

**EPA Superfund  
Explanation of Significant Differences:**

**NAVAL AIR ENGINEERING CENTER  
EPA ID: NJ7170023744  
OU 26  
LAKEHURST, NJ  
09/30/2003**

# **EXPLANATION OF SIGNIFICANT DIFFERENCES**

## **AREAS I AND J GROUND WATER NAVAL AIR ENGINEERING STATION, LAKEHURST, NJ**

Site Name: Naval Air Engineering Station

Site Location: Lakehurst, New Jersey

Lead Agency: U.S. Navy

Support Agencies: United States Environmental Protection Agency, Region II (USEPA)  
New Jersey Department of Environmental Protection (NJDEP)  
New Jersey Pinelands Commission

### **I. Statement of Purpose**

A Record of Decision (ROD) for the final remedy for groundwater at Areas I and J at the Naval Air Engineering Station (NAES) was signed on September 27, 1999. At these Areas, the selected remedy was natural restoration with long-term groundwater monitoring to address the groundwater contamination in and downgradient of Areas I and J and co-metabolism to treat the higher area of groundwater contamination. As part of the original remedy, institutional controls in the form of a Classification Exception Area (CEA) is being implemented by NJDEP. The CEA, which provides for well restrictions, was implemented for Areas I and J and associated downgradient, off-base locations because the Ground Water Quality Standards are exceeded (N.J.A.C. 7:9-6.6(a)). The CEA is unchanged by this Explanation of Significant Differences (ESD). This ESD is issued in accordance with Section 117(c) of the Comprehensive Environmental Response, Compensation and Liability Act of 1980, as amended (CERCLA), and Section 300.435(c)(2)(i) of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This ESD has been prepared to provide the public with an explanation of the nature of a change which has been made to the selected remedy set forth in the ROD; to summarize the information that led to the making of the change; and to affirm that the revised remedy complies with the statutory requirements of CERCLA Section 121, 42 U.S.C. § 9621. The proposed action, involving the injection of nanoscale particles, constitutes an alternate treatment technology at Areas I and J, that will be implemented, in lieu of co-metabolism, to reduce higher levels of contamination and expedite the achievement of overall cleanup goals. Co-metabolism was determined not to be effective and has been abandoned. The natural restoration remedy will continue and the implementation of the proposed action should accelerate the time to meet applicable or relevant and appropriate requirements (ARARs). Since the proposed action does not fundamentally alter the primary remedy or performance of the remedy, a ROD amendment is not required. This ESD is incorporated into the Administrative Record for the Site, in accordance with Section 300.825(a)(2) of the NCP.

## **II. Summary of Site History, Site Conditions and Selected Remedy**

Areas I and J are located along the southern boundary of NAES in the west central portion of the Station (see Figure 1). The NAES property boundary forms the southern border of Areas I and J. Areas I and J are largely developed and includes various Navy testing facilities, including a steam plant and catapult launching facilities. Groundwater flow in Areas I and J is in a generally east to southeast direction toward the facility boundary.

Since the facilities in Areas I and J were constructed in 1958, they have been used for the testing of aircraft launching activities. Past releases of liquid wastes associated with these testing activities resulted in the contamination of groundwater at these Areas. Potential sources of groundwater contamination east of the catapult and taxiway include past releases of wastewater from the catapult test facility, past releases of liquid wastes at the catapult test facility storage area, past releases associated with testing of catapult equipment, and former launching/recovery activities on Taxiway No. 4. This contamination occurred during the 1960's and early 1970's.

The primary contaminants present in groundwater at Areas I and J are chlorinated volatile organic compounds (cVOCs) including cis-1, 2-dichloroethene, 1,1-dichloroethene, 1,1-dichloroethane, 1,1,1-trichloroethane, trichloroethene and tetrachloroethene. Vertically, the largest amount of contamination exists in the zone from 50 to 70 feet below the ground surface. Based on geoprobe sampling conducted in Area I in 2002, contaminant levels above ARARs do not exist at 85 feet below ground surface.

