DS# 2748

DS INDEX

APN 125-25-302-001

PROJECT Elementary School at El Campo Grande & Bradley

SUBMITTAL 1st

scanning.doc

CITY OF LAS VEGAS INTER-OFFICE MEMORANDUM			DATE: August 8, 2000
TO: Land Development Services Department of Public Works			FROM: Randy Fultz, P.E. for Flood Control Project Manager Department of Public Works
SUBJECT:	Drainage Study for:		COPIES TO:
Elementary School at El Campo Grande & Bradley			Clark County School District
Cross Streets:	NWC of El Campo Grande Avenue and Bradley Road		Nevada By Design, LLC
FILE NO.	F:\Depot\DSMEMOS\DS2748A.doc		Cheri Edleman, P.E. DEVCO
Parcel Number:	125-25-302-001		
Zoning Action:			
FEMA Flood Zone	YES	No X	
Proposed Storm Drain	YES X	No	

HISTORY	DATE RECEIVED	DATE REVIEWED	COMMENTS	REVIEW FEES
1st Submittal	7/25/2000	8/8/2000	See Comments Below	$250.00
			TOTAL FEES	$250.00

REMARKS:

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

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

1. In sheet C4.03, the proposed drainage intends to sheet flow onto the future parcel to the east adjacent to Bradley Road. As stated in the study, the undeveloped portion will be parceled out; a public drainage easement to be privately maintained must be granted in the future parcel to perpetuate onsite drainage. The parcel map must provide for the drainage easement. The parcel map will not be recorded without the easement.
2. The proposed school building is set at 102.24 and will be more than 2' of fill above existing grade. Acknowledgement and approval from City of Las Vegas Current Planning Department must be obtained prior to final acceptance of this study.
3. Neon Avenue is designed to be raised approximately 3' at Station 13+30 (Sheet C5.01). Grading to the west must be shown how to tie the proposed fill back to the existing grade in adjacent property. A notarized letter of permission for offsite grading and the proposed fill in Neon Avenue must be obtained from the adjacent property owner prior to final acceptance of this study.
4. Standard Form 1 must be revised to show correct location of development.
5. Provide a legend and list of abbreviations on the plans.
6. The parking area inside the site at the corner of Corbett Street and Leon Avenue needs to be elevated to drain south to the internal valley gutter.
7. Hump the driveways at El Campo Grande Avenue 6" above the Q_{100} flow depth.
8. On Standard Form 4 use a 5 minute minimum for the final Time of Concentration (ST5D and ST6D). Correct the flow calculations accordingly.

END OF REMARKS **T/R/S: T19S/R60E/25**

B&H AREA G-25

Nevada By Design

4292 S. Maryland Parkway
Suite A
Las Vegas, NV 89119
(702) 938-1525 ÷ Fax: (702) 938-1530

RECEIVED
JUL 25 2000
CLV PUBLIC WORKS
FLOOD CONTROL

TRANSMITTAL

Date: July 24, 2000

Attention: Albert Sung
City of Las Vegas
Flood Control Division
731 South Fourth Street
Las Vegas, Nevada 89101

Project: El Campo Grande/Bradley E.S.

Project Number: #CE00041

Subject: Hydrology Study Submittal

☒ Drawing ☐ Disks
☐ Shop Drawings ☐ Specifications
☐ Other ☐ Originals

MESSAGE

Transmitted herewith are the following:

1 set – sheets C5.01 through C5.06 of improvement plans depicting street sections

Sent by:

☒ Engineer's Messenger
☐ Regular Mail
☐ OTHER (FED EXPRESS/AIRBORNE)

If items listed are not received please notify us at once.

By: Raquel Tassi, E.I.

Received by:

cc:

Providing Tomorrow's Services Today

FR126R 12/23/99

TECHNICAL DRAINAGE STUDY

FOR

Elementary School
at
El Campo Grande Avenue and Bradley Road

2748
G-25
N/C

NBD Project CE00041
CCSD #1461

June 16, 2000

Prepared For

JMA ARCHITECTURE STUDIOS
10150 Covington Cross Drive
Las Vegas, NV 89144

NEVADA BY DESIGN
PROVIDING TOMORROW'S SERVICES TODAY

Prepared By

Nevada By Design, LLC
1830 E. Sahara Avenue
Suite 209
Las Vegas, NV 89104

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

DRAINAGE SUBMITTAL CHECKLIST

Project Name: El Campo Grande Ave./Bradley Road E.S.	Map ID:	
Firm Name: Nevada By Design	Engineer: Clayton L. Nielsen	
Address: 4292 South Maryland Parkway, Suite A City: Las Vegas	State: Nevada	Zip: 89119
Phone Number: (702) 938-1525	Fax Number: (702) 938-1530	
Property Owner: Clark County School District		
Address: 4828 South Pearl Street City: Las Vegas	State: Nevada	Zip: 89121
Reviewed By: AYS	Date Received: 7/20/00	Date Accepted for Review: 7/25/00

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

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

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

I. GENERAL REQUIREMENT

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

REFERENCE:	**STANDARD FORM 2**

DRAINAGE SUBMITTAL CHECKLIST

II. MAPS AND EXHIBITS

Yes	No	
X		A copy of a current Flood Insurance Rate Map (FIRM) with the site delineated.
X		A copy of the current CCRFCD Master Plan Update Figure, (F-x), for Flood Control Facilities and Environmental areas with the site delineated.
X		Off-site drainage basin maps for existing, interim and future conditions showing the existing topography, basin boundaries, concentration points, and flows in cfs.
X		On-site drainage basin maps for existing and proposed conditions showing the existing topography, basin boundaries, concentration points, and on-site and off-site flows in cfs.
X		Vicinity Map with local and major cross streets identified and a north arrow.

III. DRAINAGE PLAN

Yes	No	
X		Sheet size: 24 x 36 sealed by a registered engineer in the State of Nevada.
X		Minimum scale: 1 = 60'.
X		Project Name.
X		Vicinity Map with local and major cross streets.
X		Revision box.
X		North arrow and bar scale.
X		Engineer's/consultant's address and phone number.
X		Elevation datum and benchmark.
X		Legend for symbols and abbreviations.
X		Cut/fill scraps, where applicable.
X		Street names, grades, widths.
X		Proposed future and existing spot grades for top of curbs and street crowns at lot lines, grade breaks, and along curb returns on both sides of the street.

REFERENCE: | **STANDARD FORM 2**

DRAINAGE SUBMITTAL CHECKLIST

III. DRAINAGE PLAN (Continued)

Yes	No	
X		Existing contours encompassing the site and 100 feet beyond with spot elevations for important locations, where appropriate.
X		Minimum finish floor elevations with top-of-curb elevations at upstream end of lot.
X		Proposed typical street sections
	N/A	Streets with off-set crowns.
X		Proposed contours or spot elevations in sufficient detail to exhibit intended drainage patterns *and slopes*
X		Property lines.
X		Right-of-way lines and widths, existing and proposed.
X		Existing improvements and their elevations.
X		Delineation of proposed on-site drainage basin s indicating area and 10-year and 100-year storm peak flows at basin concentration points.
X		Concentration points and drainage flow direction with Q_{100} and V_{100} and D_{100} in streets.
X		Cumulative flows, velocity, and direction of flow at upstream and downstream ends of site for The 10-year and 100-year flows.
X		Location and cross-section of street capacity calculations.
	N/A	Cross-sectional detail for channels, including cutoff wall locations.
X		Existing and proposed drainage facilities, appurtenances, and connections (i.e., sidewalk, ditches, swales, storm drain systems, unimproved and improved channels, and culverts, etc.) stating size, material, shape, and slope with plan and profile and HGL calculations.
	N/A	Existing and proposed drainage easements and widths shown with sufficient detail. A cross sectional detail must be provided that shows appropriate lining and reinforcement.
	N/A	Location and detail of existing, proposed, and future block wall openings. Minimum size is 16 x 48 . Wrought iron gate is required for flows> 10 cfs.
	N/A	Location and detail of flood walls illustrating depth of flow, proposed grouting height, etc.

REFERENCE:	**STANDARD FORM 2**

DRAINAGE SUBMITTAL CHECKLIST

III. DRAINAGE PLAN (Continued)

Yes	No	
X		Perimeter retaining wall locations. All existing and proposed walls (retaining screen and flood) must be shown with adjacent ground elevations. Flood walls with 8-inch concrete masonry unit.
X		Building and/or lot numbers.
	N/A	Alignment of all existing, proposed, or future Regional facilities adjacent to the site.
	N/A	Limits of existing floodplain based on current FIRM or best available information; limits of proposed floodplains based on best available information.
	N/A	For areas in Zone A, AE, AH, and AO, base flood elevations (BFEs) must be shown for each lot; BFEs may be listed on each lot, or in a table. Finish floor elevations must be a minimum of 18 inches above BFE.
X		Appropriately elevated "humps" 6 inches above the 100 year water surface elevation at site accesses where the intent is to protect the site from the Q_{100} flows.
X		Street slopes for perimeter and interior streets. The minimum slope is 0.4 percent.

IV. HYDROLOGIC ANALYSIS

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

REFERENCE:	STANDARD FORM 2

DRAINAGE SUBMITTAL CHECKLIST

V. HYDRAULIC ANALYSIS

Yes	No	
	N/A	Flow split calculations and supporting documentation or reference for the method of flow split calculations used.
X		Normal depth street flow calculations and cross section diagrams for all interior and perimeter streets. Provide "d x v" products for the Q_{100} and Q_{10} flows representing the worst case for interior and all perimeter streets. Q_{100} d x v $\leq$ 6 and 12 foot dry lane for rights-of-way $\geq$ 80 feet. Calculations must be labeled by street name as indicated on the Grading Plan.
X		A summary table of interior and exterior street capacity calculations showing the street name, Q_{100} flow, slope, depth of flow, velocity and depth times velocity product and streets needing to meet 12 foot dry lane criteria.
	N/A	Appropriate hydraulic calculations for block wall openings assuming a 50 percent vertical clogging factor. (Assume the lower half of the opening is plugged).
	N/A	Appropriate hydraulic calculations at drainage easement entrance and discharge locations to set finish floor elevations. Hydraulic calculations must include submerged weir, superelevation and tee intersection losses, where appropriate.
X		Provide necessary freeboard requirements to set the finished floor elevations of all proposed buildings, 2 x depth of flow or depth of flow plus 18 inches of freeboard, whichever is less. The minimum requirement is 6 inches above adjacent upstream top of curb. Buildings adjacent to drainage easements must always be provided with 18 inches of freeboard above the Q_{100} weir height or flow depth, which ever is greater.
	N/A	A complete water surface profile analysis (HEC-2, HEC-RAS, etc.) for channel flows and FEMA Zone A flood zones.

- Field survey data.
- Input and output information.
- Plotted cross-sections based on survey with proper encroachments.
- A map showing the location of the cross-sections.
- Analysis of both sub and super-critical flow segments.
- A summary table and a discussion of the results in the text of the report.

Yes	No	
	N/A	Provide a 50 percent clogging factor in the capacity calculation for drop inlets.
	N/A	Hydraulic calculations for culverts and storm drains. D-Load calculations must be provided for storm drain pipes in public rights-of-way, including headwater pool inundation.
X		The mitigation of nuisance water, both during construction and in the fully developed condition, must be addressed.

REFERENCE: | **STANDARD FORM 2**

DRAINAGE STUDY INFORMATION FORM

Name of Development: El Campo Grande Avenue and Bradley Road Elem. School   Date: June 16, 2000

Location of Development: a) Descriptive North~~east~~west corner of El Campo Grande Avenue and Bradley Road

b) Sect. 25 Twn 19S Rng 60E

Name of Owner Clark County School District   Assessors Parcel No.: 125-25-302-001

Telephone No.: (702) 799-7600   Facsimile No.: (702) 799-7716

Address: 4828 South Pearl Street

Las Vegas, Nevada 89121

Contact Person - Name: Kent B. Anderson   Telephone No.: (702) 938-1525

Firm: Nevada By Design

Address: 1830 East Sahara Avenue, Suite #209, Las Vegas, Nevada 89104

Type of Land Development/ Land Disturbance Process:

	Rezoning	X	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: 17 acres   Being Developed/Disturbed: 17 acres
2. Is a portion or all of the subject property located in a designated FEMA Flood Hazard Area?   YES   (NO)
3. Is the property bordered or crossed by an existing or proposed Clark County Regional Flood Control District Master Planned Facility?   YES   (NO)
4. Proposed type of development (Residential, Commercial, etc.)? Commercial (school site)
5. Approximate upstream land area which drains to the subject site? ______
6. Has the site drainage been evaluated in the past? (YES) NO If yes, please identify documentation: "Technical Drainage Study for The Ridge II", by deRoulhac Consulting, July 1998, City of Las Vegas approval in September 1998.
7. If known, please briefly identify the proposed discharge point (s) of runoff from the site: South to El Campo Grande Avenue, north to Corbett Street, and west to Leon Avenue
8. Briefly describe your proposed schedule for the subject project: A.S.AP.

PROFESSIONAL ENGINEER - STATE OF NEVADA
CLAYTON NEILSEN
CIVIL
No. 14132
Engineer's Seal 9/11/00

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

TECHNICAL DRAINAGE STUDY
for
Elementary School at
El Campo Grande Avenue and Bradley Road

NBD Project #CE00041
June 16, 2000

Prepared by:

Nevada By Design
1830 East Sahara Avenue, Suite #209
Las Vegas, Nevada 89104

TABLE OF CONTENTS

LIST OF FIGURES

APPENDICES

MAP POCKETS

SECTION I: INTRODUCTION

INTRODUCTION

The purpose of this report is to present a technical drainage study for the proposed Elementary School at El Campo Grande Avenue and Bradley Road. The proposed development encompasses approximately 17 acres of undeveloped land and is a proposed school facility with one (1) school building, playground areas, softball fields, and basketball courts. The site is located on the northwest corner of Bradley Road and El Campo Grande Avenue. Public access to the site will be provided by Corbett Street on the north while El Campo Grande Avenue will provide bus access. A vicinity map is included as Figure 1.

Several drainage studies were reviewed to determine flows that pass through the existing site, as well as flows within Corbett Street, Bradley Road, and El Campo Grande Avenue. Also, the *City of Las Vegas Flood Control Facilities Inventory and City Wide Hydrology Analysis, December 1997,* was utilized. The studies referenced are listed on page 5. Nevada By Design does concur with these studies.

This report will identify any natural washes as well as any existing drainage facilities that contribute runoff to the proposed development during a 100-year storm event. Recommendations on making improvements necessary to control stormwater generated by the 100-year storm event will be provided to the design engineer, the developer, and the Clark County Public Works Department. Since the subject property will be annexed by the City of Las Vegas, a courtesy copy of this hydrology study will also be provided to the City of Las Vegas Public Works Department. This study was conducted in accordance with the criteria set forth by the *1999 Clark County Regional Flood Control District (CCRFCD) Hydrologic Criteria and Design Manual.*

LEGAL DESCRIPTION

The site is located within a portion of Section 25, of Township 19 South, Range 60 East, M.D.B.&M. Clark County, Nevada.

FLOOD HAZARD ZONE

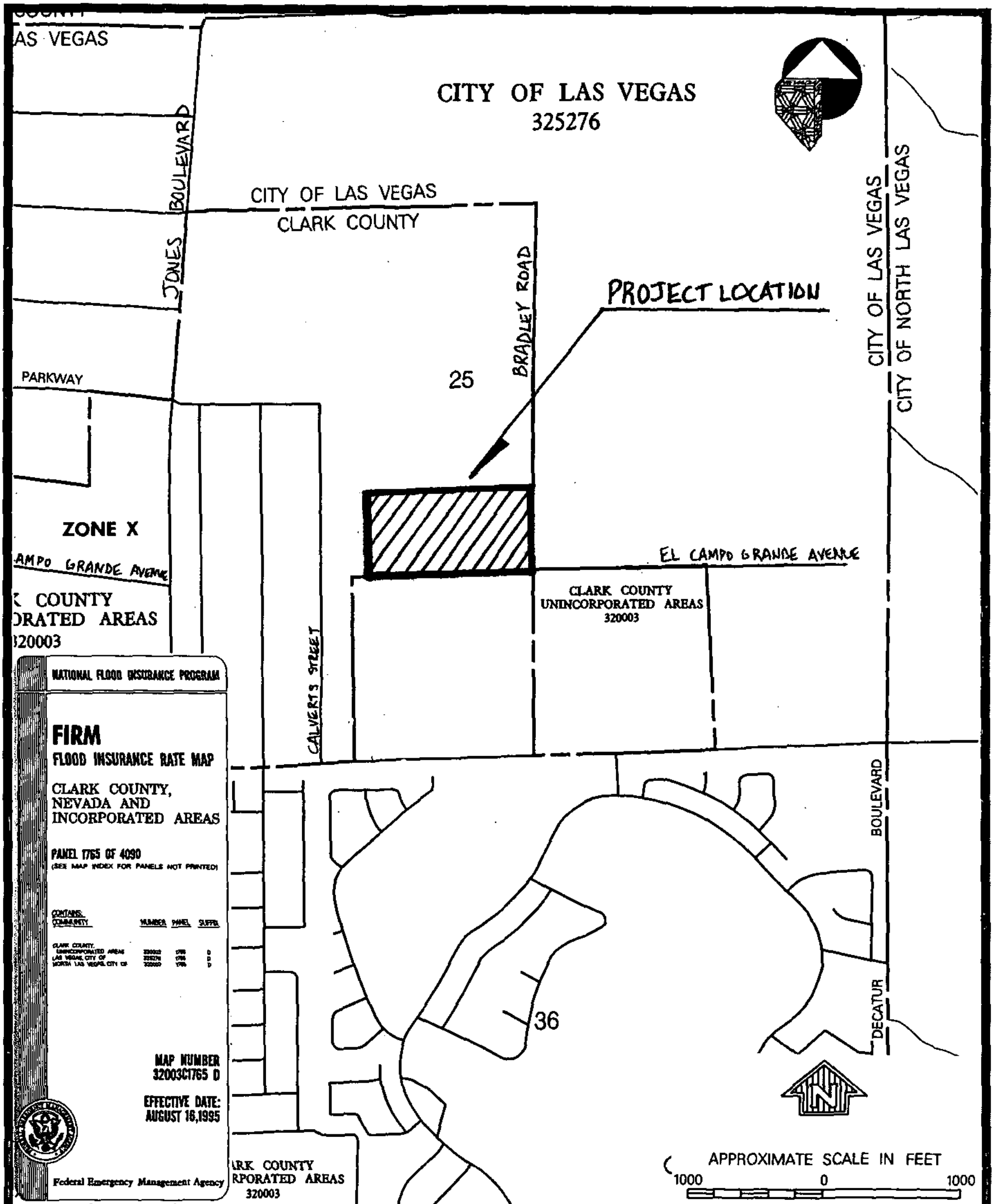
A review of the Federal Emergency Management Agency (FEMA) *Flood Insurance Rate Map (FIRM),* Community Panel Numbers 32003C1765D, effective August 16, 1995, indicates that the proposed site is located within Zone X, an area determined to be outside the 500-year floodplain. Figure 2 shows the project location depicted on the FIRM.

DRAWN BY RT
DATE 04/19/00
JOB No. 00041
SHT. 1 OF 1

NEVADA BY DESIGN

VICINITY MAP

FIGURE 1



DRAWN BY	N/A
DATE	04/20/00
JOB No.	00041
SHT. 1	OF 1

NEVADA BY DESIGN

FEMA MAP

FIGURE 2

REGIONAL FLOOD CONTROL FACILITIES

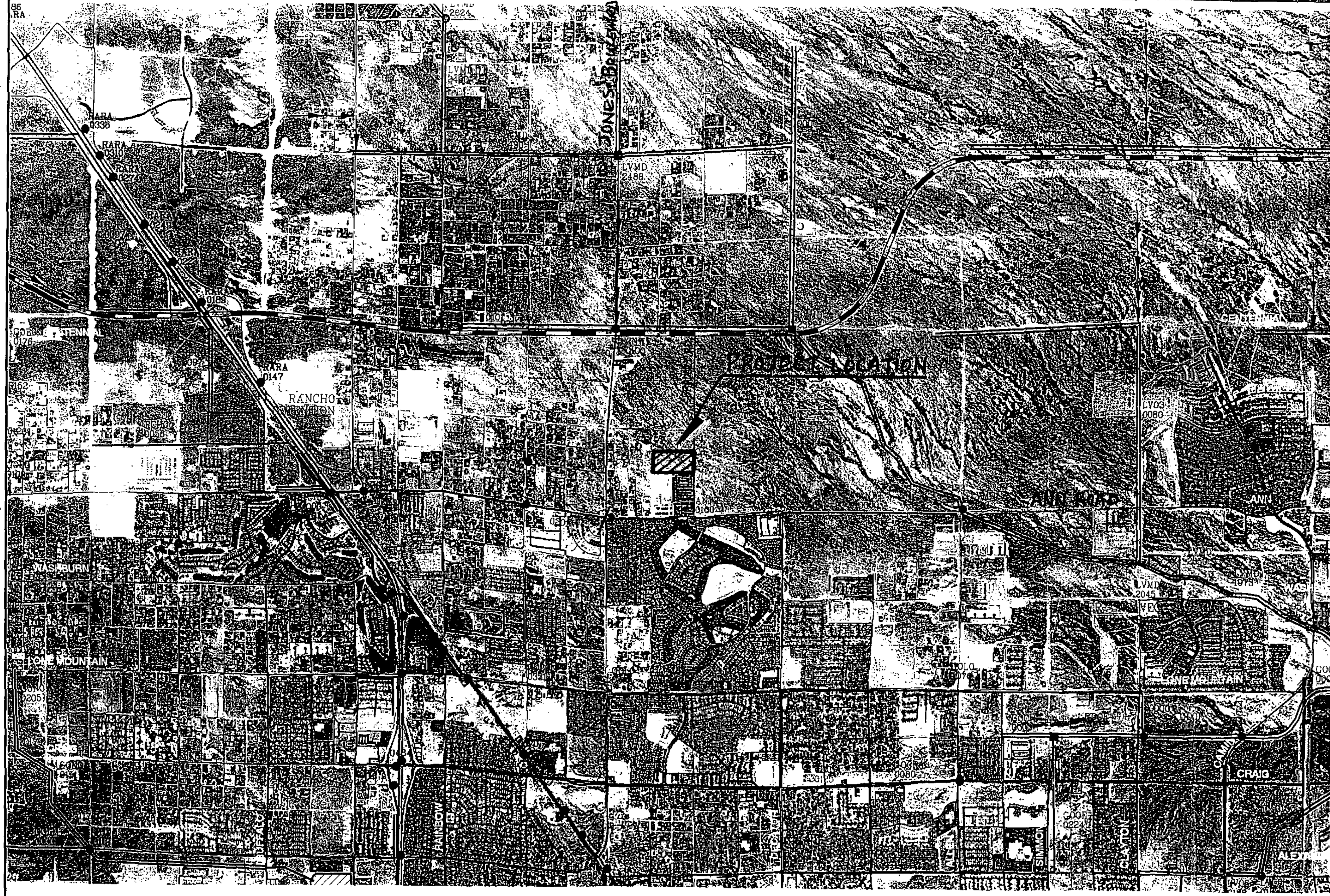
According to the *1996 Flood Control Master Plan Update for the Las Vegas Valley*, there are no Regional Flood Control Facilities adjacent to or through this site. Figure 3 shows the project location on the Master Plan Update of the Clark County Regional Flood Control District.

PREVIOUS DRAINAGE STUDIES

The following drainage studies were utilized in the preparation of this study:

"Technical Drainage Study for The Ridge II (Original Study and Addenda 1 and 2)", by deRoulhac Consulting, July 1998 through September 1998. City of Las Vegas approval September of 1998.

"Technical Drainage Study for Eagle Creek South (Original Study and Addenda 1, 2, 3, and 4)", by deRoulhac Consulting, February 1998 through July 1998. City of Las Vegas approval August of 1998.



CLARK COUNTY
REGIONAL FLOOD CONTROL DISTRICT

FLOOD CONTROL MASTER PLAN UPDATE LAS VEGAS VALLEY 1996

LEGEND

- EXISTING MASTER PLAN FACILITIES
- PROPOSED MASTER PLAN FACILITIES
- LOCAL OR UNSTUDIED FACILITIES
- DETENTION/DEBRIS BASIN
- CULVERT
- BRIDGE
- PIPELINE
- LINED CHANNEL
- UNLINED CHANNEL
- DIKE
- NATURAL WASH
- ULTIMATE DEVELOPMENT BOUNDARY
- SECONDARY FACILITIES

GRAPHIC SCALE

3000 1500 0 1000 2000 3000

(IN FEET)

SCALE: 1 INCH = 3000 FEET

FLOOD CONTROL FACILITIES

FIGURE F-6

1	2	3	4
5	6	7	8
9	10	11	12
13	14	15	16
17	18	19	20
21	22	23	24
25	26	27	

PBSJ POST, BUCKLEY, SCHUH & JERNIGAN, INC.

