GROUND-WATER QUALITY, WATER LEVELS, AND PRECIPITATION AT THE BIOSOLIDS STUDY SITE, LAKEHURST NAVAL AIR ENGINEERING STATION, NEW JERSEY, 1995-97

By Eric Jacobsen

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CONVERSION FACTORS, VERTICAL DATUM, AND ABBREVIATED WATER-QUALITY UNITS

Multiply	By	To obtain
	Length	
inch (in.)	25.4	millimeter
foot (ft)	0.3048	meter
mile (mi)	1.609	kilometer
	Area	
acre	4,047	square meter
acre	0.4047	hectare
acre	0.00405	square kilometer
square foot (ft^2)	0.09294	square meter
square mile (mi^2)	259.0	hectare
	Volume	
cubic yard	0.7646	cubic meter
	Mass	
counce, avoirdupois (oz)	28.35	gram
pound, avoirdupois (lb)	0.4536	kilogram
	Temperature	
degree Fahrenheit (°F)	°C = 5/9 x (°F-32)	degree Celsius (°C)

Sea level: In this report, "sea level" refers to the National Geodetic Vertical Datum of 1929—a geodetic datum derived from a general adjustment of the first-order level nets of the United States and Canada, formerly called Sea Level Datum of 1929.

Water-quality abbreviations:

mg/L - milligrams per liter

µg/L - micrograms per liter

µS/cm - microsiemens per centimeter at 25 degrees Celsius

sc - specific conductance

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ABSTRACT

The effects of composted biosolids on shallow ground-water quality were compared with those of a commercial grade fertilizer and a control in a field study at the Lakehurst Naval Air Engineering Station, N.J. Twenty-five plots were laid out in a 5 by 5 array, and nested wells were installed in the center of each 40- by 14-meter plot. Five additional wells and a precipitation gage were installed around the perimeter of the site. In October 1995, 15 plots were treated with a single application of "exceptional quality" composted biosolids at rates of 50, 200, and 400 pounds nitrogen per acre. Of the 10 remaining plots, 5 were treated with a single application of commercial grade fertilizer at a rate of 50 pounds nitrogen per acre, and 5 were left untreated.

Water-level data collected continuously in well 30 from July 1995 through June 1997 show ground-water levels (in feet below land surface) ranged from 9.74 to 14.08 feet. Water levels measured during four synoptic rounds indicate that ground water consistently flowed across the site from southwest to northeast. Precipitation recorded at the site was near the 30-year precipitation normal for the vicinity of the study site.

Results of analyses of ground-water samples collected five times between March 1995 and March 1997 showed the effects that occurred between pre-application and post-application of biosolids and commercial fertilizer. Specific conductance and concentrations of nitrite plus nitrate, copper, zinc, lead, ammonia, calcium, sulfate, magnesium, sodium, chloride, potassium, and dissolved organic carbon increased above pre-application levels (proportional to the amendment application rate) in samples collected during the second and third post-application sampling rounds, then decreased by the time of the fourth (and final) round. pH also showed the effects of treatment; post-application changes varied with application rates. Concentrations of phosphorus, cadmium, and chromium did not exhibit any effects of treatment.

INTRODUCTION

Vegetation is sparse or absent at hundreds of former surface mines and other severely disturbed areas located in the New Jersey Pinelands. Since 1981, the State of New Jersey has required landowners to restore abandoned resource-extraction sites while protecting the integrity of Pinelands vegetation (New Jersey Administrative Code, Title 7, Chapter 50, Subchapter 6). Because the soils at these sites are sandy and nutrient poor, natural recovery is slow. The recovery of vegetation can be accelerated by applying soil amendments to stimulate plant growth.

Composted biosolids are the residues from wastewater treatment that are exposed for several days to high temperatures to destroy pathogenic organisms. The biosolids contain high levels of nitrogen, a nutrient essential for plant growth. Biosolids can be used as a soil amendment because the material is relatively inexpensive and abundant; however, these biosolids have the potential to leach nutrients and metals. A study was conducted by the U.S. Geological Survey (USGS), in cooperation with the New Jersey Department of Environmental Protection (NJDEP), to evaluate the use of biosolids as a soil amendment and to evaluate potential negative effects on shallow ground water. Any type of soil amendment can affect ground-water quality. For this reason, the effects of using composted biosolids were evaluated and compared with the effects of a commonly used commercial fertilizer.

In 1994, a field site was established in the New Jersey Pinelands at the Lakehurst Naval Air Engineering Station, Lakehurst, N.J. (fig. 1). Site establishment work included clearing, surface grading, surveying, installation of 30 wells or well nests, and application and incorporation of soil amendments. Instruments were installed to collect continuous precipitation and ground-water-level data. Twenty-five plots were laid out in a five by five array at an unused 5-acre sand borrow pit in an area with a shallow ground-water table. The effects of a single application of composted

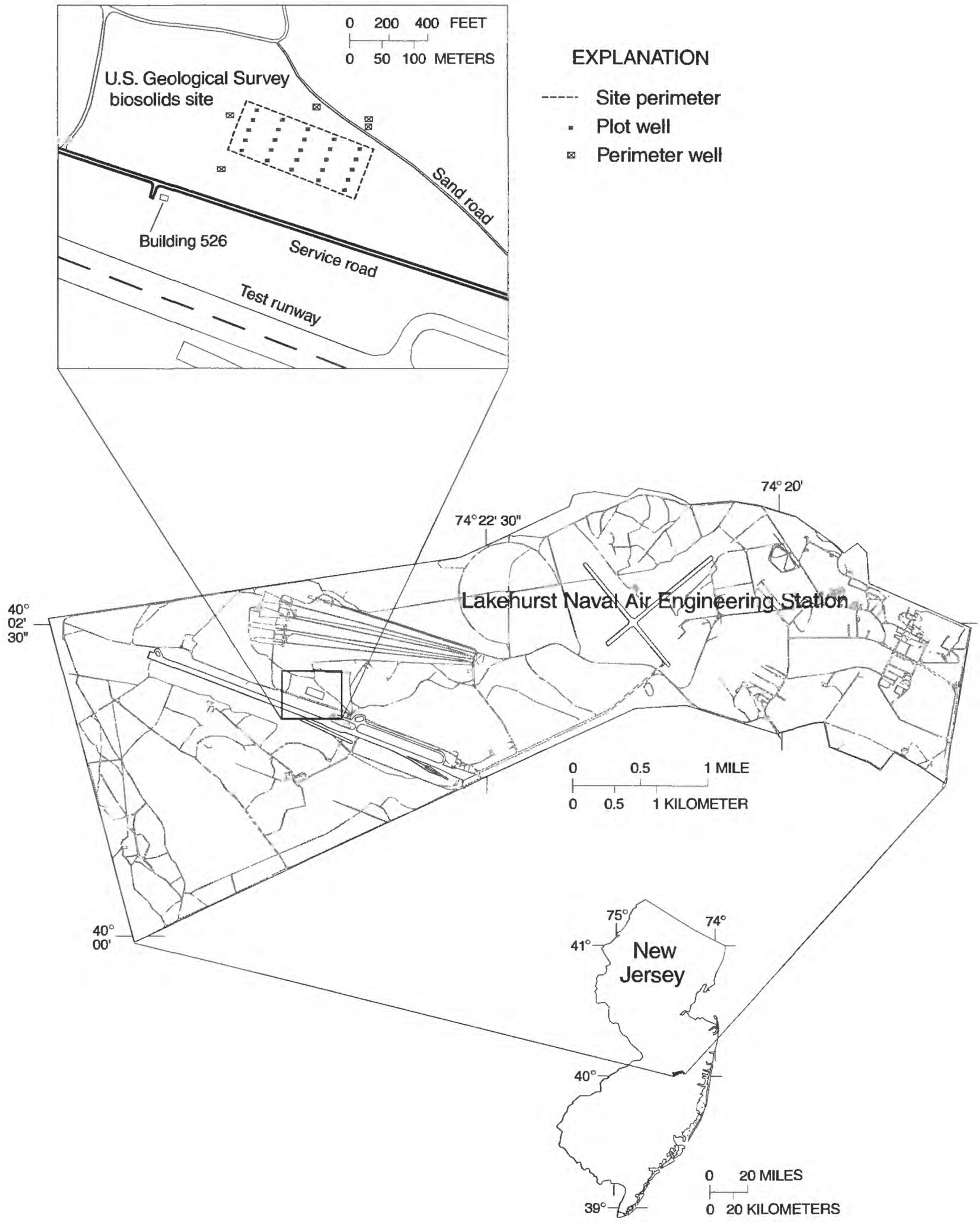


Figure 1. Location of study site at the Lakehurst Naval Air Engineering Station, Lakehurst, New Jersey.

biosolids and a commercial grade fertilizer over time on native vegetation, soil chemistry, and shallow ground-water quality were examined during 1995-97. Four treatments, consisting of the application of composted biosolids at three different rates and the application of a commercial fertilizer at one rate, were compared to a control. Rutgers University conducted the vegetation and soil chemistry components of the study; the USGS conducted the ground-water component.

For the ground-water component, nested wells were installed in the center of each plot, and five additional wells were installed around the perimeter of the site. Samples were collected before the application of the biosolids and fertilizer to determine the quality of the shallow ground water. After application, ground-water samples were collected during four rounds of sampling to determine the effects of treatment.

Purpose and Scope

This report describes the effects of applications of composted biosolids and commercial grade fertilizer on shallow ground-water quality at a site located at the Lakehurst Naval Air Engineering Station in Ocean County, New Jersey. Ground-water samples were collected during a single pre-application and four post-application rounds of sampling during March 1995 to March 1997. All samples were analyzed for nutrients and dissolved organic carbon (DOC), and selected samples for major ions and trace elements. Only pre-application samples were analyzed for volatile organic compounds (VOC's). Results of water-quality analyses and precipitation and ground-water-level data are shown in graphs and tables.

Previous Investigations

Application of municipal sludge has been shown to increase concentrations of nitrate as nitrogen in a surficial aquifer (Spalding and others, 1993; Gaggiani, 1991 and 1995; Berndt, 1993). Kam (1978) measured the concentrations in ground water of nutrients that leached from multiple applications of liquid sludge to soils in the New Jersey Pinelands and noted that increases in nitrate as nitrogen concentrations above background levels were directly proportional to the application rates. In a similar New Jersey Coastal Plain study, Higgens (1984) investigated the effects on ground water of pathogens, nutrients, and trace elements that leached from liquid sludge. In that study, the concentrations of nitrate as nitrogen were similar to those in Kam (1978), but no changes were detected in concentrations of trace elements in ground water.

Acknowledgments

The author thanks Dr. Julia Barringer of the USGS and Marjorie Kaplan of the NJDEP for taking leading roles in designing the study, and Joseph Rhyner and Lucy Bottomley of the Environmental Unit at the Lakehurst Naval Air Engineering Station for their assistance in obtaining the use of the site. The author also thanks Vincent DePaul and Timothy Oden of the USGS for assistance in preparing the site and installing instruments, and Rudy Zsolway and Ed Stevenson of the NJDEP for their assistance in collecting samples.

Description of the Study Area

The study site is in the Coastal Plain physiographic province in New Jersey and is directly underlain by the Cohansey sand, which is part of the Kirkwood-Cohansey aquifer system. The Cohansey sand is predominantly a light-colored quartz sand with minor amounts of pebbly sand, fine-to-coarse sand, silty and clayey sand, and interbedded clay (Rhodehamel, 1973).

Results of a ground penetrating radar survey at the Lakehurst study site on May 24, 1994, showed a shallow water table, approximately 11 feet below land surface, and a sand-rich area with no significant clay layers. Boring logs for two abandoned wells at the study site indicated that subsurface sediments, consisting predominantly of sand with traces of clay, silt, or gravel, are present from 0 to 102 feet below land surface (Dames and Moore, 1994).

Geologic logs made by USGS personnel for 23 of the 25 plot wells (logs were not recorded for 2 plot wells) showed no consolidated clay layers to a depth of 15 feet below land surface, the maximum depth drilled. All 23 logs indicated the presence of well-sorted quartz sand from 0 to 7 feet below land surface. Seven of the 23 logs showed all sand to 15 feet below land surface. The remaining 16 logs showed a variable zone of quartz sand grading to sands with high clay contents and small clay clasts from 7 to 15 feet below land surface.

The study site is part of an abandoned borrow pit that lies within the western half of the Lakehurst Naval Air Engineering Station. The approximately 5-acre site is surrounded on three sites by fields and woods and is adjacent to an infrequently used test runway. Areal photographs show that the site was used as a borrow pit in 1963 and 1965 and that mining activities had probably ceased by 1970 (Joseph Rhyner, Department of the Navy, oral commun., 1997). Prior to its purchase by the Navy in 1917, the Lakehurst center was used as a private ordnance range. In 1995, unexploded ordnance was discovered and removed from the site by Department of Defense personnel. An important aspect in the selection of this site over other mining sites was the full-time security afforded by its location inside a military base.

METHODS OF STUDY

Site Preparation

Initial site inspection of the borrow pit revealed that about one-half the area was sparsely vegetated; the rest was exposed sand. No abandoned equipment or discarded material was visible; these items are common in unused borrow pits. In order to remove all vegetation (a necessary prerequisite for the vegetation component of the study) and facilitate application of the soil amendments, a bulldozer was used to clear and level the site by removing several inches of surface material.

After clearing, the site was surveyed and laid out in 25 plots in a 5-by-5 array (fig. 2). The overall geometry of the pit constrained usable plot sizes to 40 by 14 meters with 3 meter spacings. A precipitation gage was installed approximately 15 meters from the western edge of the site.

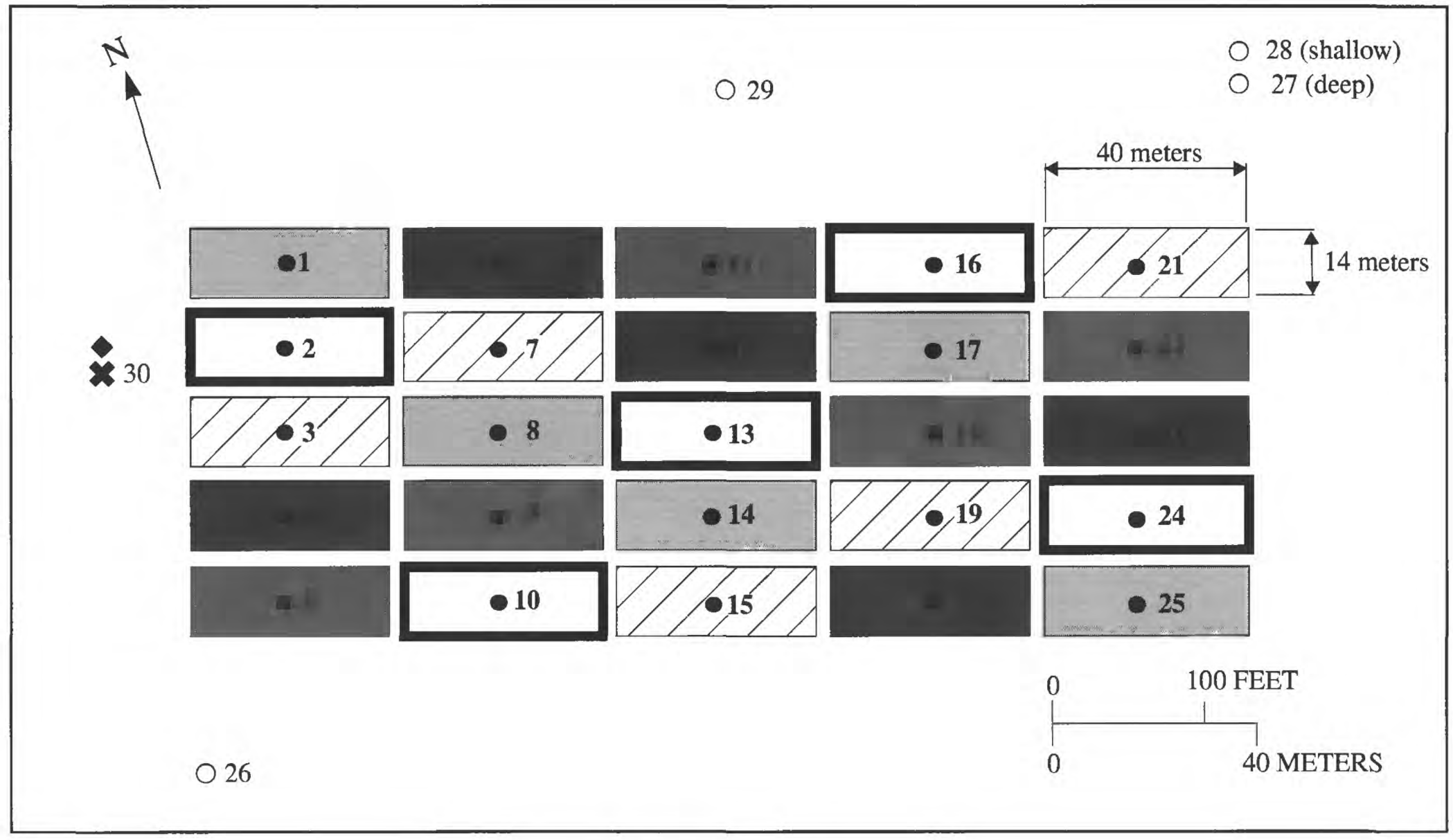
Well Construction

Nested wells designed specifically for this project were installed in the center of each of the 25 plots in September 1994. The wells consist of seven 0.25-inch inside-diameter (I.D.) schedule 80 polyvinyl chloride (PVC) pipes with staggered 9-inch-long screens (fig. 3). The 0.25-inch I.D. pipes were bundled together with plastic ties and inserted into a 2-inch I.D. PVC pipe that extends from 1 foot above the top of the highest screen to land surface. The 0.25-inch I.D. pipes were numbered 1 through 7, number 1 being the deepest.

Five 2-inch diameter, schedule 40 PVC, single-screen wells were installed around the perimeter of the site. The wells were installed in 6.5-inch-diameter holes augered to depths that ranged from 6 to 11 feet below the water table. A single 5-foot, 10-slot screen was set at the bottom of the hole, and the annular space around the screen was packed with number 2 morie sand. The remaining annular space was sealed with approximately 1 foot of number 00 morie sand and a bentonite slurry, which was installed through a tremie pipe, to land surface.

The nested wells were installed in 6.5-inch-diameter holes augured to approximately 2 feet below the water table. The annular space around the wells was packed from the bottom of screen 1 to approximately 1.5 feet above screen 7 with number 2 Morie well sand. The remaining annular space was sealed with approximately 1 foot of number 00 morie sand and a bentonite slurry, installed through a tremie pipe, to land surface. The depth to the bottom of the deepest screen in each well nest ranged from 14.1 to 15.1 feet. All pipes and screens were detergent washed, acid washed, then rinsed with de-ionized water prior to installation.

The nested well allows samples to be withdrawn from a discreet, fully saturated,



EXPLANATION

Treatment code		
A		1 times nitrogen requirement (0.8 cubic yards compost per plot)
B		4 times nitrogen requirement (3.5 cubic yards compost per plot)
C		8 times nitrogen requirement (7.0 cubic yards compost per plot)
D		1 times nitrogen requirement (69 pounds 10-10-10 fertilizer per plot)
E		Control plot

● 1	Quarter-inch diameter nested well and number (see fig.3)
○ 26	Two-inch-diameter well and number
✖ 30	One-inch-diameter well with transducer, and number
◆	Precipitation gage

Figure 2. Diagram showing latin square plot design, well and precipitation gage locations, well-construction characteristics, and application rates of soil amendments.

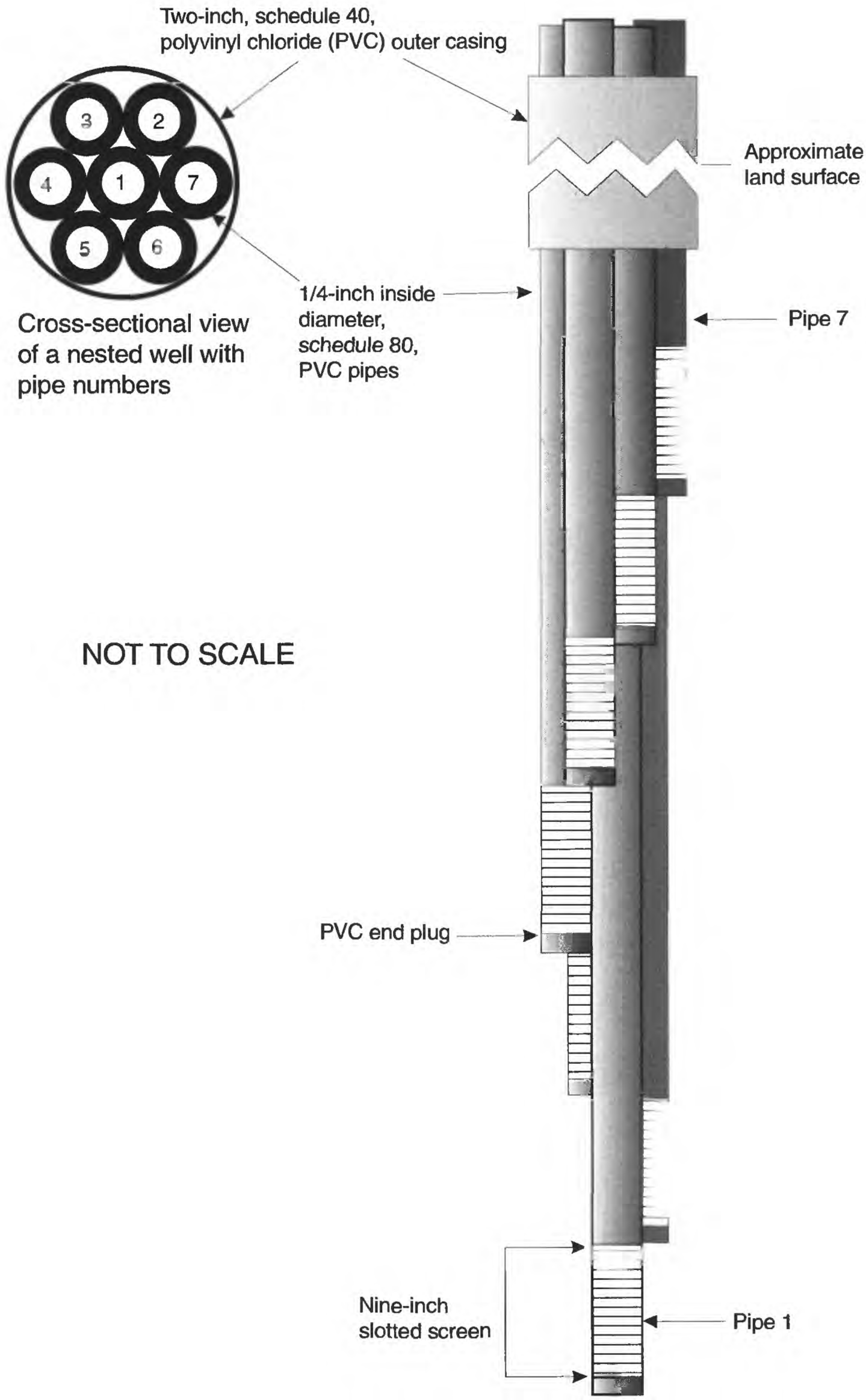


Figure 3. Typical nested-well construction.

screened interval close to the water table. By bracketing the normal annual high and low water levels, at least one of the screens in each plot well sampled during the project was fully saturated. Prior to sampling each well, the water level was measured in pipe 1 and used to determine which of the seven pipes to sample. If, for example, the water level indicated that the screened interval of pipe 4 was only partially saturated, then the sample was collected from pipe 3, the next fully saturated screened interval.

Amendments Application

A single application of composted biosolids and a commercial grade fertilizer was made in October 1995 to the 25 plots using a Latin square configuration (fig. 2). The Latin square is a five by five array where each treatment is represented once in every row and column. The design randomizes variation due to any gradient of site characteristics. This is a necessary condition for sample design, as the Latin square controls for gradients that could occur across the site, such as changes in geology, geochemistry, or hydrology.

The biosolids used in this study were obtained from the Cape May County Municipal Utilities Authority sludge composting facility and meet the U.S. Environmental Protection Agency's (USEPA) criteria for "exceptional quality" biosolids compost (William Cathcart, Cape May County Municipal Utilities Authority, oral commun., 1996; U.S. Environmental Protection Agency, 1994). The commercial fertilizer used (10-10-10, Agway Blend-Rite[1]) was obtained from a local store.

The composted biosolids, which were analyzed at Rutgers University, were 0.83 percent ammonium nitrogen, 3.25 percent organic nitrogen, and 4.08 percent total nitrogen. Dry bulk density was 306 kg/yd^3. Available nitrogen (based on a 10 percent annual mineralization rate of organic nitrogen) was about 1.2 percent. The commercial fertilizer, analyzed by the manufacturer, was 10 percent total nitrogen, 10 percent available phosphoric acid, and 10 percent potash. The primary nutrients were derived from urea, diammonium phosphate, and muriate of potash. The compost, fertilizer, and bentonite used to seal the wells were analyzed at the USGS National Water Quality Laboratory; results are presented in table 1.