The selected alternative to address groundwater in and downgradient of Areas I and J was natural restoration with long-term monitoring and treatment of the higher area of contamination. A CEA that restricts groundwater use has been established as an institutional control component of the remedy. This ESD has been prepared to use nanoscale particle technology, in lieu of co-metabolism, to reduce the higher area of groundwater contamination in Areas I and J.

The remedies selected in the September 27, 1999 ROD and this ESD are intended to allow for unrestricted use upon attainment of cleanup levels. It is the policy of the USEPA to conduct five-year reviews when the attainment of cleanup levels will take longer than five years. The next five-year review covering the NAES Site will be conducted by January 1, 2006.

## **III. Basis for the Document**

The use of natural restoration to reduce the groundwater contamination in Areas I and J is ongoing and documented by the *Final Report Groundwater Natural Restoration Study*, dated January 1999; and, the *Bi-Annual Progress Report, Groundwater Natural Restoration Study, Areas I and J*, dated October 2001 and continued groundwater monitoring. However, completed co-metabolism bench-scale and pilot studies indicated that this remedy was not effective at reducing the areas of higher VOC concentration that exist within these areas. Pilot testing of the nanoscale particle technology has shown that this may effectively reduce the higher areas of groundwater contamination in Areas I and J.

#### **IV. Description of Significant Differences**

The Navy proposes to use nanoscale particles, in lieu of co-metabolism, to reduce the higher levels of groundwater contamination and expedite the achievement of overall cleanup goals in Areas I and J.

This innovative technology involves the injection of submicron particles of zero valent iron. Nanoscale particles rapidly and completely degrade chlorinated organic compounds. When applied to water and soil contaminated with chlorine based organic solvents, the nanoscale particles remove the organic chlorine and convert the solvent to benign hydrocarbons and chloride anions.

Laboratory bench-scale testing of the nanoscale particle technology on groundwater obtained from NAES was conducted in April 2001. The results of this testing indicated that the chlorinated compounds in groundwater at Areas I and J can be completely dechlorinated with the nanoscale particles. The results of the bench-scale testing can be found in the *Treatability Study of the Use of Bimetallic Nanoscale Particles for the Treatment of Contaminated Groundwater, Naval Air Engineering Station Site, Lakehurst, New Jersey*, dated June 2001.

Field testing of the nanoscale particle technology was conducted in February 2002 to demonstrate the effectiveness of nanoscale particles at treating the chlorinated organic compounds in groundwater at NAES, Areas I and J. The results of the field testing indicate that the nanoscale particles were effective at decreasing oxidation reduction potential (ORP) in area groundwater thus creating conditions favorable for the dechlorination of chlorinated hydrocarbons. The nanoscale particles resulted in a reduction in cVOCs of 74% in the month following nanoscale particle injection at the field test site. Based upon the results of the Areas I and J Natural Restoration Study it has also been demonstrated that the half-life of the cVOCs are much shorter, and therefore the biodegradation rates quicker, where anaerobic groundwater conditions are present. The reduction in the ORP observed in the field test would further reduce the cVOC half-life and accelerate the natural restoration process. The extent of nanoscale particle migration within the aquifer was limited and, therefore, the applicability of this technology appears to be limited to source area treatment or a passive barrier type of treatment. The results of the field testing can be found in the *Pilot Test Final Report - Bimetallic Nanoscale Particles Treatment of Groundwater at Area I, Naval Air Engineering Station Site, Lakehurst, New Jersey*, dated February 2003.

As noted above, laboratory bench-scale testing and field testing of the nanoscale particle technology was conducted in April 2001 and February 2002, respectively. The technology used at that time, was bimetallic nanoscale particle (BNP). BNP involved the injection of submicron particles of zero valent iron with a trace coating of a noble catalyst. Since this technology is innovative, the use of the BNP technology has evolved since that time. An advanced version of nanoscale particles has been developed which uses porous iron, but does not require the use of a noble catalyst. The Navy is considering whether to use the BNP or porous iron based on cost or availability.

