SEPARATOR

54-00068

HAZ WASTE

COMPLIANCE

04/26/1993

NA

9545625

54-0068

CEDAR CHEMICAL CORPORATION

P.O. Box 2749, Hwy. 242 S. • West Helena, AR 72390
(501) 572-3701 • Fax No. 501-572-3795

CSN: PERMIT NO
MEDIA: HAZARDOUS, SUPERFUND

April 26, 1993

Mr. Randal K. Oberlag
Enforcement Engineer
NPDES Enforcement Section
Arkansas Department of Pollution Control & Ecology
P.O. Box 8913
Little Rock, Arkansas 72219-8913

Re: Corrective Action Schedule, Task 12 (Storm Water System) and Task 13 (Permit Modification) Submittal

Dear Mr. Oberlag:

Under the schedule for Consent Administrative Order LIS 92-198, Cedar Chemical is required to submit a Storm Water System Plan (Task 12) by May 1, 1993.

In general, the goal is to ensure that we capture, contain and pump to our biotreatment system, the rainfall associated with all storms up to, and including, a 25-year, 24-hour storm event. With this capability in place, we will abandon our one existing stormwater outfall.

This will be accomplished by enlarging our ditch system to increase storage volume, and constructing an appropriately sized berm around the industrial site perimeter to contain the water. Dual pumps, and associated concrete sumps, will transfer the accumulated water to the biotreatment system.

A detailed Scope of Work for Task 12 is enclosed and submitted for your approval.

Task 13, Permit Modification, does not require any input from Cedar Chemical at this time. Discussion with the NPDES Permits Branch has indicated that this will be an ongoing project during the course of the TRE/TIE. Cedar has informed them that any updated production or flow data that they require will be made immediately available.

Sincerely,

John Wagner

John Wagner

cc: Mr. Joe Hoover, Hazardous Waste Enforcement, ADPC&E
Mr. Randal Tomblin, Organics Division President, Cedar
Mr. David Hoppel, Plant Manager, Cedar
Mr. Allen Malone, Attorney, Cedar
Mr. Bruce Shackleford, Consultant, ECO Inc.

CEDAR CHEMICAL CORPORATION

STORM WATER PROJECT

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CEDAR CHEMICAL CORPORATION

STORMWATER RETENTION SYSTEM

SCOPE OF WORK

The Scope of Work will be performed in two phases to be completed by October 1, 1993. Some aspects of Phase I have already begun.

PHASE I

1. Establish elevations around the industrial site perimeter and determine the finish grade for a surrounding earthen berm. Based on TR-55 data (Exhibit 1), a 25-year, 24-hour storm event is a 6.8 inch rainfall which would cause a 2.93 million gallon accumulation at Cedar's West Helena facility. This is the amount of water which will be contained within the berm. TR-55 is the calculation manual, Urban Hydrology for Small Watersheds, United States Department of Agriculture. The 6.8 inches for a 25-year event was confirmed with the U.S. Meteorological Office in Denver.

2. Widen all stormwater ditches (Exhibit II, Figure ME-02). Construct them with a 4:1 side slope that will support grass growth and that can be mowed. This will contribute 2.5 million gallons of temporary storage capacity to the system. The last 100 feet of the ditch system will contain rip-rap to initiate silt removal prior to water flowing into the sump.

3. Redistribute excess soil within the industrial site in order to level all exposed areas, and groom the surface prior to putting in grass. No soil currently within the industrial site will be removed from the site.

4. Where necessary to promote grass growth, bring clean soil from off-site.

5. Pave the new shower room parking lot. The runoff will be isolated and re-directed so that it is removed from the storm water accumulation total.

6. Construct an earthen berm, containing no outfall, around the perimeter of the industrial site. This will not only contain the required volume of water within the site, but it will prevent any inflow of rainwater from off-site.

7. Plug, seed or sod all exposed areas and initiate a lawn maintenance program to ensure complete grass coverage.

PHASE II

1. Install dual 500 gpm, non-clogging, submersible, centrifugal pumps to transfer stormwater from the contained industrial site to the biotreatment system. In exhibit 1 the pump-out-interval volume (P) of 1000 gpm, when subtracted from the storm-water-interval volume (G) indicates a net accumulation of 2.25 million gallons (T) for a 25-year event. This is .25 million gallons less than the capacity of the ditches alone. The perimeter berm will further increase the capacity of the site.

2. Construct a 50,000 gallon capacity, reinforced concrete storm water sump (Exhibit II, Figure SP-03W). The sump will be in the southeast corner of the plant site at the intersection of two major containment ditches. A built-in weir will remove silt, which, because of the sloped construction of the sump, can be removed by driving a backhoe into the sump.

3. Construct a 15,000 gallon capacity, reinforced concrete storm water tank (Exhibit II, Figures ME-04 and ME-05). The tank and sump will share a common wall. The tank provides suction to the pumps, and has a built-in control panel that will start the first pump. If the tank's water level control indicates it is necessary, the second pump will be started and they will run in tandem. A high-water-level alarm will be installed for emergencies.

4. Install an 8" buried plastic pipe from the storm water tank to the API separator, located adjacent to the equalization basin in the biotreatment system. A by-pass, going directly into the equalization basin, will be built into the line for flows that exceed the design capacity of the separator (200 gpm). For daily transfers, not involving significant storm events, the existing smaller pump will be used to go through the separator.

5. Fill in the existing, unlined, stormwater sump.

6. Concurrent with this project, other tasks in the TRE will address increasing the hydraulic capacity of the biotreatment system in order to assure that all storm water can be accommodated.

Details of this Scope of Work may change as the project progresses, however, the original goal and basic concept will be adhered to.

EXHIBIT I

A. STORM WATER RUNOFF CALCULATION
(CONTAINMENT DESIGN BASIS)

B. EXCERPT TECHNICAL RELEASE 55 (TR-55)
(URBAN HYDROLOGY FOR SMALL WATERSHEDS)

EXHIBIT I - STORM WATER RUNOFF CALCULATION (CONTAINMENT DESIGN BASIS - 25 YEAR/24 HOUR STORM EVENT)
CEDAR CHEMICAL CORPORATION - ECO FIGURES ADJUSTED BY MEI (NOTE 2)

TIME (HOURS)	INTERVAL (m) (MIN)	FLOW (FT3/SEC) IMPERVIOUS AREA	FLOW (FT3/SEC) PERVIOUS AREA	TOTAL FLOW (Q) (FT3/SEC)	STORM WATER INTERVAL VOLUME (G) (GAL)	PUMP OUT INTERVAL VOLUME (P) (GAL)	STORM WATER NET ACCUMULATION INTERVAL (v) (GAL)	TOTAL ACCUMULATED STORM WATER (T) (GAL)
11.0	18	2.24	1.12	3.36	27,143	18,000	9,143	9,143
11.3	18	3.36	1.12	4.48	36,191	18,000	18,191	27,335
11.6	18	4.48	2.24	6.72	54,287	18,000	36,287	63,622
11.9	18	20.16	3.36	23.52	190,004	18,000	172,004	235,625
12.0	6	38.08	3.36	41.44	111,590	6,000	105,590	341,215
12.1	6	69.44	5.60	75.04	202,068	6,000	196,068	537,283
12.2	6	75.04	10.08	85.12	229,211	6,000	223,211	760,494
12.3	6	44.80	16.80	61.60	165,876	6,000	159,876	920,370
12.4	6	23.52	24.64	48.16	129,685	6,000	123,685	1,044,056
12.5	6	15.68	32.48	48.16	129,685	6,000	123,685	1,167,741
12.6	6	12.32	35.84	48.16	129,685	6,000	123,685	1,291,426
12.7	6	10.08	34.72	44.80	120,637	6,000	114,637	1,406,064
12.8	6	7.84	31.36	39.20	105,558	6,000	99,558	1,505,621
13.0	12	6.72	21.28	28.00	150,797	12,000	138,797	1,644,418
13.2	12	5.60	14.56	20.16	108,574	12,000	96,574	1,740,992
13.4	12	5.60	10.08	15.68	84,446	12,000	72,446	1,813,438
13.6	12	4.48	7.84	12.32	66,351	12,000	54,351	1,867,789
13.8	12	4.48	6.72	11.20	60,319	12,000	48,319	1,916,107
14.0	12	3.36	5.60	8.96	48,255	12,000	36,255	1,952,362
14.3	18	3.36	4.48	7.84	63,335	18,000	45,335	1,997,697
14.6	18	3.36	3.36	6.72	54,287	18,000	36,287	2,033,984
15.0	24	3.36	3.36	6.72	72,382	24,000	48,382	2,082,366
15.5	30	2.24	2.24	4.48	60,319	30,000	30,319	2,112,685
16.0	30	2.24	2.24	4.48	60,319	30,000	30,319	2,143,004
16.5	30	2.24	2.24	4.48	60,319	30,000	30,319	2,173,322
17.0	30	2.24	2.24	4.48	60,319	30,000	30,319	2,203,641
17.5	30	2.24	2.24	4.48	60,319	30,000	30,319	2,233,960
18.0	30	2.24	1.12	3.36	45,239	30,000	15,239	2,249,199
19.0	60	1.12	1.12	2.24	60,319	60,000	319	2,249,518
20.0	60	1.12	1.12	2.24	60,319	60,000	319	2,249,836
22.0	120	1.12	1.12	2.24	120,637	120,000	637	2,250,474 P
26.0	240	0.00	0.00	0.00	0	240,000	(240,000)	2,010,474
					2,928,474	918,000		

FORMULAS:

G (GAL) = Q (FT3/SEC) x (60 SEC/MIN) x (7.48 GAL/FT3) x m (MIN)

P (GAL) = m (MIN) x (1000 GAL/MIN)

v (GAL) = G (GAL) - P (GAL)

T (GAL) = SUM (v)

NOTES:

1. P = PEAK.
2. BASIC RUNOFF CALCULATIONS WERE DEVELOPED BY ECO, INC. USING THE COMPUTER SOFTWARE TR-55, AND ARE BASED UPON TOTAL WATERSHED AREA OF 0.027 SQUARE MILES & 6.8" RAINFALL. 1.12 ADJUSTMENT FACTOR APPLIED TO RESULTS.

DESIGN BASIS:

1. DUAL 500 GPM PUMPS = 1,000 GPM.
2. STORM WATER SUMP & DITCHES @ 2,500,000 GAL ACTUAL VOLUME.

STORM WATER SUMP & DITCHES VOLUME REQUIRED = TOTAL STORM WATER (T) PEAK = 2,250,474 GALLONS

STORM WATER SUMP & DITCHES ACTUAL VOLUME - REQUIRED VOLUME = 2,500,000 - 2,250,474 = 249,526 GALLONS SAFETY FACTOR

0272-101

REPORT DOCUMENTATION PAGE	1. REPORT NO. USDA-SW-DK-87-00 SCS/ENG/TR-55	2.	PB87-101580

. and Subtitle

Technical Release 55
Urban Hydrology for Small Watersheds, 2nd Edition

5. Report Date
June 1986

6.

. Author(s)
Soil Conservation Service

8. Performing Organization Rept. No.

. Performing Organization Name and Address

Engineering Division
Soil Conservation Service, USDA
P.O. Box 2890
Washington, D.C. 20013

10. Project/Task/Work Unit No.

11. Contract(C) or Grant(G) No.
(C)
(G)

2. Sponsoring Organization Name and Address
Engineering Division
Soil Conservation Service, USDA
P.O. Box 2890
Washington, D.C. 20013

13. Type of Report & Period Covered
Final

14.

. Supplementary Notes

Replaces previous version (PB82140666) dated January 1975.
Magnetic Tape PB87-101598

. Abstract (Limit: 200 words)

TR-55 provides simplified procedures to calculate storm runoff volume, peak rates of discharge, and storage volumes required for stormwater detention reservoirs. These procedures are applicable in small watersheds, especially urbanizing watersheds. The provides for hydrologic analysis of a watershed under various combinations of land es using single-event rainfall data.

EXHIBIT I(B)
EXCERPT
TR-55

Document Analysis a. Descriptors

Soil Conservation Service
urban watershed
Hydrology
watersheds
stormwater management
rainfall/runoff event model
peak rates
volume of runoff

. Identifiers/Open-Ended Terms

. NTI Field/Group

. ility Statement:
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19. Security Class (This Report)
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Unclassified

21. No. of Pages
142

22. Price
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(SI-Z39.18)

See Instructions on Reverse

OPTIONAL FORM 272 (4-77)
(Formerly NTIS-35)
Department of Commerce

PB87-101580

URBAN HYDROLOGY FOR SMALL WATERSHEDS

Soil Conservation Services
Washington, DC

Jun 86

U.S. DEPARTMENT OF COMMERCE
National Technical Information Service
NTIS

PB87-101580

United States
Department of
Agriculture

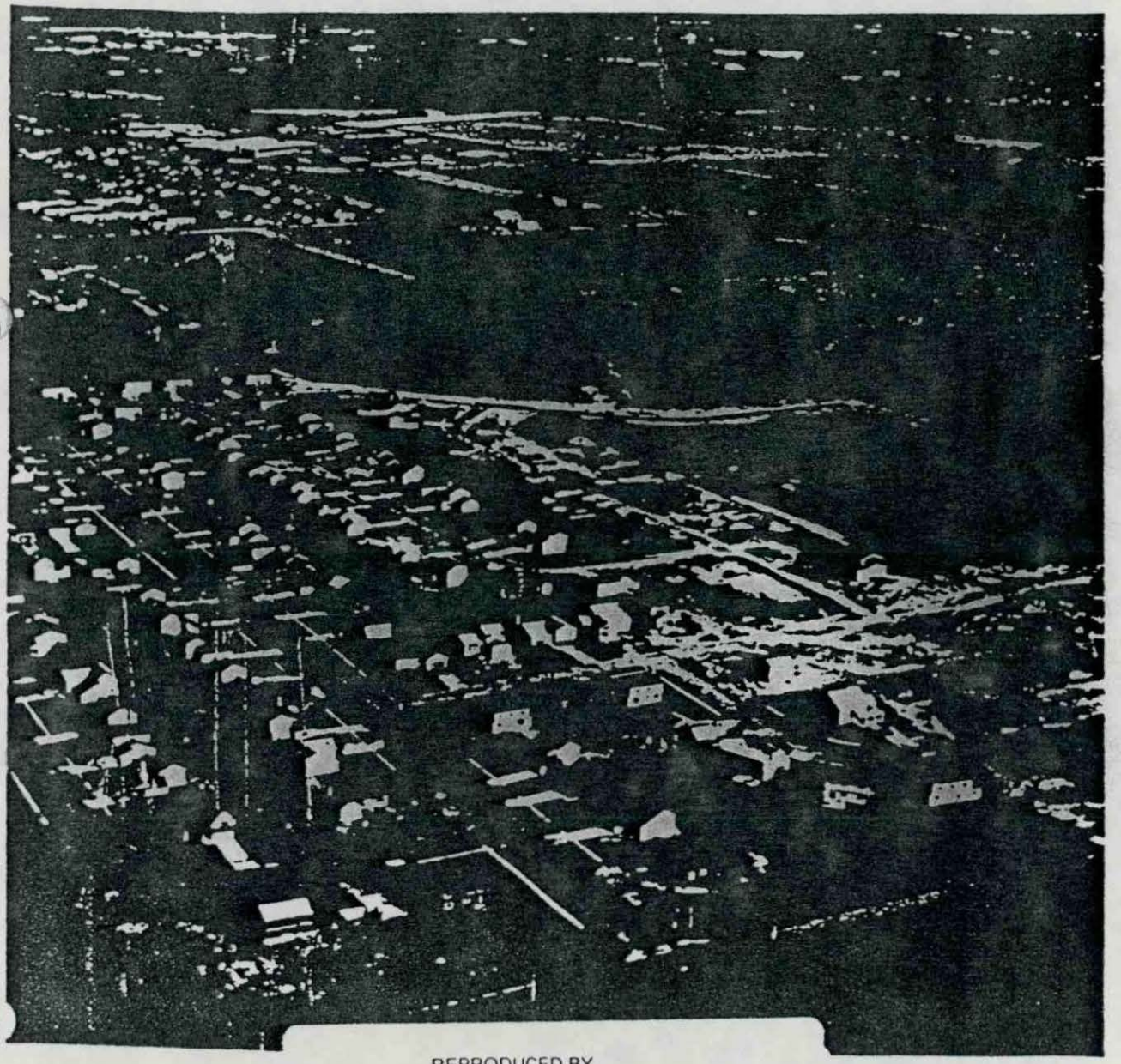
Soil
Conservation
Service

Engineering
Division

Technical
Release 55

June 1986

Urban Hydrology for Small Watersheds



REPRODUCED BY
U.S. DEPARTMENT OF COMMERCE
NATIONAL TECHNICAL
INFORMATION SERVICE
SPRINGFIELD, VA 22161

Preface

Technical Release 55 (TR-55) presents simplified procedures to calculate storm runoff volume, peak rate of discharge, hydrographs, and storage volumes required for floodwater reservoirs. These procedures are applicable in small watersheds, especially urbanizing watersheds, in the United States. First issued by the Soil Conservation Service (SCS) in January 1975, TR-55 incorporates current SCS procedures. This revision includes results of recent research and other changes based on experience with use of the original edition.

The major revisions and additions are—

1. A flow chart for selecting the appropriate procedure;
2. Three additional rain distributions;
3. Expansion of the chapter on runoff curve numbers;
4. A procedure for calculating travel times of sheet flow;
5. Deletion of a chapter on peak discharges;
6. Modifications to the Graphical Peak Discharge method and Tabular Hydrograph method;
7. A new storage routing procedure;
8. Features of the TR-55 computer program; and
9. Worksheets.

This revision was prepared by Roger Cronshey, Hydraulic Engineer, Hydrology Unit, SCS, Washington, DC; Dr. Richard H. McCuen, Professor of Civil Engineering, University of Maryland, College Park, MD; Norman Miller, Head, Hydrology Unit, SCS, Washington, DC; Dr.Walter Rawls, Hydrologist, Agricultural Research Service, Beltsville, MD; Sam Robbins (deceased), formerly Hydraulic Engineer, SCS, South National Technical Center (NTC), Fort Worth, TX; and Don Woodward, Hydraulic Engineer, SCS, Northeast NTC, Chester, PA. Valuable contributions were made by John Chenoweth, Stan Hamilton, William Merkel, Robert Rallison (ret.), Harvey Richardson, Wendell Styner, other SCS hydraulic engineers, and Teresa Seeman.

Revised June 1986

IV

STORM WATER PROJECT DRAWING LIST

FIGURE NUMBER	DRAWING NUMBER	REVISION	DESCRIPTION
SW-00	DLISTSW	A	STORM WATER PROJECT-DRAWING LIST
SP-01	B00001	A	STORM WATER PROJECT-AREA MAP TOPOGRAPHICAL SITE PLAN
SP-02W	D038SP01	A	STORM WATER PROJECT-CURRENT PLANT SITE PLAN
SP-03W	D038SP02	A	STORM WATER PROJECT-PROPOSED PLANT SITE PLAN
ME-00	B038SCH	A	STORM WATER PROJECT-PROJECT SCHEDULE
ME-01	D038PF01	A	STORM WATER PROJECT-PROCESS FLOW DIAGRAM
ME-02	D038M01	A	STORM WATER PROJECT-CONTAINMENT DITCH DESIGN
ME-03	D038M02	A	STORM WATER PROJECT-CONTAINMENT DITCH DESIGN DETAILS
ME-04	D038C01	A	STORM WATER PROJECT-STORM WATER SUMP AND TANK CONCRETE FOUNDATIONS
ME-05	D038C02	A	STORM WATER PROJECT-STORM WATER SUMP & TANK CONCRETE DETAILS AND SPECIFICATIONS

THE INFORMATION CONTAINED ON THIS DRAWING IS THE EXCLUSIVE PROPERTY OF CEDAR CHEMICAL CORP., WEST HELENA, ARKANSAS AND MAY NOT BE REPRODUCED IN ANY MANNER, DISCUSSED WITH, OR SUBMITTED TO ANY PERSON OR COMPANY WITHOUT PRIOR WRITTEN APPROVAL FROM AN AUTHORIZED REPRESENTATIVE OF CEDAR CHEMICAL CORPORATION

REV	DESCRIPTION	DATE	BY	APPROVED
A	INITIAL ISSUE	4/26/93	DR	GFM

CUSTOMER: CEDAR CHEMICAL CORPORATION
WEST HELENA ARKANSAS

DRAWING TITLE: STORM WATER PROJECT

DRAWING TYPE: DRAWING LIST

ATHER ENGINEERING, INC.

