

DS #: 4579

APN: 125-15-7797-001

Toscano Wyeth Ranch LMA Turf Conversion

PROJECT: (update to DS 2954)

SUBMITTAL: CCR FCD

SCANNED BY/DATE:

CHECKED BY/DATE:



CITY OF LAS VEGAS INTER-OFFICE MEMORANDUM		DATE: March 13, 2013
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: Toscana Wyeth Ranch LMA Turf Conversion (Update to DS2954)	
Cross Streets:	SWC of Rainbow Blvd. & Farm Rd.	Toscana-Wyeth Ranch Landscape Maintenance Association
File Number:	F:\Depot\DSMemos\DS4579B.doc	Bart Anderson, P.E., DevCo
Parcel Number:	125-15-7797-001	
Zoning Action:	N/A	
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 & Supplemental	11/15/2012 & 1/2/13	1/9/2013	Conditional Approval	\$400.00	301477: \$400
CCRFCD	3/12/2013	3/13/2013	Concurrence Recv'd	N/C	N/C
			TOTAL FEES (LDDRS):	\$400.00	----

REMARKS: Drainage Study in support of reducing turf area above channel freeboard.

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.

1. The Toscana-Wyeth Ranch Landscape Maintenance Association proposes to reduce the common area turf above the channel freeboard area and replace with Xeriscape. The flow impacting the area has been reduced with the completion of MPU facilities in the area.
2. The Landscape Plans only proposes to do the turf conversion improvements along the Rainbow Boulevard Channel between Farm Road and the Severance Channel at this time. However, this study also covers the future turf reduction in the Severance Channel and the Rainbow Boulevard Channel between the Severance Channel and existing MPU collection facility.
3. The Landscape plans by Jaramillo Landscape need to be revised to include a cross section of the channel area that shows the minimum channel depth to top of turf area per the recommendations of this study.
 - Rainbow Channel between Farm Rd. & Severance Channel - 2.5' above channel bottom.
 - Rainbow Channel between Severance Channel & MPU facility - 3.5' above channel bottom.
 - Severance Channel between Tenaya Rd. & Rainbow Channel - 4.0' above channel bottom.

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.

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

pbj

T/R/S: T19S/R60E/15
AREA G-15

 *** FAX TX REPORT ***

TRANSMISSION OK

JOB NO. 1123
 DESTINATION ADDRESS 3659317
 PSWD/SUBADDRESS
 DESTINATION ID
 ST. TIME 03/13 11:12
 USAGE T 01' 03
 PGS. 2
 RESULT OK

CITY OF LAS VEGAS INTER-OFFICE MEMORANDUM

DATE:

March 13, 2013

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:
 Toscana Wyeth Ranch LMA Turf Conversion
 (Update to DS2954)

COPIES TO:
 Lochsa Engineering

Cross Streets: SWC of Rainbow Blvd. & Farm Rd.

Toscana-Wyeth Ranch Landscape
 Maintenance Association

File Number: F:\Depot\DSMemos\DS4579B.doc

Bart Anderson, P.E., DevCo

Parcel Number: 125-15-7797-001

Zoning Action: N/A

FEMA Flood Zone YES NO **X**

Proposed Storm Drain YES NO **X**

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Drainage Study
For
Toscana Wyeth Ranch LMA
Turf Conversion
(An Update to the Offsite Master Stormwater
Hydraulic Study for Bella Vista)

JOB# 121098

November 2012

Prepared for:

Jaramillo Landscape Maintenance, LLC
9275 South Jones Boulevard
Las Vegas, Nevada 89139
(702) 251-0011

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

HYDROLOGIC CRITERIA AND DRAINAGE MANUAL
DRAINAGE STUDY INFORMATION FORM

Name of Development: Toscana Wyeth Ranch LMA - Turf Conversion Date: November 08, 2012

Location of Development: a) Descriptive (Cross Streets) North/South: Rainbow Boulevard

East/West: Farm Road

b) Section: 15 Township: 19 South Range: 60 East

c) APN : 125-15-797-001

Name of Owner: Toscana-Wyeth Ranch Landscape Maintenance Association, C/o Jaramillo Landscape Maintenance, LLC.

Telephone No.: 702-251-0011 Fax No.: (702) 870-5099 E-Mail Address: _____

Address: 9275 South Jones Boulevard, Las Vegas, Nevada 89139

Contact Person-Name: Stanley Okey Amadi, P.E. 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	<u>Landscape Turf Conversion to Xeriscape</u>

1. Total Owned Land Area: At Site: 2.0 +/- Acres Being Developed/Disturbed: <1.0 +/- 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.): Landscape Conversion

5. Approximate upstream land area which drains to the subject site: 0.0 +/- Acres

6. Has the site drainage been evaluated in the past? ☒ YES ☐ NO If yes, please identify documentation: Offsite Stormwater Hydraulics Study for Bella Vista (DS #2954)

7. If known, please briefly identify the proposed discharge point(s) of runoff from the site: Southwards within the downstream portion of Rainbow Boulevard Channel Following Existing Drainage Patterns

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



Engineer's Seal

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

***New Required Field**

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

Local Entity File No.	Revision	Date

REFERENCE:

STANDARD FORM 1

November 08, 2012

Mr. Albert Sung, P.E.
City of Las Vegas Public Works Department
333 North Rancho Drive
Las Vegas, Nevada 89106

Subject: **Drainage Study for Toscana Wyeth Ranch LMA Turf Conversion**
 An Update to the Offsite Master Stormwater Hydraulics Study for Bella Vista
 Previous CLV DS #2954
 Lochsa Job # 121098

Dear Mr. Sung,

This letter is intended as an update to the approved Offsite Master Stormwater Hydraulic Study for Bella Vista. The original "*Offsite Master Stormwater Hydraulic Study for Bella Vista*" (CLV DS#2954) prepared by De Roulhac Consulting, Inc., was approved on October 05, 2001 and will be referred to as the 'Original Study'. The purpose of this update is to re-examine the hydraulic characteristics of the interim flood control improvements installed to protect the existing Bella Vista residential subdivision prior to the construction of the permanent Clark County Regional Flood Control District (CCRFCFCD) facilities along Rainbow Boulevard. This study will establish the current flows conveyed by interim facilities and explore the potential for reclaiming or conversion of a portion of the reinforced grass lining of the interim channels into xeriscape (desert landscape). The portion of the channel currently planned for turf conversion constitutes mainly of the Rainbow North Segment; however this study will also establish limits along the other segments of Severance and Rainbow South. The study will also support the vacation of the existing 64-foot wide Public Drainage Easement over the northern portion of the Rainbow North Channel Segment upstream of Severance Channel confluence. The subject easement vacation is intended to be addressed in the near future. All the CCRFCFCD facilities upstream and around the Bella Vista subdivision, including two detention basins (Tule Springs TSDB0011 and Brent BRDB0032), the Mountain Spa/Vista Ranch Channels (MSNV0000-0125) and the Grand Teton and Rainbow Boulevard (LVMD 2525-2789) storm drains identified as future facilities during the planning of the Bella Vista subdivision, have now been fully constructed and operational. Therefore, the interim facilities will no longer capture and/or convey the designed flow capacities as the offsite flows are now intercepted and conveyed by the aforementioned network of CCRFCFCD facilities around the site.

The portions of the site (grass lined channels) being examined in this update primarily consist of the entire Severance Channel and the portion of the Rainbow Boulevard Channel upstream of the Severance Channel Confluence. These portions of the channel system span approximately 2.0 acres in area and will be identified as the project site. The site occupies a portion of the Northern Half (N1/2) of the Southeast Quarter (SE1/4) of Section 15, Township 19 South, Range 60 East, of the

M.D.M., in the City of Las Vegas, an incorporated portion of Clark County, Nevada. The project site is identified by the Assessors' Parcel Number (APN) 125-15-797-001. Please refer to the copy of the Assessor's Parcel Map provided in Appendix. Figure 1 in the appendix also shows the Vicinity Map for the subject site in relation to the surrounding streets.

The Original Study provided a conceptual design with technical hydraulic analysis for the conveyance facilities required to mitigate the offsite flows impacting the Bella Vista subdivision. These facilities mainly comprised of a reinforced grass lined channel within a 60' wide drainage easement in the alignment of Severance Lane referred to as the Severance Channel and another reinforced grass lined channel within a 64' wide drainage easement adjacent to Rainbow Boulevard and referred to as the Rainbow Boulevard Channel. The Severance Channel ties into the Rainbow Boulevard Channel near the intersection of Rainbow Boulevard and Severance Lane alignments. The Rainbow Boulevard Channel continues south to terminate at the northwest corner of the intersection of Rainbow Boulevard and Elkhorn Road. Then, a bubbler structure with two 66" storm drain connection to the end of the channel was constructed to drain the channel back to the surface and continue to discharge downstream of the intersection in the alignment of Elkhorn Road. An 18" RCP storm drain which discharges into the bubbler structure as well was also constructed as a part of the low flow and nuisance drainage system of the Rainbow Boulevard Channel. The combined design discharge conveyed by both channels to the bubbler structure was determined to be approximately 1,785 cfs during the 100-year, 6-hour storm event. The Severance Channel was designed to convey 933.50 cfs while the Rainbow Boulevard Channel upstream of the Severance Channel confluence was designed to convey 851.50 cfs. The subject facilities were designed and constructed as an interim solution to mitigate the flows impacting the proposed Bella Vista subdivision pending the construction of the aforementioned CCRFCD permanent facilities which have since then been fully installed and operational.

The "*Las Vegas Wash Middle Branch Final Design Report*" (CLV DS #4286) by VTN Nevada, constitutes the technical basis for the hydrology and hydraulic analysis of the CCRFCD Las Vegas Wash Middle Branch (LVMD) facilities and shall be referred to as the 'LVMD FDR'. Review of the LVMD FDR indicates that the offsite flows impacting the Rainbow Boulevard Channel from intersection of Whispering Sands Avenue have been completely eliminated and are now captured by a network of inlets to the existing dual 24'x8' RCB in Rainbow Boulevard. Likewise, flows conveyed by the Severance Channel currently consist of approximately 270 cfs during a 100-year, 6-hour storm event as estimated by the 'LVMD FDR'. Runoff in the Severance Channel was determined as the combination of outflows from Elkhorn Springs Detention Basin and subbasin NW150-C which includes the existing Bella Vista residential subdivision and the upstream portion of the Rainbow Boulevard Channel north of Severance Channel Confluence. The subject upstream channel area spans approximately 2.30 acres. For the purpose of this report, the upstream channel

area has been reanalyzed with the rational method as basin RBCN ($<1/3$ cfs) to determine local runoff impact if any. Please refer to the Drainage Basin Map (Sheet DR1) and the Rational Method Calculation provided in the appendix. Furthermore, a review of the "*Technical Drainage Study for Bella Vista North 80 Acres*" (DS #3047) by Lochsa Engineering also indicates that the combined onsite flows from the Bella Vista subdivision estimated at concentration point CMD9 (7/53 cfs) discharges into the Rainbow Boulevard near the confluence with the Severance Channel. Similarly, the "*Technical Drainage Study for Wyeth Ranch*" (DS #3046) by Pentacore, Inc., indicates that a portion of the onsite flows from the Wyeth Ranch subdivision estimated as concentration point CP-2 (8/25 cfs) discharges into the Severance Channel upstream of the confluence with the Rainbow Boulevard Channel. However, the total flows currently conveyed within the Rainbow Boulevard Channel downstream of the Severance Channel confluence as estimated by the LVMD FDR is approximately 270 cfs during the 100-year storm. Thus, the 100-year flow of 270 cfs has been adopted in order to provide a conservative revised hydraulic analysis of the Severance Channel. Furthermore, the "*Technical Drainage Study for Wyeth Ranch*" (DS #3046) by Pentacore, Inc., indicates that additional flows from the Wyeth Ranch subdivision discharges into the Rainbow Boulevard Channel downstream of the Severance Channel confluence. These additional flows were estimated as basin FUT-7 (3/13 cfs) and are conveyed to the Rainbow Boulevard Channel through a 30' wide drainage and utility easement. Hence, the total combined flows currently conveyed by the Rainbow Boulevard Channel downstream of Severance Channel confluence is approximately 283 cfs (i.e. $270+13$ cfs), during a 100-year storm event. This combined total flow in the Rainbow Boulevard Channel is significantly lower than the previous design capacity of the channel due to the upstream interception by the existing CCRFCD facilities. By comparison, the Rainbow Boulevard Channel flows have been reduced by approximately 84.15% from 1,785 cfs to 283 cfs. Thus, this report will re-examine the hydraulic characteristics of the channel and explore the potential for reclaiming and fill and/or removal of a portion of the reinforced grass lining within channel where possible.

The LVMD FDR provided a series of weirs with field NDOT Type 8 drop inlets at the upstream end of each weir to capture flows conveyed along the Rainbow Boulevard Channel downstream of the Severance Channel Confluence. The series of weirs/inlets were designed to capture the entire flows conveyed within the Rainbow Boulevard Channel. Since the channel flows have significantly reduced, a revised hydraulic analysis of the reinforced turf channel have been provided with the FlowMaster for the typical channel sections. The revised analysis for the Severance Channel indicates a flow depth of 2.60-feet and a velocity of 4.54 fps. Likewise, the analysis for the Rainbow Boulevard Channel indicates a flow depth of 1.14-feet and a velocity of 2.87 fps for the North Segment and a depth of 2.39-feet and a velocity of 4.53 fps for the South Segment. All the calculations indicate subcritical flow regimes with less than 1.0-feet of freeboard. However, considering the 1.0-feet minimum freeboard requirement per the CCRFCD HCDDM, the channels

still have sufficient capacity to convey the reduced flows as estimated. Thus, accounting for the required minimum freeboard along the channel segments, the minimum channel depths that must remain for the conveyance of flows are thus estimated as 2.14-feet, 3.39-feet and 3.60-feet for the Rainbow Boulevard (North and South Segments) and Severance Channels respectively. The design landscape plans for the proposed reclamation will be furnished by Jaramillo Landscape and Maintenance, LLC. Please see the attached copy of landscape plan provided in the appendix.

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 (CCRFCDD) illustrates the existing and proposed regional master planned facilities around the site as shown on Figure F-13. Review of the Master Plan Update, indicates portions of the Las Vegas Wash Middle facilities and the existing Elkhorn Detention Basin outfall facilities adjacent to the site. The CCRFCDD Master Plan Facilities are located in the alignments of Rainbow Boulevard and Severance way adjacent to the site. These Las Vegas Wash Middle facilities are identified as LVMD 2550 and LVMD 2525, while the Elkhorn Detention Basin Outfall facility is identified as EKDB 0000. The CCRFCDD Master Plan Update proposed LVMD 2550 and LVMD 2525 to consist of a 21’x6’ RCB. However, review of the LVMD FDR indicates that both facilities are constructed as a 24’x8’ RCB with discharge capacities of 2,063 cfs and 2,282 cfs respectively. The existing EKDB 0000 facilities adjacent to the site consists of a 15’ wide by 5.8’ deep grass lined channel with 3.5:1 side slopes and a design discharge capacity of 238 cfs. The revised analysis from the LVMD FDR indicates a discharge of approximately 270 cfs. This 100-year flow of 270 cfs has been utilized as the design basis to allow for the proposed turf conversion.

The project site is covered by Flood Insurance Rate Map (FIRM) for Clark County, Nevada, and incorporated areas, Community Panel Numbers: 32003C1765F and 32003C1745F, Effective Dates: November 16, 2011 and September 27, 2002 respectively. Review of the Flood Insurance Rate Maps the upstream end of Severance Channel that extends to Tenaya Way is located within panel 32003C1745F while the rest of the channel system is located within panel 3200C1765F. The Flood Insurance Maps also indicate that the entire channel system (site) is located within an area designated by FEMA as Zone “X” (unshaded). Zone “X” (unshaded) is described by FEMA as;

“Areas determined to be outside the 0.2% annual chance flood”.

Figure 2 in the Appendix illustrates the location of the site on a portion of the above referenced Flood Insurance Rate Maps.

The subject drainage study update is specifically provided to establish the current flows conveyed by interim Severance and Rainbow Boulevard Channels, and explore the potential for reclaiming or removal of a portion of the reinforced grass lining of the interim channels. A summary table of the

results of the hydraulic analysis with the current flow rates, channel flow depths and the freeboard calculations has been provided in the appendix. This update is in conformance to the original “*Offsite Master Stormwater Hydraulics Study for Bella Vista*” (DS #2954), and the “*Las Vegas Wash Middle Branch Final Design Report*” (CLV DS #4286). The site as previously designed is in accordance with the City of Las Vegas and the Clark County Departments of Public Works and the CCRFCD drainage design criteria, and is also based on generally accepted engineering practices. As previously stated, the minimum channel depths that must remain for the conveyance of flows are estimated as 2.14-feet, 3.39-feet and 3.60-feet for the Rainbow Boulevard and Severance Channels respectively. Thus, any proposed channel bank reclamation or turf conversion work can only be performed above these depths. The intended reclamation of the portions of the interim channels will not have any negative impact on the existing adjacent and downstream properties. Please refer to the attached landscape plans and details for further clarification of the proposed improvements.

If you have any questions or comments, please do not hesitate to contact our office at your earliest convenience.

Sincerely,
LOCHSA ENGINEERING

Stanley Okey Amadi, P.E.
Senior Project Engineer

HYDROLOGIC AND HYDRAULIC CALCULATIONS

*Rational Method Analysis for Basin RCBN

*FlowMaster Normal Depth Calculations with Typical Channel Sections

*Freeboard Calculations for the Typical Channel Sections

DEVELOPMENT:
CALCULATED BY:
PROJECT NUMBER:

Toscana Wyeth LMA Channel Turf Conversion
SOA
121098

DATE: Nov-12

RUNOFF DETERMINATION THROUGH MODIFIED RATIONAL METHOD
(McCarran Airport)
 $Q = K * C * I * A$
(R60E, T19S --- Section 15)

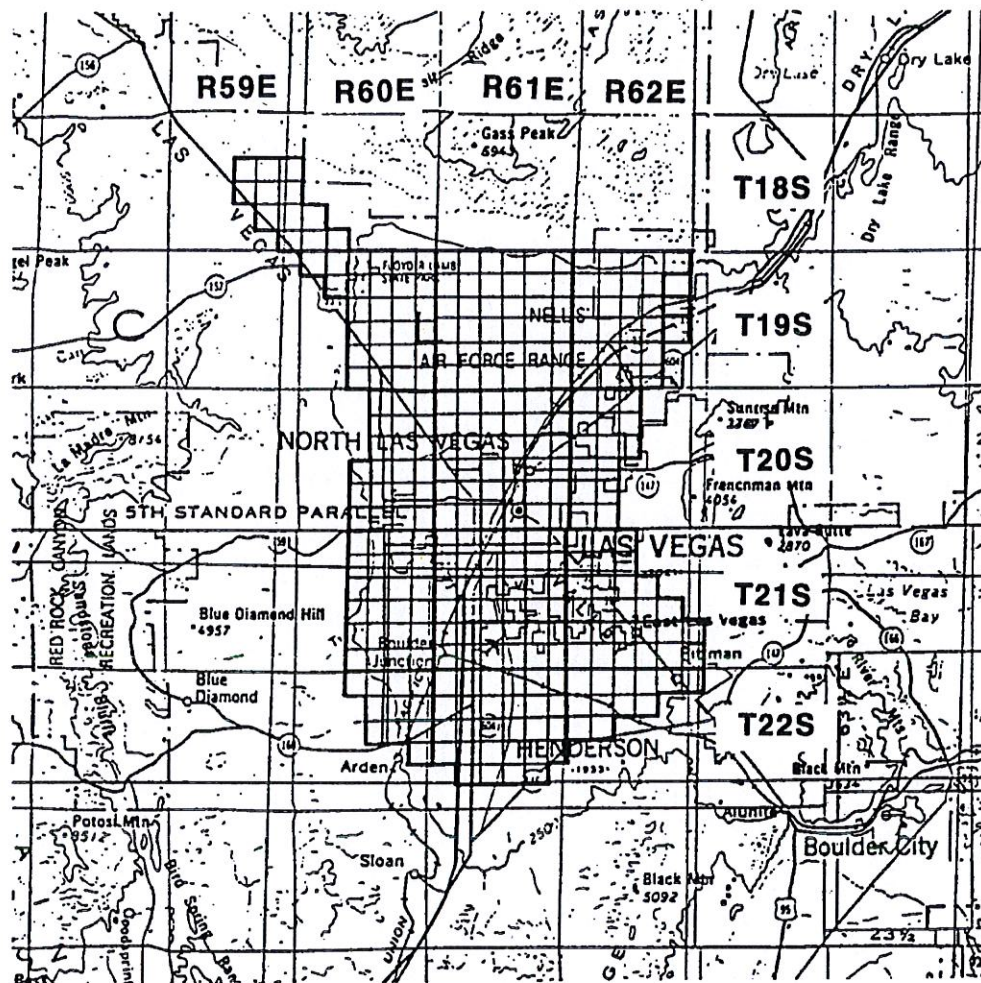
BASIN LABEL	10-Year Event				100-Year Event			
	Minimum Time of Concentration Tc (Minutes)	Runoff Coef. C	Avg. Rainfall Intensity I (inch/hour)	Area A (Acres)	Peak Flow Q (cfs)	Runoff Coef. C	Minimum Time of Concentration Tc (Minutes)	Avg. Rainfall Intensity I (inch/hour)
RBCN	5	0.10	4.20	2.300	0.483	0.30	5	7.56
					2.61			

* Note: k = CCRFCD Local Adjustment Factor = 0.50

K = Local adjustment factor for the Rational Method = 1.0 Per NDOT Standards.
TC = Minimum time of concentration is conservatively used. Per CCRFCD Manual Section 602 and 602.1, 10-minute is minimum for Non-Urban watershed, whereas a 5-minute minimum is used for urbanized areas.
C = Runoff Coefficient from Table 601 of the CCRFCD Hydrologic Criteria and Drainage Design Manual (HCDDM).
I = Average Rainfall Intensity (inches per hour) from Table 506 CCRFCD HCDDM (if within McCarran Airport), or per Section 507.20 & 507.30 (if outside McCarran Airport)
A = Basin Area (acres)
Q = Peak flow (cubic feet per second)

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

TIME-INTENSITY-FREQUENCY VALUES FOR McCARRAN AIRPORT RAINFALL AREA (IN INCHES PER HOUR)

TIME (min)	RECURRENCE INTERVAL					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
5	1.80	3.24	4.20	5.52	6.48	7.56
10	1.50	2.64	3.42	4.44	5.34	6.12
15	1.32	2.28	2.96	3.88	4.60	5.28
30	0.88	1.56	2.02	2.62	3.10	3.58
60	0.52	0.89	1.15	1.50	1.78	2.06

- NOTE: 1. Refer to Figure 513 for a description and drawing of the area included in the McCarran Airport Rainfall Area.
2. Table 501 adjustments not required.

Revision	Date

**WRC
ENGINEERING**

REFERENCE:

USACE, Los Angeles District, 1988

TABLE 506

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

RATIONAL FORMULA METHOD RUNOFF COEFFICIENTS AND AVERAGE PERCENT IMPERVIOUS AREA

LAND USE OR SURFACE CHARACTERISTICS	AVERAGE PERCENT IMPERVIOUS AREA	RUNOFF COEFFICIENTS			
		10-YEAR		100-YEAR	
		GRASS ¹	DESERT ²	GRASS ¹	DESERT ²
<u>Business and Commercial:</u>					
Downtown Areas	95	.88	.88	.89	.89
Neighborhood Areas	70	.70	.75	.80	.83
<u>Residential</u> (Average Lot Size):					
1/8 Acre or less (Multi-Unit)	65	.68	.73	.78	.80
1/4 Acre	38	.55	.62	.65	.74
1/3 Acre	30	.50	.57	.60	.70
1/2 Acre	25	.45	.53	.55	.67
1 Acre	20	.40	.49	.50	.64
2 Acre	12	.35	.45	.40	.60
<u>Industrial:</u>	72	.72	.76	.82	.84
<u>Open Space:</u> (Lawns, Parks, Golf Courses)	5	.10	-	.30	-
<u>Undeveloped Areas:</u> (Natural Vegetation)	0	-	.25	-	.50

<u>Streets and Roads:</u>					
Paved	100	.90		.93	
Gravel	20	.40		.50	
<u>Drives and Walks:</u>	95	.88		.89	
<u>Roofs:</u>	90	.85		.87	

Notes:

- ¹ Grass - Grassed Landscaping or Irrigated Vegetation
- ² Desert - Desert Landscaping or Natural Vegetation

Revision	Date

**WRC
ENGINEERING**

REFERENCE:

USDCM, DRCOG, 1969 (with modifications)

TABLE 601

Rainbow Boulevard Channel North Segment- Typical Section (100-Year)

Worksheet for Irregular Channel

Project Description	
Worksheet	Rainbow Boulevard Channel North Segment- Typical Section (100-Yea
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Slope	0.004000 ft/ft
Discharge	56.00 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	1.14 ft
Elevation Range	0.00 to 6.58
Flow Area	19.5 ft²
Wetted Perimeter	22.245 ft
Top Width	21.963 ft
Actual Depth	1.14 ft
Critical Elevation	0.80 ft
Critical Slope	0.015461 ft/ft
Velocity	2.87 ft/s
Velocity Head	0.13 ft
Specific Energy	1.27 ft
Froude Number	0.54
Flow Type	Subcritical

Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+00.00	0+64.00	0.030

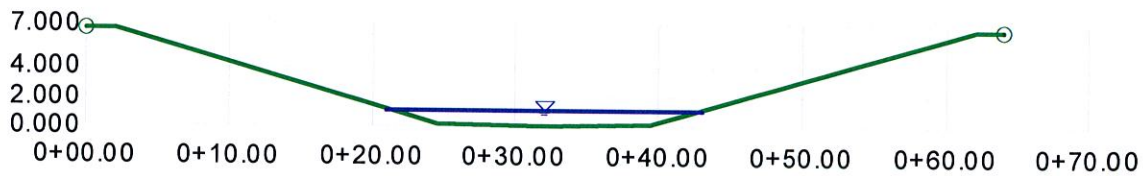
Natural Channel Points	
Station (ft)	Elevation (ft)
0+00.00	6.579
0+02.00	6.579
0+24.50	0.150
0+32.00	0.000
0+39.50	0.150
0+62.00	6.579
0+64.00	6.579

← Flow Depth in Channel = 1.14'
 Minimum Freeboard Rqd. = 1.0'
 Total Depth = 1.14 + 1.0 = 2.14'
 Thus channel depths of 2.14' must remain with reinforced turf.
 Channel Banks above 2.14' from the bottom of the channel can be reclaimed or converted.

Rainbow Boulevard Channel North Segment- Typical Section (100-Year) Cross Section for Irregular Channel

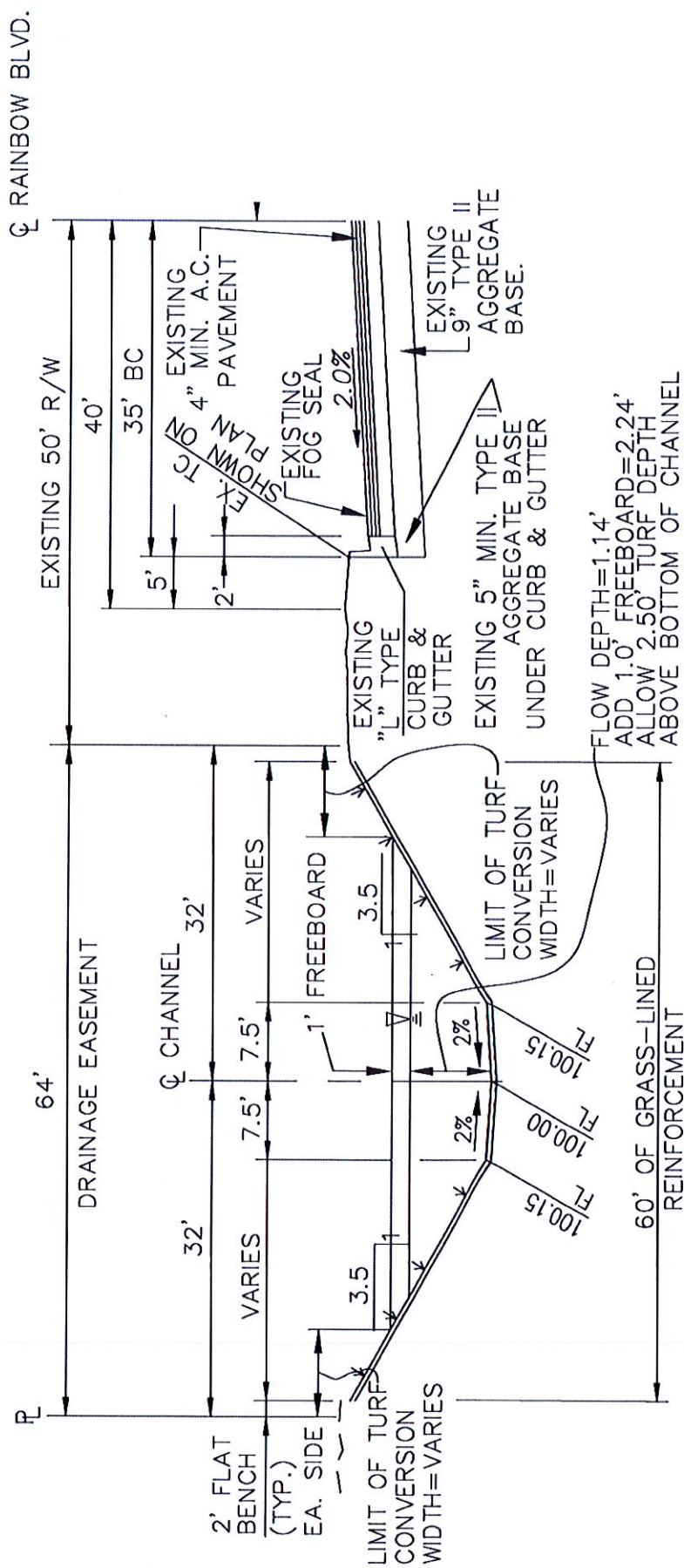
Project Description	
Worksheet	Rainbow Boulevard Channel North Segment- Typical Section (100-Yea
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data	
Mannings Coefficient	0.030
Slope	0.004000 ft/ft
Water Surface Elevation	1.14 ft
Elevation Range	0.00 to 6.58
Discharge	56.00 cfs



V:1
H:1
NTS

RAINBOW BLVD.- CHANNEL



TYPICAL SECTION-RAINBOW BLVD. NORTH CHANNEL

FROM STA. 10+65.27 TO 23+32.36

S.T.N.

Rainbow Boulevard Channel South Segment- Typical Section (100-Year)

Worksheet for Irregular Channel

Project Description	
Worksheet	Rainbow Boulevard Channel South Segment- Typical Section (100-Yea
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Slope	0.004000 ft/ft
Discharge	283.00 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	2.39 ft
Elevation Range	0.00 to 5.91
Flow Area	62.5 ft²
Wetted Perimeter	35.934 ft
Top Width	35.318 ft
Actual Depth	2.39 ft
Critical Elevation	1.79 ft
Critical Slope	0.012037 ft/ft
Velocity	4.53 ft/s
Velocity Head	0.32 ft
Specific Energy	2.71 ft
Froude Number	0.60
Flow Type	Subcritical

Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+00.00	0+64.00	0.030

Natural Channel Points	
Station (ft)	Elevation (ft)
0+00.00	5.910
0+02.00	5.910
0+22.00	0.200
0+32.00	0.000
0+42.00	0.200
0+62.00	5.910
0+64.00	5.910

← Flow Depth in Channel = 2.39'
 Minimum freeboard Req. = 1.0'
 Total depth = 2.39' + 1.0' = 3.39'
 Thus channel depth of 3.39' must remain
 with reinforced turf.
 Channel Banks above 3.39' from
 the bottom of the channel can be
 reclaimed or converted.

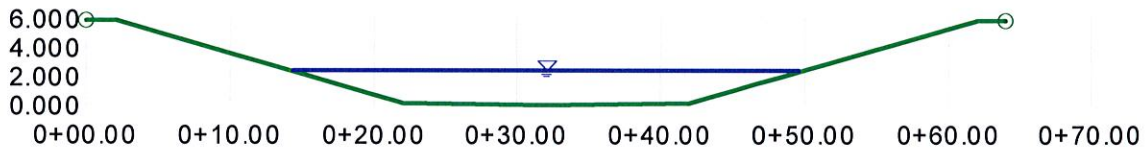
Rainbow Boulevard Channel South Segment- Typical Section (100-Year) Cross Section for Irregular Channel

Project Description

Worksheet	Rainbow Boulevard Channel South Segment- Typical Section (100-Yea
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

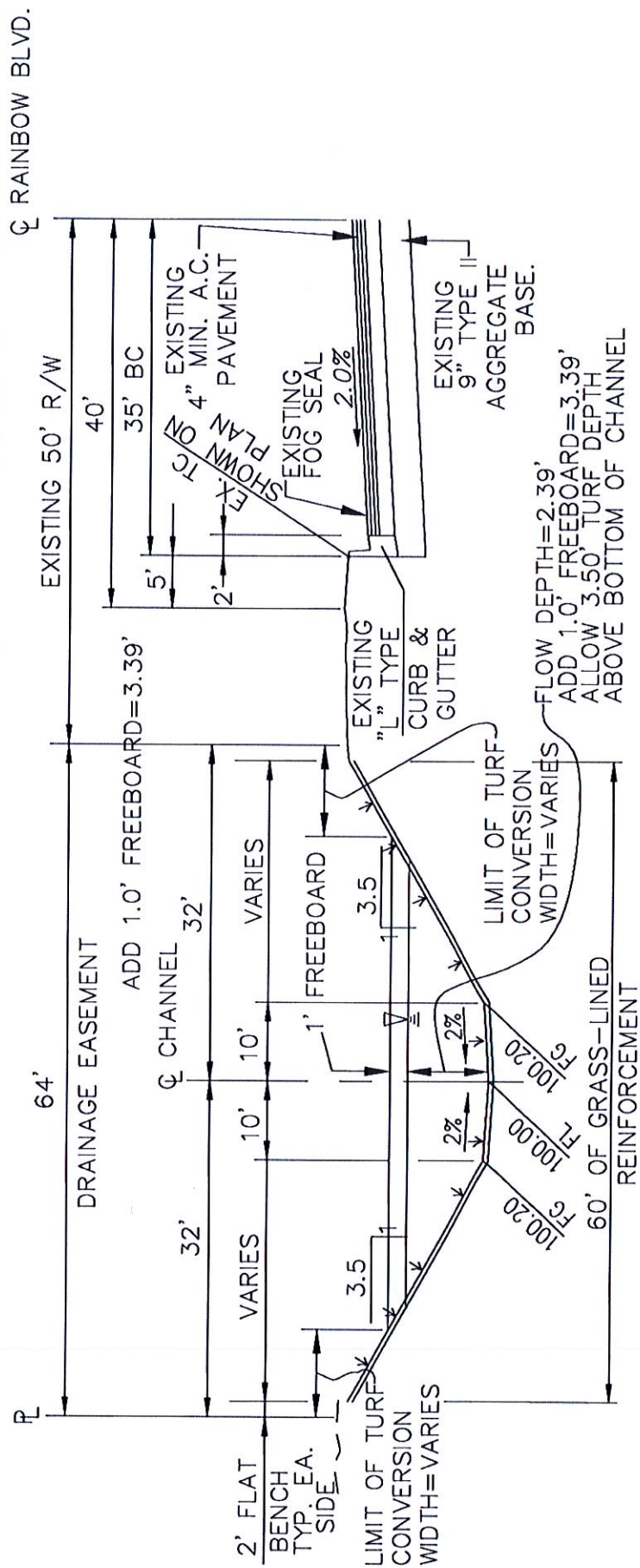
Section Data

Mannings Coefficient	0.030
Slope	0.004000 ft/ft
Water Surface Elevation	2.39 ft
Elevation Range	0.00 to 5.91
Discharge	283.00 cfs



V:1
H:1
NTS

RAINBOW BLVD.- CHANNEL



TYPICAL SECTION-RAINBOW BLVD. SOUTH CHANNEL

S.
T.
N.

FROM STA. 24+87.88 TO STA. 35+00.00

Severance Channel - Typical Section (100-Year) Worksheet for Irregular Channel

Project Description	
Worksheet	Severance Channel - Typical Section (100-Year)
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Slope	0.003800 ft/ft
Discharge	270.00 cfs

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

Results	
Mannings Coefficient	0.030
Water Surface Elevation	2.60 ft
Elevation Range	0.00 to 5.86
Flow Area	59.5 ft ²
Wetted Perimeter	32.782 ft
Top Width	32.047 ft
Actual Depth	2.60 ft
Critical Elevation	1.94 ft
Critical Slope	0.011921 ft/ft
Velocity	4.54 ft/s
Velocity Head	0.32 ft
Specific Energy	2.92 ft
Froude Number	0.59
Flow Type	Subcritical

Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+00.00	0+58.00	0.030

Natural Channel Points	
Station (ft)	Elevation (ft)
0+00.00	5.857
0+02.00	5.857
0+20.50	0.150
0+28.00	0.075
0+35.50	0.000
0+56.00	5.857
0+58.00	5.857

← Flow Depth in channel = 2.60'
 Minimum freeboard reqd. = 1.0'
 Total Depth = 2.60 + 1.0 = 3.60'
 Thus depth of 3.60' of channel
 must remain with reinforced turf.
 Channel Banks above 3.60' from
 the bottom of the channel can be
 reclaimed or converted.

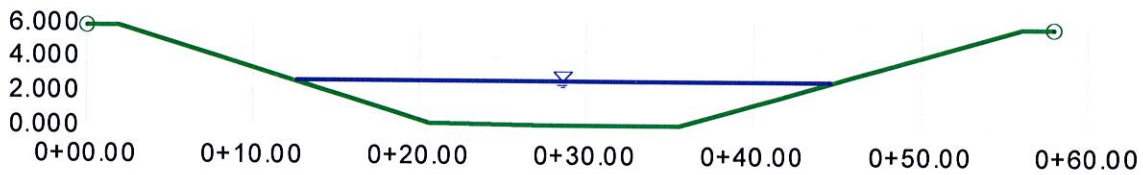
Severance Channel - Typical Section (100-Year) Cross Section for Irregular Channel

Project Description

Worksheet	Severance Channel - Typical Section (100-Year)
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data

Mannings Coefficient	0.030
Slope	0.003800 ft/ft
Water Surface Elevation	2.60 ft
Elevation Range	0.00 to 5.86
Discharge	270.00 cfs



V:1
H:1
NTS

60' PUBLIC DRAINAGE EASEMENT
TO BE PRIVATELY MAINTAINED BY H.O.A.



N.T.S.

