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[New Bedford, MA 02740](#)
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MEMORANDUM

To: Mr. Ken Gaynor, QCSM
Jacobs Engineering
New Bedford Harbor Superfund Site
103 Sawyer Street
New Bedford, MA 02746

From: Apex Companies, LLC
One Wamsutta Street
New Bedford, MA 02740

Date: 23 October, 2007

Re: **Bathymetric Survey – EPA Operable Unit #3 (OU#3)**
New Bedford Harbor Superfund Site

Bathymetric Survey: New Bedford Harbor: EPA Operable Unit #3

Apex Companies, LLC has completed the bathymetric survey of the EPA Operable Unit #3 (OU#3), per the contract modification dated 9/19/2007 to contract number 35BG0601-S07-0009 between Apex Companies, LLC and Jacobs Engineering. Apex personnel completed the bathymetric survey between Tuesday, October 2, 2007 and Saturday, October 6, 2007. The survey was performed by Apex personnel Kris van Naerssen, Greg Dolan and Josh Ray.

Apex utilized a 19-foot fiberglass survey vessel, ODEC (Bathy500 DF) digital fathometer, Trimble Pro-XRS DGPS survey system, and Hypack Version 6.2 navigation and data collection software for the survey.

The bathymetric survey data is referenced to Mean Lower Low Water vertical datum. Tidal readings were obtained from a tideboard located on the pier outside of the New Bedford Harbor Hurricane Barrier. The tideboard was placed at the eastern end of the pier located near the intersection of Franklin Street and East Rodney French Boulevard. Apex personnel installed the tideboard, which was measured in 1/10th foot increments, on September 26, 2007. The tideboard elevation is based upon geodetic control point TS1, which was installed on May 16, 2005 by Coler & Colantonio surveyors.

Weather Conditions:

10/02/07

- Temperature: 75 degrees;
- Cloud Cover: Partially Cloudy
- Wind: Varied. 5 - 15 Knots from northeast

10/03/07

- Temperature: 70 degrees;
- Cloud Cover: Overcast
- Wind: Varied. 10 - 15 Knots from southeast

10/06/07

- Temperature: 80 degrees;
- Cloud Cover: Partially Cloudy
- Wind: Varied. 5 - 10 Knots from northeast

QA/QC Checks:

- At the mooring ball located to the northeast of the East Rodney French Boulevard public boat launch, Apex used the vertical manual depth rods to check the fathometer readings, after initial instrument calibration, which included offset checks and sound velocity adjustments.
- The sound velocity check was conducted at the mooring, to ensure that the survey was ran at a sound velocity setting that reflected the water conditions. After the instrument calibrations, all rod and transducer checks correlated well.
- Fourteen manual (vertical) rod checks were performed at various depths during the survey. A survey rod was used to ensure greater accuracy during the manual rod checks. The field survey equipment passed all rod checks that were performed, as the rod and fathometer depths matched. Field notes with the QA/QC and data check results are attached to this memorandum.
- The pre-survey calibrations were conducted at 4, 5, 6, 10 and 15 feet at Operable Unit #3. Apex repeated the sound velocity checks at the completion of each survey day and prior to conducting surveys on subsequent days.
- Tide measurements were collected approximately every 20-30 minutes at the tide boards established by Apex. Readings are referenced to Mean Lower Low Water.
- Apex performed four latency line checks within the survey area by repeating survey lines in opposite directions. The results of the latency check indicated no latency discrepancies, and corrections were not required.
- Apex ran cross-tie lines in two directions (east and west) at the completion of the survey of OU#3.

Survey Procedures – Comparison to Previous Years

- All survey procedures were consistent with Apex's previous surveys at OU#3. Survey lines were run in a southeast to northwest orientation, to ensure the most bathymetric coverage over the capped area.
- The 25' spacing was consistent with the January 2006 survey. The July 2005 survey of OU#3 was conducted at 12.5' spacing, as this represented the higher resolution "As-Built" survey for the OU#3 Cap Placement Area.
- As with the previous surveys, multiple QA/QC checks (Including Rod Checks, Depth/ Rod Checks, Tide Readings and Latency checks) were performed prior to, during, and after the survey, as described above.

Processing:

Apex processed the survey data on Thursday 10/4/2007 and Wednesday 10/10/2007 using the QA/QC protocols previously noted. Pre-processing was conducted with Hypack software, and post-processing with Oasis Montaj. Corrections were applied in Hypack to account for the increased wave and wake activity at the OU#3 area. “Flyers” were removed from the data-set, and a non-linear filter was applied, removing any soundings that differed by more than 0.2-feet over 1 fiducial (sounding). Apex compared the 2007 survey results with survey data collected previously, by Apex and others, both in plan and section view. Additionally, the data from the survey was compared with the pre-dredge conditions survey. Statistics were performed on the data and the results were reviewed and analyzed. After the data had successfully passed through the QC checks, it was transcribed into the maps which are included with this memo.

Deliverables:

Apex is including with this memo:

- The 10/06/2007 Cap Thickness (Isopach) survey map;
- A copy of the previously produced 01/12/06 Cap Thickness (Isopach) survey map;
- A copy of the previously produced 07/26/05 As-Built Cap Thickness (Isopach) survey map;
- A figure depicting the limits of the 2005 Cap contour vs. 2007 Cap contours.
- Cap thickness cross section, produced from data at the southwestern portion of the Cap;
- A .pdf copy of the field notes, calibration check and data processing sheets.

