DS #: 5230

APN: 140-32-103-002

PROJECT: Desert Oasis II - Apartment Building Addition

SUBMITTAL: 2nd

SCANNED BY/DATE:

CHECKED BY/DATE:

CITY OF LAS VEGAS INTER-OFFICE MEMORANDUM				DATE: March 30, 2020
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: **Desert Oasis II – Apartment Building Addition**			**COPIES TO:** KJE Consulting Engineers
Cross Streets:	SEQ Diamond Head Drive & Lamb Boulevard			Las Vegas VOA Elderly Housing
File Number:	F:\Depot\DSMemos\DS5230B.doc			Bart Anderson, P.E., DevCo
Parcel Number:	140-32-103-002			CCRFCD
Zoning Action:	TMP-78069; SDR-78068 & VAR-78067			
FEMA Flood Zone	YES	NO	X	
Proposed Storm Drain	YES	NO	X	

HISTORY	DATE RECEIVED	DATE REVIEWED	COMMENTS	REVIEW FEES	FEES PAID Payment Trn #
1st Submittal	12/18/2019	1/14/2020	Not Approved	$400.00	3680274: $400
2nd Submittal	3/12/2020	3/30/2020	See Comments Below	$400.00	3777954: $400
			TOTAL FEES (LDDRS):		----

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

ays

T/R/S: T20S/R62E/32

AREA N-32

KJE
CONSULTING
ENGINEERS, INC.

TO: *City of Las Vegas*
c/o Albert Sung

DATE: 3/12/2020
PROJECT: 356.1

SUBJECT: *Desert Oasis II*

THE FOLLOWING ITEMS ARE:

____	FORWARD	____	HEREIN
____	RETURNED	*X*	ATTACHED
____	UNDER SEPERATE COVER		

DESCRIPTION:

1 Disk
1 Grading Plan
1 1st addendum (includes disk certification letter)
1 $400 submittal check

THESE ITEMS ARE TRANSMITTED:

____	AT YOUR REQUEST	*X*	FOR YOUR ACTION
____	FOR YOUR APPROVAL	____	FOR YOUR FILES
____	FOR YOUR REVIEW	____	FOR YOUR INFORMATION

REMARKS:

BY: *KENNETH J. ERLANGER*

CC:

THIS TRANSMITTAL HAS BEEN RECEIVED BY: _____

4222 E PINECREST CIRCLE * LAS VEGAS, NEVADA 89121
TEL (702) 597-2988 * kjeconsult@cox.net

Soil Map—Las Vegas Valley Area, Nevada, Part of Clark County
(Desert Oasis II)

Map Scale: 1:802 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 10 20 40 60

Feet: 0 35 70 140 210

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

FIGURE 12

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

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: Las Vegas Valley Area, Nevada, Part of Clark County
Survey Area Data: Version 14, Sep 16, 2019

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

Date(s) aerial images were photographed: Sep 26, 2013—Feb 25, 2014

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.

FIGURE 13

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
282	Land silty clay loam	2.6	100.0%
Totals for Area of Interest		**2.6**	**100.0%**

FIGURE 14

est. vel

Worksheet for Rectangular Channel

Project Description	
Project File	c:\haestad\fmw\356-1.fm2
Worksheet	30 inch drainage gutter
Flow Element	Rectangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.013	
Channel Slope	0.004000	ft/ft
Bottom Width	2.50	ft
Discharge	1.00	cfs

Results		
Depth	0.19	ft
Flow Area	0.47	ft^2
Wetted Perimeter	2.87	ft
Top Width	2.50	ft
Critical Depth	0.17	ft
Critical Slope	0.005266	ft/ft
Velocity	2.15	ft/s
Velocity Head	0.07	ft
Specific Energy	0.26	ft
Froude Number	0.88	
Flow is subcritical.		

FIGURE 15

est vel
Cross Section for Rectangular Channel

Project Description	
Project File	c:\haestad\fmw\356-1.fm2
Worksheet	30 inch drainage gutter
Flow Element	Rectangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficient	0.013	
Channel Slope	0.004000	ft/ft
Depth	0.19	ft
Bottom Width	2.50	ft
Discharge	1.00	cfs

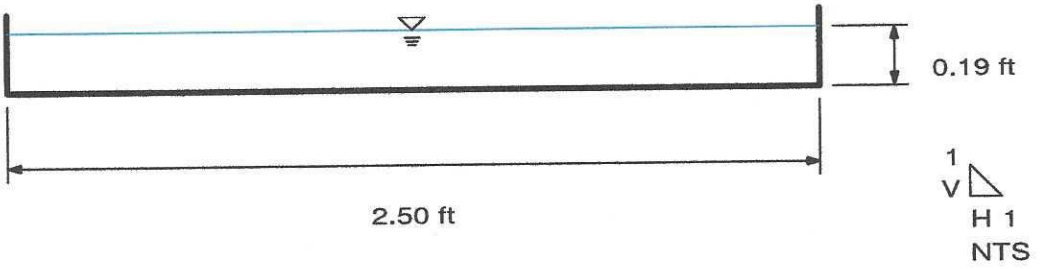


FIGURE 16

Soil Calculations for Time of Concentration and HEC-1 Input Form 4:

Onsite existing basin ONEX1

Area: 1.39 acres; 0.0022 sq. mi.

1.39 acres 100% commercial with Land silty clay loam, soil group C CN=94

Tc soil CN= 94.00
CN=94.00

K=0.0132 (94.00) - 0.39
K=0.851

Initial Overland Time
Ti = 1.8 (1.1 - 0.851) ((150)**0.5)/((2.0)**(1/3))
=4.36 minutes

Travel Time

Length:	370 feet
Slope:	0.9%
Velocity:	2.0 feet per second (figure 602)
Tt:	3.08 minutes

Final Travel Time Ti + Tt = Tc
Tc= 4.36 +3.08 = 7.44 minutes

UD=0.0744

Onsite existing basin ONEX2

Area: 1.15 acres; 0.0018 sq. mi.

1.15 acres 100% desert in poor condition with Land silty clay loam, soil group C CN=85

Tc soil CN= 85.00
CN=85.00

K=0.0132 (85.00) - 0.39
K=0.732

Initial Overland Time
Ti = 1.8 (1.1 - 0.732) ((140)**0.5)/((1.5)**(1/3))
=6.84 minutes

Travel Time

Length:	320 feet
Slope:	0.5%
Velocity:	0.85 feet per second (figure 602)
Tt:	6.27 minutes

Final Travel Time Ti + Tt = Tc
Tc= 6.84 +6.27 = 13.11 minutes
UD=0.1311

FIGURE 17

Onsite proposed basin ONPR1

Area: 1.65 acres; 0.0026 sq. mi.

1.65 acres 100% commercial with Land silty clay loam, soil group C CN=94

Tc soil CN= 94.00
CN=94.00

K=0.0132 (94.00) - 0.39
K=0.851

Initial Overland Time
Ti = 1.8 (1.1 - 0.851) ((150)**0.5)/((2.0)**(1/3))
=4.36 minutes

Travel Time

Length:	370 feet
Slope:	0.9%
Velocity:	2.0 feet per second (figure 602)
Tt:	3.08 minutes

Final Travel Time Ti + Tt = Tc
Tc= 4.36 +3.08 = 7.44 minutes

UD=0.0744

Onsite proposed basin ONPR2

Area: 0.89 acres; 0.0014 sq. mi.

0.89 acres 100% commercial with Land silty clay loam, soil group C CN=94

Tc soil CN= 94.00
CN=94.00

K=0.0132 (94.00) - 0.39
K=0.851

Initial Overland Time
Ti = 1.8 (1.1 - 0.851) ((180)**0.5)/((1.0)**(1/3))
=6.01 minutes

Travel Time

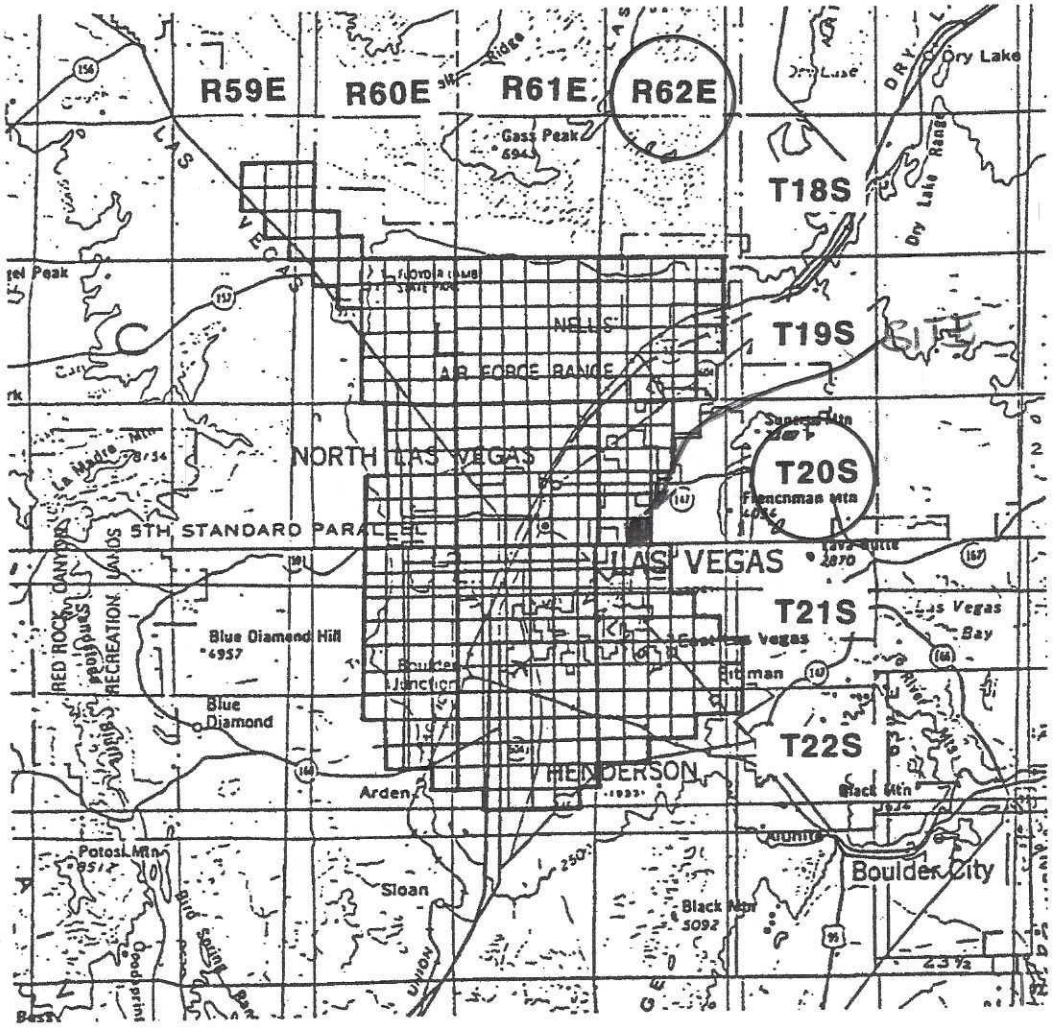
Length:	345 feet (concrete gutter)
Slope:	0.4%
Velocity:	2.15 feet per second (calculated for 1 cfs using Flowmaster figures 15-16)
Tt:	2.67 minutes

Final Travel Time Ti + Tt = Tc
Tc= 6.01+2.67 = 8.68 minutes

UD=0.0868

FIGURE 18

McCARRAN AIRPORT RAINFALL AREA



TOWNSHIP	RANGE	SECTIONS	TOWNSHIP	RANGE	SECTIONS
18 South	59 East	13-15,22-26,36	20 South	62 East	4-9,16-20,29-32
18 South	60 East	30-32	21 South	60 East	1-4,9-16,21-28,33-36
19 South	60 East	1-6,8-16,21-28,33-36	21 South	61 East	ALL SECTIONS
19 South	61 East	ALL SECTIONS	21 South	62 East	4-9,15-23, 25-36
19 South	62 East	2-11,14-23,27-34	22 South	60 East	1-4,10-15,24
20 South	60 East	1-3,10-15,21-28,33-36	22 South	61 East	1-24,26-29
20 South	61 East	ALL SECTIONS	22 South	62 East	1-10,17-18

Notes:
1. Refer to Table 505 and Figure 516 Depth-Duration- Frequency values in the McCarran Airport Rainfall Area.
2. Refer to Table 506 and Figure 517 for Time-Intensity-Frequency values on the McCarran Airport Rainfall Area.

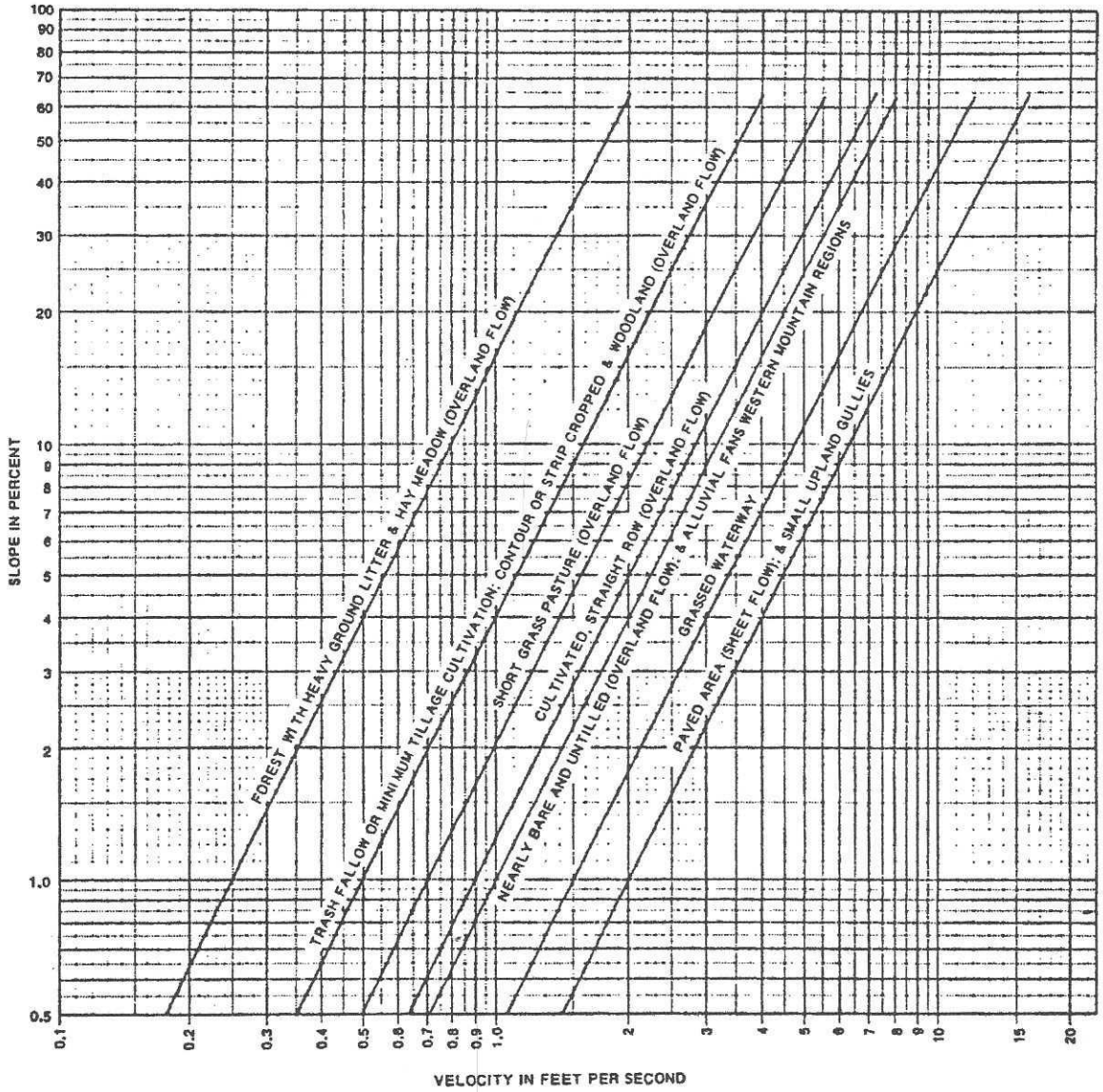
Revision	Date

WRC ENGINEERING

REFERENCE:
USACE, Los Angeles District, 1988

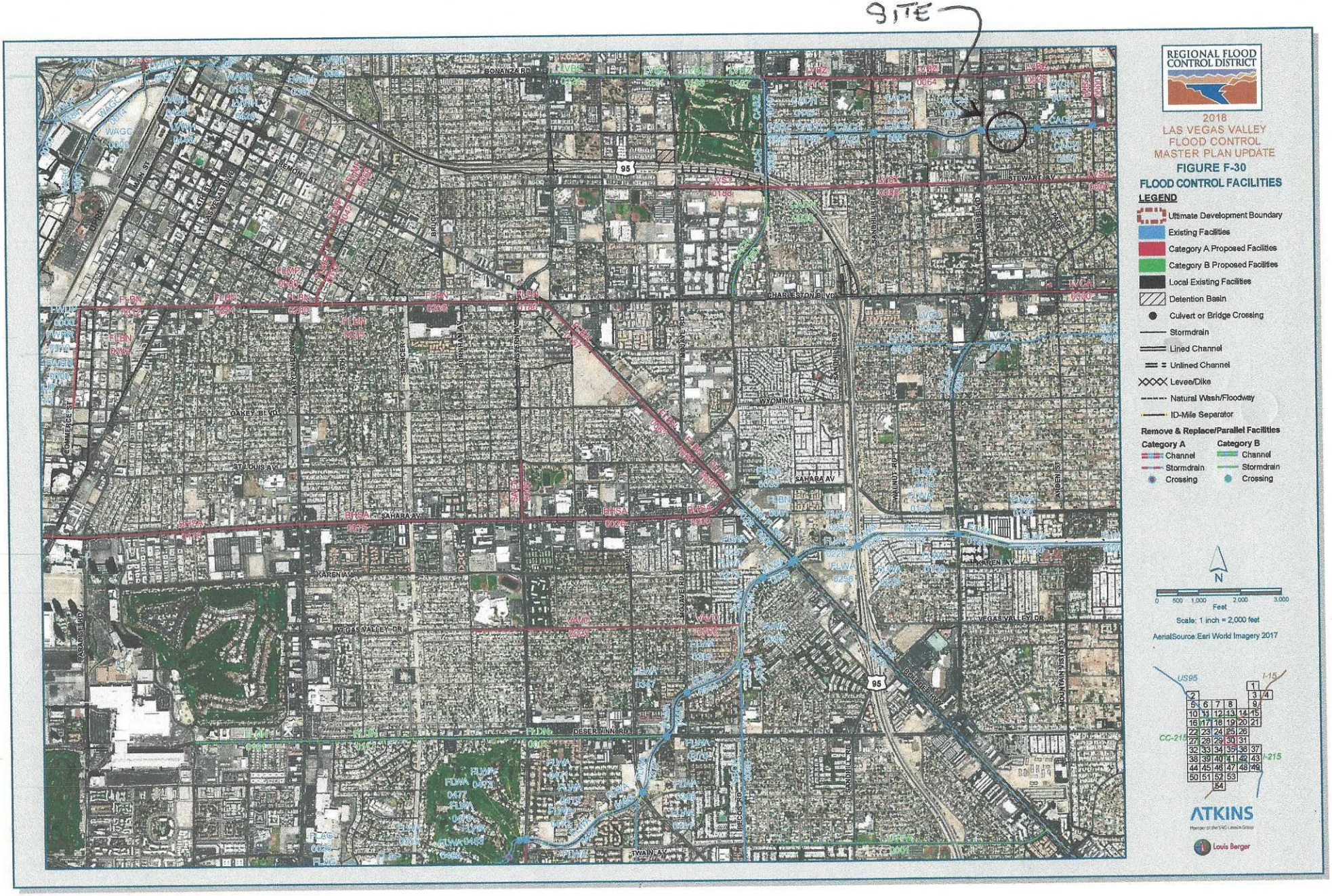
FIGURE 513

TRAVEL TIME VELOCITY



Revision	Date

WRC ENGINEERING	REFERENCE: SCS National Engineering Handbook Section 4, Hydrology, March, 1985	FIGURE 602