CEDAR CHEMICAL CORPORATION
P.O. BOX 2749
HWY. 242 S
WEST HELENA, AR 72390

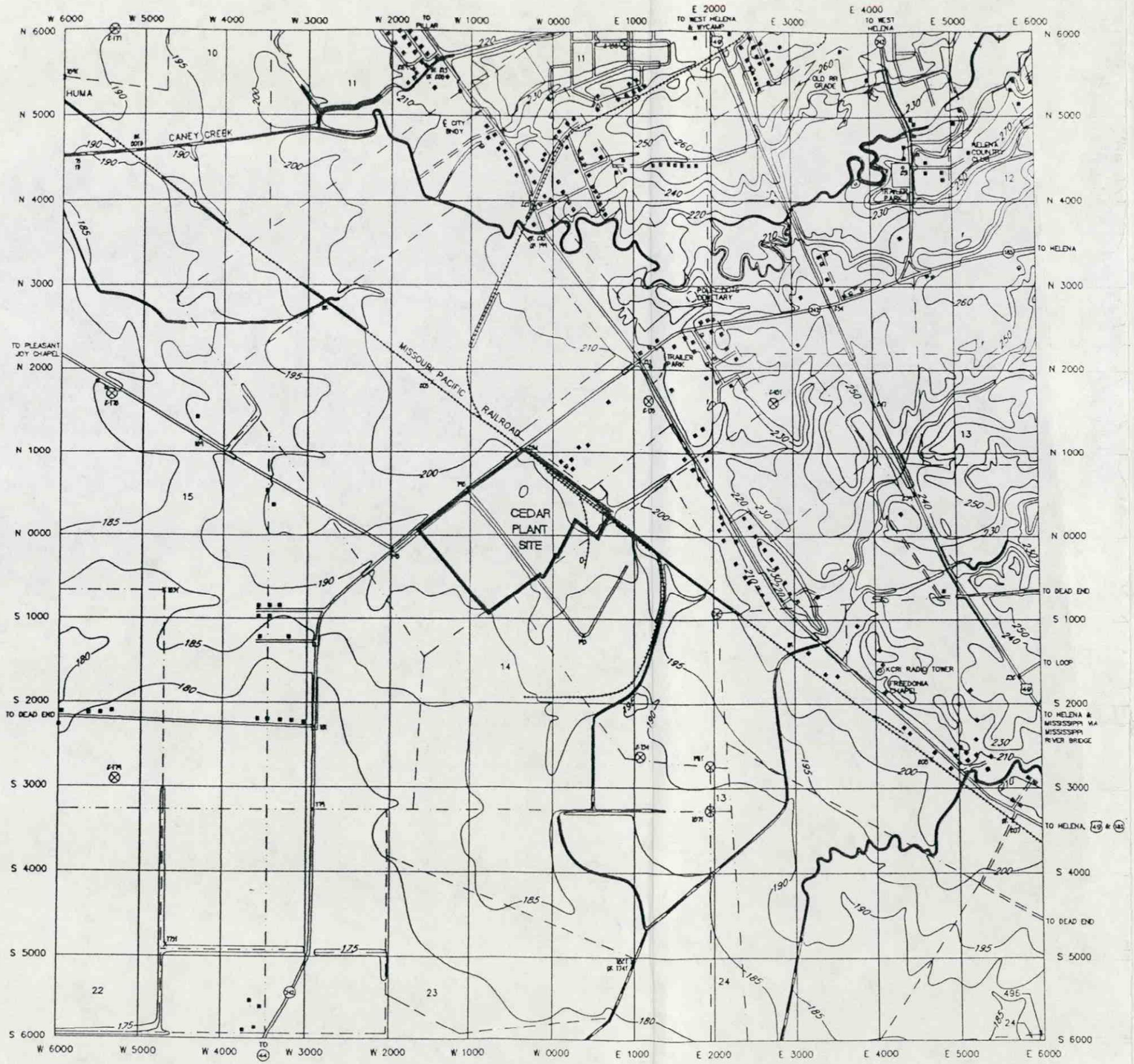
FIG NO SW-00

DATE: 4/26/93 BY: DR

SCALE: NONE APPROVED:

DWG NO: D-LIST-SW REV: A

C:\ACAD\DWGS\DLISTSW 04-27-93 15:28



THIS DRAWING WAS MADE FROM U.S.C.S. 7.5 MINUTE SERIES (TOPOGRAPHIC) MAP OF THE WEST HELENA, ARKANSAS QUADRANGLE (1982 EDITION).

0' 500' 1000' 1500' 2000'

SCALE: 1" = 600'

REV.	DESCRIPTION	DATE	BY	APPROVED
A	INITIAL RELEASE	4/19/93	BJE	GFM

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CUSTOMER: CEDAR CHEMICAL CORPORATION
ARKANSAS
WEST HELENA

DRAWING TITLE: CEDAR PLANT SITE AREA MAP

DRAWING TYPE: TOPOGRAPHICAL SITE PLAN

ATHER ENGINEERING, INC.
NEW DELL BLDG., SUITE 200
ROLLING HILLS SHOPPING CENTER
PHONE: (501) 224-7262
FAX: (501) 224-7271

CEDAR CHEMICAL CORPORATION
P.O. BOX 2749
HWY. 242 S.
WEST HELENA, AR 72390

FIG NO SP-01

DATE	BY
4/19/93	BJE
SCALE (FUNCT. DWG) 1" = 600'	APPROVED
DWG. NO. B-00-01	REV. A

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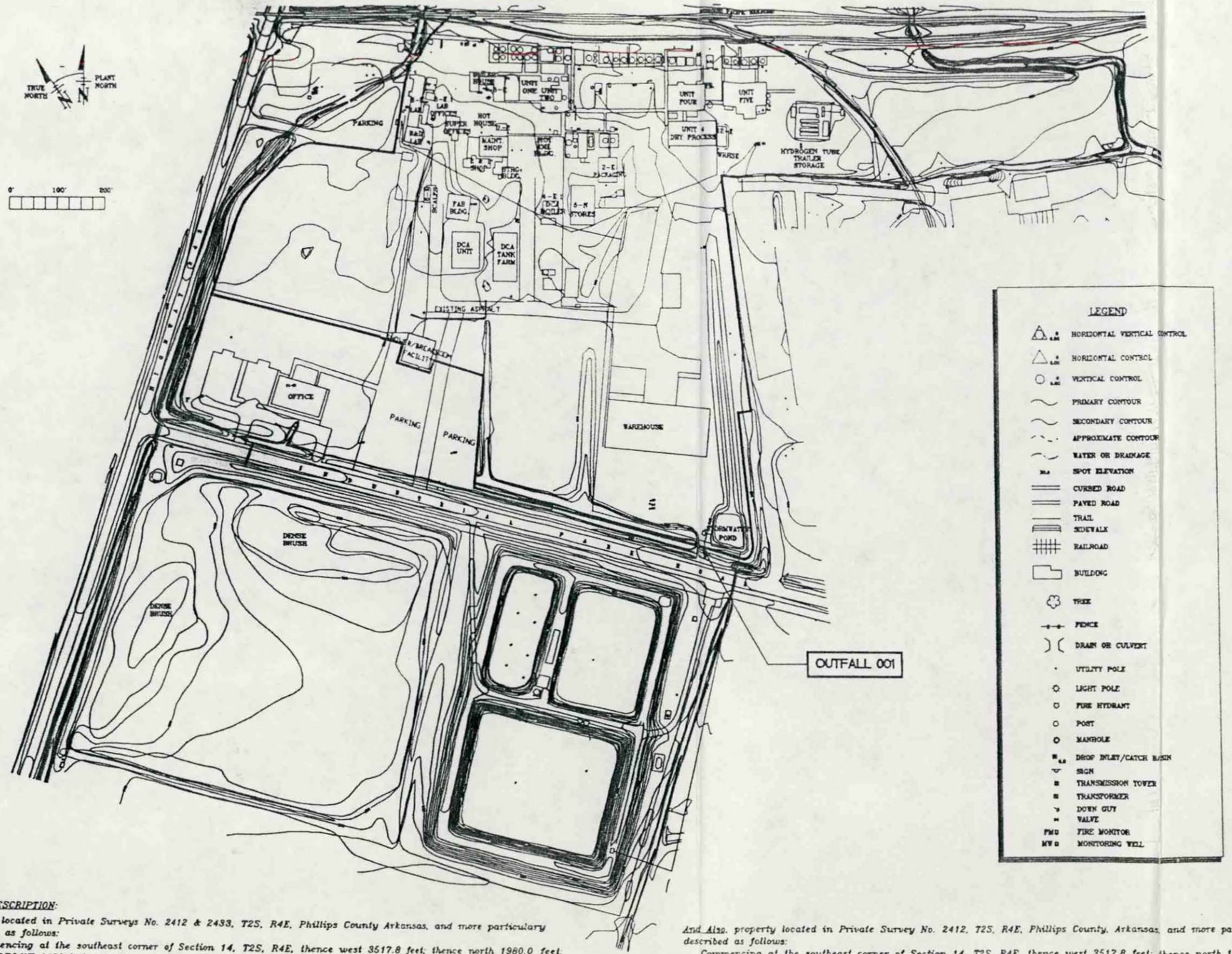

LEGAL DESCRIPTION:

Property located in Private Surveys No. 2412 & 2433, T2S, R4E, Phillips County Arkansas, and more particulary described as follows:

Commencing at the southeast corner of Section 14, T2S, R4E, thence west 3517.8 feet; thence north 1980.0 feet; thence N35°34'W 1122.6 feet to the east right-of-way of State Highway No. 242; thence N54°12'E 1553.1 feet along said east right-of-way of State Highway No. 242 to the northerly line of a dedicated street and the point of beginning; thence, from the point of beginning, S39°58'E 1341.7 feet along the northerly line of said dedicated street; thence N28°42'E 827.9 feet; thence S55°45'E 806.3 feet; thence N28°42'E 197.6 feet to the southerly line of a 50 foot easement recorded in Book 506, page 462, of the Official Records of Phillips County, Arkansas; thence N53°29'W 810.0 feet along the southerly line of said easement recorded in Book 506, page 462, to the westerly line thereof; thence N28°42'E 50.5 feet along the westerly line of said easement recorded in Book 506, page 462, to the southerly right-of-way of the Missouri Pacific Railroad; thence N53°29'W 919.5 feet along said southerly right-of-way of the Missouri Pacific Railroad to the east right-of-way of State Highway No. 242; thence S54°12'W 822.6 feet along said right-of-way of State Highway No. 242 to the point of beginning.

And Also, property located in Private Survey No. 2412, T2S, R4E, Phillips County, Arkansas, and more particularly described as follows:

Commencing at the southeast corner of Section 14, T2S, R4E, thence west 3517.8 feet; thence north 1980.0 feet; thence N35°34'W 1122.6 feet to the easterly right-of-way of State Highway No. 242; thence N54°12'E 790.52 feet along said easterly right-of-way to the point of beginning; thence from the point of beginning, continue N54°12'E 702.58 feet to the southerly right-of-way of an industrial road; thence S39°58'E 1243.29 feet along said southerly right-of-way to the westerly right-of-way of a proposed road; thence S54°12'W 702.58 feet along said westerly right-of-way; thence N39°58'W 1243.29 feet to the point of beginning, containing 20.0 acres, more or less.

REFERENCE DRAWING NO. D211L01 & NO. MPL

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REV	DESCRIPTION	DATE	BY	APPROVED
A	INITIAL ISSUE	4/27/93	BJE	GFM

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CUSTOMER: CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

DRAWING TITLE: STORM WATER PROJECT CURRENT PLANT SITE

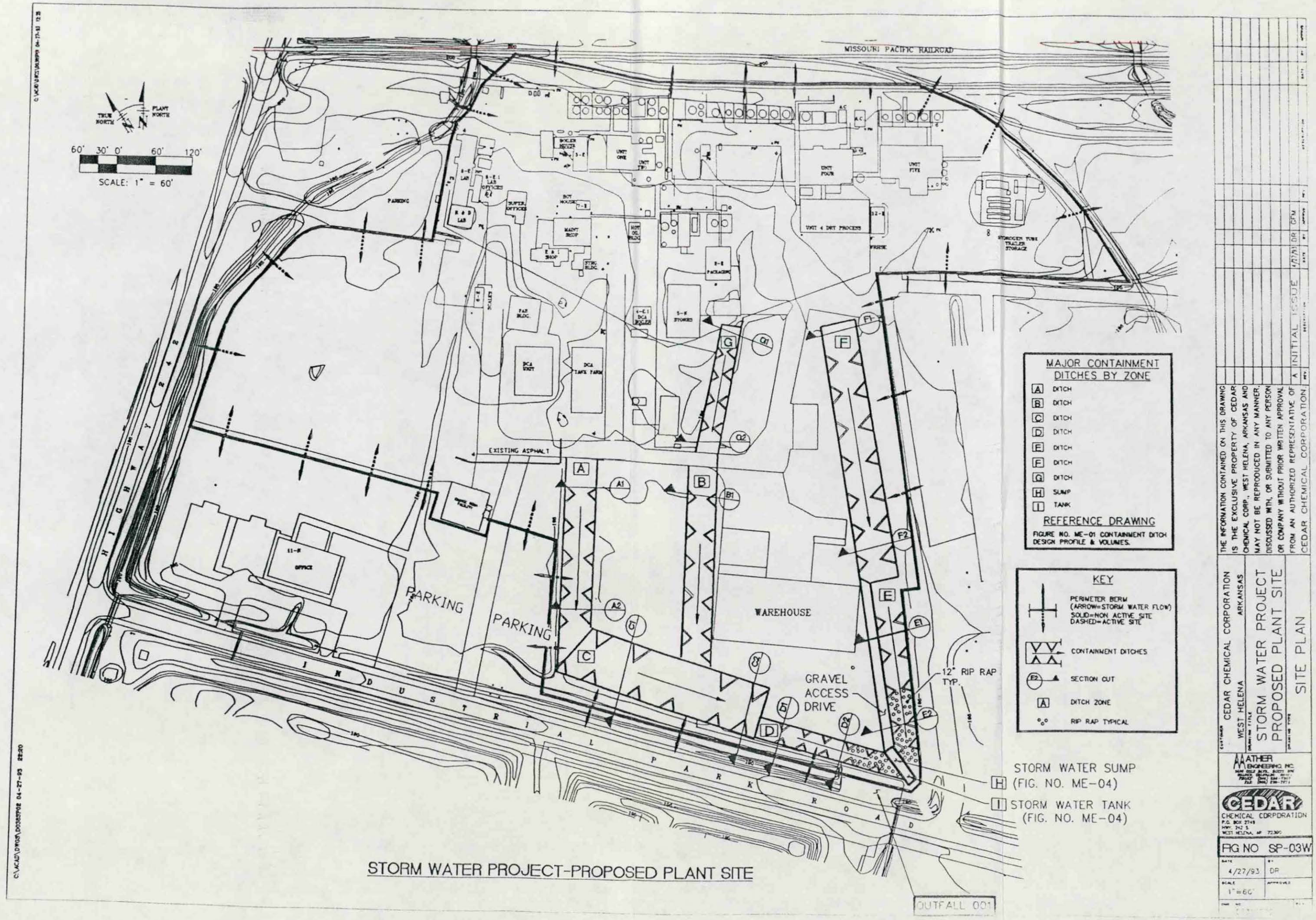
DRAWING TYPE: SITE PLAN

ATHER ENGINEERING, INC.
4670 GOLF BLVD., SUITE 300
HOLLAND, OHIO 43528
PHONE: (804) 236-7264
FAX: (804) 236-7271

CEDAR CHEMICAL CORPORATION
P.O. BOX 2749
HWY. 242 S.
WEST HELENA, AR 72390

FIG NO SP-02W

DATE	BY
4/27/93	BJE
SCALE 1" = 100'	APPROVED
DWG NO. D038SP01	REV A



STORM WATER PROJECT-PROPOSED PLANT SITE

REV	DESCRIPTION	DATE	BY	APPROVED
A	INITIAL ISSUE	1/27/93	DR	GFM

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CUSTOMER: CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

DRAWING TITLE: STORM WATER PROJECT PROPOSED PLANT SITE

DRAWING TYPE: SITE PLAN

ATHER ENGINEERING, INC.

CEDAR CHEMICAL CORPORATION
P.O. BOX 2749
HWY. 242 S.
WEST HELENA, AR 72390

FIG NO SP-03W

DATE	BY
4/27/93	DR
SCALE 1"=60'	APPROVED

CLIENT: CEDAR CHEMICAL CORPORATION

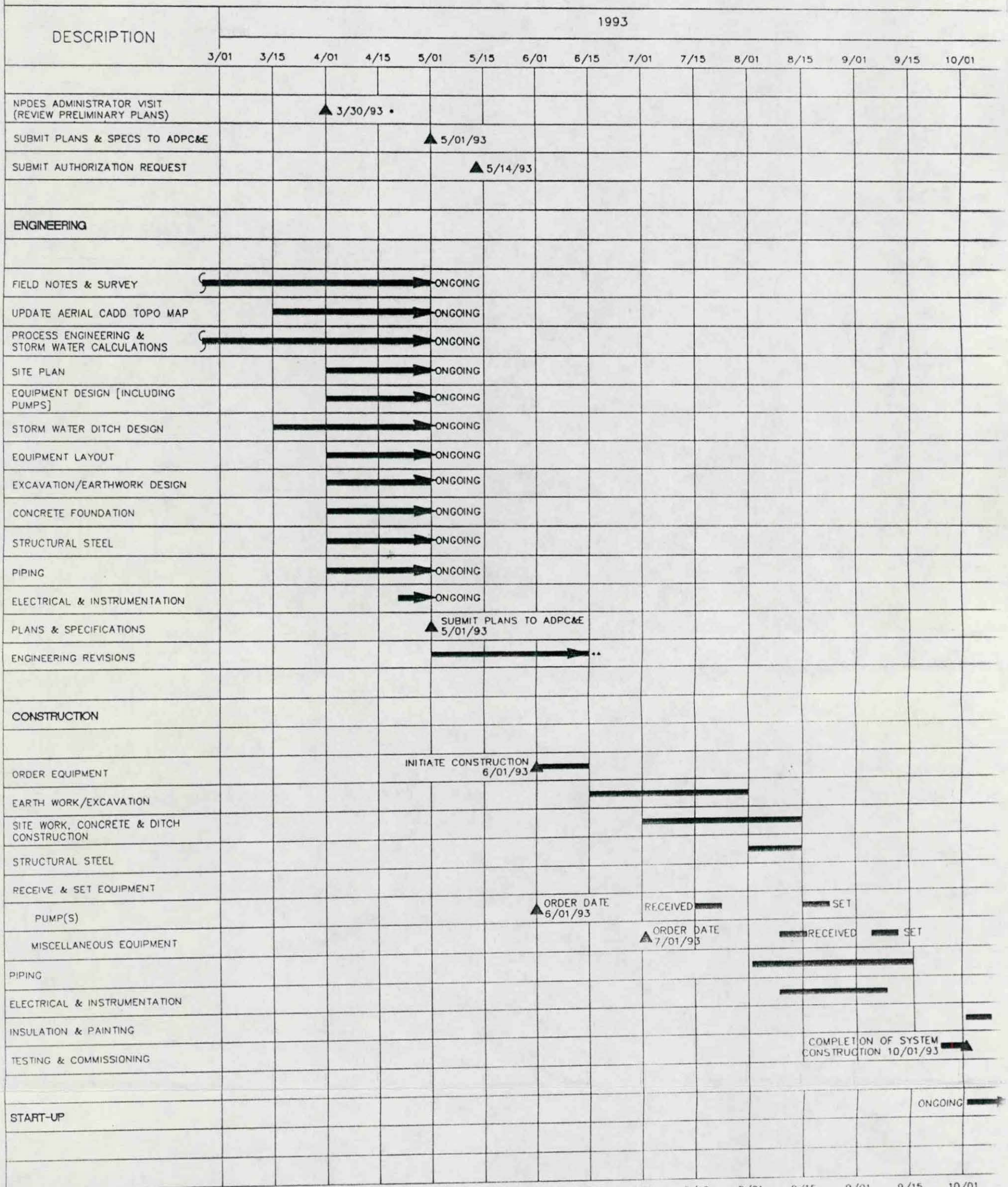
LOCATION: WEST HELENA, ARKANSAS

PROJECT: STORM WATER PROJECT

PROJECT SCHEDULE

BAR DIAGRAM

ENGINEERING – PROCUREMENT – CONSTRUCTION



C:\ACAD\DWGS\B038SCH 04-26-93 19:00

NOTES

- • PRELIMINARY PROJECT REVIEW
- •• ESSENTIAL PROJECT ENGINEERING COMPLETE

KEY

▲ MILESTONE

CEDAR CHEMICAL CORPORATION

AATHER ENGINEERING, INC.

