

STORM DRAINAGE ANALYSIS

STEPHEN LIBS CANDY COMPANY

Waterford Place Subdivision - Lot No. 7
Evansville, Indiana

BLA Project No. 197-0136-OPD

Prepared for:

Castle Contracting Corp.
2626 Kotter Avenue
Evansville, IN 47715

By:

Bernardin, Lochmueller & Associates, Inc.
6200 Vogel Road
Evansville, IN 47714-4006
(812) 479-6200

SEPTEMBER 24, 1997



BERNARDIN • LOCHMUELLER & ASSOCIATES, INC.

PLANNERS • ENGINEERS • SURVEYORS
6200 VOGEL ROAD, EVANSVILLE, INDIANA 47715-4006
PH: (812) 479-6200 / FAX: (812) 479-6262

TRANSMITTAL

DATE: September 25, 1997

TO: Vanderburgh County Surveyor
Room 325 Civic Center Complex
Evansville, IN 47708

RE: Stephen Libs Candy
Lot 7 Waterford Place Sub.
BLA Project No. :197-0136-OPD

Attn: Bill Jeffers, Deputy Surveyor

We Transmit:

Attached Under Separate Cover In Accordance With Your Request

Via:

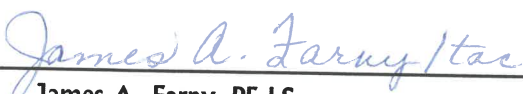
UPS Ground UPS Next Day Air First Class Mail Messenger

No. Copies	Dated	Description
1	9/24/97	Storm Drainage Analysis

Remarks: Please review and call us with your comments/revisions. We will prepare three sets for distribution after your review.

Sincerely,

BERNARDIN • LOCHMUELLER & ASSOCIATES, INC.


by: James A. Farny, PE LS

/tac

Copies to : File

INTRODUCTION

The proposed Stephen Libs Candy Company facility is located in Evansville along Vogel Road west of the Vogel Road/Burkhardt Road intersection. It is to be constructed on Lot 7 of Waterford Place Subdivision.

Waterford Place Subdivision was approved by the Area Plan Commission and has received preliminary drainage approval from the Vanderburgh County Drainage Board . The preliminary plan was approved with the premise that final drainage approval of each lot would be ascertained prior to the issuance of building permits for each individual lot.

Therefore, it is the intent of this drainage report to address the storm needs for the development of Lot 7 of Waterford Place Subdivision. This will be based on the comparison of the runoff generated by a 10 year pre-developed storm versus a 25 year developed storm. The allowable release rate will be calculated and the difference stored in a dry basin/lawn area west of the proposed structure. The outfall sewer will be sized to regulate the outflow from this developed site in such a manner that there will be no adverse effect on the adjoining properties.

METHOD

The Rational Method ($Q = CIA$) will be used to compute the 10 year undeveloped flow.

"c" = Runoff Coefficient. The existing land is extremely flat and cropped. In the past such areas have been considered to have a runoff coefficient of 0.2.

"i" = Intensity. Kerby's Formula will be used to determine the Time of Concentration for this site and the corresponding 10 year intensity will be calculated (see Appendix B). From these values the 10 year allowable runoff rate will be established.

"a" = Area. The undeveloped contributory area will be calculated.

From these factors the undeveloped runoff rate will be established.

Subsequently, a developed "c" factor will also be calculated based on the proposed site improvements (see Appendix B).

Rainfall intensity values for different duration storms having a 25 year specified return rate will be used to compute expected inflow rates into the detention pond at specified intervals.

From this, the required storage for each duration will be computed. The largest volume will be used as the required pond capacity. A dry basin will be constructed having adequate capacity to store this anticipated increase in runoff.

The detention basin outlet structure will be sized and its performance noted under various head conditions to demonstrate how it will perform under different headwaters (see Appendix D)

RESULTS

The increase in storm water runoff generated by this development will be stored as outlined above. The factors used to determine the proper storage requirement, the calculated outflow rate, available storage and outlet pipe size is listed as follows:

Contributory Area: 1.05 acres

Allowable outflow rate: 0.56 cfs

Outlet pipe: primary 6"/overflow MH Casting & 12" pipe

Required storage volume: 3159 cf

Available storage volume: 4478 cf (exceeds 100 year)

SUMMARY

The developers of this property will assume maintenance of the proposed stormwater facility. All runoff from the paved areas and roof top have been designed to drain into this facility. All swales have been designed with a minimum 0.8% grade to drain properly without the use of a paved invert.

The ditch along Vogel Road will be piped in an effort to make the area more pleasing to the eye. A second short storm sewer run will be placed up the west line that will be utilized to drain the subject property and is in an easement whereby the developer of the lot south of the subject lot can extend this pipe at a later date to be utilized in conjunction with the drainage plan implemented on the adjoining lot.

Proper implementation of the drainage plan outlined herein represents a workable plan for this lot and those other lots that adjoin this site which is in accordance with the preliminary drainage plan previously submitted and approved for this subdivision.