Discussion - Cap Changes with Time:

OU#3 Pilot Cap surveys and Cap statistics have been conducted for 2005, 2006, and 2007 (see attached). Cap statistics were conducted for both the Intended Cap Area, and for the Full Placement Area. The Intended Cap Area is that area which was designated in the design to be capped. The Full Placement Area was that area which ultimately received cap material during the cap construction.

For the 2007 dataset, the Full Placement Area limits were determined by selecting the 0.5-foot contour around the placed material. The size of the cap area in 2007 (using the 0.5-foot contour interval) was determined to be 20.76 Acres. The capped area footprint in 2005 was 18.9 acres, at the 0.5-foot contour line.

A review of the Cap surveys from 2005 through 2007 indicates that the material placed within the Intended Cap Area is acting generally as expected over time: the “peaks” are decreasing, with the material winnowed from the peaks generally moving into the valleys. The overall effect is that the Cap is flattening out and becoming more uniform within the Intended Cap Area. Statistics indicate that within the Intended Cap Area, by 2007 the Cap exceeds two feet in thickness over nearly 75% of the area, and exceeds one foot in thickness over more than 98% of the area.

In the Full Placement Area, the 2007 Cap statistics indicate that a lower percentage of the overall area is covered by the one and two foot thicknesses. It is thought that this is due to “toe-ing” at

the edges of the Cap, as placed material seeks a more stable angle of repose at the edges over time. This “toe-ing” effect is illustrated on the attached cross sections, which show a flattening of the slope at the very edge of the Cap between the 2005 and 2007 surveys. This phenomenon suggests that future Cap placement efforts in this area should include a provision to extend the Cap beyond the edge of the Intended Cap Area in order to account for “toe-ing” of the Cap at it’s edges over time.

Comparison of Statistics:

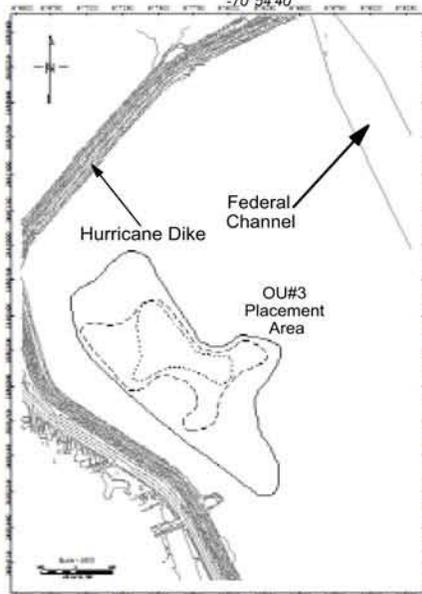
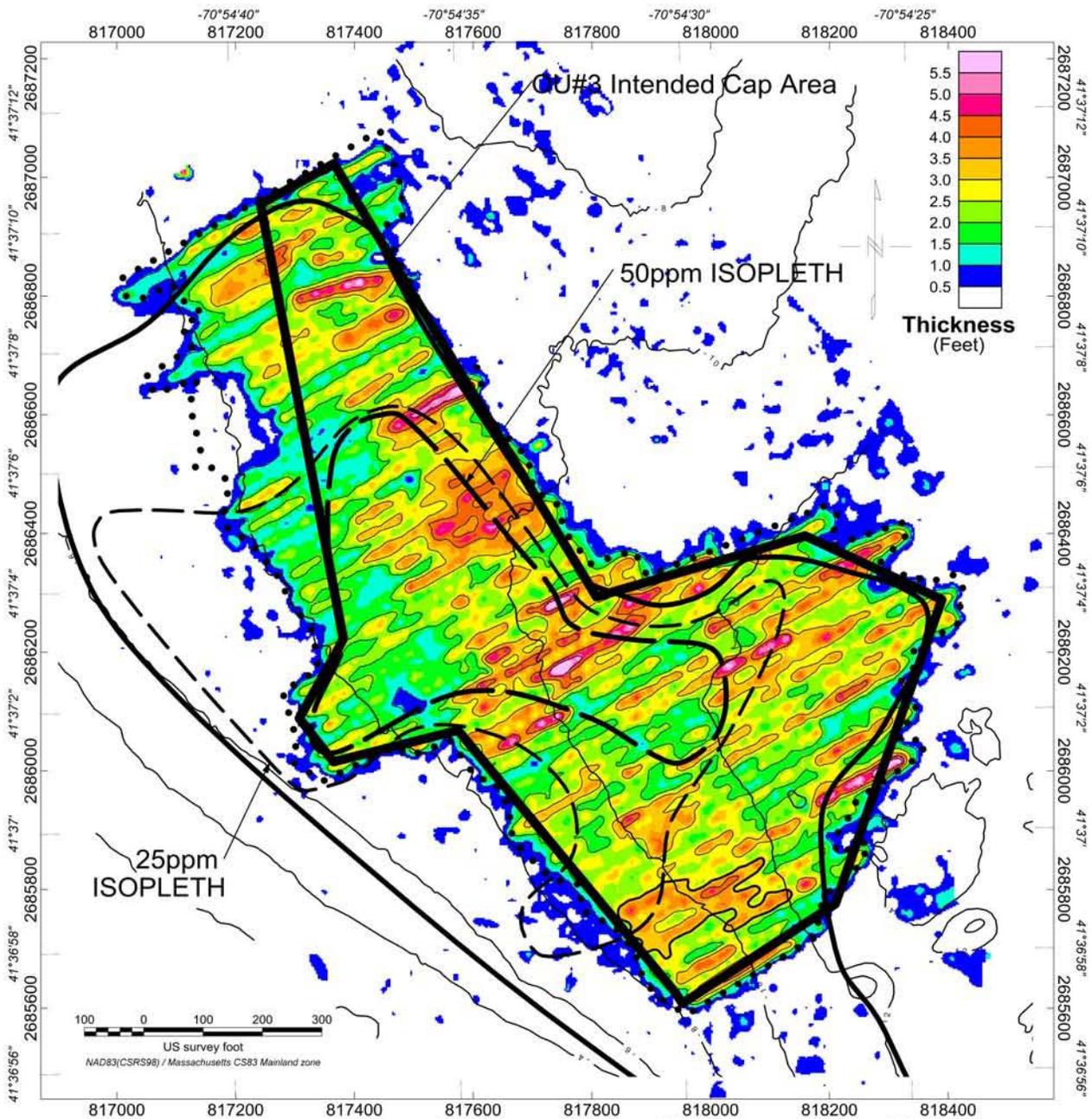
Apex has re-calculated the statistics for the material that was placed within the “Intended Cap Area” for the previous years’ surveys. The statistics have been re-calculated, so that a comparison may be made, of the same area over time. The Intended Cap Area, as defined above, is depicted on the 2007 Cap Thickness Map. The coverage percentages for the Intended Cap Area over time are presented below:

