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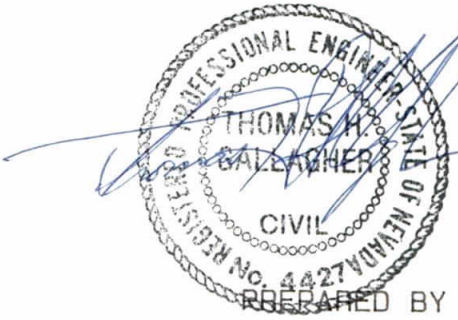
DESIGN CALCULATIONS
FOR
EVANS AND DRY CREEK
THROUGH
PARK 2001

PREPARED FOR

THE RIBEIRO CORPORATION



PREPARED BY

SUMMIT ENGINEERING CORPORATION

MAY 13, 1987

The following calculations are for the proposed drainage channels (Dry and Evans) through Park 2001.

Section 1 - Dry Creek

The design Q for this channel was 4200 CFS. This flow was derived from existing structures upstream, existing data and contributing area between upstream structures and Park 2001. This flow was confirmed by the City of Reno Engineering Department.

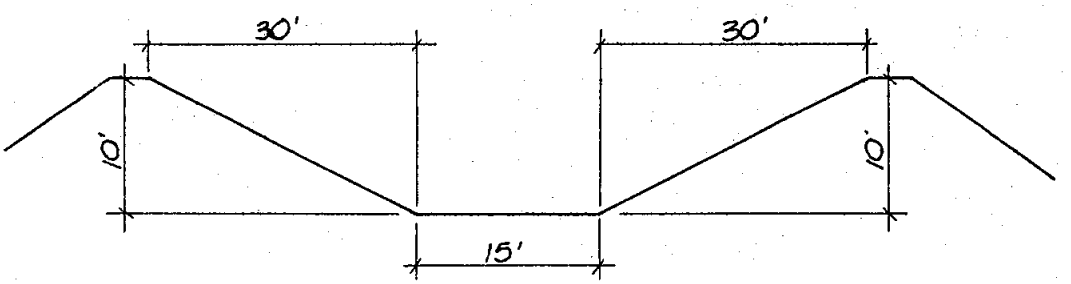
The channel is proposed to be lined with grass and maintained by Park 2001; therefore, a Mannings coefficient of 0.025 was assumed.

$$Q = 1.49\ AR^{2/3}\ S^{1/2}$$

Where:

Q = Design Flow in CFS
N = Mannings Coefficient
A = Area
R = Hydraulic Radius
S = Channel Slope in FT/FT

The following section was used:



SECTION 1

The capacity of this section flowing full is:

S = 0.~~0005~~ .005 FT/FT

N = 0.025

A = ~~400~~ 450 SF

WP = 78.25 FT

R = ~~5.11~~ 5.75 FT

$$Q = \frac{1.49}{0.025}(\sim\!\!400\sim\!\!)(\sim\!\!5.11\sim\!\!)\ 2/3\ (0.005)\ 1/2 = \sim\!\!5001\sim\!\! \text{ CFS}$$

450 5.75 6071

As this indicates, the channel has been designed to carry the required 4200 CFS.

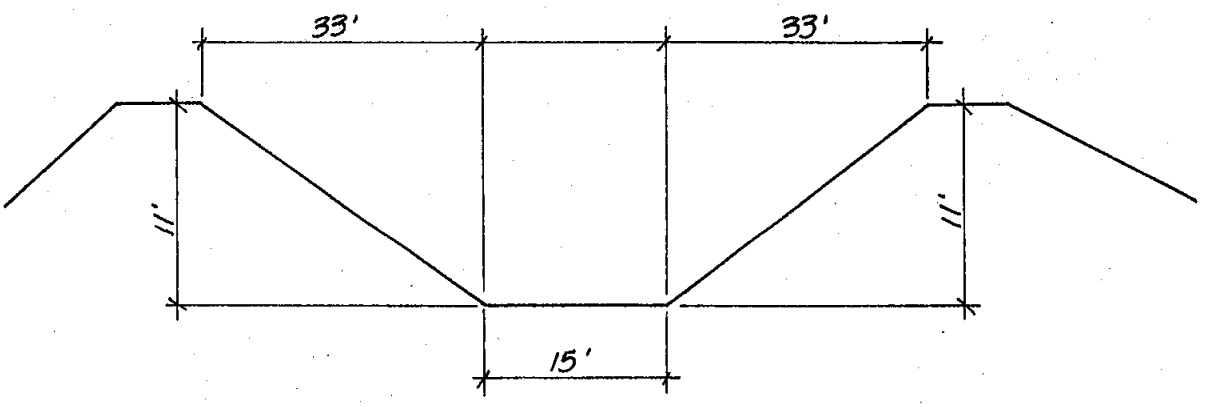
Please reference Figure 1 which indicates the velocity and actual water elevation of 4200 CFS through this channel.

