Permit No. 18-04

Carmen Johnson

Fac/Perm/Co ID #	Date	Doc ID#
~~18-09~~	~~1/25/12~~	DIN

18-04 2/2/12

Duke Power Company [redacted]

Marshall Steam Station, Catawba County

Solid Waste Landfill Permit #18-04

Information Package

for

15A NCAC 13B Rule .0503(d)(iii)

APR 1996
Received
Solid Waste

Prepared By:

William M. Miller, PE

NORTH CAROLINA PROFESSIONAL SEAL 17661 ENGINEER WILLIAM M. MILLER

William M. Miller
4-23-96

Duke Power Company

13339 Hagers Ferry Road, Mail Code MG03C4

Huntersville, NC

28078

April 23, 1996

Marshall Steam Station

Solid Waste Landfill

Permit #18-04

The following information is presented as evidence that the current landfill design for the Marshall Solid Waste Landfill meets criteria (A) of Rule 15A NCAC 13B .0503 (d) (iii). This report provides the information required in your letter of January 18, 1996.

This report includes the following sections:

1.0 Landfill Description - This section describes the types of material placed in the landfill, description of the operation of the landfill, the location and quantity of material placed to date.

2.0 Waste Type Characterization - This section provides a description of the physical and the chemical characteristics of materials placed in the landfill.

3.0 Well Construction Records

4.0 Groundwater Monitoring Program - This section includes the groundwater potentiometric map, a discussion and summary of groundwater monitoring results from 1989 to date.

5.0 Coal Ash Management Program - Duke Power is aggressively pursuing markets for ash utilized as fill material and as a component of fine aggregate in concrete products. This section presents the quantities of ash that have been utilized in that program since 1991.

6.0 Compliance Demonstration - This section discusses the plans for operating the landfill past January 1,1998.

Appendix A Marshall Steam Station Dry Ash Landfill Groundwater Monitoring Program Sampling and Analysis Plan

Appendix B Engineering Drawings - This section provides the engineering drawings showing the current configuration of the landfill, the final/ closed out configuration, and the location of the groundwater monitoring wells.

In addition to this report, a copy of the proposed revision to **Specification MS-0215.00-00-0001 Revision 4** **Marshall Steam Station Specification on Clearing, Constructing, Operating and Closing Dry Flyash Landfill** is also provided.

1.0 Landfill Description

Marshall Steam Station, located in Catawba County, is owned and operated by Duke Power (See Drawing M-10). The landfill is located on property owned by Duke Power. The landfill Permit 18-04 was obtained in 1983. Surface drainage is to the ash basin, a NPDES permitted discharge (Permit # NC0004987).

The permitted area for the landfill at Marshall consists of three areas. One area receives coal flyash (58 acres) from the steam generation at Marshall, an area that receives asbestos (38.1 acres) from Marshall and other Duke facilities, and an area that receives demolition and construction debris (2.9 acres).

1.1 Flyash Landfill

The flyash landfill consists of four phases. This area is utilized as follows:

Phase	Acreage	Status and Use
Phase I	15 acres	Closed out
Phase II	25.3 acres	At final grade and stabilized
	24.9 acres	Currently disturbed and will receive flyash
	7.8 acres	Undisturbed and not expected to receive flyash
Phase III	5.4 acres	Undeveloped
Phase IV	8.2 acres	Undeveloped

1.1.1 History of Flyash Landfill

Placement of flyash began in September 1984 in the area designated as Phase I. Phase I consists of approximately 15 acres and approximately 280,000 tons of flyash was placed between September 1984 and March 1986. Placement of ash in this area was completed around March 1986.

Placement of ash in Phase II began around March 1986. Flyash is currently being placed in Phase II. Approximately 2,615,000 tons of flyash have been placed in Phase II.

1.1.2 Estimated Capacity and Expansion Plans

The remaining storage capacity of Phase II is 1,316,000 tons. At the projected rate of flyash placement, Phase II will have sufficient capacity until at least the year 2000. The actual time to utilize the remaining storage capacity depends on the operations of Marshall's steam units and the success of the Coal Ash Management Program.

Phase III and Phase IV are undeveloped at this time. Plans are to develop Phase III first if the flyash utilization projects do not require all the flyash produced at Marshall.

The current "footprint" of the landfill and the projected waste boundary as of January 1, 1998 are shown on drawings M-10 and M-10A.

1.1.3 Flyash Landfill Operation

The operation of the landfill is detailed in the Specification MSS-0215.00-00-0001, Marshall Steam Station Units1-4 Specification on Clearing, Constructing, Operating, and Closing DryAsh Landfill. The following is a brief summary of the flyash placement and closure requirements for the flyash portion of the landfill.

The flyash is placed in lifts that are 12" or less thick at a moisture content of between 15% and 20%. Compaction throughout the lift must be no less than 90% of the Standard Proctor Density, ASTM D 698-78 Method C. All compaction is performed with the moisture content of the flyash between 5% drier and 5% wetter than optimum moisture. One density test is required for each 2000 tons of ash placed. Once the flyash reaches the design height, cover material is placed to minimize infiltration. A minimum of 1' soil is placed on horizontal surfaces and 2' of soil is placed on slopes steeper than 5%. The entire surface is then prepared for seeding by applying limestone fertilizer and then grass seed is applied.

1.2 Asbestos Landfill

The total permitted area of the asbestos landfill is 38.1 acres. This area was initially approved for disposal of asbestos in December 1987. Approximately 3.2 acres have been used for asbestos disposal operations.

1.2.1 Operation of Asbestos Landfill

The asbestos material is bagged and sealed in accordance with 40 CFR 61 Subpart M. Disposal of asbestos is in accordance with an agreement with NCDEHNR that requires the material to be covered at the end of the work day. Soil from the site is used for this cover material.

The plant logged the number of boxes, bags, etc. disposed of between January 1988 and June 1992. In June 1992, the plant began recording the weight along with the number of items received for disposal. Between June 1992 and October 1995, the plant has disposed of the following amounts of asbestos containing materials:

7/1/90 to 6/30/91	1,225 tons
7/1/91 to 6/30/92	662.8 tons
7/1/92 to 6/30/93	1,145.3 tons
7/1/93 to 6/30/94	470.7 tons
7/1/94 to 6/30/95	232.8 tons
7/1/95 to 10/11/95	22.46 tons

1.3 Demolition Material Landfill

Approximately 2.9 acres is used for disposal of demolition debris and other inert materials.

1.3.1 Operation of Demolition Material Landfill

Operation of this area is consistent with the requirements of disposal of this type of material. Site soil is used for cover material.

2.0 Waste Type Characterization

2.1 Flyash

The coal flyash placed in the Marshall Landfill is classified by ASTM C618 as Class F and is a product of burning bituminous coal. The chemical composition of this classification of flyash is:

Compounds	ASTM C618 Class F Fly Ash
Silica (SiO)	54.9%
Alumina (Al_2O_3)	25.8%
Ferric Oxide (Fe_2O_3)	6.9%
Lime (CaO)	8.7%
Magnesium Oxide (MgO)	1.8%
Sulfate (SO_3)	0.6%
Other	1.3%

Fly ash generated at Marshall Steam Station has these typical physical properties:

Specific Gravity		2.24
Classification		Gray, Fine Sandy, Clayey Silt
Atterburg Limits		Non-Plastic
Natural Moisture Content		0.3%
Standard Proctor	Optimum Moisture	15.9%
	Maximum Dry Density	90.5 lb./ft^3
Permeability: k		7.51 x 10^{-5} cm/sec
Consolidation		
Initial Void Ratio, e		0.622
Final Void Ratio, e		0.565
Compression Index, Cc		0.089
Strain at 3000 psf		1.9%

2.1.1 Toxicity Characteristic Leaching Procedure (TCLP) Test Results for Marshall Flyash

Marshall Units 1 and 2 are similar units rated at 385 megawatts of power output. Units 3 and 4 are similar and are rated at 660 megawatts of power output. For this reason, TCLP test results (USEPA method 1311) are provided for flyash from both types of units.

Constituent or Property	Result Unit 1 Flyash	Result Unit 4 Flyash	USEPA Method 1311 Limit
Silver, Ag	<.05 mg/l	0.002 mg/l	5.0 mg/l
Barium, Ba	0.392 mg/l	0.608 mg/l	100 mg/l
Cadmium, Cd	0.02 mg/l	0.0096 mg/l	1.0 mg/l
Chromium, Cr	0.553 mg/l	0.0898 mg/l	5.0 mg/l
Lead, Pb	<0.10 mg/l	<0.002 mg/l	5.0 mg/l
Arsenic, As	0.0111 mg/l	0.618 mg/l	5.0 mg/l
Selenium, Se	0.056 mg/l	0.045 mg/l	1.0 mg/l
Mercury, Hg	<0.001 mg/l	<0.001 mg/l	0.2 mg/l
% Ash	N/R	N/R	No limit
BTU	N/R	N/R	No limit
Ignitability	N/R	N/R	Yes
Total S	N/R	N/R	No Limit
Total Cl	N/R	N/R	No Limit
pH	9.18	8.37	<2.0 or >12.5
% Water	N/R	N/R	No Limit

N/R: Not Requested

2.2 Asbestos

The material placed in the asbestos portion of the landfill is generally asbestos piping insulation from Duke plants.

2.3 Demolition Debris

This material consists of inert debris such as waste concrete, block, brick, metal, building materials.

Duke Power Company
Fossil Production Department
P.O. Box 33189
422 South Church Street
Charlotte, N.C. 28242

(704) 373-4011

DUKE POWER

July 27, 1989

Mr. Bobby Lutfy
North Carolina Department of Human Resources
Division of Health Services
Solid Waste Management Section
P. O. Box 2091
Raleigh, North Carolina 27602-2091

Re: Marshall Steam Station
Flyash Landfill - Groundwater Monitoring
File: MS-723.15

Dear Mr. Lutfy:

Enclosed please find the Well Completion Records for the four monitoring wells and one observation well at Marshall Steam Station's flyash landfill.

For each monitoring well, the vertical location of the screen was controlled by the limited depth of the saturated zone above auger refusal. Also, the soil classification field report for each well indicates that the screen location is in what would be expected to be the most hydraulically conductive zone or, that there is little variation in the soil.

Sampling and inorganic analysis will be performed by Duke Power Company, Production Support Department. Sampling is scheduled to start August 28, 1989. Organic analysis will be performed by EMS Laboratories, Inc. in Charlotte, NC.

To make arrangements to accompany the sampling crew or if you have any questions, please call me at (704) 373-6133.

Very truly yours,

Ralph C Roberts

Ralph C. Roberts
Fossil Environmental Compliance

RCR:mp

Enclosures

bcc: w/o enclosures
B. K. Sipe

N. C. Department of Human Resources
Division of Health Services

WELL COMPLETION RECORD

COMPLETE ALL INFORMATION REQUESTED BELOW FOR EACH WELL INSTALLED, AND RETURN FORM TO THE N
DEPARTMENT OF HUMAN RESOURCES, SOLID AND HAZARDOUS WASTE MANAGEMENT BRANC
P. O. BOX 2091, RALEIGH, N.C. 27602

NAME OF SITE: MARSHALL STEAM STATION	PERMIT NO.: 18-04
ADDRESS: HIGHWAY #150 TERRILL, NC	OWNER (print): DUKE POWER CO.
DRILLING CONTRACTOR: DUKE POWER CO.	REGISTRATION NO.: 921

Casing Type: TRILOC THREADED PVC dia. 2" in.
Casing Depth: from 0 to 67.1 ft. - dia. 2" in.
Screen Type: TRILOC THREADED PVC dia. 2" in.
Screen Depth: from 67.1 to 77.1 ft. - dia. 2" in.

Grout Depth: from 0 to 62.0 ft. - dia. 6"
Bentonite Seal: from 62.0 to 65.0 ft. - dia. 6"
Sand/Gravel PK: from 65.0 to 80.5 ft. - dia. 6"
Total Well Depth: from 0 to 80.5 ft. - dia. 6"

Static Water Level: 49.4' feet from top of casing Date Measured 7 / 6 /

Yield (gpm): N/A Method of Testing: N/A Casing is 2.3 feet above land su

DRILLING LOG		
DEPTH FROM	TO	FORMATION DESCRIPTION
SEE ATTACHED SOIL		
TEST BORING FIELD		
REPORT FOR MW-#1.		

LOCATION SKETCH

(show distance to numbered roads, or other map reference poi

REMARKS: SCREENS ARE PLACED IN THE MOST HYDRALICALLY CONDUCTIVE ZONE PER CONVERSATIONS WITH RALPH ROBERTS AND ED SULLIVAN

DATE: 7-18-89 SIGNATURE: [signature]

DHS 3342 (6/85)

Revision 0 | Page

DUKE POWER COMPANY — MARSHALL STEAM STA.

AS-BUILT INSTALLATION SKETCH

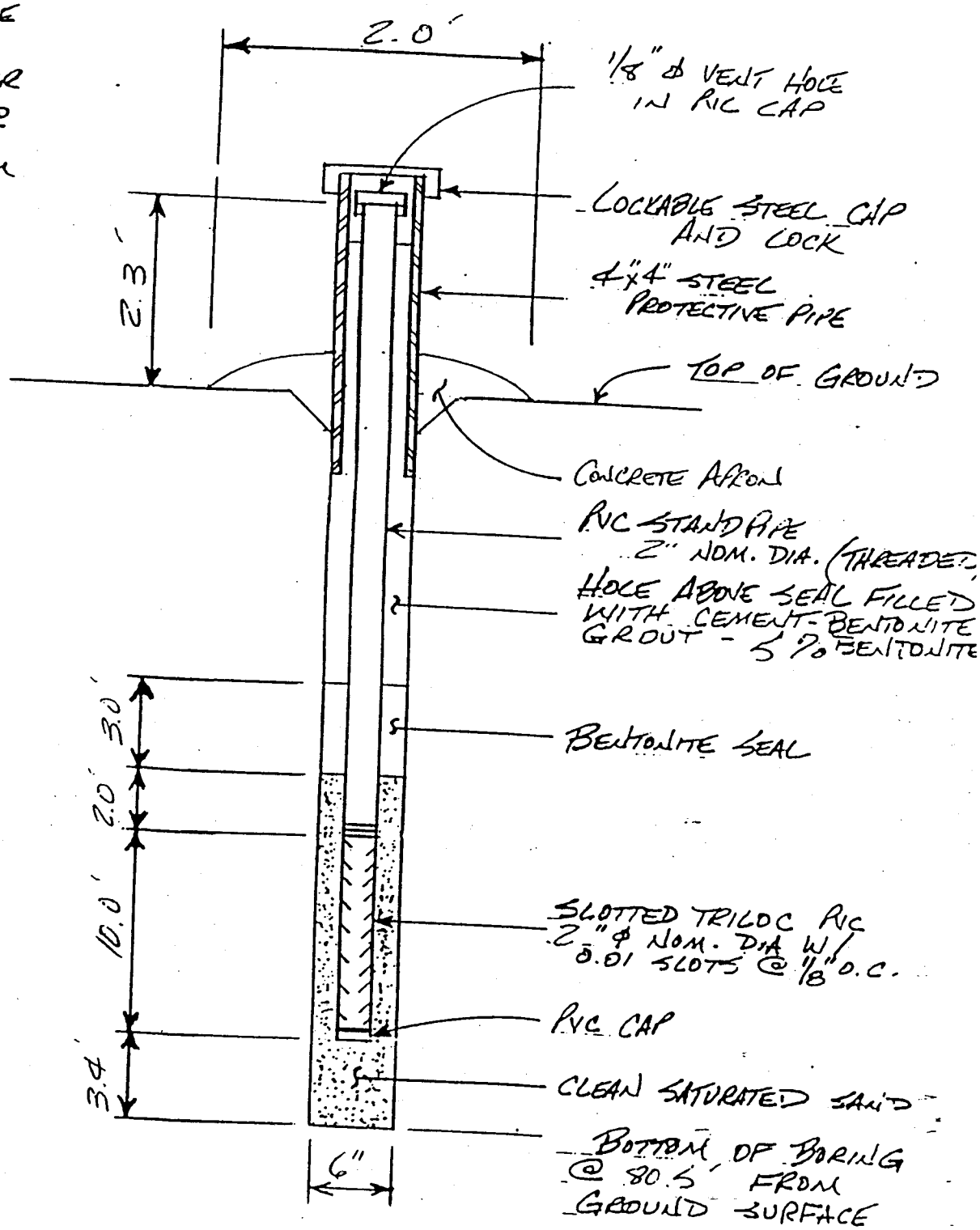
Instrument No. MW-1 Station N/A Offset N/A

By D. DICKSON Date 7-15-89

NOTE:
NOT TO SCALE

INITIAL WATER LEVEL RDG @ 49.4' FROM TOP/PIPE ON 7-6-89

T/PIPE ELEV. IS



Form 25630 (R3-87)

FORM M-26C	REVISION 2
	PAGE 1 OF 3

DUKE POWER COMPANY
CONSTRUCTION DEPARTMENT
PROJECT MASHALL

SOIL TEST BORING FIELD REPORT

JOB NO. N/A
JOB NAME FLYASH LANDFILL
DATE 6-27-89 WEATHER HOT

STARTING TIME N/A
GROUND SURFACE ELEV.
HRS. DRILLING N/A HRS. MOVING N/A
INSPECTOR D. DICKSON BORING NO. MW-1

SAMPLING		1ST 6"	2ND 6"	3RD 6"	SCALE	UD	SOIL CLASSIFICATION AND REMARKS
					0		AD-2 DRILL RIG #2555
1	4.5 6.0	3	5	5	5		YELLOW MICA. SILTY FINE TO COARSE SAND.
2	9.5 11.0	4	5	6	10		YELLOW MICA - SILTY FINE TO COARSE SAND
3	14.5 16.0	3	5	6	15		LT. OLIVE GRAY MICA. SILTY FINE TO COARSE SAND.
4	19.5 21.0	3	5	7	20		LT. OLIVE GRAY MICA. SILTY FINE TO COARSE SAND.
5	24.5 26.0	7	7	7	25		YELLOW MICA. SILTY FINE TO COARSE SAND
6	29.5 31.0	3	4	7	30		REDDISH YELLOW MICA. FINE TO MEDIUM SANDY SILT.
7	34.5 36.0	5	6	6	35		LT. OLIVE GRAY MICA. SILTY FINE TO COARSE SAND.
8	39.5 41.0	5	6	8	40		YELLOW MICA. SILTY FINE TO COARSE SAND.

+ STANDARD PENETRATION RESISTANCE IS SUM OF BLOWS FOR 2ND 6" AND 3RD 6" TO DRIVE 1-3/8" I.D., 2" O.D. SPLIT BARREL SAMPLER WITH 140 POUND HAMMER FALLING 30 INCHES

BORING TERMINATED @ 80.5
BORING REFUSAL AUGER @ 80.5'
WATER TOB DEPTH 65.0 @ 2:30 P.M 6-27-89
WATER 24 HR: DEPTH 47.1 @ 7:30 A.M. 6-28-89
WATER LOSSES N/A
CASING SIZE N/A LENGTH 0

METHOD OF ADVANCING BORING	DEPTH
POWER AUGER	0 TO ~~94.5~~ 80.5
~~HAND CHOP: W/MUD: W/WATER~~	— TO —
~~ROTARY DRILL: W/MUD: W/WATER~~	— TO —
~~DIAMOND CORE~~	— TO —

Form 25630 (R3-87)

FORM M-26C	REVISION 2
	PAGE 2 OF 3

DUKE POWER COMPANY
CONSTRUCTION DEPARTMENT
PROJECT MARSHACS.

SOIL TEST BORING FIELD REPORT

JOB NO. N/A
STARTING TIME N/A
GROUND SURFACE ELEV.
JOB NAME FLYASH LANDFILL MW'S
HRS. DRILLING N/A HRS. MOVING N/A
DATE 6-27-89 WEATHER HOT INSPECTOR D. DICKSON BORING NO. MW-1

SAMPLING		1ST 6"	2ND 6"	3RD 6"	SCALE	UD	SOIL CLASSIFICATION AND REMARKS
					40		
9	44.5				45		LT. OLIVE GRAY MICA. SILTY FINE
	46.0	5	8	9			TO COARSE SAND
							LT. OLIVE GRAY MICA. SILTY FINE
10	49.5				50		TO COARSE SAND.
	51.0	5	7	8			SAMPLE #10 WAS NOTICEABLY DAMP
11	54.5				55		LT. OLIVE GRAY MICA. SILTY FINE TO
	56.0	8	7	11			MEDIUM SAND.
							SPLIT SPOON SAMPLER RETURNED WET.
12	59.5				60		OLIVE GRAY MICA. SILTY FINE
	61.0	9	16	21			TO COARSE SAND
13	64.5				65		LT. OLIVE BRN. MICA. SILTY
	66.0	19	31	43			FINE TO MEDIUM SAND.
14	69.5				70		LT. OLIVE BRN. MICA. SILTY
	71.0	16	36	48			FINE TO MEDIUM SAND.
15	74.5				75		OLIVE GRAY MICA. SILTY FINE
	75.4	40	50=5"				TO COARSE SAND WITH GRAVELS
16	79.5				80		DARK YELLOWISH BRN. MICA. SILTY
80.4 DCD	~~81.0~~	30	50=5"				FINE TO COARSE SAND WITH GRAVELS

+ STANDARD PENETRATION RESISTANCE IS SUM OF BLOWS FOR 2ND 6" AND 3RD 6" TO DRIVE 1-3/8" I.D., 2" O.D. SPLIT BARREL SAMPLER WITH 140 POUND HAMMER FALLING 30 INCHES

BORING TERMINATED @ 80.5
BORING REFUSAL AUGER @ 80.5
WATER TOB DEPTH 65.0 @ 2:30 P.M. 6-27-89
WATER 24 HR: DEPTH 47.1 @ 7:30 A.M. 6-28-89
WATER LOSSES N/A
CASING SIZE N/A LENGTH 0

METHOD OF ADVANCING BORING	DEPTH
POWER AUGER	0 TO 80.5
~~HAND CHOP: W/MUD: W/WATER~~	—TO—
~~ROTARY DRILL: W/MUD: W/WATER~~	—TO—
~~DIAMOND CORE~~	—TO—

Form 25630 (R3-87)

FORM M-26C	REVISION 2
	PAGE 3 OF 3

DUKE POWER COMPANY
CONSTRUCTION DEPARTMENT
PROJECT MARSHALL

SOIL TEST BORING FIELD REPORT

JOB NO. N/A
STARTING TIME N/A
GROUND SURFACE ELEV.
JOB NAME FLYASH LANDFILL MW'S
HRS. DRILLING N/A HRS. MOVING N/A
DATE 6-27-89 WEATHER HOT INSPECTOR D. DICKSON BORING NO. MW-1

SAMPLING					SCALE	UD	SOIL CLASSIFICATION AND REMARKS
		1ST 6"	2ND 6"	3RD 6"	80		AUGER REFUSAL @ 80.5
							BORING TERMINATED
							SET MONITOR WELL PER ATTACHED SKETCH
					85		
					90		
					5		
					0		
					5		
					0		
					5		
					0		

+ STANDARD PENETRATION RESISTANCE IS SUM OF BLOWS FOR 2ND 6" AND 3RD 6" TO DRIVE 1-3/8" I.D., 2" O.D. SPLIT BARREL SAMPLER WITH 140 POUND HAMMER FALLING 30 INCHES

BORING TERMINATED @ 80.5
BORING REFUSAL AUGER @ 80.5
WATER TOB DEPTH 65.0 @ 7:30 P.M 6-27-89
WATER 24 HR: DEPTH 47.1' @ 7:30 AM 6-28-89
WATER LOSSES N/A
CASING SIZE N/A LENGTH 0

METHOD OF ADVANCING BORING	DEPTH
POWER AUGER	0 TO ~~74.5~~ 80.5
~~HAND CHOP: W/MUD: W/WATER~~	— TO —
~~ROTARY DRILL: W/MUD: W/WATER~~	— TO —
~~DIAMOND CORE~~	— TO —

N. C. Department of Human Resources
Division of Health Services

WELL COMPLETION RECORD

COMPLETE ALL INFORMATION REQUESTED BELOW FOR EACH WELL INSTALLED, AND RETURN FORM TO THE N. DEPARTMENT OF HUMAN RESOURCES, SOLID AND HAZARDOUS WASTE MANAGEMENT BRANCH P. O. BOX 2091, RALEIGH, N.C. 27602

NAME OF SITE: MARSHALL STEAM STATION	PERMIT NO.: 18-04
ADDRESS: HIGHWAY # 150, TERRELL, NC	OWNER (print): DUKE POWER CO.
DRILLING CONTRACTOR: DUKE POWER CO.	REGISTRATION NO.: 721

Casing Type: TRICOC THREADED PVC dia. 2" in. Grout Depth: from 0 to 18.0 ft. - dia. 6"
Casing Depth: from 0 to 23.0 ft. - dia. 2" in. Bentonite Seal: from 18.0 to 21.0 ft. - dia. 6"
Screen Type: TRICOC THREADED PVC dia. 2" in. Sand/Gravel PK: from 21.0 to 34.9 ft. - dia. 6"
Screen Depth: from 23.0 to 33.0 ft. - dia. 2" in. Total Well Depth: from 0 to 34.9 ft. - dia. 6"

Static Water Level: 7.2 feet from top of casing Date Measured 7/6/8

Yield (gpm): N/A Method of Testing: N/A Casing is 2.2 feet above land surf

DRILLING LOG		
DEPTH FROM	TO	FORMATION DESCRIPTION
		SEE ATTACHED SOIL TEST BORING FIELD REPORT FOR MW-2.

LOCATION SKETCH

(show distance to numbered roads, or other map reference poin

REMARKS: SCREEN IS PLACED IN THE MOST HYDRAULICALLY CONDUCTIVE ZONE PER CONVERSATIONS WITH RALPH ROBERTS AND ED SULLIVAN

DATE: 7-18-89 SIGNATURE: David S. Nickson

DHS 3342 (6/85)

Revision 0 | Page

DUKE POWER COMPANY — MARSHALL STEAM STA.

AS-BUILT INSTALLATION SKETCH

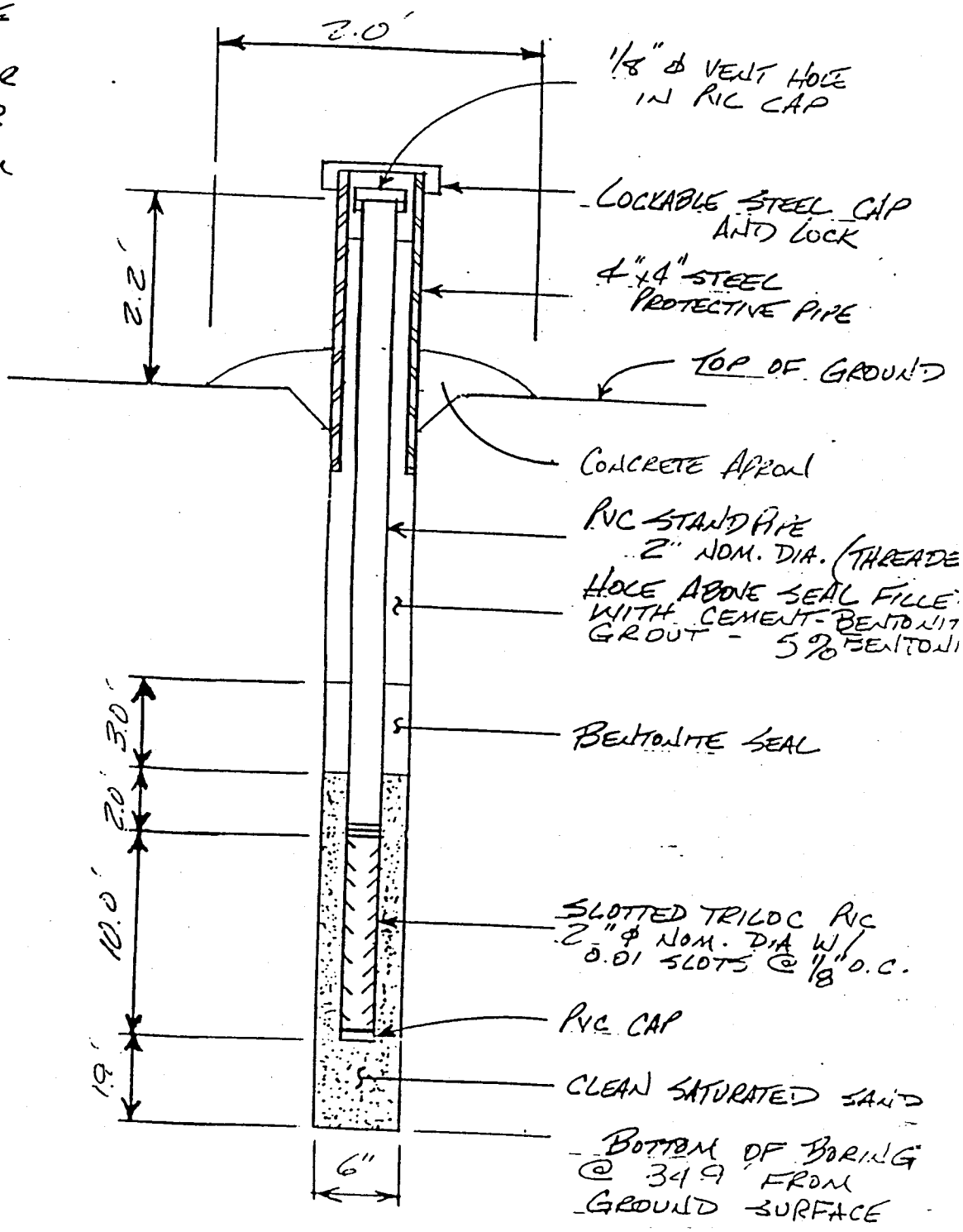
Instrument No. MW-2 Station N/A Offset N/A

By D. DICKSON Date 7-15-89

NOTE:
NOT TO SCALE

INITIAL WATER LEVEL RDG @ 7.2' FROM TOP/PIPE ON 7-6-89

T/PIPE ELEV. IS



Form 25630 (R3-87)

FORM M-26C	REVISION 2
	PAGE 1 OF 1

DUKE POWER COMPANY
CONSTRUCTION DEPARTMENT
PROJECT MARSHALL

SOIL TEST BORING FIELD REPORT

JOB NO. N/A
JOB NAME FLYASH LANDFILL MW'S
DATE 6-28-89 WEATHER Hot

STARTING TIME N/A
GROUND SURFACE ELEV.
HRS. DRILLING N/A HRS. MOVING N/A
INSPECTOR D. DICKSON BORING NO. MW-2

SAMPLING		1ST 6"	2ND 6"	3RD 6"	SCALE	UD	SOIL CLASSIFICATION AND REMARKS
					0		AD-2 DRILL RIG # 2555 SURFACE GRASS
1	4.5 6.0	3	4	4	5		REDDISH YELLOW MICA. SILTY FINE TO COARSE SAND.
2	9.5 11.0	3	4	4	10		LT. ~~BE~~ YELLOWISH BRN. MICA. SILTY FINE TO COARSE SAND.
3	14.5 16.0	3	3	4	15		LT. OLIVE GRAY MICA SILTY FINE TO COARSE SAND
4	19.5 21.0	4	7	10	20		LT. OLIVE GRAY MICA. SILTY FINE TO COARSE SAND.
5	24.5 26.0	13	26	24	25		LT. OLIVE BROWN MICA. SILTY FINE TO COARSE SAND
6	29.5 31.0	13	23	33	30		LT. OLIVE BROWN MICA. SILTY FINE TO COARSE SAND.
7	34.3 34.8	50=4"			35		NO RECOVERY
					40		AUGER REFUSAL @ 34.9 BORING TERMINATED SET 6"ϕ CASING TO 34.9' SET MONITOR WELL PER ATTACHED SKETCH.

