Dialysis sampler evaluation of groundwater-surface water interactions

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Outline

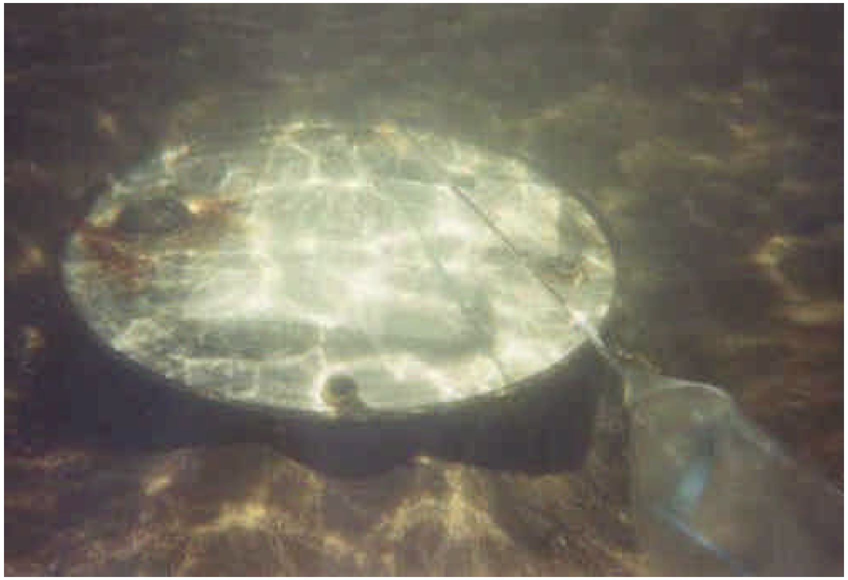
- Tools for assessing groundwater/surface water interface
- Case study: Marvin Jonas Transfer Station, NJ
- Treatment opportunities at the interface
- Case study: 22nd Street Landfill, Aberdeen Proving Ground, Maryland

Groundwater-surface water interface

- VOCs commonly discharge to surface water bodies and wetlands
- Identifying the location and nature of the discharge is a common problem
- Scale of the changes in biogeochemical conditions changes rapidly as the groundwater-surface water interface is approached

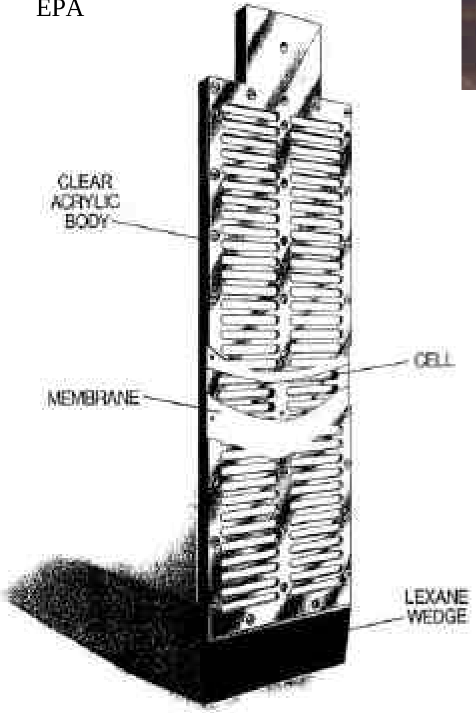
Tools for identification of groundwater discharge zones

- Nested piezometers
- Dialysis samplers
- Passive vapor samplers
- Seepage meters
- Thermal imagery