APPENDICES INDEX

Appendix A - Grading Plan

Appendix B - Runoff Coefficients/Time of Concentration

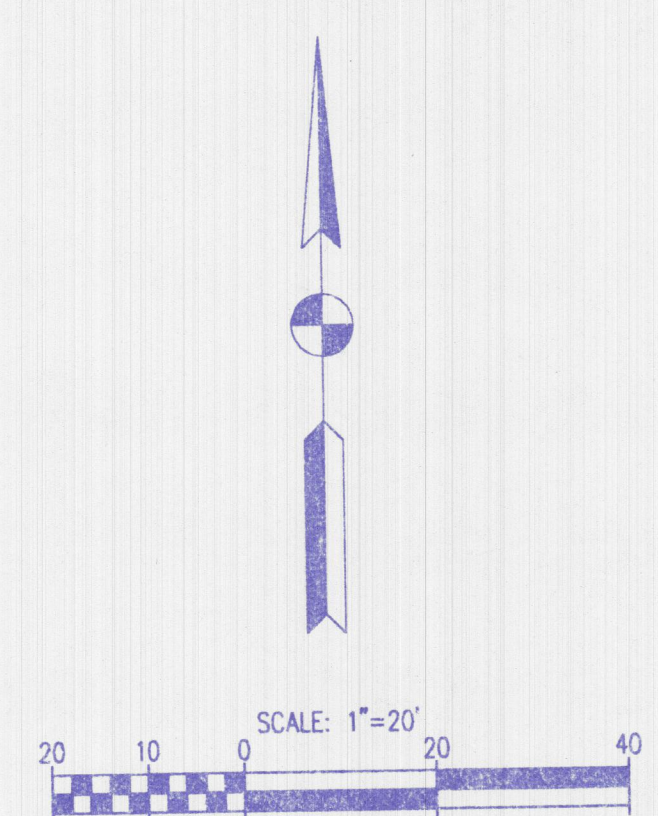
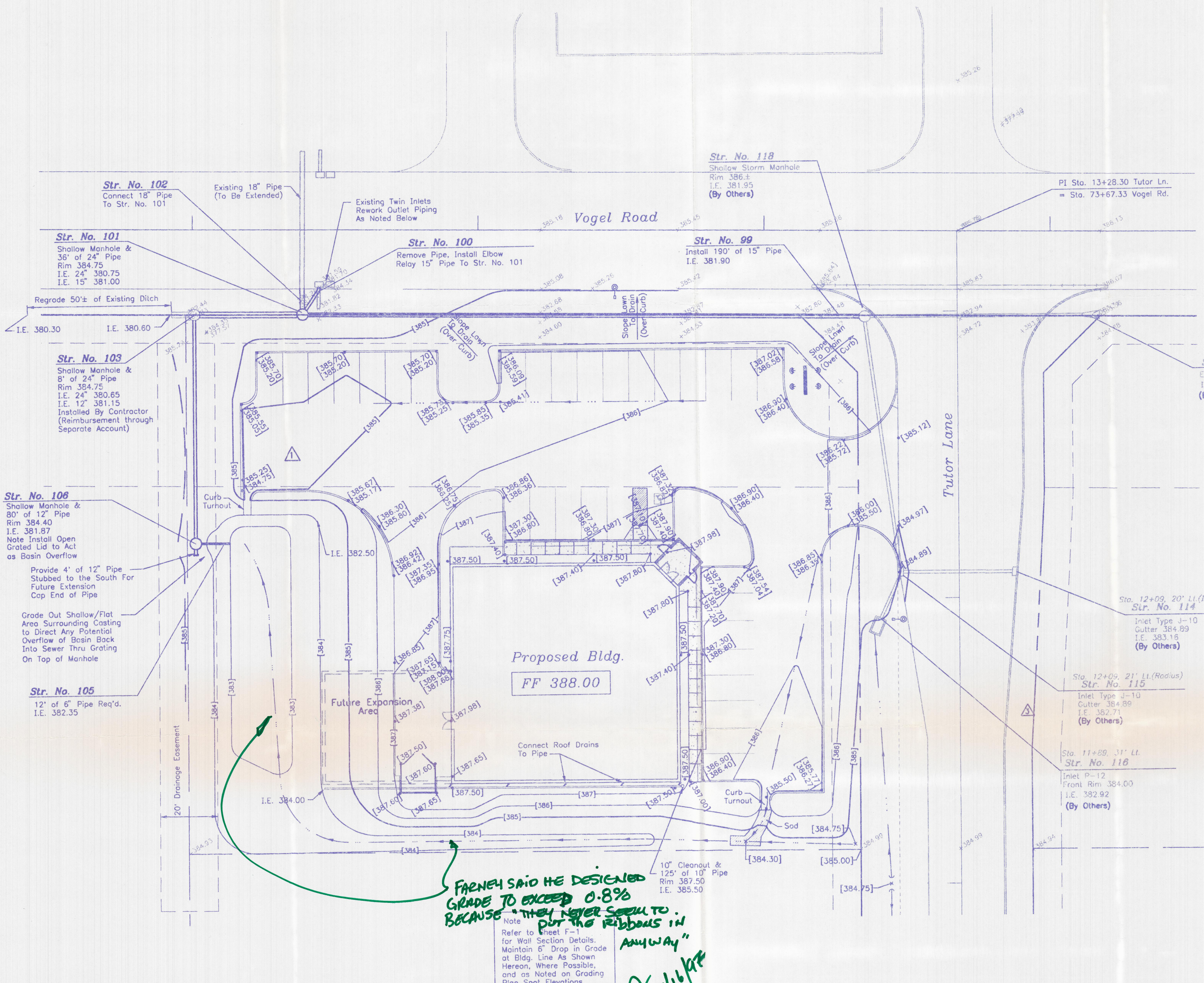
Appendix C - Storage Volume Data

Appendix D - Outlet Control Structure Analysis

Appendix E - Basin Volume



APPENDIX "A"
GRADING PLAN



Str. No. 102
Connect 18" Pipe
To Str. No. 101

Existing 18" Pipe
(To Be Extended)

Str. No. 101
Shallow Manhole &
36' of 24" Pipe
Rim 384.75
I.E. 24" 380.75
I.E. 15" 381.00

Str. No. 100
Remove Pipe, Install Elbow
Relay 15" Pipe To Str. No. 101

Str. No. 99
Install 190' of 15" Pipe
I.E. 381.90

Str. No. 118
Shallow Storm Manhole
Rim 386.3
I.E. 381.95
(By Others)

PI Sta. 13+28.30 Tutor Ln.
= Sta. 73+67.33 Vogel Rd.

Str. No. 103
Shallow Manhole &
8' of 24" Pipe
Rim 384.75
I.E. 24" 380.65
I.E. 12" 381.15
Installed By Contractor
(Reimbursement through
Separate Account)

Str. No. 117
End Section
I.E. 382.33
(By Others)

Str. No. 106
Shallow Manhole &
80' of 12" Pipe
Rim 384.40
I.E. 381.87
Note Install Open
Grated Lid to Act
as Basin Overflow

Provide 4' of 12" Pipe
Stubbed to the South For
Future Extension
Cap End of Pipe

Grade Out Shallow/Flat
Area Surrounding Casting
to Direct Any Potential
Overflow of Basin Back
Into Sewer Thru Grating
On Top of Manhole

Str. No. 105
12' of 6" Pipe Req'd.
I.E. 382.35

Sta. 12+09, 20' Lt. (In Taper)
Str. No. 114
Inlet Type J-10
Gutter 384.89
I.E. 383.15
(By Others)

Sta. 12+09, 21' Lt. (Radius)
Str. No. 115
Inlet Type J-10
Gutter 384.89
I.E. 382.71
(By Others)

Sta. 11+89, 31' Lt.
Str. No. 116
Inlet P-12
Front Rim 384.00
I.E. 382.92
(By Others)

Proposed Bldg.
FF 388.00

Future Expansion
Area

*FARNEY SAID HE DESIGNED
GRADE TO EXCEED 0.8%
BECAUSE THEY NEVER SEEM TO
PUT THE RIBBONS IN
ANYWAY*

Note
Refer to Sheet F-1
for Wall Section Details.
Maintain 6" Drop in Grade
at Bldg. Line As Shown
Hereon, Where Possible,
and as Noted on Grading
Plan Spot Elevations.

WJG 10/16/97

GENERAL STORM SEWER SPECIFICATIONS

All Materials Used Shall Be In Accordance With The Vanderburgh
County Drainage Ordinance Dated October 1994.

Storm Sewer Pipe May Be Plastic or Concrete
As Approved By Owner. Plastic Pipe Shall Be ADS-N-12 Or Equal.
No Plastic End Treatment Will Be Allowed. Concrete End
Sections Must Be Used With Plastic Pipe. All Pipe Must Meet The
Manufacturers Recommendations For Minimum & Maximum Cover.
In Areas Where Cover Does Not Fall Within The Manufacturers
Recommendations, Concrete Pipe Must Be Used.

High Density Polyethylene Type S (HDPE) Pipe Shall Be Manufactured
In Accordance With AASHTO M294. Pipe Shall Have Minimum Cell Clos-
sification Of D 324420C In Accordance With ASTM D3350.

HDPE Pipe Shall Possess Male & Female Pipe Ends Which Allow For
The Construction Of Overlapping, Gasketed Pipe Joints In Conformance
With AASHTO M294.

Reinforced Concrete Pipe Shall Be Class III, IV or V In Accordance With
ASTM C76 Latest Edition.