A DRAFT ENVIRONMENTAL RELEASE

LOCATION: WEST HELENA, AR

STORM WATER PROJECT SCHEDULE

FIG NO ME-00

DRAWING	BY	DATE
DESIGN	GPM	4/26/93
DRAWN	DR	4/26/93
CHECKED	JO	4/26/93

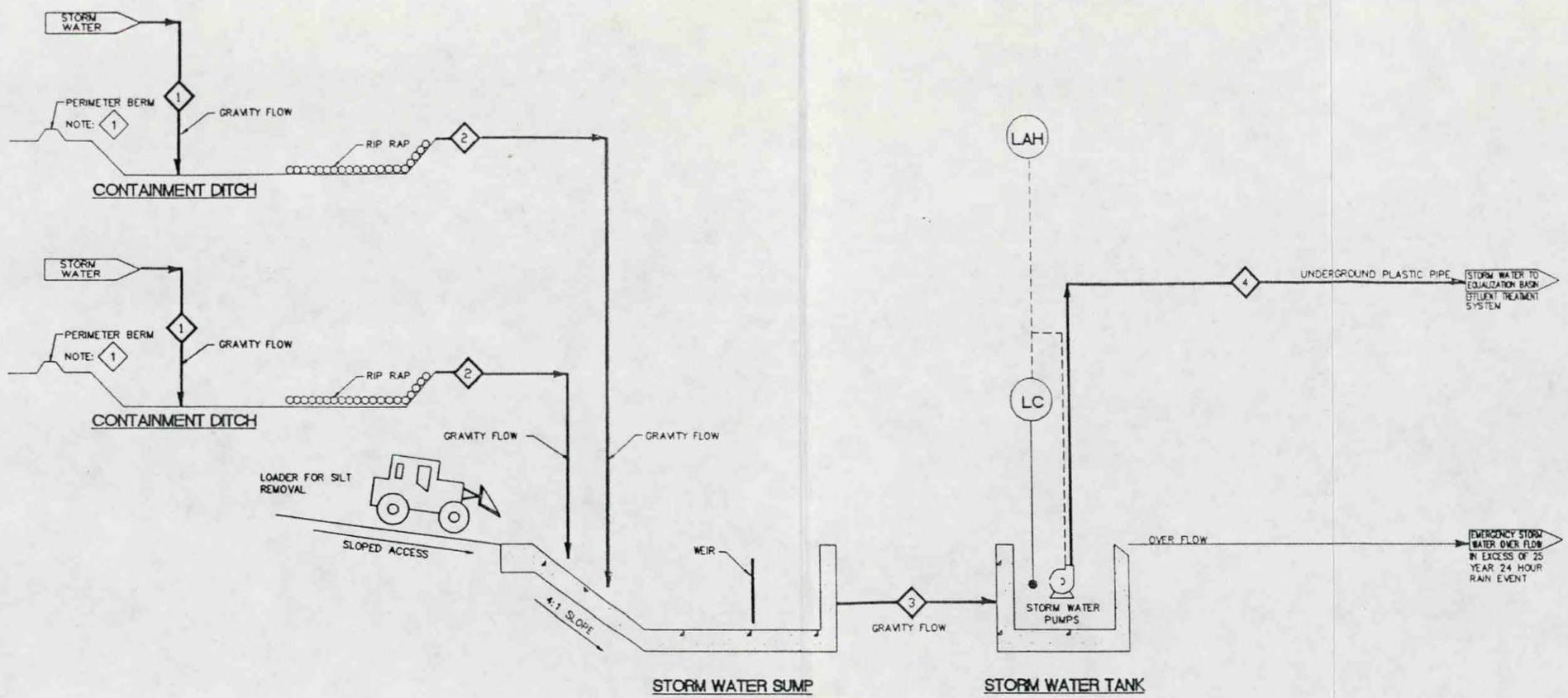
APPR.	GPM	4/26/93
APPR.	GPM	4/26/93
APPR.	GPM	4/26/93

SCALE NONE

DRAWING NO B038SCH

SHT 1 OF 1

REV A



CONTAINMENT DITCHES

CAPACITY	2,500,000 GALLONS NOMINAL
MATERIAL	EARTHEN WITH EROSION CONTROL. RIP RAP @ END OF DITCH (FOR SILT REMOVAL PRIOR TO SUMP).
SIZE	VARIES-GENERALLY 40 FT. TO 90 FT. WIDE AND 2 FT. TO 6 FT. DEEP. SIDE SLOPES 4:1.

STORM WATER SUMP

CAPACITY	50,000 GALLONS NOMINAL
MATERIAL	REINFORCED CONCRETE WITH WEIR FOR SILT REMOVAL.
NOTE:	SLOPED ENTRY FOR ACCESS FOR REMOVAL OF SILT BY LOADER.
SIZE	60'X12'X16' (LXWXH-SLOPED ENTRY)

STORM WATER TANK

CAPACITY	15,000 GALLONS NOMINAL
MATERIAL	REINFORCED CONCRETE
NOTE:	TO PROVIDE ADEQUATE SUCTION FOR STORM WATER PUMPS.
SIZE	11'X12'X16' (LXWXH)

STORM WATER PUMPS

CAPACITY	500 GPM EACH (TWO)
MATERIAL	CAST IRON
TYPE	SUBMERSIBLE CENTRIFUGAL NON-CLOGGING
SIZE	4"X4"X10" (7.5 H.P. MOTOR)

NOTE: 1

ACTIVE PLANT SITE WILL HAVE A PERIMETER BERM FOR ADDITIONAL CONTAINMENT.

KEY

LAH	LEVEL ALARM HIGH
LC	LEVEL CONTROL
——→	MAIN PROCESS FLOW
——→	SECONDARY PROCESS FLOW
- - - -	ELECTRICAL
4	STREAM NUMBER/ORDER OF FLOW SCHEME

STORM WATER PROJECT PROCESS FLOW DIAGRAM

REV	DESCRIPTION	DATE	BY	APPROVED
A	INITIAL ISSUE	4/26/93	DR	GFM

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CUSTOMER: CEDAR CHEMICAL CORP. WEST HELENA ARKANSAS

DRAWING TITLE: STORM WATER PROJECT

DRAWING TYPE: PROCESS FLOW DIAGRAM

MATHER ENGINEERING, INC.
1636 COLE BLVD., SUITE 206
GOLDEN, COLORADO 80401
PHONE: (303) 238-7353
FAX: (303) 238-7271

CEDAR CHEMICAL CORPORATION

FIG NO ME-01

DATE	BY
4/26/93	DR
SCALE CHECK DWG: AS NOTED	APPROVED
DWG NO: D-038-PF01	REV: A

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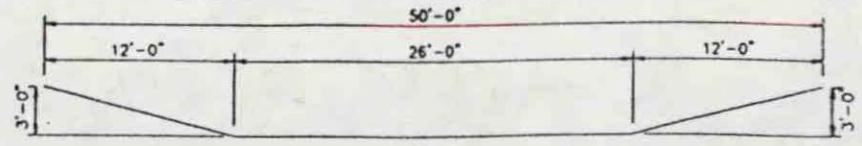
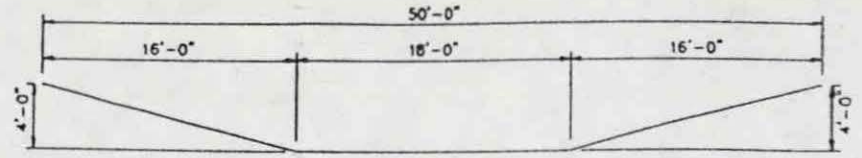
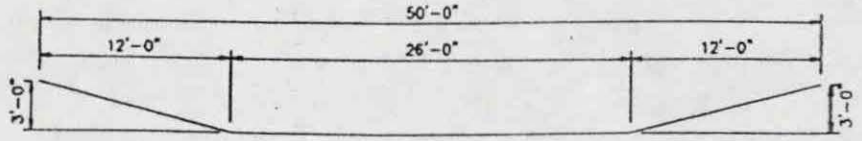
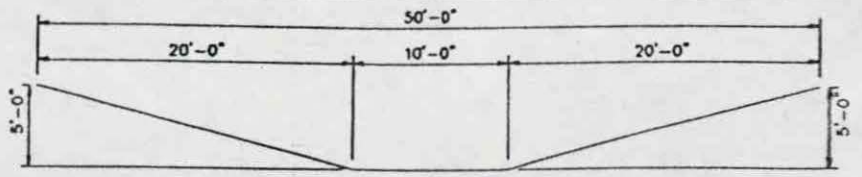
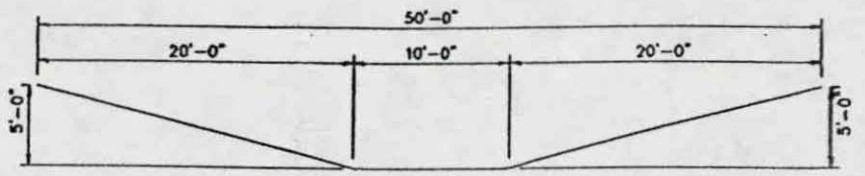
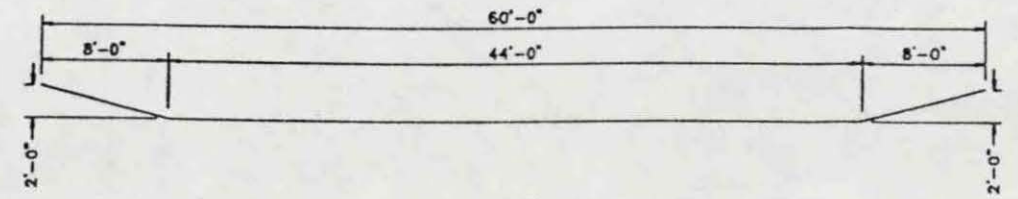
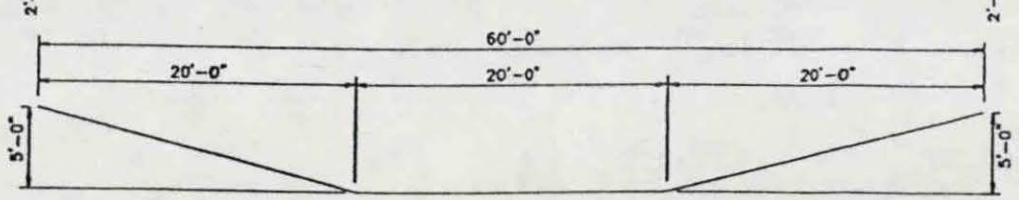
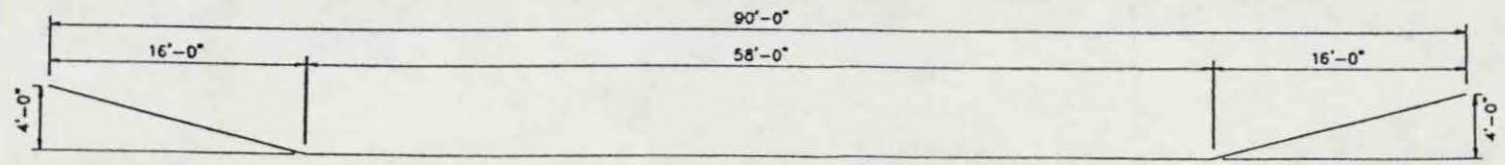
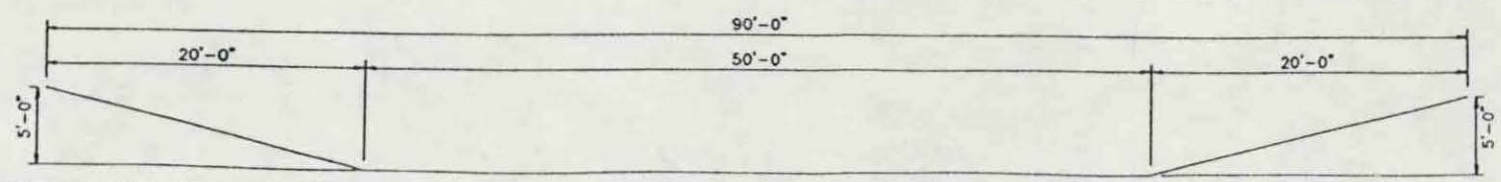
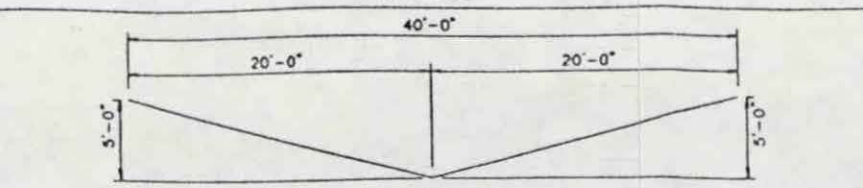
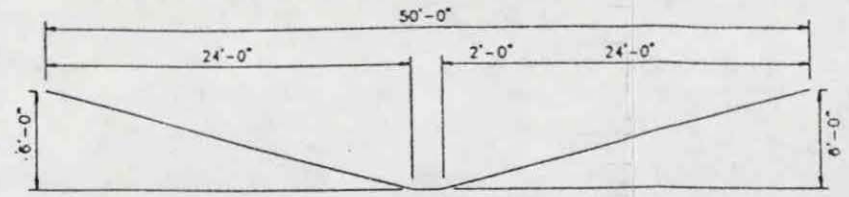
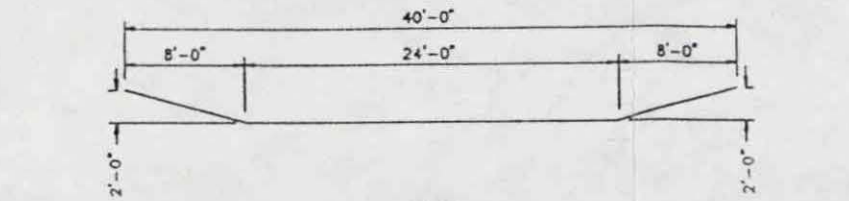
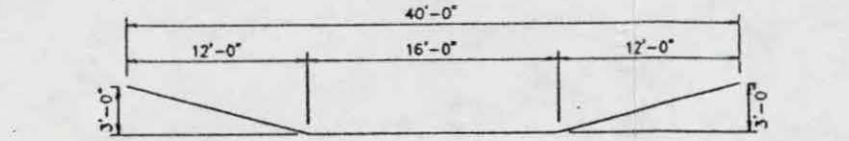
ZONE	SECTION	PROFILE	CHANNEL AREA
A	A1 (290' LONG)		76%
A	A2		68%
B	B1 (320' LONG)		76%
B	B2		60%
D	D1 (300' LONG)		60%
D	D2		52%
F	F1 (400' LONG)		87%
F	F2		67%
C	C1 (270' LONG)		82%
C	C2		78%

ZONE	SECTION	PROFILE	CHANNEL AREA
E	E1 (250' LONG)		50%
E	E2		52%
G	G1 (200' LONG)		80%
G	G2		70%

ZONE	LENGTH (FT)	x	WIDTH (FT)	x	AVERAGE DEPTH (FT)	x	AVERAGE CHANNEL AREA (%)	=	VOLUME (FT3)	=	VOLUME (GAL)
A	290		50		3.5		72%		36,540		273,319
B	320		50		4		68%		43,520		325,530
C	270		90		4.5		80%		87,480		654,350
D	300		50		5.5		56%		46,200		345,576
E	250		45		5.5		51%		31,556		236,041
F	400		60		3.5		77%		64,680		483,806
G	200		40		2.5		75%		15,000		112,200
H	SUMP										50,000
I	TANK										15,000
	TOTAL										2,495,822

REV	DESCRIPTION	DATE	BY	APPROVED
A	INITIAL RELEASE	1/27/93	BJE	CFM

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CUSTOMER: CEDAR CHEMICAL CORPORATION
WEST HELENA ARKANSAS

DRAWING TITLE: STORM WATER PROJECT
CONTAINMENT DITCH DESIGN

DESIGN TYPE: CIVIL

ATHER ENGINEERING, INC.
NEW ORLEANS, LOUISIANA 70115
TEL: (504) 894-7900
FAX: (504) 894-7911

CEDAR CHEMICAL CORPORATION
P.O. BOX 2749
HWY. 242 S.
WEST HELENA, AR 72390

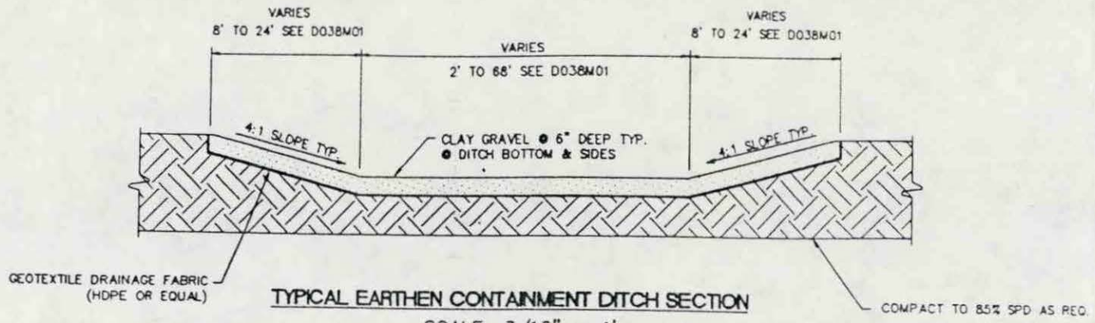
FIG NO ME-02

DATE	BY
4/27/93	BJE

SCALE: 1/8" = 1'-0"

APPROVED:

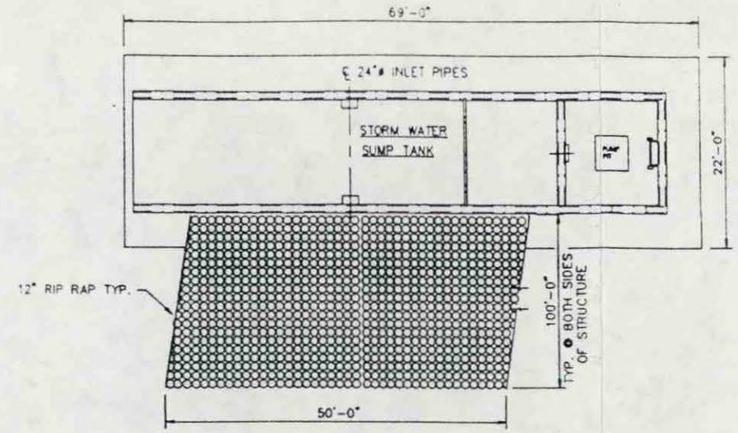
D0389A01 | A



TYPICAL EARTHEN CONTAINMENT DITCH SECTION

SCALE: 3/16" = 1'

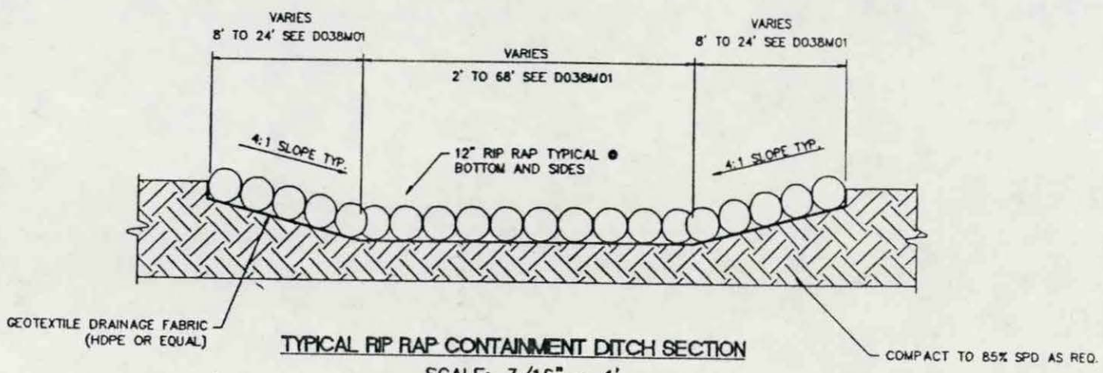
NOTE 1 2



PLAN VIEW-STORM WATER DITCH D AT STORM WATER SUMP

SCALE: 1/8" = 1"

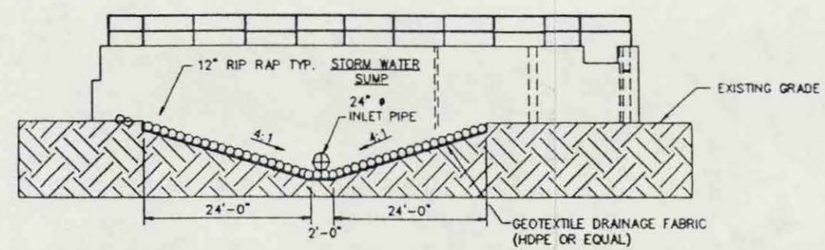
NOTE: 1



TYPICAL RIP RAP CONTAINMENT DITCH SECTION

SCALE: 3/16" = 1'

NOTE: 1



STORM WATER DITCH D AT STORM WATER SUMP (ELEVATION LOOKING EAST)

SCALE: 1/8" = 1"

NOTE: 1

STORM WATER PROJECT PROCESS FLOW DIAGRAM

NOTES:

1. SEE DRAWING D038SP02 FOR TYPICAL CROSS SECTION LOCATIONS.
2. CLAY GRAVEL SHOWN FOR SOIL STABILIZATION. OTHER EROSION CONTROL TECHNIQUES MAY BE USED, SUCH AS VEGETATION (BERMUDA GRASS) OR SELECTED USE OF OTHER LINERS OR MATERIALS.

