USGS
science for a changing world

TOXIC-SUBSTANCES HYDROLOGY PROGRAM

CAPE COD SITE

at the

MASSACHUSETTS MILITARY RESERVATION

Field Trip for the
Massachusetts Institute of Technology
Dept. of Civil and Environmental Engineering

October 2, 2004

Trip Leader: Denis LeBlanc

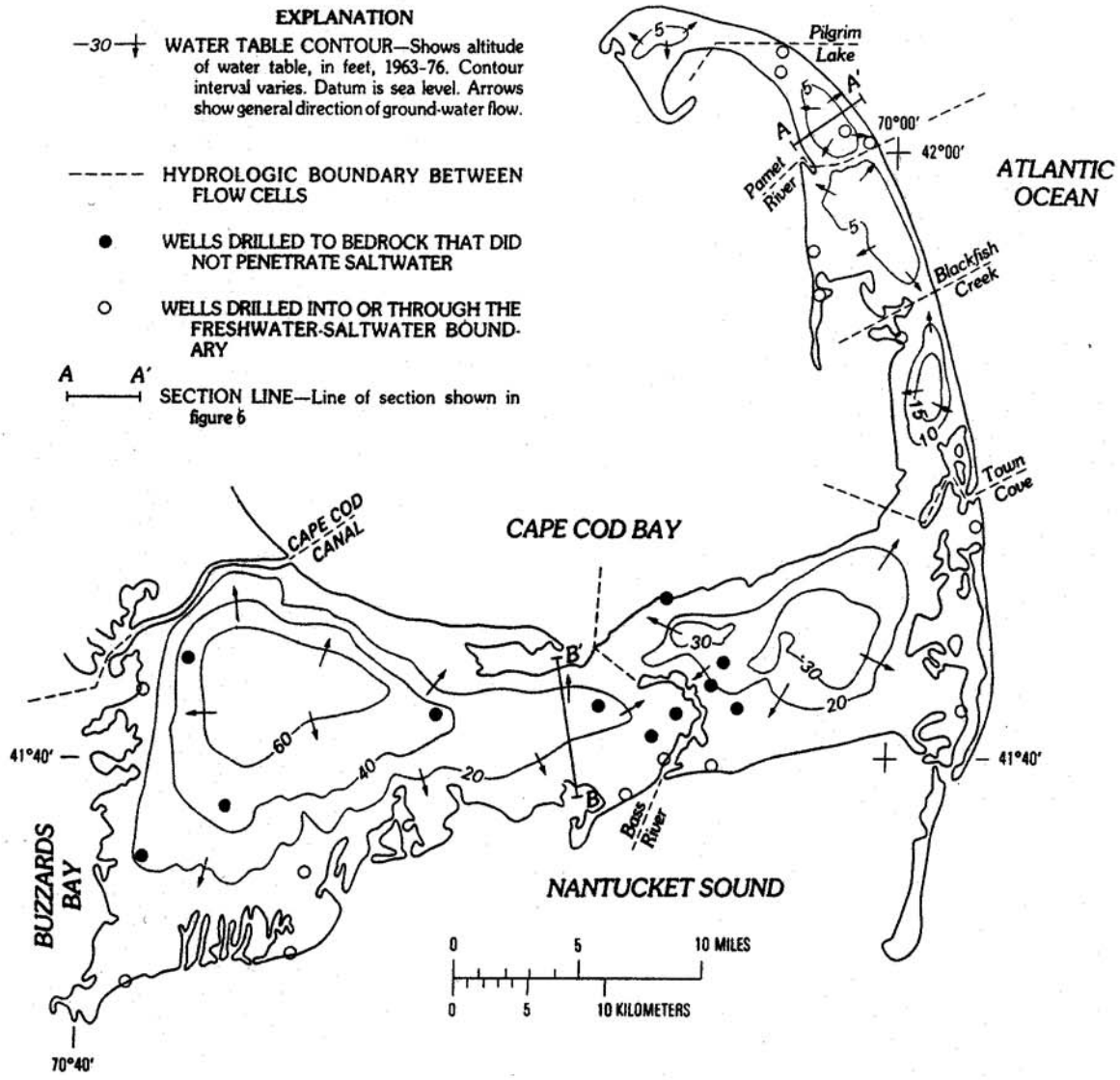
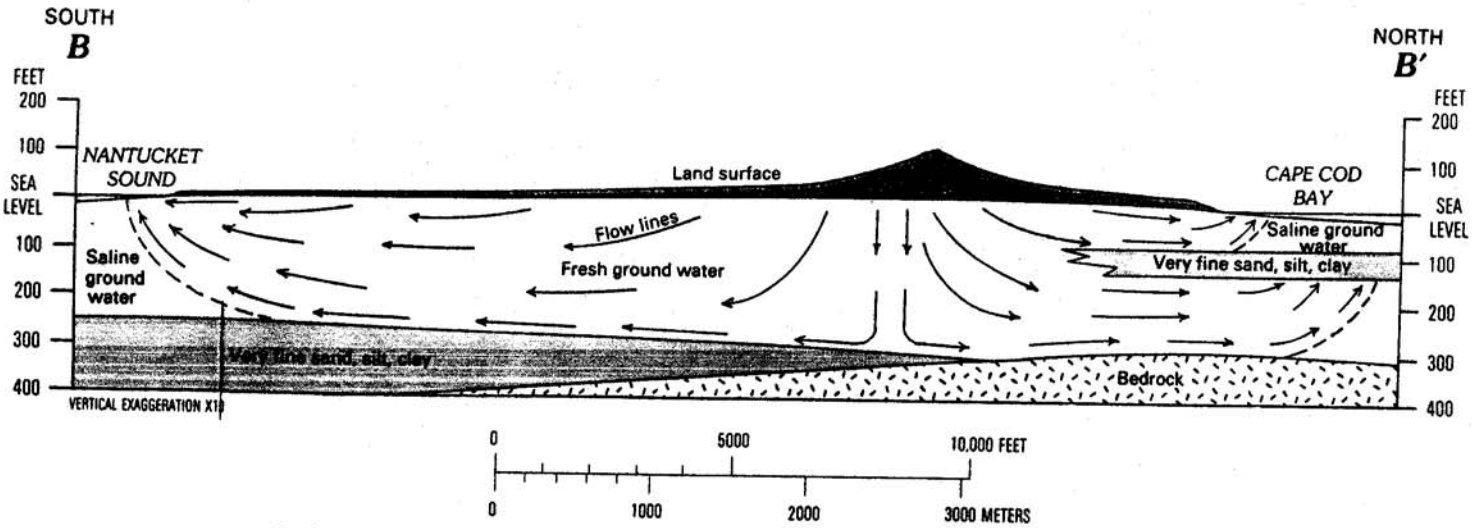


***Figure 5.*—Six ground-water flow cells and general directions of flow.**

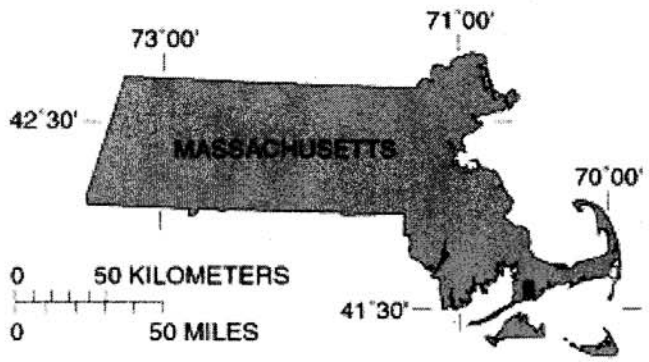
From LeBlanc and others, 1986, U.S. Geological Survey Hydrologic Investigations Atlas HA-692



