


DS# 2128

DS INDEX 5152

APN 138013010041

PROJECT Shiloh Christian School

SUMITTAL 2nd


CITY OF LAS VEGAS INTER-OFFICE MEMORANDUM	DATE: October 30, 1997
TO: Barry Thompson, P.E. Land Development Services Department of Public Works	FROM: Dennis W. Cransky, P.E. Flood Control Project Manager Department of Public Works
SUBJECT: Drainage Study for: **Shiloh Christian School** FILE NO. \\khan\flood\Depot\DS\DS2128B.doc	COPIES TO: Alpha Engineering West Charleston Baptist Church John McNellis, P.E. Willdan Associates

FEMA Flood Zone	YES	No	X
Proposed Storm Drain	YES X	No	

HISTORY	DATE RECEIVED	DATE REVIEWED	COMMENTS	REVIEW FEES
1st Submittal	9/22/97	10/08/97	See Below	$250.00
2nd submittal	10/17/97	10/27/97	See Comments Below	$250.00
			TOTAL FEES	$500.00

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

Note: the following comments are retained from the previous memo:

1. *Developments within this area will increase the runoff into the Lone Mountain Detention Basin and must excavate 200 cubic yards per acre from the basin to accommodate this additional storage volume requirement. The owner may choose to contract to excavate the material from the basin or choose to make a contribution of $2,700 per acre to have the material removed by the City in the future. Diamond Construction is currently excavating material from the basin and could provide a letter certifying that they will remove 6,000 cy (30 acres x 200 cy), from the basin. If a certification letter is not provided, a contribution of $2,700 per acre must be made prior to the recordation of the Final Map.* ***NOTE: A proposal was included in the Addendum but it was not signed by Diamond Construction. The agreement must be finalized to be accepted.***
2. *This project benefits from the Gilmore Channel System. Developments in this area will be required to make a contribution of $7,800 per acre towards the construction of the Gilmore Channel prior to recordation of the Final Map. The contribution for this project will be 30 acres x $7,800 = $234,000.*
3. *The temporary drainage facility through the ball field area must be granted as a temporary public drainage easement to be privately maintained. The documents for this easement must be prepared and will be held by the right-of-way Section for a period of three years. If the permanent facilities controlling the drainage through the site have not been completed in that time period, the documents granting the easement will be recorded.*
4. *A copy of a notarized letter from the adjacent property owners granting permission for the off-site grading shown on the grading plans will be required for all off-site grading, filling, and rip-rap placement prior to receiving a grading permit.*

New or revised comments:

5. The calculations provided for Section 1 use a flow rate of 8 cfs. Figure 6 shows a flow of 487 at Section 1. A calculation is provided for 2 typical parking lot/driveway sections using 8 cfs and 14 cfs. There is no indication of the location of these calculations and the source of the flows. The calculation for Gowan Road uses a flow rate of 225 cfs. But Figure 6 at CP2 which is at Gowan Road shows 61 cfs. The calculations and Figure 6 must be revised to coincide. The onsite and offsite flows must be combined at the concentration points on Figure 6.
6. The grades shown at the northwest corner of the site indicate that the majority of the 487 cfs in the temporary channel will flow east in Gowan Road. An offset (1/4) crown road section must be provided in Gowan in this area. This will allow a portion of the flows to flow east in Gowan Road and the balance of the flow to weir across the centerline and flow northeast into the basin. This design must be coordinated with the Land Development section.
7. The grading elevations shown on the temporary channel through the ball fields is not correct. The existing elevation contours and the proposed grades shows grade differences as much as 9 feet. The extent of the grading must be shown and the proposed grading must tie into the existing contours.
8. The Developed on-site Drainage Map must show the off-site flows impacting the site in the interim and future conditions. The off-site flows must be combined with the onsite flows at the concentration points.

END OF REMARKS **T/R/S: 20 S/ 60 E/ 7**
dws AREA L07

Facsimile Transmission

DEPARTMENT of Public Works

To: ED TANEY

Of: ALPHA ENGINEERING

Fax Number ___/877-0300 • Phone Number ___/877-1800

From: CLV - FLOOD CONTROL / SSN

	FAX	☎ PHONE
Administration	382-0848	229-6276
☐ City Engineer Division	382-3232	229-6272
☐ Architectural Services	382-3232	229-6535
☐ Construction Services	254-4541	229-6337
☐ Engineering Design	382-3232	229-6272
☐ Land Development	383-9767	229-6371
☐ Special Improvement Districts	382-3232	229-2136
☐ Street Rehabilitation	382-3232	229-6273
☐ Survey	386-5737	229-6217
☐ Traffic/Electrical Field Operations	382-0366	229-6331
☒ Engineering Planning	382-8551	229-6541
☐ Right of Way	382-8551	229-6483
☐ Streets and Sanitation	256-7817	229-6227
☐ Traffic Engineering	366-0032	229-6327
☐ Environmental	641-9738	229-6200
☐ Water Pollution Control Facility	641-9738	229-6200
☐ Industrial Waste Pretreatment	641-9738	229-6200

(Area Code: 702)

Date: 11/01/97 Time ___:___

Page 1 of 3

Message: "SHILOH CHRISTIAN SCHOOL" DRAINAGE STUDY.

City of Las Vegas - 400 E. Stewart Avenue, Las Vegas, NV 89101

TRANSMISSION REPORT

THIS DOCUMENT (REDUCED SAMPLE ABOVE) WAS SENT

** COUNT **

3

*** SEND ***

NO	REMOTE STATION I. D.	START TIME	DURATION	#PAGES	COMMENT
1	702 877 0300	11- 3-97 10:33	2'28"	3	
		TOTAL	0:02'28"	3	

XEROX TELECOPIER 7021

ALPHA ENGINEERING

Tel: (702) 877-1300
50 South Jones, Suite 202
Las Vegas, NV 89107
Fax: (702) 877-0300

Tel: (801) 628-6500
148 East Tabernacle
St. George, UT 84770
Fax: (801) 628-6553

LETTER OF TRANSMITTAL

DATE:	**October 17, 1997**
JOB NAME:	**West Charleston Baptist Church**
JOB NUMBER:	**7161-01**
TO:	**City of Las Vegas Planning & Development**
ATTENTION:	**Dennis Stransky**
ITEMS:	**1 Addendum to the Technical Drainage Study for Shiloh Christian School; 2 blueline sets of grading plans**
COMMENTS:	**For your review and approval**
FROM:	**James Aquino**

RECEIVED BY:_____

tp

ALPHA ENGINEERING COMPANY

2128
L07
$250

ADDENDUM
TECHNICAL DRAINAGE STUDY
FOR
SHILOH CHRISTIAN SCHOOL
CITY OF LAS VEGAS, NEVADA

PREPARED FOR:
WEST CHARLESTON BAPTIST CHURCH
6701 WEST CHARLESTON BOULEVARD
LAS VEGAS, NEVADA 89102

October 15, 1997

PREPARED BY:
ALPHA ENGINEERING COMPANY
50 S. JONES BOULEVARD, SUITE 202
LAS VEGAS, NEVADA 89107

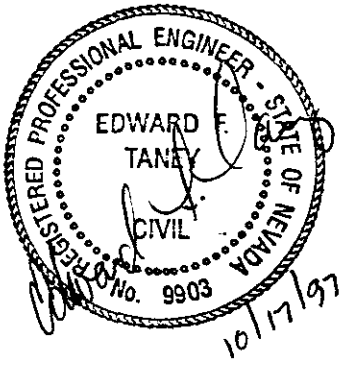
TELEPHONE (702) 877-1300
FAX (702) 877-0300

ADDENDUM
TECHNICAL DRAINAGE STUDY
FOR
SHILOH CHRISTIAN SCHOOL

Job No. 7161-01
October 15, 1997

Prepared for:

WEST CHARLESTON BAPTIST CHURCH
6701 West Charleston Boulevard
Las Vegas, Nevada 89102



Prepared by:

Alpha Engineering Company
50 South Jones, Suite 202
Las Vegas, Nevada 89107

October 15, 1997
Job No. 7161-01

Mr. Dennis Stransky, P.E.
Planning & Community Land Development
400 East Stewart
Las Vegas, Nevada 89101

SUBJECT: ADDENDUM TO THE TECHNICAL DRAINAGE STUDY FOR SHILOH CHRISTIAN SCHOOL

Dear Mr. Stransky:

Alpha Engineering Co. is pleased to submit one copy of the Addendum and two sets of the Grading Plan to the above referenced drainage study for your approval. The project site is located within a portion of North Half (N ½) of the Southwest Quarter (SW ¼) of Section 7, Township 20 South, Range 60 East, in the City of Las Vegas, Clark County, Nevada.

