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CNC CHARLESTON  
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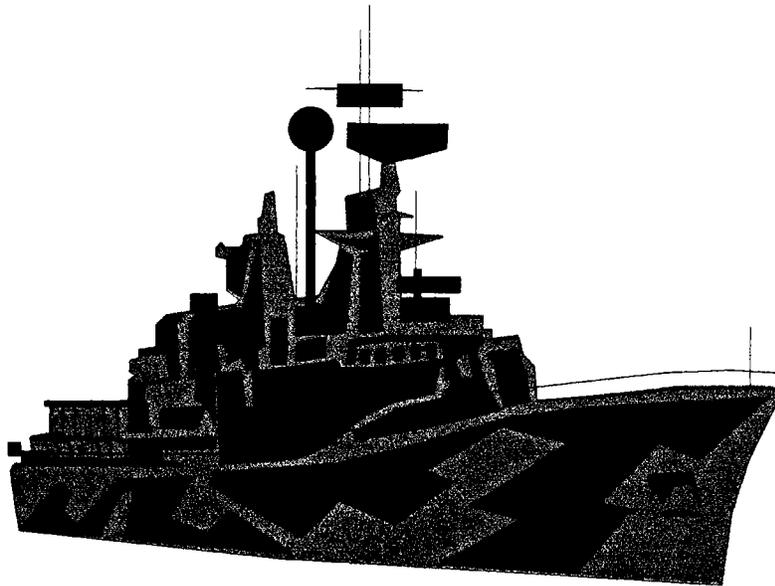
RESOURCE CONSERVATION AND RECOVERY ACT FACILITY INVESTIGATION RESULTS  
ZONE C AND ZONE I CNC CHARLESTON SC  
11/12/1996  
ENSAFE/ ALLEN AND HOSHALL

# Zones C & I

# RCRA Facility Investigation

# Results

Naval Base Charleston



Presented by: EnSafe/Allen&Hoshall  
November 12, 1996

## ACRONYMS

|             |  |
|-------------|--|
| <b>AOC</b>  | <b>Area of Concern</b>   |
| <b>CMS</b>  | <b>Corrective Measures Study</b>                                     |
| <b>COC</b>  | <b>Chemical of Concern</b>   |
| <b>COPC</b> | <b>Chemical of Potential Concern</b>                                 |
| <b>DHEC</b> | <b>South Carolina Department of Health and Environmental Control</b> |
| <b>EPA</b>  | <b>U. S. Environmental Protection Agency</b>                         |
| <b>HI</b>   | <b>Hazard Index</b>  |
| <b>HQ</b>   | <b>Hazard Quotient</b>   |
| <b>ILCR</b> | <b>Incremental lifetime excess cancer risk</b>                       |
| <b>NFA</b>  | <b>No Further Action</b>   |
| <b>PCB</b>  | <b>Polychlorinated Biphenyl</b>                                      |
| <b>RCRA</b> | <b>Resource Conservation and Recovery Act</b>                        |
| <b>RFA</b>  | <b>RCRA Facility Assessment</b>                                      |
| <b>RFI</b>  | <b>RCRA Facility Investigation</b>                                   |
| <b>SVOC</b> | <b>Semivolatile Organic Compound</b>                                 |
| <b>SWMU</b> | <b>Solid Waste Management Unit</b>                                   |
| <b>TPH</b>  | <b>Total Petroleum Hydrocarbons</b>                                  |
| <b>VOC</b>  | <b>Volatile Organic Compound</b>                                     |

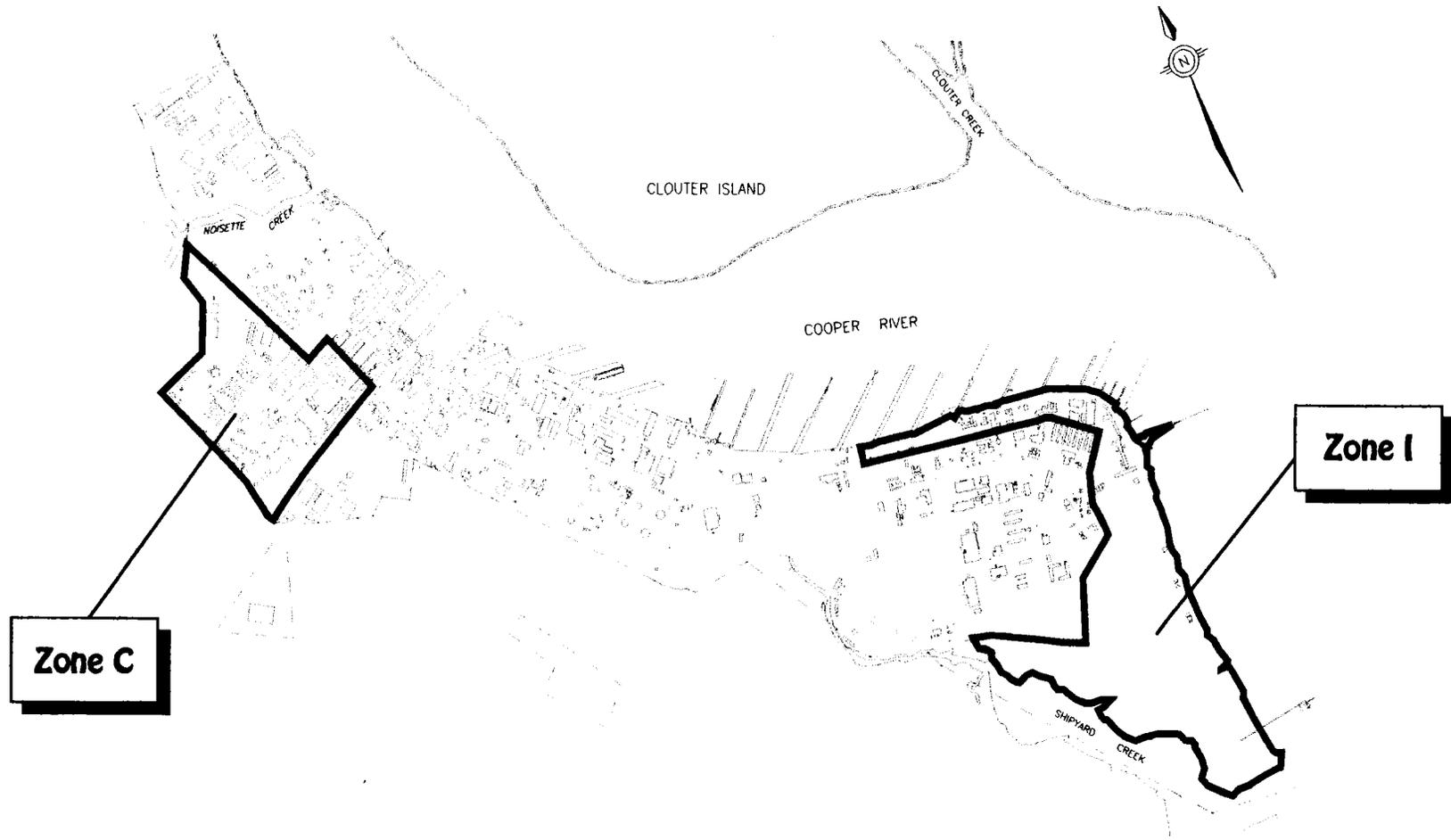
# Outline - Zones C & I RFI Results

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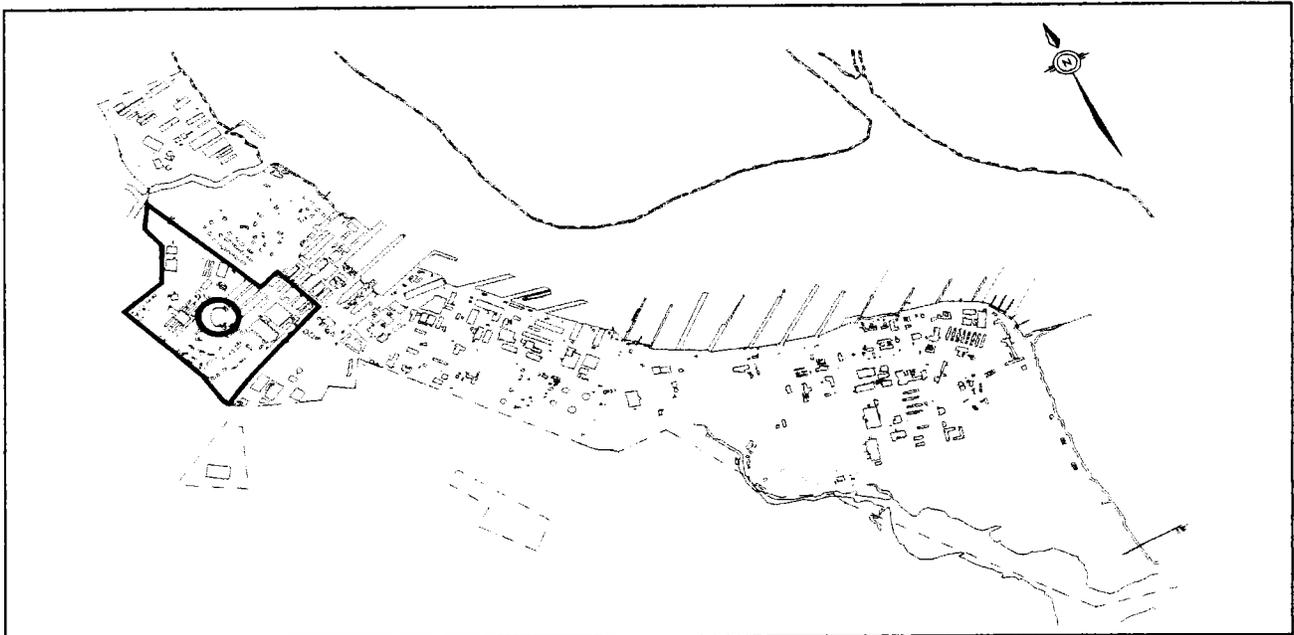
- ▲ Background
- ▲ Site-specific Results
- ▲ Risk Assessment Review
- ▲ Summary of Risks
- ▲ Recommendations
- ▲ Questions & Answers

# Charleston Naval Shipyard

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# Zone C Overview



## Location

- ▲ Zone C is located in the developed northwest portion of Naval Base Charleston.

## Reuse

- ▲ Portions of the zone are currently slated for use as open buffer space, parking lots, office property, and limited residential areas.

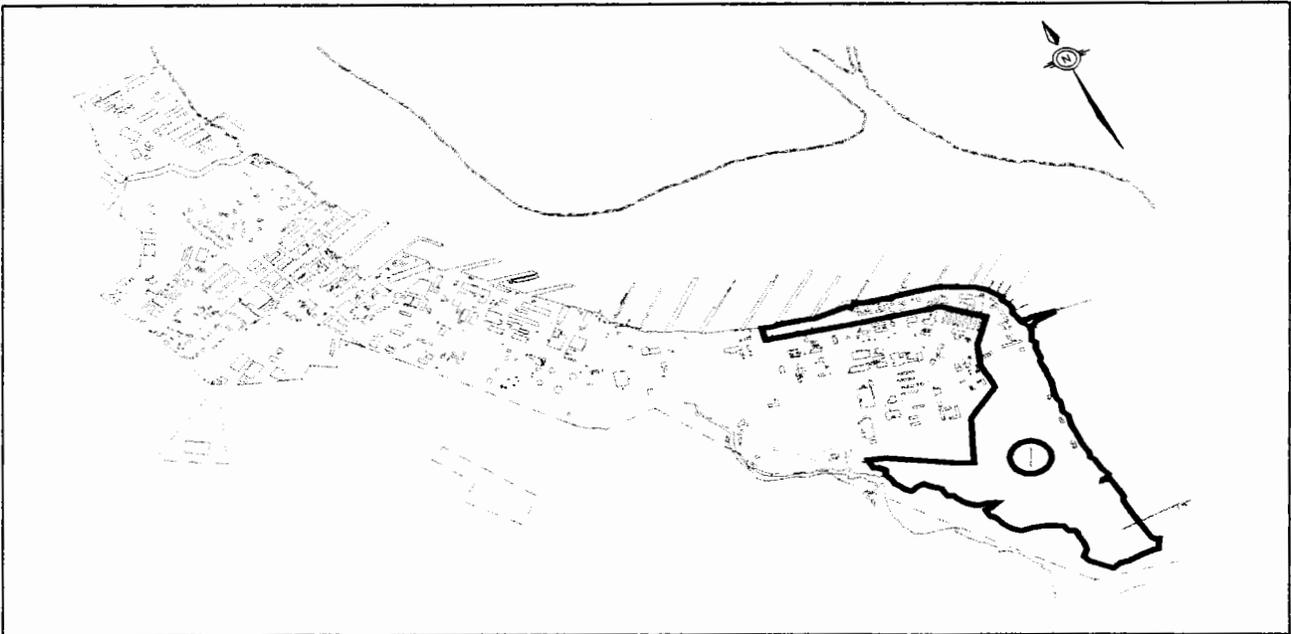
## Purpose of Investigation

- ▲ To evaluate the nature and extent of hazardous waste impacts and to identify, develop, and implement appropriate corrective measures to protect human health and the environment.

## Sampling Approach

- ▲ 3 Solid Waste Management Units (SWMUs)
- ▲ 14 Areas Of Concern (AOCs)
- ▲ 123 soil samples, 26 water samples

# Zone I Overview



## Location

- ▲ Zone I is the southern portion of the peninsula formed by Shipyard Creek and the Cooper River.

## Reuse

- ▲ Identified for marine cargo terminal, marina, office space and open buffer.