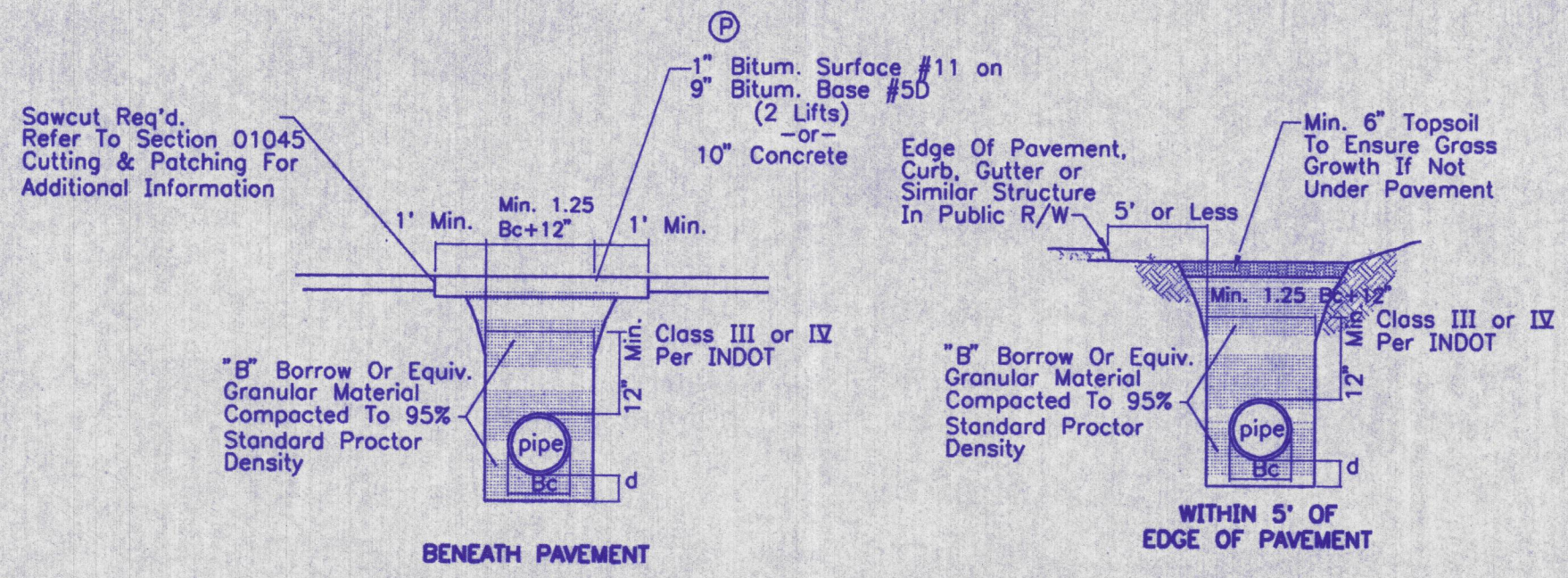
A Minimum "B" Wall Thickness Is Required. Joints Shall Be Provided
With A Groove On The Spigot For Placement Of A Rubber Gasket In
Accordance With ASTM C443.

All Manholes & Inlet Boxes Shall Be Constructed As Shown On Sheet 3.

All Parking Lot Inlets and Area Drains Shall Be Precast
Boxes. As per the INDOT Standard Specifications,
latest revision.

All Cleanouts for the Roof Drains Shall be Constructed
as Shown On Sheet 3.

