MONITORING DREDGED MATERIAL PLACEMENT OPERATIONS IN THE NEW YORK BIGHT DURING EIGHT DREDGING PROJECTS

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An undertaking of this magnitude could not have been successfully achieved without the diligence of many contributors. We whole-heartedly thank the members of the dredging community, who have made development of the ADISS system a success.

In particular, we thank the HARS Technical Manager, Dr. Stephen Knowles at the USACE, New York District Operations Division for his persistent review of the data and his patience during periods of problem solving. His faith in our effort was appreciated.

As in previous monitoring assignments at the HARS, we had the pleasure of working with the Great Lakes Superintendents and Division Engineers, Richard Murphy, Bill Moore, Chris Gunsten, Art Fletcher and Dave Cizek. These gentlemen made the work and the problems faced easier by their professional demeanor. We also thank the steady hands of Alton King and Andrew , the Great Lakes Engineers during the Kill Van Kull Improvement project. Their patience eased our task during the service visits to several vessels.

As with Great Lakes, our experiences with the supervisors and engineers at Weeks Marine, Inc., Bean-Styvesant, and Donjon Marine were supportive and professional. We had the pleasure of continuing our work with Rob Malissa, Doug Nelson, Frank Gonzalez, Mike McElroy and Steve Geer at Weeks Marine, Inc. and with Jim Thomas, Frank Belisimo and Richard Barber at Bean Styvesant. Monitoring activities for Donjon Marine were facilitated by Tom Witte, Eric King and Jim Wright.

We especially appreciate the efforts of all the Inspectors to use the monitoring tools provided by ADISSPlay to direct and record placement operations at the HARS and the Artificial Reef sites. In particular, Larry Wyman and Ed Clement became the most proficient, and set a high standard for Inspector expertise.

There is no doubt the management of today's placement activities in the New York Bight at the Historic Area Remediation Site and at the Atlantic Beach and Sandy Hook Artificial Reef sites depends on the consistent efforts of the U.S. Army Corps of Engineers and the commercial dredging contractors.

1.0 OBJECTIVES

During the 2001-dredging season, SAIC provided Automated Disposal Surveillance System (ADISS) technical support services to the U.S. Army Corps of Engineers, New York District. ADISS was employed to monitor the placement of dredged material at the Historic Area Remediation Site (HARS), the Atlantic Beach Artificial Reef Site and the Sandy Hook Reef Site (**Figure 1**). The objectives of this monitoring were to:

- Provide real-time placement information via the Internet,
- Acquire, process and submit information concerning misplaced material events,
- Provide processed ADISS and Inspector Log information on the Internet,
- Provide the placement grids used on the ADISSPlay vessel guidance for each project,
- Modify the ADISSPlay helmsman and Inspector Log software as required.

SAIC has provided monitoring services to NYD for the previous four years. Initial development of ADISS during the 1997 Capping Project preceded the introduction of ADISSPlay, the helmsman display and vessel guidance system. The present ADISS/ADISSPlay monitoring system was managed by SAIC for permittees placing dredged material within the New York Bight, and the installation and maintenance of the system on the dredge scows and tugboats occurred under separate contract with each dredging company. In addition to hardware installation and maintenance, services included field visits to occasionally recover stored ADISS/ADISSPlay data. Plots of individual transits and vessel draft were submitted to the contractors along with summaries of placement activities. Plots and information of misplacements have been provided to the NYD for management of remedial actions.

The objectives of this project were based upon previous project experiences and NYD needs. The requirement for daily monitoring has been met by posting telemetered data on the Internet, and misplacements were corroborated from processed ADISS data. Individual and summary plots of processed data were provided on the Internet at (http://www.adiss-afiss.com). ADISS data and Inspector Log information were also provided in the Disposal Analysis Network-New York (DAN-NY) format for analysis and archiving within NYD. SAIC installed the placement grids for each project within the ADISSPlay display, and modified the guidance software to include the display of draft, tug GPS positioning, and target cell selection for multiple tugs.

Toward the end of the yearly monitoring activities, a new ADISS prototype was successfully tested and significant changes to the Internet processing software were completed. The new hardware provided remote control of all the thresholds through the spread-spectrum radio modem. The remote control permitted SAIC to reset the thresholds through cellular telephone links with the Newport office facilities, and sometimes eliminated the field visits otherwise required to correct a problem. Advances in firmware needed to control the hardware also eliminated the spontaneous failures of the Global Positioning System (GPS) receivers, which had plagued the ADISS system for over a year. The automated processing of data allowed viewers to see the information on the web site as it was transmitted from the field, and eliminated the need to recover the data during service visits and wait for the completion of manual processing. Quality assurance checks remained as a way of verifying the results.

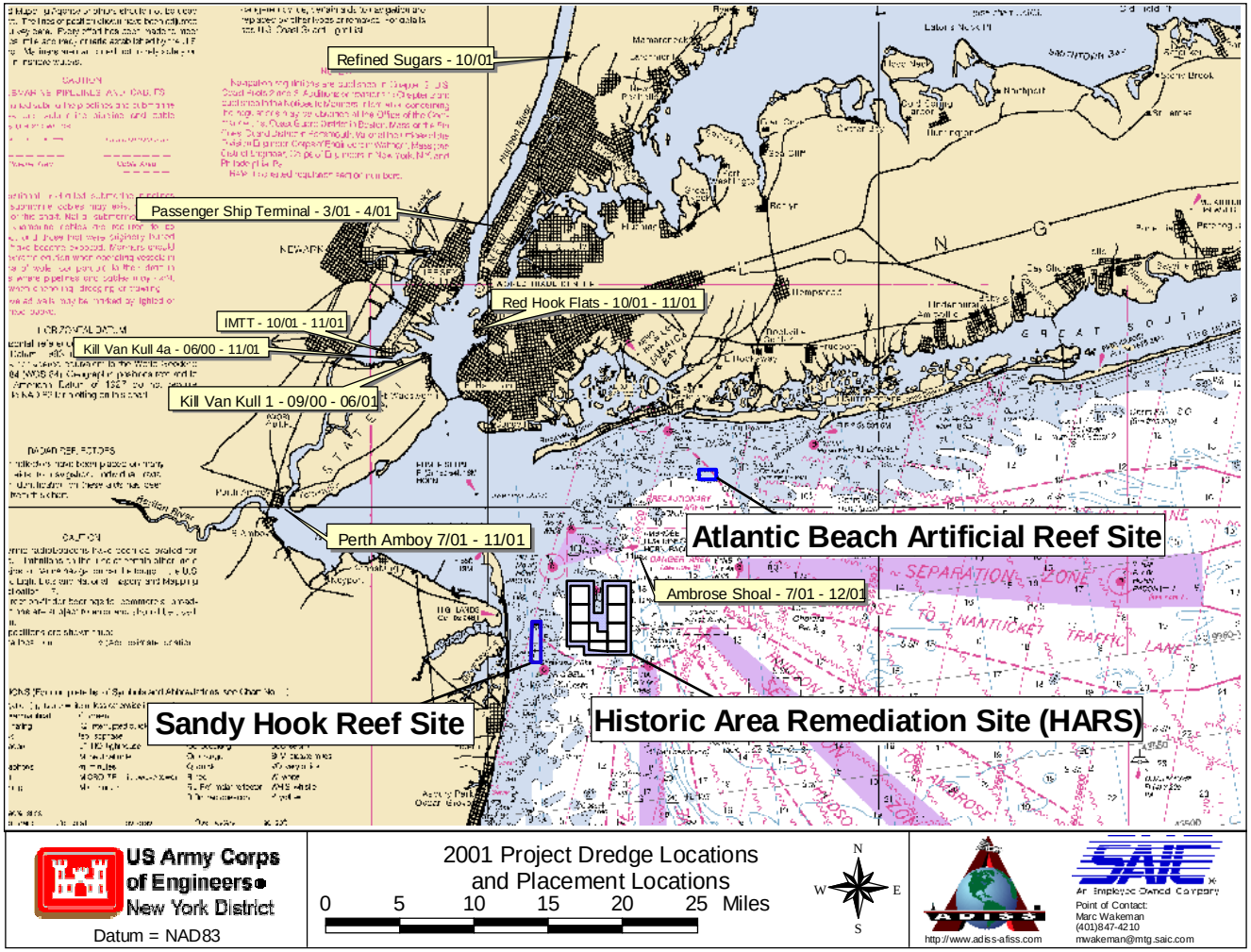

Figure 1. Placement areas for dredging projects within the New York District included the Historic Area Remediation Site, the Atlantic Beach and Sandy Hook Artificial Reef sites during 2001.

2.0 SYSTEM DESCRIPTIONS

During the initial phase of each dredging project, ADISS units were placed on the dredge scows, and ADISSPlay equipment was installed on the towing tugboat(s). ADISS is composed of a DGPS receiver, a draft sensor, and a spread-spectrum, frequency hopping radio modem. The previous ADISS systems had been equipped with Argos satellite telemetry, which was replaced with the addition of the cellular telephone technology to the ADISSPlay system installed in the wheelhouse of each tugboat. ADISSPlay consisted of a helmsman display, radio and cellular telemetry, and an Inspector database entry form. The ADISS/ADISSPlay system was adapted for monitoring placement operations at the HARS and the artificial reef sites from previous experience during the 1997 Capping Project. Toward the end of the year another modem was added to the system, which telemetered data in real-time to a base station and the Internet. Real-time tracking of each scow was initiated on the web site (http://www.adiss-afiss.com).

