City of Albuquerque

P.O. BOX 1293 ALBUQUERQUE, NEW MEXICO 87103

January 13, 1994

Paul T. Brasher, P.E.
Brasher Engineering, Inc.
11930 Menaul NE #113
Albuquerque, N.M. 87112

RE: ENGINEER'S CERTIFICATION FOR ALBUQUERQUE RANCH ESTATES (E-22/D13)
RECEIVED JANUARY 12, 1994 FOR FINANCIAL GUARANTY RELEASE
ENGINEER'S STAMP DATED 8-30-93

Dear Mr. Lorenz:

Based on the information included in the submittal referenced above, City Hydrology releases the Financial Guaranty for this project.

If I can be of further assistance, You may contact me at 768-2727.

Sincerely,

John P. Curtin

John P. Curtin, P.E.
Civil Engineer/Hydrology

xc: Linda-Michelle DeVanti, City Project #4310.90

WPHYD/3796/jpc

City of Albuquerque

P.O. BOX 1293 ALBUQUERQUE, NEW MEXICO 87103

September 27, 1993

LETTER OF ACCEPTANCE

Ricardo Roybal
City of Albuquerque
P.O. Box 1293
Albuquerque, NM 87103

RE: PROJECT NO. 4310.8 , ALBUQUERQUE RANCH ESTATES
MAP (E-22)

Dear Mr. Roybal:

This is to certify that the construction of the infrastructure listed below has been completed and accepted.

The Project is described as follows:

- Installation of the water and Sanitary Sewer mains on Royal Oak Street N.E. and Walkerway N.E. as shown on the plat of lots 1-12 and tract A-1 Albuquerque Ranch Estates

- Installation of two sidewalks culverts on Royal Oak Avenue at the two channels west of Albuquerque Ranch Estates.

Sincerely,

Russell B. Givler

Russell Givler,
Chief Construction Engineer
Public Works Department

RECEIVED
OCT 5 1993
HYDROLOGY

ALBUQUERQUE NEW MEXICO 1706

City of Albuquerque

P.O. BOX 1293 ALBUQUERQUE, NEW MEXICO 87103

March 15, 1993

Dennis A. Lorenz, P.E.
Brasher Engineering, Inc.
11930 Menaul NE #113
Albuquerque, N.M. 87112

RE: DRAINAGE REPORT FOR ALBUQUERQUE RANCH ESTATES (E-22/D13)
RECEIVED MARCH 11, 1993 FOR FINAL PLAT APPROVAL
STAMPED & DATED 3-11-93

Dear Mr. Lorenz:

Based on the information included in the submittal referenced above, City Hydrology APPROVES this project for Final Plat.

Engineer's Certification of grades in accordance with the DPM checklist will be required before release of the Financial Guaranty.

If I can be of further assistance, You may contact me at 768-2727.

Sincerely,

John P. Curtin

John P. Curtin, P.E.
PWD/Hydrology

xc: Fred Aguirre, DRB

WPHYD+3796;jpc

City of Albuquerque

P.O. BOX 1293 ALBUQUERQUE, NEW MEXICO 87103

March 4, 1993

Dennis A. Lorenz, P.E.
Brasher Engineering, Inc.
11930 Menaul NE #113
Albuquerque, N.M. 87112

RE: DRAINAGE REPORT FOR ALBUQUERQUE RANCH ESTATES (E-22/D13)
RECEIVED FEBRUARY 24, 1993 FOR ROUGH GRADING APPROVAL
STAMPED & DATED 1-22-93

Dear Mr. Lorenz:

Based on the information included in the submittal referenced above, City Hydrology APPROVES this project for Rough Grading.

Include the Grading & Erosion Control Plan in the set of construction documents that you submit for Work Order.

A Topsoil Disturbance Permit must be obtained from the Environmental Health Division prior to performing any earthwork operations.

If you have any questions about this project, you may contact me at 768-2727.

Sincerely,

John P. Curtin, P.E.
PWD/Hydrology

xc: Alan Martinez, Permits
Fred Aguirre, DRB
Larry Caudill, EHD

WPHYD+3796;jpc

DRAINAGE REPORT

FOR

ALBUQUERQUE RANCH ESTATES

PREPARED FOR:

B & A DEVELOPMENT CORPORATION
P.O. Box 3671
Albuquerque, New Mexico 87190

Prepared by:

BRASHER ENGINEERING, INC.
11930 Menaul Boulevard NE Suite 113
Albuquerque, New Mexico 87112

November 1992

DENNIS A. LORENZ
NEW MEXICO
9647
REGISTERED PROFESSIONAL ENGINEER

01-27-93
03-01-93

COMPARISON

AP	Existing Q100	Proposed Q100	Exist d100	Prop. d100	Exist. $d+V^2/2g$	Exist. $V^2/2g$	Prop. $d+V^2/2g$	Prop. $V^2/2g$	Δ $d+V^2/2g$
Basin B									
1	35.1	45.0	.44	.48	.96	.52	1.10	.62	+.14'
2	49.2	62.9	.45	.48	1.28	.83	1.48	1.00	+.20
3	60.5	73.1	.54	.56	1.18	.64	1.30	0.74	+.12
4	80.6	93.2	.55	.58	1.62	1.07	1.70	1.12	+.08
5	99.5	112.9	.64	.66	1.71	1.07	1.81	1.15	+.10
6	100.0	109.9	.65	.65	1.72	1.07	1.77	1.12	+.05
Basin A									
7 *	36.7	24.2	.55	.38	.76	.21	.55	.17	-.21'
8 *	48.8	37.9	.46	.35	1.22	.76	.95	.60	-.27'
9	56.1	45.2	.48	.45	1.33	.85	1.13	.68	-.20
10	58.7	48.9	.57	.54	1.06	.49	.94	.42	-.10
11	63.4	53.4	.62	.59	1.06	.44	.96	.37	-.10
12	69.2	60.2	.55	.52	1.31	.76	1.22	.70	-.09

Basin	Q100	
A + B	162.1	170.1

STREET DEPTH DATA EXISTING CONDITION W/O SITE							
AP	Q100 cfs	SLOPE ft/ft	WIDTH ft	d100 ft	V fps	V x d	Δ d ft
1	36.9	0.04	32	0.44	6.7	2.9	NA
2	38.8	0.059	"	0.42	7.5	3.2	"
3	54.3	0.029	"	0.52	7.0	3.6	"
4	81.7	0.045	"	0.56	9.3	5.2	"
5	103.9	0.034	"	0.64	9.4	6.0	"
6	107.0	0.034	"	0.65	9.5	6.2	"
7*	8.0	0.009	"	0.32	1.6	0.5	"
8*	25.1	0.05	"	0.29	5.4	1.6	"
9	33.1	0.05	"	0.41	5.9	2.4	"
10	41.0	0.019	"	0.50	4.8	2.9	"
11	49.2	0.014	"	0.58	4.8	3.4	"
12	56.3	0.033	"	0.51	7.4	3.8	"

* MOUNTABLE CURB & GUTTER

REV 3-1-93

PROJECT NAME ALBQ RANCH ESTATES JOB NO. 90302

SUBJECT STREET HYDRAULICS

BY DL CHECKED BY ______ DATE 3-1-93 PAGE 14 OF ______

STREET FLOW REGIMES

	ANALYSIS POINT	d_{100}	V	Fr	FLOW TYPE
BASIN 'B'	1	0.48'	7.4	1.88	SUPERCR
	2	0.48	9.0	2.29	↓
	3	0.56	7.9	1.86	↓
	4	0.58	9.5	2.20	↓
	5	0.66	9.6	2.08	↓
	6	0.65	9.5	2.08	↓
BASIN 'A'	7	0.38	3.3	0.94	SUBCR
	8	0.35	6.2	1.85	SUPERCR
	9	0.45	7.6	2.00	↓
	10	0.54	5.2	1.14	↓
	11	0.59	4.9	1.12	↓
	12	0.52	7.7	1.88	↓

RECEIVED
MAR 11 1993
HYDROLOGY DIVISION

DRAINAGE REPORT

FOR

ALBUQUERQUE RANCH ESTATES

PREPARED FOR:

B & A DEVELOPMENT CORPORATION
P.O. Box 3671
Albuquerque, New Mexico 87190

Prepared by:

BRASHER ENGINEERING, INC.
11930 Menaul Boulevard NE Suite 113
Albuquerque, New Mexico 87112

November 1992

DENNIS A. LORENZ
NEW MEXICO
9647
REGISTERED PROFESSIONAL ENGINEER

01-27-93
03-01-93
03-11-93

PURPOSE AND SCOPE

The purpose of this Drainage Report is to establish the criteria for controlling surface runoff from **ALBUQUERQUE RANCH ESTATES** and contributing off-site areas in a manner which is acceptable to the City of Albuquerque and the Metropolitan Arroyo Flood Control Authority (AMAFCA). The Plan studies the existing and developed conditions of the project site and affected off-site areas, and analyzes both conditions at the 100 year and 10 year/6 hour duration storm events. The Plan outlines drainage criteria for the fully developed condition of **ALBUQUERQUE RANCH ESTATES.**

The scope of this report is to ensure that **ALBUQUERQUE RANCH ESTATES** will be protected from storm runoff and that the development of this project will not increase the flooding potential of adjacent and downstream properties.

Approval of this Drainage Report shall facilitate Preliminary plat and Infrastructure Listing approval.

SITE LOCATION AND DESCRIPTION

ALBUQUERQUE RANCH ESTATES is located on Tramway Boulevard NE, in northeast Albuquerque, New Mexico (see Vicinity Map, Figure 1). The site is bounded on the east by old Tramway Blvd., on the south by Royal Oak Subdivision, on the west by Peppertree Subdivision, and on the north by undeveloped commercially zoned property. The site is described as **TRACT A, ALBUQUERQUE RANCH ESTATES** (filed 7-23-84, Vol. C24, Folio 133) and contains 9.143 acres.

The site is presently developed as a residential estate with 2 homes, an office building, and several garages and out buildings. The site has paved access, public utilities, and landscaping improvements. Portions of the site remain in natural condition, vegetated with native grasses.

Although the site is adjacent to Tramway Blvd., access is taken from the south by Royal Oak Street. With the reconstruction of Tramway Blvd., the old roadway corridor has been abandoned and the pavement removed.

Site topography slopes from east to west at approximately 4%. Two existing drainage channels are located at the west site boundary to drain on-site flows to existing facilities. As shown by FEMA FIRM Plate 350002 0018C, this site does not lie within a 100 year floodplain (see Figure 2).

On-site soils consist mainly of Embudo and Tijeras soils (see Figure 3), which are classified by the Soil Conservation Service as hydrologic group 'B' soils. These soil units are described by SCS as follows:

Emb - Embudo gravelly fine sandy loam; 0-5% slopes. These are generally deep, well drained soils formed in alluvium derived from decomposed, coarse-grained granitic rocks. They exhibit medium runoff characteristics with moderate erosion.

Tgb - Tijeras gravelly fine sandy loam; 1-5% slopes. These are generally deep, well drained soils formed in decomposed granitic alluvium. Runoff and water erosion are moderate.

EXISTING DRAINAGE CONDITIONS

As shown by the Existing Drainage Conditions Plan (see Plate I, in back pocket) the site accepts off-site flows from a small undeveloped basin located north of the site. This off-site flow enters the site and collects in a natural depression. It appears that the depression overflows to the west and merges with other on-site flows. A portion of old Tramway which historically drained into the site is now conveyed south to the Tramway Diversion channel by a recently constructed trainer dike placed at the east property line. On-site, five different basins exist, which are defined as follows:

Basin I:
Flows combine with off-site flows and are retained in existing pond #1. Basin I is developed with an office building and associated paving and landscaping improvements.

Basin II:
Flows are retained in existing pond #2. Basin II is undeveloped.