SITE
REGIONAL FLOOD CONTROL DISTRICT
2018
LAS VEGAS VALLEY
FLOOD CONTROL
MASTER PLAN UPDATE
FIGURE F-30
FLOOD CONTROL FACILITIES
LEGEND
Ultimate Development Boundary
Existing Facilities
Category A Proposed Facilities
Category B Proposed Facilities
Local Existing Facilities
Detention Basin
Culvert or Bridge Crossing
Stormdrain
Lined Channel
Unlined Channel
Levee/Dike
Natural Wash/Floodway
ID-Mile Separator
Remove & Replace/Parallel Facilities
Category A
Channel
Stormdrain
Crossing
Category B
Channel
Stormdrain
Crossing
N
0 500 1,000 2,000 3,000
Feet
Scale: 1 inch = 2,000 feet
AerialSource:Esri World Imagery 2017
US95
I-15
CC-215
I-215
ATKINS
Louis Berger
BONANZA RD
STEWART AV
CHARLESTON BLVD
OAKEY BLVD
WYOMING AV
ST LOUIS AV
SAHARA AV
KAREN AV
VEGAS VALLEY DR
DESERT INN RD
TWAIN AV
95
MARYLAND PKWY
SPENCER ST
NELLIS BLVD
LAS VEGAS BLVD
BOULDER HWY
MOUNTAIN VIEW ST

ID / Mile	Status	Facility Description	Length (ft.)	Flow (cfs)	HEC-1 Node	HEC-1 Model	Tributary Area (sq.mi.)	Channel Slope (%) **
BNSA		**BOULDER HIGHWAY SAHARA AVENUE**						
0000	P	18' X 14' RCB	1350	3952	CSA13*	SW3	7.93	0.59
0026	P	14' X 11' RCB	4600	3952	CSA13*	SW3	7.93	1.30
0075	P	12' X 11' RCB	5280	3952	CSA13	SW3	7.93	2.11
0175	P	14' X 14' RCB	8000	3952	CSA13	SW3	7.93	0.67
0289	P	14' X 12' RCB	2300	3680	CSA11	SW3	7.55	0.87
CABZ		**CEDAR AVENUE - BONANZA**						
0000	E	72" RCP	535					0.30
0010	E	60" RCP	1450					0.30
CACH		**CEDAR AVENUE CHANNEL**						
0000	E	CONC CHNL 10'W 8'D 1.5:1 SS (REPLACED W/ CACH0001)	1661	2427	CCCA10-C	SW3	3.05	0.20
0001	P	CONC CHNL 22'W 12'D 0:1 SS (REPLACES CACH0000)	1055	2427	CCCA10-C	SW3	3.05	0.20
0020	P	CONC CHNL 31'W 8.50-12'D 0:1 SS (REPLACES CACH0000)	450	766	CCA10-C	SW3	0.90	2.19
0027	E	2: 15' X 5' RCBC @ MARION	82	766	CCA10-C	SW3	0.90	0.35
0029	E	CONC CHNL 10'W 8'D 1.5:1 SS	1284	766	CCA10-C	SW3	0.90	0.37
0051	E	2: 15' X 5' RCBC @ PAGE	84	766	CCA10-C	SW3	0.90	0.38
0053	E	CONC CHNL 10'W 8'D 1.5:1 SS	1275	766	CCA10-C	SW3	0.90	0.38
0079	E	2: 15' X 6' RCBC @ LAMB	100	594	CCA06-C	SW3	0.70	0.39
0081	E	CONC CHNL 12'W 8'D 1.5:1 SS	2562	594	CCA06-C	SW3	0.70	0.20
0127	E	1: 12' X 4' RCBC 2:1F X 4' RCBC @ SANDHILL	80	594	CCA06-C	SW3	0.70	0.20
0129	E	CONC CHNL 10'W 8'D 1.5:1 SS	971	594	CCA06-C	SW3	0.70	0.26
0148	E	2: 12' X 5.5' RCBC @ HONOLULU	82	594	CCA06-C	SW3	0.70	0.53
0148	E	CONC CHNL 10'W 8'D 1.5:1 SS	959	594	CCA06-C	SW3	0.70	0.53
CACN		**CEDAR AVENUE - CHARLESTON**						
0000	E	72" RCP	1667					0.41
0034	E	2: 48" RCP (REPLACE W/ CACN0035)	685	430	CCH70C	SW3	0.40	0.30
0035	P0	8' X 6' RCB (REPLACES CACN0034)	685	430	CCH70C	SW3	0.40	0.30
0049	E	66" RCP (REPLACE W/ CACN0050)	2148	430	CCH70C	SW3	0.40	0.80
0050	P0	6' X 7' ROB (REPLACES CACN0046)	2148	430	CCH70C	SW3	0.40	0.80
COLM		**COLORADO / LAMB**						
0000	E	72" RCP	1500	275	CH84	SW3	0.36	0.87
FLAG		**FLAMINGO WASH - ALGONQUIN**						
0026	E	60" RCP	427	432	FW21	FLAM3A	0.47	1.20
FLBN		**FLAMINGO - BOULDER HIGHWAY NORTH**						
0001	E	4: 10' X 6' RCB	350	4898	CCFR03	Boulder4	11.25	0.58
0006	E	2: 12' X 12' RCB	1065	4898	CCFR03	Boulder4	11.25	0.20
0028	E	2: 16' X 6' RCB	275	4898	CCFR03	Boulder4	11.25	0.20
0033	E	1: 15' X 10' RCB AND 1: 16' X 10' RCB	405	4898	CCFR03	Boulder4	11.25	0.20
0036	P	16' X 10' RCB	867	2471	CFR03	SW3	3.40	0.20
0056	P	24' X 6' RCB	391	2471	CFR03	SW3	3.40	7.00
0053	P	20' X 8' RCB	1393	2372	CFR04	SW3	3.21	0.58
0157	P	18' X 8' RCB	3365	2372	CFR04	SW3	3.21	0.39
0160	P	14' X 8' RCB	494	2013	CCH87A	SW3	2.43	1.80
0205	P	10' X 8' RCB	4478	2013	CCH87A	SW3	2.43	2.00
0275	P	12' X 8' RCB	223	1584	CCCH56	SW3	1.75	3.50
0280	P	10' X 6' RCB	925	928	CCH56	SW3	1.00	2.22
0281	P	10' X 7' RCB	2850	928	CCH56	SW3	1.00	1.33
0312	P	7' X 4' RCB	2160	621	CCH52	SW3	0.62	4.20
0342	P	7' X 4' RCB	2425	621	CCH52	SW3	0.62	4.20
FLBS		**FLAMINGO - BOULDER HIGHWAY SOUTH**						
0000	E	UNLINED MEDIAN CHNL 6'W 0.5'D 4.5:1 SS	4060	684	CB4	FLAM3A	1.38	1.30
0167	E	UNLINED MEDIAN CHNL 6'W 0.5'D 9:1 SS	9850	348	CB4N	FLAM3A	0.63	0.90
FLDN		**DESERT INN DRAIN EAST**						
0000	E	60" RCP (REPLACE W/ FLDN0001)	6150	958	CFW30AW	FLAM3A	2.12	1.22
0001	P0	12' X 5' RCB (REPLACES FLDN0000)	6150	958	CFW30AW	FLAM3A	2.12	1.22
0116	E	54" RCP (REPLACE W/ FLDN0117)	2330	954	CFW29	FLAM3A	1.82	1.77
0117	P0	10' X 5' RCB (REPLACES FLDN0116)	2330	954	CFW29	FLAM3A	1.82	1.77
0158	E	48" RCP (REPLACE W/ FLDN0161)	2950	742	CFW28	FLAM3A	1.51	1.26
0161	P0	10' X 6' RCB (REPLACES FLDN0160)	2950	742	CFW28	FLAM3A	1.51	1.26
FLMP		**FLAMINGO WASH-MARYLAND PARKWAY SYSTEM**						
0000	P	12' X 6' RCB	664	689	CCH60A	SW3	0.75	0.78
0012	P	12' X 4' RCB	1535	689	CCH60A	SW3	0.75	0.48

ID / Mile	Status	Facility Description	Length (ft.)	Flow (cfs)	HEC-1 Node	HEC-1 Model	Tributary Area (sq.mi.)	Channel Slope (%) **
FLMP		**FLAMINGO WASH-MARYLAND PARKWAY SYSTEM**						
0042	P	9' X 4' RCB	1345	245	DFLAM	SW3	0.31	0.95
0068	P	42" RCP	475	245	DFLAM	SW3	0.31	0.61
FLWA		**FLAMINGO WASH**						
0080	E	CONC CHNL 90'W 8'D 0:1 SS	2655	9548	CFW06	FLAM5B	35.21	0.40
0130	E	CONC CHNL 70'W 16'D 0:1 SS	1470	9548	CFW06	FLAM5B	35.21	0.40
0136	E	TRANSITION CONC CHNL 104'W 12'D TO 70'W 16'D 0:1 SS	265	9548	CFW06	FLAM5B	35.21	3.79
0141	E	CONC CHNL 104'W 12'D 0:1 SS	455	9548	CFW06	FLAM5B	35.21	0.66
0150	E	CONC CHNL 104'W 9'D 0:1 SS	225	9548	CFW06	FLAM5B	35.21	0.00
0174	E	9: 14' X 6' RCBC @ LAMB	110	9504	CFW04	FLAM5B	34.77	1.40
0176	E	TRANSITION CONC CHNL 70'W 9'D TO 104'W 9'D 0:1 SS	290	9504	CFW04	FLAM5B	34.77	0.36
0181	E	CONC CHNL 70'W 9'D 0:1 SS	1270	9504	CFW04	FLAM5B	34.77	0.36
0200	E	CONC CHNL 70'W 8'D TO 12'D W/ PIER 0:1 SS	755	9504	CFW04	FLAM5B	34.77	0.50
0225	E	FREE SPAN BRIDGE 100'W 15'D @ I-515	170	9504	CFW04	FLAM5B	34.77	0.80
0226	E	CONC CHNL 70'W 8'D TO 12'D 0:1 SS	1500	9371	CFW03	FLAM5B	34.43	0.00
0255	E	2 SPAN BRIDGE 150'W 9'D @ BOULDER HWY	65	9371	CFW03	FLAM5B	34.43	1.00
0255	E	CONC CHNL 60'W 7.5'D 0:1 SS	40	6750	CFW03W	FLAM5B	23.17	1.00
0267	E	2 SPAN BRIDGE 150'W 9'D @ BOULDER HWY	90	6750	CFW03W	FLAM5B	23.17	1.00
0268	E	CONC CHNL 60'W 7.5'D 0:1 SS	750	6750	CFW03W	FLAM5B	23.17	0.44
0273	E	FREE SPAN BRIDGE 60'W 9'D @ MMHP	20	6750	CFW03W	FLAM5B	23.17	0.40
0274	E	CONC CHNL 60'W 8.1'D 0:1 SS	1370	6750	CFW03W	FLAM5B	23.17	1.00
0295	E	CONC CHNL 60'W 8.1'D 0:1 SS	430	6416	CFW01	FLAM5B	21.56	0.80
0307	E	CONC CHNL 60'W 8.1'D 2:1 SS	410	6416	CFW01	FLAM5B	21.56	0.70
0314	E	CONC CHNL 60'W 8.1'D 2:1 SS	1500	9106	CFW00B	FLAM5B	20.19	0.90
0347	E	5: 10' X 8' RCBC @ MOJAVE	65	9106	CFW00B	FLAM6B	20.19	0.94
0348	E	CONC CHNL 30'W 12'D 1:1 SS	1150	9106	CFW00B	FLAM6B	20.19	0.70
0375	E	6: 10' X 8' RCBC @ DESERT INN	140	8074	CFW23	FLAM5B	18.30	2.70
0377	E	CONC CHNL 50'W 9.5'D 0:1 SS	1372	8074	CFW23	FLAM5B	18.30	1.04
0399	E	FREE SPAN BRIDGE 60'W 16'D @ MCLEOD	130	8074	CFW23	FLAM5B	18.30	0.50
0401	E	CONC CHNL 50'W 11.5'D 0:1 SS	107	8074	CFW23	FLAM5B	18.30	0.50
0406	E	CONC CHNL 33'W 11.5'D 0:1 SS	710	5277	CFW21W	FLAM5B	17.42	0.79
0419	E	CONC CHNL 33'-50'W 9.8'D 0:1 SS	200	5277	CFW21W	FLAM5B	17.42	2.00
0423	E	CONC CHNL 50'W 9.8'D 0:1 SS	1685	5277	CFW23W	FLAM5B	17.42	0.78
0455	E	CONC CHNL 50'-75'W 9.8'D 0:1 SS	170	5277	CFW23W	FLAM5B	17.42	1.83
0458	E	CONC CHNL 75-80'W 9.8'D 0:1 SS	347	5277	CFW23W	FLAM5B	17.42	1.50
0471	E	5: 10' X 8' RCBC @ EASTERN	110	1841^	CFW22W'	FLAM5B	14.32	1.30
0472	E	22'X 8' RCBC @ EASTERN	110	3406^	CFW22W'	FLAM5B	14.32	0.50
0473	E	GRASS CHNL 60'W 15'D 2:1 SS	100	5247	CFW22W	FLAM5B	14.32	0.47
0477	E	3 SPAN BRIDGE 47'W 15'D	10	5247	CFW22W	FLAM5B	14.32	0.80
0478	E	GRASS CHNL 66'W 15'D 2:1 SS	520	5247	CFW22W	FLAM5B	14.32	0.47
0481	E	3: 60" CMAP @ TIOGA (REPLACE W/ FLWA0482)	60	5247	CFW22W	FLAM5B	14.32	0.67
0482	P	4: 39' X 6' RCBC @ TIOGA (REPLACES FLWA0481)	60	5247	CFW22W	FLAM5B	14.32	0.67
0483	E	GRASS CHNL 50'W 15'D 2:1 SS	300	5247	CFW22W	FLAM5B	14.32	0.53
FW15		**FREEWAY CHANNEL FROM DESERT INN TO EXPRESSWAY**						
0000	E	3: 12' X 10' RCB	2170	3695	CAL93	Boulder4	8.93	0.17
LCCH		**LAS VEGAS CREEK CHANNEL**						
0000	E	2: 12' X 7' RCB	730	3212	CAL93C	MEADOW64	9.80	1.28
0013	E	2: 12' X 6' RCB	2035	3059	CLC20-C	MEADOW64	9.80	0.82
LVBZ		**LAS VEGAS WASH - BONANZA**						
0000	P	2: 12' X 7' RCB	1760	1753	CBN15-C	SW3	2.15	0.40
0025	P	2: 12' X 7' RCB	2700	1753	CBN15-C	SW3	2.15	0.40
0084	P	2: 12' X 7' RCB	2630	1603	CBN13-C	SW3	1.87	0.40
0114	P	2: 12' X 6' RCB	2740	1311	CBN10-C	SW3	1.54	0.40
0166	E	54" RCP (REPLACE W/ LVBZ0167)	930	1106	CBN09	SW3	1.29	0.45
0167	P0	10' X 8' RCB (REPLACES LVBZ0166)	930	1106	CBN09	SW3	1.29	0.45
0187	E	48' RCP (REPLACE W/ LVBZ0188)	1235	1106	CBN09	SW3	1.29	0.71
0188	P0	9' X 9' RCB (REPLACES LVBZ0187)	1235	1106	CBN09	SW3	1.29	0.71
0210	E	42" RCP (REPLACE W/ LVBZ0211)	704	1004	CBN08	SW3	1.05	1.37
0211	P0	8' X 8' RCB (REPLACES LVBZ0210)	704	1004	CBN08	SW3	1.05	1.37
0223	E	36' RCP (REPLACE W/ LVBZ0224)	2275	656	CBN03	SW3	0.84	0.72
0224	P0	6' X 8' RCB (REPLACES LVBZ0223)	2275	656	CBN03	SW3	0.84	0.72

