HYDROLOGY H17/D1 1 PLAN

H17/D1

1 PLAN

Draft

Mr. Rufus H. Carter, Jr., P.E.
1721 Girard Boulevard, N.E.
Albuquerque, New Mexico

Reference: Revision of Recreation Facilities

Dear Mr. Carter:

~~The~~ A field inspection was has revealed that the proposed additional construction on this site will not adversely affect the adjacent property. Therfore, this office will interpose no objection to ~~new~~ ~~for~~ the proposed development.

I want also, to notify you, that the methodical computations submitted with the drainage report are not acceptable and should not be used in the future. For instance, a time of concentration ~~construction~~ of 4.0 min. ~~four~~ minutes for flow ~~on [illegible]~~ over 25 ft. ~~feet~~ of pavement is not a realistic ~~advisable~~ assumption.

The hydraulic gradient must be defined when a storm sewer design is submitted and ~~high flow can not exist over~~ surcharged conditions can exist search change ~~commission~~.

~~It has also been found that the Seelye Data Book, norem grafts~~ nomographs and formulas are not consistent with similar computations ~~from~~ for the time of concentration obtained from other sources ~~of computation~~, and are not usually acceptable in this office. Particularly in view of the high intensity participation expense in Albuquerque with the 100 year frequency storm.

~~In this nomograph is to be inter in the design manual published by the City.~~

If you want to dissuss this matter further, please don't hesitate to contact my office.

~~Be~~ Very truly yours,

Bruno Conegliano
Asst. City Engineer-Hydrology

cc: ~~Reading File~~
Drainage File
Rd Lem
Rd Hll
Fred Hgm

City of Albuquerque
P.O. BOX 1293 ALBUQUERQUE, NEW MEXICO 87103

October 9, 1979

Mr. Rufus H. Carter, Jr., P.E.
1721 Girard Blvd., N. E.
Albuquerque, New Mexico

Reference: Revision of Recreation Facilities

Dear Mr. Carter:

A field inspection has revealed that the proposed additional construction on this site will not adversely affect the adjacent property. Therefore, this office will interpose no objection to the proposed development.

I want also to notify you, that the methods of computation submitted with the drainage report, are not acceptable and should not be used in the future. For instance, a time of concentration of 4.0 min. for flow over 25 ft. of pavement is not a realistic assumption.

The hydraulic gradient must be defined when a storm sewer design is submitted and surcharged conditions can exist.

If you want to discuss this matter further, please don't hesitate to contact my office.

Very truly yours,

Bruno Conegliano
Asst. City Engineer-Hydrology

BC/lc

cc: Rich Leonard, AMAFCA
Richard Heller, City Engineer
Fred Aguirre, Asst. Hydrology Engineer
Drainage File

Boyle Engineering Corporation

1721 Girard Boulevard, N.E.
Albuquerque, New Mexico 87106

consulting engineers

505 / 266-7787

Mr. Bruno Conigliano
Ass't City Engineer-Hydrology
City Hall
Albuquerque, New Mexico 87103

RECEIVED
AUG 29 1979
CITY ENGINEER

Dear Sir:

Transmitted herewith is a copy of:

Drainage Report for Revision
of Recreation Facilities at
the Supreme Courts for
Jorge de la Torre AIA
dated August 1979.

Your review and approval at an early date will be appreciated.

Very Truly Yours,

BOYLE ENGINEERING CORPORATION

Rufus H. Carter Jr.

Rufus H. Carter. Jr., P.E.
Senior Civil Engineer

RHC/pkj
Enc.

June 2, 1975

FM
BF

City of Albuquerque
Office of the City Engineer
P. O. Box 1293
Albuquerque, New Mexico 87103

Attention: Mr. Kleston Laws

Re: Four Seasons Court Club

Dear Kleston:

I am enclosing a plan showing the proposed paving, grading and storm flow drainage for the Four Seasons Court Club. As you will note, this is a temporary solution to convey overland flow from the project to join existing paved areas which drain thru an existing overflow structure directly to the A.M.A.F.C.A. channel.

Since this is a fairly uncomplicated drainage condition, I have made only two computations. The first is for flow generated by the proposed construction and the second is for the capacity of the swale.

$Q = CIA$ = generated flow
$Q = 0.9 \times 7.2 \times 1.1 = 7.1$ cfs
Q = swale capacity (Mannings formula)
$Q = 10 \times \frac{1.486}{0.030} \times 0.63 \times 0.082 = 25.6$ cfs

Planning is underway for Phase III expansion of the Four Seasons Motor Inn which will complete the site work between the Court Club and the existing motel and give permanent status to the drainage conditions.

Please review our solution and, if acceptable, notify me and I will forward the original drawing for your signature.