An application rate of 50 lbs of nitrogen per acre (or 56.1 kg nitrogen per hectare) is recommended for establishment of permanent vegetative cover on exposed soils (New Jersey Department of Agriculture, 1987, p 3.2.1). Amendments were applied at 1, 4, and 8 times the recommended application rate. Treatment types and application rates are shown in table 2. Assigned codes (A through E) are used in the text to refer to the five different treatment types. Treatments A, B, C, and D involve the addition of soil amendments to plots; treatment E, indicates control plots (no soil amendments added).

All amendments were applied during October 24 to 27, 1994. A front end loader with a calibrated bucket was used to apply the biosolids volumetrically. While this method worked well for transporting correct volumes to each plot, it was necessary to manually rake the A and B treatment plots to obtain an even distribution of material. Sixty-nine pounds of commercial 10-10-10 fertilizer was transferred to plastic buckets and then spread by hand. Upon completion of the application process, a discer pulled by a tractor was used to incorporate the top 4 inches of material into all 25 plots. Discer blades were raised and checked between plots to prevent cross-contamination.

The process of dumping relatively small volumes of compost and hand raking it is labor intensive and probably impractical for large-scale revegetation efforts. The benefit of the method to this experiment was that exact and repeatable amounts of material could be applied to different plots. If the nitrogen content of the compost had been lower, larger volumes of compost could have been used and spread evenly with the loader, negating the need for raking. Achieving a uniform distribution of compost by using a front end loader alone would probably require applying volumes of compost that greatly exceed the vegetative nitrogen requirement.

[1]The use of trade names in this report is for identification purposes only and does not constitute endorsement by the U.S. Geological Survey.

Table 1. Results of analyses for selected constituents in composted biosolids, commercial fertilizer, and bentonite used at the biosolids study site, Lakehurst Naval Air Engineering Station, New Jersey

[All concentrations are in milligrams per kilogram; NA, not available; <, less than]

	Ag	Cu	Pb	Zn	Cd	Cr	Co	Ni
Biosolids	20	450	100	1200	2.3	200	6	27
Fertilizer	<1	1	2	16	<1	10	NA	3
Bentonite	<1	5	25	70	<1	8	NA	9

	Ba	V	Li	Be	Mo	P	Sr	As
Biosolids	340	190	3	0.5	7	23,000	240	9.0
Fertilizer	2	29	1	0.3	<5	40,000	NA	<20
Bentonite	340	22	29	1.7	<5	430	NA	<20

	Sb	Se	Hg	Fe	Mn	Al	Ti
Biosolids	1.9	1.9	1.7	54,000	4,700	11,000	2,800
Fertilizer	NA	NA	NA	3,200	136	NA	NA
Bentonite	NA	NA	NA	27,000	380	NA	1,400

Table 2. Treatment codes, amendment types, and rates of application

[cu. yds., cubic yards]

Treatment	Amendment type	Amount applied (per plot)	Nitrogen load (pounds N per acre)	Nitrogen load (pounds N per plot)
A	Biosolids	0.88 cu. yds	50	6.9
B	Biosolids	3.5 cu. yds	200	27.6
C	Biosolids	7.0 cu. yds	400	55.3
D	10-10-10 fertilizer	69 pounds	50	6.9
E	None	None	0	0

Data Collection

Three types of data were collected at the biosolids application site for the ground-water study component--ground-water levels (hourly and synoptic), hourly precipitation, and ground-water quality.

Ground-Water Quality

Ground-water samples were collected during one pre-application and four post-application rounds between March 1995 and May 1997. Samples collected included 120 environmental samples, 13 concurrent samples, 5 split samples, and 12 blanks.

Environmental Samples

Pre-application ground-water samples were collected once from each of 11 plot wells and 3 perimeter wells during March 29, 1995, to April 14, 1995. Eleven plot wells were selected as a subset to ensure an even sampling distribution across the site. Because all 25 plots were untreated at the time of the first sampling, these 11 samples effectively characterized the pre-application conditions across the site. All 11 samples were analyzed for nutrients, trace elements, major ions, dissolved organic carbon (DOC) and volatile organic compounds (VOC's). Pre-application ground-water samples were analyzed for VOC's to insure that the site was free of these constituents. Post-application ground-water samples were not analyzed for VOC's.

Post-application ground-water samples were collected from all 25 plot wells in four rounds. An effort was made to collect post-application ground-water samples immediately after intense precipitation events (greater than 1 inch of rain within 24 hours); this was accomplished for rounds 1 and 3. Nutrients and DOC were measured in samples from each round. A shorter elapse of time was expected for potential leaching of nutrients than for other constituents. For this reason, samples were not collected for dissolved trace elements and major ions during post-application round 1. Samples were collected for dissolved trace elements and major ions during post-application rounds 2, 3, and 4. Plot well 12 was sampled for total trace elements during all four post-application rounds (fig. 2). The fourth post-application round included re-sampling of three perimeter wells to determine any movement of constituents toward off-site areas.

All water samples were collected by using the ultra-clean trace-element sampling technique described by Ivahnenko and others (1996). Use of the technique increases the reliability of analytical results for concentrations in the parts-per-billion range. Contamination of samples through contact with sampling equipment, sample handling, and airborne dust particles is minimized. Site condi-

tions precluded the use of a van for sample collection; samples were collected inside a tent adjacent to the well.

Ground-water samples were collected from the plot wells using a peristaltic pump. One end of a clean acid-washed C-FLEX tube was connected to the selected pipe; the other end was placed inside the sampling tent. The six pipes not being pumped were sealed off in order to prevent induction of air. Low pumping rates were used to prevent dewatering and to minimize turbidity. The use of low-flow sampling rates has been shown to produce consistent trace-element sampling results (Puls and Powell 1992). For the majority of wells, however, limited dewatering caused some aeration of the sample. For this reason, dissolved oxygen was not monitored during purging. Temperature, pH, and specific conductance were monitored as described by Wood (1976). Turbidity was monitored using a Hach 2100P portable turbidity meter. Samples were collected after three consecutive readings differing less than 5 percent at 5 minute intervals were obtained. All tubing, filters, and fittings used were disposed of after each sample.

All chemical analyses of water reported in this study were performed at the U.S. Geological Survey National Water Quality Laboratory in Arvada, Colorado. Methods used for inorganic analyses are described in Fishman and Friedman (1989) and Fishman (1993). Constituents analyzed by inductively coupled plasma mass spectroscopy included aluminum, barium, cadmium, cobalt, lead, molybdenum, silver, zinc, antimony, beryllium, chromium, copper, manganese, nickel, and uranium. Arsenic and selenium were analyzed by hydride atomic-absorption spectrophotometry. Mercury was analyzed by cold vapor atomic-absorption spectrophotometry. Potassium was analyzed by flame atomic-absorption spectrophotometry. Methods used for organic analyses are described in Rose and Schroeder (1995).

Quality Assurance

Quality-assurance samples collected during the sampling period consisted of equipment blanks, field blanks, and concurrent field and split field samples as described by Horowitz and others (1994). High purity de-ionized water that was quality assured for use as a reagent in blanking equipment was used for all blanks. OmniSolv, a reagent-grade de-ionized water, was used in blanks analyzed for organic compounds. USGS internally generated reagent-grade deionized water was used for all other blanks. Forty quality-assurance samples were collected, representing approximately 33 percent of the environmental samples.

Equipment blanks, collected under controlled conditions, were used to assess potential contamination from sampling and processing equipment. Two equipment blanks were collected in a laboratory by using a peristaltic pump to move de-ionized water from a polyethylene standpipe through tubing and a filter into a sample bottle.

Field blanks were used to assess potential contamination from sample collection and preservation under field conditions. Twenty-one field blanks were collected, representing 18 percent of the environmental samples. Using a peristaltic pump, water was pumped directly from the laboratory container through tubing and a filter into a sample bottle. Collection and preservation of blanks was done at the well head and inside the tent prior to collecting the environmental sample. Equipment used to collect a field blank was then used to collect the environmental samples.

Concurrent field samples, collected within 5 minutes of the environmental sample, were used to assess sample reproducibility; split samples were used to assess laboratory analytical precision for selected constituents. Thirteen concurrent samples were collected by filling two sets of bottles in succession, about 5 minutes apart. Four split samples were collected as described by Ivanenko and others (1996).

Ground-Water Levels and Precipitation

Synoptic water-level studies were conducted on June 28,1996; October 1, 1996; January 7, 1997; and July 2, 1997. Water levels in the same 12 wells (table 3) were measured using a steel tape, accurate to within 0.01 feet. Measurements were repeated until two measurements within 0.02 feet were obtained. All measurements were referenced to a fixed point on the top of the well casing. A

Table 3. Water-level data for selected wells at the biosolids study site, Lakehurst Naval Air Engineering Station, New Jersey

Well number	Date	Altitude of top of casing (feet above assumed datum)	Depth to water (feet below top of casing)	Water-level altitude (feet above assumed datum)
1	07/02/97	17.64	12.21	5.43
5	07/02/97	17.73	11.99	5.74
6	07/02/97	17.84	12.75	5.09
10	07/02/97	18.10	12.49	5.61
13	07/02/97	17.33	12.03	5.30
15	07/02/97	17.56	12.02	5.54
17	07/02/97	17.19	12.23	4.96
21	07/02/97	16.86	12.22	4.64
25	07/02/97	17.25	12.18	5.07
26	07/02/97	24.75	19.22	5.53
27	07/02/97	29.65	26.13	3.52
30	07/02/97	17.53	11.85	5.68
1	01/07/97	17.64	12.27	5.37
5	01/07/97	17.73	12.08	5.65
6	01/07/97	17.84	12.83	5.01
10	01/07/97	18.10	12.65	5.45
13	01/07/97	17.33	12.20	5.13
15	01/07/97	17.56	12.24	5.32
17	01/07/97	17.19	12.38	4.81
21	01/07/97	16.86	12.40	4.46
25	01/07/97	17.25	12.39	4.86
26	01/07/97	24.75	19.19	5.56
27	01/07/97	29.65	26.11	3.54
30	01/07/97	17.53	11.88	5.65
1	10/01/96	17.64	13.26	4.38
5	10/01/96	17.73	13.05	4.68
6	10/01/96	17.84	13.81	4.03
10	10/01/96	18.10	13.55	4.55
13	10/01/96	17.33	13.06	4.27
15	10/01/96	17.56	13.09	4.47
17	10/01/96	17.19	13.31	3.88
21	10/01/96	16.86	13.32	3.54
25	10/01/96	17.25	13.28	3.97
26	10/01/96	24.75	20.14	4.61
27	10/01/96	29.65	27.14	2.51
30	10/01/96	17.53	12.83	4.70
1	06/28/96	17.64	11.97	5.67
5	06/28/96	17.73	11.49	6.24
6	06/28/96	17.84	12.57	5.27
10	06/28/96	18.10	11.94	6.16
13	06/28/96	17.33	11.44	5.89
15	06/28/96	17.56	11.41	6.15
17	06/28/96	17.19	11.73	5.46
21	06/28/96	16.86	11.95	4.91
25	06/28/96	17.25	11.66	5.59
26	06/28/96	24.75	19.00	5.75
27	06/28/96	29.65	26.08	3.57
30	06/28/96	17.53	11.73	5.80

temporary benchmark established near the site was assigned an assumed datum of 0 feet. Altitudes of the tops of well casings were surveyed relative to the assumed datum, accurate to within 0.01 feet. The approximate altitude above sea level of the benchmark, 103 feet, was estimated from the USGS 7.5-minute quadrangle map of Cassville, New Jersey. Water levels and precipitation amounts were measured hourly with a pressure transducer (installed in well 30) and a tipping bucket raingage, respectively, beginning July 18, 1995, and ending July 2,1997. Pressure transducer readings were checked monthly against steel tape measurements.

GROUND-WATER QUALITY

Environmental Samples

Results of analyses of ground-water samples collected before and after application of the soil amendments are listed in tables 4, 5, and 6. (Table 6 is at the end of the report.) Thirty-eight constituents or characteristics were measured. For most water-quality constituents, concentrations in ground-water samples either showed no effect or exhibited a trend (proportional to the rate of the amendment application) of increasing from pre-application values through post-application sampling rounds 2 or 3, then decreasing in sampling round 4. Concentrations of phosphorus, cadmium, and chromium showed no effects of treatments. Concentrations of copper, zinc, lead, nitrate, ammonia, calcium, sulfate, magnesium, sodium, chloride, potassium, and dissolved organic carbon and specific conductance showed the stated effects of treatment. From the water-quality data, one cannot determine exactly when the concentration of any constituent peaked during the sampling period. Results of analyses indicated that most constituents probably reached peak concentrations in the ground water at different times between the amendment application and post-application sampling round 3. Results of specific conductance, pH, nitrate, copper, zinc, and lead are discussed in detail below.

Specific conductance (SC) is a measure of the ability of water to conduct an electrical current and is an indirect measure of the total dissolved solids in the water. Pre-application SC values (measured during March 31-April 6, 1995, prior to the application of soil amendments during October 24-27, 1995) were consistently low for all 11 plot wells sampled, ranging from 33 to 41 µS/cm. Increases in SC values from pre-application conditions were measured about 40 days after application during the first post-application sampling round, December 4 to 7, 1995 (fig. 4).

The highest SC values and the largest range of values were measured during round 2 in ground-water samples from plots with the higher application rates, treatments B and C (table 4). Values of SC were similar for treatments A and D for all rounds and, in general, were lower than for treatments B and C. SC values measured in round 4 samples approached pre-application levels for treatments A and D, whereas SC values for treatments B and C remained elevated.

Values of SC in samples from the control plots (treatment E) increased slightly after application. SC in samples from plot 2 collected during round 1 (80 µS/cm) and plot 16 collected during round 3 (104 µS/cm) was noticeably greater than that from the other four control plots for the respective rounds.

pH is the negative logarithm of the hydrogen ion concentration and indicates whether a solution is acidic, neutral, or basic. Decreasing values of pH indicate increasing concentrations of hydrogen ions and increasing acidity. Pre-application values of pH ranged from 3.5 to 5.5, with a median of 4.7 (table 4); only two pre-application samples had a pH greater than 5.

The results of post-application rounds 2, 3, and 4 showed pH decreased in proportion to the application rate (fig. 5). The lowest median pH values for these sampling rounds were from plots treated with biosolids at the higher application rates (treatments B and C). Low pH's in shallow ground water could be a result of additional hydrogen ions produced by nitrification of ammonia (Szabo and others, 1997).

Table 4. Ranges and median values of specific conductance, pH, and concentrations of nitrite plus nitrate in ground-water samples from the biosolids study site, Lakehurst Naval Air Engineering Station, New Jersey

[Specific conductance is in microsiemens per centimeter at 25 degrees Celsius; concentrations of nitrite plus nitrate are in milligrams per liter; value in parentheses is the median; NA, not applicable]

Treatment	Pre-application round 3/29/95-4/14/95	Post-application round 1 12/4/95-12/7/95	Post-application round 2 5/15/96-6/5/96	Post-application round 3 11/7/96-11/25/96	Post-application round 4 3/11/97-4/16/97
			Specific conductance		
A	NA	51-109 (78)	31-126 (102)	54-74 (57)	38-62 (40)
B	NA	53-98 (67)	96-352 (191)	54-221 (130)	39-110 (60)
C	NA	34-305 (77)	157-348 (280)	39-221 (130)	49-168 (78)
D	NA	60-120 (101)	54-129 (111)	31-71 (49)	29-42 (35)
E	33-41 (37)	39-80 (44)	36-63 (42)	35-104 (47)	31-44 (33)
			pH		
A	NA	4.4-4.7 (4.6)	4.6-6.6 (4.8)	4.5-5.9 (5.9)	4.8-6.8 (5.2)
B	NA	4.5-5.2 (4.8)	4.4-6.2 (4.7)	4.1-5.7 (4.6)	4.6-6.5 (5.0)
C	NA	4.5-4.9 (4.7)	4.3-5.2 (4.5)	3.6-4.7 (4.3)	4.1-5.1 (4.7)
D	NA	4.5-6.2 (4.7)	4.3-6.1 (5.3)	4.5-6.1 (5.9)	5.0-6.6 (5.8)
E	3.5-5.5 (4.7)	4.8-6.0 (4.8)	4.7-5.7 (4.7)	4.5 -5.9 (4.9)	5.0-6.0 (5.2)
			Nitrite plus nitrate		
A	NA	1.9-6.2 (3.7)	3.3-6.3 (6.1)	1.7-4.3 (2.8)	0.54-1.2 (0.61)
B	NA	1.7-7.0 (3.5)	<0.05-23 (1.7)	2.2-17 (10)	0.61-5.7 (1.8)
C	NA	0.84-3.7 (2.7)	3.7-31 (7.5)	1.2-15 (6.8)	1.1-10 (2.4)
D	NA	1.4-8.7 (4.8)	1.1-12 (8.3)	0.71-4.3 (2.5)	0.21-1.0 (0.76)
E	0.21 - 1.6 (0.73)	1.3-6.0 (1.7)	0.64-2.6 (1.0)	1.1-6.6 (1.7)	0.52-1.1 (0.68)

Table 5. Ranges and median values of concentrations of copper, zinc, and lead in ground-water samples from the biosolids study site, Lakehurst Naval Air Engineering Station, New Jersey

[All concentrations are in micrograms per liter; value in parentheses is the median, --, range cannot be computed; NA, not applicable]

Treatment	Pre-application round 3/29/95-4/14/95	Post-application round 2 5/15/96-6/5/96	Post-application round 3 11/7/96-11/25/96	Post-application round 4 3/11/97-4/16/97
		Copper		
A	NA	<1-2 (1)	<1-4 (<1)	<1-2 (<1)
B	NA	1-4 (2)	2-21 (4)	1-4 (1)
C	NA	3-9 (4)	<1-7 (4)	1-3 (3)
D	NA	<1-4 (<1)	-- (<1)	<1-1 (<1)
E	<1-2 (<1)	<1-2 (1)	<1-2 (<1)	-- (<1)
		Zinc		
A	NA	<3-14 (6)	3-19 (6)	<3-14 (6)
B	NA	<3-31 (5)	<3-28 (19)	<3-25 (10)
C	NA	8-35 (14)	<3-29 (9)	5-20 (12)
D	NA	<3-15 (4)	<3-12 (<3)	<3-9 (7)
E	<1-12 (5)	<3-15 (4)	<3-4 (<3)	6-12 (10)
		Lead		
A	NA	-- (<1)	-- (<1)	-- (<1)
B	NA	-- (<1)	<1-13 (<1)	-- (<1)
C	NA	-- (<1)	<1-3 (1)	<1-1 (<1)
D	NA	-- (<1)	-- (<1)	-- (<1)
E	-- (<1)	-- (<1)	-- (<1)	-- (<1)

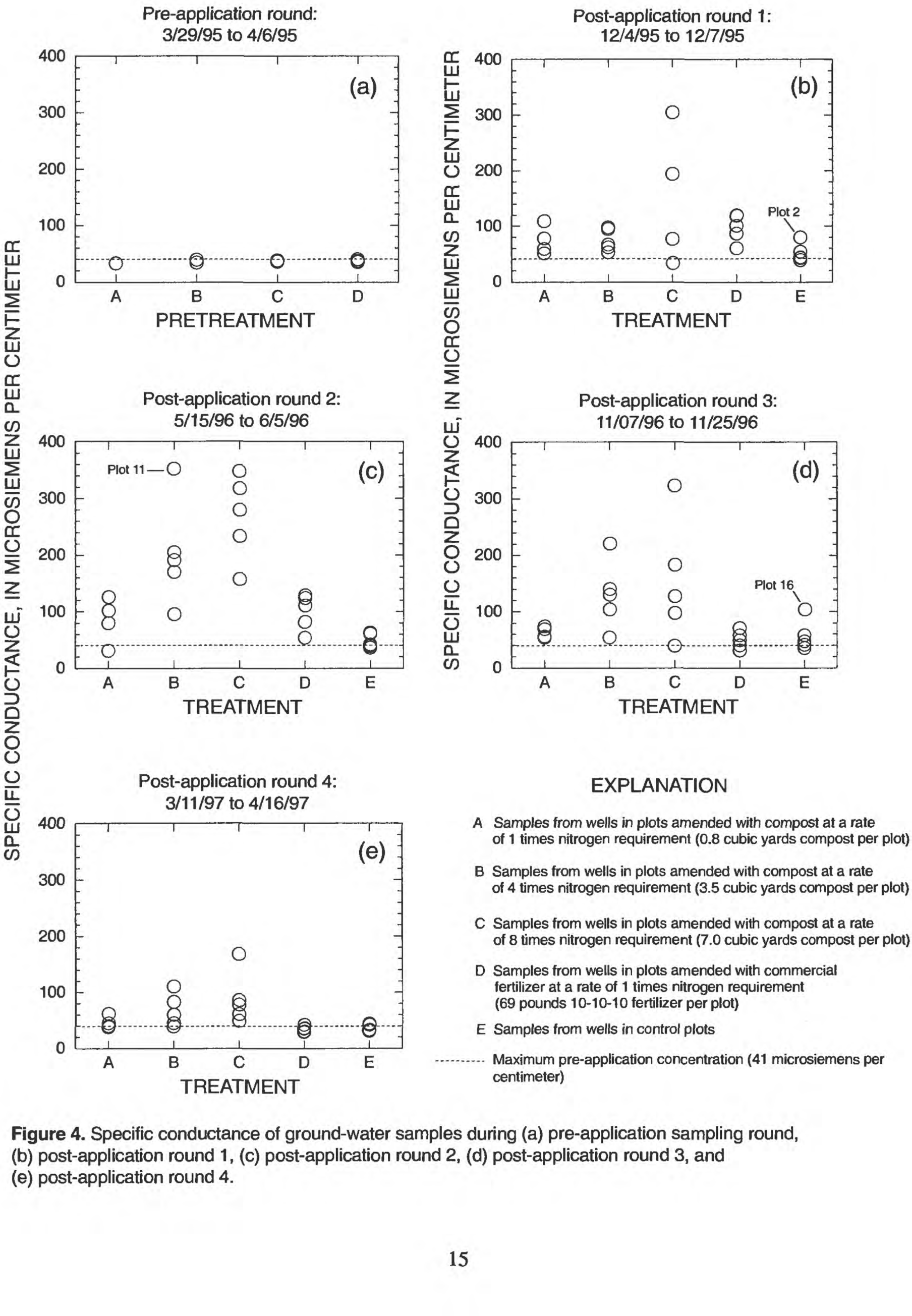


Figure 4. Specific conductance of ground-water samples during (a) pre-application sampling round, (b) post-application round 1, (c) post-application round 2, (d) post-application round 3, and (e) post-application round 4.

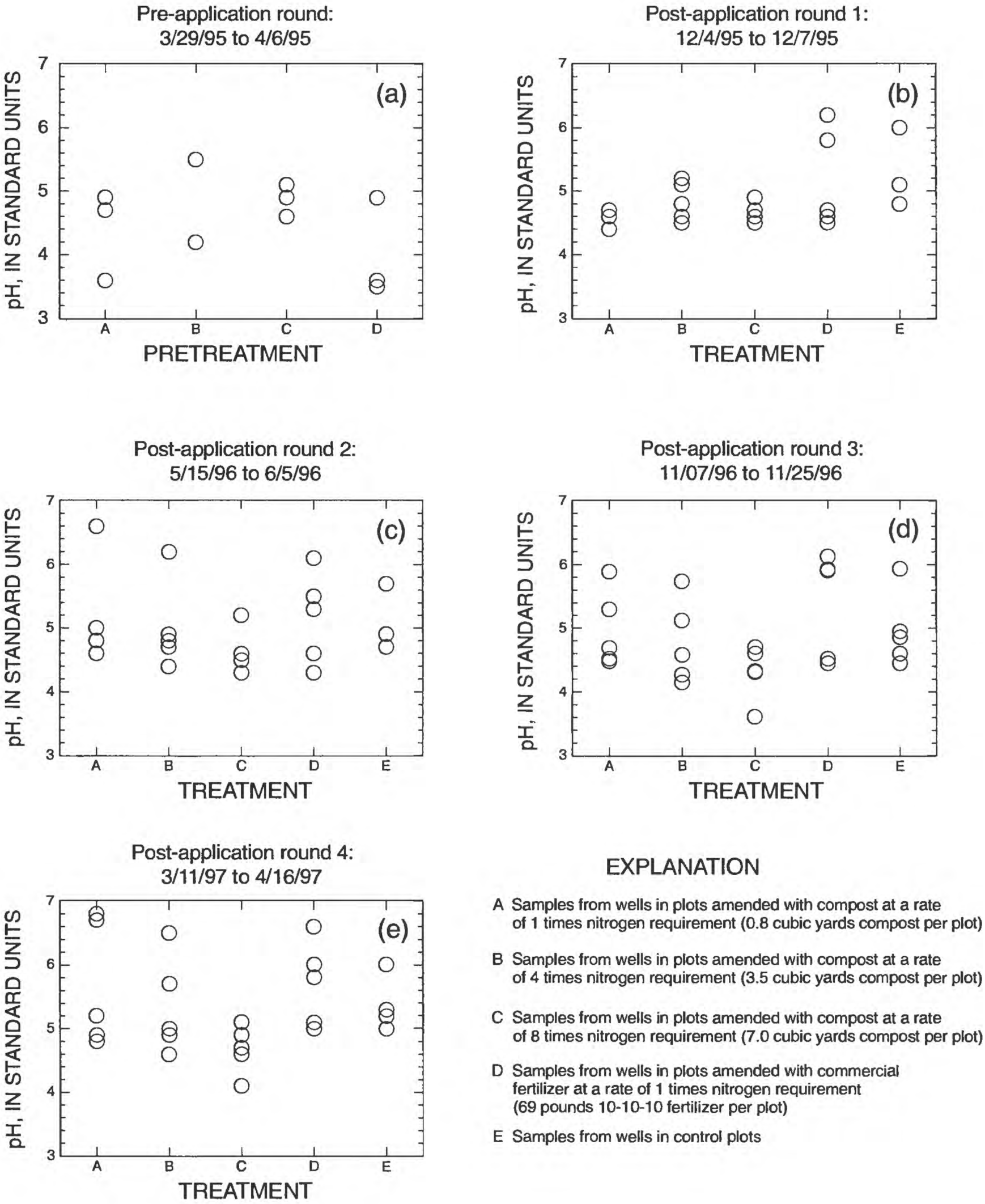


Figure 5. pH of ground-water samples during (a) pre-application sampling round, (b) post-application round 1, (c) post-application round 2, (d) post-application round 3, and (e) post-application round 4.

