

DS #: 4797

APN: 125-20-810.001 & 125-20-803.002

PROJECT: Cortina Hills Skilled Nursing

SUBMITTAL: 1st Submittal

SCANNED BY/DATE: _____

CHECKED BY/DATE: _____



CITY OF LAS VEGAS		DATE:
INTER-OFFICE MEMORANDUM		May 10, 2016
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:	
	Centennial Hills Skilled Nursing	
Cross Streets:	SEC of Rome Boulevard & Riley Street	
File Number:	F:\Depot\DSMemos\DS4797A.doc	
Parcel Number:	125-20-810-001 & 125-20-803-002	
Zoning Action:	SUP-63115 & SDR-63116	
FEMA Flood Zone	YES	NO X
Proposed Storm Drain	YES	NO X
COPIES TO:		
		Baughman & Turner, Inc.
		Delaware 118, LLC.
		Bart Anderson, P.E., DevCo
		CCRFCD
		CCPW

HISTORY	DATE RECEIVED	DATE REVIEWED	COMMENTS	REVIEW FEES	FEES PAID Payment Trn #
1 st Submittal	4/28/2016	5/10/2016	See Comments Below	\$400.00	442261: \$400
TOTAL FEES (LDDRS):				\$400.00	----

REMARKS:

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

	is approved subject to conformance to all City standards and the following conditions:
X	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 a copy of the zoning/planning conditions associated with this site (**SUP-63115 & SDR-63116**) with the next submittal to verify compliance with conditions. *Flood Control* will not issue conditional approval of the drainage study without the associated zoning/planning conditions (issued by the *City Council*). Any associated conditions of approval that revise the site drainage parameters will require that the drainage study be revised and resubmitted.
2. Sites with a grade difference of 2 feet above or below existing are required to have approval from the *City Planning and Development Department*. The engineer must submit copies of the grading plans and detail sheet with a letter justifying the grade difference to the *City Planning Department* (229-6301). The engineer must provide Planning approval with the next submittal.
3. The site is adjacent to or crosses an existing or proposed *Clark County Regional Flood Control District* (CCRFCD) master planned facility. Therefore, CCRFCD concurrence is required prior to final approval of the drainage study.
4. The site is also adjacent to the *Clark County Beltway* to the south. The engineer must coordinate with *Clark County Department of Public Works* (CCPW) and incorporate any concerns for boundary conditions along the south border. CCPW concurrence is required prior to final acceptance of the study.

5. *McCay Engineering* proposed a project (**Montecito West Surface Parking**) adjacent to the subject site to the east. The project was approved in September 2015. Coordinate with *McCay Engineering* and show the approved design in the adjacent property on the grading plan. Revise the grading plan and all pertinent section details accordingly.
6. It appears that the engineer proposed to discharge the developed site at a concentrated point at the southeast corner of the improved area into the adjacent property to the east versus the existing sheet flow drainage pattern. Obtain a notarized letter of acknowledgment from the adjacent property owner for the proposed drainage prior to the final approval of the drainage study.
7. The anticipated 100-year flow depth in *Rome Boulevard* is 0.84 ft. The street grade in *Rome Boulevard* corresponding to the high side of the proposed building is at 2525.31TC. To comply with twice-the-depth criteria, the proposed finished floor elevation must be at a minimum of $2525.31 - 0.5 + 2 \times 0.84 = 2526.49$. Review and revise the grading plan and all pertinent detail sections accordingly.
8. It appears that there is a courtyard in the center of a monolithic building. Address courtyard drainage in the next submittal.
9. A proposed triangular shape of public drainage easement (privately maintained by the property owner) at the cul-de-sac of *Riley Street* must be granted and recorded by separate document prior to the final approval of the improvement plans.
10. Identify an existing storm drain system in *Rome Boulevard* on the grading plan. Label with information such as length and type of inlets, storm drain mainline and laterals size etc. Show the *City of Las Vegas* recorded construction drawing number on the plan.
11. Provide a note on all grading plans: All onsite storm drains and the associated facilities are privately owned and to be privately maintained by the property owner.

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: T19S/R60E/20
AREA G-20

 *** FAX TX REPORT ***

TRANSMISSION OK

JOB NO. 4911
 DESTINATION ADDRESS 7028782695
 PSWD/SUBADDRESS
 DESTINATION ID
 ST. TIME 05/11 07:47
 USAGE T 00' 41
 PGS. 2
 RESULT OK

CITY OF LAS VEGAS INTER-OFFICE MEMORANDUM		DATE: May 10, 2016
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: Centennial Hills Skilled Nursing		COPIES TO: Baughman & Turner, Inc.
Cross Streets:	SEC of Rome Boulevard & Riley Street	Delaware 118, LLC.
File Number:	F:\Depot\DSMemos\DS4797A.doc	Bart Anderson, P.E., DevCo
Parcel Number:	125-20-810-001 & 125-20-803-002	CCRFC
Zoning Action:	SUP-63115 & SDR-63116	CCPW
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	4/28/2016	5/10/2016	See Comments Below	\$400.00	442261: \$400
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Baughman & Turner, Inc.

Consulting Engineers & Land Surveyors

1210 Hinson Street

Las Vegas, Nevada 89102

Telephone (702) 870-8771

LETTER OF TRANSMITTAL**DATE:** April 28, 2106**JOB NO.:** 20-19-60-19-59**ATTENTION:** Albert Sung**RE:** Centennial Hills Skilled
Nursing**TO:** City of Las Vegas- Land Development
333 N Rancho Dr.
Las Vegas, NV 89106**To whom it may concern:**

We are sending: ☐ Attached ☐ Under separate cover via Delivery the following items:

☐ Certifications ☐ Original ☐ Drawings ☐ Prints ☐ Check ☐ Deeds
☐ Tax Letters ☐ Check Prints ☐ Copy of Letter ☐ Sepias ☐ Other

Copies	Dated	Pgs.	Description
1	4/28/16		Wet Stamped copy of Drainage Study
1	4/28/16		DWG CD
1	4/28/16		Fee Check: \$400.00

These are transmitted as checked below:

☐ For approval ☐ For submittal ☐ For your use ☐ For re-submittal
☐ As requested ☐ For review and comment ☐ Other _____

REMARKS: If you should have any questions, please contact Sunshine Woods @ 870-8771.Thank you!

RECEIVED BY:		DATE:	
--------------	--	-------	--

COPY TO FILE

SIGNED: _____

If enclosures are not as noted, kindly notify us at once

**TECHNICAL DRAINAGE STUDY FOR
CENTENNIAL HILLS SKILLED NURSING
SECTION 20, TOWNSHIP 19 SOUTH, RANGE 60 EAST
CITY OF LAS VEGAS, CLARK COUNTY, NEVADA**

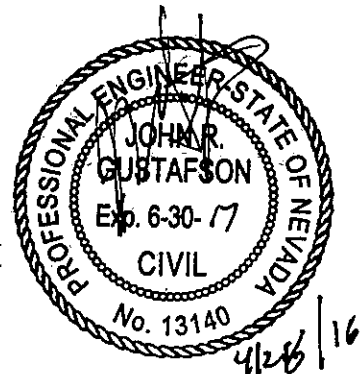
April 27, 2016

PREPARED FOR:

OCHOA DEVELOPEMENT
901 N. GREEN VALLEY PARKWAY, #130
HENDERSON, NV 89074

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: Centennial Hills Skilled Nursing Date: April 26, 2016
 Location of Development: a) Descriptive (Cross Streets) North/South: Riley Street
 East/West: Rome Boulevard
 b) Section: 20 Township: 19 S Range: 60 E
 c) APN: 125-20-810-001 and 125-20-803-002

Name of Owner: Delaware 118, LLC
 Telephone No.: (702) 444-4795 Fax No.: _____ E-Mail Address: _____
 Address: 842 South Rancho Dr #4-572 Las Vegas NV 89106

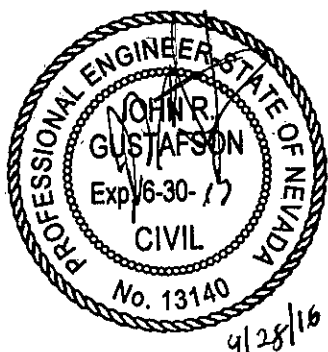
Contact Person-Name: Sunshine Woods Telephone No.: 702-870-8771
 *E-Mail Address: sunshinew@baughman-turner.com Fax No.: 702-878-2695

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	

1. Total Owned Land Area: At Site: 3.98 acres Being Developed/Disturbed: 2.86 acres
2. Is a portion or all of the subject property located in a designated FEMA Flood Hazard Area? ☐ Yes** ☒ No
3. Is the property bordered or crossed by an existing or proposed Clark County Regional Flood Control District Master Planned Facility? ☒ Yes** ☐ No
4. Proposed type of development (Residential, Commercial, Etc.): Commercial
5. Approximate upstream land area which drains to the subject site: 0 acres
6. Has the site drainage been evaluated in the past? ☐ YES ☒ NO If yes, please identify documentation: _____
7. If known, please briefly identify the proposed discharge point(s) of runoff from the site: Southeast to the Beltway channel, Proposed RCHB-0130
8. Briefly describe your proposed schedule for the subject project: ASAP



Engineer's Seal

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

*New Required Field

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

	Revision	Date
Local Entity File No. _____		

REFERENCE:

STANDARD FORM 1

Baughman & Turner, Inc.

Consulting Engineers & Land Surveyors

1210 HINSON ST.
LAS VEGAS, NEVADA 89102-1604

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

April 27, 2016
20-19-60

City of Las Vegas Public Works Department

Attn.: Alert Sung, PE, CFM

333 N. Rancho Drive, 7th Floor
Las Vegas, Nevada 89106

Re: Technical Drainage Study for Centennial Hills Skilled Nursing

Dear Mr. Sung,

Transmitted herewith for your approval is one (1) electronic copy of the hydrology study for Centennial Hills Skilled Nursing and one (1) original hard copy. The property lies at the southeast corner of Rome Blvd and Riley St. The proposed development is for a skilled nursing facility on 3.98 acres.

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

Sincerely,

Baughman & Turner, Inc.

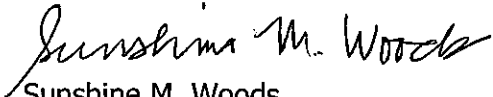

Sunshine M. Woods
Engineering Technician

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- I. Previous Studies – Technical Drainage Study for Montecito Lifestyle Center (DS3186)
- J. Previous Studies – Technical Drainage Study for Brookside (DS3476)
- K. Previous Studies – Technical Drainage Study for Sun Devil Auto (DS4422)
- L. NOFA
- M. Form 2, County Checklist, City of Las Vegas Drainage Criteria

I. INTRODUCTION

This study analyzes the development of skilled nursing facility on an undeveloped parcel of land. Analysis presented herein was established after first consulting with the Clark County Regional Control District's (CCRFCD) 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 proposed 3.98-acre site is located in a portion of the South Half (S ½) of the Southeast Quarter (SE¼) of Section 20, Township 19 South, Range 60 East, M.D.B.&M., Clark County, Nevada. The property lies at the southeast corner of Rome Boulevard and Riley Street (see Figure 1, Vicinity Map). The site is more specifically described as Assessor's Parcel Numbers 125-20-810-001 and 125-20-803-002 (see Figure 2, Assessor's Parcel Map).

B. Property Description

The property is about 3.98 acres of undeveloped land. The proposed site has undeveloped land to the west, single family residential developments to the north, commercial property to the east and the Bruce Woodbury Beltway (I215) to the south. Rome Boulevard borders the north property line and Riley Street borders the west property line (See Figure 3 and 4, Aerial Map). In the existing condition, the property slopes from the west to the east at about a 2.5% slope.

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 existing facilities on the property.

A review of the 2013 CCRFCD's Master Plan Update, Figure F-13, (see Figure 5A and 5B, Flood Control Facilities), indicates that there is an existing open earthen, riprap lined channel. There is proposed future facility, RCHB-0130, a 16 foot wide concrete channel that will be 6 feet deep with a 0:1 side slope. This channel drains to the southeast into a nearby detention basin, RCHO-0025, Rancho Road Detention Basin. There is also local storm drain in Rome Blvd which discharges into the channel. The proposed development is located at the center of sub-basin NWBC6-C, as shown on Master Plan Figure H-13 (see Figure 6, Hydrologic Sub-basins).

D. Floodplain Information

The Flood Insurance Rate Map, Clark County, Nevada, Community Panel No. 32003 C

1745 E (effective date September 27, 2002), 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 7, Flood Insurance Rate Map).

E. Previous Hydrology Studies

The following studies were reviewed in the preparation of this study. Reference material from these studies is included in Appendix H-J.

- Technical Drainage Study for Montecito Lifestyle Center (DS3186) dated July 25, 2002 by Primas and Associates, approved August 18, 2003.
- Technical Drainage Study for Brookside (DS3476) dated December 31, 2003 by Tetra Tech, Inc., approved February 27, 2004.
- Technical Drainage Study for Sun Devil Auto (DS4422) dated June 25, 2010 by Lochsa Engineering, approved October 12, 2010.

These studies calculate the offsite flows for the proposed site. The referenced studies have been reviewed by Baughman & Turner, Inc. and concur with their results.

III. HYDROLOGY

A. Existing Offsite Drainage Conditions

The offsite flows are directed around the proposed site. See Figure 8, Existing Drainage Basin Map. The flows to the north of the site travel along Rome Blvd from west to east. A small amount of storm water runoff will head south down Riley where it will enter the existing earthen channel, the Beltway Channel, located to the south of the site. The existing flows in Rome, per the approved drainage study for Montecito, OUT4, are 50 cfs in the 10 year, 6 hour storm, and 83 cfs in the 100 year, 6 hour storm (see reference figure 2-2 in appendix I). These existing flows will join the flows generated by basin ROME, 0.28 acres, half street basin of 1 cfs in both the 10 and 100 year, 6 hour storm events at a combination point CP2. Per the approved Sun Devil Study, the Beltway Channel conveys 418 cfs in the 100 year storm and the existing flows are contained within the channel with adequate freeboard, nearly 5 feet. A large 5.68 acres of undeveloped of land, OFF1, see figure 11, Offsite Drainage Basin Area, to the west of the proposed site will generate less than 1 cfs in the 10 year storm and 3 cfs in the 100 year storm. These flows will join the flows at a combination point, CP1, generated by basin RILEY. RILEY is about 0.53 acres and produces less than 1 cfs in the 10 year storm and 1 cfs in the 100 year storm.

B. Existing Onsite Drainage Conditions

Under existing conditions, the site consists of undeveloped desert land with less than 30 percent ground cover sloping to the southeast at approximately 2.5 percent. Because of

this sloping, most of the site will eventually drain into the existing earthen channel, the Beltway Channel, which runs parallel to the Bruce Woodbury Beltway, I215.

Referring to Figure 8, Existing Drainage Basin Map, the site consists of two onsite sub-basins, ON1 and ON2. Basin ON1 is a large basin, approximately 3.47 acres taking up the northern most and a part of the southern portion of the property. This basin will discharge in a southeast direction on the parcel to the east of the site, continuing to the Beltway Channel. There is a much smaller basin, approximately 0.51 acres, ON2, located in the southwest corner which also drains into the channel. The existing Beltway Channel will gather all the onsite flows, travelling in a southeast direction draining into the Rancho Road Detention Basin, RCHO-0025, to the southeast of the proposed site. The on-site basin ON1 generates less than 1 cfs for the 10-year storm event and 2 cfs for the 100-yr storm event, and basin ON2 generates less than 1 in both the 10 and 100 year, 6 hour storms. An onsite existing condition HEC-1 model has been included in Appendix E. Table 1 summarizes the HEC-1 results for existing conditions.

C. *Interim (Developed) Drainage Conditions*

The site was analyzed considering the interim conditions. During the Interim Condition, the proposed site will be mostly developed consisting of four developed basins and two undeveloped basins. The property west of the site will remain an undeveloped parcel of land, OFF1, which will generate less than 1 cfs in the 10 year storm and 3 cfs in the 100 year storm. See Figure 9, Interim Drainage Basin Map and Figure 11, Offsite Drainage Basin Area.

The onsite basins are DEV1, DEV2, DEV3, DEV4, DEON1, and DEON2. DEV4, 0.45 acres, will generate 1 cfs in both the 10 and 100 year storm. These flows will head north joining the existing flows in Rome Blvd. ROME generates 1 cfs and the flows from OUT4, referenced from the Montecito study of 50 cfs in the 10 year and 83 cfs in the 100 year storm combine at CP2. The flows from OFF1 will combine with the flows from RILEY and the flows generated from DEV3, a 0.66 acre basin generating 1 and 2 cfs in the 10 and 100 year storm. These flows will combine at CP1 for a total of 1 and 5 cfs in the 10 and 100 year storm. The runoff will continue south, exiting Riley Street through a curb opening and an underside walk drain, then entering the Beltway Channel.

The remaining basins, DEV2 (0.66 acres) generates 1 and 2 cfs in the 10 and 100 year storm will exit the parking lot through several curb openings draining into DEON1 (0.68 acres) which generating less than 1 and 1 cfs in the 10 and 100 year storm. DEV1 (1.09 acres) generates 1 and 3 cfs in the 10 and 100 year storm. These flow will exit the parking lot through curb openings and head south along a landscape swale exiting the site at the southeast corner, continuing to the Beltway Channel. The remaining basin, DEON2, 0.44 acres will generate less than 1 and 1 cfs in the 10 and 100 year storm and discharges in the Beltway Channel. An onsite Interim condition HEC-1 model has been included in Appendix F. Table 2 summarizes the HEC-1 results for the interim conditions.

The flows in the Beltway Channel have been analyzed, and a Flowmaster has shown the flows in the interim condition of 428 cfs in the 100 year storm will be accommodated within the channel, the Flowmaster results have been included in Appendix H.

D. Future Drainage Conditions

In the future, the only basins that will be changed due to future development are the offsite basin, OFF1, and on-site basins DEV5 and DEV6 which are considered fully developed commercial sites, see Figure 10, Future Drainage Basin Map. In the Future condition the basin, OFF1 will generate 6 cfs and 14 cfs in the 10- and 100-year, 6-hour storm event, respectively. This storm runoff will drain southeast, entering Riley Street and then the Beltway Channel. DEV5 and DEV6 will generate 1 and 2 cfs, and less than 1 and 1 cfs in the major and minor storms, respectively. These future flows will discharge southeast to the Beltway Channel. All other runoff and flow patterns remain the same as in the Interim Condition. An onsite future condition HEC-1 model has been included in Appendix G. Table 3 summarizes the HEC-1 results for the future conditions. Per the Master Plan update figure F-13, the proposed drainage channel, RCHB-0130 will contain 2226 cfs. Performing a Flowmaster, included in appendix H, shows just over 2 feet of freeboard; therefore, these regional flows will not impact the site negatively.

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.

IV. HYDROLOGIC/HYDRAULIC CRITERIA

A. Soil Classification

The native soils associated with the site and offsite basins have been classified by the United States Department of Agriculture Soils Conservation Service (SCS) in their soil survey of Las Vegas Valley Area as Soil Unit 191, Dalian, very cobbly fine sandy. Dalian, has a weighted hydrologic soils group of A. The curve number for the onsite existing and developed drainage areas were calculated using Table 602 and Table 602A of the HCDDM. The on and off-site associated curve numbers can be found in Appendix B along with the soils information.

B. Precipitation

The site and its related off-site basins are located outside the McCarran Airport Rainfall Area; therefore, precipitation values were determined using Figures 503 and 506 in CCRFCD's Hydrologic Criteria and Drainage Design Manual, Section 500. The 100-year and 10-year, 6-hour rainfall depth duration frequency values for the on and off-site basin are 3.00 and 1.61. 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

Tables 1-3 list the 100-year and 10-year, 6-hour storm flows. The HEC-1 printouts can be found in Appendices E - G.

Table 1 Peak Flow Summary: Existing Condition				
Source	Area (acres)	Area (mi²)	100-Year Flow (cfs)	10-Year Flow (cfs)
ROME	0.28	0.0004	1	1
OUT4			83	50
GP2			84	50

RILEY	0.53	0.0008	1	<1
OFF1	5.68	0.0089	3	<1
CP1			3	<1
ON1	3.47	0.0054	2	<1
ON2	0.51	0.0008	<1	<1
CP3			2	<1

* Referenced from Montecito

Table 2 Peak Flow Summary: Interim Condition				
Source	Area (acres)	Area (mi ²)	100-Year Flow (cfs)	10-Year Flow (cfs)
DEV4	0.45	0.0007	1	1
ROME	0.28	0.0004	1	1
OUT4			83	50
CP2			85	51
RILEY	0.53	0.0008	2	1
DEV3	0.66	0.0010	2	1
OFF1	5.68	0.0089	3	<1
CP1			5	1
DEV1	1.09	0.0017	3	1
DEV2	0.66	0.0010	2	1
DEON1	0.68	0.0011	1	<1
DEON1	0.44	0.0007	1	<1
CP3			10	3

* Referenced from Montecito

Table 3 Peak Flow: Future Condition				
Source	Area (acres)	Area (mi ²)	100-Year Flow (cfs)	10-Year Flow (cfs)
DEV4	0.45	0.0007	1	1
ROME	0.28	0.0004	1	1
OUT4			83	50
CP2			85	51
RILEY	0.53	0.0008	2	1
DEV3	0.66	0.0010	2	1
OFF1	5.68	0.0089	14	6
CP1			17	7
DEV1	1.09	0.0017	3	1
DEV2	0.66	0.0010	2	1
DEV5	0.68	0.0011	2	1
DEV6	0.44	0.0007	1	<1
CP3			25	10

* Referenced from Montecito

Analysis to determine peak flow rates were achieved using the SCS Unit Hydrograph

Method. The input parameters discussed in Section IV, A – C were input into HEC-1, and the computer software results are shown in the table above. A summary of input parameters and the HEC-1 printouts can be found in Appendices E - G.

E. Facility Design Calculations

1. Street Capacity

Street capacity analyses were performed to determine the depth of flow in the surrounding streets. Table 4 summarizes the 100 and 10-year flow in the street.

Table 4. Street Capacity Summary

Section	Location	Slope	Q (cfs)	D (feet)	V (fps)	VxD	Remarks
10-Year Flow – Interim (Developed) Conditions							
#1	Rome Upstream	2.11%	50	0.75	4.11	3.08	VxD <6 is met; D less than 1
#2	Riley Downstream	2.00%	1	0.25	2.36	0.59	VxD <6 is met; D less than 1
100-Year Flow – Interim (Developed) Conditions							
#1	Rome Upstream	2.11%	83	0.84	4.75	3.99	VxD <8 is met; D less than 2
#2	Riley Downstream	2.00%	5	0.38	3.21	1.22	VxD <8 is met; D less than 2
10-Year Flow – Future Conditions							
#2	Riley Downstream	2.00%	7	0.41	3.47	1.42	VxD <6 is met; D less than 1
100-Year Flow – Future Conditions							
#2	Riley Downstream	2.00%	17	0.55	3.92	2.16	VxD <8 is met; D less than 2

See Appendix H for street capacity calculations. As shown in the hydraulic criteria tables (tables 1-4), the HCDDM hydraulic criteria are met as follows:

- 10-year DxV products are less than 6, and with depths of flow less than 1 foot. Rome does not meet the dry lane criteria; however, there is an existing storm drain system to collect flows.
- 100-year DxV products are less than 8, and with depths of flow less than 2 feet.
- The interior drive aisles, streets, structures and landscaping areas will safely convey storm water towards the channel and Rome.

2. Finished Floor Calculations

Street capacity analyses were performed to determine the depth of flow in Rome Blvd. Table 5 below summarizes the method to determine the proposed finished floor elevation.

Table 5. Minimum Finished Floor Elevation Determination

	Street Center-line	Free-board	Finished Floor Based on Street Center Line	Flowline Elevation	Depth of Flow	Free-board	Finished Floor Based on Depth of Flow	Required Minimum Finished Floors	Proposed Minimum Elevation
Bldg 1 (Rome)	23	1.5	24.5	24.44	0.84	0.84	26.12	2526.12	2526.15
Future Bldg 2 (Riley)	22.62	1.5	23.1	22.09	0.55	0.55	23.19	2523.19	2523.20

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 18-inches above the centerline of street, whichever is highest. All finished floor elevations have met these conditions based off of Rome Blvd (the addressing street). The proposed finished floor of the nursing facility will be set at 2526.15 feet.

Finished floors will not be set off Riley Street, because this is not the addressing street. However, if an analysis is performed, the finished floor elevation is not 18 inches above the centerline of the street. At the center of the building, there is a highpoint in the street which will make the flows less than 1 cfs, therefore the proposed finished floor elevation of 2526.15 will ensure the building is protected. A future finished floor elevation of 2523.20 was set for the remainder of the undeveloped parcel.

3. Best Management Practices

The proposed site exceeds an acre in size and shall 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).

The discharge for the newly paved parking area has been designed to allow the storm water to travel through landscaping before leaving the site per Section 1503.4.5, riprap size $d_{50}=3''$.

4. Proposed Facilities

The drainage facilities required for this site consist of:

- Positive onsite grading
- finished floors set or flood protected to at least 18-inches above the centerline of street or twice the depth of flow, whichever is highest
- 2- 2ft sidewalk underdrains
- 2 ft curb openings

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. This study complies with the standards as set forth in the CCRFCD's Hydrologic Criteria and Drainage Design Manual.

B. Overall Facility Effectiveness

Development of this site will not adversely affect surrounding property owners, since current drainage patterns have not been significantly changed. The small increase in runoff generated by the developed site will be handled within the channel and detention basin.

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) SCS, 1985 - Soil Survey of the Las Vegas Valley Area, Nevada, U.S. Department of Agriculture, Soil Conservation Service, Washington D.C., July, 1985.
- 4) FEMA, 2011 - Flood Insurance Rate Maps, Clark County, Nevada, U.S. Federal Emergency Management Agency, November 16, 2011.
- 5) HEC, 1998 - HEC-1 Flood Hydrograph Package, User's Manual, U.S. Army Corps of Engineers, the Hydrologic Engineering Center, Davis, California, 1998.
- 6) Technical Drainage Study for Montecito Lifestyle Center (DS3186) dated July 25, 2002 by Primas and Associates, approved August 18, 2003.
- 7) Technical Drainage Study for Brookside (DS3476) dated December 31, 2003 by Tetra Tech, Inc., approved February 27, 2004.
- 8) Technical Drainage Study for Sun Devil Auto (DS4422) dated June 25, 2010 by Lochsa Engineering, approved October 12, 2010.



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 :

**CENTENNIAL HILLS
 SKILLED NURSING**

DATE: APR 2016
 DESIGN: SW
 DRAWN: SW1
 JOB: 20-19-60

This map is for assessment use only and does NOT represent a survey.

No liability is assumed for the accuracy of the data delineated herein. Information on roads and other non-assessed parcels may be obtained from the Road Document Listing in the Assessor's Office.

This map is compiled from official records, including surveys and deeds, but only contains the information required for assessment. See the recorded documents for more detailed legal information.

