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

October 19, 1995

Freeman Leaming
BPLW Architects & Engineers
2400 Louisiana Blvd. NE
Suite 400
Albuquerque, NM 87110

RE: HOFFMANTOWN BAPTIST CHURCH EXPANSION (E20-D20) DRAINAGE AND GRADING PLAN FOR BUILDING PERMIT APPROVAL. ENGINEER'S STAMP DATED 10-13-95.

Dear Freeman:

Based on the information provided on your October 17, 1995 submittal, the above referenced project is approved for Building Permit.

Prior to Certificate of Occupancy approval, an Engineer's Certification is required for the approved plans.

If I can be of further assistance, please feel free to contact me at 768-3622.

Sincerely,

Lisa Ann Manwill
Engineering Assoc./Hyd.

c: Kurt Browning - AMAFCA
Andrew Garcia
File

City of Albuquerque

P.O. BOX 1293 ALBUQUERQUE, NEW MEXICO 87103

March 28, 1995

Guy Jackson
BPLW
2400 Louisiana Blvd. NE Suite 400
Albuquerque, NM 87110

RE: GRADING/PAVING PLAN FOR HOFFMANTOWN BAPTIST CHURCH
(E20-D20) ENGINEER'S STAMP DATED 3/3/95.

Dear Mr. Jackson:

Based on the information provided on your March 6, 1995 submittal, the above referenced site is approved for Grading/Paving permit.

Please be advised that Engineer Certification per the D.P.M. checklist will be required after completion of Construction.

If I can be of further assistance, please feel free to contact me at 768-2667.

Sincerely,

Bernie J. Montoya, CE
Engineering Associate

BJM/dl

c: Andrew Garcia
File

Albuquerque
Metropolitan
Arroyo
Flood
Control
Authority

2600 PROSPECT N.E. · ALBUQUERQUE, N. M. 87107
TELEPHONE (505) 884-2215

January 4, 1995

Mr. Jeff Bergmann, P.E.
BPLW
American Financial Center #5
2400 Louisiana Blvd NE
Albuquerque, NM 87110

RE: Hoffmantown Baptist Church New Transformer Location on Pino Arroyo

Dear Jeff:

AMAFCA did not have a file on this site so I borrowed the City's file and did some research. It appears that the City was taking the lead on the development of the church site. Seeing that the transformer location is already in a developed area and is relatively small, no improvements to the channel will be required by AMAFCA for the installation of the transformer. I offer some additional comments:

1. There is a soil cement cut-off wall located on the north side of the arroyo. I have attached a copy of the detail. Per the new sediment and erosion design guide (not available when church site was developed in mid 80's), it appears that this wall may not be adequate. The erosion setback probably encroaches and scour may be of concern.

2. The file referenced future permanent improvements to the channel (upon ultimate development) but does not say who will construct these facilities or when. Are there plans for additional development at this site?

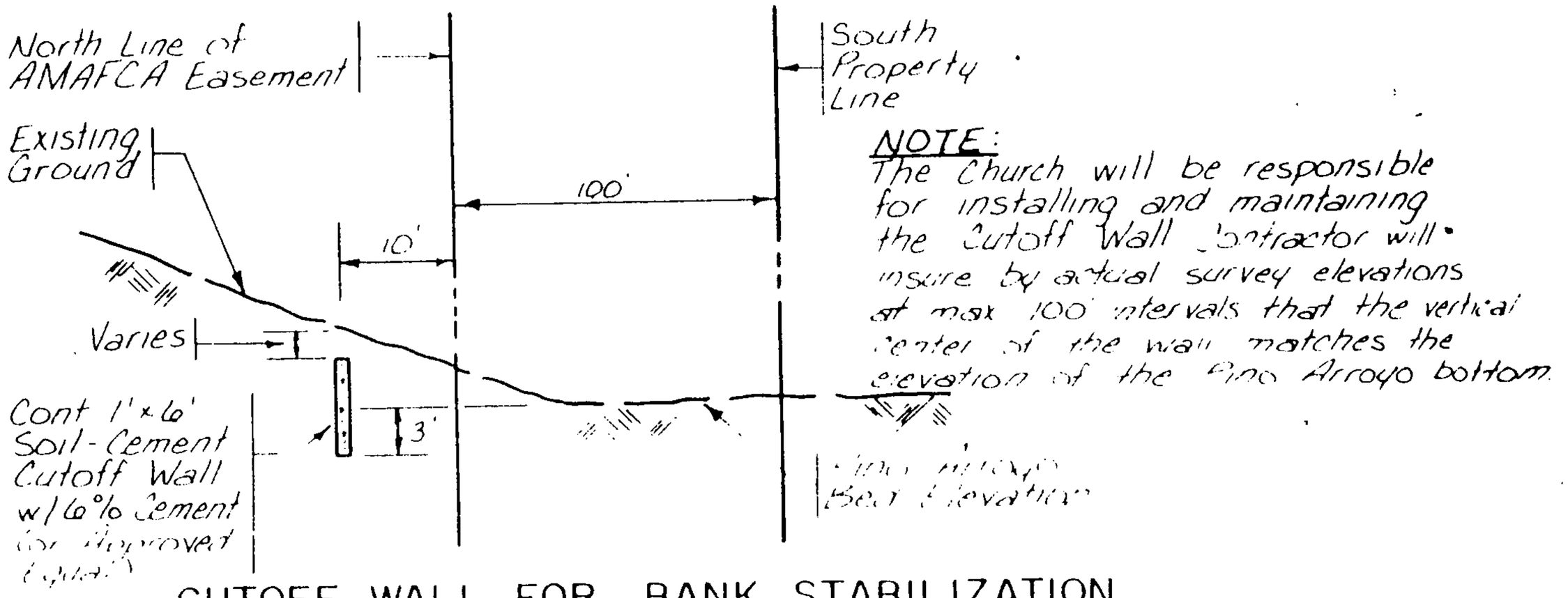
3. AMAFCA does not maintain these facilities.

If you have any questions or need more information, do not hesitate to call me.

Sincerely,
AMAFCA

Kurt Browning, P.E.
Drainage Engineer

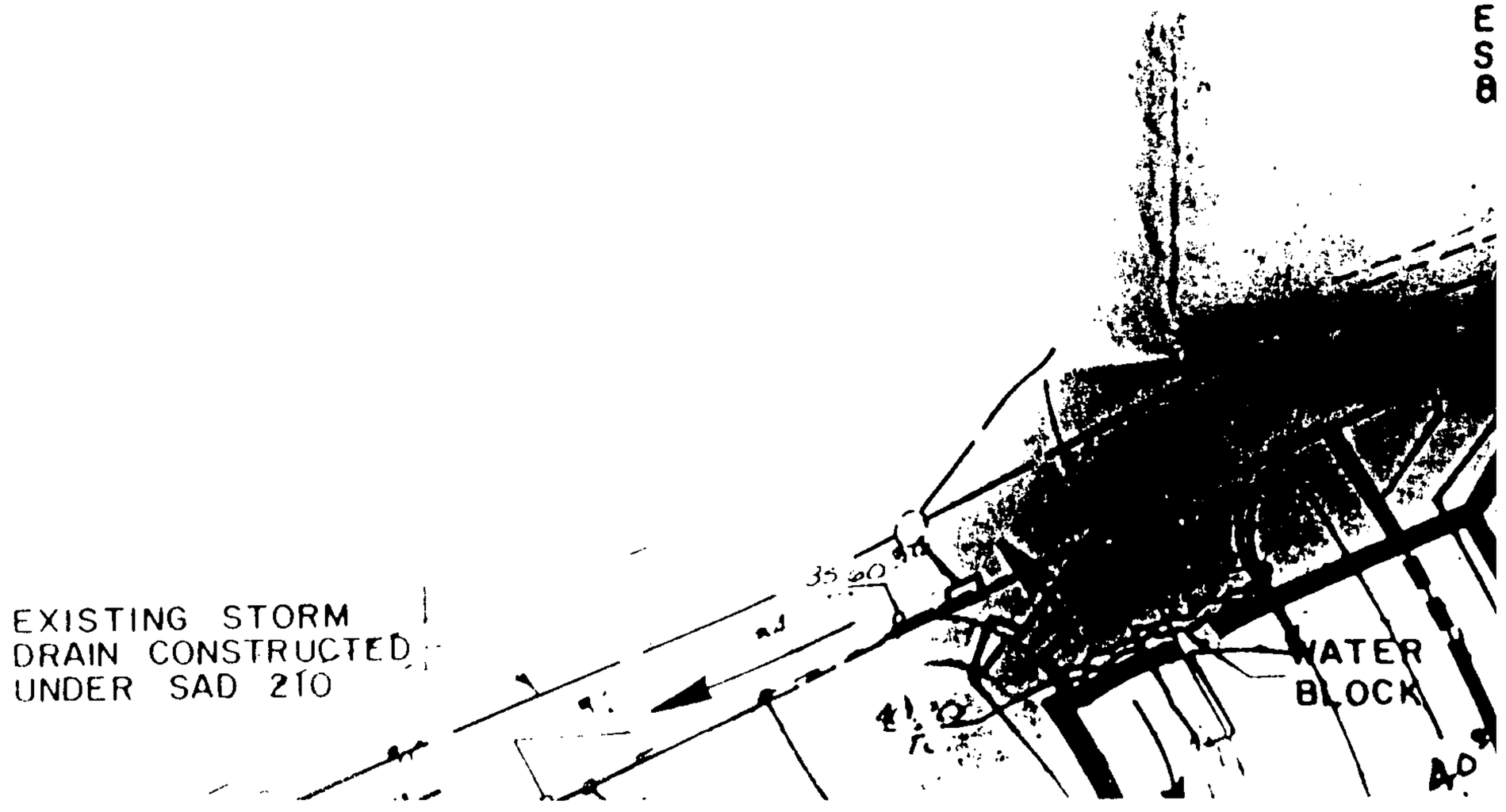
cc Ms. Susan Calongne, City/County Floodplain Administrator
Mr. Fred Aguirre, City of Albuquerque Public Works Hydrology
Mr. James Topmiller, Bohannan-Huston



CUTOFF WALL FOR BANK STABILIZATION

NO SCALE

(optional, see report)



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

August 15, 1991

Jeff Mortensen, P.E.
Jeff Mortensen & Associates, Inc.
6010-B Midway Park Boulevard, NE
Albuquerque, New Mexico 87109

RE: DRAINAGE PLAN FOR AN ADDITION TO HOFFMANTOWN BAPTIST CHURCH
(E-20/D20) ENGINEER'S STAMP DATED AUGUST 5, 1991

Dear Mr. Mortensen:

Based on the information provided on your submittal of August 6, 1991, the above referenced plan is approved for Building Permit.

Please attach a copy of this plan to the construction sets prior to sign-off by Hydrology.

If I can be of further assistance, please feel free to call me at 768-2650.

Cordially,

Bernie J. Montoya

Bernie J. Montoya, C.E.
Engineering Assistant

xc: Alan Martinez

BJM/bsj
(WP+678)

City of Albuquerque

P.O. BOX 1293 ALBUQUERQUE, NEW MEXICO 87103

DESIGN HYDROLOGY SECTION
123 Central NW, Albuquerque, NM 87102
(505) 766-7644

March 12, 1986

RECEIVED MAR 17 1986

James Topmiller
Bohannan-Huston, Inc.
4125 Carlisle Blvd., NE
Albuquerque, New Mexico 87107

RE: REVISED DRAINAGE REPORT FOR HOFFMANTOWN BAPTIST CHURCH SITE
PHASE I (E-20/D20) RECEIVED FEBRUARY 22, 1986

Dear Mr. Topmiller:

The above referenced submittal is in compliance with my previously identified requirements. Therefore, the plan, dated February 12, 1986, is hereby approved for obtaining Hydrology sign-off for the building permit on Phase I.

Please attach a copy of this plan to the construction set prior to sign-off.

Also, it is understood that additional detailed drainage plans will be submitted for review and approval prior to any further construction or permitting.

Should you have any questions, call me at 766-7644.

Cordially,

Billy J. Goolsby

Billy J. Goolsby, P.E.
C.E./Design Hydrology

52540
BJG/bsj
JT ✓
BGB ✓
cc: Bob Sheppard
Rusty Schaffer
Mike Emery

REVISED
DRAINAGE REPORT
FOR
HOFFMANTOWN BAPTIST CHURCH SITE
PHASE I

FEBRUARY 1986

PREPARED FOR:

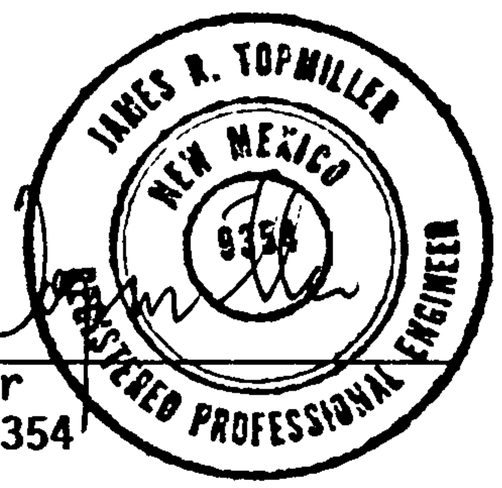
FLATOW, MOORE, BRYAN, SHAFFER AND MC CABE
5608 ZUNI S.E.
ALBUQUERQUE, NEW MEXICO 87108

PREPARED BY:

BOHANNAN-HUSTON, INC.
4125 CARLISLE BOULEVARD N.E.
ALBUQUERQUE, NEW MEXICO 87107

JOB NO. 5 254 0

James Topmiller
N.M.P.E. No. 9354



PURPOSE

The purpose of this report is to outline a grading and drainage management plan for Phase 1 of the Hoffmantown Baptist Church site. The criteria established by the City of Albuquerque Drainage Ordinance and Development Process Manual shall govern this plan.

A conceptual drainage report for the ultimate 62 acre site was reviewed and approved on January 28, 1985 (ref. E20-D20). The site has subsequently been phased. This submittal addresses the initial phase of development.

SITE LOCATION AND DESCRIPTION

The site is located in the southwest corner of the intersection of Harper Road and Ventura Street N.E. It is bounded on the south by Albuquerque Academy properties and by vacant land on the west. The ultimate site and the initial phase area is identified on Plate 1.

Phase 1 is approximately 40 acres of vacant land vegetated by sparse grasses and small shrub. Natural ground slopes range from 2-18% with an average slope of approximately 4%. The slope is downward in a southwesterly direction. The SCS soil type for the site is Embudo, corresponding to a Type "B" hydrologic soil group. A soils map is shown on Plate 2.

A wide and flat arroyo, called Arroyo del Pino, runs westerly along the site's south boundary.

EXISTING CONDITIONS

At the present time, much of the site drains in a sheet flow manner directly to the Arroyo del Pino. The remainder drains to Harper Road where the runoff eventually leaves the street and reaches Arroyo del Pino west of the site. Undeveloped site runoff from Phase 1 to the arroyo approximates 69 cfs in a 100-year storm occurrence.

Offsite runoff to the site is negligible, if any. The recently completed street improvements in the Harper Road and Ventura Street right-of-way effectively block any offsite runoff from entering the site. An existing 24" storm drain system is located in Harper Road.

The approximate 100-year floodplain of the Arroyo del Pino is identified in Plate 3 and has also been shown on the enclosed drainage/grading plan. As shown, the floodplain reflects the recent construction of Ventura Street.

PROPOSED CONDITIONS

Offsite Flows

As mentioned previously, all offsite flows will continue to be intercepted by the existing Harper Road and Ventura Street street improvements.

Onsite Flows

All runoff generated on the church site shall be directed to the Pino Arroyo. The grading/drainage plan is indicated on Sheet C3 in the rear pocket of this report. This general provision conforms with discharge requirements outlined in Special Assessment District 210 which called for directing all runoff from the Church site area to the arroyo. Phase 1 will generate developed runoff of approximately 105 cfs in the 100-year storm event, an increase of 36 cfs over the undeveloped flow-rate.

A private storm sewer system is proposed for the main site entrance's confluence with the building area. As this area will be a major collection point of church patrons, it is desirous to keep runoff out of this area. A series of inlets will accomplish this goal. Hydraulic computations for this storm system are enclosed within the Appendix of this report.

The enclosed sheets C4 through C8 provide additional onsite elevations and construction details.

Pino Arroyo Management

There will be no site construction and/or grading encroachment within the 200' AMAFCA easement. This scheme releases the need for either temporary or permanent channel improvements to the arroyo at this time. Two drainage outfalls to the Pino Arroyo are proposed adjacent to the easement by this plan. The locations are shown on the drainage/ grading plan (Sheet C3).

The east outfall discharges approximately 30 cfs from the proposed storm sewer system to the arroyo bed. The 36" RCP emerges above ground from the arroyo's side slope and discharges to a riprap blanket for energy dissipation and erosion control. The west outfall discharges the remainder of the site flows, approximately 75 cfs, to the arroyo bed. The runoff is collected at AP-6 in the southwest corner of the site and discharges in a 4' wide concrete rundown and drop structure to a riprap blanket.

Until permanent hard-lined channel improvements are constructed, the Church will be responsible for installing and maintaining the proposed outfalls and erosion-control riprap blankets.

Several alternates are being considered to insure erosion protection along the south edge of the site improvements.

One option involves preparing a "prudent line" analysis using a modified Simons-Li approach as discussed with Fred Aguirre of City Hydrology. Leedshill-Herkenhoff prepared a similar analysis for Unit 3 of Vista Grande. The analysis would identify areas adjacent to site improvements that lie in possible areas of erosion danger. If necessary, in these areas only, a buried cutoff wall will be constructed for meander protection (discussed in greater detail below). This option is being investigated at this time.

Secondly, a buried cutoff wall could be constructed adjacent to the north line of the AMAFCA easement for bank stabilization and meander protection. The approach is similar to that used on downstream properties adjacent to the Pino Arroyo and is shown on Sheet C3. The design was proposed originally by Tom Mann and Associates and called for a soil-cement composition. However, it is proposed under this plan that options remain open for cost effective alternates to the soil-cement mix. The Church would be responsible for installing and maintaining the cutoff wall until permanent channel improvements are constructed. The church will enter into an agreement with the City on the cutoff wall maintenance. For this submittal of the drainage report, this cutoff wall option is shown on the enclosed plan. However, the final solution will be subject to a determination at a later date.

