City of Albuquerque

P.O. BOX 1293 ALBUQUERQUE, NEW MEXICO 87103

July 11, 2001

Guy Jackson, PE
BPLW
6200 Uptown Blvd, Ste 400
Albuquerque, NM 87110

Re: PNM Bulk Power Services – North Area Renovations Drainage Report
Engineer's Stamp dated 6-15-01 (G16/D8B)

Dear Mr. Jackson,

Based upon the information provided in your submittal dated 6-15-01, the above referenced site cannot be approved for Building Permit until the following minor comments are addressed.

- Basin P1 is larger than EX1 although the area is purported to be equal. Please correct this.

- Basin P4 does not completely drain to the center pond. It appears that most of it drains to the existing rundown. You will need to include this volume in sizing pond B. In addition, the area noted appears to be 10% of what you're modeling.

- Your statement that "the property to east drains…. into the northwest corner of the site" is confusing. How does it get all the way to northwest corner, how much is it and does it affect the size of Pond B

- Basin P2 shows a parking lot (proposed?) but less runoff than EX2. Again, the areas are purported to be equal. Some of this runoff goes into P1 and ultimately into Stanford. How does this compare to the design amount approved for the SAD?

- Please be more specific denoting what areas will be repaved, have new paving and what will be left as is. I was not sure what you were matching.

- Please explain the purpose of the riprap rundown. Is there runoff leaving to the property north of you? How much? What is the median size of the aggregate?

If you have any questions about my comments, you can contact me at 924-3986

Sincerely,

Bradley L. Bingham

Bradley L. Bingham, PE
Sr. Engineer Hydrology

C: file

DRAINAGE INFORMATION SHEET

PROJECT TITLE: PNM Bulk Power Services ZONE ATLAS/DRWG. FILE # G-16 / D 8B

DRB#: _____ EPC #: _____ WORK ORDER # : _____

LEGAL DESCRIPTION: A portion of Block D, Indian Acres Subdivision
CITY ADDRESS: 2401 Aztec Road, NE

ENGINEERING FIRM: BPLW
ADDRESS: 6200 Uptown Blvd, NE 87110
CONTACT: Guy Jackson
PHONE: 880-9670

OWNER: PNM
ADDRESS: 2401 Aztec Road, NE
CONTACT: Steve Anderson
PHONE: 345-8411

ARCHITECT: BPLW
ADDRESS: 6200 Uptown Blvd, NE 87110
CONTACT: Edward Aragon
PHONE: 881-2759

SURVEYOR: Brasher & Lorenez
ADDRESS: 2201 San Pedro, NE
CONTACT: Paul Brasher
PHONE: 888-6088

CONTRACTOR: ---
ADDRESS: ---
CONTACT: _____
PHONE: _____

TYPE OF SUBMITTAL:

x DRAINAGE REPORT
x DRAINAGE PLAN
__ CONCEPTUAL GRADING & DRAINAGE PLAN
x GRADING PLAN
___ EROSION CONTROL PLAN
___ENGINEER'S CERTIFICATION
OTHER _____

PRE-DESIGN MEETING w/ Brad Bingham:
X YES
_ NO
__ COPY PROVIDED

CHECK TYPE OF APPROVAL SOUGHT:

__ SKETCH PLAT APPROVAL
__ PRELIMINARY PLAT APPROVAL
__ S. DEV. PLAN FOR SUB'D APPROVAL
__ S. DEV. PLAN FOR BLDG. PERMIT APPROVAL
__ SECTOR PLAN APPROVAL
__ FINAL PLAT APPROVAL
__ FOUNDATION PERMIT APPROVAL
x BUILDING PERMIT APPROVAL
__ CERTIFICATE OF OCCUPANCY APPROVAL
x GRADING PERMIT APPROVALS
x PAVING PERMIT APPROVAL
__ S.A.B. DRAINAGE REPORT
__ DRAINAGE REQUIREMENTS
x OTHER (MASTER GRADING & DRAINAGE PERMIT APPROVAL)

DATE SUBMITTED: 6-13-2001
BY: JERRIE PADILLA

RECEIVED
JUN 15 2001
HYDROLOGY SECTION

BPLW

Architects & Engineers, Inc.

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June 13, 2000

Brad Bingham, PE
Hydrology Chairman
COA - Public Works
PO Box 1293
Albuquerque, New Mexico 87103

Re: PNM Bulk Power Services
BPLW Project Number 20007.05

Dear Brad:

Attached for your review and approval are the following:

One (1) Drainage Information Sheet

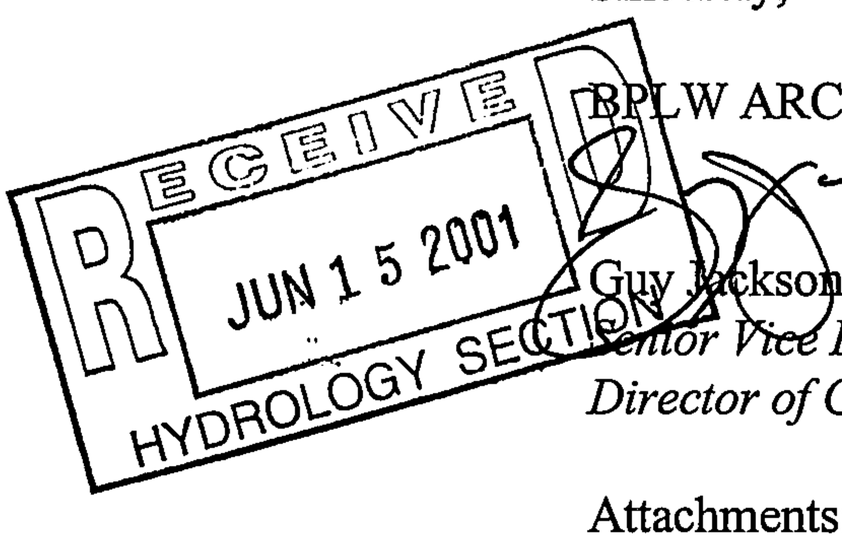
Two (2) Copies of the Master Grading and Drainage Plan and Report

The site is located at 2401 Aztec Rd. NE (northeast corner of the Aztec Rd. NE and Stanford Dr. NE intersection). Currently, the site is fully developed. However, as discussed at the pre-application meeting, remodeling of some of the existing buildings and the installation of some site improvements including but not limited to; parking canopies, landscaping, existing pavement repairs and overlays, etc. will be forthcoming and will require building and paving permits. This submittal is to submit a master grading and drainage plan and report that will bring the existing site into compliance set forth in Section 22.2 of the DPM to obtain the applicable permits sought as mentioned above.

Please contact me if you have any questions or comments.

Sincerely,

BPLW ARCHITECTS & ENGINEERS, INC.



Guy Jackson, PE
Senior Vice President
Director of Civil Engineering

Attachments:
xc: Steve Anderson – PNM
Ed Aragon –BPLW
Jerrie Padilla -BPLW

DRAINAGE REPORT

FOR

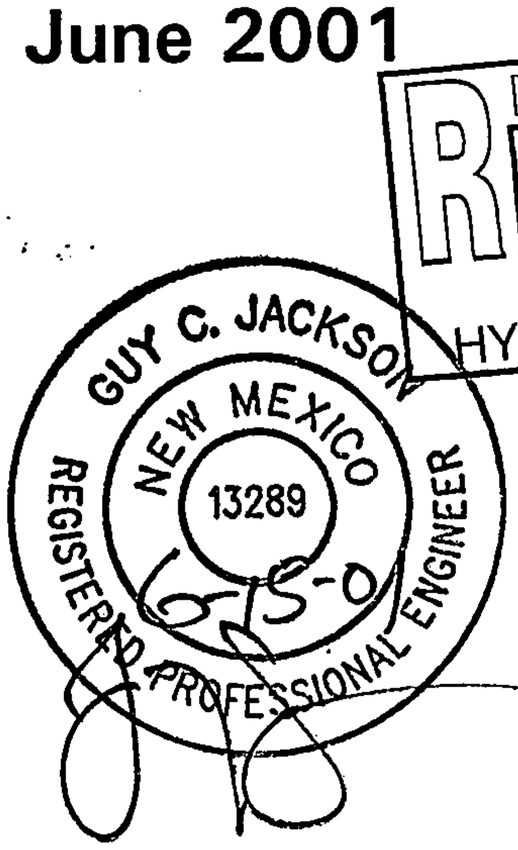
PNM BULK POWER SERVICES
NORTH AREA RENOVATIONS

BPLW PROJECT NUMBER: 20007.05

BY:

GUY C. JACKSON, PE

June 2001



BPLW
Architects & Engineers, Inc.

BPLW ARCHITECTS & ENGINEERS, INC.

TABLE OF CONTENTS

Drainage Report

General Information:

The following items pertaining to the PNM Bulk Energy Services Drainage Plan are contained herein: 1) Vicinity Map; 2) Flood Hazard Map 3) Calculations

Existing Conditions:

As shown by the Vicinity Map, the site is located north of Aztec Road, N.E. and to the east of Stanford Drive, N.E. at 2401 Aztec Road, N.E. The parcel is Block D, Indian Acres Subdivision. The property is bounded on the north by the Comanche Business Center property and to the east by the Allied Crane Commercial property. Per the flood insurance rate maps 351 of 825 for Bernalillo County, dated September 1996, the site is not in a flood hazard zone area. See the Flood Hazard Map included in this report.

The existing Basin Boundary Drainage Plan (Plate I) shows that the existing site has several buildings. There are access roads leading from Aztec Road to the main building and onto the service building at the northeast corner of the site. Currently, there are three retention ponds (A, B, & C, as shown on Plate I). Pond A collects run-off from Basin EX2. Pond B collects run-off from Basins EX3, EX4, EX5, EX8, and EX9. Pond C collects run-off from Basin EX6.

Basins EX1 and EX7 currently drain into Stanford Drive, N.E., and Aztec Road, N.E., respectively. These retention ponds will remain during the proposed improvements. Two of the ponds will require reshaping to accept the excess runoff volumes necessary per Section 22.2 – Hydrology of the Development Process Manual, Volume 2, Design Criteria, dated January 1993.

Proposed Conditions:

The proposed Basin Boundary Master Drainage Plan (Plate II) shows existing contours at 1'-0" intervals, limit and character of the proposed improvements and also the existing conditions. As shown by this plan, the proposed construction consists of remodeling the existing pre-engineered building, private water extension and fire hydrant, private sewer service, the addition of parking area to the existing southwest parking lot, covered parking canopies, walkways, landscaping and the resurfacing of four parking lots.

In the existing and proposed conditions, the parking lot at the southwest portion of the site drains into Stanford Drive. The remaining site drains to three existing on-site retention ponds. (The property to the east drains a portion of the adjacent roof area into the northwest corner of the site.) This water currently, and will continue, to be collected in pond "B". The existing site is divided to nine sub-basins. Basin "P1" (see Sheet CD.2) generates 5.70 cfs, and sheet flows west into Stanford Drive. This sheet flow was analyzed using a broad crested weir equation that indicated an average depth of .03' or 3/8" (see Sheet A-8 for calculations). Basin "P2" generates 8.32 cfs, and flows into retention pond "A". Pond "A" has been re-sized to retain the 100-yr 24-hr rainfall event. If developed flows exceed this required volume, Pond "A" has an overflow spillway that discharges into Stanford Drive. Basin "P2" shows a decrease in discharge due to grading for the new parking lot diverting a small amount of some flows into basin "P1". Basin "P3" generates 7.44 cfs, and the entire basin flows into retention pond "B". Basin "P4" generates 4.23 cfs and flowing to the center of the parking lot located along the east property line. Any overflow from Basin "P4" will flow northwest toward existing retention pond "B". There is an existing rundown channel that will convey this excess runoff without erosion of the landscaping or degradation of the asphalt pavement. Basin "P5" generates 2.70 cfs, and

consists of the existing access road, which flows to the center of the site and sheet flows into pond "B". See analysis point AP-6 on drawing C0.2. Basin "P6" generates 2.46 cfs, all excess runoff water flows into existing retention pond "C". This runoff matches the historic discharge into this pond and no new construction is proposed in this area. Basin "P7" continues to generate 1.51 cfs of historic sheet flow into Aztec Road to the south. Basin "P8" generates 5.54 cfs, flowing towards the center of the site through the parking lot east of the main building. This flow will be collected in a trench drain and conveyed to Pond "B" in a 15" PVC storm drain pipe (See AP-4). There is an existing concrete rundown channel that previously conveyed storm water from this parking lot to Pond "B". This existing rundown channel will remain after the proposed improvements as an integral part of the storm drainage system. The new trench drain system is only being installed to eliminate a shallow depression within the parking area. This shallow depression in the paving creates a maintenance problem and will be eliminated by minor re-grading (though milling and re-paving) of the existing parking lot. Existing concrete rundown (mentioned above) that formally conveyed storm water north along the east side of the main building, converges with another small rundown channel conveying roof drainage from the north-east corner of the building, and discharges into Pond "B" (See AP-3). Basin "P9" (primarily roof drainage) generates 0.53 cfs, combines with runoff from Basin "P8" and flow through an 18" square cattle guard drain to Pond "B" (See AP-5). Pond "B" has been sized to hold the 100-yr 24-hr event generated by basins 3, 5, 8a, 8b, & 9. See calculations starting on sheet A-12 in Appendix A. Ponding Volumes were calculated using City of Albuquerque hydrographs, using time of peak, time of duration and peak discharges. These calculations are included in appendix A on pages A-8 through A-20.

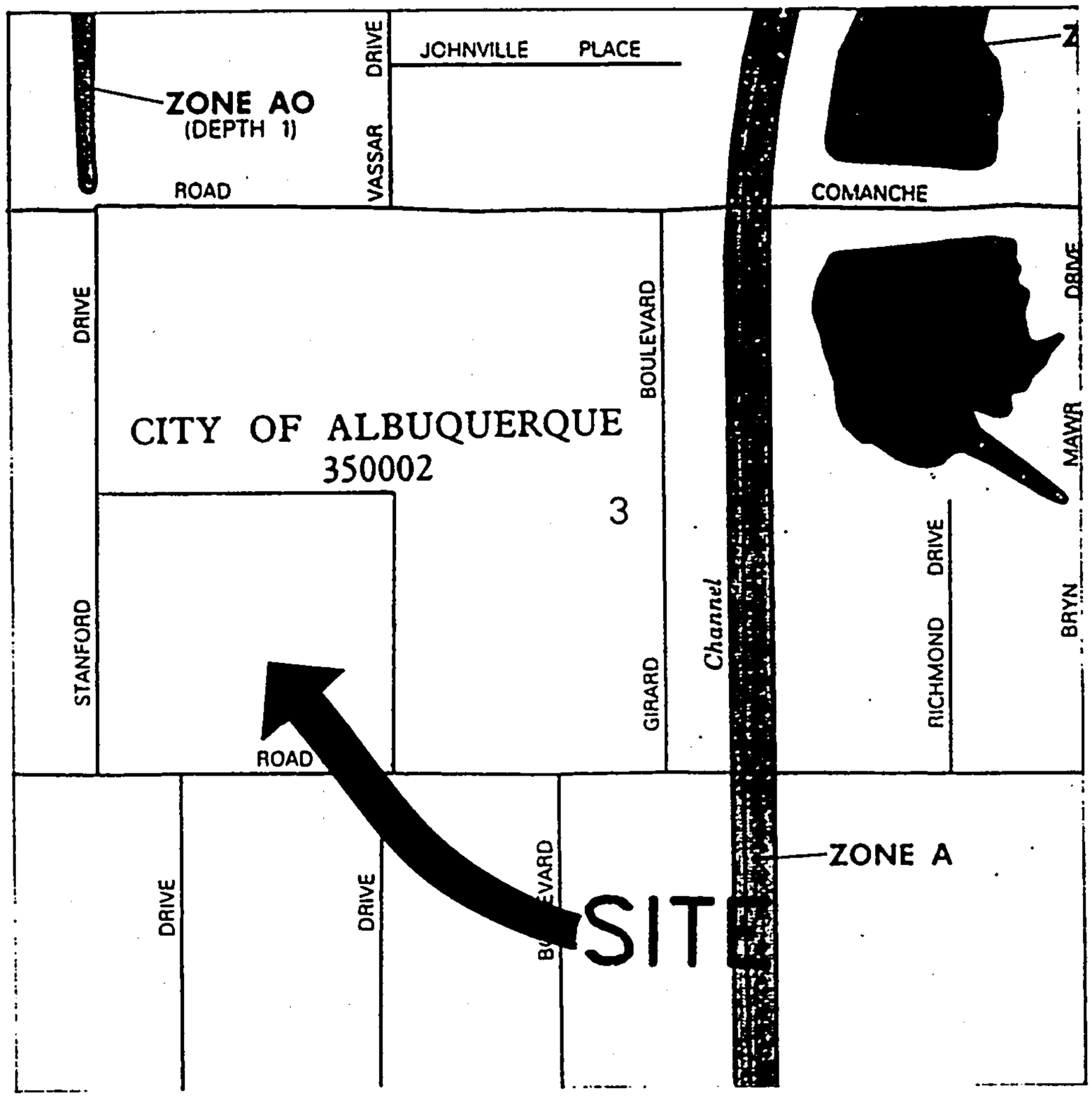
A riprap rundown will be installed north of the metal building to reduce/eliminate erosion. This rundown will only collect runoff form the future basketball court and from the roof of the existing metal building at the northwest corner of the site. This rundown channel has been analyzed using Manning's equation. See page A-21 in Appendix A.

