

DS #:

4958

APN:

163-01-162-001 5. More

PROJECT:

TRP-67900 at Charleston and Jones

SUBMITTAL:

1st

SCANNED BY/DATE:

CHECKED BY/DATE:



CITY OF LAS VEGAS INTER-OFFICE MEMORANDUM		DATE: March 13, 2018
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: TMP-67900 at Charleston and Jones	COPIES TO: Baughman & Turner, Inc.
Cross Streets:	SEC of Charleston Blvd. & Jones Blvd.	L V G #5, LLC
File Number:	F:\Depot\DSMemos\DS4958A.doc	Bart Anderson, P.E., DevCo
Parcel Number:	163-01-102-001 & more	
Zoning Action:	TMP-67900	
FEMA Flood Zone	YES NO X	
Proposed Storm Drain	YES NO X	

HISTORY	DATE RECEIVED	DATE REVIEWED	COMMENTS	REVIEW FEES	FEES PAID Payment Trn #
1 st Submittal	3/1/2018	3/13/2018	See Comments Below	\$400.00	493859: \$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.

1. Provide the following note on the map:

THIS 1-LOT COMMERCIAL SUBDIVISION SHALL PROVIDE PERPETUAL INTERSITE COMMON DRAINAGE RIGHTS ACROSS ALL EXISTING AND FUTURE PARCEL LIMITS.

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: T21S/R60E/01
AREA Q-01

TRANSACTION REPORT

MAR/13/2018/TUE 03:40 PM

FAX (TX)

#	DATE	START T.	RECEIVER	COM.TIME	PAGE	TYPE/NOTE	FILE
001	MAR/13	03:39PM	7028782695	0:00:24	1	MEMORY OK	SG3 0798

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Parcel Number:	163-01-102-001 & more		
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FEMA Flood Zone	YES	NO	X
Proposed Storm Drain	YES	NO	X

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END OF REMARKS

ays

T/R/S: T21S/R60E/01

AREA Q-01

**TECHNICAL DRAINAGE STUDY FOR
TMP-67900
SECTION 01, TOWNSHIP 21 SOUTH, RANGE 60 EAST
CITY OF LAS VEGAS, NEVADA**

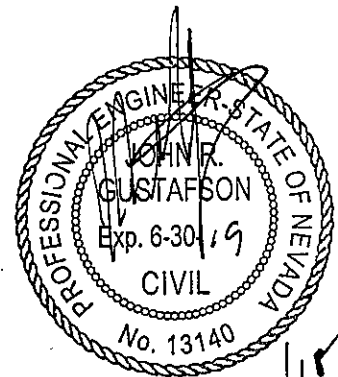
February 8, 2018

PREPARED FOR:

LVG #5, LLC
9550 S. EASTERN AVENUE, #253
LAS VEGAS, NV 89123

PREPARED BY:

BAUGHMAN & TURNER, INC.
1210 HINSON STREET
LAS VEGAS, NEVADA 89102
TEL: (702) 870-8771/FAX: (702) 878-2695



HYDROLOGIC CRITERIA AND DRAINAGE MANUAL

DRAINAGE STUDY INFORMATION FORM

Name of Development: TMP-67900 Date: January 29, 2018
 Location of Development: a) Descriptive (Cross Streets) North/South: Jones Boulevard
 East/West: Charleston Boulevard
 b) Section: 01 Township: 21 S Range: 60 E
 c) APN: 163-01-102-001, 002, 007, 037

Name of Owner: LVG #5, LLC
 Telephone No.: (702) 449-1180 Fax No.: 702-878-2695 E-Mail Address: jmaclaurin@shaw.ca
 Address 9550 S. Eastern Ave, #253 Las Vegas NV 89123

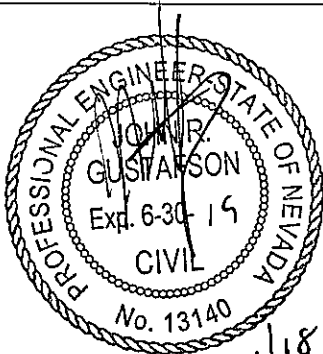
Contact Person-Name: Pamela Pitcher Telephone No.: 702-870-8771
 *E-Mail Address: pamp@baughman-turner.com Fax No.: 702-878-2695

Firm: Baughman & Turner, Inc.
 Address: 1210 Hinson Street Las Vegas, NV 89102

Type of Land Development/Land Disturbance Process:

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

- Total Owned Land Area: At Site: 2.59 acres Being Developed/Disturbed: 2.59 acres
- Is a portion or all of the subject property located in a designated FEMA Flood Hazard Area? ☐ Yes** ☒ No
- Is the property bordered or crossed by an existing or proposed Clark County Regional Flood Control District Master Planned Facility? ☒ Yes** ☐ No
- Proposed type of development (Residential, Commercial, Etc.): commercial
- Approximate upstream land area which drains to the subject site: -/+ 10 acre
- Has the site drainage been evaluated in the past? ☐ YES ☒ NO If yes, please identify documentation: _____
- If known, please briefly identify the proposed discharge point(s) of runoff from the site: North to Charleston
as it does in the existing condition.
- Briefly describe your proposed schedule for the subject project: ASAP



Engineer's Seal

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

***New Required Field**

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

Revision	Date
Local Entity File No. _____	

REFERENCE:

STANDARD FORM 1

Baughman & Turner, Inc.

Consulting Engineers & Land Surveyors

1210 HINSON ST.
LAS VEGAS, NEVADA 89102-1604

PHONE (702) 870-8771
FAX (702) 878-2695

February 8, 2018
01-21-60

City of Las Vegas, Flood Control

Attn.: Mr. Albert Sung, PE

333 N. Rancho Drive
Las Vegas, Nevada 89106

Re: Technical Drainage Study for TMP-67900

Dear Mr. Sung,

Transmitted herewith for your approval are two (2) copies of the hydrology study for LVG #5. The property lies at the southeast corner of the intersection of Jones Boulevard and Charleston Boulevard. The site is existing and this study is to satisfy the conditions of the Tentative Map.

If there are any questions concerning this study, please contact this office.

Sincerely,

Baughman & Turner, Inc.

Pamela Pitcher
Hydrology and Traffic Manager

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- L. Standard Form 2, City of Las Vegas Checklist

I. INTRODUCTION

This study analyzes the existing flows on and around a developed commercial site on 2.59 acres. This Technical Drainage Study is required by TMP-67900. Associated zoning actions GPA-67898, SUP-67953, SDR-67899 and VAC-68131 have been canceled. There will be no further development of this site, only a one lot commercial subdivision. Analysis presented herein was established after first consulting with the CCRFCD's 2013 Master Plan Update, FEMA regulations and policies, and the CCRFCD's Hydrologic Criteria and Drainage Design Manual (referred to hereafter as the HCDDM).

II. GENERAL DESCRIPTION

A. Location

The site consists of approximately 2.59 acres of developed land, located in a portion of the North Half (N½) of the Northwest Quarter (NW¼) of Section 01, Township 21 South, Range 60 East, M.D.B.&M., City of Las Vegas, Clark County, Nevada. The property lies at the southeast corner of the intersection of Charleston Boulevard and Jones Boulevard (see Figure 1, Vicinity Map). The site is more specifically described as portion of Assessor's Parcel Numbers 163-01-102-001, 002, 007, and 037 (see Figure 2, Assessor's Parcel Map).

B. Property Description

The property is about 2.59 acres of developed commercial property. An existing building was removed around 2016 creating a vacant pad on the north end of the site. The site has developed land to the north, south, west and east (See Figure 3 and 4, Aerial Map). The site is bordered by Jones Boulevard to the west and Charleston Boulevard to the north with existing multifamily residences to the east and commercial development to the south. In the existing condition, the property slopes east to the east property line then south to an existing block wall opening. The site is going to be mapped as a one lot commercial subdivision; no other development plans are expected at this time.

C. Master Planning Information

The Clark County Regional Flood Control District's (CCRFCD) 2013 Master Plan Update, a comprehensive plan to facilitate construction of regionally significant flood control structures to alleviate flooding in the Las Vegas Valley, shows one proposed facility bordering the property.

A review of the 2013 CCRFCD's Master Plan Update, Figure F-31, (see Figure 5 and 5A, Flood Control Facilities), indicates that there is one proposed facilities adjacent to or bordering the property. There is a proposed 8' x 6' RCB storm drain, identified as MECN 0123, located north of the site in Charleston Boulevard. This proposed facility is a Category A priority, that is, second five years of the 10-year plan. The proposed development is located in the middle of sub-basin CH09-C, as shown on Master Plan Figure H-31 (see Figure 6, Hydrologic Sub-basins).

A review of the City of Las Vegas' Central Neighborhood Flood Control Plan (CNFCP), Figure E-8 (See Figures 7 and 7a, Existing Drainage Conditions), indicates that there is approximately 380 and 843 cfs (10 and 100-year, respectively) in Charleston Boulevard and as much as 29 and 52 cfs in Jones Boulevard. The City's CNFCP Figure F-8, Future Drainage Conditions (See Figure 8), indicates with the construction of the Master Planned facilities, there will be less or no flow in Charleston at this location.

D. Floodplain Information

The Flood Insurance Rate Map, Clark County, Nevada, Community Panel No. 32003 C 2165 D (effective date November 16, 2011), not published by the Federal Emergency Management Agency (FEMA), indicates that the site is located in a Zone X. A Zone X is determined to be an area outside the 0.2% annual chance floodplain (see Figure 9, Flood Insurance Rate Map).

E. Previous Hydrology Studies

The following approved drainage studies were utilized in preparation of this study. Baughman & Turner, Inc. concurs with the engineering analyses presented in the studies, subject to the modifications discussed in the text of this report.

Technical Drainage Study for Desert Shadows Apartments and associated Updates, by Stantec Engineering, Orion Engineering, and Triton Engineering, Inc., last dated December 13, 2007, approved January 3, 2008, (referred to hereafter as the Desert Shadows Study). DS3226H.

This study discusses the offsite flows in Charleston and the lack of a conveyance path for the onsite flows generated by the subject site. Flows from this study will be referenced and added to the HEC-1 analysis manually. See Appendix H for referenced material.

Technical Drainage Study for Talon Professional Commercial Subdivision by James C Smith, PE, Inc., dated May 2, 2002 and approved August 13, 2002 (referred to hereafter as the Talon Study). DS3125B

This study defines the flows in Jones and does not otherwise impact this site. See Appendix I for referenced material.

Technical Drainage Study for SkipCo Building Expansion by JHR Associates, Ltd., dated November 1, 1999 and approved November 24, 1999 (referred to hereafter as the SkipCo Study). DS2577A.

This study was prepared for the subject site and discusses the drainage on the subject site before and after the expansion. This study also discusses the offsite flows in Jones and Charleston. See Appendix J for referenced material.

III. HYDROLOGY**A. Existing Offsite Drainage Conditions**

According to the SkipCo study, "The proposed building expansion may be potentially affected from the surface runoff from offsite basin CH07 as identified on Figure H-13 of the CLVCW...the anticipated ultimate surface runoff for a 100-yr storm event is 23 cfs. Offsite basin CH07 is located west from the aforementioned project site across the 100-ft right-of-way of Jones Boulevard." The SkipCo study identified the 100-yr flows from CH07 as 23 cfs, however, as identified on Figure E-08 of the CLV *Central Neighborhood Flood Control Master Plan* (CNFCMP) (See Figure 7), the flows from CH07 are 29 and 52 cfs in the 10 and 100-year storm events, respectively. As demonstrated by the Jones Boulevard depth of flow calculations, which are attached for reference, it is expected that the 59 cfs would be

contained within the westerly portion of Jones Boulevard posing no potential flooding threat to the existing site.

Offsite flows associated with Charleston Boulevard are also referenced from the CLV CNFCMP, See Figure 7. According to this reference document, the flows in Charleston at the intersection of Jones Boulevard are 380 and 843 cfs in the 10- and 100-year, 6-hour storms, respectively. This is almost double the previously approved flow of 208 and 474 cfs referenced in the CLV City Wide

No other offsite basins impact the site.

B. Existing Onsite Drainage Conditions

See Figure 10, Existing On-Site Drainage Basin Map, for existing flow patterns, basin delineation, and peak flow rates for existing onsite drainage conditions. In the existing condition, the site was analyzed as two (2) basin, labeled as OND1 AND OND2.

Basin OND1 is 2.17 acres of commercially developed land. This basin generates 6 and 3 cfs in the 100 and 10-yr, 6-hour storms, respectively. These flows travel southeast and discharge from the site through an existing 3' block wall opening to an existing 10' drainage easement on APN 163-01-111-000 as discussed in the approved drainage study for Desert Shadows.

Basin OND2 is 0.42 ac of commercially developed land with a graded dirt pad where a building recently stood. Basin OND2 generates about 2 and 1 cfs in the major and minor storm event. Runoff associated with OND2 travels northeast to exit the site at the northeast corner of the site to Charleston Blvd. These flows are included in the CLV *Central Neighborhood Flood Control Master Plan* for the flows in Charleston Blvd.

An existing condition HEC-1 model has been included in Appendix E. Reference studies can be found in Appendices H - J. Table 1 on Page 6 below summarizes the HEC-1 results for the existing conditions.

C. Interim Drainage Conditions

In the interim condition, the on and offsite is the same as the existing condition and is as discussed in Section III.A & B above.

D. Future Drainage Conditions

In the future condition the offsite flows in Charleston Boulevard will be contained in the regional facility. At this point, there will be no impact to the site from the flows in Charleston. There will be no other changes

E. Compliance with Regulations and Adopted Plans

All design criteria has been established after first consulting with the CCRFCD's 2013 Master Plan Update, FEMA regulations and policies, and the CCRFCD's Hydrologic Criteria and Drainage Design Manual. City of Las Vegas will review this study as it relates to development standards. CCRFCD will review this study as it relates to regional issues and facilities.

IV. **HYDROLOGIC/HYDRAULIC CRITERIA**

A. Soil Classification

The native soils associated with the onsite and offsite basins have been classified by the United States Department of Agriculture Soils Natural Resources Conservation Service (NRCS) in their soil survey of Las Vegas Valley Area. Soils associated with the on and off-site have been identified as Soil Unit 152, Cave gravelly fine sandy loam, Soil Unit 260, Jean gravelly loamy, fine sand, and Soil Unit 300 Las Vegas gravelly fine sandy loam. Cave gravelly fine sandy loam and Las Vegas gravelly fine sandy loam both have a weighted hydrologic curve soil group of D. Jean gravelly loamy, fine sandy has a weighted hydrologic soils group of A. The curve number for the onsite and offsite existing and developed drainage areas were calculated using Table 602 and Table 602A of the HCDDM. Calculations of the on and off-site associated curve numbers can be found in Appendix B along with the soils information. The offsite basin curve numbers can also be found in the approved referenced drainage studies (Appendices H - J).

B. Precipitation

The project and associated offsite basins are located within the McCarran Airport Rainfall area as shown on Figure 513 of the HCDDM. 10 and 100-year rainfall depths, 1.58 and 2.77, were referenced from Table 505. No aerial depth reduction factor was used. The aforementioned HCDDM figures and tables are included in Appendix C.

In accordance with the CCRFCD's Hydrologic Criteria and Drainage Design Manual, the design storm selected was a 6-hour duration storm. Three different 6-hour storm distributions are allowed in the Clark County area, labeled SDN-3, SDN-4, and SDN-5 (see Table 503). For drainage areas less than 8 square miles, an SDN-3 is required. The drainage area associated with this site is less than 8 square miles; therefore, an SDN-3 was used.

C. Time of Concentration and Lag Time

The Criteria Manual's Standard Form 4 was completed to determine the time of concentration for each drainage basin.

For all basins, which comprise less than 1 square mile, the time of concentration was calculated as follows:

$$T_c = T_i + T_t$$

Where: T_c = Time of Concentration
 T_i = Initial, inlet or overland flow time
 T_t = Travel time in the ditch, gutter, etc.

The time of concentration is the sum of the initial flow time, T_i and the travel time, T_t . The minimum T_c recommended for non-urban watersheds is 10 minutes and 5 minutes minimum for urban watersheds.

Initial flow time was calculated as follows:

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

Where: T_i = Initial overland flow time (in minutes)
 $K = 0.0132CN - 0.39$ L_o = Length of overland flow (maximum 500 feet)

CN = Curve Number

S = Average basin slope (in percent)

The lag time was calculated as follows:

$$T_{lag} = 0.6T_c \text{ (in hours) (See Appendix D for calculations)}$$

D. Summary of Findings

Table 1 lists the 100-year and 10-year, 6-hour storm flows. The HEC-1 printouts can be found in Appendices E.

Table 1. Peak Flow Summary

Existing Condition			
Source	Basin Area (ac)	100-year Flow (cfs)	10-year Flow (cfs)
OND1	2.17	6	3
Charleston Flows*	--	843	380
OND2	0.42	2	1
Jones Flows*	--	52	29

*Includes referenced flows from City of Las Vegas Central Neighborhood Flood Control Master Plan

Table 2. Peak Flow Summary

Future Condition			
Source	Basin Area (ac)	100-year Flow (cfs)	10-year Flow (cfs)
OND1	2.17	6	3
Charleston Flows*	--	0	0
OND2	0.42	2	1
Jones Flows*	--	52	29

*Includes referenced flows from City of Las Vegas Central Neighborhood Flood Control Master Plan

Analysis to determine peak flow rates were achieved using the SCS Unit Hydrograph Method. The input parameters discussed in Section IV, B – D were input into HEC-1, computer results are shown in the tables above. A summary of input parameters and the HEC-1 printouts can be found in Appendix E.

E. Facility Design Calculations

1. Street Capacity

Street capacity analyses were performed to determine the depth of flow in the surrounding streets. Table 3 summarizes the 100 and 10-year flow in the street.

Table 3.

Street Capacity Summary							
Section	Location	Slope	Q (cfs)	D (ft)	V (fps)	VxD	Remarks
10-Year Flow – Interim Conditions							
HS1	Charleston	1.19%	380	1.21	6.71	8.11	VxD <6 is not met; D greater than 1; dry lane is not met
HS2	Jones	0.85%	29	0.60	3.25	1.95	VxD <6 is met; D less than 1; dry lane is not met
HS3	Jones	0.57%	29	.69	2.88	1.99	VxD <6 is met; D less than 1; dry lane is not met
100-Year Flow – Interim Conditions							
HS1	Charleston	1.19%	842	1.57	9.16	14.38	VxD <8 is not met; D less than 2
HS2	Jones	0.85%	52	0.71	4.09	2.90	VxD <8 is met; D less than 2
HS3	Jones	0.57%	52	0.82	3.62	2.97	VxD <8 is met; D less than 2

See Appendix F for street capacity calculations. As shown in the hydraulic criteria tables (tables 1-3), the HCDDM hydraulic criteria is not always met as follows:

- 10-year DxV products are less than 6, and with depths of flow less than 1 foot. The dry lane criteria is not met on the west side of Jones Blvd, the dry lane is met on the east side.
- 10-year DxV products are more than 6, and with depths of flow more than 1 foot; and the dry lane criteria is not met in Charleston Blvd.
- 100-year DxV products are less than 8 on Jones only, and have depths of flow less than 2 feet in both streets.
- The interior drive aisles and swales will safely convey storm water towards the existing drainage easement located on the adjacent property, southeast corner of the site.

While Charleston Boulevard does not meet the HCDDM hydraulic criteria, this is an existing condition and one that Regional Flood Control has addressed in its 10-year plan. As this is an existing commercial development, flood protection can be provided for the site, if necessary.

2. Finished Floor Calculations

Street capacity analyses were performed to determine the depth of flow in Jones and Charleston Boulevard and finished floor elevations were checked against these depths. Table 4 below summarizes the method to determine the proposed finished floor elevation.

Table 4. Minimum Finished Floor Elevation Determination

Bldg #/adjacent street	Top of Curb of Adjacent street	Free-board	FF Based on top of curb	Flowline Elevation	Depth of Flow	Free-board	Finished Floor Based on Depth of Flow	Minimum Elevation
Exist. Bldg 1/Jones	93.5	0.5	94.0	91.88	0.82	0.82	93.52	2292.24
Future Pad/Charleston	90.11	0.5	90.11	89.61	1.57	1.5	92.68	2292.68

Finish Floor Elevation analysis for the building was determined according to the specifications outlined in the CCRFCD's *Hydrologic Criteria and Drainage Manual*. The finished floor must be set a minimum of twice the depth of flow, or 6-inches above the top of curb, whichever is highest. The property is addressed off of Charleston and the existing

and future building are based off of this street. The existing building is more than 200 ft from the right-of-way of Charleston and is not expected to be impacted by flows in Charleston. The existing building finished floor was checked based off of flow depths in Jones. The existing building finished floor elevation does not meet the criteria based on depth of flow of either street. It does meet the 6-inches above the top of curb based on Charleston, the addressing street.

The future finished floor elevation should be set at a minimum of 2292.68 based off of flows in Charleston Blvd, the addressing street

3. Best Management Practices

The table below provides the calculations for the impervious area for parking lots and LID's. The site will conform to the Section 1500; Structural Best Management Practices as referenced within the Clark County Flood Control District (CCRFD) Hydrologic and Drainage Design Manual (HCDDM).

PARKING LOT AREA	ACERAGE
Property size (PS)	2.59
Building Area (BA)	0.23
Total Pervious Area (TPA)	0.35
Parking Lot Area (PLA) PLA = PS-BA-TPA	2.0
Min. PLA to be treated Min = PLA x 0.75	1.5

4. Proposed Facilities

There are no proposed facilities at this time. The future building should have these recommendations:

- Positive onsite grading
- Set the future finished floor elevations at 2292.68 as a minimum.

V. CONCLUSIONS

A. Compliance with Agency Regulations

City of Las Vegas will review the Hydrology Study as it relates to development standards and overall facility effectiveness. Below is a discussion of the effectiveness of the proposed drainage scheme. Clark County Regional Flood Control District will review the study as it relates to future regional facilities. This study complies with the standards as set forth in the CCRFCD's Hydrologic Criteria and Drainage Design Manual.

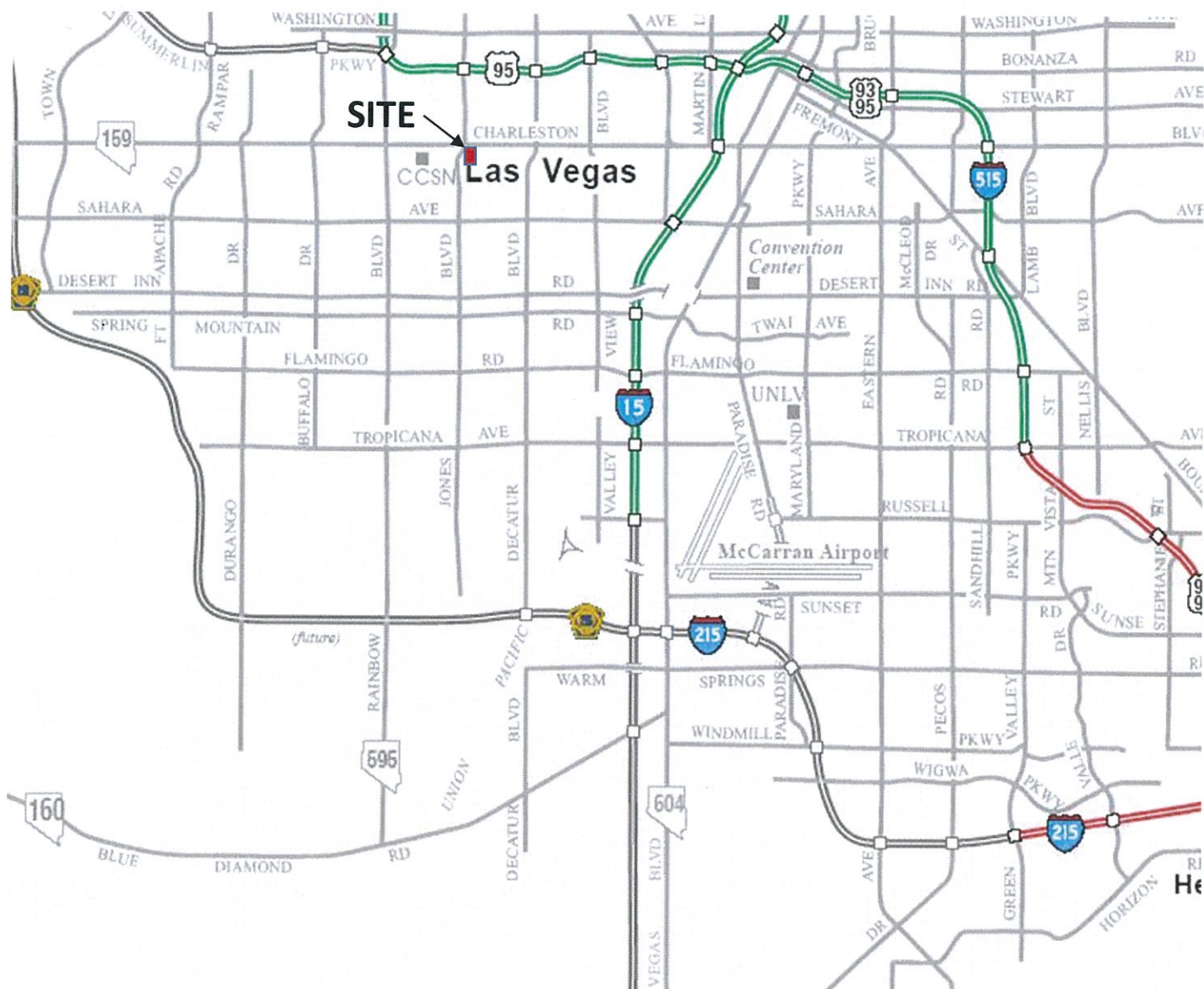
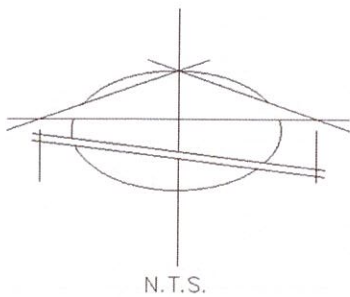
B. Overall Facility Effectiveness

As this site is currently developed, runoff from this site will not adversely affect surrounding property owners, since current drainage patterns have not been changed. In the future condition, the decrease in flows in Charleston will provide even more protection for the existing site.

