Bathymetric Survey
at the Cornfield Shoals Disposal Site
July 1987

Disposal Area Monitoring System DAMOS

Contribution 70
October 1988

US Army Corps of Engineers
New England Division

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1.0 INTRODUCTION

The Cornfield Shoals Disposal Site is located approximately 3.3 nm southeast of Cornfield Point in Old Saybrook, Connecticut. It occupies a 1 nm square area centered around 41°12.68N, 72°21.52W and has water depths in the range of 49 to 57 meters. Cornfield Shoals is presently the only site in New England managed as a dispersive site; the disposal site has a relatively smooth, sandy bottom with a shallow depression oriented in an east-west direction. The near-bottom energy regime is the highest of all DAMOS sites and this is reflected in the texture of the bottom sediments (primarily sand and gravel). Some overconsolidated clay and clay nodules from glacial lake deposits have been found in the site, providing further geological evidence of scouring. The major currents at this site are the result of an east-west tidal component and the outflow of the Connecticut River; seasonal river effects can be quite pronounced due to spring runoff and snow melt. Although recent current meter data are not available for this site, near-bottom current data obtained in 1978 (NUSC, 1979) indicate that average peak tidal velocities are on the order of 30 cm/sec in a northwest-southeast direction. The relatively high energy regime at Cornfield Shoals is equally composed of the tidal and residual (riverflow) components in contrast, for example, to the New London Disposal Site that has similar tidal current velocities but a smaller residual component, resulting in a reduced overall energy regime.

As with the other Long Island Sound disposal sites, the incidence of storm-driven wave currents is reduced due to the restricted fetch available at the site; only the most severe northeast storms have any potential for effect. There is little concern about storms and potential effects on sediment transport.

Because Cornfield Shoals is a dispersive disposal site, its use has been limited to the deposition of relatively uncontaminated dredged material from the Connecticut River and surrounding area. The average annual volume of dredged material deposited at Cornfield Shoals is approximately 55,000 m^3, however the actual amount can vary widely from year to year. Previous monitoring surveys have included study of the near-bottom currents and precision bathymetric surveys in 1978 and 1979 (NUSC, 1979). The high current conditions at this site make diving operations impossible, and deployment of other types of oceanographic sampling gear is equally difficult.

A precision bathymetric survey was conducted at the Cornfield Shoals Disposal Site on 31 July 1987 to determine if any bathymetric changes have occurred relative to prior surveys. It was expected that no accumulation of dredged material would be detected at the site even though approximately 360,000 m^3 of material has been deposited between 1979 and 1987. For the period

prior to this (1960 to 1978), approximately 1.03 million cubic meters of dredged material has been deposited at Cornfield Shoals.

2.0 METHODS

The precise navigation required for the bathymetric survey was provided by the SAIC Integrated Navigation and Data Acquisition System (INDAS). A detailed description of INDAS and its operation can be found in Contribution #60 (SAIC, 1986). Positions were determined to an accuracy of ±3 meters from ranges provided by a Del Norte Trisponder System. Shore stations were established over benchmarks at Cornfield Point and Lynde Point in Old Saybrook, Connecticut.

The depth was determined to a resolution of 0.1 feet (3.0 cm) using a Raytheon DE-719 Precision Survey Fathometer with a 208 kHz transducer. The fathometer was calibrated with a bar check at fixed depths below the transducer before the survey began. A Raytheon SSD-100 Digitizer was used to transmit the depth values to the SAIC computer system. Forty-one survey lanes were run east and west at a 25 meter lane spacing over an 1000 by 1000 meter area positioned around the center of the disposal site. (The center of the site serves as the target for all disposal operations.) This lane spacing provides good resolution for subsequent data analysis and the production of detailed depth contour charts. During analysis of the bathymetric data, the raw depth values are standardized to Mean Low Water by correcting for ship draft and for tidal changes for the duration of the survey.

3.0 RESULTS and DISCUSSION

The majority of the site resides in an irregularly shaped depression where depths range from approximately 49 meters in the northeast corner to a maximum of 57.5 meters in the south central area (Figure 3-1). Visual comparison of the July 1987 survey with surveys conducted on 30 July 1978 (Figures 3-2a,b) and on 27 January 1979 (Figure 3-3) suggests that no significant changes in depth (greater than 0.5 meters) have occurred at the site. It is important to note that these earlier surveys were conducted at a 50 meter lane spacing and with different computer and fathometer systems. Because of the different formats used to store the position and depth data for the three surveys, a direct comparison could not be made. By overlaying copies of the survey plots that were enlarged or reduced to a uniform scale, the shape and depth of the contours were compared. As expected, some inconsistencies did exist but the three survey plots were in good overall agreement.