Conclusions:

As stated above, only small offsite flows enter the site due to the drainage patterns on the neighbor's roof in the northeast corner of the site. Remaining neighbors do not have any storm water that will enter the subject site.

On site ponds have been analyzed to hold the 100-yr 24-hr event in compliance with the current City of Albuquerque Hydrology. All conveyance channels, rundowns, pipes and inlets have been sized for the 100-yr 6hr event. Storm water discharging into Aztec Road match historic values. During the predesign meeting we were granted free discharge along the west property line into Stanford Drive. — to acceptable discharge amounts

The calculations contained in this report analyze the developed conditions for the 100-year 6-hour (for peak discharge rates) rainfall event. The procedure for 40 acre or smaller basins set by section 22.2 Hydrology of the Development Process Manual, Volume 2, Design Criteria, dated January 1993, has been used to quantify the peak rate of discharge and volume of runoff generated.



FLOOD HAZARD MAP

FLOOD INSURANCE RATE MAP

351 OF 825

APPENDIX A

Drainage Summary

Project: PNM Bulk Power Services
Project Numbe: 20007.05
Date: 05/29/01
By: Jerrie P

Site Location

Precipitaion Zone 2 Per Table A-1 COA DPM Section 22.2

Existing summary

Basin Name	Ex 1	Ex 2	Ex 3	Ex 4	Ex 5	Ex 6	Ex 7	Ex 8	Ex 9
Soil Treatment (acres)									
Area "A"	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Area "B"	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Area "C"	0.82	0.94	2.40	0.24	0.26	0.44	0.27	0.41	0.02
Area "D"	0.18	1.35	0.01	0.74	0.40	0.23	0.14	0.89	0.10
Excess Runoff (acre-feet)									
100yr. 6hr.	0.11	0.33	0.23	0.15	0.10	0.08	0.05	0.20	0.02
10yr. 6hr.	0.07	0.04	0.09	0.02	0.03	0.06	0.06	0.03	0.01
2yr. 6hr.	0.01	0.01	0.00	0.01	0.01	0.01	0.01	0.01	0.02
100yr. 24hr.	0.12	0.37	0.23	0.18	0.11	0.09	0.05	0.23	0.02
Peak Discharge (cfs)									
100 yr.	3.42	9.30	7.58	4.23	2.70	2.46	1.51	5.47	0.53
10yr.	1.97	5.85	4.14	2.73	1.70	1.47	0.90	3.50	0.35
2yr.	0.83	3.08	1.46	1.52	0.90	0.69	0.42	1.90	0.20

Proposed summary

Basin Name	Pro 1	Pro 2	Pro 3	Pro 4	Pro 5	Pro 6	Pro 7	Pro 8a	Pro 8b
Soil Treatment (acres)									
Area "A"	0.00	0.00	0 00	0.00	0 00	0 00	0.00	0.00	0.00
Area "B"	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Area "C"	0.23	0.78	2.37	0.24	0 26	0.44	0.27	0.21	0.13
Area "D"	1.06	1.25	0.00	0.74	0.40	0.23	0.14	0.94	0.01
Excess Runoff (acre-feet)									
100yr. 6hr.	0.21	0.29	0.22	0.15	0.10	0.08	0.05	0.19	0.01
10yr. 6hr.	0.02	0.03	0.09	0.02	0.03	0.06	0.06	0.02	0.08
2yr. 6hr.	0.02	0.01	0.00	0.01	0.01	0.01	0.01	0.02	0.00
100yr. 24hr.	0.24	0.34	0.22	0.18	0.11	0.09	0.05	0.22	0.01
Peak Discharge (cfs)									
100 yr.	5.70	8.32	7.44	4.23	2.70	2.46	1.51	5.08	0.46
10yr.	3.72	5.26	4.05	2.73	1.70	1.47	0.90	3.31	0.25
2yr.	2.11	2.79	1.42	1.52	0.90	0.69	0.42	1.87	0.10

A-1

Drainage Summary

Pro 9	Swale	Pro 3,5,8a,8b
0.00	0.00	0 00
0.00	0.00	0.00
0.02	0.16	2.97
0.10	0.20	1.35
0.02	0.05	0.52
0.01	0.04	0.06
0.02	0.01	0.01
0.02	0.06	0.56
0.53	1.44	15.67
0.35	0.90	9.32
0.20	0.47	4.29

A-2

BPLW

Architects and Engineers

PROJECT **PNM Bulk Power Services**
PROJECT NO. **20007.05**
DATE **05/29/01**
BY **Jerrie P**

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	**Pro 1**		
Precipitation Zone		**2**	
Land Area		**1.29**	acres
Excess Precipitation Volume			
>>> 100-year 6-hour (design)		**0.21**	**acre-ft.**
10-year 6-hour		**0.02**	acre-ft.
2-year 6-hour		**0.02**	acre-ft.
100-year 24-hour		**0.24**	acre-ft.
Peak Discharge Rates (DPM)			
>>> Q100 (design)		**5.70**	**cfs**
Q10		**3.72**	cfs
Q2		**2.11**	cfs
Peak Discharge Rates (DPM-Rational Method)			
>>> Q100 (design)		**5.70**	**cfs**
Q10		**3.72**	cfs
Q2		**2.10**	cfs

CALCULATIONS FOLLOW

A-3

INPUT AND CALCULATIONS

	LOCATION	Pro 1	
>A.1	PRECIPITATION ZONE (from Table A-1)	2	
>A.2	DEPTHS (from Table A-2)		
	100-YEAR STORM (P60)	2.01	inches
	100-YEAR STORM (P360)	2.35	inches
	100-YEAR STORM (P1440)	2.75	inches
	10-YEAR (P360) (Calculated: P360*RPF10)	1.57	inches
	2-YEAR (P360) (Calculated: P360*RPF2)	1.02	inches
>A.3	LAND TREATMENTS (Ai)		
	Treatment A	0.00	acres
	Treatment B	0.00	acres
	Treatment C	0.23	acres
	Treatment D	1.06	acres
	Total Area	1.29	acres
>A.4	ABSTRACTIONS	See A.5	

CALCULATIONS FOLLOW

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	**0.53**	inches
Treatment B	**0.78**	inches
Treatment C	**1.13**	inches
Treatment D	**2.12**	inches
WEIGHTED E (Sum Ei*Ai/A)	**1.94**	inches
VOLUME V100:6h (E*A)	**0.21**	acre-ft.
	9,100.77	ft^3
10-year 6-hour		
Treatment A	**0.13**	inches
Treatment B	**0.28**	inches
Treatment C	**0.52**	inches
Treatment D	**1.34**	inches
WEIGHTED E (Sum Ei*Ai/A)	**0.24**	inches
VOLUME V10:6h (E*A)	**0.02**	acre-ft.
	676.46	ft^3
2-year 6-hour		
Treatment A	**0.00**	inches
Treatment B	**0.02**	inches
Treatment C	**0.15**	inches
Treatment D	**0.79**	inches
WEIGHTED E (Sum Ei*Ai/A)	**0.68**	inches
VOLUME V2:6h (E*A)	**0.02**	acre-ft.
	686.98	ft^3
100-year 24-hour		
VOLUME V100:24h (V100-6h+Ad*P1440-P360)/12)	**0.24**	acre-ft.
	10,639.89	ft^3

CALCULATIONS FOLLOW

A-5

INPUT AND CALCULATIONS (CON'T)

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

100-year		
Treatment A	**1.56**	cfs/acre
Treatment B	**2.28**	cfs/acre
Treatment C	**3.14**	cfs/acre
Treatment D	**4.70**	cfs/acre
Q100 (Sum Qi*Ai)	**5.70**	cfs
10-year		
Treatment A	**0.38**	cfs/acre
Treatment B	**0.95**	cfs/acre
Treatment C	**1.71**	cfs/acre
Treatment D	**3.14**	cfs/acre
Q10 (Sum Qi*Ai)	**3.72**	cfs
2-year		
Treatment A	**0.00**	cfs/acre
Treatment B	**0.08**	cfs/acre
Treatment C	**0.60**	cfs/acre
Treatment D	**1.86**	cfs/acre
Q2 (Sum Qi*Ai)	2.11	cfs

CALCULATIONS FOLLOW

A-6

RATIONAL METHOD

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

Peak Intensity (I) 100-year	**5.05**
Peak Intensity (I) 10-year	**3.41**
Peak Intensity (I) 2-year	**2.04**

RATIONAL METHOD COEFFICIENT, C
from Table A-11

100-year

Treatment A	**0.31**	cfs/acre
Treatment B	**0.45**	cfs/acre
Treatment C	**0.62**	cfs/acre
Treatment D	**0.93**	cfs/acre
Q100 (Sum Qi*I*Ai)	**5.70**	cfs

10-year

Treatment A	**0.11**	cfs/acre
Treatment B	**0.28**	cfs/acre
Treatment C	**0.50**	cfs/acre
Treatment D	**0.92**	cfs/acre
Q10 (Sum Qi*I*Ai)	**3.72**	cfs

2-year

Treatment A	**0.00**	cfs/acre
Treatment B	**0.04**	cfs/acre
Treatment C	**0.29**	cfs/acre
Treatment D	**0.91**	cfs/acre
Q2 (Sum Qi*I*Ai)	**2.10**	cfs

BPLW
Architects & Engineers, Inc.

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49 West First Street
Suite 100
Mesa, AZ 85201
(480) 827-2759

Martin Building, Suite 501
215 North Stanton Street
El Paso, TX 79901
(915) 545-1665

Project _____

Subject _____

Project # _____ Date _____ By _____

- ☐ Memorandum
- ☐ Telephone Record
- ☐ Note to the File
- ☐ Minutes of Meeting
- ☐ To be Typed
- ☐ _____

Basin P1/AP1

Need: $Q_{100} = 5.70$ cfs
depth = weir equation = $Q = CLH^{3/2}$

$C = 3.33$ $L = 376$ ft

$Q = CLH^{3/2} \Rightarrow \frac{Q}{CL} = H^{3/2} \Rightarrow \frac{5.77}{(3.3)(376)} = h^{1.5}$

$0.00460 = h^{1.5}$ $h = 0.03'$

$= 3/8"$

Basin P2/AP2

Need: $Q_{100} = 0.32$ cfs
$V_{100\,24} = V_{1440} = V_{360} + A_D * (P_{1440} - P_{360})/12$ in/ft

Weighted E = 1.7396 inches
V_{360} = weighted E * $(A_A + A_B + A_C + A_D)/12$

$= \frac{(1.7396)(2.03)}{12}$

$= 0.29$ acre-ft

From Table A-2/zone 2
$P_{360} = 2.35$
$P_{1440} = 2.75$

$V_{1440} = (V_{360} + A_D)[(P_{1440} - P_{360})/12$ in/ft$]$

$= 0.29 + [(1.25)\left(\frac{2.75 - 2.35}{12}\right)]$

$= 0.33$ acre-feet

Copies to:

BPLW

Architects & Engineers, Inc.

6200 Uptown Blvd. NE
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Albuquerque, NM 87110
(505) 881-2759

49 West First Street
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Project _____

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- ☐ Memorandum
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- ☐ To be Typed
- ☐ _____

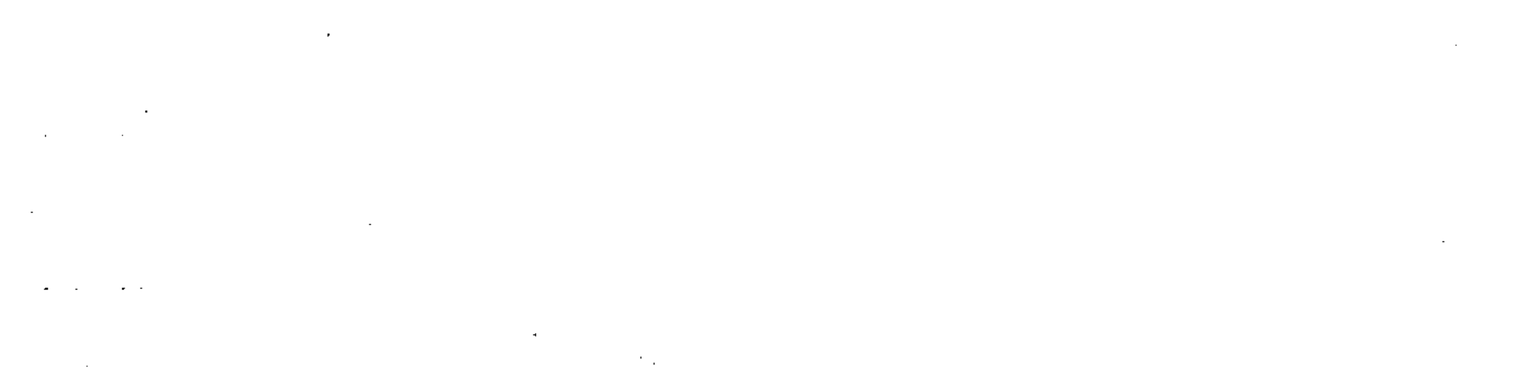
BASIN P2 / AP2 continued

Need: Vavailable = 11,008.39 cf (EXISTING POND NEEDS RESHAPING)

$V_{100(24)} = 0.33 \text{ acre-feet} \left(\frac{43560 \text{ ft}^2}{\text{acre}}\right) = 14,447.4 \text{ cf}$

Vavailable (existing) = too small
Vavailable (proposed) = 23,518.72 ft³ okay

TOP OF BERM 5090.5



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Pond calculations

Pond A (proposed)

Elevation	Area (sf)	Volume (cf)	Σ Volume
5087	3361.09		
		4,725.96	4,725.96
5088	6090.30		
		7,397.85	12,123.80
5089	8705.39		
		11,392.92	23,516.72
5090	14080.45		

Solve for MWSEL

$$y_0 = \left[\frac{x_0 - x_2}{x_1 - x_2} * (y_1 - y_2)\right] + y_2$$

y_1 89 x_1 12,123.80
y_0 x x_0 14,447.4
y_2 90 x_2 23,516.72

$$y_0 = \left[\frac{14,447.4 - 23,516.72}{12,123.80 - 23,516.72} * (89 - 90)\right] + 90$$

MWSEL = 89.20ft

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Hydrograph for Pond A / BasinP2