Pre-application concentrations of nitrite plus nitrate in ground-water samples ranged from 0.21 to 1.6 mg/L (milligrams per liter), with a median of 0.73 mg/L. Concentrations of nitrite plus nitrate increased from pre-application levels after application of the soil amendments. Concentrations of this constituent were measured in samples collected during post-application round 1 (fig. 6) through round 4 and were highest during post-application round 2. The highest concentration was measured (31 mg/L) in a ground-water sample from plot 4 (treatment C). Nitrite plus nitrate concentrations decreased during post-application rounds 3 and 4.

Grouped by treatment, the largest ranges of nitrite plus nitrate concentrations and the highest concentrations measured during rounds 2, 3, and 4 (table 4) were from plots treated with biosolids at the higher application rates (treatments B and C). The highest median nitrite plus nitrate concentration was measured for treatment B (10 mg/L) during round 3 and was more than 10 times the pre-application median.

Most post-application nitrite plus nitrate concentrations in ground-water samples from control plots (treatment E) were lower than or only slightly greater than the maximum pre-application concentration of 1.6 mg/L. Two post-application samples from control plots, however, were more than 3 times the background level--6 mg/L from plot 2 sampled during round 1 and 6.6 mg/L from plot 16 sampled during round 3. Elevated values of SC in the same samples further support the likelihood that constituents were transported from adjacent plots to control plots 2 and 16. Windblown contamination of amendments from adjacent plots and lateral transport of constituents by ground-water movement are possible mechanisms.

Pre-application concentrations of copper ranged from less than the laboratory reporting limit of 1 µg/L to 2 µg/L with a median of less than 1 µg/L. Samples were analyzed for copper during post-application rounds 2, 3, and 4 only. Initial increases in copper concentrations from pre-application conditions were measured in samples collected during post-application round 2 (fig. 7). Higher copper concentrations occurred during post-application round 3; the highest value was measured (22 µg/L) in a sample from plot 22. The concentration of copper in the biosolids used was 450 mg/kg; the USEPA Pollutant Concentration Limit is 1500 mg/kg of copper for "exceptional quality" biosolids (U.S. Environmental Protection Agency, 1994, p. 29).

Grouped by treatment, the highest medians and largest ranges of copper concentrations were measured in ground-water samples from plots treated at the higher biosolids application rates, treatments B and C (table 5). Median post-application values for these samples increased from pre-application levels through rounds 2 and 3, then decreased by round 4. Concentrations of copper in samples from control plots (treatment E) remained low during all sampling rounds.

Pre-application concentrations of zinc ranged from below the laboratory reporting limit of 1 µg/L to 12 µg/L with a median of 5 µg/L. Samples were analyzed for zinc during post-application rounds 2, 3, and 4 only. Concentrations of zinc increased from pre-application levels, starting with post-application round 2 (fig. 8), and remained elevated through round 4. The graphs for zinc do not show a clearly evident decrease in concentrations by post-application round 4, as is seen for copper, lead, and nitrite plus nitrate. The concentration of zinc in the biosolids used was 1200 mg/kg; the USEPA Pollutant Concentration Limit is 2800 mg/kg of zinc for "exceptional quality" biosolids.

Grouped by treatment, the largest ranges of zinc concentrations were measured in ground-water samples from plots treated with biosolids at the higher application rates, treatments B and C (table 5). The highest median zinc concentration was measured for treatment B (19 µg/L) during round 3 and was almost 4 times the pre-application median.

All pre-application samples contained concentrations of lead less than the laboratory reporting limit of 1 µg/L. Samples were analyzed for lead during post-application rounds 2, 3, and 4 only. Five samples collected during post-application round 3 contained concentrations of lead greater than 1 µg/L; all samples were from plots treated with biosolids at the higher application rates, treatments B and C (fig. 9). The highest lead concen-

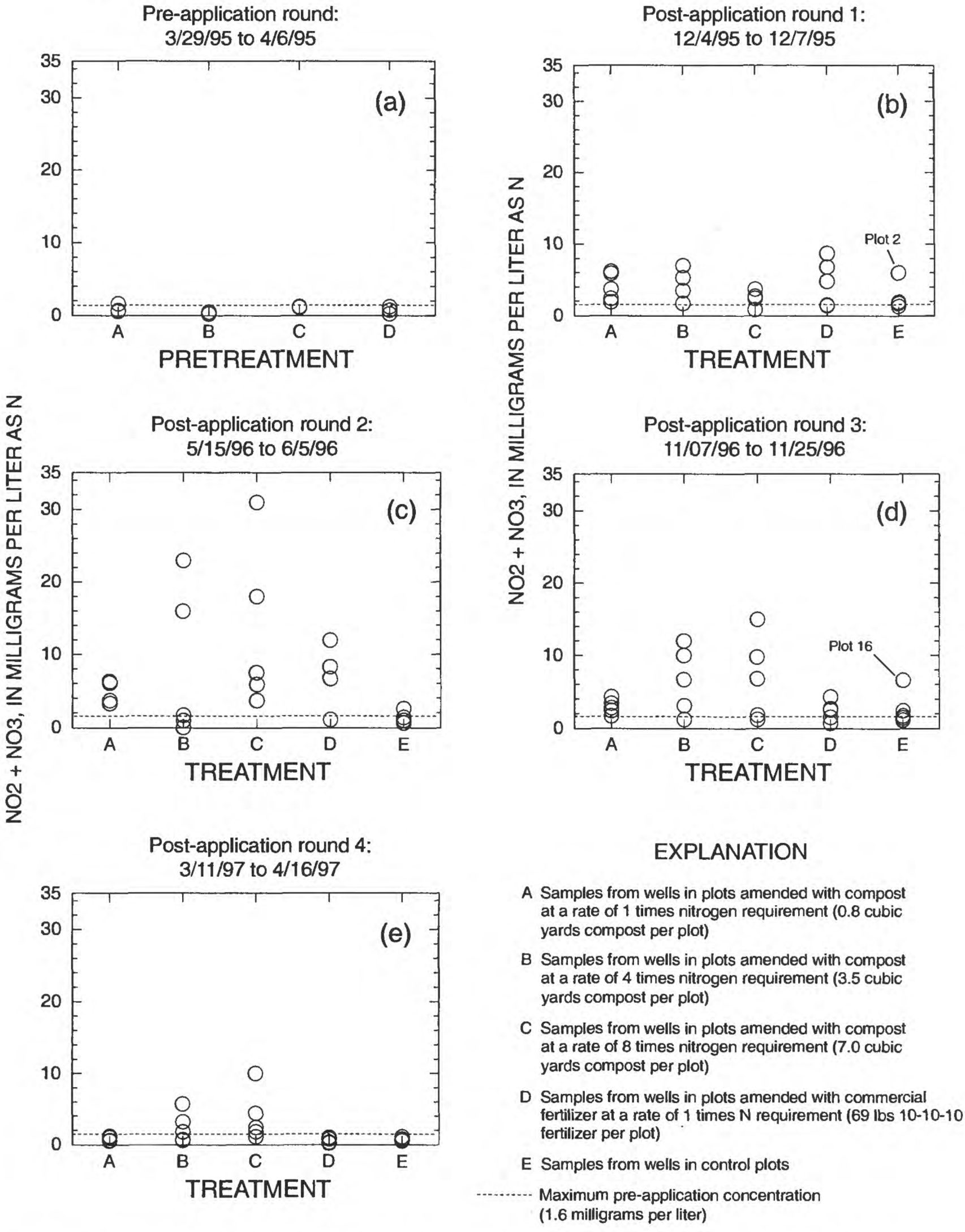
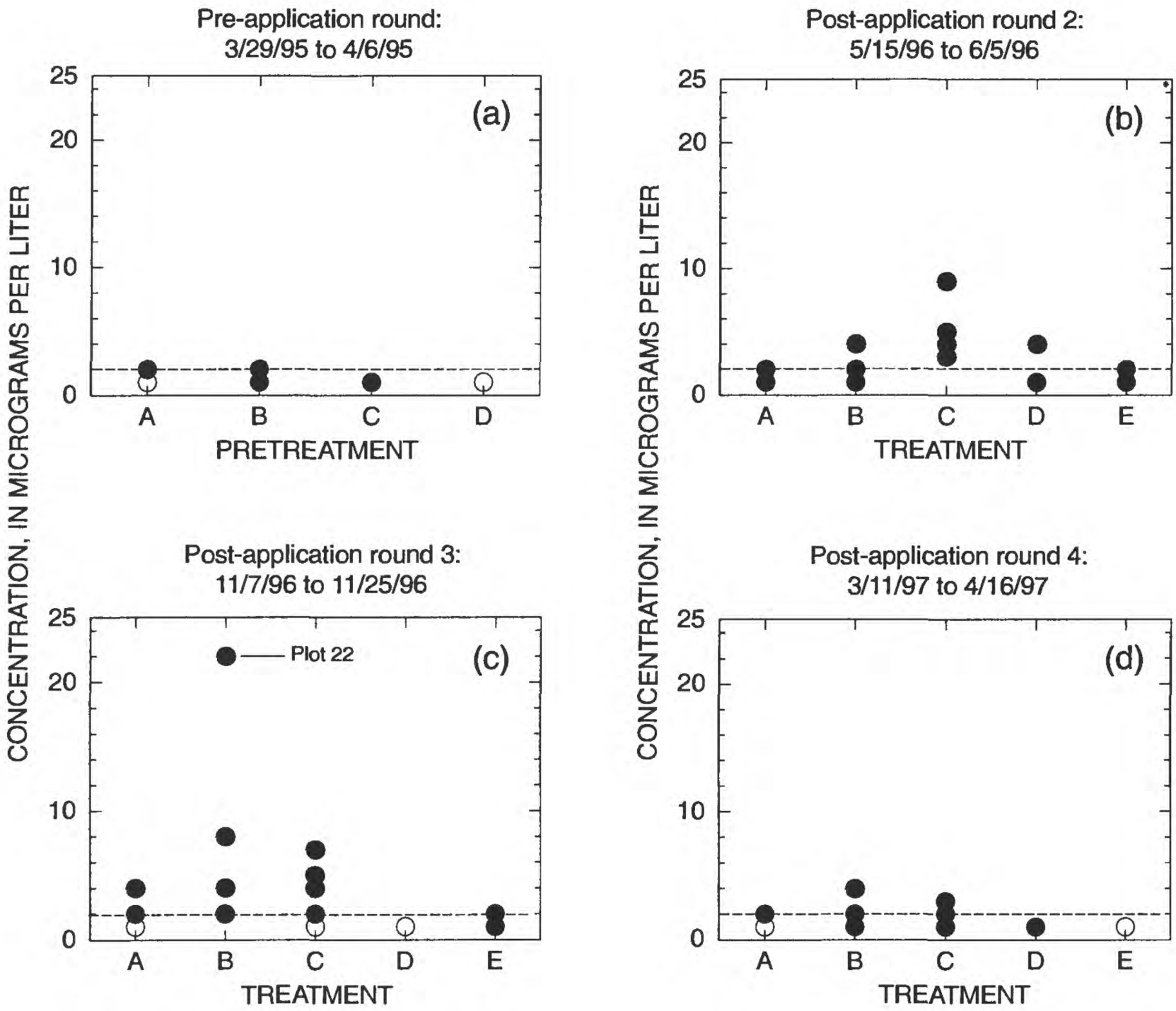


Figure 6. Concentrations of dissolved nitrite plus nitrate in ground-water samples by treatment during (a) pre-application sampling round, (b) post-application round 1, (c) post-application round 2, (d) post-application round 3, and (e) post-application round 4.



EXPLANATION

A Samples from wells in plots amended with compost at a rate of 1 times nitrogen requirement (0.8 cubic yards compost per plot

B Samples from wells in plots amended with compost at a rate of 4 times nitrogen requirement (3.5 cubic yards compost per plot

C Samples from wells in plots amended with compost at a rate of 8 times nitrogen requirement (7.0 cubic yards compost per plot

D Samples from wells in plots amended with commercial fertilizer at a rate of 1 times nitrogen requirement (69 pounds 10-10-10 fertilizer per plot)

E Samples from wells in control plots

--------- Maximum pre-application concentration (2 micrograms per liter)

● Concentrations of copper at or great than the minimum reporting limit of 1 microgram per liter

○ Concentrations of copper less than the minimum reporting limit of 1 microgram per liter

Figure 7. Concentrations of dissolved copper in ground-water samples during (a) pre-application sampling round, (b) post-application round 2, (c) post-application round 3, and (d) post-application round 4.

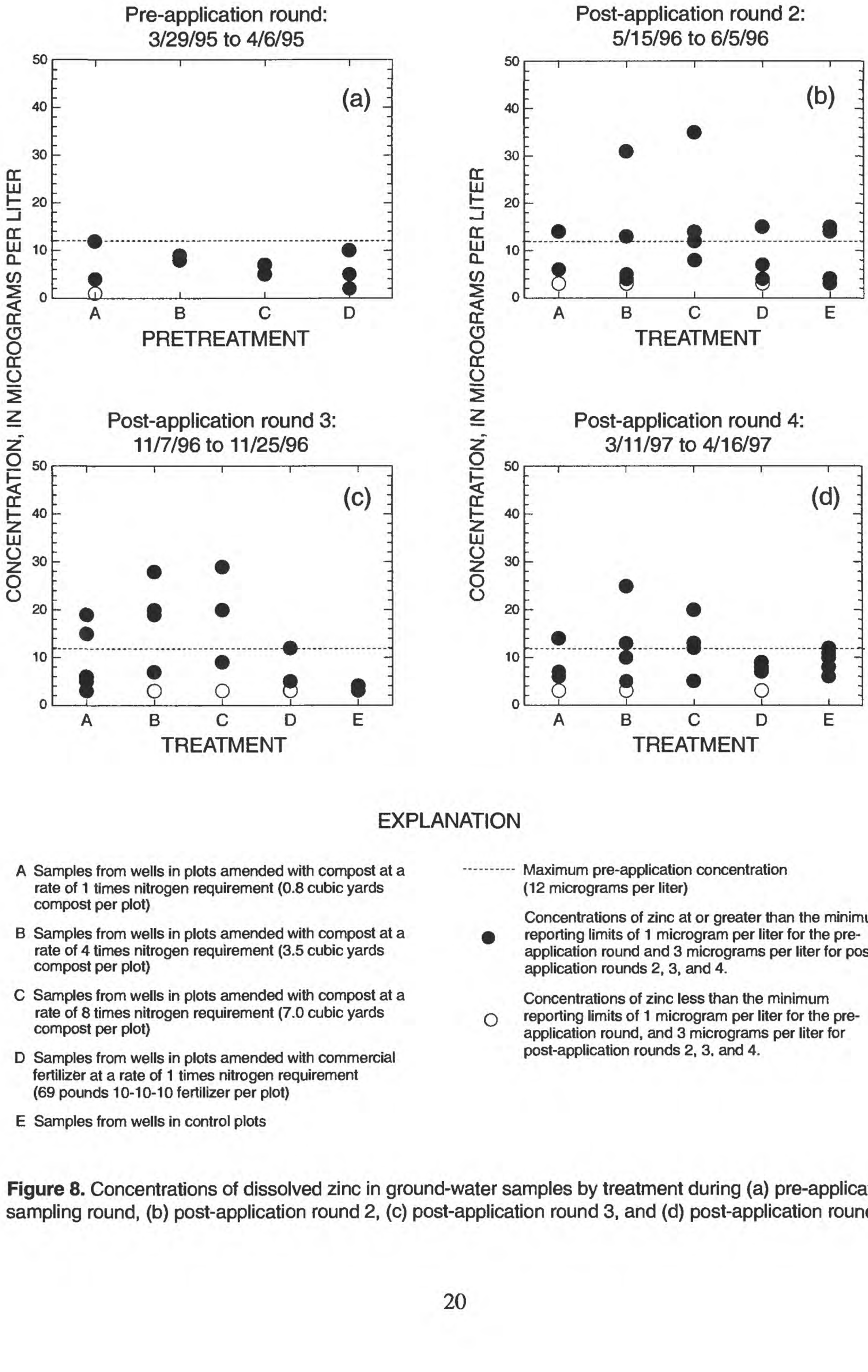
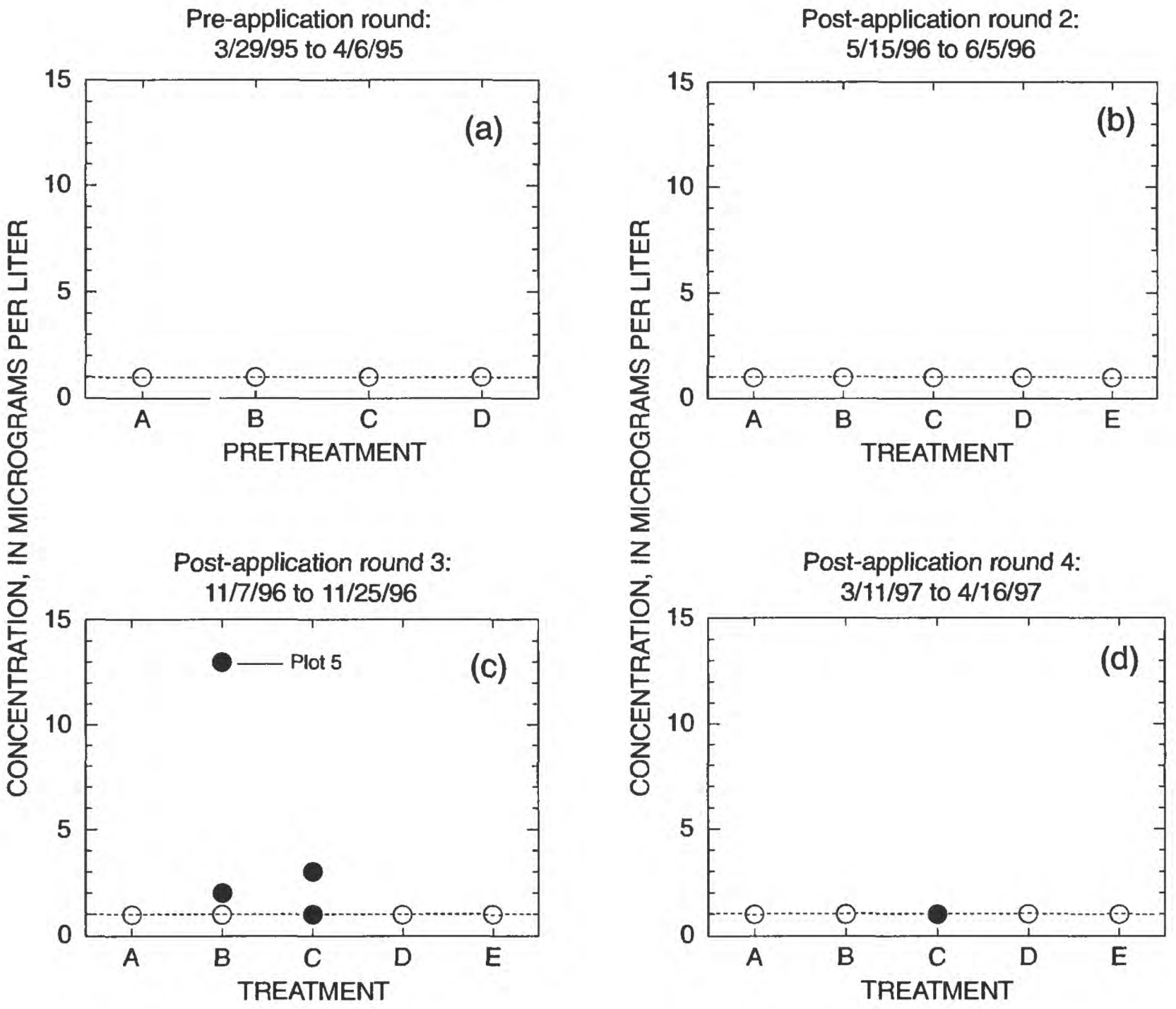


Figure 8. Concentrations of dissolved zinc in ground-water samples by treatment during (a) pre-application sampling round, (b) post-application round 2, (c) post-application round 3, and (d) post-application round 4.



EXPLANATION

A Samples from wells in plots amended with compost at a rate of 1 times nitrogen requirement (0.8 cubic yards compost per plot)

B Samples from wells in plots amended with compost at a rate of 4 times nitrogen requirement (3.5 cubic yards compost per plot)

C Samples from wells in plots amended with compost at a rate of 8 times nitrogen requirement (7.0 cubic yards compost per plot)

D Samples from wells in plots amended with commercial fertilizer at a rate of 1 times nitrogen requirement (69 pounds 10-10-10 fertilizer per plot)

E Samples from wells in control plots

--------- *Maximum pre-application sample concentration* (less than 1 microgram per liter)

● Concentrations of lead at or greater than the minimum reporting limit of 1 microgram per liter

○ Concentrations of lead less than the minimum reporting limit of 1 microgram per liter

Figure 9. Concentrations of dissolved lead in ground-water samples during (a) pre-application sampling round, (b) post-application round 2, (c) post-application round 3, and (d) post-application round 4.

tration, 13 µg/L, was present in a sample collected from plot 5 (treatment B). Only one sample collected during post-application round 4 from plot 20 (treatment C) had a lead concentration greater than 1 µg/L. All samples collected from low application rate and control plots (treatments A, D, and E, respectively) contained concentrations of lead less than the laboratory reporting limit. The concentration of lead in the biosolids was 100 mg/kg; the USEPA Pollutant Concentration Limit is 300 mg/kg of lead for "exceptional quality" biosolids.

Because most lead concentrations were at or near 1 µg/L, the highest median lead concentration, grouped by treatment, was 1 µg/L for treatment C during round 3 (table 5). All other median lead concentrations were less than 1 µg/L. The largest range of lead concentrations (<1 to 13 µg/L) occurred during round 3 for treatment B.

Three of the five perimeter wells sampled during the pre-application round and post-application round 4 showed insignificant changes in constituent concentrations and characteristics. Results from post-application round 4 indicated that samples from wells 26 and 29 had chromium concentrations of 3.9 and 3.7 µg/L, respectively. All other pre- and post-application concentrations of chromium were less than the laboratory reporting limit of 1 µg/L. The concentration of chromium in the biosolids was 200 mg/kg, well below the USEPA Pollutant Concentration Limit of 1200 mg/kg of chromium for "exceptional quality" biosolids.

Concentrations of copper and zinc in ground-water samples from treatment A plots and treatment D plots (treatments with different amendment types and identical nitrogen loads) were not proportional to the mass applied. Each treatment A plot received 195 grams of zinc and 78 grams of copper from the application of biosolids. Each treatment D plot received 0.5 grams of zinc and 0.031 grams of copper from the application of commercial fertilizer. Concentrations of copper and zinc in ground-water samples from treatment A plots and treatment D plots, however, were similar. The ranges of median concentrations of copper (<1-1 µg/L) were identical for treatment A and treatment D plots. The median concentration of zinc for treatment A plots was 6 µg/L, and concentrations ranged from <3 to 7 µg/L for treatment D plots.

Quality Assurance

Concentrations of measured constituents were below laboratory reporting limits in most of the blank samples. Results of field blank analyses are shown in table 7 (at end of report); results of equipment blank analyses are shown in table 8.