## Purpose of Investigation

- ▲ To evaluate the nature and extent of hazardous waste impacts and to identify, develop, and implement appropriate corrective measures to protect human health and the environment.

## Sampling Approach

- ▲ 2 Solid Waste Management Units (SWMUs)
- ▲ 15 Areas Of Concern (AOCs)
- ▲ 2 Other Designated Sites
- ▲ 158 soil/sediment samples, 22 water samples  
9 asbestos samples, 7 wipe samples for lead

# Common Contaminant Categories

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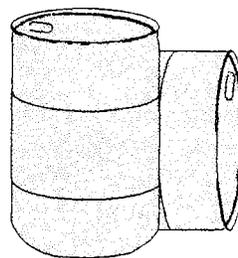
## Metals



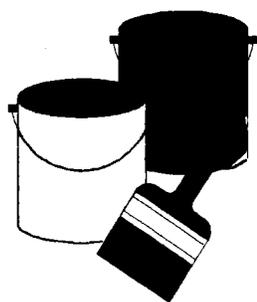
Metals are naturally occurring elements that are generally flexible and good conductors of electricity. These properties, along with the relative abundance of metals, make them valuable materials in industrial and manufacturing processes. Household items that commonly contain metals include paint and enamel, batteries, coins, and electrical components.

## Pesticides, Herbicides, & PCBs

Pesticides are chemicals used to eliminate insects and other pests. Herbicides are chemicals used to kill unwanted plants or weeds. PCBs, or Polychlorinated Biphenyls, are industrial compounds that are used as insulating and heat exchange fluids in electrical transformers, and are found in hydraulic fluids used in electrical components and systems.



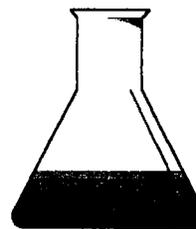
## Semivolatile Organic Compounds



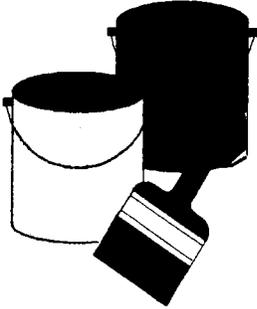
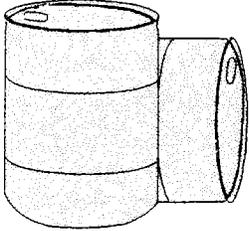
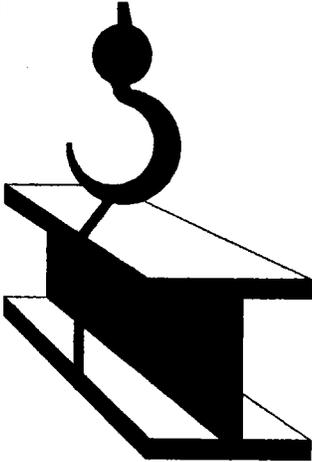
Semivolatile Organic Compounds, also called SVOCs, are common components of asphalt, coal tar, and pitch. Some SVOCs are components of diesel, jet fuel, waste oil, and hydraulic oil. A commonly used household SVOC is naphthalene, which is the main ingredient in many furniture refinishing products including paints, stains, finishes and varnish thinner.

## Volatile Organic Compounds

Volatile Organic Compounds, also called VOCs, are commonly used chemicals. Many VOCs are solvents, which are liquid compounds used to dissolve other substances. Ordinary household solvents include paint thinner and mineral spirits. Other household products that contain VOCs include hair spray, nail polish remover, air fresheners, and oven cleaners.



# Zones C & I Chemicals of Concern (COCs)

|   | <b>Contaminant</b>                | <b>Category</b> | <b>C</b> | <b>I</b> |
|---|-----------------------------------|-----------------|----------|----------|
|    | <b>1,4-Dichlorobenzene</b>        | VOC             |          | ✓        |
|   | <b>Methylene chloride</b>         | VOC             |          | ✓        |
|    | <b>3, 3 - Dimethyl Benzidine</b>  | SVOC            | ✓        |          |
|   | <b>Acetophenone</b>               | SVOC            | ✓        |          |
|   | <b>BEHP</b>                       | SVOC            | ✓        |          |
|   | <b>Benzo(a)pyrene equivalents</b> | SVOC            | ✓        | ✓        |
|   | <b>Dioxins/Furans</b>             | SVOC            | ✓        | ✓        |
|   | <b>N-Nitroso-di-n-propylamine</b> | SVOC            |          | ✓        |
|   | <b>4,4'-DDT</b>                   | Pesticide       | ✓        |          |
|   | <b>Chlordane</b>                  | Pesticide       | ✓        |          |
|   | <b>Dieldrin</b>                   | Pesticide       | ✓        |          |
|   | <b>Isodrin</b>                    | Pesticide       |          | ✓        |
|   | <b>Polychlorinated Biphenyls</b>  | PCB             |          | ✓        |
|   | <b>Aluminum</b>                   | Metal           | ✓        |          |
|  | <b>Antimony</b>                   | Metal           | ✓        |          |
|   | <b>Arsenic</b>                    | Metal           | ✓        | ✓        |
|   | <b>Beryllium</b>                  | Metal           | ✓        | ✓        |
|   | <b>Cadmium</b>                    | Metal           |          | ✓        |
|   | <b>Lead</b>                       | Metal           | ✓        |          |
|   | <b>Manganese</b>                  | Metal           | ✓        | ✓        |
|   | <b>Nickel</b>                     | Metal           | ✓        | ✓        |
|   | <b>Thallium</b>                   | Metal           | ✓        |          |

Note: This table includes only chemicals that are primary contributors to Risk/Hazard.

# Grouping of Sites - Zones C & I

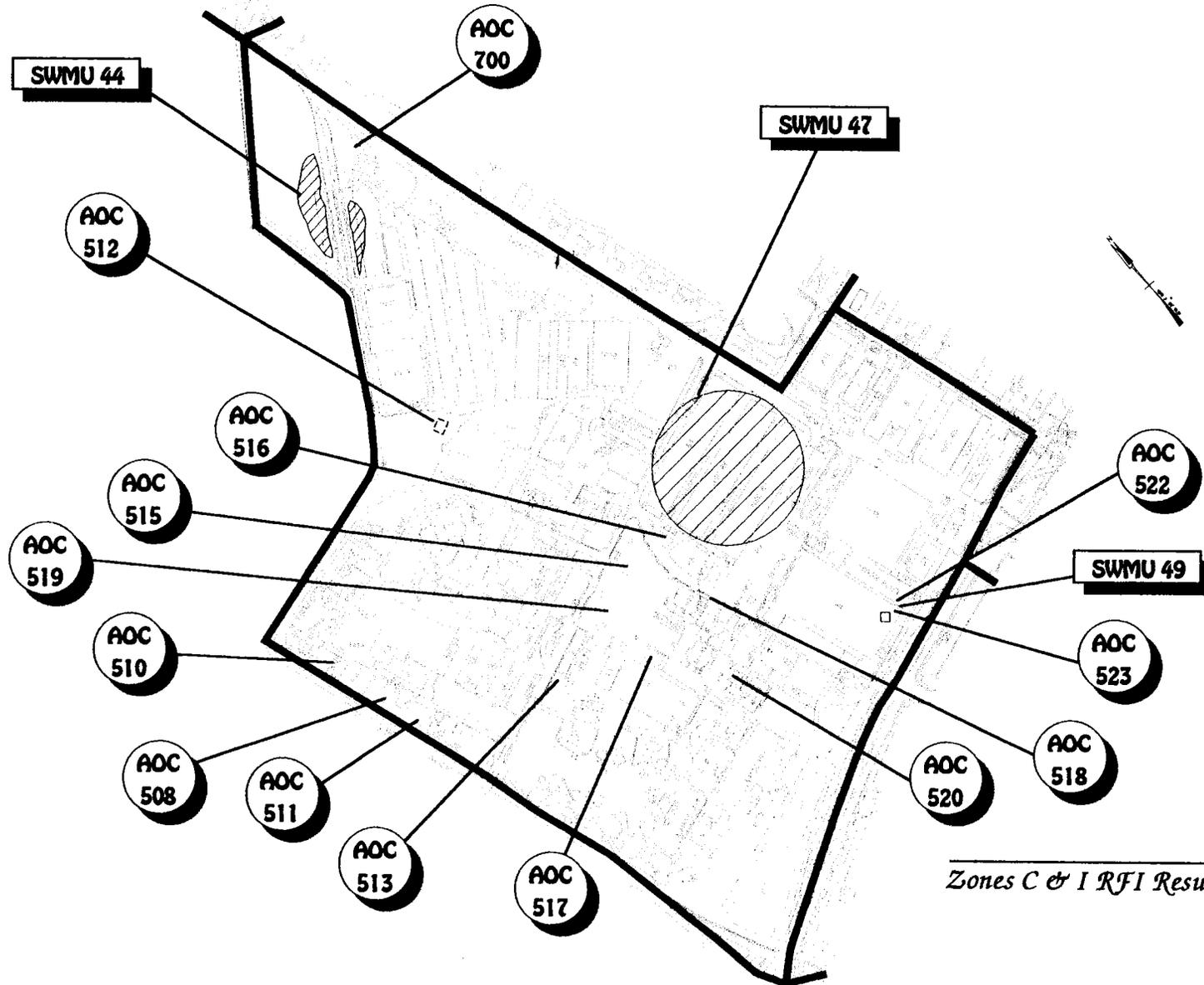
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**Grouping 1 - Petroleum Sites**

**Grouping 2 - Other Designated Sites**

**Grouping 3 - Sites Recommended for No Further Action**

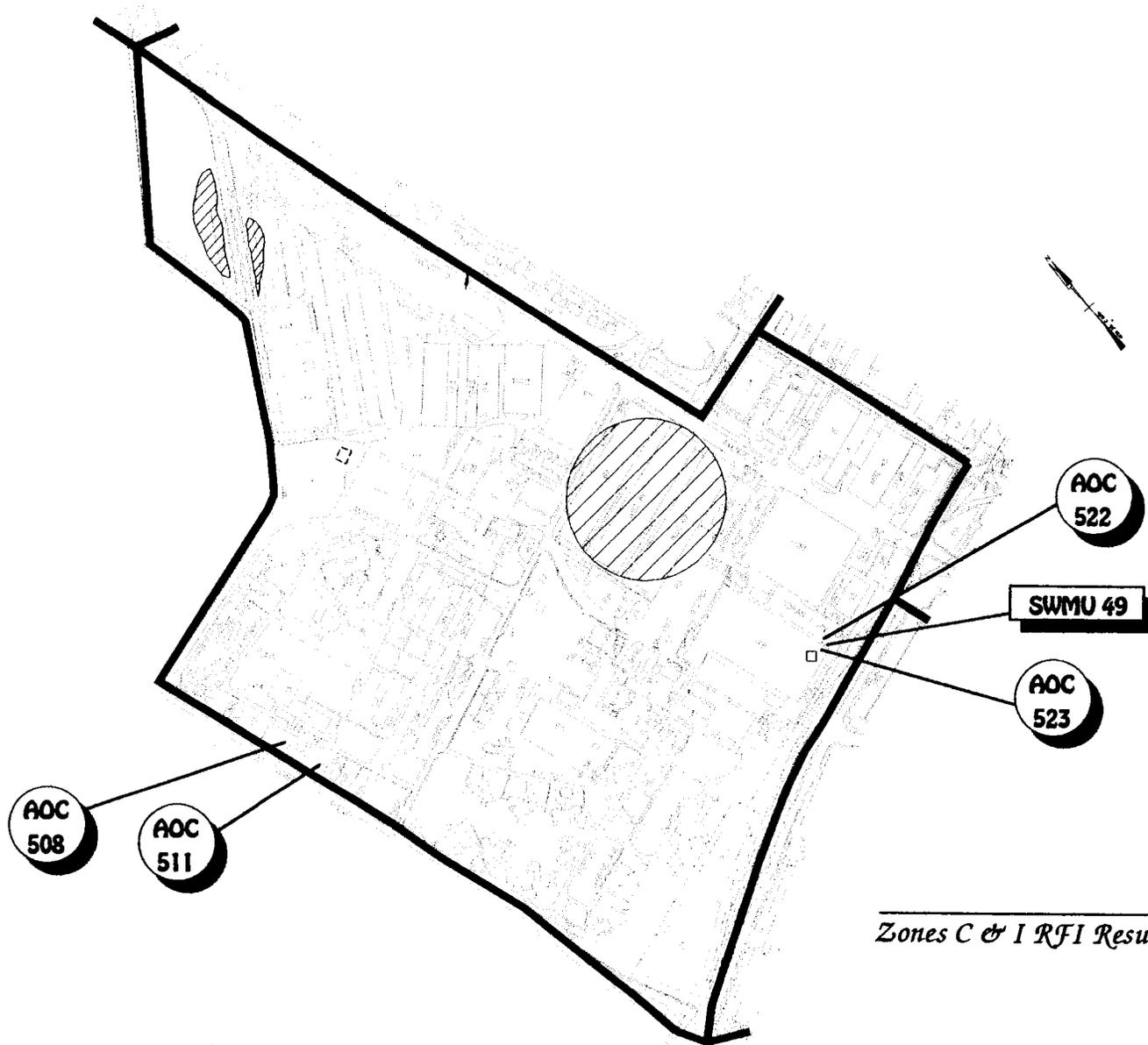
# Zone C AOCs/SWMUs



*Zones C & I RFI Results - 11/12/96*

# Zone C Grouping 1 - Petroleum Sites

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*Zones C & I RFI Results - 11/12/96*