This ESD addresses the proposed injection of nanoscale particles into the aquifer using direct-push technologies and injection wells in accordance with the *Workplan for Nanoscale Particle Treatment of Groundwater at Areas I and J*, dated September 8, 2003. Figures 1 through 5 indicate the locations where the nanoscale particles are to be injected. For additional details concerning the application of the nanoscale particles refer to the Workplan.

1. Performance: The use of nanoscale particles as an alternate method of treatment, in lieu of co-metabolism at Areas I and J, will not affect the groundwater cleanup standards as stipulated in the original ROD. By adding nanoscale particles, remediation of groundwater by natural restoration will be accelerated and groundwater cleanup goals will be accomplished sooner. The amount of nanoscale particles to be applied will be estimated based on site-specific data obtained from the bench-scale and pilot tests. Baseline sampling for contamination levels and water quality parameters (ORP, pH, Dissolved Oxygen (DO), conductivity and turbidity) of new and existing monitoring wells will be conducted prior to the injection of the nanoscale particles. After injection, these wells will be sampled and analyzed for contamination levels and water quality parameters at 1 week, 2 weeks, 4 weeks, 8 weeks, 12 weeks, 6 months, 9 months and 1 year, to monitor the effectiveness of the nanoscale particle technology and to determine whether the water quality parameters have returned to baseline conditions.

The significance of baseline conditions, is that nanoscale particles changes the groundwater chemistry, at least temporarily, as it migrates through the subsurface. For example, the nanoscale particles will deplete DO concentrations in groundwater; the ORP will be lowered following the consumption of oxygen; and, the nanoscale particles will react with chlorinated hydrocarbons to consume protons, thus the pH is expected to increase. Therefore, when the water quality parameters have returned to baseline conditions, the reaction will be complete and the nanoscale particles will no longer be present in the groundwater. At the conclusion of the 1 year sampling, the Navy will prepare a report discussing the effectiveness of the nanoscale particle technology.

The September 27,1999 ROD states, that air sparging, if demonstrated to be effective, was to be implemented as a contingency remedy. However, it has been determined that air sparging, if implemented, will have a negative impact on the anaerobic natural restoration process. Therefore, if the nanoscale particle treatment is not effective, a Technical Impracticability decision will be requested for treatment of the higher areas of groundwater contamination in accordance with Section 300.430(f)(1)(ii)(c)(3) of the NCP.

2. Timing: The injection of the nanoscale particles can be completed within 30 days once contracts are in place to accomplish the work. The material may continue to degrade chlorinated organic compounds for several months after injection. Based upon the performance of the nanoscale particle injection, additional injections or an expanded area of treatment may be initiated based upon concurrence of the Technical Review Committee (TRC). The TRC consists of the Navy, as the lead agency; and, the USEPA, NJDEP and the New Jersey Pinelands Commission, as support agencies, providing oversight of the cleanup effort at NAES.

3. Cost: The cost of implementing this technology is approximately \$200,000. Alternatively, the cost to monitor and report natural restoration in Areas I and J is approximately \$230,000 per year and it is expected to take approximately 40 years to meet ARARs via natural restoration. Therefore, if this technology is successful, ARARs may be reached ahead of schedule with significant cost savings.

## **V. Public Participation**

This ESD and the information upon which it is based have been included in the Administrative Record for the Site. The Administrative Record also includes the final ROD and all documents that formed the basis for the Navy's selection of the cleanup remedies. The Administrative Record is available for public review at the location listed below:

Ocean County Library Headquarters  
Adult Services Department  
Attn: Kathy Galya  
101 Washington Street  
Toms River, NJ 08757  
732-349-6200

Hours: Monday - Thursday: 9:00 a.m. - 9:00 p.m.  
Friday - Saturday: 9:00 a.m. - 5:00 p.m.