<u>Year</u>	<u>Thickness of Cap > 1’ Foot</u>	<u>Thickness of Cap > 2’ Foot</u>
2005	92.6%	58.5%
2006	97.8%	67.0%
2007	98.4%	74.6%

If you have any questions concerning the data collection and/or data processing activities described here-in, please do not hesitate to contact either: Kris van Naerssen, Greg Dolan or Jay Borkland (617) 728-0070. Apex is please to support Jacobs in this very important field program. Please do not hesitate to contact us if you have questions or comments.

Sincerely: Jay Borkland, Greg Dolan, Kris van Naerssen

Attachments (email attachments): maps, cross-sections, field notes and calibration forms.



STATISTICS

Intended Cap Area: AREA OF CAP ~15.24 ACRES
 THICKNESS OF CAP >1-FOOT 98.4%
 >2-FOOT 74.6%

Full Placement Area: AREA OF CAP ~20.76 ACRES
 THICKNESS OF CAP >1-FOOT 88.9%
 >2-FOOT 61.7%

Statistics Notes:

1. Statistics of "Intended Cap Area" indicates material from "peaks" continues to fill in the "valleys", increasing the overall percentage of "Intended Cap Area" covered by 1' or more of cap.
2. Statistics of the "Full Placement Area" indicates some "winnowing" of material at the edges of the cap, slightly decreasing the cap thickness at the edges as material 'toes-out'.

GENERAL NOTES:

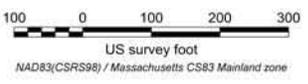
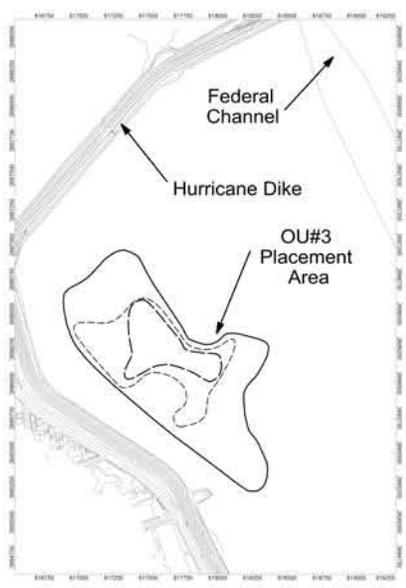
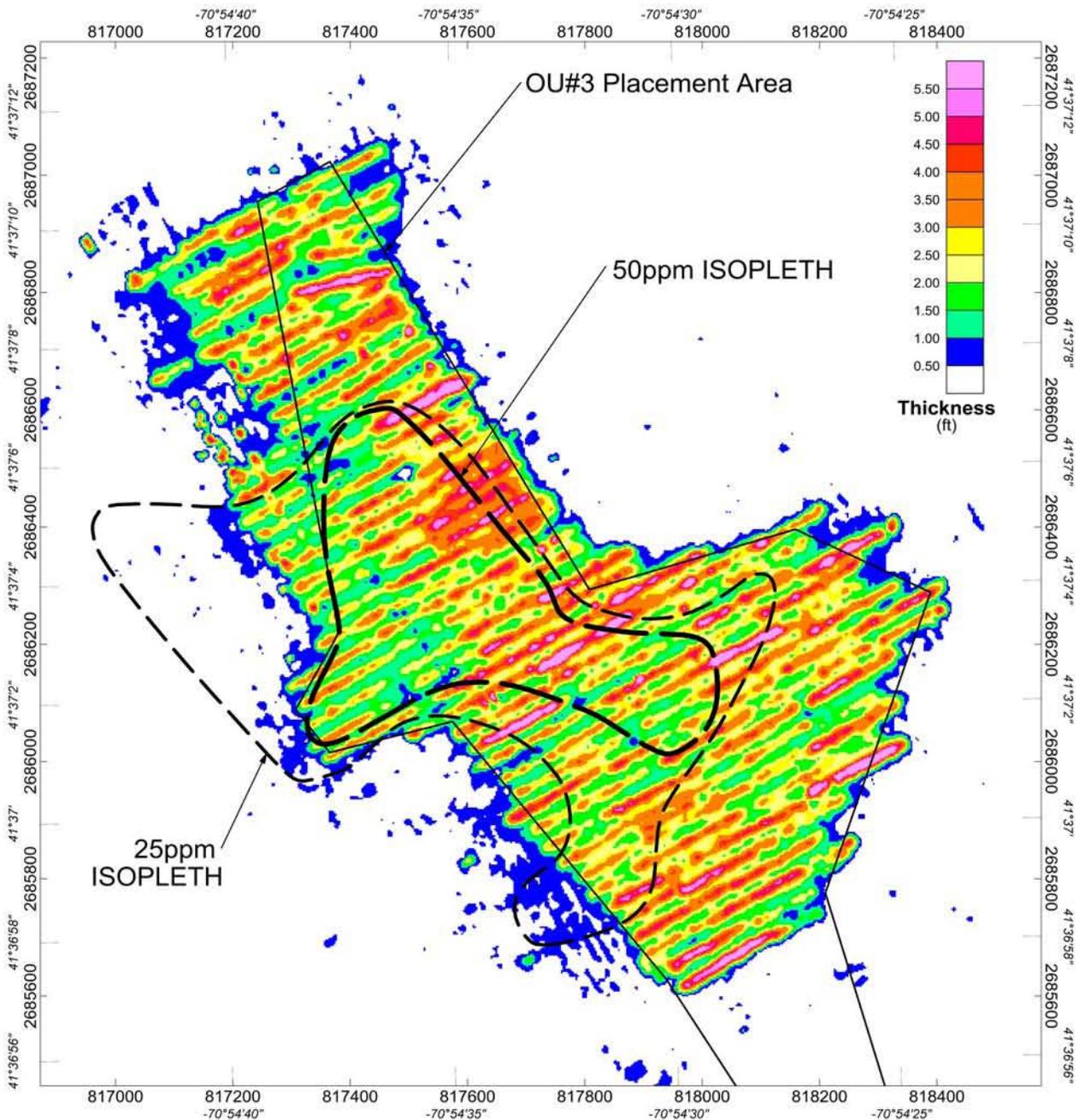
1. BATHYMETRIC INFORMATION COLLECTED BY APEX COMPANIES FROM 10/02/07 TO 10/06/07. BATHYMETRY WAS REFERENCED TO THE MEAN LOWER LOW WATER (MLLW) DATUM. THE ISOPACH (CAP THICKNESS) SURFACE WAS CONSTRUCTED BY SUBTRACTING THE DIGITAL TERRAIN MODEL (DTM) FOR THE PRE-PLACEMENT SURVEY CONDUCTED BY COLER & COLANTONIO (06/2005) FROM THE DTM CONSTRUCTED USING THE 10/02/07 THROUGH 10/06/07 DATA. DTM SURFACES WERE CONSTRUCTED USING GEOSFT'S OASIS MONTAJ'S MINIMUM CURVATURE ALGORITHMS.
2. CAP THICKNESS CONTOUR INTERVAL IS 1-FOOT.
3. STATISTICS CALCULATED USING AUTOCAD 2007 EXTENDED STATISTICS FOR THE ISOPACH DTM. STATISTICS CALCULATED FOR AREA FILLED WITHIN THE PLACEMENT FOOTPRINT.
4. PRE-PLACEMENT BASEMAP SUPPLIED BY U.S. ARMY CORPS OF ENGINEERS AND HAS NOT BEEN FIELD VERIFIED.
5. 2-FOOT BATHYMETRIC CONTOURS SHOWN ON THE PRE-PLACEMENT SURVEY PERFORMED BY COLER & COLANTONIO 8/23/05. CONTOURS REPRESENT MINIMUM CURVATURE EXISTING CONDITIONS SURFACE CONSTRUCTED BY GEOSFT'S OASIS MONTAJ.
6. INTENDED CAP AREA = AREA THAT WAS DESIGNATED IN THE DESIGN TO BE CAPPED. FULL PLACEMENT AREA = AREA THAT ULTIMATELY RECEIVED CAP MATERIAL DURING CAP CONSTRUCTION.

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**10/06/07 CAP THICKNESS
 OU#3 Placement Area Survey**

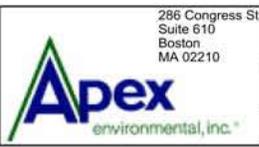
Thickness of CAP
 Constructed By Subtracting Pre and Post Final Placement Surveys