REV.	DESCRIPTION	DATE	BY	APPROVED
A	INITIAL RELEASE	4/26/93	DR	GFM

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CUSTOMER: CEDAR CHEMICAL CORP.
WEST HELENA ARKANSAS

DRAWING TITLE: STORM WATER PROJECT
CONTAINMENT DITCH DESIGN DETAILS

DRAWING TYPE: CIVIL

MATHER ENGINEERING, INC.
1536 COLE BLVD., SUITE 200
GOLDEN, COLORADO 80401
PHONE: (303) 236-7363
FAX: (303) 236-7271

CEDAR CHEMICAL CORPORATION
P.O. BOX 2748
HWY 214 E.
WEST HELENA, AR 72390

FIG NO ME-03

DATE	BY
4/26/93	DR
SCALE (UNLESS OTHERWISE NOTED)	APPROVED
AS NOTED	
DWG NO. D038M02	REV. A

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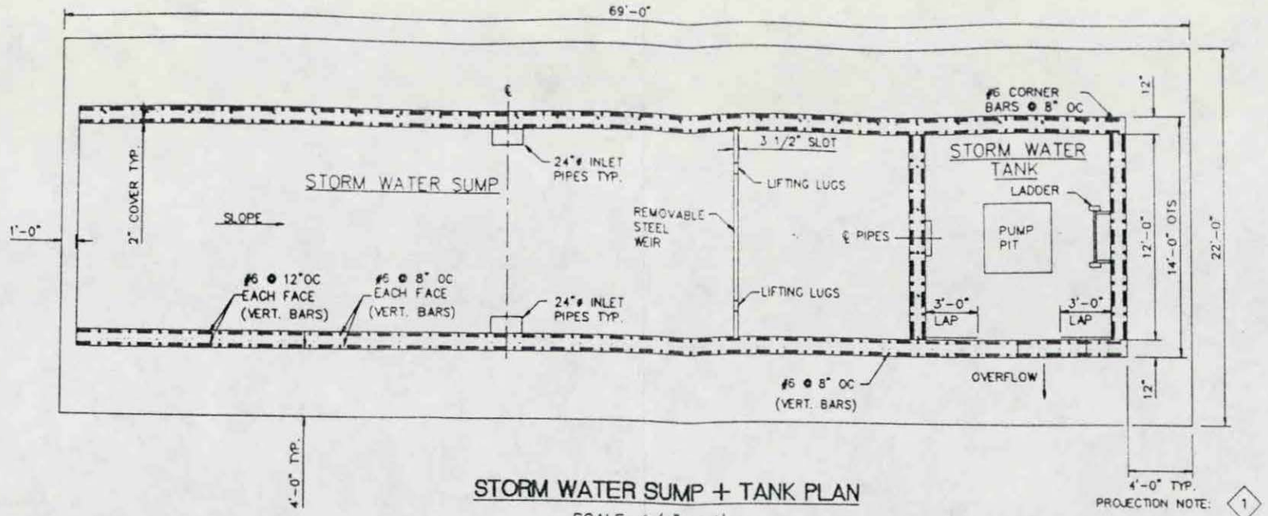
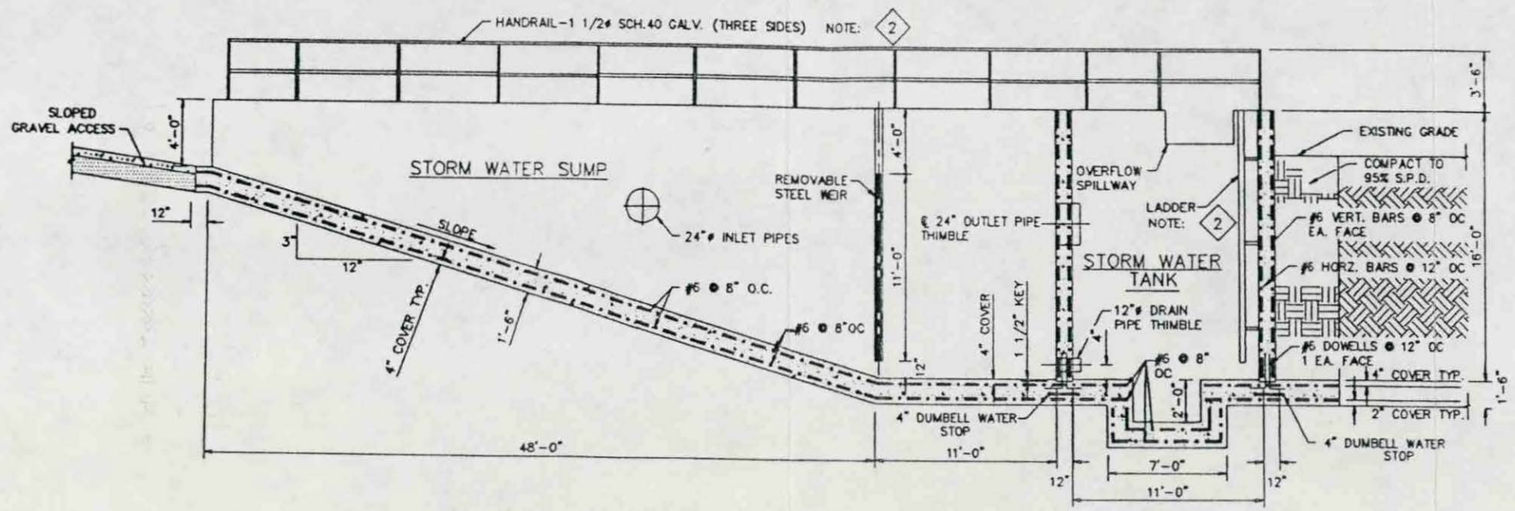


STORM WATER SUMP + TANK PLAN

SCALE: 1/4" = 1'



STORM WATER SUMP AND TANK ELEVATIONS (LOOKING NORTHEAST)

SCALE: 1/4" = 1'

STORM WATER SUMP AND TANK FOUNDATIONS

NOTES:

1. 4' PROJECTION ON THREE SIDES WILL BE VERIFIED BY SOILS REPORT.
2. LADDER AND HANDRAIL TO CONFORM TO OSHA STDS.

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REV	DESCRIPTION	DATE	BY	APPROVED
A	INITIAL ISSUE	4/26/93	DR	GFM

CUSTOMER: CEDAR CHEMICAL CORP. WEST HELENA ARKANSAS

DRAWING TITLE: STORM WATER PROJECT-STORM WATER SUMP & TANK CONCRETE FOUNDATIONS

DRAWING TYPE: CIVIL

MATHER ENGINEERING, INC.
1636 COLE BLVD., SUITE 206
GOLDEN, COLORADO 80401
PHONE: (303) 238-7353
FAX: (303) 238-7271

CEDAR CHEMICAL CORPORATION

FIG NO ME-04

DATE	BY
4/26/93	DR
SCALE (IN DWG ONLY)	APPROVED
AS NOTED	
DWG NO D-038-C01	REV A

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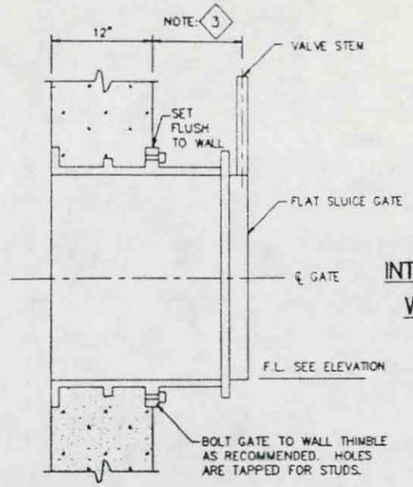
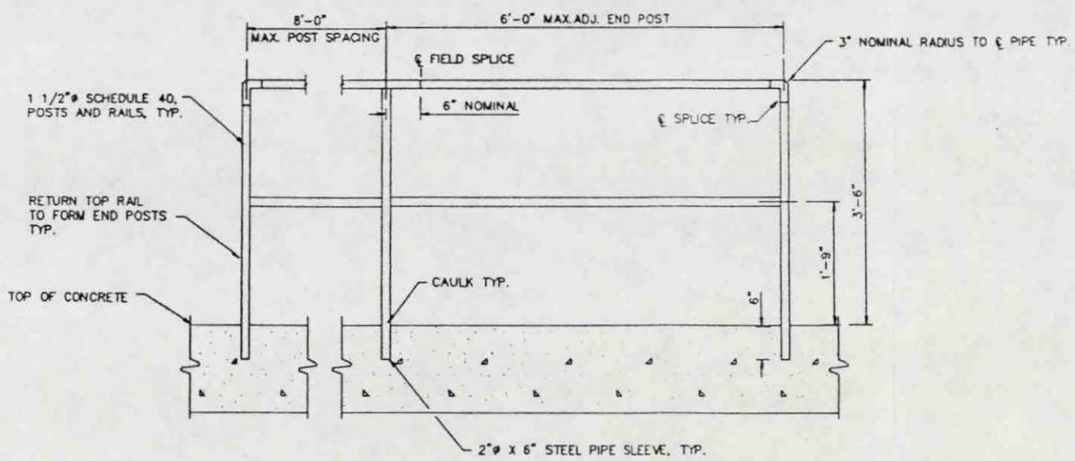


TYPICAL 12" OR 24" SLUICE GATE DETAIL

SCALE: 1 1/2" = 1'

GENERAL CONCRETE SPECIFICATIONS

1. FOUNDATIONS ARE DESIGNED FOR A MAXIMUM ALLOWABLE GROSS SOIL BEARING OF 2000 P.S.I. AT A DEPTH OF 2 FEET.
2. CONCRETE 28 DAY COMPRESSIVE STRENGTH SHALL BE 4000 P.S.I. FOR SLABS ON GRADE AND EXTERIOR CONCRETE SHALL HAVE A MINIMUM COMPRESSIVE STRENGTH OF 4000 P.S.I. CONCRETE SHALL HAVE A MINIMUM SLUMP OF 4 INCHES.
3. CONCRETE DESIGN, MIXING, AND PLACEMENT SHALL BE IN ACCORDANCE WITH ACI 318-83
4. REINFORCING STEEL SHALL BE ASTM A-513, GRADE 80 LAP REINFORCING BARS MINIMUM OF 36 BAR DIAMETERS.
5. ALL CONSTRUCTION ie. FOUNDATION WALLS, STRUCTURAL STEEL, ETC. SHALL BE BRACED TO RESIST THE APPLIED LOADS UNTIL THE CONSTRUCTION IS COMPLETE.
6. CONSTRUCTION JOINTS SHALL BE SO MADE AND LOCATED AS TO LEAST IMPAIR THE STRENGTH OF THE STRUCTURE AND SHALL BE APPROVED BY THE ENGINEER. JOINTS SHALL BE PERPENDICULAR TO THE MAIN REINFORCEMENT. CONTINUE ALL REINFORCEMENT ACROSS CONSTRUCTION JOINTS IN STRUCTURAL AREAS.
7. CONCRETE COVER, THE FOLLOWING MINIMUM CONCRETE SHALL BE PROVIDED FOR REINFORCING BARS:
   - A. CONCRETE CAST AGAINST AND PERMANENTLY EXPOSED AGAINST EARTH.....3 INCHES
   - B. CONCRETE EXPOSED TO EARTH OR WEATHER:
     - #6 THROUGH #18 BARS.....2 INCHES
     - #3 AND SMALLER.....1 1/2INCHES
   - C. CONCRETE NOT EXPOSED TO EARTH OR WEATHER:
     - SLABS, WALLS, JOINTS.....3/4 INCHES
     - BEAMS, COLUMNS.....1 1/2 INCHES
8. ALL CONCRETE MIX DESIGNS SHALL BE PROPORTIONED IN ACCORDANCE WITH ACI 318. SUBMIT MIX DESIGNS TO ENGINEER FOR APPROVAL.
9. A MINIMUM OF THREE TEST CYLINDERS WILL BE TAKEN FROM EACH CONCRETE PLACEMENT AND WILL BE MARKED FOR IDENTIFICATION, ONE TO BE TESTED AT SEVEN DAYS FOR INFORMATION AND TWO TO BE TESTED AT TWENTY-EIGHT DAYS FOR ACCEPTANCE.



TYPICAL HANDRAIL DETAIL NOTE: 4

SCALE: 1" = 1'

GENERAL STRUCTURAL NOTES:

1. DESIGN IN ACCORDANCE WITH ACI-318 & ACI-350 / SANITARY ENGINEERING STRUCTURE.
2. CALCULATION OF MAXIMUM HYDROSTATIC PRESSURE WITH GROUND WATER ASSUMED AT GRADE.
3. DIMENSION AS REQUIRED FOR FURNISHED GATE
4. POSTS, RAILINGS AND SLEEVES, SHALL BE FABRICATED FROM SCHEDULE 40 GALV. STEEL PIPE CONFORMING TO ASTM A-53.
5. CHAMFER ALL EXPOSED CONCRETE CORNERS 1" BY 45°.

STORM WATER SUMP + TANK CONCRETE DETAILS AND SPECIFICATIONS

NO.	DESCRIPTION	DATE	BY	APPROVED
A	INITIAL ISSUE	4/26/93	DR	GFM

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CUSTOMER: CEDAR CHEMICAL CORP. ARKANSAS
WEST HELENA
DRAWING TITLE: STORM WATER PROJECT-STORM WATER SUMP & TANK CONCRETE DETAILS AND SPECIFICATIONS
DRAWING TYPE: CIVIL

MATHER ENGINEERING, INC.
1698 COLE BLVD. SUITE 300
GOLDEN, COLORADO 80401
PHONE: (303) 238-7263
FAX: (303) 238-7271

CEDAR CHEMICAL CORPORATION
P.O. BOX 2068
HWY. 242 N.
WEST HELENA, AR 72390

DWG NO ME-05

DATE	BY
4/26/93	CP

SCALE (ON 24" DWG) AS NOTED | APPROVED

DWG NO | REV A

C:\ACAD\DWGS\0030C02 04-26-93 18:27

EXHIBIT III

VENDOR LITERATURE

A. SUBMERSIBLE SUMP PUMP
(CLOW YEOMANS OR EQUAL)

B. BURIED PLASTIC PIPE
(PHILLIPS DRISCOPIPE OR EQUAL)

Trigon
ENGINEERING COMPANY
ENGINEERED SYSTEMS FOR INDUSTRIAL PROCESSES, ENERGY CONSERVATION, POLLUTION CONTROL

Cedar Chemical
West Helena, Arkansas

Attn: Tom Lodice

For your consideration, we offer two sizes of duplex submersible pump sets. The smaller size will provide 500 gpm at 26'tdh. The alternate selection will provide 2750 gpm at 25'tdh. Each pump sert is quoted with float controls and duplex pump control panel.

1 Yeomans duplex submersible pump set with 2 - 4 x 4 x10 x 3 pumps of cast iron construction, with 7 1/2 hp motors, with prelubricated bearings, moisture detector, thermal protection and double mechanical seals. Pump discharge elbow is 4 x 6.Included is guide rail mounting bracket, 15' stainless steel lifting chain, Nema 4 junction box, float switch mounting bracket, 4 - mercury float switches, and duplex control panel which will include 2 - motor circuit breaker disconnects, 2 - ACL contactors, overload protectors, HOA switches, rotary alternator, run lights, terminal strip for power and floats, 110 volt control circuit, 460v 3-phase service, seal warning lights, and high water level alarm bell.
Not included are 2 - lengths of 2 1/2" schedule 40 pipe for guide rails.
Not included is hoist for removing pumps from sump.
Cable lengths provided will cover sump depth up to 10'.

Price: **$10,352**

Alternate selection:

1 Yeomans duplex submersible pump set with 2 - 8 x 8 x 15 x 5 pumps having 30 hp motors. Discharge elbow is 8 x 8. All other features and options are as stated above.

Price: **$22,322**

EXHIBIT III
(A) SUBMERSIBLE SUMP PUMP

Estimated delivery is 6-8 weeks. Shipping pointis Chicago, Illinois.
See enclosed for further details.

Gary Q. Lee

ONE TRIGON PLACE ▲ LITTLE ROCK, ARKANSAS 72209 ▲ (601) 455-2111 ▲ FAX 455-3700

CLOW

Pump Division
Clow Corporation
Melrose Park, Illinois

Clow Yeomans
SERIES 9000

Technical Specifications

NON-CLOG SUBMERSIBLE PUMPS

GENERAL

Furnish _____ non-clog submersible sewage pumps as manufactured by Clow Corporation, Pump Division, Melrose Park, Illinois.

PUMPS

Pumps shall be _____ size, Clow Yeomans Series 9000, non-clog submersible sewage pumps. Each pump shall be designed for a capacity of _____ GPM against _____ feet total dynamic head. (Optional: Pump and motor assembly shall be U/L listed.)

MOTORS

Each pump shall have a U/L listed, hermetically sealed, submersible type, electric motor of ____ HP, _____ RPM for operation on _____ volt, _____ phase, _____ hertz power designed to Class 1, Group C & D, Division 1 specifications, for use in hazardous locations and for general use in pumping water and sewage. The motor nameplate horsepower rating shall not be exceeded by the brake horsepower requirement of the pump for the design condition of service specified and for the impeller diameter furnished. The motor shaft shall be stainless steel, impervious to the liquid and waste matter which is being pumped. Thermal overload protection and a moisture detection system shall be built into the motor. The motor service factor of 1.15 shall not be exceeded at carry out conditions.

Two mechanical seals shall be used to contain the oil in the probe and detection chamber. Two probes shall be supplied in this chamber for moisture detection. The mechanical seals shall have carbon and ceramic mating faces, stainless steel metal parts and Buna N elastomers. (Option: Lower seal having solid tungston carbide dual contact surfaces.)

Twenty five feet of U/L approved, extra hard usage, multi-conductor power and control cable is supplied as standard equipment with the motor. (NEC code 501-11 Section portable utilization equipment as recommended by U/L.)

Lifting eyes shall be cast into the motor housing adequately designed to lift the pump-motor assembly.