VTN nevada

CCRFCD MASTER PLAN UPDATE

FIGURE 3

PHOTOS BY LANDISCOR
DATED: AUGUST 1995

1996 FLOOD CONTROL MASTER PLAN UPDATE LAS VEGAS VALLEY

LEGEND

STREAM NAME DESIGNATOR — AABB
PARENT STREAM NAME
STREAM NAME

ID / RIVER MILE — 0000
DISTANCE ABOVE CONFLUENCE WITH PARENT STREAM:
MILES
TENTHS OF A MILE

EXISTING FACILITY	E
PROPOSED OR MODIFIED FACILITY	P
CONTINGENCY LEVEL:	
MASTER PLAN	P1
FACILITY PLAN	P2
PRELIMINARY DESIGN	P3
DESIGN	P4
BOTTOM WIDTH	W
DEPTH	D
SIDE SLOPE, H:V	SS
CORRUGATED METAL PIPE CULVERT	CMP
CORRUGATED METAL ARCH PIPE CULVERT	CMAP
REINFORCED CONCRETE BOX	RCB
RCB CULVERT	RCBC
REINFORCED CONCRETE PIPE	RCP
RCP CULVERT	RCPC
REINFORCED CONCRETE ARCH PIPE CULVERT	RCACP
GENERAL COMMENT	G1
FACILITY SPECIFIC COMMENT	S1

NOTES:

(1) "E" FACILITIES NOT FOLLOWED BY "P" FACILITIES ARE ADEQUATE AS IS

(2) FLOW = 100 YEAR DESIGN FLOW

FLOOD CONTROL FACILITIES INVENTORY

FIGURE F-6

PBS&J, INC
VTN NEVADA

ID/ River Mile	E/P	Facility Description	Facility Length (ft)	Flow (cfs)
ANWE		ANN ROAD CHANNEL WEST		
0000	P1	12' x 9' RCB Drain	5,300	2,258
0100	P1	12' x 7' RCB Drain	5,300	1,523
0200	P1	12' x 7' RCBC @ Jones	50	1,523
0201	P1	10' x 7' RCB Drain	2,500	1,000
0265	P1	10' x 7' RCBC @ Torrey Pines	50	1,000
0266	P1	10' x 7' RCB Drain	5,000	1,000
0360	P1	10' x 7' RCBC @ Tenaya	50	1,000
0361	P1	10' x 7' RCB Drain	1,000	1,000
CNEA		CENTENNIAL PKWY CHANNEL EAST		
0117	P1	Conc Chnl 5.5'D 10'W 2:1 SS	1,800	1,000
CNWE		CENTENNIAL PKWY CHANNEL WEST		
0000	P1	Conc Chnl 8'D 14'W 2:1 SS	5,200	2,211
0100	P1	2: 8' x 6' RCBC @ Jones	50	1,303
0101	P1	Conc Chnl 5'D 10'W 2:1 SS	5,200	1,303
EKEA		ELKHORN ROAD CHANNEL EAST		
0106	P1	Conc Chnl 7'D 8'W 2:1 SS	5,350	1,887
0142	P1	Conc Chnl 6'D 8'W 2:1 SS	5,350	1,000
EKWE		ELKHORN ROAD CHANNEL WEST		
0000	P1	Conc Chnl 6'D 18'W 2:1 SS	2,500	1,799
GOBU		GOWAN NORTH - BUFFALO BRANCH		
0000	P1	10' x 8' RCB	1,700	910
0032	P1	10' x 7' RCB	1,350	750
0056	P1	10' x 6' RCB	2,620	670
0101	P1	90" RCP	2,740	400
GOCR		GOWAN OUTFALL - CRAIG ROAD BRANCH		
0000	E	Conc Chnl 6'D 12'W 2:1 SS	1,360	1,430
0022	E	3: 8.3' x 5' RCBC	650	1,430
0035	E	3: 8.3' x 5' RCBC	1,900	1,310
0071	E	2: 7.5' x 7' RCBC	300	1,310
0076	E	2: 10' x 6' RCBC	210	1,310
0080	E	114" RCP	2,420	1,310
0125	E	114" RCP	2,520	1,310
0174	E	120" RCP	300	670
0180	E	114" RCP	1,150	670
0201	E	96" RCP	1,000	670
0234	P1	90" RCP	5,900	670
GOFE		GOWAN OUTFALL - FERRELL RD BRANCH		
0000	E	72" RCP	1,320	340
GOLO		GOWAN OUTFALL - LONE MTN RD BRANCH		
0000	P1	10' x 7' RCB	1,300	940
0025	P1	8' x 7' RCB	2,700	940
0076	P1	10' x 8' RCB	3,400	1,090
0140	P1	10' x 8' RCB	4,750	1,090
0229	P1	9' x 7' RCB	2,300	800
0273	P1	8' x 6' RCB	1,700	800
0306	P1	8' x 6' RCB	1,300	800
0331	P1	72" RCP	4,200	420
GONO		GOWAN NORTH SYSTEM		
0012	P1	Conc Chnl 6.5'D 40'W 2:1 SS	5,500	5,200
0113	P1	4: 12' x 10' RCBC @ Alexander	100	5,200
0117	P1	Conc Chnl 6.5'D 40'W 2:1 SS	2,000	5,200
0151	P1	Conc Chnl 7.5'D 40'W 2:1 SS	1,450	5,200
0179	P1	Conc Chnl 7.5'D 35'W 2:1 SS	1,400	5,120
0205	P1	Conc Chnl 6.5'D 35'W 2:1 SS	1,550	5,030
GOOF		GOWAN OUTFALL FACILITIES		
0040	E	Conc Chnl 7'D 20'W 2:1 SS	1,900	2,560
0074	E	2 RCBC @ Camino al Norte	150	2,560
0077	E	Conc Chnl 7'D 20'W 2:1 SS	3,200	2,560
0146	E	2 RCBC @ Clayton	150	2,560
0149	E	Conc Chnl 7'D 20'W 2:1 SS	2,550	2,010
0197	E	2 Span Bridge 24'W @ Simmons	150	2,010
0198	P1	96" RCP	1,370	580
0224	P1	96" RCP	2,700	580
0275	P1	96" RCP	8,000	575
LV03		CLAYTON STREET CHANNEL		
0000	P1	Conc Chnl 8'D 12'W 2:1 SS	4,200	2,401
0080	P1	Conc Chnl 6'D 10'W 2:1 SS	2,800	1,919
0120	P1	Conc Chnl 5'D 6'W 2:1 SS	5,000	620
LV06		TRIBUTARY TO WESTERN TRIB @ CRAIG RD		
0100	P1	Conc Chnl 4.3'D 9'W 2:1SS	4,000	1,140
0102	E	7' x 11' RCBC @ Alexander	60	610
0138	P1	Conc Chnl 5'D 10'W 2:1 SS	1,000	610
0199	E	30' - 72' RCP	4,000	610
LVDE		LAS VEGAS WASH - DECATUR		
0000	P1	Conc Chnl 7'D 8'W 2:1 SS	3,000	594
LVMD		LAS VEGAS WASH - WESTERN TRIBUTARY		
1954	P1	Conc Chnl 7'D 30'W 2:1 SS	900	4,712
1973	E	Exist. Natural Channel	4,250	4,712
1973	P1	Conc Chnl 7'D 30'W 2:1 SS	4,250	4,712
2045	P1	Conc Chnl 7'D 30'W 2:1 SS	700	4,712
2050	P1	600 ac-ft Lower Detention Basin		8089 / 3776
2050	P1	68,000 cfs PMF Spillway		68,000
2050	P1	5: 72" Outlet Pipes	150	3,776
2061	P1	Conc Chnl 7'D 32'W 2:1 SS	5,450	6,976
2170	P1	6: 10' x 6' RCBC @ Ann Rd	200	6,976
2172	P1	Conc Chnl 7.5'D 33'W 2:1 SS	600	5,495
2206	P1	Conc Chnl 7'D 33'W 2:1 SS	7,000	5,495
2322	P1	1 Span Bridge 80'W @ Centennial Pkwy	200	5,495
2324	P1	Conc Chnl 8.5'D 32'W 2:1 SS	5,000	5,495
2443	P1	Conc Chnl 8'D 32'W 2:1 SS	5,000	5,315
2488	P1	1 Span Bridge 80'W @ Elkhorn Rd	200	5,315
2490	P1	Conc Chnl 8'D 20'W 2:1 SS	9,000	4,336
LVMJ		LAS VEGAS WASH - JONES		
0000	P1	Conc Chnl 7'D 10'W 2:1 SS	2,500	938
RAIN		RAINBOW		
0464	E	2: 6' x 2' RCBC		155
0516	E	2: 6' x 2' RCBC		310
RANC		RANCHO		
0598	E	Culvert Unknown		250
0792	E	3: 6' x 2.5' RCBC	181	50
RARA		RAINBOW, RANCHO		
0147	E	5' x 3' RCBC		123
0189	E	10' x 4' RCBC		600
0223	E	6' x 3' RCBC	150	123
0249	E	6' x 3' RCBC	150	123
0274	E	6' x 3' RCBC	150	123
0310	E	5' x 3' RCBC	150	123
0336	E	6' x 3' RCBC	150	123
RCHB		RANCHO ROAD SYSTEM - BELTWAY		
0000	P1	Conc Chnl 4.5'D 12'W 2:1SS	3,300	860
RCHO		RANCHO ROAD SYSTEM		
0000	P1	10' x 7' RCBC @ Rancho Rd	200	500
0003	P1	Conc Chnl 4'D 5'W 2:1 SS	1,300	220
0028	E	54" RCP	1,500	146
0056	P1	72" RCP	3,500	610
0061	E	125 ac-ft Rancho Rd Detention Basin Phase I		500 / 66
0061	P1	250 ac-ft Rancho Rd Det. Basin Phase II		3475 / 146
0061	P1	70,000 cfs PMF Spillway		70,000
0061	E	60" Outlet Pipe	200	146
0097	P1	Conc Chnl 6'D 16'W 2:1 SS	9,800	3,475

FIGURE 3 (CONTINUED)

SECTION II: SITE DESCRIPTION

EXISTING SITE DESCRIPTION

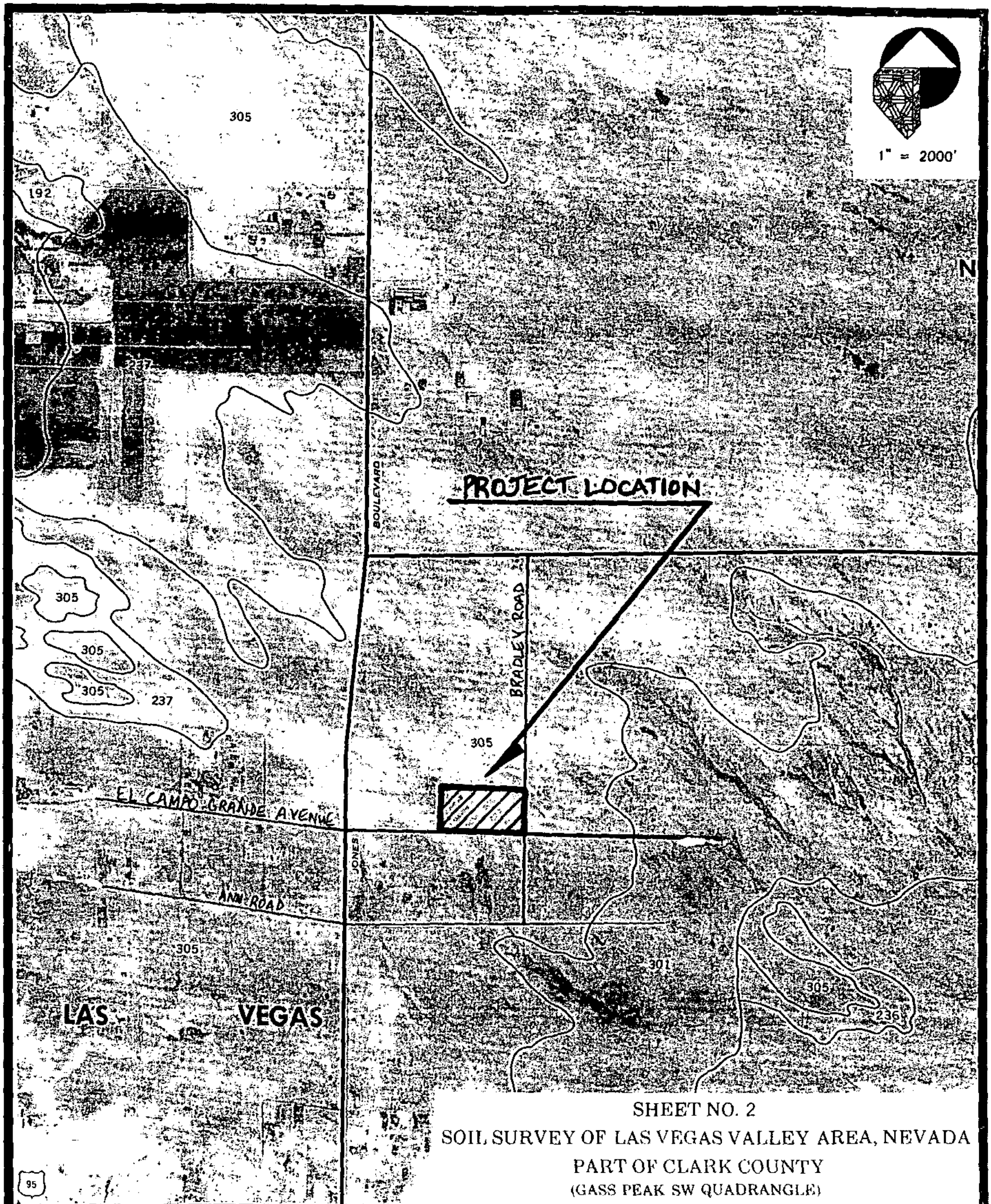
The parcel consists of approximately 17 acres of undeveloped desert. Most of the hydrologic ground cover is poor, with typical desert vegetation. There are numerous rock, dirt, and debris piles dumped on the site from previous construction in the area. Corbett Street borders the site on the north, Bradley Road is on the east, El Campo Grande Avenue is on the southern border, and undeveloped, vacant land is located on the west side of the site. This vacant land on the west is planned for the future Leon Avenue and the area west of that is zoned for single-family residential and currently consists of lots approximately one (1) acre in size.

The primary soil located in the proposed development is listed in the *Soil Conservation Service (SCS), Soil Survey of the Las Vegas Valley* as a Las Vegas/Destazo complex (Unit #305). The Las Vegas Soil is hydrologic soil group "D" and is a shallow, well drained soil located on basin floor remnants and relict alluvial flats. Destazo soil is hydrologic soil group "B" and is a very deep, well drained soil on erosional fan remnants, dissected pediments, and relict alluvial flats. Figure 4 shows the project location depicted on the SCS Soil Survey.

PROPOSED SITE DESCRIPTION

The proposed Elementary School at El Campo Grande Avenue and Bradley Road will consist of one (1) school building, playground areas, softball fields, and basketball courts. In order to meet the minimum finished floor criteria for both Clark County Public Works and City of Las Vegas Public Works, the finished floors shall be placed at an elevation that is twice the adjacent top of curb, twice the adjacent gutter flow depth during the 100-year storm event, or 18-inches above the centerline of the adjacent roadway, whichever is greater. The interior areas will be designed to convey the runoff generated by the 100-year storm to appropriate outlet points. Natural drainage patterns will be perpetuated whenever possible.

Public access to the site will be provided from the north by Corbett Street, a 60-foot right of way. El Campo Grande Avenue, also a 60-foot right of way, will provide bus access on the south side of the site. Bradley Road is an 80-foot right of way located east of the site. This roadway will not provide site access since the eastern portion of the site, nearly five (5) acres in size, will be sold at a future date and will not be developed as a part of this project. The proposed Leon Avenue, a 60-foot right of way will be fully improved and will although will be public in nature, will be utilized as a student drop off area without negatively impacting the adjacent public roadways.



DRAWN BY N/A	NEVADA BY DESIGN	SCS SOIL SURVEY	
DATE 04/20/00			
JOB No. 00041		FIGURE 4	
SHT. 1 OF 1			

EXISTING DRAINAGE DESCRIPTION

The natural drainage pattern of the area is to the south and southeast. Field investigations reveal that the there are no major washes that directly affect the site. There are no offsite basins that convey runoff to the site, however, a large quantity of offsite runoff affects the intersection of El Campo Grande Avenue and the proposed Leon Avenue located near the southwest corner of the site.

After reviewing the *City of Las Vegas Flood Control Facilites Inventory and City Wide Hydrology Analysis*, (by PBS & J, December 1997) and per conversations with Dennis Stransky at the City of Las Vegas Public Works, a discharge amount of 300 cfs was determined to be used for hydrologic analysis at the intersection of El Campo Grande Avenue and the proposed Leon Avenue. However, from the hydrology studies listed on page 9 of this report, an amount of 252 cfs was found to be at this intersection. Both of these quantities and their respective depths and velocities were considered in this report.

With the development of the Sunset Hills subdivision, located south of the site, three (3) drainage easements with a total capacity of approximately 341 cfs were constructed. The above-mentioned 252 cfs from the west is conveyed to El Campo Grande Avenue and ultimately to these drainage easements. Please see Appendix F for excerpts from the above-mentioned study.

PROPOSED DRAINAGE DESCRIPTION

The proposed site will be graded such that onsite runoff will follow similar flow paths to the natural conditions. Rainfall impacting the site will be conveyed within the parking and field areas and outlets to Corbett Street, El Campo Grande Avenue, and Leon Avenue.

Since the east half [apporoximately five (5) acres] of the existing parcel will be sold at a future date and not developed with this project, the land was considered to be offsite and the basins were given the names OFF1D and OFF2D. A small portion of the runoff generated onsite will be conveyed to this offsite, downstream area, however flows to this area will be reduced with the development of this project. This will be done to perpetuate the natural drainage patterns.

SECTION III: HYDOLOGIC METHODOLOGY AND CRITERIA

HYDROLOGIC METHODOLOGY AND CRITERIA

The *Modified Rational Method* was used to determine the peak runoff generated by the 100-year storm event. The Rational Formula method adequately approximates the peak rate of runoff from a rainstorm in a given basin. Combined runoff from more than one (1) basin is added algebraically, thus a more conservative flow rate is determined. Modified Rational Formula method calculations and parameters are included in Appendix A.

Basin Area

The existing drainage basins were determined from available 40-scale topographic maps, produced by Brenner & Associates in March 2000. The proposed onsite areas were determined from the available 40-scale rough grading plan produced by Nevada By Design in May 2000. The drainage basin maps for the existing and proposed conditions are included in map pocket 1. These areas were delineated in order to determine the discharge resulting from the 100-year storm event at various points throughout the project.

Precipitation

The project site is located within the McCarran Airport Rainfall Area. Therefore, the time-intensity-frequency curves from Figure 517 of the Clark County Regional Flood Control District's (CCRFCD) Hydrologic Criteria and Drainage Design Manual were utilized.

Hydrologic Abstractions

Runoff coefficients for this area were determined using Table 601 of the CCRFCD Hydrologic Criteria and Drainage Design Manual, "Rational Formula Method Runoff Coefficients and Average Percent Impervious Area". Table 601 has also been included in Appendix A.

Precipitation Patterns

Precipitation in the Las Vegas Valley is characterized typically by long-duration, low-intensity winter storms, and short-duration, high-intensity summer storms. The winter storms, in general, do not produce major flooding events. Summer storms produce flash floods which may threaten the health, safety, and welfare of Las Vegas Valley citizens.

SCS Lag-Time with Time of Concentration

Lag-time, T_L, is defined as the time measured from the centroid of effective rainfall to the peak of the outflow hydrograph. It is a measure of the watershed's response time and is related to basin length, slope, roughness characteristics, and land use.

Lag-times for this study were estimated by calculating the drainage basins' time of concentration, T_c. The time of concentration consists of two component times; the initial overland flow time, t_i, and the gutter or channel flow time, t_t. The equation for the time of concentration is: $T_c=t_i+t_t$

Lag-times are estimated with the following equation: $T_L=0.6T_c$

SECTION IV: HYDROLOGIC RESULTS

EXISTING DRAINAGE ANALYSIS

Per conversations with Dennis Stransky of the City of Las Vegas Flood Control Division, a flow rate of 300 cfs is to be utilized for the intersection of El Campo Grande Avenue and Leon Avenue. However, hydrologic analysis from previously approved studies of the area determined a flow rate of 252 cfs during the 100-year storm for this intersection. Both of these flow rates were analyzed in the depth of flow calculations for El Campo Grande Avenue. This offsite flow from the west combines with discharge generated in El Campo Grande Avenue (ST6E) and is conveyed in a southerly direction toward a series of existing drainage easements that were designed to convey this offsite discharge.

Also from these previously approved hydrology studies, during the 100-year storm event, a total of 45 cfs exits to Corbett Street from the Eagle Creek South subdivision located north of the site. This offsite flow combines with discharge generated by offsite basin ST1E and onsite basin ON1E and is conveyed east in Corbett Street toward Bradley Road. Near the intersection of these two (2) roadways, there is an existing storm drain system and a 20-foot drop inlet on the north side of Corbett Street, just east of Bradley Road. Although development of this project will include a 4-foot drop inlet on the south side of Corbett Street for nuisance flow, the storm drain sytem has already been analyzed in the referenced, previously approved studies and is considered to be at capacity for the purposes of this report and analysis.

The Modified Rational Formula analysis for the 100-year storm shows that onsite basin ON2E generates approximately 3 cfs that is directed east toward Bradley Road where it joins discharge created by offsite basin ST2E. Flow within this basin drains to the north where it combines with other discharge described above for a total of 58 cfs during the 100-year storm event at the intersection of Bradley Road and Corbett Street.

Onsite basin ON3E drains east and combines with discharge from offsite basin ST3E. Basins ON4E and ST4E combine and are conveyed east within El Campo Grande Avenue. All four (4) of these basins combine at the intersection of El Campo Grande Avenue and Bradley Road for a total of 12 cfs at this intersection.

Discharge generated by onsite basin ON5E is conveyed south to basin ST5E, ultimately draining to the drainage easements mentioned at the beginning of this section. Flow values for the existing condition are summarized in Table 1. The Existing Condition Drainage Basin Map is included in map pocket 1. The Modified Rational Method analysis of the existing condition is included as Appendix B.

TABLE 1
10 & 100-YEAR FLOWS
EXISTING CONDITIONS

BASIN	AREA (acres)	Q10 (cfs)	Q100 (cfs)
Total existing flow outletting to Corbett Street from Eagle Creek South	N/A	15	45
ON1E	0.96	1	2
ON2E	2.91	1	3
ST1E	1.90	2	5
ST2E	0.80	1	3
Total flow at the intersection of Corbett Street and Bradley Road	**N/A**	**20**	**58**
ON3E	5.09	1	3
ON4E	5.08	2	5
ST3E	0.52	1	2
ST4E	0.65	1	2
Total flow at the intersection of El Campo Grande Avenue and Bradley Road	**N/A**	**5**	**12**
Total flow at intersection of El Campo Grande Avenue and Leon Avenue	N/A	83	300
ON5E	3.01	1	3
ST5E	0.69	1	3
ST6E	0.34	1	2
Total flow to El Campo Grande Avenue and Sunset Hills drainage easements	**N/A**	**86**	**308**

PROPOSED DRAINAGE ANALYSIS

In the ultimate developed condition, upstream flows within the area will be greatly reduced due to construction of a 60-inch RCP located in Jones Boulevard. This storm drain system will affect discharge at the intersection of El Campo Grande Avenue and the proposed Leon Avenue. Also, according to the approved drainage studies referenced for this report, discharge outletting to Corbett Street from the Eagle Creek South development will be reduced from the current flow rate of 45 cfs to 16 cfs for the 100-year storm event.

Onsite basin ON1D generates 4 cfs and drains north to Corbett Street where it combines with runoff generated from onsite basins ON2D, ON3D, OFF1D, ST1D, and ST2D for a total peak flow of approximately 44 cfs at the intersection of Corbett Street and Bradley Road. This reduction is due to the lesser offsite flow that is conveyed to Corbett Street from the Eagle Creek South subdivision.

Runoff from onsite basins ON4D, ON5D, ON7D, and ON9D and offsite basins ST5D and ST6D combine for a total of 22 cfs during the 100-year storm. When this flow rate is added to the flow rate that is currently existing the the El Campo Grande Avenue/Leon Avenue intersection, a total of 274 cfs is conveyed through the existing drainage easements within the Sunset Hills subdivision on the south side of El Campo Grande Avenue. Using the 300 cfs quantity per City of Las Vegas Public Works, a total of roughly 322 cfs will be conveyed through these drainage easements. As stated previously, the easements have a capacity of 341 cfs. Also, finish floor elevations adjacent to the easements are well above the minimum requirement. Flow values for the developed condition are summarized in Table 2. The Proposed Condition Drainage Basin Map, is included in map pocket 2. The Modified Rational Method analysis of the developed condition is included as Appendix C.

TABLE 2
10 & 100-YEAR FLOWS
DEVELOPED CONDITIONS

BASIN	AREA (acres)	Q10 (cfs)	Q100 (cfs)
Total future flow outletting to Corbett Street from Eagle Creek South subdivision	N/A	4	16
ON1D	1.02	2	4
ON2D	1.80	4	7
ON3D	1.95	4	6

OFF1D	2.75	1	3
ST1D	2.33	3	5
ST2D	0.80	1	3
Total flow at the intersection of Corbett Street and Bradley Road	**N/A**	**19**	**44**
ON6D	1.30	2	4
ON8D	1.44	2	4
OFF2D	2.27	1	2
ST3D	0.52	1	2
ST4D	0.65	1	2
Total flow at the intersection of El Campo Grande Avenue and Bradley Road	**N/A**	**7**	**14**
Total flow at intersection of El Campo Grande Avenue and Leon Avenue	N/A	83	300
ON4D	0.44	1	2
ON5D	1.81	4	7
ON7D	0.44	2	3
ON9D	1.35	3	5
ST5D	0.69	1	3
ST6D	0.34	1	2
Total flow to El Campo Grande Avenue and Sunset Hills drainage easements	**N/A**	**95**	**322**

Street capacity calculations were completed using FlowMaster software. Results show that the VD product meets specifications on all surrounding streets except at El Campo Grande Avenue. This is due to the fact that in the existing condition it is not met and thus, cannot be met in the proposed. The 10-year, 12-foot dry lane requirement for Bradley Road is met. There will be more than 20-feet of dry lane available for emergency vehicles in each direction at Section B—B. Street capacity calculations are included in Appendix D. Table 3 summarizes the VD product results.

