOLDS ENGINEERING CO.
1925 VILLAGE CENTER CIR, STE 150
LAS VEGAS, NV 89134
(702) 582-8008

SCS UNIT HYDROGRAPH METHOD AND KINEMATIC WAVE ROUTING

RECURRENCE PERIOD(S): 10-, 100-YEAR
DESIGN STORM DURATION: 6-HOUR
STORM DISTRIBUTION: SDN 3
DEPTH AREA REDUCTION FACTOR: NONE

SITE IS LOCATED OUTSIDE MCCARRAN AIRPORT RAINFALL AREA

DESIGN RAINFALL DEPTH (INCHES)
10-YEAR: 1.61
100-YEAR: 2.86

DEPTH RATIO FOR JR CARD
10-YEAR: 0.564
100-YEAR: 1.00

35 IO OUTPUT CONTROL VARIABLES
 IPRNT 5 PRINT CONTROL
 IPLOT 0 PLOT CONTROL
 QSCAL 0. HYDROGRAPH PLOT SCALE

IT HYDROGRAPH TIME DATA
 NMIN 5 MINUTES IN COMPUTATION INTERVAL
 IDATE 1 0 STARTING DATE
 ITIME 0000 STARTING TIME
 NQ 73 NUMBER OF HYDROGRAPH ORDINATES
 NDDATE 1 0 ENDING DATE
 NDTIME 0600 ENDING TIME
 ICENT 19 CENTURY MARK

 COMPUTATION INTERVAL .08 HOURS
 TOTAL TIME BASE 6.00 HOURS

ENGLISH UNITS
DRAINAGE AREA SQUARE MILES
PRECIPITATION DEPTH INCHES
LENGTH, ELEVATION FEET
FLOW CUBIC FEET PER SECOND
STORAGE VOLUME ACRE-FEET
SURFACE AREA ACRES
TEMPERATURE DEGREES FAHRENHEIT

JP MULTI-PLAN OPTION
 NPLAN 1 NUMBER OF PLANS

JR MULTI-RATIO OPTION
 RATIOS OF PRECIPITATION
 .56 1.00

*** **

*
*
62 KK DET1
*
*

65 KO OUTPUT CONTROL VARIABLES
 IPRNT 1 PRINT CONTROL
 IPLOT 0 PLOT CONTROL
 QSCAL 0. HYDROGRAPH PLOT SCALE

HYDROGRAPH ROUTING DATA

66 RS STORAGE ROUTING

	NSTPS	1	NUMBER OF SUBREACHES						
	ITYP	STOR	TYPE OF INITIAL CONDITION						
	RSVRIC	.00	INITIAL CONDITION						
	X	.00	WORKING R AND D COEFFICIENT						

67 SA	AREA	.0	.0	.0	.0	.0	.0	.0	.2
68 SQ	DISCHARGE	0.	1.	1.	1.	2.	2.	2.	2.
69 SE	ELEVATION	85.61	85.75	86.00	86.25	86.50	86.75	87.00	87.25

COMPUTED STORAGE-ELEVATION DATA

STORAGE	.00	.00	.00	.00	.01	.01	.01	.04
ELEVATION	85.61	85.75	86.00	86.25	86.50	86.75	87.00	87.25

*** WARNING *** MODIFIED PULS ROUTING MAY BE NUMERICALLY UNSTABLE FOR OUTFLOWS BETWEEN 0. TO 1.
 THE ROUTED HYDROGRAPH SHOULD BE EXAMINED FOR OSCILLATIONS OR OUTFLOWS GREATER THAN PEAK INFLOWS.
 THIS CAN BE CORRECTED BY DECREASING THE TIME INTERVAL OR INCREASING STORAGE (USE A LONGER REACH.)