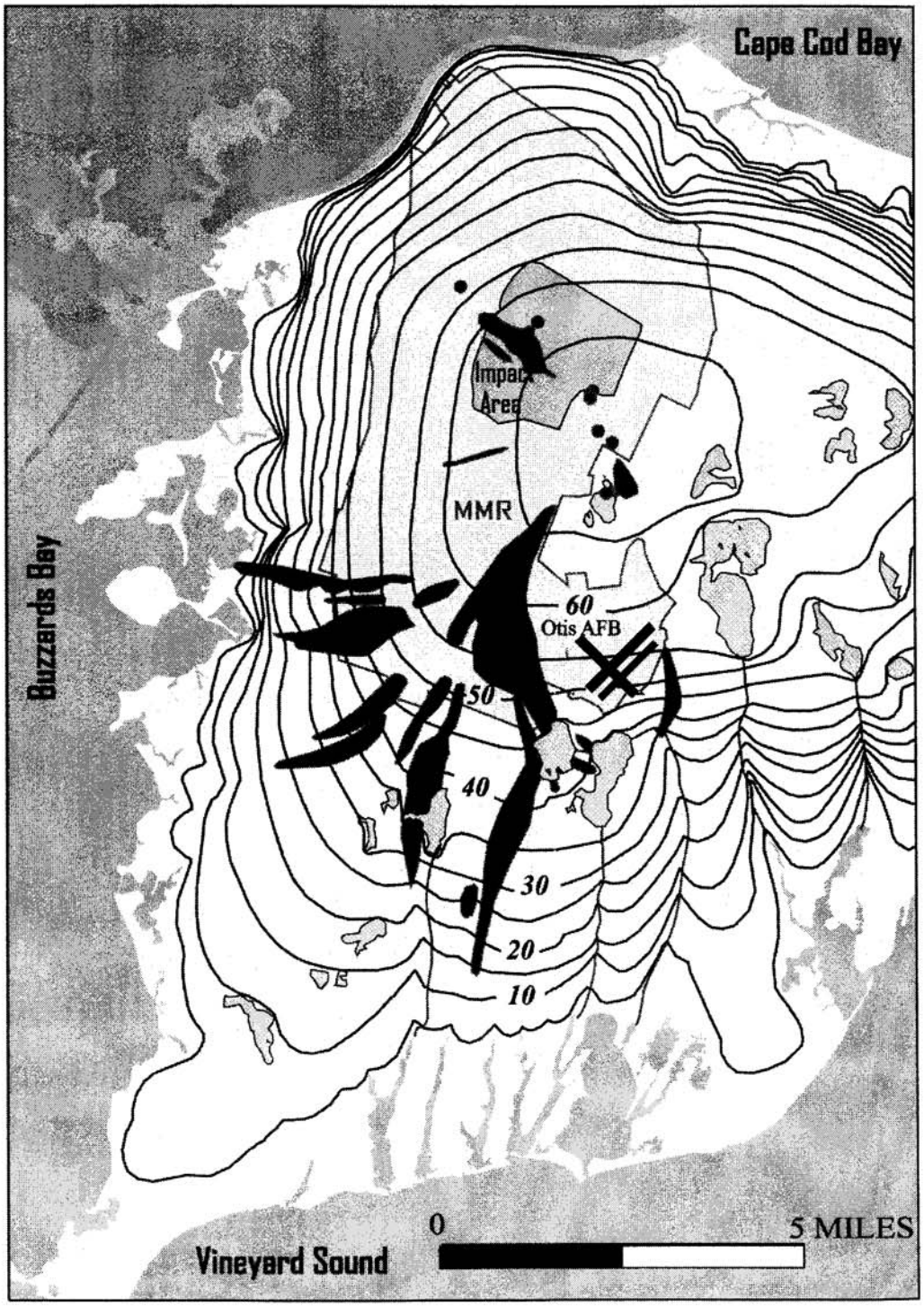
B. Section through Barnstable-Yarmouth area. Representative of inner and mid-Cape. Freshwater lens truncated by bedrock and fine-grained sediments. Silt and clay confining beds along Cape Cod Bay displace the freshwater-saltwater boundary offshore.

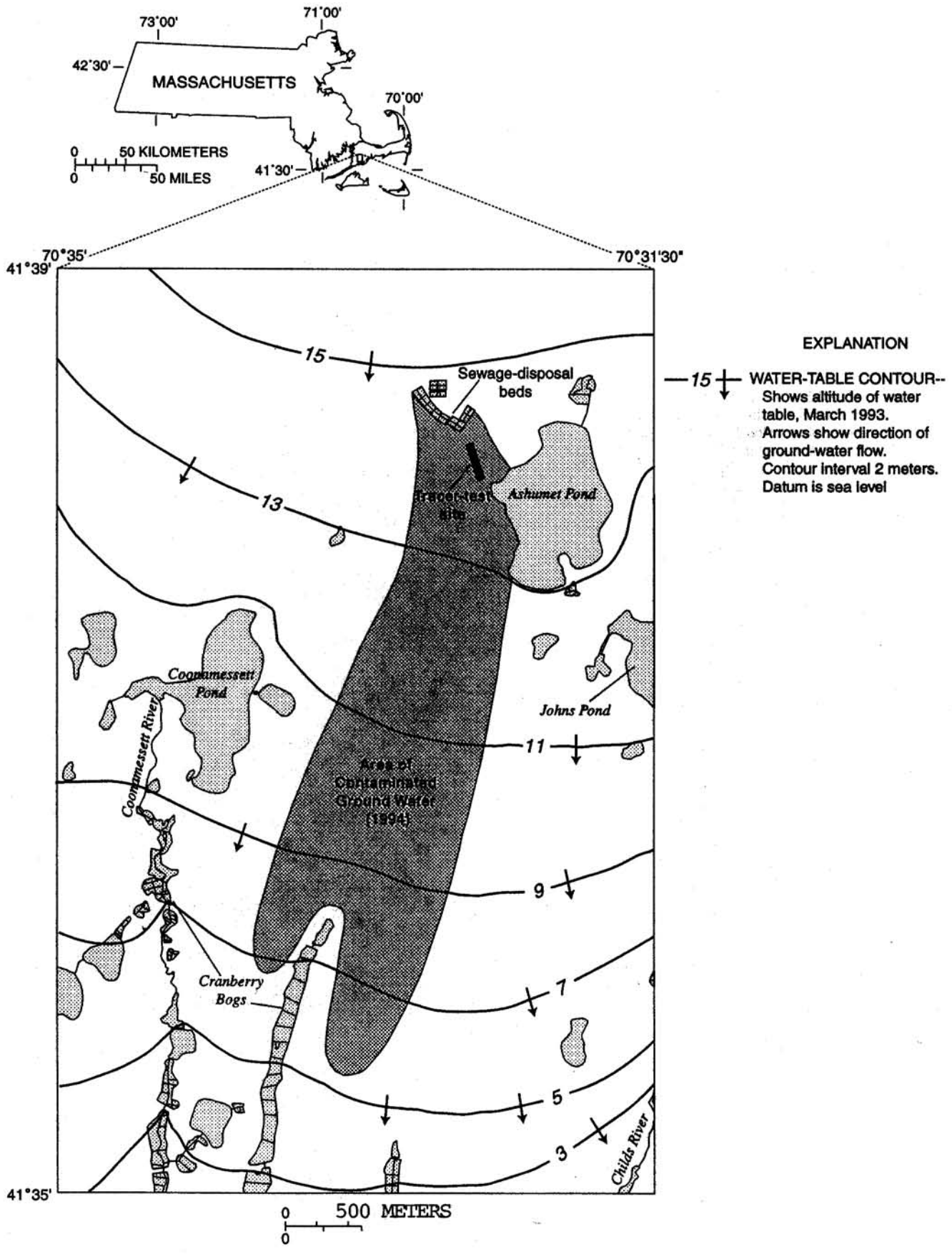
From LeBlanc and others, 1986, U.S. Geological Survey Hydrologic Investigations Atlas HA-692

MMR Plumes
June 2001



Source of data:
MMR Joint Program Office




73°00'
71°00'
42°30'
MASSACHUSETTS
70°00'
0 50 KILOMETERS
0 50 MILES
41°30'
70°35'
70°31'30"
41°39'
15
13
11
9
7
5
3
Sewage-disposal beds
Trench-test site
Ashumet Pond
Coonamessett Pond
Coonamessett River
Johns Pond
Area of Contaminated Ground Water (1994)
Cranberry Bogs
Childs River
41°35'
0 500 METERS
0
EXPLANATION
15
WATER-TABLE CONTOUR--
Shows altitude of water table, March 1993.
Arrows show direction of ground-water flow.
Contour interval 2 meters.
Datum is sea level