ID / Mile	Status	Facility Description	Length (ft.)	Flow (cfs)	HEC-1 Node	HEC-1 Model	Tributary Area (sq.mi.)	Channel Slope (%) **
LVCA		**LAS VEGAS WASH - CHARLESTON**						
0000	P	12' X 8' RCB	4000	985	CCH77-C	SW3	1.16	0.30
LVCO		**COLORADO AVENUE SYSTEM**						
0012	E	16' X 8' RCB	2560	1144	CNEL06	SW3	1.32	0.24
0064	E	10' X 8' RCB	2165	901	CCCH94	SW3	1.00	0.24
0106	E	10' X 8' RCB	580	402	CCH92-C	SW3	0.37	0.24
0109	E	10' X 6' RCB	2350	402	CCH92-C	SW3	0.37	0.67
LVOE		**OWENS AVENUE - EAST**						
0345	P	13' X 12' RCB	990	2576	DLVOE	SW5	22.61	0.60
LVST		**LAS VEGAS WASH - STEWART**						
0000	P	16' X 10' RCB	4084	1316	CST03-C	SW3	1.40	0.58
0068	P	10' X 9' RCB	4654	1135	CST01-C	SW3	1.18	0.58
0189	P	6' X 8' RCB	1980	501	CCA04	SW3	0.59	0.40
LVWH		**WASHINGTON AVENUE CHANNEL**						
0359	E	12' X 6' RCB	2110	1562^	CV1-C^	SW5SC	14.95	0.80
0426	E	16' X 8' RCB	150	1562^	CV1-C^	SW5SC	14.95	1.08
0429	E	SPLITTER STRUCTURE (2: 12' X 8' RCB)	190	2870	DCLC21	SW5	22.61	1.90
0431	E	3: 14.33' X 10' RCB	665	2870	DCLC21	SW5	22.61	0.15
0446	E	JUNCTION STRUCTURE	89	2870	DCLC21	SW5	22.61	0.15
0447	E	3: 14.33' X 10' RCB	1955	5193	CCAL93	SW5	22.05	0.15
0484	E	CONFLUENCE STRUCTURE	455	5193	CCAL93	SW5	22.05	0.15
SAEA		**SAHARA AVENUE - EASTERN LATERAL**						
0000	P	10' X 7' RCB	1440	482	CFR02	SW3	0.85	0.20
VAVD		**VEGAS VALLEY DRIVE**						
0008	P	7' X 5' RCB	1300	649	CFW41	FLAM3A	1.30	2.10
0025	P	84" RCP	5300	649	CFW41	FLAM3A	1.30	1.80
VBCH		**VAN BUSHIRK CHANNEL**						
0000	E	12' X 7' RCB	500	837	CVB16	FLAM3A	1.16	1.00
0008	E	8' X 5' RCB	5490	837	CVB16	FLAM3A	1.16	1.00
VBEA		**VAN BUSHIRK - EASTERN AVE**						
0000	P	10' X 8' RCB	3020	896	CVB11	FLAM3A	2.85	1.30
VBMC		**VAN BUSHIRK - MCLEOD DRIVE**						
0000	E	2: 8' X 8' RCB	3850	831	CVB13	FLAM3A	2.90	0.50
VBTW		**VAN BUSHIRK - TWAIN**						
0000	E	78" RCP (REPLACE W/ VBTW0001)	5640	379	CB2	FLAM3A	0.74	0.70
0001	P0	84" RCP (REPLACES VBTW0000)	5640	379	CB2	FLAM3A	0.74	0.70
WASC		**WASHINGTON AVENUE CHANNEL - GRAND CENTRAL**						
0000	E	2: 12' X 4' RCB	700	595	LC21	SW3	0.56	0.20
0014	E	1: 12' X 4' RCB AND 1: 11' X 4' RCB	2440	595	LC21	SW3	0.56	0.20
0060	E	12' X 4' RCB	455	595	LC21	SW3	0.56	0.20
WAPR		**WASHINGTON AVENUE CHANNEL PARALLEL**						
0132	E	2: 9' X 8' RCB	387	1582^	CV1-C^	SW5SC	14.95	1.67

*The HEC-1 node shown identifies the controlling concentration point for the associated facility and is located upstream of this facility due to decreasing peak flow with increasing tributary area caused by storm distribution transitions, depth area reduction factors, or attenuation of flow from routing.
**As-built or design slopes were used when available. All other slopes are based on existing topography. The user should verify the facility slope listed prior to performing any facility specific analysis.
^ For parallel facilities, the existing facility flow equals its normal depth capacity, and the proposed parallel facility flow equals the remaining flow (i.e. HEC-1 Node flow = existing facility normal depth capacity + proposed parallel facility flow).

REGIONAL FLOOD CONTROL DISTRICT

2018 LAS VEGAS VALLEY FLOOD CONTROL MASTER PLAN UPDATE

FACILITY INVENTORY FIGURE F-30

LEGEND

ID (Facility Identifier) AABBR
Parent Stream Name
Stream Name
Mile 0000
Distance Above Confluence with Parent Stream (Miles)
Miles in Hundredths

Existing Facility.....E
Proposed or Modified Facility.....P
Contingency Level
Category A.....P
Category B.....P0

Bottom Width.....W
Depth.....D
Side Slope, H:V.....SS

Construction Features

Cast in Place Concrete Pipe.....CIPCP
Corrugated Metal Arch Pipe Culvert.....CMAP
Corrugated Metal Pipe Culvert.....CMPC
High Density Polyethylene.....HDPE
Horizontal Elliptical Reinforced Concrete Pipe.....HERCP
Reinforced Concrete Arch Pipe.....RCAP
Reinforced Concrete Arch Culvert.....RCAC
Reinforced Concrete Box.....RCB
Reinforced Concrete Box Culvert.....RCBC
Reinforced Concrete Pipe.....RCP
Reinforced Concrete Pipe Culvert.....RCPC
Storm Sewer Pipe.....SSP

ATKINS
Member of the SNC Lavalin Group
Louis Berger

TABLES

DEPTH-DURATION-FREQUENCY VALUES FOR McCARRAN AIRPORT RAINFALL AREA (IN INCHES)

TIME	RECURRENCE INTERVAL 2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
5 min.	0.15	0.27	0.35	0.46	0.54	0.63
10 min.	0.25	0.44	0.57	0.74	0.89	1.02
15 min.	0.33	0.57	0.74	0.97	1.15	1.32
30 min.	0.44	0.78	1.01	1.31	1.55	1.79
1 hour	0.52	0.89	1.15	1.50	1.78	2.06
2 hour	0.59	1.01	1.30	1.70	2.01	2.30
3 hour	0.64	1.08	1.39	1.82	2.15	2.48
6 hour	0.72	1.22	1.58	2.05	2.41	2.77
24 hour (TR-55)	1.20	1.60	1.80	2.40	2.70	2.96

NOTE: 1. Refer to Figure 513 for a description and drawing of the area included in the McCarran Airport Rainfall Area.

2. The 24 hour values presented above are for use with TR-55 only.

3. Table 501 adjustments not required.

Revision	Date

RUNOFF CURVE NUMBERS
(URBAN AREAS[1])

Cover description		Curve numbers for hydrologic soil group—			
Cover type and hydrologic condition	Average percent impervious area[2]	A	B	C	D
Fully developed urban areas (vegetation established)					
Open space (lawns, parks, golf courses, cemeteries, etc.)[3]:					
Poor condition (grass cover < 50%)		68	79	86	89
Fair condition (grass cover 50% to 75%)		49	69	79	84
Good condition (grass cover > 75%)		39	61	74	80
Impervious areas:					
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)		98	98	98	98
Streets and roads:					
Paved: curbs and storm sewers (excluding right-of-way)		98	98	98	98
Paved: open ditches (including right-of-way)		83	89	92	93
Gravel (including right-of-way)		76	85	89	91
Dirt (including right-of-way)		72	82	87	89
Western desert urban areas:					
Natural desert landscaping (pervious areas only)[4]		63	77	85	88
Artificial desert landscaping (impervious weed barrier, desert shrub with 1- to 2-inch sand or gravel mulch and basin borders)		96	96	96	96
Urban districts:					
Commercial and business	85	89	92	94	95
Industrial	72	81	88	91	93
Residential districts by average lot size:					

See Table 602A

Developing urban areas					
Newly graded areas (pervious areas only, no vegetation)[5]		77	86	91	94

1 Average runoff condition, and $I_a = 0.2S$.

2 The average percent impervious area shown was used to develop the composite CN's. Other assumptions are as follows: impervious areas are directly connected to the drainage system. Impervious areas have a CN of 98, and pervious areas are considered equivalent to open space in good hydrologic condition. CN's for other combinations of conditions may be computed using Figure 603.

3 CN's shown are equivalent to those of pasture. Composite CN's may be computed for other combinations of open space cover type.

4 Composite CN's for natural desert landscaping should be computed using Figure 603 based on the impervious area percentage (CN #98) and the pervious area CN. The pervious area CN's are assumed equivalent to desert shrub in poor hydrologic condition.

5 Composite CN's to use for the design of temporary measures during grading and construction should be computed using Figure 603 based on the degree of development impervious area percentage) and the CN's for the newly graded pervious areas.

Revision	Date

RUNOFF CURVE NUMBERS
(SEMIARID RANGELANDS[1])

Cover description		Curve numbers for hydrologic soil group—			
Cover type	Hydrologic condition[2]	A[3]	B	C	D
Herbaceous—mixture of grass, weeds, and low-growing brush, with brush the minor element.	Poor		80	87	93
	Fair		71	81	89
	Good		62	74	85
Oak-aspen—mountain brush mixture of oak brush, aspen, mountain mahogany, bitter brush, maple, and other brush.	Poor		66	74	79
	Fair		48	57	63
	Good		30	41	48
Pinyon-juniper—pinyon, juniper, or both; grass understory.	Poor		75	85	89
	Fair		58	73	80
	Good		41	61	71
Sagebrush with grass understory.	Poor		67	80	85
	Fair		51	63	70
	Good		35	47	55
Desert shrub—major plants include saltbush, greasewood, creosotebush, blackbrush, burasage, palo verde, mesquite, and cactus.	Poor	63	77	85	88
	Fair	55	72	81	86
	Good	49	68	79	84

[1]Average runoff condition, and $I_a = 0.2S$.

[2]*Poor:* <30% ground cover (litter, grass, and brush overstory).
Fair: 30 to 70% ground cover.
Good: >70% ground cover.

[3]Curve numbers for group A have been developed only for desert shrub.

Revision	Date

HEC-1
EXISTING

```
1*****************************************
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*         JUN 1998 AND FEB 2010         *
*            VERSION 4.1R               *
*        RGMHEC2000 WWW.HEC-1.COM       *
*  RUN DATE   15DEC19  TIME  01:45:22   *
*                                       *
*****************************************
```

```
*****************************************
*                                       *
*    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        XX
X     X  X        X              X
XXXXXXX  XXXX     X        XXXXX  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

1 HEC-1 INPUT PAGE 1

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

   1          ID  KJE CONSULTING ENGINEERS
   2          IT       3       0       0     300
   3          IO       5
              *DIAGRAM
   4          JR    PREC     .57    1.00
   5          IN       5       0       0

   6          KK   ONEX1
   7          KM  onsitebasin ONEX1
   8          KO                                    22
   9          BA  0.0022
  10          PB    2.77
  11          PC  0.0000 0.02000 0.05700 0.07000 0.08700 0.10800 0.12400 0.13000 0.13000 0.13000
  12          PC  0.13000 0.13000 0.13000 0.13300 0.14000 0.14200 0.14800 0.15800 0.17200 0.1810
  13          PC  0.19000 0.19700 0.19900 0.20000 0.20100 0.20400 0.21400 0.22900 0.24100 0.2490
  14          PC  0.25100 0.25600 0.27000 0.27800 0.28100 0.28300 0.29500 0.32200 0.35200 0.4090
  15          PC  0.49900 0.59000 0.71000 0.74400 0.78100 0.81200 0.81900 0.83500 0.85100 0.8560
  16          PC  0.86000 0.86800 0.87600 0.88800 0.91000 0.92600 0.93700 0.95000 0.97000 0.9760
  17          PC  0.98200 0.98500 0.98700 0.98900 0.99000 0.99300 0.99300 0.99400 0.99500 0.9980
  18          PC  0.99800 0.99900 1.00000
  19          LS       0   94.00
  20          UD  0.0744

  21          KK     RT1
  22          KM  ROUTE  THROUGH    ONEX2
  23          RK     145   0.014   0.015           CIRC       2

  24          KK   ONEX2
  25          KM  ONSITEBASINONEX2
  26          KO                                    22
  27          BA  0.0018
  28          LS       0   85.00
  29          UD  0.1311

  30          KK   COMB1
  31          KM  COMBINEBASINSONEX1ANDONEX2
  32          HC       2
  33          ZZ
```

1 SCHEMATIC DIAGRAM OF STREAM NETWORK

```
INPUT
 LINE      (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

  NO.      (.) CONNECTOR        (<---) RETURN OF DIVERTED OR PUMPED FLOW

    6       ONEX1
              V
              V
   21         RT1
              .
              .
   24         .       ONEX2
```

```
            .         .
            .         .
   30       COMB1.....
```

```
 (***) RUNOFF ALSO COMPUTED AT THIS LOCATION
1*****************************************
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*         JUN 1998 AND FEB 2010         *
*             VERSION 4.1R              *
*       RGMHEC2000 WWW.HEC-1.COM        *
*  RUN DATE   15DEC19  TIME  01:45:22   *
*                                       *
*****************************************
```

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

KJE CONSULTING ENGINEERS

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

     IT           HYDROGRAPH TIME DATA
                       NMIN          3  MINUTES IN COMPUTATION INTERVAL
                      IDATE      1   0  STARTING DATE
                      ITIME        0000  STARTING TIME
                         NQ         300  NUMBER OF HYDROGRAPH ORDINATES
                     NDDATE      1   0  ENDING DATE
                     NDTIME       1457  ENDING TIME
                     ICENT          19  CENTURY MARK

                  COMPUTATION INTERVAL     .05 HOURS
                      TOTAL TIME BASE   14.95 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
                     .57      1.00
```

*** ***

```
            **************
            *            *
   6 KK     *     ONEX1  *
            *            *
            **************
```

```
   8 KO          OUTPUT CONTROL VARIABLES
                      IPRNT          5  PRINT CONTROL
                      IPLOT          0  PLOT CONTROL
                      QSCAL         0.  HYDROGRAPH PLOT SCALE
                      IPNCH          0  PUNCH COMPUTED HYDROGRAPH
                       IOUT         22  SAVE HYDROGRAPH ON THIS UNIT
                      ISAV1          1  FIRST ORDINATE PUNCHED OR SAVED
                      ISAV2        300  LAST ORDINATE PUNCHED OR SAVED
                     TIMINT       .050  TIME INTERVAL IN HOURS


         *** FDKRUT - NEWTON RAPHSON FAILEDFIXED POINT ITERATION USED - ITERATION=  1
```

*** ***

```
            **************
            *            *
  24 KK     *     ONEX2  *
            *            *
```

****

26 KO OUTPUT CONTROL VARIABLES

IPRNT	5	PRINT CONTROL
IPLOT	0	PLOT CONTROL
QSCAL	0.	HYDROGRAPH PLOT SCALE
IPNCH	0	PUNCH COMPUTED HYDROGRAPH
IOUT	22	SAVE HYDROGRAPH ON THIS UNIT
ISAV1	1	FIRST ORDINATE PUNCHED OR SAVED
ISAV2	300	LAST ORDINATE PUNCHED OR SAVED
TIMINT	.050	TIME INTERVAL IN HOURS

1

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

					RATIOS APPLIED TO PRECIPITATION RATIO 1 .57	RATIO 2 1.00
HYDROGRAPH AT						
+	ONEX1	.002	1	FLOW	2.19	4.37
				TIME	3.50	3.50
ROUTED TO						
+	RT1	.002	1	FLOW	2.16	4.33
				TIME	3.50	3.50
HYDROGRAPH AT						
+	ONEX2	.002	1	FLOW	.83	2.29
				TIME	3.55	3.55
2 COMBINED AT						
+	COMB1	.004	1	FLOW	2.95	6.46
				TIME	3.55	3.55

1

SUMMARY OF KINEMATIC WAVE - MUSKINGUM-CUNGE ROUTING
(FLOW IS DIRECT RUNOFF WITHOUT BASE FLOW)

ISTAQ	ELEMENT	DT	PEAK	TIME TO PEAK	VOLUME	INTERPOLATED TO COMPUTATION INTERVAL DT	PEAK	TIME TO PEAK	VOLUME
		(MIN)	(CFS)	(MIN)	(IN)	(MIN)	(CFS)	(MIN)	(IN)
FOR PLAN = 1 RATIO= .57									
RT1	MANE	.15	2.19	210.32	1.01	3.00	2.16	210.00	1.01

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1183E+00 EXCESS= .0000E+00 OUTFLOW= .1183E+00 BASIN STORAGE= .3606E-14 PERCENT ERROR= .0

FOR PLAN = 1 RATIO= 1.00									
RT1	MANE	.15	4.36	210.31	2.13	3.00	4.33	210.00	2.13

CONTINUITY SUMMARY (AC-FT) - INFLOW= .2497E+00 EXCESS= .0000E+00 OUTFLOW= .2497E+00 BASIN STORAGE= .3599E-14 PERCENT ERROR= .0

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

HEC-1
PROPOSED

```
1*****************************************
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*        JUN 1998 AND FEB 2010          *
*           VERSION 4.1R                *
*        RGMHEC2000 WWW.HEC-1.COM       *
*  RUN DATE   15DEC19  TIME  01:54:22   *
*                                       *
*****************************************
```

```
*****************************************
*                                       *
*    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        XX
X     X  X        X              X
XXXXXXX  XXXX     X        XXXXX  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

1 HEC-1 INPUT PAGE 1

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

            1           ID  KJE CONSULTING ENGINEERS
            2           IT       3       0       0     300
            3           IO       5
                        *DIAGRAM
            4           JR     PREC     .57    1.00
            5           IN        5       0       0

            6           KK   ONPR1
            7           KM  onsitebasin ONPR1
            8           KO                                   22
            9           BA  0.0026
           10           PB    2.77
           11           PC  0.0000 0.02000 0.05700 0.07000 0.08700 0.10800 0.12400 0.13000 0.13000 0.13000
           12           PC  0.13000 0.13000 0.13000 0.13300 0.14000 0.14200 0.14800 0.15800 0.17200 0.1810
           13           PC  0.19000 0.19700 0.19900 0.20000 0.20100 0.20400 0.21400 0.22900 0.24100 0.2490
           14           PC  0.25100 0.25600 0.27000 0.27800 0.28100 0.28300 0.29500 0.32200 0.35200 0.4090
           15           PC  0.49900 0.59000 0.71000 0.74400 0.78100 0.81200 0.81900 0.83500 0.85100 0.8560
           16           PC  0.86000 0.86800 0.87600 0.88800 0.91000 0.92600 0.93700 0.95000 0.97000 0.9760
           17           PC  0.98200 0.98500 0.98700 0.98900 0.99000 0.99300 0.99300 0.99400 0.99500 0.9980
           18           PC  0.99800 0.99900 1.00000
           19           LS       0   94.00
           20           UD  0.0744

