

## Coastal CRC - Coastal Water Habitat Mapping Project

### Milestone Report 1 for the Coastal Geomorphology and Classification Subproject

#### Sydney Harbour Sediment Sampling, August 2003

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#### Introduction

This report documents Coastal CRC fieldwork activities undertaken in Sydney Harbour, August 12, 14 and 15, 2003, by Geoscience Australia (GA) in collaboration with the Defence Science and Technology Organisation (DSTO). The GA personnel involved were David Ryan, Colin Tindall and Brendan Brooke, and the DSTO personnel included Les Hamilton and Tony White.

The report contains a description of the site selection rationale, sampling methodology, a table that contains details of the sediment samples that were collected, the quantitative analyses to be performed on each sample, and work now in progress. The objective of this work is to provide valuable ground-truthing information to compliment the Reson Seabat 8125 multi-beam benthic mapping survey currently being undertaken and add to the existing DSTO sediment dataset for Sydney Harbour.

No sampling work was undertaken on the 12th of August due to a Media Event that was organised by GA, DSTO and the CRC, and because the DSTO boat driver was ill and a replacement Navy contract driver was unavailable. A driver was not available for the 13<sup>th</sup> so the GA team returned to Canberra on the 12<sup>th</sup>. Sampling commenced on the 14<sup>th</sup> of August, however it was limited to a half-day, as the DSTO survey vessel, the *AWB 440*, began overheating in the early afternoon and was returned to Pyrmont for mechanical checks. Sampling was limited to one site on the 15<sup>th</sup> due to the repeat of the mechanical problem, the survey ending at 11 am. Consequently, of the planned 50 sample sites, only 21 were visited.



Figure 1 - The *AWB 440* in Pyrmont Bay.

### Study Site

The study area is located around and south of the Sow and Pigs Reef in the outer section of Sydney Harbour. This area is being surveyed by the Coastal CRC's Reson Seabat 8125 system, therefore, for ground-truthing purposes it was targeted for sediment sampling. The area comprises mostly sands, representing landward-migrating marine sediments that are infilling Sydney Harbour. These sands are mixed with moderate quantities of terrigenous mud. The deepest point in the survey area was 34 metres (the deep 'hole' near Chowder Bay), with shell-rich shoals averaging 7-8 m deep in the east of the region. The dredged Western shipping channel which allows safe access to Sydney Harbour cuts through the region from the north-west to the south-east, and has been dredged to an average depth of 12-15 metres. Another dredged area, the Eastern Channel and the Deviation Cut, exists to the south-east of the Sow and Pigs Reef, at about 12 metres water depth. The Sow and Pigs Reef itself is a small outcrop of bedrock that is exposed during low tide and presents a significant hazard to shipping.