# Zone C Grouping 1 - Petroleum Sites

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| Site #          | Site Description                             | Samples Collected                              |
|-----------------|--|--|
| AOCs 511/508    | Former Oil Storehouse/<br>Former Incinerator | Soil (19)                                      |
| AOC 522         | Former Grease and Wash Area                  | <i>* Not presented in<br/>Draft RFI Report</i> |
| AOC 523/SWMU 49 | Former Gas Station                           | Soil (2)<br>Groundwater (2)                    |

# Zone C Grouping 1 - AOC 508/511

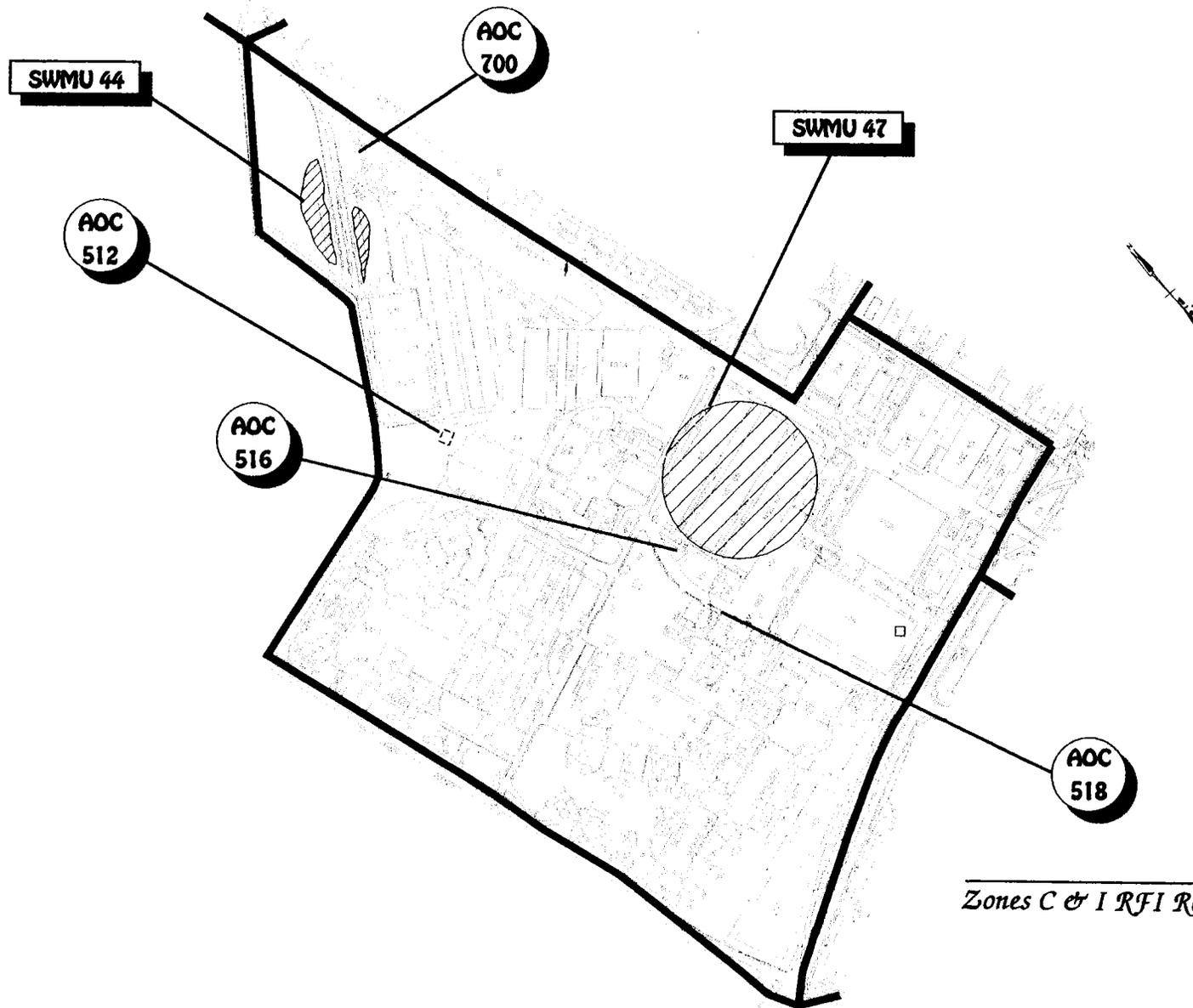


| Primary Contributors to Risk/Hazard |                            |
|-------------------------------------|----------------------------|
| Soil:                               |                            |
|                                     | Benzo(a)pyrene Equivalents |
|                                     | Chlordane                  |
|                                     | DDT                        |
|                                     | Dieldrin                   |
| Groundwater:                        |                            |
|                                     | None                       |

Legend  
● Soil Boring

# Zone C Grouping 2 - Other Designated Sites

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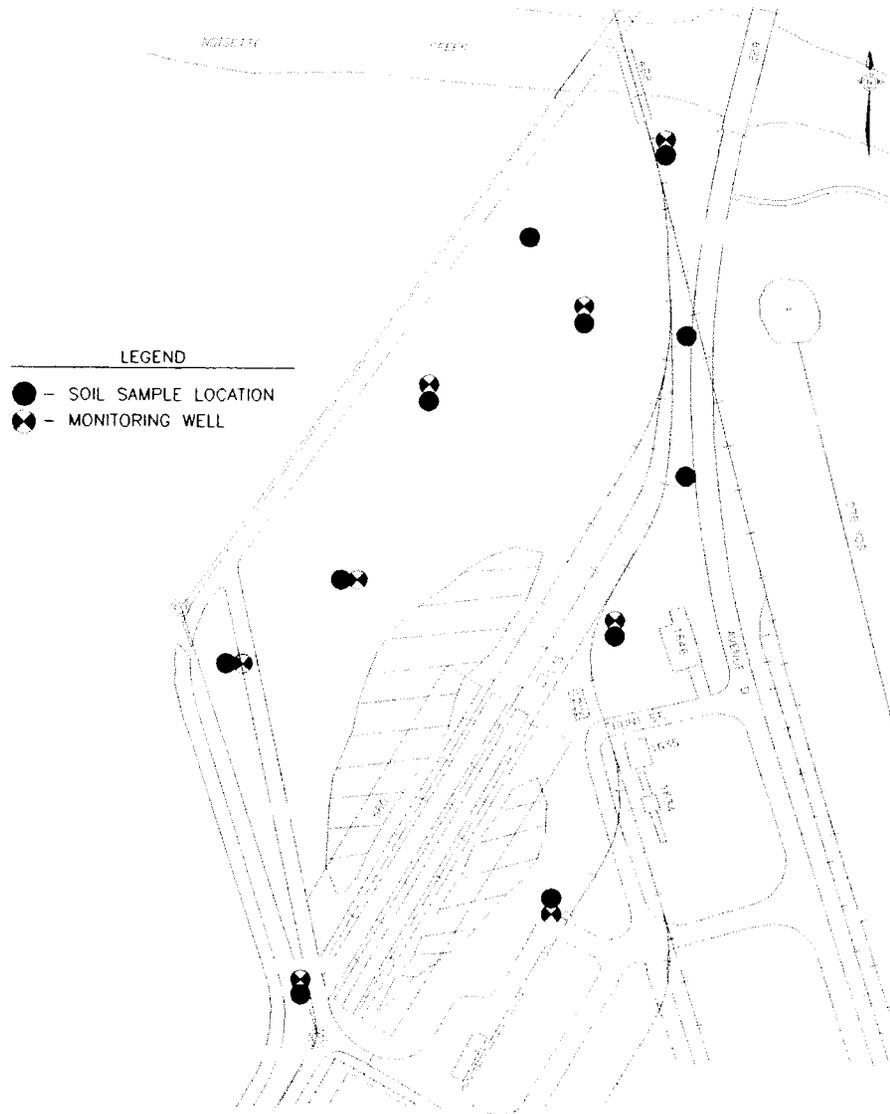


# Zone C Grouping 2 - Other Designated Sites

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| Site #          | Site Description                                      | Samples Collected                              |
|-----------------|---|--|
| SWMU 44         | Coal Storage Area                                     | Soil (19)<br>Groundwater (8)                   |
| SWMU 47/AOC 516 | Wash Area/Battery Charging<br>and Former Burning Dump | Soil (24)<br>Groundwater (14)                  |
| AOC 512         | Former Incinerator                                    | Soil (9)                                       |
| AOC 518         | Coal Storage Bins                                     | Soil (10)                                      |
| AOC 700         | Golf Course Maintenance<br>Building                   | <i>* Not presented in<br/>Draft RFI Report</i> |

# Zone C Grouping 2 - SWMU 44



## Primary Contributors to Risk/Hazard

### Soil:

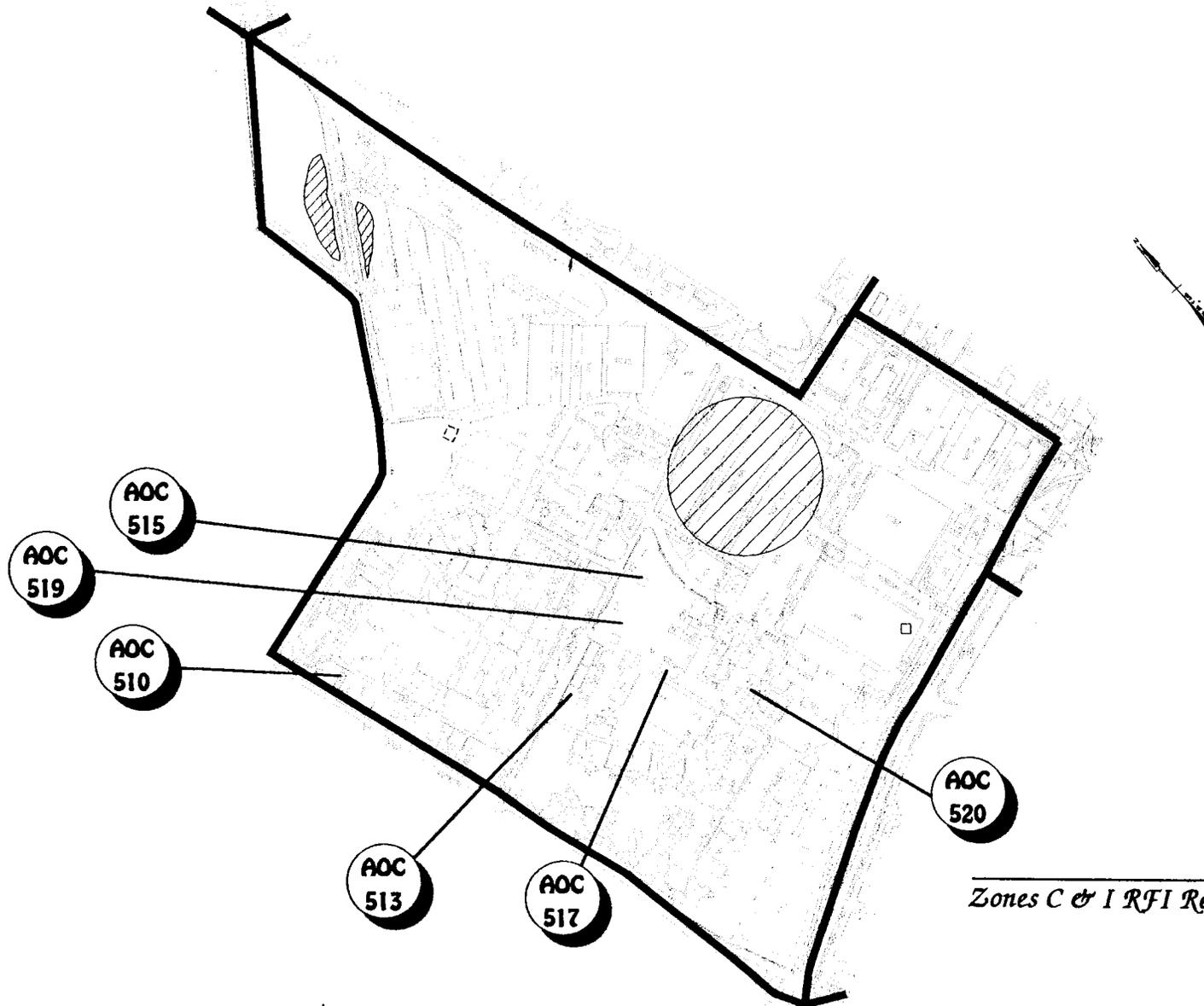
- Arsenic
- Benzo(a)pyrene equivalents

### Groundwater:

- Aluminum
- Arsenic
- Beryllium
- Manganese
- 2,3,7,8-TCDD

# Zone C Grouping 3 - No Further Action

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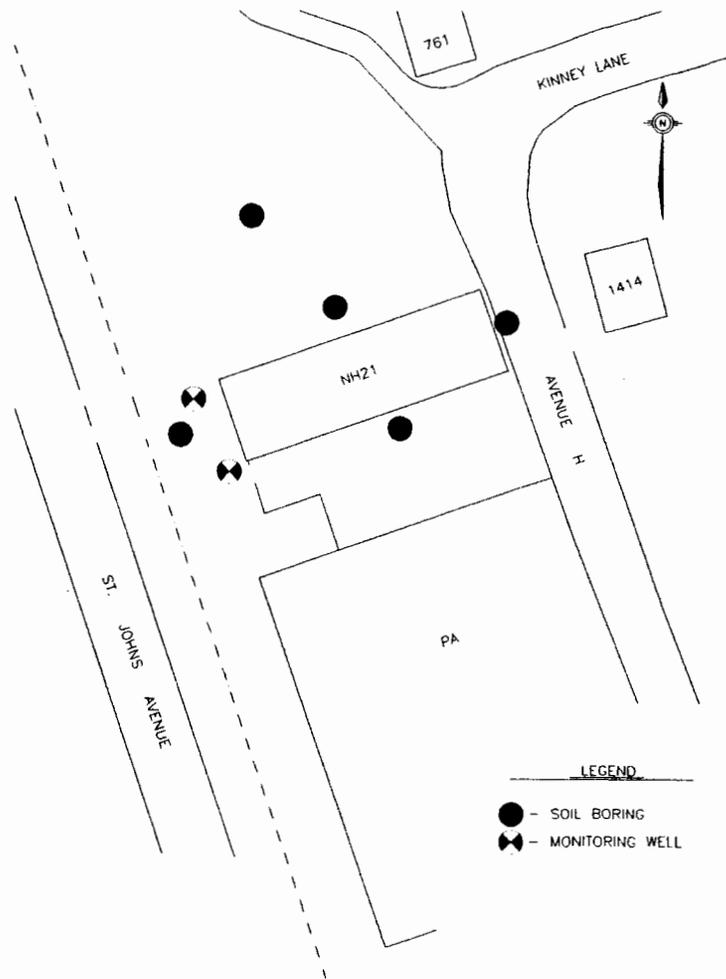
*Zones C & I RFI Results - 11/12/96*