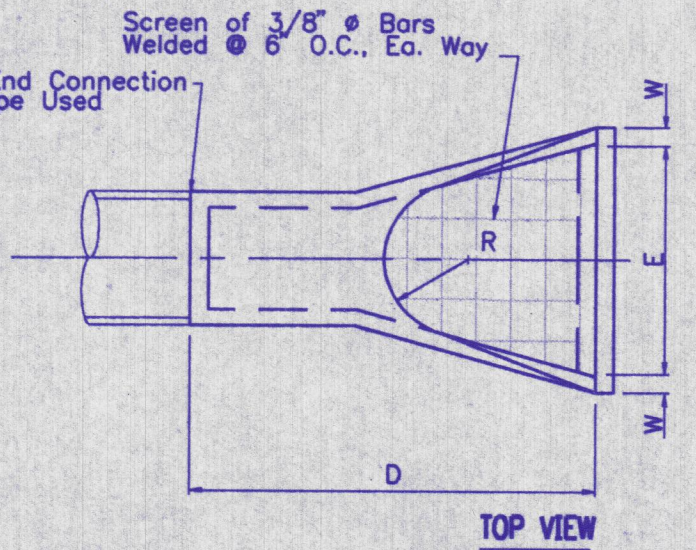
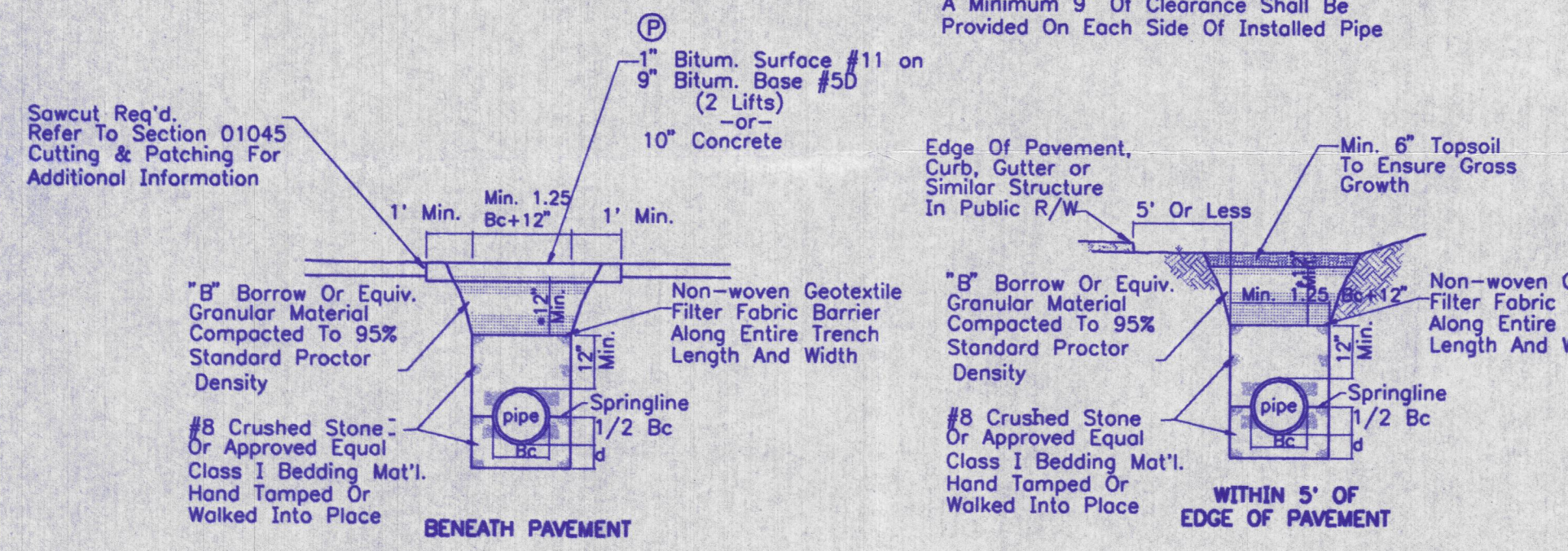
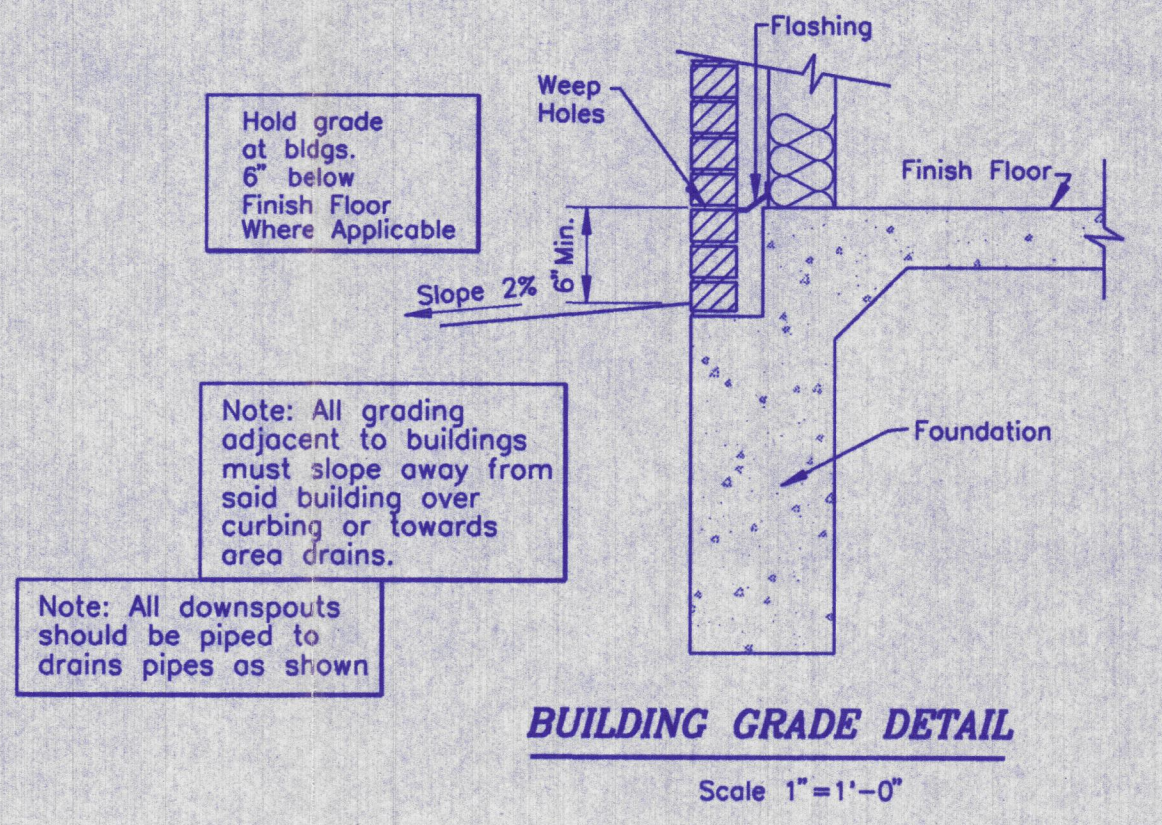
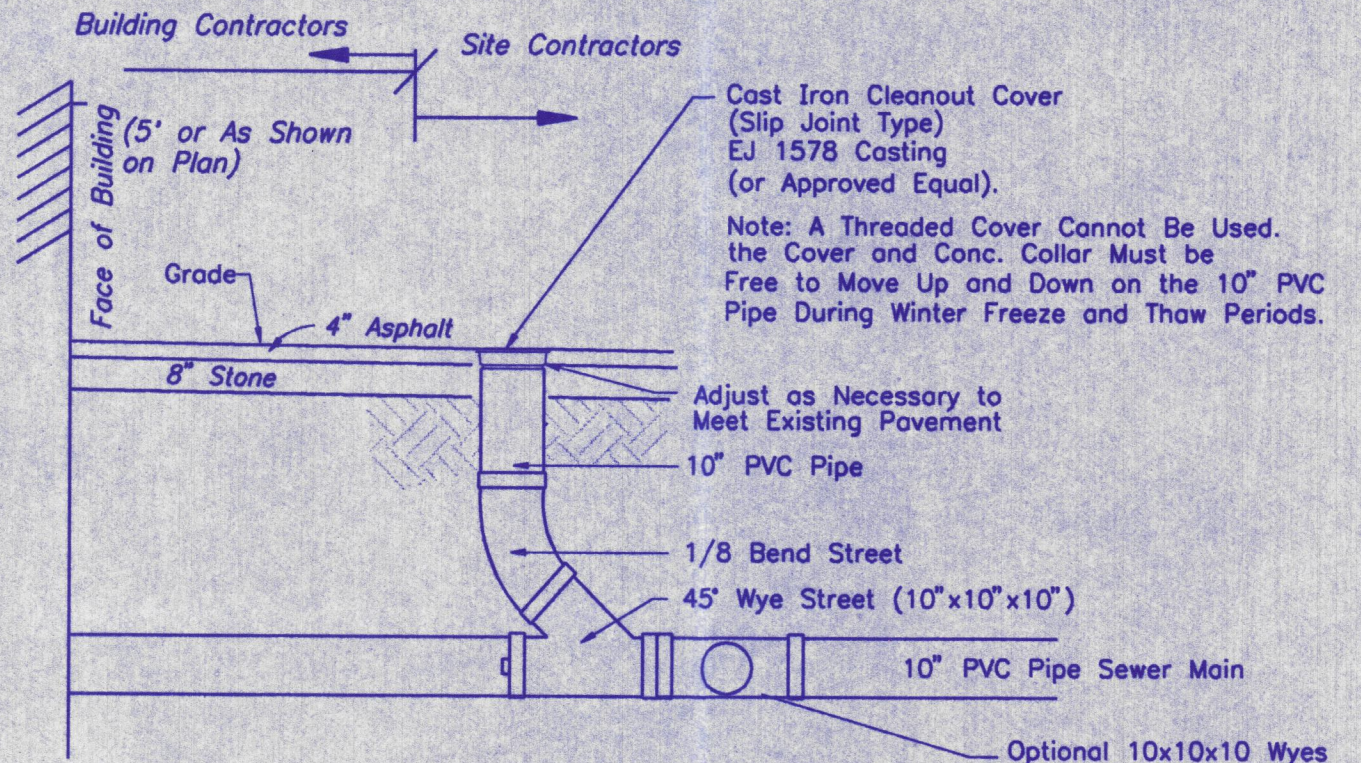
		DRAINAGE PLAN WATERFORD PLACE SUBDIVISION FOR STEPHEN LIBS CHOCOLATES VANDERBURGH COUNTY, INDIANA	
		Prepared By BERNARDIN LOCHMUELLER & ASSOC., INC. Planners - Engineers - Surveyors <small>6200 Vogel Road Columbus, IN 47316-2129</small>	DATE: 9/24/97 PROJECT NO.: 197-0136-0P0 ISSUED:
Delete Str. #104 Revise Grades	10/15/97		