The Addendum is in response to the review memorandum from the City of Las Vegas dated October 9, 1997.

Comment 1: Developments within this area will increase the runoff into the Lone Mountain Detention Basin and must excavate 200 cubic yards per acre from the basin to accommodate this additional storage volume requirement. The owner may choose to contract to excavate the material form the basin or choose to make a contribution of $2,700 per acre to have the material removed by the City in the future. Diamond Construction is currently excavating material from the basin and could provide a letter certifying that they will remove 6,000 cy (30 acres x 200 cy), from the basin. If a certification letter is not provided, a contribution of $2,700 per acre must be made prior to the recordation of the Final Map.

Response 1: A certified letter from Diamond Construction has been obtained and provided in the Appendix.

Comment 2: This project benefits from the Gilmore Channel System. Developments in this area will be required to make a contribution of $7,800 per acre towards the construction of the Gilmore Channel prior to recordation of the Final Map. The contribution for this project will be 30 acres x $7,800 = $234,000.

Response 2: Noted.

Comment 3: The temporary drainage facility through the ball field area must be granted as a temporary public drainage easement to be privately maintained. The documents for

this easement must be prepared and will be held by the Right-Of-Way Section for a period of three years. If the permanent facilities controlling the drainage through the site have not been completed in that time period, the documents granting the easement will be recorded.

Response 3: Noted. Temporary drainage easement through the ball fields has been documented and attached in the Appendix.

Comment 4: The use of the discharge of 487 cfs for the west channel calculations is unclear. The HEC-1 calculation shows a flow of approximately 2000 cfs from the off-site basins impacting the site. The study indicates that 1060 cfs will be conveyed through the site. The remaining flows must be addressed and the calculations revised accordingly.

Response 4: In the HEC-1 analysis, basin OFF1 watershed has been routed through OFF2A and combined with basins OFF2 and OFF2A watershed (1547 cfs, see C1 in the HEC-1 analysis). The routing method used in this analysis was the Muskingum Method and meets the Clark County Regional Flood Control District (CCRFCD) criteria. The HEC-1 computes the channel storage and in result, the storm hydrograph shape is modified in translation along the sub-reaches. Note that upon review of the USGS Map, Figure 5, there are seven washes that are tributary branches of basin OFF1 watershed and approximately 4 washes will impact the site. Therefore, the HEC-1 model generates the total watershed affecting the site. A portion of the flow (1448 cfs, see R1 in the HEC-1 analysis) will impact the site to the west. The west channel was designed to convey a portion of the stormwater runoff (approximately 487 cfs for the 100-year, 6-hour event) from basin OFF1, OFF2A, and OFF2. An overflow section across the ball fields onsite has been designed to convey 1060 cfs (1547 cfs – 487 cfs = 1060 cfs) for the major flows generated upstream. In this analysis, Alpha Engineering did not add flows to compute approximately 2000 cfs that would impact the west boundary. The HEC-1 model has computed the total discharge of the combined basins and routing that would impact the school site to the west.

Comment 5: The grading plan must be revised to show the proposed grading around the school. Finish grades flow lines and elevations must be provided.

Response 5: The Grading Plan has been revised to show proposed grades and flow lines around the school building. Refer to the revised Grading Plan.

Comment 6: Future top of curb elevations must be provided for the north side of Gowan Road and detail A/9 must be revised accordingly. Depth of flow and d x v calculations must be provided for Gowan Road.

Response 6: Top of curb elevations (future) has been provided on the north side of Gowan Road and detail A/9 has been revised. Future flows for Gowan has been determined to be 225 cfs for the 100-year storm event. The depth of flow is 0.85 ft and a DV Product of 6.6 which meets the Clark County Regional Flood Control District (CCRFCD) criteria. Refer to the Appendix for the hydraulic calculation.

Comment 7: A copy of a notarized letter from the adjacent property owners granting permission for the off-site grading shown on the grading plans will be required for all off-site grading, filling, and rip-rap placement prior to receiving a grading permit.

Response 7: Noted. A notarized letter from FOCUS Inc. shall been obtained and forwarded to the City.

Comment 8: The Development on-site Drainage Map must show the off-site flows impacting the site in the interim and future conditions.

Response 8: The offsite flows for the interim and future conditions are provided on Figure 6, Developed Onsite Drainage Map. Refer to the Appendix for the revised Figure 6 for further information.

Comment 9: The DARF of 0.92 was applied to the on-site basin (EXON1) in the existing HEC-1 models. The DARF for the existing and developed on-site basins should be 1.0.

Response 9: The DARF value for the existing and developed onsite basins has been revised to be 1.0. The HEC-1 analysis have revised and provided in the Appendix. Refer to the HEC-1 analysis for further information. See Table 1 below for the HEC-1 results.

TABLE 1
SHILOH CHRISTIAN SCHOOL
REVISED HEC-1 ANALYSIS

BASIN ID	10-YEAR (cfs)	100-YEAR (cfs)
EXON1	19	58
*OFF2A	24	74
DEV1	3	9
DEV2	12	29
DEV3	3	8
DEV4	0	2
DEV5	4	14
CP1	15	38
CP2	22	61

*Note: In the ultimate condition, basin OFF2A area has been reduced due to the extension of the diversion berm designed by VTN.

Comment 10: Figure 6, Developed On-site Drainage Map, must be revised to include topographic information.

***Response 10*:** The Developed Onsite Drainage Map, Figure 6 has been revised to include the topographic information. Refer to the Appendix for further information.

Comment 11: The Curve Number Determination for the developed condition must be revised to account for the impermeable areas of the site.

***Response 11*:** The CN values for the developed condition has been revised to included the impervious areas (parking lots, sidewalks, school building, etc.) for basins DEV1-5. Refer to the Appendix for the calculations for the composite CN values for the developed condition. The revised composite CN values have been implemented into the revised HEC-1 model to generate the 10-year and 100-year, 6-hour storm magnitude. Refer to the Response 9 for the HEC-1 results.

The hydraulic sections (1-3) have been revised and provided in the Appendix. Table 2 below shows the results of the depth of flow, velocity, and DV Product for the revised flows for basins DEV2, 3, & 5.

TABLE 2
SHILOH CHRISTIAN SCHOOL
DEPTH OF FLOW ANALYSIS

STREET NAMES	Q100 (cfs)	VELOCITY (fps)	DEPTH (ft)	DV PRODUCT
SECTION NO. 1	8	3.16	0.55	1.7
SECTION NO. 2	14	4.78	0.66	3.2
SECTION NO. 3	29	4.33	0.42	1.8

If you have any questions or comments, please feel free to contact me at 877-1300.

Sincerely,

Alpha Engineering Co.
James M. Aquino, E.I.
Civil Designer

APPENDIX

Diamond Construction Co., Inc.

4100 EAST CHEYENNE AVENUE
LAS VEGAS, NEVADA 89115
(702) 644-1016 Office (702)644-6541 Fax

Oct 13, 1997

97-101

PROPOSAL

Proposal To:
Shilo Middle School
C/O Clay @ Alpha Engineering
Las Vegas, Nevada

Project Location:
Ln Mountain Detention Basin
Basin Excavation
Alexander / Hualapai

We propose to furnish all supervision, labor, equipment and materials to construct the items listed below for the total price listed below.

Total Job Cost $5,700.00

Five Thousand Seven Hundred Dollars and Zero Cents

Items

Item	Description	Quantity	Units	Unit Price	Extended Price
1	Basin Excavation	6,000	CY	$0.95	$5,700.00

Notes & Inclusions

All Quantities are approximate only. Field measurements will be used for billing purposes.
One Mobilization per operation. Any additional mobilizations will be $3,000.00 each occurrence.
Any Increase or Decrease to be at unit Prices. Any Supplier Increases to be passed on at time of installation.
This proposal to become a part of any and all contract documents.
This Proposal may be withdrawn after ten (10) Days.
Any Invoice with an unpaid balance after 30 days from date of invoice, will accrue a service charge of 1% per month.