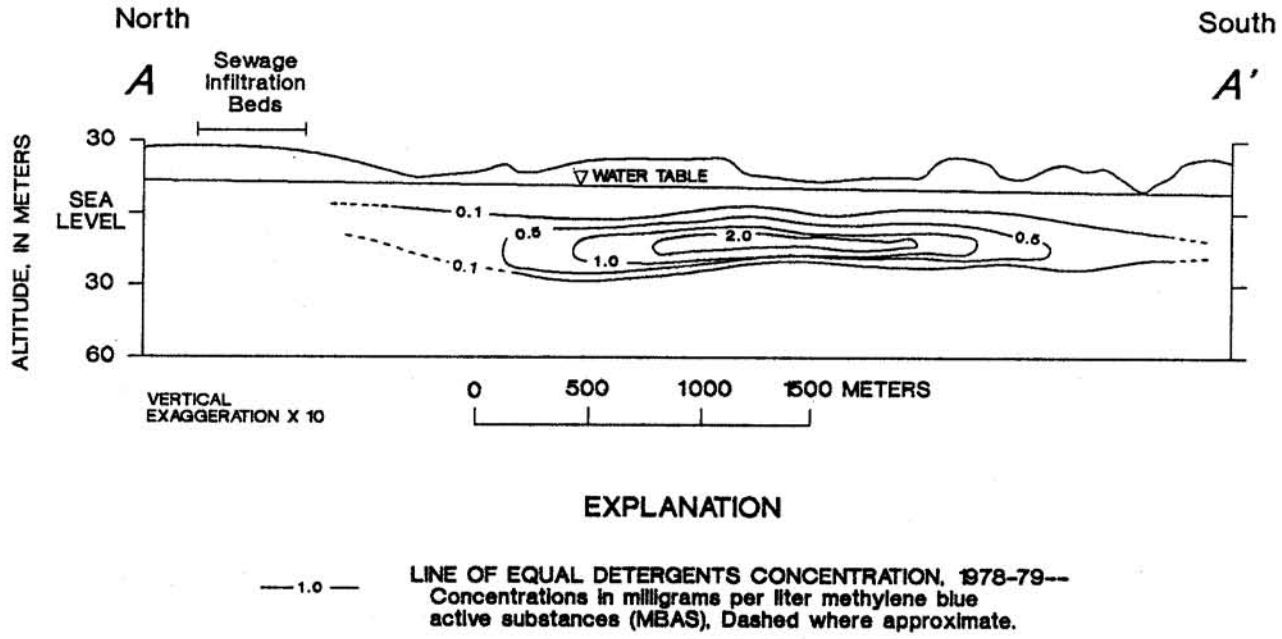
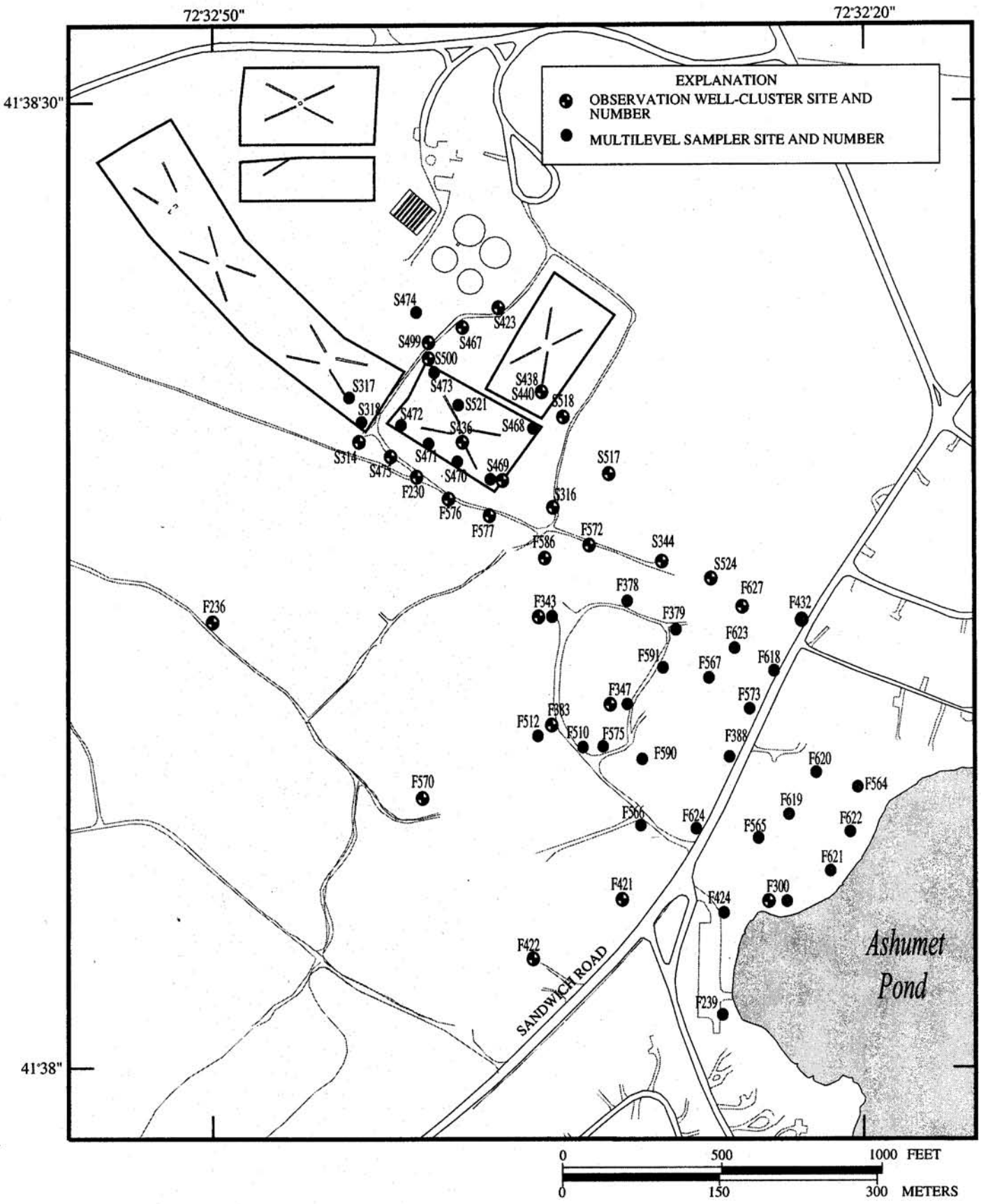


Fig. 14. Vertical distribution of detergents in sewage plume. Line of section shown in Figure 1 (from LeBlanc, 1984a).



Path: \\Sun5dmamrl\home\otis\Sampling Maps

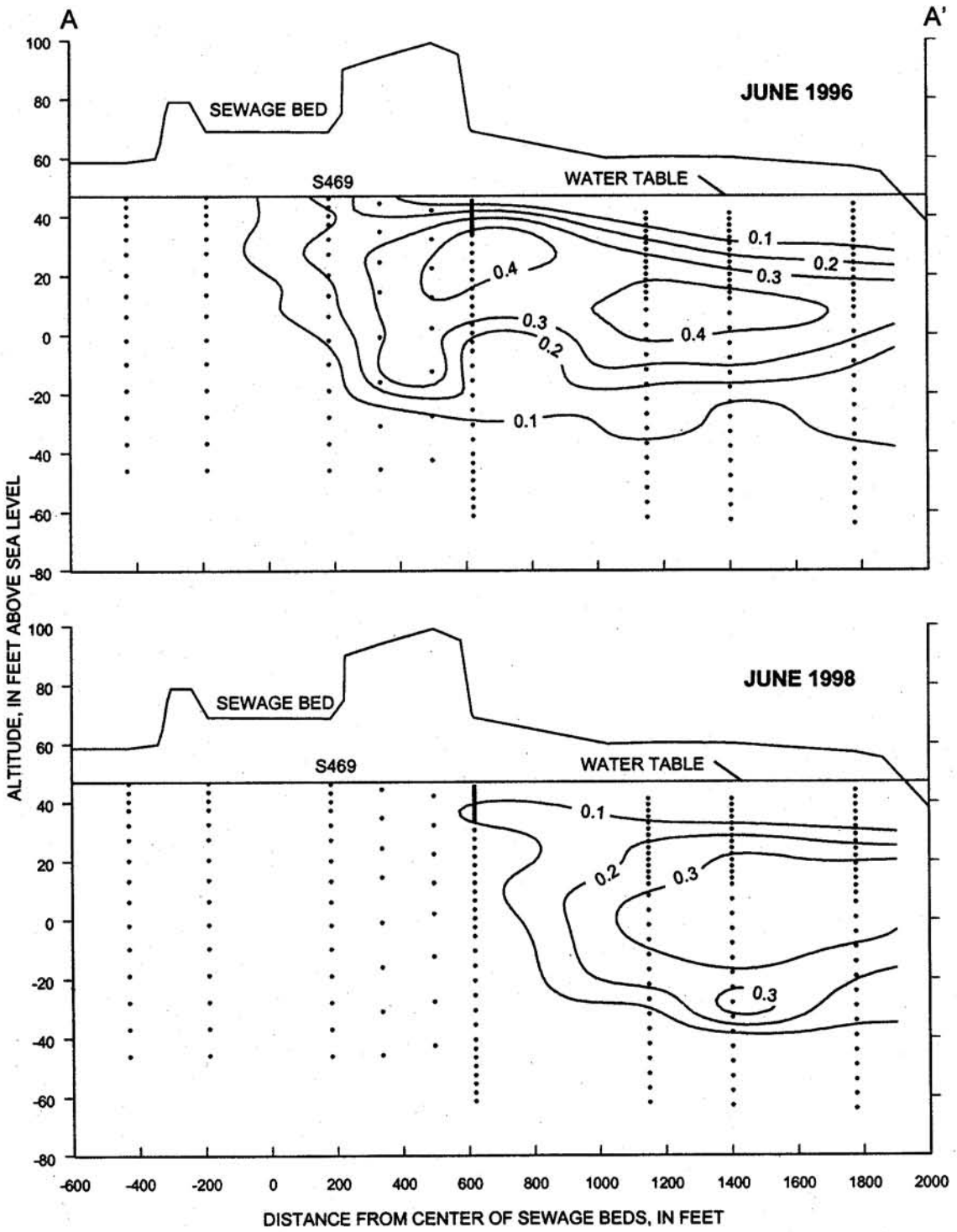


Figure 5. Longitudinal sections showing the distribution of boron concentrations between the sewage-disposal beds and Ashumet Pond, western Cape Cod, Massachusetts, June 1996 and June 1998. Lines of equal concentration in milligrams per liter. Dots show positions of well screens and multilevel-sampler ports. Location of section line shown in figure 2.