VI. REFERENCES

The following documents were used in the preparation of this hydrology study update:

- 1) DRAINAGE DESIGN MANUAL, 1999 - Hydrologic Criteria and Drainage Design Manual, Clark County Regional Flood Control District.
- 2) CCRFCD, 2013 - Flood Control Master Plan Update, Volume 1, Clark County Regional Flood Control District, James M. Montgomery Consulting Engineers, Inc., September, 2013.
- 3) NRCS, 2018 - Soil Survey of the Las Vegas Valley Area, Nevada, United States Department of Agriculture Soils, Natural Resources Conservation Service, Washington D.C., January 30, 2018.
- 4) FEMA, 2011 - Flood Insurance Rate Maps, Clark County, Nevada, U.S. Federal Emergency Management Agency, November 16, 2011.
- 5) HEC, 1998 - HEC-1vm v.2 Flood Hydrograph Package, User's Manual, U.S. Army Corps of Engineers, the Hydrologic Engineering Center, Davis, California, 1998.
- 6) Technical Drainage Study for Desert Shadows Apartments and associated Updates (DS3226H) by Stantec, Orion and Triton Engineering, last updated December 2007, approved January 3, 2008.
- 7) Technical Drainage Study for Talon Professional Commercial Subdivision (DS3125B) by James C Smith, PE, dated May 2, 2002, approved August 13, 2002.
- 8) Technical Drainage Study for SkipCo Building Expansion (DS2577A) by JHR Associates, Ltd., dated November 1, 1999, approved November 24, 1999.



VICINITY MAP

FIGURE 1

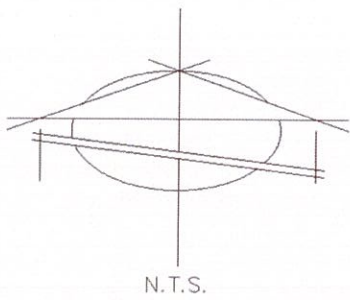


BAUGHMAN & TURNER, INC.
 CIVIL ENGINEERS LAND PLANNERS
 LAND SURVEYORS
 1210 HINSON STREET LAS VEGAS, NEVADA 89102
 (702) 870-8771

PREPARED FOR :

LVG #5, LLC

DATE: 2017
 DESIGN: PJP
 DRAWN: PJP
 JOB: 01-21-60



Charleston Blvd



AERIAL VIEW

FIGURE 3

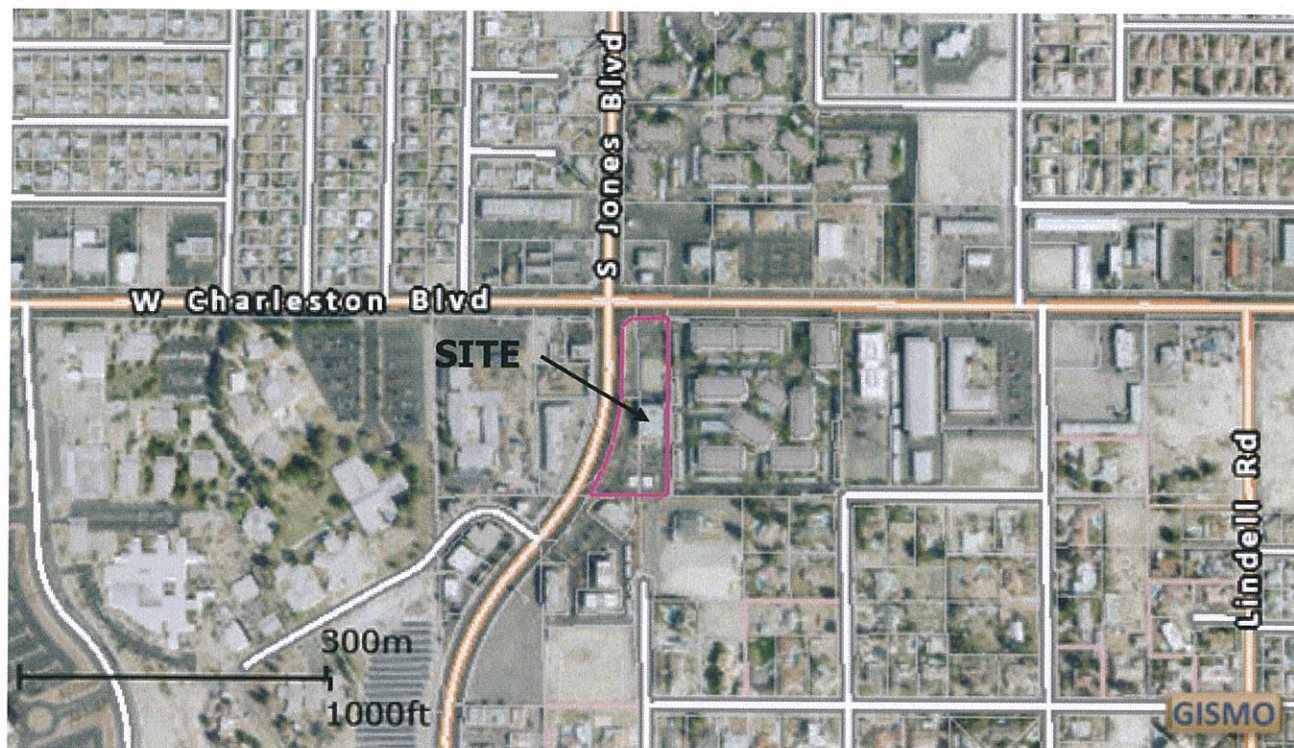
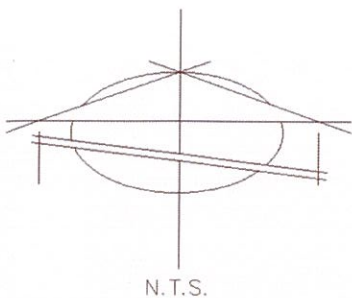


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PREPARED FOR :

LVG #5, LLC

DATE: 2017
 DESIGN: PJP
 DRAWN: PJP
 JOB: 01-21-60



GENERAL AERIAL VIEW

FIGURE 4



BAUGHMAN & TURNER, INC.
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 (702) 870-8771

PREPARED FOR :

LVG #5, LLC

DATE: 2017
 DESIGN: PJP
 DRAWN: PJP
 JOB: 01-21-60

ID / River Mile	Status	Facility Description	Length (ft.)	Flow (cfs)	HEC-1 Node	HEC-1 Model	Tributary Area (sq.mi.)	Channel Slope (%) **
BHSA		BOULDER HIGHWAY SAHARA AVENUE						
0175	P1	14' X 14' RCB	6000	3837	CSA13	SW3	7.93	0.67
0289	P1	14' X 12' RCB	2300	3566	CSA11	SW3	7.55	0.87
0331	P1	14' X 11' RCB	2000	3232	CSA10-1	SW3	7.15	1.00
CHRA		WEST CHARLESTON DRAINS - RANCHO						
0000	E	6' X 5' RCB	310	286	CAL95	SW3	0.62	1.92
0006	E	5' X 5' RCB	420	286	CAL95	SW3	0.62	1.00
0014	E	5' X 4' RCB	600	286	CAL95	SW3	0.62	1.50
FLBN		FLAMINGO - BOULDER HIGHWAY NORTH						
0281	P1	10' X 7' RCB	1300	1259	CCH56	SW3	1.64	1.33
0312	P1	7' X 4' RCB	1800	555	CCH52	SW3	0.55	4.20
0342	P1	7' X 4' RCB	2500	555	CCH52	SW3	0.55	4.20
FLFA		FLAMINGO - FASHION						
0000	E	12' X 5' RCB	2050	747	CFW17N	FLAM3A	0.72	0.28
0037	E	8' X 5' RCB	3060	526	FW14	FLAM3A	0.44	0.45
FW15		FREEWAY CHANNEL FROM DESERT INN TO EXPRESSWAY						
0000	E	3: 12' X 10' RCB	2170	3728	CAL93	SW4	10.53	0.17
0010	E	3: 12' X 10' RCB	677	3403	CAL96	SW4	10.10	0.17
0038	E	3: 12' X 10' RCB	1945	3344	CCCH22	SW4	9.92	0.17
0050	E	3: 12' X 10' RCB	870	2613	CCH50	SW4	8.54	0.17
0089	E	3: 12' X 10' RCB	980	2448	CCWAL2	SW4	8.28	0.17
0100	E	3: 12' X 9' RCB	1575	2295	COK11C	SW3	7.83	0.17
0125	E	2: 10' X 8' RCB	1350	1450	DCCSA08	SW3	6.67	0.80
0150	E	2: 10' X 8' RCB	1067	1450	DCCSA08	SW3	6.67	0.80
0175	E	2: 10' X 8' RCB	985	1450	DCCSA08	SW3	6.67	0.75
0214	P1	2: 12' X 10' RCB	1610	4104	CED10-C	SW3	6.25	0.73
0242	P1	2: 12' X 9' RCB	1500	3968	CCPS08	SW3	6.03	0.93
0271	P1	2: 12' X 10' RCB	1520	3674	CPS08	SW3	5.59	0.59
0301	P1	Conc Chnl 12'W 4'D 2:1 SS	1300	433	CCE3FD-C	SW3	0.54	0.42
FWCH		WEST CHARLESTON DRAIN						
0000	E	10' X 7' RCB	1710	1008	CCH22	SW3	1.38	0.74
0020	E	10' X 7' RCB	840	783	CCCH18-C	SW3	1.15	0.40
0036	E	9' X 7' RCB	425	783	CCCH18-C	SW3	1.15	0.40
0044	E	9' X 7' RCB	145	538	CCH18-C	SW3	0.53	0.40
0047	E	7' X 5' RCB	710	538	CCH18-C	SW3	0.53	2.05
0060	E	5' X 4' RCB	400	538	CCH18-C	SW3	0.53	0.40
FWOK		OAKEY DRAIN						
0000	E	10' X 8' RCB	1350	928	1COK11C	SW3	1.16	0.62
0020	E	10' X 8' RCB	1025	928	1COK11C	SW3	1.16	0.60
0040	E	8' X 8' RCB	960	721	COK10	SW3	0.85	1.00
0060	E	5' X 5' RCB	970	453	COK09-C	SW3	0.55	1.50
0076	E	6' X 6' RCB	1175	453	COK09-C	SW3	0.55	9.40
0100	E	6' X 6' RCB	980	453	COK09-C	SW3	0.55	1.98
FWPS		PALMYRA / SIRIUS DRAIN						
0000	P1	12' X 11' RCB	3000	3240	CCPS06	SW3	4.88	1.50
0057	P1	10' X 10' RCB	5220	1941	CPS06	SW3	2.78	1.28
0157	P1	2: 66" RCP	5100	521	CPS03	SW3	0.60	1.15
FWR2		FREEWAY CHANNEL - RAILROAD CHANNEL						
0000	E	5' X 5' RCB	377					1.60
0020	E	Earth Chnl 10'W 4'D 2:1 SS	650					0.50
FWRR		FREEWAY CHANNEL BYPASS FACILITY RR BRANCH						
0000	E	48" RCP	70					1.22
0010	E	Conc Chnl 4'W 4'D 0:1 SS	220					1.22
FWSA		FREEWAY CHANNEL - SAHARA						
0000	P1	7' X 5' RCB	5700	486	CSA08	SW3	0.42	1.49
FWSH		SHADOW LANE DRAIN						
0000	E	7' X 4' RCB	950	253	CH22-C	SW3	0.23	0.20

ID / River Mile	Status	Facility Description	Length (ft.)	Flow (cfs)	HEC-1 Node	HEC-1 Model	Tributary Area (sq.mi.)	Channel Slope (%) **
FWUP		FREEWAY CHANNEL BYPASS FACILITY						
0000	E	10' X 9' RCB	350	242	CH50	SW3	0.26	0.37
0010	E	10' X 8' RCB	804	242	CH50	SW3	0.26	0.37
0059	E	10' X 6' RCB	2680	242	CH50	SW3	0.26	0.40
0100	E	8' X 4' RCB	1440	242	CH50	SW3	0.26	0.47
FWVW		VALLEY VIEW DRAIN						
0000	P1	12' X 11' RCB	1320	1475	CCE3FA	SW3	2.67	0.30
0025	P1	10' X 10' RCB	2665	1006	CR4C1	SW3	1.74	0.30
0050	P1	8' X 6' RCB	7785	712	DFW5	SW3	1.34	1.50
FWWL		FREEWAY CHANNEL-WALDMAN AVENUE						
0000	E	6' X 6' RCB	1000	418	CWAL2	SW3	0.45	0.20
LCCH		LAS VEGAS CREEK CHANNEL						
0000	E	2: 12' X 7' RCB	730	2894	CLC20-C	MEADOWS4	9.68	1.28
0013	E	2: 12' X 6' RCB	2035	2894	CLC20-C	MEADOWS4	9.68	0.82
0051	E	2: 14' X 7' RCB	3113	2894	CLC20-C	MEADOWS4	9.68	0.60
0110	E	Transition Structure	220	2798	CCLC16-C	MEADOWS4	9.51	
0114	E	2: 14' X 7' RCB	670	2329	CRMEDET	MEADOWS4	8.25	0.80
0127	E	Transition Structure	110	2329	CRMEDET	MEADOWS4	8.25	
0139	E	2: 14' X 7' RCB	1130	2329	CRMEDET	MEADOWS4	8.25	0.50
0150	E	2: 13' X 7' RCB	200	2329	CRMEDET	MEADOWS4	8.25	0.95
0154	E	Transition Structure	190	2329	CRMEDET	MEADOWS4	8.25	
0157	E	2: 12' X 6' RCB	1650	1631	CCLC14-C	SW3	2.99	1.06
0230	E	12' X 6' RCB	2140	1381	CLC14-C	SW3	2.54	1.74
0270	E	12' X 6' RCB	1705	774	CCWA02-C	SW3	1.84	0.54
0302	E	8' X 6' RCB	3940	774	CCWA02-C	SW3	1.84	2.49
0377	E	10' X 7' RCB	1226	774	CCWA02-C	SW3	1.84	0.74
0400	E	Transition Structure	110	437	CWA02-C	SW3	1.47	0.49
0402	E	8' X 6' RCB @ Jones	535	437	CWA02-C	SW3	1.47	0.49
0412	E	60" RCP	1370	437	CWA02-C	SW3	1.47	1.08
0438	E	60" RCP	1090	162	CLC01-C	SW3	1.20	1.60
0458	E	60" RCP	1060	162	CLC01-C	SW3	1.20	1.60
0478	E	60" RCP	1110	162	CLC01-C	SW3	1.20	0.55
LCDE		LAS VEGAS CREEK - DECATUR						
0000	E	6' X 5' RCB	1800	404	LC11-C	SW3	0.38	1.26
0034	E	72" RCP	700	404	LC11-C	SW3	0.38	0.50
LCJA		LAS VEGAS CREEK - JONES						
0000	E	6' X 6' RCB	380	358	AL01B-C	SW3	0.37	0.50
0007	E	6' X 5' RCB	675	358	AL01B-C	SW3	0.37	0.62
LCME		LAS VEGAS CREEK - MEADOWS						
0000	E	14' X 8' RCB	895	1423	MEADOWDB	SW3SC	5.67	0.72
0016	E	Stilling Basin	140	1423	MEADOWDB	SW3SC	5.67	0.21
0017	E	3,300 cfs Spillway (Replace w/ LCME0018)	3300		MEADOWIN	SW3SC	5.67	
0018	P1	Modify Spillway, raise height by 1' (Replaces LCME0017)	3300		MEADOWIN	SW3SC	5.67	
0019	E	1: 11' X 5' RCB and 1: 11.5' X 5' RCB	110	1423	MEADOWDB	SW3SC	5.67	0.81
0020	E	213 ac-ft Meadows Detention Basin	4713		MEADOWIN	SW3SC	5.67	
0021	P1	Upgrade to 235 ac-ft Meadows Detention Basin	4713		MEADOWIN	SW3SC	5.67	
0026	E	Energy Dissipator	110	4713	MEADOWIN	SW3SC	5.67	2.94
0028	E	Conc Chnl 42'W 9'D 0:1 SS	922	4713	MEADOWIN	SW3SC	5.67	0.40
0040	E	Conc Chnl 40'W 10'D 0:1 SS	525	4593	CAL90-C	SW3SC	5.44	0.40
0070	E	Conc Chnl 40'W 8.5'D 0:1 SS	255	4593	CAL90-C	SW3SC	5.44	0.40
0076	E	Free Span Bridge 18'W 8'D @ Alta	100	4441	CCAL16	SW3SC	5.27	1.89
0077	E	Conc Chnl 18'W 8'D 1:1 SS	618	4441	CCAL16	SW3SC	5.27	1.89
0085	E	10' X 6' RCB @ Valley View	275	1661	1CAL16	SW3	2.09	1.89
LCRA		LAS VEGAS CREEK - RANCHO						
0000	E	12' X 8' RCB	380	783	CLC16-C	SW3	1.71	0.60
0004	E	12' X 6' RCB	2367	783	CLC16-C	SW3	1.71	0.77
LVDE		OWENS AVENUE - EAST						
0345	P1	13' X 11' RCB	1685	2369	DLVOE	SW5	22.79	0.60

ID / River Mile	Status	Facility Description	Length (ft.)	Flow (cfs)	HEC-1 Node	HEC-1 Model	Tributary Area (sq.mi.)	Channel Slope (%) **
LWVH		WASHINGTON AVENUE CHANNEL						
0431	E	3: 14.33' X 10' RCB	665	2870	DCLC21	SW5	22.79	0.15
0446	E	Junction Structure	69	2870	DCLC21	SW5	22.79	0.15
0447	E	3: 14.33' X 10' RCB	1955	4978	CCAL93	SW5	22.19	0.15
0484	E	Confluence Structure	455	4978	CCAL93	SW5	22.19	0.15
MEAL		MEADOWS ALTA						
0000	E	Conc Chnl 8'W 11'D 1:1 SS	700	1207	CAL13-3	SW3	1.48	1.58
0012	E	12' X 6' RCB @ Red Sky	160	1161	CAL10-C	SW3	1.42	3.03
0013	E	Conc Chnl 8'W 11'D 1:1 SS	320	1161	CAL10-C	SW3	1.42	3.03
0015	E	72" RCP	2500	1126	CAL11-C	SW3	1.38	1.94
0060	E	60" RCP	905	792	CBR3	SW3	1.08	1.00
0100	E	72" RCP	1160	792	CBR3	SW3	1.08	1.00
0120	E	60" RCP	3500	733	CAL05-C	SW3	1.01	1.00
0130	E	6' X 4' RCB	1150	186	AL04-C	SW3	0.18	0.40
0150	E	60" RCP	285	499	CCUS	SW3	0.74	1.40
0160	E	36" RCP	2600	331	CUS	SW3	0.56	1.25
0209	E	48" RCP	2500	150	DCR2	SW3	0.41	1.70
MECH		EXTENSION OF MEADOWS / CHARLESTON						
0059	E	36" RCP	1310					0.25
0084	E	30" RCP	2960					1.26
0108	E	30" RCP	8550	32	OAKEYOT	SW3	1.88	1.43
0310	E	24" RCP	1000	32	OAKEYOT	SW3	1.88	1.43
0323	E	15" RCP Outlet	200	32	OAKEYDB	SW3	1.88	
0324	E	201 ac-ft Oakley Detention Basin		1652	OAKEYIN	SW3	1.88	
0334	E	11' X 6' RCB	200	573	C5-OAK-C	SW3	0.56	0.50
0337	E	9' X 6' RCB	520	573	C5-OAK-C	SW3	0.56	0.50
0338	E	10' X 8' RCB	2060	1131	C3A-OAKC	SW3	1.32	1.62
0351	E	90" RCP	1350	573	C5-OAK-C	SW3	0.56	0.50
MECN		MEADOWS - CHARLESTON						
0000	P1	9' X 8' RCB	1570	1105	CCH10	SW3	1.00	1.09
0061	P1	8' X 7' RCB	3300	1105	CCH10	SW3	1.00	1.82
0123	P1	8' X 6' RCB	5200	821	CCH09-C	SW3	0.72	1.64
0223	P1	6' X 5' RCB	2700	422	CCH05-C	SW3	0.34	2.04
MEOK		OAKEY MEADOWS STORMDRAIN						
0000	E	19' X 7' RCB	900	2718	COK13	SW3SC	2.94	0.91
0017	E	19' X 8' RCB	1550	2718	COK13	SW3SC	2.94	0.80
0048	E	18' X 9' RCB	1700	2718	COK13	SW3SC	2.94	0.50
0070								



FIGURE 6



City of Las Vegas

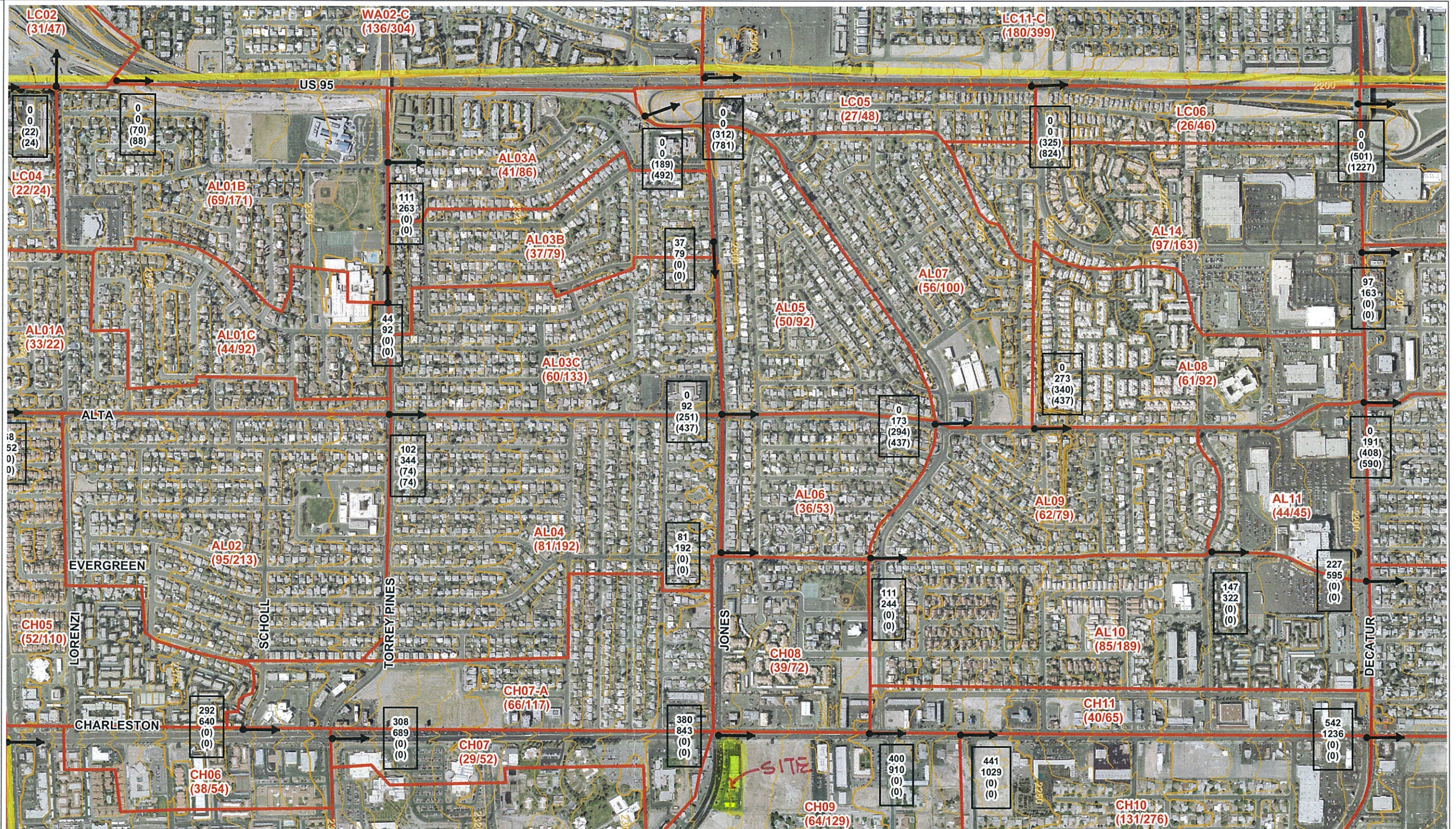
CENTRAL NEIGHBORHOOD FLOOD CONTROL MASTER PLAN

LEGEND

- Sub-basin Boundary
- LV12 Basin ID
- (10yr./100yr.) Contributing flow from the basin (cfs)
- Flow Arrow
- 250 10-Year Street Flow
500 100-Year Street Flow
(300) 10-Year Facility Flow
(800) 100-Year Facility Flow
(Flows in CFS)
- Study Area Limit

PHOTO DATE: SPRING 2004

FIGURE E-8



EXISTING DRAINAGE CONDITIONS

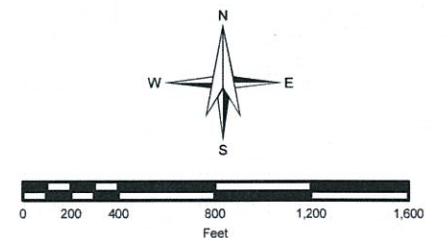


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	Durango	Rainbow	Decatur	Tonopah	5th	Pecos	Nellis
Lake Mead				1	2		
Washington				3	4	5	6
Charleston	7	8	9	10	11	12	
Sahara	13	14	15	16	17		
Desert Inn		18	19				

NOTE:
Existing conditions are based on future
Curve Number values with only existing local and
CCRFCD facilities in place.

100-Year flows at locations where a 100-Year
subbasin concentration point does not exist in the
hydrology model were based on an area-weighted
ratio of the 100-Year flows from concentration points
upstream and downstream of the location. See
Volume I for a more detailed explanation.