           21           KK     RT1
           22           KM  ROUTE  THROUGHONPR2
           23           RK     145   0.014   0.015           CIRC       2

           24           KK   ONPR2
           25           KM  ONSITEBASINONPR2
           26           KO                                    22
           27           BA  0.0014
           28           LS       0   94.00
           29           UD  0.0868

           30           KK   COMB1
           31           KM  COMBINEBASINSONPR1 ANDONPR2
           32           HC       2
           33           ZZ
```

1 SCHEMATIC DIAGRAM OF STREAM NETWORK

```
 INPUT
  LINE      (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

   NO.      (.) CONNECTOR        (<---) RETURN OF DIVERTED OR PUMPED FLOW

     6       ONPR1
               V
               V
    21         RT1
               .
               .
    24         .       ONPR2
```

```
                .          .
                .          .
   30       COMB1.....
```

```
 (***) RUNOFF ALSO COMPUTED AT THIS LOCATION
1*****************************************
 *                                       *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
 *        JUN 1998 AND FEB 2010          *
 *            VERSION 4.1R               *
 *       RGMHEC2000 WWW.HEC-1.COM        *
 *  RUN DATE   15DEC19  TIME  01:54:22   *
 *                                       *
 *****************************************
```

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

```
                     KJE CONSULTING ENGINEERS

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

     IT          HYDROGRAPH TIME DATA
                       NMIN           3  MINUTES IN COMPUTATION INTERVAL
                      IDATE      1    0  STARTING DATE
                      ITIME        0000  STARTING TIME
                         NQ         300  NUMBER OF HYDROGRAPH ORDINATES
                     NDDATE      1    0  ENDING DATE
                     NDTIME        1457  ENDING TIME
                     ICENT           19  CENTURY MARK

                   COMPUTATION INTERVAL     .05 HOURS
                        TOTAL TIME BASE   14.95 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
                    .57      1.00
```

*** ***

```
            **************
            *            *
   6 KK     *     ONPR1  *
            *            *
            **************

   8 KO          OUTPUT CONTROL VARIABLES
                      IPRNT           5  PRINT CONTROL
                      IPLOT           0  PLOT CONTROL
                      QSCAL          0.  HYDROGRAPH PLOT SCALE
                      IPNCH           0  PUNCH COMPUTED HYDROGRAPH
                       IOUT          22  SAVE HYDROGRAPH ON THIS UNIT
                      ISAV1           1  FIRST ORDINATE PUNCHED OR SAVED
                      ISAV2         300  LAST ORDINATE PUNCHED OR SAVED
                     TIMINT        .050  TIME INTERVAL IN HOURS
```

*** ***

```
            **************
            *            *
  24 KK     *     ONPR2  *
            *            *
            **************

