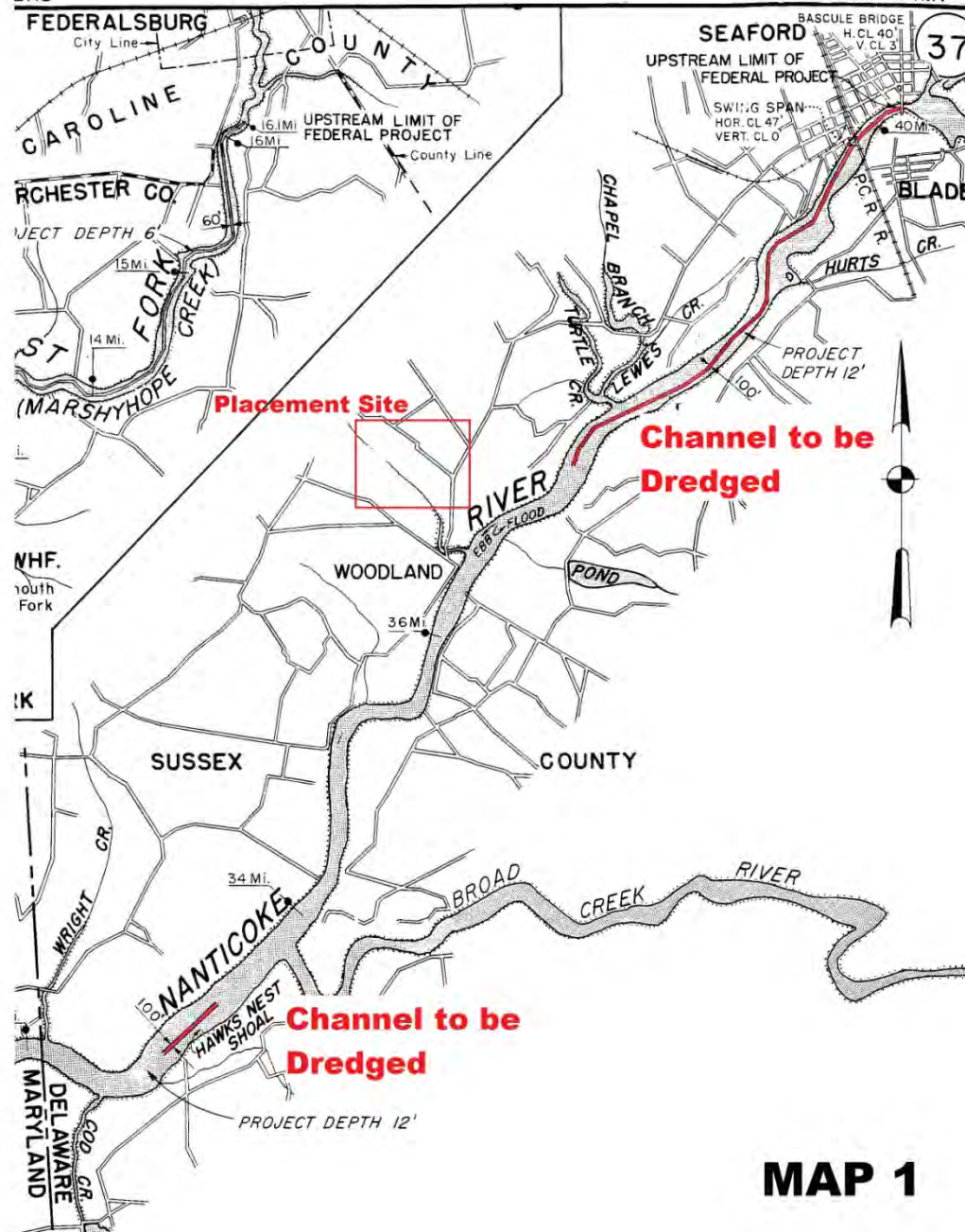


**MAINTENANCE DREDGING
NANTICOKE RIVER
SEAFORD, DELAWARE**



NANTICOKE RIVER

- Channel is authorized to a depth of 12 feet and a width of 100 feet
- Approximately 55,000 cubic yards of material will be hydraulically dredged
- A 20 acre placement site will be constructed
- Return water will be pumped back to the Nanticoke River
- No dredging 15 February through 15 June