As the figure indicates, the velocity of the flow will be 12.27 feet per second and the water depth will be 8.47 feet; thus, there will be 1.53 feet of freeboard within the channel.

Section 2 - Evans and Dry Creek - (Slope at 0.0050 FT/FT)

The design Q for this channel was 5545 CFS. This flow was derived from the same assumptions for Dry Creek as mentioned earlier and the addition of Evans Creek.

The following section was used:



SECTION 2

The capacity of this section flowing full is:

S = 0.0050 FT/FT
N = 0.0250
A = 528 FT^2
WP = 84.57 FT
R = 6.24 FT
Q = 1.49 (528)(6.24) 2/3 (0.005) 1/2 = 7542 CFS
0.025

As this indicates, the channel has been designed to carry the required 5545 CFS.

Please reference Figure 2 which indicates the velocity and actual water elevation of 5545 CFS through the channel.

As the figure indicates, the velocity of the flow will be 13.18 feet per second and the water depth will be 9.60 feet. There there will be 1.4 feet of freeboard within the channel.

Section 3 - Evans and Dry Creek (Slope at 0.0075 FT/FT)

The same design Q of 5545 CFS and cross Section 2 were used.

The capacity will be:

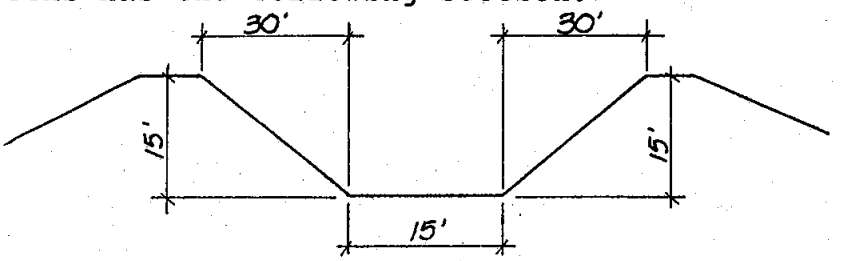
S = 0.0075 FT/FT
N = 0.025
A = 0.025
WP = 84.57 FT
R = 6.24 FT
Q = 1.49 (528)(6.24) 2/3 (0.0075) 1/2 = 9237 CFS
0.025
9235 CFS $\geq$ 5545 CFS - OK

Please reference Figure 3 which indicates the velocity and actual water elevation of 5545 CFS through the channel.

As the figure indicates, the velocity of the flow will be 15.33 feet per second and the water depth will be 8.76 feet. Thus, there will be 2.24 feet of freeboard within the channel.

Section 4 - Existing Channel (Dry and Evans)

The existing channel through Park 2001 which carries runoff from Dry and Evans Creeks has the following section.



SECTION 3

S = 0.0050 FT/FT

Mannings Coefficient = 0.030

The channel flowing full has the following capacity flowing full:

S = 0.0050 FT/FT

N = 0.030

A = 675 FT^2

WP = 82.08 FT

R = 8.22 FT

$$Q = \frac{1.49}{0.030}(675)(8.22)^{2/3}(0.0050)^{1/2} = 9655 \text{ CFS}$$

9655 CFS > 5545 CFS: OK

Please reference Figure 4 for the velocity and actual water elevation for 5545 CFS flowing through this channel.

As the figure indicates, the velocity is 12.40 feet per second and the water elevation is 11.67 feet which provides for 3.33 feet of freeboard within the channel.

Please reference Figure 5 which implements these calculations through a hydraulic grade line through the channel.

Channel Specifications

1. Channel bottom width shall be 15' as indicated on Sheets M-1 through M-3.

2. The banks shall be constructed to a 3:1 slope.

3. The entire channel shall be planted with Kentucky Bluegrass or approved equal.

4. Shrubs and trees may be planted periodically in a manor not to restrict flow.

As the calculations indicate, the velocities are between 12 and 15 feet per second. Acceptable velocities through a grass-lined channel similar to the ones proposed are in the range of 8 to 9 feet per second. Anything above this may result in some erosion damage.