## Zone C Grouping 3 - No Further Action

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| Site #       | Site Description  | Samples Collected           |
|--------------|---|-----------------------------|
| AOCs 515/519 | Former Incinerator & Paint Shop/<br>Former Boiler House | Soil (14)                   |
| AOC 513      | Former Morgue   | Soil (6)                    |
| AOC 517      | Former Indoor Firing Range                              | Soil (5)                    |
| AOC 520      | Former Garbage House                                    | Soil (8)                    |
| AOC 510      | Geotechnical Laboratory                                 | Soil (7)<br>Groundwater (2) |

# Zone C Grouping 3 - AOC 510



LEGEND

- - SOIL BORING
- ⊗ - MONITORING WELL

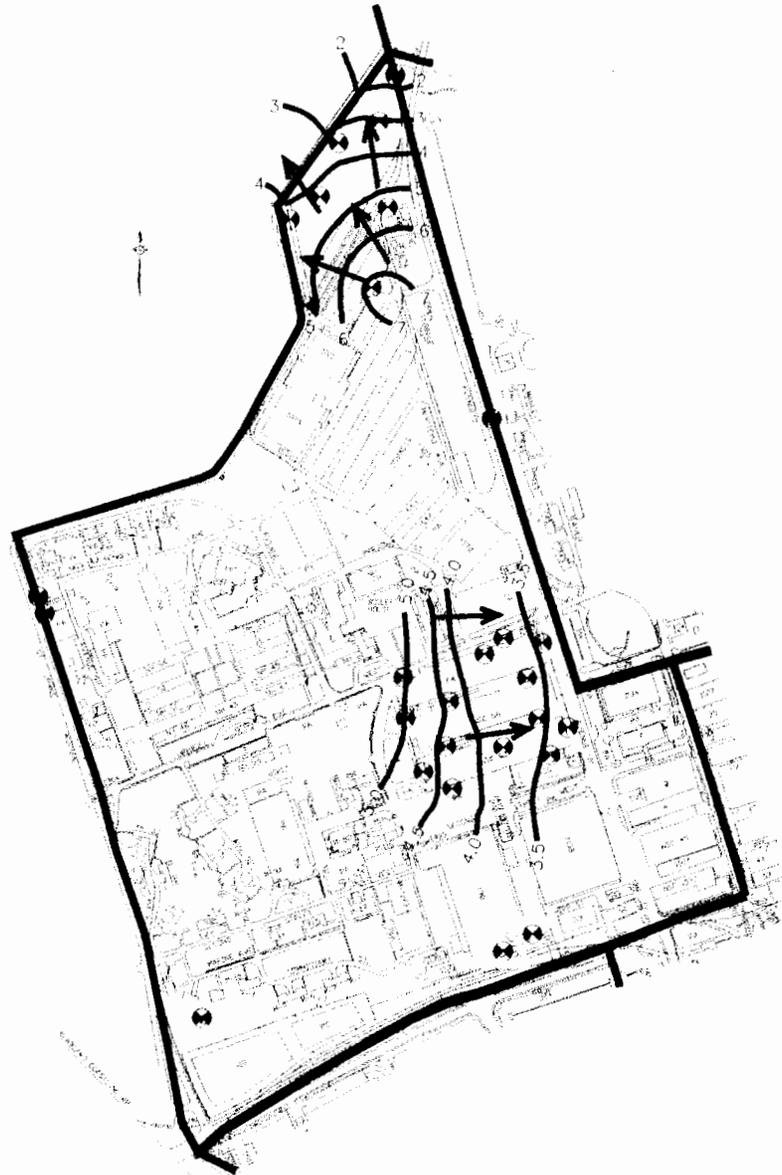
**Primary Contributors to Risk/Hazard**

**Soil:**  
None

**Groundwater:**  
None

# Zone C - Groundwater Monitoring Network

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## LEGEND

- ⊗ - MONITORING WELL
- 4.5 — CONTOUR
- - GROUNDWATER FLOW

Contour Interval is 0.5 feet

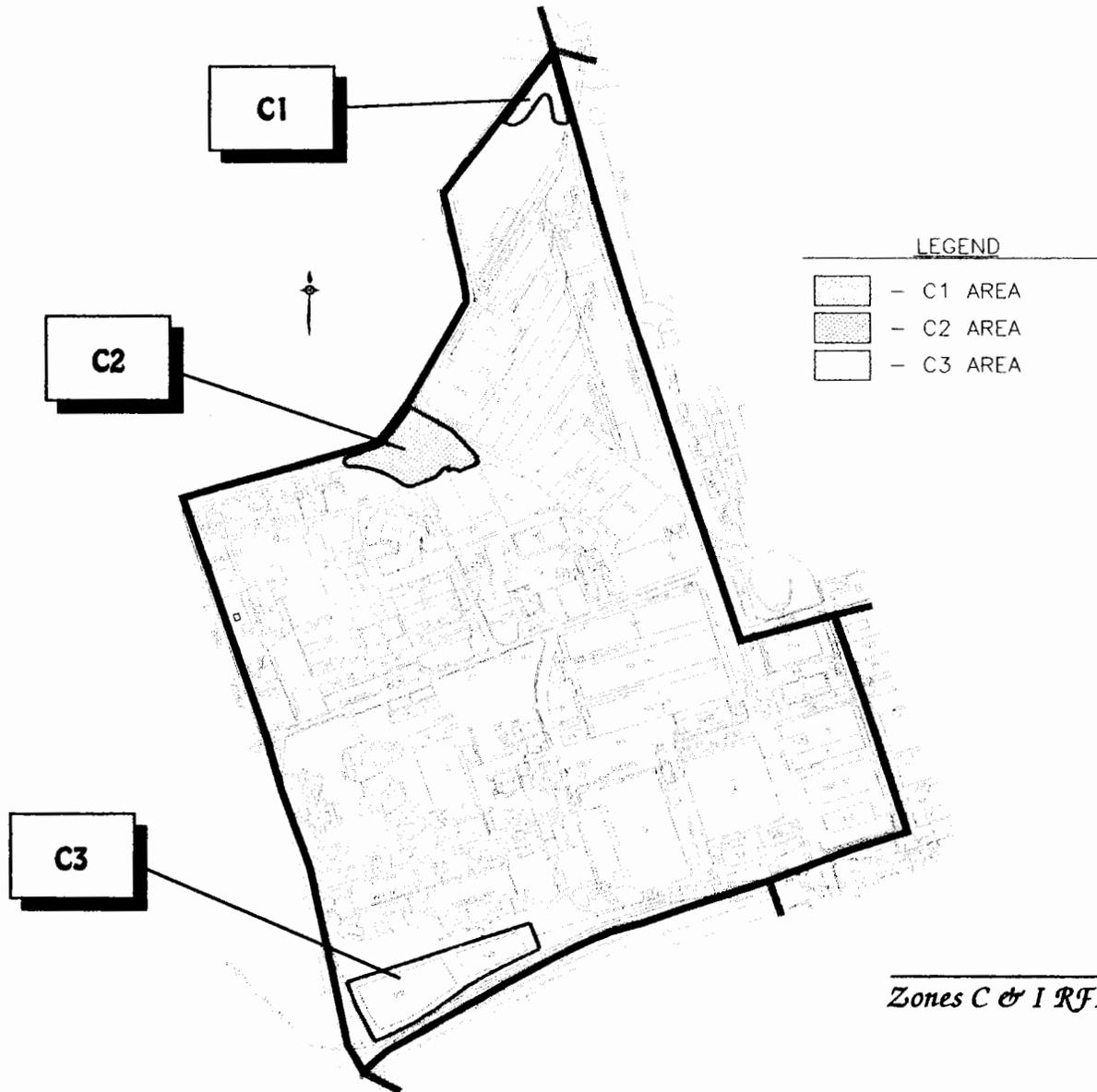
## Shallow Groundwater - COCs in Zone C

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| Area of Significant Impact | Site Description                                  | COCs Driving Risk  |
|----------------------------|---|--|
| SWMU 44                    | Coal Storage Yard                                 | Aluminum<br>Arsenic<br>Beryllium<br>Manganese<br>2,3,7,8-TCDD      |
| AOC 516/SWMU 47            | Wash Area/Battery Charging<br>Former Burning Dump | Antimony<br>Arsenic<br>Lead<br>Manganese<br>3,3-Dimethyl benzidine |
| AOC 523/SWMU 49            | Former Gas Station                                | Aluminum<br>Arsenic<br>Manganese                                   |

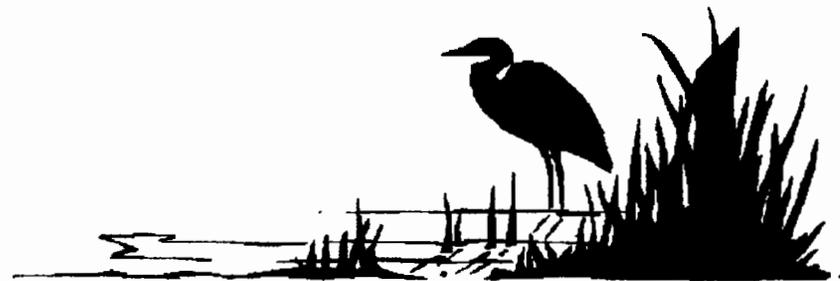
# Zone C - Ecological Areas

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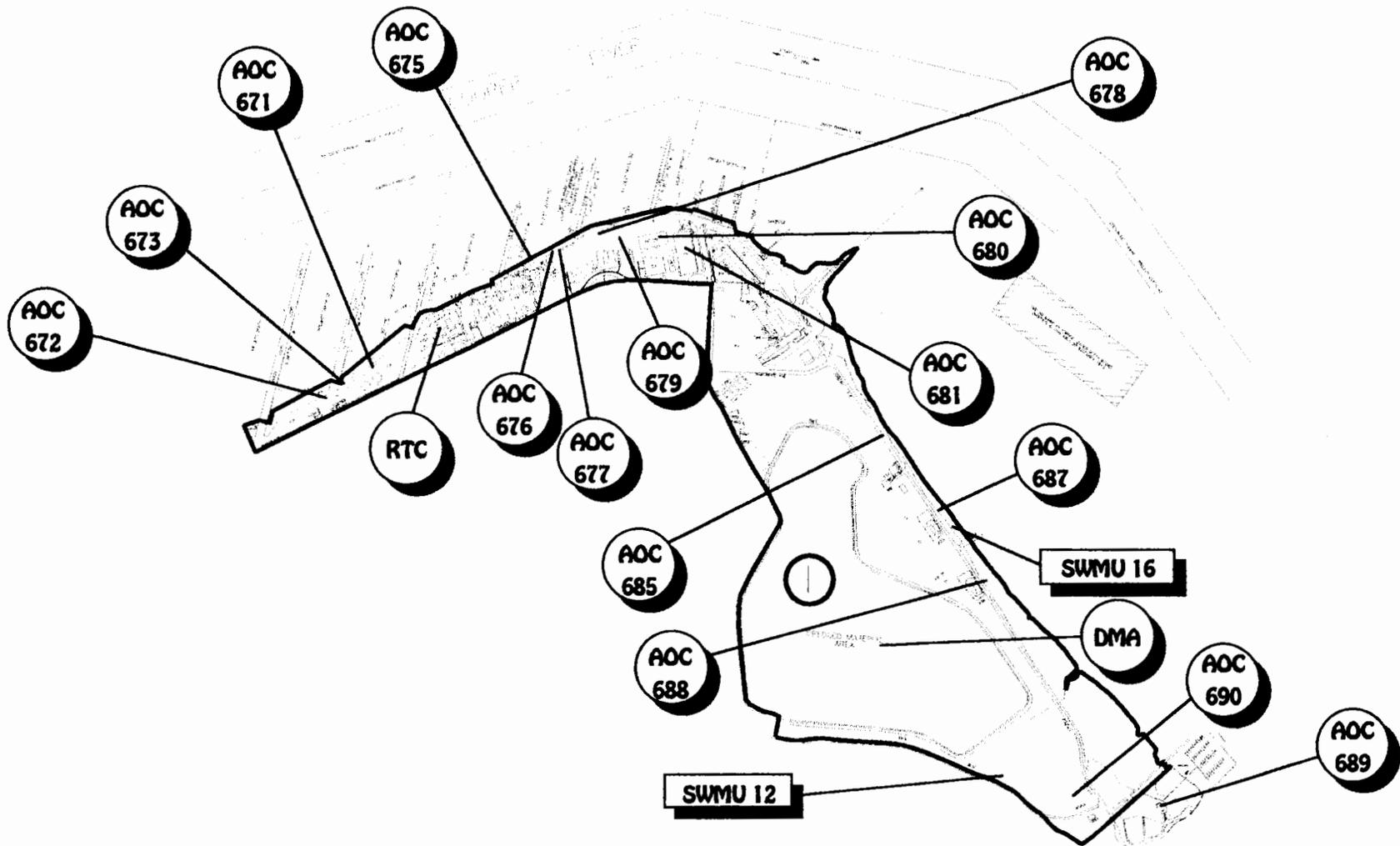
# Ecological Impacts - Zone C