Basin III:
This Basin is a portion of the existing entrance road. Flows drain to Basin IV through existing 4-inch drain pipes.

Basin IV:
This basin accepts Basin III flows. All flows drain to existing public channel 'B'. Basin IV contains the existing main house and associated improvements.

Basin V:
Basin V accepts overflow from existing pond #1. All flows drain to public channel "A". Basin V contains the guest house and associated improvements.

DEVELOPED DRAINAGE CONDITIONS

As shown by the Drainage Plan (see Plate II, in back pocket) the site is to be developed as a 12 lot residential subdivision with a 1.7 acre tract reserved for the existing office building and a 1.9 acre tract reserved for the future development of the Mckay estate. Since the existing site is developed with 2 homes, garages, outbuildings, landscaping, and paved access, the proposed development must respect these existing improvements. The proposed subdivision creates lots for the existing homesites, access road, office building, and reserves a tract for the future McKay estate. As identified by the Plan, certain existing improvements will be removed to allow for the development of future homesites.

The Plan identifies: Custom lot pad sites, recommended minimum pad elevations, spot elevations, drainage swale locations, retaining walls, required storm drainage improvements, and erosion control measures. The site is divided into 2 major drainage basins. Basin I represents the existing office building, the future McKay estate, and an existing undeveloped off-site basin (Basin VI) located north of the site which presently drains onto the property. Basin I, which presently has natural ponding areas, will be graded to allow all runoff to reach the main access road which will convey flows to Royal Oak Street. Royal Oak Street has sufficient carrying capacity to convey these developed flows, however, some modification to downstream improvements will be necessary, which will be discussed in the next section of this document. Undeveloped flows from Basin VI will be accepted and managed by this project on an interim basis. Once development of Basin VI ocurrs, this flow should be managed in a manner that does not impact this site.

Basin II consists of the proposed 12 lot residential subdivision. Since there are existing improvements on this portion of the project, the drainage management plan must provide protection without destroying the integrity of the these improvements. The Plan will incorporate on-site grading to ensure positive drainage away from all structures. Recommended minimum building pad elevations are given to ensure proper interface with existing improvements, and provide adequate flood protection. A private storm drain system will be constructed which is to consist of a HDPE mainline with area drains located at the lowpoint of each lot. These area drains will be designed with a sedimentation area to mitigate the introduction of sediment and debris into the mainline. The storm drain system will drain the existing concrete channels located at the west property line which convey the runoff to downstream improvements. Capacity exists in the existing channels to safely convey developed flows to Tamarac Street within Peppertree Subdivision. In order to provide better flood protection to downstream properties the channel exit structures will be reconstructed to direct flows downstream within Tamarac. This improvement will be discussed in the next section.

DOWNSTREAM CAPACITY

This property drains to the west through Peppertree Subdivision with the ultimate outfall for the area being a public storm drain located in Lowell Street which conveys all runoff to the Juan Tabo Dam. The Off-site Drainage Basin Map (see Figure 4) is provided to illustrate the downstream areas affected by the development of this project. Drainage studies prepared prior to the development of Peppertree Subdivision anticipated developed flows from this property and contributing off-site areas. As shown by Exhibit "A", developed flowrates of 18.5 cfs and 9.9 cfs were anticipated at channels 'A' and 'B' respectively. Checking street capacities near the channel outfall structures on Tamarac indicates that a combined developed flowrate of 18.5 + 9.9 = ~~38.4~~ 28.4 cfs will flood the streets above top of curb height which is not allowed by current City policy. In an effort to mitigate the effects of the development of this property the project site will be divided into 2 major drainage basins. As described in the previous section, Basin I (4.4 acres) will be diverted to Royal Oak Street where downstream capacity does exist. This results in lower flowrates in Tamarac which can be conveyed without serious impact to the downstream street network. As shown by the calculations, developed flows from this project are estimated at 16.2 cfs at Tamarac, which is ~~22.2~~ 12.2 cfs less than anticipated by previously approved studies.

Street depths have been determined for both pre and post-developed conditions and are presented for comparison by the reader. As shown by the tables, post-development 100 year street depths range from 0.01' to 0.09' higher than pre-developed depths, and at all but at a few analysis points the depths are below top of curb. The only areas where street depths plot above top of curb are the sections of Tamarac and San Victorio that were constructed with mountable curb and gutter. Within Tamarac, street depths are expected to 0.05' above top of curb and on San Victorio 0.02' above top of curb. The increase in street depths as a result of development are 0.06' for each section. Flow velocities are estimated at 3.3 fps in Tamarac and 6.2 fps in San Victorio. Street sections with mountable curb and gutter do not have drivepad cut-outs, therefore, it is not anticipated that street flows will jump behind the back of curb and create an erosion problem. Since the development of this property has such minor impact on downstream improvements, no additional improvements are proposed downstream from the channel outfall structures.

As previously mentioned, the north channel outfall structure at Tamarac will be modified to ensure that flows are directed downstream. Without modification it is feared that runoff may exit the west side of the street, over the mountable curb, and cause damage to private property. A sketch is provided (see page 9, Appendix) to illustrate the proposed modification. Flow from the south channel is presently directed toward San Victorio, therefore, no modification is necessary. As mentioned above, Basin I will drain through Royal Oak Subdivision within Royal Oak Street. Royal Oak Street drains to an existing concrete channel that flows to Peppertree Subdivision, and on to Lowell Street. As shown by the calculations and street depth tables, downstream capacity does exist to support developed flows. However, the channel inlet will require modification to increase capacity. As shown by the calculations and design sketches (see page 10 , Appendix), the existing sidewalk culverts will be removed to allow for greater inlet capacity. A low flow drain will be provided to handle nuisance and low frequency rainfall.

As mentioned above, the ultimate outfall for the area is a public storm drain located with Lowell Street that drains to the Juan Tabo Dam. As shown by the calculations, the existing mainline capacity of the storm drain is approximately 140 cfs, leaving 30 cfs to be conveyed overland by Lowell and Spain Road.

EROSION CONTROL

Since this site is presently developed erosion control will not be as significant a problem as with other development projects which typically employ mass grading. Care will be taken to protect all existing structures from concentrated flows and sedimentation. As shown by the Erosion Control Plan (see Plate III in back pocket), temporary sedimentation ponds will be constructed along the west property line near the inlets to each channel. This will mitigate the introduction of sediment to downstream street networks and drainage facilities. All on-site runoff will be directed to the ponds by graded swales. The first phase of the project will be the construction of the on-site storm drain system, which once in place will eliminate the need for the sedimentation ponds.

SCANLON & ASSOCIATES
CONSULTING ENGINEERS
8008 Pennsylvania Circle NE
Albuquerque, New Mexico 87110-7897
(505) 265-6941

Project OFFSITE FLOWS
Location PEPPERTREE UNIT 2 PHASE 2
Job No. 87101.1 Date 7-13-87
By [illegible] Sheet [illegible] of

COMPUTE RAINFALL INTENSITY:

$I = 6.84\,(6\text{-HR. RAIN})\,(t_c)^{-0.51}$ FROM PLATE 22.2 D-2 ALB. DPM

6-HR RAIN = 2.6" FROM PLATE 22.2 D-1 ALB. DPM

t_c = 10 min

$I = 6.84\,(2.6)\,(10)^{-0.51} = 5.50$ IN/HR

RATIONAL METHOD

$Q = C I A$

C = 0.4 FROM PEPPERTREE SUBDIVISION DRAINAGE MANAGEMENT PL

PEAK RUNOFF COMPUTATION

AREA B1

A = 8.4 ac.

Q = (0.4)(5.50)(8.4) 18.5 CFS

AREA B2

A = 4.5 ac.

Q = (0.4)(5.50)(4.5) = 9.9 CFS

RECEIVED
JUL 1- 1987
HYDROLOGY SECTION

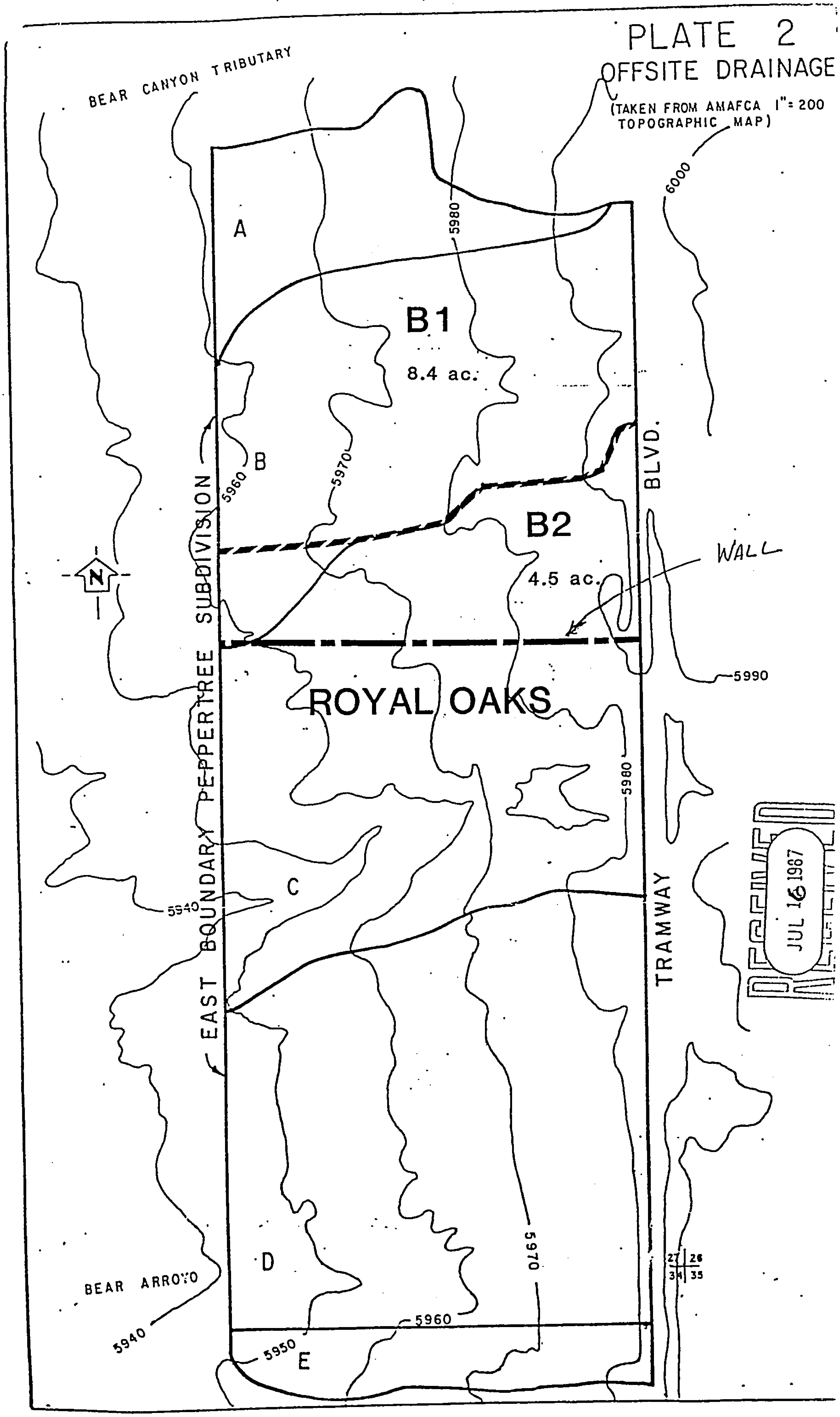


PLATE 2
OFFSITE DRAINAGE
(TAKEN FROM AMAFCA 1" = 200 TOPOGRAPHIC MAP)
BEAR CANYON TRIBUTARY
6000
5980
A
B1
8.4 ac.
B
5960
5970
BLVD.
B2
4.5 ac.
WALL
N
EAST BOUNDARY PEPPERTREE SUBDIVISION
5990
ROYAL OAKS
5980
C
5940
TRAMWAY
JUL 16 1987
RECEIVED
D
5970
27 26
34 35
BEAR ARROYO
5940
5960
5950
E

CRITERIA

I. Criteria for Hydrologic calculations is per the Rational Method for computing runoff as outlined in the Development Process Manual, Volume II, Chapter 22.