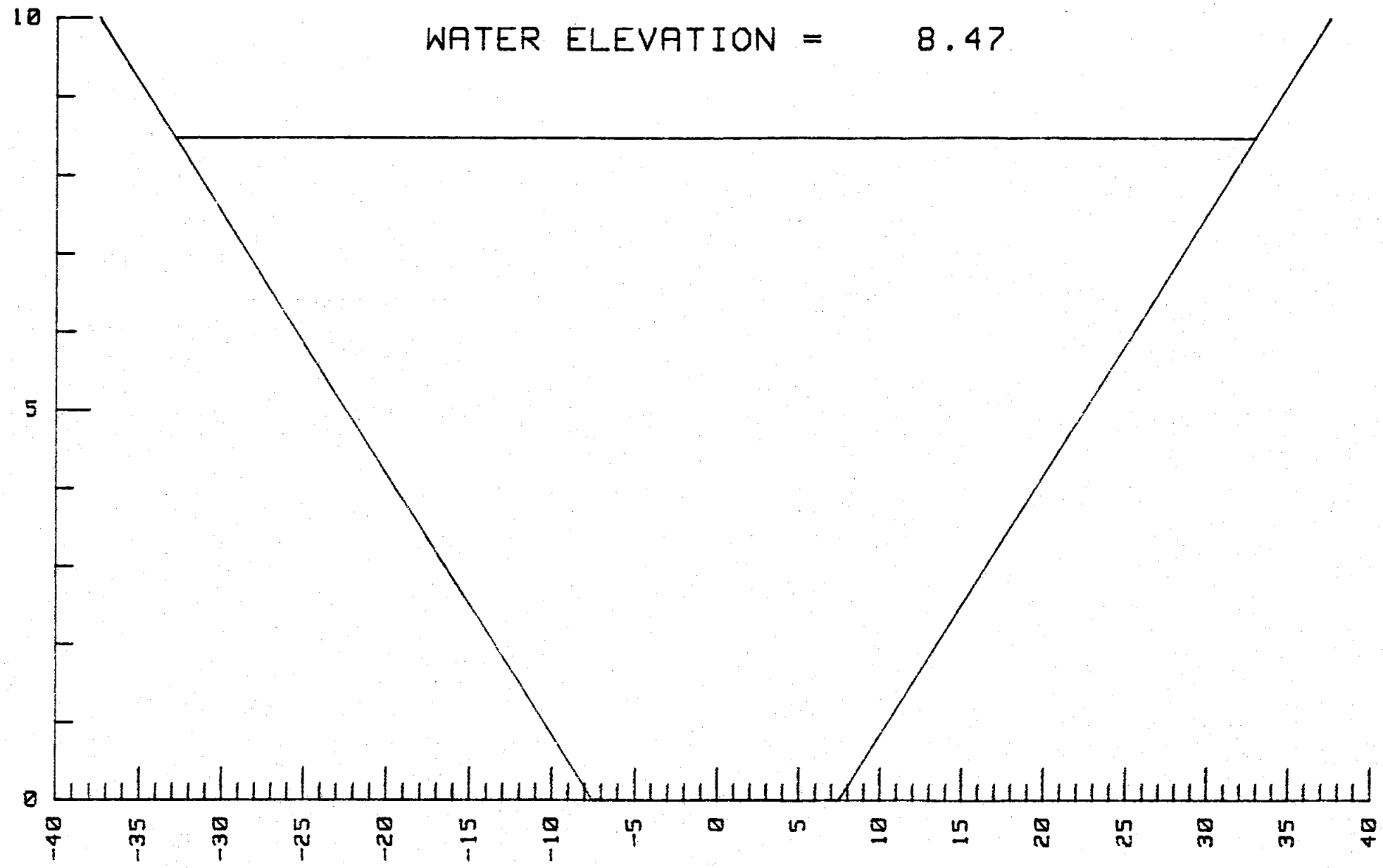
Although the velocities during a 100-year event may cause some erosion damage, with the enforcement of the maintenance agreement between the City of Reno and Park 2001, any damage to the channels will be repaired by Park 2001.

It is the developer's hope to construct the channels such that they are an attractive addition to this development. The channels will be mowed and maintained along with the other landscaped areas within Park 2001. With this we feel that constructing "cut of walls" within the channel will create a maintenance problem and create a silt trap over an area which the developers will be trying to keep green and free of debris.