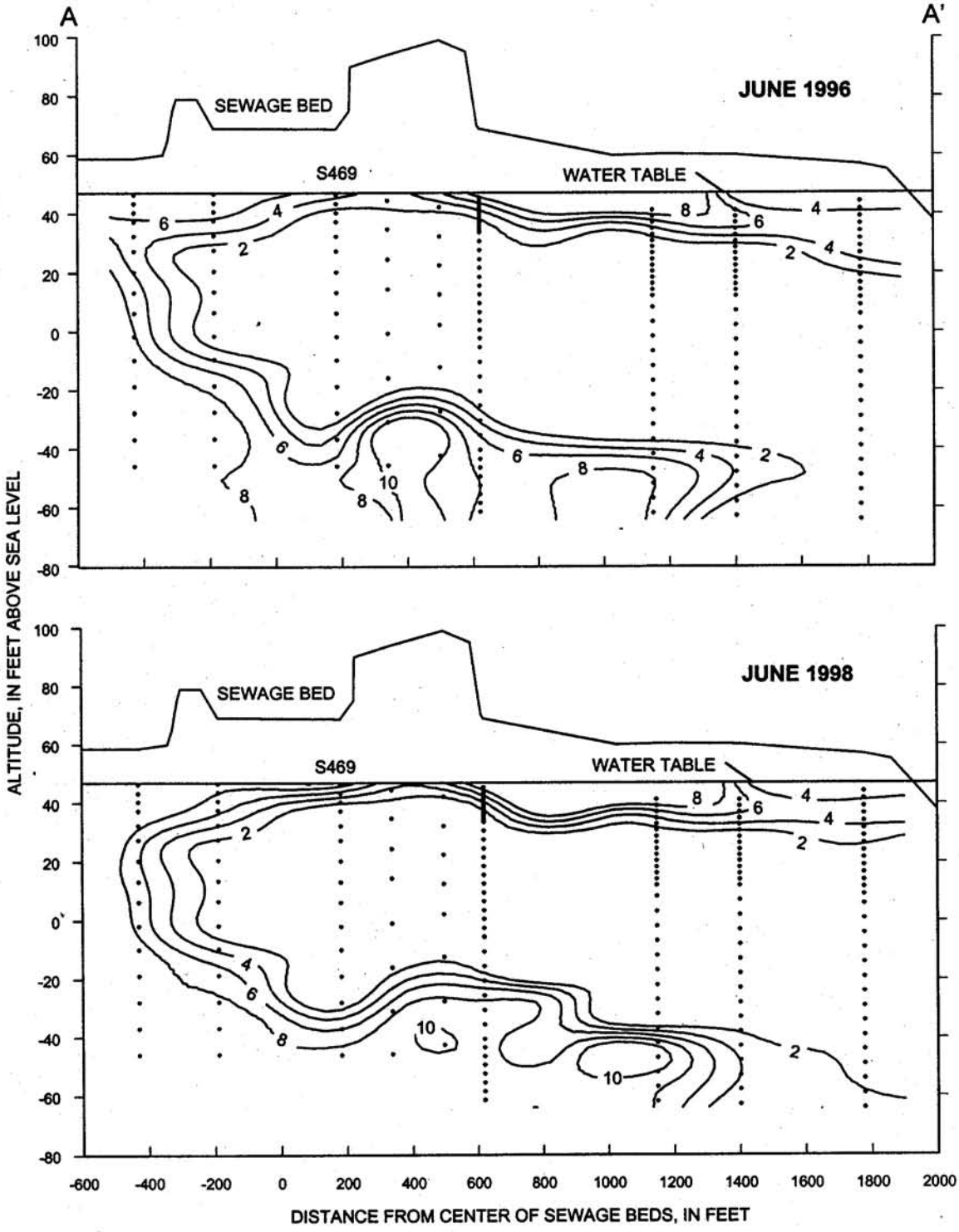
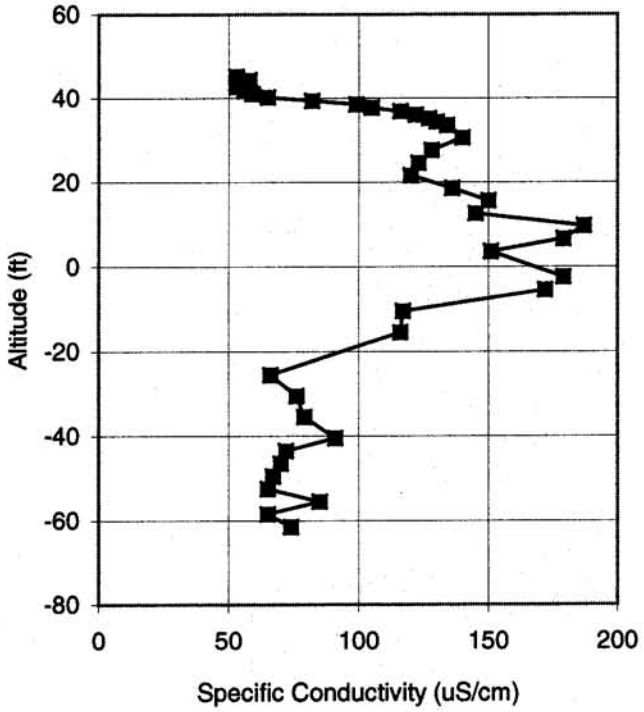
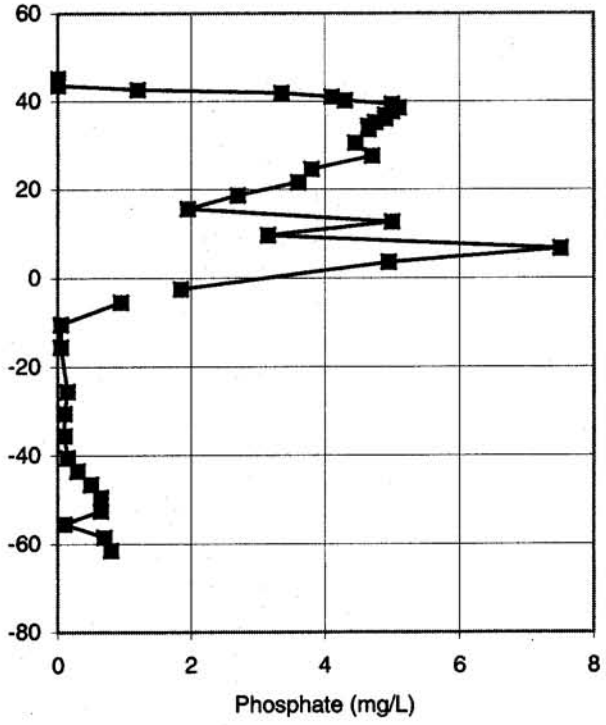
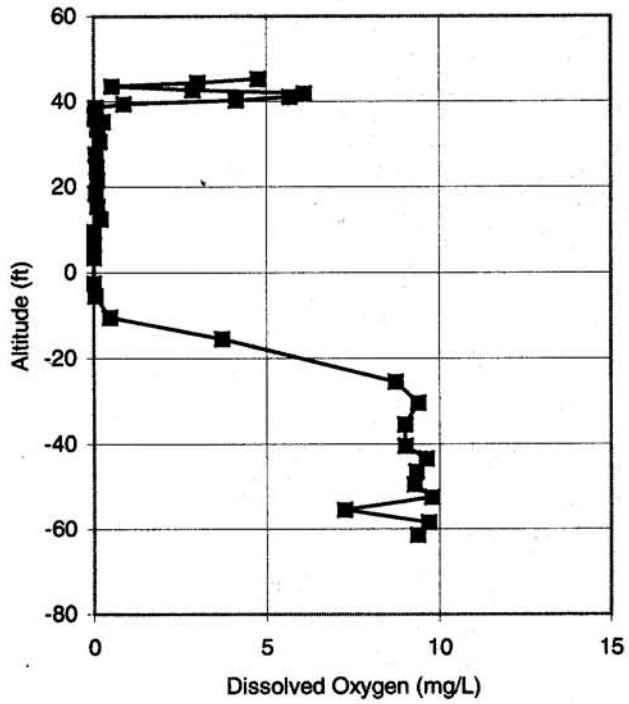


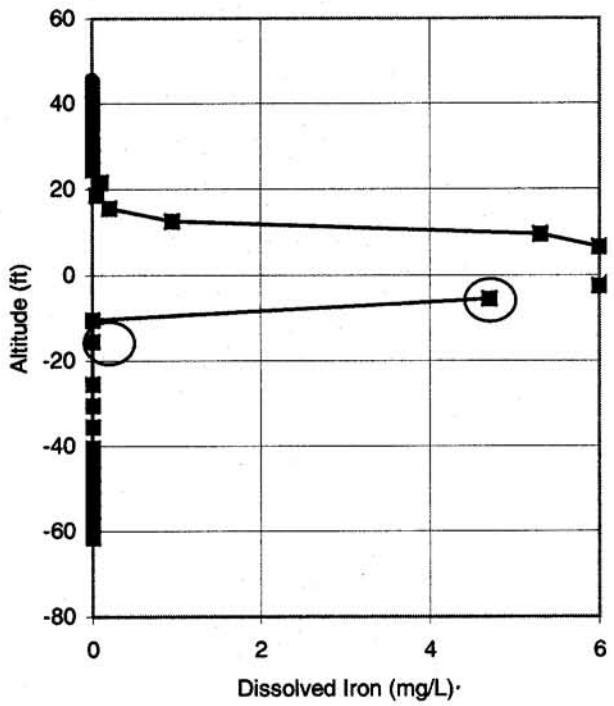
Figure 6. Longitudinal sections showing the distribution of dissolved-oxygen concentrations between the sewage-disposal beds and Ashumet Pond, western Cape Cod, Massachusetts, June 1996 and June 1998. Lines of equal concentration in milligrams per liter. Dots show positions of well screens and multilevel-sampler ports. Location of section line shown in figure 2.

F343 August 23, 2004

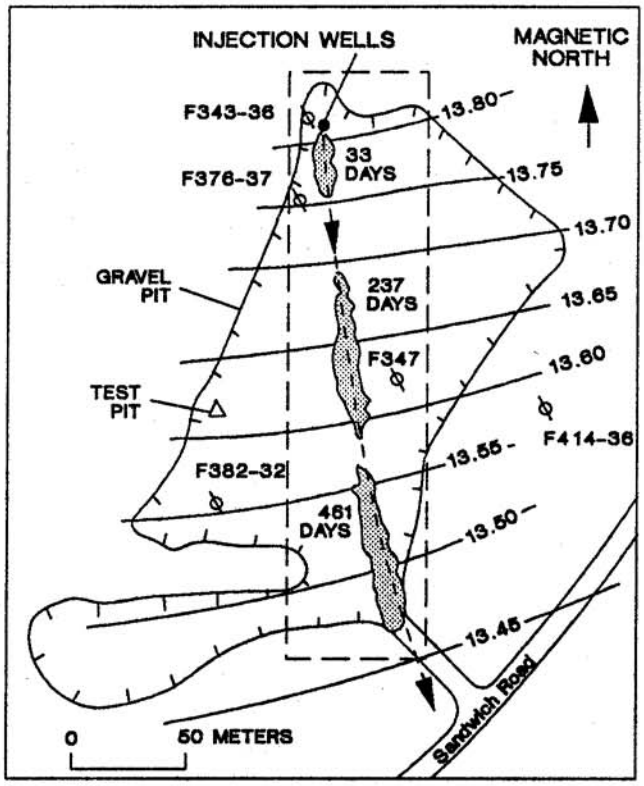








MAP VIEW OF BROMIDE TRACER CLOUD DURING 1985-88 LARGE-SCALE NATURAL-GRADIENT TRACER TEST, CAPE COD, MASSACHUSETTS



EXPLANATION

AREA OF TRACER CLOUD IN WHICH BROMIDE CONCENTRATIONS EXCEEDED 1 MILLIGRAM PER LITER

AREA OF MULTILEVEL SAMPLER ARRAY -- Shows area in figures 8 and 10.