Apex Companies, LLC



STATISTICS
 AREA OF CAP ~18.9 ACRES
 THICKNESS OF CAP >1-FOOT 98%
 >2-FOOT 70%

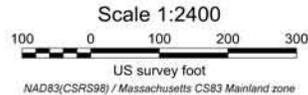
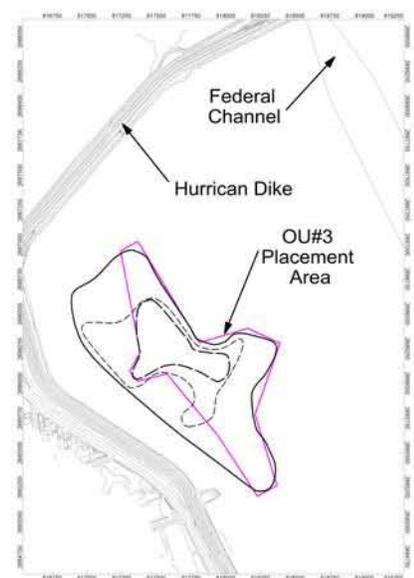
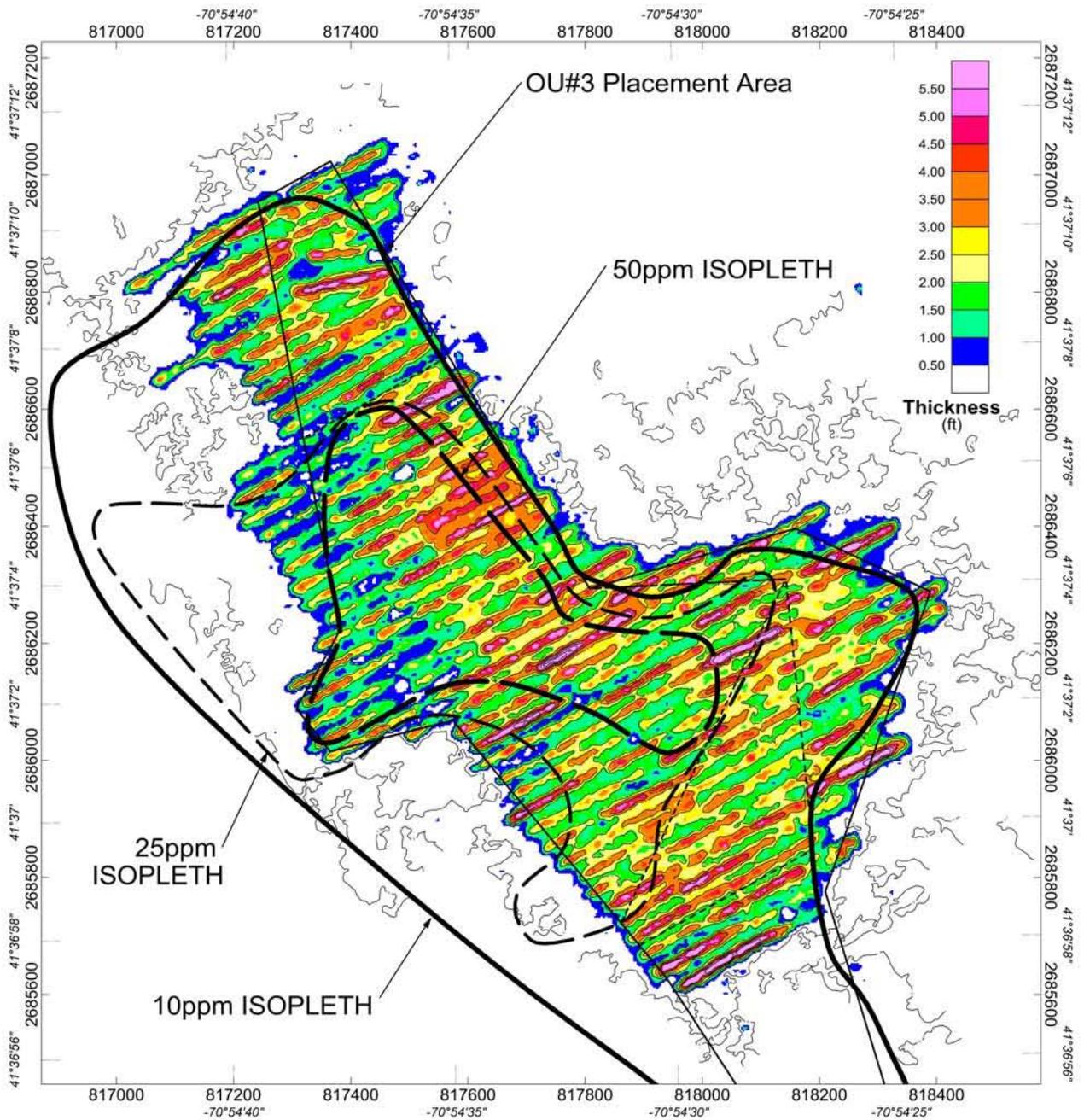
- NOTES**
1. BATHYMETRIC INFORMATION COLLECTED BY APEX ENVIRONMENTAL ON 01/12/06. BATHYMETRY WAS REFERENCED TO THE MEAN LOWER LOW WATER (MLLW) DATUM. THE ISOPACH (CAP THICKNESS) SURFACE WAS CONSTRUCTED BY SUBTRACTING THE DIGITAL TERRAIN MODEL (DTM) FOR THE PRE-PLACEMENT SURVEY CONDUCTED BY COLER & COLANTONIO FROM THE DTM CONSTRUCTED BY THE 01/12/06 DATA. DTM SURFACES WERE CONSTRUCTED USING GEOSOFIT'S OASIS MONTAJ'S MINIMUM CURVATURE ALGORITHMS.
 2. CAP THICKNESS CONTOUR INTERVAL IS 1-FOOT.
 3. STATISTICS CALCULATED USING AUTOCAD 2005 EXTENDED STATISTICS FOR THE ISOPACH DTM. STATISTICS CALCULATED FOR AREA FILLED WITHIN THE PLACEMENT FOOTPRINT.
 4. BASEMAP SUPPLIED BY U.S. ARMY CORPS OF ENGINEERS AND HAS NOT BEEN FIELD VERIFIED.
 5. 2-FOOT BATHYMETRIC CONTOURS SHOWN OF THE PRE-PLACEMENT SURVEY PERFORMED BY COLER & COLANTONIO 6/23/05. CONTOURS REPRESENT MINIMUM CURVATURE EXISTING CONDITIONS SURFACE CONSTRUCTED BY GEOSOFIT'S OASIS MONTAJ.