$d = 6'$

$Q =$

OPEN CHANNEL FLOW OF IRREGULAR SECTION

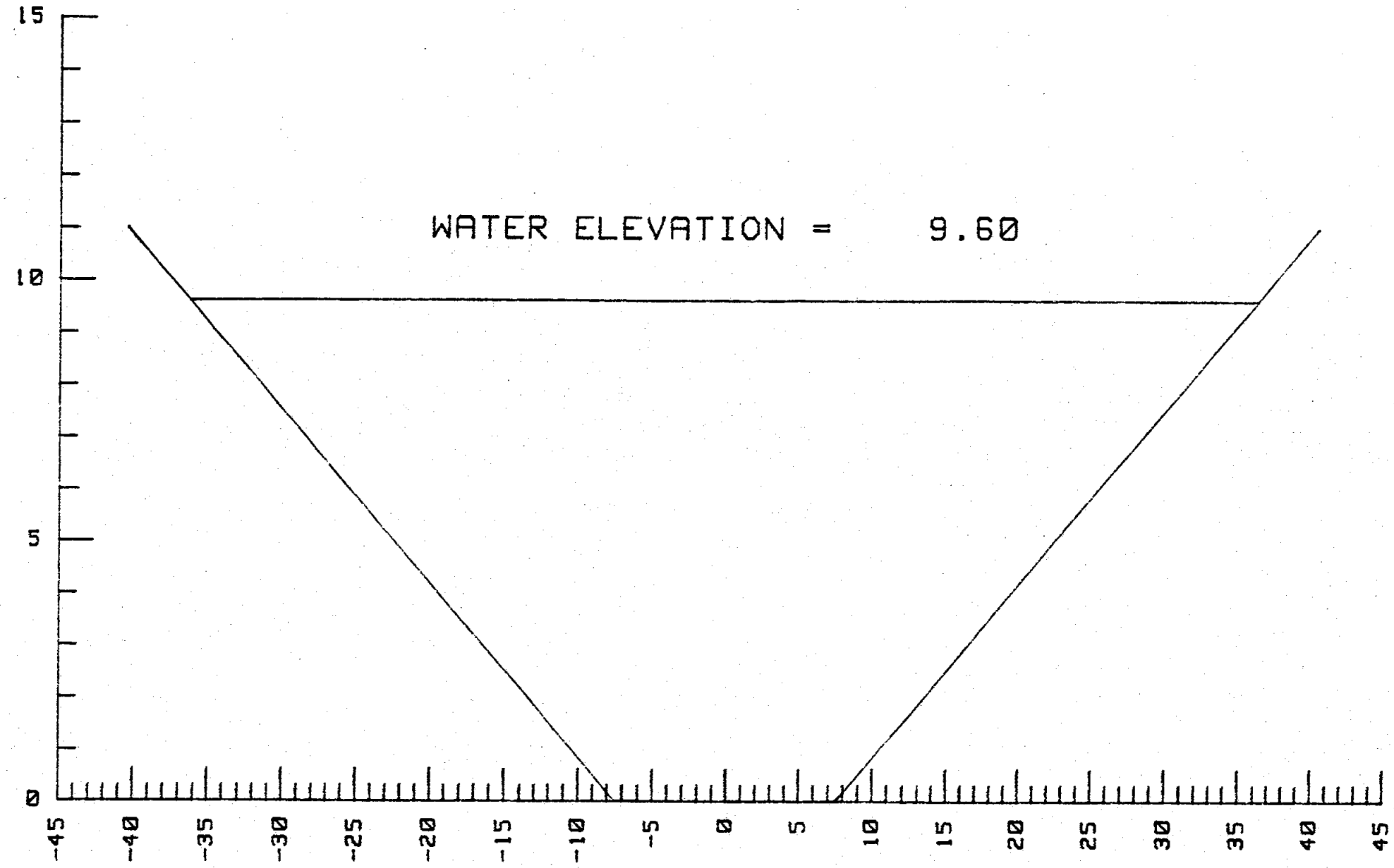


DRY CREEK

Q VALUE =	4200	WATER ELEVATION =	8.47
VELOCITY =	12.27	AREA =	342.17
CHANNEL SLOPE =	.0050	MANNINGS N =	.0250
LEFT CATCH PT. =	-32.9	RIGHT CATCH POINT =	32.9