UC-Davis

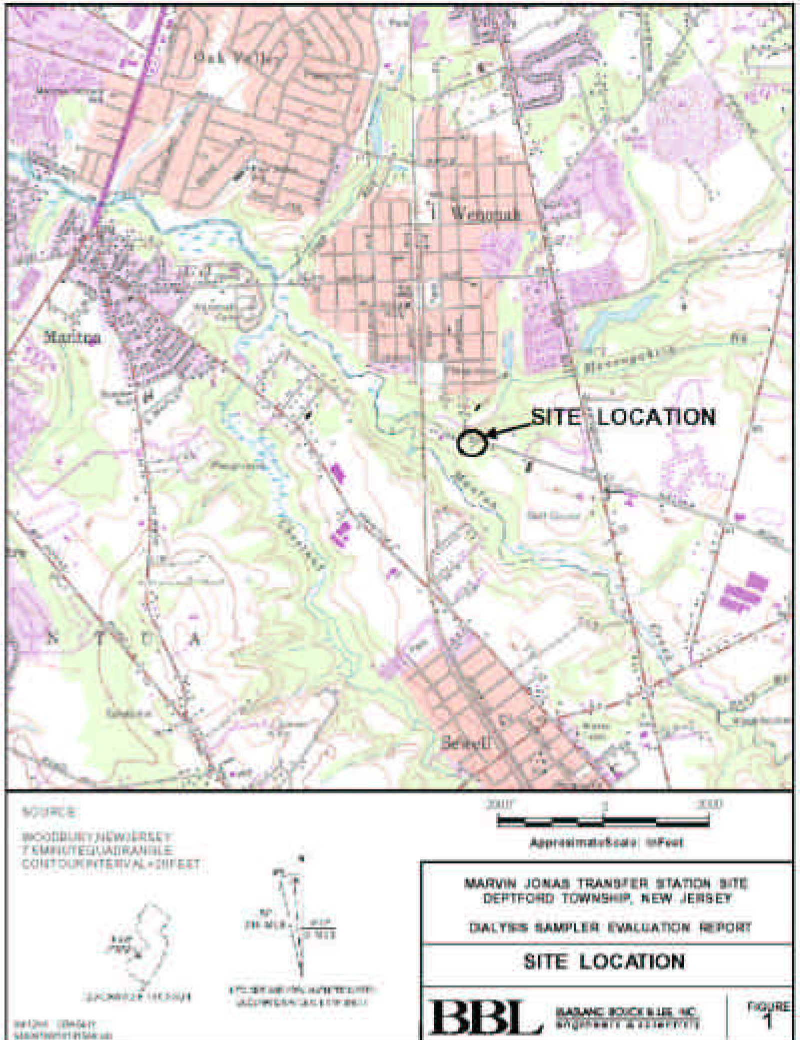
EPA

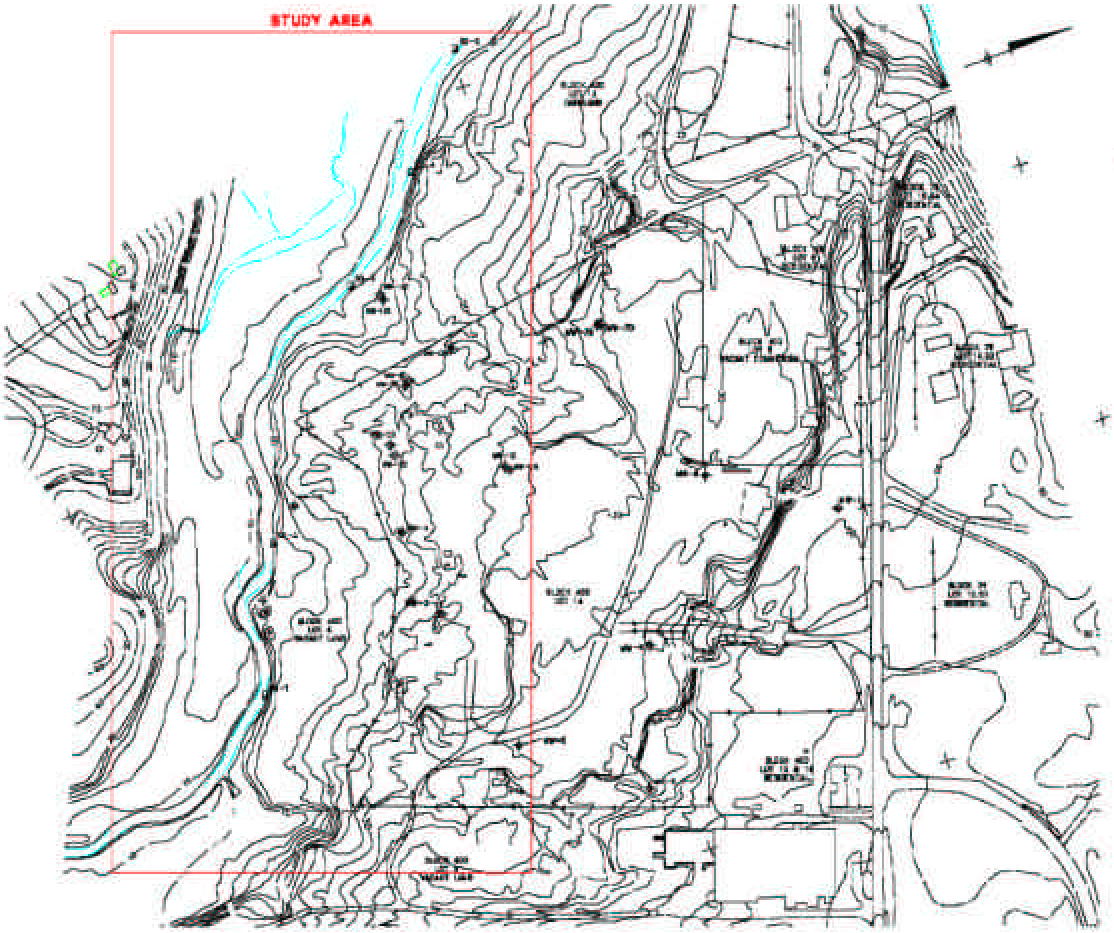


USGS

Marvin Jonas Transfer Station,NJ

- Site adjacent to small creek (Mantua Creek) in Wenonah, NJ
  - Solvent/waste reprocessing facility
  - COCs primarily chlorinated solvents and BTEX
- Natural attenuation remedy pursued
  - Circumstantial evidence that Mantua Creek is discharge point for VOCs. However, all stream grab samples non-detect for VOCs.
  - Direct evidence required to demonstrate that stream is not impacted


Oak Valley
Wenonah
Mantua
Sewell
SITE LOCATION
SOURCE:
WOODBURY, NEW JERSEY
7.5 MINUTE QUADRANGLE
CONTOUR INTERVAL = 20 FEET
2000'
0
2000'
Approximate Scale: In Feet
MARVIN JONAS TRANSFER STATION SITE
DEPTFORD TOWNSHIP, NEW JERSEY
DIALYSIS SAMPLER EVALUATION REPORT
SITE LOCATION
BBL
BLASLAND, BOUCK & LEE, INC.
engineers & scientists
FIGURE
1



LEGEND

- SHALLOW MONITORING WELL
- DEEP MONITORING WELL
- STREAM GAUGE
- STUDY AREA BOUNDARY

MARVIN JONAS TRANSFER STATION SITE
DEPTFORD TOWNSHIP, NEW JERSEY
DIALYSIS SAMPLER EVALUATION REPORT

STUDY AREA

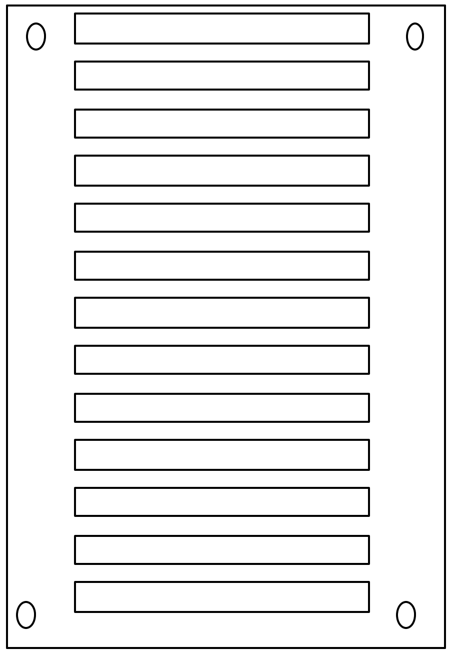
BBL BLASLAND, BOUCK & LEE, INC. engineers & scientists