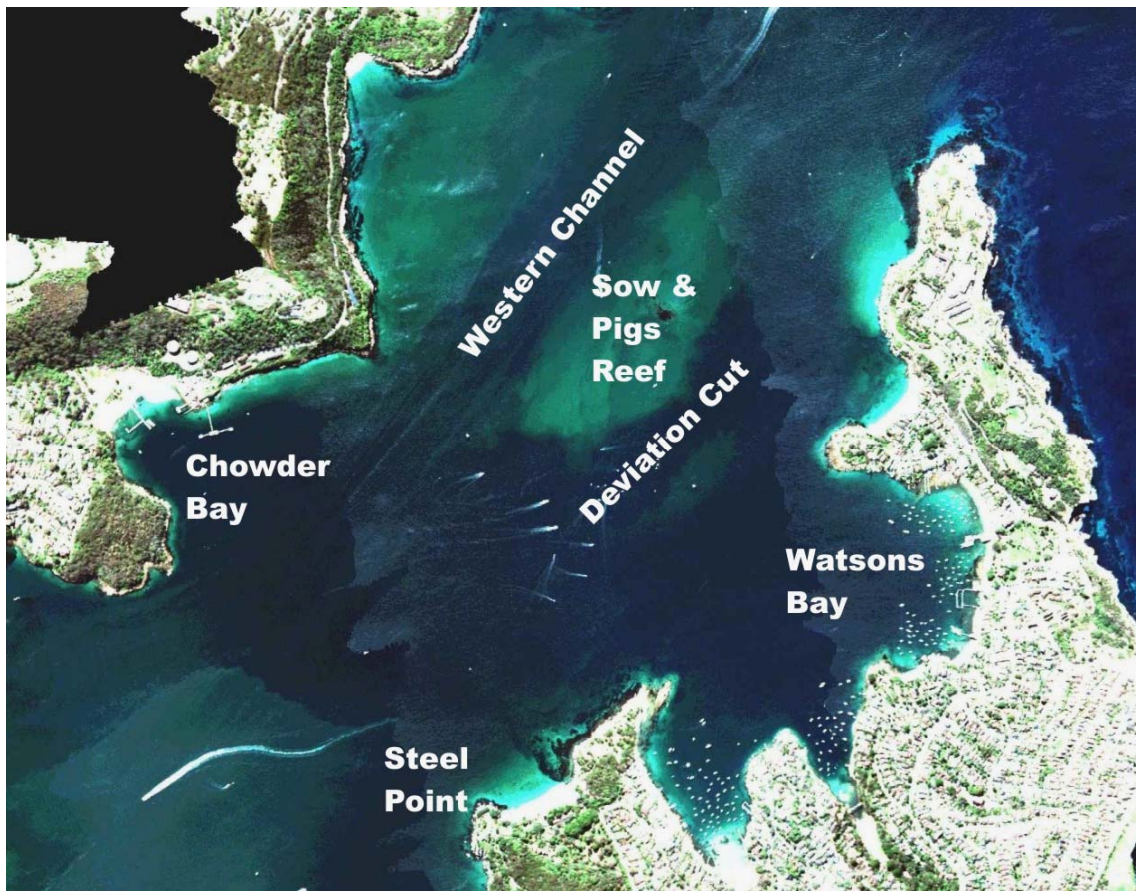


Figure 2 - Study area, showing the Western Channel, Eastern Channel, and the Sow and Pigs Reef region (aerial photograph, not georeferenced).

### Sediment Sampling Methods

For each sample site, the DGPS latitude and longitude was recorded, as was the time, and depth reading of the ships echo sounder. Navigation and location of sampling sites was achieved using the Navy's C-Map hydrographic chart navigation system. The DSTO survey vessel AWB 440 is equipped with an A-frame and capstan winch, allowing relatively easy and rapid deployment of

heavy sampling equipment. Consequently, the primary tool used in this survey was a 60 kg Smith-Mackintyre Grab sampler, capable of returning large, relatively undisturbed sand and muddy sand samples. For the muddier regions, the use of a heavy grab sampler was inappropriate (as the grab tends to bury in the sediment, and potentially returns a sub-surface sample). In these instances, a box-corer was deployed, which returns an undisturbed and generally unwashed surface sample. A number of grab and box core attempts failed to return a sample (typically due to failure of the device to fire) and were immediately re-deployed at the same site.



Figure 3a - Deployment of the Smith-Mackintyre Grab for sand and muddy sand sediments.



Figure 3b - Deployment of the Box Corer for undisturbed mud sediments.

Approximately one litre of all Smith-Mackintyre Grab samples was retained and stored in a plastic snap-lock bag. Samples retrieved using the box core were carefully stored in plastic vials (for the surface component of the sediment, 0-2 cm), and the remaining material (generally representing a depth of 2-4 cm below the substrate) was also stored in a snap lock bag. All samples were refrigerated to prevent putrefaction of the organic component of the sediments.



Figure 4a - Muddy sand sediment collected using the Smith-Mackintyre Grab Sampler (Site 58).



Figure 4b - Shelly sand sediment collected using the Smith-Mackintyre Grab Sampler (Site 54).



Figure 4c - Muddy sediment collected using the Smith-Mackintyre Grab Sampler (Site 59). Most mud sites were targeted using the Box Corer.

### Sediment Analysis

All of the sediment samples from the 21 sampling sites are currently being analysed in the GA laboratories for their physical and geochemical characteristics. The analytical procedures used are outlined in Table 1. Samples have also been retained for future analyses such as X-Ray Fluorescence determinations.

Table 1 - Analytical procedures used to determine basic sediment properties for each of the samples collected from the Sow and Pigs Reef region.