Very truly yours,

Bob

Robert T. Sheppard
Flatow, Moore, Bryan & Fairburn

RTS:mls
Encl.

cc: Mr. Dan Buckley
Mr. Bob Williams

Field Inspection 4 June 75
4 Season inlet to AMAFCA
inlet 6" high 3' wide

$Q = CLH^{3/2}$
$Q = (2.6)(3)(.5)^{3/2}$
$Q = 2.7$

Flatow · Moore · Bryan and Fairburn architects • engineers • planners, inc.
MAX FLATOW, FAIA ASSOCIATES William O. Jytte, AIA JASON P. MOORE, AIA Leon A. Ross, Jr., AIA George H. Bolling, AIA Donald M. Shaffer, AIA GARLAN D. BRYAN, AIA Wayne G. Andrews, AIA James A. Innis, P.E. ROBERT W. FAIRBURN, AIA Clarence W. Via, P.E.
ALBUQUERQUE, NEW MEXICO 87108 5301 CENTRAL AVENUE, N.E. SUITE 1600 TELEPHONE (505) 268-6783

Drainage File

City of Albuquerque

PUBLIC WORKS DEPARTMENT
ENGINEERING DIVISION

June 4, 1975

Mr. Robert T. Sheppard
Flatow, Moore, Bryan and Fairburn
5301 Central Avenue N.E.
Albuquerque, New Mexico 87108

RE: DRAINAGE FOUR SEASONS COURT CLUB

Dear Mr. Sheppard:

Your letter and calculations for the subject project have been reviewed. Field investigation shows the overflow structure which drains into the AMAFCA inlet and channel is very small. I doubt it can handle the flows shown in the above report, exclusive of those from the existing motel and the proposed Phase III. If this outlet is not adequate, overflow could occur at locations other than the inlet with potential of damaging the AMAFCA right-of-way and channel.

Since the overflow is not large enough, the subject report cannot be approved until modifications occur.

Very truly yours,

Kleston H Laws

Kleston H. Laws
Assistant City Engineer-Hydrology

KHL/fs

FM
BF

June 9, 1975

RECEIVED

JUN 10 1975

CITY ENGINEERS

Office of City Engineer
City of Albuquerque
P. O. Box 1293
Albuquerque, New Mexico 87103

Attention: Mr. Kleston Laws

Dear Kleston:

I am enclosing a print showing the work done after Phase II construction of the Four Seasons Motel (i.e., existing conditions). As you can see, the limiting factor is the notch in the existing retaining wall. This opening can easily be enlarged and the adjacent pavement regraded to accommodate projected flows from both the Court Club and Phase III expansion. I believe the following computations will show that a satisfactory solution can be obtained with the above procedure.

The entire site contains approximately 13.6 acres. Of this area, 4 acres ± of existing paved surface is directed to Carlisle Avenue; 1.5 acres ± is directed to the southwest property corner and flow conveyed to the drainage channel by area inlet and storm drain.

Treating the remaining 8.1 acres as totally hard-surfaced, the overland flow contribution is computed as follows:

$$A = 8.1 \text{ Acres}$$
$$L = 800'$$
$$S = 53\text{-}35/800 = 0.0225'/\text{ft.}$$

.62

$$Q = 8.1 \times 0.9 \times 4.7 = 34 \text{ cfs.}$$

By enlarging the existing notch to a length of 23 feet and treating it as channel flow, the capacity becomes:

$$Q_n = 11.5 \times \frac{1.486}{0.013} \times 0.613 \times 0.0474 = 38 \text{ cfs.}$$

Please consider this solution and let me know it it will fulfill your requirements.

Very truly yours,

$$34 = 2.6(L)(.5)^{3/2}$$
$$L = \frac{34}{(2.6)(.5)^{3/2}} = 37'$$

Bob

Robert T. Sheppard
RTS:ds Encls.

Flatow · Moore · Bryan and Fairburn architects • engineers • planners, inc.
MAX FLATOW, FAIA ASSOCIATES William O. Jette, AIA JASON P. MOORE, AIA Leon A. Ross, Jr., AIA George H. Bolling, AIA GARLAN D. BRYAN, AIA Donald M. Shaffer, AIA Wayne G. Andrews, AIA ROBERT W. FAIRBURN, AIA James A. Innis, P.E. Clarence W. Via, P.E.
ALBUQUERQUE, NEW MEXICO 87108 5301 CENTRAL AVENUE, N.E. SUITE 1600 TELEPHONE (505) 268-6783

June 13, 1975

Mr. Robert T. Sheppard
Flatow, Moore, Bryan and Fairburn
5301 Central Avenue N.E.
Albuquerque, New Mexico 87108

SUBJECT: DRAINAGE - FOUR SEASONS COURT CLUB

Dear Mr. Sheppard:

Enlarging the existing notch to accommodate all developed flows is a satisfactory solution. I am not certain it can be treated as a channel, especially since most water will be coming from the east or west. A weir formula would require a larger opening than the one shown. Please think about that alternate.