FIGURE 2

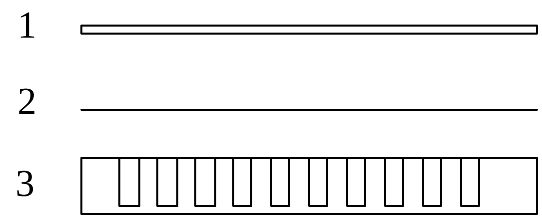
MJTS dialysis sampler sampling

- Objective: identify location of groundwater discharge and directly measure porewater concentrations of VOCs
  - 34 samplers utilized at 25’ increments along stream
  - Samplers approximately 18” long and inserted until 3 of the dialysis cells were above the sediment-water interface
  - High resolution at the groundwater-sediment interface needed
  - Dynamic sediment environment expected and observed
- Retrieved 2 weeks following insertion and selected cells sampled

Top View



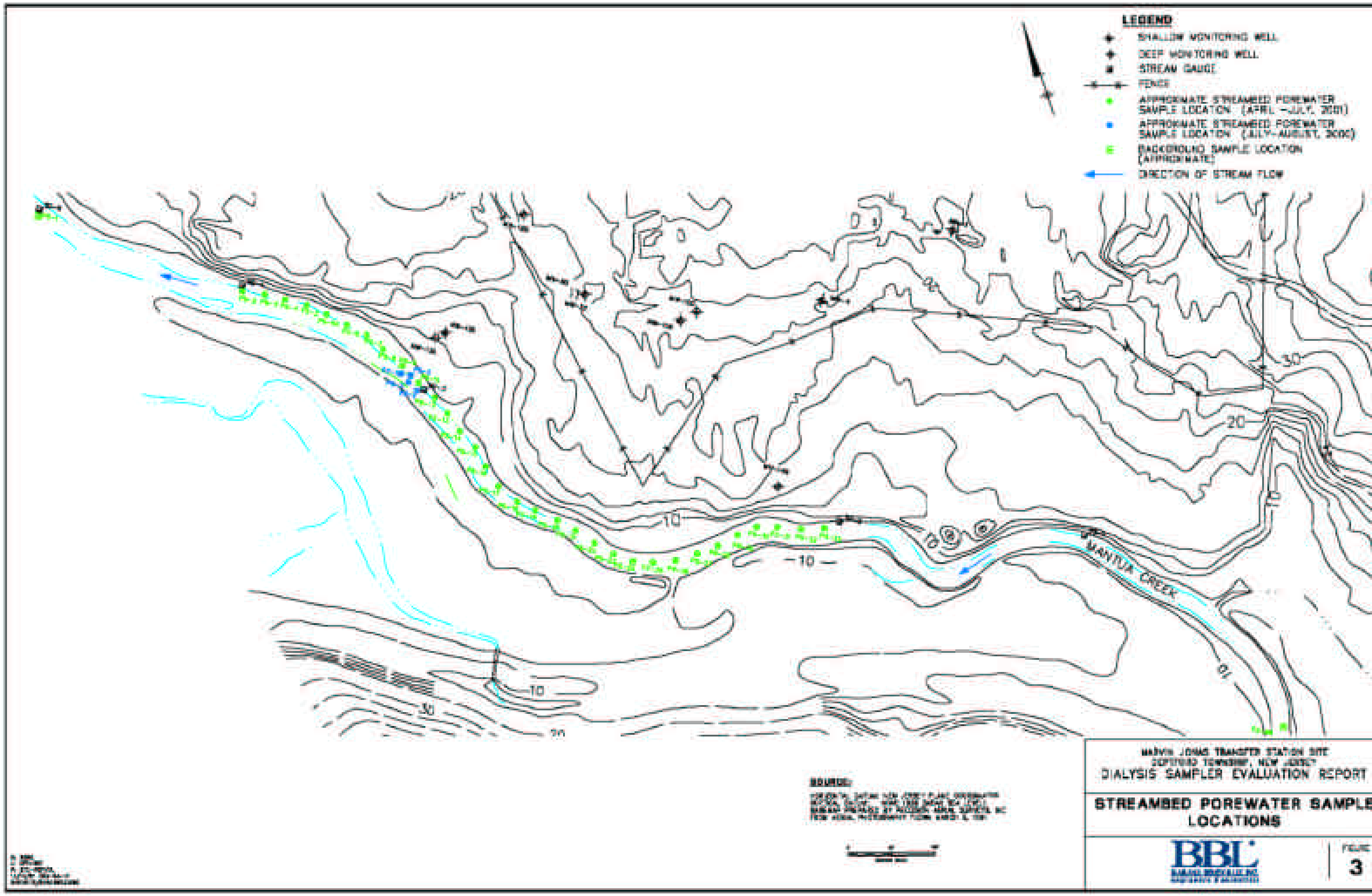
Side View

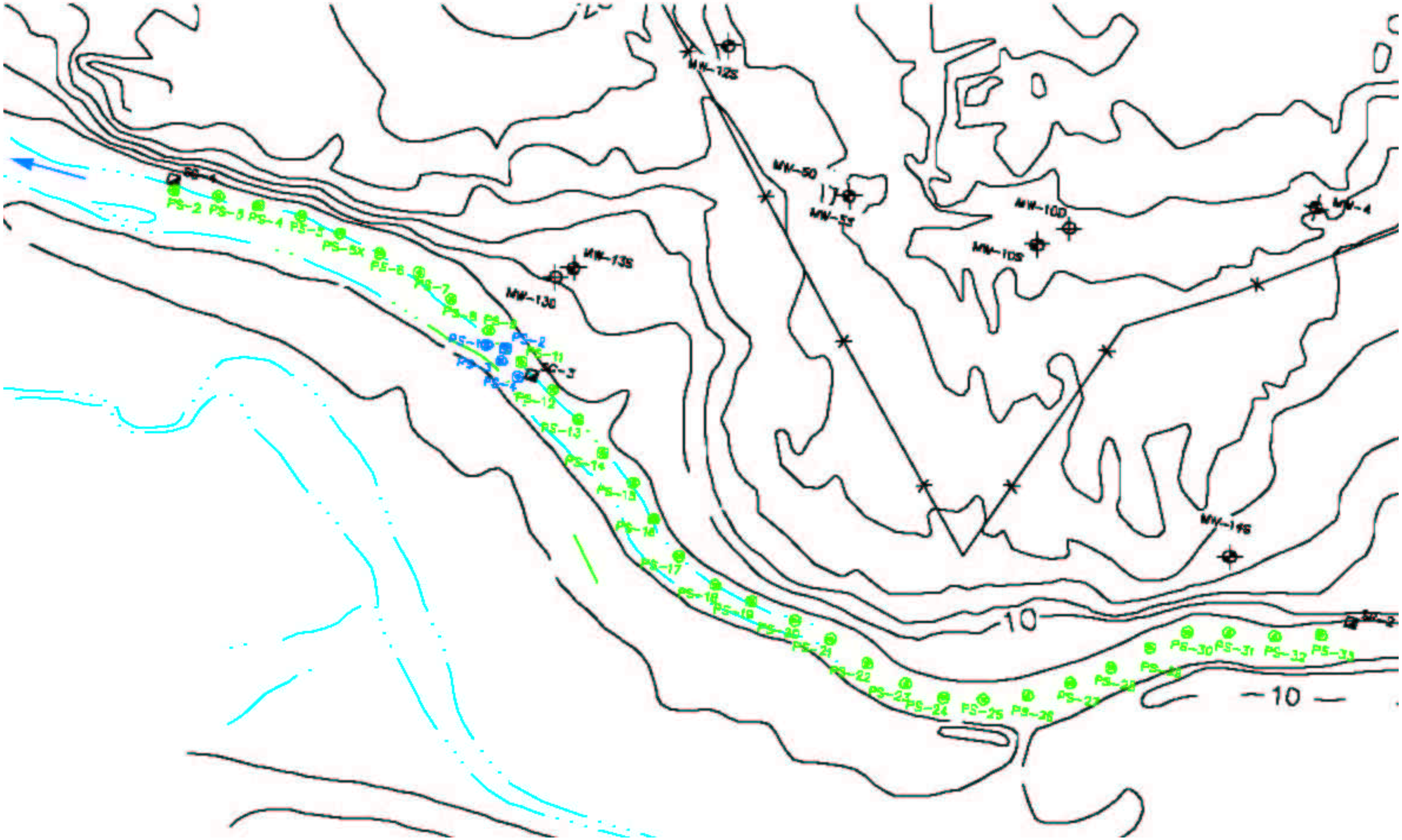


1 Rigid cover

2 0.20 µm membrane filter

3 Base with wells