SCALE: 1 inch = 800 feet

FIGURE 7



City of Las Vegas

2004 CITY OF LAS VEGAS
CENTRAL NEIGHBORHOOD
FLOOD CONTROL MASTER PLAN

LEGEND

REGIONAL STREAM NAME DESIGNATOR	AABB
REGIONAL MILE	0000
LOCAL STREAM NAME DESIGNATOR	AAB
LOCAL ID NUMBER	000
EXISTING FACILITY	E
PROPOSED OR MODIFIED FACILITY	P
CONTINGENCY LEVEL:	
CATEGORY B	P0
MASTER PLAN	P1
PRELIMINARY DESIGN	P2
DESIGN	P3
BOTTOM WIDTH	W
DEPTH	D
SIDE SLOPE, H:V	SS
LEFT SIDE SLOPE H:V	LSS
RIGHT SIDE SLOPE H:V	RSS
CORRUGATED METAL ARCH PIPE CULVERT	CMAP
CORRUGATED METAL PIPE CULVERT	CMP
DUCTILE IRON PIPE	DIP
HIGH DENSITY POLYETHYLENE PIPE	HDPE
HELICAL ELLIPTICAL REINFORCED	HERCP
CONCRETE PIPE	PDE
PUBLIC DRAINAGE EASEMENT	PVC
POLYVINYL CHLORIDE PIPE	RCB
REINFORCED CONCRETE BOX CULVERT	RCBC
REINFORCED CONCRETE ELLIPTICAL PIPE	RCEP
REINFORCED CONCRETE PIPE	RCP
REINFORCED CONCRETE PIPE ARCH	RCPA
REINFORCED CONCRETE PIPE CULVERT	RCPC
STORM SEWER PIPE	SSP
VITRIFIED CLAY PIPE	VCP

NOTES:
FLOW = 100 YEAR HEC-1 FLOW (REGIONAL)
FLOW = FACILITY CAPACITY (LOCAL FACILITIES)

FLOOD CONTROL FACILITIES INVENTORY

SHEET I - 5



ID	MILE	Status	Plan No.	Facility Description	Facility Length L (ft)	Channel Slope S (%)	Flow (cfs)
F-8							
REGIONAL FACILITIES							
LAS VEGAS CREEK CHANNEL							
LCCH	0249	E	HWY BK E-4	60" RCP	2693	1.13	277
LCCH	0300	E	HWY BK E-4	48" RCP	1109	1.13	153
LCCH	0321	E	HWY BK E-4	48" RCP	1214	1.13	153
LCCH	0344	E	HWY BK E-5	48" RCP	1531	0.66	117
LCCH	0373	E	HWY BK E-5	60" RCP	2246	0.66	212
LCCH	0420	E	HWY BK E-5	60" RCP	1109	1.50	319
LCCH	0441	E	HWY BK E-5	48" RCP	1098	1.50	176
LCCH	0460	E	HWY BK E-5	36" RCP	1289	1.62	85
LCCH	0486	E	HWY BK E-5 & R-3	42" RCP	922	1.10	106
LCCH	0502	E		36" RCP	792	1.10	70
LAS VEGAS CREEK CHANNEL - PARALLEL SYSTEM							
LCCP	0173	E2	NDOT U.S. 95 Widening	2: 12' X 6' RCB	3690	0.58	1194
LCCP	0243	E2	NDOT U.S. 95 Widening	2: 8' X 6' RCB	5658	1.03	1194
LCCP	0350	E2	NDOT U.S. 95 Widening	60" RCP	3050	1.00	783
LCCP	0408	E2	NDOT U.S. 95 Widening	36" RCP	2452	1.86	91
LCCP	0452	E2	NDOT U.S. 95 Widening	Spillway			8260
LCCP	0453	E2	NDOT U.S. 95 Widening	36" RCP Outlet Pipe	100	1.86	91
LCCP	0454	E2	NDOT U.S. 95 Widening	55 ac-ft Rainbow Detention Basin			891
LAS VEGAS CREEK - DECATUR							
LCDE	0000	E	2002 Master Plan Update	72" RCP	720	0.50	494
MEADOWS ALTA							
MEAL	0015	E	327-V231	72" RCP	2620	1.94	461
MEAL	0060	E	327-V231	60" RCP	5200	2.81	461
MEAL	0160	E	107-V1517-A	36" RCP	2505	1.22	358
MEADOWS ALTA PARALLEL							
MEAP	0000	P1	2003 CNFCMP	8' X 5' RCB	8400	1.25	677
MEAP	0172	P1	2003 CNFCMP	8' X 6' RCB	1100	0.30	416
MEADOWS - CHARLESTON							
MECN	0000	P1	2002 Master Plan Update	10' X 9' RCB	3200	1.09	1547
MECN	0061	P1	2002 Master Plan Update	8' X 8' RCB	3300	1.82	1313
MECN	0123	P1	2002 Master Plan Update	8' X 7' RCB	5200	1.64	1041
MECN	0223	P1	2002 Master Plan Update	7' X 6' RCB	2700	2.04	676
LOCAL FACILITIES							
CHN	360	E	107-V725A	18" RCP	1347		12
CHN	370	E	107V-853	18" RCP	12796		14
CHN	371	E	107-V1133	12" RCP	250	0.22	2
CHN	372	E	107-V2079	12" RCP	89	0.31	3
CHN	380	E	107-V1055	12" RCP	495		3
DCR	025	E	113-160	12" RCP	301		3
DCR	030	E	107-V1993	48" RCP	1500	0.12	144
DCR	031	E	327-V72	6" VCP	380		3
DCR	032	E	327-V72	15" RCP	564		3
DCR	035	E	107-V536	16" RCEP	256		7
DCR	040	E	327-V72	12" RCP	958	0.04	1
DCR	050	E	327-113	18" RCP	368	0.60	11
DCR	051	E	107-V717B	23" X 36" CMP	115		30
DCR	060	E	HWY BK # E-4	24" RCP	375		73
DCR	070	E	107-V817	15" RCP	713		6
FAL	010	E	327Y-4075	36" RCP	115	3.00	100
JNS	030	E	107-V948A	18" RCP	1429		6
JNS	040	E	107-V948A	15" RCP	1063		4
JNS	045	E	107-V948A	12" RCP	1306		2
JNS	048	E	327-V162 / 107-V948A	8" RCP	71		1
JNS	050	E	327-V162 / 107-V948A	12" RCP	183		2
JNS	060	E	327-V162	24" RCP	300		23
JNS	070	E	107-V948A	12" RCP	2095		2
RNB	050	E	Hwy Bk R-3	30" RCP	630	1.37	42
RNB	055	E	Hwy Bk R-6	36" RCP	666	0.40	37
RNB	100	E	Hwy Bk R-6	18" RCP	700	0.47	6
RNB	120	E	Hwy Bk R-6	60" RCP	230	5.35	522
RNB	130	E	107-V1663	36" RCP	260		94
RNB	150	E	107Y-2159-2	24" RCP	180	2.40	35
RNB	190	E	Hwy Bk R-6	30" RCP	90	0.00	
RNB	200	E	Hwy Bk R-6	18" RCP	325	0.30	6
RNB	220	E	107Y-2159-3	5" P.D.E.	30		
TRP	000	E	107-1517	18" CMP	3734		6
TRP	001	E	650.41	12" HDP	168	0.01	4
VVB	170	E	107-V1137	24" RCP	4000		23

ID	MILE	Status	Plan No.	Facility Description	Facility Length L (ft)	Channel Slope S (%)	Flow (cfs)
F-9							
REGIONAL FACILITIES							
WEST CHARLESTON DRAINS							
FWCH	0000	E	2002 Master Plan Update	84" RCP	1600	0.93	960
FWCH	0020	P1	2004 CNFCMP	10' X 7' RCB	1200	0.70	960
FWCH	0021	P1	2004 CNFCMP	8' X 4' RCB	1500	0.50	267
FWCH	0022	P1	2004 CNFCMP	8' X 6' RCB	800	0.70	515
SHADOW LANE DRAIN							
FWSH	0000	E	2002 Master Plan Update	7' X 4' RCB	1034	0.20	253
LAS VEGAS CREEK CHANNEL							
LCCH	0047	E	HWY BK E-3	Conc Chnl 9'W 8'D 3:1SS	3485	0.80	2699
LCCH	0113	E	HWY BK E-3	2 : 8' X 7' RCBC @ Rancho	100	0.84	1896
LCCH	0114	E	HWY BK E-4	Conc Chnl 9'W 7'D 1:1SS	2400	0.84	2515
LCCH	0176	E	HWY BK E-4	Conc Chnl 11'W 7'D	800	2.14	2362
LCCH	0184	E	HWY BK E-4	8' X 6' RCB Drain	2200	2.27	1284
LCCH	0249	E	HWY BK E-4	60" RCP	3300	1.13	277
LAS VEGAS CREEK CHANNEL - PARALLEL SYSTEM							
LCCP	0173	P2	2002 Master Plan Update	2: 12' X 6' RCB	3690	0.58	1194
LAS VEGAS CREEK - MEADOWS							
LCME	0000	E	565-354	14' X 8' RCB	1540	0.90	1336
LCME	0017	E	565-354	Spillway			3300
LCME	0018	E	565-354	1-11.5' X 5' RCB and 1-11' X 5' RCB Outlet Pipes	100	0.81	1336
LCME	0019	E	731-45-1A	200 ac-ft Meadows Detention Basin			4673
LCME	0020	E	565-354	Upgrade to 228 ac-ft Meadows Detention Basin			4673
LCME	0027	E	565-354	Conc Chnl 30'W 8.5'D	1000	0.40	4673
LCME	0039	E	731-45-1A	Conc Chnl 18'W 8'D 1:1SS	950	0.92	4292
LCME	0076	E	731-45-1A	Free Span Bridge 18'W 8'D @ Alta	100	1.89	4292
LCME	0077	E	731-45B-1A	Conc Chnl 18'W 8'D 1:1SS	370	1.89	4292
LCME	0084	E	731-45-1A	2 : 10' X 6' RCBC @ Valley View	174	1.89	1251
LCME	0085	E	731-45B-1B	2 : 10' X 6' RCBC @ Valley View	464	1.89	1251
LAS VEGAS CREEK - RANCHO							
LCRA	0000	E	2002 Master Plan Update	8' X 6' RCB	2500	0.50	773
MEADOWS ALTA							
MEAL	0000	E	731-45B-1B	Conc Chnl 8'W 11'D 1:1SS	710	1.58	1251
MEAL	0012	E	731-45B-1B	12' X 6' RCBC @ Red Sky	158	3.03	1251
MEAL	0013	E	731-45B-1B	Conc Chnl 12'W 9'D 1:1SS	317	3.03	1251
MEAL	0015	E	327-V231	72" RCP	2620	1.94	461
MEADOWS ALTA PARALLEL							
MEAP	0000	P1	2003 CNFCMP	8' X 5' RCB	8400	1.25	677
EXTENSION OF MEADOWS / CHARLESTON COLLECTION SYSTEM							
MECH	0000	E	731-45B-1B	10' X 6' RCB	1190	0.50	820
MECH	0021	E	731-45B-1B	6' X 5' RCB	211	1.16	487
MECH	0025	E	731-45B-1B	78" RCP	475	1.16	565
MECH	0034	E	731-45B-1C	84" RCP	1267	0.44	424
MECH	0058	E	731-55	72" RCP	700	0.42	274
MECH	0059	E	731-55	36" RCP	1280	0.42	43
MEADOWS - CHARLESTON							
MECN	0000	P1	2002 Master Plan Update	10' X 9' RCB	3200	1.09	1547
OAKLEY-15 STORM DRAIN							
MEOK	0000	P1	2002 Master Plan Update	3: 12' X 6' RCB	3300	0.61	2550
MEOK	0063	P1	2002 Master Plan Update	12' X 8' RCB	5100	0.75	1433
LOCAL FACILITIES							
ALT	000	E	107V-1164	Chnl V-Ditch	531		12
ALT	015	E	107-V3126	60" RCP	982	0.35	215
ALT	020	E	107-V3126	54" RCP	1538	0.50	187
ALT	025	E	107-V3126	48" RCP	460	1.40	165
ALT	026	E	107-V3126	48" RCP	157	1.48	88
ALT	028	E	107-V3126	36" RCP	88	0.25	77
ALT	031	E	107-V3126	30" RCP	572	0.25	57
ALT	033	E	107-V3126	30" RCP	769	0.25	32
ALT	035	E	107-V2771	8" PVC	600		
CHN	295	E	107-V2255	6" PVC	87	0.50	1
CHN	300	E	107-V725A	24" RCP	6460		10
CHN	312	E	107-V2406	12" RCP	126	0.30	2
CHN	313	E	107-V2406	8" PVC	100	0.30	1
CHN	315	E	107-V725A	2: 34" X 53" RCP	370		86
CHN	316	E	107-V725A	43" X 68" RCP	675		169
CHN	317	E	107-V725A	38" X 60" RCP	300		123
CHN	340	E	107-V725A	36" RCP	716		80
CHN	350	E	107-V725A	24" RCP	383		18

FIGURE 7a



+ PANEL NOT PRINTED - OUTSIDE COUNTY BOARD

FIRM
FLOOD INSURANCE RATE MAP
CLARK COUNTY,
NEVADA
AND INCORPORATED AREAS
(SEE LISTING OF COMMUNITIES TABLE)

MAP INDEX

PANELS PRINTED: 225, 250, 275, 300, 325, 350, 375, 400, 425, 450, 475, 500, 525, 550, 575, 600, 625, 650, 675, 700, 725, 750, 775, 800, 825, 850, 875, 900, 925, 950, 975, 1000, 1025, 1050, 1075, 1100, 1125, 1150, 1175, 1200, 1225, 1250, 1275, 1300, 1325, 1350, 1375, 1400, 1425, 1450, 1475, 1500, 1525, 1550, 1575, 1600, 1625, 1650, 1675, 1700, 1725, 1750, 1775, 1800, 1825, 1850, 1875, 1900, 1925, 1950, 1975, 2000, 2025, 2050, 2075, 2100, 2125, 2150, 2175, 2200, 2225, 2250, 2275, 2300, 2325, 2350, 2375, 2400, 2425, 2450, 2475, 2500, 2525, 2550, 2575, 2600, 2625, 2650, 2675, 2700, 2725, 2750, 2775, 2800, 2825, 2850, 2875, 2900, 2925, 2950, 2975, 3000, 3025, 3050, 3075, 3100, 3125, 3150, 3175, 3200, 3225, 3250, 3275, 3300, 3325, 3350, 3375, 3400, 3425, 3450, 3475, 3500, 3525, 3550, 3575, 3600, 3625, 3650, 3675, 3700, 3725, 3750, 3775, 3800, 3825, 3850, 3875, 3900, 3925, 3950, 3975, 4000, 4025, 4050, 4075, 4100, 4125, 4150, 4175, 4200, 4225, 4250, 4275, 4300, 4325, 4350, 4375, 4400, 4425, 4450, 4475, 4500, 4525, 4550, 4575, 4600, 4625, 4650, 4675, 4700, 4725, 4750, 4775, 4800, 4825, 4850, 4875, 4900, 4925, 4950, 4975, 5000, 5025, 5050, 5075, 5100, 5125, 5150, 5175, 5200, 5225, 5250, 5275, 5300, 5325, 5350, 5375, 5400, 5425, 5450, 5475, 5500, 5525, 5550, 5575, 5600, 5625, 5650, 5675, 5700, 5725, 5750, 5775, 5800, 5825, 5850, 5875, 5900, 5925, 5950, 5975, 6000, 6025, 6050, 6075, 6100, 6125, 6150, 6175, 6200, 6225, 6250, 6275, 6300, 6325, 6350, 6375, 6400, 6425, 6450, 6475, 6500, 6525, 6550, 6575, 6600, 6625, 6650, 6675, 6700, 6725, 6750, 6775, 6800, 6825, 6850, 6875, 6900, 6925, 6950, 6975, 7000, 7025, 7050, 7075, 7100, 7125, 7150, 7175, 7200, 7225, 7250, 7275, 7300, 7325, 7350, 7375, 7400, 7425, 7450, 7475, 7500, 7525, 7550, 7575, 7600, 7625, 7650, 7675, 7700, 7725, 7750, 7775, 7800, 7825, 7850, 7875, 7900, 7925, 7950, 7975, 8000, 8025, 8050, 8075, 8100, 8125, 8150, 8175, 8200, 8225, 8250, 8275, 8300, 8325, 8350, 8375, 8400, 8425, 8450, 8475, 8500, 8525, 8550, 8575, 8600, 8625, 8650, 8675, 8700, 8725, 8750, 8775, 8800, 8825, 8850, 8875, 8900, 8925, 8950, 8975, 9000, 9025, 9050, 9075, 9100, 9125, 9150, 9175, 9200, 9225, 9250, 9275, 9300, 9325, 9350, 9375, 9400, 9425, 9450, 9475, 9500, 9525, 9550, 9575, 9600, 9625, 9650, 9675, 9700, 9725, 9750, 9775, 9800, 9825, 9850, 9875, 9900, 9925, 9950, 9975, 10000.



MAP NUMBER
32003CIND0C

**MAP REVISED
NOVEMBER 16, 2011**

Federal Emergency Management Agency

This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at www.msc.fema.gov

FIGURE 9



United States
Department of
Agriculture

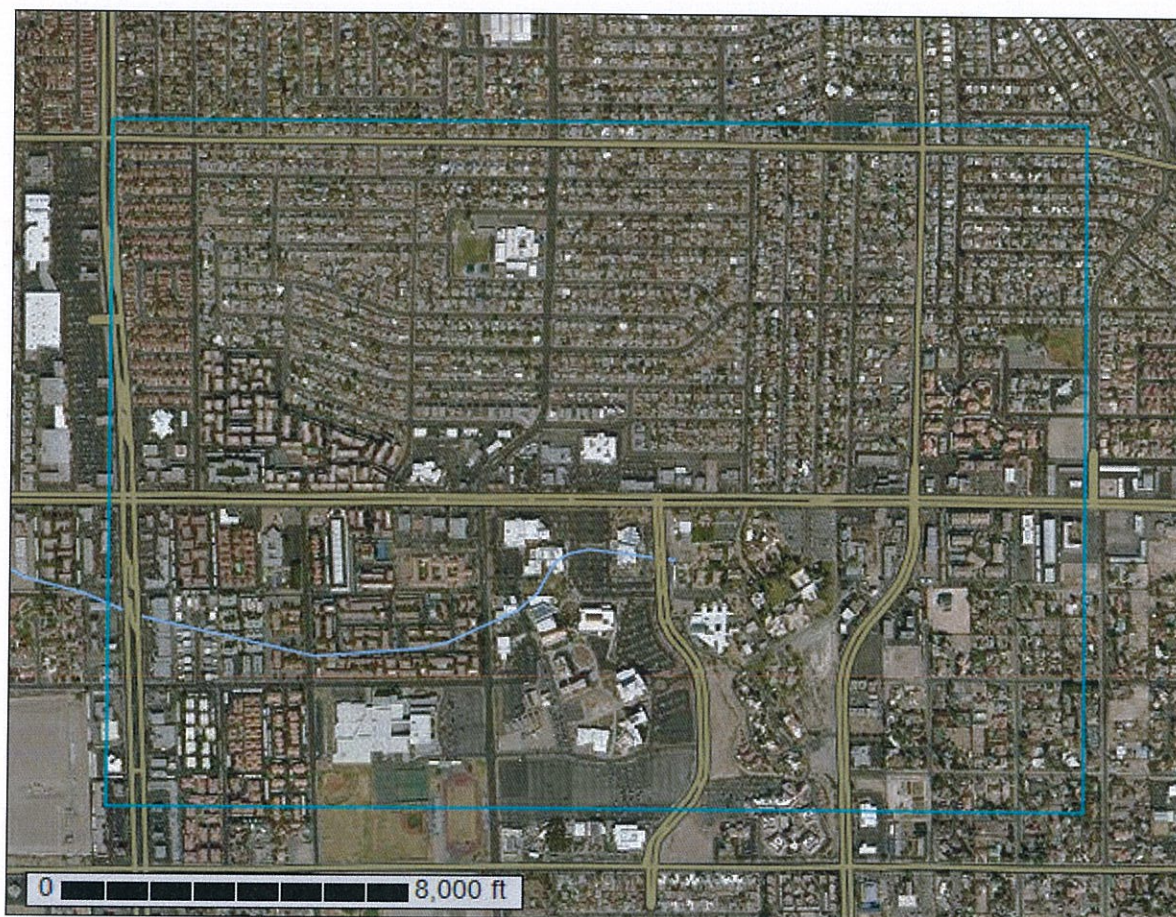
NRCS

Natural
Resources
Conservation
Service

A product of the National
Cooperative Soil Survey,
a joint effort of the United
States Department of
Agriculture and other
Federal agencies, State
agencies including the
Agricultural Experiment
Stations, and local
participants

Custom Soil Resource Report for Las Vegas Valley Area, Nevada, Part of Clark County

LVG #5



January 30, 2018

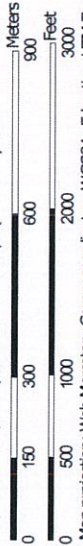
Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report Soil Map



Map Scale: 1:13,100 if printed on A landscape (11" x 8.5") sheet.



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

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		Special Line Features
	Blowout		Water Features
	Borrow Pit		Streams and Canals
	Clay Spot		Transportation
	Closed Depression		Rails
	Gravel Pit		Interstate Highways
	Gravelly Spot		US Routes
	Landfill		Major Roads
	Lava Flow		Local Roads
	Marsh or swamp		Background
	Mine or Quarry		Aerial Photography
	Miscellaneous Water		
	Perennial Water		
	Rock Outcrop		
	Saline Spot		
	Sandy Spot		
	Severely Eroded Spot		
	Sinkhole		
	Slide or Slip		
	Sodic Spot		

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 12, Sep 15, 2017

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

Date(s) aerial images were photographed: May 7, 2011—Feb 25, 2014

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background

MAP LEGEND

MAP INFORMATION

Imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

300—Las Vegas gravelly fine sandy loam, 0 to 2 percent slopes

Map Unit Setting

National map unit symbol: hrbp
Elevation: 1,800 to 2,600 feet
Mean annual precipitation: 4 to 6 inches
Mean annual air temperature: 63 to 68 degrees F
Frost-free period: 220 to 260 days
Farmland classification: Not prime farmland

Map Unit Composition

Las Vegas and similar soils: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Las Vegas

Setting

Landform: Basin-floor remnants
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from limestone

Typical profile

H1 - 0 to 1 inches: gravelly fine sandy loam
H2 - 1 to 7 inches: fine sandy loam
H3 - 7 to 11 inches: gravelly sandy clay loam
H4 - 11 to 15 inches: indurated

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: 3 to 14 inches to petrocalcic
Natural drainage class: Well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low (0.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 85 percent
Gypsum, maximum in profile: 5 percent
Salinity, maximum in profile: Nonsaline to slightly saline (0.0 to 4.0 mmhos/cm)
Sodium adsorption ratio, maximum in profile: 12.0
Available water storage in profile: Very low (about 1.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: D
Other vegetative classification: LIMY 3-5" P.Z. (030XB019NV_3)
Hydric soil rating: No

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

RUNOFF CURVE NUMBERS (URBAN AREAS¹)

Cover description		Curve numbers for hydrologic soil group—			
Cover type and hydrologic condition	Average percent impervious area ²	A	B	C	D
<i>Fully developed urban areas (vegetation established)</i>					
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 $I_p = 0.2S$.
- 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

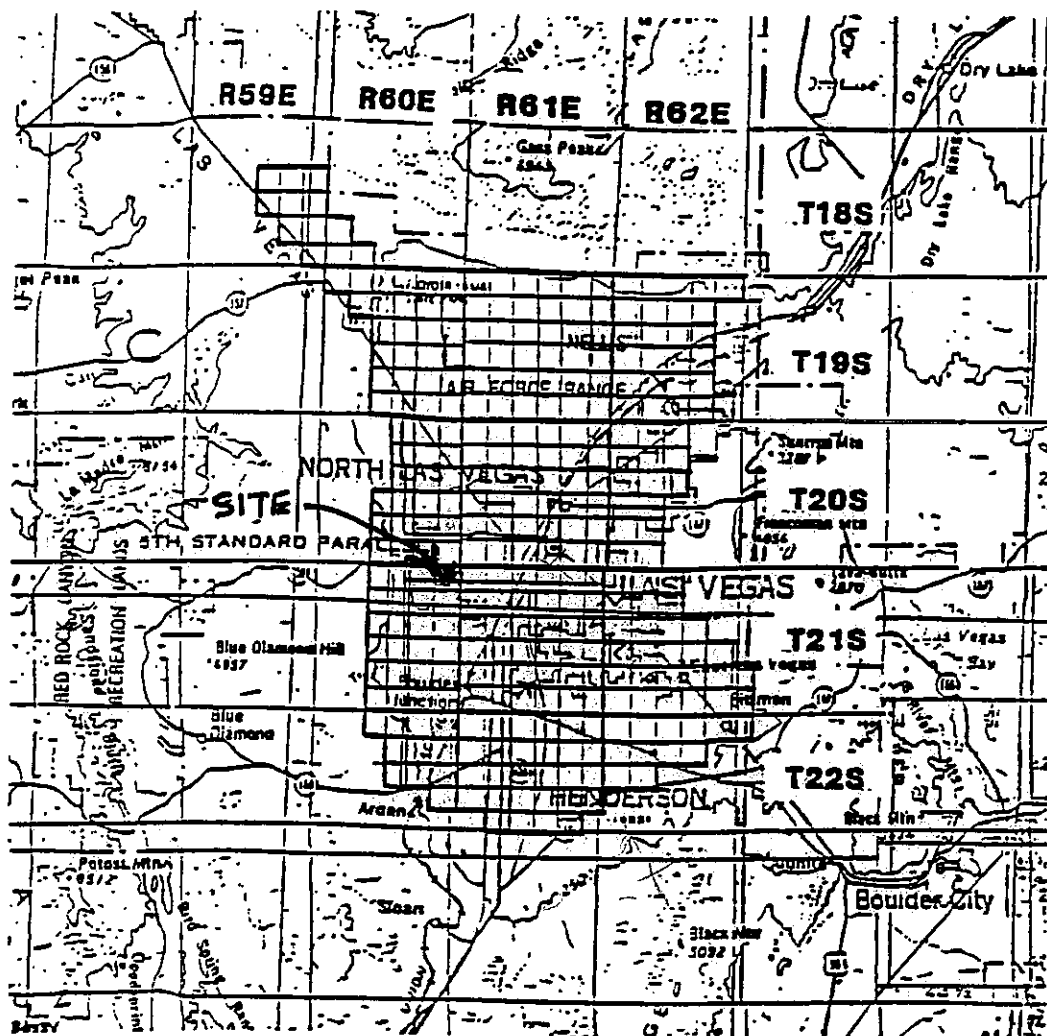
WRC
ENGINEERING

REFERENCE:

SCS TR-55, USDA, June 1986.