Future Phases

Several years are anticipated before the initiation of the second phase of construction at the church site. However, the eventual development of the "future building area" and the "future parking area", as shown on the plan, will require the replacement and upsizing of the west outfall structure. The replacement, however, can be easily accomplished with the construction of a new east-west private street planned for Phase 2 along the north edge of the AMAFCA easement. New runoff rates can then be determined for the rundown and outfall replacement.

Construction of a permanent hard-lined channel will occur sometime in the future development of the ultimate site. At that time, the two arroyo outfalls would be extended to the channel as part of any channel improvements. In addition, future site improvements may then be extended into the easement and/or floodplain.

Erosion Control

During onsite grading operations and site construction, the Contractor will establish erosion control measures as indicated on Sheet C1. These measures utilize a 2' high trench/berm combination to direct runoff to shallow sedimentation basins. Runoff will then overflow these basins and discharge at low velocities to the surrounding natural ground. The location of the trench/berms and the sedimentation basins are shown on Sheet C1.

Earthwork Excess

As graded, the site will generate a substantial excess of excavated material. This material will be removed from Phase 1 and placed on Church-owned (Phase 2) land west of Phase 1. This excess will be used in future phases or sold for off-site construction use. Spoil areas shall be reseeded with natural grasses. The spoil areas for the excess material are indicated on Sheet C1.

SUMMARY

The following key elements summarize the drainage/grading plan for Phase 1:

1. The site will be graded such that all runoff is directed to the Pino Arroyo.

2. No encroachment of site grading on the 200' AMAFCA easement will take place under this phase.

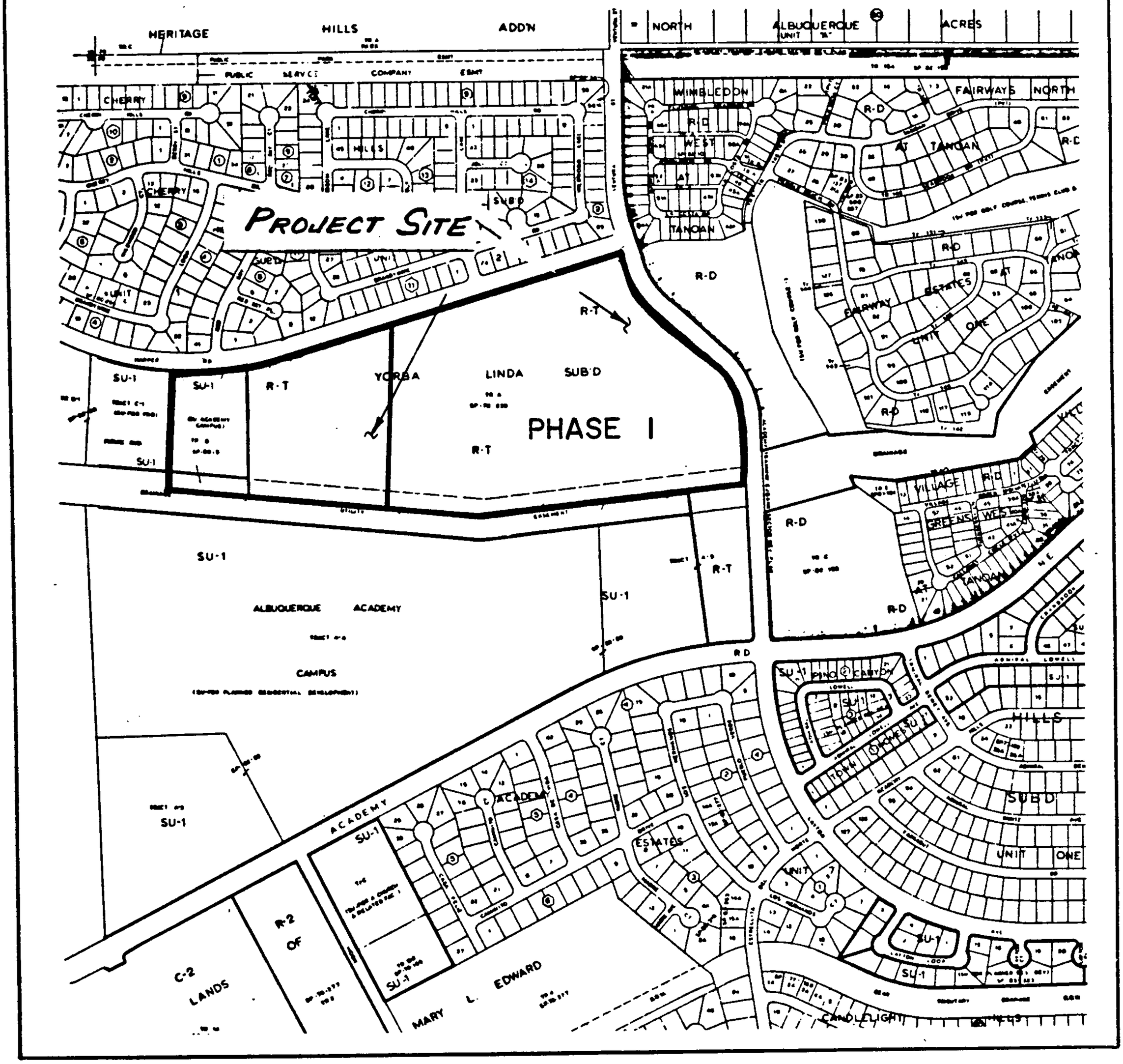
3. A private storm drain system will be utilized to remove runoff from the main entrance - building confluence.

4. Two runoff outfalls to the Pino Arroyo are provided in this plan. Both provide erosion control measures for the discharged runoff. The Church will install and maintain these outlets until the construction of permanent channel improvements.

5. A buried cutoff wall is proposed in this submittal to be constructed adjacent to the north line of the AMAFCA easement for bank stabilization and arroyo meander protection. The cutoff wall will be constructed of a soil-cement mix or an approved alternate. Other cost-effective alternates soil cement are being considered for use.

6. An alternate to the buried cutoff wall concept is currently being studied and may be submitted at a later date. A "prudent line" analysis using a modified Simons-Li approach would identify areas adjacent to the arroyo requiring erosion protection.

7. Temporary erosion control during grading operations and onsite construction shall be accomplished by trench/berms directing runoff to shallow sedimentation ponds. These measures will be implemented in a phased manner to allow for the lengthy timeframe of building construction.



LOCATION MAP

ZONE ATLAS PAGE E-20-Z

PLATE 1

CITY OF
Albuquerque

Martin J. Chávez, Mayor

April 8,1997

Guy Jackson
BPLW
2400 Louisiana Blvd. NE AFC#5 Suite 400
Albuquerque, New Mexico 87110

RE: ENGINEER CERTIFICATION FOR HOFFMANTOWN BAPTIST CHURCH (E20-D20)
CERTIFICATION STATEMENT DATED 4/2/97

Dear Mr. Jackson:

Based on the information provided on your April 2,1997 submittal, Engineer Certification for the above referenced site is acceptable.

If I can be of further assistance, please feel free to contact me at 924-3986.

C: Andrew Garcia
File

Sincerely

Bernie J. Montoya CE
Engineering Associate

CITY OF
Albuquerque

January 17, 1997

Martin J. Chávez, Mayor

Guy Jackson, PE
BPLW Architects & Engineers
2400 Louisiana Blvd. NE
Suite 400
Albuquerque, NM 87110

RE: HOFFMANTOWN BAPTIST CHURCH EXPANSION (E20-D20) DRAINAGE AND GRADING PLAN FOR BUILDING PERMIT APPROVAL. ENGINEER'S STAMP DATED 10-13-95.

Dear Guy:

Based on the information provided on your January 14, 1997 submittal, the above referenced project is approved for a 30-day Temporary Certificate of Occupancy.

If I can be of further assistance, please feel free to contact me at 768-3622.

Sincerely,

Lisa Ann Manwill
Engineering Assoc./Hyd.

c: Kurt Browning - AMAFCA
Andrew Garcia
File

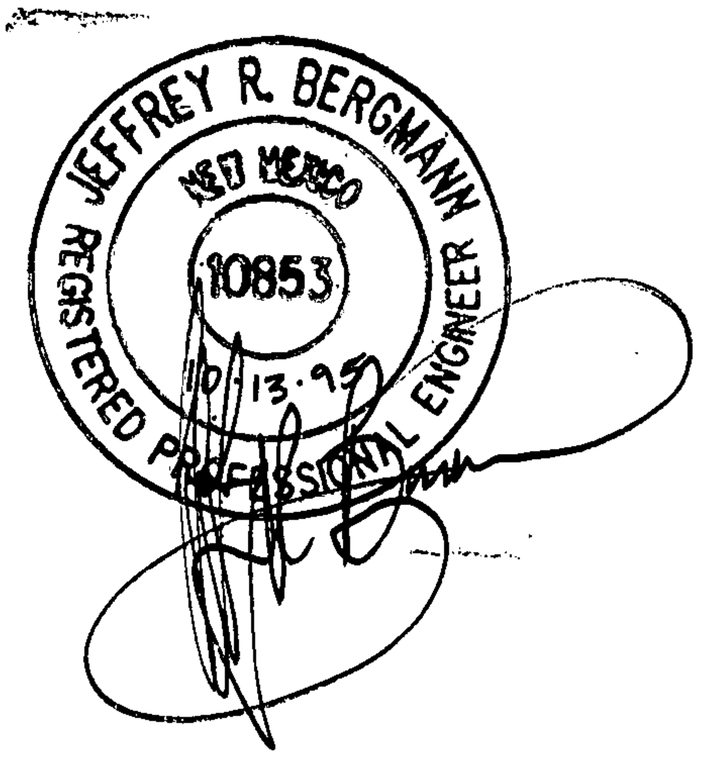
DRAINAGE PLAN
FOR
HOFFMANTOWN BAPTIST CHURCH

Albuquerque, New Mexico

BPLW Project Number: 94053.01

October 12, 1995

Prepared by:
Jeffrey R. Bergmann, PE #10853



BPLW
Architects & Engineers, Inc.
Albuquerque, New Mexico

~PURPOSE

The purpose of this report is to present the Drainage Plan for building permit approval for the construction of the Hoffmantown Baptist Church Education Building Expansion. The plans have been prepared in accordance with the Development Process Manual (DPM) of the City of Albuquerque. This report is an update of a drainage report done for the Hoffmantown Baptist Church dated October 1987 by Bohannan-Huston, Inc. It is also an update of a drainage report for the Hoffmantown Baptist Church dated 28 February 1995 by BPLW.

Excerpts from the October 1987 and 28 February 1995 drainage reports are contained in Appendix B. Updated drainage calculations and new drainage calculations are contained in Appendix C. Channel clarification drawings as well as grading and drainage plans are contained in Appendices C and D respectively. The drawings contained in Appendix D are the relevant construction documents for which approval is sought.

SITE LOCATION

The site is located in the southwest corner of Harper Road and Ventura Street, NE. The site is located near the airport terminal. The Zone Atlas Map for this area is included in Appendix A.

PROJECT SUMMARY

The Hoffmantown Baptist Church Education Building expansion consists of the addition of an approximately 29,000 square foot building and required utility services to the west of the existing main building (see Appendix D Plate 1-Sheet CD.1). This includes some site work renovation to the north and south of the existing main building. The project also consists of the construction of a drainage channel between the two existing buildings located south of the proposed expansion (see Appendix D Plate 1-Sheet CD.1). Drawings C1 and C2 in Appendix C show this concrete channel. These drawings are for clarification on the sections shown on Plate 8-Sheet C2.3.

EXISTING CONDITIONS

The existing drainage system is shown on the overall drainage plan (see Appendix D Plate 1-Sheet CD.1). The proposed work is located in Basins B and F. The area of construction is currently a paved parking area. The existing runoff flows from the area are shown in Table 1. The runoff flows in the construction area are currently carried overland with a roof drain from the existing main building discharging to the south. The existing drainage system in the construction area uses overland flow to the West Outfall (see Appendix D Plate 1-Sheet CD.1). A summary of the existing flows to the West Outfall are contained in Table 2.

It should be noted that the existing flows for basins B and F were recalculated using the current City of Albuquerque runoff calculation methods (Chapter 22.2). This was required because of the use of a method by Bohannan-Huston, Inc. in their 1987 report. This additional calculation provides a better picture of the change resulting from the proposed work.

DEVELOPED CONDITIONS

The proposed drainage system for the expansion is overland flow with some flows carried in roof drains. The building expansion will sit on top of what is now pavement. The runoff from the site will be handled in three ways: 1) two roof drains discharging through openings in the paved slope, 2) overland flow to the proposed drainage channel south of the expansion, and 3) overland flow using pavement and ground grading to convey the flows. Each of the three discharge to the West Outfall. The developed flows are shown in Tables 1 and 2. The drainage channel between the two buildings is at the south is required because of a blockage of flows from an already existing building. This channel is designed to remedy the ponding that currently occurs in the area.

The developed conditions do not increase the discharge from the area. The existing and developed flows can be seen in Tables 1 and 2.

TABLE 1 DRAINAGE BASINS B AND F
PROPOSED AND EXISTING CONDITIONS

CONTRIBUTING BASINS

Basin	Existing Q100	Proposed Q100	
F	47.87	47.00	cfs
B	30.89	31.63	cfs
Totals	**78.76**	**78.63**	cfs

TABLE 2 WEST OUTFALL CAPACITY
PROPOSED AND EXISTING CONDITIONS

EXIST. AND PROPOSED OUTFALL CAPACITY 112 cfs

CONTRIBUTING BASINS

Basin	Existing Q100	Proposed Q100	
C (1)	4.11	4.11	cfs
H (1)	3.04	3.04	cfs
F (3)	47.87	47.00	cfs
A(2)	28.00	28.00	cfs
B(3)	30.89	31.63	cfs
Totals	**113.91**	**113.78**	cfs

Existing Outfall Capacity (1)	112 cfs
Existing Outfall Discharge	113.91 cfs
Proposed Outfall Discharge	113.78 cfs

Note (1) From Drainage Report for Hoffmantown Baptist Church Temporary Parking Lot, October 1987, Bohannan-Huston, Inc. using 1984 Mayor's Emergency Order for runoff calculations.
Note (2) From Drainage Plan for Hoffmantown Baptist Church, Albuquerque, New Mexico, February 28, 1995, BPLW, Inc.
Note (3) Calculations for this project.

HYDROLOGIC CONDITIONS

The SCS soil type for the site is Embudo, corresponding to a Type "B" hydrologic soil group. A soils map is shown in Appendix A. The existing ground in the proposed construction area is currently covered by asphalt. Some turf is located near the buildings but it is minimal.

According to the Flood Boundary and Floodway Map of the City of Albuquerque, the project site does not lie in the 100-year flood plain. A copy of this map is included in Appendix A for reference.

EFFECT OF THE PROJECT ON THE DRAINAGE MASTER PLAN

This project does not alter the drainage plan as set forth in the two previous reports cited in this report. The proposed/developed flows from this expansion actually reduce the existing flows from the same area. The discharge through the West Outfall structure is at capacity currently and this project does not alter that fact (see Table 2).

WEST OUTFALL SUPPLEMENTAL INFORMATION

Kurt Browning of AMAFCA asked BPLW to provide as-built information for the West Outfall Structure. This request was made in a 22 September 95 meeting with BPLW and the City of Albuquerque Hydrology department (see Appendix C for meeting minutes). This information is contained in this section and in Appendix C.

A field survey of the West Outfall Structure was conducted on 9 and 10 October 1995 by Freeman Leaming and Ben Martinez of BPLW. The structure was measured and elevation shots were taken along length of the channel. This information is contained in Appendix C. A tape measure and a level were used to obtain the information. The depth of the channel in some areas was not obtainable through the use of the level and rod because of the grates covering the channel. The depths in these restricted areas were obtained using a steel tape lowered through the grate. The depth of the channel was reduced further due to the thickness of the grate (assumed to be 0.03').

After the field information was gathered, a comparison of the channel was made. This compared the currently existing channel to the channel in the 1987 report from Bohannan-Huston (see Appendix B). The differences found were:

1. The depth of the current channel in some areas is less than the two-foot depth in the Bohannan-Huston analysis. The smallest depth (1.89 feet) occurred at station 0.
2. The slope of the bottom of the channel is greater than the 1.5% used in the Bohannan-Huston report. This slope *averages* 2.6% through the length of the channel. The exception to this slope increase is the east side between stations 17 and 20. The slope through this reach is 1.5%.
3. The entrance appears to have been enlarged to the east with a wing wall (see sketch in Appendix C). The concrete in this area appeared to have been cut and then patched. This could be the work Kurt Browning was referring to in the 22 September 95 meeting.
4. The soil slope above the channel top at the entrance to the channel has been stabilized with concrete. This could also be some of the work Kurt Browning was referring to in the 22 September 95 meeting.

After the comparison, the channel was analyzed for capacity. This analysis was conducted using Mannings equation. Three different areas were analyzed: the opening throat with new wing wall, the channel itself at various points along the channel, and the total channel. The opening throat was analyzed for capacity. This capacity analysis showed the throat is capable carrying 293 cfs. The channel itself was analyzed along its length. This analysis showed the channel has a capacity which ranges from 111.89 cfs to 203.31 cfs. This analysis was conducted by extrapolating the information on one side of the channel to both sides. This analysis provides a "worst case" capacity for the channel. The last analysis was conducted using the average slope along the channel with the smallest depth. This analysis showed the channel has a capacity of 138.5 cfs.

It should be noted that the analyses conducted did not include the energy dissipator at the end of the channel (see sketch in Appendix C) or the entrance head loss due to turbulence.

DRAINAGE REPORT
FOR
HOFFMANTOWN BAPTIST CHURCH
TEMPORARY PARKING LOT

OCTOBER, 1987

PREPARED FOR:

HOFFMANTOWN BAPTIST CHURCH
8888 HARPER DRIVE, N.E.
ALBUQUERQUE, NEW MEXICO 87111

PREPARED BY:

BOHANNAN-HUSTON, INC.
COURTYARD I, 7500 JEFFERSON STREET, N.E.
ALBUQUERQUE, NEW MEXICO 87109

JOB NO. 87343.00

Kerry L. Davis, P.E.
N.M.P.E. No. 9984

PROJECT NAME HOFFMAN TOWN BAPTIST

PROJECT NO. 87343.00

SUBJECT DRAINAGE CALCS (AFTER DEV.)