LEGEND
SHALLOW MONITORING WELL
DEEP MONITORING WELL
STREAM GAUGE
FENCE
APPROXIMATE STREAMBED POREWATER SAMPLE LOCATION
APPROXIMATE STREAMBED POREWATER SAMPLE LOCATION
BACKGROUND SAMPLE LOCATION (APPROXIMATE)
DIRECTION OF STREAM FLOW
MANTUA CREEK
10
20
30
SOURCE:
MARVIN JONAS TRANSFER STATION SITE
DEPTFORD TOWNSHIP, NEW JERSEY
DIALYSIS SAMPLER EVALUATION REPORT
STREAMBED POREWATER SAMPLE LOCATIONS
BBL
FIGURE
3



MW-12S
MW-5D
MW-5S
MW-10D
MW-10S
MW-4
MW-13S
MW-13D
MW-14S
SG-3
PS-2
PS-3
PS-4
PS-5
PS-5X
PS-6
PS-7
PS-8
PS-9
PS-11
PS-12
PS-13
PS-14
PS-15
PS-16
PS-17
PS-18
PS-19
PS-20
PS-21
PS-22
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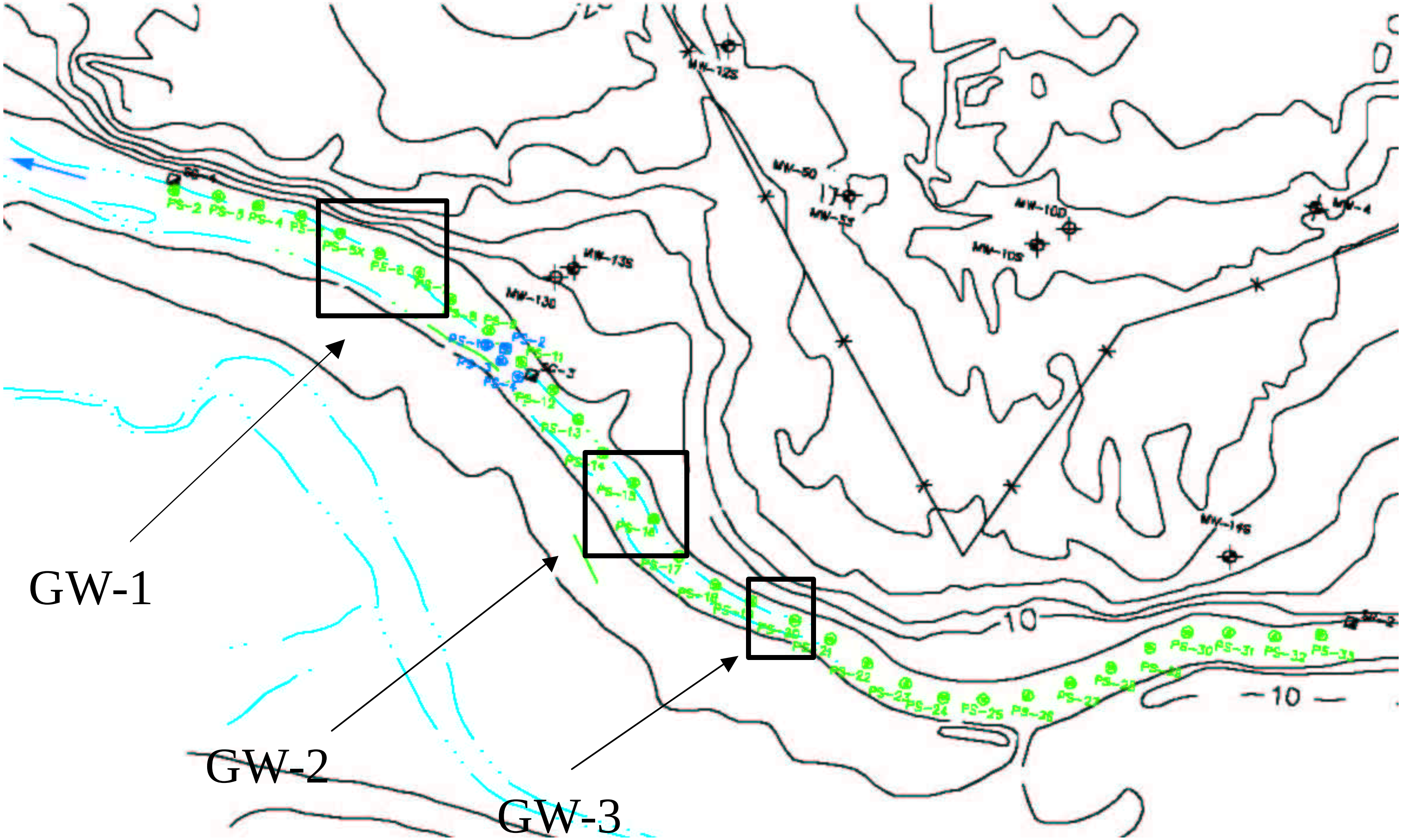
PS-32
PS-33
10
-10-