Exclusions

Cleanup of Others — Construction Water & Fees
Traffic Control — Engineering, Testing, permits, and Fees.
Caliche or Rock Excavation and removal will be done on a Hourly Rental Basis

Accepted By :

Shilo Middle School

Date:

Submitted By

Jeff Craig - Estimator

Date: 10/14/97

GOWAN ROAD

150'

150'

250'

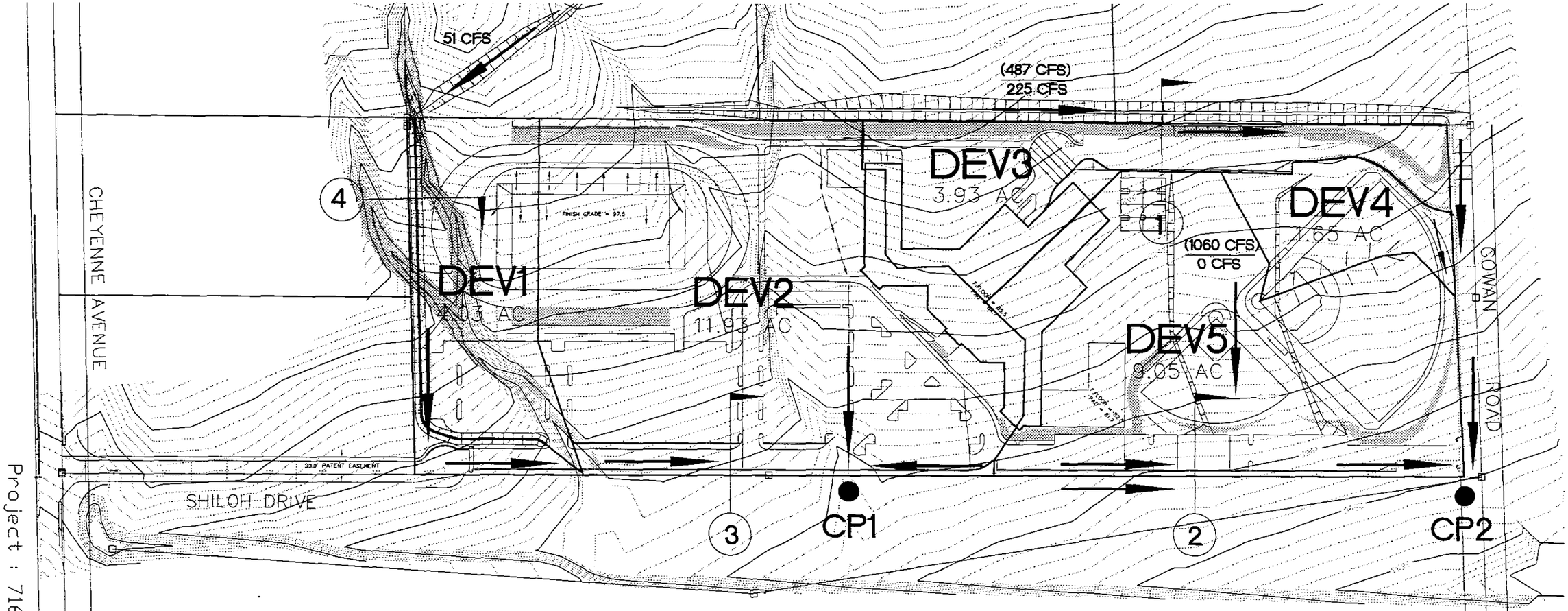
300'

400'

TEMPORARY 300 FEET DRAINAGE EASEMENT

BEING THE NORTH 300 FEET OF THE NORTH 400 FEET OF THE NORTHEAST ONE-QUARTER (NE 1/4) OF THE NORTHWEST ONE-QUARTER (NW 1/4) OF THE SOUTHWEST ONE-QUARTER (SW 1/4) OF SECTION 7, TOWNSHIP 20 SOUTH, RANGE 60 EAST, M.D.M.

SAID EASEMENT CONTAINS 4.60 ACRES, MORE OR LESS.



BASIN ID#	10-YEAR CFS	100-YEAR CFS
DEV1	3	9
DEV2	12	29
DEV3	3	8
DEV4	0	2
DEV5	4	14
CP1	15	38
CP2	22	61

DRAINAGE LEGEND

- BASIN BOUNDARY
- FLOW PATH
- CONCENTRATION POINT(s) (CP1)
- DEV1 — BASIN NAME(s)
- 23.07 AC — ACREAGE
- (487 CFS) — INTERIM CONDITION - 100 YEAR
- 225 CFS — FUTURE/ULTIMATE CONDITION - 100 YEAR

HYDRAULIC SECTIONS

(1) CROSS SECTION AND LOCATION
SEE CALCULATIONS

N

GRAPHIC SCALE

200 0 100 200 400 800

(IN FEET)
1 inch = 200 ft.

FIGURE 6

DEVELOPED ONSITE DRAINAGE MAP

ALPHA ENGINEERING
50 S. JONES, LAS VEGAS, NEVADA 89107
Telephone: (702) 877-1300

HEC-1 PARAMETERS

COMPOSITE CN DETERMINATION

DEVELOPED ONSITE BASINS

The Clark County Regional Flood Control District (CCRFCD) Manual, Table 602, 1 of 4, was utilized in determining the composite CN values for basins DEV1-5.

Cover type: Open Space (Soil Units # 502 and #152) and Impervious Areas (CN = 98);
Hydrologic Soil Group: A, B, and D.

Calculations: (Percentage of Pervious/Impervious Area) x (CN Value)

BASIN DEV1

PERVIOUS AREA	IMPERVIOUS AREA
(0.70)(79) = 55.3	(0.30)(98) = 29.4

TOTAL COMPOSITE CN = 55.3 + 29.4 = *85*

BASIN DEV2

PERVIOUS AREA	IMPERVIOUS AREA
(0.50)(77) = 38.5	(0.50)(98) = 49

TOTAL COMPOSITE CN = 38.5 + 49 = *88*

BASIN DEV3

PERVIOUS AREA	IMPERVIOUS AREA
(0.52)(74) = 38.5	(0.48)(98) = 47

TOTAL COMPOSITE CN = 38.5 + 47 = *86*

BASIN DEV4

PERVIOUS AREA	IMPERVIOUS AREA
(1.00)(74) = 74	0

TOTAL COMPOSITE CN = 74

BASIN DEV5

PERVIOUS AREA	IMPERVIOUS AREA
(0.80)(74) = 59.2	(0.20)(98) = 19.6

TOTAL COMPOSITE CN = 59.2 + 19.6 = *79*

ADJUSTED POINT RAINFALL VALUE

The project site is located within a portion of Section 7, Township 20 South, Range 60 East, M.D.M., City of Las Vegas, Nevada.

The Clark County Regional Flood Control District (CCRFCD) Manual was utilized in determining the adjusted point rainfall value.

Rainfall Depth-Duration-Frequency: (Figure 503 and 506)

10-year, 6 hour	100-year, 6 hour
1.39-inches	2.10-inches

Precipitation Adjustment Ratios: (Table 501)

10-year, 6 hour	100-year, 6 hour
1.24	1.43

Six-Hour Depth-Area-Reduction Factors: (Table 502)

The total watershed basin comprises of approximately 0.023 square miles. By interpolation with the use of Table 502; DARF $\simeq$ 0.92

Adjusted Rainfall:

BASIN OFF1

10-year, 6 hour	100-year, 6 hour
(1.24)(1.50)(0.92) = 1.71-inches	(1.43)(2.3)(0.92) = 3.03-inches

BASIN OFF2, 3

10-year, 6 hour	100-year, 6 hour
(1.24)(1.45)(0.92) = 1.65-inches	(1.43)(2.20)(0.92) = 2.89-inches

BASIN EXON1, DEV1-5

10-year, 6 hour	100-year, 6 hour
(1.24)(1.39)(1.00) = 1.72-inches	(1.43)(2.10)(1.00) = 3.00-inches

TIME OF CONCENTRATION

STANDARD FORM 4

DEVELOPMENT: SHILOH CHRISTIAN SCHOOL CALCULATED BY: JMA DATE: 10-15-97

SUB-BASIN DATA				INITIAL / OVERLAND TIME (*ti*)			TRAVEL TIME (*tt*)				*tc* CHECK (URBANIZED BASINS)		FINAL *tc*	REMARKS SHEET 1 OF 1	
DES. (1)	K (2)	AREA Ac (3a)	AREA Sq Mi (3b)	LEN Ft (4)	SLOPE % (5)	*ti* Min (6)	LEN Ft (7)	SLOPE % (8)	VEL fps (9)	*tt* Min (10)	TOTAL LENGTH Ft (11)	tc=(L/180) +10 Min (12)	Min (13)	CN (14)	TLAG (15)
	FUTURE OFFSITE														
OFF2	0.706	110.68	0.1729	500	3.00	11.01	4400	3.80	3.70	19.82	4900	37.22	30.83	83	0.308
OFF2A	0.706	49.80	0.0778	250	2.00	8.91	4000	4.00	4.00	16.67	4250	33.61	25.58	83	0.256
OFF3	0.745	28.00	0.0438	300	3.33	7.41	3400	4.00	4.00	14.17	3700	30.56	21.57	86	0.216
EXON1	0.692	30.00	0.0469	300	3.33	8.51	700	3.50	3.70	3.15	1000	15.56	11.66	82	0.117

K = 0.0132*CN-0.39

ti = 1.8(1.1-K)L^1/2/S^1/3 tc = ti + tt tl = tc*0.6

Velocity obtained from Figure 602 of the CCRFCD's Hydrologic Design and Criteria Manual.