TABLE 3
10-YEAR & 100-YEAR STORMS
VD PRODUCT

Street	Q100 (cfs)	Q10 (cfs)	Slope (%)	Depth 100yr (ft)	Depth 10-yr (ft)	V100 (ft/s)	V10 (ft/s)	VD 100yr	VD 10-yr
Corbett Street (A-A)	44	19	0.50	0.68	0.55	2.69	2.15	1.83	1.18
Bradley Road (B-B)	14	7	0.40	0.51	0.37	1.92	1.70	0.98	0.63
El Campo Grande Avenue (C-C)	322	95	1.00	1.40	0.96	7.60	5.06	10.64	4.86

SECTION V: SUMMARY

RECOMMENDATIONS

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

1. Placement of building pads, as shown on the enclosed grading plan (map pocket 3), to ensure flood protection from the 100-year storm event. Finished floors will be placed at an elevation that is greater than twice the depth of flow in the adjacent gutter flow line, 6-inches above the adjacent top of curb, and 18-inches above the centerline of the adjacent roadways.

2. Install a 4-foot drop inlet at the southwest corner of the intersection of Corbett Street and Bradley Road to convey nuisance flow to the existing storm drain system located at this intersection.

3. Construct seven (7) sidewalk underdrains to convey runoff to various outlet points as shown on the grading plan.

CONCLUSION

The Elementary School at El Campo Grande Avenue and Bradley Road is a proposed school facility. It has been determined that the development of this site will not adversely impact the existing conditions surrounding it.

In the 100-year, the developed site will discharge runoff to three (3) major points. In the existing condition, the onsite areas generate approximately 16 cfs during the 100-year storm. This flow rate will increase to 42 cfs in the developed condition. Drainage of the site is in accordance with the natural drainage pattern of the area. Street capacity calculations show that in the ultimate developed condition, all of the streets will have adequate capacity to convey the design storm with the exception of Bradley Road at Corbett Street which is an existing roadway. Onsite nuisance flows in the developed condition will be contained in the curb and gutter of the interior parking lot before eventually outletting onto Corbett Street and El Campo Grande Avenue.

It is the opinion of this firm that this report is complete in its entirety and all hazards have been investigated and dealt with individually and completely.

REFERENCES

CCRFCD Hydrologic Criteria and Drainage Design Manual, prepared by WRC Engineering Incorporated and updated by Montgomery Watson. Prepared for Clark County Regional Flood Control District, Las Vegas, Nevada.

CCRFCD Volume II Flood Control Master Plan Update of the Las Vegas Valley, PBS & J, Incorporated and VTN Nevada, February 1997. Prepared for Clark County Regional Flood Control District, Las Vegas, Nevada.

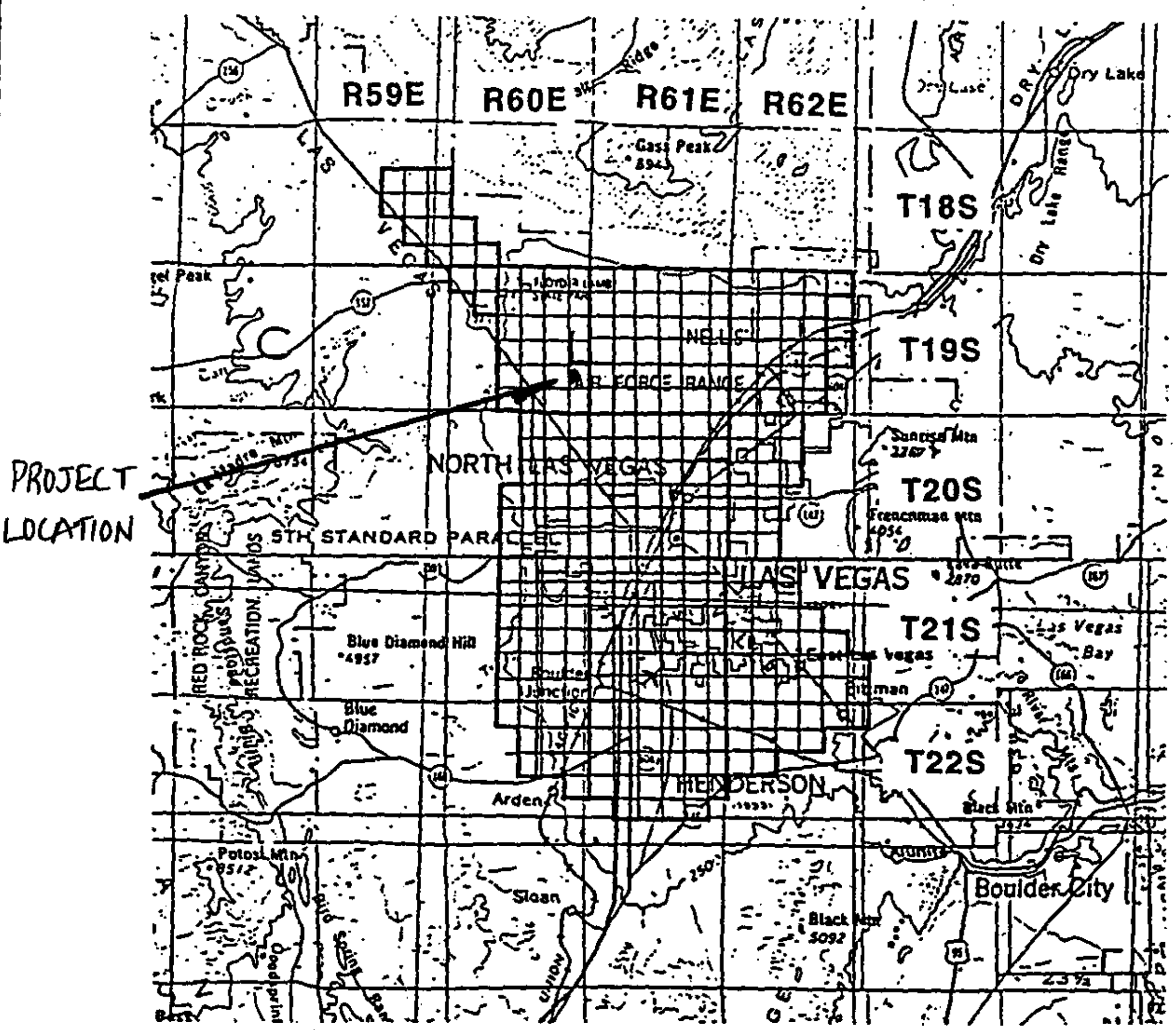
Soil Survey of the Las Vegas Valley Area, Nevada, Department of Agriculture, Soil Conservation Service, July 1985.

City of Las Vegas Northwest Neighborhood Study, PBS & J, Incorporated, Revised September 1999. Prepared for City of Las Vegas, Nevada Flood Control Division.

APPENDIX A

Modified Rational Method Parameter Calculations

McCARRAN AIRPORT RAINFALL AREA



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

Notes:

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

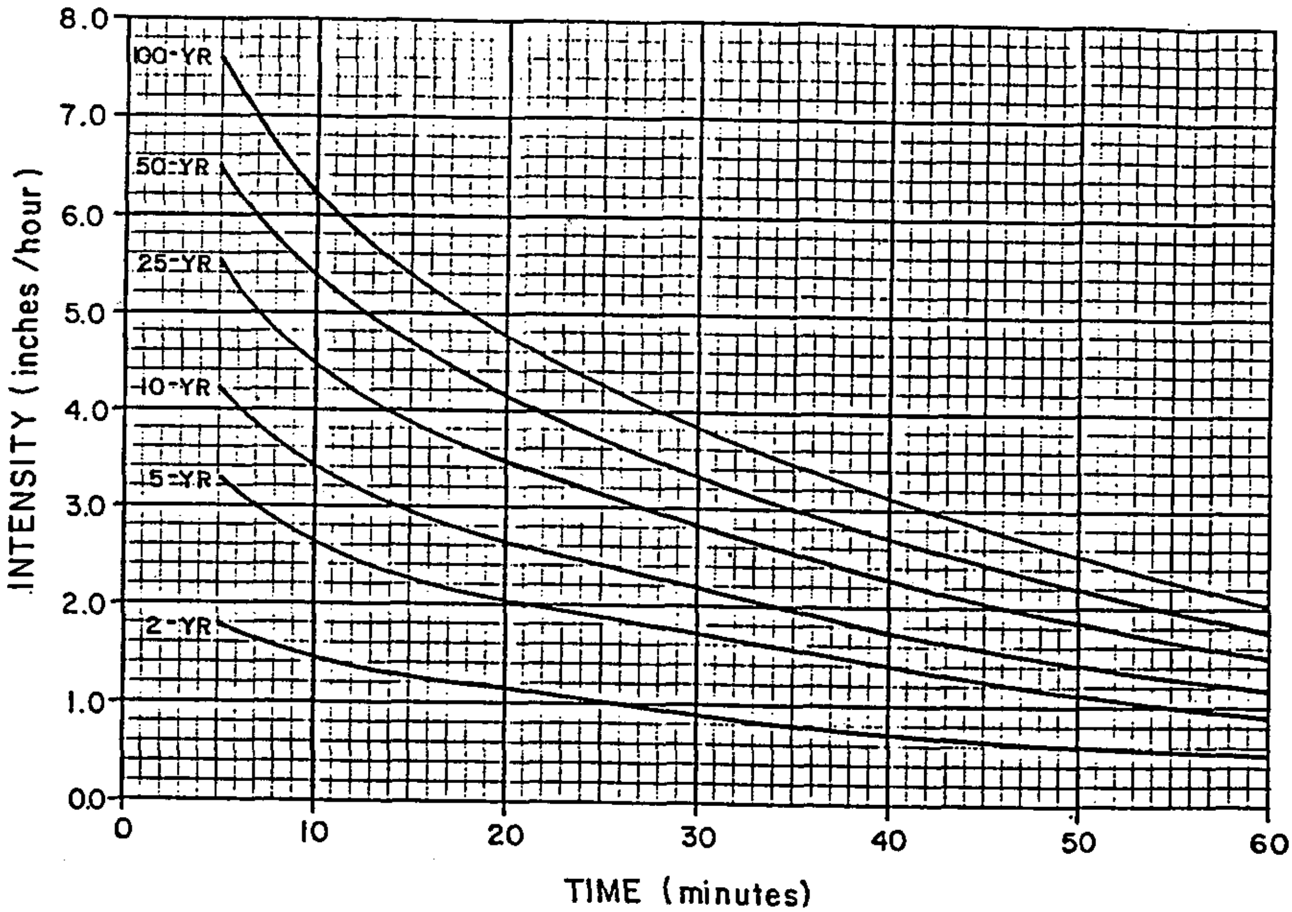
Revision	Date

WRC ENGINEERING

REFERENCE: USACE, Los Angeles District, 1988

FIGURE 513

TIME-INTENSITY-FREQUENCY CURVES FOR McCARRAN AIRPORT RAINFALL AREA



NOTE: 1. Refer to Table 506 for tabulation of Time-Intensity-Frequency Values.

Revision	Date

WRC ENGINEERING

REFERENCE: USACE, Los Angeles District, 1988

FIGURE 517

RATIONAL FORMULA METHOD RUNOFF COEFFICIENTS AND AVERAGE PERCENT IMPERVIOUS AREA

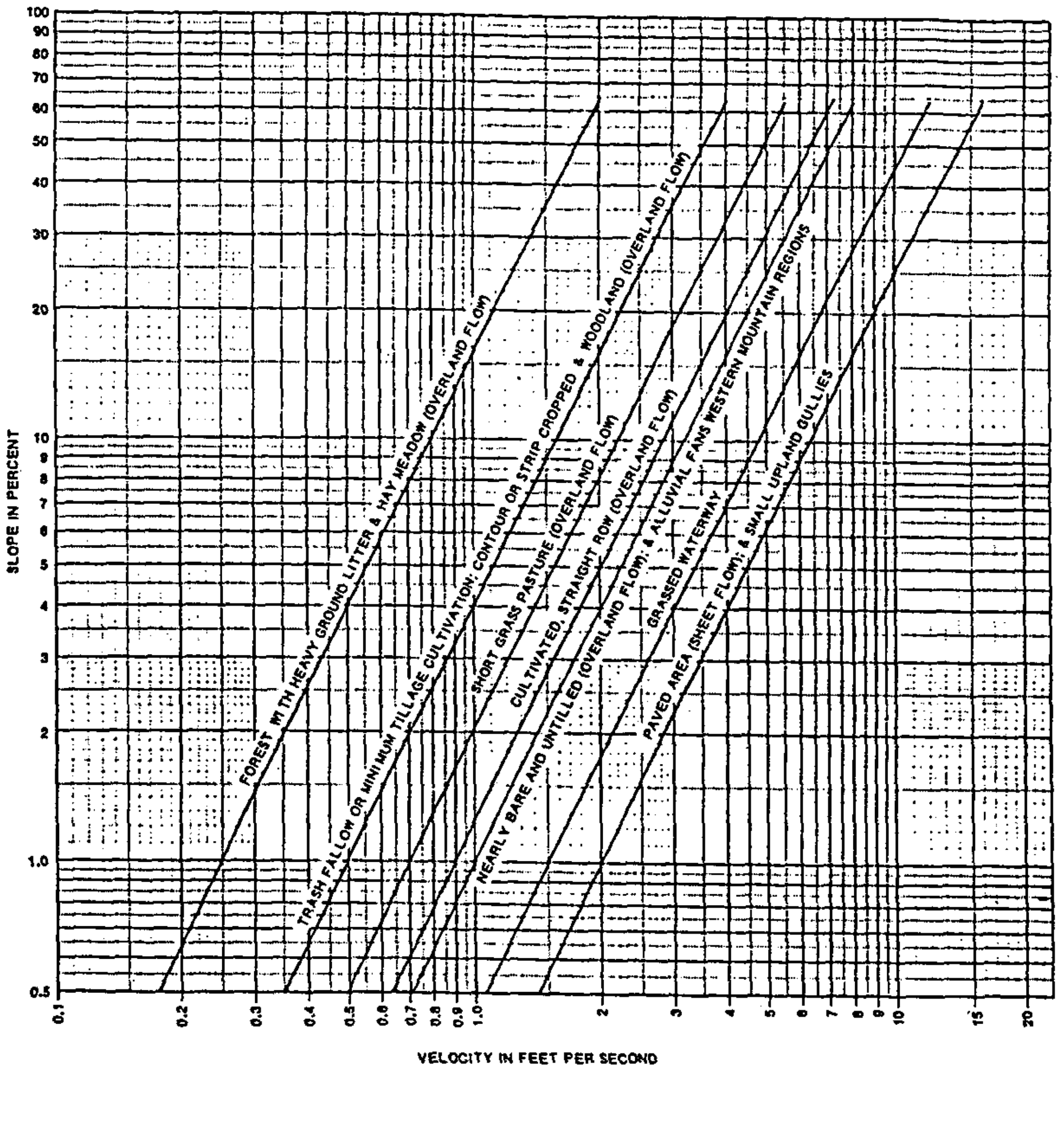
LAND USE OR SURFACE CHARACTERISTICS	AVERAGE PERCENT IMPERVIOUS AREA	RUNOFF COEFFICIENTS 10-YEAR		RUNOFF COEFFICIENTS 100-YEAR	
		GRASS[1]	DESERT[2]	GRASS[1]	DESERT[2]
Business and Commercial:					
Downtown Areas	95	.88	.88	.89	.89
Neighborhood Areas	70	.70	.75	.80	.83
Residential (Average Lot Size):					
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
Industrial:	72	.72	.76	.82	.84
Open Space: (Lawns, Parks, Golf Courses)	5	.10	-	.30	-
Undeveloped Areas: (Natural Vegetation)	0	-	.25	-	.50
Streets and Roads:					
Paved	100	.90		.93	
Gravel	20	.40		.50	
Drives and Walks:	95	.88		.89	
Roofs:	90	.85		.87	

Notes:

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

Revision	Date

TRAVEL TIME VELOCITY



Revision	Date

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

APPENDIX B

Modified Rational Method Analysis
Existing Condition

EXISTING BASIN CONDITIONS

DEVELOPMENT: EL CAMPO GRANDE AVENUE & BRADLEY ROAD
CACULATED BY: RT **DATE:** 6/13/00

SUB-BASIN DATA				INITIAL/OVERLAND TIME(t_i)			TRAVEL TIME (t_t)				t_c CHECK (URBANIZED BASINS)		FINAL t_c	REMARK
DESIG: (1)	AREA Ac (2)	CN (3)	K (4)	LENGTH Ft (5)	SLOPE % (6)	t_i Min (7)	LENGTH Ft (8)	SLOPE % (9)	VEL. Ft/S (10)	t_t Min (11)	TOTAL LENGTH Ft (12)	t_c=(L/180)+10 Min (13)	Min (14)	(15)
ON1E	0.96		0.25	100	0.90	15.85	165	0.97	1.00	2.75	265		18.60	
ON2E	2.91		0.25	150	0.80	20.19	580	0.66	0.81	11.93	730		32.12	
ON3E	5.09		0.25	270	0.74	27.79	1075	0.50	0.70	25.60	1345		53.39	
ON4E	5.08		0.25	60	1.83	9.69	890	0.55	0.75	19.78	950		29.47	
ON5E	3.01		0.25	90	1.22	13.58	495	0.51	0.69	11.96	585		25.54	
ST1E	1.90		0.90	23	2.00	1.37	1253	0.50	1.40	14.92	1276		16.29	
ST2E	0.80		0.90	33	2.00	1.64	400	0.47	1.40	4.76	433		6.40	
ST3E	0.52		0.90	33	2.00	1.64	270	0.37	1.40	3.21	303		4.86	
ST4E	0.65		0.90	23	2.00	1.37	500	0.37	1.40	5.95	523		7.32	
ST5E	0.69		0.90	23	1.00	1.73	120	0.67	1.70	1.18	143		2.90	
ST6E	0.34		0.90	23	1.20	1.62	210	0.44	1.40	2.50	233		4.12	

5 min. minimum.

$K = 0.0132\,(CN) - 0.39$ $t_i = 1.8\,(1.1-K)\,L^{1/2} / S^{1/3}$ $t_t = L / (60V)$ $t_c = t_i + t_t$
$t_L = 0.6(t_c)$

STANDARD FORM 4

Stndfrm4
6/13/00
Existing

Rational Method Runoff Determination
El Campo Grande Avenue/Bradley Road Elementary School
Existing Onsite Basin ON1E

1) Determine flow resistance coefficient, C_{10}:

C_{10} = 0.25 (Table 601) K = 0.50 (Modified Rational Method Factor)

2) Determine t_i

$t_i = (1.8(1.1 - C_{10})L^{1/2}) / S^{1/3}$ L = 100 feet S = 0.90 %

t_i = 15.84 minutes

3) Determine t_t (Figure 602)

$t_t = L / 60*V$ L = 165 feet V = 1.00 ft/sec

t_t = 2.75 minutes

4) Determine t_c

$t_c = t_i + t_t$

t_c = 18.59 minutes

5) From Table 601, Determine C

C_{10} = 0.25

C_{100} = 0.50

6) Determine i_{100} from Figure 517 (site must be in McCarran Rainfall Area)

From Graph: i_{10} = 2.75 in/hr

i_{100} = 4.95 in/hr

7) Determine Q Area = 0.96 acres

Q = KCiA

Q_{10} = 0.33 cfs

Q_{100} = 1.19 cfs

Rational Method Runoff Determination
El Campo Grande Avenue/Bradley Road Elementary School
Existing Onsite Basin ON2E

1) Determine flow resistance coefficient, C_{10}:

$C_{10} = 0.25$ (Table 601) K = 0.50 (Modified Rational Method Factor)

2) Determine t_i

$t_i = (1.8(1.1 - C_{10})L^{1/2}) / S^{1/3}$ L = 150 feet S = 0.80 %

$t_i =$ 20.17 minutes

3) Determine t_t (Figure 602)

$t_t = L / 60*V$ L = 580 feet V = 0.81 ft/sec

$t_t =$ 11.93 minutes

4) Determine t_c

$t_c = t_i + t_t$

$t_c =$ 32.10 minutes

5) From Table 601, Determine C

$C_{10} = 0.25$

$C_{100} = 0.50$

6) Determine i_{100} from Figure 517 (site must be in McCarran Rainfall Area)

From Graph: $i_{10} =$ 2.10 in/hr

$i_{100} =$ 3.70 in/hr

7) Determine Q Area = 2.91 acres

Q = KCiA

$Q_{10} =$ 0.76 cfs

$Q_{100} =$ 2.69 cfs

Rational Method Runoff Determination
El Campo Grande Avenue/Bradley Road Elementary School
Existing Onsite Basin ON3E

1) Determine flow resistance coefficient, C_{10}:

$C_{10} = 0.25$ (Table 601) K = 0.50 (Modified Rational Method Factor)

2) Determine t_i

$t_i = (1.8(1.1 - C_{10})L^{1/2}) / S^{1/3}$ L = 270 feet S = 0.74 %

$t_i =$ 27.77 minutes

3) Determine t_t (Figure 602)

$t_t = L / 60*V$ L = 1075 feet V = 0.70 ft/sec

$t_t =$ 25.60 minutes

4) Determine t_c

$t_c = t_i + t_t$

$t_c =$ 53.36 minutes

5) From Table 601, Determine C

$C_{10} = 0.25$

$C_{100} = 0.50$

6) Determine i_{100} from Figure 517 (site must be in McCarran Rainfall Area)

From Graph: $i_{10} =$ 1.30 in/hr

$i_{100} =$ 2.30 in/hr

7) Determine Q Area = 5.09 acres

Q = KCiA

$Q_{10} =$ 0.83 cfs

$Q_{100} =$ 2.93 cfs

Rational Method Runoff Determination
El Campo Grande Avenue/Bradley Road Elementary School
Existing Onsite Basin ON4E

1) Determine flow resistance coefficient, C_{10}:

C_{10} = 0.25 (Table 601) K = 0.50 (Modified Rational Method Factor)

2) Determine t_i

$t_i = (1.8(1.1 - C_{10})L^{1/2}) / S^{1/3}$ L = 60 feet S = 1.83 %

t_i = 9.71 minutes

3) Determine t_t (Figure 602)

$t_t = L / 60*V$ L = 890 feet V = 0.75 ft/sec

t_t = 19.78 minutes

4) Determine t_c

$t_c = t_i + t_t$

t_c = 29.49 minutes

5) From Table 601, Determine C

C_{10} = 0.25

C_{100} = 0.50

6) Determine i_{100} from Figure 517 (site must be in McCarran Rainfall Area)

From Graph: i_{10} = 2.20 in/hr

i_{100} = 3.90 in/hr

7) Determine Q Area = 5.08 acres

Q = KCiA

Q_{10} = 1.40 cfs

Q_{100} = 4.95 cfs

Rational Method Runoff Determination
El Campo Grande Avenue/Bradley Road Elementary School
Existing Onsite Basin ON5E

1) Determine flow resistance coefficient, C_{10}:

$C_{10} = 0.25$ (Table 601) $K = 0.50$ (Modified Rational Method Factor)

2) Determine t_i

$t_i = (1.8(1.1 - C_{10})L^{1/2}) / S^{1/3}$ L = 90 feet S = 1.22 %

$t_i =$ 13.59 minutes

3) Determine t_t (Figure 602)

$t_t = L / 60^*V$ L = 495 feet V = 0.69 ft/sec

$t_t =$ 11.96 minutes

4) Determine t_c

$t_c = t_i + t_t$

$t_c =$ 25.55 minutes

5) From Table 601, Determine C

$C_{10} = 0.25$

$C_{100} = 0.50$

6) Determine i_{100} from Figure 517 (site must be in McCarran Rainfall Area)

From Graph: $i_{10} =$ 2.40 in/hr

$i_{100} =$ 4.20 in/hr

7) Determine Q Area = 3.01 acres

Q = KCiA

Q_{10} = 0.90 cfs

Q_{100} = 3.16 cfs

Rational Method Runoff Determination
El Campo Grande Avenue/Bradley Road Elementary School
Existing Offsite Basin ST1E

1) Determine flow resistance coefficient, C_{10}:

$C_{10} = 0.90$ (Table 601) K = 0.50 (Modified Rational Method Factor)

2) Determine t_i

$t_i = (1.8(1.1 - C_{10})L^{1/2}) / S^{1/3}$ L = 23 feet S = 2.00 %

$t_i =$ 1.37 minutes

3) Determine t_t (Figure 602)

$t_t = L / 60*V$ L = 1253 feet V = 1.40 ft/sec

$t_t =$ 14.92 minutes

4) Determine t_c

$t_c = t_i + t_t$

$t_c =$ 16.29 minutes

or

$t_c = L/180 + 10$

$t_c =$ 17.09 minutes

CHOOSE THE LESSER OF THE TWO t_c

5) From Table 601, Determine C

$C_{10} = 0.90$

$C_{100} = 0.93$

6) Determine i_{100} from Figure 517 (site must be in McCarran Rainfall Area)

From Graph: $i_{10} =$ 2.80 in/hr

$i_{100} =$ 5.20 in/hr

7) Determine Q Area = 1.90 acres

Q = KCiA

$Q_{10} =$ 2.39 cfs

$Q_{100} =$ 4.59 cfs

Rational Method Runoff Determination
El Campo Grande Avenue/Bradley Road Elementary School
Existing Offsite Basin ST2E

1) Determine flow resistance coefficient, C_{10}:

$C_{10} = 0.90$ (Table 601) K = 0.50 (Modified Rational Method Factor)

2) Determine t_i

$t_i = (1.8(1.1 - C_{10})L^{1/2}) / S^{1/3}$ L = 33 feet S = 2.00 %

$t_i =$ 1.65 minutes

3) Determine t_t (Figure 602)

$t_t = L / 60*V$ L = 400 feet V = 1.40 ft/sec

$t_t =$ 4.76 minutes

4) Determine t_c

$t_c = t_i + t_t$

$t_c =$ 6.41 minutes

or

$t_c = L/180 + 10$

$t_c =$ 12.41 minutes

CHOOSE THE LESSER OF THE TWO t_c

5) From Table 601, Determine C

$C_{10} = 0.90$

$C_{100} = 0.93$

6) Determine i_{100} from Figure 517 (site must be in McCarran Rainfall Area)