LEGEND

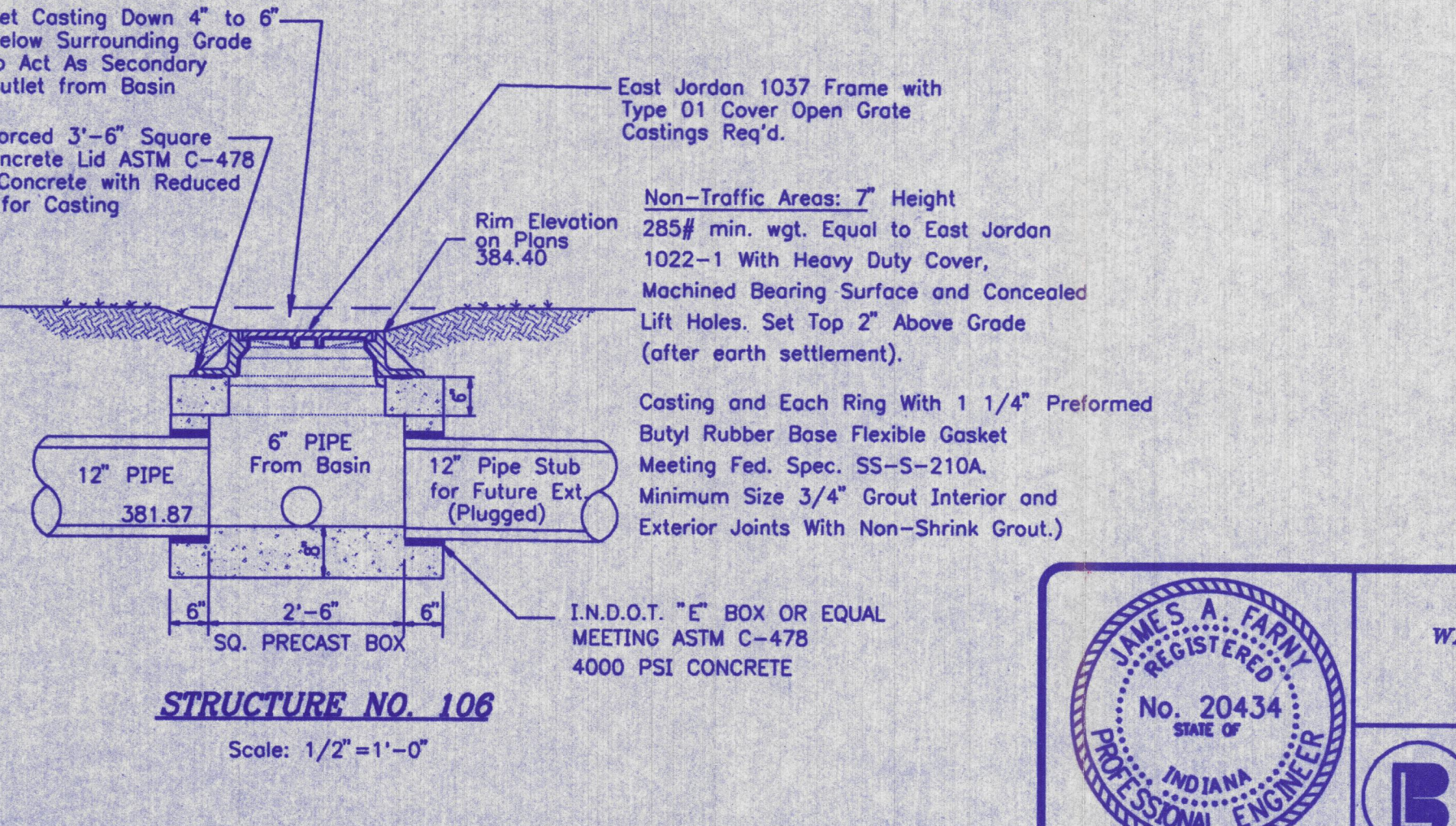
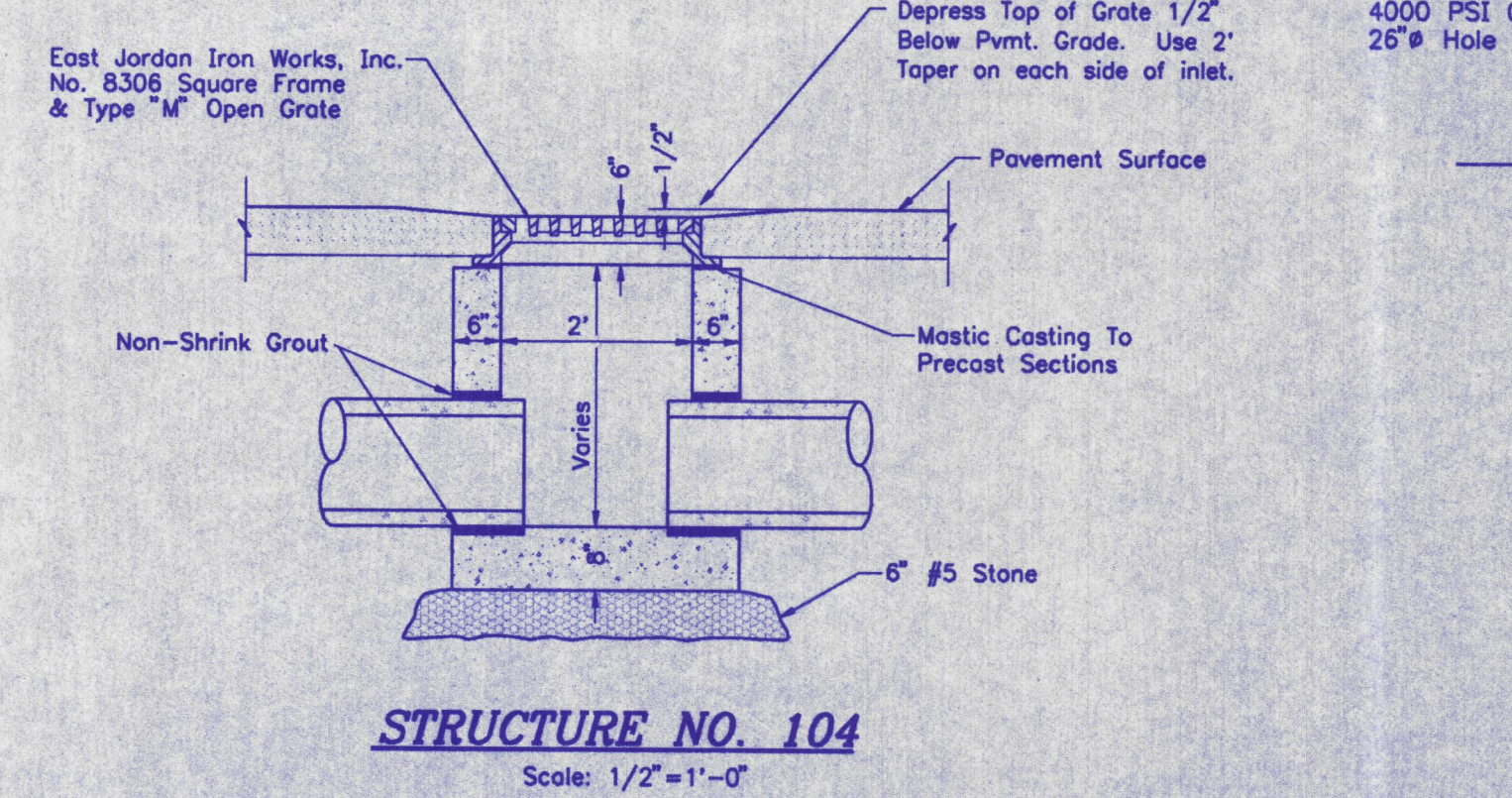
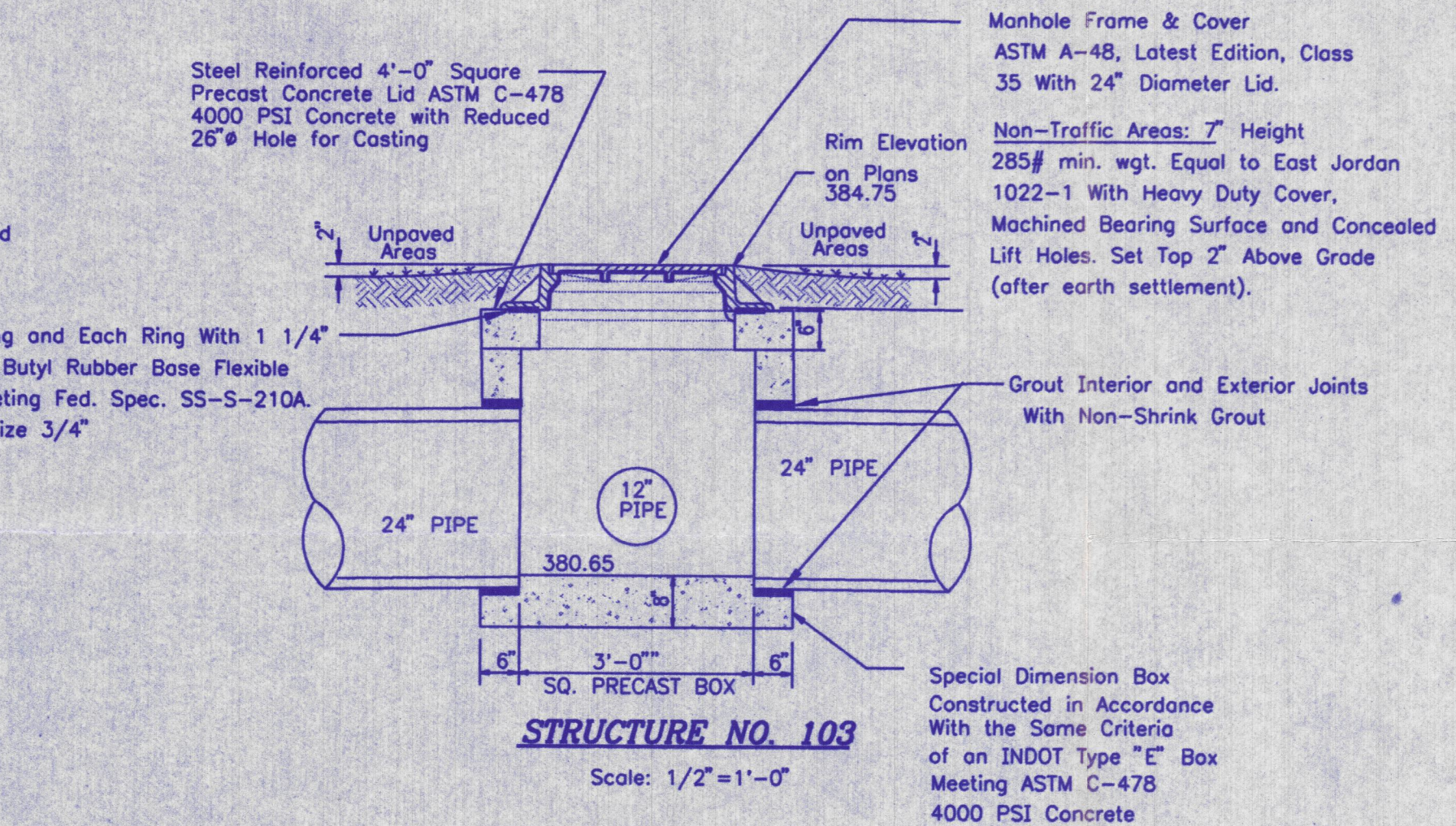