**01/12/06 CAP THICKNESS
 OU#3 Placement Area Survey**

Thickness of CAP
 Constructed By Subtracting Pre and Post Final Placement Surveys

Apex Environmental



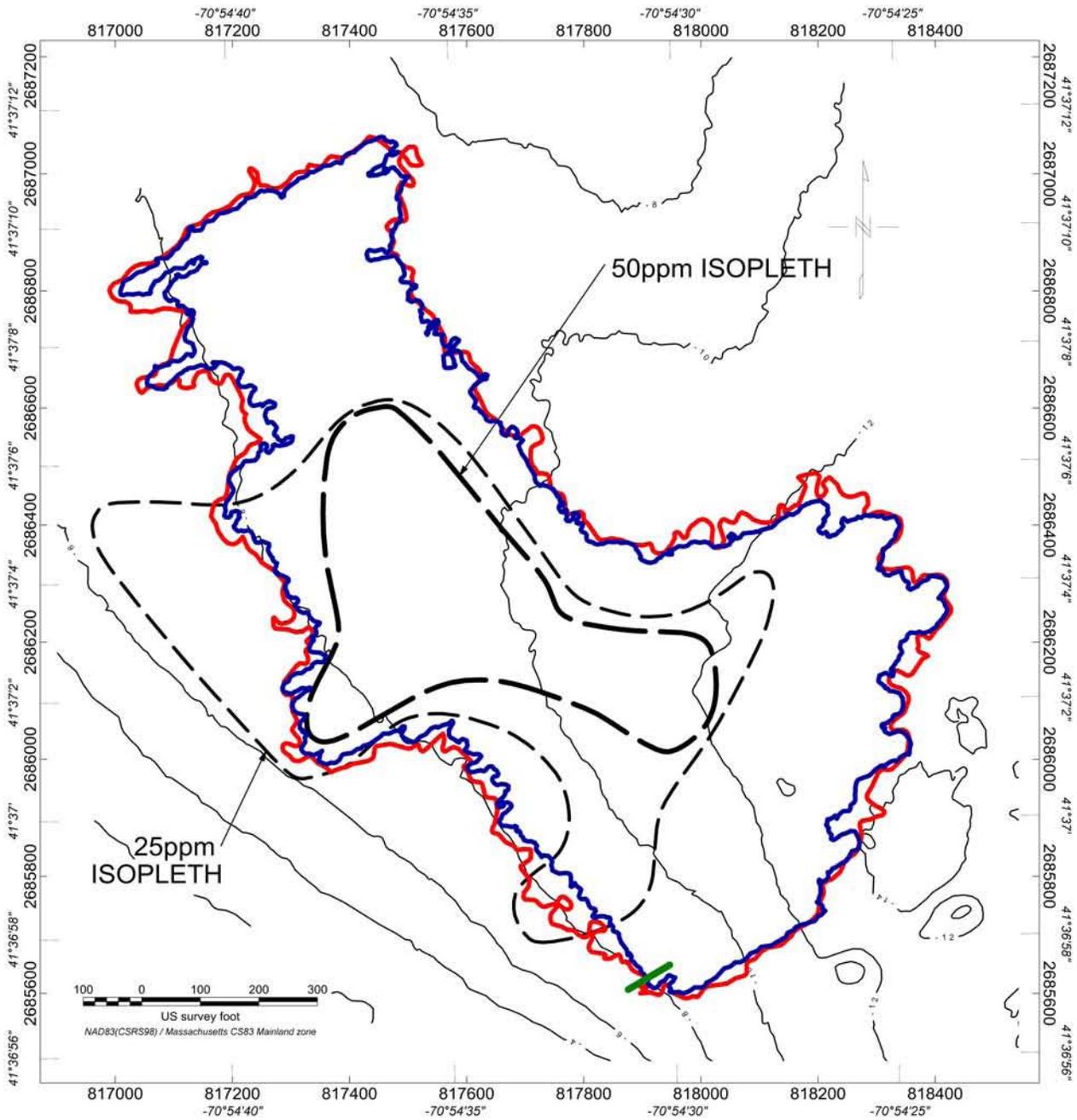
STATISTICS

AREA OF CAP ~18.9 ACRES
 THICKNESS OF CAP >1-FOOT 95%
 >2-FOOT 65%

NOTES

1. BATHYMETRIC INFORMATION COLLECTED BY APEX ENVIRONMENTAL ON 7/26/05. BATHYMETRY WAS REFERENCED TO THE MEAN LOWER LOW WATER (MLLW) DATUM. THE ISOPACH (CAP THICKNESS) SURFACE WAS CONSTRUCTED BY SUBTRACTING THE DIGITAL TERRAIN MODEL (DTM) FOR THE PRE-PLACEMENT SURVEY CONDUCTED BY COLER & COLANTONIO FROM THE DTM CONSTRUCTED BY THE 7/26/05 DATA. DTM SURFACES WERE CONSTRUCTED USING GEOSOFTS OASIS MONTAJ'S MINIMUM CURVATURE ALGORITHMS.
2. CAP THICKNESS CONTOUR INTERVAL IS 1-FOOT.
3. STATISTICS CALCULATED USING AUTOCAD 2005 EXTENDED STATISTICS FOR THE ISOPACH DTM. STATISTICS CALCULATED FOR AREA FILLED WITHIN THE PLACEMENT FOOTPRINT.
4. BASEMAP SUPPLIED BY U.S. ARMY CORPS OF ENGINEERS AND HAS NOT BEEN FIELD VERIFIED.