Questions or comments involving the Navy's action should be directed to:

Lucy S. Bottomley  
Supervisory Environmental Engineer  
Naval Air Engineering Station  
Route 547 Code 87B5  
Lakehurst, NJ 08733  
(732) 323-2612

A notice summarizing this ESD will be placed in the Asbury Park Press and the Ocean County Observer in accordance with the NCP § 300.435 (c)(2)(i).

## **VI. Support Agency Review**

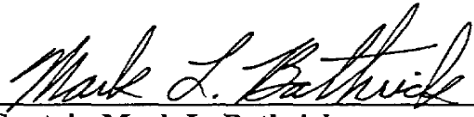
The Navy has notified the USEPA Region II, the NJDEP and the New Jersey Pinelands Commission of the changes proposed in this ESD in accordance with 40 CFR § 300.435 (c) (2). All agencies have provided comments on and approved the proposed remedy change.

In conjunction with this ESD, a *Workplan for Nanoscale Particle Treatment of Groundwater at Areas I and J*, dated September 8, 2003 has been prepared which provides specific details on the nanoscale particle technology and how it will be applied to treat Areas I and J groundwater. The injection of nanoscale particles in groundwater at this National Priority List Area will be allowed through a New Jersey Pollutant Discharge Elimination System Discharge to Ground Water Permit Equivalent in accordance with N.J.A.C. 7:14A-7.

## VII. Affirmation of Statutory Determinations

The Department of the Navy has determined that the remedy outlined in the final ROD remains protective of human health and the environment, and continues to comply with Federal and State ARARs. The use of the proposed alternate treatment technology to reduce higher areas of contamination is also protective of human health and the environment and will also meet all ARARs.

Date: 9/9/03

  
\_\_\_\_\_  
**Captain Mark L. Bathrick**  
**Commanding Officer**  
**Naval Air Engineering Station**  
**Lakehurst, New Jersey**

With the concurrence of:

Date: 9/30/03

  
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**Jane M. Kenny**  
**Regional Administrator**  
**U.S. Environmental Protection Agency, Region II**