USE THIS SCALE (FEET) WHEN MAP REDUCED FROM 11X17 ORIGINAL

ASSESSOR'S PARCELS - CLARK CO., NV.
Michele W. Shafe - Assessor

MAP LEGEND

—	PARCEL BOUNDARY	□	CONDOMINIUM UNIT	001	ROAD PARCEL NUMBER
—	SUB BOUNDARY	□	AIR SPACE PCL	001	PARCEL NUMBER
—	PM/LD BOUNDARY	□	RIGHT OF WAY PCL	1.00	ACREAGE
—	ROAD EASEMENT	□	SUB-SURFACE PCL	202	PARCEL SUB/SEQ NUMBER
---	MATCH / LEADER LINE			PB 24-45	PLAT RECORDING NUMBER
---	HISTORIC LOT LINE			5	BLOCK NUMBER
---	HISTORIC SUB BOUNDARY			5	LOT NUMBER
---	HISTORIC PM/LD BOUNDARY			GL5	GOV. LOT NUMBER
---	SECTION LINE				

BOOK **T19S R60E**

099	100	101
27126	125	124
6137	138	139

SEC. **20**

6	5	4	3	2	1
7	8	9	10	11	12
13	14	15	16	17	18
19	20	21	22	23	24
25	26	27	28	29	30
31	32	33	34	35	36

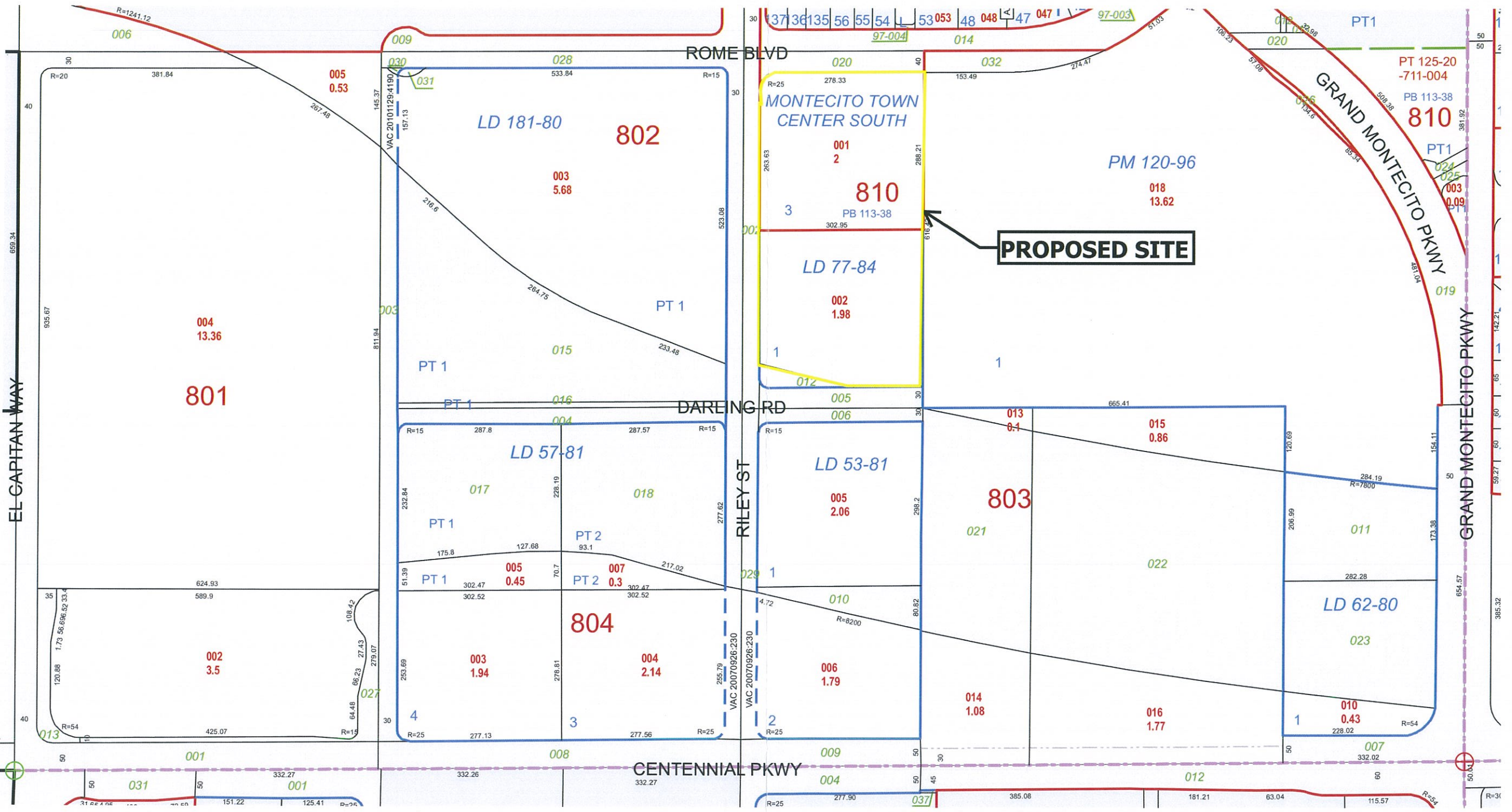
MAP **S 2 SE 4**

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5	1	5	1
6	2	6	2
7	3	7	3
8	4	8	4
5	1	5	1

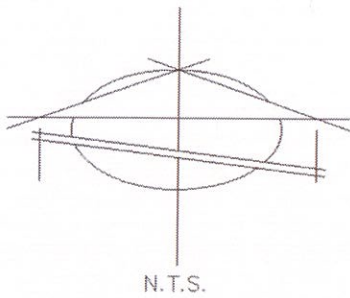
125-20-8

CLARK COUNTY
ASSESSOR
MAPPING DIVISION
NEVADA

Scale: 1" = 200' Rev: 1/27/2016



TAX DIST 200
FIGURE 2



AERIAL VIEW

FIGURE 3

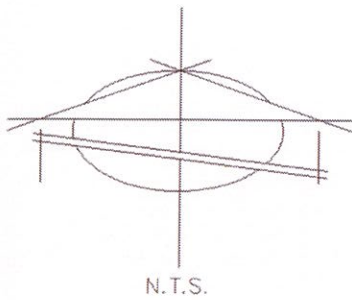


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GENERAL AERIAL VIEW

FIGURE 4



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 DRAWN: SW1
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2013
LAS VEGAS VALLEY
FLOOD CONTROL
MASTER PLAN UPDATE

FIGURE F-13

FLOOD CONTROL FACILITIES

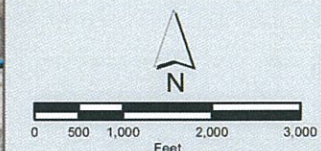
LEGEND

- Ultimate Development Boundary
- Existing Facilities
- Category A Proposed Facilities
- Category B Proposed Facilities
- Local Existing Facilities
- Local Proposed Facilities
- Detention Basin

- Stormdrain
- Lined Channel
- Unlined Channel
- Levee/Dike
- Natural Wash/Floodway
- ID-Mile Separator

Remove & Replace/Parallel Facilities

- Category A
 - Channel
 - Stormdrain
- Category B
 - Channel
 - Stormdrain



Refer to Figure G-2 for Aerial Source(s)

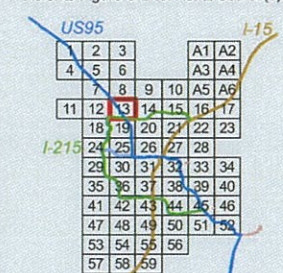
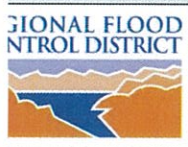


FIGURE 5A

Status	Facility Description	Length (ft.)	Flow (cfs)	HEC-1 Node	HEC-1 Model	Tributary Area (sq.mi.)	Channel Slope (%) **
E	BELTWAY CHANNEL - HUALAPAI						
E	12' X 5' RCAP	853	501	CBA3-C	WEST3	0.84	1.11
E	8' X 5' RCAP	1216	501	CBA3-C	WEST3	0.84	1.33
E	66" RCP	60	222	DNW26-C	WEST3	0.51	1.04
E	60" RCP	615	222	DNW26-C	WEST3	0.51	1.42
E	54" RCP	770	222	DNW26-C	WEST3	0.51	1.23
E	BRENT DRAINAGE SYSTEM						
E	36" RCP with 18" Orifice Plate	2170	37	BRDB	WEST3	2.48	0.40
E	45,080 cfs PMF Spillway		45080	CBROB	WEST3	2.48	
E	450 ac-ft South Environmental Enhancement Area		1902	CBROB	WEST3	2.48	
E	Energy Dissipator	100	957	CNW113-C	WEST3	1.58	
P1	8' X 6' RCB	2920	957	CNW113-C	WEST3	1.58	2.10
P1	8' X 6' RCB	2660	957	CNW113-C	WEST3	1.58	2.40
P1	12' X 6' RCB	1260	741	CNW96-C	WEST3	0.95	0.25
P1	CENTENNIAL PKWY CHANNEL WEST / U.S 95 BRANCH						
P1	Conc Chnl 22'W 10'D 0:1 SS	2690	3340	CNWBB3-C	WEST3	3.36	2.17
P1	3' 8' X 7' RCB	3380	3216	CNW103-C	WEST3	3.05	2.12
P1	3' 8' X 6' RCB	1710	2888	2CNW89-C	WEST3	2.66	2.09
P1	2' 10' X 6' RCB	1580	2160	2CNW71-E	WEST3	1.64	1.50
E	2' 10' X 6' RCB	320	1423	2CNW72-C	WEST3	1.14	0.82
E	15' X 9' RCB	1127	1423	2CNW72-C	WEST3	1.14	0.82
E	Transition Structure	59	1423	2CNW72-C	WEST3	1.14	0.77
E	15' X 9' RCB	290	653	CNW74-C	WEST3	0.44	0.77
E	10' X 6' RCB	2680	653	CNW74-C	WEST3	0.44	2.50
E	Transition Structure	60	653	CNW74-C	WEST3	0.44	1.50
E	5' X 5' RCB	670	339	NW62-S	WEST3	0.22	1.50
E	CENTENNIAL PKWY CHANNEL WEST / GRAND TETON BRANCH						
E	10' X 5' RCB	2376	600	CNW71-E	WEST3	0.47	2.58
P0	6' X 6' RCB	3980	600	CNW71-E	WEST3	0.47	3.00
E	6' X 5' RCAP	5472	363	KYLEDET*	KYLED8	57.73	3.72
E	CENTENNIAL PKWY CHANNEL WEST / KYLE CANYON BRANCH						
E	12' X 4' RCB	377	999	CNW72-C	WEST3	0.71	4.58
E	10' X 5' RCB	874	999	CNW72-C	WEST3	0.71	3.28
E	8' X 5' RCB	1385	999	CNW72-C	WEST3	0.71	2.40
P0	84" RCP	2610	854	CNW72-C	WEST3	0.71	3.60
E	CENTENNIAL PKWY CHANNEL WEST						
E	Conc Chnl 40'W 9.5'D 0:1 SS	2279	4233	CNW3B3-C	WEST3	5.64	0.42
E	3' 18' X 8' RCBC @ Torrey Pines	200	4233	CNW3B3-C	WEST3	5.64	0.42
E	Conc Chnl 40'W 9'D 0:1 SS	150	4233	CNW3B3-C	WEST3	5.64	0.41
E	Conc Chnl 36'W 10'D 0:1 SS	1200	4067	CNW2D4-C	WEST3	5.15	0.42
E	Conc Chnl 36'W 9'D 0:1 SS	2470	4067	CNW2D4-C	WEST3	5.15	1.00
E	2' 18' X 8.5' RCBC @ Rio Vista	100	4067	CNW2D4-C	WEST3	5.15	0.51
E	Conc Chnl 36'W 9.5'D 0:1 SS	405	3951	CNW2D3-C	WEST3	4.65	0.51
E	Conc Chnl 36'W 9'D 0:1 SS	575	3951	CNW2D3-C	WEST3	4.65	0.51
E	Conc Chnl 32'W 10'D 0:1 SS	229	3951	CNW2D3-C	WEST3	4.65	0.51
E	32' X 10' RCBC @ Tenaya	142	3951	CNW2D3-C	WEST3	4.65	0.51
E	Conc Chnl 32'W 9'D 0:1 SS	579	3951	CNW2D3-C	WEST3	4.65	0.64
E	Conc Chnl 13'W 10'D 2:1 SS	605	3593	CNW2B2-C	WEST3	3.84	1.19
P2	Conc Chnl 32'W 10'D 0:1 SS	235	3593	CNW2B2-C	WEST3	3.84	1.19
P2	32' X 10' RCB	3259	3593	CNW2B2-C	WEST3	3.84	1.79
E	22' X 7' RCB	785	3593	CNW2B2-C	WEST3	3.84	1.79
P1	32' X 10' RCB	2200	3593	CNW2B2-C	WEST3	3.84	1.75
E	ELKHORN SPRINGS AND BUFFALO						
E	60" RCP	1046	375	NW134-C	WEST3	0.46	1.00
E	ELKHORN SPRINGS DETENTION BASIN						
E	Grass Chnl 15'W 5.8'D 3.5:1 SS	2575	238	CNW150-C	WEST3	1.41	0.39
E	4' X 3' RCB	160	120	ELKBASIN	WEST3	0.84	0.50
E	48" RCP	1270	120	ELKBASIN	WEST3	0.84	1.23
E	60" RCP	1095	120	ELKBASIN	WEST3	0.84	0.13
E	48 ac-ft Elkhorn Springs Detention Basin		629	CNW133-C	WEST3	0.84	

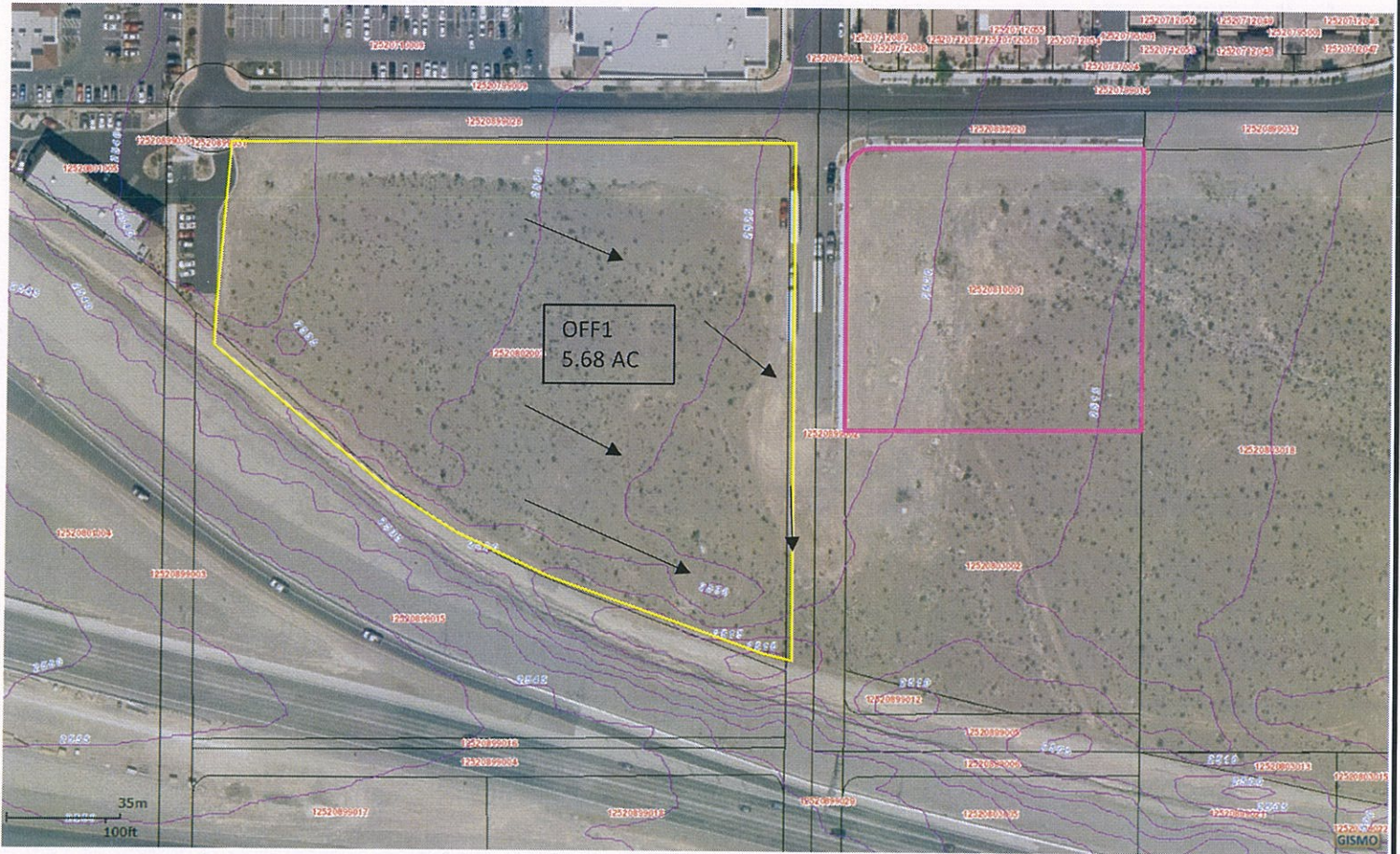
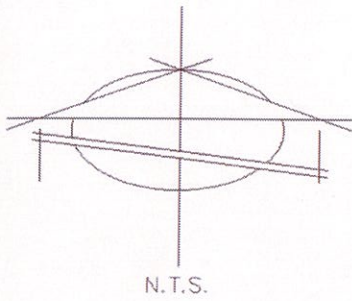
ID / River Mile	Status	Facility Description	Length (ft.)	Flow (cfs)	HEC-1 Node	HEC-1 Model	Tributary Area (sq.mi.)	Channel Slope (%) **
EKHU		ELKHORN AND HUALAPAI						
0000	E	6' X 5' RCB Overflow Structure	48	638	CNW26-C	WEST3	0.51	0.91
0001	E	6' X 5' RCAP	72	638	CNW26-C	WEST3	0.51	0.91
0003	E	6' X 4' RCAP	980	638	CNW26-C	WEST3	0.51	3.61
0020	E	6' X 5' RCAP	150	638	CNW26-C	WEST3	0.51	3.61
0023	E	8' X 5' RCAP	1200	638	CNW26-C	WEST3	0.51	0.90
GOEC		GOWAN NORTH - EL CAPITAN BRANCH						
0176	P1	78" RCP	1320	363	CCPFR-C	ALLGOW3	0.46	1.15
GONO		GOWAN NORTH SYSTEM						
0511	P1	7' X 6' RCB	1320	546	CCPHW-C	ALLGOW3	0.60	1.14
LVMD		LAS VEGAS WASH - MIDDLE						
2490	E	2' 13' X 7' RCB	2555	2278	CNW168-C	CWEST3	4.69	0.40
2507	E	2' 13' X 9' RCB	2831	2278	CNW168-C	CWEST3	4.69	0.36
2525	E	24' X 8' RCB	1140	1913	CNW159-C	CWEST3	3.91	0.40
2550	E	24' X 8' RCB	1445	1664	CD161-C	CWEST3	3.41	0.40
2574	E	24' X 8' RCB	1430	1664	CD161-C	CWEST3	3.41	0.40
2599	E	Conc Chnl 24'W 7'D 2:1 SS	1577	1585	CNW162-C	CWEST3	3.08	0.50
2632	E	18' X 5' RCB	1580	968	CNW138-C	WEST3	1.16	0.46
2661	E	18' X 5' RCB	2640	968	CNW138-C	WEST3	1.16	0.46
2711	E	10' X 5' RCB	1320	968	CNW138-C	WEST3	1.16	1.54
2737	E	10' X 5' RCB	1320	818	CNW139-C	WEST3	0.93	2.22
2763	E	6' X 5' RCB	1320	818	CNW139-C	WEST3	0.93	1.79
2789	E	6' X 5' RCB	1470	818	CNW139-C	WEST3	0.93	2.17
MOHU		MOCCASIN - HUALAPAI BRANCH						
0000	P0	14' X 8' RCB	1920	761	2CNW45-N	LOWER3	2.10	0.50
0036	P0	10' X 8' RCB	2590	368	CNW45-N	LOWER3	1.15	0.50
0085	P0	72" RCP	790	368	CNW45-N	LOWER3	1.15	3.00
0100	P0	Natural Wash	850	65	DMODB1	LOWER3	0.81	3.00
0116	P0	60" RCP	12	65	DMODB1	LOWER3	0.81	3.00
0118	P0	Natural Wash	3485	65	DMODB1	LOWER3	0.81	3.00
MOIR		MOCCASIN - IRON MOUNTAIN BRANCH						
0000	P0	66" RCP	2770	446	2CNW33-C	LOWER3	1.76	3.60
MOKC		MOCCASIN AND KYLE CANYON						
0000	P1	11' X 8' RCB	5450	2662	CNW35-C	LOWER3	2.69	3.40
MOSM		MOCCASIN AND SHEEP MOUNTAIN PARKWAY						
0000	P0	14' X 9' RCB	3370	3778	CNW64-C	LOWER3	5.32	2.40
0064	P0	14' X 8' RCB	880	3505	CNW50-C	LOWER3	4.99	3.00
0080	P0	14' X 8' RCB	710	3325	2CNW35-C	LOWER3	4.80	3.00
MSNV		MOUNTAIN SPAVISTA RANCH						
0000	E	6' 12' X 5' RCBC @ Grand Teton	273	679	CNW163-C	CWEST3	1.67	0.40
0005	E	Grass Chnl 100'W 4.5'D 10:1 SS	6325	679	CNW163-C	CWEST3	1.67	0.40
0125	E	Grass Chnl 100'W 4.5'D 10:1 SS	1300	116	CNW147E	WEST3	1.54	0.40
RACO		RACEL STREET COLLECTOR						
0000	E	96" RCP Baffled Energy Dissipator	54	497	CNW111S	WEST3	0.55	4.20
0001	E	78" RCP	3245	497	CNW111S	WEST3	0.55	2.46
0064	E	78" RCP	2650	423	DNW111S	WEST3	0.44	2.09
RCBC		RANCHO ROAD SYSTEM - BELTWAY CHANNEL						
0000	E	6' X 5' RCB	1062	222	FADB	WEST3	1.60	1.04
0002	E	54" RCP Outlet with 41" Orifice	503	222	FADB	WEST3	1.60	2.38
0003	E	2,341 cfs PMF Spillway		2341	FADBIN	WEST3	1.60	
0004	E	76 ac-ft Fort Apache Detention Basin		1255	FADBIN	WEST3	1.60	
0007	E	Energy Dissipator	100	1255	FADBIN	WEST3	1.60	
0009	E	12' X 6' RCBC @ Fort Apache Detention Basin	133	1255	FADBIN	WEST3	1.60	1.79
0012	E	Conc Chnl 12'W 6'-7'D 0:1 SS	1937	1255	FADBIN	WEST3	1.60	3.15
0048	E	12' X 6' RCBC @ Grand Canyon	140	1040	CMNA1	WEST3	1.32	3.15
0051	E	Conc Chnl 12'W 6'-8'D 0:1 SS						

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



2013 LAS VEGAS VALLEY





EXISTING OFFSITE DRAINAGE BASINS

FIGURE 11



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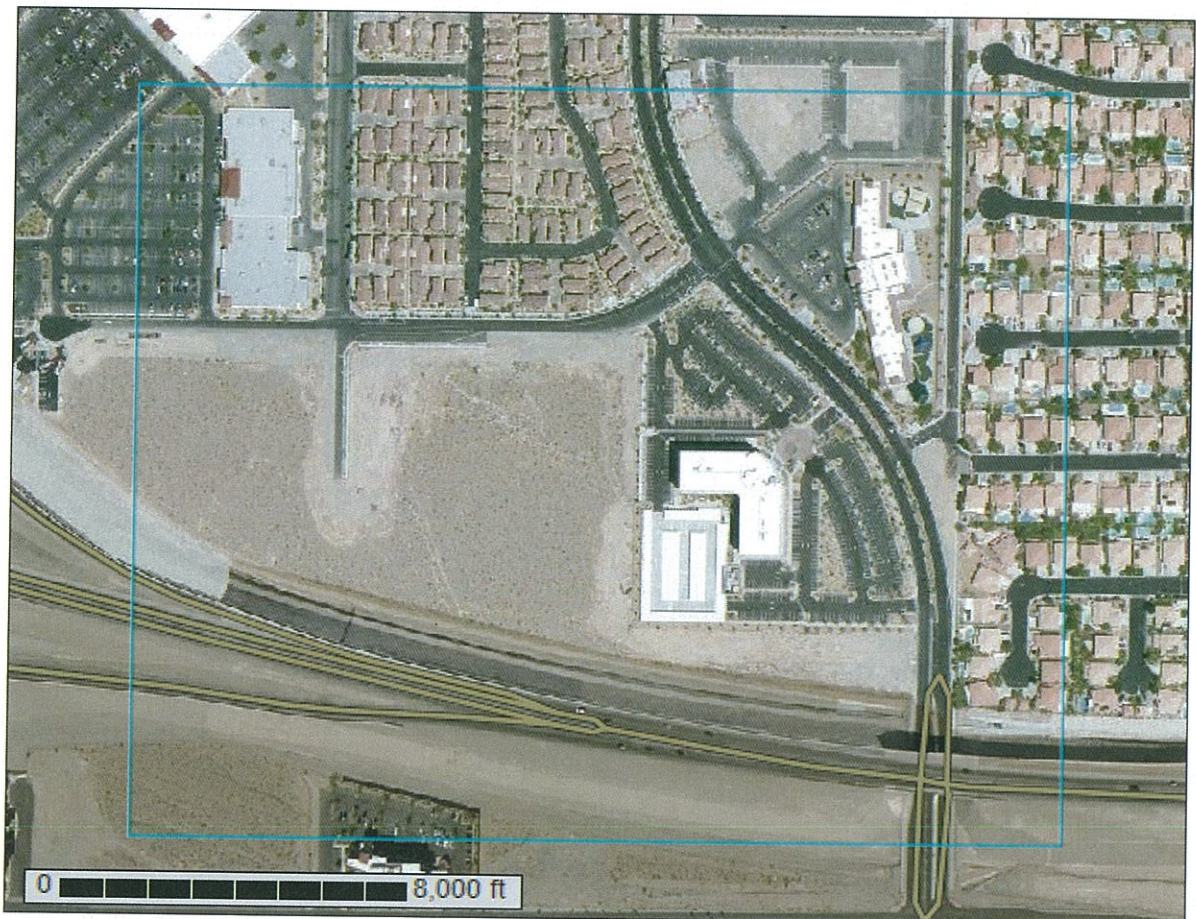
United States
Department of
Agriculture

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



April 7, 2016

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 LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Map Unit Polygons

Soil Map Unit Lines

Soil Map Unit Points

Special Point Features

Blowout

Borrow Pit

Clay Spot

Closed Depression

Gravel Pit

Gravelly Spot

Landfill

Lava Flow

Marsh or swamp

Mine or Quarry

Miscellaneous Water

Perennial Water

Rock Outcrop

Saline Spot

Sandy Spot

Severely Eroded Spot

Sinkhole

Slide or Slip

Sodic Spot

Water Features

Streams and Canals

Transportation

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

Background

Aerial Photography

Spoil Area

Stony Spot

Very Stony Spot

Wet Spot

Other

Special Line Features

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: <http://websoilsurvey.nrcs.usda.gov>
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 10, Aug 22, 2014

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

Map Unit Legend

Las Vegas Valley Area, Nevada, Part of Clark County (NV788)			
Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
191	Dalian very cobbly fine sandy loam, 2 to 8 percent slopes	78.2	100.0%
Totals for Area of Interest		78.2	100.0%

Map Unit Descriptions

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

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

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

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

Las Vegas Valley Area, Nevada, Part of Clark County

191—Dalian very cobbly fine sandy loam, 2 to 8 percent slopes

Map Unit Setting

National map unit symbol: hrb4
Elevation: 2,200 to 3,400 feet
Mean annual precipitation: 4 to 6 inches
Mean annual air temperature: 61 to 66 degrees F
Frost-free period: 210 to 250 days
Farmland classification: Not prime farmland

Map Unit Composition

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

Description of Dalian

Setting

Landform: Fan skirts
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Alluvium derived from limestone and dolostone

Typical profile

H1 - 0 to 5 inches: very cobbly fine sandy loam
H2 - 5 to 60 inches: very gravelly fine sandy loam

Properties and qualities

Slope: 2 to 8 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 60 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: Low (about 4.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: A

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

RUNOFF CURVE NUMBERS (SEMIARID RANGELANDS¹)

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

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

²Poor: <30% ground cover (litter, grass, and brush overstory).

Fair: 30 to 70% ground cover.

Good: >70% ground cover.

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

Revision	Date

**WRC
ENGINEERING**

REFERENCE:

SCS TR-55, USDA, June 1986.

**TABLE 602
4 of 4**

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

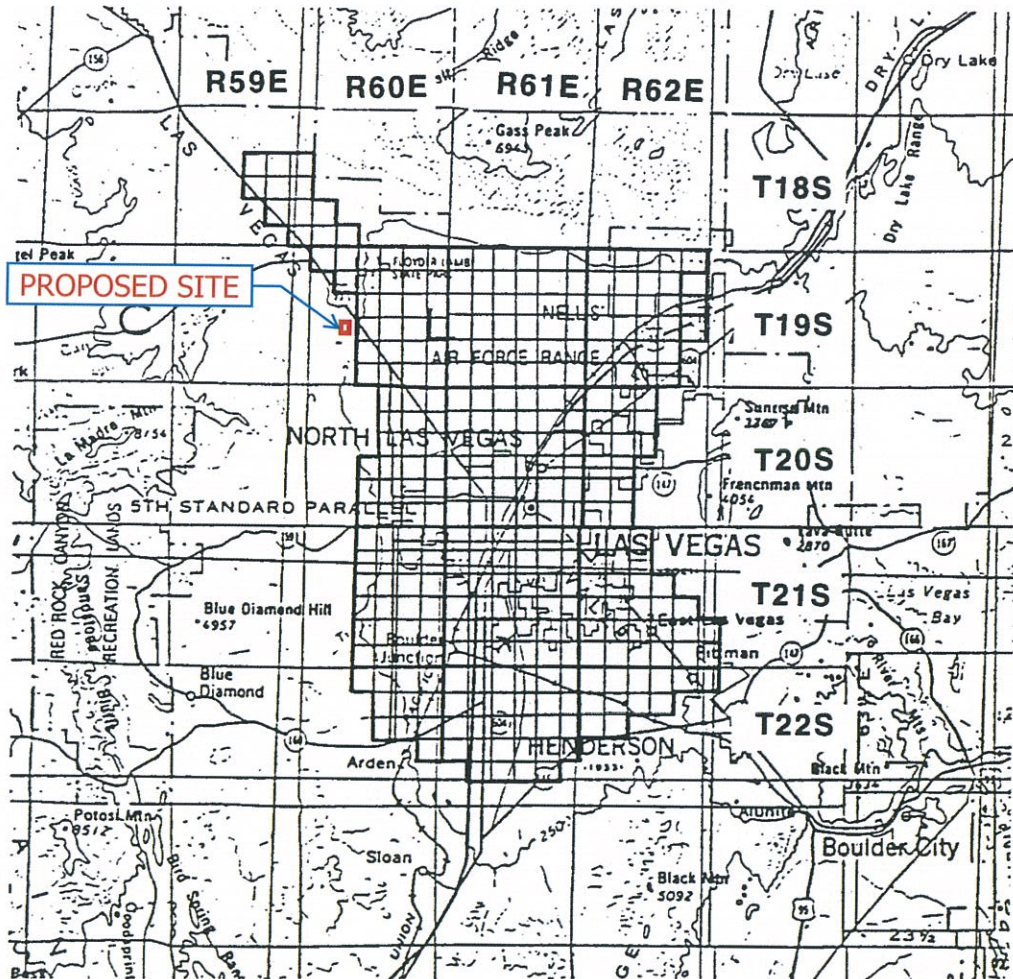
WRC
ENGINEERING

REFERENCE:
SCS TR-55, USDA, June 1986.