286 Congress St Suite 610 Boston MA 02210	07/26/05 CAP THICKNESS OU#3 Placement Area Survey
Thickness of CAP Constructed By Subtracting Pre and Final Placement Surveys	
Apex Environmental	



2007 OU#3 CAP Footprint: AREA OF CAP ~20.76 ACRES

2005 OU#3 CAP Footprint: AREA OF CAP ~18.9 ACRES

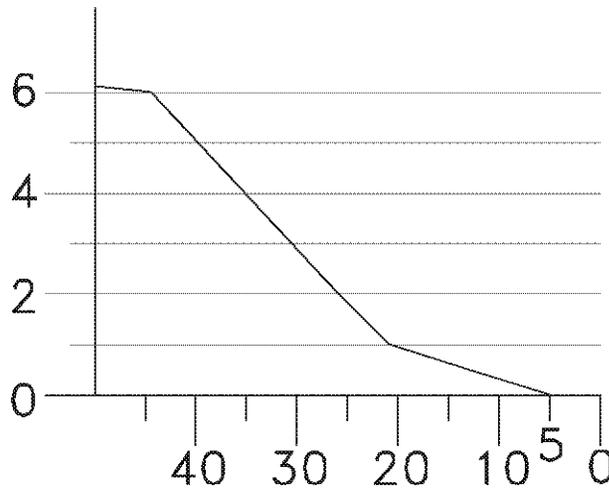
Cross-Section Location

GENERAL NOTES:

1. CAP FOOTPRINT AREA DETERMINED AT THE 0.5-FOOT CONTOUR INTERVAL.
2. 2007 BATHYMETRIC INFORMATION COLLECTED BY APEX COMPANIES FROM 10/02/07 TO 10/06/07. BATHYMETRY WAS REFERENCED TO THE MEAN LOWER LOW WATER (MLLW) DATUM. THE 2007 ISOPACH (CAP THICKNESS) SURFACE WAS CONSTRUCTED BY SUBTRACTING THE DIGITAL TERRAIN MODEL (DTM) FOR THE PRE-PLACEMENT SURVEY CONDUCTED BY COLER & COLANTONIO (06/2005) FROM THE DTM CONSTRUCTED USING THE 10/02/07 THROUGH 10/06/07 DATA.
3. THE 2005 ISOPACH (CAP THICKNESS) SURFACE WAS CONSTRUCTED BY SUBTRACTING THE DIGITAL TERRAIN MODEL (DTM) FOR THE PRE-PLACEMENT SURVEY CONDUCTED BY COLER & COLANTONIO (06/2005) FROM THE DTM CONSTRUCTED USING BATHYMETRIC DATA COLLECTED BY APEX ON 7/26/2005.
4. PRE-PLACEMENT BASEMAP SUPPLIED BY U.S. ARMY CORPS OF ENGINEERS AND HAS NOT BEEN FIELD VERIFIED.
5. DTM SURFACES WERE CONSTRUCTED USING GEOSOFF'S OASIS MONTAJ'S MINIMUM CURVATURE ALGORITHMS.
6. CAP THICKNESS CROSS SECTIONS WERE CONSTRUCTED IN GEOSOFF'S OASIS MONTAJ AND IN AUTOCAD.

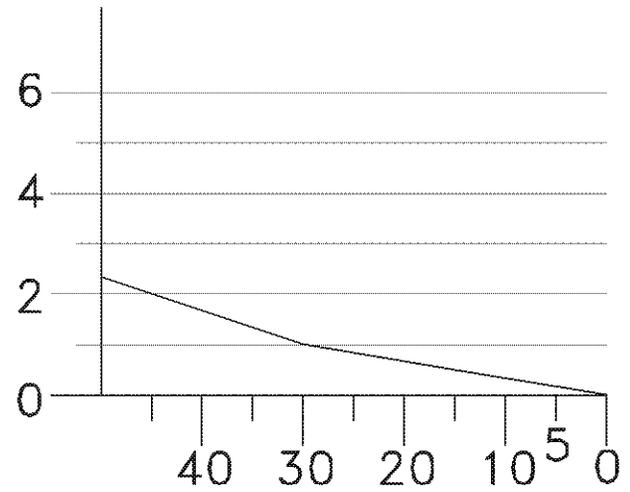
CAP Footprint Comparisons OU#3 Placement Area Survey
2005 vs. 2007 CAP Footprint CAP Area Constructed at 0.5-Foot Contour Interval
Apex Companies, LLC

2005 PROFILE AT EDGE OF CAP



VERTICAL SCALE EXAGGERATION 5:1

2007 PROFILE AT EDGE OF CAP



VERTICAL SCALE EXAGGERATION 5:1



Date of Survey 10/2/07
 Date of Processing 10/14/07
 Areas Surveyed OU #3
 Surveyors KUN + JFR
 Processors KUN
 Oasis Project Name JACOBS 2007