# Proposed Site Locations For Nanoscale Particle Injection Points and Wells

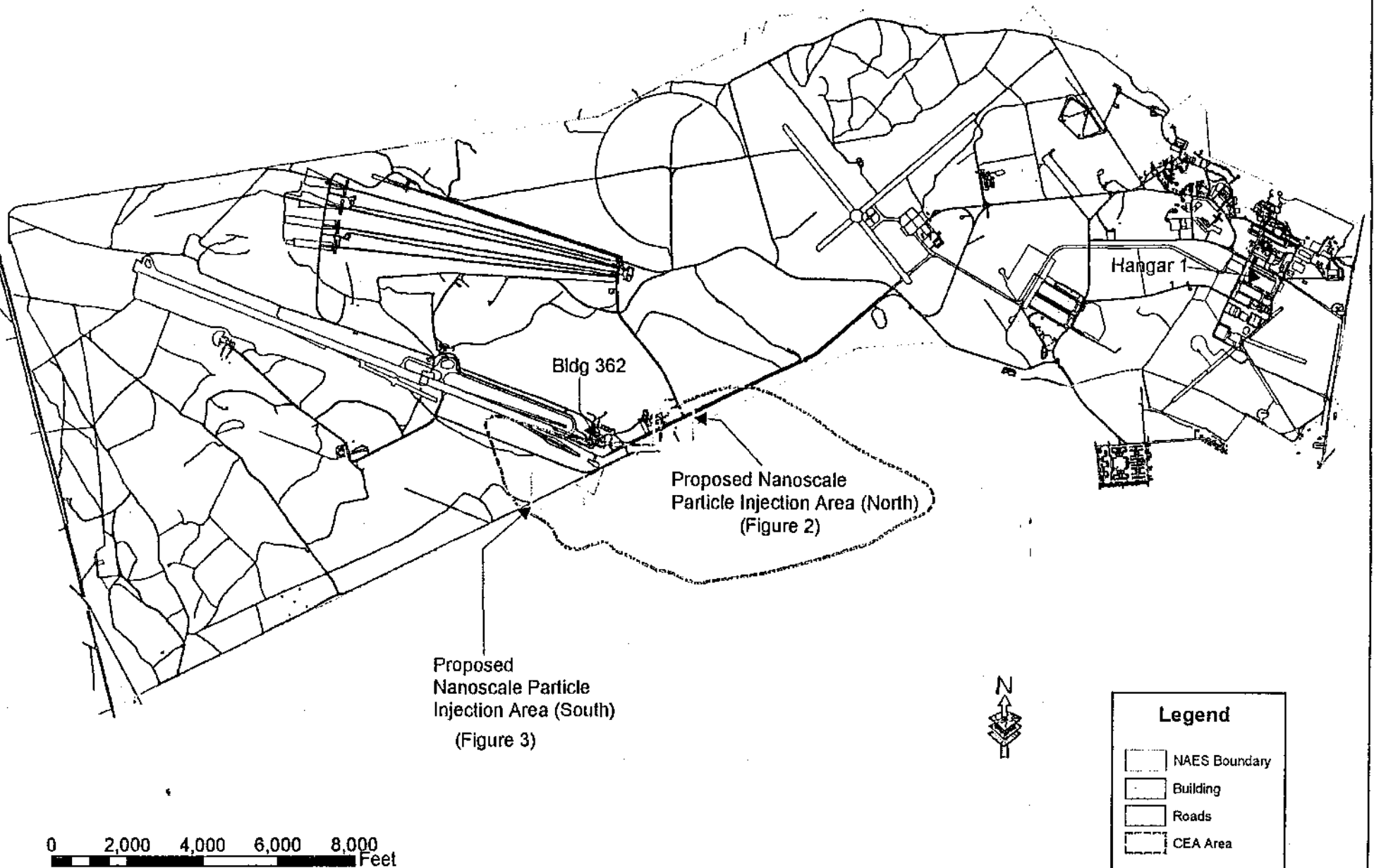


Figure 1

# Proposed Nanoscale Particle Injection Wells, Northern