HYDROLOGY E18/D16 2 PLANS

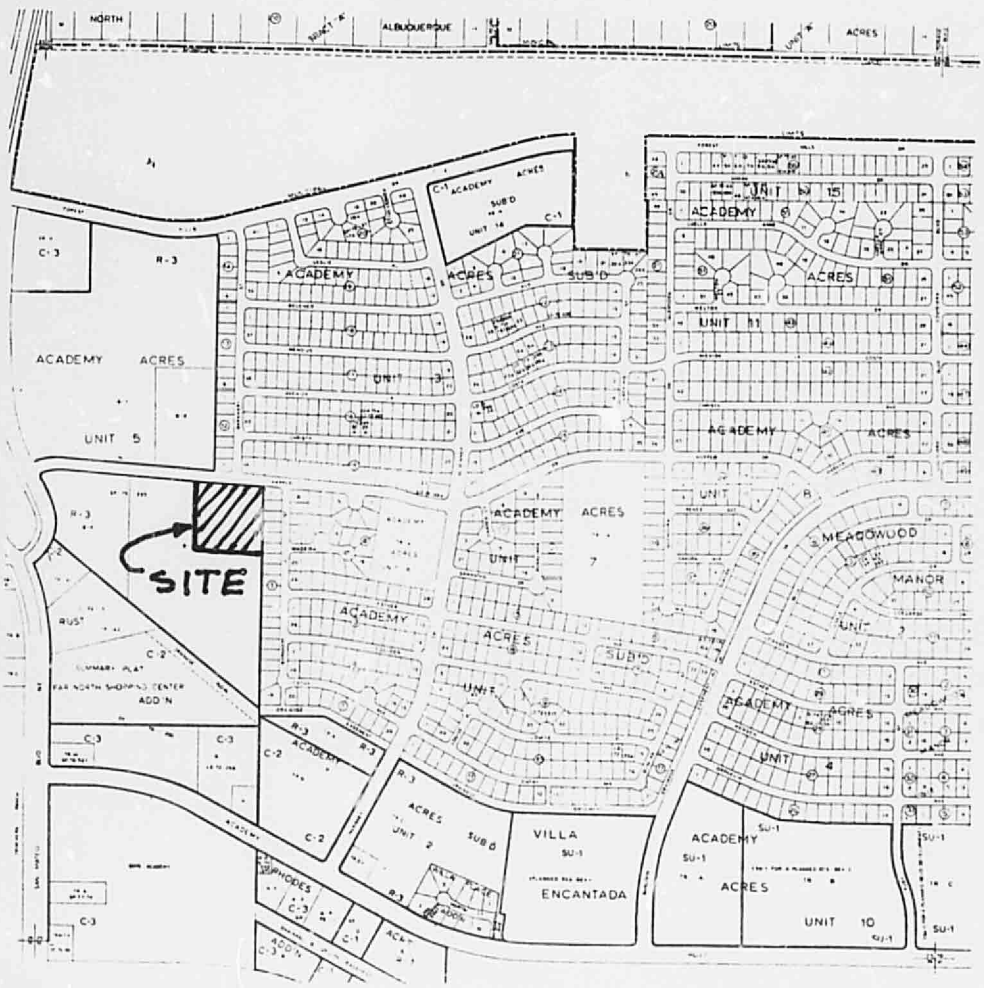
E18/D16

2 Plans

HARPER PLACE

NM 1-20 & NM 1-21
6400 Harper Place, N.E.
Albuquerque, New Mexico

DRAINAGE STUDY


NORTH
ALBUQUERQUE
ACRES
C-3
R-3
ACADEMY
ACRES
UNIT 5
SITE
R-3
RUST
C-2
SUMMARY PLAT
FAR NORTH SHOPPING CENTER
ADD'N
C-3
C-3
C-2
R-3
ACADEMY
C-2
R-3
ACRES
SUBD
UNIT 2
VILLA
SU-1
ENCANTADA
RHODES
C-3
C-3
C-1
ACADEMY
ACRES
SUBD
UNIT 16
C-1
ACADEMY
ACRES
SUBD
UNIT 3
ACADEMY
ACRES
UNIT 7
ACADEMY
ACRES
SUBD
UNIT
ACADEMY
ACRES
UNIT 15
ACADEMY
ACRES
UNIT 11
AGADEMY
ACRES
UNIT 8
MEADOWOOD
MANOR
UNIT 9
ACADEMY
ACRES
UNIT 4
ACADEMY
SU-1
SU-1
ACRES
UNIT 10
SU-1
SU-1

E-18-Z

flatow
moore
bryan &
associates

william jette
leon ross
rusty shaffer
wayne andrews
jon moore

ARCHITECTS
ENGINEERS
PLANNERS

5608 zuni s.e.
p.o. box 8266
buquerque, n.m. 87198
phone 505/268-6783

April 10, 1981

Re: Harper Place NM 1-20 & NM 1-21
6400 Harper Place N.E.
Albuquerque, New Mexico

This project is being developed for the City of Albuquerque Housing Authority. They will be rental public housing units owned by the City of Albuquerque.