Given
$A_T = 2.03$ acres $A_D = 1.25$ acres $t_c = 0.2$ hour
$Q_p = 8.32$ cfs $A_C = 0.78$ acres

$$t_p = (0.7)(t_c) + (1.6 - A_D/A_T)/12$$

$$= [(0.7)(0.2)] + \frac{\left(1.6 - \frac{1.25}{2.03}\right)}{12} = \underline{0.2220 \text{ hours}}$$

Duration of Peak

$$(0.25)\left(\frac{A_D}{A_T}\right) = (0.25)\left(\frac{1.25}{2.03}\right) = 0.1539 \text{ hours}$$

$$t_B = \left[(2.107)(E)\left(\frac{A_T}{Q_P}\right)\right] - \left[(.25)\left(\frac{A_D}{A_T}\right)\right]$$

$$E = \frac{E_A A_A + E_B A_B + E_C A_C + E_D A_D}{A_A + A_B + A_C + A_D}$$

Zone 2: Treatment C = 1.13
Treatment D = 2.12

$$E = \frac{(1.13)(0.78) + (2.12)(1.25)}{0.78 + 1.25} = 1.7396 \text{ inches}$$

$$t_B = \left[(2.107)(1.7396)\left(\frac{2.03}{8.32}\right)\right] - 0.1539 = \underline{0.7404 \text{ hours}}$$

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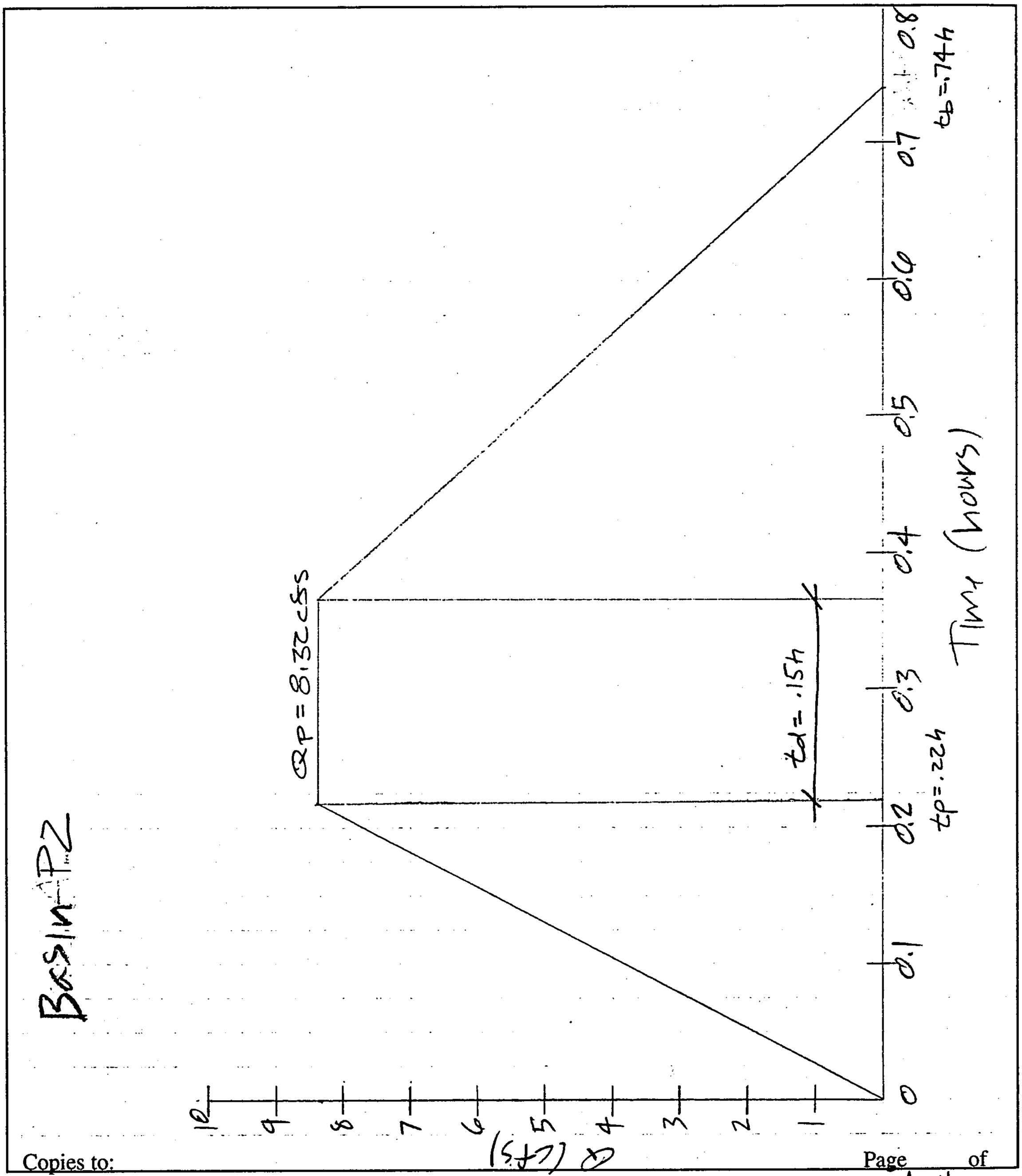

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Pond B / Basins P3, P5, P8a & P8b

Basin #	Total Area (acre)	Area C (acre)	Area D (acre)
P3	2.37	2.37	0
P5	0.66	0.26	0.40
P8a	1.15	0.21	0.94
P8b	0.14	0.13	0.01
	4.32	2.97	1.35

Given
$Q_P = 15.67$ cfs $\quad A_T = 4.32$ acres $\quad A_D = 1.35$ acres
$A_C = 2.97$ acres $\quad t_c = 0.2$ hours

$$t_p = (0.7)(t_c) + (1.6 - A_D/A_T)/12$$

$$= [(0.7)(0.2)] + \left[\frac{1.6 - (1.35/4.32)}{12}\right] = \underline{0.2472 \text{ hours}}$$

Duration of Peak:

$$(0.25)\left(\frac{A_D}{A_T}\right) = (0.25)\left(\frac{1.35}{4.32}\right) = \underline{0.0781 \text{ hours}}$$

$$t_B = [(2.107)(E)\left(\frac{A_I}{Q_P}\right)] - [(.25)\left(\frac{A_D}{A_T}\right)]$$

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$$E = \frac{E_C A_C + E_D A_D}{A_C + A_D}$$

From Table A-8/zone 2:
Treatment C = 1.13
Treatment D = 2.12

$$E = \frac{(1.13)(2.97) + (2.12)(1.35)}{2.97 + 1.35} = 1.4393 \text{ hours}$$

$$t_B = \left[(2.107)(1.4393)\left(\frac{4.32}{15.67}\right)\right] - 0.0781 = 0.7579 \text{ hours}$$

Area under Trapezoid

$$A = \frac{(b_1 + b_2)h}{2} = \frac{(0.0781 + 0.7579)(15.67)}{2}$$

$$= (6.55)(3600) = 23,580.21 \text{ cf}$$

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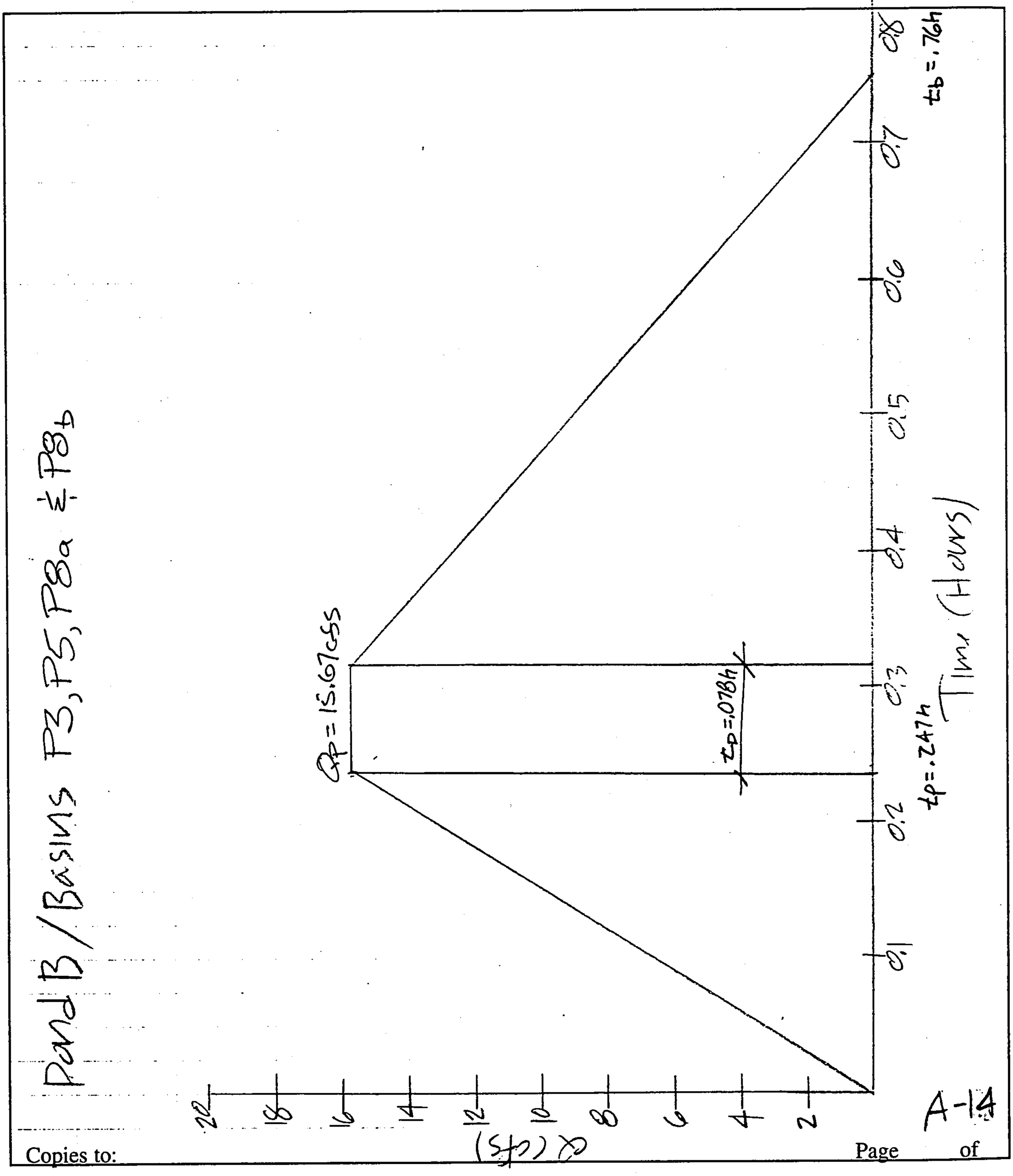

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Pond B / Basin P3, P5, P8a & P8b

Elevation	Area (sf)	Volume (cf)	Σ Volume
89	4034.02	=	
		5220.92	5220.92
90	6407.81		
		8104.20	13,325.12
91	9800.59		
		12,126.02	25,451.13
92	14451.44		
		16,905.09	42,356.22
93	19358.73		

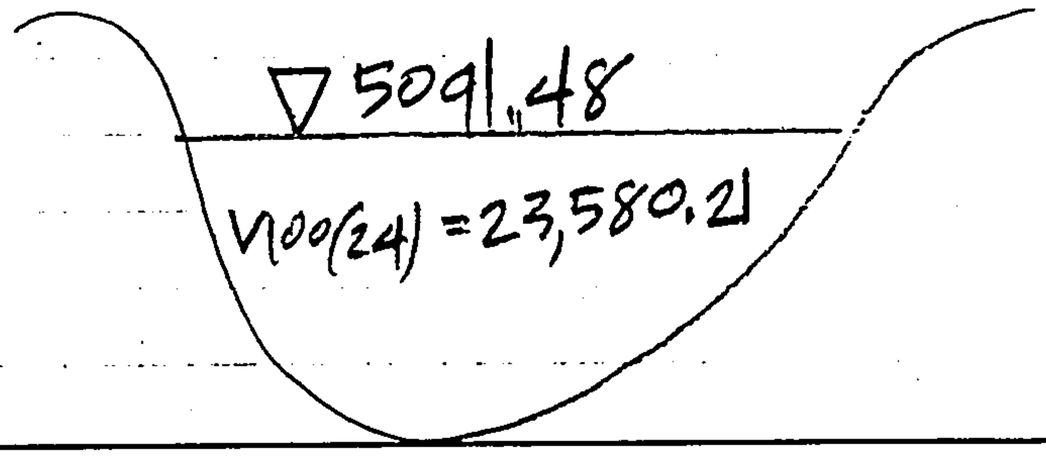
solve for MWSEL:

$$Y_0 = \left[\frac{X_0 - X_2}{X_1 - X_2} \times (Y_1 - Y_2)\right] + Y_2$$

$Y_1 = 91$ $X_1 = 13,325.12$
$Y_0 = X$ $X_0 = 23,580.21$
$Y_2 = 92$ $X_2 = 34,793.85$

$$X^0 = \left[\frac{23,580.21 - 34,793.85}{13,325.12 - 34,793.85}\right) \times (91 - 92)\Big] + 92$$

MWSEL = 91.48 ft



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Hydrograph for Pond C/Basin P6

Given:

$A_T = 0.67$ acres $A_D = 0.23$ acres $t_c = 0.2$ hour

$Q_P = 2.46$ cfs $A_C = 0.44$ acres

$$t_p = (0.7)(t_c) + (1.6 - A_D/A_T)/12$$

$$= [(0.7)(0.2)] + \frac{\left[1.6 - \left(\frac{0.23}{0.67}\right)\right]}{12} = \underline{0.2447 \text{ hours}}$$

Duration of Peak

$$(0.25)\left(\frac{A_D}{A_T}\right) = (0.25)\left(\frac{0.23}{0.67}\right) = 0.0858 \text{ hours}$$

$$t_B = \left[(2.107)(E)\left(\frac{A_T}{Q_P}\right)\right] - \left[(.25)\left(\frac{A_D}{A_T}\right)\right]$$

$$E = \frac{E_C A_C + E_D A_D}{A_T} = \frac{(1.13)(0.44) + (2.12)(0.23)}{0.67}$$

$$= 1.4699 \text{ inches}$$

$$t_B = \left[(2.107)(1.4699)\left(\frac{0.67}{2.46}\right)\right] - 0.0858 = 0.7577 \text{ hours}$$