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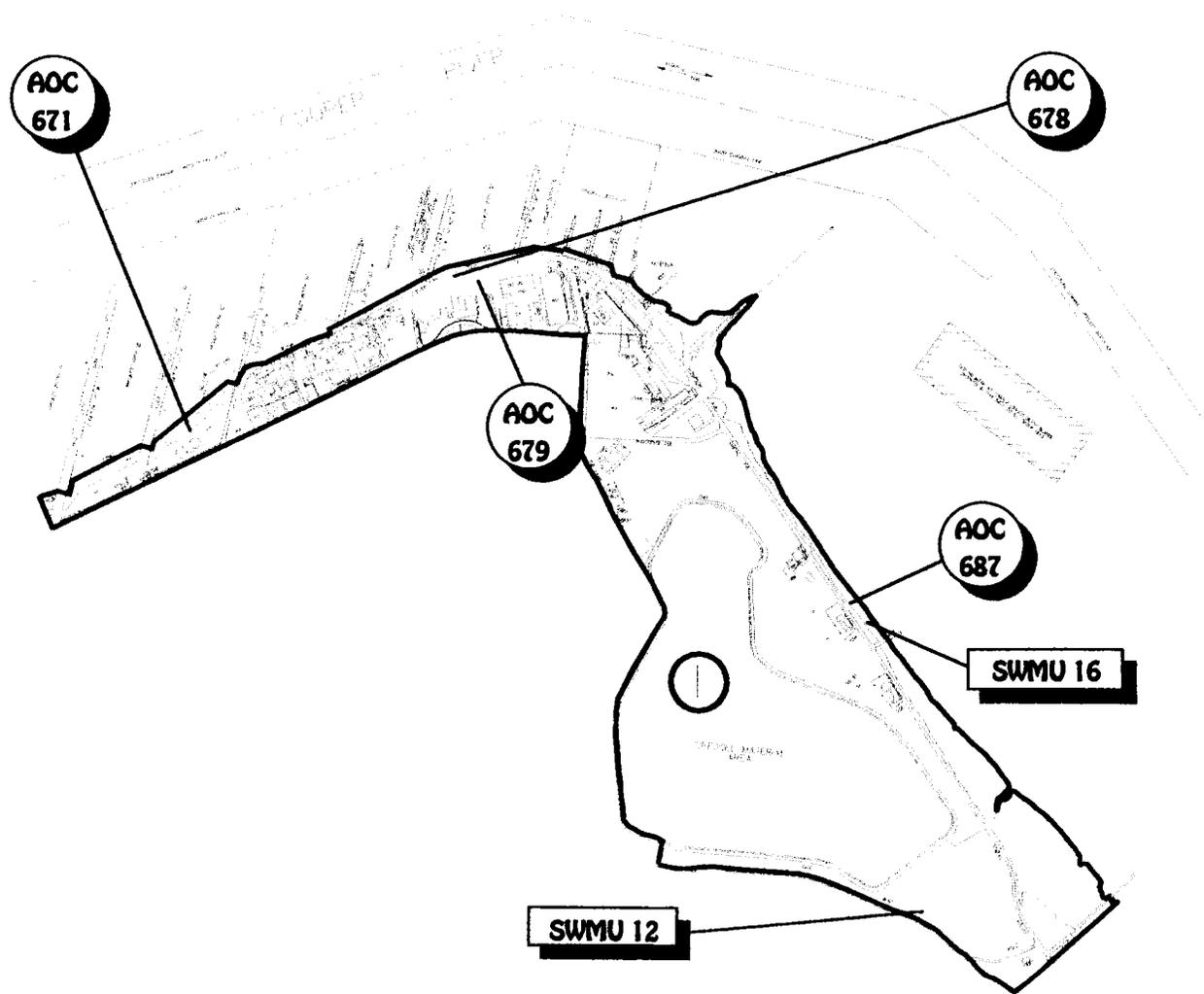
| Sub Zone | Description                             | Associated Sites | COCs                              | Receptors Potentially at Risk   |
|----------|---|------------------|-----------------------------------|---|
| C-1      | Dense shrubs and tall grasses           | SWMU 44          | Metals (arsenic, copper) in soil  | Noisette Creek (Zone J), small mammals, soil biota, and vegetation (seedlings). |
| C-2      | Grass field with few trees              | AOCs 512 & 509   | Metals (arsenic, copper) in soil. | Small mammals, soil biota, and vegetation (seedlings).                          |
| C-3      | Detention ponds with aquatic vegetation | AOC 504          | Arsenic in nearby soil.           | Small mammals and birds.  |

# Zone I AOCs/SWMUs



# Zone I Grouping 1 - Petroleum Sites

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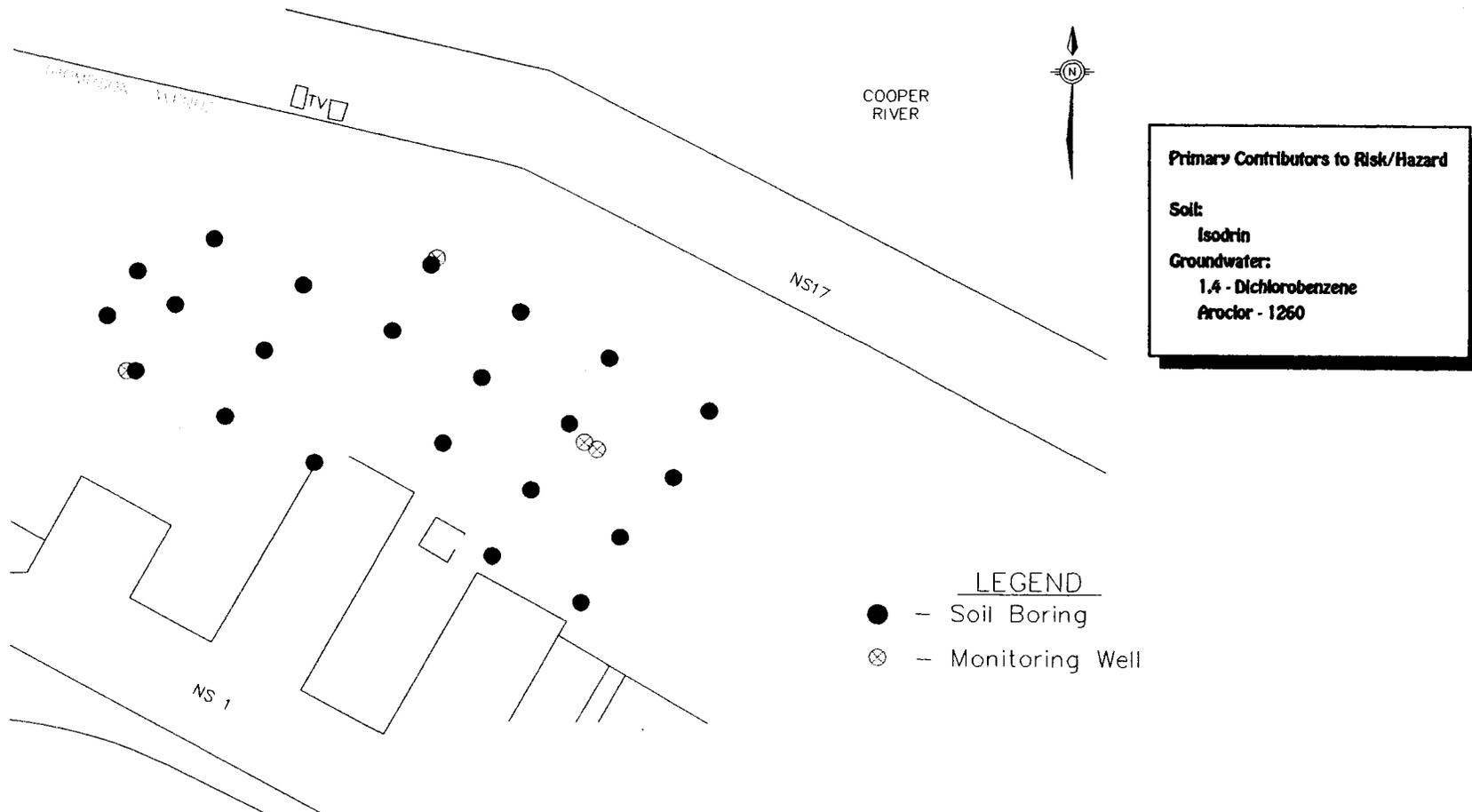


# Zone I Grouping 1 - Petroleum Sites

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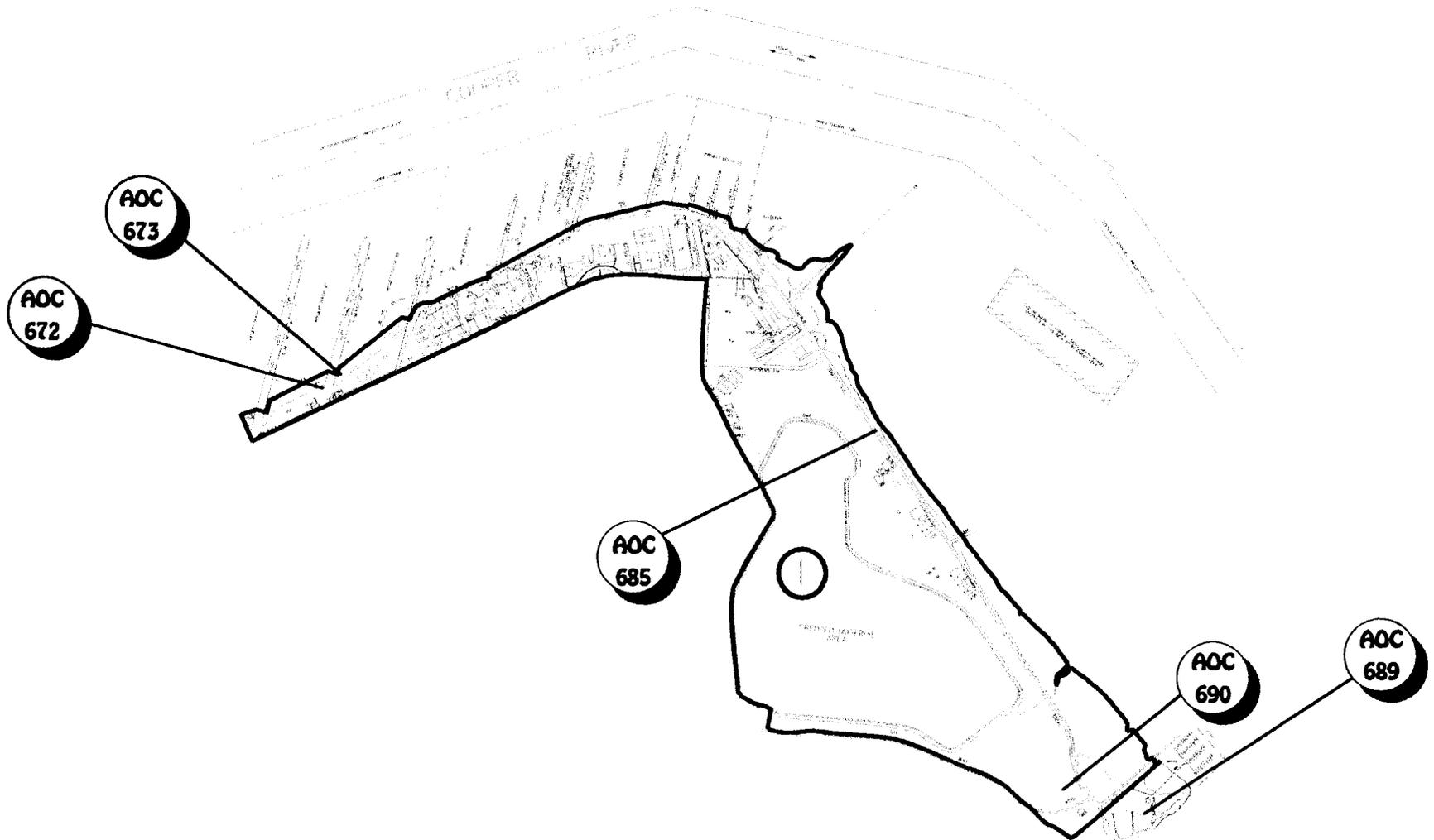
| Site #          | Site Description   | Samples Collected                    |
|-----------------|--|--------------------------------------|
| AOC 671         | Underground Storage Tanks for Aviation Gasoline          | Soil (10)<br>Groundwater (4)         |
| AOCs 678 & 679  | Former Firefighter School/Former Firefighter Wash Rack   | Soil (23)<br>Groundwater (2)         |
| SWMU 12         | Former Firefighter Training Site                         | Soil (15)<br>Groundwater (3)         |
| SWMU 16/AOC 687 | Unauthorized Open Storage Site/Ammunition Storage Bunker | Soil/Sediment (6)<br>Groundwater (4) |