From Graph: $i_{10} =$ 4.00 in/hr

$i_{100} =$ 7.10 in/hr

7) Determine Q Area = 0.80 acres

Q = KCiA

Q_{10} = 1.44 cfs

Q_{100} = 2.64 cfs

Rational Method Runoff Determination
El Campo Grande Avenue/Bradley Road Elementary School
Existing Offsite Basin ST3E

1) Determine flow resistance coefficient, C_{10}:

C_{10} = 0.90 (Table 601) K = 0.50 (Modified Rational Method Factor)

2) Determine t_i

$t_i = (1.8(1.1 - C_{10})L^{1/2}) / S^{1/3}$ L = 33 feet S = 2.00 %

t_i = 1.65 minutes

3) Determine t_t (Figure 602)

$t_t = L / 60*V$ L = 270 feet V = 1.40 ft/sec

t_t = 3.21 minutes

4) Determine t_c

$t_c = t_i + t_t$

t_c = 4.86 minutes

or

$t_c = L/180 + 10$

t_c = 11.68 minutes

CHOOSE THE LESSER OF THE TWO t_c

5) From Table 601, Determine C

C_{10} = 0.90

C_{100} = 0.93

6) Determine i_{100} from Figure 517 (site must be in McCarran Rainfall Area)

From Graph: i_{10} = 4.20 in/hr

i_{100} = 7.60 in/hr

7) Determine Q Area = 0.52 acres

Q = KCiA

Q_{10} =	0.98 cfs
Q_{100} =	1.84 cfs

Rational Method Runoff Determination
El Campo Grande Avenue/Bradley Road Elementary School
Existing Offsite Basin ST4E

1) Determine flow resistance coefficient, C_{10}:

C_{10} = 0.90 (Table 601) K = 0.50 (Modified Rational Method Factor)

2) Determine t_i

$t_i = (1.8(1.1 - C_{10})L^{1/2}) / S^{1/3}$ L = 23 feet S = 2.00 %

t_i = 1.37 minutes

3) Determine t_t (Figure 602)

$t_t = L / 60 * V$ L = 500 feet V = 1.40 ft/sec

t_t = 5.95 minutes

4) Determine t_c

$t_c = t_i + t_t$

t_c = 7.33 minutes

or

$t_c = L/180 + 10$

t_c = 12.91 minutes

CHOOSE THE LESSER OF THE TWO t_c

5) From Table 601, Determine C

C_{10} = 0.90

C_{100} = 0.93

6) Determine i_{100} from Figure 517 (site must be in McCarran Rainfall Area)

From Graph: i_{10} = 3.80 in/hr

i_{100} = 6.90 in/hr

7) Determine Q Area = 0.65 acres

Q = KCiA

Q_{10} =	1.11 cfs
Q_{100} =	2.09 cfs

Rational Method Runoff Determination
El Campo Grande Avenue/Bradley Road Elementary School
Existing Offsite Basin ST5E

1) Determine flow resistance coefficient, C_{10}:

$C_{10} = 0.90$ (Table 601) $K = 0.50$ (Modified Rational Method Factor)

2) Determine t_i

$t_i = (1.8(1.1 - C_{10})L^{1/2}) / S^{1/3}$ L = 23 feet S = 1.00 %

$t_i =$ 1.73 minutes

3) Determine t_t (Figure 602)

$t_t = L / 60^*V$ L = 120 feet V = 1.70 ft/sec

$t_t =$ 1.18 minutes

4) Determine t_c

$t_c = t_i + t_t$

$t_c =$ 2.90 minutes

or

$t_c = L/180 + 10$

$t_c =$ 10.79 minutes

CHOOSE THE LESSER OF THE TWO t_c

5) From Table 601, Determine C

$C_{10} = 0.90$

$C_{100} = 0.93$

6) Determine i_{100} from Figure 517 (site must be in McCarran Rainfall Area)

From Graph: $i_{10} =$ 4.60 in/hr

$i_{100} =$ 8.55 in/hr

7) Determine Q Area = 0.69 acres

Q = KCiA

$Q_{10} =$ 1.43 cfs

$Q_{100} =$ 2.74 cfs

Rational Method Runoff Determination
El Campo Grande Avenue/Bradley Road Elementary School
Existing Offsite Basin ST6E

1) Determine flow resistance coefficient, C_{10}:

$C_{10} = 0.90$ (Table 601) K = 0.50 (Modified Rational Method Factor)

2) Determine t_i

$t_i = (1.8(1.1 - C_{10})L^{1/2}) / S^{1/3}$ L = 23 feet S = 1.20 %

$t_i =$ 1.63 minutes

3) Determine t_t (Figure 602)

$t_t = L / 60{*}V$ L = 210 feet V = 1.40 ft/sec

$t_t =$ 2.50 minutes

4) Determine t_c

$t_c = t_i + t_t$

$t_c =$ 4.13 minutes

or

$t_c = L/180 + 10$

$t_c =$ 11.29 minutes

CHOOSE THE LESSER OF THE TWO t_c

5) From Table 601, Determine C

$C_{10} = 0.90$

$C_{100} = 0.93$

6) Determine i_{100} from Figure 517 (site must be in McCarran Rainfall Area)

From Graph: $i_{10} =$ 4.40 in/hr

$i_{100} =$ 7.90 in/hr

7) Determine Q Area = 0.34 acres

Q = KCiA

Q_{10} =	0.67 cfs
Q_{100} =	1.25 cfs

APPENDIX C

Modified Rational Method Analysis
Proposed Condition

DEVELOPED BASIN CONDITIONS

DEVELOPMENT: EL CAMPO GRANDE AVENUE & BRADLEY ROAD
CACULATED BY: RT **DATE:** 6/15/00

SUB-BASIN DATA				INITIAL/OVERLAND TIME(t_i)			TRAVEL TIME (t_t)				t_c CHECK (URBANIZED BASINS)		FINAL t_c	REMARK
DESIG:	AREA	CN	K	LENGTH	SLOPE	t_i	LENGTH	SLOPE	VEL.	t_t	TOTAL LENGTH	t_c=(L/180)+10		
	Ac			Ft	%	Min	Ft	%	Ft/S	Min	Ft	Min	Min	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
OFF1D	2.75		0.25	215	0.47	28.85	190	0.57	1.50	2.11	405		30.97	
OFF2D	2.27		0.25	180	0.56	24.90	240	0.36	1.40	2.86	420		27.76	
ON1D	1.02		0.88	45	1.00	2.66	110	1.05	2.10	0.87	155	10.86	3.53	
ON2D	1.80		0.88	60	4.45	1.86	202	1.28	2.20	1.53	262	11.46	3.40	
ON3D	1.95		0.88	25	3.20	1.34	515	1.05	2.10	4.09	540	13.00	5.43	
ON4D	0.44		0.88	50	0.96	2.84	82	3.16	3.50	0.39	132	10.73	3.23	
ON5D	1.81		0.88	80	2.13	2.75	115	3.29	3.60	0.53	195	11.08	3.29	
ON6D	1.30		0.88	25	3.20	1.34	515	1.05	2.10	4.09	540	13.00	5.43	
ON7D	0.92		0.88	115	1.57	3.65	135	2.91	3.30	0.68	250	11.39	4.34	
ON8D	1.44		0.88	50	1.60	2.39	590	0.97	1.90	5.18	640	13.56	7.57	
ON9D	1.35		0.88	50	1.00	2.80	230	2.17	2.90	1.32	280	11.56	4.12	
ST1D	2.33		0.90	23	2.00	1.37	1563	0.48	1.40	18.61	1586	18.81	18.81	
ST2D	0.80		0.90	33	2.00	1.64	400	0.47	1.40	4.76	433	12.41	6.40	
ST3D	0.52		0.90	33	2.00	1.64	270	0.37	1.40	3.21	303	11.68	4.86	
ST4D	0.65		0.90	23	2.00	1.37	500	0.37	1.40	5.95	523	12.91	7.32	
ST5D	0.69		0.90	23	1.00	1.73	120	0.67	1.70	1.18	143	10.79	2.90	
ST6D	0.80		0.90	23	2.00	1.37	365	1.15	2.15	2.83	388	12.16	4.20	

$K = 0.0132 (CN) - 0.39$ $t_i = 1.8 (1.1-K) L^{1/2} / S^{1/3}$ $t_t = L / (60V)$ $t_c = t_i + t_t$

$t_L = 0.6(t_c)$

STANDARD FORM 4

Stndfrm4
6/15/00
Developed

Rational Method Runoff Determination
El Campo Grande Avenue/Bradley Road Elementary School
Developed Offsite Basin OFF1D

1) Determine flow resistance coefficient, C_{10}:

$C_{10} = 0.25$ (Table 601) $K = 0.50$ (Modified Rational Method Factor)

2) Determine t_i

$t_i = (1.8(1.1 - C_{10})L^{1/2}) / S^{1/3}$ L = 215 feet S = 0.47 %

$t_i =$ 28.78 minutes

3) Determine t_t (Figure 602)

$t_t = L / 60^*V$ L = 190 feet V = 1.50 ft/sec

$t_t =$ 2.11 minutes

4) Determine t_c

$t_c = t_i + t_t$

$t_c =$ 30.89 minutes

5) From Table 601, Determine C

$C_{10} = 0.25$

$C_{100} = 0.50$

6) Determine i_{100} from Figure 517 (site must be in McCarran Rainfall Area)

From Graph: $i_{10} =$ 2.20 in/hr

$i_{100} =$ 3.80 in/hr

7) Determine Q Area = 2.75 acres

Q = KCiA

$Q_{10} =$ 0.76 cfs

$Q_{100} =$ 2.61 cfs

Rational Method Runoff Determination
El Campo Grande Avenue/Bradley Road Elementary School
Developed Offsite Basin OFF2D

1) Determine flow resistance coefficient, C_{10}:

$C_{10} = 0.25$ (Table 601) K = 0.50 (Modified Rational Method Factor)

2) Determine t_i

$t_i = (1.8(1.1 - C_{10})L^{1/2}) / S^{1/3}$ L = 180 feet S = 0.56 %

$t_i =$ 24.86 minutes

3) Determine t_t (Figure 602)

$t_t = L / 60*V$ L = 240 feet V = 1.40 ft/sec

$t_t =$ 2.86 minutes

4) Determine t_c

$t_c = t_i + t_t$

$t_c =$ 27.71 minutes

5) From Table 601, Determine C

$C_{10} = 0.25$

$C_{100} = 0.50$

6) Determine i_{100} from Figure 517 (site must be in McCarran Rainfall Area)

From Graph: $i_{10} =$ 2.30 in/hr

$i_{100} =$ 4.00 in/hr

7) Determine Q Area = 2.27 acres

Q = KCiA

$Q_{10} =$ 0.65 cfs

$Q_{100} =$ 2.27 cfs

Rational Method Runoff Determination
El Campo Grande Avenue/Bradley Road Elementary School
Developed Onsite Basin ON1D

1) Determine flow resistance coefficient, C_{10}:

C_{10} = 0.88 (Table 601) K = 0.50 (Modified Rational Method Factor)

2) Determine t_i

$t_i = (1.8(1.1 - C_{10})L^{1/2}) / S^{1/3}$ L = 45 feet S = 1.00 %

t_i = 2.66 minutes

3) Determine t_t (Figure 602)

$t_t = L / 60*V$ L = 110 feet V = 2.10 ft/sec

t_t = 0.87 minutes

4) Determine t_c

$t_c = t_i + t_t$

t_c = 3.53 minutes

or

$t_c = L/180 + 10$

t_c = 10.86 minutes

CHOOSE THE LESSER OF THE TWO t_c

5) From Table 601, Determine C

C_{10} = 0.88

C_{100} = 0.89

6) Determine i_{100} from Figure 517 (site must be in McCarran Rainfall Area)

From Graph: i_{10} = 4.50 in/hr

i_{100} = 8.25 in/hr

7) Determine Q Area = 1.02 acres

Q = KCiA

Q_{10} = 2.02 cfs

Q_{100} = 3.74 cfs

Rational Method Runoff Determination
El Campo Grande Avenue/Bradley Road Elementary School
Developed Onsite Basin ON2D

1) Determine flow resistance coefficient, C_{10}:

$C_{10} = 0.88$ (Table 601) K = 0.50 (Modified Rational Method Factor)

2) Determine t_i

$t_i = (1.8(1.1 - C_{10})L^{1/2}) / S^{1/3}$ L = 60 feet S = 4.45 %

$t_i =$ 1.87 minutes

3) Determine t_t (Figure 602)

$t_t = L / 60*V$ L = 202 feet V = 2.20 ft/sec

$t_t =$ 1.53 minutes

4) Determine t_c

$t_c = t_i + t_t$

$t_c =$ 3.40 minutes

or

$t_c = L/180 + 10$

$t_c =$ 11.46 minutes

CHOOSE THE LESSER OF THE TWO t_c

5) From Table 601, Determine C

$C_{10} = 0.88$

$C_{100} = 0.89$

6) Determine i_{100} from Figure 517 (site must be in McCarran Rainfall Area)

From Graph: $i_{10} =$ 4.55 in/hr

$i_{100} =$ 8.30 in/hr

7) Determine Q Area = 1.80 acres

Q = KCiA

$Q_{10} =$ 3.60 cfs

$Q_{100} =$ 6.65 cfs

Rational Method Runoff Determination
El Campo Grande Avenue/Bradley Road Elementary School
Developed Onsite Basin ON3D

1) Determine flow resistance coefficient, C_{10}:

$C_{10} = 0.88$ (Table 601) K = 0.50 (Modified Rational Method Factor)

2) Determine t_i

$t_i = (1.8(1.1 - C_{10})L^{1/2}) / S^{1/3}$ L = 25 feet S = 3.20 %

$t_i =$ 1.35 minutes

3) Determine t_t (Figure 602)

$t_t = L / 60{*}V$ L = 515 feet V = 2.10 ft/sec

$t_t =$ 4.09 minutes

4) Determine t_c

$t_c = t_i + t_t$

$t_c =$ 5.44 minutes

or

$t_c = L/180 + 10$

$t_c =$ 13.00 minutes

CHOOSE THE LESSER OF THE TWO t_c

5) From Table 601, Determine C

$C_{10} = 0.88$

$C_{100} = 0.89$

6) Determine i_{100} from Figure 517 (site must be in McCarran Rainfall Area)

From Graph: $i_{10} =$ 4.15 in/hr

$i_{100} =$ 7.40 in/hr

7) Determine Q Area = 1.95 acres

Q = KCiA

$Q_{10} =$ 3.56 cfs

$Q_{100} =$ 6.42 cfs

Rational Method Runoff Determination
El Campo Grande Avenue/Bradley Road Elementary School
Developed Onsite Basin ON4D

1) Determine flow resistance coefficient, C_{10}:

$C_{10} = 0.88$ (Table 601) $K = 0.50$ (Modified Rational Method Factor)

2) Determine t_i

$t_i = (1.8(1.1 - C_{10})L^{1/2}) / S^{1/3}$ L = 50 feet S = 0.96 %

$t_i =$ 2.84 minutes

3) Determine t_t (Figure 602)

$t_t = L / 60{*}V$ L = 82 feet V = 3.50 ft/sec

$t_t =$ 0.39 minutes

4) Determine t_c

$t_c = t_i + t_t$

$t_c =$ 3.23 minutes

or

$t_c = L/180 + 10$

$t_c =$ 10.73 minutes

CHOOSE THE LESSER OF THE TWO t_c

5) From Table 601, Determine C

$C_{10} = 0.88$

$C_{100} = 0.89$

6) Determine i_{100} from Figure 517 (site must be in McCarran Rainfall Area)

From Graph: $i_{10} =$ 4.60 in/hr

$i_{100} =$ 8.40 in/hr

7) Determine Q Area = 0.44 acres

Q = KCiA

$Q_{10} =$ 0.89 cfs

$Q_{100} =$ 1.64 cfs

Rational Method Runoff Determination
El Campo Grande Avenue/Bradley Road Elementary School
Developed Onsite Basin ON5D

1) Determine flow resistance coefficient, C_{10}:

C_{10} = 0.88 (Table 601) K = 0.50 (Modified Rational Method Factor)

2) Determine t_i

$t_i = (1.8(1.1 - C_{10})L^{1/2}) / S^{1/3}$ L = 80 feet S = 2.13 %

t_i = 2.76 minutes

3) Determine t_t (Figure 602)

$t_t = L / 60{*}V$ L = 115 feet V = 3.60 ft/sec

t_t = 0.53 minutes

4) Determine t_c

$t_c = t_i + t_t$

t_c = 3.29 minutes

or

$t_c = L/180 + 10$

t_c = 11.08 minutes

CHOOSE THE LESSER OF THE TWO t_c

5) From Table 601, Determine C

C_{10} = 0.88

C_{100} = 0.89

6) Determine i_{100} from Figure 517 (site must be in McCarran Rainfall Area)

From Graph: i_{10} = 4.57 in/hr

i_{100} = 8.35 in/hr

7) Determine Q Area = 1.81 acres

Q = KCiA

Q_{10} = 3.64 cfs

Q_{100} = 6.73 cfs

Rational Method Runoff Determination
El Campo Grande Avenue/Bradley Road Elementary School
Developed Onsite Basin ON6D

1) Determine flow resistance coefficient, C_{10}:

C_{10} = 0.88 (Table 601) K = 0.50 (Modified Rational Method Factor)

2) Determine t_i

$t_i = (1.8(1.1 - C_{10})L^{1/2}) / S^{1/3}$ L = 25 feet S = 3.20 %

t_i = 1.35 minutes

3) Determine t_t (Figure 602)

$t_t = L / 60*V$ L = 515 feet V = 2.10 ft/sec

t_t = 4.09 minutes

4) Determine t_c

$t_c = t_i + t_t$

t_c = 5.44 minutes

or

$t_c = L/180 + 10$

t_c = 13.00 minutes

CHOOSE THE LESSER OF THE TWO t_c

5) From Table 601, Determine C

C_{10} = 0.88

C_{100} = 0.89

6) Determine i_{100} from Figure 517 (site must be in McCarran Rainfall Area)

From Graph: i_{10} = 4.15 in/hr

i_{100} = 7.40 in/hr

7) Determine Q Area = 1.30 acres

Q = KCiA

Q_{10} = 2.37 cfs

Q_{100} = 4.28 cfs

Rational Method Runoff Determination
El Campo Grande Avenue/Bradley Road Elementary School
Developed Onsite Basin ON7D

1) Determine flow resistance coefficient, C_{10}:

C_{10} = 0.88 (Table 601) K = 0.50 (Modified Rational Method Factor)

2) Determine t_i

$t_i = (1.8(1.1 - C_{10})L^{1/2}) / S^{1/3}$ L = 115 feet S = 1.57 %

t_i = 3.66 minutes

3) Determine t_t *(Figure 602)*

$t_t = L / 60*V$ L = 135 feet V = 3.30 ft/sec

t_t = 0.68 minutes

4) *Determine t_c*

$t_c = t_i + t_t$

t_c = 4.34 minutes

or

$t_c = L/180 + 10$

t_c = 11.39 minutes

CHOOSE THE LESSER OF THE TWO t_c

5) From Table 601, Determine C

C_{10} = 0.88

C_{100} = 0.89

6) Determine i_{100} from Figure 517 (site must be in McCarran Rainfall Area)

From Graph: i_{10} = 4.32 in/hr

i_{100} = 7.85 in/hr

7) Determine Q Area = 0.92 acres

Q = KCiA

Q_{10} = 1.75 cfs

Q_{100} = 3.21 cfs

Rational Method Runoff Determination
El Campo Grande Avenue/Bradley Road Elementary School
Developed Onsite Basin ON8D

1) Determine flow resistance coefficient, C_{10}:

$C_{10} = 0.88$ (Table 601) K = 0.50 (Modified Rational Method Factor)

2) Determine t_i

$t_i = (1.8(1.1 - C_{10})L^{1/2}) / S^{1/3}$ L = 50 feet S = 1.60 %

$t_i =$ 2.40 minutes

3) Determine t_t (Figure 602)

$t_t = L / 60 * V$ L = 590 feet V = 1.90 ft/sec

$t_t =$ 5.18 minutes

4) Determine t_c

$t_c = t_i + t_t$

$t_c =$ 7.57 minutes

or

$t_c = L/180 + 10$

$t_c =$ 13.56 minutes

CHOOSE THE LESSER OF THE TWO t_c

5) From Table 601, Determine C

$C_{10} = 0.88$

$C_{100} = 0.89$

6) Determine i_{100} from Figure 517 (site must be in McCarran Rainfall Area)

From Graph: $i_{10} =$ 3.80 in/hr

$i_{100} =$ 6.80 in/hr

7) Determine Q Area = 1.44 acres

Q = KCiA

$Q_{10} =$ 2.41 cfs

$Q_{100} =$ 4.36 cfs

Rational Method Runoff Determination
El Campo Grande Avenue/Bradley Road Elementary School
Developed Onsite Basin ON9D

1) Determine flow resistance coefficient, C_{10}:

$C_{10} = 0.88$ (Table 601) K = 0.50 (Modified Rational Method Factor)

2) Determine t_i

$t_i = (1.8(1.1 - C_{10})L^{1/2}) / S^{1/3}$ L = 50 feet S = 1.00 %

$t_i =$ 2.80 minutes

3) Determine t_t (Figure 602)

$t_t = L / 60*V$ L = 230 feet V = 2.90 ft/sec

$t_t =$ 1.32 minutes

4) Determine t_c

$t_c = t_i + t_t$

$t_c =$ 4.12 minutes

or

$t_c = L/180 + 10$

$t_c =$ 11.56 minutes

CHOOSE THE LESSER OF THE TWO t_c

5) From Table 601, Determine C

$C_{10} = 0.88$

$C_{100} = 0.89$

6) Determine i_{100} from Figure 517 (site must be in McCarran Rainfall Area)

From Graph: $i_{10} =$ 4.40 in/hr

$i_{100} =$ 7.95 in/hr

7) Determine Q Area = 1.35 acres

Q = KCiA

$Q_{10} =$ 2.61 cfs

$Q_{100} =$ 4.78 cfs

Rational Method Runoff Determination
El Campo Grande Avenue/Bradley Road Elementary School
Developed Offsite Basin ST1D

1) Determine flow resistance coefficient, C_{10}:

$C_{10} = 0.90$ (Table 601) K = 0.50 (Modified Rational Method Factor)

2) Determine t_i

$t_i = (1.8(1.1 - C_{10})L^{1/2}) / S^{1/3}$ L = 23 feet S = 2.00 %

$t_i =$ 1.37 minutes

3) Determine t_t (Figure 602)

$t_t = L / 60*V$ L = 1563 feet V = 1.40 ft/sec

$t_t =$ 18.61 minutes

4) Determine t_c

$t_c = t_i + t_t$

$t_c =$ 19.98 minutes

or

$t_c = L/180 + 10$

$t_c =$ 18.81 minutes

CHOOSE THE LESSER OF THE TWO t_c

5) From Table 601, Determine C

$C_{10} = 0.90$

$C_{100} = 0.93$

6) Determine i_{100} from Figure 517 (site must be in McCarran Rainfall Area)

From Graph: $i_{10} =$ 2.70 in/hr

$i_{100} =$ 4.90 in/hr

7) Determine Q Area = 2.33 acres

Q = KCiA

$Q_{10} =$ 2.83 cfs

$Q_{100} =$ 5.31 cfs

Rational Method Runoff Determination
El Campo Grande Avenue/Bradley Road Elementary School
Developed Offsite Basin ST2D

1) Determine flow resistance coefficient, C_{10}:

$C_{10} = 0.90$ (Table 601) K = 0.50 (Modified Rational Method Factor)

2) Determine t_i

$t_i = (1.8(1.1 - C_{10})L^{1/2}) / S^{1/3}$ L = 33 feet S = 2.00 %

$t_i =$ 1.65 minutes

3) Determine t_t (Figure 602)

$t_t = L / 60*V$ L = 400 feet V = 1.40 ft/sec

$t_t =$ 4.76 minutes

4) Determine t_c

$t_c = t_i + t_t$

$t_c =$ 6.41 minutes

or

$t_c = L/180 + 10$

$t_c =$ 12.41 minutes

CHOOSE THE LESSER OF THE TWO t_c

5) From Table 601, Determine C

$C_{10} = 0.90$

$C_{100} = 0.93$

6) Determine i_{100} from Figure 517 (site must be in McCarran Rainfall Area)

From Graph: $i_{10} =$ 4.00 in/hr

$i_{100} =$ 7.10 in/hr

7) Determine Q Area = 0.80 acres

Q = KCiA

$Q_{10} =$ 1.44 cfs

$Q_{100} =$ 2.64 cfs

Rational Method Runoff Determination
El Campo Grande Avenue/Bradley Road Elementary School
Developed Offsite Basin ST3D

1) Determine flow resistance coefficient, C_{10}:

C_{10} = 0.90 (Table 601) K = 0.50 (Modified Rational Method Factor)

2) Determine t_i

$t_i = (1.8(1.1 - C_{10})L^{1/2}) / S^{1/3}$ L = 33 feet S = 2.00 %

t_i = 1.65 minutes

3) Determine t_t (Figure 602)

$t_t = L / 60*V$ L = 270 feet V = 1.40 ft/sec

t_t = 3.21 minutes

4) Determine t_c

$t_c = t_i + t_t$

t_c = 4.86 minutes

or

$t_c = L/180 + 10$

t_c = 11.68 minutes

CHOOSE THE LESSER OF THE TWO t_c

5) From Table 601, Determine C

C_{10} = 0.90

C_{100} = 0.93

6) Determine i_{100} from Figure 517 (site must be in McCarran Rainfall Area)

From Graph: i_{10} = 4.20 in/hr

i_{100} = 7.60 in/hr

7) Determine Q Area = 0.52 acres

Q = KCiA

Q_{10} = 0.98 cfs

Q_{100} = 1.84 cfs

Rational Method Runoff Determination
El Campo Grande Avenue/Bradley Road Elementary School
Developed Offsite Basin ST4D

