ASSESSMENT OF ALTERNATE DREDGING TECHNOLOGIES PNEUMATIC SEDIMENT SUSPENSION SYSTEM FOR

IMTT - BAYONNE

BAYONNE, NEW JERSEY

FINAL REPORT

June 23, 2000
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AIR GUARD™ Pneumatic Sediment Suspension System

REPORT PREPARED BY:

35 Corporate Drive
Trumbull, CT 06611
203-268-5007 Fax 203-268-8821
http://www.ocean-coastal.com

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1.0 INTRODUCTION

This report was prepared in order to document the findings of a one year environmental and hydrographic survey program conducted as part of the Air Guard™ Pneumatic Sediment Suspension System installation at IMTT in Bayonne. The Air Guard™ System was installed, as part of a pilot program funded by New Jersey Maritime Resources, in order to minimize sedimentation in an existing barge berth at the IMTT facility. The system was installed in April of 1998 and was operational on April 17th.

The Air Guard™ System at IMTT is located at Pier #3 and consists of a submerged network of perforated piping placed along the riverbed. The linear footage of the piping is approximately 825 feet. An air compressor is located upland to supply the submerged piping. The compressor forces air through the perforated pipe creating an upward stream of air bubbles that serves to keep sediments in suspension within the local vicinity of Pier #3. Please refer to Appendix A for the vicinity plan and the system layout.

Permit conditions set forth by both the New Jersey Department of Environmental Protection (NJ-DEP) and the U.S. Army Corps of Engineers (ACOE) mandated a bi-monthly testing protocol to determine the both the environmental and hydrographic effects of the Air Guard™ System. This report summarizes the findings of this year long investigation.

1.1 Key Personnel

The Personnel listed were essential in the installation and monitoring of the Air Guard™ Pneumatic Sediment Suspension System are as follows:

OWNER:	**HYDROGRAPHIC SURVEYS:**
IMTT-Bayonne	Ocean and Coastal / Hydrographic
Bayonne Industries, Inc.	Surveys, LLC
250 East 22nd Street	35 Corporate Drive
Bayonne, NJ 07002	Trumbull, CT 06611
Contact: Robert Weaver, PhD, P.E.	Contact: Scott Anastasio

SPONSOR:

New Jersey Maritime Resources
28 West State Street
P.O. Box 837, 8th Floor
Trenton, NJ 08625-0837
Contact: M. Scott Douglas

ENVIRONMENTAL SURVEYS:

Ocean and Coastal Consultants, Inc.
35 Corporate Drive
Trumbull, CT 06611
Contact: Steve Edwards
Consultant

SYSTEM DESIGN AND INSTALLATION:

Air Guard™, Inc.
35 Corporate Drive
Trumbull, CT 06611
Contact: Stanley White, P.E.

1.2 TESTING SCHEDULE

The environmental and hydrographic surveys were performed on a bi-monthly schedule as per requirements set forth by the NJ-DEP and ACOE. The schedule for the surveys was as follows:

Survey #	Environmental Survey	Hydrographic Survey
Baseline	February 5 & 6, 1999	March 8 & 12, 1999
#1	May 7 & 8, 1999	May 10, 12, & 17, 1999
#2	July 29 & 30, 1999	July 13, 14, & 15, 1999
#4	September 23 & 24, 1999	September 14, 21, & 22, 1999
#5	November 11 & 12, 1999	November 16 & 17, 1999
#6	February 3 & 4, 2000	January 12 & 13, 2000
#7	April 6 & 7, 2000	April 10 & 11, 2000

2.0 HYDROGRAPHIC SURVEYING

The purpose of the Air Guard™ System at Pier #3 is to reduce sedimentation and to minimize maintenance dredging requirements. In order to accurately assess the benefits of the system installation an intensive hydrographic survey program was implemented. The methods employed to perform this data collection are as follows.

2.1 METHODOLOGY

The Condition Surveys at IMTT - Bayonne consisted of three (3) distinct phases. These phases were composed of several tasks, required to generate the bathymetric data and resulting volume computations, and included:

(1) Preliminary Navigation and Planimetrics
(2) Bathymetric Survey
(3) Data Analysis and Computations

Preliminary Navigation and Planimetrics

Prior to conducting any depth surveys at the site, site controls were established and referenced to known benchmarks. Each site is different and often requires some modification of standard procedures. The location of the hydrographic survey sites utilized for this report are included in Appendix C.

Following establishment of the survey controls, planned survey traverse lines were developed and the known start and end points as well as reference azimuth were placed in memory of the computer which is maintained on-board the survey vessel. The same tracklines were used for each hydrographic survey.

Bathymetric Survey

To collect depth soundings referenced to known horizontal and vertical datums, highly sophisticated equipment and procedures have been employed. To collect and combine depth soundings with horizontal position data in real time, the Starlink 212G/MBA-2DGPS sub-meter positioning system was interfaced with the Innerspace Technologies, Inc., Model 448 Thermal Depth Sounder recorder. The survey vessel was tracked during each run along the previously established survey tracklines. Through the HYPACK hydrographic survey software, the vessel was provided with on-screen positioning, including steering data, distance along each trackline, offset from the trackline, and other position information. Position data (x, y location), recorded depth (z location), and time of record was logged to the appropriate HYPACK file for each recorded depth location. Observed tidal elevation data was recorded into a separate file at approximately 10 minute intervals or every 0.10 ft change to provide for tidal corrections of the recorded depths.

Fathometer calibrations were also performed at the beginning and end of each survey day. The bar check method was exercised using an 8 inch wide flat bar on marked cables. The bar checks were executed in the vicinity of the survey area to depths of 35, 30, 20 and 10 feet to adjust the sound velocity parameters on the fathometer.

Data Analysis and Computations

Survey data was stored in the HYPACK software and analyzed using both HYPACK and AutoCAD. Each survey trackline was assigned a unique name to facilitate data analysis. Utilizing HYPACK, each file was reviewed and corrected for tidal and other site variations.

Survey tracklines were established in five (5) foot increments for Pier # 3 and twenty-five (25) foot increments for all other sections. Depth sounding data was taken along each survey trackline to a point where the survey vessel was hindered by an obstruction such as the pier fender structures or the oil boom containment system. The volume templates were designed

to encompass the largest zone possible without sacrificing the quality of the data coverage. The section boundaries illustrated in the Key Plan were developed within the reaches that depth data could be accurately obtained.

3.0 HYDROGRAPHIC SURVEY RESULT ANALYSIS

The results from the hydrographic surveying effort were analyzed for the duration of the survey period. Bi-monthly reports were distributed to the NJ-DEP, ACOE, and other interested parties during the operation of the Air Guard™ System. To facilitate the comparison of sedimentation rates in the various zones two methods of analysis have been included. First, multiple cross-sections were developed throughout the survey area to provide a graphical depiction of the initial and final bathymetry. These cross-sections and a key plan for their locations is included in Appendix D. Second, the volume of sediment accumulated in the six (6) distinct survey zones were tabulated, a spreadsheet comparing the results is located in Appendix E.

3.1 CROSS-SECTION COMPARISON

To analyze the results of the survey effort are three sets of cross-sections taken from the four berth areas that were surveyed. These berth areas are designated as Pier #2 Zone, Coal Pier Zone, Pier #3 (Air Guard™) Zone, and Pier #4 Zone. It was chosen to compare these areas due to their similarity of orientation to the current stream and location along the existing bulkhead line. The three sections at each location include the following:

1) Sections A-A, D-D, G-G, K-K (located ±60 feet from the bulkhead line)
2) Sections B-B, E-E, H-H (located ±170 feet from bulkhead line in Pier #2 Zone, Coal Pier Zone, Pier #3 (Air Guard™) Zone)
   Section L-L (located ±260 feet from bulkhead line in Pier #4 Zone
3) Sections C-C, F-F, J-J, M-M (longitudinal sections)

It is apparent from review of the sections that the Air Guard™ System aided in limiting accretion in the Pier #3 berth. This conclusion can be derived from comparison of the cross-sections from the four aforementioned zones:

Pier #2 Zone: Analysis of the Pier #2 Zone indicates accumulation of sediment in all cross-section views, A-A, B-B, and C-C. The range of accretion within this Zone from March 1999 to April 2000 is approximately 1 to 3 feet. This accretion is the greatest amount evidenced in any of the barge berths surveyed. The deepest area of sediment accumulation occurred near the head end (inshore) of the berth. This can be attributed to the reduced current velocities in this area caused by adjacent structures and the shallower depth.

Coal Pier Zone: The Coal Pier Zone sedimentation is less than the adjacent Pier #2 Zone and ranges typically from 0.5 to 1 feet. There is evidence of scour on the east side of section D-D.

Pier #3 Zone: The Pier #3 Zone is the location of the Air Guard™ System. Accretion in this area ranges from typical values of 0.5 feet to isolated areas of 1 foot maximum. The accumulated sediment in this vicinity is lower than the Pier #2 Zone and the Coal Pier Zone as expected due to the operation of the Pneumatic Sediment Suspension System. A diving inspection was undertaken on April of this year which confirmed the general lack of sedimentation on and around the manifold piping. It should be noted in these cross-sections that there is a very steep slope on the western side of the barge berth, this condition was also confirmed by diving inspection. This slope is caused by recent maintenance dredging activities substantially completed in January 1998. To some extent the failure of this slope contributed to the accretion within the project test site. The Air

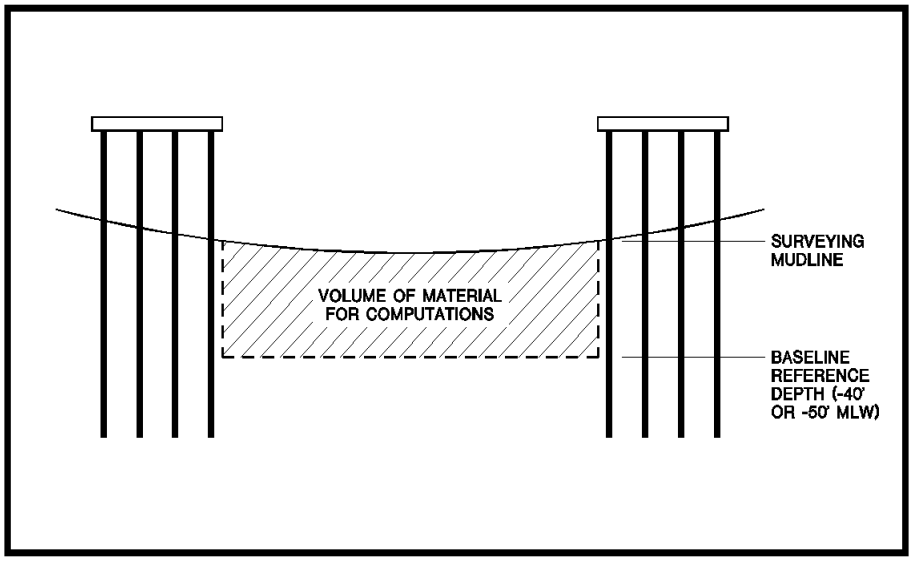
Guard™ System was not designed to resuspend the volume of material displaced by the slope failure and this fact should be considered when judging the success of the system.

Pier #4 Zone: The Pier #4 Zone show evidence of both accretion and scour at different areas of the berth. Review of the longitudinal cross-section reveals that there is accretion at the southern end of the berth and scour at the northern end of the berth. This finding is confirmed by the two transverse cross-sections K-K and L-L. Although this pattern defies the typical process of sedimentation occurring initially at the head (inshore) end of the berth, it can be explained by the operational differences of this specific berth area. Of all the areas surveyed this berth was the only one which provided offloading capabilities for two barges, at Pier #3 and Pier #4. Due to the increased berth width, if only one barge were off-loading than a tugboat would have adequate clearance to navigate within the berth area to move the barge. Propeller wash due to tugboat navigation can create a significant amount of scour which would explain the apparent deepening at the head-end of the berth.

The review of the aforementioned data indicates that the Air Guard™ System is significantly aiding in the maintenance of adequate berth depths. Of the four sites analyzed, the greatest amount of sedimentation occurred in the Pier #2 Zone. As stated previously, the Pier #2 Zone was initially chosen for testing due to it's similarity to the Pier #3 (Air Guard) Zone. This Zone is located farthest from the Air Guard™ System. The Coal Pier Zone and the Pier #4 Zone are immediately adjacent to the Air Guard™ test berth and would reap the benefits of the sediment suspension caused by the system.

3.2 VOLUME COMPARISON

Another method of determining the effectiveness of the Air Guard™ System is by comparing the changes in volume within specific Zones relative to an initial baseline depth. Six (6) areas were created for this volume comparison and include the four berth areas reviewed in the cross-section analysis. The two additional areas include Area #1 and Area #2. Area #1 is located immediately south of the Pier #3 (Air Guard™) Zone and the Coal Pier Zone. Area #2 is located further south of Area #1 and parallels the federal channel for the length of the testing area. A key plan of the zone locations and a spreadsheet of the volume computations is included in Appendix E. For the purposes of the tests, volumes are based on an arbitrary and common "baseline reference depth". The calculated volumes consist of the volume of material between the baseline reference depth and the mudline at the time of survey, as shown in the following illustration:



Utilizing the volume data, calculations were performed to determine the average overall depth of sedimentation throughout each of the aforementioned zones. These depths represent an average amount of sediment uniformly deposited on, or displaced from the footprint of the zone. Although

review of the cross-sections indicates that the sedimentation does not occur uniformly, the average depths will provide a valid comparison of the gross accumulations within the respective zones. Please refer to the following table for the average sedimentation depths in all zones surveyed:

Zone	Accretion Volume (cy)	Zone Footprint Area (ft^2)	Avg. Sedimentation Depth (in)
Area #1	**769**	**40,119**	**6.2**
Area #2	**2,707**	**154,350**	**5.7**
Pier #2	**1,448**	**27,594**	**17.0**
Coal Pier	**1,085**	**30,218**	**11.6**
Pier #3 (Air Guard™)	**500**	**27,905**	**5.8**
Pier #4	**447**	**37,023**	**3.9**

4.0 ENVIRONMENTAL TESTING

In accordance with regulatory permit issued by the NJ-DEP and the ACOE, environmental testing was performed to assess local chemical, physical and biological impacts caused by the Air Guard™ System.

4.1 Testing Procedures

In order to establish a causal relationship between the operation of Air Guard™ System and a change in aquatic biota, it was necessary to either have extensive baseline data upon which future data can be compared, or attempt to make real-time comparisons between the test site and a control site. Permit special conditions set forth by NJDEP required the establishment of the necessary baseline data and the program was structured to compare between the project site and selected control sites as well as the baseline data.

The ability to document meaningful results is predicated upon selection of an appropriate control site. The control sites were selected based on similarity to the project site relative to:

1. Presence of structure, open water vs protected

2. Water velocity and currents
3. Salinity regime
4. Water depth
5. Sediment characteristics
6. Temperature and dissolved oxygen
7. Food resources

The sampling areas included the project area, Pier #3 and the adjacent pier areas to the east and west. These areas are referred to as follows; Pier 4 Zone consists of the area between Pier #3 and Pier #4, Pier 3 Zone (the location of the Air Guard™ System) consists of the test area located west of Pier #3, and the Coal Pier Zone consists of the area west of the coal pier. Due to barge traffic within the project vicinity, it was occasionally necessary to relocate sampling efforts to other berths. Please refer to Appendix F for the locations of the environmental sampling.

The sampling effort extended over an entire year to assess the various species and age classes that utilize the project areas at different times of the year. The baseline survey was performed on February 5 and 6, 1999 and additional surveys were performed bi-monthly beginning in May. Adverse impacts are typically reflected by shifts in community structure within the area. Even intensive sampling during periods of low population density often fail to demonstrate any significant trends. By sampling resident populations every other month over the entire year, the ability to reflect population changes is greatly enhanced.

4.2 Chemical Sampling

Water chemistry was conducted during each environmental testing effort. Water quality determinations included; turbidity, temperature, dissolved oxygen, salinity, and percent saturation. All samples were collected with a Wildco dissolved oxygen sampling bottle. Dissolved oxygen samples were fixed in the field using the azide modification of the Winkler or iodometric method. Titration of the fixed samples was conducted in the laboratory at the end of the day according to procedures set forth in Standard Methods for the Analysis of

Water and Wastewater (APHA, 1992). Data for water chemistry was collected in each of the three specified locations and is tabulated in Appendix G.

4.3 Nekton and Pelagic Macroinvertebrates Sampling

Since effectiveness of sampling methods will vary by species, age class, and season, the design to assess fish and pelagic macroinvertebrate distribution and abundances relative to the sediment suspension system was conducted using a variety of collection gear types. The types of gear utilized are as follows:

Gear	Description
16-ft Otter Trawl	Wings and body mesh (1.0 in^2, 2.0 in^2 stretched) Bag mesh (0.75 in^2, 1.5 in^2 stretched) Cod-end liner (0.25 in^2, 0.5 in^2 stretched)
Trap Net	Frame (3ft x 3ft) Lead (25ft x 3 ft) Mesh (0.25 in^2, 0.5 in^2 stretched)
Gill Net - Surface	Monofilament, 50 ft long x 8 ft deep (1.5 in^2 mesh)
Gill Net - Bottom	Monofilament, 50 ft long x 8 ft deep (1.5 in^2 mesh)

Trawling

Sampling consisted of a series of short trawls repeated at surface and bottom at each of the three similar sites. Bottom trawls were conducted with a 16-ft otter trawl rigged with weighted doors and deployed from a 17-ft Boston whaler powered with a 90 horsepower engine. Trawls at the Pier 4 Zone and the Coal Pier Zone were conducted through the inter-pier basin from the bulkhead to the pierhead line. Due to the presence of the pneumatic piping array within the Pier 3 Zone, the towing was restricted within the berth area. All tows were based on a tow speed of approximately 150 cm/sec over the bottom and were timed with a stopwatch. Surface trawls were conducted with the same gear except the weighted doors were attached to buoys to maintain the net at the surface.

Trap Nets

Three trap nets were set, one at each zone. The trap nets were 3x3-ft box nets with a 25-ft lead line. The nets were deployed off the bow of the boat after the bottom of the lead was attached to an anchor set alongside the adjacent pier structure. The top of the lead was tied off to the pier structure. The lead was then payed out perpendicular to the pier as the boat backed off the anchor. When the end of the lead was reached, the trap was lowered over the bow while tension was maintained on the lead line. The complete trap and lead line was then stretched taut and another anchor secured the trap in place.

Only two trap nets were set during the final survey due to the loss of one of the units during the February 2000 survey and the inability to get a replacement in time.

Gill Nets

Bottom gill nets and surface gill nets were deployed at each of the three sampling locations. The gill nets were 50-ft long x 8-ft deep, 0.75 inch monofilament.

Gill nets were set off the bow of the boat while it moved slowly in reverse. Before the net was payed out, an anchor and buoy and line were attached to one end. When completely payed out, the net was pulled taut and the other end was also anchored and secured in place.

Sample Analysis

All fish collected in the samples were identified, counted, and measured (total length) in the field. Care was taken to minimize mortality associated with the collection and handling of the specimens. All specimens were immediately released upon completion of analysis.

5.0 ENVIRONMENTAL SURVEY ANALYSIS

The results of the environmental survey were reviewed to determine any beneficial or adverse impacts associated with the Air Guard™ System installation. The water quality and fish sampling information is presented in the Appendices for review.

5.1 Chemical Analysis

Various water quality properties were recorded during each of the sampling efforts. In order to analyze the effects of the Air Guard™ System on oxygenation, stratification, and turbidity in the water column, four pieces of data were graphed to demonstrate a trend among the water properties. These pieces of data include, dissolved oxygen concentration, temperature readings, salinity titration, and secchi disk readings.

Dissolved Oxygen: Dissolved oxygen (DO) concentrations for the entire survey effort were plotted on three separate graphs. These graphs are located in Appendix G. The graphs are separated for Surface, Mid-Depth, and Bottom DO readings. The DO levels for all water depths indicate a typical pattern of near saturation in the winter months and reduced levels in the summer months. At all water depths, the DO level of the Pier 3 Zone (Air Guard™ Location) was elevated relative to the other locations when the DO levels dropped in the summer months. During the cooler weather the DO concentrations approached saturation and were more uniform throughout the survey site. This trend indicates that the aeration of the local waterbody within the Pier #3 area, by the Air Guard™ System, is helping to raise DO levels during the critical summer months.

It should also be noted, when reviewing the DO data, that a separate Air Guard™ System was installed at IMTT in 1995. This system is at the Platty Kill Creek located immediately east of Pier #4. The continuous operation of this system since 1995 will have contributed to increased DO concentrations within the immediate area.

Temperature & Salinity Results: The results from water temperature readings and salinity concentrations at the three test water depths were plotted to determine if there were any effects on stratification of the waterbody due to the Air Guard™ System. These graphs are located in Appendix G. Review of these graphs indicates that there is no effect on stratification, either positive or negative, caused by the Air Guard™ System.

Secchi Disk: Secchi Disk readings were taken at each water quality station to determine the level of turbidity with the water column. A graph is presented in Appendix G detailing the results of the readings. The results indicate that the Air Guard™ System does not cause increased turbidity due to the sediment suspension operation.

5.2 Nekton and Pelagic Macroinvertebrate Analysis

Results from the fish sampling effort have been included in tabular format in Appendix H. The table presents quantity of organisms in Catch Per Unit Effort (CPUE). The CPUE quantity denotes an equivalent ten minute trawl or twenty four hour gill net or trap net catch. Data obtained from the seven survey efforts indicate no definitive trends relative to fish distribution. NJ-DEP officials voiced concern that the pneumatic array of the Air Guard™ System may cause avoidance of this area by fish. Test results have shown that adult striped bass actually frequent the Air Guard™ site in higher numbers when present in the area.

When reviewing Appendix H it should be noted that a majority of the specimens collected were obtained with a bottom trawl. Due to the presence of the pneumatic array at the Pier 3 Zone, the trawl run in this location needed to be shortened significantly. This was necessary in order to assure that the trawl net would not get fouled on the Air Guard™ System. This fact accounts for some reduced specimen quantities obtained from a bottom trawl within the Pier 3 Zone.

6.0 SYSTEM OPERATION

6.1 Operational Costs

The compressed air required for operation of the Air Guard™ Pneumatic Sediment Suspension System is supplied by an upland air compressor. The compressor is an electrically powered, rotary screw air compressor. System operational costs consist of two major components:

1. Power (electricity): This component is a function of the amount of usage and the unit cost of electricity. Assuming that the system is operated continuously and an average unit cost of $0.07 per kilowatthour for electricity, the

approximate annual cost for power would be $19,250.00.

2. Compressor Maintenance: The rotary screw air compressor requires periodic maintenance of certain components in order to extend service life and to minimize the possibility for mechanical breakdowns. Such items generally include inspecting and replacing coolant and filters. The approximate annual cost of preventative compressor maintenance is $7600.00.

7.0 CONCLUSIONS

The Air Guard™ Pneumatic Sediment Suspension System was installed at the IMTT-Bayonne facility in order to reduce the requirements of maintenance dredging. Review of the hydrographic data indicate that the system has been effective in reducing sedimentation within Pier #3. This fact is clearly shown when comparing sedimentation rates between the Pier #2 Zone and the Pier #3 Zone. Volumes of sediment accumulation are 1,886 cubic yards and 378 cubic yards, respectively. These sediment volumes represent an average accretion of 22.1 inches at the Pier #2 Zone and 4.4 inches at the Pier #3 Zone. This shows sedimentation occurring at a rate approximately 500% greater within Pier #2 compared to the Air Guard™ location. This reduction in sedimentation will significantly extend periods between dredging activities, thereby reducing environmental risks associated with dredging while making marine terminal operations more economically feasible.

It is important to note that the sedimentation rates in areas immediately adjacent to the test site, the Coal Pier Zone and Pier #4 Zone, exhibited a reduced amount of sedimentation when compared to Pier #2. This may be due in a large part to the Air Guard™ System at Pier #3.

The environmental sampling associated with this test program indicate that there are no negative environmental impacts associated with the Air Guard™ System installation. Review of the Dissolved Oxygen (DO) concentrations show that during summer months, when ambient DO levels are reduced, readings within the Air Guard™ zone are consistently higher than the adjacent test sites. This is an important fact, especially when considering the many waterbodies in this vicinity suffer from hypoxia. Increased DO levels will reduce the chances of hypoxia occurrence.

The process of maintenance dredging is costly and potentially harmful to the adjacent fisheries habitats. Furthermore, dredge material disposal alternatives are becoming further limited due to increased environmental regulations. The Air Guard™ System is an effective method to reduce maintenance dredging activities and the inherent environmental risks, while providing beneficial environmental impacts.