One field blank of the 22 analyzed for copper showed a concentration greater than the laboratory reporting limits of 1 µg/L or 0.2 µg/L. (Blanks in subset were analyzed with a method that uses a lower reporting limit of 0.2 µg/L). Five field blanks of the 22 analyzed for zinc contained concentrations greater than the laboratory reporting limits of 3 µg/L or 0.5 µg/L. One field blank of the eight analyzed for nitrite plus nitrate contained concentrations greater than the laboratory reporting limit of 0.05 mg/L. Three field blanks of the eight analyzed for ammonia contained concentrations greater than the laboratory reporting limit of 0.015 mg/L. A field blank collected on April 1, 1995, at plot 25 contained concentrations of calcium, magnesium, sodium, potassium, barium, manganese, zinc, and aluminum greater than the laboratory reporting limits. Most of the constituents detected in field blanks were at or near the reporting limits. Equipment blanks contained insignificant concentrations of the measured constituents, indicating that the equipment used was unlikely to leach those constituents into the samples.

Results of analyses showed insignificant differences between split or concurrent samples and the environmental counterparts in most cases (table 6). An environmental sample and the split sample collected at plot 5 on March 24, 1997, contained concentrations of ammonia at 8.1 mg/L and less than 0.2 mg/L, respectively. An environmental sample and the concurrent sample collected on June 5, 1996, at plot 15 contained concentrations of copper at 4 µg/L and 1 µg/L, respectively.

Table 8. Results of analyses for selected constituents in equipment blank samples

[mg/L, milligrams per liter; µg/L, micrograms per liter; S, nalgene standpipe; C, one-quarter-inch inside-diameter polyvinyl chloride well casing;T, three-eighths-inch inside-diameter silicon tubing; F, 0.45-micron filter; P, Grundfoss stainless-steel submersible pump; USGS, U.S. Geological Survey]

Station number	Date	Time	Reagent grade deionized water source	Equipment blanked	Nitrogen, ammonia dissolved (mg/L as N)	Nitrogen, nitrite dissolved (mg/L as N)	Nitrogen, ammonia + organic dis. (mg/L as N)	Nitrogen, NO2+NO3 dissolved (mg/L as N)	Phosphorus ortho, dissolved (mg/L as P)
400000074000093	03-09-95	1300	EM Science	S, C, T, F	--	--	--	--	--
400000074000097	03-09-95	1200	USGS	S, C, T	<0.015	<0.010	<0.20	<0.050	<0.010
	03-09-95	1230	USGS	S, C, T, F	<.015	<.010	<.20	<.050	<.010
	02-03-97	1630	USGS	S, C, T, F, P	<.015	.020	<.20	<.050	<.010

Station number	Date	Time	Carbon, organic dissolved (mg/L)	Calcium dissolved (mg/L)	Magnesium, dissolved (mg/L)	Sodium, dissolved (mg/L)	Potassium, dissolved (mg/L)	Chloride, dissolved (mg/L)	Sulfate dissolved (mg/L as SO4)
400000074000093	3-09-95	1300	--	--	--	--	--	--	--
400000074000097	3-09-95	1200	0.30	0.10	<0.10	<0.10	0.10	<0.10	<0.10
	3-09-95	1230	--	<.10	<.10	<.10	<.10	--	--
	2-09-97	1630	--	--	--	--	--	--	--

Table 8. Results of analyses for selected constituents in equipment blank samples--Continued

Station number	Date	Time	Fluoride, dissolved (mg/L)	Silica, dissolved (mg/L as SIO2)	Arsenic dissolved (µg/L)	Barium, dissolved (µg/L)	Beryllium, dissolved (µg/L)	Cadmium dissolved (µg/L)	Chromium, dissolved (µg/L)	Cobalt, dissolved (µg/L)	Copper, dissolved (µg/L)
400000074000093	3-09-95	1300	--	--	--	--	--	--	--	--	--
400000074000097	3-09-95	1200	<0.10	<0.10	<1	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	3-09-95	1230	--	--	<1	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	2-09-97	1630	--	--	--	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0

Station number	Date	Time	Iron, dissolved (µg/L)	Lead, dissolved (µg/L)	Manganese, dissolved (µg/L)	Molybdenum, dissolved (µg/L)	Nickel, dissolved (µg/L)	Silver, dissolved (µg/L)	Zinc, dissolved (µg/L)	Antimony, dissolved (µg/L)	Aluminum, dissolved (µg/L)
400000074000093	3-09-95	1300	--	--	--	--	--	--	--	--	--
400000074000097	3-09-95	1200	<10	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	4.0
	3-09-95	1230	<10	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	5.0
	2-09-97	1630	--	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	2.0

Station number	Date	Time	Selenium, dissolved (µg/L)	Uranium natural dissolved (µg/L)	Mercury dissolved (µg/L)	Acid neutralizing capacity (ANC) water, unfiltered, laboratory (mg/L as $CaCO_3$)
400000074000093	3-09-95	1300	--	--	--	--
400000074000097	3-09-95	1200	<1	<1.0	<.1	1.2
	3-09-95	1230	<1	<1.0	<.1	--
	2-09-97	1630	--	<1.0	<.1	--

GROUND-WATER LEVELS AND PRECIPITATION

Hourly water levels and daily precipitation amounts are shown in figure 10. Total precipitation amounts recorded at the site were 17.35 inches from July 18 to December 31, 1995; 46.22 inches from January 1 to December 31, 1996; and 20.98 inches from January 1 to July 2, 1997. The 30-year (1961-90) precipitation normals recorded at Toms River, N.J., for the periods July to December, January to December, and January to June were 24.71, 47.14, and 22.43 inches, respectively (Owenby and Ezell, 1992). The maximum daily precipitation recorded (3.17 inches) was measured on October 18, 1996. Ground-water levels (in feet below land surface) in plot well 30 ranged from 14.08 ft on October 23, 1995, to 9.74 ft on May 11, 1997. Water levels measured during the four synoptic studies (table 3) indicated a relatively consistent horizontal ground-water-flow direction across the site from southwest to northeast. Maximum differences in water levels among plot wells ranged from 1.10 to 1.33 feet.

SUMMARY

Water-quality, water-level, and precipitation data were collected from a five-acre study site at the Lakehurst Naval Air Engineering Center, New Jersey, to determine the effects of composted biosolids and commercial fertilizer on shallow ground-water quality. Water levels measured during four synoptic sampling rounds indicated that shallow ground water flowed consistently across the site from southwest to northeast; differences in water levels among plot wells ranged from 1.10 to 1.33 feet. Total precipitation amounts recorded at the site for the periods July 18 to December 31, 1995, January 1 to December 31, 1996, and January 1 to July 2, 1997, were 17.35 inches, 46.22 inches, and 20.98 inches, respectively. These amounts were slightly less than the 30-year precipitation normals for the vicinity.

Water-quality data showed the effects of treatment from pre-application to post-application through four rounds of sampling. Specific conductance and concentrations of nitrite plus nitrate, copper, zinc, lead, ammonia, calcium, sulfate, magnesium, sodium, chloride, potassium, and dissolved organic carbon increased from pre-application conditions (proportional to amendment application rate) through post-application sampling rounds 2 or 3, then decreased by the time of round 4. pH decreased during post-application rounds 2, 3, and 4 in proportion to the application rate. Concentrations of phosphorus, cadmium, and chromium were at or less than the laboratory reporting limits throughout the sampling period, showing no effects of treatment.

Specific conductance of the ground water increased dramatically after application of all soil amendments; the largest increases were associated with biosolids applied at 4 and 8 times the recommended vegetative nitrogen requirement (treatments B and C). Median pH values decreased in post-application rounds 2, 3, and 4 as amendment loading increased. This decrease could be a result of nitrification. Concentrations of nitrite plus nitrate increased in the shallow ground water as a result of the application of both composted biosolids and commercial fertilizer. Concentrations of copper, zinc, and lead in shallow ground water increased as a result of the application of biosolids at the higher rates (treatments B and C). Concentrations of copper, zinc, and lead in the biosolids were less than the U.S. Environmental Protection Agency Pollutant Concentration Limits for "exceptional quality" biosolids. Specific conductance and concentrations of nitrite plus nitrate were greater than pre-application levels in some control plot samples (treatment E). Windblown contamination by amendments from adjacent plots and lateral transport of constituents by ground-water movement are possible causes.

Concentrations of copper and zinc in ground-water samples from plots treated with biosolids at 1 times the nitrogen requirement (treatment A) and with commercial fertilizer (treatment D) were not proportional to the mass of copper and zinc in the amendments. Control plot samples (treatment E) showed some limited effects of treatment, particularly for specific conductance and nitrite plus nitrate.

The application method used for this study was highly labor intensive for treatments A and B

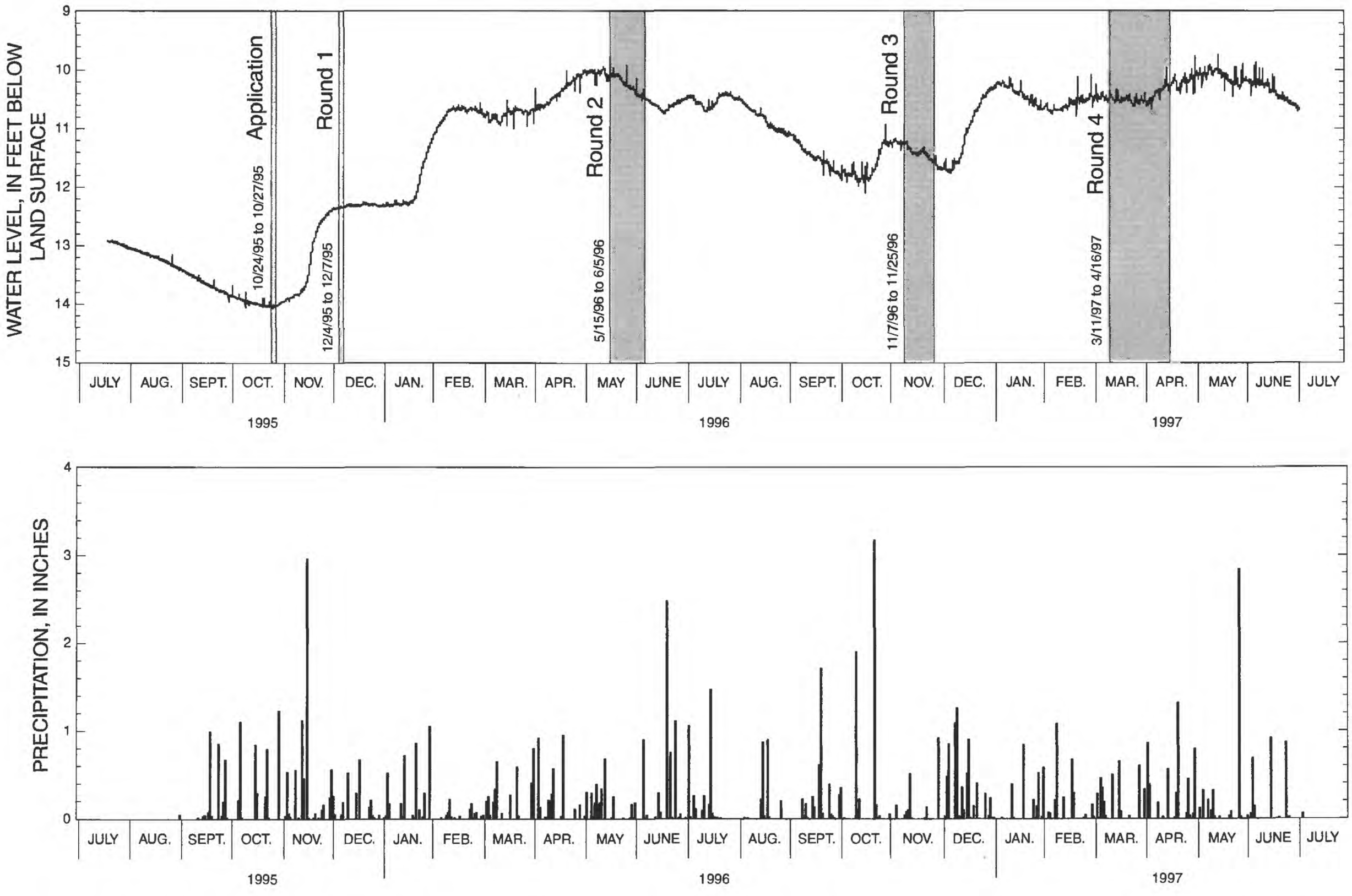


Figure 10. Water-level hydrograph for well 30 with dates of amendment application and post-application sampling rounds, and hyetograph, 1995-97.

with composted biosolids. A larger scale revegetation effort using a similar compost, applied in a similar manner, could require using application rates that greatly exceed vegetative requirements for nitrogen.

REFERENCES CITED

Berndt, M.P., 1993, Ground-water quality near an inactive landfill and sludge-spreading area, Tallahassee, Florida, 1993: U.S. Geological Survey Water-Resources Investigations Report 93-4027, 23 p.

Dames and Moore, 1994, Peliminary Draft Report Recharge Basin Study Areas I and J, Naval Air Warfare Center - Aircraft Division, Lakehurst, New Jersey: Unpublished consultants report, Dames and Moore, Cranford, New Jersey, Feb. 21, 1994, 7 chaps., 4 apps.

Fishman, M.J., ed., 1993, Methods of analysis by the U.S. Geological Survey National Water Quality Laboratory--Determination of inorganic and organic constituents in water and fluvial sediments: U.S. Geological Survey Open-File Report 93-125, 217 p.

Fishman, M.J., and Friedman, L.C., eds., 1989, Methods for determination of inorganic substances in water and fluvial sediments: U.S. Geological Survey Techniques of Water-Resources Investigations, book 5, chap. A1, 545 p.

Gaggiani, N.G., 1991, Effects of land disposal of municipal sewage sludge on soil, streambed sediment, and ground- and surface-water quality at a site near Denver, Colorado: U.S. Geological Survey Water-Resources Investigations Report 90-4106, 163 p.

____1995, Ground-water flow and effects of agricultural application of sewage sludge and other fertilizers on the chemical quality of sediments in the unsaturated zone and ground water near Platteville, Colorado, 1985-89: U.S. Geological Survey Water-Resources Investigations Report 94-4037, 41 p.

Higgens, A.J., 1984, Impacts on ground water due to land application of sewage sludge: Water Resources Bulletin, v. 20, no. 3, p. 425-434.

Horowitz, A.J., Demas, C.R., Fitzgerald, K.K., Miller, T.L., and Richert, D.A., 1994, U.S. Geological Survey protocol for the collection and processing of surface-water samples for the subsequent determination of inorganic constituents in filtered water: U.S. Geological Survey Open-File Report 94-539, 57 p.

Ivahnenko, Tamara, Szabo, Zoltan, and Hall, G.S., 1996, Use of an ultra-clean sampling technique with inductively coupled plasma-mass spectrometry to determine trace-element concentrations in water from the Kirkwood-Cohansey aquifer system, Coastal Plain, New Jersey: U.S.Geological Survey Open-File Report 96-142, 37 p.

Kam,W., 1978, Effects of controlled land application of sludge on ground water quality, Ocean County, New Jersey: U.S. Geological Survey Open-File Report 78-492, 86 p.

New Jersey Administrative Code, Pinelands Management Plan: Resource extraction, Title 7, Chapter 50, Subchapter 6, p. 6.61-6.69.

New Jersey Department of Agriculture, April 1987, Standards for soil erosion and sediment control in New Jersey: Trenton, N.J., Division of Rural Resources, New Jersey Department of Agriculture, 316 p.

Owenby, J.R., and Ezell, D.S., 1992, Monthly station normals of temperature, precipitation, and heating and cooling degree days, 1961-90, New Jersey: Asheville, N.C., Climatography of the United States No. 81, U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Climatic Data Center, January 1992, 15 p.

Puls, R.W., and Powell, R.M., 1992, Acquisition of representative ground water quality samples for metals: Ground Water Monitoring Review, v. 12, no. 3, p. 167-176.

REFERENCES CITED--Continued

Rhodehamel, E.C., 1973, Geology and water resources of the Wharton Tract and Mullica River basin in southern New Jersey: New Jersey Department of Environmental Protection, Division of Water Resources Special Report No. 36, 58 p.

Rose, D.L., and Schroeder, M.P., 1995, Methods of analysis by the U.S. Geological Survey National Water Quality Laboratory--Determination of volatile organic compounds in water by purge and trap capillary gas chromatography/mass spectrometry: U.S. Geological Survey Open-File Report 94-708, 26 p.

Spalding, R.F., Exner, M.E., Martin, G.E., and Snow, D.D, 1993, Effects of sludge disposal on ground-water nitrate concentrations: Journal of Hydrology, v. 142, p. 229-249.

Szabo, Zoltan, Rice, D.E., MacLeod, C.L., and Barringer, T.H., 1997, Relation of distribution of radium, nitrate, and pesticides to agricultural land use and depth, Kirkwood-Cohansey aquifer system, New Jersey Coastal Plain, 1990-91: U.S. Geological Survey Water-Resources Investigations Report 96-4165A, 119 p.

U.S. Environmental Protection Agency, 1994, A plain English guide to the EPA Part 503 Biosolids Rule: USEPA/832/R-93/003, 176 p.

Wood, W.W., 1976, Guidelines for collection and field analysis of ground-water samples for selected unstable constituents in water and fluvial sediments: U.S. Geological Survey Techniques of Water-Resources Investigations, Book 1, Chap. D2, 24 p.

Table 6. Field measurements and results of analyses for selected constituents in environmental, split, and concurrent samples collected at the biosolids study site, Lakehurst Naval Air Engineering Station, New Jersey, March 1995 to April 1997

[ft, feet, µS/cm, microsiemens per centimeter at 25 degrees Celsius; mg/L, milligrams per liter; µg/L, micrograms per liter; NTU, nephelumetric turbidity unit; --, no data; <, less than]

Local identifier	Station number	Well number	Date	Time	Sample type	Depth of well, total (ft)	Depth to top of screened interval (ft)	Depth to bottom of screened interval (ft)	Altitude of land surface datum (ft above sea level)	Turbidity (NTU)
PLOT 1 LNAS NEST	400134074235601	1	03-30-95	1350	Environmental	14.68	13.75	14.58	119	0.90
			12-04-95	1335	Environmental	14.68	13.75	14.58	119	--
			06-04-96	1351	Environmental	14.68	11.26	12.09	119	--
			11-18-96	1218	Environmental	14.68	12.92	13.75	119	770
			03-11-97	1049	Environmental	14.68	11.26	12.09	119	.50
PLOT 2 LNAS NEST	400134074235701	2	12-04-95	1310	Environmental	14.20	13.27	14.10	119	--
			06-04-96	1213	Environmental	14.20	10.78	11.61	119	--
			11-07-96	1626	Environmental	14.20	11.61	12.44	119	2.3
			11-07-96	1626	Concurrent	14.20	11.61	12.44	119	4.0
			03-11-97	1425	Environmental	14.20	10.78	11.61	119	.20
PLOT 3 LNAS NEST	400134074235702	3	12-04-95	1436	Environmental	14.30	13.41	14.24	119	--
			05-30-96	1540	Environmental	14.30	10.92	11.75	119	.10
			11-14-96	1230	Environmental	14.30	11.75	12.58	119	32
			03-12-97	1055	Environmental	14.30	10.92	11.75	119	6.3
			03-12-97	2400	Split	14.30	10.92	11.75	119	6.7
PLOT 4 LNAS NEST	400133074235701	4	12-04-95	1505	Environmental	14.20	13.32	14.15	119	--
			06-04-96	1506	Environmental	14.20	10.83	11.66	119	--
			11-25-96	1330	Environmental	14.20	11.66	12.49	119	.20
			03-21-97	1200	Environmental	14.20	10.83	11.66	119	.40
PLOT 5 LNAS NEST	400133074235702	5	04-06-95	1415	Environmental	14.20	13.27	14.10	119	.70
			04-06-95	1416	Concurrent	14.20	13.27	14.10	119	.20
			12-04-95	1603	Environmental	14.20	13.27	14.10	119	--
			12-04-95	1604	Concurrent	14.20	13.27	14.10	119	--
			05-29-96	1349	Environmental	14.20	10.78	11.61	119	6.0
			11-19-96	1412	Environmental	14.20	11.61	12.44	119	79
			11-19-96	1413	Concurrent	14.20	11.61	12.44	119	46
			03-24-97	1135	Environmental	14.20	10.78	11.61	119	.75
			03-24-97	2400	Split	14.20	10.78	11.61	119	.70
PLOT 6 LNAS NEST	400134074235501	6	12-05-95	1128	Environmental	14.80	13.88	14.71	119	--
			12-05-95	1128	Concurrent	14.80	13.88	14.71	119	--
			05-16-96	1358	Environmental	14.80	12.22	13.05	119	.80
			11-14-96	1021	Environmental	14.80	13.05	13.88	119	.30
			03-18-97	1048	Environmental	14.80	12.22	13.05	119	2.5

Table 6. Field measurements and results of analyses for selected constituents in environmental, split, and concurrent samples collected at the biosolids study site, Lakehurst Naval Air Engineering Station, New Jersey, March 1995 to April 1997--Continued

Local identifier	Date	Time	Specific conductance, field (µS/cm)	Specific conductance, laboratory (µS/cm)	Oxygen, dissolved (mg/L)	pH whole water, field (standard units)	pH whole water, laboratory (standard units)	Alkalinity, filtered, fixed endpoint titration, field (mg/L as $CaCO_3$)	Acid neutralizing capacity, water, unfiltered, fixed endpoint titration, field (mg/L as $CaCO_3$)	Alkalinity laboratory (mg/L as $CaCO_3$)	Nitrogen, ammonia, dissolved (mg/L as N)	Nitrogen, nitrite dissolved (mg/L as N)
PLOT 1 LNAS NEST	03-30-95	1350	33	32	--	3.6	5.3	--	--	<10	<0.015	0.010
	12-04-95	1335	51	--	--	4.7	--	--	--	--	<.015	<.010
	06-04-96	1351	31	62	9.6	4.7	4.7	1	--	--	.040	--
	11-18-96	1218	56	55	--	4.7	4.6	2	--	--	<.015	<.010
	03-11-97	1049	45	42	--	4.8	5.5	<1	--	--	<.015	<.010
PLOT 2 LNAS NEST	12-04-95	1310	80	--	--	5.1	--	--	--	--	<.015	<.010
	06-04-96	1213	42	41	--	5.7	6.3	3	--	11	.020	--
	11-07-96	1626	35	35	--	5.9	5.9	4	--	--	.070	.010
	11-07-96	1626	35	35	--	5.9	6.0	--	--	--	.050	.010
	03-11-97	1425	31	31	--	6.0	6.0	3	--	--	<.015	<.010
PLOT 3 LNAS NEST	12-04-95	1436	119	--	--	6.2	--	--	--	--	.160	<.010
	05-30-96	1540	124	119	9.5	6.1	6.2	4	--	--	.030	--
	11-14-96	1230	49	49	--	5.9	6.5	4	--	--	<.015	<.010
	03-12-97	1055	35	36	--	5.8	6.5	3	--	--	<.015	<.010
	03-12-97	2400	--	40	--	--	7.3	--	--	--	<.015	<.010
PLOT 4 LNAS NEST	12-04-95	1505	305	--	--	4.9	--	--	--	--	1.70	<.010
	06-04-96	1506	318	306	3.2	4.3	4.3	<1	--	--	5.90	--
	11-25-96	1330	98	96	--	4.6	4.4	1	--	--	<.015	<.010
	03-21-97	1200	61	59	--	5.1	4.7	1	--	--	<.015	<.010
PLOT 5 LNAS NEST	04-06-95	1415	39	36	--	5.5	5.3	--	--	B	<.015	<.010
	04-06-95	1416	39	37	--	5.5	5.2	--	--	B	<.015	<.010
	12-04-95	1603	62	--	--	5.2	--	--	--	--	<.015	<.010
	12-04-95	1604	62	--	--	5.2	--	--	--	--	<.015	<.010
	05-29-96	1349	96	94	10.1	4.7	4.6	--	1	--	4.10	--
	11-19-96	1412	130	134	--	4.3	4.1	<1	--	--	.380	.010
	11-19-96	1413	130	137	--	4.3	4.1	--	--	--	.420	.010
	03-24-97	1135	45	42	--	4.9	4.4	3	--	--	<.015	<.010
	03-24-97	2400	--	42	--	--	4.4	--	--	--	<.015	<.010
PLOT 6 LNAS NEST	12-05-95	1128	194	--	--	4.7	--	--	--	--	1.50	<.010
	12-05-95	1128	194	--	--	4.7	--	--	--	--	1.60	<.010
	05-16-96	1358	348	341	9.4	5.2	4.7	--	--	--	5.70	--
	11-14-96	1021	183	180	--	4.3	4.4	1	--	--	.070	<.010
	03-18-97	1048	78	78	--	4.9	4.5	2	--	--	<.015	<.010

Table 6. Field measurements and results of analyses for selected constituents in environmental, split, and concurrent samples collected at the biosolids study site, Lakehurst Naval Air Engineering Station, New Jersey, March 1995 to April 1997--Continued