A. RAINFALL: P100 = 2.90 in. P10 = 1.90 in.

B. TIME OF CONCENTRATION:

$$Tc = 0.0078(L)^{0.77}/(S)^{0.385}, \text{ min.}$$

Where: L = length, ft
S = slope, ft/ft

C. CURVE NUMBER:

CN determined by Plates 22.2 C-2 & C-3

D. RATIONAL 'C' FACTOR:

Rational "C" factor determined by "Notice of Emergency Rule", dated 2-19-1986:

Surface type	"C" Value
streets, conc.	0.95
roofs	0.90
lawns, landsc.	0.25
undeveloped	0.40

E. RUNOFF:

Q = CiA, cfs

Where: A = area, acres
i = rainfall intensity, in/hr
C = rational "C" factor

F. VOLUME:

V = 3630AR, cf

Where: A = area, acres
R = direct runoff, in

HYDROLOGY

EXISTING CONDITION

AP	BASIN	AREA acre	Tc min	i100 in/hr	C	CN	R10 in	R100 in	Q10 cfs	Q100 cfs	V10 cf	V100 cf
A	I	1.65	10	6.13	0.54	77	0.45	1.10	3.6	5.5	2695	6588
B	II	1.56	10	6.13	0.40	70	0.25	0.70	2.5	3.8	1416	3964
C	III	0.22	10	6.13	0.95	97	1.60	2.70	0.8	1.3	1278	2156
D	IV	2.25	10	6.13	0.43	74	0.35	0.90	3.9	5.9	2859	7350
E	V	3.46	10	6.13	0.49	74	0.35	0.90	6.8	10.4	4396	11304
F	VI	0.73	10	6.13	0.40	70	0.25	0.70	1.2	1.8	662	1855
7	A1	2.1	10	6.13	0.62	80	0.50	1.20	5.3	8.0	3812	9148
8	+A2	6.6	10	6.13	"	"	"	"	16.5	25.1	11979	28750
9	+A3	8.7	10	6.13	"	"	"	"	21.7	33.1	15790	37897
10	+A4	10.8	10	6.13	"	"	"	"	26.9	41.0	19602	47045
11	+A5	13.6	11	5.84	"	"	"	"	32.3	49.2	24684	59242
12	+A6	17.6	14	5.16	"	"	"	"	37.0	56.3	31944	76666
1	B1	9.7	11	5.84	"	"	"	"	23.1	35.1	17606	42253
2	+B2	14.8	13	5.36	"	"	"	"	32.3	49.2	26862	64469
3	+33	18.9	14	5.16	"	"	"	"	39.7	60.5	34304	82328

A_T = 9.87 Ac ?

Q_{100} = 28.7

10 (beside rows 1, 2 and 3)

HYDROLOGY

EXISTING CONDITION

AP	BASIN	AREA acre	Tc min	i100 in/hr	C	CN	R10 in	R100 in	Q10 cfs	Q100 cfs	V10 cf	V100 cf
4	+B4	26.1	15	4.98	0.62	80	0.50	1.20	52.9	80.6	47372	113692
5	+B5	33.3	16	4.82	0.62	80	0.50	1.20	65.4	99.5	60440	145055
6	+B6	37.5	20	4.30	0.62	80	0.50	1.20	65.7	100.0	68063	163350
7	SITE	9.87	10	6.13	0.45	74	0.35	0.90	17.9	27.2	12540	32245
7	+ A1	11.97	10	6.13	0.50	74	0.35	0.90	24.1	36.7	15209	39106
8	+ A2	16.47	12	5.59	0.53	75	0.40	1.05	32.1	48.8	23914	62775
9	+ A3	18.57	12	5.59	0.54	75	0.40	1.05	36.8	56.1	26964	70780
10	+ A4	20.67	14	5.16	0.55	76	0.40	1.10	38.5	58.7	30013	82535
11	+ A5	23.47	16	4.82	0.56	76	0.40	1.10	41.6	63.4	34078	93716
12	+ A6	27.47	19	4.42	0.57	77	0.45	1.10	45.5	69.2	44872	109688
6	A+B+SITE	65.0	20	4.30	0.58	78	0.45	1.10	106.5	162.1	106178	259,545

HYDROLOGY
DEVELOPED CONDITIONS

AP	BASIN	AREA acre	Tc min	i100 in/hr	C	CN	R10 in	R100 in	Q10 cfs	Q100 cfs	V10 cf	V100 cf
1	I+ +B1	13.3	11	5.84	0.58	77	0.45	1.10	29.6	45.0	21726	53107
2	+B2	19.9	13	5.36	0.59	78	0.50	1.15	41.3	62.9	36118	83072
3	+B3	24.0	14	5.16	0.59	78	0.50	1.15	48.0	73.1	43560	100188
4	+B4	31.2	15	4.93	0.60	78	0.50	1.15	61.2	93.2	56628	130244
5	+B5	35.4	16	4.82	0.61	79	0.50	1.15	74.2	112.9	69696	160301
6	+B6	41.9	20	4.30	0.61	79	0.50	1.15	72.2	109.9	76048	174912
7	II+A1	7.6	10	6.13	0.52	75	0.40	1.05	15.9	24.2	11035	28967
8	+A2	12.1	12	5.59	0.56	76	0.40	1.10	24.9	37.9	17569	48315
9	+A3	14.2	12	5.59	0.57	77	0.45	1.10	29.7	45.2	23196	56701
10	+A4	16.3	14	5.16	0.58	78	0.50	1.15	32.1	48.9	29584	68044
11	+A5	19.1	16	4.82	0.58	78	0.50	1.15	35.1	53.4	34666	79733
12	+A6	23.1	19	4.42	0.59	78	0.50	1.15	39.6	60.2	41926	96431
13	I	3.67	10	6.13	0.51	74	0.35	0.90	7.5	11.5	3777	11990
14	VI	0.73	10	6.13	0.40	70	0.25	0.70	1.2	1.8	662	1855
13	I+VI	4.40	10	6.13	0.49	74	0.35	0.90	8.7	13.2	5590	14375

HYDROLOGY

DEVELOPED CONDITIONS

AP	BASIN	AREA acre	Tc min	i100 in/hr	C	CN	R10 in	R100 in	Q10 cfs	Q100 cfs	V10 cf	V100 cf
15	IIA	1.85	10	6.13	0.48	74	0.35	0.90	3.6	5.4	2350	6043
15	IIB	1.30	10	6.13	0.48	74	0.35	0.90	2.5	3.8	1652	4248
16	IIC	2.35	10	6.13	0.48	74	0.35	0.90	4.5	6.9	2986	7678
15	IIA+B	3.15	10	6.13	0.48	74	0.35	0.90	6.1	9.3	4002	10291
7	II	5.5	10	6.13	0.48	74	0.35	0.90	10.6	16.2	6988	17969
6	A+B+SITE	65.0	20	—	0.61	79	0.50	1.15	111.8	170.1	117975	271343

STREET DEPTH DATA
EXISTING CONDITION

	AP	Q100 cfs	SLOPE ft/ft	WIDTH ft	d100 ft	V fps	$V^2/2g$	Δ d ft	F_r
	1	35.1	0.04	32'	0.44	5.8	0.52'	NA	1.54
	2	49.2	0.059	"	0.45	7.3	0.83	"	1.92
	3	60.5	0.029	"	0.54	6.4	0.64	"	1.53
BASIN 'B'	4	80.6	0.045	"	0.55	8.3	1.07	"	1.97
	5	99.5	0.034	"	0.64	8.3	1.07	"	1.83
	6	100.0	0.034	"	0.65	8.3	1.07	"	1.81
	7 *	36.7	0.007	"	0.55	3.7	0.21	"	0.88
	8 *	48.8	0.05	"	0.46	7.0	0.76	"	1.82
	9	56.1	0.05	"	0.48	7.4	0.85	"	1.88
BASIN 'A'	10	58.7	0.019	"	0.57	5.6	0.49	"	1.31
	11	63.4	0.014	"	0.62	5.3	0.44	"	1.19
	12	69.2	0.033	"	0.55	7.0	0.76	"	1.66

* MOUNTABLE C & G

STREET DEPTH DATA
DEVELOPED CONDITION

	AP	Q100 cfs	SLOPE ft/ft	WIDTH ft	d100 ft	V fps	$V^2/2g$	Δ d ft	F_r
BASIN 'B'	1	45.0	0.04	32	0.48	6.3	0.62	+0.04	1.60
	2	62.9	0.059	"	0.48	8.0	1.00	+0.03	2.03
	3	73.1	0.029	"	0.56	6.9	0.74	+0.02	1.62
	4	93.2	0.045	"	0.58	8.5	1.12	+0.03	1.97
	5	112.9	0.034	"	0.66	8.6	1.15	+0.02	1.87
	6	109.9	0.034	"	0.65	8.5	1.12	-0-	1.86
BASIN 'A'	7 *	24.2	0.009	"	0.38	3.3	0.17	-0.17'	0.94
	8 *	37.9	0.05	"	0.35	6.2	0.60	-0.11	1.85
	9	45.2	0.05	"	0.45	6.6	0.68	-0.03	1.73
	10	48.9	0.019	"	0.54	5.2	0.42	-0.03	1.25
	11	53.4	0.014	"	0.59	4.9	0.37	-0.03	1.12
	12	60.2	0.033	"	0.52	6.7	0.70	-0.03	1.64

* MOUNTABLE CURB & GUTTER

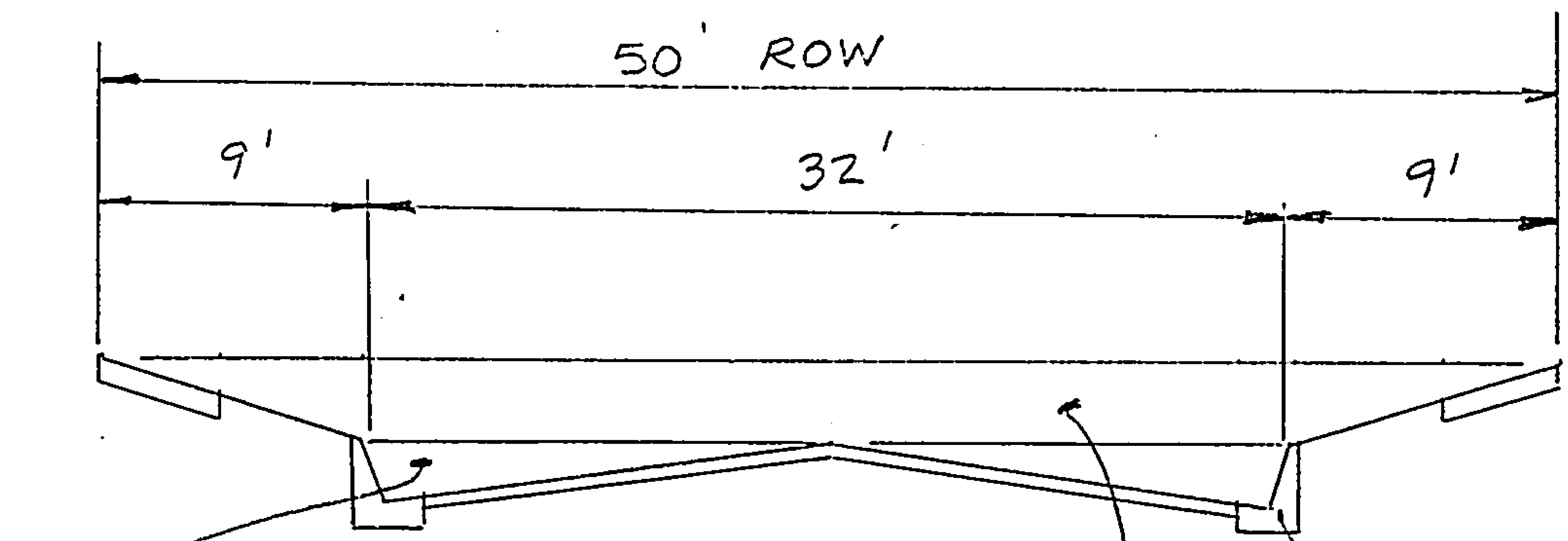
PROJECT NAME ALBQ RANCH ESTATES JOB NO. 90302