HYDROGRAPH AT STATION DET1
 PLAN 1, RATIO = .56

DA	MON	HRMN	ORD	OUTFLOW	STORAGE	STAGE	*	DA	MON	HRMN	ORD	OUTFLOW	STORAGE	STAGE	*	DA	MON	HRMN	ORD	OUTFLOW	STORAGE	STAGE
1	0000	1	0.	.0	85.6	*	*	1	0205	26	0.	.0	85.6	*	*	1	0410	51	0.	.0	85.6	*
1	0005	2	0.	.0	85.6	*	*	1	0210	27	0.	.0	85.6	*	*	1	0415	52	0.	.0	85.6	*
1	0010	3	0.	.0	85.6	*	*	1	0215	28	0.	.0	85.6	*	*	1	0420	53	0.	.0	85.6	*
1	0015	4	0.	.0	85.6	*	*	1	0220	29	0.	.0	85.7	*	*	1	0425	54	0.	.0	85.6	*
1	0020	5	0.	.0	85.6	*	*	1	0225	30	0.	.0	85.6	*	*	1	0430	55	0.	.0	85.7	*
1	0025	6	0.	.0	85.7	*	*	1	0230	31	0.	.0	85.6	*	*	1	0435	56	0.	.0	85.7	*
1	0030	7	0.	.0	85.7	*	*	1	0235	32	0.	.0	85.6	*	*	1	0440	57	0.	.0	85.7	*
1	0035	8	0.	.0	85.6	*	*	1	0240	33	0.	.0	85.6	*	*	1	0445	58	0.	.0	85.7	*
1	0040	9	0.	.0	85.6	*	*	1	0245	34	0.	.0	85.6	*	*	1	0450	59	0.	.0	85.7	*
1	0045	10	0.	.0	85.6	*	*	1	0250	35	0.	.0	85.6	*	*	1	0455	60	0.	.0	85.7	*
1	0050	11	0.	.0	85.6	*	*	1	0255	36	0.	.0	85.6	*	*	1	0500	61	0.	.0	85.6	*
1	0055	12	0.	.0	85.6	*	*	1	0300	37	0.	.0	85.6	*	*	1	0505	62	0.	.0	85.6	*
1	0100	13	0.	.0	85.6	*	*	1	0305	38	0.	.0	85.7	*	*	1	0510	63	0.	.0	85.6	*
1	0105	14	0.	.0	85.6	*	*	1	0310	39	0.	.0	85.7	*	*	1	0515	64	0.	.0	85.6	*
1	0110	15	0.	.0	85.6	*	*	1	0315	40	1.	.0	85.8	*	*	1	0520	65	0.	.0	85.6	*
1	0115	16	0.	.0	85.6	*	*	1	0320	41	1.	.0	85.9	*	*	1	0525	66	0.	.0	85.6	*
1	0120	17	0.	.0	85.6	*	*	1	0325	42	1.	.0	86.1	*	*	1	0530	67	0.	.0	85.6	*
1	0125	18	0.	.0	85.6	*	*	1	0330	43	1.	.0	86.3	*	*	1	0535	68	0.	.0	85.6	*
1	0130	19	0.	.0	85.6	*	*	1	0335	44	1.	.0	86.3	*	*	1	0540	69	0.	.0	85.6	*
1	0135	20	0.	.0	85.6	*	*	1	0340	45	1.	.0	86.0	*	*	1	0545	70	0.	.0	85.6	*
1	0140	21	0.	.0	85.6	*	*	1	0345	46	1.	.0	85.8	*	*	1	0550	71	0.	.0	85.6	*
1	0145	22	0.	.0	85.6	*	*	1	0350	47	0.	.0	85.7	*	*	1	0555	72	0.	.0	85.6	*
1	0150	23	0.	.0	85.6	*	*	1	0355	48	0.	.0	85.7	*	*	1	0600	73	0.	.0	85.6	*
1	0155	24	0.	.0	85.6	*	*	1	0400	49	0.	.0	85.7	*	*							
1	0200	25	0.	.0	85.6	*	*	1	0405	50	0.	.0	85.6	*	*							

PEAK FLOW	TIME		MAXIMUM	AVERAGE	FLOW
			6-HR	24-HR	72-HR
+	(CFS)	(HR)			6.00-HR
+	1.	3.50	0.	0.	0.
			(INCHES)	1.390	1.390
			(AC-FT)	0.	0.

PEAK STORAGE	TIME		MAXIMUM	AVERAGE	STORAGE
			6-HR	24-HR	72-HR
+	(AC-FT)	(HR)			6.00-HR
+	0.	3.50	0.	0.	0.