—13.45— WATER-TABLE CONTOUR, AUGUST 2, 1985 -- Shows altitude of water table. Contour interval .05 meters. Datum is sea level.

PREDICTED PATH OF TRACER CLOUD

MONITORING WELLS

Fig. 4. Tracer-test site in abandoned gravel pit, showing water table, location of selected monitoring sites, and predicted and observed path of bromide tracer cloud. Water-table map from Garabedian et al. (1988). Site of test pit in Figure 3 shown by triangle. Only monitoring wells referred to in this report are shown.

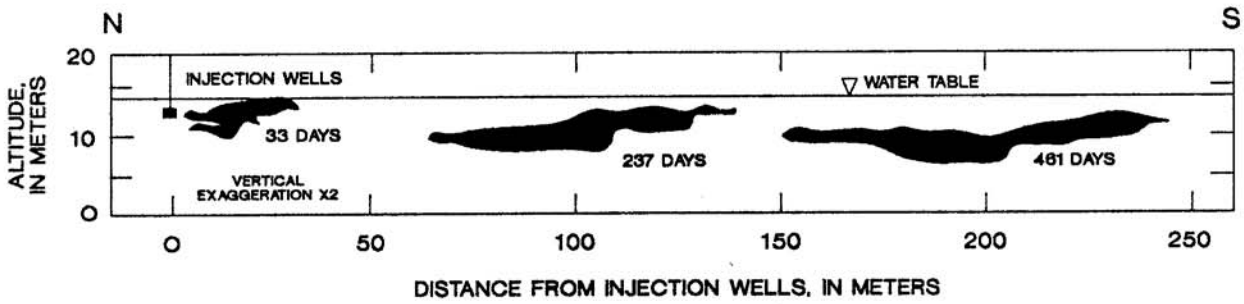
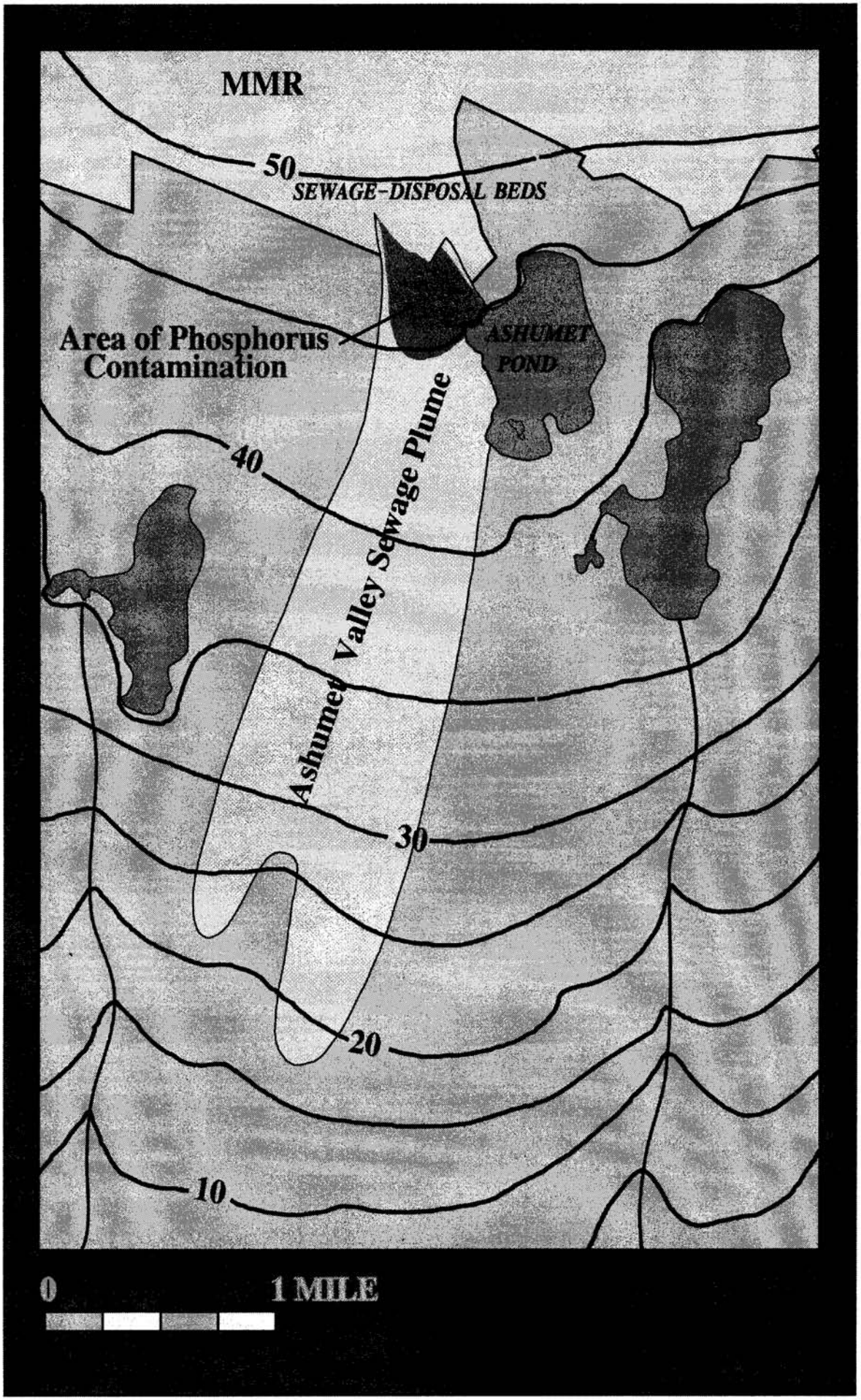
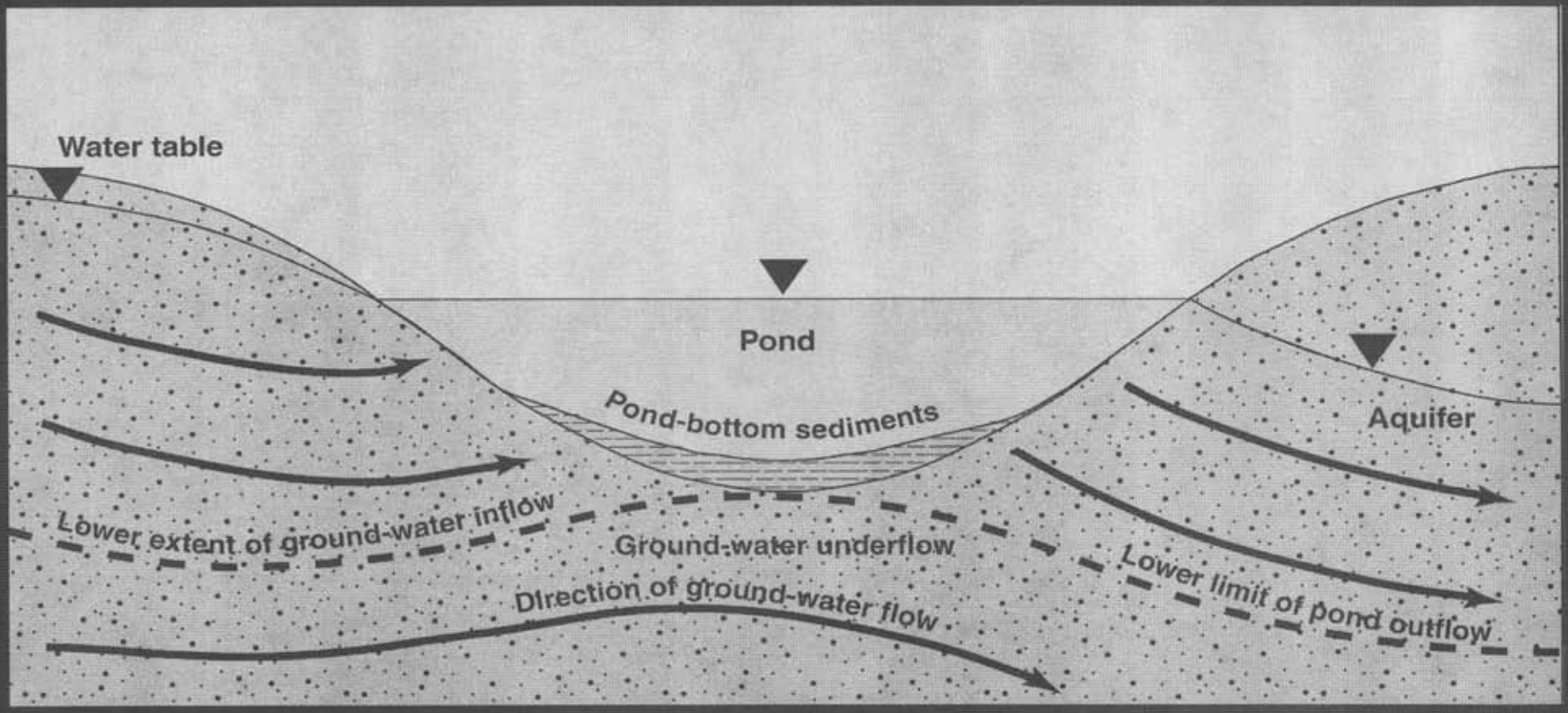