TABLE 602
1 of 4

McCARRAN AIRPORT RAINFALL AREA



TOWNSHIP RANGE SECTIONS

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

TOWNSHIP RANGE SECTIONS

20 South	62 East	4-9, 16-20, 29-32
21 South	60 East	1-4, 9-16, 21-28, 33-36
21 South	61 East	ALL SECTIONS
21 South	62 East	4-9, 15-23, 25-36
22 South	60 East	1-4, 10-15, 24
22 South	61 East	1-24, 26-29
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

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

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

**WRC
ENGINEERING**

REFERENCE:
USACE, Los Angeles District, 1988

TABLE 505

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

SIX-HOUR STORM DISTRIBUTIONS

Percent of Total Storm Depth				Percent of Total Storm Depth			
Storm Time (In Minutes)	SDN3	SDN4	SDN5	Storm Time (In Minutes)	SDN3	SDN4	SDN5
0	0.0	0.0	0.0	185	32.2	37.6	43.0
5	2.0	2.0	2.0	190	35.2	41.5	47.7
10	5.7	5.8	5.9	195	40.9	46.2	51.4
15	7.0	7.5	8.0	200	49.9	53.0	56.1
20	8.7	9.9	11.0	205	59.0	61.0	63.0
25	10.8	12.6	14.4	210	71.0	71.0	71.0
30	12.4	13.7	15.0	215	74.4	73.2	72.0
35	13.0	14.5	16.0	220	78.1	75.6	73.1
40	13.0	14.9	16.8	225	81.2	78.2	75.2
45	13.0	15.1	17.1	230	81.9	79.9	77.9
50	13.0	15.5	18.0	235	83.5	81.3	79.0
55	13.0	15.6	18.2	240	85.1	82.3	79.5
60	13.0	15.9	18.7	245	85.6	83.0	80.4
65	13.3	16.2	19.0	250	86.0	83.5	81.0
70	14.0	16.9	19.7	255	86.8	84.4	82.0
75	14.2	17.2	20.2	260	87.6	85.1	82.6
80	14.8	17.9	21.0	265	88.8	86.4	84.0
85	15.8	18.9	22.0	270	91.0	88.5	85.9
90	17.2	20.1	23.0	275	92.6	90.8	88.9
95	18.1	21.1	24.1	280	93.7	92.4	91.0
100	19.0	22.0	25.0	285	95.0	94.4	93.8
105	19.7	22.8	25.9	290	97.0	96.8	96.6
110	19.9	23.2	26.5	295	97.6	97.3	97.0
115	20.0	24.0	28.0	300	98.2	97.8	97.4
120	20.1	24.6	29.0	305	98.5	98.2	97.9
125	20.4	25.2	30.0	310	98.7	98.4	98.1
130	21.4	26.0	30.5	315	98.9	98.6	98.3
135	22.9	26.9	30.9	320	99.0	98.8	98.5
140	24.1	27.6	31.0	325	99.3	99.1	98.9
145	24.9	28.3	31.7	330	99.3	99.2	99.0
150	25.1	28.6	32.1	335	99.4	99.3	99.2
155	25.6	29.2	32.7	340	99.5	99.4	99.3
160	27.0	30.2	33.3	345	99.8	99.7	99.6
165	27.8	31.2	34.6	350	99.8	99.8	99.7
170	28.1	32.1	36.1	355	99.9	99.9	99.9
175	28.3	33.2	38.1	360	100.0	100.0	100.0
180	29.5	35.2	40.8				

- Notes: 1. For drainage areas less than 8 square miles in size, use SDN 3.
 2. For drainage areas greater than or equal to 8 square miles and less than 12 square miles in size, use SDN 4.
 3. For drainage areas greater than or equal to 12 square miles, use SDN 5.
 4. A graphical representation of these values is presented on Figure 515.

Revision	Date

REFERENCE:

TABLE 503

BAUGHMAN & TURNER, INC.
CONSULTING ENGINEERS

STANDARD FORM 4


```

1*****
*
* FLOOD HYDROGRAPH PACKAGE (HEC-1)
* JUN 1998
* VERSION 4.1
*
* RUN DATE 08FEB18 TIME 10:46:45
*
*****

```

```

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

```

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X X XXXXXX XXXX X
X X X X X XX
X X X X X
XXXXXX XXXX X XXXX X
X X X X X
X X X X X
X X XXXXXX XXXX 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

*DIAGRAM
1 ID
2 ID LVG #5
3 ID
4 ID Existing Condition
5 ID
6 ID File N:\LVG5\DOCS\HYDROLOGY\HEC1\LVG5EX.DAT
7 ID
8 ID
9 IT 5 300
10 IO 5
11 IN 5
12 JR PREC 0.57 1.0
* *****
* Existing Conditions *
* *****

13 KK OND1
14 BA 0.0034
15 PB 2.77
16 PC 0.00 2 5.7 7 8.7 10.8 12.4 13 13 13
17 PC 13 13 13 13.3 14 14.2 14.8 15.8 17.2 18.1
18 PC 19 19.7 19.7 20.1 20.1 20.4 21.4 22.9 24.1 24.9
19 PC 25.1 25.6 27 27.8 28.1 28.3 29.5 32.2 35.2 40.9
20 PC 49.9 59 71 74.4 78.1 81.2 81.9 83.5 85.1 85.6
21 PC 86 86.8 87.6 88.8 91 92.6 93.7 95 97 97.6
22 PC 98.2 98.5 98.7 98.9 99 99.3 99.3 99.4 99.5 99.8
23 PC 99.8 99.9 100
24 LS 95
25 UD 0.099