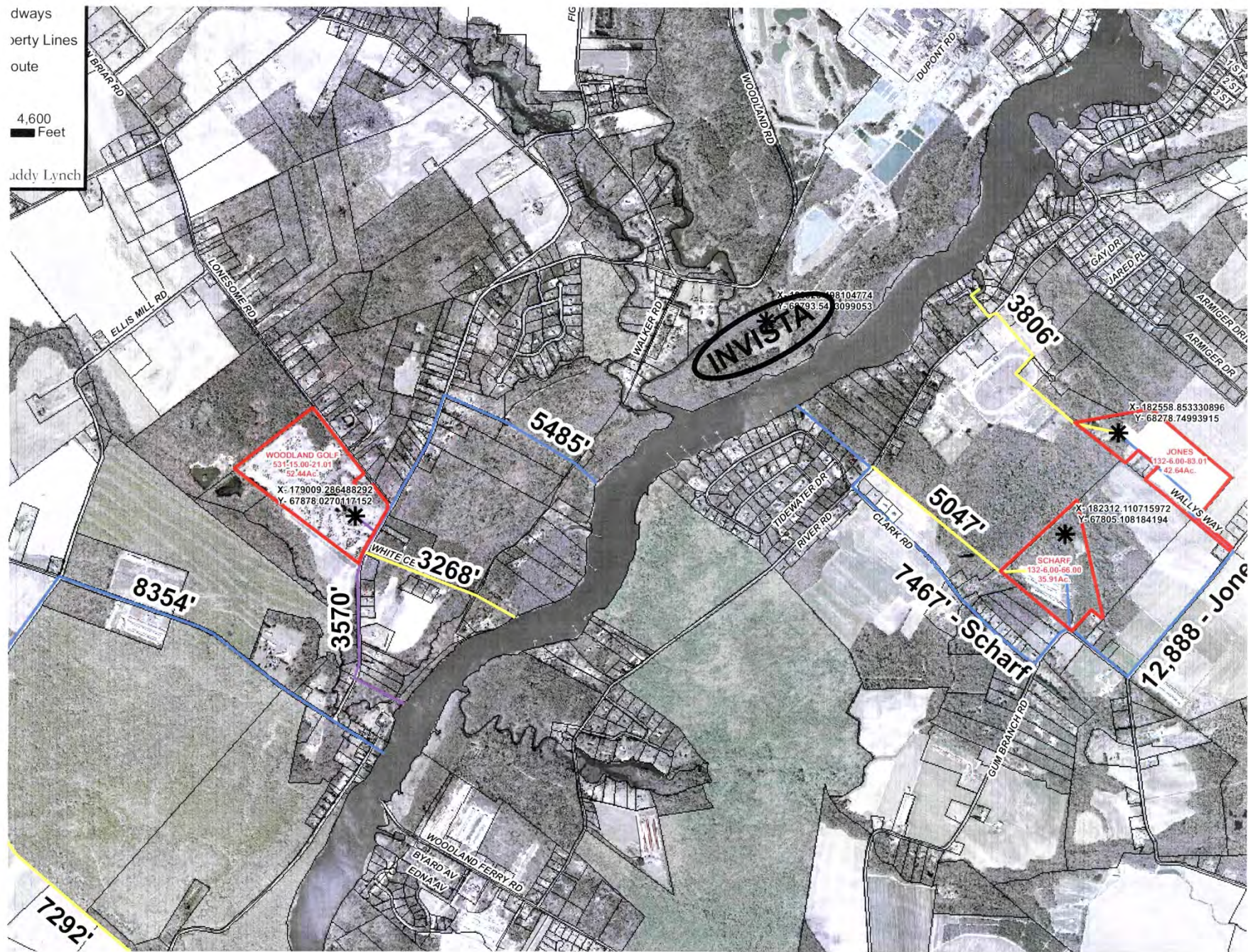


MAP 1

dwys
erty Lines
oute

4,600
Feet

addy Lynch



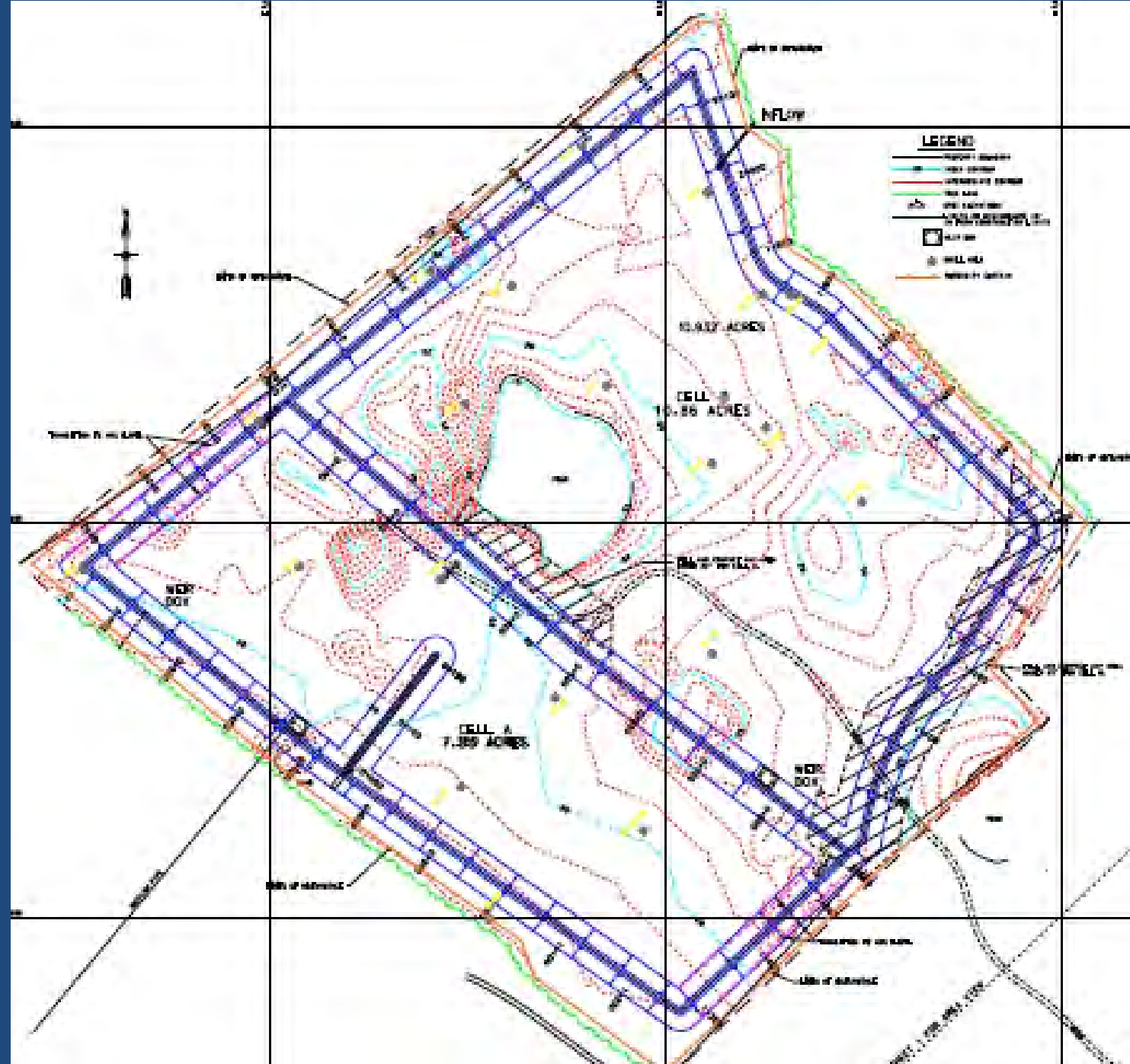
TRESPASSING
ON PROPERTY
NO FISHING
NO SWIMMING
FERRY SLIPS

LOW CLEARANCE
VEHICLES
MAY NOT CLEAR RAMPS
DURING LOW AND HIGH TIDES.
BOARD FERRY AT OWN RISK!