NOTE: FOR THE FUTURE CONDITION, OFF2 AND OFF2A AREA HAS BEEN REDUCED ASSUMING THAT VTN'S DIVERSION BERM HAS BEEN EXTENDED TO GOWAN ROAD.

EXISTING/FUTURE OFFSITE/ONSITE AND DEVELOPED ONSITE HEC-1 ANALYSIS (REVISED)

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1*************************************
*                                   *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*            SEPTEMBER 1990         *
*             VERSION 4.0           *
*                                   *
*  RUN DATE  10/15/1997  TIME  10:03:29 *
*                                   *
*************************************
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*************************************
*                                   *
*    U.S. ARMY CORPS OF ENGINEERS     *
*    HYDROLOGIC ENGINEERING CENTER    *
*          609 SECOND STREET          *
*       DAVIS, CALIFORNIA 95616       *
*           (916) 756-1104            *
*                                   *
*************************************
```


SHILOH CHRISTIAN SCHOOL
EXISTING/FUTURE OFFSITE/ONSITE
AND
DEVELOPED CONDITION
(REVISED)

```
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

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

          *DIAGRAM
    1     ID      ALPHA ENGINEERING, INC.
    2     ID      TECHNICAL DRAINAGE STUDY FOR SHILOH CHRISTIAN SCHOOL
    3     ID      JOB NO. 7161-01
    4     ID      CITY OF LAS VEGAS
    5     ID
    6     ID      EXISTING & FUTURE OFFSITE/ONSITE AND DEVELOPED ONSITE CONDITIONS
    7     ID
    8     ID      INPUT FILE: SHILOH.DAT
    9     ID      OUTPUT FILE: SHILOH.OUT
   10     ID
   11     ID      *************************************************************
   12     ID      *       DRAINAGE BASINS AREA IS LESS THAN 1 SQ MI           *
   13     ID      *       DEPTH-DURATION-FREQUENCY VALUE = 3.03 INCH          *
   14     ID      *       DEPTH-AREA-REDUCTION VALUE = 0.98                   *
   15     ID      *       STORM DISTRIBUTION NUMER 3                          *
   16     ID      *       ABSTRACTION METHOD: SCS                             *
   17     ID      *       ROUTING METHOD: MUSKINGUN, KINEMATIC                *
   18     ID      *       RATIO 1 = 10-YEAR                                   *
   19     ID      *       RATIO 2 = 100-YEAR                                  *
   20     ID      *************************************************************
   21     ID
   22     IT       5       0       0     300
   23     IO       5
   24     IN       5
   25     JR    PREC     .56     1.0
          * EXISTING OFFSITE/ONSITE CONDITION - THREE TRIBUTARY BASIN : OFF1, OFF2, OFF3;*

   26     KK    OFF1
   27     KM    EXISTING OFFSITE BASIN 1
   28     BA    2.31
   29     PB    3.03
   30     PC    .000    .020    .057    .076    .087    .106    .124    .130    .130    .130
   31     PC    .130    .130    .130    .133    .140    .142    .148    .156    .172    .181
   32     PC    .190    .197    .199    .200    .201    .204    .214    .229    .241    .249
   33     PC    .251    .256    .270    .278    .281    .283    .295    .322    .352    .409
   34     PC    .499    .590    .710    .744    .781    .812    .819    .835    .851    .856
   35     PC    .860    .866    .876    .886    .910    .926    .937    .950    .970    .976
   36     PC    .982    .985    .987    .989    .990    .993    .993    .994    .995    .998
   37     PC    .998    .999    1.00
   38     LS       0      86
   39     UD    .580

   40     KK      R1
   41     KM   ROUTING BASIN OFF1 WATERSHED THROUGH BASIN OFF2
   42     RM       2   0.481    0.15

   43     KK    OFF2
   44     KM    EXISTING OFFSITE BASIN 2
   45     PB    2.89
   46     BA    .399
   47     LS       0      83
   48     UD    .452
```

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

  49      KK      C1
  50      KM   COMBINE ROUTED FLOW AND BASIN OFF2
  51      HC       2

  52      KK      R2
  53      KM   ROUTING COMBINED FLOW THRU EXON1 - USING KINEMATIC ROUTING
  54      RK     700    .043    .025           TRAP      15       2

  55      KK    OFF3
  56      KM   EXISTING OFFSITE BASIN 3
  57      BA    .044
  58      LS       0      86
  59      UD    .216

  60      KK      R3
  61      KM   ROUTING OFF3 RUNOFF THRU BASIN EXON1 - USING KINEMATIC ROUTING
  62      RK    1990    .025    .025           TRAP      15       2

  63      KK   EXON1
  64      KM    EXISTING ONSITE BASIN 1
  65      PB    3.00
  66      BA    .047
  67      LS       0      82
  68      UD    .117

  69      KK     CP1
  70      KM   COMBINE ALL ROUTED FLOWS AND BASIN EXON1 RUNOFF TO CONCENTRATION POINT 1 (CP1
  71      HC       3
          * FUTURE CONDITION - DIVERSION BERM IN PLACE UPSTREAM DESIGN BY VTN NEVADA *
          * REFER TO VTN'S STUDY - SHADOW HILLS UNIT 1 *

  72      KK    OFF1
  73      KM    EXISTING OFFSITE BASIN 1
  74      BA    2.31
  75      PB    3.03
  76      LS       0      86
  77      UD    .560

  78      KK      R1
  79      KM   ROUTING BASIN OFF1 WATERSHED THROUGH BASIN OFF2
  80      RM       2   0.481    0.15

  81      KK   OFF2A
  82      KM   EXISTING OFFSITE BASIN 2A
  83      PB    2.89
  84      BA    .248
  85      LS       0      83
  86      UD    .452
          * NOTE THAT BASIN OFF2 (FROM EXISTING) HAS BEEN SUBDIVIDED INTO TWO BASINS - *
          * OFF2 AND OFF2A *
```

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

  87      KK    OFF2
  88      KM   EXISTING OFFSITE BASIN 2
  89      BA    .151
  90      LS       0      83
  91      UD    .256

  92      KK      C1
  93      KM   COMBINE BASIN OFF2 AND OFF2A RUNOFF TO C1
  94      HC       3

  95      KK      R2
  96      KM   ROUTING COMBINED FLOW THRU EXON1 - USING KINEMATIC ROUTING
  97      RK     700    .043    .025            TRAP      15       2

  98      KK    OFF3
  99      KM   EXISTING OFFSITE BASIN 3
 100      BA    .044
 101      LS       0      86
 102      UD    .216

 103      KK      R3
 104      KM   ROUTING OFF3 RUNOFF THRU BASIN EXON1 - USING KINEMATIC ROUTING
 105      RK    1990    .025    .025            TRAP      15       2

 106      KK   EXON1
 107      KM   EXISTING ONSITE BASIN 1
 108      PB    3.06
 109      BA    .047
 110      LS       0      82
 111      UD    .117

 112      KK     CP1
 113      KM   COMBINE ALL ROUTED FLOWS AND BASIN EXON1 RUNOFF TO CP1
 114      HC       3
          * IN THE ULTIMATE CONDITION, ASSUMING VTN'S DIVERSION BERM HAS BEEN EXTENDED *
          * TO GOWAN ROAD *

 115      KK * OFF2A
 116      KM   EXISTING OFFSITE BASIN 2A
 117      BA    .078
 118      LS       0      83
 119      UD   0.256
          *
          * DEVELOPED ONSITE CONDITION - SHILOH CHRISTIAN SCHOOL SITE *