SHEET 1 OF

BY SMD DATE 9/24/87.

CH'D DATE

APPENDED

UNDEVELOPED DRAINAGE

Basin	Area (ac.)	Length (ft.)	Top Elev. (ft.)	Bottom Elev. (ft.)	Slope (ft/ft)	Time of Concentration	Soil Group	% Impervious	Runoff Coefficient, C	100 YEAR 6 Hr. Rain Volume (in.)	100 YEAR I/6 Hr Rain (in./hr.)	100 YEAR Peak Flow Rate Q (cfs)	100 YEAR Runoff Volume (ac. ft.)	10 YEAR 6 Hr. Rain Volume (in.)	10 YEAR I/6 Hr. Rain (in./hr.)	10 YEAR Peak Flow Rate Q (cfs)	10 YEAR Runoff Volume
A	6.57	830	64	40	.0481	10	B	0	0.34	2.41	5.07	11.32	0.45	1.58	3.30	22.18	0.8
B	6.72	940	46	30	.0170	10	B	100	1.00	2.4	5.07	34.07	11.34	1.58	3.30	4.59	0.1
C	1.39	1140	64	38	.0228	10	B	100	1.00	2.4	5.07	7.05	0.28	1.58	3.30	2.67	0.
D	0.81	430	64	40	.03381	10	B	100	1.00	2.4	5.07	4.11	0.16	1.58	3.30	11.31	0.4
E	4.08	600	68	42	.0433	10	B	88	0.84	2.4	5.07	17.38	0.161	1.58	3.30	27.80	1.3
F	10.22	1800	40	24	.0089	15	B	100	1.00	2.4	4.13	42.2	2.04	1.58	2.72	5.48	0.2
G	1.46	1010	66	40	.0257	10	B	100	1.00	2.4	5.07	8.42	0.33	1.58	3.30	1.98	0.0
H	0.60	340	50	40	.0294	10	B	100	1.00	2.4	5.07	3.04	0.12	1.58	3.30		
Ref.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17

References:

1,2,3,4,5	Basin areas, lengths, top and bottom elevations and slopes from Plate ___.	10, 14	DPM Plate	22.2 D-1
6.	Tc by Kirpich formula $T_c = .0078 \frac{\text{Length}^{.77}}{\text{Slope}^{.385}}$ (10 minutes minimum)	11, 15	DPM Plate	22.2 D-2
7.	See Soils Map Plate ___ and Text.	12, 16	Rational Formula	$Q = CIA$
8	By area computation.	13, 17	Rational Formula	$V = \frac{\text{Rainfall}}{12} \times C \times A$
9.	DPM Plate 22.2 C-1			

ANALYSIS POINT SUMMARY

ANALYSIS POINT (AP #)	BASINS DRAINED	100-YEAR FLOWRATE (CFS)
AP-1	H	3.0 cfs
AP-2	G	8.4 cfs
AP-3	D	4.1 cfs
AP-4	E	17.4 cfs
AP-5	A	11.3 cfs
AP-6	C, H, F, A, B	75.2 cfs *
AP-7	G, E, D	29.9 cfs

* this is a conservative value due to the sedimentation basin in Basin A

UNDEVELOPED FLOWRATE PHASE 1

by Rational Method

L = 1450' approx. by Kirpich, T_c = 8.77 min
Slope = 02.50% use 10 Min.
intensity = 5.07 in/hr C = 0.34
Area = 40 acres

$Q = CIA = 68.95 = 69$ cfs

UNDEVELOPED FLOW RATE ~ TEMPORARY PARKING (BEF) SUMMARY

ANALYSIS POINT (AP#)	BASINS DRAINED	100YR FLOW RATE (CFS)
AP-1	H	3.0
AP-2	G	8.4
AP-3	b	4.1
AP-4	E	17.4
AP-5	A	11.3
AP-6	A,C,H,F,B	75.2*
AP-7	G,E,D	29.9

* CONSERVATIVE DUE TO SEDIMENTATION BASIN IN A.

DEVELOPED FLOW RATE ~ TEMPORARY PARKING (AFT) SUMMARY

ANALYSIS POINT (AP#)	BASINS DRAINED	100YR FLOWRATE (CFS)
AP-1	H	3.0
AP-2	G	8.4
AP-3	D	4.1
AP-4	E	17.4
AP-5	A	11.3
AP-6	A,C,H,F,B	97.7
AP-7	G,E,D	29.9

BOHANNAN-HUSTON INC.

PROJECT NAME HOFFMANTOWN SHEET 2 OF

PROJECT NO. 87343.00 BY SD DATE OCT 1, 1987

SUBJECT DRAINAGE ~ TEMP. PARKING CH'D " DATE "

WEST OUTFALL TO ARROYO
AP-⑥

all 100-yr storm values

Check capacity of proposed rundown .....

AP-⑤ flowrate = 75.2 cfs (97.7 cfs)
rectangular channel, 4'X 2' deep cross-section
slope = 1.5 %
solve for capacity by Manning's

$$Q = \frac{1.489}{n} A (R_h)^{2/3} S^{1/2}$$

where $A = 2'(4') = 8\ \square'$
$R_h = A/P = 8/8 = 1$
$n = 0.013$ (concrete)

then flowrate capacity, $Q = 112.2$ cfs >> 75.2 OK

* see note below

Note: this is even more adequate a capacity when it is considered that the 75 cfs is high (does not consider the time lag in Basin A)

rip-rap requirements .....

use grouted riprap (see Sheet C-7)

PROJECT NAME HOFFMANTOWN SITE SHEET 1 OF
PROJECT NO. 52540 BY James Top DATE 12-16-85
SUBJECT DRAINAGE CALS. CH'D " DATE 12-16-85

rev. 10/5/87

BPLW
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PROJECT **HOFFMANTOWN BAPTIST CHURCH**
PROJECT NO. **94053.01**
DATE **22 Aug 95**
BY **Freeman G. Leaming**

DPM Section 22.2 - Hydrology

Part A-Watersheds less than 40 acres.
January, 1993

INSTRUCTIONS

- Spread sheet requires three input areas (dark cells):
  - Location
  - >A.1 Precipitation Zone
  - >A.3 Land Treaments
- Values from the tables are automatically placed using "if" statements.
- Table values should be checked for correctness for each use.

SUMMARY

Location **BASIN B EXISTING**		
Precipitation Zone	**3**	
Land Area	**6.53**	acres
Excess Precipitation Volume		
>>> 100-year 6-hour (design)	**1.19**	**acre-ft.**
10-year 6-hour	**0.01**	acre-ft.
2-year 6-hour	**0.02**	acre-ft.
100-year 24-hour	**1.43**	acre-ft.
Peak Discharge Rates (DPM)		
>>> Q100 (design)	**30.89**	**cfs**
Q10	**20.42**	cfs
Q2	**11.89**	cfs
Peak Discharge Rates (DPM)		
>>> Q100 (design)	**30.78**	**cfs**
Q10	**20.46**	cfs
Q2	**11.86**	cfs

CALCULATIONS FOLLOW

BPLW
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PROJECT **HOFFMANTOWN BAPTIST CHURCH**
PROJECT NO. **94053.01**
DATE **22 Aug 95**
BY **Freeman G. Leaming**

INPUT AND CALCULATIONS

LOCATION **BASIN B EXISTING**

>A.1 PRECIPITATION ZONE (from Table A-1) **3**

>A.2 DEPTHS
(from Table A-2)

100-YEAR STORM (P60)	**2.14**	inches
100-YEAR STORM (P360)	**2.60**	inches
100-YEAR STORM (P1440)	**3.10**	inches
10-YEAR (P360) (Calculated: P360*RPF10)	**1.73**	inches
2-YEAR (P360) (Calculated: P360*RPF2)	**1.13**	inches

>A.3 LAND TREATMENTS (Ai)

Treatment A	**0.00**	acres
Treatment B	**0.78**	acres
Treatment C	**0.00**	acres
Treatment D	**5.75**	acres
Total Area	**6.53**	acres

>A.4 ABSTRACTIONS **See A.5**

CALCULATIONS FOLLOW

BPLW
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PROJECT **HOFFMANTOWN BAPTIST CHURCH**
PROJECT NO. **94053.01**
DATE **22 Aug 95**
BY **Freeman G. Leaming**

INPUT AND CALCULATIONS (CON'T)

>A.5 EXCESS PRECIPITATION 6 HOUR AND 24 HOUR (Ei)
from Table A-8

100-year 6-hour		
Treatment A	**0.66**	inches
Treatment B	**0.92**	inches
Treatment C	**1.29**	inches
Treatment D	**2.36**	inches
WEIGHTED E (δEi*Ai/A)	**2.19**	inches
VOLUME V100:6h (E*A)	**1.19**	acre-ft.
	51,863.99	ft^3
10-year 6-hour		
Treatment A	**0.19**	inches
Treatment B	**0.36**	inches
Treatment C	**0.62**	inches
Treatment D	**1.50**	inches
WEIGHTED E (δEi*Ai/A)	**0.12**	inches
VOLUME V10:6h (E*A)	**0.01**	acre-ft.
	390.93	ft^3
2-year 6-hour		
Treatment A	**0.00**	inches
Treatment B	**0.06**	inches
Treatment C	**0.20**	inches
Treatment D	**0.89**	inches
WEIGHTED E (δEi*Ai/A)	**0.79**	inches
VOLUME V2:6h (E*A)	**0.02**	acre-ft.
	1,033.49	ft^3
100-year 24-hour		
VOLUME V100:24h (V100-6h+Ad*P1440-P360)/12)	**1.43**	acre-ft.
	62,300.24	ft^3

CALCULATIONS FOLLOW

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PROJECT **HOFFMANTOWN BAPTIST CHURCH**
PROJECT NO. **94053.01**
DATE **22 Aug 95**
BY **Freeman G. Leaming**

INPUT AND CALCULATIONS (CON'T)

>A.6 PEAK DISCHARGE RATE FOR SMALL WATERSHEDS (Qi)
from Table A-9

100-year			
Treatment A		**1.87**	cfs/acre
Treatment B		**2.60**	cfs/acre
Treatment C		**3.45**	cfs/acre
Treatment D		**5.02**	cfs/acre

	Q100 (δQi*Ai)	**30.89**	cfs
		==========	
10-year			
Treatment A		**0.58**	cfs/acre
Treatment B		**1.19**	cfs/acre
Treatment C		**2.00**	cfs/acre
Treatment D		**3.39**	cfs/acre

	Q10 (δQi*Ai)	**20.42**	cfs
		==========	
2-year			
Treatment A		**0.00**	cfs/acre
Treatment B		**0.21**	cfs/acre
Treatment C		**0.78**	cfs/acre
Treatment D		**2.04**	cfs/acre

	Q2 (δQi*Ai)	**11.89**	cfs
		==========	

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PROJECT **HOFFMANTOWN BAPTIST CHURCH**
PROJECT NO. **94053.01**
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RATIONAL METHOD

PEAK INTENSITY (in/hr at tc=0.2 hour)
from Table A-10

Peak Intensity (I) 100-year	**5.38**
Peak Intensity (I) 10-year	**3.65**
Peak Intensity (I) 2-year	**2.21**

RATIONAL METHOD COEFFICIENT, C
from Table A-11

100-year

Treatment A	**0.35**	cfs/acre
Treatment B	**0.48**	cfs/acre
Treatment C	**0.64**	cfs/acre
Treatment D	**0.93**	cfs/acre
Q100 (δQi*I*Ai)	**30.78**	cfs

10-year

Treatment A	**0.16**	cfs/acre
Treatment B	**0.33**	cfs/acre
Treatment C	**0.55**	cfs/acre
Treatment D	**0.93**	cfs/acre
Q10 (δQi*I*Ai)	**20.46**	cfs

2-year

Treatment A	**0.00**	cfs/acre
Treatment B	**0.10**	cfs/acre
Treatment C	**0.35**	cfs/acre
Treatment D	**0.92**	cfs/acre
Q2 (δQi*I*Ai)	**11.86**	cfs

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PROJECT **HOFFMANTOWN BAPTIST CHURCH**
PROJECT NO. **94053.01**
DATE **22 Aug 95**
BY **Freeman G. Leaming**

DPM Section 22.2 - Hydrology

Part A-Watersheds less than 40 acres.
January, 1993

INSTRUCTIONS

- Spread sheet requires three input areas (dark cells):
  - Location
  - >A.1 Precipitation Zone
  - >A.3 Land Treaments
- Values from the tables are automatically placed using "if" statements.
- Table values should be checked for correctness for each use.

SUMMARY

Location	**HOFFMANTOWN BASIN "B" PROPOSED**		
Precipitation Zone		**3**	
Land Area		**6.58**	acres
Excess Precipitation Volume			
	>>> 100-year 6-hour (design)	**1.22**	**acre-ft.**
	10-year 6-hour	**0.01**	acre-ft.
	2-year 6-hour	**0.02**	acre-ft.
	100-year 24-hour	**1.47**	acre-ft.
Peak Discharge Rates (DPM)			
	>>> Q100 (design)	**31.63**	**cfs**
	Q10	**21.03**	cfs
	Q2	**12.36**	cfs
Peak Discharge Rates (DPM)			
	>>> Q100 (design)	**31.52**	**cfs**
	Q10	**21.07**	cfs
	Q2	**12.33**	cfs

CALCULATIONS FOLLOW

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PROJECT **HOFFMANTOWN BAPTIST CHURCH**
PROJECT NO. **94053.01**
DATE **22 Aug 95**
BY **Freeman G. Leaming**

INPUT AND CALCULATIONS

LOCATION **HOFFMANTOWN BASIN "B" PROPOSED**

>A.1 PRECIPITATION ZONE (from Table A-1) **3**

>A.2 DEPTHS
(from Table A-2)

100-YEAR STORM (P60)	**2.14**	inches
100-YEAR STORM (P360)	**2.60**	inches
100-YEAR STORM (P1440)	**3.10**	inches
10-YEAR (P360) (Calculated: P360*RPF10)	**1.73**	inches
2-YEAR (P360) (Calculated: P360*RPF2)	**1.13**	inches

>A.3 LAND TREATMENTS (AI)

Treatment A	**0.00**	acres
Treatment B	**0.58**	acres
Treatment C	**0.00**	acres
Treatment D	**6.00**	acres
Total Area	**6.58**	acres

>A.4 ABSTRACTIONS **See A.5**

CALCULATIONS FOLLOW

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PROJECT **HOFFMANTOWN BAPTIST CHURCH**
PROJECT NO. **94053.01**
DATE **22 Aug 95**
BY **Freeman G. Leaming**

INPUT AND CALCULATIONS (CON'T)

>A.5 EXCESS PRECIPITATION 6 HOUR AND 24 HOUR (Ei)
from Table A-8

100-year 6-hour		
Treatment A	**0.66**	inches
Treatment B	**0.92**	inches
Treatment C	**1.29**	inches
Treatment D	**2.36**	inches
WEIGHTED E (∑Ei*Ai/A)	**2.23**	inches
VOLUME V100:6h (E*A)	**1.22**	acre-ft.
	53,337.77	ft^3
10-year 6-hour		
Treatment A	**0.19**	inches
Treatment B	**0.36**	inches
Treatment C	**0.62**	inches
Treatment D	**1.50**	inches
WEIGHTED E (∑Ei*Ai/A)	**0.09**	inches
VOLUME V10:6h (E*A)	**0.01**	acre-ft.
	288.48	ft^3
2-year 6-hour		
Treatment A	**0.00**	inches
Treatment B	**0.06**	inches
Treatment C	**0.20**	inches
Treatment D	**0.89**	inches
WEIGHTED E (∑Ei*Ai/A)	**0.82**	inches
VOLUME V2:6h (E*A)	**0.02**	acre-ft.
	1,067.45	ft^3
100-year 24-hour		
VOLUME V100:24h (V100-6h+Ad*P1440-P360)/12)	**1.47**	acre-ft.
	64,227.77	ft^3

CALCULATIONS FOLLOW

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PROJECT **HOFFMANTOWN BAPTIST CHURCH**
PROJECT NO. **94053.01**
DATE **22 Aug 95**
BY **Freeman G. Leaming**

INPUT AND CALCULATIONS (CON'T)

>A.6 PEAK DISCHARGE RATE FOR SMALL WATERSHEDS (QI)
from Table A-9

100-year			
Treatment A		**1.87**	cfs/acre
Treatment B		**2.60**	cfs/acre
Treatment C		**3.45**	cfs/acre
Treatment D		**5.02**	cfs/acre

Q100 (ΣQi*Ai)		**31.63**	cfs
		==========	
10-year			
Treatment A		**0.58**	cfs/acre
Treatment B		**1.19**	cfs/acre
Treatment C		**2.00**	cfs/acre
Treatment D		**3.39**	cfs/acre

Q10 (ΣQi*Ai)		**21.03**	cfs
		==========	
2-year			
Treatment A		**0.00**	cfs/acre
Treatment B		**0.21**	cfs/acre
Treatment C		**0.78**	cfs/acre
Treatment D		**2.04**	cfs/acre

Q2 (ΣQi*Ai)		**12.36**	cfs
		==========	

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PROJECT **HOFFMANTOWN BAPTIST CHURCH**
PROJECT NO. **94053.01**
DATE **22 Aug 95**
BY **Freeman G. Leaming**

RATIONAL METHOD

PEAK INTENSITY (in/hr at tc=0.2 hour)
from Table A-10

Peak Intensity (I) 100-year	**5.38**
Peak Intensity (I) 10-year	**3.65**
Peak Intensity (I) 2-year	**2.21**

RATIONAL METHOD COEFFICIENT, C
from Table A-11

100-year

Treatment A	**0.35**	cfs/acre
Treatment B	**0.48**	cfs/acre
Treatment C	**0.64**	cfs/acre
Treatment D	**0.93**	cfs/acre
Q100 (∑Qi*I*Ai)	**31.52**	cfs

10-year

Treatment A	**0.16**	cfs/acre
Treatment B	**0.33**	cfs/acre
Treatment C	**0.55**	cfs/acre
Treatment D	**0.93**	cfs/acre
Q10 (∑QI*I*AI)	**21.07**	cfs

2-year

Treatment A	**0.00**	cfs/acre
Treatment B	**0.10**	cfs/acre
Treatment C	**0.35**	cfs/acre
Treatment D	**0.92**	cfs/acre
Q2 (∑QI*I*AI)	**12.33**	cfs

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PROJECT **HOFFMANTOWN BAPTIST CHURCH**
PROJECT NO. **94053.01**
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DPM Section 22.2 - Hydrology

Part A-Watersheds less than 40 acres.
January, 1993

INSTRUCTIONS

- Spread sheet requires three input areas (dark cells):
  - Location
  - >A.1 Precipitation Zone
  - >A.3 Land Treaments
- Values from the tables are automatically placed using "if" statements.
- Table values should be checked for correctness for each use.