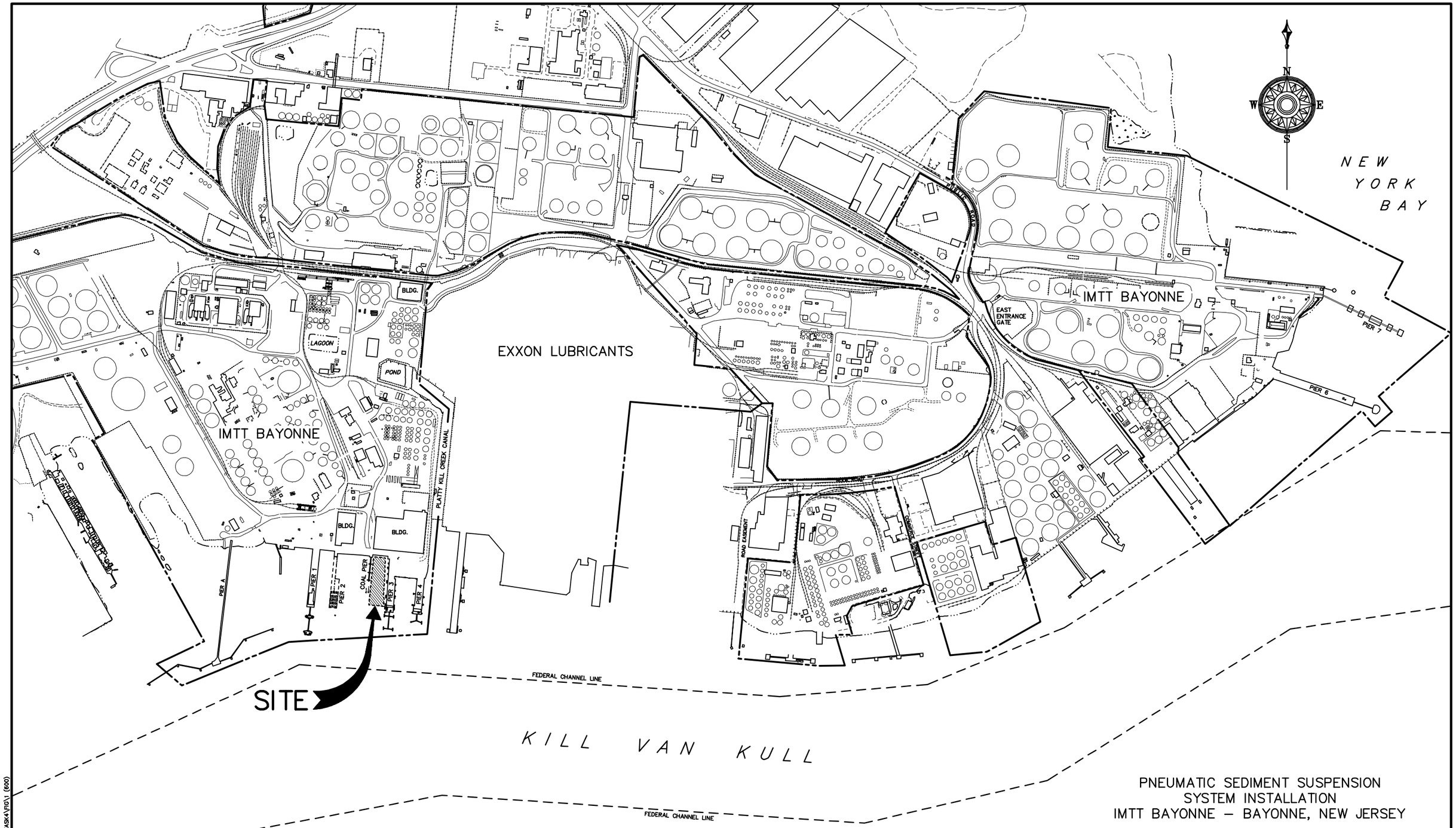
APPENDIX A

PROJECT PLANS

Figure 1 Site Plan
Figure 2 Air Guard™ Manifold Configuration at Pier 3 Zone

Air Guard™ Pneumatic Sediment Suspension System

Ocean and Coastal Consultants, Inc.
35 Corporate Drive
Trumbull, CT 06611
203-268-5007



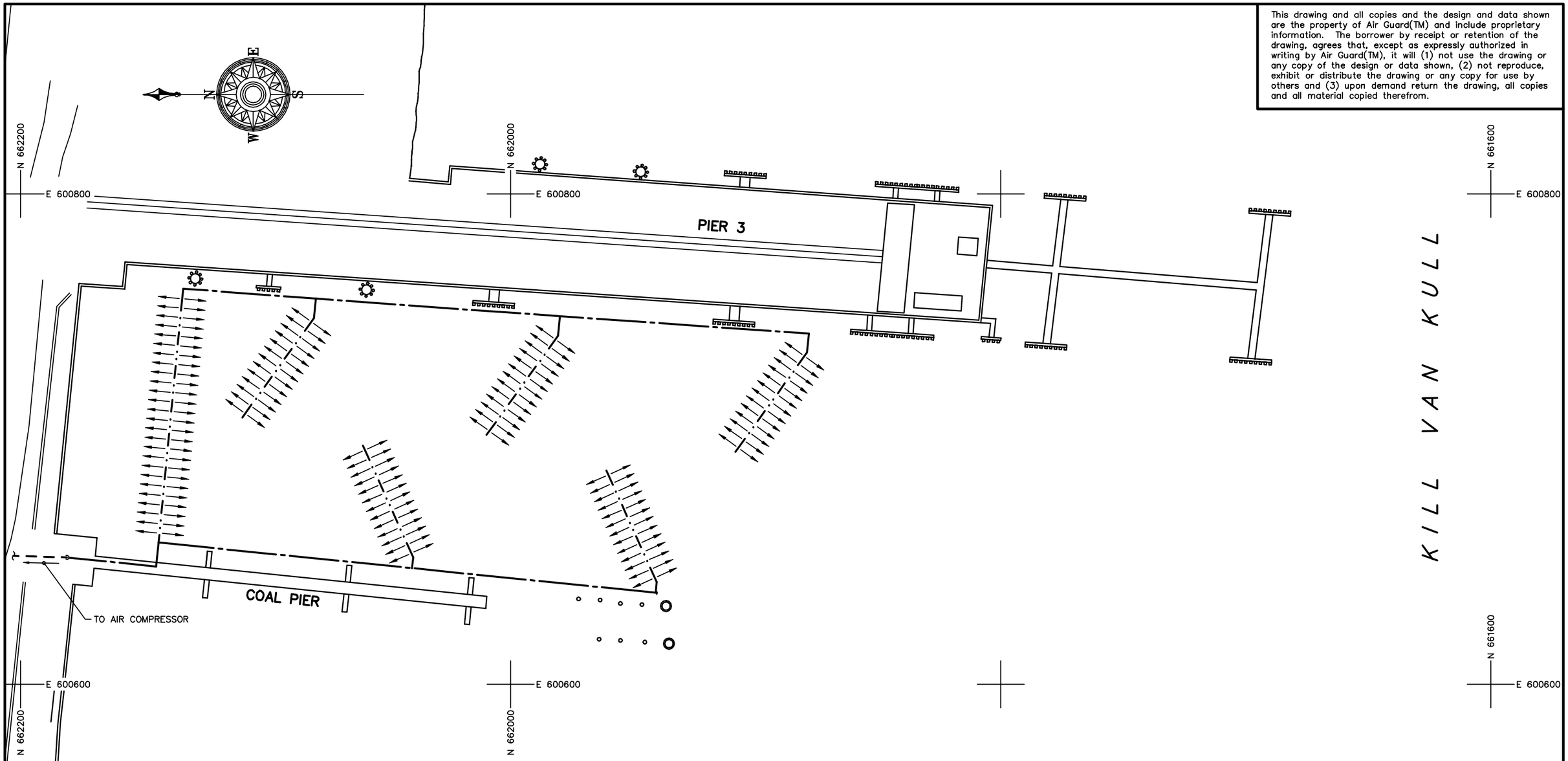
9212.3\TASK4\FIG\1 (600)

AIR GUARD™

PNEUMATIC SEDIMENT SUSPENSION
SYSTEM INSTALLATION
IMTT BAYONNE – BAYONNE, NEW JERSEY

SITE PLAN

DATE: 5–11–00 SCALE: 1"=600' **FIG. 1**



9212.3\TASK4\FIG\2 (40)

AIR GUARD™

LEGEND

- DELIVERY PIPING (ON BOTTOM)
- DELIVERY PIPING (UPLAND)
- MANIFOLD (ON BOTTOM)

PNEUMATIC SEDIMENT SUSPENSION
SYSTEM INSTALLATION
IMTT BAYONNE – BAYONNE, NEW JERSEY

AIR GUARD MANIFOLD CONFIGURATION AT PIER 3 ZONE

DATE: 5–11–00 SCALE: 1"=40' **FIG. 2**

APPENDIX B

REPRESENTATIVE PHOTOGRAPHS

Air Guard™ Pneumatic Sediment Suspension System

Ocean and Coastal Consultants, Inc.
35 Corporate Drive
Trumbull, CT 06611
203-268-5007

Photo #1: Air Guard™ System in operation (facing south)

Photo #2: Air Compressor

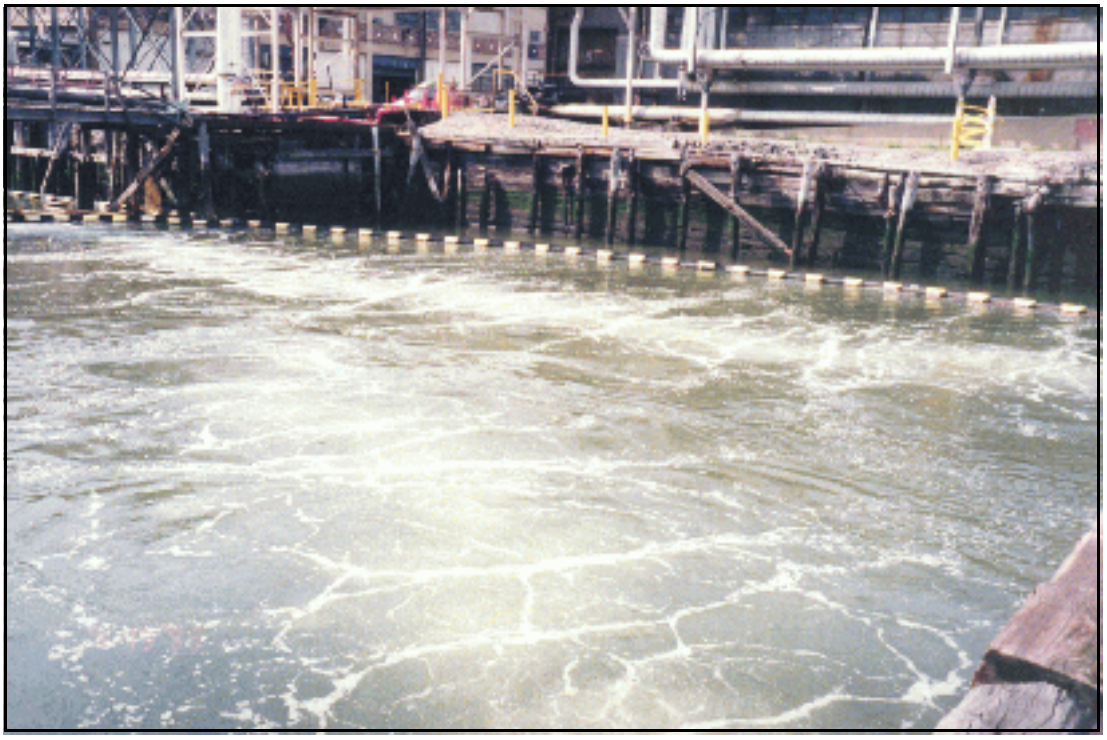


Photo #3: Air Guard™ System in operation (facing north)

Photo #4: Hydrographic survey of Pier #3 Zone

Photo #5: Air Guard™ System fabrication

Photo #6: Air Guard™ System fabrication

APPENDIX C

HYDROGRAPHIC SURVEY PLANS

Figure 3 Hydrographic Survey - March 1999 - Baseline Plan
Figure 4 Hydrographic Survey - Pier 3 Zone - March 1999 - Baseline Plan
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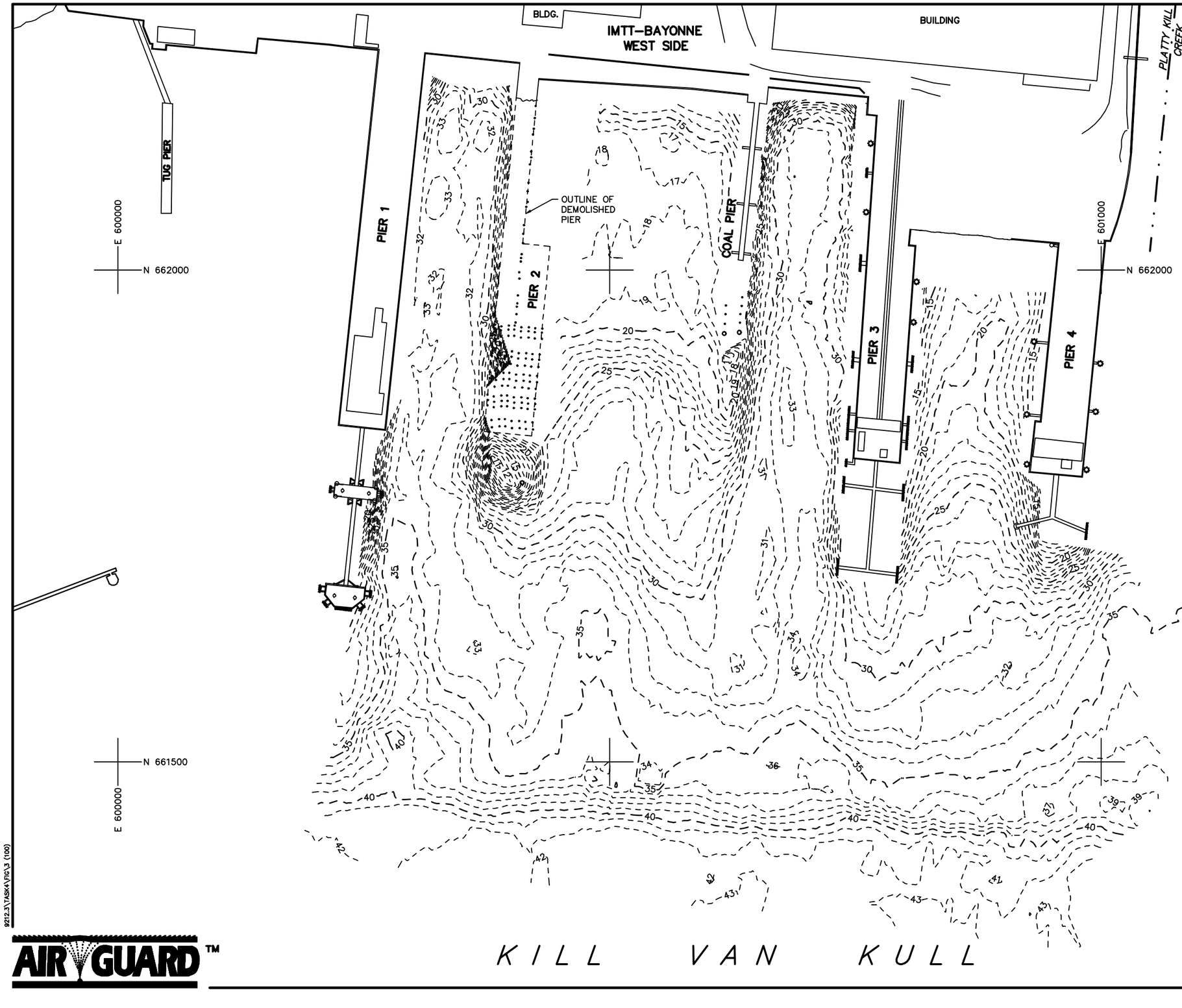
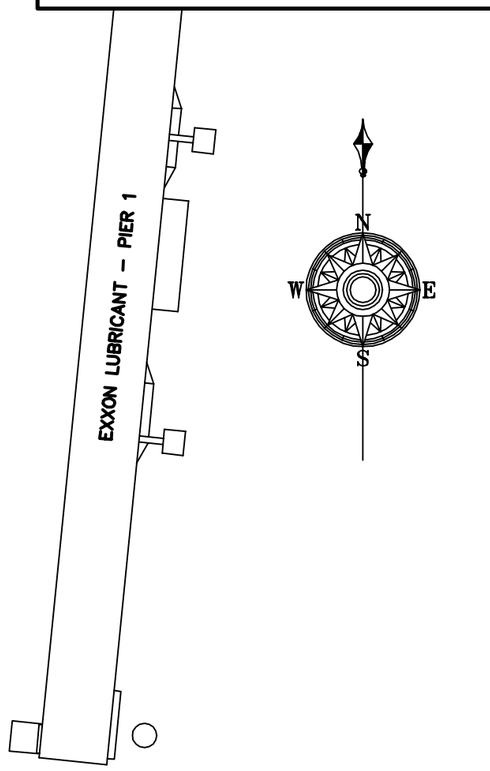
Ocean and Coastal Consultants, Inc.
35 Corporate Drive
Trumbull, CT 06611
203-268-5007





NOTES

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2. THIS GENERAL SITE PLAN IS NOT FOR CONSTRUCTION PURPOSES, NOR IS IT INTENDED TO REFLECT A CURRENT TOPOGRAPHIC AND/OR BOUNDARY SURVEY.
3. COORDINATES ARE BASED ON THE NAD 83 NEW JERSEY MERCATOR AND EXPRESSED IN FEET.
4. ALL CONTOURS ARE NEGATIVE AND IN FEET REFERENCED TO MEAN LOW WATER DATUM (MLWD).
5. HYDROGRAPHIC DATA SHOWN HEREON WAS COLLECTED ON MARCH 8 & 12, 1999. THE DATA WAS COLLECTED BY OCEAN AND COASTAL CONSULTANTS, INC. AND CAN ONLY REFLECT CONDITIONS AS THEY EXISTED DURING THE TIME OF SURVEY.

PNEUMATIC SEDIMENT SUSPENSION
SYSTEM INSTALLATION
IMTT BAYONNE – BAYONNE, NEW JERSEY

HYDROGRAPHIC SURVEY
MARCH 1999 – BASELINE PLAN

DATE: 5–11–00 SCALE: 1"=100' **FIG. 3**

9212.3\TASK4\File\3 (100)

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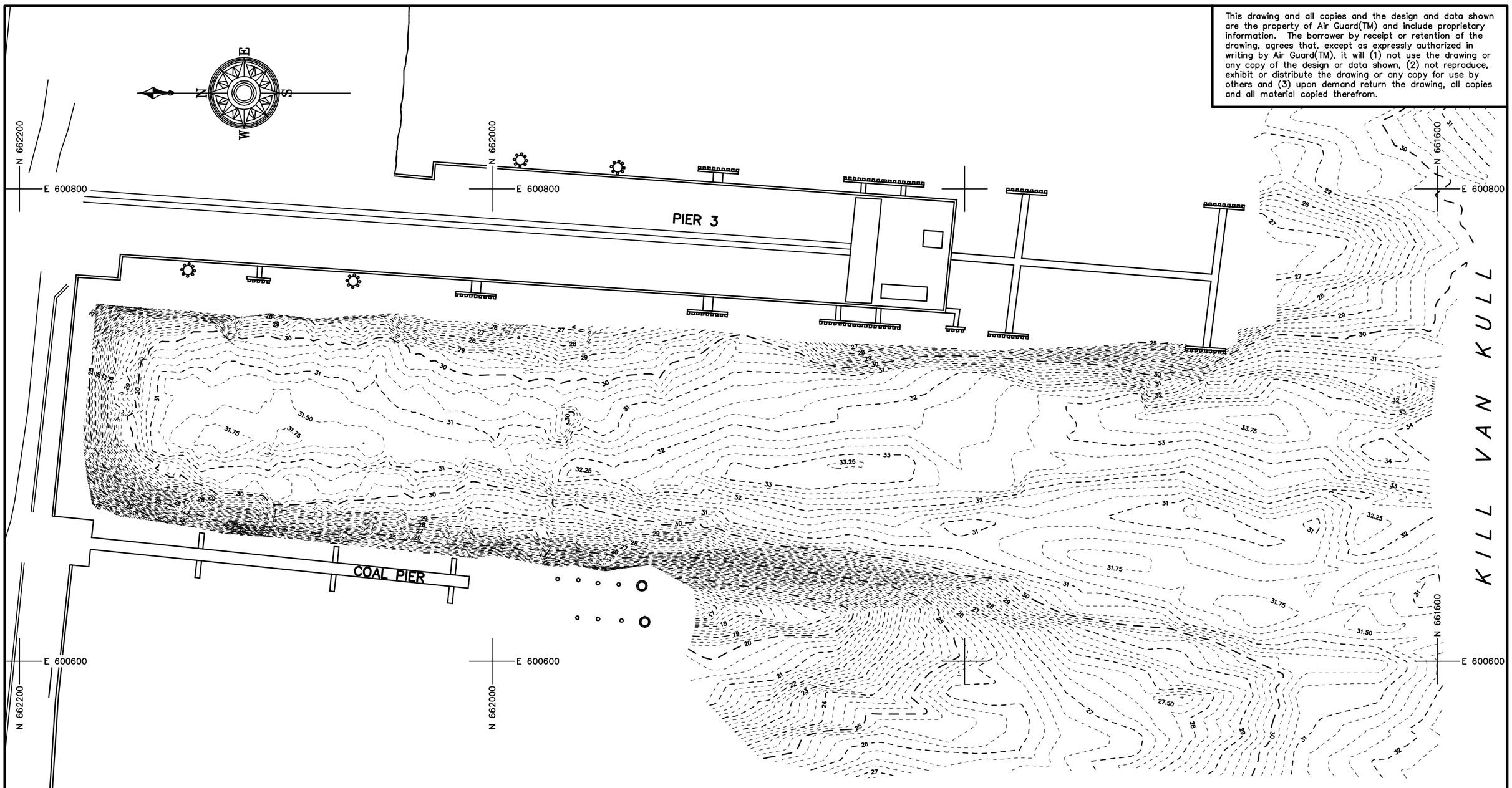

NOTES

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2. ALL CONTOURS ARE NEGATIVE AND IN FEET REFERENCED TO MEAN LOW WATER DATUM (MLWD).
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PNEUMATIC SEDIMENT SUSPENSION
SYSTEM INSTALLATION
IMTT BAYONNE – BAYONNE, NEW JERSEY

HYDROGRAPHIC SURVEY
PIER 3 ZONE
MARCH 1999 – BASELINE PLAN

DATE: 5–11–00 SCALE: 1"=40' **FIG. 4**

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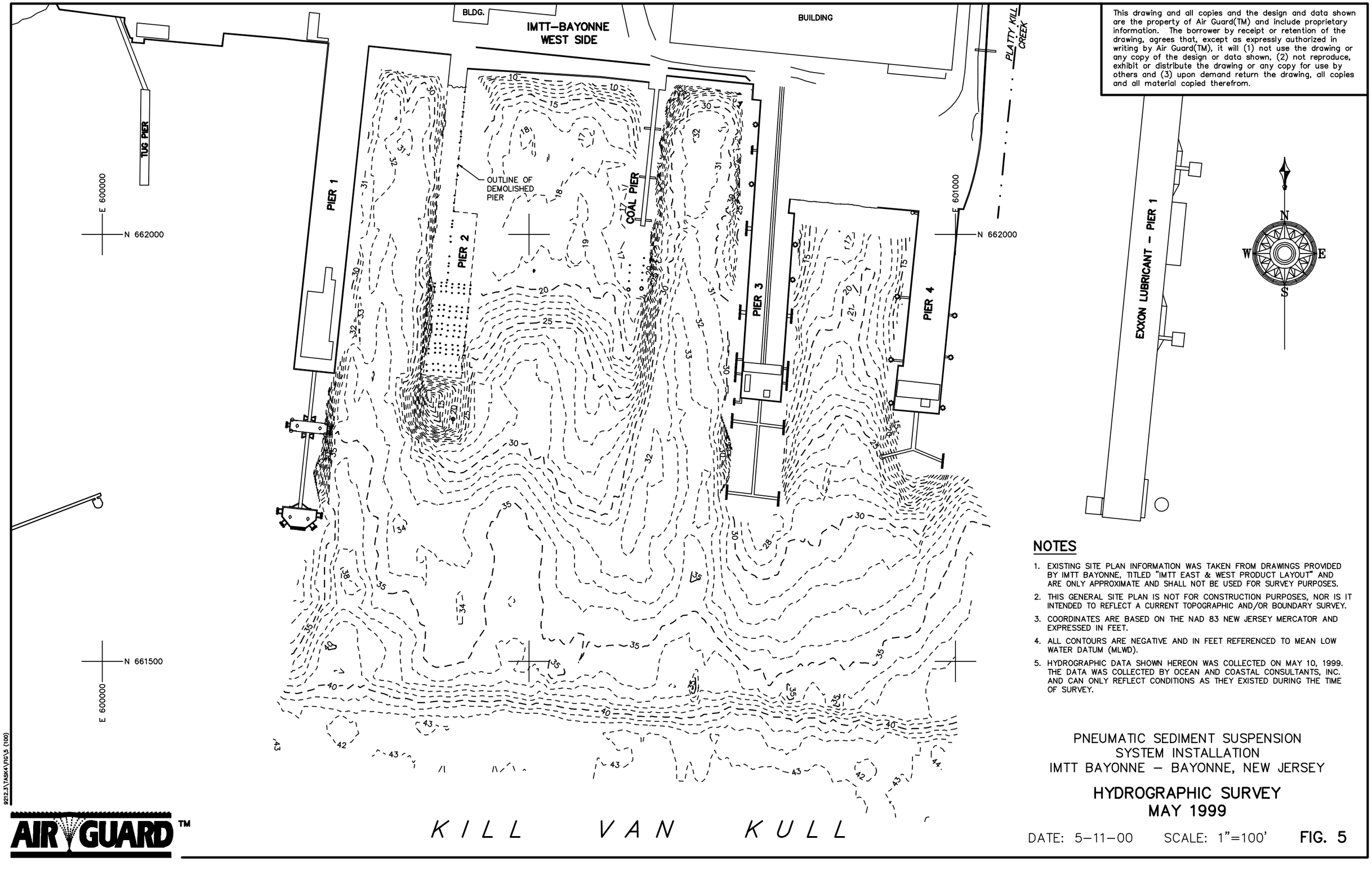
9212.3\TASK4\Fig\4 (40)



NOTES

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2. THIS GENERAL SITE PLAN IS NOT FOR CONSTRUCTION PURPOSES, NOR IS IT INTENDED TO REFLECT A CURRENT TOPOGRAPHIC AND/OR BOUNDARY SURVEY.
3. COORDINATES ARE BASED ON THE NAD 83 NEW JERSEY MERCATOR AND EXPRESSED IN FEET.
4. ALL CONTOURS ARE NEGATIVE AND IN FEET REFERENCED TO MEAN LOW WATER DATUM (MLWD).
5. HYDROGRAPHIC DATA SHOWN HEREON WAS COLLECTED ON MAY 10, 1999. THE DATA WAS COLLECTED BY OCEAN AND COASTAL CONSULTANTS, INC. AND CAN ONLY REFLECT CONDITIONS AS THEY EXISTED DURING THE TIME OF SURVEY.