GW-1
GW-2
GW-3
MW-12S
MW-5D
MW-5S
MW-10D
MW-10S
MW-4
MW-13S
MW-13D
MW-14S
PS-2
PS-3
PS-4
PS-5X
PS-6
PS-12
PS-13
PS-14
PS-15
PS-16
PS-17
PS-18
PS-20
PS-21
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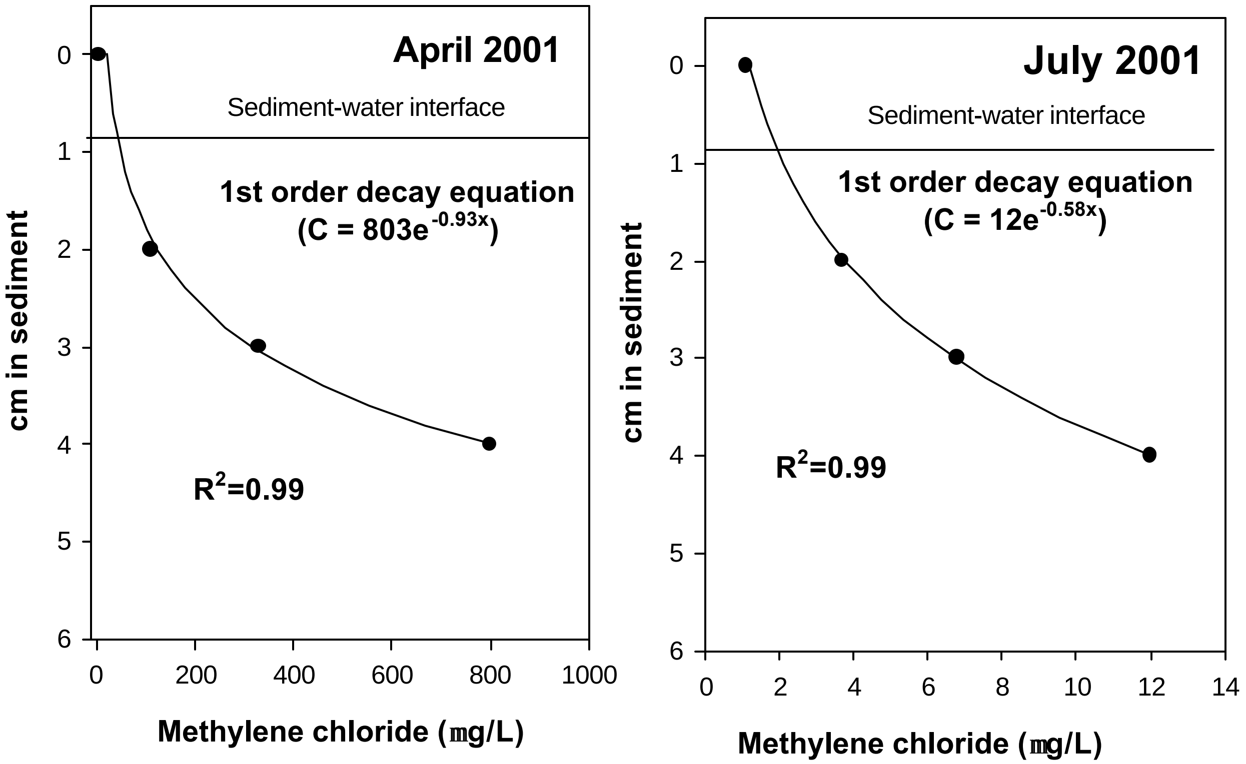
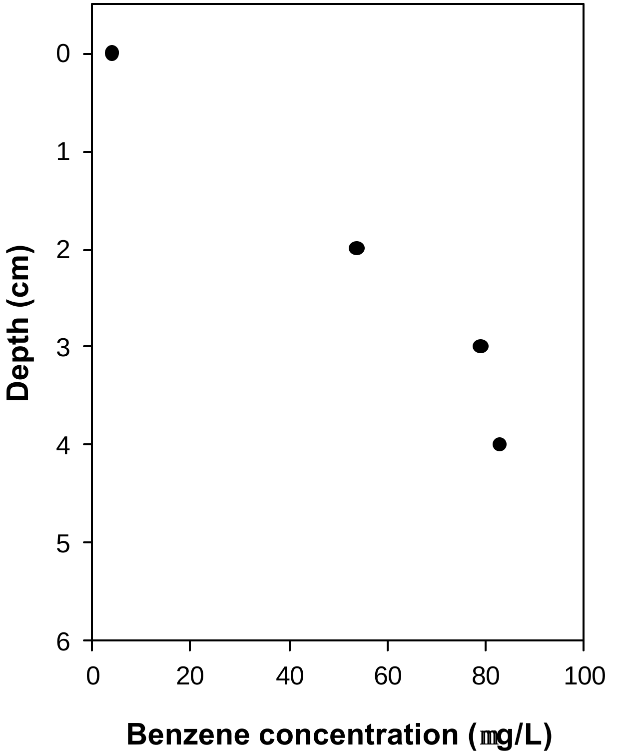
PS-31
PS-32
PS-33
10
10