# Zone I Grouping 1 - AOC 678/679



# Zone I Grouping 2 - Other Designated Sites

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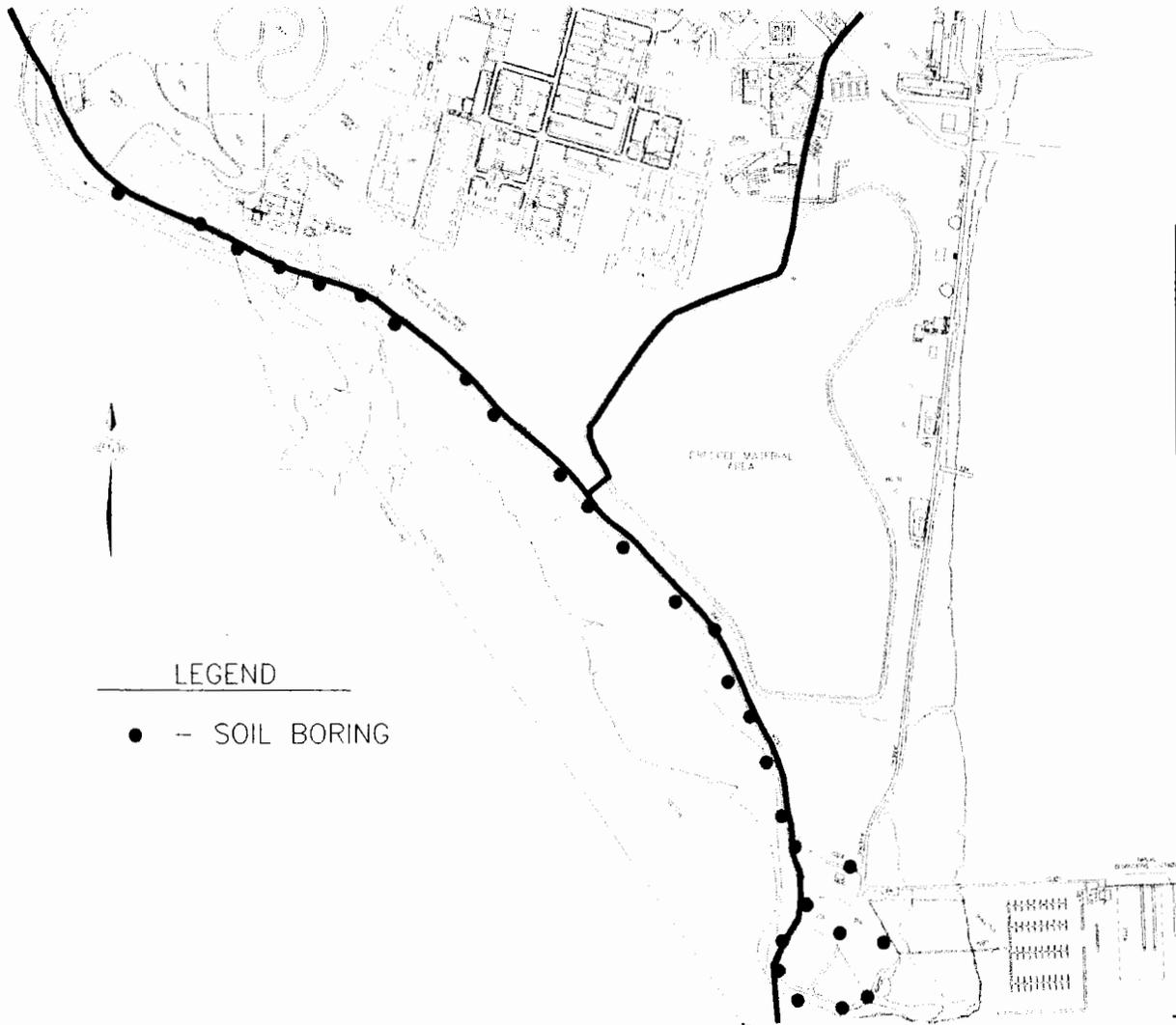


# Zone I Grouping 2 - Other Designated Sites

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| Site #         | Site Description   | Samples Collected |
|----------------|--|-------------------|
| AOCs 672 & 673 | PCB Transformer Substation                               | Soil (10)         |
| AOC 685        | Former Smoke Drum Area                                   | Soil (15)         |
| AOCs 689 & 690 | Unknown Material Disposal Site<br>Dredged Materials Area | Soil (33)         |

# Zone I Grouping 2 - AOC 689/690



LEGEND

● - SOIL BORING

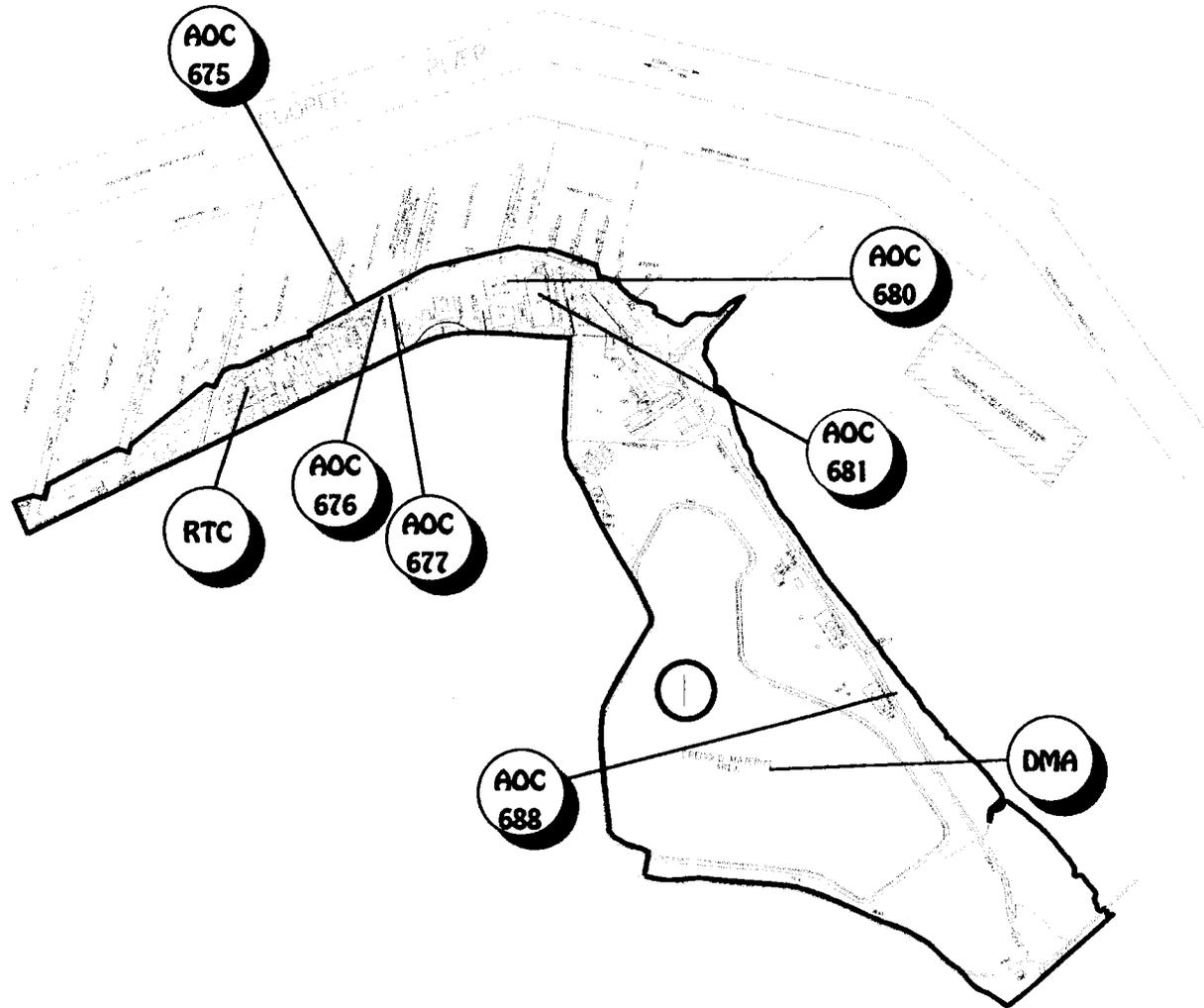
**Primary Contributors to Risk/Hazard**

**Soil:**  
Benzofluorene Equivalents

**Groundwater:**  
None

# Zone I Grouping 3 - No Further Action

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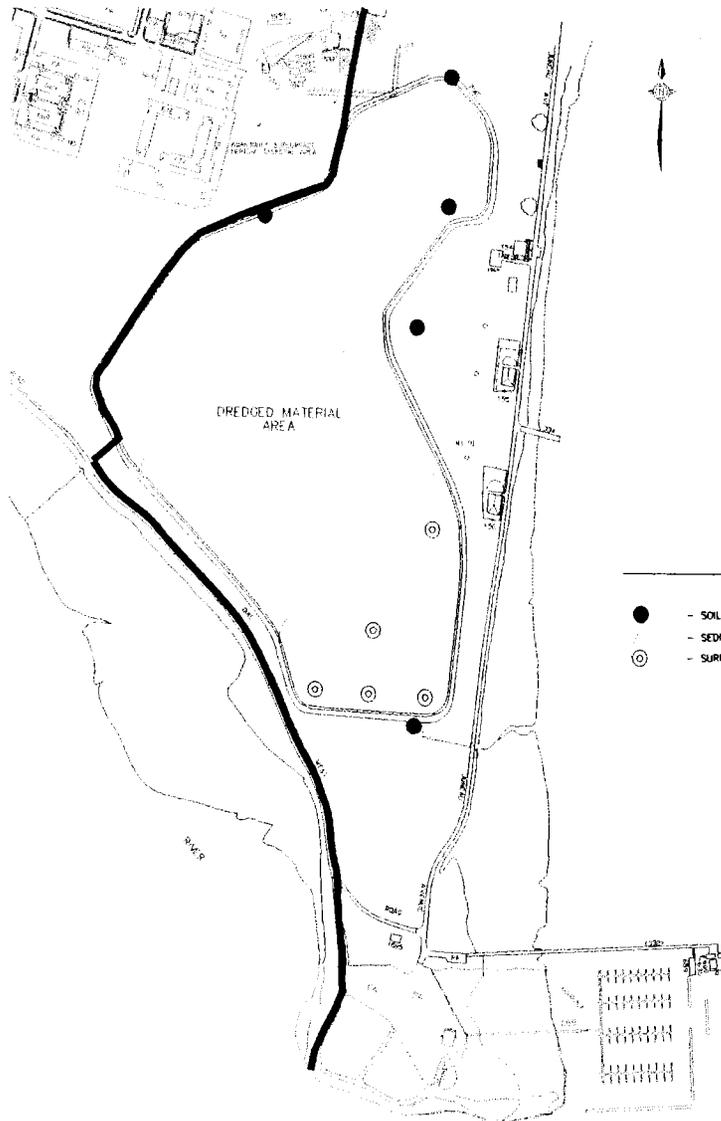


## Zone I Grouping 3 - No Further Action

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| Site #             | Site Description                                       | Samples Collected                       |
|--------------------|--|---|
| DMA                | Dredged Materials Area                                 | Soil/Sediment (14)<br>Surface Water (5) |
| RTC                | Reserve Training Center                                | Soil (10)                               |
| AOC 680            | Former Grinding<br>Room/Brake Repair Area              | Asbestos Samples (9)<br>Lead Wipes (7)  |
| AOC 681            | Blast Booth  | Soil (5)                                |
| AOC 688            | Ammunition Storage Bunker                              | Soil/Sediment (2)                       |
| AOCs 675, 676, 677 | Diesel Fuel UST<br>Incinerator<br>Petroleum Spill Site | Soil/Sediment (15)<br>Groundwater (4)   |