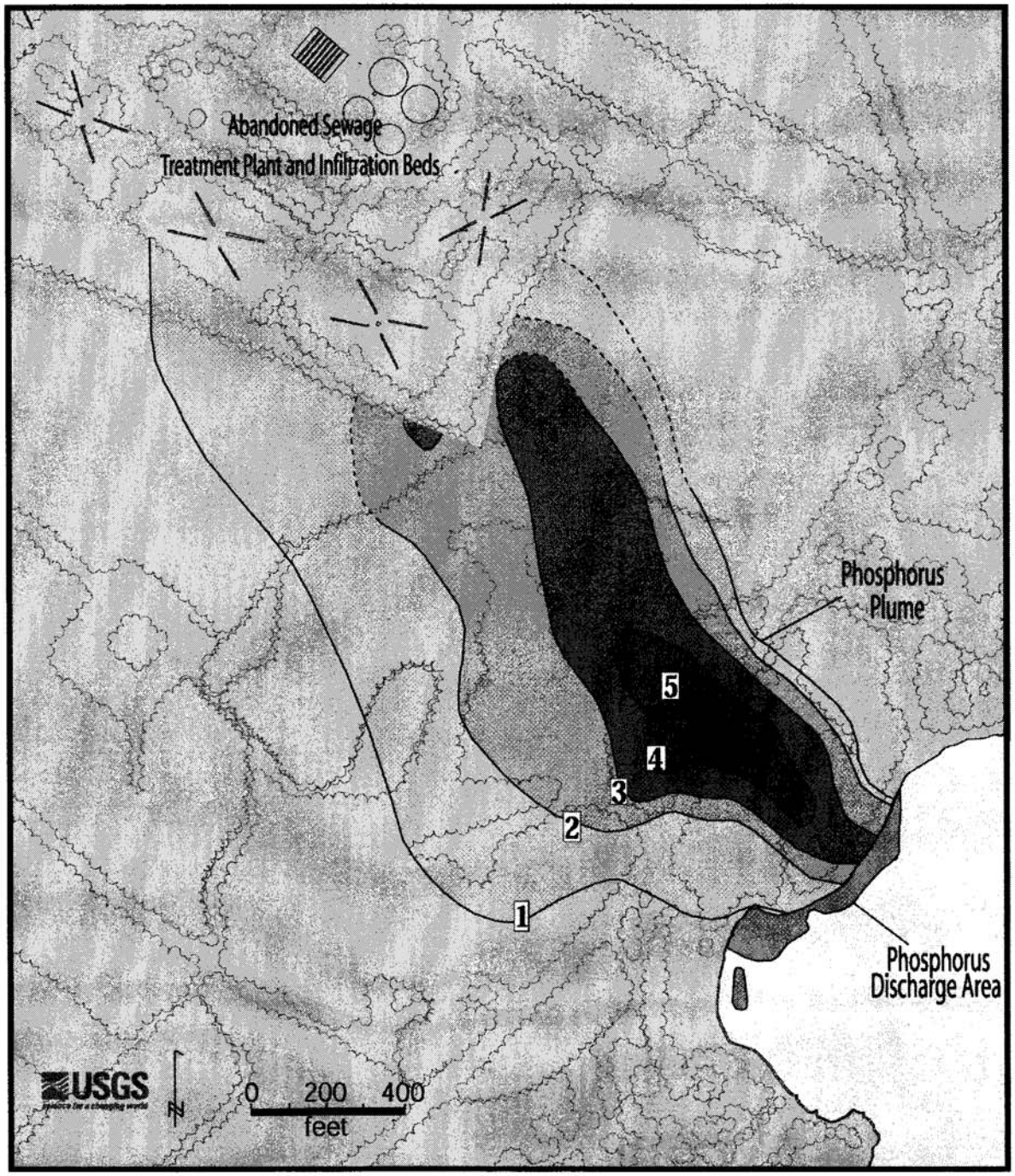
Fig. 11. Vertical location of bromide tracer cloud at 33, 237, and 461 days after injection. Cloud locations defined by zones in which bromide concentration exceeded 1 mg/L. Line of section approximately along A-A' in Figure 9.


MMR
50
SEWAGE-DISPOSAL BEDS
Area of Phosphorus Contamination
ASHUMET POND
40
Ashumet Valley Sewage Plume
30
20
10
0
1 MILE