A description of the ADISS system is available in the report of the prototype system (SAIC, 1998a), and the initial Argos satellite telemetry, which was retrofitted during the 1997 Capping Project, was described in the project report (SAIC, 1998b). The ADISSPlay system, including the Inspector Log entry forms, as well as the automatic processing of the Argos-telemetered data via the Internet were described in a letter report (SAIC, 1998c). The display of the ADISS data on the Internet and its availability utilizing an executable viewer were described in a project report (SAIC, 1999a). A summary description of the ADISS/ADISSPlay system, the Argos and Internet display system and access to the processed data is provided in last year's activity report (SAIC, 2001).

2.1 ADISS/ADISSPlay Vessel System

Originally created to monitor the placement of Category II material within the New York Mud Dump Site during the 1997 Capping Project, ADISS consisted of GPS and DGPS receivers, antennas, a high-speed logger, flash-ram memory, a small 12-volt battery, and a pressure sensor. The firmware enabled the logger to determine vessel draft from the pressure sensor, proximity to the placement target, and accidental disposal outside the boundaries of the target. ADISS operated automatically for over a week at a time before battery replacement was required. Unattended, ADISS recorded scow loading positions, and their transit and placement locations over a hundred trips to the Mud Dump (SAIC, 1997). The system was also used to monitor and record capping operations from several hopper dredges (SAIC, 1998b). NYD operations managers relied on weekly data updates to redirect placement activities during the project.

Toward the end of the 1997 Capping project, Argos satellite telemetry was retrofitted to the system. Daily e-mail messages received at SAIC revealed vessel status, battery voltage, and load and placement times and locations. This information was decoded, plotted and submitted to NYD managers, and offered the first opportunity to oversee operations in near real-time.

The need for the real-time display of scow position during placement events was demonstrated during the 1998 Passenger Ship Terminal Project, when significant differences occurred between the ADISS and Inspector Log information (SAIC, 1998d). The ability to receive and plot the information in the tug's wheelhouse was not realized with Argos. Instead, VHF radio modems

were added, and data were transmitted to a laptop computer, equipped with display and logging software during the 1999 Refined Sugar dredging project. Scow position was plotted over a target grid, allowing the precise placement of each load within a predetermined cell. The target assignments were entered into the ADISSPlay computer during its installation. During operation, the Inspector would input the trip number, the tug and scow identities, the vessel draft and the volume of material loaded prior to shipping a scow, and following its course to target. The inclusion of ADISSPlay increased placement accuracy from 25% to 70% initially (SAIC, 1999b), and to 88% after grid shapes were reformed to accommodate steerage (SAIC, 1999a).

The addition of Inspector logs and NOS chart overlays soon followed. Complete Inspector Logs were stored to the database, printed and faxed to the NYD for confirmation. NOS overlays enhanced the usefulness of the ADISSPlay system and included digitized charts with Aids to Navigation. Other refinements included the automatic selection of target cells based upon predicted tides and expected time of arrival, and the automated processing of ADISS data transmitted from the tugs and displayed on the Internet (SAIC, 2001).

2.2 ADISS Data Telemetry

During the initial HARS monitoring project in 1998, the Internet display of placement events was developed to monitor disposal activities in real-time without visiting the installations to retrieve the stored data for each event. The e-mail messages received from the Argos service were automatically decoded, plotted by the SAIC server and posted on the ADISS web site. The automated system was improved during 1999 to broadcast an alarm in the event of misplacement.

The purpose of the Argos monitoring was to provide NYD with a means of detecting misplacements outside the permitted area. By monitoring the web site, misplacements could be detected several days before weekly processing of ADISS data signaled corrective action by NYD. In fact, the Argos information often precipitated the immediate retrieval of ADISS data to confirm the precise location of misplacements.

Early in 2001, the Argos satellite transmitters were replaced as a means of data telemetry with cellular telephones. The new link allowed the entire dataset for each trip to be transmitted immediately following placement, so the information could be posted on the web site. Since the entire dataset, including the Inspector log information was transmitted the cellular link eliminated the need to visit the scows and tugs to download the data. The cellular link also improved the timeliness of the reports, because its service was available 24 hours daily. The Argos system only provided partial coverage during the day. It was sometimes unavailable for six hours at a time due to gaps in the over flight coverage.

At the end of 2001, a radio modem network was established in New York Harbor to provide real-time tracking of the scows on the Internet. Local coverage was reliable, so each scow sent its position and draft information to the network through the towing tugboats equipped with ADISSPlay (**Figure 2**).

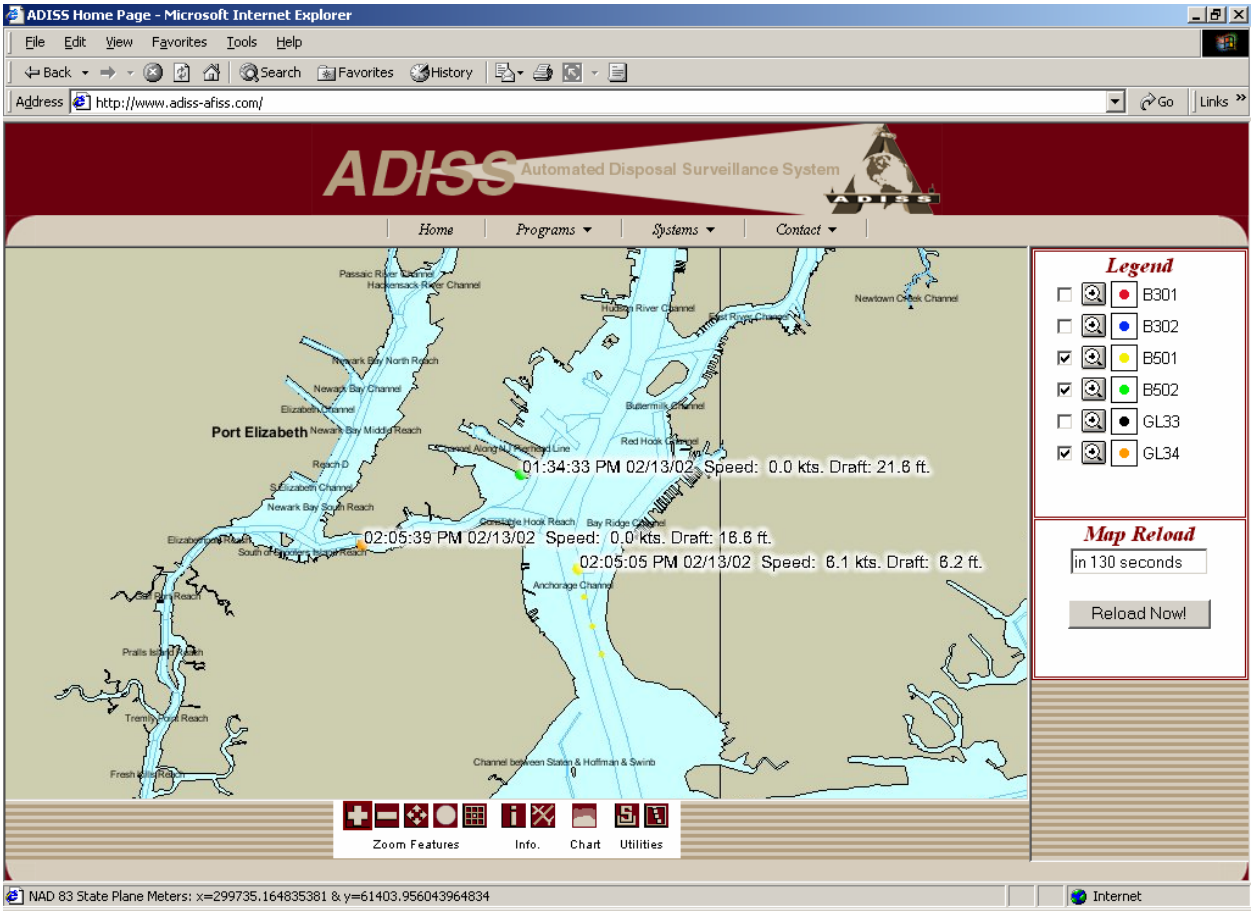

Figure 2. Internet display of real-time tracking of dredge material scows during the Kill Van Kull Improvement projects.

2.3 ADISS Data Web Display

All of the ADISS data for each of the projects was plotted and posted on the ADISS web page (http://www.adiss-afiss.com). Track line plots showed the transit of each scow, and the location of each placement (**Figure 3**). Draft verses time graphs verified the scows had not leaked during transit, and that the entire contents were deposited on target. Copies of the inspector logs were also available through the web site, and could be printed out to make hardcopies.