# Zone I Grouping 3 - DMA



**Primary Contributors to Risk/Hazard**

**Soil:**  
None

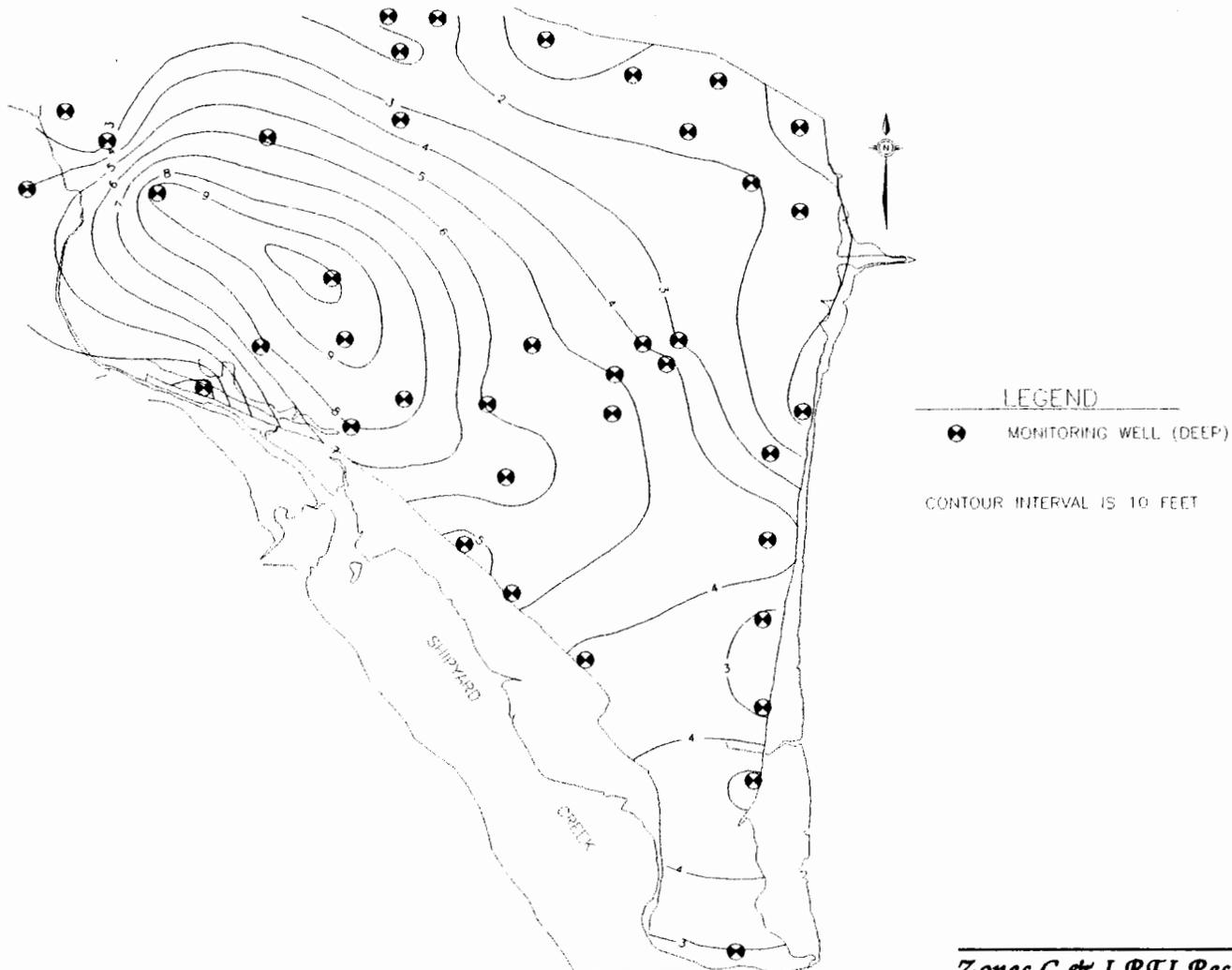
**Surface water:**  
None

LEGEND

- - SOIL SAMPLE LOCATIONS
- - SEDIMENT SAMPLE LOCATIONS
- ⊙ - SURFACE WATER SAMPLE LOCATIONS

# Zone I - Groundwater Monitoring Network Lower Zone/Shallow Aquifer

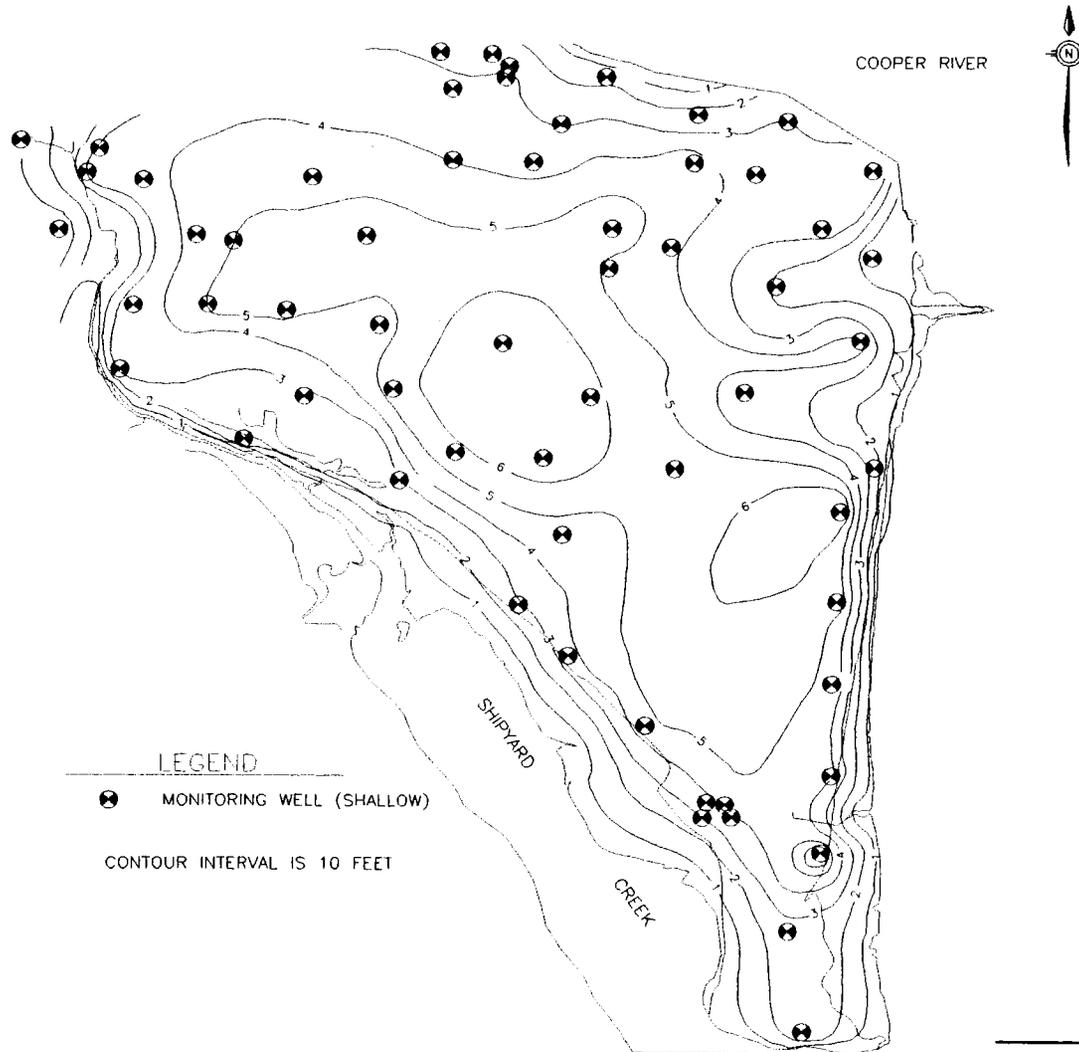
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*Zones C & I RFI Results - 11/12/96*

# Zone I - Groundwater Monitoring Network Upper Zone/Shallow Aquifer

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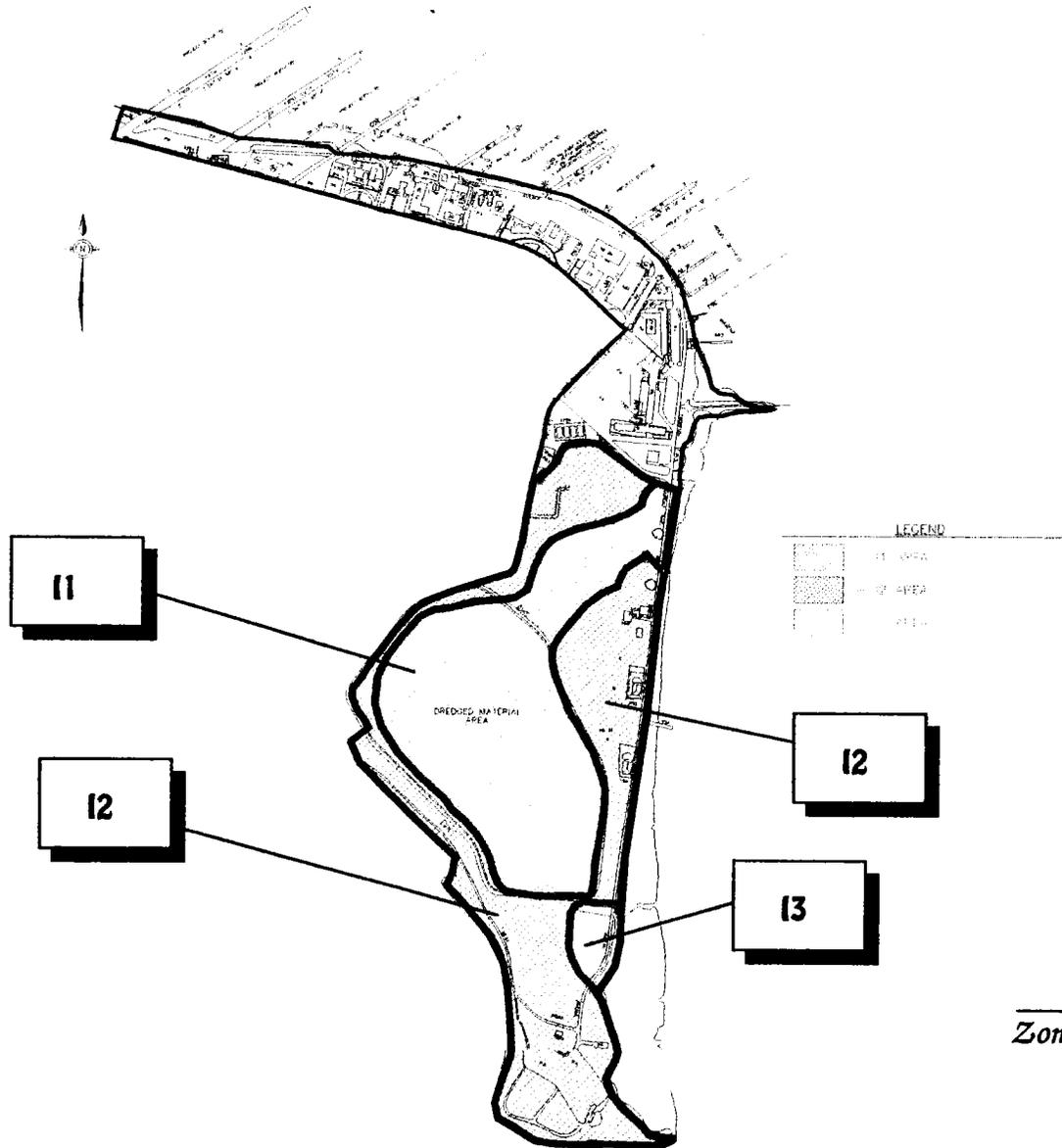
*Zones C & I RFI Results - 11/12/96*

# Shallow Groundwater - COCs in Zone I

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| Area of Significant Impact | Site Description  | COCs Driving Risk   |
|----------------------------|---|---|
| AOCs 678 & 679             | Former Firefighter School<br>Former Firefighter Wash Rack                         | 1, 4 - Dichlorobenzene<br>Aroclor - 1260                                |
| AOC 687/SWMU 16            | Ammunition Storage Bunker<br>Unauthorized Storage of Paint and<br>Other Materials | Arsenic<br>Methylene chloride   |
| SWMU 12                    | Former Firefighter Training Area  | 2,3,7,8 - TCDD equivalents<br>Arsenic<br>Cadmium<br>Manganese<br>Nickel |

# Zone I - Ecological Areas



# Ecological Impacts - Zone I



| Sub Zone | Description                                   | Associated Sites                     | COCs   | Receptors Potentially at Risk   |
|----------|---|--------------------------------------|--|---|
| I-1      | Dredged Material Area with shrubs and grasses | None                                 | Surface Water<br>Metals and pesticides<br>Sediment<br>Metals and semivolatiles<br><br>Soil<br>Zinc | Aquatic wildlife in the Cooper River and Shipyard Creek.<br><br>Herbaceous vegetation (seedlings) |
| I-2      | Forest with some grass fields                 | AOCs: 685, 687, 688, 690<br>SWMU: 12 | Metals (arsenic, copper, lead, zinc) and pesticides in soil.                                       | Small mammals<br>Soil biota<br>Vegetation (seedlings)   |
| I-3      | Wetland                                       | None                                 | Metals and pesticides in sediment.   | Aquatic wildlife in the Cooper River.   |

# Review of Risk

There is no such thing as **ZERO** risk.

## Risk Assessment - Procedure to evaluate risk.

- STEP 1** . . . . . Hazard Identification  
*Collect samples. Analyze for type and concentration of contaminants.*
- STEP 2** . . . . . Exposure Assessment  
*Will people come into contact with the hazard? And if so, who? how? how often? and why?*
- STEP 3** . . . . . Toxicity Assessment  
*What is harmful about the chemical? Is it carcinogenic or non-carcinogenic?*
- STEP 4** . . . . . Risk Characterization  
*Determine if potential exposures are great enough to cause human health problems.*

## Risk Management - How to manage risk.

- Question 1** . . . . Should cleanup be undertaken?
- Question 2** . . . . What should cleanup levels be?
- Question 3** . . . . What cleanup methods should, or can be used?

# Review of Risk (cont'd)

## Carcinogenic Risk

- ▲ Potential to cause cancer.
- ▲ Risk estimated as probability of getting cancer from exposure.
  - ✓ 1 in 10,000 risk =  $10^{-4}$
  - ✓ 1 in a million (1,000,000) =  $10^{-6}$

## Non-carcinogenic Risk (Toxicity)

- ▲ Health effects other than cancer.
- ▲ Risk is compared to a calculated value called a hazard index or hazard quotient.
  - ✓  $\frac{\text{Intake}}{\text{Reference Dose}} = \text{Hazard Quotient (HQ)}$
  - ✓ Sum of Hazard Quotients = Hazard Index (HI)

# Review of Risk (cont'd)

## Carcinogenic Risk

- ✓  $< 10^{-6}$  EPA/DHEC generally doesn't require action.
- ✓  $> 10^{-4}$  EPA/DHEC generally requires action.
- ✓ Risk Management: EPA/DHEC must consider many factors that may influence risk such as:
  - ▲ Who will be affected and how?
  - ▲ Future site use.
  - ▲ Existing features (e.g., buildings).
  - ▲ Probability of exposure.