SUBJECT

BY DC CHECKED BY DATE 10-23-92 PAGE 8 OF

STREET DEPTH ANALYSIS

DETERMINE d_{100} @ AP 7 & 8 FOR EXISTING MOUNTABLE C & G:



EXIST MOUNTABLE C & G

$A = 16(0.33)\frac{1}{2}(2) = 5.28\ SF$

$A = 32Y + 9Y = 41Y$

BY MANNINGS EQN: $Q = \frac{1.49}{n} A R^{2/3} S^{1/2}$

WHERE: $n = 0.017$ S = VARIABLE

$A = 5.28 + 41Y$ Q = VARIABLE

$P = 32.6 + 54Y$

SOLVING FOR Y_0:

EXIST	AP 7	d_{100} = 0.32'	V = 1.6 FPS
	AP 8	0.29'	= 5.4
DEV.	AP 7	0.33'	3.3
	AP 8	0.35'	6.2

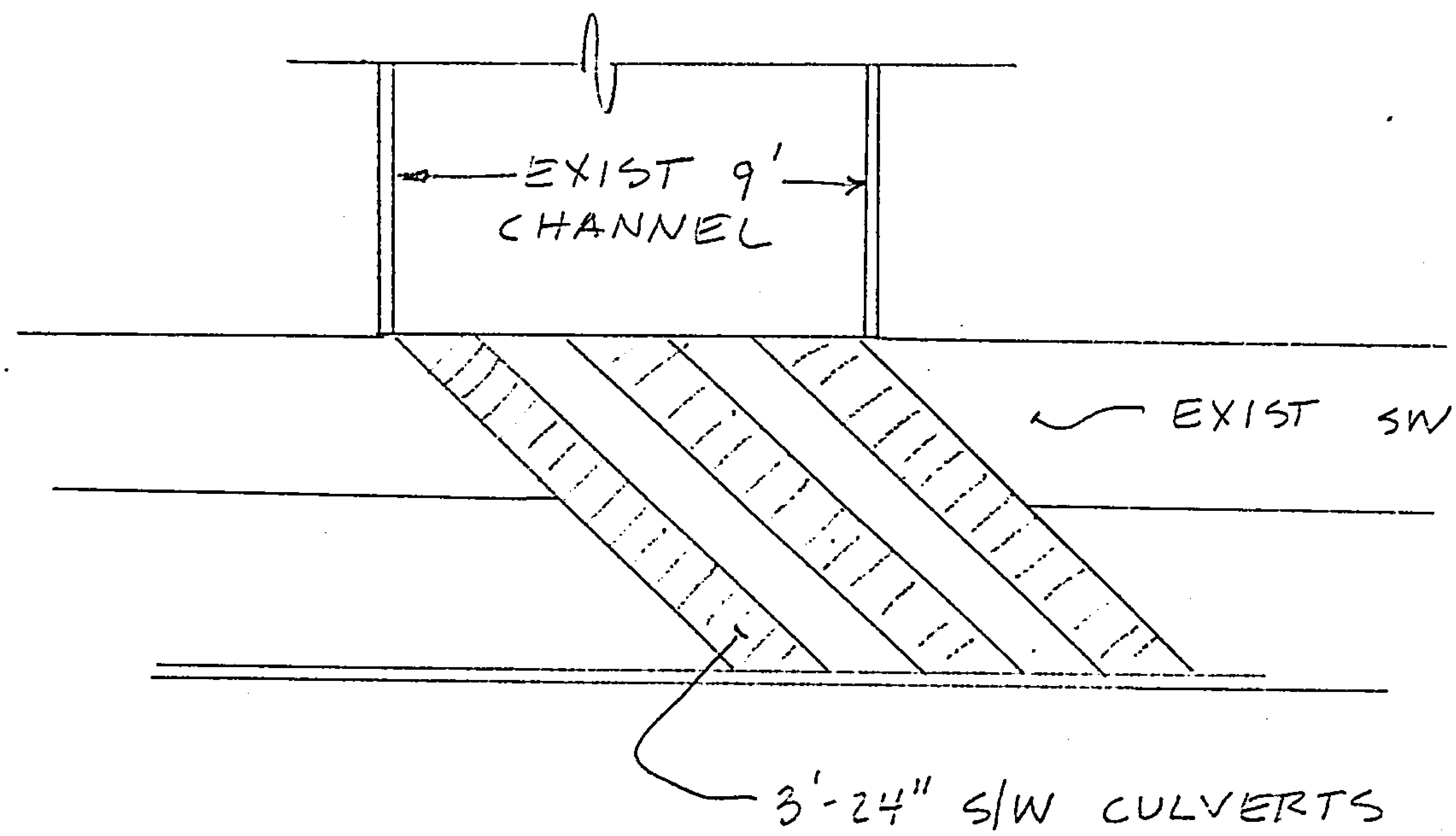
$d + \frac{V^2}{2g} = .95'$

PROJECT NAME ALBQ RANCH ESTATES JOB NO. 90302

SUBJECT

BY DL CHECKED BY DATE 10-23-92 PAGE 9 OF

PEPPERTREE CHANNEL RECONSTRUCTION



Ⓐ CHECK CHANNEL CAPACITY

LET $H = 1'$ $S_{min} = 0.013$ Q_{100} DEV = 9.3 CFS MAX BASINS IIA+B

BY MANNING'S EQN:

$$Q = \frac{1.49}{0.013}(9)\left(\frac{9}{11}\right)^{2/3}(0.013)^{1/2} = 102.9 \text{ CFS} \gg Q_{100}$$

Ⓑ CHECK S/W CULVERT CAPACITY

BY WEIR: LET $H = 0.67$ $L = 2'$

$$Q = 3(3.33)(2)(.67)^{3/2} = 11.0 \text{ CFS} > Q_{100}$$

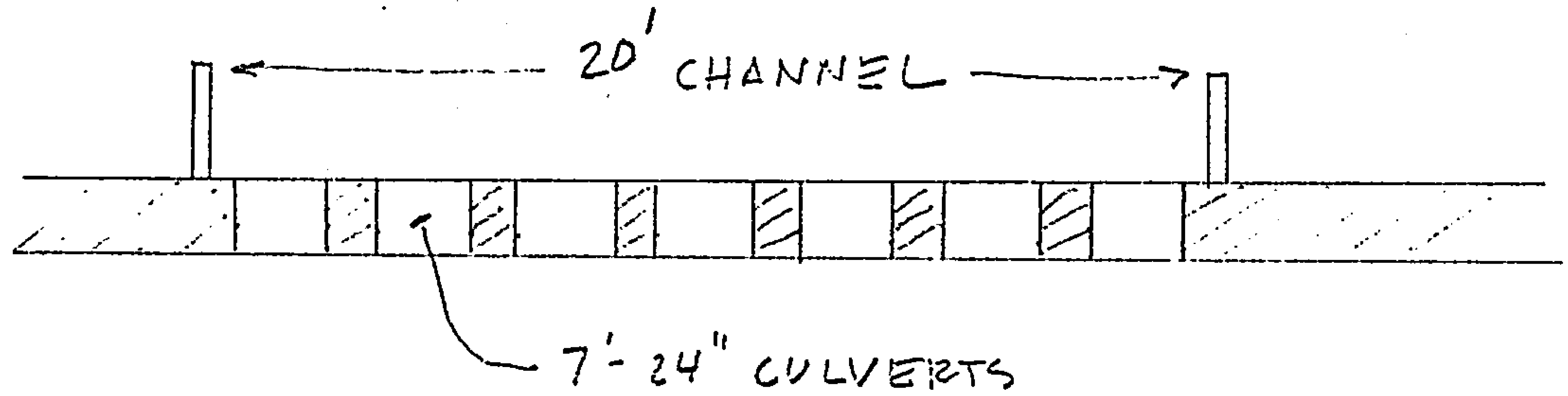
PROJECT NAME ALBQ RANCH ESTATES JOB NO. 90302

SUBJECT

BY DL CHECKED BY DATE 10-23-92 PAGE 10 OF

ROYAL OAK CHANNEL REDESIGN

RECONSTRUCT CHANNEL INLET AT ROYAL OAK TO ACCEPT DEVELOPED FLOWS:



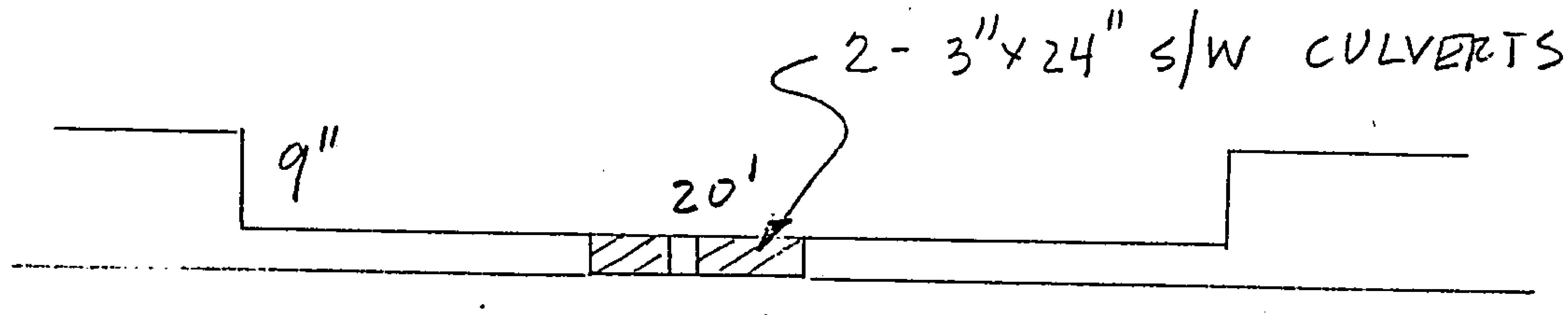
EXISTING INLET SECT.

USING WEIR: $Q = 3.33 L H^{1.5}$

$Q_{MAX} = 7(3.33)(2)(.67)^{1.5} = 25.6$ CFS

Q_{100} DEV = 47.8 CFS

⇒ REMOVE CULVERTS; PROVIDE S/W CULVERTS FOR LOW FLOWS



$Q_{MAX} = 3.33(20)(0.75')^{3/2} = 43.3$ CFS

REV 1-25-93

PROJECT NAME ALBQ RANCH ESTATES JOB NO. 90302

SUBJECT

BY DL CHECKED BY DATE 1-25-93 PAGE 11 OF

S/W CULVERT CAPACITY

$Q_{EA} = 3.33(2)(0.25)^{3/2} = 0.83$ CFS

TOTAL CAPACITY = $43.3 + 2(0.83) = 45.0$ CFS

CHECK CHANNEL CAPACITY:

BY MANNINGS

$$Q = \frac{1.49}{0.013}(0.75)(19)(0.70)^{2/3}(0.005)^{1/2} = 91.0 \text{ CFS}$$

$> Q_{100}$

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SUBJECT

BY DL CHECKED BY DATE 10-23-92 PAGE 12 OF

LOWELL ST STORM DRAIN

CHECK MAINLINE CAPACITY:

PER AS-BUILT INFO:

$D = 42''$ Q_{100} DEV = 170.1 CFS

$S = 0.0193$ $n = 0.013$

BY MANNINGS:

$Q_{MAX} = 140$ CFS W/O PRESSURE

$\Delta Q = 30.1$ CFS (OVERLAND IN LOWELL)

BRASHER ENGINEERING, INC.