 120      KK    DEV1
 121      KM   DEVELOPED ONSITE BASIN 1
 122      BA   .0063
 123      LS       0      85
 124      UD    .111
```

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

  125     KK      R1
  126     KM    ROUTING DEV1 RUNOFF TO CP1
  127     RK     350    .020    .022            TRAP       2       4

  128     KK    DEV2
  129     KM   DEVELOPED ONSITE BASIN 2
  130     BA   .0186
  131     LS       0      88
  132     UD    .118

  133     KK     CP1
  134     KM   COMBINE ROUTED FLOW AND DEV2 RUNOFF
  135     HC       2

  136     KK      R2
  137     KM   ROUTING COMBINED FLOWS (CP1) TO CP2
  138     RK    1170    .020    .022            TRAP       2       4

  139     KK    DEV5
  140     KM   DEVELOPED ONSITE BASIN 5
  141     BA   .0141
  142     LS       0      79
  143     UD    .167

  144     KK    DEV3
  145     KM   DEVELOPED ONSITE BASIN 3
  146     BA   .0061
  147     LS       0      56
  148     UD    .172

  149     KK    DEV4
  150     KM   DEVELOPED ONSITE BASIN 4
  151     BA   .0026
  152     LS       0      74
  153     UD    .122

  154     KK      C1
  155     KM * COMBINE DEV3 & 4 RUNOFF
  156     HC       2

  157     KK      R3
  158     KM   ROUTING C1 RUNOFF TO CP2
  159     RK     500    .025    .017            TRAP      30       5

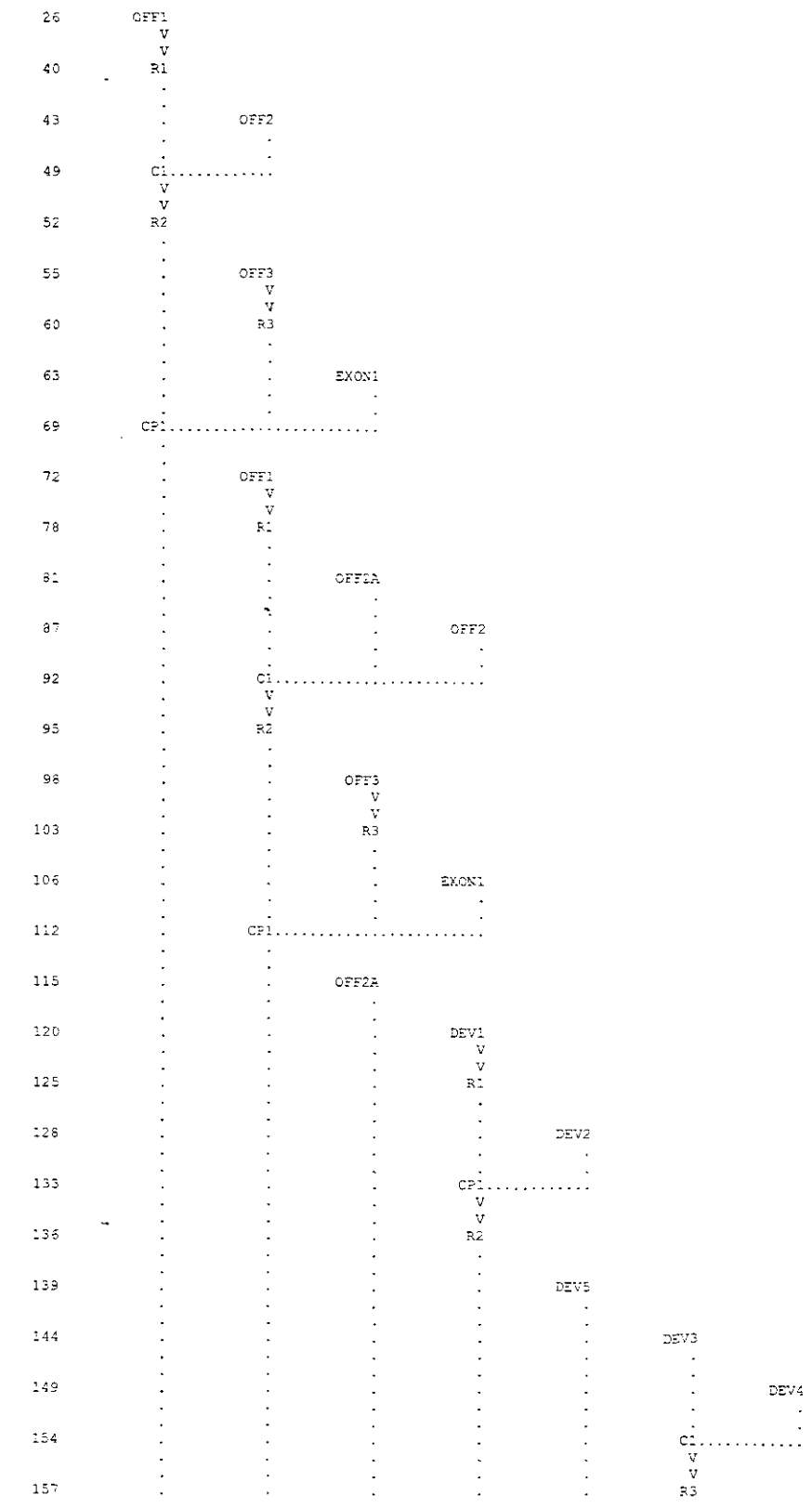
  160     KK     CP2
  161     KM   COMBINE ALL ROUTED FLOWS TO CP2
  162     HC       3
  163     ZZ
```

1

SCHEMATIC DIAGRAM OF STREAM NETWORK

INPUT LINE NO.

(V) ROUTING (.) CONNECTOR (---->) DIVERSION OR PUMP FLOW (<----) RETURN OF DIVERTED OR PUMPED FLOW



```
                .         .         .         .         .         .
                .         .         .         .         .         .
160             .         .         .       CP2.....................
```

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

```
1*************************************                 *************************************
*                                   *                 *                                   *
*   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  10/15/1997  TIME  10:03:29*                 *         (916) 756-1104            *
*                                   *                 *                                   *
*************************************                 *************************************
```

ALPHA ENGINEERING, INC.
TECHNICAL DRAINAGE STUDY FOR SHILOH CHRISTIAN SCHOOL
JOB NO. 7161-01
CITY OF LAS VEGAS

EXISTING & FUTURE OFFSITE/ONSITE AND DEVELOPED ONSITE CONDITIONS

INPUT FILE: SHILOH.DAT
OUTPUT FILE: SHILOH.OUT

```
*************************************************************************
*       DRAINAGE BASINS AREA IS LESS THAN 1 SQ MI                       *
*       DEPTH-DURATION-FREQUENCY VALUE = 3.03 INCH                      *
*       DEPTH-AREA-REDUCTION VALUE = 0.92                               *
*       STORM DISTRIBUTION NUMER 3                                      *
*       ABSTRACTION METHOD: SCS                                         *
*       ROUTING METHOD: MUSKINGUN, KINEMATIC                            *
*       RATIO 1 = 10-YEAR                                               *
*       RATIO 2 = 100-YEAR                                              *
*************************************************************************
```

```
23 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
                  .56      1.00
```

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

OPERATION	STATION	AREA	PLAN		RATIOS APPLIED TO PRECIPITATION RATIO 1 .56	RATIO 2 1.00
HYDROGRAPH AT						
+	OFF1	2.31	1	FLOW	657.	1747.
				TIME	4.08	4.00
ROUTED TO						
+	R1	2.31	1	FLOW	541.	1448.
				TIME	4.50	4.50
HYDROGRAPH AT						
+	OFF2	.40	1	FLOW	92.	285.
				TIME	3.92	3.92
2 COMBINED AT						
+	C1	2.71	1	FLOW	584.	1567.
				TIME	4.50	4.42
ROUTED TO						
+	R2	2.71	1	FLOW	583.	1565.
				TIME	4.50	4.42
HYDROGRAPH AT						
+	OFF3	.04	1	FLOW	19.	50.
				TIME	3.67	3.67
ROUTED TO						
+	R3	.04	1	FLOW	18.	50.
				TIME	3.75	3.67
HYDROGRAPH AT						
+	EXON1	.05	1	FLOW	19.	58.
				TIME	3.58	3.58
3 COMBINED AT						
+	CP1	2.80	1	FLOW	590.	1583.
				TIME	4.50	4.50
HYDROGRAPH AT						
+	OFF1	2.31	1	FLOW	657.	1747.
				TIME	4.08	4.00
ROUTED TO						
+	R1	2.31	1	FLOW	541.	1448.
				TIME	4.50	4.50
HYDROGRAPH AT						
+	OFF2A	.25	1	FLOW	57.	177.
				TIME	3.92	3.92
HYDROGRAPH AT						
+	OFF2	.15	1	FLOW	46.	142.
				TIME	3.75	3.67
3 COMBINED AT						
+	C1	2.71	1	FLOW	578.	1547.
				TIME	4.50	4.50
ROUTED TO						
+	R2	2.71	1	FLOW	577.	1547.
				TIME	4.50	4.50
HYDROGRAPH AT						
+	OFF3	.04	1	FLOW	19.	50.
				TIME	3.67	3.67
ROUTED TO						
+	R3	.04	1	FLOW	18.	50.
				TIME	3.75	3.67
HYDROGRAPH AT						
+	EXON1	.05	1	FLOW	19.	58.
				TIME	3.58	3.58
3 COMBINED AT						
+	CP1	2.50	1	FLOW	584.	1564.
				TIME	4.50	4.50
HYDROGRAPH AT						
+	OFF2A	.08	1	FLOW	26.	78.
				TIME	3.75	3.67
HYDROGRAPH AT						
+	DEV1	.01	1	FLOW	3.	9.
				TIME	3.58	3.58