A combination of factors control the accumulation of dredged material at Cornfield Shoals. Because no disposal buoy is deployed, dredging contractors are required to dispose at a set of

LORAN-C time delay numbers for the center of the disposal site. Given the precision of LORAN-C (approximately 30 to 60 meters, depending on the combination of slave stations used) and how close to those numbers the scows actually get, disposal occurs in a dispersed pattern around the true coordinates. This results in a thin layer of material spread over much of the site. The high energy regime at the site acts to move the material during convective descent as well as after impact with the bottom. The presence of sand and gravel throughout the majority of the site suggests that the bottom current velocities are sufficient to resuspend fine-grained material for transport in the predominant directions of flow (northwest and southeast).

Because of the small volume of material deposited at Cornfield Shoals over the last ten years, the disposal procedures used, and dispersion, a thin layer (< 0.5 m) of dredged material could have accumulated throughout much of the site and not be detected by the visual comparison of the present survey with those performed in 1978 and 1979. Detecting such thin layers would normally be difficult even with computer-aided comparisons of surveys due to relatively rapid changes in depth and an irregular bottom topography. The 360,000 m^3 of material deposited between the 1978 and 1987 surveys would result in a layer of approximately 0.36 m if spread evenly throughout the survey area. At a containment site, such as the Central Long Island Sound (CLIS) site where point dumping occurs at a taut-moored disposal buoy, this amount of material would have created a distinct mound approximately 2 meters high with a radius of 150 to 200 meters. The lack of a significant topographic feature at Cornfield Shoals is most likely due to both the disposal procedures used and the high energy regime responsible for dispersing the material.

4.0 REFERENCES

NUSC, 1979. DAMOS Disposal Area Monitoring System Annual Data Report: Proceedings of Symposium, 14-15 May 1979. Naval Underwater SYstems Center, Newport RI.

SAIC, 1986. Seasonal Monitoring Cruise at the New London Disposal Site, July 1986. SAIC Report #86/7540&C60 , US Army Corps of Engineers, New England Division, Waltham, MA. DAMOS Contribution #60.