Local identifier	Date	Time	Nitrogen, ammonia+ organic dissolved (mg/L as N)	Nitrogen, NO_2+NO_3 dissolved (mg/L as N)	Phosphorus ortho, dissolved (mg/L as P)	Carbon, organic dissolved (mg/L)	Calcium, dissolved (mg/L)	Magnesium, dissolved (mg/L)	Sodium, dissolved (mg/L)	Potassium, dissolved (mg/L)
PLOT 1 LNAS NEST	03-30-95	1350	<0.20	0.550	<0.010	0.30	1.6	0.92	1.0	0.30
	12-04-95	1335	<.20	2.40	<.010	--	--	--	--	--
	06-04-96	1351	<.20	3.30	--	.60	2.4	2.3	1.7	.20
	11-18-96	1218	<.20	2.80	<.010	.40	2.2	1.8	1.0	.30
	03-11-97	1049	<.20	1.20	<.010	.40	1.6	1.4	1.4	.10
PLOT 2 LNAS NEST	12-04-95	1310	<.20	6.00	<.010	--	--	--	--	--
	06-04-96	1213	<.20	1.40	--	.30	2.7	1.8	.80	.20
	11-07-96	1626	<.20	1.10	<.010	.50	2.2	1.5	.80	.20
	11-07-96	1626	<.20	1.10	<.010	.60	2.3	1.5	.80	.20
	03-11-97	1425	<.20	.520	<.010	.50	2.0	1.3	.60	.10
PLOT 3 LNAS NEST	12-04-95	1436	2.2	4.80	<.010	--	--	--	--	--
	05-30-96	1540	<.20	12.0	--	.40	9.0	5.7	1.7	.30
	11-14-96	1230	<.20	2.50	<.010	.70	3.1	2.1	1.1	.20
	03-12-97	1055	<.20	.870	<.010	.60	2.2	1.4	.90	.30
	03-12-97	2400	<.20	.840	<.010	.50	2.2	1.4	.90	.20
PLOT 4 LNAS NEST	12-04-95	1505	3.9	3.70	<.010	--	--	--	--	--
	06-04-96	1506	6.5	31.0	--	2.8	17	9.3	3.8	1.4
	11-25-96	1330	.60	6.80	<.010	3.3	5.7	3.0	1.4	.90
	03-21-97	1200	.20	1.80	<.010	2.1	3.4	1.9	.90	.60
PLOT 5 LNAS NEST	04-06-95	1415	<.20	.460	<.010	.40	2.3	1.2	1.0	.20
	04-06-95	1416	<.20	.480	<.010	.30	2.3	1.2	1.0	.20
	12-04-95	1603	<.20	1.70	<.010	--	--	--	--	--
	12-04-95	1604	<.20	1.70	<.010	--	--	--	--	--
	05-29-96	1349	4.2	1.70	--	1.8	1.7	1.4	2.1	.70
	11-19-96	1412	.70	10.0	<.010	1.3	3.5	2.2	1.6	.70
	11-19-96	1413	.70	9.90	<.010	1.2	3.6	2.3	1.6	.70
	03-24-97	1135	<.20	.720	<.010	.80	1.3	.70	1.1	.18
	03-24-97	2400	8.1	.710	<.010	.70	1.3	.70	1.1	.30
PLOT 6 LNAS NEST	12-05-95	1128	2.8	3.70	<.010	--	--	--	--	--
	12-05-95	1128	2.9	3.70	<.010	--	--	--	--	--
	05-16-96	1358	7.0	19.0	--	7.0	19	14	6.2	.80
	11-14-96	1021	.70	15.0	<.010	3.2	9.5	6.3	2.9	.60
	03-18-97	1048	.30	2.40	<.010	2.3	4.3	2.8	1.1	.40

Table 6. Field measurements and results of analyses for selected constituents in environmental, split, and concurrent samples collected at the biosolids study site, Lakehurst Naval Air Engineering Station, New Jersey, March 1995 to April 1997--Continued

Local identifier	Date	Time	Chloride, dissolved (mg/L)	Sulfate, dissolved (mg/L as SO_4)	Fluoride, dissolved (mg/L)	Silica, dissolved (mg/L as SiO_2)	Arsenic, dissolved (µg/L)	Barium, dissolved (µg/L)	Beryllium, dissolved (µg/L)	Cadmium, dissolved (µg/L)
PLOT 1 LNAS NEST	03-30-95	1350	1.6	7.8	<0.10	1.7	<1	19	<1.0	<1.0
	12-04-95	1335	--	--	--	--	--	--	--	--
	06-04-96	1351	1.9	8.1	--	--	--	--	--	<1.0
	11-18-96	1218	1.6	7.8	--	--	--	--	--	<1.0
	03-11-97	1049	1.3	8.9	--	--	--	--	--	<1.0
PLOT 2 LNAS NEST	12-04-95	1310	--	--	--	--	--	--	--	--
	06-04-96	1213	1.8	5.8	--	--	--	--	--	<1.0
	11-07-96	1626	.80	5.9	--	--	--	--	--	<1.0
	11-07-96	1626	.80	5.9	--	--	--	--	--	1.0
	03-11-97	1425	1.8	5.0	--	--	--	--	--	<1.0
PLOT 3 LNAS NEST	12-04-95	1436	--	--	--	--	--	--	--	--
	05-30-96	1540	4.4	3.8	--	--	--	--	--	<1.0
	11-14-96	1230	1.4	5.8	--	--	--	--	--	<1.0
	03-12-97	1055	2.0	4.8	--	--	--	--	--	<1.0
	03-12-97	2400	1.9	4.8	--	--	--	--	--	<1.0
PLOT 4 LNAS NEST	12-04-95	1505	--	--	--	--	--	--	--	--
	06-04-96	1506	3.1	12	--	--	--	--	--	<1.0
	11-25-96	1330	1.1	11	--	--	--	--	--	<1.0
	03-21-97	1200	1.8	13	--	--	--	--	--	<1.0
PLOT 5 LNAS NEST	04-06-95	1415	1.4	9.0	<.10	2.9	<1	24	<1.0	<1.0
	04-06-95	1416	1.4	9.2	<.10	2.9	<1	25	<1.0	<1.0
	12-04-95	1603	--	--	--	--	--	--	--	--
	12-04-95	1604	--	--	--	--	--	--	--	--
	05-29-96	1349	2.4	22	--	--	--	--	--	<1.0
	11-19-96	1412	1.3	9.7	--	--	--	--	--	<1.0
	11-19-96	1413	1.3	10	--	--	--	--	--	<1.0
	03-24-97	1135	1.8	7.5	--	--	--	--	--	<1.0
	03-24-97	2400	1.8	7.4	--	--	--	--	--	<1.0
PLOT 6 LNAS NEST	12-05-95	1128	--	--	--	--	--	--	--	--
	12-05-95	1128	--	--	--	--	--	--	--	--
	05-16-96	1358	6.0	65	--	--	--	--	--	<1.0
	11-14-96	1021	1.0	19	--	--	--	--	--	<1.0
	03-18-97	1048	1.1	18	--	--	--	--	--	<1.0

Table 6. Field measurements and results of analyses for selected constituents in environmental, split, and concurrent samples collected at the biosolids study site, Lakehurst Naval Air Engineering Station, New Jersey, March 1995 to April 1997--Continued

Local identifier	Date	Time	Chromium, dissolved (µg/L)	Cobalt, dissolved (µg/L)	Copper, dissolved (µg/L)	Iron, dissolved (µg/L)	Lead, dissolved (µg/L)	Manganese, dissolved (µg/L)	Molybdenum, dissolved (µg/L)	Mercury, dissolved (µg/L)
PLOT 1 LNAS NEST	03-30-95	1350	<1.0	1.0	2.0	<3.0	<1.0	13	<1.0	<0.1
	12-04-95	1335	--	--	--	--	--	--	--	--
	06-04-96	1351	<1.0	--	1.0	--	<1.0	--	--	--
	11-18-96	1218	<1.0	--	4.0	--	<1.0	--	--	--
	03-11-97	1049	<1.0	--	<1.0	--	<1.0	--	--	--
PLOT 2 LNAS NEST	12-04-95	1310	--	--	--	--	--	--	--	--
	06-04-96	1213	<1.0	--	<1.0	--	<1.0	--	--	--
	11-07-96	1626	<1.0	--	<1.0	--	<1.0	--	--	--
	11-07-96	1626	<1.0	--	<1.0	--	<1.0	--	--	--
	03-11-97	1425	<1.0	--	<1.0	--	<1.0	--	--	--
PLOT 3 LNAS NEST	12-04-95	1436	--	--	--	--	--	--	--	--
	05-30-96	1540	<1.0	--	<1.0	--	<1.0	--	--	--
	11-14-96	1230	<1.0	--	<1.0	--	<1.0	--	--	--
	03-12-97	1055	<1.0	--	<1.0	--	<1.0	--	--	--
	03-12-97	2400	<1.0	--	1.0	--	<1.0	--	--	--
PLOT 4 LNAS NEST	12-04-95	1505	--	--	--	--	--	--	--	--
	06-04-96	1506	<1.0	--	9.0	--	<1.0	--	--	--
	11-25-96	1330	<1.0	--	5.0	--	<1.0	--	--	--
	03-21-97	1200	<1.0	--	3.0	--	<1.0	--	--	--
PLOT 5 LNAS NEST	04-06-95	1415	<1.0	1.0	1.0	<3.0	<1.0	15	<1.0	<0.1
	04-06-95	1416	<1.0	1.0	1.0	3.0	1.0	15	<1.0	<0.1
	12-04-95	1603	--	--	--	--	--	--	--	--
	12-04-95	1604	--	--	--	--	--	--	--	--
	05-29-96	1349	<1.0	--	2.0	--	<1.0	--	--	--
	11-19-96	1412	<1.0	--	8.0	--	13	--	--	--
	11-19-96	1413	<1.0	--	7.0	--	13	--	--	--
	03-24-97	1135	<1.0	--	1.2	--	<1.0	--	--	--
	03-24-97	2400	<1.0	--	1.0	--	<1.0	--	--	--
PLOT 6 LNAS NEST	12-05-95	1128	--	--	--	--	--	--	--	--
	12-05-95	1128	--	--	--	--	--	--	--	--
	05-16-96	1358	<1.0	--	5.0	--	<1.0	--	--	--
	11-14-96	1021	<1.0	--	4.0	--	1.0	--	--	--
	03-18-97	1048	<1.0	--	3.0	--	<1.0	--	--	--

Table 6. Field measurements and results of analyses for selected constituents in environmental, split, and concurrent samples collected at the biosolids study site, Lakehurst Naval Air Engineering Station, New Jersey, March 1995 to April 1997--Continued

Local identifier	Date	Time	Nickel, dissolved (µg/L)	Silver, dissolved (µg/L)	Zinc, dissolved (µg/L)	Antimony, dissolved (µg/L)	Aluminum, dissolved (µg/L)	Selenium, dissolved (µg/L)	Uranium natural, dissolved (µg/L)
PLOT 1 LNAS NEST	03-30-95	1350	2.0	<1.0	13	<1.0	110	<1	<1.0
	12-04-95	1335	--	--	--	--	--	--	--
	06-04-96	1351	--	--	14	--	--	--	--
	11-18-96	1218	--	--	15	--	--	--	--
	03-11-97	1049	--	--	7.0	--	--	--	--
PLOT 2 LNAS NEST	12-04-95	1310	--	--	--	--	--	--	--
	06-04-96	1213	--	--	3.0	--	--	--	--
	11-07-96	1626	--	--	3.0	--	--	--	--
	11-07-96	1626	--	--	<3.0	--	--	--	--
	03-11-97	1425	--	--	8.0	--	--	--	--
PLOT 3 LNAS NEST	12-04-95	1436	--	--	--	--	--	--	--
	05-30-96	1540	--	--	4.0	--	--	--	--
	11-14-96	1230	--	--	<3.0	--	--	--	--
	03-12-97	1055	--	--	<3.0	--	--	--	--
	03-12-97	2400	--	--	<3.0	--	--	--	--
PLOT 4 LNAS NEST	12-04-95	1505	--	--	--	--	--	--	--
	06-04-96	1506	--	--	35	--	--	--	--
	11-25-96	1330	--	--	9.0	--	--	--	--
	03-21-97	1200	--	--	13	--	--	--	--
PLOT 5 LNAS NEST	04-06-95	1415	2.0	<1.0	8.0	<1.0	59	<1	<1.0
	04-06-95	1416	2.0	<1.0	7.0	<1.0	64	<1	<1.0
	12-04-95	1603	--	--	--	--	--	--	--
	12-04-95	1604	--	--	--	--	--	--	--
	05-29-96	1349	--	--	5.0	--	--	--	--
	11-19-96	1412	--	--	20	--	--	--	--
	11-19-96	1413	--	--	21	--	--	--	--
	03-24-97	1135	--	--	9.8	--	--	--	--
	03-24-97	2400	--	--	14	--	--	--	--
PLOT 6 LNAS NEST	12-05-95	1128	--	--	--	--	--	--	--
	05-16-96	1128	--	--	--	--	--	--	--
	11-14-96	1358	--	--	12	--	--	--	--
	03-18-97	1021	--	--	20	--	--	--	--

Table 6. Field measurements and results of analyses for selected constituents in environmental, split, and concurrent samples collected at the biosolids study site, Lakehurst Naval Air Engineering Station, New Jersey, March 1995 to April 1997--Continued

Local identifier	Station number	Well number	Date	Time	Sample type	Depth of well, total (ft)	Depth to top of screened interval (ft)	Depth to bottom of screened interval (ft)	Altitude of land surface datum (feet above sea level)	Turbidity (NTU)
PLOT 7 LNAS NEST	400133074235501	7	03-30-95	1615	Environmental	15.20	14.30	15.13	119	48
			12-05-95	1100	Environmental	15.20	14.30	15.13	119	--
			05-23-96	1728	Environmental	15.20	11.81	12.64	119	3.0
			11-07-96	1455	Environmental	15.20	12.64	13.47	119	9.2
			04-03-97	1330	Environmental	15.20	11.81	12.64	119	.27
PLOT 8 LNAS NEST	400133074235502	8	12-05-95	1030	Environmental	14.90	13.97	14.80	119	--
			05-21-96	1558	Environmental	14.90	11.48	12.31	119	.20
			05-21-96	1559	Concurrent	14.90	11.48	12.31	119	.30
			11-21-96	1130	Environmental	14.90	12.31	13.14	119	30
			03-12-97	1230	Environmental	14.90	11.48	12.31	119	.30
PLOT 9 LNAS NEST	400132074235601	9	03-29-95	1505	Environmental	14.70	13.77	14.66	119	.60
			12-04-95	1650	Environmental	14.70	13.77	14.66	119	--
			06-05-96	1340	Environmental	14.70	11.28	12.11	119	--
			11-19-96	1040	Environmental	14.70	12.11	12.94	119	.80
			03-21-97	1100	Environmental	14.70	11.28	12.11	119	.60
PLOT 10 LNAS NEST	400132074235301	10	12-04-95	1632	Environmental	14.60	13.70	14.53	119	--
			05-23-96	1043	Environmental	14.60	11.21	12.04	119	43
			11-21-96	1240	Environmental	14.60	12.04	12.87	119	.30
			03-19-97	1550	Environmental	14.60	11.21	12.04	119	1.6
PLOT 11 LNAS NEST	400133074235301	11	12-05-95	1230	Environmental	15.40	14.50	15.33	119	--
			05-30-96	1149	Environmental	15.40	12.01	12.84	119	4.9
			11-12-96	1207	Environmental	15.40	12.84	13.67	119	3.3
			03-17-97	1500	Environmental	15.40	12.01	12.84	119	.90
PLOT 12 LNAS NEST	400133074235302	12	04-06-95	1215	Environmental	15.00	14.10	14.93	119	16
			12-05-95	1250	Environmental	15.00	14.10	14.93	119	--
			05-22-96	1406	Environmental	15.00	11.61	12.44	119	.90
			11-20-96	1300	Environmental	15.00	13.27	14.10	119	50
			03-17-97	1620	Environmental	15.00	11.61	12.44	119	.40
PLOT 13 LNAS NEST	400132074235401	13	12-05-95	1310	Environmental	14.90	13.20	14.03	119	--
			05-22-96	1558	Environmental	14.90	11.54	12.37	119	.20
			11-19-96	1155	Environmental	14.90	12.37	13.20	119	5.6
			03-24-97	1306	Environmental	14.90	11.54	12.37	119	1.8

Table 6. Field measurements and results of analyses for selected constituents in environmental, split, and concurrent samples collected at the biosolids study site, Lakehurst Naval Air Engineering Station, New Jersey, March 1995 to April 1997--Continued

Local identifier	Date	Time	Specific conductance, field (µS/cm)	Specific conductance, laboratory (µS/cm)	Oxygen, dissolved (mg/L)	pH whole water, field (standard units)	pH whole water, laboratory (standard units)	Alkalinity, filtered, fixed endpoint titration, field (mg/L as $CaCO_3$)	Alkalinity, laboratory (mg/L as $CaCO_3$)	Nitrogen, ammonia, dissolved (mg/L as N)	Nitrogen, nitrite, dissolved (mg/L as N)
PLOT 7 LNAS NEST	03-30-95	1615	37	37	--	3.6	7.2	--	19	<0.015	0.010
	12-05-95	1100	101	--	--	5.8	--	--	--	<.015	<.010
	05-23-96	1728	111	108	--	5.5	6.7	4	--	.080	--
	11-07-96	1455	58	58	--	5.9	5.9	6	--	.160	.010
	04-03-97	1330	42	42	--	6.0	5.9	6	--	<.015	<.010
PLOT 8 LNAS NEST	12-05-95	1030	59	--	--	4.6	--	--	--	<.015	<.010
	05-21-96	1558	80	78	11.6	4.8	4.7	1	--	<.015	--
	05-21-96	1559	80	77	11.6	4.8	4.7	1	--	<.015	--
	11-21-96	1130	69	67	--	4.5	4.5	<1	--	<.015	.010
	03-12-97	1230	38	37	--	4.9	5.1	<1	--	<.015	<.010
PLOT 9 LNAS NEST	03-29-95	1505	34	30	--	4.2	4.8	--	<1.0	<.015	<.010
	12-04-95	1650	53	--	--	4.6	--	--	--	<.015	<.010
	06-05-96	1340	170	168	9.3	4.4	4.5	--	--	.480	--
	11-19-96	1040	140	149	--	4.2	4.0	<1	--	<.015	<.010
	03-21-97	1100	83	79	--	4.6	4.4	<1	--	<.015	<.010
PLOT 10 LNAS NEST	12-04-95	1632	54	--	--	6.0	--	--	--	<.015	<.010
	05-23-96	1043	63	60	9.8	4.7	4.7	<1	<5	<.015	--
	11-21-96	1240	E58	54	--	4.6	4.8	1	--	<.015	<.010
	03-19-97	1550	44	44	--	5.0	4.7	1	--	<.015	<.010
PLOT 11 LNAS NEST	12-05-95	1230	95	--	--	4.8	--	--	--	<.015	<.010
	05-30-96	1149	352	343	9.6	4.8	4.6	1	--	.370	--
	11-12-96	1207	221	218	--	4.6	4.7	1	--	.060	.020
	03-17-97	1500	110	109	--	5.0	4.7	3	--	<.015	<.010
PLOT 12 LNAS NEST	04-06-95	1215	36	34	--	5.2	5.0	--	<1.0	<.015	<.010
	12-05-95	1250	34	--	--	4.9	--	--	--	<.015	<.010
	05-22-96	1406	157	151	6.7	4.6	4.6	<1	--	1.70	--
	11-20-96	1300	39	36	--	4.7	4.8	4	--	<.015	<.010
	03-17-97	1620	86	77	--	4.6	4.4	<1	--	.090	<.010
PLOT 13 LNAS NEST	12-05-95	1310	39	--	--	4.8	--	--	--	<.015	<.010
	05-22-96	1558	39	36	9.9	4.9	5.9	1	<5	.030	--
	11-19-96	1155	41	40	--	5.0	4.8	1	--	<.015	<.010
	03-24-97	1306	33	31	--	5.3	4.9	3	--	<.015	<.010

Table 6. Field measurements and results of analyses for selected constituents in environmental, split, and concurrent samples collected at the biosolids study site, Lakehurst Naval Air Engineering Station, New Jersey, March 1995 to April 1997--Continued

Local identifier	Date	Time	Nitrogen, ammonia + organic dissolved (mg/L as N)	Nitrogen, NO_2+NO_3 dissolved (mg/L as N)	Phosphorus ortho, dissolved (mg/L as P)	Carbon, organic total (mg/L)	Carbon, organic dissolved (mg/L)	Calcium, dissolved (mg/L)	Magnesium, dissolved (mg/L)	Sodium, dissolved (mg/L)	Potassium, dissolved (mg/L)
PLOT 7 LNAS NEST	03-30-95	1615	<0.20	0.730	<0.010	0.40	0.40	2.1	1.3	1.0	0.40
	12-05-95	1100	.80	6.80	<.010	--	--	--	--	--	--
	05-23-96	1728	.40	8.30	--	.50	.50	7.8	4.9	1.3	.40
	11-07-96	1455	<.20	2.70	<.010	.60	.60	4.1	2.5	1.1	.50
	04-03-97	1330	<.20	1.00	<.010	.40	.40	2.9	1.8	.82	.24
PLOT 8 LNAS NEST	12-05-95	1030	.20	1.90	<.010	--	--	--	--	--	--
	05-21-96	1558	<.20	3.70	--	--	1.0	4.3	3.3	1.4	.20
	05-21-96	1559	<.20	3.70	--	--	1.0	4.3	3.2	1.4	.20
	11-21-96	1130	<.20	3.40	<.010	--	.50	2.7	2.3	1.0	.30
	03-12-97	1230	<.20	1.00	<.010	--	.60	1.8	1.4	.80	.20
PLOT 9 LNAS NEST	03-29-95	1505	<.20	.210	<.010	--	.40	1.1	.90	1.0	.20
	12-04-95	1650	<.20	1.70	<.010	--	--	--	--	--	--
	06-05-96	1340	1.2	.970	--	--	4.0	6.5	5.6	8.9	.50
	11-19-96	1040	.30	12.0	<.010	--	1.2	4.6	3.6	1.6	.50
	03-21-97	1100	<.20	3.20	<.010	--	.80	2.0	1.6	4.0	.30
PLOT 10 LNAS NEST	12-04-95	1632	<.20	1.30	<.010	--	--	--	--	--	--
	05-23-96	1043	<.20	.640	--	--	.30	1.2	1.1	4.9	.20
	11-21-96	1240	<.20	1.40	<.010	--	.20	1.2	1.0	3.8	.30
	03-19-97	1550	<.20	.680	<.010	--	.30	.88	.80	3.2	.20
PLOT 11 LNAS NEST	12-05-95	1230	<.20	5.30	<.010	--	--	--	--	--	--
	05-30-96	1149	1.2	23.0	--	--	4.6	25	16	5.4	.40
	11-12-96	1207	.40	17.0	<.010	--	2.2	15	8.9	3.0	.50
	03-17-97	1500	.30	5.70	<.010	--	2.1	6.8	4.2	1.8	.30
PLOT 12 LNAS NEST	04-06-95	1215	<.20	1.10	<.010	.20	.20	1.8	1.1	.90	.30
	12-05-95	1250	<.20	.840	<.010	--	--	--	--	--	--
	05-22-96	1406	2.4	5.90	--	4.0	3.2	9.0	4.8	2.7	.80
	11-20-96	1300	<.20	1.20	<.010	.30	.20	1.8	1.0	1.0	.30
	03-17-97	1620	.20	4.40	<.010	--	1.1	4.2	2.2	1.1	.40
PLOT 13 LNAS NEST	12-05-95	1310	<.20	1.70	<.010	--	--	--	--	--	--
	05-22-96	1558	<.20	1.00	--	--	.20	1.7	.96	1.6	.30
	11-19-96	1155	<.20	1.70	<.010	--	.20	2.0	1.2	1.0	.30
	03-24-97	1306	<.20	.790	<.010	--	.30	1.6	.78	1.1	.30

Table 6. Field measurements and results of analyses for selected constituents in environmental, split, and concurrent samples collected at the biosolids study site, Lakehurst Naval Air Engineering Station, New Jersey, March 1995 to April 1997--Continued