ROUTED TO						
+	R1	.01	1	FLOW	3.	9.
				TIME	3.58	3.58
HYDROGRAPH AT						
+	DEV2	.02	1	FLOW	12.	29.
				TIME	3.58	3.58
2 COMBINED AT						
+	CP1	.02	1	FLOW	15.	38.
				TIME	3.58	3.58
ROUTED TO						
+	R2	.02	1	FLOW	15.	38.
				TIME	3.58	3.58
HYDROGRAPH AT						
+	DEV5	.01	1	FLOW	4.	14.
				TIME	3.58	3.58
HYDROGRAPH AT						
+	DEV3	.01	1	FLOW	3.	8.
				TIME	3.58	3.58
HYDROGRAPH AT						
+	DEV4	.00	1	FLOW	0.	2.
				TIME	3.58	3.58
2 COMBINED AT						
+	C1	.01	1	FLOW	4.	10.
				TIME	3.58	3.58
ROUTED TO						
+	R3	.01	1	FLOW	3.	10.
				TIME	3.67	3.58
3 COMBINED AT						
+	CP2	.05	1	FLOW	22.	61.
				TIME	3.58	3.58

1

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

ISTAQ	ELEMENT	DT	PEAK	TIME TO PEAK	VOLUME	INTERPOLATED TO COMPUTATION INTERVAL DT	PEAK	TIME TO PEAK	VOLUME
		(MIN)	(CFS)	(MIN)	(IN)	(MIN)	(CFS)	(MIN)	(IN)
FOR PLAN = 1 RATIO= .86									
R2	MANE	.32	583.26	270.21	.60	5.00	583.05	270.00	.60

CONTINUITY SUMMARY (AC-FT) - INFLOW= .8678E-02 EXCESS= .0000E+00 OUTFLOW= .8678E-02 BASIN STORAGE= .6987E-07 PERCENT ERROR= .0

FOR PLAN = 1 RATIO= 1.00									
R2	MANE	.13	1566.84	265.35	1.64	5.00	1565.07	265.00	1.64

CONTINUITY SUMMARY (AC-FT) - INFLOW= .2369E-03 EXCESS= .0000E+00 OUTFLOW= .2369E-03 BASIN STORAGE= .7647E-07 PERCENT ERROR= .0

FOR PLAN = 1 RATIO= .56									
R3	MANE	1.80	18.63	224.25	.57	5.00	18.41	225.00	.57

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1343E-01 EXCESS= .0000E+00 OUTFLOW= .1348E-01 BASIN STORAGE= .2142E-05 PERCENT ERROR= -.2

FOR PLAN = 1 RATIO= 1.00									
R3	MANE	1.44	50.15	222.78	1.57	5.00	49.64	220.00	1.57

CONTINUITY SUMMARY (AC-FT) - INFLOW= .3681E-01 EXCESS= .0000E+00 OUTFLOW= .3686E-01 BASIN STORAGE= .2079E-05 PERCENT ERROR= -.1

FOR PLAN = 1 RATIO= .56									
R2	MANE	.32	577.58	270.47	.60	5.00	577.08	270.00	.60

CONTINUITY SUMMARY (AC-FT) - INFLOW= .8678E-02 EXCESS= .0000E+00 OUTFLOW= .8678E-02 BASIN STORAGE= .7718E-07 PERCENT ERROR= .0

FOR PLAN = 1 RATIO= 1.00									
R2	MANE	.15	1546.92	270.12	1.64	5.00	1546.82	270.00	1.64

CONTINUITY SUMMARY (AC-FT) - INFLOW= .2369E-03 EXCESS= .0000E+00 OUTFLOW= .2369E-03 BASIN STORAGE= .7647E-07 PERCENT ERROR= .0

FOR PLAN = 1 RATIO= .56									
R3	MANE	1.80	18.63	224.25	.57	5.00	18.41	225.00	.57

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1343E-01 EXCESS= .0000E+00 OUTFLOW= .1345E-01 BASIN STORAGE= .2142E-05 PERCENT ERROR= -.2

FOR PLAN = 1 RATIO= 1.00									
R3	MANE	1.44	50.15	222.78	1.57	5.00	49.64	220.00	1.57

CONTINUITY SUMMARY (AC-FT) - INFLOW= .3681E-01 EXCESS= .0000E+00 OUTFLOW= .3686E-01 BASIN STORAGE= .2079E-05 PERCENT ERROR= -.1

FOR PLAN = 1 RATIO= .56									
R1	MANE	.48	3.30	218.42	.57	5.00	3.28	215.00	.57

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1914E-00 EXCESS= .0000E-00 OUTFLOW= .1915E-00 BASIN STORAGE= .1883E-10 PERCENT ERROR= .0

FOR PLAN = 1 RATIO= 1.00									
R1	MANE	.48	8.82	215.04	1.59	5.00	8.82	215.00	1.59

CONTINUITY SUMMARY (AC-FT) - INFLOW= .5836E-00 EXCESS= .0000E-00 OUTFLOW= .5837E-00 BASIN STORAGE= .2502E-10 PERCENT ERROR= .0

FOR PLAN = 1 RATIO= .56									
R2	MANE	1.01	15.22	216.74	.66	5.00	14.89	215.00	.66

CONTINUITY SUMMARY (AC-FT) - INFLOW= .9006E-00 EXCESS= .0000E-00 OUTFLOW= .9015E-00 BASIN STORAGE= .1955E-08 PERCENT ERROR= -.1

FOR PLAN = 1 RATIO= 1.00									
R2	MANE	.61	37.73	215.69	1.76	5.00	37.53	215.00	1.76

CONTINUITY SUMMARY (AC-FT) - INFLOW= .2838E-01 EXCESS= .0000E-00 OUTFLOW= .2841E-01 BASIN STORAGE= .2441E-08 PERCENT ERROR= -.1