TABLE 602
1 of 4

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

McCARRAN AIRPORT RAINFALL AREA



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

Notes:

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

Revision	Date

WRC
ENGINEERING

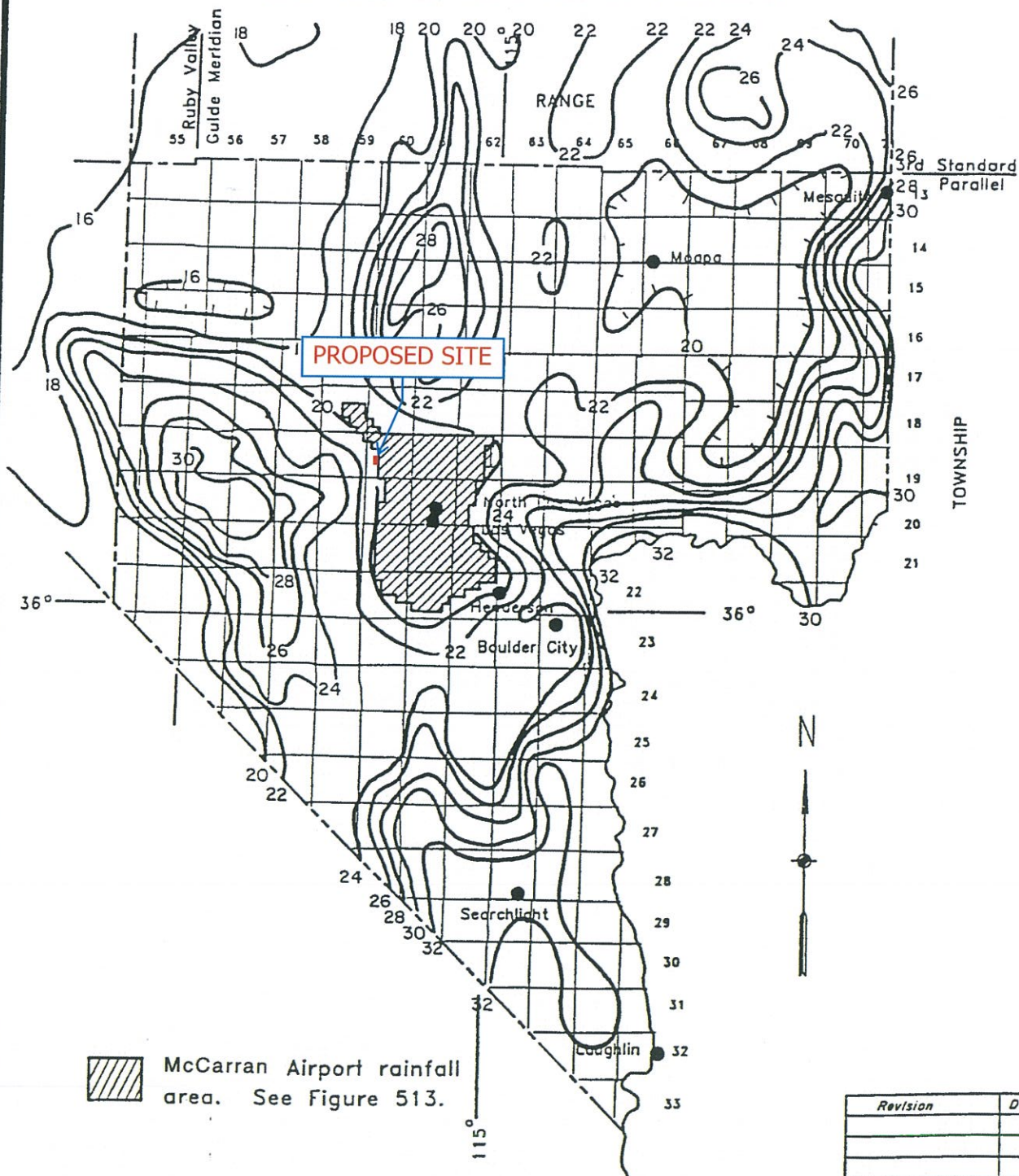
REFERENCE:

USACE, Los Angeles District, 1988

FIGURE 513

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

RAINFALL DEPTH-DURATION-FREQUENCY 100-YEAR, 6-HOUR (DEPTHS IN TENTHS OF INCHES)



WRC
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REFERENCE:
NOAA ATLAS 2, VOLUME VII NEVADA, 1973

FIGURE 506

PRECIPITATION ADJUSTMENT RATIOS

<u>Recurrence Interval</u>	<u>Ratio to NOAA Atlas 2</u>
2-year	1.00
5-year	1.16
10-year	1.24
25-year	1.33
50-year	1.39
100-year	1.43

100 YEAR:
 $2.1 \times 1.43 = 3.00$

10 YEAR:
 $1.3 \times 1.24 = 1.61$

RATIO:
 $1.61 / 3.00 = 0.54$

- NOTE: 1. Multiply the values obtained from the NOAA Atlas 2 by the above ratios to obtain the adjusted precipitation values.
2. NOAA Atlas 2 values for use with TR-55 shall not be adjusted by the above ratios.
3. Tables 505 and 506 require no adjustments.

<i>Revision</i>	<i>Date</i>

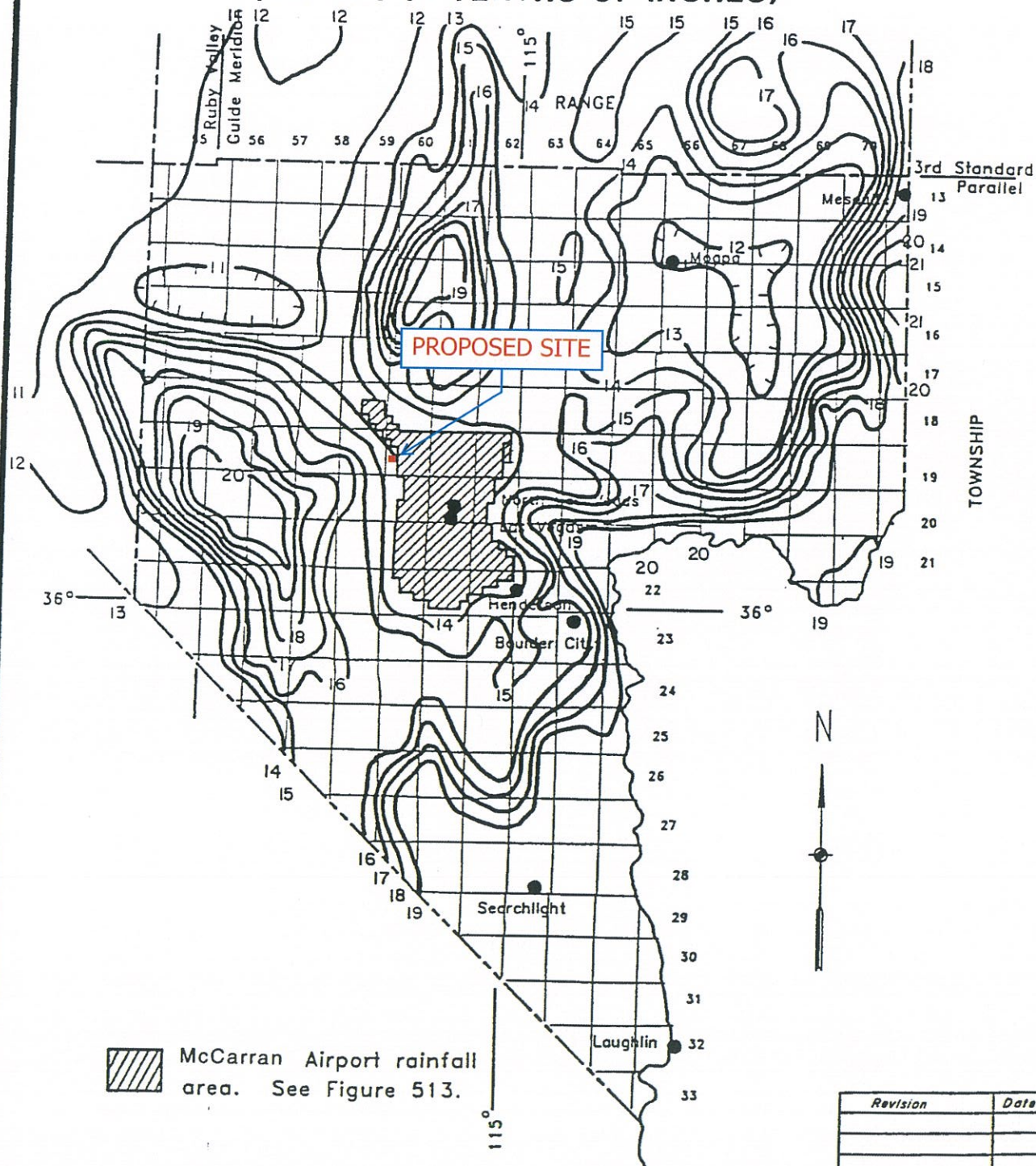
**WRC
ENGINEERING**

REFERENCE:
 USACE, Los Angeles District, 1988

TABLE 501

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

RAINFALL DEPTH-DURATION-FREQUENCY 10-YEAR, 6-HOUR (DEPTHS IN TENTHS OF INCHES)



Revision	Date

WRC
ENGINEERING

REFERENCE:
NOAA ATLAS 2, VOLUME VII NEVADA, 1973

FIGURE 503

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

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

TIME OF CONCENTRATION

BAUGHMAN & TURNER, INC.
CONSULTING ENGINEERS

PROJECT NO. : 20-19-60

DEVELOPMENT : Centennial Hills Skilled Nursing

FILE : Existing & Developed Condition

CALCULATED BY: sw

DATE : 04/28/16

Sub-Basin Data					Initial/Overland Time (T _i)			Travel Time (T _d)					T _c		T _c Check (Urbanized Basins)		Final T _c	T _{lag}	Remarks	
DESIG	CN	K	AREA (acres)	AREA (mi ²)	LENGTH (ft)	SLOPE (%)	T _i (min)	LENGTH (ft)	SLOPE (%)	V ₁ (fps)	V ₂ (fps)	T ₁ (min)	T _c =T _i +T ₁ (min)		TOTAL (ft)		T _c (min)	T _c (min)	T _{lag} (hrs)	Remarks
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)		

Existing Condition

ON1	63	0.442	3.47	0.0054	170	2.90	10.8	380	3.20	2.65	N/A	2.4	13.2	N/A	N/A	13.2	0.132	EX
ON2	63	0.442	0.51	0.0008	80	2.50	7.8	350	2.600	2.39	N/A	2.4	10.3	N/A	N/A	10.3	0.103	EX
ROME	98	0.904	0.28	0.0004	40	1.25	2.1	300	2.00	2.86	N/A	1.8	3.8	340.0	11.9	3.8	0.050	DEV
RILEY	82	0.692	0.53	0.0008	30	3.00	2.8	535	1.100	2.12	3.21	4.1	6.9	565.0	13.1	6.9	0.069	DEV
OFF1	63	0.442	5.68	0.0089	300	2.00	16.3	1085	2.30	2.24	4.46	5.9	22.2	N/A	N/A	22.2	0.222	EX

Interim Condition

DEV1	89	0.785	0.94	0.0015	170	3.3	5.0	410	1.80	2.71	N/A	2.5	7.5	580.0	13.2	7.5	0.075	DEV
DEV2	89	0.785	0.66	0.0010	80	1.1	4.9	160	1.60	2.56	N/A	1.0	6.0	240.0	11.3	6.0	0.060	DEV
DEV3	89	0.785	0.66	0.00103	120	0.1	13.4	220	1.00	2.02	N/A	1.8	15.2	340.0	11.9	11.9	0.119	DEV
DEV4	89	0.785	0.60	0.0009	70	2.50	3.5	334	2.10	2.93	N/A	1.9	5.4	404.0	12.2	5.4	0.054	DEV
DEON1	77	0.626	0.68	0.0011	33	5.00	2.9	460	0.250	0.74	N/A	10.4	13.2	N/A	N/A	13.2	0.132	EX
DEON2	77	0.626	0.44	0.0007	210	0.50	15.6	500	0.50	1.05	N/A	8.0	23.5	N/A	N/A	23.5	0.235	EX
ROME	98	0.904	0.28	0.0004	40	1.25	2.1	300	2.00	2.86	N/A	1.8	3.8	340.0	11.9	3.8	0.050	DEV
RILEY	88	0.772	0.53	0.0008	30	3.00	2.2	535	1.100	2.12	3.21	4.1	6.4	565.0	13.1	6.4	0.064	DEV
OFF1	63	0.442	5.68	0.0089	300	2.00	16.3	1085	2.30	2.24	4.46	5.9	22.2	N/A	N/A	22.2	0.222	EX

T _f = (1.48(1-K)L ^{0.5})/(S ^{0.5})		For the travel time (T _i) calculations,		Travel Time Velocity Formulas		All basins over one square mile are calculated by the equation	
T _c = T _i + T ₁		V ₁ applies to the first 500 feet of travel distance;		Existing	Developed	T _{lag} = 20Kn(L ^{0.5} /S ^{0.5})	
K = 0.0132(CN) ^{-0.39}		V ₂ applies to the remaining travel distance.		V ₁ = 14.8*(S/100) ^{0.5}	V ₂ = 20.2*(S/100) ^{0.5}	and denoted by shaded gray	
T _{lag} = 0.6T _c				V ₁ = 14.8*(S/100) ^{0.5}	V ₂ = 30.6*(S/100) ^{0.5}	(See Worksheet).	

REFERENCE:

STANDARD FORM 4

TIME OF CONCENTRATION

BAUGHMAN & TURNER, INC.
CONSULTING ENGINEERS

PROJECT NO.:	20-19-60
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DEVELOPMENT : Centennial Hills Skilled Nursing

FILE : Existing & Developed Condition

CALCULATED BY: SW

DATE : 04/28/16

[illegible]

REFERENCE:

STANDARD FORM 4

All basins over one square mile are calculated by the equation $T_{lag} = 20Kn(L^* / S^{0.5})^{0.33}$ and denoted by shaded gray (See Worksheet).


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1*****
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* FLOOD HYDROGRAPH PACKAGE (HEC-1)
* JUN 1998
* VERSION 4.1
*
* RUN DATE 27APR16 TIME 09:36:38
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*
* U.S. ARMY CORPS OF ENGINEERS
* HYDROLOGIC ENGINEERING CENTER
* 609 SECOND STREET
* DAVIS, CALIFORNIA 95616
* (916) 756-1104
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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

1 HEC-1 INPUT PAGE 1

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

1 *DIAGRAM
2 ID
3 ID Centennial Hills Skilled Nursing
4 ID Existing Condition
5 ID File N:\Ochoa.Rome-Riley\Docs\Hydrology\HEC1\EX.hcl ID
6 ID
7 IT 5 300
8 IO 5
9 IN 5
10 JR PREC 0.54 1.0
* *****
* Existing Conditions *
* *****

11 KK ON1
12 BA .0054
13 PB 3.00
14 PC 0.00 2 5.7 7 8.7 10.8 12.4 13 13 13
15 PC 13 13 13 13.3 14 14.2 14.8 15.8 17.2 18.1
16 PC 19 19.7 19.7 20.1 20.1 20.4 21.4 22.9 24.1 24.9
17 PC 25.1 25.6 27 27.8 28.1 28.3 29.5 32.2 35.2 40.9
18 PC 49.9 59 71 74.4 78.1 81.2 81.9 83.5 85.1 85.6
19 PC 86 86.8 87.6 88.8 91 92.6 93.7 95 97 97.6
20 PC 98.2 98.5 98.7 98.9 99 99.3 99.3 99.4 99.5 99.8
21 PC 99.8 99.9 100
22 LS 63
23 UD 0.132

24 KK ON2
25 BA 0.0008
26 LS 63
27 UD 0.103

28 KK CP3
29 HC 2

30 KK ROME
31 BA 0.0004 B
32 LS 98
33 UD 0.050

34 KK RILEY
35 BA 0.0008 B
36 LS 82
37 UD 0.069

38 KK OFF1
39 BA 0.0089 B
40 LS 63
41 UD 0.222

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1 HEC-1 INPUT PAGE 2

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

42 KK CP1
43 HC 2
44 ZZ

```


SCHEMATIC DIAGRAM OF STREAM NETWORK

```

INPUT
LINE      (V) ROUTING      (--->) DIVERSION OR PUMP FLOW
NO.        (.) CONNECTOR    (<---) RETURN OF DIVERTED OR PUMPED FLOW

11         ON1
.
.
24         .              ON2
.
.
28         CP3.....
.
.
30         .              ROME
.
.
34         .              RILEY
.
.
38         .              OFF1
.
.
42         .              CP1.....

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(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

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*****
* FLOOD HYDROGRAPH PACKAGE (HEC-1) *
*   JUN 1998                *
*   VERSION 4.1             *
* RUN DATE 27APR16 TIME 09:36:38 *
*****

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

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Centennial Hills Skilled Nursing
Existing Condition

File N:\Ochoa.Rome-Riley\Docs\Hydrology\HEC1\EX.hcl

ID

```

8 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
          .54        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 .54	RATIO 2 1.00
HYDROGRAPH AT					
+	ON1	.01	1	FLOW TIME	0. 4.92 2. 3.58
HYDROGRAPH AT					
+	ON2	.00	1	FLOW TIME	0. 4.83 0. 3.58

2 COMBINED AT						
+	CP3	.01	1	FLOW	0.	2.
				TIME	4.92	3.58
HYDROGRAPH AT						
+	ROME	.00	1	FLOW	1.	1.
				TIME	3.50	3.50
HYDROGRAPH AT						
+	RILEY	.00	1	FLOW	0.	1.
				TIME	3.50	3.50
HYDROGRAPH AT						
+	OFF1	.01	1	FLOW	0.	3.
				TIME	4.92	3.75
2 COMBINED AT						
+	CP1	.01	1	FLOW	0.	3.
				TIME	3.50	3.67

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


```

1*****
*
* FLOOD HYDROGRAPH PACKAGE (HEC-1)
* JUN 1998
* VERSION 4.1
*
* RUN DATE 28APR16 TIME 10:36:57
*
*****

```

```

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

```

```

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

```

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

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE. THE DEFINITION OF -AMSK- 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 Centennial Hills Skilled Nursing
3 ID Interim Condition I
4 ID
5 ID File N:\Ochoa.Rome-Riley\Docs\Hydrology\HEC1\In.hcl ID
6 ID
7 IT 5 300
8 IO 5
9 IN 5
10 JR PREC 0.54 1.0
* *****
* Interim Conditions *
* *****
11 KK DEV3
12 BA .0010
13 PB 3.00
14 PC 0.00 2 5.7 7 8.7 10.8 12.4 13 13 13
15 PC 13 13 13.3 14 14.2 14.8 15.8 17.2 18.1
16 PC 19 19.7 19.7 20.1 20.1 20.4 21.4 22.9 24.1 24.9
17 PC 25.1 25.6 27 27.8 28.1 28.3 29.5 32.2 35.2 40.9
18 PC 49.9 59 71 74.4 78.1 81.2 81.9 83.5 85.1 85.6
19 PC 86 86.8 87.6 88.8 91 92.6 93.7 95 97 97.6
20 PC 98.2 98.5 98.7 98.9 99 99.3 99.3 99.4 99.5 99.8
21 PC 99.8 99.9 100
22 LS 89
23 UD 0.119
24 KK RILEY
25 BA 0.0008
26 LS 88
27 UD 0.064
28 KK OFF1
29 BA 0.0089
30 LS 63
31 UD 0.222
32 KK CP1
33 HC 3
34 KK DEV2
35 BA 0.0010
36 LS 89
37 UD 0.060
38 KK DEV1
39 BA 0.0015
40 LS 89
41 UD 0.075

```

1

HEC-1 INPUT

PAGE 2

```

LINE ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10
42 KK DEON1
43 BA 0.0011
44 LS 77
45 UD 0.132

```


46	KK	DEON2	
47	BA	0.0007	77
48	UD	0.235	
49	KK	CP3	
50	HC	5	
51	KK	DEV4	
52	BA	0.0009	
53	LS		89
54	UD	0.054	
55	KK	ROME	
56	BA	0.0004	
57	LS		98
58	UD	0.050	
59	KK	CP2	
60	HC	2	
61	ZZ		

1

SCHEMATIC DIAGRAM OF STREAM NETWORK

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

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

```

11      DEV3
      .
24      .      RILEY
      .
28      .      .      OFF1
      .
32      CP1.....
      .
34      .      DEV2
      .
38      .      .      DEV1
      .
42      .      .      .      DEON1
      .
46      .      .      .      .      DEON2
      .
49      CP3.....
      .
51      .      DEV4
      .
55      .      .      ROME
      .
59      .      CP2.....
  
```

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

```

*****
* FLOOD HYDROGRAPH PACKAGE (HEC-1) *
* JUN 1998 *
* VERSION 4.1 *
* RUN DATE 28APR16 TIME 10:36:57 *
*****
  
```

```

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

Centennial Hills Skilled Nursing
Interim Condition

File N:\Ochoa.Rome-Riley\Docs\Hydrology\HEC1\In.hcl

I

ID

8 IO

OUTPUT CONTROL VARIABLES

IPRNT	5	PRINT CONTROL
IPLT	0	PLOT CONTROL
QSCAL	0.	HYDROGRAPH PLOT SCALE

IT

HYDROGRAPH TIME DATA

NMIN	5	MINUTES IN COMPUTATION INTERVAL
IDATE	1	STARTING DATE
ITIME	0000	STARTING TIME
NQ	300	NUMBER OF HYDROGRAPH ORDINATES
NDDATE	2	ENDING DATE
NDTIME	0055	ENDING TIME
TCENT	14	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
.54 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 .54	RATIO 2 1.00
HYDROGRAPH AT					
+	DEV3	.00	1 FLOW	1.	2.
			TIME	3.58	3.58
HYDROGRAPH AT					
+	RILEY	.00	1 FLOW	1.	2.
			TIME	3.50	3.50
HYDROGRAPH AT					
+	OFF1	.01	1 FLOW	0.	3.
			TIME	4.92	3.75
3 COMBINED AT					
+	CP1	.01	1 FLOW	1.	5.
			TIME	3.50	3.58
HYDROGRAPH AT					
+	DEV2	.00	1 FLOW	1.	2.
			TIME	3.50	3.50
HYDROGRAPH AT					
+	DEV1	.00	1 FLOW	1.	3.
			TIME	3.50	3.50
HYDROGRAPH AT					
+	DEON1	.00	1 FLOW	0.	1.
			TIME	3.58	3.58
HYDROGRAPH AT					
+	DEON2	.00	1 FLOW	0.	1.
			TIME	3.75	3.67
5 COMBINED AT					
+	CP3	.01	1 FLOW	3.	10.
			TIME	3.50	3.50
HYDROGRAPH AT					
+	DEV4	.00	1 FLOW	1.	2.
			TIME	3.50	3.50
HYDROGRAPH AT					
+	ROME	.00	1 FLOW	1.	1.
			TIME	3.50	3.50
2 COMBINED AT					
+	CP2	.00	1 FLOW	1.	3.
			TIME	3.50	3.50

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


```

*****
*
* FLOOD HYDROGRAPH PACKAGE (HEC-1)
* JUN 1998
* VERSION 4.1
*
* RUN DATE 28APR16 TIME 11:00:22
*
*****

```

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

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

```

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

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

1 HEC-1 INPUT PAGE 1

```

LINE ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10
*DIAGRAM
1 ID
2 ID Centennial Hills Skilled Nursing
3 ID Future Condition ID
4 ID
5 ID File N:\Ochoa.Rome-Riley\Docs\Hydrology\HEC1\dev.hcl ID
6 ID
7 IT 5 300
8 IO 5
9 IN 5
10 JR PREC 0.54 1.0
* *****
* Future (Developed) Condition *
* *****
11 KK DEV3
12 BA .0010
13 PB 3.00
14 PC 0.00 2 5.7 7 8.7 10.8 12.4 13 13 13
15 PC 13 13 13.3 14 14.2 14.8 15.8 17.2 18.1
16 PC 19 19.7 19.7 20.1 20.1 20.4 21.4 22.9 24.1 24.9
17 PC 25.1 25.6 27 27.8 28.1 28.3 29.5 32.2 35.2 40.9
18 PC 49.9 59 71 74.4 78.1 81.2 81.9 83.5 85.1 85.6
19 PC 86 86.8 87.6 88.8 91 92.6 93.7 95 97 97.6
20 PC 98.2 98.5 98.7 98.9 99 99.3 99.3 99.4 99.5 99.8
21 PC 99.8 99.9 100
22 LS 89
23 UD 0.119
24 KK RILEY
25 BA 0.0008
26 LS 98
27 UD 0.055
28 KK OFF1
29 BA 0.0089
30 LS 89
31 UD 0.126
32 KK CP1
33 HC 3
34 KK DEV2
35 BA 0.0010
36 LS 89
37 UD 0.060
38 KK DEV1
39 BA 0.0015
40 LS 89
41 UD 0.075

```

HEC-1 INPUT PAGE 2

```

LINE ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10
42 KK DEV5
43 BA 0.0011
44 LS 89

```

46	KK	DEV6	
47	BA	0.0007	89
48	UD	0.139	
49	KK	CP3	
50	HC	5	
51	KK	DEV4	
52	BA	0.0009	
53	LS		89
54	UD	0.054	
55	KK	ROME	
56	BA	0.0004	
57	LS		98
58	UD	0.050	
59	KK	CP2	
60	HC	2	
61	ZZ		

1

SCHEMATIC DIAGRAM OF STREAM NETWORK

INPUT LINE	(V) ROUTING	(--->) DIVERSION OR PUMP FLOW
NO.	(.) CONNECTOR	(<---) RETURN OF DIVERTED OR PUMPED FLOW
11	DEV3	
24	RILEY	
28	OFF1	
32	CPI	
34	DEV2	
38	DEV1	
42	DEV5	
46	DEV6	
49	CP3	
51	DEV4	
55	ROME	
59	CP2	

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

```

*****
* FLOOD HYDROGRAPH PACKAGE (HEC-1) *
*   JUN 1998                   *
*   VERSION 4.1                 *
* RUN DATE 28APR16 TIME 11:00:22 *
*****

```

```

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

```

Centennial Hills Skilled Nursing
Future Condition

ID

File N:\Ochoa.Rome-Riley\Docs\Hydrology\HEC1\dev.hcl

ID

8 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	STARTING DATE
ITIME	0000	STARTING TIME
NQ	300	NUMBER OF HYDROGRAPH ORDINATES
NDDATE	2	ENDING DATE
NDTIME	0055	ENDING TIME

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
.54 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 .54	RATIO 2 1.00
HYDROGRAPH AT					
+	DEV3	.00	1 FLOW	1.	2.
			TIME	3.58	3.58
HYDROGRAPH AT					
+	RILEY	.00	1 FLOW	1.	2.
			TIME	3.50	3.50
HYDROGRAPH AT					
+	OFF1	.01	1 FLOW	6.	14.
			TIME	3.58	3.58
3 COMBINED AT					
+	CP1	.01	1 FLOW	7.	17.
			TIME	3.58	3.58
HYDROGRAPH AT					
+	DEV2	.00	1 FLOW	1.	2.
			TIME	3.50	3.50
HYDROGRAPH AT					
+	DEV1	.00	1 FLOW	1.	3.
			TIME	3.50	3.50
HYDROGRAPH AT					
+	DEV5	.00	1 FLOW	1.	2.
			TIME	3.50	3.50
HYDROGRAPH AT					
+	DEV6	.00	1 FLOW	0.	1.
			TIME	3.58	3.58
5 COMBINED AT					
+	CP3	.01	1 FLOW	10.	25.
			TIME	3.50	3.50
HYDROGRAPH AT					
+	DEV4	.00	1 FLOW	1.	2.
			TIME	3.50	3.50
HYDROGRAPH AT					
+	ROME	.00	1 FLOW	1.	1.
			TIME	3.50	3.50
2 COMBINED AT					
+	CP2	.00	1 FLOW	1.	3.
			TIME	3.50	3.50

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

Cross Section for Rome HS1 100 year

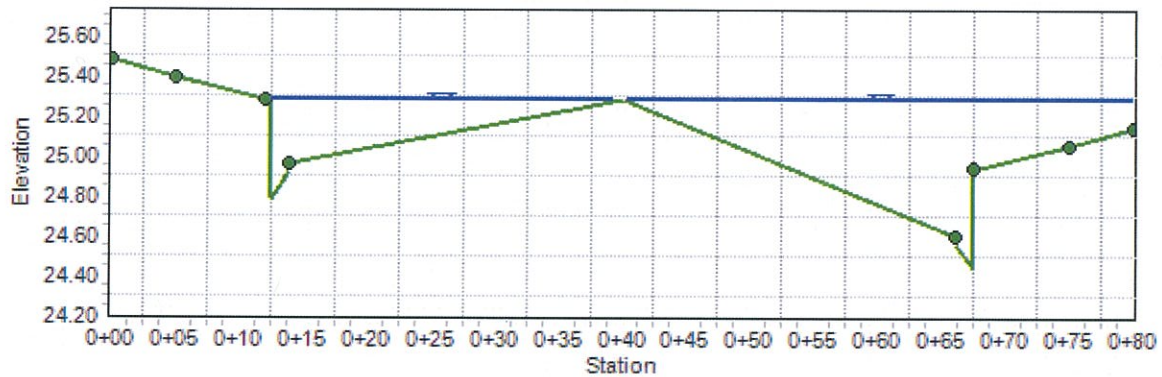
Project Description

Friction Method Manning Formula
Solve For Normal Depth

Input Data

Channel Slope 0.02110 ft/ft
Normal Depth 0.84 ft
Discharge 83.00 ft³/s

Cross Section Image



Project Description

Manning Formula

Normal Depth

Section Definitions

Roughness Segment Definitions

Worksheet for Rome HS1 100 year

Input Data

Start Station	Ending Station	Roughness Coefficient
(0+75, 25.05)	(0+80, 25.15)	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	0.84	ft
Elevation Range	24.44 to 25.49 ft	
Flow Area	17.49	ft²
Wetted Perimeter	67.57	ft
Hydraulic Radius	0.26	ft
Top Width	66.35	ft
Normal Depth	0.84	ft
Critical Depth	0.95	ft
Critical Slope	0.00730	ft/ft
Velocity	4.75	ft/s
Velocity Head	0.35	ft
Specific Energy	1.19	ft
Froude Number	1.63	
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	0.84	ft
Critical Depth	0.95	ft