Local identifier	Date	Time	Chloride, dissolved (mg/L)	Sulfate dissolved (mg/L as SO_4)	Fluoride, dissolved (mg/L)	Silica, dissolved (mg/L as SiO_2)	Arsenic, dissolved (µg/L)	Arsenic, total (µg/L)	Barium, dissolved (µg/L)	Beryllium, dissolved (µg/L)	Cadmium dissolved (µg/L)
PLOT 7 LNAS NEST	03-30-95	1615	1.2	6.8	<0.10	1.2	<1	--	22	<1.0	<1.0
	12-05-95	1100	--	--	--	--	--	--	--	--	--
	05-23-96	1728	5.6	5.4	--	--	--	--	--	--	<1.0
	11-07-96	1455	1.7	6.4	--	--	--	--	--	--	<1.0
	04-03-97	1330	1.6	6.7	--	--	--	--	--	--	<1.0
PLOT 8 LNAS NEST	12-05-95	1030	--	--	--	--	--	--	--	--	--
	05-21-96	1558	2.7	12	--	--	--	--	--	--	<1.0
	05-21-96	1559	2.7	12	--	--	--	--	--	--	<1.0
	11-21-96	1130	1.1	11	--	--	--	--	--	--	<1.0
	03-12-97	1230	1.1	7.6	--	--	--	--	--	--	<1.0
PLOT 9 LNAS NEST	03-29-95	1505	1.0	9.9	<.10	2.4	<1	--	27	<1.0	<1.0
	12-04-95	1650	--	--	--	--	--	--	--	--	--
	06-05-96	1340	5.6	53	--	--	--	--	--	--	<1.0
	11-19-96	1040	1.1	12	--	--	--	--	--	--	<1.0
	03-21-97	1100	.90	16	--	--	--	--	--	--	<1.0
PLOT 10 LNAS NEST	12-04-95	1632	--	--	--	--	--	--	--	--	--
	05-23-96	1043	1.7	16	--	--	--	--	--	--	<1.0
	11-21-96	1240	1.4	12	--	--	--	--	--	--	<1.0
	03-19-97	1550	1.1	11	--	--	--	--	--	--	<1.0
PLOT 11 LNAS NEST	12-05-95	1230	--	--	--	--	--	--	--	--	--
	05-30-96	1149	6.3	58	--	--	--	--	--	--	<1.0
	11-12-96	1207	1.9	21	--	--	--	--	--	--	<1.0
	03-17-97	1500	1.0	21	--	--	--	--	--	--	<1.0
PLOT 12 LNAS NEST	04-06-95	1215	1.2	6.6	<.10	1.8	<1	<1	22	<1.0	<1.0
	12-05-95	1250	--	--	--	--	--	--	--	--	--
	05-22-96	1406	4.8	28	--	--	--	<1	--	--	<1.0
	11-20-96	1300	1.3	6.7	--	--	--	<1	--	--	<1.0
	03-17-97	1620	1.4	9.7	--	--	--	<1	--	--	<1.0
PLOT 13 LNAS NEST	12-05-95	1310	--	--	--	--	--	--	--	--	--
	05-22-96	1558	1.5	7.2	--	--	--	--	--	--	<1.0
	11-19-96	1155	1.4	6.7	--	--	--	--	--	--	<1.0
	03-24-97	1306	1.0	6.2	--	--	--	--	--	--	<1.0

Table 6. Field measurements and results of analyses for selected constituents in environmental, split, and concurrent samples collected at the biosolids study site, Lakehurst Naval Air Engineering Station, New Jersey, March 1995 to April 1997--Continued

Local identifier	Date	Time	Cadmium, water unfiltered total (µg/L)	Chromium, dissolved (µg/L)	Chromium, total recoverable (µg/L)	Cobalt, dissolved (µg/L)	Copper, dissolved (µg/L)	Copper, total recoverable (µg/L)	Iron, total recoverable (µg/L)	Iron, dissolved (µg/L)	Lead, dissolved (µg/L)
PLOT 7 LNAS NEST	03-30-95	1615	--	<1.0	--	<1.0	<1.0	--	--	<3.0	<1.0
	12-05-95	1100	--	--	--	--	--	--	--	--	--
	05-23-96	1728	--	<1.0	--	--	1.0	--	--	--	<1.0
	11-07-96	1455	--	<1.0	--	--	<1.0	--	--	--	<1.0
	04-03-97	1330	--	<1.0	--	--	<1.0	--	--	--	<1.0
PLOT 8 LNAS NEST	12-05-95	1030	--	--	--	--	--	--	--	--	--
	05-21-96	1558	--	<1.0	--	--	<1.0	--	--	--	<1.0
	05-21-96	1559	--	<1.0	--	--	<1.0	--	--	--	<1.0
	11-21-96	1130	--	<1.0	--	--	2.0	--	--	--	<1.0
	03-12-97	1230	--	<1.0	--	--	<1.0	--	--	--	<1.0
PLOT 9 LNAS NEST	03-29-95	1505	--	<1.0	--	1.0	2.0	--	--	<3.0	<1.0
	12-04-95	1650	--	--	--	--	--	--	--	--	--
	06-05-96	1340	--	<1.0	--	--	4.0	--	--	--	<1.0
	11-19-96	1040	--	<1.0	--	--	4.0	--	--	--	<1.0
	03-21-97	1100	--	<1.0	--	--	2.0	--	--	--	<1.0
PLOT 10 LNAS NEST	12-04-95	1632	--	--	--	--	--	--	--	--	--
	05-23-96	1043	--	<1.0	--	--	1.6	--	--	--	<1.0
	11-21-96	1240	--	<1.0	--	--	<1.0	--	--	--	<1.0
	03-19-97	1550	--	<1.0	--	--	<1.0	--	--	--	<1.0
PLOT 11 LNAS NEST	12-05-95	1230	--	--	--	--	--	--	--	--	--
	05-30-96	1149	--	<1.0	--	--	2.0	--	--	--	<1.0
	11-12-96	1207	--	<1.0	--	--	2.0	--	--	--	<1.0
	03-17-97	1500	--	<1.0	--	--	1.0	--	--	--	<1.0
PLOT 12 LNAS NEST	04-06-95	1215	<1	<1.0	<1	<1.0	1.0	<1	50	<3.0	<1.0
	12-05-95	1250	--	--	--	--	--	--	--	--	--
	05-22-96	1406	<1	<1.0	<1	--	3.0	4	50	--	<1.0
	11-20-96	1300	<1	<1.0	<1	--	<1.0	<1	360	--	<1.0
	03-17-97	1620	<1	<1.0	<1	--	1.0	1	<10	--	<1.0
PLOT 13 LNAS NEST	12-05-95	1310	--	--	--	--	--	--	--	--	--
	05-22-96	1558	--	<1.0	--	--	<1.0	--	--	--	<1.0
	11-19-96	1155	--	<1.0	--	--	<1.0	--	--	--	<1.0
	03-24-97	1306	--	<1.0	--	--	<1.0	--	--	--	<1.0

Table 6. Field measurements and results of analyses for selected constituents in environmental, split, and concurrent samples collected at the biosolids study site, Lakehurst Naval Air Engineering Station, New Jersey, March 1995 to April 1997--Continued

Local identifier	Date	Time	Lead, total recoverable (µg/L)	Manganese, total recoverable (µg/L)	Manganese, dissolved (µg/L)	Molybdenum, dissolved (µg/L)	Molybdenum, total recoverable (µg/L)	Mercury, dissolved (µg/L)	Mercury, total recoverable (µg/L)	Nickel, dissolved (µg/L)	Nickel, total recoverable (µg/L)
PLOT 7 LNAS NEST	3-30-95	1615	--	--	11	<1.0	--	--	--	<1.0	--
	12-05-95	1100	--	--	--	--	--	--	--	--	--
	05-23-96	1728	--	--	--	--	--	--	--	--	--
	11-07-96	1455	--	--	--	--	--	--	--	--	--
	04-03-97	1330	--	--	--	--	--	--	--	--	--
PLOT 8 LNAS NEST	12-05-95	1030	--	--	--	--	--	--	--	--	--
	05-21-96	1558	--	--	--	--	--	--	--	--	--
	05-21-96	1559	--	--	--	--	--	--	--	--	--
	11-21-96	1130	--	--	--	--	--	--	--	--	--
	03-12-97	1230	--	--	--	--	--	--	--	--	--
PLOT 9 LNAS NEST	03-29-95	1505	--	--	11	<1.0	--	<.1	--	2.0	--
	12-04-95	1650	--	--	--	--	--	--	--	--	--
	06-05-96	1340	--	--	--	--	--	--	--	--	--
	11-19-96	1040	--	--	--	--	--	--	--	--	--
	03-21-97	1100	--	--	--	--	--	--	--	--	--
PLOT 10 LNAS NEST	12-04-95	1632	--	--	--	--	--	--	--	--	--
	05-23-96	1043	--	--	--	--	--	--	--	--	--
	11-21-96	1240	--	--	--	--	--	--	--	--	--
	03-19-97	1550	--	--	--	--	--	--	--	--	--
PLOT 11 LNAS NEST	12-05-95	1230	--	--	--	--	--	--	--	--	--
	05-30-96	1149	--	--	--	--	--	--	--	--	--
	11-12-96	1207	--	--	--	--	--	--	--	--	--
	03-17-97	1500	--	--	--	--	--	--	--	--	--
PLOT 12 LNAS NEST	04-06-95	1215	<1	10	8.0	<1.0	<1	<.1	<.10	1.0	1
	12-05-95	1250	--	--	--	--	--	--	--	--	--
	05-22-96	1406	<1	20	--	--	<1	--	<.10	--	1
	11-20-96	1300	2	10	--	--	4	--	<.10	--	<1
	03-17-97	1620	<1	10	--	--	<1	--	<.10	--	1
PLOT 13 LNAS NEST	12-05-95	1310	--	--	--	--	--	--	--	--	--
	05-22-96	1558	--	--	--	--	--	--	--	--	--
	11-19-96	1155	--	--	--	--	--	--	--	--	--
	03-24-97	1306	--	--	--	--	--	--	--	--	--

Table 6. Field measurements and results of analyses for selected constituents in environmental, split, and concurrent samples collected at the biosolids study site, Lakehurst Naval Air Engineering Station, New Jersey, March 1995 to April 1997--Continued

Local identifier	Date	Time	Silver, dissolved (µg/L)	Zinc, dissolved (µg/L)	Zinc, total recoverable (µg/L)	Antimony, dissolved (µg/L)	Aluminum, total recoverable (µg/L)	Aluminum, dissolved (µg/L)	Selenium, dissolved (µg/L)	Selenium, total (µg/L)	Uranium, natural dissolved (µg/L)
PLOT 7 LNAS NEST	03-30-95	1615	<1.0	2.0	--	<1.0	--	27	<1	--	<1.0
	12-05-95	1100	--	--	--	--	--	--	--	--	--
	05-23-96	1728	--	<3.0	--	--	--	--	--	--	--
	11-07-96	1455	--	<3.0	--	--	--	--	--	--	--
	04-03-97	1330	--	<3.0	--	--	--	--	--	--	--
PLOT 8 LNAS NEST	12-05-95	1030	--	--	--	--	--	--	--	--	--
	05-21-96	1558	--	6.0	--	--	--	--	--	--	--
	05-21-96	1559	--	<3.0	--	--	--	--	--	--	--
	11-21-96	1130	--	19	--	--	--	--	--	--	--
	03-12-97	1230	--	6.0	--	--	--	--	--	--	--
PLOT 9 LNAS NEST	03-29-95	1505	<1.0	9.0	--	<1.0	--	144	<1	--	<1.0
	12-04-95	1650	--	--	--	--	--	--	--	--	--
	06-05-96	1340	--	31	--	--	--	--	--	--	--
	11-19-96	1040	--	28	--	--	--	--	--	--	--
	03-21-97	1100	--	25	--	--	--	--	--	--	--
PLOT 10 LNAS NEST	12-04-95	1632	--	--	--	--	--	--	--	--	--
	05-23-96	1043	--	15	--	--	--	--	--	--	--
	11-21-96	1240	--	<3.0	--	--	--	--	--	--	--
	03-19-97	1550	--	12	--	--	--	--	--	--	--
PLOT 11 LNAS NEST	12-05-95	1230	--	--	--	--	--	--	--	--	--
	05-30-96	1149	--	13	--	--	--	--	--	--	--
	11-12-96	1207	--	7.0	--	--	--	--	--	--	--
	03-17-97	1500	--	5.0	--	--	--	--	--	--	--
PLOT 12 LNAS NEST	04-06-95	1215	<1.0	7.0	<10	<1.0	220	66	<1	<1	<1.0
	12-05-95	1250	--	--	--	--	--	--	--	--	--
	05-22-96	1406	--	14	10	--	630	--	--	<1	--
	11-20-96	1300	--	<3.0	<10	--	1,100	--	--	<1	--
	03-17-97	1620	--	5.0	<10	--	550	--	--	<1	--
PLOT 13 LNAS NEST	12-05-95	1310	--	--	--	--	--	--	--	--	--
	05-22-96	1558	--	<3.0	--	--	--	--	--	--	--
	11-19-96	1155	--	<3.0	--	--	--	--	--	--	--
	03-24-97	1306	--	11	--	--	--	--	--	--	--

Table 6. Field measurements and results of analyses for selected constituents in environmental, split, and concurrent samples collected at the biosolids study site, Lakehurst Naval Air Engineering Station, New Jersey, March 1995 to April 1997--Continued

Local identifier	Station number	Well number	Date	Time	Sample type	Depth of well, total (ft)	Depth to top of screened interval (ft)	Depth to bottom of screened interval (ft)	Altitude of land surface datum (feet above sea level)	Turbidity (NTU)
PLOT 14 LNAS NEST	400132074235402	14	12-05-95	1430	Environmental	14.80	13.04	13.87	119	--
			05-22-96	1132	Environmental	14.80	11.38	12.21	119	6.7
			11-25-96	1127	Environmental	14.80	12.21	13.04	119	2.2
			04-03-97	1125	Environmental	14.80	11.38	12.21	119	5.5
PLOT 15 LNAS NEST	400131074235401	15	03-30-95	1735	Environmental	14.70	13.82	14.65	119	.80
			12-05-95	1450	Environmental	14.70	12.99	13.82	119	--
			12-05-95	1451	Concurrent	14.70	12.99	13.82	119	--
			06-05-96	1522	Environmental	14.70	11.33	12.16	119	--
			06-05-96	1523	Concurrent	14.70	11.33	12.16	119	--
			11-22-96	1218	Environmental	14.70	12.16	12.99	119	5.4
			03-19-97	1330	Environmental	14.70	11.33	12.16	119	4.5
PLOT 16 LNAS NEST	400133074235201	16	12-07-95	1109	Environmental	14.80	13.87	14.70	119	--
			12-07-95	1110	Concurrent	14.80	13.87	14.70	119	--
			05-30-96	1716	Environmental	14.80	11.38	12.21	119	.20
			11-15-96	1040	Environmental	14.80	13.04	13.87	119	220
			03-18-97	1555	Environmental	14.80	11.38	12.21	119	.40
PLOT 17 LNAS NEST	400132074235201	17	04-01-95	1630	Environmental	15.00	14.07	14.90	119	<.10
			04-01-95	1700	Concurrent	15.00	14.07	14.90	119	.10
			12-07-95	1043	Environmental	15.00	13.24	14.07	119	--
			05-15-96	1435	Environmental	15.00	12.41	13.24	119	4.0
			11-07-96	1210	Environmental	15.00	12.41	13.24	119	1.3
			03-27-97	1143	Environmental	15.00	11.58	12.41	119	23
PLOT 18 LNAS NEST	400132074235202	18	12-05-95	1625	Environmental	14.70	12.99	13.82	119	--
			05-23-96	1537	Environmental	14.70	11.33	12.16	119	30
			11-15-96	1235	Environmental	14.70	12.16	12.99	119	3.1
			03-27-97	1537	Environmental	14.70	11.33	12.16	119	14
PLOT 19 LNAS NEST	400131074235201	19	04-01-95	1815	Environmental	14.50	13.61	14.44	119	<.10
			12-05-95	1554	Environmental	14.50	12.78	13.61	119	--
			05-30-96	1318	Environmental	14.50	11.12	11.95	119	14
			11-20-96	1042	Environmental	14.50	11.95	12.78	119	9.2
			11-20-96	2400	Split	14.50	11.95	12.78	119	9.3
			03-27-97	1350	Environmental	14.50	11.12	11.95	119	3.8
PLOT 20 LNAS NEST	400131074235301	20	12-05-95	1525	Environmental	14.60	12.87	13.70	119	--
			06-05-96	1220	Environmental	14.60	11.21	12.04	119	--
			11-12-96	1503	Environmental	14.60	12.04	12.87	119	1.2
			03-27-97	1712	Environmental	14.60	11.21	12.04	119	34

Table 6. Field measurements and results of analyses for selected constituents in environmental, split, and concurrent samples collected at the biosolids study site, Lakehurst Naval Air Engineering Station, New Jersey, March 1995 to April 1997--Continued

Local identifier	Date	Time	Specific conductance, field (µS/cm)	Specific conductance, laboratory (µS/cm)	Oxygen, dissolved (mg/L)	pH, whole water, field (standard units)	pH, whole water, laboratory (standard units)	Alkalinity filtered, incremental titration, field (mg/L as $CaCO_3$)	Alkalinity, filtered, fixed endpoint titration, field (mg/L as $CaCO_3$)	Alkalinity, laboratory (mg/L as $CaCO_3$)	Nitrogen, ammonia, dissolved (mg/L as N)	Nitrogen, nitrite, dissolved (mg/L as N)
PLOT 14 LNAS NEST	12-05-95	1430	78	--	--	4.7	--	--	--	--	<0.015	<0.010
	05-22-96	1132	102	100	9.6	6.6	6.8	--	8	--	.030	--
	11-25-96	1127	54	54	--	5.9	6.6	--	4	--	<.015	.020
	04-03-97	1125	40	40	--	6.8	6.3	--	36	--	<.015	<.010
PLOT 15 LNAS NEST	03-30-95	1735	40	38	--	3.5	4.7	--	--	<1.0	<.015	.010
	12-05-95	1450	87	--	--	4.5	--	--	--	--	.080	<.010
	12-05-95	1451	87	--	--	4.5	--	--	--	--	.070	<.010
	06-05-96	1522	54	50	9.6	4.3	4.5	--	--	--	.230	--
	06-05-96	1523	54	50	9.7	4.3	4.5	--	--	--	.230	--
	11-22-96	1218	40	38	--	4.5	4.6	--	--	--	<.015	.010
	03-19-97	1330	30	30	--	5.0	4.7	--	3	--	<.015	<.010
PLOT 16 LNAS NEST	12-07-95	1109	44	--	--	4.8	--	--	--	--	<.015	<.010
	12-07-95	1110	44	--	--	4.8	--	--	--	--	<.015	<.010
	05-30-96	1716	61	57	10.4	4.7	4.8	--	1	<.5	.020	--
	11-15-96	1040	104	99	--	4.4	4.5	--	1	--	.020	<.010
	03-18-97	1555	42	42	--	5.2	5.3	2	--	--	<.015	<.010
PLOT 17 LNAS NEST	04-01-95	1630	33	32	--	4.9	5.4	--	--	1.2	.020	<.010
	04-01-95	1700	33	32	--	4.9	4.9	--	--	1.2	<.015	<.010
	12-07-95	1043	109	--	--	4.6	--	--	--	--	<.015	<.010
	05-15-96	1435	126	126	--	5.0	4.7	--	--	<.5	.040	--
	11-07-96	1210	E74	73	--	5.3	5.3	--	3	--	.040	.010
	03-27-97	1143	62	61	--	6.7	6.3	--	16	--	<.015	<.010
PLOT 18 LNAS NEST	12-05-95	1625	98	--	--	4.5	--	--	--	--	<.015	<.010
	05-23-96	1537	205	202	9.7	6.2	6.5	--	8	--	.030	--
	11-15-96	1235	104	102	--	5.7	6.1	--	4	--	<.015	<.010
	03-27-97	1537	60	60	--	6.5	6.2	--	9	--	<.015	<.010
PLOT 19 LNAS NEST	04-01-95	1815	37	37	--	4.9	4.8	--	--	<1.0	.020	<.010
	12-05-95	1554	120	--	--	4.6	--	--	--	--	.030	.020
	05-30-96	1318	129	125	10.3	4.6	4.5	--	1	--	.790	--
	11-20-96	1042	71	68	--	4.4	4.5	--	<1	--	<.015	<.010
	11-20-96	2400	71	68	--	4.4	4.6	--	--	--	<.015	<.010
	03-27-97	1350	36	36	--	5.1	4.7	--	3	--	<.015	<.010
PLOT 20 LNAS NEST	12-05-95	1525	77	--	--	4.6	--	--	--	--	<.015	<.010
	06-05-96	1220	234	231	9.4	4.3	4.3	--	--	--	6.60	--
	11-12-96	1503	324	301	--	3.6	3.7	--	<1	--	3.30	.010
	03-27-97	1712	168	159	--	4.1	3.9	--	<1	--	.550	<.010

Table 6. Field measurements and results of analyses for selected constituents in environmental, split, and concurrent samples collected at the biosolids study site, Lakehurst Naval Air Engineering Station, New Jersey, March 1995 to April 1997--Continued

Local identifier	Date	Time	Nitrogen, ammonia+ organic dissolved (mg/L as N)	Nitrogen, NO_2+NO_3 dissolved (mg/L as N)	Phosphorus ortho, dissolved (mg/L as P)	Carbon, organic dissolved (mg/L)	Calcium, dissolved (mg/L)	Magnesium, dissolved (mg/L)	Sodium, dissolved (mg/L)	Potassium, dissolved (mg/L)	Chloride, dissolved (mg/L)
PLOT 14 LNAS NEST	12-05-95	1430	0.20	3.70	<0.010	--	--	--	--	--	--
	05-22-96	1132	<.20	6.30	--	.90	6.6	4.4	2.8	.20	2.1
	11-25-96	1127	<.20	2.40	<.010	.60	3.3	2.2	1.8	.10	1.3
	04-03-97	1125	<.20	.610	<.010	.60	2.7	1.7	1.1	.13	2.0
PLOT 15 LNAS NEST	03-30-95	1735	<.20	1.20	<.010	.30	1.4	1.3	1.0	.20	.90
	12-05-95	1450	15	1.40	<.010	--	--	--	--	--	--
	12-05-95	1451	14	1.40	<.010	--	--	--	--	--	--
	06-05-96	1522	.30	1.10	--	.30	1.3	1.5	1.0	.30	2.3
	06-05-96	1523	.30	1.10	--	.30	1.3	1.6	1.0	.30	2.4
	11-22-96	1218	<.20	1.50	<.010	.20	1.1	1.1	.60	.40	.80
	03-19-97	1330	<.20	.310	<.010	.20	.79	.78	.70	.50	1.6
PLOT 16 LNAS NEST	12-07-95	1109	<.20	1.70	<.010	--	--	--	--	--	--
	12-07-95	1110	<.20	1.70	<.010	--	--	--	--	--	--
	05-30-96	1716	<.20	2.60	--	.40	3.0	1.8	1.6	.30	1.8
	11-15-96	1040	<.20	6.60	.010	.60	5.6	3.4	1.4	.30	1.6
	03-18-97	1555	<.20	1.10	<.010	.50	2.1	1.5	1.1	.10	1.2
PLOT 17 LNAS NEST	04-01-95	1630	<.20	.700	<.010	.50	1.5	1.1	.90	.10	1.4
	04-01-95	1700	<.20	.680	<.010	.40	1.5	1.1	.90	.10	1.4
	12-07-95	1043	<.20	6.20	<.010	--	--	--	--	--	--
	05-15-96	1435	.30	6.10	--	1.5	7.7	5.7	1.7	.20	3.7
	11-07-96	1210	<.20	4.30	<.010	1.0	4.6	3.3	1.2	.20	1.0
	03-27-97	1143	<.20	.540	<.010	1.4	4.4	3.5	.60	<.10	2.0
PLOT 18 LNAS NEST	12-05-95	1625	<.20	7.00	<.010	--	--	--	--	--	--
	05-23-96	1537	.40	<.050	--	2.7	13	11	3.3	.20	2.8
	11-15-96	1235	.30	6.70	<.010	2.1	6.5	4.7	2.6	.40	1.2
	03-27-97	1537	<.20	1.80	<.010	2.7	3.9	3.0	1.0	.20	1.5
PLOT 19 LNAS NEST	04-01-95	1815	<.20	1.20	<.010	.50	1.3	1.3	1.0	.20	1.4
	12-05-95	1554	.20	8.70	<.010	--	--	--	--	--	--
	05-30-96	1318	.80	12.0	--	.60	5.9	5.4	1.2	.40	3.2
	11-20-96	1042	<.20	4.30	<.010	.90	2.8	2.5	1.0	.20	1.6
	11-20-96	2400	<.20	4.30	<.010	1.0	2.9	2.6	1.0	.20	1.7
	03-27-97	1350	<.20	.760	<.010	.90	1.4	1.3	.60	.10	1.7
PLOT 20 LNAS NEST	12-05-95	1525	.40	2.40	<.010	--	--	--	--	--	--
	06-05-96	1220	7.0	3.70	--	4.8	7.5	6.2	4.2	.80	5.4
	11-12-96	1503	3.9	1.80	<.010	3.5	6.9	5.1	3.4	1.5	3.1
	03-27-97	1712	.90	1.0	<.010	2.3	4.4	2.7	1.5	.70	1.2

Table 6. Field measurements and results of analyses for selected constituents in environmental, split, and concurrent samples collected at the biosolids study site, Lakehurst Naval Air Engineering Station, New Jersey, March 1995 to April 1997--Continued