  26 KO          OUTPUT CONTROL VARIABLES
                      IPRNT           5  PRINT CONTROL
                      IPLOT           0  PLOT CONTROL
```

QSCAL	0.	HYDROGRAPH PLOT SCALE
IPNCH	0	PUNCH COMPUTED HYDROGRAPH
IOUT	22	SAVE HYDROGRAPH ON THIS UNIT
ISAV1	1	FIRST ORDINATE PUNCHED OR SAVED
ISAV2	300	LAST ORDINATE PUNCHED OR SAVED
TIMINT	.050	TIME INTERVAL IN HOURS

1

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 .57	RATIO 2 1.00
HYDROGRAPH AT						
+	ONPR1	.003	1	FLOW	2.59	5.16
				TIME	3.50	3.50
ROUTED TO						
+	RT1	.003	1	FLOW	2.56	5.11
				TIME	3.50	3.50
HYDROGRAPH AT						
+	ONPR2	.001	1	FLOW	1.35	2.67
				TIME	3.55	3.55
2 COMBINED AT						
+	COMB1	.004	1	FLOW	3.89	7.79
				TIME	3.50	3.50

1

SUMMARY OF KINEMATIC WAVE - MUSKINGUM-CUNGE ROUTING
(FLOW IS DIRECT RUNOFF WITHOUT BASE FLOW)

ISTAQ	ELEMENT	DT	PEAK	TIME TO PEAK	VOLUME	INTERPOLATED TO COMPUTATION INTERVAL DT	PEAK	TIME TO PEAK	VOLUME
		(MIN)	(CFS)	(MIN)	(IN)	(MIN)	(CFS)	(MIN)	(IN)
FOR PLAN = 1 RATIO= .57									
RT1	MANE	.25	2.58	210.41	1.01	3.00	2.56	210.00	1.01

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1398E+00 EXCESS= .0000E+00 OUTFLOW= .1398E+00 BASIN STORAGE= .3578E-14 PERCENT ERROR= .0

FOR PLAN = 1 RATIO= 1.00									
RT1	MANE	.18	5.14	210.36	2.13	3.00	5.11	210.00	2.13

CONTINUITY SUMMARY (AC-FT) - INFLOW= .2951E+00 EXCESS= .0000E+00 OUTFLOW= .2951E+00 BASIN STORAGE= .3591E-14 PERCENT ERROR= .0

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

APPENDIX II

File DS INDEX 4359

CITY OF LAS VEGAS INTER-OFFICE MEMORANDUM	DATE: July 26, 1996
TO: Dan Bender Land Development Services Department of Public Works	FROM: Dennis W. Stransky, P.E. Department of Public Works Flood Control
SUBJECT: Technical Drainage Study for: Las Vegas VOA Elderly Housing FILE NO. H:\DEPOT\DS\DS1892A.DOC	COPIES TO: Azimuth Engineering Las Vegas VOA Elderly Housing, Inc. John McNellis, P.E. Willdan Associates

HISTORY	DATE RECEIVED	DATE REVIEWED	COMMENTS	REVIEW FEES
1st Submittal	7/15/96	7/26/96	See comments below	$250.00
			TOTAL FEES	$250.00

REMARKS:

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

	is acceptable in concept subject to conformance to all City standards and the following conditions.
X	must be resubmitted or supplemented including the following:
	must have Clark County Regional Flood Control District concurrence

1. The site is adjacent to or crosses and existing or proposed Clark County Regional Flood Control District (CCRFCD) master planned facility. Therefore, CCRFCD concurrence is required prior to final acceptance of the drainage study.
2. A flow split calculation must be provided to verify that flow from Lamb Boulevard will not enter Diamond Head Drive or provide existing topography and grade elevations that show that there is a high point on Diamond Head Drive approximately 60 feet east of Lamb Boulevard as shown on the "Existing Drainage Basins" map.
3. Rip-rap is not permitted within the channel right-of-way on the channel access road. A storm drain pipe and drop inlet must be provided conveying the flow into the channel. Details and cross sections of the design must be provided. The overflow path must also be delineated.
4. Flow depth calculations for the proposed onsite channel, drop inlet and storm drain must be provided.
5. Proposed grading on the south side of the site between the Cedar Avenue channel and the proposed building must be provided showing the flows conveyed to the onsite drainage channel.
6. The onsite drainage channel must be shown on the grading plan and the final map as a 10 foot public drainage easement to be privately maintained.
7. The following comments refer to the grading plan:

FIGURE A

a) A vicinity map must be provided on the grading plan

b) The elevations and labeling on the north side of the site and on Diamond Head Drive are unreadable. The Grading Plan must be revised accordingly.

c) Existing finished grades of the Cedar Avenue Channel must be provided

d) It appears that a new wall is proposed along the east side of the site, a note must be added addressing the existing walls to be removed and the extent of the proposed wall.

e) There is a typo in the label on the channel, it should read CEDAR AVENUE CHANNEL.

END OF REMARKS
Wld/tlc

T/R/S 20 S / 62 E / 32
AREA N-32

C:\03228\projects\165a

FIGURE B

1892
N-32
Paid 7/15/96

DRAINAGE STUDY
FOR
LAS VEGAS VOA ELDERLY HOUSING
LAMB BOULEVARD AND DIAMOND HEAD DRIVE

A PORTION OF THE NORTHWEST QUARTER (NW 1/4) OF THE
NORTHWEST QUARTER (NW 1/4) OF SECTION 32, TOWNSHIP 20 SOUTH,
RANGE 62 EAST, M.D.M.
A.P.N. 140-32-103-002

JULY, 1996

PREPARED FOR: LAS VEGAS VOA ELDERLY HOUSING, INC.
3939 NORTH CAUSEWAY BOULEVARD, SUITE 300
METAIRIE, LOUISIANA 70002

c/o E.G. RADIG INC.
1577 FOOTHILL DRIVE
BOULDER CITY, NEVADA 89005

PREPARED BY: AZIMUTH ENGINEERING & SURVEYING, INC.
301 W. BASIC ROAD
HENDERSON, NEVADA 89015

FIGURE C

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

DRAINAGE STUDY INFORMATION FORM

Name of Development: Las Vegas VOA Elderly Housing Date: 01 JUL 96

Location of Development: a) Descriptive Southside of Diamond Head Dr. east of Lamb
b) Sect. 32 Twn. 20S Rng. 62E

Name of Owner: Las Vegas VOA Elderly Housing Assessors Parcel No: 140-32-103-002

Contact Person-Name: G.H. Billingsley Telephone No: (702) 566-6706

Firm: Azimuth Engineering & Surveying, Inc.

Address: 301 W. Basic Road, Henderson, Nevada 89015

Type of Land Development/Land Disturbance Process:

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

1. Total Owned Land Area: At Site: 4.86 ac. Being Developed/Disturbed: 4.86 ac.
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.)? Residential
5. Approximate upstream land area which drains to the subject site? 1 ac
6. Has the site drainage been evaluated in the past? YES (NO.) If yes, please identify documentation:
7. If known, please briefly identify the proposed discharge point(s) of runoff from the site: Diamond Head Drive and Cedar Avenue Drainage Channel
8. Briefly describe your proposed schedule for the subject project: Construction upon approval of drainage study and improvement plans

PROFESSIONAL ENGINEER STATE OF NEVADA
GEOFFREY BILLINGSLEY
02 JUL 96
CIVIL
No. 3562
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.

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

Revision	Date

Local Entity File No.

REFERENCE:

STANDARD FORM 1

FIGURE D

S T R E E T F L O W S

Manning's Equation for flow capacity in a street section.
DIAMOND HEAD DRIVE

Input variables:		Output variables:	
Flow depth, d	0.44 ft	Capacity at d	7.4 cfs
Road width	50.0 ft	Velocity	1.5 fps
Sidewalk width	5.0 ft	Top width	60.0 ft
Crown height	0.63 ft		
Curb height	6 in	CAPACITY:	
Street slope	0.37 %	@ top of curb	11.7 cfs
Rt back of walk	100.0 %	@ back of walk	20.9 cfs
Lt back of walk	100.0 %		

FLOW DEPTH

FIGURE E

The project site is also impacted by flow carried in the Cedar Avenue Drainage Channel.

DEVELOPED CONDITIONS

The developed condition will change the amount of onsite flow routed to Diamond Head Drive and the Cedar Avenue Drainage Channel. Diamond Head Drive will receive the discharge from the northerly 1.9 acres of the site while the southerly 3.0 acres will discharge to the Cedar Avenue Drainage Channel

HYDROLOGY AND HYDRAULICS

The localized hydrology, including the project site, was analyzed with a HEC-1 model in both the undeveloped condition and after development. Results of this analysis is shown below. The v*d product for Diamond Head Drive is also shown below based on Hydropack calculations with data from the HEC-1 model.

EXISTING CONDITIONS

Drainage basin	10 yr (cfs)	100 yr (cfs)
Diamond Head Apts	2	3
VOA Site North	1	4
VOA Site South	1	4

DEVELOPED CONDITIONS

Drainage Basin	10 yr (cfs)	100 yr (cfs)
Diamond Head Apts	2	3
VOA Site North	3	6
VOA Site South	3	7

DIAMOND HEAD DRIVE v*d product

$$v*d = 0.44 * 1.5$$

$$v*d = 0.66 < 8$$

Rainfall intensities for the HEC-1 model were taken from NOAA Atlas 2 adjusted for the McCarran Airport Rainfall Area utilizing a six hour storm with distribution SDN 3, all data taken from Clark County Regional Flood Control District "Hydrologic Criteria and Drainage Manuual", WRC Engineering, Inc. adopted October, 1990. SCS curve numbers were selected based on soils information and level and type of development as published in the Clark County Regional Flood Control District "The Master Plan Update of the Las Vegas Valley", volume II, by James M. Montgomery, August, 1991, and a site visit.

Offsite flows carried by the Cedar Avenue Drainage Channel

FIGUREF

HYDROLOGY STUDY
FOR
DESERT OASIS II
APARTMENT BUILDING ADDITION

356.1

Prepared for:

Las Vegas VOA Elderly Housing
4445 Diamond Head Drive
Las Vegas, Nevada 89110

Prepared by:

KJE Consulting Engineers, Inc
4222 E. Pinecrest Circle
Las Vegas, Nevada 89121
(702)597-2988

HYDROLOGIC CRITERIA AND DRAINAGE MANUAL

DRAINAGE STUDY INFORMATION FORM

Name of Development: DESERT OASIS II Date: 12-15-19

Location of Development: a) Descriptive (Cross Streets) North/South: LAMB BOULEVARD

East/West: DIAMOND HEAD DRIVE

b) Section: 32 Township: 20 S Range: 62 E

c) APN: 140-32-103-002

Name of Owner: LAS VEGAS VOA ELDERLY HOUSING

Telephone No.: 702-364-8027 Fax No.: NA E-Mail Address: ggi@gekakis.com

Address: 4445 DIAMOND HEAD DRIVE

Contact Person-Name: KENNETH J ERLANGER **Telephone No.:** 702-597-2988

E-Mail Address: KJRCONSULT@COX.NET **Fax No.:** NA

Firm: KJE CONSULTING ENGINEERS INC.

Address: 4222 E PINECREST CIR. LV NV 89121

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	X	Building Permit		

1. Total Owned Land Area: At Site: 4.86 ACRES Being Developed/Disturbed: 1.15 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? PER UNDERSTANDING WILL NOT TOUCH AREA AROUND FACILITY ☐ **Yes**** ☐ **No**
4. Proposed type of development (Residential, Commercial, Etc.): COMMERCIAL RETIREMENT
5. Approximate upstream land area which drains to the subject site: NA
6. Has the site drainage been evaluated in the past? ☒ **YES** ☐ **NO** If yes, please identify documentation: LAS VEGAS VOA ELDERLY HOUSING (DS A359)
7. If known, please briefly identify the proposed discharge point(s) of runoff from the site: INTO EXISTING STORM DRAIN AT SOUTHEAST PROPERTY CORNER.
8. Briefly describe your proposed schedule for the subject project: ASAP

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

Engineer's Seal

Local Entity File No.

REFERENCE:

STANDARD FORM 1

Updated 05/01/2008

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

DRAINAGE SUBMITTAL CHECKLIST

Project Name: DESERT OASIS II	Map ID: 32003C2187 F
Firm Name: KJE CONSULTING	Engineer: KENNETH J ERLANGER
Address: 4222 EAST E. PINECREST CIR.	
City: LAS VEGAS State: NV Zip: 89121	
Phone Number: 702-597-2988	Fax Number: NA
Property Owner: LAS VEGAS VOA ELDERLY HOUSING	
Address: 4445 DIAMOND HEAD DR.	
City: LAS VEGAS State: NV Zip: 89110	

Reviewed By:	Date Received:	Date Accepted for Review:

The following checklist is intended as a guide for the engineer preparing a Technical Drainage Study to submit to the local entity and Clark County Regional Flood Control District (if necessary). The listed items are the minimum information required prior to the entity performing a review. The engineer will remain responsible to ensure the Technical Drainage Study is prepared within the guidelines as set forth in the Clark County Regional Flood Control District (CCRFCD) Hydrologic Criteria and Drainage Design Manual (MANUAL).

This document is intended as an aid in preparing Technical Drainage Studies. Each study submitted is reviewed for compliance with local and regional criteria. This form is not intended to be all inclusive and does not limit the extent of the information, calculations or exhibits which may be necessary to properly evaluate the intended land use.

If items are not applicable for the subject site, provide N/A.

I. GENERAL REQUIREMENT

Yes	No	
X		Design Manual **Standard Form 1** with the engineer's seal and signature.
X		Design Manual **Standard Form 4**.
X		2 copies of the 24" x 36" Drainage Plan.
NA		A notarized letter from the adjacent property owner(s) allowing off-site grading or discharge.

II. MAPS AND EXHIBITS

Yes	No	
X		A copy of a current Flood Insurance Rate Map (FIRM) with the site delineated.
X		A copy of the current CCRFCD Master Plan Update Figure, (F-x), for Flood Control Facilities and Environmental areas with the site delineated.

REFERENCE:	STANDARD FORM 2

DRAINAGE SUBMITTAL CHECKLIST

II. MAPS AND EXHIBITS (Continued)

Yes	No	
NA		Off-site drainage basin maps for existing, interim and future conditions showing the existing topography, basin boundaries, concentration points, and flows in cfs.
X		On-site drainage basin maps for existing and proposed conditions showing the existing topography, basin boundaries, concentration points, and on-site and off-site flows in cfs.
X		Vicinity Map with local and major cross streets identified and a north arrow.

III. DRAINAGE PLAN

Yes	No	
X		Sheet size: 24" x 36" sealed by a registered engineer in the State of Nevada.
X		Minimum scale: 1" = 60'.
X		Project name.
X		Vicinity Map with local and major cross streets.
X		Revision box.
X		North arrow and bar scale.
X		Engineer's/consultant's address and phone number.
X		Elevation datum and benchmark.
X		Legend for symbols and abbreviations.
X		Cut/fill scarps, where applicable.
X		Street names, grades, widths.
NA		Proposed future and existing spot grades for top of curbs and street crowns at lot lines, grade breaks, and along curb returns on both sides of the street.
X		Existing contours encompassing the site and 100 feet beyond with spot elevations for important locations, where appropriate.
X		Minimum finish floor elevations with top-of-curb elevations at upstream end of lot.