PUMP CONSTRUCTION

The pumping unit shall be constructed in accordance with A.S.T.M. Specifications No. A48-76, Class 30, which shall include cast iron for motor, integral support legs, pump casing and impeller. All pipe flanges shall be faced and to the thickness required for compliance with 125 lb. American Standard. Bolt slots are acceptable in lieu of drilled holes.

PUMP CASING

The pump casing shall be of the volute type and made of cast iron. The casing shall be of one piece construction and of center line discharge design to minimize clogging or flow interference. (Option: Furnish stainless steel fasteners, Option: Furnish exterior coating of coal tar epoxy, Option: Bronze or stainless steel suction wearing ring.)

IMPELLER

The impeller shall be cast in one piece and directly mounted to a one piece stainless steel pump-motor shaft. It shall not require separate pump shaft or coupling. Each impeller shall be an enclosed type. The impeller shall pass a _____ sphere. The ends of the blades shall be rounded to prevent clogging. The impeller is to have pump out vanes to reduce thrust and to pump out grit from the seal area. (Option: Bronze or stainless steel wearing ring.)

The impeller hub shall be provided with a keyway and key and will be locked to the pump shaft and maintained in this position by a washer and self-locking impeller screw or nut.

MOTOR BEARINGS

Bearings shall be in accordance with electric motor specification B-10, life of 15,000 hours. The bottom bearing is to be a locked shaft, high thrust, anit-friction bearing which prevents shaft movement.

DUAL RAIL QUICK LIFT ASSEMBLY FOR 4, 6, 8, 10, and 12" SUBMERSIBLE PUMPS

GENERAL

Furnish _____ "Quick Lift" slide rail mechanisms to guide submersible pump from upper level to its operational location in the sump basin.

ELBOW

The base elbow shall be cast in accordance with A.S.T.M. Specification No. A48-76, Class 30. All pipe flanges shall be faced and to the thickness required for compliance with 125 lb. American Standard. Bolt slots are acceptable in lieu of drilled holes. Bolt slots in the base are to be provided for mounting the elbow to the concrete floor or sole plate. The base elbow is specifically designed to permit the slide mechanism to link up the pump with the base elbow.

GUIDE PIPES

The guide pipes are to be constructed from standard steel schedule 40 or schedule 80 pipe. The guide pipes are to be attached to the concrete basin cap at the upper level by an attachment bracket. Intermediate brackets shall be supplied as indicated on drawings. The pipes shall be of the size indicated on the drawings. (Option: Pipe available in hot dipped galvanized or stainless steel.)

GUIDE PLATE

A ductile iron guide plate will guide the pump assembly down the guide pipes until the latch contacts the discharge elbow. (Option: Bronze construction on U/L listed equipment.)

The pump then fulcrums about this point and positions the pump discharge flange to properly engage it with the discharge elbow.

The guide plate is designed to permit removal of the pump, without having to disconnect any parts.

A neoprene jam washer shall fit in the slide plate to minimize leakage between the pump casing and base elbow. (Option: metal to metal without washer.)

CHAIN

A ¼" or ⅜" high test, welded galvanized steel chain shall lift the pump motor assembly from the sump basin. The upper end shall be hung on a hook on the access door. (Option: Hot dipped galvanized for U/L listed equipment.)

WINCH

One winch shall be used to service both pumps in duplex stations. The galvanized aircraft cable type winch shall have a fabricated steel support frame and have a capacity of 1500 pounds. The cable end is to be fitted with a grab hook to properly link up with the lifting chain attached to the pump-motor combination. (Large Pumps equipped with 320 TY and 360 TY motors should use a 1 ton or 2 ton electric hoist for pump removal as required.)

DUPLEX LEADER™ SUBMERSIBLE PUMP CONTROL PANEL

Furnish and install one (1) Clow/Yeomans Duplex Leader pump motor control panel for pump motor and auxiliary accessories for manual and automatic operation. The panel enclosure shall be NEMA Type (3R) (4) (12) for operation on _____ volts 3 phase, 60 hertz power supply. Enclosure shall include dead front outer door and inner barrier cover plate. Motor control components shall be sized to operate remotely located submersible pump motors of _____ horsepower at _____ RPM.

The motor control panel shall include the following for each pump motor: a motor protector disconnect, a motor starting contactor, a test-off-auto selector switch for automatic or manual mode control and a unit running light (green). Automatic mode control is supplied through remotely located liquid level sensors with normally open contacts.

One (1) control circuit transformer - line voltage primary - fused 120v/24v secondary shall be furnished to provide 24 volt control voltage to remotely located liquid level sensors and pilot control circuits of auxiliary equipment.

A set of liquid level control relays control the automatic mode through remotely located liquid level sensors. The liquid level controller shall respond to 4 levels of operation from the sensors.

Sensor:	S1: All Pumps Stop-Low Water Level
	S2: Lead Pump Start
	S3: Lag Pump Start
	S4: High Water Alarm

An automatic electric alternator shall be provided to: equalize wear and usage of the pumps, alternate operational sequence of pumps on successive starts and start lag pump if lead pump has failed to start or is unable to handle the load and the level continues to rise.

A moisture detection system for each motor will be furnished. The system will incorporate panel mounted components and two (2) moisture sensing probes mounted in the oil chamber of the motor between the mechanical seals. Should water enter this chamber it will actuate the moisture probes signaling the panel mounted components consisting of alarm light (amber) and identified with legend plate "seal leak".

Motor mounted thermal devices are a series connected automatic reset normally closed circuit. When excessive heat occurs it causes the thermostat to open stopping the motor.

Specifiable Options Are As Follows:

A High water relay with terminals for float switch and a remote alarm.
B Weatherproof high water alarm dome light (red).
C High water alarm horn with silence button.
D The addition of moisture detection relay with automatic motor shutdown feature to the standard seal leak detection system.
E Elapsed pump running time meter(s) - six (6) digit - reading hours and tenths.
F Test buttons - one(1) for each float switch.
G 120v cabinet heater with thermostat control.

CLOW

Pump Division
Clow Corporation
Melrose Park, Illinois

Clow Yeomans
SERIES 9000

DUPLEX LEADER SUBMERSIBLE PUMP CONTROL PANEL

(Dwg. No. 103563-C)

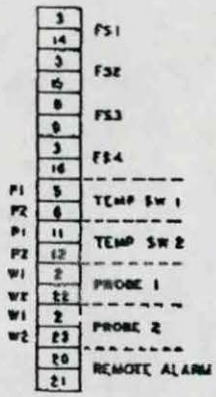
SERVICE VOLTAGE	MOTOR HP	CABINET SIZE NEMA 3R, 4, 12
230 460	3/10 5/20	20 x 20 x 6
230 460	15 30	24 x 20 x 8
230 460	20 40	30 x 24 x 8

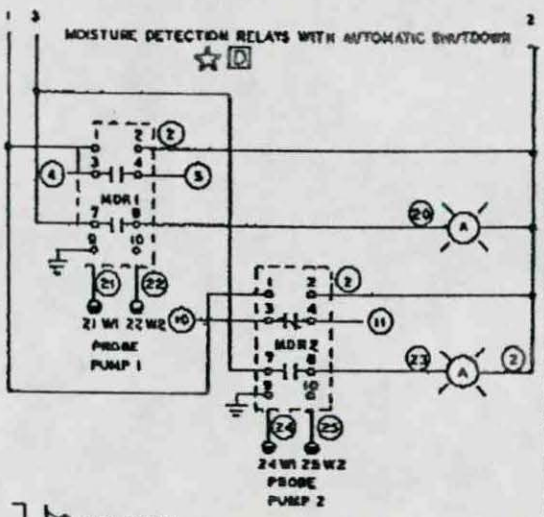
SPECIFIABLE OPTIONS ☆

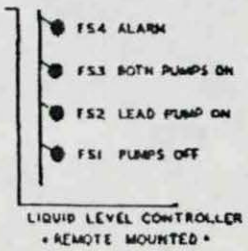
A = NOT FURNISHED
B = NOT FURNISHED
C = NOT FURNISHED
D = NOT FURNISHED
E = NOT FURNISHED
F = NOT FURNISHED
G = NOT FURNISHED

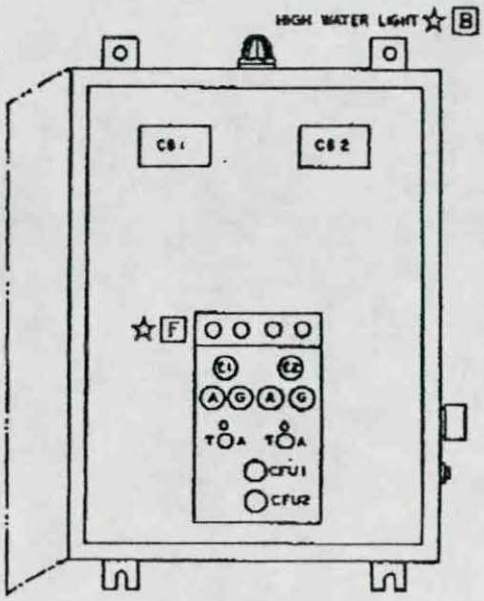
CB CIRCUIT BREAKER
TSR TRANSFORMER SWITCHING RELAY
CT CONTROL TRANSFORMER
CFU1 CONTROL FUSE 120 V
CFU2 CONTROL FUSE 24 V
M MOTOR CONTACTOR
G GREEN RUNNING LIGHT
SS TEST-OFF-AUTO SWITCH-SPRING RETURN FROM TEST TO OFF
ALT ALERNATOR
CR CONTROL RELAY
PB PUSH BUTTON
R RED HIGH WATER DOME LIGHT
H HORN
A AMBER MOISTURE SEAL LEAK LIGHT
MDR MOISTURE DETECTOR RELAY
FS FLOAT-SWITCH NOT IN THIS CABINET
E ELAPSED TIME METER
T THERMOSTAT
HTR HEATER

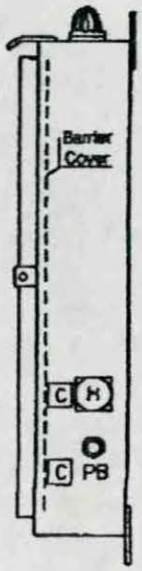
⊖ TERMINAL
(30) WIRE NO.
▲ REMOTE DEVICE - FIELD WIRING REQUIRED











☆ OPTIONS TO BE SPECIFIED

Prepared By: _____ Date: _____

CLOW

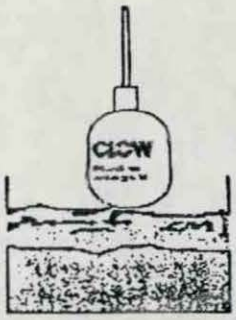
Pump Division
Clow Corporation
Melrose Park, Illinois

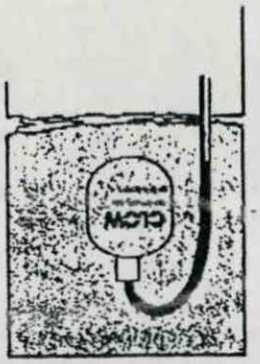
Clow Yeomans
SERIES 9000

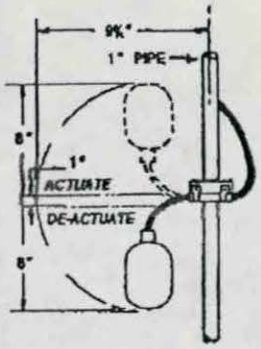
MERCURY LEVEL TILT SWITCHES

UL LISTED

- PILOT DUTY
- INDUSTRIAL CONTROL EQUIPMENT





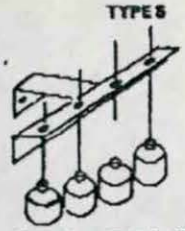


TYPE P

1" Pipe by others

Pipe mounted Model includes Polypropylene Clamp.

TYPE S

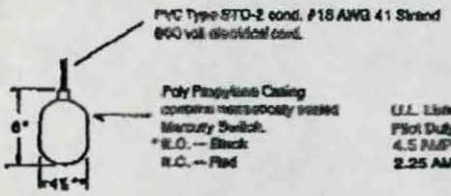


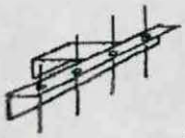
Type "S" with Stabilizing Weight

1" pipe by others

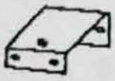
The float is a direct acting float switch. Each float contains a single pole mercury switch which actuates when the longitudinal axis of the float is horizontal, and deactuates when the liquid level falls 1" below the activation level.

The float is a chemical resistant polypropylene casing with a firmly bonded electrical cable protruding. One end of the cable is permanently connected to the enclosed mercury switch and the entire assembly is encapsulated to form a completely water tight and impact resistant unit.





CS-4-37
Wall Mounting Bracket
Qty. 4 - Type "S" Polo Floats



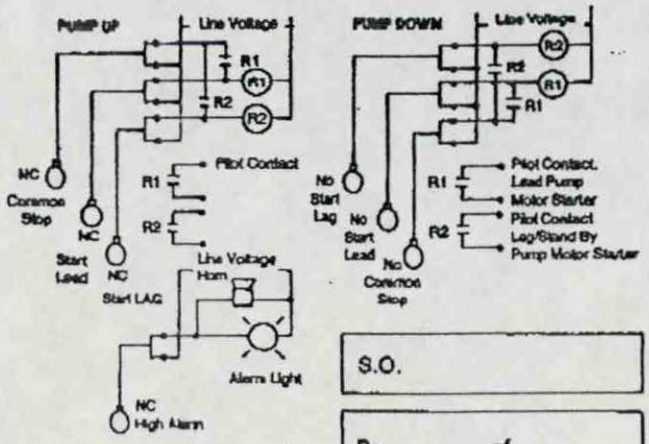
CS-4-36
Wall Mtg Bkt.
Qty. 1 - Type "P" Polo Float

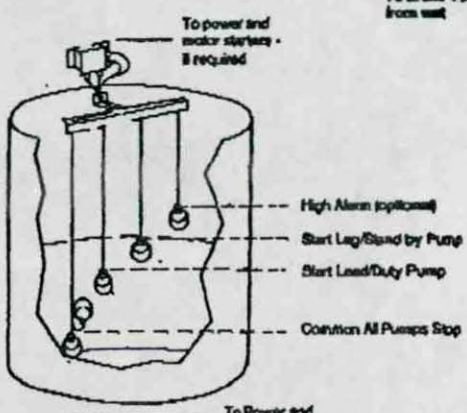
CS-4-40
WSTB Pipe Stabilizing Bkt.
To brace 1 pipe from wall

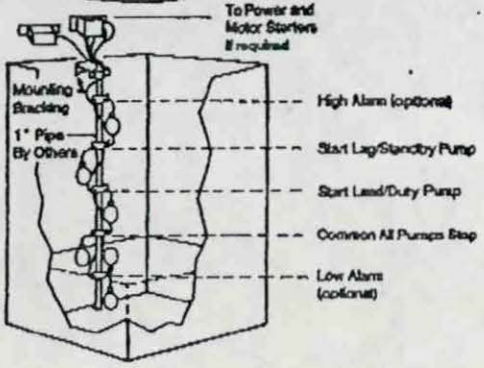
Switch Arrangement	Cable Length	Suspended Types		Pipe Mounted Type P	
		Model No.	Ship Wt.	Model No.	Ship Wt.
Normally Open	20	S20 NO	4	P20 NO	2
	30	*S30 NO	4½	P30 NO	2½
	40	S40 NO	5½	P40 NO	3½
Normally Closed	20	S20 NC	4	P20 NC	2
	30	S30 NC	4½	P30 NC	2½
	40	S40 NC	5½	P40 NC	3½

*Clow Std.

— TYPICAL 2 PUMP CIRCUITS







S.O.

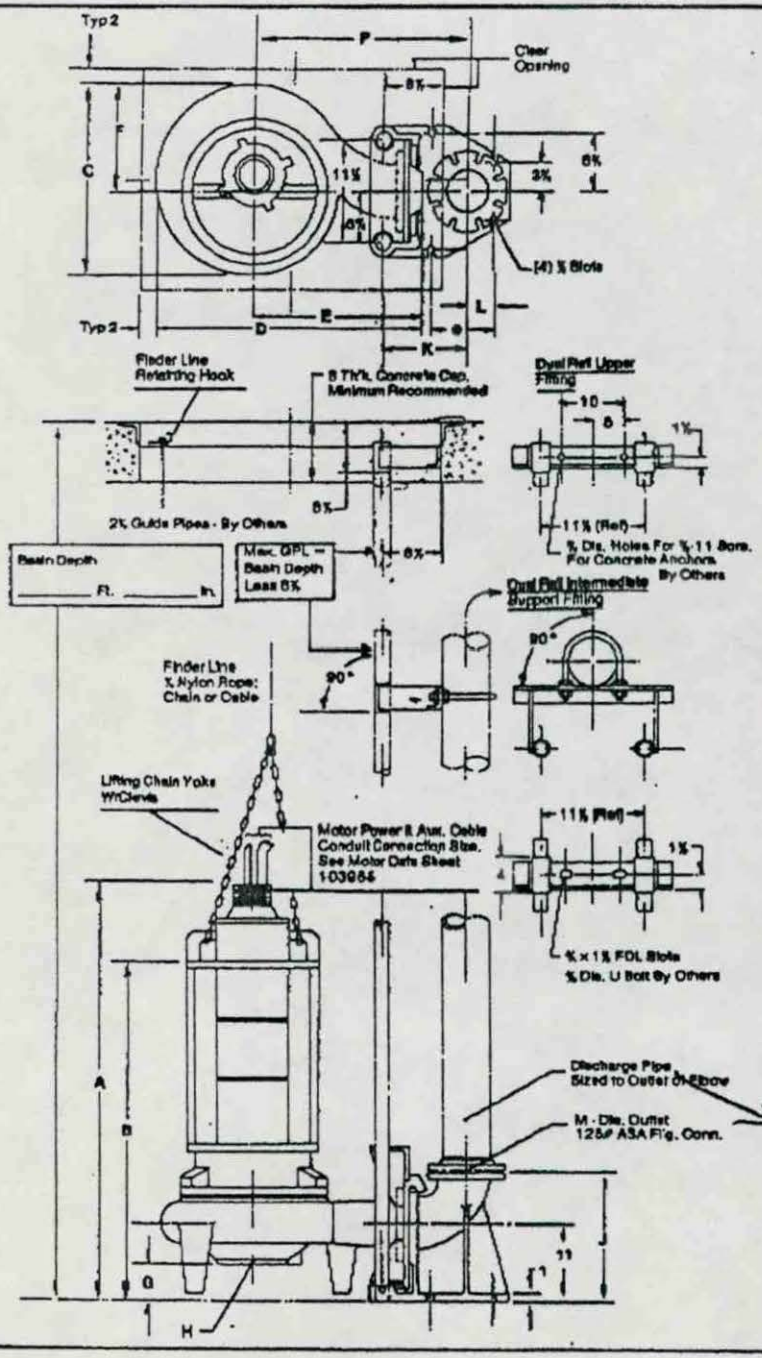
Pg. of

CLOW

Pump Division
Clow Corporation
Melrose Park, Illinois

SERIES 9000 SUBMERSIBLE PUMPS

With Dual Rail Quick Lift Fittings - 6 x 6; 6 x 8
Pump Units 4 x 4 x 7 x 3; 2½; ~~2, 4 x 4 x 10 x 3~~ 4 x 4 x 12 x 3; 4 x 4 x 15 x 3
(Dwg. No. 104062)



SUBMERSIBLE

Squirrel Cage Induction Motors
Totally Enclosed Non-Ventilated
W/Thermal Protection/Moisture Detection
UL Approved Class 1 Groups C & D
TY Motor Frame/HP Ratings

Customer: _____
P.O. No.: _____
Name of Job: _____
Pump Model: _____
Mt'r. Frame: _____
Conditions: _____ USGPM
@ _____ FT. TDH:
_____ HP; _____ RPM; _____ Vac:
_____ Ph; _____ Hertz:
S.O. No.: _____
Marks: _____

SINGLE PHASE 115 • 230 VAC 60 HERZ			THREE PHASE 200 • 230 • 460 • 575 VAC 60 HERZ		
MOTOR HP	OPERATING RPM 1750	OPERATING RPM 1150	OPERATING RPM 1750	OPERATING RPM 1150	OPERATING RPM 575
1	140	160	140	140	160
1½					
2	180	210		180	
3			180	210	210
5	210				
7½			210	260	260
10					
15			260	320	320
20					
25					
30			320		
40					
50					
60					
75					

- Quick Lift Assembly (Pump - Slide Plate Ass'y.)
- Standard (All Iron)
- UL Listed (Non-Sparking)

QUICK LIFT STATIONARY ELL	J	K	L	M
6 x 6	19	12	4	6
6 x 8	20	13	3	6

SERIES 9000 MODEL UNIT	MOTOR FRAME	A	B	UNIT WT. #	GUIDE PIPE NOM. NO.	GUIDE PIPE MAX. SECT. LG'TH	C	D	E	F	G	H	P 6 x 6	P 6 x 8
4 x 4 x 7 x 3	140	39½	27½	306	40	16'-0	11½	17½	14½	6½	4½	4	19½	—
x 2½	180	40½	29½	390	40	16'-0								
x 2	—	—	—	—	—	—								
4 x 4 x 10 x 3	180	39½	26½	410	40	16'-0	16½	25½	17½	7½	3½	4	23	24
	210	45	32½	690	40	16'-0								
	260	51½	37½	735	40	12'-0								
4 x 4 x 12 x 3	180	39½	28	425	40	16'-0	19½	27½	18½	8	3½	4	26½	27½
	210	44½	32½	710	40	16'-0								
	260	50½	36½	735	40	12'-0								
	320	54	42	870	80	14'-0								
4 x 4 x 15 x 3	260	47½	37½	870	40	12'-0	22½	34	22½	11½	6½	4	30½	31½
	320	55	43	960	80	14'-0								

All Dimensions shown in inches. Subject to change without notice.