Ground-Water Flow-Through Ponds



USGS

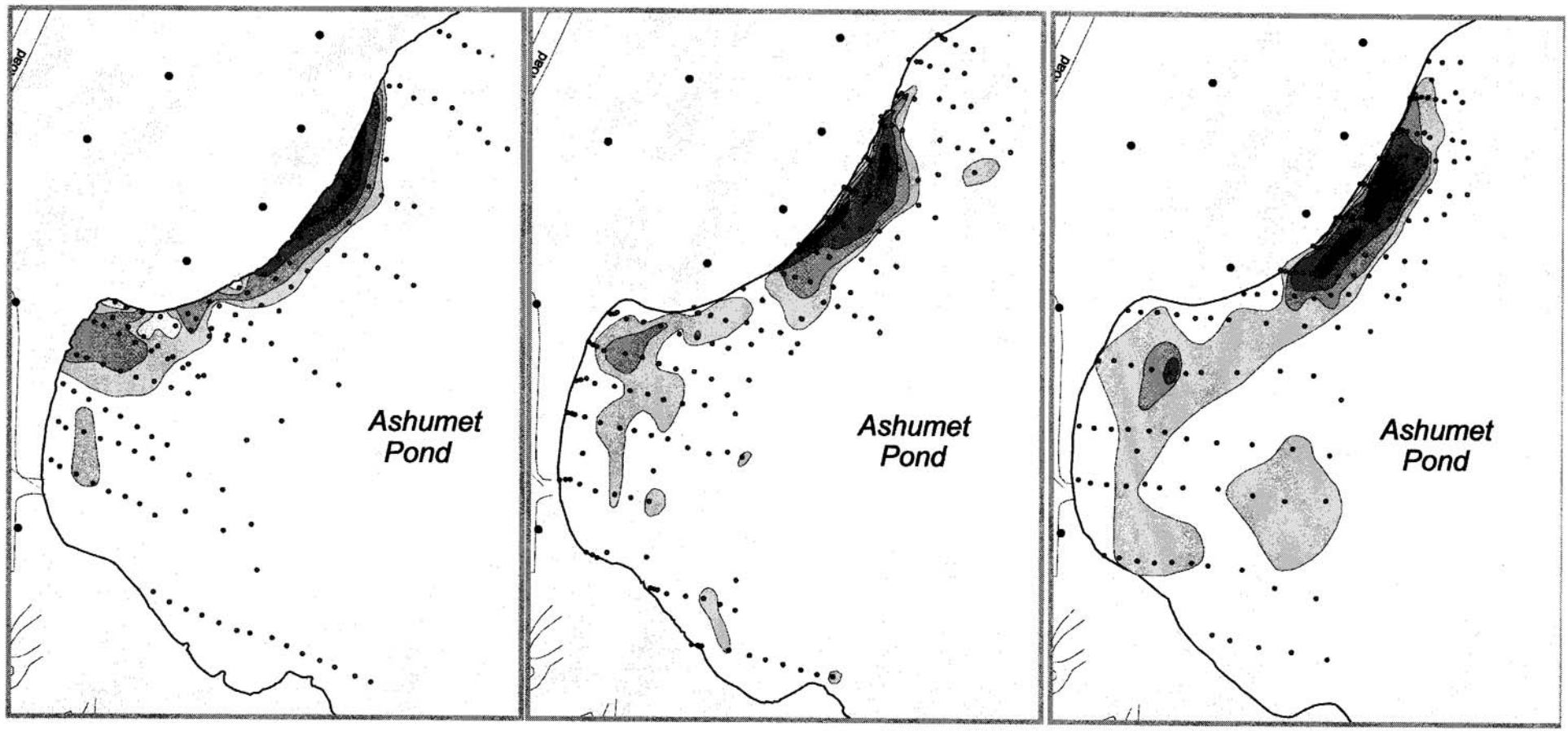


Phosphorus Plume And Discharge Area

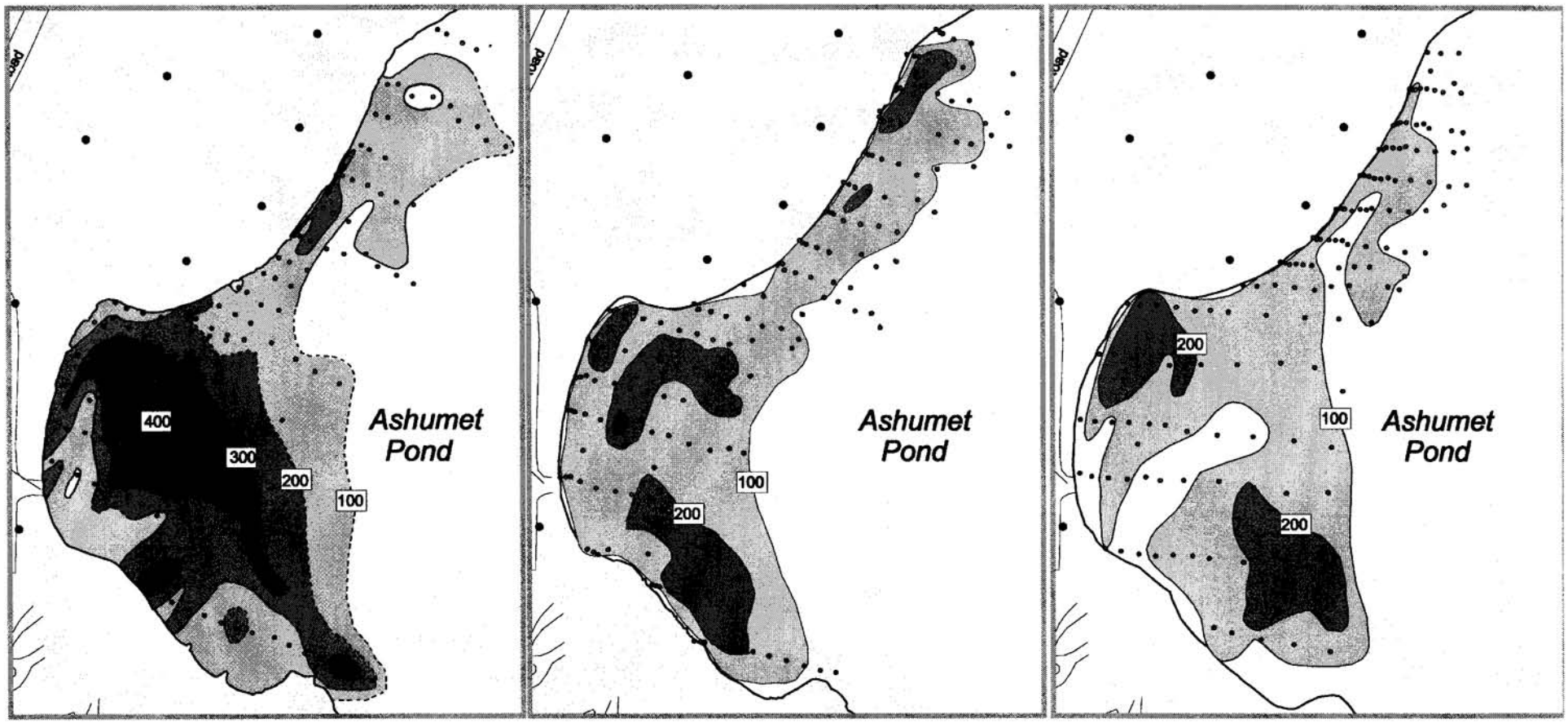
1999

P in mg/L

PHOSPHORUS (mg/L as P)



SPECIFIC CONDUCTANCE (µS/cm)



August 1999 September 2001 June 2003

100-200 200-300 300-400 >400 µS/cm

0 250 500 FEET
0 50 100 METERS

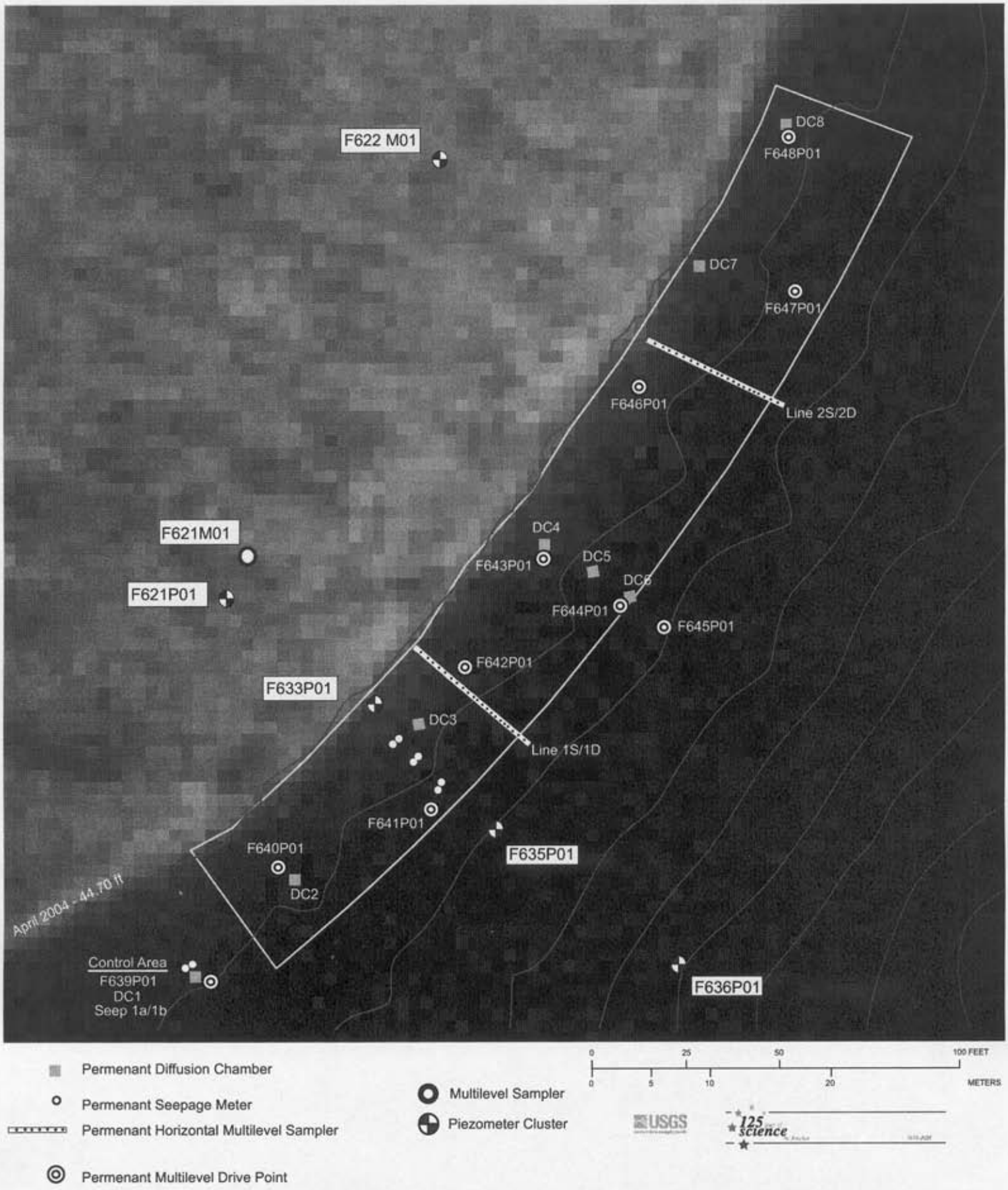
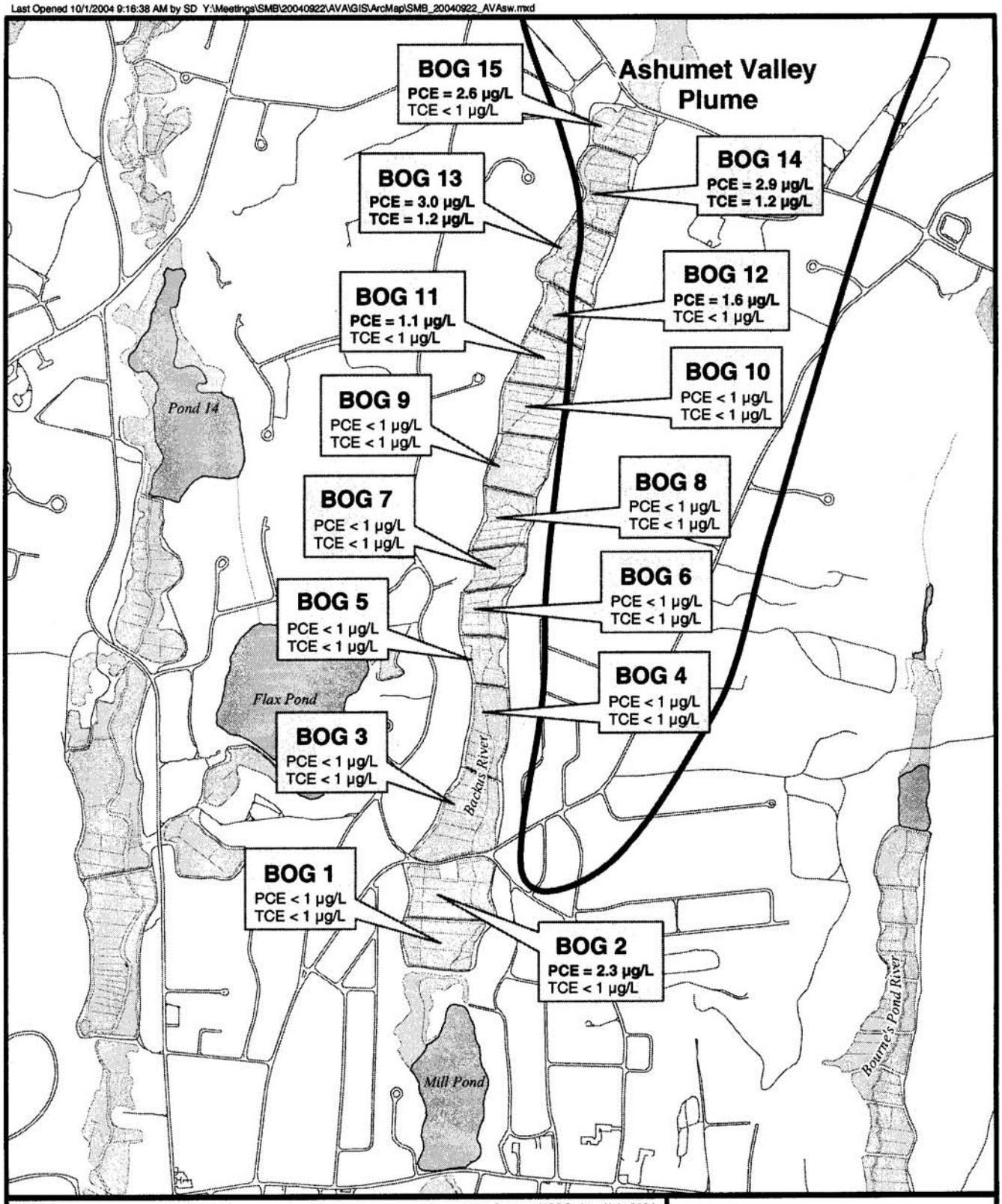


Figure 5. Final locations of permanent seepage meters, multilevel drive points, horizontal multilevel samplers, and diffusion chambers. (Total seepage locations = 4, total multilevel drive points = 8, total MLS lines = 2 (coupled), total diffusion chamber locations = 8).