WOODLAND
FERRY
CLOSED THURSDAYS
FOR SERVICING
10:00 AM-12:00 PM

WOODLAND FERRY
HOURS OF OPERATION
7:00 A.M. - 6:30 P.M.
(CONDITIONS PERMITTING)
CLOSED:
THANKSGIVING DAY, CHRISTMAS DAY
AND NEW YEARS DAY





Testing and Evaluation of Dredged Materials

**Protection of Human Health
and the Environment**

Introduction

- **Navigation channel dredging**
- **US ACE must test and evaluate dredge materials (sediment) within the federal channel before dredging**
- **Protect human health and the environment**

Introduction – Nanticoke River

- Sediment in the Nanticoke River near Seaford have been tested three times in the last 15 years
- DNREC (1997), *“Chemical Contaminants in Sediments of the Nanticoke River”*

Introduction – Local Conditions

- **Local Conditions: types and amounts of chemicals present in the river today**
- **US ACE compares these conditions to those that could be created by dredging**

Screening

- Many different types of screening and many different sets of numbers that regulators have created for this purpose
- Bulk Chemical (what is in the water or what is attached to the sediment)
- Elutriate (what comes off the sediment when dredging happens)
- TCLP (what comes off when in the placement site) that could leach into the groundwater

Screening

- Lab results for these tests will report:
 - (1) a real number from the analysis
 - (2) identify that the chemical was undetected (“U”), or
 - (3) estimated (“J”)
- Screen using real numbers
- Compare to DNREC or DNREC approved screening criteria
- Terminology: “no impacts” or “exceedance”

Screening

Bulk Chemistry – Surface water

- Environmental: No impacts
- Human Health: No impacts
- (PCBs are estimated; new more current analyses forthcoming)

Bulk Chemistry - Sediment

- Environmental (river): No impacts
- Environment (placement site): No impacts
- Human Health: No impacts

Screening

Elutriate:

- **Environmental: No impacts**
- **Human Health: No impacts**

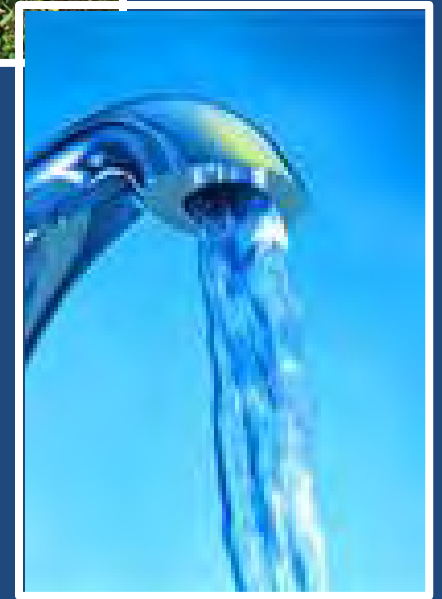
TCLP:

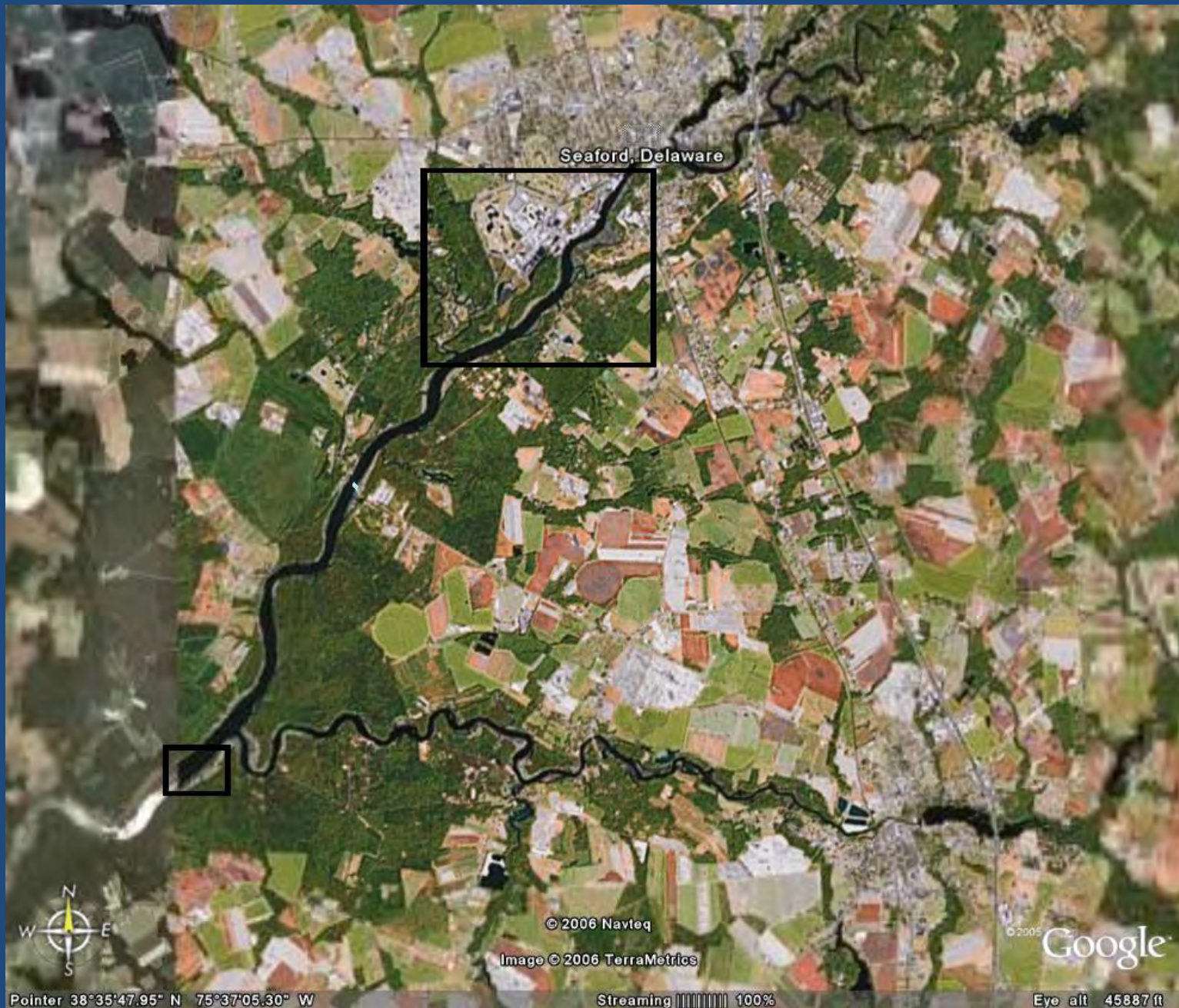
- **No impacts to groundwater**

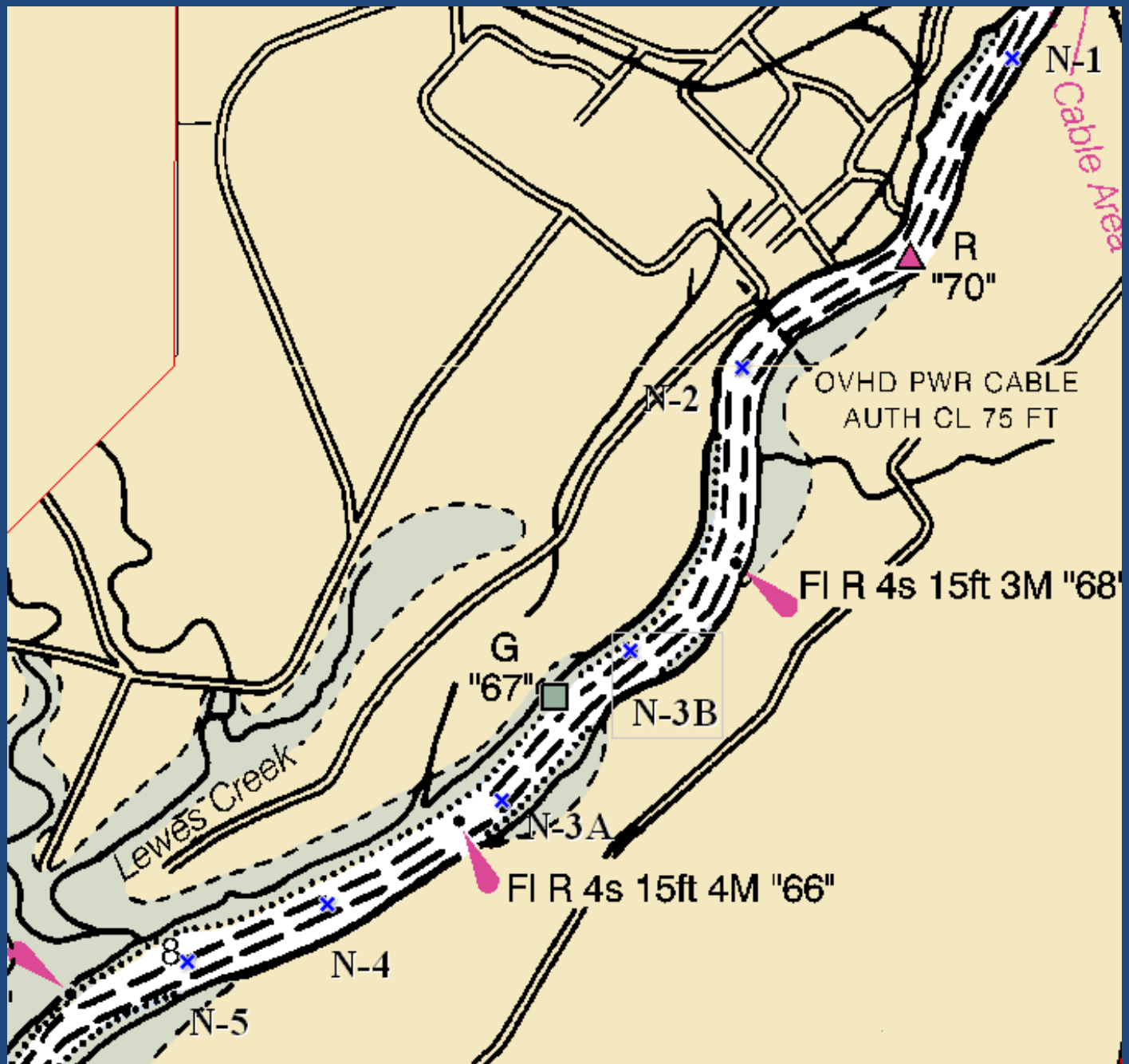
Bottom Line