Freeboard calculations for Rainbow Boulevard Channel (North Segment)

Toscana Wyeth Ranch LMA Turf Conversion

Typican Section

Calculated by: SOA

Section 706.1.3 of Hydrologic Criteria and Drainage Design Manual (HCDDM)

Equation 741: (Subcritical Flow)

$$Fb = 0.5 + V^2/2g$$

Solve equation 747 for Fb:

$$V = 2.87 \text{ ft/sec}$$

$$d = 1.14 \text{ ft}$$

$$Fb = 0.63 \text{ ft}$$

$$\text{Rqd. Min. Fb} = 1.00 \text{ ft} \quad (\text{CCRFCD HCDDM})$$

Freeboard calculations for Rainbow Boulevard Channel (South Segment)

Toscana Wyeth Ranch LMA Turf Conversion

Typican Section

Calculated by: SOA

Section 706.1.3 of Hydrologic Criteria and Drainage Design Manual (HCDDM)

Equation 741: (Subcritical Flow)

$$Fb = 0.5 + V^2/2g$$

Solve equation 747 for Fb:

$$V = 4.53 \text{ ft/sec}$$

$$d = 2.39 \text{ ft}$$

$$Fb = 0.82 \text{ ft}$$

$$\text{Rqd. Min. Fb} = 1.00 \text{ ft} \quad (\text{CCRFCD HCDDM})$$

Freeboard calculations for Severance Channel

Toscana Wyeth Ranch LMA Turf Conversion

Typican Section

Calculated by: SOA

Section 706.1.3 of Hydrologic Criteria and Drainage Design Manual (HCDDM)

Equation 741: (Subcritical Flow)

$$Fb = 0.5 + V^2/2g$$

Solve equation 747 for Fb:

$$V = 4.54 \text{ ft/sec}$$

$$d = 2.60 \text{ ft}$$

$$Fb = 0.82 \text{ ft}$$

$$\text{Rqd. Min. Fb} = 1.00 \text{ ft} \quad (\text{CCRFCD HCDDM})$$

FIGURES

*Assessors Parcel Map (APN) for the Project Site

*Vicinity Map

*Flood Insurance Rate Map

*Mater Plan Update Figures H-13 and F-13 with Facilities Table

*Drainage Basin Map (Sheet DR1) for Basin RBCN

*Architectural Landscape Plan for Turf Conversion

NOTES

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 WHEN MAP REDUCED FROM 1:111,000 ORIGINAL

MAP LEGEND

- PARCEL BOUNDARY
- SUB BOUNDARY
- PMAD BOUNDARY
- ROAD EASEMENT
- HISTORIC LOT LINE
- HISTORIC SUB BOUNDARY
- SECTION LINE
- CONDOMINIUM UNIT
- AIR SPACE PCL
- RIGHT OF WAY PCL
- 202 PARCEL SUB/REG NUMBER
- P8 24-45 PLAT RECORDING NUMBER
- 5 BLOCK NUMBER
- 5 LOT NUMBER
- 6.5 GOV LOT NUMBER

ASSESSOR'S PARCELS - CLARK CO., NV.
Michelle W. Shafer - Assessor

BOOK **T19S R60E**

SEC. **15**

MAP **N 2 SE 4**

125-15-7

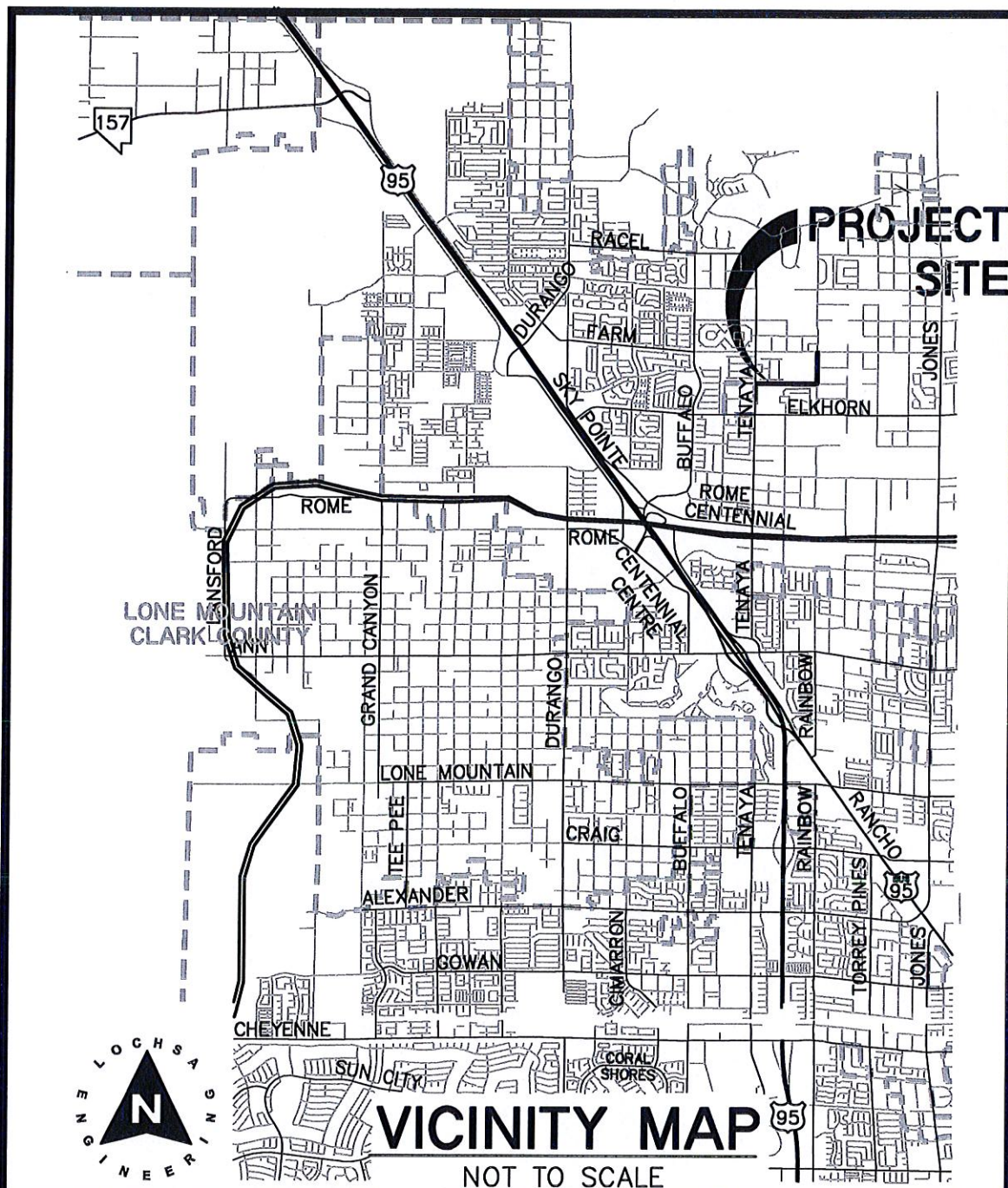


Scale: 1" = 200' Rev: 02/09/2011

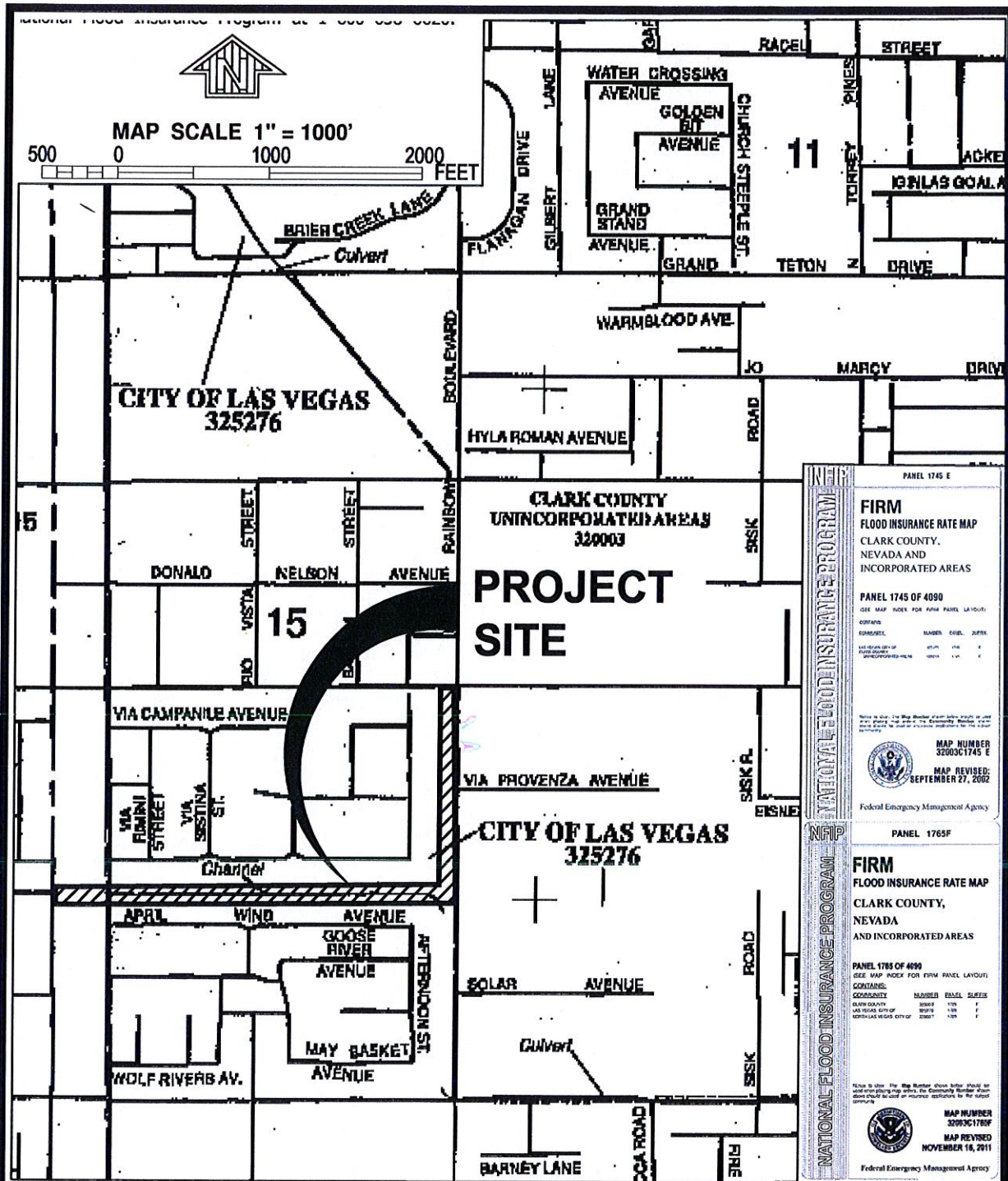


TAX DIST 200

Handwritten note: 200-001



DRAWN BY: SOA	SCALE: N.T.S.	VICINITY MAP (FIGURE 1)	PROJECT No.:
CHECKED BY: HMN	DATE: 11/08/12		121098
 6345 South Jones Blvd. Suite 100 Las Vegas, NV 89118 Phone (702) 365-9312 - Fax (702) 365-9317		TOSCAN WYETH LMA CHANNEL TURF CONVERSION	SHEET No. V-M SHEET 1 OF 1



DRAWN BY: SOA SCALE: 1"=1000'

CHECKED BY: HMN DATE: 11/08/12

Lochsa
engineering

6345 South Jones Blvd. Suite 100
Las Vegas, NV 89118
Phone (702) 365-9312 - Fax (702) 365-9317

FLOOD INSURANCE RATE MAP (FIGURE 2)

**TOSCANA WYETH LMA
CHANNEL TURF CONVERSION**

PROJECT No.:

121098

SHEET No.

F-M

SHEET 1 OF 1

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 1745 E

FIRM
FLOOD INSURANCE RATE MAP
CLARK COUNTY,
NEVADA AND
INCORPORATED AREAS

PANEL 1745 OF 4090
SEE MAP INDEX FOR FIRM PANEL LAYOUT

CONTRACT	NUMBER	DATE	SHEET
CLARK COUNTY	1745	1/18/02	1
CLARK COUNTY	1745	1/18/02	2

MAP NUMBER
329003/1745 E

MAP REVISED
SEPTEMBER 27, 2002

Federal Emergency Management Agency

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 1765F

FIRM
FLOOD INSURANCE RATE MAP
CLARK COUNTY,
NEVADA
AND INCORPORATED AREAS

PANEL 1765 OF 4090
SEE MAP INDEX FOR FIRM PANEL LAYOUT

CONTRACT	NUMBER	DATE	SHEET
CLARK COUNTY	1765	1/18/02	1
CLARK COUNTY	1765	1/18/02	2

MAP NUMBER
329003/1765F

MAP REVISED
NOVEMBER 18, 2011

Federal Emergency Management Agency



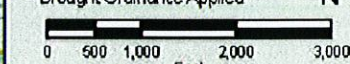
Ultimate Development Boundary
 Watershed Boundary
 Subbasin Boundary
 Drought Ordinance Boundary
 Flow Arrows

- Existing Facilities
- Category A Proposed Facilities
- Category B Proposed Facilities
- Category A Remove & Replace/
Parallel Facilities
- Category B Remove & Replace/
Parallel Facilities

- | Type | Hydrologic Soil Groups |
|------|-------------------------------------|
| A | Low Runoff Potential |
| B | Moderately Low Runoff Potential |
| C | Moderately High Runoff Potential |
| D | High Runoff Potential/Rock Outcrops |

1	Undeveloped Land, Open Desert
2	Parks, Golf Courses
3	Rural
4 / 14*	Low Density Residential
5 / 15*	Medium Density Residential
6 / 16*	High Density Residential
7 / 17*	Public Facility, Residential
8 / 18*	Very High Density Residential
9 / 19*	Commercial, Retail, Casino, High Rise Condominiums
10 / 20*	Light Industrial
11 / 21*	Heavy Industrial
12 / 22*	Schools
13	Lakes

* Drought Ordinance Applied



Feet
Scale: 1 inch = 2,000 feet

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

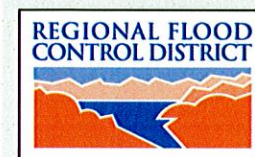


ID / River Mile	Status	Facility Description	Length (ft.)	Flow (cfs)	HEC-1 Node	HEC-1 Model	Tributary Area (sq.mi.)	Channel Slope (%) **
BCHU		BELTWAY CHANNEL - HUALAPAI						
0000	E	12' X 5' RCAP	853	501	CBA3-C	WEST3	0.84	1.11
0017	E	8' X 5' RCAP	1216	501	CBA3-C	WEST3	0.84	1.33
0040	E	66" RCP	60	222	DNW26-C	WEST3	0.51	1.04
0042	E	60" RCP	615	222	DNW26-C	WEST3	0.51	1.42
0054	E	54" RCP	770	222	DNW26-C	WEST3	0.51	1.23
BRDB		BRENT DRAINAGE SYSTEM						
0000	P3	36" RCP with 18" Orifice Plate	2170	37	BRDB	WEST3	2.48	0.40
0031	P3	45,080 cfs PMF Spillway		45080	CBRDB	WEST3	2.48	
0032	P3	450 ac-ft South Environmental Enhancement Area		1902	CBRDB	WEST3	2.48	
0033	P3	Energy Dissipator	100	957	CNW113-C	WEST3	1.58	
0043	P1	8' X 6' RCB	2920	957	CNW113-C	WEST3	1.58	2.10
0107	P1	8' X 6' RCB	2660	957	CNW113-C	WEST3	1.58	2.40
0157	P1	12' X 6' RCB	1260	741	CNW96-C	WEST3	0.95	0.25
CN95		CENTENNIAL PKWY CHANNEL WEST / U.S. 95 BRANCH						
0000	P2	Conc Chnl 22W 10'D 0:1 SS	2690	3340	CNWBB3-C	WEST3	3.36	2.17
0068	P1	3' X 8' 7" RCB	3380	3216	CNW103-C	WEST3	3.05	2.12
0102	P1	3' X 8' 6" RCB	1710	2888	2CNW89-C	WEST3	2.66	2.09
0167	P1	2' X 10' 6" RCB	1580	2160	2CNW71-E	WEST3	1.64	1.50
0199	P3	Conc Chnl 15W 11'D 0:1 SS	1015	1609	2CNW72-C	WEST3	1.17	0.82
0218	P3	16' X 8' RCB	556	1609	2CNW72-C	WEST3	1.17	0.77
0257	P3	Transition Structure	100	1609	2CNW72-C	WEST3	1.17	0.77
0259	P3	16' X 8' RCB	2848	674	CNW74-C	WEST3	0.45	2.06
0313	P3	Transition Structure	240	674	CNW74-C	WEST3	0.45	1.50
0318	P3	14' X 6' RCB	797	333	NW62-S	WEST3	0.21	1.47
0333	P3	12' X 6' RCB	300	333	NW62-S	WEST3	0.21	5.50
CNGT		CENTENNIAL PKWY CHANNEL WEST / GRAND TETON BRANCH						
0000	P3	10' X 5' RCB	2290	600	CNW71-E	WEST3	0.47	2.63
0043	P0	6' X 6' RCB	3980	600	CNW71-E	WEST3	0.47	3.00
0118	E	6' X 5' RCAP	5472	363	KYLEDET*	KYLEDB	57.73	3.72
CNKC		CENTENNIAL PKWY CHANNEL WEST / KYLE CANYON BRANCH						
0000	E	12' X 4' RCB	377	999	CNW72-C	WEST3	0.71	4.58
0007	E	10' X 5' RCB	874	999	CNW72-C	WEST3	0.71	3.28
0024	E	8' X 5' RCB	1385	999	CNW72-C	WEST3	0.71	2.40
0050	P0	6' X 6' RCB	2830	999	CNW72-C	WEST3	0.71	3.00
0104	P0	6' X 5' RCB	565	452	NW45-S	WEST3	0.27	3.00
0115	P0	72" RCP	1513	452	NW45-S	WEST3	0.27	3.00
CNWE		CENTENNIAL PKWY CHANNEL WEST						
0150	P2	Conc Chnl 42W 10'D 0:1 SS	720	4233	CNW3B3-C	WEST3	5.64	0.40
0173	P2	42' X 10' RCBC @ Torrey Pines	190	4233	CNW3B3-C	WEST3	5.64	0.40
0176	P2	Conc Chnl 32W 12'D 0:1 SS	795	4233	CNW3B3-C	WEST3	5.64	0.40
0189	P2	Conc Chnl 32W 10'D 0:1 SS	1845	4067	CNW2D4-C	WEST3	5.15	0.54
0226	P2	Conc Chnl 12W 12'D 2:1 SS	1165	4067	CNW2D4-C	WEST3	5.15	1.00
0251	P2	Conc Chnl 12W 12'D 2:1 SS	1135	3951	CNW2D3-C	WEST3	4.65	0.59
0271	P2	Conc Chnl 32W 10'D 0:1 SS	185	3951	CNW2D3-C	WEST3	4.65	0.59
0274	E	32' X 10' RCBC @ Tenaya	130	3951	CNW2D3-C	WEST3	4.65	0.45
0277	P2	Conc Chnl 13W 10'D 2:1 SS	590	3951	CNW2D3-C	WEST3	4.65	0.45
0287	P2	Conc Chnl 13W 10'D 2:1 SS	605	3593	CNW2B2-C	WEST3	3.84	1.19
0301	P2	Conc Chnl 32W 10'D 0:1 SS	235	3593	CNW2B2-C	WEST3	3.84	1.19
0304	P2	32' X 10' RCB	6510	3593	CNW2B2-C	WEST3	3.84	1.75
EKBU		ELKHORN SPRINGS AND BUFFALO						
0000	P1	78" RCP	860	375	NW134-C	WEST3	0.46	1.00
EKDB		ELKHORN SPRINGS DETENTION BASIN						
0000	E	Grass Chnl 15W 5.8'D 3.5:1 SS	2575	238	CNW150-C	WEST3	1.41	0.39
0025	E	4' X 3' RCB	160	120	ELKBASIN	WEST3	0.84	0.50
0026	E	48" RCP	1270	120	ELKBASIN	WEST3	0.84	1.23
0049	E	60" RCP	1095	120	ELKBASIN	WEST3	0.84	0.13
0070	E	48 ac-ft Elkhorn Springs Detention Basin		629	CNW133-C	WEST3	0.84	
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
EKHU		ELKHORN AND HUALAPAI						
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
LYMD		LAS VEGAS WASH - MIDDLE						
2490	P2	2' X 13' X 7' RCB	2555	2278	CNW168-C	CWEST3	4.69	0.40
2507	E	2' X 13' X 9' RCB	2831	2278	CNW168-C	CWEST3	4.69	0.36
2525	P1	21' X 6' RCB	1140	1913	CNW159-C	CWEST3	3.91	0.40
2550	P1	21' X 6' RCB	1445	1664	CD161-C	CWEST3	3.41	0.40
2574	P1	21' X 6' RCB	1430	1664	CD161-C	CWEST3	3.41	0.60
2599	P1	Conc Chnl 30W 5'D 2:1 SS	1577	1585	CNW162-C	CWEST3	3.08	0.40
2632	P1	13' X 5' RCB	1580	968	CNW138-C	WEST3	1.16	0.59
2661	P1	11' X 5' RCB	2640	968	CNW138-C	WEST3	1.16	1.00
2711	P1	8' X 5' RCB	1320	968	CNW138-C	WEST3	1.16	1.80
2737	P1	8' X 5' RCB	1320	818	CNW139-C	WEST3	0.93	1.81
2763	P1	78" RCP	1320	818	CNW139-C	WEST3	0.93	2.40
MOFA		MOCCASIN - FORT APACHE						
0024	P0	12' X 6' RCB	1520	394	DNW100-W	LOWER3	0.46	0.25
0053	P0	10' X 6' RCB	1345	258	DNW78-C	LOWER3	0.24	0.25
MOKY		MOCCASIN - KYLE CANYON BRANCH						
0078	P0	2' X 13' X 7' RCB	965	1205	CNW50-E	LOWER3	1.06	0.40
0096	P0	2' X 13' X 7' RCBC @ US 95	210	1066	CNW35-C	LOWER3	0.89	1.70
0100	P0	2' X 13' X 7' RCB	1515	1066	CNW35-C	LOWER3	0.89	0.40
0129	P0	2' X 11' X 7' RCB	675	779	CNW33-C	LOWER3	0.64	0.40
0142	P0	2' X 9' X 7' RCB	430	779	CNW33-C	LOWER3	0.64	0.40
MSNV		MOUNTAIN SPAMSTA RANCH						
0000	E	6' X 12' X 5' RCBC @ Grand Teton	273	679	CNW163-C	CWEST3	1.67	0.40
0005	E	Grass Chnl 100W 4.5'D 10:1 SS	6325	679	CNW163-C	CWEST3	1.67	0.40
0125	E	Grass Chnl 100W 4.5'D 10:1 SS	1300	116	CNW147-E	WEST3	1.54	0.40
RACO		RACEL STREET COLLECTOR						
0000	P3	96" RCP Baffled Energy Dissipator	54	497	CNW111S	WEST3	0.55	4.20
0001	P3	78" RCP	3245	497	CNW111S	WEST3	0.55	2.46
0064	P3	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 12W 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 12W 6' 8"D 0:1 SS	2660	1040	CMNA1	WEST3	1.32	3.44
0096	E	1' X 10' X 6' and 1' X 6' RCBC @ Hualapai Way	190	1040	CMNA1	WEST3	1.32	1.93
0100	E	Conc Chnl 12W 5.5'D 0:1 SS	2085	598	CDMNA1	WEST3	0.48	2.88
0140	E	Conc Chnl 10W 5'D 0:1 SS	2155	598	CDMNA1	WEST3	0.48	1.65
RCHB		RANCHO ROAD SYSTEM - BELTWAY						
0034	E	Conc Chnl 21W 8'D 0:1 SS	1000	2631	CNW1C-W	WEST3	4.68	1.19
0053	E	2' X 12' X 8' RCBC @ South Ramp Connector	85	2304	CDW1C1	WEST3	4.31	1.40
0054	E	Conc Chnl 21W 8'D 0:1 SS	432	2304	CDW1C1	WEST3	4.31	1.51
0062	E	Transition Structure	130	2304	CDW1C1	WEST3	4.31	1.51
0065	E	24' X 7' RCB	480	2304	CDW1C1	WEST3	4.31	0.30
0074	E	24' X 6' RCB	50	2226	CNWBC6-C	WEST3	4.17	0.30
0075	E	20' X 6' RCBC @ Beltway	428	2226	CNWBC6-C	WEST3	4.17	2.81
0083	P2	20' X 6' RCB	950	2226	CNWBC6-C	WEST3	4.17	2.49
0101	P2	Conc Chnl 20W 7'D 0:1 SS	980	2226	CNWBC6-C	WEST3	4.17	2.38
0120	E	20' X 6' RCBC @ Grand Montecito	120	2226	CNWBC6-C	WEST3	4.17	1.00
RCHB		RANCHO ROAD SYSTEM - BELTWAY						
0122	P2	Conc Chnl 16' 20W 6'D 0:1 SS	350	2226	CNWBC6-C	WEST3	4.17	1.84
0130	P2	Conc Chnl 16W 6'D 0:1 SS	1012	2226	CNWBC6-C	WEST3	4.17	2.67
0149	P2	Conc Chnl 16W 6' 7"D 0:1 SS	87	1888	CNWBC3	WEST3	3.75	2.27
0151	P2	Conc Chnl 16W 7'D 0:1 SS	1255	1888	CNWBC3	WEST3	3.75	2.65
0171	E	16' X 6' RCBC @ El Capitan Way	234	1888	CNWBC3	WEST3	3.75	1.75
0175	E	Conc Chnl 14W 7'D 0:1 SS	1220	1888	CNWBC3	WEST3	3.75	2.93
0198	E	Conc Chnl 14W 7'D 0:1 SS	225	1402	CNWBA6-C	WEST3	3.61	2.93
0227	P1	11' X 8' RCB	1885	1402	CNWBA6-C	WEST3	3.61	2.17
0250	P1	11' X 8' RCB	3200	1402	CNWBA6-C	WEST3	3.61	1.06
0295	P1	7' X 6' RCB	5525	973	CNW68-C	WEST3	1.75	3.30
TSDB		TULE SPRINGS DRAINAGE SYSTEM						
0000	E	2' X 10' X 4' RCBC @ Echo Grande	100	26	TULEDB	WEST3	1.35	1.04
0002	P3	36" RCP with 22" Orifice Plate	320	26	TULEDB	WEST3	1.35	0.33
0010	P3	14,013 cfs PMF Spillway		14013	CTULEDB	WEST3	1.35	
0011	P3	117 ac-ft North Environmental Enhancement Area		804	CTULEDB	WEST3	1.35	
0012	P3	Energy Dissipator	260	376	CNW148-C	WEST3	0.52	
0023	P1	84" RCP	1320	376	CNW148-C	WEST3	0.52	0.80
0059	P1	78" RCP	2640	376	CNW148-C	WEST3	0.52	1.03

* The HEC-1 node shown identifies the controlling concentration point for the associated facility and is located upstream of this facility due to decreasing peak flow with increasing tributary area caused by storm distribution transitions, depth area reduction factors, or attenuation of flow from routing.

** As-built or design slopes were used when available. All other slopes are based on existing topography. The user should verify the facility slope listed prior to performing any facility specific analysis.

* For parallel facilities, the existing facility flow equals its normal depth capacity, and the proposed parallel facility flow equals the remaining flow (i.e., HEC-1 Node flow = existing facility normal depth capacity + proposed parallel facility flow).

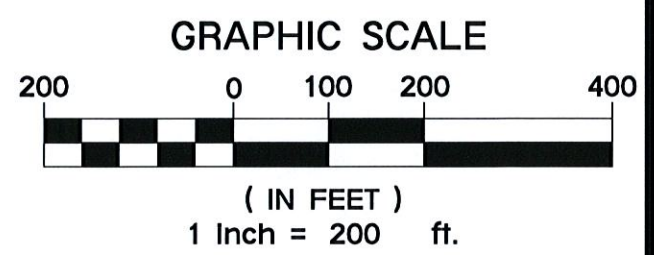
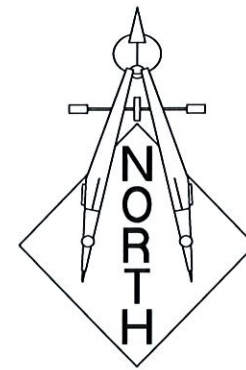
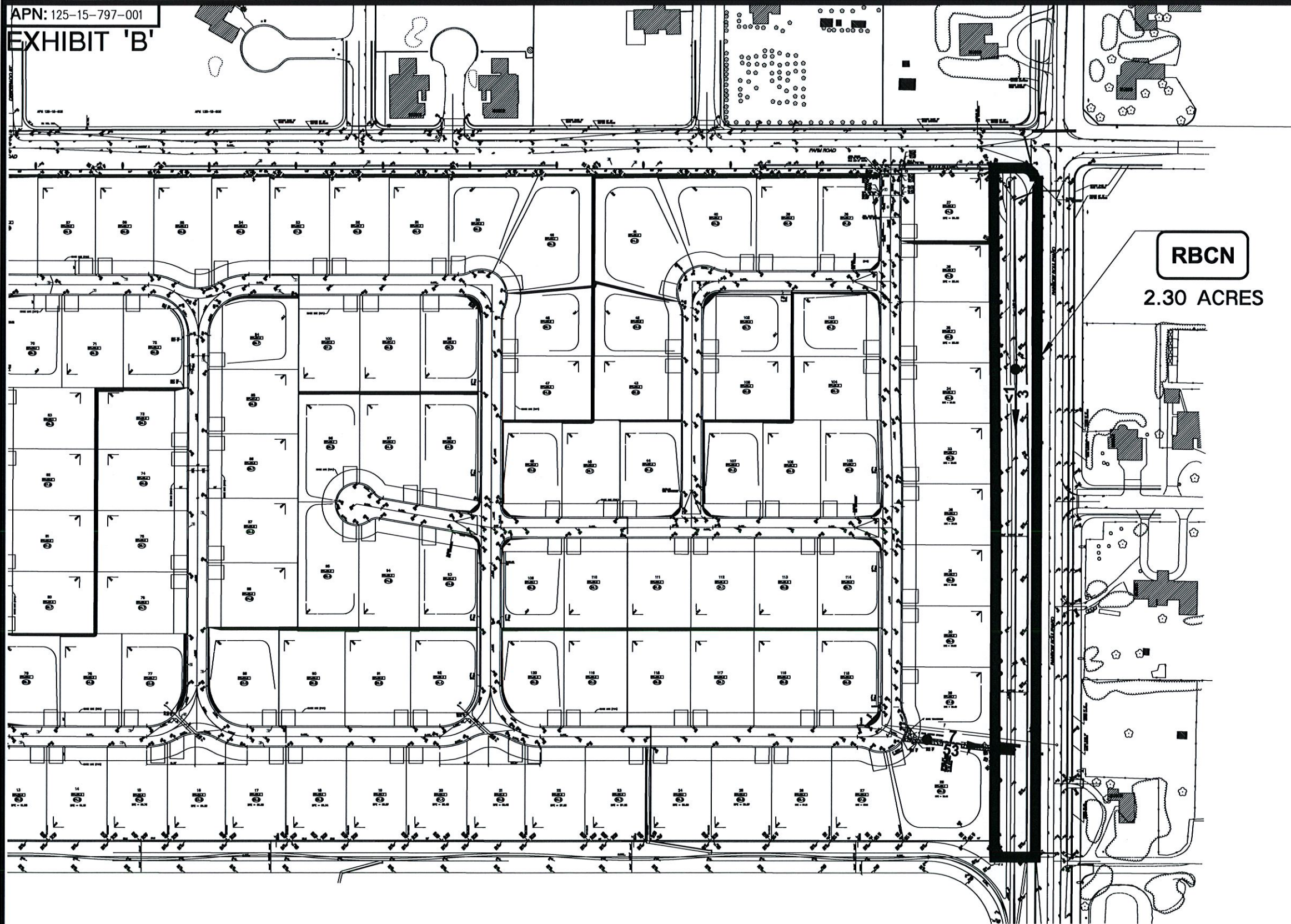


2008 LAS VEGAS VALLEY FLOOD CONTROL MASTER PLAN UPDATE FACILITY INVENTORY FIGURE F - 13

L	ID (Facility Identifier)	AABB
E	Parent Stream Name	
G	Stream Name	
E	River Mile	0000
N	Distance Above Confluence	
D	with Parent Stream (Miles)	
	Miles in Hundredths	

Existing Facility.....	E	Bottom
------------------------	---	--------

APN: 125-15-797-001
EXHIBIT 'B'



DRAINAGE LEGEND	
ND1	DRAINAGE BASIN LABEL
•	CONCENTRATION POINT
CMD1	COMBINATION POINT
—	BASIN BOUNDARY LINE
○	STORAGE POINT
SUMP-1 1 (1.0)(1.2) 1 (1.0)(1.2)	Q10 (V10)(D10) Q100 (V100)(D100)
2 3	Q10 FLOW IN CFS (10 YR.) Q100 FLOW IN CFS (100 YR.)
→	FLOW DIRECTION
1D	HYDRAULIC CROSS-SECTION
HEC-RAS	
—	HEC-RAS CONTROL LINE
—	LIMITS OF FEMA ZONE "A"
100	HEC-RAS CROSS-SECTION AND STATION NUMBER
—	100 YR. WATER SURFACE ELEV.

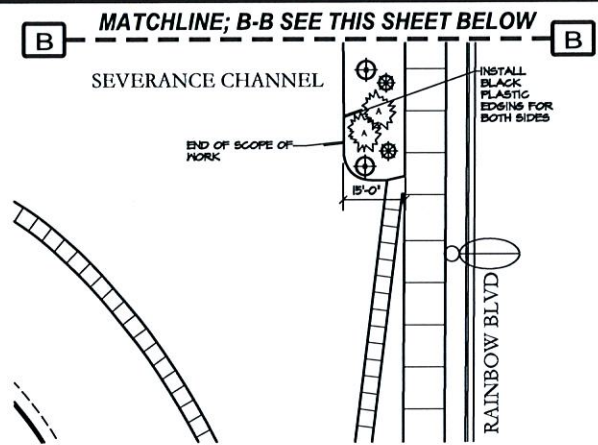
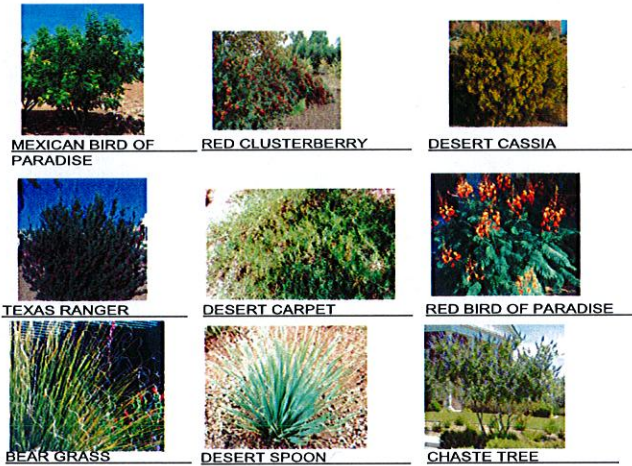
DRAWN BY: S.O.A.	SCALE: 1"=200'	FILE NAME: 121098-101-DR.dwg
CHECKED BY: H.M.N.	DATE: 11/06/12	LEGEND
LOCHSA ENGINEERING 6345 SOUTH JONES BLVD., SUITE 100 LAS VEGAS, NV 89118 P: 702 365-9312, F: 702 365-9317		FOUND MONUMENTATION
		CENTER LINE
		ROW LINE
		EASEMENT LINE
		SECTION LINE
		PROPERTY LINE
		ADJACENT PROPERTY LINE

ONSITE DRAINAGE BASIN MAP
(PROPOSED CONDITION)

TOSCANA WYETH LMA
CHANNEL TURF CONVERSION

PROJECT No.:
121098

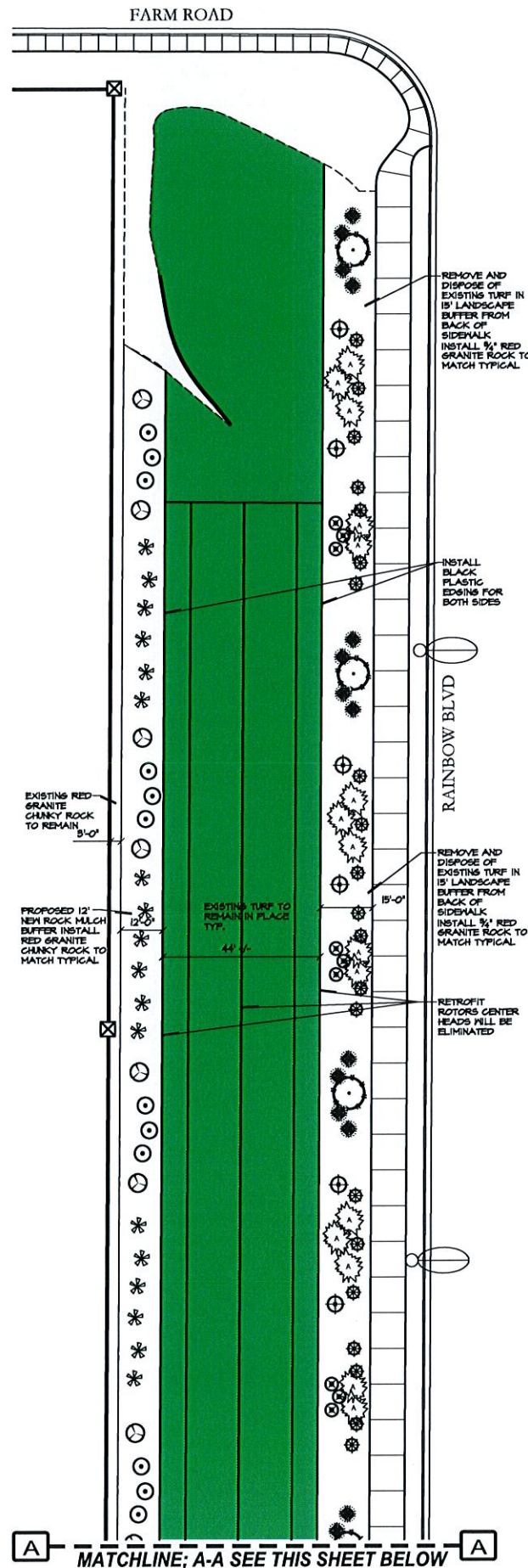
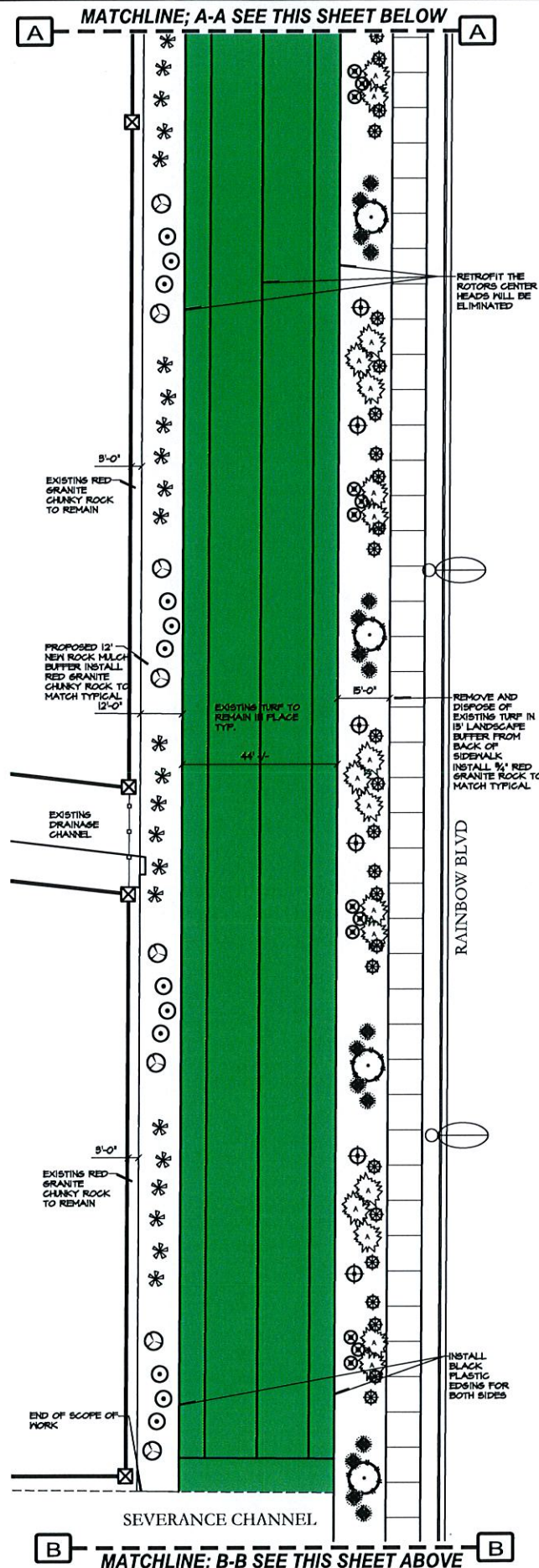
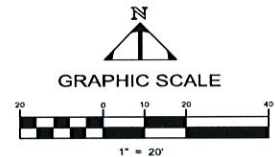
SHEET No.
DR1
SHEET 1 OF 1



MATERIAL LEGEND XERISCAPE

SYMBOL	BOTANICAL NAME	COMMON NAME	SIZE	QTY.
	Caesalpinia mexicana SNWA CC 28	Mexican Bird of Paradise	5 Gal.	24
	Cotoneaster lacteus SNWA CC 28	Red Clusterberry	5 Gal.	66
	Senna nemophila SNWA CC 28	Desert Cassia	5 Gal.	36
	Leucophyllum langmaniae Green Cloud SNWA CC 28	Green Cloud Texas Ranger	5 Gal.	30
	Acacia redolens 'Desert Carpet' SNWA CC 113	Desert Carpet Acacia	5 Gal.	52
	Caesalpinia pulcherrima SNWA CC 28	Red Bird of Paradise	5 Gal.	22
	Nolina bigelovii	Bear Grass	5 Gal.	44
	Dasylirotr wheeleri SNWA CC 28	Desert Spoon	5 Gal.	72
	Pistacia chinensis SNWA 530 Standard	Chinese Pistache	24" Box	11

- NOTE:
1. Remove and dispose of 32,984 s.f. of existing turf.
 2. Install 175 tons of red granite chunky rock to match existing as close as possible.
 3. Install 160 tons of 3/4" red granite to match existing as close as possible.
 4. Retrofit rotors center heads will be eliminated.
 5. Install 2538 l.f. of black plastic edging around new turf areas.



LANDSCAPE PLANS
TOSCANA WYETH LMA

JOB: TOSCANA WYETH LMA
FARM AND RAINBOW

Jaramillo LANDSCAPE & MAINTENANCE, LLC
"Our Work Is Our Reference"
8775 SOUTH JONES BLVD.
LAS VEGAS, NV 89123
PH: 702.251.0071
FAX: 702.251.0099

XERISCAPE CONVERSION
PLANTING PLAN

KUC
DESIGNED BY:

KUC
DRAWN BY:

April 25, 2012
DATE:

L1.0
SHEET:

REFERENCES

**“Las Vegas Wash Middle Branch Final Design Report”* (CLV DS #4286)

**“Technical Drainage Study for Bella Vista North 80 Acres”* (DS #3047)

**“Technical Drainage Study for Wyeth Ranch”* (DS #3046)

DS #:

DS 4286

APN:

125-23-199-001

PROJECT:

LAS VEGAS WASH MIDDLE BRANCH STORM DRAIN
RAINBOW STORM DRAIN - ELKHORN TO GRAND TETON.

SUBMITTAL:

— 2ND SUBMITTAL
FINAL DESIGN REPORT

SCANNED BY/DATE:

CHECKED BY/DATE:



Las Vegas Wash Middle Branch

Rainbow Storm Drain
Elkhorn to Grand Teton



July 2008

prepared for



pr

Final Design Report for the

Las Vegas Wash Middle Branch

**Rainbow Storm Drain
Elkhorn to Grand Teton**

July 2008

Prepared for



City of Las Vegas

Prepared by



W.O. #6952



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1.0 INTRODUCTION

1.1 STUDY OVERVIEW AND PURPOSE

On December 5, 2007, VTN received a Notice To Proceed (NTP) for the *Las Vegas Wash Middle Branch – Rainbow Storm Drain, Elkhorn to Grand Teton*, herein referred to as the Rainbow Storm Drain. The Rainbow Storm Drain is described in the 2002 Master Plan Update (MPU) as Facility Numbers LVMD 2525 through LVMD 2599. There have been several Master Plan Amendments (MPA) to the 2002 MPU. The hydrology for this project is based on the MPA for the Las Vegas Wash Middle Branch dated December 6, 2004.

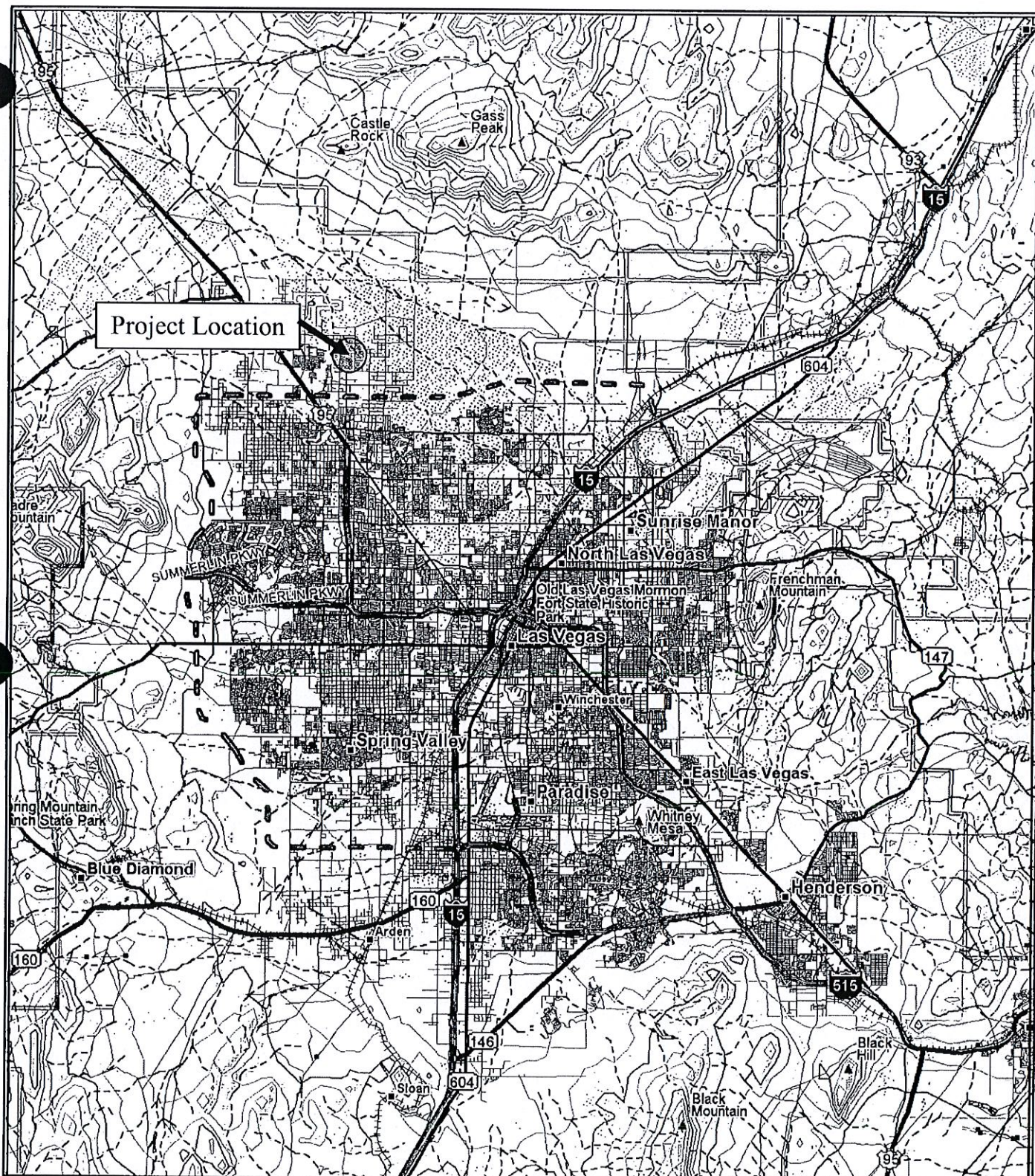
The storm drain systems that have been designed for this project will include reinforced concrete open channel, reinforced concrete box (RCB), and reinforced concrete pipe (RCP) laterals. In addition, design of collection systems at the following locations will be required: Rainbow Boulevard at Elkhorn Road, Rainbow Boulevard at the Severance Channel, Rainbow Boulevard at Farm Road, Rainbow Boulevard at Donald Nelson Avenue, Rainbow Boulevard at Whispering Sands Drive, and the design of storm drain laterals that collect drainage from an existing 64' x 6' grass lined open channel along Rainbow Boulevard between the Severance Channel and Elkhorn Road.