Legend

Plume Boundary

Bog

Note: Samples collected by USGS. Analyses performed by USEPA.

Data Source: USGS, June/July 2004

N

0 530 1,060 Feet

FIGURE 2

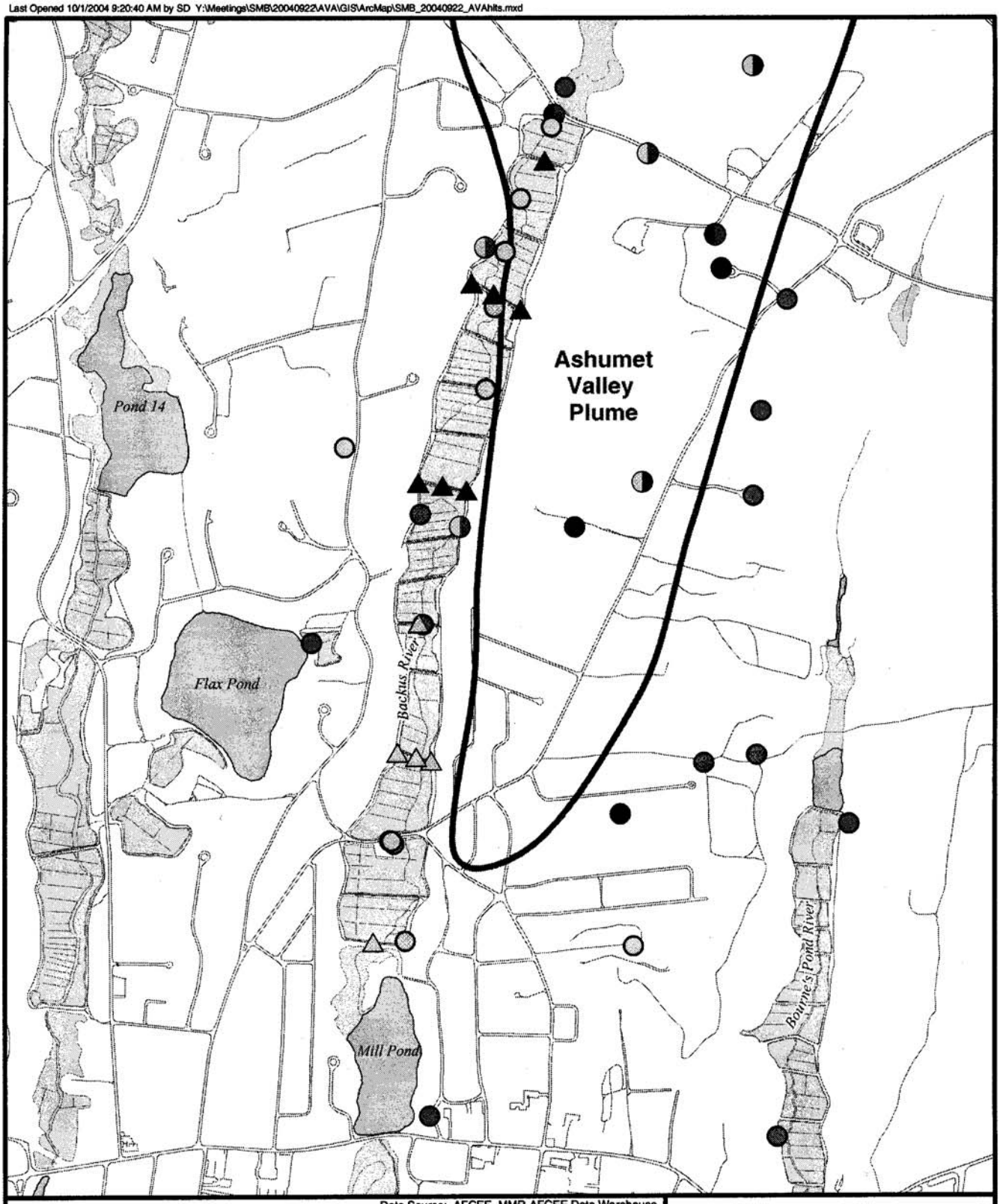
BACKUS RIVER SURFACE WATER SAMPLING RESULTS

AFCEE - Massachusetts Military Reservation

September 2004 SMB Meeting

CH2MHILL

Last Opened 10/1/2004 9:20:40 AM by SD Y:\Meetings\SMB\20040922\AVA\GIS\ArcMap\SMB_20040922_AVAhits.mxd



Data Source: AFCEE, MMR-AFCEE Data Warehouse

Legend

- Plume Boundary
- Bog

USGS Direct Push Groundwater Samples:

- Detection Above MCL
- Detection Below MCL

AFCEE Direct Push Goundwater Samples:

- Detection Above MCL
- Detection Below MCL
- No Detection

N

0 580 1,160 Feet

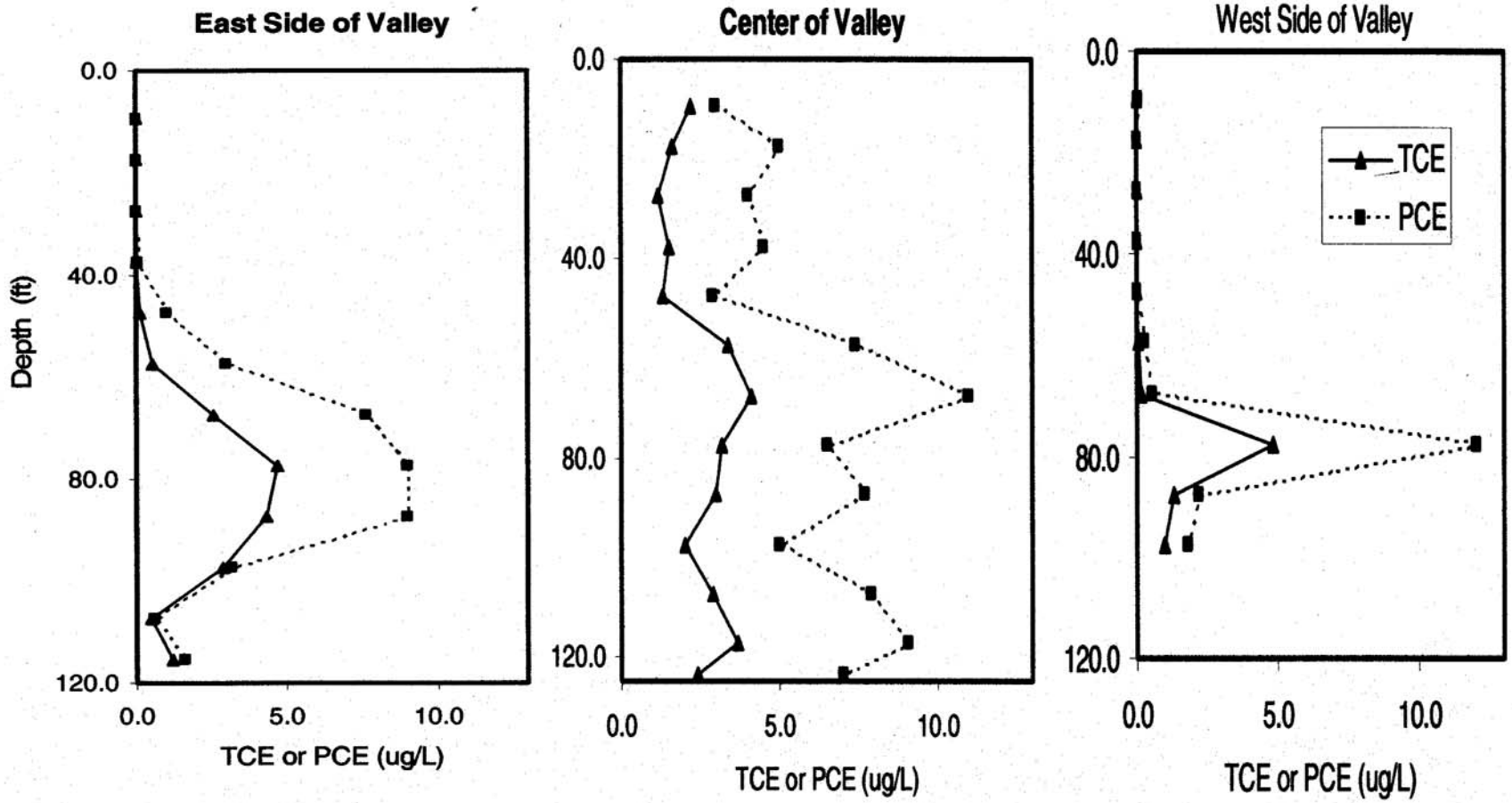
FIGURE 1

ASHUMET VALLEY AXIAL LEADING EDGE HITS MAP

AFCEE - Massachusetts Military Reservation

September 2004 SMB Meeting

CH2MHILL


East Side of Valley
Center of Valley
West Side of Valley
Depth (ft)
0.0
40.0
80.0
120.0
0.0
5.0
10.0
TCE or PCE (ug/L)
TCE
PCE