SUMMARY

Location	**HOFFMANTOWN BASIN "F" EXISTING**	
Precipitation Zone	**3**	
Land Area	**10.52**	acres
Excess Precipitation Volume		
>>> 100-year 6-hour (design)	**1.82**	**acre-ft.**
10-year 6-hour	**0.01**	acre-ft.
2-year 6-hour	**0.02**	acre-ft.
100-year 24-hour	**2.18**	acre-ft.
Peak Discharge Rates (DPM)		
>>> Q100 (design)	**47.87**	**cfs**
Q10	**31.17**	cfs
Q2	**17.73**	cfs
Peak Discharge Rates (DPM)		
>>> Q100 (design)	**47.70**	**cfs**
Q10	**31.24**	cfs
Q2	**17.69**	cfs

CALCULATIONS FOLLOW

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PROJECT **HOFFMANTOWN BAPTIST CHURCH**
PROJECT NO. **94053.01**
DATE **22 Aug 95**
BY **Freeman G. Leaming**

INPUT AND CALCULATIONS

LOCATION **HOFFMANTOWN BASIN "F" EXISTING**

>A.1 PRECIPITATION ZONE (from Table A-1) **3**

>A.2 DEPTHS
(from Table A-2)

100-YEAR STORM (P60)	**2.14**	inches
100-YEAR STORM (P360)	**2.60**	inches
100-YEAR STORM (P1440)	**3.10**	inches
10-YEAR (P360) (Calculated: P360*RPF10)	**1.73**	inches
2-YEAR (P360) (Calculated: P360*RPF2)	**1.13**	inches

>A.3 LAND TREATMENTS (Ai)

Treatment A	0.00	acres
Treatment B	2.04	acres
Treatment C	0.00	acres
Treatment D	8.48	acres
Total Area	**10.52**	acres

>A.4 ABSTRACTIONS **See A.5**

CALCULATIONS FOLLOW

BPLW
Architects & Engineers, Inc.

PROJECT **HOFFMANTOWN BAPTIST CHURCH**
PROJECT NO. **94053.01**
DATE **22 Aug 95**
BY **Freeman G. Leaming**

INPUT AND CALCULATIONS (CON'T)

>A.5 EXCESS PRECIPITATION 6 HOUR AND 24 HOUR (Ei)
from Table A-8

100-year 6-hour		
Treatment A	**0.66**	inches
Treatment B	**0.92**	inches
Treatment C	**1.29**	inches
Treatment D	**2.36**	inches
WEIGHTED E (ΣEi*Ai/A)	**2.08**	inches
VOLUME V100:6h (E*A)	**1.82**	acre-ft.
	79,459.25	ft^3
10-year 6-hour		
Treatment A	**0.19**	inches
Treatment B	**0.36**	inches
Treatment C	**0.62**	inches
Treatment D	**1.50**	inches
WEIGHTED E (ΣEi*Ai/A)	**0.19**	inches
VOLUME V10:6h (E*A)	**0.01**	acre-ft.
	634.65	ft^3
2-year 6-hour		
Treatment A	**0.00**	inches
Treatment B	**0.06**	inches
Treatment C	**0.20**	inches
Treatment D	**0.89**	inches
WEIGHTED E (ΣEi*Ai/A)	**0.73**	inches
VOLUME V2:6h (E*A)	**0.02**	acre-ft.
	952.72	ft^3
100-year 24-hour		
VOLUME V100:24h (V100-6h+Ad*P1440-P360)/12)	**2.18**	acre-ft.
	94,850.45	ft^3

CALCULATIONS FOLLOW

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PROJECT **HOFFMANTOWN BAPTIST CHURCH**
PROJECT NO. **94053.01**
DATE **22 Aug 95**
BY **Freeman G. Leaming**

INPUT AND CALCULATIONS (CON'T)

>A.6 PEAK DISCHARGE RATE FOR SMALL WATERSHEDS (Qi)
from Table A-9

100-year			
Treatment A		**1.87**	cfs/acre
Treatment B		**2.60**	cfs/acre
Treatment C		**3.45**	cfs/acre
Treatment D		**5.02**	cfs/acre

	Q100 (ΣQi*Ai)	**47.87**	cfs
		==========	
10-year			
Treatment A		**0.58**	cfs/acre
Treatment B		**1.19**	cfs/acre
Treatment C		**2.00**	cfs/acre
Treatment D		**3.39**	cfs/acre

	Q10 (ΣQi*Ai)	**31.17**	cfs
		==========	
2-year			
Treatment A		**0.00**	cfs/acre
Treatment B		**0.21**	cfs/acre
Treatment C		**0.78**	cfs/acre
Treatment D		**2.04**	cfs/acre

	Q2 (ΣQi*Ai)	**17.73**	cfs
		==========	

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PROJECT **HOFFMANTOWN BAPTIST CHURCH**
PROJECT NO. **94053.01**
DATE **22 Aug 95**
BY **Freeman G. Leaming**

RATIONAL METHOD

PEAK INTENSITY (in/hr at tc=0.2 hour)
from Table A-10

Peak Intensity (I) 100-year	**5.38**
Peak Intensity (I) 10-year	**3.65**
Peak Intensity (I) 2-year	**2.21**

RATIONAL METHOD COEFFICIENT, C
from Table A-11

100-year

Treatment A	**0.35**	cfs/acre
Treatment B	**0.48**	cfs/acre
Treatment C	**0.64**	cfs/acre
Treatment D	**0.93**	cfs/acre
Q100 (ΣQI*I*AI)	**47.70**	cfs

10-year

Treatment A	**0.16**	cfs/acre
Treatment B	**0.33**	cfs/acre
Treatment C	**0.55**	cfs/acre
Treatment D	**0.93**	cfs/acre
Q10 (ΣQI*I*AI)	**31.24**	cfs

2-year

Treatment A	**0.00**	cfs/acre
Treatment B	**0.10**	cfs/acre
Treatment C	**0.35**	cfs/acre
Treatment D	**0.92**	cfs/acre
Q2 (ΣQi*I*Ai)	**17.69**	cfs

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PROJECT **HOFFMANTOWN BAPTIST CHURCH**
PROJECT NO. **94053.01**
DATE **22 Aug 95**
BY **Freeman G. Leaming**

DPM Section 22.2 - Hydrology

Part A-Watersheds less than 40 acres.
January, 1993

INSTRUCTIONS

- Spread sheet requires three input areas (dark cells):
  - Location
  - >A.1 Precipitation Zone
  - >A.3 Land Treaments
- Values from the tables are automatically placed using "if" statements.
- Table values should be checked for correctness for each use.

SUMMARY

Location	**HOFFMANTOWN BASIN "F" PROPOSED**	
Precipitation Zone	**3**	
Land Area	**10.46**	acres
Excess Precipitation Volume		
>>> 100-year 6-hour (design)	**1.78**	**acre-ft.**
10-year 6-hour	**0.02**	acre-ft.
2-year 6-hour	**0.02**	acre-ft.
100-year 24-hour	**2.12**	acre-ft.
Peak Discharge Rates (DPM)		
>>> Q100 (design)	**47.00**	**cfs**
Q10	**30.45**	cfs
Q2	**17.16**	cfs
Peak Discharge Rates (DPM)		
>>> Q100 (design)	**46.82**	**cfs**
Q10	**30.52**	cfs
Q2	**17.13**	cfs

CALCULATIONS FOLLOW

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PROJECT **HOFFMANTOWN BAPTIST CHURCH**
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DATE **22 Aug 95**
BY **Freeman G. Leaming**

INPUT AND CALCULATIONS

LOCATION **HOFFMANTOWN BASIN "F" PROPOSED**

>A.1 PRECIPITATION ZONE (from Table A-1) **3**

>A.2 DEPTHS
(from Table A-2)

100-YEAR STORM (P60)	**2.14**	inches
100-YEAR STORM (P360)	**2.60**	inches
100-YEAR STORM (P1440)	**3.10**	inches
10-YEAR (P360) (Calculated: P360*RPF10)	**1.73**	inches
2-YEAR (P360) (Calculated: P360*RPF2)	**1.13**	inches

>A.3 LAND TREATMENTS (AI)

Treatment A	**0.00**	acres
Treatment B	**2.18**	acres
Treatment C	**0.15**	acres
Treatment D	**8.13**	acres
Total Area	**10.46**	acres

>A.4 ABSTRACTIONS **See A.5**

CALCULATIONS FOLLOW

BPLW
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PROJECT **HOFFMANTOWN BAPTIST CHURCH**
PROJECT NO. **94053.01**
DATE **22 Aug 95**
BY **Freeman G. Leaming**

INPUT AND CALCULATIONS (CON'T)

>A.5 EXCESS PRECIPITATION 6 HOUR AND 24 HOUR (Ei)
from Table A-8

100-year 6-hour		
Treatment A	**0.66**	inches
Treatment B	**0.92**	inches
Treatment C	**1.29**	inches
Treatment D	**2.36**	inches
WEIGHTED E (∑Ei*Ai/A)	**2.04**	inches
VOLUME V100:6h (E*A)	**1.78**	acre-ft.
	77,630.82	ft^3
10-year 6-hour		
Treatment A	**0.19**	inches
Treatment B	**0.36**	inches
Treatment C	**0.62**	inches
Treatment D	**1.50**	inches
WEIGHTED E (∑Ei*Ai/A)	**0.23**	inches
VOLUME V10:6h (E*A)	**0.02**	acre-ft.
	753.93	ft^3
2-year 6-hour		
Treatment A	**0.00**	inches
Treatment B	**0.06**	inches
Treatment C	**0.20**	inches
Treatment D	**0.89**	inches
WEIGHTED E (∑Ei*Ai/A)	**0.71**	inches
VOLUME V2:6h (E*A)	**0.02**	acre-ft.
	924.07	ft^3
100-year 24-hour		
VOLUME V100:24h		
(V100-6h+Ad*P1440-P360)/12)	**2.12**	acre-ft.
	92,386.77	ft^3

CALCULATIONS FOLLOW

BPLW
Architects & Engineers, Inc.

PROJECT **HOFFMANTOWN BAPTIST CHURCH**
PROJECT NO. **94053.01**
DATE **22 Aug 95**
BY **Freeman G. Leaming**

INPUT AND CALCULATIONS (CON'T)

>A.6 PEAK DISCHARGE RATE FOR SMALL WATERSHEDS (Qi)
from Table A-9

100-year		
Treatment A	**1.87**	cfs/acre
Treatment B	**2.60**	cfs/acre
Treatment C	**3.45**	cfs/acre
Treatment D	**5.02**	cfs/acre
Q100 (ΣQi*Ai)	**47.00**	cfs
10-year		
Treatment A	**0.58**	cfs/acre
Treatment B	**1.19**	cfs/acre
Treatment C	**2.00**	cfs/acre
Treatment D	**3.39**	cfs/acre
Q10 (ΣQi*Ai)	**30.45**	cfs
2-year		
Treatment A	**0.00**	cfs/acre
Treatment B	**0.21**	cfs/acre
Treatment C	**0.78**	cfs/acre
Treatment D	**2.04**	cfs/acre
Q2 (ΣQi*Ai)	**17.16**	cfs

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PROJECT **HOFFMANTOWN BAPTIST CHURCH**
PROJECT NO. **94053.01**
DATE **22 Aug 95**
BY **Freeman G. Leaming**

RATIONAL METHOD

PEAK INTENSITY (in/hr at tc=0.2 hour)
from Table A-10

Peak Intensity (I) 100-year	**5.38**
Peak Intensity (I) 10-year	**3.65**
Peak Intensity (I) 2-year	**2.21**

RATIONAL METHOD COEFFICIENT, C
from Table A-11

100-year

Treatment A	**0.35**	cfs/acre
Treatment B	**0.48**	cfs/acre
Treatment C	**0.64**	cfs/acre
Treatment D	**0.93**	cfs/acre
Q100 (∑QI*I*AI)	**46.82**	cfs

10-year

Treatment A	**0.16**	cfs/acre
Treatment B	**0.33**	cfs/acre
Treatment C	**0.55**	cfs/acre
Treatment D	**0.93**	cfs/acre
Q10 (∑QI*I*AI)	**30.52**	cfs

2-year

Treatment A	**0.00**	cfs/acre
Treatment B	**0.10**	cfs/acre
Treatment C	**0.35**	cfs/acre
Treatment D	**0.92**	cfs/acre
Q2 (∑QI*I*AI)	**17.13**	cfs

Drainage Areas
Hoffmantown Baptist Church
24 August 1995
fgl
BPLW

① Sidewalk Culvert Drainage Area
② Channel Drainage Area
③ Channel Between Buildings South of Expansion

BPLW
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PROJECT **HOFFMANTOWN BAPTIST CHURCH**
PROJECT NO. **94053.01**
DATE **22 Aug 95**
BY **Freeman G. Leaming**

DPM Section 22.2 - Hydrology

Part A-Watersheds less than 40 acres.
January, 1993

INSTRUCTIONS

- Spread sheet requires three input areas (dark cells):
  - Location
  - >A.1 Precipitation Zone
  - >A.3 Land Treaments
- Values from the tables are automatically placed using "if" statements.
- Table values should be checked for correctness for each use.

SUMMARY

Location	**BUILDING ROOF-SIDEWALK CULVERT**	
Precipitation Zone	**3**	
Land Area	**0.37**	acres
Excess Precipitation Volume		
>>> 100-year 6-hour (design)	**0.07**	**acre-ft.**
10-year 6-hour	**0.00**	acre-ft.
2-year 6-hour	**0.03**	acre-ft.
100-year 24-hour	**0.09**	acre-ft.
Peak Discharge Rates (DPM)		
>>> Q100 (design)	**1.86**	**cfs**
Q10	**1.25**	cfs
Q2	**0.75**	cfs
Peak Discharge Rates (DPM)		
>>> Q100 (design)	**1.85**	**cfs**
Q10	**1.26**	cfs
Q2	**0.75**	cfs

CALCULATIONS FOLLOW

BPLW
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PROJECT **HOFFMANTOWN BAPTIST CHURCH**
PROJECT NO. **94053.01**
DATE **22 Aug 95**
BY **Freeman G. Leaming**

INPUT AND CALCULATIONS

LOCATION **BUILDING ROOF-SIDEWALK CULVERT**

>A.1 PRECIPITATION ZONE (from Table A-1) **3**

>A.2 DEPTHS
(from Table A-2)

100-YEAR STORM (P60)	**2.14**	inches
100-YEAR STORM (P360)	**2.60**	inches
100-YEAR STORM (P1440)	**3.10**	inches
10-YEAR (P360) (Calculated: P360*RPF10)	**1.73**	inches
2-YEAR (P360) (Calculated: P360*RPF2)	**1.13**	inches

>A.3 LAND TREATMENTS (Ai)

Treatment A	0.00	acres
Treatment B		acres
Treatment C	0.00	acres
Treatment D	0.37	acres
Total Area	**0.37**	acres

>A.4 ABSTRACTIONS **See A.5**

CALCULATIONS FOLLOW

BPLW
Architects & Engineers, Inc.

PROJECT **HOFFMANTOWN BAPTIST CHURCH**
PROJECT NO. **94053.01**
DATE **22 Aug 95**
BY **Freeman G. Leaming**

INPUT AND CALCULATIONS (CON'T)

>A.5 EXCESS PRECIPITATION 6 HOUR AND 24 HOUR (Ei)
from Table A-8

100-year 6-hour		
Treatment A	**0.66**	inches
Treatment B	**0.92**	inches
Treatment C	**1.29**	inches
Treatment D	**2.36**	inches
WEIGHTED E (∑Ei*Ai/A)	**2.36**	inches
VOLUME V100:6h (E*A)	**0.07**	acre-ft.
	3,169.72	ft^3
10-year 6-hour		
Treatment A	**0.19**	inches
Treatment B	**0.36**	inches
Treatment C	**0.62**	inches
Treatment D	**1.50**	inches
WEIGHTED E (∑Ei*Ai/A)	**0.00**	inches
VOLUME V10:6h (E*A)	**0.00**	acre-ft.
	0.00	ft^3
2-year 6-hour		
Treatment A	**0.00**	inches
Treatment B	**0.06**	inches
Treatment C	**0.20**	inches
Treatment D	**0.89**	inches
WEIGHTED E (∑Ei*Ai/A)	**0.89**	inches
VOLUME V2:6h (E*A)	**0.03**	acre-ft.
	1,163.05	ft^3
100-year 24-hour		
VOLUME V100:24h (V100-6h+Ad*P1440-P360)/12)	**0.09**	acre-ft.
	3,841.27	ft^3

CALCULATIONS FOLLOW

BPLW
Architects & Engineers, Inc.