PNEUMATIC SEDIMENT SUSPENSION
SYSTEM INSTALLATION
IMTT BAYONNE – BAYONNE, NEW JERSEY

HYDROGRAPHIC SURVEY
MAY 1999

DATE: 5–11–00 SCALE: 1"=100' **FIG. 5**

9212.3\TASK4\FIG\5 (100)

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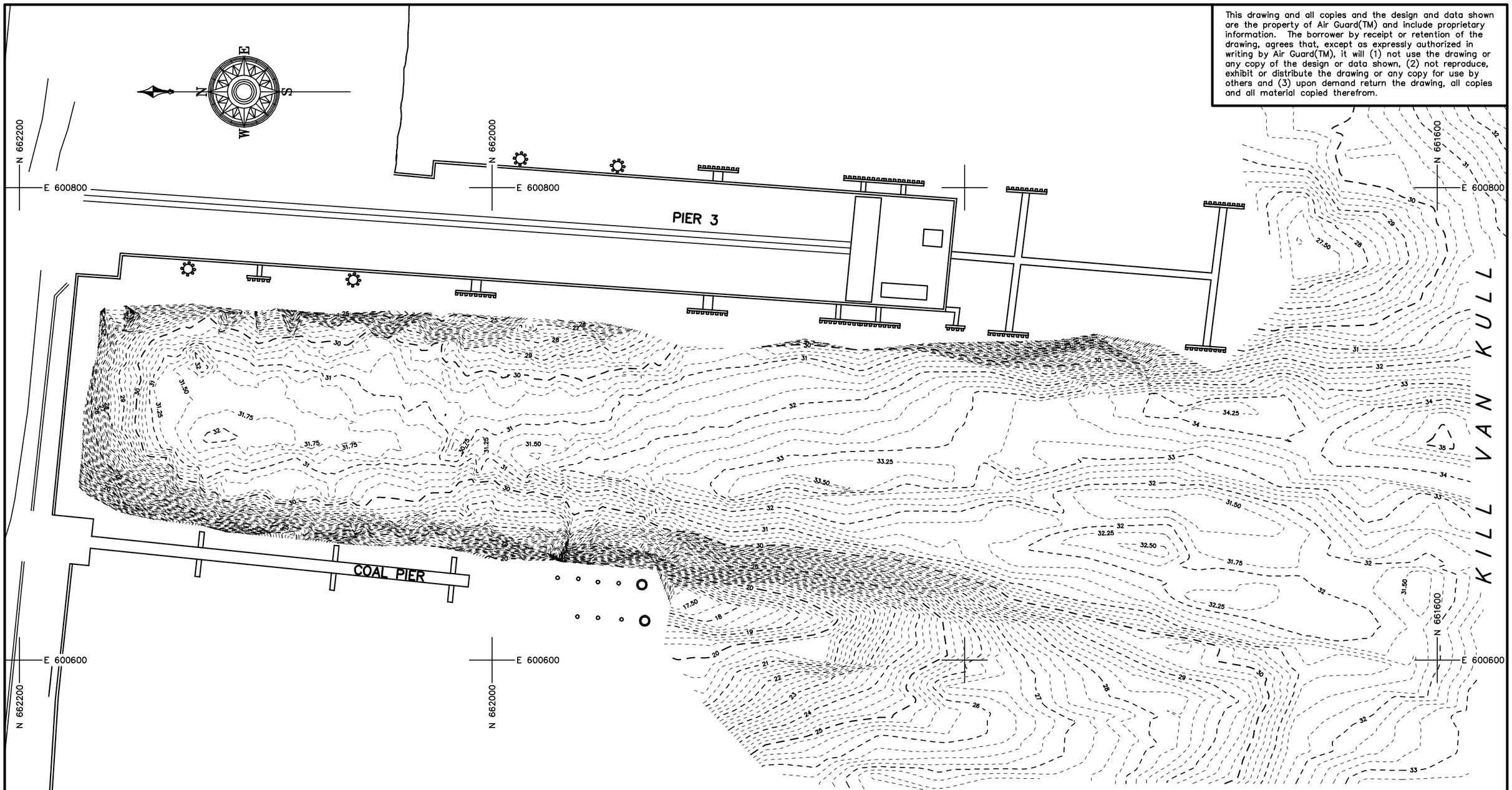

NOTES

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PNEUMATIC SEDIMENT SUSPENSION
SYSTEM INSTALLATION
IMTT BAYONNE – BAYONNE, NEW JERSEY

HYDROGRAPHIC SURVEY
PIER 3 ZONE
MAY 1999

DATE: 5–11–00 SCALE: 1"=40' **FIG. 6**

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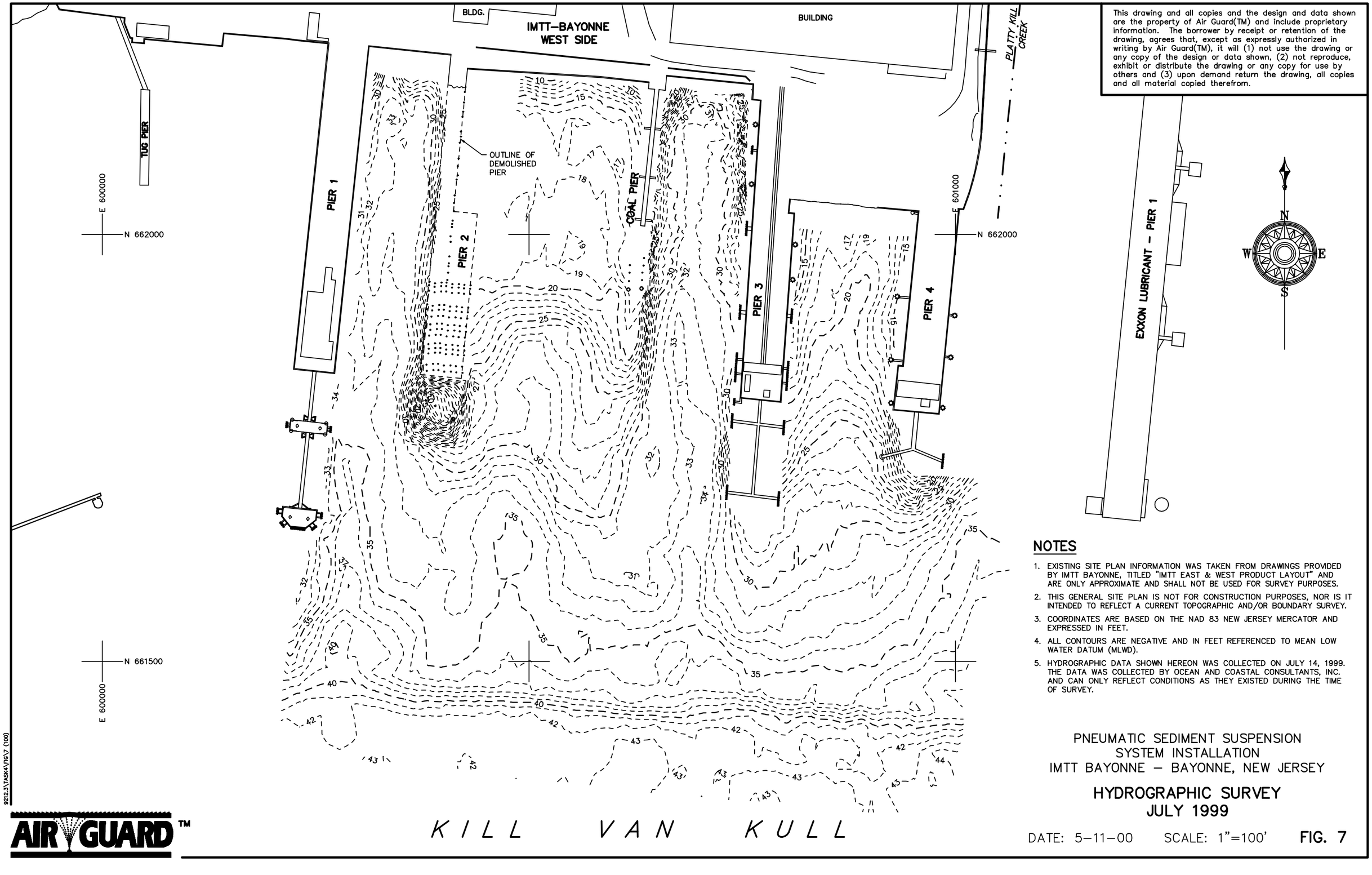
9212.3\TASK4\fig\6 (40)



NOTES

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3. COORDINATES ARE BASED ON THE NAD 83 NEW JERSEY MERCATOR AND EXPRESSED IN FEET.
4. ALL CONTOURS ARE NEGATIVE AND IN FEET REFERENCED TO MEAN LOW WATER DATUM (MLWD).
5. HYDROGRAPHIC DATA SHOWN HEREON WAS COLLECTED ON JULY 14, 1999. THE DATA WAS COLLECTED BY OCEAN AND COASTAL CONSULTANTS, INC. AND CAN ONLY REFLECT CONDITIONS AS THEY EXISTED DURING THE TIME OF SURVEY.

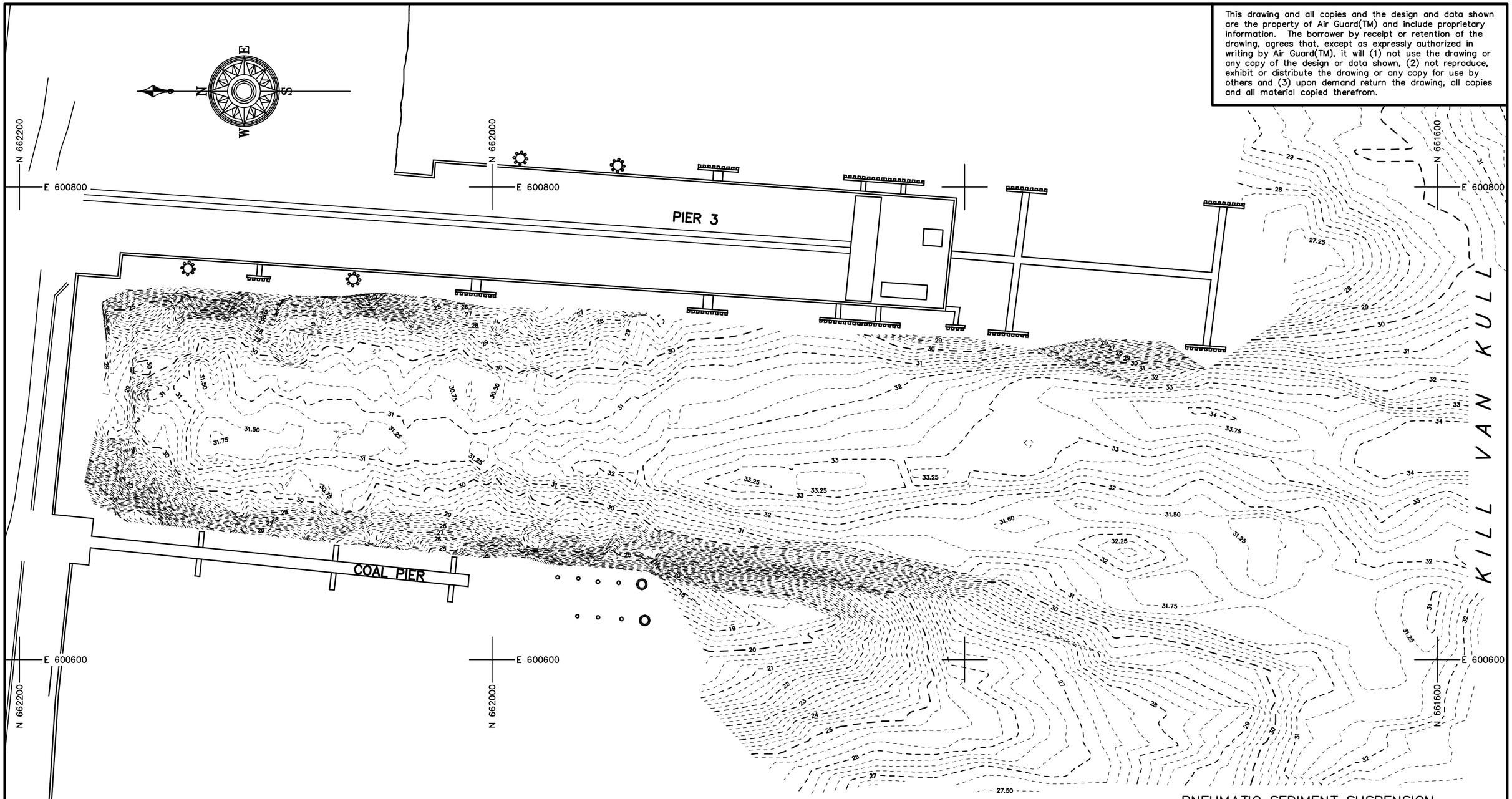
PNEUMATIC SEDIMENT SUSPENSION
SYSTEM INSTALLATION
IMTT BAYONNE – BAYONNE, NEW JERSEY

HYDROGRAPHIC SURVEY
JULY 1999

DATE: 5–11–00 SCALE: 1"=100' **FIG. 7**

9212.3\TASK4\FIG7 (100)

AIR GUARD™



NOTES

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9212.3\TASK4\FIG\8 (40)

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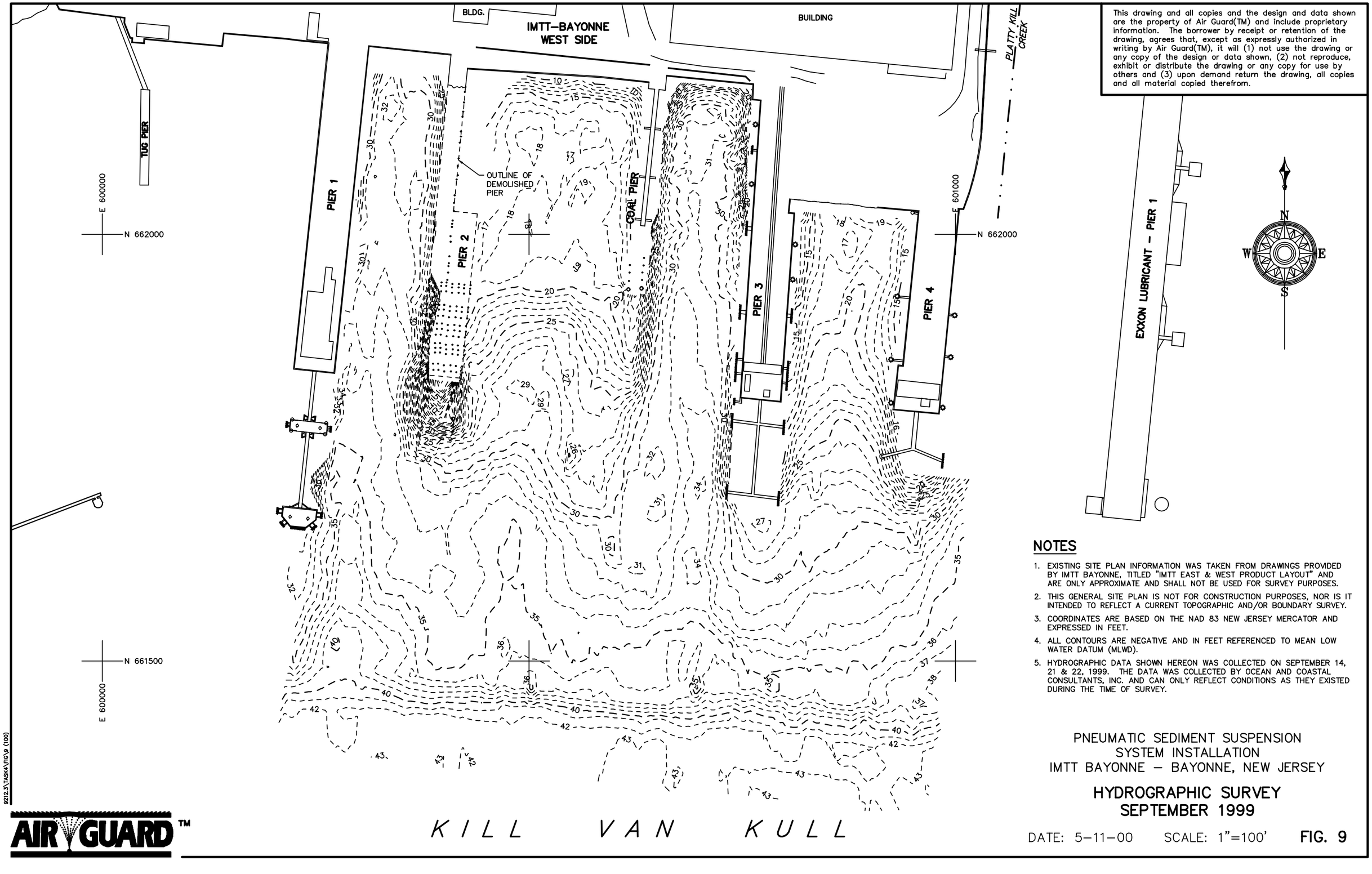
PNEUMATIC SEDIMENT SUSPENSION
SYSTEM INSTALLATION
IMTT BAYONNE – BAYONNE, NEW JERSEY

HYDROGRAPHIC SURVEY
PIER 3 ZONE
JULY 1999

DATE: 5–11–00 SCALE: 1"=40' **FIG. 8**



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3. COORDINATES ARE BASED ON THE NAD 83 NEW JERSEY MERCATOR AND EXPRESSED IN FEET.
4. ALL CONTOURS ARE NEGATIVE AND IN FEET REFERENCED TO MEAN LOW WATER DATUM (MLWD).
5. HYDROGRAPHIC DATA SHOWN HEREON WAS COLLECTED ON SEPTEMBER 14, 21 & 22, 1999. THE DATA WAS COLLECTED BY OCEAN AND COASTAL CONSULTANTS, INC. AND CAN ONLY REFLECT CONDITIONS AS THEY EXISTED DURING THE TIME OF SURVEY.

PNEUMATIC SEDIMENT SUSPENSION
SYSTEM INSTALLATION
IMTT BAYONNE – BAYONNE, NEW JERSEY

HYDROGRAPHIC SURVEY
SEPTEMBER 1999

DATE: 5–11–00 SCALE: 1"=100' **FIG. 9**

9212.3\TASK4\fig\9 (100)

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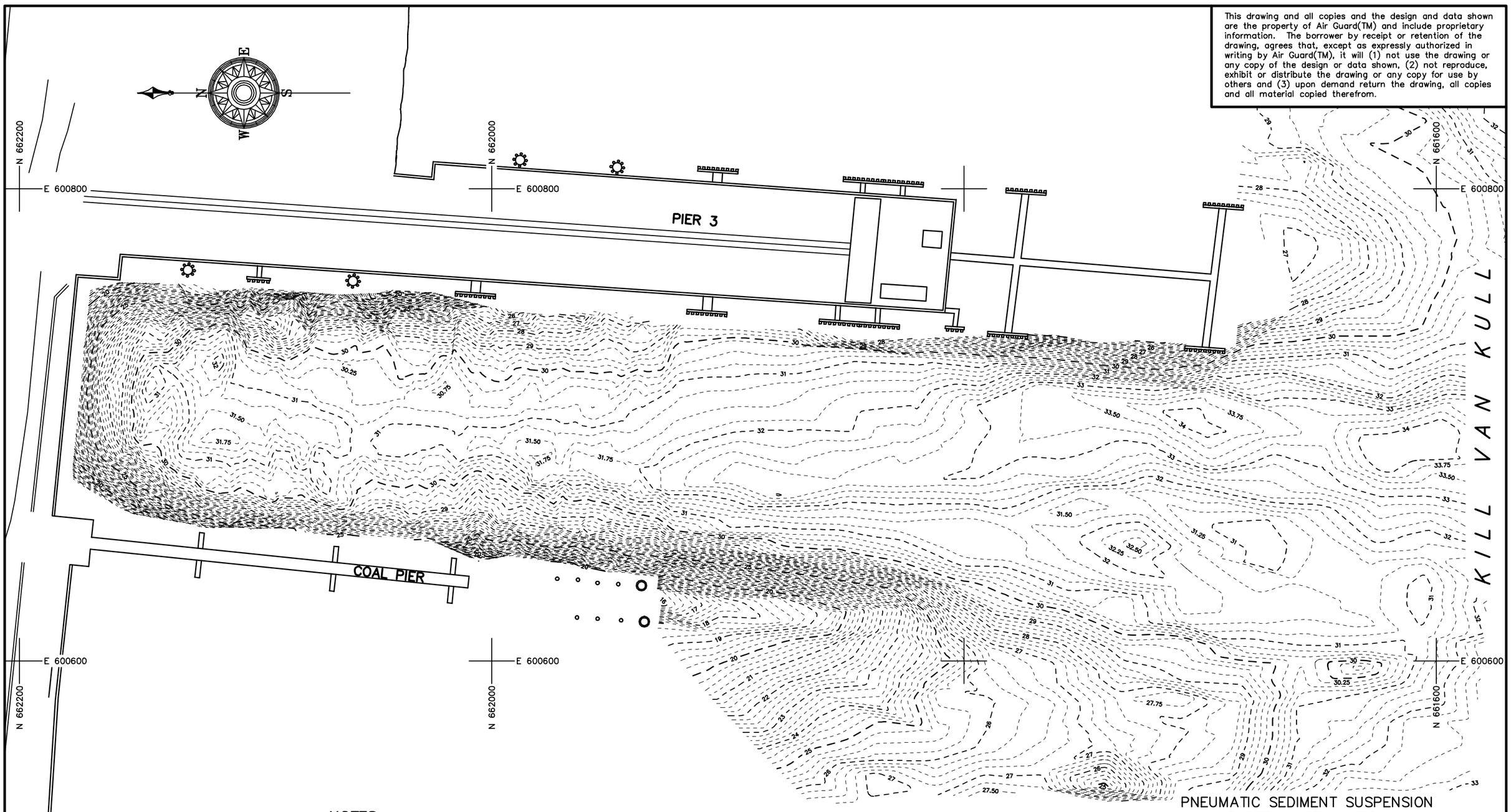