BORING TERMINATED @ 34.9
BORING REFUSAL AUGER @ 34.9'
WATER TOB DEPTH 15.0' ON 6.28.89
WATER 24 HR: DEPTH 5.0' ON 7-6-89
WATER LOSSES NONE
CASING SIZE PW (6"ϕ) LENGTH 34.9'

METHOD OF ADVANCING BORING	DEPTH
POWER AUGER	0 TO 34.9
~~HAND CHOP: W/MUD: W/WATER~~	—TO—
~~ROTARY DRILL: W/MUD: W/WATER~~	—TO—
~~DIAMOND CORE~~	—TO—

+ STANDARD PENETRATION RESISTANCE IS SUM OF BLOWS FOR 2ND 6" AND 3RD 6" TO DRIVE 1-3/8" I.D., 2" O.D. SPLIT BARREL SAMPLER WITH 140 POUND HAMMER FALLING 30 INCHES

N. C. Department of Human Resources
Division of Health Services

WELL COMPLETION RECORD

COMPLETE ALL INFORMATION REQUESTED BELOW FOR EACH WELL INSTALLED, AND RETURN FORM TO THE N. DEPARTMENT OF HUMAN RESOURCES, SOLID AND HAZARDOUS WASTE MANAGEMENT BRANCH P. O. BOX 2091, RALEIGH, N.C. 27602

NAME OF SITE: MARSHALL STEAM STATION	PERMIT NO.: 18-04
ADDRESS: HIGHWAY #150 TERRELL, NC	OWNER (print): DUKE POWER CO.
DRILLING CONTRACTOR: DUKE POWER CO.	REGISTRATION NO.: 921

Casing Type: TRILOC THREADED PVC dia. 2" in. Grout Depth: from 0 to 14.0 ft. - dia. 6
Casing Depth: from 0 to 15.9 ft. - dia. 2" in. Bentonite Seal: from 11.0 to 14.0 ft. - dia. 6
Screen Type: TRILOC THREADED PVC dia. 2" in. Sand/Gravel PK: from 14.0 to 27.4 ft. - dia. 6
Screen Depth: from 15.9 to 25.9 ft. - dia. 2" in. Total Well Depth: from 0 to 27.4 ft. - dia. 6

Static Water Level: 8.9' feet from top of casing Date Measured 7/6/8

Yield (gpm): N/A Method of Testing: N/A Casing is 2.1 feet above land sur

DRILLING LOG		
DEPTH FROM	TO	FORMATION DESCRIPTION
SEE ATTACHED SOIL		
TEST BORING FIELD		
REPORT FOR MW-#3.		

LOCATION SKETCH

(show distance to numbered roads, or other map reference poir

REMARKS: SCREEN IS PLACED IN THE MOST HYDRAULICALLY CONDUCTIVE ZONE PER CONVERSATIONS WITH RALPH ROBERTS AND ED SULLIVAN.

DATE: 7-18-89 SIGNATURE: David L. Nichols

DHS 3342 (6/85)

Revision 0 | Page

DUKE POWER COMPANY — MARSHALL STEAM STA.

AS-BUILT INSTALLATION SKETCH

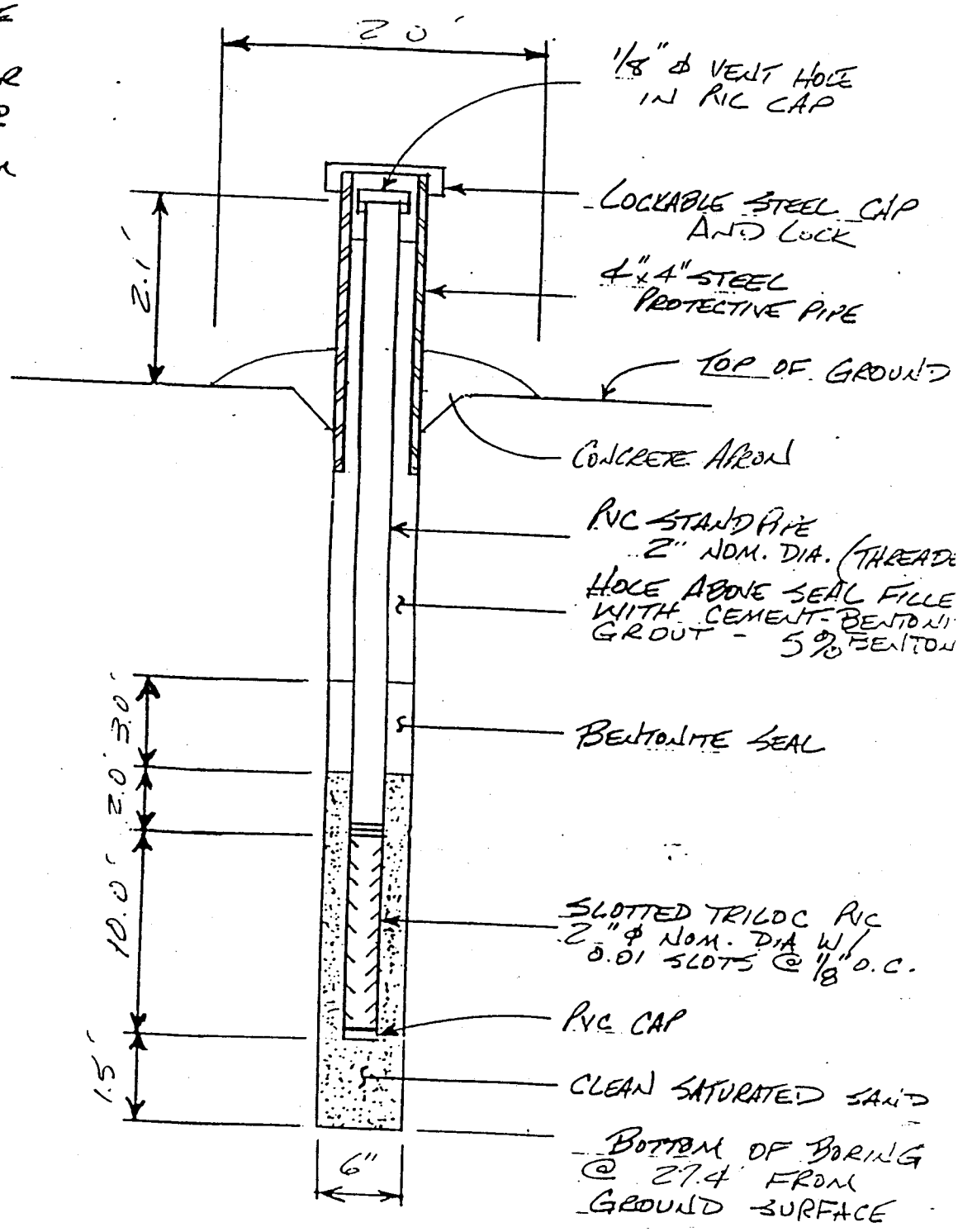
Instrument No. MH-3 Station N/A Offset N/A

By D. DICKSON Date 7-15-89

NOTE:
NOT TO SCALE

INITIAL WATER LEVEL RDG @ 8.9' FROM TOP/PIPE ON 7-6-89

T/PIPE ELEV. 15



Form 25630 (R3-87)

FORM M-26C	REVISION 2
	PAGE 1 OF 1

DUKE POWER COMPANY
CONSTRUCTION DEPARTMENT
PROJECT MARSHALL

SOIL TEST BORING FIELD REPORT

JOB NO. N/A
STARTING TIME N/A
GROUND SURFACE ELEV.
JOB NAME FLYASH LANDFILL MW's
HRS. DRILLING N/A HRS. MOVING N/A
DATE 6-29-89 WEATHER HOT INSPECTOR D. DICKSON BORING NO. MW-3

SAMPLING		1ST 6"	2ND 6"	3RD 6"	SCALE	UD	SOIL CLASSIFICATION AND REMARKS
					0		AD-2 DRILL RIG #2555
1	4.8 / 6.3	3	3	4	5		STRONG BROWN MICA. FINE TO MED. SANDY SILT.
2	9.8 / 11.3	9	13	21	10		WHITE MICA. FINE TO COARSE SAND
3	14.8 / 16.3	12	21	16	15		WHITE MICA. FINE TO COARSE SAND
4	19.8 / 21.3	15	14	13	20		VERY PALE BROWN MICA. FINE TO COARSE SAND.
5	24.8 / 26.3	3	3	5	25		STRONG BROWN MICA. SILTY FINE TO MEDIUM SAND.
							AUGER REFUSAL @ 27.4' BORING TERMINATED SET MONITOR WELL PER ATTACHED SKETCH
					30		
					35		
					40		

+ STANDARD PENETRATION RESISTANCE IS SUM OF BLOWS FOR 2ND 6" AND 3RD 6" TO DRIVE 1-3/8" I.D., 2" O.D. SPLIT BARREL SAMPLER WITH 140 POUND HAMMER FALLING 30 INCHES

BORING TERMINATED @ 27.4
BORING REFUSAL AUGER @ 27.4'
WATER TOB DEPTH 21.0 ON 6-29-89
WATER 24 HR: DEPTH 6.8' ON 7-6-89
WATER LOSSES N/A
CASING SIZE N/A LENGTH 0

METHOD OF ADVANCING BORING	DEPTH
POWER AUGER	0 TO 27.4
~~HAND CHOP: W/MUD: W/WATER~~	— TO —
~~ROTARY DRILL: W/MUD: W/WATER~~	— TO —
~~DIAMOND CORE~~	— TO —

27.4

N. C. Department of Human Resources
Division of Health Services

WELL COMPLETION RECORD

COMPLETE ALL INFORMATION REQUESTED BELOW FOR EACH WELL INSTALLED, AND RETURN FORM TO THE N. DEPARTMENT OF HUMAN RESOURCES, SOLID AND HAZARDOUS WASTE MANAGEMENT BRANC . O. BOX 2091, RALEIGH, N.C. 27602

NAME OF SITE: MARSHALL STEAM STATION	PERMIT NO.: 18-04
ADDRESS: HIGHWAY #150 TERRILL, NC	OWNER (print): DUKE POWER CO
DRILLING CONTRACTOR: DUKE POWER CO.	REGISTRATION NO.: 921

Casing Type: TRLOC THREADED PVC dia. 2 in. Grout Depth: from 0 to 32.5 ft. - dia. 6
Casing Depth: from 0 to 37.4 ft. - dia. 2 in. Bentonite Seal: from 32.5 to 35.5 ft. - dia. 6
Screen Type: TRLOC THREADED PVC dia. 2 in. Sand/Gravel PK: from 35.5 to 49.6 ft. - dia. 6
Screen Depth: from 37.4 to 47.4 ft. - dia. 2 in. Total Well Depth: from 0 to 49.6 ft. - dia. 6

Static Water Level: 34.3 feet from top of casing Date Measured 7/6/8

Yield (gpm): N/A Method of Testing: N/A Casing is 2.6 feet above land surf

DRILLING LOG		
DEPTH FROM	TO	FORMATION DESCRIPTION
SEE ATTACHED		
SOIL TEST BORING		
FIELD REPORT		
FOR MW-#4.		

LOCATION SKETCH

(show distance to numbered roads, or other map reference poin

REMARKS: SCREEN IS PLACED IN THE MOST HYDRAULICALLY CONDUCTIVE ZONE PER CONVERSATIONS WITH RALPH ROBERTS AND ED SULLIVAN.

DATE: 7-18-89 SIGNATURE: [signature]

DHS 3342 (6/85)

DUKE POWER COMPANY – MARSHALL STEAM STA.

AS-BUILT INSTALLATION SKETCH

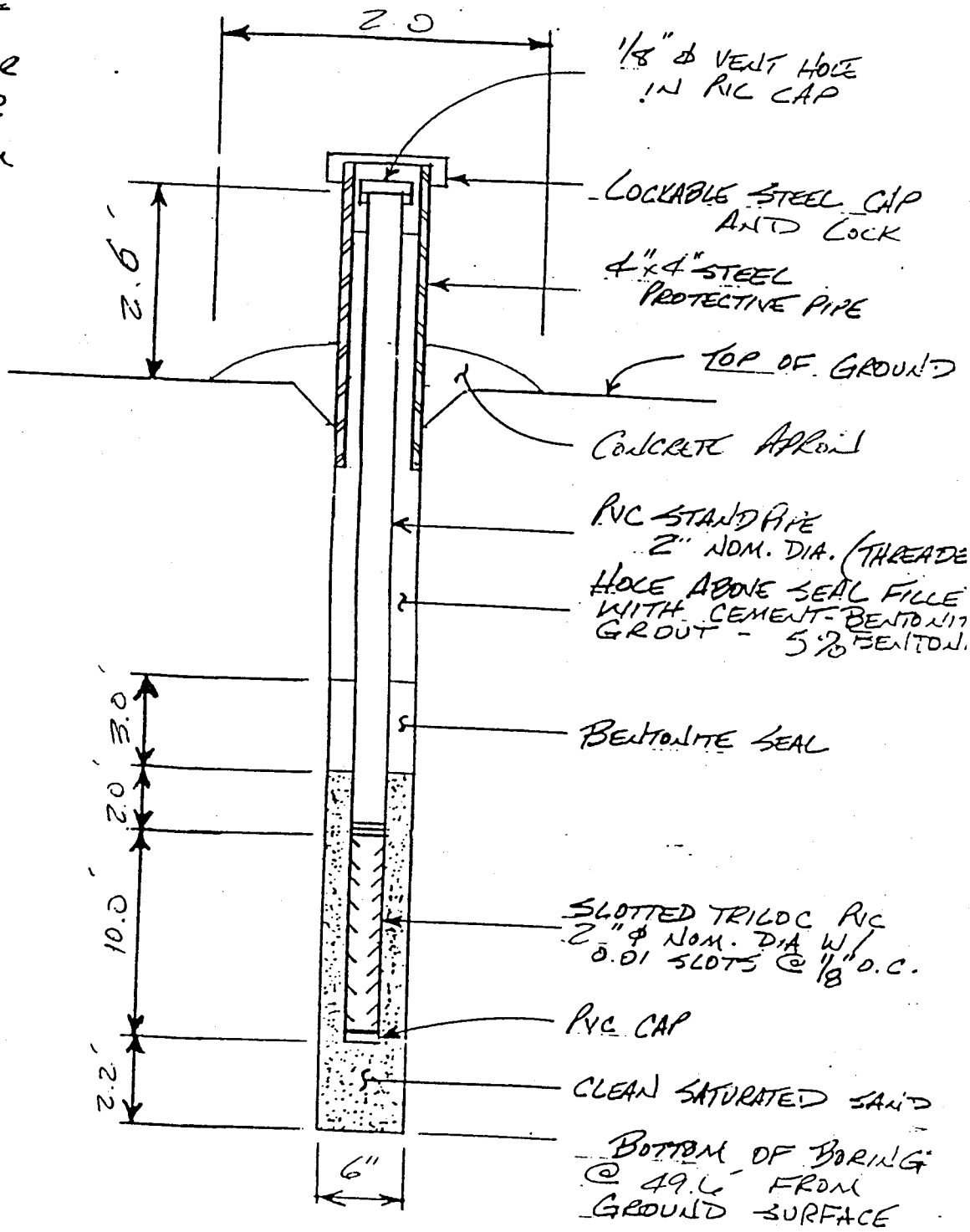
Instrument No. MW-4 Station N/A Offset N/A

By D. DICKSON Date 7-15-89

NOTE:
NOT TO SCALE

INITIAL WATER LEVEL RDG @ 34.3' FROM TOP/PIPE ON 7-6-89

T/PIPE ELEV. IS



Form 25630 (R3-87)

FORM M-26C	REVISION 2
	PAGE 1 OF 2

DUKE POWER COMPANY
CONSTRUCTION DEPARTMENT
PROJECT MARSHALL

SOIL TEST BORING FIELD REPORT

JOB NO. N/A
STARTING TIME N/A
GROUND SURFACE ELEV.
JOB NAME FLYASH LANDFILL MW'S
HRS. DRILLING N/A HRS. MOVING N/A
DATE 6-30-89 WEATHER HOT INSPECTOR D. DICKSON BORING NO. MW-4A

SAMPLING		1ST 6"	2ND 6"	3RD 6"	SCALE	UD	SOIL CLASSIFICATION AND REMARKS
					0		AD-2 DRILL RIG # 2555
1	4.2						YELLOWISH RED MICA. SILTY FINE TO
	5.7	6	7	8			MEDIUM SAND.
					5		
2	9.2						WHITE MICA. FINE TO COARSE SAND
	10.7	7	6	6	10		
3	14.2						STRONG BROWN MICA. FINE TO
	15.7	4	6	7	15		MEDIUM SANDY SILT.
4	19.2						BROWNISH YELLOW MICA. SILTY FINE
	20.7	3	5	7	20		TO MEDIUM SAND
5	24.2						LT. OLIVE BROWN MICA. SILTY FINE
	25.7	5	6	7	25		TO MEDIUM SAND
6	29.2				30		OLIVE MICA. SILTY FINE TO
	30.7	5	7	7			MEDIUM SAND.
7	34.2				35		OLIVE MICA. SILTY FINE TO
	35.7	4	6	7			MEDIUM SAND.
							OLIVE GRAY MICA. SILTY FINE TO
8	39.2				40		COARSE SAND.
	40.7	13	26	18			SPLIT SPOON SAMPLER RETRIEVED WET

+ STANDARD PENETRATION RESISTANCE IS SUM OF BLOWS FOR 2ND 6" AND 3RD 6" TO DRIVE 1-3/8" I.D., 2" O.D. SPLIT BARREL SAMPLER WITH 140 POUND HAMMER FALLING 30 INCHES

BORING TERMINATED @ 49.6
BORING REFUSAL AUGER @ 49.6'
WATER TOB DEPTH 46.0' ON 6-30-89
WATER 24 HR: DEPTH 31.7 ON 7-6-89
WATER LOSSES N/A
CASING SIZE N/A LENGTH 0

METHOD OF ADVANCING BORING	DEPTH
POWER AUGER	0 TO 49.6
~~HAND CHOP: W/MUD: W/WATER~~	—TO—
~~ROTARY DRILL: W/MUD: W/WATER~~	—TO—
~~DIAMOND CORE~~	—TO—

Form 25630 (R3-87)

FORM M-26C	REVISION 2
	PAGE 2 OF 2

DUKE POWER COMPANY
CONSTRUCTION DEPARTMENT
PROJECT MARSHALL

SOIL TEST BORING FIELD REPORT

JOB NO. N/A
JOB NAME FLYASH LANDFILL MW'S
DATE 6-30-89 WEATHER HOT

STARTING TIME N/A
GROUND SURFACE ELEV.
HRS. DRILLING N/A HRS. MOVING N/A
INSPECTOR D. DICKSON BORING NO. MW-4A

SAMPLING		1ST 6"	2ND 6"	3RD 6"	SCALE	UD	SOIL CLASSIFICATION AND REMARKS
					40		
9	44.2						OLIVE BROWN MICA. SILTY FINE
	45.0/2	50=4"			45		TO COARSE SAND.
10	49.2				50		LT. OLIVE GRAY MICA. SILTY FINE
	49.5	50=3"					TO COARSE SAND
							AUGER REFUSAL @ 49.6'
							BORING TERMINATED
					55		SET MONITOR WELL
							PER ATTACHED SKETCH.
					60		
					65		
					70		
					5		
					0		

BORING TERMINATED @ 49.6
BORING REFUSAL AUGER @ 49.6
WATER TOB DEPTH 46.0' ON 6-30-89
WATER 24 HR: DEPTH 31.7' ON 9-6-89
WATER LOSSES N/A
CASING SIZE N/A LENGTH 0

METHOD OF ADVANCING BORING	DEPTH
POWER AUGER	0 TO 49.6
~~HAND CHOP: W/MUD: W/WATER~~	— TO —
~~ROTARY DRILL: W/MUD: W/WATER~~	— TO —
~~DIAMOND CORE~~	— TO —

+ STANDARD PENETRATION RESISTANCE IS SUM OF BLOWS FOR 2ND 6" AND 3RD 6" TO DRIVE 1-3/8" I.D., 2" O.D. SPLIT BARREL SAMPLER WITH 140 POUND HAMMER FALLING 30 INCHES

Form 25630 (R3-87)

FORM M-26C	REVISION 2
	PAGE 1 OF 2

DUKE POWER COMPANY
CONSTRUCTION DEPARTMENT
PROJECT B MARSHALL

SOIL TEST BORING FIELD REPORT

JOB NO. N/A
JOB NAME FLYASH LANDFILL MW'S
DATE 6-29-89 WEATHER HOT

STARTING TIME N/A
GROUND SURFACE ELEV.
HRS. DRILLING N/A HRS. MOVING N/A
INSPECTOR D. DICKSON BORING NO. MW-4

	SAMPLING	1ST 6"	2ND 6"	3RD 6"	SCALE	UD	SOIL CLASSIFICATION AND REMARKS
					0		AD-2 DRILL RIG + 2555
1	4.5 6.0	3	4	4	5		RED MICA. SILTY FINE TO MEDIUM SAND
2	9.5 11.0	6	3	3	10		LT. BROWNISH GRAY MICA. SILTY FINE TO MEDIUM SAND.
3	14.5 16.0	4	5	6	15		LT. BROWNISH GRAY MICA. SILTY FINE TO COARSE SAND.
4	19.5 21.0	2	4	6	20		LT. BROWNISH GRAY MICA. SILTY FINE TO MEDIUM SAND.
5	24.5 26.0	6	8	9	25		LT. BROWNISH GRAY MICA. SILTY FINE TO MEDIUM SAND.
6	29.5 31.0	5	10	12	30		LT. BROWNISH GRAY MICA. SILTY FINE TO MEDIUM SAND.
7	34.5 36.0	3	5	4	35		LT. BROWNISH GRAY MICA. SILTY FINE TO MEDIUM SAND.
8	39.5 41.0	5	8	13	40		LT. BROWNISH GRAY MICA. SILTY FINE TO MEDIUM SAND.

+ STANDARD PENETRATION RESISTANCE IS SUM OF BLOWS FOR 2ND 6" AND 3RD 6" TO DRIVE 1-3/8" I.D., 2" O.D. SPLIT BARREL SAMPLER WITH 140 POUND HAMMER FALLING 30 INCHES

BORING TERMINATED
BORING REFUSAL
WATER TOB DEPTH
WATER 24 HR: DEPTH
WATER LOSSES
CASING SIZE LENGTH

METHOD OF ADVANCING BORING	DEPTH
POWER AUGER	TO
HAND CHOP: W/MUD: W/WATER	TO
ROTARY DRILL: W/MUD: W/WATER	TO
DIAMOND CORE	TO

DRY BORING - SEE MW-4A

Form 25630 (R3-87)

FORM M-26C	REVISION 2
	PAGE 2 OF 2

DUKE POWER COMPANY
CONSTRUCTION DEPARTMENT
PROJECT MARSHALL

SOIL TEST BORING FIELD REPORT

JOB NO. N/A
JOB NAME FLYASH LANDFILL MKT'S
DATE 6-29-89 WEATHER HOT

STARTING TIME N/A
GROUND SURFACE ELEV.
HRS. DRILLING N/A HRS. MOVING N/A
INSPECTOR D. DICKSON BORING NO. MW-4

SAMPLING		1ST 6"	2ND 6"	3RD 6"	SCALE	UD	SOIL CLASSIFICATION AND REMARKS
					40		
9	44.5				45		LT. GRAY MICA. SILTY FINE TO MEDIUM SAND.
	~~44.5~~ 45.0		50=6"				FOR CLARIFICATION - 44.5 - 45.0 50=6"
							AUGER REFUSAL @ 47.9'
					50		DRY BORING - MOVED TO ALTERNATE BORING SITE # MW-4A
					55		
					60		
					65		
					70		
					75		
					80		

BORING TERMINATED
BORING REFUSAL
WATER TOB DEPTH
WATER 24 HR: DEPTH
WATER LOSSES
CASING SIZE LENGTH

METHOD OF ADVANCING BORING	DEPTH
POWER AUGER	TO
HAND CHOP: W/MUD: W/WATER	TO
ROTARY DRILL: W/MUD: W/WATER	TO
DIAMOND CORE	TO

+ STANDARD PENETRATION RESISTANCE IS SUM OF BLOWS FOR 2ND 6" AND 3RD 6" TO DRIVE 1-3/8" I.D., 2" O.D. SPLIT BARREL SAMPLER WITH 140 POUND HAMMER FALLING 30 INCHES

N. C. Department of Human Resources
Division of Health Services

WELL COMPLETION RECORD

COMPLETE ALL INFORMATION REQUESTED BELOW FOR EACH WELL INSTALLED, AND RETURN FORM TO THE N.C. DEPARTMENT OF HUMAN RESOURCES, SOLID AND HAZARDOUS WASTE MANAGEMENT BRANCH P. O. BOX 2091, RALEIGH, N.C. 27602

NAME OF SITE: MARSHALL STEAM STATION	PERMIT NO.: 18-04
ADDRESS: HIGHWAY #150 TERRILL, NC	OWNER (print): DUKE POWER CO.
DRILLING CONTRACTOR: DUKE POWER CO.	REGISTRATION NO.: 921

Casing Type: TRILOC THREADED PVC dia. 2 in. Grout Depth: from 0 to 3.5 ft. - dia. 6 in.
Casing Depth: from 0 to 53.2 ft. - dia. 2 in. Bentonite Seal: from 3.5 to 6.5 ft. - dia. 6 in.
Screen Type: TRILOC THREADED PVC dia. 2 in. Sand/Gravel PK: from 6.5 to 64.5 ft. - dia. 6 in.
Screen Depth: from 53.2 to 63.2 ft. - dia. 2 in. Total Well Depth: from 0 to 64.5 ft. - dia. 6 in.

Static Water Level: 44.9 feet from top of casing Date Measured 7/6/8

Yield (gpm): N/A Method of Testing: N/A Casing is 2.3 feet above land surf

DRILLING LOG

DEPTH FROM	TO	FORMATION DESCRIPTION
		SEE ATTACHED SOIL
		TEST BORING FIELD
		REPORT FOR OB-#1
		SEE ALSO BORING
		FIELD REPORT FOR MW-#1
		WHICH IS LOCATED APPROX
		80' AWAY.

LOCATION SKETCH

(show distance to numbered roads, or other map reference point

REMARKS: FOR WATER TABLE ONLY - BOTTOM OF SCREEN PLACED 20' BELOW STATIC WATER TABLE IN LIEU OF FUTURE DROUGHT CONDITIONS PER RALPH ROBERTS.