The retaining wall and/or curbs on the south property line must be sufficiently high to prevent drainage reaching the channel, except at the paved inlet.

Your plans showing the increased notch width may be submitted for approval.

Very truly yours,

Kleston H. Laws
Hydrology Engineer

KHL/fs

RECEIVED

JUN 30 1975

CITY ENGINEERS

FM
BF

June 17, 1975

Office of the City Engineer
City of Albuquerque
P. O. Box 1293
Albuquerque, New Mexico 87103

Attention: Mr. Kleston Laws

Re: Four Seasons Coutt Club

Dear Kleston:

Enclosed is a sketch for your approval showing the proposed notch widening. As you can see in the Plan, a width greater than 23' would extend the notch past the points where the retaining wall changes direction. At your suggestion I recomputed the notch by the following weir formula:

$$Q = CL\left(H + \alpha \frac{V^2}{2g}\right)^{3/2}$$

$$Q = 3 \times 23 \left[0.5 + 1.2 \frac{(2.5^2)}{64.4}\right]^{3/2} = 33.4 \text{ cfs}$$

This is very close to the computed value of 34 cfs for overland flow. Temporary impounding of water on the parking lot behind the 6" wall extension above the pavement will have no deletenious effect.

Very truly yours,

Bob

Robert T. Sheppard
Flatow, Moore, Bryan & Fairburn

RTS:mls

Encl.

Flatow · Moore · Bryan and Fairburn architects • engineers • planners, inc.
MAX FLATOW, FAIA
ASSOCIATES William O. Jette, AIA
JASON P. MOORE, AIA
Leon A. Ross, Jr., AIA George H. Bolling, AIA
GARLAN D. BRYAN, AIA
Donald M. Shaffer, AIA Wayne G. Andrews, AIA
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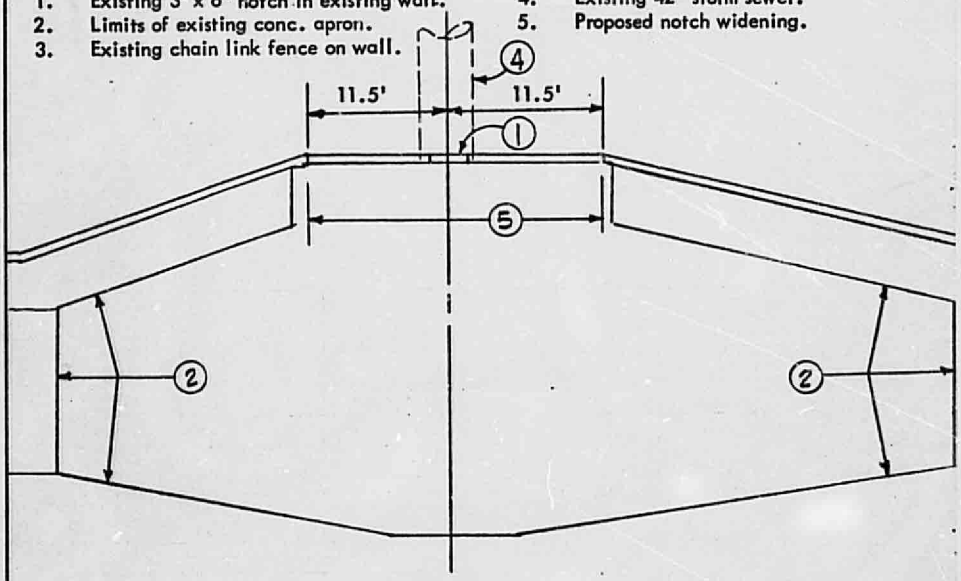
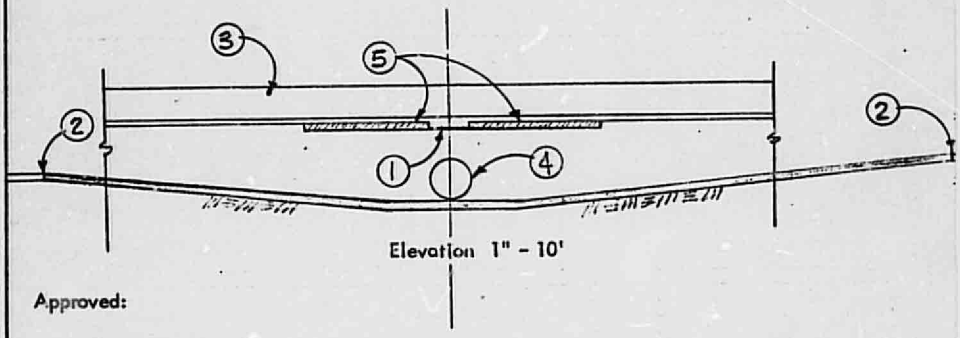
ALBUQUERQUE, NEW MEXICO 87108
5301 CENTRAL AVENUE, N.E.
SUITE 1600
TELEPHONE (505) 268-6783

Notes:

1. Existing 3' x 6" notch in existing wall.
2. Limits of existing conc. apron.
3. Existing chain link fence on wall.
4. Existing 42" storm sewer.
5. Proposed notch widening.