PROJECT **HOFFMANTOWN BAPTIST CHURCH**
PROJECT NO. **94053.01**
DATE **22 Aug 95**
BY **Freeman G. Leaming**

INPUT AND CALCULATIONS (CON'T)

>A.6 PEAK DISCHARGE RATE FOR SMALL WATERSHEDS (QI)
from Table A-9

100-year		
Treatment A	**1.87**	cfs/acre
Treatment B	**2.60**	cfs/acre
Treatment C	**3.45**	cfs/acre
Treatment D	**5.02**	cfs/acre
Q100 (ΣQi*Ai)	**1.86**	cfs
10-year		
Treatment A	**0.58**	cfs/acre
Treatment B	**1.19**	cfs/acre
Treatment C	**2.00**	cfs/acre
Treatment D	**3.39**	cfs/acre
Q10 (ΣQi*Ai)	**1.25**	cfs
2-year		
Treatment A	**0.00**	cfs/acre
Treatment B	**0.21**	cfs/acre
Treatment C	**0.78**	cfs/acre
Treatment D	**2.04**	cfs/acre
Q2 (ΣQi*Ai)	**0.75**	cfs

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PROJECT **HOFFMANTOWN BAPTIST CHURCH**
PROJECT NO. **94053.01**
DATE **22 Aug 95**
BY **Freeman G. Leaming**

RATIONAL METHOD

PEAK INTENSITY (in/hr at tc=0.2 hour)
from Table A-10

Peak Intensity (I) 100-year	**5.38**
Peak Intensity (I) 10-year	**3.65**
Peak Intensity (I) 2-year	**2.21**

RATIONAL METHOD COEFFICIENT, C
from Table A-11

100-year

Treatment A	**0.35**	cfs/acre
Treatment B	**0.48**	cfs/acre
Treatment C	**0.64**	cfs/acre
Treatment D	**0.93**	cfs/acre
Q100 (ΣQi*I*Ai)	**1.85**	cfs

10-year

Treatment A	**0.16**	cfs/acre
Treatment B	**0.33**	cfs/acre
Treatment C	**0.55**	cfs/acre
Treatment D	**0.93**	cfs/acre
Q10 (ΣQi*I*Ai)	**1.26**	cfs

2-year

Treatment A	**0.00**	cfs/acre
Treatment B	**0.10**	cfs/acre
Treatment C	**0.35**	cfs/acre
Treatment D	**0.92**	cfs/acre
Q2 (ΣQi*I*Ai)	**0.75**	cfs

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PROJECT	**HOFFMANTOWN BAPTIST CHURCH**
PROJECT NO.	**94053.01**
DATE	**15 Jun 95**
BY	**Freeman G. Leaming**

RECTANGULAR SECTION - Sidewalk Culvert

Depth (d)=	0.5	ft
Mannings n (n)=	0.014	
HGL Slope (h)=	0.02	ft/ft
Channel Width (W)=	2	ft
Area (A)=	W*d	
A=	1	ft^2
Wetted Perimeter (P)=	W+2*d	
P=	3.00	ft.
Hydraulic Radius (R)=	A/P	
R=	0.33	ft
Flow (Q)=	1.49/n*A*R^2/3*h^1/2	
Q=	7.24	cfs

< 1.86 OKAY

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PROJECT **HOFFMANTOWN BAPTIST CHURCH**
PROJECT NO. **94053.01**
DATE **22 Aug 95**
BY **Freeman G. Leaming**

DPM Section 22.2 - Hydrology

Part A-Watersheds less than 40 acres.
January, 1993

INSTRUCTIONS

Spread sheet requires three input areas (dark cells):
Location
>A.1 Precipitation Zone
>A.3 Land Treaments
Values from the tables are automatically placed using "if" statements.
Table values should be checked for correctness for each use.

SUMMARY

Location **SOUTHWEST CHANNEL NEAR WEB**		
Precipitation Zone	**3**	
Land Area	**1.63**	acres
Excess Precipitation Volume		
>>> 100-year 6-hour (design)	**0.28**	**acre-ft.**
10-year 6-hour	**0.02**	acre-ft.
2-year 6-hour	**0.02**	acre-ft.
100-year 24-hour	**0.33**	acre-ft.
Peak Discharge Rates (DPM)		
>>> Q100 (design)	**7.35**	**cfs**
Q10	**4.77**	cfs
Q2	**2.69**	cfs
Peak Discharge Rates (DPM)		
>>> Q100 (design)	**7.32**	**cfs**
Q10	**4.78**	cfs
Q2	**2.68**	cfs

CALCULATIONS FOLLOW

BPLW
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PROJECT **HOFFMANTOWN BAPTIST CHURCH**
PROJECT NO. **94053.01**
DATE **22 Aug 95**
BY **Freeman G. Leaming**

INPUT AND CALCULATIONS

LOCATION **SOUTHWEST CHANNEL NEAR WEB**

>A.1 PRECIPITATION ZONE (from Table A-1) **3**

>A.2 DEPTHS
(from Table A-2)

100-YEAR STORM (P60)	**2.14**	inches
100-YEAR STORM (P360)	**2.60**	inches
100-YEAR STORM (P1440)	**3.10**	inches
10-YEAR (P360) (Calculated: P360*RPF10)	**1.73**	inches
2-YEAR (P360) (Calculated: P360*RPF2)	**1.13**	inches

>A.3 LAND TREATMENTS (Ai)

Treatment A	0.00	acres
Treatment B	0.30	acres
Treatment C	0.07	acres
Treatment D	1.26	acres
Total Area	**1.63**	acres

>A.4 ABSTRACTIONS **See A.5**

CALCULATIONS FOLLOW

BPLW
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PROJECT **HOFFMANTOWN BAPTIST CHURCH**
PROJECT NO. **94053.01**
DATE **22 Aug 95**
BY **Freeman G. Leaming**

INPUT AND CALCULATIONS (CON'T)

>A.5 EXCESS PRECIPITATION 6 HOUR AND 24 HOUR (Ei)
from Table A-8

100-year 6-hour		
Treatment A	**0.66**	inches
Treatment B	**0.92**	inches
Treatment C	**1.29**	inches
Treatment D	**2.36**	inches
WEIGHTED E (δEi*Ai/A)	**2.05**	inches
VOLUME V100:6h (E*A)	**0.28**	acre-ft.
	12,123.84	ft^3
10-year 6-hour		
Treatment A	**0.19**	inches
Treatment B	**0.36**	inches
Treatment C	**0.62**	inches
Treatment D	**1.50**	inches
WEIGHTED E (δEi*Ai/A)	**0.24**	inches
VOLUME V10:6h (E*A)	**0.02**	acre-ft.
	817.48	ft^3
2-year 6-hour		
Treatment A	**0.00**	inches
Treatment B	**0.06**	inches
Treatment C	**0.20**	inches
Treatment D	**0.89**	inches
WEIGHTED E (δEi*Ai/A)	**0.71**	inches
VOLUME V2:6h (E*A)	**0.02**	acre-ft.
	924.70	ft^3
100-year 24-hour		
VOLUME V100:24h (V100-6h+Ad*P1440-P360)/12)	**0.33**	acre-ft.
	14,410.74	ft^3

CALCULATIONS FOLLOW

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PROJECT **HOFFMANTOWN BAPTIST CHURCH**
PROJECT NO. **94053.01**
DATE **22 Aug 95**
BY **Freeman G. Leaming**

INPUT AND CALCULATIONS (CON'T)

>A.6 PEAK DISCHARGE RATE FOR SMALL WATERSHEDS (QI)
from Table A-9

100-year			
Treatment A		**1.87**	cfs/acre
Treatment B		**2.60**	cfs/acre
Treatment C		**3.45**	cfs/acre
Treatment D		**5.02**	cfs/acre

	Q100 (δQi*Ai)	**7.35**	cfs
		==========	
10-year			
Treatment A		**0.58**	cfs/acre
Treatment B		**1.19**	cfs/acre
Treatment C		**2.00**	cfs/acre
Treatment D		**3.39**	cfs/acre

	Q10 (δQi*Ai)	**4.77**	cfs
		==========	
2-year			
Treatment A		**0.00**	cfs/acre
Treatment B		**0.21**	cfs/acre
Treatment C		**0.78**	cfs/acre
Treatment D		**2.04**	cfs/acre

	Q2 (δQi*Ai)	**2.69**	cfs
		==========	

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PROJECT **HOFFMANTOWN BAPTIST CHURCH**
PROJECT NO. **94053.01**
DATE **22 Aug 95**
BY **Freeman G. Leaming**

RATIONAL METHOD

PEAK INTENSITY (in/hr at tc=0.2 hour)
from Table A-10

Peak Intensity (I) 100-year	**5.38**
Peak Intensity (I) 10-year	**3.65**
Peak Intensity (I) 2-year	**2.21**

RATIONAL METHOD COEFFICIENT, C
from Table A-11

100-year

Treatment A	**0.35**	cfs/acre
Treatment B	**0.48**	cfs/acre
Treatment C	**0.64**	cfs/acre
Treatment D	**0.93**	cfs/acre
Q100 (δQi*I*Ai)	**7.32**	cfs

10-year

Treatment A	**0.16**	cfs/acre
Treatment B	**0.33**	cfs/acre
Treatment C	**0.55**	cfs/acre
Treatment D	**0.93**	cfs/acre
Q10 (δQi*I*Ai)	**4.78**	cfs

2-year

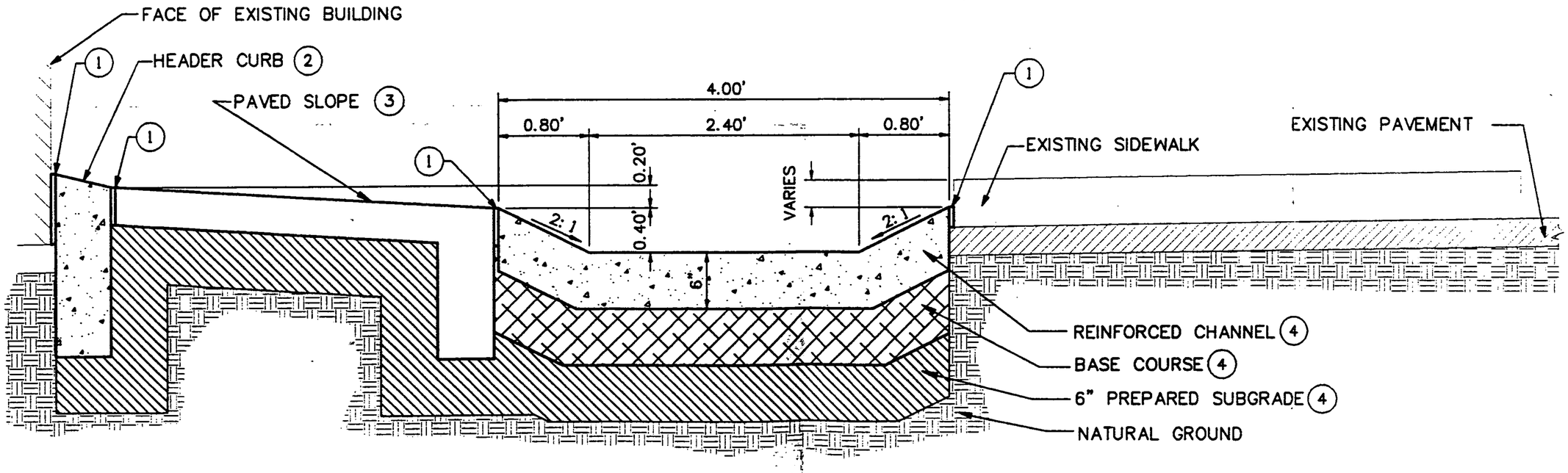
Treatment A	**0.00**	cfs/acre
Treatment B	**0.10**	cfs/acre
Treatment C	**0.35**	cfs/acre
Treatment D	**0.92**	cfs/acre
Q2 (δQi*I*Ai)	**2.68**	cfs

GENERAL NOTES:

A. THIS DRAWING IS A CLARIFICATION OF DETAIL SHOWN ON DRAWING C2.3 DATED 14 AUG 95.

KEYED NOTES:

1. 1/2" EXPANSION JOINT. USE JOINT SEALER ON EXPANSION JOINTS WHICH ABUT THE REINFORCED CHANNEL.
2. CONSTRUCT HEADER CURB PER CITY OF ALBUQUERQUE STANDARD DRAWING NO. 2415. REDUCE DEPTH OF BURY OF CURB WHERE REQUIRED AT BUILDING FOUNDATION CROSSINGS.
3. SEE 9 (1.1 — 5.2)
4. SEE 24 (1.1 — 5.1)



TYPICAL CHANNEL SECTION

SCALE: 1"= 1'-0"

6 (2.3 — 2.3)

08-24-95

BPLW
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2400 Louisiana Boulevard NE
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(505) 881-2769
88 East Main Street
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Mesa, Arizona 85201
(602) 827-2769

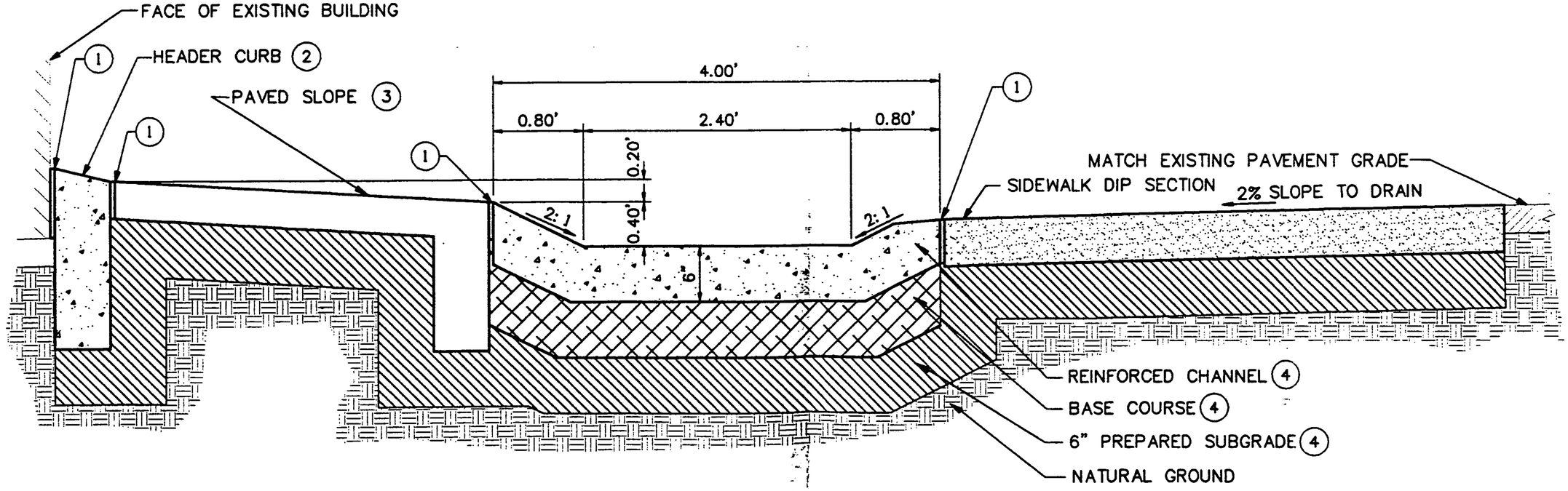
PROJECT NAME: CHURCH
PROJECT NAME: HOFFMANTOWN BAPTIST CH
PROJECT NO. 94053.01
DATE 24 AUG 95
SUPPLEMENTARY DRAWING NO. C1

GENERAL NOTES:

A. THIS DRAWING IS A CLARIFICATION OF DETAIL SHOWN ON DRAWING C2.3 DATED 14 AUG 95.

KEYED NOTES:

1. 1/2" EXPANSION JOINT. USE JOINT SEALER ON EXPANSION JOINTS WHICH ABUT THE REINFORCED CHANNEL.
2. CONSTRUCT HEADER CURB PER CITY OF ALBUQUERQUE STANDARD DRAWING NO. 2415. REDUCE DEPTH OF BURY OF CURB WHERE REQUIRED AT BUILDING FOUNDATION CROSSINGS.
3. SEE 9 / 1.1 – 5.2
4. SEE 24 / 1.1 – 5.1



7 / 2.3 – 2.3

CHANNEL SECTION AT SIDEWALK DIP

SCALE: 1"= 1'-0"

08-24-95

BPLW
Architects & Engineers, Inc.
2400 Louisiana Boulevard NE
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88 East Main Street
Suite 602
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PROJECT NAME: HOFFMANTOWN BAPTIST CHURCH

PROJECT NO. 94053.01

DATE 24 AUG 95

SUPPLEMENTARY DRAWING NO. C2

BPLW
Architects & Engineers, Inc.

PROJECT	**HOFFMANTOWN BAPTIST CHURCH**
PROJECT NO.	**94053.01**
DATE	**15 Jun 95**
BY	**Freeman G. Leaming**

TRAPEZOIDAL SECTION - *Southwest Channel Near WEB*

Depth (d)=	0.4	ft
Side Slope (s)=	2	:1
Mannings n (n)=	0.014	
HGL Slope (h)=	0.015	ft/ft
Total Width (Wt)=	4	ft

Trapezoidal Width (W)=	2*d/(1/s)	
W=	1.6	ft.
Bottom Width (B)=	Wt-W	
B=	2.4	
Area (A)=	W/2*d+B*d	
A=	1.28	ft^2
Wetted Perimeter (P)=	ЯT(d^2+(W/2)^2)+B	
P=	4.19	ft.
Hydraulic Radius (R)=	A/P	
R=	0.31	ft
Flow (Q)=	1.49/n*A*R^2/3*h^1/2	
Q=	7.57	cfs < 7.35 Q100 OKAY

BPLW
Architects & Engineers, Inc.

PROJECT **HOFFMANTOWN BAPTIST CHURCH**
PROJECT NO. **94053.01**
DATE **22 Aug 95**
BY **Freeman G. Leaming**

LAND TREATMENT DETERMINATIONS

BASINS B AND F, ROOF FLOWS, SOUTHWEST CHANNEL

BASIN B

EXISTING CONDITIONS

GRASS AREAS (Type B)

Grass Area*	Ft^2	Acres	Land Treatment
1X	5,094.57	0.12	B
2X	1,921.15	0.04	B
3X	2,175.44	0.05	B
4X	2,381.79	0.05	B
5X	22,375.15	0.51	B
Total Grass Area	**33,948.10**	**0.78**	

LAND TREATMENT DETERMINATIONS*

Area Type	Ft^2	Acres	Land Treatment
Total Area	284,313.54	6.53	Varies
Grassed Area (B)	-33,948.10	-0.78	B
Total Impervious	**250,365.44**	**5.75**	D

* The land treatments in basin B are type B, and type D The impervious area is determined by taking the total area and removing the type B.

BPLW
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PROJECT **HOFFMANTOWN BAPTIST CHURCH**
PROJECT NO. **94053.01**
DATE **22 Aug 95**
BY **Freeman G. Leaming**

BASIN B
PROPOSED CONDITIONS

GRASS AREAS (Type B)

Grass Area*	Ft^2	Acres	Land Treatment
1	19,264.11	0.44	B
2	573.07	0.01	B
3	196.00	0.00	B
4	3,898.52	0.09	B
5	1,333.55	0.03	B
9	77.37	0.00	B
Total Grass Area	**25,342.62**	**0.58**	

LAND TREATMENT DETERMINATIONS*

Area Type	Ft^2	Acres	Land Treatment
Total Area	286,686.50	6.58	Varies
Grassed Area (B)	-25,342.62	-0.58	B
Total Impervious	**261,343.88**	**6.00**	D

* The land treatments in basin B are type B, and type D. The impervious area is determined by taking the total area and removing the type B areas.