Local identifier	Date	Time	Sulfate, dissolved (mg/L as SO_4)	Fluoride, dissolved (mg/L)	Silica, dissolved (mg/L as SiO_2)	Arsenic, dissolved (µg/L)	Barium, dissolved (µg/L)	Beryllium, dissolved (µg/L)	Cadmium dissolved (µg/L)	Chromium, dissolved (µg/L)
PLOT 14 LNAS NEST	12-05-95	1430	--	--	--	--	--	--	--	--
	05-22-96	1132	7.9	--	--	--	--	--	<1.0	<1.0
	11-25-96	1127	8.9	--	--	--	--	--	<1.0	<1.0
	04-03-97	1125	5.4	--	--	--	--	--	<1.0	<1.0
PLOT 15 LNAS NEST	03-30-95	1735	10	<.10	1.9	<1	17	<1.0	<1.0	<1.0
	12-05-95	1450	--	--	--	--	--	--	--	--
	12-05-95	1451	--	--	--	--	--	--	--	--
	06-05-96	1522	8.6	--	--	--	--	--	<1.0	<1.0
	06-05-96	1523	8.5	--	--	--	--	--	<1.0	<1.0
	11-22-96	1218	6.0	--	--	--	--	--	<1.0	<1.0
	03-19-97	1330	5.6	--	--	--	--	--	<1.0	<1.0
PLOT 16 LNAS NEST	12-07-95	1109	--	--	--	--	--	--	--	--
	12-07-95	1110	--	--	--	--	--	--	--	--
	05-30-96	1716	9.8	--	--	--	--	--	<1.0	<1.0
	11-15-96	1040	12	--	--	--	--	--	<1.0	<1.0
	03-18-97	1555	8.7	--	--	--	--	--	<1.0	<1.0
PLOT 17 LNAS NEST	04-01-95	1630	6.8	<.10	1.0	<1	8.0	<1.0	<1.0	<1.0
	04-01-95	1700	7.1	<.10	1.0	<1	8.0	<1.0	<1.0	<1.0
	12-07-95	1043	--	--	--	--	--	--	--	--
	05-15-96	1435	21	--	--	--	--	--	<1.0	<1.0
	11-07-96	1210	11	--	--	--	--	--	<1.0	<1.0
	03-27-97	1143	8.4	--	--	--	--	--	<1.0	<1.0
PLOT 18 LNAS NEST	12-05-95	1625	--	--	--	--	--	--	--	--
	05-23-96	1537	16	--	--	--	--	--	<1.0	<1.0
	11-15-96	1235	12	--	--	--	--	--	1.0	<1.0
	03-27-97	1537	11	--	--	--	--	--	<1.0	<1.0
PLOT 19 LNAS NEST	04-01-95	1815	7.7	<.10	1.8	<1	14	<1.0	<1.0	<1.0
	12-05-95	1554	--	--	--	--	--	--	--	--
	05-30-96	1318	6.1	--	--	--	--	--	<1.0	<1.0
	11-20-96	1042	7.2	--	--	--	--	--	<1.0	<1.0
	11-20-96	2400	7.3	--	--	--	--	--	<1.0	<1.0
	03-27-97	1350	6.7	--	--	--	--	--	<1.0	<1.0
PLOT 20 LNAS NEST	12-05-95	1525	--	--	--	--	--	--	--	--
	06-05-96	1220	69	--	--	--	--	--	<1.0	<1.0
	11-12-96	1503	39	--	--	--	--	--	<1.0	<1.0
	03-27-97	1712	17	--	--	--	--	--	<1.0	<1.0

Table 6. Field measurements and results of analyses for selected constituents in environmental, split, and concurrent samples collected at the biosolids study site, Lakehurst Naval Air Engineering Station, New Jersey, March 1995 to April 1997--Continued

Local identifier	Date	Time	Cobalt, dissolved (µg/L)	Copper, dissolved (µg/L)	Iron, dissolved (µg/L)	Lead, dissolved (µg/L)	Manganese, dissolved (µg/L)	Mercury, dissolved (µg/L)	Molybdenum, dissolved (µg/L)	Nickel, dissolved (µg/L)	Silver, dissolved (µg/L)
PLOT 14 LNAS NEST	12-05-95	1430	--	--	--	--	--	--	--	--	--
	05-22-96	1132	--	2.0	--	<1.0	--	--	--	--	--
	11-25-96	1127	--	<1.0	--	<1.0	--	--	--	--	--
	04-03-97	1125	--	<1.0	--	<1.0	--	--	--	--	--
PLOT 15 LNAS NEST	03-30-95	1735	1.0	<1.0	<3.0	<1.0	7.0	<.1	<1.0	<1.0	<1.0
	12-05-95	1450	--	--	--	--	--	--	--	--	--
	12-05-95	1451	--	--	--	--	--	--	--	--	--
	06-05-96	1522	--	4.0	--	<1.0	--	--	--	--	--
	06-05-96	1523	--	1.0	--	<1.0	--	--	--	--	--
	11-22-96	1218	--	<1.0	--	<1.0	--	--	--	--	--
	03-19-97	1330	--	<1.0	--	<1.0	--	--	--	--	--
PLOT 16 LNAS NEST	12-07-95	1109	--	--	--	--	--	--	--	--	--
	12-07-95	1110	--	--	--	--	--	--	--	--	--
	05-30-96	1716	--	1.2	--	<1.0	--	--	--	--	--
	11-15-96	1040	--	2.0	--	<1.0	--	--	--	--	--
	03-18-97	1555	--	<1.0	--	<1.0	--	--	--	--	--
PLOT 17 LNAS NEST	04-01-95	1630	<1.0	<1.0	<3.0	<1.0	2.0	.1	<1.0	<1.0	<1.0
	04-01-95	1700	<1.0	<1.0	5.0	<1.0	2.0	.2	<1.0	<1.0	<1.0
	12-07-95	1043	--	--	--	--	--	--	--	--	--
	05-15-96	1435	--	1.0	--	<1.0	--	--	--	--	--
	11-07-96	1210	--	<1.0	--	<1.0	--	--	--	--	--
	03-27-97	1143	--	2.0	--	<1.0	--	--	--	--	--
PLOT 18 LNAS NEST	12-05-95	1625	--	--	--	--	--	--	--	--	--
	05-23-96	1537	--	3.6	--	<1.0	--	--	--	--	--
	11-15-96	1235	--	2.0	--	<1.0	--	--	--	--	--
	03-27-97	1537	--	4.0	--	<1.0	--	--	--	--	--
PLOT 19 LNAS NEST	04-01-95	1815	<1.0	<1.0	<3.0	<1.0	8.0	.1	<1.0	<1.0	<1.0
	12-05-95	1554	--	--	--	--	--	--	--	--	--
	05-30-96	1318	--	<1.0	--	<1.0	--	--	--	--	--
	11-20-96	1042	--	<1.0	--	<1.0	--	--	--	--	--
	11-20-96	2400	--	<1.0	--	<1.0	--	--	--	--	--
	03-27-97	1350	--	1.0	--	<1.0	--	--	--	--	--
PLOT 20 LNAS NEST	12-05-95	1525	--	--	--	--	--	--	--	--	--
	06-05-96	1220	--	4.0	--	<1.0	--	--	--	--	--
	11-12-96	1503	--	7.0	--	3.0	--	--	--	--	--
	03-27-97	1712	--	3.0	--	1.0	--	--	--	--	--

Table 6. Field measurements and results of analyses for selected constituents in environmental, split, and concurrent samples collected at the biosolids study site, Lakehurst Naval Air Engineering Station, New Jersey, March 1995 to April 1997--Continued

Local identifier	Date	Time	Zinc, dissolved (µg/L)	Antimony, dissolved (µg/L)	Aluminum, dissolved (µg/L)	Selenium, dissolved (µg/L)	Uranium natural, dissolved (µg/L)
PLOT 14 LNAS NEST	12-05-95	1430	--	--	--	--	--
	05-22-96	1132	<3.0	--	--	--	--
	11-25-96	1127	5.0	--	--	--	--
	04-03-97	1125	<3.0	--	--	--	--
PLOT 15 LNAS NEST	03-30-95	1735	5.0	<1.0	198	<1	<1.0
	12-05-95	1450	--	--	--	--	--
	12-05-95	1451	--	--	--	--	--
	06-05-96	1522	7.0	--	--	--	--
	06-05-96	1523	7.0	--	--	--	--
	11-22-96	1218	12	--	--	--	--
	03-19-97	1330	9.0	--	--	--	--
PLOT 16 LNAS NEST	12-07-95	1109	--	--	--	--	--
	12-07-95	1110	--	--	--	--	--
	05-30-96	1716	14	--	--	--	--
	11-15-96	1040	4.0	--	--	--	--
	03-18-97	1555	6.0	--	--	--	--
PLOT 17 LNAS NEST	04-01-95	1630	4.0	<1.0	103	<1	<1.0
	04-01-95	1700	4.0	<1.0	114	<1	<1.0
	12-07-95	1043	--	--	--	--	--
	05-15-96	1435	<10	--	--	--	--
	11-07-96	1210	6.0	--	--	--	--
	03-27-97	1143	14	--	--	--	--
PLOT 18 LNAS NEST	12-05-95	1625	--	--	--	--	--
	05-23-96	1537	<3.0	--	--	--	--
	11-15-96	1235	<3.0	--	--	--	--
	03-27-97	1537	<3.0	--	--	--	--
PLOT 19 LNAS NEST	04-01-95	1815	5.0	<1.0	200	<1	<1.0
	12-05-95	1554	--	--	--	--	--
	05-30-96	1318	15	--	--	--	--
	11-20-96	1042	<3.0	--	--	--	--
	11-20-96	2400	<3.0	--	--	--	--
	03-27-97	1350	8.0	--	--	--	--
PLOT 20 LNAS NEST	12-05-95	1525	--	--	--	--	--
	06-05-96	1220	14	--	--	--	--
	11-12-96	1503	29	--	--	--	--
	03-27-97	1712	20	--	--	--	--

Table 6. Field measurements and results of analyses for selected constituents in environmental, split, and concurrent samples collected at the biosolids study site, Lakehurst Naval Air Engineering Station, New Jersey, March 1995 to April 1997--Continued

Local identifier	Station number	Well number	Date	Time	Sample type	Depth of well, total (ft)	Depth to top of screened interval (ft)	Depth to bottom of screened interval (ft)	Altitude of land surface datum (feet above sea level)	Turbidity (NTU)
PLOT 21 LNAS NEST	400132074235001	21	04-01-95	1400	Environmental	14.90	14.02	14.85	119	0.10
			12-07-95	1142	Environmental	14.90	13.19	14.02	119	--
			05-24-96	1303	Environmental	14.90	11.53	12.36	119	.20
			05-24-96	1304	Concurrent	14.90	11.53	12.36	119	.30
			11-14-96	1520	Environmental	14.90	12.36	13.19	119	44
			03-19-97	1155	Environmental	14.90	11.53	12.36	119	.70
PLOT 22 LNAS NEST	400132074235002	22	12-07-95	1232	Environmental	15.00	14.17	14.90	119	--
			05-29-96	1630	Environmental	15.00	11.68	12.51	119	1.8
			11-13-96	1408	Environmental	15.00	14.17	14.90	119	--
			11-13-96	1326	Environmental	15.00	12.51	13.34	119	46
			03-24-97	1434	Environmental	15.00	11.68	12.51	119	.50
			03-24-97	1435	Concurrent	15.00	11.68	12.51	119	.40
PLOT 23 LNAS NEST	400131074235001	23	04-14-95	1150	Environmental	14.90	13.97	14.80	119	.40
			12-07-95	1310	Environmental	14.90	13.14	13.97	119	--
			05-21-96	1250	Environmental	14.90	11.48	12.31	119	1.1
			11-21-96	1430	Environmental	14.90	12.31	13.14	119	3.2
			11-21-96	1520	Environmental	14.90	13.97	14.80	119	--
			03-18-97	1335	Environmental	14.90	12.31	13.14	119	.60
PLOT 24 LNAS NEST	400131074235101	24	12-07-95	1336	Environmental	14.40	12.64	13.47	119	--
			05-23-96	1232	Environmental	14.40	10.15	10.98	119	.30
			11-19-96	1542	Environmental	14.40	11.81	12.64	119	77
			03-17-97	1252	Environmental	14.40	10.98	11.81	119	110
PLOT 25 LNAS NEST	400130074235101	25	04-01-95	1225	Environmental	14.40	13.47	14.30	119	.40
			12-07-95	1417	Environmental	14.40	12.64	13.47	119	--
			12-07-95	1418	Concurrent	14.40	12.64	13.47	119	--
			06-04-96	1722	Environmental	14.40	10.98	11.81	119	--
			11-22-96	1010	Environmental	14.40	11.81	12.64	119	5.2
			11-22-96	2400	Split	14.40	11.81	12.64	119	2.6
			04-02-97	1340	Environmental	14.40	10.98	11.81	119	26

Table 6. Field measurements and results of analyses for selected constituents in environmental, split, and concurrent samples collected at the biosolids study site, Lakehurst Naval Air Engineering Station, New Jersey, March 1995 to April 1997--Continued

Local identifier	Date	Time	Specific conductance, field (µS/cm)	Specific conductance, laboratory (µS/cm)	Oxygen, dissolved (mg/L)	pH whole water, field (standard units)	pH whole water, laboratory (standard units)	Alkalinity, filtered fixed endpoint titration, field (mg/L as $CaCO_3$)	Acid neutralizing capacity, water, unfiltered, fixed endpoint titration, field (mg/L as $CaCO_3$)	Alkalinity, laboratory (mg/L as $CaCO_3$)	Nitrogen, ammonia, dissolved (mg/L as N)	Nitrogen, nitrite, dissolved (mg/L as N)
PLOT 21 LNAS NEST	04-01-95	1400	35	35	--	4.9	4.8	--	--	<1.0	<0.015	<.010
	12-07-95	1142	60	--	--	4.7	--	--	--	--	<.015	<.010
	05-24-96	1303	82	80	9.9	5.3	6.3	2	--	--	<.015	--
	05-24-96	1304	82	81	9.9	5.3	6.3	2	--	--	<.015	--
	11-14-96	1520	31	32	--	6.1	6.8	5	--	--	<.015	<.010
	03-19-97	1155	29	29	--	6.6	6.3	7	--	--	<.015	<.010
PLOT 22 LNAS NEST	12-07-95	1232	67	--	--	5.1	--	--	--	--	<.015	<.010
	05-29-96	1630	191	188	10.2	4.9	4.7	--	1	--	.240	--
	11-13-96	1408	63	--	--	5.1	--	--	--	--	.040	.020
	11-13-96	1326	54	54	--	5.1	5.7	2	--	--	.020	.020
	03-24-97	1434	39	39	--	5.7	5.3	3	--	--	<.015	<.010
	03-24-97	1435	--	40	--	--	5.3	--	--	--	<.015	<.010
PLOT 23 LNAS NEST	04-14-95	1150	38	35	--	4.6	4.6	--	--	--	.020	.010
	12-07-95	1310	77	--	--	4.5	--	--	--	--	.160	<.010
	05-21-96	1250	280	270	8.2	4.5	4.4	--	--	--	13.0	--
	11-21-96	1430	127	119	--	4.2	4.2	--	--	--	.540	<.010
	11-21-96	1520	76	--	--	4.3	--	--	--	--	.140	.010
	03-18-97	1335	49	46	--	4.7	4.4	2	--	--	<.015	<.010
PLOT 24 LNAS NEST	12-07-95	1336	43	--	--	4.8	--	--	--	--	<.015	<.010
	05-23-96	1232	36	35	10.0	4.7	4.7	1	--	<.5	<.015	--
	11-19-96	1542	47	47	--	4.9	4.7	2	--	--	<.015	<.010
	03-17-97	1252	32	31	--	5.0	6.4	3	--	--	<.015	<.010
PLOT 25 LNAS NEST	04-01-95	1225	41	41	--	4.7	4.5	--	--	--	<.015	<.010
	12-07-95	1417	80	--	--	4.4	--	--	--	--	<.015	<.010
	12-07-95	1418	80	--	--	4.4	--	--	--	--	<.015	<.010
	06-04-96	1722	109	106	10.2	4.8	4.7	1		--	.060	--
	11-22-96	1010	57	56	--	4.5	4.6	--	--	--	<.015	.010
	11-22-96	2400	57	55		4.5	4.6	--	--	--	<.015	<.010
	04-02-97	1340	39	39		5.2	6.1	--	--	--	<.015	<.010

Table 6. Field measurements and results of analyses for selected constituents in environmental, split, and concurrent samples collected at the biosolids study site, Lakehurst Naval Air Engineering Station, New Jersey, March 1995 to April 1997--Continued

Local identifier	Date .	Time	Nitrogen, ammonia+ organic dissolved (mg/L as N)	Nitrogen, NO_2+NO_3 dissolved (mg/L as N)	Phosphorus ortho, dissolved (mg/L as P)	Carbon, organic dissolved (mg/L)	Calcium, dissolved (mg/L)	Magnesium, dissolved (mg/L)	Sodium, dissolved (mg/L)	Potassium, dissolved (mg/L)	Chloride, dissolved (mg/L)
PLOT 21 LNAS NEST	04-01-95	1400	<0.20	.220	<0.010	.30	1.5	.94	1.3	.20	1.3
	12-07-95	1142	1.9	1.50	<.010	--	--	--	--	--	--
	05-24-96	1303	<.20	6.70	--	.30	5.1	3.3	2.6	.10	2.6
	05-24-96	1304	<.20	6.30	--	.20	5.1	3.3	2.6	<.10	2.6
	11-14-96	1520	<.20	.710	<.010	.40	1.9	1.1	1.3	.10	.80
	03-19-97	1155	<.20	.210	<.010	.30	1.7	1.0	1.3	.10	2.0
PLOT 22 LNAS NEST	12-07-95	1232	.30	3.50	<.010	--	--	--	--	--	--
	05-29-96	1630	.70	16.0	--	2.0	13	8.0	2.9	.50	2.7
	11-13-96	1408	.20	3.10	<.010	--	--	--	--	--	--
	11-13-96	1326	.30	2.20	<.010	1.9	3.3	1.9	1.1	.50	1.1
	03-24-97	1434	<.20	.610	<.010	.90	2.3	1.3	1.2	.30	2.2
	03-24-97	1435	<.20	.610	<.010	.90	2.3	1.3	1.2	.40	2.2
PLOT 23 LNAS NEST	04-14-95	1150	<.20	1.20	<.010	.30	1.2	1.1	.70	<.10	1.5
	12-07-95	1310	.30	2.70	<.010	--	--	--	--	--	--
	05-21-96	1250	14	7.50	--	7.2	8.3	5.4	3.6	1.1	4.6
	11-21-96	1430	.80	9.80	<.010	1.5	4.9	2.6	1.2	.50	1.2
	11-21-96	1520	.30	5.10	<.010	--	--	--	--	--	--
	03-18-97	1335	<.20	1.10	<.010	2.3	2.1	1.1	.70	.20	1.0
PLOT 24 LNAS NEST	12-07-95	1336	<.20	1.90	<.010	--	--	--	--	--	--
	05-23-96	1232	<.20	.650	--	.20	1.6	.90	.90	.20	1.7
	11-19-96	1542	<.20	2.40	<.010	.80	2.1	1.4	1.0	.30	1.6
	03-17-97	1252	<.20	.620	<.010	.30	1.1	.85	1.0	.10	.90
PLOT 25 LNAS NEST	04-01-95	1225	<.20	1.60	<.010	.40	<.020	<.010	<.20	<.10	1.4
	12-07-95	1417	<.20	5.90	<.010	--	--	--	--	--	--
	12-07-95	1418	<.20	5.90	<.010	--	--	--	--	--	--
	06-04-96	1722	.20	6.10	--	.80	5.1	4.4	3.5	.20	2.1
	11-22-96	1010	<.20	1.70	<.010	.80	2.3	1.7	.80	.10	.70
	11-22-96	2400	<.20	1.70	<.010	1.2	2.3	1.7	.80	<.10	.70
	04-02-97	1340	<.20	.610	<.010	--	1.9	1.5	1.1	<.10	1.7

Table 6. Field measurements and results of analyses for selected constituents in environmental, split, and concurrent samples collected at the biosolids study site, Lakehurst Naval Air Engineering Station, New Jersey, March 1995 to April 1997--Continued

Local identifier	Date	Time	Sulfate, dissolved (mg/L as SO_4)	Fluoride, dissolved (mg/L)	Silica, dissolved (mg/L as SiO_2)	Arsenic, dissolved (µg/L)	Barium, dissolved (µg/L)	Beryllium, dissolved (µg/L)	Cadmium dissolved (µg/L)	Chromium, dissolved (µg/L)
PLOT 21 LNAS NEST	04-01-95	1400	8.5	<0.10	1.3	<1	14	<1.0	<1.0	<1.0
	12-07-95	1142	--	--	--	--	--	--	--	--
	05-24-96	1303	5.3	--	--	--	--	--	<1.0	<1.0
	05-24-96	1304	5.3	--	--	--	--	--	<1.0	<1.0
	11-14-96	1520	5.6	--	--	--	--	--	<1.0	<1.0
	03-19-97	1155	4.5	--	--	--	--	--	<1.0	<1.0
PLOT 22 LNAS NEST	12-07-95	1232	--	--	--	--	--	--	--	--
	05-29-96	1630	14	--	--	--	--	--	<1.0	<1.0
	11-13-96	1408	--	--	--	--	--	--	--	--
	11-13-96	1326	11	--	--	--	--	--	<1.0	<1.0
	03-24-97	1434	8.3	--	--	--	--	--	<1.0	<1.0
	03-24-97	1435	8.4	--	--	--	--	--	<1.0	<1.0
PLOT 23 LNAS NEST	04-14-95	1150	8.3	<.10	1.3	<1	10	<1.0	<1.0	<1.0
	12-07-95	1310	--	--	--	--	--	--	--	--
	05-21-96	1250	66	--	--	--	--	--	<1.0	<1.0
	11-21-96	1430	7.2	--	--	--	--	--	<1.0	<1.0
	11-21-96	1520	--	--	--	--	--	--	--	--
	03-18-97	1335	9.4	--	--	--	--	--	<1.0	<1.0
PLOT 24 LNAS NEST	12-07-95	1336	--	--	--	--	--	--	--	--
	05-23-96	1232	7.1	--	--	--	--	--	<1.0	<1.0
	11-19-96	1542	5.8	--	--	--	--	--	1.0	<1.0
	03-17-97	1252	7.0	--	--	--	--	--	<1.0	<1.0
PLOT 25 LNAS NEST	04-01-95	1225	6.5	<.10	<.010	<1	<1.0	<1.0	<1.0	<1.0
	12-07-95	1417	--	--	--	--	--	--	--	--
	12-07-95	1418	--	--	--	--	--	--	--	--
	06-04-96	1722	11	--	--	--	--	--	<1.0	<1.0
	11-22-96	1010	12	--	--	--	--	--	<1.0	<1.0
	11-22-96	2400	12	--	--	--	--	--		
	04-02-97	1340	9.2	--	--	--	--	--	<1.0	<1.0

Table 6. Field measurements and results of analyses for selected constituents in environmental, split, and concurrent samples collected at the biosolids study site, Lakehurst Naval Air Engineering Station, New Jersey, March 1995 to April 1997--Continued

Local identifier	Date	Time	Cobalt, dissolved (µg/L)	Copper, dissolved (µg/L)	Iron, dissolved (µg/L)	Lead, dissolved (µg/L)	Manganese, dissolved (µg/L)	Mercury, dissolved (µg/L)	Molybdenum, dissolved (µg/L)	Nickel, dissolved (µg/L)
PLOT 21 LNAS NEST	04-01-95	1400	<1.0	<1.0	<3.0	<1.0	7.0	0.2	<1.0	<1.0
	12-07-95	1142	--	--	--	--	--	--	--	--
	05-24-96	1303	--	<1.0	--	<1.0	--	--	--	--
	05-24-96	1304	--	<1.0	--	<1.0	--	--	--	--
	11-14-96	1520	--	<1.0	--	<1.0	--	--	--	--
	03-19-97	1155	--	<1.0	--	<1.0	--	--	--	--
PLOT 22 LNAS NEST	12-07-95	1232	--	--	--	--	--	--	--	--
	05-29-96	1630	--	1.0	--	<1.0	--	--	--	--
	11-13-96	1408	--	--	--	--	--	--	--	--
	11-13-96	1326	--	21	--	2.0	--	--	--	--
	03-24-97	1434	--	1.0	--	<1.0	--	--	--	--
	03-24-97	1435	--	2.0	--	<1.0	--	--	--	--
PLOT 23 LNAS NEST	04-14-95	1150	<1.0	<1.0	<3.0	<1.0	2.0	.2	<1.0	<1.0
	12-07-95	1310	--	--	--	--	--	--	--	--
	05-21-96	1250	--	4.0	--	<1.0	--	--	--	--
	11-21-96	1430	--	2.0	--	1.0	--	--	--	--
	11-21-96	1520	--	--	--	--	--	--	--	--
	03-18-97	1335	--	2.0	--	<1.0	--	--	--	--
PLOT 24 LNAS NEST	12-07-95	1336	--	--	--	--	--	--	--	--
	05-23-96	1232	--	2.0	--	<1.0	--	--	--	--
	11-19-96	1542	--	1.0	--	<1.0	--	--	--	--
	03-17-97	1252	--	<1.0	--	<1.0	--	--	--	--
PLOT 25 LNAS NEST	04-01-95	1225	<1.0	<1.0	<3.0	<1.0	<1.0	.1	<1.0	<1.0
	12-07-95	1417	--	--	--	--	--	--	--	--
	12-07-95	1418	--	--	--	--	--	--	--	--
	06-04-96	1722	--	<1.0	--	<1.0	--	--	--	--
	11-22-96	1010	--	<1.0	--	<1.0	--	--	--	--
	11-22-96	2400					--	--	--	--
	04-02-97	1340	--	<1.0	--	<1.0	--	--	--	--