FOR PLAN = 1 RATIO= .56

```
                R3  MANE          .87       3.47    217.24       .50       5.00       3.37    220.00          .50

CONTINUITY SUMMARY (AC-FT) - INFLOW= .2296E-00 EXCESS= .0000E+00 OUTFLOW= .2298E+00 BASIN STORAGE= .2360E-07 PERCENT ERROR=   -.1

          FOR PLAN = 1  RATIO= 1.00
                R3  MANE          .60      10.30    216.26      1.44       5.00      10.00    215.00         1.44

CONTINUITY SUMMARY (AC-FT) - INFLOW= .6668E+00 EXCESS= .0000E-00 OUTFLOW= .6673E+00 BASIN STORAGE= .1830E-07 PERCENT ERROR=   -.1


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

HYDRAULIC ANALYSIS

HYDRAULIC SECTION NO. 1
Worksheet for Irregular Channel

Project Description	
Project File	c:\james\hydrology\shiloh\typ_sect.fm2
Worksheet	DEV3 - Q100 = 8 CFS
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Input Data		
Channel Slope	0.007500	ft/ft
Discharge	8.00	cfs

Elevation range: 0.00 ft to 3.23 ft.

Station (ft)	Elevation (ft)	Start Station	End Station	Roughness
0.00	3.23	0.00	0.00	0.013
0.00	2.73	0.00	63.50	0.017
63.50	0.17	63.50	65.00	0.013
63.50	0.13	65.00	70.00	0.022
65.00	0.00			
65.00	0.50			
70.00	0.60			

Results		
Wtd. Mannings Coefficient	0.013	
Water Surface Elevation	0.55	ft
Flow Area	2.53	ft²
Wetted Perimeter	13.72	ft
Top Width	13.16	ft
Height	0.55	ft
Critical Depth	0.59	ft
Critical Slope	0.004568	ft/ft
Velocity	3.16	ft/s
Velocity Head	0.15	ft
Specific Energy	0.70	ft
Froude Number	1.27	
Flow is supercritical.		

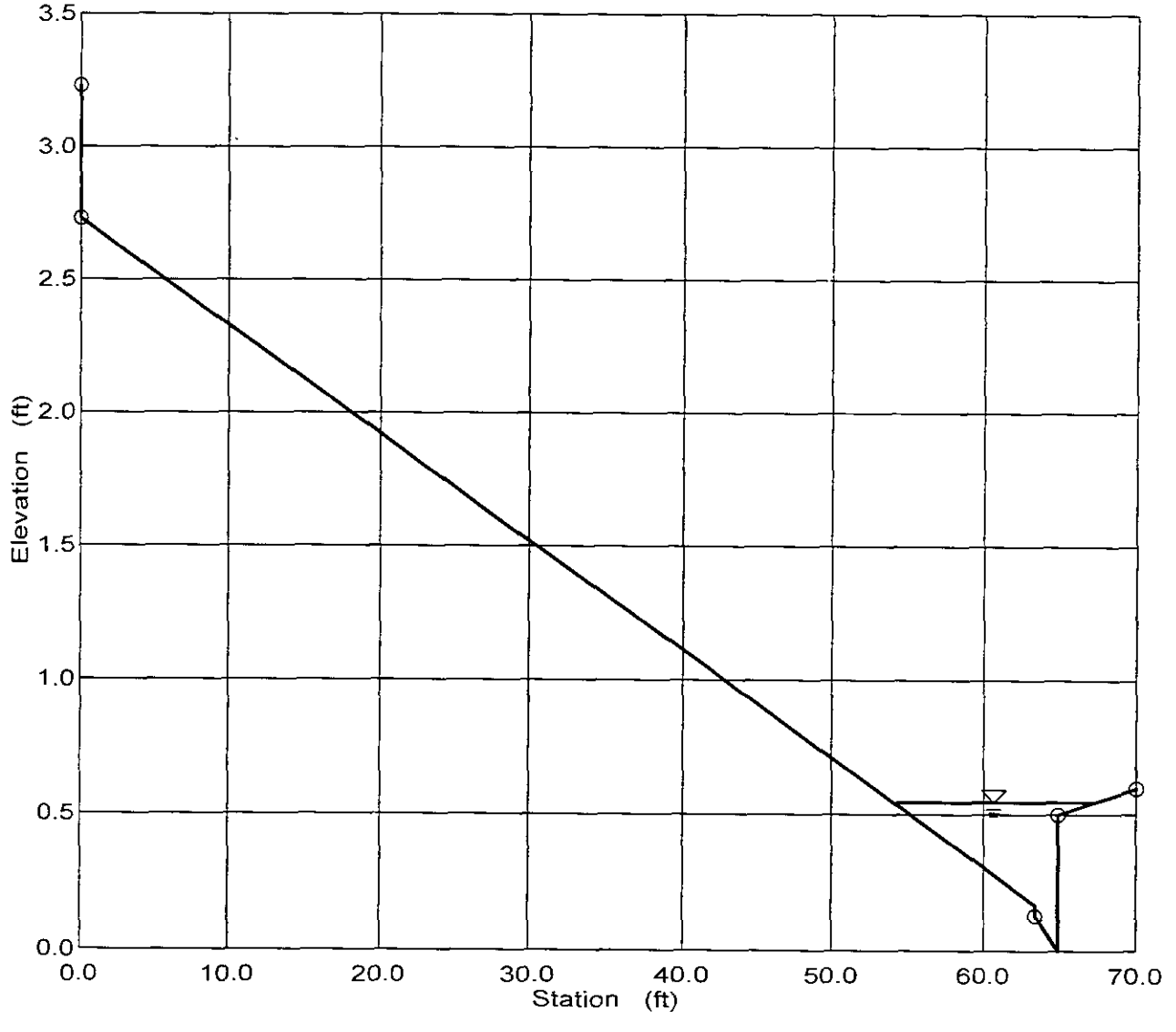
Notes:

DV PRODUCT IS 1.7 < 8.0 O.K.
DEPTH OF FLOW IS 0.55' < 2.0 O.K.

TYP PARKING LOT/DRIVEWAY SECTION
Cross Section for Irregular Channel

Project Description	
Project File	c:\james\hydrology\shiloh\typ_sect.fm2
Worksheet	DEV3 - Q100 = 8 CFS
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Section Data		
Wtd. Mannings Coefficient	0.013	
Channel Slope	0.007500	ft/ft
Water Surface Elevation	0.55	ft
Discharge	8.00	cfs



HYDRAULIC SECTION NO. 2
Worksheet for Irregular Channel

Project Description	
Project File	c:\james\hydrology\shiloh\typ_sect.fm2
Worksheet	DEV5 - Q100 = 14 CFS
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Input Data		
Channel Slope	0.013000	ft/ft
Elevation range: 0.00 ft to 4.36 ft.		

Station (ft)	Elevation (ft)	Start Station	End Station	Roughness
0.00	4.36	0.00	0.50	0.013
0.50	4.34	0.50	61.50	0.017
0.50	3.85	61.50	63.50	0.013
61.50	0.17			
61.50	0.13			
63.00	0.00			
63.00	0.50			
63.50	0.51			

Discharge	14.00	cfs

Results		
Wtd. Mannings Coefficient	0.015	
Water Surface Elevation	0.66	ft
Flow Area	2.93	ft²
Wetted Perimeter	10.79	ft
Top Width	10.08	ft
Height	0.66	ft
Critical Depth	0.77	ft
Critical Slope	0.005207	ft/ft
Velocity	4.78	ft/s
Velocity Head	0.35	ft
Specific Energy	1.01	ft
Froude Number	1.56	
Flow is supercritical.		
Water elevation exceeds lowest end station by 0.15 ft.		

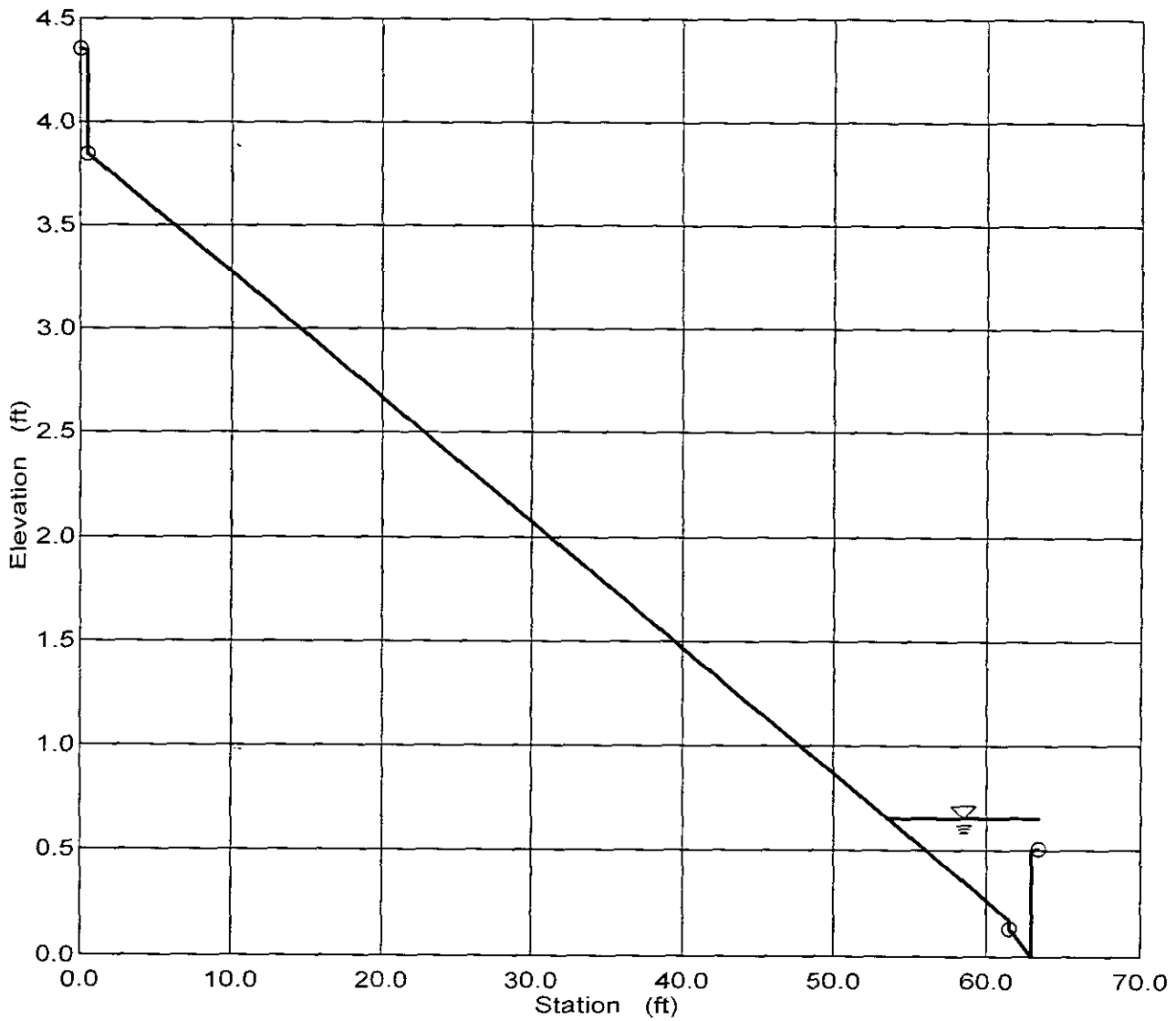
Notes:

DV PRODUCT IS 3.2 < 8.0 O.K.
DEPTH OF FLOW IS 0.66' < 2.0 O.K.
NOTE: VELOCITY DOES NOT EXCEED 5 FPS, THEREFORE VELOCITY IS NOT EROSIVE.

TYP PARKING LOT/DRIVEWAY SECTION
Cross Section for Irregular Channel