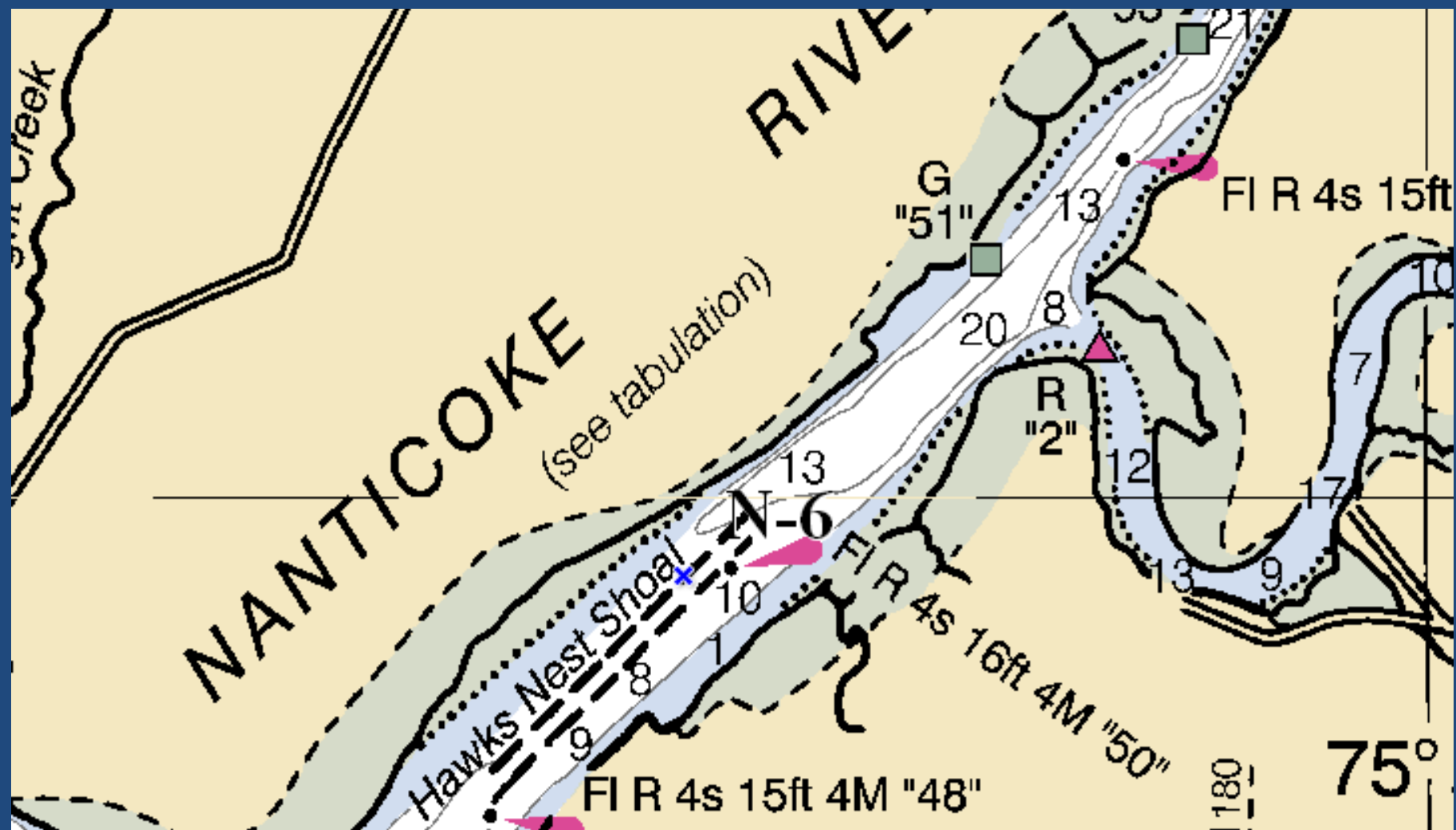
Will this dredging adversely impact the aquatic or terrestrial environments (ecological and human health)?