Sediment Parameter	Analytical Procedure
Sediment Grainsize	<ol style="list-style-type: none"> <li>1. Wet sieve the sample with 2000um and 63um sieves into gravel:sand:mud fractions and calculate the dry weight percentages for each fraction.</li> <li>2. The gravel fraction to be retained for a visual description of the composition and size distribution of this sediment.</li> <li>3. The mud and sand fractions are then further analysed separately by a Malvern laser particle analyser to produce particle distributions for each fraction.</li> </ol>
Carbonate (% CaCO <sub>3</sub> ) Content	<ol style="list-style-type: none"> <li>1. Carbonate contents to be determined in the combined mud and sand fraction using a standard carbonate bomb technique.</li> <li>2. Carbonate content of the gravel fraction to be determined by visual estimation.</li> </ol>
Total Organic Carbon (TOC)	<ol style="list-style-type: none"> <li>1. To be determined on a TOC analyser (Rock Eval analytical instrument)</li> </ol>

### Map of Sample Sites

A simple map has been provided to show the locations of each of the samples collected in the survey (Figure 5). Table 2 (below) provides a detailed field log for each of the samples collected.

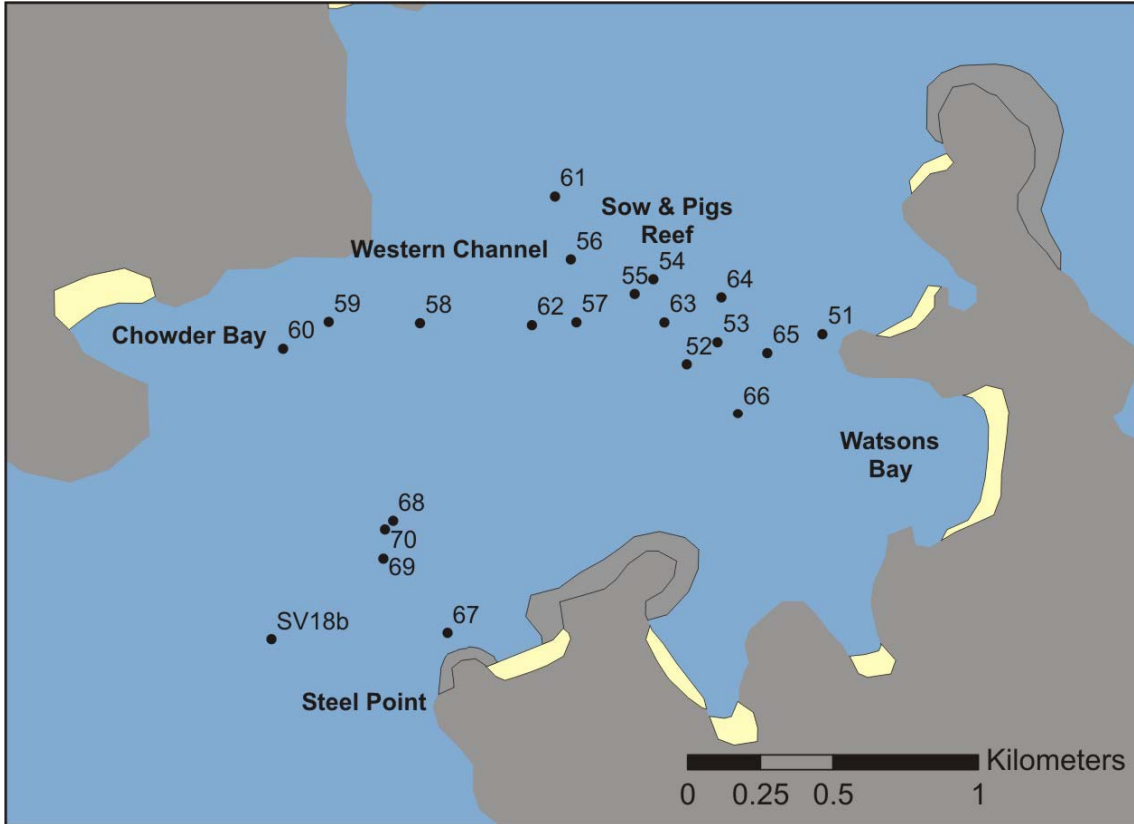


Figure 5 - Sample sites in the Sow and Pigs Reef region, Sydney Harbour.