PEAK STAGE	TIME		MAXIMUM	AVERAGE	STAGE
			6-HR	24-HR	72-HR
+	(FEET)	(HR)			6.00-HR
+	86.32	3.50	85.67	85.67	85.67

CUMULATIVE AREA = .00 SQ MI

HYDROGRAPH AT STATION DET1
 PLAN 1, RATIO = 1.00

DA	MON	HRMN	ORD	OUTFLOW	STORAGE	STAGE	*	DA	MON	HRMN	ORD	OUTFLOW	STORAGE	STAGE	*	DA	MON	HRMN	ORD	OUTFLOW	STORAGE	STAGE
1	0000	1	0.	.0	85.6	*	*	1	0205	26	0.	.0	85.6	*	*	1	0410	51	0.	.0	85.6	*
1	0005	2	0.	.0	85.6	*	*	1	0210	27	0.	.0	85.7	*	*	1	0415	52	0.	.0	85.7	*
1	0010	3	0.	.0	85.7	*	*	1	0215	28	0.	.0	85.7	*	*	1	0420	53	0.	.0	85.7	*
1	0015	4	0.	.0	85.7	*	*	1	0220	29	0.	.0	85.7	*	*	1	0425	54	0.	.0	85.7	*
1	0020	5	0.	.0	85.7	*	*	1	0225	30	0.	.0	85.7	*	*	1	0430	55	1.	.0	85.7	*
1	0025	6	0.	.0	85.7	*	*	1	0230	31	0.	.0	85.6	*	*	1	0435	56	1.	.0	85.7	*
1	0030	7	0.	.0	85.7	*	*	1	0235	32	0.	.0	85.6	*	*	1	0440	57	0.	.0	85.7	*
1	0035	8	0.	.0	85.7	*	*	1	0240	33	0.	.0	85.7	*	*	1	0445	58	0.	.0	85.7	*
1	0040	9	0.	.0	85.6	*	*	1	0245	34	0.	.0	85.7	*	*	1	0450	59	1.	.0	85.7	*
1	0045	10	0.	.0	85.6	*	*	1	0250	35	0.	.0	85.6	*	*	1	0455	60	0.	.0	85.7	*
1	0050	11	0.	.0	85.6	*	*	1	0255	36	0.	.0	85.6	*	*	1	0500	61	0.	.0	85.7	*

1	0055	12	0.	.0	85.6	*	1	0300	37	0.	.0	85.7	*	1	0505	62	0.	.0	85.6
1	0100	13	0.	.0	85.6	*	1	0305	38	1.	.0	85.7	*	1	0510	63	0.	.0	85.6
1	0105	14	0.	.0	85.6	*	1	0310	39	1.	.0	85.8	*	1	0515	64	0.	.0	85.6
1	0110	15	0.	.0	85.6	*	1	0315	40	1.	.0	86.0	*	1	0520	65	0.	.0	85.6
1	0115	16	0.	.0	85.6	*	1	0320	41	2.	.0	86.4	*	1	0525	66	0.	.0	85.6
1	0120	17	0.	.0	85.6	*	1	0325	42	2.	.0	86.8	*	1	0530	67	0.	.0	85.6
1	0125	18	0.	.0	85.7	*	1	0330	43	2.	.0	87.0	*	1	0535	68	0.	.0	85.6
1	0130	19	0.	.0	85.7	*	1	0335	44	2.	.0	87.1	*	1	0540	69	0.	.0	85.6
1	0135	20	0.	.0	85.7	*	1	0340	45	2.	.0	87.0	*	1	0545	70	0.	.0	85.6
1	0140	21	0.	.0	85.7	*	1	0345	46	2.	.0	86.9	*	1	0550	71	0.	.0	85.6
1	0145	22	0.	.0	85.7	*	1	0350	47	2.	.0	86.4	*	1	0555	72	0.	.0	85.6
1	0150	23	0.	.0	85.6	*	1	0355	48	1.	.0	85.9	*	1	0600	73	0.	.0	85.6
1	0155	24	0.	.0	85.6	*	1	0400	49	0.	.0	85.7	*						
1	0200	25	0.	.0	85.6	*	1	0405	50	0.	.0	85.7	*						

PEAK FLOW	TIME		6-HR	MAXIMUM AVERAGE FLOW		6.00-HR
+	(CFS)	(HR)		24-HR	72-HR	
+	2.	3.58	(CFS)	0.	0.	0.
			(INCHES)	2.626	2.626	2.626
			(AC-FT)	0.	0.	0.
PEAK STORAGE	TIME		6-HR	MAXIMUM AVERAGE STORAGE		6.00-HR
+	(AC-FT)	(HR)		24-HR	72-HR	
	0.	3.58		0.	0.	0.
PEAK STAGE	TIME		6-HR	MAXIMUM AVERAGE STAGE		6.00-HR
+	(FEET)	(HR)		24-HR	72-HR	
	87.08	3.58		85.78	85.78	85.78
CUMULATIVE AREA =				.00 SQ MI		