DATE: 7-18-89 SIGNATURE: [signature]

DHS 3342 (6/85)

DUKE POWER COMPANY – MARSHALL STEAM STATION

AS-BUILT INSTALLATION SKETCH

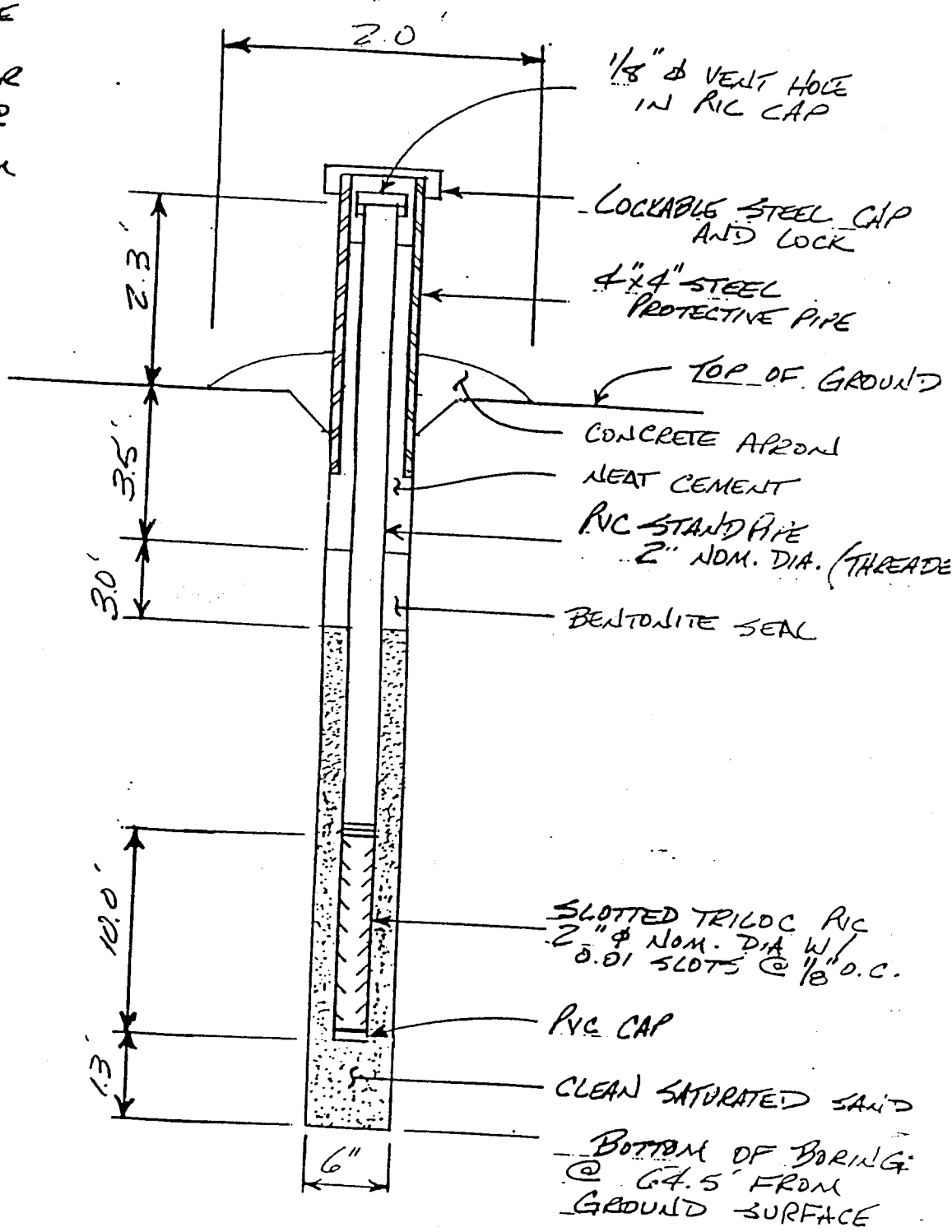
Instrument No. OB-1 Station N/A Offset N/A

By D. DICKSON Date 7-15-89

NOTE:
NOT TO SCALE

INITIAL WATER LEVEL RDG @ 44.9' FROM TOP/PIPE ON 7-6-89

T/PIPE ELEV. 15



Form 25630 (R3-87)

FORM M-26C	REVISION 2
	PAGE 1 OF 1

DUKE POWER COMPANY
CONSTRUCTION DEPARTMENT
PROJECT MARSHALL

SOIL TEST BORING FIELD REPORT

JOB NO. N/A
JOB NAME FLYASH LANDFILL MH'S
DATE 6-28-89 WEATHER HOT

STARTING TIME N/A
GROUND SURFACE ELEV.
HRS. DRILLING N/A HRS. MOVING N/A
INSPECTOR D. DICKSON BORING NO. OB-1

SAMPLING					SCALE	UD	SOIL CLASSIFICATION AND REMARKS
		1ST 6"	2ND 6"	3RD 6"	0		AD-2 DRILL RIG # 2555
NO SAMPLING REQUIRED PER RALPH ROBERTS					5		AUGERED TO 64.5'
							SET OBSERVATION WELL PER ATTACHED SKETCH.
					0		
					5		
					0		
					5		
					0		
					5		
					0		

+ STANDARD PENETRATION RESISTANCE IS SUM OF BLOWS FOR 2ND 6" AND 3RD 6" TO DRIVE 1-3/8" I.D., 2" O.D. SPLIT BARREL SAMPLER WITH 140 POUND HAMMER FALLING 30 INCHES

BORING TERMINATED @ 64.5'
BORING REFUSAL N/A
WATER TOB DEPTH 63.0' @ 11:00 A.M. 6-28-89
WATER 24 HR: DEPTH 42.6 @ 7:00 A.M. 6-29-87
WATER LOSSES N/A
CASING SIZE N/A LENGTH 0

METHOD OF ADVANCING BORING	DEPTH
POWER AUGER	0 TO 64.5
~~HAND CHOP: W/MUD: W/WATER~~	— TO —
~~ROTARY DRILL: W/MUD: W/WATER~~	— TO —
~~DIAMOND CORE~~	— TO —

4.0 Groundwater Monitoring Program

The groundwater monitoring program consists of 4 wells used to monitor water quality (MW-1, MW-2, MW-3, MW-4) and one well to measure water level only (OB-1). The location of these wells is shown on drawing M-10 (Note: Well OB-1 is labeled as OW-1 on this drawing). Well MW-4 is used to measure the water quality upgradient from the landfill.

The elevation of the ground at the well casing, the top of screen elevation, and the elevation of auger refusal (blow count, N >50 for 5") for the wells are listed below:

Well #	Ground Elevation (ft)	Top of Screen Elevation (ft)	Elevation of Auger Refusal (ft)
MW-1	821.2	754.1	740.7
MW-2	794.9	771.9	760.0
MW-3	811.0	795.1	783.6
MW-4	864.5	827.1	814.9
OB-1	823.6	770.0	759.1

These wells were installed in July 1989 and are read once annually. The results of these readings are shown in **Section 4.3 Results of Groundwater Monitoring Program.**

4.1 Soils

The soils within the project are mapped as Pacolet and Wilkes by the USDA Soil Conservation Survey of Catawba County (October 1975). In 1991, a subsurface investigation was undertaken to support the design of a proposed embankment across the ash basin. Data from 17 samples obtained from 4 boring performed in the vicinity of the flyash portion of the landfill were reviewed. These logs indicate that the soils to a depth of about 20 feet are classified as a silty fine to medium sand. The boring logs for the installation of the monitoring wells classify the soil as a slilty fine to coarse sand, depending on the depth of the soil. Gradation tests indicate that the surface soils average approximately 30% by weight passing a Number 200 sieve. Permeability of these soils are in the order of 10^{-6} cm/sec.

4.2 Analysis of Groundwater Monitoring Results

This section will briefly summarize the groundwater quality from the monitoring well network surrounding the Marshall Steam Station Dry Ash Landfill and generally focus on indicator parameters. Indicator parameters are physical and chemical compounds that can be used to identify overall trends in water quality for groups of individual parameters. For example, total dissolved solids can indicate changes in cations and anions. The groundwater at the landfill has been monitored since August 1989.

The groundwater monitoring results have consistently met the 15A NCAC 2L standards with the exception of the values for pH and manganese. The values for pH and

manganese are consistent with historical data at the site and are not believed to be attributed to the landfill.

pH: pH values have remained fairly constant, with minor fluctuations since the initial monitoring. The low pH values can be attributed to the soils of the Piedmont Region. These soils typically have a low pH. Pacolet soils have a pH range of from 5.1 to 5.5. Wilkes soils have a pH range of from 5.6 to 7.3.

Field Conductivity: A measure of the electrical conductivity of the water and an indirect measurement of the cation/anion activity. The conductivity has increased in all wells, except monitoring well MW-4. It has increased most in MW-3. Well MW-3 is located near a wetland area and adjacent to a private property with livestock. Runoff from the property to the wetland area and subsequent infiltration may be the cause for the increases in conductivity values over time. This same trend is reported for other parameters such as chloride, nitrate+nitrite.

TDS (Total Dissolved Solids): TDS has decreased over time at all monitoring wells. The variation between wells has also decreased over time.

Sulfate: Sulfate is a conservative parameter that will undergo little transformation as it moves through the groundwater. Generally speaking, sulfates are found in coal and coal ash, and is a good parameter for monitoring leachate activity from the landfill. At the downgradient well, MW-1, sulfate has changed little since the initial monitoring began in 1989.

Chloride: Chloride, like sulfate is a conservative parameter that can be used as a tracer in groundwater studies. Chloride concentrations in coal ash would not be expected to be high and the data supports that assumption. Chloride has remained relatively constant over time, with the exception of MW-3, where the concentrations have steadily increased over time.

Fluoride: Remained relatively stable through 1994. In 1995, fluoride indicated a positive trend, with the highest values recorded during the August 1985 sampling event.

TOC (Total Organic Carbon): TOC can be used as an indicator for the presence of hydrocarbons. The relatively low concentrations of TOC at all wells, would indicate hydrocarbons are of minimal concern.

COD (Chemical Oxygen Demand): In general, an indicator that gives the relative strength of parameters that will consume oxygen through chemical reactions. For all wells COD has been at or below the detection limit since the November 1991 sampling event.

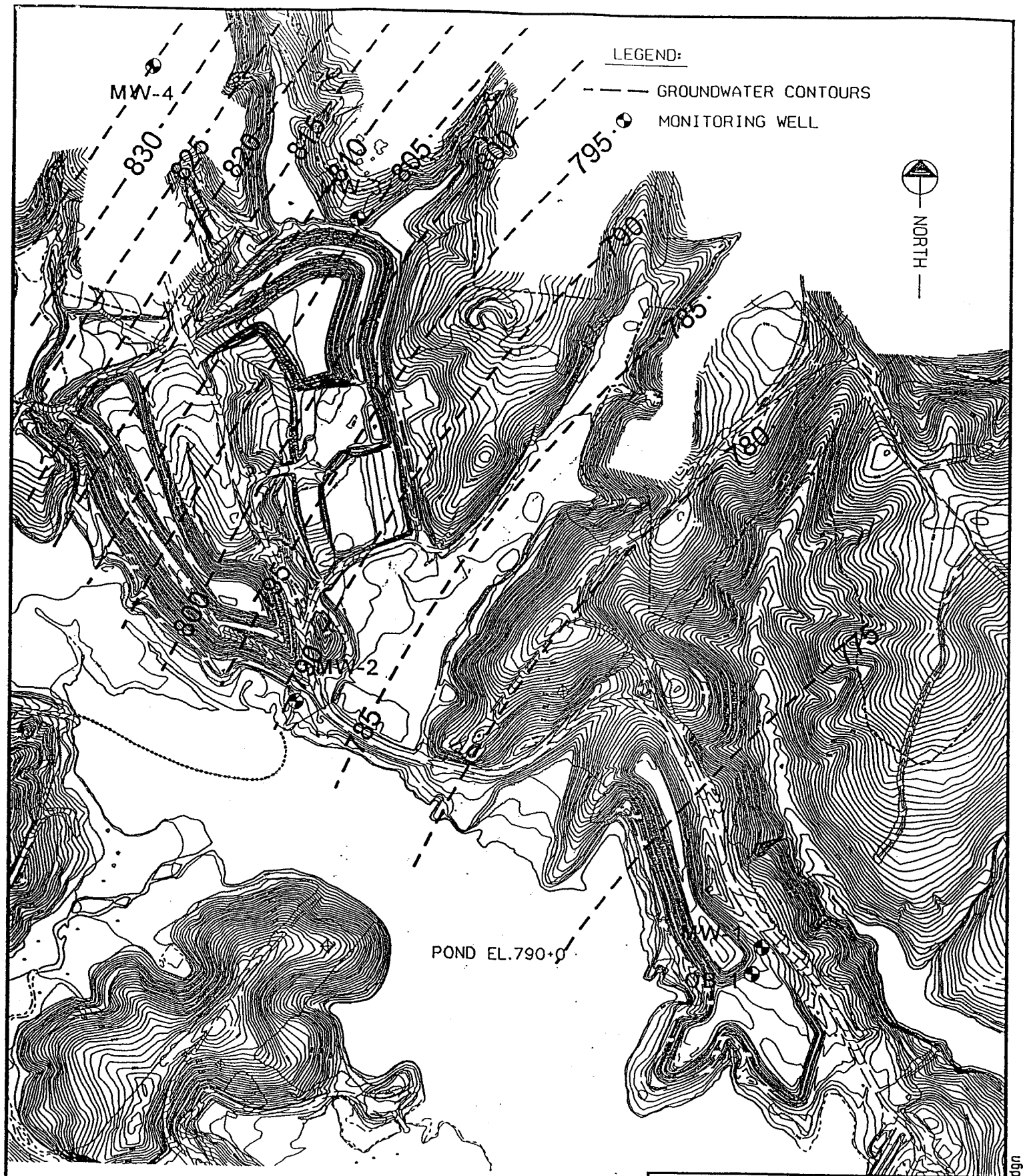
BOD (Biochemical Oxygen Demand): In general, BOD is an indicator of the oxygen consuming capacity of the waste materials caused by biological degradation. Values for BOD for all wells have been less than 1.0 mg/l BOD since the August 1992 sampling event. Biological degradation is minimal at the landfill.

TOX (Total Organic Halides): In general, TOX is an indicator for the presence of chlorinated solvents, pesticides, and herbicides. Since the start of sampling, TOX has been at or below the detection limit.

Nitrate+Nitrite: These parameters have been near the detection limit for all sampling events at all wells except MW-3. At MW-3, these parameters have increased since the start of sampling. Nitrate is a conservative parameter in groundwater and is associated with livestock waste.

Trace Metals: For the most part, trace metals have remained low and at or near the detection limit for the entire monitoring period. Little metal mobility has taken place over time, as evidenced by the low concentrations in the downgradient wells. This mobility may be associated with the ability of Piedmont soils to effectively bind these trace metals.

4.3 Results of Groundwater Monitoring Program



NOTE: GW CONTOURS DRAWN FROM MONITORING WELL WATER ELEVATIONS OF FEBRUARY 13, 1996.

500 0 500 1000 1500

SCALE IN FEET

DUKE POWER COMPANY

MARSHALL STEAM STATION

SOLID WASTE LANDFILL #18-04

c:\marshall\mamx-1.dgn

[redacted]ble 1

MARSHALL LANDFILL GROUNDWATER

WELL (loc)	DATE (mm/dd/yy)	WELL DEPTH (ft)	TIME (hh/mm)	DEPTH TO WATER (ft)	FIELD PH (units)	FIELD COND (umho/cm)	FIELD TEMP deg C	LAB PH (units)	TDS (mg/l)	SO4 (mg/l)	CL (mg/l)	NO3+NO2 (mg/l)	F (mg/l)	TOC (mg/l)	COD (mg/l)	BOD (mg/l)	TOX (mg/l)	AG (mg/l)	AS (mg/l)	BA (mg/l)	CD (mg/l)	CR (mg/l)	CU (mg/l)	FE (mg/l)	HG (mg/l)	MN (mg/l)	PB (mg/l)	SE (mg/l)	ZN (mg/l)
(NC GW STDS)					6.5-8.5			6.5-8.5	500	250	250	10+1	2					0.018	0.05	2	0.005	0.05	1	0.3	0.0011	0.05	0.015	0.05	2.1
MW-1	8/29/89	78.75	1	49.20	5.8	62.0	17.1	6.4	70 <	1.0	3.6	0.07 <	0.10	0.30 <	5.0	0.81 <	0.01 <	0.0002 <	0.001	0.080	0.00011	0.0018 <	0.0300	0.800 <	0.0002	0.060 <	0.0020 <	0.002	0.020
MW-1	10/16/90	78.75	920	48.20	6.0	58.0	15.7	6.2	71	1.1	1.5	0.31	0.10	0.28	11.6	0.30	<	0.0002 <	0.001	0.066	0.00036 <	0.0010 <	0.0300	0.310 <	0.0001	0.035 <	0.0020 <	0.002 <	0.004
MW-1	11/12/91	78.80	910	62.60	5.2	56.0		6.1	54	1.7	1.4	0.25 <	0.10	0.25 <	10.0	1.10 <	0.01	0.0002 <	0.001	0.060	0.00010	0.0039	0.0013	0.260 <	0.0001	0.028 <	0.0020 <	0.002 <	0.010
MW-1	8/27/92	78.80	933	49.00	5.6	54.0	16.6	6.3	57	6.3	2.2	0.30 <	0.10	0.41 <	10.0	0.20 <	0.01 <	0.0002 <	0.001	0.067 <	0.00010	0.0040	0.0012	0.170 <	0.0002	0.025 <	0.0100 <	0.002	0.018
MW-1	3/30/93	78.75	1420	47.35	5.9	56.0	16.3	5.8	140	1.8	1.6	0.22 <	0.10	0.60 <	10.0	0.70 <	0.01 <	0.0002 <	0.005	0.094	0.00072	0.0025	0.0011	1.250 <	0.0001	0.063 <	0.0020 <	0.005	0.028
MW-1	8/2/93	78.75	1145	47.35	6.0	59.8	16.3	5.7	61 <	1.0	1.7	0.20	0.11	0.40 <	10.0	0.50 <	0.01 <	0.0002 <	0.005	0.075 <	0.10000	0.0028 <	0.0005	0.088 <	0.0001 <	0.005 <	0.0020 <	0.005 <	0.010
MW-1	2/1/94	78.75	1345	49.90	5.7	61.0	15.4	6.0	51 <	1.0	1.6	0.16	0.10	0.60 <	10.0	0.80 <	0.01 <	0.0002	0.005	0.063 <	0.00010	0.0030 <	0.0005 <	0.035 <	0.0001	0.015 <	0.0020 <	0.001	0.010
MW-1	8/8/94	78.75	835	49.26	5.9	62.0	16.1	6.0	72 <	1.0	1.6	0.18	0.11	0.21 <	10.0	0.50 <	0.01 <	0.0002 <	0.001	0.067 <	0.00010	0.0032	0.0007	0.030 <	0.0001	0.013 <	0.0020	0.003 <	0.005
MW-1	2/1/95	78.75	1350	50.08	5.8	63.1	16.6	6.3	48 <	1.0	2.0	0.19	0.17	0.43 <	10.0	0.60 <	0.01 <	0.0002 <	0.001	0.298	0.00013	0.0045	0.0058	5.477	0.0001	0.483	0.0074	0.001	0.038
MW-1	3/16/95	78.75	925	50.34	6.1	62.5	16.0										<	0.0002 <	0.001	0.075	0.00010	0.0032	0.0013	0.093 <	0.0001	0.015 <	0.0020 <	0.001	0.009
MW-1	8/8/95	78.75	1005	50.42	6.1	63.0	16.2	5.9	63 <	1.0	1.4	0.15	0.37	0.40	10.0	0.00 <	0.01 <	0.0002 <	0.005	0.074 <	0.00010	0.0036 <	0.0005	0.020 <	0.0001	0.013 <	0.0020 <	0.001 <	0.005

WELL (loc)	DATE (mm/dd/yy)	WELL DEPTH (ft)	TIME (hh/mm)	DEPTH TO WATER (ft)	FIELD PH (units)	FIELD COND (umho/cm)	FIELD TEMP deg C	LAB PH (units)	TDS (mg/l)	SO4 (mg/l)	CL (mg/l)	NO3+NO2 (mg/l)	F (mg/l)	TOC (mg/l)	COD (mg/l)	BOD (mg/l)	TOX (mg/l)	AG (mg/l)	AS (mg/l)	BA (mg/l)	CD (mg/l)	CR (mg/l)	CU (mg/l)	FE (mg/l)	HG (mg/l)	MN (mg/l)	PB (mg/l)	SE (mg/l)	ZN (mg/l)
(NC GW STDS)					6.5-8.5			6.5-8.5		250	250	10+1	2					0.018	0.05	2	0.005	0.05	1	0.3	0.0011	0.05	0.015	0.05	2.1
MW-2	8/29/89	35.10	3	35.10	5.7	66.0	17.6	6.7	94	11.0	1.6	0.34 <	0.10	0.48 <	5.0	0.33 <	0.01 <	0.0002 <	0.001	0.070	0.00014	0.0021 <	0.0300 <	0.050 <	0.0002	0.070 <	0.0020 <	0.002	0.130
MW-2	10/16/90	35.05	1045	6.10	5.9	76.0	16.2	6.0	81	12.4	3.0 <	0.05 <	0.10	0.41	10.5	0.30	<	0.0002 <	0.001	0.055	0.00234 <	0.0010 <	0.0300 <	0.050 <	0.0001	0.010 <	0.0020 <	0.002 <	0.004
MW-2	11/12/91	35.10	1005	7.10	5.3	74.0		5.9	69	13.7	3.0	0.05 <	0.10	0.33 <	10.0	0.80 <	0.01	0.0002 <	0.001	0.050	0.00056	0.0028	0.0028 <	0.050 <	0.0001	0.006 <	0.0020 <	0.002	0.010
MW-2	8/27/92	35.10	1040	6.50	5.5	66.0	16.4	6.5	92	3.1	3.6 <	0.05 <	0.10	0.31 <	10.0 <	0.10 <	0.01	0.0002 <	0.001	0.052 <	0.00010	0.0025	0.0013	0.180	0.0002	0.009 <	0.0100 <	0.002	0.033
MW-2	3/30/93	35.10	1325	5.45	5.8	67.0	16.0	5.7	85	12.3	0.2	0.05 <	0.10	0.60 <	10.0	0.30 <	0.01 <	0.0002 <	0.005	0.050	0.00088 <	0.0010	0.0016 <	0.050 <	0.0001	0.006 <	0.0020 <	0.005	0.038
MW-2	8/2/93	35.10	1110	6.83	5.9	69.8	16.2	5.7	76	11.5	3.4	0.06	0.10	0.60 <	10.0	0.70 <	0.01 <	0.0002 <	0.005	0.049 <	0.10000	0.0010 <	0.0005	0.063 <	0.0001 <	0.005 <	0.0020 <	0.005 <	0.010
MW-2	2/1/94	35.10	1140	6.47	5.6	71.9	15.0	5.9 <	10	11.6	3.2	0.07 <	0.10	0.70	11.0	0.20 <	0.01 <	0.0002 <	0.005	0.042 <	0.00010	0.0011	0.0005	0.041 <	0.0001	0.005 <	0.0020 <	0.001	0.008
MW-2	8/8/94	35.10	920	7.30	5.7	72.5	15.7	6.0	86	10.8	3.2	0.07	0.10	0.30 <	10.0	0.40 <	0.01 <	0.0002 <	0.001	0.045 <	0.00010	0.0015 <	0.0005	0.058 <	0.0001	0.005 <	0.0020	0.003 <	0.005
MW-2	2/1/95	35.10	1245	6.84	5.7	73.9	15.3	6.0	62	10.9	3.3	0.09	0.12	0.41 <	10.0	0.30 <	0.01 <	0.0002 <	0.001	0.044 <	0.00010	0.0012	0.0009	0.050 <	0.0001 <	0.005	0.0026	0.002 <	0.005
MW-2	3/16/95	35.10																											
MW-2	8/8/95	35.10	930	7.21	5.9	72.9	15.7	5.9	78	14.0	3.4	0.09	0.25	0.38 <	10.0	0.00 <	0.01 <	0.0002 <	0.005	0.049 <	0.00010 <	0.0010	0.0008	0.033 <	0.0001	0.005 <	0.0020 <	0.001	0.006

WELL (loc)	DATE (mm/dd/yy)	WELL DEPTH (ft)	TIME (hh/mm)	DEPTH TO WATER (ft)	FIELD PH (units)	FIELD COND (umho/cm)	FIELD TEMP deg C	LAB PH (units)	TDS (mg/l)	SO4 (mg/l)	CL (mg/l)	NO3+NO2 (mg/l)	F (mg/l)	TOC (mg/l)	COD (mg/l)	BOD (mg/l)	TOX (mg/l)	AG (mg/l)	AS (mg/l)	BA (mg/l)	CD (mg/l)	CR (mg/l)	CU (mg/l)	FE (mg/l)	HG (mg/l)	MN (mg/l)	PB (mg/l)	SE (mg/l)	ZN (mg/l)
(NC GW STDS)					6.5-8.5			6.5-8.5		250	250	10+1	2					0.018	0.05	2	0.005	0.05	1	0.3	0.0011	0.05	0.015	0.05	2.1
MW-3	8/29/89	28.15	5	8.90	5.3	28.0	18.4	6.5	25 <	1.0	3.7	0.25 <	0.10	0.29 <	5.0	0.32 <	0.01 <	0.0002 <	0.001	0.110 <	0.00010 <	0.0010 <	0.0300	0.970 <	0.0002	0.150	0.0038 <	0.002	0.010
MW-3	10/16/90	28.15	1215	8.65	5.4	30.0	18.1	5.5	37 <	1.0	3.8	0.96 <	0.10	0.24 <	10.0	0.40	<	0.0002 <	0.001	0.088	0.00023 <	0.0010 <	0.0300	0.120 <	0.0001	0.140 <	0.0020 <	0.002 <	0.004
MW-3	11/12/91	28.15	1325	8.60	4.8	44.0		5.4 <	10	1.5	4.5	2.32 <	0.10	0.18 <	10.0	0.90 <	0.01	0.0002 <	0.001	0.120	0.00015	0.0021 <	0.0005 <	0.050 <	0.0001	0.160 <	0.0020 <	0.002	0.020
MW-3	8/27/92	28.15	1140	8.52	4.9	54.0	16.5	5.5	39	3.1	5.3	3.60 <	0.10	0.19 <	10.0	0.20 <	0.01	0.0002 <	0.001	0.062	0.00035	0.0024	0.0011	1.490	0.0002	0.060 <	0.0100 <	0.002	0.019
MW-3	3/30/93	28.15	1135	7.24	5.0	60.0	15.4	5.1	112	2.9	5.3	4.20 <	0.10	0.50	10.0	0.40 <	0.01 <	0.0002 <	0.005	0.181	0.00095 <	0.0010	0.0017	0.060 <	0.0001	0.166 <	0.0020 <	0.005	0.070
MW-3	8/2/93	28.15	910	8.69	5.2	68.2	15.5	4.8	55 <	1.0	5.9	4.86 <	0.10	0.20 <	10.0	0.60 <	0.01 <	0.0002 <	0.005	0.209	0.18000 <	0.0010 <	0.0005 <	0.050 <	0.0001	0.157 <	0.0020 <	0.005	0.016
MW-3	2/1/94	28.15	1020	7.99	5.0	79.1	15.5	5.2 <	10 <	1.0	6.2	4.66 <	0.10	0.30 <	10.0	0.70 <	0.01 <	0.0002 <	0.005	0.223 <	0.00010 <	0.0010 <	0.0005 <	0.035 <	0.0001	0.161 <	0.0020 <	0.001	0.016
MW-3	8/8/94	28.15	1000	8.40	5.0	79.0	15.6	5.4	64 <	1.0	6.5	7.71 <	0.10	0.17 <	10.0	0.20 <	0.01 <	0.0002 <	0.001	0.247	0.00140	0.0011	0.0007	0.033 <	0.0001	0.150 <	0.0020	0.003	0.015
MW-3	2/1/95	26.30	1155	7.87	5.0	82.5	16.0	5.2	43 <	1.0	7.2	5.69 <	0.10	0.24 <	10.0	0.20 <	0.01 <	0.0002 <	0.001	0.557 <	0.00010	0.0024	0.0040	1.794 <	0.0001	0.176	0.0073	0.002	0.390
MW-3	3/16/95	26.30	1040	7.62	5.4	80.8	15.6										<	0.0002 <	0.001	0.261 <	0.00010 <	0.0010	0.0010	0.027 <	0.0001	0.129 <	0.0020 <	0.001	0.019
MW-3	8/8/95	26.30	845	8.65	5.3	82.9	15.7	5.1	71	2.5	7.7	5.83	0.17	1.20 <	10.0	0.00 <	0.01 <	0.0002 <	0.005	0.270 <	0.00010 <	0.0010	0.0016	0.046	0.0002	0.120 <	0.0020 <	0.001	0.016