Oasis Step

Title File Created 100207.TID
 Speed Velocity File 100207.VFL

1524 m/sec

Hyack Line	Single Beam Edit	Exported from Oasis?	
43.1143	✓	✓	
44.1147	✓	✓	
45.1151	✓	✓	
46.1212	✓	✓	
47.1214	✓	✓	
48.1216	✓	✓	
49.1218	✓	NO	LATENCY
49.1220	✓	✓	
50.1222	NO - JUNK	NO	JUNK
50A1222	✓	✓	
51.1225	✓	✓	
52.1230	✓	✓	
53.1244	✓	✓	
54.1257	✓	✓	
55.1300	✓	✓	
56.1305	✓	✓	
56.1310	✓	NO	LATENCY
56.1314	✓	NO	LATENCY
57.1318	✓	✓	
58.1324	✓	✓	
59.1332	✓	✓	
60.1337	✓	✓	
61.1342	✓ (waves)	✓	
62.1351	✓	✓	
63.1355	✓	✓	
64.1400	✓	✓	
64.1402	✓	✓	
65.1410	✓	✓	
66.1416	✓	✓	
67.1422	✓	✓	
67.1429	✓	✓	
68.1437	✓	✓	
69.1440	✓	✓	
70.1447	✓	✓	
71.1447	✓	✓	
71.1452	✓	✓	
72.1454	✓	✓	
73.1455	✓ (waves)	✓	
69.1457	✓	✓	
68.1500	✓ (waves)	✓	
45.1520	✓	✓	
46.1524	✓	✓	
47.1527	✓	✓	
48.1529	✓ (waves)	✓	
49.1532	✓	✓	
50.1537	✓	✓	
51.1540	✓	NO ✓	X-TIE
52.1543	✓	NO ✓	X-TIE
51.1550	✓	✓	

Oasis Database Name

Oasis New Grid Name

Oasis Previous Week Grid Name

Isopach Grid Name

- a subtracted grid
 (previous week minus current week)

Isopach Grid Statistics

Mean	
Median	
Mode	
Std Dev	

Database Profile View

Current Data	
Previous Data	
OK?	

Oasis Column for EXPORT

Name of Exported .XYZ files

Sorted in Hyack(s)

North Area	
South Area	

Name of Export Files

Time/Date Processing Completed

X, Y, Corr, Row, Tide, File
 OU # - 100207 + 100307, TX



Date of Survey 10/3/07
 Date of Processing 10/4/07
 Areas Surveyed OU #3
 Surveyors KUN - GED
 Processors KUN
 Oasis Project Name JALOS 2007

XYZ
 Oasis Step

3.280' / m

Grid File Created 100307.TID
 Sound Velocity File 100307.VEC

155.48 m / sec

Hypack Line	Single Beam File		Exported from Oasis?
1 8-117	✓		
2 9-119	✓		
3 10-120	✓		
4 11-120	✓		
5 12-120	✓		
6 13-120	✓		
7 14-121	✓		
8 15-121	✓		
9 16-121	✓		
10 17-121	✓		
11 18-121	✓		
12 19A-121	✓ (waves)		
13 20-121	✓ (waves)	No	(ATTN)
14 20-121	✓		
15 21-121	✓		
16 22-130	✓		
17 23-130	✓		
18 24-131	✓		
19 25-131	✓		
20 26-131	✓		
21 27-131	✓		
22 28-131	✓ (waves)		
23 29-131	✓		
24 30-140	✓		
25 31-140	✓		
26 32-141	✓		
27 33-140	✓		
28 34-141	✓		
29 35-141	✓		
30 36-141	✓		
31 37-142	✓		
32 38-141	✓		
33 39-141	✓		
34 40-140	✓		
41 41-140	✓		
42			
43			
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55			

Oasis Database Name

Oasis New Grid Name

Oasis Previous Week Grid Name

Isopach Grid Name

- a subtracted grid
 (previous week minus current week)

Isopach Grid Statistics	
Mean	
Median	
Mode	
Std Dev	

Database Profile View	
Current Data	
Previous Data	
OK?	

Oasis Column for EXPORT

Name of Exported .XYZ files

Sorted To Hypack (SS)	
North Area	
South Area	

Name of Sorted Files

Time/Date Processing Completed

X, Y, Corr, Row, TID, Row
 OU #3 - 100207 + 100307.TXT



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Date of Survey 10/6/07
 Date of Processing 10/10/07
 Areas Surveyed OU #3
 Surveyors KW + GSD
 Processors KW
 Oasis Project Name JACOBS 2007

Hypack Step

Oasis Step

Tide File Created 100607_ou#3.tid
 Sound Velocity File 100607_ou#3.vsc

WAVES
 →
 WAVES
 →

Hypack Line	Single Beam File	Exported	Exported from Oasis?
1 52-1126	/	/	/
2 53-1127	/	/	/
3 54-1128	/	/	/
4 55-1129	/	/	/
5 56-1130	/	/	/
6 57-1131	/	/	/
7 58-1140	/	/	/
8 59-1142	/	/	/
9 60-1144	/	/	/
10 61-1146	/	/	/
11 62-1150	/	/	/
12 63-1152	/	/	/
13 64-1210	/	/	/
14 65-1212	/	/	/
15 1-1216	/	/	/
16 2-1219	/	/	/
17 3-1221	/	/	/
18 4-1223	/	/	/
19 5-1225	/	/	/
20 6-1227	/	/	/
21 7-1230	/	/	/
22 8-1233	/	/	/
23 9-1235	/	/	/
24 10-1239	X-TIE	NO	
25			
26			
27			
28			
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38			
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54			
55			

Oasis Database Name

Oasis New Grid Name

Oasis Previous Week Grid Name

Isopach Grid Name

- a subtracted grid
 (previous week minus current week)

Isopach Grid Statistics	
Mean	
Median	
Mode	
Std Dev	

Database Profile View	
Current Data	
Previous Data	
OK?	

Oasis Column for EXPORT

Name of Exported .XYZ files

Sorted in Hypack (B5)	
North Area	
South Area	

Name of Sorted Files

Time/Date Processing Completed

X, Y, Corr, row, Tide, File