1.2 SITE LOCATION

The Project is located in Sections 10, 14, and 15 of Township 19 South, Range 60 East, M.D.M., Clark County, Nevada. Refer to Figure 1, Vicinity Map (following this page) for the general location of this project. The project area receives storm runoff from an approximately 5.5 mi² tributary area, bordered by US 95 to the west, Elkhorn Road to the south, Iron Mountain Road to the north, and Rainbow Boulevard to the east. There is very little curb and gutter throughout the watershed, so facilities will be designed to convey the ultimate flow-rate but the collection facilities will use field inlets in interim until curb and gutter is constructed in the area.

1.3 SITE DESCRIPTION

The Rainbow Storm Drain Planning Area consists almost entirely of low-density residential zoning with undeveloped open areas. The area generally slopes to the southeast and is not fully developed. Rainbow Boulevard is partially paved and has only minimal roadway improvements. On the downstream end of the project, the Las Vegas Wash Middle Branch Elkhorn Storm Drain Project is currently under construction. The Rainbow Storm Drain Project is being designed to discharge into the double 13' x 9' RCB, which is being constructed with the Elkhorn Storm Drain



Vicinity Map

Las Vegas Wash Middle Branch
Rainbow Storm Drain – Elkhorn to Grand Teton

Figure 1

7/22/2008

Project. Upstream of the project but within the project watershed, the construction of two detention basins will reduce flow for this project considerably, thus allowing smaller more cost effective facilities. These two detention basins are currently being designed. The Rainbow Storm Drain Project will begin at the downstream end of an existing culvert under Grand Teton Drive. Refer to Appendix F for a photographic survey of the existing conditions of the project site.

1.4 PREVIOUS HYDROLOGY STUDIES

The following is a list of previous Hydrology Studies that have been utilized in development of this study.

TABLE 1.4.1 – PREVIOUS HYDROLOGY STUDIES

Study	Prepared By	Dated
Las Vegas Valley Flood Control Master Plan Update	Clark County Regional Flood Control District	2002
Amendment to the 2002 Master Plan Update for Las Vegas Wash Middle Branch	The Louis Berger Group, Inc.	December 6, 2006
Amendment to the 2002 Master Plan Update for the Racel Street Collector	The Louis Berger Group, Inc.	January 8, 2007
Preliminary Design Report for the Las Vegas Wash Middle Branch	The Louis Berger Group, Inc.	August 14, 2006
Draft Design Report for the Las Vegas Wash Middle Branch – Rainbow Storm Drain	VTN Nevada	March 2008

1.5 COORDINATION

During the design phase, monthly coordination meetings have been held with project stakeholders including the City of Las Vegas Engineering, Sanitation and Flood Control Departments, and the Clark County Regional Flood Control District (CCRFCDD). Copies of the Progress Meeting Memorandums 1 through 4 can be found in Appendix F. In addition, VTN has initiated project coordination with local utility agencies. The results of the utility search are documented in Section 3.0 of the report.

1.6 FLOODPLAIN INFORMATION

The project limits are located in Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM) Community Panel Number 32003C1765 E, Clark County, Nevada and Incorporated Areas, effective date August 16, 1995, and revised September 27, 2002. According to the map, the project limits lie in the "Un-shaded Zone X" which is determined to be outside a 0.2% (or 500 year) annual chance floodplain. See Appendix A for the FIRM Map discussed above, taken from the Clark County Regional Flood Control District website, and is for reference only.

1.7 REGIONAL FLOOD CONTROL MASTER PLAN INFORMATION

The Rainbow Storm Drain is located in the Clark County Regional Flood Control District (CCRFCDD) 2002 Master Plan Update (MPU) and has been amended several times to incorporate new detention basins upstream of the project. All MPU and MPA figures can be found in Appendix A.

The hydraulic and hydrologic procedures presented in this report follow methods accepted by the Hydraulic Criteria and Drainage Design Manual (HCDDM) published by CCRFCDD.

The following Table 1.7.1 listing the facilities that were proposed in the 2002 MPU for the project study area has also been included for reference.

TABLE 1.7.1 – 2002 MPU FLOOD CONTROL FACILITIES

ID / River Mile	Facility Description	Length, ft	Flow, cfs	Slope, %
LAS VEGAS WASH - MIDDLE				
LVMD2632	11' X 9' RCBC	1400	1359	0.59
LVMD2599	Concrete Channel 20'W 10.5'D 0:1 SS	1700	3528	0.70
LVMD2574	2: 12' X 10' RCB	1320	3528	0.61
LVMD2550	3: 12' X 9' RCB	1320	3528	0.38
LVMD2525	3: 12' X 9' RCB	1320	3528	0.39

On December 6, 2004, the Regional Flood Control Board of Directors approved an Amendment (2004 MPA) to the 2002 MPU for the Las Vegas Wash Middle Branch. The Amendment revised the configuration of the drainage facilities in the project area by adding the Tule Springs

Detention Basin and the Brent Detention Basin in the upstream watershed of the project. These two detention basins, once completed, will intercept a vast majority of the existing flow patterns and significantly reduce the flow rates for the Rainbow Storm Drain. The Amendment also reduces the size of all facilities, which in turn reduces the cost associated with construction of required facilities.

Table 1.7.2, below, lists the facilities that were included in the approved 2004 Master Plan Amendment for the Las Vegas Wash Middle Branch. A comparison between Table 1.7.1 and 1.7.2 shows the change in facility sizes. These facilities may continue to change through the Final Design of the Rainbow Storm Drain.

TABLE 1.7.2 – 2004 MPA FACILITIES

ID / River Mile	Facility Description	Length, ft	Flow, cfs	Slope, %
BRENT DETENTION BASIN				
BRDB0000	7' X 7' RCBC / 12" Orifice	1680	12	0.70
BRDB0032	150 ac-ft Brent Lane Detention Basin		1768	
BRDB0033	Energy Dissipater		1768	
BRDB0043	8' X 6' RCBC	3370	1207	2.10
BRDB0107	8' X 6' RCBC	2660	1207	2.40
BRDB0157	12' X 6' RCBC	2620	746	0.25
BRDB0207	10' X 5' RCBC	1330	408	0.25
LAS VEGAS WASH - MIDDLE				
LVMD2324	2: 14' X 8' RCBC	5280	3590	0.40
LVMD2443	2: 13' X 7' RCBC	5280	2957	0.40
LVMD2490	2: 13' X 7' RCBC	1320	2373	0.40
LVMD2525	22' X 6' RCBC	1320	2373	0.40
LVMD2550	22' X 6' RCBC	1320	2104	0.40
LVMD2574	22' X 6' RCBC	1320	2104	0.60
LVMD2599	Concrete Channel 30'W 5'D 2:1 SS	1700	2027	0.40
LVMD2632	14' X 5' RCBC	1400	1095	0.59
LVMD2661	12' X 5' RCBC	2640	1095	1.00
LVMD2711	9' X 5' RCBC	1320	1095	1.80
LVMD2737	9' X 5' RCBC	1320	1095	1.81
LVMD2763	72" RCP	2640	525	2.40
RACEL STREET COLLECTOR				
RACO0000	60" RCP	710	162	0.70
TULE SPRINGS DETENTION BASIN				

TSDB0000	2: 10' X 4' RCBC / 12" Orifice	610	8	0.25
TSDB0011	50 ac-ft Tule Springs Detention Basin		564	
TSDB0012	Energy Dissipater		564	
TSDB0023	84" RCP	1910	494	0.80
TSDB0059	78" RCP	2640	381	1.03

The cost analysis for the 2004 MPA determined that the proposed modifications to the storm drain configuration in the study area would save approximately \$10 million over the 2002 MPU proposed storm drain configuration.

1.8 RIGHT-OF-WAY AND EASEMENTS

Proposed storm drain facilities for this project have been designed to be within existing right-of-way constraints and drainage easements. No additional permanent right-of-way is required for this project. However, an Authorization to Enter Property, or AEP, will be needed to construct some of the drop inlets. These inlets are located within the street right-of-way but require temporary additional easements to construct these inlets. Refer to Appendix G for all of the AEP's needed with legal descriptions. Below is a summary table for all AEP's needed.

TABLE 1.8.1 – AEP Requirements

Parcel Number	Parcel Owner	Area of AEP (ft ²)
125-15-610-004	Lyon William Homes Inc.	200
458-15-610-003	Lyon William Homes Inc.	200
125-15-501-001	Gilcrease Orchard Foundation	400
125-14-110-012	Plaster Development Company, Inc.	128
125-14-201-001	Thomas Rick Roberts	196
125-15-604-004	Ryan Timothy G & Maureen	400
125-14-301-004	Barney Pauline	196

2.0 GEOTECHNICAL EVALUATION

GEOTEK, Inc. prepared the Geotechnical Exploration Report for the Rainbow Storm Drain Project on January 18, 2008. The geotechnical report was conducted to identify properties of the existing ground conditions throughout the project. GEOTEK gave recommendations for backfill and for design parameters for concrete culverts and concrete lined open channels. This allows VTN to design the bedding of the storm drain with required backfill requirements. The geotechnical report also goes into greater detail about the project pertaining to: subsurface conditions, ground water, tectonic faulting, geologic constraints, and laboratory testing. GEOTEK concluded, based on their field testing, engineering, and geologic analysis, that the proposed alignment is suited for construction from a geotechnical engineering and geologic viewpoint. The Geotechnical Report can be found in Appendix D.

3.0 UTILITY SUMMARY

Numerous utility companies were contacted to establish the location of existing and proposed facilities throughout the project area. Each utility company was given a set of preliminary plans to identify the location of their existing facilities. Potholes were taken at the location of all potential conflicts. The main utility conflict is the relocation of a 24" sewer mainline from Elkhorn Road to Whispering Sands Drive and all laterals that tie into the existing sewer main.

To assist in coordinating utility conflicts with the utility agencies, a utility conflict schedule has been created. The conflict schedule consists of a matrix showing all potential utility conflicts with proposed storm drains. It also shows required clearances where applicable. Refer to Appendix E for the Utility Conflict Matrix.

TABLE 3.0.1 – UTILITY CONTACTS

Utility Name	Contact Person	Phone Number
Embarq	Janie Stokes	244-7806
Southwest Gas Corp.	Bob Middag	365-2071
Cox Communications	Doney Villareal	384-8084 ext. 8276
Nevada Power Co.	Maggie Crittle	402-4159
AT&T Fiber Optic Cable	Walter Werstuik	(701) 963-7964
Kinder/Morgan Energy Partners, L.P.	A. Dianne Sidorewicz	(714) 560-4400
Las Vegas Valley Water District	Brandi Guenon	870-2011
Southern Nevada Water Authority	Marie Green	862-3459
Verizon Business	Tony Williamson	432-5401
Freeway & Arterial System of Transportation	Thomas Wolch	432-5310
Kern River Gas Transmission	Rick Wonner	696-3605
Integra Telecom (formerly Electric Light wave)	Robert Russell	(480) 889-6008
Time Warner Telecom	Hank Schlesinger	474-7100
Broadwing Communications	Norman Garcia	(512) 742-3827
Level 3 Communications	Megan Gillespie	(661) 331-3127
CLV Collection System Planning	John Day	229-6278

4.0 HYDROLOGIC ANALYSIS

The 2004 MPA hydrologic model was used as the basis for this hydrologic analysis, which updated the 2002 MPU hydrologic model. VTN reviewed and verified the hydrology in MPA. VTN has accepted the hydrology within the MPA, but has modified the Depth Area Reduction Factor (DARF) to get a more precise flow rate for each design point. Refer to Figure 2 in Appendix A for the Drop Inlet Hydrology within the project limits. During the design of this project, the 2008 MPU is being assembled and completed; this differs slightly from the 2004 MPA, but will not change the ongoing facility parameters of this project.

4.1 STORM WATER FLOW SUMMARY

The HEC-1 files developed by the 2002 MPU and the 2004 MPA were used as a basis for developing the drainage models for the project site. This study contains an ultimate model, and a paper copy is included in Appendix B. Refer to the 2004 MPA Figures H-3A and H-4A in Appendix A for sub-basin delineations. The Rainbow Storm Drain facility is being designed to convey the rainfall runoff from the 100-year (frequency), 6-hour (duration) storm event. Table 4.1.1 summarizes the design flow-rates for this project.

TABLE 4.1.1 – 100-YR STORM DESIGN POINT FLOW VALUES

Location	Design Point	2004 MPA – Ultimate 100– Year Flow Rate (cfs)
Golf Course north of Grand Teton	CNW163-C	938
Grand Teton west of Golf Course	CNW139-C	1124
Grand Teton and Golf Course	2C163-C	1921
Whispering Sands west of Rainbow	NW162-C	134
Whispering Sands and Rainbow	CNW162-C	2001
Farm west of Rainbow	DNW161-C	115
Farm and Rainbow	CD161-C	2063
Severance west of Rainbow	CNW150-C	270
Severance and Rainbow	CCNW150-	2282
Elkhorn west of Rainbow	NW159-C	145
Elkhorn and Rainbow	CNW159	2385

5.0 HYDRAULIC ANALYSIS

The hydraulic analysis used for the design of this project included: Water Surface Pressure Gradient for Windows (WSPGW), HEC-RAS, HY8, FlowMaster, and the use of various spreadsheets; the results of which can be found in Appendix C. The WSPGW Computer Program was used to calculate the hydraulic grade-line (HGL) and energy grade-line (EGL) of the storm drain mainline. VTN used WSPGW for the entire reach of the proposed improvements from Grand Teton Drive, within Rainbow Boulevard, to Elkhorn Road; and then from Rainbow Boulevard to Decatur Boulevard within Elkhorn; and finally, from Elkhorn Road to the Northern 215 Beltway within Decatur Boulevard. This provides a more accurate HGL by analyzing the entire reach to account for negative backwater effects. HEC-RAS was used to compare the results from WSPGW within the open channel portion of the project, which is from Grand Teton Drive to Whispering Sands Drive. As can be seen below in Table 5.1.1, WSPGW yielded the most conservative flow depths; therefore will be used as the benchmark.

TABLE 5.1.1 – FLOW COMPARISON BETWEEN WSPGW AND HEC-RAS

Station	WSPGW Flow Depth (FT)	HEC-RAS Flow Depth (FT)	WSPGW Velocity (FT/S)	HEC-RAS Velocity (FT/S)
815.65	4.315	2.79	4.53	6.59
1078.92	2.003	1.56	12.97	16.04
1217.09	3.005	2.85	13.46	12.95
1426.86	4.065	3.2	15.5	14.95
2555.18	3.862	3.18	16.55	15.06
2655.18	3.432	3.58	23.32	22.35
2713.66	3.537	3.86	22.63	20.76

The goal of the Rainbow Storm Drain Project is to design hydraulically efficient storm water conveyance facilities that meets the design criteria presented in the CCRFCD HCDDM. Hydraulic analysis has been performed using the WSPGW and HEC-RAS computer programs to model storm drain and open channel mainlines, small lateral pipes have been modeled using Clark County Standard Form 6, and inlet calculations have been performed based on FHWA HEC-22 with clogging factors derived from the CCRFCD HCDDM. Refer to Appendix C for all hydraulic calculations.

6.0 STORM DRAIN FACILITIES

6.1 MULTIPLE BOX CULVERTS UNDERNEATH GRAND TETON DRIVE

There are six existing 12' x 5 RCBC that cross under Grand Teton Drive and convey storm water under the road. In the interim condition, all six of these culverts will be left open although the flow will be significantly reduced once the Tule Springs Detention Basin and the Brent Detention Basin are constructed. In the ultimate configuration, the CCRFCD MPU shows a large RCB Facility being extended to the west along Grand Teton. The two western most existing 12' x 5' cells will connect the system within Grand Teton Drive MPU Facility (LVMD2632). VTN has analyzed this culvert crossing for the ultimate condition, but the interim configuration will be constructed at this time. Refer to 90% Storm Drain Plan and Profile Sheets in Appendix H.

6.2 OPEN CHANNEL FROM GRAND TETON DRIVE TO WHISPERINGS SANDS DRIVE

The open channel from Grand Teton Drive to Whispering Sands Drive is a concrete lined trapezoidal channel with the dimensions 20' bottom width x 10.5' deep with 2:1 SS in the 2002 MPU, while the 2005 MPA Facility is a 30' bottom width x 5' deep x 2:1 SS. The proposed alignment for the Rainbow Storm Drain is a 24' bottom width x 7' deep x 2:1 SS concrete lined trapezoidal open channel.

The channel was changed to minimize the grading required and allow for future construction at Grand Teton Drive. In addition, by using a 24' base width, the channel bottom matches the proposed box conduit downstream width. There is a 100' right-of-way in which to construct the open channel; VTN has designed the project to avoid impacts to adjacent developments and properties. Trapezoidal open channels provide a hydraulically efficient open channel section that is cost effective where right-of-way is available. The open channel will also include a 12' maintenance road on each side to allow for swift water rescue and maintenance access. This segment of open channel will be approximately 1600 feet including transition structures and confluence structures. The slope of channel varies from 0.51% to 5.00% to minimize grading around channel walls.

6.3 RCB FROM WHISPERING SANDS DRIVE TO ELKHORN ROAD

The RCB from Whispering Sands Drive to Elkhorn Road as described in the 2002 MPU varied from twin 12' x 9' to twin 12' x 10' box conduits. The 2004 changed these facilities into twin 13' x 7' RCB. VTN is proposing using a single cell 24' x 8' RCB.

At Whispering Sands Drive, the concrete lined open channel will transition into a 24' x 8' RCB. This size facility can be constructed as a cast-in-place or Precast Mega RCB's determined by the contractor. A large single box like this requires a thicker deck lid but has numerous advantages over a multi-celled RCB design, including hydraulic efficiency, constructability, and cost. One box is more hydraulically efficient because there is a uniform section with no center pier thus eliminating some hydraulic losses and the necessity of flow transfer structures. A single box culvert simplifies construction making it easier to lay one box rather than placing two boxes side by side. One box is typically more cost efficient.

The slope of the box along Rainbow Boulevard is constrained by the tie in point at Elkhorn Road where the RCB will tie into a facility that is currently under construction. The slope is also limited because the slope of Rainbow Boulevard is at or near 0.40%. The length of this segment of the project is approximately 4000 feet.

6.4 SEVERANCE CHANNEL

The Severance Channel is an existing grass lined trapezoidal channel that serves as the outfall for the Elkhorn Springs Detention Basin and several sub-basins downstream of the detention basin. The Severance Channel conflues with another grass lined channel at Rainbow Boulevard. The Rainbow grass lined channel parallels Rainbow Boulevard from Farm Road to Elkhorn Drive and is of similar size.

One of objectives for this reach of the project is to collect this flow in the grass channel and convey it into the MPU Facility. One option considered for doing this will be to add a series of weirs along the channel with field NDOT Type 8 drop inlets at the upstream end of each weir to capture flow. Once flow enters the field inlet, the storm flow will be conveyed by HERCP into the MPU Facility. Another option analyzed was to add a RCB in the Severance Channel to collect flow, and convey it over to the MPU Facility via RCB; however, due to profile constraints with sewer and the MPU Facility, this box would have to be 24' wide by 3' tall. This option is unpractical in a cost comparison for the two options and in hydraulic function since there would one large point discharge into the MPU Facility severely affecting the hydraulics of the system compared to several smaller point discharges. Therefore, the weir/field inlets option will used for this project.

Each weir will be one foot high, traverse the bottom width of the channel, and have 4:1 approach slopes; this allows head to build over the drop inlet, which increases the efficiency and the flow interception of the drop inlet. There will be 5 NDOT Type 8 drop inlets, one at each weir and two at the low point of the channel. Each weir will be covered in riprap with the riprap extending four feet above the invert of the weir along the channel bank to limit erosion and protect the weir and inlet.

6.5 DROP INLET DESIGN AND STREET FLOW

Drop inlets were designed using procedures described in HEC-22 and the CCRFCD HCDDM. Spreadsheets have been developed to perform the drop inlet calculations. Since there is little curb and gutter within the limits of the project, NDOT field inlets will be needed. Once curb and gutter is constructed, the field inlet can be removed, and a combination drop inlet can be constructed

and connected to the pipe the field inlet used. VTN is proposing that 20' Type DM2 and CM2 combinations drop inlets be used for the ultimate design to replace NDOT Type 2 and 2A field inlets. The proposed NDOT Type 2 and 2A field inlets are being used for an interim condition, only to be replaced with the 20' Combination inlets to be used in the ultimate condition (once curb and gutter is constructed). The proposed interim inlets have been offset 7' from the back of sidewalk, which will be the face of curb location ultimately.

Combination drop inlets that are than 20' tend to lose interception efficiency and get expensive and difficult to construct and therefore are not proposed in capturing large amounts for storm flow in the ultimate design. A Standard Form 6 has been completed to design and calculate the 100-year hydraulic grade lines in every lateral; note that the ultimate flow-rate has been used, refer to Appendix C for these calculations. The typical RCP that connects the field inlets to the mainline range from 18" to 48"; these lateral pipes will have enough capacity for the ultimate flow captured by the combination drop inlets.

Street flow was considered in only the ultimate design because of the lack of existing curb and gutter throughout the watershed; thus, making it difficult to analyze a non-uniform roadway section when storm water will not be confined to the road. FlowMaster was used to determine the velocity and depth within the street section using standard 60', 80', and 100' RTC Street ROW sections. For the major (100-year) storm, the product of the velocity and depth cannot be greater than 8 per CCRFCD, refer to Appendix C for the FlowMaster calculations. Drop inlets were designed to intercept a large portion of the storm water as to limit the flow within the street but 100% efficiency in drop inlet interception is very difficult and expensive to achieve for inlets on grade. Refer to Appendix C for the hydraulic calculations showing size, type, location, and interception of all drop inlets.

6.6 RAINBOW GRASS LINED CHANNEL RESTORATION

The Home Owners Associations (HOA) of surrounding developments west of Rainbow Boulevard between Elkhorn Road and Farm Road paralleling Rainbow Boulevard would like to eliminate the high maintenance cost of the grass lined channel. To accomplish this, the channel downstream of the Severance Channel will be lined with rock riprap in parts while the channel north of the Severance channel will be filled in with the excavation from the large 24' x 8' RCB being placed within Rainbow Boulevard. Once the channel is filled in, desert landscape can be placed on top of the excavation by the HOA. This will allow the HOA to maintain an open space within the development without the expensive maintenance cost of the grass lined channel.

Coordination between the City and the HOA has been in progress and the HOA will need to complete an update to the drainage study for this area. Once completed the HOA can allow the contractor place excavated material in the channel, but it will be up to the HOA to compact, grade, and ensure fill areas are constructed in accordance to their landscape plans. The HOA may coordinate with the contractor on doing this work but it will not be the financial responsibility of the City or CCRFCD.

One alignment alternative that was considered was to place the MPU RCB within the grass channel and fill the channel in. However, this alternative was eliminated because this alignment would conflict the existing 24" sanitary sewer, which cannot be relocated due to the flat slope in the area.

7.0 CONSTRUCTION CONSIDERATIONS

There are a number of issues related to the construction of this project that need to be given consideration during the design phase. The following is a brief summary of the construction issues.

7.1 PERMITTING

When constructing a large storm drain facility, there are a number of permits that will be required. Some of the permits will need to be obtained prior to construction, and some will be obtained by the contractor after the project has been awarded to them. A permit matrix has been developed to help anticipate and prepare for construction. A copy of the permit matrix is included in Appendix F.

7.2 SCHEDULE

Based on the current design schedule, the final bid documents will be completed in January 2009. The city will do the funding project presentation to CCRFCD around September 2008. This will enable the city to begin the bidding phase in late January 2009, with construction phase beginning in May 2009.

7.3 PHASING RECOMMENDATIONS / ACCESS

The majority of the Rainbow Storm Drain project will be constructed in the existing dedicated right-of-way for Rainbow Boulevard. Between Elkhorn Road and Farm Road, the Rainbow Storm Drain Facility is aligned on the east half of Rainbow Boulevard, which should allow sufficient room to construct the storm drain and traffic can be shifted to the west. Between Farm Road and Whispering Sands Drive, the storm drain shifts to the middle of Rainbow Boulevard to avoid

conflicts with existing utilities. The contractor will likely have to detour traffic on to other streets to provide enough room for construction. Between Whispering Sands Drive and Grand Teton Drive, the storm drain transitions into open channel. This section of the project will be constructed in a 100-foot wide drainage easement. The contractor work area will be confined to the 100-foot wide easement.

7.4 ENVIRONMENTAL CONSTRAINTS

A facility specific (Section 8) Environmental Analysis prepared by Newfields, was completed in February 2008 for the Rainbow Storm Drain Project. The Section 8 was submitted to CCRFCD for review. The Section 8 was accepted by the CCRFCD on February 19, 2008. The analysis and CCRFCD acceptance can be found in Appendix F. The following mitigation measures are recommended:

- 1) Standard engineering design and construction practices should provide adequate mitigation for "Geology and Soils";
- 2) For "Air Quality", the contractor will be required to obtain a permit from the Clark County Department of Air Quality and comply with all stipulated mitigation measures; and
- 3) "Surface Water" concerns will be mitigated by implementation of BMP's

Finally, because the project does not require the placement of fill materials into "Waters of the US" that are in the jurisdictional authority of the Corps of Engineers Regulatory Division, a 404 Permit is not required.

8.0 CONCLUSIONS AND RECOMMENDATIONS

This Final Design Report for the Rainbow Storm Drain and the accompanying Plans and Specifications comprise the 90% Design submittal. The 100-year storm flows for the project were established for the ultimate conditions. Refer to Section 5 for a summary of the 100-year flows at important design points and Appendix B for the hydrologic analysis models and back-up information.

VTN is recommending building the MPU Facilities discussed in Section 6; all hydraulic calculations can be found in Appendix C that support and back-up the construction of the recommended facilities. A copy of the 90% Drainage Plan and Profile Sheets are included in Appendix H.

9.0 REFERENCES

- *Las Vegas Valley Flood Control Master Plan Update*, Clark County Regional Flood Control District, 2002.
- *Hydraulic Criteria and Drainage Design Manual*, Clark County Regional Flood Control District, 1999.
- *Amendment to the 2002 Master Plan Update for Las Vegas Wash Middle Branch*, The Louis Berger Group, Inc., December 6, 2004.
- *Preliminary Design Report for the Las Vegas Wash Middle Branch*, The Louis Berger Group, Inc., August 14, 2006.
- *Contract Plans for the Las Vegas Wash – Middle Branch, Elkhorn Storm Drain, Rainbow Boulevard to Torrey Pines Drive*, The Louis Berger Group, Inc., October 15, 2007.
- *Flood Insurance Rate Map, Community Panel Number 32003C1765 E*, Clark County, Nevada, effective August 16, 1995, revised September 27, 2002.
- *Improvement Plans for Whisperings Sands and Rainbow, a Residential Subdivision*, Taney Engineering, July 21, 2006.
- *Computer Software Utilized*

Program	Publisher	Version
HEC-RAS	United State Army Corps of Engineers (USACE)	4.0 Beta
WSPGW	CIVILDESIGN, Inc.	14.05
FlowMaster	Haestad Methods, Inc.	2005
HY8	Federal Highway Administration (FHWA)	7.0

Final Design Report for the

Las Vegas Wash Middle Branch

**Rainbow Storm Drain
Elkhorn to Grand Teton**

Appendix B

Hydrologic Calculations



Final Design Report for the

Las Vegas Wash Middle Branch

**Rainbow Storm Drain
Elkhorn to Grand Teton**

B - 1

Ultimate HEC-1 Model



HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

TIME OF CONCENTRATION

The Louis Berger Group, Inc.
File: FORM4.XLS

Las Vegas Valley Master Plan Update
Northern Las Vegas Wash Watershed
Ultimate Conditions

BY: MSS
DATE: 12/6/04

SUB-BASIN DATA					INITIAL / OVERLAND TIME (Ti)		TRAVEL TIME (Tt)						Tc	Tc	Tag	REMARKS	
DESIG: (1)	DEV/JEX. (D or E)	CN	K	AREA Ac	AREA Mi ²	INITIAL LENGTH Feet (4)	SLOPE % (5)	Ti Min (6)	TRAVEL LENGTH Feet (7)	SLOPE % (8)	VELOCITY FPS (9a)	V2 VELOCITY FPS (9b)	Tt Min (10)	Min (13)	Min (14)	Tag=	RAINFALL
			(2)	(3)												0.57C/60 Hours	Q100/Q10 Inches
NW100-C	D	84	0.7188	211.84	0.331	100	1.0	6.9	6360	2.5	3.2	4.8	22.8	29.7	45.9	0.297	
NW102-C	D	84.1	0.7201	286.08	0.447	100	1.0	6.8	6500	2.7	3.3	5.0	22.4	29.3	46.7	0.293	
NW111-N	D	90.8	0.8086	165.76	0.259	100	1.0	5.2	5200	2.5	3.2	4.8	18.8	24.0	39.4	0.240	
NW111-S	D	90.8	0.8086	94.72	0.148	100	1.0	5.2	5200	2.5	3.2	4.8	18.8	24.0	39.4	0.240	
NW116-C	D	80.8	0.6766	128.64	0.201	100	1.0	7.6	5350	2.4	3.1	4.8	19.6	27.2	40.3	0.272	
NW128-N	D	75.7	0.6092	160.00	0.250	100	1.0	8.8	5800	1.6	2.5	3.8	26.5	35.3	42.8	0.353	
NW128-S	D	75.7	0.6092	170.24	0.266	100	1.0	8.8	6200	1.7	2.6	4.0	27.0	35.9	45.0	0.359	
NW129-C	D	84.6	0.7267	115.20	0.180	100	1.0	6.7	5500	2.2	3.0	4.5	21.2	27.9	41.1	0.279	
NW130-E	D	82.9	0.7043	61.44	0.096	100	1.0	7.1	2400	1.7	2.6	4.0	11.2	18.3	23.9	0.183	
NW130-W	D	82.9	0.7043	90.88	0.142	100	1.0	7.1	2900	1.6	2.5	3.8	13.8	20.9	26.7	0.208	
NW139-C	D	86.4	0.7505	318.72	0.498	100	1.0	6.3	7100	2.1	2.9	4.4	27.6	33.9	50.0	0.339	
NW142-N	D	85.5	0.7386	101.76	0.159	100	1.0	6.5	4200	2.1	3.0	4.5	16.6	23.1	33.9	0.231	
NW144-W	D	82.2	0.6950	246.40	0.385	100	1.0	7.3	7700	1.9	2.8	4.2	31.6	38.9	53.3	0.389	
NW144-E	D	82.2	0.6950	65.92	0.103	100	1.0	7.3	1800	1.1	2.1	3.2	10.6	17.9	20.6	0.179	
NW147-W	D	80	0.6660	39.04	0.061	100	1.0	7.8	3200	1.6	2.5	3.8	15.1	22.9	28.3	0.229	
NW147-E	D	80	0.6660	109.44	0.171	100	1.0	7.8	6600	1.4	2.4	3.7	31.1	38.9	47.2	0.389	
NW78-C	D	87.6	0.7663	122.24	0.191	100	1.0	6.0	5900	2.4	3.1	4.7	21.8	27.8	43.3	0.278	

Tc = Ti + Tt Tag = 0.6 Tc
Ti = 1.8 (1.1 - K) L^{1/2} / S^{1/3}
K = 0.0132 (CN) - 0.39
Tc Check = L^{1/80} + 10

For the travel time (Tt) calculations,
V1 applies to the first 500 feet of travel distance;
V2 applies to the remaining travel distance.

Existing V1 = 14.8*(S/100)^{1/2}
Existing V2 = 29.4*(S/100)^{1/2}

Developed V1 = 20.2*(S/100)^{1/2}
Developed V2 = 30.6*(S/100)^{1/2}

REFERENCE :

STANDARD FORM 4

FLOOD HYDROGRAPH PACKAGE (HEC-1)
JUN 1998
VERSION 4.1
RUN DATE 06DEC04 TIME 12:53:01

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

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X   X   XXXXXX   XXXXX   X
X   X   X   X   X   X   XX
X   X   X   X   X   X   X
XXXXXX XXXX   X   XXXXX   X
X   X   X   X   X   X   X
X   X   X   X   X   X   X
X   X   XXXXXX   XXXXX   XXX

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

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE PORTMAN77 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
*** FREE ***
1          ID   MODIFIED BY THE LOUIS BERGER GROUP, INC.
2          ID   ADDED TULE SPRINGS AND BRENT DETENTION BASINS AND RESPECTIVE COLLECTION FACI
3          ID-
4          ID   CLARK COUNTY REGIONAL FLOOD CONTROL DISTRICT 2002 MASTER PLAN UPDATE
5          ID   NORTHERN LAS VEGAS WASH WATERSHED
6          ID   RECOMMENDED DRAINAGE SYSTEM WITH ULTIMATE DEVELOPMENT
7          ID   INPUT FILE = WESTJA.DAT
8          ID   INPUT FILE DATE = 11/22/04
9          ID   DESIGN STORM = 100-YEAR 6-HOUR STORM
10         ID   STORM DISTRIBUTION = SDM3
11         ID   MODELED BY = PBS6J - MATT BAIRD
12         ID   STORM CENTERING = WEST TRIBUTARY
13         ID   DOWNSTREAM OF THE UPPER LAS VEGAS WASH DETENTION BASIN TO THE
14         ID   MOST DOWNSTREAM POINT IN THE WATERSHED
15         ID   COMBINATION POINTS WERE REMOVED DOWNSTREAM OF DETENTION BASINS
16         ID   TO SIMULATE NECESSARY STORM CENTERINGS
17         ID
18         ID   JR CARDS CONTAIN DARFS BASED ON THE FOLLOWING VALUES:
19         ID
20         ID   AREA (SQUARE MILES)      DARF
21         ID   0 - 0.5                  0.99
22         ID   0.5 - 1                  0.975
23         ID   1 - 2                    0.95
24         ID   2 - 3                    0.925
25         ID   3 - 4                    0.915
26         ID   4 - 5                    0.908
27         ID   5 - 6                    0.903
28         ID   6 - 7                    0.895
29         ID   7 - 8                    0.885
30         ID
31         IT       5      0      0      300
32         IO       5      0      0
33         IN       5      0      0
34         JR   PREC   0.99   0.975   0.95   0.925   0.915   0.908   0.903   0.895   0.885
35
36         KK NW129-C
37         KM   MODIFIED BY BERGER
38         BA   0.184
39         PB   2.77
40         PC   0.000   0.020   0.057   0.070   0.087   0.108   0.124   0.130   0.130   0.130
41         PC   0.130   0.130   0.130   0.133   0.140   0.142   0.148   0.158   0.172   0.181
42         PC   0.190   0.197   0.199   0.200   0.201   0.204   0.214   0.229   0.241   0.249
43         PC   0.251   0.256   0.270   0.278   0.281   0.283   0.295   0.322   0.352   0.409
44         PC   0.499   0.590   0.710   0.744   0.781   0.812   0.819   0.835   0.851   0.856
45         PC   0.860   0.868   0.876   0.888   0.910   0.926   0.937   0.950   0.970   0.976
46         PC   0.982   0.985   0.987   0.989   0.990   0.993   0.993   0.994   0.995   0.998
47         PC   0.998   0.999   1.000
48         LS       0      84.6
49         UD   0.279

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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
49         KK RC129-C
50         KM   ROUTE CNW129-C TO CNW148-C
51         KM   MODIFIED BY BERGER
52         KM   FACILITY = TULE SPRINGS DETENTION BASIN
53         KM   FACILITY ID-MILE = TSDB 0059
54         RD   2640 0.0103 0.015      0   CIRC   6.5      0
55
56         KK NW102-C
57         KM   MODIFIED BY BERGER
58         BA   0.447
59         PB   2.77
60         LS       0      84.1
61         UD   0.293
62
63         KKRNW102-C
64         KM   ROUTE NW102-C TO CNW130-C
65         KM   MODIFIED BY BERGER
66         RD   4000 0.0175 0.015      0   TRAP      0      50

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65 KK NW130W
66 KM MODIFIED BY BERGER
67 KM SPLIT NW130-C INTO NW130W AND NW130E
68 BA 0.142
69 PB 2.77
70 LS 0 82.9
71 UD 0.209
*

72 KK CNW130W
73 KM COMBINE RNW102-C AND CNW130-C
74 KM MODIFIED BY BERGER
75 HC 2
*

76 KK*NO_FLOW
77 KM ALL FLOW REMOVED (SENT NORTH TO UPPER LAS VEGAS WASH)
78 DT*REMOVED
79 DI 0 100000
80 DQ 0 100000
*

81 KK NW130E
82 KM MODIFIED BY BERGER
83 KM SPLIT NW130-C INTO NW130W AND NW130E
84 BA 0.096
85 PB 2.77
86 LS 0 82.9
87 UD 0.183
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1

HEC-1 INPUT

PAGE 3

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

88 KK RNW130E
89 KM ROUTE CNW130E TO CNW148-C
90 KM MODIFIED BY BERGER
91 RD 5400 0.006 0.015 0 TRAP 0 50
*

92 KK CNW130E
93 KM COMBINE RNW130E AND *NO_FLOW
94 KM MODIFIED BY BERGER
95 HC 2
*

96 KK NW148-C
97 BA 0.260
98 PB 2.77
99 LS 0 81.0
100 UD 0.409
*

101 KKNW148-C
102 KM COMBINE NW148-C, RNW130-C AND RC129-C
103 KM LOG CABIN AND BUFFALO
104 HC 3
*

105 KK RC148-C
106 KM ROUTE CNW148-C TO CNW157
107 KM MODIFIED BY BERGER
108 KM FACILITY = TULE SPRINGS DETENTION BASIN
109 KM FACILITY ID-MILE = TSDB 0023
110 RD 1910 0.008 0.015 0 CIRC 7 0
*

111 KK NW128N
112 KM BASIN NW128 DIVIDED INTO NW 128N AND NW128S BY BERGER
113 BA 0.250
114 PB 2.77
115 LS 0 75.7
116 UD 0.353
*

117 KK CNW128N
118 KM COMBINE CNW148-C AND NW128N
119 HC 2
*

120 KK NW157
121 BA 0.199
122 PB 2.77
123 LS 0 71.9
124 UD 0.361
*

1

HEC-1 INPUT

PAGE 4

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

125 KK CTULEDB
126 KM COMBINE CNW128N AND NW157
127 KM MODIFIED BY BERGER
128 HC 2
*

129 KK TULEDB
130 KO 3
131 KM FACILITY = TULE SPRINGS DETENTION BASIN
132 KM FACILITY ID-MILE = TSDB 0011
133 KM 12" ORIFICE PLATE
134 RS 1 STOR 0
135 SV 0.0 1.4 6.4 17.1 35.4 61.4 91.9
136 SE 2427 2428 2429 2430 2431 2432 2433
137 SQ 0.0 2.6 4.6 6.0 7.1 8.0 8.9
*

138 KK*NO_FLOW
139 KM ALL FLOW REMOVED (STORM CENTERED BELOW DB FOR DOWNSTREAM FACILITIES)
140 DT*REMOVED
141 DI 0 100000
142 DQ 0 100000
*

143 KK NW128S
144 KM BASIN NW128 DIVIDED INTO NW128N AND NW128S BY BERGER

145 BA 0.266
 146 PB 2.77
 147 LS 0 75.7
 148 UD 0.359
 *
 149 KK NW147E
 150 KM BASIN NW147-C DIVIDED INTO NW147E AND NW147W BY BERGER
 151 BA 0.171
 152 PB 2.77
 153 LS 0 80.0
 154 UD 0.389
 *
 155 KK CNW147E
 156 KM COMBINE NW128S, NW147E, AND *NO_FLOW
 157 HC 3
 *
 158 KK RC147E
 159 KM ROUTE CNW147E TO CNW155-C
 160 KM FACILITY = MOUNTAIN SPA/VISTA RANCH
 161 KM FACILITY ID-MILE = MSNW 0000
 162 KM LINING = GRASS
 163 RD 5800 0.004 0.03 0 TRAP 100 10
 *

HEC-1 INPUT

PAGE 5

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

164 KK NW100-C
 165 KM MODIFIED BY BERGER
 166 BA 0.331
 167 PB 2.77
 168 LS 0 84.0
 169 UD 0.297
 *
 170 KKRNW100-C
 171 KM ROUTE NW100-C TO CNW116-C
 172 KM LOG CABIN
 173 KM MODIFIED BY BERGER
 174 RD 4000 0.016 0.015 0 TRAP 0 50
 *
 175 KK NW116-C
 176 KM MODIFIED BY BERGER
 177 BA 0.201
 178 PB 2.77
 179 LS 0 80.8
 180 UD 0.272
 *
 181 KKCWN116-C
 182 KM COMBINE NW116-C AND RNW100-C
 183 HC 2
 *
 184 KKRNW116-C
 185 KM ROUTE NW116-C TO NW115-C
 186 KM MODIFIED BY BERGER
 187 KM FACILITY = BRENT DETENTION BASIN
 188 KM FACILITY ID-MILE = BRDB 0157
 189 RD 1280 0.0025 0.015 0 TRAP 12 0
 *
 190 KK NW78-C
 191 KM MODIFIED BY BERGER
 192 BA 0.191
 193 PB 2.77
 194 LS 0 87.6
 195 UD 0.278
 *
 196 KK RNW78-C
 197 KM ROUTE NW78-C TO CNW115-C
 198 KM IRON MOUNTAIN
 199 KM MODIFIED BY BERGER
 200 RD 5200 0.0269 0.015 0 TRAP 0 50
 *