NA		Proposed typical street sections.

REFERENCE:	STANDARD FORM 2

DRAINAGE SUBMITTAL CHECKLIST

III. DRAINAGE PLAN (Continued)

Yes	No	
NA		Streets with off-set crowns.
X		Proposed contours or spot elevations in sufficient detail to exhibit intended drainage patterns and slopes.
X		Property lines.
X		Right-of-way lines and widths, existing and proposed.
X		Existing improvements and their elevations.
X		Delineation of proposed on-site drainage basins indicating area and 10-year and 100-year storm peak flows at basin concentration points.
NA		Concentration points and drainage flow direction with Q_{100} and V_{100} and D_{100} in streets.
NA		Cumulative flows, velocity, and direction of flow at upstream and downstream ends of site for the 10-year and 100-year flows.
NA		Location and cross-section of street capacity calculations.
NA		Cross-sectional detail for channels, including cutoff wall locations.
X		Existing and proposed drainage facilities, appurtenances, and connections (i.e., sidewalk, ditches, swales, storm drain systems, unimproved and improved channels, and culverts, etc.) stating size, material, shape, and slope with plan and profile and HGL calculations.
X		Existing and proposed drainage easements and widths shown with sufficient detail. A cross sectional detail must be provided that shows appropriate lining and reinforcement.
NA		Location and detail of existing, proposed, and future block wall openings. Minimum size is 16" x 48". Wrought iron gate is required for flows > 10 cfs.
NA		Location and detail of flood walls illustrating depth of flow, proposed grouting height, etc.
NA		Perimeter retaining wall locations. All existing and proposed walls (retaining screen and flood) must be shown with adjacent ground elevations. Flood walls with 8-inch concrete masonry unit.
X		Building and/or lot numbers.
X		Alignment of all existing, proposed, or future Regional Facilities adjacent to the site.
NA		Limits of existing floodplain based on current FIRM or best available information; limits of proposed floodplains based on best available information.

REFERENCE:	**STANDARD FORM 2**

DRAINAGE SUBMITTAL CHECKLIST

III. DRAINAGE PLAN (Continued)

Yes	No	
NA		For areas in Zone A, AE, AH, and AO, base flood elevations (BFEs) must be shown for each lot; BFEs may be listed on each lot, or in a table. Finish floor elevations must be a minimum of 18 inches above BFE.
X		Appropriately elevated "humps" 6 inches above the 100 year water surface elevation at site accesses where the intent is to protect the site from the Q_{100} flows.
X		Street slopes for perimeter and interior streets. The minimum slope is 0.4 percent.
NA		Location and detail of best management practice (BMP) for parking lots and low impact development (LID) (if required).

IV. HYDROLOGIC ANALYSIS

Yes	No	
X		Appropriate soil information and Soils Map for existing and future conditions with subbasins and property delineated.
X		Input and output information for existing conditions from computer models (HEC-1 or TR-55). The flow routing diagram must be provided with HEC-1 models.
X		Input and output information for future conditions from computer models (HEC-1 or TR-55). The flow routing diagram must be provided with HEC-1 models.
X		Use of correct precipitation values in and around the McCarran Airport rainfall area.
X		A discussion in the text of the hydrologic analysis justifying subbasin boundaries and cutoffs, supporting assumptions, and calculations.
X		A summary table of stormwater flows showing basin area, Q_{10} and Q_{100} for both individual basins and combined basin flows, where applicable.
X		Copies of supporting technical information referenced from a previously approved study and a statement accepting these results.
X		On-site facilities must perpetuate flows through or around the site without significantly impacting adjacent property owners in accordance with current Nevada Drainage Law.
NA		Calculation for impervious area for parking lots and LIDs (if required).

REFERENCE:	STANDARD FORM 2

DRAINAGE SUBMITTAL CHECKLIST

V. HYDRAULIC ANALYSIS

Yes	No	
NA	_____	Flow split calculations and supporting documentation or reference for the method of flow split calculations used.
NA	_____	Normal depth street flow calculations and cross section diagrams for all interior and perimeter streets. Provide "d x v" products for the Q_{100} and Q_{10} flows representing the worst case for interior and all perimeter streets. Q_{100} d x v $\leq$ 8. Q_{10} d x v $\leq$ 6 and 12 foot dry lane for rights-of-way $\geq$ 80 feet. Calculations must be labeled by street name as indicated on the Grading Plan.
NA	_____	A summary table of interior and exterior street capacity calculations showing the street name, Q_{100} flow, slope, depth of flow, velocity and depth times velocity product and streets needing to meet 12 foot dry lane criteria.
NA	_____	Appropriate hydraulic calculations for block wall openings assuming a 50 percent vertical clogging factor. (Assume the lower half of the opening is plugged.)
NA	_____	Appropriate hydraulic calculations at drainage easement entrance and discharge locations to set finish floor elevations. Hydraulic calculations must include submerged weir, superelevation and tee intersection losses, where appropriate.
X	_____	Provide necessary freeboard requirements to set the finished floor elevations of all proposed buildings, 2 x depth of flow or depth of flow plus 18 inches of freeboard, whichever is less. The minimum requirement is 6 inches above adjacent upstream top of curb. Buildings adjacent to drainage easements must always be provided with 18 inches of freeboard above the Q_{100} weir height or flow depth, whichever is greater.
NA	_____	A complete water surface profile analysis (HEC-2, HEC-RAS, etc.) for channel flows and FEMA Zone A flood zones. • Field survey data. • Input and output information. • Plotted cross-sections based on survey with proper encroachments. • A map showing the location of the cross-sections. • Analysis of both sub and super-critical flow segments. • A summary table and a discussion of the results in the text of the report.
X	_____	Provide a 50 percent clogging factor in the capacity calculation for drop inlets.
NA	_____	Hydraulic calculations for culverts and storm drains. D-Load calculations must be provided for storm drain pipes in public rights-of-way, including headwater pool inundation.
NA	_____	The mitigation of nuisance water, both during construction and in the fully developed condition, must be addressed.
NA	_____	Provide BMP type, size and supporting calculations for parking lots and LIDs (if required).

REFERENCE:	STANDARD FORM 2

TABLE OF CONTENTS

APPENDIX I

STANDARD FORM 4

FIGURES

TABLES

HEC I OUTPUT

APPENDIX II

LAS VEGAS VOA ELDERLY HOUSING FIGURES A-F

2. GENERAL LOCATION AND DEVELOPMENT DESCRIPTION

2.1 LOCATION

The site is located in the East Half (E 124), of the Southwest Quarter (SW 1/4), of the Northwest Quarter (NW 1/4), of the Northwest Quarter (NW 1/4), of Section 32, Township 20 South, Range 62 East, M.D.M., Clark County, Nevada. In particular the site (APN 140-32-103-002) consist of approximately 4.86 acres located on the south side of Diamond Head Drive (figure 1).

2.2 PROJECT DESCRIPTION

The parcel of land consist of 4.86 acres of property that has already been mostly developed as a VOA elderly housing development (Desert Oasis I) with the exception of the southern 1.1 acres that was left undeveloped for a future expansion. The plans call for the addition of an apartment building addition that is designated as Desert Oasis II at the southern end of the parcel. The proposed improvements consist of a two story apartment building that contains approximately 38,000 SF. There will also be the addition of a row of parking spaces between the proposed building and the existing driveway.

The site is mostly already developed with a flows split near the center of the property that allows for the northern portion of the site to drain in a northerly direction onto Diamond Head Drive, and the southern portion of the site to drain in a southeasterly direction into the existing drop inlet that is located at the southeast corner of the existing parking lot. The flows from this drop inlet are conveyed by an existing 24 inch RCP storm drain pipe to the south east corner of the property where an existing type "B" drop inlet is located that captures flows from approximately 1.1 acres of undeveloped property. These flows combine and then drain directly to the south via the existing 24 inch RCP storm drain pipe into the existing Cedar Avenue drainage channel.

The high point of the flow line in the parking lot is located over 2 feet above the flow line on Diamond Head Drive. A review of the original drainage study for the Las Vegas VOA Elderly Housing development (DS 4359) has determined that the original flow depth calculations for Diamond Head Drive (see appendix II - figure A-E) is 0.44 feet (figure E) based on a flow 20.9 cfs. Based on this information, the site will be safe with a high point elevation of over 2 feet above the flow line depth. From our discussion with Albert Sung, P.E. at the City of Las Vegas, if we can show that the back side of the site is protected, we will be able to evaluate just the southern portion of the site, as well as verify the depth of flow within the adjacent Cedar Avenue drainage channel.

2.3 EXISTING SITE CONDITIONS AND DRAINAGE FACILITIES

As discussed in section 2.2, the parcel of land consist of 4.86 acres of property of which only 1.1 acres in undeveloped. As already discussed, with the high point near the center of the property, we will only need to look at the existing site conditions as they exist on the southern portion of the property as designated by basins ONEX1 and ONEX2 on the existing drainage basin map DR1 as shown at the back of the report. Basin ONEX1 (1.39 acres) consisting of the southern portion of the existing building, driveway, and the parking all the way to the southern limits of the existing development which point there exist an empty lot that will be used for this proposed development. The empty lot is designated as basin ONEX2 (1.15 acres) and contains the proposed additional parking lane, new building and flat work, landscape, and other proposed improvements that are part of the proposed Desert Oasis II improvements.

The flows from basin ONEX1 currently drain along the existing gutter lines to a point located near the southeast corner of the existing parking lot where it drains to a low point and into a type "A" drop inlet and grate. The flows from this drop inlet are conveyed by an existing 24 inch RCP storm drain pipe to the south east corner of the property where an existing type "B" drop inlet is located.

The flows from basin ONEX2 currently drain in a southerly direct at a slope of approximately 1.5% and then are conveyed in an easterly direction towards the existing type "B" drop inlet at a slope of approximately 0.5%.

The combined flows from basins ONEX1 and ONEX2 drain directly to the south via the existing 24 inch RCP storm drain pipe into the existing Cedar Avenue drainage channel. There are no plans to make any changes to the existing storm drain improvements beyond putting in a swale at the northern property limits to convey flows into the existing Type "A" drop inlet.

3. DRAINAGE BASIN DESCRIPTION

3.1 OFF-SITE FLOW DESCRIPTION

Due to the fact that we will not need to evaluate any offsite basins beyond the existing Cedar Avenue channel, that is located at the southern property limits, we will not need to further address this section. It should be noted that per a meeting with Albert Sung, P.E. we will provide an cross section analysis of the Cedar Avenue Channel which is designated as CACH 0053 by the facility inventory figure F-30 and figure F-30 which shows the location of the facilities. These figure are shown in the appendix for the 2018 Las Vegas Valley Flood Control Master Plan Update.

The facility inventory information has designated section CACH 0053 of the Cedar

Avenue Channel as a 10 foot wide concrete channel that is 6 foot deep with side slopes of 1.5:1 that has an average slope of 0.38% per design (field conditions show a slope of 0.42%) in the direction of flow from. Per facility inventory figure F-31 we have a designated flow of 766 cfs for CACH 0053. Using Flowmaster we analyzed the cross section perpendicular to the furthest upstream point of the proposed building, which is 24 feet from the western property line, and determined that the proposed building is safely above the elevation of the Cedar Avenue channel. Figures 3-4 in appendix I shows that we a slope of 0.38% (field conditions show a slope of 0.42% but we have used the more conservative design slope) with a flow of 766 cfs which provides us with a depth of 1,766.90 feet. The proposed finished floor elevation 1,771.34 feet

	Storm Flow	Depth	Proposed FF	Clearance
Cedar Ave. Channel	766 CFS	1,766.90 ft	1,771.34 ft	4.44 ft

We have a clearance of 4.44 feet between the proposed finished floor elevation and the depth of flow during the 100 year storm event flow of 766 cfs. This is sufficiently protected against flooding.

3.2 ON-SITE DRAINAGE DESCRIPTION

The onsite consist of a total of 2.54 acres of which 1.39 acres is already developed, and the remaining 1.15 acres will be developed as part of this project. Existing conditions have been discussed in section 2.3 for onsite basins ONEX1 and ONEX2.