The project is to be built in an existing R-3 zone and required no action by the Environmental Planning Commission. The plans have been approved by all sections of the City's Code Administration Division with the exception of drainage.

Sincerely;

Robert R. McCabe, AIA, APA
Vice Presid[illegible]

RMc:cb

flatow
moore
bryan &
associates

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DRAINAGE STUDY - HARPER PLACE

March, 1981

The area under study is located at the southeast corner of Harper Place and Harper Drive, N.E. and contains 4.17 acres. Drainage flow is from east to west. The watershed is isolated by a continuous block wall along the east property line and a curbed drive to the south. The area is not in a flood plain.

In a telephone conversation with Mr. Fred Arfman on April 10, 1981, he assured me that design of Harper Drive was such that the 100 year storm would not overflow the street. This study was done by Mr. Arfman while he was with C.C.I.C. and is on file with the City. It is entitled "Harper Drive Drainage Study" and done in 1978-79.
The property is subdivided into three watersheds which contribute to the three retaining ponds. (see attached grading plan). The watershed area tabulations are as follows:

Area A - 131,700 s.f.

Area B - 15,030 s.f.

Area C - 22,950 s.f.

Composite "C" values for subdivisions:

$$\text{Composite "C"} = \frac{\text{Hardsurface} \times 0.9 + \text{Landscaped} \times 0.4}{\text{Total Area}}$$

Area	Hardsurface	Landscaped	Composite "C"
A	114,500 s.f.	17,000 s.f.	0.83
B	11,430 s.f.	3,600 s.f.	0.78
C	18,550 s.f.	4,400 s.f.	0.80

Developed Volumetric Flow for 100 year storm.

$$QD = \frac{\text{Composite "C"} \times \text{rainfall} \times \text{area}}{12}$$

Where rainfall is 2.6" and area is in square feet.

Area	QD
A	23,684
B	2,540
C	3,978

The undeveloped volumetric flow for the total area is computed and proportioned to the subbasins by percentage. "C" = 0.4

Q_u = 15,742

Area	% of Total	Q_u
A	77	12,121
B	9	1,417
C	14	2,204

The required ponding is therefore:

Area A - 11,563 cu.ft.

Area B - 1,123 cu. ft.

Area C - 1,774 cu. ft.

All ponds are designed to contain the increased runoff for the 100 year storm. The maximum sideslope at any point is 1 ft. in 3 ft. and,as they are also landscaped areas,all slopes are planted to prevent erosion.

The capacities of the ponds are calculated by the formula for the frustrum of a pyramid, where:

$$V = 1/3\ (A_1 + A_2 + \sqrt{A_1 A_2})\ h$$

The retention capacities are as follows:

Pond A: 1/3(5390 + 1950 + 3240) 4 = 14,100, cu. ft.

Pond B: 1/3(1575 + 495 + 883) 2 = 1,986 cu. ft.

Pond C: 1/3(1800 + 610 + 1048) 2 = 2,305 cu. ft.

In the event that the 100 year storm is exceeded, Ponds B and C will overflow to Pond A along the swaled route indicated on the plan. Pond A will convey the overflow to the existing storm sewer in Harper Drive.

Volumetric overflow for the developed area is computed using 5.4"/hr. rainfall and a composite "C" of the average for the sub-basins.

Q overflow = 3.90 x 5.4 x 0.80 = 16.85 cfs.

For the overflow structure, assume a 30" RCP flush pipe set vertically with the bell end up and at elevation 5211.80 and filled

with concrete to form an invert at elevation 5207.60. The top of the berm is at 5212.3. Assume a 15" RCP overflow pipe.

Check the weir length by the formula:

$$L = \frac{Q}{CH\ 3/2}$$

Where C = Weir coefficient

H = Head water depth = 12.3 - 11.8 = 0.5'

$$\frac{H}{D} = \frac{0.5}{1.25} = 0.4$$

C for $\frac{H}{D}$ = 0.4 is 3.22 *

$$L = \frac{8.74}{322\ (0.5)}\ 1.5 = 7.68'$$

Circumference of 30" RCP = 7.85'

overflow pipe to existing 36" storm sewer, Manning formula

Use 15" RCP at s = 0.058'/ft

$$Q = 1.23 \times \frac{1.486}{0.015} \times 0.241 \times 0.461 = 13.54 \text{ cfs.}$$

See detail on attached plan.