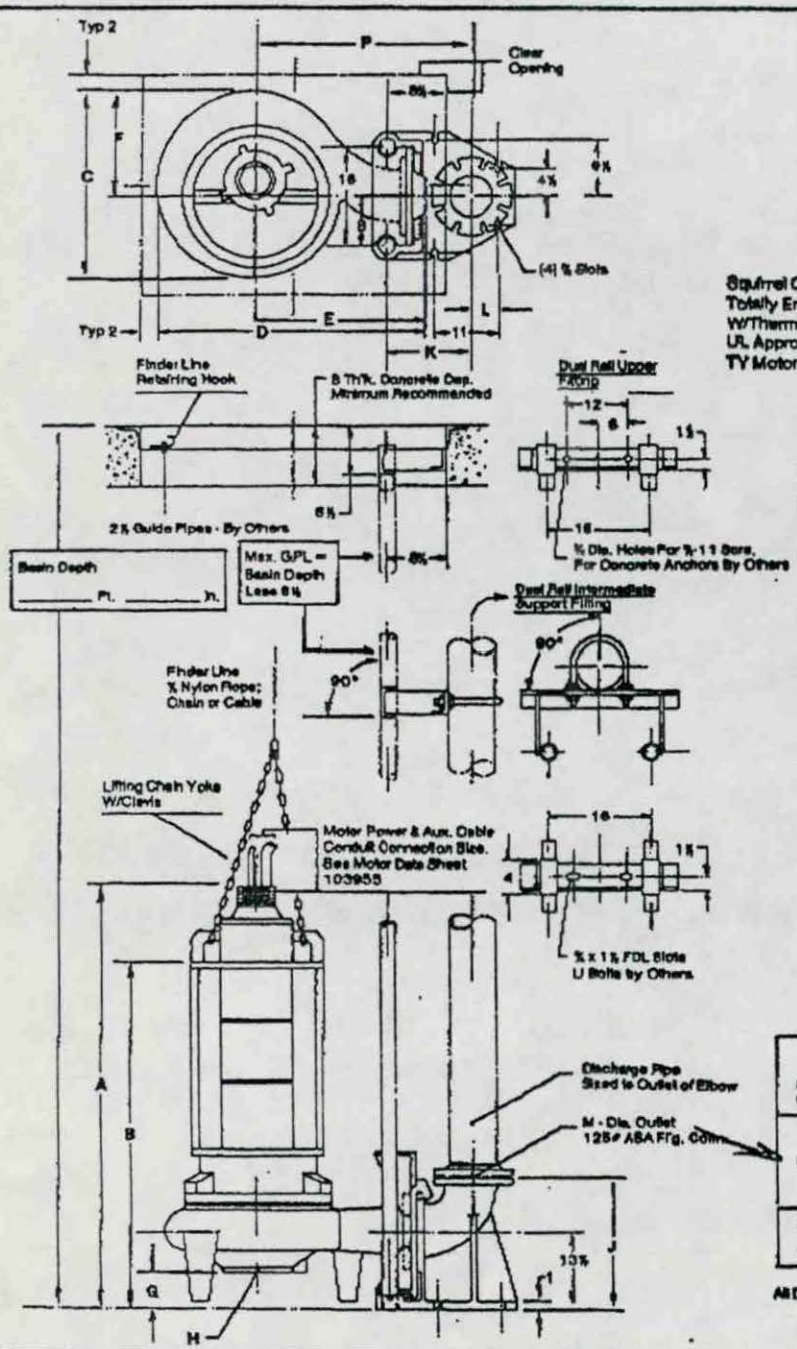
Clow Yeomans
SERIES 9000

CLOW

Pump Division
Clow Corporation
Melrose Park, Illinois

SERIES 9000 SUBMERSIBLE PUMPS

With Dual Rail Quick Lift Fittings - 8 x 8; 8 x 10
Pump Units 8 x 8 x 15 x 5; 8 x 8 x 17 x 4; 8 x 8 x 18 x 5
(Dwg. No. 104060)



SUBMERSIBLE

Squirrel Cage Induction Motors
Totally Enclosed Non-Ventilated
W/Thermal Protection/Moisture Detection
UL Approved Class 1 Groups C & D
TY Motor Frame/HP Ratings

THREE PHASE
200 • 230 • 460 • 575 VAC

MOTOR HP	OPERATING RPM 1750	1150	875
5	210		210
7½		210	
10			250
15		250	
20			320
25	250		
30		320	
40			
50	320		
60			360
75		360	
100	360		
125			
150			

Customer: _____
P.O. No.: _____
Name of Job: _____
Pump Model: _____ Mtr. Frame: _____
Conditions: _____ USGPM@ _____ FT. TDH:
____ HP; ____ RPM; ____ Vac: ____ Ph; ____ Hertz;
S.O. No.: _____
Marks: _____

• Quick Lift Assembly (Pump - Slide Plate Ass'y.)	
• Standard (All Iron)	• UL Listed (Non-Sparking)

QUICK LIFT STATIONARY ELL	J	K	L	M
8 x 8	22¾	13	5	8
8 x 10	24¾	15	3	10

SERIES 9000 MODEL UNIT	MOTOR FRAME	A	B	UNIT WT. #	GUIDE PIPE SCH. NO.	GUIDE PIPE MAX. SECT. LG'TH	C	D	E	F	G	H	P 8 x 8	P 8 x 10
8 x 8 x 15 x 5	250	63¾	43¾	1175	40	12'-0	26	27	20¾	1¾	6¾	8	31	35
	320	69¾	48¾	1395	80	10'-0								
	360	63¾	62¾	1675	80	8'-0								
8 x 8 x 17 x 4	320	69¾	48¾	1875	80	10'-0	30	30¾	23¾	1¾	6	8	31	35
8 x 8 x 18 x 5	360	63¾	62¾	1975	80	8'-0								

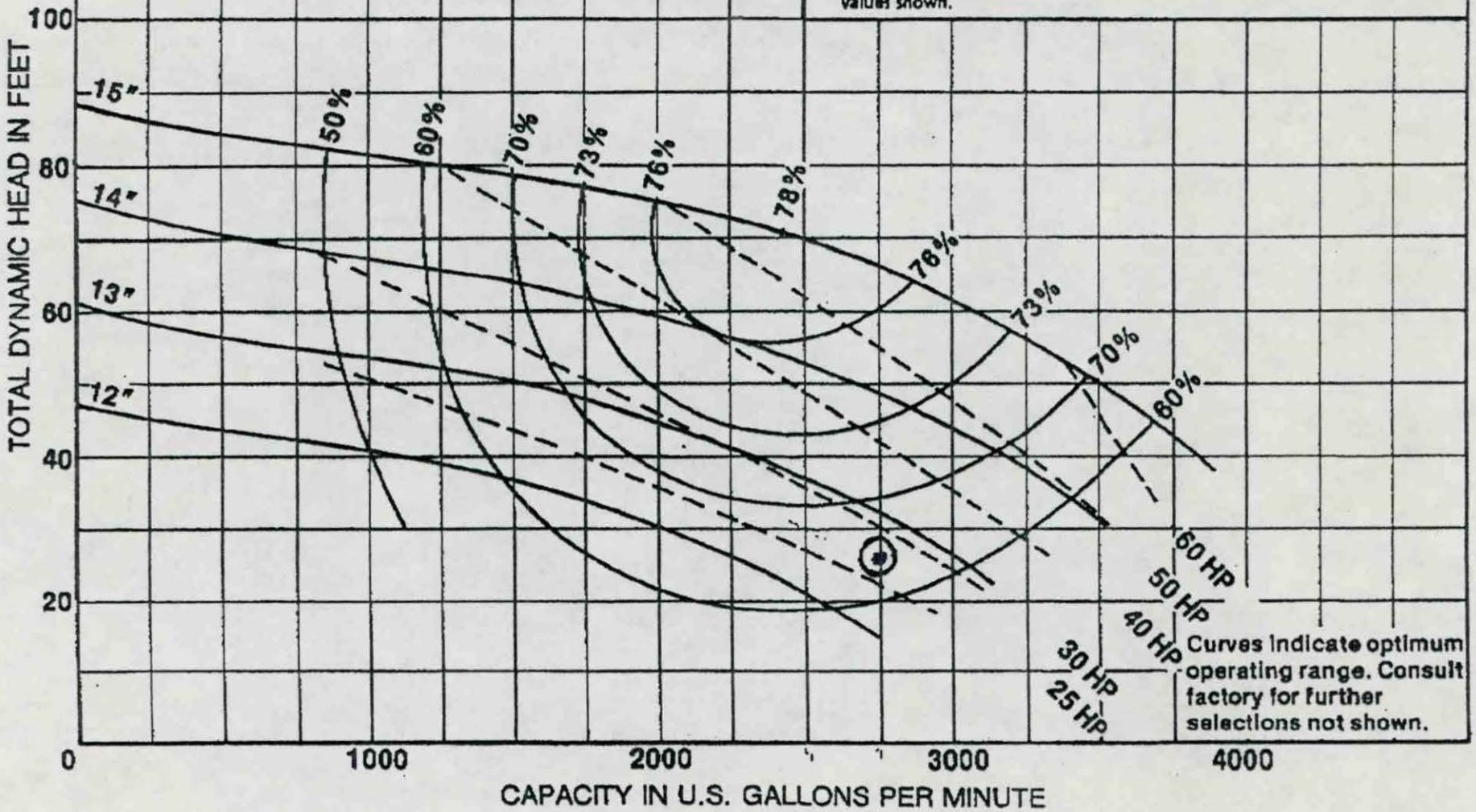
All Dimensions in Inches. Subject to change without notice.

Clow Yeomans
SERIES 9000

CLOW/Yeomans PUMP DIVISION
1999 N. RUBY STREET
MELROSE PARK, ILLINOIS

CURVE NO.: 3633 SIZE: 8 x 8 x 15 x 5
SPEED: 1160 MAX. SPHERE: 5"
IMP. NO.: Y-4619 DISCHARGE SIZE: 8"

Performance is based on Hydraulic Institute test procedure, at standard conditions. For guaranteed efficiency, deduct 2 percentage points from values shown.



Curves indicate optimum operating range. Consult factory for further selections not shown.

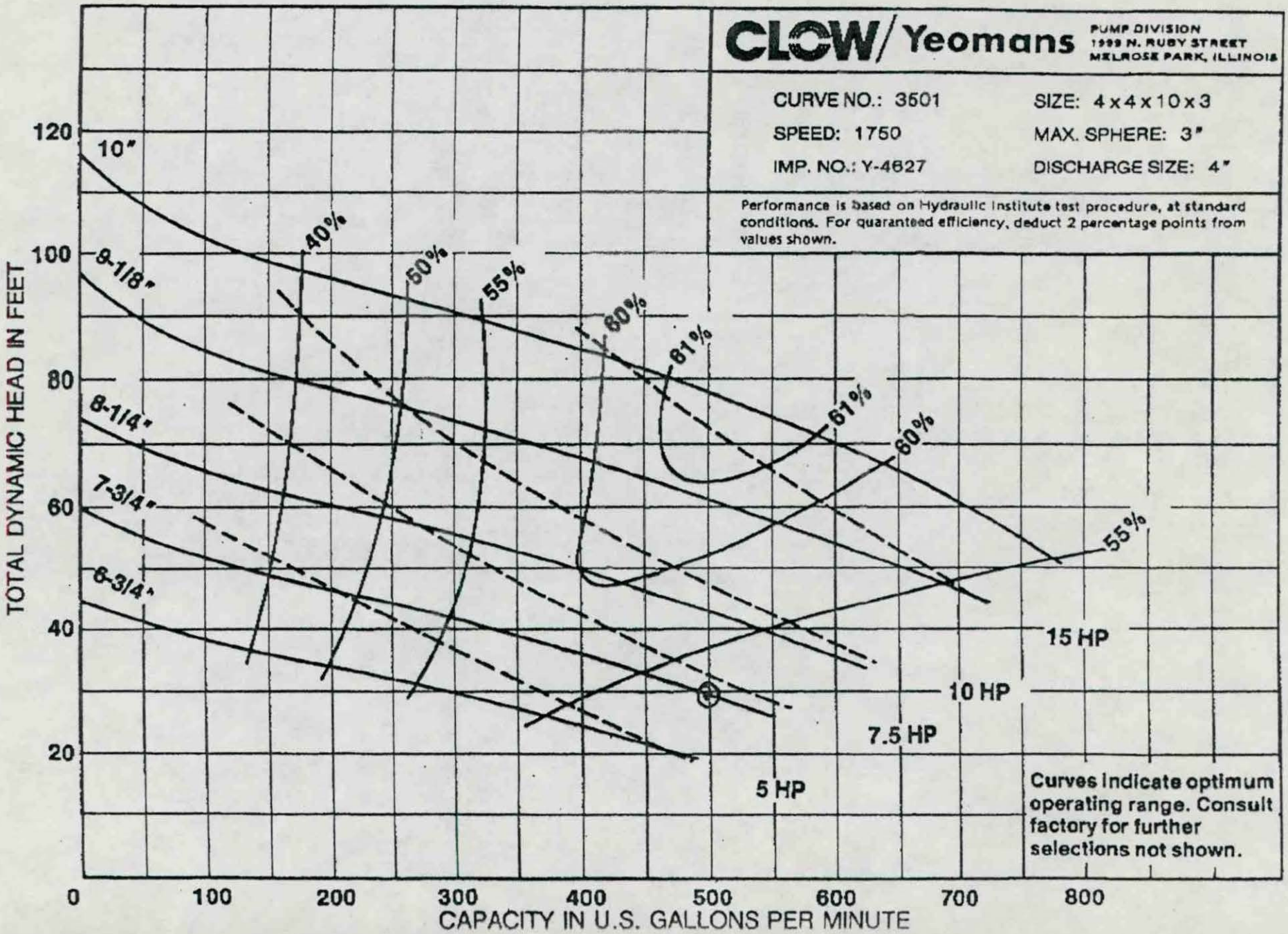
CLOW/Yeomans PUMP DIVISION 1999 N. RUBY STREET MELROSE PARK, ILLINOIS

CURVE NO.: 3501 SIZE: 4 x 4 x 10 x 3

SPEED: 1750 MAX. SPHERE: 3"

IMP. NO.: Y-4627 DISCHARGE SIZE: 4"

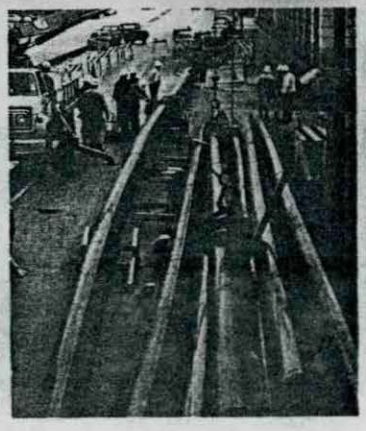
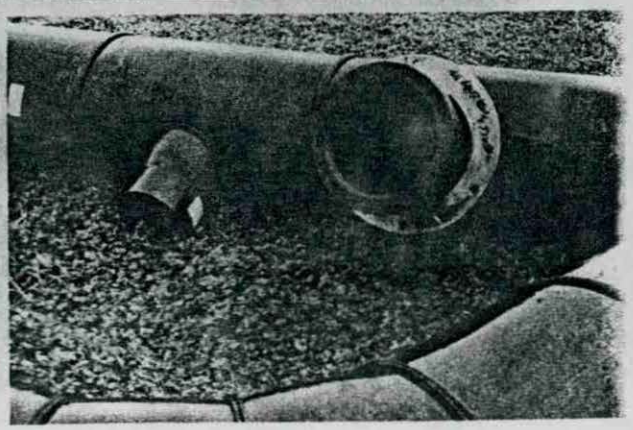
Performance is based on Hydraulic Institute test procedure, at standard conditions. For guaranteed efficiency, deduct 2 percentage points from values shown.



Curves indicate optimum operating range. Consult factory for further selections not shown.

DRISCOPIPE®

Piping Systems

PHILLIPS 66

EXHIBIT III
(B) BURIED PLASTIC PIPE

Contents

Introduction 1
Driscopipe Materials 2
Effect of Density 2
Effect of Molecular Weight and Molecular Weight Distribution 2
Identification and Standard Designation of PE Materials 3
Identification by Cell Classification 4
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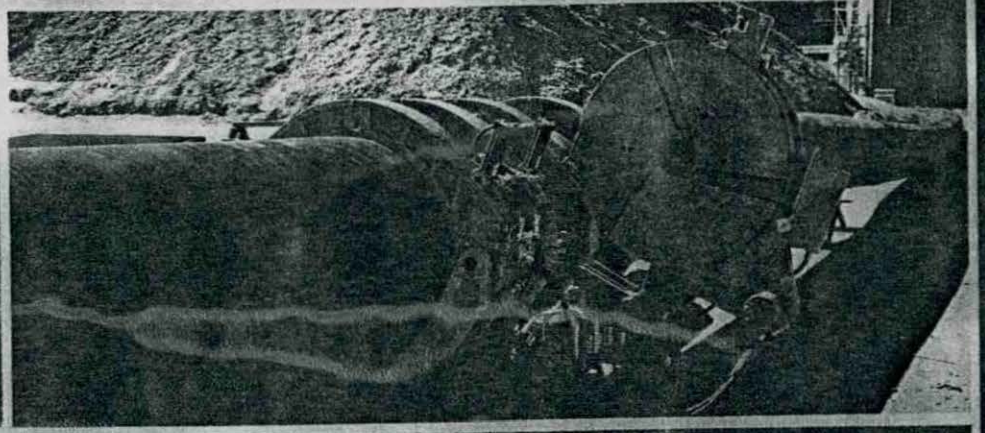
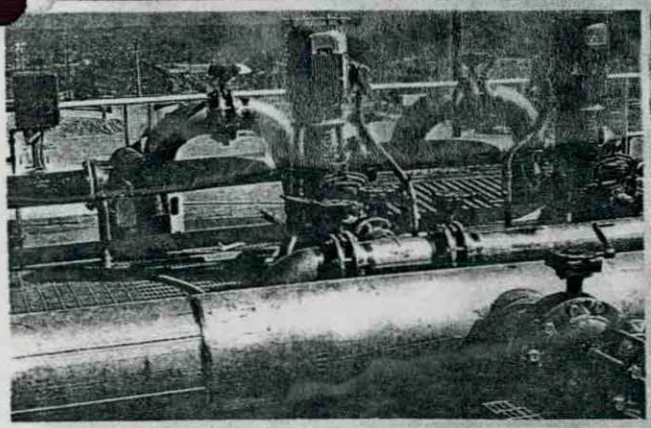
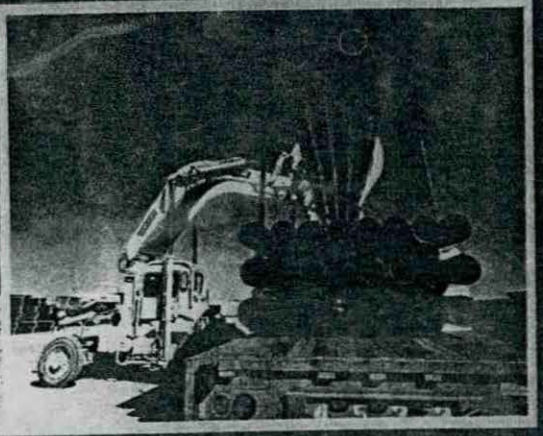
Life Expectancy 6
Lightweight 6
Flow Factors 6
Joining System 6
Butt Fusion Equipment 6
Toughness 6
Abrasion Resistance 7
Weatherability 7
Pressure Capability 7
Temperature Stability 7
Temperature Response 7
Fabrication 8
Standards 8-9

Photographs shown are typical Driscopipe installations.