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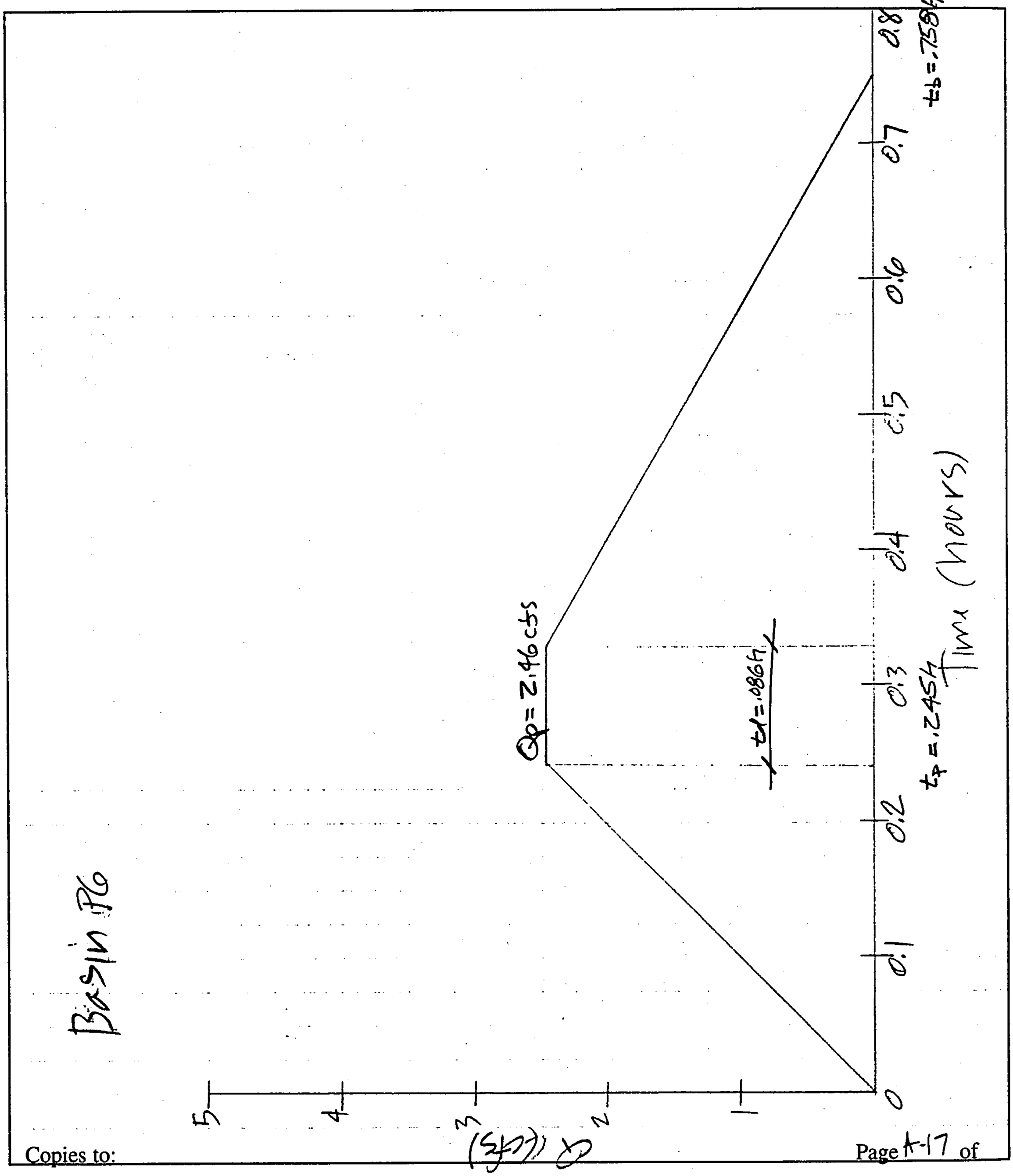

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Volums from Hydrographs:

Basin P2

Area 1 = $\frac{1}{2}bh = \frac{1}{2}[(0.2220)(8.32)] = 0.9235$

Area 2 = $bh = (0.1539)(8.32) = 1.2804$

Area 3 = $\frac{1}{2}bh = \frac{1}{2}[(0.3645)(8.32)] = \frac{1.5163}{(3.7202)(3600)}$

$= 13,392.72\ ft^3$

Basin P3 (at Present Conditions)

Area 1 = $\frac{1}{2}bh = \frac{1}{2}[(0.2733)(7.44)] = 1.0166$

Area 2 = $\frac{1}{2}bh = \frac{1}{2}[(0.4851)(7.44)] = \frac{1.8045}{(2.8212)(3600)}$

$= 10,156.32\ ft^3$

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BasinPG:

$$\text{Area} = \frac{(b_1 + b_2)h}{2} = \frac{(0.2447 + 0.7577)2.46}{2}$$

$$= (1.2329)(3600)$$

$$= 4,438.44 \text{ ft}^3$$

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Pond Calculations:

Pond A: (existing)

Elevation	Area (sf)	Volume (cf)	Σ volume
5086			
5087	529.04	1,749.99	1,749.99
5088	2970.95	3,740.14	5,490.14
5089	4509.34	5,518.25	11,008.39
5090	6527.16		

Pond B:

Elevation	Area (sf)	Volume (cf)	Σ volume
5090	5169.75	6476.08	6476.08
5091	7782.41	9900.51	16,376.59
5092	12018.62	14,199.93	30,576.52
5093	16381.24		

Pond C:

Elevation	Area (sf)	Volume (cf)	Σ volume
5094	1760.81	3247.13	3247.13
5095	4733.45		

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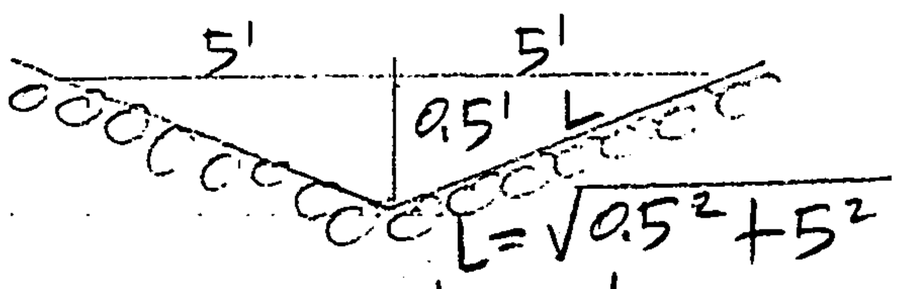
Basin P2/AP12

$Q_{req} = 1.44$ cfs



$n = 0.035$ (stony cobbles)

Mannings Equation: $Q = \frac{k}{n} A R^{2/3} S^{1/2}$

$k = 1.486$ $n = 0.035$ $R = A/P$ $WP = P = 2L$

$A = (\frac{1}{2} \times 5' \times .5')2 = 2.5 ft^2$

$WP = 2(\sqrt{5^2 + 0.5^2}) = 10.04 ft$

$R = \frac{2.5 ft^2}{10.04 ft} = 0.25 ft$

$S = \frac{1'}{106.29'} = 0.009 = 0.01 ft/ft$

$Q = \left(\frac{1.486}{0.035}\right)(2.5 ft^2)(0.25)^{2/3}(0.01 ft/ft)^{1/2}$

$Q = 4.21$ cfs > 1.44 okay

$A = d \times d \times 10 = 10d^2$

$WP = 2(\sqrt{10^2 + d^2}) \approx 20d$

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$$R = \frac{d}{2}$$

$$Q = \frac{k}{n} A R^{2/3} S^{1/2}$$

$$1.44 \text{ cfs} = \left(\frac{1.486}{0.035}\right)(10d^2)\left(\frac{d}{2}\right)^{2/3}(0.01)^{1/2}$$

$$d = 0.36'$$

$$= 4\,3/8''$$

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BASIN P4/AP10

Need: Q_{100} (Historic) = 4.23 cfs

Q_{100} (Developed) = 4.23 cfs

No change

BASIN P5/AP9

Need: Q_{100} (Historic) = 2.70 cfs

Q_{100} (Developed) = 2.70 cfs

No change

BASIN P6/AP8

Need: Q_{100} (Historic) = 2.46 cfs

Q_{100} (Developed) = 2.46 cfs

No change

BASIN P7/AP7

Need; Q_{100} (Historic) = 1.51 cfs

Q_{100} (Developed) = 1.51 cfs

No change

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PNM - Bulk Power Services
Worksheet for Circular Channel

Project Description	
Worksheet	pnm
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Discharge

Input Data		
Mannings Coefficient	0.013	
Slope	0.007500	ft/ft
Depth	0.93	ft
Diameter	15	in

Results		
Discharge	5.05	cfs
Flow Area	1.0	ft²
Wetted Perimeter	2.60	ft
Top Width	1.09	ft
Critical Depth	0.91	ft
Percent Full	74.4	%
Critical Slope	0.007871	ft/ft
Velocity	5.16	ft/s
Velocity Head	0.41	ft
Specific Energy	1.34	ft
Froude Number	0.96	
Maximum Discharg	6.02	cfs
Discharge Full	5.59	cfs
Slope Full	0.006120	ft/ft
Flow Type	Subcritical	

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Table
Rating Table for Circular Channel

Project Description	
Worksheet	pnm
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Discharge

Input Data		
Mannings Coefficient	0.013	
Slope	0.007500	ft/ft
Diameter	15	in

Attribute	Minimum	Maximum	Increment
Depth (ft)	0.10	1.25	0.05

Depth (ft)	Discharge (cfs)	Velocity (ft/s)	Flow Area (ft^2)	Wetted Perimeter (ft)	Top Width (ft)
0.10	0.07	1.59	4.6e-2	0.72	0.68
0.15	0.17	2.05	0.1	0.88	0.81
0.20	0.31	2.45	0.1	1.03	0.92
0.25	0.49	2.80	0.2	1.16	1.00
0.30	0.71	3.12	0.2	1.28	1.07
0.35	0.96	3.41	0.3	1.39	1.12
0.40	1.24	3.66	0.3	1.50	1.17
0.45	1.55	3.90	0.4	1.61	1.20
0.50	1.89	4.11	0.5	1.71	1.22
0.55	2.24	4.31	0.5	1.81	1.24
0.60	2.61	4.48	0.6	1.91	1.25
0.65	2.99	4.63	0.6	2.01	1.25
0.70	3.37	4.77	0.7	2.11	1.24
0.75	3.76	4.89	0.8	2.22	1.22
0.80	4.14	4.99	0.8	2.32	1.20
0.85	4.51	5.07	0.9	2.42	1.17
0.90	4.86	5.13	0.9	2.53	1.12
0.95	5.18	5.18	1.0	2.65	1.07
1.00	5.47	5.20	1.1	2.77	1.00
1.05	5.71	5.19	1.1	2.90	0.92
1.10	5.90	5.16	1.1	3.04	0.81
1.15	6.00	5.08	1.2	3.21	0.68
1.20	5.99	4.95	1.2	3.42	0.49
1.25	5.59	4.56	1.2	3.93	0.68

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Flow Master

To get approximation of what size will work you need basin Q_{100} & approx size of pipe and then go to charts to see if it falls in curve.

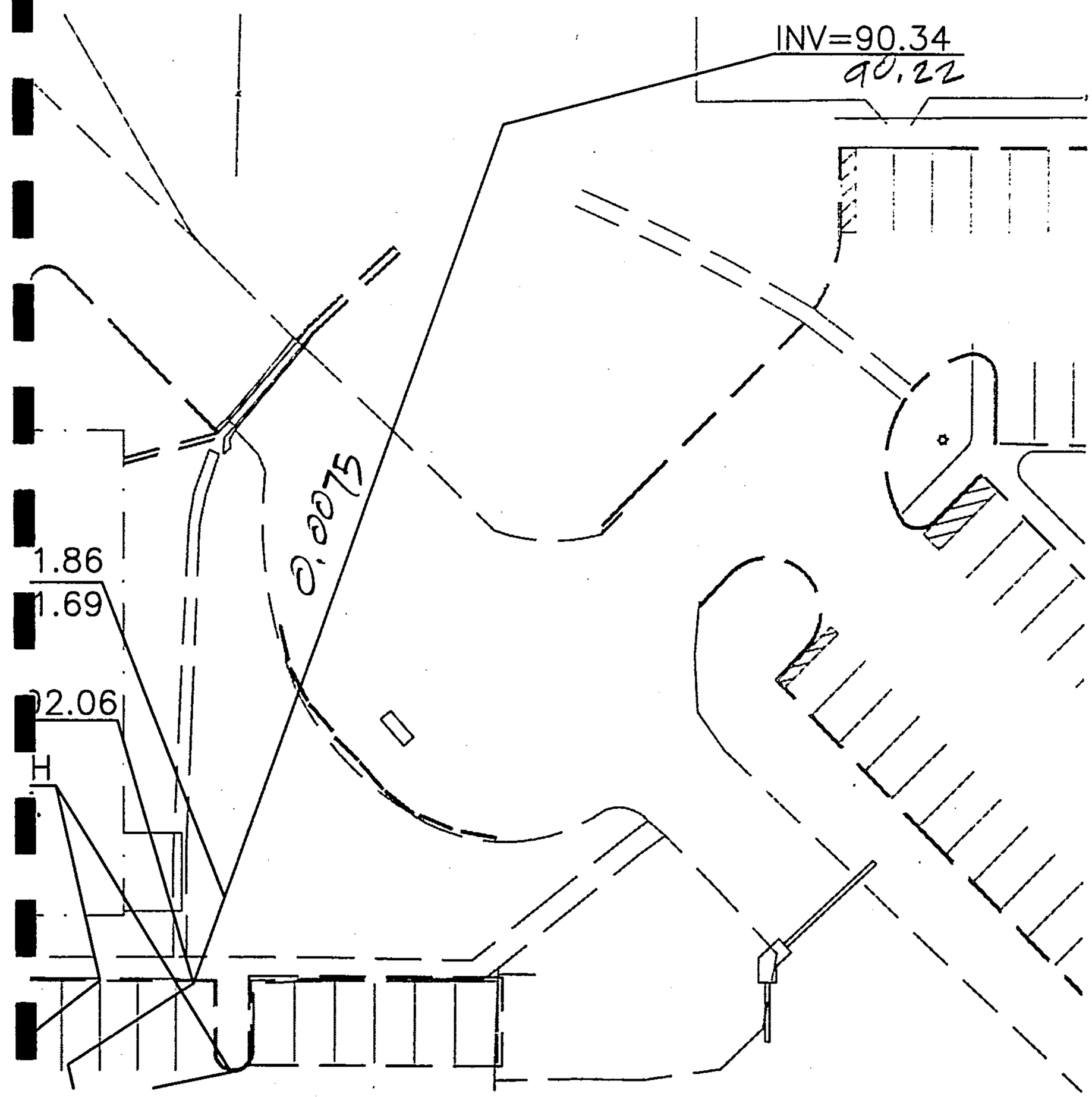
15" PVC PIPE

length = 180'

slope = 0.0075 ft/ft

Q_{100} = 5.08 cfs

max full for CQA = 75% of pipe



APPENDIX B

Plate I	Existing Basin Boundary & Drainage Plan
Plate II	Proposed Basin Boundary & Master Drainage Plan

City of Albuquerque

P.O. BOX 1293 ALBUQUERQUE, NEW MEXICO 87103

April 2, 2002

Guy C. Jackson, PE
BPLW Architects & Engineers
6200 Uptown Blvd. NE
Albuquerque, NM 87110

Re: PNM Bulk Power Services Revised Grading and Drainage Plan
Engineer's Stamp Dated 3-28-02, (G16/D8B)

Dear Mr. Jackson,

Based on the information contained in your submittal dated 3-28-02, the above referenced plan is approved for Building Permit.

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

Also, prior to Certificate of Occupancy release, Engineer Certification per the DPM checklist will be required.

If you have any questions, you can contact me at 924-3984.

Sincerely,

Leslie Romero
Engineering Associate, PWD
Development and Building Services

C: Terri Martin, Hydrology
File (2)

City of Albuquerque

P.O. BOX 1293 ALBUQUERQUE, NEW MEXICO 87103

August 23, 2001

Guy Jackson, PE
BPLW
6200 Uptown Blvd, Ste 400
Albuquerque, NM 87110

Re: PNM Bulk Power Services – North Area Renovations Drainage Report
Engineer's Stamp dated 8-2-01 (G16/D8B)

Dear Mr. Jackson,

Based upon the information provided in your submittal dated 8-7-01, the above referenced site is approved for Building Permit.

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

Also, prior to Certificate of Occupancy release, Engineer Certification per the DPM checklist will be required.

If you have any questions, you can contact me at 924-3986.