*Table 15, Page 174, Handbook of Concrete Culvert Pipe Hydraulics.

Undeveloped Flow for the 5 Year Storm

Rainfall = 3.43"/hr. from NOAA Atlas 2, Vol. 4, NM.

Undeveloped for Pond C

$Q_u = 0.53 \times 3.43 \times 0.40 = 0.73$ cfs.

Undeveloped for Pond B

$Q_u = 0.35 \times 3.43 \times 0.40 = 0.48$

Undeveloped for Pond A

$Q_u = 3.02 \times 3.43 \times 0.40 = 4.14$ cfs

$\sum Q_u = 0.73 + 0.48 + 4.14 = 5.35$ cfs

Pond C drain to manhole

Use 8" CMP at s = 0.0103'/ft

$$Q = 0.35 \times \frac{1.486}{0.026} \times 0.101 \times 0.303 = 0.61 \text{ cfs.}$$

Pond B to Pond A

$Q = 0.73 + 0.48 = 1.21$ cfs

Use 10" CMP at s = 0.0101'/ft.

$$Q = 0.55 \times \frac{1.486}{0.026} \times 0.10 \times 0.351 = 1.10 \text{ cfs}$$

Pond B drain to manhole

Use 8" CMP at s = 0.0140/ft.

$$Q = 0.35 \times \frac{1.486}{0.026} \times 0.118 \times 0.303 = 0.72 \text{ cfs}$$

Developed vs. Undeveloped Volumetric Flow for the 5 Year Storm

Pond C

$$\Delta Q = \frac{(22{,}950 \times 1.4)}{12} (0.80 - 0.40) = 1{,}071 \text{ cf}$$

Pond B

$$\Delta Q = \frac{(15{,}030 \times 1.4)}{12} (0.80 - 0.40) = 701 \text{ cf}$$

Pond A

$$\Delta Q = \frac{(131{,}700 \times 1.4)}{12} (0.80 - 0.40) = 6{,}146 \text{ cf}$$

Pond depth for 5 year volume:

Pond A - 4.0' = H
Pond B - 2.0' = H
Pond C - 2.0' = H

Orifice Flow Computations:

Pond A - 3 openings @ 6" diam. = 0.59 sf

Ponds B & C - 16 openings @ 1/2" diam. = 16 x 0.0014 sf

Contraction coefficient $C_c = 0.60$

$$Q = C_c A \sqrt{2gH} \quad *$$

Pond A

$$Q = [0.60\ (0.59) \sqrt{64.4 \times 4.0}\ ] = 5.68 \text{ cfs}$$

Pond B

$$Q = [0.60\ (0.0014) \sqrt{64.4 \times 2.0}]16 = 0.15 \text{ cfs}$$

Pond C

$$Q = [0.60\ (0.0014) \sqrt{64.4 \times 2.0}]\ 16 = 0.15 \text{ cfs}$$

* Page 70, Handbook of Concrete Pipe Hydraulics

Recap of Flow Quantities

Pipe flow from Pond C to manhole = 0.61 cfs
Orifice flow from Pond C = 0.15 cfs

Pipe flow from manhole to Pond A = 1.10 cfs
Orifice flow from Ponds B & C = 0.30 cfs

Orifice flow from Ponds A, B & C = 5.98

Pipe flow from Pond A to storm sewer =13.54 cfs.

Check for pipe control - Reach 1. from overflow structure to existing storm sewer.

L = 50'

H = 5211.6 - 5208.8 = 2.8'

$S = \frac{2.8}{50} = 5.6\%$ on H.G.L.

n for 15" RCP = 0.015

Capacity = 13.3 cfs

Check for inlet control

$H = 5211.6 - (5208.0 + \frac{15"}{2}) = 3.4'$

Cc = 0.6

$Q = (.6)(1.23) \sqrt{64.4 \times 3.4} = 10.92$ cfs

Orifice control in Reach 1.

Inlet structure.

$H = 5211.6 - (5208.0 + \frac{6"}{2}) = 3.35$

3 orifices @ 6" Ø

$Q = 3(.196)\ (.6)\ \sqrt{64.4 \times 3.35} = 5.12$ cfs

Check for pipe control - Reach 2, from overflow structure to manhole.