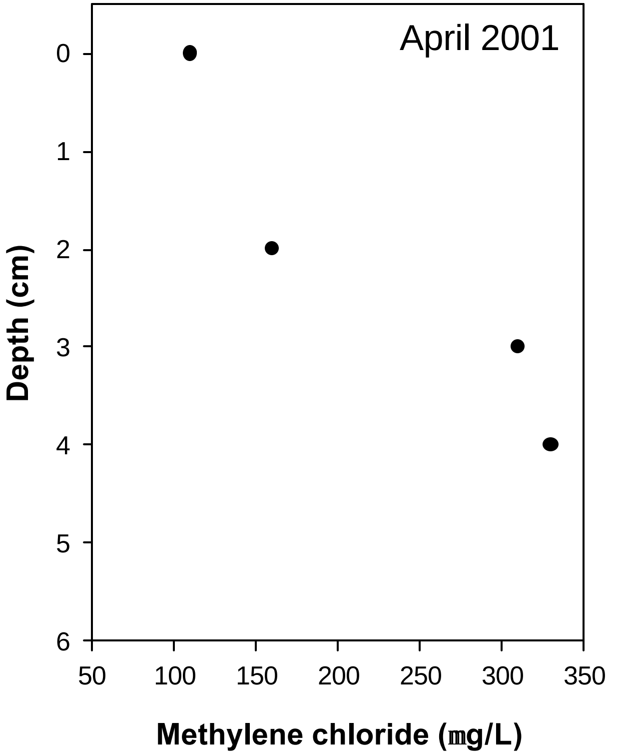
Groundwater discharge zone #1

April 2001



July 2001
All cells non-detect

Groundwater discharge zone #2



July 2001- sampled cells
Below quantitation

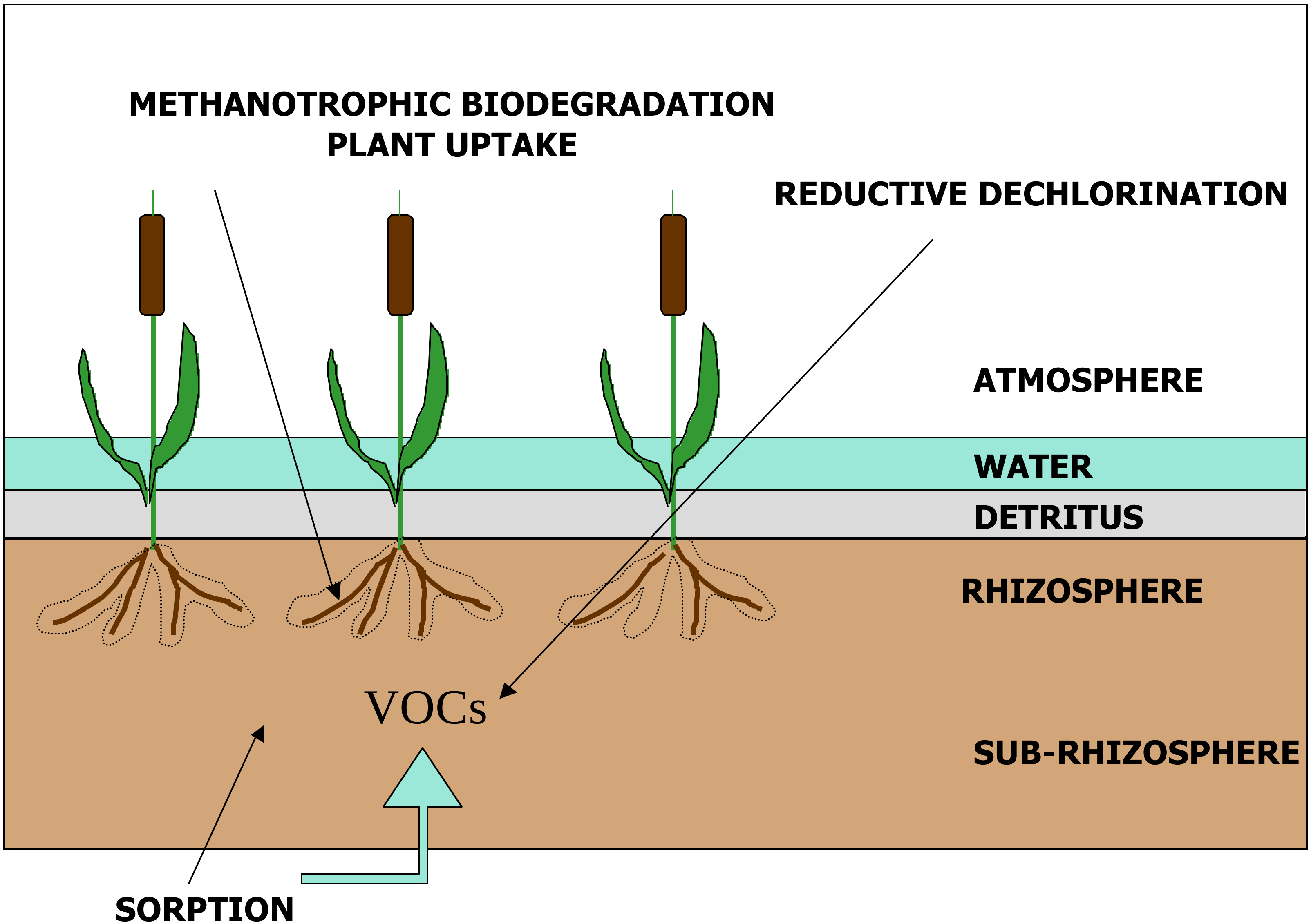
Groundwater discharge zone #3

Regulatory interaction

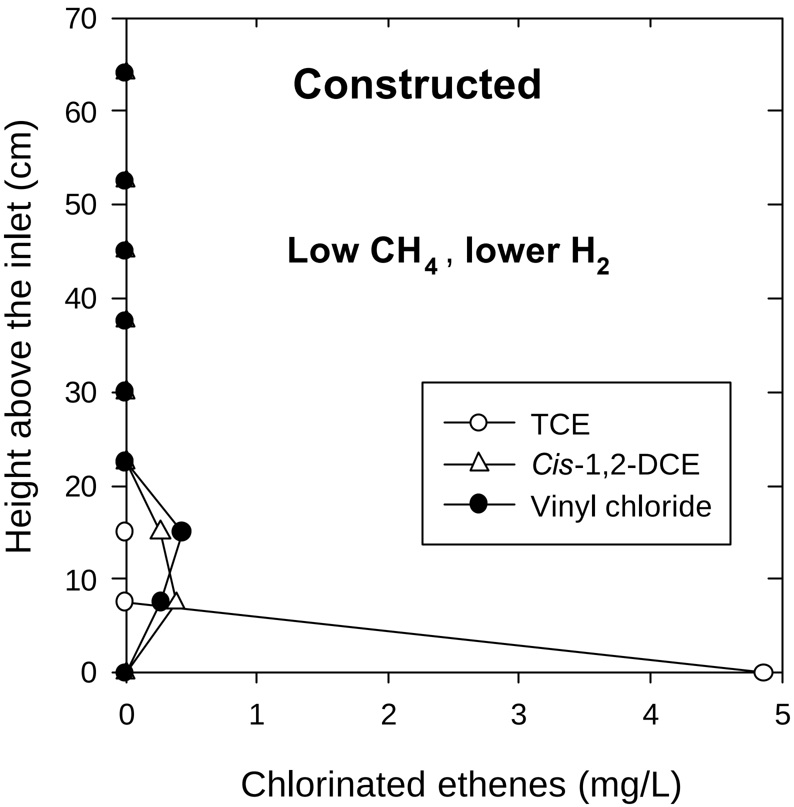
- “Convincing evidence of biodegradation in plume prior to discharging to creek”
- However, detects of benzene of 3.1 ug/L and 4.9 ug/L in groundwater discharge zones 1 and 2, respectively exceeded NJDEP surface water quality criteria. This creates problem.
- De minimis zone? Need for a ecological risk assessment?