Worksheet for Rome HS1 100 year

GVF Output Data

Channel Slope	0.02110	ft/ft
Critical Slope	0.00730	ft/ft

Cross Section for Rome HS1 10 year

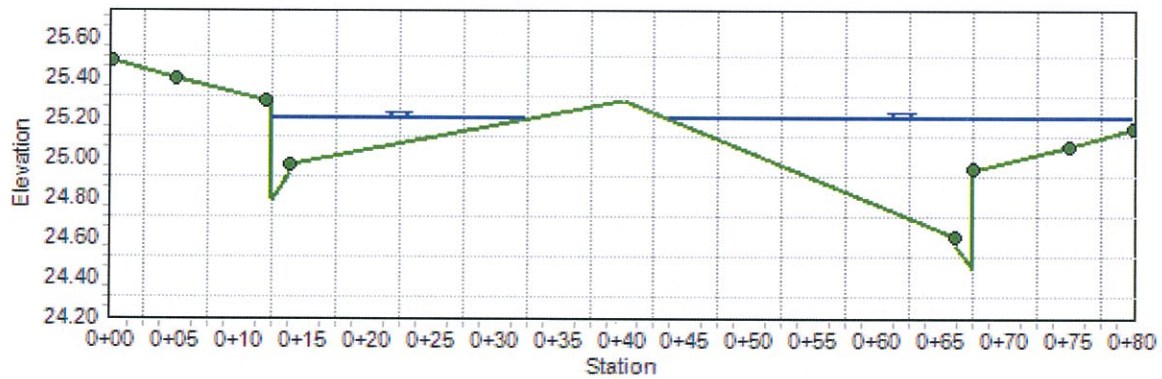
Project Description

Friction Method Manning Formula
Solve For Normal Depth

Input Data

Channel Slope 0.02110 ft/ft
Normal Depth 0.75 ft
Discharge 50.00 ft³/s

Cross Section Image



Project Description

Manning Formula

Normal Depth

Section Definitions

Worksheet for Rome HS1 10 year

Input Data

Start Station	Ending Station	Roughness Coefficient
(0+75, 25.05)	(0+80, 25.15)	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	0.75	ft
Elevation Range	24.44 to 25.49	ft
Flow Area	12.17	ft ²
Wetted Perimeter	57.23	ft
Hydraulic Radius	0.21	ft
Top Width	56.18	ft
Normal Depth	0.75	ft
Critical Depth	0.84	ft
Critical Slope	0.00817	ft/ft
Velocity	4.11	ft/s
Velocity Head	0.26	ft
Specific Energy	1.02	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	0.75	ft
Critical Depth	0.84	ft

Worksheet for Rome HS1 10 year

GVF Output Data

Channel Slope	0.02110	ft/ft
Critical Slope	0.00817	ft/ft

(Interim)

Friction Method	Manning Formula
Solve For	Normal Depth

Channel Slope	0.02000	ft/ft
Normal Depth	0.38	ft
Discharge	5.00	ft ³ /s

Worksheet for Riley HS2 100 year Developed

Project Description

Friction Method Manning Formula
Solve For Normal Depth

Input Data

Channel Slope 0.02000 ft/ft
Discharge 5.00 ft³/s
Section Definitions

Station (ft)	Elevation (ft)
--------------	----------------

0+00	22.69
0+05	22.59
0+06	22.59
0+06	22.09
0+07	22.22
0+07	22.26
0+25	22.62
0+45	23.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 22.69)	(0+07, 22.26)	0.013
(0+07, 22.26)	(0+25, 22.62)	0.017
(0+25, 22.62)	(0+45, 23.00)	0.035

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 0.38 ft
Elevation Range 22.09 to 23.00 ft
Flow Area 1.56 ft²

Worksheet for Riley HS2 100 year Developed

Results

Wetted Perimeter	12.35	ft
Hydraulic Radius	0.13	ft
Top Width	11.92	ft
Normal Depth	0.38	ft
Critical Depth	0.43	ft
Critical Slope	0.00767	ft/ft
Velocity	3.21	ft/s
Velocity Head	0.16	ft
Specific Energy	0.54	ft
Froude Number	1.57	
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	0.38	ft
Critical Depth	0.43	ft
Channel Slope	0.02000	ft/ft
Critical Slope	0.00767	ft/ft

Interim

Cross Section for Riley HS2 10 year Developed

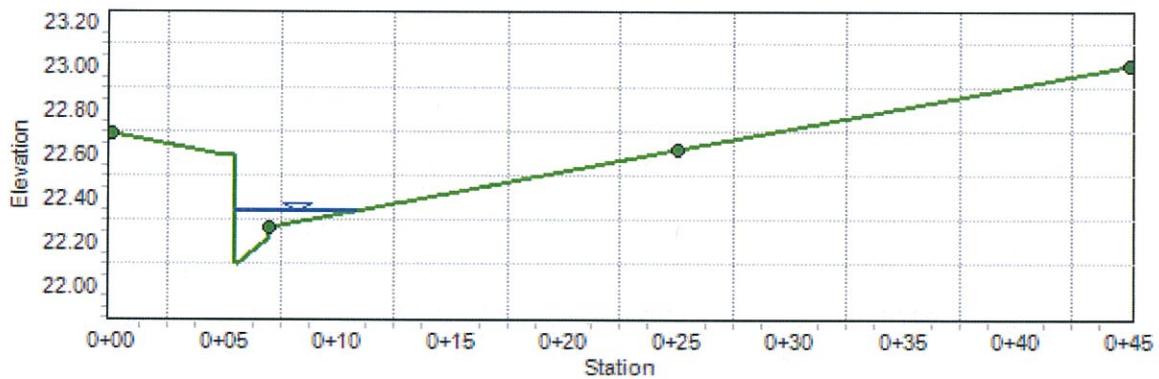
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.02000	ft/ft
Normal Depth	0.25	ft
Discharge	1.00	ft ³ /s

Cross Section Image



Worksheet for Riley HS2 10 year Developed

Project Description

Friction Method Manning Formula
Solve For Normal Depth

Input Data

Channel Slope 0.02000 ft/ft
Discharge 1.00 ft³/s
Section Definitions

Station (ft)	Elevation (ft)
0+00	22.69
0+05	22.59
0+06	22.59
0+06	22.09
0+07	22.22
0+07	22.26
0+25	22.62
0+45	23.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 22.69)	(0+07, 22.26)	0.013
(0+07, 22.26)	(0+25, 22.62)	0.017
(0+25, 22.62)	(0+45, 23.00)	0.035

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 0.25 ft
Elevation Range 22.09 to 23.00 ft
Flow Area 0.42 ft²

Worksheet for Riley HS2 10 year Developed

Results

Wetted Perimeter	5.67	ft
Hydraulic Radius	0.07	ft
Top Width	5.38	ft
Normal Depth	0.25	ft
Critical Depth	0.28	ft
Critical Slope	0.00876	ft/ft
Velocity	2.36	ft/s
Velocity Head	0.09	ft
Specific Energy	0.33	ft
Froude Number	1.48	
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	0.25	ft
Critical Depth	0.28	ft
Channel Slope	0.02000	ft/ft
Critical Slope	0.00876	ft/ft

Future

Cross Section for Riley HS2 100 year

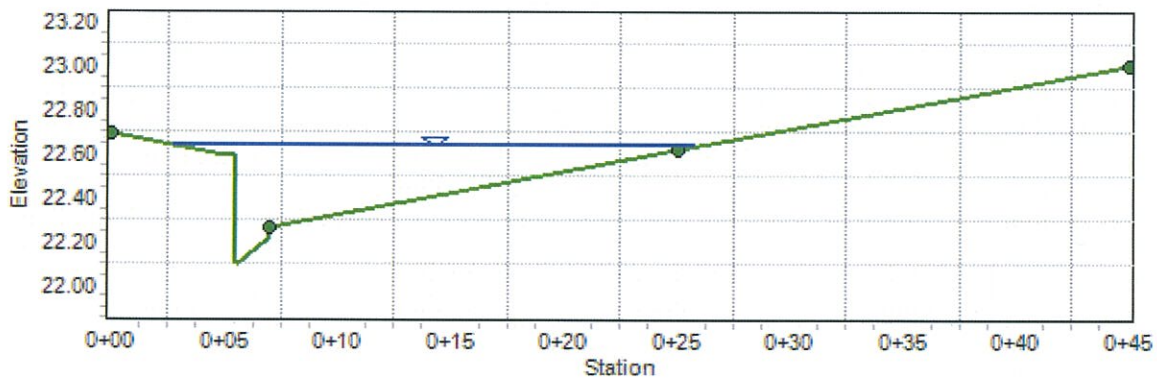
Project Description

Friction Method Manning Formula
Solve For Normal Depth

Input Data

Channel Slope 0.02000 ft/ft
Normal Depth 0.55 ft
Discharge 17.00 ft³/s

Cross Section Image



Future

Worksheet for Riley HS2 100 year

Project Description

Friction Method Manning Formula
Solve For Normal Depth

Input Data

Channel Slope 0.02000 ft/ft
Discharge 17.00 ft³/s
Section Definitions

Station (ft)	Elevation (ft)
0+00	22.69
0+05	22.59
0+06	22.59
0+06	22.09
0+07	22.22
0+07	22.26
0+25	22.62
0+45	23.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 22.69)	(0+07, 22.26)	0.013
(0+07, 22.26)	(0+25, 22.62)	0.017
(0+25, 22.62)	(0+45, 23.00)	0.035

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 0.55 ft
Elevation Range 22.09 to 23.00 ft
Flow Area 4.34 ft²

Future

Worksheet for Riley HS2 100 year

Results

Wetted Perimeter	23.71	ft
Hydraulic Radius	0.18	ft
Top Width	23.16	ft
Normal Depth	0.55	ft
Critical Depth	0.62	ft
Critical Slope	0.00743	ft/ft
Velocity	3.92	ft/s
Velocity Head	0.24	ft
Specific Energy	0.79	ft
Froude Number	1.60	
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	0.55	ft
Critical Depth	0.62	ft
Channel Slope	0.02000	ft/ft
Critical Slope	0.00743	ft/ft

Future

Cross Section for Riley HS2 10 year

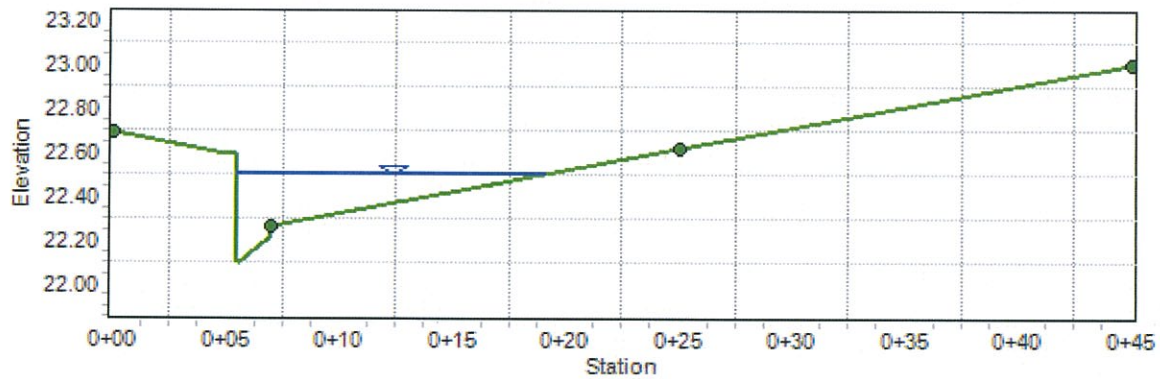
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.02000	ft/ft
Normal Depth	0.41	ft
Discharge	7.00	ft ³ /s

Cross Section Image



Future

Worksheet for Riley HS2 10 year

Project Description

Friction Method Manning Formula
Solve For Normal Depth

Input Data

Channel Slope 0.02000 ft/ft
Discharge 7.00 ft³/s
Section Definitions

Station (ft)	Elevation (ft)
0+00	22.69
0+05	22.59
0+06	22.59
0+06	22.09
0+07	22.22
0+07	22.26
0+25	22.62
0+45	23.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 22.69)	(0+07, 22.26)	0.013
(0+07, 22.26)	(0+25, 22.62)	0.017
(0+25, 22.62)	(0+45, 23.00)	0.035

Options

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

Results

Normal Depth 0.41 ft
Elevation Range 22.09 to 23.00 ft
Flow Area 2.02 ft²

Future

Worksheet for Riley HS2 10 year

Results

Wetted Perimeter	14.18	ft
Hydraulic Radius	0.14	ft
Top Width	13.72	ft
Normal Depth	0.41	ft
Critical Depth	0.48	ft
Critical Slope	0.00738	ft/ft
Velocity	3.47	ft/s
Velocity Head	0.19	ft
Specific Energy	0.60	ft
Froude Number	1.60	
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	0.41	ft
Critical Depth	0.48	ft
Channel Slope	0.02000	ft/ft
Critical Slope	0.00738	ft/ft

Project Description

Manning Formula

Normal Depth

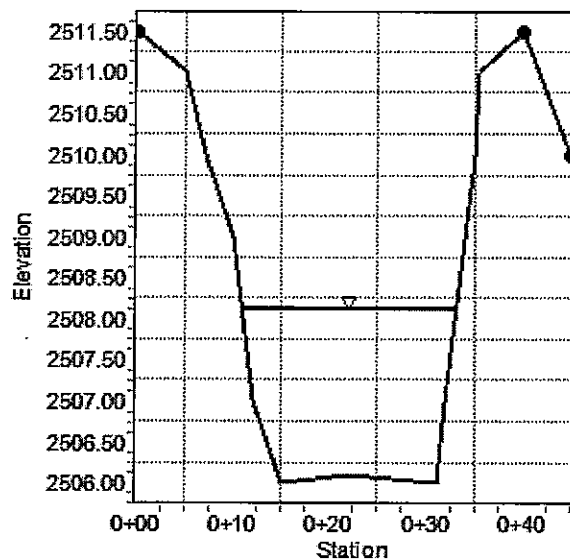
Input Data

0.02200 ft/ft

2.11 ft

428.00 ft³/s

Cross Section Image



Worksheet for HS3 CHANNEL 100 year

Project Description

Friction Method Manning Formula
Solve For Normal Depth

Input Data

Channel Slope 0.02200 ft/ft
Discharge 428.00 ft³/s
Section Definitions

Station (ft)	Elevation (ft)
--------------	----------------

0+00	2511.50
0+05	2511.00
0+07	2510.00
0+10	2509.00
0+12	2507.00
0+15	2506.00
0+22	2506.10
0+31	2506.00
0+32	2507.00
0+33	2508.00
0+34	2509.00
0+35	2510.00
0+36	2511.00
0+40	2511.50
0+45	2510.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 2511.50)	(0+40, 2511.50)	0.030
(0+40, 2511.50)	(0+45, 2510.00)	0.030

Options

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

Worksheet for HS3 CHANNEL 100 year

Options

Closed Channel Weighting Method Pavlovskii's Method

Results

Normal Depth	2.11	ft
Elevation Range	2506.00 to 2511.50	ft
Flow Area	40.67	ft ²
Wetted Perimeter	23.72	ft
Hydraulic Radius	1.71	ft
Top Width	22.22	ft
Normal Depth	2.11	ft
Critical Depth	2.56	ft
Critical Slope	0.01119	ft/ft
Velocity	10.52	ft/s
Velocity Head	1.72	ft
Specific Energy	3.83	ft
Froude Number	1.37	
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	2.11	ft
Critical Depth	2.56	ft
Channel Slope	0.02200	ft/ft
Critical Slope	0.01119	ft/ft

Cross Section for Future RCHB-0130

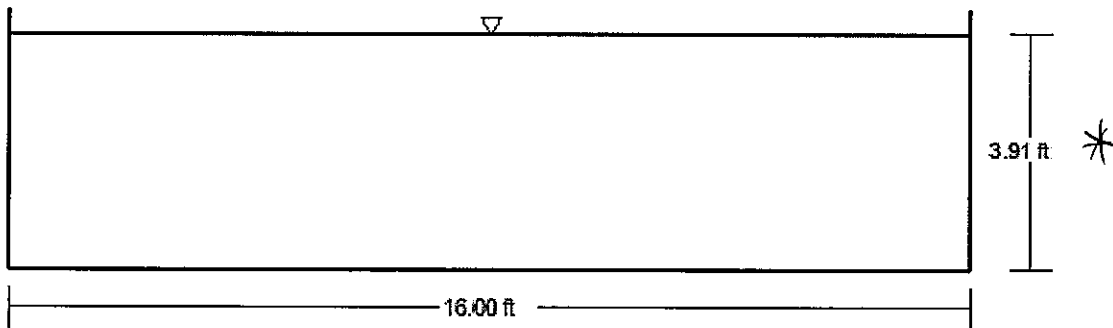
Project Description

Friction Method Manning Formula
Solve For Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.02670	ft/ft
Normal Depth	3.91	ft
Bottom Width	16.00	ft
Discharge	2226.00	ft ³ /s

Cross Section Image



* proposed channel walls will be 6' high. $V:1 \triangle H:1$

Worksheet for Future RCHB-0130

Project Description

Friction Method Manning Formula
Solve For Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.02670	ft/ft
Bottom Width	16.00	ft
Discharge	2226.00	ft ³ /s

Results

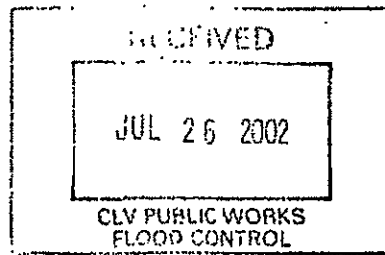
Normal Depth	3.91	ft
Flow Area	62.60	ft ²
Wetted Perimeter	23.82	ft
Hydraulic Radius	2.63	ft
Top Width	16.00	ft
Critical Depth	8.44	ft
Critical Slope	0.00316	ft/ft
Velocity	35.56	ft/s
Velocity Head	19.65	ft
Specific Energy	23.56	ft
Froude Number	3.17	
Flow Type	Supercritical	

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	3.91	ft
Critical Depth	8.44	ft
Channel Slope	0.02670	ft/ft
Critical Slope	0.00316	ft/ft



Technical Drainage Study
for

Montecito Lifestyle Center

DS 3186

G20.
7/26/2002
\$ 250.00

Prepared for:

Montecito Town Center, LLC
6600 W. Charleston Blvd.
Suite 124
Las Vegas, NV 89146

Kohl's
N56 W. 17000 Ridgewood Drive
Menomonee Falls, Wisconsin 53051

July 25, 2002



**PRIMAS AND
ASSOCIATES**
CONSULTING
ENGINEERS

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

DRAINAGE STUDY INFORMATION FORM

Name of Development: Montecito Lifestyle Center Date: 37462

Location of Development: a) Descriptive: Rome and El Capitan to Elkhorn and Durang
b) Sect. 20 Twn. 19S Rng. 60E

Name of Owner: Montecito Town Center, LLC Assessors Parcel No: 125-20-701-001

Contact Person Name: James Kelley Telephone No: (702) 228-8183

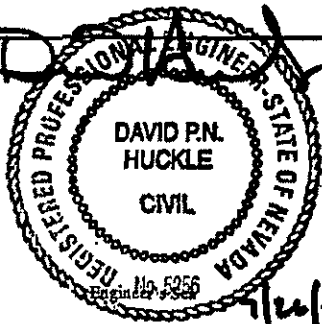
Firm: Primas and Associates Consulting Engineer

Address: 1091 S. Churron Rd., Ste. A-4 Las Vegas, Nevada 89145

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: 39 +/- Being Developed/Disturbed 39 +/-
- 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 subdivision
- Approximate upstream land area which drains to the subject site 86 +/-
- Has the site drainage been evaluated in the past
If yes, please identify documentation YES ☐ NO ☒
- If known, please briefly identify the proposed discharge point(s) of runoff from the site
Rome Blvd. and Riley Street
- Briefly describe your proposed schedule for the subject project
Begin grading November 2001



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

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

Local Entity File No _____

Revision	Date

PACE Job Number:

079.01001

STANDARD FORM 1



DS #

3186

DS INDEX:

APN:

125-20-701-001

PROJECT: MONTECITO LIFESTYLE CENTER

SUBMITTAL

1st submittal



CITY OF LAS VEGAS		DATE:
INTER-OFFICE MEMORANDUM		August 8, 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: Montecito Lifestyle Center		COPIES TO: Montecito Town Center, LLC
Cross Streets:	NEC Centennial & El Capitan	Primas and Associates
FILE NO.:	F:\Depot\DSMEMOS\DS3186A.DOC	Cheri Edelman, P.E., DEVCO
Parcel Number:	125-20-701-001	CCRFGD
Zoning Action:		CCPW
FEMA Flood Zone:	YES	No X
Proposed Storm Drain:	YES	No X

HISTORY	DATE RECEIVED	DATE REVIEWED	COMMENTS	REVIEW FEES
1 st Submittal	07/26/2002	08/08/2002	Not Accepted	\$250.00
TOTAL FEES (LDDRS):				\$250.00

REMARKS:

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

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

- The Montecito Town Center Master Drainage study must be approved before this study.
- A meeting with flood control staff was held on 8/07/02 to discuss the Montecito Town Center Master Drainage study. During that meeting the engineer agreed to provide additional information in the study. The additional information for Montecito Town Center must be incorporated into this study. Additional comments to this study may be added based on the revised Master Drainage study.
- The following comments pertain to the grading plans:
 - Provide building numbers for all proposed buildings. (on sheet 4)
 - Label the proposed and future top (on opposite side of the street) of curb grades on all perimeter streets.
- Several points in the grading plan appear to pond. There seems to be a low point in the curb northeast of building Retail #1 with a curb elevation of 59.51. Another low point is in the valley gutter on the south side of Retail #1 with a 55.69 finish grade elevation. West of Retail #7 two elevations are labeled 41.35 and 41.15 creating flat valley gutters. Review and revise the grading plan to remove all low points that would trap storm and nuisance water. Provide sufficient detail to verify positive drainage.
- The interim flow for many of the perimeter streets is above the back of sidewalk and erosive (or will be with the revised street flows.) Provide erosion protection for the landscape area in the form of a stem wall, riprap, or approved alternate as required in the Regional Flood Control District Manual in section 904.3. Revise the grading plan and sections accordingly.

CITY OF LAS VEGAS		DATE:
INTER-OFFICE MEMORANDUM		March 20, 2003
TO: Land Development Services Department of Public Works		FROM: Albert Sung, P.E. <i>[Signature]</i> Flood Control Project Engineer Department of Public Works
SUBJECT:	Drainage Study for: Montecito Lifestyle Center	
Cross Streets:	NEC Centennial & El Capitan	
FILE NO.:	DS3186C	
Parcel Number:	125-20-701-001	
Zoning Action:	CCPWF	
FEMA Flood Zone	YES	No X
Proposed Storm Drain	YES X	No

HISTORY	DATE RECEIVED	DATE REVIEWED	COMMENTS	REVIEW FEES	Fees Paid GR #
1 st Submittal	07/26/2002	08/08/2002	Not Accepted	\$250.00	
2 nd Submittal & Supplement	08/20/2002	08/27/2002 09/04/02	Acceptable in Concept	\$250.00	\$500.00:90350
3 rd Submittal & Supplement	03/13/2003 03/20/2003	03/20/2003	See Comments Below	\$250.00	\$250.00:100728
			TOTAL FEES (LDDRS):	\$750.00	\$750.00

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:
	must have Clark County Regional Flood Control District concurrence
	must have Clark County Public Works concurrence

1. The engineer must provide cross sections and details of the proposed retaining/floodwall at the southwest corner of the site as shown on Sheet G4. A cross section was provided along El Capitan Way. Additional cross sections are needed at the Beltway and the site access drive. The floodwall must be a minimum of 8-inch CMU, solid grouted to a minimum elevation of 1.74-feet above the top of curb elevations along El Capitan. Current Planning must review the wall location at the back of the sidewalk.
2. The retaining/floodwall is shown as designed by others. The wall design must include the stormwater flow at the top of the retaining wall and must be approved by the Building Department prior to permit.
3. The Montecito Town Center Master drainage study requires high points in El Capitan south of Elkhorn and Dorrell, in Frontage south of the Dorrell alignment, and in Deer Springs east of the Frontage Road. These high points are required to maintain the flow routing assumptions presented in this study. If improvement plans are submitted without these features then the Montecito Town Center Master drainage study must be updated.

CITY OF LAS VEGAS		DATE:
INTER-OFFICE MEMORANDUM		August 18, 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: Montecito Lifestyle Center		COPIES TO: Montecito Town Center, LLC
Cross Streets:	NEC Centennial & El Capitan	Primas and Associates
FILE NO.:	DS3186D	Bart Anderson, P.E., DEVCO
Parcel Number:	125-20-701-001	
Zoning Action:		
FEMA Flood Zone	YES No X	
Proposed Storm Drain	YES X No	

HISTORY	DATE RECEIVED	DATE REVIEWED	COMMENTS	REVIEW FEES	Fees Paid GR #
1 st Submittal	07/26/2002	08/08/2002	Not Accepted	\$250.00	
2 nd Submittal & Supplement	08/20/2002	08/27/2002 09/04/02	Acceptable in Concept	\$250.00	\$500.00:90350
3 rd Submittal & Supplement	03/13/2003 03/20/2003	03/20/2003	See Comments Below	\$250.00	\$250.00:100728
4 th Submittal	08/12/2003	08/18/2003	See Comments Below		
			TOTAL FEES (LDDRS):	\$750.00	\$750.00

SUPPLEMENTAL INFORMATION TO REMOVE FLOOD BERMS ALONG RILEY & ROME

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:
	must have Clark County Regional Flood Control District concurrence
	must have Clark County Public Works concurrence

The supplement to remove the berms along Riley Street and Rome Boulevard is accepted without conditions; however, the following conditions from March 20, 2003 memorandum will remain until satisfied.

1. The engineer must provide cross sections and details of the proposed retaining/floodwall at the southwest corner of the site as shown on Sheet G4. A cross section was provided along El Capitan Way. Additional cross sections are needed at the Beltway and the site access drive. The floodwall must be a minimum of 8-inch CMU, solid grouted to a minimum elevation of 1.74-feet above the top of curb elevations along El Capitan. Current Planning must review the wall location at the back of the sidewalk.
2. The retaining/floodwall is shown as designed by others. The wall design must include the stormwater flow at the top of the retaining wall and must be approved by the Building Department prior to permit.

CITY OF LAS VEGAS INTER-OFFICE MEMORANDUM

DATE:

September 20, 2004

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:
Montecito Lifestyle Center – Update for Pad 9

COPIES TO:
Primas and Associates

Cross Streets: NEC Centennial Blvd. & El Capitan Way

Montecito Town Center, LLC

FILE NO.: F:\Depot\DSMEMOS\DS3186E.doc

Bart Anderson, P.E., DEVCO

Parcel Number: 125-20-701-001

Zoning Action:

FEMA Flood Zone YES No X

Proposed Storm Drain YES X No

HISTORY	DATE RECEIVED	DATE REVIEWED	COMMENTS	REVIEW FEES	Fees Paid Tm. #
1 st Submittal	7/26/2002	8/8/2002	Not Accepted	\$250.00	---
2 nd Submittal & Supplement	8/20/2002	8/27/2002 9/4/2002	Acceptable in Concept	\$250.00	90350: \$250
3 rd Submittal & Supplement	3/13/2003 3/20/2003	3/20/2003	See Comments Below	\$250.00	100728: \$250
4 th Submittal	8/12/2003	8/18/2003	Accepted	N/C	N/C
5 th Submittal	8/24/2004 9/17/2004	9/20/2004	See Comments Below	\$100.00	8526: \$100
TOTAL FEES (LDDRS):				\$850.00	Balance: \$250

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:
	must have Clark County Regional Flood Control District concurrence

1. Provide waterproofing membrane at the west building wall of Pad 9. Provide a section across the west wall to show as such 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 of a project.

END OF REMARKS
JWB/PBJ/ays

T/R/S: T19S/R60E/20
AREA G20

6. 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.
7. Review the driveway hump elevations. If the intent is to keep offsite storm water from entering the site, then the driveways must be elevated at the flow line to six inches above the street water surface elevation. If the intent is to pass offsite water through the site then provide calculations to quantify the amount of storm water to be passed through the site and provide drainage easements through the site along the flow path. Label all such drainage easements as "Public drainage easement to be privately maintained" on the grading plan.
8. Revise the street sections provided to show existing grade and proposed improvements. The sections as presented do not represent what condition will exist in the areas labeled "future."
9. This drainage study assumes that the project will be constructed in one phase. If improvement plans are submitted to break the project into separate phases, a drainage study update will be required for each phase addressing the interim condition.
10. Sites with a grade difference of 2 feet above or below existing are required to have approval from the City Planning and Development Department. The engineer must submit copies of the Grading plans and Detail sheet with a letter justifying the grade difference to Matt Pinjuv [Tel: (702) 229-6793] at the CLV Current Planning Division. A representative from this division will promptly reply with the Current Planning approval or comment. Please provide a Current Planning approval with the next submittal.
11. The site is adjacent to or crosses an existing or proposed Clark County Regional Flood Control District (CCRFCD) master planned facility. Therefore, CCRFCD concurrence is required prior to final acceptance of the drainage study.
12. This site is adjacent to the ongoing Clark County Western Beltway Project. The engineer must coordinate with Clark County Public Works Department and incorporate any concerns for boundary conditions along the Northern Beltway. CCPW concurrence is required prior to final acceptance of the study.