HEC-1 INPUT

PAGE 6

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

201 KK NW115-C
 202 BA 0.227
 203 PB 2.77
 204 LS 0 80.5
 205 UD 0.265
 *
 206 KKCWN115-C
 207 KM COMBINE RNW116-C, RNW78-C, AND NW115-C
 208 HC 3
 *
 209 KKRNW115-C
 210 KM ROUTE CNW115-C TO CNW113-C
 211 KM MODIFIED BY BERGER
 212 KM FACILITY = BRENT DETENTION BASIN
 213 KM FACILITY ID-MILE = BRDB 0157
 214 RD 1340 0.0025 0.015 0 TRAP 12 0
 *
 215 KK NW96-C
 216 BA 0.260
 217 PB 2.77
 218 LS 0 89.7
 219 UD 0.260
 *
 220 KK RNW96-C
 221 KM ROUTE NW96-C TO CNW113-C
 222 KM IRON MOUNTAIN
 223 KM MODIFIED BY BERGER
 224 KM FACILITY = BRENT DETENTION BASIN

225 KM FACILITY ID-MILE = BRDB 0107
 226 RD 2660 0.024 0.015 0 CIRC 6 0
 *
 227 KK NW113-C
 228 BA 0.235
 229 PB 2.77
 230 LS 0 86.9
 231 UD 0.280
 *
 232 KKCWN113-C
 233 KM COMBINE NW113-C AND RNW96-C
 234 HC 2
 *
 235 KKC2W113-C
 236 KM COMBINE CNW113-C AND RNW115-C
 237 HC 2
 *

1

HEC-1 INPUT

PAGE 7

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

238 KKRWN113-C
 239 KM ROUTE CNW113-C TO CNW147W
 240 KM MODIFIED BY BERGER
 241 KM FACILITY = BRENT DETENTION BASIN
 242 KM FACILITY ID-MILE = BRDB 0043
 243 RD 2500 0.021 0.015 0 TRAP 8 0
 *
 244 KK NW147W
 245 KM BASIN NW147-C DIVIDED INTO NW147S AND NW147W BY BERGER
 246 BA 0.061
 247 PB 2.77
 248 LS 0 80.0
 249 UD 0.229
 *
 250 KK CNW147W
 251 KM COMBINE RNW113-C AND CNW147W
 252 HC 2
 *
 253 KK RC147W
 254 KM ROUTE CNW147W TO BRENT DETENTION BASIN
 255 KM MODIFIED BY BERGER
 256 KM FACILITY = BRENT DETENTION BASIN
 257 KM FACILITY ID-MILE = BRDB 0043
 258 RD 870 0.021 0.015 0 TRAP 8 0
 *
 259 KK NW111N
 260 KM BASIN NW111-C DIVIDED INTO NW111N AND NW111S BY BERGER
 261 BA 0.259
 262 PB 2.77
 263 LS 0 90.8
 264 UD 0.240
 *
 265 KK RNW111N
 266 KM ROUTE NW111N TO CNW144W
 267 KM MODIFIED BY BERGER
 268 RD 6500 0.021 0.015 0 TRAP 0 50
 *
 269 KK NW144W
 270 KM BASIN NW144-C DIVIDED INTO NW144S AND NW144W BY BERGER
 271 BA 0.385
 272 PB 2.77
 273 LS 0 82.2
 274 UD 0.389
 *

1

HEC-1 INPUT

PAGE 8

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

275 KK CNW144W
 276 KM COMBINE NW144W AND RNW111N
 277 KM MODIFIED BY BERGER
 278 HC 2
 *
 279 KKCWN144W
 280 KM COMBINE CNW144W AND RC147W
 281 KM MODIFIED BY BERGER
 282 HC 2
 *
 283 KK NW142N
 284 KM BASIN NW142-C DIVIDED INTO NW142N AND NW142S BY BERGER
 285 BA 0.159
 286 PB 2.77
 287 LS 0 85.5
 288 UD 0.231
 *
 289 KKC BRENTDB
 290 KM COMBINE CNW144W AND NW142N
 291 HC 2
 *
 292 KK BRENTDB
 293 KO 3
 294 KM FACILITY = BRENT DETENTION BASIN
 295 KM ID MILE = BRDB 0032
 296 KM 12" ORIFICE PLATE
 297 RS 1 STOR 0
 298 SV 0.0 1.0 3.6 8.7 16.7 27.8 42.0 59.4 79.9 103.6
 299 SV 130.7 161.0 194.4
 300 SE 2441 2442 2443 2444 2445 2446 2447 2448 2449 2450
 301 SE 2451 2452 2453
 302 SQ 0.0 2.6 4.6 6.0 7.1 8.0 8.9 9.6 10.4 11.0
 303 SQ 11.7 12.3 12.8
 *

304 KK*NO_FLOW
 305 KM ALL FLOW REMOVED (STORM CENTERED BELOW DB FOR DOWNSTREAM FACILITIES)
 306 DT*REMOVED
 307 DI 0 100000
 308 DQ 0 100000
 *

309 KK NW144E
 310 KM BASIN NW144-C DIVIDED INTO NW144E AND NW144W BY BERGER
 311 BA 0.103
 312 PB 2.77
 313 LS 0 82.2
 314 UD 0.179
 *

HEC-1 INPUT

PAGE 9

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

315 KK CNW144E
 316 KM COMBINE *NO_FLOW AND NW144E
 317 HC 2
 *

318 KK RC144E
 319 KM ROUTE CNW144E TO CNW155-C
 320 KM FACILITY = MOUNTAIN SPA/VISTA RANCH
 321 KM FACILITY ID-MILE = MSNW 0000
 322 KM LINING = GRASS
 323 RD 5800 0.004 0.03 0 TRAP 100 10
 *

324 KK NW155-C
 325 BA 0.439
 326 PB 2.77
 327 LS 0 86.1
 328 UD 0.365
 *

329 KKNW155-C
 330 KM COMBINE NW155-C, RC147E AND RC144E
 331 HC 3
 *

332 KK RC155-C
 333 KM ROUTE CNW155-C TO CNW163-C
 334 KM FACILITY = MOUNTAIN SPA/VISTA RANCH
 335 KM FACILITY ID-MILE = MSNW 0000
 336 KM LINING = GRASS
 337 RD 2000 0.004 0.03 0 TRAP 100 10
 *

338 KK NW165
 339 BA 0.335
 340 PB 2.77
 341 LS 0 78.2
 342 UD 0.444
 *

343 KK RNW165
 344 KM ROUTE NW165 TO CNW164
 345 KM MOUNTAIN SPA CHANNEL
 346 RD 3000 0.0073 0.02 0 TRAP 50 5
 *

347 KK NW164
 348 BA 0.301
 349 PB 2.77
 350 LS 0 87.4
 351 UD 0.274
 *

HEC-1 INPUT

PAGE 10

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

352 KK CNW164
 353 KM COMBINE NW164 AND RNW165
 354 HC 2
 *

355 KK RCNW164
 356 KM ROUTE CNW164 TO CNW163-C
 357 KM MOUNTAIN SPA CHANNEL
 358 RD 2200 0.01 0.02 0 TRAP 50 5
 *

359 KK NW163-C
 360 BA 0.361
 361 PB 2.77
 362 LS 0 83.5
 363 UD 0.354
 *

364 KKNW163-C
 365 KM COMBINE NW163-C, RCNW164 AND RC155-C
 366 HC 3
 *

367 KK NW111S
 368 KM BASIN NW111-C DIVIDED INTO NW111N AND NW111S BY BERGER
 369 BA 0.148
 370 PB 2.77
 371 LS 0 90.8
 372 UD 0.240
 *

373 KK RNW111S
 374 KM ROUTE NW111S TO CNW109-C
 375 KM MODIFIED BY BERGER
 376 RD 1100 0.004 0.015 0 TRAP 0 50
 *

377 KK NW109-C
 378 BA 0.358
 379 PB 2.77
 380 LS 0 86.1

381 UD 0.253
*
382 KKCWN109-C
383 KM COMBINE RNV111S AND NW109-C
384 HC 2
*

HEC-1 INPUT

PAGE 11

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

385 KK RC109-C
386 KM ROUTE CNW109-C TO CNW139-C
387 KM FACILITY = LAS VEGAS WASH MIDDLE
388 KM FACILITY ID-MILE = LVMD 2711,2737,2763
389 KM LINING = RCB
390 RD 5300 0.0213 0.013 0 DEEP 9 0
*

391 KK NW138-C
392 BA 0.233
393 PB 2.77
394 LS 0 87.1
395 UD 0.390
*

396 KK NW139-C
397 BA 0.498
398 PB 2.77
399 LS 0 86.4
400 UD 0.339
*

401 KKCWN139-C
402 KM COMBINE NW139-C, NW138-C, AND RC109-C
403 KM GRAND TETON AND BUFFALO
404 HC 3
*

405 KK RC139-C
406 KM ROUTE CNW139-C TO 2C163-C
407 KM FACILITY = LAS VEGAS WASH MIDDLE
408 KM FACILITY ID-MILE = LVMD 2632,2640,2661
409 KM LINING = RCB
410 RD 3900 0.0103 0.015 0 DEEP 12 0
*

411 KK 2C163-C
412 KM COMBINE CNW163-C AND RC139-C
413 HC 2
*

414 KK RC163-C
415 KM ROUTE 2C163-C TO CNW162-C
416 KM FACILITY = LAS VEGAS WASH MIDDLE
417 KM FACILITY ID-MILE = LVMD 2599
418 KM LINING = CONCRETE
419 RD 1700 0.007 0.015 0 TRAP 20 0
*

HEC-1 INPUT

PAGE 12

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

420 KK NW162-C
421 BA 0.249
422 PB 2.77
423 LS 0 78.8
424 UD 0.436
*

425 KKCWN162-C
426 KM COMBINE NW162-C AND RC163-C
427 KM LAS VEGAS WASH MIDDLE @ GILCREASE
428 HC 2
*

429 KK RC162-C
430 KM ROUTE CNW162-C TO CD161-C
431 KM FACILITY = LAS VEGAS WASH MIDDLE
432 KM FACILITY ID-MILE = LVMD 2574
433 KM LINING = RCB
434 RD 1320 0.006 0.015 0 TRAP 22 0
*

435 KK NW161-C
436 BA 0.329
437 PB 2.77
438 LS 0 80.5
439 UD 0.465
*

440 KKDWN161-C
441 KM DIVERT 70 CFS FROM NW161-C TO NW150-C
442 KM IN PROPOSED LOCAL FACILITY
443 DTDWN150-C
444 DI 0.000 51 71 500 1000 5000
445 DQ 0.000 50 70 70 70 70
*

446 KK CD161-C
447 KM COMBINE DWN161-C AND RC162-C
448 KM LAS VEGAS WASH MIDDLE @ FARM
449 HC 2
*

450 KKRC161-C
451 KM ROUTE CD161-C TO CNW159-C
452 KM FACILITY = LAS VEGAS WASH MIDDLE
453 KM FACILITY ID-MILE = LVMD 2550
454 KM LINING = RCB
455 RD 1320 0.004 0.015 0 TRAP 22 0
*

HEC-1 INPUT

PAGE 13

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

456 KK NW134-C
 457 BA 0.536
 458 PB 2.77
 459 LS 0 88.1
 460 UD 0.429
 *

461 KK NW133-C
 462 BA 0.377
 463 PB 2.77
 464 LS 0 87.6
 465 UD 0.505
 *

466 KCCNW133-C
 467 KM COMBINE NW133-C AND RC134-C
 468 KM BUFFALO AND SEVERANCE
 469 HC 2
 *

470 KKLKBASIN
 471 KM FACILITY = ELKHORN SPRINGS DETENTION BASIN
 472 KM FACILITY ID-MILE = EKDB 0070
 473 KM STORAGE VOLUME = 48 ACRES-FEET
 474 KM OUTLET = 60" RCP
 475 KM SPILLWAY LENGTH =
 476 KM SPILLWAY HEIGHT =
 477 KO 3
 478 RS 1 STOR -1
 479 SA 3.32 3.65 3.98 4.32 4.67 5.03 5.4
 480 SE 2388 2390 2392 2394 2396 2398 2400
 481 SQ 0 35.5 66 86.4 102.8 116.9 129.5
 *

482 KK REKLD8
 483 KM ROUTE ELKBASIN TO CRD150-C
 484 KM FACILITY = ELKHORN SPRINGS DETENTION BASIN
 485 KM FACILITY ID-MILE = EKDB 0049
 486 KM LINING = RCP
 487 RD 2258 0.0128 0.013 0 CIRC 5 0
 *

488 KKNW150-C
 489 KM RETRIEVE DNW150-C
 490 DRDNW150-C
 *

491 KK RD150-C
 492 KM ROUTE DNW150-C TO NW150-C
 493 KM TENAYA
 494 RD 1300 0.004 0.016 0 TRAP 0 50
 *

HEC-1 INPUT

PAGE 14

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

495 KRCRD150-C
 496 KM COMBINE RD150-C AND REKLD8
 497 KM SEVERANCE AND TENAYA
 498 HC 2
 *

499 KK RCRD150
 500 KM ROUTE CRD150-C TO CNW150-C
 501 KM FACILITY = ELKHORN SPRINGS DETENTION BASIN
 502 KM FACILITY ID-MILE = EKDB 0000
 503 KM LINING = GRASS
 504 RD 2640 0.0057 0.03 0 TRAP 15 3.5
 *

* KK 'NO_FLOW
 * KM ALL FLOW REMOVED
 * KM TURN THIS GROUP OF CARDS ON/OFF TO CHECK STORM CENTERING
 * KM DOWNSTREAM OF ELKHORN SPRINGS DETENTION BASIN
 * KM ONLY NODE CNW3D4-C IS AFFECTED -- STORM WILL CHANGE TO SDN4
 * KM IF DETENTION BASIN FLOW IS USED, REMAINS SDN3 IF NOT.
 * DT *REMOVED
 * DI 0 100000
 * DQ 0 100000
 *

505 KK NW150-C
 506 BA 0.244
 507 PB 2.77
 508 LS 0 79.9
 509 UD 0.472
 *

510 KCCNW150-C
 511 KM COMBINE NW150-C AND RCRD150
 512 KM ELKHORN AND TENAYA
 513 HC 2
 *

514 KCCCNW150-
 515 KM COMBINE CNW150-C AND RCD161-C
 516 KM ELKHORN AND TENAYA
 517 HC 2
 *

518 KK RC150-C
 519 KM ROUTE CNW150-C TO CCNW159-C
 520 KM FACILITY = LAS VEGAS WASH MIDDLE
 521 KM FACILITY ID-MILE = LVMD 2525
 522 KM LINING = RCB
 523 RD 1320 0.004 0.015 0 TRAP 22 0
 *

HEC-1 INPUT

PAGE 15

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

524 KK NW159-C
 525 BA 0.249
 526 PB 2.77
 527 LS 0 80.8
 528 UD 0.456

529 KK CCNW159
 530 KM COMBINE NW159-C AND RC150-C
 531 KM LAS VEGAS WASH MIDDLE @ ELKHORN AND RAINBOW
 532 HC 2
 *
 533 KK RC159-C
 534 KM ROUTE CCNW159-C TO CNW168-C
 535 KM FACILITY = LAS VEGAS WASH MIDDLE
 536 KM FACILITY ID-MILE = LVMD 2490
 537 KM LINING = RCB
 538 RD 2600 0.004 0.015 0 TRAP 26 0
 *
 539 KK NW172-C
 540 BA 0.272
 541 PB 2.77
 542 LS 0 81.3
 543 UD 0.417
 *
 544 KKRNW172-C
 545 KM ROUTE NW172-C TO CNW170-C
 546 KM TORREY PINES
 547 RD 2600 0.0069 0.016 0 TRAP 0 50
 *
 548 KK NW170-C
 549 BA 0.254
 550 PB 2.77
 551 LS 0 81.8
 552 UD 0.406
 *
 553 KKCNW170-C
 554 KM COMBINE NW170-C AND RNW172-C
 555 KM FARM AND TORREY PINES
 556 HC 2
 *
 557 KK RC170-C
 558 KM ROUTE CNW170-C TO NW168-C
 559 KM TORREY PINES
 560 RD 2600 0.004 0.016 0 TRAP 0 50
 *

1

HEC-1 INPUT

PAGE 16

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

561 KK NW168-C
 562 BA 0.254
 563 PB 2.77
 564 LS 0 80.1
 565 UD 0.408
 *
 566 KKCNW168-C
 567 KM COMBINE NW168-C, RC170-C AND RC159-C
 568 KM LAS VEGAS WASH MIDDLE @ TORREY PINES
 569 HC 3
 *
 570 KK RC168-C
 571 KM ROUTE CNW168-C TO 2C178-C
 572 KM FACILITY = LAS VEGAS WASH MIDDLE
 573 KM FACILITY ID-MILE = LVMD 2490
 574 KM LINING = RCB
 575 RD 2600 0.004 0.015 0 TRAP 26 0
 *
 576 KK NW180-C
 577 BA 0.245
 578 PB 2.77
 579 LS 0 80.9
 580 UD 0.422
 *
 581 KKRNW180-C
 582 KM ROUTE NW180-C TO CNW178-C
 583 KM FACILITY = LAS VEGAS WASH JONES
 584 KM FACILITY ID-MILE = LVMD 0000
 585 KM LINING = RCB
 586 RD 2600 0.004 0.015 0 DEEP 7 0
 *
 587 KK NW178-C
 588 BA 0.250
 589 PB 2.77
 590 LS 0 82.1
 591 UD 0.406
 *
 592 KKCNW178-C
 593 KM COMBINE NW178-C AND RNW180-C
 594 KM LAS VEGAS WASH-JONES FLOW @ LAS VEGAS WASH MIDDLE
 595 HC 2
 *

1

HEC-1 INPUT

PAGE 17

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

596 KK 2C178-C
 597 KM COMBINE CNW178-C AND RC168-C
 598 KM LAS VEGAS WASH MIDDLE @ JONES
 599 HC 2
 *
 600 KK RC178-C
 601 KM ROUTE 2C178-C TO CNW188-C
 602 KM FACILITY = LAS VEGAS WASH MIDDLE
 603 KM FACILITY ID-MILE = LVMD 2443
 604 KM LINING = RCB
 605 RD 2600 0.004 0.015 0 TRAP 26 0
 *

606 KK NW188-C
 607 BA 0.246
 608 PB 2.77
 609 LS 0 84.0
 610 UD 0.394
 *
 611 KRCNW188-C
 612 KM COMBINE NW188-C AND RC178-C
 613 KM LAS VEGAS WASH MIDDLE @ BRADLEY
 614 HC 2
 *
 615 KK RC188-C
 616 KM ROUTE CNW188-C TO 2C198-C
 617 KM FACILITY = LAS VEGAS WASH MIDDLE
 618 KM FACILITY ID-MILE = LVMD 2443
 619 KM LINING = RCB
 620 RD 2600 0.0040 0.015 0 TRAP 26 0
 *
 621 KK NW190-C
 622 BA 0.209
 623 PB 2.77
 624 LS 0 83.0
 625 UD 0.383
 *
 626 KRCNW190-C
 627 KM ROUTE NW190-C TO CNW200-C
 628 KM FARM
 629 RD 2600 0.004 0.016 0 TRAP 0 50
 *
 630 KK NW200-C
 631 BA 0.226
 632 PB 2.77
 633 LS 0 85.1
 634 UD 0.400
 *

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HEC-1 INPUT

PAGE 18

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

635 KRCNW200-C
 636 KM COMBINE NW200-C AND RNM190-C
 637 KM FARM AND DECATUR
 638 HC 2
 *
 639 KK RC200-C
 640 KM ROUTE CNW200-C TO CNW198-C
 641 KM FACILITY = LAS VEGAS WASH DECATUR
 642 KM FACILITY ID-MILE = LVDE 0000
 643 KM LINING = RCP
 644 RD 2640 0.006 0.013 0 CIRC 8 0
 *
 645 KK NW198-C
 646 BA 0.249
 647 PB 2.77
 648 LS 0 88.4
 649 UD 0.400
 *
 650 KRCNW198-C
 651 KM COMBINE NW198-C AND RC200-C
 652 KM LAS VEGAS WASH-DECATUR @ LAS VEGAS WASH MIDDLE
 653 HC 2
 *
 654 KK 2C198-C
 655 KM COMBINE CNW198-C AND RC188-C
 656 KM LAS VEGAS WASH MIDDLE @ DECATUR
 657 HC 2
 *
 658 KK RC198-C
 659 KM ROUTE 2C198-C TO CNW3C2-C
 660 KM FACILITY = LAS VEGAS WASH MIDDLE
 661 KM FACILITY ID-MILE = LVMD 2324
 662 KM LINING = RCB
 663 RD 2600 0.004 0.015 0 TRAP 28 0
 *
 664 KK NW3C2-C
 665 BA 0.495
 666 PB 2.77
 667 LS 0 86.4
 668 UD 0.550
 *
 669 KRCNW3C2-C
 670 KM COMBINE NW3C2-C AND RC198-C
 671 KM LAS VEGAS WASH MIDDLE @ DEER SPRINGS
 672 HC 2
 *

1

HEC-1 INPUT

PAGE 19

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

673 KK RC3C2-C
 674 KM ROUTE CNW3C2-C TO CNW3D4-C
 675 KM FACILITY = LAS VEGAS WASH MIDDLE
 676 KM FACILITY ID-MILE = LVMD 2324
 677 KM LINING = RCB
 678 RD 2600 0.004 0.015 0 TRAP 28 0
 *
 679 KK NW3D4-C
 680 BA 0.256
 681 PB 2.77
 682 LS 0 88.7
 683 UD 0.417
 *

684 KKCWN3D4-C
 685 KM COMBINE NW3D4-C AND RC3C2-C
 686 KM LAS VEGAS MIDDLE FLOW U/S CENTENNIAL PKWY CHANNEL WEST
 687 HC 2
 688 ZZ

1

SCHEMATIC DIAGRAM OF STREAM NETWORK

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

```

35 NW129-C
   V
   V
49 RC129-C
   .
   .
55     NW102-C
   .     V
   .     V
61     RNW102-C
   .
   .
65     .     NW130W
   .
72     .     CNW130W
   .
78     .     <---*REMOVED
76     .     *NO_FLOW
   .
81     .     NW130E
   .     V
   .     V
88     .     RNW130E
   .
92     .     CNW130E
   .
96     .     NW148-C
   .
101    CNW148-C
   .
   V
105    RC148-C
   .
   .
111    .     NW128N
   .
117    CNW128N
   .
   .
120    .     NW157
   .
125    CTULEDB
   .
   V
129    TULRDB
   .
140    <---*REMOVED
138    *NO_FLOW
   .
143    .     NW128S
   .
149    .     NW147B
   .
155    CNW147E
   .
   V
158    RC147B
   .
   .
164    .     NW100-C
   .     V
   .     V
170    .     RNW100-C
   .
   .
175    .     NW116-C
   .
181    .     CNW116-C
   .     V
   .     V
184    .     RNW116-C
   .
   .
190    .     NW78-C
   .     V
   .     V
196    .     RNW78-C
   .
   .
201    .     NW115-C
   .
206    .     CNW115-C
   .
   V
209    .     RNW115-C
   .
   .
215    .     NW96-C
   .     V
   .     V
  
```


220		RNW96-C
227		NW113-C
232		CNW113-C
235	C2W113-C	
	V	
	V	
238	RNW113-C	
244		NW147W
250	CNW147W	
	V	
	V	
253	RC147W	
259		NW111N
	V	
	V	
265	RNW111N	
269		NW144W
275		CNW144W
279	CCNW144W	
283		NW142N
289	CBRENTDB	
	V	
	V	
292	BRENTDB	
306		*REMOVED
304	*NO_FLOW	
309		NW144E
315	CNW144E	
	V	
	V	
318	RC144E	
324		NW155-C
329	CNW155-C	
	V	
	V	
332	RC155-C	
338		NW165
	V	
	V	
343	RNW165	
347		NW164
352	CNW164	
	V	
	V	
355	RCNW164	
359		NW163-C
364	CNW163-C	
367		NW111S
	V	
	V	
373	RNW111S	
377		NW109-C
382	CNW109-C	
	V	
	V	
385	RC109-C	
391		NW138-C
396		NW139-C
401	CNW139-C	
	V	
	V	
405	RC139-C	

411 2C163-C
 V
 414 RC163-C
 V
 420 NW162-C
 V
 425 CNW162-C
 V
 429 RC162-C
 V
 435 NW161-C
 V
 443 DNW161-C DNW150-C
 440
 446 CD161-C
 V
 450 RCD161-C
 V
 456 NW134-C
 V
 461 NW133-C
 V
 466 CNW133-C
 V
 470 BLKBASIN
 V
 482 REKLDB
 V
 490 DNW150-C DNW150-C
 488
 V
 491 RD150-C
 V
 495 CRD150-C
 V
 499 RCRD150
 V
 505 NW150-C
 V
 510 CNW150-C
 V
 514 CCNW150
 V
 518 RC150-C
 V
 524 NW159-C
 V
 529 CCNW159
 V
 533 RC159-C
 V
 539 NW172-C
 V
 544 RNW172-C
 V
 548 NW170-C
 V
 553 CNW170-C
 V
 557 RC170-C
 V
 561 NW168-C
 V
 566 CNW168-C
 V
 570 RC168-C
 V
 576 NW180-C
 V
 581 RNW180-C
 V
 587 NW178-C
 V
 592 CNW178-C
 V
 596 2C178-C
 V
 600 RC178-C

606 NW188-C
 611 CNW188-C
 V
 V
 615 RC188-C
 621 NW190-C
 V
 V
 626 RNW190-C
 630 NW200-C
 635 CNW200-C
 V
 V
 639 RC200-C
 645 NW198-C
 650 CNW198-C
 654 2C198-C
 V
 V
 658 RC198-C
 664 NW3C2-C
 669 CNW3C2-C
 V
 V
 673 RC3C2-C
 679 NW3D4-C
 684 CNW3D4-C

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

FLOOD HYDROGRAPH PACKAGE (HEC-1)
 JUN 1998
 VERSION 4.1
 RUN DATE 06DEC04 TIME 12:53:01

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

MODIFIED BY THE LOUIS BERGER GROUP, INC.
 ADDED TULE SPRINGS AND BRENT DETENTION BASINS AND RESPECTIVE COLLECTION FACT

CLARK COUNTY REGIONAL FLOOD CONTROL DISTRICT 2002 MASTER PLAN UPDATE
 NORTHERN LAS VEGAS WASH WATERSHED
 RECOMMENDED DRAINAGE SYSTEM WITH ULTIMATE DEVELOPMENT
 INPUT FILE = WEST3A.DAT
 INPUT FILE DATE = 11/22/04
 DESIGN STORM = 100-YEAR 6-HOUR STORM
 STORM DISTRIBUTION = SDN3
 MODELED BY = PBS&J - MATT BAIRD
 STORM CENTERING = WEST TRIBUTARY
 DOWNSTREAM OF THE UPPER LAS VEGAS WASH DETENTION BASIN TO THE
 MOST DOWNSTREAM POINT IN THE WATERSHED
 COMBINATION POINTS WERE REMOVED DOWNSTREAM OF DETENTION BASINS
 TO SIMULATE NECESSARY STORM CENTERINGS

JR CARDS CONTAIN DARFS BASED ON THE FOLLOWING VALUES:

AREA (SQUARE MILES)	DARF
0 - 0.5	0.99
0.5 - 1	0.975
1 - 2	0.95
2 - 3	0.925
3 - 4	0.915
4 - 5	0.908
5 - 6	0.903
6 - 7	0.895
7 - 8	0.885

32 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
STORAGE VOLUME
SURFACE AREA
TEMPERATURE

CUBIC FEET PER SECOND
ACRE-FEET
ACRES
DEGREES FAHRENHEIT

JP MULTI-PLAN OPTION
NPLAN 1 NUMBER OF PLANS

JR MULTI-RATIO OPTION
RATIOS OF PRECIPITATION
.99 .98 .95 .93 .92 .91 .90 .89 .88

129 KK

TULEDB

130 KO

OUTPUT CONTROL VARIABLES

IPRNT 3 PRINT CONTROL
IPLOT 0 PLOT CONTROL
QSCAL 0. HYDROGRAPH PLOT SCALE
FACILITY = TULE SPRINGS DETENTION BASIN
FACILITY ID-MILE = TSDB 0011
12" ORIFICE PLATE

HYDROGRAPH ROUTING DATA

134 RS

STORAGE ROUTING

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

135 SV

STORAGE

.0 1.4 6.4 17.1 35.4 61.4 91.9

136 SE

ELEVATION

2427.00 2428.00 2429.00 2430.00 2431.00 2432.00 2433.00

137 SQ

DISCHARGE

0. 3. 5. 6. 7. 8. 9.

HYDROGRAPH AT STATION TULEDB
FOR PLAN 1, RATIO = .99

PEAK FLOW	TIME	6-HR	24-HR	72-HR	24.92-HR
+	(CFS)				
+	8. 6.58	8. 6.58	7. 6.58	6. 6.58	6. 6.58
	(INCHES)	.045	.157	.157	.157
	(AC-FT)	4.	13.	13.	13.
PEAK STORAGE	TIME	6-HR	24-HR	72-HR	24.92-HR
+	(AC-FT)				
+	51. 6.58	50.	40.	38.	38.
PEAK STAGE	TIME	6-HR	24-HR	72-HR	24.92-HR
+	(FEET)				
+	2431.60 6.58	2431.55	2430.89	2430.75	2430.75
CUMULATIVE AREA =		1.58 SQ MI			

HYDROGRAPH AT STATION TULEDB
FOR PLAN 1, RATIO = .98

PEAK FLOW	TIME	6-HR	24-HR	72-HR	24.92-HR
+	(CFS)				
+	8. 6.58	8. 6.58	7. 6.58	6. 6.58	6. 6.58
	(INCHES)	.044	.156	.156	.156
	(AC-FT)	4.	13.	13.	13.
PEAK STORAGE	TIME	6-HR	24-HR	72-HR	24.92-HR
+	(AC-FT)				
+	49. 6.58	48.	38.	37.	37.
PEAK STAGE	TIME	6-HR	24-HR	72-HR	24.92-HR
+	(FEET)				
+	2431.54 6.58	2431.50	2430.84	2430.70	2430.70
CUMULATIVE AREA =		1.58 SQ MI			

HYDROGRAPH AT STATION TULEDB
FOR PLAN 1, RATIO = .95

PEAK FLOW	TIME	6-HR	24-HR	72-HR	24.92-HR
+	(CFS)				
+	8. 6.42	7. 6.42	7. 6.42	6. 6.42	6. 6.42
	(INCHES)	.044	.154	.154	.154
	(AC-FT)	4.	13.	13.	13.
PEAK STORAGE	TIME	6-HR	24-HR	72-HR	24.92-HR
+	(AC-FT)				
+	47. 6.58	46.	36.	35.	35.
PEAK STAGE	TIME	MAXIMUM AVERAGE STAGE			

			6-HR	24-HR	72-HR	24.92-HR
+	(FEET)	(HR)				
	2431.45	6.58	2431.40	2430.75	2430.62	2430.62

CUMULATIVE AREA = 1.58 SQ MI

HYDROGRAPH AT STATION TULEDB
FOR PLAN 1, RATIO = .93

PEAK FLOW	TIME		6-HR	24-HR	72-HR	24.92-HR
+	(CFS)	(HR)				
	7.	6.42	(CFS)			
			7.	6.	6.	6.
			(INCHES)	.043	.152	.152
			(AC-FT)	4.	13.	13.

PEAK STORAGE	TIME		6-HR	24-HR	72-HR	24.92-HR
+	(AC-FT)	(HR)				
	45.	6.58	43.	34.	33.	33.

PEAK STAGE	TIME		6-HR	24-HR	72-HR	24.92-HR
+	(FEET)	(HR)				
	2431.35	6.58	2431.31	2430.67	2430.53	2430.53

CUMULATIVE AREA = 1.58 SQ MI

HYDROGRAPH AT STATION TULEDB
FOR PLAN 1, RATIO = .92

PEAK FLOW	TIME		6-HR	24-HR	72-HR	24.92-HR
+	(CFS)	(HR)				
	7.	6.42	(CFS)			
			7.	6.	6.	6.
			(INCHES)	.043	.151	.151
			(AC-FT)	4.	13.	13.

PEAK STORAGE	TIME		6-HR	24-HR	72-HR	24.92-HR
+	(AC-FT)	(HR)				
	44.	6.58	42.	33.	32.	32.

PEAK STAGE	TIME		6-HR	24-HR	72-HR	24.92-HR
+	(FEET)	(HR)				
	2431.32	6.58	2431.27	2430.63	2430.50	2430.50

CUMULATIVE AREA = 1.58 SQ MI

HYDROGRAPH AT STATION TULEDB
FOR PLAN 1, RATIO = .91

PEAK FLOW	TIME		6-HR	24-HR	72-HR	24.92-HR
+	(CFS)	(HR)				
	7.	6.42	(CFS)			
			7.	6.	6.	6.
			(INCHES)	.043	.150	.150
			(AC-FT)	4.	13.	13.

PEAK STORAGE	TIME		6-HR	24-HR	72-HR	24.92-HR
+	(AC-FT)	(HR)				
	43.	6.58	42.	33.	32.	32.

PEAK STAGE	TIME		6-HR	24-HR	72-HR	24.92-HR
+	(FEET)	(HR)				
	2431.29	6.50	2431.25	2430.61	2430.48	2430.48

CUMULATIVE AREA = 1.58 SQ MI

HYDROGRAPH AT STATION TULEDB
FOR PLAN 1, RATIO = .90

PEAK FLOW	TIME		6-HR	24-HR	72-HR	24.92-HR
+	(CFS)	(HR)				
	7.	6.42	(CFS)			
			7.	6.	6.	6.
			(INCHES)	.043	.150	.150
			(AC-FT)	4.	13.	13.

PEAK STORAGE	TIME		6-HR	24-HR	72-HR	24.92-HR
+	(AC-FT)	(HR)				
	43.	6.58	41.	32.	31.	31.

PEAK STAGE	TIME		6-HR	24-HR	72-HR	24.92-HR
+	(FEET)	(HR)				
	2431.27	6.50	2431.23	2430.59	2430.46	2430.46

CUMULATIVE AREA = 1.58 SQ MI

HYDROGRAPH AT STATION TULEDB
FOR PLAN 1, RATIO = .89

PEAK FLOW	TIME		6-HR	24-HR	72-HR	24.92-HR
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+	(CFS)	(HR)					
+	7.	6.42	(CFS)	7.	6.	6.	6.
			(INCHES)	.043	.149	.149	.149
			(AC-FT)	4.	13.	13.	13.

PEAK STORAGE	TIME		6-HR	24-HR	72-HR	24.92-HR
+	(AC-FT)	(HR)				
	42.	6.58	41.	32.	31.	31.

PEAK STAGE	TIME		6-HR	24-HR	72-HR	24.92-HR
+	(FEET)	(HR)				
	2431.24	6.50	2431.20	2430.56	2430.43	2430.43

CUMULATIVE AREA = 1.58 SQ MI

HYDROGRAPH AT STATION TULEDB
FOR PLAN 1, RATIO = .88

PEAK FLOW	TIME		6-HR	24-HR	72-HR	24.92-HR
+	(CFS)	(HR)				
	7.	6.42	(CFS)	7.	6.	6.
			(INCHES)	.043	.148	.148
			(AC-FT)	4.	12.	12.

PEAK STORAGE	TIME		6-HR	24-HR	72-HR	24.92-HR
+	(AC-FT)	(HR)				
	41.	6.58	40.	31.	30.	30.

PEAK STAGE	TIME		6-HR	24-HR	72-HR	24.92-HR
+	(FEET)	(HR)				
	2431.21	6.50	2431.16	2430.52	2430.39	2430.39

CUMULATIVE AREA = 1.58 SQ MI

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292 KK

BRENTDB

293 KO

OUTPUT CONTROL VARIABLES

IPRNT 3 PRINT CONTROL
IPLOT 0 PLOT CONTROL
QSCAL 0 HYDROGRAPH PLOT SCALE
FACILITY = BRENT DETENTION BASIN
ID MILE = BRDB 0032
12" ORIFICE PLATE

HYDROGRAPH ROUTING DATA

297 RS

STORAGE ROUTING

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

298 SV

STORAGE

.0	1.0	3.6	8.7	16.7	27.8	42.0	59.4	79.9	103.6
130.7	161.0	194.4							

300 SE

ELEVATION

2441.00	2442.00	2443.00	2444.00	2445.00	2446.00	2447.00	2448.00	2449.00	2450.00
2451.00	2452.00	2453.00							

302 SQ

DISCHARGE

.0	3.	5.	6.	7.	8.	9.	10.	10.	11.
12.	12.	13.							

HYDROGRAPH AT STATION BRENTDB
FOR PLAN 1, RATIO = .99

PEAK FLOW	TIME		6-HR	24-HR	72-HR	24.92-HR
+	(CFS)	(HR)				
	12.	6.58	(CFS)	12.	11.	11.
			(INCHES)	.050	.181	.181
			(AC-FT)	6.	22.	22.

PEAK STORAGE	TIME		6-HR	24-HR	72-HR	24.92-HR
+	(AC-FT)	(HR)				
	168.	6.75	166.	139.	134.	134.

PEAK STAGE	TIME		6-HR	24-HR	72-HR	24.92-HR
+	(FEET)	(HR)				
	2452.21	6.75	2452.14	2450.78	2450.42	2450.42

CUMULATIVE AREA = 2.31 SQ MI

HYDROGRAPH AT STATION BRENTDB
FOR PLAN 1, RATIO = .98

PEAK FLOW	TIME		6-HR	24-HR	72-HR	24.92-HR
+	(CFS)	(HR)				
			(CFS)			

+	12.	6.58	(INCHES) (AC-FT)	12. .050 6.	11. .179 22.	11. .179 22.	11. .179 22.
PEAK STORAGE		TIME		6-HR	MAXIMUM AVERAGE STORAGE	24-HR	72-HR
+	(AC-FT)	(HR)					24.92-HR
	164.	6.75		162.	135.	130.	130.
PEAK STAGE		TIME		6-HR	MAXIMUM AVERAGE STAGE	24-HR	72-HR
+	(FEET)	(HR)					24.92-HR
	2452.08	6.75		2452.02	2450.66	2450.31	2450.31

CUMULATIVE AREA = 2.31 SQ MI

HYDROGRAPH AT STATION BRENTDB
FOR PLAN 1, RATIO = .95

PEAK FLOW		TIME		6-HR	MAXIMUM AVERAGE FLOW	24-HR	72-HR
+	(CFS)	(HR)					24.92-HR
+	12.	6.58	(CFS)	12.	11.	11.	11.
			(INCHES)	.049	.177	.177	.177
			(AC-FT)	6.	22.	22.	22.
PEAK STORAGE		TIME		6-HR	MAXIMUM AVERAGE STORAGE	24-HR	72-HR
+	(AC-FT)	(HR)					24.92-HR
	157.	6.75		155.	129.	124.	124.
PEAK STAGE		TIME		6-HR	MAXIMUM AVERAGE STAGE	24-HR	72-HR
+	(FEET)	(HR)					24.92-HR
	2451.86	6.67		2451.80	2450.46	2450.11	2450.11

CUMULATIVE AREA = 2.31 SQ MI

HYDROGRAPH AT STATION BRENTDB
FOR PLAN 1, RATIO = .93

PEAK FLOW		TIME		6-HR	MAXIMUM AVERAGE FLOW	24-HR	72-HR
+	(CFS)	(HR)					24.92-HR
+	12.	6.58	(CFS)	12.	11.	10.	10.
			(INCHES)	.048	.175	.175	.175
			(AC-FT)	6.	22.	22.	22.
PEAK STORAGE		TIME		6-HR	MAXIMUM AVERAGE STORAGE	24-HR	72-HR
+	(AC-FT)	(HR)					24.92-HR
	150.	6.67		148.	123.	119.	119.
PEAK STAGE		TIME		6-HR	MAXIMUM AVERAGE STAGE	24-HR	72-HR
+	(FEET)	(HR)					24.92-HR
	2451.64	6.67		2451.57	2450.25	2449.91	2449.91

CUMULATIVE AREA = 2.31 SQ MI

HYDROGRAPH AT STATION BRENTDB
FOR PLAN 1, RATIO = .92

PEAK FLOW		TIME		6-HR	MAXIMUM AVERAGE FLOW	24-HR	72-HR
+	(CFS)	(HR)					24.92-HR
+	12.	6.58	(CFS)	12.	11.	10.	10.
			(INCHES)	.048	.174	.174	.174
			(AC-FT)	6.	21.	21.	21.
PEAK STORAGE		TIME		6-HR	MAXIMUM AVERAGE STORAGE	24-HR	72-HR
+	(AC-FT)	(HR)					24.92-HR
	147.	6.67		145.	121.	116.	116.
PEAK STAGE		TIME		6-HR	MAXIMUM AVERAGE STAGE	24-HR	72-HR
+	(FEET)	(HR)					24.92-HR
	2451.55	6.67		2451.48	2450.17	2449.83	2449.83

CUMULATIVE AREA = 2.31 SQ MI

HYDROGRAPH AT STATION BRENTDB
FOR PLAN 1, RATIO = .91

PEAK FLOW		TIME		6-HR	MAXIMUM AVERAGE FLOW	24-HR	72-HR
+	(CFS)	(HR)					24.92-HR
+	12.	6.58	(CFS)	12.	11.	10.	10.
			(INCHES)	.048	.174	.174	.174
			(AC-FT)	6.	21.	21.	21.
PEAK STORAGE		TIME		6-HR	MAXIMUM AVERAGE STORAGE	24-HR	72-HR
+	(AC-FT)	(HR)					24.92-HR
	146.	6.67		143.	119.	115.	115.
PEAK STAGE		TIME		6-HR	MAXIMUM AVERAGE STAGE	24-HR	72-HR
+	(FEET)	(HR)					24.92-HR
	2451.49	6.67		2451.42	2450.11	2449.78	2449.78

CUMULATIVE AREA = 2.31 SQ MI

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HYDROGRAPH AT STATION BRENTDB
FOR PLAN 1, RATIO = .90

PEAK FLOW      TIME      6-HR      24-HR      72-HR      24.92-HR
+ (CFS)        (HR)
+ 12.          6.58      (CFS)      12.         11.         10.         10.
              (INCHES) .048        .173        .173        .173
              (AC-FT)  6.         21.         21.         21.

PEAK STORAGE   TIME      6-HR      24-HR      72-HR      24.92-HR
+ (AC-FT)      (HR)
+ 144.         6.67      142.       118.       114.       114.

PEAK STAGE     TIME      6-HR      24-HR      72-HR      24.92-HR
+ (FEET)       (HR)
+ 2451.44      6.67      2451.38    2450.07    2449.74    2449.74

CUMULATIVE AREA = 2.31 SQ MI

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HYDROGRAPH AT STATION BRENTDB
FOR PLAN 1, RATIO = .89

PEAK FLOW      TIME      6-HR      24-HR      72-HR      24.92-HR
+ (CFS)        (HR)
+ 12.          6.58      (CFS)      12.         11.         10.         10.
              (INCHES) .048        .172        .172        .172
              (AC-FT)  6.         21.         21.         21.

PEAK STORAGE   TIME      6-HR      24-HR      72-HR      24.92-HR
+ (AC-FT)      (HR)
+ 142.         6.67      140.       116.       112.       112.