## Non-carcinogenic Risk (Toxicity)

- ✓ A hazard index  $< 1$  indicates that no toxic effect is likely.
- ✓ A hazard index  $> 1$  indicates that a toxic effect is likely, typically in sensitive individuals.
- ✓ Example of a Conservative Assumption:
  - Chemical 1: HQ = 0.7 - lungs
  - Chemical 2: HQ = 0.2 - kidney
  - Chemical 3:  $\frac{HQ = 0.2}{HI = 1.1}$  - mucus membrane

(Although no organ specific HQ is  $> 1$ , assume an overall toxic effect is possible.)

**Summary of Surface Soil COCs  
Naval Base Charleston Zone C  
Charleston, South Carolina**

| Chemical                              | AOC 516 |         | AOC 508 | AOC 510 | AOC 512 | AOC 518 | AOC 519 |
|---------------------------------------|---------|---------|---------|---------|---------|---------|---------|
|                                       | SWMU 44 | SWMU 47 | 511     |         |         |         | 515     |
| <b>Semivolatile Organic Compounds</b> |         |         |         |         |         |         |         |
| Benzo(a)pyrene Equivalents            | X       | X       | X       | X       | X       |         |         |
| <b>Metals</b>                         |         |         |         |         |         |         |         |
| Aluminum                              | X       |         |         |         |         |         |         |
| Arsenic                               | X       | X       |         |         |         |         |         |
| Beryllium                             | X       | X       |         |         | X       |         |         |
| Manganese                             | X       |         |         |         |         |         |         |
| Thallium                              | X       |         |         |         |         |         |         |
| <b>Chlorinated Pesticides</b>         |         |         |         |         |         |         |         |
| Dieldrin                              |         |         | X       |         |         |         |         |
| DDT                                   |         |         | X       |         |         |         |         |
| Chlordane                             |         |         | X       |         |         | X       |         |
| <b>General Petroleum Products</b>     |         |         |         |         |         |         |         |
| Total Petroleum HC                    |         | Y       | Y       |         |         |         | Y       |

**NOTES:**

X indicates the chemical was identified as a COC in surface soil.

Y indicates petroleum hydrocarbons were detected in soil at concentrations exceeding 100 mg/kg.

**Summary of Groundwater COCs  
Naval Base Charleston Zone C  
Charleston, South Carolina**

| Chemical                              | SWMU 44 | SWMU 47 | SWMU 49 |
|---------------------------------------|---------|---------|---------|
|                                       | AOC 516 | AOC 516 | AOC 523 |
| <b>Semivolatile Organic Compounds</b> |         |         |         |
| BEHP                                  | X       |         |         |
| Acetophenone                          | X       |         |         |
| 3,3-Dimethylbenzidine                 |         | X       |         |
| <b>Dioxins/Furans</b>                 |         |         |         |
| 2,3,7,8-TCDD equivalents              | X       |         |         |
| <b>Metals</b>                         |         |         |         |
| Aluminum                              | X       |         | X       |
| Antimony                              | X       | X       |         |
| Arsenic                               | X       | X       | X       |
| Beryllium                             | X       |         |         |
| Lead                                  |         | X       |         |
| Manganese                             | X       | X       | X       |
| Nickel                                | X       |         |         |
| <b>General Petroleum Products</b>     |         |         |         |
| Total Petroleum HC                    |         | X       | X       |

**NOTES:**

X indicates the chemical was identified as a COC in groundwater

**Summary of Surface Soil COCs  
Naval Base Charleston Zone I  
Charleston, South Carolina**

| Chemical                              | AOC | AOC        | AOC        | AOC | AOC               | AOC        |
|---------------------------------------|-----|------------|------------|-----|-------------------|------------|
|                                       | 671 | 672<br>673 | 678<br>679 | 685 | 687<br>SWMU<br>16 | 689<br>690 |
| <b>Semivolatile Organic Compounds</b> |     |            |            |     |                   |            |
| Benzo(a)pyrene Equivalents            | X   |            | X          | X   | X                 | X          |
| N-Nitroso-di-n-propylamine            | X   |            |            |     |                   |            |
| <b>Chlorinated Pesticides</b>         |     |            |            |     |                   |            |
| Isodrin                               |     |            | X          |     |                   |            |
| <b>Metals</b>                         |     |            |            |     |                   |            |
| Arsenic                               |     | X          |            | X   |                   |            |
| Beryllium                             |     |            |            | X   |                   |            |

**NOTES:**

X indicates the chemical was identified as a COC in surface soil.

**Summary of Groundwater COCs  
Naval Base Charleston Zone I  
Charleston, South Carolina**

| Chemical                           | AOC        | AOC               | AOC        |
|------------------------------------|------------|-------------------|------------|
|                                    | 678<br>679 | 687<br>SWMU<br>16 | SWMU<br>12 |
| <b>Volatile Organic Compounds</b>  |            |                   |            |
| 1,4-Dichlorobenzene                | X          |                   |            |
| Methylene chloride                 |            | X                 |            |
| <b>Chlorinated Pesticides/PCBs</b> |            |                   |            |
| Aroclor-1260                       | X          |                   |            |
| <b>Dioxins/Furans</b>              |            |                   |            |
| 2,3,7,8-TCDD equivalents           |            |                   | X          |
| <b>Metals</b>                      |            |                   |            |
| Arsenic                            |            | X                 | X          |
| Cadmium                            |            |                   | X          |
| Manganese                          |            |                   | X          |
| Nickel                             |            |                   | X          |

**NOTES:**

X indicates the chemical was identified as a COC in groundwater

**Summary of Risk and Hazard Projections  
Naval Base Charleston Zone C  
Charleston, South Carolina**

| Site            | Matrix      | ILCR   |           |       | Hazard Index |      | TPH | Primary Contributors to Risk/Hazard                                      |
|-----------------|-------------|--------|-----------|-------|--------------|------|-----|--|
|                 |             | < 10-6 | 10-6/10-4 | >10-4 | < 1          | > 1  |     |  |
| SWMU 44         | Soil        |        | W         | R     | W            | R    |     | Arsenic, Benzo(a)pyrene equivalents                                      |
|                 | Groundwater |        |           | R, W  |              | R, W |     | Aluminum, Arsenic, Manganese, Beryllium, 2378-TCDD                       |
| SWMU 47/AOC 516 | Soil        |        | R, W      |       | W            | R    | Yes | Aluminum, Arsenic, Lead, Thallium, Beryllium, Benzo(a)pyrene equivalents |
|                 | Groundwater |        |           | R, W  |              | R, W | Yes | Antimony, Arsenic, Lead, Manganese, 3,3-Dimethylbenzidine                |
| AOC 508 & 511   | Soil        |        | R, W      |       | R, W         |      | Yes | Benzo(a)pyrene equivalents, Chlordane, DDT, Dieldrin                     |
| AOC 515 & 519   | Soil        | R, W   |           |       | R, W         |      | Yes | None   |
| AOC 523/SWMU 49 | Soil        | R, W   |           |       | R, W         |      |     | None   |
|                 | Groundwater |        |           | R, W  |              | R, W | Yes | Aluminum, Arsenic, Manganese   |
| AOC 510         | Soil        | R, W   |           |       | R, W         |      |     | None   |
|                 | Groundwater | R, W   |           |       | R, W         |      |     | None   |
| AOC 512         | Soil        | W      | R         |       | R, W         |      |     | Beryllium, Benzo(a)pyrene equivalents                                    |
| AOC 513         | Soil        | R, W   |           |       | R, W         |      |     | None   |
| AOC 517         | Soil        | R, W   |           |       | R, W         |      |     | None   |
| AOC 518         | Soil        | W      | R         |       | R, W         |      |     | Chlordane  |
| AOC 520         | Soil        | R, W   |           |       | R, W         |      |     | None   |

**NOTES:**

R indicates the resident projections fell within the corresponding risk/hazard range.

W indicates the site worker projections fell within the corresponding risk/hazard range.

AOC 522 & 700 were not investigated during initial field efforts; results and findings are to be presented in Draft Final RFI Report

Yes indicates petroleum hydrocarbons were detected in soil at concentrations exceeding 100 mg/kg.

**Summary of Risk and Hazard Projections  
Naval Base Charleston Zone I  
Charleston, South Carolina**

| Site               | Matrix          | ILCR   |           |       | Hazard Index |      | Primary Contributors to Risk/Hazard                    |
|--------------------|-----------------|--------|-----------|-------|--------------|------|--|
|                    |                 | < 10-6 | 10-6/10-4 | >10-4 | < 1          | > 1  |  |
| AOC 671            | Soil            | W      | R         |       | R, W         |      | Benzo(a)pyrene equivalents, N-Nitroso-di-n-propylamine |
|                    | Groundwater     | R, W   |           |       | R, W         |      | None   |
| AOC 672 & 673      | Soil            |        | R, W      |       | W            | R    | Arsenic  |
| AOC 675, 676 & 677 | Soil            | R, W   |           |       | R, W         |      | None   |
|                    | Groundwater     | R, W   |           |       | R, W         |      | None   |
| AOC 678 & 679      | Soil            | W      | R         |       | R, W         |      | Isodrin  |
|                    | Groundwater     |        | W         | R     | R, W         |      | 1,4-Dichlorobenzene, Aroclor-1260                      |
| AOC 680            | Wipe            | R, W   |           |       | R, W         |      | None   |
| AOC 681            | Soil            | R, W   |           |       | R, W         |      | None   |
| AOC 685            | Soil            |        | R, W      |       | R, W         |      | Benzo(a)pyrene equivalents, Arsenic, Beryllium         |
| AOC 687/SWMU 16    | Soil            | R, W   |           |       | R, W         |      | None   |
|                    | Groundwater     |        |           | R, W  |              | R, W | Arsenic, Methylene chloride                            |
| AOC 688            | Soil (sediment) | R, W   |           |       | R, W         |      | None   |
| AOC 689 & 690      | Soil            | W      | R         |       | R, W         |      | Benzo(a)pyrene equivalents                             |
| SWMU 12            | Soil            | R, W   |           |       | R, W         |      | None   |
|                    | Groundwater     |        |           | R, W  |              | R, W | 2,3,7,8-TCDD, Arsenic, Cadmium, Manganese, Nickel      |
| RTC                | Soil            | R, W   |           |       | R, W         |      | None   |
| DMA                | Soil (sediment) | R, W   |           |       | R, W         |      | None   |

**NOTES:**

R indicates the resident projections fell within the corresponding risk/hazard range.

W indicates the site worker projections fell within the corresponding risk/hazard range.

# Zone C Recommendations

| Site #              | Site Description  | NFA   | Further Action |     |
|---------------------|---|---|----------------|-----|
|                     |   |   | TPH            | BRA |
| SWMU 44             | Coal Storage Area   |   |                | ✓   |
| AOC 516/<br>SWMU 47 | Wash Area/Battery Charging and<br>Former Burning Dump         |   | ✓              | ✓   |
| AOC 508/511         | Former Incinerator and Former<br>Oil Storage House            |   | ✓              |     |
| AOC 515/519         | Former Incinerator/Paint Shop and<br>Former Boiler House      |   | ✓              |     |
| AOC 523/<br>SWMU49  | Former Gas Station  |   | ✓              | ✓   |
| AOC 510             | Geotechnical Laboratory                                       | ✓   |                | ✓   |
| AOC 512             | Former Incinerator  |   |                | ✓   |
| AOC 513             | Former Morgue   | ✓   |                |     |
| AOC 517             | Former Indoor Firing Range                                    | ✓   |                |     |
| AOC 518             | Coal Storage Bins   |   |                | ✓   |
| AOC 520             | Former Garbage House  | ✓   |                |     |
| AOC 522<br>AOC 700  | Former Grease and Wash Bldg.<br>Golf Course Maintenance Bldg. | * To be addressed in<br>Draft-Final RFI Report. |                |     |

NFA = No Further Action

TPH = Further Action is required due to presence of *Total Petroleum Hydrocarbons*.

BRA = Further Action is required according to *Baseline Risk Assessment*.

# Zone I Recommendations

| Site #  | Site Description                     | NFA | Further Action |     |
|---------|--------------------------------------|-----|----------------|-----|
|         |                                      |     | TPH            | BRA |
| SWMU 12 | Former Fire Fighter Training Area    |     |                | ✓   |
| SWMU 16 | Unauthorized Storage Area            |     |                | ✓   |
| AOC 671 | Underground Storage Tank Site        |     |                | ✓   |
| AOC 672 | PCB Transformer Site                 |     |                | ✓   |
| AOC 673 | Oil, Solvent, and Paint Storage Area |     |                | ✓   |
| AOC 675 | Underground Storage Tank Site        | ✓   |                |     |
| AOC 676 | Incinerator                          | ✓   |                |     |
| AOC 677 | Petroleum Spill Site                 | ✓   |                |     |
| AOC 678 | Former Fire Fighter School           |     |                | ✓   |
| AOC 679 | Former Fire Fighter Wash Rack        |     |                | ✓   |
| AOC 680 | Grinding Room/Brake Repair Area      | ✓   |                |     |
| AOC 681 | Blast Booth                          | ✓   |                |     |
| AOC 685 | Former Smoke Drum Area               |     |                | ✓   |
| AOC 687 | Ammunition Storage Bunker            |     |                | ✓   |
| AOC 688 | Ammunition Storage Bunker            | ✓   |                |     |
| AOC 689 | Unauthorized Disposal Area           |     |                | ✓   |
| AOC 690 | Dredged Materials Area               |     |                | ✓   |
| DMA     | Dredged Materials Area               | ✓   |                |     |
| RTC     | Reserve Training Center              | ✓   |                |     |

NFA = No Further Action

TPH = Further Action is required due to presence of *Total Petroleum Hydrocarbons*.

BRA = Further Action is required according to *Baseline Risk Assessment*.

# Next Steps

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## ▲ Regulatory Review

- (Reports Submitted January 1996)

## ▲ Public Comment

## ▲ Permit Revision