END OF REMARKS
JWB

T/R/S: 19S/60E/20
AREA G20

SECTION 1.0 - INTRODUCTION

1.1 Location and Description

Montecito Lifestyle Center is situated in the northwest portion of the Las Vegas Valley; the proposed Montecito Lifestyle Center is located at the southeast corner of Deer Springs Way and El Capitan Way (see **Figure 1-1, Vicinity Map**). The property's assessor's parcel number is 125-20-701-001 and is located in Section 20, Township 19 South, Range 60 East M.D.M., and City of Las Vegas, Clark County, Nevada. Deer Springs Way, Rome Boulevard, Riley Street and El Capitan Way bound it on the north, south, east and west, respectively. It consists of approximately 39± acres of vacant land, which is intended for commercial and residential use.

1.2 Objective

The intent of this study is to address existing and proposed drainage conditions that may have significant impact to the proposed Montecito Lifestyle Center for the 100-year and 10-year storm event. It will identify any drainage issues that may pose a problem to the site and will address mitigation measures to perpetuate flows through or around the site. This report will also address regional and local storm drain systems that are proposed adjacent to or within the site.

1.3 Existing Site Conditions

Currently contributing watersheds surrounding the project are rural in nature with the exception of the Spinnaker at Town Center, currently under construction, located northwest of the subject site. The natural terrain through the site is generally uniform with a slope between 2% and 3 %. The surface runoff generally flows from northwest to southeast. These runoffs are currently being conveyed by existing washes that are flowing across the site, which ultimately discharge to Durango Road and RHB 0066.

1.4 CCRFCD Criteria Master Plan Information

Figure 1-2, CCRFCD Master Plan Update depicts the location of the site with respect to the Clark County Regional Flood Control District (CCRFCD) Master Plan Facilities taken from the "*1996 Flood Control Master Plan Update Las Vegas Valley*". Currently the master planned regional channel located to the south of the site is partially improved, meaning that the channel has been graded and culverts are in place underneath El Capitan Way just north of the I-215 Beltway. This channel is labeled only as a secondary facility.

1.5 Northwest Neighborhood Master Plan Information

There are two proposed local pipeline facilities adjacent to the site. The first is along the El Capitan Way alignment and is described as being a 36" pipe having 1% slope, while the other is along the Deer Springs Way alignment and is described as a 24" pipe having 2.5% slope.

In addition, Figure 2-3, Northwest Neighborhood Master Plan shows a regional facility labeled "RCHB 0066". Based on the construction plan for the "WB/NB Segment Las Vegas Beltway – El Capitan to Jones" prepared by VTN, the channel west of El Capitan is described as earthen channel 4-ft deep, 5-ft wide bottom width and having 2:1 side slope. It then transitions into a 6'x16' box culvert under El Capitan and finally transitioning again to an earthen channel 5-ft deep, 10-ft wide bottom width and having 2:1 side slope east of El Capitan.

1.6 FEMA Floodplain Information

The floodplain information for Montecito Lifestyle Center can be found on the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map for Clark County, Nevada, Community-Panel Numbers 32003C1745 D. The published date of the Flood Insurance Rate Map is August 16, 1995. Refer to Figure 1-3, FEMA Map for the FEMA Flood Zones in the vicinity of the project site. The site is located in Zone X. Zone X is defined by FEMA as: "Areas determined to be outside of the 500-year floodplain." Due to classification of this proposed site, no submittal to FEMA will be necessary.

SECTION 2.0 – HYDROLOGIC ANALYSIS

The hydrologic methodology used to compute storm water runoff for Montecito Lifestyle Center is the Modified Rational Formula. This method of analysis is in conformance with the CCRFCD Drainage Design Manual Section 304.3. The Spinnaker at Town Center interim condition HEC-1 (SCS Unit or Kinematic Wave) results are algebraically added to the results obtained from the Rational Method and used as offsite flows. Supporting documentation for the Rational Method Formula is included in Appendix A.

2.1 Referenced Studies

The "City of Las Vegas Northwest Neighborhood Study, Revised September 1999" and the "Clark County Regional Flood Control District Master Plan Update, 1996" are used and referenced in this report.

In addition, the previously approved "Technical Hydrology Study for Spinnaker at Town Center" by Tetra Tech is referenced as well. In general, this study accepts the findings concluded in the reports mentioned above. Any deviations

mentioned in this report from the listed report above, will be addressed and supported.

2.2 Existing Drainage Conditions

OFFSITE:

For the existing drainage conditions, the approved drainage study for Spinnaker at Town Center was utilized. Spinnaker's interim flows were used as a portion of offsite flows impacting the site's western and northern boundaries. **Figure 2-1, Existing Drainage Condition Map**, illustrates offsite runoff impacting the subject site. At concentration point CP1, the flow impacting the site is Q_{10}/Q_{100} of 9/50 cfs, CP2 Q_{10}/Q_{100} of 15/48 cfs, CP3 Q_{10}/Q_{100} is 11/35 cfs, and CP4 of Q_{10}/Q_{100} is 13/63 cfs respectively.

Existing Drainage Condition Offsite and Total Flow at West Edge of Site.

Basin/Combination Point Label	Area (acres)	Q_{10} (cfs)	Q_{100} (cfs)
OF1	19.5	5	20
OF2	17	5	17
OF3	15	4	15
OF4	13.6	4	14
CP1 (Sum of OF1 & EXOF3B)	N/A	9	50
CP2 (Sum of OF2 & PT5)	N/A	15	48
CP3 (Sum of OF3 & PT6)	N/A	11	35
CP4 (Sum of CP1 & OF4)	N/A	13	63

ONSITE:

Existing runoff generated by the site is currently being conveyed across the site in an east/southeast direction by existing natural washes, which ultimately discharge to Durango Road, east of the site. Flow is then conveyed south to RCHB 0066. The table below shows the runoff produced by the onsite basins and the total flow at the edge of the site.

Existing Drainage Condition Onsite and Total Flow at East Edge of Site.

Basin/Combination Point Label	Area (acres)	Q_{10} (cfs)	Q_{100} (cfs)
ON1	16.32	4	16
ON2	9.96	3	10
ON3	0.67	0	1
ON4	13.14	4	13
CP5 (Sum of CP3 & ON3)	N/A	11	36
CP6 (Sum of CP2 & ON2)	N/A	17	58
CP7 (Sum of CP1 & ON1)	N/A	14	66
CP8 (Sum of CP4 & ON4)	N/A	17	76

2.3 Interim Drainage Conditions

OFFSITE:

In the interim drainage condition, Spinnaker's interim runoff is used. From Spinnaker, the interim condition discharge locations designated as (PT5, PT6 and EXOF3B), illustrated on Figure 2-1 and produced the following results:

Interim Offsite Flows from Spinnaker

Basin	Q_{10} (cfs)	Q_{100} (cfs)
PT5*	10	31
PT6*	7	20
EXOF3B*	4	30

* Gathered from the Spinnaker Development (Excerpts included in Appendix D)

The interim flows from Spinnaker were then algebraically added to the Rational Method Formula. Results determined from the offsite basins for Montecito Lifestyle Center are listed below:

Modified Rational Method: $Q = kCIA$

$k =$	0.5	Local factor
$i_{10} =$	2.2 in/hr	
$i_{100} =$	4.0 in/hr	

Basin	Area (ac)	C10	C100	Q_{10} (cfs)	Q_{100} (cfs)
OF1	19.5	0.25	0.50	5	20
OF2	17	0.25	0.50	5	17
OF3	15	0.25	0.50	4	15
OF4	13.6	0.25	0.50	4	14

As a result, the total offsite flows impacting the proposed Montecito Lifestyle Center are:

Concentration		
Point	Q_{10} (cfs)	Q_{100} (cfs)
CP1	9	50
CP2	15	48
CP3	11	35
CP4	13	63

Offsite runoff from basins OF1 and EXOF3B are combined at CP1 generating $Q_{100}=50$ cfs and $Q_{10}=9$ cfs that impacts El Capitan Way, which is then combined with runoff from OF4 at CP4 resulting in $Q_{100}=63$ cfs and $Q_{10}=13$ cfs. Concentration points CP2 and CP3 both impact the Deer Springs Way roadway alignment. CP2 and CP3 generated $Q_{100}=48$ cfs/ $Q_{10}=15$ cfs and $Q_{100}=35$ cfs/ $Q_{10}=11$ cfs, respectively.

To convey the runoff at concentration CP1 and CP4, a temporary swale will need to be installed on the west half street of El Capitan Way from existing wash, at CP1, to the discharge location at the regional facility. Runoff from CP2 and CP3 can be conveyed along the north half street of Deer Springs Way where a temporary swale will also be installed discharging east of the site at OUT1, into an existing wash placing it back to its historic flow path.

ONSITE:

Figure 2-2, Interim Drainage Condition Map, illustrates onsite drainage basin breakdown and the table below summarizes the flow generated by each basin:

	Area (ac)	C ₁₀	C ₁₀₀	Q ₁₀ (cfs)	Q ₁₀₀ (cfs)
ON1	6.71	0.75	0.83	5	11
ON2	0.63	0.90	0.93	1	1
ON3	6.16	0.75	0.83	5	10
ON4	8.15	0.75	0.83	7	14
ON5	7.06	0.75	0.83	6	12
ON6	6.99	0.75	0.83	5	11
ON7	0.40	0.90	0.93	0.5	1
ON8	0.60	0.90	0.93	1	1
ON9	1.56	0.90	0.93	2	4
ON10	2.00	0.90	0.93	3	4

ONSITE BASIN ROUTING:

Runoff from ON1 and ON2 are combined in Riley Street at OUT2 and flow south on Riley to OUT3. Flow from ON3 and ON8 discharges onto Riley Street and combines with OUT2 at OUT3. Runoff from ON5 and ON6 are conveyed to Rome Boulevard and combined at OUT5. Runoff from ON4 and ON7 is combined at the corner of Riley and Rome where it combines with the other discharge points at OUT4; these flows are then discharged into an existing natural channel adjacent to the intersection of Rome and Riley. All onsite-generated runoff will outfall into existing washes where it will discharge into RCHB 0066. The table below shows all combined flows. Discharge point OUT4, for Interim Drainage Conditions, is the same as CP8 for Existing Drainage Conditions; the flow at this point in existing conditions is greater than the flow in interim therefore there is no increase in flow at this point to down stream property.

Concentration Point	Combined Basins	Q ₁₀ (cfs)	Q ₁₀₀ (cfs)
OUT1	CP2 & CP3 & ON9	28	86
OUT2	ON1 & ON2	6	12
OUT3	ON3, 8, OUT2	12	24
OUT5	ON5 & ON6	11	23
OUT4	OUT3, 5, ON4, 7	30	60

Interim Drainage Facilities

Two temporary diversion channels are proposed with this development. A diversion channel will be installed within El Capitan right-of-way, and the other will be installed within Deer Springs Way right-of-way.

The El Capitan channel will convey a flow of 63 cfs in the Interim Drainage Condition. As future development occurs to the west of the site within Montecito Town Center, the El Capitan diversion channel will convey more offsite flow. The channel has been designed with 2.5 ft of freeboard to allow more flow to enter the channel, as it will be extended to the north to protect future developments within Montecito Town Center. This diversion channel will discharge into RCHB 0066 at its intersection with El Capitan. Currently a box culvert with a concrete trapezoid to rectangular transition structure exists at the intersection of El Capitan and RCHB 0066. We are proposing to discharge the diversion channel into the transition structure. Erosion protection will be provided at the outlet of the diversion channel. Flowmaster output shows that the velocity at normal depth is only 4.46 fps; this will require no lining for the majority of the channel. As the channel outfalls into RCHB 0066 the velocity will increase and riprap will be required to mitigate erosion at the edge of RCHB 0066. Grouted riprap will be provided for the last fifteen feet of channel as it outfalls into the transition structure.

The Deer Springs Diversion channel will be designed to handle 83 cfs for the interim Condition. This channel will not be needed once development north of Montecito Lifestyle Center occurs. This channel will discharge into natural channels at the east end of the site. From there flows will head east onto Durango, where they will be collected and discharged into RCHB 0066.

2.4 Ultimate Drainage Condition

OFFSITE:

For the Ultimate Drainage Condition, the CLV-NNS was utilized in determining offsite flows that will impact the site. The CLV-NNS shows that there is one location where flows will impact the subject site. A flow split occurs at the intersection of El Capitan and Deer Springs Way. In the 100-year storm event 62 cfs are proposed to cross El Capitan and flow down Deer Springs Way; 39 cfs are proposed as surface flow in El Capitan at this point with 32 cfs flowing in proposed storm drain system. Further down El Capitan a 100-year surface flow of 128 cfs and a storm drain flow of 66 cfs are proposed at the intersection of El Capitan and Clark County 215 where the system will discharge into RCHB 0066.

Ultimate Offsite Flows

Location	Q ₁₀ (cfs) Surface	Q ₁₀₀ (cfs) Surface	Q ₁₀ (cfs) System	Q ₁₀₀ (cfs) System
El Capitan & Deer Springs	0-El Capitan 0-Deer Springs	39-El Capitan 62-Deer Springs	32-El Capitan 0-Deer Springs	32-El Capitan 0-Deer Springs
El Capitan.	0	128	66	66

These flows are adequately handled in the rights-of-way of the streets with a portion of the flow intercepted by the storm system.

ONSITE:

The Ultimate Onsite Drainage Condition produces the same amount of runoff as the Interim Drainage Condition. These flows will be handled in the same manner as interim flows. All flows produced by the site are discharged to Riley Street and Rome Boulevard. Both Riley Street and Rome Boulevard will have full street improvements in the Ultimate Drainage Condition. Flow on Riley Street will flow south to Rome Boulevard. These flows will continue east in Rome Boulevard where a portion of the flow will be picked up by a future storm drain. Their ultimate destination remains RCHB 0066 where storm drains and surface flow will discharge.

2.5 Street Flow Calculations

Street flow calculations we performed using Flowmaster Software. Two conditions were analyzed. In Interim Drainage Conditions roadside swales will divert all flows away from El Capitan Way and Deer Springs Way; the only flow that will impact these streets will be the rain that falls directly on them. Sub-basins were delineated and flows were calculated for El Capitan and Deer Springs.

In Ultimate Drainage Conditions the CLV-NNS was used to determine the flows in both El Capitan Way and Deer Springs Way.

Flowmaster software was used to perform normal depth calculations based on Manning's equation. Flowmaster results are included in **Appendix B**. The tables below summarize the street flow for the 100-year and 10-year water depth, velocity, and depth times velocity (DxV) results for interim and ultimate drainage conditions. Per the CCRFCD manual, the maximum allowed DxV for the 100-year storm event is eight and the maximum DxV for the 10-year storm event is six; other criteria for maximum depth and dry lane criteria are also considered. As shown in the tables below, all the DxV values are well below the maximum values for both the 100-year and 10-year storm events. Flow spread in the 10-year storm event for El Capitan Way and Deer Springs Way does not inundate interior lanes; the ten year dry lane criteria is met and the depth of flow is less than 1-ft for both major streets. El Capitan Way cross-sections are G and H. Deer Springs Way cross-sections are E and F. The cross section locations and identifications can be found on **Figure 2-2**.

Street Flow Summary Interim Conditions

Cross Section Identification	Q ₁₀₀ , cfs	Q ₁₀ , cfs	V ₁₀₀ , fps	V ₁₀ , fps	D ₁₀₀ , ft	D ₁₀ , ft	DxV (100-yr)	DxV (10-yr)
Section A	11	6	3.85	3.31	0.24	0.19	0.924	0.63
Section B	12	6	2.12	1.69	0.34	0.27	0.72	0.46
Section C	14	7	5.73	4.82	0.32	0.24	1.83	1.16
Section D	11	5	2.55	2.09	0.29	0.22	0.74	0.46
Section E [†]	3	2	3.09	2.79	0.20	0.17	0.62	0.47
Section F [†]	3	2	3.09	2.79	0.20	0.17	0.62	0.47
Section G [†]	4	2	3.05	2.57	0.23	0.18	0.70	0.46
Section H [†]	4	2	3.05	2.57	0.23	0.18	0.70	0.46
Section I	60	30	6.08	4.83	0.67	0.54	4.07	2.61
Section J	60	30	4.59	3.76	0.74	0.60	3.40	2.26

[†] Offsite runoff is contained within the temporary swales.

Street Flow Summary Ultimate Conditions

Cross Section Identification	Q ₁₀₀ , cfs	Q ₁₀ , Cfs	V ₁₀₀ , fps	V ₁₀ , fps	D ₁₀₀ , ft	D ₁₀ , ft	DxV (100-yr)	DxV (10-yr)
Section A	11	6	3.85	3.31	0.24	0.19	0.92	0.63
Section B	12	6	2.12	1.69	0.34	0.27	0.72	0.46
Section C	14	7	5.73	4.82	0.32	0.24	1.83	1.16
Section D	11	5	2.55	2.09	0.29	0.22	0.74	0.46
Section E	62	4	5.08	2.82	0.53	0.21	2.69	0.59
Section F	24	4	5.08	2.82	0.53	0.21	2.69	0.59
Section G	128	4	5.56	2.57	0.66	0.18	3.67	0.46
Section H	128	4	5.56	2.57	0.66	0.18	3.67	0.46
Section I	60	30	6.08	4.83	0.67	0.54	4.07	2.61
Section J	60	30	4.59	3.76	0.74	0.60	3.40	2.26

2.6 Proposed Drainage Facilities

In accordance with the Northwest Neighborhood Master Plan, this development will install half street improvements for Deer Springs, El Capitan, Rome and Riley, including the local pipelines identified in the master plan. Approximately 700-lf of 24-inch pipe will be installed on Deer Springs Way. Capped inlets will be provided at the west and east curb returns of the second entry along Deer Springs Way and the west curb return at the intersection of Deer Springs Way and Riley Street.

Along El Capitan Way, half street improvements will be provided. Currently there are a number of Special Improvement Districts (SID) in planning for El Capitan Way. These SID's propose a 10-yr storm drain for El Capitan Way. Funds will be provided for this SID for the installation of the proposed storm drain system if it has not been constructed already.

Temporary trapezoidal swales along the north and west side of Deer Springs Way and El Capitan Way, respectively will be provided to capture and convey interim flows from offsite basins. Along Deer Springs, a 15-ft wide earthen lined channel will be provided having a 3-ft wide bottom depth and 3:1 side slopes. Along El Capitan Way, a 30-ft wide earthen lined channel will be provided having a 5-ft wide bottom, 4-ft depth and 3:1 side slopes. An easement and/or right-of-way must be acquired prior to constructing the temporary swale in El Capitan; right-of-way is currently available in Deer Springs Way as the property north of Montecito Lifestyles Center is under the same ownership.

The 15-ft wide channel along Deer Springs will discharge its flows into the existing wash located east of Riley Street, while the 30-ft wide channel along El Capitan Way will discharge into the regional facility south of the site.

Although the storm drainpipe will not be utilized in the interim condition, a pipe capacity calculation was performed using Flowmaster utilizing the preliminary pipe slopes outlined in the master plan. The table below summarizes the capacities for each pipe and the Flowmaster results are included in Appendix C.

Pipe Capacity Summary		
Size (in)	Slope (ft/ft)	Capacity (cfs)
30	0.017	54

Deer Springs Way storm drain plan and profile are shown with the grading plans. The storm drain is to be extended in the future, and has been stubbed out to accept flows from the north side of Deer Springs Way. Manholes are spaced per minimum spacing guidelines from the HCDDM at 400-ft or less. Manholes are also placed where laterals are proposed to connect to main line. Type C drop inlets are utilized at the previously mentioned curb locations. Inlet size calculations are shown in Appendix B. Storm drain hydraulic grade line is shown on the profile drawings; a standard form 6 analysis was performed to show that the HGL would be at least 1 foot below the street surface. Standard Form 6 can be seen in Appendix B. The HGL is below the street throughout the length of the storm drain. 30" and 24" HDPE pipe is used. This storm drain will adequately convey a design flow of 38 cfs; design flow of 38 cfs is used to keep the water surface in Deer Springs Way below the top of curb in ultimate conditions.

SECTION 3.0 - CONCLUSION

The recommendation of this drainage study for the proposed Montecito Lifestyle Center is to install a storm drain in the El Capitan Way and Deer Springs Way alignment. The proposed storm drain system in El Capitan alignment will include a 36-inch storm drain and a 24-inch storm drain in the Deer Springs alignment. In addition, during the interim condition, temporary trapezoidal swale will be provided along the north and west side of Deer Springs Way and El Capitan Way, respectively.

This study complies with the policy required by the City of Las Vegas and the Clark County Regional Flood Control District. All hydrologic and hydraulic design within the project development will adhere to the requirements of these agencies. The drainage plan will convey onsite runoff development and will not significantly impact downstream properties.

SECTION 4.0 - REFERENCES

Clark County Regional Flood Control District, August 1999,
Hydrologic Criteria and Drainage Design Manual

PBS&J, February 1997, The Master Plan Update for the Las Vegas Valley
(CCRFCF Update).

City of Las Vegas, Northwest Neighborhood Flood Control Master Plan,
December 1997

City of Las Vegas, Northwest Neighborhood Flood Control Master Plan Phase 2,
September 1999

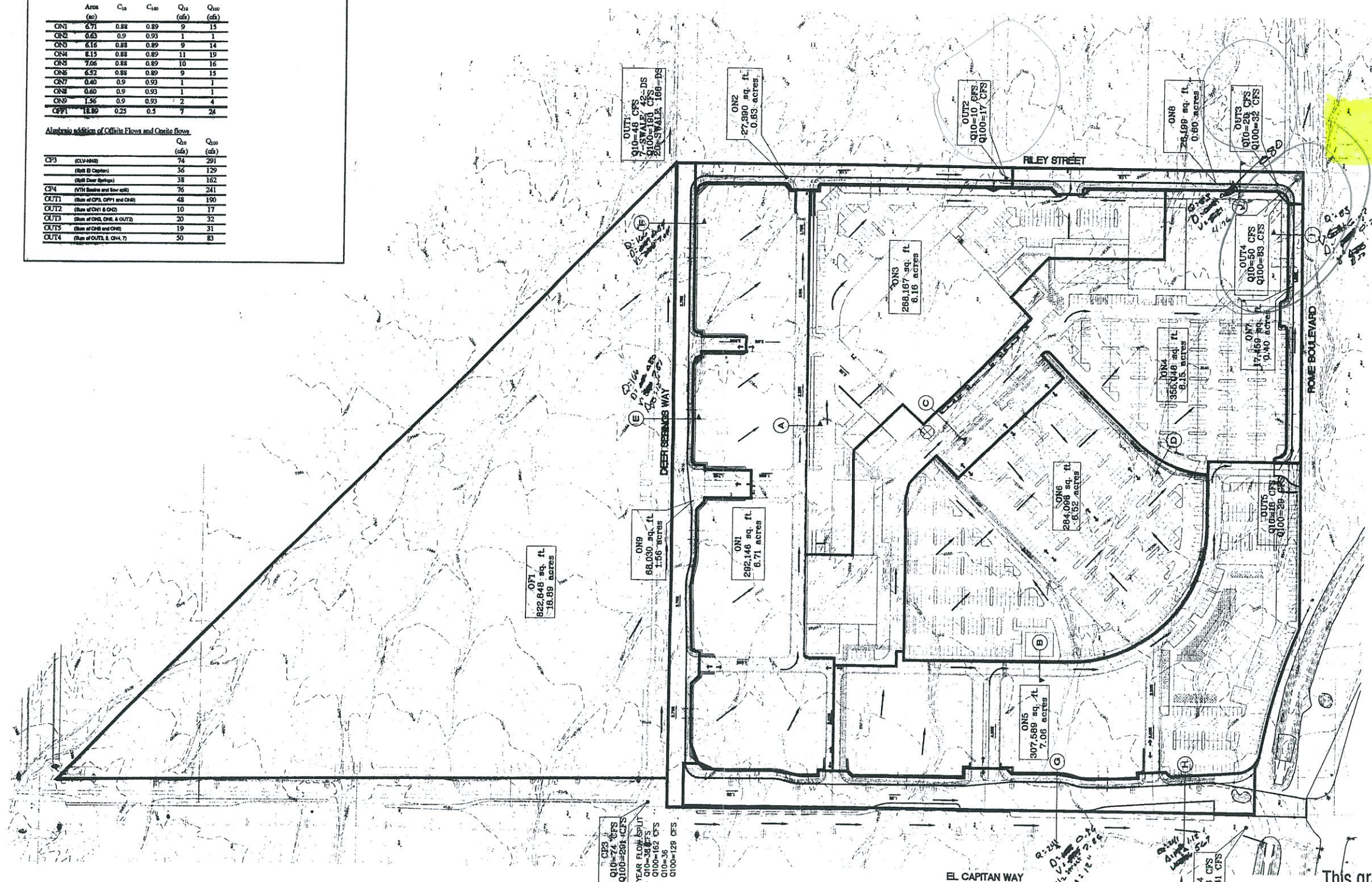
Tetra Tech, October 2001, Technical Hydrology Study for Spinnaker at Town
Center.

Rational Method Formula: $Q = Kiia$
 $i_p = 3.16$ in/hr
 $i_{100} = 5.11$ in/hr
 $K = 0.5$; CCRPCD local factor

Area (ac)	C_{10}	C_{100}	Q_{10} (cfs)	Q_{100} (cfs)
ON1	0.71	0.88	0.89	9
ON2	0.63	0.9	0.93	1
ON3	6.16	0.88	0.89	9
ON4	8.15	0.88	0.89	11
ON5	7.06	0.88	0.89	10
ON6	6.52	0.88	0.89	9
ON7	0.40	0.9	0.93	1
ON8	0.40	0.9	0.93	1
ON9	1.56	0.9	0.93	2
CP1	18.89	0.25	0.5	7

Algebraic addition of Offsite Flows and Onsite flows

	Q_{10} (cfs)	Q_{100} (cfs)
CP3 (SQUARED)	74	291
(Off B Capital)	36	129
(Off Deer Springs)	38	162
CP4 (Off B Capital and Deer Springs)	76	241
OUT1 (Sum of CP3, CP4 and CP4)	48	190
OUT2 (Sum of ON1 & ON2)	10	17
OUT3 (Sum of ON3, ON4, & ON5)	20	32
OUT4 (Sum of ON6 and ON7)	19	31
OUT5 (Sum of OUT1 & OUT4)	50	83



10 YEAR / 100 YEAR FLOW FROM DEER SPRINGS - Q10=38 CFS Q100=162 CFS
 EL CAPITAN - Q10=128 CFS

This grading plan is a part of drainage study # 3186 which was received on 8/12/03 and accepted on 8/18/03. Page 1 of 1.

FIGURE 2-2

MONTECITO LIFESTYLE CENTER

INTERIM DRAINAGE CONDITION MAP

SCALE (H): 1"=100'

SCALE (V): 1"=10'

DRAWN: [Signature]

DESIGN: [Signature]

CHECKED: [Signature]

DATE: 07/09/02

RECOMMENDED BY: DAVID P. HUCKLE

CIVIL

8/20/02

SHEET

OF

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NO. REVISIONS

NO.	REVISIONS	BY	DATE	APPR.



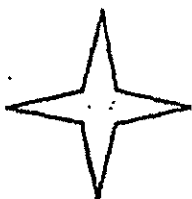
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APN: 125-20-701-002 & 125-20-711-001

PROJECT: BROOKSIDE

SUBMITTAL 1st submittal



Rec'd: 12/31/03

DS 3476

TECHNICAL HYDROLOGY
STUDY FOR BROOKSIDE

6-20

\$400

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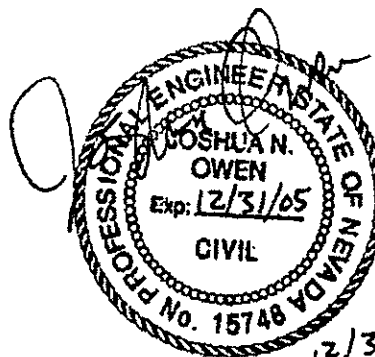


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1 INTRODUCTION

1.1 Study Overview and Purpose

This study is intended to serve as a technical hydrology study for approximately 20 acres of land to be developed as the Richmond American residential subdivision *Brookside*.

1.2 Location

The Brookside site is located within the southeast quarter (SE1/4) of Section 20, Township 19 South, Range 60 East, Mount Diablo Meridian, Clark County Nevada. The site is located at the southeast corner of the intersection of Deer Springs Way and Riley Street (see Figure 1, *Vicinity Map*).

1.3 Existing Site Description

The site is 20.88 acres of undeveloped land in poor hydrologic condition. The area slopes generally to the east. The site is surrounded by residential subdivisions and undeveloped land.

1.4 CCRFCD Master Plan Information

As shown on Figure F-4 of the *Flood Control Master Plan Update of the Las Vegas Valley* (MPU) (Reference #1), the site is not located adjacent to any existing or proposed Regional Flood Control facilities (see Figure 2).

Figure H-4 of the MPU indicates that the site lies within hydrologic sub-basin NWBC6-C (see Figure 3, *Hydrologic Sub-Basins*).

1.5 FEMA Flood Plain Information

A review of the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM) Community-Panel Number 32003C1745 E, effective date September 27, 2002 (Reference #3), indicates the site is located within a FEMA Zone 'X'. Zone 'X' is described by FEMA as an area outside of the 500-year floodplain (see Figure 4, *Flood Insurance Rate Map*).

1.6 Previous Drainage Studies

There are no site specific drainage studies that have been approved. However, there are drainage studies in the surrounding area that have been approved, which have provided the design for the perimeter streets and storm drain facilities. The following plans have been provided in Appendix A, as reference material, for the perimeter streets:

- Riley Street- Montecito at Town Center South by Primas & Associates
- Rome Boulevard- Montecito Town Center South by Primas & Associates
- Montecito Parkway- Montecito Parkway Improvements by PBS&J
- Deer Springs Way- Montecito Town Center East by Primas & Associates

2 METHODOLOGY

2.1 Compliance with Regulations

This study complies with the standards set forth within the Clark County Regional Flood Control District's (CCRFCDD) *Hydrologic and Drainage Design Manual* and the City of Las Vegas drainage requirements.