PEAK STAGE     TIME      6-HR      24-HR      72-HR      24.92-HR
+ (FEET)       (HR)
+ 2451.37      6.67      2451.31    2450.01    2449.68    2449.68

CUMULATIVE AREA = 2.31 SQ MI

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HYDROGRAPH AT STATION BRENTDB
FOR PLAN 1, RATIO = .88

PEAK FLOW      TIME      6-HR      24-HR      72-HR      24.92-HR
+ (CFS)        (HR)
+ 12.          6.58      (CFS)      12.         11.         10.         10.
              (INCHES) .048        .171        .171        .171
              (AC-FT)  6.         21.         21.         21.

PEAK STORAGE   TIME      6-HR      24-HR      72-HR      24.92-HR
+ (AC-FT)      (HR)
+ 139.         6.67      137.       114.       110.       110.

PEAK STAGE     TIME      6-HR      24-HR      72-HR      24.92-HR
+ (FEET)       (HR)
+ 2451.26      6.67      2451.22    2449.92    2449.59    2449.59

CUMULATIVE AREA = 2.31 SQ MI

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470 KK      ELKBASIN
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477 KO      OUTPUT CONTROL VARIABLES
            IPRNT      3      PRINT CONTROL
            IPLOT      0      PLOT CONTROL
            QSCAL      0      HYDROGRAPH PLOT SCALE

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HYDROGRAPH ROUTING DATA

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478 RS      STORAGE ROUTING
            NSTPS      1      NUMBER OF SUBREACHES
            ITYP      STOR TYPE OF INITIAL CONDITION
            RSVRIC     -1.00 INITIAL CONDITION
            X          .00 WORKING R AND D COEFFICIENT

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479 SA      AREA      3.3      3.7      4.0      4.3      4.7      5.0      5.4
480 SE      ELEVATION 2388.00 2390.00 2392.00 2394.00 2396.00 2398.00 2400.00
481 SQ      DISCHARGE 0.       36.     66.     86.     103.    117.    130.

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COMPUTED STORAGE-ELEVATION DATA

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STORAGE      .00      6.97      14.60      22.89      31.88      41.58      52.01
ELEVATION    2388.00 2390.00 2392.00 2394.00 2396.00 2398.00 2400.00

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WARNING --- ROUTED OUTFLOW (130.) IS GREATER THAN MAXIMUM OUTFLOW (130.) IN STORAGE-OUTFLOW TABLE
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HYDROGRAPH AT STATION ELKBASIN
 FOR PLAN 1, RATIO = .99

PEAK FLOW	TIME		6-HR	24-HR	72-HR	24.92-HR
+	(CFS)	(HR)				
+	130.	5.50	(CFS)	110.	39.	37.
			(INCHES)	1.122	1.582	1.582
			(AC-FT)	55.	77.	77.

PEAK STORAGE	TIME		6-HR	24-HR	72-HR	24.92-HR
+	(AC-FT)	(HR)				
+	53.	5.50		38.	12.	11.

PEAK STAGE	TIME		6-HR	24-HR	72-HR	24.92-HR
+	(FEET)	(HR)				
+	2400.11	5.50		2397.21	2390.97	2390.86

CUMULATIVE AREA = .91 SQ MI

*** *** *** *** ***

HYDROGRAPH AT STATION ELKBASIN
 FOR PLAN 1, RATIO = .98

PEAK FLOW	TIME		6-HR	24-HR	72-HR	24.92-HR
+	(CFS)	(HR)				
+	129.	5.50	(CFS)	109.	38.	37.
			(INCHES)	1.105	1.546	1.546
			(AC-FT)	54.	75.	75.

PEAK STORAGE	TIME		6-HR	24-HR	72-HR	24.92-HR
+	(AC-FT)	(HR)				
+	51.	5.50		37.	12.	11.

PEAK STAGE	TIME		6-HR	24-HR	72-HR	24.92-HR
+	(FEET)	(HR)				
+	2399.85	5.50		2396.98	2390.88	2390.77

CUMULATIVE AREA = .91 SQ MI

*** *** *** *** ***

HYDROGRAPH AT STATION ELKBASIN
 FOR PLAN 1, RATIO = .95

PEAK FLOW	TIME		6-HR	24-HR	72-HR	24.92-HR
+	(CFS)	(HR)				
+	126.	5.50	(CFS)	106.	36.	35.
			(INCHES)	1.076	1.486	1.486
			(AC-FT)	52.	72.	72.

PEAK STORAGE	TIME		6-HR	24-HR	72-HR	24.92-HR
+	(AC-FT)	(HR)				
+	49.	5.50		35.	11.	10.

PEAK STAGE	TIME		6-HR	24-HR	72-HR	24.92-HR
+	(FEET)	(HR)				
+	2399.42	5.50		2396.59	2390.73	2390.63

CUMULATIVE AREA = .91 SQ MI

*** *** *** *** ***

HYDROGRAPH AT STATION ELKBASIN
 FOR PLAN 1, RATIO = .93

PEAK FLOW	TIME		6-HR	24-HR	72-HR	24.92-HR
+	(CFS)	(HR)				
+	123.	5.50	(CFS)	103.	35.	34.
			(INCHES)	1.047	1.427	1.427
			(AC-FT)	51.	69.	69.

PEAK STORAGE	TIME		6-HR	24-HR	72-HR	24.92-HR
+	(AC-FT)	(HR)				
+	47.	5.50		33.	10.	10.

PEAK STAGE	TIME		6-HR	24-HR	72-HR	24.92-HR
+	(FEET)	(HR)				
+	2398.99	5.50		2396.21	2390.59	2390.50

CUMULATIVE AREA = .91 SQ MI

*** *** *** *** ***

HYDROGRAPH AT STATION ELKBASIN
 FOR PLAN 1, RATIO = .92

PEAK FLOW	TIME		6-HR	24-HR	72-HR	24.92-HR
+ (CFS)	(HR)					
+ 122.	5.50	(CFS)	102.	34.	33.	33.
		(INCHES)	1.035	1.403	1.403	1.403
		(AC-FT)	50.	68.	68.	68.

PEAK STORAGE	TIME		6-HR	24-HR	72-HR	24.92-HR
+ (AC-FT)	(HR)					
+ 46.	5.50		33.	10.	10.	10.

PEAK STAGE	TIME		6-HR	24-HR	72-HR	24.92-HR
+ (FEET)	(HR)					
+ 2398.83	5.50		2396.06	2390.54	2390.44	2390.44

CUMULATIVE AREA = .91 SQ MI

HYDROGRAPH AT STATION ELKBASIN
FOR PLAN 1, RATIO = .91

PEAK FLOW	TIME		6-HR	24-HR	72-HR	24.92-HR
+ (CFS)	(HR)					
+ 121.	5.50	(CFS)	101.	34.	33.	33.
		(INCHES)	1.027	1.386	1.386	1.386
		(AC-FT)	50.	68.	68.	68.

PEAK STORAGE	TIME		6-HR	24-HR	72-HR	24.92-HR
+ (AC-FT)	(HR)					
+ 45.	5.50		32.	10.	9.	9.

PEAK STAGE	TIME		6-HR	24-HR	72-HR	24.92-HR
+ (FEET)	(HR)					
+ 2398.71	5.50		2395.95	2390.50	2390.40	2390.40

CUMULATIVE AREA = .91 SQ MI

HYDROGRAPH AT STATION ELKBASIN
FOR PLAN 1, RATIO = .90

PEAK FLOW	TIME		6-HR	24-HR	72-HR	24.92-HR
+ (CFS)	(HR)					
+ 121.	5.50	(CFS)	100.	34.	33.	33.
		(INCHES)	1.021	1.374	1.375	1.375
		(AC-FT)	50.	67.	67.	67.

PEAK STORAGE	TIME		6-HR	24-HR	72-HR	24.92-HR
+ (AC-FT)	(HR)					
+ 45.	5.50		32.	10.	9.	9.

PEAK STAGE	TIME		6-HR	24-HR	72-HR	24.92-HR
+ (FEET)	(HR)					
+ 2398.62	5.50		2395.88	2390.47	2390.38	2390.38

CUMULATIVE AREA = .91 SQ MI

HYDROGRAPH AT STATION ELKBASIN
FOR PLAN 1, RATIO = .89

PEAK FLOW	TIME		6-HR	24-HR	72-HR	24.92-HR
+ (CFS)	(HR)					
+ 120.	5.50	(CFS)	99.	33.	32.	32.
		(INCHES)	1.011	1.356	1.356	1.356
		(AC-FT)	49.	66.	66.	66.

PEAK STORAGE	TIME		6-HR	24-HR	72-HR	24.92-HR
+ (AC-FT)	(HR)					
+ 44.	5.50		31.	10.	9.	9.

PEAK STAGE	TIME		6-HR	24-HR	72-HR	24.92-HR
+ (FEET)	(HR)					
+ 2398.49	5.50		2395.76	2390.43	2390.34	2390.34

CUMULATIVE AREA = .91 SQ MI

HYDROGRAPH AT STATION ELKBASIN
FOR PLAN 1, RATIO = .88

PEAK FLOW	TIME		6-HR	24-HR	72-HR	24.92-HR
+ (CFS)	(HR)					
+ 119.	5.50	(CFS)	98.	33.	31.	31.
		(INCHES)	.999	1.332	1.332	1.332
		(AC-FT)	49.	65.	65.	65.

PEAK STORAGE	TIME		6-HR	24-HR	72-HR	24.92-HR
+ (AC-FT)	(HR)					
+ 43.	5.50		30.	9.	9.	9.

CUMULATIVE AREA = .91 SQ MI

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

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO PRECIPITATION								
				RATIO 1 .99	RATIO 2 .98	RATIO 3 .95	RATIO 4 .93	RATIO 5 .92	RATIO 6 .91	RATIO 7 .90	RATIO 8 .89	RATIO 9 .88
HYDROGRAPH AT +	NW129-C	.18	1 FLOW TIME	164. 3.75	160. 3.75	153. 3.75	147. 3.75	144. 3.75	142. 3.75	141. 3.75	139. 3.75	136. 3.75
ROUTED TO +	RC129-C	.18	1 FLOW TIME	164. 3.75	159. 3.75	153. 3.75	146. 3.75	144. 3.75	142. 3.75	140. 3.75	138. 3.75	136. 3.75
HYDROGRAPH AT +	NW102-C	.45	1 FLOW TIME	384. 3.75	374. 3.75	359. 3.75	343. 3.75	337. 3.75	332. 3.75	329. 3.75	324. 3.75	318. 3.75
ROUTED TO +	RNW102-C	.45	1 FLOW TIME	387. 3.83	378. 3.83	362. 3.83	346. 3.83	339. 3.83	335. 3.83	332. 3.83	327. 3.83	320. 3.83
HYDROGRAPH AT +	NW130W	.14	1 FLOW TIME	132. 3.67	128. 3.67	123. 3.67	117. 3.67	115. 3.67	114. 3.67	112. 3.67	111. 3.67	109. 3.67
2 COMBINED AT +	CNW130W	.59	1 FLOW TIME	482. 3.83	470. 3.83	451. 3.83	431. 3.83	423. 3.83	418. 3.83	414. 3.83	408. 3.83	400. 3.83
DIVERSION TO +	*REMOVED	.59	1 FLOW TIME	482. 3.83	470. 3.83	451. 3.83	431. 3.83	423. 3.83	418. 3.83	414. 3.83	408. 3.83	400. 3.83
HYDROGRAPH AT +	*NO_FLOW	.59	1 FLOW TIME	0. .00	0. .00	0. .00	0. .00	0. .00	0. .00	0. .00	0. .00	0. .00
HYDROGRAPH AT +	NW130E	.10	1 FLOW TIME	94. 3.58	91. 3.58	87. 3.58	83. 3.58	82. 3.58	81. 3.58	80. 3.58	78. 3.58	77. 3.58
ROUTED TO +	RNW130E	.10	1 FLOW TIME	91. 3.92	89. 3.92	85. 3.92	81. 3.92	80. 3.92	78. 3.92	78. 3.92	76. 3.92	75. 3.92
2 COMBINED AT +	CNW130E	.69	1 FLOW TIME	91. 3.92	89. 3.92	85. 3.92	81. 3.92	80. 3.92	78. 3.92	78. 3.92	76. 3.92	75. 3.92
HYDROGRAPH AT +	NW148-C	.26	1 FLOW TIME	161. 3.83	157. 3.83	149. 3.83	142. 3.83	139. 3.83	137. 3.83	136. 3.83	133. 3.83	130. 3.92
3 COMBINED AT +	CNW148-C	1.13	1 FLOW TIME	393. 3.83	381. 3.83	363. 3.83	348. 3.83	340. 3.83	335. 3.92	332. 3.92	327. 3.92	320. 3.92
ROUTED TO +	RC148-C	1.13	1 FLOW TIME	390. 3.92	380. 3.92	362. 3.92	347. 3.92	340. 3.92	335. 3.92	332. 3.92	327. 3.92	319. 3.92
HYDROGRAPH AT +	NW128N	.25	1 FLOW TIME	124. 3.83	120. 3.83	113. 3.83	107. 3.83	104. 3.83	102. 3.83	101. 3.83	99. 3.83	96. 3.83
2 COMBINED AT +	CNW128N	1.38	1 FLOW TIME	508. 3.92	494. 3.92	470. 3.92	449. 3.92	440. 3.92	433. 3.92	428. 3.92	422. 3.92	412. 3.92
HYDROGRAPH AT +	NW157	.20	1 FLOW TIME	75. 3.83	72. 3.83	67. 3.83	63. 3.83	61. 3.83	60. 3.83	59. 3.83	57. 3.83	56. 3.83
2 COMBINED AT +	CTULEDB	1.58	1 FLOW TIME	581. 3.92	564. 3.92	536. 3.92	511. 3.92	500. 3.92	492. 3.92	486. 3.92	479. 3.92	467. 3.92
ROUTED TO +	TULEDB	1.58	1 FLOW TIME	8. 6.58	8. 6.58	8. 6.42	7. 6.42	7. 6.42	7. 6.42	7. 6.42	7. 6.42	7. 6.42
** PEAK STAGES IN FEET **												
1 STAGE TIME				2431.60 6.58	2431.54 6.58	2431.45 6.58	2431.35 6.58	2431.32 6.58	2431.29 6.50	2431.27 6.50	2431.24 6.50	2431.21 6.50
DIVERSION TO +	*REMOVED	1.58	1 FLOW TIME	8. 6.58	8. 6.58	8. 6.42	7. 6.42	7. 6.42	7. 6.42	7. 6.42	7. 6.42	7. 6.42
HYDROGRAPH AT +	*NO_FLOW	1.58	1 FLOW TIME	0. .00	0. .00	0. .00	0. .00	0. .00	0. .00	0. .00	0. .00	0. .00
HYDROGRAPH AT +	NW128S	.27	1 FLOW TIME	131. 3.83	126. 3.83	119. 3.83	112. 3.83	110. 3.83	108. 3.83	106. 3.83	104. 3.83	101. 3.83
HYDROGRAPH AT +	NW147E	.17	1 FLOW TIME	104. 3.83	101. 3.83	96. 3.83	91. 3.83	89. 3.83	88. 3.83	87. 3.83	85. 3.83	83. 3.83
3 COMBINED AT +	CNW147E	2.01	1 FLOW TIME	234. 3.83	227. 3.83	215. 3.83	203. 3.83	199. 3.83	195. 3.83	193. 3.83	189. 3.83	185. 3.83

ROUTED TO	RC147E	2.01	1	FLOW TIME	256. 4.25	253. 4.25	247. 4.25	236. 4.25	229. 4.25	224. 4.25	220. 4.25	213. 4.25	198. 4.25
HYDROGRAPH AT	NW100-C	.33	1	FLOW TIME	281. 3.75	274. 3.75	263. 3.75	251. 3.75	247. 3.75	244. 3.75	241. 3.75	238. 3.75	233. 3.75
ROUTED TO	RNW100-C	.33	1	FLOW TIME	283. 3.83	275. 3.83	264. 3.83	252. 3.83	247. 3.83	244. 3.83	241. 3.83	238. 3.83	233. 3.83
HYDROGRAPH AT	NW116-C	.20	1	FLOW TIME	150. 3.75	146. 3.75	139. 3.75	132. 3.75	130. 3.75	128. 3.75	127. 3.75	124. 3.75	122. 3.75
2 COMBINED AT	CNW116-C	.53	1	FLOW TIME	419. 3.83	408. 3.83	390. 3.83	372. 3.83	365. 3.83	360. 3.83	357. 3.83	351. 3.83	344. 3.83
ROUTED TO	RNW116-C	.53	1	FLOW TIME	414. 3.83	404. 3.83	385. 3.83	368. 3.83	360. 3.83	356. 3.83	352. 3.83	346. 3.83	339. 3.83
HYDROGRAPH AT	NW78-C	.19	1	FLOW TIME	195. 3.67	191. 3.67	183. 3.67	176. 3.67	173. 3.67	171. 3.67	170. 3.67	167. 3.67	165. 3.67
ROUTED TO	RNW78-C	.19	1	FLOW TIME	199. 3.83	194. 3.83	187. 3.83	180. 3.83	177. 3.83	175. 3.83	173. 3.83	171. 3.83	168. 3.83
HYDROGRAPH AT	NW115-C	.23	1	FLOW TIME	168. 3.67	163. 3.75	156. 3.75	148. 3.75	145. 3.75	143. 3.75	142. 3.75	139. 3.75	136. 3.75
3 COMBINED AT	CNW115-C	.95	1	FLOW TIME	764. 3.83	746. 3.83	712. 3.83	681. 3.83	668. 3.83	660. 3.83	653. 3.83	642. 3.83	630. 3.83
ROUTED TO	RNW115-C	.95	1	FLOW TIME	757. 3.83	737. 3.83	704. 3.83	673. 3.83	660. 3.83	652. 3.83	644. 3.83	634. 3.83	622. 3.83
HYDROGRAPH AT	NW96-C	.26	1	FLOW TIME	302. 3.67	296. 3.67	285. 3.67	275. 3.67	271. 3.67	268. 3.67	266. 3.67	262. 3.67	258. 3.67
ROUTED TO	RNW96-C	.26	1	FLOW TIME	293. 3.75	287. 3.75	277. 3.75	267. 3.75	263. 3.75	260. 3.75	259. 3.75	256. 3.75	251. 3.75
HYDROGRAPH AT	NW113-C	.23	1	FLOW TIME	231. 3.67	226. 3.67	217. 3.75	209. 3.75	205. 3.75	203. 3.75	201. 3.75	199. 3.75	195. 3.75
2 COMBINED AT	CNW113-C	.50	1	FLOW TIME	524. 3.75	513. 3.75	495. 3.75	476. 3.75	468. 3.75	463. 3.75	460. 3.75	454. 3.75	446. 3.75
2 COMBINED AT	C2W113-C	1.44	1	FLOW TIME	1232. 3.75	1200. 3.75	1151. 3.83	1103. 3.83	1084. 3.83	1072. 3.83	1060. 3.83	1044. 3.83	1026. 3.83
ROUTED TO	RNW113-C	1.44	1	FLOW TIME	1229. 3.83	1199. 3.83	1150. 3.83	1101. 3.83	1082. 3.83	1070. 3.83	1058. 3.83	1042. 3.83	1024. 3.83
HYDROGRAPH AT	NW147W	.06	1	FLOW TIME	47. 3.67	46. 3.67	44. 3.67	42. 3.67	41. 3.67	40. 3.67	40. 3.67	39. 3.67	38. 3.67
2 COMBINED AT	CNW147W	1.51	1	FLOW TIME	1267. 3.83	1236. 3.83	1185. 3.83	1135. 3.83	1115. 3.83	1102. 3.83	1090. 3.83	1074. 3.83	1055. 3.83
ROUTED TO	RC147W	1.51	1	FLOW TIME	1266. 3.83	1235. 3.83	1184. 3.83	1134. 3.83	1114. 3.83	1101. 3.83	1089. 3.83	1072. 3.83	1053. 3.83
HYDROGRAPH AT	NW111N	.26	1	FLOW TIME	324. 3.67	318. 3.67	307. 3.67	296. 3.67	292. 3.67	289. 3.67	287. 3.67	284. 3.67	279. 3.67
ROUTED TO	RNW111N	.26	1	FLOW TIME	316. 3.83	310. 3.83	299. 3.83	289. 3.83	285. 3.83	282. 3.83	280. 3.83	276. 3.83	272. 3.83
HYDROGRAPH AT	NW144W	.38	1	FLOW TIME	262. 3.83	255. 3.83	244. 3.83	232. 3.83	228. 3.83	225. 3.83	222. 3.83	219. 3.83	214. 3.83
2 COMBINED AT	CNW144W	.64	1	FLOW TIME	578. 3.83	565. 3.83	543. 3.83	521. 3.83	512. 3.83	506. 3.83	502. 3.83	495. 3.83	486. 3.83
2 COMBINED AT	CCNW144W	2.15	1	FLOW TIME	1845. 3.83	1800. 3.83	1727. 3.83	1655. 3.83	1626. 3.83	1607. 3.83	1591. 3.83	1567. 3.83	1539. 3.83
HYDROGRAPH AT	NW142N	.16	1	FLOW TIME	162. 3.67	158. 3.67	152. 3.67	145. 3.67	143. 3.67	141. 3.67	140. 3.67	138. 3.67	135. 3.67
2 COMBINED AT	CBRENTDB	2.31	1	FLOW TIME	1970. 3.83	1923. 3.83	1845. 3.83	1768. 3.83	1738. 3.83	1717. 3.83	1700. 3.83	1675. 3.83	1645. 3.83
ROUTED TO	BRENTDB	2.31	1	FLOW TIME	12. 6.58	12. 6.58	12. 6.58	12. 6.58	12. 6.58	12. 6.58	12. 6.58	12. 6.58	12. 6.58
** PEAK STAGES IN FEET **													
1	STAGE	2452.21	2452.08	2451.86	2451.64	2451.55	2451.49	2451.44	2451.37	2451.28			
	TIME	6.75	6.75	6.67	6.67	6.67	6.67	6.67	6.67	6.67			
DIVERSION TO	*REMOVED	2.31	1	FLOW	12.	12.	12.	12.	12.	12.	12.	12.	12.

				TIME	6.58	6.58	6.58	6.58	6.58	6.58	6.58	6.58
HYDROGRAPH AT	*NO_FLOW	2.31	1	FLOW TIME	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HYDROGRAPH AT	NW144E	.10	1	FLOW TIME	98.3.58	96.3.58	91.3.58	87.3.58	85.3.58	84.3.58	83.3.58	82.3.58
2 COMBINED AT	CNW144E	2.41	1	FLOW TIME	98.3.58	96.3.58	91.3.58	87.3.58	85.3.58	84.3.58	83.3.58	82.3.58
ROUTED TO	RC144E	2.41	1	FLOW TIME	111.4.25	94.4.25	88.4.33	106.4.33	90.4.33	105.4.33	90.4.33	102.4.33
HYDROGRAPH AT	NW155-C	.44	1	FLOW TIME	371.3.83	362.3.83	348.3.83	334.3.83	328.3.83	324.3.83	321.3.83	317.3.83
3 COMBINED AT	CNW155-C	4.87	1	FLOW TIME	543.4.25	519.4.25	497.4.25	462.4.25	453.4.25	434.4.25	429.4.25	415.4.33
ROUTED TO	RC155-C	4.87	1	FLOW TIME	517.4.42	499.4.42	480.4.42	457.4.42	442.4.42	433.4.42	423.4.42	412.4.42
HYDROGRAPH AT	NW165	.34	1	FLOW TIME	171.3.92	166.3.92	157.3.92	149.3.92	145.3.92	143.3.92	141.3.92	139.3.92
ROUTED TO	RNW165	.34	1	FLOW TIME	170.4.00	165.4.00	156.4.00	148.4.00	144.4.08	142.4.08	141.4.08	138.4.08
HYDROGRAPH AT	NW164	.30	1	FLOW TIME	308.3.67	301.3.67	289.3.67	278.3.67	273.3.67	270.3.67	268.3.67	264.3.67
2 COMBINED AT	CNW164	.64	1	FLOW TIME	402.3.83	391.3.83	373.3.83	355.3.83	348.3.83	343.3.83	340.3.83	334.3.83
ROUTED TO	RCNW164	.64	1	FLOW TIME	394.3.92	388.3.83	366.3.83	348.3.92	344.3.83	340.3.92	334.3.92	328.3.92
HYDROGRAPH AT	NW163-C	.36	1	FLOW TIME	274.3.83	267.3.83	255.3.83	244.3.83	240.3.83	236.3.83	234.3.83	231.3.83
3 COMBINED AT	CNW163-C	5.86	1	FLOW TIME	1023.3.92	999.3.92	954.3.92	910.3.92	896.3.92	885.3.92	874.3.92	860.3.92
HYDROGRAPH AT	NW111S	.15	1	FLOW TIME	185.3.67	182.3.67	176.3.67	169.3.67	167.3.67	165.3.67	164.3.67	162.3.67
ROUTED TO	RNW111S	.15	1	FLOW TIME	178.3.75	176.3.75	171.3.75	164.3.75	163.3.75	163.3.75	161.3.75	158.3.75
HYDROGRAPH AT	NW109-C	.36	1	FLOW TIME	361.3.67	352.3.67	338.3.67	324.3.67	319.3.67	315.3.67	312.3.67	308.3.67
2 COMBINED AT	CNW109-C	.51	1	FLOW TIME	535.3.67	525.3.67	502.3.67	484.3.67	477.3.67	471.3.67	466.3.67	458.3.67
ROUTED TO	RC109-C	.51	1	FLOW TIME	528.3.75	521.3.75	497.3.75	481.3.75	474.3.75	466.3.75	463.3.75	458.3.75
HYDROGRAPH AT	NW138-C	.23	1	FLOW TIME	200.3.83	195.3.83	188.3.83	180.3.83	177.3.83	175.3.83	174.3.83	171.3.83
HYDROGRAPH AT	NW139-C	.50	1	FLOW TIME	444.3.75	434.3.75	417.3.75	400.3.75	393.3.75	388.3.75	385.3.75	379.3.75
3 COMBINED AT	CNW139-C	1.24	1	FLOW TIME	1165.3.75	1143.3.75	1095.3.75	1054.3.75	1038.3.75	1023.3.75	1015.3.75	1002.3.75
ROUTED TO	RC139-C	1.24	1	FLOW TIME	1152.3.83	1128.3.83	1083.3.83	1038.3.83	1026.3.83	1014.3.83	1003.3.83	987.3.83
2 COMBINED AT	2C163-C	7.10	1	FLOW TIME	2167.3.83	2123.3.83	2029.3.83	1937.3.83	1912.3.83	1885.3.83	1863.3.83	1832.3.83
ROUTED TO	RC163-C	7.10	1	FLOW TIME	2146.3.83	2102.3.83	2007.3.83	1915.3.83	1889.3.83	1864.3.83	1842.3.83	1810.3.83
HYDROGRAPH AT	NW162-C	.25	1	FLOW TIME	133.3.92	129.3.92	122.3.92	116.3.92	113.3.92	112.3.92	110.3.92	108.3.92
2 COMBINED AT	CNW162-C	7.35	1	FLOW TIME	2275.3.83	2228.3.83	2125.3.83	2027.3.83	1999.3.83	1972.3.83	1949.3.83	1915.3.83
ROUTED TO	RC162-C	7.35	1	FLOW TIME	2251.3.83	2204.3.83	2102.3.92	2010.3.92	1980.3.92	1955.3.92	1936.3.92	1905.3.92
HYDROGRAPH AT	NW161-C	.33	1	FLOW TIME	186.3.92	180.3.92	172.3.92	163.3.92	160.3.92	157.3.92	156.3.92	153.3.92

DIVERSION TO	DNW150-C	.33	1	FLOW	70.	70.	70.	70.	70.	70.	70.	70.	70.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.67
HYDROGRAPH AT	DNW161-C	.33	1	FLOW	116.	110.	102.	93.	90.	87.	86.	83.	80.
				TIME	3.92	3.92	3.92	3.92	3.92	3.92	3.92	3.92	3.92
2 COMBINED AT	CD161-C	7.68	1	FLOW	2361.	2307.	2204.	2103.	2070.	2043.	2022.	1988.	1954.
				TIME	3.92	3.83	3.92	3.92	3.92	3.92	3.92	3.92	3.92
ROUTED TO	RCD161-C	7.68	1	FLOW	2359.	2302.	2201.	2100.	2066.	2040.	2018.	1983.	1949.
				TIME	3.92	3.92	3.92	3.92	3.92	3.92	3.92	3.92	3.92
HYDROGRAPH AT	NW134-C	.54	1	FLOW	454.	444.	428.	411.	404.	400.	397.	391.	385.
				TIME	3.83	3.83	3.83	3.83	3.83	3.83	3.83	3.83	3.83
HYDROGRAPH AT	NW133-C	.38	1	FLOW	286.	279.	269.	258.	254.	251.	249.	245.	241.
				TIME	3.92	3.92	3.92	3.92	3.92	3.92	3.92	3.92	3.92
2 COMBINED AT	CNW133-C	.91	1	FLOW	736.	720.	693.	667.	656.	648.	643.	634.	624.
				TIME	3.92	3.92	3.92	3.92	3.92	3.92	3.92	3.92	3.92
ROUTED TO	ELKBASIN	.91	1	FLOW	130.	129.	126.	123.	122.	121.	121.	120.	119.
				TIME	5.50	5.50	5.50	5.50	5.50	5.50	5.50	5.50	5.50
** PEAK STAGES IN FEET **													
ROUTED TO	REKLDB	.91	1	FLOW	130.	129.	126.	123.	122.	121.	121.	120.	119.
				TIME	5.50	5.50	5.50	5.50	5.50	5.50	5.50	5.50	5.50
HYDROGRAPH AT	DNW150-C	.00	1	FLOW	70.	70.	70.	70.	70.	70.	70.	70.	70.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.67
ROUTED TO	RD150-C	.00	1	FLOW	72.	73.	73.	74.	74.	75.	75.	75.	74.
				TIME	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75
2 COMBINED AT	CRD150-C	.91	1	FLOW	196.	193.	188.	185.	184.	183.	182.	181.	179.
				TIME	5.08	5.17	4.58	4.58	4.58	4.58	4.58	4.58	4.50
ROUTED TO	RCD150	.91	1	FLOW	196.	193.	188.	184.	183.	182.	182.	180.	179.
				TIME	5.25	5.25	4.75	4.75	4.67	4.67	4.67	4.67	4.58
HYDROGRAPH AT	NW150-C	.24	1	FLOW	132.	128.	122.	116.	113.	111.	110.	108.	106.
				TIME	3.92	3.92	3.92	3.92	3.92	3.92	3.92	3.92	3.92
2 COMBINED AT	CNW150-C	1.16	1	FLOW	282.	278.	269.	261.	258.	256.	254.	252.	249.
				TIME	4.08	4.08	4.08	4.08	4.08	4.08	4.17	4.17	4.17
2 COMBINED AT	CCNW150-	8.84	1	FLOW	2632.	2571.	2462.	2353.	2316.	2288.	2265.	2227.	2188.
				TIME	3.92	3.92	3.92	3.92	3.92	3.92	3.92	3.92	3.92
ROUTED TO	RC150-C	8.84	1	FLOW	2623.	2563.	2452.	2341.	2305.	2275.	2252.	2215.	2176.
				TIME	3.92	3.92	3.92	3.92	3.92	3.92	3.92	3.92	3.92
HYDROGRAPH AT	NW159-C	.25	1	FLOW	144.	140.	134.	127.	125.	123.	122.	120.	117.
				TIME	3.92	3.92	3.92	3.92	3.92	3.92	3.92	3.92	3.92
2 COMBINED AT	CCNW159	9.08	1	FLOW	2767.	2704.	2586.	2468.	2430.	2398.	2373.	2334.	2293.
				TIME	3.92	3.92	3.92	3.92	3.92	3.92	3.92	3.92	3.92
ROUTED TO	RC159-C	9.08	1	FLOW	2738.	2676.	2554.	2434.	2395.	2366.	2338.	2298.	2256.
				TIME	3.92	3.92	3.92	3.92	3.92	3.92	3.92	3.92	3.92
HYDROGRAPH AT	NW172-C	.27	1	FLOW	169.	165.	157.	150.	147.	145.	143.	141.	138.
				TIME	3.92	3.92	3.92	3.92	3.92	3.92	3.92	3.92	3.92
ROUTED TO	RNW172-C	.27	1	FLOW	171.	166.	158.	151.	148.	146.	144.	142.	139.
				TIME	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
HYDROGRAPH AT	NW170-C	.25	1	FLOW	165.	161.	153.	146.	143.	141.	140.	137.	134.
				TIME	3.83	3.83	3.83	3.83	3.83	3.83	3.83	3.83	3.83
2 COMBINED AT	CNW170-C	.53	1	FLOW	328.	319.	304.	289.	283.	279.	276.	271.	266.
				TIME	3.92	3.92	3.92	3.92	3.92	3.92	3.92	3.92	3.92
ROUTED TO	RC170-C	.53	1	FLOW	327.	319.	304.	289.	284.	280.	277.	272.	266.
				TIME	4.08	4.08	4.08	4.08	4.08	4.08	4.08	4.08	4.08
HYDROGRAPH AT	NW168-C	.25	1	FLOW	150.	146.	139.	132.	129.	127.	126.	124.	121.
				TIME	3.83	3.83	3.83	3.92	3.92	3.92	3.92	3.92	3.92
3 COMBINED AT	CNW168-C	9.86	1	FLOW	3169.	3094.	2951.	2809.	2761.	2726.	2699.	2655.	2606.
				TIME	3.92	3.92	3.92	3.92	3.92	3.92	4.00	4.00	4.00
ROUTED TO	RC168-C	9.86	1	FLOW	3145.	3070.	2936.	2805.	2757.	2721.	2696.	2651.	2602.
				TIME	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
HYDROGRAPH AT	NW180-C	.25	1	FLOW	148.	144.	138.	131.	128.	127.	125.	123.	121.

Q₁₀₀ = 290 g/s
is the flow
estimated as
being conveyed
by the existing
grass lined
channel from
sewerage to
Rainbow
Boulevard
and ultimately
discharges into
the 24" x 8' RCB
in Rainbow
BLVD. Includes
local flows
from Bella Vista
Q₁₀₀ = 53 cfs
Analyzed as
a portion of
Basin NW180-C

FIGURE H-4A

--	--

2002
LAS VEGAS VALLEY
FLOOD CONTROL
MASTER PLAN UPDATE
(RECOMMENDED)

LEGEND

Amendment Hydrology Change
Amendment Facilities Change
Ultimate Development Boundary
Watershed Boundary
ID Subarea Boundary
Flow Arrows

Flood Control Facilities

Existing Facilities
Proposed Facilities

Type Hydrologic Soil Groups

A Low Runoff Potential
B Moderately Low Runoff Potential
C Moderately High Runoff Potential
D High Runoff Potential

Typical Land Use

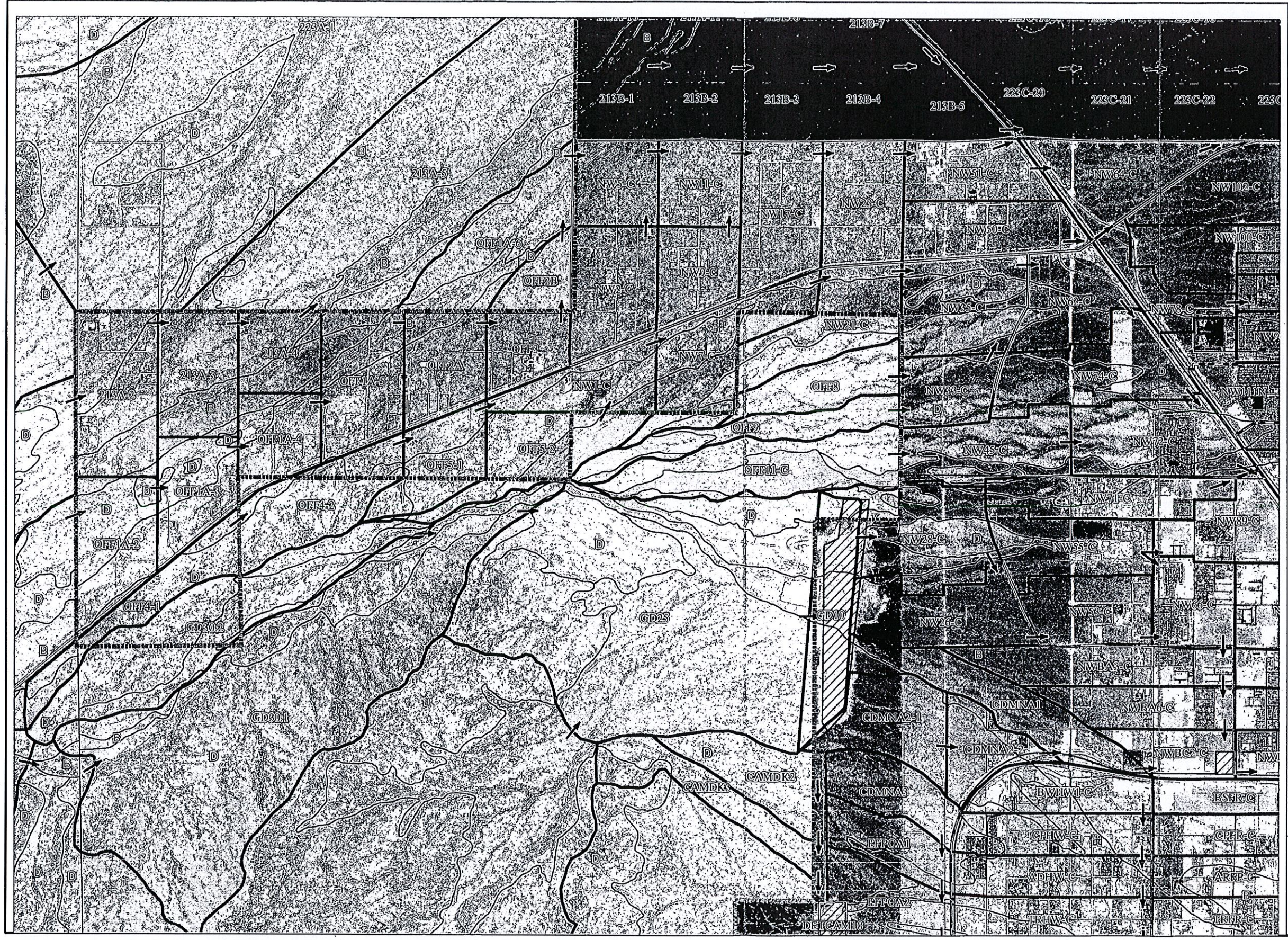
1 Undeveloped Land, Open Desert
2 Parks, Golf Courses
3 Rural
4 Low Density Residential
5 Medium Density Residential
6 High Density Residential
7 Public Facility, Multi Family
8 Commercial, Office, Retail, Casino
9 Light Industrial
10 Heavy Industrial
11 Schools
12 Lakes

0 1,000 2,000 3,000 4,000 5,000
Feet

SCALE: 1 inch = 3000 feet

US95 I-215 I-15

HYDROLOGIC SUBAREAS,
LAND USE & SOILS
FIGURE H-3A



DS #:

DS 4286

APN:

125-23-199-00

LAS VEGAS WASH MIDDLE BRANCH STORM DRAIN

PROJECT:

RAINBOW STORM DRAIN - ELKHORN TO GRAND TETON

SUBMITTAL:

3RD SUBMITTAL
ADDENDUM #1 to FINAL DESIGN REPORT

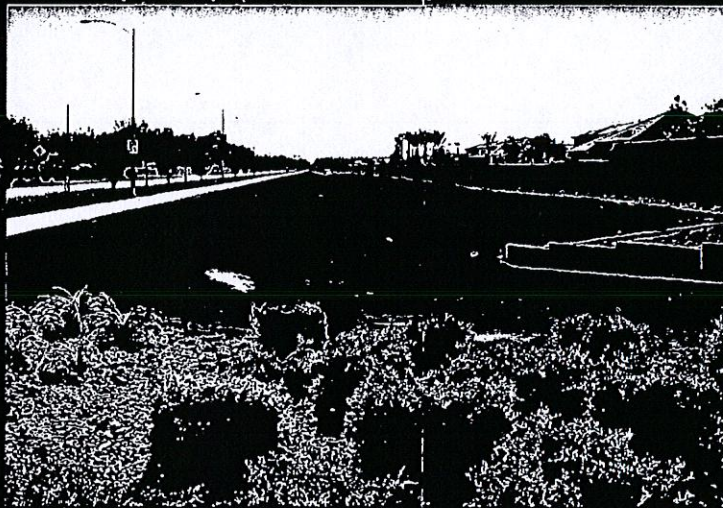
SCANNED BY/DATE:

CHECKED BY/DATE:



Las Vegas Wash Middle Branch

Rainbow Storm Drain
Elkhorn to Grand Teton



November 2008

prepared for



prepared by



*Final Design Report
Addendum #1*

Las Vegas Wash Middle Branch

**Rainbow Storm Drain
Elkhorn to Grand Teton**

November 2008

Prepared for

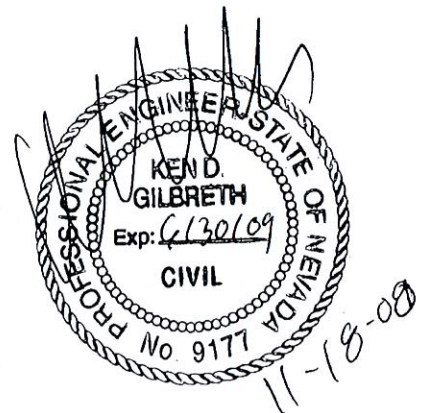


City of Las Vegas

Prepared by



W.O. #6952



1.0 INTRODUCTION

This Addendum Number 1 has been prepared to document the progress of the design for the Rainbow Storm Drain, Elkhorn Road to Grand Teton Drive. The purpose of this addendum is to provide updated project design analysis that has been performed since the 90% Design Submittal, which included, the Final Design Report and the 90% - Civil Plans, Cost Estimate, and Specifications. The Final Design Report for the Las Vegas Wash Middle Branch – Rainbow Storm Drain, Elkhorn to Grand Teton was dated July 2008 and should be used with this addendum for reference. (Refer to the Final Design Report for unchanged calculations not contained within this addendum). This addendum contains updated calculations and reference information that has changed due to the progress of the design, approval of the 2008 MPU, or to comments received since the 90% Design Submittal.

2.0 HYDROLOGIC SUMMARY

The 100-year surface flow rates were derived from the HEC-1 models in the Final Design Report; refer to that document for the HEC-1 files. A summary table has been provided below illustrating design flows at each particular combination point as well as the adjusted depth area reduction factor (DARF). Also included in this summary table is the corresponding tributary area.