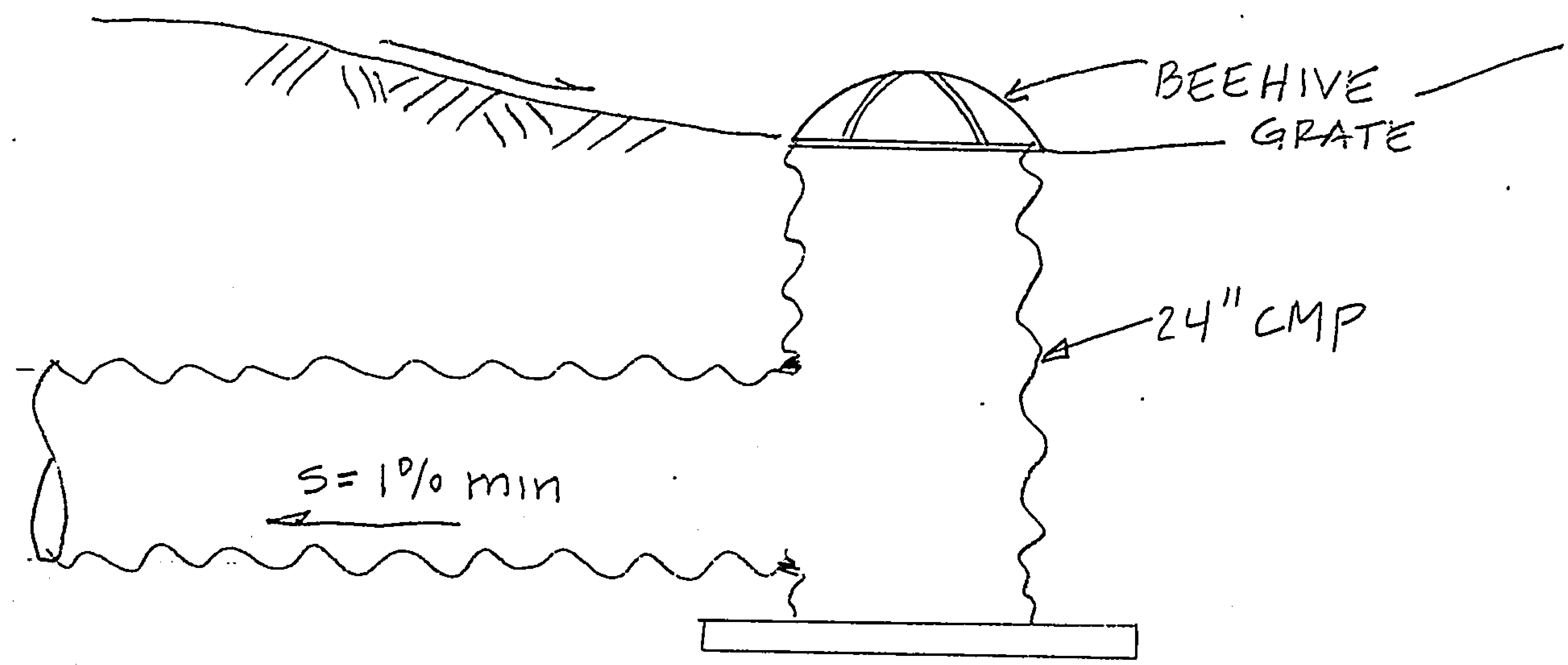
PROJECT NAME ALBQ RANCH ESTATES JOB NO. 90302

SUBJECT

BY DL CHECKED BY DATE 10-23-92 PAGE 13 OF

ON-SITE STORM DRAIN SYSTEM

USE CMP MAINLINES WITH BEEHIVE TYPE INLETS LOCATED ON EACH LOT:



Q_{100} DEV = 9.3 CFS @ AP # 15

FIND CMP SIZE @ S = 0.01 n = 0.025

$A = \pi r^2$ $p = 2\pi r$.

$9.3\ CFS = \frac{1.49}{0.024} AR^{2/3}(.1)$

$AR^{2/3} = 1.42$

$r = 0.9' \pm$

USE 24" CMP

HYDROGRAPH COMPUTATION WORKSHEET

DATE 3-10-93
COMPUTED BY DL
CHECK BY ______

PROJECT ALB RANCH EST

LOCATION BASIN 'A' + EXIST SITE

ANALYSIS POINT # 12

(DR. AREA) A = 27.47 ACRES

T_c 19 MIN

POINT RAINFALL 2.9 IN. FROM PLATE 22.2 D-1

CN = ______ FROM PLATES 22.2 C-2, 22.2 C-3

RUNOFF VOLUME R = ____ IN. FROM PLATE 22.2 C-4

COMPUTED T_p = ______ MIN. $T_p = T_c$ (Rounded to even minute)

$q_p = \frac{45.4A}{T_p}$ = ______ CFS./INCH OF RUNOFF

$(R \times q_p) = Q_{peak}$ = 69.2 CFS

$t(\text{COLUMN})=(t/T_p)$ $t=T_p(t/T_p)$

$y = \frac{Q}{Q_{peak}}$ $Q = y(Q_{peak})$

	(t/T_p)	t (min.)	y	Q (cfs)
1	0	0	0	0
2	.1		.03	
3	.2	3.8	.10	6.9
4	.3		.190	
5	.4		.310	
6	.5	9.5	.470	35.5
7	.6		.660	
8	.7		.820	
9	.8	15.2	.930	64.4
10	.9	17.1	.990	68.5
11	1.0	19	1.00	69.2
12	1.1	20.9	.990	68.5
13	1.2	22.8	.930	64.4
14	1.3		.860	
15	1.4		.780	
16	1.5	28.5	.680	47.1
17	1.6		.560	
18	1.7		.460	
19	1.8		.390	
20	1.9		.330	
21	2.0	38	.280	19.4
22	2.2		.207	
23	2.4		.147	
24	2.6		.107	
25	2.8		.077	
26	3.0	57	.055	3.8
27	3.2		.040	
28	3.4		.029	
29	3.6		.021	
30	3.8		.015	
31	4.0	76	.011	0.8
32	4.5		.005	
33	5.0	95	.000	0

PLATE 22.2 F-1

13.

HYDROGRAPH COMPUTATION WORKSHEET

DATE 3-10-93
COMPUTED BY DL
CHECK BY ______

PROJECT ALB RANCH EST

LOCATION BASIN 'A' + DEV 'II'

ANALYSIS POINT # 12

(DR. AREA) A = 23.1 ACRES

T_c 19 MIN

POINT RAINFALL 2.9 IN. FROM PLATE 22.2 D-1

CN = ______ FROM PLATES 22.2 C-2, 22.2 C-3

RUNOFF VOLUME R = ____ IN. FROM PLATE 22.2 C-4

COMPUTED T_p = ______ MIN. $T_p = T_c$ (Rounded to even minute)

$q_p = \frac{45.4A}{T_p}$ = ______ CFS./INCH OF RUNOFF

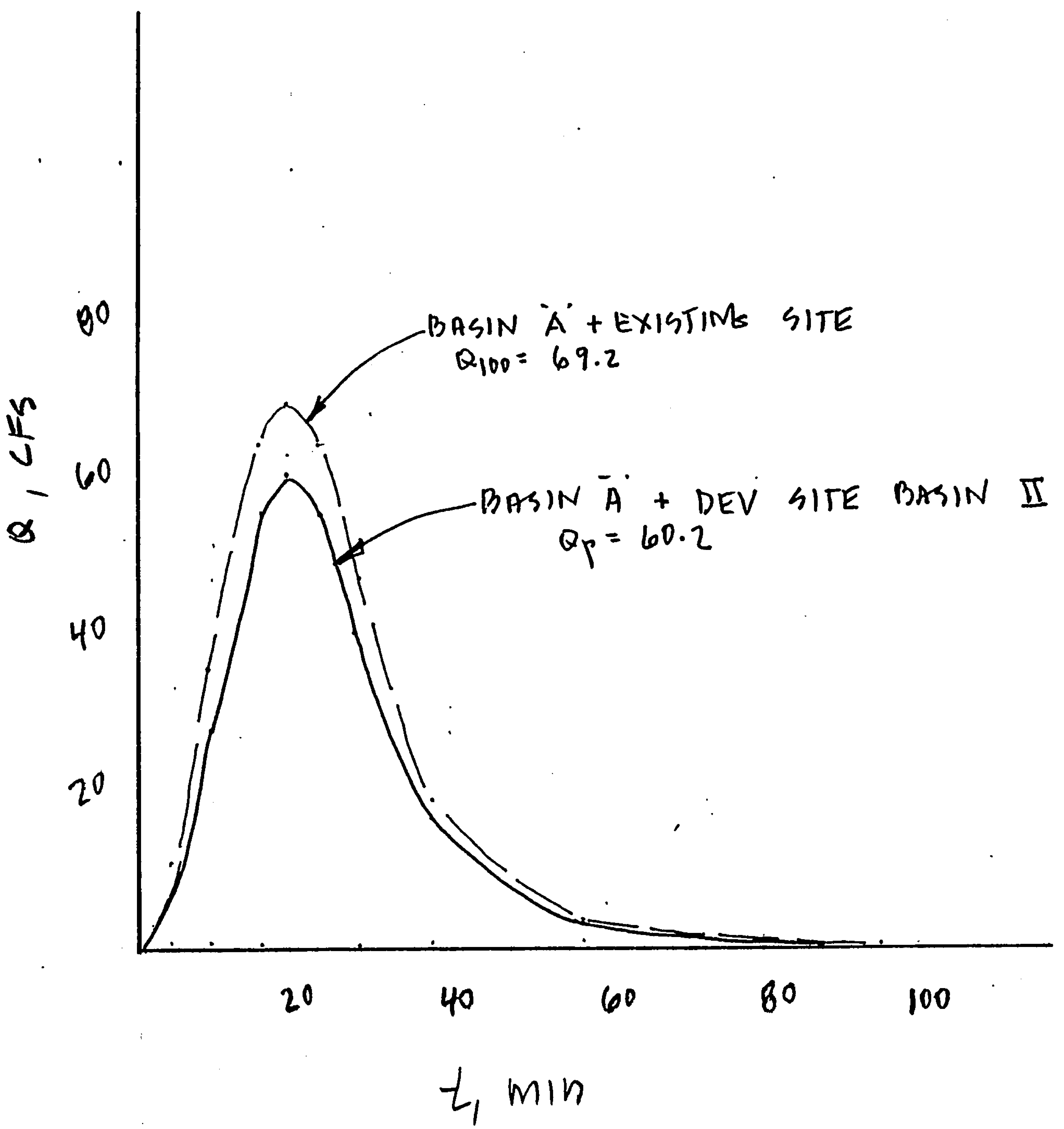
$(R \times q_p) = Q_{peak}$ = 60.2 CFS

t(COLUMN)=(t/T_p) $t = T_p(t/T_p)$

$y = \frac{Q}{Q_{peak}}$ $Q = y(Q_{peak})$

	(t/T_p)	t (min.)	y	Q (cfs)
1	0	0	0	0
2	.1		.03	
3	.2	3.8	.10	6.0
4	.3		.190	
5	.4		.310	
6	.5	9.5	.470	28.3
7	.6		.660	
8	.7		.820	
9	.8	15.2	.930	56.0
10	.9	17.1	.990	59.6
11	1.0	19	1.00	60.2
12	1.1	20.9	.990	59.6
13	1.2	22.8	.930	56.0
14	1.3		.860	
15	1.4		.780	
16	1.5	28.5	.680	40.9
17	1.6		.560	
18	1.7		.460	
19	1.8		.390	
20	1.9		.330	
21	2.0	38	.280	16.9
22	2.2		.207	
23	2.4		.147	
24	2.6		.107	
25	2.8		.077	
26	3.0	57	.055	3.3
27	3.2		.040	
28	3.4		.029	
29	3.6		.021	
30	3.8		.015	
31	4.0	76	.011	0.7
32	4.5		.005	
33	5.0	95	.000	0

PLATE 22.2 F-1



BASIN "A" + EXISTING SITE
Q100 = 69.2
BASIN "A" + DEV SITE BASIN II
Qp = 60.2
Q, CFS
80
60
40
20
20
40
60
80
100
t, MIN

HYDROGRAPH COMPUTATION WORKSHEET

DATE 3-10-93
COMPUTED BY DL
CHECK BY ______

PROJECT ALB RANCH EST.