BPLW
Architects & Engineers, Inc.

PROJECT **HOFFMANTOWN BAPTIST CHURCH**
PROJECT NO. **94053.01**
DATE **22 Aug 95**
BY **Freeman G. Leaming**

BASIN F
EXISTING CONDITIONS

GRASS AREAS

Grass Area	Ft^2	Acres	Land Treatment
1X	2,948.15	0.07	B
2X	432.20	0.01	B
3X	3,053.92	0.07	B
4X	6,829.60	0.16	B
5X	5,113.46	0.12	B
6X	2,159.39	0.05	B
18b	59.63	0.00	B
19b	19.98	0.00	B
20	6044.06	0.14	B
21	69.51	0.00	B
22	274.86	0.01	B
23	163.76	0.00	B
24	819.13	0.02	B
25	65.09	0.00	B
26	153.06	0.00	B
27	17,339.40	0.40	B
28	2,800.00	0.06	B
29	1,920.00	0.04	B
30	157.00	0.00	B
31	314.00	0.01	B
32	314.00	0.01	B
33	628.00	0.01	B
34	628.00	0.01	B
35	225.00	0.01	B
36	900.00	0.02	B
37	402.00	0.01	B
38	600.00	0.01	B
39	32,475.00	0.75	B
40	351.25	0.01	B
41	179.32	0.00	B
42	303.46	0.01	B
43	137.07	0.00	B
44	221.75	0.01	B
45	467.17	0.01	B
46	150.87	0.00	B
47	331.80	0.01	B
Total Grass Area	**89,050.89**	**2.04**	

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PROJECT **HOFFMANTOWN BAPTIST CHURCH**

PROJECT NO. **94053.01**

DATE **22 Aug 95**

BY **Freeman G. Leaming**

LAND TREATMENT DETERMINATIONS*

Area Type	Ft^2	Acres	Land Treatment
Total Area	458,173.50	10.52	Varies
Grassed Area (B)	-89,050.89	-2.04	B
Total Impervious	**369,122.61**	**8.47**	D

* The land treatments in basin F are type B and type D. The impervious area is determined by taking the total area and removing the type B.

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PROJECT **HOFFMANTOWN BAPTIST CHURCH**

PROJECT NO. **94053.01**

DATE **22 Aug 95**

BY **Freeman G. Leaming**

BASIN F

PROPOSED CONDITIONS

GRASS AREAS

Grass Area	Ft^2	Acres	Land Treatment
5	127.39	0.00	B
6	3,079.67	0.07	B
7a	1,150.72	0.03	C
7b	1,745.35	0.04	B
8a	5,234.24	0.12	C
8b	3,470.73	0.08	B
10	248.72	0.01	B
11	141.24	0.00	B
12	94.05	0.00	B
13	3,610.84	0.08	B
14	707.06	0.02	B
15	1,519.88	0.03	B
16a	255.65	0.01	B
16b	88.20	0.00	B
17	82.63	0.00	B
18a	7,901.46	0.18	B
18b	59.63	0.00	B
19a	3318.69	0.08	B
19b	19.98	0.00	B
20	6044.06	0.14	B
21	69.51	0.00	B
22	274.86	0.01	B
23	163.76	0.00	B
24	819.13	0.02	B
25	65.09	0.00	B
26	153.06	0.00	B
27	17,339.40	0.40	B
28	2,800.00	0.06	B
29	1,920.00	0.04	B
30	157.00	0.00	B
31	314.00	0.01	B
32	314.00	0.01	B
33	628.00	0.01	B
34	628.00	0.01	B
35	225.00	0.01	B
36	900.00	0.02	B
37	402.00	0.01	B
38	600.00	0.01	B
39	32,475.00	0.75	B
40	351.25	0.01	B
41	179.32	0.00	B
42	303.46	0.01	B
43	137.07	0.00	B
44	221.75	0.01	B
45	467.17	0.01	B
46	150.87	0.00	B
47	331.80	0.01	B
Total Grass Area	**101,290.69**	**2.33**	

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PROJECT **HOFFMANTOWN BAPTIST CHURCH**
PROJECT NO. **94053.01**
DATE **22 Aug 95**
BY **Freeman G. Leaming**

GRASS AREA SUMMARY

Land Treatment	Ft^2	Acres
C	6,384.96	0.15
B	94,905.73	2.18

LAND TREATMENT DETERMINATIONS*

Area Type	Ft^2	Acres	Land Treatment
Total Area	455,800.54	10.46	Varies
Grassed Area (B)	-94,905.73	-2.18	B
Grassed Area (C)	-6,384.96	-0.15	C
Total Impervious	**354,509.85**	**8.14**	D

* The land treatments are type B, type C, and type D. The impervious area is determined by taking the total area and removing the type B and type C areas.

BUILDING ROOF-SIDEWALK CULVERT

PROPOSED CONDITIONS

LAND TREATMENT DETERMINATIONS*

Area Type	Ft^2	Acres	Land Treatment
Total Area	16,124.41	0.37	D

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PROJECT **HOFFMANTOWN BAPTIST CHURCH**
PROJECT NO. **94053.01**
DATE **22 Aug 95**
BY **Freeman G. Leaming**

SOUTHWEST CHANNEL NEAR WEB
PROPOSED CONDITIONS

GRASS AREAS

Grass Area	Ft^2	Acres	Land Treatment
13	3,610.84	0.08	B
14	707.06	0.02	B
40	351.25	0.01	B
41	179.32	0.00	B
42	303.46	0.01	B
43	137.07	0.00	B
44	221.75	0.01	B
16a	255.65	0.01	B
16b	88.20	0.00	B
18a Modified	3,769.83	0.09	B
18b	59.63	0.00	B
8a Modified	3,120.13	0.07	C
8b	3,470.73	0.08	B
Total Grass Area	**16,274.92**	**0.37**	

GRASS AREA SUMMARY

Land Treatment	Ft^2	Acres
C	3,120.13	0.07
B	13,154.79	0.30

LAND TREATMENT DETERMINATIONS*

Area Type	Ft^2	Acres	Land Treatment
Total Area	71,039.00	1.63	Varies
Grassed Area (B)	-13,154.79	-0.30	B
Grassed Area (C)	-3,120.13	-0.07	C
Total Impervious	**54,764.08**	**1.26**	D

* The land treatments are type B, type C, and type D. The impervious area is determined by taking the total area and removing the type B and type C areas.

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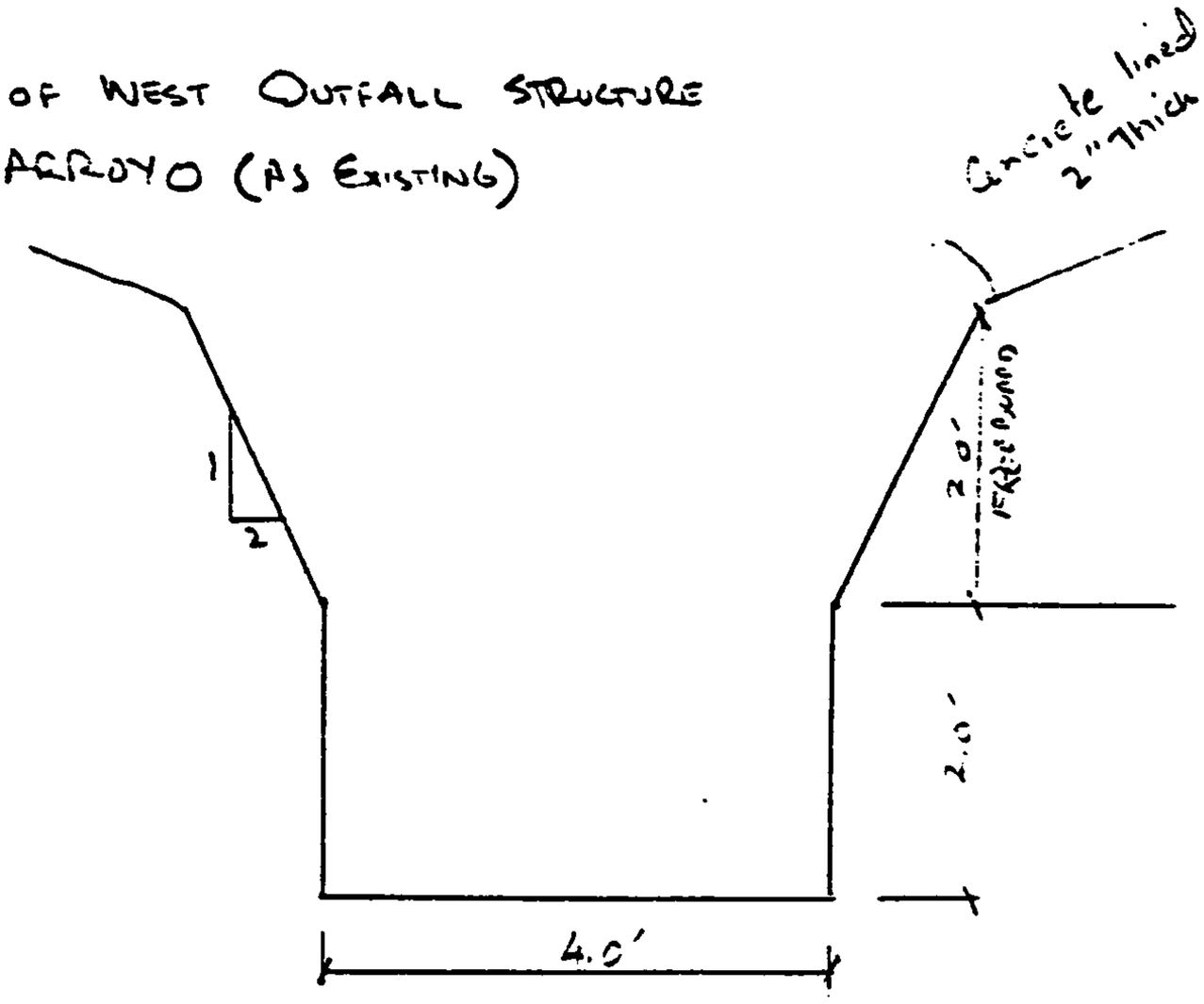
Project HOFFMAN BAPTIST CHURCH

Subject WEST OUTFALL IN PINO ARROYO

Project No. 94053 Date 2-23-95 By MNM

- ☐ Memorandum
- ☐ Telephone record
- ☐ Note to the file
- ☐ Minutes of meeting
- ☐ To be typed
- ☐ _____

CAPACITY OF WEST OUTFALL STRUCTURE
IN PINO ARROYO (AS EXISTING)



$S = 1.5\%$ (0.015)

$n = 0.013$ for Concrete

$A = 4 \times 2 = 8$ sf

$P = 4 + 2 + 2 = 8'$

$R_H = \frac{8}{8} = 1$

$$Q = \frac{1.486}{n} A R_H^{2/3} S^{1/2}$$

$$= \frac{1.486}{0.013} \times 8 \times 1^{2/3} \times 0.015^{1/2}$$

$Q = 112$ c/s ~ CAPACITY OF WEST OUTFALL STRUCTURE

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PROJECT **HOFFMANTOWN BAPTIST CHURCH**
PROJECT NO. **94053.01**
DATE **22 Aug 95**
BY **Freeman G. Leaming**

WEST OUTFALL CAPACITY

WEST OUTFALL CAPACITY
PROPOSED CONDITIONS

CONTRIBUTING BASINS

Basin	Acres	Q100*
C (1)	1.39	4.11 cfs
H (1)	0.60	3.04 cfs
F (3)		47.00 cfs
A(2)	6.57	28.00 cfs
B(3)		31.63 cfs
Totals	**8.56**	**113.78** cfs

Existing Outfall Capacity (1)		112 cfs		
Proposed Outfall Discharge		113.78 cfs		
	112	**<**	**113.78**	**OVERFLOW**

Note (1) From Drainage Report for Hoffmantown Baptist Church Temporary Parking Lot, October 1987, Bohannan-Huston, Inc.
Note (2) From Drainage Plan for Hoffmantown Baptist Church, Albuquerque, New Mexico, February 28, 1995, BPLW, Inc.
Note (3) Calculations for this project.

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Project Hoffmantown

Subject West Outfall

Project No. 94055.01 Date 10/11/95 By pgl

- ❑ Memorandum
- ❑ Telephone record
- ❑ Note to the file
- ❑ Minutes of meeting
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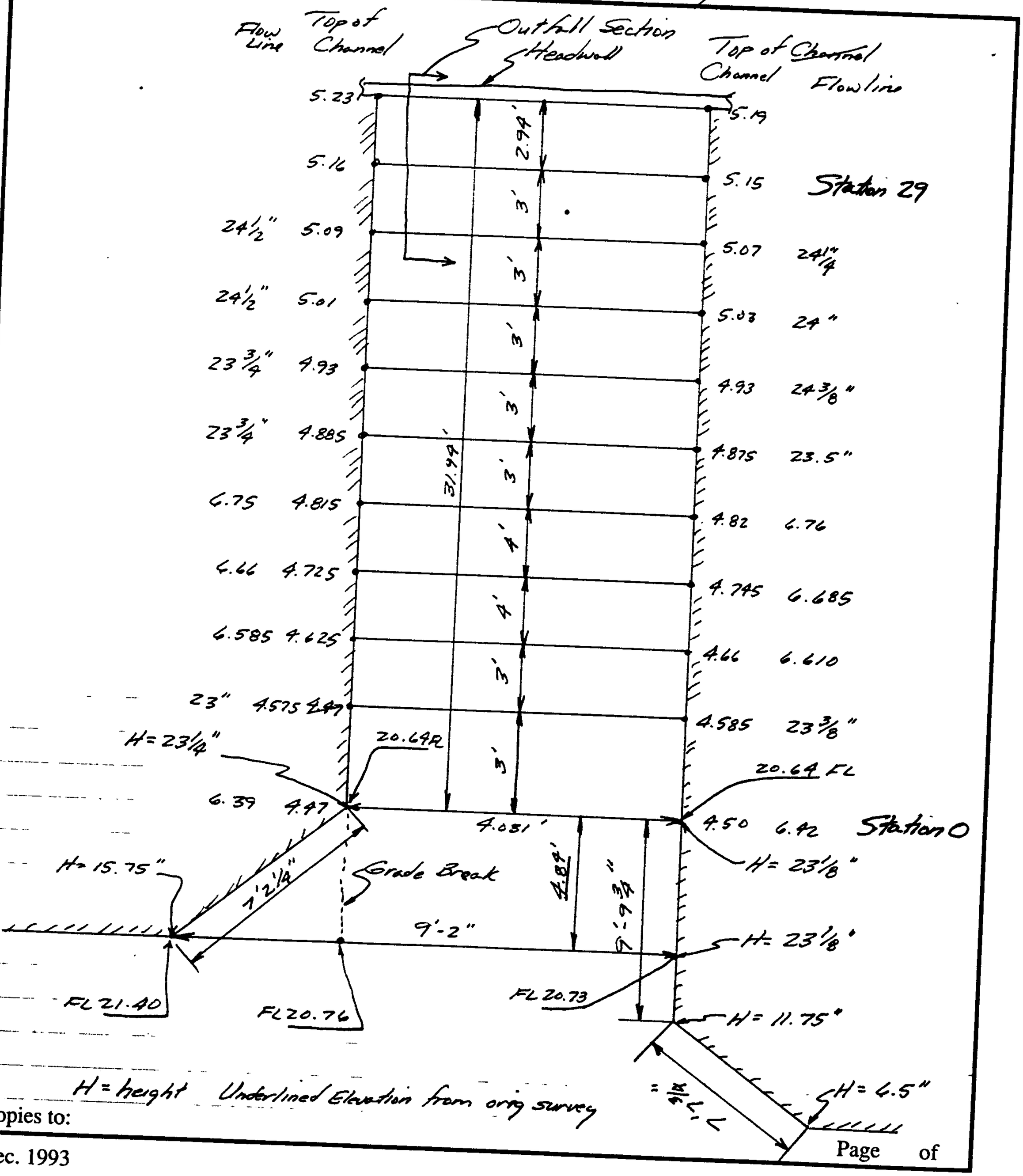
- ❑ _____



H = height Underlined Elevation from orig survey

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Designing to Shape the Future