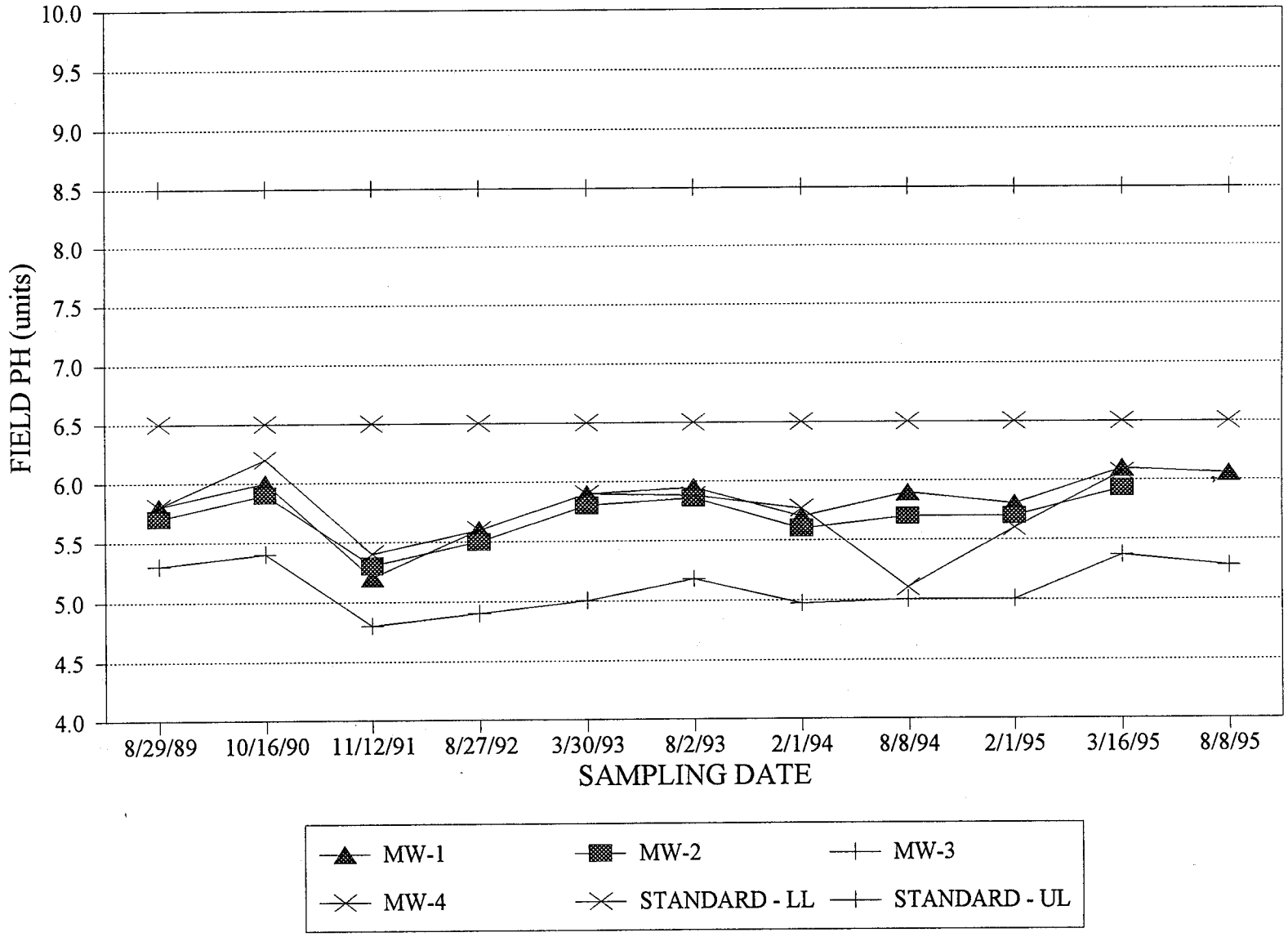
WELL (loc)	DATE (mm/dd/yy)	WELL DEPTH (ft)	TIME (hh/mm)	DEPTH TO WATER (ft)	FIELD PH (units)	FIELD COND (umho/cm)	FIELD TEMP deg C	LAB PH (units)	TDS (mg/l)	SO4 (mg/l)	CL (mg/l)	NO3+NO2 (mg/l)	F (mg/l)	TOC (mg/l)	COD (mg/l)	BOD (mg/l)	TOX (mg/l)	AG (mg/l)	AS (mg/l)	BA (mg/l)	CD (mg/l)	CR (mg/l)	CU (mg/l)	FE (mg/l)	HG (mg/l)	MN (mg/l)	PB (mg/l)	SE (mg/l)	ZN (mg/l)
(NC GW STDS)					6.5-8.5			6.5-8.5		250	250	10+1	2					0.018	0.05	2	0.005	0.05	1	0.3	0.0011	0.05	0.015	0.05	2.1
MW-4	8/29/89	50.20	7	33.70	5.8	58.0	16.5	6.7	46	1.3	1.4 <	0.05 <	0.10	0.34 <	5.0	0.52 <	0.01 <	0.0002 <	0.001	0.070 <	0.00010	0.0028 <	0.0300	2.500 <	0.0001	0.150 <	0.0020 <	0.002	0.010
MW-4	10/16/90	50.20	1520	31.95	6.2	62.0	17.0	6.0	60	2.4	1.6 <	0.05 <	0.10	0.77	11.8	1.00	<	0.0002 <	0.001	0.065	0.00017 <	0.0010 <	0.0300	1.040 <	0.0001	0.086	0.0021 <	0.002 <	0.004
MW-4	11/12/91	50.20	1120	32.20	5.4	42.0		6.0	50	4.4	1.6	0.06 <	0.10	1.75 <	10.0	2.00 <	0.01 <	0.0002 <	0.001	0.070	0.00019	0.0036	0.0041	2.200 <	0.0001	0.089 <	0.0020 <	0.002	0.020
MW-4	8/27/92	50.20	1300	31.80	5.6	44.0	17.2	6.1	57 <	1.0	1.8 <	0.05 <	0.10	0.22 <	10.0	0.20 <	0.01	0.0002 <	0.001 <	0.010 <	0.00010	0.0030	0.0015 <	0.050	0.0002 <	0.005 <	0.0100 <	0.002	0.027
MW-4	3/30/93	50.20	1035	28.67	5.9	44.0	15.3	5.8	119	1.4	1.6 <	0.05 <	0.10	0.60 <	10.0	0.50 <	0.01 <	0.0002 <	0.005	0.053	0.00066 <	0.0010	0.0011	0.230 <	0.0001	0.042 <	0.0020 <	0.005	0.072
MW-4	8/2/93	50.20	1020	29.53	5.9	46.1	16.0	5.7	44 <	1.0	1.7 <	0.05 <	0.10	0.40 <	10.0	0.60 <	0.01 <	0.0002 <	0.005	0.053 <	0.10000 <	0.0010 <	0.0005	0.157 <	0.0001	0.018 <	0.0020 <	0.005	0.011
MW-4	2/1/94	50.20	920	32.18	5.8	47.2	13.8	5.9	50 <	1.0	1.4 <	0.05 <	0.10	0.30 <	10.0	0.50 <	0.01 <	0.0002 <	0.005	0.046 <	0.00010 <	0.0010	0.0015	0.040 <	0.0001	0.024 <	0.0020 <	0.001	0.003
MW-4	8/8/94	50.20	1100	32.09	5.1	52.7	15.8	5.8	54 <	1.0	1.5 <	0.05 <	0.10	0.17 <	10.0	0.20 <	0.01 <	0.0002 <	0.001	0.049 <	0.00010	0.0011	0.0005	0.096 <	0.0001	0.026 <	0.0020	0.002 <	0.005
MW-4	2/1/95	50.20	1045	32.99	5.6	44.1	13.4	5.9	32	2.2	1.6 <	0.05 <	0.10	0.54 <	10.0	0.60 <	0.01 <	0.0002 <	0.001	0.058 <	0.00010	0.0013	0.0014	0.222 <	0.0001	0.038	0.0020 <	0.001	0.006
MW-4	3/16/95	50.20																											
MW-4	8/8/95	50.20	800	33.02	6.1	45.1	15.5	6.0	48	3.2	1.7	0.05	0.24	0.31 <	10.0	0.00 <	0.01 <	0.0002 <	0.005	0.053 <	0.00010 <	0.0010 <	0.0005	0.480 <	0.0001	0.033 <	0.0020 <	0.001 <	0.005

Table 1 continued

WELL (loc)	DATE (mm/dd/yy)	WELL DEPTH (ft)	TIME (hh/mm)	DEPTH TO WATER (ft)	FIELD PH (units)	FIELD COND (umho/cm)	FIELD TEMP deg C	LAB PH (units)	TDS (mg/l)	SO4 (mg/l)	CL (mg/l)	NO3+NO2 (mg/l)	F (mg/l)	TOC (mg/l)	COD (mg/l)	BOD (mg/l)	TOX (mg/l)	AG (mg/l)	AS (mg/l)	BA (mg/l)	CD (mg/l)	CR (mg/l)	CU (mg/l)	FE (mg/l)	HG (mg/l)	MN (mg/l)	PB (mg/l)	SE (mg/l)	ZN (mg/l)
(NC GW STDS)					6.5-8.5			6.5-8.5		250	250	10+1	2					0.018	0.05	2	0.005	0.05	1	0.3	0.0011	0.05	0.015	0.05	2.1
TRP BLK	8/29/89	9						6.0	<	1.0 <	1.0 <	0.05 <	0.10	0.20			< 0.01 <	0.0002 <	0.001 <	0.010 <	0.00010 <	0.0010 <	0.0300 <	0.050 <	0.0001 <	0.003 <	0.0020 <	0.002 <	0.004
TRP BLK	8/29/89	10						5.9	<	1.0 <	1.0 <	0.05 <	0.10	0.18			< 0.01 <	0.0002 <	0.001 <	0.010 <	0.00010 <	0.0010 <	0.0300 <	0.050 <	0.0001 <	0.003 <	0.0020 <	0.002 <	0.004
TRP BLK	10/16/90							5.9	<	1.0 <	1.0 <	0.05 <	0.10	0.17 <	10.0		<	0.0002 <	0.001 <	0.010	0.00151 <	0.0010 <	0.0300 <	0.050 <	0.0001 <	0.003 <	0.0020 <	0.002 <	0.004
TRP BLK	11/12/91		730					5.9 <	10	3.6 <	1.0 <	0.05 <	0.10	0.31 <	10.0		< 0.01 <	0.0002 <	0.001 <	0.010 <	0.00010	0.0016 <	0.0005 <	0.050 <	0.0001 <	0.005 <	0.0020 <	0.002 <	0.010
TRP BLK	8/27/92							5.7	<	1.0 <	1.0 <	0.05 <	0.10	0.25 <	10.0			0.0002 <	0.001	0.190 <	0.00010	0.0010	0.0007	0.580	0.0002	0.196 <	0.0100 <	0.002	0.028
FLD BLK	8/29/89	11						5.7	<	1.0 <	1.0 <	0.05 <	0.10	0.17			< 0.01 <	0.0002 <	0.001 <	0.010	0.00150	0.0022 <	0.0300 <	0.050 <	0.0001 <	0.003 <	0.0020 <	0.002 <	0.004
FLD BLK	8/29/89	12						5.8	<	1.0 <	1.0 <	0.05 <	0.10	0.18			< 0.01 <	0.0002 <	0.001 <	0.010 <	0.00010 <	0.0010 <	0.0300 <	0.050 <	0.0001 <	0.003 <	0.0020 <	0.002 <	0.004
FLD BLK	10/16/90							5.8	<	1.0 <	1.0 <	0.05 <	0.10	0.16	13.2		<	0.0002 <	0.001 <	0.010	0.00053 <	0.0010 <	0.0300 <	0.050 <	0.0001 <	0.003 <	0.0020 <	0.002 <	0.004
FLD BLK	3/30/93							5.7	<	1.0 <	1.0 <	0.05 <	0.10	0.10	10.5		< 0.01 <	0.0002 <	0.005 <	0.010	0.00110 <	0.0010	0.0009 <	0.050 <	0.0001 <	0.005 <	0.0020 <	0.005	0.079
FLD BLK	8/2/93		1140					6.2 <	10 <	1.0 <	1.0 <	0.05 <	0.10	0.20 <	10.0		< 0.01 <	0.0002 <	0.005 <	0.010 <	0.10000 <	0.0010 <	0.0005 <	0.050 <	0.0001 <	0.005 <	0.0020 <	0.005 <	0.010
FLD BLK	2/1/94		1350					5.5	<	1.0 <	1.0 <	0.05 <	0.10	0.20 <	10.0		< 0.01 <	0.0002 <	0.005 <	0.020 <	0.00010 <	0.0010 <	0.0005 <	0.035 <	0.0001 <	0.002 <	0.0020 <	0.001 <	0.002
FLD BLK	8/8/94		1055					6.6	<	1.0 <	1.0 <	0.05 <	0.10	0.10 <	10.0		0.01 <	0.0002 <	0.001 <	0.005 <	0.00010 <	0.0010 <	0.0005 <	0.010 <	0.0001 <	0.005 <	0.0020	0.002 <	0.005
FLD BLK	2/1/95		1400					5.7	<	1.0 <	1.0 <	0.05 <	0.10	0.10 <	10.0		< 0.01 <	0.0002 <	0.001 <	0.005 <	0.00010 <	0.0010 <	0.0005 <	0.010 <	0.0001 <	0.005 <	0.0020 <	0.001 <	0.005
FLD BLK	3/16/95		1045															< 0.0002 <	0.001 <	0.005 <	0.00010 <	0.0010	0.0008 <	0.010 <	0.0001 <	0.005 <	0.0020 <	0.001 <	0.005
FLD BLK	8/8/95		1000					5.7		1.1 <	1.0 <	0.05	0.15	0.30 <	10.0		< 0.01 <	0.0002 <	0.005 <	0.005 <	0.00010 <	0.0010 <	0.0005 <	0.010 <	0.0001 <	0.005 <	0.0020 <	0.001 <	0.005

WELL (loc)	DATE (mm/dd/yy)	WELL DEPTH (ft)	TIME (hh/mm)	DEPTH TO WATER (ft)	FIELD PH (units)	FIELD COND (umho/cm)	FIELD TEMP deg C	LAB PH (units)	TDS (mg/l)	SO4 (mg/l)	CL (mg/l)	NO3+NO2 (mg/l)	F (mg/l)	TOC (mg/l)	COD (mg/l)	BOD (mg/l)	TOX (mg/l)	AG (mg/l)	AS (mg/l)	BA (mg/l)	CD (mg/l)	CR (mg/l)	CU (mg/l)	FE (mg/l)	HG (mg/l)	MN (mg/l)	PB (mg/l)	SE (mg/l)	ZN (mg/l)
(NC GW STDS)					6.5-8.5			6.5-8.5		250	250	10+1	2					0.018	0.05	2	0.005	0.05	1	0.3	0.0011	0.05	0.015	0.05	2.1
OB-1	8/28/89	65.50		44.30																									
OB-1	10/16/90	65.45		43.80																									
OB-1	11/12/91	65.50	1400	44.10																									
OB-1	8/27/92	65.50		44.10																									
OB-1	3/30/93	65.40		42.65																									
OB-1	8/2/93	65.40		42.90																									
OB-1	2/1/94	65.40		44.50																									
OB-1	8/8/94	65.40		44.25																									
OB-1	2/1/95	65.40		44.66																									
OB-1	3/16/95	65.40																											
OB-1	8/8/95	65.40		45.12																									

MARSHALL LANDFILL GROUNDWATER



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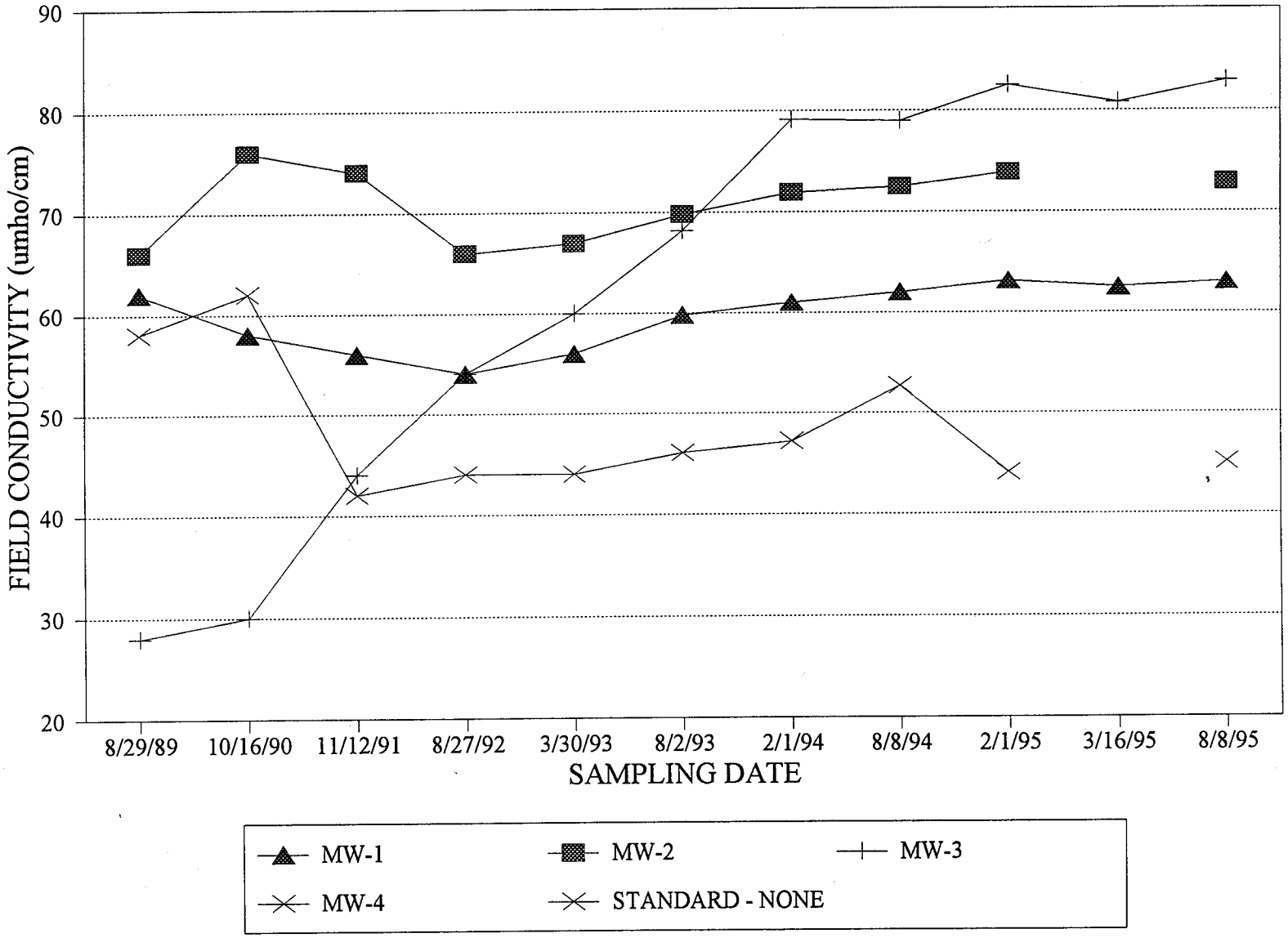

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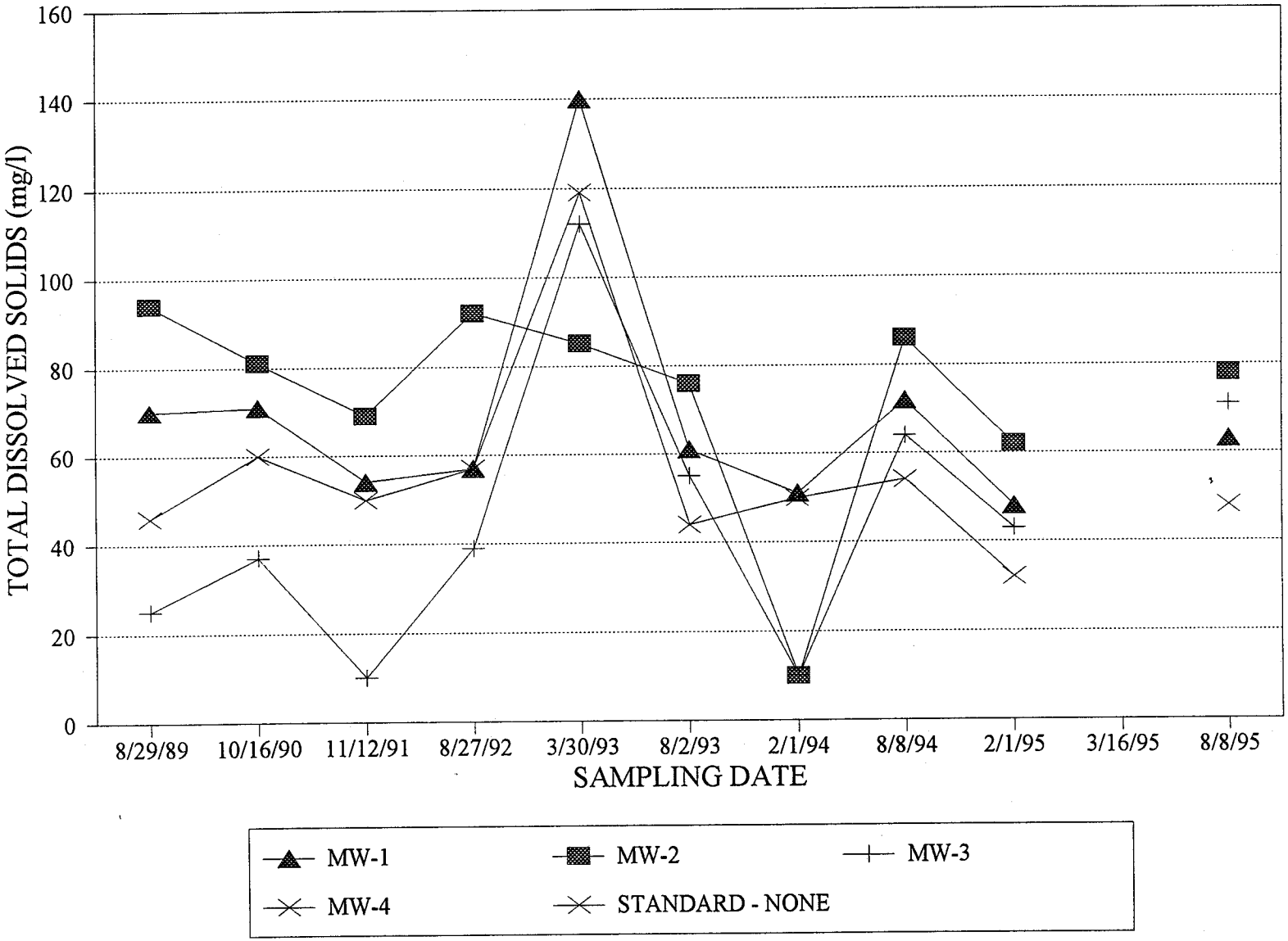

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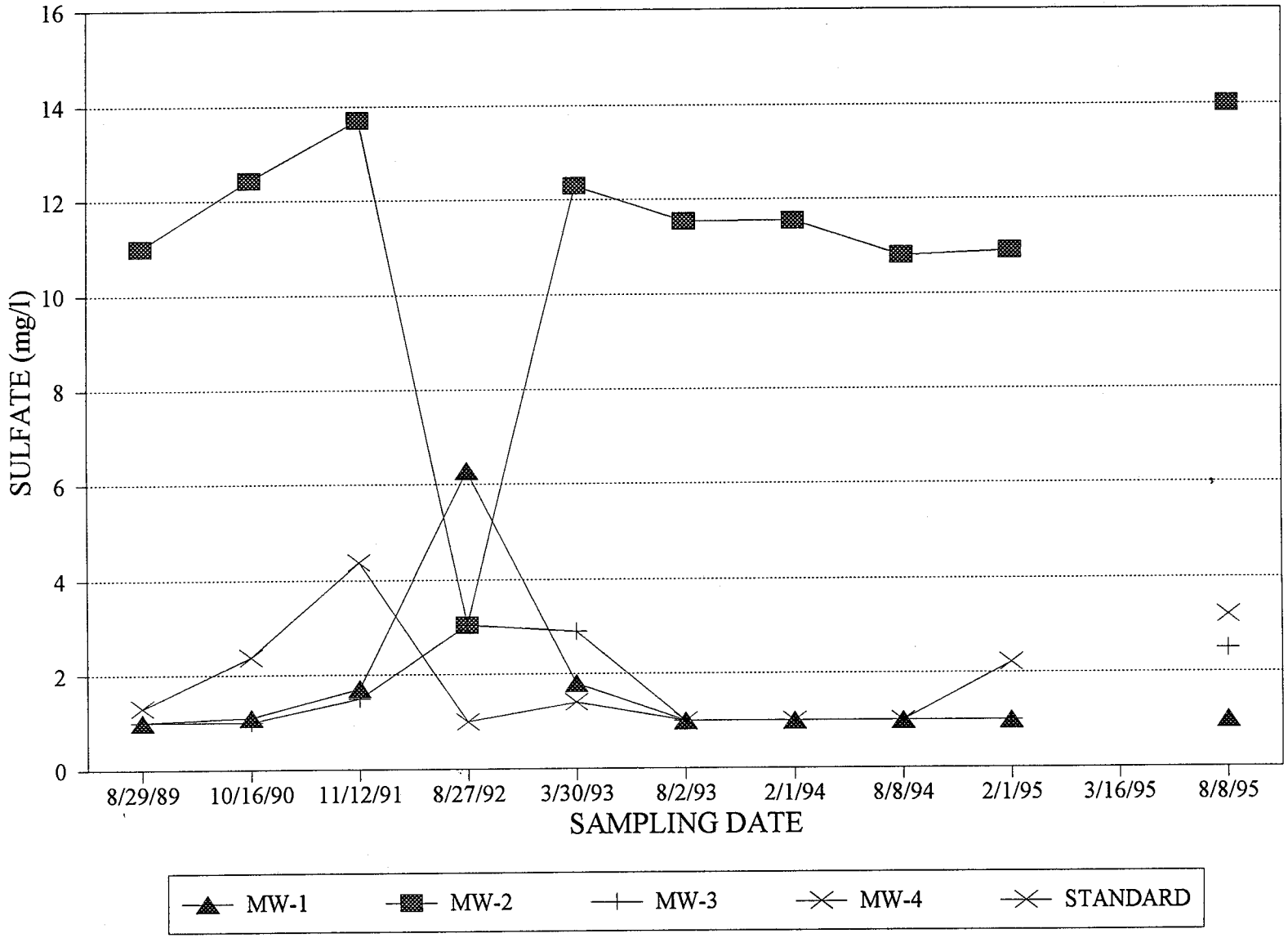

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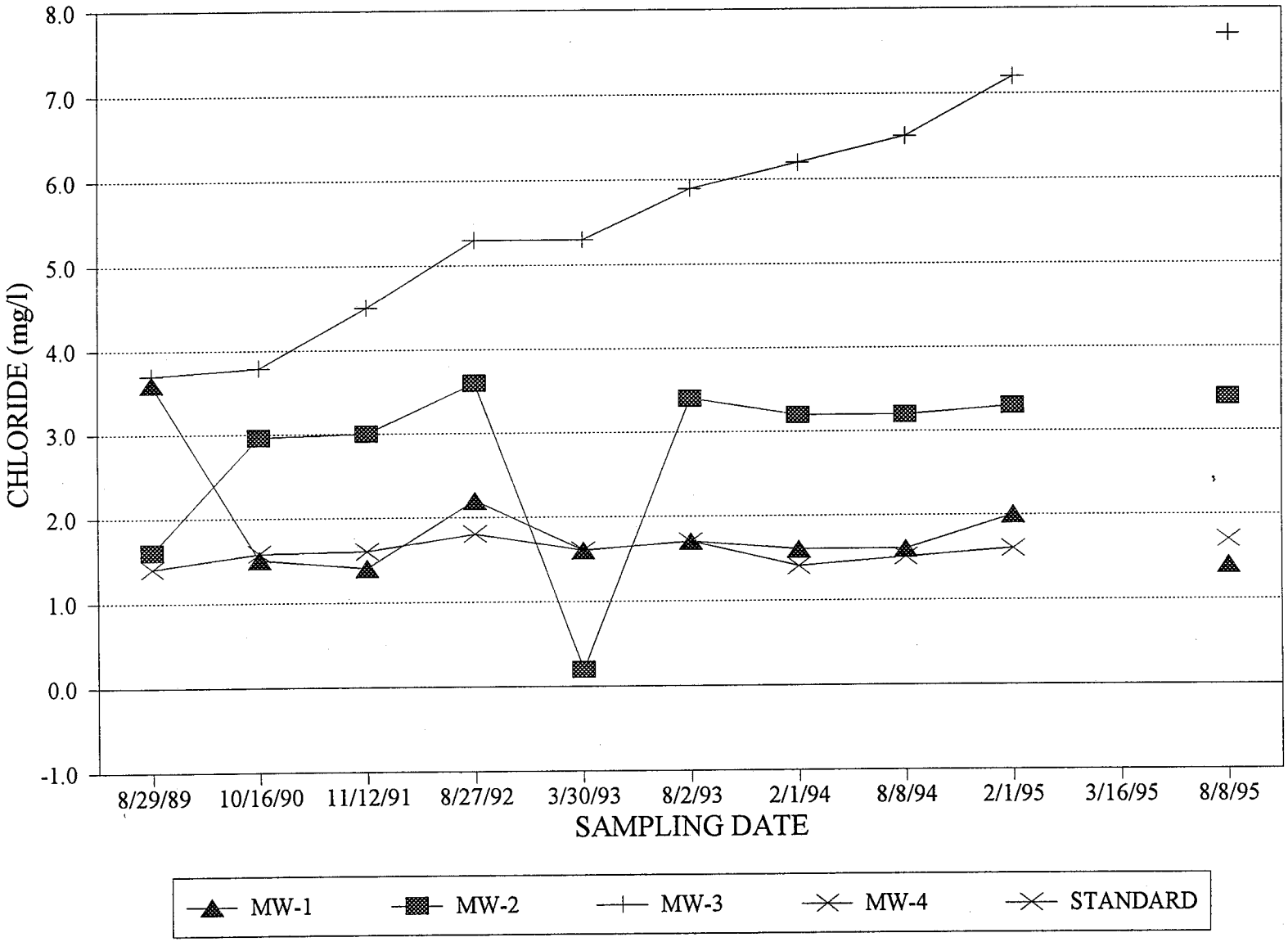