Sincerely,

Bradley L. Bingham

Bradley L. Bingham, PE
Sr. Engineer Hydrology

C: file

DRAINAGE AND TRANSPORTATION INFORMATION SHEET

(REV. 1/11/2002)

G-16/D8B

PROJECT TITLE: PNM Bulk Power Services ZONE MAP/DRG. FILE #: G-16
DRB #: _____ EPC#: _____ WORK ORDER#: _____

LEGAL DESCRIPTION: A portion of Block D, Indian Acres Subdivision
CITY ADDRESS: 2401 Aztec Road, NE

ENGINEERING FIRM: BPLW Architects & Engineers — CONTACT: Guy Jackson
ADDRESS: 6200 Uptown Blvd NE — PHONE: 880-9670
CITY, STATE: Albuquerque NM — ZIP CODE: 87110

OWNER: PNM — CONTACT: Steve Anders
ADDRESS: 2401 AZTEC — PHONE: 345-8411
CITY, STATE: Albuquerque, NM — ZIP CODE: _____

ARCHITECT: BPLW — CONTACT: Guy Jackson
ADDRESS: See Above — PHONE: _____
CITY, STATE: _____ — ZIP CODE: _____

SURVEYOR: Bradley & Lorenz — CONTACT: Paul Bradley
ADDRESS 2201 San Pedro NE — PHONE: 888-6088
CITY, STATE: Alb, NM 87110 — ZIP CODE: _____

CONTRACTOR: Albuquerque Asphalt — CONTACT: Raud Pulliam
ADDRESS: _____ — PHONE: _____
CITY, STATE: _____ — ZIP CODE: _____

CHECK TYPE OF SUBMITTAL:

- ✓ DRAINAGE REPORT · Revised
- ✓ DRAINAGE PLAN · Revised
- ____ CONCEPTUAL GRADING & DRAINAGE PLAN
- ✓ GRADING PLAN · Revised
- ____ EROSION CONTROL PLAN
- ____ ENGINEER'S CERTIFICATION (HYDROLOGY)
- ____ CLOMR/LOMR
- ____ TRAFFIC CIRCULATION LAYOUT (TCL)
- ____ ENGINEERS CERTIFICATION (TCL)
- ____ ENGINEERS CERTIFICATION (DRB APPR. SITE PLAN)
- ____ OTHER

CHECK TYPE OF APPROVAL SOUGHT:

- ____ SIA / FINANCIAL GUARANTEE RELEASE
- ____ PRELIMINARY PLAT APPROVAL
- ____ S. DEV. PLAN FOR SUB'D. APPROVAL
- ____ S. DEV. PLAN FOR BLDG. PERMIT APPROVAL
- ____ SECTOR PLAN APPROVAL
- ____ FINAL PLAT APPROVAL
- ____ FOUNDATION PERMIT APPROVAL
- X BUILDING PERMIT APPROVAL
- ____ CERTIFICATE OF OCCUPANCY (PERM.)
- ____ CERTIFICATE OF OCCUPANCY (TEMP.)
- X GRADING PERMIT APPROVAL
- X PAVING PERMIT APPROVAL
- ____ WORK ORDER APPROVAL
- ____ OTHER (SPECIFY)

WAS A PRE-DESIGN CONFERENCE ATTENDED:

- X YES
- ____ NO
- ____ COPY PROVIDED

RECEIVED
MAR 28 2002
HYDROLOGY SECTION

DATE SUBMITTED: 3/30/02 BY: _____

Requests for approvals of Site Development Plans and/or Subdivision Plats shall be accompanied by a drainage submittal. The particular nature , location and scope ot the proposed development defines the degree of drainage detail. One or more of the following levels of submittal may be required based on the following:

1. **Conceptual Grading and Drainage Plan**: Required for approval of Site Development Plans greater than five
2. **Drainage Plans**: Required for building permits, grading permits, paving permits and site plans less than five (5)
3. **Drainage Report**: Required for subdivisions containing more than ten (10) lots or constituting five (5) acres or

BPLW

Architects & Engineers, Inc.

6200 Uptown Blvd. NE
Suite 400
Albuquerque, New Mexico 87110
(505) 881-BPLW (2759)
FAX (505) 881-1230
web site: http://www.bplw.com

March 28, 2002

Brad Bingham, PE
Hydrology Chairman
COA - Public Works
PO Box 1293
Albuquerque, New Mexico 87103

Re: PNM Bulk Power Services (Revised Grading Plan)
BPLW Project Number 20007.05

Dear Brad:

Attached for your review and approval are the following:

One (1) Drainage Information Sheet

One (1) Revised Copy of the Master Grading and Drainage Plan and Report

This submittal reflects a small basin change in Basins P1 and P2. The submittal also reflects the addition of approximately 6825 sf of asphaltic concrete pavement in Basins P2A and P2B.

Please contact me if you have any questions or comments.

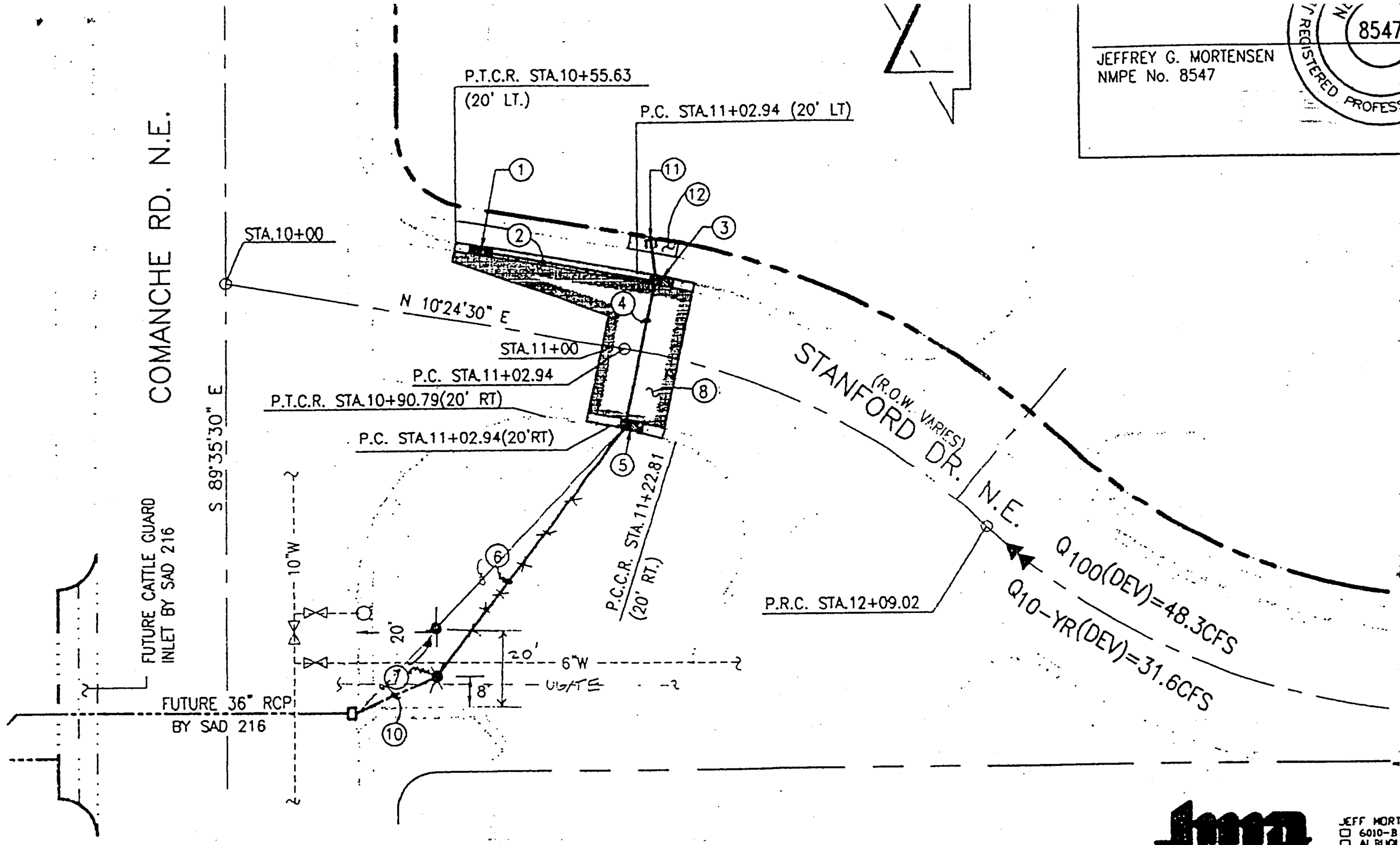
Sincerely,

BPLW ARCHITECTS & ENGINEERS, INC.

Guy Jackson PE
Director of Civil Engineering

Attachments:

xc: Steve Anderson – PNM



3 STANFORD DRIVE N.E. PUBLIC STORM DRAIN IMPROVEMENTS
SCALE: 1" = 30'

JEFFREY G. MORTENSEN
NMPE No. 8547
DATE

NEW MEXICO 8547 REGISTERED PROFESSIONAL ENGINEER

ENGINEER'S SEAL

JEFF MORTENSEN & ASSOCIATES, INC.
6010-B MIDWAY PARK BLVD. N.E.
ALBUQUERQUE NEW MEXICO 87109
ENGINEERS SURVEYORS (505) 345-4250

NO.	DATE	REMARKS	BY
2	10/99	AS-BUILT AND CERTIFY	MDS
4	10/99	ADD THIS SHEET	MDS
3	11/99	ADD DETAIL	CJS
		Revisions	
		DESIGN	
		Designed By M.D.S.	Date 10-99
		Drawn By S.G.H./J.Y.R.	Date 10-99
		Checked By J.G.M.	Date 10-99

CITY OF ALBUQUERQUE
PUBLIC WORKS DEPARTMENT
ENGINEERING DEVELOPMENT GROUP

TITLE: COMANCHE BUSINESS CENTER
COMANCHE ROAD SIDEWALK AND DRAINAGE DETAILS

Design Review Committee	City Engineer Approval	Last Design Update	Mo./Day/Yr.	Mo./Day/Yr.

Zone Map No. Sheet Of

PLATE III

BPLW

Architects & Engineers, Inc.

6200 Uptown Blvd. NE
Suite 400
Albuquerque, New Mexico 87110
(505) 881-BPLW (2759)
FAX (505) 881-1230
e-mail: bplwnm@bplw.com
web site: http://www.bplw.com

August 6, 2001

Brad Bingham, PE
Hydrology Chairman
COA - Public Works
PO Box 1293
Albuquerque, New Mexico 87103

Re: PNM Bulk Power Services
BPLW Project Number 20007.05

Dear Brad:

Attached for your review and approval are the following:

One (1) Drainage Information Sheet

One (1) Copy of the Master Grading and Drainage Plan and Report

One (1) Copy of the Construction Plans

The following are our responses to comments received on your July 11, 2001review letter. They are as follows:

- Basin P1 was larger that the existing EX1. The existing basin was drawn incorrectly. A quick review of the plans will show that, in the existing conditions, there is an existing swale along the north side of the proposed parking lot discharging into Stanford. The existing Basin EX1 has been adjusted on the Existing Drainage Plan (Sheet CD.1).
- After a site verification site visit, it is obvious that your second comment is correct. Even if the water did make it into the center pond, the invert is only 12" max below the rundown invert. This runoff volume has been accounted for in Pond "B". You are also correct on the size of the area that was modeled. It has been increased and modified on the plan (Sheet CD.2).
- The statement should have read into the "**northeast** corner of the site". This has been corrected. The property to the east only discharges its adjacent roof drains onto the PNM Site. The roof area draining onto the PNM project site is approximately 60'x100' and could generate a maximum discharge 0.65 cfs. The design of the storm drainage ponds provided an additional 12" of freeboard. This small increase should easily be accommodated within the existing design.
- The parking lot located within Basin P2 for the most part is existing. We are adding covered canopies and one additional row of cars. The

DRAINAGE INFORMATION SHEET

PROJECT TITLE: PNM Bulk Power Services ZONE ATLAS/DRWG. FILE # G-16 / D8B

DRB#: _____ EPC #: _____ WORK ORDER # : _____

LEGAL DESCRIPTION: A portion of Block D, Indian Acres Subdivision
CITY ADDRESS: 2401 Aztec Road, NE

ENGINEERING FIRM: BPLW CONTACT: Guy Jackson
ADDRESS: 6200 Uptown Blvd, NE 87110 PHONE: 880-9670

OWNER: PNM CONTACT: Steve Anderson
ADDRESS: 2401 Aztec Road, NE PHONE: 345-8411

ARCHITECT: BPLW CONTACT: Edward Aragon
ADDRESS: 6200 Uptown Blvd, NE 87110 PHONE: 881-2759

SURVEYOR: Brasher & Lorenez CONTACT: Paul Brasher
ADDRESS: 2201 San Pedro, NE PHONE: 888-6088

CONTRACTOR: --- CONTACT: _____
ADDRESS: --- PHONE: _____

TYPE OF SUBMITTAL:

x DRAINAGE REPORT
x DRAINAGE PLAN
___ CONCEPTUAL GRADING & DRAINAGE PLAN
x GRADING PLAN
___ EROSION CONTROL PLAN
___ ENGINEER'S CERTIFICATION
OTHER _____

PRE-DESIGN MEETING w/ Brad Bingham:
X YES
_ NO
__ COPY PROVIDED

CHECK TYPE OF APPROVAL SOUGHT:

___ SKETCH PLAT APPROVAL
___ PRELIMINARY PLAT APPROVAL
___ S. DEV. PLAN FOR SUB'D APPROVAL
__ S. DEV. PLAN FOR BLDG. PERMIT APPROVAL
___ SECTOR PLAN APPROVAL
___ FINAL PLAT APPROVAL
___ FOUNDATION PERMIT APPROVAL
x BUILDING PERMIT APPROVAL
___ CERTIFICATE OF OCCUPANCY APPROVAL
x GRADING PERMIT APPROVALS
x PAVING PERMIT APPROVAL
___ S.A.B. DRAINAGE REPORT
__ DRAINAGE REQUIREMENTS
x OTHER (MASTER GRADING & DRAINAGE PERMIT APPROVAL)

DATE SUBMITTED: 8-7-2001
BY: Guy Jackson

RECEIVED
AUG 7 2001
PWD/DESIGN REVIEW

approved discharge into Stanford per Comanche Business Center drawing (Plate III - City of Albuquerque project no. 605681) is 48.3 cfs and the final developed discharge from our analysis is 5.70 cfs from our site.

- When the plans were first submitted, the owner wanted to resurface all of the existing parking areas. Due to actual costs of the proposed resurfacing, this has been eliminated. The construction plans now clearly indicate the locations for the new or surface parking areas.
- The riprap along the north side of the site is to convey water from roof drains and a small portion of the site east of the new Cardio Building near the northwest corner of the site This riprap is to minimize local erosion only. There is no discharge from this site to the north. There is an existing retaining wall along the north property boundary. Aggregate sizes are D50=6" and D10=3".

Please contact me if you have any questions or comments.

Sincerely,

BPLW ARCHITECTS & ENGINEERS, INC.