1) Determine flow resistance coefficient, C_{10}:

C_{10} = 0.90 (Table 601) K = 0.50 (Modified Rational Method Factor)

2) Determine t_i

$t_i = (1.8(1.1 - C_{10})L^{1/2}) / S^{1/3}$ L = 23 feet S = 2.00 %

t_i = 1.37 minutes

3) Determine t_t (Figure 602)

$t_t = L / 60{*}V$ L = 500 feet V = 1.40 ft/sec

t_t = 5.95 minutes

4) Determine t_c

$t_c = t_i + t_t$

t_c = 7.33 minutes

or

$t_c = L/180 + 10$

t_c = 12.91 minutes

CHOOSE THE LESSER OF THE TWO t_c

5) From Table 601, Determine C

C_{10} = 0.90

C_{100} = 0.93

6) Determine i_{100} from Figure 517 (site must be in McCarran Rainfall Area)

From Graph: i_{10} = 3.80 in/hr

i_{100} = 6.90 in/hr

7) Determine Q Area = 0.65 acres

Q = KCiA

Q_{10} = 1.11 cfs

Q_{100} = 2.09 cfs

Rational Method Runoff Determination
El Campo Grande Avenue/Bradley Road Elementary School
Developed Offsite Basin ST5D

1) Determine flow resistance coefficient, C_{10}:

$C_{10} = 0.90$ (Table 601) $K = 0.50$ (Modified Rational Method Factor)

2) Determine t_i

$t_i = (1.8(1.1 - C_{10})L^{1/2}) / S^{1/3}$ L = 23 feet S = 1.00 %

$t_i =$ 1.73 minutes

3) Determine t_t (Figure 602)

$t_t = L / 60*V$ L = 120 feet V = 1.70 ft/sec

$t_t =$ 1.18 minutes

4) Determine t_c

$t_c = t_i + t_t$

$t_c =$ 2.90 minutes

or

$t_c = L/180 + 10$

$t_c =$ 10.79 minutes

CHOOSE THE LESSER OF THE TWO t_c

5) From Table 601, Determine C

$C_{10} = 0.90$

$C_{100} = 0.93$

6) Determine i_{100} from Figure 517 (site must be in McCarran Rainfall Area)

From Graph: $i_{10} =$ 4.60 in/hr

$i_{100} =$ 8.55 in/hr

7) Determine Q Area = 0.69 acres

Q = KCiA

$Q_{10} =$ 1.43 cfs

$Q_{100} =$ 2.74 cfs

Rational Method Runoff Determination
El Campo Grande Avenue/Bradley Road Elementary School
Developed Offsite Basin ST6D

1) Determine flow resistance coefficient, C_{10}:

$C_{10} = 0.90$ (Table 601) $K = 0.50$ (Modified Rational Method Factor)

2) Determine t_i

$t_i = (1.8(1.1 - C_{10})L^{1/2}) / S^{1/3}$ L = 23 feet S = 2.00 %

$t_i =$ 1.37 minutes

3) Determine t_t (Figure 602)

$t_t = L / 60^*V$ L = 365 feet V = 2.15 ft/sec

$t_t =$ 2.83 minutes

4) Determine t_c

$t_c = t_i + t_t$

$t_c =$ 4.20 minutes

or

$t_c = L/180 + 10$

$t_c =$ 12.16 minutes

CHOOSE THE LESSER OF THE TWO t_c

5) From Table 601, Determine C

$C_{10} = 0.90$

$C_{100} = 0.93$

6) Determine i_{100} from Figure 517 (site must be in McCarran Rainfall Area)

From Graph: $i_{10} =$ 4.40 in/hr

$i_{100} =$ 7.90 in/hr

7) Determine Q Area = 0.80 acres

Q = KCiA

$Q_{10} =$ 1.58 cfs

$Q_{100} =$ 2.94 cfs

APPENDIX D

Hydraulic Capacity Calculations

SECTION A-A

Corbett Street Q100 = 44 cfs
Worksheet for Irregular Channel

Project Description	
Project File	i:\fmw\00041.fm2
Worksheet	Corbett Street Q100 = 45 cfs
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Input Data

Channel Slope 0.50 %

Elevation range: 0.00 ft to 0.64 ft.

Station (ft)	Elevation (ft)	Start Station	End Station	Roughness
0.00	0.60	0.00	5.00	0.013
5.00	0.50	5.00	55.00	0.017
5.00	0.00	55.00	60.00	0.013
6.50	0.13			
6.50	0.17			
30.00	0.64			
53.50	0.17			
53.50	0.13			
55.00	0.00			
55.00	0.50			
60.00	0.60			

Discharge 44.00 cfs

Results		
Wtd. Mannings Coefficient	0.016	
Water Surface Elevation	0.68	ft
Flow Area	16.36	ft²
Wetted Perimeter	61.27	ft
Top Width	60.00	ft
Height	0.68	ft
Critical Depth	0.67	ft
Critical Slope	0.006157	ft/ft
Velocity	2.69	ft/s
Velocity Head	0.11	ft
Specific Energy	0.80	ft
Froude Number	0.91	

Flow is subcritical.

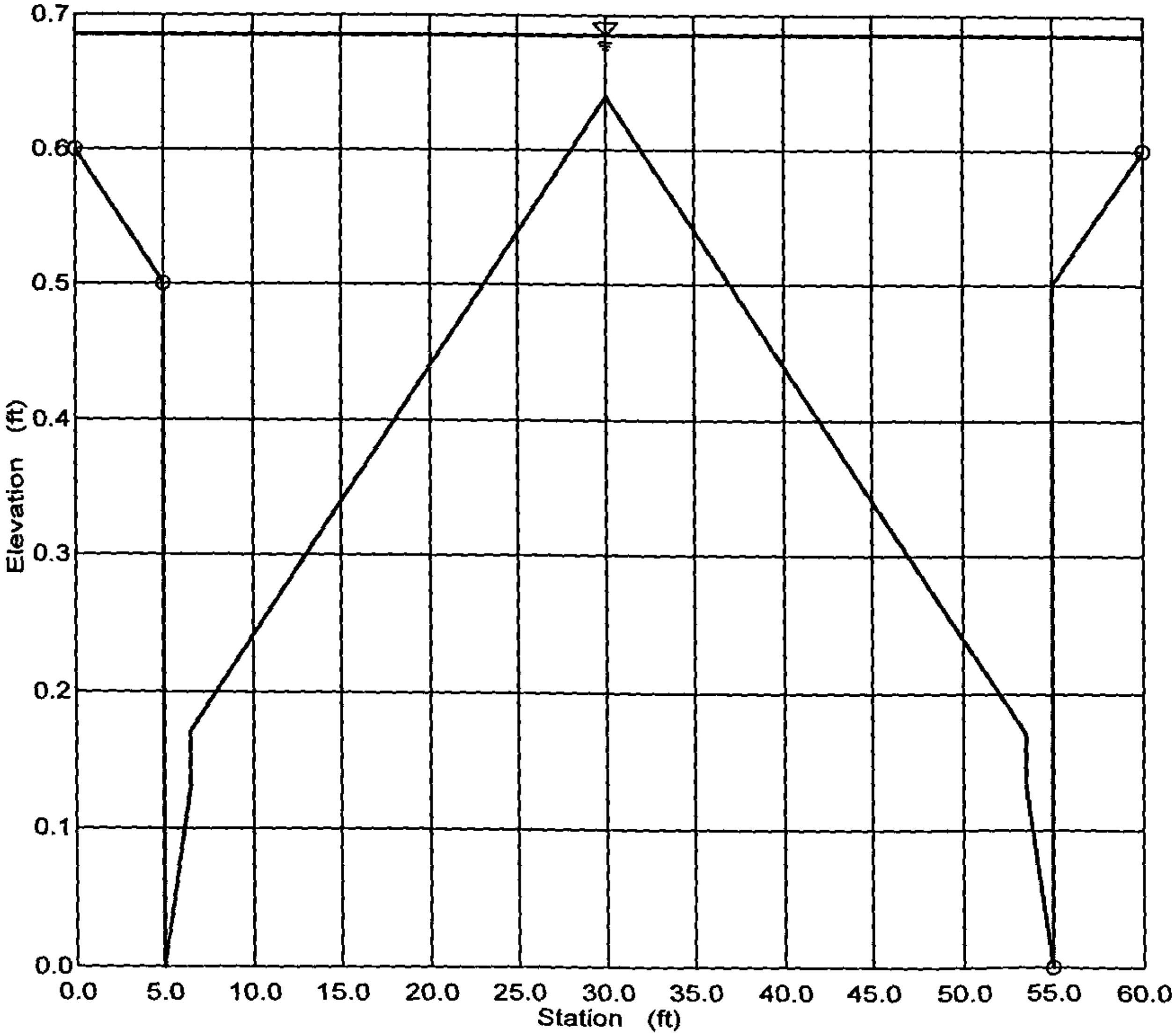
Water elevation exceeds lowest end station by 0.08 ft.

SECTION A-A

Corbett Street Q100 = 44 cfs
Cross Section for Irregular Channel

Project Description	
Project File	i:\fmw\00041.fm2
Worksheet	Corbett Street Q100 = 45 cfs
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Section Data		
Wtd. Mannings Coefficient	0.016	
Channel Slope	0.50	%
Water Surface Elevation	0.68	ft
Discharge	44.00	cfs



SECTION A-A

Corbett Street Q10 = 19 cfs
Worksheet for Irregular Channel

Project Description	
Project File	i:\fmw\00041.fm2
Worksheet	Corbett Street Q10 = 15 cfs
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Input Data

Channel Slope 0.50 %

Elevation range: 0.00 ft to 0.64 ft.

Station (ft)	Elevation (ft)	Start Station	End Station	Roughness
0.00	0.60	0.00	5.00	0.013
5.00	0.50	5.00	55.00	0.017
5.00	0.00	55.00	60.00	0.013
6.50	0.13			
6.50	0.17			
30.00	0.64			
53.50	0.17			
53.50	0.13			
55.00	0.00			
55.00	0.50			
60.00	0.60			

Discharge 19.00 cfs

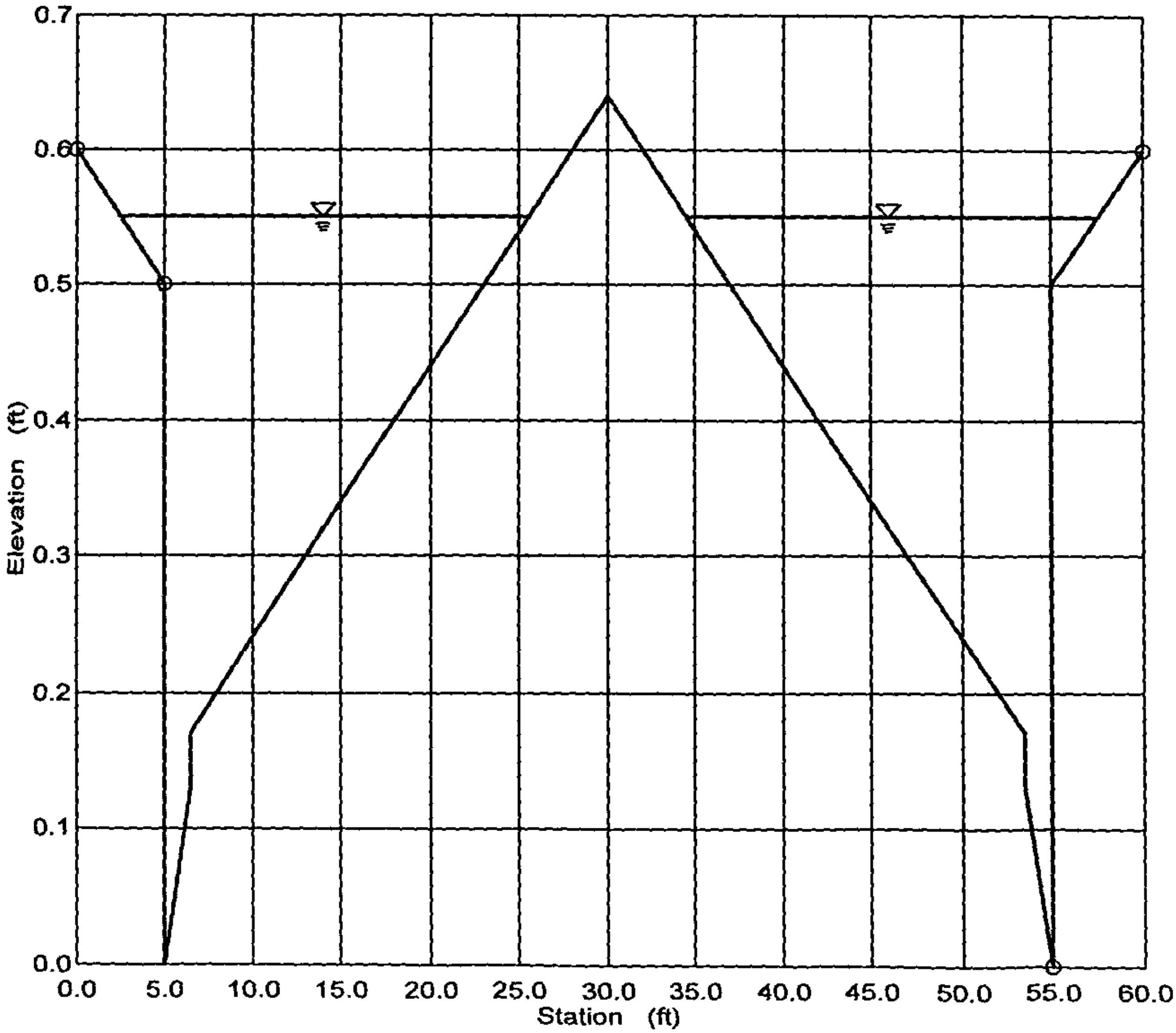
Results		
Wtd. Mannings Coefficient	0.016	
Water Surface Elevation	0.55	ft
Flow Area	8.82	ft²
Wetted Perimeter	47.20	ft
Top Width	46.10	ft
Height	0.55	ft
Critical Depth	0.53	ft
Critical Slope	0.006978	ft/ft
Velocity	2.15	ft/s
Velocity Head	0.07	ft
Specific Energy	0.62	ft
Froude Number	0.87	
Flow is subcritical.		
Flow is divided.		

SECTION A - A

Corbett Street Q10 = 19 cfs
Cross Section for Irregular Channel

Project Description	
Project File	i:\fmw\00041.fm2
Worksheet	Corbett Street Q10 = 15 cfs
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Section Data		
Wtd. Mannings Coefficient	0.016	
Channel Slope	0.50	%
Water Surface Elevation	0.55	ft
Discharge	19.00	cfs



SECTION B-B

Bradley Road Q100 = 14 cfs
Worksheet for Irregular Channel

Project Description	
Project File	i:\fmw\00041.fm2
Worksheet	Bradley Road Q100 = 14 cfs
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Input Data

Channel Slope 0.40 %

Elevation range: 0.00 ft to 0.84 ft.

Station (ft)	Elevation (ft)
0.00	0.60
5.00	0.50
5.00	0.00
6.50	0.13
6.50	0.17
40.00	0.84
73.50	0.17
73.50	0.13
75.00	0.00
75.00	0.50
80.00	0.60

Start Station	End Station	Roughness
0.00	6.50	0.013
6.50	73.50	0.017
73.50	80.00	0.013

Discharge 14.00 cfs

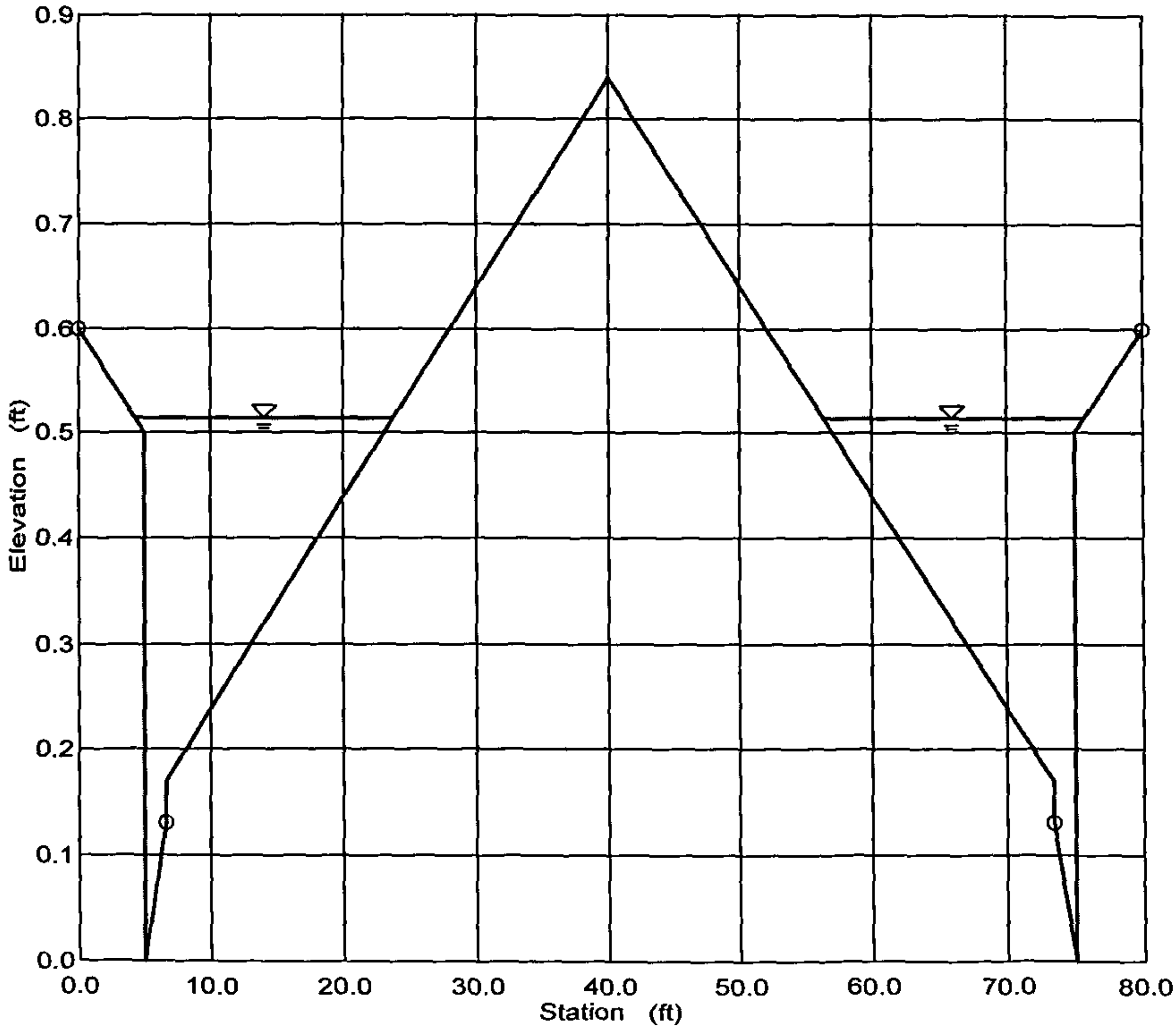
Results		
Wtd. Mannings Coefficient	0.016	
Water Surface Elevation	0.51	ft
Flow Area	7.27	ft²
Wetted Perimeter	39.90	ft
Top Width	38.80	ft
Height	0.51	ft
Critical Depth	0.48	ft
Critical Slope	0.006011	ft/ft
Velocity	1.92	ft/s
Velocity Head	0.06	ft
Specific Energy	0.57	ft
Froude Number	0.78	
Flow is subcritical.		
Flow is divided.		

SECTION B-B

Bradley Road Q100 = 14 cfs
Cross Section for Irregular Channel

Project Description	
Project File	*i:\fmw\00041.fm2*
Worksheet	Bradley Road Q100 = 14 cfs
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	*Water Elevation*

Section Data		
Wtd. Mannings Coefficient	0.016	
Channel Slope	0.40	%
Water Surface Elevation	0.51	ft
Discharge	14.00	cfs



SECTION B-B

Bradley Road Q10 = 7 cfs
Worksheet for Irregular Channel

Project Description	
Project File	i:\fmw\00041.fm2
Worksheet	Bradley Road Q10 = 7 cfs
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Input Data

Channel Slope 0.40 %

Elevation range: 0.00 ft to 0.84 ft.

Station (ft)	Elevation (ft)	Start Station	End Station	Roughness
0.00	0.60	0.00	6.50	0.013
5.00	0.50	6.50	73.50	0.017
5.00	0.00	73.50	80.00	0.013
6.50	0.13			
6.50	0.17			
40.00	0.84			
73.50	0.17			
73.50	0.13			
75.00	0.00			
75.00	0.50			
80.00	0.60			

Discharge 5.00 cfs

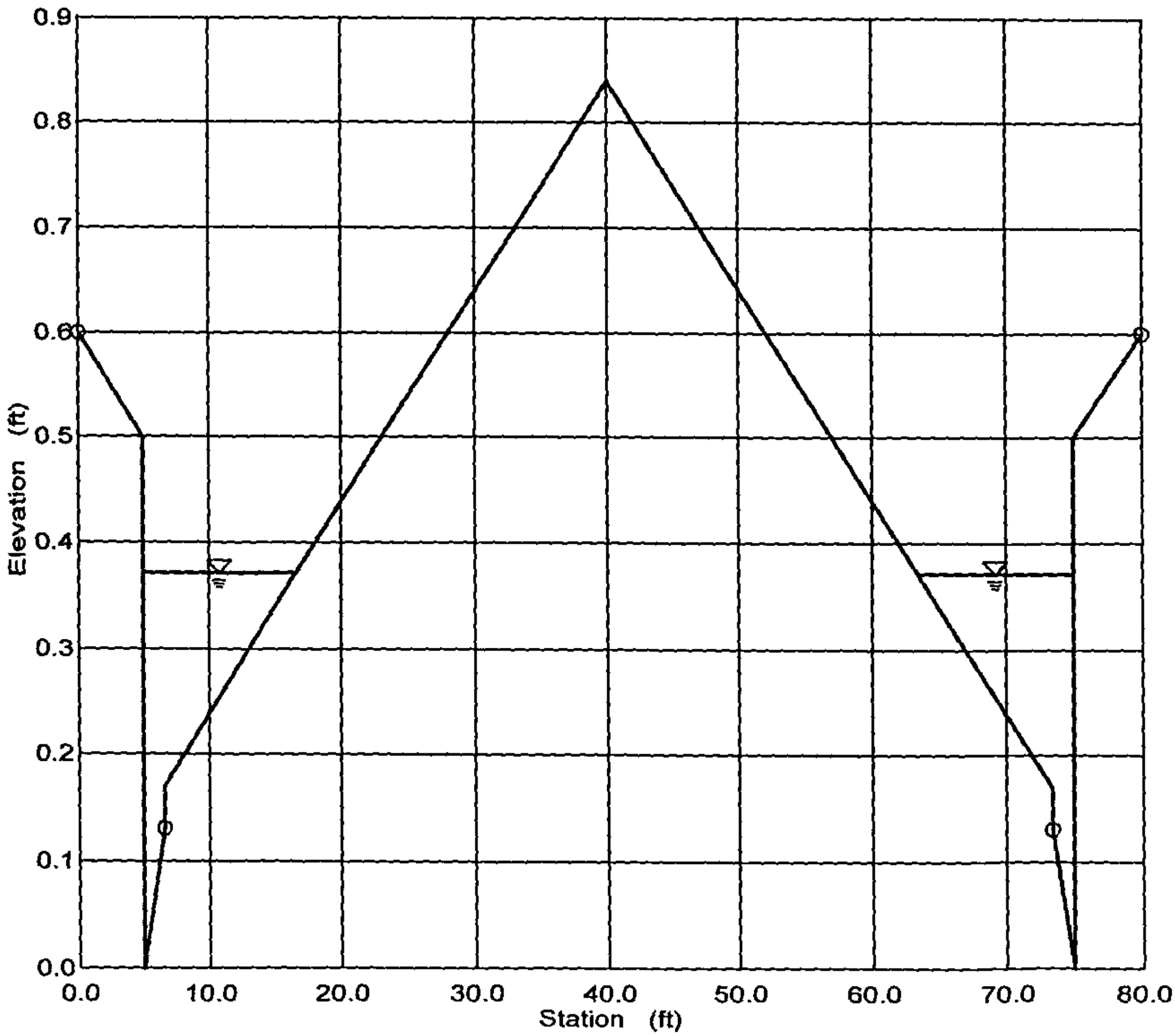
Results		
Wtd. Mannings Coefficient	0.014	
Water Surface Elevation	0.37	ft
Flow Area	2.94	ft²
Wetted Perimeter	23.93	ft
Top Width	23.09	ft
Height	0.37	ft
Critical Depth	0.35	ft
Critical Slope	0.005515	ft/ft
Velocity	1.70	ft/s
Velocity Head	0.05	ft
Specific Energy	0.42	ft
Froude Number	0.84	
Flow is subcritical.		
Flow is divided.		

SECTION B-B

Bradley Road Q10 = 7 cfs
Cross Section for Irregular Channel

Project Description	
Project File	i:\fmw\00041.fm2
Worksheet	Bradley Road Q10 = 7 cfs
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Section Data		
Wtd. Mannings Coefficient	0.014	
Channel Slope	0.40	%
Water Surface Elevation	0.37	ft
Discharge	5.00	cfs



SECTION C-C

El Campo Grande Avenue Q100 = 322 cfs
Worksheet for Irregular Channel

Project Description	
Project File	i:\fmw\00041.fm2
Worksheet	El Campo Grande Avenue Q100 = 322 cfs
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Input Data

Channel Slope 1.00 %

Elevation range: 0.00 ft to 1.54 ft.