26 KK OND2
27 BA 0.0007
28 LS 95
29 UD 0.058
30 ZZ

```

```

1 SCHEMATIC DIAGRAM OF STREAM NETWORK

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

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

13 OND1
.
26 OND2
.

```

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

```

1*****
*
* FLOOD HYDROGRAPH PACKAGE (HEC-1)
* JUN 1998
* VERSION 4.1
*
* RUN DATE 08FEB18 TIME 10:46:45
*
*****

```

```

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

```


LVG #5

Existing Condition

File N:\LVG5\DOCS\HYDROLOGY\HEC1\LVG5EX.DAT

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

IT HYDROGRAPH TIME DATA
 NMIN 5 MINUTES IN COMPUTATION INTERVAL
 IDATE 1 0 STARTING DATE
 ITIME 0000 STARTING TIME
 NQ 300 NUMBER OF HYDROGRAPH ORDINATES
 NDDATE 2 0 ENDING DATE
 NDTIME 0055 ENDING TIME
 ICENT 19 CENTURY MARK

 COMPUTATION INTERVAL .08 HOURS
 TOTAL TIME BASE 24.92 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

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	RATIO 2
				.57	1.00
HYDROGRAPH AT					
+	OND1	.00	1	FLOW	3. 6.
				TIME	3.50 3.50
HYDROGRAPH AT					
+	OND2	.00	1	FLOW	1. 2.
				TIME	3.50 3.50

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

Cross Section for HS1 Charleston 100-yr

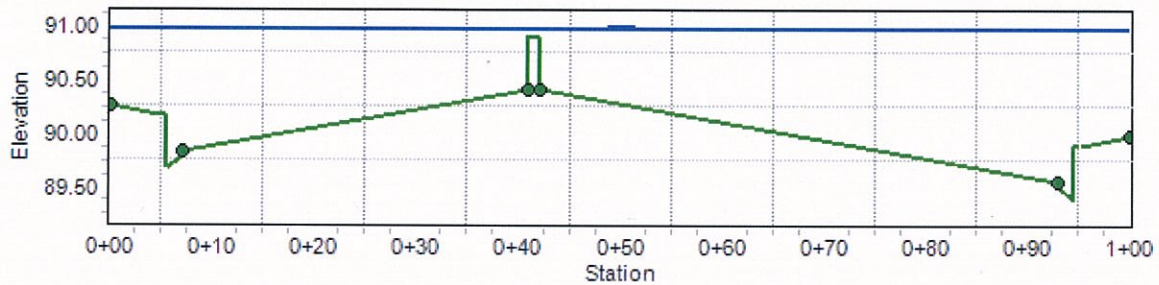
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.01190	ft/ft
Normal Depth	1.57	ft
Discharge	843.00	ft ³ /s

Cross Section Image



Project Description

Manning Formula

Normal Depth

Input Data

0.01190 ft/ft

843.00. ft³/s

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	90.26
0+05.00	90.16
0+05.50	90.16
0+05.50	89.66
0+07.00	89.79
0+07.00	89.83
0+41.00	90.41
0+41.00	90.91
0+42.00	90.90
0+42.00	90.41
0+93.00	89.56
0+93.00	89.52
0+94.50	89.39
0+94.50	89.89
0+95.00	89.89
1+00.00	89.99

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 90.26)	(0+07.00, 89.83)	0.013
(0+07.00, 89.83)	(0+41.00, 90.41)	0.017
(0+41.00, 90.41)	(0+42.00, 90.41)	0.013
(0+42.00, 90.41)	(0+93.00, 89.56)	0.017
(0+93.00, 89.56)	(1+00.00, 89.99)	0.013

Worksheet for HS1 Charleston 100-yr

Options

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

Results

Normal Depth	1.57	ft
Elevation Range	89.39 to 90.91	ft
Flow Area	92.08	ft ²
Wetted Perimeter	103.76	ft
Hydraulic Radius	0.89	ft
Top Width	100.00	ft
Normal Depth	1.57	ft
Critical Depth	1.95	ft
Critical Slope	0.00378	ft/ft
Velocity	9.16	ft/s
Velocity Head	1.30	ft
Specific Energy	2.87	ft
Froude Number	1.68	
Flow Type	Supercritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	1.57	ft
Critical Depth	1.95	ft
Channel Slope	0.01190	ft/ft
Critical Slope	0.00378	ft/ft

Cross Section for HS1 Charleston 10-yr

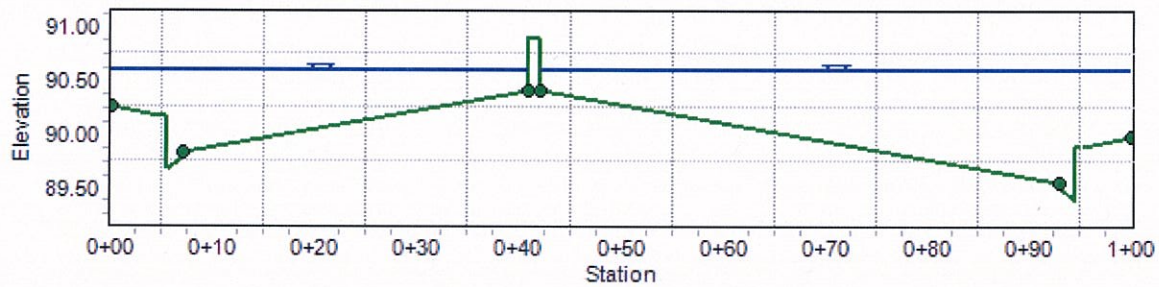
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.01190	ft/ft
Normal Depth	1.21	ft
Discharge	380.00	ft³/s

Cross Section Image



Project Description

Input Data

Station (ft)	Elevation (ft)
0+00.00	90.26
0+05.00	90.16
0+05.50	90.16
0+05.50	89.66
0+07.00	89.79
0+07.00	89.83
0+41.00	90.41
0+41.00	90.91
0+42.00	90.90
0+42.00	90.41
0+93.00	89.56
0+93.00	89.52
0+94.50	89.39
0+94.50	89.89
0+95.00	89.89
1+00.00	89.99

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 90.26)	(0+07.00, 89.83)	0.013
(0+07.00, 89.83)	(0+41.00, 90.41)	0.017
(0+41.00, 90.41)	(0+42.00, 90.41)	0.013
(0+42.00, 90.41)	(0+93.00, 89.56)	0.017
(0+93.00, 89.56)	(1+00.00, 89.99)	0.013

Worksheet for HS1 Charleston 10-yr

Options

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

Results

Normal Depth	1.21	ft
Elevation Range	89.39 to 90.91	ft
Flow Area	56.71	ft ²
Wetted Perimeter	101.44	ft
Hydraulic Radius	0.56	ft
Top Width	99.00	ft
Normal Depth	1.21	ft
Critical Depth	1.41	ft
Critical Slope	0.00447	ft/ft
Velocity	6.70	ft/s
Velocity Head	0.70	ft
Specific Energy	1.91	ft
Froude Number	1.56	
Flow Type	Supercritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	1.21	ft
Critical Depth	1.41	ft
Channel Slope	0.01190	ft/ft
Critical Slope	0.00447	ft/ft

Cross Section for HS2 Jones 100-yr 1/2

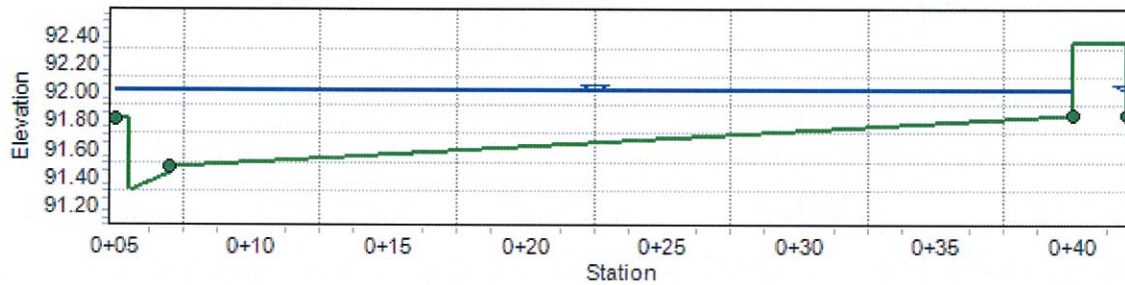
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.00850	ft/ft
Normal Depth	0.71	ft
Discharge	52.00	ft ³ /s

Cross Section Image



Worksheet for HS2 Jones 100-yr 1/2

Project Description

Friction Method Manning Formula
Solve For Normal Depth

Input Data

Channel Slope 0.00850 ft/ft
Discharge 52.00 ft³/s
Section Definitions

Station (ft)	Elevation (ft)
0+05.00	91.80
0+05.50	91.80
0+05.50	91.30
0+07.00	91.43
0+07.00	91.47
0+40.00	91.84
0+40.00	92.34
0+42.00	92.34
0+42.00	91.84

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+05.00, 91.80)	(0+07.00, 91.47)	0.013
(0+07.00, 91.47)	(0+40.00, 91.84)	0.017
(0+40.00, 91.84)	(0+42.00, 91.84)	0.013

Options

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

Results

Normal Depth 0.71 ft
Elevation Range 91.30 to 92.34 ft

Worksheet for HS2 Jones 100-yr 1/2

Results

Flow Area	12.72	ft ²
Wetted Perimeter	36.26	ft
Hydraulic Radius	0.35	ft
Top Width	35.00	ft
Normal Depth	0.71	ft
Critical Depth	0.75	ft
Critical Slope	0.00576	ft/ft
Velocity	4.09	ft/s
Velocity Head	0.26	ft
Specific Energy	0.97	ft
Froude Number	1.20	
Flow Type	Supercritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.71	ft
Critical Depth	0.75	ft
Channel Slope	0.00850	ft/ft
Critical Slope	0.00576	ft/ft

Cross Section for HS2 Jones 10-yr 1/2

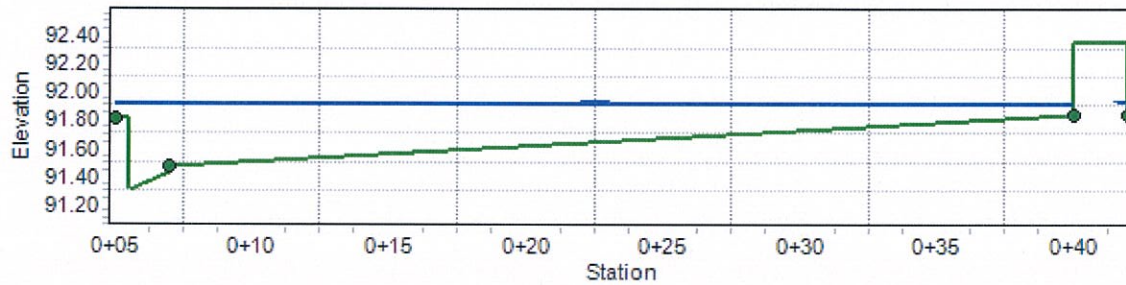
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.00850	ft/ft
Normal Depth	0.60	ft
Discharge	29.00	ft³/s

Cross Section Image



Worksheet for HS2 Jones 10-yr 1/2

Project Description

Friction Method Manning Formula
Solve For Normal Depth

Input Data

Channel Slope 0.00850 ft/ft
Discharge 29.00 ft³/s
Section Definitions

Station (ft)	Elevation (ft)
0+05.00	91.80
0+05.50	91.80
0+05.50	91.30
0+07.00	91.43
0+07.00	91.47
0+40.00	91.84
0+40.00	92.34
0+42.00	92.34
0+42.00	91.84

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+05.00, 91.80)	(0+07.00, 91.47)	0.013
(0+07.00, 91.47)	(0+40.00, 91.84)	0.017
(0+40.00, 91.84)	(0+42.00, 91.84)	0.013

Options

Current Roughness weighted Method Pavlovskii's Method
Open Channel Weighting Method Pavlovskii's Method
Closed Channel Weighting Method Pavlovskii's Method

Results

Normal Depth 0.60 ft
Elevation Range 91.30 to 92.34 ft

Worksheet for HS2 Jones 10-yr 1/2

Results

Flow Area	8.93	ft ²
Wetted Perimeter	35.83	ft
Hydraulic Radius	0.25	ft
Top Width	35.00	ft
Normal Depth	0.60	ft
Critical Depth	0.62	ft
Critical Slope	0.00646	ft/ft
Velocity	3.25	ft/s
Velocity Head	0.16	ft
Specific Energy	0.76	ft
Froude Number	1.13	
Flow Type	Supercritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.60	ft
Critical Depth	0.62	ft
Channel Slope	0.00850	ft/ft
Critical Slope	0.00646	ft/ft

Cross Section for HS3 Jones 100-yr 1/2

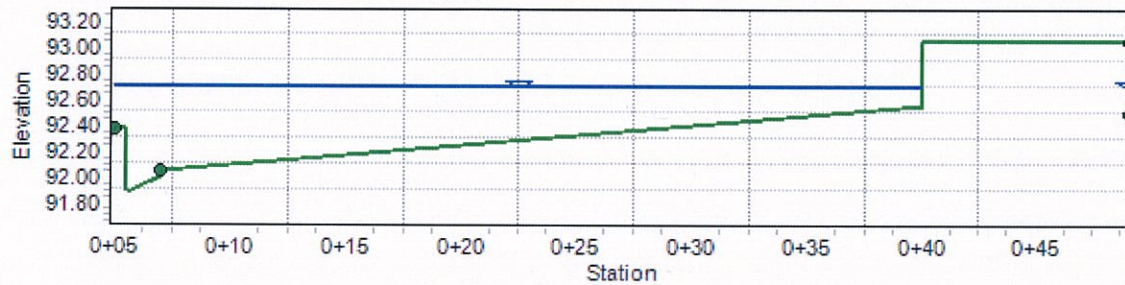
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.00570	ft/ft
Normal Depth	0.82	ft
Discharge	52.00	ft ³ /s

Cross Section Image



Worksheet for HS3 Jones 100-yr 1/2

Results

Flow Area	14.37	ft²
Wetted Perimeter	36.41	ft
Hydraulic Radius	0.39	ft
Top Width	35.00	ft
Normal Depth	0.82	ft
Critical Depth	0.82	ft
Critical Slope	0.00575	ft/ft
Velocity	3.62	ft/s
Velocity Head	0.20	ft
Specific Energy	1.02	ft
Froude Number	1.00	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.82	ft
Critical Depth	0.82	ft
Channel Slope	0.00570	ft/ft
Critical Slope	0.00575	ft/ft

Cross Section for HS3 Jones 10-yr 1/2

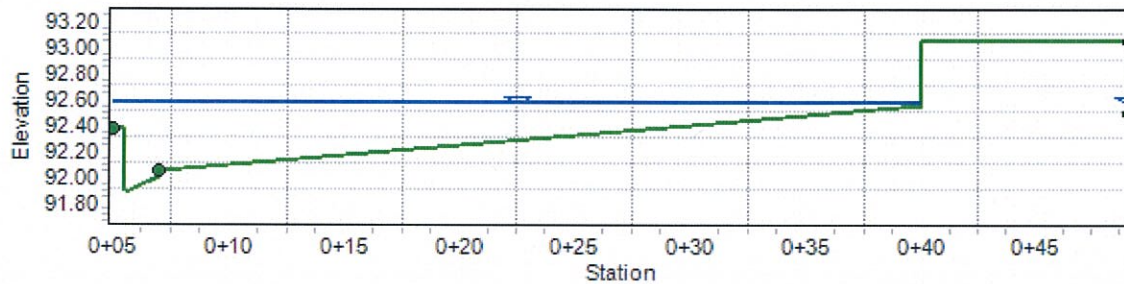
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.00570	ft/ft
Normal Depth	0.69	ft
Discharge	29.00	ft ³ /s

Cross Section Image



Worksheet for HS3 Jones 10-yr 1/2

Project Description

Friction Method Manning Formula
Solve For Normal Depth

Input Data

Channel Slope 0.00570 ft/ft
Discharge 29.00 ft³/s
Section Definitions

Station (ft)	Elevation (ft)
0+05.00	92.38
0+05.50	92.38
0+05.50	91.88
0+07.00	92.01
0+07.00	92.05
0+40.00	92.55
0+40.00	93.05
0+49.00	93.05
0+49.00	92.50

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+05.00, 92.38)	(0+07.00, 92.05)	0.013
(0+07.00, 92.05)	(0+49.00, 93.05)	0.017
(0+49.00, 93.05)	(0+49.00, 92.50)	0.013

Options

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

Results

Normal Depth 0.69 ft
Elevation Range 91.88 to 93.05 ft

Worksheet for HS3 Jones 10-yr 1/2

Results

Flow Area	10.08	ft ²
Wetted Perimeter	35.91	ft
Hydraulic Radius	0.28	ft
Top Width	35.00	ft
Normal Depth	0.69	ft
Critical Depth	0.68	ft
Critical Slope	0.00645	ft/ft
Velocity	2.88	ft/s
Velocity Head	0.13	ft
Specific Energy	0.82	ft
Froude Number	0.95	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.69	ft
Critical Depth	0.68	ft
Channel Slope	0.00570	ft/ft
Critical Slope	0.00645	ft/ft

Cross Section for HS3 Jones 100-yr

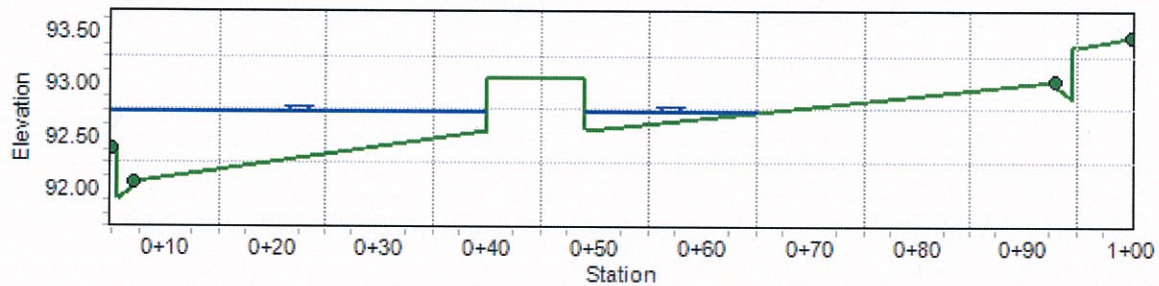
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.00570	ft/ft
Normal Depth	0.84	ft
Discharge	52.00	ft ³ /s

Cross Section Image



Worksheet for HS3 Jones 100-yr

Project Description

Friction Method Manning Formula
Solve For Normal Depth

Input Data

Channel Slope 0.00570 ft/ft
Discharge 52.00 ft³/s
Section Definitions

Station (ft)	Elevation (ft)
0+05.00	92.38
0+05.50	92.38
0+05.50	91.88
0+07.00	92.01
0+07.00	92.05
0+40.00	92.55
0+40.00	93.05
0+49.00	93.05
0+49.00	92.55
0+93.00	93.02
0+93.00	92.98
0+94.50	92.85
0+94.50	93.35
0+95.00	93.35
1+00.00	93.45

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+05.00, 92.38)	(0+07.00, 92.05)	0.013
(0+07.00, 92.05)	(0+93.00, 93.02)	0.017
(0+93.00, 93.02)	(1+00.00, 93.45)	0.013

Options

Current Roughness weighted Pavlovskii's Method
Method

Worksheet for HS3 Jones 100-yr

Options

Open Channel Weighting Method Pavlovskii's Method
Closed Channel Weighting Method Pavlovskii's Method

Results

Normal Depth	0.84	ft
Elevation Range	91.88 to 93.45	ft
Flow Area	16.70	ft ²
Wetted Perimeter	52.44	ft
Hydraulic Radius	0.32	ft
Top Width	51.20	ft
Normal Depth	0.84	ft
Critical Depth	0.83	ft
Critical Slope	0.00620	ft/ft
Velocity	3.11	ft/s
Velocity Head	0.15	ft
Specific Energy	0.99	ft
Froude Number	0.96	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.84	ft
Critical Depth	0.83	ft
Channel Slope	0.00570	ft/ft
Critical Slope	0.00620	ft/ft

Block Wall Opening Computation

FACILITY DESCRIPTION

Project Name: LVG #5

Date: 2/12/2018

File Name: LVG #5

By: PJP

Known Information:

H = Height of Opening (ft)	1.00
L = Length of Opening (ft)	3.00
Cf = Clogging Factor (%)	50

Weir Conditions:

$$Q = C_w * L * H_{clg}^{3/2}$$

Cw = Weir Coefficient	2.70
H _{clg} = Height with clogging	0.5
Q = Flow allowed through opening	2.9

Orifice Conditions:

$$Q = C_o * A_{clg} * (2gH_{clg})^{1/2}$$

Co = Orifice Coefficient	0.67
A _{clg} = Area with clogging	1.50
Q = Flow allowed through opening	4.0

Worst Case Scenario Occurs Under Weir Conditions

Allowed Flow Through Opening = 2.9 cfs = 10-yr

SUBMERGED WEIR CALCULATION

$$Q_{\text{submerged}} = C * L * H_1^{1.5} * [1 - (H_2/H_1)^{1.5}]^{0.385}$$

Where Q=Discharge at submerged weir (cfs)
 L=Effective weir length (ft)
 H2=Height of flow downstream of weir (ft)
 H1=Height of flow upstream of weir (ft)

Q= 6 cfs
C= 3
L= 3 ft
H2= 0.21 ft
H1= 0.8 ft

Qsubmerged= 6.091539 cfs

WEIR ELEVATION	87.77	TC ELEVATION
HEAD	0.80	
FREE BOARD	1.50	
MIN FF ELEV.	<u>90.07</u>	→ Ex. FF = 92.24

*REFERENCED FROM THE "2005 MODEL DRAINAGE MANUAL" BY AMERICAN ASSOCIATION OF
STATE HIGHWAY AND TRANSPORTATION OFFICIALS (equ. 12-6 & 12-7)

Instructions

- 1.) Input Q which is the known total flow in easement
- 2.) Insert C (weir coefficient)
- 3.) Input L which is the width of easement
- 4.) Input H_2 which is the depth of flow at the downstream end of the easement
- 5.) Vary H_1 until $Q_{\text{submerged}}$ is equal to Q
- 6.) Input Weir elevation which is usually the TC elevation
- 7.) Input any freeboard requirements
- 8.) Read Min. FF Elevation

Worksheet for Existing Flume east of site

Project Description

Friction Method Manning Formula
Solve For Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.03800	ft/ft
Bottom Width	4.00	ft
Discharge	6.00	ft³/s

Results

Normal Depth	0.21	ft
Flow Area	0.82	ft²
Wetted Perimeter	4.41	ft
Hydraulic Radius	0.19	ft
Top Width	4.00	ft
Critical Depth	0.41	ft
Critical Slope	0.00425	ft/ft
Velocity	7.27	ft/s
Velocity Head	0.82	ft
Specific Energy	1.03	ft
Froude Number	2.82	
Flow Type	Supercritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.21	ft
Critical Depth	0.41	ft
Channel Slope	0.03800	ft/ft
Critical Slope	0.00425	ft/ft

Cross Section for Existing Flume east of site

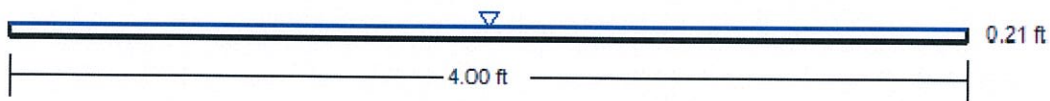
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.013
Channel Slope	0.03800 ft/ft
Normal Depth	0.21 ft
Bottom Width	4.00 ft
Discharge	6.00 ft ³ /s

Cross Section Image



V: 1
H: 4

CITY OF LAS VEGAS		DATE:
INTER-OFFICE MEMORANDUM		January 3, 2008
TO: Land Development Services Department of Public Works		FROM: Oh Sang Kwon, P.E.  Flood Control Project Engineer Department of Public Works
SUBJECT:	Drainage Study for:	
	Desert Shadows Apts. (Update #1)	
Cross Streets:	SEC of Charleston Boulevard & Jones Boulevard	
File Number:	F:\Depot\DSMEMOS\DS3226H.doc	
Parcel Number:	163-01-102-003	
Zoning Action:	ZON-1315	
FEMA Flood Zone	YES	NO X
Proposed Storm Drain	YES	NO x
		COPIES TO: Triton Engineering, Inc. Signature Homes Bart Anderson, P.E., DevCo

HISTORY	DATE RECEIVED	DATE REVIEWED	COMMENTS	REVIEW FEES	FEES PAID Transaction #
1 st Submittal	12/19/2007	1/3/2008	See Comments Below	\$400.00	84520: \$400
			TOTAL FEES (LDDRS):	\$400.00	----

REMARKS:

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

X	is approved subject to conformance to all City standards and the following conditions:
	must be resubmitted or supplemented including the following:
	is conditionally approved subject to Clark County Regional Flood Control District concurrence.
	is conditionally approved subject to City of North Las Vegas 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 Amendment 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.

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

osk

T/R/S: T21S/R60E/01
AREA Q-01

Triton



Engineering

December 13, 2007

Albert Sung, P. E.
City of Las Vegas Public Works
Development Services
731 S. 4th Street
Las Vegas, NV 89101

Subject: Update #2 to the Technical Drainage Study for
Desert Shadows Apartments
S side of Charleston Boulevard, 150' east of Jones intersection
Original CLV DS# 3226;

Mr. Sung:

This letter and data submittal is intended to serve as Update #2 to the Technical Drainage Study for Desert Shadows Apartments. The original study and Update #1 to that study were prepared by others and approved by the City of Las Vegas in 2003. Both of these previous studies were reviewed and found to be reasonable and acceptable.

The site is not located in a FEMA Special Flood Hazard Zone A. The site is bound by Clark County Regional Flood Control District Master Planned Facility MECN 0061, which is a proposed 8'x8' RCB planned for Charleston Boulevard, which borders the site on the north.

The purpose for Update #1 to the Technical Drainage Study for Desert Shadows Apartments was to establish the fact that the site was becoming converted from apartments to condominiums. No changes to the site or the drainage conditions of the site were proposed with the Update #1, thus it is not further considered in this Update #2. The main body of the text from Update #1 is included in the appendix of this submittal.

The purpose of this Update #2 submittal is for slight changes in the flow path of minor drainage flows in the landscape areas on the southeast corner of the site. On the original drawings, drainage flow from the planter area on the eastern and southern borders of the site

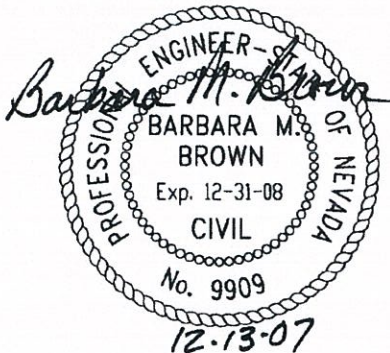
was shown to pass through block wall openings, combining with the major portion of runoff from the site downstream of the site boundary wall at the southeast corner. Actually, the block wall openings were never incorporated into the project, and currently this minor runoff flow ponds against the wall, eventually spilling over as weir flow into the existing concrete drainage flume. The purpose of this Update #2 is to address changes to the drainage conditions at this southeast corner to improve the drainage conditions, allowing these minor, often nuisance flows, to more easily enter the concrete flume and exit the site through the existing wrought iron gate, along with the main runoff from the site.

The changes to the drainage flow paths included in this submittal are shown on the drawings in this submittal package. Flow in the planter area is going to be redirected using a newly constructed flowline, that runs around the wall and discharges into the flume through a newly-constructed v-notch in the concrete curb.

There were no block wall opening calculations, and no flow line calculations incorporated with the original drainage study. Likely there were no calculations since the peak flow rate is expected to be minor, generated in planter areas less than 0.1 acres in area. The peak flow rate generated is expected to be much less than 1 cfs, approaching the corner from either the north or west. However, to ensure that the flow is non-erosive, a normal-depth calculation was performed using 1 cfs and the typical section for the revised flow line. The calculation is included in the appendix of this submittal.

We hope that this submittal provides you with the information needed for approval of the slight changes to the site.

Sincerely,



Momentum Engineers, Ltd.
Barbara M. Brown, P. E.
Subcontractor for
Triton Engineering, LLC

**REFERENCE MATERIAL FROM
"UPDATE #1 TO THE TECHNICAL DRAINAGE
STUDY FOR DESERT SHADOWS APARTMENTS"**



***UPDATE #1 TO THE
TECHNICAL DRAINAGE STUDY
FOR
DESERT SHADOWS APARTMENTS***

**Job No. 053-0505
January 11, 2007**

Prepared by:

**Orion Engineering and Surveying, Inc.
7391 Prairie Falcon Road, Suite 150
Las Vegas, Nevada 89128**

Prepared for:

**Signature Homes
801 S. Rancho Drive, Suite E-4
Las Vegas, NV 89106
(702) 671-6000**



January 11, 2007
Job No. 053-0505

Mr. Albert Y. Sung, P.E.
City of Las Vegas
Department of Public Works
731 S. 4th Street
Las Vegas, NV 89101

Subject: Update #1 to the Technical Drainage Study for Desert Shadows Apartments

Dear Mr. Sung:

Orion Engineering and Surveying is pleased to provide one copy of Update #1 to the Technical Drainage Study for the above-mentioned study. The Desert Shadows Apartments development is located within a portion of the Northeast Quarter (NE $\frac{1}{4}$) of Section 1, of Township 21 South, Range 60 East, M.D.M, City of Las Vegas, Nevada. The project site lies along Charleston Boulevard southeast of the Charleston/Jones intersection. A Vicinity Map has been included as Figure 1.

The Technical Drainage Study and addendum for Desert Shadows Apartments, aka Charleston/Jones Apartments, originally conducted by Stantec Consultants, was approved by the City of Las Vegas on March 27, 2003. The purpose of this update is to inform the City of Las Vegas that Signature Homes has decided to change the development use from apartments to condos. This development revision will not bring about any modifications to the hydrologic/hydraulic design of the multi-family units. The subdivision shall retain the same runoff curve number, 93, associated with apartment/condo land use per Table 602A of the CCRFCD Manual that will not produce different flowrates. Furthermore, the drainage pattern will not be altered and onsite runoff, 13/27 cfs, will continue to convey southeast direction towards the 10-foot public drainage easement at the corner of the site. All buildings are flood protected against onsite and offsite flows. No flows will be directed into Charleston Boulevard.

Refer to Appendix A, Reference Materials, for all pertinent materials from the previously approved Technical Drainage Study for Charleston/Jones Apartments (aka Desert Shadows Apartments) by Stantec including approval letter, figures, hydrologic and hydraulic calculations, and cross sections. A Tentative Map prepared by Orion Engineering which depicts a condominium conversion has also been provided. Refer to Appendix B for Improvement Plans provided by Stantec Consulting, Inc.

Desert Shadows Apartments

I hope this letter and the enclosed reference material answers any question. If you need any additional information, please do not hesitate to call at (702) 739-5921.

Sincerely,

ORION ENGINEERING AND SURVEYING

Isaac Guzman
Hydrology Department

**REFERENCE MATERIAL FROM
"TECHNICAL DRAINAGE STUDY FOR DESERT
SHADOWS APARTMENTS"**

Stantec Consulting Inc.
7251 West Charleston Boulevard
Las Vegas NV 89117
Tel: (702) 258-0115 Fax: (702) 258-4956
stantec.com



Stantec

Rec'D 10-23-02
DS 3226
Q-1
250,00

**Technical Drainage Study
For
Charleston/Jones Apartments**

**October, 2002
88100117**

Prepared for:

**Executive Development Corp.
7321 W Charleston Blvd
Las Vegas, Nevada 89117
Ph. (702) 877-6222**

Prepared by:

**Stantec Consulting Inc.
7251 W. Charleston Blvd.
Las Vegas, Nevada 89117
Ph. (702) 258-0115
Fax (702) 258-4956**

Buildings

Environment

Industrial

Transportation

Urban Land

CITY OF LAS VEGAS INTER-OFFICE MEMORANDUM

DATE:

March 27, 2003

TO:

Land Development Services
Department of Public Works

FROM:

Greg McDermott, P.E.
Flood Control Project Manager
Department of Public Works

SUBJECT:

Drainage Study for:

Charleston / Jones Apartments

COPIES TO:

Stantec Consulting, Inc.

Cross Streets:

SEC Charleston Blvd. & Jones Blvd.

Executive Development Corporation

FILE NO.:

F:\Dept\DSMEMOS\DS3226B.doc

Bart Anderson, P.E., DEVCO

Parcel Number:

163-01-102-003

Zoning Action:

FEMA Flood Zone:

YES

No

X

Proposed Storm Drain

YES

No

X

HISTORY	DATE RECEIVED	DATE REVIEWED	COMMENTS	REVIEW FEES	FEES PAID G.R. #
1 st Submittal	10/23/2002	11/6/2002	Not Accepted	\$250.00	93684: \$250
2 nd Submittal	3/7/2003	3/26/2003	See Comments Below	\$250.00	100369: \$250
TOTAL FEES (LDDRS):				\$500.00	—

REMARKS:

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

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

- It was previously requested that the engineer provide a table on the grading plans that shows a quantity estimate of all off-site and on-site flood control improvements such as solid grouted stem wall, protection berm and/or riprap. All drainage improvements must be bonded and inspected. In the addendum it stated that the quantities were added to sheet C2, however, sheet C2 was not included in the submittal.
- The drainage easement along the southern portion of this project must be granted as a Public Drainage Easement to be Privately Maintained prior to the issuance of any permits.

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 Amendment 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.

END OF REMARKS

T/R/S: T21S/R60E/01
AREA Q-01

Stantec Consulting Inc.
7251 West Charleston Boulevard
Las Vegas NV 89117
Tel: (702) 258-0115 Fax: (702) 258-4956
stantec.com



Stantec

March 6, 2003
File: 88100117

City of Las Vegas
Department of Public Works
731 S. 4th Street
Las Vegas, Nevada 89101

ATTN: Albert Y. Sung, P.E.

Reference: Addendum #1 - Response to Review Comments dated 11/6/2002 for
Charleston/Jones Apartments- (Now known as Desert Shadows
Apartments).

Dear Mr. Sung:

Enclosed please find the response to review comments, which were faxed to our office
on November 7, 2002, regarding the above subject (copy enclosed). The following items
are addressed:

Comment 1: Provide document to show the vacation of Holmby Avenue or
Holmby must be improved.

Response 1: A copy of the vacation application and legal description is included.

Comment 2: Provide existing grading information 100' beyond the perimeter of
the site. Make the existing contours legible on the Grading Plans.
Provide contour elevation designations. Clearly depict the offsite
drainage pattern on the grading plan.

Response 2: Revised plans accordingly.

Comment 3: The boundary condition to the west is not clear. Show whether
there is an existing wall and/or location of any wall openings

Response 3: The original intent was to transfer 10' feet to the property to the West.
This has not yet happened. Clarified plans and sections accordingly.

Buildings

Environment

Industrial

Transportation

Urban Land

- Comment 4:** On Sheet C3, Section W-W, extend the flood wall a minimum of two cells above the Q_{100} water surface. Solid grout the cells or the finish floor of Buildings 1, 7 & 8 must be raised to meet the CCRFGD criteria. On Sections Z-Z and ZZ-ZZ solid grout the screen wall a minimum of two cells above the new grades to contain any overflow onsite. Change Construction Note 27 to either a 12" pipe or a sidewalk underdrain. Revise the grades accordingly. Make the same change on Sheets C4, C5 and C6. Revise the detail on Sheet C7.
- Response 4:** Solid-grouted cells as required to protect Buildings 1, 7 and 8. Revised sidewalk drain to use standard sidewalk drain per USD Dwg. No. 236.
- Comment 5:** The engineer must provide a table on the grading plans that shows a quantity estimate of all private flood control improvements such as solid grouted stem wall, protection berm and/or riprap. The private flood control improvements must be bonded and inspected.
- Response 5:** Added quantities to Sheet C2. *Didn't include C2*
- Comment 6:** The offsite flow must be contained within the Public Drainage Easement. On Sheet C5 revise the grading on the southwest corner to contain the flow. Provide a 4' wide valley gutter along the flow path.
- Response 6:** Added L type curb & gutter and 3' wide valley gutter to contain the flows. (3' wide valley gutter is typical throughout the site.)
- Comment 7:** The last stretch of the proposed drainage easement at the southeast corner must be 20' wide instead of 10'. Revise the grading plan and pertinent detail accordingly. The public drainage easement (privately maintained) must be recorded either in the final map or by separate document.
- Response 7:** Revised easement to 20' wide. The easement will be recorded by separate document.
- Comment 8:** On Sheet C7 provide sideflow weir calculations for the outlet at the southeast corner of the site. Revise the design of the entrance to the channel accordingly. Indicate Section BB-BB in the plan view. It is referenced incorrectly in Section B-B. Place construction notes on this sheet.
- Response 8:** Relocated section BB-BB from Section B-B to plan view.

Comment 9: The grades in the swale on the south west side of Building 5 are 0.0027 not 0.01. Provide a storm drain system if a minimum grade of 1% can't be achieved. Recalculate the FFE of Building 5 to be 6" above the highest overflow path if storm drains are used.

Response 9: Grade 85.23 on the Southeast side should have been 84.7. FFE is OK as is.

Comment 10: On Sheet C6 the grades south and east of Building 2 both in the swale, in the parking area and along the east property line are incorrect. Revise these accordingly and recalculate the flow depths.

Response 10: Reviewed grades and added grades to clarify drainage.

Comment 11: Show an existing local storm drain in Charleston Boulevard on the grading plan.

Response 11: Added existing storm drain to plans.

Comment 12: The following finish floors do not meet the regional flood control district minimum criteria of twice the Q100 depth of flow up to 18 inches above the water surface (CCRFCD Manual Section 304.4.E.1) or 6-inch minimum above the highest adjacent top of curb (CCRFCD Manual Section 1602 304.4.E.1). The following finish floors must be revised.

BUILDING	FF shown	Min FF
Clubhouse	86.00	85.1
6	87.70	87.9
4	87.00	87.4

Response 12: Clubhouse is revised as noted. Building 6 is OK as is and Building 4 is OK as is.*

*Area is near local high point where no flows will occur and a minor swale is provided to drain between building and the curb. This was discussed with you on November 12, 2002 and you agreed this protection would meet the intent of the criteria.

March 6, 2003
Albert Y. Sung, P.E.
Page 4 of 4

If you should have any questions or require additional information, please do not hesitate to contact our office at 258-0115.

Sincerely,

STANTEC CONSULTING INC.



Alexander Kingston, E.I.T.
Hydrologist

Richard W. Cummock
Project Manager

I. GENERAL LOCATION AND DEVELOPMENT DESCRIPTION

A. Scope

The purpose of this study is to provide a technical hydrologic and hydraulic analysis for the Charleston/Jones Apartments, a multifamily residential development. The developer of this site is Executive Development Corp. This study addresses the existing and proposed conditions that affect the on-site and off-site drainage. The criteria set forth in the Clark County Regional Flood Control District (CCRFCD) "Hydrologic Criteria Manual," hereafter referred to as the "Drainage Criteria Manual," (Reference 6) is being used as the technical basis for this study.

B. Location of Property

The site lies East of the intersection of Charleston Boulevard and Jones Boulevard (See Figure 1, *Vicinity Map*) and is within the City of Las Vegas. The proposed project is within the Northeast $\frac{1}{4}$ section of Section 1, Township 21 South, Range 60 East, M.D.M., Clark County, Nevada. The site is bordered by Charleston Boulevard to the North, commercial sites to the East and West, and unimproved dedicated right-of-way (to be vacated) to the South.

C. Description of Property

The site currently consists of undeveloped desert with little vegetation and slopes to the Southeast at an approximate slope of 1.6%. The future Charleston/Jones Apartments project site is approximately 7.5 acres and consists of 8 multifamily residential apartment buildings. The future site also contains a clubhouse and a pool/spa area.

II. DRAINAGE BASIN DESCRIPTION

A. Off-Site Drainage Description

Off-site basin OFF-1 drains into Charleston/Jones Multifamily site from the West. Flows from basin OFF-1 are the only offsite flows that enter the site (see Figures 2 and 3). Basin OFF-1 contributes a 100-year flow of 6 cfs and a 10-year flow of 3 cfs. Basin OFF-1 is a developed commercial property. Storm runoff to the North of basin OFF-1 is draining North and is assumed to be included in the offsite flows in Charleston Blvd. Charleston Blvd contains a 100-year flow of 474 cfs and a 10-year flow of 208 cfs and drains to the East (Reference 7).

B. On-Site Drainage Description

In existing conditions the site drains Southeast at a slope of approximately 1.6%. Flows from basin OFF-1 drain onto the site and then follow onsite drainage patterns (see Figure 2, *Existing Conditions Exhibit*). The site currently drains into Holmby Avenue. Table 1 summarizes off-site and on-site existing peak flow rates for the 10-year and 100-year storm event.

Table 1 – Off-Site/Existing Flow Rates

BASIN	AREA (acres)	Q10 (cfs)	Q100 (cfs)
OFF-1	1.74	3	6
EX-1	7.53	7	17

C. Master Planning Information

There are no Regional Flood Control Facilities through or adjacent to the site. Storm flows on Charleston Blvd are from the City of Las Vegas – City Wide Hydrology Study Update – 1997 (Reference 7 and Figure H-13).

D. FEMA Flood Hazard Zone

The Special Flood Hazard Areas for Clark County, Nevada are outlined in the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps dated August 16, 1995. The site was determined to be located in the area covered by Community Panel No. 320003 C 2161 D. This panel was not printed by FEMA since it is located entirely in FEMA "Zone X" (See Figure 3, *FEMA Map*).

E. Previous Drainage Studies

There were no previous drainage studies referenced for this Technical Drainage Study.

III. PROPOSED DRAINAGE FACILITIES

A. General Description

The flows in the site after development will be conveyed by the interior driveways and parking areas and will concentrate at the Southeast corner of the site (see Figure 4, *Proposed Conditions Exhibit*). Nuisance flows will follow on-site drainage patterns. A standard sidewalk under drain will be constructed at the Southeast corner of the site to convey nuisance flow.

The site has been analyzed as one on-site basin; FUT-1. Off-site basin OFF-1 will drain onto the project site through an existing drainage swale and a proposed block wall opening. Basin OFF-1 will combine with basin FUT-1 at concentration point CP-1. The combined flows will then drain through an 8-foot wide concrete-lined swale and then into Holmby Avenue. Table 2 summarizes proposed basin storm flow rates.

Table 2 – Proposed Flow Rates

BASIN	AREA (acres)	Q10 (cfs)	Q100 (cfs)
FUT-1	7.53	11	23
OFF-1	1.74	3	6
CP-1	-	13	27

B. Compliance with Regulations and Adopted Plans

This study has been prepared in accordance with the CCRFCD's *Hydrologic Criteria and Drainage Design Manual* (Reference 6) and Clark County's *Uniform Regulations for the Control of Drainage*.

C. Hydrologic Analysis

Existing and proposed watersheds were modeled using the generalized storm network computation capabilities of the U.S. Army Corps of Engineer's HEC-1 Flood Hydrograph computer model (Reference 4). The HEC-1 computer program has a wide range of capabilities in modeling gauged and ungauged watersheds, with most of the latest techniques for simulating precipitation, evaporation, surface impoundment, flood routing, flow diversions and splits. Since the study watershed is ungauged, the analysis used to model runoff incorporated the Soil Conservation Service (SCS) unit hydrograph method to develop a hypothetical flood hydrograph (Reference 2).

The Drainage Criteria Manual was used to establish the point precipitation values and rainfall distribution (SDN 3). The NOAA precipitation values were then adjusted by the recommended correction factors to develop point rainfall depths for storm events that best simulate the hydrologic area. The point precipitation values are shown in Table 3 for the six-hour duration storm event. The six-hour storm has been selected in accordance with the Drainage Criteria Manual.

Table 3 - Point Precipitation Values

Inches (6-Hour Duration)		
	10-Year	100-Year
Precipitation Values *	1.58	2.77
Ratio of 10-year to 100-year flows	.57	

From CCRFCD Drainage Criteria Manual - Table 505 (Enclosed in the Appendix)

The curve numbers were developed based on vegetation, soils group information, land use, and antecedent moisture conditions (AMC II) in accordance with the standard methods of the Soil Conservation Services (SCS). The curve numbers were determined from the curve number tables included in the Appendix.

The soils information was obtained from the SCS Soils Survey of the Las Vegas Valley Area (Reference 3) and the CCRFCD MPU Soils Map Figure H-14 (Reference 5). The MPU Soils Map is shown in the appendix.

titled, *MPU Hydraulic Subareas, Land Use & Soils Map*. This Survey delineates families of soil types and the hydrologic soil group of each family. Figure H-14 shows the soil boundary delineation as well as the site location. An examination of this figure shows "D" type soils. "D" type soils are soils where infiltration is low and water transmission is high.

The time between a brief heavy rain and the maximum runoff rate is called lag time. Lag can be estimated from historical hydrographs or it can be estimated from specific watershed characteristics such as watershed length, slope and flow retardance. Based on studies of many storm events for a range of watershed conditions, the following empirical relationship between lag (L) and time of concentration (Tc) was derived:

$$L = 0.6T_c \quad T_c = \frac{L_{ws}}{3,600V} + T_i$$

where: L_{ws} = Hydraulic length
 V = Average Velocity
 T_i = Initial flow time

Average velocities for estimating travel time for surface flow were used to develop a time of concentration. To determine initial flow times, the equation $T_i = 1.8(1.1-K)L^{1/2}/S^{1/3}$ was used as outlined in the Criteria Manual.

D. Facility Design Calculations

The existing street flow depth in Charleston Blvd was computed using FlowMaster to size protection berms for the site. The flow depth in Charleston Blvd is about 1 foot above the flowline. All on-site flows concentrate in the Southeast corner of the site with no flows draining to Charleston Blvd. Off-site flows will enter the site through an existing off-site swale and then drain through a minimum 16" x 48" block wall opening. Once these flows combine (CP-1) they will pass over an 15.46-ft long submerged weir and drain into an 8-foot concrete swale and then follow existing drainage conditions to the East. A 10-foot public drainage easement has been provided for the off-site flows and the combined flows and it will be privately maintained. The height of ponding upstream of the weir location is equal to 0.70-feet. The water height in the concrete swale will be 0.38 feet.

Hydraulic calculations are based on Manning's Equation and were performed utilizing typical street cross sections. Block wall calculations are based on the weir equation. Table 4 summarizes the source of street cross section flows. Table 5 summarizes the street cross section flow depths. Hydraulic calculations, block wall calculations are included in the Appendix.

Table 4 - Source of Flows

Section	Source of the 100-year flow Used for Street Calculations
A	Charleston Flow from Reference 7
B	Half of Flow Generated by Basin FUT-1
C	CP-1 Flow minus half of Flow Generated by Basin FUT-1

Table 5 - Proposed Normal Depth Calculations

Section	Slope (%)	Q ₁₀₀ (cfs)	Velocity (fps)	Depth (ft)	D X V	10-Year Dry Lane (ft)
A	0.80	474	6.55	0.97	6.35	N/A
B	1.00	12	3.20	0.56	1.79	N/A
C	0.64	16	3.13	0.55	1.72	N/A

Flows in the interior driveways are 0.56 feet and 0.55 feet. The finish floor elevation will be at least twice the depth of flow for the entire site. Please note that several buildings have finish floors that are less than 6" above the adjacent top of curb, the curbs are located at local high points where flows are draining away from the buildings. The site will be protected from flows in Charleston by berms at the entrances and floodwalls along the property line.

IV. CONCLUSIONS

1. The hydrologic analysis utilized the HEC-1 computer model. The hydrologic analysis has been prepared in conformance with the policies outlined in the CCRFCD's *Hydrologic Criteria and Drainage Design Manual* and on generally accepted engineering practices.
2. The proposed development will be in compliance with the *Clark County Regional Flood Control District Flood Control Master Plan Update* upon final build out.
3. The site is not located within a FEMA Special Flood Hazard Zone.
4. Finished floor elevations have been set to meet the criteria of the manual. Finished floors near Charleston Blvd will be protected from Charleston flows by berms at each entrance and floodwalls along the property line.
5. A continuous 10-foot public drainage easement will be provided for off-site flows that will be privately maintained.
6. The development of the proposed site is anticipated to have no significant impact to down stream developments.
7. The proposed measures present in this study are in compliance with all current applicable laws and regulations.
8. Nuisance flows during construction will be handled in as determined within the Charleston/Jones Apartments "Stormwater Pollution Prevention Plan." Nuisance flows after completion of the construction will follow proposed storm flow drainage patterns.

!!
 HEC1 S/N: 1333000362 HVersion: 6.40 Data File: 88100117.MC1