Basin ONPR1 consist of the existing basin ONEX1 plus the proposed parking lane addition as well as part of the building that drains towards the north as shown on the Proposed Drainage Basin Map DR2 which is in the back of the report. This basin consist of a total of 1.65 acres that drains to the north and into the drop inlet that was discussed earlier. This basin has an initial overland flow of about 150 feet with an average slope of 2.0%, and a travel time flow distance of 370 feet with an average slope of around 0.9% slope along the curb and gutter line. The flow from this basin drain to the existing drop inlet as discussed in section 2.3.

Basin ONPR2 consist of the remainder of basin ONEX2 when full developed (0.89 acres). This basin drains in a southerly direction with a portion of the building draining towards the west and then south until reaching the proposed 30 inch wide "U" gutter with an average slope of 1.0% The rest of the site drains south until draining into the proposed "U" gutter. The proposed "U" gutter has a slope of 0.4% and drains directly to the east until draining into the existing Type "B" drop inlet as discussed in section 2.3.

3.3 MASTER PLANNING INFORMATION

According to the 2018 Las Vegas Valley Flood Control Master Plan Update figure F-30 and the Facility Inventory figure F-30, this site is located adjacent to the Cedar Avenue channel which is designated as CACH0053. While the site is located adjacent to the existing channel, there are no planned improvements that will have any impact on the existing channel (see appendix I for figures).

3.4 FLOODPLAIN INFORMATION

The site is located within the area that is designated by Panel Number 32003C2187 F. According to the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM) Community Panel Number 32003C2187 F (figure 2), Clark County, Nevada, revised November 16, 2011, the site is located in a zone X which is an area determined to be outside the 0.2% annual chance floodplain. The flood map information is shown on figure 2 as well as the limits of the AE and AO zones are also shown on the grading.

3.5 PREVIOUS HYDROLOGY STUDIES

This site was evaluated in the past by the Las Vegas VOA elderly housing drainage study (see appendix II - figure A-E) which is designated at drainage study Index 4359. We have reviewed the drainage study and concur with the findings. We are not able to review the drainage study map since it was not included in the available drainage study documents that are available, but we do believe that the existing improvements do match to the intent of the original study.

I Kenneth J. Erlanger, P.E. concur with the findings of the above study and will discuss an documentation that is included from the original study when necessary.

4. PROPOSED DRAINAGE FACILITIES

4.1 DISCUSSION OF LOCAL ON-SITE FACILITIES

1) The plans for this site include setting the elevation of the proposed building at an elevation of 1771.34' which is lower than the existing building but more than sufficient to protect the site against flows from out on Diamond Head and from flows from within the Cedar Avenue channel as discussed in section 3.1.

2) We have also provided for the design of a 30 inch wide concrete "U" gutter that will drain the site to the existing drop inlet. The concrete lined drainage swale that conveys the flows from ONPR2 to the existing drop inlet has a 10 year storm event of 1.35 cfs and a 100 year storm event of 2.67 cfs. The following is the

output for the 2.5 foot wide drainage "U" gutter that has a slope of 0.40% (figures 5-8):

	10-yr Event	Velocity	Depth	V x D
concrete swale	1.35 CFS	2.40 FPS	0.23 FT	0.55

	100-yr Event	Velocity	Depth	V x D
concrete swale	2.67 CFS	3.05 FPS	0.35 FT	1.07

Based on the output for the drainage swale, the 100 year storm event will easily be conveyed within the 2.5 foot wide "U" gutter.

3) The remainder of the proposed improvements will drain within landscape swales and or along the curb and gutters located within the parking lot as discussed earlier.

4.3 DISCUSSION OF REGIONAL FACILITIES

According to the 2018 Las Vegas Valley Flood Control Master Plan Update figure F-30 and the Facility Inventory figure F-30, this site is located adjacent to the Cedar Avenue channel which is designated as CACH0053. While the site is located adjacent to the existing channel, there are no planned improvements that will have any impact on the existing channel (see appendix I for figures).

4.4 DISCUSSION OF COMPLIANCE WITH VARIOUS REGULATIONS

The proposed development is designed to comply with Clark County Public Works and Clark County Regional Flood Control District (CCRFCD) regulations. This study will also comply with the CCRFCD Hydrologic Criteria and Drainage Design Manual requirements.

It should be noted that no offsite drainage improvements are required as part of this development.

4.5 DISCUSSION OF HYDROLOGIC METHODS AND PARAMETERS

4.5.1 Rainfall Criteria

The onsite and offsite basins are located within the McCarran Airport Rainfall Area (figure 513). The rain depth has been determined based on the rainfall depth-duration-frequency values for McCarran Airport rainfall area (table 505) as follows:

10-Year Rainfall	1.58 inches
100-Year Rainfall	2.77 inches

4.5.2 Runoff Computations

The runoff computations were calculated based on the Web Soil Survey National Cooperative Soil Survey. The soil survey designated the type of soil as 100% 282-Land silty clay loam (figures 9-11). The soil map and information for the location and percentage of soils (100% 282 soil) are shown on the soil report (figures 12-13). Type 282 soil is a hydrologic soil group C. The soil maps have been used to set the hydrologic soil groups that have then been used to determine the curve number (CN) based on Table 602 1 of 4 for commercial properties and Table 602 4 of 4 for desert shrub.

The lag times for existing and proposed conditions are calculated as shown on figures 17-18 and as shown on Standard Form 4.

The travel time was determined using figure 602 for the existing and proposed basins, and using Flowmaster to determine the proposed "U" gutter velocity as shown on figures 7-8.

4.5.3 Analysis

The HEC-1, Flood Hydrograph Package, was used to determine the 10-year and 100-year storm event flows from offsite and onsite basins under existing and proposed conditions.

The outputs are shown in section 4.5.4.

4.5.4 Peak Flow Rates

EXISTING- FLOW SUMMARIES

BASIN	10-YEAR FLOW (CFS)	100-YEAR FLOW (CFS)
ONEX1	2.19	4.37
RT1	2.16	4.33
ONEX2	0.83	2.29
COMB1	2.95	6.46

PROPOSED- FLOW SUMMARIES

BASIN	10-YEAR FLOW (CFS)	100-YEAR FLOW (CFS)
ONEX1	**2.59**	**5.16**
RT1	**2.56**	**5.11**
ONEX2	**1.35**	**2.67**
COMB1	**3.89**	**7.79**

4.6 FACILITY DESIGN CALCULATIONS

4.6.1 On-site

The on-site facilities have been discussed in section 4.1.

4.6.2 Off-site

No off-site facilities are being designed

5.0 CONCLUSIONS

5.1 COMPLIANCE WITH APPLICABLE LAWS AND REGULATIONS

The site will comply with all applicable laws and regulations. The proposed apartment building has been set at an elevation that is 4.44 feet above the storm flow in the adjacent Cedar Avenue Channel.

	Storm Flow	Depth	Proposed FF	Clearance
Cedar Ave. Channel	766 CFS	1,766.90 ft	1,771.34 ft	4.44 ft

It should be noted that the drainage from the site increases from 3 cfs to 3.89 cfs for the 10 year storm event, and from 7 cfs to 7.79 cfs for the 100 year storm event, which is an increase of less than 1 cfs.

5.2 EFFECTIVENESS OF FACILITIES

The following onsite drainage facilities will be constructed as part of this site development:

1) The adjacent Cedar Avenue channel runs at a depth of 1,766,90 for the designated 766 cfs flow for the 100 year storm event, and the proposed finished floor is at an

elevation of 1,771.34 for a clearance of 4.44 feet.

2) The proposed 30 inch wide "U" gutter has a depth of 0.23 feet for the 10 year storm event and 0.35 feet for the 100 year storm event which will be contained within the 0.50 foot deep gutter.

	10-yr Event	Velocity	Depth	V x D
concrete swale	1.35 CFS	2.40 FPS	0.23 FT	0.55

	100-yr Event	Velocity	Depth	V x D
concrete swale	2.67 CFS	3.05 FPS	0.35 FT	1.07

3) The only other improvement consist of swales with a minimum slope of 1.0% and the existing curb and gutter system that was already developed as part of the existing site.

5.3 IMPACT ON OFF-SITE PROPERTY AND FACILITIES

The existing parcel is mostly developed, so the proposed improvements only change the flow by 0.89 cfs for the 10-year storm event and 0.79 cfs for the 100-year storm event.

5.4 HYDROLOGIC/HYDRAULIC CALCULATIONS

The hydrologic and hydraulic calculations are located in the appendix.

APPENDIX I

FORM 4

REFERENCE:

TIME OF CONCENTRATION AND HEC-1 INPUT

DEVELOPMENT Desert Oasis II

CALCULATED BY KENNETH J. ERLANGER **DATE** 12/14/2019

Sub-Basin Data				Initial / Overland Time (t_i)			Travel Time (t_t)				t_c Check (Urbanized Basins)		Final (t_c)			Remarks
KK			BA											UD	LS	HEC-1 Card
Desig. (1)	K (2)	Area Ac. (3)	Area Sq. Mi. (4)	Length Ft. (5)	Slope % (6)	t_i Min. (7)	Length Ft. (8)	Slope % (9)	Vel. FPS (10)	t_t Min. (11)	Total Length Ft. (12)	t_c=(L/180)+10 Min. (13)	Min. (14)	Lag Time Hr. (15)	CN (16)	
ONEX1	0.8510	1.39	0.0022	150	2	4.36	370	0.9	2	3.08	520	12.89	7.44	0.0744	94.00	
ONEX2	0.7320	1.15	0.0018	140	1.5	6.84	320	0.5	0.85	6.27			13.11	0.1311	85.00	
ONPR1	0.8510	1.65	0.0026	150	2.0	4.36	370	0.9	2	3.08	520	12.89	7.44	0.0744	94.00	
ONPR2	0.8510	0.89	0.0014	180	1.0	6.01	345	0.4	2.15	2.67	525	12.92	8.68	0.0868	94.00	

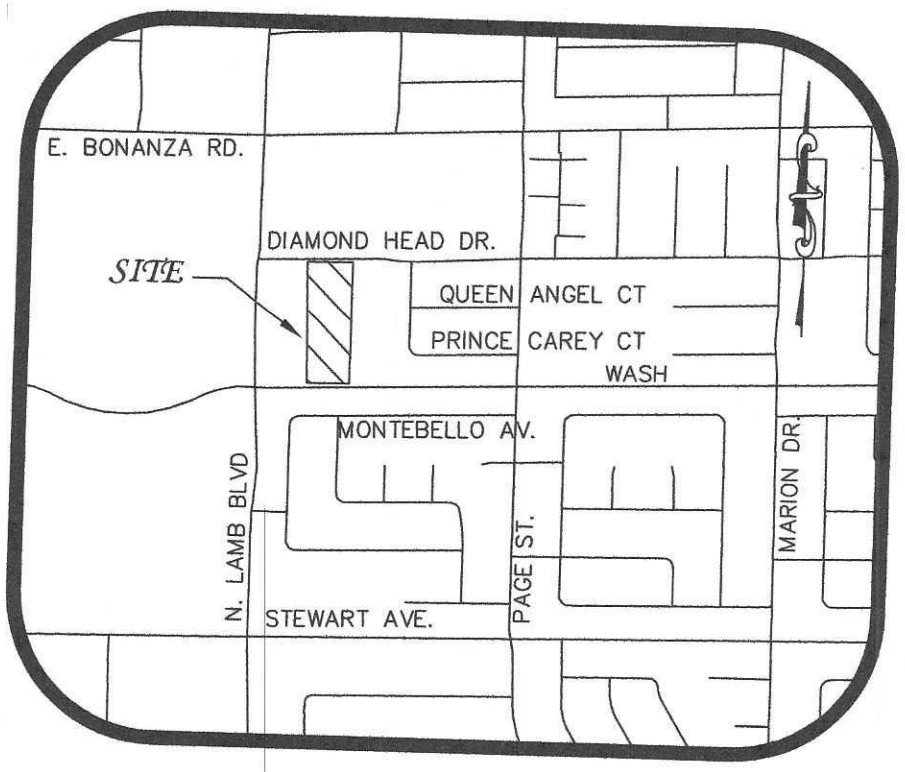
$$t_i = 1.8(1.1 - K)L^{1/2} / S^{1/3}$$

$$t_c = (t_i) + (t_t)$$

STANDARD FORM 4

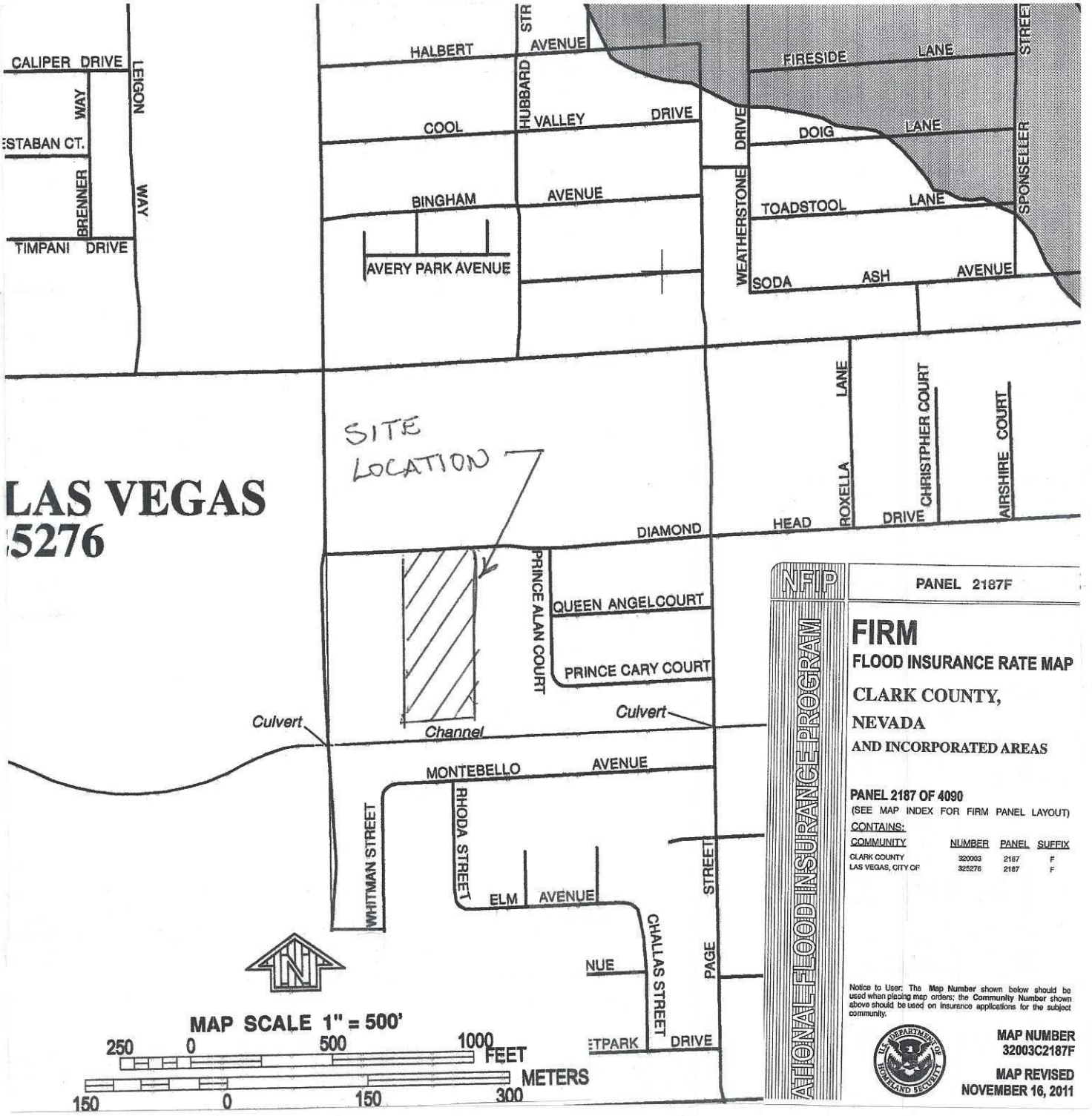
				REVISION
				DATE

FIGURES



VICINITY MAP

FIGURE 1



FLOOD INSURANCE RATE MAP
PANEL NUMBER 32003C2187F

FIGURE 2

CACH0053-worksheet
Worksheet for Irregular Channel

Project Description	
Project File	c:\haestad\fmw\356-1.fm2
Worksheet	CACH0053
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Input Data		
Channel Slope	0.003800	ft/ft

Elevation range: 1,762.80 ft to 1,769.90 ft.

Station (ft)	Elevation (ft)	Start Station	End Station	Roughness
0.00	1,769.70	0.00	26.00	0.025
26.00	1,769.10	26.00	54.00	0.015
34.00	1,762.80	54.00	60.00	0.025
44.00	1,762.80			
54.00	1,769.00			
60.00	1,769.90			

Discharge	766.00	cfs

Results		
Wtd. Mannings Coefficient	0.015	
Water Surface Elevation	1,766.90	ft
Flow Area	65.16	ft²
Wetted Perimeter	24.40	ft
Top Width	21.81	ft
Height	4.10	ft
Critical Depth	1,767.33	ft
Critical Slope	0.002587	ft/ft
Velocity	11.76	ft/s
Velocity Head	2.15	ft
Specific Energy	1,769.04	ft
Froude Number	1.20	
Flow is supercritical.		

FIGURE 3

CACH0053 cross section
Cross Section for Irregular Channel

Project Description	
Project File	c:\haestad\fmw\356-1.fm2
Worksheet	CACH0053
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Section Data		
Wtd. Mannings Coefficient	0.015	
Channel Slope	0.003800	ft/ft
Water Surface Elevation	1,766.90	ft
Discharge	766.00	cfs

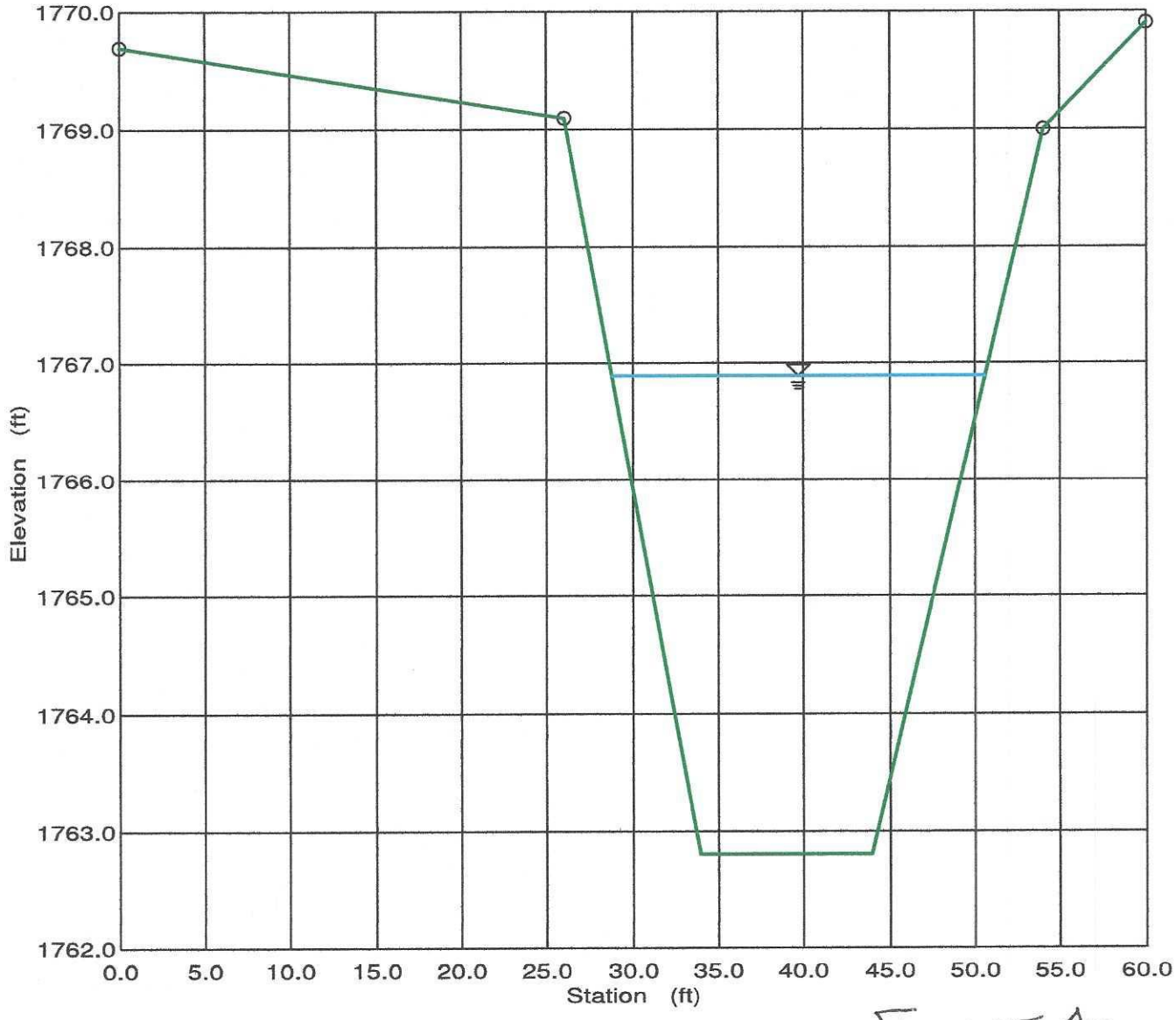


FIGURE 4

10 yr storm event
Worksheet for Rectangular Channel

Project Description	
Project File	c:\haestad\fmw\356-1.fm2
Worksheet	30 inch drainage gutter
Flow Element	Rectangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.013	
Channel Slope	0.004000	ft/ft
Bottom Width	2.50	ft
Discharge	1.35	cfs

Results		
Depth	0.23	ft
Flow Area	0.56	ft^2
Wetted Perimeter	2.95	ft
Top Width	2.50	ft
Critical Depth	0.21	ft
Critical Slope	0.005101	ft/ft
Velocity	2.40	ft/s
Velocity Head	0.09	ft
Specific Energy	0.31	ft
Froude Number	0.89	
Flow is subcritical.		

FIGURE 5.

10 yr event
Cross Section for Rectangular Channel

Project Description	
Project File	c:\haestad\fmw\356-1.fm2
Worksheet	30 inch drainage gutter
Flow Element	Rectangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficient	0.013	
Channel Slope	0.004000	ft/ft
Depth	0.23	ft
Bottom Width	2.50	ft
Discharge	1.35	cfs

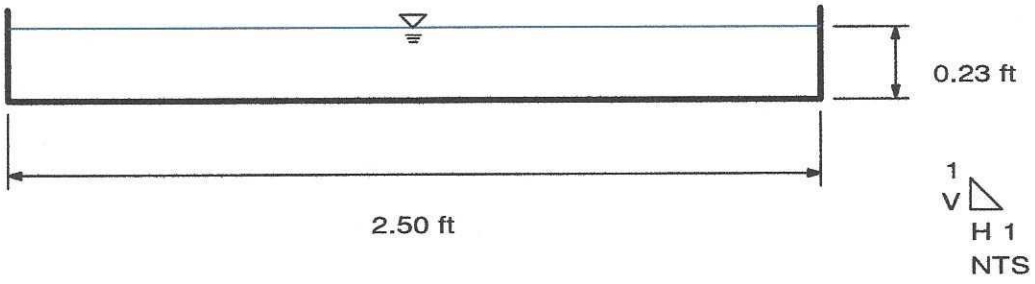


FIGURE 6

100 yr storm event
Worksheet for Rectangular Channel

Project Description	
Project File	c:\haestad\fmw\356-1.fm2
Worksheet	30 inch drainage gutter
Flow Element	Rectangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.013	
Channel Slope	0.004000	ft/ft
Bottom Width	2.50	ft
Discharge	2.67	cfs

Results		
Depth	0.35	ft
Flow Area	0.88	ft^2
Wetted Perimeter	3.20	ft
Top Width	2.50	ft
Critical Depth	0.33	ft
Critical Slope	0.004872	ft/ft
Velocity	3.05	ft/s
Velocity Head	0.14	ft
Specific Energy	0.49	ft
Froude Number	0.91	
Flow is subcritical.		

FIGURE 7

100 yr event
Cross Section for Rectangular Channel

Project Description	
Project File	c:\haestad\fmw\356-1.fm2
Worksheet	30 inch drainage gutter
Flow Element	Rectangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficient	0.013	
Channel Slope	0.004000	ft/ft
Depth	0.35	ft
Bottom Width	2.50	ft
Discharge	2.67	cfs

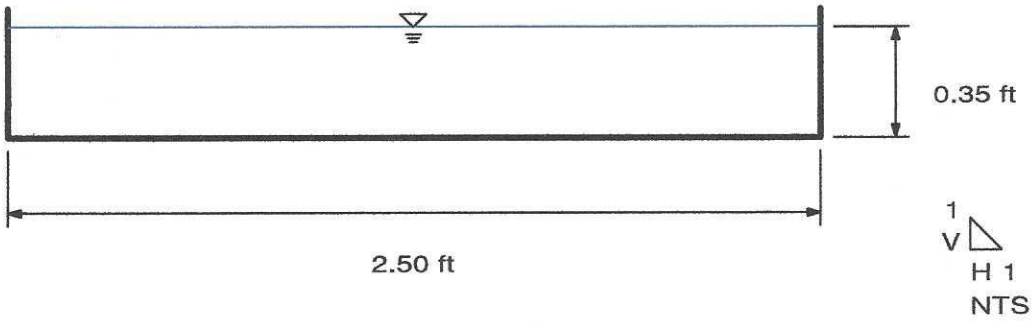


FIGURE 8

Map Unit Description

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions in this report, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named, soils that are similar to the named components, and some minor components that differ in use and management from the major soils.

Most of the soils similar to the major components have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Some minor components, however, have properties and behavior characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

FIGURE 9

Soils that have profiles that are almost alike make up a *soil series*. All the soils of a series have major horizons that are similar in composition, thickness, and arrangement. Soils of a given series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Additional information about the map units described in this report is available in other soil reports, which give properties of the soils and the limitations, capabilities, and potentials for many uses. Also, the narratives that accompany the soil reports define some of the properties included in the map unit descriptions.