FIGURE 1

OPEN CHANNEL FLOW OF IRREGULAR SECTION

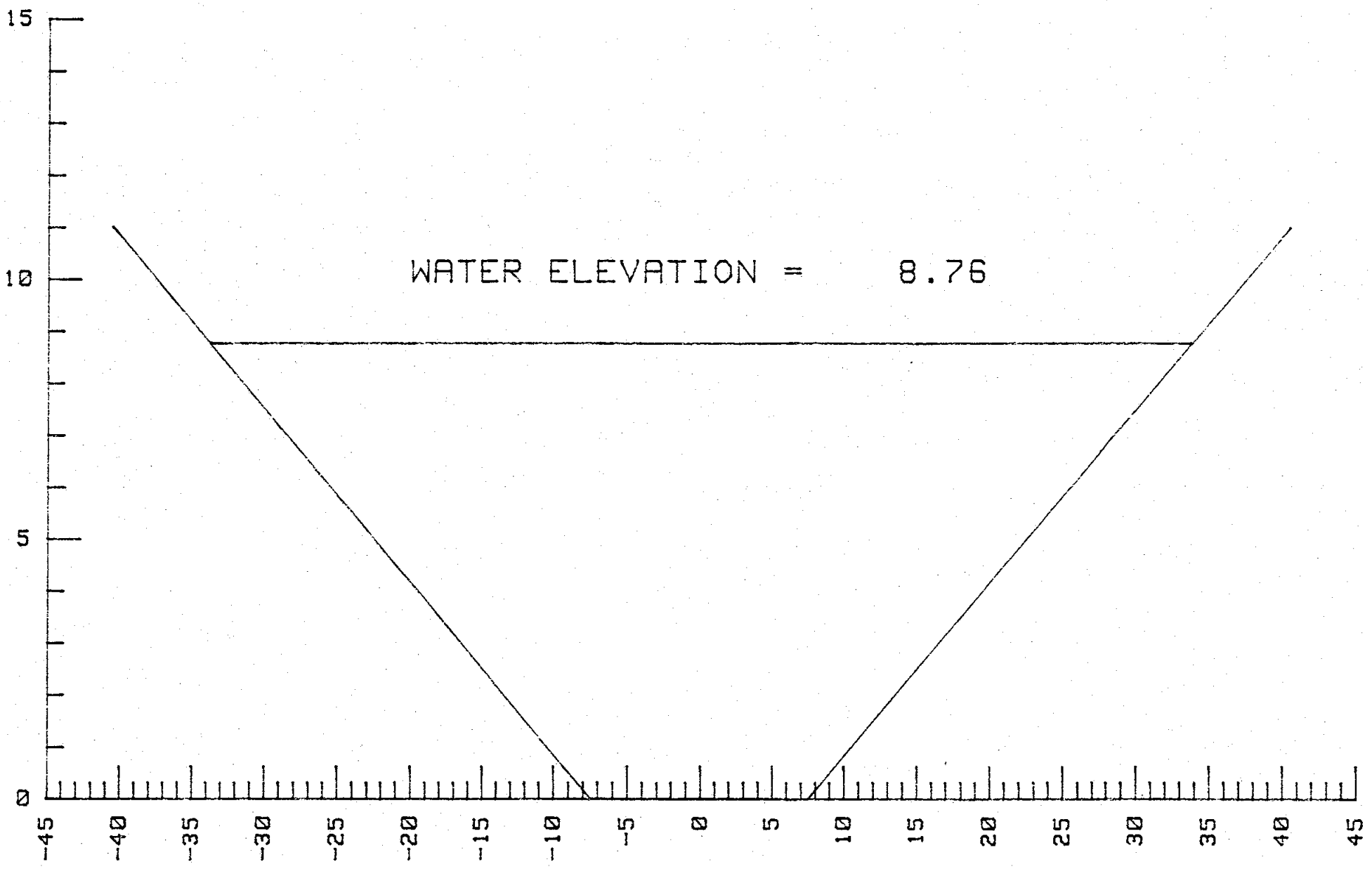


DRY & EVANS CREEK

Q VALUE =	5545	WATER ELEVATION =	9.60
VELOCITY =	13.18	AREA =	420.64
CHANNEL SLOPE =	.0050	MANNINGS N =	.0250
LEFT CATCH PT. =	-36.3	RIGHT CATCH POINT =	36.3