Data plots were provided by several means. Daily placement information was provided through the cellular telephones to the Internet via the automated posting system. Access to the automatically generated track plots and draft graphics was password protected, while the project was current. Until the conclusion of each project, the data was considered preliminary and in draft form. Restricted access to the information permitted the regulators and project managers time to work out the solutions to potential problems. Then, after the project had concluded, password protection was removed to provide public access.

Access to the processed ADISS data was also provided on compact disk to NYD. Data processed from the ADISSPlay cellular transmissions were plotted on a weekly basis at SAIC and submitted to the dredging contractors within a few days of transmission. The processed data was also converted to the DAN-NY database format at SAIC and sent to NYD for review and analysis using the tools resident in the DAN-NY system. The process required seven to ten days for the data to be received and reviewed by NYD.

After review and completion of each project, SAIC removed the passwords protecting the display of the data. Public access to the data plots was available at (http://www.adiss-afiss.com). In addition to the plots, access to project reports, like this one, was also available on the NYD web site (http://www.nan.usace.army.mil/business/prjlinks/dmmp/benefic/hars.htm). Reports were converted to 'pdf.' format to promote public outreach from the ADISS web site.

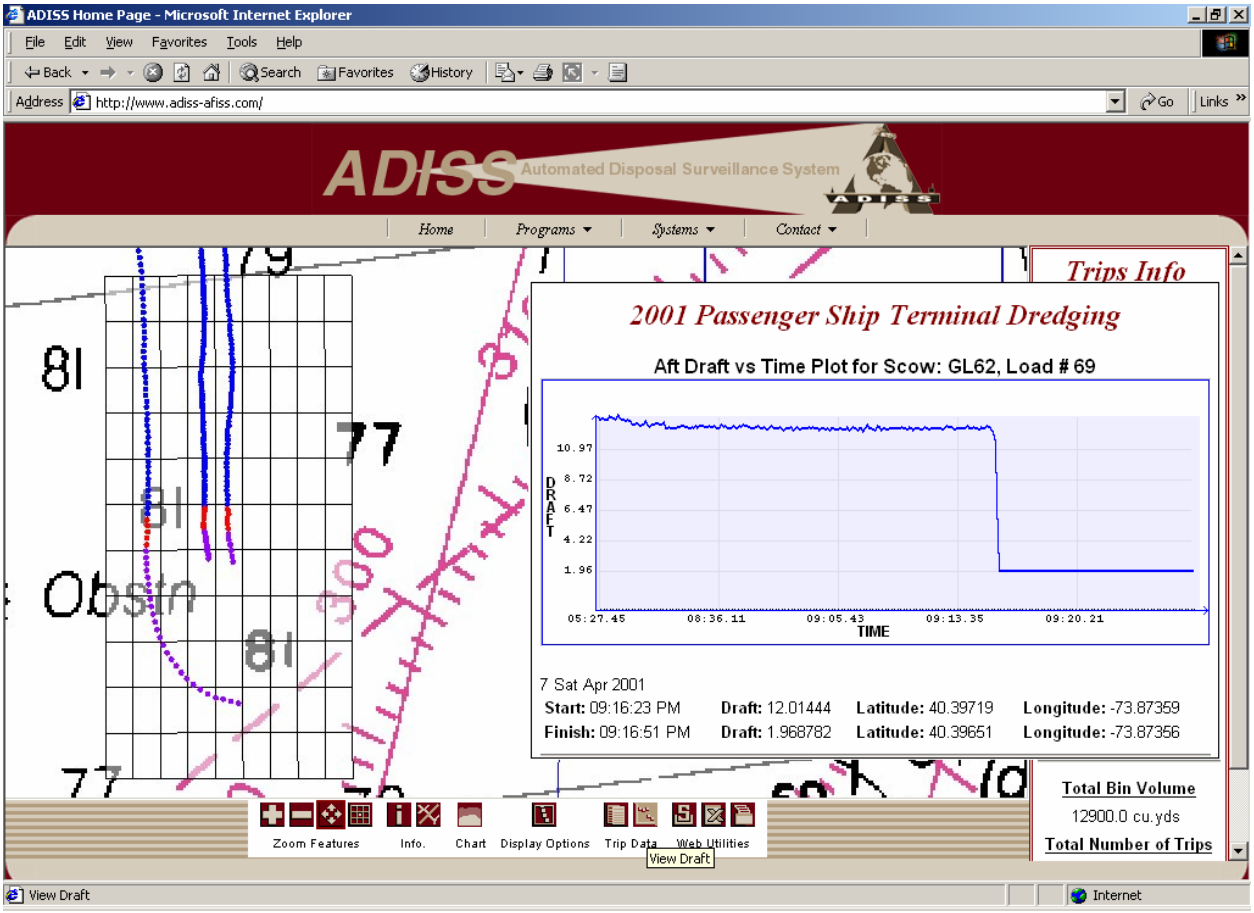

Figure 3. Internet display of scow trackline and draft data transmitted from ADISSPlay.

3.0 FIELD SERVICES AND DATA PROCESSING

A total of ten dredging projects were monitored during the 2001 season, and eight were concluded as of February 2002. Of the eight, two improvement projects took place within the Kill Van Kull and Newark Bay, and six maintenance projects throughout the New York Harbor and in the Raritan River were completed (**Figure 1**). Summary plots of all placements are posted on the ADISS Web Site (http://www.adiss-afiss.com). The following table lists the dates and dredging contractors for each project, and includes the number of scow trips, ADISS records and percentage of successful placement records at the HARS and the Atlantic Beach Artificial Reef and Sandy Hook Artificial Reef sites.

Project	Date	Contractor	Trips	Records	Percent
Kill Van Kull 4	06/00-11/01	Weeks Marine	205	189	92
Kill Van Kull 1	09/00-06/01	Bean-Stuyvesant	284	279	98
PST-2001	03/01-04/01	Great Lakes	72	71	99
Perth Amboy	07/01-11/01	Weeks Marine	350	344	98
Ambrose Shoal	07/01-12/01	Great Lakes	385	362	94
Refined Sugar	10/01	Weeks Marine	11	11	100
IMTT	10/01-11/01	Great Lakes	46	46	100
Red Hook Flats	10/01-11/01	Weeks Marine	152	152	100
Eight Projects		**Three Firms**	**1,505**	**1,454**	**97**

A total of 1,454 trips were recorded from a grand total of 1,505 trips for eight projects. The ADISS/ADISSPlay system documented 97 percent of all transits made to both the HARS and Atlantic Beach Artificial Reef and Sandy Hook Artificial Reef sites. Of the missed 51 trips, most were due to GPS receiver failure, a problem finally solved at the end of the 2001 season.

3.1 Kill Van Kull Channel Deepening Project 4, June 2000 – November 2001

Initially started on June 12, 2000 by Weeks Marine Inc., a total of six scows and ten tugs were used during operations. Several of the scows were reintroduced several times from other on-going projects. In fact, Weeks Marine was operating as many as four dredging operations simultaneously during the height of the season. During this busy period new ADISS designs were tested and brought into the monitoring programs. Two new types of GPS antennas were tested, and the solar battery chargers were added. The VHF radios previously used to telemeter data between the scow and the towing tugboat was replaced with a spread-spectrum modem.

All of these changes required the cooperation of the Inspectors. When problems arose, some chose to ignore the situation, while others worked with SAIC to troubleshoot the problems over the cellular link. As a result of cooperative troubleshooting, an alternative means of recording a transit was discovered, when the ADISS equipment aboard the scow malfunctioned. Trip 194 was recorded with ADISSLt, which estimated the scow position from tug GPS position and tow wire distance. The Inspector was asked to switch to ADISSLt after he was unable to establish communications with the ADISS unit. Though the trip was successfully recorded, ADISSLt was a temporary solution, and ADISS was repaired when the scow returned to the dredge site. In this manner, the dredging operations were not delayed and the placement data was acquired.

In total, 151 placements were made at the Atlantic Beach Artificial Reef site and 37 were made at the Sandy Hook Artificial Reef site. **Figure 4** shows a summary plot of 151 disposals within the Atlantic Beach Artificial Reef site. Approximately 412,000 cubic yards of material was deposited within the target grid, which proved to be more than the anticipated volume. The NYD had planned to place 200,000 cubic yards at the site, but due to an oversight, more material was placed than originally intended. By the time NYD had received the bathymetry data from the Survey Branch, many high spots above the depth minimum (40 feet MLW) had developed from overfilling the target cells. NYD halted placement operations at the Atlantic Beach Artificial Reef site, and issued an emergency dredging contract to reduce the height of the reef structure to the permitted depth of 40 feet. The remainder of the material dredged on the project was placed during 37 placements at the Sandy Hook Artificial Reef site (**Figure 5**).