Plan 1" = 10'



Elevation 1" - 10'

Approved:

Assistant City Engineer, Hydrology Date

City Engineer Date

FM BF FLATOW MOORE BRYAN & FAIRBURN
SUITE 1600 FIRST NATIONAL BANK BUILDING
5301 CENTRAL AVENUE, N.E. 505-268-6783
ALBUQUERQUE, NEW MEXICO 87108

Project Four Seasons Drainage Revision
Client Dale Bellamah Corporation
By RTS Date June 17, 1975 Page 1 of 1

DRAINAGE REPORT

FOR

REVISION OF RECREATION FACILITIES

AT

THE SUPREME COURTS

FOR

JORGE DE LA TORRE

AIA

AUGUST 1979

Boyle Engineering Corporation
Consulting engineers / architects

RECEIVED
AUG 29 1979
CITY ENGINEER

DRAINAGE REPORT

FOR

REVISION OF RECREATION FACILITIES

AT

THE SUPREME COURTS

AUGUST 1979

CONTENTS

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Appendix A

Hydrologic and Hydraulic Computations - Surface Flow

I.	TIME OF CONCENTRATION	A-1
II.	DETERMINATION OF INTENSITY	A-2
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Appendix B

Hydraulic Computations - Flow in Pipes and Channels

Existing 6" Pipe at - 1% slope	B-1
New 6" Pipe at - 0.766% slope	B-1
New 8" Pipe at - 0.766% slope	B-2
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Rating Curves	B-4

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Rating at Outfall Section	C-2

DRAINAGE REPORT

FOR

REVISION OF RECREATIONAL FACILITIES

AT

THE SUPREME COURTS

I. PURPOSE

The purpose of this report is to examine and identify any change in runoff characteristics that may be generated by revision of the recreation facilities on a tract at 4100 Prospect Avenue in Albuquerque.

II. SCOPE

At present there are on the site four tennis courts, a building housing racquet ball courts and other recreational facilities, vehicular parking and the necessary driveways, and some landscaped areas with lawn and trees.

It is proposed to expand the racquet ball facilities, reduce tennis facilities to two courts, revise vehicular parking and accompanying driveways, and modify the landscaped area consistent with the other changes.

While the quantity and intensity of precipitation on the area will in no way change with the proposed construction there may be change in the peak and volume of the runoff due to change in areas and character of the surfaces on which precipitation will fall. It is the results of study of these changes in runoff that is herein presented.

The accompanying plat Plate 1 shows the proposed grading elevations and drainage pattern.

III. LOCATION AND DESCRIPTION

As noted above the tract in question is identified as 4100 Prospect Avenue in Albuquerque. It is bounded on the north by Prospect Avenue; on the east by Morningside Drive; on the south by the Embudo Diversion Channel; and on the west by the Four Seasons Motor Inn. Originally the tract was within the Timoteo Chavez Addition; however, with land adjustments due to the Embudo Diversion Channel, the tract is now identified as Tract 6B, Carlisle Replat. The tract is some 2.501 acres in extent of which some 2.091 acres are herein considered. A private passage easement extends across the property near and approximately parallel to the south boundary.

There is no off-site flow onto the area. The property is not in a flood plain. Surface drainage flowing on the south side of Prospect Avenue and on the west side of Morningside Drive are effectively excluded from the area as vehicular access is over a hump the crest of which is at least equal

in elevation to the adjacent top of curb. Along the south boundary to the tract, adjacent terrain lies several feet below the level of the parking area; vertical separation is maintained by a retaining will. On the west, the contiguous parking lot for the Four Seasons Motor Inn slopes to the west thus precluding any inflow from that direction. Plate 1 shows the general layout of the area and proposed changes.

IV. EXISTING DRAINAGE - ON SITE

Generally, on site drainage is southerly and then westerly.

Below surface storm drains accomodate excessive precipitation from the landscaped (sodded) areas east and north of the existing building. It is notable that sod is heavy and dense; movement of flow would be very slow even on a steep slope. Runoff from the roof of the existing building drops through four rain water leaders all of which contribute to the below surface storm drain system. The storm drain system "day-lights" on the north side of the passageway easement near the west boundary of the tract.