NOTES

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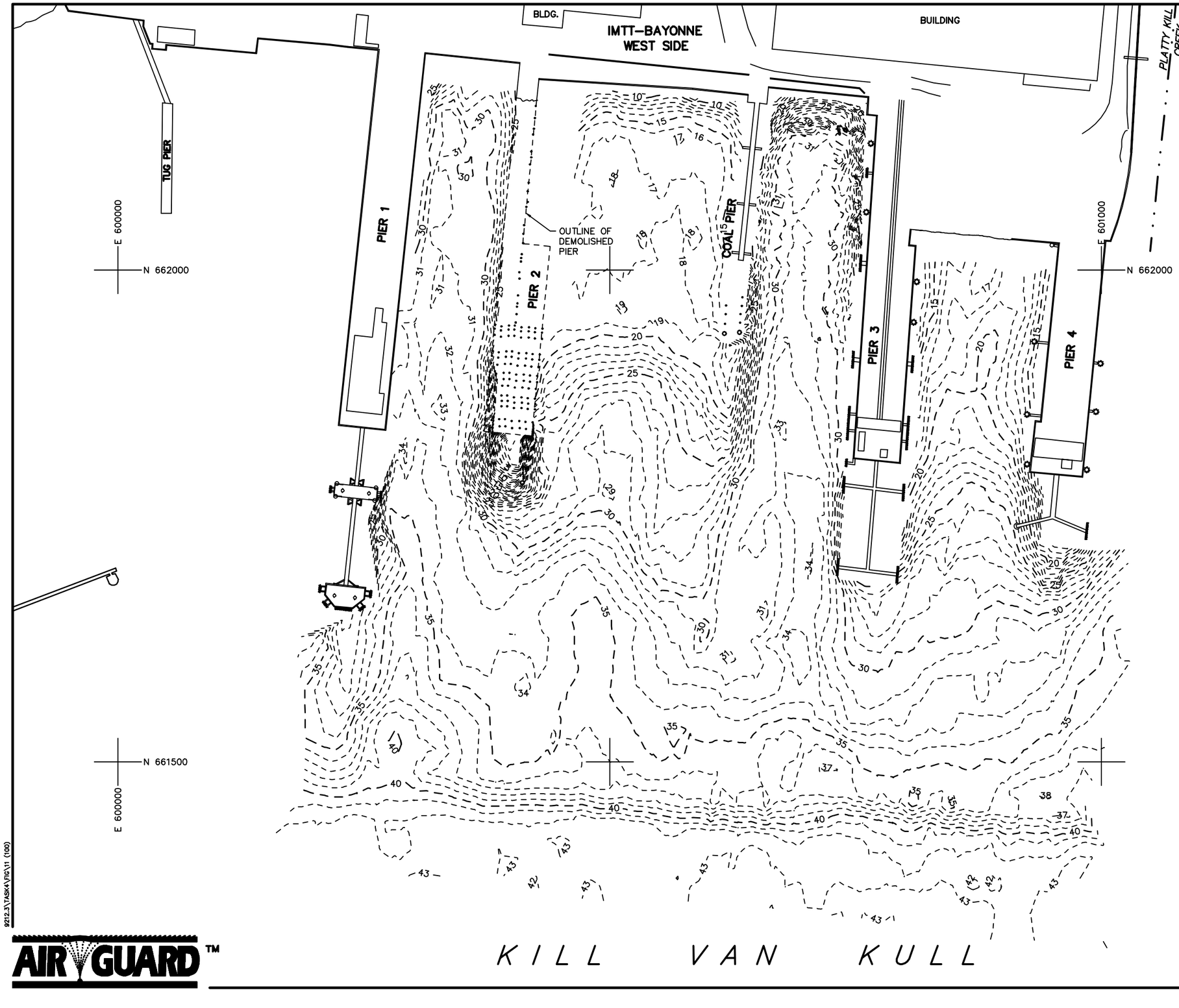
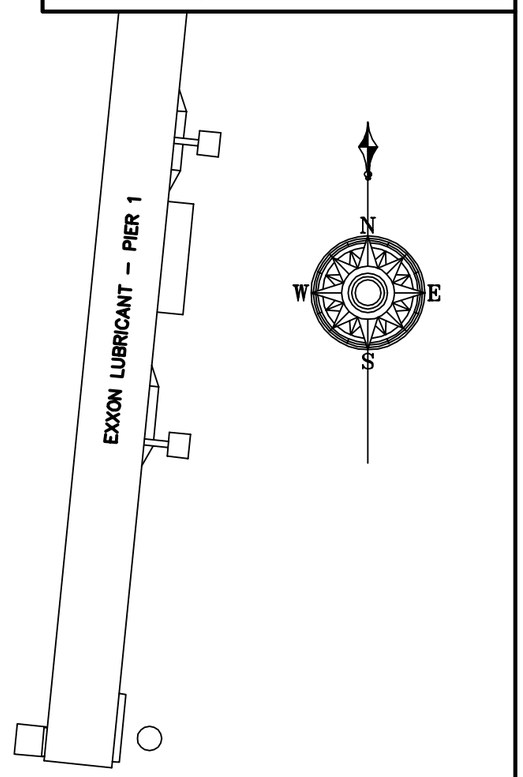
9212.3\TASK4\FIG\10 (40)

PNEUMATIC SEDIMENT SUSPENSION
SYSTEM INSTALLATION
IMTT BAYONNE – BAYONNE, NEW JERSEY

HYDROGRAPHIC SURVEY
PIER 3 ZONE
SEPTEMBER 1999

DATE: 5–11–00 SCALE: 1"=40' **FIG. 10**





NOTES

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4. ALL CONTOURS ARE NEGATIVE AND IN FEET REFERENCED TO MEAN LOW WATER DATUM (MLWD).
5. HYDROGRAPHIC DATA SHOWN HEREON WAS COLLECTED ON NOVEMBER 16 & 17, 1999. THE DATA WAS COLLECTED BY OCEAN AND COASTAL CONSULTANTS, INC. AND CAN ONLY REFLECT CONDITIONS AS THEY EXISTED DURING THE TIME OF SURVEY.

PNEUMATIC SEDIMENT SUSPENSION
SYSTEM INSTALLATION
IMTT BAYONNE – BAYONNE, NEW JERSEY

HYDROGRAPHIC SURVEY
NOVEMBER 1999

DATE: 5–11–00 SCALE: 1"=100' **FIG. 11**

9212.3\TASK4\FIG\11 (100)

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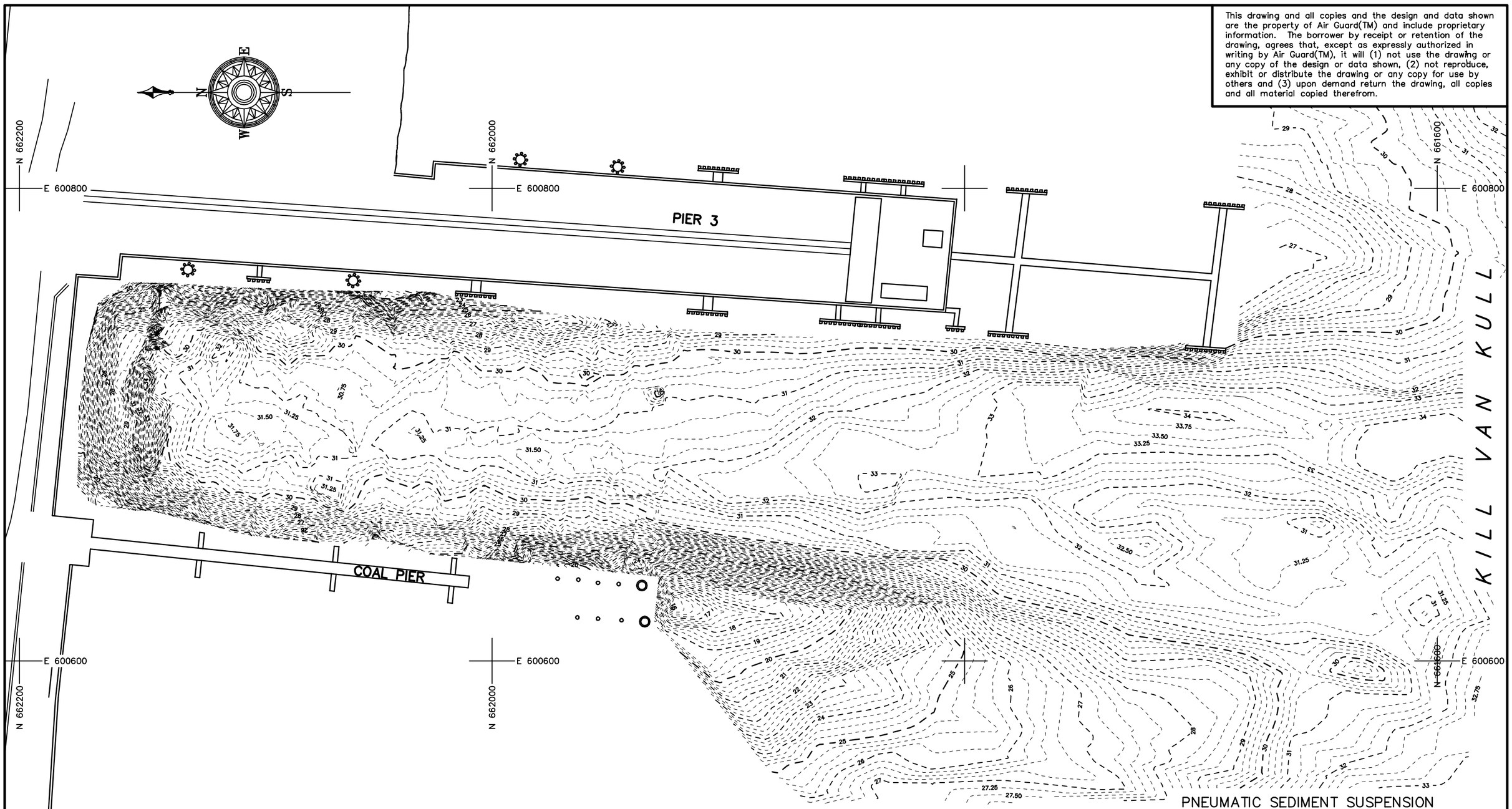

NOTES

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9212.3\TASK4\FIG\12 (40)

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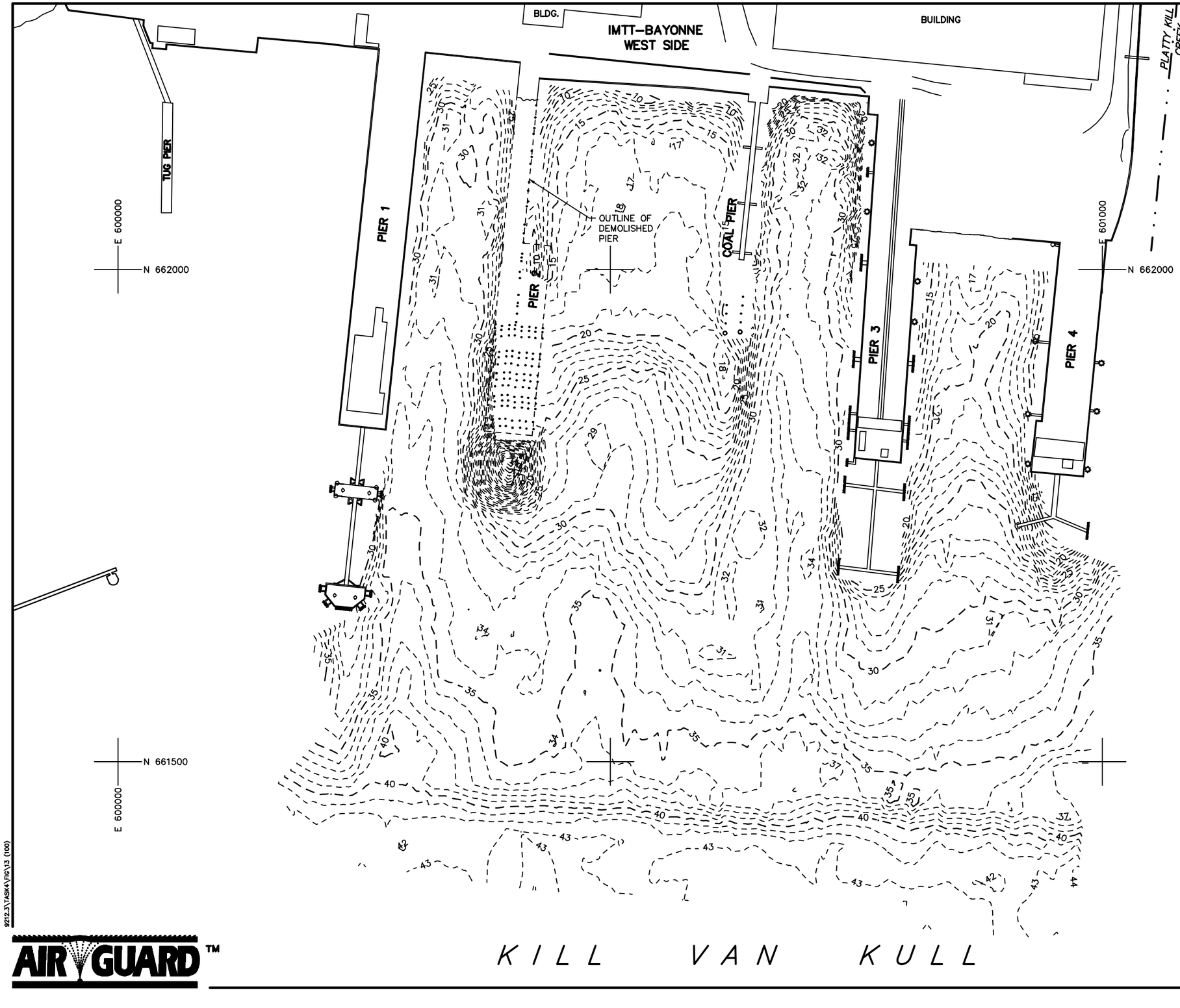
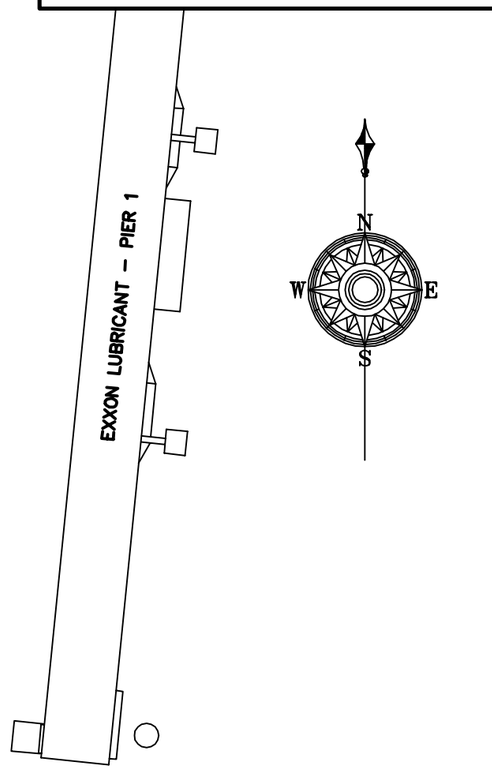
PNEUMATIC SEDIMENT SUSPENSION
SYSTEM INSTALLATION
IMTT BAYONNE – BAYONNE, NEW JERSEY

HYDROGRAPHIC SURVEY
PIER 3 ZONE
NOVEMBER 1999

DATE: 5–11–00 SCALE: 1"=40' **FIG. 12**





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PNEUMATIC SEDIMENT SUSPENSION
SYSTEM INSTALLATION
IMTT BAYONNE – BAYONNE, NEW JERSEY

HYDROGRAPHIC SURVEY
JANUARY 2000

DATE: 5–11–00 SCALE: 1"=100' **FIG. 13**

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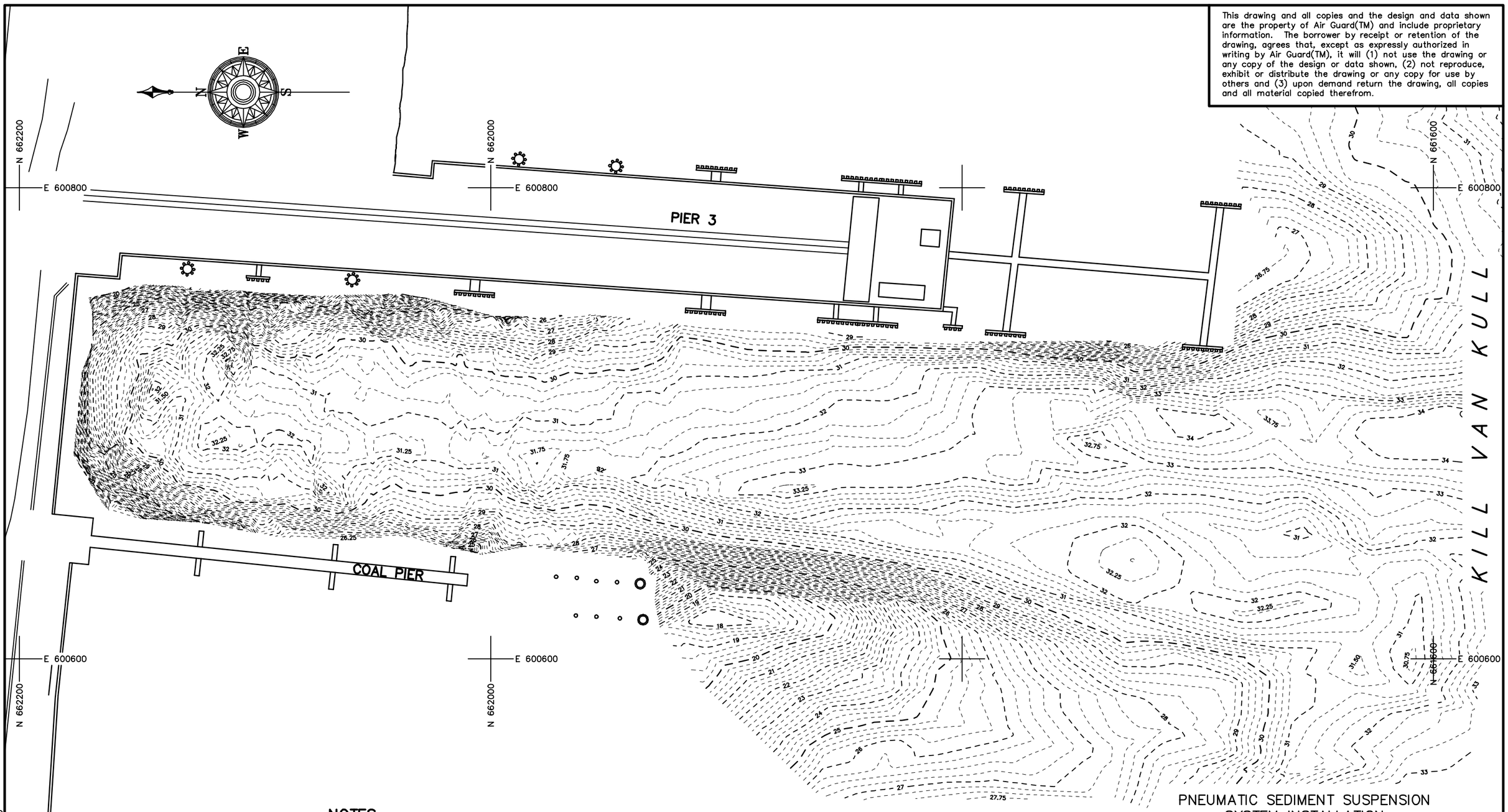
9212.3\TASK4\Fig\13 (100)



NOTES

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PNEUMATIC SEDIMENT SUSPENSION
SYSTEM INSTALLATION
IMTT BAYONNE – BAYONNE, NEW JERSEY

HYDROGRAPHIC SURVEY
PIER 3 ZONE
JANUARY 2000

DATE: 5–11–00 SCALE: 1"=40' **FIG. 14**

9212.3\TASK4\FIG\14 (40)

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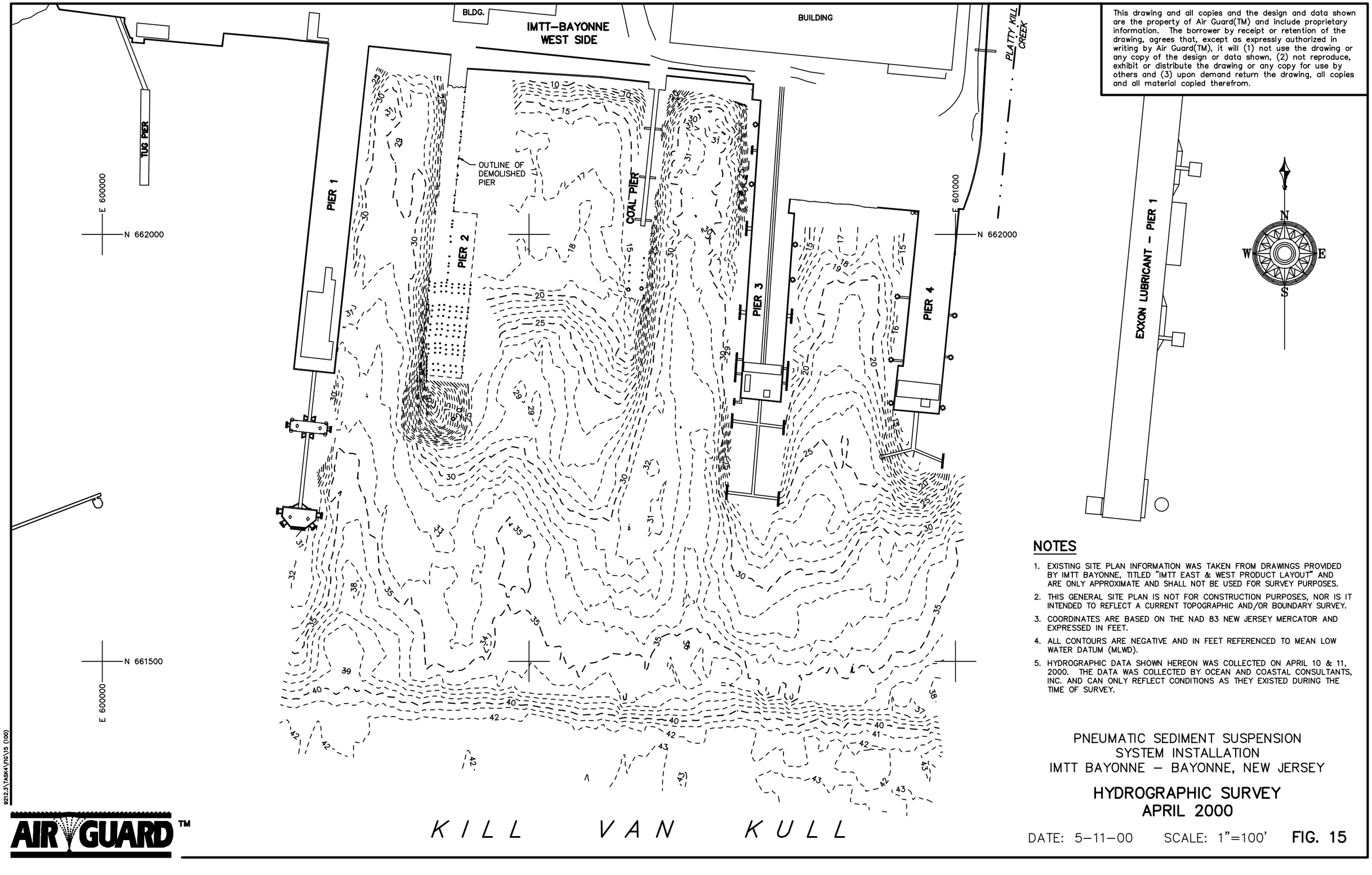

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PNEUMATIC SEDIMENT SUSPENSION
SYSTEM INSTALLATION
IMTT BAYONNE – BAYONNE, NEW JERSEY

HYDROGRAPHIC SURVEY
APRIL 2000

DATE: 5–11–00 SCALE: 1"=100' **FIG. 15**

9212.3\TASK4\File\15 (100)

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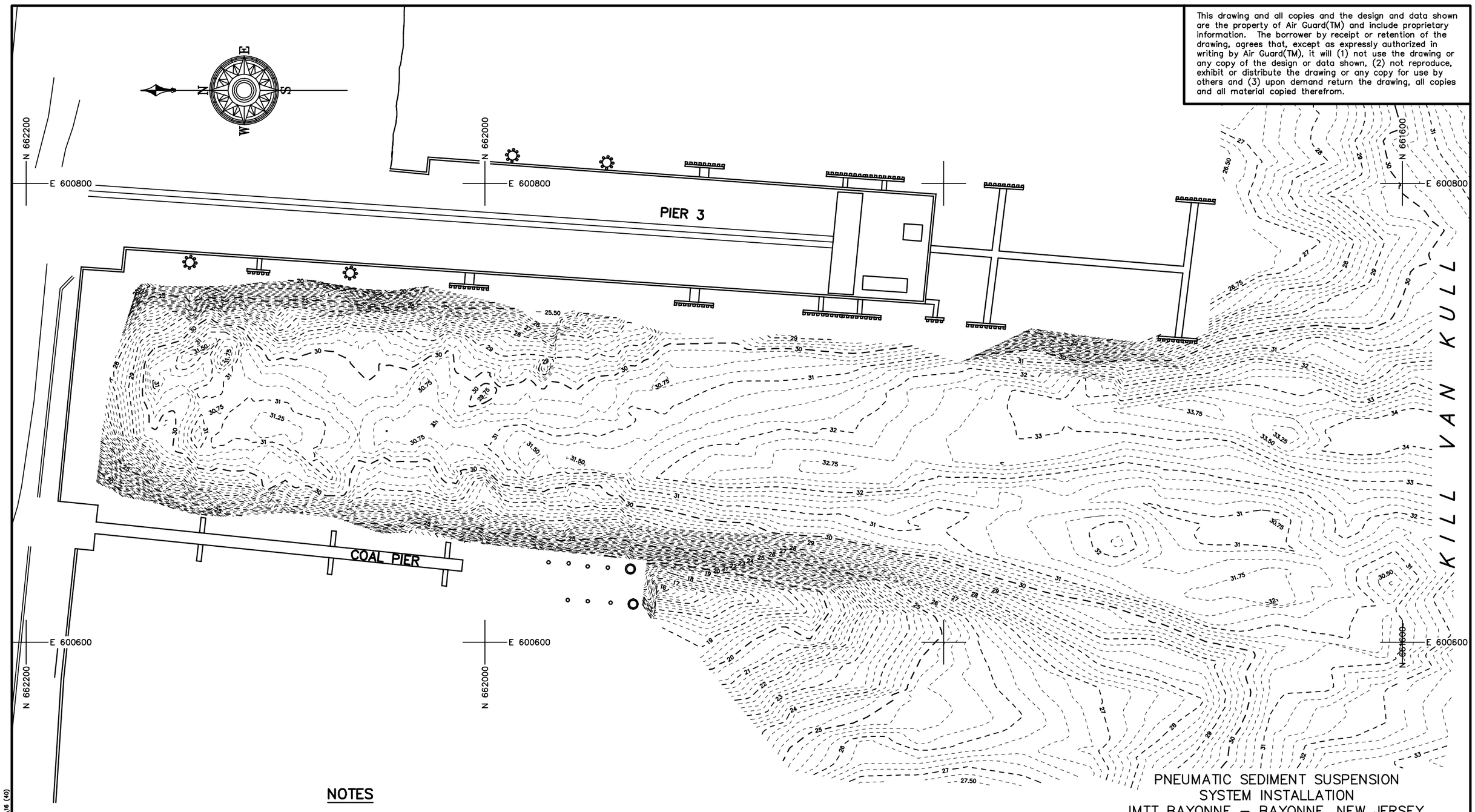