Project Description	
Project File	c:\james\hydrology\shiloh\typ_sect.fm2
Worksheet	DEV5 - Q100 = 14 CFS
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Section Data		
Wtd. Mannings Coefficient	0.015	
Channel Slope	0.013000	ft/ft
Water Surface Elevation	0.66	ft
Discharge	14.00	cfs



HYDRAULIC SECTION NO. 3
Worksheet for Irregular Channel

Project Description	
Project File	c:\james\hydrology\shiloh\typ_sect.fm2
Worksheet	DEV2 - Q100 = 29 CFS
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Input Data		
Channel Slope	0.016000	ft/ft

Elevation range: 0.00 ft to 0.95 ft.

Station (ft)	Elevation (ft)	Start Station	End Station	Roughness
0.00	0.95	0.00	12.00	0.013
12.00	0.71	12.00	38.50	0.017
12.00	0.21	38.50	40.50	0.013
38.50	0.17			
38.50	0.13			
40.00	0.00			
40.00	0.50			
40.50	0.51			

Discharge	29.00	cfs

Results		
Wtd. Mannings Coefficient	0.016	
Water Surface Elevation	0.42	ft
Flow Area	6.70	ft²
Wetted Perimeter	28.68	ft
Top Width	28.00	ft
Height	0.42	ft
Critical Depth	0.51	ft
Critical Slope	0.006114	ft/ft
Velocity	4.33	ft/s
Velocity Head	0.29	ft
Specific Energy	0.71	ft
Froude Number	1.56	
Flow is supercritical.		

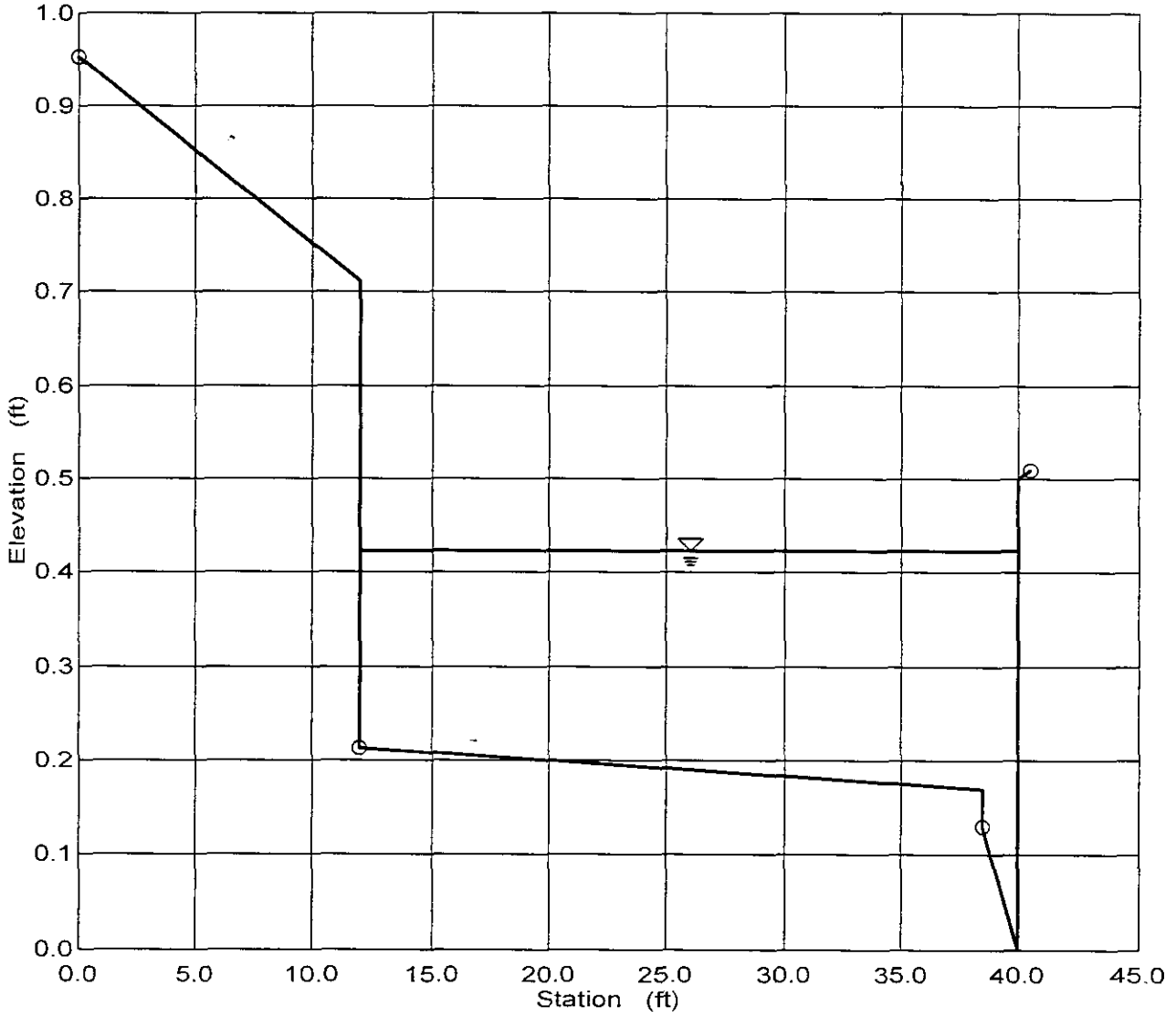
Notes:

DV PRODUCT IS 1.8 < 8.0 O.K.
DEPTH OF FLOW IS 0.42' < 2.0' O.K.

TYP PARKING LOT/DRIVEWAY SECTION
Cross Section for Irregular Channel

Project Description	
Project File	c:\james\hydrology\shiloh\typ_sect.fm2
Worksheet	DEV2 - Q100 = 29 CFS
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Section Data		
Wtd. Mannings Coefficient	0.016	
Channel Slope	0.016000	ft/ft
Water Surface Elevation	0.42	ft
Discharge	29.00	cfs



GOWAN ROAD - Q100 = 225 CFS
Worksheet for Irregular Channel

Project Description	
Project File	c:\james\hydrology\shiloh\typ_sect.fm2
Worksheet	TYP 80' R/W -NORMAL CROWN- "L" CURB
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Discharge

Input Data		
Channel Slope	0.025000	ft/ft
Water Surface Elevation	0.85	ft

Elevation range: 0.00 ft to 2.00 ft.

Station (ft)	Elevation (ft)	Start Station	End Station	Roughness
0.00	2.00	0.00	7.01	0.013
0.01	0.60	7.01	72.99	0.016
5.00	0.50	72.99	80.00	0.013
5.50	0.50			
5.51	0.00			
7.00	0.13			
7.01	0.17			
40.00	0.83			
72.99	0.17			
73.00	0.13			
74.49	0.00			
74.50	0.50			
75.00	0.50			
79.99	0.60			
80.00	2.00			

Results		
Wtd. Mannings Coefficient	0.015	
Discharge	225.36	cfs
Flow Area	29.12	ft²
Wetted Perimeter	81.56	ft
Top Width	79.98	ft
Height	0.85	ft
Critical Depth	1.12	ft
Critical Slope	0.004150	ft/ft
Velocity	7.74	ft/s
Velocity Head	0.93	ft
Specific Energy	1.78	ft
Froude Number	2.26	
Flow is supercritical.		

Notes: DV PRODUCT IS 6.6 < 8.0 O.K.
DEPTH OF FLOW IS 0.85' < 2.0 O.K.
A FLOW OF 225 CFS (ULTIMATE CONDITION) GENERATED BY OFF2 AND OFF2A WAS UTILIZED.

TYP GOWAN ROAD SECTION
Cross Section for Irregular Channel

Project Description	
Project File	c:\james\hydrology\shiloh\typ_sect.fm2
Worksheet	TYP 80' R/W -NORMAL CROWN- "L" CURB
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Discharge

Section Data		
Wtd. Mannings Coefficient	0.015	
Channel Slope	0.025000	ft/ft
Water Surface Elevation	0.85	ft
Discharge	225.36	cfs