Station (ft)	Elevation (ft)
0.00	1.54
5.00	1.44
5.00	0.94
6.50	1.07
6.50	1.11
53.50	0.17
53.50	0.13
55.00	0.00
55.00	0.50
60.00	0.60

Start Station	End Station	Roughness
0.00	6.50	0.013
6.50	53.50	0.017
53.50	60.00	0.013

Discharge 322.00 cfs

Results		
Wtd. Mannings Coefficient	0.016	
Water Surface Elevation	1.40	ft
Flow Area	42.37	ft²
Wetted Perimeter	56.85	ft
Top Width	55.00	ft
Height	1.40	ft
Critical Depth	1.66	ft
Critical Slope	0.003777	ft/ft
Velocity	7.60	ft/s
Velocity Head	0.90	ft
Specific Energy	2.29	ft
Froude Number	1.53	

Flow is supercritical.

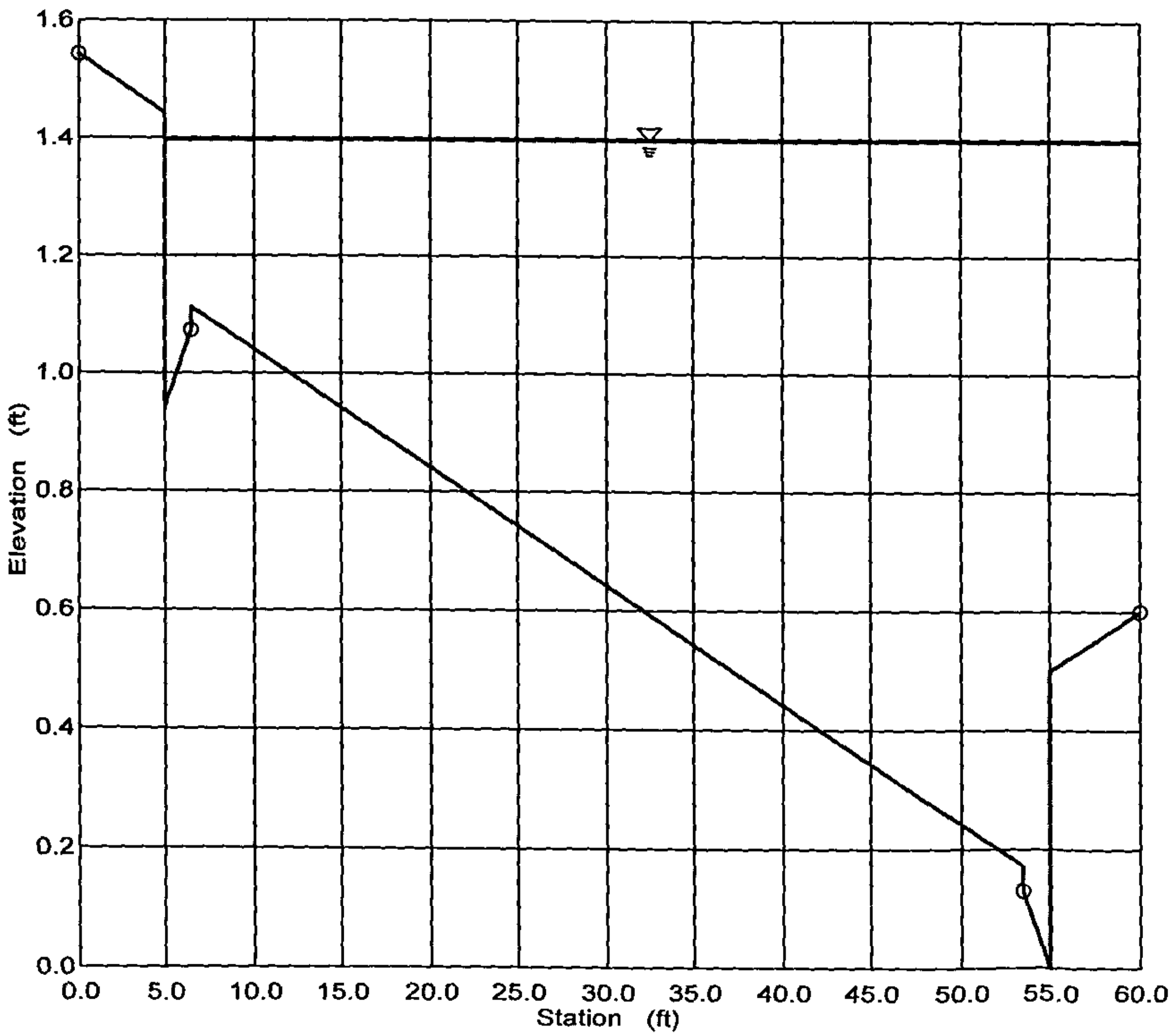
Water elevation exceeds lowest end station by 0.80 ft.

SECTION C-C

El Campo Grande Avenue Q100 = 322 cfs
Cross Section for Irregular Channel

Project Description	
Project File	i:\fmw\00041.fm2
Worksheet	El Campo Grande Avenue Q100 = 322 cfs
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Section Data		
Wtd. Mannings Coefficient	0.016	
Channel Slope	1.00	%
Water Surface Elevation	1.40	ft
Discharge	322.00	cfs



SECTION C-C

El Campo Grande Avenue Q10 = 95 cfs
Worksheet for Irregular Channel

Project Description	
Project File	i:\fmw\00041.fm2
Worksheet	El Campo Grande Avenue Q10 = 95 cfs
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Input Data

Channel Slope 1.00 %

Elevation range: 0.00 ft to 1.54 ft.

Station (ft)	Elevation (ft)
0.00	1.54
5.00	1.44
5.00	0.94
6.50	1.07
6.50	1.11
53.50	0.17
53.50	0.13
55.00	0.00
55.00	0.50
60.00	0.60

Start Station	End Station	Roughness
0.00	6.50	0.013
6.50	53.50	0.017
53.50	60.00	0.013

Discharge 95.00 cfs

Results		
Wtd. Mannings Coefficient	0.016	
Water Surface Elevation	0.96	ft
Flow Area	18.78	ft²
Wetted Perimeter	46.87	ft
Top Width	45.94	ft
Height	0.96	ft
Critical Depth	1.07	ft
Critical Slope	0.004901	ft/ft
Velocity	5.06	ft/s
Velocity Head	0.40	ft
Specific Energy	1.35	ft
Froude Number	1.39	

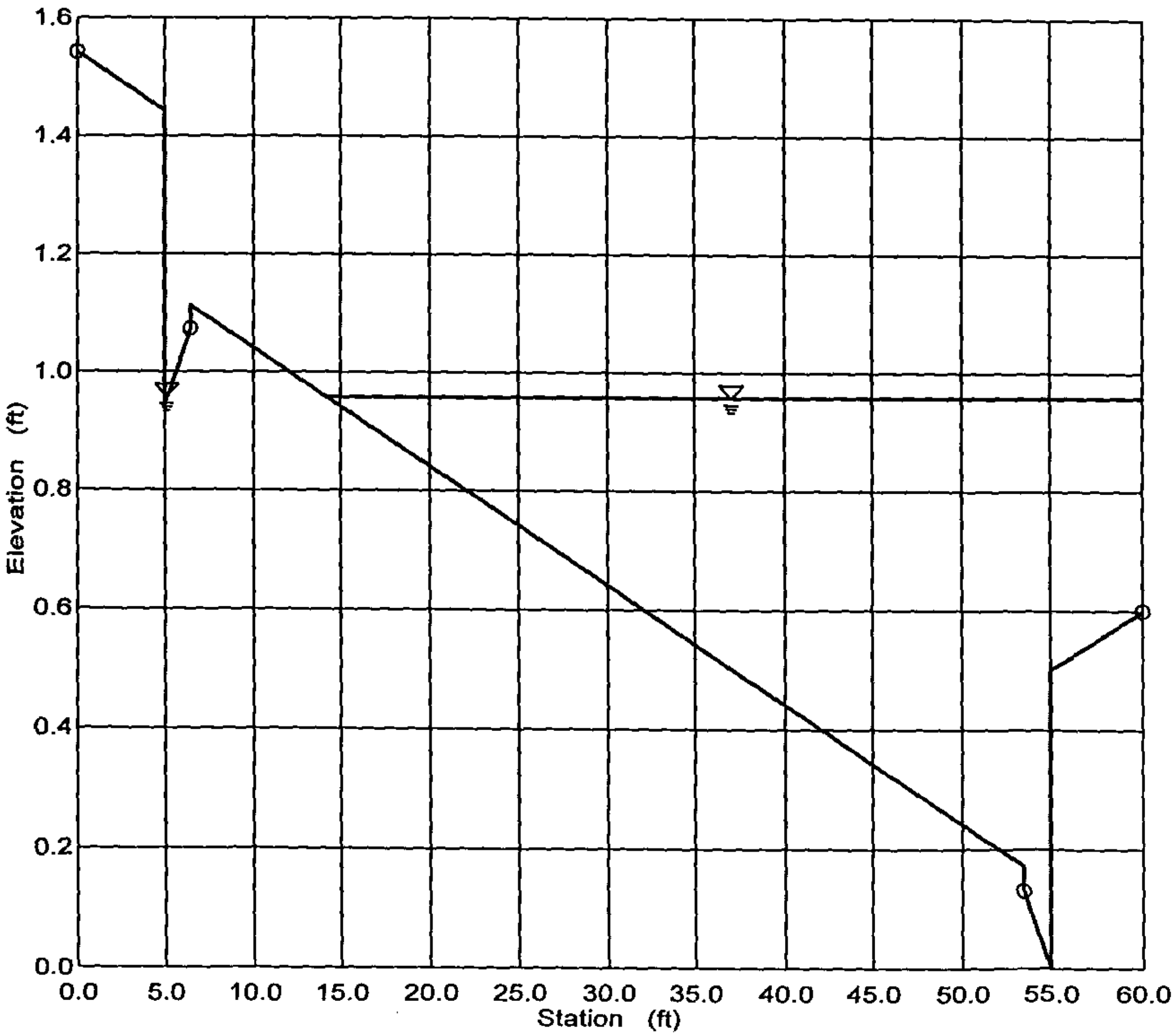
Flow is supercritical.
Flow is divided.
Water elevation exceeds lowest end station by 0.36 ft.

SECTION C-C

El Campo Grande Avenue Q10 = 95 cfs
Cross Section for Irregular Channel

Project Description	
Project File	i:\fmw\00041.fm2
Worksheet	El Campo Grande Avenue Q10 = 95 cfs
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Section Data		
Wtd. Mannings Coefficient	0.016	
Channel Slope	1.00	%
Water Surface Elevation	0.96	ft
Discharge	95.00	cfs



APPENDIX E

Excerpts From Previously Approved Hydrology Studies

```
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*           SEPTEMBER 1990             *
*            VERSION 4.0               *
*                                      *
* RUN DATE  07/09/1998  TIME  09:23:28 *
*                                      *
****************************************
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****************************************
*                                      *
*   U.S. ARMY CORPS OF ENGINEERS       *
*   HYDROLOGIC ENGINEERING CENTER      *
*         609 SECOND STREET            *
*      DAVIS, CALIFORNIA 95616         *
*          (916) 756-1104              *
*                                      *
****************************************
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X     X  XXXXXXX   XXXXX         X
X     X  X        X     X       XX
X     X  X        X              X
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

EXISTING CONDITIONS

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

  1        ID    THE RIDGE II -- EXISTING OFFSITE HYDROLOGY
  2        ID    EXOFF.DAT
  3        ID    SE CORNER OF TROPICAL AND BRADLEY IN LAS VEGAS, NV
  4        ID    JULY 1998
  5        ID    MCARREN AIRPORT PRECIPITATION DATA
           *DIAGRAM
  6        IT        5                         300
  7        IN        5
  8        IO        5
  9        JR     PREC    0.57     1.00
           * **********

 10        KK    OFF-A
 11        KM    AREA TRIBUTARY TO WEST EDGE OF EAGLE CREEK ESTATES SOUTH SITE
 12        BA   .16125
 13        PB     2.77
 14        PC   0.0000  0.0200  0.0570  0.0700  0.0870  0.1080  0.1240  0.1300  0.1300  0.1300
 15        PC   0.1300  0.1300  0.1300  0.1330  0.1400  0.1420  0.1480  0.1580  0.1720  0.1810
 16        PC   0.1900  0.1970  0.1990  0.2000  0.2010  0.2040  0.2140  0.2290  0.2410  0.2490
 17        PC   0.2510  0.2560  0.2700  0.2780  0.2810  0.2830  0.2950  0.3220  0.3520  0.4090
 18        PC   0.4990  0.5900  0.7100  0.7440  0.7810  0.8120  0.8190  0.8350  0.8510  0.8560
 19        PC   0.8600  0.8680  0.8760  0.8880  0.9100  0.9260  0.9370  0.9500  0.9700  0.9760
 20        PC   0.9820  0.9850  0.9870  0.9890  0.9900  0.9930  0.9930  0.9940  0.9950  0.9980
 21        PC   0.9980  0.9990  1.0000
 22        LS        0    82.8
 23        UD    1.680
           * **********

 24        KK   SCHOOL
 25        KM    FUTURE SCHOOL SITE ON SW CORNER OF BRADLEY AND CORBETT
 26        BA   .01563
 27        LS        0      85
 28        UD    0.452
           * **********

 29        KK   EX-ECS
 30        KM    EXIST SITE FROM EAGLE CREEK SOUTH DRNG STUDY
 31        BA   .02703
 32        LS        0      85
 33        UD     .420
           * **********

 34        KK   INFAWN
 35        KM    TOTAL EXIST FLOW EXCLUDING TROPICAL PKWY
 36        HC        3
           * **********

 37        KK    OFF-B
 38        KM    TROPICAL PKWY WEST OF BRADLEY RD
 39        BA   .28844
 40        LS        0    81.1
 41        UD    2.498
           * **********
```

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

 42           KK   OFF-C
 43           KM   BRADLEY ROAD NORTH OF TROPICAL PARKWAY
 44           BA  .14063
 45           LS       0    84.6
 46           UD   1.385
              * **********

 47           KK   BRTROP
 48           KM   BRADLEY AND TROPICAL INTERSECTION
 49           HC       2
              * **********

 50           KK   OFFNO
 51           KM   EXISTING OFFSITE AT BRADLEY RD / BIG FAWN AVE (CORBETT) FROM NORTH & WEST
 52           HC       2
              * **********

 53           KK   OFF-D
 54           KM   EL CAMPO GRANDE WEST OF BRADLEY (BEFORE SUNSET HILLS INTERCEPTION)
 55           BA  1.5781
 56           LS       0    82.2
 57           UD   3.400
              * **********

 58           KK   SUNHIL
 59           KM   FLOW ACCEPTANCE FROM EL CAMPO GRANDE INTO SUNSET HILLS UNIT 4 SUBDIVISION
 60           KM   (INTO TWO 20-FT EASEMENTS @ 96.6 CFS EACH, AND ONE 54-IN RCP @ 147.8 CFS,
 61           KM   PER SUMMIT ENGINEERING REPORT - 1994)
 62           DT   SUNHQ
 63           DI       0     300     341     400
 64           DQ       0     300     341     341
              * **********

 65           KK   FLOSPL
 66           KM   FLOW SPLIT AT EL CAMPO GRANDE / BRADLEY
 67           KM   DIVERSION BASED ON RATING CURVE FROM HEC-RAS FLOW SPLIT ANALYSIS
 68           KM   DIVERSION TO BRADLEY SOUTH AND EL CAMPO GRANDE EAST
 69           KM   UNDIVERTED RUNOFF WOULD GO NORTH ON BRADLEY
 70           DT   SPLIT
 71           DI       0      30      70     100     143
 72           DQ       0       0       1       9      30
              * **********

 73           KK   TOTOFF
 74           KM   TOTAL OFFSITE Q AT BRADLEY / CORBETT
 75           HC       2
              * **********

 76           KK   EXSITE
 77           KM   EXISTING SITE
 78           BA  .02964
 79           LS       0      85
 80           UD    .313
 81           ZZ
```

SCHEMATIC DIAGRAM OF STREAM NETWORK

```
 PUT
 INE     (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

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

 10       OFF-A
            .
            .
 24         .       SCHOOL
            .         .
            .         .
 29         .         .        EX-ECS
            .         .          .
            .         .          .
 34      INFAWN.......................

            .
 37         .       OFF-B
            .         .
            .         .
 42         .         .        OFF-C
            .         .          .
            .                    .
 47         .      BRTROP..........
            .         .
            .         .
 50      OFFNO............

            .
 53         .      OFF-D
            .         .
            .         .
 62         .         .-------->   SUNHQ
 58         .      SUNHIL
            .         .
            .         .
 70         .         .-------->   SPLIT
 65         .      FLOSPL
            .         .
            .         .
 73      TOTOFF............
            .
            .
 76         .      EXSITE

 ) RUNOFF ALSO COMPUTED AT THIS LOCATION
```

```
****************************************                    ****************************************
                                       *                    *                                      *
  FLOOD HYDROGRAPH PACKAGE  (HEC-1)    *                    *   U.S. ARMY CORPS OF ENGINEERS       *
           SEPTEMBER 1990              *                    *   HYDROLOGIC ENGINEERING CENTER      *
             VERSION 4.0               *                    *         609 SECOND STREET            *
                                       *                    *     DAVIS, CALIFORNIA 95616          *
 RUN DATE  07/09/1998  TIME  09:23:28  *                    *         (916) 756-1104               *
                                       *                    *                                      *
****************************************                    ****************************************
```

```
                    THE RIDGE II -- EXISTING OFFSITE HYDROLOGY
                    EXOFF.DAT
                    SE CORNER OF TROPICAL AND BRADLEY IN LAS VEGAS, NV
                    JULY 1998
                    MCARREN AIRPORT PRECIPITATION DATA

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

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

             COMPUTATION INTERVAL     .08 HOURS
                  TOTAL TIME BASE   24.92 HOURS

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

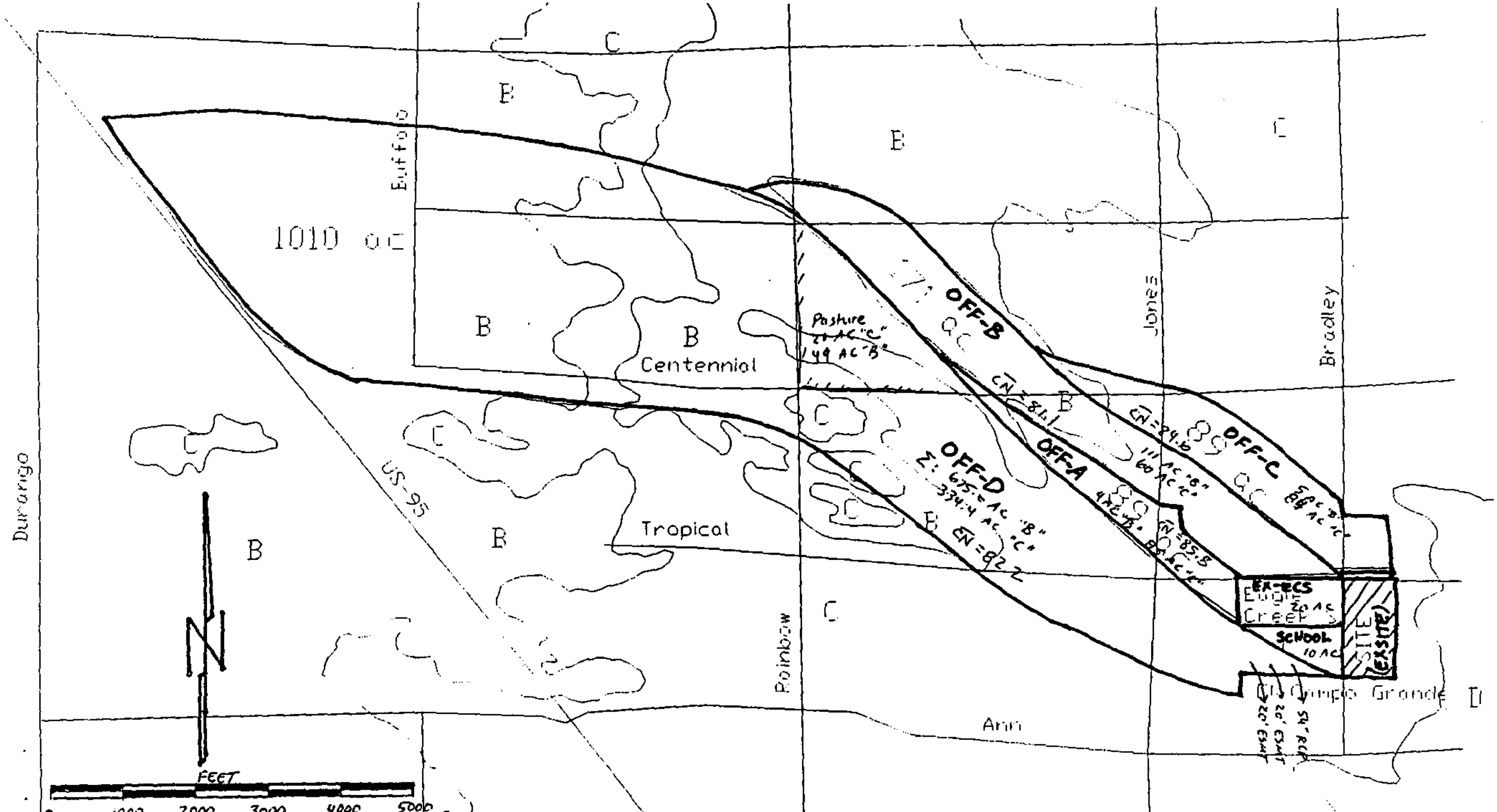
   JP        MULTI-PLAN OPTION
                  NPLAN          1  NUMBER OF PLANS

   JR        MULTI-RATIO OPTION
                RATIOS OF PRECIPITATION
                  .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

					RATIOS APPLIED TO PRECIPITATION	
ERATION	STATION	AREA	PLAN		RATIO 1	RATIO 2
					.57	1.00
DROGRAPH AT	OFF-A	.16	1	FLOW	15.	45.
				TIME	5.58	5.33
DROGRAPH AT	SCHOOL	.02	1	FLOW	4.	11.
				TIME	3.92	3.92
DROGRAPH AT	EX-ECS	.03	1	FLOW	7.	21.
				TIME	3.92	3.83
COMBINED AT	INFAWN	.20	1	FLOW	18.	54.
				TIME	5.17	5.17
DROGRAPH AT	OFF-B	.29	1	FLOW	18.	56.
				TIME	6.42	6.25
DROGRAPH AT	OFF-C	.14	1	FLOW	17.	48.
				TIME	5.08	5.00
COMBINED AT	BRTROP	.43	1	FLOW	30.	91.
				TIME	5.58	5.50
COMBINED AT	OFFNO	.63	1	FLOW	48.	142.
				TIME	5.42	5.33
ROGRAPH AT	OFF-D	1.58	1	FLOW	83.	252.
				TIME	7.25	7.17
VERSION TO	SUNHQ	1.58	1	FLOW	83.	252.
				TIME	7.25	7.17
ROGRAPH AT	SUNHIL	1.58	1	FLOW	0.	0.
				TIME	.08	.08
ERSION TO	SPLIT	1.58	1	FLOW	0.	0.
				TIME	.08	.08
OGRAPH AT	FLOSPL	1.58	1	FLOW	0.	0.
				TIME	.08	.08
OMBINED AT	TOTOFF	2.21	1	FLOW	48.	142.
				TIME	5.42	5.33
OGRAPH AT	EXSITE	.03	1	FLOW	9.	26.
				TIME	3.75	3.75

NORMAL END OF HEC-1 ***



HYDROLOGIC SOIL GROUPS IN EXISTING OFFSITE WATERSHED

```
****************************************
*                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
*             SEPTEMBER 1990           *
*              VERSION 4.0             *
*                                      *
* RUN DATE  07/09/1998  TIME  08:48:29 *
*                                      *
****************************************
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***************************************
*                                     *
*   U.S. ARMY CORPS OF ENGINEERS      *
*   HYDROLOGIC ENGINEERING CENTER     *
*         609 SECOND STREET           *
*      DAVIS, CALIFORNIA 95616        *
*          (916) 756-1104             *
*                                     *
***************************************
```