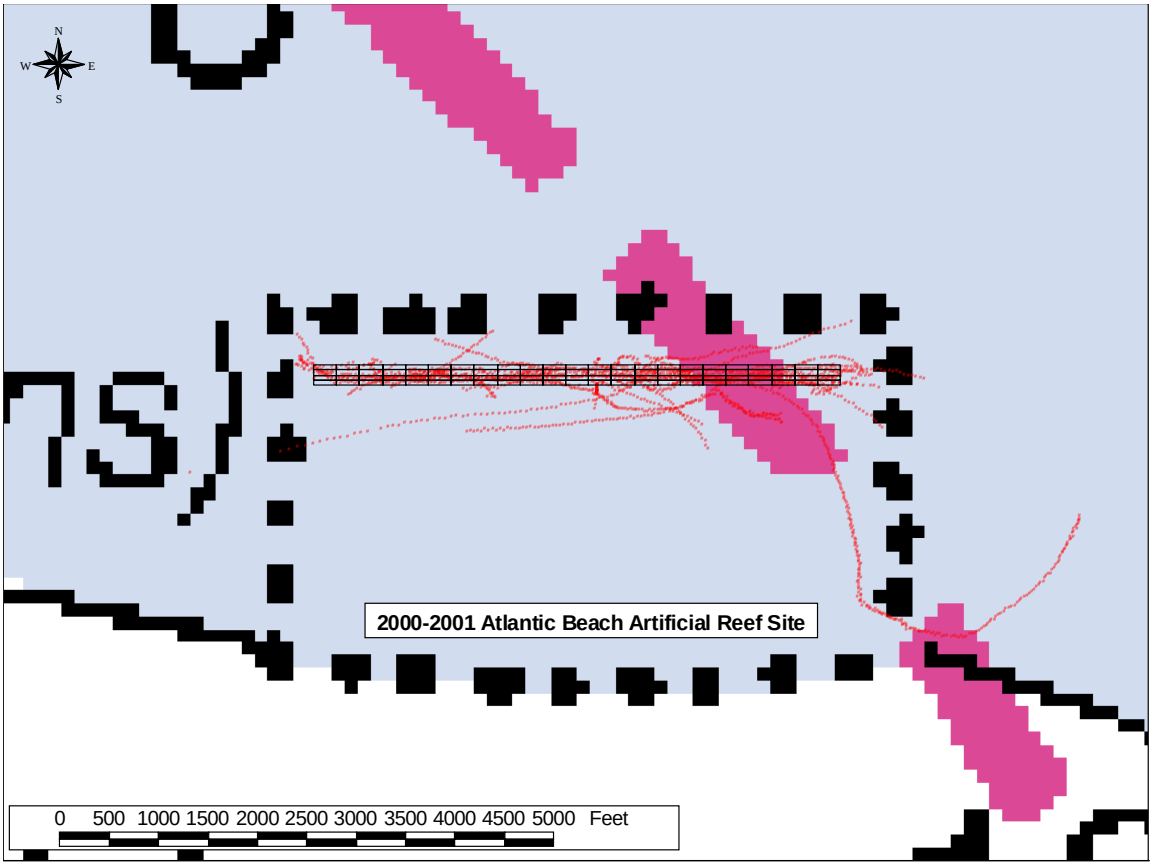

Figure 4. Summary of 151 placements at the Atlantic Beach Artificial Reef site during the Kill Van Kull 4 project, June 2000-January 2001.

An alternative to managing the placement operations efficiently was needed. Before the end of the project, NYD had directed SAIC to devise a predictive tool for on-going and future placement projects. As a first step, SAIC compared available bathymetric data acquired by the Survey Branch to estimate the volume of material added to the Atlantic Beach Artificial Reef site by 151 placements of the dredged material. The volume of placed material was estimated by a

bathymetric depth differencing method, and agreed with the dredge estimates of material removed from the dredged site within five percent. This meant the dredge estimates (with ADISS placement data) could be used to accurately predict the volume of each cell. Subsequently, when SAIC acquired the bathymetric data, comparisons were made between ADISS data and depth differences to estimate the volume of placed material per cell as well as the height of the accumulated sediment. When completed, the bathymetric depth differencing information helped refine predictions, and prevented the overfilling of target cells. Eventually, NYD will have a tool for managing placement operations on a daily basis, once the predicted number and volume of placements per cell have been incorporated into the ADISS web site.

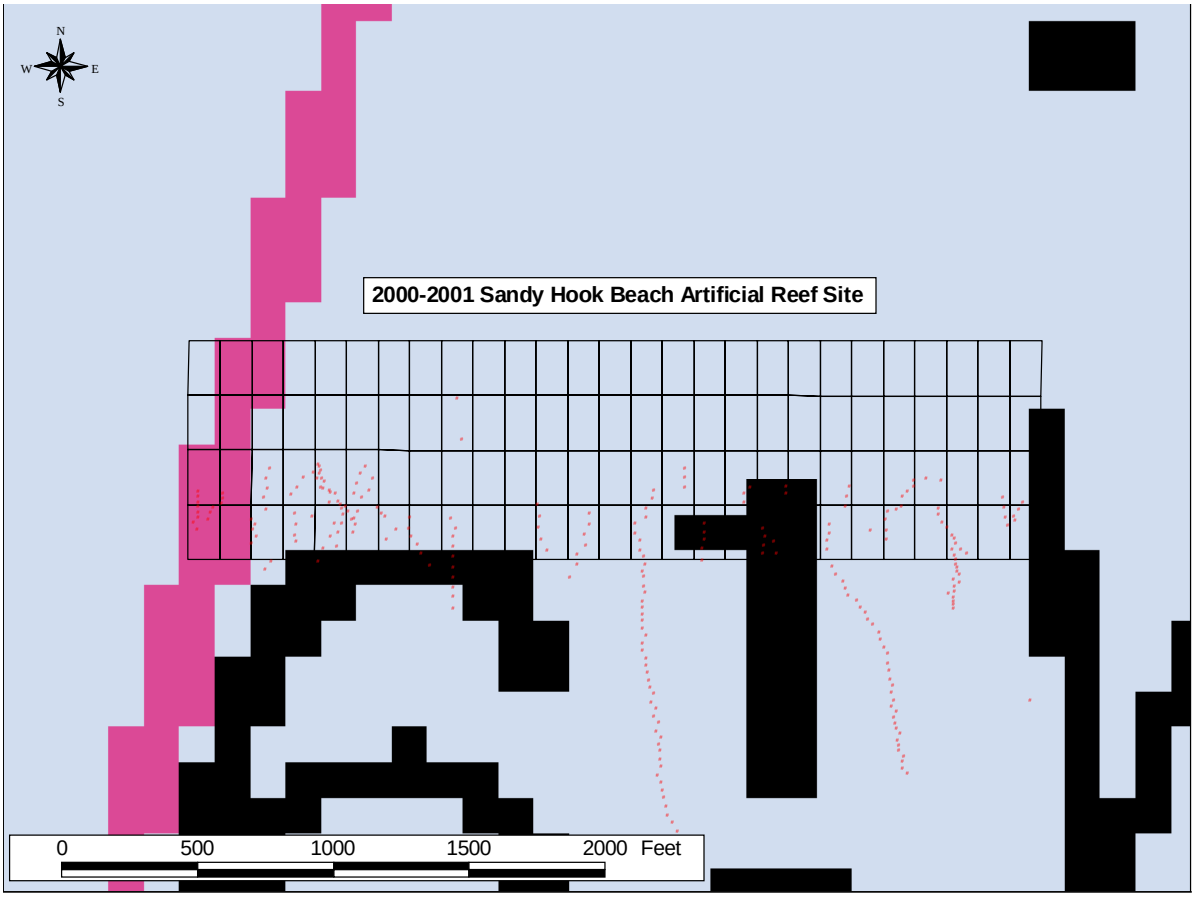

Figure 5. Summary of 37 placements at the Sandy Hook Artificial Reef site during the Kill Van Kull 4 project, January-November 2001.

3.2 Kill Van Kull Channel Deepening Project 1, September 2000 – June 2001

This project was divided into two parts: the first project was completed by Great Lakes Dredge and Dock and the second by Bean-Stuyvesant LLC. Great Lakes project was started on May 25, 1999, and was completed by November 30, 1999 (SAIC, 2001). The second part of the project placed dredged material at the HARS from September 29, 2000, through June 1, 2001 (**Figure 6**).

During that time, five trips were also made to the Sandy Hook Artificial Reef site. In total, 98% of all 293 trips were recorded by the system. Several of the failures were due to antenna incompatibility, and had occurred during the redesign of system.