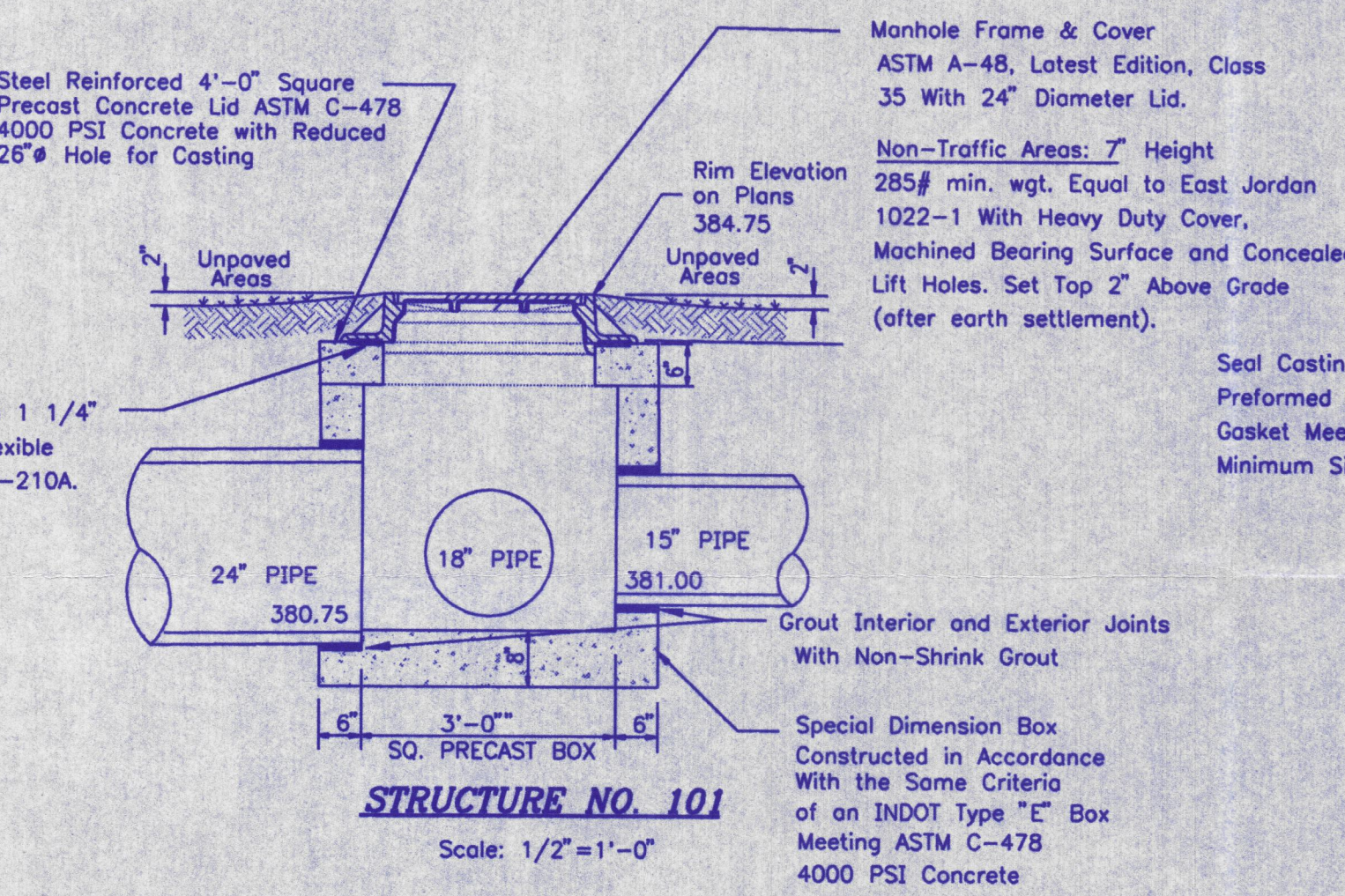
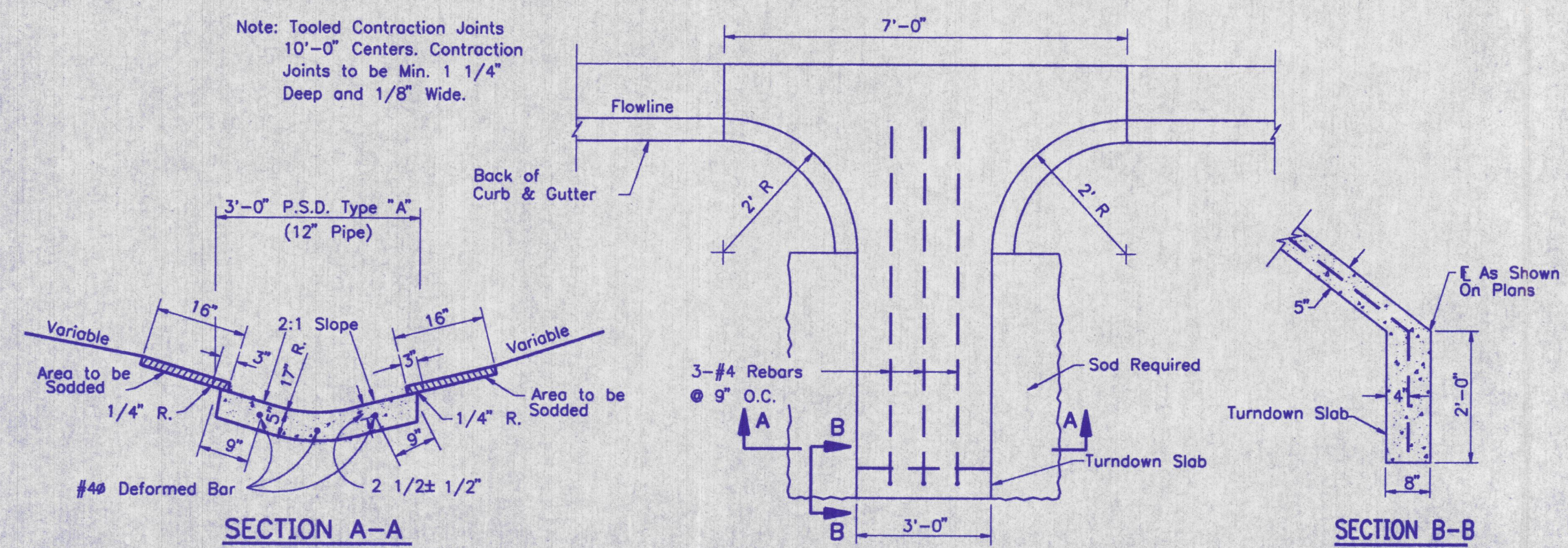
Bc Outside Diameter
D Inside Diameter
d Depth of Bedding Material Below Pipe