PEAK FLOW AND STAGE (END-OF-PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
 FLOWS IN CUBIC FEET PER SECOND, AREA IN SQUARE MILES
 TIME TO PEAK IN HOURS

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO PRECIPITATION	
				RATIO 1 .56	RATIO 2 1.00
HYDROGRAPH AT +	OFX1	.01	1 FLOW TIME	5. 3.50	11. 3.50
HYDROGRAPH AT +	OFX2	.00	1 FLOW TIME	4. 3.50	6. 3.50
HYDROGRAPH AT +	OND1	.00	1 FLOW TIME	2. 3.50	3. 3.50
ROUTED TO +	DET1	.00	1 FLOW TIME	1. 3.50	2. 3.58
			** PEAK STAGES IN FEET **		
			1 STAGE TIME	86.32 3.50	87.08 3.58
HYDROGRAPH AT +	OND2	.00	1 FLOW TIME	4. 3.50	7. 3.50
2 COMBINED AT +	CPP0	.00	1 FLOW TIME	5. 3.50	9. 3.50
HYDROGRAPH AT +	ONI3	.00	1 FLOW TIME	2. 3.50	4. 3.50
HYDROGRAPH AT +	OFX3	.00	1 FLOW TIME	2. 3.50	4. 3.50
5 COMBINED AT +	CPP1	.02	1 FLOW TIME	19. 3.50	34. 3.50

+ 1/2 cfs* = 6/11 cfs

*** NORMAL END OF HEC-1 ***

* flow generated in north half of Sky Pointe Dr adjacent
 to site; one-half peak flow from OFX3

Worksheet for Submerged Orifice at Detention Basin

Project Description	
Solve For	Discharge
Input Data	
Headwater Elevation	87.08 ft
Centroid Elevation	85.61 ft
Tailwater Elevation	85.61 ft
Discharge Coefficient	0.650
Opening Width	1.00 ft
Opening Height	0.34 ft
Results	
Discharge	2.12 cfs
Headwater Height Above Centroid	1.47 ft
Tailwater Height Above Centroid	0.00 ft
Flow Area	0.3 ft ²
Velocity	6.32 ft/s

Rating Table for Submerged Orifice at Detention Basin

Project Description			
Solve For		Discharge	
Input Data			
Headwater Elevation	87.08 ft		
Centroid Elevation	85.61 ft		
Tailwater Elevation	85.61 ft		
Discharge Coefficient	0.650		
Opening Width	1.00 ft		
Opening Height	0.34 ft		
Headwater Elevation (ft)	Discharge (cfs)	Velocity (ft/s)	
85.75	0.65		1.95
86.00	1.09		3.26
86.25	1.40		4.17
86.50	1.65		4.92
86.75	1.86		5.57
87.00	2.06		6.15
87.25	2.24		6.68

Worksheet for Section 1 - N 1/2 Sky Pointe Dr (Int 10-yr)

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth
Input Data	
Channel Slope	0.0380 ft/ft
Discharge	6.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	2.60
0+00.00	0.60
0+05.00	0.50
0+05.50	0.48
0+05.50	0.00
0+07.00	0.13
0+07.00	0.17
0+30.00	0.63

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 2.60)	(0+07.00, 0.13)	0.013
(0+07.00, 0.13)	(0+30.00, 0.63)	0.016

Options	
Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results	
Normal Depth	0.36 ft
Elevation Range	0.00 to 2.60 ft
Flow Area	1.3 ft ²
Wetted Perimeter	11.39 ft
Hydraulic Radius	0.12 ft
Top Width	10.99 ft
Normal Depth	0.36 ft
Critical Depth	0.45 ft
Critical Slope	0.0067 ft/ft
Velocity	4.47 ft/s
Velocity Head	0.31 ft
Specific Energy	0.67 ft

Worksheet for Section 1 - N 1/2 Sky Pointe Dr (Int 10-yr)

Results	
Froude Number	2.256
Flow Type	Supercritical
GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0
GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.36 ft
Critical Depth	0.45 ft
Channel Slope	0.0380 ft/ft
Critical Slope	0.0067 ft/ft