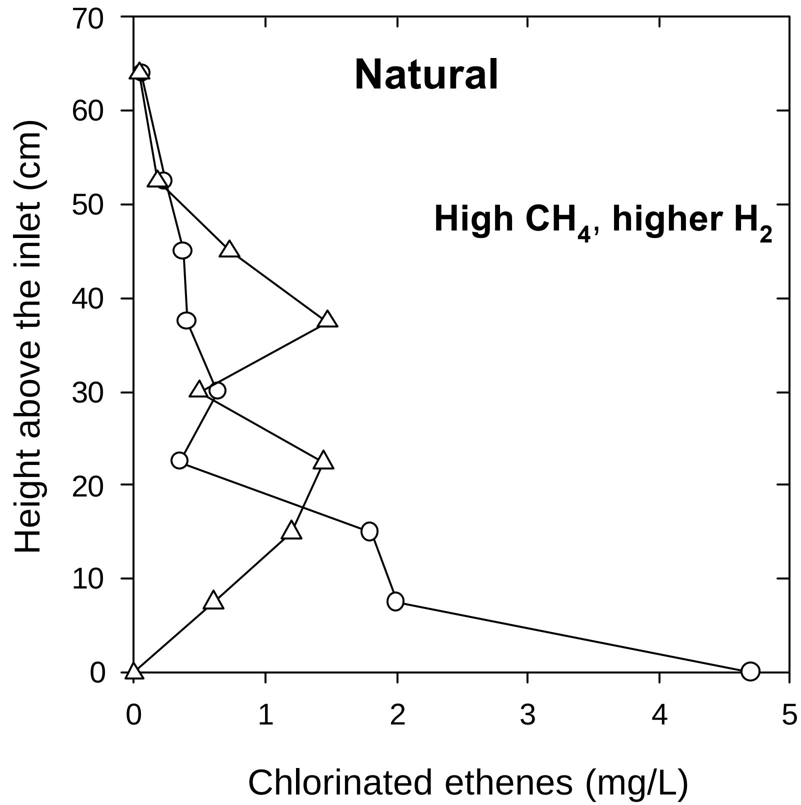
Treatment Opportunities at interface? Constructed wetland approach

- A constructed wetland to treat both chlorinated and non-chlorinated VOCs maximizing biodegradation, minimizing volatilization while operating year-round
- Wetland is constructed as an alternative discharge point for the groundwater plume within the site boundary either passively intercepting the plume or serving as a component of a pump and treat system


METHANOTROPHIC BIODEGRADATION
PLANT UPTAKE
REDUCTIVE DECHLORINATION
ATMOSPHERE
WATER
DETRITUS
RHIZOSPHERE
VOCs
SUB-RHIZOSPHERE
SORPTION