Depth of Bedding Material Below Pipe	
D	d
27" & Smaller	3"
30" to 60"	4"
66" & Larger	6"



DIMENSIONS

DIA.	WGT. (LBS)	WALL	A	B	C	D	E	G	R	SLOPE
12"	530	2"	5"	1'-10"	4'-3"	6'-1"	2'-0"	2"	9"	2:1
15"	740	2-1/4"	7"	2'-3"	4'-0"	6'-3"	2'-6"	2 1/2"	11"	2:1
18"	990	2-1/2"	11"	2'-1"	4'-1"	6'-2"	3'-0"	2 1/2"	12"	2:1
24"	1260	2-3/4"	11"	2'-9"	3'-5"	6'-3"	3'-6"	2 3/4"	13"	2:1
24"	1520	3"	12"	3'-7"	2'-8"	6'-3"	4'-0"	3"	14"	2:1
30"	2190	3-1/2"	1'-2"	4'-6"	1'-6"	6'-0"	5'-0"	3 1/2"	15"	3:1
36"	4100	4"	1'-3"	5'-2"	2'-9"	8'-1"	6'-0"	4"	20"	3:1



DETAILS
WATERFORD PLACE SUBDIVISION
STEPHEN LIBS CHOCOLATES
VANDERBURGH COUNTY, INDIANA

Prepared By
BERNARDIN LOCHMUELLER & ASSOC., INC.
Planners · Engineers · Surveyors
6509 Hoop Road
Carmel, IN 47715 (317)478-0200

DATE: 9/24/97
PROJECT NO.: 197-0136-OPD
ISSUED:

DATE: 9/24/97
SHEET: 3
Of 3

JAMES A. FANNIN
REGISTERED PROFESSIONAL ENGINEER
No. 20434
STATE OF INDIANA

S:\PROJECTS\94-002\LIBS\DETAILS_09/24/97_16:03.PDS

APPENDIX "B"
RUNOFF COEFFICIENT
TIME OF CONCENTRATION
INTENSITY

TIME OF CONCENTRATION

SHEET FLOW

$$TC = .827 \left[\frac{(N)(L)}{\sqrt{S}} \right]^{.467}$$

(Kerby's Formula)

N = 0.4 Coefficient Grass

L = Length

S = Slope

$$L = 280'$$

$$H = 385 - 384.35 = 0.65$$

$$S = .0023$$

$$T_c = .827 \left[\frac{(0.4)(280)}{\sqrt{.0023}} \right]^{.467} = 31 \text{ minutes}$$

INTENSITY

$$i_{10} = \frac{C(T)^\alpha}{(T_c+d)^\beta}$$

Factors for Evansville

$$C = 1.9533$$

$$\alpha = 0.1747$$

$$d = 0.522$$

$$\beta = 1.6408$$

T = duration

T_c = Time of Concentration (10 yr. undeveloped)

$$i_{10} = \frac{1.9533(10)^{0.1747}}{(31.0/60+0.522)^{1.6408}} = \frac{2.9206}{1.0642} = 2.74$$

$$i_{10} = 2.74$$

UNDEVELOPED "C" FACTOR = 0.20 (Table 803)
Cultivated Fields (Less than 2%)

NOTE: *This is a value used extensively throughout the area that lies between the Lloyd Expressway and Morgan Avenue and between Green River Road & I-164*

DEVELOPED WEIGHTED "C" FACTOR

Building	6,160 SF (0.95)	=	5,852
Pavement	17,124 SF (0.95)	=	16,268
Lawn	22,630 SF (0.15)	=	3,395
	<hr/>		<hr/>
	42,914 SF/1.05 Acres		25,515
	25,515/45,914	=	0.56

0.15 - Table 3.2(b) lawns

0.95 - Table 3.2(b) Roofs/Asphalt

APPENDIX "C"
STORAGE VOLUME DATA

PROJECT: libs candy store

DATE: 09/25/97

ENGINEER:BERNARDIN LOCHMUELLER AND ASSOCIATES, INC

DESIGN RETURN PERIOD: 5\10\25\100
 RELEASE RATE PERIOD: 5\10\25\100
 WATERSHED AREA (ACRES): 1.05
 TIME OF CONCENTRATION UNDEV. (min): 31
 RAINFALL INTENSITY (INCHES/HR): 3.10 2.744320 2.604832
 UNDEVELOPED RUNOFF COEFFICIENT: 0.2
 UNDEVELOPED RUNOFF RATE (CFS): 0.58
 DEVELOPED RUNOFF COEFFICIENT: 0.56

25 YEAR STORM

STORM DURATION (HRS)	RAINFALL INTENSITY (INCH/HR)	INFLOW RATE (CFS)	OUTFLOW RATE (CFS)	STORAGE RATE (CFS)	REQUIRED STORAGE (ACRE-FT)
0.08	8.02	4.71	0.58	4.14	0.028
0.17	6.20	3.64	0.58	3.07	0.043
0.25	5.26	3.10	0.58	2.52	0.052
0.33	4.62	2.72	0.58	2.14	0.059
0.42	4.09	2.40	0.58	1.83	0.064
0.50	3.72	2.19	0.58	1.61	0.067
0.58	3.42	2.01	0.58	1.44	0.069
0.67	3.15	1.85	0.58	1.27	0.071
0.75	2.94	1.73	0.58	1.15	0.072
0.83	2.76	1.62	0.58	1.05	0.072
0.92	2.59	1.52	0.58	0.95	0.073
1.00	2.45	1.44	0.58	0.87	0.072
1.25	2.11	1.24	0.58	0.67	0.069
1.50	1.86	1.10	0.58	0.52	0.065
1.75	1.67	0.98	0.58	0.40	0.059
2.00	1.51	0.89	0.58	0.31	0.052
2.50	1.27	0.75	0.58	0.17	0.036
3.00	1.10	0.65	0.58	0.07	0.018
4.00	0.87	0.51	0.58	-0.07	-0.022

PEAK STORAGE (ACRE/FT): 0.07
 PEAK STORAGE (CUBIC FT): 3159.16

5 YEAR STORM

STORM DURATION (HRS)	RAINFALL INTENSITY (INCH/HR)	INFLOW RATE (CFS)	OUTFLOW RATE (CFS)	STORAGE RATE (CFS)	REQUIRED STORAGE (ACRE-FT)
0.08	6.17	3.63	0.65	2.98	0.020
0.17	4.73	2.78	0.65	2.13	0.030
0.25	3.99	2.35	0.65	1.70	0.035
0.33	3.49	2.05	0.65	1.40	0.038
0.42	3.07	1.81	0.65	1.16	0.040
0.50	2.79	1.64	0.65	0.99	0.041
0.58	2.56	1.50	0.65	0.85	0.041
0.67	2.34	1.38	0.65	0.73	0.041
0.75	2.19	1.29	0.65	0.63	0.040
0.83	2.05	1.20	0.65	0.55	0.038
0.92	1.92	1.13	0.65	0.48	0.037
1.00	1.81	1.07	0.65	0.42	0.035
1.25	1.55	0.91	0.65	0.26	0.027
1.50	1.36	0.80	0.65	0.15	0.019
1.75	1.22	0.71	0.65	0.06	0.009
2.00	1.10	0.65	0.65	-0.00	-0.001
2.50	0.92	0.54	0.65	-0.11	-0.023
3.00	0.79	0.47	0.65	-0.18	-0.046
4.00	0.62	0.36	0.65	-0.29	-0.095