2.2 Hydrologic Criteria

2.2.1 Rainfall Criteria

The site is located outside of the McCarran Airport Rainfall Area. The 10 and 100 year, 6 hour duration, rainfall amounts were obtained from Figures 503 and 506 of the CCRFCDD Flood Control Manual. The adjusted precipitation values for the 10 and 100 year storms are 1.61 and 2.86 inches, respectively (see *Appendix B*).

The watershed encompasses less than 8-square miles, therefore a Storm Distribution Number three (SDN #3) was used for the HEC-1 model.

2.2.2 Runoff Computations

The U. S. Army Corps of Engineers HEC-1 flood hydrograph package was used to determine the peak runoff generated during the 100- and 10-year, 6-hour storm events. The HEC-1 computer model simulates the surface runoff response of a given watershed to rainfall. The HEC-1 program represents the watershed as an interconnected system of hydraulic components. Each component represents an aspect of the rainfall runoff process within a portion of the watershed. The smaller portion is referred to as a sub-basin. The computed hydrographs from each sub-basin are then combined at appropriate locations to obtain the final discharge hydrograph.

The SCS curve number method was used to determine the infiltration rates for the drainage basins. The soil groups for the existing project site were determined using the 2002 MPU (see Figure 5, *Existing Basins*). The site and off-site basins are located within Hydrologic Soil Group B. Curve numbers were selected from Table 602 of the CCRFCDD Manual for each drainage basin and are summarized in Table 1, *Drainage Basin Parameters*. Curve number calculations are located in *Appendix C*.

Lag Time T_L is defined as the time measured from the centroid of effective rainfall to the peak of the outflow hydrograph. It is a measure of the watershed's response time, and is a coherent property to basin length, slope, roughness characteristics, and land use. The lag-times for this study were estimated by calculating the drainage basins' time of concentration, T_C . The time of concentration consists of two components; the initial overland flow time, t_i , and the gutter or channel flow time, t_c . The equation for the time of concentration is $T_C = t_i + t_c$. The equation for lag time is $T_L = 0.6T_C$. Lag times were calculated using Standard Form 4 of the CCRFCDD Manual. Calculations are located in the appendices with the HEC-1 models.

Table 1. Drainage Basin Parameters

BASIN	AREA (acres)	BASIN DESCRIPTION	CN	LAG (hr)
EXISTING BASINS				
EXON1	20.94	Desert Shrub-Poor Hydrologic Condition	77	0.3393
EXOF1	18.28	Desert Shrub-Poor Hydrologic Condition	77	0.5486
DEVELOPED BASINS				
DEON1	4.43	Residential- less than 6,000 sqft lots	92	0.1047
DEON2	3.77	Residential- less than 6,000 sqft lots	92	0.1053
DEON3	1.98	Residential- less than 6,000 sqft lots	92	0.0958
DEON4	5.87	Residential- less than 6,000 sqft lots	92	0.1134
DEON5	1.23	Residential- less than 6,000 sqft lots	92	0.0926
DEON6	3.06	Residential- less than 6,000 sqft lots	98	0.0813
DEON7	.59	Residential- less than 6,000 sqft lots	98	0.0548

3 EXISTING DRAINAGE CONDITIONS

3.1 Existing Offsite Drainage Description

The offsite basin is undeveloped. The offsite flows in EXOF1 include a base flow defined by the approved *Spinnaker at Town Center* drainage study prepared by Tetra Tech. A base flow of 46 cfs for the Q10 and 320 cfs for the Q100 has been referenced from PT4 from within this study and has been applied to EXOF1. A reference figure from this study is included and can be found in Appendix D.

Offsite flows in Deer Springs Way, Riley Street, and Rome Boulevard have been defined by the approved *Montecito Lifestyle Center* drainage study prepared by Primas & Associates. These flows are shown on Figure 5, *Existing Basins*. A reference figure from this study is included in Appendix A.

3.2 Existing Onsite Drainage Description

The site was analyzed as one basin (see Figure 5, *Existing Basins*). Flows from this basin discharge to the east.

The HEC-1 analysis and Standard Form 4 for the existing drainage conditions are located in Appendix E. Table 2 summarizes the runoff amounts.

Table 2. Existing Basin Runoff Amounts

BASIN / CONCENTRATION POINT	AREA (acres)	10-YEAR FLOW (cfs)	100-YEAR FLOW (cfs)
EXOF1	18.28	49	333
EXON1	20.94	5	19

4 DEVELOPED DRAINAGE CONDITIONS

4.1 Interim Drainage Conditions

The interim drainage condition model is a developed site with existing off-site drainage basins.

Developed On-site drainage basins are delineated on Figure 6, *Interim Drainage Conditions*. A high point has been provided on Riley Street near the intersection of Deer Springs Way in order to restrict the Deer Springs flows from traveling down Riley Street. A flow-split calculation, based upon the Pima County flowsplit methodology, has been provided to show how much of this flow is diverted to Montecito Parkway and how much will remain in Deer Springs (see Appendix F).

The HEC-1 analysis, Standard Form 4, and flowsplit calculations for the interim drainage conditions are located in *Appendix F*. Table 3 summarizes the runoff amounts.

Table 3. Interim Drainage Conditions

BASIN / CONC. POINT	AREA (Acres)	Q ₁₀ (cfs)	Q ₁₀₀ (cfs)
DEON1	4.43	5	12
DEON2	3.77	5	10
DEON3	1.98	3	6
DEON4	5.87	7	15
DEON5	1.23	30	89
DEON6	3.06	6	10
DEON7	.59	31	62
EXOF1	18.28	49	333
PT1	-	10	22
PT2	-	10	21
PT3	-	51	105
PT4	-	77	420
PT5	-	34	146
PT6	-	85	251

4.2 Future Drainage Conditions

Off-site flows for the future drainage conditions within Deer Springs Way are referenced from the Montecito at Town Center East drainage study by Primas and Associates, which provided the design of the existing storm drain in Deer Springs Way (see Appendix A for a reference figure). Per the *Ultimate Conditions* drainage figure for Montecito at Town Center East, there are 76 and 218 cfs in Deer Springs for the 10 and 100 year storms, respectively. The existing storm drain in Deer Springs Way will capture the 10 year storm and has been incorporated into the HEC-1 model.

Per the *Interim Drainage Conditions* and *Ultimate Drainage Conditions* figures for Montecito Lifestyle Center, the flows in Riley Street and Rome Boulevard will not change from the interim condition. The 10 and 100 year flows of 30 and 60 cfs in Rome Boulevard have been entered into the future condition HEC-1 model as a base flow in basin DEON7. The referenced figures are located in Appendix A. A series of existing drop inlets along Rome Boulevard will capture the 10 year storm by the time flows reach concentration point PT3. Flows diverted into the storm drain have been incorporated into the HEC-1 model.

The HEC-1 analysis and flowsplit calculations for the Deer Springs / Montecito intersection for the future drainage conditions are located in Appendix G. The future condition HEC-1 model is illustrated with Figure 7, *Future Drainage Conditions*.

Table 4. Future Drainage Conditions

BASIN / CONC. POINT	AREA (Acres)	Q ₁₀ (cfs)	Q ₁₀₀ (cfs)
DEON1	4.43	5	12
DEON2	3.77	5	10
DEON3	1.98	3	6
DEON4	5.87	7	15
DEON5	1.23	78	221
DEON6	3.06	6	10
DEON7	.59	1	62
PT1	-	10	22
PT2	-	10	21
PT3	-	21	105
PT5	-	6	63
PT6	-	27	168
PT6A	-	0	115

5 PROPOSED DRAINAGE FACILITIES

5.1 Street Capacities

Street capacities were calculated based on the interim drainage condition model, which represents the worst case street flows. Table 4 summarizes the street capacities. Calculations are located in *Appendix H*.

Table 4. Street Capacities

Section	Street Name	Q10/Q100 (cfs)	D10/D100 (ft)	V10/V100 (ft/s)	V x D
1	Verona	5/10	.27/.32	4.5/5.15	1.22/1.65
2	Calla Lily Drive	3/6	.36/.42	2.31/2.94	.83/1.23
3	Calla Lily Drive	5/10	.39/.48	2.86/3.23	1.12/1.55
4	Calla Lily Drive	5/10	.31/.36	2.87/3.82	.89/1.38
5	Amaryllis Hills	3/6	.26//.31	2.98/3.39	.77/1.05
6	Gloriosa Drive	7/15	.36/.43	2.69/3.28	.97/1.41
7	Deer Springs Way	77/420	.62/.99	6.09/10.15	3.78/10.05
8	Montecito Parkway	34/146	.54/.80	4.07/5.72	2.20/4.58
9	Rome Boulevard	51/105	.55/.68	5.72/6.43	3.15/4.37
10	Riley Street	5/12	.38/.49	3.27/3.80	1.24/1.86
11	Riley Street	12/24	.49/.60	3.79/4.16	1.86/2.50
12	Driveway	10/21	.26/.34	2.94/3.54	.76/1.20
13	Rome Boulevard	41/84	.56/.69	4.31/4.84	2.41/3.34
14	Deer Springs Way	30/89	.47/.65	5.30/6.24	2.49/4.06

Street capacity calculation section 11 shows that the flows discharged by the Montecito Lifestyle Center are contained on the west half of Riley Street.

5.2 Drainage Easements

Two drainage easements have been provided. The first easement is located at the southeast corner of the site and will provide drainage from flows conveyed to concentration point PT2. The second easement is located at the southwest corner of the site and will provide drainage for flows generated by basin DEON2. Hydraulic calculations for the easements are located in *Appendix I*.

5.3 Drop Inlets

There are existing drop inlets on Deer Springs Way and Rome Boulevard, designed to pick up 10 year flows. Figure 8, *Drop Inlet Locations*, shows the locations of the existing and proposed drop inlets. According to the Montecito at Town Center East *Ultimate Conditions* figure (see *Appendix A*) 56 and 186 cfs impacts the site at the northwest corner. The Montecito at Town Center East sheet PP1 (see *Appendix A*) indicates that the inlet on the north side of the street intercepts 53 cfs. This inlet has been labeled as DI#7 on Figure 8. An additional inlet has been added on the south side of the street (DI#2 on Figure 8) to intercept the remaining 3 cfs.

The existing drop inlet at the northwest corner of the Deer Springs / Montecito intersection (DI#6) was designed to capture 14 cfs. DI#1 is proposed and will capture the 10 year storm overflow from DI#6 and flows from basin DEON5.

Existing drop inlets #4 and #5 in Rome Boulevard each have a capacity to capture 30.5 and 27.5 cfs, respectively (see reference material in Appendix A). These two existing inlets will capture the entire 10 year flow generated by basin DEON1 and the 10 year flow of 30 cfs at the Riley Street / Rome Boulevard intersection, which was determined by the Montecito Lifestyle Center. It is assumed that inlets #4 and #5 will each capture half of the total 10 year flow at the Riley Street / Rome Boulevard intersection, which is 17.5 cfs per inlet.

DI#3 is an existing inlet at the northwest corner of the Riley Street / Rome Boulevard intersection. This inlet has a capacity of 29 cfs and will capture flows generated by basins DEON2, DEON3, DEON4, DEON6 and DEON7.

Drop inlet capacity calculations for drop inlets 1,2, and 3 are located in Appendix J.

6 CONCLUSIONS

The following recommendations are provided to facilitate safety, both public and private, for the proposed residential development.

1. Elevate the finished floors to a minimum of twice the depth of flow up to 18 inches above the adjacent street flowline to prevent inundation by the 100-year, 6-hour storm event.
2. Construct all proposed street and gutter improvements to allow proper conveyance of stormwater.
3. Provide drop inlets along Deer Springs Way to collect 10 year storm flows.

7 REFERENCES

1. *2002 CCRFCD Flood Control Master Plan*, Post, Buckley, Schuh, and Jernigan, Inc. and VTN Nevada, 1996.
2. *Flood Insurance Rate Map, Community 32003C2150 E*, effective date September 27, 2002, Clark County, Nevada.
3. *CCRFCD Hydrologic Criteria and Drainage Design Manual*, WRC Engineering, 1990.

file

**CITY OF LAS VEGAS
INTER-OFFICE MEMORANDUM**

DATE:

June 1, 2004 *MS*

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:
Brookside - Stockpile Permit

COPIES TO:
Tetra Tech, Inc.

Cross Streets: SWC Montecito Pkwy & Deer Springs Way

Richmond American

File Number: F:\Depot\DSMemos\DS3476C.doc

Bart Anderson, P.E., DevCo

Parcel Number: 125-20-701-002 & 125-20-711-001

Marv Stine, CLV Engineering Design

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. No.
1 st Submittal	12/31/2003	1/15/2004	Not Approved	\$400.00	116867: \$400
2 nd Submittal	2/13/2004	2/27/2004	Approved	\$400.00	119499: \$400
3 rd Submittal	5/13 & 5/27/2004	6/1/2004	See Comments Below	\$100.00	125046: \$100
TOTAL FEES (LDDRS):				\$900.00	---

REMARKS:

3rd Submittal: Stockpile Permit Only

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.

Note: All land surface area disturbances over 1 acre require a storm water discharge permit issued by the Nevada Division of Environmental Protection (NDEP). 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. A storm water discharge permit application and associated information may be downloaded from the web site:

<http://www.state.nv.us/ndep/bwpc/storm01.htm>

Projects that disturb more than one acre of land must submit to NDEP a "Notice of Intent" for inclusion under Storm Water Permit No. NVR100000 along with the appropriate filing fee.

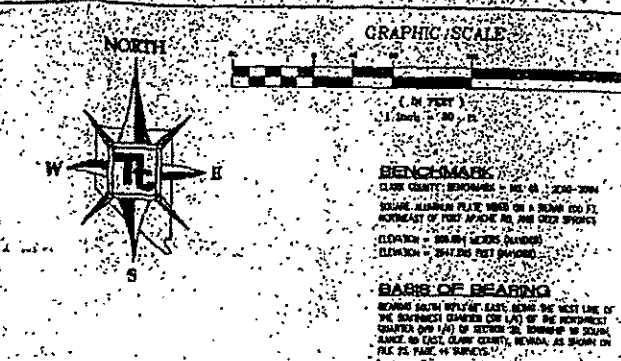
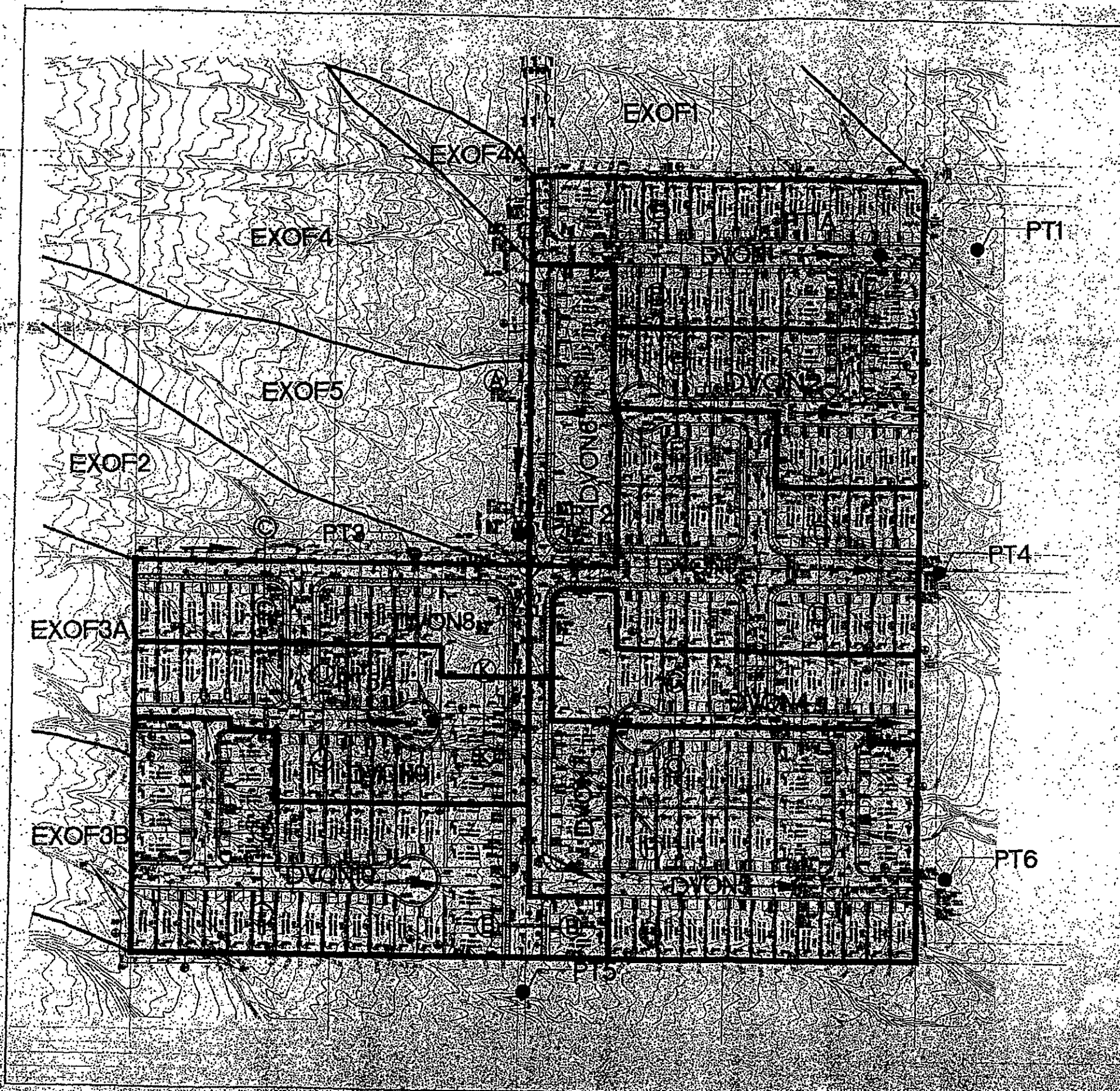
NOTE: Any future changes to the proposed design (or design assumptions) as outlined in the approved drainage study and attached preliminary grading plan which affect drainage must be addressed in a Drainage Study Amendment and accepted by the City of Las Vegas Flood Control Section. Additionally, conditional 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

ays

T/R/S: T19S/R60E/20

AREA G-20



- LEGEND**
- DVON1 BASIN NAME
 - PT1 CONCENTRATION POINT
 - Basin Boundary
 - Location of Street Capacity Calculation

STREET	Q ₁₀₀ (cfs)	Q ₁₀ (cfs)	Q ₅ (cfs)	Q ₂ (cfs)
Campbell Rd (Sec A-A)	1402	0.39464	3707.21	18572.2
Campbell Rd (Sec B-B)	1091	0.47481	1333.43	7522.6
Durham Ln (Sec C-C)	4028	0.50101	1125.47	3599.67
Durham Ln (Sec D-D)	145170	0.54859	1144.96	1816.2
Old Haskins (Sec E-E)	14077	0.50848	1104.19	1800.8
Edenbrook Street (Sec F-F)	147	0.27014	430.02	101.11
Durham Ln (Sec G-G)	3515	0.44030	2301.25	1041.03
Hayward Ln (Sec H-H)	77228	0.13047	1534.15	1152.82
Hayward Ln (Sec I-I)	611	0.32642	1574.15	1671.8
Smalley Ln (Sec J-J)	413	0.29940	1094.19	0.9677
Edenbrook (Sec K-K)	115	0.33	172.51	111.65

BASIN NAME	CONCENTRATION POINT	AREA (acres)	10-YEAR FLOW (cfs)	100-YEAR FLOW (cfs)
EXOF4A		0.79	1	1
DVON1		5.58	4	12
PT1A		4.37	4	13
EXOF1		12	2	11
PT1		16.37	5	20
EXOF4		22	3	18
EXOF5		8	1	6
DVON5		1.71	2	5
PT2		29.71	4	27
EXOF2		321	39	287
DVON5		2.15	2	7
PT3		323.16	40	289
DVON5		4.86	8	15
PT4		367.83	46	320
EXOF3A		2	1	6
DVON9		3.34	4	11
PT5A		10.34	4	15
DVON10		5	8	17
PT5		15.34	10	31
DVON2		2.39	3	8
DVON4		1.5	2	5
DVON7		1.36	1	4
DVON5		4.71	6	16
PT6		6.07	7	20
EXOF3B		1.30	4	30

ROYAL CONSTRUCTION LLC
1000 N. BRUNNEN DRIVE, SUITE 200
LAS VEGAS, NV 89119
(702) 651-7770

TETRA TECH, INC.
1000 N. BRUNNEN DRIVE, SUITE 200
LAS VEGAS, NV 89119
(702) 651-7770

FIGURE 7
INTERIM ON-SITE DRAINAGE BASINS

SPINKER AT TOWN CENTER
CITY OF LAS VEGAS, NEVADA

DATE: 01/15/2015
BY: J. B. B. (JBB)
CHECKED BY: J. B. B. (JBB)
SCALE: 1" = 100'

PROJECT NO: PNYRCC007

GENERAL NOTES:

1. THE RILEY STREET PLAN AND PROFILE IS A PART OF THE MONTECITO TOWN CENTER SOUTH PROJECT. THE RILEY STREET PLAN AND PROFILE IS A PART OF THE MONTECITO TOWN CENTER SOUTH PROJECT. THE RILEY STREET PLAN AND PROFILE IS A PART OF THE MONTECITO TOWN CENTER SOUTH PROJECT.
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10. THE RILEY STREET PLAN AND PROFILE IS A PART OF THE MONTECITO TOWN CENTER SOUTH PROJECT. THE RILEY STREET PLAN AND PROFILE IS A PART OF THE MONTECITO TOWN CENTER SOUTH PROJECT. THE RILEY STREET PLAN AND PROFILE IS A PART OF THE MONTECITO TOWN CENTER SOUTH PROJECT.

REVISIONS:

NO.	DESCRIPTION	DATE
1	ISSUED FOR PERMITS	01/25/2003

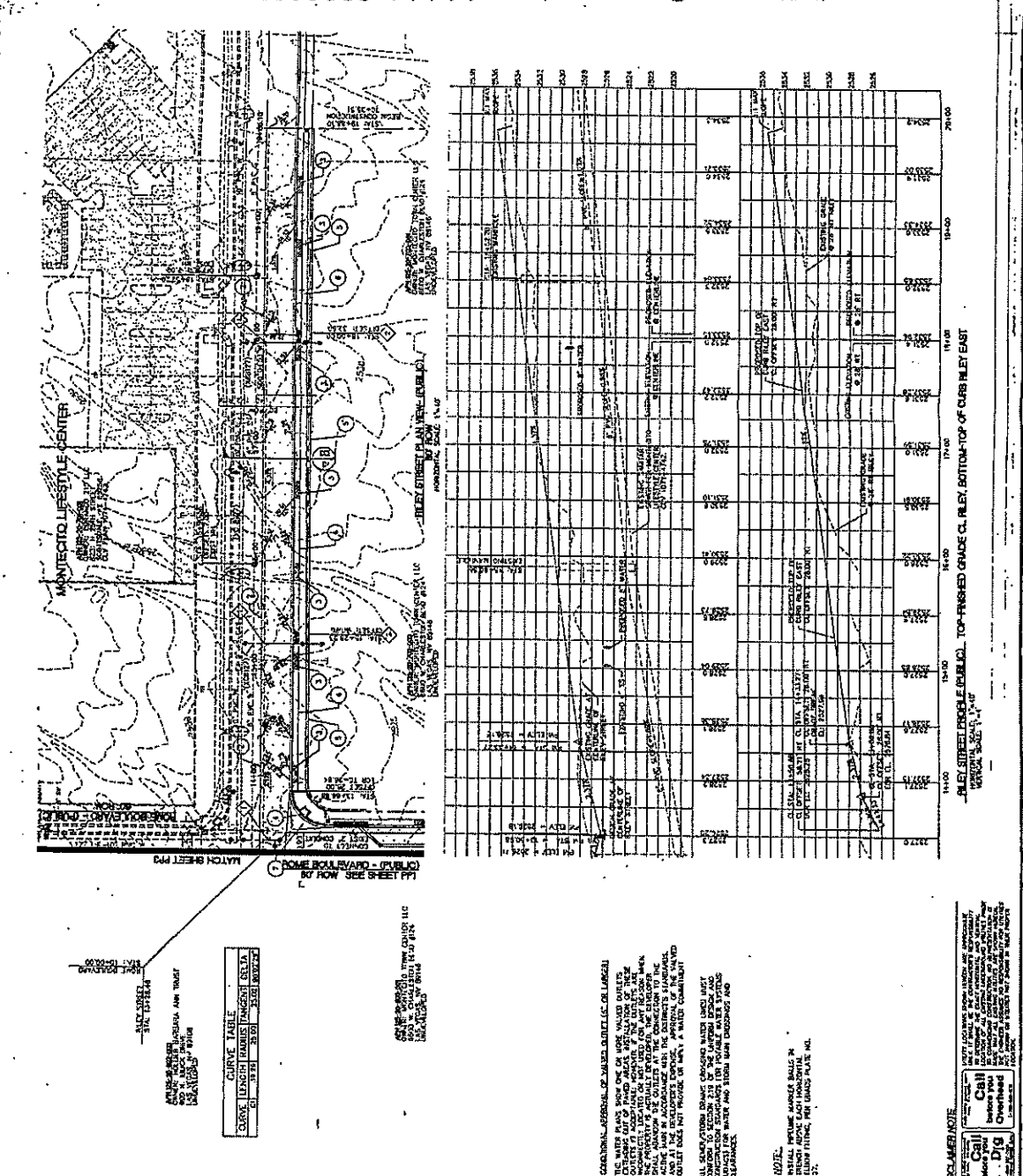
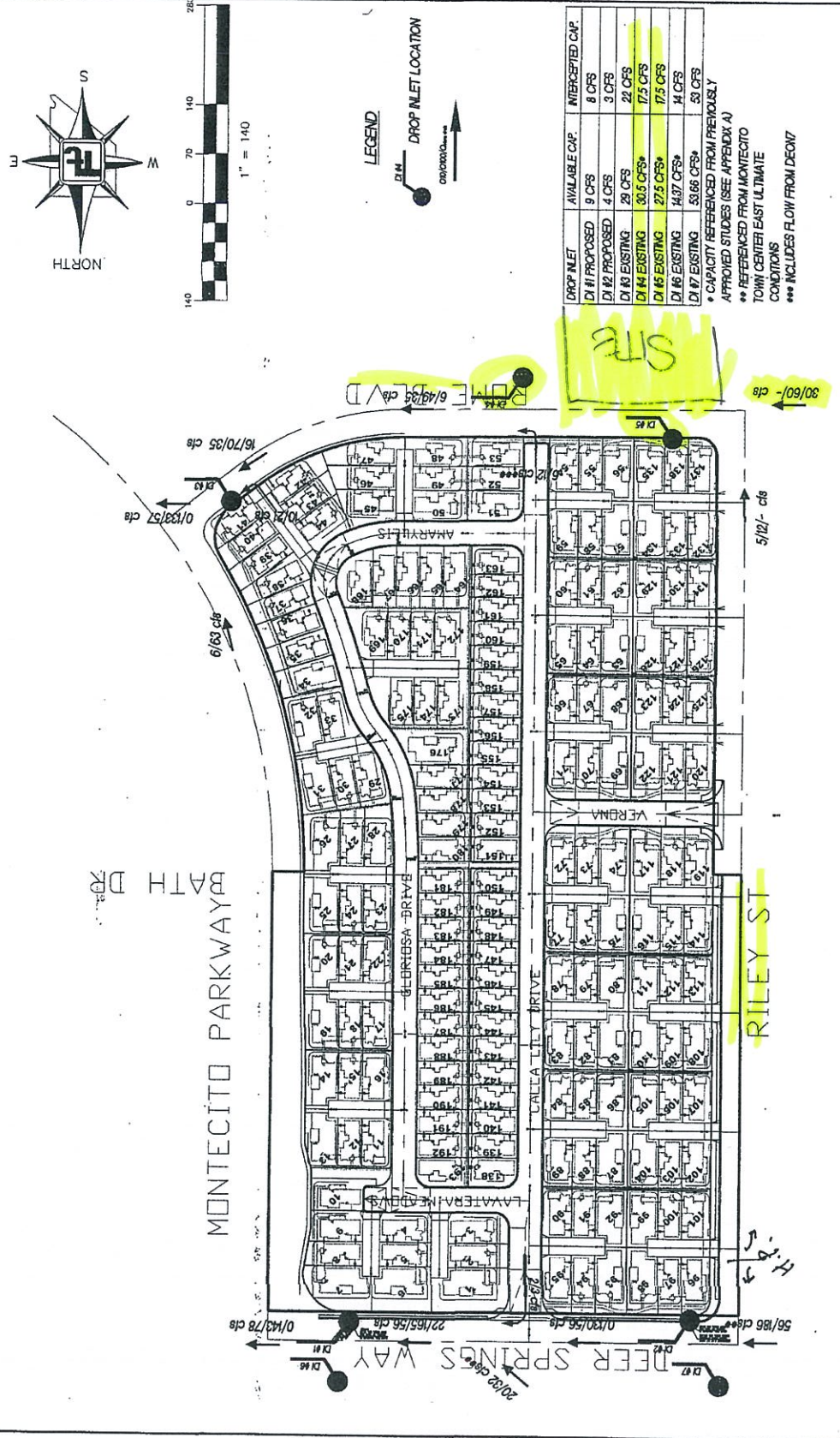


FIGURE 8





NORTHWEST NEIGHBORHOOD STUDY

LEGEND



FIGURE F-1

FUTURE DRAINAGE CONDITIONS



PBSI
801 North Green Valley Parkway, Suite 100
Henderson, Nevada 89014-8139
Phone: 702/261-7276
Fax: 702/261-7200

DECISION	DEVELOPER	RESEARCHER	MANAGER	TECHNICAL	FINANCIAL	MARKETING	OPERATIONS	LEGAL	ENVIRONMENTAL	COMMUNITY	GOVERNMENT
1	2	3	4	5	6	7	8	9	10	11	12
13	14	15	16	17	18	19	20	21	22	23	24