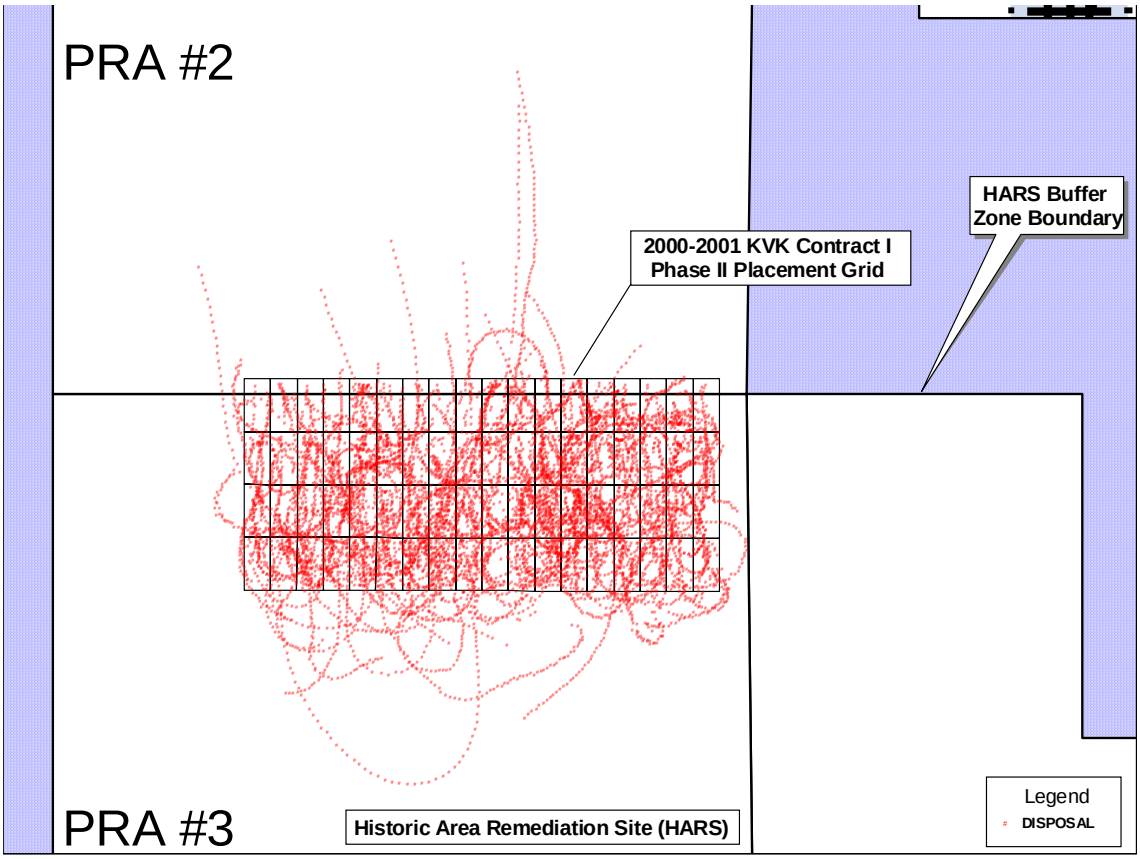

Figure 6. Summary of 284 placements at the Historic Area Remediation Site, Priority Area #3 during the Kill Van Kull Contract #1 Project, September 2000-June 2001.

Plots of each placement and draft record are available on the Internet at (http://www.adiss-afiss.com), and can be accessed by choosing a trip number. The mixture of fine and coarse material dredged from the project contained little water, and increased the disposal time over the target cell to minutes instead of seconds. Since the tug maintained control of the tow by 'making way', a prolonged departure of the load from the scow meant the entire contents were rarely deposited while the scow was within the target cell boundaries. Thus, some of the material was deposited outside the boundaries of the target cells.

3.3 Passenger Ship Terminal Maintenance Project, March - April 2000

The ITO Passenger Ship Terminal maintenance project began the maintenance-dredging season in the New York District on March 23, 2000. The 'Glamour Piers' are typically the first dredged for maintenance, clearing the berthing areas of accumulated silt and clay in preparation for the arrival of the cruise ships. Usually difficult to track in the Upper Harbor, ADISS succeeded in

recording all 99% of all 72 transits to the HARS. A single trip was missed, because the battery had discharged. Previously difficult to track in the upper harbor due to radio interference, the spreading-frequency modems worked without a single failure during the project.

During the initial phase of the project, ADISS equipment was placed on three scows and two tugs. Both tugs alternated tows with the three scows until March 31, 2001, when the scow GL-32 misplaced trip 32 in Priority Remediation Area (PRA) 1, instead of the assigned target. The scow was removed from rotation and repaired the following day, and the project continued without further incident to the end of the project on April 8, 2001.

Plots of each placement and draft record are available on the ADISS Web Site, and can be accessed by choosing a trip number. All show the accurate placement within the designated target grid, except for trip #32, which was misplaced in PRA#1 of the HARS. **Figure 7** is a summary plot of all 72 trips. The fine material dredged from the PST contained significant volumes of water, reducing the disposal time over the target cell to seconds instead of minutes. Since the tug maintained control of the tow by 'making way', a quick departure of the load from the scow meant the entire contents were deposited while the scow was within each target cell.

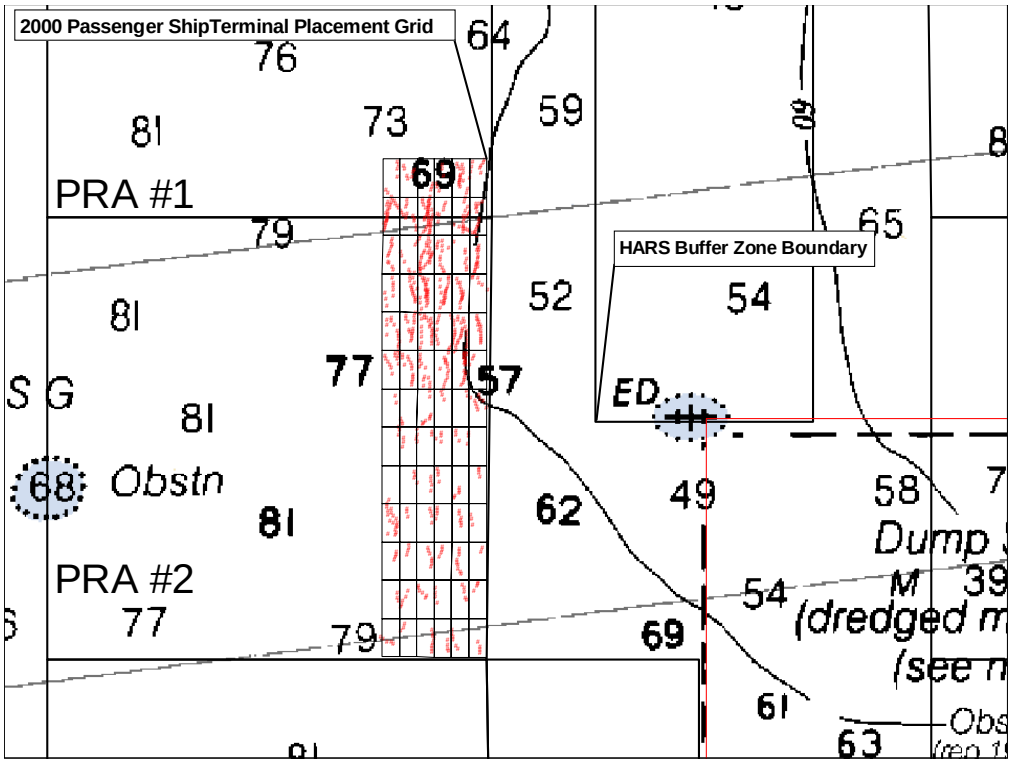

Figure 7. Summary of 72 placements at the Historic Area Remediation Site, Priority Area #2 during the Passenger Ship Terminal Project, March-April 2001.

3.4 Perth Amboy Maintenance Project, July – November 2001

ADISS successfully monitored over 98% of all 350 placements during the Perth Amboy project. Weeks Marine scows *W-254, W-255, W-256, W-257, W-258, W-259, W-260* and *W-264* were installed with ADISS equipment throughout the project, sometimes by Weeks personnel. Six of the eight scows were rotated into service twice or more during the project. Towing operations started by July 17th, and ended on November 9, 2001. ADISSPlay was installed aboard the towing tugs, *Katherine, Ivory Coast, Matthew and C Angelo* during the fifteen-week period.

During the project, six trips were missed by ADISS. Two of the missed trips (42 and 321) were not recorded, because the GPS receiver component malfunctioned. The placement for trip 321 was recorded using ADISSLt, which estimated the scow position from tug GPS position and tow distance layback. Trip 54 was not recorded, because the scow was loaded too light to trigger the pressure sensor threshold. Trip 217 was not recorded due to a tracking error, which cannot be explained without more information. Trip 301 was missed, when the *W-254* was rotated into service without ADISS. After Weeks installed ADISS, trip 302 was also missed, because the unit was not properly activated.

Data plotted from the scows showed momentary gaps in the trackline during twenty transits. Fortunately, none of the gaps occurred during any of the placements. Replacement pressure sensors installed aboard the *W-254* and *W-257* toward the end of the project routinely produced sudden increases in pressure during transit to the HARS. Plotted draft records acquired from the *W-254* and *W-257* showed a two-foot increase in draft, which occurred at the beginning of the two-minute recording interval of each trip. A subsequent inquiry to the sensor manufacturer revealed the newly provided sensors were constructed with a thicker diaphragm, which required a longer warm up time to produce an accurate reading. Unknown to SAIC at the time, the sensors installed on the *W-254* and the *W-257* were constructed with thick diaphragms, and required changes in the ADISS firmware to lengthen the sensor warm up times.