NOTES

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PNEUMATIC SEDIMENT SUSPENSION
SYSTEM INSTALLATION
IMTT BAYONNE – BAYONNE, NEW JERSEY

HYDROGRAPHIC SURVEY
PIER 3 ZONE
APRIL 2000

DATE: 5–11–00 SCALE: 1"=40' **FIG. 16**

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9212.3\TASK4\FIG\16 (40)

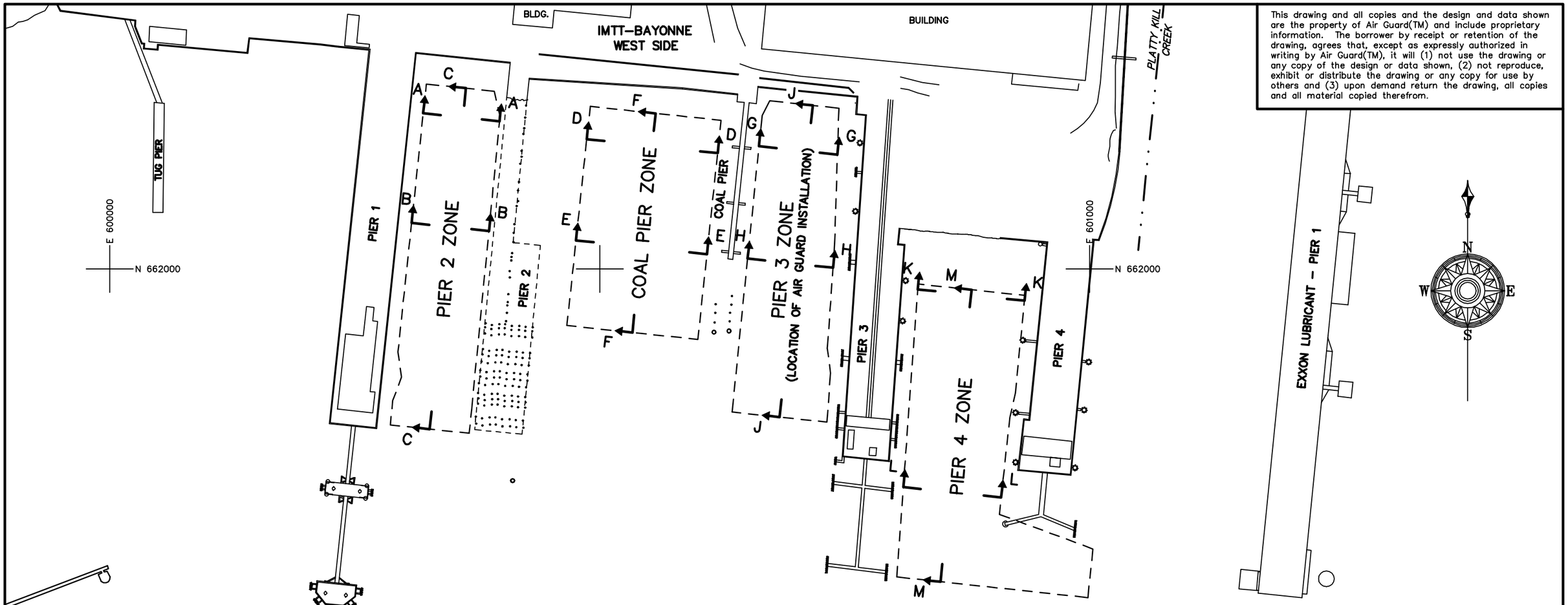
APPENDIX D

HYDROGRAPHIC SURVEY CROSS-SECTIONS

Figure 17 Cross Section Key Plan
Figure 18 Section A-A at Pier 2 Zone
Figure 19 Section B-B at Pier 2 Zone
Figure 20 Section C-C at Pier 2 Zone
Figure 21 Section D-D at Coal Pier Zone
Figure 22 Section E-E at Coal Pier Zone
Figure 23 Section F-F at Coal Pier Zone
Figure 24 Section G-G at Pier 3 (Air Guard) Zone
Figure 25 Section H-H at Pier 3 (Air Guard) Zone
Figure 26 Section J-J at Pier 3 (Air Guard) Zone
Figure 27 Section K-K at Pier 4 Zone
Figure 28 Section L-L at Pier 4 Zone
Figure 29 Section M-M at Pier 4 Zone

Air Guard™ Pneumatic Sediment Suspension System

Ocean and Coastal Consultants, Inc.
35 Corporate Drive
Trumbull, CT 06611
203-268-5007



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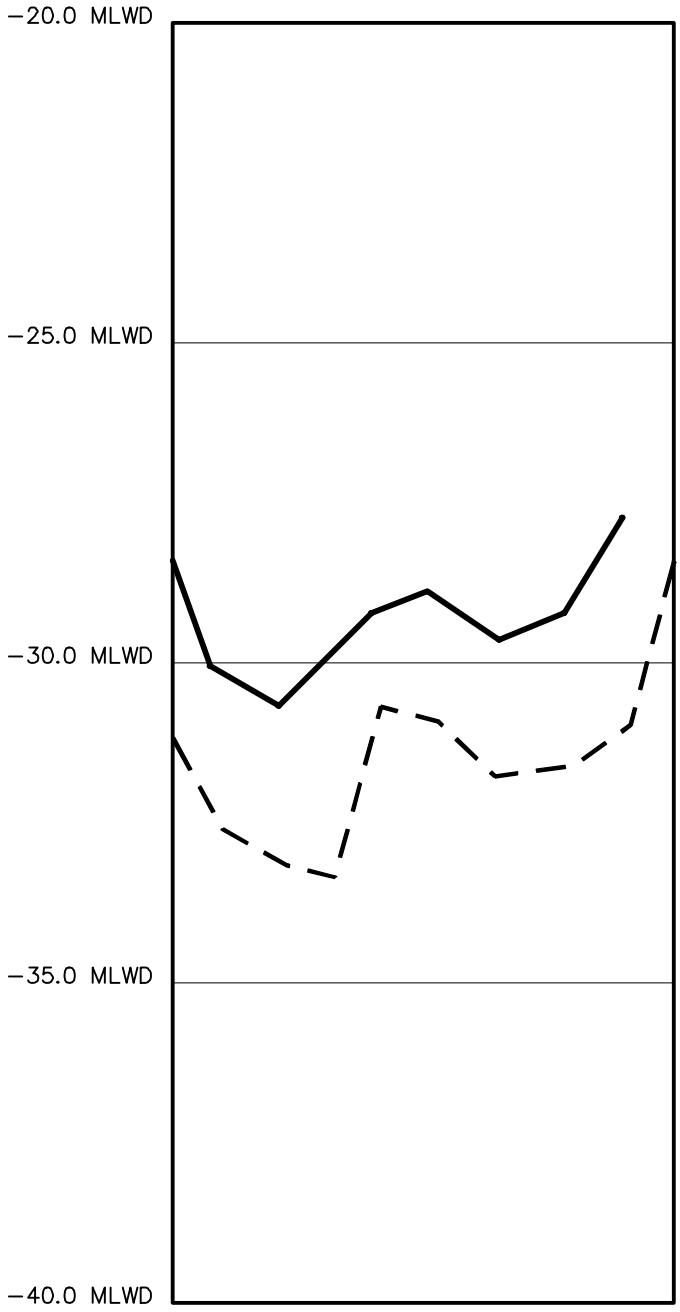
PNEUMATIC SEDIMENT SUSPENSION
SYSTEM INSTALLATION
IMTT BAYONNE – BAYONNE, NEW JERSEY

CROSS–SECTION KEY PLAN

DATE: 5–11–00 SCALE: 1"=100' **FIG. 17**

9212.3\TASK4\FIG\17 (100)

AIR GUARD™



VERT. SCALE: 1"=3'
HORIZ. SCALE: 1"=30'

LEGEND

— — — MARCH 1999
——— APRIL 2000

REV. 1–16–01

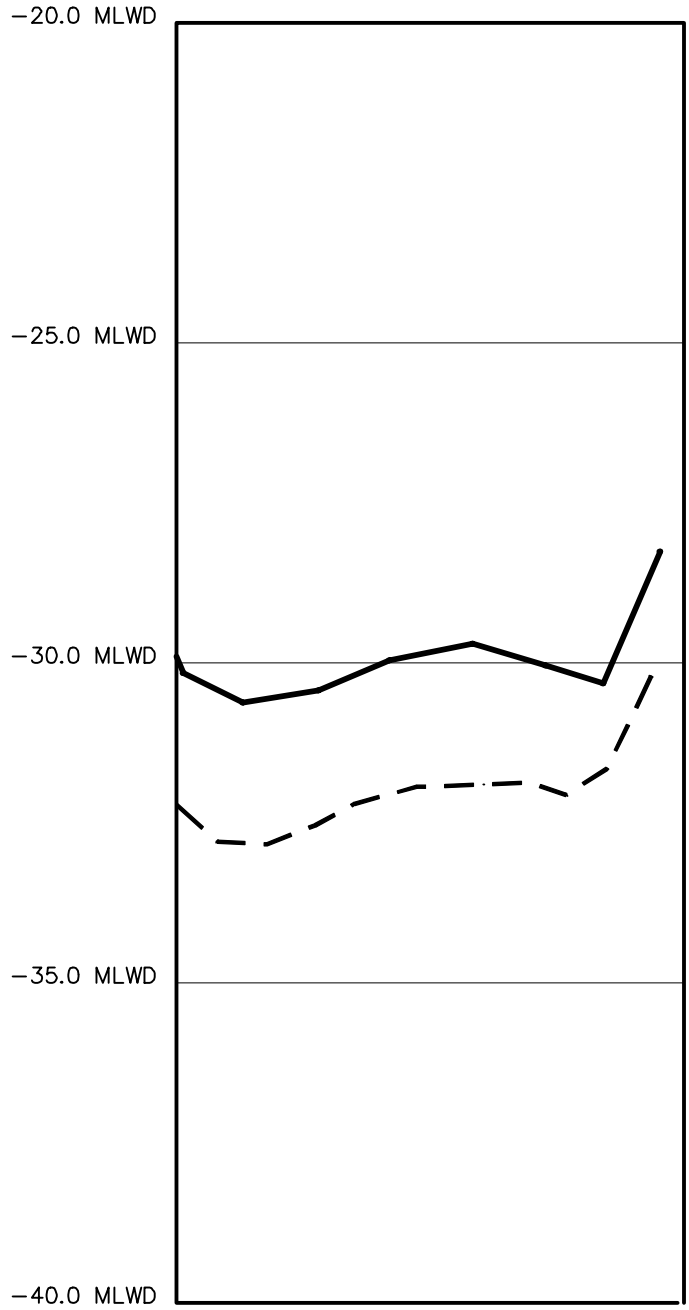
PNEUMATIC SEDIMENT SUSPENSION
SYSTEM INSTALLATION
IMTT BAYONNE – BAYONNE, NEW JERSEY

SECTION A–A AT PIER 2 ZONE

DATE: 5–11–00 SCALE: AS NOTED **FIG. 18**

AIR GUARD™

9212.3\TASK4\FIG\18 (30)



VERT. SCALE: 1"=3'
HORIZ. SCALE: 1"=30'

LEGEND

— — — MARCH 1999
——— APRIL 2000

REV. 1–16–01

PNEUMATIC SEDIMENT SUSPENSION
SYSTEM INSTALLATION
IMTT BAYONNE – BAYONNE, NEW JERSEY

SECTION B–B AT PIER 2 ZONE

DATE: 5–11–00 SCALE: AS NOTED **FIG. 19**

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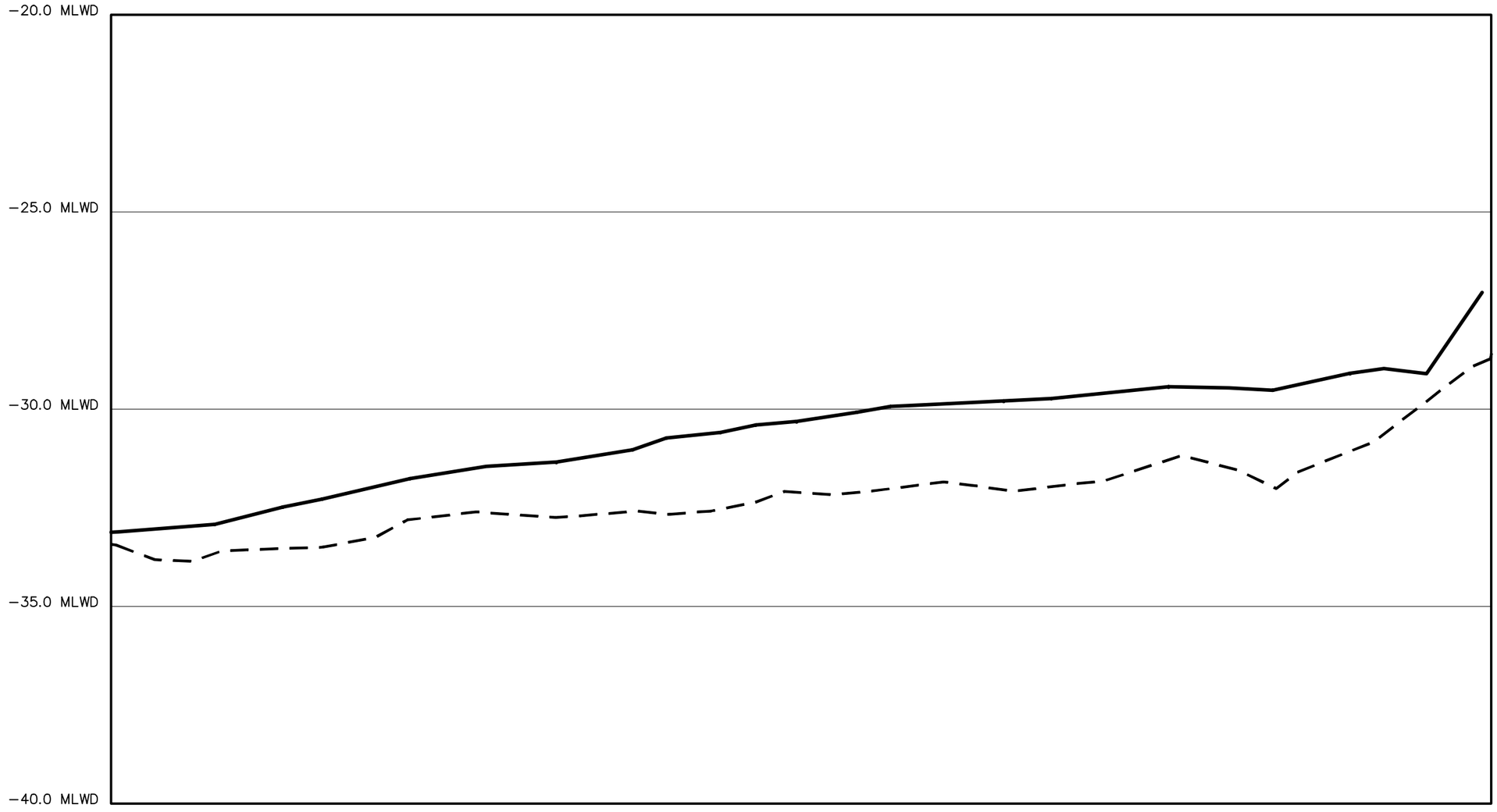
9212.3\TASK4\FIG\19 (30)



VERT. SCALE: 1"=3'
HORIZ. SCALE: 1"=30'

LEGEND

— — — MARCH 1999
——— APRIL 2000

REV. 1–16–01

9212.3\TASK4\FIG\20 (30)

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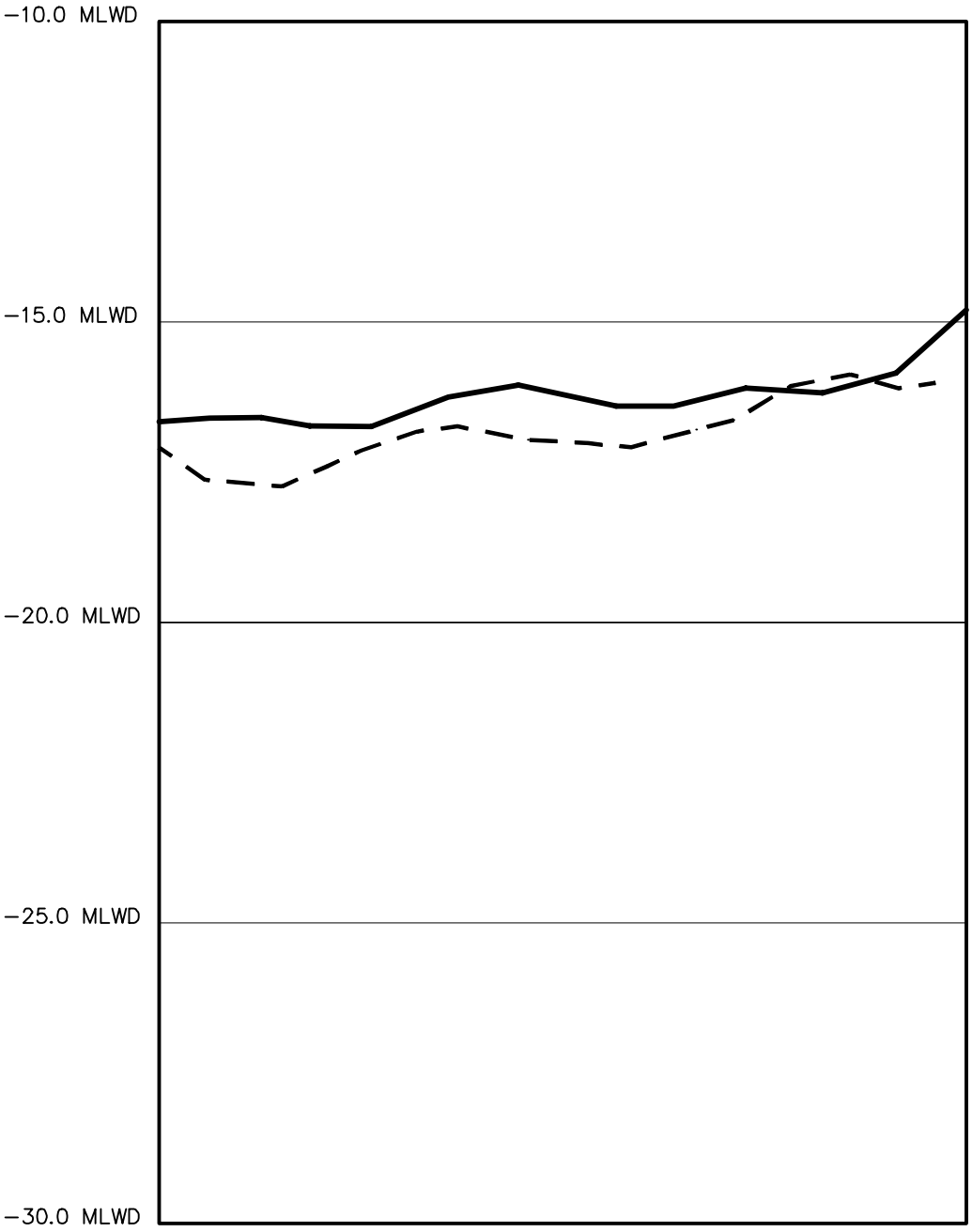
PNEUMATIC SEDIMENT SUSPENSION
SYSTEM INSTALLATION
IMTT BAYONNE – BAYONNE, NEW JERSEY

SECTION C–C AT PIER 2 ZONE

DATE: 5–11–00 SCALE: AS NOTED **FIG. 20**



VERT. SCALE: 1"=3'
HORIZ. SCALE: 1"=30'

LEGEND

— — — MARCH 1999
——— APRIL 2000

REV. 1−16−01

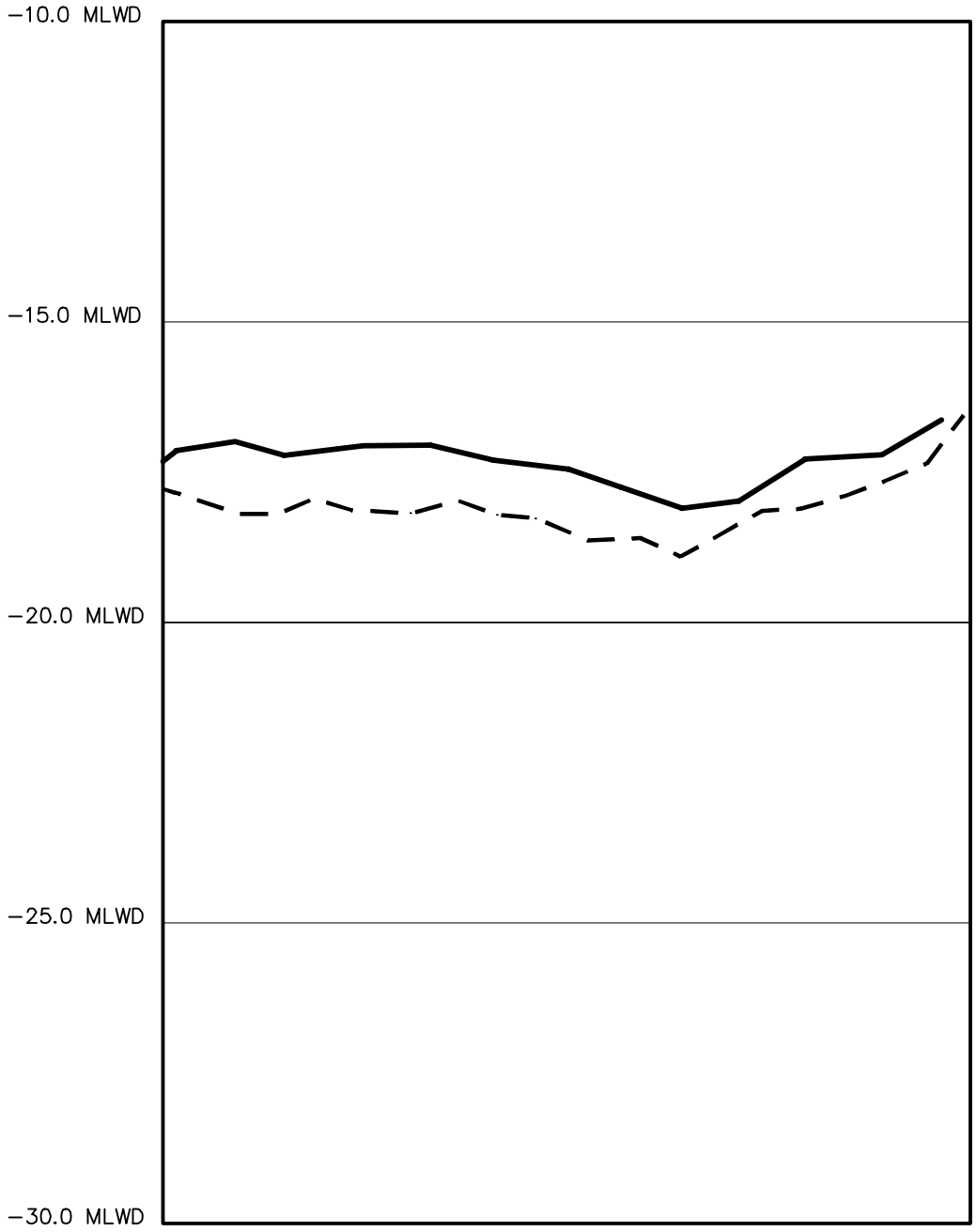
PNEUMATIC SEDIMENT SUSPENSION
SYSTEM INSTALLATION
IMTT BAYONNE − BAYONNE, NEW JERSEY

SECTION D−D AT COAL PIER ZONE

DATE: 5−11−00 SCALE: AS NOTED **FIG. 21**

AIR GUARD™

9212.3\TASK4\FIGV21 (30)