```

.....
* FLOOD HYDROGRAPH PACKAGE (HEC-1)
* SEPTEMBER 1990
* VERSION 4.0
* RUN DATE 10/15/2002 TIME 09:59:01
*
.....
  
```

```

.....
* U.S. ARMY CORPS OF ENGINEERS
* HYDROLOGIC ENGINEERING CENTER
* 609 SECOND STREET
* DAVIS, CALIFORNIA 95616
* (916) 736-1104
*
.....
  
```

CHARLESTON 4 JONES APARTMENTS
 EXISTING/PROPOSED CONDITIONS BY: ALEX KINGSTON
 OCTOBER 15, 2002 FILE: 88100117.MC1

```

6 IO OUTPUT CONTROL VARIABLES
  IFPRT 5 PRINT CONTROL
  IPLOT 0 PLOT CONTROL
  QSCAL 0. HYDROGRAPH PLOT SCALE

IT HYDROGRAPH TIME DATA
  MNIN 2 MINUTES IN COMPUTATION INTERVAL
  IDATE 1 0 STARTING DATE
  ITIME 0000 STARTING TIME
  NQ 300 NUMBER OF HYDROGRAPH ORDINATES
  NDDATE 1 0 ENDING DATE
  METIME 0936 ENDING TIME
  ICENT 19 CENTURY MARK

COMPUTATION INTERVAL .03 HOURS
TOTAL TIME BASE 9.97 HOURS
  
```

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

JP MULTI-PLAN OPTION 1 NUMBER OF PLANS
 NPLAN

JR MULTI-RATIO OPTION
 RATIOS OF PRECIPITATION
 .57 1.00

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	RATIO 2
HYDROGRAPH ATD	EX-1	.01	1	.57	1.00
			FLOW	7.	17.
			TIME	3.53	3.57
HYDROGRAPH ATD	FUT-1	.01	1	10.	21.
			FLOW	3.57	3.53
HYDROGRAPH ATD	OFF-1	.00	1	3.	6.
			FLOW	3.50	3.50
2 COMBINED ATD	CP-1	.01	1	13.	27.
			FLOW	3.53	3.53
			TIME		

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

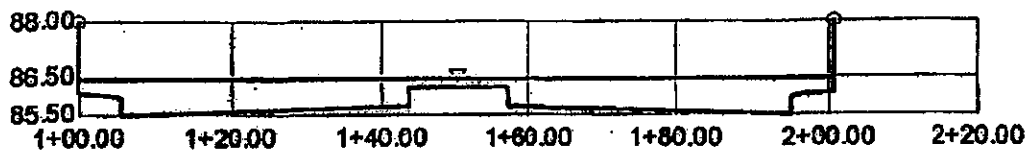
CHARLESTON 100-YEAR FLOW DEPTH
Worksheet for Irregular Channel

Natural Channel Points	
Station (ft)	Elevation (ft)
2+00.67	86.10
2+00.67	88.00

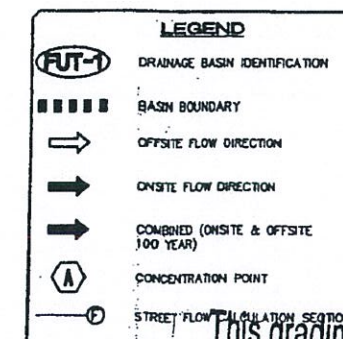
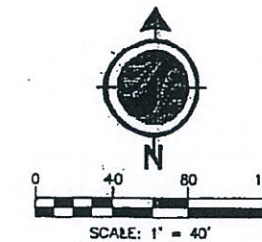
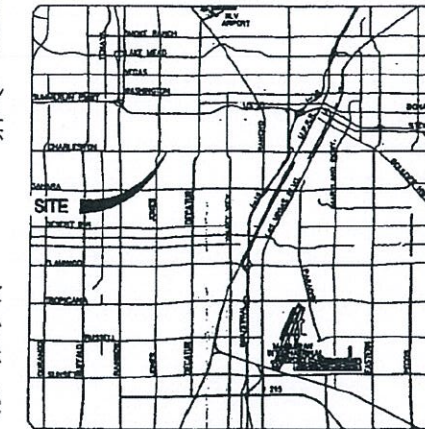
Cross Section **Cross Section for Irregular Channel**

Project Description	
Worksheet	Section A - Charleston Blvd
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data	
Mannings Coefficient	0.016
Slope	0.80 %
Water Surface Elevation	86.47 R
Elevation Range	85.50 to 88.00
Discharge	474 cfs



V:5.0
H:1
NTS



STORM FLOW SUMMARY EXISTING CONDITION			
BASIN	AREA (acres)	CHIN (cfs)	C
EX-1	7.53	10/22/21	
OFF-1	174.1	3P	

FLOW CALCULATION SECTION

This grading plan is a part of drainage study

LOW SUMMARY

CONDITION:

AREA (acres)

CH (cfs)

CH (cfs)

received

[illegible]

Stantec Consulting Inc.
6763 W. Charleston Blvd.
Las Vegas NV U.S.A.
89146-1049
Tel. 702.258.0115
Fax. 702.258.4956
www.stantec.com

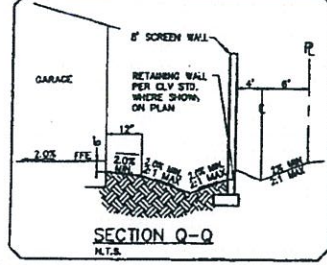
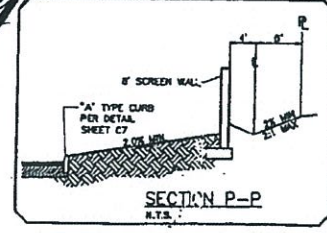
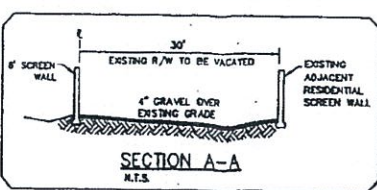
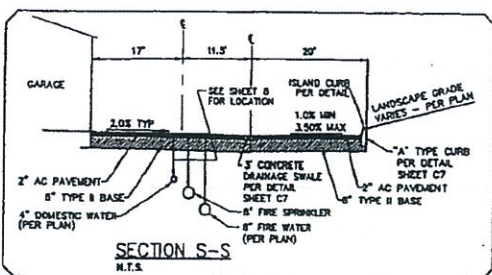
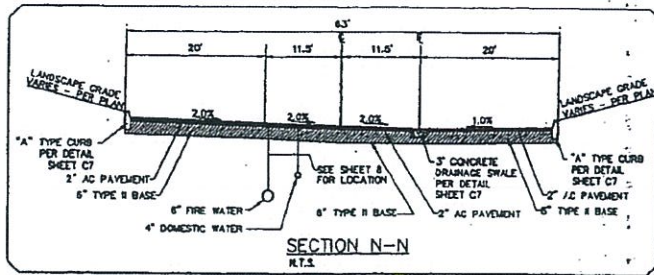
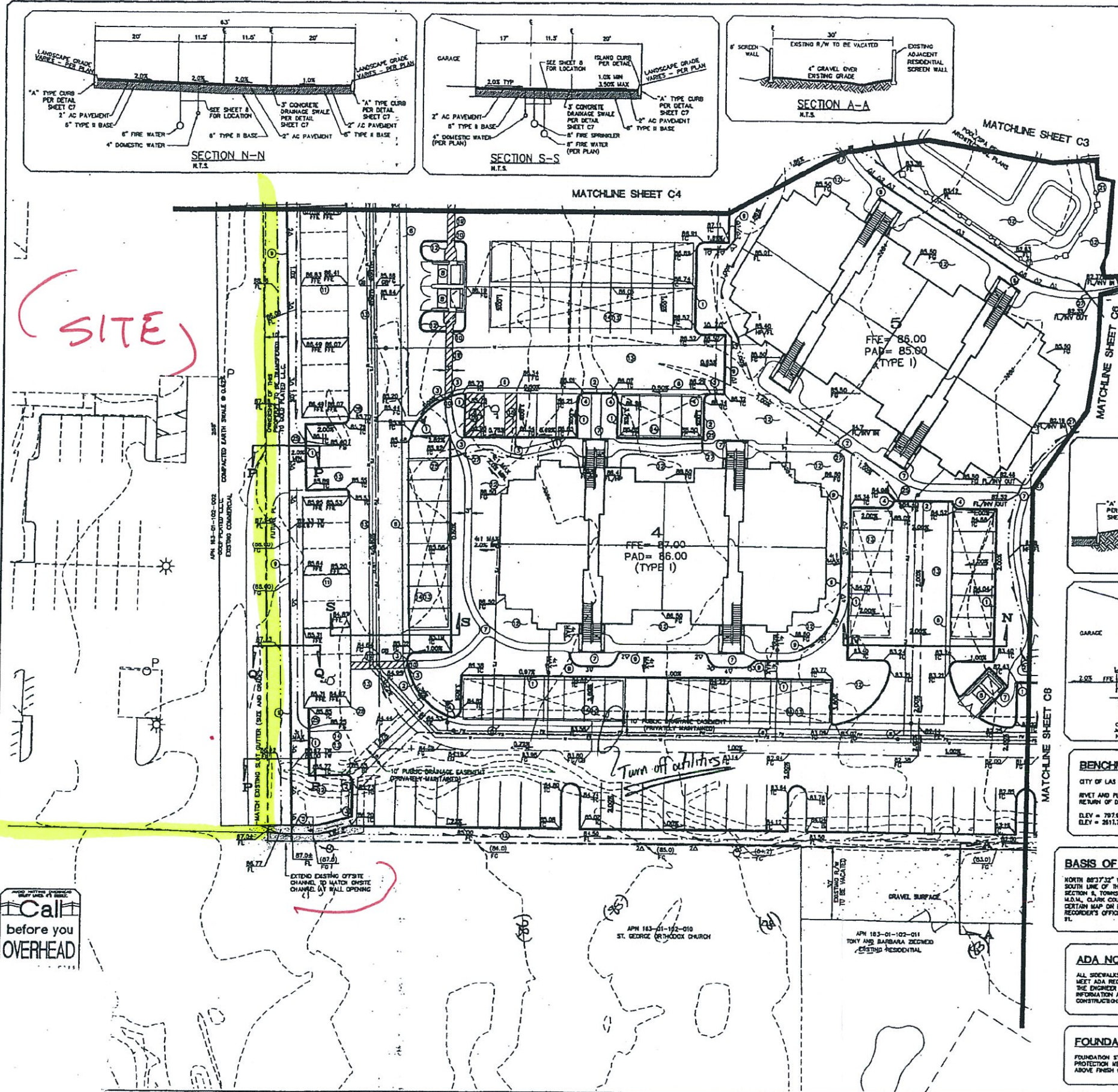


EXECUTIVE DEVELOPMENT CORPORATION
JONES & CHARLESTON

Call before you OVERHEAD

Grading Improvements (017)-improvements plan, including residential, road, OS, Apr 2003 - 2:30pm

(SITE)



BENCHMARK
CITY OF LAS VEGAS BENCHMARK (BLV10-BWS)
Rivet and Plate in Top of Curb at the Northwest
Return of Desert Inn Road and Durango Drive.
Elev = 797.8053 METERS (NAVD83)
Elev = 2617.78 U.S. SURVEY FEET (NAVD83 CALC.)

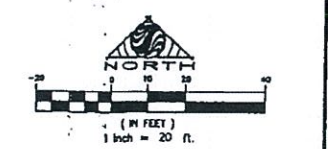
BASIS OF BEARINGS
NORTH 88°17'32\"/>

ADA NOTE
ALL SIDEWALKS AND HANDICAP ACCESS RAMPS SHALL
MEET ADA REQUIREMENTS. CONTRACTOR SHALL NOTIFY
THE ENGINEER OF ANY DISCREPANCIES BETWEEN
INFORMATION AND ADA REQUIREMENTS PRIOR TO
CONSTRUCTION.

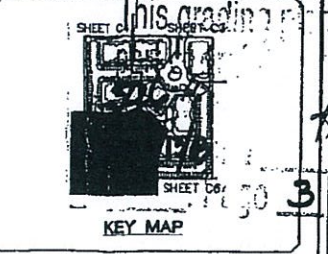
FOUNDATION WALL NOTE
FOUNDATION STEM WALLS TO RECEIVE WATER
PROTECTION MEMBRANE ON EXTERIOR SURFACE TO 6\"/>

- ENGINEER'S NOTES**
1. SEE ARCHITECT'S PLANS FOR ADDITIONAL HANDICAP ACCESSIBILITY INFORMATION AND DETAILS.
 2. THE PROPOSED AC GRADES ARE 0.5' LOWER THAN THE TOP OF CURB GRADES AT "A" TYPE CURBS UNLESS OTHERWISE NOTED.
 3. CONTRACTOR TO VERIFY SITE CONDITIONS PRIOR TO CONSTRUCTION.
 4. CONTRACTOR IS RESPONSIBLE FOR DUST AND EROSION CONTROL DURING CONSTRUCTION.
 5. SEE LANDSCAPE PLANS FOR LANDSCAPING AND ON-SITE IRRIGATION. CONTRACTOR TO PROTECT EXISTING LANDSCAPING.
 6. SEE DETAIL SHEET FOR ON-SITE PAVEMENT SECTION. CONTRACTOR TO VERIFY WITH SOILS REPORT.
 7. ENGINEER TO BE NOTIFIED OF ANY DISCREPANCIES IMMEDIATELY.
 8. THESE PLANS SHALL NOT, IN PART OR IN WHOLE, BE USED FOR CONSTRUCTION UNTIL APPROVED AND SIGNED BY THE GOVERNING AGENCIES.
 9. ALL WORK PERTAINING TO THIS SITE SHALL CONFORM WITH THE SOILS REPORT PREPARED BY GEO TECH, INC. WORK ORDER NO. 3887-LVL, DATED JUNE 13, 2002.

- CONSTRUCTION NOTES**
1. CONSTRUCT "A" TYPE CURB PER DETAIL SHEET C7.
 2. CONSTRUCT 24\"/>
 3. CONSTRUCT "B" CURB.
 4. CONSTRUCT "C" TYPE CURB AND OUTLET TO 3\"/>
 5. CONSTRUCT WALL OPENING PER DETAIL SHEET C7.
 6. CONSTRUCT 8\"/>
 7. CONSTRUCT 1\"/>
 8. CONSTRUCT 1\"/>
 9. CONSTRUCT TRASH ENCLOSURE PER ARCHITECT PLANS.
 10. CONSTRUCT RETAINING/SCREEN WALL.
 11. CONSTRUCT HANDICAP RAMP PER A.I.A. DETAIL 7 SHEET C8.
 12. CONSTRUCT GARAGE PER ARCHITECTURAL PLANS.
 13. CONSTRUCT ON-SITE HANDSCAPE/LANDSCAPE AREA. SEE ARCHITECT PLANS FOR DETAILS.
 14. CONSTRUCT AC PAVEMENT PER DETAIL SHEET C7.
 15. CONSTRUCT GENERAL PARKING AREA STRIPING PER HORIZONTAL CONTROL PLAN.
 16. CONSTRUCT HANDICAP STRIPING PER HORIZONTAL CONTROL PLAN.
 17. CONSTRUCT PASSENGER LOADING ZONE STRIPING PER ARCHITECT PLANS.
 18. CONSTRUCT 24\"/>
 19. SAWCUT AS REQUIRED AND MATCH EXISTING CURB & OUTLET.
 20. ADA 1/4\"/>
 21. CONSTRUCT ON-SITE CHANNEL PER DETAIL SHEET C7.
 22. WROUGHT IRON FENCE AND GATE PER ARCHITECTURAL PLANS.
 23. COVERED PASSING STRUCTURE PER ARCHITECTURAL PLANS.
 24. WROUGHT IRON BREAK AWAY GATE FOR FIRE DEPARTMENT ACCESS PER ARCHITECTURAL PLANS.
 25. 8\"/>
 26. INSTALL 1/4\"/>
 27. INSTALL 8\"/>
 28. INSTALL SIDEWALK DRAIN PER USG DRAWING NO. 238.
 29. GARAGE FFE TO PAVEMENT - SEE DETAIL SHEET C7.
 30. STEP SIDEWALK 7\"/>



I CERTIFY THAT THIS GRADING PLAN CONFORMS TO THE APPROVED DRAINAGE STUDY FOR THIS SITE ON FILE AT CITY OF LAS VEGAS.
RICHARD H. CUNNINGHAM, PE NO. 6447 DATE



DATE: 3/29/2003
PM: 2:30
DRAWN BY: S.W.
DESIGNED BY: R.S.
CHECKED BY: R.W.C.
SCALE: 1/8\"/>

Stantec
Executive Development
7231 West Cheyenne Blvd.
Las Vegas, NV 89117
Tel: 702.877.8222
Fax: 702.267.3537

EXECUTIVE DEVELOPMENT CORPORATION
DESERT SHADOWS APARTMENTS
GRADING PLAN

5.5
13
CLV, DWG #

CITY OF LAS VEGAS		DATE: <i>MS</i>
INTER-OFFICE MEMORANDUM		August 16, 2002
TO: Land Development Services Department of Public Works		FROM: Albert Sung, P.E. Flood Control Project Engineer Department of Public Works
SUBJECT: Drainage Study for: Talon Professional Commercial Subdivision		COPIES TO: BTS Investments
Cross Streets:	SEC of Jones Blvd. & Charleston Blvd.	CSA Engineering
File Number:	F:\Depot\DSMEMOS\DS3125B.doc	Cheri Edelman, P.E., DEVCO
Parcel Number:	163-01-102-009, 013, 016 to 018 & 023 to 027	
Zoning Action:		
FEMA Flood Zone	YES	NO X
Proposed Storm Drain	YES	NO X

HISTORY	DATE RECEIVED	DATE REVIEWED	COMMENTS	REVIEW FEES	FEES PAID G.R. #
1 st Submittal	5/2/2002	5/14/2002	Not Accepted	\$250.00	—
2 nd Submittal	7/29 & 8/13/2002	8/16/2002	See Comments Below	\$250.00	—
TOTAL FEES (LDDRS):				\$500.00	90193

REMARKS:

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

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

- All drainage easements must be recorded as "Public Drainage Easement to be privately maintained" in the commercial plat map.

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 Amendment 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.

END OF REMARKS
B&H/ssn

T/R/S: T21S/R60E/01
AREA Q-01

DRAINAGE STUDY

FOR

**TALON PROFESSIONAL SUBDIVISION
(TM-0031-02)**

A.P.N.#S 163-01-102-009,013,016,017,018,023,024,025,026 & 027

**PREPARED FOR: BRAMBLE DEVELOPMENT GROUP
2590 LINDELL ROAD
LAS VEGAS, NEVADA 89148**

**PREPARED BY: JAMES C. SMITH, R.C.E. 6331
5160 S. EASTERN AVE., #F
LAS VEGAS, NEVADA 89119
(702) 262-9626 FAX: 739-7211**

ON-SITE BASIN

THE EXISTING ON SITE BASIN CONSISTS OF THE ENTIRE 4.51 ACRE SITE. BASED ON EXISTING GRADES THE SITE NOW DRAINS FROM THE SOUTHWEST TO THE NORTHEAST. THIS SITE AND THE 2.07 LAND TRACT (LOCATED TO THE SOUTHWEST OF THE SITE) NOW WILL DRAIN TO THE NORTHEAST ONTO THE PARCEL LOCATED TO THE EAST OF THE SUBJECT SITE.

RED ROCK STREET (PARTIALLY IMPROVED) IS LOCATED ALONG THE EASTERN BOUNDARY. THIS ROADWAY IS THE EASTERN BOUNDARY OF THE BASIN. BASED ON EXISTING GRADES, THE ROADWAY NOW DRAINS TO THE SOUTH AND THENCE EAST ON DEL REY AVE.. THE PORTION OF DEL-REY AVE. ALONG THE SOUTHERN BOUNDARY OF THE SITE HAS BEEN VACATED.

THE ON-SITE BASIN IS BOUNDED ON THE WEST BY JONES. BLVD., ON THE NORTH BY COMMERCIAL DEVELOPMENT THAT HAS DRAINAGE TO THE EAST AND ON THE SOUTH BY RESIDENTIAL DEVELOPMENT THAT ALSO HAS EXISTING DRAINAGE TO THE EAST.

A TR-55 ANALYSIS WAS DONE FOR THIS ON-SITE BASIN (IDENTIFIED AS ON-SITE BASIN A-1 ON THE ENCLOSED BASIN MAP). BASED ON THE SOILS BEING 60% TYPE "A" AND 40% TYPE "D" FOR THIS BASIN. THE RESULTING TR-55 CALCULATIONS FOR THE SITE FOR EXISTING (UNDEVELOPED CONDITIONS) WAS $Q_{100} = 7.0$ CFS. FOR THE DEVELOPED CONDITION THE Q_{100} FLOW WAS DETERMINED TO BE 14.0 CFS.

CONCLUSIONS AND RECOMMENDATIONS

- 1.) THE SITE IS NOT LOCATED IN A FEMA FLOOD ZONE.
- 2.) THE AREA HAS BEEN ANALYZED FOR FLOWS BY A PREVIOUS STUDY. A 312 CFS FLOW IS SHOWN IN THIS STUDY FOR FLOWS IN THE JONES BLVD. AREA. THE FLOW DEPTH WAS DETERMINED FOR THE 100 YR. STORM EVENT IN JONES BLVD. ADJACENT TO THE SITE. THE ENTRANCE DRIVEWAY HAS BEEN ELEVATED 6 INCHES ABOVE THE DETERMINED 100 FLOW DEPTH TO PREVENT STORMWATERS FROM ENTERING THE SITE.
- 3.) THE FINISH FLOOR ELEVATIONS HAVE BEEN SET ABOVE THE 100 YR. FLOW ELEVATION WITHIN THE SITE.
- 4.) AS PROPOSED, ON-SITE GRADING WILL RESULTS IN MAINTAINING THE HISTORICAL FLOW PATTERNS/DIRECTIONS.
- 5.) THE WALL OPENING ALONG THE EASTERN BOUNDARY IS PROVIDED FOR SITE DRAINAGE AND AS SAFETY OUTLET FOR THE DETENTION AREA. IT IS POSITIONED IN THE LOW SPOT ALONG THE PROPERTY LINE.
- 6.) THE OFF-SITE FLOW FORM THE ADJACENT AREA TO THE SOUTHEAST OF THE SITE, IS BEING ALLOWED TO ENTER AND DRAIN THROUGH THE SITE.
- 7.) NO FLOW FROM ADJACENT PROPERTIES ALONG THE NORTH AND SOUTH PROPERTY LINES IMPACT THE SITE.
- 7.) FLOWS ON RED ROCK STREET AREA ARE CONTAINED WITHIN THE ROADWAY. THE PROPOSED ROADWAY DESIGN IS CONSISTENT TO EXISTING GRADES.

JAMES C. SMITH, P.E.
5160 S. EASTERN AVE., STE. #F
LAS VEGAS, NEVADA 89119
(702) 262-9626 FAX: 739-7211

Rec'd
8/13/02
3125
Q-01
\$250

AUGUST 13, 2002

MR. ALBERT SUNG, P.E.
FLOOD CONTROL PROJECT ENGINEER
LAND DEVELOPMENT SERVICES
DEPARTMENT OF PUBLIC WORKS
CITY OF LAS VEGAS

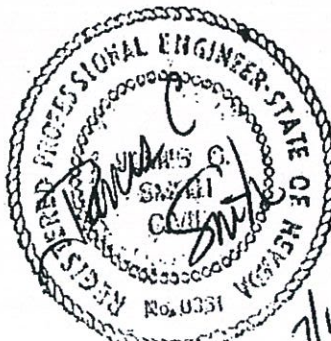
RE: TALON PROFESSIONAL COMMERCIAL SUBDIVISION
SE CORNER OF JONES BLVD. & JONES BLVD.

THE FOLLOWING ARE IN RESPONSE TO THE INTER-OFFICE MEMORANDUM, DATED
AUGUST 8, 2002 FOR THE ABOVE-REFERENCED PROJECT:

- 1.) THE FLOW ON JONES BOULEVARD ADJACENT TO THE SITE, ACCORDING TO THE CITY WIDE HYDROLOGY STUDY, UPDATE -1997, FIGURES 15 & 17 (FIGURE 15 PREVIOUSLY SUBMITTED AND FIGURE 17 ATTACHED) IS ACTUALLY $Q_{100} = 32$ CFS, NOT 312 CFS AS STATED IN THE PREVIOUS SUBMITTAL.
A NEW FLOWMASTER CALCULATION FOR JONES BLVD. WAS DONE BASED ON THE CORRECT FLOW. THE FLOW DEPTH WAS DETERMINED TO BE 0.41 FEET. THE VELOCITY IS 2.31 FEET AND THE VXD RATIO IS 0.95.
SINCE THE 100 YEAR FLOW IS CONTAINED IN THE RIGHT-OF-WAY, NO ADDITIONAL FLOW EXCEPT THE 6.0 CFS WILL IMPACT THE WESTERN BOUNDARY OF THE SITE.
- 2.) A SOLID GROUTED WALL IS PROPOSED ALONG JONES BLVD. ADJACENT THE SITE, BUT NONE IS NEED TO PROTECT STORMWATERS FOR THE PROPERTY TO THE WEST OF THE SITE AS THE NEW FLOWMASTER CALCULATION DETERMINED THE WATER IS CONTAINED IN THE RIGHT-OF-WAY.
- 3.) THE CURB PROFILE FOR RED-ROCK STREET HAS BEEN EXTENDED TO INCLUDE THE ENTIRE RUN OF THE CURB ON THE ROADWAY. THE ACTUAL END OF CURB IS THE HIGH POINT OF THE CURB.
- 4.) THE ON-SITE SIDEWALK UNDERDRAINS HAVE BEEN NOTED AS BEING 4 INCHES IN HEIGHT AND TWO FEET IN WIDTH ON THE GRADING PLAN.
- 5.) THE DRAINAGE EASEMENT ACROSS THE SITE HAS BEEN NOTED AS "PUBLIC DRAINAGE EASEMENT TO BE PRIVATELY MAINTAINED BY THE HOMEOWNERS ASSOCIATION". THIS WILL BE SHOWN ON THE FINAL MAP. IF THIS NEEDS TO BE A COMMON LOT, IT WILL BE SHOWN AS SUCH ON THE FINAL SUBDIVISION MAP.
- 6.) THE ELEVATIONS AT THE SIDEWALK AND AROUND BUILDINGS G & H HAVE BEEN MODIFIED TO SHOW POSITIVE DRAINAGE.
- 7.) THE 10 FT. NOTATION ON THE DRAINAGE EASEMENT HAS BEEN CHANGED TO 15 FT.
- 8.) THE SOLID GROUTED WALLS ARE SHOWN WITH DARKER CELLS TO THE LIMITS OF THE DETAIL NOTES.

SINCERELY,

JAMES C. SMITH, R.C.E. 6331



7/14/02

Worksheet for Irregular Channel

Project Description	
Worksheet	JONES BLVD.FLOW(100'RV
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Slope	0.005000 ft/ft
Discharge	23.00 cfs

Options	
Current Roughness Method	Improved Lotter's Method
Open Channel Weighting Method	Improved Lotter's Method
Closed Channel Weighting Method	Horton's Method

Results	
Mannings Coefficient	0.017
Water Surface Elevation	94.81 ft
Elevation Range	94.40 to 95.66
Flow Area	9.9 ft²
Wetted Perimeter	43.46 ft
Top Width	43.00 ft
Actual Depth	0.41 ft
Critical Elevation	94.78 ft
Critical Slope	0.007209 ft/ft
Velocity	2.31 ft/s
Velocity Head	0.08 ft
Specific Energy	94.89 ft
Froude Number	0.85
Flow Type	Subcritical

$$X \times D \text{ Ratio} = (0.41)(2.31) = 0.95$$

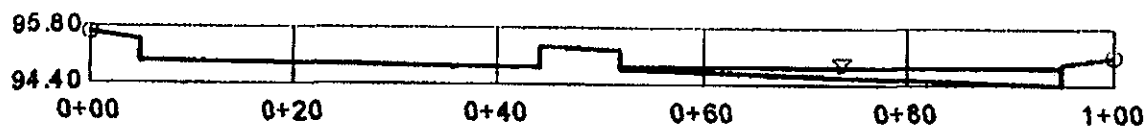
Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+00	1+00	0.017

Natural Channel Points	
Station (ft)	Elevation (ft)
0+00	95.66
0+05	95.46
0+05	94.96
0+44	94.82
0+44	95.32
0+52	95.25
0+52	94.75
0+85	94.40
0+85	94.80
1+00	95.10

Cross Section Cross Section for Irregular Channel

Project Description	
Worksheet	JONES BLVD.FLOW(100'RW
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data	
Mannings Coefficient	0.017
Slope	0.005000 ft/ft
Water Surface Elevation	94.81 ft
Elevation Range	94.40 to 95.66
Discharge	23.00 cfs



V:4.0
H:1
NTS

CITY OF LAS VEGAS		DATE:	
INTER-OFFICE MEMORANDUM		November 21, 1999	
TO: Land Development Services Department of Public Works		FROM: Dennis W. Stransky, P.E. Flood Control Project Manager Department of Public Works	
SUBJECT: Drainage Study for: SkipCo Building Expansion		COPIES TO: JHR Associates, Ltd.	
Cross Streets:	Charleston and Jones	SkipCo Cheri Edelman, P.E., DEVCO	
FILE NO.:	F:\Depot\DSMEMOS\DS2577A.doc		
Parcel Number:	163-01-102-001, 002, 007		
Zoning Action:	Existing building		
FEMA Flood Zone	YES No X		
Proposed Storm Drain	YES No X		

HISTORY	DATE RECEIVED	DATE REVIEWED	COMMENTS	REVIEW FEES
1st Submittal	11/17/1999	<u>11/24/1999</u>	See Comments Below	\$250.00
			TOTAL FEES:	\$250.00

REMARKS:

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

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

1. The top of berm elevations and the limits of the berm must be shown on the grading plan.

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 Amendment 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.

PLANS SENT TO LAND DEVELOPMENT yes (initial)

END OF REMARKS

dws

T/R/S: 21S/60E/01

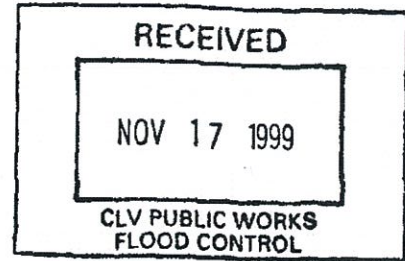
AREA Q01

JHR Associates, Ltd.

P.O. BOX 28631 LAS VEGAS, NEVADA 89126

November 1, 1999

City of Las Vegas
Flood Control Division
Attn: Mr. Dennis Stransky, P.E.
731 South Fourth Street
Las Vegas, Nevada 89101
Ph: (702) 229-2142



Re: SkipCo Building Expansion - Hydrology UPDATE

Dear Mr. Stransky:

The above referenced project is located within the Northwest ¼ of Section 1 of Township 21 South, Range 60 East, M.D.M., Clark County Nevada, refer to the **Vicinity Map** of the attached **Grading Plan**. The project site is located on the southeast corner of the intersection of Charleston Boulevard at Jones Boulevard. The project site is further identified as parcel number 163-01-102-001, 002, and 007 for a total of 2.4 Acres, refer to the attached **Assessor's Parcel Map**. A building expansion of 17,794 sq.ft. is a proposed addition to the existing 16,138 sq.ft. building as shown on the attached **Grading Plan**. The aforementioned project site lies within a FEMA Flood Zone 'X' as identified on the Flood Insurance Rate Map Community Panel No. 2165. A Flood Zone 'X' is determined to be outside the 500-year flood plain. This floodplain determination is also reflected within the **City of Las Vegas Flood Control Facilities and City Wide Hydrology Analysis Volume II, Dated December 1997 (CLVCW)**, which is contained in the appendix.

Pursuant to our discussion of the 19th of October, the original hydrology study for the existing SkipCo Building was waived. It is the intent of this document to address the potential hydrologic impact of a 100-year storm event to the proposed building expansion only. Also, pursuant to our discussion of the 19th of the hydrologic impact in the area, the **CLVCW** is satisfactory to serve as a basis in determining a potential flooding threat to the proposed building expansion.

2577
Q-01
\$250

The proposed building expansion may be potentially affected from the surface runoff from offsite basin **CH07** as identified on **Figure H-13** of the **CLVCW**, which is contained in the appendix. As shown on this figure, the anticipated ultimate surface runoff for a 100-year storm event is 23 cfs. Offsite basin **CH07** is located west from the aforementioned project site across the 100-ft right-of-way of Jones Boulevard. As demonstrated by the Jones Boulevard depth of flow calculations, which are attached for reference, it is expected that the 23 cfs would be contained within the westerly portion of Jones Boulevard posing no potential flooding threat to the proposed building expansion.

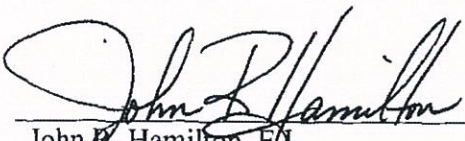
The proposed building expansion is more than 200 ft from the right-of-way of Charleston Boulevard and is not expected to be affected by an anticipated surface flow within Charleston Boulevard. As shown on **Figure H-13**, 474 cfs is expected within the right-of-way of Charleston Boulevard. As demonstrated by the Charleston Boulevard depth of flow calculations, which are attached for reference, it is expected that a flow depth of 1.13 ft from surface flow of 474 cfs will not pose any threat to the proposed building expansion, refer to attached **Grading Plan**.

The existing on-site drainage patterns will remain virtually unchanged and the on-site discharge point will continue to be the southeasterly corner of the project site for on-site basin **ON-1 (1.4 Acres)**, as shown on the attached **Grading Plan**. As demonstrated by the attached **HEC-1** analysis, the surface runoff in the developed condition will remain virtually unchanged for both the 10-year and 100-year storm event. The anticipated on-site surface runoff is 3 and 5 cfs for both the 10-year and 100-year storm respectively. It should be noted that a roadway dedication for Holmby Avenue exists at the southeasterly portion of project site and is further identified on file at the Clark County Recorder's Office as Book No. 0874 as Document No. 0910828. However, this roadway dedication is currently in the process of being vacated. Additionally, no drainage easements are required since all three (3) of the aforementioned parcels are under the same ownership.

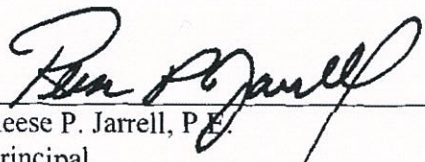
In conclusion, it was deemed appropriate to set a finished floor elevation of 2292.12 ft to be the same as the existing SkipCo building due to the lack of any potential flooding impact. However, since the finished floor elevation of the proposed building is 6-inches below the flowline of Jones Boulevard, a 12-inch minimum landscape berm will be set in place as additional precautionary flood protection measures, refer to attached Grading Plan.

If you should have any questions regarding this submittal or require further information, please do not hesitate to contact our office at (702) 876-2341.

Respectfully submitted,



John R. Hamilton, E.I.
Project Engineer



Reese P. Jarrell, P.E.
Principal