TABLE 2.0.1 – HEC-1 SUMMARY TABLE

Location	Design Point	100-year Flow Rate (cfs)	Trib. Area (mi ²)	DARF Area ¹ (mi ²)	DARF Value
Golf Course north of Grand Teton	CNW163-C	938	5.86	2.22	0.928
Grand Teton west of Golf Course	CNW139-C	1124	1.24	1.24	0.960
Grand Teton and Golf Course	2C163-C	1921	7.10	3.46	0.915
Whispering Sands west of Rainbow	NW162-C	134	0.25	0.25	0.990
Whispering Sands and Rainbow	CNW162-C	2001	7.35	3.71	0.913
Farm west of Rainbow	DNW161-C	115	0.33	0.33	0.987
Farm and Rainbow	CD161-C	2063	7.68	4.04	0.910
Severance west of Rainbow	CNW150-C	270	1.16	1.16	0.964
Severance and Rainbow	CCNW150-	2282	8.84	5.20	0.904
Elkhorn west of Rainbow	NW159-C	145	0.25	0.25	0.990
Elkhorn and Rainbow	CNW159	2385	9.08	5.44	0.903

¹ DARF Area subtracts the area from upstream detention basins to obtain a higher flow

Severance
Channel
flows

2.1 HYDROLOGIC STUDY COMPARISON

Several hydrologic Master Plan Models have been produced for the project tributary area including the 1999 Northwest Neighborhood Study Phase II, 2002 Master Plan Update, 2007 Racel Street Collector Master Plan Amendment, and the 2008 Master Plan Update. Each of these master plan models was referenced for the hydrologic model for this project; refer to the Final Design Report for the design HEC-1 model. The project HEC-1 model features a design flow rate of 1124 cubic feet per second in the Grand Teton System based on the Racel Street Collector Master Plan Amendment approved in January of 2007. The 1999 Northwest Neighborhood Study Phase II has a significantly higher flow rate of 1754 cfs at this location. The Northwest Neighborhood Study included a larger tributary area. A portion of the area was diverted into master planned detention basins upstream, thus reducing the ultimate flow rate. The 2008 MPU flow rates for the area were compared against the 2007 Racel Street Collector MPA flows, and were found to be a couple hundred cubic feet per second lower in general. In a conservative approach, the CLV and the CCRFCD collectively agreed the 2007 MPA flows should be used for the design of the Rainbow Storm Drain facilities; refer to Meeting Memorandum Number 8 in Appendix C. Table 2.1.1 below is a comparison of flow rates between the different hydrologic studies.

TABLE 2.1.1 – HYDROLOGIC STUDY COMPARISON TABLE

Location	Design Point	2002 MPU Flow Rate (cfs)	2007 MPA Flow Rate ^{††} (cfs)	2008 MPU Flow Rate (cfs)
Golf Course north of Grand Teton	CNW163-C	2555	938	679
Grand Teton west of Golf Course	CNW139-C	1359	1124	968
Grand Teton and Golf Course	2C163-C	3528	1921	1585
Whispering Sands west of Rainbow	NW162-C	133	134	134
Whispering Sands and Rainbow	CNW162-C	3528	2001	1664
Farm west of Rainbow	DNW161-C	116	115	115
Farm and Rainbow	CD161-C	3528	2063	1664
Severance west of Rainbow	CNW150-C	197	270	181
Severance and Rainbow	CCNW150-	3528	2282	1664
Elkhorn west of Rainbow	NW159-C	144	145	129
Elkhorn and Rainbow	CNW159	3528	2385	1916

^{††}These numbers indicate design flow rates used for this project.

Appendix A contains maps and figures that pertain to this project including: the FEMA Flood-Zone Map, 2002 and 2008 Master Plan Update Figures, 2007 Racel Street Collector Master Plan Amendment Figures, and a Drop Inlet Summary Figure. The Master Plan Update and Master Plan Amendment figures included in Appendix A were obtained from the original document so that they are more distinct and clear. All hydrologic and hydraulic calculations were derived from and done in accordance with the "Hydrologic Criteria and Drainage Design Manual" published by the Clark County Regional Flood Control District. The updated hydraulic calculations can be found in Appendix B and include: Drop Inlet Calculations, Modified Standard Form 6, D-Load Calculations, WSPGW Models, and HY8 Analysis. Pre-Final Storm Drain Plan and Profile Drawings have been included in Appendix D as well.

3.0 SUPPLEMENTAL DOCUMENTATION

Since the 90% submittal, there have been several meetings between CLV, VTN, and various utility companies; the associated meeting minutes have been provided in Appendix C. This Addendum also includes the responses to all review comments that were provided to VTN for the Final Design Report, the 90% - Civil Plans, Cost Estimate, and Specifications. (Refer to Appendix C for all comment responses and matrices). In addition to the meeting minutes and review comment matrices, additional potholes were completed for several water and gas crossings that are in potential conflict. This pothole data and an updated Utility Conflict Matrix have also been included in Appendix C.

Technical Drainage Study for BELLA VISTA

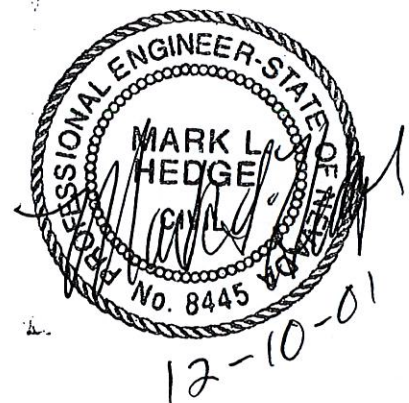
JOB# 9006.32

December 2001

Prepared for:

TOLL BROTHERS

Prepared By:
LOCHSA ENGINEERING
5828 Spring Mountain Road
Suite 308
Las Vegas, Nevada 89146-8896
(702) 365-9312



CLARK COUNTY
REGIONAL FLOOD CONTROL DISTRICT



RECEIVED

APR - 7 2003

DEVELOPMENT SERVICES
CIVIL ENGINEERING

Gale Wm. Fraser, II, P.E.
General Manager/Chief
Engineer

BOARD OF DIRECTORS

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Bryan A. Nix
City of Boulder City

Bruce L. Woodbury
Clark County

March 5, 2002

Mr. Randy Fultz, P.E.
City of Las Vegas Public Works
731 S. Fourth St
Las Vegas, NV 89101

DISTRICT CONCURRENCE: BELLA VISTA UPDATE (DS2954E) 02-12248

Dear Mr. Fultz:

Clark County Regional Flood Control District (District) reviewed Technical Drainage Study dated November 26, 2002, for the above-mentioned project as submitted by Lochsa Engineering. In addition, District is in receipt of the Conditional Letter of Acceptance from City of Las Vegas Public Works dated January 13, 2003.

District concurs with acceptance of this Technical Drainage Study by City of Las Vegas Public Works.

District's review of this project was limited to issues of Regional Flood Control Significance as defined in *Uniform Regulations for the Control of Drainage*.

Please be aware that as additional information becomes available and/or restudies of Flood Insurance Studies are performed, information submitted by Lochsa Engineering may be superseded. Compliance with regulatory elements and design standards specified in *Uniform Regulations for the Control of Drainage* does not imply a guarantee that properties will be free from flooding or flood damage. The District, its officials, or employees assume no liability for information, data, or conclusions presented by consulting engineers. We, therefore, make no warranties, either expressed or implied, in conducting this review.

GALE WM. FRASER, II, P.E.
General Manager/Chief Engineer

BY: 
Andrew R. Trelease, P.E.
Senior Civil Engineer

ART:css

c: Michael P. Vialpando, P.E., Lochsa Engineering
Darde G. De Roulhac, P.E., De Roulhac Consulting
Dave Betley, P.E., Department of Development Services

File: 19-60-15.LOC

600 S. Grand Central Parkway, Suite 300 • Las Vegas, Nevada 89106-4511
(702) 455-3139 • FAX: (702) 455-3870
Website: <http://www.ccrfd.org>



Department of Development Services Civil Engineering Division

500 S Grand Central Pky 1st Fl • PO Box 551842 • Las Vegas NV 89155-1842
(702) 455-4600 • Fax (702) 388-2550

Phil Rosenquist, Director • Carla J. Pearson, Assistant Director

February 25, 2003

Lochsa Engineering
5828 Spring Mountain Road, Suite 308
Las Vegas, Nevada 89146
Fax: (702) 365-9317

CONCURRENCE FOR THE DRAINAGE STUDY FOR BELLA VISTA - SEC. 15, T. 19 S., R. 60 E. - HTE 02- 12248

The above-referenced site is located in the City of Las Vegas adjacent to Clark County unincorporated areas. The drainage study was submitted to the County for concurrence. The County has reviewed the study and all addenda. In addition, the County has received the acceptance letter dated March 26, 2002 from the City of Las Vegas.

Please note that the County's review of this development is limited to drainage issues significant to Clark County unincorporated areas. The County concurs with the acceptance of this drainage study by the City of Las Vegas, subject to the following conditions:

As set forth in the submittal:

1. The following drainage facilities shall be constructed:
 - a. Approximately 5 LF of 18-inch HDPE, with stub and cap at the upstream end, located on the east one-half of Rainbow Boulevard at stations 11+00 and 23+38.02
 - b. A beehive drop inlet and approximately 18 LF of 18-inch HDPE on the north side of Farm Road, near station 10+60
 - c. Dual elliptical 48-inch by 76-inch RCP's with bubbler structure, and 18-inch HDPE, at the intersection of Rainbow Boulevard and Elkhorn Road, as shown on the improvement plan sheet 8, signed and sealed by Michael P. Vialpando, P.E., on September 16, 2002, and sheet 11, signed and sealed by Kenneth W. Karren, Jr., P.E., on September 16, 2002
2. A bond estimate must be submitted to Clark County Civil Engineering Division for the above-mentioned stormwater management facilities;

BOARD OF COUNTY COMMISSIONERS
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YVONNE ATKINSON GATES • MARK A. JAMES • RORY REID • MYRNA WILLIAMS • BRUCE L. WOODBURY
THOM REILLY, County Manager

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

DRAINAGE STUDY INFORMATION FORM

Name of Development: Bella Vista Date: December 6, 2001Location of Development: a) Descriptive (Cross Streets) Southeast corner of Tenaya Way and Farm Roadb) Sect. 15 Twn 19 Rng. 60Name of Owner: Toll Brothers Assessors Parcel No: 125-15-701-001Telephone No: (702) 243-9800 Facsimile No: _____Address: 1635 Village Center Circle, Suite 100Las Vegas, Nevada 89134Contact Person-Name: Hani M. Noshi Telephone No: 702-365-9312Firm: Lochsa EngineeringAddress: 5828 Spring Mountain Road, Suite 308 Las Vegas, Nevada 89146

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 Permit1. Total Owned Land Area: At Site: 160 Acres Being Developed/ Disturbed: 80 Acres2. Is a portion of all of the subject property located in a designated FEMA Flood Hazard Area? ☐ Yes ☒ No3. Is the property bordered or crossed by an existing or proposed Clark County Regional Flood Control District Master Planned Facility? ☒ Yes ☐ No4. Proposed type of development (Residential, Commercial, Etc.)? Residential5. Approximate upstream land area which drains to the subject site? 1 Square Mile6. Has the site drainage been evaluated in the past? ☒ Yes ☐ No If yes, please identify documentation

Off-site Master Storm Water Hydraulics Study for Bella Vista, October 2001

7. If known, please briefly identify the proposed discharge point(s) of runoff from the site: Conner of Severence And Rainbow onto theProposed Channel Along Rainbow.8. Briefly describe your proposed schedule for the subject: ASAP

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

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

Local Entity File No.

Revision	Date

REFERENCE:

STANDARD FORM 1

100-year storm events. As shown in the analysis the private street flows meet the requirement set forth by CCRFCD.

Half the runoff flow within Rainbow Boulevard will be conveyed through the proposed channel along the west side of Rainbow Boulevard as determined by the approved Master Study for Bella Vista (Reference 6). The Rainbow channel will therefore convey 261.5 and 851.5 cfs during the 10-and 100-year storm events, respectively. Confluence between proposed Rainbow and Severence channel is at the southeast corner of the site. Flow within the proposed Rainbow and Severence channels was analyzed in the Master Study for Bella Vista using the HEC-RAS software developed by the US Army Corps of Engineers. The hydraulic analysis for the proposed channels is included in Appendix D.

B. Onsite Drainage

The proposed developed site has been delineated into 16 drainage basins labeled ND1 through ND16. The developed drainage scheme is designed to follow the historical drainage pattern. The developed basins drains to the east and south (with the exception of basins ND15 and ND16) with the runoff flowing towards the intersection of Rainbow Boulevard and Severence Avenue and onto the proposed channel along Rainbow Boulevard. Runoff flows generated through all the developed basins are conveyed through curb gutters withing the onsite roads. Runoff generated through basin ND1(1/4 cfs) is routed through and combined with basin ND2(0/4 cfs) at concentration point CMD1(1/7 cfs). The combined flow at CMD1 is routed through basin ND4(0/4 cfs). Similarly, runoff generated through basin ND3(0/2 cfs) is routed through a

portion of the basin ND4(0/4 cfs). The routed flows from CMD1 and ND3 are combined with runoff from basin ND4 at CMD2(2/13 cfs). The combined flows at CMD2 and runoff from ND5(1/5 cfs) are routed through and combined with basin ND6(0/3 cfs) at CMD3(2/19 cfs). Runoff generated through basin ND7(1/4 cfs) is routed through and combined with basin ND8(1/5 cfs) at CMD4(1/8 cfs). The combined flow at CMD4 is routed through and combined with basin ND9(2/8 cfs) at CMD5(3/16 cfs). Runoff from CMD5 and ND10(1/5 cfs) are routed through and combined with basin ND11(0/4 cfs) at CMD6(4/24 cfs). Similarly, flows from CMD6 and ND12(1/4 cfs) are routed through and combined with basin ND13(0/3 cfs) at CMD7(5/31 cfs). The combined flow at CMD7 is routed through and combined with ND14(0/3 cfs) at CMD8(5/34 cfs). Flows at CMD3(2/19 cfs) and CMD8(5/34 cfs) are combined at CMD9(7/53 cfs). Flow at CMD9(7/53 cfs) represents the total runoff flow conveyed through the drainage easement at the southeast corner of the site. Flows through the drainage easement are discharged onto the channel along Rainbow Boulevard proposed in the approved Master Study for Bella Vista (Reference 6). The hydraulic analysis of the drainage easement is included in Appendix B.

Runoff flows from basins ND15(1/2 cfs) and ND16(2/5 cfs) are routed through the curb gutters to flow onto Tenaya Way.

The offsite flows impacting the site are conveyed through proposed turf-lined channels along Rainbow Boulevard and Severence Avenue. The channels were designed in the approved "Offsite Master Stormwater Hydraulics Study for Bella Vista" and addendum (Reference 6). A copy of the HEC-RAS analysis for the channels as analyzed in the Master Study is included in the Appendix D.

**Peak Flow Summary
Developed Condition**

HEC-1 I.D.	Area (acres)	10-year Flow (cfs)	100-year Flow (cfs)
ND1	4.78	1	4
RTND1	-	1	4
ND2	4.53	<1	4
CMD1	-	1	7
RTCD1	-	1	7
ND3	3.03	<1	2
RTND3	-	<1	2
ND4	5.19	<1	4
CMD2	-	2	13
RTCD2	-	2	13
ND5	5.72	1	5
RTND5	-	1	5
ND6	3.58	<1	3
CMD3	-	2	19
ND7	3.13	1	4
RTND7	-	1	3
ND8	5.48	1	5
CMD4	-	1	8
RTCD4	-	1	8
ND9	7.75	2	8
CMD5	-	3	16
RTCD5	-	3	16
ND10	6.15	1	5
RTND10	-	1	5
ND11	5.08	<1	4
CMD6	-	4	24

**Peak Flow Summary
Developed Condition**

HEC-1 I.D.	Area (acres)	10-year Flow (cfs)	100-year Flow (cfs)
RTCD6	-	4	24
ND12	5.75	1	4
RTND12	-	1	4
ND13	3.80	<1	3
CMD7	-	5	31
RTCD7	-	5	31
ND14	4.20	<1	3
CMD8	-	5	34
CMD9	-	7	53
RTCD9	-	7	53
ND15	0.57	1	2
ND16	2.33	2	5
RAINB	3.18	5	9

Bella Vista Technical Drainage Study

**10-Year and 100-Year,
6-Hour Storms
Developed condition**

FILE: 9006D.DAT

FLOOD HYDROGRAPH PACKAGE (HEC-1) *

MAY 1991 *

VERSION 4.0.1E *

Lahey F77L-EM/32 version 5.01 *

Dodson & Associates, Inc. *

* RUN DATE 12/07/01 TIME 10:31:36 *

* U.S. ARMY CORPS OF ENGINEERS *
* HYDROLOGIC ENGINEERING CENTER *
* 609 SECOND STREET *
* DAVIS, CALIFORNIA 95616 *
* (916) 551-1748 *

```

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

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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


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

 1      ID      BELLA VISTA TECHNICAL DRAINAGE STUDY
 2      ID      PROPOSED CONDITION - ONSITE IN DEVELOPED STATES
 3      ID      USING SCS METHODS AND KINEMATIC WAVE ROUTING
 4      ID      MASTER PLAN ADJUSTED 6-HOUR RAINFALL AND STORM DISTRIBUTION
 5      ID      LOCHSA JOB# 9006.32
 6      ID
 7      ID
 8      ID      INPUT FILE NAME: 9006D.DAT
 9      ID
10      ID      DECEMBER 2001
11      ID
12      ID      *****
13      ID      *****
14      ID      INSIDE McCARRAN AIRPORT RAINFALL AREA
15      ID
16      ID      10 & 100 YEAR - 6 HOUR STORM EVENT
17      ID      PRECIPITATION BASED ON TABLE 505
18      ID      10-YEAR ADJUSTED RAINFALL DEPTH = 1.58in
19      ID      100-YEAR ADJUSTED RAINFALL DEPTH = 2.77in
20      ID
21      ID      10-YEAR RAINFALL DEPTH RATIO (JR CARD) = 1.58/2.77 = 0.5704
22      ID
23      ID      *****
24      ID
25      ID      *****
26      ID      *DIAGRAM
27      IT      3              300
28      IO      5              0
29      IN      5
30      JR      PREC 0.5704 1.000
31
32      KK      ND1
33      KM      ONSITE BASIN ND-1
34      PB      2.77
35      PC      0.0      .02      .057      .07      .087      .108      .124      .13      .13      .13
36      PC      .13      .13      .13      .133      .14      .142      .148      .158      .172      .181
37      PC      .19      .197      .199      .2      .201      .204      .214      .229      .241      .249
38      PC      .251      .256      .27      .278      .281      .283      .295      .322      .352      .409
39      PC      .499      .59      .71      .744      .781      .812      .819      .835      .851      .856
40      PC      .86      .868      .876      .888      .91      .926      .937      .95      .97      .976
41      PC      .982      .985      .987      .989      .99      .993      .993      .994      .995      .998
42      PC      .998      .999      1.0
43      BA      .00747
44      LS      0      71.0
45      UD      .165
46
47      KK      RTND1
48      KM      ROUTE ND1 THROUGH THE ONSITE ND2
49      RK      950      0.004      0.016      0      TRAP      1.5      25

```

LINE	ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10
47	KK ND2
48	KM DEVELOPED ONSITE BASIN ND2
49	BA .00707
50	LS 0 70.0
51	UD .158
52	KK CMD1
53	KM COMBINE RTND1 AND ND2
54	HC 2
55	KK RTCD1
56	KM ROUTE CMD1 THROUGH ONSITE ND4
57	RK 700 0.004 0.016 0 TRAP 1.5 25 ..
58	KK ND3
59	KM DEVELOPED ONSITE BASIN ND3
60	BA .00474
61	LS 0 70.0
62	UD .141
63	KK RTND3
64	KM ROUTE ND3 THROUGH A PORTION OF ONSITE ND4
65	RK 360 0.004 0.016 0 TRAP 1.5 25
66	KK ND4
67	KM DEVELOPED ONSITE BASIN ND4
68	BA .00811
69	LS 0 70.0
70	UD .153
71	KK CMD2
72	KM COMBINE RTCD1, RTND3 AND ND4
73	HC 3
74	KK RTCD2
75	KM ROUTE CMD2 THROUGH A PORTION OF ONSITE ND6
76	RK 375 0.004 0.016 0 TRAP 1.5 25
77	KK ND5
78	KM DEVELOPED ONSITE BASIN ND5
79	BA .00894
80	LS 0 70.0
81	UD .148
82	KK RTND5
83	KM ROUTE ND5 THROUGH ONSITE ND6
84	RK 500 0.004 0.016 0 TRAP 1.5 25
85	KK ND6
86	KM DEVELOPED ONSITE BASIN ND6
87	BA .00559
88	LS 0 70.0
89	UD .142

LINE	ID	1	2	3	4	5	6	7	8	9	10	
90	KK	CMD3										
91	KM	COMBINE RTCD2, RTND5 AND ND6										
92	HC	3										
93	KK	ND7										
94	KM	DEVELOPED ONSITE BASIN ND7										
95	BA	.00489										
96	LS	0	75.0									
97	UD	.149										
98	KK	RTND7										
99	KM	ROUTE ND7 THROUGH ONSITE ND8										
100	RK	625	0.0045	0.016	0	TRAP	1.5	25				
101	KK	ND8										
102	KM	DEVELOPED ONSITE BASIN ND8										
103	BA	.00856										
104	LS	0	71.0									
105	UD	.158										
106	KK	CMD4										
107	KM	COMBINE ND7 AND ND8										
108	HC	2										
109	KK	RTCD4										
110	KM	ROUTE CMD4 THROUGH A PORTION OF ONSITE ND9										
111	RK	390	0.004	0.016	0	TRAP	1.5	25				
112	KK	ND9										
113	KM	DEVELOPED ONSITE BASIN ND9										
114	BA	.01211										
115	LS	0	75.0									
116	UD	.164										
117	KK	CMD5										
118	KM	COMBINE RTCD4 AND ND9										
119	HC	2										
120	KK	RTCD5										
121	KM	ROUTE CMD5 THROUGH ONSITE ND11										
122	RK	550	0.004	0.016	0	TRAP	1.5	25				
123	KK	ND10										
124	KM	DEVELOPED ONSITE BASIN ND10										
125	BA	.00961										
126	LS	0	70.0									
127	UD	.162										
128	KK	RTND10										
129	KM	ROUTE ND10 THROUGH ONSITE ND11										
130	RK	700	0.004	0.016	0	TRAP	1.5	25				

[illegible]

LINE	ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10
172	KK RTCD9
173	KM ROUTE CMD9 TO THE CHANNEL
174	RK 165 0.010 0.013 0 TRAP 0.0 9
175	KK ND15
176	KM DEVELOPED ONSITE BASIN ND15
177	BA .00089
178	LS 0 88.4
179	UD .062
180	KK ND16
181	KM DEVELOPED ONSITE BASIN ND16
182	BA .00364
183	LS 0 88.4
184	UD .127
185	KK RAINB
186	KM PORTION OF RAINBOW BOULEVARD ALONG THE EAST BORDER OF THE SITE
187	BA .00497
188	LS 0 98.0
189	UD .142
190	ZZ

SCHEMATIC DIAGRAM OF STREAM NETWORK

INPUT LINE	(V) ROUTING	(--->) DIVERSION OR PUMP FLOW
NO.	(.) CONNECTOR	(<---) RETURN OF DIVERTED OR PUMPED FLOW
30	ND1	
	V	
	V	
44	RTND1	
	.	
47	.	ND2
	.	
52	CMD1.....	
	V	
	V	
55	RTCD1	
	.	
58	.	ND3
	.	V
	.	V
63	RTND3	
	.	
66	.	ND4
	.	
71	CMD2.....	
	V	
	V	
74	RTCD2	
	.	
77	.	ND5
	.	V
	.	V
82	RTND5	
	.	
85	.	ND6
	.	
90	CMD3.....	
	.	
93	.	ND7
	.	V
	.	V
98	RTND7	
	.	
101	.	ND8
	.	
106	CMD4.....	
	V	

109 RTCD4
112 ND9
117 CMD5
 V
 V
120 RTCD5
123 ND10
 V
 V
128 RTND10
131 ND11
136 CMD6
 V
 V
139 RTCD6
142 ND12
 V
 V
147 RTND12
150 ND13
155 CMD7
 V
 V
158 RTCD7
161 ND14
166 CMD8
169 CMD9
 V
 V
172 RTCD9
175 ND15
180 ND16

185

RAINB

***) RUNOFF ALSO COMPUTED AT THIS LOCATION

FLOOD HYDROGRAPH PACKAGE (HEC-1)

MAY 1991

VERSION 4.0.1E

Lahey F77L-EM/32 version 5.01

Dodson & Associates, Inc.

RUN DATE 12/07/01 TIME 10:31:36

U.S. ARMY CORPS OF ENGINEERS

HYDROLOGIC ENGINEERING CENTER

609 SECOND STREET

DAVIS, CALIFORNIA 95616

(916) 551-1748

BELLA VISTA TECHNICAL DRAINAGE STUDY

PROPOSED CONDITION - ONSITE IN DEVELOPED STATES

USING SCS METHODS AND KINEMATIC WAVE ROUTING

MASTER PLAN ADJUSTED 6-HOUR RAINFALL AND STORM DISTRIBUTION

LOCHSA JOB# 9006.32

INPUT FILE NAME: 9006D.DAT

DECEMBER 2001

INSIDE McCARRAN AIRPORT RAINFALL AREA

10 & 100 YEAR - 6 HOUR STORM EVENT

PRECIPITATION BASED ON TABLE 505

10-YEAR ADJUSTED RAINFALL DEPTH = 1.58in

100-YEAR ADJUSTED RAINFALL DEPTH = 2.77in

10-YEAR RAINFALL DEPTH RATIO (JR CARD) = $1.58/2.77 = 0.5704$

27 IO

OUTPUT CONTROL VARIABLES

IPRNT 5 PRINT CONTROL

IPLOT 0 PLOT CONTROL

QSCAL 0. HYDROGRAPH PLOT SCALE

IT

HYDROGRAPH TIME DATA

NMIN 3 MINUTES IN COMPUTATION INTERVAL

IDATE 1 0 STARTING DATE

ITIME 0000 STARTING TIME

NQ 300 NUMBER OF HYDROGRAPH ORDINATES

NDDATE 1 0 ENDING DATE

NDTIME 1457 ENDING TIME

ICENT 19 CENTURY MARK

COMPUTATION INTERVAL 0.05 HOURS

TOTAL TIME BASE 14.95 HOURS

ENGLISH UNITS

DRAINAGE AREA SQUARE MILES

PRECIPITATION DEPTH INCHES

LENGTH, ELEVATION	FEET
FLOW	CUBIC FEET PER SECOND
STORAGE VOLUME	ACRE-FeET
SURFACE AREA	ACRES
TEMPERATURE	DEGREES FAHRENHEIT

JP	MULTI-PLAN OPTION	
	NPLAN	1 NUMBER OF PLANS

JR	MULTI-RATIO OPTION	
	RATIOS OF PRECIPITATION	
	0.57	1.00

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

STATION	STATION	AREA	PLAN	RATIOS APPLIED TO PRECIPITATION		
				RATIO 1	RATIO 2	
				0.57	1.00	
HYDROGRAPH AT	ND1	0.01	1	FLOW	1.	4.
				TIME	3.70	3.60
REDUCED TO	RTND1	0.01	1	FLOW	1.	4.
				TIME	3.85	3.70
HYDROGRAPH AT	ND2	0.01	1	FLOW	0.	4.
				TIME	3.75	3.60
COMBINED AT	CMD1	0.01	1	FLOW	1.	7.
				TIME	3.80	3.65
REDUCED TO	RTCD1	0.01	1	FLOW	1.	7.
				TIME	3.90	3.70
HYDROGRAPH AT	ND3	0.00	1	FLOW	0.	2.
				TIME	3.70	3.60
REDUCED TO	RTND3	0.00	1	FLOW	0.	2.
				TIME	3.75	3.65
HYDROGRAPH AT	ND4	0.01	1	FLOW	0.	4.
				TIME	3.75	3.60
COMBINED AT	CMD2	0.03	1	FLOW	2.	13.
				TIME	3.90	3.70
REDUCED TO	RTCD2	0.03	1	FLOW	2.	13.
				TIME	3.95	3.70
HYDROGRAPH AT	ND5	0.01	1	FLOW	1.	5.
				TIME	3.70	3.60
REDUCED TO	RTND5	0.01	1	FLOW	1.	5.
				TIME	3.80	3.65
HYDROGRAPH AT	ND6	0.01	1	FLOW	0.	3.
				TIME	3.70	3.60
COMBINED AT	CMD3	0.04	1	FLOW	2.	19.
				TIME	3.90	3.65
HYDROGRAPH AT	ND7	0.00	1	FLOW	1.	4.
				TIME	3.65	3.60
REDUCED TO	RTND7	0.00	1	FLOW	1.	3.
				TIME	3.70	3.65
HYDROGRAPH AT	ND8	0.01	1	FLOW	1.	5.

				TIME	3.70	3.60
2 COMBINED AT	CMD4	0.01	1	FLOW	1.	8.
				TIME	3.70	3.65
UTED TO	RTCD4	0.01	1	FLOW	1.	8.
				TIME	3.75	3.65
DROGRAPH AT	ND9	0.01	1	FLOW	2.	8.
				TIME	3.65	3.60
COMBINED AT	CMD5	0.03	1	FLOW	3.	16.
				TIME	3.70	3.65
UTED TO	RTCD5	0.03	1	FLOW	3.	16.
				TIME	3.75	3.65
DROGRAPH AT	ND10	0.01	1	FLOW	1.	5.
				TIME	3.75	3.60
UTED TO	RTND10	0.01	1	FLOW	1.	5.
				TIME	3.85	3.70
DROGRAPH AT	ND11	0.01	1	FLOW	0.	4.
				TIME	3.70	3.60
COMBINED AT	CMD6	0.04	1	FLOW	4.	24.
				TIME	3.80	3.65
UTED TO	RTCD6	0.04	1	FLOW	4.	24.
				TIME	3.80	3.70
DROGRAPH AT	ND12	0.01	1	FLOW	1.	4.
				TIME	3.75	3.60
UTED TO	RTND12	0.01	1	FLOW	1.	4.
				TIME	3.80	3.65
DROGRAPH AT	ND13	0.01	1	FLOW	0.	3.
				TIME	3.70	3.60
COMBINED AT	CMD7	0.06	1	FLOW	5.	31.
				TIME	3.80	3.65
UTED TO	RTCD7	0.06	1	FLOW	5.	31.
				TIME	3.85	3.70
DROGRAPH AT	ND14	0.01	1	FLOW	0.	3.
				TIME	3.70	3.60
COMBINED AT	CMD8	0.06	1	FLOW	5.	34.
				TIME	3.85	3.70
COMBINED AT	CMD9	0.11	1	FLOW	7.	53.
				TIME	3.85	3.70
UTED TO	RTCD9	0.11	1	FLOW	7.	53.
				TIME	3.85	3.70
DROGRAPH AT	ND15	0.00	1	FLOW	1.	2.

Combined flows
discharging into channel
from Belle Vista
flows are already accounted
for as a portion of Basin NWISD-C
By The LVMS PDR.

				TIME	3.50	3.50
HYDROGRAPH AT	ND16	0.00	1	FLOW	2.	5.
				TIME	3.55	3.55
HYDROGRAPH AT	RAINB	0.00	1	FLOW	5.	9.
				TIME	3.55	3.55

SUMMARY OF KINEMATIC WAVE - MUSKINGUM-CUNGE ROUTING

(FLOW IS DIRECT RUNOFF WITHOUT BASE FLOW)

INTERPOLATED TO
COMPUTATION INTERVAL

ISTAQ	ELEMENT	DT	PEAK	TIME TO PEAK	VOLUME	DT	PEAK	TIME TO PEAK	VOLUME
		(MIN)	(CFS)	(MIN)	(IN)	(MIN)	(CFS)	(MIN)	(IN)

FOR PLAN = 1 RATIO= 0.57

RTND1	MANE	2.98	0.54	230.80	0.12	3.00	0.54	231.00	0.12
-------	------	------	------	--------	------	------	------	--------	------

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.4786E-01 EXCESS=0.0000E+00 OUTFLOW=0.4818E-01 BASIN STORAGE=0.1026E-06 PERCENT ERROR= -0.7

FOR PLAN = 1 RATIO= 1.00

RTND1	MANE	2.47	3.91	221.84	0.63	3.00	3.91	222.00	0.63
-------	------	------	------	--------	------	------	------	--------	------

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.2517E+00 EXCESS=0.0000E+00 OUTFLOW=0.2519E+00 BASIN STORAGE=0.1178E-06 PERCENT ERROR= -0.1

FOR PLAN = 1 RATIO= 0.57

RTCD1	MANE	2.56	0.93	233.84	0.11	3.00	0.93	234.00	0.11
-------	------	------	------	--------	------	------	------	--------	------

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.8751E-01 EXCESS=0.0000E+00 OUTFLOW=0.8758E-01 BASIN STORAGE=0.2985E-06 PERCENT ERROR= -0.1

FOR PLAN = 1 RATIO= 1.00

RTCD1	MANE	1.63	7.05	223.30	0.61	3.00	6.99	222.00	0.61
-------	------	------	------	--------	------	------	------	--------	------

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.4745E+00 EXCESS=0.0000E+00 OUTFLOW=0.4745E+00 BASIN STORAGE=0.4287E-06 PERCENT ERROR= 0.0

FOR PLAN = 1 RATIO= 0.57

RTND3	MANE	2.38	0.29	225.74	0.10	3.00	0.29	228.00	0.10
-------	------	------	------	--------	------	------	------	--------	------

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.2637E-01 EXCESS=0.0000E+00 OUTFLOW=0.2643E-01 BASIN STORAGE=0.3149E-08 PERCENT ERROR= -0.2

FOR PLAN = 1 RATIO= 1.00

RTND3	MANE	1.19	2.44	217.50	0.59	3.00	2.42	219.00	0.59
-------	------	------	------	--------	------	------	------	--------	------

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.1492E+00 EXCESS=0.0000E+00 OUTFLOW=0.1493E+00 BASIN STORAGE=0.3362E-08 PERCENT ERROR= -0.1

FOR PLAN = 1 RATIO= 0.57

RTCD2	MANE	1.30	1.56	235.66	0.11	3.00	1.54	237.00	0.11
-------	------	------	------	--------	------	------	------	--------	------

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.1592E+00 EXCESS=0.0000E+00 OUTFLOW=0.1593E+00 BASIN STORAGE=0.2938E-06 PERCENT ERROR= 0.0

FOR PLAN = 1 RATIO= 1.00

RTCD2 MANE 0.78 12.71 222.28 0.60 3.00 12.71 222.00 0.60

TINUITY SUMMARY (AC-FT) - INFLOW=0.3792E+00 EXCESS=0.0000E+00 OUTFLOW=0.8795E+00 BASIN STORAGE=0.3521E-06 PERCENT ERROR= 0.0

FOR PLAN = 1 RATIO= 0.57

RTND5 MANE 2.18 0.54 227.04 0.10 3.00 0.54 228.00 0.10

TINUITY SUMMARY (AC-FT) - INFLOW=0.4974E-01 EXCESS=0.0000E+00 OUTFLOW=0.4987E-01 BASIN STORAGE=0.1300E-07 PERCENT ERROR= -0.3

FOR PLAN = 1 RATIO= 1.00

RTND5 MANE 1.33 4.57 218.76 0.59 3.00 4.55 219.00 0.59

TINUITY SUMMARY (AC-FT) - INFLOW=0.2815E+00 EXCESS=0.0000E+00 OUTFLOW=0.2817E+00 BASIN STORAGE=0.1066E-07 PERCENT ERROR= -0.1

FOR PLAN = 1 RATIO= 0.57

RTND7 MANE 2.30 0.72 221.71 0.20 3.00 0.72 222.00 0.20

TINUITY SUMMARY (AC-FT) - INFLOW=0.5123E-01 EXCESS=0.0000E+00 OUTFLOW=0.5128E-01 BASIN STORAGE=0.2383E-07 PERCENT ERROR= -0.1

FOR PLAN = 1 RATIO= 1.00

RTND7 MANE 1.61 3.50 218.48 0.81 3.00 3.49 219.00 0.81

TINUITY SUMMARY (AC-FT) - INFLOW=0.2122E+00 EXCESS=0.0000E+00 OUTFLOW=0.2125E+00 BASIN STORAGE=0.2255E-07 PERCENT ERROR= -0.1

FOR PLAN = 1 RATIO= 0.57

RTCD4 MANE 1.41 1.34 225.18 0.15 3.00 1.34 225.00 0.15

TINUITY SUMMARY (AC-FT) - INFLOW=0.1061E+00 EXCESS=0.0000E+00 OUTFLOW=0.1061E+00 BASIN STORAGE=0.4243E-07 PERCENT ERROR= 0.0

FOR PLAN = 1 RATIO= 1.00

RTCD4 MANE 0.83 7.94 220.16 0.70 3.00 7.94 219.00 0.70

TINUITY SUMMARY (AC-FT) - INFLOW=0.5009E+00 EXCESS=0.0000E+00 OUTFLOW=0.5013E+00 BASIN STORAGE=0.5623E-07 PERCENT ERROR= -0.1

FOR PLAN = 1 RATIO= 0.57

RTCD5 MANE 1.63 2.92 226.57 0.17 3.00 2.92 225.00 0.17

TINUITY SUMMARY (AC-FT) - INFLOW=0.2330E+00 EXCESS=0.0000E+00 OUTFLOW=0.2331E+00 BASIN STORAGE=0.1558E-06 PERCENT ERROR= -0.1

FOR PLAN = 1 RATIO= 1.00

RTCD5 MANE 1.02 16.03 220.90 0.75 3.00 15.92 219.00 0.75

TINUITY SUMMARY (AC-FT) - INFLOW=0.1026E+01 EXCESS=0.0000E+00 OUTFLOW=0.1027E+01 BASIN STORAGE=0.1670E-06 PERCENT ERROR= -0.1

FOR PLAN = 1 RATIO= 0.57

RTND10	MANE	2.85	0.57	231.56	0.10	3.00	0.57	231.00	0.10
--------	------	------	------	--------	------	------	------	--------	------

NTINUIITY SUMMARY (AC-FT) - INFLOW=0.5347E-01 EXCESS=0.0000E+00 OUTFLOW=0.5357E-01 BASIN STORAGE=0.3499E-07 PERCENT ERROR= -0.2

FOR PLAN = 1 RATIO= 1.00

RTND10	MANE	1.76	4.71	220.36	0.59	3.00	4.64	222.00	0.59
--------	------	------	------	--------	------	------	------	--------	------

NTINUIITY SUMMARY (AC-FT) - INFLOW=0.3025E+00 EXCESS=0.0000E+00 OUTFLOW=0.3028E+00 BASIN STORAGE=0.5283E-07 PERCENT ERROR= -0.1

FOR PLAN = 1 RATIO= 0.57

RTCD6	MANE	0.85	3.93	229.05	0.14	3.00	3.92	228.00	0.14
-------	------	------	------	--------	------	------	------	--------	------

NTINUIITY SUMMARY (AC-FT) - INFLOW=0.3310E+00 EXCESS=0.0000E+00 OUTFLOW=0.3311E+00 BASIN STORAGE=0.1978E-06 PERCENT ERROR= 0.0

FOR PLAN = 1 RATIO= 1.00

RTCD6	MANE	0.55	24.37	220.20	0.69	3.00	23.97	222.00	0.69
-------	------	------	-------	--------	------	------	-------	--------	------

NTINUIITY SUMMARY (AC-FT) - INFLOW=0.1580E+01 EXCESS=0.0000E+00 OUTFLOW=0.1581E+01 BASIN STORAGE=0.1896E-06 PERCENT ERROR= 0.0

FOR PLAN = 1 RATIO= 0.57

RTND12	MANE	2.11	0.53	228.64	0.10	3.00	0.53	228.00	0.10
--------	------	------	------	--------	------	------	------	--------	------

NTINUIITY SUMMARY (AC-FT) - INFLOW=0.5002E-01 EXCESS=0.0000E+00 OUTFLOW=0.5011E-01 BASIN STORAGE=0.7318E-08 PERCENT ERROR= -0.2

FOR PLAN = 1 RATIO= 1.00

RTND12	MANE	1.29	4.39	218.51	0.59	3.00	4.38	219.00	0.59
--------	------	------	------	--------	------	------	------	--------	------

NTINUIITY SUMMARY (AC-FT) - INFLOW=0.2830E+00 EXCESS=0.0000E+00 OUTFLOW=0.2834E+00 BASIN STORAGE=0.8031E-08 PERCENT ERROR= -0.1

FOR PLAN = 1 RATIO= 0.57

RTCD7	MANE	1.06	4.79	230.43	0.13	3.00	4.77	231.00	0.13
-------	------	------	------	--------	------	------	------	--------	------

NTINUIITY SUMMARY (AC-FT) - INFLOW=0.4141E+00 EXCESS=0.0000E+00 OUTFLOW=0.4143E+00 BASIN STORAGE=0.3754E-06 PERCENT ERROR= 0.0

FOR PLAN = 1 RATIO= 1.00

RTCD7	MANE	0.78	30.93	220.84	0.66	3.00	30.81	222.00	0.66
-------	------	------	-------	--------	------	------	-------	--------	------

NTINUIITY SUMMARY (AC-FT) - INFLOW=0.2051E+01 EXCESS=0.0000E+00 OUTFLOW=0.2052E+01 BASIN STORAGE=0.4098E-06 PERCENT ERROR= 0.0

FOR PLAN = 1 RATIO= 0.57

RTCD9	MANE	0.20	7.32	231.34	0.12	3.00	7.30	231.00	0.12
-------	------	------	------	--------	------	------	------	--------	------

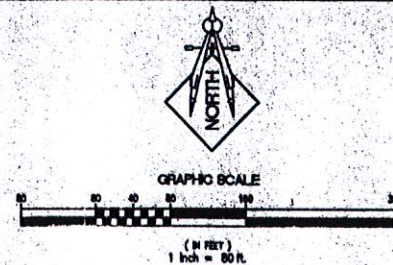
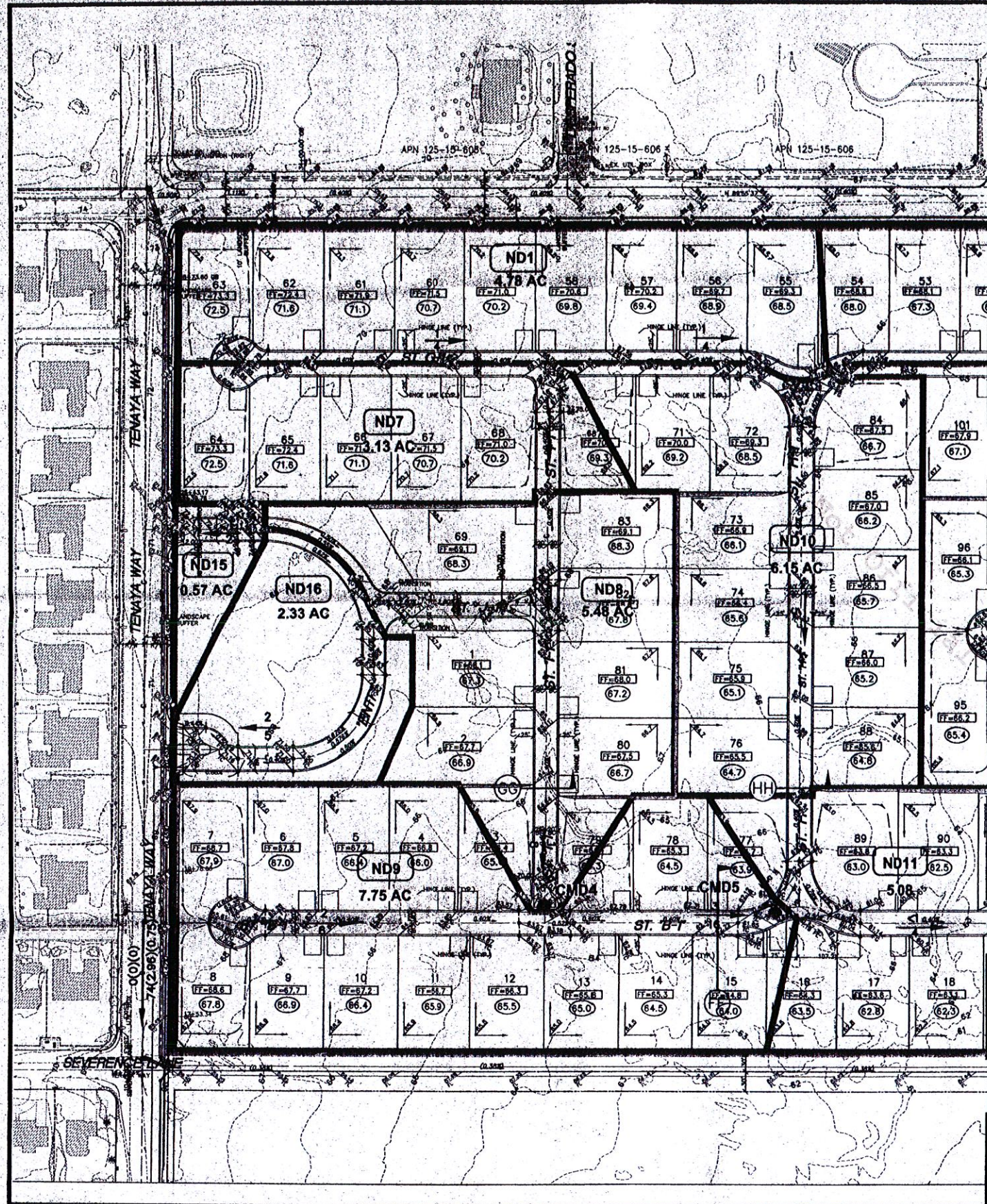
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FOR PLAN = 1 RATIO= 1.00