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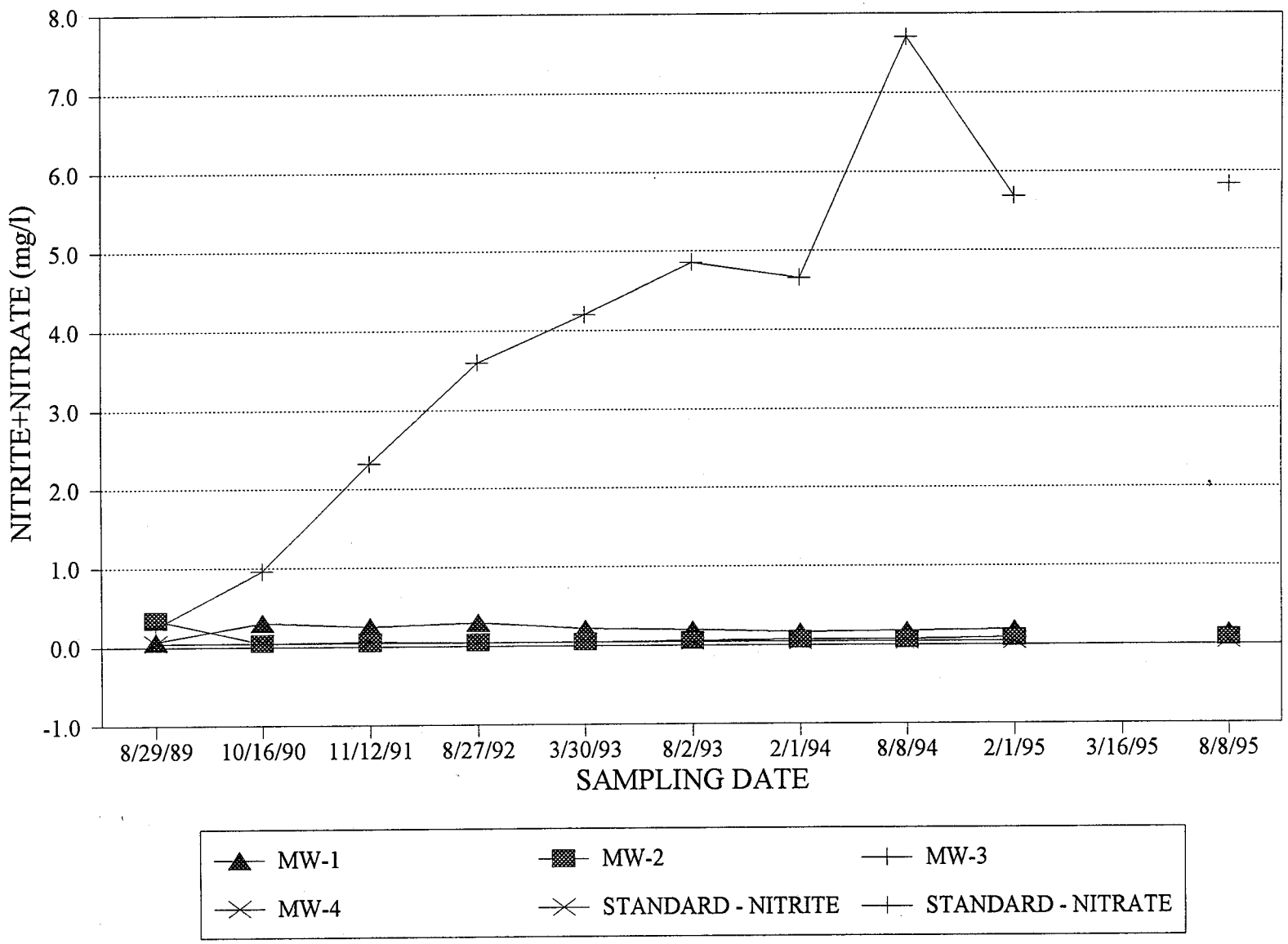

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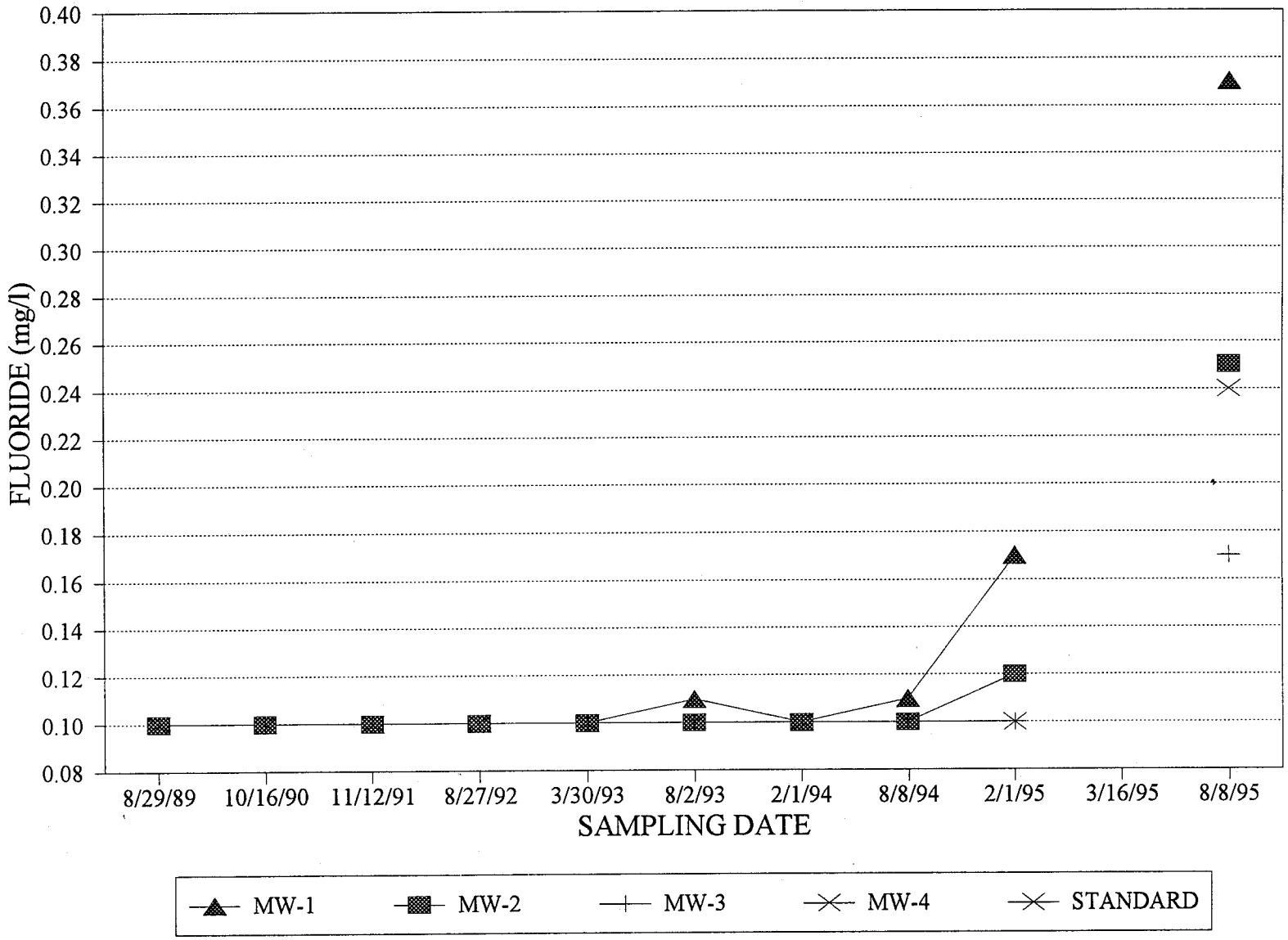

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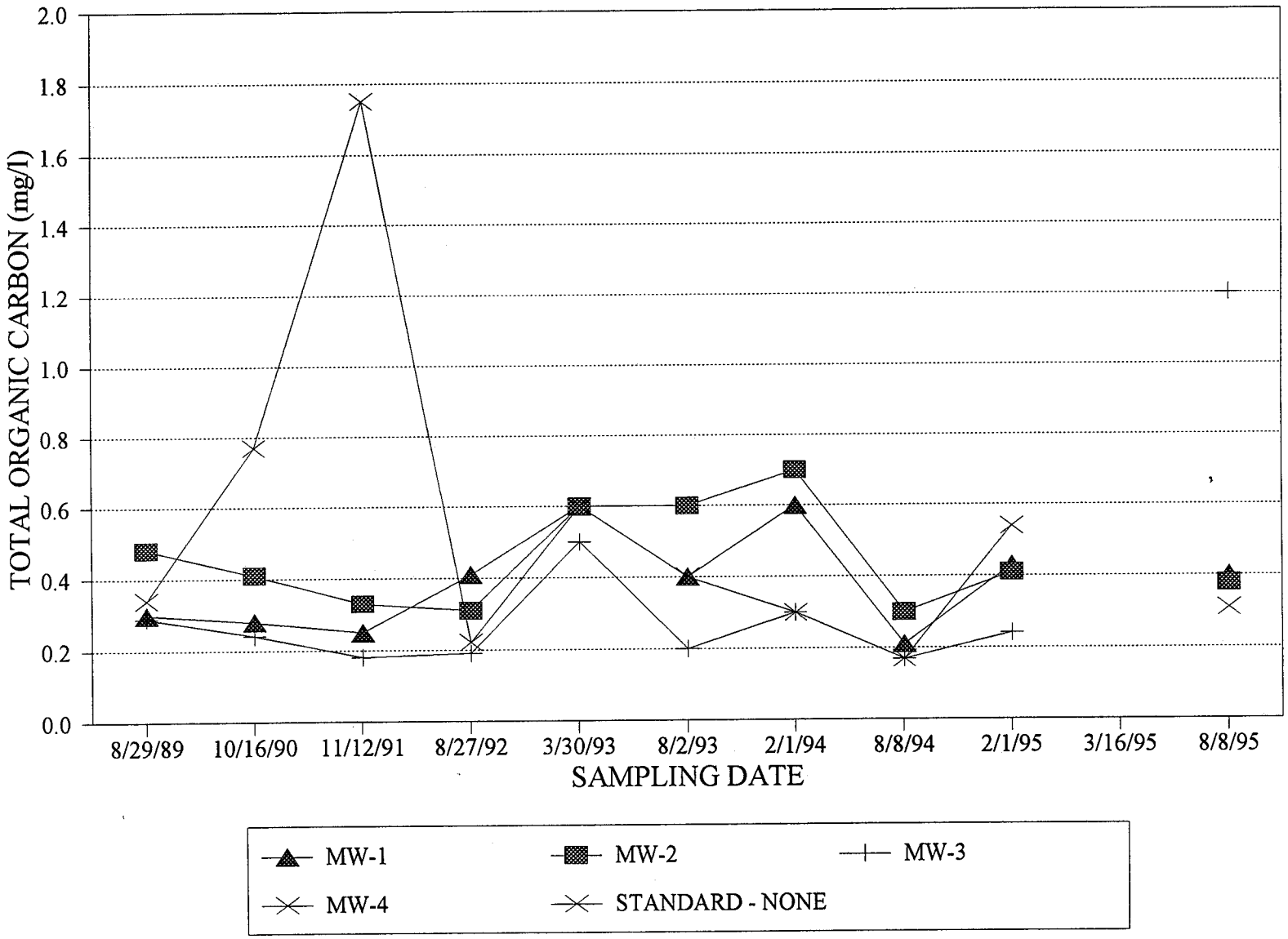

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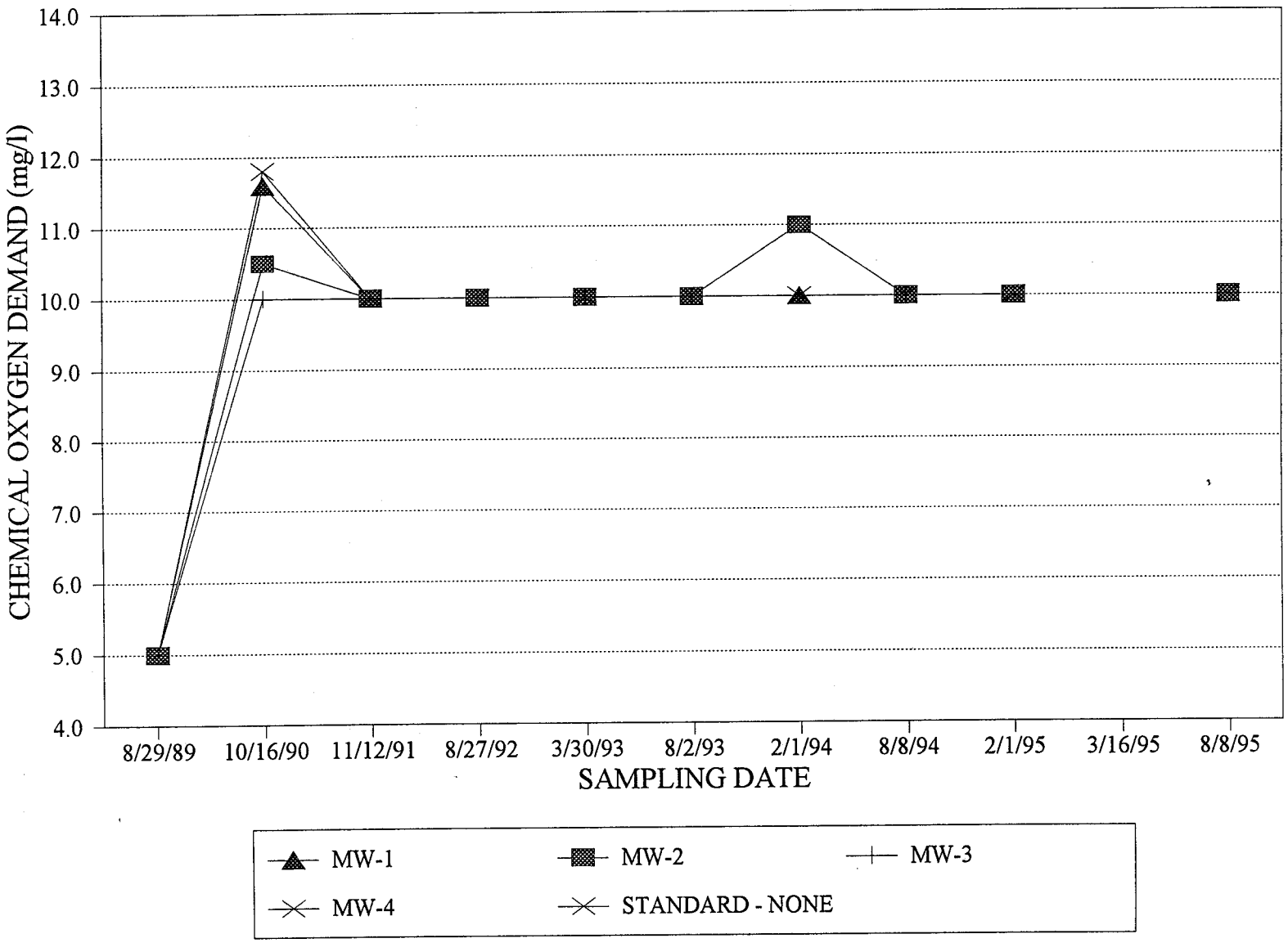

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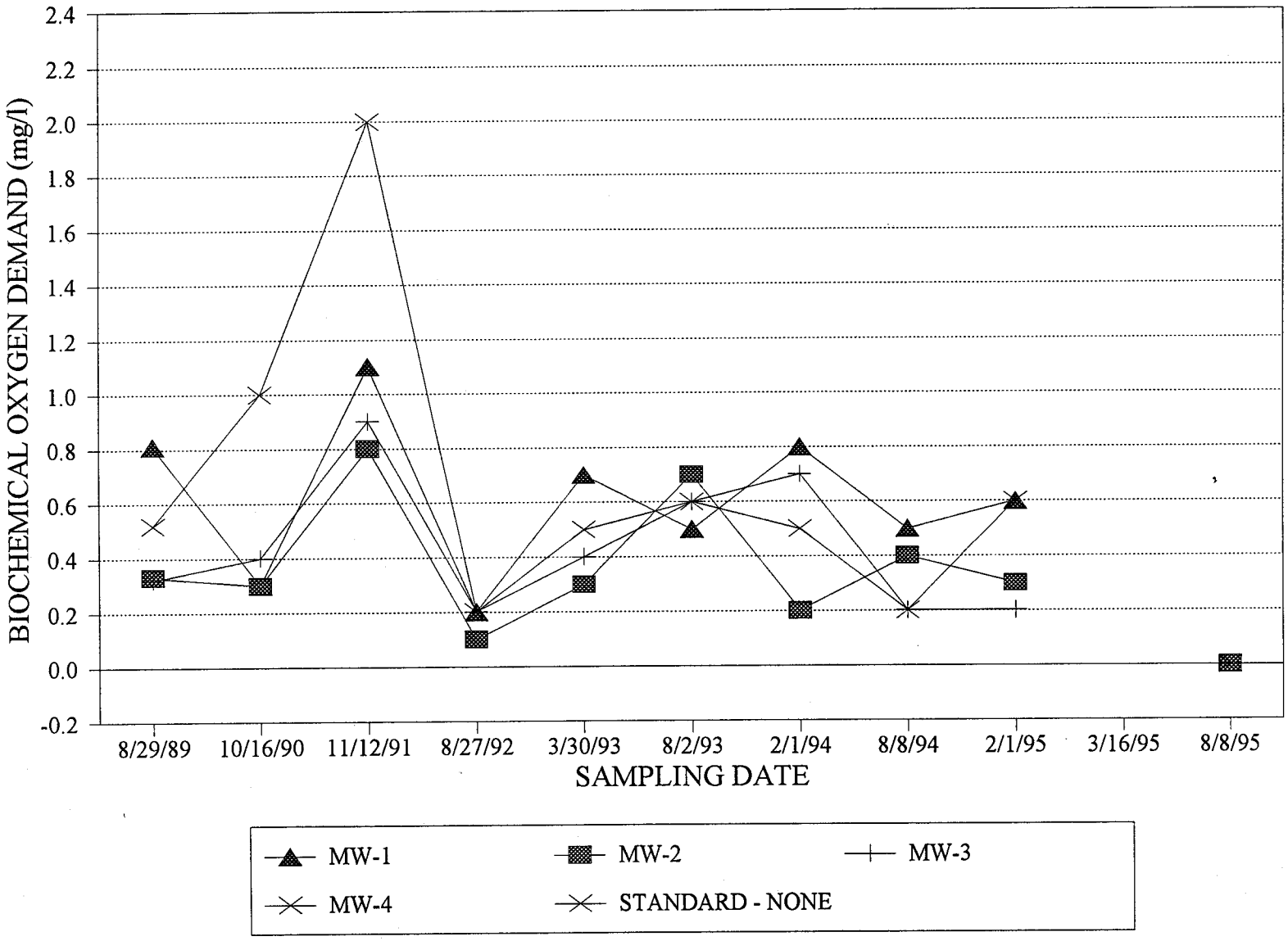

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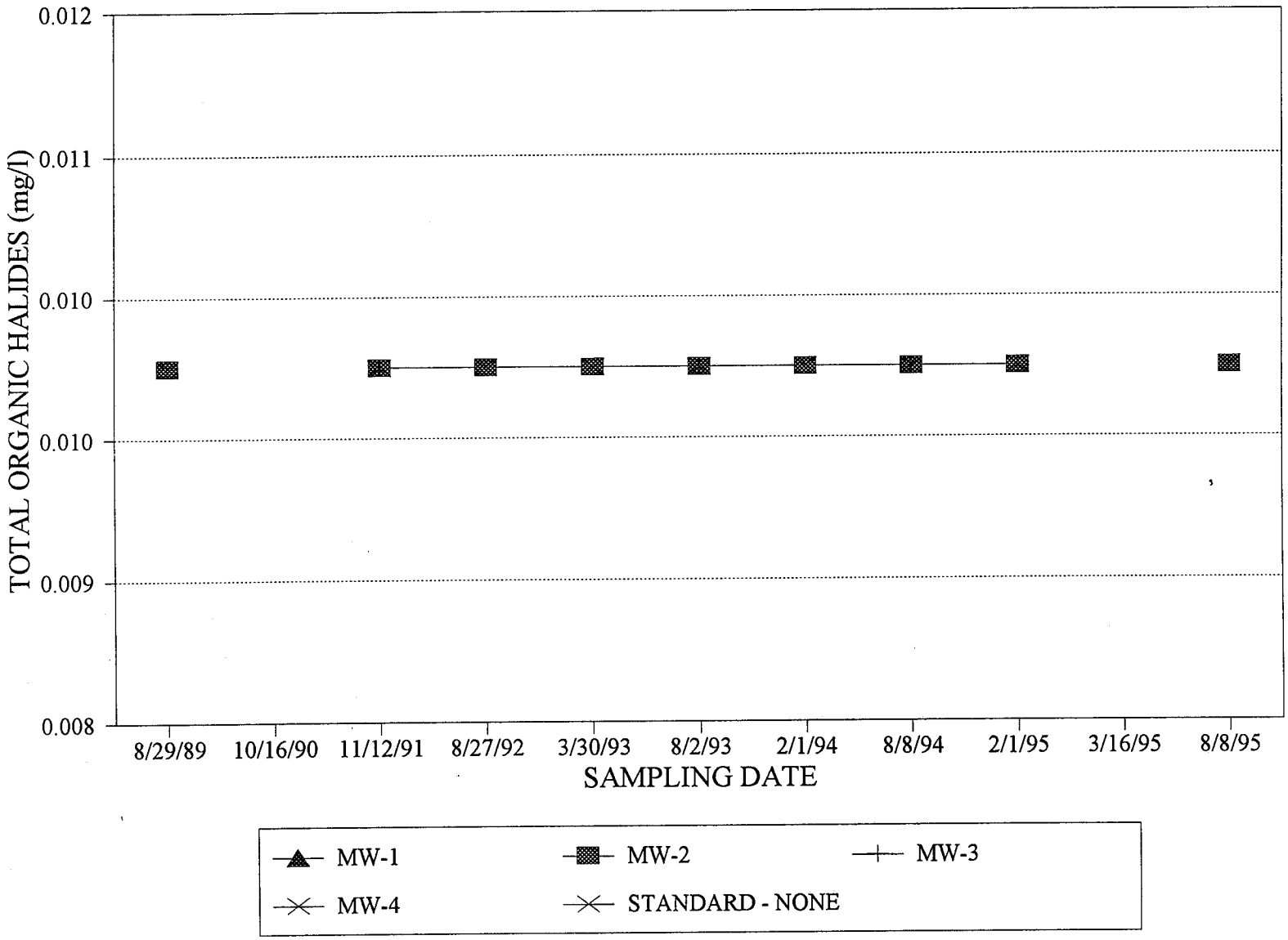

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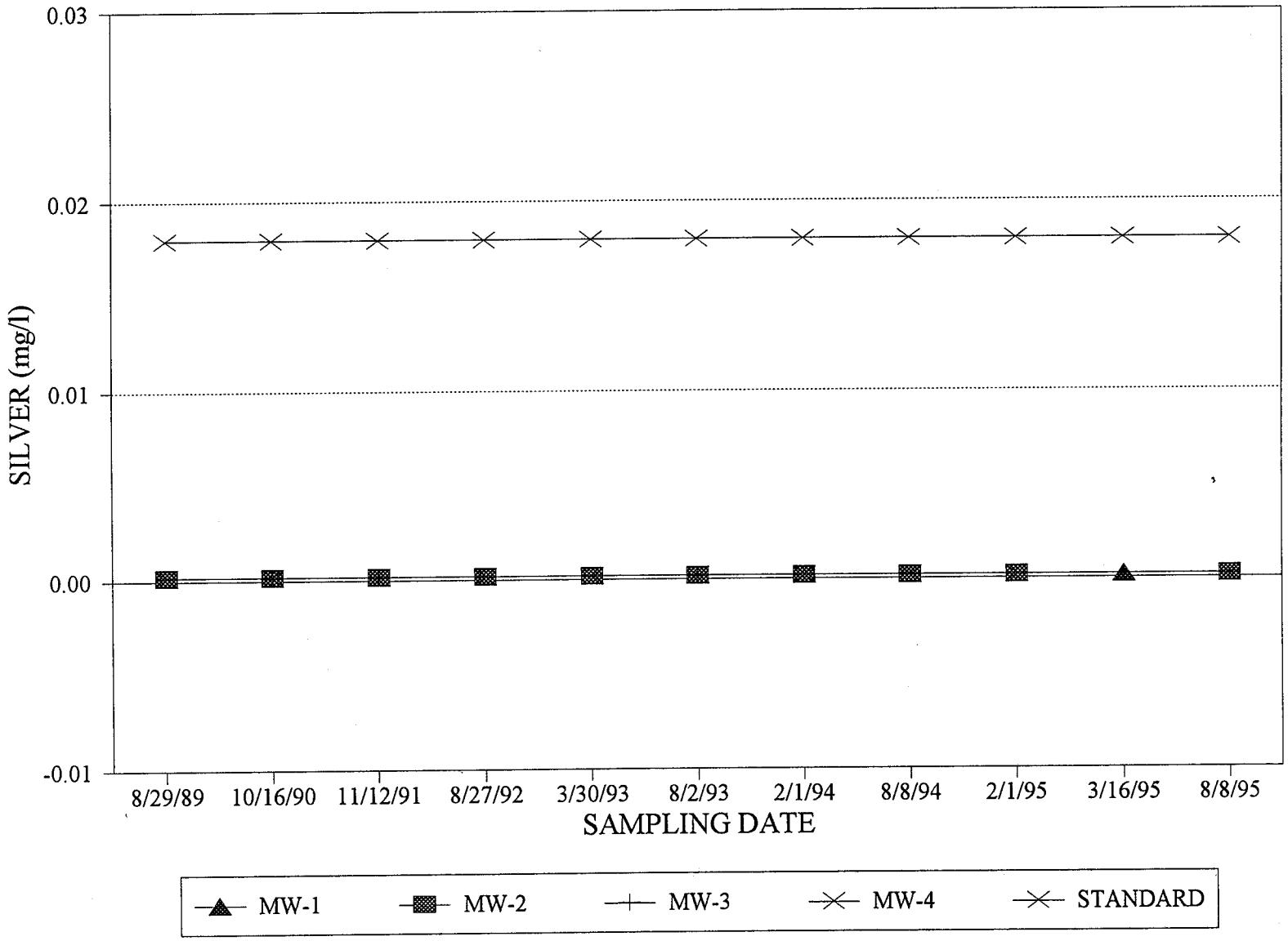