FIGURE 2

OPEN CHANNEL FLOW OF IRREGULAR SECTION

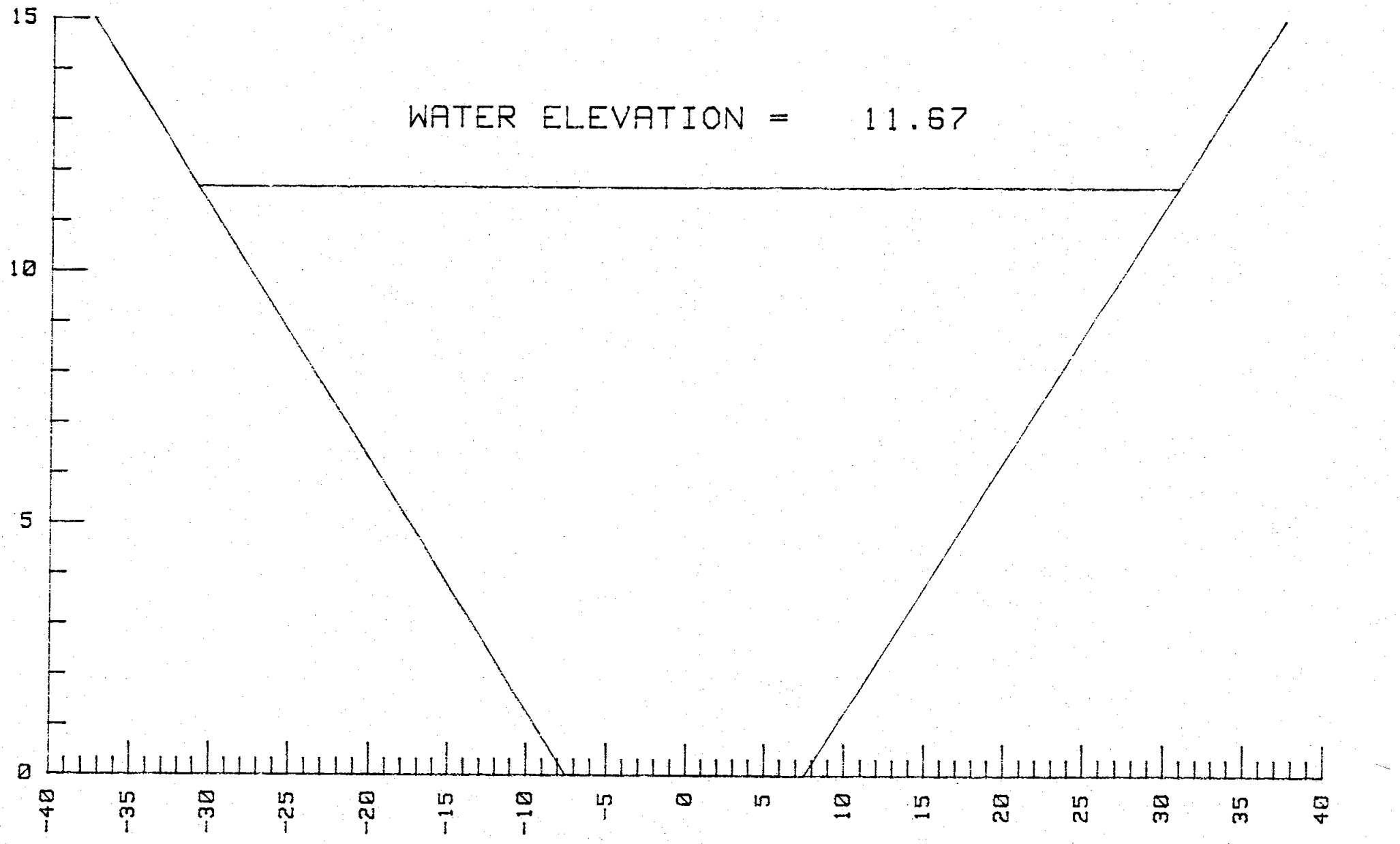


DRY &EVANS CREEK

Q VALUE =	5545	WATER ELEVATION =	8.76
VELOCITY =	15.33	AREA =	361.79
CHANNEL SLOPE =	.0075	MANNINGS N =	.0250
LEFT CATCH PT.=	-33.8	RIGHT CATCH POINT =	33.8