RTCD9	MANE	0.12	52.86	222.11	0.63	3.00	52.84	222.00	0.63
-------	------	------	-------	--------	------	------	-------	--------	------

NTINUITY SUMMARY (AC-FT) - INFLOW=0.3595E+01 EXCESS=0.0000E+00 OUTFLOW=0.3595E+01 BASIN STORAGE=0.1469E-06 PERCENT ERROR= 0.0

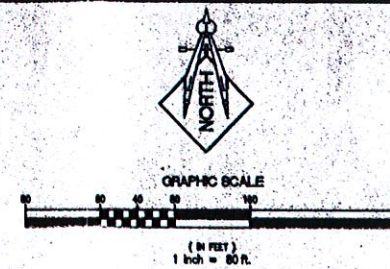
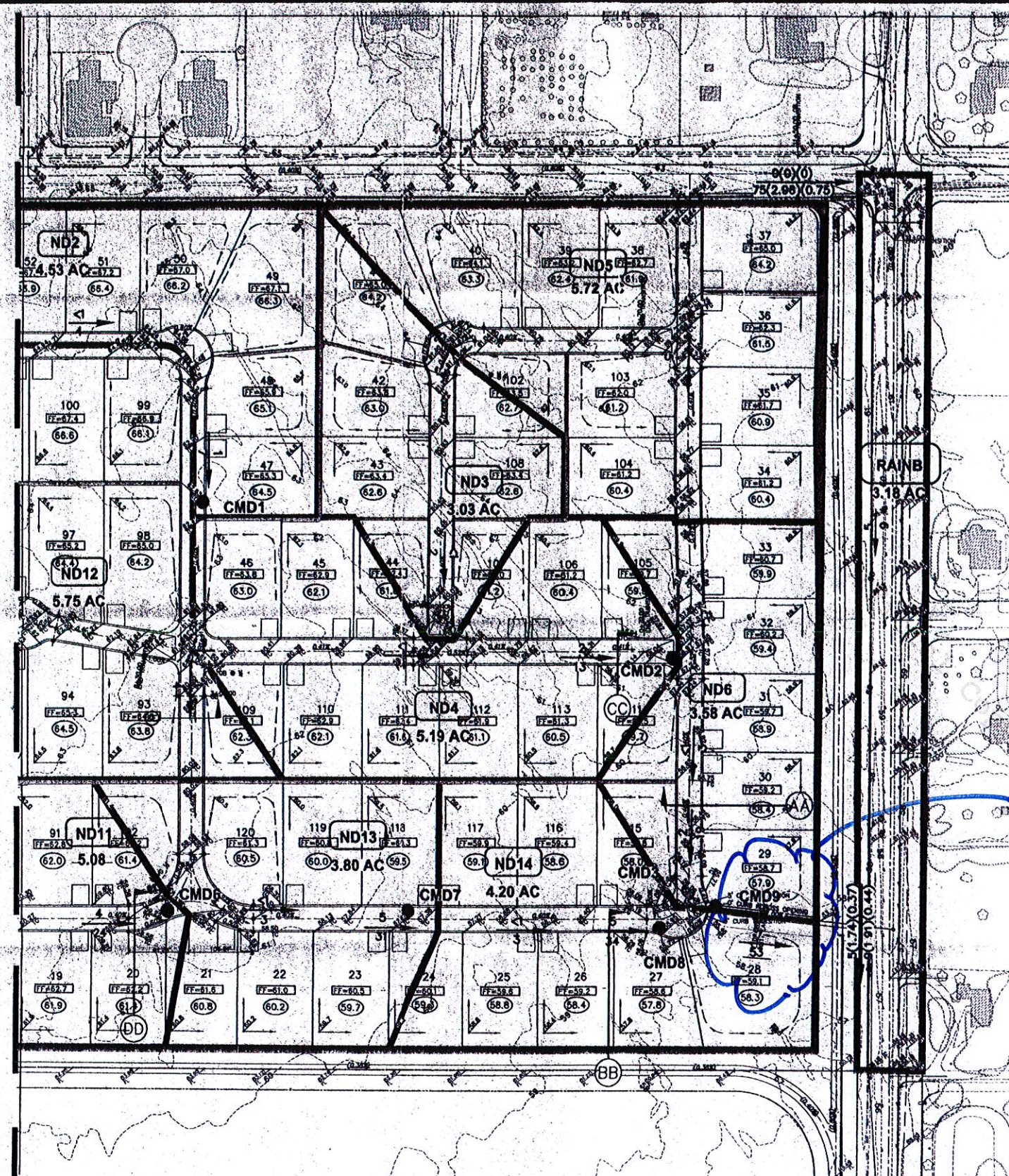
* NORMAL END OF HEC-1 ***



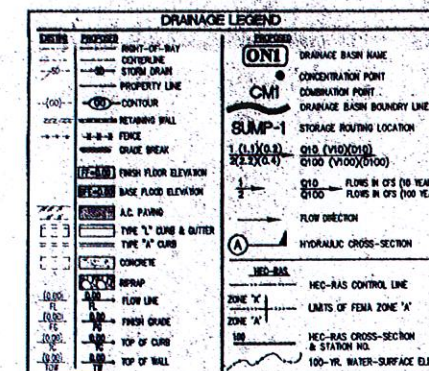
PEAK FLOW SUMMARY PROPOSED CONDITION			
NEC-1 ID	AREA (AC)	10-YR Q	100-YR Q
ND1	4.78	1	4
ND2	4.53	1	4
ND3	3.03	1	2
ND4	5.19	1	4
ND5	5.72	1	5
ND6	3.55	1	3
ND7	3.13	1	3
ND8	4.48	1	3
ND9	7.75	2	8
ND10	6.15	1	5
ND11	5.08	1	4
ND12	5.75	1	4
ND13	3.80	1	3
ND14	4.70	1	3
ND15	0.57	1	1
ND16	2.33	1	2
RAND	3.18	1	3

DRAINAGE LEGEND	
	RIGHT-OF-WAY
	CENTERLINE
	STORM DRAIN
	PROPERTY LINE
	CONTOUR
	RETAINING WALL
	FENCE
	GRADE BREAK
	FINISH FLOOR ELEVATION
	BASE FLOOR ELEVATION
	AC PAVING
	TYPE 'A' CURB & GUTTER
	CONCRETE
	HRPAP
	FLOW LINE
	FINISH GRADE
	TOP OF CURB
	TOP OF WALL
	DRAINAGE BASIN NAME
	CONCENTRATION POINT
	DRAINAGE BASIN BOUNDARY LINE
	STORAGE ROUTING LOCATION
	10-YR Q
	100-YR Q
	FLOW IN 10-YR Q
	FLOW IN 100-YR Q
	FLOW DIRECTION
	HYDRAULIC CROSS-SECTION
	NEC-RAS CONTROL LINE
	LIMITS OF FEMA ZONE 'A'
	NEC-RAS CROSS-SECTION & STATION NO.
	100-YR WATER-SURFACE ELEV.

TOLL BROTHERS 1835 VILLAGE CENTER CIRCLE, SUITE 100 LAS VEGAS, NEVADA 89134 PHONE (702) 343-8800		LOCHSA ENGINEERING 2000 S. RAYMOND AVE., SUITE 300 LAS VEGAS, NV 89146 (702) 365-9312 FAX (702) 365-9317	
ON-SITE DRAINAGE BASIN MAP (B) (DEVELOPED CONDITION)		PROJECT NAME	
DATE: 12-3-01	DESIGNED BY: [Signature]	CHECKED BY: [Signature]	SCALE: 1"=50'
DRAWN BY: [Signature]		PROJECT NO.: [Signature]	DATE: 12-3-01
[Professional Engineer Seal]		[Professional Engineer Seal]	
2 OF 2 SHEETS		2 OF 2 SHEETS	



NO.1 - ID	AREA (AC)	10-YR Q	100 - YR Q
NO-1	4.76	1	4
NO2	4.53	<1	1
NO3	3.03	<1	2
NO4	5.19	<1	4
NO5	6.57	2	18
NO6	3.58	<1	3
NO3 - 3	-	2	18
NO2	3.13	1	4
NO3	5.40	2	18
NO4	-	1	8
NO8	7.75	2	8
NO5	8.15	3	18
NO10	8.15	3	18
NO11	9.08	<1	4
NO12	5.5	4	24
NO13	5.75	4	24
NO13	3.90	<1	3
NO17	-	5	31
NO14	4.26	<1	3
NO28	-	5	31
NO18	-	7	53
NO15	0.57	1	2
NO16	2.35	2	9
NO19	3.14	2	9



Additional flows
discharging into the
channel from Belle Vista
Area is already analyzed as
a portion of Basin 1150-C
by the LWD FDR.

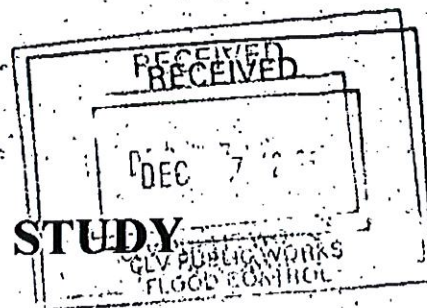
 SHEET DR (A)	DRAWN BY: JESB	12-2-01	TOLL BROTHERS 1835 VILLAGE CENTER CIRCLE, SUITE 100 FORTY-FOUR, CALIFORNIA 94034 PHONE: (702) 243-0800	TOLL BROTHERS 1835 VILLAGE CENTER CIRCLE, SUITE 100 FORTY-FOUR, CALIFORNIA 94034 PHONE: (702) 243-0800
	DESIGNED BY: JMM	12-2-01		
SCALE: PROJECT NO.:	12-2-01	TOLL BROTHERS BELLA VISTA	TOLL BROTHERS BELLA VISTA	TOLL BROTHERS 1835 VILLAGE CENTER CIRCLE, SUITE 100 FORTY-FOUR, CALIFORNIA 94034 PHONE: (702) 243-0800



TECHNICAL DRAINAGE STUDY

FOR

WYETH RANCH



3046
G115
#20
CCRFCD

December 6, 2001

Prepared for

Pulte Homes of Nevada
1635 Village Center Circle, #200
Las Vegas, Nevada 89134
(702) 256-7900

Project No.: 0147.0230

Prepared by

PENTACORE



CITY OF LAS VEGAS INTER-OFFICE MEMORANDUM

DATE:
Revised
June 25, 2003

TO:
Land Development Services
Department of Public Works

FROM:
Greg McDermott, P.E. *GM*
Flood Control Project Manager
Department of Public Works

SUBJECT: Drainage Study for:
WYETH RANCH

COPIES TO:
Pulte Homes of Nevada

Cross Streets: NEC Elkhorn Road & Tenaya Way

Stantec

FILE NO.: F:\Depot\DSMEMOS\DS3046D.doc

Bart Anderson, P.E., DEVCO

Parcel Number: 125-15-801-001

Council Liaison Office - Ward 6
Attn: Leni Skaar

Zoning Action:

CCRFC

FEMA Flood Zone YES No **X**

Proposed Storm Drain YES **X** No

HISTORY	DATE RECEIVED	DATE REVIEWED	COMMENTS	REVIEW FEES
1 st Submittal	12/7/2001	12/21/2001	Not Accepted	\$250.00
2 nd Submittal	1/9/2002	1/23/2002	Not Accepted	\$250.00
3 rd Submittal	1/28/2002	1/29/2002	Pending CCRFC	N/C
Revised Memo	4/11/2003	4/11/2003	Acceptable	N/C
Revised Memo	6/25/2003	6/25/2003	See Comments Below	N/C
			TOTAL FEES (LDDRS):	\$500.00

REMARKS:

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

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

- The Rainbow Channel is substantially complete. Hold released on building permits for Lots 47 through 57.**

The following comments will be repeated from the previous submittal until they are resolved:

- Provide removable bollards or wrought iron fence at the beginning and end of all drainage easements. Provide construction notes and details for these improvements on the improvement plans.*

(Clarification: The removable bollards provided are located 20 feet from the back of curb at the entrance to the drainage easements. Revise the improvement plans to show the removable bollards at 5 feet or less from the back of curb to prevent vehicle parking or storage within the easement.)

- The grass-lined channel in the Severance alignment must be constructed prior to the subject development.*
- It is understood that a single Home Owners Association (HOA) will be formed between the subject development and the north 80-acre development. A Joint Maintenance & Liability Agreement*

between a single Association and the City of Las Vegas must be prepared and executed prior to the recordation of the final map.

5. Per previous comment #7: *The stem wall adjacent to the sidewalk must be shown to provide 8" CMU solid grouted to 2 courses above the back of walk. Revise details I/8 and I/9 accordingly.*
6. Sheet 6: Provide 18" lateral at the drop inlet in the intersection of Severance channel and Rainbow Boulevard to pass centerline of Rainbow.

Sheet 7: Provide 18" lateral from the SDMH at Sta 10+65.43 (Elkhorn) to pass the centerline of street.

END OF REMARKS

Gam/jwb/ays

T/R/S: T19S/R60E/15

AREA G15

HYDROLOGIC CRITERIA AND DRAINAGE MANUAL

DRAINAGE STUDY INFORMATION FORM

Name of Development: WYETH RANCH Date: 6-Dec-01

Location of Development: a) Descriptive NE INTERSECTION OF RAINBOW BLVD
b) Sect. 15 Twn. 19S Rng. 60E AND ELKHORN ROAD

Name of Owner: PULTE HOMES Assessors Parcel No: 125-15-801-001

Contact Person- Name: Alex Kingston E.I.T. Telephone No: (702) 258-0115
Firm: Stantec Engineering Inc.
Address: 6763 West Charleston Boulevard, 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: 80.77 ac Being Developed/Disturbed: 75.08 AC.

2. Is a Portion or all of the subject property in a designated FEMA Flood Hazard Area? YES* NO

3. Is the Property bordered or crossed by an existing or proposed Clark County Regional Flood Control District Master Planned Facility? YES* NO

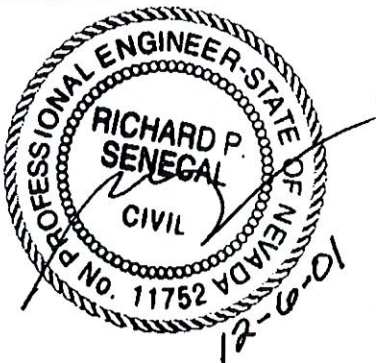
4. Proposed type of development (Residential, Commercial, Etc.)? RESIDENTIAL

5. Approximate upstream land area which drains to the subject site? Approx. 10.0 SQ MILES

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: ELKHORN ROAD

8. Briefly describe your proposed schedule for the subject project: Construction to begin as soon as possible after City of Las Vegas approval.



Engineer's Seal

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

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

Local Entity file No. _____

revision	date

REFERENCE:

STANDARD FORM 1

1.0 GENERAL LOCATION AND DEVELOPMENT DESCRIPTION

1.1 Scope

The purpose of this study is to provide a detailed hydrologic and hydraulic analysis for the development of Wyeth Ranch. This study will address the existing and future conditions that effect the onsite and offsite drainage. The criteria set forth in the Clark County Regional Flood Control District "Hydrologic Criteria and Drainage Design Manual", (Reference 6), has been used as the technical basis for this study.

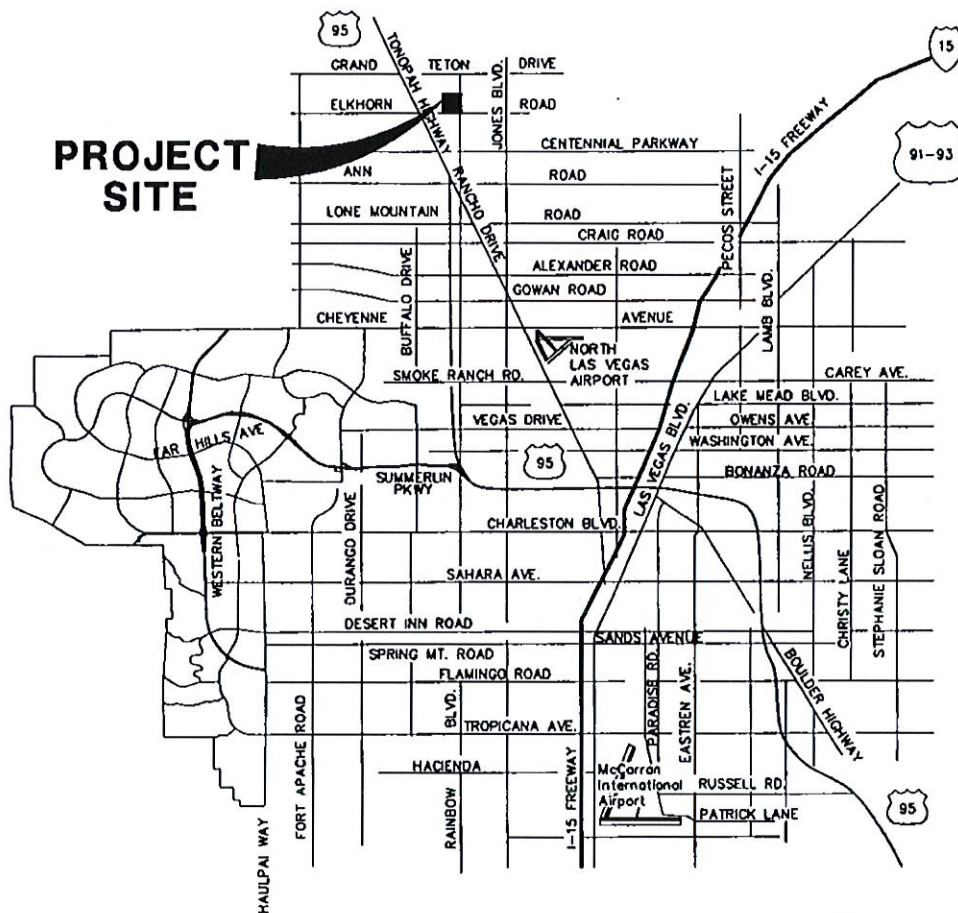
1.2 Location

Wyeth Ranch is located in the Northwest quadrant of Elkhorn Road and Rainbow Blvd, City of Las Vegas, Clark County, Nevada. The proposed project is within a portion of Section 15, Township 19 South, Range 60 East, M.D.M, City of Las Vegas, Clark County Nevada.

1.3 Description of Project

The project site will include 161 single-family homes on approximately 75 acres. The site will include the full development of various minor interior streets common to the project. Also half-street development on Rainbow Blvd., Elkhorn Road, and Tenaya Way that are adjacent to the Wyeth Ranch project site.

A grassed lined channel runs East/West along the Northern boundary of the project. According to the "Channel Hydraulics Amendment to the Offsite Master Stormwater Hydraulics Study for Bella Vista" (Reference 7), the layout of the grassed lined channel will be developed with the property to the North. The water surface elevation and cross sections locations for the channel, an HEC-RAS analysis and original calculations for the channel can be found in the Appendix (Reference 7). The channel will also turn South and also run along the Eastern edge of the site.



VICINITY MAP



Stantec Consulting
6783 W. Charleston Blvd.
Las Vegas, Nevada 89148
Tel: (702) 258-0115
Fax: (702) 258-4956
stantec.com

VICINITY MAP

WYETH RANCH

FIGURE 1

Job #: 0147.0230

2.0 DRAINAGE BASIN DESCRIPTION

2.1 Offsite Drainage Description

The offsite flows that impact the site the Wyeth Ranch were determined in the "Channel Hydraulics Amendment to the Offsite Master Stormwater Hydraulics Study for Bella Vista" (Reference 7).

2.2 Onsite Drainage Description

The existing onsite drainage patterns are generally from the Northwest to the Southeast at a slope of approximately 1.5%. The proposed project site consists of undeveloped desert with a few small washes and sparse vegetation (See Existing Onsite Basin Map, Figure 2). The existing condition of the site results in 100-year and 10-year storm flows of 29 cfs and 96 cfs, respectively (See Appendix).

When the Wyeth Ranch site is developed, the onsite flows will be conveyed South to Elkhorn Road and North/East into the existing grassed lined channel.

3.0 PROPOSED DRAINAGE FACILITIES

3.1 General Description

The project site consists of 161 single-family homes. There will be three perimeter half streets included in the project, Tenaya Way, Elkhorn Road, and North Rainbow Blvd. The Wyeth Ranch site will consist of nine sub-basins FUT-1 through FUT-9. The onsite flows will be conveyed in the street sections throughout the site. The 37-ft wide interior streets will outlet the onsite flows into onsite drainage easements, where the flows will be conveyed South onto Elkton Road and to the existing grass lined that borders the site. Figure 5 illustrates the proposed drainage basins for the project site. Figures 5 also illustrates the offsite flows in the proposed and existing condition.

3.2 Compliance with Regulations and Adopted Plans

This study has been prepared in accordance with the CCRFCD's *Hydrologic Criteria and Drainage Design Manual* (Reference 6) and Clark County's *Uniform Regulations for the Control of Drainage*. The study is in compliance with all Master Planned Flood Control Facilities, FEMA flood plain regulations and all proposed modifications to or verifications of the FEMA regulated floodplain through the subject site, and Uniform Regulations.

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

3.4 Facility Design Calculations

Surface flow on the streets provides for the storm water conveyance for the Wyeth Ranch site. Hydraulic calculations for the streets are based on Manning's Equation and were performed utilizing a typical street section and the total runoff for each basin on the project site.

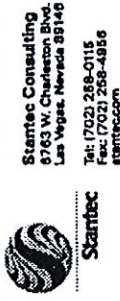
Table 4 summarizes the results of the HEC-1 analysis.

TABLE 4
RESULTS OF HEC-1 ANALYSIS

Basin/Concentration Point	Area (acres)	Q ₁₀₀ (cfs)	Q ₁₀ (cfs)
FUT-1	7.60	11	3
FUT-2	3.50	6	2
FUT-3	2.15	17	6
CP-1	N/A	23	8
FUT-4	2.61	4	2
FUT-5	1.41	7	2
FUT-6	1.41	18	5
CP-2	N/A	25	8
FUT-7	1.41	13	3
FUT-8	1.41	5	1
FUT-9	1.41	13	2
CP-3	N/A	18	3

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

TIME OF CONCENTRATION



PROJECT NO.: 0147.0230

DEVELOPMENT: WYETH RANCH

FILE: WRSf4.xls

CALCULATED BY: Alex Kingston

DATE: 12/4/01

Sub-Basin Data				Initial/Overland Time (Ti)				Travel Time (Tt)				Tc	Tc Check (Urbanized Basins)		Final Tc	Flag	Remarks
BASIN (1a)	DEVEX (1b)	CN (1c)	K (2)	AREA (acres) (3a)	AREA (sq.mi.) (3b)	LENGTH (ft) (4)	SLOPE (ft/ft) (5)	LENGTH (ft) (7)	SLOPE (ft/ft) (8)	VELOCITY (9a)	VELOCITY (9b)	Tt (min) (10)	Tc-Tt+Tt (min) (11)	Tc (min) (13)	Tc (min) (14)	Flag (hrs) (15)	(16)
PROPOSED CONDITION																	
FUT-1	D	83	0.71	7.6	0.0119	150	0.010	8.7	0.0050	1.4	2.2	9	17	1000.0	16	16	0.16
FUT-2	D	81	0.68	3.5	0.0055	148	0.010	9.2	0.0050	1.4	2.2	8	17	888.0	15	15	0.15
FUT-3	D	83	0.71	10.0	0.0156	150	0.010	8.7	0.0050	1.4	2.2	8	16	900.0	15	15	0.15
FUT-4	D	98	0.90	1.3	0.0020	500	0.010	7.9				0	8	500.0	13	8	0.08
FUT-5	D	83	0.71	4.1	0.0064	148	0.010	8.6	0.0050	1.4	2.2	8	16	888.0	15	15	0.15
FUT-6	D	81	0.68	12.6	0.0197	149	0.010	9.2	0.0050	1.4	2.2	12	21	1429.0	18	18	0.18
FUT-7	D	75	0.60	15.7	0.0245	153	0.010	11.1	0.0050	1.4	2.2	10	21	1233.0	17	17	0.17
FUT-8	D	75	0.60	4.8	0.0075	146	0.010	10.9	0.0050	1.4	2.2	10	21	1196.0	17	17	0.17
FUT-9	D	72	0.56	15.5	0.0242	141	0.010	11.5	0.0050	1.4	2.2	11	22	1271.0	17	17	0.17
EXISTING CONDITION																	
EX-1	E	81	0.68	75.1	0.1173	500	0.014	15.1	0.015	1.8	3.6	12	27	NA	NA	27	0.27

Ti = (1.8(1.1-K) L^{0.5} (1/2)) / (S^{0.5} 1/3) For Tt Calculations,

Tc = Ti + Tt

K = 0.0132(CN)-0.39

Tlag = 0.6Tc

Existing: V1 = 14.8(S)^{0.5}; V2 = 29.4(S)^{0.5}

Developed: V1 = 20.2(S)^{0.5}; V2 = 30.6(S)^{0.5}

V1 applies to the first 500 feet of travel distance; and V2 applies to the remaining

Assumes all basins are smaller than one (1) square mile.

REFERENCE:

STANDARD FORM 4

00
 HEC1 S/N: 1333000362 HMVersion: 6.40 Data File: 1470230.HC1

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*****
* FLOOD HYDROGRAPH PACKAGE (HEC-1) *
* SEPTEMBER 1990 *
* VERSION 4.0 *
* RUN DATE 12/04/2001 TIME 15:51:11 *
*****

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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
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X X X X X X
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X X X X X X
X X X X X X
X X XXXXXXX XXXXX XXX