VERT. SCALE: 1"=3'
HORIZ. SCALE: 1"=30'

LEGEND

— — — MARCH 1999
——— APRIL 2000

REV. 1−16−01

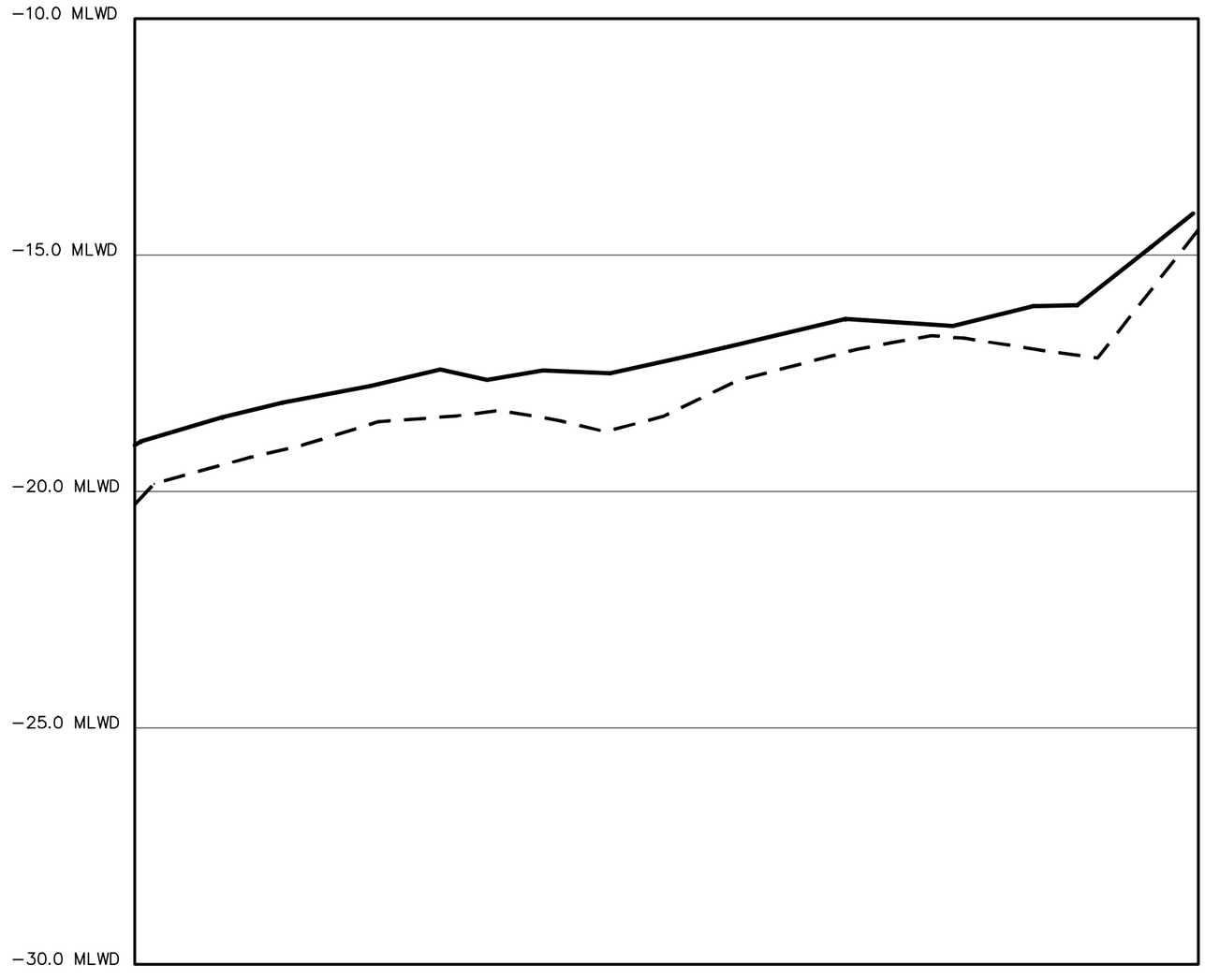
PNEUMATIC SEDIMENT SUSPENSION
SYSTEM INSTALLATION
IMTT BAYONNE − BAYONNE, NEW JERSEY

SECTION E−E AT COAL PIER ZONE

DATE: 5−11−00 SCALE: AS NOTED **FIG. 22**

AIR GUARD™

9212.3\TASK4\FIG\22 (30)



VERT. SCALE: 1"=3'
HORIZ. SCALE: 1"=30'

LEGEND

— — — MARCH 1999
——— APRIL 2000

REV. 1–16–01

9212.3\TASK4\FIG\23 (30)

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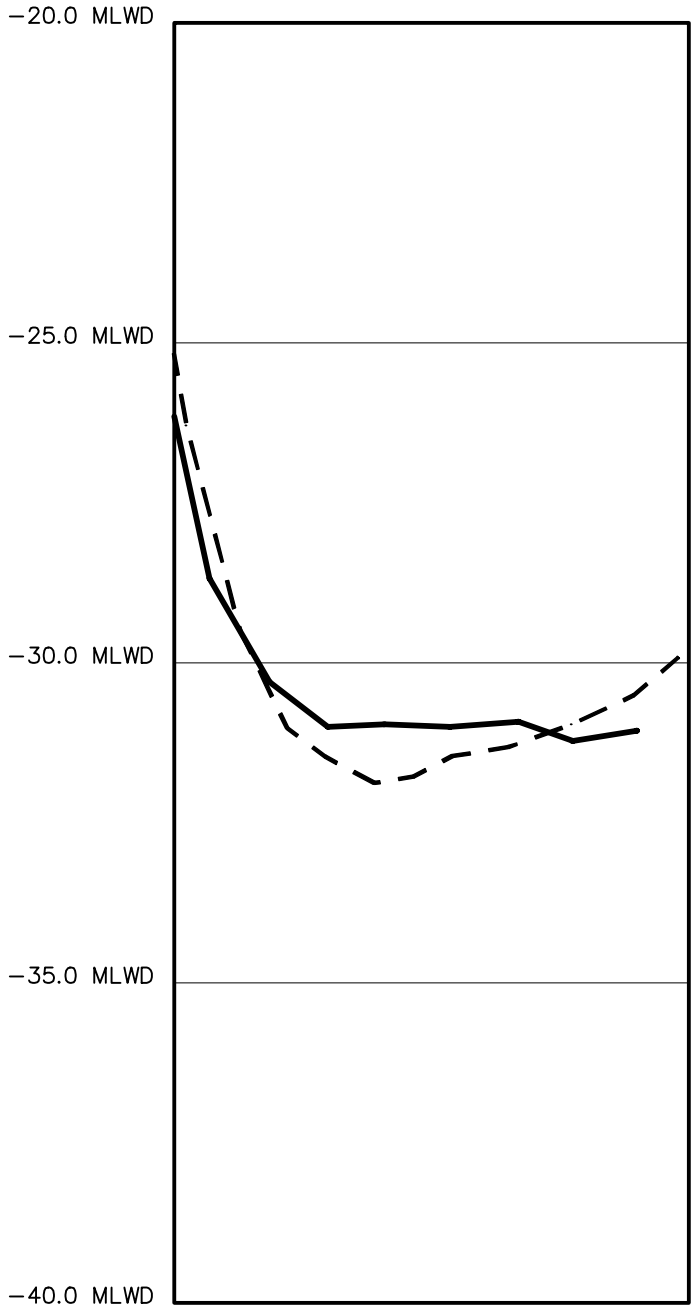
PNEUMATIC SEDIMENT SUSPENSION
SYSTEM INSTALLATION
IMTT BAYONNE – BAYONNE, NEW JERSEY

SECTION F–F AT COAL PIER ZONE

DATE: 5–11–00 SCALE: AS NOTED **FIG. 23**



VERT. SCALE: 1"=3'
HORIZ. SCALE: 1"=30'

LEGEND

— — — MARCH 1999
——— APRIL 2000

REV. 1–16–01

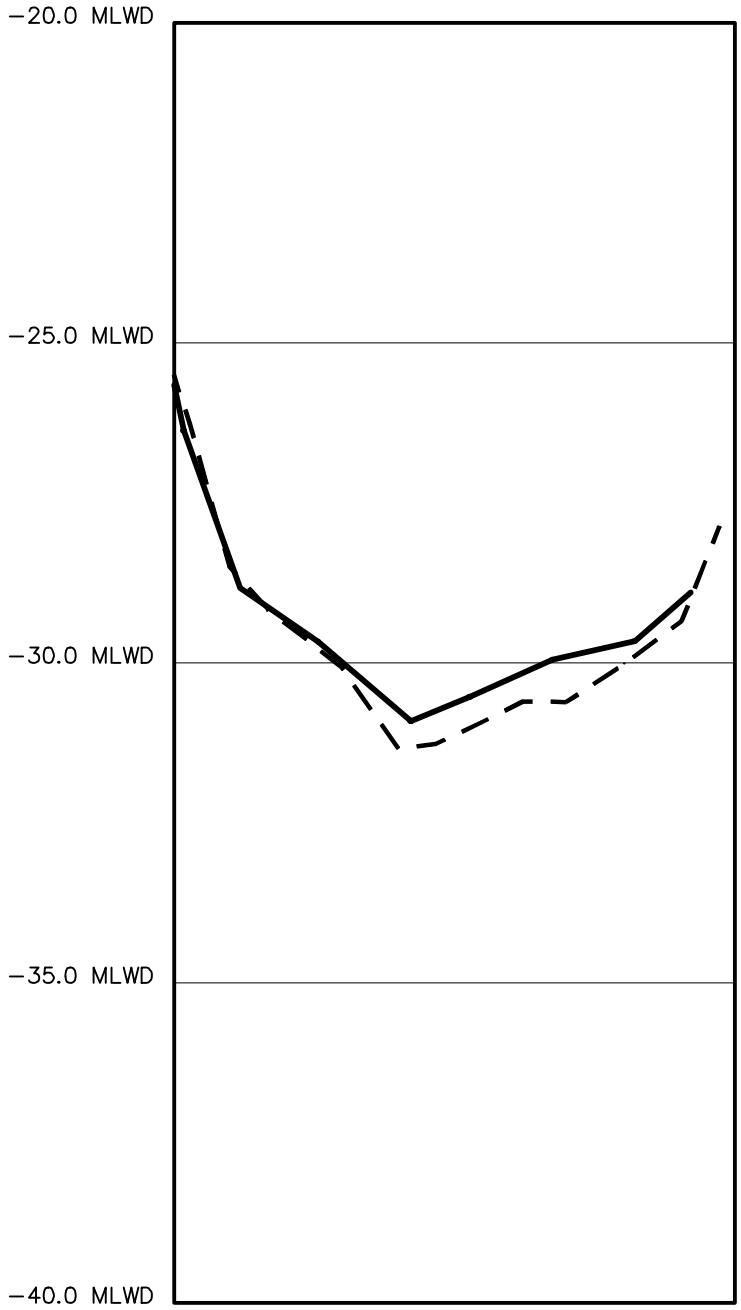
PNEUMATIC SEDIMENT SUSPENSION
SYSTEM INSTALLATION
IMTT BAYONNE – BAYONNE, NEW JERSEY

SECTION G–G AT
PIER 3 (AIR GUARD) ZONE

DATE: 5–11–00 SCALE: AS NOTED **FIG. 24**

AIR GUARD™

9212.3\TASK4\FIG\24 (30)



VERT. SCALE: 1"=3'
HORIZ. SCALE: 1"=30'

LEGEND

— — — MARCH 1999
——— APRIL 2000

REV. 1–16–01

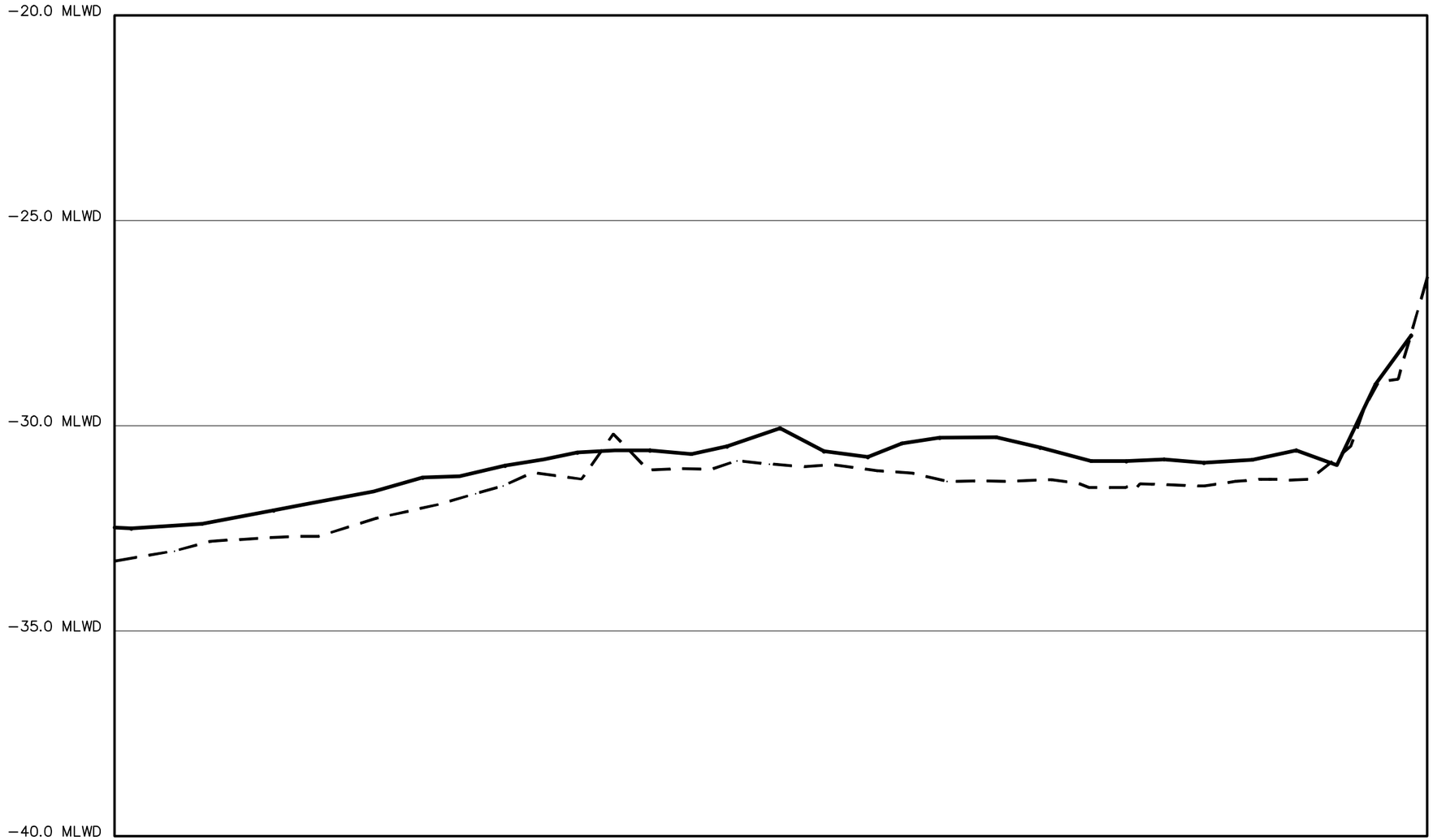
PNEUMATIC SEDIMENT SUSPENSION
SYSTEM INSTALLATION
IMTT BAYONNE – BAYONNE, NEW JERSEY

SECTION H–H AT
PIER 3 (AIR GUARD) ZONE

DATE: 5–11–00 SCALE: AS NOTED **FIG. 25**

AIR GUARD™

9212.3\TASK4\FIG\25 (30)



VERT. SCALE: 1"=3'
HORIZ. SCALE: 1"=30'

LEGEND

— — — MARCH 1999
——— APRIL 2000

REV. 1−16−01

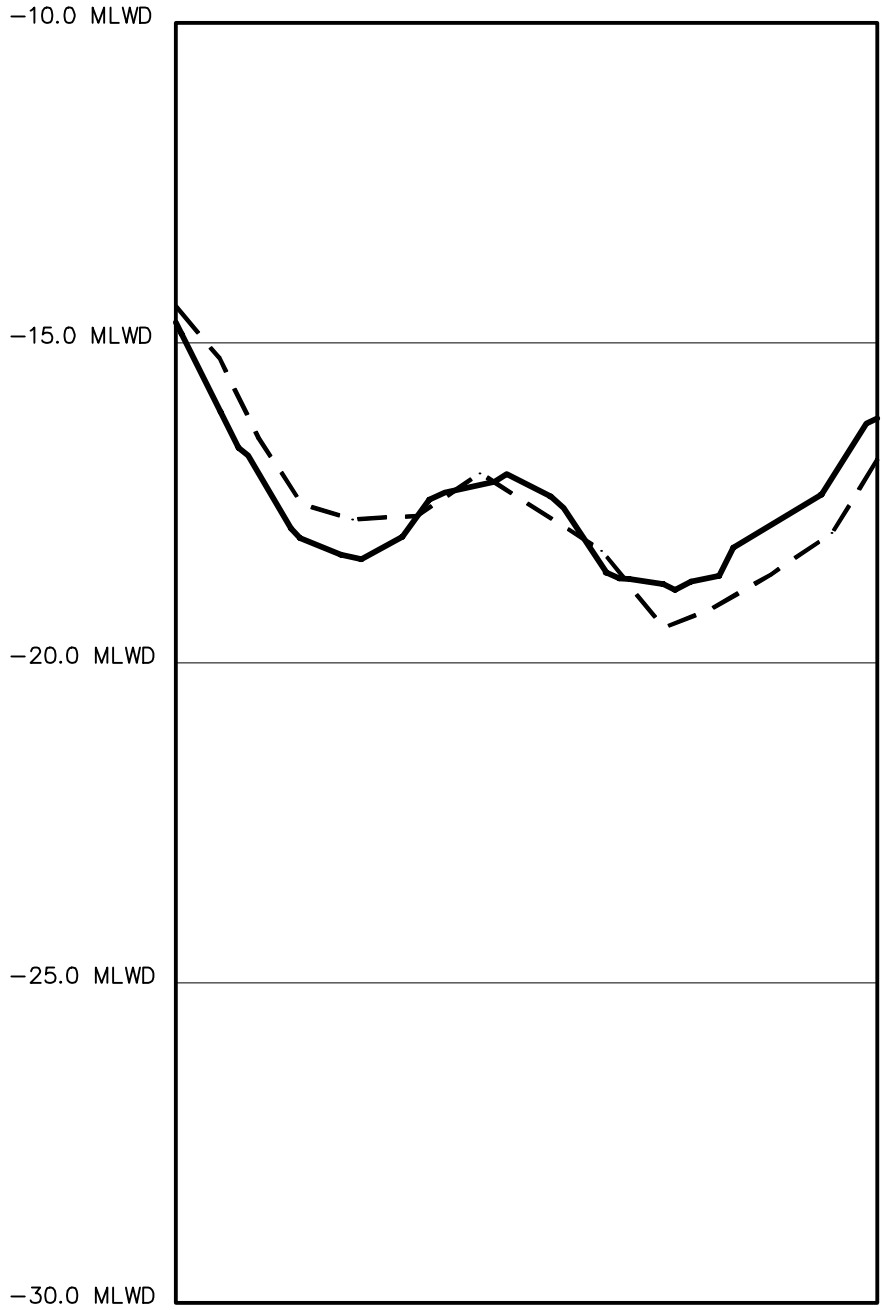
9212.3\TASK4\FIG\26 (30)

AIR GUARD™

PNEUMATIC SEDIMENT SUSPENSION
SYSTEM INSTALLATION
IMTT BAYONNE − BAYONNE, NEW JERSEY

SECTION J−J AT
PIER 3 (AIR GUARD) ZONE

DATE: 5−11−00 SCALE: AS NOTED **FIG. 26**



VERT. SCALE: 1"=3'
HORIZ. SCALE: 1"=30'

LEGEND

— — — MARCH 1999
——— APRIL 2000

REV. 1–16–01

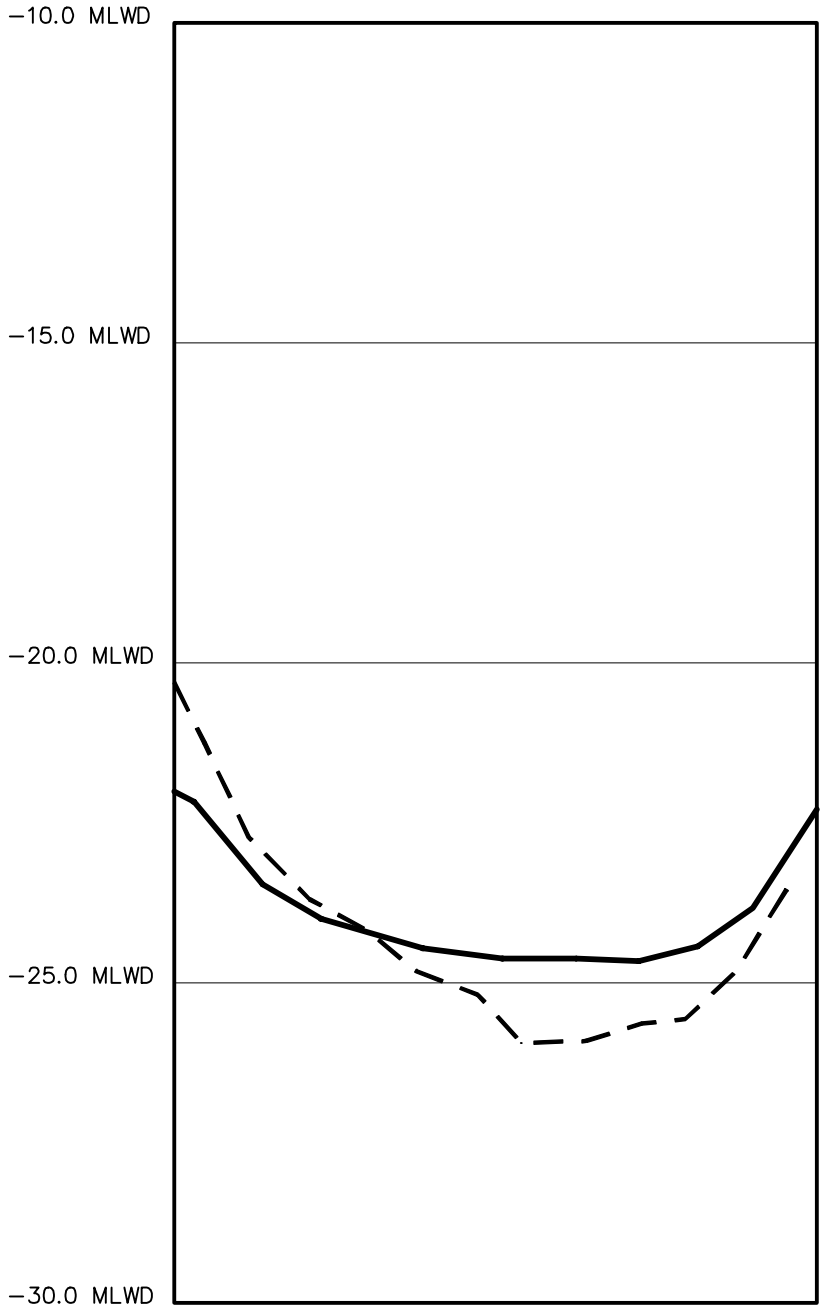
PNEUMATIC SEDIMENT SUSPENSION
SYSTEM INSTALLATION
IMTT BAYONNE – BAYONNE, NEW JERSEY

SECTION K–K AT PIER 4 ZONE

DATE: 5–11–00 SCALE: AS NOTED **FIG. 27**

AIR GUARD™

9212.3\TASK4\FIG\27 (30)



VERT. SCALE: 1"=3'
HORIZ. SCALE: 1"=30'