Contaminant profiles in mesocosms

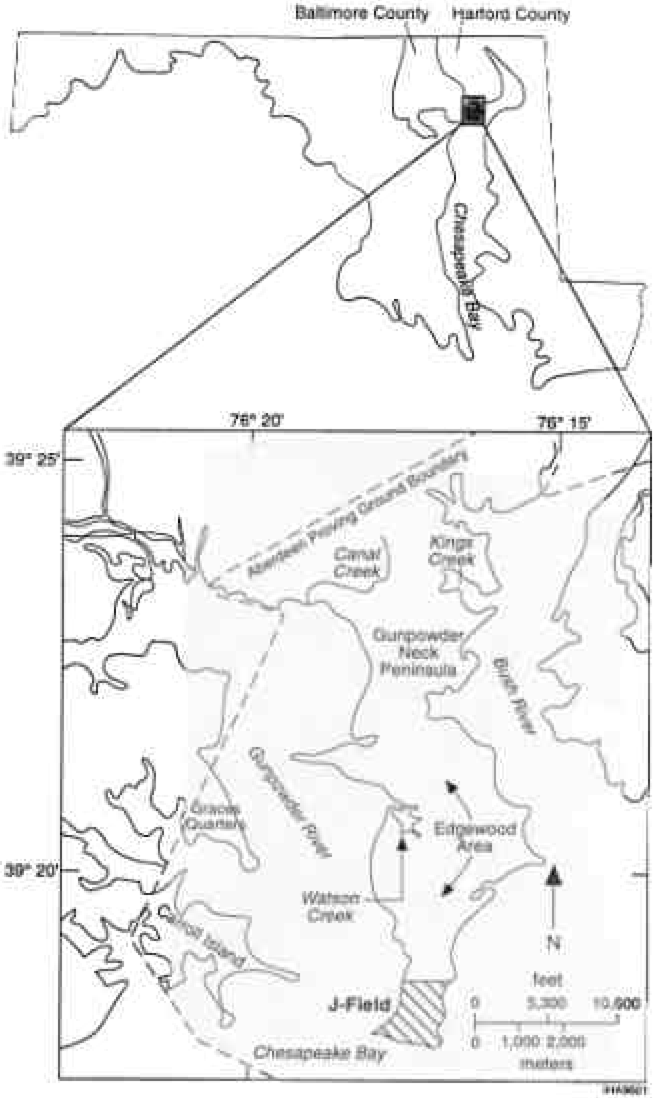


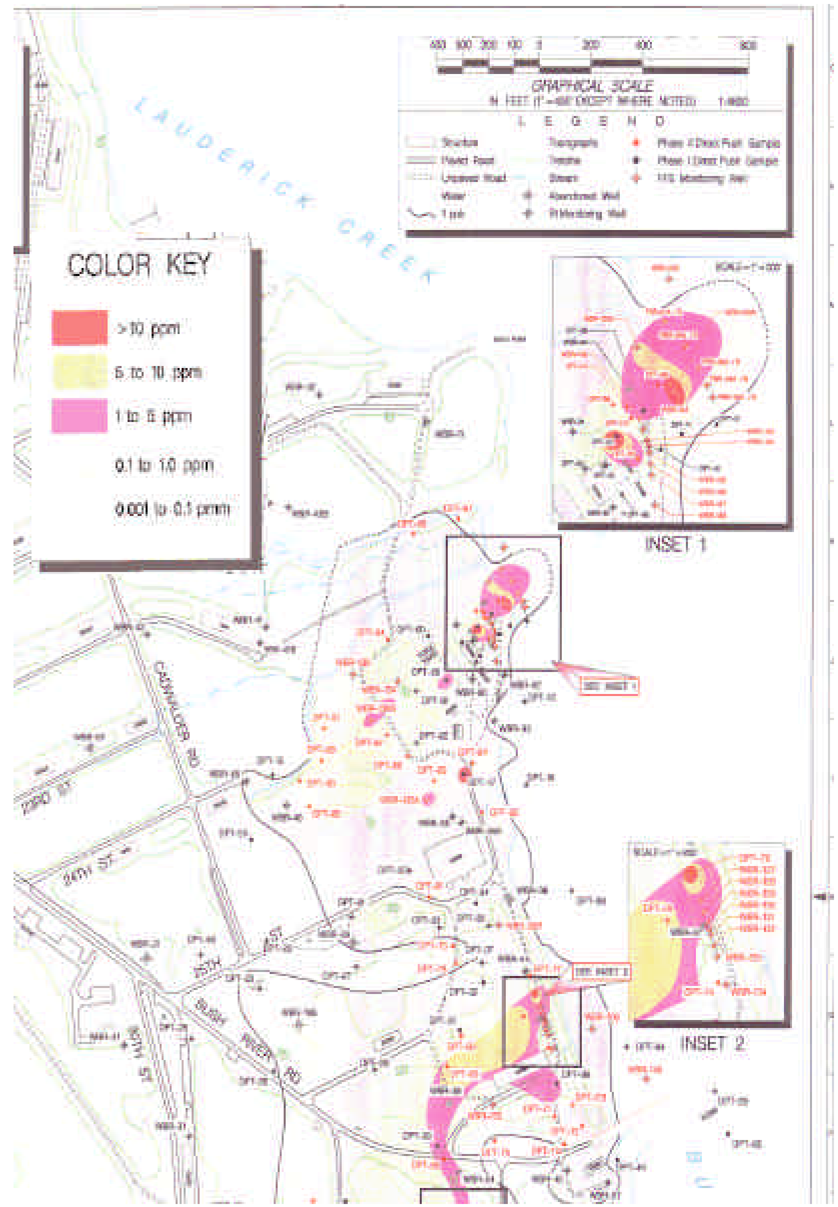


22nd Street Landfill- APG

- Landfill for municipal waste and chemical disposal, also UXO issues
- Built directly adjacent to s. Bush River within an existing wetland
  - Few remedial options without directly attacking landfill
  - Treatment wetland concept very familiar at APG

- Motivation: passively treat plume/landfill leachate prior to discharge to Chesapeake Bay


Baltimore County
Harford County
Chesapeake Bay
76° 20'
76° 15'
39° 25'
39° 20'
Aberdeen Proving Ground Boundary
Canal Creek
Kings Creek
Gunpowder Neck Peninsula
Bush River
Gunpowder River
Graces Quarters
Edgewood Area
Watson Creek
Carroll Island
J-Field
Chesapeake Bay
N
feet
0 5,300 10,600
0 1,000 2,000
meters


GRAPHICAL SCALE
LAUDERICK CREEK
COLOR KEY
>10 ppm
5 to 10 ppm
1 to 5 ppm
0.1 to 1.0 ppm
0.001 to 0.1 ppm
INSET 1
INSET 2
CASIMIR RD
23RD ST
24TH ST
25TH ST
BUSH RIVER RD

Treatment wetland plan for 22nd Street Landfill

- Assess discharge zone seasonally using dialysis samplers and other approaches
- Construct treatment wetland over discharge zone. Depth of peat material dictated by concentrations in groundwater.
- Passive treatment accomplished by rhizospheric biodegradation, sorption, and other relevant processes