Las Vegas Valley Area, Nevada, Part of Clark County

282—Land silty clay loam

Map Unit Setting

National map unit symbol: hrbn
Elevation: 1,200 to 2,400 feet
Mean annual precipitation: 4 to 6 inches
Mean annual air temperature: 66 to 70 degrees F
Frost-free period: 230 to 250 days

FIGURE 10

Farmland classification: Not prime farmland

Map Unit Composition

Land and similar soils: 100 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Land

Setting

Landform: Alluvial flats
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Mixed alluvium

Typical profile

H1 - 0 to 2 inches: silty clay loam
H2 - 2 to 64 inches: stratified silt loam to silty clay

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Somewhat poorly drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.14 to 0.57 in/hr)
Depth to water table: About 36 to 42 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 15 percent
Gypsum, maximum in profile: 10 percent
Salinity, maximum in profile: Strongly saline (16.0 to 32.0 mmhos/cm)
Sodium adsorption ratio, maximum in profile: 90.0
Available water storage in profile: High (about 10.8 inches)

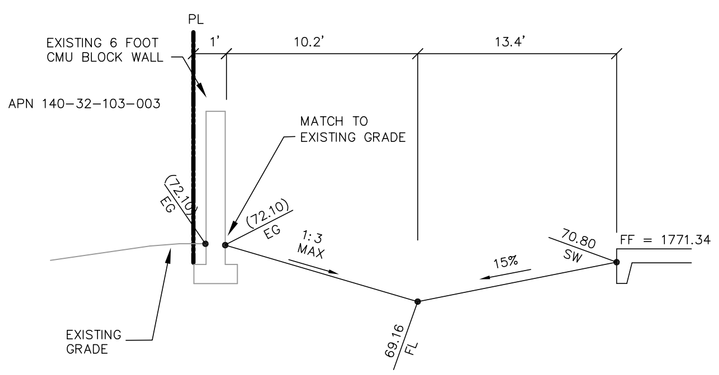
Interpretive groups

Land capability classification (irrigated): 6w
Land capability classification (nonirrigated): 7w
Hydrologic Soil Group: C
Ecological site: SALINE BOTTOM (R030XY024NV)
Hydric soil rating: No

Data Source Information

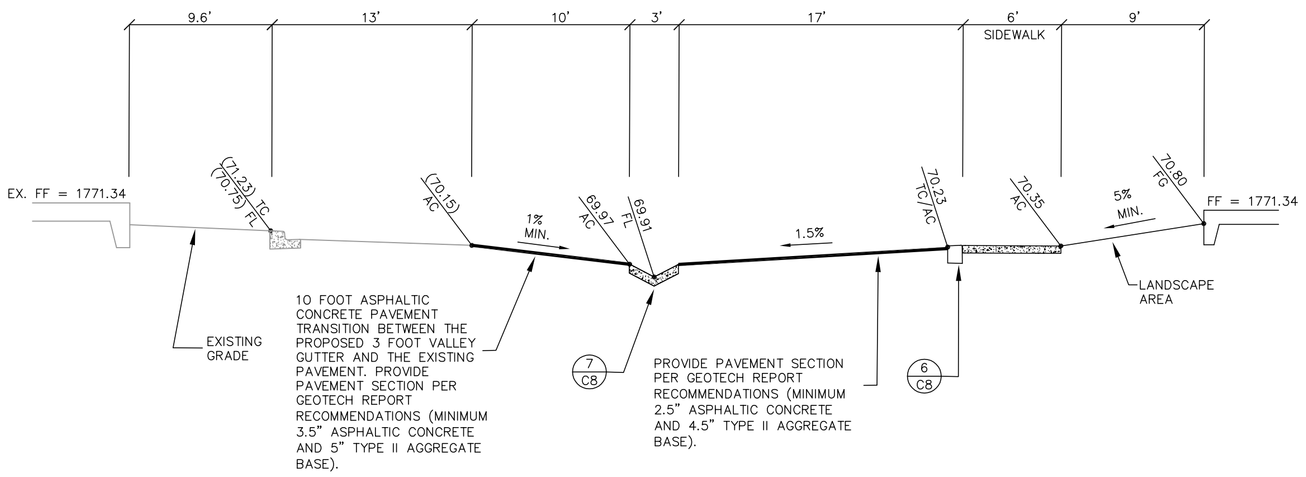
Soil Survey Area: Las Vegas Valley Area, Nevada, Part of Clark County
Survey Area Data: Version 14, Sep 16, 2019

FIGURE 11



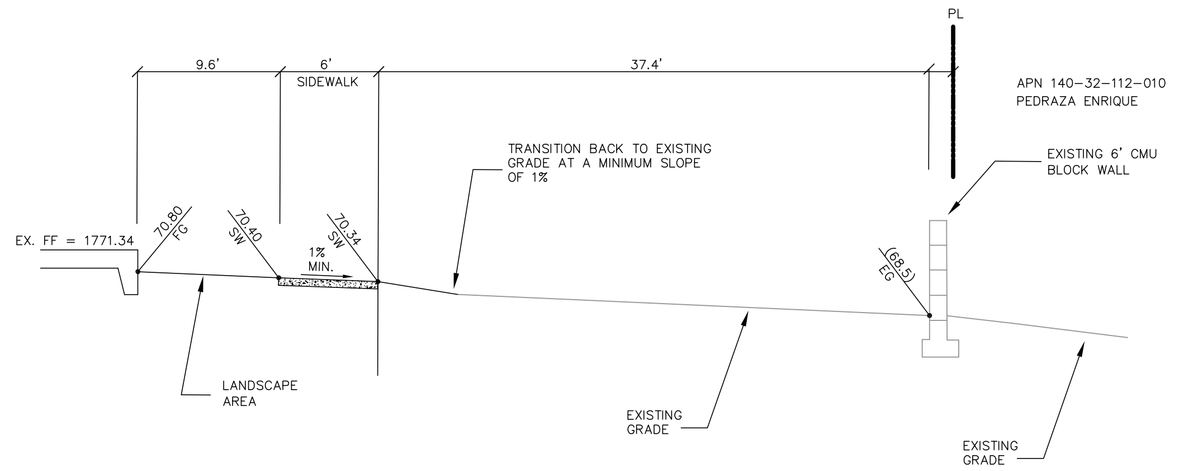
1/C8 WESTERN PROPERTYLINE CROSS SECTION

N.T.S.



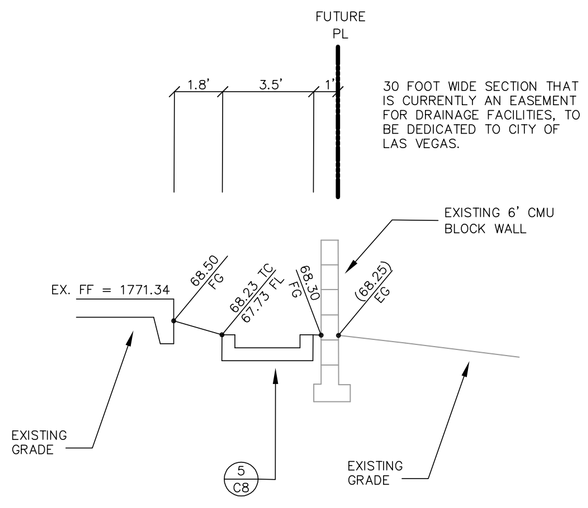
2/C8 PARKING LOT/BUILDING SECTION

N.T.S.



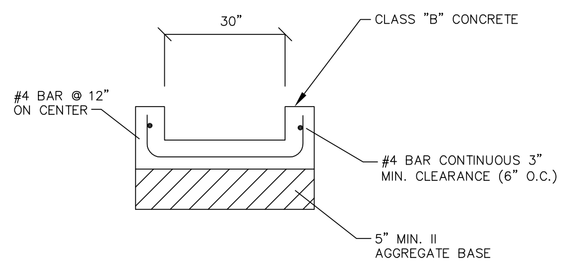
3/C8 EASTERN PROPERTY LINE SECTION

N.T.S.



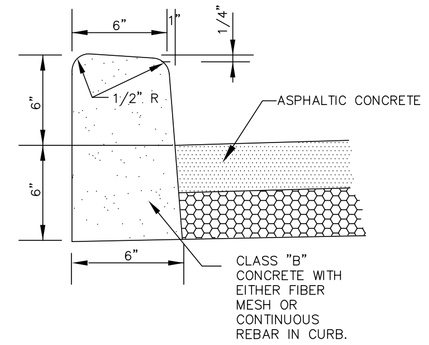
4/C8 SOUTHERN (FUTURE) PROPERTY LINE SECTION

N.T.S.



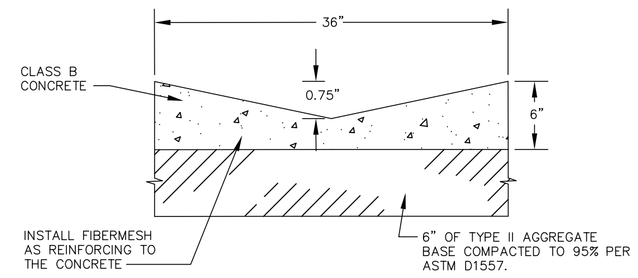
5/C8 3.5 FT. "U" GUTTER DETAIL

N.T.S.



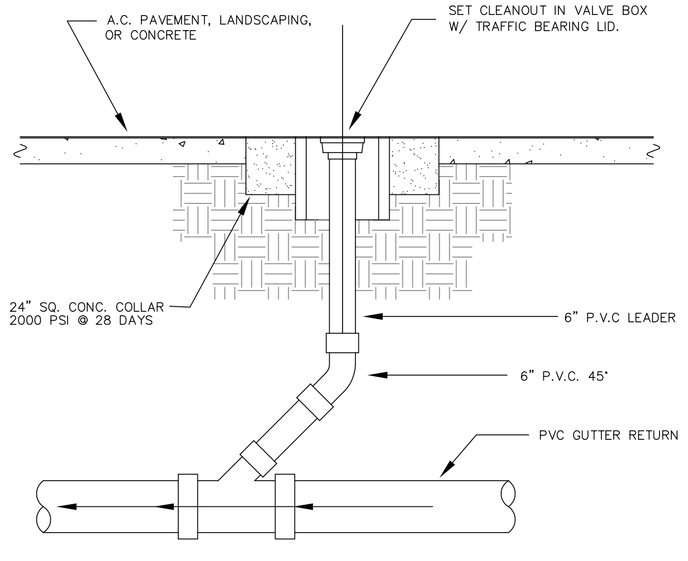
6/C8 TYPE "A" CURB CROSS SECTION

N.T.S.



7/C8 3 FT. VALLEY GUTTER DETAIL

N.T.S.



8/C8 CLEAN-OUT DETAIL

N.T.S.

REV	DATE	BY

LAS VEGAS VOA ELDERLY HOUSING
4445 S. DIAMOND HEAD DRIVE
LAS VEGAS, NEVADA 89110

4222 E. PINECREST CIRCLE
LAS VEGAS, NV. 89121
PH. (702) 597-2988
kjeconsul@cox.net
KJE CONSULTING ENGINEERS, INC.

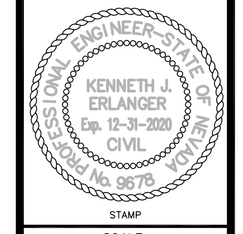
SHEET: **DETAIL SHEET APN 140-32-103-002**

TITLE: **DESERT OASIS II 4445 S. DIAMOND HEAD DRIVE**

DRAWN BY:	DESIGNED BY:	CHECKED BY:	PROJECT NO:
KJE 12/15/19	KJE 12/15/19	KJE 12/15/19	356.1

FILE NAME: DETAIL-356-1(C8).DWG

SEAL



STAMP

SCALE
HORIZONTAL: 1"=20'
VERTICAL: NA

SHEET
C8
8 OF 8 SHEETS

CLV#

GRAPHIC SCALE

30 0 15 30 60 120

(IN FEET)
1 inch = 30 ft.

N

PRICE ALAN COURT
(PUBLIC STREET)

KINGSCREST
BOOK 26, PAGE 62
PLATS

140-32-112-001
REVI HOME LIMITED
FF=1771.10'

140-32-112-002
GALLARDO ALEXANDER OMAR
FF=1770.97'

140-32-112-003
NEM SAVON
FF=1770.39'

140-32-112-004
OSORIO ERNESTO &
DALIA DINORA
FF=1770.12'

140-32-112-005
GARCIA MARISOL
FF=1769.83'

140-32-112-006
FERNANDEZ RICARDO
FF=1769.63'

140-32-112-007
CARILLO ARTEMIA
FF=1769.44'

140-32-112-008
KNICKERSTAKS COMPANY LLC
FF=1769.15'

140-32-112-009
COREAS-BERMUDEZ EDWIN
FF=1768.92'

140-32-112-010
PEDRAZA ENRIQUE &
CHAVEZDEPEDRAZA ALMA
FF=1768.64'

RESIDENTIAL PLANNED DEVELOPMENT
R-PD6

RESIDENTIAL PLANNED DEVELOPMENT
R-PD6

COMB1

SSMH RIM=1768.86'
SS INV THRU=1764.85'
EX. 8" PVC SS

EX. 8" ACP WL

DEDICATED PUBLIC RIGHT-OF-WAY
O.R. 19941123 0081

DIAMOND HEAD DRIVE
(PUBLIC STREET)

N 87°56'58" E - 339.26'

S 00°08'47" W - 597.10'

N 00°13'47" E - 595.11'

ONEX1
1.39 AC

ONEX2
1.15 AC

140-32-103-002
LAS VEGAS VOA ELDERLY HOUSING
FF=1772.90'

EX. 6" SS

EX. 4" PVC WL

EX. 8" PVC WL

EX. TYPE "A"
DROP INLET
L=4' INLET
D=2.5' GRATE
INV.=65.7

EX. TYPE "B"
DROP INLET
D=2.5' GRATE
INV.=63.6

EX. 24" RCP
DRAIN PIPE
S=1.4%

0.30%

0.85%

S 88°17'30" W - 339.05'

S 88°17'30" W - 339.05'

EX. ASPHALT PATH

CEDAR CHANNEL
CROSS SECTION
DEPTH ANALYSIS

140-32-103-001
LANGDON NEVADA II LLP
RESIDENTIAL PLANNED DEV.
R-PD21

140-32-103-003
CHURCH BAPTIST IMMANUEL
R-E (CHURCH)

FF=1773.47'

FF=1773.47'

FF=1772.80'

E. BONANZA RD.

DIAMOND HEAD DR.

SITE

QUEEN ANGEL CT

PRINCE CAREY CT

WASH

MONTEBELLO AV.

N. LAMB BLVD

PAGE ST.

MARION DR.

STEWART AVE.

VICINITY MAP
NOT TO SCALE

EXISTING CONDITION
PEAK FLOW RATE

BASIN	10-YR EVENT	100-YR EVENT
ONEX1	2.19 CFS	4.37 CFS
ONEX2	0.83 CFS	2.29 CFS

EXISTING CONDITION
DRAINAGE COMBINE POINT

COMB PT	10-YR	100-YR
COMB1	2.95 CFS	6.46 CFS

THE FLOWS FROM ONEX1 DRAIN TO THE EXISTING TYPE "A" DROP INLET THAT IS LOCATED AT THE SOUTHEAST CORNER OF THE EXISTING PARKING LOT. THESE FLOWS DRAIN WITHIN THE EXISTING 24" RCP STORM DRAIN PIPE TO THE SOUTHEAST PROPERTY CORNER WHERE THEY COMBINE WITH THE FLOWS FROM ONEX2 WITHIN THE EXISTING TYPE "B" DROP INLET. THE COMBINED FLOWS DRAIN WITHIN THE EXISTING 24" RCP DRAIN PIPE DAYLIGHTING INTO THE EXISTING CEDAR AVENUE CHANNEL

CEDAR AVE. CHANNEL
DRAINAGE COMBINE POINT

STORM FLOW	DEPTH	PROP. FF	CLEARANCE
766 CFS	1,766.90 FT	1,771.34 FT	4.44 FT

REV	DATE	BY

LAS VEGAS VOA ELDERLY HOUSING
4445 S. DIAMOND HEAD DRIVE
LAS VEGAS, NEVADA 89110

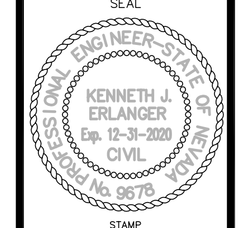
KJE CONSULTING ENGINEERS, INC.
4222 E. PINECREST CIRCLE
LAS VEGAS, NV. 89121
PH. (702) 597-2988
kjeconsul@cox.net

SHEET
EXISTING DRAINAGE BASIN MAP
APN 140-32-103-002

TITLE
DESERT OASIS II
4445 S. DIAMOND HEAD DRIVE

DRAWN BY: K.K.E 12/15/19
DESIGNED BY: K.K.E 12/15/19
CHECKED BY: K.K.E 12/15/19
PROJECT NO: 272.15
FILE NAME: EX-DR-356-10W2

SEAL



STAMP

SCALE
HORIZONTAL: 1"=30'
VERTICAL: NA

SHEET
DR1
1 OF 2 SHEETS

CLV#

LEGEND

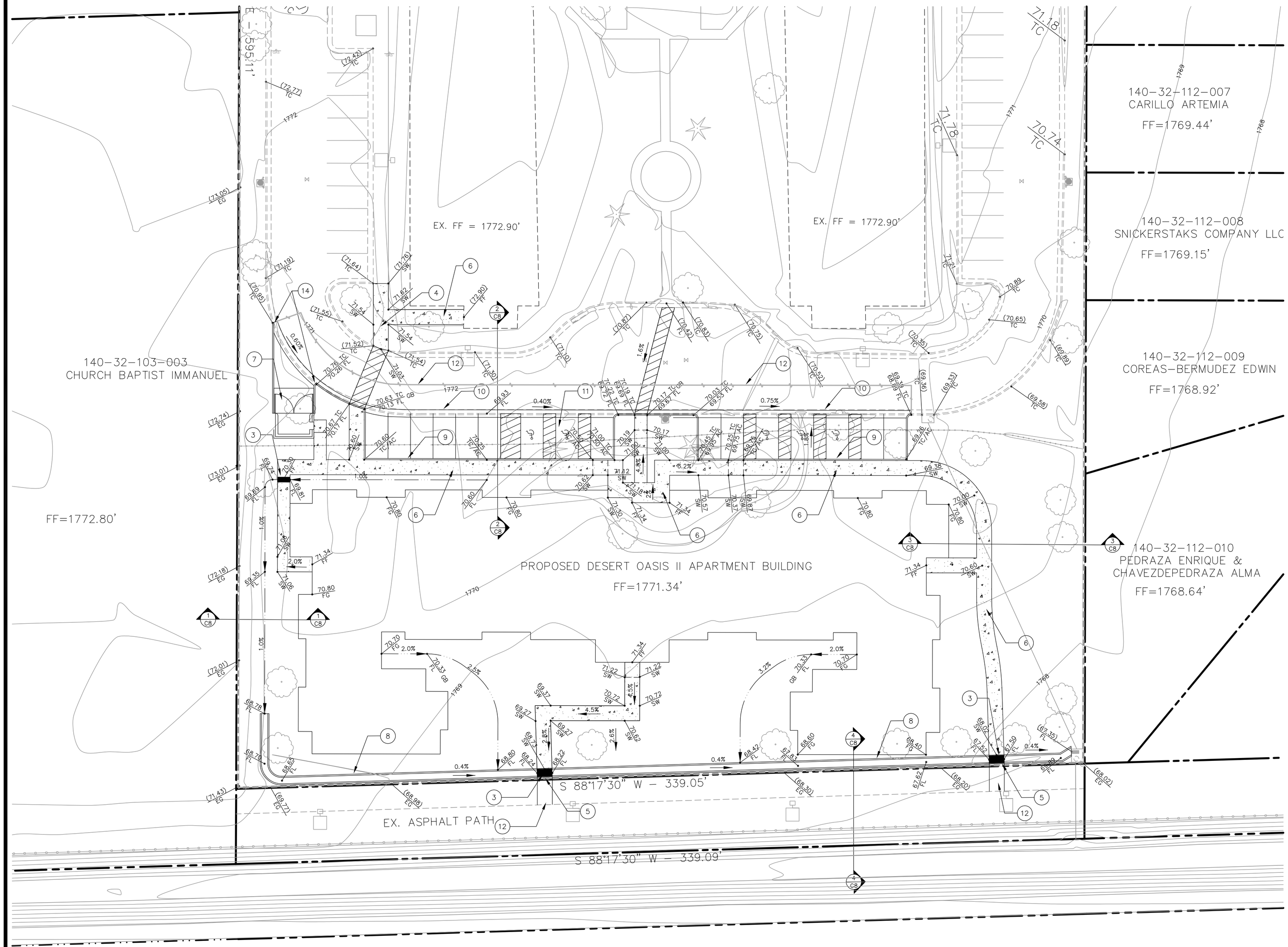
2263	EXISTING CONTOURS
2263	PROPOSED CONTOURS
36.66	PROPOSED GRADE
(63.33)	EXISTING GRADE
SS	PROPOSED SANITARY SEWER LINE
SS	EXISTING SANITARY SEWER LINE
WL	PROPOSED WATER LINE
WL	EXISTING WATER LINE
WL	PROPOSED FIRE SPRINKLER LINE
GAS	EXISTING GAS LINE
	EXIST./PROP. EDGE OF ASPHALT
	PROPERTY/RIGHT-OF-WAY LINE
	CENTERLINE
	EXIST./PROP. BLOCK WALL
	EX. OVERHEAD POWER/TELEPHONE
	SAWCUT LINE
S	EXIST./PROP SANITARY SEWER MANHOLE
	EXIST./PROP. 100W HPS STREETLIGHT
	HANDICAPPED SYMBOL
	EXIST./PROP. FIRE HYDRANT
	EXIST./PROP. GATE VALVE
	EXIST./PROP. REDUCING VALVE
	EXIST./PROP. CLEANOUT
	PROPOSED ASPHALT
	PROPOSED CONCRETE
	PROPOSED RIP-RAP

ABBREVIATIONS

AC	ASPHALTIC CONCRETE
BCR	BEGINNING OF CURB RETURN
BSW	BACK OF SIDEWALK
CLV	CITY OF LAS VEGAS
CL	CENTERLINE
CO	SEWER CLEANOUT
CONC	CONCRETE
EAC	EXISTING ASPHALTIC CONCRETE
ECR	END OF CURB RETURN
EP	EDGE OF PAVEMENT
ETC	EXISTING TOP OF CURB
EX	EXISTING
FF	FINISHED FLOOR
FL	FLOWLINE
GB	GRADE BREAK
HP	HIGH POINT
IE	INVERT ELEVATION
LVVWD	LAS VEGAS VALLEY WATER DISTRICT
NTS	NOT TO SCALE
OH	EXISTING OVERHEAD POWER
PE	PAD ELEVATION
PL	PROPERTY LINE
PP	POWER POLE
SD	STORM DRAIN LINE
SF	SQUARE FEET
SL	STREET LIGHT
SS	SANITARY SEWERLINE
STA	STATION
SW	SIDEWALK
TC	TOP OF CURB
TYP	TYPICAL
VG	VALLEY GUTTER
WL	WATERLINE
WM	WATER METER

NOTES:

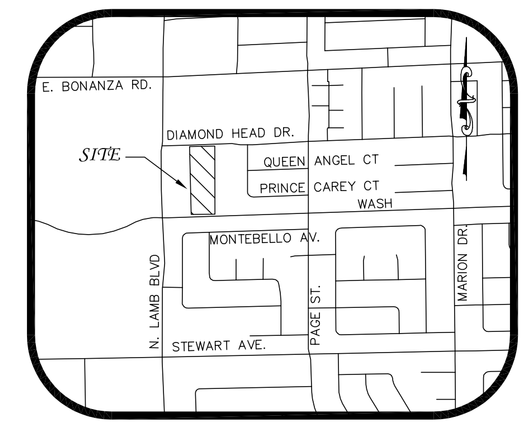
LOCATION OF UNDERGROUND UTILITIES ON THE DRAWINGS WERE OBTAINED BY A SEARCH OF AVAILABLE RECORDS. THE ENGINEER ASSUMES NO RESPONSIBILITY FOR UTILITIES NOT SHOWN OR IN THE LOCATION SHOWN ON THE DRAWINGS.



GRAPHIC SCALE

30 0 15 30 60 120

(IN FEET)
1 inch = 30 ft.



VICINITY MAP
NOT TO SCALE

N

BENCHMARK

BENCHMARK ID 6C0228SWS
1,762.040 FEET (573.071 M) (NAVD 88)

2 INCH BRASS CAP REFERENCE MONUMENT IN TOP OF CURB NORTHEAST CORNER OF NELLIS BOULEVARD AND BONANZA ROAD, NEAR THE PC OF NELLIS BOULEVARD.

BASIS OF BEARING

NORTH 87°56'58" EAST, BEING THE CENTERLINE OF DIAMOND HEAD DRIVE AS SEEN IN FILE 82, PAGE 58 OF SURVEYS, RECORDED IN THE CLARK COUNTY, NEVADA'S RECORDER'S OFFICE.

FLOOD ZONE INFORMATION

THIS PROPERTY IS LOCATED IN ZONE "X", INDICATING THAT THIS PARCEL IS NOT LOCATED IN A FLOOD ZONE, PER FLOOD INSURANCE RATE MAP 32003C2187F, EFFECTIVE DATE NOVEMBER 16, 2011.

EARTHWORK QUANTITIES

CUT	0 CY
FILL	1800 CY

THESE QUANTITIES ARE FOR PLANS CHECKING PURPOSES ONLY AND SHOULD NOT BE USED BY CONTRACTORS TO DETERMINE FINAL QUANTITIES.

CONSTRUCTION NOTES

1. LOCATION OF UNDERGROUND UTILITIES ON THE DRAWINGS WERE OBTAINED BY A SEARCH OF AVAILABLE RECORDS. THE ENGINEER ASSUMES NO RESPONSIBILITY FOR UTILITIES NOT SHOW OR IN THE LOCATION SHOWN ON THE DRAWINGS.
2. REFER TO GEOTECHNICAL EVALUATION FOR A TWO-STORY APARTMENT BUILDING AT 4445 DIAMOND HEADE DRIVE AS PREPARED BY GEOTEK, INC. ON SEPTEMBER 6, 2019, AND STAMPED BY LUCAS A. JACO , P.E. FOR GRADING AND PAVING RECOMMENDATIONS FOR THE PROPOSED SITE IMPROVEMENTS. PROJECT NO. 14709.1-LV
3. INSTALL SIDEWALK DRAIN WITH ADA ACCESSIBLE SURFACE CROSSING DRAINAGE.
4. INSTALL SIDEWALK RAMP USING TRUNCATED DOMES PER DRAWING NO. 235 OF THE UNIFORM STANDARD DRAWINGS, CLARK COUNTY AREA.
5. SEE ARCHITECTURAL PLANS FOR REMOVE OF SECTION OF EXISTING CMU WALL AND THE INSTALLATION OF ACCESS GATE.
6. INSTALL SIDEWALK PER DRAWING NO. 234 OF THE UNIFORM STANDARD DRAWINGS, CLARK COUNTY AREA.
7. EXISTING TRASH ENCLOSURE PER ARCHITECTURAL DRAWINGS.
8. INSTALL 30" WIDE "U" GUTTER PER DETAIL (5/C8).
9. INSTALL "A" CURB PER DETAIL (6/C8).
10. INSTALL 36" SIDE "V" GUTTER PER DETAIL (7/C8).
11. REFER TO GEOTECHNICAL EVALUATION FOR PAVEMENT RECOMMENDATIONS:

    FIRE ACCESS/DRIVE LANE 3.5" ASPHALTIC CONCRETE; 5.0" TYPE II AGGREGATE BASE
    PARKING LANE 2.5" ASPHLATIC CONCRETE; 4.5" TYPE II AGGREGATE BASE
12. PROVIDE AN ASPHALTIC CONCRETE PAVEMENT TRANSITION BETWEEN THE CMU WALL GATE AND EXISTING ASPHALTIC PAVEMENT PATH WITH A MAXIMUM SLOPE OF 4%.
13. PROVIDE AN ASPHALTIC CONCRETE TRANSITION BETWEEN THE PROPOSED GUTTER LINE AND THE EXISTING PAVEMENT TO A MINIMUM DISTANCE OF 10 FEET. VERIFY A MINIMUM SLOPE OF 1%.
14. PROVIDE A STANDARD 30" ROLL CURB PER DRAWING 217.S1 OF THE UNIFORM STANDARD DRAWINGS CLARK COUNTY ALONG THE GUTTER IN FRONT OF THE PROPOSED TRASH ENCLOSURE.

CALL before you DIG 811 UNDERGROUND SERVICE (USA) AVOID CUTTING UNDERGROUND UTILITY LINES. IT'S COSTLY

CALL before you Overhead 1-702-227-2929 UNDERGROUND SERVICE (USA) AVOID CUTTING UNDERGROUND UTILITY LINES. IT'S COSTLY

AVOID HITTING UNDERGROUND TRAFFIC SIGNAL CONDUIT AND LIGHT POLE CABLES IT'S COSTLY
Call before you UnderGround
1-702-455-7544 CLARK COUNTY TRAFFIC OPERATIONS
AND
1-702-432-5300 FREEWAY AND ARTERIAL SYSTEM OF TRANSPORTATION

REV	DATE	BY

LAS VEGAS VOA ELDERLY HOUSING
4445 S. DIAMOND HEAD DRIVE
LAS VEGAS, NEVADA 89110

KJE CONSULTING ENGINEERS, INC.
4222 E. PINECREST CIRCLE
LAS VEGAS, NV. 89121
PH. (702) 597-2988
kjeconsul@cox.net

SHEET: **GRADING PLAN**
APN 140-32-103-002

TITLE: **DESERT OASIS II**
4445 S. DIAMOND HEAD DRIVE

DRAWN BY: K.E.	12/15/19	CHECKED BY: K.E.	12/15/19
DESIGNED BY: K.E.	12/15/19	PROJECT NO: 356.1	FILE NAME: GD-356-1(C3).DWG

SEAL

KENNETH J. ERLANGER
Exp. 12-31-2020
CIVIL
No. 9678
PROFESSIONAL ENGINEER-STATE OF NEVADA

STAMP

SCALE
HORIZONTAL: 1"=20'
VERTICAL: NA

SHEET
C3
3 OF 9 SHEETS

CLV#

DIAMOND HEAD DRIVE
(PUBLIC STREET)

DEDICATED PUBLIC RIGHT-OF-WAY PER O.R. 19941123:01061

N 87°56'58" E - 338.26'

SSMH RIM=1768.86'
SS INV THRU=1764.85'

140-32-112-001
REV1 HOME LIMITED
FF=1771.10'

140-32-112-002
GALLARDO ALEXANDER OMAR
FF=1770.97'

140-32-112-003
NEM SAVON
FF=1770.39'

140-32-112-004
OSORIO ERNESTO & DALIA DINORA
FF=1770.12'

140-32-112-005
GARCIA MARISOL
FF=1769.83'

140-32-112-006
FERNANDEZ RICARDO
FF=1769.63'

140-32-112-007
CARILLO ARTEMIA
FF=1769.44'

140-32-112-008
SNICKERSTAKS COMPANY LLC
FF=1769.15'

140-32-112-009
COREAS-BERMUDEZ EDWIN
FF=1768.92'

140-32-112-010
PEDRAZA ENRIQUE & CHAVEZDEPEDRAZA ALMA
FF=1768.64'

PRICE ALAN COURT
(PUBLIC STREET)

KINGSCREST
BOOK 26, PAGE 62
PLATS

FF=1773.47'

140-32-103-001
LANGDON NEVADA II LLP

FF=1773.47'

140-32-103-002
LAS VEGAS VOA ELDERLY HOUSING
FF=1772.90'

N 00°13'47" E - 595.11'

S 00°08'47" W - 597.10'

ONPR1
1.65 AC

ONPR2
0.89 AC

COMB1

140-32-103-003
CHURCH BAPTIST IMMANUEL

FF=1772.80'

PROPOSED DESERT OASIS II APARTMENT BUILDING
FF=1771.34'

EX. TYPE "A" DROP INLET
L=4' INLET
D=2.5' GRATE
INV=65.7

EX. 24" RCP DRAIN PIPE
S=1.4%

EX. TYPE "B" DROP INLET
D=2.5' GRATE
INV=63.6

0.50%

S 88°17'30" W - 339.05'

S 88°17'30" W - 339.09'

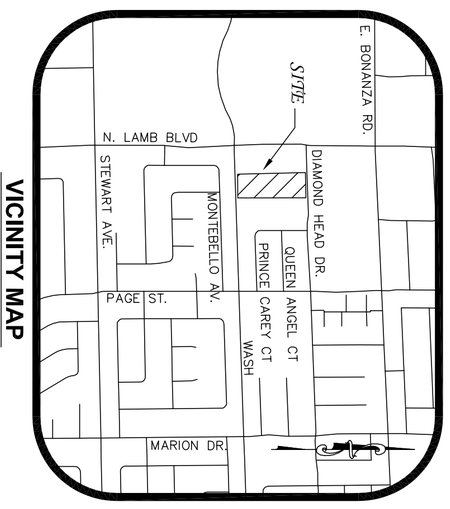
EX. ASPHALT PATH

CEDAR CHANNEL
CROSS SECTION
DEPTH ANALYSIS

GRAPHIC SCALE
(IN FEET)
1 inch = 30 ft.
30 0 15 30 60 120

N

VICINITY MAP
NOT TO SCALE



EXISTING CONDITION
PEAK FLOW RATE

BASIN	10-YR EVENT	100-YR EVENT
ONPR1	2.59 CFS	5.16 CFS
ONPR2	1.35 CFS	2.67 CFS

EXISTING CONDITION
DRAINAGE COMBINE POINT

COMB PT	10-YR	100-YR
COMB1	3.89 CFS	7.79 CFS

THE FLOWS FROM ONEX1 DRAIN TO THE EXISTING TYPE "A" DROP INLET THAT IS LOCATED AT THE SOUTHEAST CORNER OF THE EXISTING PARKING LOT. THESE FLOWS DRAIN WITHIN THE EXISTING 24" RCP STORM DRAIN PIPE TO THE SOUTHEAST PROPERTY CORNER WHERE THEY COMBINE WITH THE FLOWS FROM ONEX2 WITHIN THE EXISTING TYPE "B" DROP INLET. THE COMBINED FLOWS DRAIN WITHIN THE EXISTING 24" RCP DRAIN PIPE DAYLIGHTING INTO THE EXISTING CEDAR AVENUE CHANNEL

CEDAR AVE. CHANNEL
DRAINAGE COMBINE POINT

STORM FLOW	DEPTH	PROP. FF	CLEARANCE
766 CFS	1,766.90 FT	1,771.34 FT	4.44 FT

PROFESSIONAL ENGINEER
STATE OF NEVADA
KENNETH J. ERLANGER
Exp. 12-31-2020
CIVIL
No. 9678

SEAL

STAMP

SCALE
HORIZONTAL: 1"=30'
VERTICAL: NA

SHEET
DR2
2 OF 2 SHEETS

CLV#

DRAWN BY: KJE 12/15/19
DESIGNED BY: KJE 12/15/19
CHECKED BY: KJE 12/15/19
PROJECT NO: 272.15
FILE NAME: EX-DR-356-1.DWG

SHEET
PROPOSED DRAINAGE BASIN MAP
APN 140-32-103-002

TITLE
DESERT OASIS II
4445 S. DIAMOND HEAD DRIVE

LAS VEGAS VOA ELDERLY HOUSING
4445 S. DIAMOND HEAD DRIVE
LAS VEGAS, NEVADA 89110

KJE CONSULTING ENGINEERS, INC.
4222 E. PINECREST CIRCLE
LAS VEGAS, NV. 89121
PH. (702) 597-2988
kjeconsult@cox.net

REV	DATE	BY