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

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

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

ULTIMATE DEVELOPED CONDITION

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

               *DIAGRAM
** FREE ***
               ID   THE RIDGE II
               ID   FILE NAME: Ridge.dat
               ID   SE CORNER OF TROPICAL AND BRADLEY IN LAS VEGAS, NV
               ID   MAY 1998
               ID
               ID   EXTRACT FROM THE CITY OF LAS VEGAS NORTHWEST NEIGHBORHOOD AREA PLAN
               ID   FOR THOSE AREAS DRAINING TO BRADLEY/EL CAMPO GRANDE & BRADLEY/CORBETT + SITE
               ID   FOR ULTIMATE DEVELOPED CONDITIONS ONLY.
               ID
               ID   DEVELOPED CONDITION SITE AND EAGLE CREEK SOUTH SITE ADDED TO:
               ID   NORTHWEST NEIGHBORHOOD STUDY AND CITY-WIDE HYDROLOGY STUDY UPDATE
               ID   FOR:  THE CITY OF LAS VEGAS
               ID
               ID   AUGUST 1997
               ID   REFERENCE NUMBER: 51300
               ID
               ID   EXTRACTED FROM AREA PLAN HEC1 FILE: ULTWEST3.DAT
               ID   WEST TRIBUTARY OF THE UPPER LAS VEGAS WASH
               ID   MODEL FOR AREA DOWNSTREAM OF THE KYLE CANYON DETENTION BASIN AND
               ID   WITHIN THE CITY OF LAS VEGAS CORPORATE BOUNDARY
               ID
               ID   FUTURE CONDITION, EXISTING AND PROPOSED FACILITIES AND ULTIMATE LAND USE
               ID
               ID   REGIONAL FACILITIES FOLLOW "ADDENDUM #2 TO KYLE CANYON DETENTION BASIN
               ID   OUTFALL FACILITIES", ALTERNATIVE 1D, BY: VTN NEVADA, DATED: MARCH 1997,
               ID   WITH THE EXCEPTION OF A FLOW SPLIT AT CENTENNICAL AND U.S. 95.
               ID   (CONNECTING RCHB 0066 AND RCHO 0097, AND THE REALIGNMENT OF RCHB 0000).
               ID
               ID SPECIAL NOTES:
               ID
               ID 1.  INTERPOLATION BETWEEN FLOWS WAS COMPLETED TO OBTAIN THE MOST ACCURATE
               ID     FLOW FOR EACH TRIBUTARY AREA AT EACH CONCENTRATION POINT.
               ID 2.  IT SHOULD BE NOTED THAT AT CENTENNIAL AND US 95 THE FIRST 2500 CFS
               ID     IS DIVERTED TO THE EAST IN THE CENTENNIAL CHANNEL, THEREFORE NO FLOW
               ID     WILL DRAIN SOUTH ALONG US 95 UNTIL THE TOTAL FLOW AT CENTENNIAL AND
               ID     US 95 REACHES 2501 CFS.
               ID 3.  THE TRIBUTARY AREA TO THE RANCHO DETENTION BASIN (~11 SQ. MI.) IS NOT
               ID     CONSIDERED WHEN CALCULATING THE DARF FOR FLOWS IN ANN RD. DOWNSTREAM
               ID     OF THE DETENTION BASIN.
               ID 4.  THE PEAK FLOW ALONG US 95 UPSTREAM OF THE RANCHO DETENTION BASIN AND
               ID     THE PEAK STAGE IN THE DETENTION BASIN IS OBTAINED FROM HEC-1
               ID     MODEL RCHOPK3.DAT.  THAT HEC-1 MODEL CONTAINS A REVISED STORM
               ID     CENTERING THAT IMPACTS THE PREVIOUSLY MENTION AREAS.
               ID 5.  TO OBTAIN THE PEAK 100-YEAR FLOWS IN THE CENTENNIAL CHANNEL EAST OF
               ID     US 95, HEC-1 MODELS CENTPK3.DAT AND CENTPKS.DAT SHOULD BE USED.  THESE
               ID     MODELS ALSO CONTAIN REVISED STORM CENTERINGS THAT IMPACT THE
               ID     PREVIOUSLY MENTIONED AREAS.  PEAK 10-YEAR FLOWS FOR THE CENTENNIAL
               ID     CHANNEL ARE OBTAINED FROM ULTWEST3.DAT AND ULTWESTS.DAT.
               ID 6.  ALL DIVERSIONS TO PROPOSED RCP'S ARE DIVERSIONS TO 10-YEAR FACILITIES
               ID     PROPOSED IN THIS STUDY.  IF A DIVERSION TO A 10-YEAR FACILITY OCCURS
               ID     AT A STREET INTERSECTION WITH A SURFACE FLOW SPLIT THEN THE 10-YEAR
               ID     FLOW IS DIVERTED TO THE PROPOSED FACILITY FIRST AND THEN THE
               ID     REMAINING FLOW IS CONSIDERED FOR THE SURFACE FLOW SPLIT, BUT THIS IS
```

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

ID       ALL DONE WITH ONE SET OF DI-DQ CARDS OR ONE DIVERSION.
ID  7.   ONLY 10-YEAR FLOWS FROM SUBBASINS PT3AA2 AND PT2AA1 ARE BROUGHT INTO
ID       THIS HEC-1 MODEL.  THIS IS ACCOMPLISHED USING A MULTIPLAN RUN WITH
ID       JP AND KP CARDS, FOR THE 100-YEAR FLOWS IN ANN RD. PLAN 1 SHOULD BE
ID       USED, FOR THE 10-YEAR PLAN 2 FLOWS SHOULD BE USED.
ID  8.   DUE TO THE NUMBER OF DIVERSIONS AND THE FACT THAT TRIBUTARY AREA IS
ID       NOT CARRIED WITH A DIVERTED FLOW, IT MAY BE DIFFICULT TO DETERMINE THE
ID       CORRECT DARF TO USE FOR CERTAIN CONCENTRATION POINTS, HOWEVER, AS A
ID       GENERAL RULE TRIBUTARY AREA WAS NOT MANUALLY CARRIED WITH A DIVERTED
ID       FLOW UNLESS THE AREA WAS GREATER THAT 1 SQUARE MILE.  ADDITIONALLY,
ID       IN SOME AREAS THE TRIBUTARY AREA FOR A DIVERTED FLOW WAS ESTIMATED
ID       BASED ON THE AMOUNT OF THE TOTAL FLOW DIVERTED.
ID
ID   JR CARD RATIOS REPRESENT DEPTH-AREA REDUCTION FACTORS (DARF'S)
ID
ID   100-YEAR,  6-HOUR STORM,  SDN3
ID   DARF RATIOS FOR AREAS OF 0, 1, 2, 6 AND 10 SQUARE MILES FOR 100-YEAR
ID   DARF RATIOS FOR AREAS OF 0, 2, 6 AND 10 SQUARE MILES FOR 10-YEAR
ID
IT       5       0       0     300
IO       5       0       0
IN       5       0       0
JR    PREC       1    0.97    0.93     0.9    0.86    0.57    0.53   0.513    0.49
*

KK  ANN2C1
BA    0.12
PB   2.774
PC   0.000   0.020   0.057   0.070   0.087   0.108   0.124   0.130   0.130   0.130
PC   0.130   0.130   0.130   0.133   0.140   0.142   0.148   0.158   0.172   0.181
PC   0.190   0.197   0.199   0.200   0.201   0.204   0.214   0.229   0.241   0.249
PC   0.251   0.256   0.270   0.278   0.281   0.283   0.295   0.322   0.352   0.409
PC   0.499   0.590   0.710   0.744   0.781   0.812   0.819   0.835   0.851   0.856
PC   0.860   0.868   0.876   0.888   0.910   0.926   0.937   0.950   0.970   0.976
PC   0.982   0.985   0.987   0.989   0.990   0.993   0.993   0.994   0.995   0.998
PC   0.998   0.999   1.000
LS       0    82.6
UD   0.257
*

KK DANN2C1
KM  FLOW SPLIT AT TORREY PINES AND AZURE
KM  DIVERT FLOW TO TORREY PINES
KM  REMAINING FLOW CONTINUES EAST IN AZURE
KM  CROWN NOT HELD IN EITHER STREET
KM  DIVERT FIRST 33 CFS TO PROPOSED 42" PIPE IN TORREY PINES
KM  MINIMUM 1 CFS WILL REMAIN TO AVOID ZERO FLOW
DT DANN2C3
DI       0      11      34     133     533    1033
DQ       0      10      33      82     297     578
*
```

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


 100         KK   RD2C1
 101         KM  ROUTE TO ANN2C2
 102         RK     2600  0.0058    0.02       0    TRAP      50       2
             *

 103         KK  ANN2C2
 104         BA     0.12
 105         PB   2.774
 106         LS        0    81.7
 107         UD   0.251
             *

 108         KK    C2C2
 109         KM  COMBINE RD2C1 & ANN2C2
 110         HC        2
             *

 111         KK   DANN2
 112         KM  FLOW SPLIT AT JONES AND AZURE
 113         KM  DIVERT FLOW TO JONES
 114         KM  REMAINING FLOW CONTINUES EAST IN AZURE
 115         KM  CROWN NOT HELD IN EITHER STREET
 116         KM  DIVERT FIRST 31 CFS TO PROPOSED 42" RCP IN JONES
 117         KM  MINIMUM 1 CFS WILL REMAIN TO AVOID ZERO FLOW
 118         DT DANN2C4
 119         DI        0       11       32      131      531     1031
 120         DQ        0       10       31       80      296      596
             *
             *

 121         KK DANN2C3
 122         KM  RETRIEVE FLOW DIVERTED AT TORREY PINES AND AZURE (ANN2C1)
 123         DR DANN2C3
             *

 124         KK RDAN2C3
 125         KM  ROUTE TO ANN2C3
 126         RK     1320  0.0038    0.02       0    TRAP      70       2
             *

 127         KK  ANN2C3
 128         BA     0.11
 129         PB   2.774
 130         LS        0    80.5
 131         UD   0.254
             *

 132         KK    C2C3
 133         KM  COMBINE DANN2C3 & ANN2C3
 134         HC        2
             *
```

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

 135        KK   2D2C3
 136        KM  DIVERT FIRST 57 CFS TO PROPOSED 48" RCP IN TORREY PINES
 137        KM  REMAINING FLOW CONTINUES EAST IN TROPICAL
 138        KM  MINIMUM 1 CFS WILL REMAIN TO AVOID ZERO FLOW
 139        DT DANN2D1
 140        DI       0      11      58     150     500    1000
 141        DQ       0      10      57      57      57      57
            *

 142        KK    R2C3
 143        KM  ROUTE TO ANN2C4
 144        RK    2440  0.0041    0.02       0    TRAP      70       2
            *

 145        KK DANN2C4
 146        KM  RETRIEVE FLOW DIVERTED AT JONES AND AZURE (ANN2C2)
 147        DR DANN2C4
            *

 148        KK RDAN2C4
 149        KM  ROUTE TO ANN2C4
 150        RK    1320  0.0038    0.02       0    TRAP      90       2
            *

 151        KK  ANN2C4
 152        BA    0.12
 153        PB   2.774
 154        LS       0    83.2
 155        UD   0.250
            *

 156        KK    C2C4
 157        KM  COMBINE R2C3, DANN2C4 AND ANN2C4
 158        HC       3
            *

 159        KK   2D2C4
 160        KM  DIVERT FIRST 64 CFS TO PROPOSED 54" RCP IN TORREY PINES
 161        KM  REMAINING FLOW CONTINUES EAST IN TROPICAL
 162        KM  MINIMUM 1 CFS WILL REMAIN TO AVOID ZERO FLOW
 163        DT    D2D2
 164        DI       0      11      65     150     500    1000
 165        DQ       0      10      64      64      64      64
            *
            *

 166        KK DANN2D1
 167        KM  RETRIEVE FLOW DIVERTED TO PROPOSED RCP IN TORREY PINES
 168        DR DANN2D1
            *
```

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

 169          KK   RD2D1
 170          KM  ROUTE TO ANN2D1
 171          RK    1320   0.003   0.015       0    CIRC     5.5
              *

 172          KK  ANN2D1
 173          BA    0.11
 174          PB   2.774
 175          LS       0    83.9
 176          UD   0.265
              *

 177          KK    C2D1
 178          KM  COMBINE DANN2D1 AND ANN2D1
 179          HC       2
              *

 180          KK   2D2D1
 181          KM  DIVERT FIRST 87 CFS TO PROPOSED 54" RCP IN TORREY PINES
 182          KM  REMAINING FLOW CONTINUES EAST IN EL CAMPO GRANDE
 183          KM  MINIMUM 1 CFS WILL REMAIN TO AVOID ZERO FLOW
 184          DT DANN2D3
 185          DI       0      11      88     200    1000
 186          DQ       0      10      87      87      87
              *

 187          KK RANN2D1
 188          KM  ROUTE TO ANN2D2
 189          RK    2500   0.004    0.02       0    TRAP      70       2
              *

 190          KK    D2D2
 191          KM  RETRIEVE FLOW DIVERTED TO RCP IN JONES
 192          DR    D2D2
              *

 193          KK   RD2D2
 194          KM  ROUTE TO ANN2D2
 195          RK    1320   0.003   0.015       0    CIRC     4.5
              *

 196          KK  ANN2D2
 197          BA    0.11
 198          PB   2.774
 199          LS       0    82.8
 200          UD   0.253
              *

 201          KK CANN2D2
 202          KM  COMBINE RANN2D1, D2D2 AND ANN2D2
 203          HC       3
              *
```

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

204           KK DANN2D2
205           KM  FLOW SPLIT AT JONES AND EL CAMPO GRANDE
206           KM  DIVERT FLOW TO JONES
207           KM  REMAINING FLOW CONTINUES EAST IN EL CAMPO GRANDE
208           KM  CROWN NOT HELD IN EITHER STREET
209           KM  DIVERT FIRST 91 CFS TO PROPOSED 60" RCP IN JONES
210           KM  MINIMUM 1 CFS WILL REMAIN TO AVOID ZERO FLOW
211           DT DANN2D4
212           DI        0      11      92     191     591    1091
213           DQ        0      10      91     137     345     634
              *

214           KK   RD2D2
215           KM  ROUTE TO ANN3B1
216           RK     2650  0.0022    0.02       0    TRAP      50       2
              *

217           KK  ANN3B1
218           KM   ANN3B1 BASIN AREA MODIFIED TO EXCLUDE EAGLE CREEK SOUTH AND OFF-3
219           BA   .0767
220           PB   2.774
221           LS       0    82.7
222           UD   0.257
              *

223           KK    C3B1
224           KM  COMBINE RD2D2 AND ANN3B1
225           HC       2
              *

226           KK  SUNHIL
227           KM   FLOW ACCEPTANCE FROM EL CAMPO GRANDE INTO SUNSET HILLS UNIT 4 SUBDIVISION
228           KM   (INTO TWO 20-FT EASEMENTS @ 96.6 CFS EACH, AND ONE 54-IN RCP @ 147.8 CFS,
229           KM   PER SUMMIT ENGINEERING REPORT - 1994)
230           DT   SUNHQ
231           DI       0     300     341     400
232           DQ       0     300     341     341
              *  *********

233           KK  FLOSPL
234           KM   FLOW SPLIT AT EL CAMPO GRANDE / BRADLEY
235           KM   DIVERSION BASED ON RATING CURVE FROM HEC-RAS SPLIT FLOW ANALYSIS
236           KM   DIVERSION TO BRADLEY SOUTH AND EL CAMPO GRANDE EAST
237           DT   SPLIT
238           DI       0      30      70     100     143
239           DQ       0       0       1       9      30
              *  ***********************************************************************
              *
              * **********
              *  ULTIMATE DEVELOPED DRAINAGE AREAS
              * **********
```

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

 240          KK   OFF-3
 241          KM   OFFSITE DRAINAGE IMPACTING WEST EDGE OF SITE
 242          BA  .01781
 243          PB    2.77
 244          LS       0      80
 245          UD    .172
              * **********

 246          KK  RTOFF3
 247          KM   ROUTE OFF-3 DOWN CORBETT
 248          RK    1320   0.004   0.016       0    TRAP      50       0
              * **********

 249          KK  CORBET
 250          KM   CORBETT STREET RIGHT-OF-WAY
 251          BA  .00234
 252          LS       0      98
 253          UD    .138
              * **********

 254          KK  CR@BRD
 255          HC       2
              * **********
              * **********

 256          KK    REST
 257          KM   RESTON ST & W. PART OF BURLINGAME
 258          BA  .00520
 259          LS       0      83
 260          UD    .149
              * **********

 261          KK     BAN
 262          KM   BANFIELD ST
 263          BA  .00255
 264          LS       0      90
 265          UD    .104
              * **********

 266          KK  BANRES
 267          KM   RESTON + BANFIELD
 268          HC       2
              * **********

 269          KK  RBANRE
 270          RK     856   .0048    .016       0    TRAP      36       0
              * **********

 271          KK     HAM
 272          KM   HAMDEN ST
 273          BA  .00255
 274          LS       0      90
 275          UD    .104
              * **********
```

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

 276        KK    RHAM
 277        RK     630   .0048    .016       0    TRAP      36       0
            * **********

 278        KK    KENT
 279        KM    KENTLANDS ST
 280        BA   .00255
 281        LS       0      90
 282        UD     .104
            * **********

 283        KK    RKENT
 284        RK     370   .0048    .016       0    TRAP      36       0
            * **********

 285        KK    BURLIN
 286        KM    EAST PART OF BURLINGAME ST.
 287        BA    .0042
 288        LS       0      90
 289        UD     .156
            * **********

 290        KK    CBURL
 291        HC       4
            * **********

 292        KK    BRIDGA
 293        KM    BRIDGEHAMPTON ST NEAR COMMON AREA A
 294        BA   .00188
 295        LS       0      90
 296        UD     .121
            * **********

 297        KK    RBRDGA
 298        RK     260   .0048    .016       0    TRAP      36       0
            * **********

 299        KK    BRIDGB
 300        KM    BRIDGEHAMPTON ST NEAR COMMON AREA B
 301        BA   .00150
 302        LS       0      90
 303        UD     .105
            * **********

 304        KK    CBRDGB
 305        HC       2
            * **********

 306        KK    RBRDGB
 307        RK     260   .0048    .016       0    TRAP      36       0
            * **********
```

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

308          KK  BRIDGC
309          KM   BRIDGEHAMPTON ST NEAR COMMON AREA C
310          BA  .00189
311          LS       0       90
312          UD    .105
             * **********

313          KK  CBRDGC
314          HC       2
             * **********

315          KK  RBRDGC
316          RK     375   .0048    .016       0    TRAP      36       0
             * **********

317          KK  BRIDGD
318          KM   BRIDGEHAMPTON ST NEAR COMMON AREA D
319          BA  .00231
320          LS       0       90
321          UD    .118
             * **********

322          KK  CBRDGD
323          HC       2
             * **********

324          KK  RBRDGD
325          RK     380   .0048    .016       0    TRAP      36       0
             * **********

326          KK     OAK
327          KM   OAKTON ST
328          BA  .00256
329          LS       0       90
330          UD    .120
             * **********

331          KK    COAK
332          HC       2
             * **********

333          KK  EAGLES
334          KM   TOTAL DISCHARGE FROM DEVEL EAGLE CREEK SOUTH SITE
335          HC       2
             * **********

336          KK  BRDSCH
337          KM   2.5 AC +/- OF FUTURE SCHOOL BLDG. ESTIMATED TO DRAIN TO BRADLEY
338          BA  .00391
339          LS       0       94
340          UD    .107
             * **********
```

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

 341         KK  BRDLEY
 342         KM   DRADLEY ROAD R-O-W
 343         BA  .00375
 344         LS       0      98
 345         UD     .157
             * **********

 346         KK  IN2RDG
 347         KM   FLOW AT BRADLEY / CORBETT ENTERING THE RIDGE II
 348         HC       5
             * **********

 349         KK   RTOFF
 350         KM   ROUTE OFFSITE Q THROUGH SITE
 351         RK     675   0.004   0.016       0    TRAP      35       0
             *  *********
             *  ONSITE RUNOFF FROM THE RIDGE II
             *  *********
             *

 352         KK  STRKPT
 353         BA  .00342
 354         LS       0   88.25
 355         UD     .131

 356         KK    FAWN
 357         BA  .00508
 358         LS       0   88.25
 359         UD     .132

 360         KK    DAWN
 361         BA  .00583
 362         LS       0   88.25
 363         UD     .130

 364         KK   HEART
 365         BA  .00652
 366         LS       0   88.25
 367         UD     .132

 368         KK  RIDGE2
 369         KM   ONSITE FLOWS FOR THE RIDGE II WHICH DRAIN TO EASEMENT
 370         HC       4

 371         KK  EASMNT
 372         KM   TOTAL Q100 AT EASEMENT (ONSITE + OFFSITE)
 373         HC       2

 374         KK    BSKY
 375         KM   PART OF SITE DRAINING TO EL CAMPO GRANDE
 376         BA  .00880
 377         LS       0   88.25
 378         UD     .144
 379         ZZ
```

SCHEMATIC DIAGRAM OF STREAM NETWORK

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

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

  77     ANN2C1
            .
            .
  97        .-------> DANN2C3
  90    DANN2C1
            V
            V
 100     RD2C1
            .
            .
 103        .       ANN2C2
            .          .
            .          .
 108      C2C2............
            .
            .
 118        .-------> DANN2C4
 111      DANN2
            .
            .
 123        .          .<------- DANN2C3
 121        .       DANN2C3
            .          V
            .          V
 124        .       RDAN2C3
            .          .
            .          .
 127        .          .      ANN2C3
            .          .         .
            .          .         .
 132        .        C2C3............
            .          .
            .          .
 139        .          .-------> DANN2D1
 135        .        2D2C3
            .          V
            .          V
 142        .        R2C3
            .          .
            .          .
 147        .          .         .<------- DANN2C4
 145        .          .      DANN2C4
            .          .         V
            .          .         V
 148        .          .      RDAN2C4
            .          .         .
            .          .         .
 151        .          .         .      ANN2C4
            .          .         .         .
            .          .         .         .
 156        .        C2C4......................
            .          .
            .          .
```

```
163      .        .------->    D2D2
159      .     2D2C4
         .        .
         .        .
168      .        .           .<------- DANN2D1
166      .        .       DANN2D1
         .        .           V
         .        .           V
169      .        .        RD2D1
         .        .           .
         .        .           .
172      .        .           .        ANN2D1
         .        .           .            .
         .        .           .            .
177      .        .        C2D1............
         .        .           .
         .        .           .
184      .        .           .-------> DANN2D3
180      .        .       2D2D1
         .        .           V
         .        .           V
187      .        .      RANN2D1
         .        .           .
         .        .           .
192      .        .           .            .<-------    D2D2
190      .        .           .          D2D2
         .        .           .             V
         .        .           .             V
193      .        .           .         RD2D2
         .        .           .             .
         .        .           .             .
196      .        .           .             .       ANN2D2
         .        .           .             .             .
         .        .           .             .             .
201      .        .      CANN2D2.......................
         .        .           .
         .        .           .
211      .        .           .-------> DANN2D4
204      .        .     DANN2D2
         .        .           V
         .        .           V
214      .        .       RD2D2
         .        .           .
         .        .           .
217      .        .           .        ANN3B1
         .        .           .            .
         .        .           .            .
23       .        .       C3B1............
         .        .           .
         .        .           .
30       .        .           .------->    SUNHQ
226      .        .     SUNHIL
         .        .           .
         .        .           .
237      .        .           .------->    SPLIT
33       .        .     FLOSPL
         .        .           .
         .        .           .
240      .        .           .        OPP-3
         .        .           .            V
```

```
         .       .       .      V
246      .       .       .   RTOFF3
         .       .       .      .
         .       .       .      .
249      .       .       .      .      CORBET
         .       .       .      .         .
         .       .       .      .         .
254      .       .       .   CR@BRD............
         .       .       .      .
         .       .       .      .
256      .       .       .      .        REST
         .       .       .      .         .
         .       .       .      .         .
261      .       .       .      .         .        BAN
         .       .       .      .         .          .
         .       .       .      .         .          .
266      .       .       .      .      BANRES............
         .       .       .      .         V
         .       .       .      .         V
269      .       .       .      .      RBANRE
         .       .       .      .         .
         .       .       .      .         .
271      .       .       .      .         .        HAM
         .       .       .      .         .          V
         .       .       .      .         .          V
276      .       .       .      .         .       RHAM
         .       .       .      .         .          .
         .       .       .      .         .          .
278      .       .       .      .         .          .        KENT
         .       .       .      .         .          .          V
         .       .       .      .         .          .          V
283      .       .       .      .         .          .       RKENT
         .       .       .      .         .          .          .
         .       .       .      .         .          .          .
285      .       .       .      .         .          .          .        BURLIN
         .       .       .      .         .          .          .           .
         .       .       .      .         .          .          .           .
290      .       .       .      .      CBURL.................................
         .       .       .      .         .
         .       .       .      .         .
292      .       .       .      .         .      BRIDGA
         .       .       .      .         .          V
         .       .       .      .         .          V
297      .       .       .      .         .      RBRDGA
         .       .       .      .         .          .
         .       .       .      .         .          .
299      .       .       .      .         .          .       BRIDGB
         .       .       .      .         .          .          .
         .       .       .      .         .          .          .
304      .       .       .      .         .      CBRDGB............
         .       .       .      .         .          V
         .       .       .      .         .          V
306      .       .       .      .         .      RBRDGB
         .       .       .      .         .          .
         .       .       .      .         .          .
308      .       .       .      .         .          .       BRIDGC
         .       .       .      .         .          .          .
         .       .       .      .         .          .          .
313      .       .       .      .         .      CBRDGC............
         .       .       .      .         .          V
```

```
             .         .         .         .         .         V
315          .         .         .         .         .    RBRDGC
             .         .         .         .         .         .
             .         .         .         .         .         .
317          .         .         .         .         .         .    BRIDGD
             .         .         .         .         .         .         .
             .         .         .         .         .         .         .
322          .         .         .         .         .    CBRDGD..........
             .         .         .         .         .         V
             .         .         .         .         .         V
324          .         .         .         .         .    RBRDGD
             .         .         .         .         .         .
             .         .         .         .         .         .
326          .         .         .         .         .         .       OAK
             .         .         .         .         .         .         .
             .         .         .         .         .         .         .
331          .         .         .         .         .      COAK..........
             .         .         .         .         .         .
             .         .         .         .         .         .
333          .         .         .         .    EAGLES..........
             .         .         .         .         .
             .         .         .         .         .
336          .         .         .         .         .    BRDSCH
             .         .         .         .         .         .
             .         .         .         .         .         .
341          .         .         .         .         .         .    BRDLEY
             .         .         .         .         .         .         .
             .         .         .         .         .         .         .
346          .         .    IN2RDG........................................
             .         .         V
             .         .         V
349          .         .     RTOPP
             .         .         .
             .         .         .
352          .         .         .    STRKPT
             .         .         .         .
             .         .         .         .
356          .         .         .         .      FAWN
             .         .         .         .         .
             .         .         .         .         .
360          .         .         .         .         .      DAWN
             .         .         .         .         .         .
             .         .         .         .         .         .
364          .         .         .         .         .         .     HEART
             .         .         .         .         .         .         .
             .         .         .         .         .         .         .
368          .         .         .    RIDGE2..............................
             .         .         .         .
             .         .         .         .
371          .         .    EASMNT..........
             .         .         .
             .         .         .
374          .         .         .      BSKY
```

**) RUNOFF ALSO COMPUTED AT THIS LOCATION

```
*****************************************                         **************************************
*                                       *                         *                                    *
*  FLOOD HYDROGRAPH PACKAGE  (HEC-1)    *                         *   U.S. ARMY CORPS OF ENGINEERS     *
*          SEPTEMBER 1990               *                         *   HYDROLOGIC ENGINEERING CENTER    *
*           VERSION 4.0                 *                         *         609 SECOND STREET          *
*                                       *                         *      DAVIS, CALIFORNIA 95616       *
* RUN DATE  07/09/1998  TIME  08:48:29  *                         *          (916) 756-1104            *
*                                       *                         *                                    *
*****************************************                         **************************************
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THE RIDGE II
FILE NAME: Ridge.dat
SE CORNER OF TROPICAL AND BRADLEY IN LAS VEGAS, NV
MAY 1998

EXTRACT FROM THE CITY OF LAS VEGAS NORTHWEST NEIGHBORHOOD AREA PLAN
FOR THOSE AREAS DRAINING TO BRADLEY/EL CAMPO GRANDE & BRADLEY/CORBETT + SITE
FOR ULTIMATE DEVELOPED CONDITIONS ONLY.