LOCATION BASIN 'B'- EXIST.

ANALYSIS POINT # 6

(DR. AREA) A = 37.5 ACRES

T_c 20. MIN

POINT RAINFALL 2.90 IN. FROM PLATE 22.2 D-1

CN = ______ FROM PLATES 22.2 C-2, 22.2 C-3

RUNOFF VOLUME R = ______ IN. FROM PLATE 22.2 C-4

COMPUTED T_p = ______ MIN. $T_p = T_c$ (Rounded to even minute)

$q_p = \frac{45.4A}{T_p}$ = ______ CFS./INCH OF RUNOFF

$(R \times q_p) = Q_{peak}$ = 100.0 CFS

$t(\text{COLUMN}) = (t/T_p)$ $t = T_p(t/T_p)$

$y = \frac{Q}{Q_{peak}}$ $Q = y(Q_{peak})$

	(t/T_p)	t (min.)	y	Q (cfs)
1	0	0	0	0
2	.1	2	.03	3
3	.2		.10	
4	.3		.190	
5	.4		.310	
6	.5	10	.470	47
7	.6		.660	
8	.7		.820	
9	.8	16	.930	93
10	.9	18	.990	99
11	1.0	20	1.00	100
12	1.1	22	.990	99
13	1.2	24	.930	93
14	1.3		.860	
15	1.4		.780	
16	1.5	30	.680	68
17	1.6		.560	
18	1.7		.460	
19	1.8		.390	
20	1.9		.330	
21	2.0	40	.280	28
22	2.2		.207	
23	2.4		.147	
24	2.6		.107	
25	2.8		.077	
26	3.0	60	.055	5.5
27	3.2		.040	
28	3.4		.029	
29	3.6		.021	
30	3.8		.015	
31	4.0	80	.011	1
32	4.5		.005	
33	5.0	100	.000	0

PLATE 22.2 F-1

HYDROGRAPH COMPUTATION WORKSHEET

DATE 3-10-93
COMPUTED BY DL
CHECK BY ______

PROJECT ALB RANCH EST

LOCATION BASIN 'B' + DEV 'I'

ANALYSIS POINT # 6

(DR. AREA) A = 41.9 ACRES

T_c 20 MIN

POINT RAINFALL 2.90 IN. FROM PLATE 22.2 D-1

CN = ______ FROM PLATES 22.2 C-2, 22.2 C-3

RUNOFF VOLUME R = ____ IN. FROM PLATE 22.2 C-4

COMPUTED T_p = ______ MIN. (Rounded to even minute) $T_p = T_c$

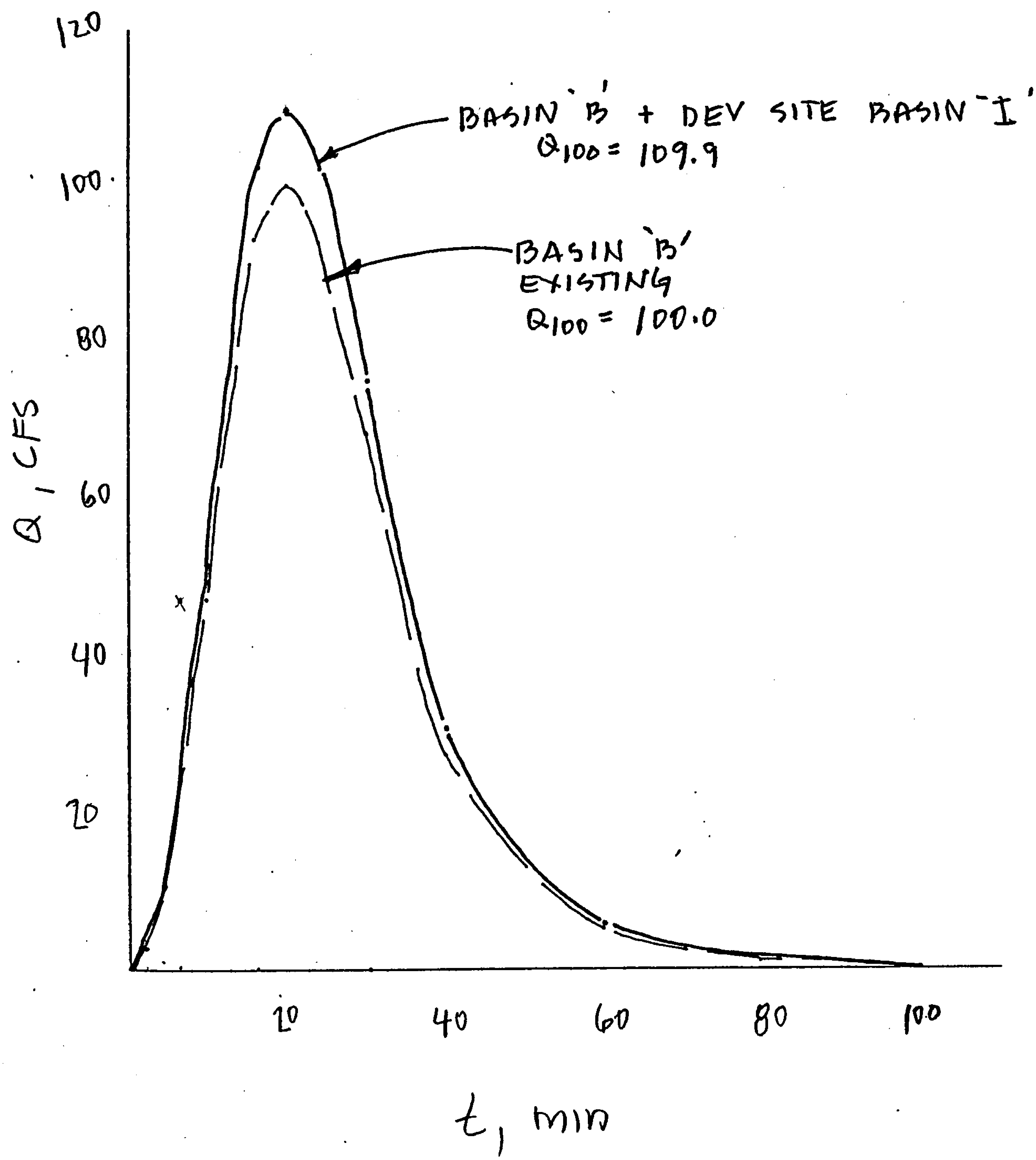
$q_p = \frac{45.4A}{T_p}$ = ______ CFS./INCH OF RUNOFF

$(R \times q_p) = Q_{peak}$ = 109.9 CFS

t(COLUMN)=(t/T_p) $t=T_p(t/T_p)$

$y = \frac{Q}{Q_{peak}}$ $Q = y(Q_{peak})$

	(t/T_p)	t (min.)	y	Q (cfs)
1	0	0	0	0
2	.1		.03	
3	.2	4	.10	11.0
4	.3		.190	
5	.4		.310	
6	.5	10	.470	51.7
7	.6		.660	
8	.7		.820	
9	.8	16	.930	102.2
10	.9	18	.990	108.8
11	1.0	20	1.00	109.9
12	1.1	22	.990	108.8
13	1.2	24	.930	102.2
14	1.3		.860	
15	1.4		.780	
16	1.5	30	.680	74.7
17	1.6		.560	
18	1.7		.460	
19	1.8		.390	
20	1.9		.330	
21	2.0	40	.280	30.8
22	2.2		.207	
23	2.4		.147	
24	2.6		.107	
25	2.8		.077	
26	3.0	60	.055	6.0
27	3.2		.040	
28	3.4		.029	
29	3.6		.021	
30	3.8		.015	
31	4.0	80	.011	1.2
32	4.5		.005	
33	5.0	100	.000	0



BASIN 'B' + DEV SITE BASIN 'I'
Q100 = 109.9
BASIN 'B'
EXISTING
Q100 = 100.0
Q, CFS
120
100
80
60
40
20
20
40
60
80
100
t, min

HYDROGRAPH COMPUTATION WORKSHEET

DATE 3-10-93
COMPUTED BY DL
CHECK BY ______

PROJECT ALB RANCH EST

LOCATION BASINS A+B + EXIST SITE

ANALYSIS POINT # 6

(DR. AREA) A = 65.0 ACRES

T_c 20 MIN

POINT RAINFALL 2.9 IN. FROM PLATE 22.2 D-1

CN = ______ FROM PLATES 22.2 C-2, 22.2 C-3

RUNOFF VOLUME R = ____ IN. FROM PLATE 22.2 C-4

COMPUTED T_p = ______ MIN. $T_p = T_c$ (Rounded to even minute)

$q_p = \frac{45.4A}{T_p}$ = ______ CFS./INCH OF RUNOFF

$(R \times q_p) = Q_{peak}$ = 162.1 CFS

$t(\text{COLUMN}) = (t/T_p)$ $t = T_p(t/T_p)$

$y = \frac{Q}{Q_{peak}}$ $Q = y(Q_{peak})$

	(t/T_p)	t (min.)	y	Q (cfs)
1	0	0	0	0
2	.1	0	.03	4.9
3	.2	4	.10	16.2
4	.3		.190	
5	.4		.310	
6	.5	10	.470	76.2
7	.6		.660	
8	.7		.820	
9	.8	16	.930	150.8
10	.9	18	.990	160.5
11	1.0	20	1.00	162.1
12	1.1	22	.990	160.5
13	1.2	24	.930	150.8
14	1.3		.860	
15	1.4		.780	
16	1.5	30	.680	110.2
17	1.6		.560	
18	1.7		.460	
19	1.8		.390	
20	1.9		.330	
21	2.0	40	.280	45.4
22	2.2		.207	
23	2.4		.147	
24	2.6		.107	
25	2.8		.077	
26	3.0	60	.055	8.9
27	3.2		.040	
28	3.4		.029	
29	3.6		.021	
30	3.8		.015	
31	4.0	80	.011	1.8
32	4.5		.005	
33	5.0	100	.000	0

.59
4.30

28.4 E
29.0 D

HYDROGRAPH COMPUTATION WORKSHEET

DATE 3-10-93
COMPUTED BY DL
CHECK BY

PROJECT ALB RANCH EST

LOCATION BASINS A+B+ DEV SITE

ANALYSIS POINT # 6

(DR. AREA) A = 65.0 ACRES

T_c 20 MIN

POINT RAINFALL 2.9 IN. FROM PLATE 22.2 D-1

CN = ______ FROM PLATES 22.2 C-2, 22.2 C-3

RUNOFF VOLUME R = ____ IN. FROM PLATE 22.2 C-4

COMPUTED T_p = ______ MIN. $T_p = T_c$ (Rounded to even minute)