Answer: No









Local Conditions - Surface Water (Testing)

- Evaluation at the dredging site
- Polychlorinated biphenyls (PCBs)
- Metals/inorganics (arsenic, cadmium, chromium, copper, lead, mercury, zinc)
- Misc: ammonia, nitrogen, phosphorus, total suspended solids (TSS)



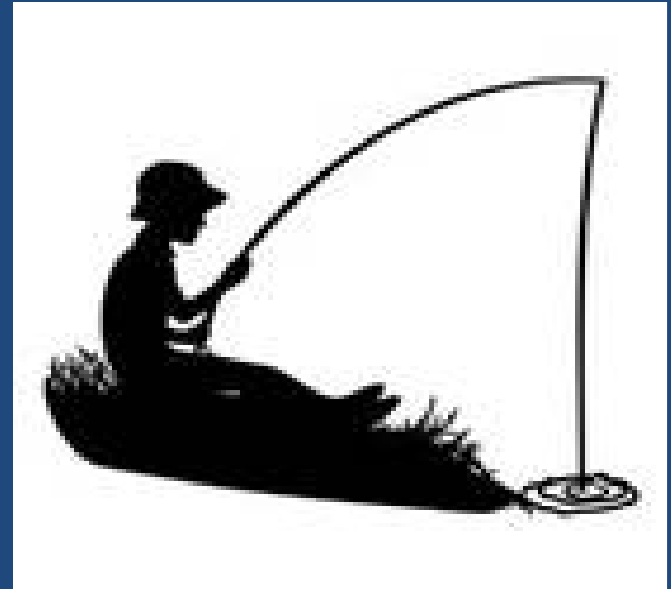
Local Conditions - Surface Water (Evaluation)

Environment (Table 1)

- Total PCBs - Slight exceedance (estimated)

Human Health (Table 2)

- Total PCBs - Slight exceedance (estimated)
- New PCB data coming soon with more sensitive analyses



Effluent Elutriate (water) - Testing

- Evaluation for the placement site
- Designed to mimic partitioning of chemicals off of sediment during the settling phase
- Put sediment in a beaker with water, stir and let it settle
- Test water phase the same way you test surface water (total PCBs, metals and general chemistry)

Effluent Elutriate - Evaluation

Environment (Table 3)

- Minor exceedances of metals; no impacts when the water is returned to the river

Human Health (Table 4)