FIGURE 3

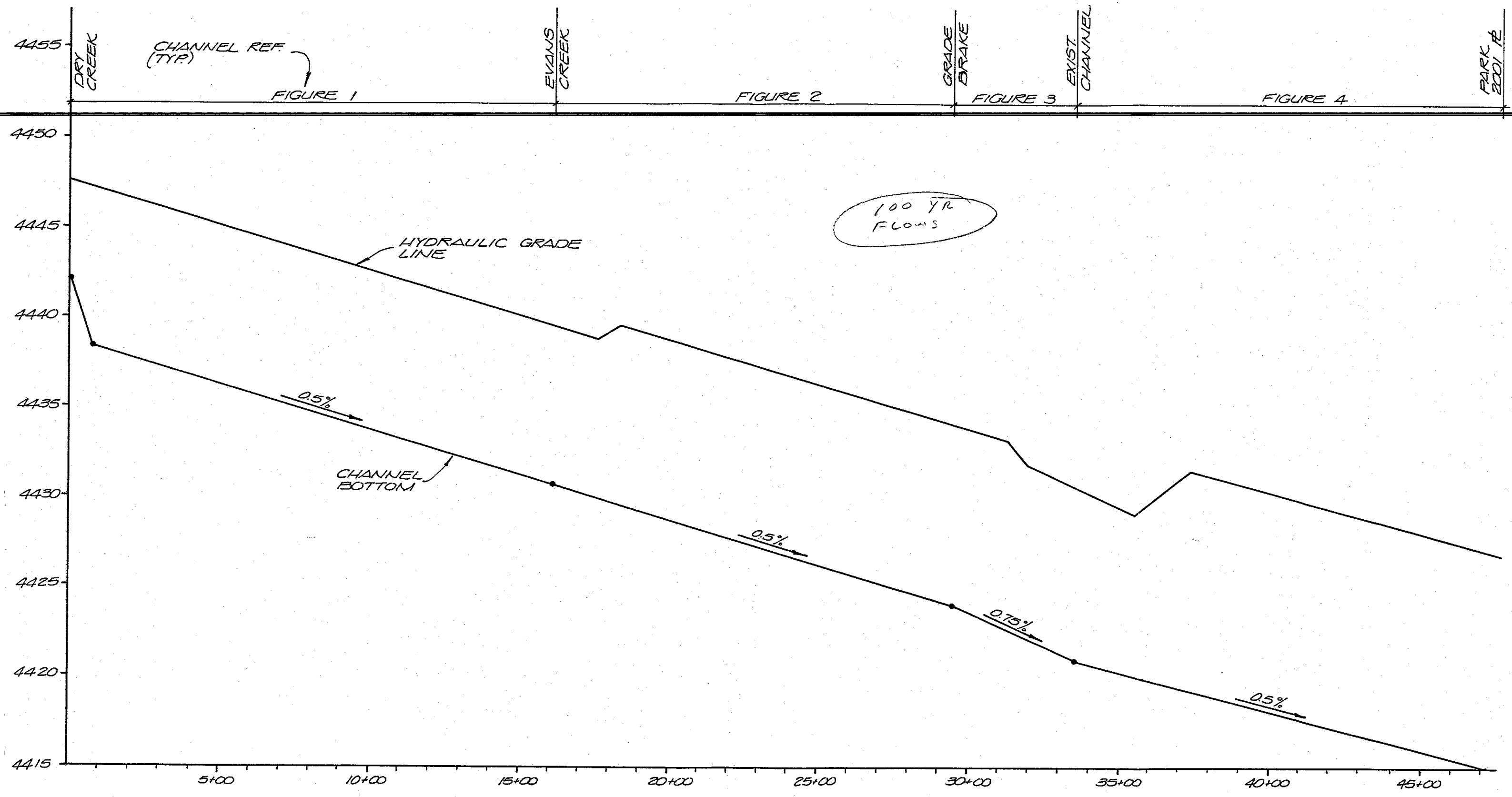
OPEN CHANNEL FLOW OF IRREGULAR SECTION



DRY & EVANS CREEK

Q VALUE =	5545	WATER ELEVATION =	11.67
VELOCITY =	12.40	AREA =	447.31
CHANNEL SLOPE =	.0050	MANNINGS N =	.0300
LEFT CATCH PT.=	-30.8	RIGHT CATCH POINT =	30.8

FIGURE 4



SCALE:

HORIZ: 1" = 300'
VERT: 1" = 5'

FIGURE 5