$q_p = \frac{45.4A}{T_p} =$ ______ CFS./INCH OF RUNOFF

$(R \times q_p) = Q_{peak} =$ 170.1 CFS

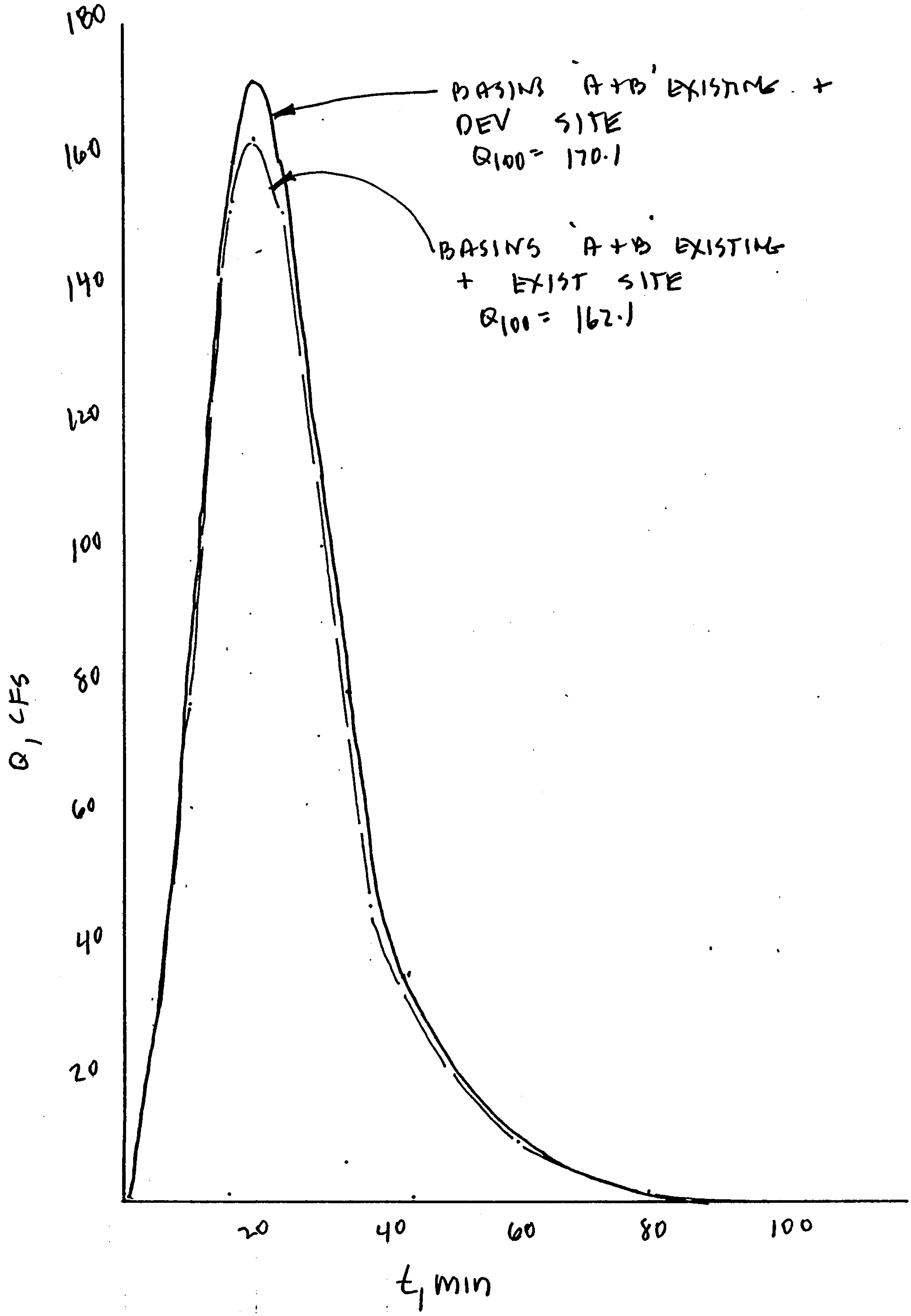
$t(\text{COLUMN}) = (t/T_p)$ $t = T_p(t/T_p)$

$y = \frac{Q}{Q_{peak}}$ $Q = y(Q_{peak})$

	(t/T_p)	t (min.)	y	Q (cfs)
1	0	0	0	0
2	.1	0	.03	5.1
3	.2	4	.10	17.0
4	.3		.190	
5	.4	8	.310	52.7
6	.5		.470	
7	.6	12	.660	112.3
8	.7		.820	
9	.8	16	.930	158.2
10	.9	18	.990	168.4
11	1.0	20	1.00	170.1
12	1.1	22	.990	168.4
13	1.2	24	.930	158.2
14	1.3		.860	
15	1.4		.780	132.7
16	1.5		.680	
17	1.6		.560	
18	1.7	34	.460	78.2
19	1.8		.390	
20	1.9		.330	
21	2.0		.280	
22	2.2	44	.207	35.7
23	2.4		.147	
24	2.6		.107	
25	2.8		.077	
26	3.0		.055	
27	3.2	64	.040	6.8
28	3.4		.029	
29	3.6		.021	
30	3.8		.015	
31	4.0		.011	
32	4.5		.005	
33	5.0	100.	.000	0

0.60

PLATE 22.2 F-1



180
160
140
120
100
80
60
40
20
Q, CFS
20
40
60
80
100
t, min
BASINS 'A+B' EXISTING + DEV SITE
Q100 = 170.1
BASINS 'A+B' EXISTING + EXIST SITE
Q100 = 162.1

HYDRAULIC GRADE LINE CALCULATIONS

DESIGN CRITERIA:

I. The HGL calculations presented herein are in accordance with the Development Process Manual, Volume II, Chapter 22.

II. Headlosses

Friction: $h_f = s_f L = (Q/K)^2 L$

Velocity: $h_v = v^2/2g$

Manhole: $h_{mh} = 0.05 h_v$

Bend: $h_b = k_b h_v$ $\quad k_b = 0.20\sqrt{\Delta/90}$

Angle: $h_{ap} = 0.0033\,\theta\,(v^2/2g)$

Junction: $h_j = y + h_{v1} - h_{v2}$

$$y = \frac{Q_2 v_2 - Q_1 v_1 - Q_3 v_3 \cos}{1/2(A_1 + A_2)g} + \frac{(s_{f1} + s_{f2})L}{2}$$

Where: $Q = \frac{1.49}{n} A R^{0.67} S^{0.5}$

Friction slope $= s_f = (Qn/1.49AR^{0.67})^2$

$$K = 1.49AR^{0.67}/n$$

PROJECT NAME ALBQ RANCH EST JOB NO. 90302

SUBJECT HGL

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I. LINE "A"

STA 9+87.43 SD OUTLET @ CHANNEL

DET d: $Q = 9.2$ CFS $Q_f = 14.7$

$D = 24''$ $n = 0.020$ $S = 0.01$

$Q/Q_f = 0.63$ $d/D_f = 0.58$ $d = 1.16'$

$A_f = 3.14$ SF $A/A_f = 0.61$ $A = 1.92$ sf

$V_f = 2.9$ FPS $V/V_F = 1.05$ $V = 3.2$ fps

$R_f = 0.50$ $R/R_f = 1.08$ $R = 0.54'$

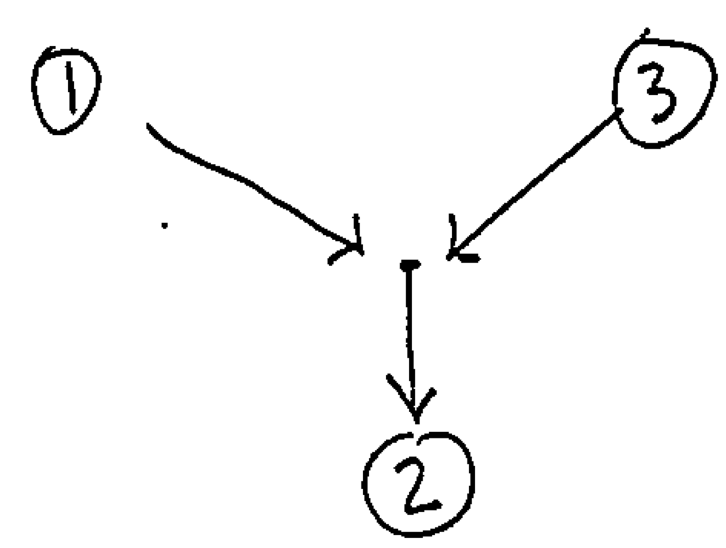
$K = 94.83$ $S_f = 0.0094$

HGL @ STA 9+87.43 = 55.0 + 1.16 56.16

STA 9+88.45

WYE (OUT) HGL = 56.16 + 0.01 = 56.17

WYE (IN)



$\theta = 60°$
$\cos\theta = 0.50$

$Q_1 = 5.4$ $Q_{1f} = 6.7$ $Q/Q_{f_1} = 0.81$ $d/D_f = 0.68$

$A_{f_1} = 1.77$ $A/A_{f_1} = 0.73$ $A_1 = 1.3$ $d_1 = 1.02'$

$V_{f_1} = 3.8$ $V/V_{f_1} = 1.12$ $V_1 = 4.1$ $h_{V_1} = 0.26'$

$R_{f_1} = 0.38$ $R/R_{f_1} = 1.17$ $R_1 = 0.44$

$K_1 = 56.01$ $S_1 = 0.01$

$S_{f_1} = 0.0093$

PROJECT NAME ALBQ RANCH EST JOB NO.

SUBJECT

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$Q_3 = 3.8$ $Q_f = 6.7$ $Q/Q_f = 0.57$ $K_3 = 39.22$

$A_{f_3} = 1.77$ $A/A_f = 0.55$ $A_3 = 0.97$ $S_{f_3} = 0.0094$

$V_{f_3} = 3.8$ $V/V_f = 1.03$ $V_3 = 3.9$ $S_3 = 0.01$

$R_{f_3} = 0.38$ $R/R_f = 1.05$ $R_3 = 0.4$

$d/D_{f_3} = 0.54$ $d_3 = 0.81'$

$Q_2 = 9.2$ $V_2 = 3.2$ $A_2 = 1.92$ $R_2 = 0.54'$ $S_{f_2} = 0.0094$

$h_{v_2} = 0.16'$

$$h_j = \Delta y + h_{v_1} - h_{v_2}$$

$$\Delta y = \frac{9.2(3.2) - 5.4(4.1) - 3.8(3.9)(0.5)}{1/2\,(1.3 + 1.92)\,g} - 6\frac{(0.0093 + 0.0094)}{2}$$

$\Delta y = 0.06'$ $h_j = 0.06 + 0.26 - 0.16 = \underline{0.16'}$

$\Rightarrow$ HGL WYE (IN) $= 56.17 + 0.16 = \underline{56.33}$

STA 10+20

HGL (DI) OUT $= 56.33 + 0.0093(23.10) = \underline{56.54}$

$Q_1 = 3.0$ CFS $Q_f = 4.2$ $Q/Q_f = 0.71$ $K_1 = 29.6$

$d = 15''$ $d/D_f = 0.62$ $d_1 = 0.78'$

$A_f = 1.23$ $A/A_f = 0.65$ $A_1 = 0.80$ $S_{f_1} = 0.010$

$R_f = 0.31$ $R/R_f = 1.13$ $R_1 = 0.35$ $S_1 = 0.01$

$V_f = 3.4$ $V/V_f = 1.08$ $V_1 = 3.7$

PROJECT NAME ALBQ RANCH EST JOB NO.