Plume

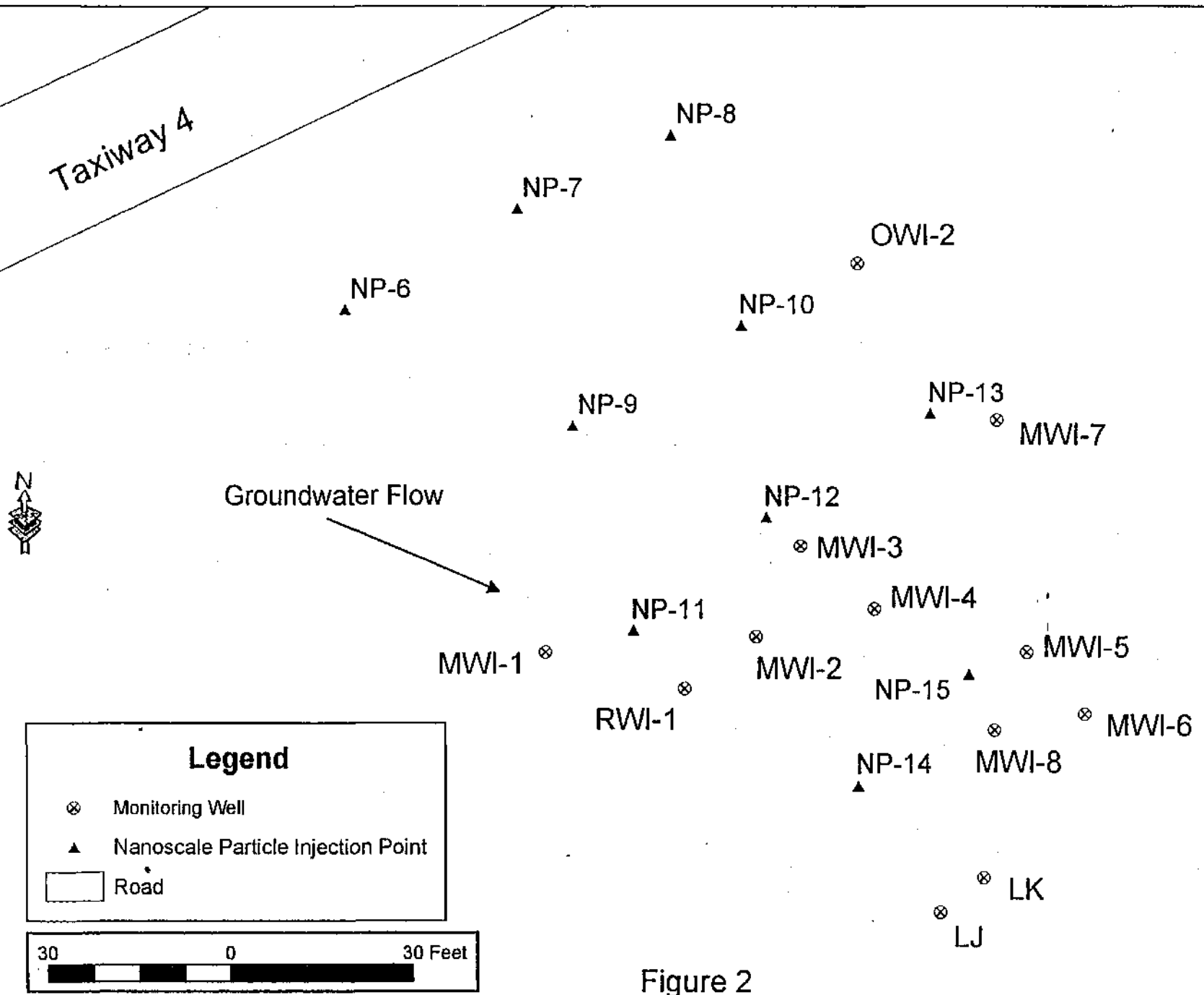


Figure 2

# Proposed Nanoscale Particle Injection Wells, Southern Plume

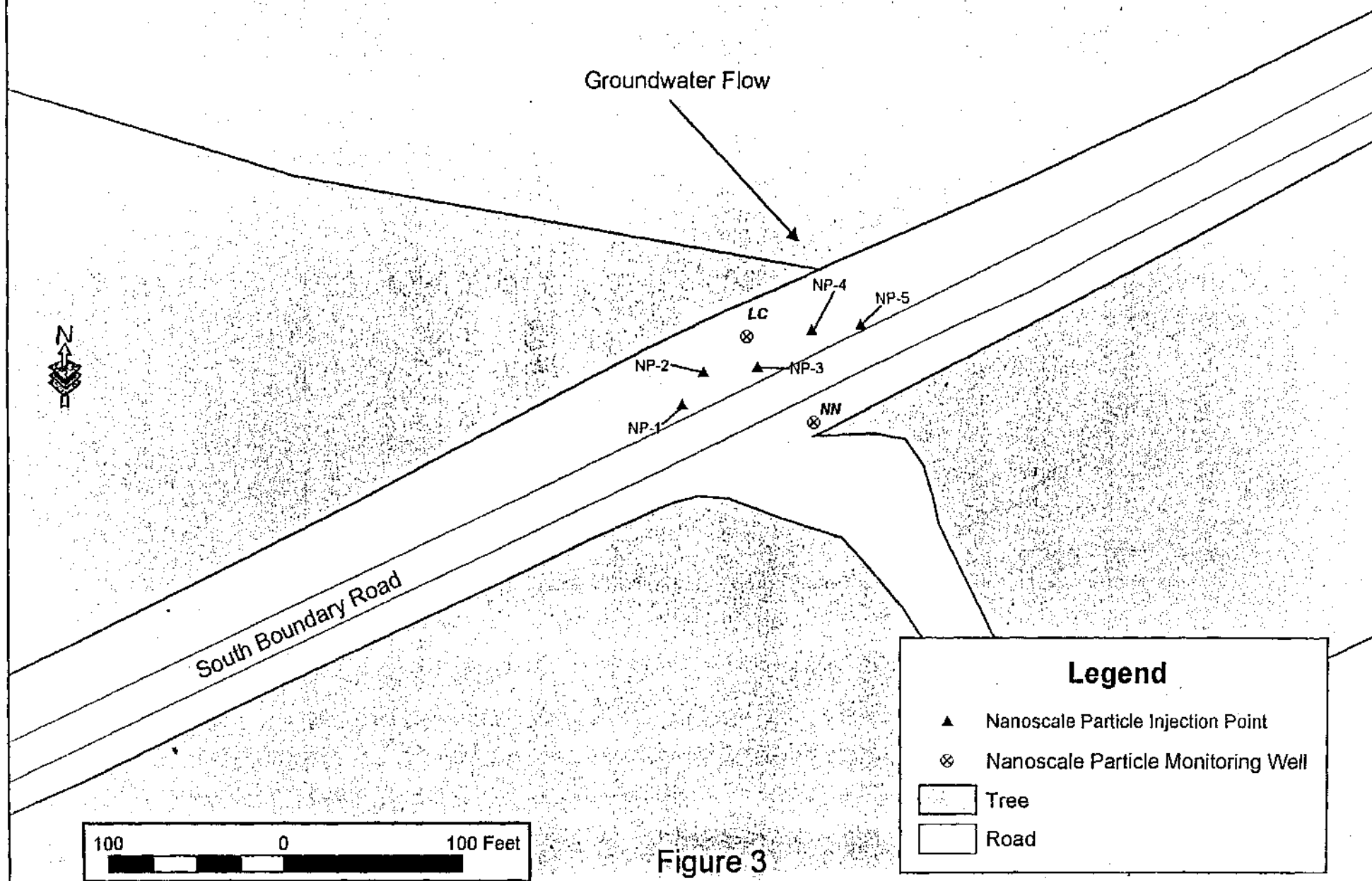


Figure 3

MALAPAQUA BROOK

PZI-26

LN  
LO(I)  
LP(D)  
ND

BOUNDARY

N.A.W.C. PROPERTY

LL(I)  
LM(D) 59.12

50

ND  
LJ(I)  
LK(D) 57.69

ND  
LZ(I)  
MA(D)

10

LX(I)  
LY(D)

MF(I)  
MG(D)

MB(I)  
MC(D)