Guy Jackson PE
Director of Civil Engineering

Attachments:

xc: Steve Anderson – PNM
Ed Aragon –BPLW
Dave Aube -BPLW
Jerrie Padilla -BPLW

DRAINAGE REPORT

FOR

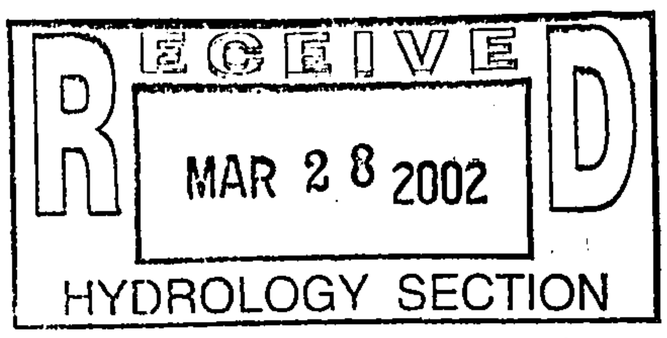
PNM BULK POWER SERVICES
NORTH AREA RENOVATIONS

BPLW PROJECT NUMBER: 20007.05

BY:

GUY C. JACKSON, PE

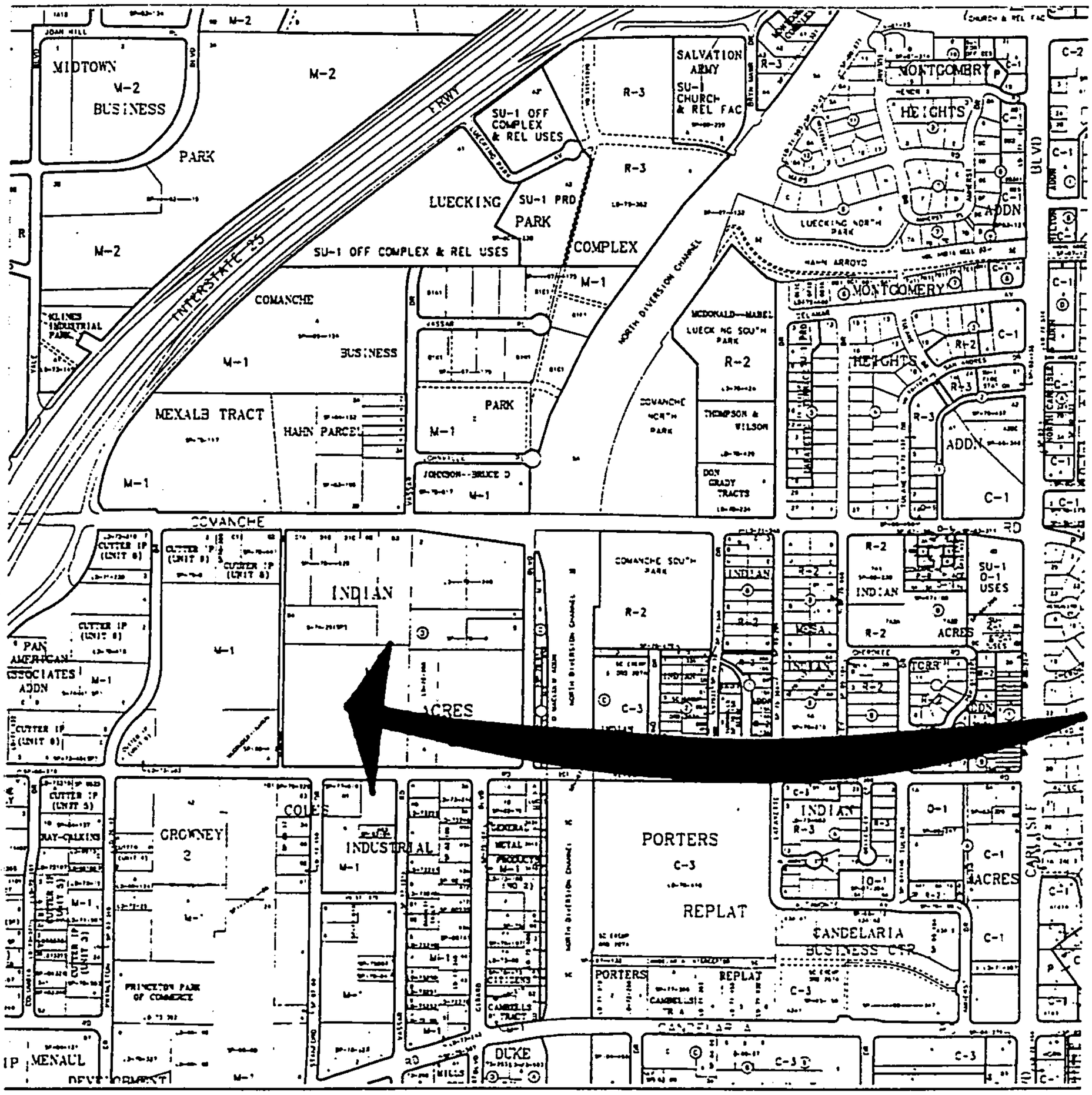
~~August 2001~~
MARCH 2002



BPLW
Architects & Engineers, Inc.

BPLW ARCHITECTS & ENGINEERS, INC.

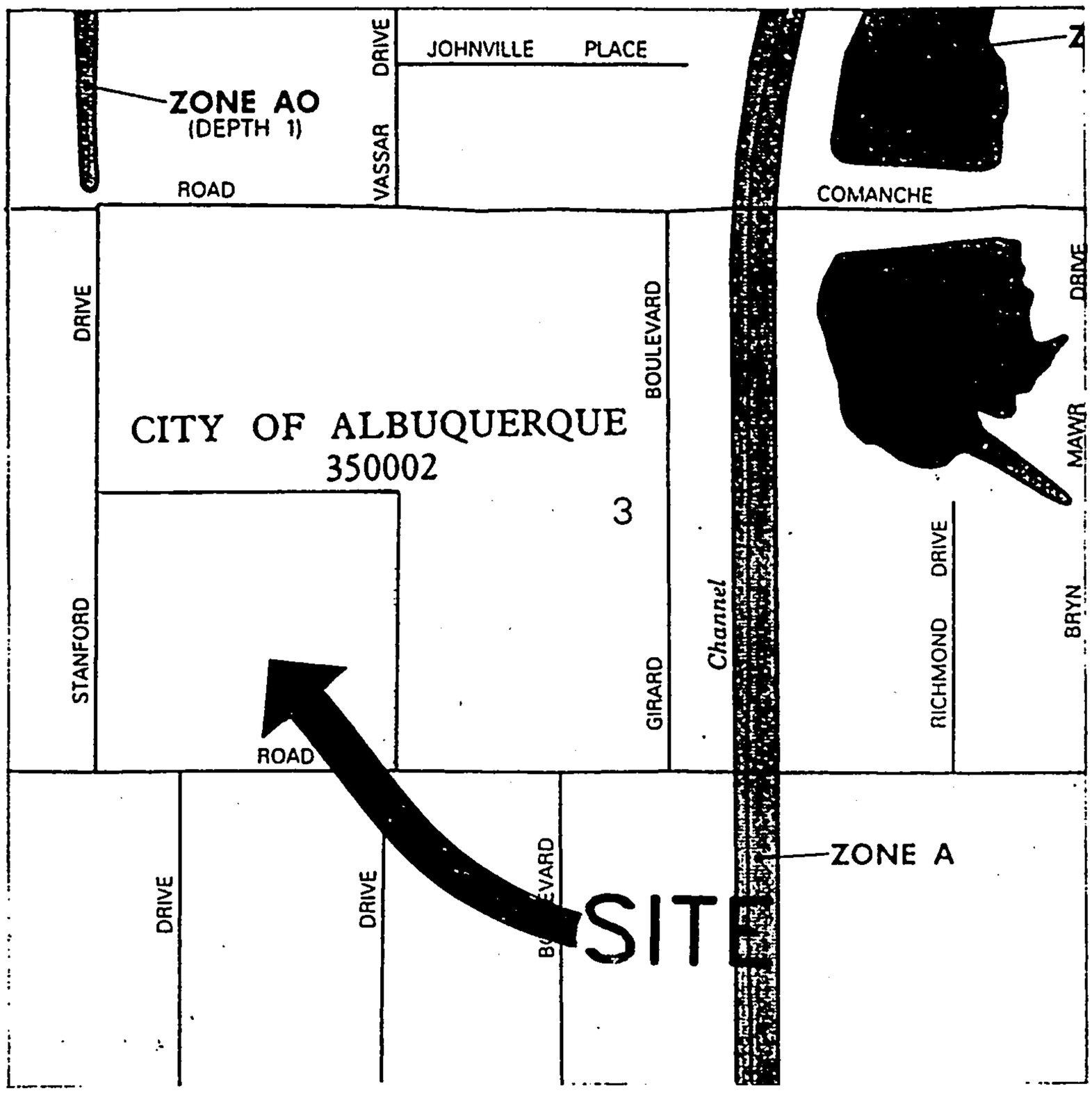
TABLE OF CONTENTS



VICINITY MAP

G-16-Z
NO SCALE

VICINITY MAP



FLOOD HAZARD MAP

FLOOD INSURANCE RATE MAP

351 OF 825

Drainage Report

General Information:

The following items pertaining to the PNM Bulk Energy Services Drainage Plan are contained herein: 1) Vicinity Map; 2) Flood Hazard Map 3) Calculations

Existing Conditions:

As shown by the Vicinity Map, the site is located north of Aztec Road, N.E. and to the east of Stanford Drive, N.E. at 2401 Aztec Road, N.E. The parcel is Block D, Indian Acres Subdivision. The property is bounded on the north by the Comanche Business Center property and to the east by the Allied Crane Commercial property. Per the flood insurance rate maps 351 of 825 for Bernalillo County, dated September 1996, the site is not in a flood hazard zone area. See the Flood Hazard Map included in this report.

The existing Basin Boundary Drainage Plan (Plate I) shows that the existing site has several buildings. There are access roads leading from Aztec Road to the main building and onto the service building at the northeast corner of the site. Currently, there are three retention ponds (A, B, & C, as shown on Plate I). Pond A collects run-off from Basin EX2. Pond B collects run-off from Basins EX3, EX4, EX5, EX8, and EX9. Pond C collects run-off from Basin EX6. Basins EX1 and EX7 currently drain into Stanford Drive, N.E., and Aztec Road, N.E., respectively. These retention ponds will remain during the proposed improvements. Two of the ponds will require reshaping to accept the excess runoff volumes necessary per Section 22.2 – Hydrology of the Development Process Manual, Volume 2, Design Criteria, dated January 1993.

Proposed Conditions:

The proposed Basin Boundary Master Drainage Plan (Plate II) shows existing contours at 1'-0" intervals, limit and character of the proposed improvements and also the existing conditions. As shown by this plan, the proposed construction consists of remodeling the existing pre-engineered building, private water extension and fire hydrant, private sewer service, the addition of parking area to the existing southwest parking lot, covered parking canopies, walkways, landscaping and the resurfacing of four parking lots.

In the existing and proposed conditions, the parking lot at the southwest portion of the site drains into Stanford Drive. The remaining site drains to three existing on-site retention ponds. The property to the east drains a portion of the adjacent roof area into the northwest corner of the site. This water currently, and will continue, to be collected in pond "B". The existing site is divided to nine sub-basins. Basin "P1" (see Sheet CD.2) generates 5.70 cfs, and sheet flows west into Stanford Drive. This sheet flow was analyzed using a broad crested weir equation that indicated an average depth of .03' or 3/8" (see Sheet A-8 for calculations). Basin "P2" generates ~~8.32~~ 8.04 cfs, and flows into retention pond "A". Pond "A" has been re-sized to retain the 100-yr 24-hr rainfall event. If developed flows exceed this required volume, Pond "A" has an overflow spillway that discharges into Stanford Drive. Basin "P2" shows a decrease in discharge due to grading for the new parking lot diverting a small amount of some flows into basin "P1". Basin "P3" generates ~~7.44~~ 8.01 cfs, and the entire basin flows into retention pond "B". Basin "P4" generates 4.23 cfs and flowing to the center of the parking lot located along the east property line. Any overflow from Basin "P4" will flow northwest toward existing retention pond "B". There is an existing rundown channel that will convey this excess runoff without erosion of the landscaping or degradation of the asphalt pavement. Basin "P5" generates 2.70 cfs, and

Δ Grading Revisions 3/02

consists of the existing access road, which flows to the center of the site and sheet flows into pond "B". See analysis point AP-6 on drawing C0.2. Basin "P6" generates 2.46 cfs, all excess runoff water flows into existing retention pond "C". This runoff matches the historic discharge into this pond and no new construction is proposed in this area. Basin "P7" continues to generate 1.51 cfs of historic sheet flow into Aztec Road to the south. Basin "P8" generates 5.54 cfs, flowing towards the center of the site through the parking lot east of the main building. This flow will be collected in a trench drain and conveyed to Pond "B" in a 15" PVC storm drain pipe (See AP-4). There is an existing concrete rundown channel that previously conveyed storm water from this parking lot to Pond "B". This existing rundown channel will remain after the proposed improvements as an integral part of the storm drainage system. The new trench drain system is only being installed to eliminate a shallow depression within the parking area. This shallow depression in the paving creates a maintenance problem and will be eliminated by minor re-grading (though milling and re-paving) of the existing parking lot. Existing concrete rundown (mentioned above) that formally conveyed storm water north along the east side of the main building, converges with another small rundown channel conveying roof drainage from the north-east corner of the building, and discharges into Pond "B" (See AP-3). Basin "P9" (primarily roof drainage) generates 0.53 cfs, combines with runoff from Basin "P8" and flow through an 18" square cattle guard drain to Pond "B" (See AP-5). Pond "B" has been sized to hold the 100-yr 24-hr event generated by basins 3, 5, 8a, 8b, & 9. See calculations starting on sheet A-12 in Appendix A. Ponding Volumes were calculated using City of Albuquerque hydrographs, using time of peak, time of duration and peak discharges. These calculations are included in appendix A on pages A-8 through A-20.

A riprap rundown will be installed north of the metal building to reduce/eliminate erosion. This rundown will only collect runoff form the future basketball court and from the roof of the existing metal building at the northwest corner of the site. This rundown channel has been analyzed using Manning's equation. See page A-21 in Appendix A.

Conclusions:

As stated above, only small offsite flows enter the site due to the drainage patterns on the neighbor's roof in the northeast corner of the site. Remaining neighbors do not have any storm water that will enter the subject site.

On site ponds have been analyzed to hold the 100-yr 24-hr event in compliance with the current City of Albuquerque Hydrology. All conveyance channels, rundowns, pipes and inlets have been sized for the 100-yr 6hr event. Storm water discharging into Aztec Road match historic values. During the predesign meeting we were granted free discharge along the west property line into Stanford Drive.

The calculations contained in this report analyze the developed conditions for the 100-year 6-hour (for peak discharge rates) rainfall event. The procedure for 40 acre or smaller basins set by section 22.2 Hydrology of the Development Process Manual, Volume 2, Design Criteria, dated January 1993, has been used to quantify the peak rate of discharge and volume of runoff generated.