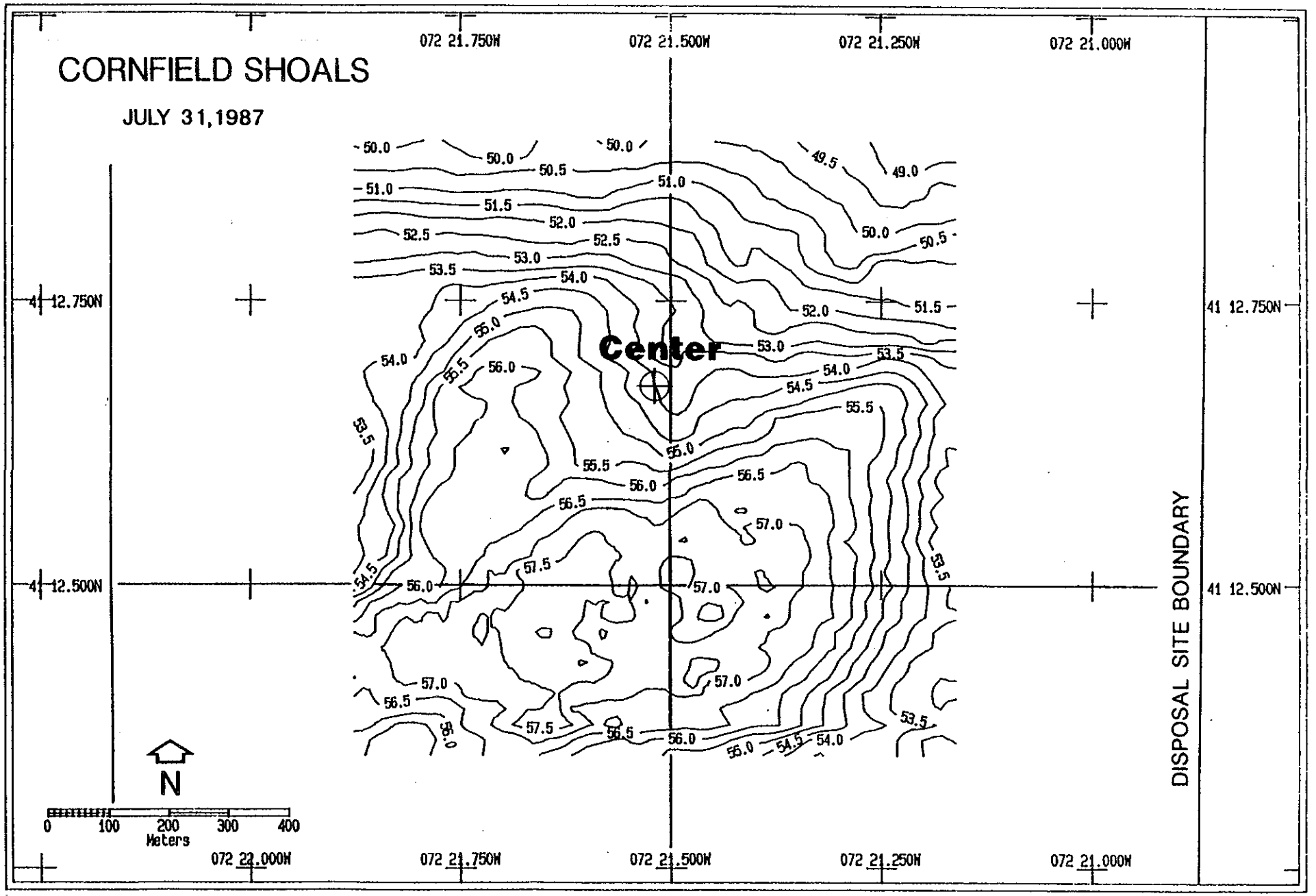

Figure 3-1. Contoured depth (meters) plot of the Cornfield Shoals Disposal Site, 31 July 1987.