From north to south; slopes are quite steep (up to 15%) from Prospect Avenue to the north sides of the tennis courts and the existing building. The tennis courts and the roof of the existing building are flat but slope enough to afford drainage. The vehicular space between the building and tennis courts slopes sharply to the west; at the east edge of the tennis courts flow moves southerly. From the south sides of the tennnis courts and the existing building, slopes vary but are rather sharply south across the vehicular space to the confining curb near and approximately parallel to the property line. The vehicular space along the southerly strip of the tract slopes westerly at rates varying from 10% on the exit ramp from Morningside Drive to 1% near and at the western tract boundary. It is notable that the cross section of the vehicular strip along the south side of the tract, changes to an inverted crown near the western boundary of the tract. Accordingly flow passes along the approximate center of the Passage Easement. All runoff moves toward and accumulates in the Passageway Easement at the west boundary of the tract.

Appendix A contains an analysis of flow based on the time of concentration from the most remote point on the tract viz; in the north east corner in heavy, dense sod.

V. PROPOSED CONSTRUCTION

Briefly proposed construction contemplates:

A. The surrender of most of the Landscaped area north and some of the north end of the two easterly tennis courts to new additional vehicular space;

B. The removal of the two easterly tennis courts the area covered by the more westerly of which will become parking space with accompanying drive way;

C. An addition to and westerly extension of the existing building to include the contiguous vehicular space and one tennis court;

D. The surrender of the landscaped strip south of the two tennis courts noted in B above in favor of additional parking space;

E. Minor modification on both sides at the lower end of off ramp from Prospect Avenue.

F. The addition of five parking spaces on the north side at the low end of the off ramp from Morningside Drive.

VI. REVISED DRAINAGE

Storm flow from the landscaped area north of the existing building and runoff that drops through the two rain water leaders on the north side of the building will continue to be carried in the below-surface storm drains to the junction box, invert elevation 40.70. From this junction box a new below-surface 8-inch pipe, westerly some 91 feet to a new junction box; thence southerly some 118 feet, to the junction box, invert elevation 39.09; thence some 15 feet to elevation 39.00 into the Passageway Easement in a rectangular channel. The relative capacities of the retained old line and the new 8-inch line and the rectangular channel are developed and shown in Appendix B.

Runoff from the landscaped area east of the existing building and that which drops through the two rain water leaders on the south side of the building will contingue through the pipe system as it now exists.

That segment of the subsurface storm drains from junction box, invert elevation 40.70 and junction box, invert elevation 39.52 will be abondoned and any or all removed consistent with construction requirements.

Drainage from the new building will descend through rain water leaders but impact will occur on splash block at or near the pavement level. All finished grades will be such that runoff will accumulate and flow from the tract at the present outflow location.

As noted in Appendix A, Part IV Determination of Runoff, an increase of 0.53 cubic feet per second may be expected in the event of the 100-year storm. A rating curve for the inverted crown section shows a slight increase in stage that is well within the hydraulic capacity of the section. This is developed and shown in Appendix C. The modest increase in volume will not extend the period of flow but will appear as small increments of increased rate of flow both as the peak is attained and as flow recedes.

Since flow is unimpeded on the tract in question and is also unimpeded as it passed across the contiguous property for discharge directly in the Embudo Diversion Channel, there is no ponding under existing conditions or the revised condition.

Respectfully submitted:

BOYLE ENGINEERING CORPORATION

Rufus H. Carter, Jr.

Rufus H. Carter, Jr., P.E.
New Mexico Registration No. 29

RUFUS H. CARTER, JR.
NEW MEXICO
29
LAND SURVEYOR
REGISTERED PROFESSIONAL ENGINEER

APPENDIX A

HYDROLOGIC AND HYDRAULIC COMPUTATIONS

SURFACE FLOW

APPENDIX A

HYDROLOGIC - HYDRAULIC COMPUTATIONS

I. TIME OF CONCENTRATION

A. Flow path from NE corner of tract to the SW corner.

Lawn 75 feet at average slope - 9.33%

6" ACP 185 feet at 1.00% slope

8" ACP 114 feet at 0.43% slope

Pavement 25 feet at 1.00% slope

B. For flow across lawn:

(Reference 1. page 18-01, Figure H)

Flow across lawn for 75 feet - 11 minutes

C. Flow in 6" ACP Assume 4" deep

(Reference 2, pp 7-13; 7-;7; 7-30, Table 7-5)

$$V = \frac{1.486}{n} r^{2/3} s^{1/2}$$

For 6" pipe: D/d = 0.667 r = 0.292 X 6/12 = 0.146

$$V = \frac{1.486}{0.015} \times 0.146^{2/3} \; 0.01^{1/2}$$

= 99.07 X 0.277 X 0.10

= 2.74 feet per second

For 185', t_c = 67.52 seconds (Use 68 seconds)