APPENDIX A

Drainage Summary

Project: PNM Bulk Power Services
Project Numbe: 20007.05
Date: 05/29/01
By: Jerrie P

Site Location

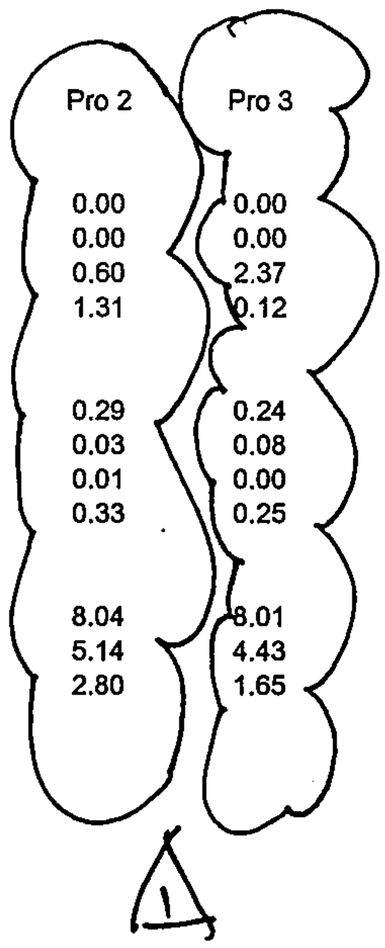
Precipitaion Zone 2 Per Table A-1 COA DPM Section 22.2

Existing summary

Basin Name	Ex 1	Ex 2	Ex 3	Ex 4	Ex 5	Ex 6	Ex 7	Ex 8	Ex 9
Soil Treatment (acres)									
Area "A"	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Area "B"	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Area "C"	1.11	0.88	2.40	0.24	0.26	0.44	0.27	0.41	0.02
Area "D"	0.18	1.11	0.01	0.74	0.40	0.23	0.14	0.89	0.10
Excess Runoff (acre-feet)									
100yr. 6hr.	0.14	0.28	0.23	0.15	0.10	0.08	0.05	0.20	0.02
10yr. 6hr.	0.07	0.04	0.09	0.02	0.03	0.06	0.06	0.03	0.01
2yr. 6hr.	0.01	0.01	0.00	0.01	0.01	0.01	0.01	0.01	0.02
100yr. 24hr.	0.14	0.32	0.23	0.18	0.11	0.09	0.05	0.23	0.02
Peak Discharge (cfs)									
100 yr.	4.33	7.98	7.58	4.23	2.70	2.46	1.51	5.47	0.53
10yr.	2.46	4.99	4.14	2.73	1.70	1.47	0.90	3.50	0.35
2yr.	1.00	2.59	1.46	1.52	0.90	0.69	0.42	1.90	0.20

Proposed summary

Basin Name	Pro 1	Pro 2	Pro 3	Pro 4	Pro 5	Pro 6	Pro 7	Pro 8a	Pro 8b
Soil Treatment (acres)									
Area "A"	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Area "B"	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Area "C"	0.23	0.60	2.37	0.24	0.26	0.44	0.27	0.21	0.13
Area "D"	1.06	1.31	0.12	0.74	0.40	0.23	0.14	0.94	0.01
Excess Runoff (acre-feet)									
100yr. 6hr.	0.21	0.29	0.24	0.15	0.10	0.08	0.05	0.19	0.01
10yr. 6hr.	0.02	0.03	0.08	0.02	0.03	0.06	0.06	0.02	0.08
2yr. 6hr.	0.02	0.01	0.00	0.01	0.01	0.01	0.01	0.02	0.00
100yr. 24hr.	0.24	0.33	0.25	0.18	0.11	0.09	0.05	0.22	0.01
Peak Discharge (cfs)									
100 yr.	5.70	8.04	8.01	4.23	2.70	2.46	1.51	5.08	0.46
10yr.	3.72	5.14	4.43	2.73	1.70	1.47	0.90	3.31	0.25
2yr.	2.11	2.80	1.65	1.52	0.90	0.69	0.42	1.87	0.10



1 BASIN CHANGES 3/02

Drainage Summary

Pro 9	Swale	Pro 3,4,5,8a,8b
0.00	0.00	0.00
0.00	0.00	0.00
0.02	0.16	3.21
0.10	0.20	2.09
0.02	0.05	0.67
0.01	0.04	0.05
0.02	0.01	0.01
0.02	0.06	0.74
0.53	1.44	19.90
0.35	0.90	12.05
0.20	0.47	5.81

A-2

BPLW

Architects and Engineers

PROJECT **PNM Bulk Power Services**
PROJECT NO. **20007.05**
DATE **05/29/01**
BY **Jerrie P**

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	**Pro 1**		
Precipitation Zone		**2**	
Land Area		**1.29**	acres
Excess Precipitation Volume			
	>>> 100-year 6-hour (design)	**0.21**	**acre-ft.**
	10-year 6-hour	**0.02**	acre-ft.
	2-year 6-hour	**0.02**	acre-ft.
	100-year 24-hour	**0.24**	acre-ft.
Peak Discharge Rates (DPM)			
	>>> Q100 (design)	**5.70**	**cfs**
	Q10	**3.72**	cfs
	Q2	**2.11**	cfs
Peak Discharge Rates (DPM-Rational Method)			
	>>> Q100 (design)	**5.70**	**cfs**
	Q10	**3.72**	cfs
	Q2	**2.10**	cfs

CALCULATIONS FOLLOW

A-3

INPUT AND CALCULATIONS

	LOCATION	**Pro 1**	
>A.1	PRECIPITATION ZONE (from Table A-1)	**2**	
>A.2	DEPTHS		
	(from Table A-2)		
	100-YEAR STORM (P60)	**2.01**	inches
	100-YEAR STORM (P360)	**2.35**	inches
	100-YEAR STORM (P1440)	**2.75**	inches
	10-YEAR (P360) (Calculated: P360*RPF10)	**1.57**	inches
	2-YEAR (P360) (Calculated: P360*RPF2)	**1.02**	inches
>A.3	**LAND TREATMENTS (Ai)**		
	Treatment A	**0.00**	acres
	Treatment B	**0.00**	acres
	Treatment C	**0.23**	acres
	Treatment D	**1.06**	acres
	Total Area	**1.29**	acres
>A.4	**ABSTRACTIONS**	**See A.5**	

CALCULATIONS FOLLOW

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	**0.53**	inches
Treatment B	**0.78**	inches
Treatment C	**1.13**	inches
Treatment D	**2.12**	inches
WEIGHTED E (Sum Ei*Ai/A)	**1.94**	inches
VOLUME V100:6h (E*A)	**0.21**	acre-ft.
	9,100.77	ft^3
10-year 6-hour		
Treatment A	**0.13**	inches
Treatment B	**0.28**	inches
Treatment C	**0.52**	inches
Treatment D	**1.34**	inches
WEIGHTED E (Sum Ei*Ai/A)	**0.24**	inches
VOLUME V10:6h (E*A)	**0.02**	acre-ft.
	676.46	ft^3
2-year 6-hour		
Treatment A	**0.00**	inches
Treatment B	**0.02**	inches
Treatment C	**0.15**	inches
Treatment D	**0.79**	inches
WEIGHTED E (Sum Ei*Ai/A)	**0.68**	inches
VOLUME V2:6h (E*A)	**0.02**	acre-ft.
	686.98	ft^3
100-year 24-hour		
VOLUME V100:24h (V100-6h+Ad*P1440-P360)/12)	**0.24**	acre-ft.
	10,639.89	ft^3

CALCULATIONS FOLLOW

A-5

INPUT AND CALCULATIONS (CON'T)

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

100-year		
Treatment A	**1.56**	cfs/acre
Treatment B	**2.28**	cfs/acre
Treatment C	**3.14**	cfs/acre
Treatment D	**4.70**	cfs/acre
Q100 (Sum Qi*Ai)	**5.70**	cfs
10-year		
Treatment A	**0.38**	cfs/acre
Treatment B	**0.95**	cfs/acre
Treatment C	**1.71**	cfs/acre
Treatment D	**3.14**	cfs/acre
Q10 (Sum Qi*Ai)	**3.72**	cfs
2-year		
Treatment A	**0.00**	cfs/acre
Treatment B	**0.08**	cfs/acre
Treatment C	**0.60**	cfs/acre
Treatment D	**1.86**	cfs/acre
Q2 (Sum Qi*Ai)	**2.11**	cfs

CALCULATIONS FOLLOW

A-6

RATIONAL METHOD

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

Peak Intensity (I) 100-year	**5.05**
Peak Intensity (I) 10-year	**3.41**
Peak Intensity (I) 2-year	**2.04**

RATIONAL METHOD COEFFICIENT, C
from Table A-11

100-year		
Treatment A	**0.31**	cfs/acre
Treatment B	**0.45**	cfs/acre
Treatment C	**0.62**	cfs/acre
Treatment D	**0.93**	cfs/acre
Q100 (Sum Qi*I*Ai)	5.70	cfs
10-year		
Treatment A	**0.11**	cfs/acre
Treatment B	**0.28**	cfs/acre
Treatment C	**0.50**	cfs/acre
Treatment D	**0.92**	cfs/acre
Q10 (Sum Qi*I*Ai)	3.72	cfs
2-year		
Treatment A	**0.00**	cfs/acre
Treatment B	**0.04**	cfs/acre
Treatment C	**0.29**	cfs/acre
Treatment D	**0.91**	cfs/acre
Q2 (Sum Qi*I*Ai)	2.10	cfs

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BASIN P1/AP1

Need: $Q_{100} = 5.70$ cfs
depth = weir equation = $Q = CLH^{3/2}$

$C = 3.33$ $L = 376$ ft

$Q = CLH^{3/2} \Rightarrow \frac{Q}{CL} = H^{3/2} \Rightarrow \frac{5.7}{(3.3)(376)} = h^{1.5}$

$0.00460 = h^{1.5}$ $h = 0.03'$

$= 3/8"$

Basin P2/AP2

Need: $Q_{100} = 0.32$ cfs
$V100_{24} = V1440 = V360 + A_D * (P1440 - P360)/12 in/ft$

Weighted E = 1.7396 inches
$V360 =$ weighted $E * (A_A + A_B + A_C + A_D)/12$
$= \frac{(1.7396)(2.03)}{12}$

$= 0.29$ acre-ft

From Table A-2/zone 2
P360 = 2.35
P1440 = 2.75

$V1440 = (V360 + A_D)[(P1440 - P360)/12 in/ft)]$
$= 0.29 + [(1.25)(\frac{2.75 - 2.35}{12})]$
$= 0.33$ acre-feet

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BASIN P2 / AP2 continued

Need: Vavailable = 11,008.3 cf (EXISTING POND NEEDS RESHAPING).

$V_{100(24)} = 0.33 \text{ acre-ft} \left(\frac{43560 \text{ ft}^2}{\text{acre}}\right) = 14,447.4 \text{ cf}$

Vavailable (existing) = too small
Vavailable (proposed) = 23,518.72 ft³ okay

TOP OF BERM 5090.5

▽ 5089.20 ft

$V_{100(24)} = 14,447.4 \text{ cf}$

5087

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Pond calculations

Pond A (proposed)

Elevation	Area (sf)	Volume (cf)	Σ Volume
5087	3361.0		
		4,725.90	4,725.90
5088	6090.30		
		7,397.85	12,123.80
5089	8705.39		
		11,392.92	23,516.72
5090	14080.45		

Solve for MWSEL

$$y_0 = \left[\frac{x_0 - x_2}{x_1 - x_2} * (y_1 - y_2) \right] + y_2$$

y_1 89 x_1 12,123.80
y_0 x x_0 14,447.4
y_2 90 x_2 23,516.72

$$y_0 = \left[\frac{14,810 - 23,516.72}{12,123.80 - 23,516.72} * (89 - 90) \right] + 90$$

MWSEL = 89.76ft
89.24ft

1

Δ Basin Changes 3/02

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Hydrograph for Pond A / BasinP2

Given
$A_T = 2.03$ acres $A_D = 1.25$ acres $t_c = 0.2$ hour
$Q_p = 8.32$ cfs $A_L = 0.78$ acres

$$t_p = (0.7)(t_c) + (1.6 - A_D/A_T)/12$$

$$= \frac{[(0.7)(0.2)] + (1.6 - \frac{1.25}{2.03})}{12} = \underline{0.2220 \text{ hours}}$$

Duration of Peak

$$(0.25)\left(\frac{A_D}{A_T}\right) = (0.25)\left(\frac{1.25}{2.03}\right) = 0.1539 \text{ hours}$$

$$t_B = \left[(2.107)(E)\left(\frac{A_T}{Q_P}\right)\right] - \left[(.25)\left(\frac{A_D}{A_T}\right)\right]$$

$$E = \frac{E_A A_A + E_B A_B + E_C A_C + E_D A_D}{A_A + A_B + A_C + A_D}$$

Zone 2: Treatment C = 1.13
Treatment D = 2.12

$$E = \frac{(1.13)(0.78) + (2.12)(1.25)}{0.78 + 1.25} = 1.7396 \text{ inches}$$

$$t_B = \left[(2.107)(1.7396)\left(\frac{2.03}{8.32}\right)\right] - 0.1539 = \underline{0.7404 \text{ hours}}$$

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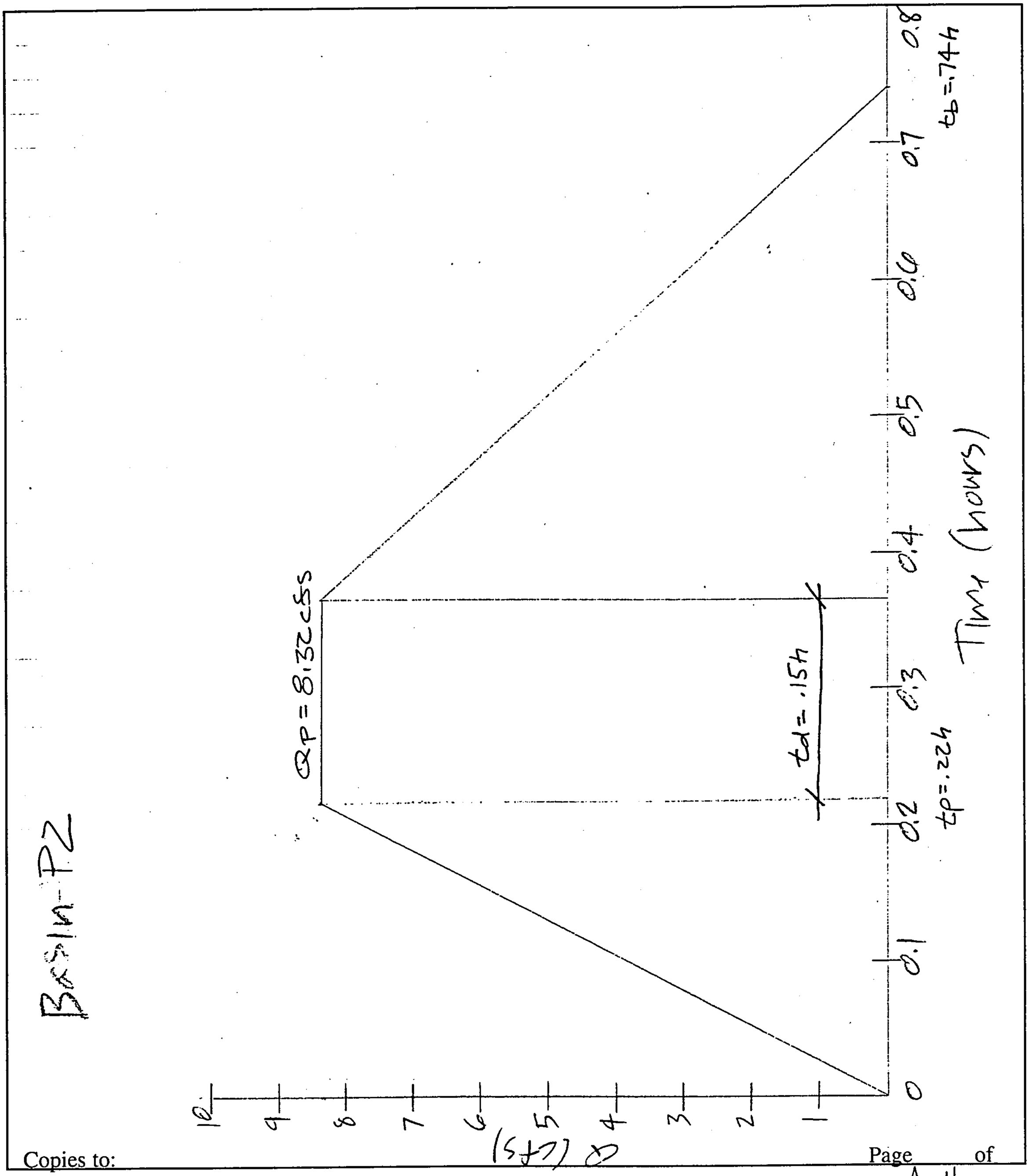

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Pond B/Basin P3, P4, P5, P8a & P8b

Basin #	Area (acre)	Area C (acre)	Area D (acre)
P3	2.37	2.37	0
P4	0.98	0.24	0.74
P5	0.66	0.26	0.40
P8a	1.15	0.21	0.94
P8b	0.14	0.13	0.01
	5.30	3.21	2.09

Given:
$Q_p = 19.91$ $A_T = 5.32$ acres $A_C = 3.21$ acres $A_D = 2.09$ acres $t_c = 0.2$ hours

$t_p = 0.7 t_c + (1.6 - A_D/A_T)/12$

$= [(0.7)(0.2)] + \left[1.6 - \frac{2.09}{5.30}\right]/12 = 0.2404$ hours

Duration of Peak:

$(0.25)\left(\frac{A_D}{A_T}\right) = (0.25)\left(\frac{2.09}{5.30}\right) = 0.0985$ hours