100 YEAR STORM

STORM DURATION (HRS)	RAINFALL INTENSITY (INCH/HR)	INFLOW RATE (CFS)	OUTFLOW RATE (CFS)	STORAGE RATE (CFS)	REQUIRED STORAGE (ACRE-FT)
0.08	9.52	5.60	0.65	4.95	0.033
0.17	7.40	4.35	0.65	3.70	0.052
0.25	6.30	3.70	0.65	3.05	0.064
0.33	5.54	3.26	0.65	2.61	0.072
0.42	4.91	2.89	0.65	2.24	0.078
0.50	4.48	2.63	0.65	1.98	0.083
0.58	4.12	2.43	0.65	1.77	0.086
0.67	3.80	2.23	0.65	1.58	0.088
0.75	3.55	2.09	0.65	1.44	0.090
0.83	3.34	1.96	0.65	1.31	0.091
0.92	3.13	1.84	0.65	1.19	0.091
1.00	2.97	1.75	0.65	1.10	0.091
1.25	2.57	1.51	0.65	0.86	0.090
1.50	2.27	1.33	0.65	0.68	0.085
1.75	2.03	1.19	0.65	0.54	0.079
2.00	1.84	1.08	0.65	0.43	0.072
2.50	1.56	0.92	0.65	0.27	0.055
3.00	1.35	0.79	0.65	0.14	0.036
4.00	1.07	0.63	0.65	-0.02	-0.008

39603 CF

APPENDIX "D"
OUTLET CONTROL STRUCTURE ANALYSIS



DETAIL SKETCH

Check using Orifice Equation

$$Q = C_d A \sqrt{2gh}$$

$$C_d = 0.6$$

$$g = 32.2$$

$$h = 383.5 - 382.35 = 1.15$$

$$Q = (0.6)(A) \sqrt{2(32.2)(1.15)} =$$

$$Q = (0.6)(A)(9.6058)$$

$$0.56 = (A)(5.1635)$$

$$A = .1085$$

$$A = \pi r^2 \quad r^2 = \frac{A}{\pi}$$

$$r = \sqrt{\frac{A}{\pi}} = \sqrt{\frac{.1085}{\pi}} = 0.1858 \approx 4\frac{1}{2}'' \phi \text{ PIPE}$$

Use 6" ϕ PIPE \rightarrow

Note H_g's suggest 6" Too large but
 as noted above next available
 size down (4") is not large
 enough.

Therefore We RECOMMEND 6" PIPE /
 lower maintenance

SUMMARY

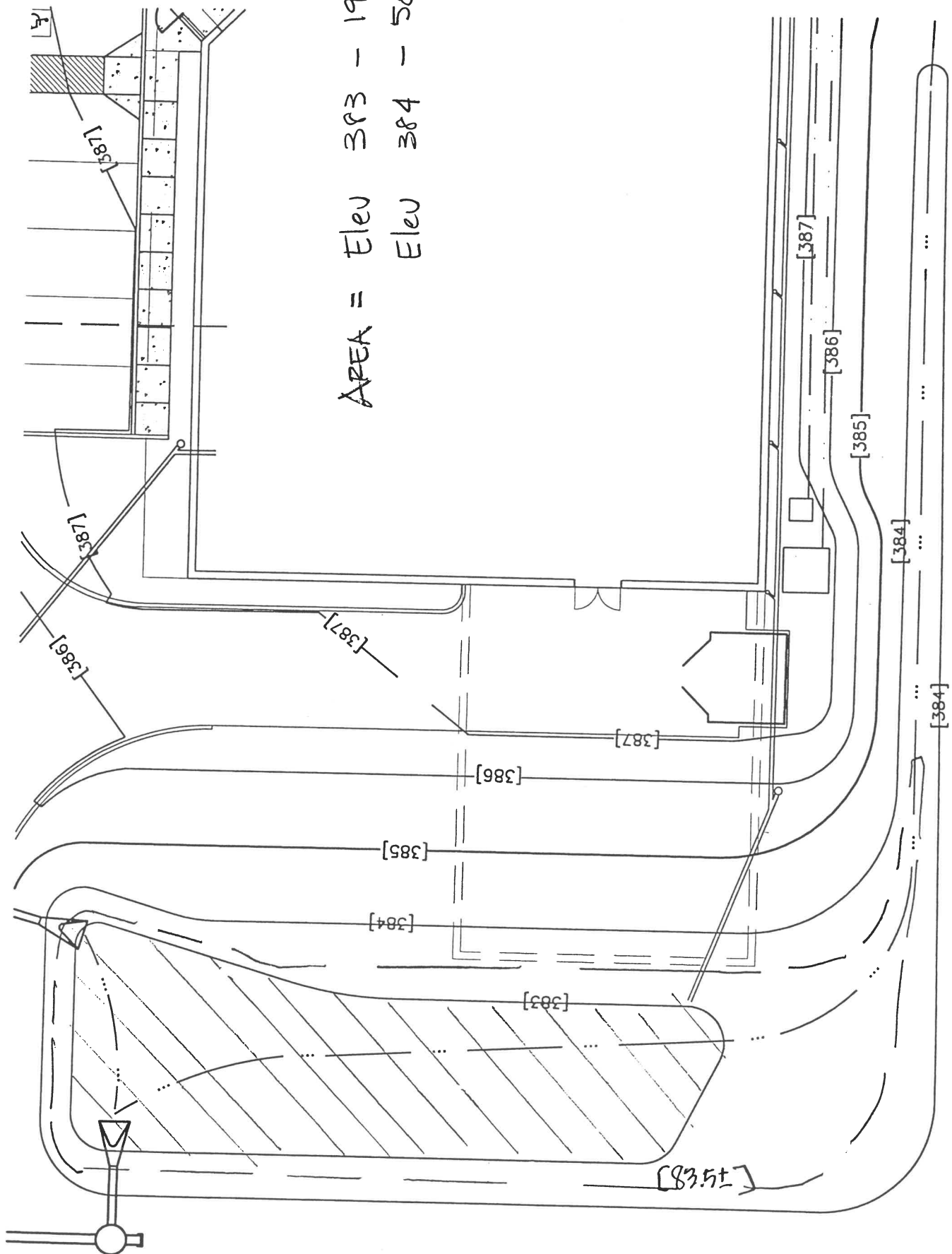
ITEM	QUANTITY	PAGE

APPENDIX "E"
BASIN VOLUME

BASIN VOLUMES

Following is a brief explanation of the procedures used in the calculations of cubic footage of site water detention for the above referenced project. Keep in mind that this is a theoretical analysis and that actual finish grading may vary slightly.

Elevation 382.35 =	0 SF			
		>	979 CF	
Elevation 383 =	1957 SF		> 4478 CF	> 3159 CF <i>required</i>
		>	3499 CF	
Elevation 384 =	5041 SF			



AREA = Elev 383 - 1957 SF
 Elev 384 - 5041 SF

[383.5±]

[383]

[384]

[385]

[386]

[387]

[386]

[387]

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