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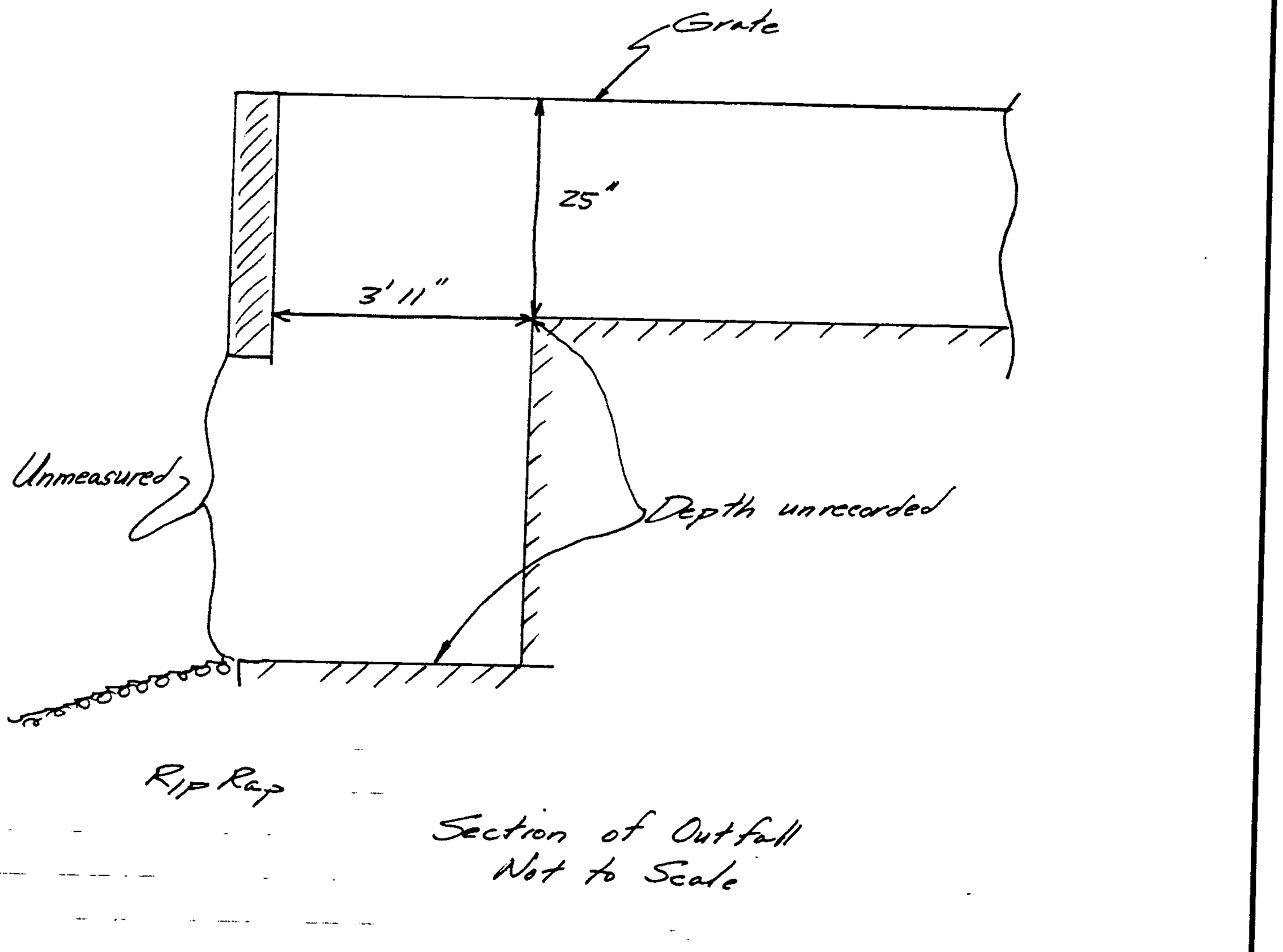
Project Hoffman town

Subject West Outfall

Project No. 94053.01 Date 10/4/95 By fgl

- ❑ Memorandum
- ❑ Telephone record
- ❑ Note to the file
- ❑ Minutes of meeting
- ❑ To be typed
- ❑ _____



Section of Outfall
Not to Scale

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Designing to Shape the future

Hoffmantown Baptist Church'
West Outfall Survey Information
Survey Conducted 10 Oct 95

Station 0 Flowline Elevation (orig survey) 20.64
Level Elevation (LE) = FL elevtion + Rod Reading Flowline
Level Elevation (LE) = 27.06

Reduce Depth for Grate= 0.03 feet
Channel Wid 4.031 feet
n= 0.013

WEST SIDE

Station	Rod Reading (RR) Channel Top	Top Elevation LE-RR	Rod Reading Channel FL	Flowline Elevation LE-RR	Taped* Depth Inches	Taped* Depth Feet	Flowline** Elevation	Depth Top Channel-FL-Grate	Slope	Average Depth Feet	Area Feet^2	Wetted Perimeter Feet	Hydraulic Radius	Q (Mannings) cfs	Q Average West & East (cfs)
0	4.5	22.56	6.42	20.64			20.64	1.89							
3	4.59	22.47			23.375	1.95	20.52	1.95	0.039	1.92	7.74	7.87	0.98	173.78	166.69
6	4.66	22.4	6.61	20.45			20.45	1.95	0.024	1.95	7.86	7.93	0.99	138.72	149.92
10	4.75	22.31	6.69	20.37			20.37	1.94	0.020	1.95	7.84	7.92	0.99	126.22	122.35
14	4.82	22.24	6.76	20.3			20.30	1.94	0.018	1.94	7.82	7.91	0.99	117.66	125.31
17	4.88	22.18			23.5	1.96	20.22	1.96	0.026	1.95	7.86	7.93	0.99	144.63	160.10
20	4.93	22.13			24.375	2.03	20.10	2.03	0.041	1.99	8.04	8.02	1.00	186.87	149.38
23	5.03	22.03			24	2.00	20.03	2.00	0.023	2.02	8.12	8.06	1.01	141.71	172.51
26	5.07	21.99			24.25	2.02	19.97	2.02	0.020	2.01	8.10	8.05	1.01	132.84	144.17
29	5.15	21.91					n/a								
32	5.19	21.87					n/a								

* The depths of the channel in this area were measured with a tape due to the grate covering the channel.
** The flowline elevation is taken from the rod reading or calculated by subtracting the taped depth from the top channel elevation.

EAST SIDE

Station	Rod Reading (RR) Channel Top	Top Elevation LE-RR	Rod Reading Channel FL	Flowline Elevation LE-RR	Taped* Depth Inches	Taped* Depth Feet	Flowline** Elevation	Depth Top Channel-FL-Grate	Slope	Average Depth Feet	Area Feet^2	Wetted Perimeter Feet	Hydraulic Radius	Q (Mannings) cfs	Q Average West & East (cfs)
0	4.47	22.59	6.39	20.67			20.67	1.89							
3	4.575	22.485			23	1.91666667	20.57	1.92	0.034	1.90	7.67	7.84	0.98	159.60	
6	4.625	22.435	6.59	20.47			20.47	1.97	0.033	1.94	7.82	7.91	0.99	161.12	
10	4.725	22.335	6.66	20.4			20.40	1.94	0.018	1.95	7.86	7.93	0.99	118.47	
14	4.815	22.245	6.75	20.31			20.31	1.94	0.023	1.94	7.80	7.90	0.99	132.95	
17	4.885	22.175			23.75	1.97916667	20.20	1.98	0.038	1.96	7.89	7.95	0.99	175.56	
20	4.93	22.13			23.75	1.97916667	20.15	1.98	0.015	1.98	7.98	7.99	1.00	111.89	
23	5.01	22.05			24.5	2.04166667	20.01	2.04	0.048	2.01	8.10	8.05	1.01	203.31	
26	5.09	21.97			24.5	2.04166667	19.9283333	2.041666667	0.027	2.04	8.23	8.11	1.01	155.50	
29	5.16	21.9					n/a								
32	5.23	21.83					n/a								

* The depths of the channel in this area were measured with a tape due to the grate covering the channel.
** The flowline elevation is taken from the rod reading or calculated by subtracting the taped depth from the top channel elevation.

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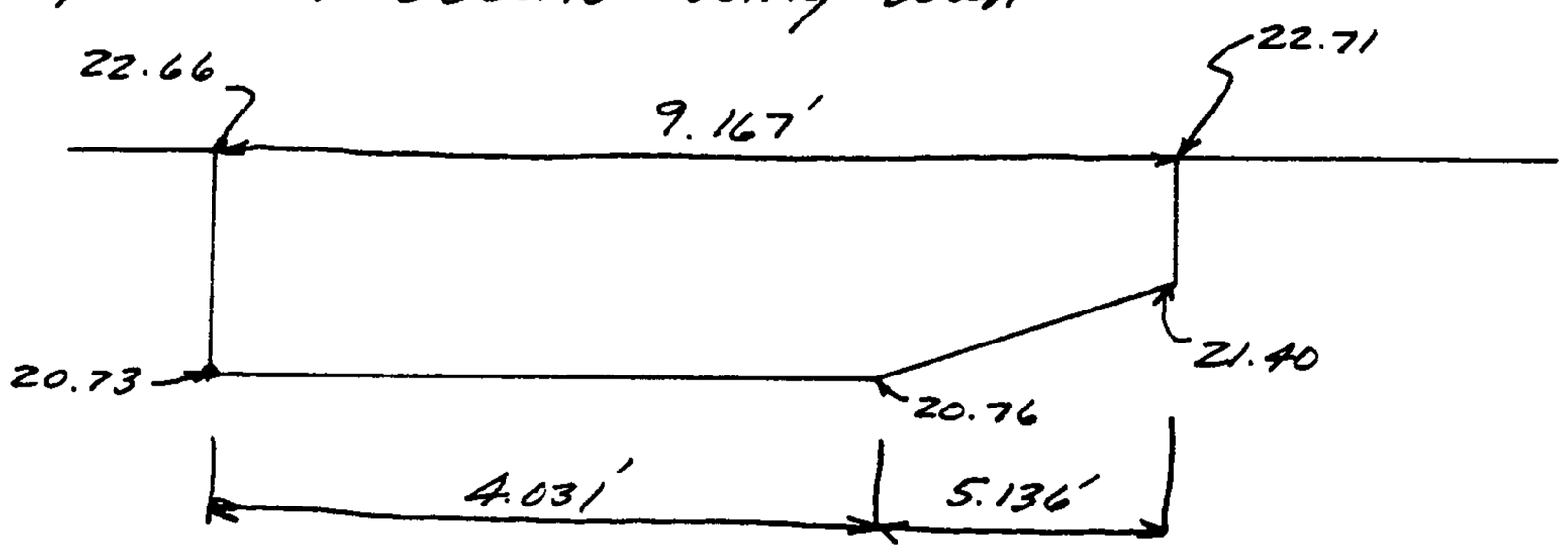
Project Hoffmantown

Subject West Outfall

Project No 94153.01 Date 10/11/95 By tgl

- ☐ Memorandum
- ☐ Telephone record
- ☐ Note to the file
- ☐ Minutes of meeting
- ☐ To be typed
- ☐ _____

Flow at second wing wall



$$A = (4.031)'(1.927') + (5.136')(1.31') + (5.136')(0.617')/2$$

$$= 16.08\ ft^2$$

$$P = 1.93' + 4.031' + \sqrt{5.136^2 + 0.64^2} + 1.31'$$

$$= 12.44\ ft$$

$n = 0.013 \qquad S = 0.018$

Mannings Equation

$$Q = \frac{1.49}{0.013}(16.08)\left(\frac{16.08}{12.44}\right)^{2/3} 8(0.018)^{1/2}$$

$$Q = 293\ cfs$$

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PROJECT	**HOFFMANTOWN BAPTIST CHURCH**
PROJECT NO.	**94053.01**
DATE	**11 Oct 95**
BY	**Freeman G. Leaming**

RECTANGULAR SECTION

Depth (d)=	**1.89**	ft
Mannings n (n)=	**0.013**	
HGL Slope (h)=	**0.026**	ft/ft
Channel Width (W)=	**4.031**	ft

Area (A)=	W*d
A=	7.61859 ft^2
Wetted Perimeter (P)=	W+2*d
P=	7.81 ft.
Hydraulic Radius (R)=	A/P
R=	0.98 ft
Flow (Q)=	1.49/n*A*R^2/3*h^1/2
Q=	**138.48** cfs

SOILS MAP

REFERENCE: SCS BERNALILLO COUNTY SOIL SURVEY

PLATE 2

FLOOD INSURANCE MAP

REFERENCE: FLOOD INSURANCE STUDY

PLATE 3

DEVELOPED DRAINAGE

Basin	Area (ac.)	Length (ft.)	Top Elev. (ft.)	Bottom Elev. (ft.)	Slope (ft/ft.)	Time of Concentration	Soil Group	% Impervious	Runoff Coefficient, C	100 YEAR 6 Hr. Rain Volume (in.)	100 YEAR I/6 Hr. Rain (in./hr.)	100 YEAR Peak Flow Rate Q (cfs)	100 YEAR Runoff Volume (ac. ft.)	10 YEAR 6 Hr. Rain Volume (in.)	10 YEAR I/6 Hr. Rain (in./hr.)	10 YEAR Peak Flow Rate Q (cfs)	10 YEAR Runoff Volume (ac. ft.)
A	0.57	880	64	40	.0289	10	B	0	0.34	2.4	5.07	11.32	0.45	1.58	3.30	[illegible]	
B	0.72	940	46	30	.0170	10	B	0	0.34	2.4	5.07	11.58	0.46	1.58	3.30	7.54	0.30
C	1.39	1140	64	38	.0228	10	B	100	1.00	2.4	5.07	7.05	0.28	1.58	3.30	4.59	0.18
D	0.81	630	64	40	.0381	10	B	100	1.00	2.4	5.07	4.11	0.16	1.58	3.30	2.67	0.11
E	4.08	600	68	42	.0433	10	B	88	0.84	2.4	5.07	17.38	0.67	1.58	3.30	11.31	0.45
F	10.22	1800	40	24	.0089	15	B	100	1.00	2.4	4.13	42.21	1.04	1.58	2.72	27.80	1.35
G	1.66	1010	66	40	.0257	10	B	100	1.00	2.4	5.07	8.42	0.33	1.58	3.30	5.48	0.22
H	0.60	340	50	40	.0294	10	B	100	1.00	2.4	5.07	3.04	0.12	1.58	3.30	1.98	0.08
Ref.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17

References:

1,2,3,4,5 Basin areas, lengths, top and bottom elevations and slopes from Plate ____.

6. Tc by Kirpich Formula $T_c = .0078 \frac{Length^{0.77}}{Slope^{0.385}}$ (10 minutes minimum)

7. See Soils Map Plate ____ and Text.

8. By area computation.

9. DPM Plate 22.2 C-1

10, 14 DPM Plate 22.2 D-1

11, 15 DPM Plate 22.2 D-2

12, 16 Rational Formula $Q = CIA$

13, 17 Rational Formula $V = Rainfall \times C \times A$

PROJECT NAME Hoffmantown Baptist Church SHEET 1 OF ____

PROJECT NO. 52540 BY TG DATE 12/ /85

SUBJECT Drainage Calc. CH'D James Tap DATE 12/12/85

ANALYSIS POINT SUMMARY

ANALYSIS POINT (AP #)	BASINS DRAINED	100-YEAR FLOWRATE (CFS)
AP-1	H	3.0 cfs
AP-2	G	8.4 cfs
AP-3	D	4.1 cfs
AP-4	E	17.4 cfs
AP-5	A	11.3 cfs
AP-6	C, H, F, A, B	75.2 cfs *
AP-7	G, E, D	29.9 cfs

* this is a conservative value due to the sedimentation basin in Basin A

UNDEVELOPED FLOWRATE PHASE 1

by Rational Method .....

L = 1450' approx. by Kirpich, T_c = 8.77 min
use 10 min.
Slope = 02,50%
intensity = 5.07 in/hr C = 0.34
Area = 40 acres

$Q = CIA = 48.95 = 69$ cfs

WEST OUTFALL TO ARROYO AP-(6)

all 100-yr storm values

Check capacity of proposed rundown .....

AP-(6) flowrate = 75.2 cfs
rectangular channel, 4'X 2' deep cross-section
slope = 1.5%
solve for capacity by Manning's

$$Q = \frac{1.489}{n} A (R_h)^{2/3} S^{1/2}$$

where $A = 2'(4') = 8\ \square'$
$R_h = A/P = 8/8 = 1$
$n = 0.013$ (concrete)

then flowrate capacity, $\boxed{Q = 112.2\ cfs}$ OK $>>$ 75.2 * see note below

Note: this is even more adequate a capacity when it is considered that the 75 cfs is high (does not consider the time lag in Basin A)

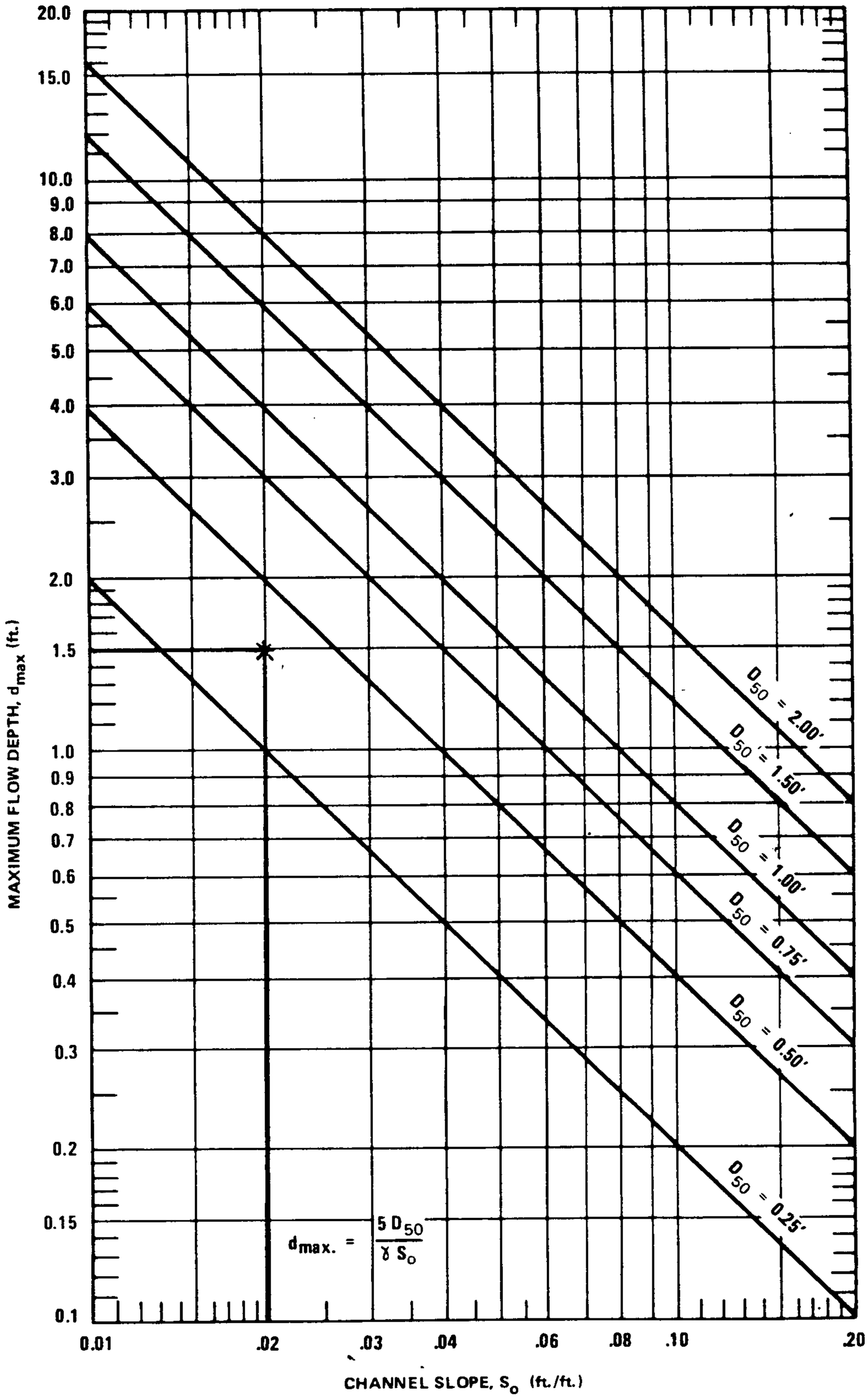
rip-rap requirements .....

use grouted riprap (see Sheet C-7)

PROJECT NAME HOFFMANTOWN SITE SHEET 1 OF
PROJECT NO. 52540 BY James Top DATE 12·16·85
SUBJECT DRAINAGE CALS. CH'D " DATE 12·16·85

Chart 27

"DESIGN OF STABLE CHANNELS WITH FLEXIBLE LININGS"
HEC NO. 15 - FED. HYWAY ADMIN.