$t_B = \left[(2.107)(E)\left(\frac{A_T}{Q_p}\right)\right] - \left[(0.25)\left(\frac{A_D}{A_T}\right)\right]$

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$$E = \frac{E_C A_C + E_D A_D}{A_C + A_D}$$

From Table A-8/zone 2:
Treatment C = 1.13
Treatment D = 2.12

$$E = \frac{(1.13)(3.21) + (2.12)(2.09)}{5.30} = 1.5203$$

$$t_B = \left[(2.107)(1.5203)\left(\frac{5.30}{19.91}\right)\right] - 0.0985 = 0.7542 \text{ hours}$$

Area under Trapezoid

$$A = \frac{(b_1 + b_2)h}{2} = \frac{(0.0985 + 0.7542)19.91}{2}$$

$$= (8.48)(3600) = 30,528.00 \text{ cf}$$

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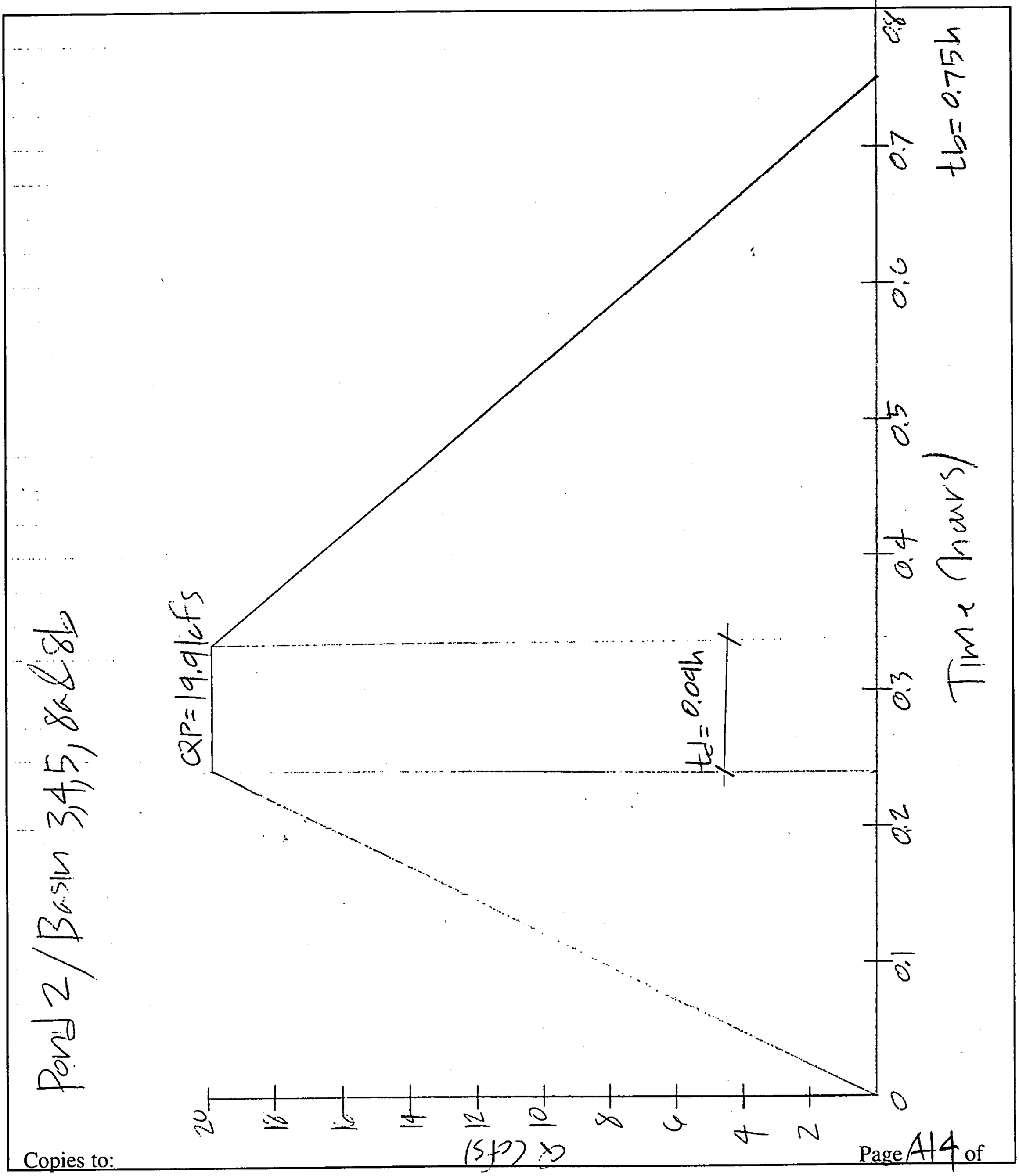

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Pond B / Basin 3, 4, 5, 8a & 8b

Elevation	Area (sf)	Volume (cf)	Σ Volume
89	6488.32		
90	9053.67	7770.91	7770.91
91	12177.02	10,615.04	18,386.64
92	15984.24	14,080.93	32,467.57
93	20255.65	18,119.94	50,587.51

Solve for MWSEL:

$$y_0 = \left[\frac{x_0 - x_2}{x_1 - x_2} * (y_1 - y_2)\right] + y_2$$

$y_1 = 91$ $x_1 = 18,386.64$
$y_0 = x$ $x_0 = 30,528.00$
$y_2 = 92$ $x_2 = 32,467.57$

$$y_0 = \left[\frac{34412}{\cancel{30,528} - 32,467.57} * (91 - 92)\right] + 92$$

$$\cancel{18,386.64} - 32,467.57$$

92.14

MWSEL = ~~91.86~~ ft

92.14

∇ ~~5041.86~~ ft

$V_{(92-91)} = \cancel{30528}$ cf
34,412 cf

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Hydrograph for Pond C/Basin P6

Given:

$A_T = 0.67$ acres $A_D = 0.23$ acres $t_c = 0.2$ hour

$Q_p = 2.46$ cfs $A_C = 0.44$ acres

$$t_p = (0.7)(t_c) + (1.6 - A_D/A_T)/12$$

$$= [(0.7)(0.2)] + \frac{[1.6 - (\frac{0.23}{0.67})]}{12} = \underline{0.2447 \text{ hours}}$$

Duration of Peak

$$(0.25)\left(\frac{A_D}{A_T}\right) = (0.25)\left(\frac{0.23}{0.67}\right) = 0.0858 \text{ hours}$$

$$t_B = \left[(2.107)(E)\left(\frac{A_T}{Q_P}\right)\right] - \left[(.25)\left(\frac{A_D}{A_T}\right)\right]$$

$$E = \frac{E_C A_C + E_D A_D}{A_T} = \frac{(1.13)(0.44) + (2.12)(0.23)}{0.67}$$

$$= 1.4699 \text{ inches}$$

$$t_B = \left[(2.107)(1.4699)\left(\frac{0.67}{2.46}\right)\right] - 0.0858 = 0.7577 \text{ hours}$$

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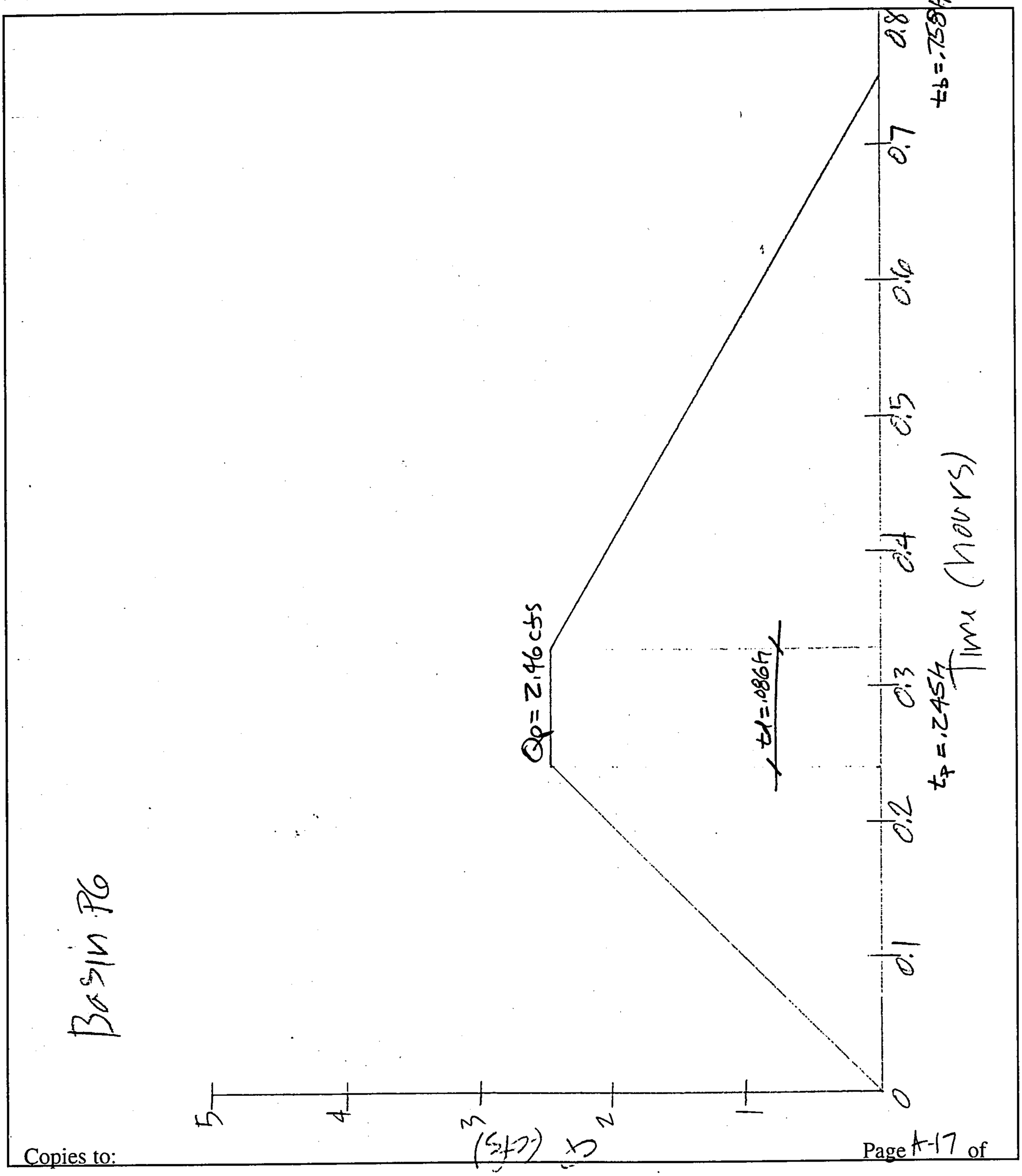

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Volumes from Hydrographs:

Basin P2

Area 1 = $\frac{1}{2}bh = \frac{1}{2}[(0.2220)(8.32)] = 0.9235$

Area 2 = $bh = (0.1539)(8.32) = 1.2804$

Area 3 = $\frac{1}{2}bh = \frac{1}{2}[(0.3645)(8.32)] = 1.5163$

$\frac{(3.7202)(3600)}{}$

$= 13,392.72 \text{ ft}^3$

Basin P3: (at Present Conditions)

Area 1 = $\frac{1}{2}bh = \frac{1}{2}[(0.2733)(7.44)] = 1.0166$

Area 2 = $\frac{1}{2}bh = \frac{1}{2}[(0.4851)(7.44)] = 1.8045$

$\frac{(2.8212)(3600)}{}$

$= 10,156.32 \text{ ft}^3$

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BASIN PG:

$$\text{Area} = \frac{(b_1 + b_2)h}{2} = \frac{(0.2447 + 0.7577)2.46}{2}$$

$$= (1.2329)(3600)$$

$$= 4,438.44 \text{ ft}^3$$

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Pond Calculations:

Pond A: (existing)

Elevation	Area (sf)	Volume (cf)	Σ volume
5086			
5087	529.04	1,749.99	1,749.99
5088	2970.95	3,740.14	5,490.14
5089	4509.34	5,518.25	11,008.39
5090	6527.16		

Pond B:

Elevation	Area (sf)	Volume (cf)	Σ volume
5090	5169.75	6476.08	6476.08
5091	7782.41	9900.51	16,376.59
5092	12018.62	14,199.93	30,576.52
5093	16381.24		

Pond C:

Elevation	Area (sf)	Volume (cf)	Σ volume
5094	1760.81	3247.13	3247.13
5095	4733.45		

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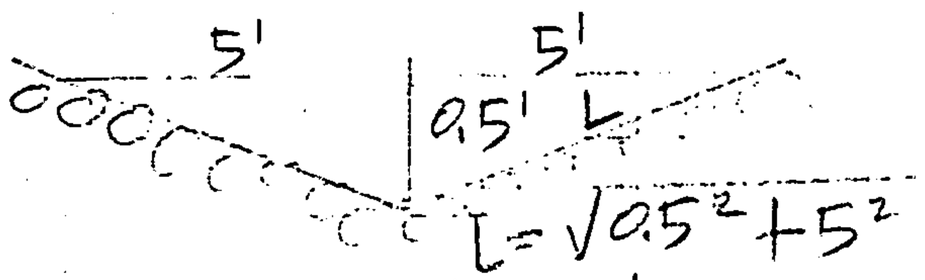
Basin P2/A7/2

$Q_{req} = 1.44$ cfs



$n = 0.035$ (stony cobbles)

Manning's Equation: $Q = \frac{k}{n} A R^{2/3} S^{1/2}$

$k = 1.486$ $n = 0.035$ $R = A/P$ $WP = P = 2L$

$A = \left(\frac{1}{2} \times 5' \times .5'\right) 2 = 2.5 ft^2$

$WP = 2\left(\sqrt{5^2 + 0.5^2}\right) = 10.04 ft$

$R = \frac{2.5 ft^2}{10.04 ft} = 0.25 ft$

$S = \frac{1'}{106.24'} = 0.001 = 0.01 ft/ft$

$Q = \left(\frac{1.486}{0.035}\right) 2.5 ft^2 (0.25)^{2/3} (0.01 ft/ft)^{1/2}$

$Q = 4.21$ cfs > 1.44 cfs ok

$A = d \times d \times 10 = 10d^2$

$WP = 2\left(\sqrt{10^2 + d^2}\right) \approx 20d$

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(505) 881-2759

49 West First Street
Suite 100
Mesa, AZ 85201
(480) 827-2759

Martin Building, Suite 501
215 North Stanton Street
El Paso, TX 79901
(915) 545-1665

Project_____

Subject_____

Project # _____ Date _____ By_____

- ☐ Memorandum
- ☐ Telephone Record
- ☐ Note to the File
- ☐ Minutes of Meeting
- ☐ To be Typed
- ☐ _____

$$R = \frac{d}{2}$$

$$Q = \frac{k}{n} A R^{2/3} S^{1/2}$$

$$1.44 \text{ cfs} = \left(\frac{1.486}{0.035}\right)(10d^2)\left(\frac{d}{2}\right)^{2/3}(0.01)^{1/2}$$

$$d = 0.36'$$

$$= 4\,3/8''$$

Copies to:

BPLW

Architects & Engineers, Inc.

6200 Uptown Blvd. NE
Suite 400
Albuquerque, NM 87110
(505) 881-2759

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BasinP4/AP10

Need: Q100 (Historic) = 4.23 cfs

Q100 (Developed) = 4.23 cfs

No change

BasinP5/AP9

Need: Q100 (Historic) = 2.70 cfs

Q100 (Developed) = 2.70 cfs

No change

BasinP6/AP8

Need: Q100 (Historic) = 2.46 cfs

Q100 (Developed) = 2.46 cfs

No change

BasinP7/AP7

Need; Q100 (Historic) = 1.51 cfs

Q100 (Developed) = 1.51 cfs

No change

Copies to:

APPENDIX B

Plate I	Existing Basin Boundary & Drainage Plan
Plate II	Proposed Basin Boundary & Master Drainage Plan