NOTE: Ultimate drainage conditions are based on future CN values with all flood control facilities in place

REVISED SEPTEMBER 1999



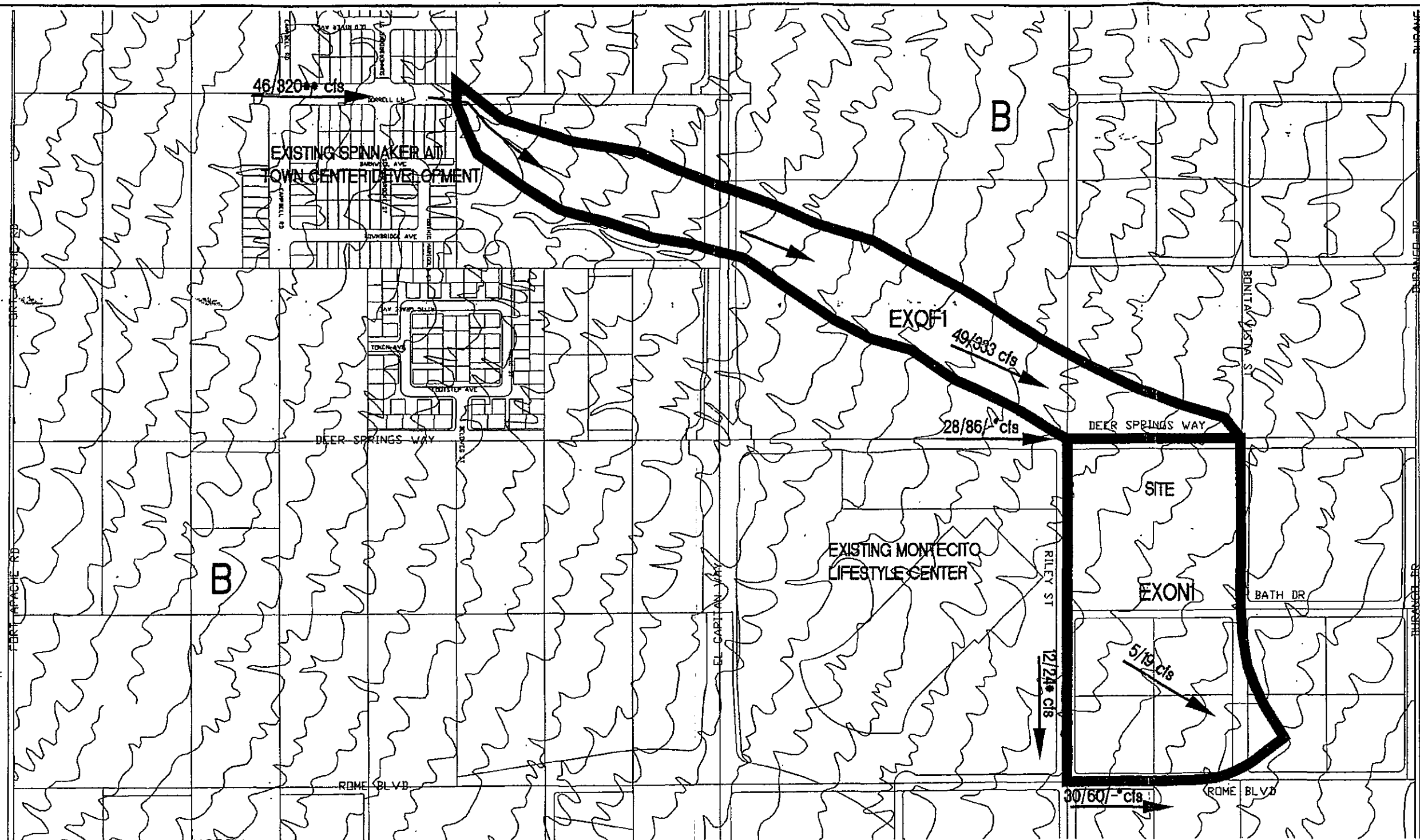
	10-YEAR STREET FLOW	100-YEAR STREET FLOW	10-YEAR FACILITY FLOW	100-YEAR FACILITY FLOW
250				
500				
3000				
18000				

(FLOWS IN CFS)

FLOWERS IN CEST

(IN FEET)

SCALE: 1 INCH = 800 FEET



LEGEND

- B** SOIL TYPE
- BASIN BOUNDARY
- * REFERENCED FROM MONTECITO LIFESTYLE CENTER STUDY
- ** REFERENCED FROM SPINNAKER AT TOWN CENTER STUDY

FIGURE 5

EXISTING BASINS

BROOKSIDE

RICHMOND AMERICAN

SHEET

1

1 OF 1



TETRA TECH, INC.

INFRASTRUCTURE SOUTHWEST GROUP

401 N. Buffalo Dr. Suite 100, Las Vegas, Nevada 89128 (702) 242-4200

DS #: 4422

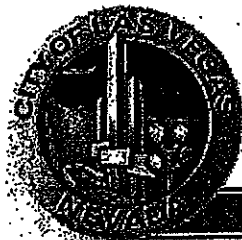
APN: _____

PROJECT: Drainage Study For Sun Auto

SUBMITTAL: 1ST
~~#~~ Submittal

SCANNED BY/DATE: _____

CHECKED BY/DATE: _____



Technical Drainage Study
for
Sun Devil Auto

JOB# 101039

June 2010

Prepared for:

J & N Development
1830 East Elliot Road
Tempe, Arizona 85284
(480) 491-6651

Prepared By:

LOCHSA ENGINEERING
6345 South Jones Boulevard
Suite 100
Las Vegas, Nevada 89118
(702) 365-9312

DS4422
6-20
6/25/10
\$400.00

Revised/
Concurrence
Required

HYDROLOGIC CRITERIA AND DRAINAGE MANUAL

DRAINAGE STUDY INFORMATION FORM

Name of Development: Sun Devil Auto Date: June 24, 2010

Location of Development: a) Descriptive (Cross Streets) North/South: Juliano Road
East/West: Rome Boulevard

b) Section: 20 Township: 19 South Range: 60 East

c) APN: 125-20-801-005

Name of Owner: Isaiah 54 17, LLC. C/o J & R Developments

Telephone No.: (480) 491-6651 Fax No.: (480) 491-6663 E-Mail Address: joel.higginbotham@sundevilauto.com

Address: 1830 East Elliot Road, Tempe, Arizona 85284

Contact Person-Name: Stanley Okey Amadi

Telephone No.: (702) 365-9312

* E-Mail Address: stanley@lochsa.com

Fax No.: (702) 365-9317

Firm: Lochsa Engineering

Address: 6345 South Jones Boulevard, Suite 100, Las Vegas, Nevada 89118

Type of Land Development/Land Disturbance Process:

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

1. Total Owned Land Area: At Site: 0.35 +/- Acres Being Developed/Disturbed: 0.60 +/- Acres

2. Is a portion or all of the subject property located in a designated FEMA Flood Hazard Area? ☐ Yes** ☒ No

3. Is the property bordered or crossed by an existing or proposed Clark County Regional Flood Control District Master Planned Facility? ☒ Yes** ☐ No

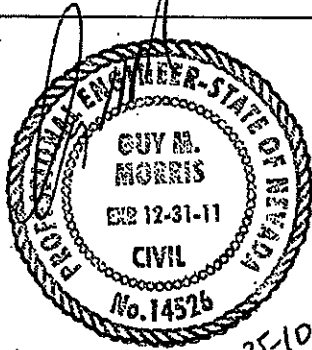
4. Proposed type of development (Residential, Commercial, Etc.): Commercial

5. Approximate upstream land area which drains to the subject site: 3.75 Square Mile Conveyed in the Beltway Channel (RCHB 0151)

6. Has the site drainage been evaluated in the past? ☐ YES ☒ NO If yes, please identify documentation: _____

7. If known, please briefly identify the proposed discharge point(s) of runoff from the site: To Rome Boulevard through the Driveways

8. Briefly describe your proposed schedule for the subject project: ASAP



Engineer's Seal

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

*New Required Field

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

Revision	Date

Local Entity File No. _____

REFERENCE:

STANDARD FORM 1

CITY OF LAS VEGAS		DATE:
INTER-OFFICE MEMORANDUM		October 12, 2010
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 Sun Auto	
Cross Streets:	SWC of Rome Boulevard & Juliano Road	
File Number:	F:\Depot\DSMemos\DS4422D.doc	
Parcel Number:	125-20-801-005 & 125-20-802-003	
Zoning Action:	ZON-36949; SUP-36950; SDR-36953; VAR-36954; MOD-36955; VAC-37100 & VAR-37101	
FEMA Flood Zone:	YES	NO X
Proposed Storm Drain:	YES	NO X
COPIES TO:		Lochsa Engineering
		Isaiah 54: 17, LLC
		Bart Anderson, P.E., DevCo
		CCRFCD
		CCPW

HISTORY	DATE RECEIVED	DATE REVIEWED	COMMENTS	REVIEW FEES	FEES PAID Transaction #
1 st Submittal	6/28/2010	7/8/2010	Not Approved	\$400.00	147569: \$400
2 nd Submittal	7/22/2010	8/5/2010	Conditional Approval	\$400.00	149467: \$400
CCRFCD (3 rd)	8/23/2010	9/1/2010	Concurrence Recv'd	N/C	N/C
CCPW & Notarized Letter Recv'd (4 th)	10/12/2010	10/12/2010	Concurrence Recv'd	N/C	N/C
TOTAL FEES (LDDRS):				\$800.00	—

REMARKS:

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

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

- Per previous Comment #8, the notarized addendum and the original "Grant of Reciprocal Easements for Parcel No.s 125-20-801-005 and 125-20-802-003" must be recorded with the *Clark County Recorder Office* prior to the final approval of the improvement plans.
- VAC-37100, a petition to vacate portions of *Rome Boulevard* and *Juliano Road* adjacent to the subject site shall be approved and recorded 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 of a project.

CITY OF LAS VEGAS		DATE:
INTER-OFFICE MEMORANDUM		August 5, 2010
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 Sun Auto		COPIES TO: Lochsa Engineering
Cross Streets:	SWC of Rome Boulevard & Juliano Road	Isaiah 54: 17, LLC
File Number:	F:\Depot\DSMemos\DS4422B.doc	Bart Anderson, P.E., DevCo
Parcel Number:	125-20-801-005 & 125-20-802-003	CCRFC
Zoning Action:	ZON-36949; SUP-36950; SDR-36953; VAR-36954; MOD-36955; VAC-37100 & VAR-37101	CCPW
FEMA Flood Zone	YES	NO X
Proposed Storm Drain	YES	NO X

HISTORY	DATE RECEIVED	DATE REVIEWED	COMMENTS	REVIEW FEES	FEES PAID Transaction #
1 st Submittal	6/28/2010	7/8/2010	Not Approved	\$400.00	147569: \$400
2 nd Submittal	7/22/2010	8/5/2010	See Comments Below	\$400.00	149467: \$400
TOTAL FEES (LDDRS):				\$800.00	---

REMARKS:

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

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

1. This drainage study is acceptable in concept; however, *City of Las Vegas* will not formally accept the study until the *Clark County Regional Flood Control District* (CCRFC) has issued a letter of concurrence. The Engineer should contact the CCRFC to confirm that they have begun their review.
2. The site is also adjacent to the existing Clark County Beltway project. The engineer must coordinate with *Clark County Department of Public Works* (CCPW) and incorporate any concerns for boundary conditions along the southern border of the development. CCPW concurrence is required prior to the final acceptance of the study.
3. Per previous Comment #5, the proposed building must be flood protected to the interim flows in the *Beltway Channel*. Provide typical cross section at the southwest building wall to verify whether there is any flood wall (such as concrete wall or 8"-CMU solid grouted wall) proposed at the property line. The last submittal had not provided any sections to prove as such. This must be addressed prior to the final approval of the drainage study.
4. Per previous Comment #7, a copy of the notarized letter of permission from the property owner to the east allowing offsite grading must be provided to *City of Las Vegas Flood Control Section* prior to final acceptance of the drainage study.

5. Per previous Comment #8, the notarized addendum and the original "Grant of Reciprocal Easements for Parcel No.s 125-20-801-005 and 125-20-802-003" must be recorded with the *Clark County Recorder Office* prior to the final approval of the improvement plans.
6. VAC-37100, a petition to vacate portions of *Rome Boulevard* and *Juliano Road* adjacent to the subject site shall be approved and recorded prior to the issuance of any permits.

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: T19S/R60E/20
AREA G-20

CITY OF LAS VEGAS		DATE:
INTER-OFFICE MEMORANDUM		September 1, 2010
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 Sun Auto		COPIES TO: Lochsa Engineering
Cross Streets:	SWC of Rome Boulevard & Juliano Road	Isaiah 54: 17, LLC
File Number:	F:\Depot\DSMemos\DS4422C.doc	Bart Anderson, P.E., DevCo
Parcel Number:	125-20-801-005 & 125-20-802-003	CCRFGD
Zoning Action:	ZON-36949; SUP-36950; SDR-36953; VAR-36954; MOD-36955; VAC-37100 & VAR-37101	CCPW
FEMA Flood Zone:	YES	NO X
Proposed Storm Drain:	YES	NO X

HISTORY	DATE RECEIVED	DATE REVIEWED	COMMENTS	REVIEW FEES	FEES PAID Transaction #
1 st Submittal	6/28/2010	7/8/2010	Not Approved	\$400.00	147569: \$400
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CCRFGD	8/23/2010	9/1/2010	Concurrence Recv'd	N/C	N/C
TOTAL FEES (LDDRS):				\$800.00	---

REMARKS:

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

	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.
X	is conditionally approved subject to Clark County Department of Public Works concurrence.

1. The site is adjacent to the existing Clark County Beltway project. The engineer must coordinate with *Clark County Department of Public Works (CCPW)* and incorporate any concerns for boundary conditions along the southern border of the development. CCPW concurrence is required prior to the final acceptance of the study.
2. Per previous Comment #5, the proposed building must be flood protected to the interim flows in the *Beltway Channel*. Provide typical cross section at the southwest building wall to verify whether there is any flood wall (such as concrete wall or 8"-CMU solid grouted wall) proposed at the property line. The last submittal had not provided any sections to prove as such. This must be addressed prior to the final approval of the drainage study.
3. Per previous Comment #7, a copy of the notarized letter of permission from the property owner to the east allowing offsite grading must be provided to *City of Las Vegas Flood Control Section* prior to final acceptance of the drainage study.

Technical Drainage Study for Sun Devil Auto

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1. GENERAL LOCATION AND DEVELOPMENT DESCRIPTION**1.1 Purpose**

Lochsa Engineering has been retained by J&N DBA Sun Devil Auto Service to provide a technical drainage study for the proposed Sun Devil Auto Service Shop to be located at the cul-de-sac and/or knuckle end of Rome Boulevard, directly north of the Las Vegas Beltway (CC-215) westbound off ramp to Durango Drive. The existing site is currently undeveloped and generally consists of the characteristic desert vegetation. The purpose of this study is to provide a detailed analyses of the existing hydrology of the site and the offsite basins impacting the site as well as recommend a drainage plan for the proposed development. This study will also address half street improvements of the perimeter streets and construction of any required flood control facilities that may be required to protect the site.

1.2 Location of Property

The site is located directly north of the Las Vegas Beltway, between Durango Drive and Riley Street. Rome Boulevard provides access to the site and terminates in a cul-de-sac at the entrance to the site. The site is bordered by an undeveloped parcel to the east, while the existing Montecito Lifestyle Center is directly north of the site. The Las Vegas Beltway (NDOT) right-of-way forms the southern property line of the site. Although, the ultimate Beltway Improvements have not been constructed adjacent to the site, there is an existing riprap lined trapezoidal channel within the NDOT right-of-way adjacent to the site that conveys offsite flows away from the site. Likewise, the existing Montecito Lifestyle Center directly north protects the site from any flows in Durango Drive,

and also drains away from the site.

The site occupies a portion of the Southern Half (S 1/2) of the Southeast Quarter (SE1/4) of Section 20, Township 19 South, Range 60 East, of the M.D.M., in the City Las Vegas, an unincorporated portion of Clark County, Nevada. The project site consists of one parcel identified by the Assessor's Parcel Numbers (APN) 125-20-801-005. Please refer to the copy of the APN Map provided in the appendix. The Vicinity Map (Figure 1) which indicates the location of the site in relation to other surrounding streets is also provided in Appendix.

1.3 Description of Property

The project parcel is area of approximately 0.35 acres of undeveloped land with characteristic desert vegetation. The site generally slopes to east at approximately 2.70% and the portion adjacent to Rome Boulevard appears to have been partially grubbed or rough graded.

A review of the current 2008 Flood Control Master Plan Update (Reference 2), Figure H-13, and the Natural Resources Conservation Service (NRCS) Web Soil Survey 2.0 (Reference 3) indicate that the site and its local offsite basins fall within an area mainly consisting of the hydrologic soil group B. Soil group B is defined as soils with "Moderate Infiltration Rate and Moderately Low Runoff Potential". The Curve Numbers (CN) for the existing and developed conditions have been determined from Table 602 of the CCRFCD Hydrologic Criteria and Drainage Design Manual.

2. DRAINAGE DESCRIPTION

2.1 Existing Drainage Conditions

In the 2008 Flood Control Master Plan Update for the Las Vegas Valley, the entire valley was hydrologically divided into ten watersheds and each watershed was further subdivided into subareas. The site falls within subbasin NWB6C-6 in the Northern Las Vegas Wash Watershed as analyzed in the CCRFCD Master Plan Update (Reference 2). The site is also located within a portion of subbasin GD28BC5 analyzed in the "*City of Las Vegas Northwest Neighborhood Study Phase 2*" by prepared by Post Buckley Schuh & Jernigan (Reference 5). Review of the Existing Drainage Conditions Map (Figure E-1) from Reference 5 indicates that approximately 58 cfs and 258 cfs will be conveyed east along Rome Boulevard adjacent to the site. However, significant upstream improvements have occurred which now routes flows along El Capitan Way (now the new Durango Drive alignment) to the Beltway Channel adjacent to the site. Thus, majority of the offsite flows no longer directly impact the site from the west as Rome Boulevard does not intersect Durango Drive (formerly El Capitan Way) but terminates in a cul-de-sac at the northeast corner of the site.

A. Offsite Drainage

The location and size of the project parcel provides complete protection from localized offsite flows due to the existing surrounding improvements and no adjacent roadway that conveys flows to the site. However, a portion of the existing Montecito Lifestyle Center discharges into the existing Rome Boulevard cul-de-sac adjacent to the site. A review of the "*Technical Drainage Study for Montecito Lifestyle Center*" (DS #3186; Reference 6) prepared by Primas and Associates, indicates

that the portions of the Montecito Lifestyle Center site that discharges into the cul-de-sac were analyzed as basins ON5 (10/16 cfs) and ON6 (9/15 cfs). These basins will algebraically combine to approximately 19 cfs and 31 cfs for the 10-year and 100-year, 6-hour storms respectively. The combined runoff flows around the cul-de-sac and eventually continues east along Rome Boulevard downstream of the Sun Devil Auto Service site.

Other offsite flows in the vicinity of the site are generally conveyed east within the existing CCRFCD riprap channel along the Las Vegas Beltway (CC-215) right-of-way adjacent to the site. A review of the CCRFCD Master Plan Update indicates that there are three main upstream facilities that contribute runoff to the riprap channel. Two of the upstream facilities are regional (CCRFCD) which includes the existing outfall system (RCBC 0000 and 0002) for the 76 ac-ft Fort Apache Detention basin (RCBC 0004) and the proposed Rancho Road System-Beltway (RCHB 0227, 0250, and 0295). The third facility is the local City of Las Vegas Storm Drain System in the new Durango Drive (formerly El Capitan Way) that discharges into the CCRFCD Culvert (RCHB 0171) underneath El Capitan Way as addressed in the plans for "*Durango Drive Improvements I-215 to US95*" by VTN Nevada (Reference 7). The ultimate flows from all the three upstream storm drain systems are intended to be conveyed along the Beltway Channel and Culvert (RCHB 0175) underneath El Capitan Way through the portion of the Beltway Channel (RCHB 0151) adjacent to the site. Although, portions of the main channel (RCHB 0171, 0175 and 0198) have been installed, the upstream system (RCHB 0227, 0250, and 0295) which collects majority of the intended flows ($\approx 1,402$ cfs) are yet to be constructed. Thus, the existing flows currently conveyed in the Beltway

Channel adjacent to the site only consists of the runoff (≈ 222 cfs) from the Fort Apache Detention outfall, and the flows (≈ 196 cfs) discharging into the channel through the City of Las Vegas Storm Drain in El Capitan Way. These flows algebraically combines to be approximately 418 cfs during a 100-year, 6-hour storm event. Although, a review of the 2000 Improvement Plans for Northern Segment Las Vegas Beltway from El Capitan to Jones Boulevard prepared by Parsons Transportation Group and VTN Nevada (Reference 8), indicates that the existing condition 100-year flows in the Beltway Channel adjacent to the site is approximately 258 cfs. The Beltway Improvement Plans also indicate that the Water Surface Elevations (WSE) in the channel adjacent to the site ranges from approximately 2544.50' to 2534.0'. A revised normal depth analysis of the existing Beltway Channel adjacent to the site has been provided based on the estimated 100-year flow of approximately 418 cfs. The analysis indicates a WSE of approximately 2540.20'. The channel bank finished grade elevations at the cross-section location is approximately 2545', which indicates that the flows in the channel are contained with adequate freeboard. Thus, the existing site is adequately protected from the exiting offsite flows conveyed by the adjacent Beltway Channel.

B. Onsite Drainage

The site in its existing condition generally consists of the characteristic desert vegetation, and has been analyzed as one drainage basin labeled NX1 ($<1/1$ cfs). Runoff from NX1 sheet flows northeast through the adjacent parcel (APN: 125-20-802-003), and eventually discharges into Rome Boulevard. A portion of this adjacent parcel (≈ 0.25 acres), is currently being developed with the subject project to provide a shared access between both parcels per the agreement of the two parcel

owners. Therefore, the subject onsite basin NX1 is analyzed to consist of approximately 0.60 acres. Please refer to the appendix for the Existing Condition Onsite Drainage Map (Sheet DR1) provided.

2.2 Interim Drainage Condition

A. Offsite Drainage

For the interim condition, the offsite drainage patterns will remain as already described in the existing condition. Upstream flows are routed into the Beltway Channel adjacent to the site, and the flows in the channel will maintain the hydraulic characteristic already described in the existing condition. Likewise, the flows in Rome Boulevard adjacent to the site will consist of the runoff from basins ON5 (10/16 cfs) and ON6 (9/15 cfs) in addition to the flows discharging into the cul-de-sac from the developed Sun Devil Auto site {basin ND1 (1/2 cfs)}. These basins will algebraically combine to approximately 20 cfs and 33 cfs for the 10-year and 100-year, 6-hour storms respectively. The combined runoff will generally flow around the cul-de-sac and eventually continues east along Rome Boulevard downstream of the site. Thus, the only change in the quantity of offsite flows will result from the development of the site which is an increase of approximately 1 cfs during the 100-year storm event {compare NX1 (<1/1 cfs) to ND1 (1/2 cfs)}.

B. Onsite Drainage

The site will be developed to consist of a proposed building with surrounding parking lots and drive aisles in the interim condition. The developed site has been analyzed as one drainage basin labeled ND1 (1/2 cfs). Runoff from basin ND1 will discharge into Rome Boulevard cul-de-sac through the proposed driveways to combine with the other offsite flows in the street. The onsite

drainage basin have been depicted on the Developed Condition Onsite Drainage Map (Sheet DR2) provided in the appendix.

2.3 Future Drainage Condition

A. Offsite Drainage

For the future condition, since no offsite basins directly impacts the site in both the existing and interim conditions, no future condition offsite flows are expected to impact the site directly. Thus, the surface flows in Rome Boulevard cul-de-sac will remain approximately 20 cfs and 33 cfs during the 10-year and 100-year, 6-hour storms respectively as already described and addressed for the interim condition.

However, a review of Figure F-1 of the City of Las Vegas Northwest Neighborhood Study (Reference 5) indicates that the regional offsite flows to be conveyed in the Beltway Channel adjacent to the site will be approximately 558 cfs and 1,663 cfs, during the 10-year and 100-year, 6-hour storms respectively. Likewise, the CCRFCD Master Plan Update for the Las Vegas Valley (Reference 2) indicates that the future 100-year flows to be conveyed in the adjacent Beltway Channel will be approximately 1,888 cfs. The channel is identified as RCHB 0151 in the CCRFCD Master Plan Update and will consist of concrete with a 16' wide bottom, 7.0' deep and a 0:1 side slope (i.e. rectangular). It will be approximately 1,255 feet long and will be constructed at a 2.65% bed slope. A normal depth FlowMaster analysis of the future channel section indicates a flow depth of 3.50-feet and a velocity of 33.69 feet per second. This implies that the future channel dimensions and geometric parameters will contain and convey the expected 100-year flows with adequate

freeboard. Thus, the subject Sun Devil Auto Service site will be adequately protected from the future flows in the channel due to a 100-year, 6-hour storm event.

B. Onsite Drainage

In the future condition, the developed onsite drainage patterns and runoff values will remain the same as already described for the interim condition, since ultimate development of the site will be provided in the interim condition. Therefore, no re-analysis of the onsite basin has been provided for the future condition.

2.3 Master Planning Information

The "2008 Las Vegas Valley Flood Control Master Plan Update", dated September 2008, as prepared by Post Buckley Schuh and Jernigan, Inc. (PBS&J), in association with Louis Berger Group and Parsons Brinckerhoff, for the Clark County Regional Flood Control District (CCRFCD) (Reference 2) illustrates the existing and proposed regional master planned facilities around the site as shown on Figure F-13.

Review of the Master Plan Update (Reference 2), indicates that there is a future Clark County Regional Flood Control District Master Plan facility in the alignment of the Las Vegas Beltway adjacent to the site. This facility is identified as the Rancho Road System-Beltway RCHB 0151, and is described as a proposed 16'Wx7'D Concrete Channel with 0:1 side slopes. The channel will be approximately 1,255-feet long with a discharge capacity of 1,888 cfs, and will be constructed with a channel slope of approximately 2.65%.

2.4 Flood Plain Information

The project site is covered by the Flood Insurance Rate Map (FIRM) for Clark County,

Nevada, and incorporated areas, Community Panel Numbers: 32003C 1745 E, Effective Date: September 27, 2002 (Reference 4). Review of panel 3200C 1745 E indicates that the entire site is located within FEMA Flood Zone "X" (unshaded). Zone "X" (unshaded) is described by the Federal Emergency Management Agency (FEMA) as:

"Areas determined to be outside the 0.2% annual chance floodplain"

An exhibit from the FEMA Flood Insurance Rate Map (Figure 2) showing the location of the site is attached in the appendix.

2.5 Previous Drainage Studies

The overall area is covered within the CCRFCD *"2008 Las Vegas Valley Flood Control Master Plan Update Volume I and II"* (Reference 2). The site and its offsite watersheds are also covered in the *"City of Las Vegas Northwest Neighborhood Study Phase 2"* (Reference 5). The *"Technical Drainage Study for Montecito Lifestyle Center"* (DS #3186; Reference 6) prepared by addressed the portions of the Montecito Lifestyle Center site that discharges into the cul-de-sac of Rome Boulevard adjacent to the site. Likewise, the plans for *"Durango Drive Improvements I-215 to US95"* by VTN Nevada (Reference 7) addressed the flows discharging into the beltway channel from the City of Las Vegas storm drain facility in Durango Drive. Similarly, the *"2000 Improvement Plans for Northern Segment Las Vegas Beltway from El Capitan to Jones Boulevard"* by Parsons Transportation Group and VTN Nevada (Reference 8) addressed the interim flows in the channel. Lochsa Engineering has reviewed the above mentioned studies and plans and generally concurs with all the pertinent referenced data and results established therein.

3. PROPOSED DRAINAGE FACILITIES

3.1 General Description

This report is being submitted to address construction of the proposed Sun Devil Auto Service center and offsite improvements. Although the offsite improvements associated to this development will only consist of the southern half of the cul-de-sac end of Rome Boulevard with the necessary pavement transition. Runoff from the site has been designed to flow away from the proposed building pad, and to sheet flow into Rome Boulevard right-of-way adjacent to the site. Onsite drainage has been analyzed as one drainage basin labeled ND1 in the developed condition. The flood control and conveyance system that is proposed for the developed conditions has been designed to maintain as much as possible the historic drainage patterns. Rome Boulevard adjacent to the site is a cul-de-sac with insignificant flows generated by the subject site and a portion of the existing Montecito Lifestyle Center. The street capacity calculation provided indicates a flow depth of 0.53-feet. Thus, the finished floor elevation of the proposed building is set at more than 18" above centerline elevation of the cul-de-sac in Rome Boulevard adjacent to the site.

3.2 Compliance with Regulations and Adopted Plans

The hydrologic analysis and drainage design of this development is in compliance with local requirements, including the Clark County Regional Flood Control District (CCRFCDD) "*Hydrologic Criteria and Drainage Design Manual*" (HCDDM) (Reference 1), and the CCRFCDD "*Flood Control Master Plan Update*" (Reference 2). The design of this development is also in compliance with the Federal Emergency Management Agency (FEMA)(Reference 4). The portion of Rome Boulevard

adjacent to the suite is a cul-de-sac with a flow depth of 0.53-feet. Therefore, the finished floor criteria of 18" above centerline governs the design.