DEVELOPED CONDITION SITE AND EAGLE CREEK SOUTH SITE ADDED TO:
NORTHWEST NEIGHBORHOOD STUDY AND CITY-WIDE HYDROLOGY STUDY UPDATE
FOR: THE CITY OF LAS VEGAS

AUGUST 1997
REFERENCE NUMBER: 51300

EXTRACTED FROM AREA PLAN HEC1 FILE: ULTWEST3.DAT
WEST TRIBUTARY OF THE UPPER LAS VEGAS WASH
MODEL FOR AREA DOWNSTREAM OF THE KYLE CANYON DETENTION BASIN AND
WITHIN THE CITY OF LAS VEGAS CORPORATE BOUNDARY

FUTURE CONDITION, EXISTING AND PROPOSED FACILITIES AND ULTIMATE LAND USE

REGIONAL FACILITIES FOLLOW "ADDENDUM #2 TO KYLE CANYON DETENTION BASIN
OUTFALL FACILITIES", ALTERNATIVE 1D, BY: VTN NEVADA, DATED: MARCH 1997,
WITH THE EXCEPTION OF A FLOW SPLIT AT CENTENNICAL AND U.S. 95.
(CONNECTING RCHB 0066 AND RCHO 0097, AND THE REALIGNMENT OF RCHB 0000).

SPECIAL NOTES:

1. INTERPOLATION BETWEEN FLOWS WAS COMPLETED TO OBTAIN THE MOST ACCURATE FLOW FOR EACH TRIBUTARY AREA AT EACH CONCENTRATION POINT.
2. IT SHOULD BE NOTED THAT AT CENTENNIAL AND US 95 THE FIRST 2500 CFS IS DIVERTED TO THE EAST IN THE CENTENNIAL CHANNEL, THEREFORE NO FLOW WILL DRAIN SOUTH ALONG US 95 UNTIL THE TOTAL FLOW AT CENTENNIAL AND US 95 REACHES 2501 CFS.
3. THE TRIBUTARY AREA TO THE RANCHO DETENTION BASIN (~11 SQ. MI.) IS NOT CONSIDERED WHEN CALCULATING THE DARF FOR FLOWS IN ANN RD. DOWNSTREAM OF THE DETENTION BASIN.
4. THE PEAK FLOW ALONG US 95 UPSTREAM OF THE RANCHO DETENTION BASIN AND THE PEAK STAGE IN THE DETENTION BASIN IS OBTAINED FROM HEC-1 MODEL RCHOPK3.DAT. THAT HEC-1 MODEL CONTAINS A REVISED STORM CENTERING THAT IMPACTS THE PREVIOUSLY MENTION AREAS.
5. TO OBTAIN THE PEAK 100-YEAR FLOWS IN THE CENTENNIAL CHANNEL EAST OF US 95, HEC-1 MODELS CENTPK3.DAT AND CENTPK5.DAT SHOULD BE USED. THESE MODELS ALSO CONTAIN REVISED STORM CENTERINGS THAT IMPACT THE

PREVIOUSLY MENTIONED AREAS. PEAK 10-YEAR FLOWS FOR THE CENTENNIAL CHANNEL ARE OBTAINED FROM ULTWEST3.DAT AND ULTWESTS.DAT.

6. ALL DIVERSIONS TO PROPOSED RCP'S ARE DIVERSIONS TO 10-YEAR FACILITIES PROPOSED IN THIS STUDY. IF A DIVERSION TO A 10-YEAR FACILITY OCCURS AT A STREET INTERSECTION WITH A SURFACE FLOW SPLIT THEN THE 10-YEAR FLOW IS DIVERTED TO THE PROPOSED FACILITY FIRST AND THEN THE REMAINING FLOW IS CONSIDERED FOR THE SURFACE FLOW SPLIT, BUT THIS IS ALL DONE WITH ONE SET OF DI-DQ CARDS OR ONE DIVERSION.
7. ONLY 10-YEAR FLOWS FROM SUBBASINS PT3AA2 AND PT2AA1 ARE BROUGHT INTO THIS HEC-1 MODEL. THIS IS ACCOMPLISHED USING A MULTIPLAN RUN WITH JP AND KP CARDS, FOR THE 100-YEAR FLOWS IN ANN RD. PLAN 1 SHOULD BE USED, FOR THE 10-YEAR PLAN 2 FLOWS SHOULD BE USED.
8. DUE TO THE NUMBER OF DIVERSIONS AND THE FACT THAT TRIBUTARY AREA IS NOT CARRIED WITH A DIVERTED FLOW, IT MAY BE DIFFICULT TO DETERMINE THE CORRECT DARF TO USE FOR CERTAIN CONCENTRATION POINTS, HOWEVER, AS A GENERAL RULE TRIBUTARY AREA WAS NOT MANUALLY CARRIED WITH A DIVERTED FLOW UNLESS THE AREA WAS GREATER THAT 1 SQUARE MILE. ADDITIONALLY, IN SOME AREAS THE TRIBUTARY AREA FOR A DIVERTED FLOW WAS ESTIMATED BASED ON THE AMOUNT OF THE TOTAL FLOW DIVERTED.

JR CARD RATIOS REPRESENT DEPTH-AREA REDUCTION FACTORS (DARF'S)

100-YEAR, 6-HOUR STORM, SDN3
DARF RATIOS FOR AREAS OF 0, 1, 2, 6 AND 10 SQUARE MILES FOR 100-YEAR
DARF RATIOS FOR AREAS OF 0, 2, 6 AND 10 SQUARE MILES FOR 10-YEAR

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

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

                COMPUTATION INTERVAL     .08 HOURS
                     TOTAL TIME BASE   24.92 HOURS

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

   JP          MULTI-PLAN OPTION
                    NPLAN            1  NUMBER OF PLANS

   JR          MULTI-RATIO OPTION
                  RATIOS OF PRECIPITATION
                1.00     .97     .93     .90     .86     .57     .53     .51     .49
```

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

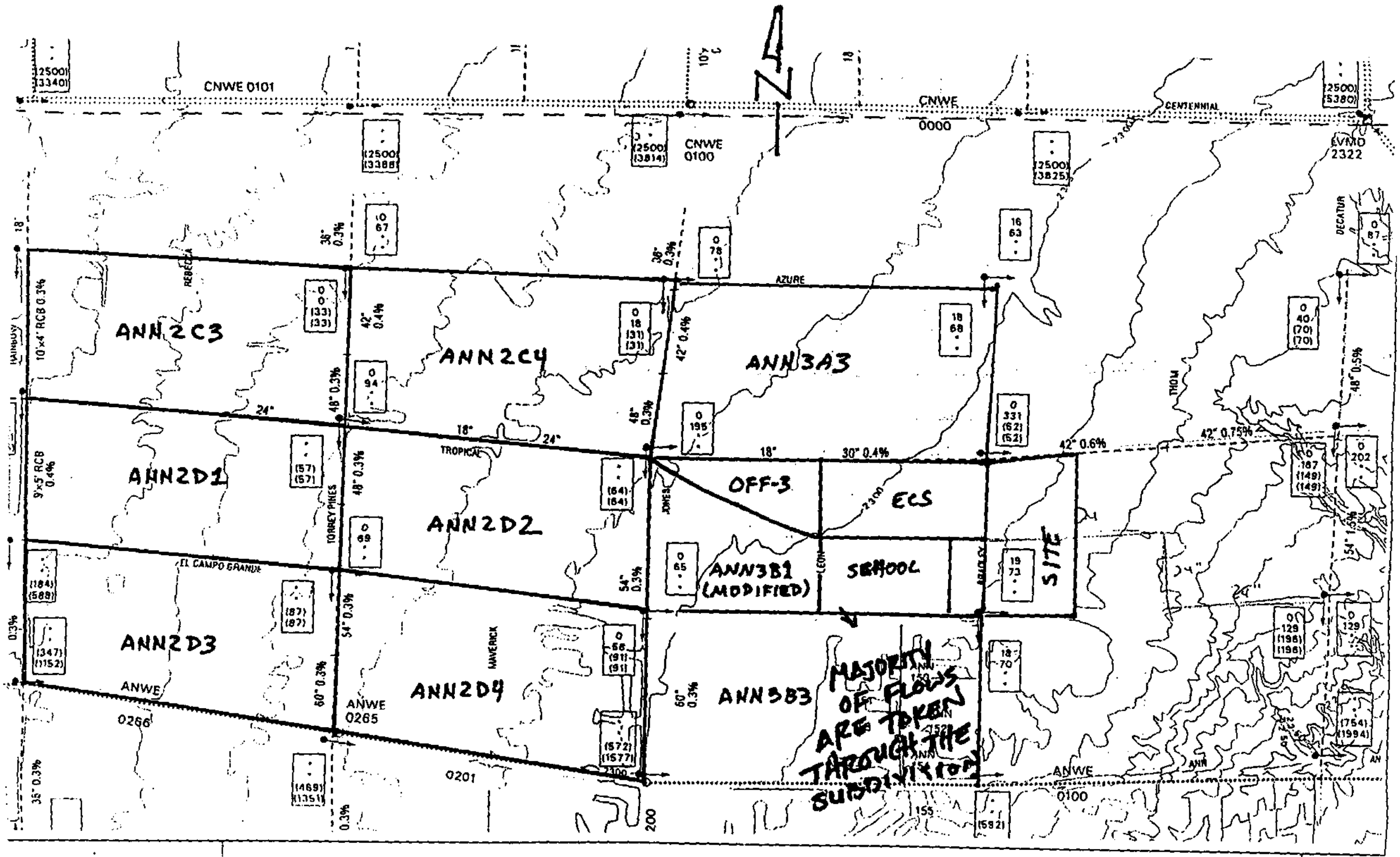
					RATIOS APPLIED TO PRECIPITATION								
ERATION	STATION	AREA	PLAN		RATIO 1	RATIO 2	RATIO 3	RATIO 4	RATIO 5	RATIO 6	RATIO 7	RATIO 8	RATIO 9
					1.00	.97	.93	.90	.86	.57	.53	.51	.49
HYDROGRAPH AT	ANN2C1	.12	1	FLOW	103.	98.	91.	86.	79.	34.	28.	26.	23.
				TIME	3.67	3.67	3.67	3.67	3.67	3.75	3.75	3.75	3.75
DIVERSION TO	DANN2C3	.12	1	FLOW	67.	65.	61.	59.	55.	33.	27.	25.	22.
				TIME	3.67	3.67	3.67	3.67	3.67	3.75	3.75	3.75	3.75
YDROGRAPH AT	DANN2C1	.12	1	FLOW	36.	33.	30.	27.	24.	1.	1.	1.	1.
				TIME	3.67	3.67	3.67	3.67	3.67	3.50	3.50	3.50	3.58
UTED TO	RD2C1	.12	1	FLOW	35.	33.	29.	26.	23.	1.	1.	1.	1.
				TIME	3.83	3.83	3.83	3.83	3.92	4.17	4.25	4.17	4.25
DROGRAPH AT	ANN2C2	.12	1	FLOW	100.	95.	88.	82.	76.	31.	26.	24.	21.
				TIME	3.67	3.67	3.67	3.67	3.67	3.75	3.75	3.75	3.75
COMBINED AT	C2C2	.24	1	FLOW	126.	122.	104.	97.	86.	31.	26.	24.	21.
				TIME	3.75	3.75	3.83	3.83	3.83	3.75	3.75	3.75	3.75
VERSION TO	DANN2C4	.24	1	FLOW	78.	75.	67.	63.	58.	30.	25.	23.	20.
				TIME	3.75	3.75	3.83	3.83	3.83	3.75	3.75	3.75	3.75
ROGRAPH AT	DANN2	.24	1	FLOW	49.	46.	37.	34.	28.	1.	1.	1.	1.
				TIME	3.75	3.75	3.83	3.83	3.83	3.50	3.50	3.58	3.58
ROGRAPH AT	DANN2C3	.00	1	FLOW	67.	65.	61.	59.	55.	33.	27.	25.	22.
				TIME	3.67	3.67	3.67	3.67	3.67	3.75	3.75	3.75	3.75
OUTED TO	RDAN2C3	.00	1	FLOW	67.	64.	61.	58.	55.	33.	27.	25.	22.
				TIME	3.75	3.75	3.75	3.75	3.75	3.83	3.83	3.83	3.83
YDROGRAPH AT	ANN2C3	.11	1	FLOW	85.	81.	74.	70.	64.	25.	21.	19.	17.
				TIME	3.67	3.67	3.67	3.67	3.67	3.75	3.75	3.75	3.75
COMBINED AT	C2C3	.11	1	FLOW	151.	143.	134.	127.	118.	57.	47.	43.	38.
				TIME	3.75	3.75	3.75	3.75	3.75	3.75	3.83	3.83	3.83
VERSION TO	DANN2D1	.11	1	FLOW	57.	57.	57.	57.	57.	56.	46.	42.	37.
				TIME	3.50	3.50	3.50	3.50	3.50	3.75	3.83	3.83	3.83
ROGRAPH AT	2D2C3	.11	1	FLOW	94.	86.	77.	70.	61.	1.	1.	1.	1.
				TIME	3.75	3.75	3.75	3.75	3.75	3.50	3.58	3.58	3.58
TED TO	R2C3	.11	1	FLOW	92.	85.	75.	69.	59.	1.	1.	1.	1.
				TIME	3.83	3.83	3.83	3.83	3.83	4.33	4.42	4.83	4.42
ROGRAPH AT	DANN2C4	.00	1	FLOW	78.	75.	67.	63.	58.	30.	25.	23.	20.
				TIME	3.75	3.75	3.83	3.83	3.83	3.75	3.75	3.75	3.75
TED TO	RDAN2C4	.00	1	FLOW	77.	74.	66.	62.	57.	30.	25.	23.	20.

				TIME	3.83	3.83	3.83	3.92	3.92	3.83	3.83	3.83	3.83
DROGRAPH AT	ANN2C4	.12	1	FLOW	108.	103.	95.	90.	83.	36.	30.	28.	25.
				TIME	3.67	3.67	3.67	3.67	3.67	3.75	3.75	3.75	3.75
COMBINED AT	C2C4	.23	1	FLOW	259.	246.	222.	205.	185.	64.	53.	48.	43.
				TIME	3.83	3.83	3.83	3.83	3.83	3.75	3.75	3.83	3.83
VERSION TO	D2D2	.23	1	FLOW	64.	64.	64.	64.	64.	63.	52.	47.	42.
				TIME	3.50	3.50	3.50	3.50	3.50	3.75	3.75	3.83	3.83
HYDROGRAPH AT	2D2C4	.23	1	FLOW	195.	182.	158.	141.	121.	1.	1.	1.	1.
				TIME	3.83	3.83	3.83	3.83	3.83	3.50	3.50	3.50	3.50
YDROGRAPH AT	DANN2D1	.00	1	FLOW	57.	57.	57.	57.	57.	56.	46.	42.	37.
				TIME	3.50	3.50	3.50	3.50	3.50	3.75	3.83	3.83	3.83
UTED TO	RD2D1	.00	1	FLOW	57.	57.	57.	57.	57.	55.	45.	41.	36.
				TIME	3.58	3.58	3.58	3.58	3.58	3.83	3.83	3.83	3.83
DROGRAPH AT	ANN2D1	.11	1	FLOW	99.	94.	88.	83.	77.	34.	29.	27.	24.
				TIME	3.67	3.67	3.67	3.67	3.67	3.75	3.75	3.75	3.75
COMBINED AT	C2D1	.11	1	FLOW	156.	151.	145.	140.	134.	87.	72.	66.	59.
				TIME	3.67	3.67	3.67	3.67	3.67	3.75	3.83	3.83	3.83
VERSION TO	DANN2D3	.11	1	FLOW	87.	87.	87.	87.	87.	86.	71.	65.	58.
				TIME	3.50	3.50	3.50	3.50	3.50	3.75	3.83	3.83	3.83
DROGRAPH AT	2D2D1	.11	1	FLOW	69.	64.	58.	53.	47.	1.	1.	1.	1.
				TIME	3.67	3.67	3.67	3.67	3.67	3.42	3.50	3.50	3.50
JTED TO	RANN2D1	.11	1	FLOW	68.	64.	57.	52.	45.	1.	1.	1.	1.
				TIME	3.83	3.83	3.83	3.83	3.92	6.17	6.17	4.42	4.67
DROGRAPH AT	D2D2	.00	1	FLOW	64.	64.	64.	64.	64.	63.	52.	47.	42.
				TIME	3.50	3.50	3.50	3.50	3.50	3.75	3.75	3.83	3.83
ROUTED TO	RD2D2	.00	1	FLOW	64.	64.	64.	64.	64.	62.	51.	47.	41.
				TIME	3.58	3.58	3.58	3.58	3.58	3.83	3.83	3.83	3.83
YDROGRAPH AT	ANN2D2	.11	1	FLOW	96.	92.	85.	80.	74.	32.	27.	25.	22.
				TIME	3.67	3.67	3.67	3.67	3.67	3.75	3.75	3.75	3.75
COMBINED AT	CANN2D2	.22	1	FLOW	214.	209.	194.	185.	167.	91.	76.	69.	61.
				TIME	3.83	3.75	3.83	3.83	3.83	3.75	3.83	3.83	3.83
VERSION TO	DANN2D4	.22	1	FLOW	149.	146.	139.	134.	126.	90.	75.	68.	60.
				TIME	3.83	3.75	3.83	3.83	3.83	3.75	3.83	3.83	3.83
ROGRAPH AT	DANN2D2	.22	1	FLOW	65.	62.	55.	51.	41.	1.	1.	1.	1.
				TIME	3.83	3.75	3.83	3.83	3.83	3.42	3.42	3.50	3.50
TED TO	RD2D2	.22	1	FLOW	64.	62.	53.	45.	36.	1.	1.	1.	1.
				TIME	3.92	3.92	4.00	4.00	4.08	4.42	4.83	4.42	4.50
ROGRAPH AT	ANN3B1	.08	1	FLOW	66.	63.	58.	55.	51.	22.	18.	17.	15.
				TIME	3.67	3.67	3.67	3.67	3.67	3.75	3.75	3.75	3.75
COMBINED AT	C3B1	.30	1	FLOW	111.	106.	86.	76.	65.	22.	18.	17.	15.

				TIME	3.92	3.92	4.00	4.00	4.00	3.75	3.75	3.75	3.75
IVERSION TO	SUNHQ	.30	1	FLOW	111.	106.	86.	76.	65.	22.	18.	17.	15.
				TIME	3.92	3.92	4.00	4.00	4.00	3.75	3.75	3.75	3.75
YDROGRAPH AT	SUNHIL	.30	1	FLOW	0.	0.	0.	0.	0.	0.	0.	0.	0.
				TIME	.08	.08	.08	.08	.08	.08	.08	.08	.08
DIVERSION TO	SPLIT	.30	1	FLOW	0.	0.	0.	0.	0.	0.	0.	0.	0.
				TIME	.08	.08	.08	.08	.08	.08	.08	.08	.08
HYDROGRAPH AT	FLOSPL	.30	1	FLOW	0.	0.	0.	0.	0.	0.	0.	0.	0.
				TIME	.08	.08	.08	.08	.08	.08	.08	.08	.08
DROGRAPH AT	OFF-3	.02	1	FLOW	16.	15.	14.	13.	12.	4.	4.	3.	3.
				TIME	3.58	3.58	3.58	3.58	3.58	3.67	3.67	3.67	3.67
UTED TO	RTOFF3	.02	1	FLOW	15.	14.	13.	12.	11.	4.	4.	3.	3.
				TIME	3.67	3.67	3.67	3.67	3.75	3.75	3.75	3.83	3.83
DROGRAPH AT	CORBET	.00	1	FLOW	4.	4.	4.	4.	4.	2.	2.	2.	2.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58
COMBINED AT	CR@BRD	.02	1	FLOW	19.	18.	16.	15.	14.	6.	5.	4.	4.
				TIME	3.67	3.67	3.67	3.67	3.67	3.75	3.75	3.75	3.83
DROGRAPH AT	REST	.01	1	FLOW	6.	5.	5.	5.	4.	2.	2.	1.	1.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58
DROGRAPH AT	BAN	.00	1	FLOW	4.	4.	4.	3.	3.	2.	2.	1.	1.
				TIME	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.58
COMBINED AT	BANRES	.01	1	FLOW	9.	9.	8.	8.	7.	4.	3.	3.	3.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58
OUTED TO	RBANRE	.01	1	FLOW	9.	9.	8.	8.	7.	3.	3.	3.	3.
				TIME	3.58	3.58	3.58	3.58	3.67	3.67	3.67	3.67	3.67
DROGRAPH AT	HAM	.00	1	FLOW	4.	4.	4.	3.	3.	2.	2.	1.	1.
				TIME	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.58
TED TO	RHAM	.00	1	FLOW	4.	4.	4.	3.	3.	2.	1.	1.	1.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.67	3.67
ROGRAPH AT	KENT	.00	1	FLOW	4.	4.	4.	3.	3.	2.	2.	1.	1.
				TIME	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.58
TED TO	RKENT	.00	1	FLOW	4.	4.	4.	3.	3.	2.	2.	1.	1.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58
ROGRAPH AT	BURLIN	.00	1	FLOW	6.	6.	6.	5.	5.	3.	2.	2.	2.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58
COMBINED AT	CBURL	.02	1	FLOW	23.	22.	21.	20.	18.	9.	8.	8.	7.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58	3.67	3.67	3.67
OGRAPH AT	BRIDGA	.00	1	FLOW	3.	3.	3.	2.	2.	1.	1.	1.	1.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58
TED TO	RBRDGA	.00	1	FLOW	3.	3.	3.	2.	2.	1.	1.	1.	1.

				TIME	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58
/DROGRAPH AT	BRIDGB	.00	1	FLOW	2.	2.	2.	2.	2.	1.	1.	1.	1.
				TIME	3.50	3.50	3.50	3.50	3.50	3.50	3.58	3.58	3.58
COMBINED AT	CBRDGB	.00	1	FLOW	5.	5.	5.	4.	4.	2.	2.	2.	2.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58
ROUTED TO	RBRDGB	.00	1	FLOW	5.	5.	5.	4.	4.	2.	2.	2.	2.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58
HYDROGRAPH AT	BRIDGC	.00	1	FLOW	3.	3.	3.	3.	2.	1.	1.	1.	1.
				TIME	3.50	3.50	3.50	3.50	3.50	3.50	3.58	3.58	3.58
COMBINED AT	CBRDGC	.01	1	FLOW	8.	8.	7.	7.	6.	3.	3.	3.	3.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58
UTED TO	RBRDGC	.01	1	FLOW	8.	7.	7.	7.	6.	3.	3.	3.	2.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58
DROGRAPH AT	BRIDGD	.00	1	FLOW	3.	3.	3.	3.	3.	2.	1.	1.	1.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58
COMBINED AT	CBRDGD	.01	1	FLOW	11.	11.	10.	10.	9.	5.	4.	4.	4.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58
UTED TO	RBRDGD	.01	1	FLOW	11.	10.	10.	9.	9.	5.	4.	4.	3.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58	3.67	3.67	3.67
ROGRAPH AT	OAK	.00	1	FLOW	4.	4.	4.	3.	3.	2.	2.	1.	1.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58
COMBINED AT	COAK	.01	1	FLOW	15.	14.	13.	13.	12.	6.	5.	5.	5.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58
2 COMBINED AT	EAGLES	.03	1	FLOW	38.	36.	34.	32.	30.	15.	13.	13.	11.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58
YDROGRAPH AT	BRDSCH	.00	1	FLOW	7.	7.	6.	6.	6.	3.	3.	3.	3.
				TIME	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50
DROGRAPH AT	BRDLEY	.00	1	FLOW	7.	7.	6.	6.	6.	4.	3.	3.	3.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58
COMBINED AT	IN2RDG	.35	1	FLOW	67.	64.	60.	57.	53.	25.	22.	21.	19.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58
TED TO	RTOFF	.35	1	FLOW	64.	61.	57.	54.	51.	24.	21.	20.	19.
				TIME	3.58	3.58	3.58	3.67	3.67	3.67	3.67	3.67	3.67
ROGRAPH AT	STRKPT	.00	1	FLOW	5.	5.	4.	4.	4.	2.	2.	2.	2.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58
ROGRAPH AT	FAWN	.01	1	FLOW	7.	7.	6.	6.	6.	3.	3.	2.	2.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58
ROGRAPH AT	DAWN	.01	1	FLOW	8.	8.	7.	7.	7.	3.	3.	3.	3.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58
ROGRAPH AT	HEART	.01	1	FLOW	9.	9.	8.	8.	7.	4.	3.	3.	3.

				TIME	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58
4 COMBINED AT	RIDGE2	.02	1	FLOW	29.	28.	26.	25.	24.	12.	11.	10.	9.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58
2 COMBINED AT	EASMNT	.37	1	FLOW	94.	89.	84.	79.	74.	36.	31.	30.	27.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58
HYDROGRAPH AT	BSKY	.01	1	FLOW	12.	12.	11.	10.	10.	5.	4.	4.	4.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58



DEVELOPED OFFSITE WATERSHED MAP

(Based on PBS&J Northwest Neighborhood Master Plan)