Driscopipe® Piping Systems

Introduction

Driscopipe high density polyethylene piping systems offer innovative new solutions to old materials handling problems. These piping systems give the modern engineer proven engineered solutions to many traditional problems and new applications.

The plastics industry is more than 100 years old, but polyethylene was not discovered until the 1930s. Early polyethylenes were low density and were used mostly for cable coatings. The high density polyethylenes utilized in today's modern piping systems were developed in the early 1950s.

Phillips Petroleum Company was one of the first major oil and gas producing companies to diversity in the petrochemical field to upgrade by-products of their producing and refining processes. Phillips is one of the world's largest producers of polyolefin plastics as well as many other petrochemicals. Polymerization processes developed by Phillips are used world wide. Today, much of the world's high density PE is made by the Phillips process. It is through this leadership and long established technical know-how that specialized pipe resins were developed by Phillips.

Driscopipe Piping Systems are the result of a continued team effort by Phillips 66 Company and its subsidiary – Phillips Driscopipe, Inc. – to research and develop complete polyethylene piping systems of exceptional quality for demanding applications. Phillips 66 Company, takes raw natural gas liquid products produced by Phillips and converts them into base petrochemical feedstocks, such as ethylene. At the Houston Chemical Complex these feedstocks are converted into numerous polyolefin plastics which are sold under the familiar Marlex® trademark. Some of these Marlex resins are tailor-made for polyethylene pipe. For example, M-8000 is a very high molecular weight resin which is used to manufacture Driscopipe products which are extremely tough and durable. Phillips has developed special processing techniques and equipment for this resin which achieve finished products unmatched in the industry in quality, engineering properties and performance. Phillips also makes lower molecular weight pipe resins for conventional extrusions.

Marlex resin was introduced in 1962, and the Driscopipe piping systems produced with this resin have been installed world wide. Literally, thousands of miles of this pipe are in service in hundreds of different industrial, municipal and general applications. Engineers have used Driscopipe to solve a wide range of problems related to cost, corrosion and serviceability which elude traditional materials.

Marlex M-8000 resin was introduced in 1978 and is an improved very-high molecular weight, high density polyethylene. It has all the original characteristics, yet has greater long-term hydrostatic strength, allowing greater design pressures. Product lines made from Marlex M-8000 resin include Driscopipe 8600 Industrial and Driscopipe 8000 Gas Distribution piping systems. Because of the special processing requirements, Marlex M-8000 is extruded only by Phillips Driscopipe, Inc.

Phillips Driscopipe, Inc. also offers product lines made of lower molecular weight polyethylene materials for use in those applications where job requirements are less demanding. These piping products are made by conventional extrusion methods from other pipe resins such as Marlex TR-480 and TR-418.

Phillips 66 Company and its subsidiary, Phillips Driscopipe, Inc., form a totally integrated effort from the natural resource raw materials at the well head to the finished piping product. This total organization has been developing, testing and providing high density polyethylene compounds, piping components and systems since the discovery of high density polyethylene.

When a Driscopipe System is installed, the owner acquires a product whose performance has been proven by long established technology, experience and reliability. A complete team of dedicated Phillips people stand ready to help solve your material handling problems.

Driscopipe Materials

The family of Marlex olefin polymers includes a complete range of low, medium and high density polyethylene and polypropylene. Tailored resins are specifically designed for blow molding, injection molding, thermo-forming, cable coatings, pipe extrusions, film, fiber, filament and other specific applications.

Marlex high density polyethylene is manufactured by the Phillips process at moderate pressures and temperatures. In the case of copolymers, ethylene and another olefin, such as butene or hexene, are dissolved in a solvent and the solution contacted by one of a variety of catalysts. Depending on the feedstock and the type of catalyst used, a copolymer is formed which varies in type and degree of chain branching of the molecules. The number of different resins which can be produced is almost limitless. Because of Phillips background in research and development of polymerization processes, it has historically been able to create resin with excellent balance of physical properties for specific applications.

Driscopipe systems are expected to give many years of trouble-free service when exposed to a broad variety of environments and working conditions. To meet such exacting requirements, Phillips developed several Marlex polyethylene pipe compounds. The service life characteristics of Driscopipe Systems are determined by the physical and chemical properties of the compound and the processing of each resin into a finished product. These systems are the result of years of development work aimed at producing polyethylene piping systems capable of meeting the most demanding requirements.

Effect of Density

Polyethylene materials are generally classified into three categories of low, medium and high density; also designated as Type I, II and III polyethylene, respectively. In recent years, only medium and high density polyethylene materials have been used for pipe. The introduction of high density polyethylene in the early 50s made it possible to achieve great improvements in physical properties of pipe as compared to the low and medium density products at that time. As density increases, tensile strength, surface hardness, stiffness, softening temperature and chemical resistance are all increased.

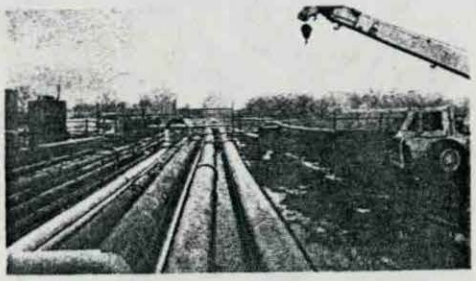
Effect of Molecular Weight and Molecular Weight Distribution

Following the discovery of high density polyethylenes, continued investigation revealed that further improvements in physical properties could be made by increasing the average molecular weight. Increased values are realized in melt viscosity, tensile strength, elongation, resistance to creep, impact strength, notch sensitivity, resistance to low temperature brittleness and resistance to environmental stress cracking. Through careful programming of the polymerization reaction, Phillips controls the density and the molecular weight to obtain polyethylene pipe compounds with exceptional service life performance.

The plastics industry has always characterized polyethylene by molecular weight. Most of the time this is done by measuring the melt viscosity of the resin, called melt index, which is related to the molecular weight. However, for those polyethylenes having a weight average molecular weight above 250,000, the "melt index" is zero. For the group of resins with weight average molecular weights in the range of 250,000 to 1.5 million, a procedure known as "high load melt index" is used to characterize the particular polyethylene. The HLMI uses higher loads to measure the melt viscosity. Resins with molecular weights above 1.5 million are generally characterized by solution viscosity or other more sophisticated molecular weight determination techniques. The high load melt index test procedure used to identify Driscopipe is described in ASTM* D 1238.

In addition to density and molecular weight, a third parameter, molecular weight distribution, is generally used to describe the resin. These three parameters determine the properties which a specific resin will have. In relating physical and chemical properties to density, average molecular weight and molecular weight distribution, it is an oversimplification to state that a property is dependent entirely on any one of them. It is true, though, that many properties are more dependent on one parameter than the other two, and for this reason some generalizations can be made. The effects of increasing density, for example, were described earlier.

*ASTM – American Society for Testing and Materials



The effect of molecular weight and molecular weight distribution is more complex than density and can have various meanings. During the synthesis of these polymers, all the molecules do not grow to the same size. The size variation may be small or great depending upon the polymerization process involved. One of the terms most frequently used to describe the size variation is molecular weight distribution. Because of this size variation, these polymers do not possess a specific molecular weight in the usual sense of a pure compound. Instead, the molecular weights are at best only average values. When discussing the molecular weight of polyethylene, one of three types is usual: number average molecular weight, weight average molecular weight or viscosity molecular weight. All expressions are determined differently by exacting analytical procedures. Generally, molecular weight and molecular weight distribution have the following effects:

Property	As Average Molecular Weight Increases (Melt Index Decreases)	As Molecular Weight Distribution Broadens
Melt Viscosity	Increases	–
Tensile Strength at Rupture	Increases	No Significant Change
Elongation at Rupture	Increases	No Significant Change
Resistance to Creep	Increases	Increases
Impact Strength	Increases	–
Environmental Stress Cracking Resistance	Increases	Increases

Identification and Standard Designation of PE Materials

Polyethylene piping materials for many years have been identified by a material code designation defined in ASTM Standard D 1248 entitled "Polyethylene Plastics Molding and Extrusion Materials". The code consisted of two letters, "PE" for polyethylene, and four arabic numbers. Originally, the first number designated the type PE, i.e., Type I or II or III which identified the material as low, medium or high density PE. The second number designated the Grade, which further identified the PE by other properties such as chemical resistance. The last two numbers of the code represented the hydrostatic design stress rating at 73.4° F for the pipe product. Thus, a polyethylene pipe designated as PE 3408 was a high density (Type III), Grade 3 product with a design stress rating of 800 psi.

ASTM D 1248 has been revised several times during the past few years and the code designations have been changed to better meet the needs of the industry.

In the Standard's current issue, polyethylene piping materials are defined by:

(a) Type
Identification by nominal density (g/cm^3):

Type I (0.910 to .925) – Low Density

Type II (0.926 to .940) – Medium Density

Type III (0.941 to .959) – High Density

Type IV (0.960 & higher) – High Density The density shown is for uncolored PE. Please note that Type III and IV are still described by the term, High Density.

(b) Class
Identification by composition
Class A – Natural color only

Class B – Colors, including white and black

Class C – Black (Weather Resistant) containing 2% or more Carbon Black.

(c) Category
Identification by nominal flow rate; g/10 min at 190°C, 2160 grams load:
Category 1 – >25
2 – >10 to 25
3 – >1.0 to 10
4 – >0.4 to 1.0
5 – 0.4 Max

The nominal flow rate is also known as the Melt Index.

(d) Grade
Identification by other key characteristics such as tensile strength, elongation, brittleness temperature and stress crack resistance as set out in the standard:

For example:

Property	Grade P24	Grade P34
Tensile Strength, psi	1800	3200
Elongation, %	400	500
Brittleness Temp, °C	–60	–70
Environmental Stress Crack Resistance, hrs., F_{20}	192	192

Conditions of test and requirements for these minimum values are set forth in ASTM D 1248.

By designations defined in ASTM D 1248, Driscopipe 8600 and 1000 are identified as Type III, Class C, Category 5, Grade P34 (IIIC5 P34) polyethylene compounds.

Clarification is needed regarding two parts of this designation; category and grade.

Driscopipe 8600 is of such high molecular weight that the melt flow is zero at the test conditions set forth for Melt Index. The melt flow for Driscopie 8600 can be measured by increasing the load conditions of the test (High Load Melt Index – Condition F).

When revising ASTM D 1248, effort was made to match the old pipe designations (PE2306, PE 3306, etc.) with those same ones in the new identification systems. Thus, a Grade P24 is still a Type II (medium density), Category 5 material. However, Grade P34 is an exception since it identifies a Type III material of a grade not previously specified (very high molecular weight).

Current material designations are generally shown in the product standards by a method which combines the old and new systems of D 1248, i.e., Grade P24 is PE2406 and Grade P34 is PE3408. The old style designation is nearly always used in the markings on the product.

In 1974, ASTM wrote a new materials standard (ASTM D 3350) "Polyethylene Plastics Pipe and Fittings Materials" specifically for polyethylene pipe and fittings materials primarily because the old system (ASTM D 1248) does not adequately describe the different PE pipe materials. This is particularly true in the case of Grade P34 resins.

ASTM D 3350 uses a cell classification system to designate the PE pipe and fittings materials. This system provides for more specific identification of the PE compound by using cell classification limits for density, melt index, flexural modulus, tensile strength, environmental stress crack resistance and hydrostatic design stress at 23° C (73.4° F). Provisions are made to designate color, and design stresses at elevated temperatures are recognized. Use of the new cell classification tells more about the PE compound than does the old system, and this can help assure the user of receiving the quality of product desired.

The designation PE3406 was first recognized in ASTM standards in 1968. Since that time, PE3408 has become recognized throughout the industry as a premium quality material representing exceptional performance . . . primarily for two reasons . . . The recognition of Grade P34 to designate a very high molecular weight polyethylene material and the outstanding success of Marlex M-8000 resin sold as Driscopipe.

Identification by Cell Classification

By the cell classification system of ASTM D 3350, Driscopipe 8600 is a PE355434C which describes this compound as having the following primary properties:

Property	Cell Classification
1. Density, g/cm^3 (Base resin)	.941 – .955 (cell 3)
2. Melt Index, g/10 min	<4.0 Condition F Method D 1238, (cell 5)
3. Flexural Modulus, psi	120,000 to 160,000 (cell 5)
4. Tensile Strength @ Yield, psi	3000 – 3500 (cell 4)
5. Environmental Stress Crack Resistance F_{20}, hrs, min.	Test Condition C, 192 hr., (cell 3)
6. Hydrostatic Design Basis @ 23°C (73.4°F), psi	1600 (cell 4)
7. Color & UV Stabilizer Code	C (Black with 2% minimum carbon black)

Although the cell classification system is an improvement, it does an incomplete job of describing Driscopipe 8600. The highest cell requirements for ESCR (Property no. 5) is that the PE material not have more than 20% stress crack failures in ten (10) samples after 192 hours at 100°C. Although most PE3408 and PE2406 materials pass this test . . . Driscopipe 8600 has been tested for more than 10,000 hours . . . with zero (0) failures . . . and the tests are continuing with no indication that failure will occur. No ESCR test procedure has yet been devised which causes Driscopipe 8600 to fail. This super resistance to stress-crack failure is a quality which is unique. This is also reflected in the pipe ring ESCR test described in ASTM F 1248. Driscopipe 8600 has surpassed 10,000 hours in this test with no failures.

Driscopipe Systems

The objective of Phillips Driscopipe is to offer safe, reliable and economical piping systems to provide effective solutions to material handling problems. These polyethylene systems are usually selected for the job because they offer advantages not available through the use of other materials. However, to obtain long reliable service life from a polyethylene piping system, the user must be careful to select high quality systems.

Phillips Driscopipe, Inc. offers a complete line of pipe, fittings, accessories, technical and installation service through qualified and experienced distributors. Through the efforts of this entire organization, a very long list of satisfied users, both large and small, have found effective, reliable solutions to their piping applications, attesting to the high quality of these systems. Millions of feet of Driscopipe are installed every year in hundreds of different applications, *and the incidence of failures in these piping systems since the early 60s is insignificant.* This outstanding record of success emphasizes the unusual quality and engineering properties of Marlex resins, the quality controlled proprietary production methods of Driscopipe piping systems, and the high integrity and reliability of the butt fusion and side-wall joining methods for these systems. All these features are successful developments of the Phillips family of companies.

Driscopipe Systems include:

- A complete range of pipe and fittings sizes and design pressure ratings.
- Trained, qualified distributors.
- Technical service assistance for systems design, installation and on-the-job consultation.
- Readily available installation equipment.
- Continual product research, development and testing.
- Economical product availability through strategically located plants throughout the U.S.
- Quality Assurance.
- Custom design and fabrication of non-standard and special components.

Current brochures regarding available components included in the Driscopipe systems are available upon request.

Applications

Driscopipe is being used successfully in hundreds of industrial, municipal, mining, general and very specialized applications. These consumers have chosen Driscopipe polyethylene piping because it offers a combination of special engineering characteristics to solve difficult and specialized material handling applications or offers special cost-saving solutions to otherwise expensive installations.

Typical applications include the use of Driscopipe to handle corrosive waste, erosive waste, sewage, drainage, chemical process fluids, mine tailings, acids, caustic solutions, sludge, process and potable water, saltwater, corrosive gases, slurries, mud, crude oil, etc.

These fluids are handled at temperatures from below freezing up to 180°F and at pressures from 0 psi to 265 psi, both above and below ground.

Industries that are using Driscopipe include petroleum refining, petrochemical manufacturing , oil and gas production, hard and soft rock mining, paper and pump mills, power generation, sewage treatment plants, automotive manufacturing, farming, breweries, municipalities, metals manufacturing, food processing, fertilizer, chemical processing, and gas utilities.

One of the most important uses of Driscopipe in many of these industries is for the renewal of leaking, cracked, deteriorated or corroded lines through the unique, cost effective slip lining technique. Slip lining is especially adaptable with Driscopipe because of the extreme toughness and abrasion resistance of this material, its flexibility and the reliability of the butt fusion joining system.

The slip lining technique is widely used in both municipal and industrial applications. Rehabilitation in this manner minimizes downtime in operations, reduces installation costs, eliminates costly excavations and disruptions, and can result in substantial cost savings over direct replacement. Lining an existing system with a Driscopipe liner will reduce the inside diameter, but flow capacity will not necessarily be reduced. In fact, it may be increased due to the extremely smooth inside surface which offers much lower resistance to flow. This surface will remain smooth as it does not corrode, pit or deteriorate due to corrosive liquids or gases.

Benefits – Advantages – Cost Saving Opportunities

When compared to the traditional piping materials, Driscopipe high density polyethylene piping systems offer significant cost savings in installation labor and equipment, proven engineered solutions and freedom of design, reduced maintenance cost, and extended life for most pipeline systems. These benefits, advantages and cost saving opportunities are derived from the basic and unique properties and characteristics of Driscopipe.

Chemical Resistance

Driscopipe is for all practical purposes, chemically inert. There are only a few strong chemicals which will affect it. Natural chemicals in the soil will not attack Driscopipe or cause it to degrade in any way. It is not an electrical conductor and does not rot, rust or corrode by electrolytic action. It neither supports the growth of nor is affected by algae, bacteria or fungi and is resistant to marine biological attack. Gaseous hydrocarbons have no adverse effect on expected service life. Liquid hydrocarbons will permeate the wall and reduce hydrostatic strength but do not degrade the material. Upon evaportation of the hydrocarbon, the pipe will regain its original physical properties.

Life Expectancy

The hydrostatic design basis for Driscopipe is based on extensive hydrostatic testing data evaluated by standardized industry methods. Life expectancy is estimated conservatively to be in excess of 50 years for transporting water at ambient temperature (73.4°F). Internal and external environmental conditions for each application may alter the expected life or change the recommended design basis to achieve the same life expectancy. These conclusions are supported by more than twenty years of actual experience.

Lightweight

Driscopipe weighs much less than most other pipes of the same size. The specific gravity is .955 – .957 . . . it floats in water. It is 70-90% lighter than concrete, cast iron or steel, making it easier to handle and install. Substantial savings can be realized by reduced manpower and equipment requirements.

Flow Factors

Driscopipe polyethylene has an extremely smooth inside surface. It maintains excellent flow properties throughout its service life due to its excellent chemical and abrasion resistance. Because of smooth walls and the non-wetting characteristic of polyethylene, higher flow capacity and reduced friction loss is possible with Driscopipe. In many cases this higher flow capacity may permit the use of smaller diameter pipe. A "C" factor of 155 is commonly used in fluid flow calculations (Hazen-Williams Formula).

Joining System

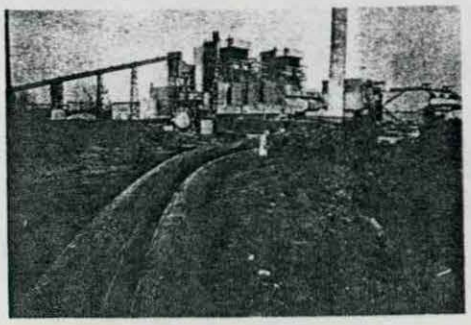
Driscopipe is joined by the heat fusion technique commonly called "butt fusion." This is a simple, visual procedure with straight forward uncomplicated instructions pioneered and developed by Phillips. It is recognized in the industry as a joining system of very high integrity and reliability. It is cost effective. No couplings are required. Joints are stronger than the pipe itself in both tension and hydrostatic loading. Driscopipe may also be joined by mechanical means, such as flange adapters and flanges or compression couplings. It cannot be joined by solvent cements or adhesives as they do not bond to Driscopipe.