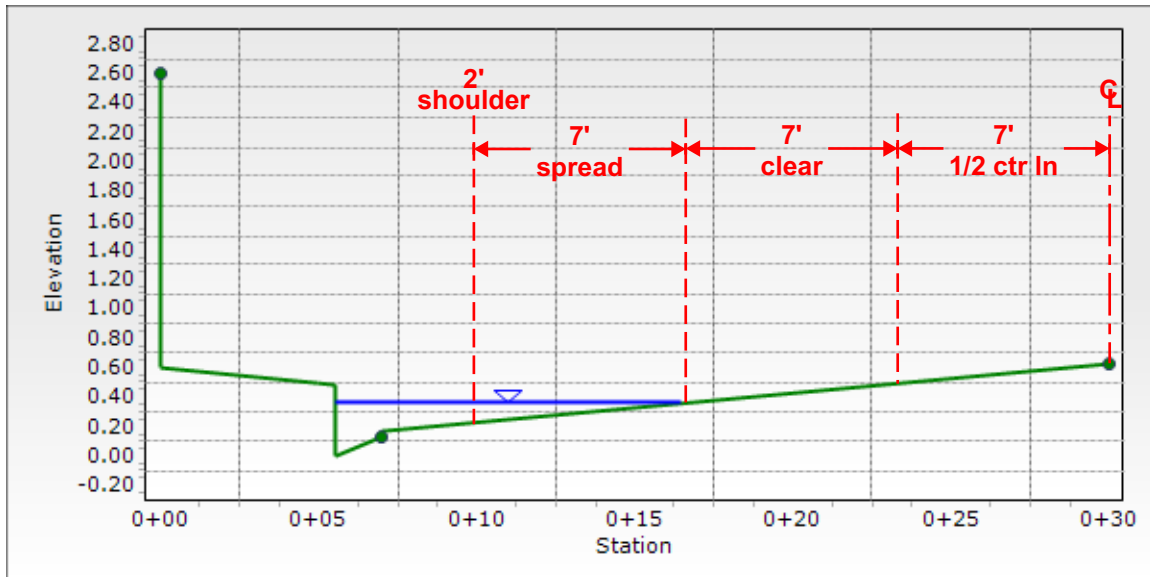
Cross Section for Section 1 - N 1/2 Sky Pointe Dr (Int 10-yr)

Project Description

Friction Method	Manning
Solve For	Formula
	Normal Depth

Input Data

Channel Slope	0.0380 ft/ft
Normal Depth	0.36 ft
Discharge	6.00 cfs



NDOT COMMENT LETTER

October 10, 2022



STEVE SISOLAK
Governor

STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION
1263 S. Stewart Street
Carson City, Nevada 89712

Kristina L. Swallow, P.E., Director

In Reply Refer to:

October 10, 2022

C019

Mr. James G. Reynolds, P.E.
Reynolds Engineering Co
1925 Village Center Cir, Ste 150
Las Vegas, NV 89134

TECHNICAL DRAINAGE STUDY
Fort Apache-Sky Pointe Storage
95 Storage LLC
Clark County

Dear Mr. Reynolds:

The Nevada Department of Transportation (NDOT) Hydraulics Section has received and reviewed the following document(s) for the above-referenced project.

Document:	Dated:
Technical Drainage Study for Fort Apache-Sky Pointe Storage	March, 2022
Addendum 1 to the Technical Drainage Study for Fort Apache-Sky Pointe Storage	May, 2022
Addendum 2 to the Technical Drainage Study for Fort Apache-Sky Pointe Storage	June, 2022

The drainage design information presented in the reviewed document(s):

	is acceptable in concept. Final Hydraulic Section approval will be based on review of final design documents submitted with the NDOT Right-Of-Way Occupancy Permit application that must be submitted for this project.
	is acceptable in concept. Final Hydraulic Section approval will be based on review of final design documents submitted with the NDOT Right-Of-Way Occupancy Permit application that must be submitted for this project. The following comments should be addressed with the permit application:
x	must be supplemented or modified to satisfy the following comment(s) before preliminary Hydraulic Section approval can be granted:

1. Please include additional drop inlets to contain spread violation on Sky Point Dr, and submit spread calculations.
2. This drainage study is acceptable in concept. Final approval by the hydraulic division will be based on review of final design documents submitted with NDOT Right-of way Occupancy Permit application that must be submitted for this project.

All submittals regarding this project must be forwarded through (or copied to) the local NDOT District permitting office. All pertinent drainage design documents (including those previously submitted for preliminary review) must be submitted to the local NDOT District permitting office with the Right-Of-Way Occupancy Permit Application. All plans and reports must be signed and stamped by a Nevada registered civil engineer.

No liability is assumed by the Department in performing this review. Verification and acceptance of all background information, design data and conclusions is the responsibility of the consulting engineer.