Plots of each placement and draft record are available on the ADISS Web Site (http://www.adiss-afiss.com), and can be accessed by choosing a trip number. Most show the accurate placement within the designated target grid. **Figure 8** is a summary plot of all 350 trips. The fine material dredged from the Perth Amboy project contained large amounts of water, decreasing the disposal time over the target cell to seconds instead of minutes. Since the tugs maintained control of the tows by 'making way', rapid departures of the loads from the scows meant the entire contents were usually deposited while the scows were within the target cell boundaries.

One of the placements targeted for the grid occurred outside the boundary of the Priority Remediation Area 2 (PRA-2). Placement for trip 208 took place during transit in PRA-1, still within the HARS boundaries for placement. Remarkably, the towing crews managed to place virtually the entire volume of dredged material evenly throughout the target area, creating a cap of clean material within one section of the HARS.

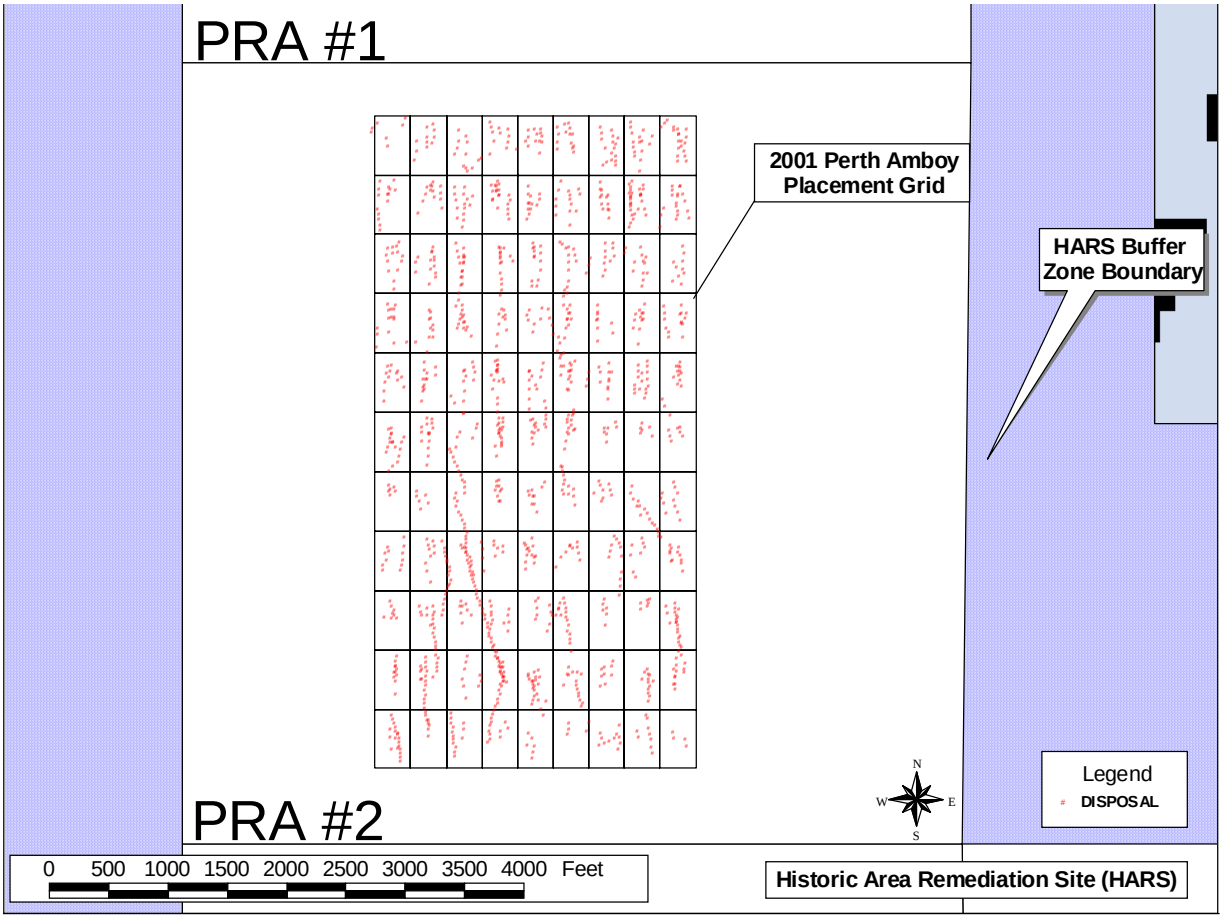

Figure 8. Summary of 350 placements at the Historic Area Remediation Site, Priority Area #2 during the Perth Amboy project, July-November 2001.

3.5 Ambrose Shoals Improvement Project, July – December 2001

The Ambrose Shoals improvement project was initiated by the Great Lakes dredge *New York* to clear the stony material deposited at the entrance of Ambrose Channel during the historical construction of New York's subway system. Once removed by the excavator dredge, the stone cap gave way to medium sand, which was then removed by the hopper dredges, *Manhattan Island* and *Padre Island*.

ADISS successfully monitored 94% of all 385 placements. Placement positions at the two Sandy Hook Artificial Reef site grids were determined from the sudden change in scow draft as monitored by the pressure sensors installed in the aft ram well of each scow or hopper dredge.

Great Lakes scows *GL-31* and *GL-33* were installed with ADISS equipment for the project by July 28th along with the ADISSPlay equipment for the tug, *William Colonon.* By August 5th, the stone cap had been removed, and the excavator equipment had been removed. The hopper dredge, *Manhattan Island*, was equipped with ADISSPlay by August 31st, and was demobilized by October 20th. The *Padre Island* was mobilized by November 13th, and then demobilized by December 9th, 2001.

During the project, the ADISSPlay data indicated a few operational problems. The ADISSPlay installation aboard the *Manhattan Island* was equipped with a standard ADISS unit, which telemetered data from atop the bridge to the Inspector's station, located within the wheelhouse. Six trips, five trips, then four trips (32-37, 144-148, and 231-235) were not recorded, because the GPS receiver had failed within the ADISS unit, and the unit could not be replaced until the ADISS Technician gained access to the vessel. Hopper dredges cycled from dredging at the Ambrose Shoals site to placement activities at the Sandy Hook Artificial Reef sites within hours, instead of days, so several trips were missed before the units were replaced. Toward the end of the project, the ADISS installation atop the bridge was replaced with a prototype Automated Fishing Survey System (AFISS). AFISS successfully recorded over 100 trips with one failure, which was due to an ADISSPlay malfunction. The ADISS units aboard the *GL-31* and *GL-33* functioned as intended without incident during the first phase of the project.

Another remedy was also instituted during the Ambrose Shoals project to avoid the problems created by failed GPS components. Inspectors switched to the ADISSLt version of ADISSPlay as an alternative until the GPS component could be replaced within ADISS. The alternative logged hopper position based on GPS input from a Garmin III+ model, which had been interfaced to the ADISSPlay computer by the ADISS Programmer. This alternate source of position information provided stability within the electronically 'noisy' environment of the hopper dredge. Since ADISSLt did not receive draft input from the ADISS unit, the time of placement were indicated by the Inspectors. Bin opening and closing buttons were provided on the ADISSPlay entry screen for this purpose.

Plots of each placement and draft record are available on the ADISS Web Site, and can be accessed by choosing a trip number. Most show the accurate placement within the two designated target grids. **Figure 9** is a summary plot of all 362 trips. The sandy material later dredged from Ambrose Shoals by the hopper dredges contained significant amounts of water, decreasing the disposal time over the target cell to seconds instead of minutes. Though some of the material adhered to the bin doors, and was washed out with monitors, most of the material exited the hopper within the first few seconds. Since the hopper dredges were able to maintain position with bow thrusters, the entire contents of each load was often deposited within the designated target cell boundaries.