- Total PCBs exceeded
- Test being repeated and data to be reported soon

Compare River Water and Elutriate

Chemical	Ecological			Human Health		
(Dissolved)	Lowest Standard	River Water	Elutriate	Lowest Standard	River Water	Elutriate
PCBs	14	20.96	1.27	0.064	20.96	1.27
Arsenic	150	10 U	8	10	10 U	8
Cadmium	0.2	5 U	0.5 U	31	5U	0.5 U
Chromium	49	5 U	2	100	5 U	2
Copper	5.8	1.2 B	12	1300	1.2 B	12
Lead	1.2	3 U	5.4	15	3 U	5.4
Mercury	0.077	0.2 U	0.02	NC	0.2 U	0.02 U
Zinc	76.0	21.1	407 (91 (med))	7400	21.1	407 (91 med)

Leaching Potential (TCLP) - Testing

- Use this test to see if there will be impact to groundwater
- TCLP (acidic water percolates through a soil column)
- Severe leaching test (acid dissolved chemicals, especially metals)
- Tested for VOCs, SVOCs, total PCBs, pesticides, metals

Leaching to Groundwater - Evaluation

Impacts to Groundwater

(Table 5):

- no exceedances of drinking water standards
- no impact to local wells and drinking water supply



Local Conditions - Bulk Sediment (Testing)

- Evaluation at the dredging site as sediment and at the placement site as soil
- Tested for multiple categories of analyses (VOCs, SVOCs, PAHs, pesticides, total PCBs, metals)
- Tested for general chemistry (nitrogen, phosphorous, as well as general chemistry and sediment texture (sand, silt, clay and percent solids)

Local Conditions - Bulk Sediment (Evaluation)

Environmental (Table 6):

- 5 PAHs (all “U”)
- 2 pesticides (both “U”)
- 2 metals (slight exceedances, arsenic, zinc)
- Sediments are very fine textured (bind chemicals tightly)



Sediment as Soil – Evaluation

- Evaluation at the placement site

Environmental (Table 7)

- 4 exceedances of metals
- 3 of the 4 metals are within Delaware background conc.
- Zinc is about double background



Local Conditions - Sediment as Soil Comparison to Delaware Background Environmental Screening

Metal	DE Bkgrd (mg/kg)	Lowest Standard (EcoSSL) (mg/kg)	Dredge Material (mg/kg)
Cadmium	1 -3	0.36	1
Lead	30 – 100	11	23
Mercury	0.1 - 0.3	0.10	0.14
Zinc	60 - 90	46	173

Sediment as Soil - Evaluation

Human Health (Table 8)

- Screened for unrestricted and restricted use
- Unrestricted use: residential (live there)
- Restricted use: commercial (work there)
- Same results for both restricted/unrestricted:
 - 1 - PAH (flagged “U”)
 - 2 - pesticides (both flagged “U”)
 - PCBs – slight exceedance (standard = 2 mg/kg, result = 3.4 mg/kg)
 - 1-metal (arsenic, DE background = 1 – 10 mg/kg, result – 11 mg/kg)

Soil Screening Perspective - Zinc

Cold-EEZE = 13.3 mg Zn/2 g piece
= 948 mg/kg (500 pieces)

US EPA Eco SSL = 173 mg/kg
(2 x 1 quart Mason jars)



Nanticoke Sediment – Then and Now

Chemical Name	Units	Screening TEC	DNREC Conc Range (1997)	US ACE Conc Range (2006)
Total PAHs	ug/kg	1,610	1.14029 - 1.759	512 - 2,566
Total PCBs	ug/kg	59.8	0.00005660 - 0.00010299	0 - 6.74
METALS				
Arsenic	mg/kg	9.79	11.18 - 17.89	5.9 - 15.3
Cadmium	mg/kg	0.99	1.80 - 2.48	0.67 - 1.7
Chromium	mg/kg	43.4	24.63 - 32.12	7.7 - 17.9
Copper	mg/kg	31.6	28.81 - 41.96	14.9 - 33.3
Lead	mg/kg	35.8	29.26 - 34.25	15 - 28.5
Mercury	mg/kg	0.18	0.035 - 2.74	0.079 - 0.16
Zinc	mg/kg	150	208 - 235	91.1 - 224

Compare River Water and Elutriate

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Zinc	76.0	21.1	407 (91 (med))	7400	21.1	407 (91 med)

Leaching to Groundwater

- Acid leaching test showed no exceedances
- No leaching to groundwater
- County will install sentinel wells to ensure these conditions are maintained

Local Conditions - Sediment as Soil Comparison to Delaware Background Environmental Screening

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