Please email me at rmohansingh@dot.nv.gov should you have any questions..

Sincerely,



Rupali Mohansingh, P.E.
Senior Hydraulic Engineer

cc: Mario Gomez, P.E., District I Engineer
Michelle Castro, District Traffic Engineer
Mike Alameda, Headquarters Right-of-Way
Charles Molisee, District Permit Inspection Coordinator
James Ragan, District I Permits
Abid Sulahria, P.E., District I Assistant District Engineer
Martin Strganac, P.E., District I Assistant District Engineer
Tracy Geter, Supervisor 1

INITIAL SUBMITTAL TO NDOT

September 7, 2022

REYNOLDS ENGINEERING CO.

LAS VEGAS, NEV

September 7, 2022

State of Nevada
Department of Transportation
District 1 Permit Office
123 E Washington Ave
Las Vegas, NV 89101

Attn: Permits

Re: TDS for Fort Apache-Sky Pointe Storage
Reynolds Engineering Co. Job No. 21011

To Whom It May Concern:

This letter and supporting calculation are being furnished along with the Technical Drainage Study (TDS) for the above referenced project for Nevada Department of Transportation (NDOT) Hydraulics Section review. The subject development is located on the north side of Sky Pointe Dr east of US 95 near milepost 91 within APN 125-07-710-001 in Las Vegas, Clark County, Nevada. The TDS was approved by City of Las Vegas (CLV) Public Works on July 6, 2022. Following CLV approval, Sky Pointe Dr was identified as an NDOT-maintained frontage road. As such, the grading plans have been revised to call out an NDOT standard driveway in Sky Pointe Dr. The revised grading plans are attached.

In accordance with the NDOT Drainage Manual, a 10-year spread calculation was performed for Sky Pointe Dr for the interim (proposed) condition. The calculation modeled the north half of the roadway adjacent to the proposed development and utilized a peak 10-year flow rate of 7 cfs. This is the combined 10-year peak flow from on-site basins OND1 (2 cfs), OND2 (4 cfs) and one-half OFX3 (2 cfs), or 1 cfs, as analyzed in the TDS. Refer to attached FlowMaster worksheet and annotated cross-section.

The calculation shows a spread of approx. 8 feet into the single 14-foot travel lane, leaving 6 feet clear. While this exceeds the max. 1/2-lane spread criterion, 6 feet clear

would meet the criterion for a standard 12-ft travel lane and should therefore be considered adequate for the purpose of this analysis. Note also that existing storm drain facilities located less than 200 ft. east in the Sky Pointe Dr and Fort Apache Rd intersection would intercept this 10-year flow.

If you have any questions regarding this submittal or require additional information to complete your review, please contact this office.

Respectfully submitted,

Reynolds Engineering Co.

James G. Reynolds, P.E.
Principal Civil Engineer

Worksheet for Section 1 - N 1/2 Sky Pointe Dr (Int 10-yr)

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth
Input Data	
Channel Slope	0.0380 ft/ft
Discharge	7.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	2.60
0+00.00	0.60
0+05.00	0.50
0+05.50	0.48
0+05.50	0.00
0+07.00	0.13
0+07.00	0.17
0+30.00	0.63

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 2.60)	(0+07.00, 0.13)	0.013
(0+07.00, 0.13)	(0+30.00, 0.63)	0.016

Options	
Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results	
Normal Depth	0.37 ft
Elevation Range	0.00 to 2.60 ft
Flow Area	1.5 ft ²
Wetted Perimeter	12.14 ft
Hydraulic Radius	0.12 ft
Top Width	11.72 ft
Normal Depth	0.37 ft
Critical Depth	0.48 ft
Critical Slope	0.0066 ft/ft
Velocity	4.64 ft/s
Velocity Head	0.33 ft
Specific Energy	0.71 ft

Worksheet for Section 1 - N 1/2 Sky Pointe Dr (Int 10-yr)

Results	
Froude Number	2.279
Flow Type	Supercritical
GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0
GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.37 ft
Critical Depth	0.48 ft
Channel Slope	0.0380 ft/ft
Critical Slope	0.0066 ft/ft

Cross Section for Section 1 - N 1/2 Sky Pointe Dr (Int 10-yr)

Project Description

Friction Method	Manning
Solve For	Formula
	Normal Depth

Input Data

Channel Slope	0.0380 ft/ft
Normal Depth	0.37 ft
Discharge	7.00 cfs