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*****
*****
::: Full Microcomputer Implementation :::
::: by :::
::: Haestad Methods, Inc. :::
::: :::
*****
*****

```

37 Brookside Road * Waterbury, Connecticut 06708 * (203) 755-1666

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

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIQR- 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

00

HEC-1 INPUT

PAGE 1

LINE	ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10
1	*DIAGRAM
2	ID WYETH RANCH
3	ID EXISTING & PROPOSED CONDITIONS BY: ALEX KINGSTON E.I.T.
4	ID NOVEMBER 2001 FILE: 1470230.HC1
5	IT 5 0 0 300
6	IO 5 0
7	IN 5 0 0
8	JR PREC .57 1
9	KK EX-1
10	KM BASIN EX-1 (EXISTING CONDITION)
11	BA 0.1173
12	PC .000 .020 .057 .070 .087 .108 .124 .130 .130 .130
13	PC .130 .130 .130 .133 .140 .142 .148 .158 .172 .181
14	PC .190 .197 .199 .200 .201 .204 .214 .229 .241 .249
15	PC .251 .256 .270 .278 .281 .283 .295 .322 .352 .409
16	PC .499 .590 .710 .744 .781 .812 .819 .835 .851 .856
17	PC .860 .868 .876 .888 .910 .926 .937 .950 .970 .976
18	PC .982 .985 .987 .989 .990 .993 .993 .994 .995 .998
19	PC .998 .999 1.00
20	PB 2.77
21	LS 0 81
22	UD .24
23	KK FUT-1
24	KM BASIN FUT-1 (FUTURE CONDITION)
25	BA 0.0119
26	LS 0 83
27	UD .25
28	KK FUT-2
29	KM BASIN FUT-2 (FUTURE CONDITION)
30	BA 0.0055
31	LS 0 81
32	UD 0.14
33	KK FUT-3
34	KM BASIN FUT-3 (FUTURE CONDITION)
35	BA 0.0156
36	LS 0 83
37	UD 0.14
38	KK CP-1
39	HC 2
40	KK FUT-4
41	KM BASIN FUT-4 (FUTURE CONDITION)
42	BA 0.0020
43	LS 0 98
44	UD 0.11

□ □

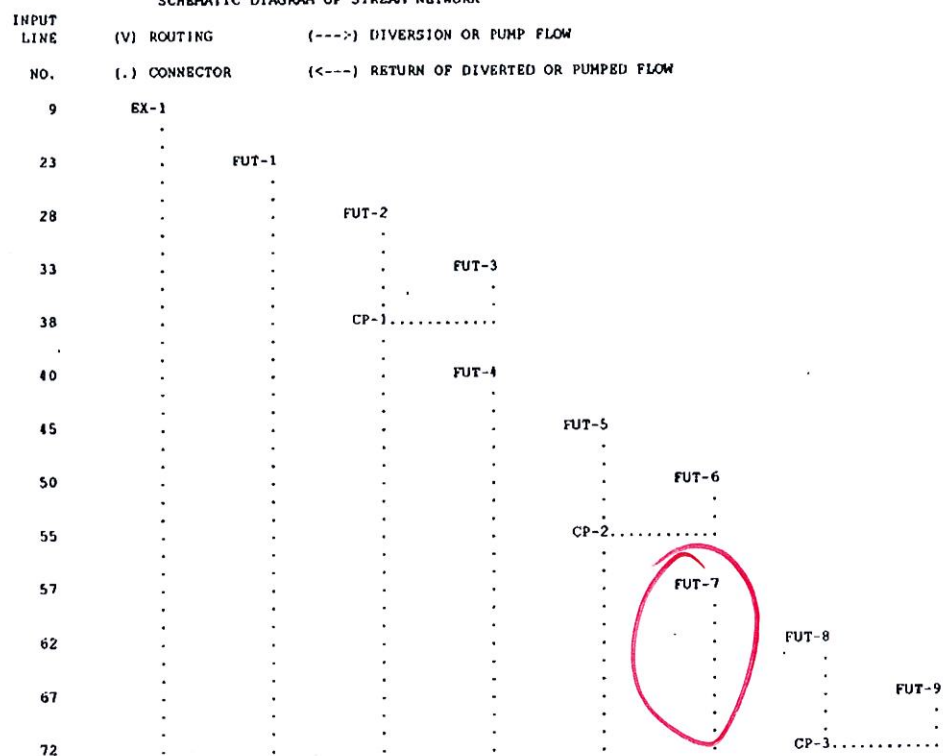
HEC-1 INPUT

PAGE 2

LINE	ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10
45	KK FUT-5
46	KM BASIN FUT-5 (FUTURE CONDITION)
47	BA 0.0064
48	LS 0 83
49	UD 0.14
50	KK FUT-6
51	KM BASIN FUT-6 (FUTURE CONDITION)
52	BA 0.0197
53	LS 0 81
54	UD 0.18
55	KK CP-2
56	HC 2
57	KK FUT-7
58	KM BASIN FUT-7 (FUTURE CONDITION)
59	BA 0.0197
60	LS 0 75
61	UD 0.16
62	KK FUT-8
63	KM BASIN FUT-8 (FUTURE CONDITION)
64	BA 0.0075
65	LS 0 75
66	UD 0.16
67	KK FUT-9
68	KM BASIN FUT-9 (FUTURE CONDITION)
69	BA 0.0242
70	LS 0 72
71	UD 0.17
72	KK CP-3
73	HC 2
74	ZZ

O D

SCHEMATIC DIAGRAM OF STREAM NETWORK



(**) RUNOFF ALSO COMPUTED AT THIS LOCATION

00
 HEC1 S/N: 1333000362 HMVersion: 6.40 Data File: 1470230.HC1

.....
 * FLOOD HYDROGRAPH PACKAGE (HEC-1) *
 * SEPTEMBER 1990 *
 * VERSION 4.0 *
 * RUN DATE 12/04/2001 TIME 15:51:11 *
 *

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

WYETH RANCH
 EXISTING & PROPOSED CONDITIONS BY: ALEX KINGSTON E.I.T.
 NOVEMBER 2001 FILE: 1470230.HC1

6 10 OUTPUT CONTROL VARIABLES
 IPRNT 5 PRINT CONTROL
 IPILOT 0 PLOT CONTROL
 QSCAL 0. HYDROGRAPH PLOT SCALE

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

 COMPUTATION INTERVAL .08 HOURS
 TOTAL TIME BASE 24.92 HOURS

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

JP MULTI-PLAN OPTION
 NPLAN 1 NUMBER OF PLANS

JR MULTI-RATIO OPTION
 RATIOS OF PRECIPITATION
 .57 1.00

□ □

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

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO PRECIPITATION	
				RATIO 1 .57	RATIO 2 1.00
HYDROGRAPH ATD	EX-1	.12	1 FLOW TIME	29. 3.75	96. 3.67
HYDROGRAPH ATD	FUT-1	.01	1 FLOW TIME	3. 3.75	11. 3.67
HYDROGRAPH ATD	FUT-2	.01	1 FLOW TIME	2. 3.58	6. 3.58
HYDROGRAPH ATD	FUT-3	.02	1 FLOW TIME	6. 3.58	17. 3.58
2 COMBINED ATD	CP-1	.02	1 FLOW TIME	8. 3.58	23. 3.58
HYDROGRAPH ATD	FUT-4	.00	1 FLOW TIME	2. 3.50	4. 3.50
HYDROGRAPH ATD	FUT-5	.01	1 FLOW TIME	2. 3.58	7. 3.58
HYDROGRAPH ATD	FUT-6	.02	1 FLOW TIME	5. 3.67	18. 3.58
2 COMBINED ATD	CP-2	.03	1 FLOW TIME	8. 3.58	25. 3.58
HYDROGRAPH ATD	FUT-7	.02	1 FLOW TIME	3. 3.67	13. 3.58
HYDROGRAPH ATD	FUT-8	.01	1 FLOW TIME	1. 3.67	5. 3.58
HYDROGRAPH ATD	FUT-9	.02	1 FLOW TIME	2. 3.75	13. 3.58
2 COMBINED ATD	CP-3	.03	1 FLOW TIME	3. 3.67	18. 3.58

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

additional discharge into
 the Rainbow Boulevard channel
 from the Wyeth Ranch

DRAINAGE EASEMENT

&

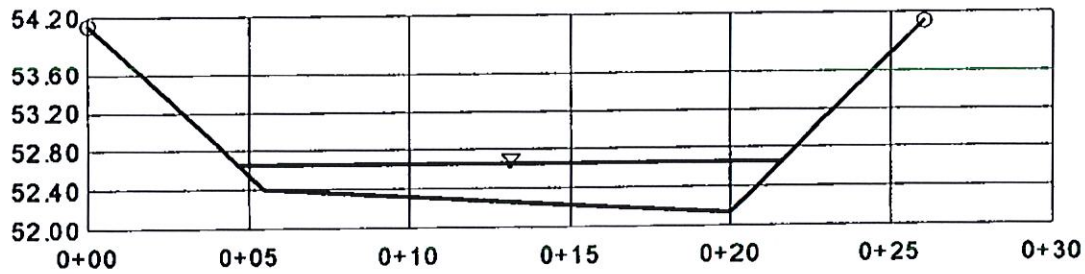
WEIR ANALYSIS

Cross Section Basin FUT-7 Drainage Easement (COMMON LOT F)

Cross Section for Irregular Channel

Project Description	
Worksheet	BASIN FUT-7 DRAINAGE EASEMENT
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data	
Mannings Coefficient	0.025
Slope	0.5000 %
Water Surface Elevation	52.66 ft
Elevation Range	52.15 to 54.10
Discharge	13.00 cfs



V:3.0
H:1
NTS

BASIN FUT-7 DRAINAGE EASEMENT (Common Lot F)

Worksheet for Irregular Channel

Project Description	
Worksheet	BASIN FUT-7 DRAINAGE EASEMENT
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Slope	0.5000 %
Discharge	13.00 cfs

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

Results	
Mannings Coefficient	0.025
Water Surface Elevation	52.66 ft
Elevation Range	52.15 to 54.10
Flow Area	6.1 ft ²
Wetted Perimeter	17.04 ft
Top Width	16.92 ft
Actual Depth	0.51 ft
Critical Elevation	52.56 ft
Critical Slope	1.4183 %
Velocity	2.12 ft/s
Velocity Head	0.07 ft
Specific Energy	52.73 ft
Froude Number	0.62
Flow Type	Subcritical

Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+00	0+26	0.025

Natural Channel Points	
Station (ft)	Elevation (ft)
0+00	54.10
0+06	52.40
0+20	52.15
0+26	54.10

WEIR @ BASIN FUT-7 DRAINAGE EASEMENT (COMMON LOT F)
Worksheet for Sharp Crested Rectangular Weir

Project Description

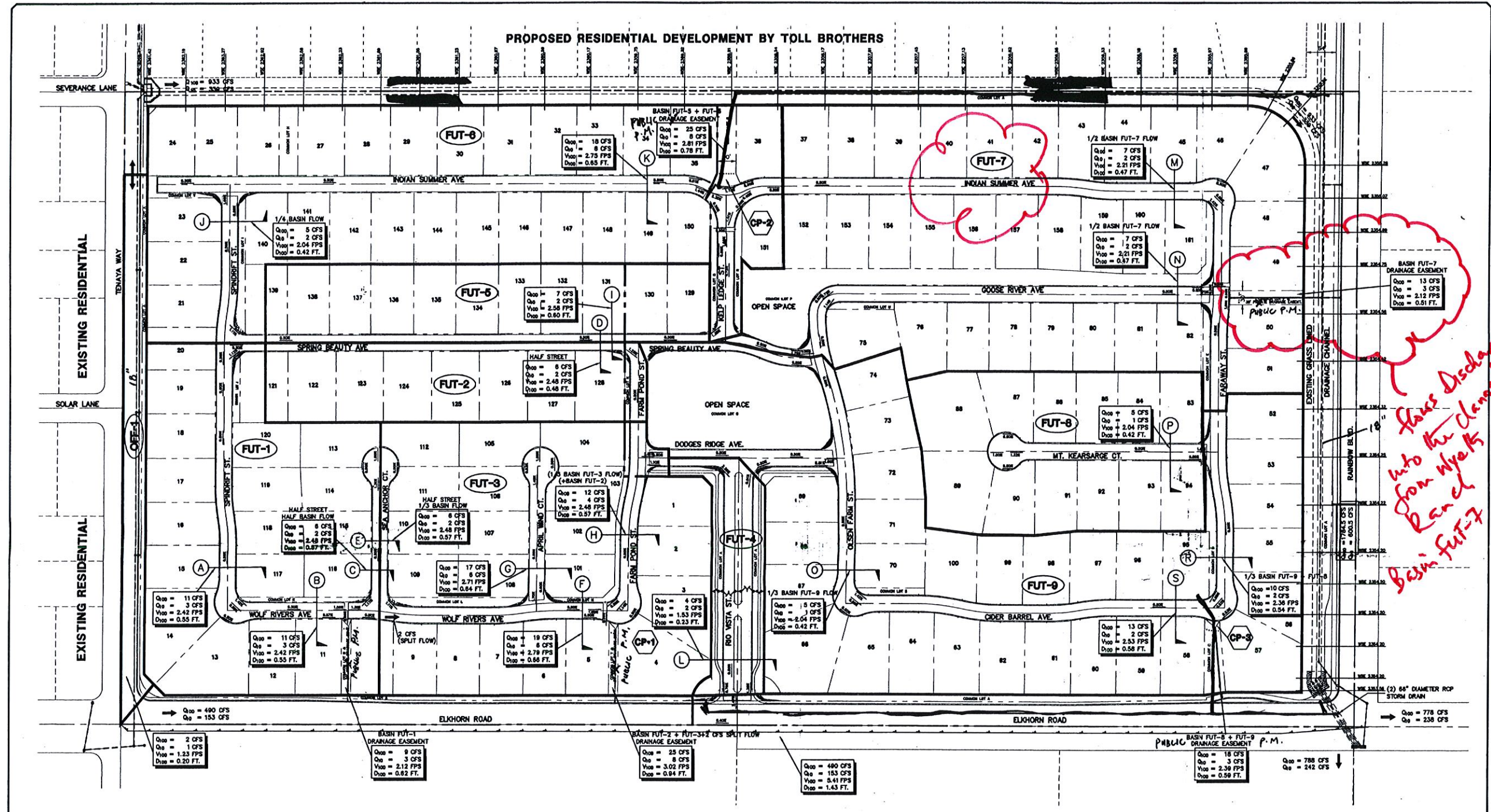
Worksheet	Weir @ Basin FUT-7 Drainage Easement
Type	Sharp Crested Rectangular Weir
Solve For	Headwater Elevation

Input Data

Discharge	13.00 cfs
Crest Elevation	0.00 ft
Tailwater Elevation	0.51 ft
Discharge Coefficient	3.33 US
Crest Length	14.50 ft
Number of Contractions	1

Results

Headwater Elevation	0.61 ft
Headwater Height Above Crest	0.61 ft
Tailwater Height Above Crest	0.51 ft
Flow Area	8.8 ft ²
Velocity	1.47 ft/s
Wetted Perimeter	15.72 ft
Top Width	14.50 ft



**TABLE 3
OFF-SITE BASINS**

BASIN	AREA (acres)	Q ₁₀ (cfs)	Q ₅ (cfs)
OFF-1	1.30	1	2

**TABLE 1
ON-SITE BASINS**

BASIN	AREA (acres)	Q ₁₀ (cfs)	Q ₅ (cfs)
FUT-1	7.60	3	11
FUT-2	3.50	2	6
FUT-3	10.00	6	17
FUT-4	1.30	2	4
FUT-5	4.10	2	7
FUT-6	12.60	5	18
FUT-7	15.70	3	13
FUT-8	4.80	1	5
FUT-9	15.50	2	13

the site spans across 2 soil zones

**TABLE 2
COMBINED FLOWS LOCATIONS**

BASINS	Q ₁₀ (cfs)	Q ₅ (cfs)
FUT-2+FUT-3 + 2 CFS SPLIT FLOW	8	25
FUT-5+FUT-6	8	25
FUT-8+FUT-9	3	18



This grading plan is a part of a drainage study #2014 which was reviewed on 1/18/02 and approved on 1/22/02.

FIGURE 5

CLV, DMC

PULTE HOMES
1635 VILLAGE CENTER CIRCLE, SUITE 250
LAS VEGAS, NEVADA 89134
(702) 258-7900

PENTACORE
CIVIL ENGINEERING, LAND SURVEYING - PLANNING
CONSULTING
1000 WEST CHARLESTON ROAD, SUITE 200
LAS VEGAS, NEVADA 89146
(702) 258-0115

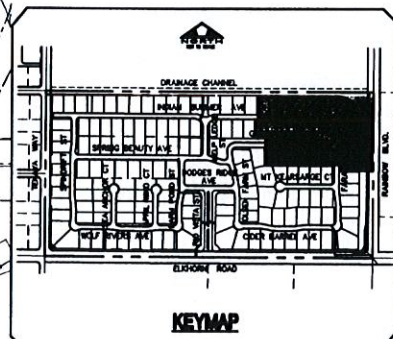
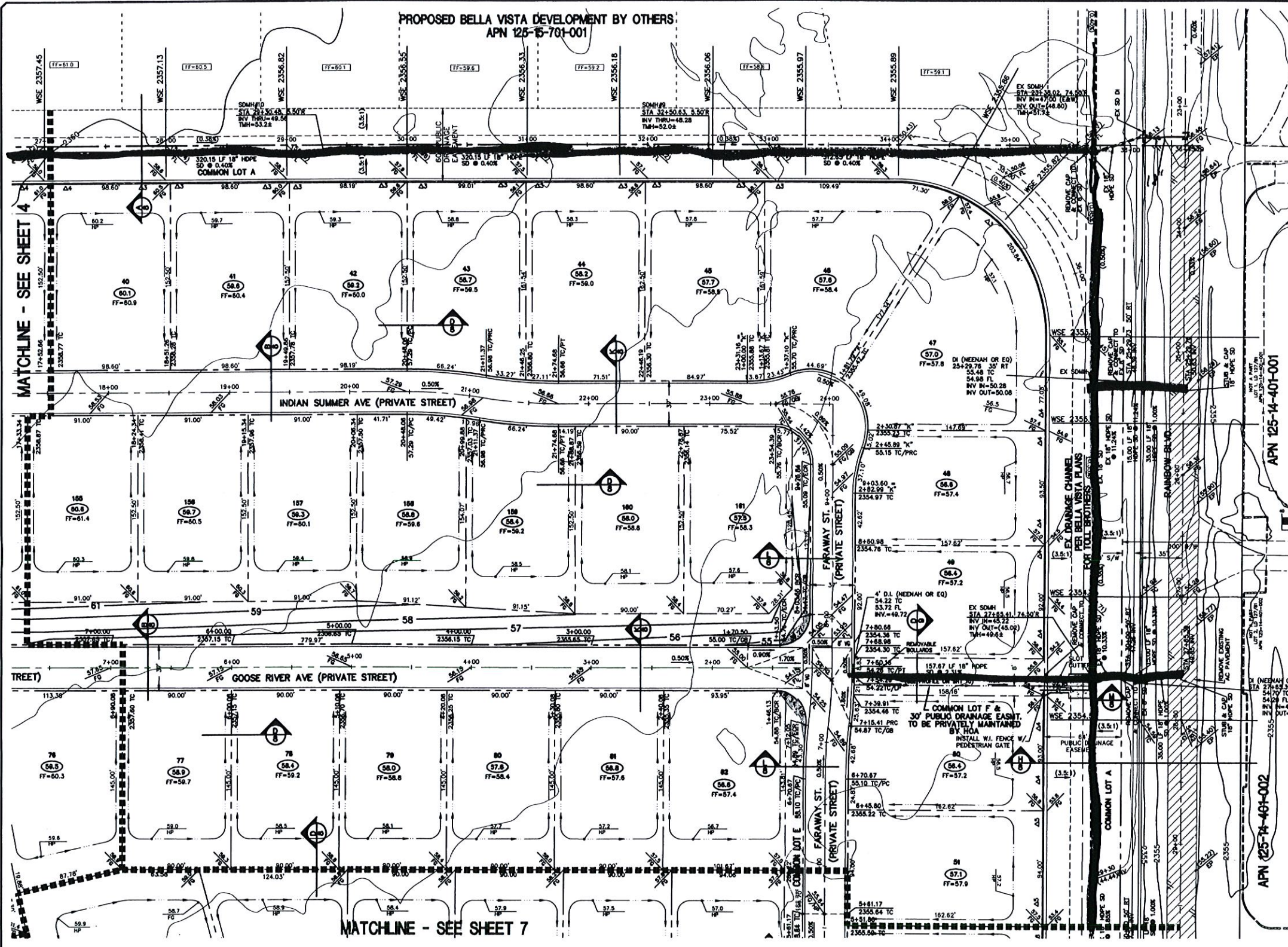
PROPOSED ON-SITE BASIN MAP
FIGURE 5

WYETH RANCH

DATE: 12/05/01
PA: S. L. Y.
DRAWN BY:
DESIGNED BY:
CHECKED BY:
ADA CHECKED:
JOB NO.: 0147-0230
SCALE: 1"=100'

NO. DESCRIPTION DATE APPTD

Page 111 01/08/2002 08:42:00 023006.dwg



BENCHMARK
CITY OF LAS VEGAS BENCHMARK NO. 11590 115WS.
RIVET AND PLATE IN TOP OF CURB, SOUTH SIDE OF
RAINBOW BLVD. AND FLANAGAN DRIVE, 200' NORTH
OF GRAND TETON DRIVE.
ELEVATION = 2378.52 (NAVD 88)

This grading plan is a
part of drainage study
#2006 which was received
on 1/24/07 and on 1/24/07

ENGINEER'S CERTIFICATE
I CERTIFY THIS GRADING PLAN IS IN CONFORMANCE WITH
THE APPROVED DRAINAGE STUDY FOR THIS PROJECT AND
FILE AT THE CITY OF LAS VEGAS, CLARK COUNTY, NEVADA.
RICHARD P. SENECA, PE, No. 11752

- ENGINEER'S NOTES**
- 1) CONTRACTOR IS RESPONSIBLE FOR DUST AND EROSION CONTROL DURING CONSTRUCTION.
 - 2) SEE LANDSCAPE PLANS FOR LANDSCAPING AND ON-SITE IRRIGATION.
 - 3) SEE DETAIL SHEET FOR ON-SITE PAVEMENT SECTIONS. CONTRACTOR TO VERIFY WITH SOILS REPORT.
 - 4) ENGINEER TO BE NOTIFIED OF ANY DISCREPANCIES IMMEDIATELY.
 - 5) THESE PLANS SHALL NOT, IN PART OR IN WHOLE, BE USED FOR CONSTRUCTION UNTIL APPROVED AND SIGNED BY THE GOVERNING AGENCIES.
 - 6) CONTRACTOR TO MAINTAIN POSITIVE DRAINAGE AWAY FROM PROPOSED BUILDINGS.

PUBLIC DRAINAGE EASEMENTS
ALL PRIVATE STREETS ARE PUBLIC DRAINAGE EASEMENTS TO BE PRIVATELY MAINTAINED BY HOME OWNERS ASSOCIATION (HOA).

BASIS OF BEARING
THE BASIS OF BEARING FOR THIS SURVEY IS THE WEST LINE OF THE SOUTHEAST QUARTER (SE 1/4) OF SECTION 15, TOWNSHIP 19 SOUTH, RANGE 60 EAST, W.D.M., CLARK COUNTY, NEVADA, AS SHOWN IN FILE 115, PAGE 13 OF OFFICIAL RECORDS, CLARK COUNTY, NEVADA. I.E. NORTH 00°15'00" EAST

Avoid hitting overhead power lines. It's costly.
Call before you dig.
1-702-593-6111

Avoid cutting underground utility lines. It's costly.
Call before you dig.
1-800-227-2600
UNDERGROUND SERVICE ALERT (USA)

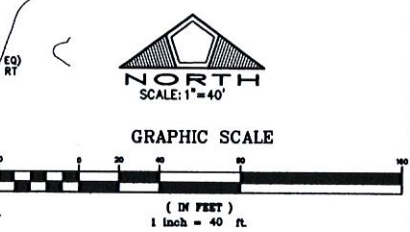
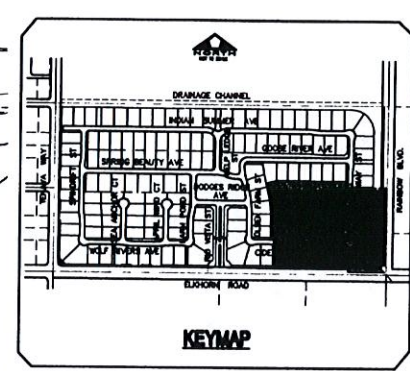
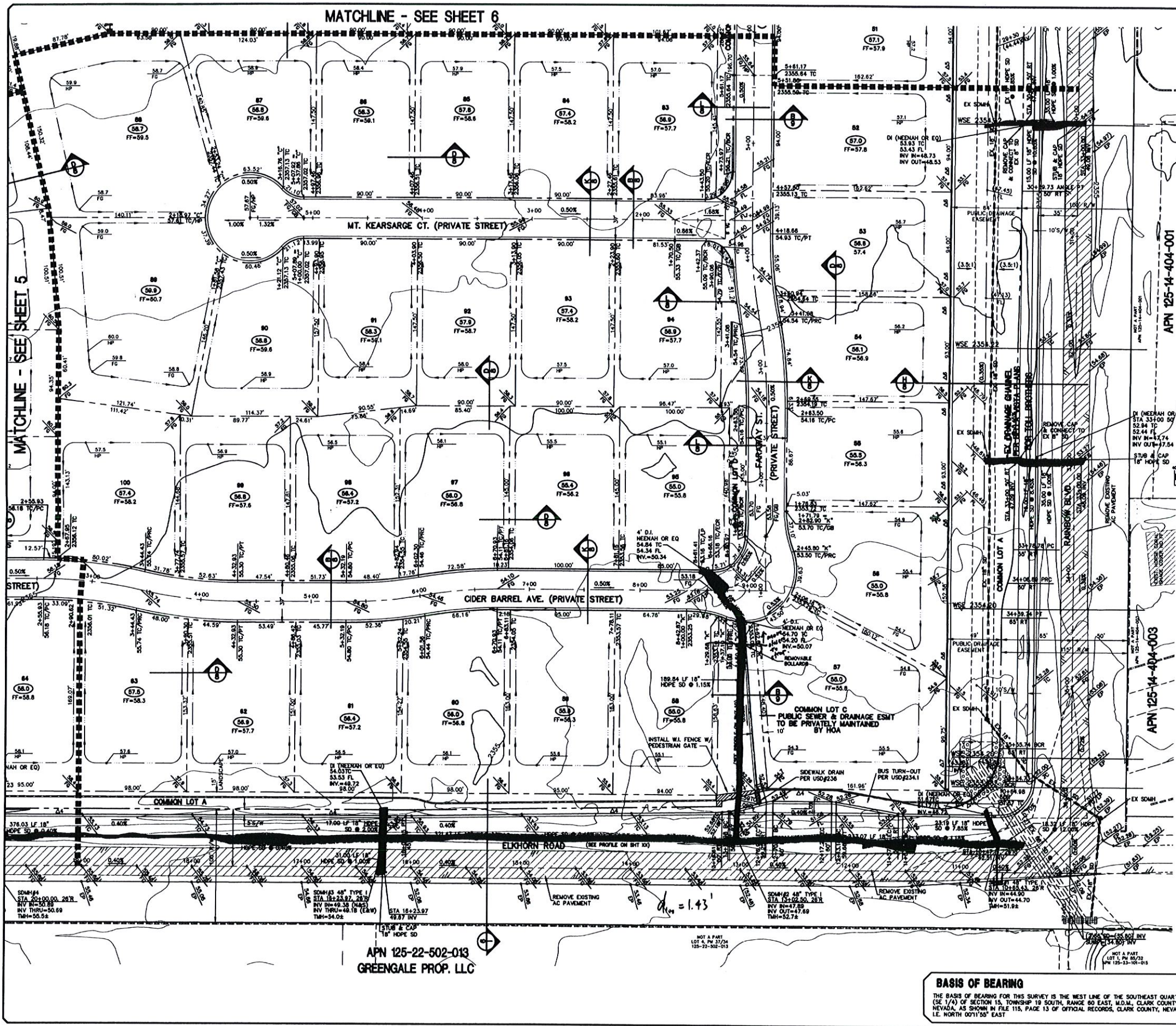
PROFESSIONAL ENGINEER - STATE OF NEVADA
RICHARD P. SENECA
11752

SHEET **6** OF 10
C.L.V. DWG.#

PULTE HOMES
1635 VILLAGE CENTER CIRCLE, SUITE 250
LAS VEGAS, NEVADA 89134
(702) 256-7900

GRADING PLAN V
WYETH RANCH

PENTACORE
CIVIL ENGINEERING, LAND SURVEYING, PLANNING
CONSULTING, AND CONSTRUCTION
1635 VILLAGE CENTER CIRCLE, SUITE 250
LAS VEGAS, NEVADA 89134
(702) 256-7900



PUBLIC DRAINAGE EASEMENTS
ALL PRIVATE STREETS ARE PUBLIC DRAINAGE EASEMENTS TO BE PRIVATELY MAINTAINED BY HOME OWNERS ASSOCIATION (HOA)

ENGINEER'S NOTES
1) CONTRACTOR IS RESPONSIBLE FOR DUST AND EROSION CONTROL DURING CONSTRUCTION.
2) SEE LANDSCAPE PLANS FOR LANDSCAPING AND ON-SITE IRRIGATION.
3) SEE DETAIL SHEET FOR ON-SITE PAVEMENT SECTIONS. CONTRACTOR TO VERIFY WITH SOILS REPORT.
4) ENGINEER TO BE NOTIFIED OF ANY DISCREPANCIES IMMEDIATELY.
5) THESE PLANS SHALL NOT, IN PART OR IN WHOLE, BE USED FOR CONSTRUCTION UNTIL APPROVED AND SIGNED BY THE GOVERNING AGENCIES.
6) CONTRACTOR TO MAINTAIN POSITIVE DRAINAGE AWAY FROM PROPOSED BUILDINGS.

BENCHMARK
CITY OF LAS VEGAS BENCHMARK NO. 11V90 11SW5.
RIVET AND PLATE IN TOP OF CURB, SOUTH SIDE OF RAINBOW BLVD. AND FLANAGAN DRIVE, 200' NORTH OF GRAND TETON DRIVE.
ELEVATION: = 2376.52 (NAVD 88)

This grading plan is a part of a drainage study #3046 which was received on 1/19/07 at 1:00 PM.

ENGINEER'S CERTIFICATE
I CERTIFY THIS GRADING PLAN IS THE APPROVED GRADING STUDY FOR THE PROJECT SHOWN ON FILE AT THE CITY OF LAS VEGAS.
DATE: 11/19/07
SIGNATURE: RICHARD P. SENECA
TITLE: SENIOR CIVIL ENGINEER

BASIS OF BEARING
THE BASIS OF BEARING FOR THIS SURVEY IS THE WEST LINE OF THE SOUTHEAST QUARTER (SE 1/4) OF SECTION 15, TOWNSHIP 19 SOUTH, RANGE 80 EAST, M.D.M., CLARK COUNTY, NEVADA, AS SHOWN IN FILE 115, PAGE 13 OF OFFICIAL RECORDS, CLARK COUNTY, NEVADA. I.E. NORTH 00°11'55" EAST

NO.

DESCRIPTION

DATE

APPROVED

PULTE HOMES

1635 VILLAGE CENTER CIRCLE, SUITE 250

LAS VEGAS, NEVADA 89134

(702) 258-7500

PENTACORE

ONE RIVERSIDE DRIVE, SUITE 200

CONSTRUCTION MANAGEMENT

6703 WEST CHARLESTON BOULEVARD

LAS VEGAS, NEVADA 89146

(702) 258-0115

GRADING PLAN VI

WYETH RANCH

DATE: 11/19/07

DRAWN BY: SLY

DESIGNED BY: SLY

CHECKED BY: SLY

JOB NO.: 0147.0230

SCALE: 1" = 40'

PROFESSIONAL ENGINEER - STATE OF NEVADA

RICHARD P. SENECA

CIVIL

11752

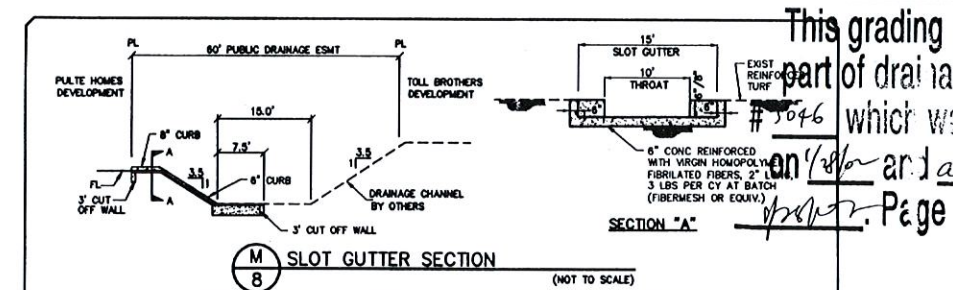
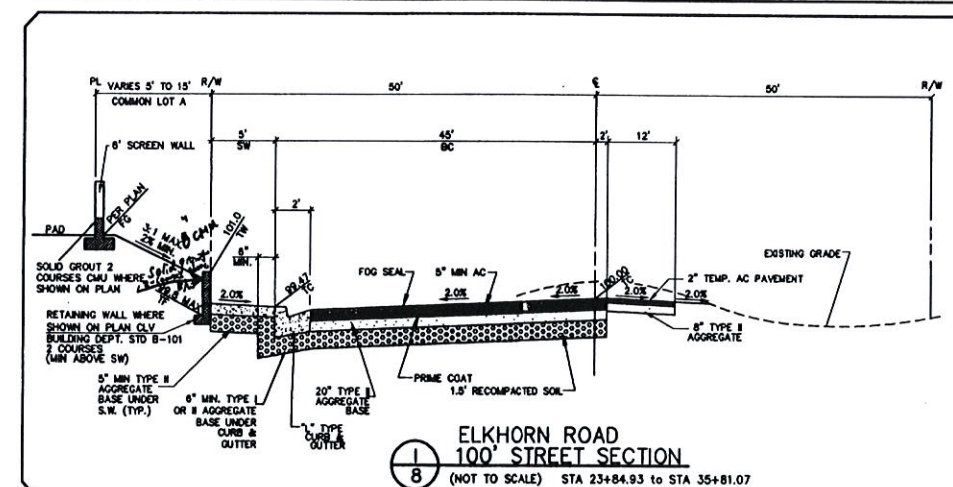
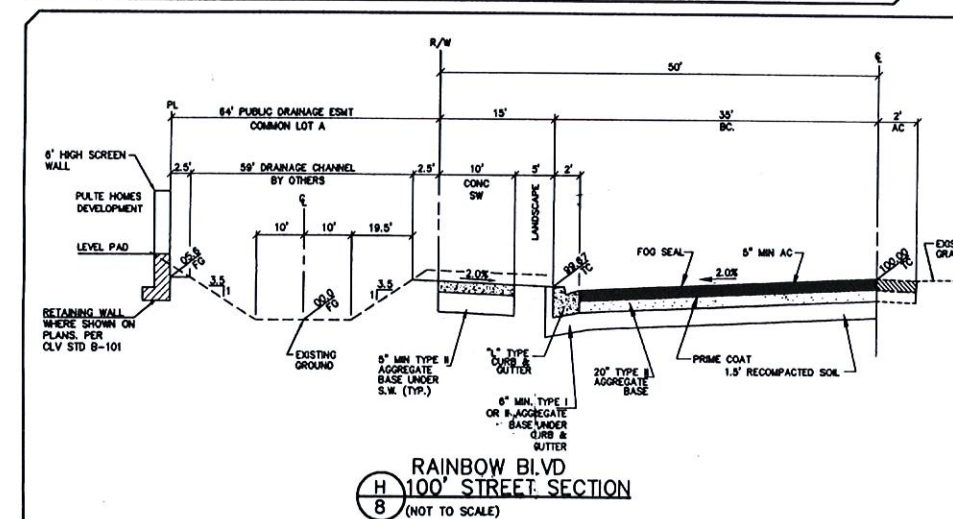
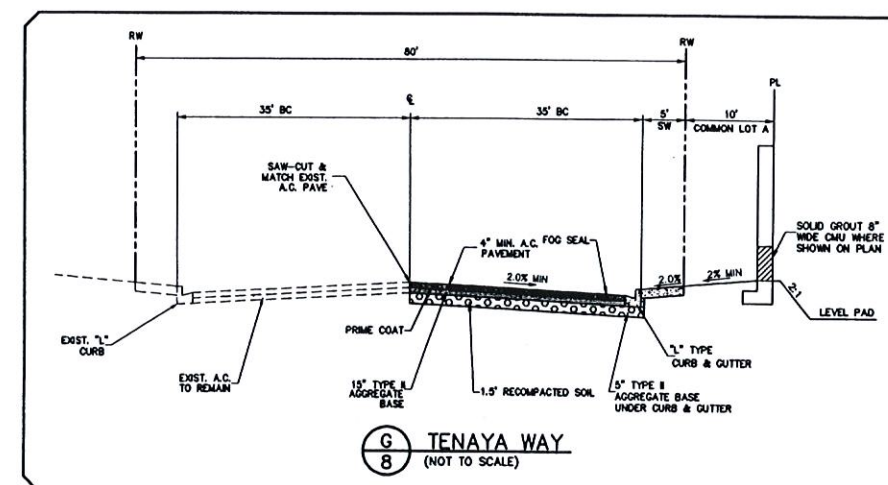
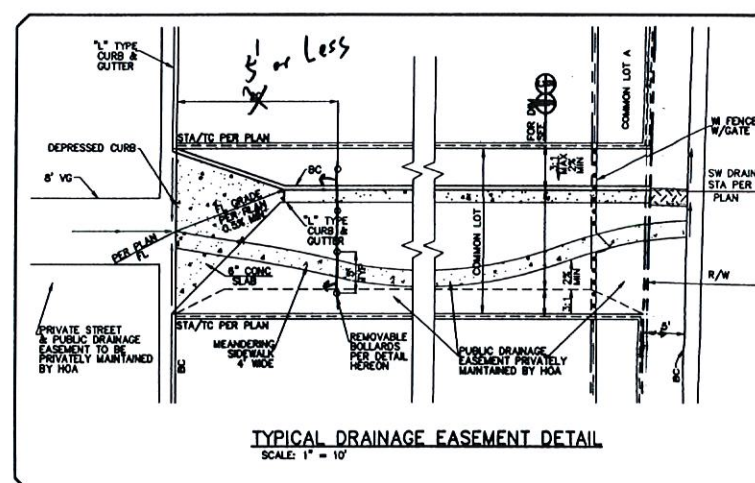
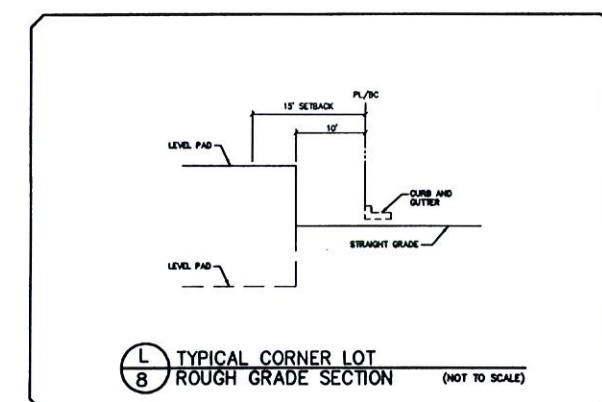
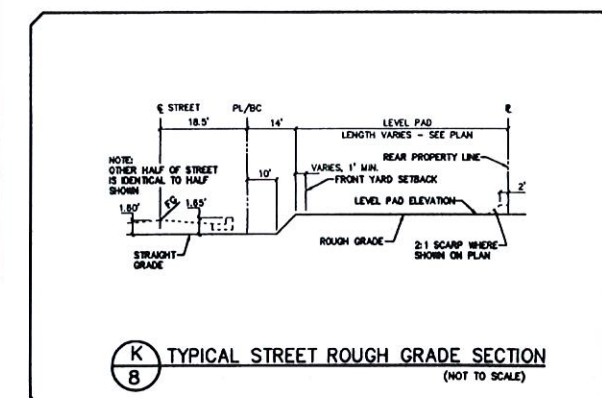
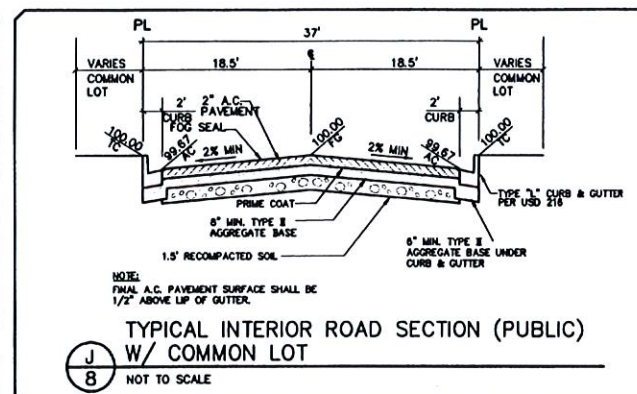
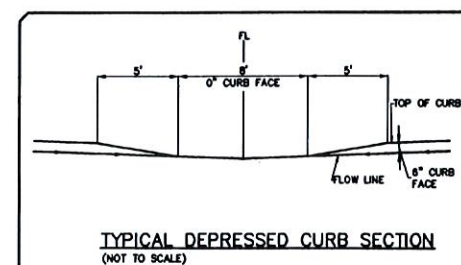
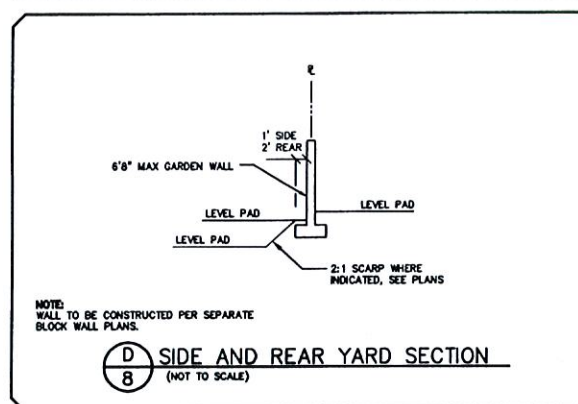
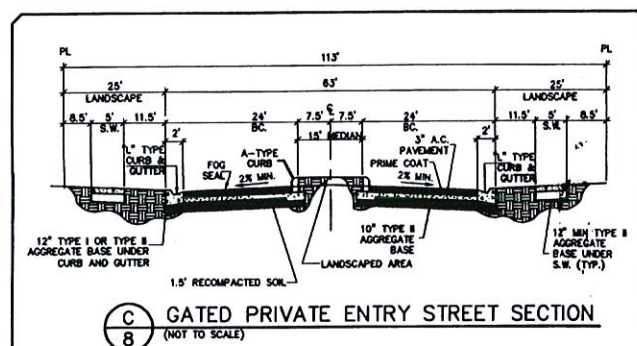
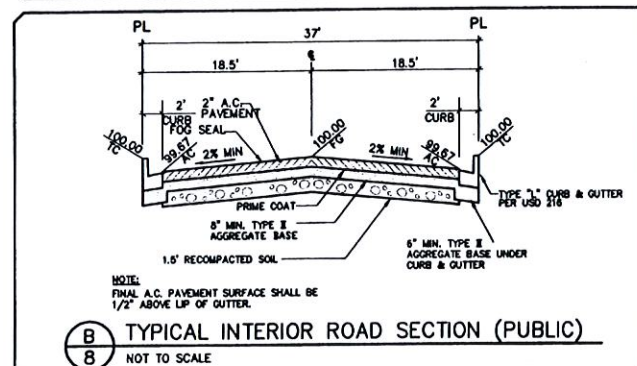
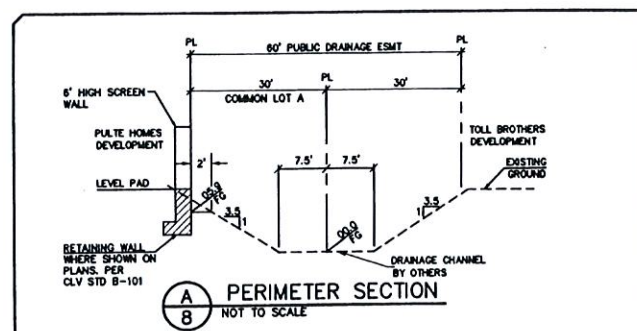
11/20/07

SHEET

7

OF 10

C.L.V. DWG.#



This grading plan is a part of drainage study # 5046 which was received on 7/28/00 and approved by the City of [illegible]. Page 7 of 7

[illegible]

PULTE HOMES
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PENTACORE
CIVIL ENGINEERING • LAND SURVEYING • PLANNING
CONSTRUCTION MANAGEMENT • ADA CONSULTING
676.3 WEST CHARLESTON BOULEVARD
LAS VEGAS, NEVADA 89148 (702) 238-0115

GRADING SECTIONS AND DETAILS

WYETH RANCH

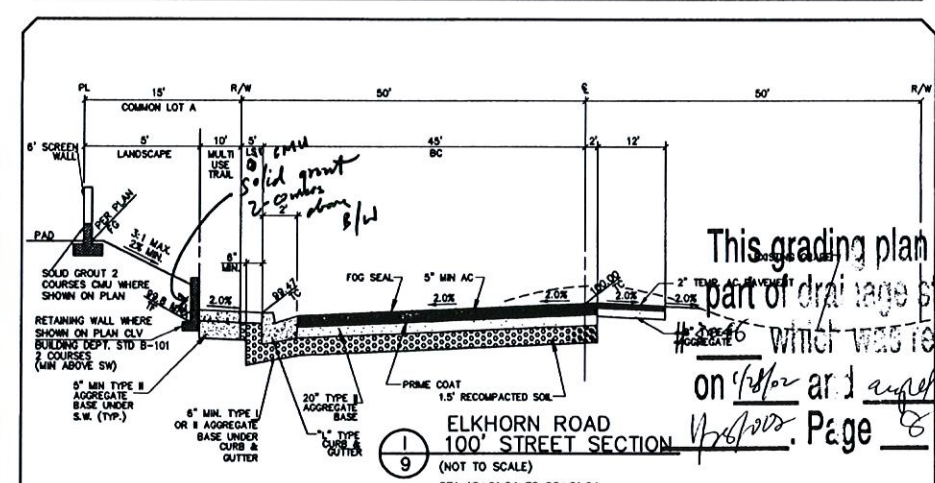
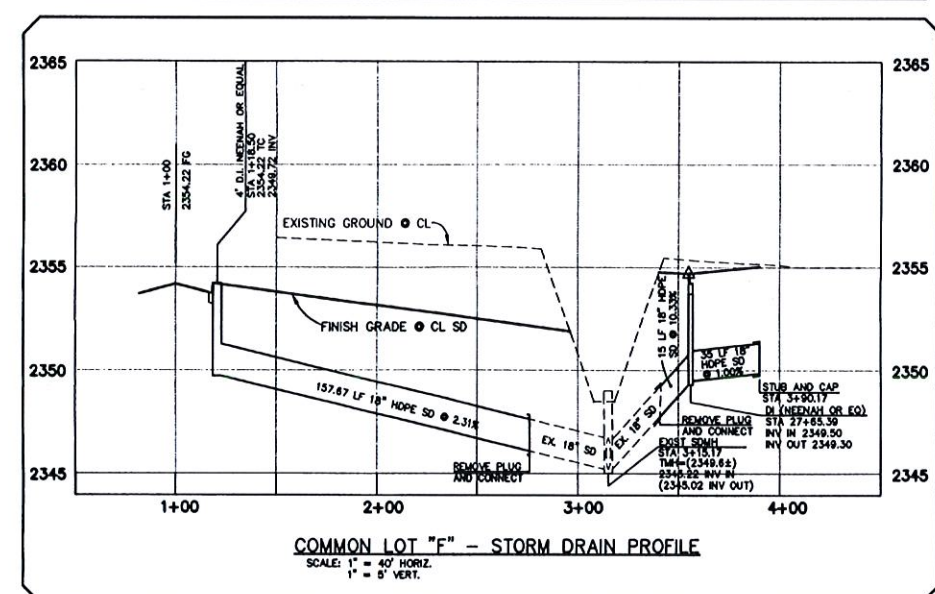
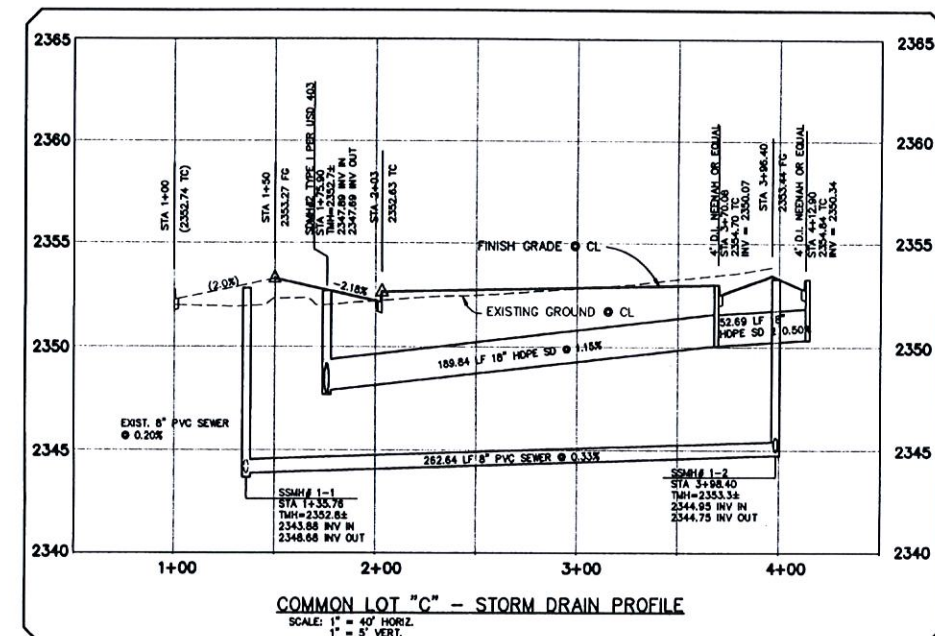
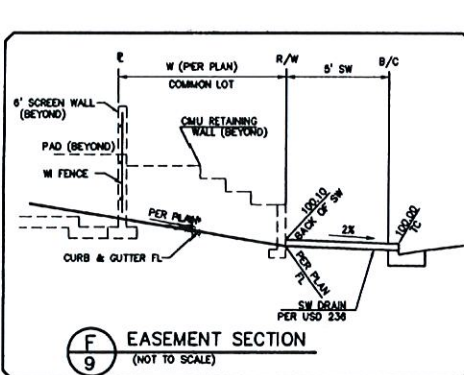
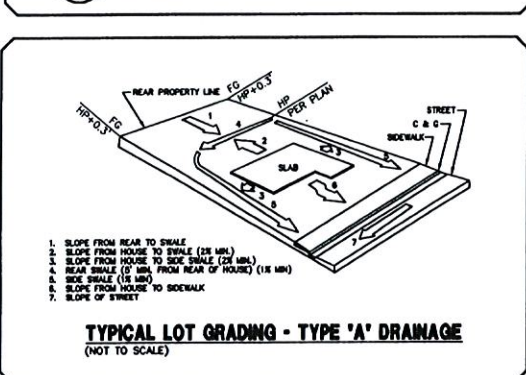
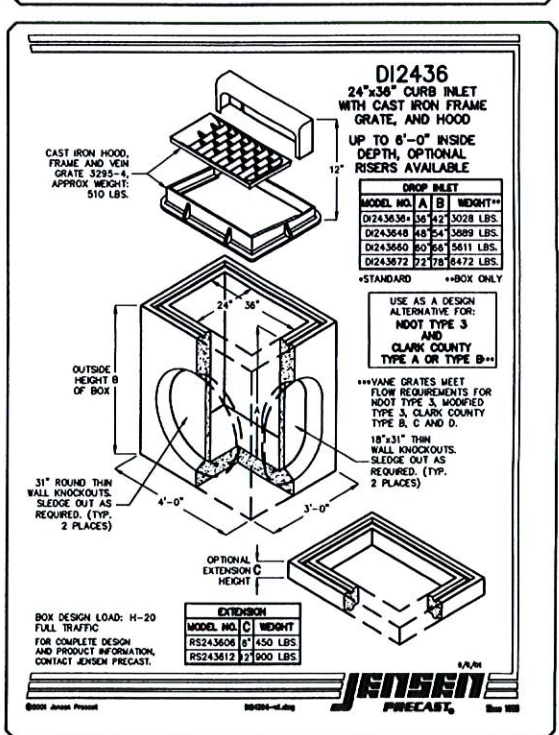
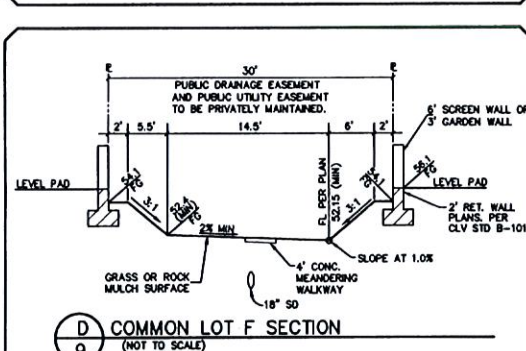
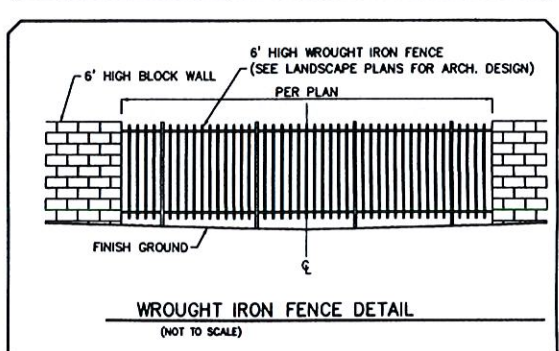
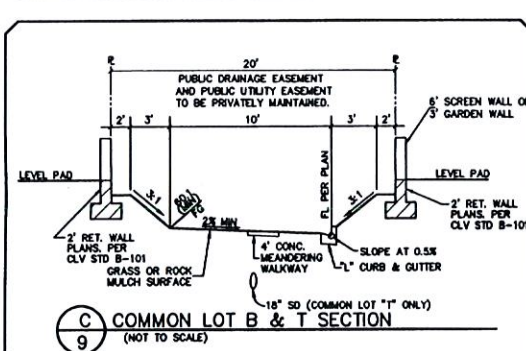
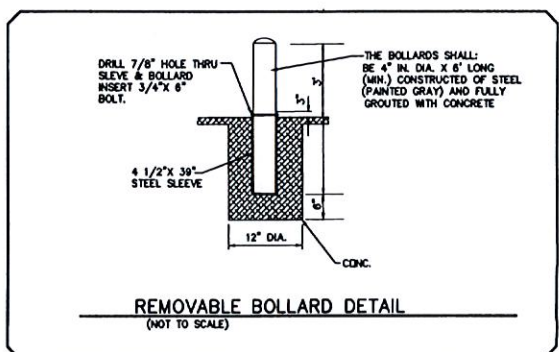
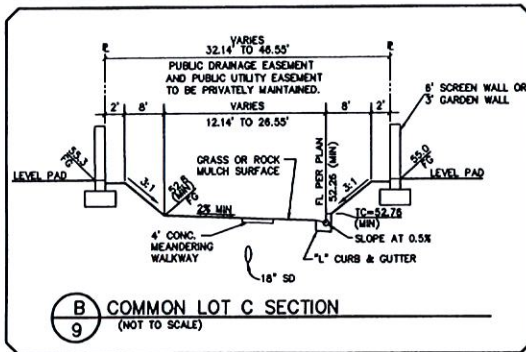
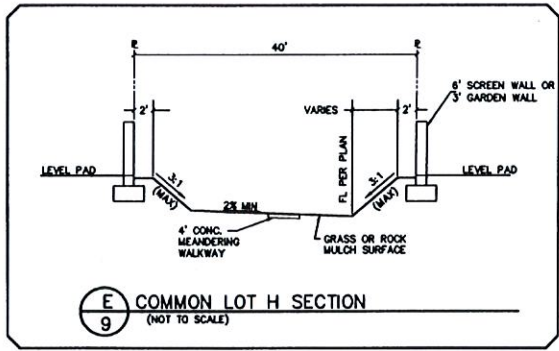
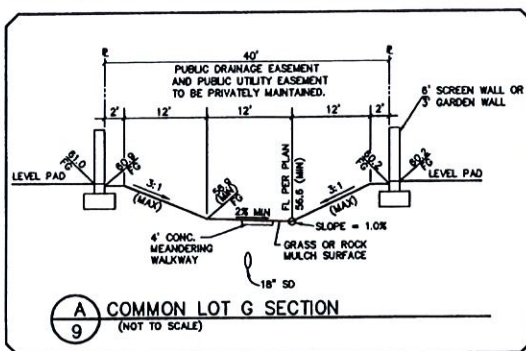
DATE:	11/19/01
DRAWN BY:	SLY
DESIGNED BY:	
CHECKED BY:	
ADA CHECKED:	
JOB NO.:	0147-0230

PROFESSIONAL ENGINEER - STATE OF MONTANA
 RICHARD P. SNEYD
 CIVIL
 11752

7-25-02

SHEET 8 OF 10

C.L.V. DWG.#



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PENTACORE
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1000 S. MAIN STREET, SUITE 100
LAS VEGAS, NEVADA 89101
(702) 267-7800

GRADING SECTIONS, DETAILS & STORM DRAIN PROFILES

WYETH RANCH

DATE: 11/19/03
DRAWN BY: SLY
DESIGNED BY: SLY
CHECKED BY: SLY
JOB NO.: 0147.0230
SCALE: 1" = 40'

REGISTERED ENGINEER - STATE OF NEVADA
RICHARD P. SENEAL
CIVIL
11752

1. SLOPE FROM REAR TO DRAIN
2. SLOPE FROM HOUSE TO DRAIN (2% MIN.)
3. SLOPE FROM HOUSE TO SIDE DRAIN (2% MIN.)
4. REAR DRIVE (2% MIN. FROM REAR OF HOUSE) (1% MIN.)
5. SIDE DRIVE (1% MIN.)
6. SLOPE FROM HOUSE TO SIDEWALK
7. SLOPE OF STREET

1. SLOPE FROM REAR TO DRAIN
2. SLOPE FROM HOUSE TO DRAIN (2% MIN.)
3. SLOPE FROM HOUSE TO SIDE DRAIN (2% MIN.)
4. REAR DRIVE (2% MIN. FROM REAR OF HOUSE) (1% MIN.)
5. SIDE DRIVE (1% MIN.)
6. SLOPE FROM HOUSE TO SIDEWALK
7. SLOPE OF STREET

This grading plan is a part of drainage study #2026 which was recorded on 1/10/02 and amended on 1/10/02. Page 8 of 8