3.3 Hydrologic Criteria

A detailed hydrologic delineation was carried out using 1-foot contour topographic plan for the existing onsite basin, whereas the proposed development grading plan is used for the delineation of the developed onsite conditions. The onsite and offsite tributary watersheds of this study area fall within the Northern Las Vegas Wash Watershed. The rainfall values used for the hydrologic analysis of the site represent the 10-year and 100-year storm recurrence events, each with a six-hour duration. The site is outside the boundary for using the McCarran Airport Rainfall Data, therefore precipitation data was determined using Figures 503 and 506 of the HCDDM (Reference 1). The rainfall values obtained from Figure 503 and 506 are multiplied by the precipitation adjustment ratios to obtain the adjusted point rainfall values. The adjusted point rainfall values for the 6-hour, 10-year and 100-year storm events are determined to be approximately 1.51 and 2.86 inches, respectively. The rainfall losses due to infiltration, interception, etc. are represented using the SCS curve number (CN) method recommended in the CCRFCD's Manual (Reference 1). The SCS method divides the soils into four hydrologic groups as A, B, C and D. A review of the 2008 Flood Control Master Plan Update (Reference 3), Figure H-13 and the Natural Resources Conservation Service (NRCS) Web Soil Survey 2.0 (Reference 3), indicates that the site and majority of its tributary offsite watersheds are located within the hydrologic soil group B. Soil group B is defined as soils with "Moderate infiltration rate and moderately low runoff potential". The Curve Numbers (CN) for the existing

conditions as analyzed has been determined from Table 602 of the CCRFCD Hydrologic Criteria and Drainage Design Manual. The runoff hydrograph is determined from the design precipitation for each sub-basin using the Soil Conservation Service (SCS) unit hydrograph method.

Calculations used in the hydrologic analysis for the offsite and onsite basins for existing and developed conditions are attached in Appendix A.

3.4 Facility Design Calculations

All drainage facilities within this project have been designed in accordance with the CCRFCD "*Hydrologic Criteria and Drainage Design Manual*" (Reference 1). Street flow capacities were calculated based on Manning's equation. The onsite drainage plan will be developed to closely resemble historic drainage patterns. No adverse impact will be caused on other adjacent offsite properties. The proposed development will construct the remainder southern half of the cul-de-sac end of Rome Boulevard adjacent to the site. A perimeter screen/retaining wall combination will also be constructed along the southwestern boundary of the site. The finished floor elevation of the proposed building is set and/or flood protected above the following criteria for Rome Boulevard:

- Twice the depth of flow (100-year, 6-hour runoff) in the adjacent gutter flow line up to a maximum of 18-inches above the water surface elevation:
- 18" above the street centerline elevation measured at the center of the building.

4. CONCLUSIONS AND RECOMMENDATIONS

1. This project is in compliance with the applicable drainage laws as recognized by the State of Nevada.
2. This project is in compliance with the CCRFCD "*Master Plan Update*", and is not near any Master Planned Facilities.
3. This project is in compliance with the CCRFCD "*Hydrologic Criteria and Drainage Design Manual*" (Reference 1).
4. The site is generally located within Federal Emergency Management Agency (FEMA) Flood Zone "X" (unshaded).
5. The drainage facilities for this project have been designed to control and convey the onsite runoff from the 100-year storm safely through the site. In addition, they have been designed based on generally accepted engineering practices. The finished floor elevation of the proposed building is set more than 18" above the street elevation in the cul-de-sac of Rome Boulevard adjacent to the site.

5. REFERENCES

1. Clark County Regional Flood Control District, "*Hydrologic Criteria and Drainage Design Manual*", August 1999.
2. Post Buckley, Schuh & Jernigan (PBS&J), Inc., in association with, Louis Berger Group and Parsons Brinckerhoff, "*2008 Las Vegas Valley Flood Control Master Plan Update, Volume 1 and II*", September 2008.
3. Natural Resources Conservation Service (NRCS), "2007 Web Soil Survey 2.0", September 2007.
4. Federal Emergency Management Agency (FEMA), "*Flood Insurance Rate Map; Community Panel Number 32003C1745 E; Clark County, Nevada and Incorporated Areas*", Effective Date: September 27, 2002.
5. Post Buckley, Schuh & Jernigan (PBS&J), Inc., "*City of Las Vegas Northwest Neighborhood Study Phase 2*", Revised September 1999.
6. Primas and Associates, Inc., "*Technical Drainage Study for Montecito Lifestyle Center*" (DS #3186), approved on March 20, 2003.
7. VTN Nevada, "*Durango Drive Improvements I-215 to US95*" Record Drawings dated December 2003.
8. Parsons Transportation Group and VTN Nevada, "*2000 Improvement Plans for Northern Segment Las Vegas Beltway from El Capitan to Jones Boulevard*", Dated October 2000.

CCRFCD Beltway Channel RCHB 0151 - Ultimate Condition (100-Year)
Worksheet for Rectangular Channel

Project Description	
Worksheet	CCRFCD Beltway Channel RCHB 0151 - Ultimate Condition (100-Yr)
Flow Element	Rectangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Mannings Coefficient	0.013
Slope	0.026500 ft/ft
Bottom Width	16.00 ft
Discharge	1,888.00 cfs

Results	
Depth	3.50 ft
Flow Area	56.0 ft ²
Wetted Perimeter	23.01 ft
Top Width	16.00 ft
Critical Depth	7.56 ft
Critical Slope	0.003047 ft/ft
Velocity	33.69 ft/s
Velocity Head	17.64 ft
Specific Energy	21.14 ft
Froude Number	3.17
Flow Type	Supercritical

Notes: Q100=1,888 cfs (Being the Ultimate Condition Design Flow from the CCRFCD Master Plan Update)

CCRFCD Beltway Channel RCHB 0151 - Ultimate Condition (100-Year)
Worksheet for Rectangular Channel

Project Description	
Worksheet	CCRFCD Beltway Channel RCHB 0151 - Ultimate Condition (100-Yr)
Flow Element	Rectangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Mannings Coefficient	0.013
Slope	0.026500 ft/ft
Bottom Width	16.00 ft
Discharge	1,888.00 cfs

Results	
Depth	3.50 ft
Flow Area	56.0 ft ²
Wetted Perimeter	23.01 ft
Top Width	16.00 ft
Critical Depth	7.56 ft
Critical Slope	0.003047 ft/ft
Velocity	33.69 ft/s
Velocity Head	17.64 ft
Specific Energy	21.14 ft
Froude Number	3.17
Flow Type	Supercritical

Notes: Q100=1,888 cfs (Being the Ultimate Condition Design Flow from the CCRFCD Master Plan Update)

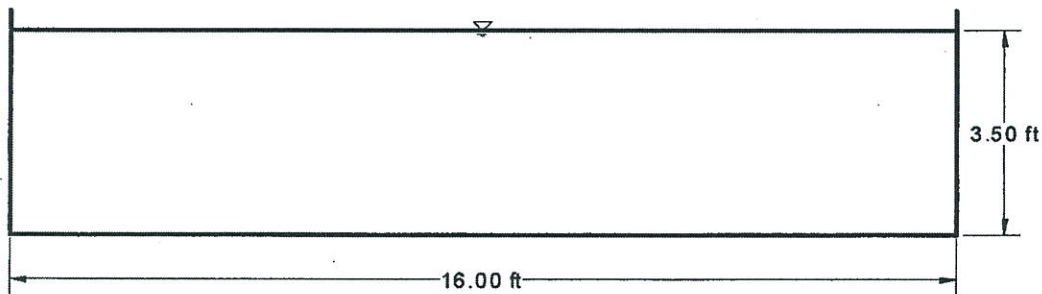
CCRFCD Beltway Channel RCHB 0151 - Ultimate Condition (100-Year)
Cross Section for Rectangular Channel

Project Description

Worksheet	CCRFCD Beltway Channel RCHB 0151 - Ultimate Condition (100-Yr
Flow Element	Rectangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data

Mannings Coefficient	0.013
Slope	0.026500 ft/ft
Depth	3.50 ft
Bottom Width	16.00 ft
Discharge	1,888.00 cfs



7' deep
side

V:1
H:1
NTS

CCRFCD Beltway Channel RCHB 0151 - Interim Condition (100-Year)

Worksheet for Irregular Channel

Project Description

Worksheet	CCRFCD Beltway Channel RCHB 0151 - Interim Condition (100-Ye
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data

Slope	0.022000 ft/ft
Discharge	418.00 cfs

Options

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

Results

Mannings Coefficient	0.030
Water Surface Elevation	2,540.20 ft
Elevation Range	2,537.00 to 2,546.00
Flow Area	37.2 ft²
Wetted Perimeter	19.66 ft
Top Width	17.80 ft
Actual Depth	3.20 ft
Critical Elevation	2,540.76 ft
Critical Slope	0.011230 ft/ft
Velocity	11.24 ft/s
Velocity Head	1.96 ft
Specific Energy	2,542.16 ft
Froude Number	1.37
Flow Type	Supercritical

Roughness Segments

Start Station	End Station	Mannings Coefficient
0+00.00	0+56.70	0.030

Natural Channel Points

Station (ft)	Elevation (ft)
0+00.00	2,545.90
0+17.00	2,545.00
0+19.00	2,544.00
0+21.00	2,543.00
0+23.00	2,542.00
0+25.00	2,541.00
0+27.00	2,540.00
0+29.00	2,539.00
0+31.00	2,538.00
0+34.60	2,537.00
0+40.00	2,537.00
0+40.50	2,538.00
0+42.00	2,539.00

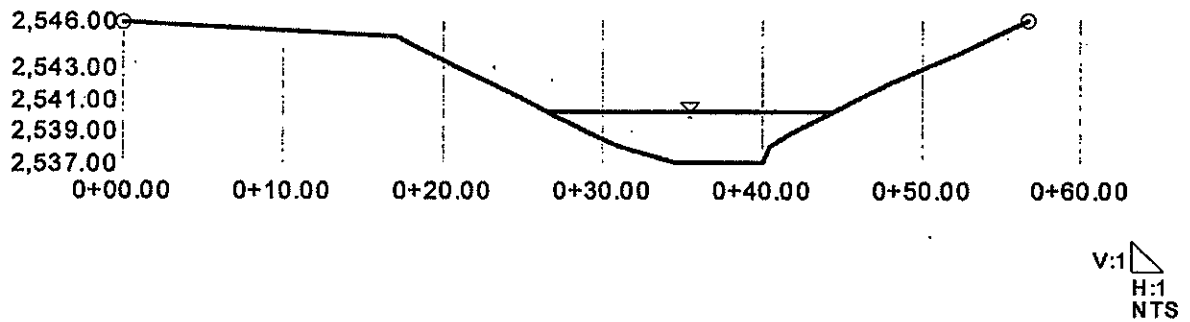
**CCRFCD Beltway Channel RCHB 0151 - Interim Condition (100-Year)
Worksheet for Irregular Channel**

Natural Channel Points	
Station (ft)	Elevation (ft)
0+44.00	2,540.00
0+46.00	2,541.00
0+48.00	2,542.00
0+50.00	2,543.00
0+52.50	2,544.00
0+54.50	2,545.00
0+56.70	2,546.00

Notes: Q100=222 cfs (From Fort Apache Detention Basin Outfall) + 196 cfs (From the Storm Drain System in Durango Drive discharging into the Beltway Channel)

CCRFCD Beltway Channel RCHB 0151 - Interim Condition (100-Year) **Cross Section for Irregular Channel**

Project Description	
Worksheet	CCRFCD Beltway Channel RCHB 0151 - Interim Condition (100-Ye
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth
Section Data	
Mannings Coefficient	0.030
Slope	0.022000 ft/ft
Water Surface Elevation	2,540.20 ft
Elevation Range	2,537.00 to 2,546.00
Discharge	418.00 cfs





Oseha Kome / Riley

**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

April 21, 2016

Delaware 118, LLC
840 South Rancho Drive, Suite #4-572
Las Vegas, Nevada 89106

**RE: SUP-63115 [PRJ-63053] - SPECIAL USE PERMIT RELATED TO SDR-
63116
CITY COUNCIL MEETING OF APRIL 20, 2016**

Dear Applicant:

The City Council at a regular meeting held on April 20, 2016 *APPROVED* a request for an Appeal of the Approval by the Planning Commission on a request for a Special Use Permit FOR A PROPOSED CONGREGATE CARE FACILITY at the southeast corner of Riley Street and Rome Boulevard (APNs 125-20-810-001 and 125-20-803-002), T-C (Town Center) Zone [MS-TC (Main Street Mixed Use - Town Center) and Mixed Use Commercial Montecito Town Center Special Land Use Designations], Ward 6 (Ross) [PRJ-63053].

This approval is subject to the following conditions:

Planning

1. Approval of and conformance to the Conditions of Approval for a Site Development Plan Review (SDR-63116) shall be required.
2. This approval shall be void two years from the date of final approval, unless exercised pursuant to the provisions of LVMC Title 19.16. An Extension of Time may be filed for consideration by the City of Las Vegas.
3. All necessary building permits shall be obtained and final inspections shall be completed in compliance with Title 19 and all codes as required by the Department of Building and Safety.
4. These Conditions of Approval shall be affixed to the cover sheet of any plan set submitted for building permit, as well as submitted as part of any business license application.

CITY OF LAS VEGAS
DEPARTMENT OF PLANNING
DEVELOPMENT SERVICES CENTER
33 NORTH RANCHO DRIVE
3RD FLOOR
LAS VEGAS, NEVADA 89106

VOICE 702.229.6301
FAX 702.474.0352
TTY 7-1-1

www.lasvegasnevada.gov



/city of las vegas

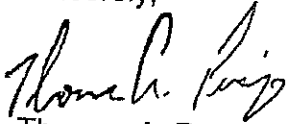
2014 WINNER OF THE U.S. CONFERENCE OF MAYORS CLIMATE PROTECTION AWARD

Delaware 118, LLC
SUP-63115 [PRJ-63053] - Page Two
April 21, 2016

5. All City Code requirements and design standards of all City departments must be satisfied, except as modified herein.

The Notice of Final Action was filed with the Las Vegas City Clerk on April 21, 2016.

Sincerely,



Thomas A. Perrigo
Director
Department of Planning

TAP:clb

cc: Mr. Michael Ochoa
Michael Ochoa Development Company
901 N. Green Valley Parkway, Suite #130
Henderson, Nevada 89074

Ms. Lucy Stewart
LAS Consulting
1916 Trail Peak Lane
Las Vegas, Nevada 89134

Roohani Khusrow Family Trust
9500 Hillwood Drive, Suite #201
Las Vegas, Nevada 89134



**LAS VEGAS
CITY COUNCIL**

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STAVROS S. ANTHONY
BOB COFFIN
BOB BEERS

ELIZABETH N. FRETWELL
CITY MANAGER

April 21, 2016

Delaware 118, LLC
840 S. Rancho Drive, Suite #4-572
Las Vegas, Nevada 89106

**RE: SDR-63116 [PRJ-63053] - SITE DEVELOPMENT PLAN REVIEW
RELATED TO SUP-63115
CITY COUNCIL MEETING OF APRIL 20, 2016**

Dear Applicant:

Your request for a Site Development Plan Review FOR A PROPOSED 41,756 SQUARE-FOOT, 72-BED CONGREGATE CARE FACILITY WITH A WAIVER OF THE TOWN CENTER DEVELOPMENT STANDARDS TO ALLOW NONE OF THE BUILDING TO BE BUILT TO THE FRONT SETBACK LINE WHERE A MINIMUM OF 80 PERCENT IS REQUIRED on 3.98 acres at the southeast corner of Riley Street and Rome Boulevard (APNs 125-20-810-001 and 125-20-803-002), T-C (Town Center) Zone [MS-TC (Main Street Mixed Use - Town Center) and Mixed Use Commercial Montecito Town Center Special Land Use Designations], Ward 6 (Ross) [PRJ-63053], was considered by the Planning Commission on March 8, 2016.

This approval is subject to the following conditions:

Planning

1. Approval of and conformance to the Conditions of Approval for Special Use Permit (SUP-63115) shall be required, if approved.
2. This approval shall be void two years from the date of final approval, unless exercised pursuant to the provisions of LVMC Title 19.16. An Extension of Time may be filed for consideration by the City of Las Vegas.
3. All development shall be in conformance with the site and landscape plan date stamped 02/10/16, and building elevations, date stamped 01/21/16 and 02/10/16, except as amended by conditions herein.
4. A Waiver from Town Center Development Standards Manual Section C.1.C is hereby approved, to allow none of the building to be built to the front setback line where an 80 percent build-to-line ratio is required.

2014 WINNER OF THE U.S. CONFERENCE OF MAYORS CLIMATE PROTECTION AWARD

CITY OF LAS VEGAS
DEPARTMENT OF PLANNING
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/city of las vegas

5. A revised site plan shall be submitted to and approved by the Department of Planning Department, prior to or at the time application is made for a building permit, to show special paving at the pick-up and drop-off area in accordance with Montecito Town Center Land Use and Design Standards.
 6. All trash enclosures shall contain solid walls, opaque doors and a trellis or roof in conformance to Montecito Town Center Land Use and Design Standards.
 7. All necessary building permits shall be obtained and final inspections shall be completed in compliance with Title 19 and all codes as required by the Department of Building and Safety.
 8. These Conditions of Approval shall be affixed to the cover sheet of any plan set submitted for building permit.
 9. The applicant shall coordinate with the City Surveyor and other city staff to determine the most appropriate mapping action necessary to consolidate the existing lots. The mapping action shall be completed and recorded prior to the issuance of any building permits.
 10. A technical landscape plan, signed and sealed by a Registered Architect, Landscape Architect, Residential Designer or Civil Engineer, must be submitted prior to or at the same time application is made for a building permit. A permanent underground sprinkler system is required, and shall be permanently maintained in a satisfactory manner; the landscape plan shall include irrigation specifications. Installed landscaping shall not impede visibility of any traffic control device. The technical landscape plan shall include the following changes from the conceptual landscape plan:
 - a. Show the existing streetscapes along Riley Street and Rome Boulevard adjacent to this site in conformance with the Town Center Development Standards Manual. The streetscapes shall indicate the existing sidewalks and amenity zones, as well as the required street trees and amenities. Failure to conform to the Town Center Development Standards Manual shall require an additional site review and accompanying waiver.
 11. 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.
 12. All City Code requirements and design standards of all City Departments must be satisfied, except as modified herein.
-

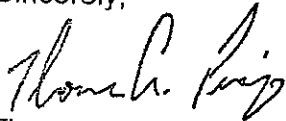
Public Works

13. Prior to the issuance of any building permits, dedicate the east half of the cul-de-sac shown adjacent to Assessor Parcel Number 125-20-803-002.
14. Concurrent with construction of this site, construct all incomplete half-street improvements adjacent to this site meeting Town Center Development Standards. The improvements on Riley Street may terminate just south of the proposed driveway.
15. Correct all Americans with Disabilities Act (ADA) deficiencies on the sidewalk and sidewalk ramps adjacent to this site on Riley Street and Rome Boulevard in accordance with code requirements of Title 13.56.040 to the satisfaction of the City Engineer concurrent with development of this site. All existing paving damaged or removed by this development shall be restored at its original location and to its original width concurrent with development of this site.
16. Unless otherwise allowed by the City Engineer, construct sidewalk on at least one side of all access drives connecting this site to the adjacent public streets concurrent with development of this site. The connecting sidewalk shall extend from the sidewalk on the public street to the first intersection of the on-site roadway network and shall be terminated on-site with a handicap ramp.
17. Landscape and maintain all unimproved rights-of-way on Riley Street and Rome Boulevard adjacent to this site. All landscaping and private improvements installed with this project shall be situated and maintained so as to not create sight visibility obstructions for vehicular traffic at all development access drives and abutting street intersections.
18. Submit an Encroachment Agreement for landscaping and private improvements in the Riley Street and Rome Boulevard public rights-of-way prior to this issuance of permits for these improvements. The applicant must carry an insurance policy for the term of the Encroachment Agreement and add the City of Las Vegas as an additionally insured entity on this insurance policy. If requested by the City, the applicant shall remove property encroaching in the public right-of-way at the applicant's expense pursuant to the terms of the City's Encroachment Agreement. The installation and maintenance of all private improvements in the public right-of-way shall be the responsibility of the applicant and any successors in interest to the property and assigns pursuant to the terms of the Encroachment Agreement. Coordinate all requirements for the Encroachment Agreement with the Land Development Section of the Department of Building and Safety (702-229-4836).

19. 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 Notice of Final Action was filed with the Las Vegas City Clerk on April 21, 2016.

Sincerely,



Thomas A. Perrigo
Director
Department of Planning

TAP:clb

cc: Mr. Michael Ochoa
Michael Ochoa Development Company
901 N. Green Valley Parkway, Suite #130
Henderson, Nevada 89074

Ms. Lucy Stewart
LAS Consulting
1916 Trail Peak Lane
Las Vegas, Nevada 89134

Roohani Khusrow Family Trust
9500 Hillwood Drive, Suite #201
Las Vegas, Nevada 89134

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL																										
DRAINAGE SUBMITTAL CHECKLIST																										
Project Name: Ponderosa Plastering	Map ID:																									
Firm Name: Baughman & Turner, Inc.	Engineer:																									
Address: 1210 Hinson Street																										
City: Las Vegas	State: NV	Zip: 89122																								
Phone Number: 702-870-8771	Fax Number: 702-8782695																									
Property Owner: Randy Peck																										
Address: PO Box 400130																										
City: Las Vegas	State: NV	Zip: 89140-0130																								
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: none;"> <tr> <td style="width: 10%; text-align: center;">Yes</td> <td style="width: 10%; text-align: center;">No</td> <td></td> </tr> <tr> <td style="text-align: center;"><u>X</u></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;"><u>X</u></td> <td style="text-align: center;">_____</td> <td>Design Manual Standard Form 4.</td> </tr> <tr> <td style="text-align: center;"><u>X</u></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;"><u>N/A</u></td> <td>A notarized letter from the adjacent property owner(s) allowing off-site grading or discharge.</td> </tr> </table> II. MAPS AND EXHIBITS <table style="width: 100%; border: none;"> <tr> <td style="width: 10%; text-align: center;">Yes</td> <td style="width: 10%; text-align: center;">No</td> <td></td> </tr> <tr> <td style="text-align: center;"><u>X</u></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;"><u>X</u></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> </table>			Yes	No		<u>X</u>	_____	Design Manual Standard Form 1 with the engineer's seal and signature.	<u>X</u>	_____	Design Manual Standard Form 4.	<u>X</u>	_____	2 copies of the 24" x 36" Drainage Plan.	_____	<u>N/A</u>	A notarized letter from the adjacent property owner(s) allowing off-site grading or discharge.	Yes	No		<u>X</u>	_____	A copy of a current Flood Insurance Rate Map (FIRM) with the site delineated.	<u>X</u>	_____	A copy of the current CCRFCD Master Plan Update Figure, (F-x), for Flood Control Facilities and Environmental areas with the site delineated.
Yes	No																									
<u>X</u>	_____	Design Manual Standard Form 1 with the engineer's seal and signature.																								
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REFERENCE:		STANDARD FORM 2																								

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

DRAINAGE SUBMITTAL CHECKLIST

II. MAPS AND EXHIBITS (Continued)

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

III. DRAINAGE PLAN

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

REFERENCE:

STANDARD FORM 2

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

DRAINAGE SUBMITTAL CHECKLIST

III. DRAINAGE PLAN (Continued)

Yes	No	
☒	☐	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.
☒	☐	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.
☐	☐ N/A	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.
☐	☐ N/A	Location and detail of flood walls illustrating depth of flow, proposed grouting height, etc.
☒	☐	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 | |
|--------------------------|--------------------------|--|
| ☐ | <u>N/A</u> | 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. |
| ☐ | <u>N/A</u> | 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. |
| <u>X</u> | ☐ | Street slopes for perimeter and interior streets. The minimum slope is 0.4 percent. |
| <u>X</u> | ☐ | Location and detail of best management practice (BMP) for parking lots and low impact development (LID) (if required). |

IV. HYDROLOGIC ANALYSIS

- | Yes | No | |
|--------------------------|--------------------------|--|
| <u>X</u> | ☐ | Appropriate soil information and Soils Map for existing and future conditions with subbasins and property delineated. |
| <u>X</u> | ☐ | 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. |
| <u>X</u> | ☐ | 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. |
| <u>X</u> | ☐ | Use of correct precipitation values in and around the McCarran Airport rainfall area. |
| <u>X</u> | ☐ | A discussion in the text of the hydrologic analysis justifying subbasin boundaries and cutoffs, supporting assumptions, and calculations. |
| <u>X</u> | ☐ | A summary table of stormwater flows showing basin area, Q_{10} and Q_{100} for both individual basins and combined basin flows, where applicable. |
| <u>X</u> | ☐ | Copies of supporting technical information referenced from a previously approved study and a statement accepting these results. |
| <u>X</u> | ☐ | On-site facilities must perpetuate flows through or around the site without significantly impacting adjacent property owners in accordance with current Nevada Drainage Law. |
| ☐ | <u>N/A</u> | 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

- N/A Flow split calculations and supporting documentation or reference for the method of flow split calculations used.
- X 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.
- X 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.
- N/A Appropriate hydraulic calculations for block wall openings assuming a 50 percent vertical clogging factor. (Assume the lower half of the opening is plugged.)
- X Appropriate hydraulic calculations at drainage easement entrance and discharge locations to set finish floor elevations. Hydraulic calculations must include submerged weir, superelevation and tee intersection losses, where appropriate.
- X Provide necessary freeboard requirements to set the finished floor elevations of all proposed buildings, 2 x depth of flow or depth of flow plus 18 inches of freeboard, whichever is less. The minimum requirement is 6 inches above adjacent upstream top of curb. Buildings adjacent to drainage easements must always be provided with 18 inches of freeboard above the Q_{100} weir height or flow depth, whichever is greater.
- N/A 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.
- N/A Provide a 50 percent clogging factor in the capacity calculation for drop inlets.
- N/A 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.
- X The mitigation of nuisance water, both during construction and in the fully developed condition, must be addressed.
- X Provide BMP type, size and supporting calculations for parking lots and LIDs (if required).

REFERENCE:

STANDARD FORM 2



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 (CCRFCDD) 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 CCRFCDD Hydrologic Criteria and Drainage Design Manual (Design Manual).

An appointment must be made to preview this checklist in conjunction with CCRFCDD 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.)
X		Copies of all conditions of approval for development related to this property. (e.g. zoning, use permit, tentative map, etc.) Verify compliance with conditions.
X		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	
X		(1) 24" X 36" copy of the Grading Plan, (including all Detail Sheets) sealed by the engineer.
X		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.
X		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.)

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II. GRADING PLAN INFORMATION		
Yes	No	
N/A		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.
X		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.
X		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.
X		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.
X		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.)
X		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.
X		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	
X		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.
X		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.
N/A		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.
X		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.
X		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.

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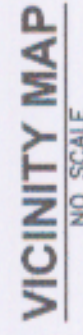
III. Local Entity Criteria - City of Las Vegas – Manual Section 1600		
Yes	No	
N/A		Lots with "B and C Type Drainage" that drain from one lot to another through a drainage easement shall be required to install an underground nuisance drainage system or a 2-foot valley gutter. 16" x 24" minimum block wall openings are required for both options.
N/A		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.

APN: 125-20-810-001 & 125-20-803-002

1	CV01	COVER SHEET
2	GN01	GENERAL NOTES
3	GP01	GRADING PLAN
4	DT01	DETAIL SHEET
5	PP01	PLAN & PROFILE
6	PP02	PLAN & PROFILE



1. PRE-DEVELOPMENT MEETING WITH
DEPARTMENT OF PUBLIC WORKS
DEVELOPMENT REVIEW DIVISION, OFF-SITE
INSPECTOR REQUIRED. CONTACT CIVIL
ENGINEERING INSPECTOR AT
(702)-455-4610.

APPROVALS

APPROVED FOR CONSTRUCTION

LAS VEGAS VALLEY WATER DISTRICT ENGINEERING SERVICES MANAGER

DATE: _____ PROJECT NO. _____
 LWWD APPROVED FIRE FLOW _____ GPM AT 20 PSI RESIDUAL
 SHEETS CV01,GN01, PP01 & UP01

--NO PUBLIC SEWER FACILITIES PROPOSED--

CLARK COUNTY WATER RECLAMATION DISTRICT

DATE
CHWD PROJECT NUMBER IS _____ SIGNATURE ON THESE PLANS SHALL NOT BE CONSTRUED TO BE A PERMIT FOR OR AN APPROVAL OF ANY VIOLATION OF CLARK COUNTY WATER RECLAMATION DISTRICT RULES, REGULATIONS, OR DESIGN AND CONSTRUCTION STANDARDS. THE APPROVAL OF THESE DRAWINGS DOES NOT GUARANTEE CAPACITY IN THE DISTRICT'S COLLECTION OR TREATMENT SYSTEM.

NEVADA POWER COMPANY

NEVADA POWER COMPANY ACKNOWLEDGES THAT WE HAVE RECEIVED YOUR PLANS AND WILL PROVIDE SERVICE TO ALL ELECTRICAL NEEDS ASSOCIATED WITH THIS PROJECT.

NEVADA POWER COMPANY RESERVES THE RIGHT TO ALTER ANY EXISTING OR FUTURE CONFLICTS ONCE THE FINAL DESIGN IS COMPLETED. THE NEW SERVICE AND THE RESOLUTION OF ANY CONFLICTS WILL BE COMPLETED PURSUANT TO THE NEVADA PUBLIC UTILITY COMMISSION'S RULE AND REGULATIONS.

DATE

DISCLAIMER NOTE

UTILITY LOCATIONS SHOWN HEREON ARE APPROXIMATE ONLY. IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO DETERMINE THE EXACT HORIZONTAL AND VERTICAL LOCATION OF ALL EXISTING UNDERGROUND AND OVERHEAD UTILITIES PRIOR TO COMMENCING CONSTRUCTION. NO REPRESENTATION IS MADE THAT ALL EXISTING UTILITIES ARE SHOWN HEREON. THE ENGINEER ASSUMES NO RESPONSIBILITY FOR UTILITIES NOT SHOWN OR UTILITIES NOT SHOWN IN THEIR PROPER LOCATION.

CONSTRUCTION NOTES

[illegible]

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