D. Flow in 8" ACP Assume 6" deep.

(Reference 2, pp 7-13; 7-17; 7-30 Table 7-5)

$$V = \frac{1.486}{0.015} r^{2/3} s^{1/2}$$

For 8" pipe D/d = 0.75 r = 0.302 X 8/12 = 0.2013

$$V = \frac{1.486}{0.015} \times 0.2013^{2/3} \times 0.0043^{1/2}$$

= 99.07 X 0.344 X 0.0656

= 2.24 feet/second

For 114 feet, t_c = 50.89 seconds (Use 51 seconds)

E. Flow across pavement:

(Reference 1, page 18-01, Figure H)

Flow across pavement for 25': Est. 4 minutes

F. Total time of concentration:

Lawn	11 minutes	66.0 seconds
6" ACP 185' long		68.0
8' ACP 114' long		51.0
Pavement 25'	4 minutes =	240.0
Total		1019.0 seconds
	(Use 17.0 minutes)	16.98 minutes

Concentration of flow from the NE corner of the tract requires more time than the flow originating at any other location. Conditions contributing to this period of concentration do not change with new construction nor does the new construction provide any path of flow requiring an longer period of time.

II. DETERMINATION OF INTENSITY

(Reference 3, Chart 1)

For 100-year storm: $I = \frac{189}{t+25}$

$I = \frac{189}{17.0+25} = \frac{189}{42.0} = 4.50$ inches/hour

III. AVERAGE COEFFICIENT OF RUNOFF

Type of	Existing			Revised		
Surface	Sq. Ft.	C	Adj. Sq. Ft.	Sq. Ft.	C.	Adj. Sq. Ft.
Roof	14720	0.9	13248	26328	0.9	23695
Pavement	46995	1.0	46995	45500	1.0	45500
Landscaped	29373	0.4	11749	19260	0.4	7704
TOTALS	91088		67293	91088		72349

$\frac{67293}{91088} = 0.739$ $\frac{72349}{91088} = 0.794$

IV. DETERMINATION OF RUNOFF

A. Peak flow: Q = CIA

Existing	Revised
$Q_{100} = 0.739 \times 4.50 \times 2.09$	$= 0.794 \times 4.50 \times 2.09$
$= 6.95$ cfs	$- 7.47$ cfs

B. Volume of flow: V= AC

(Reference 1, p. 18-01, Figure F)

Existing: V = 2.09 x 43560 x 0.739 x 2.65/12 = 14857 Cu. Ft.

Revised: V = 2.09 x 43560 x 0.794 x 2.65/12 = 15963 Cu. Ft.

C. Anticipated Change:

	Existing	Revised	Change
Peak Flow	6.95 cfs	7.47 cfs	+0.52 cfs
Volume	14858 cu. ft.	15963 cu. ft.	+1106 cu. ft.

V. REFERENCES

1. Data Book for Civil Engineers, Design, 1960 Elwyn E. Seelye
2. Handbook of Hydraulics, Fifth Edition, 1963 Horace Williams King, Ernest F. Brater
3. Master Plan of Drainage, City of Albuquerque, New Mexico and Environs 1963; Gordon Herkenhoff and Associates, Consulting Engineers, Albuquerque, New Mexico

APPENDIX B

HYDRAULIC COMPUTATIONS

FLOW IN PIPES AND CHANNEL

Pipe: 6" diameter @ 1% slope flowing part full. $n = 0.015$ $s = 0.01$ $s^{1/2} = 0.1$

6" = 0.5 ft. $V = \frac{1.486}{n} r^{2/3} s^{1/2} = \frac{1.486}{0.015} \times 0.1 \times r^{2/3} = 9.91\ r^{2/3}$

Depth of flow	$r = C_r d$ King; p. 7-30	$r^{2/3}$	V $9.91/r^{2/3}$	a $a = C_a d^2$ King; p. 7-30	$Q = av$
1"	0.104d = 0.052	0.139	1.38	$0.0853d^2 = 0.0213$	0.029 cfs.
2"	0.186d = 0.093	0.205	2.03	$0.2292d^2 = 0.0573$	0.116
3"	0.250d = 0.125	0.250	2.48	$0.393d^2 = 0.0982$	0.243
4"	0.292d = 0.146	0.277	2.75	$0.556d^2 = 0.139$	0.382
5"	0.304d = 0.152	0.285	2.82	$0.699d^2 = 0.175$	0.494

Pipe: 6" diameter @ 0.770% slope flowing part full. $n = 0.015$ $s = 0.00770$ $s^{1/2} = 0.0877$

6" = 0.5 ft. $v = \frac{1.486}{n} r^{2/3} s^{1/2} = \frac{1.486}{0.015} \times 0.0877 \times r^{2/3} = 8.69\ r^{2/3}$