LEGEND

— — — MARCH 1999
——— APRIL 2000

REV. 1–16–01

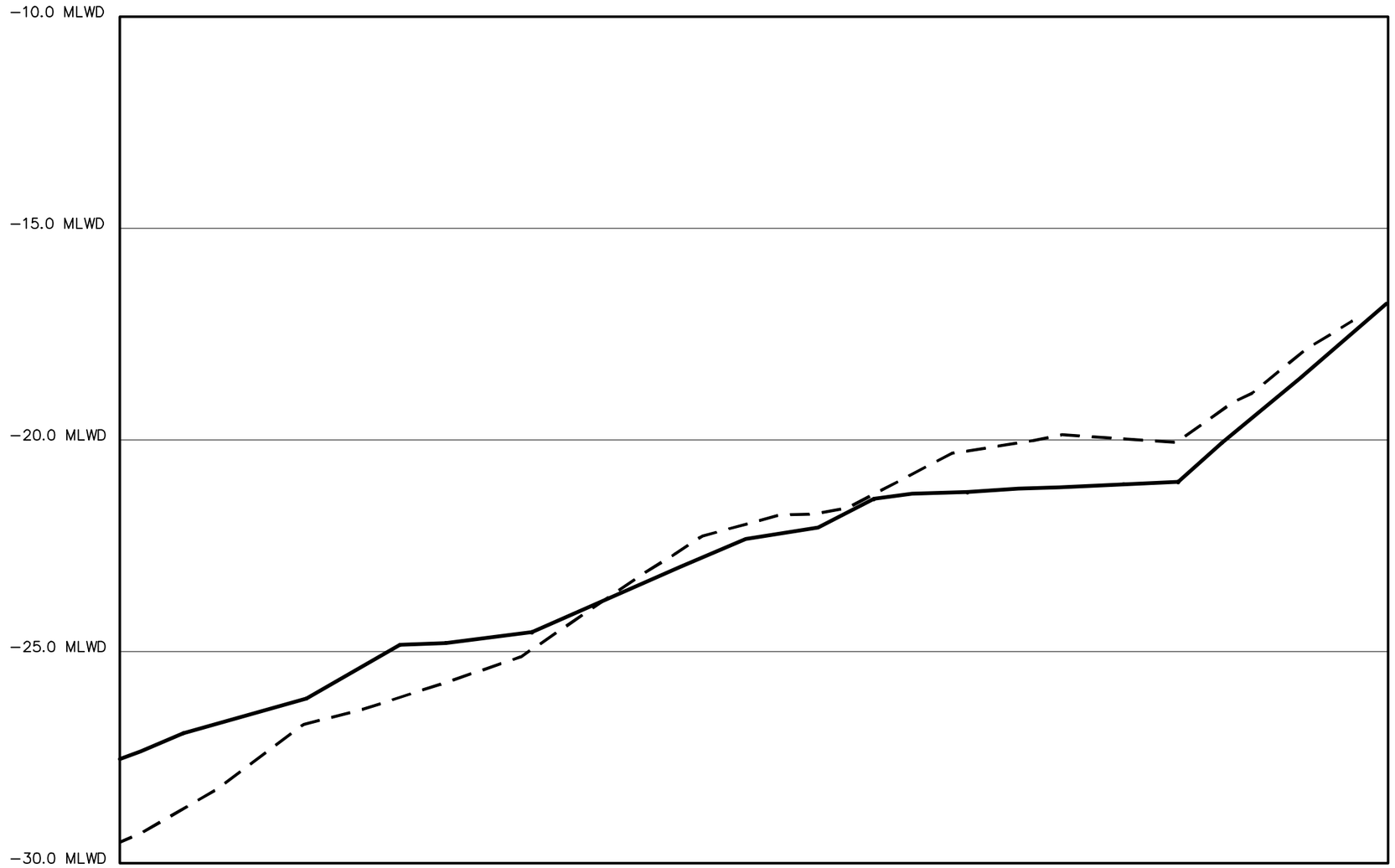
PNEUMATIC SEDIMENT SUSPENSION
SYSTEM INSTALLATION
IMTT BAYONNE – BAYONNE, NEW JERSEY

SECTION L–L AT PIER 4 ZONE

DATE: 5–11–00 SCALE: AS NOTED **FIG. 28**

AIR GUARD™

9212.3\TASK4\FIG\28 (30)



VERT. SCALE: 1"=3'
HORIZ. SCALE: 1"=30'

LEGEND

— — — MARCH 1999
——— APRIL 2000

REV. 1–16–01

9212.3\TASK4\FIG\29 (30)

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PNEUMATIC SEDIMENT SUSPENSION
SYSTEM INSTALLATION
IMTT BAYONNE – BAYONNE, NEW JERSEY

SECTION M–M AT PIER 4 ZONE

DATE: 5–11–00 SCALE: AS NOTED **FIG. 29**

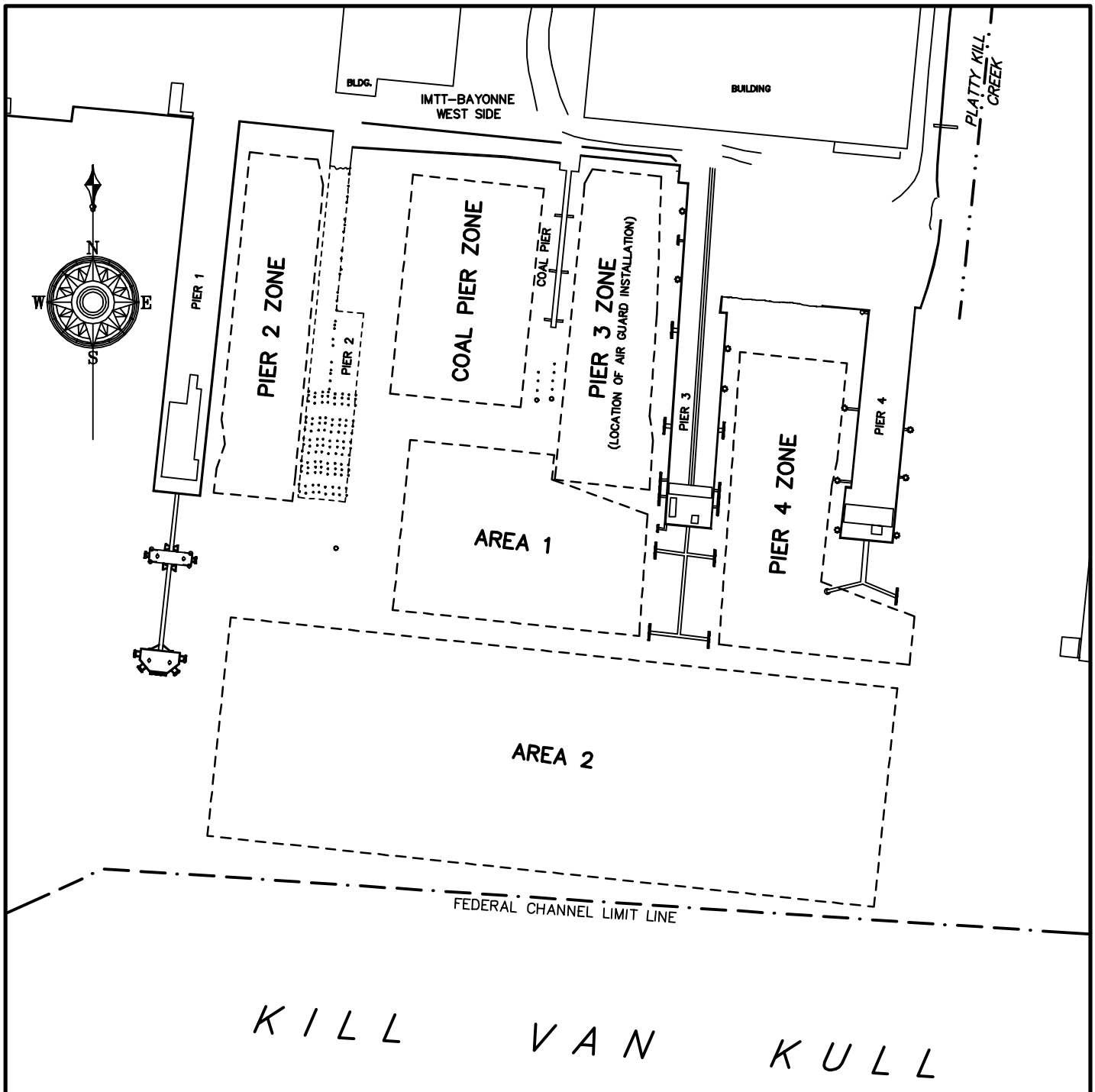
APPENDIX E

HYDROGRAPHIC SURVEY VOLUME COMPARISON

Figure 30 Volume Comparison Key Plan
Figure 31 Hydrographic Survey Volume Comparison Data

Air Guard™ Pneumatic Sediment Suspension System

Ocean and Coastal Consultants, Inc.
35 Corporate Drive
Trumbull, CT 06611
203-268-5007



9212.3\TASK4\FIG\30 (150)

PNEUMATIC SEDIMENT SUSPENSION
SYSTEM INSTALLATION
IMTT BAYONNE – BAYONNE, NEW JERSEY

VOLUME COMPARISON KEY PLAN

AIR GUARD™

DATE: 5–11–00 SCALE: 1"=150' **FIG. 30**

OCEAN AND COASTAL CONSULTANTS, INC.
PNEUMATIC SEDIMENT SUSPENSION SYSTEM
Job #9212.3

HYDROGRAPHIC SURVEY VOLUME TABULATION

PIER 2 VOLUMES (CU YDS)

SURVEY DATE	VOLUME
05/12/1999	8,485
07/15/1999	8,593
09/22/1999	8,927
11/16/1999	9,291
01/13/2000	9,346
04/11/2000	9,933

PIER 3 VOLUMES (CU YDS)

SURVEY DATE	VOLUME
05/10/1999	9,751
07/13/1999	9,816
09/21/1999	10,036
11/16/1999	10,110
01/12/2000	9,745
04/11/2000	10,251

PIER 4 VOLUMES (CU YDS)

SURVEY DATE	VOLUME
05/12/1999	23,892
07/15/1999	24,164
09/14/1999	24,484
11/17/1999	24,449
01/12/2000	24,308
04/10/2000	24,339

COAL PIER VOLUMES (CU YDS)

SURVEY DATE	VOLUME
05/10/1999	24,788
07/14/1999	25,005
09/14/1999	24,811
11/17/1999	25,147
01/13/2000	25,386
04/11/2000	25,873

AREA 1 VOLUMES (CU YDS)

SURVEY DATE	VOLUME
05/10/1999	16,336
07/13/1999	16,568
09/21/1999	16,736
11/17/1999	16,770
01/12/2000	16,556
04/10/2000	17,105

AREA 2 VOLUMES (CU YDS)

SURVEY DATE	VOLUME
05/10/1999	89,630
07/14/1999	90,870
09/14/1999	91,657
11/17/1999	90,448
01/12/2000	90,240
04/10/2000	92,337

ALL VOLUME TEMPLATES ARE REFERENCED TO (-40.0' MLW) EXCEPT AREA # 2 (-50.0' MLW)
BASELINE DATA NOT INCLUDED

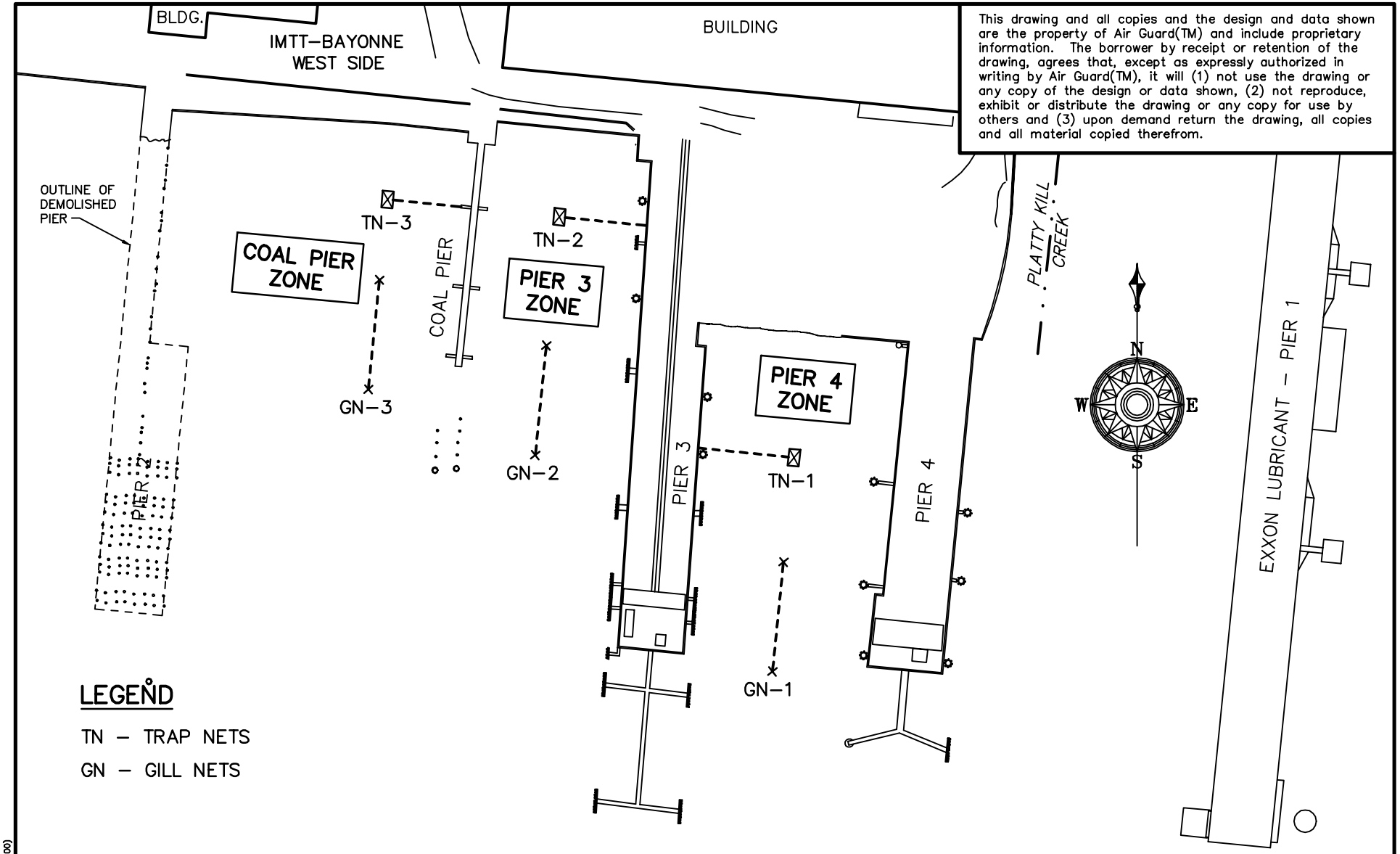
APPENDIX F

ENVIRONMENTAL SURVEY LOCATIONS

Figure 32 Aquatic Sampling Sites - Trap Nets and Gill Nets
Figure 33 Aquatic Sampling Sites - Trawl and Water Quality

Air Guard™ Pneumatic Sediment Suspension System

Ocean and Coastal Consultants, Inc.
35 Corporate Drive
Trumbull, CT 06611
203-268-5007



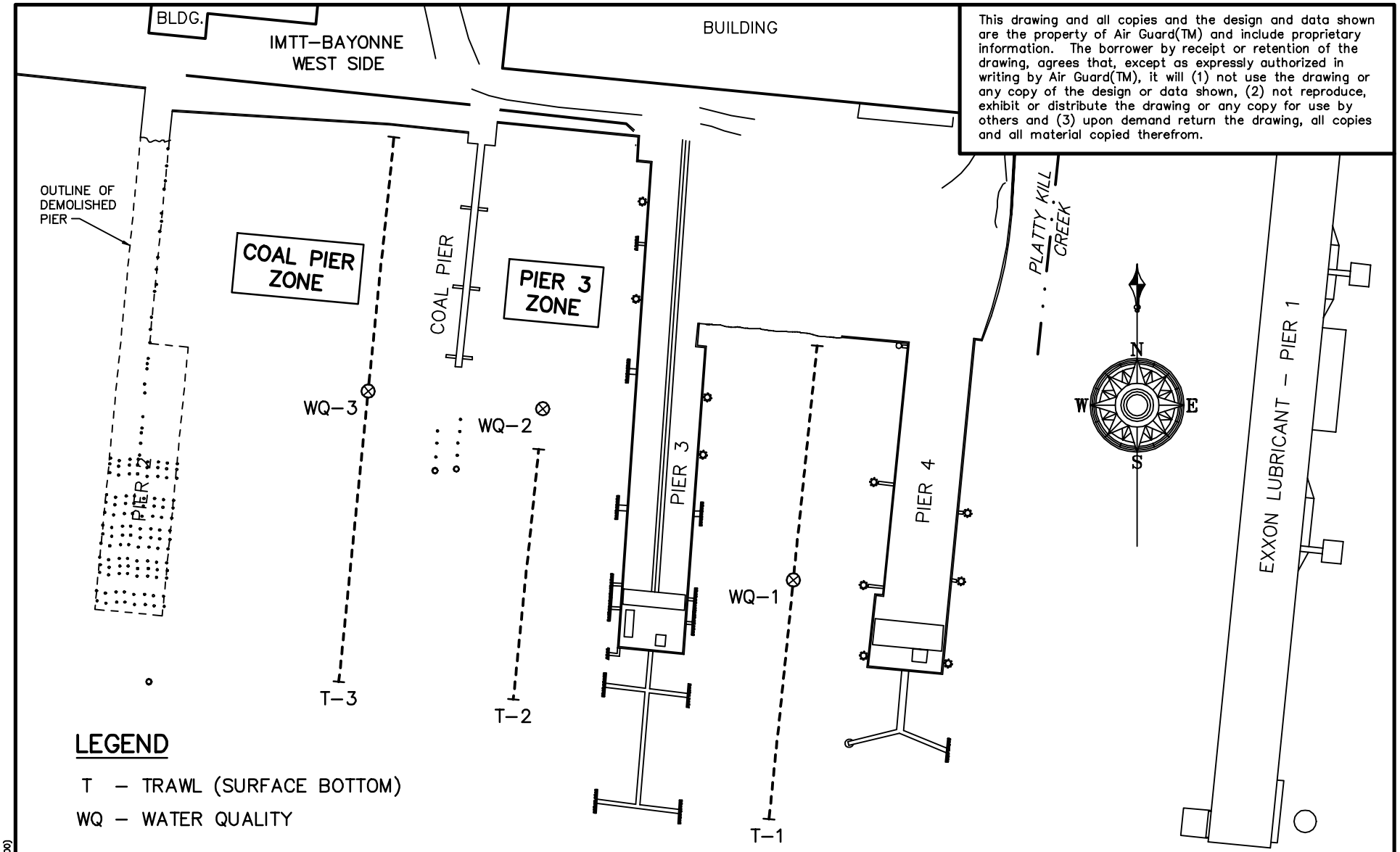
PNEUMATIC SEDIMENT SUSPENSION
SYSTEM INSTALLATION
IMTT BAYONNE – BAYONNE, NEW JERSEY

AQUATIC SAMPLING SITES

DATE: 5–11–00 SCALE: 1"=100' **FIG. 32**

AIR GUARD™

9212.3\TASK4\FIG\32 (100)



LEGEND

T – TRAWL (SURFACE BOTTOM)

WQ – WATER QUALITY

9212.3\TASK4\FIG\33 (100)

PNEUMATIC SEDIMENT SUSPENSION
SYSTEM INSTALLATION
IMTT BAYONNE – BAYONNE, NEW JERSEY

AQUATIC SAMPLING SITES

AIR GUARD™

DATE: 5–11–00 SCALE: 1"=100' **FIG. 33**

APPENDIX G

WATER QUALITY SAMPLING RESULTS

Figure 34 Dissolved Oxygen Concentration Graphs
Figure 35 Dissolved Oxygen Concentration Data
Figure 36 Temperature Sampling Graphs
Figure 37 Temperature Sampling Data
Figure 38 Salinity Sampling Graphs
Figure 39 Salinity Sampling Data
Figure 40 Secchi Disk Readings Graph

Air Guard™ Pneumatic Sediment Suspension System

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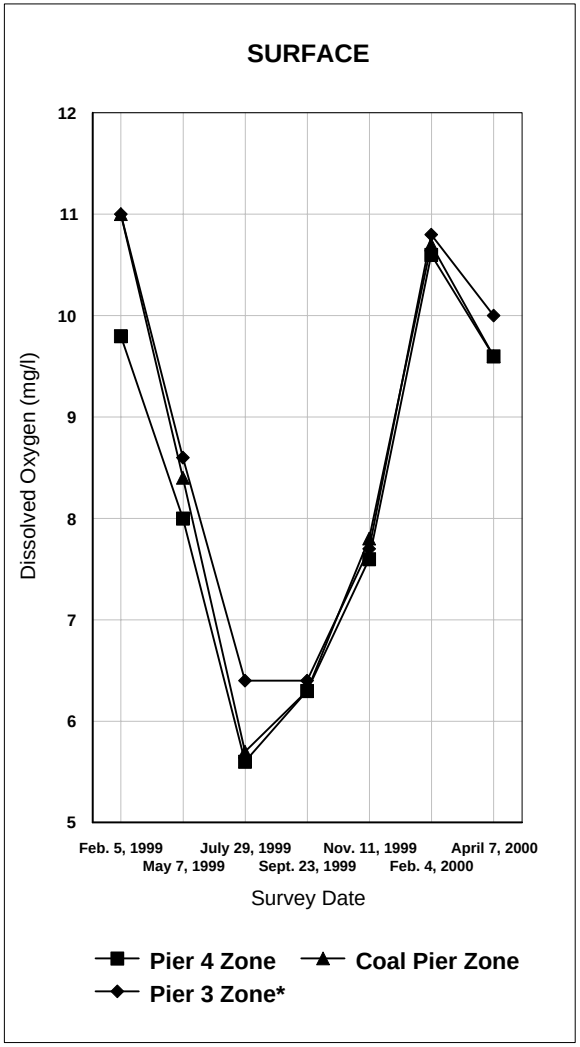
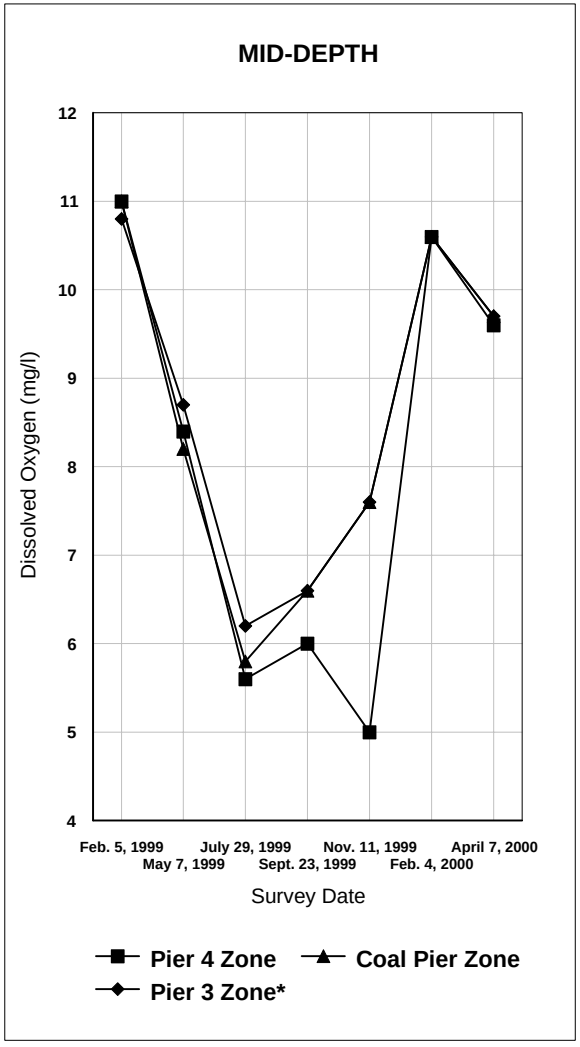
Trumbull, CT 06611
203-268-5007

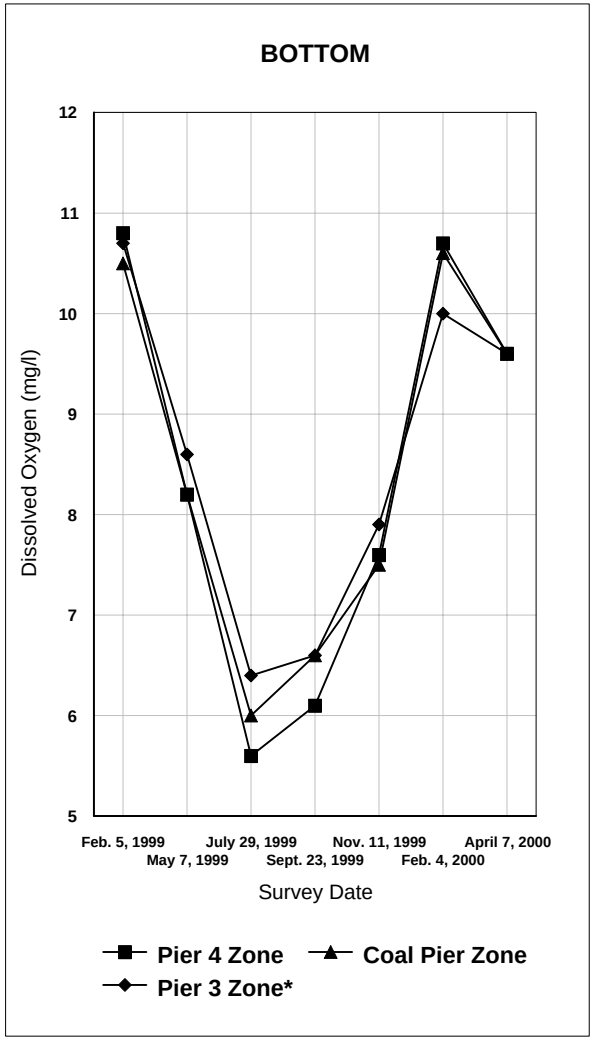
OCEAN AND COASTAL CONSULTANTS, INC.
AIR GUARD, INC.
PNEUMATIC SEDIMENT SUSPENSION SYSTEM