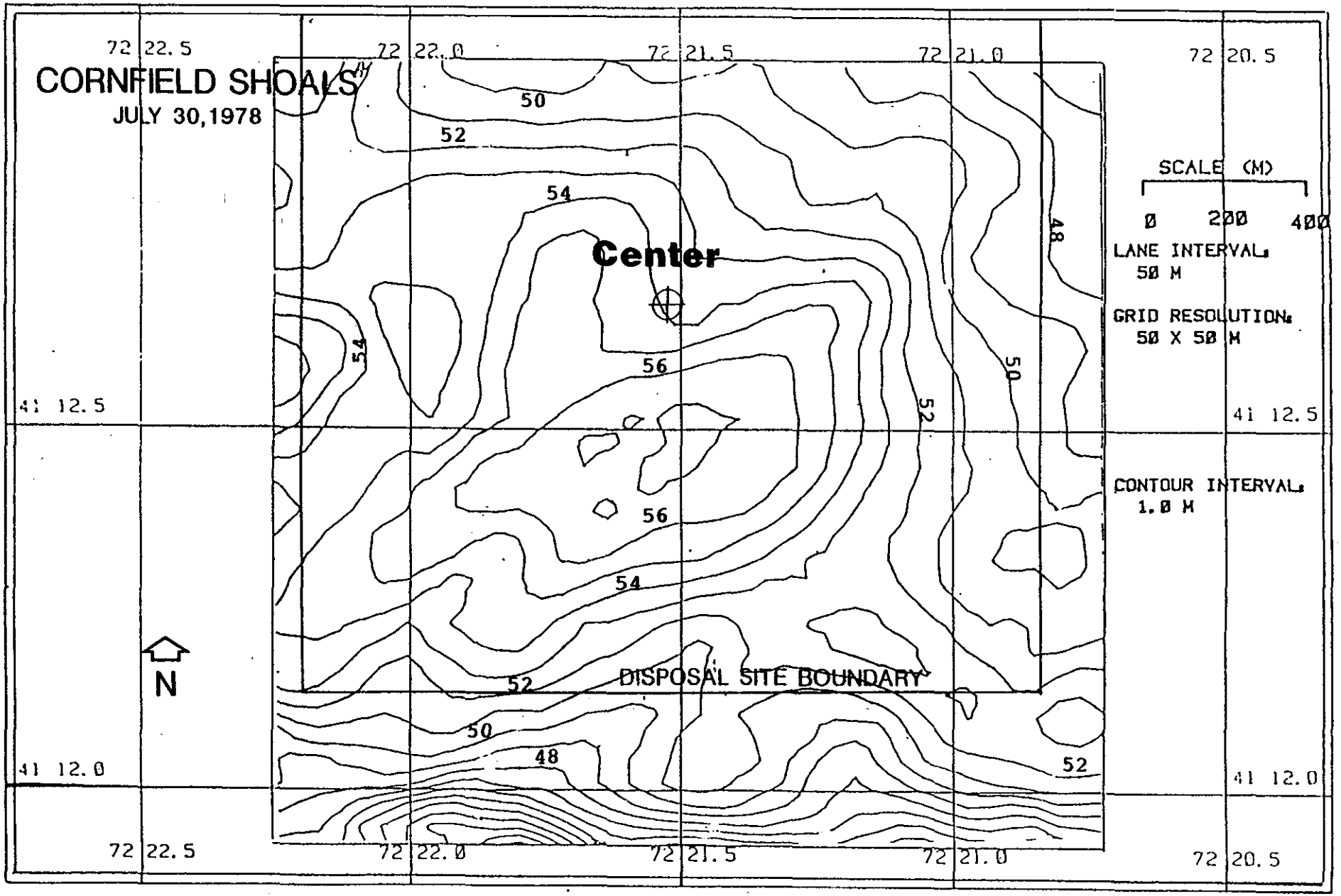

Figure 3-2a. Contoured depth (meters) plot of the Cornfield Shoals Disposal Site, 30 July 1978.

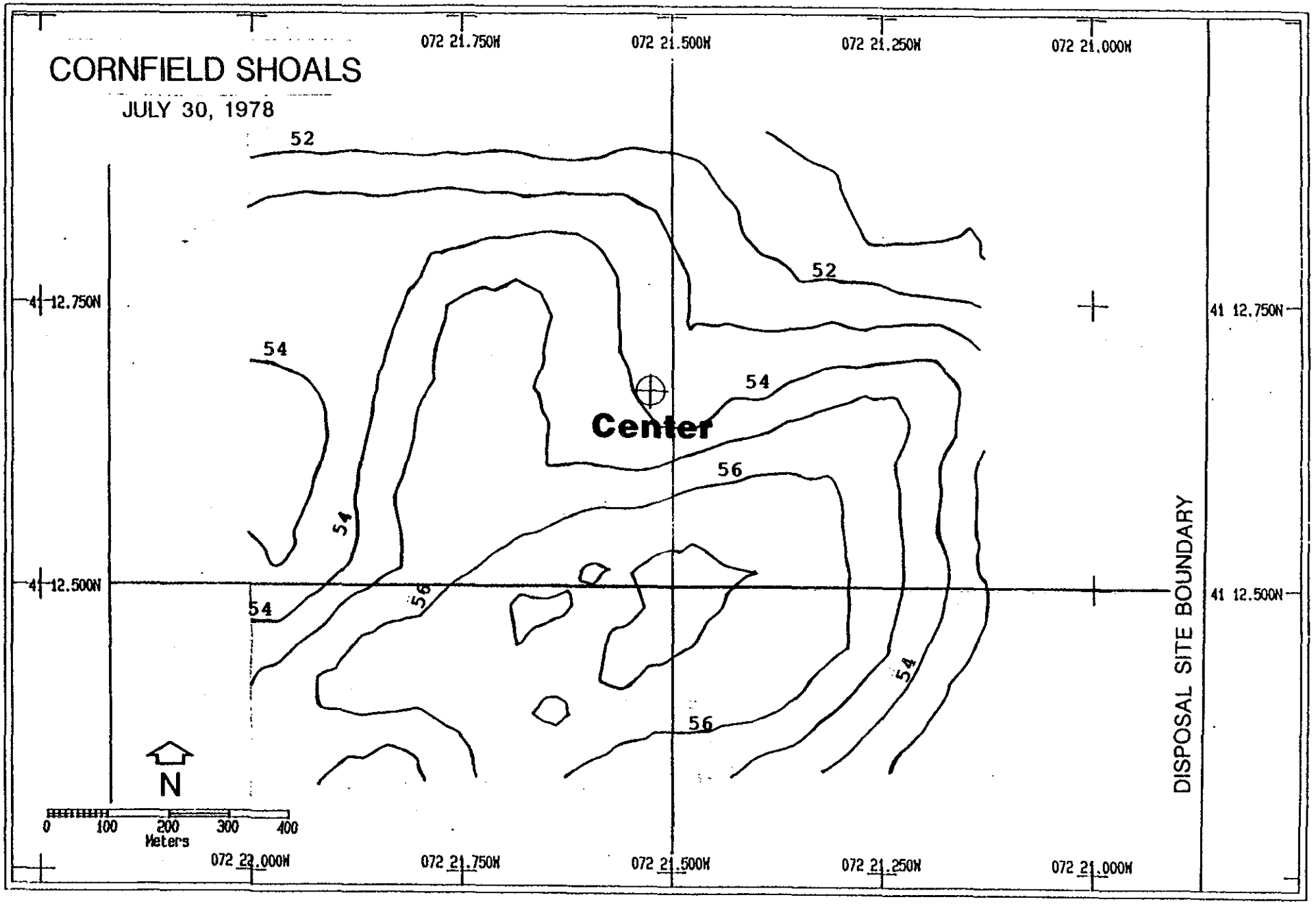

Figure 3-2b. Enlarged contoured depth (meters) plot of the Cornfield Shoals Disposal Site, 30 July 1978.