Table 6. Field measurements and results of analyses for selected constituents in environmental, split, and concurrent samples collected at the biosolids study site, Lakehurst Naval Air Engineering Station, New Jersey, March 1995 to April 1997--Continued

Local identifier	Date	Time	Silver, dissolved (µg/L)	Zinc, dissolved (µg/L)	Antimony, dissolved (µg/L)	Aluminum, dissolved (µg/L)	Selenium, dissolved (µg/L)	Uranium natural, dissolved (µg/L)
PLOT 21 LNAS NEST	04-01-95	1400	<1.0	10	<1.0	126	<1	<1.0
	12-07-95	1142	--	--	--	--	--	--
	05-24-96	1303	--	<3.0	--	--	--	--
	05-24-96	1304	--	<3.0	--	--	--	--
	11-14-96	1520	--	5.0	--	--	--	--
	03-19-97	1155	--	7.0	--	--	--	--
PLOT 22 LNAS NEST	12-07-95	1232	--	--	--	--	--	--
	05-29-96	1630	--	4.0	--	--	--	--
	11-13-96	1408	--	--	--	--	--	--
	11-13-96	1326	--	19	--	--	--	--
	03-24-97	1434	--	13	--	--	--	--
	03-24-97	1435	--	13	--	--	--	--
PLOT 23 LNAS NEST	04-14-95	1150	<1.0	5.0	<1.0	323	<1	<1.0
	12-07-95	1310	--	--	--	--	--	--
	05-21-96	1250	--	8.0	--	--	--	--
	11-21-96	1430	--	<3.0	--	--	--	--
	11-21-96	1520	--	--	--	--	--	--
	03-18-97	1335	--	5.0	--	--	--	--
PLOT 24 LNAS NEST	12-07-95	1336	--	--	--	--	--	--
	05-23-96	1232	--	4.0	--	--	--	--
	11-19-96	1542	--	<3.0	--	--	--	--
	03-17-97	1252	--	10	--	--	--	--
PLOT 25 LNAS NEST	04-01-95	1225	<1.0	<1.0	<1.0	3.0	<1	<1.0
	12-07-95	1417	--	--	--	--	--	--
	12-07-95	1418	--	--	--	--	--	--
	06-04-96	1722	--	<3.0	--	--	--	--
	11-22-96	1010	--	3.0	--	--	--	--
	11-22-96	2400	--	<3.0	--	--	--	--
	04-02-97	1340	--	<3.0	--	--	--	--

Table 6. Field measurements and results of analyses for selected constituents in environmental, split, and concurrent samples collected at the biosolids study site, Lakehurst Naval Air Engineering Station, New Jersey, March 1995 to April 1997--Continued

Local identifier	Station number	Well number	Date	Time	Sample type	Depth of well, total (ft)	Depth to top of screened interval (ft)	Depth to bottom of screened interval (ft)	Altitude of land surface datum (feet above sea level)	Turbidity (NTU)
WELL 26 LNAS	400132074235901	26	04-04-95	1310	Environmental	25.00	20	25	123	1.8
			04-11-97	1145	Environmental	25.00	20	25	123	.56
WELL 27 DEEP LNAS	400134074234901	27	04-04-95	1855	Environmental	37.00	32	37	130	260
			04-09-97	1135	Environmental	37.00	32	37	130	9.3
WELL 28 SHALLOW LNAS	400134074234902	28	04-16-97	1214	Environmental	32.00	27	32	130	6.2
WELL 29 LNAS	400134074235101	29	04-06-95	1835	Environmental	32.00	27	32	129	33
			04-06-95	1835	Split	32.00	27	32	129	33
			04-08-97	1420	Environmental	32.00	27	32	129	14

Local identifier	Date	Time	Specific conductance, field (µS/cm)	Specific conductance, laboratory (µS/cm)	pH whole water, field (standard units)	pH whole water, laboratory (standard units)	Alkalinity, laboratory (mg/L as $CaCO_3$)	Nitrogen, ammonia, dissolved (mg/L as N)	Nitrogen, nitrite, dissolved (mg/L as N)	Nitrogen, ammonia+ organic, dissolved (mg/L as N)
WELL 26 LNAS	04-04-95	1310	45	46	4.2	4.5	--	<0.015	<0.010	<0.20
	04-11-97	1145	41	40	4.7	4.5	--	<.015	<.010	<.20
WELL 27 DEEP LNAS	04-04-95	1855	43	42	4.7	4.7	--	<.015	<.010	<.20
	04-09-97	1135	43	41	5.0	5.5	--	<.015	<.010	<.20
WELL 28 SHALLOW LNAS	04-16-97	1214	42	40	4.9	5.1	--	--	--	--
WELL 29 LNAS	04-06-95	1835	35	33	5.0	5.4	1.3	<.015	<.010	<.20
	04-06-95	1835	35	33	5.0	6.3	1.3	<.015	<.010	<.20
	04-08-97	1420	33	32	4.9	4.9	--	<.015	<.010	<.20

Table 6. Field measurements and results of analyses for selected constituents in environmental, split, and concurrent samples collected at the biosolids study site, Lakehurst Naval Air Engineering Station, New Jersey, March 1995 to April 1997--Continued

Local identifier	Date	Time	Nitrogen, NO_2+NO_3 dissolved (mg/L as N)	Phosphorus ortho, dissolved (mg/L as P)	Carbon, organic dissolved (mg/L)	Calcium, dissolved (mg/L)	Magnesium, dissolved (mg/L)	Sodium, dissolved (mg/L)	Potassium, dissolved (mg/L)	Chloride, dissolved (mg/L)
WELL 26 LNAS	04-04-95	1310	1.50	<0.010	0.30	2.1	0.48	1.3	0.60	2.2
	04-11-97	1145	1.10	<.010	--	1.4	.37	1.1	.48	1.8
WELL 27 DEEP LNAS	04-04-95	1855	.210	<.010	.50	2.6	.56	1.4	.50	3.1
	04-09-97	1135	.250	<.010	.60	2.4	.55	1.5	.53	3.1
WELL 28 SHALLOW LN	04-16-97	1214	--	--	.80	1.9	.52	1.6	.43	3.5
WELL 29 LNAS	04-06-95	1835	.320	<.010	.40	2.1	.64	1.2	.50	2.8
	04-06-95	1835	.320	<.010	.40	2.1	.63	1.2	.50	3.0
	04-08-97	1420	.270	<.010	.30	1.9	.51	1.3	.50	2.0

Local identifier	Date	Time	Sulfate, dissolved (mg/L as SO_4)	Fluoride, dissolved (mg/L)	Silica, dissolved (mg/L as SiO_2)	Arsenic, dissolved (µg/L)	Barium, dissolved (µg/L)	Beryllium, dissolved (µg/L)	Cadmium dissolved (µg/L)	Chromium, dissolved (µg/L)
WELL 26 LNAS	04-04-95	1310	6.5	<0.10	4.0	<1	120	<1.0	<1	<1
.	04-11-97	1145	5.4	--	--	--	--	--	<1	3.9
WELL 27 DEEP LNAS	04-04-95	1855	9.7	<.10	4.1	<1	30	<1.0	<1	<1
.	04-09-97	1135	8.6	--	--	--	--	--	<1	<1
WELL 28 SHALLOW LN	04-16-97	1214	7.5	--	--	--	--	--	<1	1.1
WELL 29 LNAS	04-06-95	1835	5.9	<.10	4.4	<1	34	<1.0	<1	<1
.	04-06-95	1835	5.9	<.10	4.4	<1	35	<1.0	<1	<1
.	04-08-97	1420	5.9	--	--	--	--	--	<1	3.7

Table 6. Field measurements and results of analyses for selected constituents in environmental, split, and concurrent samples collected at the biosolids study site, Lakehurst Naval Air Engineering Station, New Jersey, March 1995 to April 1997--Continued

Local identifier	Date	Time	Cobalt, dissolved (µg/L)	Copper, dissolved (µg/L)	Iron, dissolved (µg/L)	Lead, dissolved (µg/L)	Manganese, dissolved (µg/L)	Mercury, dissolved (µg/L)	Molybdenum, dissolved (µg/L)	Nickel, dissolved (µg/L)
WELL 26 LNAS	04-04-95	1310	5	1	<3	<1	84	0.2	<1.0	4.0
	04-11-97	1145	--	1	--	<1	--	--	--	--
WELL 27 DEEP LNAS	04-04-95	1855	2	2.0	13	<1	49	<.1	<1.0	5.0
	04-09-97	1135	--	1	--	<1	--	--	--	--
WELL 28 SHALLOW LN	04-16-97	1214	--	<1	--	<1	--	--	--	--
WELL 29 LNAS	04-06-95	1835	3	1.0	5	<1	68	<.1	<1.0	4.0
	04-06-95	1835	3	1.0	7	<1	67	<.1	<1.0	4.0
	04-08-97	1420	--	<1	--	<1	--	--	--	--

Local identifier	Date	Time	Silver, dissolved (µg/L)	Zinc, dissolved (µg/L)	Antimony, dissolved (µg/L)	Aluminum, dissolved (µg/L)	Selenium, dissolved (µg/L)	Uranium, natural, dissolved (µg/L)
WELL 26 LNAS	04-04-95	1310	<1.0	7.0	<1.0	421	<1	<1.0
	04-11-97	1145	--	9.1	--	--	--	--
WELL 27 DEEP LNAS	04-04-95	1855	<1.0	15	<1.0	129	<1	<1.0
	04-09-97	1135	--	5.9	--	--	--	--
WELL 28 SHALLOW LN	04-16-97	1214	--	7.4	--	--	--	--
WELL 29 LNAS	04-06-95	1835	<1.0	4.0	<1.0	49	<1	<1.0
	04-06-95	1835	<1.0	5.0	<1.0	48	<1	<1.0
	04-08-97	1420	--	<3.0	--	--	--	--

Table 7. Results of analyses for selected constituents in field blank samples collected at the biosolids study site, Lakehurst Naval Air Engineering Station, New Jersey, March 1995 to April 1997

[ft, feet; µS/cm, microsiemens per centimeter at 25 degrees Celsius; mg/L, milligrams per liter; µg/L, micrograms per liter; NTU, nephelumetric turbidity unit; mg/L, milligrams per liter; --, not analyzed for the indicated constituent]

Local identifier	Station number	Date	Time	Nitrogen, ammonia dissolved (mg/L as N)	Nitrogen, nitrite dissolved (mg/L as N)	Nitrogen, ammonia+ organic dis (mg/L as N)	Nitrogen, NO2+NO3 dissolved (mg/L as N)	Phosphorus ortho, dissolved (mg/L as P)	Carbon, organic dissolved (mg/L)
PLOT 1 LNAS NEST	400134074235601	03-30-95	1300	--	--	--	--	--	--
PLOT 2 LNAS NEST	400134074235701	03-11-97	1355	<0.015	<.010	<.20	0.050	<0.010	0.20
PLOT 4 LNAS NEST	400133074235701	06-04-96	1530	--	--	--	--	--	--
		11-25-96	1300	--	--	--	--	--	--
PLOT 5 LNAS NEST	400133074235702	05-29-96	1505	.020	--	<.20	<.050	--	.20
PLOT 6 LNAS NEST	400134074235501	11-14-96	1000	--	--	--	--	--	--
PLOT 8 LNAS NEST	400133074235502	11-21-96	1020	<.015	.010	<.20	<.050	<.010	.10
PLOT 9 LNAS NEST	400132074235601	11-19-96	1005	--	--	--	--	--	--
PLOT 10 LNAS NEST	400132074235301	03-19-97	1515	<.015	<.010	<.20	<.050	<.010	.10
PLOT 14 LNAS NEST	400132074235402	05-22-96	1133	--	--	--	--	--	--
		04-03-97	1030	--	--	--	--	--	--
PLOT 16 LNAS NEST	400133074235201	03-18-97	1515	--	--	--	--	--	--

Local identifier	Date	Calcium, dissolved (mg/L)	Magnesium, dissolved (mg/L)	Sodium, dissolved (mg/L)	Potassium, dissolved (mg/L)	Chloride, dissolved (mg/L)	Sulfate, dissolved (mg/L as SO_4)	Silica, dissolved (mg/L)	Arsenic, dissolved (µg/L)
PLOT 1 LNAS NEST	03-30-95	<0.10	<0.10	<0.10	0.10	--	--	--	<1
PLOT 2 LNAS NEST	03-11-97	<.02	<.01	<.20	<.10	<0.10	<0.10	--	--
PLOT 4 LNAS NEST	06-04-96	--	--	--	--	--	--	--	--
	11-25-96	--	--	--	--	--	--	--	--
PLOT 5 LNAS NEST	05-29-96	<.02	<.01	<.20	<.10	<.10	<.10	--	--
PLOT 6 LNAS NEST	11-14-96	<.02	<.01	<.20	<.10	<.10	<.10	--	--
PLOT 8 LNAS NEST	11-21-96	<.02	<.01	<.20	<.10	<.10	<.10	--	--
PLOT 9 LNAS NEST	11-19-96	--	--	--	--	--	--	--	--
PLOT 10 LNAS NEST	03-19-97	<.02	<.01	<.20	<.10	.70	<.10	--	--
PLOT 14 LNAS NEST	05-22-96	--	--	--	--	--	--	--	--
	04-03-97	--	--	--	--	--	--	--	--
PLOT 16 LNAS NEST	03-18-97	--	--	--	--	--	--	--	--

Table 7. Results of analyses of field blank samples collected at the biosolids study site, Lakehurst Naval Air Engineering Station, New Jersey, March 1995 to April 1997--Continued

Local identifier	Date	Barium, dissolved (µg/L)	Berlium, dissolved (µg/L)	Cadmium dissolved (µg/L)	Chromium, dissolved (µg/L)	Cobalt, dissolved (µg/L)	Copper, dissolved (µg/L)
PLOT 1 LNAS NEST	03-30-95	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
PLOT 2 LNAS NEST	03-11-97	--	--	<1.0	<1.0	--	<1.0
PLOT 4 LNAS NEST	06-04-96	--	--	<1.0	<1.0	--	<1.0
	11-25-96	--	--	<1.0	<1.0	--	<1.0
PLOT 5 LNAS NEST	05-29-96	--	--	<1.0	<1.0	--	<1.0
PLOT 6 LNAS NEST	11-14-96	--	--	<1.0	<1.0	--	<1.0
PLOT 8 LNAS NEST	11-21-96	--	--	<1.0	<1.0	--	<1.0
PLOT 9 LNAS NEST	11-19-96	--	--	<1.0	<1.0	--	<1.0
PLOT 10 LNAS NEST	03-19-97	--	--	<1.0	<1.0	--	<1.0
PLOT 14 LNAS NEST	05-22-96	--	--	<1.0	<1.0	--	<1.0
	04-03-97	--	--	<1.0	<1.0	--	<1.0
PLOT 16 LNAS NEST	03-18-97	--	--	<1.0	<1.0	--	<1.0

Local identifier	Date	Iron, dissolved (µg/L)	Lead, dissolved (µg/L)	Manganese, dissolved (µg/L)	Mercury dissolved (µg/L)	Molybdenum, dissolved (µg/L)	Nickel, dissolved (µg/L)	Silver, dissolved (µg/L)
PLOT 1 LNAS NEST	03-30-95	<10	<1.0	<1.0	<0.1	<1.0	<1.0	<1.0
PLOT 2 LNAS NEST	03-11-97	--	<1.0	--	--	--	--	--
PLOT 4 LNAS NEST	06-04-96	--	--	--	--	--	--	--
	11-25-96	--	<1.0	--	--	--	--	--
PLOT 5 LNAS NEST	05-29-96	--	<1.0	--	--	--	--	--
PLOT 6 LNAS NEST	11-14-96	--	<1.0	--	--	--	--	--
PLOT 8 LNAS NEST	11-21-96	--	<1.0	--	--	--	--	--
PLOT 9 LNAS NEST	11-19-96	--	<1.0	--	--	--	--	--
PLOT 10 LNAS NEST	03-19-97	--	<1.0	--	--	--	--	--
PLOT 14 LNAS NEST	05-22-96	--	--	--	--	--	--	--
	04-03-97	--	<1.0	--	--	--	--	--
PLOT 16 LNAS NEST	03-18-97	--	<1.0	--	--	--	--	--

Table 7. Results of analyses of field blank samples collected at the biosolids study site, Lakehurst Naval Air Engineering Station, New Jersey, March 1995 to April 1997--Continued

Local identifier	Date	Zinc, dissolved (µg/L)	Antimony, dissolved (µg/L)	Aluminum, dissolved (µg/L)	Selenium, dissolved (µg/L)	Uranium natural dissolved (µg/L)
PLOT 1 LNAS NEST	03-30-95	<1.0	<1.0	1.0	<1	<1.0
PLOT 2 LNAS NEST	03-11-97	<3.0	--	--	--	--
PLOT 4 LNAS NEST	06-04-96	11	--	--	--	--
	11-25-96	<3.0	--	--	--	--
PLOT 5 LNAS NEST	05-29-96	<3.0	--	--	--	--
PLOT 6 LNAS NEST	11-14-96	<3.0	--	--	--	--
PLOT 8 LNAS NEST	11-21-96	<3.0	--	--	--	--
PLOT 9 LNAS NEST	11-19-96	<3.0	--	--	--	--
PLOT 10 LNAS NEST	03-19-97	7.0	--	--	--	--
PLOT 14 LNAS NEST	05-22-96	<3.0	--	--	--	--
	04-03-97	<3.0	--	--	--	--
PLOT 16 LNAS NEST	03-18-97	<3.0	--	--	--	--

Local identifier	Date	Time	Nitrogen, ammonia dissolved (mg/L as N)	Nitrogen, nitrite dissolved (mg/L as N)	Nitrogen, ammonia + organic dis. (mg/L as N)	Nitrogen, NO2+NO3 dissolved (mg/L as N)	Phosphorus ortho, dissolved (mg/L as P)	Carbon, organic dissolved (mg/L)	Calcium dissolved (mg/L)	Magnesium, dissolved (mg/L)
PLOT 17 LNAS NEST	11-07-96	1036	0.100	0.010	<0.20	<0.050	<0.010	0.10	<0.02	<0.01
PLOT 19 LNAS NEST	03-27-97	1300	<.015	<.010	<.20	<.050	<.010	.10	<.02	<.01
PLOT 23 LNAS NEST	05-21-96	1251	.050	--	<.20	.060	--	.20	<.02	<.01
PLOT 24 LNAS NEST	05-23-96	1330	--	--	--	--	--	--	--	--
	03-17-97	1215	--	--	--	--	--	--	--	--
PLOT 25 LNAS NEST	12-07-95	1357	<.015	<.010	<.20	<.050	<.010	--	--	--
PLOT 25 LNAS NEST	04-01-95	1150	--	--	--	--	--	--	1.5	1.3
WELL 26 LNAS	04-11-97	1045	--	--	--	--	--	--	<.002	<.001
WELL 29 LNAS	04-06-95	1700	--	--	--	--	--	--	<.10	<.10
	04-08-97	1320	--	--	--	--	--	--	<.002	<.001

Table 7. Results of analyses of field blank samples collected at the biosolids study site, Lakehurst Naval Air Engineering Station, New Jersey, March 1995 to April 1997--Continued

Local identifier	Date	Sodium, dissolved (mg/L)	Potassium, dissolved (mg/L)	Chloride, dissolved (mg/L)	Sulfate dissolved (mg/L as SO_4)	Silica, dissolved (mg/L)	Arsenic, dissolved (µg/L)	Barium, dissolved (µg/L)
PLOT 17 LNAS NEST	11-07-96	<0.20	<0.10	<0.10	<0.10	--	--	--
PLOT 19 LNAS NEST	03-27-97	<.20	<.10	<.10	<.10	--	--	--
PLOT 23 LNAS NEST	05-21-96	<.20	<.10	<.10	<.10	--	--	--
PLOT 24 LNAS NEST	05-23-96	--	--	--	--	--	--	--
	03-17-97	--	--	--	--	--	--	--
PLOT 25 LNAS NEST	12-07-95	--	--	--	--	--	--	--
PLOT 25 LNAS NEST	04-01-95	1.0	.10	--	--	<.10	<1	13
WELL 26 LNAS	04-11-97	.064	--	--	--	<0.02	--	<0.20
WELL 29 LNAS	04-06-95	<.10	<.10	--	--	--	<1	<1.0
	04-08-97	<.025	--	--	--	<.02	--	<.20

Local identifier	Date	Beryllium, dissolved (µg/L)	Boron, dissolved (µg/L)	Cadmium dissolved (µg/L)	Chromium, dissolved (µg/L)	Cobalt, dissolved (µg/L)	Copper, dissolved (µg/L)	Iron, dissolved (µg/L)	Lead, dissolved (µg/L)
PLOT 17 LNAS NEST	11-07-96	--	--	<1.0	<1.0	--	<1.0	--	<1.0
PLOT 19 LNAS NEST	03-27-97	--	--	<1.0	<1.0	--	<1.0	--	<1.0
PLOT 23 LNAS NEST	05-21-96	--	--	<1.0	<1.0	--	<1.0	--	<1.0
PLOT 24 LNAS NEST	05-23-96	--	--	<1.0	<1.0	--	<1.0	--	--
	03-17-97	--	--	<1.0	<1.0	--	<1.0	--	<1.0
PLOT 25 LNAS NEST	12-07-95	--	--	--	--	--	--	--	--
PLOT 25 LNAS NEST	04-01-95	<1.0	--	<1.0	<1.0	<1.0	2.0	20	<1.0
WELL 26 LNAS	04-11-97	<0.20	4.9	<.30	<.20	<0.20	<.20	3.0	<.30
WELL 29 LNAS	04-06-95	<1.0	--	<1.0	<1.0	<1.0	<1.0	<3.0	<1.0
	04-08-97	<.20	8.0	.44	<.20	.30	<.20	7.8	<.30

Table 7. Results of analyses of field blank samples collected at the biosolids study site, Lakehurst Naval Air Engineering Station, New Jersey, March 1995 to April 1997--Continued

Local identifier	Date	Manganese, dissolved (µg/L)	Mercury dissolved (µg/L)	Thallium, dissolved (µg/L)	Molybdenum, dissolved (µg/L)	Nickel, dissolved (µg/L)	Silver, dissolved (µg/L)	Strontium, dissolved (µg/L)	Zinc, dissolved (µg/L)
PLOT 17 LNAS NEST	11-07-96	--	--	--	--	--	--	--	<3.0
PLOT 19 LNAS NEST	03-27-97	--	--	--	--	--	--	--	<3.0
PLOT 23 LNAS NEST	05-21-96	--	--	--	--	--	--	--	<3.0
PLOT 24 LNAS NEST	05-23-96	--	--	--	--	--	--	--	<3.0
	03-17-97	--	--	--	--	--	--	--	<3.0
PLOT 25 LNAS NEST	12-07-95	--	--	--	--	--	--	--	--
PLOT 25 LNAS NEST	04-01-95	5.0	<.1	--	<1.0	<1.0	<1.0	--	5.0
WELL 26 LNAS	04-11-97	0.23	--	<0.10	<0.20	0.56	<0.20	<0.10	.83
WELL 29 LNAS	04-06-95	<1.0	<0.1	--	<1.0	<1.0	<1.0	--	<1.0
	04-08-97	.36	--	<.10	<.20	<.50	<.20	<.10	.79

Local identifier	Date	Antimony, dissolved (µg/L)	Aluminum, dissolved (µg/L)	Selenium, dissolved (µg/L)	Uranium, natural dissolved (µg/L)
PLOT 17 LNAS NEST	11-07-96	--	--	--	--
PLOT 19 LNAS NEST	03-27-97	--	--	--	--
PLOT 23 LNAS NEST	05-21-96	--	--	--	--
PLOT 24 LNAS NEST	05-23-96	--	--	--	--
	03-17-97	--	--	--	--
PLOT 25 LNAS NEST	12-07-95	--	--	--	--
PLOT 25 LNAS NEST	04-01-95	<1.0	233	<1	<1.0
WELL 26 LNAS	04-11-97	<0.20	2.0	--	<0.20
WELL 29 LNAS	04-06-95	<1.0	1.0	<1	<1.0
	04-08-97	<.20	2.4	--	<.20

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