$L = 240'$

$H = 5214.0 - 5211.6 = 2.4'$

$S = \frac{2.4}{240} = 1.0\%$

n for 10" CMP = 0.026

Capacity = 1.10 cfs

Check for inlet control

$H = 5214.0 - (5207.6 + \frac{10"}{2}) = 5.98'$

$Cc = 0.6$

$Q = (.6)\ (.55)\ \sqrt{64.4 \times 5.98} = 6.48$ cfs

Pipe control in Reach 2.

Check for pipe control - Reach 3 from manhole to Pond C inlet.

Head loss = $h_f = f \frac{L}{D} \frac{V^2}{2g}$

$f = 185 \frac{n^2}{D} = 185 \left(\frac{.026^2}{.67}\right) = 0.14$

$14.0 - 11.9 = \frac{v^2}{2g} + 2.4 + 09.49 + h_f$

$2.1 = 0.16\ v^2 + 11.89 + .32\ v^2$

$.336\ v^2 = 9.79$

$v = 5.4$ cfs

$Q = 0.35 \times 5.4 = 3.44$ cfs

Check for inlet control

$H = 5214.0 - (5209.49 + \frac{8}{2}) = 4.18'$

$Q = (.6)\ (.35)\ \sqrt{64.4 \times 4.18} = 3.44$ cfs

Pipe control in Reach 3.

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

June 17, 1981

Flatow, Moore, Bryan & Assoc.
5608 Zuni S.E.
Albuquerque, N.M. 87108
c/o Bob Sheppard

Mr. Sheppard:

Enclosed you will find the letter requested concerning Harper Place Drive.

Very truly yours,

Brian G. Burnett
Civil Engineer/Hydrology

BGB/tsl

Attachment

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

May 20, 1981

Max Flatow, P.E.
Flator, Moore, Bryan & Assoc.
5608 Zuni S.E.
Albuquerque, N.M. 87108

RE: HARPER PLACE DR. E-18-~~5~~ D16

Dear Mr. Flatow:

The referenced drainage report satisfies the City and AMAFCA requirements, therefore the report is approved. However, before the building plans can be released you must obtain approval for the storm drain connection and delineate the four foot safety fence on the plans.

Also, I would like to make a couple of recommendations regarding this project:

1. Recommend adequate cover over the 10" C.M.P. as opposed to leaving the pipe exposed as indicated in your cross-section plan.

2. Because of the amount of construction detail provided on the grading and drainage plan, I would strongly recommend that you, as the design engineer, certify the proposed construction to provide coordination between the design and the field construction.

If you have any questions concerning the above, please feel free to call on me.

Very truly yours,

Chuck Easterling, P.E.
Principal Asst./City Eng./Hydrology

CE/tsl

flatow
moore
bryan &
associates

william jette
leon ross
rusty shaffer
wayne andrews
jon moore

ARCHITECTS
ENGINEERS
PLANNERS

5608 zuni s.e.
p.o. box 8266
albuquerque, n.m. 87198
telephone 505/268-6783

DRAINAGE STUDY - HARPER PLACE

MARCH 1981

The area under study is located at the southeast corner of Harper Place and Harper Drive, N.E. and contains 4.17 acres. Drainage flow is from east to west. The watershed is isolated by a continuous block wall along the east property line and a curbed drive to the south. The area is not in a flood plain.

The property is subdivided into three watersheds which contribute to the three retaining ponds. (See attached grading plan) The watershed area tabulations are as follows:

Area A - 131,700 sf.

Area B - 15,030 sf.

Area C - 22,950 sf.

RECEIVED
MAY 18 1981
CITY ENGINEER

Composite "C" values for subdivisions:

$$\text{Composite "C"} = \frac{\text{Hardsurface} \times 0.9 + \text{Landscaped} \times 0.4}{\text{Total Area}}$$

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Where rainfall is 2.6" and area is in square feet.

Area	Q_D
A	23,684
B	2,540
C	3,978

The undeveloped volumetric flow for the total area is computed and proportioned to the subbasins by percentage. "C" = 0.4

Q_u = 15,742

Area	% of Total	Q_u
A	77	12,121
B	9	1,417
C	14	2,204

DISAPPROVED FOR DRAINAGE
4-8-81
DATE
F. D. Regan P.E.

The required ponding is therefore:

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Area B - 1,123 cu. ft.
Area C - 1,774 cu. ft.

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The capacities of the ponds are calculated by the formula for the frustum of a pyramid, where

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The retention capacities are as follows:

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Pond C: 1/3 (1800 + 610 + 1048) 2 = 2,405 cu. ft.

In the event that the 100 year storm is exceeded, Ponds B and C will overflow to Pond A along the swaled route indicated on the plan. Pond A will convey the overflow to the existing storm sewer in Harper Drive.