Depth of flow	$r = C_r d$ King; p. 7-30	$r^{2/3}$	$8.69\ r^{2/3}$	$a = C_a d^2$ King; p. 7-30	$Q = av$
1"	0.104d = 0.052	0.139	1.21	$0.0853d^2 = 0.0213$	0.026 cfs
2"	0.186d = 0.093	0.205	1.78	$0.2292d^2 = 0.0573$	0.101
3"	0.250d = 0.125	0.250	2.17	$0.393d^2 = 0.0982$	0.213
4"	0.292d = 0.146	0.277	2.41	$0.556d^2 = 0.139$	0.335
5"	0.304d = 0.152	0.285	2.48	$0.699d^2 = 0.175$	0.433

Pipe: 8" diameter @ 0.770% slope flowing part full. $n = 0.015$ $s = 0.0077$ $s^{1/2} = 0.0877$

8" = 0.67 ft. $V = \frac{1.486}{n} r^{2/3} s^{1/2} = \frac{1.486}{0.015} \times 0.0877\, r^{2/3} = 8.69\, r^{2/3}$

Depth of flow	$r = C_r d$ King; p 7-30	$r^{2/3}$	V $8.69\, r^{2/3}$	$a = C_a d^2$ King; p 7-30	$Q = av$
1"	0.078d = 0.0522	0.140	1.21	$0.057d^2 = 0.0256$	0.031
2"	0.147d = 0.0985	0.213	1.85	$0.1535d^2 = 0.0689$	0.128
3"	0.202d = 0.135	0.264	2.29	$0.2692d^2 = 0.121$	0.277
4"	0.250d = 0.168	0.304	2.64	$0.393d^2 = 0.176$	0.464
5"	0.283d = 0.190	0.330	2.87	$0.517d^2 = 0.232$	0.665
6"	0.302d = 0.202	0.345	3.00	$0.632d^2 = 0.284$	0.851
7"	0.302d = 0.202	0.345	3.00	$0.729d^2 = 0.327$	0.971

Rectangular Section, 2-foot bottom $n = 0.015$ $s = 0.006$ $s^{1/2} = 0.0775$

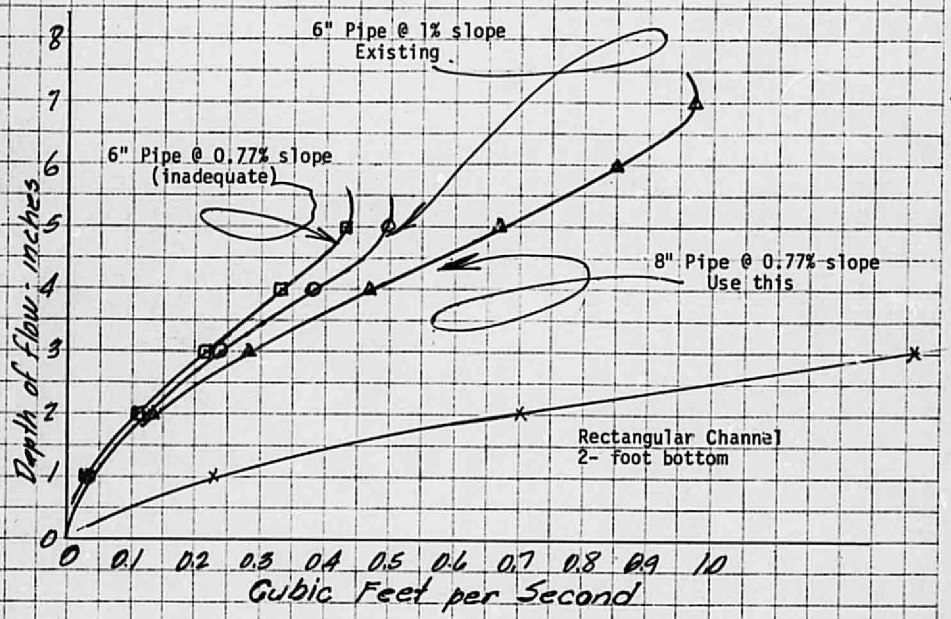
$$v = \frac{1.486}{n} r^{2/3} s^{1/2} = \frac{1.486}{0.015} \times 0.00775\, r^{2/3} = 7.68\, r^{2/3}$$

Depth of flow	a sq. ft.	P	r	$r^{2/3}$	v	Q av
0	0	0	0	0	0	0
1"	0.1667	2.1667	0.0769	0.181	1.39	0.23
2"	0.3333	2.333	0.1428	0.273	2.10	0.70
3"	0.5000	2.500	0.2000	0.342	2.63	1.31
4"	0.6667	2.667	0.2500	0.397	3.05	2.03