```

*****
*
* FLOOD HYDROGRAPH PACKAGE (HEC-1)
* BY THE COE IN FEBRUARY 1981
* REVISED 02 AUG 88
*
* RUN DATE 11/02/1999 TIME 10:39:44
*
*****

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*****
*
* DODSON AND ASSOCIATES, INC.
* HYDROLOGIST AND CIVIL ENGINEERS
* 7015 W TIDWELL SUITE 107
* HOUSTON, TEXAS 77092
* (713) 895-8322
*
*****

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X   X XXXXXXX XXXX      X
X   X X      X   X      XX
X   X X      X          X
XXXXXX XXXX   X      XXXX X
X   X X      X          X
X   X X      X   X      X
X   X XXXXXXX XXXX      XXX

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

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

```

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

1         ID
          *DIAGRAM
2         ID      SKIPCO BUILDING EXPANSION -- PROJECT NUMBER 124-99-388
3         ID      SKIPCO BUILDING EXPANSION -- PROJECT NUMBER 124-99-388
4         ID      SKIPCO BUILDING EXPANSION -- PROJECT NUMBER 124-99-388
5         ID      SKIPCO BUILDING EXPANSION -- PROJECT NUMBER 124-99-388
6         ID      SKIPCO BUILDING EXPANSION -- PROJECT NUMBER 124-99-388
7         ID      SKIPCO BUILDING EXPANSION -- PROJECT NUMBER 124-99-388
8         ID      SKIPCO BUILDING EXPANSION -- PROJECT NUMBER 124-99-388
9         ID
10        ID      ANALYSIS BY:   JHR ASSOCIATES, LTD.
11        ID                        4880 W.UNIVERSITY, SUITE B-2
12        ID                        LAS VEGAS, NEVADA 89103
13        ID                        (702) 876-2341
14        ID
15        ID      ***** EXISTING AND DEVELOPED CONDITIONS
16        ID      ***** EXISTING AND DEVELOPED CONDITIONS
17        ID      ***** EXISTING AND DEVELOPED CONDITIONS
18        ID      ***** EXISTING AND DEVELOPED CONDITIONS
19        ID      ***** EXISTING AND DEVELOPED CONDITIONS
20        ID      ***** EXISTING AND DEVELOPED CONDITIONS
21        ID      ***** EXISTING AND DEVELOPED CONDITIONS
22        ID      ***** EXISTING AND DEVELOPED CONDITIONS
23        ID
24        ID
25        ID      *****
26        ID      *          HYDROLOGY STUDY          *
27        ID      *              FOR              *
28        ID      *6-HOUR STORM/DEVELOPED CONDITION *
29        ID      *          100 YEAR STORM          *
30        ID      *                                  *
31        ID      *****
32        ID
33        IT      5          0          0          300
34        IO      5          0          0
35        IN      5          0          0
36        JR      PREC      1          .57

37        KK      ON1E
38        KM      RUNOFF ON1-EXISTING CONDITION
39        BA      .0022
40        PB      2.77
41        PC      0.000  0.020  0.057  0.070  0.087  0.108  0.124  0.130  0.130  0.130
42        PC      0.130  0.130  0.130  0.133  0.140  0.142  0.148  0.158  0.172  0.181
43        PC      0.190  0.197  0.199  0.200  0.201  0.204  0.214  0.229  0.241  0.249
44        PC      0.251  0.256  0.270  0.278  0.281  0.283  0.295  0.322  0.352  0.409
45        PC      0.499  0.590  0.710  0.744  0.781  0.812  0.819  0.835  0.851  0.856
46        PC      0.860  0.868  0.876  0.888  0.910  0.926  0.937  0.950  0.970  0.976
47        PC      0.982  0.985  0.987  0.989  0.990  0.993  0.993  0.994  0.995  0.998
48        PC      0.998  0.999  1.000
49        LS      0          95
50        UD      .05

```

LINE	ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10
51	KK ON1D
52	KM RUNOFF ON1-DEVELOPED CONDITION
53	BA .0022
54	LS 0 98
55	UD .05
56	ZZ

SCHEMATIC DIAGRAM OF STREAM NETWORK

INPUT

LINE	(V) ROUTING	(--->) DIVERSION OR PUMP FLOW
NO.	(.) CONNECTOR	(<---) RETURN OF DIVERTED OR PUMPED FLOW
37	ON1E	
	.	
	.	
51	.	ON1D

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

```
*****
*
* FLOOD HYDROGRAPH PACKAGE (HEC-1)
* BY THE COE IN FEBRUARY 1981
* REVISED 02 AUG 88
*
* RUN DATE 11/02/1999 TIME 10:39:44
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* DODSON AND ASSOCIATES, INC.
* HYDROLOGIST AND CIVIL ENGINEERS
* 7015 W TIDWELL SUITE 107
* HOUSTON, TEXAS 77092
* (713) 895-8322
*
*****
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```

```
ANALYSIS BY: JHR ASSOCIATES, LTD.
              4880 W.UNIVERSITY, SUITE B-2
              LAS VEGAS, NEVADA 89103
              (702) 876-2341
```

```
***** EXISTING AND DEVELOPED CONDITIONS
***** EXISTING AND DEVELOPED CONDITIONS
***** EXISTING AND DEVELOPED CONDITIONS
***** EXISTING AND DEVELOPED CONDITIONS
***** EXISTING AND DEVELOPED CONDITIONS
***** EXISTING AND DEVELOPED CONDITIONS
***** EXISTING AND DEVELOPED CONDITIONS
***** EXISTING AND DEVELOPED CONDITIONS
```

```
*****
* HYDROLOGY STUDY
* FOR
*6-HOUR STORM/DEVELOPED CONDITION
* 100 YEAR STORM
*
*****
```

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