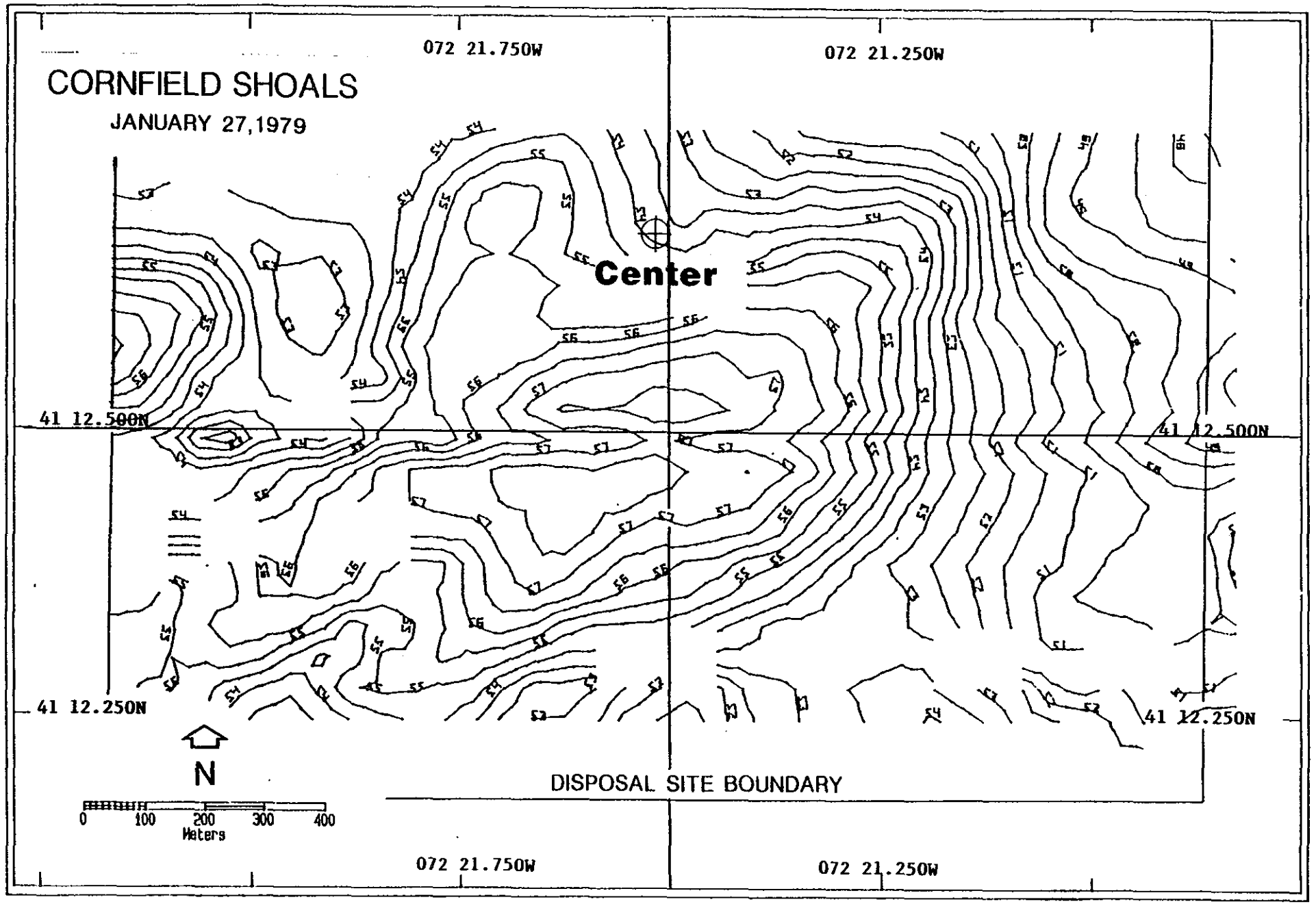

Figure 3-3. Contoured depth (meters) plot of the Cornfield Shoals Disposal Site, 27 January 1979. Suspect data occurs in east-west lane just below center.