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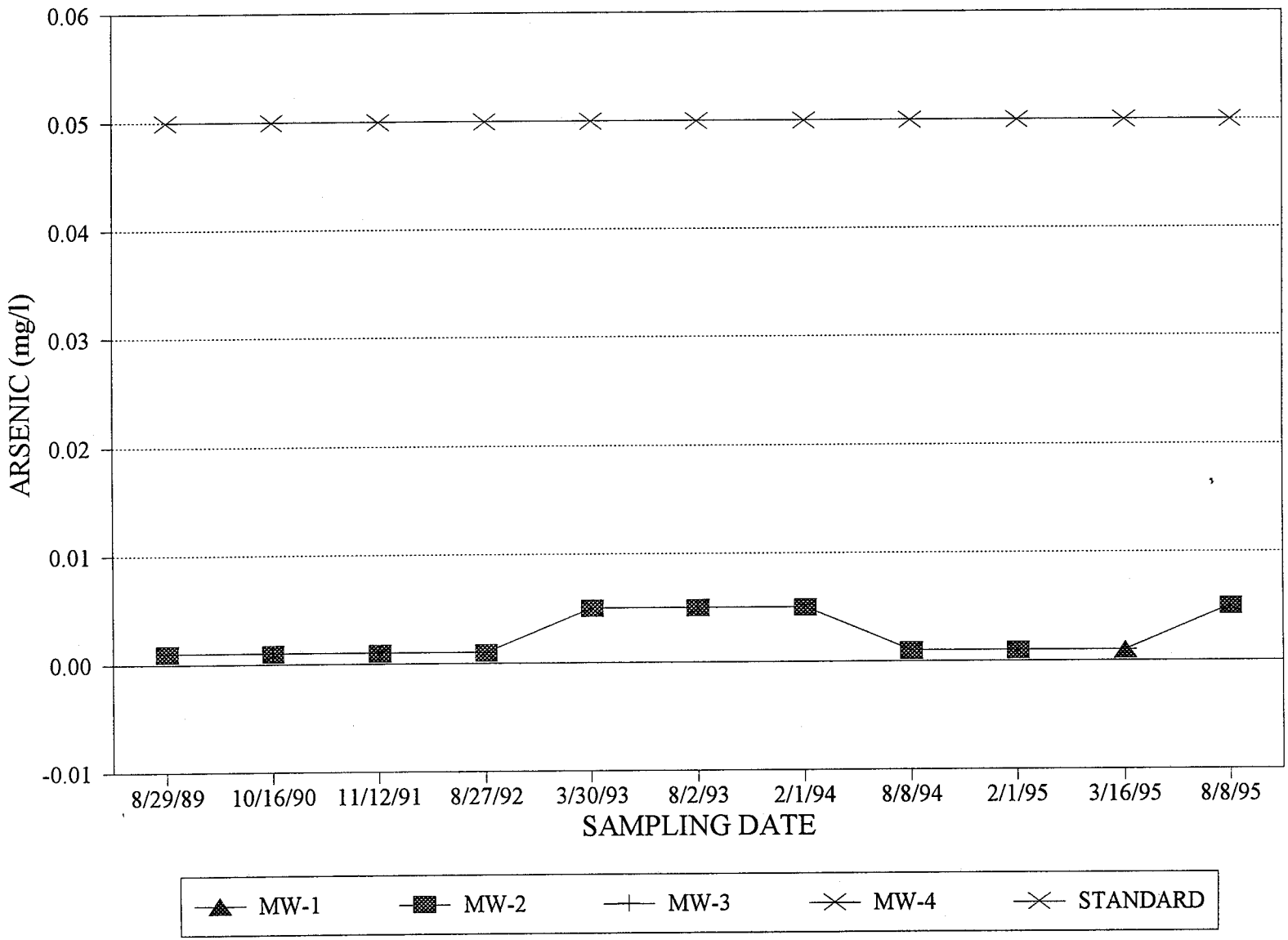

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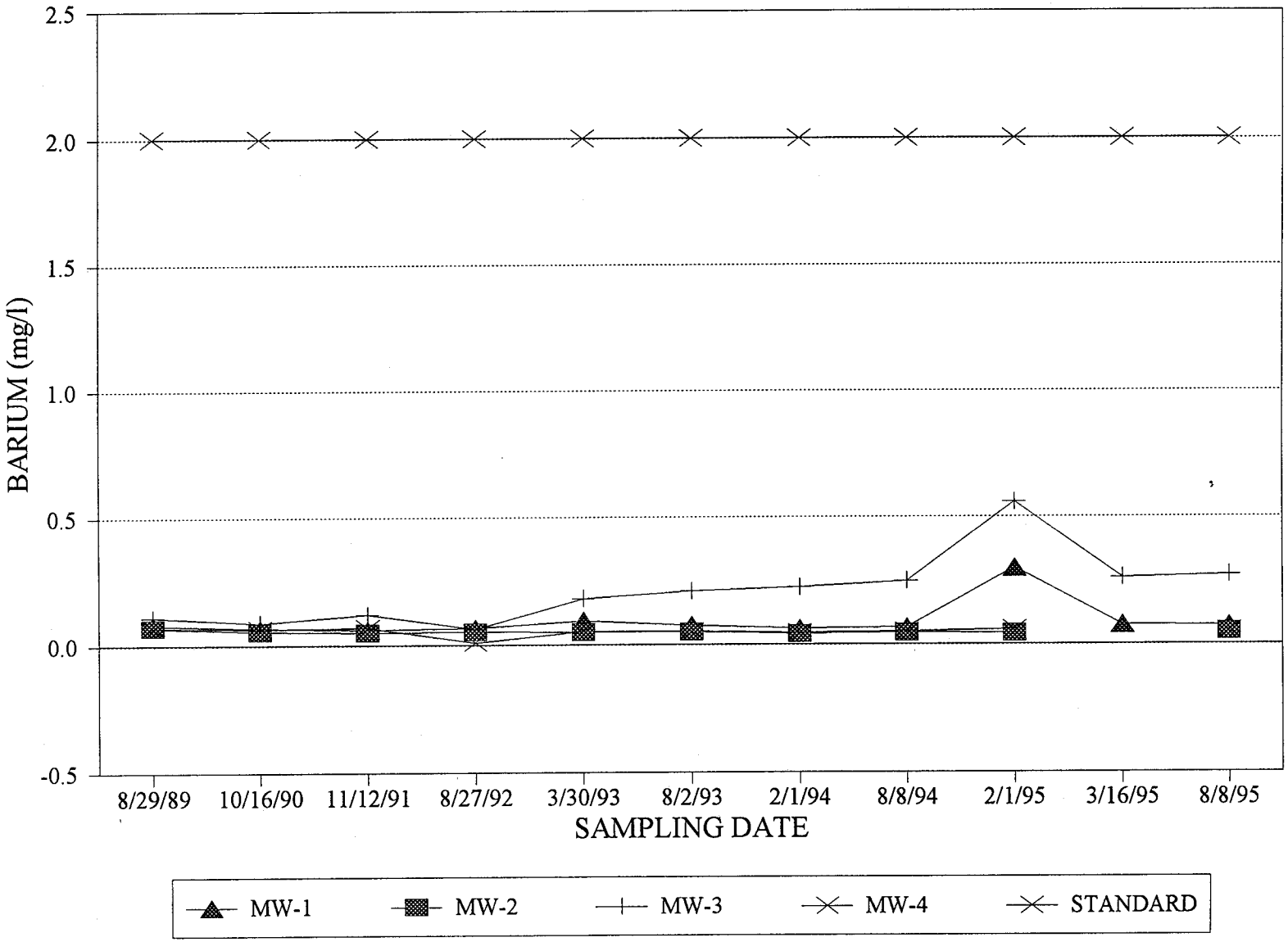

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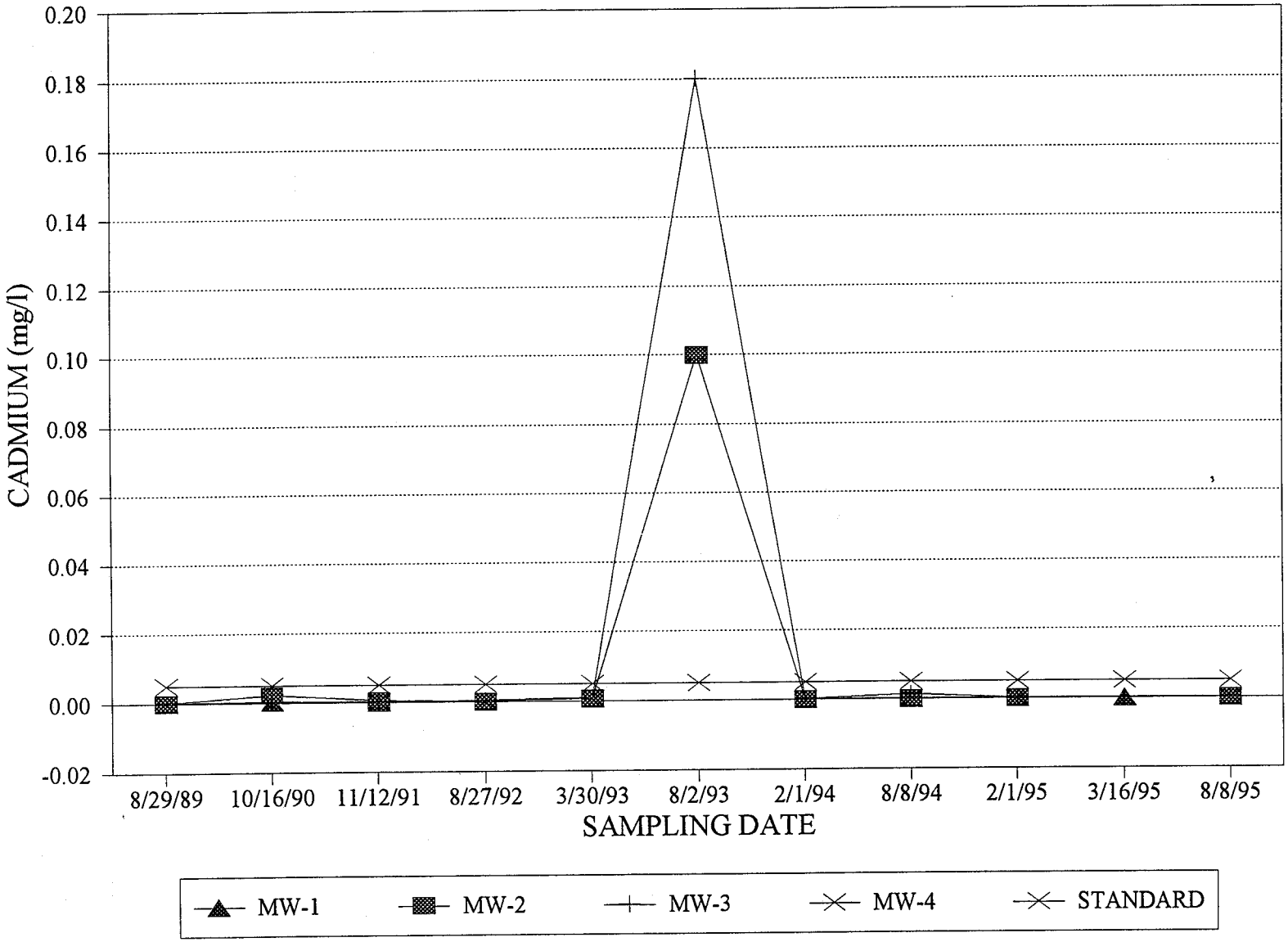

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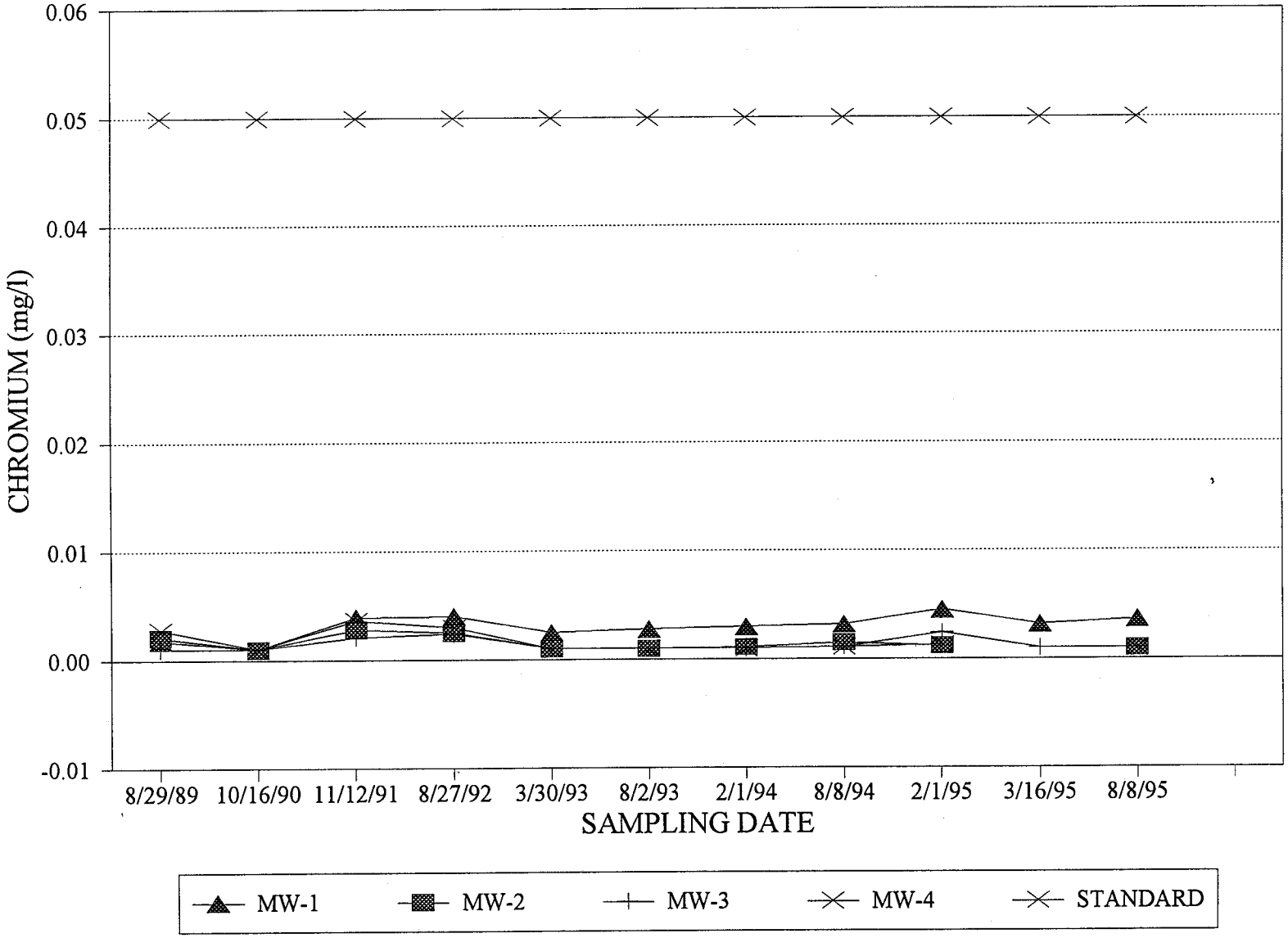

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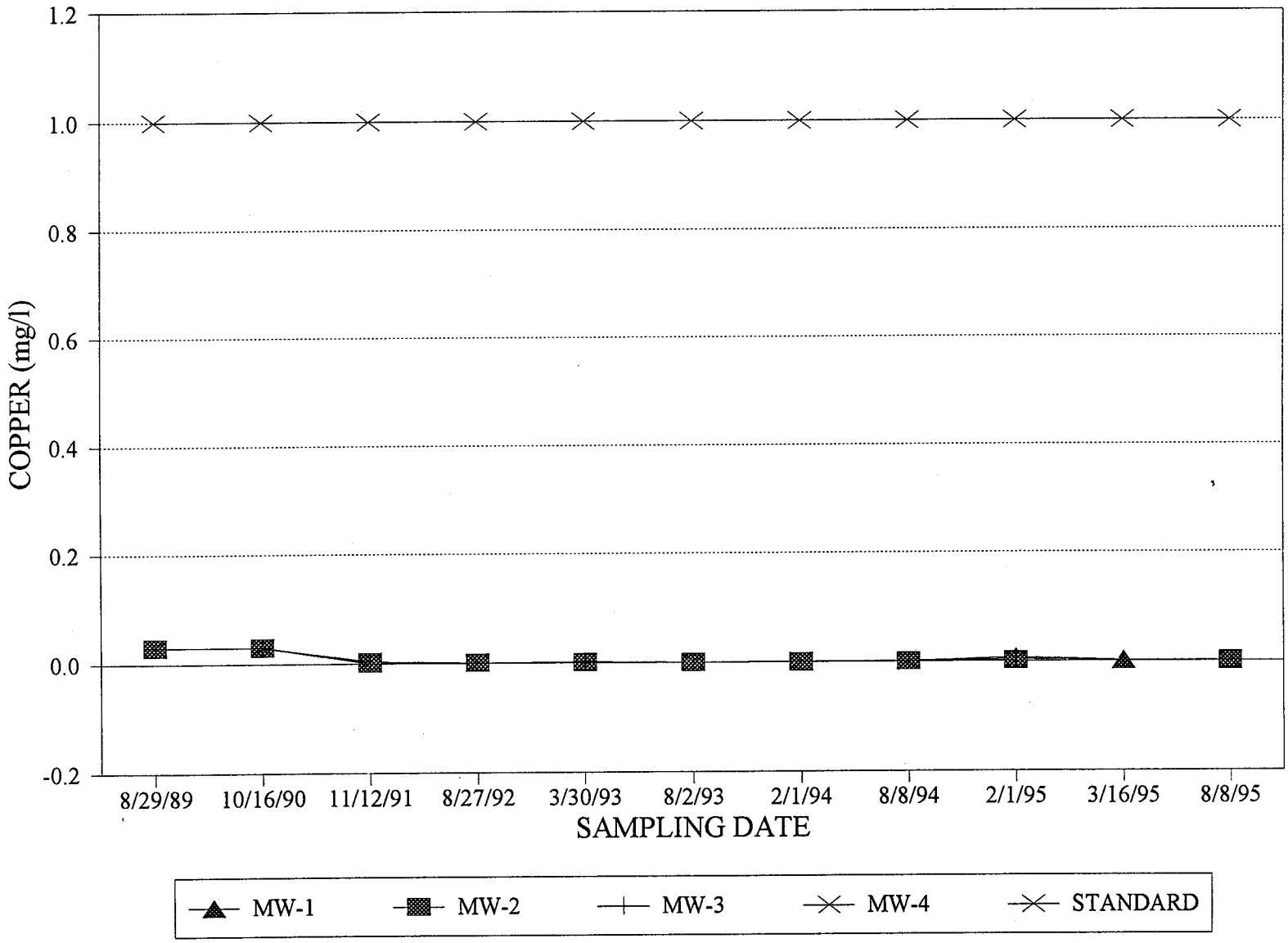

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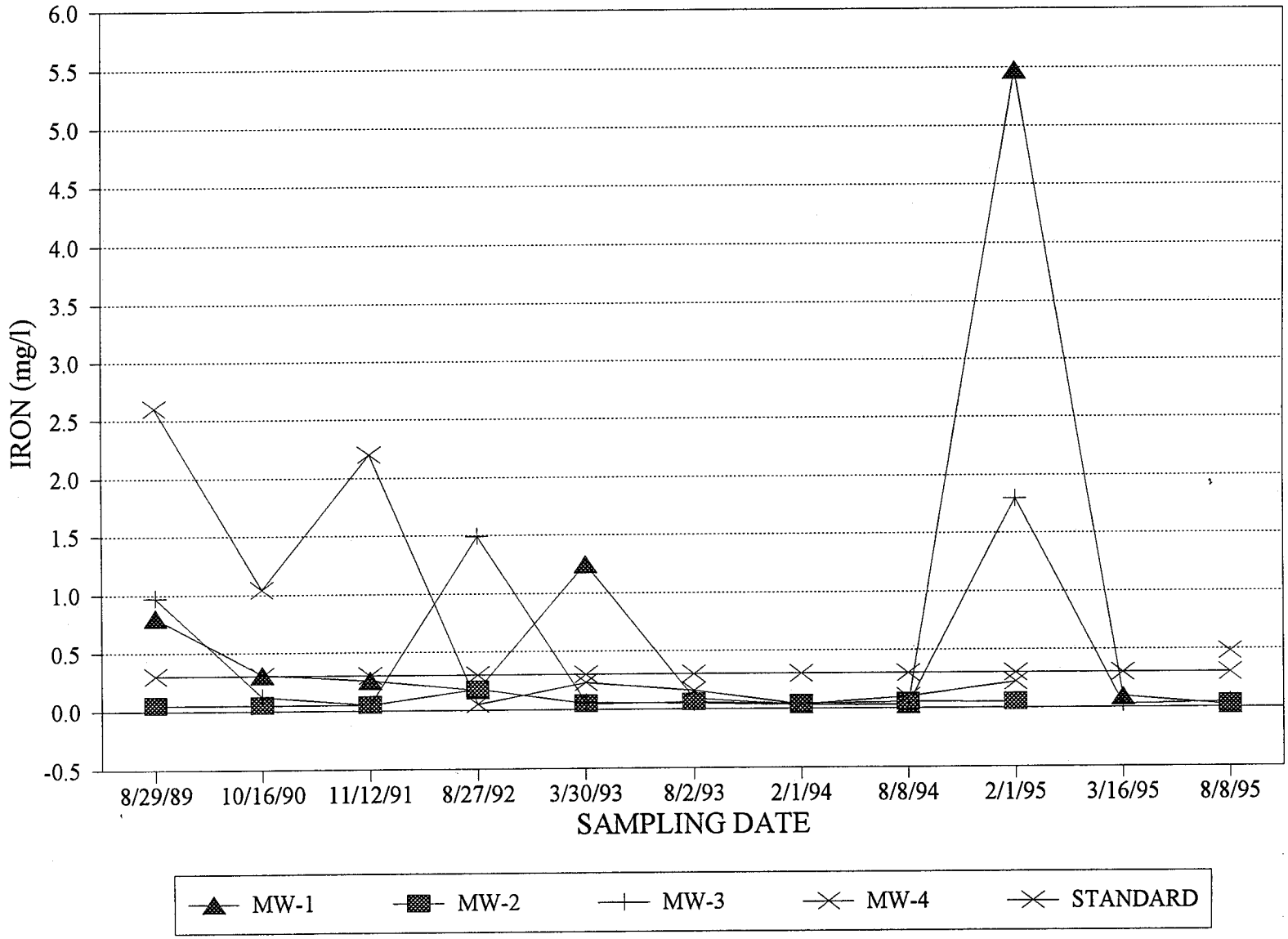

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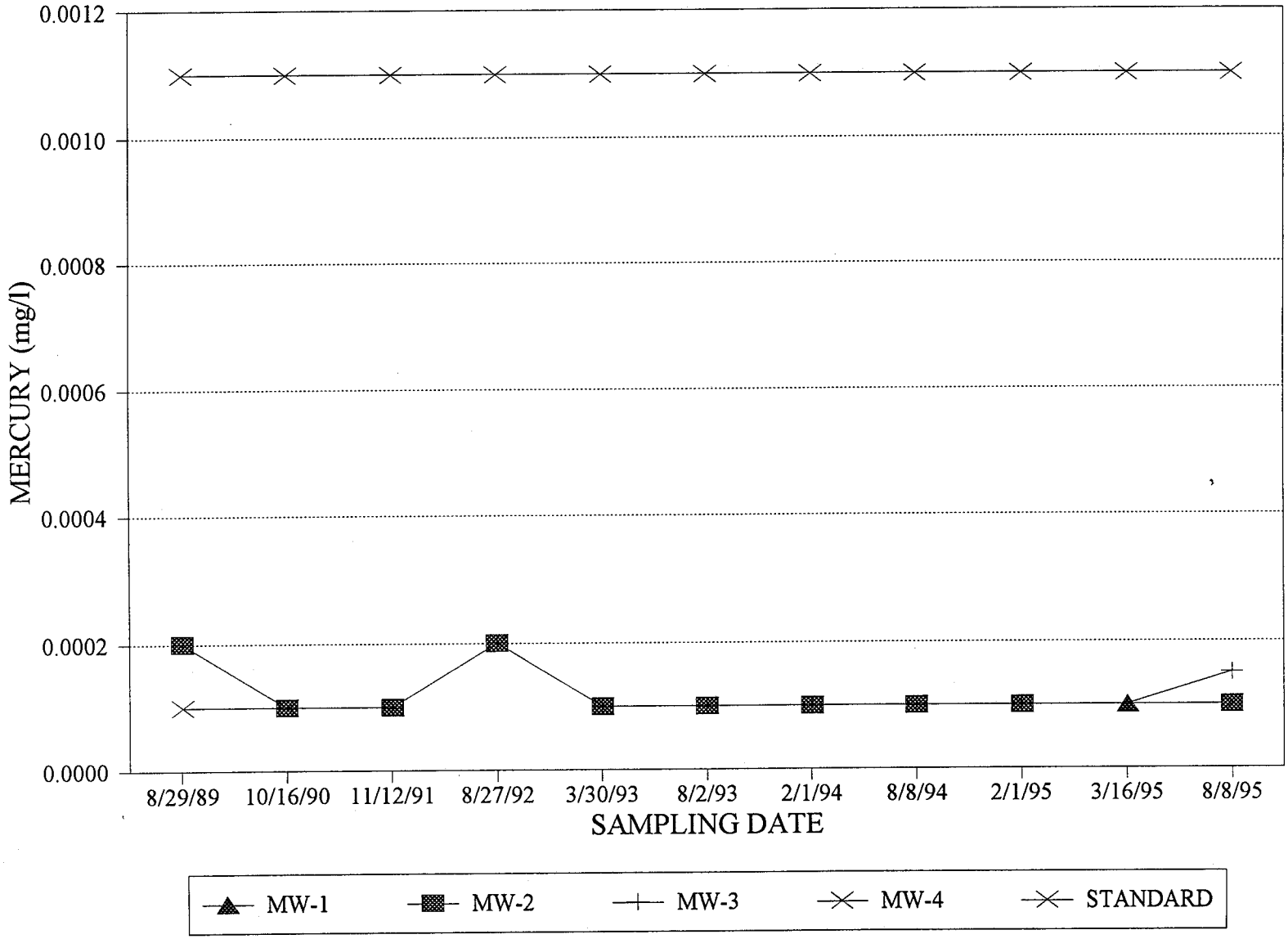

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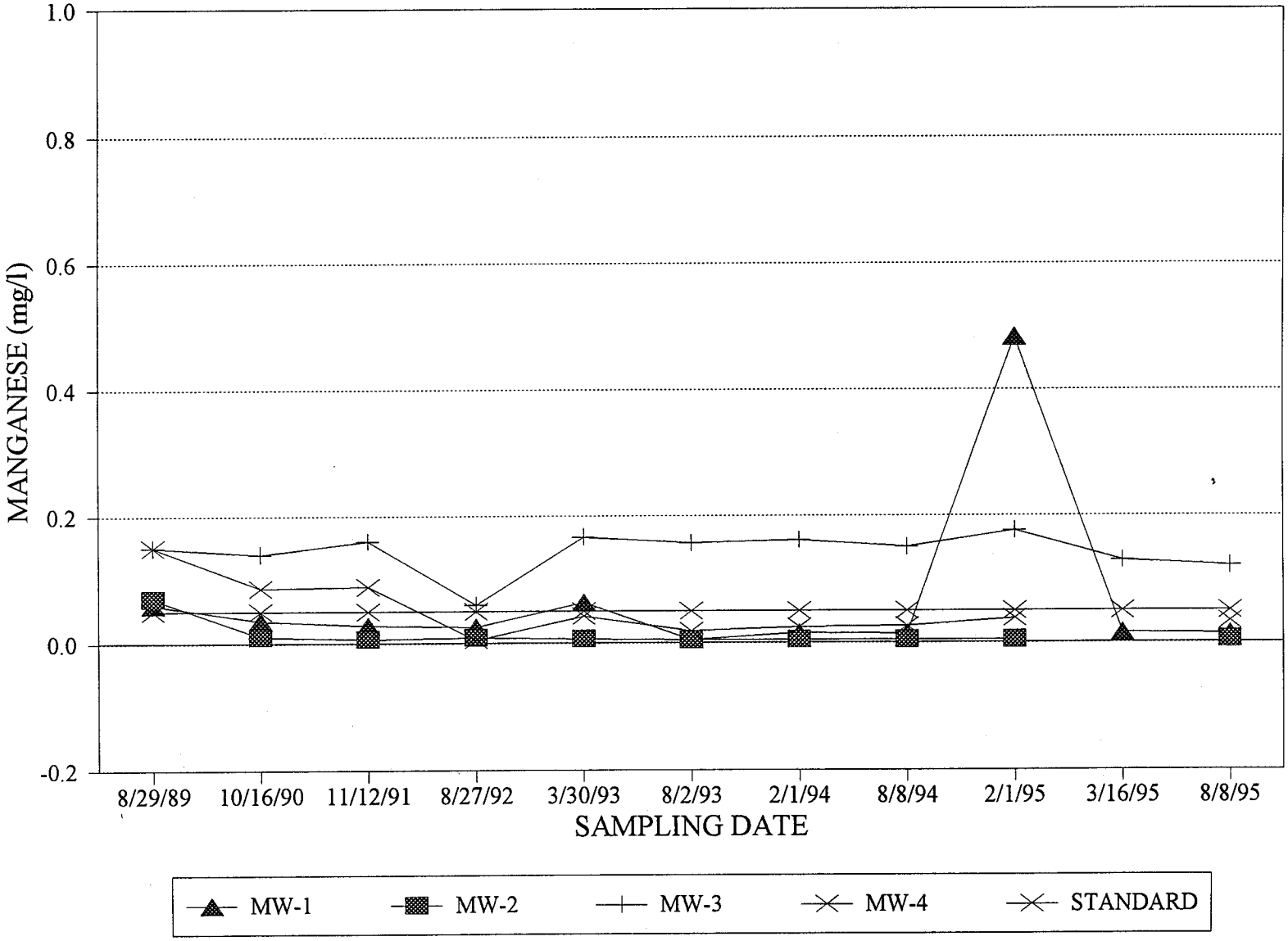