BQ

SITE

ND  
LH(I)  
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2.3  
LF(I)  
LG(D)  
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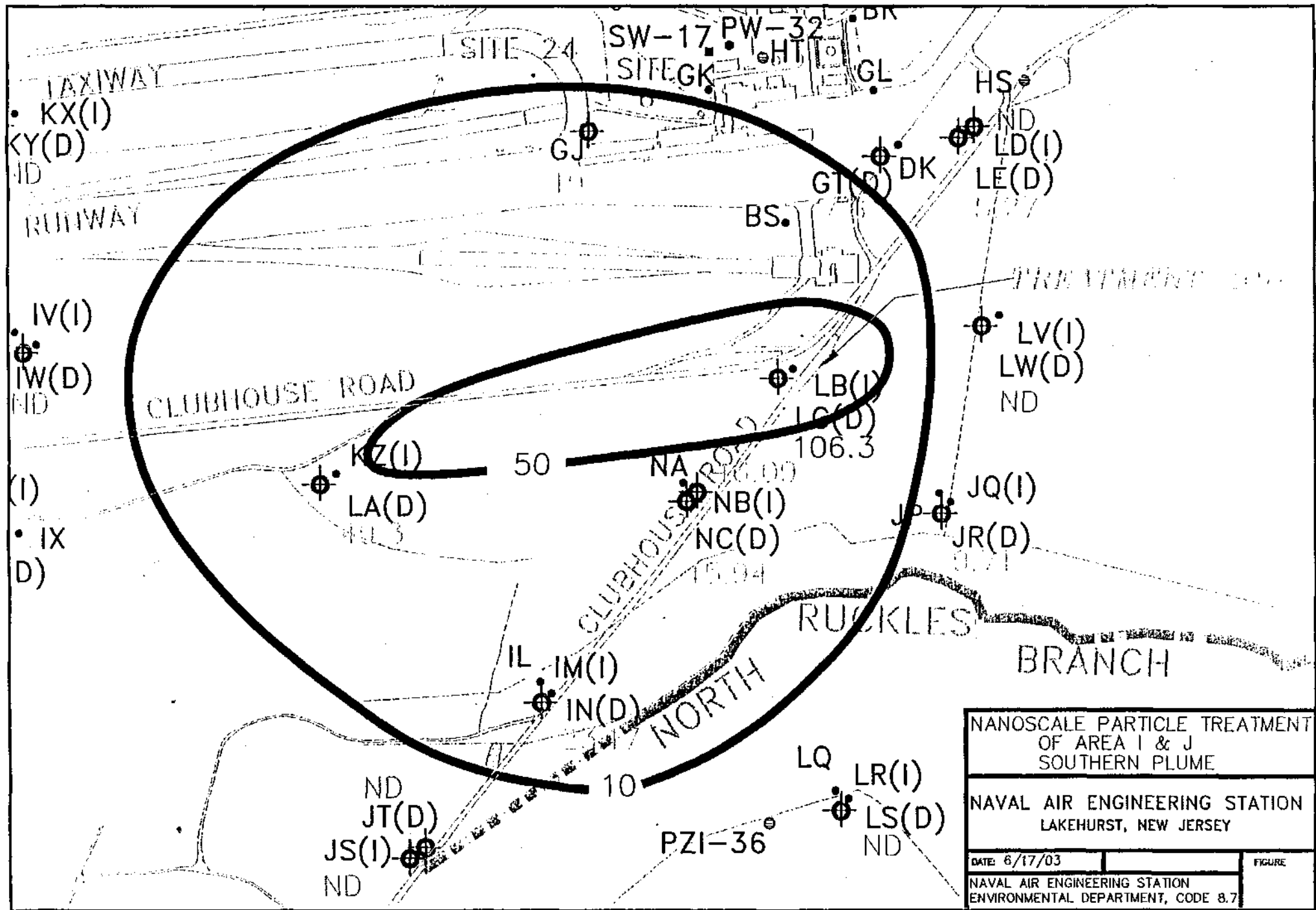
NANOSCALE PARTICLE TREATMENT  
OF AREA I & J  
NORTHERN PLUME

NAVAL AIR ENGINEERING STATION  
LAKEHURST, NEW JERSEY

DATE: 6/17/03

FIGURE

NAVAL AIR ENGINEERING STATION  
ENVIRONMENTAL DEPARTMENT, CODE 8.7



NANOSCALE PARTICLE TREATMENT OF AREA I & J SOUTHERN PLUME	
NAVAL AIR ENGINEERING STATION LAKEHURST, NEW JERSEY	
DATE: 6/17/03	FIGURE
NAVAL AIR ENGINEERING STATION ENVIRONMENTAL DEPARTMENT, CODE 8.7	