```
IT HYDROGRAPH TIME DATA
      NMIN      5 MINUTES IN COMPUTATION INTERVAL
      IDATE      1 0 STARTING DATE
      ITIME      0000 STARTING TIME
      NQ         300 NUMBER OF HYDROGRAPH ORDINATES
      NDDATE      2 0 ENDING DATE
      NDTIME      0055 ENDING TIME
      ICENT      19 CENTURY MARK
```

COMPUTATION INTERVAL .08 HOURS
TOTAL TIME BASE 24.92 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
1.00 .57

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	RATIO 2
				1.00	.57
HYDROGRAPH AT	ON1E	.00	1 FLOW	5.	3.
			TIME	3.50	3.50
HYDROGRAPH AT	ON1D	.00	1 FLOW	5.	3.
			TIME	3.50	3.50

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

CHARLESTON BLVD - 100 YR
Worksheet for Irregular Channel

Project Description	
Project File	j:\proj\skipco\food\flowmstr.fm2
Worksheet	CHARLESTON BLVD - 100 YR
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

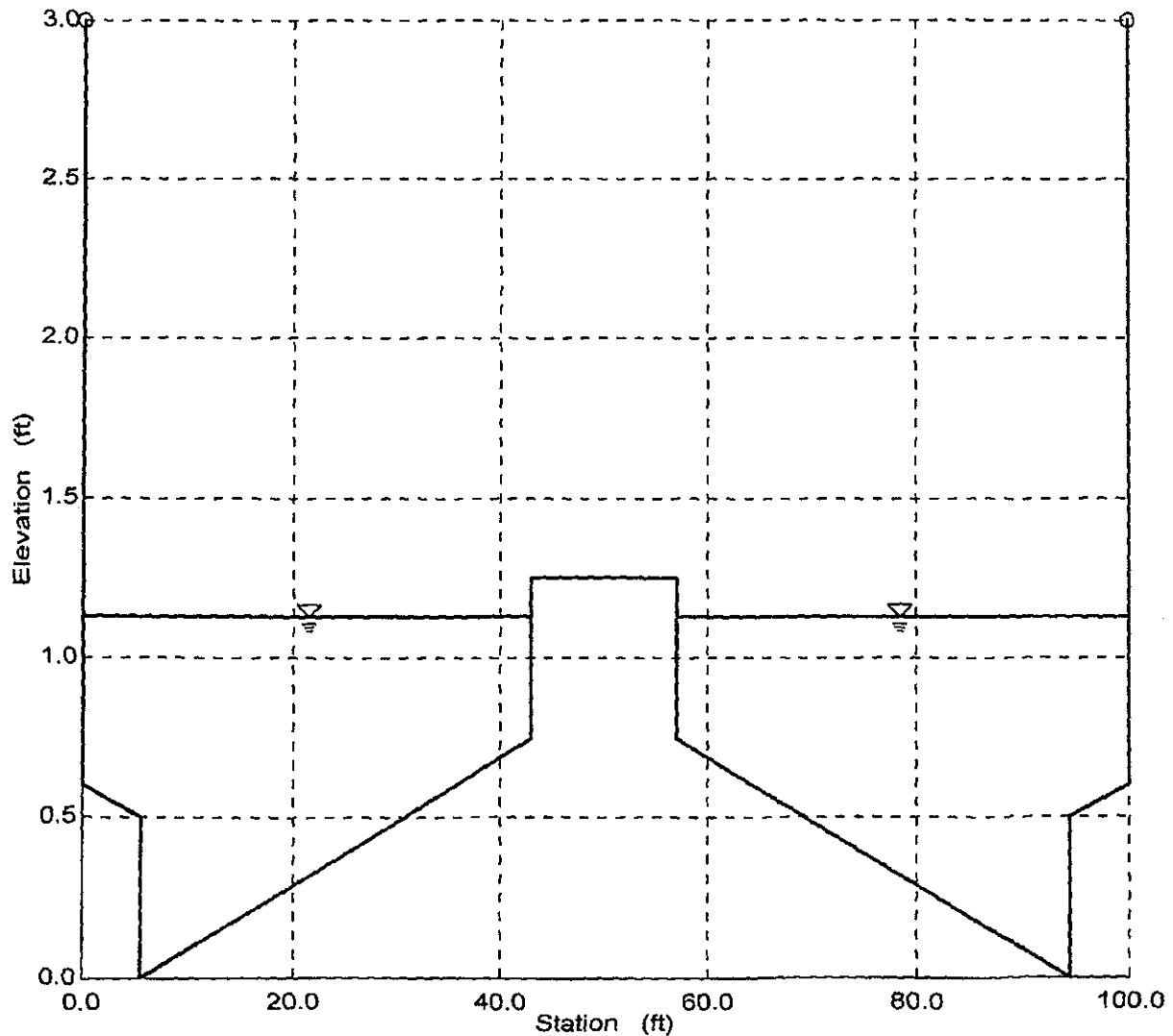
Input Data				
Channel Slope		0.007000 ft/ft		
Elevation range: 0.00 ft to 3.00 ft.				
Station (ft)	Elevation (ft)	Start Station	End Station	Roughness
0.00	3.00	0.00	100.00	0.013
0.00	0.60			
5.50	0.50			
5.50	0.00			
43.00	0.75			
43.00	1.25			
57.00	1.25			
57.00	0.75			
94.50	0.00			
94.50	0.50			
100.00	0.60			
100.00	3.00			
Discharge	474.00	cfs		

Results		
Wtd. Mannings Coefficient	0.013	
Water Surface Elevation	1.13	ft
Flow Area	62.59	ft ²
Wetted Perimeter	88.82	ft
Top Width	86.00	ft
Height	1.13	ft
Critical Depth	1.40	ft
Critical Slope	0.002688	ft/ft
Velocity	7.57	ft/s
Velocity Head	0.89	ft
Specific Energy	2.02	ft
Froude Number	1.57	
Flow is supercritical.		
Flow is divided.		

CHARLESTON BLVD - 100 YR
Cross Section for Irregular Channel

Project Description	
Project File	j:\proj\skipco\flowmstr.fm2
Worksheet	CHARLESTON BLVD - 100 YR
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Section Data	
Wtd. Mannings Coefficient	0.013
Channel Slope	0.007000 ft/ft
Water Surface Elevation	1.13 ft
Discharge	474.00 cfs



JONES BLVD - 100 YR - HALF STREET
Worksheet for Irregular Channel

Project Description	
Project File	j:\proj\skipcoflood\flowmstr.fm2
Worksheet	JONES BLVD - 100 YR - HALF STREET
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

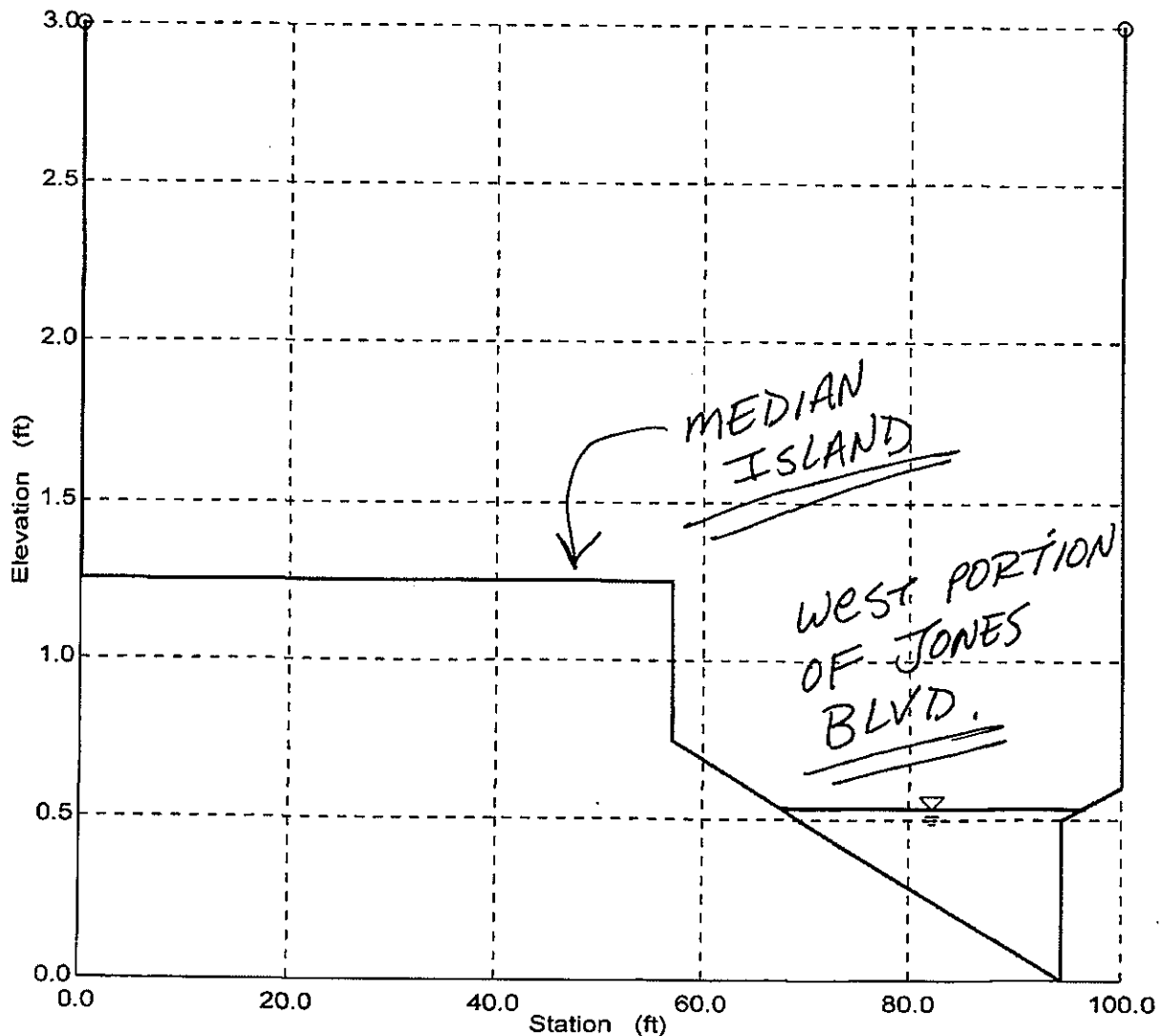
Input Data				
Channel Slope		0.005000 ft/ft		
Elevation range: 0.00 ft to 3.00 ft.				
Station (ft)	Elevation (ft)	Start Station	End Station	Roughness
0.00	3.00	0.00	100.00	0.013
0.00	1.25			
5.50	1.25			
43.00	1.25			
57.00	1.25			
57.00	0.75			
94.50	0.00			
94.50	0.50			
100.00	0.60			
100.00	3.00			
Discharge	23.00	cfs		

Results		
Wtd. Mannings Coefficient	0.013	
Water Surface Elevation	0.54	ft
Flow Area	7.24	ft ²
Wetted Perimeter	29.36	ft
Top Width	28.85	ft
Height	0.54	ft
Critical Depth	0.56	ft
Critical Slope	0.003971	ft/ft
Velocity	3.18	ft/s
Velocity Head	0.16	ft
Specific Energy	0.69	ft
Froude Number	1.12	
Flow is supercritical.		

JONES BLVD - 100 YR - HALF STREET
Cross Section for Irregular Channel

Project Description	
Project File	j:\proj\skipco\flood\flowmstr.fm2
Worksheet	JONES BLVD - 100 YR - HALF STREET
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Section Data	
Wtd. Mannings Coefficient	0.013
Channel Slope	0.005000 ft/ft
Water Surface Elevation	0.54 ft
Discharge	23.00 cfs





DS#

2577

DS INDEX

APN

163-01-102-001,002,007

PROJECT

SkipCo Building Expansion

SUBMITTAL

Grading Plan





February 16, 2017

LVG #5 LLC

9550 South Eastern Avenue, Suite #253
Las Vegas, Nevada 89123

**LAS VEGAS
CITY COUNCIL**

Carolyn G. Goodman
Mayor

Steven D. Ross
Mayor Pro Tem

Lois Tarkanian
Ricki Y. Barlow
Stavros S. Anthony
Bob Coffin
Bob Beers

Elizabeth N. Fretwell
City Manager

**RE: TMP-67900 [PRJ-67307] - TENTATIVE MAP RELATED TO GPA-67898,
SUP-67953, SDR-67899 AND VAC-68131
CITY COUNCIL MEETING OF FEBRUARY 15, 2017**

Dear Applicant:

The City Council at a regular meeting held on February 15, 2017 **APPROVED** a request for a Tentative Map FOR A ONE-LOT COMMERCIAL SUBDIVISION on 2.55 acres at the southeast corner of Charleston Boulevard and Jones Boulevard (APNs 163-01-102-001, 002, 007 and 037), C-1 (Limited Commercial) Zone, Ward 1 (Tarkanian) [PRJ-67307].

This approval is subject to the following conditions:

Planning

1. Approval of the Tentative Map shall be for no more than four (4) years. If a Final Map is not recorded on all or a portion of the area embraced by the Tentative Map within four (4) years of the approval of the Tentative Map, this action is void.
2. Approval of a General Plan Amendment (GPA-67898) and Site Development Plan Review (SDR-67899) shall be required, if approved.
3. The Final Map shall contain a note granting perpetual common access and parking across the entire subdivision.
4. A fully operational fire protection system, including fire apparatus roads, fire hydrants and water supply, shall be installed and shall be functioning prior to construction of any combustible structures.
5. In conjunction with creation, declaration and recordation of the subject common-interest community, and prior to recordation of the Covenants, Codes and Restrictions ("CC&R"), or conveyance of any unit within the community, the Developer is required to record a Declaration of Private Maintenance Requirements ("DPMR") as a covenant on all associated properties, and on behalf of all current and future property owners. The DPMR is to include a listing of all privately owned and/or maintained

CITY HALL
495 S. MAIN ST.
LAS VEGAS, NV 89101
702.229.6011
TTY 711



infrastructure improvements, along with assignment of maintenance responsibility for each to the common interest community or the respective individual property owners, and is to provide a brief description of the required level of maintenance for privately maintained components. The DPMR must be reviewed and approved by the City of Las Vegas Department of Field Operations prior to recordation, and must include a statement that all properties within the community are subject to assessment for all associated costs should private maintenance obligations not be met, and the City of Las Vegas be required to provide for said maintenance. Also, the CC&R are to include a statement of obligation of compliance with the DPMR. Following recordation, the Developer is to submit copies of the recorded DPMR and CC&R documents to the City of Las Vegas Department of Field Operations.

6. All development is subject to the conditions of City Departments and State Subdivision Statutes.

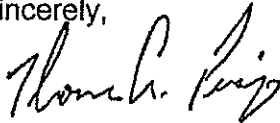
Public Works

7. Per Title 19.16.060.W.1, add a note to the Final Map stating, "All lots created by this Final Map shall have perpetual, irrevocable common access rights to all driveways servicing this overall site unless incompatible uses can be demonstrated to the satisfaction of the City Engineer."
8. The onsite sewer shall be private and per Title 19.16.060.W.2, sewer service for this commercial subdivision shall be shown in accordance with one of the following two alternatives, and the appropriate note shall appear on the face of the recorded Final Map:
 - I. Onsite sewers are a common element privately owned and maintained per the Conditions, Covenants, and Restrictions (CC&Rs) of this commercial subdivision.
 - II. Onsite sewers are a common element privately owned and maintained per the Joint Use Agreement of this commercial subdivision.
9. Per Title 19.16.060.W.3, provide a note on the Final Map that states "All subdivided lots within this Final Map shall provide perpetual inter-lot drainage rights across all existing and future parcel limits."
10. Contact the City Engineer's Office at 702-229-6272 to coordinate the development of this project with the "West Charleston Bus Turnouts Improvement" project, and any other public improvement projects adjacent to this site. Comply with the recommendations of the City Engineer.

11. A Drainage Plan and Technical Drainage Study must be submitted to and approved by the Department of Public Works prior to the issuance of any building or grading permits or submittal of any construction drawings, whichever may occur first. Provide and improve all drainageways recommended in the approved drainage plan/study. The developer of this site shall be responsible to construct such neighborhood or local drainage facility improvements as are recommended by the City of Las Vegas Neighborhood Drainage Studies and approved Drainage Plan/Study concurrent with development of this site. The Drainage Study required by SDR-67889 may be used to satisfy this condition.
12. The approval of all Public Works related improvements shown on this Tentative Map is in concept only. Specific design and construction details relating to size, type and/or alignment of improvements, including but not limited to street, sewer and drainage improvements, shall be resolved prior to approval of the construction plans by the City. No additional deviations from adopted City Standards shall be allowed unless specific written approval for such is received from the City Engineer prior to the recordation of a Final Map or the approval of subdivision related construction plans, whichever may occur first. Approval of this Tentative Map does not constitute approval of any deviations. If such approval cannot be obtained, a revised Tentative Map must be submitted showing elimination of such deviations.
13. Comply with all applicable conditions of approval for the Site Development Plan Review SDR-67899 and any other site related actions.

The Notice of Final Action was filed with the Las Vegas City Clerk on February 16, 2017.

Sincerely,



Thomas A. Perrigo
Director
Department of Planning

TAP:PL:clb

cc: Mr. Wayne Gibson
Murphy Oil, USA
422 N. Washington Street
El Dorado, Arkansas 71730

Ms. Jennifer Lazovich
Kaempfer Crowell
1980 Festival Plaza Drive, Suite #650
Las Vegas, Nevada 89135





CITY OF LAS VEGAS

MINIMUM DRAINAGE STUDY CRITERIA STANDARD FORM 2 CHECKLIST SUPPLEMENT

(Revised 5/18/11)

The following checklist is intended as a supplemental guide for the engineer preparing a Technical Drainage Study submittal to the City of Las Vegas. This supplement focuses on requirements specific to the City of Las Vegas. The requirements presented are in addition to the Clark County Regional Flood Control District (CCRFCD) Manual Standard Form 2. The listed items are the minimum information required prior to the City performing a review. The engineer will remain responsible to ensure the Technical Drainage Study is prepared within the guidelines as set forth in the CCRFCD Hydrologic Criteria and Drainage Design Manual (Design Manual).

An appointment must be made to preview this checklist in conjunction with CCRFCD Standard Form 2 prior to the City accepting a new drainage study for review. The engineer must contact the Flood Control Section at (702) 229-6541 to schedule a submittal appointment.

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

I. GENERAL REQUIREMENT		
Yes	No	
N/A		A notarized letter from the adjacent property owner(s) allowing off-site grading. (A copy of the letter must be received prior to final acceptance of the drainage study.)
✓		Copies of all conditions of approval for development related to this property. (e.g. zoning, use permit, tentative map, etc.) Verify compliance with conditions.
		An electronic copy of the complete submittal is required to be submitted with one original hard copy of the study. Electronic documents should be on a universal computer-readable digital output device replicating your submittal. An Indexed Portable Document Format (PDF) or Print Ready CAD file formats with a minimum of 300dpi are the desired formats. If figures are in color, they must be scanned in color and saved as a separate file. _____ by initial here, the engineer on record acknowledges that the electronic copy is an identical replicate of the original hard copy submitted to the City of Las Vegas.

II. GRADING PLAN INFORMATION		
Yes	No	
✓		SITE PLAN (1) 24" X 36" copy of the Grading Plan , (including all Detail Sheets) sealed by the engineer.
✓		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. Note: Proposed top of curb elevations must be provided for both sides of roadways even if only half street construction is required.
✓		Label existing topography at a minimum 5 foot elevation interval including adjacent developments, finished floor elevations of existing buildings and top of existing curbs extending 100 feet around the perimeter of the site. (*Measured from the centerline of the adjacent roadway.)

CITY OF LAS VEGAS MINIMUM DRAINAGE STUDY CRITERIA CHECKLIST

II. GRADING PLAN INFORMATION		
Yes	No	
✓		Proposed on-site and off-site storm drains and other flood control facilities with plan and profile sheets for public storm drains showing the class of pipe, (Class III, IV, V, etc.), design hydraulic grade line, (HGL) and 100 year storm flow. A public drainage easement must be provided over on-site storm drains conveying off-site flows. An overflow path must be provided over all storm drains.
✓		All existing and "to be constructed" walls with cross-sections showing wall type, (e.g. block wall, retaining wall, flood wall, etc.), with limits clearly defined, adjacent ground elevations. Wall heights must meet current ordinances and in no case exceed 14 feet above the adjacent property.
✓		Street slopes for both interior and perimeter streets. Note: The minimum slope for a roadway is 0.4 percent, a minimum 18-inch storm drain must be provided where minimum slopes cannot be met.
N/A		Back of lot elevations and lot drainage pattern for all lots including common lots.
N/A		Sites with a grade difference two feet above or below existing ground are required to have approval from City of Las Vegas Current Planning. Current Planning approval is required prior to final approval of the drainage study.
✓		On-site facilities must perpetuate flows through or around the site without significantly impacting adjacent property owners. (The project must pass flows through the site every 600 feet where the project is blocking flow paths.)
N/A		This project uses a solid grouted stem wall (or approved alternate) at the back of sidewalk to provide erosion protection for landscaped areas where the depth of flow in the roadway exceeds the back of walk elevation. A corresponding cross-section detail is included.
N/A		Commercial and Common Lot Landscape areas are not allowed to drain over the sidewalk. The grading plans show flow lines with grades and sidewalk under drains for all landscape areas draining to the public ROW.

III. Local Entity Criteria - City of Las Vegas – Manual Section 1600		
Yes	No	
N/A		Concrete valley gutters are required in parking lots with slopes less than 1 percent. Slopes through cul-de-sac must be at a 1 percent minimum where flow is drained through the cul-de-sac.
✓		Ten-foot wide public drainage easements to be privately maintained are allowed for flow less than 20 cfs. The depth of flow entering the easement must be checked using the submerged weir calculation.
✓		The limits of the flood zones and the base flood elevations (BFE) must be shown on all grading plans for all developments within a Special Flood Hazard Zone A, AO, AE, etc.
		Minimum finish floor elevation is 6 inches above highest adjacent top of curb. Finish floor calculations must include allowances for super elevations on curves and velocity head for tee intersections.
✓		Finished floor elevations for buildings adjacent to public drainage easements must be a minimum of 18 inches above the Q100 weir of submerged weir elevation, whichever is greater.

CITY OF LAS VEGAS MINIMUM DRAINAGE STUDY CRITERIA CHECKLIST

III. Local Entity Criteria - City of Las Vegas – Manual Section 1600		
Yes	No	
N/A		Lots with "B and C Type Drainage" that drain from one lot to another through a drainage easement shall be required to install an underground nuisance drainage system or a 2-foot valley gutter. 16" x 24" minimum block wall openings are required for both options.
✓		Bubblers are required across 80 foot and greater ROW streets. When flows exceed 10 cfs, bubblers larger than 18 inches will be required up to a maximum of 36". Inlets must be sized to match the pipe size provided.

- Contact the Flood Control Section regarding the drainage study review fee. These fees are payable at the time of submittal.
- The Drainage Study must be conditionally approved prior to submitting improvement plans to the Civil and Planning Development of the Department of Building and Safety for review.

This document is intended as an aid in preparing Technical Drainage Studies for the City of Las Vegas. 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.

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL																										
DRAINAGE SUBMITTAL CHECKLIST																										
Project Name: <u>LVG #5</u>	Map ID:																									
Firm Name: <u>Baughman & Turner, Inc</u>	Engineer: <u>John Gustafson</u>																									
Address: <u>1210 Hinson St</u>																										
City: <u>Las Vegas</u>	State: <u>NV</u>	Zip: <u>89102</u>																								
Phone Number: <u>702-870-8771</u>	Fax Number: <u>702-878-2695</u>																									
Property Owner: <u>LVG #5, LLC</u>																										
Address: <u>9550 S. Eastern Ave, 253</u>																										
City: <u>Las Vegas</u>	State: <u>NV</u>	Zip: <u>89123</u>																								
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 <table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 10%; text-align: center;">Yes</th> <th style="width: 10%; text-align: center;">No</th> <th></th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">☒</td> <td style="text-align: center;">☐</td> <td>Design Manual Standard Form 1 with the engineer's seal and signature.</td> </tr> <tr> <td style="text-align: center;">☒</td> <td style="text-align: center;">☐</td> <td>Design Manual Standard Form 4.</td> </tr> <tr> <td style="text-align: center;">☒</td> <td style="text-align: center;">☐</td> <td>2 copies of the 24" x 36" Drainage Plan.</td> </tr> <tr> <td style="text-align: center;">☒</td> <td style="text-align: center;">☐</td> <td>A notarized letter from the adjacent property owner(s) allowing off-site grading or discharge.</td> </tr> </tbody> </table> II. MAPS AND EXHIBITS <table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 10%; text-align: center;">Yes</th> <th style="width: 10%; text-align: center;">No</th> <th></th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">☒</td> <td style="text-align: center;">☐</td> <td>A copy of a current Flood Insurance Rate Map (FIRM) with the site delineated.</td> </tr> <tr> <td style="text-align: center;">☒</td> <td style="text-align: center;">☐</td> <td>A copy of the current CCRFCD Master Plan Update Figure, (F-x), for Flood Control Facilities and Environmental areas with the site delineated.</td> </tr> </tbody> </table>			Yes	No		☒	☐	Design Manual Standard Form 1 with the engineer's seal and signature.	☒	☐	Design Manual Standard Form 4 .	☒	☐	2 copies of the 24" x 36" Drainage Plan.	☒	☐	A notarized letter from the adjacent property owner(s) allowing off-site grading or discharge.	Yes	No		☒	☐	A copy of a current Flood Insurance Rate Map (FIRM) with the site delineated.	☒	☐	A copy of the current CCRFCD Master Plan Update Figure, (F-x), for Flood Control Facilities and Environmental areas with the site delineated.
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REFERENCE:		STANDARD FORM 2																								

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

DRAINAGE SUBMITTAL CHECKLIST

II. MAPS AND EXHIBITS (Continued)

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

III. DRAINAGE PLAN

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

REFERENCE:

STANDARD FORM 2

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

DRAINAGE SUBMITTAL CHECKLIST

III. DRAINAGE PLAN (Continued)

Yes	No	
<u>N/A</u>	☐	Streets with off-set crowns.
☒	☐	Proposed contours or spot elevations in sufficient detail to exhibit intended drainage patterns and slopes.
☒	☐	Property lines.
☒	☐	Right-of-way lines and widths, existing and proposed.
☒	☐	Existing improvements and their elevations.
☒	☐	Delineation of proposed on-site drainage basins indicating area and 10-year and 100-year storm peak flows at basin concentration points.
☒	☐	Concentration points and drainage flow direction with Q_{100} and V_{100} and D_{100} in streets.
☒	☐	Cumulative flows, velocity, and direction of flow at upstream and downstream ends of site for the 10-year and 100-year flows.
☒	☐	Location and cross-section of street capacity calculations.
<u>N/A</u>	☐	Cross-sectional detail for channels, including cutoff wall locations.
☒	☐	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.
☒	☐	Existing and proposed drainage easements and widths shown with sufficient detail. A cross sectional detail must be provided that shows appropriate lining and reinforcement.
☒	☐	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.
<u>N/A</u>	☐	Location and detail of flood walls illustrating depth of flow, proposed grouting height, etc.
<u>N/A</u>	☐	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.
☒	☐	Building and/or lot numbers.
☒	☐	Alignment of all existing, proposed, or future Regional Facilities adjacent to the site.
☒	☐	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

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

DRAINAGE SUBMITTAL CHECKLIST

III. DRAINAGE PLAN (Continued)

Yes No

- N/A _____ 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.
- ✓ _____ 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.
- ✓ _____ Street slopes for perimeter and interior streets. The minimum slope is 0.4 percent.
- _____ _____ Location and detail of best management practice (BMP) for parking lots and low impact development (LID) (if required).

IV. HYDROLOGIC ANALYSIS

Yes No

- ✓ _____ Appropriate soil information and Soils Map for existing and future conditions with subbasins and property delineated.
- ✓ _____ 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.
- ✓ _____ 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.
- ✓ _____ Use of correct precipitation values in and around the McCarran Airport rainfall area.
- ✓ _____ A discussion in the text of the hydrologic analysis justifying subbasin boundaries and cutoffs, supporting assumptions, and calculations.
- ✓ _____ A summary table of stormwater flows showing basin area, Q_{10} and Q_{100} for both individual basins and combined basin flows, where applicable.
- ✓ _____ Copies of supporting technical information referenced from a previously approved study and a statement accepting these results.
- ✓ _____ On-site facilities must perpetuate flows through or around the site without significantly impacting adjacent property owners in accordance with current Nevada Drainage Law.
- ✓ _____ Calculation for impervious area for parking lots and LIDs (if required).

REFERENCE:

STANDARD FORM 2

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

DRAINAGE SUBMITTAL CHECKLIST

V. HYDRAULIC ANALYSIS

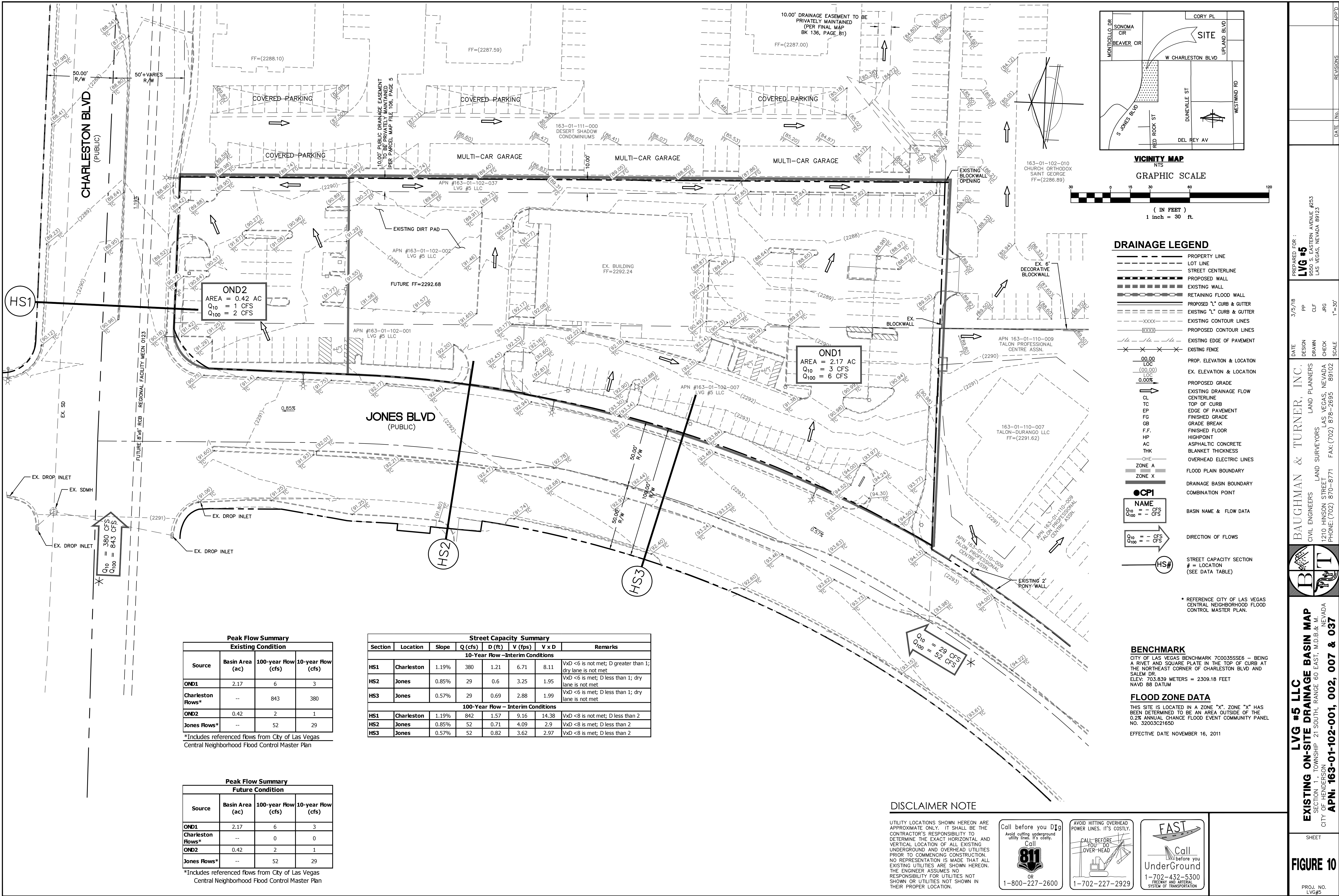
Yes	No	
<u>N/A</u>	☐	Flow split calculations and supporting documentation or reference for the method of flow split calculations used.
☒	☐	Normal depth street flow calculations and cross section diagrams for all interior and perimeter streets. Provide "d x v" products for the Q_{100} and Q_{10} flows representing the worst case for interior and all perimeter streets. $Q_{100} d \times v \leq 8$. $Q_{10} d \times v \leq 6$ and 12 foot dry lane for rights-of-way ≥ 80 feet. Calculations must be labeled by street name as indicated on the Grading Plan.
☒	☐	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.
☒	☐	Appropriate hydraulic calculations for block wall openings assuming a 50 percent vertical clogging factor. (Assume the lower half of the opening is plugged.)
☒	☐	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.
☒	☐	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.
<u>N/A</u>	☐	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.
☒	☐	Provide a 50 percent clogging factor in the capacity calculation for drop inlets.
<u>N/A</u>	☐	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.
<u>N/A</u>	☐	The mitigation of nuisance water, both during construction and in the fully developed condition, must be addressed.
<u>N/A</u>	☐	Provide BMP type, size and supporting calculations for parking lots and LIDs (if required).

REFERENCE:

STANDARD FORM 2



N:\LVG#5.LLC - 6029 W. Charleston L197\DCS\Hydrology\Figures\LVG-EX-DBM.dwg, 3/5/2018 6:06:14 PM



Peak Flow Summary			
Existing Condition			
Source	Basin Area (ac)	100-year Flow (cfs)	10-year Flow (cfs)
OND1	2.17	6	3
Charleston Flows*	--	843	380
OND2	0.42	2	1
Jones Flows*	--	52	29

*Includes referenced flows from City of Las Vegas Central Neighborhood Flood Control Master Plan

Peak Flow Summary			
Future Condition			
Source	Basin Area (ac)	100-year Flow (cfs)	10-year Flow (cfs)
OND1	2.17	6	3
Charleston Flows*	--	0	0
OND2	0.42	2	1
Jones Flows*	--	52	29

*Includes referenced flows from City of Las Vegas Central Neighborhood Flood Control Master Plan

Street Capacity Summary						
Section	Location	Slope	Q (cfs)	D (ft)	V (fps)	V x D
10-Year Flow - Interim Conditions						
HS1	Charleston	1.19%	380	1.21	6.71	8.11
HS2	Jones	0.85%	29	0.6	3.25	1.95
HS3	Jones	0.57%	29	0.69	2.88	1.99
100-Year Flow - Interim Conditions						
HS1	Charleston	1.19%	842	1.57	9.16	14.38
HS2	Jones	0.85%	52	0.71	4.09	2.9
HS3	Jones	0.57%	52	0.82	3.62	2.97

PREPARED FOR:
LVG #5

DATE: 3/5/18
DESIGN: PP
DRAWN: CLF
CHECK: JRG
SCALE: 1"=30'

BAUGHMAN & TURNER, INC.
CIVIL ENGINEERS
1210 HINSON STREET
LAS VEGAS, NEVADA 89102
PHONE: (702) 870-8771 FAX: (702) 878-2695

LVG #5 LLC
EXISTING ON-SITE DRAINAGE BASIN MAP
SECTION 1, TOWNSHIP 21 SOUTH, RANGE 80 EAST, M.D.B. & M.
CITY OF HENDERSON
APN: 163-01-102-001, 002, 007 & 037

SHEET

FIGURE 10

PROJ. NO.
LVG#5

REVISIONS
DATE No. APP'D