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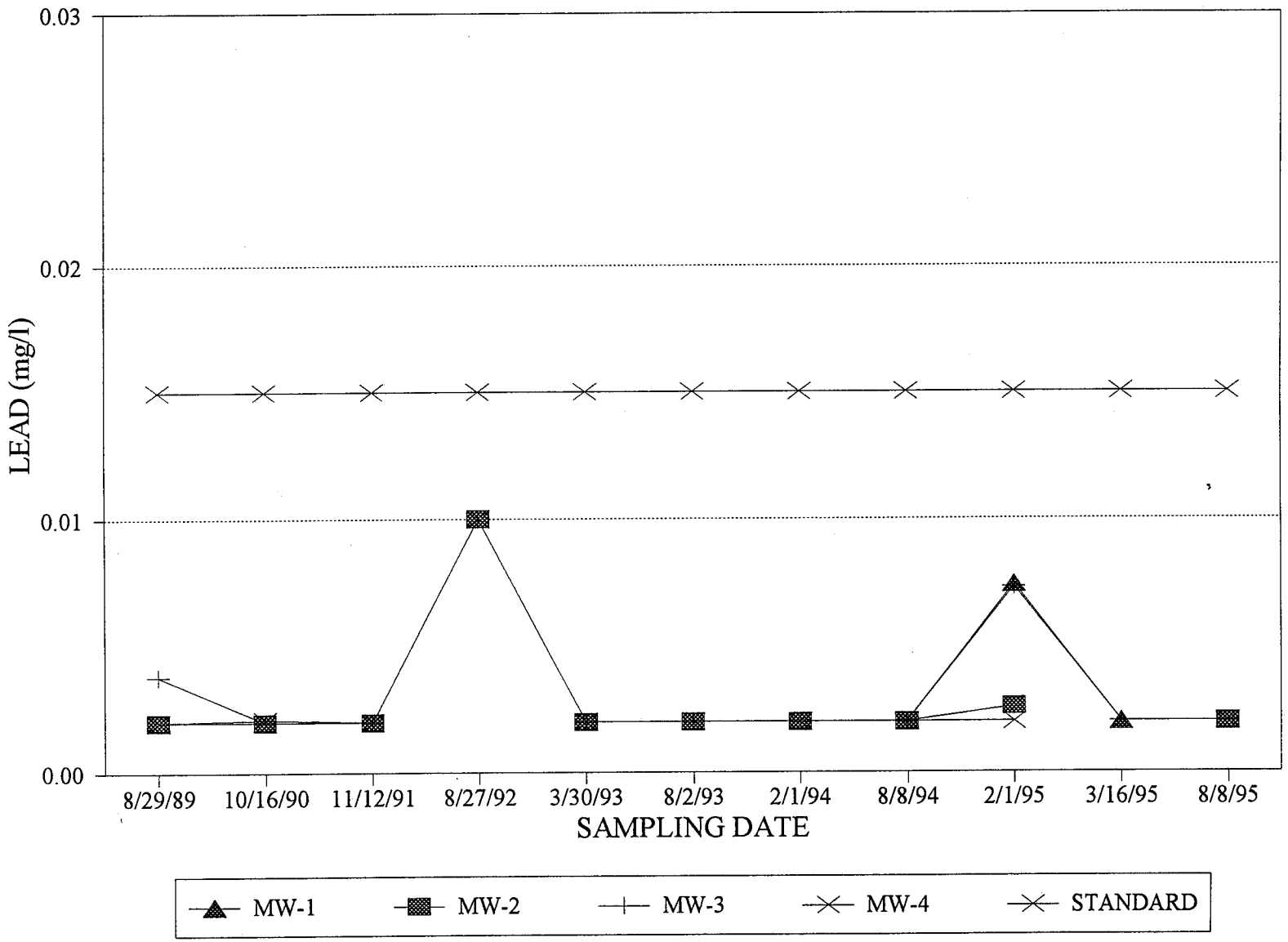

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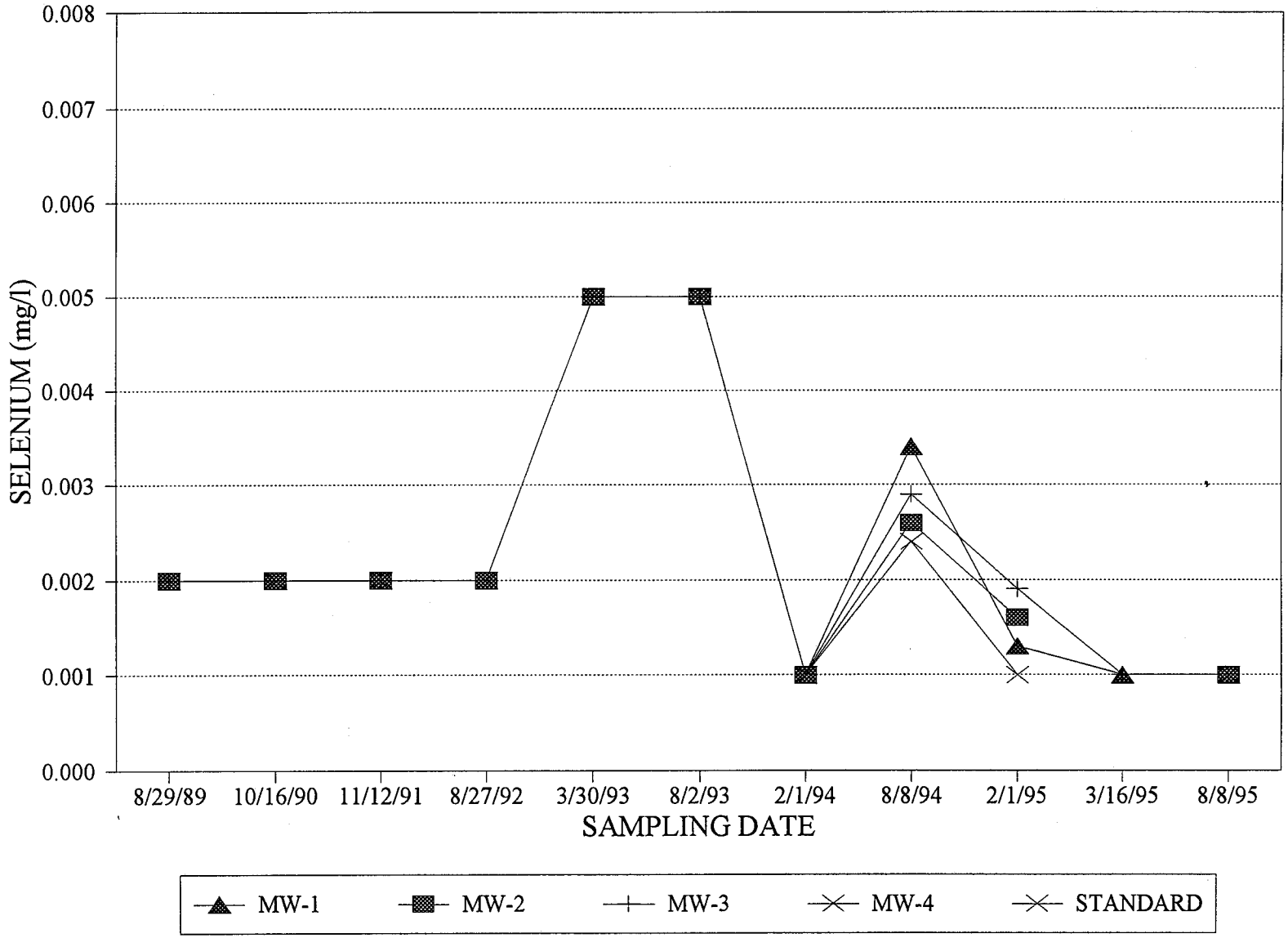

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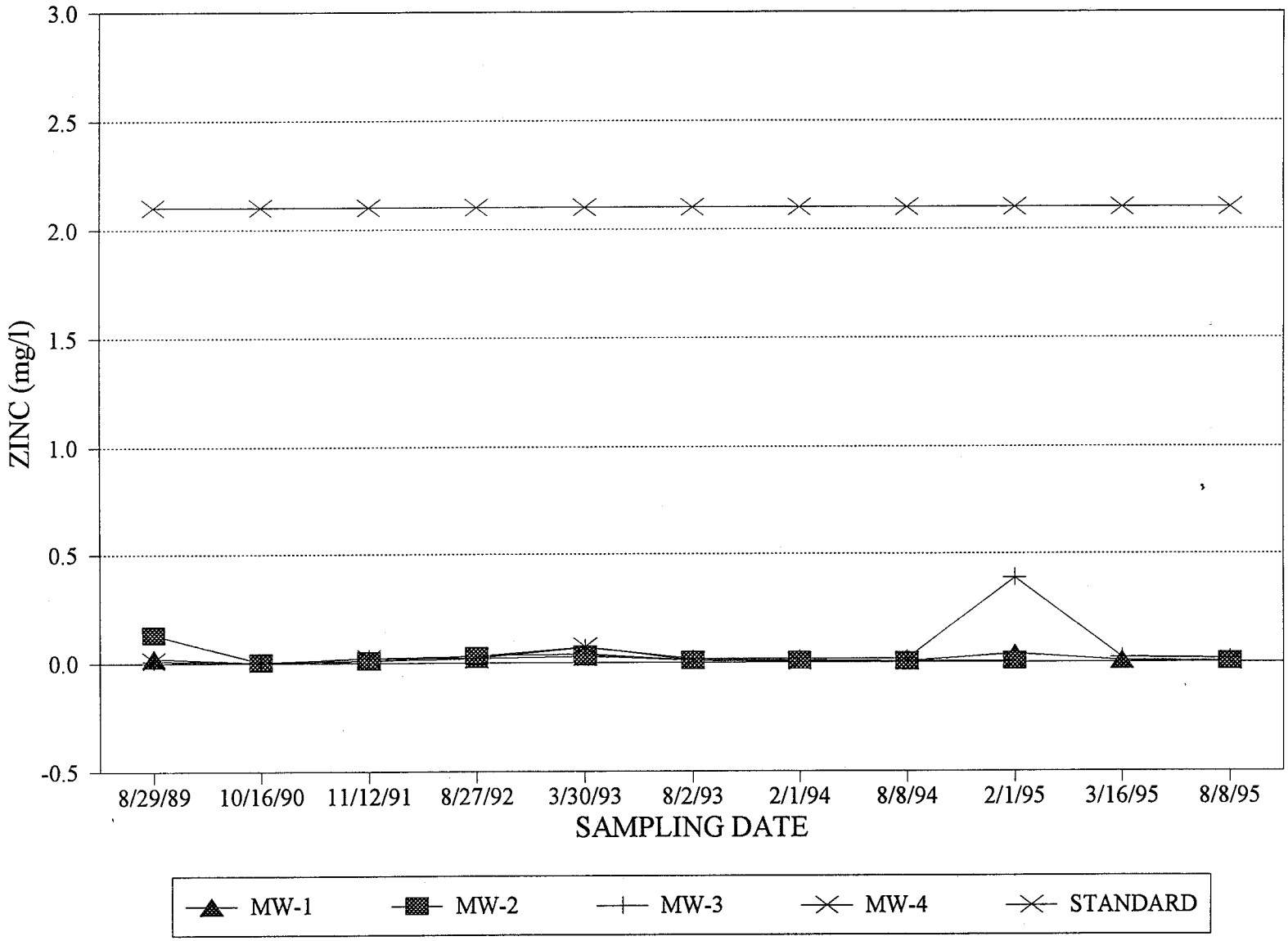


5.0 Coal Ash Management Program

Duke Power Company operates 8 (eight) coal fired power stations within its North and South Carolina service territory. In late 1993, a work group whose function is to manage the production, utilization (recycling), and disposal of ash generated by Duke in a consolidated and consistent manner was formed.

One of the group's primary objectives is to seek and develop opportunities for cost effective utilization of coal ash in accordance with applicable environmental regulations. Prior to the formation of the group, Duke utilized approximately 25% of the coal ash generated by the system on an annual basis. Ash utilization percentages for the system increased to 57% and 76% in 1994 and 1995, respectively. The increase in ash utilization has been facilitated by the development of ash reuse program permits and a generally improved performance of Duke's ash marketers.

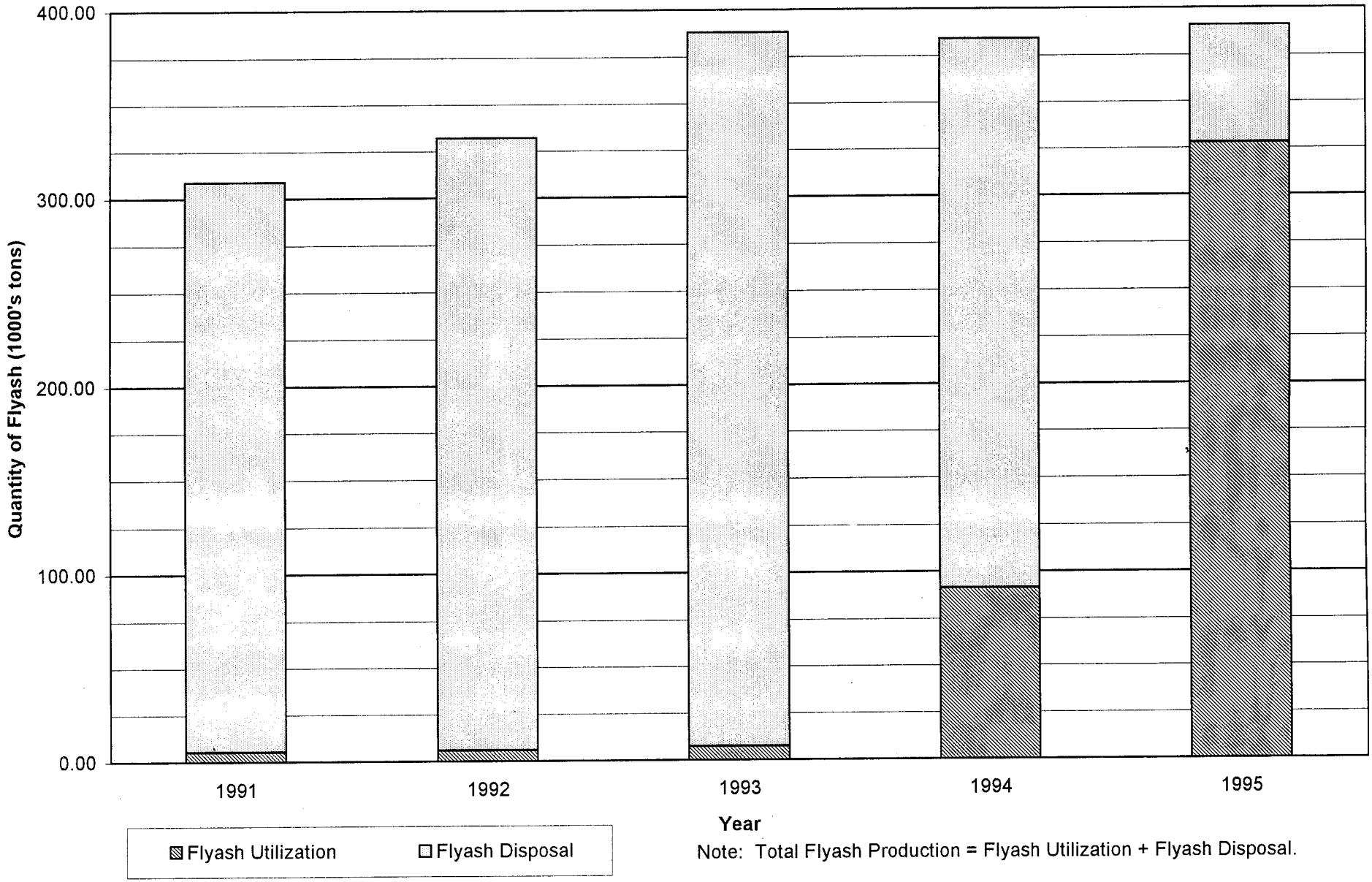
The quantities of flyash disposed and flyash utilized at Marshall for 1991 to 1995 is shown below and graphically presented in Figure 1.

Flyash Production, Utilization, and Disposal at Marshall

1991 to 1995

Year	Flyash Produced (Tons)	Flyash Utilized (Tons)	Flyash Utilized (%)	Flyash Disposed (Tons)
1991	308.8	5.2	1.5%	303.6
1992	332.2	5.7	1.7%	326.6
1993	387.9	7.2	1.9%	380.8
1994	383.9	91.2	23.7%	292.7
1995	390.7	327.8	83.9%	62.9

Marshall Steam Station Annual Disposition of Flyash
Figure 1



Note: Total Flyash Production = Flyash Utilization + Flyash Disposal.

6.0 Compliance Demonstration

Duke proposes to operate the existing landfill after January 1, 1998, with the current design. Based on the past history of compliance with the ground water standards in 15A NCAC 2L, and the types of materials placed in the landfill, no changes in the design in the landfill are warranted. We believe that the historic groundwater data is of greater value than results gained from modeling and do not feel that groundwater modeling of the landfill is warranted to prove compliance with 15A NCAC 2L.

Appendix A

Marshall Steam Station Dry Ash Landfill Ground Water Monitoring Program
Sampling and Analysis Plan

MARSHALL STEAM STATION
DRY ASH LANDFILL
GROUND-WATER MONITORING PROGRAM
SAMPLING AND ANALYSIS PLAN

Prepared By:
Duke Power Company
Environmental Division
Environmental Chemistry
March 19, 1996

Ronald A. Santini, PH-GW, 3-19-96

Ronald A. Santini, PH-GW (American Institute of Hydrology)

1.0 PROGRAM DESCRIPTION

1.1 SCOPE OF WORK

This Ground-Water Monitoring Program is designed to address the Duke Power Company (DPC) permit requirement for ground-water monitoring around the Dry Ash Landfill at Marshall Steam Station. It has been prepared according to the guidelines set forth by the North Carolina Water Quality Guidance Document for Solid Waste Facilities (SW-1001-87), and by the EPA in "Interim Guidelines and Specifications for Preparing Quality Assurance Plans" (QAMS-500/80), and documents the methodologies of field sampling, record-keeping protocols, data quality objectives, and data validation procedures that will be used in this program.

1.2 BACKGROUND

The current permit for the landfill was issued on December 30, 1983. The landfill is permitted to accept fly ash, asbestos, landclearing and inert debris (concrete, bricks, stumps, wood, scrap metal, glass, building materials, crating, asphalt and roofing materials.

During the period of June, 1973 to June 1975, 542,370 tons of fly ash has been disposed in the landfill. In addition, 629 tons of debris and 762 tons of asbestos have been placed in the landfill over this period.

The ash landfill area covers approximately 73 acres, while the asbestos landfill area covers 38.5 acres and the debris landfill area covers 2.75 acres.

1.3 WELL LOCATION AND INSTALLATION

Five wells have been installed to determine ground-water quality in the vicinity of the landfill . Monitoring well MW4 is located upgradient of the landfill area and four wells, MW1, MW2, MW3 and OB1 are located downgradient of the landfill. Observation well, OB1 is used for water elevation measurements only. The locations of these wells are shown on Figure 1 and well elevations and North Carolina State Plane Coordinates are shown in Table 1.

Each of the wells is screened near the water table. These wells are constructed of two-inch diameter PVC well screen and casing. Each well intercepts the aquifer with a ten foot section of pvc well screen with a slot size of 0.010 inch. These wells were installed by a North Carolina registered driller in accordance with applicable NCDEHNR regulations. Figure 2 shows a typical construction diagram for the wells. The wells are equipped with dedicated pump systems (Figure 3).

1.4 PARAMETERS AND FREQUENCY

Proposed parameters, units of measure, methods, and detection limits are presented in Table 2. The parameters represent pertinent groundwater quality standards. The wells are sampled semi-annually in February and August. Sampling results will be submitted to the State within 90 days of sampling.

1.5 DATA QUALITY OBJECTIVES

The overall quality assurance (QA) objective is to ensure that data of known and acceptable quality are provided. All measurements will be made so as to yield results that are representative of the groundwater. All data will be calculated and reported in units consistent with those of other agencies and organizations to allow comparability of data bases.

The QA objectives for precision, accuracy, and completeness have been established by the laboratory(s) in accordance with EPA or other accepted agencies for each measurement variable

(where possible). The objectives are outlined in the Duke Power Company Laboratory Services Procedures Manual, and are available upon request.

Detection limits for the water analyses presented in Table 2 are generally specified by the analytical methods. As stated above, appropriate methods have been selected to meet applicable standards for groundwater quality or the requirements of applicable permits. Instances may occur, however, in which the condition of the sample will not allow detection of the desired limits for various parameters either because of matrix interferences or high analyte concentrations requiring sample dilution. The laboratory(s) will provide sufficient information with each data package to allow reviewers of the data to be aware of encountered sample problems.

2.0 SAMPLING PROCEDURES

2.1 SAMPLING EQUIPMENT

Development, purging and sampling equipment are chosen to ensure the materials making up the equipment are compatible with the sample parameters and also comply with state and federal regulatory requirements for sampling. Positive-gas-displacement fluorocarbon resin bladder pumps are installed in each monitoring wells as dedicated purging and sampling systems.

2.1.1 Equipment Cleaning Procedures

All equipment used to monitor groundwater elevations and quality at the landfill use dedicated equipment. However, in the event non-dedicated equipment is used, reusable water level meters, development pumps, purging, and sampling equipment are cleaned between wells in accordance with standard EPA approved cleaning procedures for field equipment described in "Standard Operating Procedures and Quality Assurance Manual", Engineering Support Branch, EPA Region IV, February 1, 1991.

2.2 GROUND-WATER SAMPLING

2.2.1 Developing the Well

After installation of new wells, and prior to initial sampling, the monitoring wells are 'developed'. Development removes silt that has settled into the bottom of the well following installation, and removes fine silt and clay particles from the well screen and sandpack surrounding the screen, to avoid future clogging of the well or poor well performance. Development involves removing an estimated ten or more well volumes from the well using a positive-gas-displacement fluorocarbon resin bladder pump with an up-and-down agitation to loosen particles from the well screen. After development of a well, a true well depth is recorded.

2.2.2 Ground-Water Level and Total Depth Measurements

Water-level measurements are required to confirm the ground-water flow direction and to calculate the volume of standing water in the well. All monitoring wells have been surveyed by a registered surveyor to determine the elevation of the top of each well casing. All depth and water-level measurements are referenced to the top of the well casing and recorded to the nearest one-hundredth of a foot.

In non-dedicated systems, water-level measurements are made with the use of an electronic measuring device which consists of a spool of dual conductor wire, a probe attached to the end, and an indicator. When the probe comes in contact with water, the circuit is closed and a meter light and/or buzzer attached to the spool signal the contact. The probe is lowered further until it rests on the bottom of the well to determine the depth of the well. The depth and water level are used to determine that the well has not filled with silt and to calculate the volume of standing well water. The volume of well water (in liters) is calculated using the following equation:

$$V = h \times \pi r^2 \times (28.32\ l/ft^3)$$

where V = volume of standing water (liters)
h = height of standing water (feet)= casing depth - water level
r = radius of well casing (feet)

In dedicated systems, an accurate well depth is determined, as indicated above, after development of the well and prior to installation of the dedicated water level probe and pump.

This well depth is referenced until replacement of the dedicated water level probe and/or pump is necessary. The dedicated water level probe consists of a pressure transducer and electronic meter. The height of water above the probe is measured and subtracted from the depth to which the probe was placed in the well to yield the depth of the water (example: the dedicated probe is positioned 15 ft down from the top of the casing, the meter reads 6 feet of water above the probe, the water level is thus 9 feet below the top of the casing). The calculation of standing water is the same as for non-dedicated systems. The total depth, water-level measurements, and calculated well volume are recorded on the Ground-Water Monitoring Data Sheet (Figure 4).

2.2.3 Purging the Well

Prior to each sampling event, the well is purged to remove the standing water which may not be representative of formation water. Purging is accomplished by pumping. Dedicated bladder pump intakes are set about 1 foot above the bottom of the well.

Three to five times the calculated standing water volume (V) is removed from the well during purging. The water removed is measured in a graduated container. Under normal rates of recovery, monitoring wells should be sampled within eight hours of purging in accordance with EPA guidelines. In low-yield wells (wells that are incapable of yielding three to five standing water volumes), water is purged so that it is removed from the bottom of the screened interval. Low-yield wells are evacuated to dryness once; as soon as the well recovers sufficiently, the first sample is tested for pH and specific conductance (Section 2.2.4). Samples are then collected in the order of the parameters' volatilization sensitivity (Section 2.2.5).

2.2.4 Field Measurements

During purging of the well, grab samples are collected after each of the three or more well volumes are removed to obtain measurements of pH, specific conductivity. Stable readings during a purging event in a well are considered those which 1) do not indicate an increasing or decreasing trend, and 2) are within 10% of each other for specific conductance, and within 0.2 pH units over three consecutive readings.

The field instrumentation is calibrated with reference standards prior to and after each sampling day as described in the Environmental Chemistry Procedure 3210 or manufacturers specifications (available upon request). The pH meter is calibrated with two different pH standards which usually bracket the expected ground-water pH (pH standards 7.0 and 4.0). The conductivity meter is calibrated with a standard nearest the expected ground-water conductivity. Calibration results are recorded on the Field Sampling Calibration Form (Figure 5). The sample readings are recorded on the Ground-Water Monitoring Data Sheet (Figure 4).

2.2.5 Sample Collection

After sufficient purging and stable field measurements, the wells are sampled for the parameters of interest. If non-dedicated or non-disposable equipment is used (i.e. cleaned in the field between wells), background wells are sampled before downgradient wells. Sampling personnel wear clean, disposable, non-powdered latex gloves at each well. Samples are collected in the order of the volatilization sensitivity of the parameters:

- Volatile Organics (VOA)
- Total metals
- Sulfate and chloride
- Nitrate
- TDS

VOA samples are collected with no headspace in the sample containers to minimize the possibility of volatilization of organics.

If ground-water samples for which metals analysis will be conducted have a turbidity of higher than 50 NTU, the sample is collected unpreserved. The unpreserved sample is stored at 4°C until delivered to the laboratory. The laboratory will filter and digest the sample within 72 hours of sample collection. Samples are not to be filtered in the field.

2.2.6 Sample Containers, Volume, Preservative, and Holding Time

All sample containers supplied for the collection of ground-water samples by the laboratory are new, precleaned and/or prebaked as approved by EPA procedures appropriate for the parameters of interest. Table 3 summarizes the sample containers, sample volume, preservation procedures and holding times required for each type of sample and parameter. Sample containers are kept closed until used. All sample containers are provided by DPC or vendor laboratories.

3.0 SAMPLE TRACKING

The chain of custody program allows for the tracing of possession and handling of individual samples from the time of field collection through laboratory analysis and report preparation.

3.1 SAMPLE LABELING

Sample containers are labeled at the time of sampling with the following information: sampling date and time, sample identification number, and initials of sample collector.

3.2 FIELD LOG BOOK

A Field Log Book is maintained during the course of the field work to document the following:

- Identification of well
- Well depth
- Static water level depth and measurement technique
- Presence of immiscible layers and detection method
- Well yield - high or low
- Purge volume or pumping rate
- Sample identification numbers
- Well evacuation procedure/equipment
- Sample withdrawal procedure/equipment
- Date and time of collection
- Types of sample containers used
- Identification of replicates or blind samples
- Preservative(s) used
- Parameters requested for analysis
- Field analysis data and methods
- Sample distribution and transporter
- Field observations on sampling event
- Name of collector(s)
- Climatic conditions including estimate of air temperature

This information is contained on the Ground-Water Monitoring Data Sheets , the Field Sampling Calibration Form, or the Chain-of-Custody Record and Analysis Request Form (See Section 3.3) which are filled out for each sampling event. These loose-leaf sheets are arranged in sequential order and filed by project and date. All recorded entries are made in indelible ink. Errors are corrected by drawing a line through the error, initialing and dating the correction, and starting a new entry on the next line (if necessary).

3.3 CHAIN-OF-CUSTODY RECORD AND ANALYSIS REQUEST FORM (CCRARF)

The CCRARF (Figure 6) accompanies the sample(s), traces sample possession from time of collection to delivery to the laboratory(s), and clearly identifies which sample containers have been designated for each requested parameter. The record includes the following types of information:

- Sample identification number
- Signature of collector
- Date and time of collection
- Sample type (e.g., groundwater, immiscible layer)
- Identification of well
- Number of containers

- Parameters requested for analysis
- Preservative used
- Signature of persons involved in the chain of possession
- Inclusive dates of possession

3.4 SAMPLE CUSTODY, SHIPMENT AND LABORATORY RECEIPT

For the purpose of these procedures, a sample is considered in custody if it is:

- In actual possession of the responsible person;
- In view, after being in physical possession;
- Locked so that no one can tamper with it, after having been in physical custody; or in a secured area, restricted to authorized personnel. All samples are maintained in the custody of the sampling crew during the sampling event. At the end of each sampling day and prior to the transfer of the samples off-site, chain-of-custody entries are completed on the CCRARF for all samples. Upon transfer of custody, the chain-of-custody form is signed by a sampling crew member, including the date and time. Samples are delivered to outside laboratories by DPC personnel or courier.

All chain-of-custody forms received by the laboratory(s) are signed and dated by the respective Supervising Scientist(s) or their designee (at the DPC lab), or the laboratory sample custodian (at vendor labs) immediately following receipt by the laboratory.