Volumetric overflow for the developed area is computed using 5.4" rainfall and a composite "C" of the average for the subbasins.

$$Q \text{ overflow} = \frac{169{,}680 \times 5.4 \times 0.80}{12} = 61{,}084$$

$$\Delta Q = 61{,}084 - 30{,}202 = 30{,}882 \text{ cf/hr.}$$

$$\Delta Q = 8.58 \text{ cfs}$$

For the overflow structure assume a 30" RCP flush pipe set vertically with the bell end up and at elevation 5211.80 and filled with concrete to form an invert at elevation 5207.60. The top of the berm is at 5212.3.

Check the weir length by the formula

$$L = \frac{Q}{CH^{3/2}}$$

Where C = Weir coefficient
H = headwater depth = 12.3 - 11.8 = 0.5'

$$\frac{H}{D} = \frac{0.5}{2.5} = 0.2$$

C for $\frac{H}{D}$ = 0.2 is 3.25*

$L = \frac{8.58}{3.25\ (0.5)}\ 1.5 = 7.47'$

Circumferance of 30" RCP = 7.85'

Overflow pipe to existing 36" storm sewer, Manning formula

Use 12" RCP at s = 0.058'/ft,

$Q = .785 \times \frac{1.486}{0.013} \times 0.241 \times 0.397 = 8.59$ cfs

See detail on attached plan.

*Table 15, page 174, Handbook of Concrete Culvert Pipe Hydraulics.

Developed and Undeveloped Flow for the 5 Year Storm

Rainfall = 3.43"/hr. from NOAA Atlas 2, Vol. 4, N.M.

Developed and Undeveloped for Pond C

$Q_D = \frac{22{,}950 \times 3.43 \times 0.80}{12} = 5{,}248$ cfh

$Q_U = \frac{22{,}950 \times 3.43 \times 0.40}{12} = 2{,}624$ cfh

$\Delta Q = 5{,}248 - 2{,}624 = 2{,}624$ cfh = 0.73 cfs

Developed and Undeveloped for Pond B

$Q_D = \frac{15{,}030 \times 3.43 \times 0.78}{12} = 3{,}351$ cfh

$Q_U = \frac{15{,}030 \times 3.43 \times 0.40}{12} = 1{,}718$ cfh

$\Delta Q = 3{,}351 - 1{,}718 = 1{,}633$ cfh = 0.45 cfs

Pond C drain to Pond B connection

Use 8" CMP at s = 0.0103'/ft.

$Q = 0.35 \times \frac{1.486}{0.021} \times 0.101 \times 0.303 = 0.76$ cfs

Pond B to Pond A

$Q = 0.73 + 0.45 = 1.18$ cfs

Use 10" CMP at s= 0.013'/ft.

$$Q = 0.55 \times \frac{1.486}{0.021} \times 0.101 \times 0.351 = 1.38 \text{ cfs}$$

Pond B drain to connection point

Use 8" CMP at s = 0.005'/ft.

$$Q = 0.35 \times \frac{1.486}{0.021} \times 0.0707 \times 0.303 = 0.53 \text{ cfs}$$

CITY OF ALBUQUERQUE

ALBUQUERQUE, NEW MEXICO

INTER-OFFICE CORRESPONDENCE February 27, 1981 REF. NO._____

TO: Bruno Conegliano, Assistant Hydrology Engineer

FROM: Fred Aguirre, Civil Engineer

SUBJECT: Items to be included with the drainage report and grading plan

1) Provide a datum.
2) Indicate direction of roof drainage including canales, gutters and downspouts.
3) Outline the contributory drainage areas, including roof areas and how this runoff will be intercepted by the pond.
4) Provide flow lines with arrows and spot elevations for confirmation.
5) Provide calculations showing developed and undeveloped volumetric flow rate to each pond.
6) Show that pond volumes balance with area contributing to the pond.
7) Show the pond overflow point with a spot elevation and slope protection if necessary.
8) Provide positive discharge of ponds with required rate calculations and orifice calculations.
9) Provide details of curb cuts, catch basin, pond outlet and any other significant drainage structure.
10) Provide City top of curb elevations.
11) Show the required elevations for the City standard drivepad. See Std. Dwg. P11.
12) Provide a soil investigation report allowing the close proximity ponding to the buildings.
13) Provide location map.
14) Provide legible proposed and existing grades at the property line.
15) Safety protection required for ponds.
16) Provide distinguishable contour symbols for the proposed and existing.
17) Also see items indicated in red on the grading plan.

Reviewed comments with Bob Shepard 2-25-81.

FA/fs

DISAPPROVED FOR DRAINAGE

2-25-81
DATE

SIGNATURE TITLE

2152