MAXIMUM PERMISSIBLE DEPTH OF FLOW (d_{max}) FOR CHANNELS LINED WITH ROCK RIPRAP

DRAINAGE FLUME @ BASIN A AND DETENTION POND

flume flowrate .....

check by weir equation (broad-crested)

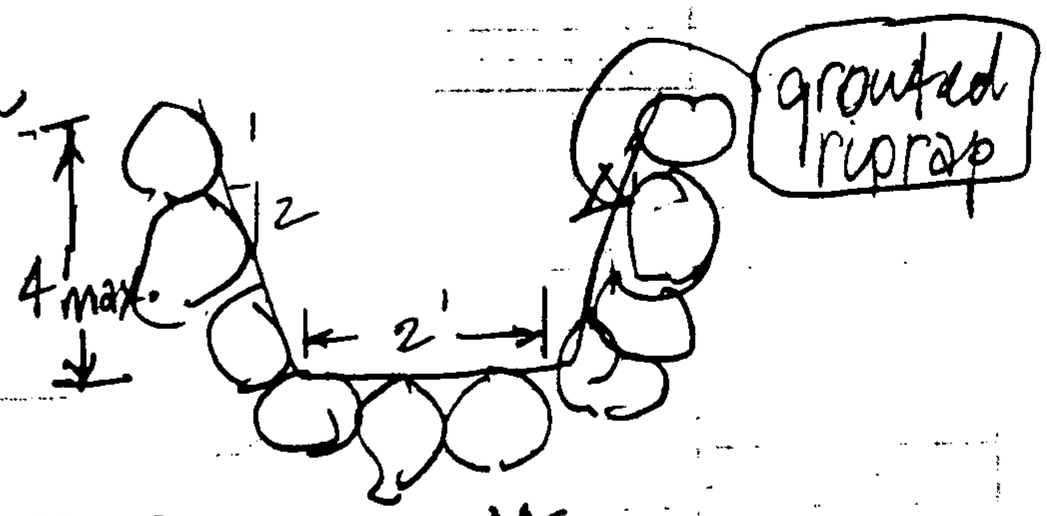
Q_{max} to flume = 11.3 cfs (AP-5)

C = 3.0 (Handbook of Hydraulics)

$Q = C L H^{3/2}$ weir equation

use L = 2'

try H = ?



FLUME CROSS-SECTION

calculate h when pond volume of 100-year storm is reached (assume no discharge) @ 19549 C.FT.

area of pond (approx.) = 13200 SQ.FT.

then approx. depth = 1.5 ft

use H = 1.5' (not max. depth)

then flume (weir) capacity = $3.0(2')\,1.5^{3/2}$

= 11 cfs < 11.3 cfs (peak flowrate)

* no overtopping of berm will occur

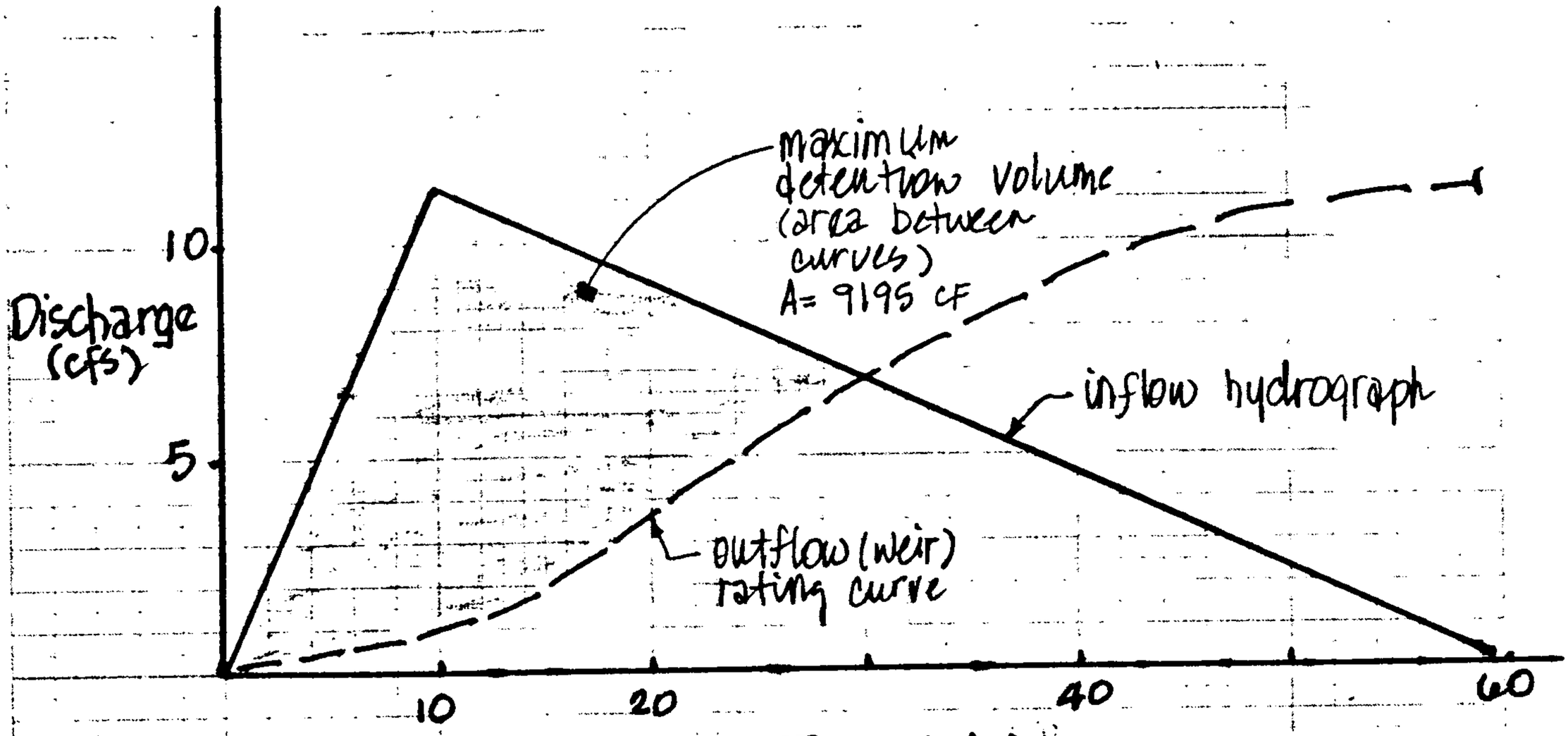
BOHANNAN HUSTON INC.

PROJECT NAME HOFFMANTOWN SITE SHEET 1 OF 2

PROJECT NO. 52540 BY James Top DATE 12.16.85

SUBJECT DRAINAGE CALCS. CH'D " DATE "

Drainage Flume (cont.)



Graph Development Chart:

Time	Pond Volume	Pond Depth	Outflow Cap. of Weir	Inflow Flow rate
2 min.	252 ft³	0.02'	0.02 cfs	2.1 cfs
4	1080	0.08	0.14	4.4
6	2376	0.20	0.50	6.6
10	3390	0.26	0.80	11.3
20	9450	0.72	3.67	9
40	17610	1.33	9.20	4.5
60	20250	1.50	11.00	0

AVE. POND AREA = 13200 SF

MAXIMUM POND VOLUME = 9195 C.F.

MAX. POND DEPTH = 0.70'

BOHANNAN HUSTON INC.

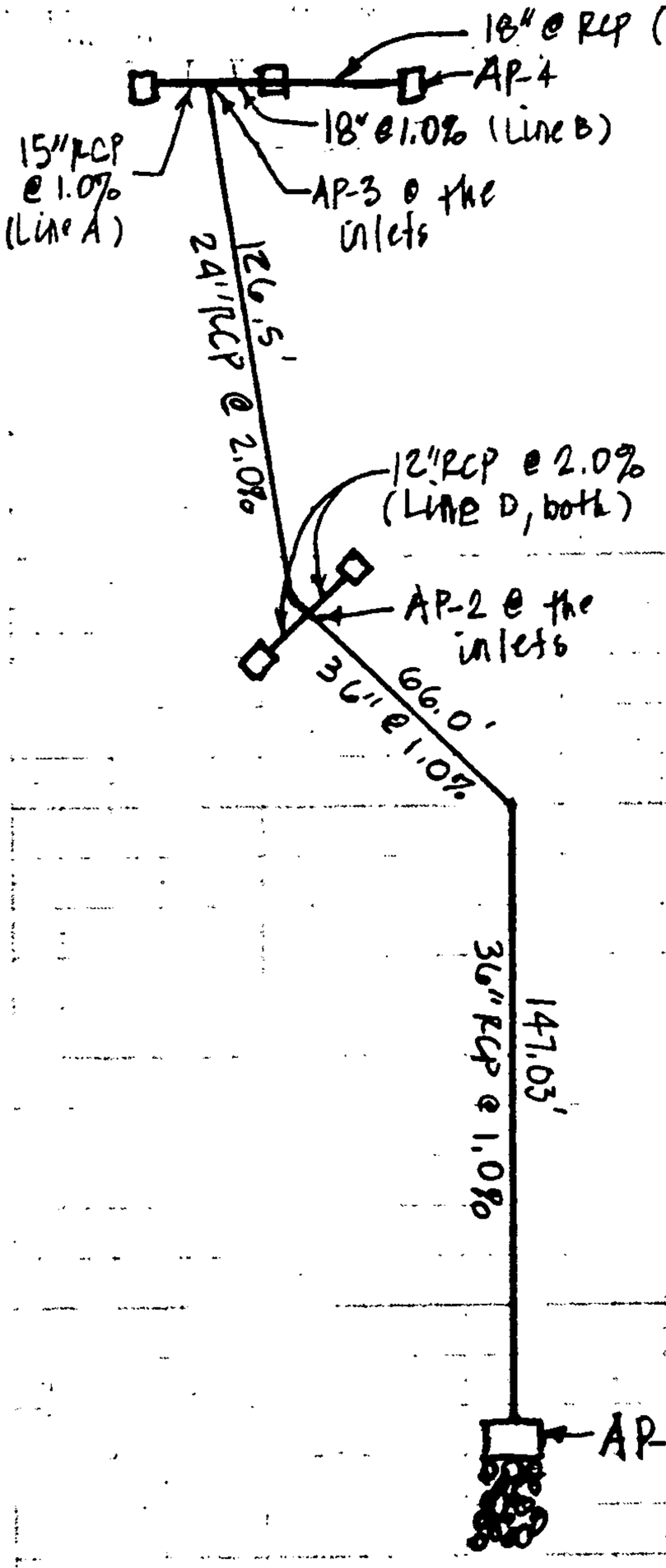
PROJECT NAME HOFFMANTOWN SITE SHEET 2 OF 2

PROJECT NO. 52540 BY JAMESTOP DATE 12.16.85

SUBJECT DRAINAGE CALC. CH'D " DATE 12.16.85

STORM SEWER HYDRAULICS

all 100-yr storm values



Inflow data:

AP-2	8.4 cfs	(4.2 @ each inlet)
AP-3	4.1 cfs	(2.05 @ each inlet)
AP-4	17.4 cfs	
AP-7	29.9 cfs	

Ignore routing, assume all peaks hit simultaneously.....

Line	(cfs) Capacity	(cfs) Inflow		
A	6.5	2.05	OK	downsize. use 12" @ 3.6 cfs capacity
B	10.5	19.5	NOT OK	use 24" (22.5 cfs)
C	10.5	17.4	NOT OK	use 21" (15.8 cfs) with head OK
D	5.0	4.2	OK	
AP-3 to AP-2	32	21.5	OK	
AP-2 to AP-7	66	29.9	OK	downsize to 30" (cap = 41.0 cfs)

check orifice @ AP-4*:

orifice equation

$Q = CA\sqrt{2gh}$, where h = inlet depth = ±5'

A (18") = 1.77 sq. ft.

C = 0.6

Q = 19.0 cfs > 17.4 OK

*assume others are OK (small inflows)

PROJECT NAME Hoffman town site SHEET 1 OF 2

PROJECT NO. 52540 BY JamesTop DATE 12.16.85

SUBJECT Drainage Calc. CH'D " DATE "

Check grate capacity ..... by orifice equation

$Q = CA\sqrt{2gh}$

grate area = 4.37 sq. ft.

	req'd inflow	req'd head	
Grate @ AP-3 = 2.05 cfs		0.01'	OK
Grate @ AP-4 = 17.4 cfs		0.68'	not OK if 6" curb is used ..... (8" curb OK) or allow run over curb
Grate @ AP-2 = 4.2 cfs		0.04'	OK

riprap bed ..... @ arroyo

use grouted riprap (see sheet C7)

PROJECT NAME Hoffmantown site SHEET 2 OF 2

PROJECT NO. 52540 BY James Top DATE 12.16.85

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RIPRAP DESIGN

1) design channel-type riprap lining along fill embankment near AP-7 (sheet C3)

- Slope of natural arroyo = ± 1%
- assume 2-3' flow depth in arroyo (considering the wide and flat nature of this arroyo, this should be adequate)
- from Chart 17, use <u>min. D_{50} = 9" riprap rock size</u>
  18" thick bed
  use Gradation for Type L, Table 5-1 enclosed
  w/ 5/8" pea gravel bed

2) design riprap @ AP-6 - outlet condition .....

- need dissipation of energy from riprap
- 2'X4' outlet opening,
- due to the drop structure, outlet velocity is minimum and energy is already being dissipated
- outlet Q = 75 cfs
- assume tailwater depth = 2' max.
- allowable channel velocity downstream = 5.5 fps (min. erosion of soil @ 5.5 fps)
- using Table 5-7 enclosed .....

$$Q/WH = 75\,cfs/2(4) = 9.37$$

$$Y_t/H = 2/2 = 1 \quad \text{(conservative)}$$

from Table, use Type L, <u>$D_{50} \approx 9$ inches</u>
(use gradation of Table 5-1)

from Fig. 5-5, depth of riprap = <u>2 (K_M) = 18" on 6" of 5/8" pea gravel bed</u>

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3) design riprap @ AP-1 - outlet conditions

- Q = 30 cfs
- circular 36" outlet
- assume outlet depth, Y_T = 2' approx.
- then $Q/D^{1.75} = 4.39$

  $Y_T/D = 0.67$

- from Table 5-6, use Type L riprap, <u>$D_{50} = 9" = K_m$</u> (see Table 5-1)
- use 2 K_m = 18" min. depth of Type L stone <u>on 6" of 5/8" pea gravel bed</u>

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Table 5-1
CLASSIFICATION AND GRADATION OF ORDINARY RIPRAP

Riprap Designation	% Smaller Than Given Size By Weight	Minimum Dimension Inches	K_m* Inches
Type VL	100 35-55 10	9** 6 2	6***
Type L	100 35-55 10	12** 9 2	9***
Type M	100 35-55 10	18** 12 3	12
Type H	100 35-55 10	24** 18 6	18
Type VH	100 35-55 10	36** 24 6	24

*K_m= mean particle size
**At least 30% of all stones by weight shall be this dimension.
***Bury types VL and L with native soil to protect from vandalism damage.

broom. Grouted riprap should meet all the requirements for ordinary riprap except that the smallest rock fraction should be eliminated from the gradation and a reduction of riprap size by one designation is also permitted. As with ordianry riprap, grouted riprap should be founded on an adequate bedding. The grout should contain air entrainment, have a 28-day strength of at least 2400 psi and should have a high slump (5 to 7 inches) in order to penetrate either full depth of the riprap layer or at least 2 feet where the riprap layer is thicker than 2-feet. Grout penetration may be accomplished by rodding, vibrating, or pumping of the grout into the riprap voids. Concrete having maximum aggregate size of 2/4-inches may be substituted for grout when using riprap designation type M or larger. Weep holes should be

Table 5-6
RIPRAP EROSION PROTECTION AT CONDUIT OUTLETS
CIRCULAR CONDUIT

$Q / D^{1.75}$	Y_t / D			
	.15-.35	.36-.55	.56-.79	$\geq$ .8
0- 1.9	**	**	**	**
2- 3.9	Type L	Type L	**	**
4- 5.9	Type L	Type L	Type L	Type L
6- 7.9	Type L	Type L	Type L	Type L
8- 9.9	Type M	Type L	Type L	Type L
10-11.9	Type M	Type L	Type L	Type L
12-13.9	Type H	Type M	Type L	Type L
14-15.9	Type H	Type H	Type L	Type L
16-17.9	Type VH	Type H	Type M	Type L
18-19.9	Type VH	Type VH	Type M	Type M
20-22.	*	Type VH	Type H	Type H

*Riprap requirements exceed Type VH

**Use Type L for a distance of 3 times culvert height downstream

Table 5-7
RIPRAP EROSION PROTECTION AT CONDUIT OUTLETS
RECTANGULAR CONDUIT

Q / WH	Y_t / H			
	.15-.35	.36-.55	.56-.79	$\geq$ .8
0- 1.9	**	**	**	**
2- 3.9	Type L	Type L	**	**
4- 5.9	Type L	Type L	Type L	**
6- 7.9	Type L	Type L	Type L	Type L
8- 9.9	Type M	Type L	Type L	Type L
10-11.9	Type H	Type M	Type L	Type L
12-13.9	Type VH	Type H	Type M	Type L
14-15.9	*	Type H	Type M	Type L
16-17.9	*	Type VH	Type H	Type M
18-20.	*	Type VH	Type VH	Type H

*Riprap requirements exceed Type VH
**Use Type L for a distance of 3 times culvert height downstream