The analysts at the laboratory(s) maintain a sample-tracking record that will follow each sample through all stages of laboratory processing. The sample tracking records show the date of sample extraction or preparation, and analysis. These records are used to determine compliance with holding time limits during lab audits and data validation.

Custody procedures followed by DPC laboratory personnel are described in detail in the DPC Laboratory Services Procedures Manual.

4.0 ANALYTICAL PROCEDURES

The main analytical laboratory used in this program is the DPC Laboratory Services Laboratory: N.C. Drinking Water (NC031) and Wastewater (#248) Certifications. The organizational structure and staff qualifications of the laboratory are discussed in its generic Quality Assurance Program (QAP). The QAP and Laboratory Services Procedures Manual are available for review upon request to:

Laboratory Manager
Laboratory Services Section
Duke Power Company Environmental Division
Applied Science Center
13339 Hagers Ferry Road
Huntersville, North Carolina 28078
704-875-5304

Vendor laboratories that meet EPA and S. C. certification requirements may be used for analyses which cannot be performed in-house.

The analytical procedures used for this Ground-Water Monitoring Program are briefly described in Table 1. Conductivity, pH, and/or turbidity are measured in the field according to DPC Laboratory Services Procedures Manual or instrument manufacturers' instructions.

5.0 INTERNAL QUALITY CONTROL CHECKS

Internal laboratory control checks used by the laboratories are described in their generic QAP and procedures manual. The laboratories demonstrate the ability to produce acceptable results using the methods specified.

Internal quality control checks for sampling procedures and laboratory analyses will be conducted with each sampling event. These checks will consist of the preparation and submittal of field blanks, trip (travel) blanks, and/or field replicates for analysis of all parameters at frequencies described in the laboratory(s) procedures manuals. Equipment rinsate blanks for laboratory-cleaned equipment will be collected quarterly.

The above field QC blanks and replicates included as internal QC checks are described as follows:

- **Field Blanks**: A field blank consists of sample containers filled in the field with organic-free, deionized or distilled water prepared and preserved in the same manner as the samples. The field blank is transported to the laboratory with the samples and analyzed along with the field samples for the constituents of interest to check for contamination imparted to the samples by the sample container, preservative, or other exogenous sources.

- **Trip Blanks**: A trip (travel) blank is a sample container filled with organic-free water in the laboratory that travels unopened with the sample bottles. It is returned to the laboratory with the field samples, and analyzed along with the field samples for parameters of interest.

- **Field Replicates**: A field replicate is a duplicate sample prepared at the sampling locations from equal portions of all sample aliquots combined to make the sample. Both the field replicate and the sample are collected at the same time, in the same container type, preserved in the same way, and analyzed by the same laboratory as a measure of sampling and analytical precision.

6.0 VALIDATION OF FIELD DATA PACKAGE

The field data package will be reviewed by the Project Scientist for completeness and accuracy using the Field Data Validation Checklist (Figure 7). The field data package includes all of the field records and measurements developed by the sampling team personnel. The field data package validation procedure consist of:

- A review of field data contained on the Ground-Water Monitoring Data Sheets for completeness.
- A verification that equipment blanks, field blanks, and trip blanks were properly prepared, identified, and analyzed.
- A check of the Field Sampling Calibration Form for equipment calibration and instrument condition.
- A review of the Chain-Of-Custody Record and Analysis Request Form for proper completion, signatures of field personnel and the laboratory sample custodian, and dates, and for verification that the correct analyses were specified.

7.0 REPORT SUBMITTAL

A summary table of the field and laboratory data and a cover letter describing trends will be submitted to the North Carolina Department of Environment, Health, and Natural Resources within 90 days of sampling. The State will be notified in the event that vendor lab analyses have not been completed within this time frame. All Ground-Water Monitoring Data Sheets, Field Calibration Forms, Chain-of-Custody Record and Analysis Request Forms, Laboratory(s) QA data, and Data Validation Checklists are kept in fire-proof file cabinets or microfiched, and are available upon request.

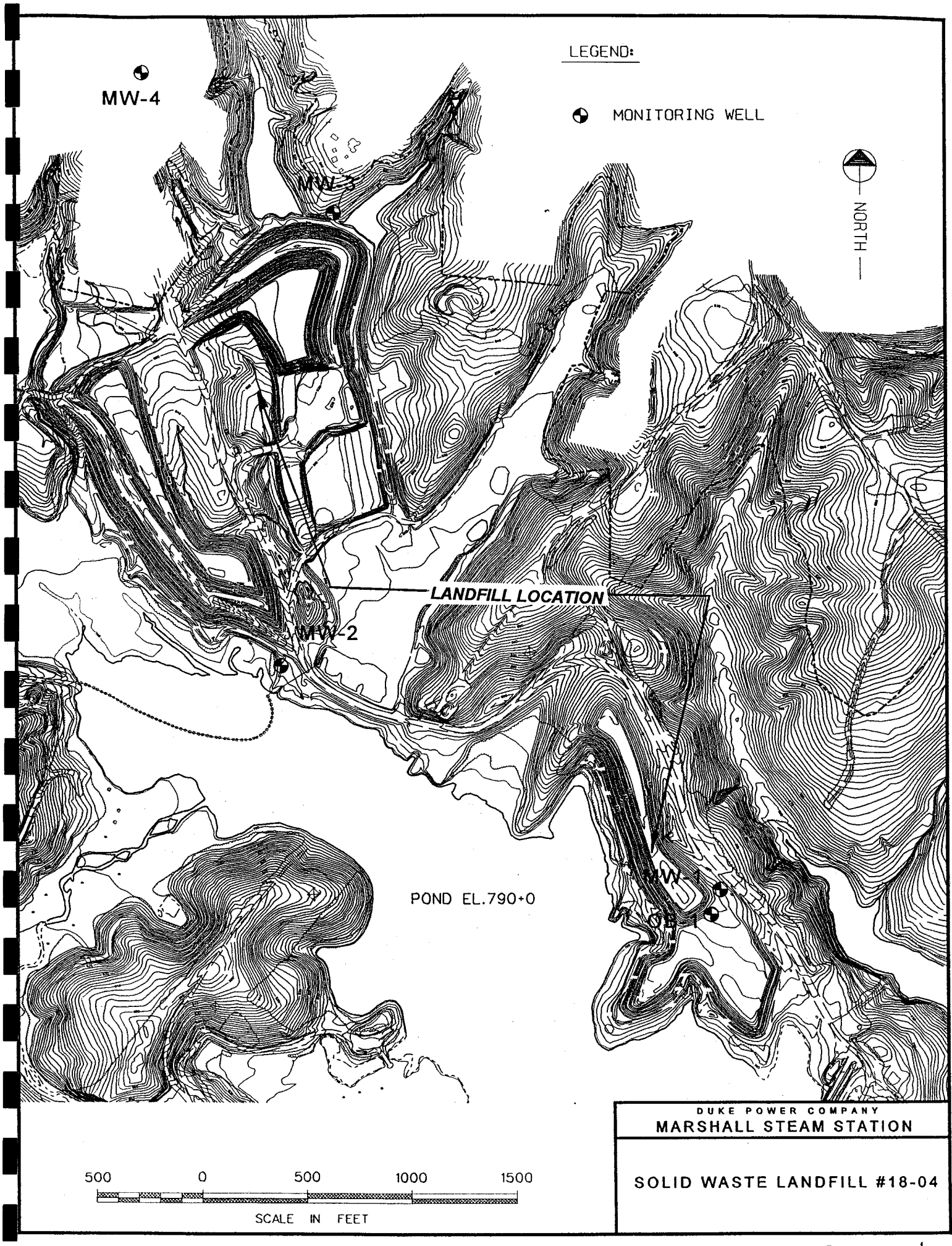
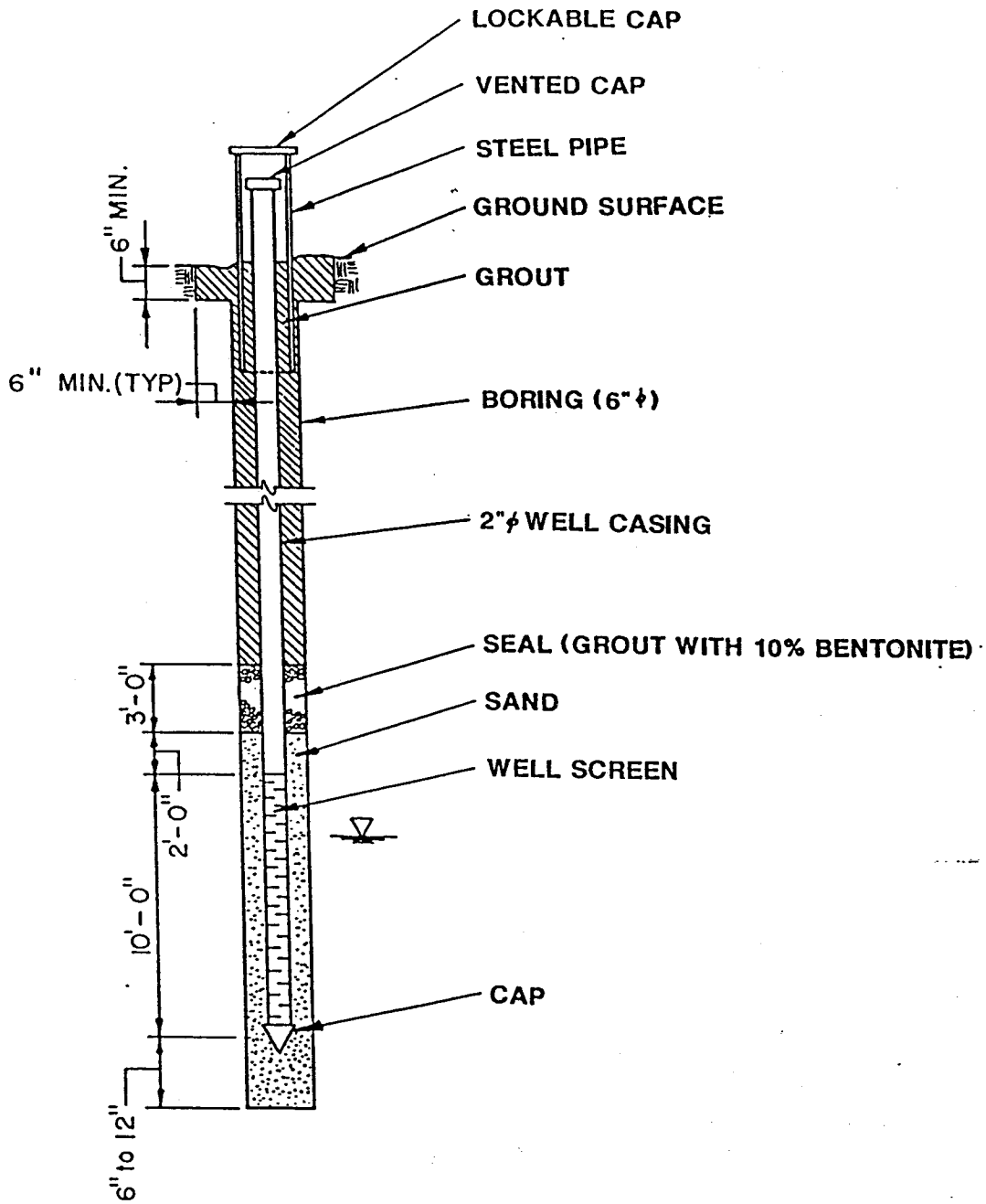

LEGEND:
MONITORING WELL
NORTH
MW-4
MW-3
MW-2
MW-1
LANDFILL LOCATION
POND EL.790+0
500
0
500
1000
1500
SCALE IN FEET
DUKE POWER COMPANY
MARSHALL STEAM STATION
SOLID WASTE LANDFILL #18-04
c:\marshall\mamw-1.dgn

FIGURE 1



NOTES: 1.ALL DIMENSIONS ARE APPROXIMATE.
2.ALL CASING MATERIAL SHALL BE Sch 40 PVC.
3.WELL SCREEN MATERIAL SHALL BE Sch 40 PVC.

DUKE POWER CO.
GROUNDWATER MONITORING WELL DETAIL

FIGURE 2

WELL WIZARD®

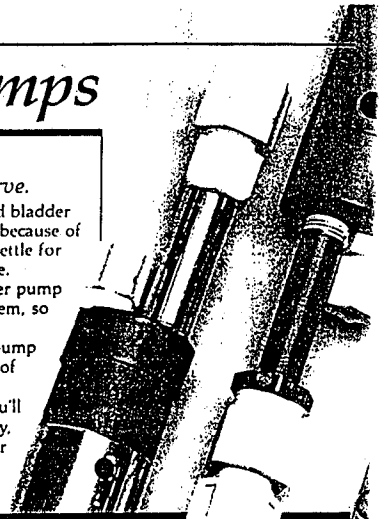
Sampling Pumps

Choose the system that gives you the superior performance you deserve.

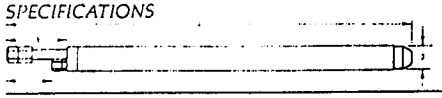
The whole reason you're selecting a dedicated bladder pump system for groundwater monitoring is because of its accuracy and long-term reliability. Don't settle for second best—get the high quality you deserve.

QED built the business of dedicated bladder pump systems. Our pumps are the heart of the system, so we spare no effort to make them the best.

Many of the details that make a superior pump are subtle modifications resulting from years of experience. They may not be obvious at first glance, but check the specs of our pumps. You'll find flow rates, pumping lifts, material quality, durability, and selection that clearly show our commitment to supplying you with the best pumps possible.



SPECIFICATIONS



MODEL NO	BODY MATERIAL	BLADDER MATERIAL	TUBE FITTINGS*	MAXIMUM LIFT (Ft.)	A (Dimension in inches)	B	C	D	PUMP WEIGHT (Lbs.)
P-1100	PVC	PVC	Polypropylene	300	40.85	4.65	3.70	1.66	3
T-1100	Teflon	Teflon	Teflon	250	40.33	4.13	2.96	1.66	4
P-1101	PVC	Teflon	Polypropylene	300	40.85	4.65	3.70	1.66	3
P-1101H	PVC	Teflon	316 S.S.	600	40.75	4.50	3.70	1.66	3
SP-1101P	316 S.S.	Teflon	316 S.S.	1000	40.50	4.12	3.12	1.66	10
T-1200	Teflon/316 S.S.	Teflon	316 S.S.	300	41.14	3.93	3.06	1.50	5
P-1201	PVC/316 S.S.	Teflon	Polypropylene	300	41.23	4.02	3.06	1.50	4
P-1201H	PVC/316 S.S.	Teflon	316 S.S.	600	41.37	4.16	3.20	1.50	4
T-1300	Teflon/316 S.S.	Teflon	316 S.S.	200	15.87	3.87	2.87	1.00	3

* All Air Supply Tube Fittings 0.25" OD. Discharge Tube Fittings 0.25" OD. Except T-1300 0.375" OD.

T-1300 requires Clamp Tool No. 35160 for valid attachment of tubing. Clamps are provided with pump.

PLEASE NOTE: Intake Screens are standard on T-1300 and are optional on other models. Please consult QED.

Field Replaceable Bladders

For Pumps	W/ Hand Tool	W/O Hand Tool
T-1100	14055	14065
P-1101	14057	14067
T-1200	35315	35320
P-1201	35315	35320

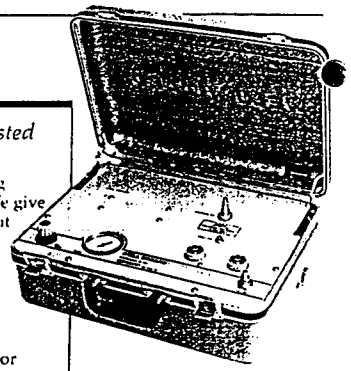
Note: All kits contain 2 bladder sleeves and seal replacement sets. 35315 includes pin punch.

WELL WIZARD®

Controllers

State-of-the-art, 100% performance-tested units cycle pumps automatically.

QED has more experience designing and building pneumatic controller devices than anyone else. We give you a better choice of controllers, with or without drivers—all field-proven performers. Versatile QED controllers are fully adjustable, can operate high-rate purge pumps and still be throttled down to 0 psi for TEGD-recommended low flow rates for sample vial filling. One-person portability, fast set-up, and unattended cycling greatly reduce labor requirements.

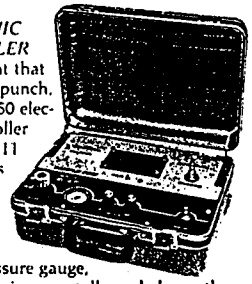


STANDARD & HIGH-PRESSURE CONTROLLER

All 3013 series models are compatible with a wide range of external gas sources and use sophisticated pneumatic design that requires no batteries or electrical supply. Optional Pump Manifold (Model 3000) lets one controller operate three sampling pumps within a 20-foot radius simultaneously. High pressure models allow pump lifts to 1000 feet.

ELECTRONIC CONTROLLER

A lightweight that packs a real punch, the Model 350 electronic controller weighs only 11 pounds, runs pumps up to 250 ft. deep. Complete with flow throttle, pressure gauge, and other environmentally-sealed, weather-resistant components, enclosed in a tough, protective carrying case.



SPECIFICATIONS

Model No.	Logic	Maximum Supply Pressure	Maximum Pump Depth	Wt.
3013	Pneumatic	125	250'	22
3013H	Pneumatic	300	600'	26
3013-TH	Pneumatic	500	1000'	32
350	Electronic	125	250'	12

3013 Series size: 18"L x 11"H x 8"W x 6"H
350 size: 13" x 12" x 6"

Extra performance built right in

Pneumatic power
3013 series controllers have all-pneumatic design for maximum reliability. No battery to drain, no long waits for recharging or replacement batteries—if you've got pressure, you've got power. Third-generation pneumatic logic controls provide inherent shock and moisture resistance for real field ruggedness.

Electronic efficiency
Model 350 has uniquely efficient circuits that work for 100 hours on one set of cheap, readily available AA batteries. Warning light shows a full day's power left, so you won't get left out in the field.

Stay in the driver's seat
Field-proven compressor carts roll easily on high-flotation pneumatic tires, for true one-person portability even in heavy mud or snow. Constructed to take long hours, rough terrain—and the payloads are QED's reliable, high-power engine/compressor combinations that can operate pumps to 300 feet.

No hidden charges
QED systems come complete—no extra costs for hoses, batteries, chargers or other necessary equipment. For example, all units have two 20 foot, heavy-duty industrial air supply hoses with quick-connect fittings—standard, not additional.

FIGURE 3

DUKE POWER COMPANY
GROUNDWATER MONITORING DATA SHEET

LOCATION:			
PROCEDURE NUMBER:	3600		
SAMPLING DATE:		FIELD CREW	

MONITORING WELL NUMBER: [ ]

WATER LEVEL METER #: [ ]

TIME SAMPLE COLLECTED: [ ]

WELL VOLUME CALCULATION

WELL DIAMETER (INCHES)	WELL DEPTH (FEET)	-	WATER LEVEL (FEET)	=	WATER COLUMN (FEET)	X	3.14 x r^2	=	VOLUME (FT^3)
2"		-		=	0.00	X	0.0218	=	0.0
4"		-		=	0.00	X	0.0873	=	0.0

LITERS PER WELL VOLUME REMOVED:

WELL VOLUME	LITERS TO REMOVE: (FT^3 x 28.32 l/FT^3)	
	2" WELL	4" WELL
1	0	0
5	0	0
10	0	0
20	0	0

OBSERVATIONS:

ODORS DETECTED:		FREE PRODUCT MEASUREMENT:	
TYPE:		METHOD:	
STRONG:		THICKNESS:	
MINOR:		OTHER:	
NONE:			

WATER LEVEL (FEET)	METHOD (P=PUMP) (B=BAIL)	VOLUME (LITERS)	EVACUATED VOLUME (LITERS)		pH (SU)	TEMP (deg C)	SPECIFIC CONDUCT. (umho/cm)		COMPLETE EVACUATION (Y/N)
N/A									

COMMENTS: WATER LEVEL AND WELL DEPTH REFERENCED TO TOP OF PVC WELL CASING.

FIGURE 4

rm 35489 (R12-88)

FIELD SAMPLING CALIBRATION DATA FORM

tudy _____

ate _____ Weather Conditions _____

Collectors _____ Surface Unit Reader _____

quipment: Surface Unit # _____ Transmitter # _____

Cable# _____ Battery # _____

ther Equipment: _____

Procedure Number 3210 Water Quality Analyzer H20

Calibration Time		Time		Time		Time	
Variable	Calib.	Initial Value	Adjust To	Initial Value	Adjust To	Initial Value	Adjust To
Temp. (°C)		___.___ -->	___.___	___.___ -->	___.___	___.___ -->	___.___
		___.___ -->	___.___	___.___ -->	___.___	___.___ -->	___.___
Therm # _____		___.___ -->	___.___	___.___ -->	___.___	___.___ -->	___.___
DO (mg/1)	W		___.___		___.___		___.___
	W		___.___		___.___		___.___
	W		___.___		___.___		___.___
	AW	___.___ -->	___.___	___.___ -->	___.___	___.___ -->	___.___
	B	___.___ -->	___.___	___.___ -->	___.___	___.___ -->	___.___
pH (units)	B	___.___ -->	7.00	___.___ -->	7.00	___.___ -->	7.00
	B	___.___ -->	4.00	___.___ -->	4.00	___.___ -->	4.00
	B	___.___ -->	10.00	___.___ -->	10.00	___.___ -->	10.00
SP Cond. (umho/cm)	SS	___.___ -->	___.___	___.___ -->	___.___	___.___ -->	___.___
	SS	___.___ -->	___.___	___.___ -->	___.___	___.___ -->	___.___
	SS	___.___ -->	___.___	___.___ -->	___.___	___.___ -->	___.___
Orp. (mv)	SS	_____ -->	_____	_____ -->	_____	_____ -->	_____
	SS	_____ -->	_____	_____ -->	_____	_____ -->	_____

KEY:
B = Buffer
SS = Standard Solution
-- > = Adjusted To
W = Winkler
AW = Average Winkler
- / - > = Not Adjusted To
NA = Not Applicable

FIGURE 5

Form 35226 (R10-93)

CHAIN OF CUSTODY RECORD AND ANALYSIS REQUEST FORM *

DUKE POWER COMPANY
Laboratory Services
MNS Bldg. # 7405 (MG03A1)
13339 Hagers Ferry Road
Huntersville, NC 28078

LS CLIENT CONTACT/PHONE[1]: _____

CLIENT[2]: _____

Project Name[3]: _____

Results to/Phone[4]: _____

Address and/or PROFS[5]: _____

Matrix (type of samples)/QC Level[6]: _____

SAM No.[7]: _____

ANALYSES REQUESTED by bottle type—MUST NOTE PRESERVATIVE[12] (may note special DL or Method)[13]

FRAC[8]	CHEMPLOT Number[9]	Sample Description or ID[10]	Collected using sampling instructions[11]															
			Date	Time	Name													

Sample Preserved ❑ Yes ❑ No [14]
Name:

Total # of samples[15]:

Delivered by[16]:	Delivered by:	Delivered by:
Date/Time:	Date/Time:	Date/Time:
Received by:	Received by:	Received by:

Turnaround Requested[19]:
- ❑ Routine (3 weeks)
- ❑ Rush (2 weeks)
- ❑ Emergency Rush
- ❑ Date Results Requested _____

Comments[17]: _____

* See instructions on back of form.

[18] White, canary — LS Files Pink — Client Copy

FIGURE 6

Duke Power Company
Groundwater Monitoring Program
Field Data Validation Checklist

Data Validation Item	Yes	No
1. Has the Ground Water Monitoring Data Sheets been reviewed for completeness ?		
2. Were all equipment blanks, field blanks and trip blanks properly prepared, identified and analyzed?		
3. Was the Field Sampling Calibration Form completed?; Was the equipment within procedure calibration limits?		
4. Was the Chain-of- Custody Record completed, with the analyses requested, the number of containers, preservatives added, dates, times and signatures of field personnel and lab personnel ?		

Comments:_____

_____

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_____ _____

Project Scientist Signature

FIGURE 7

Table 1. Monitoring Well Information

WELL ID	UNITS	MW1	MW2	MW3	MW4	OB1
NORTH	Feet	682,767.3	683,834.2	685,990.7	686,658.4	682,648.4
EAST	Feet	1,417,124.7	1,415,046.3	1,415,309.4	1,414,395.4	1,417,080.7
LOCATION		DOWN	DOWN	DOWN	UP	DOWN
TYPE		PVC	PVC	PVC	PVC	PVC
DIAMETER	Inches	2"	2"	2"	2"	2"
TOP OF CASING	Feet (amsl)	823.75	797.21	813.07	867.15	825.85
TOTAL DEPTH	Feet	79.65	35.31	27.97	50.05	65.85
DEPTH OT WATER	Feet	50.87	7.83	7.48	32.30	45.61
SCREEN LENGTH	Feet	10'	10'	10'	10'	10'
TOP OF SCREEN	Feet (amsl)	754.1	771.9	795.1	827.1	770.0
BOTTOM OF SCREEN	Feet (amsl)	744.1	761.9	785.1	817.1	760.0
PUMP TYPE		BLADDER	BLADDER	BLADDER	BLADDER	NONE
PUMP INLET ELEVATION	Feet (amsl)	745.1	762.9	786.1	818.1	761.0

Table 2. Sample Parameters, Analytical Methods and Detection Limits

PARAMETER	UNITS	ANALYTICAL METHOD	DETECTION LIMITS
Insitu Parameters			
Field pH	pH Units	Hydrolab	NA
Specific Conductance	umhos/cm	Hydrolab	NA
Temperature	°C	Hydrolab	NA
Water Levels	ft	Water Level Meter	0.010 ft
Laboratory Analyses			
Nitrate	mg/l	EPA 353.2	0.05
Chloride	mg/l	EPA 325.2	1.0
Arsenic	mg/l	SM3030C/EPA 206.2	0.0010
Barium	mg/l	SM3030C/EPA 200.7	0.0050
Cadmium	mg/l	SM3030C/EPA 213.2	0.00010
Chromium	mg/l	SM3030C/EPA 218.2	0.0010
Copper	mg/l	SM3030C/EPA 220.2	0.0050
Iron	mg/l	SM3030C/EPA 200.7	0.010
Lead	mg/l	SM3030C/EPA 239.2	0.0020
Manganese	mg/l	SM3030C/EPA 200.7	0.0050
Mercury	mg/l	SM3030C/EPA 245.1	0.00010
Selenium	mg/l	SM3030C/EPA 270.2	0.0010
Silver	mg/l	SM3030C/EPA 272.2	0.00020
Zinc	mg/l	SM3030C/EPA 200.7	0.0050
Sulfate	mg/l	EPA 375.4	1.0
Fluoride	mg/l	EPA 340.2	0.10
TDS	mg/l	EPA 160.1	1.0
Volatile Organics	ug/l	EPA 624	2.0

Table 3. Sample Containers, Volumes, Preservatives and Holding Times.

PARAMETER	CONTAINERS	PRESERVATIVES	HOLDING TIMES
Insitu Parameters			
Field pH	Insitu	None	Analyze Immediately
Specific Conductance	Insitu	None	Analyze Immediately
Temperature	Insitu	None	Analyze Immediately
Laboratory Analyses			
Nitrate	500 ml HDPE	Cool 4°C	48 hrs
Chloride	500 ml HDPE	None Required	28 days
Arsenic	500 ml HDPE	pH<2 HNO_3	6 months
Barium	500 ml HDPE	pH<2 HNO_3	6 months
Cadmium	500 ml HDPE	pH<2 HNO_3	6 months
Chromium	500 ml HDPE	pH<2 HNO_3	6 months
Copper	500 ml HDPE	pH<2 HNO_3	6 months
Iron	500 ml HDPE	pH<2 HNO_3	6 months
Lead	500 ml HDPE	pH<2 HNO_3	6 months
Manganese	500 ml HDPE	pH<2 HNO_3	6 months
Mercury	500 ml HDPE	pH<2 HNO_3	6 months
Selenium	500 ml HDPE	pH<2 HNO_3	6 months
Silver	500 ml HDPE	pH<2 HNO_3	6 months
Zinc	500 ml HDPE	pH<2 HNO_3	6 months
Sulfate	500 ml HDPE	Cool 4°C	28 days
Fluoride	500 ml HDPE	pH<2 HNO_3	6 months
TDS	500 ml HDPE	Cool 4°C	7 days
Volatile Organics	40 ml Amber Glass	pH<2 HCL, 4°C, Zero Head Space	14 days

Duke Power Company
Groundwater Monitoring Program
Field Data Validation Checklist

Data Validation Item	Yes	No
1. Has the Ground Water Monitoring Data Sheets been reviewed for completeness ?		
2. Were all equipment blanks, field blanks and trip blanks properly prepared, identified and analyzed?		
3. Was the Field Sampling Calibration Form completed?; Was the equipment within procedure calibration limits?		
4. Was the Chain-of- Custody Record completed, with the analyses requested, the number of containers, preservatives added, dates, times and signatures of field personnel and lab personnel ?		

Comments:_____

_____

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_____ _____
Project Scientist Signature

Appendix B

Engineering Drawings

Drawings

M-10	Revision 1
M-10A	Revision 0