Boyle Engineering Corporation

BY _____ DATE _____ SUBJECT Supreme Courts Pipe Ratings. SHEET NO. ____ OF ____

CHKD. BY _____ DATE _____ JOB NO. _____



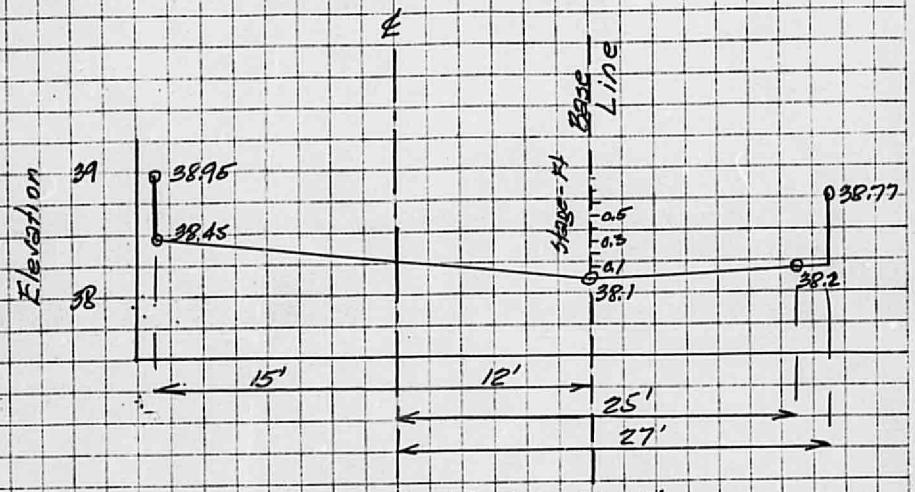
APPENDIX C

RATING OF OUTFALL SECTION

Boyle Engineering Corporation

BY Carter DATE 8 VIII 79 SUBJECT Supreme Courts Outflow Rating Curve SHEET NO. ____ OF ____

CHKD. BY ____ DATE ____ JOB NO. ____



SECTION AT OUTFLOW

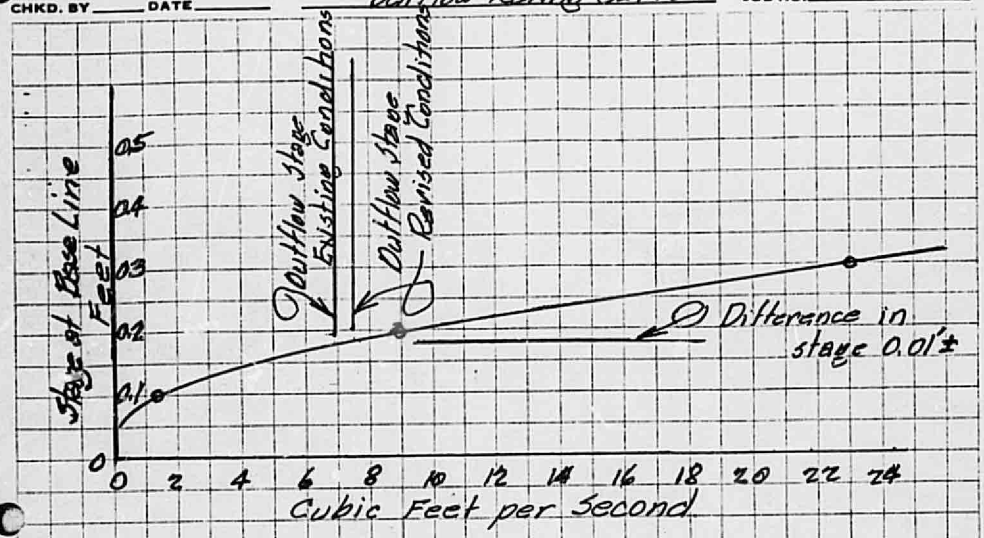
Stage on Base Line	WP	a	r
0	0	0	0
0.1	20.7	1.035	0.050
0.2	30.5	3.69	0.121
0.3	38.3	7.11	0.186
0.4	42.4	11.22	0.265
0.5	42.5	15.42	0.363

Slope = 1% $s = 0.01$ $n = 0.15$

$$V = \frac{1.486}{n} r^{2/3} s^{1/2} = \frac{1.486}{0.015} r^{2/3} \times 0.01^{1/2} = 9.91 r^{2/3}$$

Stage	r	$r^{2/3}$	$9.91 r^{2/3}$	a	Q
0.1	0.050	0.136	1.34	1.035	1.39
0.2	0.121	0.245	2.42	3.69	8.94
0.3	0.186	0.326	3.23	7.11	22.96
0.4	0.265	0.413	4.09	11.22	45.89
0.5	0.363				

Boyle Engineering Corporation

BY Carter DATE 8 VIII 79 SUBJECT Supreme Court's Outflow Rating Curve SHEET NO. ____ OF ____

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