SUBJECT

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$h_{MH} = 0.05\, h_v$ $h_{v_1} = 0.21$ $h_{MH} = 0.01'$

HGL (DI) IN = 56.54 + 0.01 = 56.55

STA 11+28.13

HGL (90°) OUT = 56.55 + 108'(0.010) = 57.63

$Q_1 = 3.0$ $Q_f = 8.4$ $Q/Q_f = 0.33$ $K_1 = 13.95$

$d_1 = 15''$ $d/d_f = 0.40$ $d_1 = 0.50$ $Sf_1 = 0.046$

$A_f = 1.23$ $A/A_f = 0.37$ $A_1 = 0.46$ $h_B = 0.2\, hv_1 = 0.12'$

$V_f = 6.8$ $V/V_f = 0.90$ $V_1 = 6.12$

$R_f = 0.31$ $R/R_f = 0.85$ $R_1 = 0.26$ $S_1 = 0.040$

HGL (90°) IN = 57.63 + 0.12 = 57.75

STA 12+51.13

HGL DI (OUT) = 57.75 + 123(0.046) = 63.41

$Q_1 = 2.2$ $Q_f = 3.1$ $Q/Q_f = 0.71$

$d_1 = 12''$ $d/d_f = 0.62$ $d_1 = 0.62'$ $K_1 = 16.25$

$A_f = 0.79$ $A/A_f = 0.65$ $A_1 = 0.51$ $Sf_1 = 0.0183$

$R_f = 0.25$ $R/R_f = 1.13$ $R_1 = 0.28$ $S_1 = 0.018$

$V_f = 3.9$ $V/V_f = 1.08$ $V_1 = 4.5$

$h_{MH} = 0.05\, hv_1 = 0.02'$

HGL DI (IN) = 63.41 + 0.02 = 63.43

PROJECT NAME ALBQ RANCH EST JOB NO.

SUBJECT

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STA 13+78.13

HGL DI (OUT) = 63.43 + 127 (0.0183) = 65.75

$Q_1 = 1.1$ $Q_f = 4.7$ $Q/Q_f = 0.23$ $S_1 = 0.04$

$d = 12''$ $d/d_f = 0.33$ $d_1 = 0.33'$ $K_1 = 5.9$

$A_f = 0.79$ $A/A_f = 0.3$ $A_1 = 0.24$

$V_f = 5.9$ $V/V_f = 0.83$ $V_1 = 4.9$ $S_{f_1} = 0.035$

$R_f = 0.25$ $R/R_f = 0.75$ $R_1 = 0.19$ $h_{MH} = 0.02'$

HGL DI (IN) = 65.75 + 0.02 = 65.77

STA 14+78.13

HGL DI (OUT) = 65.77 + 100 (0.035) = 69.27

PROJECT NAME ALBQ RANCH EST JOB NO.

SUBJECT

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II LINE B.

STA 9+87.43

$Q = 6.9$ CFS $Q_f = 14.7$ $Q/Q_f = 0.47$ $d = 24''$

$A_f = 3.14$ $A/A_f = 0.47$ $A = 1.48$ $d/D_f = 0.48$

$R_f = 0.50$ $R/R_f = 0.97$ $R = 0.49$ $d = 0.96'$

$V_f = 2.9$ $V/V_f = 0.97$ $V = 2.8$

$S = 0.01$ $K = 68.5$ $S_f = 0.010$

HGL @ STA 9+87.43 = 56.7 + 0.48 = 57.18

STA 10+00

HGL 90° (OUT) = 57.18 + 13(0.01) = 57.31

$h_B = 0.20$ $h_V = 0.02$

HGL 90° (IN) = 57.31 + 0.02 = 57.33

STA 10+24

HGL DI (OUT) = 57.33 + 24(0.01) = 57.57

$Q_1 = 5.6$ $Q_f = 6.7$ $Q/Q_f = 0.83$ $S_1 = 0.01$

$d = 18''$ $d/D_f = 0.70$ $d_1 = 1.05'$

$A_f = 1.77$ $A/A_f = 0.75$ $A_1 = 1.32$ $K_1 = 56.87$

$R_f = 0.38$ $R/R_f = 1.17$ $R_1 = 0.44$ $S_{f_1} = 0.0097$

$V_f = 3.8$ $V/V_f = 1.12$ $V_1 = 4.3$

$h_{MH} = 0.01$

PROJECT NAME ALBQ RANCH EST JOB NO.

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HGL DI (IN) = 57.57 + h_{MH} = 57.58

STA 11+27

HGL DI (OUT) = 57.58 + 103 (0.0097) = 58.58

Q_1 = 3.8 Q_f = 6.7 Q/Q_f = 0.57

d = 15" d/D_f = 0.54 d_1 = 0.68 S_1 = 0.0256

A_f = 1.23 A/A_f = 0.55 A_1 = 0.68 K_1 = 24.2

R_f = 0.31 R/R_f = 1.05 R_1 = 0.33 Sf_1 = 0.0247

V_f = 5.4 V/V_f = 1.03 V_1 = 5.6 h_{MH} = 0.02

HGL DI (IN) = 58.58 + h_{MH} = 58.60

STA 12+38.87

HGL DI (OUT) = 58.60 + 112 (0.0247) = 61.37

Q = 3.1 Q_f = 6.7 Q/Q_f = 0.46

d = 15" d/d_f = 0.48 S = 0.0256

A/A_f = 0.46 A_1 = 0.57 K_1 = 19.0

R/R_f = 0.97 R_1 = 0.30 Sf_1 = 0.0266

V/V_f = 0.97 V_1 = 5.2 h_{MH} = 0.02

HGL DI (IN) = 61.37 + h_{MH} = 61.39

STA 13+57.49

HGL DI (OUT) = 61.39 + 119 (0.0266) = 64.55

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$Q_1 = 1.8$ $Q_f = 2.3$ $Q/Q_f = 0.78$ $S_1 = 0.01$

$d = 12"$ $d/d_f = 0.67$ $d_1 = 0.67'$ $K_1 = 18.7$

$A_f = 0.79$ $A/A_f = 0.72$ $A_1 = 0.57$

$R_f = 0.25$ $R/R_f = 1.17$ $R_1 = 0.29$ $S_{f_1} = 0.0151$

$V_f = 2.9$ $V/V_f = 1.12$ $V_1 = 3.3$ $h_{MH} = 0.01$

$h_b = 0.03$

HGL DI (IN) = $64.55 + h_{MH} + h_b =$ 64.59

STA 14+20

HGL = $64.59 + 63(0.0151) =$ 65.54

$Q = 1.8$ $Q_f = 5.1$ $Q/Q_f = 0.35$ $S = 0.050$

$d = 12"$ $d/d_f = 0.4$ $d_1 = 0.4'$

$A/A_f = 0.38$ $A = 0.30$ $K_1 = 8.1$

$R/R_f = 0.87$ $R = 0.22$ $S_{f_1} = 0.0489$

$V/V_f = 0.90$ $V = 5.8$ $h_b = 0.10$

STA 14+58.56

HGL TEE (OUT) = $65.54 + 39(0.0489) =$ 67.45

HGL TEE (IN) = $67.45 + h_b =$ 67.55

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$Q = 0.9$ $Q_f = 5.1$ $Q/Q_f = 0.18$ $S = 0.05$

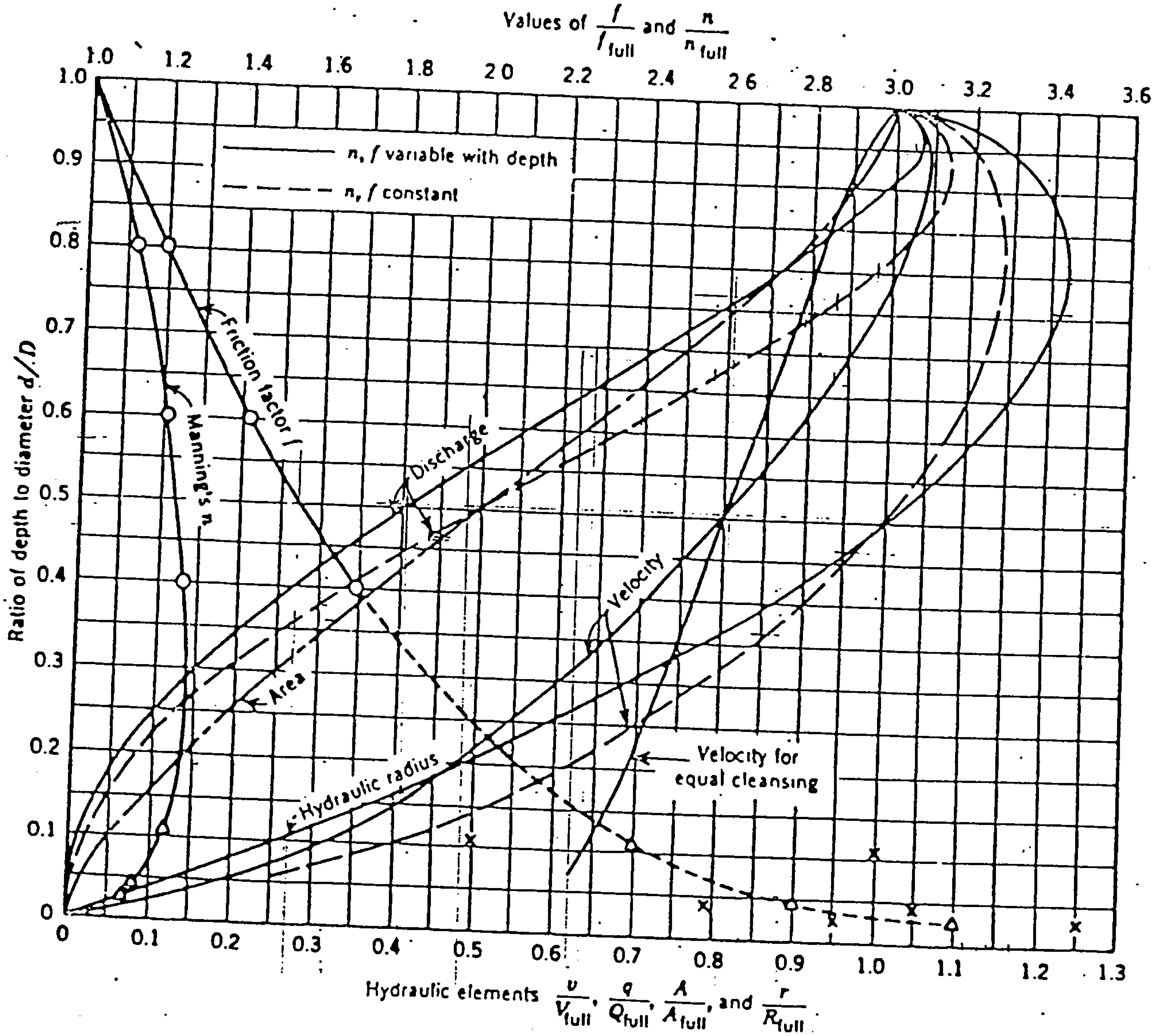
$d = 12''$ $d/d_f = 0.3$ $d = 0.3'$ $K = 4.6$

$A_f = 0.79$ $A/A_f = 0.25$ $A = 0.20$ $S_f = 0.039$

$R_f = 0.25$ $R/R_f = 0.68$ $R = 0.17$

$V_f = 6.5$ $V/V_f = 0.77$ $V = 5.0$

$HGL = 67.55 + 48(0.039) = \underline{69.42}$



v = Actual velocity of flow (fps)
V_{full} = Velocity flowing full (fps)
q = Actual quantity of flow (cfs)
Q_{full} = Capacity flowing full (cfs)
A = Area occupied by flow (ft^2)
A_{full} = Area of pipe (ft^2)
r = Actual hydraulic radius (ft.)
R_{full} = Hydraulic radius of full pipe (ft.)

FIGURE 8-1. HYDRAULIC ELEMENTS OF CIRCULAR CONDUITS (2)