### Other Work In Progress

GA has conducted an inter-library search of literature to create a bibliography of references pertaining to the substrates and biota of Sydney harbour. A comprehensive literature review on the sediment distribution in Sydney Harbour is being compiled from this and other survey information. Additionally, as further spatial data becomes available, a GIS is being developed to enable better visualisation of the substrate characteristics of the Harbour.

## Sample Descriptions

Table 2 - Detailed field information for all of the sediment samples collected during the first Sydney Harbour survey.

WPT	Long (dd)	Lat (dd)	Date	Time	Sounder Depth (m)	Deployments	Samples Taken	Site Description	Sed. Description
SV18 b	151.258380	-33.850150	14_8_03	10:26:00	14.7	S-M Grab, CTD	1 bag, CTD surface & bottom	Revisited DSTO sample site	Sandy Shelly Mud
51	151.275400	-33.840715	14_8_03	10:52:00	18	S-M Grab, Failed box core	1 bag	Muddy hole, west of Laings Point	Sandy Mud
52	151.271210	-33.841642	14_8_03	11:16:00	8.4	Failed S-M Grab, S-M Grab	1 bag	Bank, west of Laings Point and south of Deviation Cut	Shelly Sand
53	151.272160	-33.840963	14_8_03	11:30:00	8.5	S-M Grab	1 bag	Bank, west of Laings Point and south of Deviation Cut	Shelly Sand, lots of large shell frags
54	151.270180	-33.839022	14_8_03	11:40:00	5.5	S-M Grab	1 bag	Bank, south of the Sow and Pigs	Sand and Shell
55	151.269600	-33.839473	14_8_03	11:45:00	5.8	S-M Grab	1 bag	Bank, south of the Sow and Pigs	Sand and Shell
56	151.267630	-33.838412	14_8_03	11:52:00	7.5	S-M Grab	1 bag	SW of Sow and Pigs	Clean sand
57	151.267800	-33.840345	14_8_03	11:59:00	7.1	Failed S-M Grab, S-M Grab	1 bag	SW of Sow and Pigs	Clean sand
58	151.262970	-33.840375	14_8_03	12:10:00	15.8	S-M Grab	1 bag	Channel	Shelly sand
59	151.260150	-33.840332	14_8_03	12:28:00	33.1	Failed S-M Grab, S-M Grab	1 bag	Deep hole south of Georges Head	Soft mud
60	151.258740	-33.841162	14_8_03	13:30:00	30.7	Box core	1 bag (2-4 cm depth), 2 vials (surface)	Deep hole south of Georges Head	Soft mud

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61	151.267140	-33.836473	14_8_03	13:53:00	15.5	Failed S-M Grab, S-M Grab	1 bag	Channel	Sand and Shell
62	151.266430	-33.840435	14_8_03	14:01:00	10.6	S-M Grab	1 bag	Potential seagrass bed south of Sow & Pigs	Clean sand
63	151.270520	-33.840350	14_8_03	14:09:00	13.5	S-M Grab	1 bag	Deviation Cut	Organic muddy sand
64	151.272280	-33.839580	14_8_03	14:15:00	12.2	S-M Grab	1 bag	Deviation Cut	Shelly muddy sand
65	151.273700	-33.841297	14_8_03	14:28:00	12.7	Failed S-M Grab, S-M Grab	1 bag	West of the muddy hole near Laings Pt	Sandy mud
66	151.272790	-33.843182	14_8_03	?	13.3	S-M Grab	1 bag	West of the muddy hole near Laings Pt	Sandy mud
67	151.263820	-33.849955	14_8_03	14:38:00	9.3	S-M Grab	1 bag	Shark Point	Hard packed sand
68	151.262140	-33.846505	14_8_03	14:44:00	30.2	S-M Grab	1 bag	Further out from Shark Bay	?
69	151.261840	-33.847672	15_8_03	11:00:00	30.3	S-M Grab	1 bag	Further out from Shark Bay	Sticky sandy mud & worms
70	151.261890	-33.846772	15_8_03	11:35:00	32.5	2 Failed Box Cores, 1 Successful	1 bag (2-4 cm depth), 2 vials (surface)	Further out from Shark Bay, deeper hole	?