* Air Guard Site

DISSOLVED OXYGEN CONCENTRATION GRAPHS







OCEAN AND COASTAL CONSULTANTS, INC.
AIR GUARD, INC.
PNEUMATIC SEDIMENT SUSPENSION SYSTEM

DISSOLVED OXYGEN CONCENTRATION DATA

Survey Date: Feb. 5, 1999

	DO (mg/l)		
Elevation	**WQ1**	**WQ2 ***	**WQ3**
Surface	9.80	11.00	11.00
Mid-Depth	11.00	10.80	11.00
Bottom	10.80	10.70	10.50

Survey Date: May 7, 1999

	DO (mg/l)		
Elevation	**WQ1**	**WQ2 ***	**WQ3**
Surface	8.00	8.60	8.40
Mid-Depth	8.40	8.70	8.20
Bottom	8.20	8.60	8.20

Survey Date: July 29, 1999

	DO (mg/l)		
Elevation	**WQ1**	**WQ2 ***	**WQ3**
Surface	5.60	6.40	5.70
Mid-Depth	5.60	6.20	5.80
Bottom	5.60	6.40	6.00

Survey Date: Sept. 23, 1999

	DO (mg/l)		
Elevation	**WQ1**	**WQ2 ***	**WQ3**
Surface	6.30	6.40	6.30
Mid-Depth	6.00	6.60	6.60
Bottom	6.10	6.60	6.60

Survey Date: Nov. 11, 1999

	DO (mg/l)		
Elevation	**WQ1**	**WQ2 ***	**WQ3**
Surface	7.60	7.70	7.80
Mid-Depth	7.60	7.60	7.60
Bottom	7.60	7.90	7.50

Survey Date: Feb. 4, 2000

	DO (mg/l)		
Elevation	**WQ1**	**WQ2 ***	**WQ3**
Surface	10.60	10.80	10.70
Mid-Depth	10.60	10.60	10.60
Bottom	10.70	10.00	10.60

Survey Date: Feb. 5, 1999

	DO (mg/l)		
Elevation	**WQ1**	**WQ2 ***	**WQ3**
Surface	9.60	10.00	9.60
Mid-Depth	9.60	9.70	9.70
Bottom	9.60	9.60	9.60

*** Note: WQ2 is the Air Guard System location**

OCEAN AND COASTAL CONSULTANTS, INC.
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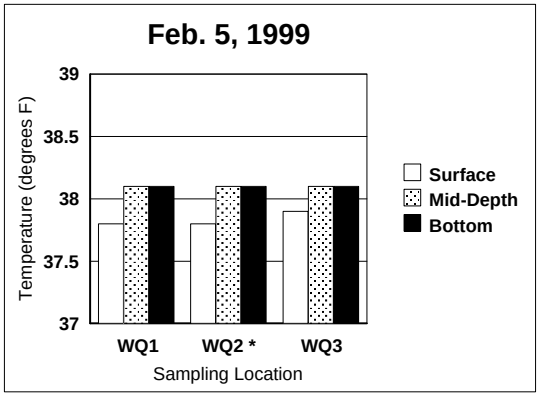
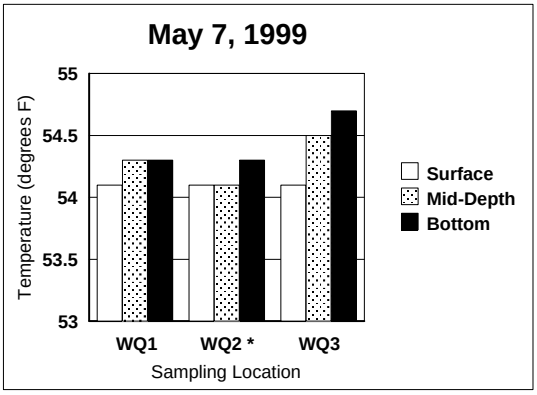
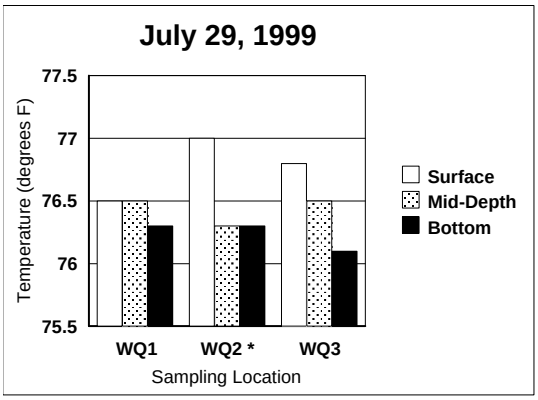
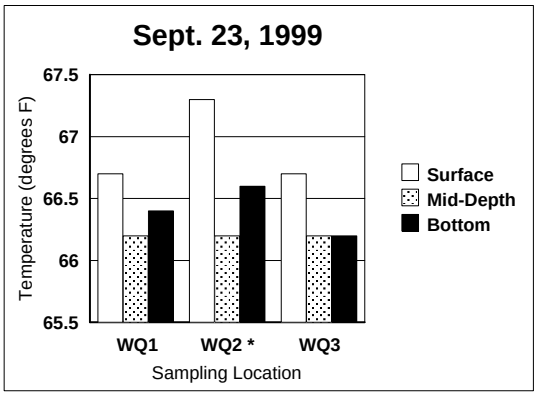
PNEUMATIC SEDIMENT SUSPENSION SYSTEM

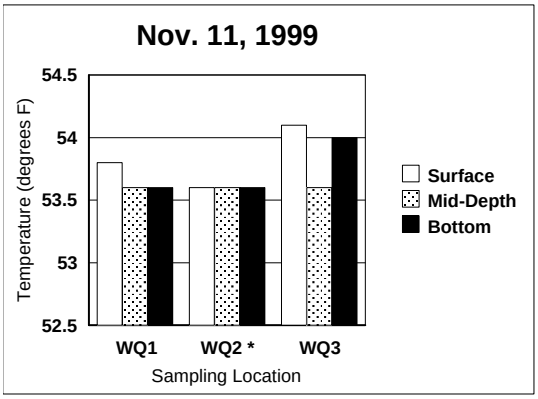
TEMPERATURE SAMPLING GRAPHS

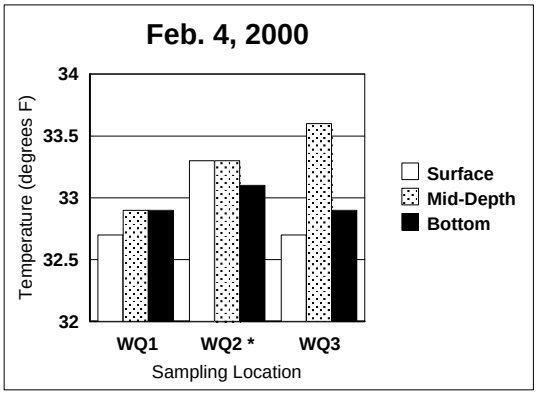


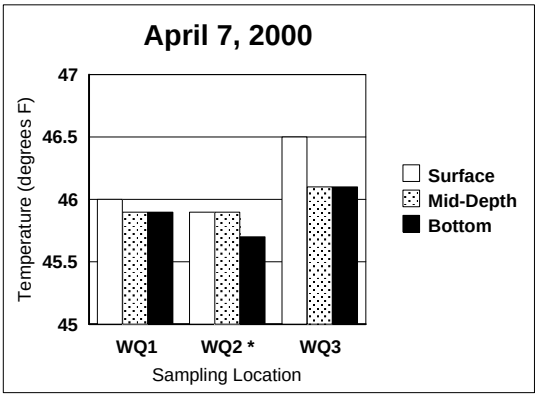












*** Note: WQ2 is the Air Guard System location**

OCEAN AND COASTAL CONSULTANTS, INC.
AIR GUARD, INC.
PNEUMATIC SEDIMENT SUSPENSION SYSTEM

TEMPERATURE SAMPLING DATA

Survey Date: Feb. 5, 1999

	Temperature (degrees F)		
Elevation	**WQ1**	**WQ2 ***	**WQ3**
Surface	37.80	37.80	37.90
Mid-Depth	38.10	38.10	38.10
Bottom	38.10	38.10	38.10

Survey Date: May 7, 1999

	Temperature (degrees F)		
Elevation	**WQ1**	**WQ2 ***	**WQ3**
Surface	54.10	54.10	54.10
Mid-Depth	54.30	54.10	54.50
Bottom	54.30	54.30	54.70

Survey Date: July 29, 1999

	Temperature (degrees F)		
Elevation	**WQ1**	**WQ2 ***	**WQ3**
Surface	76.50	77.00	76.80
Mid-Depth	76.50	76.30	76.50
Bottom	76.30	76.30	76.10

Survey Date: Sept. 23, 1999

	Temperature (degrees F)		
Elevation	**WQ1**	**WQ2 ***	**WQ3**
Surface	66.70	67.30	66.70
Mid-Depth	66.20	66.20	66.20
Bottom	66.40	66.60	66.20

Survey Date: Nov. 11, 1999

	Temperature (degrees F)		
Elevation	**WQ1**	**WQ2 ***	**WQ3**
Surface	53.80	53.60	54.10
Mid-Depth	53.60	53.60	53.60
Bottom	53.60	53.60	54.00

Survey Date: Feb. 4, 2000

	Temperature (degrees F)		
Elevation	**WQ1**	**WQ2 ***	**WQ3**
Surface	32.70	33.30	32.70
Mid-Depth	32.90	33.30	33.60
Bottom	32.90	33.10	32.90

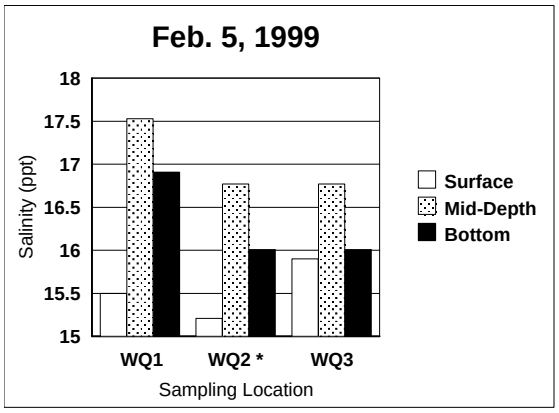
Survey Date: April 7, 2000

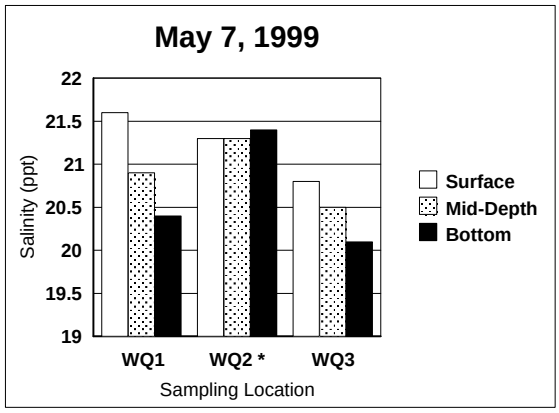
	Temperature (degrees F)		
Elevation	**WQ1**	**WQ2 ***	**WQ3**
Surface	46.00	45.90	46.50
Mid-Depth	45.90	45.90	46.10
Bottom	45.90	45.70	46.10

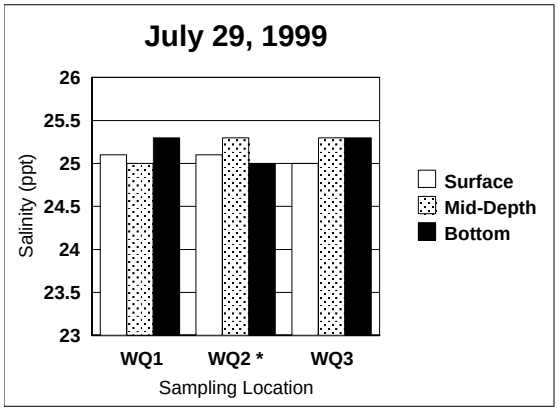
*** Note: WQ2 is the Air Guard System location**

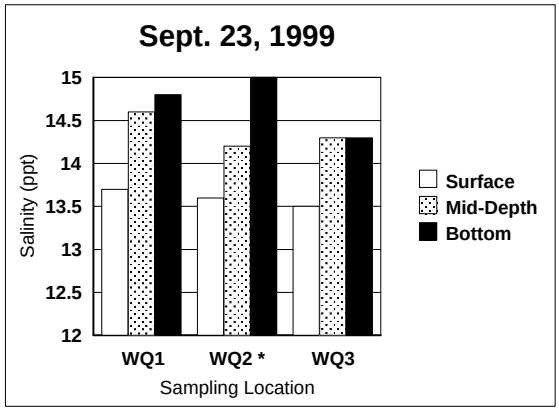
OCEAN AND COASTAL CONSULTANTS, INC.
AIR GUARD, INC.
PNEUMATIC SEDIMENT SUSPENSION SYSTEM

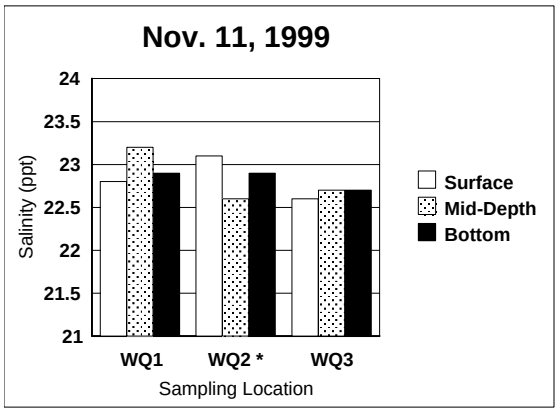
SALINITY SAMPLING GRAPHS

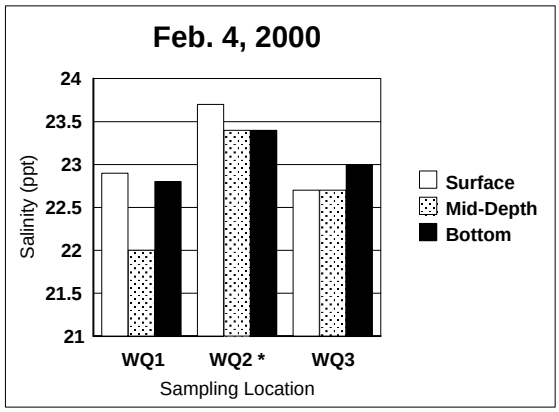


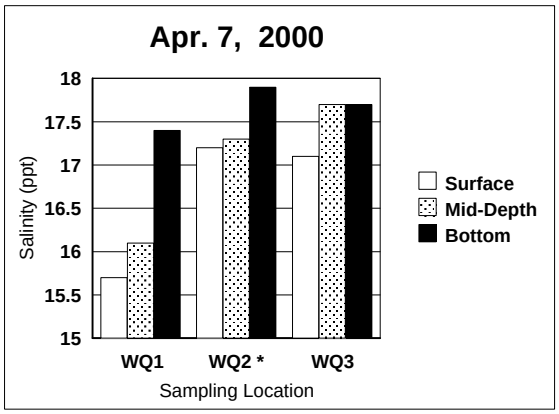












*** Note: WQ2 is the Air Guard System location**

OCEAN AND COASTAL CONSULTANTS, INC.
AIR GUARD, INC.
PNEUMATIC SEDIMENT SUSPENSION SYSTEM

SALINITY SAMPLING DATA

Survey Date: Feb. 5, 1999

	Salinity (ppt)		
Elevation	**WQ1**	**WQ2 ***	**WQ3**
Surface	15.50	15.21	15.90
Mid-Depth	17.53	16.77	16.77
Bottom	16.91	16.01	16.01

Survey Date: May 7, 1999

	Salinity (ppt)		
Elevation	**WQ1**	**WQ2 ***	**WQ3**
Surface	21.60	21.30	20.80
Mid-Depth	20.90	21.30	20.50
Bottom	20.40	21.40	20.10

Survey Date: July 29, 1999

	Salinity (ppt)		
Elevation	**WQ1**	**WQ2 ***	**WQ3**
Surface	25.10	25.10	25.00
Mid-Depth	25.00	25.30	25.30
Bottom	25.30	25.00	25.30

Survey Date: Sept. 23, 1999

	Salinity (ppt)		
Elevation	**WQ1**	**WQ2 ***	**WQ3**
Surface	13.70	13.60	13.50
Mid-Depth	14.60	14.20	14.30
Bottom	14.80	15.00	14.30

Survey Date: Nov. 11, 1999

	Salinity (ppt)		
Elevation	**WQ1**	**WQ2 ***	**WQ3**
Surface	22.80	23.10	22.60
Mid-Depth	23.20	22.60	22.70
Bottom	22.90	22.90	22.70

Survey Date: Feb. 4, 2000

	Salinity (ppt)		
Elevation	**WQ1**	**WQ2 ***	**WQ3**
Surface	22.90	23.70	22.70
Mid-Depth	22.00	23.40	22.70
Bottom	22.80	23.40	23.00

Survey Date: April 7, 2000

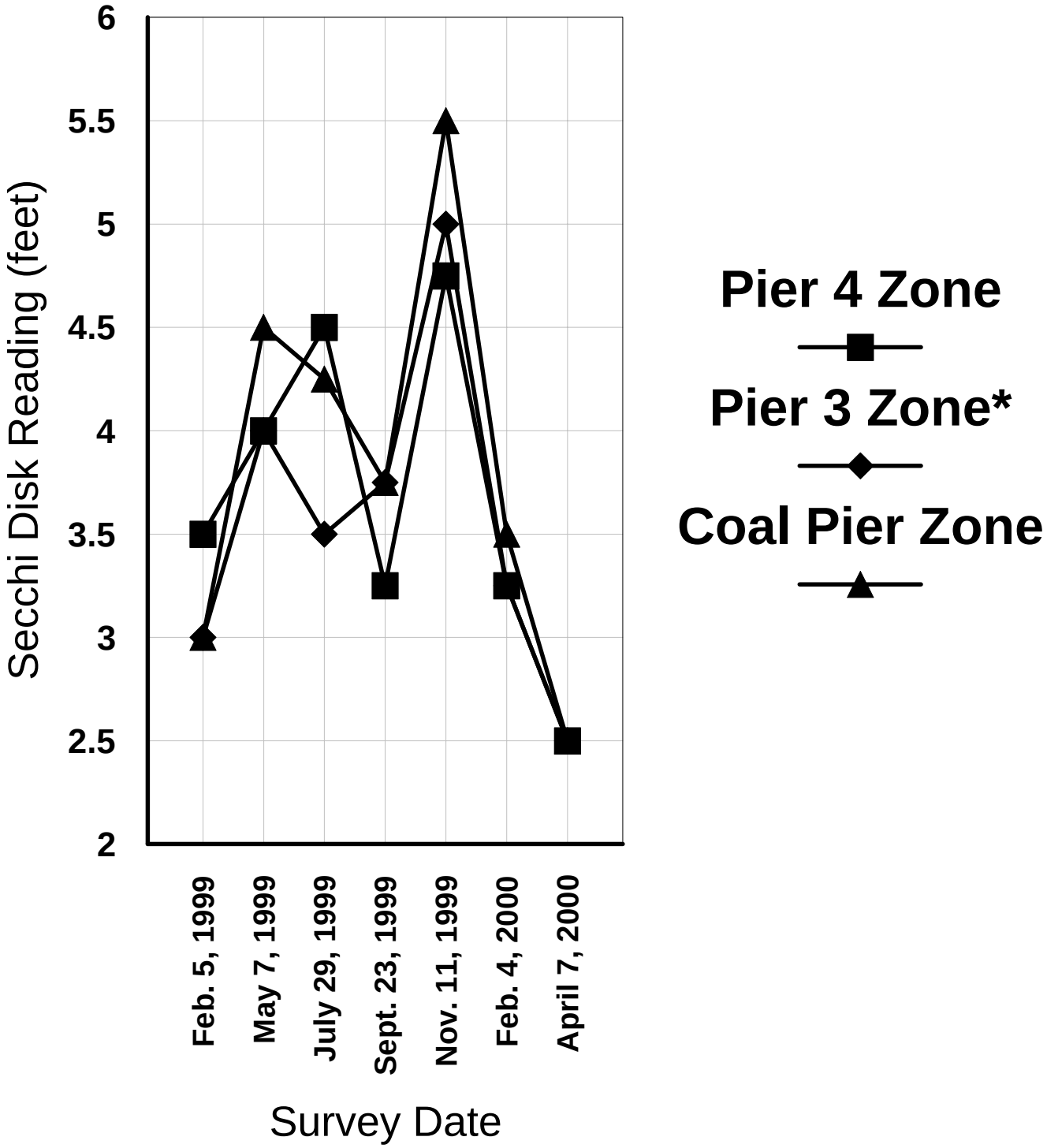
	Salinity (ppt)		
Elevation	**WQ1**	**WQ2 ***	**WQ3**
Surface	15.70	17.20	17.10
Mid-Depth	16.10	17.30	17.70
Bottom	17.40	17.90	17.70

*** Note: WQ2 is the Air Guard System location**

OCEAN AND COASTAL CONSULTANTS, INC.

AIR GUARD Pneumatic Sediment Suspension System

Secchi Disk Readings



*Air Guard Site

APPENDIX H

FISH SAMPLING RESULTS

Figure 41 Fish Distribution - Catch Per Unit Effort Data

Air Guard™ Pneumatic Sediment Suspension System

Ocean and Coastal Consultants, Inc.
35 Corporate Drive
Trumbull, CT 06611
203-268-5007

OCEAN AND COASTAL CONSULTANTS, INC.
PNEUMATIC SEDIMENT SUSPENSION SYSTEM
Job #9212.3

FISH DISTRIBUTION - CATCH PER UNIT EFFORT (CPUE) DATA

CPUE = 10 minute trawl or 24 gill net or trap net

		March 1999 - Baseline			May 1999			July 1999			September 1999			November 1999			February 2000			April 2000		
Collection Gear	**Species**	**Pier 4 Zone**	**Pier 3 Zone (Air Guard)**	**Coal Pier Zone**	**Pier 4 Zone**	**Pier 3 Zone (Air Guard)**	**Coal Pier Zone**	**Pier 4 Zone**	**Pier 3 Zone (Air Guard)**	**Coal Pier Zone**	**Pier 4 Zone**	**Pier 3 Zone (Air Guard)**	**Coal Pier Zone**	**Pier 4 Zone**	**Pier 3 Zone (Air Guard)**	**Coal Pier Zone**	**Pier 4 Zone**	**Pier 3 Zone (Air Guard)**	**Coal Pier Zone**	**Pier 4 Zone**	**Pier 3 Zone (Air Guard)**	**Coal Pier Zone**
Gill Net (Surface)																						
	Alosa sp.																					21.3
	Blueback Herring													2.2	5.1	5.5						
	Clupeidae sp.										NS	NS	9.1									
	Cunner																				1	
	Spot							19.4	8.2	27.2												
	Striped Bass				0.6	12.6			3.7							1.1						
	Weakfish														1							
	White Perch						0.6													0.9		
Gill Net (Bottom)																						
	Alewife				NS		1															
	Alosa sp.																				1	1
	Blue Crab				NS	1																
	Blueback Herring													3		4.2						
	Clupeidae sp.										6.3											
	Spot							3	7.4	3.9												
	Striped Bass				NS	2.1					2.7	7.1		3	1	2.1				2		1
	Weakfish													2	3.1	3.2						
	White Perch													1	2	3.2					2	1
Trap Net																						
	American Eel						0.9															
	Atlantic Tomcod	2		1		3.7	3.8													NS	3.1	1
	Blackfish							5.9		NS	0.9			1		0.9		0.9				
	Blue Crab					3.7																
	Cunner					0.9								1	3.7	2.8						
	Goby sp.												2.8									
	Mud Crab					0.9																
	Naked Goby					0.9																
	Northern Pipefish												0.9		0.9							
	Striped Bass							4.9	1.8	NS												
	Weakfish															0.9						
	White Perch																			NS		1
Surface Trawl																						
	Bay Anchovy							5														
	Spot							5														
Bottom Trawl																						
	Alosa sp.																			3.3		
	Atlantic Silverside												2.2									
	Atlantic Tomcod				15		12.5													19.2	6.7	8.4
	Blackfish										16.6		4.7	3.4		7.5						
	Blue Crab	12.7			15		17.5	70	46.6	35	142.5	10	80.3	5	3.4	107.5	3.4	3.4	123.4		2.2	80
	Blueback Herring														5							
	Butterfish												2.2									
	Clupeidae sp.											2.5										
	Cunner							3.4						6.6								
	Fluke								6.6	5												
	Mud Crab	2.2			30			3.4														
	Northern Pipefish																			3.4		
	Scup										2.5	12.5	4.7									
	Sea Robin					6.7																
	Seahorse										2.5											3.4
	Spider Crab							6.6	20													
	Spot							13.4														
	Striped Bass				5			96.7	46.6	185		3.4	5	3.4						140	3.3	65
	Striped Sea Robin							66.6	26.7	10	2.5		4.7	2.5		2.5						
	Summer Flounder										5		7.2									
	White Perch																			16.6		
	Windowpane Flounder				5			6.6												11.6	6.7	18.4
	Winter Flounder					6.7		3.4	6.6	10	5.8	5.8	14.2		15	5		3.4		10	11.1	11.6