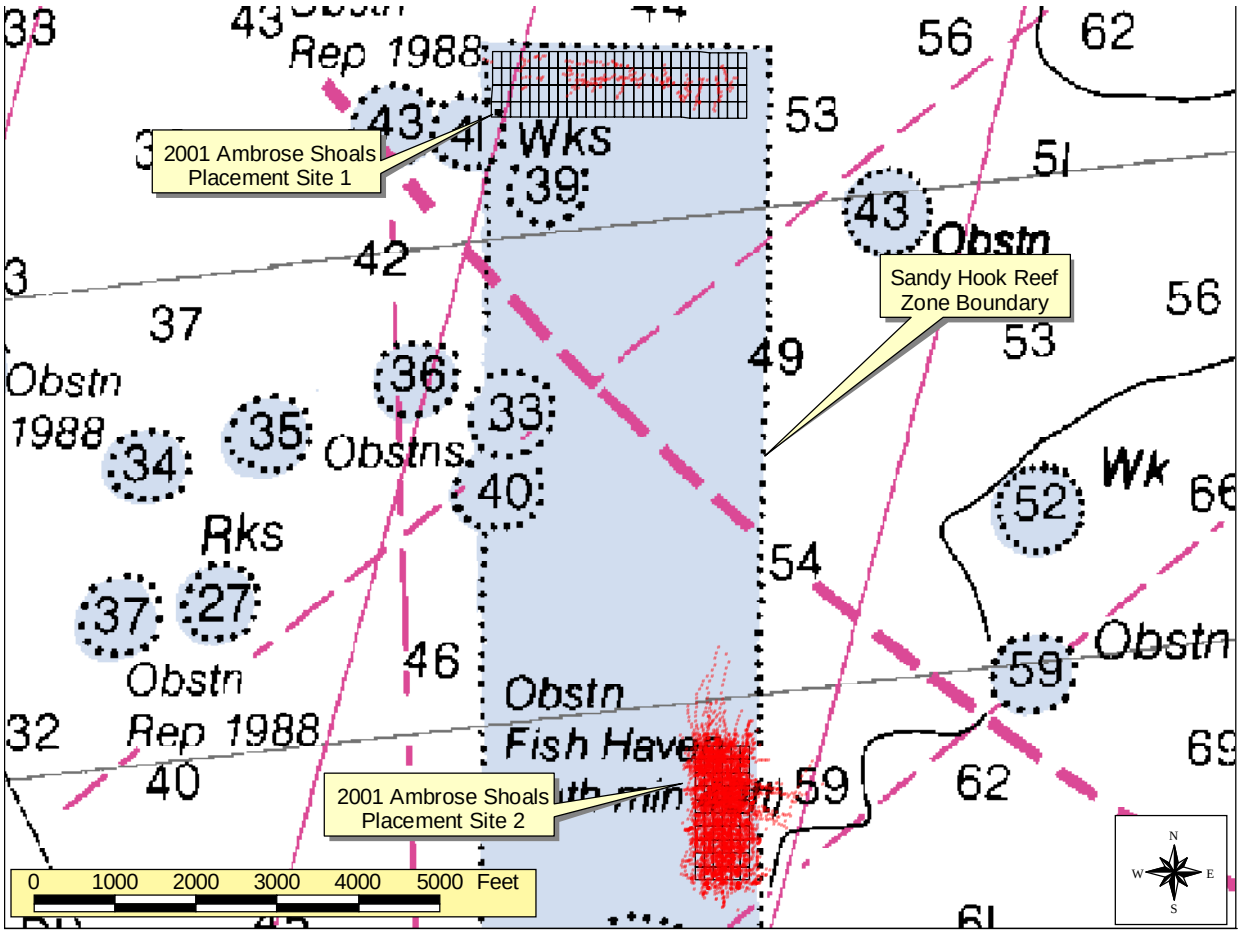

Figure 9. Summary of 362 placements at the two Sandy Hook Artificial Reef sites, during the Ambrose Shoals project, July-December 2001.

3.6 Jack Frost Refined Sugar Maintenance Project, October 2001

The Jack Frost Refined Sugar maintenance project usually ends the maintenance-dredging season in the New York District on October 15th of each year. The sugar piers are seasonally the last dredged for maintenance, clearing the berthing areas of accumulated silt and clay in preparation for the arrival of the bulk cargo ships. Previously difficult to track in the Upper Harbor due to radio interference, the spreading frequency modems worked without a single failure during the project total of 11 trips to the HARS.

ADISS successfully monitored 100% of all placements. Placement positions were determined from the sudden change in scow draft as monitored by the pressure sensors installed in the aft ram well of each scow.

Weeks scows *W-255* and *W-264* were instrumented with ADISS equipment for the project, and performed well during the project's brief duration without incident. Towing operations began October 2, and were concluded by October 8, 2001.

During the project, the Inspector logs, which would normally be completed and submitted electronically with the scow tracking information was not completed using the ADISS system. Instead, the logs were filled out by hand and faxed to the NYD. At the request of the NYD, no Inspector log information was entered into the ADISS system and transmitted to SAIC. The lack of the Inspector log information prevented SAIC from performing the quality assurance checks that normally take place. To date, these checks have not been performed, because copies of the logs have not been provided.

Plots of each placement and draft record are available on the ADISS Web Site, and can be accessed by choosing a trip number. All show the accurate placement within the designated target grid. **Figure 10** is a summary plot of all 11 trips. The fine material dredged from the Refined Sugar piers contained significant volumes of water, reducing the disposal time over the target cell to seconds instead of minutes. Since the tug maintained control of the tow by 'making way', a quick departure of the load from the scow meant the entire contents were deposited while the scow was within the target cell boundaries.

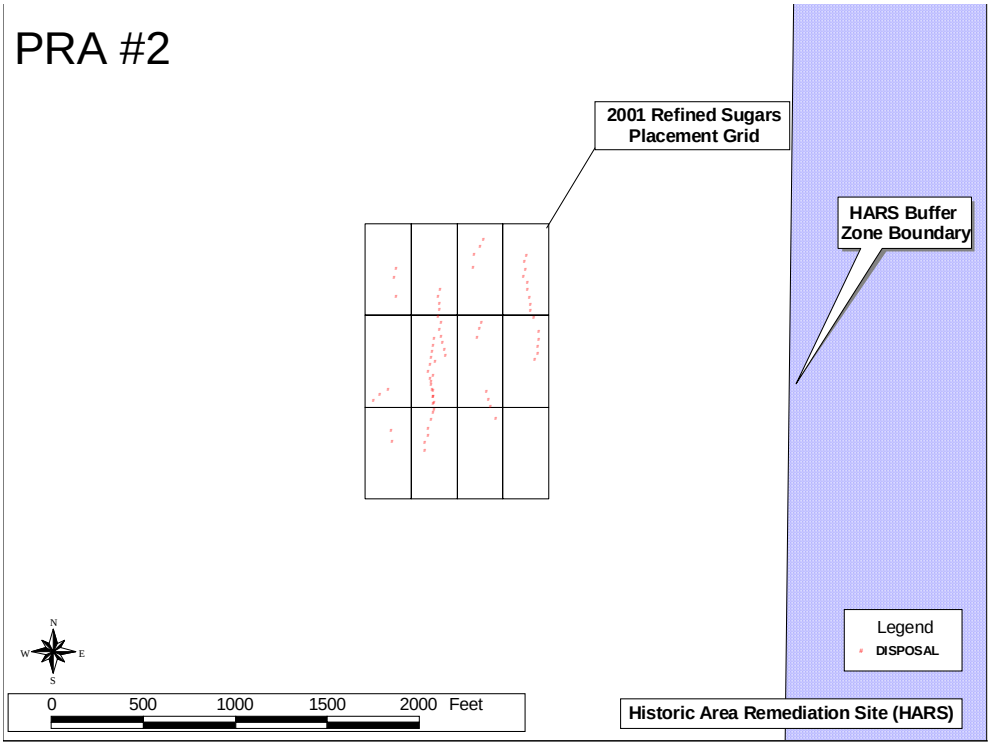

Figure 10. Summary of 11 placements at the Historic Area Remediation Site, Priority Area #2 during the Refined Sugar Project, October 2001.

3.7 IMTT Maintenance Project, August – September 2001

The IMTT petroleum piers were dredged to maintain adequate depth for the bulk carriers transferring product to the attached tank farm.

ADISS successfully monitored 100% of all 46 placements. Placement positions were determined from the sudden change in scow draft as monitored by the pressure sensors installed in the aft ram well of each scow.

Great Lakes scows *GL-31* and *GL-33* were installed with ADISS equipment for the project by October 4th, but *GL-33* was not rotated into service until October 11th. Instead, the Bean-Stuyvesant scow *T-302* was used with the *GL-31* to start the project. Operations with all three scows continued until October 16th, when the project was temporarily ended at trip number 40. Dredging resumed on November 2nd with scows *GL-31* and *GL-33*, and was completed on November 23rd with trip number 46.

During the project, the ADISS data indicated a few operational problems. The ADISS installation aboard *GL-31*, showed irregular tracks during trip numbers 8, 12, 24, 28, 32 and 42. Evidently the GPS receiver component on the ADISS unit occasionally lost its lock with the GPS satellite signal or incorrectly processed the signal, resulting in momentary scatter in the trackline plot. The ADISS units aboard the *GL-33* and *T-302* did not demonstrate this tendency during the project, and behaved normally.

Decreases in draft sensor measurements occurred during trip number16 aboard *GL-31*. The drop is sudden, near the end of the trip, and appears to decrease by almost 1.5 feet. No other decreases occur during other trips.

Plots of each placement and draft record are available on the ADISS Web Site, and can be accessed by choosing a trip number. Most show the accurate placement within the designated target grid. **Figure 11** is a summary plot of all 46 trips. The sandy material dredged from the IMTT piers contained significant amounts of sticky clay, increasing the disposal time over the target cell to minutes instead of seconds. Since the tug maintained control of the tow by 'making way', a slow departure of the load from the scow meant the entire contents were rarely deposited while the scow was within the target cell boundaries.

The final trip (number 46) shows some evidence of a late placement, which extended outside the grid boundaries. A check with the Inspector log entry available on the ADISS web site documents the scow opening mechanism failed during the placement, delaying the disposal of the dredged material load.