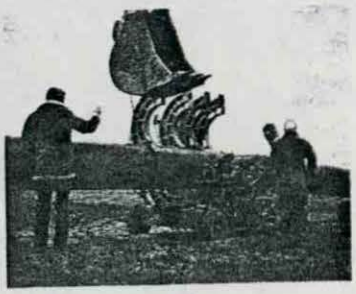
Butt Fusion Equipment

The first crude "butt fusion" equipment for high density polyethylene was developed by Phillips in the late 50s following its first commercial production of this piping material. The joining method proved so successful that Phillips rapidly developed more sophisticated equipment and continued this developmental activity through the early 70s. Since that time, with Phillips' guidance, other firms have developed an extensive line of fusion equipment which is readily available through Driscopipe distributors, or direct from the manufacturer. There are literally millions of Driscopipe fusion joins in service today giving trouble-free performance. The incidence of failure is insignificant.

Toughness

The overall "toughness" of Driscopipe is an important characteristic of the pipe which is derived from many of the chemical and physical properties of the material as well as the extrusion method. The pipe is not brittle. It flexes, bends and absorbs impact loads over a wide temperature range of – 180°F up to its softening temperature of 260°F. This inherent resiliency and flexibility allow the pipe to absorb surge pressures, vibration and stresses caused by soil movement. Driscopipe can be deformed without





permanent damage and with no adverse effect on long term service life. It is easily cold bent in the field to a minimum radius between 20 to 40 times the pipe diameter. It is flexible for contouring to installation conditions. Its flexibility and weight allow it to be butt fused in one location and pulled into difficult locations to facilitate easy installation, or be assembled above ground and rolled into less expensive narrow trenches.

Driscopipe has very low notch sensitivity, high tear strength and excellent scratch abrasion resistance. Its resistance to environmental stress cracking is superior, ensuring no effect on long term service life from installation scratches. The extreme toughness of Driscopipe is one of its outstanding engineering characteristics leading to innovative piping design.

Abrasion Resistance

Driscopipe performs well in handling highly abrasive materials in low pressure – high velocity slurry systems. Controlled tests have shown that Driscopipe will generally out-perform steel pipe in this type of service by a ratio of 4 to 1. It also outlasts rubber-lined steel in most slurry applications due to its smooth, tough interior surface. Driscopipe has proven itself in many mining applications.

Weatherability

Driscopipe is protected against degradation which could be caused by ultra-violet rays when exposed to direct sunlight. The material contains 2½% finely divided carbon black . . . which also accounts for the black color of Driscopipe. Carbon black is the most effective single additive capable of enhancing the weathering characteristics of plastic materials. The protection which even relatively low levels of carbon black impart to plastic is so great it is not necessary to use other light stabilizers or UV absorbers.

Weatherability tests indicate that Driscopipe can be safely stored outside in most climates for periods of many years without danger of loss of physical properties due to UV exposure.

Pressure Capability

Refer to the Systems Design brochure for complete details but, in general, Phillips Driscopipe offers HDPE pipe for gravity flow and pressure service through 265 psi at 73°F for 50 years of service at a 2:1 safety factor. Product description sheets which provide size, SDR and pressure ratings are available.

Temperature Stability

The exposure of Driscopipe to normal changes in temperature does not cause degradation of the material. However, some of the physical and chemical properties of the pipe will change as temperature is increased or decreased.

Driscopipe will soften and start to melt at about 260°F. A temperature range of 475-500°F is used to fusion join the 8600 piping system. A temperature range of 375-400°F is used to fusion join the Driscopipe 1000 piping system. Refer to Driscopipe's qualified fusion procedures for details. Pipe is fabricated at about the same temperature. To protect the material against degradation at higher temperature, it has been stabilized. This stabilizer protects the material against thermal degradation which might otherwise occur during manufacture, outside storage or installation.

Driscopipe has been tested for thousands of hours at elevated temperatures of 140°F and 176°F without thermal degradation. These long-term pressure tests at the higher temperatures are used to obtain recommended design strengths for the pipe at these temperatures.

Temperature Response

All thermoplastic piping materials are affected by temperature changes. It is general industry practice to characterize these materials at ambient temperature, 23°C (73.4°F).

As temperature increases, long-term strength decreases and vice-versa. Long term strength test data for Driscopipe is available at 73.4°F, 100°F, 120°F and 140°F to verify its performance. Some polyethylene piping materials cannot be evaluated at higher temperatures because they fail prematurely. Knowledge of long-term strength at various temperatures allows for selective design of a system. The maximum recommended operating temperature for *pressurized* Driscopipe is 140°F. The maximum recommended operating temperature for *gravity flow* Driscopipe is 180°F when properly installed.

The designer must also consider other effects caused by changes in temperature, such as expansion and contraction forces and movement, changes in chemical resistance, flexibility, tensile strength, etc. Technical information relative to Driscopipe is available upon request.

Fabrication

Standard molded line fittings are available for Driscopipe in sizes through 12" IPS. Fittings fabricated from pipe are available in various pressure ranges in sizes ½" through 54". Standard fabricated fittings and special items or assemblies are available on special order. Design services are available to assist in designing system components to meet needs for special applications.

Standards

The following is a partial list of standard product specifications, methods of tests, recommended practices, industry technical reports and bulletins which are related to polyethylene piping systems. These are informative and useful to the designer and owner. Copies are available from the sponsoring organization. Information may also be obtained through a Driscopipe distributor or Phillips Driscopipe, Inc.

ASTM
American Society for Testing and Materials
1916 Race Street, Philadelphia, PA 19103

ASTM D 1248 Standard Specification for Polyethylene Plastics Molding and Extrusion Materials

ASTM D 3350 Standard Specification for Polyethylene Plastics (PE) Pipe and Fitting Materials

ASTM D 2447 Standard Specification for Polyethylene (PE) Plastic Pipe, Schedules 40 and 80 Based on Controlled Outside Diameter

ASTM D 3035 Standard Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Controlled Outside Diameter

ASTM D 3261 Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing

ASTM D 1693 Test Method for Environmental Stress – Cracking of Ethylene Plastics

ASTM D 2837 Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials

ASTM D 2321 Recommended Practice for Underground Installation of Flexible Thermoplastic Sewer Pipe

ASTM D 790 Test Method for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials

ASTM F 412
Definitions of Terms Relating to Plastic Pipe Systems

ASTM F 585 Practice for Insertion of Flexible Polyethylene Pipe into Existing Sewers

ASTM F 894 Standard Specification for Polyethylene (PE) Large Diameter Profile Wall Sewer and Drain Pipe

ASTM F 714 Standard Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter

ASTM F 1248 Determination of Environmental Stress Crack Resistance (ESCR) of Polyethylene Pipe

NSF
National Sanitation Foundation
NSF Building, Ann Arbor, Michigan 48105

NSF Standard 14
Thermoplastic Materials, Pipe, Fittings, Valves, Traps and Joining Materials

NSF Seal of Approval Listing of Plastic Materials, Pipe, Fittings and Appurtenances and Waste Water (NSF Testing Laboratory)

AWWA
American Water Works Assocation
666 West Quincy Avenue, Denver, Colo. 80235

AWWA C-901
Polyethylene (PE) Pressure Pipe, ½" through 3", for Water.

AWWA C-906
Polyethylene (PE) Pressure Pipe and Fittings 4" through 63" for Water Distribution.

CGSB
Canadian Government Standard Board
Ottawa, Ontario, Canada, K1A 0S5

CGSB 41-GP-25
Pipe, Polyethylene, for the Transport of Liquids

PPI
Plastic Pipe Institute
A Division of The Society of The Plastics Industry, Inc.
Wayne Interchange Plaza II
155 Route 46 West
Wayne, NJ 07470
(201) 812-9076

PPI publishes Technical Reports such as *TR5, "Standards for Plastic Piping."* This technical report is an extensive list of the most used standards and codes for procurement or identification of high quality plastic piping components. A list of Technical Reports and Technical Notes prepared and issued by PPI is also included. Copies are available from the above address. PPI also publishes informative bulletins on subjects such as "Pipeline Rehabilitation with Polyolefin Pipe."

These reports are developed and published with the technical help and financial support of members of the Plastic Pipe Institute, such as Phillips Driscopipe, Inc.

FM
Factory Mutual Research
1151 Boston – Providence Turnpike
P.O. Box 9102
Norwood, Mass 02062

FM listing is currently available for Driscopipe 1000 only in sizes 2" IPS through 12" IPS in SDR 9 and SDR 11, by size per order.

CSA
Canadian Standards Association
178 Rexdale Blvd.
Rexdale, Ontario, Canada M9W 1R3

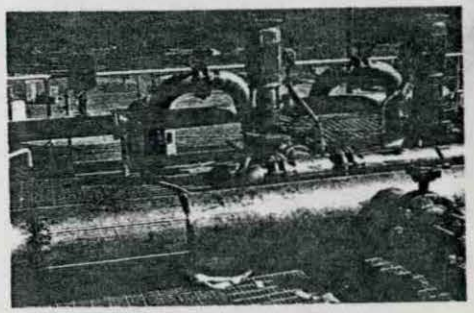
CSA B 137.0
Definitions, General Requirements and Methods of Testing for Thermoplastic Piping

CSA B 137.1
Polyethylene Pipe for Cold Water Services

CSA B 137.4
Polyethylene Piping for Gas Services

CSA B 196.1
Plastic Underground Power Cable Ducting

The Driscopipe performance team offers you innovative solutions to your piping requirements. Contact your nearest Driscopipe Sales Representative. He'll give you personalized technical service, installation assistance and all the cost-saving advantages of a Driscopipe Piping System. Engineered for Performance!



DRISCOPIPE

Phillips Driscopipe, Inc.
A Subsidiary of Phillips 66 Company

To Secure Product Information or Leave a Message for a Sales Engineer or Technical Service Representative:

Mail:
Attn: Customer Service Department
P.O. Box 83-3866
2929 North Central Expressway
Suite 100
Richardson, Texas 75083

Phone:
U.S. Domestic Toll Free (800) 527-0662

TWX:
910-867-4818

Fax:
214-783-2689

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PLASTICS WITH POWER TO WIN®

1707-90 A 01
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DRISCOPIPE

Driscopipe® 1000 series

Data Sheet

PHILLIPS 66

Customer Benefits

High quality Driscopipe® 1000 is manufactured from extra high molecular weight, high density PE3408 polyethylene pipe grade resin.

This black, weather-resistant pipe exhibits . . . .

- **Outstanding Chemical & Corrosion Resistance**
- **High Environmental Stress Cracking Resistance**
- **Improved Flow Characteristics**
- **Toughness & Ductility**
- **Flexibility with lightweight**
- **Non-Toxic**
- **Abrasion Endurance**
- **Fatigue Endurance**
- **Long-term Hydrostatic Strength / Physical strength**
- **Reliability**

Suggested Industries & Applications

- **Industrial Water Distribution**
- **Agriculture**
- **Landfills**
- **Marine**
- **Pollution Control**
- **Pulp / paper / wood**
- **Power Plants**
- **Petrochemical**
- **Mining / Mineral Processing**
- **Dredging / sand / gravel**
- **Organic Chemicals**
- **Inorganic Chemicals**
- **Aquaculture**
- **Hazardous Waste**
- **Local / State / Federal Gov'ts.**
- **Cement Plants**
- **Irrigation**
- **Municipal**
- **Gravity sewers**
- **Forced main sewers**
- **Water distribution**
- **Sewer treatment**
- **Sludge handling**
- **Leachate collection**
- **Dual Containment**
- **Brine**
- **Fertilizer**
- **Acid / Caustic lines**
- **Utility / Process piping**
- **Slurry**
- **SX acid mining**
- **Tailings disposal**
- **Marinas**
- **Snow melting / making**
- **Hard rock mining**
- **Coal Slurry / Processing**
- **Dredging**
- **Water intakes**
- **Water outfalls**
- **Fire-water**
- **De-Watering**
- **Fly-Ash disposal**
- **Temporary pipelines**
- **Cable Stayed Bridges**
- **Golf course irrigation**
- **Farmland irrigation**
- **Swimming pools**
- **Ice rinks**
- **. . . . and many others**

Available in sizes
1" thru 54"

Specification Data

The resin, pipe & fittings comply with these accepted (and other) industry standards . . . .

ASTM F-714 - Pipe Standard

ASTM D3261 - Fittings Standard

Cell Classification -
ASTM D3350 - PE345434C

ASTM D1248 - Type III. Class C
Category 5. Grade P34

EPA 9090 ISO #161

PPI Designation - PE3408

NSF - Listed, Standard #14 (by size,per order)

Factory Mutual (by size, per order) ◀ FM ▶

CGSB41 - GP-25M-Pipe Standard

AWWA C901 - Potable Water Pipe & Tubing

American Water Works Association

Printed in Texas, USA

Driscopipe® 1000

Typical Physical Properties ⊕

Property		Specification	Units	Nominal Value
Material Designation		PPI / ASTM	-	PE 3408
Material Classification		ASTM D-1248	-	III C 5 P34
Cell Classification		ASTM D-3350	-	345434C
Density	(3)	ASTM D-1505	gm / cm^3	0.955
Melt Index	(4)	ASTM D-1238 (2.16 kg/190°C)	gm / 10 min.	0.11 ♦
Flex Modulus	(5)	ASTM D-790	psi	135,000
Tensile Strength	(4)	ASTM D-638	psi	3200
ESCR	(3)	ASTM D-1693	F_o, Hours	> 5000**
HDB @ 73° F	(4)	ASTM D-2837	psi	1600
U-V Stablizer	(C)	ASTM D-1603	% C	2.5
Hardness		ASTM D-2240	Shore "D"	65
Compressive Strength (Yield)		ASTM D-695	psi	1600
Tensile Strength @ Yield (Type IV Spec.)		ASTM D-638 (2" / min)	psi	3200
Elongation @ Yield		ASTM D-638	%, minimum	8
Tensile Strength @ Break (Type IV Spec.)		ASTM D-638	psi	5000
Elongation @ Break		ASTM D-638	%, minimum	750
Modulus of Elasticity		ASTM D-638	psi	130,000
ESCR				
(Cond A,B, C: Mold. Slab)		ASTM D-1693	F_o, Hours	> 5000 **
(Compressed Ring - pipe)		ASTM F-1248	F_{50}, Hours	> 1000 **
Slow Crack Growth		Battelle Method	Days to Failure	> 64
Impact Strength (IZOD) (.125" Thick)		ASTM D-256 (Method A)	In-lb / in notch	42
Linear Thermal Expansion Coef.		ASTM D-696	in / in / ° F	1.2×10^{-4}
Thermal Conductivity		ASTM D-177	BTU - in/ ft^2 / hrs/ ° F	2.7
Brittleness Temp.		ASTM D-746	° F	< -180
Vicat Soft. Temp.		ASTM D-1525	° F	257
Heat Fusion Cond.			psi @ °F	75 @ 400

⊕ This list of Typical Physical Properties is intended for basic characterization of the pipe, and does not represent specific determinations or specifications.

** Tests were discontinued because no failures and no indication of stress crack initiation.

♦ Average Melt Index value with a standard deviation of 0.01.

Distributed by:

PHILLIPS DRISCOPIPE, INC.
A SUBSIDIARY OF PHILLIPS 66 COMPANY

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Fax: 1-214-783-2689

Printed in Texas, USA 6-91

DRISCOPIPE

Driscopipe® 8600 series

Data Sheet

PHILLIPS 66

Customer Benefits

High quality Driscopipe® 8600 is manufactured from Marlex M-8000® very high molecular weight, high density PE3408 polyethylene pipe grade resin.

This black , weather-resistant pipe exhibits. . . . .

- Excellent Enviromental Stress Cracking Resistance
- Outstanding Chemical & Corrosion Resistance
- Superior Toughness & Ductility
- Improved Flow Characteristics
- Extended Physical & Hydrostatic Strength
- Greater Abrasion Resistance / Endurance
- Flexibility with lightweight
- Fatigue Resistance
- Reliability
- Virtual Inertness / No taste transmission
- Non-Toxicity

Suggested Industries and Applications

- Mining
- Pulp / Paper / Wood
- Organic Chemicals
- Inorganic Chemicals
- Petrochemicals
- Dredging / Sand / Gravel
- Agriculture
- Metal (Cu,Al,Fe, etc.)
- Industrial
- Municipal
- Water
- Cement Plants
- Hazardous Waste
- Irrigation
- Marinas
- Salt Mines
- Sugar Mills
- Coal Slurry / Coal Prep
- Tailings Slurry
- SX acid mining
- Hard Rock Disposal
- Utility / process piping
- Water handling / distribution
- Gravity & force-main sewers
- Fertilizer
- Brine
- Sewer treatment / sludge
- Acid / caustic lines
- Leachate collection
- Dual Containment
- Snow Melting / Making
- Ice Rinks
- Aquaculture
- Fire-water mains
- Water intakes
- Water outfalls
- De-watering
- Sludge piping
- River Crossings
- High purity processes
- Potable water
- Temporary pipelines
- Storage tank piping
- Fly ash lines
- Golf courses
- Swimming Pools
- .... and many others

Available in sizes ¾" thru 48"

Specification Data

The resin, pipe & fittings comply with these accepted (and other) industry standards . . . .

ASTM F-714 Pipe STD.

ASTM D3261 Fittings STD.

Cell Classification
ASTM D3350 - PE355434C

Material Description -
ASTM D1248 - Type III, Class C
Category 5, Grade P34

AWWA C901

American Water Works Association

PPI - PE3408 Designation

NSF - Listed, Std. #14
(by size,per order)

NSF

CGSB 41 - GP-25M

printed in Texas USA 4/91

Driscopipe® 8600

Typical Physical Properties ⊕

Property	Specification	Units	Nominal Value
Material Designation	PPI / ASTM	-	PE 3408
Material Classification	ASTM D-1248	-	III C 5 P34
Cell Classification	ASTM D-3350	-	355434C
Density (3)	ASTM D-1505	gm / cm^3	0.957
Melt Flow (5)	ASTM D-1238 (21.6/190)	gm / 10 min.	1.5
Flex Modulus (5)	ASTM D-790	psi	135,000
Tensile Strength (4)	ASTM D-638	psi	3500
ESCR (3)	ASTM D-1693	F_o, Hours	> 10,000**
HDB @ 73° F (4)	ASTM D-2837	psi	1600
U-V Stablizer (c)	ASTM D-1603	% C	2.5
Hardness	ASTM D-2240	Shore "D"	65
Compressive Strength (Yield)	ASTM D-695	psi	1600
Tensile Strength @ Yield (Type IV Spec.)	ASTM D-638 (2" / min)	psi	3500
Elongation @ Yield	ASTM D-638	%, minimum	8
Tensile Strength @ Break (Type IV Spec.)	ASTM D-638	psi	5000
Elongation @ Break	ASTM D-638	%, minimum	600
Modulus of Elasticity	ASTM D-638	psi	130,000
ESCR			
(Cond A,B, C: Mold. Slab)	ASTM D-1693	F_o, Hours	> 10,000 **
(Compressed Ring - pipe)	ASTM F-1248	F_o, Hours	> 10,000 **
Slow Crack Growth	Battelle Method	Days to Failure	> 64
Impact Strength (IZOD)	ASTM D-256	In-lb / in notch	
(.125" Thick)	(Method A)		144
(.250" Thick)			84
Linear Thermal Expansion Coef.	ASTM D-696	in / in / ° F	1.2×10^{-4}
Thermal Conductivity	ASTM D-177	BTU - in/ ft^2 / hrs/ ° F	2.7
Brittleness Temp.	ASTM D-746	° F	< -180
Vicat Soft. Temp.	ASTM D-1525	° F	257
Heat Fusion Cond.		psi @ °F	150 @ 500

⊕ This list of Typical Physical Properties is intended for basic characterization of the pipe, and does not represent specific determinations or specifications.

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