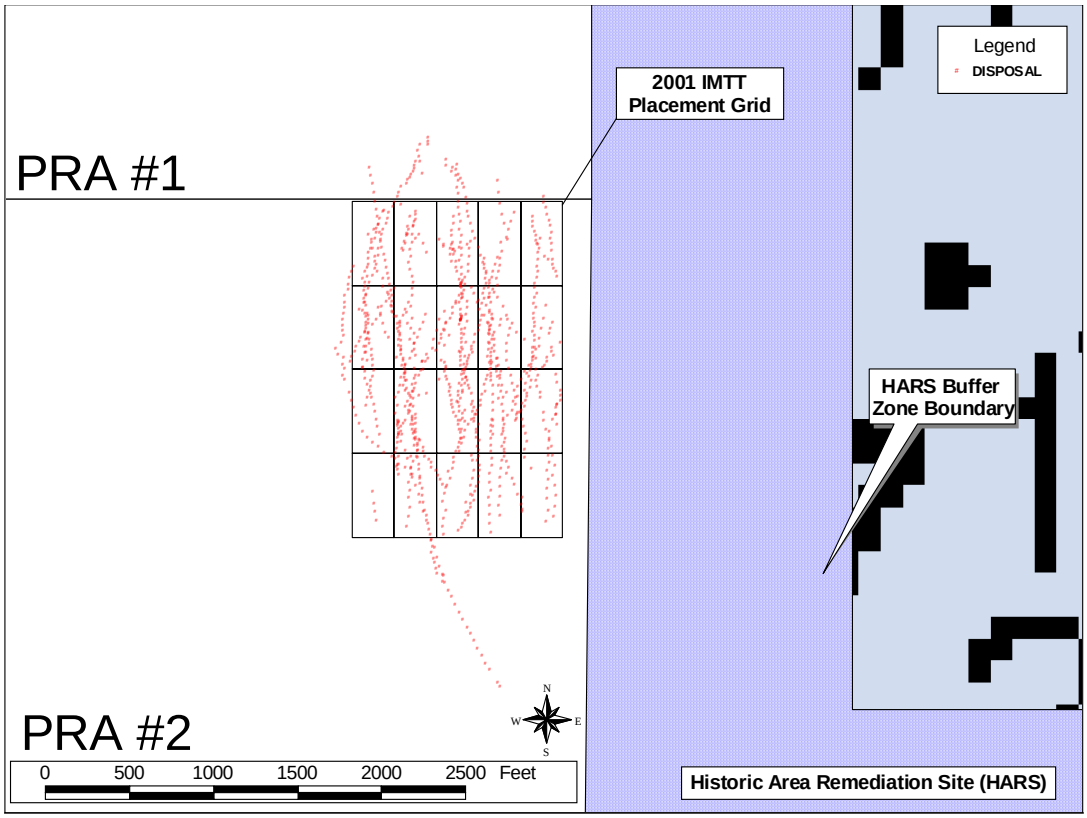

Figure 11. Summary of 46 placements at the Historic Area Remediation Site, Priority Area #2 during the IMTT project, October-November 2001.

3.8 Red Hook Flats Maintenance Project, October – November 2001

ADISS successfully monitored 100% of all 152 placements during the Red Hook Flats project. Placement positions were determined from the sudden change in scow draft as monitored by the pressure sensors installed in the aft ram well of each scow.

Weeks Marine scows *W-255* and *W-264* were installed with ADISS equipment by October 9th, when towing operations started. The Weeks Marine scow *W-255* was rotated out of service November 14th, and was replaced by the *W-254*, which operated to the end of the project with the *W-264* on November 28th, 2001.

ADISSPlay was installed aboard the towing tug, *Katherine* at the beginning of the project and switched to the *Emma Roehrig* on November 14th, and finally to the *Matthew* on November 23rd.

During the project, the ADISS data indicated a few technical problems. Data plotted from the *W*-264, *W*-255, and the *W-254* showed momentary gaps in the trackline during eleven transits. Fortunately, none of the gaps occurred during any of the placements. The ADISS data acquired from the *W-264* and *W-254* showed irregular tracks during twelve trips. Evidently the GPS

receiver component in the ADISS unit occasionally lost lock with the GPS satellite signal or incorrectly processed the signal, resulting in momentary scatter in the trackline plot. The ADISS unit installed aboard the *W-254* routinely produced a sudden increase in pressure readings since its introduction to the project, November 14th.

All plotted draft records acquired from *W-254* show a two-foot increase in draft, which occurred at the beginning of the two-minute recording interval of each trip. A subsequent inquiry to the sensor manufacturer revealed the newly provided sensors were constructed with a thicker diaphragm, which required a longer warm up time to produce an accurate reading. Unknown to SAIC at the time, the sensor installed on the *W-254* was constructed with a thick diaphragm, and required a change in the ADISS firmware to lengthen the sensor warm up time.

Plots of each placement and draft record are available on the ADISS Web Site, and can be accessed by choosing a trip number. Most show the accurate placement within the designated target grid. **Figure 12** is a summary plot of all 152 trips. The fine material dredged from the Red Hook flats contained some sticky clay, increasing the disposal time over the target cell to minutes instead of seconds. Since the tug maintained control of the tow by 'making way', a slow departure of the load from the scow meant the entire contents were rarely deposited while the scow was within the target cell boundaries.

A few of the placements targeted for the last row of cells partially occurred outside the boundary of the grid. Some of the over placement was due to the nature of the material, and some to the particularities of the scow opening device on the *W-264*. A check with the Inspector logs on the ADISS web site revealed the scow opening mechanism was slow during the placement, delaying the disposal of the dredged material load.

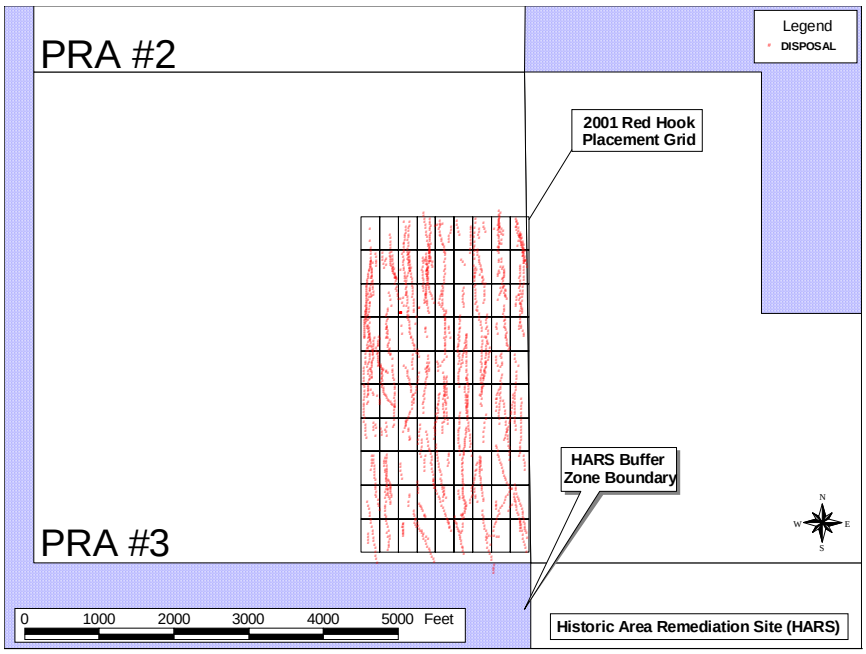

Figure 12. Summary of 152 placements at the Historic Area Remediation Site, Priority Area #3 during the Red Hook Flats project, October-November 2001.

4.0 SUMMARY AND RECOMMENDATIONS

The following summarizes the results of monitoring the placement operations at the HARS and the Atlantic Beach and Sandy Hook Artificial Reef sites during the 2001 dredging season:

- ADISS units aboard several scows and a hopper dredge, and ADISSPlay systems in the wheelhouses of the tugs recorded 97% of all placement events.

- The ARGOS data telemetry system was replaced with the cellular telephone link for reporting ADISS and ADISSPlay information to the ADISS web site, and for remote trouble-shooting from SAIC.

- The VHF radio modems on the scows and tugs were replaced with spread-spectrum radio modems for the ADISS-to-ADISSPlay data communications link.

- The ADISS web site was revised to:

  Query, plot and display ADISS placement information from the database,
  - Receive automated e-mail warnings of scow leakage or misplacement,
  - Plot summaries of all center placements for each project,
  - Query, plot and display ADISS vessel draft information from the database, and
  - Provide a summary display of recent placement information for each user.

- Replaced all Trimble CM-3 receivers with ACE-3 components, and retrofitted ADISS hardware with crash-proof protection.

- Initiated real-time tracking of dredge scows through a spread-spectrum modem network and the password-protected ADISS web site display.

The following recommendations are suggested improvements to HARS and Artificial Reef site management operations:

- Provide up to date NOS marine weather forecasts and NOAA buoy reports for towing tugboats via the ADISS web site on the ADISSPlay program.

- Include the NYD Transportation Placement Log (TPL) checklist as part of ADISSPlay, and transmit the exceptions as noted by the Inspectors to NYD.

Provide an ADISSPlay input for a relative scow bearing.

Provide an ADISSPlay input for volume based on density estimates and vessel draft.

Create a management tool to display target grid cell eligibility on the ADISS web site based on minimum depth and volume predictions and ADISS placement data.

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